SMITH MOUNTAIN LAKE CORRIDORS STUDY

Prepared by the Staff
of the
Fifth Planning District Commission

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This report was prepared by the staff of the Fifth Planning District Commission through the assistance of the United States Department of Transportation, Federal Highway Administration and the Virginia Department of Transportation.

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Federal Highway Administration and Virginia Department of Transportation acceptance of this report as fulfillment of the objectives of this planning study does not constitute endorsement/approval of the need for any recommended improvements, nor does it constitute approval of their location and design, nor commitment to fund any such improvements. Additional project level environmental assessments and/or studies of alternatives may be necessary.

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TABLE OF CONTENTS

LIST OF TABLES

APPENDIX I

LIST OF MAPS

CHAPTER 1

INTRODUCTION

Background

The Roanoke Valley, with a population of approximately 220,000 people, is the fourth largest metropolitan area in Virginia. It is the commercial and cultural center of western Virginia. Smith Mountain Lake is one of the largest and most popular outdoor recreation centers in southwest Virginia. The relative proximity of the Roanoke Valley and Smith Mountain Lake makes for easy access between the two areas. Many residents of the Roanoke Valley make day and weekend trips to Smith Mountain Lake to enjoy the water based activities and the relaxed environment. In fact, many residents of the Roanoke Valley own vacation property on Smith Mountain Lake and make the trip between the two areas on a weekly basis during the summer months and even through much of the rest of the year. Many Smith Mountain Lake residents and visitors make day trips to the Roanoke Valley to enjoy the wide array of cultural and commercial assets available. Further, the Smith Mountain Lake area has become an increasingly popular residential location for Roanoke Valley employees. This increased residential popularity of the Smith Mountain Lake area has driven an expansion in both the development of new housing in the area and increased traffic on area roads, particularly on roads which connect the Roanoke Valley with Smith Mountain Lake. Many of the roads used to travel between the Roanoke Valley and Smith Mountain Lake are old, narrow rural roads which were designed prior to the popularity of this particular traffic pattern. Resident and government concerns have been heightened in recent years with regard to the current transportation networks ability to handle the increased traffic volumes in terms of both safety and efficiency. This section of the report focuses on the impact of this increased traffic volume between the Roanoke Valley and Smith Mountain Lake on the roads of the Roanoke Valley.

There are many roadways which connect various locations in the Smith Mountain Lake region to the individual localities of the Roanoke Valley. In order to narrow the study area to fit the limited scope and budget of this report, the study area for this section of the report is limited to the four most popular and heavily travelled of the possible corridors between Smith Mountain Lake and the Roanoke Valley falling within the boundaries of the Fifth Planning District Commission. These include: 1) Washington Avenue between Pollard Street and Preston Road in the Town of Vinton and Route 24 (also called Washington Avenue) from Preston Road in the Town of Vinton to the Roanoke County boundary with Bedford County, 2) Route 116 from Jefferson Street in Roanoke City to the Roanoke County boundary with Franklin County, 3) Route 220 in Roanoke County from the Roanoke County boundary with Roanoke City to the Roanoke County boundary with Franklin County and 4) Route 634 in Roanoke County from the Roanoke County boundary with the Town of Vinton to the Roanoke County boundary with Bedford County. Segments of these and other important routes are reviewed in the other two area analysis sections of this report. The section of Route 634 located within the Town of Vinton has been excluded from the study area as funds for major improvements have been allocated to it

in the State Six Year Improvement Program making an analysis of current conditions of little value. The study area for this section of the report can be seen on Map 1.

Goals and Objectives

The goals of this section of the ***Smith Mountain Lake Corridors Study*** are to document existing conditions in selected corridors in the study area, identify problems in these corridors and make recommendations which will improve travel in these corridors both in terms of safety and convenience. These goals can be achieved by addressing both general and site specific deficiencies in the facilities and providing recommendations to improve those identified deficiencies keeping in mind the needs of both local and through traffic.

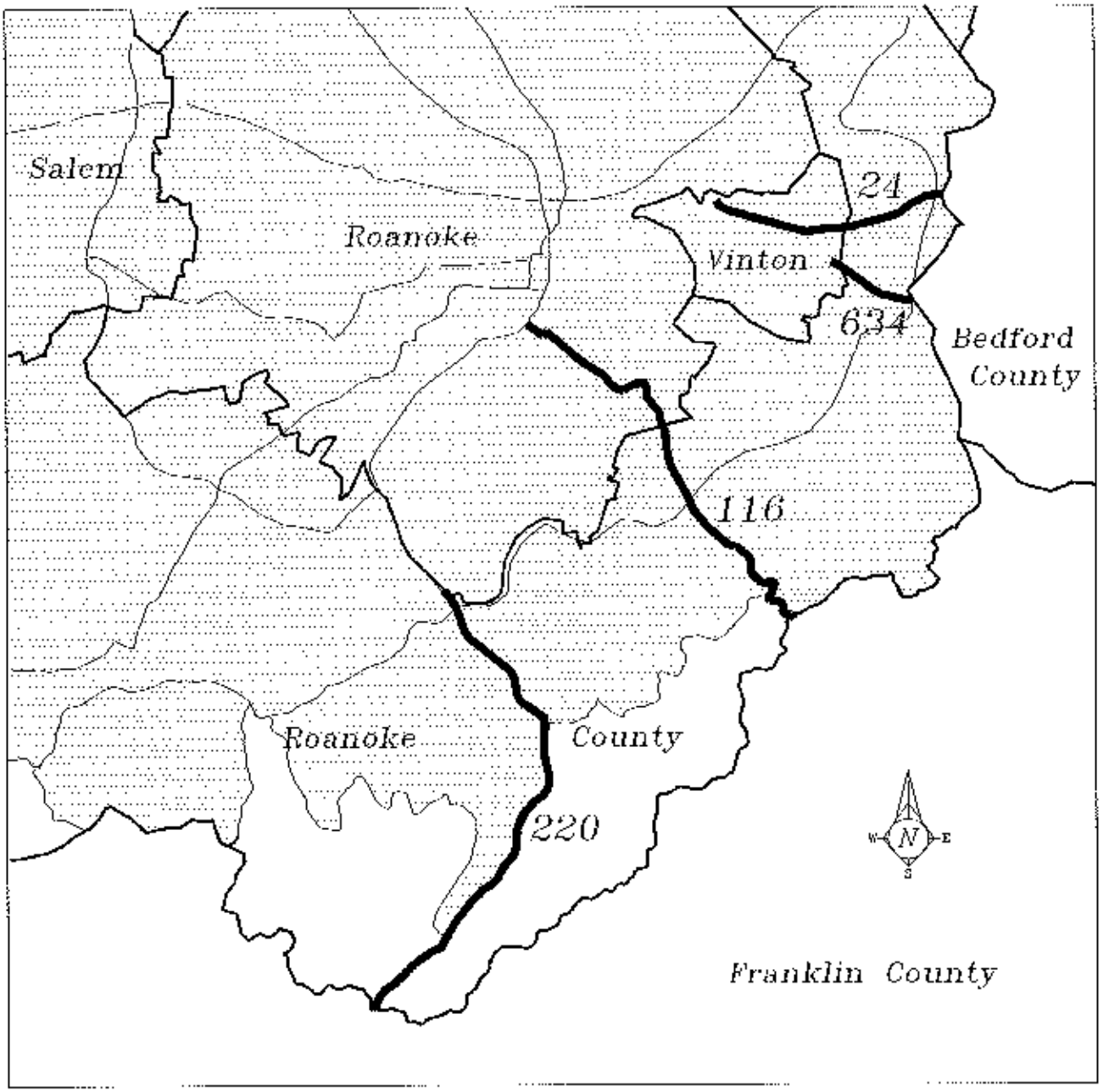
Study Approach

The study approach was to rely on traffic count data, accident data, physical geometries data and other background information. Using the collected information, analyses of traffic circulation and growth patterns, roadway efficiency, roadway geometrics and roadway safety were conducted. Sites contributing to traffic congestion and accidents were identified and causes were documented based on these analyses. Recommendations to improve safety and traffic congestion were then made for both specific sites and the corridors in general.

Smith Mountain Lake Corridors Study

5th PDC Study Corridors

MAP I



Study Corridors

Political Boundary

Roanoke Valley Area MPO

Scale 1"=10,000'

5thPDC

CHAPTER 2

DATA COLLECTION AND SYSTEM DESCRIPTION

Data Collection Procedures

Data used in this section of the study were obtained from several different sources. The staff of the Fifth Planning District Commission collected physical characteristics and peak hour traffic data through field data collection techniques. Average daily traffic volumes (ADT), 24-hour traffic counts and accident data were obtained from data resources maintained by the Virginia Department of Transportation (VDOT). Other data were collected from material stored in the Fifth Planning District Commission library and interviews with local officials and interested citizens.

System Description

The study covers segments of four different corridors which connect the Roanoke Valley to the Smith Mountain Lake (see Table 1).

Table 1: Study Area Road Sections

Route Number	Road Name	From	To
***	Washington Avenue	Pollard Street	Preston Road
24	Washington Avenue	Preston Road	Bedford/Roanoke County Line
116	JAE Valley Road	Franklin/Roanoke County Line	South City Line Roanoke
116	Mount Pleasant Boulevard	South City Line Roanoke	Rutrough Road
116	Riverland Road	Rutrough Road	Piedmont Street
116	Piedmont Avenue	Riverland Road	Walnut Avenue
116	Walnut Avenue	Piedmont Street	Jefferson Street
220	Rocky Mount Road	Franklin/Roanoke County Line	South City Line Roanoke
634	Hardy Road	East City Line Vinton	Bedford/Roanoke County Line

Most of the roads in the study area are located within the boundary of the Metropolitan Planning Organization (MPO). Only the southernmost 1.2 miles of Route 220 are located outside of the MPO boundary. According to the federal functional classification of highways, most of Washington Avenue/Route 24 is an Urban Minor Arterial with the exception between Mitchell Street and Preston Road in the Town of Vinton is classified as an Urban Local Road. Route 116 from Jefferson Street in Roanoke City to the Blue Ridge Parkway in Roanoke County is classified as an Urban Minor Arterial while the remaining length of Route 116 in the study area is classified as a Rural Major Collector. Almost all of Route 220 in the study area is classified as a Rural Principle Arterial. Only the segment of Route 220 between the Blue Ridge Parkway and the Roanoke County/City boundary is classified as an Urban Principal Arterial. Route 634 in the study area is classified as an Urban Collector. All but Rural Minor Collectors and Local Roads are currently eligible for federal funding in most cases.

All roads in the study area lie partially within an existing floodplain. Washington Avenue/Route 24 and Route 634 pass through the Wolf Creek floodplain at the Roanoke County/Vinton border. Routes 116 and 220 both pass through the Back Creek floodplain in Roanoke County. Route 116 also passes through the Roanoke River floodplain in Roanoke City.

There are a wide variety of land uses located within the four study corridors. The one trend that holds true for all four corridors is that the land uses tend to become more urban in nature, both residential and commercial, close to the City of Roanoke. As the corridors move toward the boundaries of Roanoke County and Bedford or Franklin County the typical land uses become more rural, including agricultural and rural residential development. Further, all four corridors lie at least partially in areas which have experienced significant growth, particularly in terms of residential development, over the past few years and which are likely to experience continued growth in both residential and commercial development over the next several years.

CHAPTER 3

DATA ANALYSIS

A physical geometrics analysis, a traffic growth and circulation analysis, a highway efficiency analysis and a traffic accident analysis were carried out for each of the four corridors in the study area. The physical geometries analysis reviews existing physical conditions including pavement widths, lane widths, shoulder widths, pavement markings, posted speed limits and other physical characteristics which impact on travel conditions. The pavement and shoulder width data represent segment averages and do not reflect exact measurements across an entire road segment.

The traffic growth and circulation analysis reviews the growth of traffic volumes in corridor segments over the course of several years and looks at projected future traffic volumes. Also, variations of peak hour volumes between an "average" traffic day and a "lake" traffic day were reviewed. A "lake" traffic day is defined, for the purposes of this study, as a day on which traffic volumes would typically be expected to be high due to the presence of additional traffic between the Roanoke Valley and the Smith Mountain Lake area. Peak hour count data for "lake" traffic days were collected on Friday the 25th of August, 1995 for Route 116 and the remaining study corridors on Friday the 1st of September, 1995 which coincided with the Labor Day weekend. Data were collected on Friday evenings based on information provided by local sources that Friday evenings on the study corridors typically carry additional traffic to and from the Smith Mountain Lake area. An "average" traffic day is defined, for the purposes of this study, as a day on which traffic volumes in the study corridors would typically be expected to be average due to the lack of any influencing factors such as snow, school holidays, etc. Peak hour count data for "average" traffic days were collected on Friday the 9th of February for Washington Avenue/Route 24 and Route 220 and on Friday the 23rd of February for Routes 116 and 634. Data were collected on Friday evenings in order to facilitate a logical comparison between "average" and "lake" traffic peak hour counts.

The highway efficiency analysis employed two separate analysis techniques to review the efficiency of the study corridors. One is to determine if the facility is operating within designed traffic capacity by comparing traffic volume (the number of vehicles actually on the facility) data with design service volume data (the number of vehicles the facility is designed to carry before being over capacity, at level-of-service D). The other is to utilize both physical geometric and peak-hour traffic volume inputs to derive a measurement of operating efficiency defined as a level-of-service (LOS). LOS calculations were accomplished through the use of the Highway Capacity Software (HCS) which utilizes methodological approaches described in the 1985 edition of the ***Highway Capacity Manual***. LOS measurements are based on a scale from A through F where an A represents a free flow traffic conditions and an F indicates that the facility is operating over capacity. A facility is generally considered to be operating satisfactorily when it is at an LOS of D or better (localities often set their own LOS standards depending upon the conditions of the facility under review and other local criteria). For more information regarding highway level-of-service analysis methodology see the ***1985 Highway Capacity Manual*** (HCM).

The traffic accident analysis attempts to identify significant patterns in accident occurrences. This might include patterns involving lighting conditions, weather conditions, physical location, collision type or any number of other variables. These patterns are used in conjunction with the traffic volume and physical geometries data to locate potentially dangerous locations. All accident data analyzed were obtained from VDOT and pertain to all accidents reported during the three year time period between January 1, 1992 and December 31, 1994.

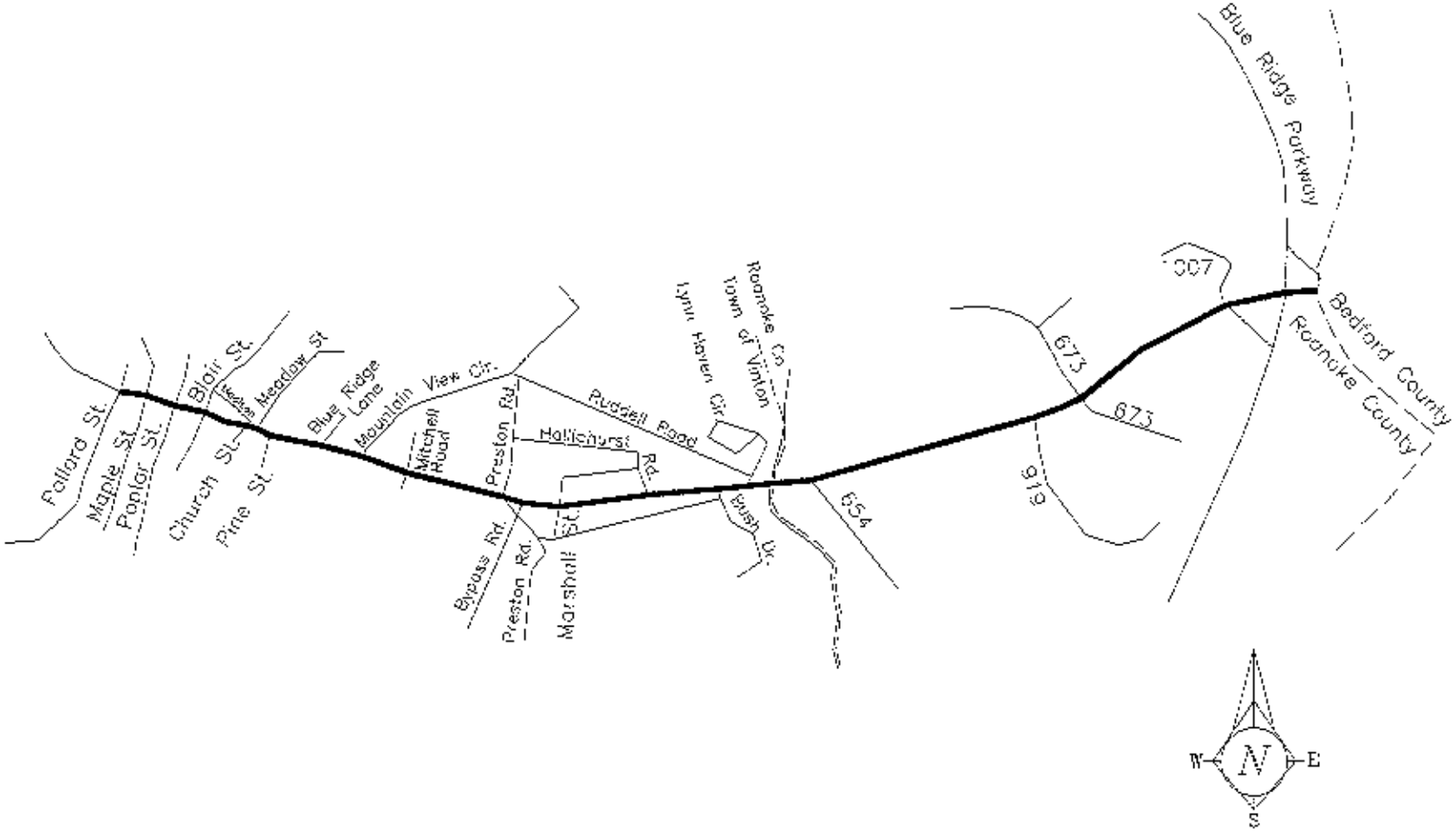
Washington Avenue/Route 24

The Washington Avenue/Route 24 study corridor is 2.76 miles long with 1.25 miles in Roanoke County and the remaining 1.51 miles in the Town of Vinton (see Map II). It is a four-lane highway (two westbound and two eastbound lanes) divided by a double yellow line between Pollard and Preston Streets in the Town of Vinton, a ten foot wide raised median between Preston Street and the East Town Line of Vinton and a sixteen foot grass median between the East Town Line of Vinton and the Roanoke/Bedford County boundary. Because it is a four-lane facility, passing is allowed in the entire corridor in both directions. There are sidewalks on both sides of Washington Avenue/Route 24 between Pollard and Mitchell Streets, but none on either side of the street for the remainder of the study corridor. There is a curb and gutter located on both sides of Washington Avenue/Route 24 within the limits of the Town of Vinton, but only intermittently within Roanoke County. There is no access control in the study area and there are many curb cuts to provide access to a variety of land uses. There is no on-street parking allowed within the study corridor. The posted speed limit is 25 miles per hour between Pollard and Mitchell Streets, 35 miles per hour between Mitchell Street and the East Town Line of Vinton and 45 miles per hour in Roanoke County. The study corridor width ranges between 44 and 52 feet. Lane widths range between 11 and 12 feet. Shoulder widths range between two and four feet where one exists. There are four traffic signals located in the Washington Avenue/Route 24 study corridor at the intersections of Washington Avenue/Route 24 and Pollard Street, Mountain View Road, By-Pass Road and at the entrance of the East Vinton Plaza in Roanoke County.

Washington Avenue/Route 24 is a major commercial route through the Town of Vinton and eastern Roanoke County. VDOT has classified the land uses located in this corridor as being suburban high density indicating the fact that there are more than 21 access points per mile. Land use within the corridor is highly varied including single-family residential, multi-family residential, commercial of varying intensities including a large outdoor shopping center called the East Vinton Plaza, public institution including the William Byrd High School, recreational and other urban uses. There is little vacant land left in this corridor with the exception of the eastern portion of the corridor near the Roanoke/Bedford County boundary where some vacant land still exists. Future development will likely involve a change of current land use rather than the introduction of a new land use on currently undeveloped land, except in the eastern part of the study corridor where new residential development could occur.

To reveal historic variations of traffic volumes along the Washington Avenue/Route 24 corridor during average traffic days, Table 2 lists the 24-hour two directional traffic volumes between 1984 and 1994 at three different locations along the Washington Avenue/Route 24 study corridor.

Route 24/Washington Ave.



MAP II

Scale 1"=1800'

5thPDC

Table 2: 24-Hour Traffic Volumes For Washington Avenue/Route 24 Study Corridor

Year	Between Maple Street & Poplar Street	Between the East Town Line of Vinton & Route 654	Between Route 926 & the Blue Ridge Parkway
1984	13,410	17,690	13,730
1986	17,280	19,140	14,230
1988	Not Available	23,249	16,972
1990	21,323	24,390	18,702
1992	20,949	26,992	21,995
1994	21,891	25,167	22,350
1984-1994 absolute change	8,481	7,477	8,620
1984-1994 percent change	63%	42%	63%

source: ***Roanoke 24-Hour Traffic Volumes***, VDOT

The highest traffic volumes in the study corridor occur near the East Town Line of Vinton. Interestingly, this location has also experienced the slowest traffic volume growth within the study corridor. Traffic volume actually declined at this location between 1992 and 1994. Traffic volume in the study corridor is growing fastest, both in terms of absolute and percent growth, near the Blue Ridge Parkway and the Roanoke/Bedford County boundary.

According to VDOT, average travel speeds in the corridor are as follows: 25 miles per hour between Pollard and Mitchell Streets, 33 miles per hour between Preston Street and the East Town Line of Vinton and 33 miles per hour between the East Town Line of Vinton and the Roanoke /Bedford County boundary. Data on average travel speeds between Mitchell and Preston Streets were unavailable. When average travel speed data are compared to the respective speed limits it is clear that traffic flow is most impeded in the eastern portion of the corridor located in Roanoke County.

In order to reveal the affect of "lake" traffic on the Washington Avenue/Route 24 corridor, a comparison was made between two-directional evening peak hour traffic volumes on an "average" traffic day and a "lake" traffic day as defined earlier in this section. Table 3 displays a comparison between "lake" traffic day evening peak hour counts and "average" traffic day evening peak hour counts. The counts were taken as close as possible to the Roanoke/Bedford County line to capture all "lake" traffic while avoiding internal Town of Vinton and Roanoke County traffic. All traffic counts were taken on a Friday evening during the same time frame at the same location in the study corridor in order to maintain consistency between the "lake" and "average" day data.

Table 3: Comparison of Washington Avenue/Route 24 Evening Peak Hour Volumes

Time	Two Directional Traffic Volumes		Difference Between "Lake" and "Average" Traffic Volumes	
	"Lake" Traffic Day	"Average" Traffic Day		
4:30 - 4:45	374	341	33	8.8%
4:45 - 5:00	381	384	-3	-.8%
5:00 - 5:15	391	410	-19	-4.9%
5:15 - 5:30	392	401	-9	-2.3%
5:30 - 5:45	432	417	15	3.5%
5:45 - 6:00	350	394	-44	-12.6%
6:00 - 6:15	334	357	-23	-6.9%
6:15 - 6:30	338	369	-31	-9.2%
Total	2992	3073	-81	-2.7%
Peak Hour (Shaded)	1596	1622	-26	-1.6%

Note: a negative (-) difference indicates "lake" volumes less than equivalent "average" volumes

As can be seen in Table 3, the two-directional evening peak hour traffic volume on the "lake" traffic day was 1596 vehicles. Contrary to what might have been expected, there were only two boat trailers counted in the study corridor during the evening peak hour on the "lake"traffic day and only five boat trailers counted during the entire counting period. The two-directional evening peak hour traffic volume on the "average" traffic day was 1622 vehicles. The evening peak 15-min periods for both "average" and "lake" traffic volumes are reflected in shades. This difference in evening peak hour counts (26 vehicles) suggests that there is no adverse impact to traffic volumes on the Washington Avenue/Route 24 study corridor created by "lake" traffic. Interestingly, westbound traffic (toward the Roanoke Valley from the Smith Mountain Lake area) was slightly higher on the "lake" traffic day than on the "average" traffic day while eastbound traffic (toward the Smith Mountain Lake area from the Roanoke Valley) was slightly lower on the "lake" traffic day than on the "average" traffic day. While this is the opposite of what might have been expected, the differences were small enough to be explained by normal variations in daily traffic volumes.

VDOT maintains historical, current and projected future average daily traffic (ADT) volumes in their State Highway Planning System (SHiPS) database for selected road segments in Virginia. Year 1992 and 2015 volumes for segments of the Washington Avenue/Route 24 corridor contained in the SHiPS database are displayed in Table 4. The SHiPS database also contains

design service volume data (design service volume is the traffic volume operating at the level of service D for which the roadway capacity was calculated) which are also displayed in Table 4. It is important to note that on selected urban routes, Year 2015 design service volumes do not match current year design service volumes. This anomaly occurs where expected increases in traffic volume on smaller intersecting routes will interfere with the capacity of the main route to carry the same volume of traffic as in the current analysis year.

Table 4: Year 1992 and 2015 Traffic Volumes for Washington Avenue/Route 24 Segments

Washington Avenue/Route 24 Segment		1992		2015		1992 - 2015	
From Route	To Route	Design Service Volume	Volume	Design Service Volume	Volume	Absolute Volume Change	Percent Volume Change
Pollard Street	Mitchell Street	24,356	21,995	20,806	28,600	6,605	30%
Mitchell Street	Preston Street	25,371	21,995	23,036	28,600	6,605	30%
Preston Street	East Town Line - Vinton	31,067	26,992	31,067	44,300	17,308	64%
East Town Line- Vinton	Roanoke - Bedford Boundary	26,813	24,858	26,813	34,100	9,242	37%

source: ***Virginia Statewide Highway Planning System***

VDOT forecasts for the year 2015 indicate that the center portion of the corridor is expected to remain the highest traffic volume area of the study corridor. This is consistent with historical and current traffic volume data. However, the data in Table 4 suggest that traffic volume in the central portion of the study corridor will grow at a faster rate than elsewhere in the study corridor. This finding is not consistent with historical traffic growth patterns in the study corridor. This suggests that either historical growth patterns will flatten in the future or that the Year 2015 forecasts displayed in Table 4 underestimate future traffic volume growth in the eastern and western portions of the study corridor and overestimate traffic growth in the central portion of the study corridor.

Two approaches can be used to measure the efficiency of the study corridor. One is to determine if the facility is operating within capacity by comparing segment traffic volume data to segment design service volume data to derive a volume to service volume ratio (V/SV). A V/SV of one

or more (V/SV $\geq$ 1) indicates that the facility is operating over the calculated capacity. This data is contained in Table 5.

Table 5: Year 1992 and 2015 V/SV Ratios for Washington Avenue/Route 24 Segments

Washington Avenue/Route 24 Segment		Year 1992 V/SV Ratio	Year 2015 V/SV Ratio
From Route	To Route		
Pollard Street	Mitchell Street	0.90	1.37
Mitchell Street	Preston Street	0.87	1.24
Preston Street	East Town Line of Vinton	0.87	1.43
East Town Line of Vinton	Roanoke/Bedford County Line	0.93	1.27

source: ***Virginia Statewide Highway Planning System***

As can be seen in Table 5, no segment in the study corridor had a V/SV ratio of more than one in 1992 indicating that no segment was operating over capacity at that time. These calculations do indicate, however, that the facility is closest to capacity and, therefore, experiencing the highest levels of congestion during the day in the eastern portion of the study corridor. This is consistent with earlier findings. V/SV calculations for the year 2015 indicate that all segments in the study corridor will be over capacity by the year 2015.

A second approach to measuring efficiency of the study corridor is to determine the segment levels-of-service (LOS) using the Highway Capacity Software. In this manner a comparison can be made between the operating efficiency of the study corridor on "average" traffic days and "lake" traffic days. An LOS analysis was performed only for the segment of the study corridor for which two-directional evening peak hour counts were collected for both "average" and "lake" traffic days. This was the easternmost segment of the study corridor.

The LOS analysis reveals that the study corridor is currently operating at an LOS of A in the westbound (toward Vinton) direction and B in the eastbound direction (toward Smith Mountain Lake) on a "lake" traffic day and an LOS of A in the westbound direction and B in the eastbound direction on an "average" traffic day. This indicates that the Washington Avenue/Route 24 study corridor is operating satisfactorily near the Roanoke/Bedford County boundary under both traffic conditions considered. This is consistent with earlier findings in this report.

Table I-1 through I-14 in Appendix I present the following information: accidents per mile by segment, accidents by specific corridor location, accidents by segment by severity, accidents by segment by alcohol involvement, accidents by segment by driver action creating accident conditions, accidents by segment by type of collision, accidents by segment by year, accidents by segment by month, accidents by segment by day of week, accidents by segment by time of day, accidents by segment by weather conditions, accidents by segment by surface conditions,

accidents by segment by light conditions and accidents by segment by roadway defects.

A total of 141 accidents were reported in the Washington Avenue/Route 24 study corridor during the three year time period between January 1, 1992 and December 31, 1994. These accidents involved 283 vehicles of various types, the vast majority of which were passenger vehicles. The analysis of accidents by location revealed that the segment of Washington Avenue/Route 24 with the highest number of accidents (21) was the 0.48 mile segment between Route 654 and Route 1010 in Roanoke County in the eastern portion of the study corridor. This segment is the longest in the study corridor and several commercial developments, including the East Vinton Plaza, access to the study corridor on this segment. The second highest accident segment was the .06 mile segment between Maple and Poplar Streets in the Town of Vinton in the western portion of the study corridor. This is one of the shortest segments in the study corridor.

The analysis of accidents per mile, conducted in order to equalize data across segments of varying lengths, revealed that the study corridor segment with the highest number of accidents per mile during the three year study period was the segment between Maple and Poplar Streets (12 accidents, 200 accidents per mile).

The 141 accidents reported over the three year study period occurred at 74 different locations within the study corridor. Approximately 75 percent (56 accident) of accidents occurred at single-accident locations (a single-accident location is a location where only one accident occurred during the three year study period), while the remaining 25 percent (18 accidents) of accidents occurred at multi-accident locations (a multi-accident location is a location where more than one accident occurred during the three year study period). The location within the study corridor with the highest number of accidents (12) was the intersection of Mountain View Road and Washington Avenue/Route 24. Two locations within the study corridor were tied for the second highest number of accidents (8) occurring over the three year study period. Those two locations were the intersections of Washington Avenue/Route 24 and Maple and Blair Streets. Seven accidents occurred at the intersection of Pollard Street and Washington Avenue/Route 24. Six accidents occurred at each of the four following intersections with Washington Avenue/Route 24: Preston Road, By-Pass Road, Marshall Street and Route 673. There were six three-accident locations and four two-accident locations within the study corridor.

Of the twelve accidents occurring at the intersection of Mountain View Road and Washington Avenue/Route 24, all but two occurred on a dry surface during daylight hours. Half of these twelve accidents (6) were angle collisions (one vehicle colliding with one or more vehicles at an angle, regardless of direction of travel) involving a vehicle attempting to make a left-hand turn through the intersection from Washington Avenue/Route 24 to either Mountain View Road or a parking lot for the Washington Avenue Professional Park. Four of these six accidents (25 percent of the twelve accidents occurring at this intersection) were caused by the left-turning vehicle failing to yield the right-of-way. The intersection is located on a steep grade below the crest of a hill making it difficult for vehicles approaching the intersection from either the west or east to see oncoming vehicles. This intersection should be reviewed for the signal allocation for

left-turn motions from Washington Avenue/Route 24 in either direction in order to determine if more time should be allotted to either of these movements, a separate left-turn lane should be constructed or if left-turn motions should be prohibited from being performed at this intersection.

While there is no apparent pattern to accidents occurring at either the intersection of Washington Avenue/Route 24 and Maple or Blair Streets, it is true that neither of these intersections is signalized. An intersection analysis should be conducted to determine if improvements are required to better control traffic flow or if the installation of a traffic signal is warranted.

The analysis of accidents by year revealed no significant trend in terms of one year having more accidents than the other two years of the study period. The analysis of accidents by month revealed that October was the highest accident month over the three year study period, but only by one accident over the month of May. The months when the highest levels of "lake" traffic would be expected to impact accident levels (May through September) were not different from the rest of the year. In fact, the data suggest that the Spring (March, April and May) with 46 accidents (33 percent) was the most likely season for an accident to occur within the study corridor. No trend was detected with regard to one day being more prone to accident occurrences than any other day of the week. The analysis of accidents by time of day revealed that the most likely time for accident occurrence (66 of 141 accidents, 47 percent) over the three year analysis period was roughly during the evening peak hour between 2 and 7 pm.

Of the 141 accidents occurring during the three year analysis period, 104 (74 percent) occurred on a dry road surface. A majority (84 accidents, 60 percent) of the 141 accidents occurred in clear weather conditions. Just over three-quarters of the 141 accidents (110) occurred in full daylight. Almost all (134 accidents, 95 percent) of the 141 accidents occurred on segments with no roadway defects. A synthesis of this data shows that the majority of accidents occurred in dry, clear, daylight conditions on a defect free road segment.

The analysis of accidents by type of collision revealed that the vast majority of the 141 accidents occurring over the three year study period were either rear end collisions (53 accidents, 38 percent) or angle collisions (61 accidents, 43 percent) in which vehicles travelling in the same direction collide from the side. The analysis of accidents by driver action creating accident conditions revealed that the largest single driver action creating accident conditions in the study corridor over the study period was driver actions taken while not having right-of-way (35 accidents, 25 percent). The other two driver actions found to have played a critical role in creating accidents were driver inattention (25 accidents, 18 percent) and following to closely (24 accidents, 17 percent). The analysis of accidents by alcohol involvement revealed that only five accidents (4 percent) occurring in the study corridor during the study period were related to the consumption of alcohol.

There were no accidents resulting in a fatality within the Washington Avenue/Route 24 study corridor. There were 55 accidents reported during the study period which resulted in the injury of 86 people. This represents almost 40 percent of all reported accidents in the study corridor.

The remaining 86 accidents reported involved only property damage.

The average number of injury accidents per study corridor segment during the three year study period was 2.6 accounting for 4.1 injuries. The highest injury accident segment in the study corridor was the segment between Route 654 and Route 1010 with ten of the 55 injury accidents (18 percent) accounting for 19 of the 86 people injured overall (22 percent and almost five times the corridor average). This was also the highest overall accident segment within the study corridor as noted earlier in this section.

Two segments within the study corridor were tied for the second highest number of injury accidents (6) occurring over the three year study period. Those two segments were between Pollard and Maple Streets and Blair and Church Streets. Other segments with higher than average injury accident occurrence rates were between Maple and Poplar Streets, Marshall Street and Bush Drive, Bush Drive and the East Town Line of Vinton, Route 673 and Route 926, Route 926 and the westernmost ramp to the Blue Ridge Parkway and the easternmost ramp to the Blue Ridge Parkway and the Roanoke/Bedford County Line.

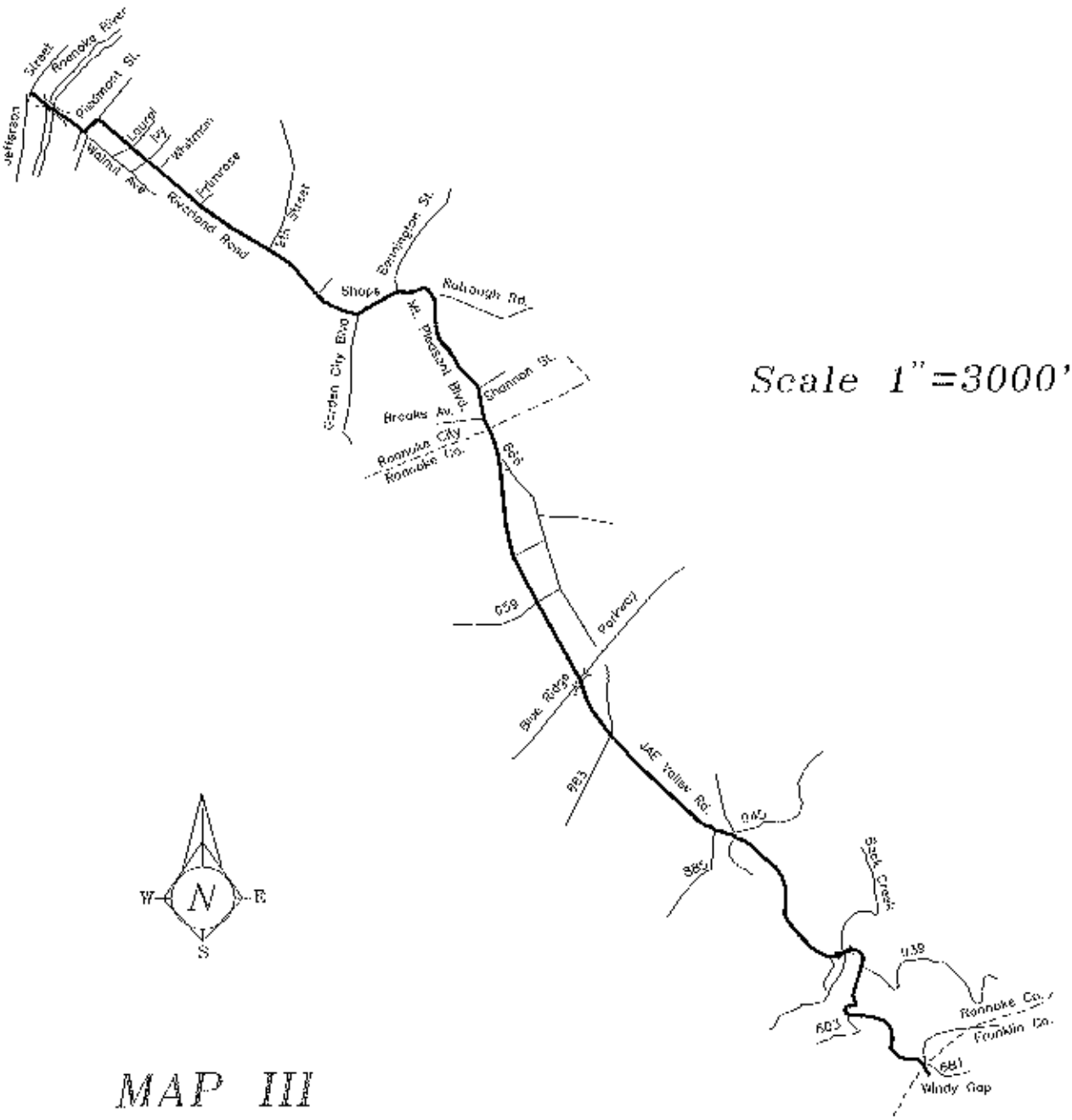
The single location in the study corridor with both the highest number of injury accidents and the most number of people injured in accidents over the three year study period was the intersection of Blair Street and Washington Avenue/Route 24. A total of ten people were injured in five accidents at this one location. This further reinforces the recommendation made earlier in this section that this intersection be reviewed with regard to signalization.

Route 116

The Route 116 study corridor consists of all or part of five different roads in Roanoke City and Roanoke County (see Map III). The study corridor begins at the Roanoke/Franklin County boundary and follows JAE Valley Road, Mount Pleasant Boulevard, Riverland Road, Piedmont Street and Walnut Avenue where it ends at the intersection of Walnut Avenue and Jefferson Street in Roanoke City. The study corridor is 6.2 miles long with 3.3 miles in Roanoke County and 2.9 miles in Roanoke City. It is a two lane road with no medians. Passing is not allowed on most of the corridor with the exception of a small passing zone between the Roanoke City boundary with Roanoke County and the Blue Ridge Parkway. There are sidewalks, curbs and gutters located on both sides of the study corridor on Piedmont Street and Walnut Avenue. The remainder of the study corridor has no sidewalks or curbs and gutters. The only on-street parking in the study corridor occurs on Riverland Road between Whitman and Piedmont Streets. No bicycle facilities or access controls exist within the Route 116 study corridor. Posted speed limits vary in the study corridor from as low as 25 miles per hour on some segments in Roanoke City to as high as 55 miles per hour on some segments in Roanoke County. Pavement widths in the study corridor range between 20 and 24 feet while lane widths vary correspondingly from 10 to 12 feet. The .9 mile section between Back Creek in Roanoke County and the Roanoke/Franklin County boundary is only 20 feet wide and consists of a steep grade and tight turns as it climbs 330 feet to Windy Gap (elevation 1257 feet) on the crest of the Blue Ridge Mountains. The portion of the study corridor located between the Roanoke City/County boundary and Rutrough Road consists of several sharp vertical curves, narrow pavement, encroaching residential development and a close-by stream bed. Three traffic signals are located along the Route 116 study corridor at the intersection of Walnut Avenue and Jefferson Street and the intersections of Riverland Road and 9th Street, Garden City Boulevard and 75 feet south of Garden City Boulevard at a small shopping center entrance.

VDOT has classified the land uses along the Route 116 study as belonging to four different categories: outer business district, residential, suburban low density and rural. These are based both on land use (residential, commercial, etc.) and the number of access points per mile. Land uses in the corridor consist mostly of single family residential development of various densities. Most commercial development in the study corridor is located near the intersections of Piedmont Street and Walnut Avenue and Riverland Road and Garden City Boulevard. Access for the Roanoke Industrial Center is provided at the intersection of 9th Street and Riverland Road. Access for the City Fire Station No. 11 is provided at the intersection of Riverland Road and Bennington Street. The Mount Pleasant Rescue Squad and Fire Department, located near the intersection of JAE Valley Road and Mayfield Drive, also uses Route 116 as its primary vehicle dispatch corridor. The section east of the Blue Ridge Parkway consists of single family residential and agricultural uses. This section has the highest potential for future development in the study corridor based on the amount of available undeveloped land.

Route 116



MAP III

5thPDC

To reveal historic variations of traffic volumes, Table 6 lists the 24-hour two directional traffic volumes between 1984 and 1994 at four different locations along the Route 116 study corridor. It should be noted that VDOT discontinued part of it's count program in 1987 and that fact is reflected in the unavailability of traffic volume data between Route 681 and Back Creek in the study corridor. An estimate of growth has been made for this section of the study corridor by assuming that the rate of growth was the same as the next section of the study corridor, located between the Blue Ridge Parkway and Route 659.

Table 6: 24-Hour Traffic Volumes For Route 116 Study Corridor

Year	Between Route 681 & Back Creek	Between Blue Ridge Parkway & Route 659	Between Bennington St. & Garden City Blvd	Between the Roanoke River & Jefferson St.
1984	3,841	4,260	7,560	6,440
1986	4,357	4,060	7,970	6,190
1988	*	4,480	8,350	4850
1990	*	4,571	8,725	4935
1992	*	4,868	8,892	5614
1994	* (4,724 - estimated)	5,229	9,177	6428
1984-1994 absolute change	(883- estimated)	969	1,617	-12
1984-1994 percent change	(23% - estimated)	23%	21%	-.2%

source: ***Virginia Statewide Highway Planning System*** and ***Roanoke 24-Hour Traffic Volumes***, VDOT

Note: * indicates data which was not available

The highest traffic volumes in the study corridor occur between Garden City Boulevard and Bennington Street. This can, in part, be attributed to the fact that this part of the study corridor carries both Route 116 through traffic and traffic travelling between Bennington Street, Rutrough Road and Garden City Boulevard. This section has also experienced the largest absolute growth in traffic volume in the study corridor over the ten year study period. The fastest growing sections of the study corridor, on a percent growth basis, are located in the southern portions of the study corridor near the Blue Ridge Parkway and the Roanoke/Bedford County boundary.

Over the ten year study period, the bulk of the Route 116 study corridor saw an increase of

approximately 22 percent in traffic volume. The far northern section of the study corridor consisting of Walnut Avenue, Piedmont Street and part of Riverland Road actually experienced a small decrease in traffic volume. This can, in part, be accounted for by the unique alignment of this section of the study corridor which consists of a stoplight, a bridge and a left and right-turn "dogleg" which places a driver on three different urban streets in a very short distance. This section of the study corridor has been at or above it's design capacity for several years. In fact, the Roanoke City Engineering Department developed five different realignment alternatives intended to improve traffic flow from Jefferson Street to Mount Pleasant Boulevard through the study corridor. Two alternatives were recommended. One was to remove the "dogleg" caused by the use of Piedmont Street as a through connection for the study corridor by connecting Riverland Road directly to Walnut Avenue with a new facility. The second was to encourage traffic bound for the Smith Mountain Lake area to utilize Bennington Street to Route 116 southbound instead of accessing the Route 116 corridor at the intersection of Jefferson Street and Walnut Avenue.

According to VDOT, average travel speeds in the rural southern portion of the study corridor, between the Blue Ridge Parkway and Windy Gap (Roanoke/Franklin County boundary) are between 38 and 41 miles per hour. Average travel speeds are below the established 55 mile per hour speed limit due to the constraining physical characteristics of the study corridor alignment which include steep grades and sharp horizontal and vertical curves. In fact, much of the segment from Back Creek south to the Roanoke/Franklin County boundary has signage recommending safe travel speeds of no more than 15 miles per hour.

Table 7 displays a comparison between "lake" traffic day evening peak hour counts and "average" traffic day evening peak hour counts on the Route 116 study corridor. The counts were taken as close as possible to the Roanoke/Franklin County boundary to capture all "lake" traffic while avoiding internal Roanoke City and County traffic. All traffic counts were taken on a Friday evening during the same time frame at the same location in the study corridor in order to maintain consistency between the "lake" and "average" day data.

Table 7: Comparison of Route 116 Evening Peak Hour Volumes

Time	Two Directional Traffic Volumes		Difference Between "Lake" and "Average" Traffic Volumes	
	"Lake" Traffic Day	"Average" Traffic Day		
4:30 - 4:45	104	110	-6	-5.8%
4:45 - 5:00	108	118	-10	-9.3%
5:00 - 5:15	118	102	16	13.6%
5:15 - 5:30	135	132	3	2.2%
5:30 - 5:45	128	125	3	2.3%
5:45 - 6:00	125	125	0	0.0%
6:00 - 6:15	99	97	2	2.0%
6:15 - 6:30	80	83	-3	-3.8%
Total	897	892	5	0.6%
Peak Hour (Shaded)	506	484	22	4.4%

Note: a negative (-) difference indicates "lake" volumes less than equivalent "average" volumes

As can be seen in Table 7, the two-directional evening peak hour traffic volume on the "lake" traffic day was 506 vehicles. The evening peak 15-min periods for both "average" and "lake" traffic volumes are reflected in shades. There were four southbound boat trailers counted in the study corridor during the entire two hour counting period. The two-directional evening peak hour traffic volume on the "average" traffic day was 484 vehicles. This difference in evening peak hour counts (22) suggests that there is no adverse impact to traffic volumes on the Route 116 study corridor created by "lake" traffic.

Year 1987-1992 traffic volume, Year 2015 traffic volume and design service volume data for segments of the Route 116 study corridor contained in the VDOT SHPS database are displayed in Table 8.

Table 8: Year 1987-1992 and 2015 Traffic Volumes for Route 116 Segments

Route 116 Segment		1987-1992		2015		1992-2015	
From Route	To Route	Design Service Volume	Volume and Year	Design Service Volume	Volume	Absolute Volume Change	Percent Volume Change
Route 681	Back Creek	3,402	4,424 (1987)	3,402	7,018	2,594	59%
Back Creek	Blue Ridge Parkway	5,958	4,424 (1987)	5,958	6,300	1,876	42%
Blue Ridge Parkway	Roanoke City/County Boundary	3,832	4,724 (1987)	3,832	7,200	2,476	52%
Roanoke City/County Boundary	Rutrough Road	3,588	4,571 (1990)	3,588	7,200	2,629	58%
Rutrough Road	Bennington Street	5,922	8,725 (1990)	5,922	11,400	2,675	31%
Bennington Street	9th Street	*	8,892 (1992)	13,194	14,300	5,408	61%
9th Street	Piedmont Street	5,922	8,397 (1992)	5,922	8,600	203	2%
Riverland Road	Walnut Avenue	5,499	8,397 (1992)	5,499	8,600	203	2%
Piedmont Street	Jefferson Street	5,461	5,614 (1992)	5,461	8,600	2,986	53%

source: ***Virginia Statewide Highway Planning System***
Note: * indicates data which was not available

VDOT forecasts for the year 2015 indicate that the portion of the study corridor located between Bennington Street and 9th Street is expected to remain the highest traffic volume area of the study corridor. This section is also expected to have the highest traffic volume growth rate in the study corridor over the course of the study period. This finding is substantially consistent with historical traffic growth patterns.

Traffic volumes on the southern portion of the study corridor near Back Creek are also expected to grow at a rapid rate. Since the rural count program was discontinued in 1987, accurate traffic

volume data for this segment have not been available for several years. It is difficult without accurate and up-to-date traffic volume data to determine whether this expectation of high traffic volume growth on the southern section of the study corridor is consistent with historical traffic growth patterns. It is therefore recommended that traffic volume data be updated for this part of the study corridor to verify the accuracy of the year 2015 traffic volume projection. The projected growth in traffic volume, assuming it is accurate, combined with the development potential of the area and the physical restraints of the current roadway alignment will create a potentially hazardous traffic situation in the future. Consideration should be given to either developing a strategy to reduce the rate of traffic volume growth on or improving the physical geometric limitations of this part of the study corridor.

Another high growth area is expected to be the area between the Roanoke City/County boundary and Rutrough Road. This too creates a potentially hazardous scenario based on the physical restraints of portions of this section of the study corridor which include several sharp vertical curves, narrow pavement, encroaching residential development and the close proximity of a stream bed. Again, consideration should be given to either developing a strategy to reduce the rate of traffic volume growth on or improving the physical geometric limitations of this part of the study corridor.

As can be seen in Table 9, which lists volume to service volume ratios in the study corridor, only one segment (Back Creek to the Blue Ridge Parkway) in the Route 116 study corridor was operating below capacity during the respective year for which traffic volume data was available. V/SV calculations for the year 2015 indicate that all segments in the study corridor will be operating over capacity by the year 2015. The segment of the study corridor expected to be the most congested is the far southern segment near the Roanoke/Franklin County boundary. This is because traffic volume is expected to grow by the highest rate on this segment of the study corridor, but is designed to carry the smallest traffic volume in the study corridor. This finding is consistent with previous findings in this section of the report and bolsters the recommendations made.

V/SV calculations for the year 2015 also indicate that the segment between the Roanoke City/County boundary and Rutrough Road is expected to carry twice its designed volume by the year 2015. This segment is four feet narrower than adjacent segments and has several physical characteristics which restrain the efficient movement of traffic. This finding is consistent with previous findings in this section of the report and bolsters the recommendations made.

The LOS analysis reveals that the study corridor is currently operating at an overall LOS of E on a "lake" traffic day and an LOS of E on an "average" traffic day. This indicates that the Route 116 study corridor is not operating satisfactorily near the Roanoke/Franklin County boundary under either traffic condition considered. This is consistent with earlier findings in this report.

Table 9: Year 1992 and 2015 V/SV Ratios for Route 116 Segments

Route 116 Segment		1987-1992 V/SV Ratio	Year 2015 V/SV Ratio
From Route	To Route		
Route 681	Back Creek	1.30	2.06
Back Creek	Blue Ridge Parkway	0.74	1.06
Blue Ridge Parkway	Roanoke City/County boundary	1.23	1.88
Roanoke City/County boundary	Rutrough Road	1.27	2.01
Rutrough Road	Bennington Street	1.47	1.93
Bennington Street	9th Street	*	1.08
9th Street	Piedmont Street	1.42	1.45
Riverland Road	Walnut Avenue	1.53	1.56
Piedmont Street	Jefferson Street	1.03	1.57

source: ***Virginia Statewide Highway Planning System***
Note: * indicates data which was not available

Table I-15 through I-28 in Appendix I present various accident data for the Route 116 study corridor. There were a total of 67 accidents reported on the corridor during the three year period between January 1,1992 and December 31, 1994. These accidents involved 117 vehicles of various types, the vast majority of which were passenger vehicles. The analysis of accidents by location revealed that the .56 mile segment between Route 939 and Route 945 in Roanoke County near Back Creek had the highest number of accidents (7). This segment consists of several sharp vertical curves with short lines of sight and is the second longest of the 24 segments in the study corridor. The second highest accident segment (6) was between Route 663 North and Route 659 in Roanoke County near the Blue Ridge Parkway.

The analysis of accidents per mile, conducted in order to equalize data across segments of varying length, revealed that the study corridor segment with the highest number of accidents per mile during the three year study period was the segment of Piedmont Street between Riverland Road and Walnut Avenue (5 accidents, 71.53 accidents per mile). The two adjoining segments, between Hamilton Terrace and Piedmont Street and Laurel Street and Piedmont Street had the second and third highest accidents per mile. This indicates that the section of the study corridor located in Roanoke City between Laurel Street and Hamilton Terrace has the highest concentration of accidents in the study corridor. This section includes the two intersections which form the "dogleg" discussed earlier and which the Roanoke City Traffic Engineering Department has recommended be improved.

The 67 accidents reported over the three year study period occurred at 56 different locations within the study corridor. Approximately 73 percent of accidents (49 accidents) occurred at single-accident locations, while the remaining 27 percent (18 accidents) occurred at multi-accident locations. The location within the study corridor with the highest number of accidents (4) was the intersection of Piedmont Street and Riverland Road. The intersections of Riverland Road and Laurel Avenue and Riverland Road and 9th Street had the second highest number of accidents (3). Riverland Road is not signalized at Piedmont Street or Laurel Avenue, but does have a signal at 9th Street. No pattern seems to exist in the accident locations, however, in several instances police reports mention improperly parked vehicles near the intersections of Riverland Road with Piedmont Street and Laurel Avenue. Two of the three multiple-accident locations mentioned above (Riverland Road and Piedmont Street and Riverland Road and Laurel Avenue) would be removed from the Route 116 study corridor if the recommendations regarding the removal of the "dogleg" intersections made by the Roanoke City Traffic Engineering Department were implemented.

The analysis of accidents by year revealed no significant trend in terms of one year having more accidents than the other two years of the study period. The analysis of accidents by month revealed that May was the highest accident month (12) over the three year study period with August as the next highest accident month. The months when the highest levels of "lake" traffic would be expected to impact accident levels (May through September) represented nearly 50 percent of accidents in the study corridor. No trend was detected with regard to one day being more prone to accident occurrences than any other day of the week. The analysis of accidents by time of day revealed that the most likely time for accident occurrence (7 accidents, 11 percent) was either between 5 and 6 pm or between 10 and 11 pm. The finding that the most accidents occurred during the evening peak was to be expected, but the finding that many accidents occurred late at night (19 between the hours of 9 pm and 2 am, 28 percent) indicates that many accidents occurring in the study corridor are not related to typical commuter traffic.

Of the 67 accidents occurring during the three year analysis period, 72 percent occurred on a dry road surface, 58 percent occurred in clear weather conditions, 49 percent occurred in full daylight, and 93 percent occurred on roadways free of defects. That most accidents occurred on a dry road surface, in clear weather conditions and on a roadway free of defects. However, 51 percent of accidents occurred in darkness or under partial light conditions.

The analysis of accidents by type of collision revealed that over half of accidents were either angle collisions (31 percent) or fixed object/off road collisions (27 percent). The analysis of accidents by driver action creating accident conditions revealed that driver inattention accounted for 24 percent of accidents. Another 30 percent of accidents (15 percent each) could be attributed to excessive speed and failure to yield right-of-way. These findings of high numbers of accidents involving off road object collisions caused by excessive speed and driver inattention indicate that physical characteristics of the roadway may have contributed to accidents on the study corridor. This finding is consistent with earlier findings related to the physical restraints of the roadbed.

Importantly, the analysis of accidents by alcohol involvement revealed that nearly 30 percent (19) of all accidents reported during the three year study period were related to the consumption of alcohol. Nationally, less than 4 percent of all reported accidents are related to alcohol. This finding suggests that accidents occurring in the study corridor are related to recreational traffic and not commuter traffic, which is consistent with findings made earlier regarding accident occurrences by time of day.

There were no accidents resulting in a fatality within the Route 116 study corridor. Of the 67 accidents reported during the study period, 29 (43 percent) resulted in the injury of 47 people. The remaining 38 accidents reported involved only property damage.

The highest injury accident segment in the study corridor was the segment between Route 939 and Route 945 with 6 of the 29 injury accidents (21 percent) accounting for 14 of the 47 (30 percent) people injured. This was also the highest overall accident segment within the study corridor, as noted earlier in this section. Many of the accidents on this section resulted from vehicles crossing a double yellow line or running off the shoulder of the road on a sharp vertical curve. Several accidents occurred on a series of curves approximately 250 feet north of Route 939 near Back Creek. The next highest injury accident segments were on Piedmont Street between Riverland Road and Walnut Avenue and on Riverland Road between Laurel and Piedmont Streets.

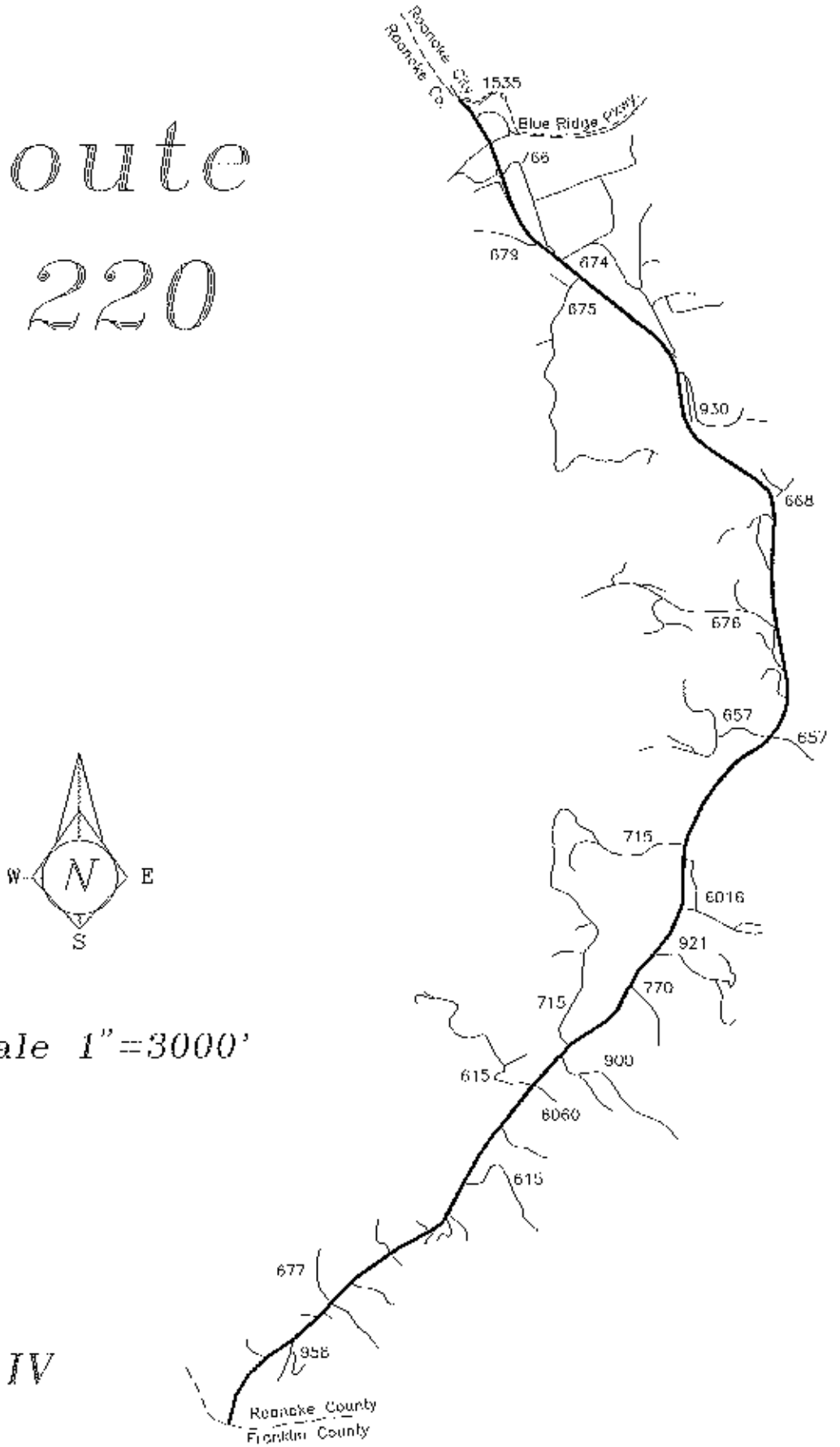
Route 220

The 6.46 mile Route 220 study corridor begins at the Roanoke/Franklin County boundary and ends at the Roanoke City/County boundary located just north of Route 1535 and the Blue Ridge Parkway (see Map IV). The study corridor is located entirely within Roanoke County. The corridor is a four-lane divided highway and has no curbs and gutters, sidewalks or access control. Many intersections in the Route 220 study corridor have a left or right turn lane in addition to the existing four lanes. Because it is a four-lane facility, passing is allowed in the entire study corridor in both directions. There is no on-street parking allowed within the study corridor. The width of the study corridor ranges between 44 and 48 feet. Lane widths range from 11 to 12 feet. The median varies in width from 13 to 15 feet. Shoulder widths range between one and six feet. The posted speed limit at the northern end of the study corridor is 45 miles per hour while the speed limit for the rest of the study corridor is 55 miles per hour. There are a few sharp vertical curves near the center of the study corridor between Route 677 and Route 676. The study corridor contains one traffic signal which is located at the intersection of Route 220 and Route 679. This intersection was only recently signalized and was not in place during the accident study period for this study.

Route 220 is one of the major north-south routes through the Roanoke Valley. Route 220 connects the Roanoke Valley to the Alleghany Highlands and Interstate 64 to the north and to Martinsville and Greensboro and Interstate 85 to the south. Also, the Route 220 corridor is currently listed in the National Highway System as being within the future alignment of Interstate 73. The development of Interstate 73 would remove any current physical defects and alignment problems from the Route 220 study corridor as well as limit the number access points on facility to interstate standards. However, the implementation of Interstate 73 improvements will not occur for several years.

The study corridor is utilized by many motorists as a through route to a distant location well outside of the study corridor itself. Therefore, traffic on the study corridor is less affected by internal land uses than are the other study corridors under analysis in this report. Most of the land in the study corridor is occupied by typical rural land uses including vacant forested land, rural low-density commercial and residential land uses. The segment from Route 770 to the Roanoke City/County boundary is classified by VDOT as suburban-low density based on the number of access points per mile. The suburban-low density segment contains several small commercial land uses (gas stations, a motel, a restaurant etc.). Additional development is likely throughout the study corridor based on the amount of vacant land that appears to be available.

Route 220



Scale 1"=3000'

MAP IV

5thPDC

To reveal historic variations of traffic volumes, Table 10 lists the 24-hour two directional traffic volumes between 1984 and 1994 on two segments of the Route 220 study corridor. The ***Average Daily Traffic Volumes on Interstate, Arterial and Primary Routes*** book maintained by VDOT contains an estimate of traffic volumes for a single 18 mile segment of Route 220 which encompasses the entire study corridor and much more. This estimate is not sufficiently detailed for the purposes of this study. The only other reliable data sources available contain volume data for only two short segments on the entire 6.46 mile study corridor. There is, therefore, a lack of reliable traffic volume data for much of the study corridor and the data which is available contains chronological gaps. Any conclusions drawn from this data are incomplete and should be verified by more detailed and reliable data.

Table 10: 24-Hour Traffic Volumes For Route 220 Corridor

Year	Between Route 677 and Roanoke/Franklin County Boundary	Between Route 1535 and the Blue Ridge Parkway
1984	14,818	20,750
1986	17,047	20,250
1988	*	22,596
1990	25,502	22,825
1992	25,622	35,110
1994	*	27,228
1984-1994 absolute change	10,804 (1984-1992)	6,478
1984-1994 percent change	73% (1984-1992)	31%

source: ***Virginia Statewide Highway Planning System*** and ***Roanoke 24-Hour Traffic Volumes***, VDOT
Note: * indicates data which was not available

Based on the data shown in Table 10, the urban segment of the Route 220 study corridor located near the Roanoke City/County boundary (between Route 1535 and the Blue Ridge Parkway) has a higher traffic volume than the more rural segment located near the Roanoke/Franklin County boundary (Route 677 to the Roanoke/Franklin County boundary). The data also indicates that the rural southern portion of the study corridor experienced a faster rate of traffic volume growth than the more urban northern portion of the study corridor.

Table 11 displays a comparison between Route 220 "lake" traffic day evening peak hour counts and "average" traffic day evening peak hour counts. The counts were taken south of the Blue

Ridge Parkway, but north of connector routes to the Smith Mountain Lake area in order to capture "lake" traffic, but to avoid as much internal Roanoke County and Blue Ridge Parkway traffic as possible.

Table 11: Comparison of Route 220 Evening Peak Hour Volumes

Time	Two Directional Traffic Volumes		Difference Between "Lake" and "Average" Traffic Volumes	
	"Lake" Traffic Day	"Average" Traffic Day		
4:30 - 4:45	372	575	-203	-54.6%
4:45 - 5:00	581	573	8	1.4%
5:00 - 5:15	583	644	-61	-10.5%
5:15 - 5:30	673	648	25	3.7%
5:30 - 5:45	651	668	-17	-2.6%
5:45 - 6:00	653	572	81	12.4%
6:00 - 6:15	588	611	-23	-3.9%
6:15 - 6:30	564	455	109	19.3%
Total	4665	4746	-81	-1.7%
Peak Hour (Shaded)	2565	2533	32	1.2%

Note: a negative (-) difference indicates "lake" volumes less than equivalent "average" volumes

As can be seen in Table 11, the two-directional evening peak hour traffic volume on the "lake" traffic day was 2,565 vehicles. The two-directional evening peak hour traffic volume on the "average" traffic day was 2,533 vehicles. The evening peak 15-min periods for both "average" and "lake" traffic volumes are reflected in shades. This difference in evening peak hour counts (32 vehicles) suggests that there is no adverse impact to traffic volumes on the Route 220 study corridor created by "lake" traffic. However, northbound peak hour traffic (toward the Roanoke Valley from the Smith Mountain Lake area) was much higher (278 vehicles) higher on the "lake" traffic day than on the "average" traffic day while southbound traffic (toward the Smith Mountain Lake area from the Roanoke Valley) was much lower (246 vehicles) on the "lake" traffic day than on the "average" traffic day. This is the opposite of what might have been expected and may indicate that there is some variation between summer and winter traffic, but is difficult to attribute to "lake" traffic based on the direction of the increased flow of traffic.

Year 1990-1992 traffic volume, Year 2015 traffic volume and design service volume data for segments of the Route 220 study corridor contained in the VDOT SHiPS database are displayed in Table 12.

Table 12: Year 1990 - 1992 and 2015 V/SV Ratios for Route 220 Segments

Route 220 Segment		1990-1992		2015		1992-2015	
From Route	To Route	Design Service Volume	Volume and Year	Design Service Volume	Volume	Absolute Volume Change	Percent Volume Change
Franklin/ Roanoke County Boundary	Route 677	45,367	25,622 (1992)	45,367	46,765	21,143	83%
Route 677	.42 miles south of Route 615	36,033	25,622 (1992)	36,033	46,765	21,143	83%
.42 miles south of Route 615	Route 615	27,033	25,622 (1992)	27,033	46,765	21,143	83%
Route 615	Route 900	42,667	25,622 (1992)	42,667	46,765	21,143	83%
Route 900	Route 770	35,015	25,622 (1992)	35,015	32,700	7,078	28%
Route 770	Route 715	31,533	25,622 (1992)	31,533	32,700	7,078	28%
Route 715	Route 668	36,033	19,200 (1990)	36,033	32,900	13,700	71%
Route 668	Blue Ridge Parkway	36,033	22,800 (1990)	36,033	39,600	16,800	74%
Blue Ridge Parkway	Roanoke City/County Boundary	38,787	22,800 (1990)	38,787	39,600	16,800	74%

source: ***Virginia Statewide Highway Planning System***

VDOT forecasts indicate that traffic volumes in the southern segments of the study corridor are expected to increase by up to 83 percent by the year 2015. The volumes on segments closer to

the City of Roanoke are expected to grow at the slightly slower rate of 74 percent. Again, it is important to note that traffic volume data for one segment was applied to multiple segments within the study corridor making any conclusions drawn from this very unreliable.

As can be seen in Table 13, which lists volume to service volume ratios in the Route 220 study corridor, no segment in the Route 220 study corridor was operating above capacity during the respective year for which traffic volume data was available. VSV calculations for the year 2015 indicate that all but two segments in the study corridor will be operating over capacity by the year 2015. The segment of the study corridor expected to be the most congested is the segment near Route 615. This is because future traffic volumes are expected to grow by the highest rate on this segment of the study corridor, but it is designed to carry the smallest traffic volume in the study corridor.

Table 13: Year 1992 and 2015 V/SV Ratios for Route 220 Segments

Route 220 Segment		Year 1990-1992 V/SV Ratio	Year 2015 V/SV Ratio
From Route	To Route		
Franklin/Roanoke County Boundary	Route 677	0.56	1.03
Route 677	.42 miles south of Route 615	0.71	1.30
.42 mile south of Route 615	Route 615	0.95	1.73
Route 615	Route 900	0.60	1.10
Route 900	Route 770	0.73	0.93
Route 770	Route 715	0.81	1.04
Route 715	Route 668	0.53	0.91
Route 668	Blue Ridge Parkway	0.63	1.10
Blue Ridge Parkway	Roanoke City/County Boundary	0.59	1.02

source: ***Virginia Statewide Highway Planning System***

The LOS analysis reveals that the study corridor is currently operating at an LOS of B in the northbound (toward Roanoke City) direction and B in the southbound direction (toward Smith Mountain Lake) on a "lake" traffic day and an LOS of C in the northbound direction and B in the southbound direction on an "average" traffic day. This indicates that the Route 220 study corridor is operating satisfactorily under both traffic conditions considered. This is consistent with findings made earlier in this report.

Table I-29 through I-42 in Appendix I present accident data for the Route 220 study corridor. There were a total of 128 accidents involving 224 vehicles during the three year period between January 1, 1992 and December 31, 1994.

The analysis of accidents by location revealed that the .73 mile segment between Route 677 and Route 615 south had the highest number of accidents (23). This segment is the longest of the 27 segments in the Route 220 study corridor. The second highest accident (15 accidents) segment was between Route 668 and Route 930, which was the second longest segment in the corridor at .62 miles. The analysis of accidents per mile, conducted in order to equalize data across segments of varying length, revealed that the study corridor segment with the highest number of accidents per mile during the three year study period was the segment between Route 1535 and the Roanoke City/County boundary (5 accidents, 166.67 accidents per mile). The segment with the second highest accidents rate per mile was between the Blue Ridge Parkway and Route 766 (2 accidents, 100 accidents per mile).

The 128 accidents reported over the three year study period occurred at 108 different locations within the study corridor. Exactly 50 percent of accidents (64 accidents) occurred at single-accident locations, while the remaining 50 percent (64 accidents) occurred at multi-accident locations. The location within the study corridor with the highest number of accidents (8) was the intersection of Route 220 and Route 679. This intersection was not signalized when these eight accidents occurred. The intersection of Route 220 and Route 679 was signalized on August 11, 1995. This will help reduce the number of accidents at this intersection. The intersection with Route 675 had the second highest number of accidents (7), while the intersection with Route 676 had six accidents over the three year study period. These multiple-accident intersections most likely have more vehicles performing turn movements through them because they provide access to residential areas which are set back from Route 220. A more detailed analysis of these intersections would be required to determine if improvements, such as turning lanes or signalization, are warranted.

The analysis of accident by year, month and time of day did not reveal any unusual patterns. The three hours from 3:00 pm to 6:00 pm were the highest accident hours and accounted for 31 percent (40 accidents) of the 128 accidents, as may be expected for a peak traffic period.

Of the 128 accidents occurring during the three year analysis period, 90 percent (116 accidents) occurred on a roadway free of defects. The analysis of accidents by weather condition revealed that 78 percent of accidents (100 accidents) occurred in clear or cloudy conditions, while 22 percent occurred in rain, sleet, snow or mist. The analysis of accidents by light condition revealed that 63 percent of accidents (81 accidents) occurred during daylight hours. The analysis of accidents by surface condition revealed that 74 percent of accidents (95 accidents) occurred on a dry surface.

The analysis of accidents by type of collision revealed that 32 percent (41 accidents) of accidents in the study corridor were collisions with fixed off-road objects. Thirty percent (39 accidents)

were angle collisions and 18 percent (23 accidents) were rear-end collisions. Twenty-three percent (29 accidents) of study corridor accidents were caused by driver inattention. Failure to yield right of way accounted for 20 percent (26 accidents) of the accidents and fifteen percent of the accidents could be attributed to excessive speed or following too closely (10 accidents each).

There were two fatal accidents occurring in the study corridor which took the lives of two people. One of these fatal accidents occurred at the intersection of Route 676 and Route 220. The accident at the intersection of Route 676 and Route 220 involved an eastbound, left-turning vehicle entering Route 220 from Route 676 and being struck by a southbound vehicle on Route 220. Vehicle movements through this intersection are controlled by a stop sign, This intersection has been identified as one of the highest accident locations in the study corridor. The other fatal accident occurred north of the intersection of Route 921 and Route 220 where there are several vertical curves in the Route 220 alignment. This accident involved a single northbound vehicle striking a guardrail and crossing the median and flipping several times before coming to a stop.

Of the remaining, non-fatal accidents, 48 percent (62 accidents) resulted in the injury of 97 people. Fifty percent (64 accidents) of accidents resulted in only property damage. The highest injury accident segment in the study corridor was the segment between Route 677 and Route 615 south (13 injury accidents). A number of accidents on this segment occurred as a result of ice on bridges.

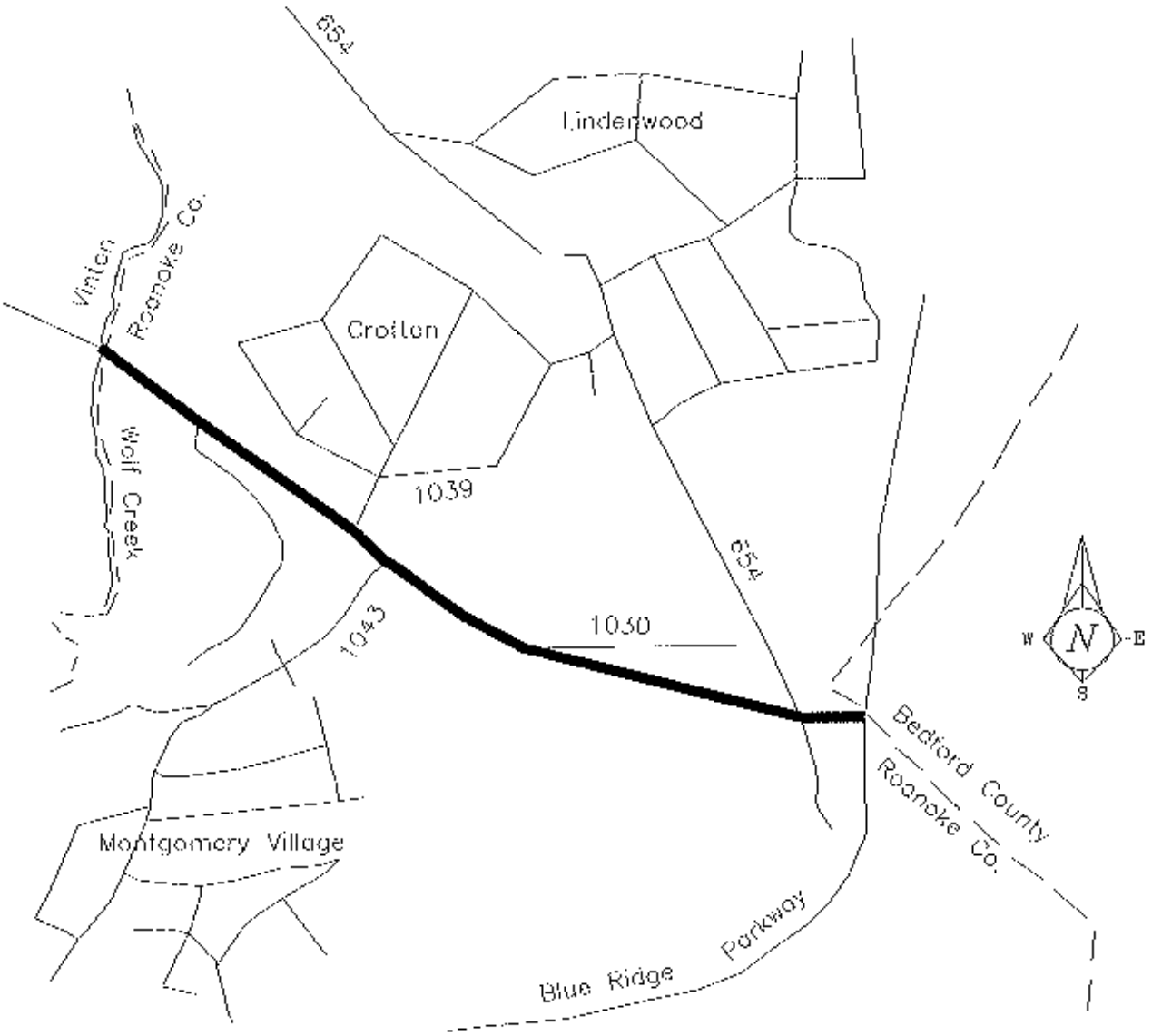
Route 634

The one mile Route 634 study corridor is located entirely within Roanoke County (see Map V). It is a two lane highway marked with a double yellow line and white edge lines. Passing is allowed on 18 percent of the study corridor (where). There are no sidewalks or curbs and gutters within the study corridor. Many driveways and roadways access Route 634 in the study corridor as there is no access control. There is no on-street parking allowed in the study corridor. The speed limit in the study corridor is 45 miles per hour and the average travel speed is 42 miles per hour. Route 634 in the study corridor is 24 feet wide. Lane widths are 12 feet. Both sides of Route 634 have two to four foot wide gravel and earthen shoulders. There are no traffic signals located in the study corridor.

Route 634 in the Town of Vinton was not evaluated in this study because it is scheduled to be widened and improved in the statewide ***Six Year Improvement Program*** making an analysis of current operating conditions of little value. Route 634 in the Town of Vinton will become a four lane divided highway after plans are implemented while Route 634 in Roanoke County will remain a two lane undivided facility. The improved section of Route 634 in the Town of Vinton will be designed to accommodate a class two bicycle facility (a designated bicycle lane which lies within the same roadbed as the motorized vehicular facility) making it even wider than a typical four-lane divided highway.

VDOT has classified the land uses located in the study corridor as being suburban low density. This classification is based on the existence of between eleven and twenty-one access points (driveways, roads and other private entrances) per mile in the study corridor. The majority of land in the study corridor is used for residential purposes of various densities. Two large subdivisions (200+ single family homes) which generate substantial traffic volumes are located north and south of the study corridor just a few yards east of the Vinton/Roanoke County boundary. The development to the north accesses the study corridor via Route 1037 while the development to the south accesses the study corridor via Route 1043. Additionally, field observation data suggest that additional traffic in the study corridor from Route 1037 is generated by the Lindenwood residential area located north of Route 654. These developments generate considerable traffic in the study corridor. Additional development is likely within the study corridor. The scheduled improvements to Route 634 in Vinton will only serve to increase development pressures in the study corridor.

Route 634/Hardy Road



MAP V

Scale 1"=1000'

5thPDC

In order to reveal historic variations in traffic volumes, Table 14 lists the 24-hour two directional traffic volumes between 1984 and 1994 at five different location along the study corridor.

Table 14: 24-Hour Traffic Volumes For Route 634 Study Corridor

Year	Between Vinton/Roanoke County Boundary & Route 1037	Between Route 1037 & Route 1043	Between Route 1043 & Route 1030	Between Route 1030 & Route 654	Between Route 654 & Bedford/Roanoke County Boundary
1984	8,433	6,696	4,284	4,263	4,449
1986	11,373	8,121	5,525	5,559	6,166
1988	11,615	2,020	5,662	*	*
1990	11,716	*	*	*	6,603
1992	12,114	*	*	*	6,649
1994	12,317	4,096	6,218	5,459	6,003
1984-1994 absolute change	3,884	-2,600	1,934	1,196	1,554
1984-1994 percent change	46%	-39%	45%	28%	35%

source: ***Secondary Traffic Section Tabulation Report***, VDOT
Note: * indicates data which was not available

The highest traffic volumes in the study corridor occur between the Vinton/Roanoke County boundary and Route 1037. This can, in part, be attributed to the large number of residential units located on and off of Route 1037 as well as to the observed use of Route 1037 as a through route to the Lindenwood neighborhood north of the study corridor. This segment also experienced the largest absolute and percent growth in traffic volume in the study corridor over the ten year study period. Data indicate that approximately half the traffic in the study corridor originates or terminates at Route 1037.

Data for the short segment between Route 1037 and Route 1043 indicate that traffic volumes actually declined by 39 percent over the ten year study period. This does not correlate with the data for other segments of the study corridor and differ from observed traffic movements in the study corridor. Large fluctuations in the data, especially between 1986 to 1988, also indicate that the data for this segment of the study corridor are not reliable. It is likely that traffic generated

by the residential development located on and off Route 1043 impacts Route 634 substantially.

Table 15 displays a comparison between "lake" traffic day evening peak hour counts and "average" traffic day evening peak hour counts on the Route 634 study corridor. The counts were taken near the Roanoke/Bedford County boundary in order to capture all "lake" traffic while avoiding internal Roanoke County traffic. All traffic counts were taken on a Friday evening during the same time frame at the same location in the study corridor in order to maintain consistency between the "lake" and "average" traffic day data.

Table 15: Comparison of Route 634 Corridor Peak Hour Volumes

Time	Two Directional Traffic Volumes		Difference Between "Lake" and "Average" Traffic Volumes	
	"Lake" Traffic Day	"Average" Traffic Day		
4:30 - 4:45	97	128	-31	-32.0%
4:45 - 5:00	98	112	-14	-14.3%
5:00 - 5:15	99	107	-8	-8.1%
5:15 - 5:30	112	154	-42	-37.5%
5:30 - 5:45	130	129	1	0.1%
5:45 - 6:00	108	137	-29	-27.9%
6:00 - 6:15	141	119	22	15.6%
6:15 - 6:30	109	113	-4	-3.7%
Total	894	999	-105	-11.7%
Peak Hour (Shaded)	491	539	-48	-9.8%

Note: a negative (-) difference indicates "lake" volumes less than equivalent "average" volumes

As can be seen in Table 15, the two-directional evening peak hour traffic volume on the "lake" traffic day was 491 vehicles. The two-directional evening peak hour traffic volume on the "average" traffic day was 539 vehicles. This difference in evening peak hour counts (48 vehicles) suggests that there is no adverse impact to traffic volumes on the Route 634 study corridor created by "lake" traffic. The evening peak 15-min periods for both "average" and "lake" traffic volumes are reflected in shades.

Year 1992 and 2015 traffic volume and design service volume data for the Route 634 study corridor contained in the VDOT SHiPS database are displayed in Table 16. Roanoke County traffic volume data indicate that the VDOT SHiPS data listed for the entire Route 634 study

corridor are only valid for the segment from the Vinton/Roanoke County boundary to Route 1037. Similar data for the remainder of the study corridor are unavailable as VDOT has utilized the data valid only for the segment between the Vinton/Roanoke County boundary and Route 1037 for the entire study corridor. It is recommended that VDOT consider dividing the current Route 634 study corridor SHiPS data into smaller segments in order to create a more detailed database for future monitoring and planning purposes. The segment of the study corridor shown in Table 16 is expected to experience a 39 percent growth in traffic volume by 2015.

Table 16: Year 1992 and 2015 Volumes and Design Service Volumes for Route 634

Route 634 Segment		1992		2015		1992-2015	
From Route	To Route	Design Service Volume	Volume	Design Service Volume	Volume	Absolute Volume Change	Percent Volume Change
Vinton/Roanoke County Boundary	Route 1037	7,326	12,114	7,326	16,800	4,686	39%

source: ***Virginia Statewide Highway Planning System***

Table 17 displays the year 1992 and 2015 V/SV ratios for the Route 634 segment from the Vinton/Roanoke County boundary Route 1037.

Table 17: Year 1992 and 2015 V/SV Ratios for Route 634 Segment

Route 634 Segment		Year 1992 V/SV Ratio	Year 2015 V/SV Ratio
From Route	To Route		
Vinton/Roanoke County Boundary	Route 1037	1.65	2.29

source: ***Virginia Statewide Highway Planning System***

In 1992, the segment of the Route 634 study corridor between the Vinton/Roanoke County boundary and Route 1037 was above capacity. By the year 2015 it is expected to be 2.29 times above capacity.

The high projected V/SV ratio, the expected daily traffic volume growth and the pressure for further residential development in the study corridor spurred on by the widening of the Town of Vinton section of Route 634 to four lanes suggests that improvements to the Route 634 study corridor segment between the Vinton/Roanoke County boundary and Route 1037 will be required in the short run to avoid serious deterioration of traffic conditions. A more detailed study of this segment, including intersection analysis, should be conducted in order to develop a list of recommended improvements.

The LOS analysis reveals that the study corridor is currently operating at an overall LOS of C on a "lake" traffic day and an LOS of C on an "average" traffic day. This indicates that the easternmost segment of the Route 634 study corridor is operating satisfactorily under both traffic conditions considered.

Table I-43 through I-56 in Appendix I present accident data for the Route 634 study corridor. There were a total of 15 accidents involving 28 vehicles during the three year period between January 1, 1992 and December 31, 1994. It is important to note that the small data sample (15 accidents) made accident analysis difficult and results may not be representative of long term trends.

The analysis of accidents by location revealed that the .33 mile segment between Route 1043 and Route 1030 had the highest number of accidents (9). This is the longest segment in the study corridor. The second highest (3 accidents) segments were between Route 1037 and Route 1043, and between Route 654 and the Roanoke/Bedford County boundary. The analysis of accidents per mile, conducted in order to equalize data across segments of varying length, revealed that the segment between Route 1037 and Route 1043 had the highest accident rate per mile (3 accidents, 75 accidents per mile).

The 15 accidents reported over the three year study period occurred at five different locations within the study corridor. Approximately 87 percent of accidents (13 accidents) happened at a multiple accident location. Five accidents occurred at the intersection of Route 634 and Route 1043, three accidents occurred at the intersection of Route 634 and Route 1037, and three accidents occurred at the intersection of Route 634 and Route 654. Of the remaining four accidents, one was related to traffic activity at the intersection of Route 634 and Route 1043. Thus, 40 percent (six accidents) were related to traffic through the intersection of Route 634 and Route 1043.

The analysis of accidents by year, month and time of day revealed that accident occurrence could not be linked to any one month or season. It can be noted that six accidents (40 percent) occurred on a Friday and an additional three (20 percent) occurred on a Saturday. In all, 67 percent of the 15 accidents occurred on a Friday, Saturday or Sunday. Three accidents (20 percent) occurred between 5 pm and 6 pm.

An analysis of accidents by roadway defect, surface condition, weather condition and light condition revealed no unusual patterns. The analysis of accidents by type of collision revealed that seven (47 percent) were angle collisions, four (27 percent) were rear-end collisions and three (20 percent) were fixed object/off road collisions. The analysis of accidents by driver action revealed that three accidents (20 percent) were caused by failure to yield right-of-way and another 20 percent were caused by driver inattention. Two (13 percent) were caused by following to closely, while another two were caused by excessive speed. Alcohol was not a factor in any of the 15 accidents.

There were no accidents resulting in a fatality in the Route 634 study corridor. Of the 15 accidents reported during the study period, eight (53 percent) resulted in the injury of 17 people. The remaining seven accidents resulted in only property damage. The highest injury segment was between Route 1037 and Route 1043 with six of the eight injury accidents.

CHAPTER 4

FINDINGS & RECOMMENDATIONS

Findings

Route 24/Washington Avenue

- The center portion of the study corridor in the Town of Vinton has the highest traffic volume, but traffic volume is growing fastest in the eastern portion of the study corridor in Roanoke County.
- Average speeds are lowest in the eastern portion of the study corridor.
- The facility is closest to capacity and, therefore, experiencing the highest levels of congestion during the day in the eastern portion of the study corridor.
- There is no adverse impact to traffic volumes on the Washington Avenue/Route 24 study corridor indicated by "lake" traffic.
- All segments in the study corridor are projected to be over capacity ($V/SV \geq 1$)by the year 2015.
- The highest number of accidents and injury accidents occurred between Route 654 and Route 1010 in the eastern portion of the study corridor.
- The highest number of accidents per mile occurred between Maple and Poplar Streets in the western portion of the study corridor.
- More accidents occurred at the intersection of Mountain View Road and Washington Avenue/Route 24 than any other single location in the study corridor.
- Other locations with high numbers of accidents were at the intersections of Washington Avenue/Route 24 and Maple, Blair, Pollard and Marshall Streets, Preston and By-Pass Roads, and Route 673.
- The location in the study corridor with both the highest number of injury accidents and the most number of people injured was the intersection of Blair Street and Washington Avenue/Route 24.

Route 116

- Traffic volume data later than 1987 was unavailable for the southern section of the study

corridor.

- The section of the study corridor between Back Creek and the Roanoke/Franklin County boundary is narrow and consists of a very steep grade and tight turns.

- The portion of the study corridor located between the Roanoke City/County boundary and Rutrough Road consists of several sharp horizontal curves, narrow pavement, encroaching residential development and a close-by stream bed.

- The highest traffic volumes occur between Garden City Boulevard and Bennington Street in Roanoke City, but is growing fastest in the southern portions of the study corridor in Roanoke County.

- The far northern section of the study corridor consisting of Walnut Avenue, Piedmont Street and part of Riverland Road experienced a decrease in traffic volume which can partially be accounted for by an alignment consisting of a stoplight, a bridge and a left and right-turn "dogleg." This section of the study corridor has been operating at or above capacity for several years.

- Average speeds are lowest in the southern portion of the study corridor.

- There is no adverse impact to traffic volumes on the Route 116 study corridor created by "lake" traffic.

- The segment between Back Creek and the Blue Ridge Parkway currently operates below capacity and all segments in the study corridor will be operating over capacity by the year 2015.

- The far southern segment is projected to be the most congested by the year 2015.

- The segment between the Roanoke City/County boundary and Rutrough Road is projected to carry twice capacity by the year 2015.

- The segment between Route 939 and Route 945 in Roanoke County near Back Creek had the highest number of accidents and injuries.

- The highest number of accidents per mile and the second highest number of injuries occurred on Piedmont Street between Riverland Road and Walnut Avenue in Roanoke City.

- More accidents occurred at the intersection of Piedmont Street and Riverland Road than at any other single location in the study corridor.

- Many accidents occurred late at night indicating that many accidents in the study corridor

are not related to typical commuter traffic.

- High numbers of accidents involved off road object collisions indicating that physical characteristics of the roadway itself may have contributed to accidents.

- Nearly 30 percent of all accidents reported were related to the consumption of alcohol suggesting that many accidents are not related to typical commuter traffic.

Route 220

- There are a few sharp vertical curves near the center of the study corridor between Route 677 and Route 676

- The Route 220 corridor is currently listed in the National Highway System as being within the future alignment of Interstate 73. The development of Interstate 73 would remove any current physical defects and alignment problems from the Route 220 study corridor as well as limit the number access points on facility to interstate standards. However, the implementation of Interstate 73 improvements will not occur for several years.

- There is a lack of reliable traffic volume data for much of the study corridor and the data which is available contains chronological gaps. Conclusions drawn from this data are incomplete and should be verified by more detailed and reliable data.

- There is no adverse impact to traffic volumes on the Route 220 study corridor created by "lake" traffic.

- All but two segments in the study corridor are projected to be operating over capacity by the year 2015.

- The segment projected to be the most congested is near Route 615 in the southern portion of the study corridor.

- The segment between Route 677 and Route 615 south had the highest number of accidents.

- The segment with the highest number of accidents per mile was between Route 1535 and the Roanoke City/County boundary

- More accidents occurred at the intersection of Route 220 and Route 679 than at any other single location in the study corridor. This intersection was not signalized during the accident analysis study period, but has since been signalized.

- Several accidents also occurred at the intersections of Route 220 and Route 675 and 676.

- A fatal accident occurred at the intersection of Route 676 and Route 220.

- A fatal accident occurred north of the intersection of Route 921 and Route 220 where there are several vertical curves in the Route 220 alignment.

- The highest injury accident segment in the study corridor was the segment between Route 677 and Route 615 south. A number of accidents on this segment occurred as a result of ice on bridges.

Route 634

- Route 634 in the Town of Vinton was not evaluated in this study because it is scheduled to be widened and improved over the course of the next few years.

- Data for the segment between Route 1037 and Route 1043 does not correlate with the data for other segments of the study corridor and differ from observed traffic movements in the study corridor. Large fluctuations in the data, especially between 1986 to 1988, also indicate that the data for this segment of the study corridor are not reliable.

- VDOT SIIiPS data for the study corridor east of Route 1037 are invalid as VDOT has applied the data valid only for the segment between the Vinton/Roanoke County boundary and Route 1037 for the entire study corridor.

- The highest and fastest growing traffic volumes occur between the Vinton/Roanoke County boundary and Route 1037.

- There is no adverse impact to traffic volumes on the Route 634 study corridor created by "lake" traffic.

- The segment between the Vinton/Roanoke County boundary and Route 1037 was above capacity and is projected to be 2.29 times above capacity by the year 2015.

- The small data sample made accident analysis difficult and results may not be representative of long term trends.

- The segment between Route 1043 and Route 1030 had the highest number of accidents

- The segment between Route 1037 and Route 1043 had the most injuries and highest accident rate per mile.

- More accidents occurred at the intersection of Route 634 and Route 1043 than at any

other single location in the study corridor.

Recommendations

The recommendations section coordinates research findings and analysis results to provide localities with a workable list of potential improvement elements. Efforts are made to ensure that only feasible, acceptable and potentially effective solutions are considered. Candidate actions are refined into detailed physical, operational and other necessary changes tailored to specific problems and locations. Improvement recommendations should be coordinated with both the local secondary six year plans and the statewide ***Six-Year Improvement Program*** and local land use and economic development policies so that these improvements are in harmony with other initiatives and may be allocated funds for implementation based on local priorities.

The following recommendations are based solely on the analysis conducted in this study. These recommendations are made based solely on the transportation analysis made as part of this study and do not take into account the potential environmental, land-use and other socio-economic impacts and costs which may be associated with their implementation. It is suggested that environmental, land-use and other cost/benefit analyses be conducted prior to the implementation of any of the more substantial and expensive of the following recommendations. Further, members of the community should be given an opportunity to participate in the decision making process with regard to the implementation of any suggested transportation improvements. Further, this list includes some recommendations which, if implemented, would be expensive and require significant construction. Not all recommendations need be implemented in order to improve conditions within the study area. Incremental implementation of lower cost, less intrusive improvements may be adequate to improve conditions over the short run. Priorities with regard to which recommendations are appropriate to implement and the time frame for implementation should be established by localities, VDOT and the public. It is important to further note that not all road improvements, regardless of merit, can be implemented due to funding limitations. This fact should be accounted for when setting implementation priorities.

General Recommendations

- Land uses in the four study area localities should be tailored so as not to channel significant traffic onto study corridor segment which are currently operating at or over capacity. Efforts should be made to improve all segments which are currently operating at or over capacity by such means as are necessary.

- Future land uses in the four study area localities should be tailored so as not to significantly impact traffic volumes on study corridor segment which are projected to be operating at or over capacity by the year 2015. Efforts should be made to either curtail traffic on or improve all segments which are projected to be operating at or over capacity by the year 2015 in advance of this condition.

Site Specific Recommendations

Washington Avenue/Route 24

- Warning signals should be installed on Washington Avenue/Route 24 to the east and west of the intersection of Mountain View Road and Washington Avenue/Route 24 warning motorists of potential left-turning vehicles at the intersection.

- The intersection of Mountain View Road and Washington Avenue/Route 24 should be reviewed for the signal allocation for left-turn motions from Washington Avenue/Route 24 in either direction in order to determine if more time should be allotted to either of these movements, separate left-turn lanes should be constructed or if left-turn motions should be entirely prohibited from being performed at this intersection.

- The intersection of Washington Avenue/Route 24 and Blair Street should be reviewed to determine if improvements or signalization is warranted.

- The intersection of Washington Avenue/Route 24 and Maple Street should be reviewed to determine if improvements or signalization is warranted.

- The intersection of Washington Avenue/Route 24 and the access road to William Byrd High school in the eastern portion of the study corridor should be reviewed to determine if improvements or signalization is warranted.

- The signalized intersection of Washington Avenue/Route 24 and the East Vinton Plaza should be reviewed to determine if allocation of time is appropriate for turning motion volumes.

- As traffic volumes increase, particularly in the eastern portion of the study corridor, access control measures should be implemented in order to limit the number of points at which vehicles can access Washington Avenue/Route 24 directly.

Route 116

- Traffic volume data should be updated for the southern portions of the study corridor in order to assess historical traffic trends, determine current operating efficiency and to improve the accuracy of future traffic volume projections.

- Either a congestion management strategy should be developed to reduce the rate of traffic volume growth south of Back Creek or improvements increasing capacity should be implemented.

- Either a congestion management strategy should be developed to reduce the rate of traffic volume growth between the Roanoke City and Roanoke County boundary lines or improvements increasing the roadway capacity should be made.

- The intersection of Route 116 and Bennington Street in Roanoke City should be reviewed to determine if signalization is warranted.

- The Roanoke City Engineering Department suggestions to improve traffic flow from Jefferson Street to Mount Pleasant Boulevard through the study corridor should be implemented. The recommendations included removing the "dogleg" caused by the use of Piedmont Street as a through connection for the study corridor by connecting Riverland Road directly to Walnut Avenue with a new facility and encouraging traffic bound for the Smith Mountain Lake area to utilize Bennington Street to Route 116 southbound instead of accessing the Route 116 corridor at the intersection of Jefferson Street and Walnut Avenue.

Route 220

- More detailed traffic volume data should be collected for the entire study corridor in order to asses historical traffic trends, determine current operating efficiency and to improve the accuracy of future traffic volume projections.

- The intersection of Route 220 and Route 675 should be reviewed to determine if the addition of turn-lanes or signalization is warranted.

- The intersection of Route 220 and Route 676 should be reviewed to determine if the addition of turn-lanes or signalization is warranted.

- Where feasible, spot improvements to straighten the corridor should be made between Route 677 and Route 676. High implementation costs should be avoided as the eventual construction of Interstate 73 will completely alter traffic patterns in this corridor.

Route 634

- More detailed traffic volume data should be collected for the segment of study corridor between Route 1037 and Route 1043 in order to asses historical traffic trends, determine current operating efficiency and to improve the accuracy of future traffic volume projections.

- VDOT should update the current Route 634 study corridor SHiPS database using data from the ***Secondary Traffic Section Tabulation Report*** in order to create a more detailed database for future monitoring and planning purposes.

- Improvements to the segment between the Vinton/Roanoke County boundary and Route 1037 will be required in the short run to avoid serious deterioration of traffic conditions. A more detailed study of this segment, including intersection analysis, should be conducted in order to develop a list of recommended improvements.