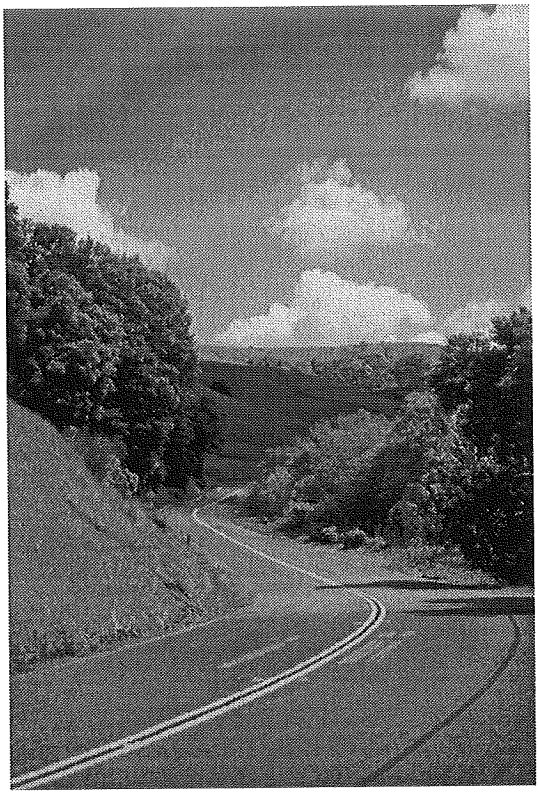
ROUTE 221
SUB-AREA ROADS STUDY



Prepared by the Staff
of the
Fifth Planning District Commission

June 1995

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.

The contents of this report reflect the views of the author, who is responsible for the facts and the accuracy of the data presented herein. The contents do not necessarily reflect the official views or the policy of the Federal Highway Administration, the Virginia Department of Transportation or the County of Roanoke. This report does not constitute a standard, specification, regulation.

Federal Highway Administration, Virginia Department of Transportation and County of Roanoke acceptance of this report as fulfillment 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.

ACKNOWLEDGEMENTS

The ***Route 221 Sub-Area Roads Study*** has been prepared by the staff of the Fifth Planning District Commission as required by the ***Fiscal Year 1995 Unified Transportation Work Program***. The professional advice and assistance of several individuals was invaluable to the completion of this project.

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EXECUTIVE SUMMARY

One of the fastest growing locations in the Roanoke Valley lies on either side of Route 221 south of Route 419. This area of Roanoke County encompasses part or all of the Cave Spring, the Back Creek, the Poage's Mill and the Bent Mountain neighborhoods. This part of southwest Roanoke County has seen a tremendous expansion in residential development over the past several years. Most of this residential development is occurring either directly on old existing farm roads or in residential subdivisions which funnel traffic onto these small rural roads. Narrow pavement widths, sharp curves, limited sight distances, steep gradients, narrow or no shoulders and increasingly high traffic volumes characterize the conditions currently found on these old roads. Pressure for future residential development abounds. Attractions for future residential development include the significant aesthetic appeal of the area due to the proximity of the mountains and the Blue Ridge Parkway, excellent public schools and the potential extension of public water, public sewer and natural gas service. Increased residential development, and the increased traffic volumes that residential development generates, will further exacerbate the congestion and safety problems experienced on these secondary roads which are not designed to current standards. This study focuses on the nineteen highest traffic volume roads in this area of Roanoke County and documents existing conditions, identifies problems and makes recommendations to improve both safety and convenience.

A traffic growth and circulation analysis, a highway level-of-service (LOS) analysis, a physical geometries analysis and a traffic accident analysis were carried out for each of the nineteen roads within the study area. The traffic growth and circulation analysis reviews the growth of traffic volumes between 1984 and 1994. The highway LOS analysis utilizes both physical geometric and peak-hour traffic volume input to derive a measurement of operating efficiency. 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 have an impact on travel conditions. The traffic accident analysis attempts to identify significant patterns in accident occurrences.

Based on the above mentioned analysis, a list of recommendations to improve the roads reviewed in this study was made. These recommendations were made based solely on transportation analysis 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, as well as a full public participation process, be conducted prior to the implementation of any of the more substantial and expensive recommendations. Incremental implementation of the lower cost, less intrusive improvements may be adequate to improve conditions in the short run.

General Recommendations: 1) Roads in the study area with unprotected shoulders which meet or exceed VDOT criteria should be considered for the placement of a guardrail. Priority should be given to roads which are either considered hazardous or high volume; 2) Roads in the study area meeting VDOT criteria should be considered for the placement of a yellow center line and/or a white road edge marking; and 3) Roads in the study area with current daily traffic volumes meeting VDOT criteria should be considered for widening. Priority should be given to

those roads which are expected to see substantial gains in daily traffic volumes in the future or which are deemed unsafe.

Site Specific Recommendations

Route 613 - **Short Term**: 1) Widen and straighten between Route 1564 and Route 1726, and 2) Conduct a traffic signal study at the intersections of Route 904 and Route 907.

Route 688 - **Short Term**: 1) Conduct a traffic speed study, and 2) Widen and straighten between Route 613 and Route 934.

Route 689 - **Short Term**: 1) Post warning signs between Route 1796 and Route 1668, and 2) Conduct a traffic signal study at the intersection of Route 1796. **Long Term**: Widen and straighten between Route 1796 and Route 1668.

Route 690 - **Short Term**: Post warning signs along the entire length of Route 690. **Long Term**: Widen and straighten between Route 689 and Route 745.

Route 692 - **Short Term**: 1) Post additional warning signs along the entire length of Route 692, and 2) Lengthen and flatten the approach from Route 692 to Route 221 and clear vegetation at this intersection. **Long Term**: Widen and straighten between Route 221 and Route 762.

Route 694 - **Short Term**: Post warning signs along the entire length of Route 694. **Long Term**: 1) Widen and straighten between Route 695 and Route 221, and 2) Straighten and realign Route 670 East and Route 670 West to create a four-legged intersection.

Route 696 - **Short Term**: Post warning signs north of Route 221.

Route 735 - **Short Term**: Post warning signs along the entire length of Route 735.

Route 745 - **Short Term**: Conduct a traffic speed study. **Long Term**: Widen and lengthen between Route 221 and Route 690.

Route 752 - **Short Term**: Post warning signs along the entire length of Route 752.

Route 897 - **Short Term**: Revisit and give strong consideration of implementation to the 1980's VDOT plan to improve Route 897.

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CHAPTER 1

INTRODUCTION

Background

One of the fastest growing locations in the Roanoke Valley lies on either side of Route 221 (Bent Mountain Road) south of Route 419 (Electric Road). This area is located in the southwestern portion of Roanoke County and encompasses part or all of the Cave Spring neighborhood, the Back Creek neighborhood, the Poage's Mill neighborhood and the Bent Mountain neighborhood.

This part of southwest Roanoke County has seen a tremendous expansion in residential development over the past several years. Most of this residential development is occurring either directly on old existing farm roads or in residential subdivisions which funnel traffic onto these small rural roads. Narrow pavement widths, sharp curves, limited sight distances, steep gradients, narrow or no shoulders and increasingly high traffic volumes characterize the conditions currently found on these old roads. Pressure for future residential development in this area of southwest Roanoke County abounds. Attractions for future residential development include the significant aesthetic appeal of the area due to the proximity of the mountains and the Blue Ridge Parkway, excellent public schools and the potential extension of public water, public sewer and natural gas service. Increased residential development, and the increased traffic volumes that residential development generates, will further exacerbate the congestion and safety problems experienced on these secondary roads which are not designed to current standards.

At the same time, traffic conditions on Route 221 have also deteriorated. In order to improve conditions on Bent Mountain Road itself, the Virginia Department of Transportation (VDOT) has begun to implement the Phase II planning process for the planned improvement of Route 221 between the end of the Phase I improvement (from Route 419 to Route 735, which has already been completed) and planned Phase III improvement (from Route 752 to the foot of Bent Mountain). While this upgrade will ease some of the existing traffic problems on Route 221, it can also generate additional traffic on the old farm roads adjacent to it.

During the two fiscal years between July 1, 1995 and June 30, 1997, the Roanoke Valley Area Metropolitan Planning Organization will conduct a large scale study of the Route 221 corridor which will incorporate several different land-use scenarios based on the final outcome of the Route 221 planning process being conducting currently by VDOT.

This study, therefore, focuses only on those roads which feed residential traffic onto Route 221. In order to narrow the study area to fit the limited scope and budget of this study, only segments of the nineteen highest traffic volume side roads (based on 1994 traffic counts) adjacent to Route 221 have been included in the study area for this report. The study area can be seen on Map 1 and includes segments of the following routes: Route 613 (Merriman Road), Route 688 (Cotton Hill Road), Route 689 (Roselawn Road), Route 690 (Poage Valley Road, Poage Valley Road

Extension and South Roselawn Road), Route 692 (Mount Chestnut Road), Route 694 (Twelve O'Clock Knob Road), Route 696 (Martins Creek Road and Apple Grove Lane), Route 735 (Coleman Road), Route 745 (Ran Lynn Road), Route 752 (Old Mill Road), Route 897 (Crystal Creek Drive), Route 907 (Ranchcrest Drive), Route 1646 (Chatsworth Drive), Route 1668 (Rosecrest Road), Route 1683 (Arlington Hills Drive) and Route 1950 (Forest Edge Drive).

Goals and Objectives

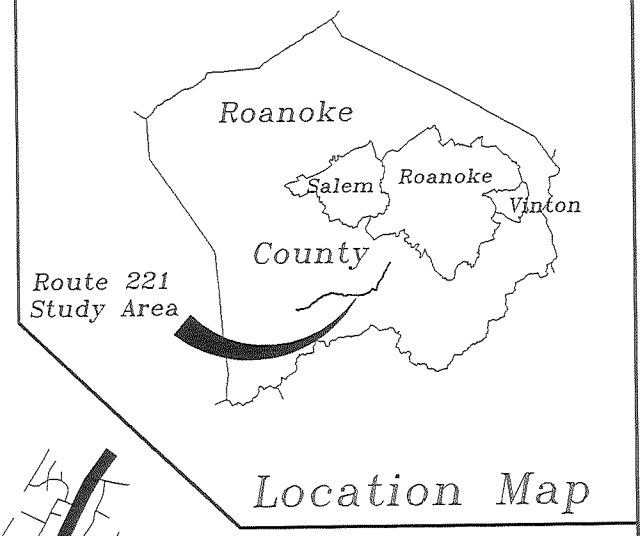
The goals of the ***Route 221 Sub-Area Roads Study*** are to document existing conditions, identify problems in the study area and make recommendations which will improve travel in the study area in terms of both safety and convenience. These goals can be achieved by addressing both general and site specific deficiencies and providing strategies for improving those identified deficiencies.

Study Approach

The study approach was to rely on data collected during field surveys conducted by the staff of the Fifth Planning District Commission, traffic count and accident data provided by VDOT, school bus routing data provided by the Roanoke County Public School Administration and other background information supplied through interviews with local officials and residents. Road maps of the area, comprehensive plans and other pertinent information sources were employed in conducting this study.

Using the above information, traffic patterns, highway levels-of-service (LOS), roadway geometries and roadway safety for every road in the study area were analyzed. Intersections were analyzed in a general manner, but were not analyzed for level-of-service because of both the budgetary constraints on data collection and on the uncertainty of future intersection locations and traffic volumes created by the planned improvements of Route 221 within the study area. 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 study area in general.

Route 221 Study Area



Location Map

1" = 4,500'

MAP 1

Fifth Planning District Commission, 1995

CHAPTER 2

DATA COLLECTION AND SYSTEM DESCRIPTION

Data Collection Procedures

Data used in this study was obtained from several different sources. The staff of the Fifth Planning District Commission collected physical characteristics data and land use data through field data collection techniques. Average daily traffic volumes (ADT) and accident count data were obtained from VDOT. Other data was collected from material stored in the Fifth Planning District Commission library, comprehensive plans for relevant areas of Roanoke County and interviews with local officials and interested citizens.

System Description

The study covers all or part of nineteen different roads in the Back Creek, Poage's Mill and Cave Spring neighborhoods of southwest Roanoke County (see Table 1). These roads are the primary components of a network of mostly secondary roads which feed residential traffic in the area to Route 221. Route 221 is the primary connector between this part of southwest Roanoke County and Roanoke City, the City of Salem and the Electric Road/Electric Road area of Roanoke County where a wide variety of services and job opportunities are available.

Most of the roads in the study area are located within the boundary of the Metropolitan Planning Organization (MPO). Only relatively small portions of Martin Creek Road, Twelve O'Clock Knob Road and Mount Chestnut Road fall outside of the MPO boundary. According to the functional classification of highways, most of the roads in the study area are classified as local roads. Merriman Road is classified as an Urban Collector. Roselawn Road is classified as a Rural Major Collector with the exception of the quarter mile closest to Route 221 which is classified as an Urban Collector. Twelve O'Clock Knob Road is classified as a Rural Major Collector. Ran Lynn Road is classified as a Rural Minor Collector. According to the federal aid classification system, Urban Collector and Rural Major Collector roads are eligible for federal funding. Rural Minor Collectors and local roads are not eligible for federal funding.

The following roads in the study area are partially within an existing flood plain: Martins Creek Road, Apple Grove Road, Old Mill Road, Twelve O'Clock Knob Road, Mount Chestnut Road, Poage Valley Road, Poage Valley Road Extension, Cotton Hill Road, Ran Lynn Road, Coleman Road, Crystal Creek Drive and Merriman Road. Most of these roads lie in the flood plain of Back Creek only where they intersect Route 221. Almost the entire length of Martins Creek Road lies within the Martins Creek flood plain.

The current land uses in the study area consist almost entirely of residential and agricultural development. Much of the residential development is of the suburban subdivision variety, but there are many rural homesteads still left in place along the sides of the study area roads. Many

of the agricultural uses consist of small horse farms, truck farms, a vineyard, pasture land and forested land. There are two elementary schools and a junior high school within the study area. These are the only traffic generators located in the study area. The tremendous growth in residential development is expected to continue for the foreseen future. Also, a new high school is expected to be built in the study area which will be a large traffic generator.

Table 1: Study Area Road Sections

Route Number	Road Name	From Route	To Route
613	Merriman Road	688	907
688	Cotton Hill Road	613	221
689	Roselawn Road	692	221
690	Poage Valley Road Extension	691	221
690	Poage Valley Road	221	745
690	South Roselawn Road	745	689
692	Mount Chestnut Road	221	689
694	Twelve O'Clock Knob Road	221	695
696	Martins Creek Road	Dead End	221
696	Apple Grove Lane	221	Dead End
735	Coleman Road	Dead End	221
745	Ran Lynn Road	221	Dead End
752	Old Mill Road	221	221
897	Crystal Creek Drive	221	613
907	Ranchcrest Drive	1470	221
1646	Chatsworth Drive	Dead End	221
1668	Rosecrest Road	689	221
1683	Arlington Hills Road	221	Dead End
1950	Forest Edge Drive	221	2035

CHAPTER 3

DATA ANALYSIS

A traffic growth and circulation analysis, a highway level-of-service (LOS) analysis, a physical geometries analysis and a traffic accident analysis were carried out for each of the nineteen roads within the study area. The traffic growth and circulation analysis reviews the growth of traffic volumes on roadway segments between 1984 and 1994. New roads have been added during those ten years. Data from 1984 was modified to match corresponding 1994 data wherever the addition of new roads occurred. The circulation of school buses and other traffic movement considerations are reviewed in this analysis. School buses generally operate in Roanoke County between 7:15 and 8:45 in the morning and 1:45 and 4:00 in the afternoon.

The highway LOS analysis utilizes both physical geometric and peak-hour traffic volume input to derive a measurement of operating efficiency. LOS calculations were accomplished through the use of the Highway Capacity Software (HCS) which was developed using the two lane highway methodology described in Chapter 8 of the 1985 edition of the ***Highway Capacity Manual*** (HCM). An LOS analysis was conducted for the highest traffic volume segment of each road in the study area and for segments which had physical or other characteristics which were out of the ordinary and worthy of further scrutiny. If the highest volume segment was found to be functioning at an acceptable level of service, it was assumed that the road as a whole was functioning at an acceptable level of service. The peak-hour traffic volume on all roads in the study area was assumed to be 9% of the total vehicles per day and the directional distribution was assumed to be 85/15. This was based on traffic circulation data collected on Route 221 by VDOT. It should be noted that the use of the HCS computer model presents some limitations. These limitations are related to the input parameters accepted by the HCS. For example, the HCS only allows the input of lane widths of nine feet or more. Many of the roads in the study area have lane widths of less than nine feet. The fact that the HCS does not account for smaller than nine foot lane widths skews the results of the LOS calculation. This same limitation exists with regard to the design speed and terrain parameters accepted by the HCS. The LOS as obtained by the HCS is therefore likely to be somewhat better than is actually the case due to these limitations. However, these limitations are not significant enough to invalidate the calculation and in most cases have little effect on the calculation of LOS for planning purposes. For more information regarding highway level-of-service analysis methodology, see Chapter 8 of the ***1985 Highway Capacity Manual*** (HCM) or Appendix I of this study.

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 have an impact on travel conditions. Data used in this study regarding pavement and shoulder widths come from a VDOT road inventory. The pavement and shoulder width data represent segment averages and do not reflect exact measurements at all points along a road segment. Roads with no posted speed limits have an implied speed limit of 55 miles per hour in the Commonwealth of Virginia.

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 physical geometries data to locate potentially dangerous locations. All accident data analyzed in this study were obtained from the Traffic Engineering Division of VDOT and pertain to all accidents reported during the three year time period between January 1, 1992 and December 31, 1994.

Route 613 (Merriman Road)

Current traffic volumes (see Table 2) on Route 613 (Merriman Road) are highest near the Penn Forest Elementary School, a local industrial park and near the Cave Spring Elementary and Junior High Schools. The highest traffic volume segment of Merriman Road in 1994 was between Route 904 (Starkey Road) and Route 1723 (Commonwealth Drive). This segment is busy because Starkey/Buck Mountain Road is the only cross-county connection to the eastern part of the county other than Route 419 and because Commonwealth Drive is the only access road to an industrial park. The second highest road segment is between Commonwealth Drive and Route 897 (Crystal Creek Drive) where the Penn Forest Elementary School is located. Another high volume segment lies between Route 1667 (Ingleside Drive) and Route 907 (Ranchcrest Drive). This segment has a high traffic volume because Ranchcrest Drive connects Merriman Road to Bent Mountain Road. Also, the Cave Spring Elementary and Junior High Schools are on Ranchcrest Drive.

The fastest growing segments in terms of absolute growth were the same three identified above as being the highest volume segments. The fastest growing segment in terms of percent growth was the segment between Commonwealth Drive and Crystal Creek Drive where the Penn Forest Elementary School is located. There are up to 30 school buses on Merriman Road during an average weekday because of the concentration of schools in the area.

Route 613 in the study area is 2.9 miles long. It is a two-lane highway divided by a yellow line, but has no road edge markings. No passing is allowed. There are no sidewalks on either side of Merriman Road. There is a curb and gutter located on the east side of Merriman Road between Route 1726 (Cartwright Drive) and Route 1640 (Pine Acres Lane). The posted speed limit is 35 mile per hour with the exception of the segments near Penn Forest Elementary School where the posted speed limit is 25 miles per hour. Merriman Road is 22 feet wide between Route 688 (Cotton Hill Road) and Route 1564 (Meadowlark Road), 20 feet wide between Meadow Lark Road and Cartwright Drive, 28 feet wide between Cartwright Drive and Pine Acres Lane and 18 feet wide between Pine Acres Lane and Ranchcrest Drive. Improvements are planned for this last section of Merriman Road. Shoulder widths range between four and six feet. There are sharp curves just south of Ranchcrest Drive and between Cartwright Drive and Meadowlark Road. There is a very sharp curve at the intersection of Meadowlark Road. The shoulder drops steeply west of Merriman Road between Cartwright Drive and Meadowlark Road and east to a creek south of the intersection with Route 615 (Starlight Lane).

Table 2: Route 613 Traffic Growth

Road Segment		Segment Length	ADT 1994	ADT 1984	Absolute Growth	Percent Growth
From Route	To Route					
688	683	0.57	941	921	20	2%
683	615	0.31	1899	1028	871	85%
615	904	0.51	2801	1780	1021	57%
904	1723	0.06	5545	3043	2502	82%
1723	897	0.09	5424	2815	2609	93%
897	1564	0.11	2760	2499	261	10%
1564	1726	0.52	2517	2291	226	10%
1726	1771	0.03	3256	2829	427	15%
1771	800	0.13	3549	3034	515	17%
800	1681	0.14	4965	4134	831	20%
1681	1640	0.14	4677	4189	488	12%
1640	1667	0.16	4114	3961	153	4%
1667	907	0.09	5500	4267	1233	29%

ADT: Average Daily Traffic

North of Starkey Road, Merriman Road is a heavily developed residential road and land for future development is limited. South of Starkey Road, Merriman Road is much less heavily developed and the potential for development is higher. There is some industrial development on Merriman Road south of Starkey Road. Also, the property on either side of Crystal Creek Drive at the intersection with Merriman Road is the proposed location of a new high school. This would dramatically increase the traffic volume on Merriman Road.

An LOS analysis reveals that the highest volume segment of Merriman Road (between Starkey Road and Commonwealth Drive) is currently operating at an LOS of C. This indicates that Merriman Road is operating satisfactorily during the peak traffic volume hour.

There were 28 accidents on Merriman Road in the study area between 1992 and 1994. None of these accidents were fatal, but eleven resulted in injury. The total amount of property damage caused by these accidents was estimated at $106,500. The majority of these 28 accidents occurred under the following conditions: during daylight (18; 64%), on a dry surface (21; 75%), during the peak travelling hours (eight between 7:00 and 9:00 am; 29% and eight between 3:00

and 6:00 pm; 29%) and during a weekday (23; 82%). The majority of accidents were either a rear end collision (8; 29%), an angle collision (8; 29%) or a collision with a fixed object off the road (7; 25%). Further, the majority of accidents on Merriman Road were caused by driver inattention (18; 64%).

Table 3: Route 613 Accidents By Location

Road Segment		Segment Length	Total	Accident Per Mile
From Route	To Route			
688	683	0.57	3	5.3
683	615	0.31	1	3.2
615	904	0.51	1	2.0
904	1723	0.06	3	50.0
1723	897	0.09	0	0.0
897	1564	0.11	1	9.1
1564	1726	0.52	7	13.5
1726	1771	0.03	0	0.0
1771	800	0.13	1	7.7
800	1681	0.14	4	28.6
1681	1640	0.14	1	7.1
1640	1667	0.16	1	6.3
1667	907	0.09	5	55.6

Note: accidents occurring at "To" intersections of road segments are included in the next segment count. Accidents occurring at the "To" intersection of the last segment are included in the accident count for that last segment.

As can be seen in Table 3, the highest accident segment of Merriman Road is between Meadowlark Road and Cartwright Drive. Further, seven accidents occurred either at or within two-tenths of a mile of Meadowlark Road. The most likely contributing factors for the accidents occurring at Meadowlark Road are the sharpness of the curve at this intersection, the fact that the road narrows on this segment in relation to adjacent segments and the steep drop and narrowness of the shoulder. Improvements should be made to this segment of Merriman Road. Widening, straightening and the addition of a guardrail would improve both safety and circulation.

The segment with the most accidents per mile was between Ingleside Drive and Ranchcrest Drive. Problems on this segment of Merriman will be dealt with in the near future as part of the road improvement planned by VDOT. Also, the accident data show that three accidents occurred

at the intersection of Merriman Road and Starkey Road and at the intersection of Merriman Road and Ranchcrest Drive. The accidents at both Starkey Road and Ranchcrest Drive can largely be accounted for by the fact that these are among the highest traffic volume locations on Merriman Road. Both of these intersections should be analyzed to determine whether signalization is warranted.

Route 688 (Cotton Hill Road)

Current traffic volumes (see Table 4) on Route 688 are highest near Route 221. The highest traffic volume segments of Cotton Hill Road in 1994 were the segments between Route 221 and Route 888 (Raintree Road) and between Raintree Road and Route 934 (Shingle Ridge Road).

Table 4: Route 688 Traffic Growth

Road Segment		Segment Length	ADT 1994	ADT 1984	Absolute Growth	Percent Growth
From Route	To Route					
613	763	0.52	488	347	141	41%
763	853	0.71	456	307	149	49%
853	854	0.09	388	237	151	64%
854	653	0.16	440	343	97	28%
653	934	0.59	599	390	209	54%
934	888	0.13	876	581	295	51%
888	221	0.50	959	672	287	43%

ADT: Average Daily Traffic

The fastest growing segments in terms of absolute growth were the same two identified above as being the highest volume segments. The fastest growing segment in terms of percent growth was between Route 853 (Briar Ridge Circle) and Route 854 (Mason Knob Trail) where new residential development is located. Two school buses travel on Cotton Hill Road four times a day and an additional bus uses the road twice a day.

Route 688 is approximately 2.7 miles long. It is a two lane undivided road with no road edge markings. There is no sidewalk, curb or gutter on either side of Cotton Hill Road. There is no posted speed limit, but there are several warning signs posted alerting motorists of approaching curves and recommending maximum safe travelling speeds. Cotton Hill Road is 16 feet wide between Merriman Road and Route 763 (Branico Drive), 14 feet wide between Branico Drive and Mason Knob Road and 18 feet wide between Mason Knob Road and Route 221. Shoulders are two feet wide for the entire length of Cotton Hill Road. There are several sharp curves along Cotton Hill Road, the majority of which are located between Branico Road and Shingle Ridge

Road The shoulder drops steeply south and west of Cotton Hill Road to a creek between Merriman Road and Route 653 (Grubb Road).

Cotton Hill Road is a quickly developing residential road. There are several subdivisions on roads which intersect Cotton Hill Road. There are a few large subdivisions in the process of being developed whose only access will be onto Cotton Hill Road. Further, there are still many acres of developable land available on side roads off Cotton Hill Road and along Cotton Hill Road itself. If the new high school is built on Crystal Creek Road at Merriman Road, development pressure on Cotton Hill Road will increase along with traffic volumes.

An LOS analysis reveals that the highest volume segment of Cotton Hill Road (between Raintree Road and Route 221) is currently operating at an LOS of B. This indicates that Cotton Hill Road is operating satisfactorily during the peak traffic volume hour. However, the impending arrival of several hundred additional vehicles from the new subdivisions discussed above and the potential development of a new high school nearby implies that the current performance of Cotton Hill Road does not realistically reflect it's future performance.

Table 5: Route 688 Accidents By Location

Road Segment		Segment Length	Total	Accident Per Mile
From Route	To Route			
613	763	0.52	5	9.6
763	853	0.71	2	2.8
853	854	0.09	0	0.0
854	653	0.16	0	0.0
653	934	0.59	1	1.7
934	888	0.13	0	0.0
888	221	0.50	2	4.0

Note: accidents occurring at "To" intersections of road segments are included in the next segment count. Accidents occurring at the "To" intersection of the last segment are included in the accident count for that last segment.

There were ten accidents on Cotton Hill Road between 1992 and 1994. None of these accidents were fatal, but five resulted in injury. The total amount of property damage caused by these accidents was estimated at $28,200. The majority of these ten accidents occurred under the following conditions: during darkness (7; 70%), on a wet or icy surface (6; 60%), during off peak travelling hours (8; 80%) and during a weekday (7; 70%). The majority of accidents were either non-collision accidents (5; 50%) or a collision with a fixed object off the road (4; 40%). Further, the majority of accidents on Cotton Hill Road were caused by driver inattention (4;40%) or driver speeding (2; 20%).

As can be seen in Table 5, the highest accident segment both in terms of absolute number and accidents per mile was between Merriman Road and Branico Drive. Further, five accidents occurred within a tenth of a mile of each other at a blind curve approximately one quarter mile west of Merriman Road. The most likely contributing factors for these accidents were the sharpness of the curve, the narrowness of the pavement and the steepness and narrowness of the shoulder. Improvements can be made to Cotton Hill Road to improve conditions at this and other hazardous locations. Widening of the pavement surface and the shoulders, straightening of both the horizontal and vertical curves and perhaps the addition of a guardrail would dramatically improve traffic safety and circulation. It would also be beneficial if traffic volumes were closely monitored on the segments of Cotton Hill Road which do not currently meet the minimum traffic volume criteria for the application of road markings in order to identify when traffic volumes become high enough to necessitate the addition of center and road-edge markings. A traffic speed study should also be conducted in order to determine average speeds of through traffic with the intent of lowering the speed limit on Cotton Hill Road. Any lowered speed limit should be enforced in order to encourage compliance.

Route 689 (Roselawn Road)

Current traffic volumes (see Table 6) on Route 689 are highest near Route 221. The highest traffic volume segments of Roselawn Road in 1994 were the segments between Route 221 and Route 1552 (Pleasant Hill Drive), between Pleasant Hill Drive and Route 1788 (Wing Commander Drive) and between Wing Commander Drive and Route 1796 (Canter Drive).

The fastest growing segments in terms of absolute growth were the same three identified above as being the highest volume segments. The fastest growing segment in terms of percent growth was between Pleasant Hill Drive and Wing Commander Drive where significant residential development is located. Two school buses travel on Roselawn Road four times a day.

Route 689 is approximately 2.4 miles long. It is a two lane undivided road between Route 692 (Mount Chestnut Road) and Route 690 South (South Roselawn Road) with no road edge markings, but between South Roselawn Road and Route 221 it is a yellow center line divided road. The intersection of Roselawn Road and Route 221 is signalized. There is no sidewalk, curb or gutter located on either side of Roselawn Road. The posted speed limit between Route 221 and Route 1668 (Rosecrest Road) is 25 miles per hour and 35 miles per hour between Rosecrest Road and Mount Chestnut Road. Roselawn Road is 18 feet wide between Wing Commander Drive and Rosecrest Road and between South Roselawn Road and Mount Chestnut Road, 22 feet wide between Rosecrest Road and South Roselawn Road, 32 feet wide between Wing Commander Drive and Route 1782 (Williamsburg Court) and 44 feet wide between Williamsburg Court and Route 221. Shoulder widths range between two and six feet wide. There are several sharp curves on Roselawn Road, the majority of which are located between Rosecrest Road and Canter Drive. There are no warning signs posted to inform motorists of road conditions or suggesting appropriate safe speeds for navigating the curves.

Table 6: Route 689 Traffic Growth

Road Segment		Segment Length	ADT 1994	ADT 1984	Absolute Growth	Percent Growth
From Route	To Route					
692	1767	0.34	472	399	73	18%
1767	739	0.19	518	399	119	30%
739	1537	0.32	734	454	280	62%
1537	1515	0.07	714	596	118	20%
1515	690 North	0.26	749	596	153	26%
690 North	690 South	0.04	962	662	300	45%
690 South	1641	0.50	1010	753	257	34%
1641	1518	0.44	1347	562	785	140%
1518	1796	0.15	1288	562	726	129%
1796	1788	0.05	3314	1089	2225	204%
1788	1552	0.06	3517	1089	2428	223%
1552	221	0.01	3698	1357	2341	173%

ADT: Average Daily Traffic

Roselawn Road is an already heavily developed residential road between Route 221 and South Roselawn Road and is developing steadily for the rest of the length of the road. There are several subdivisions located along side roads which intersect Roselawn Road. There are many acres of developable land available on side roads off Roselawn Road and along Roselawn Road itself.

An LOS analysis reveals that the highest volume segment of Roselawn Road (between Route 221 and Pleasant Hill Drive) is currently operating at an LOS of D. This indicates that traffic on this segment of Roselawn Road during the peak traffic volume hour is congested.

There were eleven accidents on Roselawn Road between 1992 and 1994. None of these accidents were fatal, but two resulted in injury. The total amount of property damage caused by these accidents was estimated at $43,490. The majority of these eleven accidents occurred under the following conditions: on a dry surface (6; 55%), during off peak travelling hours (7; 64%) and during a weekday (7; 64%). Five (45%) of the accidents occurred in the daylight and five (45%) occurred at night and one accident occurred at dusk. The majority of accidents were collisions with a fixed object off the road (6; 55%). Further, the majority of accidents on Roselawn Road were caused by driver inattention (6;55%).

Table 7: Route 689 Accidents By Location

Road Segment		Segment Length	Total	Accident Per Mile
From Route	To Route			
692	1767	0.34	1	2.9
1767	739	0.19	1	5.3
739	1537	0.32	0	0.0
1537	1515	0.07	0	0.0
1515	690 North	0.26	1	3.8
690 North	690 South	0.04	0	0.0
690 South	1641	0.50	2	4.0
1641	1518	0.44	3	6.8
1518	1796	0.15	0	0.0
1796	1788	0.05	3	60.0
1788	1552	0.06	0	0.0
1552	221	0.01	0	0.0

Note: accidents occurring at "To" intersections of road segments are included in the next segment count. Accidents occurring at the "To" intersection of the last segment are included in the accident count for that last segment.

As can be seen in Table 7, the highest accident segments of Roselawn Road are between Route 1641 (Highfields Road) and Route 1641 (Rosecliff Road) and between Canter Drive and Wing Commander Drive. The second of these two segments also had the most accidents per mile. Further, eight (73%) accidents occurred on the section of Roselawn Road between South Roselawn Road and Canter Drive The most likely contributing factor for these accidents were the sharpness of the curves and the steepness and narrowness of the shoulders. The addition of warning signs advising motorists of roadway conditions and recommending a maximum safe speed would improve safety on an incremental basis. Long term improvements can be made to Roselawn Road to make conditions safer. Widening of the pavement surface and the shoulders, straightening of the curves and the addition of a guardrail would improve both safety and circulation. Further, three accidents occurred at the intersection of Roselawn Road and Canter Drive. This intersection should be analyzed to determine whether signalization is warranted.

Route 690 (Poage Valley Road Extension, Poage Valley Road and South Roselawn Road)

Route 690 is called Poage Valley Road Extension south of Route 221, Poage Valley Road between Route 221 and Route 745 (Ran Lynn Road) and South Roselawn Road between Ran

Lynn Road and Route 689 (Roselawn Road). Current traffic volumes (see Table 8) on Route 690 are highest near Route 221. The highest traffic volume segments of Route 690 in 1994 were the segments between Route 221 and Route 691 (Dawnwood Road) and between Route 221 and Route 923 (Corntassel Lane).

Table 8: Route 690 Traffic Growth

Road Segment		Segment Length	ADT 1994	ADT 1984	Absolute Growth	Percent Growth
From Route	To Route					
691	221	0.70	486	399	87	22%
221	923	0.40	401	268	133	50%
923	745	0.60	352	260	92	35%
745	689	1.14	149	149	0	0%

Note: Thick lines indicate change in road name.
ADT: Average Daily Traffic

The fastest growing segment in terms of absolute and percent growth was between Route 221 and Corntassel Lane. This can in part be explained by the presence of residential development on Corntassel Lane and other residential roads which intersect Corntassel Lane. Commuters traffic then use this segment of Route 690 to reach Route 221. Two school buses travel on all segments of Route 690 four times a day.

Route 690 in the study area is approximately 2.8 miles long. It is a two lane undivided road with no road edge markings. There is no sidewalk, curb or gutter located on either side of Route 690. There is no posted speed limit, but there is a warning sign posted on South Roselawn Road advising of approaching curves and recommending that traffic slow to an appropriate speed. Route 690 ranges between 14 and 18 feet wide and shoulder widths range between two and five feet wide. There are several sharp curves on South Roselawn Road. The shoulder also drops steeply on the west side of South Roselawn Road. While there is one hazard sign posted on this segment of Route 690, additional warnings and safe speed recommendations should be made.

Route 690 is a developing residential road, particularly on the sections north of Route 221. There is a lot of subdivision development on Corntassel Road off Poage Valley Road as well as on Poage Valley Road itself. There is currently a subdivision under construction on South Roselawn Road and there are other subdivisions also located on this part of Route 690. Route 690 also has some established residential and agricultural land-uses located on it, as well as some older residential subdivision development on Dawnwood Road which intersects Poage Valley Road Extension. There is potential for additional residential development on vacant land on both sides of Route 690, particularly where farms are currently located.

An LOS analysis reveals that the highest volume segment of Route 690 (between Route 221 and Dawnwood Road) is currently operating at an LOS of B. This indicates that Route 690 is operating satisfactorily during the peak traffic volume hour.

There were four accidents on Route 690 between 1992 and 1994. None of these accidents were fatal, but one resulted in injury. The total amount of property damage caused by these accidents was estimated at $10,800. All four (100%) accidents occurred in darkness. Three occurred on a wet surface (75%). Three of these four accidents occurred during non-peak travel hours (75%). Two occurred on a weekday (50%) and two occurred on a weekend day (50%). Three (75%) of the accidents were a collision with a fixed object off the road while the other one (25%) were described as non-collision accidents.

Table 9: Route 690 Accidents By Location

Road Segment		Segment Length	Total	Accident Per Mile
From Route	To Route			
691	221	0.70	1	1.4
221	923	0.40	0	0.0
923	745	0.60	0	0.0
745	689	1.14	3	2.6

Note: accidents occurring at "To" intersections of road segments are included in the next segment count. Accidents occurring at the "To" intersection of the last segment are included in the accident count for that last segment. Thick lines indicate change in road name

As can be seen in Table 9, the highest accident segment of Route 690 is on South Roselawn Road. This same segment also had the most accidents per mile. The most likely contributing factors for these accidents were the sharpness of the curves, obscured lines of sight and the steepness and narrowness of the shoulder to the west of this segment. Posting additional warning signs advising motorists of the upcoming roadway conditions and recommending a maximum safe speed would improve safety on an incremental basis. Long term improvements can be made to South Roselawn Road to make conditions safer. Straightening of the sharpest curves and the addition of a guardrail where it is not presently in place would dramatically improve both traffic safety and traffic circulation.

Route 692 (Mount Chestnut Road)

Current traffic volumes (see Table 10) on Route 692 are highest near Route 221. The highest traffic volume segment of Mount Chestnut Road in 1994 was between Route 221 and Route 762 (Ivy Mountain Road).

Table 10: Route 692 Traffic Growth

Road Segment		Segment Length	ADT 1994	ADT 1984	Absolute Growth	Percent Growth
From Route	To Route					
221	762	1.67	513	364	149	41%
762	689	2.13	181	140	41	29%

ADT: Average Daily Traffic

The fastest growing segment of Mount Chestnut Road in terms of both absolute and percent growth was the same segment identified above as being the highest volume segment. One school bus travels on Mount Chestnut Road three times a day. At the intersection of Mount Chestnut Road and Route 221, school buses turning from Mount Chestnut Road onto Route 221 will only make left hand turns onto Route 221 because of the high volume of traffic and the obscured line of sight. This is true even though the Back Creek Elementary School is to the right for school buses turning onto Route 221 from Mount Chestnut Road. Instead, school busses turn north on Route 221 and turn left onto Route 1776 (Pencheck Circle) in order to turn around and head back south on Route 221 to reach the Back Creek Elementary School. Also, the undercarriages of school buses turning from Mount Chestnut Road onto Route 221 are scraped. Both of these problems, an obscured line of sight and scraped undercarriages, are caused by excessively sharp vertical curvature of the approach from Mount Chestnut Road onto Route 221. These problems could be resolved by making this approach longer and less steep. Also, clearance of the brush and foliage at this intersection would improve the line of sight.

Route 692 is approximately 3.8 miles long. It is a two lane undivided road with no road edge markings. There is no sidewalk, curb or gutter located on either side of Route 692. There is no posted speed limit, but there is a warning sign posted near Route 221 advising motorists that road conditions are poor for the next two miles and displaying the generic symbol for a road with several sharp curves. Route 692 is 16 feet wide and has shoulder widths ranging between two and three feet for the entire length of the road. There are several sharp, blind curves on Mount Chestnut Road, particularly near where the road peaks in terms of altitude. The shoulder drops steeply to a creek on the west side of Mount Chestnut Road between Route 221 and the top of the hill. This steep slope is protected for two-tenths of a mile south of Ivy Mountain Road by a guardrail, but not on the rest of the road where the drop becomes several yards deep.

Mount Chestnut Road is a developing residential road. There are subdivisions on side roads off this road. There are also well established residential and agricultural land uses located on both sides of Mount Chestnut Road. There is potential for additional residential development on vacant land on both sides of this road.

An LOS analysis reveals that the highest volume segment of Route 692 (between Route 221 and Ivy Mountain Road) is currently operating at an LOS of B. This indicates that Route 692 is operating satisfactorily during the peak traffic volume hour.

There were a total of four accidents on Mount Chestnut Road between 1992 and 1994. None of these accidents were fatal, but two resulted in injury. The total amount of property damage caused by these accidents was estimated at $18,800. Two (50%) of these accidents occurred during daylight hours. Three occurred on a dry surface (3; 75%). All four accidents occurred between the hours of 2:00 pm and 7:00 pm and three occurred during a weekday (3; 75%). Two (50%) of the accidents were a collision with a fixed object off the road while the other two (50%) were described as non-collision accidents.

Table 11: Route 692 Accidents By Location

Road Segment		Segment Length	Total	Accident Per Mile
From Route	To Route			
221	762	1.67	3	1.8
762	689	2.13	1	0.5

Note: accidents occurring at "To" intersections of road segments are included in the next segment count. Accidents occurring at the "To" intersection of the last segment are included in the accident count for that last segment.

As can be seen in Table 11, the highest accident segment of Mount Chestnut Road is between Route 221 and Ivy Mountain Road. This same segment also had the most accidents per mile. The most likely contributing factors for these accidents were the sharpness of the curves, obscured lines of sight, the narrowness of the pavement and the steepness and narrowness of the shoulder to the south of this segment. Posting additional warning signs advising motorists of the upcoming roadway conditions and recommending a maximum safe speed would improve safety on an incremental basis. Long term improvements can be made to Mount Chestnut Road to make conditions safer. Widening of the pavement surface and the shoulders, straightening of the sharpest curves and the addition of a guardrail where they are not presently located would dramatically improve both traffic safety and traffic circulation.

Route 694 (Twelve O'Clock Knob Road)

Current traffic volumes (see Table 12) on Route 694 are highest near Route 221. The highest traffic volume segment of Twelve O'Clock Knob Road in 1994 was between Route 221 and Route 1780 (Poages Mill Drive).

The fastest growing segment of Twelve O'Clock Knob Road in terms of absolute growth was the same segment identified above as being the highest volume segment. The fastest growing segment in terms of percent growth was between Poages Mill Drive and Canyon Road. One school bus travels on Twelve O'Clock Knob Road three times a day. The Roanoke County School system will not allow schools buses to use Route 670 West (Lost Mountain Road) because it poses a safety hazard. Further, school buses turning from Route 670 East (Canyon Road) onto Twelve O'Clock Knob Road in the direction of the City of Salem cannot make this turn in one try, but instead must turn as far as they can and then back up in order to straighten

themselves out enough to continue along Twelve O'Clock Knob Road. In order to improve this and the first situation, Lost Mountain Road and Canyon Road would need to be realigned so that they intersected Twelve O'Clock Knob Road at a right angle at a point directly opposite from each other forming a four legged intersection. Also, high traffic volumes on Route 221 make it difficult for school buses to turn safely from Twelve O'Clock Knob Road onto Route 221. This is particularly true for school buses turning toward the Back Creek Elementary School which is located only a few yards south of this intersection.

Table 12: Route 694 Traffic Growth

Road Segment		Segment Length	ADT 1994	ADT 1984	Absolute Growth	Percent Growth
From Route	To Route					
221	1780	0.65	962	587	375	64%
1780	670 East	0.37	750	447	303	68%
670 East	695	0.85	515	315	200	63%

ADT: Average Daily Traffic

Route 694 in the study area is approximately 1.9 miles long. It is a two lane road divided by a yellow center line for approximately the first mile and then it is an undivided two-lane road with no road edge markings. There is no sidewalk, curb or gutter located on either side of Route 694. There is no posted speed limit on Route 694. Route 694 is 18 feet wide between Route 221 and Lost Mountain Road and is 16 feet wide between Lost Mountain Road and Route 695 (Ridgelea Road). Shoulder widths range between two and four feet wide. There are several sharp, blind curves on Twelve O'Clock Knob Road, but there are no warning signs posted advising motorists of hazardous road conditions or recommending maximum safe speeds. The shoulder drops steeply to a creek on the south side of Twelve O'Clock Knob Road west of Route 221. This steep slope is not protected by a guardrail and reaches several feet deep in spots.

Twelve O'Clock Knob Road is a developing residential road. There are subdivisions (Poages Mill Estates) on side roads off Poages Mill Drive and Ridgelea Road, both of which intersect Twelve O'Clock Knob Road. There are also well established residential and agricultural land uses located on both sides of Twelve O'Clock Knob Road. There is potential for additional residential development on vacant land on both sides of Route 694, particularly where horse farms are currently located.

An LOS analysis reveals that the highest volume segment of Route 694 (between Route 221 and Poages Mill Drive) is currently operating at an LOS of B. This indicates that Route 694 is operating satisfactorily during the peak traffic volume hour.

There were a total of five accidents on Twelve O'Clock Knob Road between 1992 and 1994. None of these accidents were fatal, but two resulted in injury. The total amount of property damage caused by these accidents was estimated at $12,100. The majority of these accidents

occurred under the following conditions: during darkness (3; 60%), on a dry surface (3; 60%), during off peak travelling hours (3; 60%) and during a weekday (4; 80%). The majority of accidents were a collision with a fixed object off the road (4; 80%). Further, the majority of accidents on Twelve O'Clock Knob Road were caused by driver inattention (3; 60%)

Table 13: Route 694 Accidents By Location

Road Segment		Segment Length	Total	Accident Per Mile
From Route	To Route			
221	1780	0.65	3	4.6
1780	670 East	0.37	1	2.7
670 East	695	0.85	1	1.2

Note: accidents occurring at "To" intersections of road segments are included in the next segment count. Accidents occurring at the "To" intersection of the last segment are included in the accident count for that last segment.

As can be seen in Table 13, the highest accident segment of Twelve O'Clock Knob Road is between Route 221 and Poages Mill Drive. This same segment also had the most accidents per mile. Further, two accidents occurred within a few feet of each other at a sharp, S-curve just a few feet before the intersection of Twelve O'Clock Knob Road and Poages Mill Drive. The most likely contributing factors for these accidents were the sharpness of the curve at this intersection, the narrowness of the pavement at this location and the steepness and narrowness of the shoulder to the south of this segment. Posting warning signs advising motorists of the upcoming roadway conditions and recommending a maximum safe speed would improve safety on an incremental basis. Long term improvements can be made to Twelve O'Clock Knob Road to make conditions safer. Widening of the pavement surface and the shoulders, straightening of the sharpest curves and the addition of guardrail where they are not presently located would dramatically improve both traffic safety and traffic circulation.

Route 696 (Martins Creek Road and Apple Grove Lane)

Route 696 is called Apple Grove Lane south of Route 221 and Martins Creek Road north of Route 221. Current traffic volumes (see Table 14) on Route 696 are highest near Route 221. The highest traffic volume segment of Route 696 in 1994 was between Route 221 and Route 1790 (Carriage Hills Drive).

The fastest growing segment of Route 696 in terms of absolute and percent growth was the same segment identified above as being the highest volume segment. One school bus travels on Apple Grove Lane four times a day. Two buses travel on Martins Creek Road four times a day. School buses turn around after an S-curve between Carriage Hills Drive and the dead end on Martins Creek Road because there is no adequate location for a school bus to turnaround beyond this point. The road also becomes too narrow for the safe passage of a school bus at this point.

Table 14: Route 696 Traffic Growth

Road Segment		Segment Length	ADT 1994	ADT 1984	Absolute Growth	Percent Growth
From Route	To Route					
Dead End	1790	2.15	341	257	84	33%
1790	221	0.15	872	541	331	61%
221	Dead End	0.80	344	312	32	10%

Note: Thick lines indicate change in road name.
ADT: Average Daily Traffic

Route 696 is approximately 3.1 miles long. It is a two lane undivided road with no road edge markings. There is no sidewalk, curb or gutter located on either side of Route 696. There is no posted speed limit on Route 696. Route 696 ranges between 12 and 14 feet wide and shoulder widths are between one and four feet. There are no warning signs posted on Route 696 advising motorists of dangerous conditions or recommending a maximum safe speed to drive at. This is particularly lacking on Martins Creek Road where there are several sharp curves between Route 1790 (Carriage Hills Drive) and the dead end. The shoulder also drops steeply to a creek on the south side of Martins Creek Road west of Route 221. This steep slope is not protected by a guardrail and reaches several feet deep in spots. The addition of warning signs in the short term and of a guardrail in the long term would dramatically improve safety conditions.

Both Apple Grove Lane and Martins Creek Road are developing residential road. There is a large subdivision development on side roads off Martins Creek Road and well established residential and agricultural land uses located on both sides of both Apple Grove Lane and Martins Creek Road. There is potential for additional residential development on vacant land on both sides of Route 696, with the exception of the very steep sloped area near the dead end of Martins Creek Road, particularly where horse farms are currently located.

An LOS analysis reveals that the highest volume segment of Route 696 (between Route 221 and Carriage Hills Drive) is currently operating at an LOS of B. This indicates that Route 696 is operating satisfactorily during the peak traffic volume hour

As can be seen in Table 15, there were no accidents on Route 696 between 1992 and 1994.

Table 15: Route 696 Accidents By Location

Road Segment		Segment Length	Total	Accident Per Mile
From Route	To Route			
Dead End	1790	2.15	0	0.0
1790	221	0.15	0	0.0
221	Dead End	0.80	0	0.0

Note: accidents occurring at "To" intersections of road segments are included in the next segment count. Accidents occurring at the "To" intersection of the last segment are included in the accident count for that last segment. Thick lines indicate change in road name

Route 735 (Coleman Road)

Traffic volumes (see Table 16) on Route 735 have remained relatively unchanged over the ten years between 1984 and 1994. Coleman Road is the access road to Route 221 for residential development a few subdivisions and for residential development on Coleman Road itself. Two buses travel four times daily on Coleman Road.

Table 16: Route 735 Traffic Growth

Road Segment		Segment Length	ADT 1994	ADT 1984	Absolute Growth	Percent Growth
From Route	To Route					
Dead End	221	0.45	290	281	9	3%

ADT: Average Daily Traffic

Route 735 is approximately 0.5 miles long. It is a two lane road with no center line or road edge markings. There is no sidewalk, curb or gutter located on either side of Coleman Road. There is no posted speed limit on Coleman Road. Coleman Road is 16 feet wide with four foot shoulders. There are several sharp curves on Coleman Road. There are no warning signs posted on Coleman Road advising motorists of dangerous roadway conditions or recommending maximum safe speeds of travel. The shoulder drops steeply on south of Coleman Road. This steep slope is not protected by a guardrail and reaches several feet deep in places. The addition of warning signs in the short term and of a guardrail in the long term would dramatically improve safety conditions.

Coleman Road is a mostly developed residential road. There are subdivisions in existence on this road and there is some potential for additional residential development, but the majority of the land adjacent to the road is already developed which limits the amount of additional development which can occur in the future.

An LOS analysis reveals that Coleman Road is currently operating at an LOS of A. This indicates that it is operating satisfactorily during the peak traffic volume hour.

As can be seen in Table 17, there were no accidents on Coleman Road between 1992 and 1994.

Table 17: Route 735 Accidents By Location

Road Segment		Segment Length	Total	Accident Per Mile
From Route	To Route			
Dead End	221	0.45	0	0.0

Note: accidents occurring at "To" intersections of road segments are included in the next segment count. Accidents occurring at the "To" intersection of the last segment are included in the accident count for that last segment.

Route 745 (Ran Lynn Road)

Current traffic volumes (see Table 18) on Route 745 are highest near Route 221. The highest traffic volume segment of Mount Chestnut Road in 1994 was between Route 221 and Route 690 (where Route 690 changes names from Poage Valley Road to South Roselawn Road).

Table 18: Route 745 Traffic Growth

Road Segment		Segment Length	ADT 1994	ADT 1984	Absolute Growth	Percent Growth
From Route	To Route					
221	690	0.30	841	606	235	39%
690	Dead End	1.00	488	338	150	44%

ADT: Average Daily Traffic

The fastest growing segment of Ran Lynn Road in terms of absolute growth was the same segment identified above as being the highest volume segment. The fastest growing segment in terms of percent growth was the segment between Route 690 and the dead end of Ran Lynn Road. One school bus travels on Ran Lynn Road four times a day.

Route 745 is approximately 1.3 miles long. It is a two lane undivided road with no road edge markings. There is no sidewalk, curb or gutter located on either side of Ran Lynn Road. There is no posted speed limit on Ran Lynn Road. There are warning signs posted on Ran Lynn Road advising motorists of hazardous roadway and recommending maximum safe speeds of travel. Ran Lynn Road is 14 feet wide with two foot shoulders. There are several sharp curves along the entire length of Ran Lynn Road. There is a particularly sharp and blind curve approximately one quarter mile east of the intersection of Ran Lynn Road and Route 221. The shoulder drops steeply on the southwest side of Ran Lynn Road to a creek the entire length of the road. This steep slope is not protected by a guardrail and reaches several feet deep in spots.

Ran Lynn Road is a developing residential road. There are subdivisions in existence on this road and there is potential for additional residential development on vacant land, particularly at locations where small horse farms are located.

An LOS analysis reveals that the highest volume segment of Ran Lynn Road (between Route 221 and Route 690) is currently operating at an LOS of B. This indicates that Ran Lynn Road is operating satisfactorily during the peak traffic volume hour.

There were a total of four accidents on Ran Lynn Road between 1992 and 1994. None of these accidents were fatal, but two resulted in injury. The total amount of property damage caused by these accidents was estimated at $10,500. Three of the four accidents occurred in darkness (75%). Two of the accidents occurred on dry pavement (50%)while the other two occurred on a wet or icy pavement surface (50%). Three of the accidents occurred during off peak travelling hours (75%) and during a weekday (75%). All four accidents were collisions with a fixed object off the road (100%).

Table 19: Route 745 Accidents By Location

Road Segment		Segment Length	Total	Accident Per Mile
From Route	To Route			
221	690	0.30	3	10.0
690	Dead End	1.00	1	1.0

Note: accidents occurring at "To" intersections of road segments are included in the next segment count. Accidents occurring at the "To" intersection of the last segment are included in the accident count for that last segment.

As can be seen in Table 19, the highest accident segment of Ran Lynn Road both in terms of the number of total accidents and the number of accidents per mile is the segment between Route 221 and Route 690. Further, three of the four accidents occurred at the sharp curve located a quarter mile from the intersection of Route 221 and Ran Lynn Road. The most likely contributing factors for these accidents are the sharpness of the curve, the fact that the road and the shoulder are both very narrow and the steepness of the shoulder to the southwest of this segment. Widening, straightening and perhaps the addition of a guardrail on this segment would improve both traffic safety and traffic circulation. A traffic speed study should also be conducted in order to determine average speeds of through traffic with the intent of lowering the speed limit on Ran Lynn Road. Any lowered speed limit should be enforced in order to encourage compliance.

Route 752 (Old Mill Road)

Current traffic volumes (see Table 20) on Route 752 are highest near Route 221. The highest traffic volume segment of Old Mill Road in 1994 was between Route 221 and Route 764 (Vinyard Road).

The fastest growing segment of Old Mill Road in terms of absolute and percent growth was the same segment identified above as being the highest volume segment. Two buses travel on Old Mill Road four times daily. School buses will not make a left hand turn onto Route 221 from Old Mill Road at the northern intersection of these two roads because of an obstructed line of sight. Instead, school busses have to access Route 221 at the southern intersection. This situation would be improved if Old Mill Road met Route 221 at an angle closer to 90 degrees and if the vertical curvature of the approach from Old Mill Road were made flatter. This situation may be improved as part of the scheduled improvement of Route 221.

Table 20: Route 752 Traffic Growth

Road Segment		Segment Length	ADT 1994	ADT 1984	Absolute Growth	Percent Growth
From Route	To Route					
221	759	0.44	236	204	32	16%
759	764	1.30	98	97	1	1%
764	221	0.90	344	240	104	43%

ADT: Average Daily Traffic

Route 752 is approximately 2.6 miles long. It is a two lane undivided road with no road edge markings. There is no sidewalk, curb or gutter located on either side of Old Mill Road. The posted speed limit on Old Mill Road is 25 miles per hour. Old Mill Road is 16 feet wide between Route 221 and Route 764 (Vinyard Road) and between Route 221 and Route 870 (Old Bent Mountain Road) and is 14 feet wide on the rest of the road Shoulder widths range between one and two feet for the entire length of Old Mill Road. There are several sharp curves on Old Mill Road, particularly between Route 937 (Whistler Drive) and Vinyard Road and between Route 759 (Berganblick Lane) and Old Bent Mountain Road. There is a warning sign posted near Vinyard Road advising of roadway conditions and recommending a maximum safe speed of travel, but no sign is posted near Berganblick Lane or Old Bent Mountain Road. The shoulder drops steeply to a creek at various points along Old Mill Road. This steep slope is not protected by a guardrail and reaches several feet deep in spots.. The addition of warning signs in the short term and of a guardrail in the long term would dramatically improve safety conditions.

Old Mill Road is a developing residential road. There are subdivisions located on side roads off of Old Mill Road as well as older established residential and agricultural land uses. There is potential for additional residential development on vacant land on both sides of Old Mill Road, particularly where arms are currently located.

An LOS analysis reveals that the highest volume segment of Old Mill Road (between Route 221 and Vinyard Road) is currently operating at an LOS of B. This indicates that Old Mill Road is operating satisfactorily during the peak traffic volume hour.

As can be seen in Table 21, there were no accidents on Route 696 between 1992 and 1994.

Table 21: Route 752 Accidents By Location

Road Segment		Segment Length	Total	Accident Per Mile
From Route	To Route			
221	759	0.44	0	0.0
759	764	1.30	0	0.0
764	221	0.90	0	0.0

Note: accidents occurring at "To" intersections of road segments are included in the next segment count. Accidents occurring at the "To" intersection of the last segment are included in the accident count for that last segment.

Route 897 (Crystal Creek Drive)

Current traffic volumes (see Table 22) on Route 897 are highest near Route 613 (Merriman Road) and the Penn Forest Elementary School. The highest traffic volume segment of Crystal Creek Drive in 1994 was between Merriman Road and Route 1726 (Cartwright Drive). Traffic volumes can be expected to increase dramatically on this segment of Crystal Creek Drive if the construction of a new Cave Spring High School facility occurs on the corner of Crystal Creek Drive and Merriman Road as proposed.

Table 22: Route 897 Traffic Growth

Road Segment		Segment Length	ADT 1994	ADT 1984	Absolute Growth	Percent Growth
From Route	To Route					
221	1716	0.60	325	272	53	19%
1716	1726	0.37	289	272	17	6%
1726	613	0.72	616	618	-2	0%

ADT: Average Daily Traffic

The fastest growing segment of Crystal Creek Drive in terms of absolute and percent growth was the same segment identified above as being the highest volume segment. It is important to note that the segment of Crystal Creek Drive between Route 221 and Route 1716 (Willow Spring Road) is the only segment of road in the entire study area which experienced a decrease in traffic volume. This is because this segment of Crystal Creek Road is popularly considered a safety hazard and is avoided both in terms of through traffic and in terms of residential development. This fact is upheld by the fact that the Roanoke County School System will not send a bus onto this segment of Crystal Creek Drive. Two school buses travel on the segments of Crystal Creek Road between Merriman Road and Willow Spring Road four times a day.

Route 897 is approximately 1.7 miles long. It is a two lane road divided by a yellow center line with white road edge markings for the first few yards past Route 221 and then it is an undivided two-lane road with no road edge markings. There is no sidewalk, curb or gutter located on either side of Route 897. The posted speed limit is 25 miles per hour and there are a few yellow hazard signs posted along the road warning of upcoming sharp curves and which recommend maximum safe speeds of travel. Route 897 is 16 feet wide and has four foot wide shoulders. There are several sharp, blind curves on Crystal Creek Drive. It is particularly poorly aligned between Route 221 and Willow Spring Road. The shoulder drops steeply to a creek on the south side of Crystal Creek Drive. This steep slope is not protected by a guardrail and reaches several yards deep in spots. In fact, houses are located on the bank of the creek whose roofs are actually below the level of the road. Crystal Creek Drive poses a safety hazard and should be improved in order to limit the potential of a serious accident. This would mostly require the realignment and widening of the road where sharp, line of sight obstructed curves are located, as well as the inclusion of a guardrail where it would help stop vehicles from sliding over the side of the shoulder where the creek is located.

Crystal Creek Drive is a relatively stagnant road in terms of residential development. There is some residential development on side roads which intersect Crystal Creek Drive, as well as some established residential land uses located on both sides of Crystal Creek Drive. There are two large tracts of land on Crystal Creek where it intersects Merriman Road. This is the likely location of a proposed new Cave Spring High School. This would dramatically increase the traffic volume on Crystal Creek Road as it will become the shortest access route between the new school facility and Route 221.

An LOS analysis reveals that the highest volume segment of Route 897 (between Merriman Road and Cartwright Drive) is currently operating at an LOS of B. This indicates that Route 897 is operating satisfactorily during the peak traffic volume hour.

There were 16 accidents on Crystal Creek Drive between 1992 and 1994. None of these accidents were fatal, but five resulted in injury. The total amount of property damage caused by these accidents was estimated at $48,375. The majority of these accidents occurred under the following conditions: during darkness (10; 63%), on a dry surface (13; 81%), during off peak travelling hours (12; 75%) and during a weekday (11; 69%). The majority of accidents were collisions with a fixed object off the road (9; 56%). There was no clear major factor for the majority of accidents. Five (5; 31%) accidents were caused by driver inattention and three (3; 19%) accidents apiece were caused by drunk drivers and by driver speeding.

As can be seen in Table 23, the highest accident segment of Crystal Creek Drive both in terms of the number of total accidents and the number of accidents per mile is the segment between Route 221 and Willow Spring Road. In fact, a truck slid backward over the side of this road into the creek bed 40 feet below in June of this year. The most likely contributing factors for these accidents are the sharpness of the curves, the fact that the road and the shoulder are both very narrow and the steepness of the shoulder south of this segment of Crystal Creek Drive.

Table 23: Route 897 Accidents By Location

Road Segment		Segment Length	Total	Accident Per Mile
From Route	To Route			
221	1716	0.60	13	21.7
1716	1726	0.37	2	5.4
1726	613	0.72	1	1.4

Note: accidents occurring at "To" intersections of road segments are included in the next segment count. Accidents occurring at the "To" intersection of the last segment are included in the accident count for that last segment.

In the late 1980's, VDOT proposed that this road be completely realigned from Route 221 to Merriman Road. This proposed reconstruction would have straightened, widened and moved Crystal Creek Drive away from the creek bed making it a much safer road to travel on. Residents of Crystal Creek Drive opposed the plan on the grounds that it would attract more through traffic making the road less safe and more congested. The Roanoke County Board of Supervisors never acted on the proposal and the improvements were never made to the road. In light of both the high number of accidents which have occurred on Crystal Creek Drive between 1992 and 1994 and the impending development of the new Cave Spring High School, the plan to improve Crystal Creek Drive should be revisited and given strong consideration for implementation. This is the most dangerous road in the study area and has great potential for significant traffic growth in the future.

Route 907 (Ranchcrest Drive)

Current traffic volumes (see Table 24) on Route 907 are equal on both segments of Ranchcrest Drive in the study area. They are also among the highest in the study area.

Table 24: Route 907 Traffic Growth

Road Segment		Segment Length	ADT 1994	ADT 1984	Absolute Growth	Percent Growth
From Route	To Route					
613	1682	0.09	3527	3504	23	1%
1682	221	0.23	3527	2955	572	19%

ADT: Average Daily Traffic

The fastest growing segment of Ranchcrest Drive in terms of absolute growth was the segment between Route 221 and Route 1682 (Springlawn Avenue). The fastest growing segment in terms of percent growth was the segment between Merriman Road and Springlawn Avenue. Because of the presence of more than one school on this road there are as many as 25 school busses traveling on Ranchcrest Drive throughout the course of a day.

Route 907 in the study area is approximately 0.3 miles long. It is a two-lane road center line divided road with white road edge markings. The intersection of Ranchcrest Drive and Route 221 is signalized. There are four lanes at the approach to Route 221 for approximately 100 feet, a left turn only lane and a shared right turn/through lane to accommodate vehicles coming from Ranchcrest Drive and two to accommodate traffic coming onto Ranchcrest Drive. No passing is allowed on Ranchcrest Drive. There is no sidewalk, curb or gutter located on either side of Ranchcrest Drive. The posted speed limit is 25 mile per hour. Ranchcrest Drive is 20 feet wide between Route 221 and Merriman Road. Improvements are planned for the section of Merriman Road which intersects Ranchcrest Drive which should improve the circulation of traffic between the two roads in the future. Shoulder widths range between four and seven feet wide in the study area. Ranchcrest Drive has no identifiable hazardous physical characteristics.

Ranchcrest Drive is heavily developed, having both residential and public facilities in the form of schools located on it. As, the vast majority of land on Ranchcrest Drive is already developed, there is little likelihood of there being additional development occurring in the foreseeable future. If the new Cave Spring High School is built on the property on either side of Crystal Creek Road at the intersection with Merriman Road, traffic volumes on Ranchcrest Drive are likely to increase.

An LOS analysis reveals that both segments of Ranchcrest Drive in the study area are currently operating at an LOS of C. This indicates that Ranchcrest Drive is operating satisfactorily during the peak traffic volume hour.

There were three accidents in the study area on Ranchcrest Drive between 1992 and 1994. None of these accidents were fatal, but one resulted in an injury. The total amount of property damage caused by these accidents was estimated at $4,580. Two of these accidents (66%) occurred in daylight while the third was at night. Two occurred on a dry surface (66%) while the third was on a wet surface. Two occurred during the peak travelling hours (one between 7:00 and 9:00 am one between 3:00 and 6:00 pm) and all three occurred during a weekday. One accident was a rear end collision, one was an angle collision and one was a collision with a fixed object off the road. Two of the accidents were caused by driver inattention (66%) while the third was caused by a defective vehicle.

Table 25: Route 907 Accidents By Location

Road Segment		Segment Length	Total	Accident Rate
From Route	To Route			
613	1682	0.09	1	11.1
1682	221	0.23	2	8.7

Note: accidents occurring at "To" intersections of road segments are included in the next segment count. Accidents occurring at the "To" intersection of the last segment are included in the accident count for that last segment.

Of the three accidents listed in Table 25, two occurred at the intersection of Route 221 and Ranchcrest Drive. The third occurred at the intersection of Ranchcrest Drive and Springlawn Avenue. Based on the major factor data discussed above, it is clear that all three of these accidents were not caused by any physical or other characteristic of Ranchcrest Drive itself. The only contributing factor that was attributable to the roadway itself was the fact that Ranchcrest Drive is a high traffic volume roadway which heightens the likelihood of an accident occurring due to driver inattention or a defective vehicle.

Route 1646 (Chatsworth Drive)

Traffic volumes (see Table 26) on Route 1646 have grown dramatically over the ten years between 1984 and 1994. Chatsworth Drive is the access road to Route 221 for more than one residential subdivision. Two school buses travel four times daily on Chatsworth Drive.

Table 26: Route 1646 Traffic Growth

Road Segment		Segment Length	ADT 1994	ADT 1984	Absolute Growth	Percent Growth
From Route	To Route					
Dead End	221	0.11	1168	309	859	278%

ADT: Average Daily Traffic

Route 1646 is approximately 0.1 miles long. It is a two lane road with a yellow center line for the first few yards and then there is no center line or road edge markings. There are both curbs and gutters on this road, but there are no sidewalks. No passing is allowed on Chatsworth Drive. The posted speed limit is 25 mile per hour. Chatsworth Drive is 32 feet wide. Chatsworth Drive has no identifiable hazardous physical characteristics.

Chatsworth Drive is a heavily developed subdivision access road. There are a couple of roads intersecting this road (Route 4076 and Route 1656) which also have residential development on them. These roads and Chatsworth Drive have little or no undeveloped land left available and are therefore unlikely to experience any further residential or other development in the future.

An LOS analysis reveals that Chatsworth Drive is currently operating at an LOS of B. This indicates that Chatsworth Drive is operating satisfactorily during the peak traffic volume hour.

There was one accident on Chatsworth Drive between 1992 and 1994. This accident resulted in no injury, but there was $3,400 of property damage caused. This accident occurred in daylight between 7:00 and 8:00 am on a Wednesday. It was an angle collision on a dry surface and was caused by driver inattention.

The accident listed in Table 27 occurred at the intersection of Route 221 and Chatsworth Road. Based on the major factor data discussed above, it is clear that this accident was not caused by any physical or other characteristic of Chatsworth itself

Table 27: Route 1646 Accidents By Location

Road Segment		Segment Length	Total	Accident Per Mile
From Route	To Route			
Dead End	221	0.11	1	9.1

Note: accidents occurring at "To" intersections of road segments are included in the next segment count. Accidents occurring at the "To" intersection of the last segment are included in the accident count for that last segment.

Route 1668 (Rosecrest Road)

Traffic volumes (see Table 28) on Route 1668 have grown moderately over the ten years between 1984 and 1994. Rosecrest Road is a well established residential road which runs between Roselawn Road and Route 221. Two school bus travels four times daily on Rosecrest Road.

Table 28: Route 1668 Traffic Growth

Road Segment		Segment Length	ADT 1994	ADT 1984	Absolute Growth	Percent Growth
From Route	To Route					
689	221	0.47	880	731	149	20%

ADT: Average Daily Traffic

Route 1668 is approximately 0.5 miles long. It is a two lane road with no center line or road edge markings. There are intermittent curbs and gutters, but there are no sidewalks. No passing is allowed on Rosecrest Road. The posted speed limit is 25 mile per hour. Rosecrest Road ranges between 20 and 24 feet wide and has seven foot shoulders where there are no curbs. Rosecrest Road has no identifiable hazardous physical characteristics.

Rosecrest Road is a heavily developed residential road. There are a couple of side roads intersecting this road which also have residential development on them. These roads and Rosecrest Road have little or no undeveloped land left available and are therefore unlikely to experience any further residential or other development in the future.

An LOS analysis reveals that Rosecrest Road is currently operating at an LOS of B. This indicates that Rosecrest Road is operating satisfactorily during the peak traffic volume hour.

There were two accidents on Rosecrest Road between 1992 and 1994. None of these accidents were fatal, but one resulted in an injury. The total amount of property damage caused by these accidents was estimated at $8,000. One of these accidents occurred at dusk while the other was at night. Both occurred on a wet surface. One occurred during the afternoon and the other occurred in the early morning and both occurred on a weekday. Both accidents were with a fixed object off the road and were caused by driver inattention.

Table 29: Route 1668 Accidents By Location

Road Segment		Segment Length	Total	Accident Per Mile
From Route	To Route			
689	221	0.47	2	4.3

Note: accidents occurring at "To" intersections of road segments are included in the next segment count. Accidents occurring at the "To" intersection of the last segment are included in the accident count for that last segment.

Both accidents listed in Table 29 occurred close to Roselawn Road. Based on the major factor data discussed above, it is clear that both of these accidents were not caused by any physical or other characteristic of Rosecrest Road itself. The only contributing factor that was attributable to the roadway itself was the fact that Rosecrest Road is a high traffic volume roadway relative to the other roadways in the study area which heightens the likelihood of an accident occurring due to driver inattention.

Route 1683 (Arlington Hills Drive)

Traffic volumes (see Tables 30) on Route 1683 have grown moderately over the ten years between 1984 and 1994. Arlington Hills Drive is a well established residential road which connects a few other well established residential roads to Route 221. Arlington Hills Drive is used by school busses as a shortcut route between Route 221 and Merriman Road and there are therefore as many as 15 to 20 school bus on Arlington Hills Drive throughout the course of a day.

Table 30: Route 1683 Traffic Growth

Road Segment		Segment Length	ADT 1994	ADT 1984	Absolute Growth	Percent Growth
From Route	To Route					
221	Dead End	0.28	1488	1336	152	11%

ADT: Average Daily Traffic

Route 1683 is approximately 0.3 miles long. It is a two-lane road with a yellow center line for the first few yards and then no center line or road edge markings. There are both curbs and gutters, but there are no sidewalks. No passing is allowed. The posted speed limit is 25 mile per hour. Arlington Hills Drive ranges between 28 and 30 feet wide. Arlington Hills Drive has no identifiable hazardous physical characteristics.

Arlington Hills Drive is the main access road for a fully developed residential area. There is little land left for future development. This implies that traffic volumes will stabilize at current levels.

An LOS analysis reveals that the segment of Arlington Hills Drive is currently operating at an LOS of B. This indicates that Arlington Hills Drive is operating satisfactorily during the peak traffic volume hour.

As can be seen in Table 31, there were no accidents on Arlington Hills Drive between 1992 and 1994.

Table 31: Route 1683 Accidents By Location

Road Segment		Segment Length	Total	Accident Per Mile
From Route	To Route			
221	Dead End	0.28	0	0.0

Note: accidents occurring at "To" intersections of road segments are included in the next segment count. Accidents occurring at the "To" intersection of the last segment are included in the accident count for that last segment.

Route 1950 (Forest Edge Drive)

Route 1950 was not in existence in 1984 and a traffic growth analysis can therefore not be conducted. Two school buses travel four times daily on Forest Edge Drive.

Table 32: Route 1950 Traffic Growth

Road Segment		Segment Length	ADT 1994	ADT 1984	Absolute Growth	Percent Growth
From Route	To Route					
221	2035	0.07	664	N/A	N/A	N/A

ADT: Average Daily Traffic

Route 1950 in the study area is .07 miles long. It is a two-lane road with no center line or road edge markings. No passing is allowed. The posted speed limit is 25 mile per hour. Forest Edge Drive is 22 feet wide with eight foot shoulders. Forest Edge Drive poses no hazard to motorists.

Forest Edge Drive is the main access road for a large subdivision. The subdivision is comprised of several residential roads which all connect to Forest Edge Drive before it intersects Route 221.

An LOS analysis reveals that the segment of Forest Edge Drive operating at an LOS of B. This indicates that Forest Edge Drive is operating satisfactorily during the peak traffic volume hour.

As can be seen in Table 33, no accidents occurred on Forest Edge Drive between 1992 and 1994.

Table 33: Route 1950 Accidents By Location

Road Segment		Segment Length	Total	Accident Per Mile
From Route	To Route			
221	2035	0.07	0	0.0

Note: accidents occurring at "To" intersections of road segments are included in the next segment count. Accidents occurring at the "To" intersection of the last segment are included in the accident count for that last segment.

CHAPTER 4

TRANSPORTATION IMPROVEMENT ELEMENTS

The Transportation Improvement Element 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 the Roanoke County secondary six year plan which receives funding from the Commonwealth Transportation Board's ***Six-Year Improvement Program*** and local land use and economic development policies so that these improvements are in harmony with other initiatives.

The following recommendations are based solely on the analysis conducted in this study. Citizen input must be considered prior to any implementation of any of the following recommendations. This list includes some recommendations which, if implemented, would be expensive (see Appendix II for a brief summary of transportation financing techniques) and require significant construction. These recommendations were made only after careful consideration of less expensive alternatives. Also, not all recommendations need be implemented in order to improve conditions within the study area. The implementation of a few of the recommendations 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 Roanoke County, 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

- VDOT design standards for guardrail placement involves such factors as the shoulder width, the degree of shoulder slope and the recoverable area beyond the shoulder. Roads in the study area with unprotected shoulders which meet or exceed the VDOT criteria should be considered for the placement of a guardrail. Priority should be given to roads which are either considered hazardous based on accident data or considered high volume based on 1994 traffic counts.

- VDOT design standards for roadway markings state that the criteria for a yellow center line marking is that the paved surface be at least 18 feet wide and that there be at least 500 vehicles per day using that segment of road. The criteria for a white edge line is that the pavement surface be at least 20 feet wide and there be a yellow center line present. Roads in the study area meeting these VDOT criteria should be considered for the placement of a yellow center line and/or a white road edge marking. The VDOT Salem Residency Office has allocated funding to upgrade the roadway markings on Roanoke County secondary roads meeting the new criteria.

- VDOT design standards for rural local roads state that pavement widths for roads with traffic volumes of 400 vehicles or more in rolling or level terrain should be a minimum of 22 feet. Rural local roads with current daily traffic volumes between 250 and 400 vehicles should have a pavement surface of at least 20 feet wide. Rural local roads with current daily traffic volumes below 250 vehicles should have a pavement surface of at least 18 feet wide. Roads in the study area with current daily traffic volumes meeting any of the above stated criteria should be considered for widening. Priority should be given to those roads which are expected to see substantial gains in daily traffic volumes in the future or which are deemed unsafe based on accident data.

Site Specific Recommendations

Route 613 (Merriman Road)

- Short Term: Given the current volume of traffic using Merriman Road and the potential for additional traffic based on the likely development of a new high school on Route 897 (Crystal Creek Drive) and Merriman Road, the road segment between Route 1564 (Meadowlark Road) and Route 1726 (Cartwright Drive) should be widened and straightened in order to reduce the hazard presented by the sharp, blind curves and a steep and narrow shoulder to the south and west of the road. The sharp curve at Meadowlark Road should be straightened as part of this road improvement.

- Short Term: Based on accident and traffic volume data, a traffic engineering study should be conducted at the intersection of Route 904 (Starkey Road) and Merriman Road to determine if signalization is warranted.

- Short Term: Based on accident and traffic volume data, a traffic engineering study should be conducted at the intersection of Route 907 (Ranchcrest Drive) and Merriman Road to determine if signalization is warranted.

Route 688 (Cotton Hill Road)

- Short Term: A traffic speed study should be conducted to determine average speeds of through traffic with the intent of lowering the speed limit on Cotton Hill Road where it is warranted.

- Short Term: Given the potential for additional traffic based on the development pressure on this and adjoining roads and the likely development of a new high school on Route 897 (Crystal Creek Drive) and Route 613 (Merriman Road), the section of Cotton Hill Road between Merriman Road and Route 934 (Shingle Ridge Road) should be widened and straightened in order to reduce the hazard presented by the sharp, blind curves and a steep and narrow shoulder to the south and west of the road.

Route 689 (Roselawn Road)

- Short Term: Based on accident data, warning signs should be posted between Route 1796 (Canter Drive) and Route 1668 (Rosecrest Road) advising motorists of roadway conditions and recommending a maximum safe speed of travel.

- Short Term: Based on accident and traffic volume data, a traffic engineering study should be conducted at the intersection of Roselawn Road and Canter Drive to determine if signalization is warranted.

- Long Term: Given the potential for additional traffic based on the development pressure on this and adjoining roads, the section of Roselawn Road between Canter Drive and Rosecrest Road should be widened and straightened in order to reduce the hazard presented by the sharp, blind curves and a steep and narrow shoulder to the north and east of the road.

Route 690 (Poage Valley Road, Poage Valley Road Extension and South Roselawn Road)

- Short Term: Based on accident data, warning signs should be posted along the entire length of Route 690 advising motorists of roadway conditions and recommending a maximum safe speed of travel. This is particularly important on South Roselawn Road where the most severe curves are located.

- Long Term: Given the potential for additional traffic based on development pressure, South Roselawn Road should be widened and straightened in order to reduce the hazard presented by the sharp, blind curves and a steep and narrow shoulder to the north and west of the road.

Route 692 (Mount Chestnut Road)

- Short Term: Additional warning signs should be posted along the entire length of Mount Chestnut Road advising motorists of roadway conditions and recommending a maximum safe speed of travel.

- Short Term: In order to improve circulation and safety, the approach from Mount Chestnut Road to Route 221 should be lengthened and flattened. Clearance of brush and foliage would also improve the line of sight at this intersection.

- Long Term: Given the potential for additional traffic based on development pressure, Mount Chestnut Road should be widened and straightened between Route 221 and Route 762 (Ivy Mountain Road) in order to reduce the hazard presented by the sharp, blind curves and a steep and narrow shoulder to the south and west of the road.

Route 694 (Twelve O'Clock Knob Road)

- Short Term: Warning signs should be posted along the entire length of Twelve O'Clock Knob Road advising motorists of roadway conditions and recommending a maximum safe speed of travel.

- Long Term: Given the potential for additional traffic based on development pressure, Twelve O'Clock Knob Road should be widened and straightened between Route 695 (Ridgelea Road) and Route 221 in order to reduce the hazard presented by the sharp, blind curves and a steep and narrow shoulder to the south and west of the road.

- Long Term: In order to improve access, circulation and safety, Route 670 East (Canyon Road) and Route 670 West (Lost Mountain Road) should be realigned so that they meet Twelve O'Clock Knob Road at right angles creating a four-legged intersection.

Route 696 (Apple Grove Lane and Martins Creek Road)

- Short Term: Warning signs should be posted on Martins Creek Road advising motorists of roadway conditions and recommending a maximum safe speed of travel.

Route 735 (Coleman Road)

- Short Term: Warning signs should be posted on Coleman Road advising motorists of roadway conditions and recommending a maximum safe speed of travel.

Route 745 (Ran Lynn Road)

- Short Term: A traffic speed study should be conducted to determine average speeds of through traffic with the intent of lowering the speed limit on Ran Lynn Road where it is warranted.

- Long Term: Given the potential for additional traffic based on development pressure, Ran Lynn Road should be widened and straightened between Route 221 and Route 690 (South Roselawn Road) in order to reduce the hazard presented by the sharp, blind curves and a steep and narrow shoulder to the south and west of the road.

Route 752 (Old Mill Road)

- Short Term: Warning signs should be posted on Old Mill Road advising motorists of roadway conditions and recommending a maximum safe speed of travel.

Route 897 (Crystal Creek Drive)

- Short Term: In the late 1980's, VDOT proposed that Crystal Creek Drive be straightened, widened and moved away from a creek bed in order to make it a safer road. Given the potential for dramatically increased traffic volumes based on the likely development of a new high school on Crystal Creek Drive and Route 613 (Merriman Road), the plan to improve Crystal Creek Drive should be revisited and given the strongest possible consideration for implementation.

APPENDIX I

Two-Lane Highway

Level-Of-Service Analysis

The *1985 Highway Capacity Manual* (HCM) states that, "a two-lane highway may be defined as a two-lane roadway having one lane for use by traffic in each direction. Passing of slower vehicles requires the use of the opposing lane where sight distance and gaps in the opposing traffic stream permit. As volumes and/or geometric conditions increase, the ability to pass decreases, resulting in the formation of platoons in the traffic stream. Motorists in these platoons are subject to delay because of the inability to pass."

Two-lane highways can meet several transportation needs including the provision of mobility between traffic generators, the provision of accessibility to a specific area and the provision of a scenic recreational resource. Three parameters are used to describe service quality for two-lane highways: 1) average travel speed, 2) percent time delay, and 3) capacity utilization. Average travel speed reflects the mobility function of two-lane highways, and is the length of the highway segment under consideration divided by the average travel time of all vehicles traversing the segment in both directions over some designated time interval. Percent time delay reflects both mobility and access functions, and is defined as the average percent of time that all vehicles are delayed while travelling in platoons due to the inability to pass. The utilization of capacity reflects the access function, and is defined as the ratio of the demand flow rate to the capacity of the facility. Level-of-service (LOS) criteria utilize all three of these parameters and as such provides the best method to evaluate the operating efficiency of any particular facility.

The HCM classifies highway service quality using six levels of service: A, B, C, D, E and F. It is important to understand what each level of service represents. They are described below:

> LOS A represents the highest quality of traffic service and would result in average speeds approaching 60 miles per hour on two-lane highways. The passing frequency required to maintain these speeds has not reached a demanding level. Passing demand is well below passing capacity and almost no platoons of three or more vehicles are observed. Drivers would be delayed no more than 30 percent of the time by slow-moving vehicles.
>
> LOS B represents the region of traffic flow wherein speeds of 55 miles per hour or slightly higher are expected on level terrain. Passing demand needed to maintain desired speeds becomes significant and approximately equals the passing capacity at the lower boundary of LOS B. Drivers are delayed up to 45 percent of the time on average.
>
> LOS C represents conditions characterized by increases in traffic flow resulting in noticeable increases in platoon formation, platoon size and frequency of passing impediment. Average speed still exceeds 52 miles per hour on level terrain even though unrestricted passing demand exceeds passing capacity. While traffic flow is stable, it is becoming susceptible to congestion due to turning traffic and slow-moving vehicles. Percent time delays are up to 60 percent.

LOS D represents conditions characterized by unstable traffic flow. Passing demand is very high while passing capacity approaches zero. Mean platoon sizes of 5 to 10 vehicles are common although speeds up to 50 miles per hour can still be maintained under ideal conditions. The fraction of no passing zones along the roadway section usually has little influence on passing. Turning vehicles and/or roadside distractions cause major shockwaves in the traffic stream. The percentage of time motorists are delayed approaches 75 percent.

LOS E represents traffic flow conditions on two-lane highways having a percent time delay of greater than 75 percent. Even under ideal conditions speeds will drop to below 50 miles per hour. Passing is virtually impossible and platooning becomes intense when slower vehicles or other interruptions are encountered. The highest volume attainable under LOS E defines the capacity of the highway. Under ideal conditions, capacity for a two-lane highway is 2,800 passenger car equivalents (passenger car equivalents take into account the differences between heavy vehicles and passenger cars for the purposes of calculating a level-of-service) per hour. Prevailing conditions such as terrain and directional split can lower the ideal capacity.

LOS F represents heavily congested flow with traffic demand exceeding capacity. Volumes are lower than capacity and speeds are below capacity speed.

APPENDIX II

Transportation Financing Techniques

There are several traditional ways in which roadway improvements can be funded. There are also many communities which have developed innovative and creative ways to fund transportation improvement projects. This is particularly true in jurisdictions located in "Home Rule" states where a locality may implement public policy initiatives unless specifically prohibited from doing so by the state constitution. Virginia is a "Dillon Rule" state where a locality may implement public policy initiatives only as specifically allowed by the state constitution. Some transportation financing techniques employed around the country may, therefore, not be appropriate for implementation in Virginia localities. The following is a list of some transportation improvement financing strategies which may be employed in Virginia. For more information on this subject see ***Alternative Financing for Urban Transportation: The State of the Practice*** by the U.S. Department of Transportation, July 1986.

- **Federal and State Transportation Funding:** local transportation improvement projects are funded through federal and state funding through the Commonwealth Transportation Board's ***Six Year Improvement Program***. Localities can request that specific priority projects be included in the six year program for funding and implementation.

- **Local General Funds:** local jurisdictions are free to finance transportation improvement projects from their local general funds.

- **Municipal Bonds:** local jurisdictions are free to finance local transportation improvement projects through the issuance of municipal bonds

- **Motor Fuels Tax:** localities which are members of a Transportation District Commission granted taxing authority by the Commonwealth of Virginia, may levy up to a two percent tax on the sale of motor fuels. Depending on the agreement reached between member jurisdictions of the Commission, some funds raised from a motor fuels tax may be applied toward local roadway improvement projects.

- **Proffer System:** originating in Fairfax County, the proffer system allows county officials to negotiate agreements with developers under which developers have offered to finance road improvements in return for zoning changes and occupancy permits.

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