3.0 AFFECTED ENVIRONMENT

3.1 TRANSPORTATION SETTING

3.1.1 Existing Transportation Network

3.1.1.1 Existing Non-Highway System

Transportation facilities and services, while mainly concentrated in the Roanoke and Martinsville areas, are located throughout the entire study area. Non-highway transportation components include an airport, rail (freight) systems, and public transit. Airport facilities are located immediately adjacent to I-581 in Roanoke at the Roanoke Regional Airport. Rail facilities include freight lines operated by Norfolk Southern Corporation. The majority of rail lines are located in the Roanoke portion of the study area. One line runs parallel to U.S. Route 220 from Roanoke, down through Martinsville, and continues south beyond the North Carolina state line. The largest public transportation system in the study area is the Greater Roanoke Transit Company, Valley Metro. The Valley Metro system operates ten fixed service routes in the City of Roanoke, and in portions of Salem, Vinton, and Roanoke County. The highway transportation system is the main focus of the affected environment review and is discussed in further detail in following sections.

3.1.1.2 Existing Highway System

U.S. Route 220 is a divided four-lane highway with a posted speed limit of 55 miles per hour (mph) (88.5 kilometers per hour (km/h)) throughout most of the study area. The route provides for regional traffic service from I-81, south into North Carolina, as well as for local traffic between Roanoke, Rocky Mount, Martinsville, and Ridgeway. Several east-west routes intersect U.S. Route 220 within the study area - including U.S. Route 221, Route 40, and U.S. Route 58. Route 122 connects Rocky Mount to Bedford County and Bedford City to the east. Route 116 intersects Route 122 at Burnt Chimney and continues north to the City of Roanoke. These two routes connect the Smith Mountain Lake resort and retirement area with Rocky Mount, Roanoke, and Bedford. The third state primary route is Route 40, an east-west facility. Route 40 passes through the center of Franklin County and connects with U.S. Route 29 in Pittsylvania County. Table 3.1-1 presents the U.S. Route 220 and the major crossroads roadway characteristics in the study area.

Two U.S. highways and three Virginia primary highways traverse the study area in the Martinsville-Henry County area. U.S. Route 58 runs east-west through the City of Martinsville and Henry County. It intersects U.S. Route 29 in Pittsylvania County and the Blue Ridge Parkway in Patrick County (both outside of the study area). U.S. Route 58 is part of VDOT's arterial system and has interchanges at U.S. Route 220 South, Alternate Route 57, and U.S. Route 220 North. U.S. Route 220 provides access to I-85 and I-40 in Greensboro, North Carolina. The U.S. Route 220 Martinsville Bypass was completed in 1980, connecting U.S. Route 220 south of Martinsville with U.S. Route 220 north of Martinsville. The U.S. Route 58 Bypass connects the U.S. Route 220 Martinsville Bypass with U.S. Route 58 East.

Several local roads are important routes for travelers to the Smith Mountain Lake resort and residential areas. Travelers arriving from the north use either U.S. Route 220 or Route 122. Others use either Route 116 or Route 634 (Hardy Road). Those arriving from the south rely on U.S. Route 220, Route 108, and Route 690. Various secondary routes and local streets that provide for vehicular circulation within Roanoke, Franklin, and Henry counties also intersect U.S. Route 220.

Development within the study area outside the urban areas of Roanoke, Rocky Mount, and Martinsville is largely agricultural and low density residential. The roadway facilities in the area are predominantly rural in nature. Due to the generally rolling and even mountainous terrain, existing roadways generally exhibit a high degree of horizontal and vertical curvature.

Table 3.1-1
CHARACTERISTICS OF THE EXISTING ROAD NETWORK

Route and Location	Number of Lanes	Maximum Grade (percent)
North/South Routes		
U.S. Route 220 Corridor		
U.S. Route 220 from Route 419 to Blue Ridge Parkway	4	6
U.S. Route 220 from Blue Ridge Parkway to Buck Mountain Road	4	5
U.S. Route 220 from Buck Mountain Road to U.S. Route 220 Bypass in Rocky Mount	4	9
U.S. Route 220 from U.S. Route 220 Bypass in Rocky Mount to Route 57	4	4
U.S. Route 220 from Route 57 to U.S. Route 58	4	5
U.S. Route 220 from U.S. Route 58 to U.S. Route 58 Bypass	4	4
U.S. Route 220 from U.S. Route 58 Bypass to U.S. Route 220 Bypass N. Ridgeway	4	4
U.S. Route 220 from U.S. Route 220 Bypass North Ridgeway to U.S. Route 220 South Ridgeway	4	2
U.S. Route 220 from U.S. Route 220 South Ridgeway to North Carolina state line	4	4
East/West Routes		
Route 116 Franklin County Line to Roanoke	2	8-10
Route 40 West of Rocky Mount	2	6
Route 40 East of Rocky Mount	2	6
Route 122 at Route 40 East of Rocky Mount	2	3
Route 57 from Route 903 to U.S. Route 220	4	3
Route 57 from U.S. Route 220 to Route 609	2	3
Route 57 Alternate from Route 903 to U.S. Route 220	2	2
U.S. Route 58 West of U.S. Route 220 Bypass	4	4
U.S. Route 58 East of U.S. Route 220 Bypass	4	2
Route 87 North Carolina state line to Ridgeway	2	1

Source: VDOT published inventory, 1997.

Re-occurring congestion in the study area is currently limited to the main interstate highways and the interchange areas in and near Roanoke. Highway congestion currently occurs along I-581 during the peak hours. Congested conditions are frequent in the Elm Avenue interchange area. The close proximity of the ramp intersections along Elm Avenue along with the high turning movements at these signalized locations contributes to the frequent peak hour traffic congestion. Queues of vehicles in the right-hand lanes along I-581 also occur approaching the Orange Avenue and Williamson Avenue interchange off-ramps during the morning inbound peak period. Similarly, occasional traffic queues can occur along I-81 during the peak periods. The congestion is usually found in advance of the I-581 interchange exit ramps from I-81, mainly during the morning peak period. Heavy traffic movements can also occur along the section of U.S. Route 220 south of the limited access highway portion of the roadway. Reduced travel speeds and frequent queues of vehicles occur due to the presence of signalized and unsignalized intersections combined with the lack of access control in this area.

3.1.2 Existing Volumes and LOS

3.1.2.1 Traffic Count Program Results

A traffic count program was conducted for the study area in the fall of 1997. Traffic data recovered from this effort included mainline tube counts and turning movements at major intersections. Traffic volumes as discussed in this analysis represent two-way, 24-hour traffic along the various roadway segments in the study area. Traffic volume ranges from 17,500 to 40,400 along existing U.S. Route 220 at the locations counted. The highest counted volumes were located in the northern sections of U.S. Route 220 near Roanoke and in the sections around Martinsville. Twenty-four-hour traffic volumes along other roadways in the study area are as follows:

- 45,500 on Route 419 west of U.S. Route 220;
- 12,200 on the U.S. Route 58 Bypass around Martinsville east and west of U.S. Route 220;

- between 8,000 and 14,500 on U.S. Route 220 Business in Rocky Mount; and
- 22,300 on U.S. Route 220 Business east of U.S. Route 220.

Roadways such as the Blue Ridge Parkway and Buck Mountain Road were found to have relatively low daily traffic volumes. The volumes ranged from 1,600 to 2,500 on the Blue Ridge Parkway and 5,400 on Buck Mountain Road.

In addition to the traffic count program throughout the study area, a supplemental traffic count program was conducted in March 1999 along the downtown Roanoke sections of I-581 and portions of U.S. Route 220. Along I-581, mainline sections of the highway were counted along with all entrance and exit ramps at the interchanges between Orange Avenue and Route 419. In addition, traffic counts were taken along three central portions of U.S. Route 220 in Franklin County. The counts were conducted to provide additional traffic data to develop a more thorough understanding and analysis of traffic conditions along exiting I-581 and U.S. Route 220.

3.1.2.2 Existing ADT

Existing ADT volumes along roadways in the U.S. Route 220 study area were obtained from the count program described above and supplemented with a study area modal and existing counts from VDOT Traffic Data. This information is summarized in Table 3.1-2 and illustrated in Figure 3.1-1. As indicated, traffic volumes along U.S. Route 220 range from 11,400 north of the North Carolina state line to 56,300 south of Route 24. In the middle of the study area, ADT volumes are between 11,400 and 32,300 along U.S. Route 220. ADT volumes along I-581 in Roanoke range from 75,100 north of U.S. Route 460 (Orange Avenue) to 89,300 south of U.S. Route 460. On I-81, ADT volumes are in the order of 36,600 north of U.S. Route 220 to 57,900 north of I-581. Other ADT volumes in the study area include U.S. Route 460 at 37,800 east of Alternate U.S. Route 220, U.S. Route 221 at 18,100 west of U.S. Route 220, and U.S. Route 58 at 17,900 east of the U.S. Route 220 Bypass around Martinsville.

Table 3.1-2
1997 EXISTING ADT AND LOS

Route and Location	ADT	LOS (Peak Hour)
I-81 - South of I-581	48,800	D
I-81 - North of I-581	57,900	E
I-81 - North of U.S. Route 220	36,600	C
I-581 - South of I-81	76,000	C
I-581 - North of U.S. Route 460	75,100	C
I-581 - Route 11 to U.S. Route 460	89,300	D
I-581 - Route 24 to U.S. Route 11	76,200	D
U.S. Route 220 - Route 24 to Wonju Street	58,300	D
U.S. Route 220 - Wonju Street to Route 419	48, 600	B
U.S. Route 220 - South of Route 419	32,300	C
U.S. Route 220 - South of Boones Mill	27,100	B
U.S. Route 220 - South of Rocky Mount	17,500	A
U.S. Route 220 - South of Sydnorsville	19,600	A
U.S. Route 220 - South of Franklin County	21,400	A
U.S. Route 220 - South of Bassett Forks	20,400	A
U.S. Route 220 - North of Ridgeway	12,900	A
U.S. Route 220 - North of North Carolina state line	11,400	A
U.S. Route 460 - East of Alternate U.S. Route 220	37,800	C
U.S. Route 460 - I-581 to Alternate U.S. Route 220	21,900	B
Route 24 - East of U.S. Route 220	12,200	A
U.S. Route 221 - West of U.S. Route 220	18,100	E
Route 40 - West of Rocky Mount	4,500	C
Route 40 - East of Rocky Mount	7,900	D
Route 122 at Route 40 - East of Rocky Mount	5,400	C
Route 57 - West of U.S. Route 220	12,500	E

Route and Location	ADT	LOS (Peak Hour)
Route 57 - East of Martinsville	9,700	E
U.S. Route 58 - West of U.S. Route 220 Bypass	8,000	A
U.S. Route 58 - East of U.S. Route 220 Bypass	17,900	A

3.1.2.3 Truck Volumes

Goods movement is an important factor in traffic generation and composition currently experienced in the study area. Trucks comprise between 14 and 17 percent of U.S. Route 220's daily traffic within the study area. This percentage is much higher than what is experienced on similar rural principal arterials. Table 3.1-3 compares U.S. Route 220's percent truck volumes with other Virginia interstates and selected primary highway segments. Study area businesses and manufacturing operations contribute to the truck volumes. Textile, furniture, manufactured housing, aggregate quarries, and window manufacturing are located in the study area. Several of the manufacturers in the central and southern portions of the study area maintain headquarters in the Piedmont Triad area (Greensboro, High Point, and Winston-Salem, North Carolina). Along with manufacturing facilities located in the southern portions of the study area, these commercial activities contribute to the high percentages of truck traffic on U.S. Route 220. U.S. Route 220 serves as the key access road to the north as well, providing businesses with access to I-81 and its links to I-64, I-66, and I-77.

Table 3.1-3
PERCENT TRUCKS ON U.S. ROUTE 220 AND SELECTED ROUTES

Route	Percent Trucks
U.S. Route 220 – South of Rocky Mount	14 %
U.S. Route 220 – Near North Carolina state line	17 %
I-64 – West of Lexington	23 %
I-64 – East of Charlottesville	17 %
I-77 – South of US 52	21 %
I-81 – North of I-581	21 %
I-95 – North of Fredericksburg	10 %
I-95 – Near North Carolina state line	17 %
I-295 – West of US 360	11 %
I-581 – South of Hershberger Rd	7 %
U.S. Route 29 – South of Lynchburg	8 %
U.S. Route 58 – East of Martinsville	8 %

Sources: 2003, VDOT Permanent Traffic Count Locations.

3.1.2.4 Existing LOS Conditions

LOS refers to the degree of roadway or intersection congestion. LOS is described using a letter scale from "A" to "F", with "A" representing the best service and "F" representing the worst. Table 3.1-4 relates LOS to the corresponding traffic operation. LOS is calculated from the available roadway capacity and ADTs. Existing traffic volumes provide an indication of current (1997) traffic operations. They are used to estimate existing LOS. VDOT has an ongoing traffic count program which measures traffic along routes within the study area. VDOT traffic volumes serve as the basis for transportation planning by the cities, counties and PDCs. The American Association of State Highway Transportation Officials (AASHTO) manual on Geometric Design of Highways and Streets calls for a design year LOS of "B" on through and auxiliary lanes, a LOS of "C" on ramps, Collector-Distributor (C-D) roads, and a LOS of "D" in metropolitan areas.

Table 3.1-4
LOS DESCRIPTIONS

LOS	Description	Congestion Level
A	Free traffic flow with low volumes and high speeds. Speeds controlled by driver desires, speed limits, and roadway physical conditions.	Low
B	Stable traffic flow, with operating speeds remaining near free flow. Drivers still have reasonable freedom to maneuver.	Low
C	Stable flow, but higher volumes more closely control speeds and maneuverability.	Moderate
D	Approach unstable flow with tolerable operating speeds maintained, but considerably affected by changes in operating conditions.	Moderate
E	Unstable flow with low speed and momentary stoppages.	Severe
F	Forced flow with low speed. Stop-and-go with stoppages for long periods are possible.	Severe

Source: Highway Capacity Manual, USDOT, 1994.

LOS calculations were developed for the segments of U.S. Route 220 and its crossroads within the study area, as well as for mainline segments of I-581. The data presented herein provides an indication of how each roadway facility segment operates under normal conditions. Congestion at intersection locations may be more severe due to intersection capacity controls. Two-lane highways, multi-lane highways, and freeway facilities each have different flow characteristics, and therefore require separate computational procedures to evaluate the quality of flow measured as LOS.

Although the LOS for a particular facility type can be compared under various traffic conditions, comparison of LOS for differing facilities is not as self-evident. For example, the criteria used to determine LOS for freeways and multi-lane highways is traffic density. The maximum allowable density of traffic for a given LOS on a freeway is lower than for the same LOS on a multi-lane highway, but is not indicative of lower performance for freeways than for multi-lane highways. This is due to the ability of a freeway, at any given traffic density, to accommodate larger volumes of traffic at higher speeds. LOS for all alternatives and roadways were determined using the Highway Capacity Software (HCS) and the Corridor Simulation analysis program (CORSIM).

A detailed analysis of I-581 and U.S. Route 220 was conducted through downtown Roanoke. This analysis indicated that LOS currently ranges between B and D in the peak period operations on the mainline highway sections. LOS D conditions are seen in the heavily traveled merge and diverge section between Orange Avenue and the Williamson Road exit and entrance ramps.

Utilizing 1997 traffic count data and the HCS, it was found that U.S. Route 220 from Route 419 to the North Carolina state line operates between a LOS A and C during the peak hour. Similarly, U.S. Route 58 and Route 24 also were found to operate at LOS A during their 1997 peak hour. Peak hour LOS are summarized in Table 3.1-2 and illustrated in Figure 3.1-1. Current conditions indicate that U.S. Route 460 east and west of Alternate U.S. Route 220 operates between a LOS C and B, respectively, during peak hour periods. The 1997 traffic operations for all sections of I-81 in the study area were found to range between LOS C and E. Two-lane highways in the study area were analyzed and found to currently operate at lower LOS. U.S. Route 221 west of U.S. Route 220 was found to have a LOS E during the peak hour. Route 40 ranged from LOS C west of Rocky Mount to LOS D east of Rocky Mount. The ADT count indicated that Route 57 operates at LOS E, while Route 122 operates at LOS C.

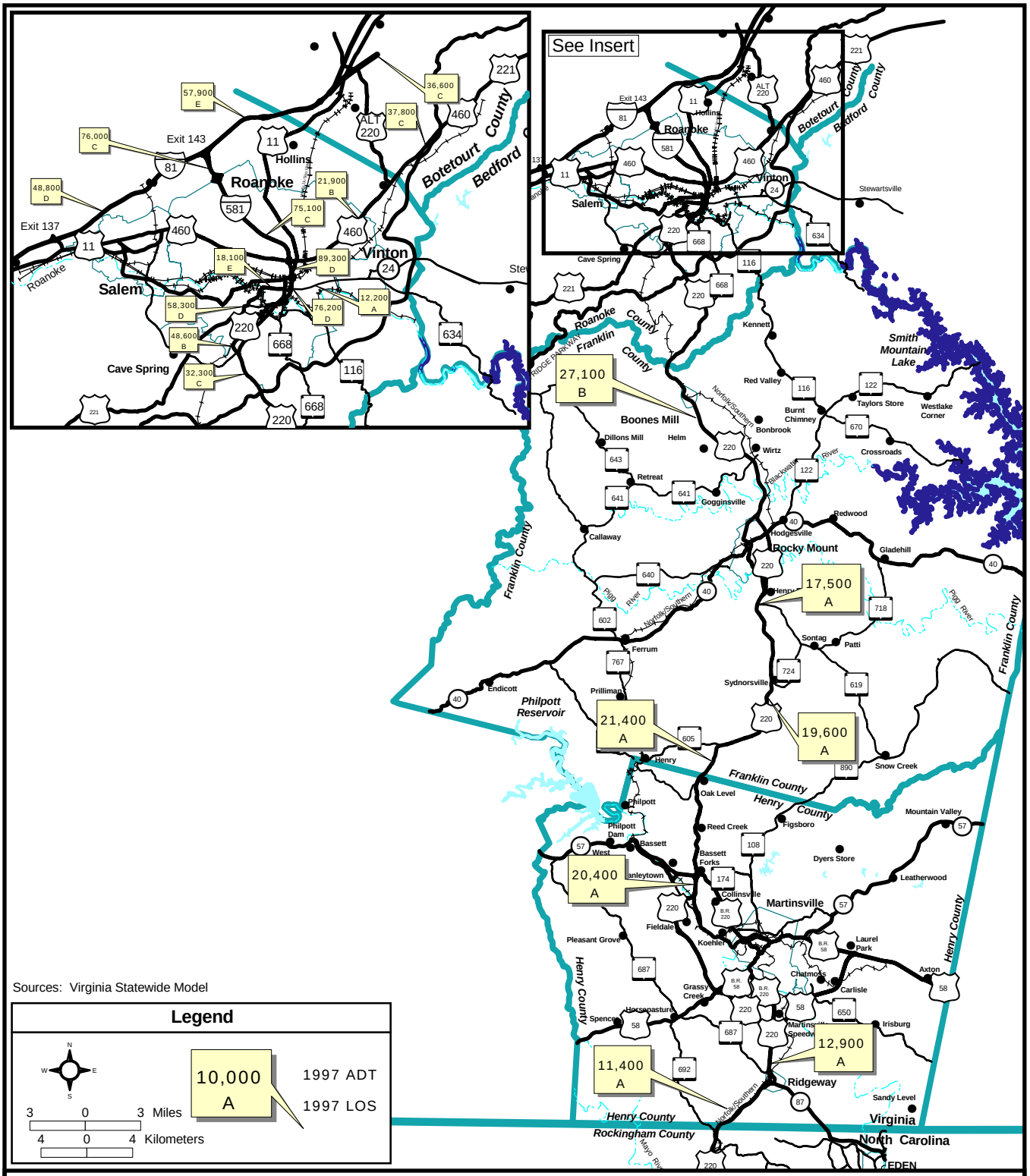

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FIGURE 3.1-1
EXISTING LEVEL OF SERVICE AND AVERAGE DAILY TRAFFIC

3.1.3 Safety Issues in the U.S. Route 220 Corridor

Safety on U.S. Route 220 is an issue of concern. Existing U.S. Route 220 was constructed in the 1950s and 1960s to then acceptable design standards that were greatly reduced from those used today. Traffic volumes also were not as high as today's volumes. High accident rates, fatalities, and spills of hazardous materials contributed to a 1993 request by Henry County to VDOT for a U.S. Route 220 accident analysis. VDOT responded by completing a safety analysis (see Table 1.3-1). Field inspections and speed studies were conducted to assess design and operational factors affecting accidents and safety in the corridor.

Henry, Franklin, and Roanoke counties located along U.S. Route 220 each include numerous crossovers or places where vehicles can cross the roadway. All of these locations are unsignalized crossings and in many instances the available space in the median is too small to allow for a safe turn. Many of these crossings do not have left turn pockets to store the vehicles safely away from fast moving through traffic. "On a 55 mile per hour [88.5 km/h] facility, the absence of left turn lanes could severely reduce operational efficiency and, at the same time, decrease safety." (VDOT, Route 220 Safety Report, September 1994). Table 3.1-5 summarizes the crossovers by county and the feature(s) that causes them to be unsafe.

Table 3.1-5
NUMBER OF CROSSOVERS BY COUNTY

County and Mileage (Kilometers)	Number of Crossovers with No Turn Lanes	Number of Crossovers with Turn Lanes in Only One Direction	Total Number of Crossovers
Roanoke - 6 Miles (9.7 Km)	28	4	44
Franklin - 22 Miles (35.4 Km)	22	11	69
Henry - 24 Miles (38.6 Km)	22	4	62

Source: Route 220 Safety Report, VDOT, September 1994.

U.S. Route 220 is a four-lane, divided full-access highway. The spacing and widths of crossover areas along the corridor are too close together and too narrow. The VDOT Road Design Manual states a desirable crossover spacing of 900 feet (274 meters) with a minimum sight distance of 600 feet (183 meters) for design speeds of 50 mph (88.5 km/h). In a one-half mile (0.8 kilometer) - long portion of U.S. Route 220 just below the Blue Ridge Parkway 11 separate crossovers exist. Four of these crossings are within 105 feet (32 meters) of each other and the rest are no farther than 580 feet (177 meters) apart. Only four of these have a left turn lane and three of these are in only one direction. A second issue related to the dangers of these crossovers is the narrow median width, in which a vehicle is expected to wait until it is clear to proceed. The VDOT Road Design Manual recommends a minimum median width of 16 feet (5 meters) on arterials where speeds are in the low to intermediate range. On higher speed facilities, the recommended median width is 40 feet (12.2 meters).

In a study conducted by VDOT, 12 crossovers located in high accident rate locations in Roanoke County were recommended for closure. The study noted that one-half of the crossovers in Roanoke County do not meet minimum spacing requirements. In addition, five crossovers in Franklin County and four in Henry County were recommended for closure. Along the existing roadway, the majority of the crossovers are protected with left turn lanes in both directions in these two counties. The study however, identified the need for improvements to the turning lanes at the intersections of Route 87 in Henry County and Route 1301 (in Franklin County) with U.S. Route 220. The existing roadway alignment and narrower lane widths south of Ridgeway and a water runoff problem in the vicinity of Route 669 also were identified.

Speeding on U.S. Route 220 also contributes to the high numbers of accidents. A speed analysis was conducted in four locations, each with a posted speed limit of either 45 mph (72.4 km/h) (Boones Mill) or 55 mph (88.5 km/h). The VDOT safety analysis reports, "Ideally, the 85th percentile speed should correspond to the posted speed limit." In all four locations, the 85th percentile speed exceeded the posted speed limit. The report notes, "Roadway sections with a speed differential greater than 10 miles per hour [16.1 km/h] have much greater accident rates than sections with a speed differential less than 10 miles per hour [16.1 km/h]." Recommendations for greater enforcement, particularly in Boones Mill were made.

There are few options for the movement of goods to destinations north and south in the study area other than U.S. Route 220. Steep grades, uncontrolled access along U.S. Route 220, and poor sight distance also contribute to the safety problems on U.S. Route 220 for automobile and truck drivers.

VDOT has completed some of the study recommendations and continues to implement recommendations as part of the ongoing road maintenance. Most improvements have been made in the vicinity of the U.S. Route 220 and Route 902 intersection and the U.S. Route 220 and Route 605 intersection at the Henry County line. The District has reduced the speed limit to 45 mph (72.2 km/h) in the vicinity of Clarence's Steak House (just south of Martinsville) and has installed a flashing warning light at the intersection. Discussions with the State Police about speed enforcement have been initiated. The long-term plan of VDOT is to begin design of the Route 902 relocation to tie-in opposite Route 1360. Along with this planned relocation, VDOT plans to close several crossovers and entrances as well as provide left turn lanes at crossovers left open. Plans also include the installation of over-sized "congested area" warning signs with flashers on both directions of U.S. Route 220. In addition, VDOT plans to install thermoplastic rumble strips on U.S. Route 220 immediately before the warning signs to provide an auditory warning to drivers. Despite these minor safety improvements, accidents will continue to be an issue on U.S. Route 220 because of the increasing volume of traffic, the high percentage of trucks, and the overall geometrics, which fail to meet current design standards.

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