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Alternatives Study Report

Blowing Rock Bypass Alternatives

1. INTRODUCTION AND SUMMARY

1.1 PROPOSED ACTION

The North Carolina Department of Transportation (NCDOT) proposes to improve US 321 to a multilane facility for a distance of approximately 7.0 kilometers (4.3 miles) in Caldwell and Watauga Counties. Both widening the existing road and Blowing Rock bypass alternatives are being considered. The project area for this bypass alternatives study extends as far south as 0.9 kilometer (0.6 mile) south of Falcon Crest Road (SR 1421) and as far north as the SR 1533 (Aho Road)/US 321 intersection in order to capture the full range of potential bypass corridors ([see Figure 1](#)).

1.2 PURPOSE OF STUDY

The US 321 EIS Study is being performed in three phases: I) bypass alternatives study, II) preparation of a Draft Environmental Impact Statement for public and agency review that compares the widening and bypass alternatives, and III) preparation of a Final Environmental Impact Statement that responds to public and agency comments and identifies a preferred alternative. This report documents the findings of Phase I. Its purpose is to document the:

- Project's purpose and need.
- Selection of bypass alternatives for detailed evaluation in an Environmental Impact Statement.

1.3 PROJECT AREA

The project area is shown in [Figure 1](#) and consists of: US 321 on the west and southwest; the US 321/SR 1533 (Aho Road) intersection on the north; a line between a point approximately one kilometer south of Falcon Crest Road and a point on the Yadkin River approximately 1,000 meters due south of the Watauga/Caldwell County line on the southeast; and the Yadkin River, Horse Ridge, and Thunder Hill on the northeast. The project area was expanded in the middle of the study to include an area north of the Blue Ridge Parkway.

1.4 SUMMARY OF BYPASS ALTERNATIVES STUDY FINDINGS

1.4.1 Purpose and Need

Consistency with County and State Plans

The 1981 Thoroughfare Plan for Caldwell County states that US 321 should be widened from two to four lanes. The plan currently is being updated. The 1993 Thoroughfare Plan for Region D (Alleghany, Ashe, Avery, Mitchell, Watauga, Wilkes, and Yancy Counties) assumes that US 321 is widened as specified in the Transportation Improvement Program. The Watauga County component of the Region D plan was adopted by Watauga County.

In 1989, the North Carolina State legislature designated a network of US and NC highways as intrastate corridors. The Intrastate System was established to connect major population centers and provide safe, convenient travel for motorists. It is designed to support statewide growth and development objectives (NCDOT, August 1992). US 321 is a part of the North Carolina Intrastate System.

Improvement of Roadway Characteristics

Existing US 321 is substandard because of steep grades, sharp curves, and narrow pavement widths. A widening alternative and each of the bypass alternatives would be an improvement over these conditions. The further south a bypass begins, however, the more there is of US 321 that would remain unimproved. The closer the beginning of the bypass portion is to the southern town limits of Blowing Rock, the less there is of US 321 that would remain unimproved.

Highway Capacity and Level of Service

The existing highway system lacks the capacity to handle projected traffic in the year 2025. Either a four-lane road or a bypass will relieve forecast congestion on existing US 321. A bypass with a Blue Ridge Parkway crossing would be less effective at reducing traffic on existing US 321.

The segment of US 321 south of Blowing Rock currently is operating at an undesirable peak hour level of service E (defined in section 2.5.3). Traffic in Blowing Rock is operating at a desirable peak hour level of service C. Without improvements, the level of service will worsen and reach level of service F south of Blowing Rock and E and F in Blowing Rock by 2025.

Safety

Accident rates along the segment of US 321 in the project area are substantially higher than the average accident rates for similar roads in North Carolina. Improving the existing road would allow safe passing of slower moving vehicles, permit smoother flow of traffic, allow vehicles to enter and exit the roadway more easily, and reduce the chances of head-on and rear-end collisions. Traffic using a bypass would have these same benefits. Although the number of accidents could decrease on portions of US 321 that remain unimproved with the bypass alternatives because of fewer vehicles on existing US 321, accident rates (based on vehicle miles traveled) would remain unchanged..

1.4.2 Potential Bypass Alternatives

Engineering, traffic, and environmental considerations were used to evaluate initially ten potential bypass location corridors. All included a northern terminus at Opossum Hollow Road south of the Blue Ridge Parkway. At the urging of the Concerned Citizens of Blowing Rock and the Blowing Rock Town Council, four potential corridors that cross the Blue Ridge Parkway in a tunnel were added; three were proposed by the Concerned Citizens of Blowing Rock, and one was developed by the study team. Constraints primarily related to terrain resulted in tunnel lengths longer than proposed by the Concerned Citizens. The Concerned Citizens' preferred location for returning the bypass to US 321 south of the Parkway also was added and connected to the southern termini of the three Concerned Citizens' corridors. The corridors are shown in [Figure 2](#). The initial 10 are A, B, C, D, AG, BG, CG, DG, E, and F. Those added later include CC-AI, CC-BI, CC-CI, and AJ, which cross under the Parkway in a tunnel, and CC-AH, CC-BH, and CC-CH.

All of the corridors south of Blowing Rock, except Alternatives E and F can be mixed and matched with any ending point on the north. Alternative F can be combined with the northern ending point associated with alternatives CC-AH, CC-BH, and CC-CH.

1.4.3 Alternatives Selected for Further Study and Comparison to the Widening Alternative

Alternatives E; a combination of F with the northern ending point used for alternatives CC-AH, CC-BH, and CC-CH (Alternative FH); CC-CH; CC-CI (includes a tunnel) will be studied in greater detail and compared to the widening alternative in the Draft Environmental Impact Statement. These corridors were chosen for the following reasons:

- Alternative E (will be referred to as Bypass Alternative 1 in the DEIS)
 - It is the shortest and least expensive bypass alternative .
 - It can be designed to avoid area historic resources.
 - It would have the least visual impact on the Blue Ridge Parkway.
 - It would have a minimal impact on the Blowing Rock Assembly Grounds when compared to the other alternatives ending south of the Blue Ridge Parkway.
- Alternative FH (will be referred to as Bypass Alternative 2 in the DEIS)
 - Like Alternative E, it can be designed to avoid area historic resources.
 - Its northern terminus is between the Blue Ridge Parkway and the northern-most residential subdivision in Blowing Rock, unlike E, which terminates at Opossum Hollow Road. The Blowing Rock Town Council and many members of the Citizens' Advisory Committee have stated their objections to a northern terminus at Opossum Hollow Road.
- Alternative CC-CH (will be referred to as Bypass Alternative 3 in the DEIS)
 - In the past, representatives from the Concerned Citizens of Blowing Rock have indicated that the best corridor for returning a bypass to US 321 south of the Parkway was one that remained as close to the Parkway as possible.
 - It bypasses the final curves on existing US 321 before Blowing Rock, an area where sharp curves (20 to 45 mph design speeds) and steep grades (6.6 to 7.6 percent) would remain with the widening alternative. This feature is also important to several citizen

representatives.

- Alternative CC-CI (tunnel; will be referred to as Bypass Alternative 4 in the DEIS)
 - It avoids the Town of Blowing Rock by ending north of the Parkway, a feature important to the Town Council of Blowing Rock and many members of the project's Citizens' Advisory Committee.
 - Like CC-CH, it bypasses the final curves on existing US 321 before Blowing Rock, an area where sharp curves and steep grades would remain with the widening alternative.

None of the alternatives selected for further study and comparison to the widening alternative performs well on all evaluation criteria: engineering, cost, traffic, and environmental (natural and social). Based on the information known to date, the NCDOT cannot conclude at this time that any of the bypass alternatives are reasonable alternatives. Each of the four selected for further evaluation offers a different set of trade-offs, particularly between social and natural resource impacts. They, in combination with the widening alternative, appear to be a set of alternatives that best represents the differing issues and concerns associated with the US 321 improvements project.

The NCDOT will not select an alternative for implementation until after the DEIS is completed and is reviewed by citizens and regulatory agencies. The alternative selected for implementation could be one of the four bypass alternatives listed above or the widening alternative.

2. PURPOSE OF AND NEED FOR THE PROPOSED ACTION

2.1 PROJECT SETTING

2.1.1 Land Use and Character

The project area is in western North Carolina and encompasses the northern part of Caldwell County and the southern part of Watauga County, including the resort community of Blowing Rock ([see Figure 1](#)). Land use in the project area includes scattered rural residential development in Caldwell County and eastern Blowing Rock, as well as concentrated low-density residential, commercial, and recreational development in Blowing Rock both east and west of US 321. Within Blowing Rock, US 321 passes through the Green Park Historic district, which is listed in the National Register of Historic Places. US 321 passes adjacent to the Green Park Inn and the Blowing Rock Country Club, which are included in the historic district. Development along US 321 in the southern portion of Blowing Rock is primarily low-density residential, while the primary development along US 321 in the northern portion of Blowing Rock is commercial. Development in Blowing Rock off of US 321 is primarily single-family residential. The Blue Ridge Parkway is near the northern border of the project area. A church assembly grounds is adjacent to the Parkway. Between the Blue Ridge Parkway and Aho Road (the northern boundary of the project area), the small amount of development is primarily rural residential. Along US 321, between the Parkway and Aho Road, there are a few commercial establishments on the east side. At the intersection of US 321 and Aho Road, there is a mobile home park.

2.1.2 Area Growth

Caldwell County's population grew 4.4 percent (67,746 to 70,709) from 1980 to 1990; between 1990 and 2000, the County is expecting a 4.4 percent growth in population (70,709 to 73,813) (NCDEHR, State Center for Health and Environmental Statistics). The rate of growth within Caldwell County is slower than surrounding counties and the State of North Carolina.

Watauga County's population grew by 16.7 percent from 1980 to 1990 (31,666 to 36,952); a 10.2 percent increase in population is projected for the period 1990 to 2000 (36,952 to 40,726) (Watauga County Planning Department). The census population figures do not represent the seasonal/part-year residents. Blowing Rock's permanent population in 1990 was 1,248 (1990 US Census). The town's population rises to about 10,000 persons in the summer months, as estimated by Blowing Rock town staff.

2.1.3 Transportation Plans

The project is included as TIP No. R-2237C in the 1997-2003 update of the North Carolina Transportation Improvement Program (June 1996) covering the period from Federal Fiscal Year (FFY) 1997 to FFY 2003. Right-of-way acquisition and construction currently are not scheduled.

The following additional transportation improvement projects are near the project area:

R-2237A	Widen US 321 to a multi-lane road from NC 268 at Patterson to SR 1370 (Nelson Chapel Road) in Caldwell County.
R-2237B	Widen US 321 to a multi-lane road from SR 1370 (Nelson Chapel Road) to SR 1500 (Blackberry Road) in Caldwell County.
R-529	Widen US 421 to a multi-lane road from NC 194 in Boone to two miles east of US 221 in Watauga County (part under construction).
U-2202	Widen US 221 to a multi-lane road from US 221/321 to US 421/NC 194 in Boone.
R-2566	Widen NC 105 to a multi-lane road from US 221 in Avery County to SR 1107 in Boone (only planning and design scheduled).
U-2703	US 421 bypass south of Boone, part on new location (scheduled for environmental review only).
R-2615	Widen US 421 to a multi-lane road from US 221 in Boone to the Tennessee State Line (identified as a future need only).

2.2 PROJECT HISTORY

The improvement of most of US 321 to a multi-lane road is specified in the 1989 Highway Trust Fund Act for North Carolina. In 1993, an Environmental Assessment (EA) was prepared that recommended widening US 321 from NC 268 in Patterson to US 221 in Blowing Rock. A Finding of No Significant Impact (FONSI) was prepared for the southern 10.8 miles of the project area, from NC 268 to SR 1500 (Blackberry Road). At public hearings, representatives of government, businesses, Appalachian State University, and the public spoke in favor of a four-lane US 321 between Lenoir and Boone. In addition, many citizens from Blowing Rock and the State Historic Preservation Office strongly preferred a project that included a bypass around Blowing Rock. The FONSI therefore indicated that an Environmental Impact Statement would be prepared for the northern 4.3 miles of the EA's project area (from SR 1500 [Blackberry Road] to US 221 in Blowing Rock) that compared the widening alternative with a Blowing Rock bypass.

Widening US 321 to four lanes between NC 268 and SR 1500 will improve traffic flow and increase safety along that portion of US 321. The objectives of the state's intrastate corridor system also will be met for that portion of US 321. These benefits will be achieved independent of any improvements between SR 1500 and US 221.

2.3 SYSTEM LINKAGE

In the 1989 Highway Trust Fund Act, the North Carolina State legislature designated a network of US and state highways as intrastate corridors. The Intrastate System was established to connect major population centers and provide safe, convenient travel for motorists. It is designed to support statewide growth and development objectives. The intrastate system plan calls for the widening of existing two-lane sections to

multi-lane facilities. US 321 from the South Carolina border south of Gastonia to its junction with US 421 west of Boone, North Carolina is part of the intrastate system. This corridor is defined as the principal north-south route uniting the western Piedmont.

2.4 INTERMODAL TRANSPORTATION

AppalCart, the Boone bus system, operates a morning and an afternoon bus to Blowing Rock Monday through Friday. The bus makes two stops on US 321.

2.5 NEED FOR ACTION

The need for an improved US 321 is reflected in the following ways:

- The improvement is in the thoroughfare plans for both Caldwell and Watauga Counties.
- The existing road is substandard because of narrow pavement width, sharp curves and steep grades. The improvement of roadway characteristics that currently increase the potential for accidents would include the addition of through lanes and turning lanes, wider shoulders, and straightening of substandard curves.
- The segment of US 321 south of Blowing Rock currently is operating at level of service E (defined in section 2.5.3). Without improvements, the level of service will continue to worsen and reach level of service F south of Blowing Rock and E and F in Blowing Rock by 2025.
- Accident rates along the segment of US 321 in the project area are substantially higher than the average accident rates for similar roads in North Carolina. The proposed improvements would allow safe passing of slower moving vehicles, permit smoother flow of traffic, allow vehicles to enter and exit the roadway more easily, and reduce the chances of head-on and rear-end collisions.
- US 321 is a part of the North Carolina intrastate system. The system plan calls for the widening of all existing two-lane sections within this corridor to multi-lane facilities.

These plans and needs are described in detail in the following paragraphs.

2.5.1 Thoroughfare Plans

The 1981 Thoroughfare Plan prepared by the NCDOT for Caldwell County states that existing US 321 should be adequate through 2000, but, ultimately, the number of lanes should be increased from two to four. The Caldwell County Thoroughfare Plan currently is being updated. When identifying future road improvement needs, the 1993 Thoroughfare Plan for Region D (Alleghany, Ashe, Avery, Mitchell, Watauga, Wilkes, and Yancy Counties) assumes that US 321 is widened as specified in the Transportation Improvement Program. The Watauga County component of the Region D plan was adopted by Watauga County.

2.5.2 Existing Roadway Characteristics

US 321 is designated as a principal arterial in the statewide highway network and carries both local and through traffic. The segment of US 321 to be examined in the Draft Environmental Impact Statement includes up to 3.4 kilometers (2.1 miles) of rural highway south of Green Hill Road and 3.5 kilometers (2.2 miles) of urban arterial in the Town of Blowing Rock.

Roadway Characteristics and Posted Speeds

The roadway can be described best in three sections, each with common characteristics:

- The rural section south of Blowing Rock.
- The urban section between Green Hill Road and US 321 Business in Blowing Rock.
- The urban section between US 321 Business and US 221 in Blowing Rock.

The two-lane rural section south of Blowing Rock has a narrow 6.7-meter (22-foot) paved travelway with a one-foot paved shoulder on each side and a speed limit of 80 kilometers per hour (kph) [50 miles per hour (mph)]. The horizontal alignment is poor with numerous sharp curves up to 30 degrees (60-meter radius) [design speed approximately 40 kph (25 mph)]. In addition, the terrain is mountainous with steep grades between 6 and 8 percent occurring regularly.

The two-lane urban section of US 321 between Green Hill Road and US 321 Business (which passes through the Green Park Historic District) is approximately 1.3 kilometers (0.8 mile) long with a 7.3-meter (24-foot) pavement width and a narrow travelway varying between 6.1 and 6.7 meters (20 and 22 feet). The speed limit is 60 kph (35 mph). Grass shoulders are either non-existent or very narrow. The horizontal alignment is fair with a series of four reverse curves up to 24 degrees (70-meter radius) [design speed approximately 50 kph (30 mph)]. The terrain is rolling with a maximum grade of 3.5 percent.

The 2.3-kilometer (1.4-mile) urban section between US 321 Business and US 221 has two lanes with a pavement width varying between a narrow 6.1 meters and 11.0 meters (20 and 36 feet with the wider width occurring where there is a turn lane) and a speed limit of 60 kph (35 mph). The northernmost 0.16 kilometer (0.1 mile) of this section has four lanes. The alignment is generally straight on rolling terrain with a maximum grade of seven percent.

Passing opportunities along the entire project length are limited because of the terrain and sight distance restrictions.

Sidewalks, Bicycle Facilities and Pedestrian Movements

There are no sidewalks along the project, except for a single sidewalk in front of the Green Park Inn. A sidewalk is proposed in the *Boone/Blowing Rock Alternative Transportation Plan* (1997) for US 321 between its intersection with US 321 Business to US 221. Concentrations of pedestrian travel across US 321 occur at three points in Blowing Rock -- Green Hill Road area, Sunset Drive and Opossum Hollow Road. In the Green Hill Road area, pedestrians cross US 321 between the Green Park Inn and a parking

lot opposite the Inn. A pedestrian/bicycle path is proposed along US 321 from its intersection with US 221 to the southern town limits of Boone. In addition, bicycle routes are proposed for Opossum Hollow Road, Wonderland Drive, Goforth Road and Green Hill Road. The plan in which these improvements are proposed was adopted by the Boone Town Council in November 1995 and by the Blowing Rock Town Commission in September 1994. It was submitted to the NCDOT in 1996 for funding.

Intersections and Access Control

The US 221, Sunset Drive and Shoppes on the Parkway/Opossum Hollow Road intersections, all in Blowing Rock, are signalized. Traffic volumes on most intersecting roads are light. No restriction on access to abutting properties applies.

Drainage Structures

There are no major drainage structures along the project.

School Bus Use

Elementary and high school bus routes use or cross US 321. The buses frequently enter and exit US 321, but because of the arrangement of the route, the children do not need to cross US 321 to load or unload.

2.5.3 Highway Capacity

Traffic Volumes

[Figure 3](#) and [Table 1](#) show the average daily traffic (ADT) in May 1994 for each major link on US 321 and projected for 2025. The existing ADT in May ranged from 7,250 to 12,150 vehicles through Blowing Rock and was 6,550 vehicles south of the town limits. The existing May ADT figures are actual counts taken as a part of preparation of a new Boone thoroughfare plan. May was chosen for the counts by the NCDOT after consultation with local officials and represents an "average" month. The projected traffic volumes for the design year 2025 are based on local population and employment growth trends.

The 2025 May ADT would range between 12,450 and 24,900 vehicles through Blowing Rock, depending upon the location, and would be about 14,100 vehicles south of the town limits. The forecasts include nine percent daily truck traffic on US 321. Because non-truck traffic makes up a higher percentage of total traffic during peak hours, the peak hour truck percentages are assumed to be one-half of the daily percentage.

Level of Service

Level of service (LOS) is a qualitative measure that characterizes the operational conditions within a traffic stream and the perception of traffic service by motorists and passengers. The different levels of

service characterize these conditions in terms of such factors as speed and travel time, freedom to maneuver, traffic interruptions, and comfort and convenience. Six levels are used to measure level of service. They range from the letter A to F. For roadways, LOS A indicates no congestion and LOS F represents more traffic demand than road capacity and extreme delays.

[Table 2](#) provides a general description of various level of service categories for roadways as given in the *1994 Highway Capacity Manual*, as well as descriptions for signalized and unsignalized intersections. Specific level of service definitions vary for two-lane highways, multi-lane highways and intersections. In addition, the level of service for signalized and unsignalized intersections cannot be compared directly. In general, a poor level of service rating still can be considered acceptable for an unsignalized intersection. This is because the unsignalized intersection analysis is based upon the availability of gaps in traffic for minor street traffic, which means an intersection can have a poor level of service despite no delays on the major street. The signalized intersection analysis provides an overall average delay and level of service for the entire intersection.

New or upgraded roads in rural areas in North Carolina typically are designed for LOS C in the design year. This policy is based on pages 89 to 92 of *A Policy on Geometric Design of Highways and Streets* (American Association of State Highway and Transportation Officials, 1990). For urban areas, LOS D is typically acceptable when it is too costly or environmentally damaging to design for a better level of service, but LOS C is preferred. The goal for the US 321 improvements is LOS C or better in 2025.

1994. [Table 3](#) presents the peak-hour level of service for each road link. [Table 4](#) summarizes the level of service for each intersection. US 321 currently operates at LOS E south of Blowing Rock. Since LOS E defines the capacity of the highway, it indicates high delays and little or no passing opportunities during peak periods. A primary reason for this condition is the mountainous terrain and resulting slow truck speeds. Through Blowing Rock, however, the level of service is at or better than LOS C in all locations. All signalized and unsignalized intersections currently operate at LOS C or better.

2025. [Table 3](#) also includes level of service in 2025 for the No-Build Alternative. The road south of Blowing Rock would operate at LOS F in the peak periods. US 321 through Blowing Rock would operate at LOS E between Green Hill Road and US 321 Business. Between US 321 Business and US 221, US 321 would operate at LOS F. Traffic flow under these conditions would be extremely congested during peak periods.

The level of service at all existing signalized intersections on US 321 would deteriorate to conditions worse than LOS F as shown in [Table 4](#). The level of service of the unsignalized intersections at Green Hill Road, US 321 Business, and the Food Lion entrance also would deteriorate to F. A planning level signal warrant analysis (using ADT and peak hour-based warrants and the *Institute of Transportation Engineers Manual of Traffic Signal Design, Second Edition*) indicated the need for traffic signals at these intersections by 2025.

2.5.4 Accidents/Safety

Accident data for the project area were assessed for the period between January 1, 1991 and December 31, 1994. Accident rates, categorized by fatal accidents, non-fatal injury accidents, property damage accidents, and total number of reported accidents, were compared to average rates for other roads with similar characteristics in North Carolina. Average crash rates for various roads in North Carolina are based on NCDOT data for the years 1992 through 1994.

The accident rates are accidents per 100 million vehicle-kilometers driven. [Table 5](#) shows the accident rates for the existing roadway and the average rates for rural and urban two-lane roadways in North Carolina.

Rural Section

The rural section of US 321 in the project area starts at SR 1421 (Falcon Crest Road) and ends at the Watauga County line. It has a total length of 5.7 kilometers. As indicated in [Table 5](#), the accident rate for the rural portion of the project area roadway (south of Blowing Rock) is substantially higher than the state average for a roadway with similar characteristics. Though there were no reported fatal accidents during the period, the total reported accident rate is 67 percent higher than the state average. The non-fatal accident rate is 78 percent higher than the state average, and the property damage accident rate is 61 percent higher than the state average.

The differences between Blowing Rock's three-year record of no fatalities and the statewide averages for the same period are not statistically significant. It takes far more than three years for 100 million kilometers of travel to occur on this segment of US 321 and the number of fatal accidents in North Carolina is far lower than other types of accidents. Thus, the focus of this study is on differences in total, non-fatal and property damage accidents.

The type of accidents on the rural section can be divided into broad categories. Over 40 percent of the accidents involved single vehicles running off the road. In addition, 20 percent of the accidents were the result of vehicles rear-ending a slower or stopped vehicle. The provision of extra lanes and standard shoulders could reduce these accidents significantly. Improvement of the sharp curves also could result in fewer vehicles running off the road. Locations with particularly high accident rates include some intersections and sharp curves through the rural mountain section.

While weather plays a factor in some accidents, no specific trends were noted in the accident analysis. Accidents increased in the winter months between December and February, presumably because of icy conditions. No data were available to measure the effect of fog on accidents.

Two sections of the existing rural section of US 321 were identified as high accident locations. Accidents at these locations typically reflected poor horizontal geometric conditions (sharp curves). In addition, one

high accident intersection was identified in the analysis. These locations are:

- Approximately 1.1 kilometer (0.7 mile) passing and reverse curve section south of SR 1500 (Blackberry Road) -- 27 total accidents, 31 injuries.
- Approximately 1.1 kilometer (0.7 mile) reverse curve section south of Blowing Rock Town Limits -- 19 total accidents, 24 injuries.
- SR 1500 (Blackberry Road) Intersection -- 7 total accidents, 12 injuries.

Urban Section

The existing accident rates in Blowing Rock (urban section) are presented and compared with North Carolina averages in [Table 5](#). The total accident rate for the existing US 321 through Blowing Rock is 80 percent higher than similar urban US routes in North Carolina. The non-fatal injury accident rate is 112 percent higher than the state average, and the property damage accident rate is 60 percent higher than the state average.

Accident records indicate that almost all intersections on this section of US 321 are prone to a high number of accidents. A majority of these accidents involved vehicles rear-ending slow or stopped vehicles. In addition, between US 321 Business and US 221, accidents often were related to traffic entering/exiting driveways. No weather-related trends were observed in the urban section.

The analysis identified specific high accident locations. Of the six locations identified, five were intersections. The single roadway section identified includes a series of reverse curves (curve in one direction that is followed almost immediately by a curve in the opposite direction), as well as three closely spaced intersections with poor sight distance. The locations are:

- Green Hill Road (SR 1354)/Rock Road intersection -- 9 total accidents, 1 injury.
- Pinnacle Avenue, Country Club Road and Norwood Circle -- 12 total accidents, 7 injuries.
- US 321 Business intersection -- 13 total accidents, 8 injuries.
- Sunset Drive signalized intersection -- 13 total accidents, 7 injuries.
- US 221 signalized intersection -- 8 total accidents, 3 injuries.
- Shoppes on the Parkway signalized intersection -- 15 total accidents, 11 injuries.

2.5.5 Legislation

In 1989, the North Carolina State legislature designated a network of US and NC highways as intrastate corridors. The Intrastate System was established to connect major population centers and provide safe, convenient travel for motorists. It is designed to support statewide growth and development objectives (NCDOT, August 1992). US 321 is a part of the North Carolina Intrastate System.

2.6 PURPOSE OF ACTION

Based on the above description of needs, the purpose of the proposed project is to:

- Meet the objectives of county thoroughfare plans and the 1989 Highway Trust Fund Act.
- Improve future traffic flow.
- Reduce accidents.

3. AFFECTED ENVIRONMENT

This section describes the existing social, natural resource, historic resource, and visual characteristics within the project area. The descriptions of social and visual resources encompass both the project area south of the Parkway and that north of the Parkway. The natural resource and historic resource discussions only relate to the area south of the Parkway. The characteristics described are those relevant to the comparison of potential bypass alternatives presented later in this report. As a part of this analysis, a land suitability display was prepared to identify land uses and sensitive features within the project area south of the Parkway.

3.1 SOCIAL

This section describes the communities in the project area and their characteristics.

3.1.1 Caldwell County

The Caldwell County portion of the project area is in Patterson Township and consists primarily of the Blackberry Valley/Bailey Camp community area. The township is predominantly white (99 percent), with an elderly population of 13 percent and a low income population of 12 percent. These figures are slightly higher than those for the county as a whole (1990 Census of Population and Housing). The median household income for the township is \$21,767 compared to \$25,691 for Caldwell County.

Blackberry Valley/Bailey Camp Community Area

The Blackberry Valley/Bailey Camp communities are sparsely populated and rural, consisting largely of farms and forest. The area, approximately 2.4 kilometers (1.5 miles) south of Blowing Rock, is traversed by unpaved, narrow, winding roads with sections of steep grades. The two primary roads are Blackberry Road and Bolick Road. Most homes are in the valleys, although some are clustered on ridges. Community facilities include two churches, a school and a "country" store. Several cemeteries are in the area. Along US 321, one can find a few single-family homes and the Valley View Motel, which overlooks Blackberry Valley. Blackberry Ridge condominiums, a six-unit multi-family structure, is on the east side of US 321 north of this area.

Blowing Rock

The southern end of Blowing Rock is in Caldwell County and consists primarily of low-density, single-family units. This area includes the Green Park Inn.

3.1.2 Watauga County

The Watauga County portion of the project area consists primarily of the Town of Blowing Rock, a resort village that is home to a large seasonal and retirement population. The town is approximately 99 percent white, with an elderly population of 24 percent (compared to 97 percent and 11 percent, respectively, for Watauga County). According to town planners, the seasonal population is approximately 10,000, just over eight times the permanent population in 1990. Census figures indicate that 46 percent of the dwelling units in Blowing Rock are second homes. In 1990, the median income for Blowing Rock was \$25,521 compared to \$20,252 for Watauga County (1990 Census of Population and Housing).

Green Hill/Green Hill Road Area

This area consists primarily of single-family second homes. Many overlook the Blackberry Valley/Bailey Camp area. As one travels north on Green Hill Road and nears the Blue Ridge Parkway, development transitions into a more rural, farm community. New second home subdivisions are developing adjacent to Green Hill Road. The Blowing Rock Country Club golf course and a church are also in this area. The Five Points (A.L. Shuford) House, a National Register-eligible property, is on Green Hill Road.

The farming community near the north end of Green Hill Road includes the Craig farm. The Craig property is adjacent to the Blue Ridge Parkway on Green Hill Road and between the Blue Ridge Parkway and Blowing Rock Assembly Grounds. The property was split in 1935 when right-of-way was acquired for the Blue Ridge Parkway. The construction of Green Hill Road and Wonderland Drive further divided the original property. Descendants of the Craig family own individual homes in the area.

Wonderland Drive Area

This area lies between Green Hill and Goforth Roads. All of the homes along this winding, partially paved road are adjacent to the golf course. Much of the land along Wonderland Drive is undeveloped.

Blowing Rock Assembly Grounds Area

The Blowing Rock Assembly Grounds is a conference and retreat center sponsored by the United Church of Christ. Its entrance is on Goforth Road and the grounds extend to the Blue Ridge Parkway boundary. The Assembly Grounds was founded in the late 1940s. Most facilities are congregated in one area and include a lodge, dormitories, and gym. Six two-bedroom cottages are also on the property. Two miles of hiking trails and an open field used for recreation lie between the lodge and the Blue Ridge Parkway. The woods in this area are used for high school retreats with an ecology theme. A spring on the property is the source of the New River. The Assembly Grounds can house approximately 400 guests.

Homes, including second homes, lie along Goforth Road opposite the Assembly Grounds.

Opossum Hollow Road Area

This area extends from Sunset Drive to the US 321/Shoppes on the Parkway intersection. It contains a mixture of old and new homes and some commercial properties near the intersection with US 321. An electrical substation is also near this intersection. The First Independent Baptist Church, the former Blowing Rock Negro Community Church, is near Opossum Hollow Road. The entrance to the Hillwinds Estates subdivision is on Opossum Hollow Road.

Thunder Mountain Road/Aho Road Area

This area lies just north of the Parkway and includes a cluster of homes on Thunder Mountain Road and its environs and a mobile home park on Aho Road at its intersection with US 321. Near the Parkway, the area consists largely of farmland and forest.

3.1.3 Public Recreation Lands

The project area contains the Blue Ridge Parkway and Moses Cone Memorial Park.

3.1.4 Farmlands

The US Department of Agriculture, Natural Resource Conservation Service (formerly Soil Conservation Service) has identified three general categories of important farmland soils -- prime, unique, and statewide and local important. Prime, as well as statewide and local important farmland soils, are found in the project area. Prime farmlands consist of soils that are best suited for producing food, forage, fiber, and oilseed crops. Such soils have properties that are favorable for production of sustained high yields with minimal inputs of energy and resources. Farmland of statewide and local importance consists of soils that do not meet all of the requirements for prime farmland because of steepness of slope, permeability, susceptibility to erosion, low available water capacity, or some other soil property. Statewide and locally important farmland, however, is considered valuable in the production of crops when managed according to modern farming methods, including drainage to control excess water. Soils that have a special set of properties that are unique to producing certain high-value crops meet the requirements for unique farmland.

About 7 percent, or 8,376 hectares (20,686 acres), of Caldwell County meet the requirements for prime farmland. There is no statewide or locally important farmland in Caldwell County. About 2.5 percent, or 2,081 hectares (5,140 acres), meet the requirements for prime and statewide (but not locally) important in Watauga County.

3.1.5 Noise

Fundamental Concepts of Highway Noise

Environmental noise, intensity, or level is quantified in decibels (dB). The most commonly used measure of noise level is the A-weighted sound level (dBA). Scientists have found that the human ear is more sensitive to midrange frequencies than it is to either low or very high frequencies. At the same sound level, midrange frequencies therefore are heard as louder than low or very high frequencies. This characteristic of the human ear is taken into account in an A-weighted sound level.

The sound level from any roadway fluctuates from moment to moment as time passes. To take this into account, a common descriptor for environmental noise is L_{eq} . L_{eq} is defined as the continuous A-weighted sound level that in a given time period contains the same energy as the actual time varying sound during that period. L_{eq} has been shown to be a particularly stable descriptor for traffic noise assessment. L_{eq} typically is evaluated over a one-hour period. All noise levels determined in this study are one-hour L_{eq} .

Existing Noise Levels

A noise measurement survey was conducted in the project area on May 20 and 21, 1996 to document existing (i.e. ambient) noise levels. Sites selected were representative of noise sensitive receptors within the project area. [Table 6](#) lists the locations where measurements were made and the measured L_{eq} . The measurements were taken prior to the decision to expand the project area to include the area north of the Parkway.

The locations were selected so that there were no or minimal buffers or barriers between the roadway and receptor.

Noise measurements were recorded for 10 to 20 minute periods. The noise meter used for this project was a Type-I Noise Level Analyzer B&K/2230. Accessories included a B&K 4230 calibrator, and B&K 1565 microphone and windshield. The microphone was placed five feet above the ground. Measured levels ranged from 41.0 dBA in the woods along an Assembly Grounds' trail and 41.8 dBA on Green Hill to 53.0 dBA at a home below the Valley View Motel (on US 321) and 53.4 dBA near a lunch stand on the Blowing Rock Country Club's golf course.

3.1.6 Hazardous Materials and Underground Storage Tanks

A field reconnaissance within the bypass corridors (including their widening segments) and a search of appropriate federal and state agency files were conducted to determine if there were any potential hazardous material spill sites or potential underground storage tank sites adjacent to any of the corridors south of the Parkway. The study was done prior to the decision to expand the project area to include the area north of the Parkway. No potential hazardous material spill sites were found. One potential underground storage tank site was found adjacent to US 321 at SR 1422 (Old US 321) north of Harrison Cemetery.

3.2 NATURAL RESOURCES

This discussion of natural resources was prepared prior to the decision to expand the project area to encompass the area north of the Parkway. That area is not expected to be substantially different from the following description.

3.2.1 Physical Resources

Topography

The project area is situated in the Mountain physiographic province and within the Grandfather Mountain Window geologic region. The area is underlain by lateral belts of Blowing Rock gneiss, biotite granitic gneiss, Linville metadiabase, and metisiltstone (Department of Natural Resources and Community Development [DNRCD], 1985).

Topographically, the project area can be separated into two regions. The southern and eastern portion of the project area consists of the flanks of the Blue Ridge Mountains and is characterized by steep, deeply dissected slopes. The northern and western portions of the project area, the Blowing Rock plateau, are above the Blue Ridge Flank where topography is much less severe. This region is characterized by hilly terrain with gentler slopes but steep areas along drainage ways. Elevations within the project area range from a low of approximately 756 m (2,480 feet) mean sea level (MSL) in Bailey Camp Creek to a high of approximately 1,170 m (3,840 feet) MSL near the Blowing Rock Assembly Grounds (USGS Boone and Globe topographic quadrangle maps).

Soils

Soils on the steep, deeply dissected slopes of the Blue Ridge Flank consist primarily of the Chestnut-Edneyville Association in Caldwell County (SCS 1989) and Stony rough land in Watauga County (SCS 1944). These soils typically occur on 15 to 80 percent slopes, are well-drained and formed in the residuum of metamorphic rock. Erosion is a severe hazard in areas where the surface is bare or has been disturbed. A variety of soil mapping units occurs in the area around Blowing Rock (above the Blue Ridge Flank), of which Ashe soils are most common. This soil typically occurs on 30 to 60 percent slopes, is well-drained and is formed in the residuum of granite, acidic gneiss and schist. Erosion is a moderate hazard in areas where the surface is bare or disturbed.

Water Resources

Creeks and tributaries below Blowing Rock, on the Blue Ridge Flank, are part of the Yadkin-Pee Dee River Basin (USGS Hydrologic Unit 03040101). Creeks and tributaries in the vicinity of Blowing Rock, above the Blue Ridge Flanks, are part of the New River Basin (USGS Hydrologic Unit 05050001).

The Yadkin-Pee Dee Basin streams drain the Blue Ridge Flank generally from northwest to southeast. Named streams within the Yadkin-Pee Dee River Basin portion of the project area include Martin Branch, Bailey Camp Creek, Ooten Creek, and Jackson Camp Creek (shown in [Figure 4](#)). All of these streams have been assigned a best usage classification of C Tr. Class C uses include aquatic life propagation and survival, fishing, wildlife, secondary recreation, and agriculture. Secondary recreation involves human body contact with water on an infrequent or incidental basis. Tr is a supplemental classification designating waters suitable for natural trout propagation and maintenance of stocked trout (NC DEM, 1993).

Middle Fork of the South Fork of the New River is the only named stream within the New River Basin portion of the project area. This stream has been assigned a best usage classification of WS-IV +. Class WS IV waters are protected as water supplies that are generally in moderately to highly developed watersheds. Discharge of treated water is granted under permits and local programs to control non-point source and stormwater discharge of pollution are required. These waters are also suitable for all Class C uses. The "+" designation indicates that these waters are subject to a special management strategy concerning stormwater controls and water quality standards in order to protect downstream waters designated as an Outstanding Resource Water (ORW). The New River is considered an ORW because of portions of it are designated as wild and scenic, although not the portion in the project area. This federal designation seeks to keep such waters free-flowing by prohibiting dams and other obstructions.

3.2.2 Biotic Resources

Plant Communities

The project area is mostly forested because of its rugged terrain and inaccessibility. Existing US 321 is the only paved road that traverses the Blue Ridge Flank in the vicinity of the project area. The few unpaved roads either follow ridge lines or streams. Only small areas adjacent to these roads have been cleared for residential dwellings, usually accompanied by agricultural and pastoral plots. Also associated with residential areas are orchards and Christmas tree plantations. Within the project area, four broad classifications of plant communities were identified: one natural community, cove forest; and three variations of disturbed land: pastoral/agricultural land, plantation/orchard and residential/disturbed land.

Cove Forest. The cove forest is a diverse community, documented by Schafale and Weakley (1990), that supports a mixture of hardwoods and conifers in the canopy. The canopy is typically characterized by eastern hemlock (*Tsuga canadensis*), northern red oak (*Quercus rubra*), red maple (*Acer rubrum*), tulip poplar (*Liriodendron tulipifera*), sweet pignut hickory (*Carya glabra*), fraser magnolia (*Magnolia fraseri*), and rock chestnut oak (*Quercus montana*). The cove forest has a relatively open subcanopy including saplings of canopy species, witch hazel (*Hamamelis virginiana*), hop hornbeam (*Ostrya virginiana*), cherry birch (*Betula lutea*), and sourwood (*Oxydendrum arboreum*). This community can be separated into two subtypes based on orientation: the rich cove forest and the acidic cove forest. The rich cove forest is primarily found on south-facing slopes, which receive more sunlight and, therefore, are warmer and drier than north-facing slopes. Acidic cove forests occur on north-facing

slopes, which are typically shady, cooler and moister. The rich cove forest supports a variety of shrubs and herbs, while the acidic cove forest is dominated by ericaceous shrubs such as rosebay rhododendron (*Rhododendron maxim*) and mountain laurel (*Kalmia latifolia*).

In some areas, the cove forest displays signs of past logging. These areas were left with sufficient cull trees and are succeeding rapidly to steady-state conditions. Therefore, these successional areas were included in this community description.

Pastoral/Agricultural Land. Most of this community comprises cow and horse pastures adjacent to residential dwellings. Scattered trees include red maple and black locust (*Robinia pseudoacacia*). These areas support a variety of herbs and grasses. Agricultural plots are small, and principle crops include corn (*Zea mays*) and wheat (*Triticum* sp.).

Plantation Orchard. This community is the result of clearing native vegetation and deliberate planting and maintenance for Christmas tree and fruit production. Christmas tree plantations consist primarily of Fraser fir (*Abies fraseri*). Orchards contain apple (*Pyrus malus*) and pecan (*Carya illinoensis*) trees.

Residential/Disturbed Land. This community has been altered substantially from the natural condition and includes housing developments, maintained rights-of-way, roads, and roadside margins. Some of these areas have been overrun with invasive weedy species where left untended.

Wetlands and Waters of the United States

Water bodies such as rivers, lakes and streams are subject to jurisdictional consideration under Section 404 of the Clean Water Act. However, by regulation, wetlands also are considered "waters of the United States" (33 CRF 328.3). Wetlands are defined by the presence of three criteria: hydrophytic vegetation, hydric soils and evidence of hydrology during the growing season (DOA, 1987). The location of wetlands and water bodies in the project area south of the Blue Ridge Parkway is shown in [Figure 4](#).

Rivers and streams within the project area are riverine in nature as defined by Cowardin *et al.* (1979), while wetlands in the project area are palustrine in nature. Jurisdictional areas in the project area are limited in extent and consist of the types described below.

The rivers and streams are primarily bank-to-bank, surface water systems and are considered riverine, upper perennial, unconsolidated bottom, permanently-flooded (R3UBH) systems. These systems are typically steep, with gravel, cobble or boulder substrates. They gather water from seeps and precipitation and channel it rapidly out of the area.

Man-made ponds in the project area are considered palustrine, unconsolidated bottom, permanently-flooded, impounded (PUBHh) systems. These appear to have been created primarily for recreational fishing and as reservoirs for crop irrigation and livestock watering.

Bog wetlands adjacent to streams are considered palustrine, forested, broad-leaved deciduous/needle-leaved evergreen, semipermanently-flooded (PFO 1/4F) systems. These wetlands support a canopy of red maple, sweet birch and eastern hemlock. The shrub layer may be dominated by rosebay rhododendron. Many herbs and mosses that have adapted to wetland hydrology carpet the wetland.

Protected Species

Federal Species. The following federal-protected Endangered (E), Threatened (T), or Proposed (P) species are listed by the US Fish and Wildlife Service (USFWS) as having ranges that extend into Caldwell (C) and Watauga (W) Counties as of May 2, 1997:

	<u>Status</u>	<u>County</u>
Spruce-fir moss spider (<i>Microhexura montivaga</i>)	E	C
Carolina northern flying squirrel(<i>Glaucomys sabrinuscoloratus</i>)	E	W
Spreading avens (<i>Geum radiatum</i>)	E	W
Roan Mountain bluet (<i>Houstonia montana</i>)	T	C,W
Heller's blazing star (<i>Liatris helleri</i>)	P	W
Bog Turtle (<i>Clemmys muhlenbergii</i>)		

The Spruce-fir moss spider inhabits moss mats that grow on rocks and boulders under high-altitude spruce-fir forests in the southern Appalachian Mountains. Adults are only 0.3 to 0.5 centimeters (0.1 to 0.2 inches) in length. This species is extremely vulnerable to desiccation and is adapted to the high rainfall of these mountains and the moist environment provided by the mosses (Harp, 1992). The preferred habitat of the Spruce-fir moss spider does not occur within the project area, and no records of this species are known from the project area.

The northern flying squirrel is a nocturnal denizen of mixed and coniferous forests in the northern United States and Canada. Adults range in size from 26 to 32 centimeters (10.5 to 12.5 inches) long. This squirrel has a loose, furred fold of skin on each side of the body between the wrists and the ankles that can be spread to form the wings for gliding. The northern flying squirrel is known from high-elevation, isolated pockets in the mountains of North Carolina, including Roan Mountain, Mt. Mitchell, and The Great Smokey Mountains (Wiegl, 1987). The preferred habitat of the northern flying squirrel does not occur within the project area, and no records of this species are known from the project area.

Spreading avens is an erect, densely hairy, perennial herb that grow to 51 centimeters (20 inches) tall. Bright yellow, five-petaled flowers are produced from June to August (Massey *et al*, 1983). Spreading avens is found in a few northwestern counties of North Carolina and in nearby counties of Tennessee. This species usually occurs at elevations greater than 1,524 meters(5,000 feet) on mountain balds, in crevices of granitic rock, or in grassy clearings; it cannot tolerate shading or crowding (Kral, 1983). Preferred habitat of spreading avens does not occur within the project area, and no records are known from the project area.

Roan Mountain bluet is a low, erect to spreading perennial herb that grows to 15 centimeters (6 inches) high. Small, deep purple flowers are produced in June and July. This species is endemic to the high Blue Ridge mountains of North Carolina and Tennessee, mostly from 1,280 to 1,920 meters (4,200 to 6,300 feet) in elevation. The Roan Mountain bluet grows in crevices of rock outcrops or in thin, frost-heaved, gravelly soils of grassy balds near summit outcrops (Weakley, 1993). The preferred habitat of this species does not occur in the project area, and no records are known from the project area.

Heller's Blazing star is an erect, herbaceous perennial that grows to 41 centimeters (16 inches) high. Small purple

to lavender tubular flowers bloom from July to September (Massey *et al.*, 1983). Distribution of Heller's blazing star is limited mostly to the mountains of North Carolina. Heller's blazing star is usually found in full sun growing in shallow, acid soils on granitic outcrops, ledges and cliff faces (Kral, 1983). The preferred habitat of this species only occurs adjacent to US 321. Heller's Blazing star was not found during a survey of bare, cut rock faces along existing US 321 in August 1994.

The bog turtle is a small turtle reaching an adult size of approximately 8 to 10 cm (3 to 5 inches). This otherwise darkly-colored species is readily identifiable by the presence of a bright orange or yellow blotch on the sides of the head and neck (Martof *et. al.*, 1980). The bog turtle population has declined drastically within the northern portion of its range because of over-collection and habitat alteration. As a result, the USFWS officially proposed in the January 29, 1997 Federal Register (62 FR 4229) to list bog turtle as threatened within the northern portion of its range; and within the southern portion of its range, which includes North Carolina, the bog turtle is proposed for listing as threatened because of its similarity of appearance to the northern population. The proposed listing would allow incidental take of bog turtles in the southern population resulting from otherwise lawful activity.

The bog turtle is typically found in bogs, marshes, and wet pastures, usually in association with aquatic or semi-aquatic vegetation and small, shallow streams over soft bottoms (Palmer and Braswell, 1995). In North Carolina, bog turtles have a discontinuous distribution in the mountains and western piedmont. The preferred habitat of this species occurs within the project area (bog wetlands associated with the stream adjacent to Wonderland Drive, crossed by Alternatives E and F); however, the bog turtle has not been documented from the project area.

Federal Species of Concern. The May 2, 1997 USFWS list also includes a category of species designated as Federal Species of Concern (FSC). The FSC designation provides no federal protection for the species listed. There are 13 species with this designation listed for Caldwell County and 17 species with this designation listed for Watauga County.

<u>Common Name</u>	<u>Scientific Name</u>	<u>County</u>	<u>Potential Habitat</u>
Hellbender	<i>Cryptobranchus alleganiensis</i>	W	Yes
Cerulean warbler	<i>Dendroica cerulea</i>	W	Yes
Alleghany woodrat	<i>Neotama magister</i>	C, W	Yes
Southern water shrew	<i>Sorex palustris punctulatus</i>	W	Yes
Appalachian cottontail	<i>Sylvilagus obsurus</i>	W	Yes
Green floater	<i>Lasmigona subviridis</i>	W	No
Diana fritillary butterfly	<i>Speyeria diana</i>	C,W	Yes
Margarita River skimmer	<i>Macromia margarita</i>	C	No
Edmund's snaketail dragonfly	<i>Ophiogomphus edmundo</i>	C	Yes
Fraser fir	<i>Abies fraseri</i>	C,W	No
Mountain bittercress	<i>Cardamine clematitidis</i>	C,W	Yes

Bent avens	<i>Geum geniculatum</i>	C,W	Yes
Butternut	<i>Juglans cinerea</i>	C,W	Yes
Gray's lily	<i>Lilium grayi</i>	C,W	Yes
Tall larkspur	<i>Delphinium exaltatum</i>	W	No
Glade spurge	<i>Euphorbia purpurea</i>	W	No
Bog bluegrass	<i>Poa paludigena</i>	W	Yes
Sweet pinesap	<i>Monotropsis odorata</i>	C,W	Yes
Riparian vervain	<i>Verbena riparia</i>	C	Yes
A liverwort	<i>Bazzania nudicaulis</i>	C,W	No
A liverwort	<i>Plagiochila sullivantii</i>	C	Yes

No FSC-designated species have been documented within the project area according to Natural Heritage Program (NHP) records (July, 1997). FSC-designated species that have been documented in the vicinity of the project area include gray's lily, which has been documented approximately 3.2 kilometers (2 miles) north of the project area in Moses Cone Memorial Park on the Blue Ridge Parkway; and the Allegheny woodrat, which has been documented approximately 0.3 kilometer (0.2 mile) west of the project area near "The Blowing Rock."

Habitat of many of these species occurs within the project area. The hellbender and Margarita River skimmer (dragonfly) are associated with larger streams; the cerulean warbler occurs on steep slopes and coves; the Allegheny woodrat, Appalachian cottontail, and sweet pinesap occur in rocky thickets and forests; the southern water shrew, Edmund's snaketail dragonfly, mountain bittercress, bent avens, and riparian vervain occur on montane stream banks; the Diana fritillary butterfly and butternut occur in rich forests; and gray's lily and bog bluegrass occur in bog wetlands. No FSC species were observed during site visits.

State Species. Species of mammals, birds, reptiles, amphibians, and plants with the North Carolina status of Endangered, Threatened or Special Concern receive limited protection under the North Carolina Endangered Species Act (G.S. 113-331 *et seq.*) and the North Carolina Plant Protection Act of 1979 (G.S. 106-202.12 *et seq.*). Based on a review of National Heritage Program (NHP) files (May 28, 1996), several state-listed species are known to occur within 3.2 kilometers (2 miles) of the project area.

Queen-of-the-prairie (*Filipendula rubra*) is a State Endangered grass that has been documented approximately 0.8 kilometers (0.5 mile) from the project area, adjacent to the east side of US 221/321 just north of the Blue Ridge Parkway. Gray's lily (*Lilium grayi*) is a State Threatened herb that has been documented approximately 3.2 kilometers (2 miles) north of the project area in Moses Cone Memorial Park on the Blue Ridge Parkway. The Allegheny woodrat (*Neotoma floridana magister*) is a State species of Special Concern that has been documented approximately 0.3 kilometers (0.2 mile) west of the project area near "The Blowing Rock."

3.3 HISTORIC RESOURCES

An historic architectural survey found that the project area contains one National Register historic district, Green Park Historic District, and two resources individually listed in the National Register, the Green Park Inn and the Bollinger-Hartley House. No properties are on the Department of Cultural Resources Study List. One property within the project area, the Five Points (A.L. Shuford House), is considered individually eligible for the National Register. A second property, the Young-Shaw-Steele House, is considered to be eligible for the National Register

as an expansion of the Green Park Historic District. These properties are shown in [Figure 5](#) and descriptions are provided in the *Phase I Architectural Reconnaissance Survey* (March 1996) and *Phase II Architectural Survey* (February 1997). A field visit revealed two old houses on Thunder Mountain Road north of the Parkway, but no survey has been done to determine their eligibility.

3.4 VISUAL RESOURCES

The project area is in the Blue Ridge Mountains of western North Carolina, a very scenic section of the state. This area attracts many tourists because of its natural beauty and visual quality.

With the exception of an area at the southern end of the project area, which was clear cut in 1992, the entire project area is attractive visually, both north and south of the Blue Ridge Parkway. There are three locations in the area containing the potential bypass alternatives, however, that contain particularly high quality views. These are the Green Hill/Green Hill Road area, Assembly Grounds area, and the Blue Ridge Parkway.

3.4.1 Green Hill/Green Hill Road Area

High Quality Views

Many homes that line the ridge just east of Green Hill and Green Hill Road overlook the Blackberry Valley/Bailey Camp area. These are long-distance views overlooking numerous hills and valleys. The hills are forested. The bottoms of the valleys are developed as described in [section 3.1.1](#) under "Blackberry Valley/Bailey Camp Community Area." At some locations, the vegetation partially obscures views.

Viewers

Residents of the homes lining the ridge are the primary viewers. There are no public viewpoints. This view cannot be seen from public roads.

3.4.2 Blowing Rock Assembly Grounds

High Quality Views

The main entrance to the lodge at the Assembly Grounds lodge overlooks the dense forest on the hillside between the lodge and the Blue Ridge Parkway. An open, grassy area lies below the lodge in the foreground. The view can best be seen after walking across the parking lot at the main entrance to the lodge. The view is the only one from the lodge that conveys the sense of remoteness desired at a retreat center.

Viewers

Persons attending retreats at the Assembly Grounds are the viewers. There are no public viewpoints. This view cannot be seen from public roads.

3.4.3 Blue Ridge Parkway

High Quality Views

The Blue Ridge Parkway is a National Park whose primary feature is a recreational road that offers drivers views of the mountains and the valleys below them. As such, the attractiveness of all views from the Parkway is important to achieving the Parkway's objectives. Protection of high quality views is a high priority for Parkway officials, particularly views from scenic viewpoints where drivers can stop along the Parkway and views that remain in the view of passengers in moving vehicles for longer than the few moments it takes to pass by them.

Most views from the Parkway into the project area are blocked by intervening hills and trees. This is particularly true west of Green Hill Road. At two locations, however, the project area can be seen readily from the Parkway. The first is the Thunder Hill overlook. Here, a parking lot is provided so Parkway visitors can stop and view Blackberry Valley and the surrounding hills. The landscape viewed is, for the most part, the same as that viewed from homes lining the Blue Ridge Flank east of Green Hill Road, although from a different angle. The view to the right from the Thunder Hill overlook includes the Blue Ridge Flank. Much of the flank is forested. Homes lining the top of the flank can be seen but are quite small because they are approximately 1,100 meters (3,600 feet) from the overlook. The view of the flank is partially blocked by Locust Ridge, which extends away from and perpendicular to the flank.

The second view of the project area from the Parkway is the Green Hill Road area. No opportunities to stop are provided to motorists, but views here are primarily open farmland, providing motorists with a roadside view that lasts more than a few moments. Motorists can see open pasture and some cultivated fields, as well as homes and other buildings, primarily those associated with the farmland. The open lands extend to the Parkway boundary.

Finally, Parkway officials also prefer that terrain be the primary determinant of whether development is being introduced to Parkway views. This position assumes that vegetation that now blocks views of development later could die, exposing additional development. Without existing vegetation, lands in the Thunder Mountain Road, Assembly Grounds, and Hillside Estates areas could be viewed from the Parkway.

Viewers

Viewers are the Blue Ridge Parkway users.

4. IDENTIFICATION AND DEVELOPEMENT OF POTENTIAL BYPASS ALTERNATIVES

4.1 DESIGN CRITERIA AND ASSUMPTIONS

4.1.1 Key Design Criteria

The design criteria and typical section used for the development of bypass alternatives are the same as those used for the widening alternative south of Blowing Rock. The functional classification of a Blowing Rock bypass would be rural arterial. The design speed assumed is 80 kph (50 mph). The typical section used (shown in [Figure 6](#)) includes four 3.6-meter (12-foot) travel lanes with a 1.2-meter (4-foot) flush median. Three-meter (10-foot) shoulders, of which 1.2 meters (4 feet) would be paved, are assumed. Because of the project area's mountainous terrain, a preferred maximum grade of seven percent is assumed, with an allowed maximum grade of eight percent.

4.1.2 Initial Location Selection Criteria

The following criteria were chosen initially by the study team for identifying potential bypass alternatives:

- Neither cross nor use lands from the Blue Ridge Parkway.
- Avoid concentrations of development.
- Avoid historic resources.
- Follow the natural terrain as much as possible to minimize heights of cuts and fills.
- Meet federal and state design criteria for roads of this type.
- Consider locations suggested by citizens, refining them as necessary to conform with the other criteria.

Bypass alternatives that crossed the Blue Ridge Parkway were not proposed initially because:

- Crossing the Parkway would reduce the effectiveness of the bypass in attracting traffic from existing US 321 to the bypass. The opportunity for the bypass to attract some local trips would be lost because the northern terminus would be well north of Blowing Rock's commercial areas. Through trips between the Parkway and points south of Blowing Rock would remain on existing US 321 unless the Parkway crossing included an intersection or an interchange (see [section 6.1](#)).
- A surface crossing would require a deep cut in the ridge paralleling the Parkway and, thus, would have a substantial visual impact on the Parkway.
- A tunnel under the Parkway would be extremely expensive.
- The Blue Ridge Parkway is both a public park and an historic resource. Its application for National Landmark status is pending. Federal law requires there be no other prudent and feasible alternative to use of lands from public parks and historic resources. A surface crossing of the Parkway would use park lands.
- In order to use lands from the Parkway, the NCDOT would have to purchase new Parkway lands

from the list of high priority lands included in the Parkway's approved Land Use Action Plan.

- The Environmental Impact Statement would need to evaluate the cumulative impact of the new crossing combined with all past, present and reasonable future actions affecting the Parkway regardless of what agency (federal or nonfederal) or person undertakes such actions. This would include all past and planned roadway projects affecting the Parkway since its construction.

All of the initial alternatives ended at Opossum Hollow Road. A terminus closer to the Parkway was not considered initially because, although it would reduce residential impacts, it would require a deep cut into an existing knob in order to keep the bypass' grades within the design criteria limits (eight percent). In contrast, there is a narrow valley at the Opossum Hollow Road location that would reduce the amount of earthwork required to build the bypass. A terminus closer to the Parkway ultimately was considered.

4.1.3 Location Selection Criteria Requested by Citizen Representatives

The Blowing Rock Town Council, the Concerned Citizens of Blowing Rock, and other citizens felt that their interests were not being represented by the initial bypass locations identified by the study team based on the location and design criteria presented in [sections 4.1.1](#) and [4.1.2](#). Therefore, the study team evaluated several additional alternatives.

Location criteria particularly important to the Concerned Citizens of Blowing Rock were:

- Preferably begin the bypass south of the "S" curves at the last passing section on US 321 before Blowing Rock.
- Definitely begin south of the final sharp curves just south of the Blowing Rock Town Limits.
- Avoid displacement.
- Stay out of Blowing Rock completely.
- Cross the Parkway in a tunnel that is as short as possible. If one must remain south of the Parkway, parallel the Parkway as closely as possible.
- Minimize the use of grades greater than six percent.

The study team developed designs for and evaluated three alternatives proposed by the Concerned Citizens of Blowing Rock that included a tunnel under the Blue Ridge Parkway. The locations suggested by the citizens were used. Designs developed for these alternatives were reviewed with representatives of the Concerned Citizens prior to their completion. Grades greater than six percent were minimized; otherwise, the study team's design criteria were assumed. The completed designs conformed to the specifications requested by the Concerned Citizens except for tunnel length.

The tunnels were made longer than desired by the Concerned Citizens for two reasons: 1) the width of the ridge through which the tunnel passes is greater than the tunnel length desired by the Concerned Citizens and 2) a longer tunnel allows natural slopes to be retained above the portal end wall. Experience with other tunnels in the southeastern United States indicates that the height of portal cuts should be minimized to reduce the possibility of significant stability problems both during construction and in

service. Stabilizing unstable cut slopes can be expensive. Stabilizing a cut slope above the portal end wall is particularly important because, unlike cut slopes that parallel a highway, any rock that falls off slopes above the portal will fall directly on the highway or a passing vehicle.

The study team also developed designs for a tunnel alternative along a corridor preferred by the study team that was consistent with the Concerned Citizen's criteria listed above.

Finally, the study team examined the means for returning to US 321 just south of the Parkway as suggested by the Concerned Citizens of Blowing Rock. It rejoins US 321 at the New River Inn rather than Opossum Hollow Road and stays as close to the Blue Ridge Parkway boundaries as possible.