

4.0 ENVIRONMENTAL CONSEQUENCES

4.1 TRANSPORTATION

4.1.1 Traffic Analysis

An analysis of the forecast traffic volumes and the resulting LOS and transportation measures of effectiveness was conducted in order to assess the traffic and transportation impacts of the potential alternatives and the ALC in the study area. Several project alternatives were in consideration leading up to the identification of the ALC, which are summarized in the following alternative categories:

- No-Build Alternative
- TSM Alternative
- Build Alternative Options
- ALC Alternative

The No-Build Alternative provides a baseline of conditions against which other alternatives are compared. The No-Build Alternative includes all planned minor intersections, interchange and roadway improvements that address local problems, as well as routine maintenance improvements that maintain the continuing operation of the existing roadway. It also includes committed and funded roadway and transit projects programmed in the 1998-1999 STIP. Secondary road improvements currently programmed are also included. The TSM Alternative includes all of the improvements in the No-Build Alternative plus improvements to upgrade U.S. Route 220. The Build Alternative includes all improvements in the No-Build Alternative, plus a new interstate with full access control. The Build Alternative would be built to interstate design standards with typically four travel lanes (two in each direction). There were several optional routes for the Build Alternative and within each option there were a number of alignment variations. The ALC Alternative represents an alignment of the preferred design options from the analyzed Build Alternatives.

The potential traffic impacts for each project alternative were evaluated for the horizon year 2020. Year 2020 traffic forecasts were generated for a No-Build Alternative, identified project alignment alternatives (Build Alternatives), and the ALC Alternative for a comparison analysis. Further analysis of the ALC was conducted using 2025 traffic forecasts, which is described in Section 4.1.15.

4.1.2 Methods

To analyze potential traffic impacts for the project alternatives, 2020 ADT Volumes were generated, which have since been updated to 2025, utilizing a travel demand model designed specifically for this study. The I-73 model was developed from a model used in a previous VDOT study and modified using information from the Roanoke MPO regional model and other refinements to assure that a sufficient representation of the roadway network statewide and in the study area was included. Traffic counts provided by VDOT and other sources were used to validate the model. The traffic volumes were forecast by direction for the I-73 Build and ALC Alternatives and the No-Build Alternative. The model was also used to analyze the existing traffic conditions in the study area. The model analysis identified traffic volumes for 1997 existing conditions along major roadways within the study area.

4.1.3 Traffic Forecasts

The increase or decrease in traffic forecast volumes for the ALC Alternative and each of the project alternatives as compared to the No-Build scenario is described below. The comparison, summarized in Table 4.1-1, examines the forecasted ADT traffic volumes for the year 2020 and 2025. The traffic will be further updated to the appropriate design year as specific projects go through the design process and to construction. All projects must be designed using traffic data from the date of FHWA design approval plus 20 years.

4.1.3.1 No-Build Alternative

The year 2025 No-Build Alternative forecasts indicate that overall, small increases in traffic along U.S. Route 220 would occur. The lack of improvements associated with the No-Build Alternative would not alleviate existing safety concerns nor reduce minor congestion along the roadway. 2025 No-Build ADT volumes along I-581 and U.S. Route 220 would range from 18,200 to 113,400.

**Table 4.1-1
2020 and 2025 ADT VOLUMES FOR STUDY AREA ROADWAYS**

Route and Location	2020						2025	
	No-Build	Option 1	Option 2	Option 3	Option 4	ALC	No-Build	ALC
I-81 – South of I-581	56,500	72,300	73,900	74,200	58,300	74,200	58,300	76,600
I-81 – North of I-581	62,300	78,100	72,600	72,500	71,100	72,500	63,300	73,700
I-81 – North of U.S. Route 220	40,100	49,700	49,600	49,500	49,100	49,500	40,900	50,500
I-581 – South of I-81	84,500	92,000	99,700*	99,800*	82,900	99,800*	86,500	107,800*
I-581 – North of U.S. Route 460	91,300	88,800	106,400*	106,600*	89,700	106,600*	95,300	115,100*
I-581 – U.S. Route 460 to U.S. Route 11	108,700	105,700	126,700*	126,900*	106,700	126,900*	113,400	137,100*
I-581 – U.S. Route 11 to Route 24	92,700	90,100	108,000*	108,200*	91,000	108,200*	96,700	116,900*
U.S. Route 220 – Route 24 to Wonju Street	68,200	67,900	26,900	98,700*	66,400	98,700*	70,600	106,600*
U.S. Route 220 – Wonju Street (I-581) to Route 419	54,500	56,500	28,400	69,300*	52,300	69,300*	55,900	74,800*
U.S. Route 220 – South of Clearbrook / I-73 Diverge	36,100	37,500	18,800	18,800	34,700	18,800	37,000	19,300
U.S. Route 220 – South of Boones Mill	27,200	28,200	6,300	6,300	17,300	6,300	27,200	6,300
U.S. Route 220 – South of Rocky Mount	18,100	13,400	4,800	0	6,400	4,800	18,200	4,800
U.S. Route 220 – South of Sydnorsville	19,800	14,500	6,500	4,600	8,500	6,500	19,800	6,500
U.S. Route 220 – South of Franklin County	21,700	16,400	15,100	8,200	11,700	13,400	21,800	13,400
U.S. Route 220 – South of Bassett Forks	20,700	15,800	16,900	10,000	10,700	15,200	20,800	15,200
U.S. Route 220 – Martinsville Bypass South of U.S. Route 58	20,100	17,400	20,100	15,000	13,800	17,900	22,000	19,500
U.S. Route 220 – North of Ridgeway	18,600	14,000	15,100	15,100	32,900	14,900	20,100	16,100
U.S. Route 220 – North of North Carolina state line	17,500	12,900	14,000	14,000	17,500	13,800	19,200	15,100
U.S. Route 460 – East of Alternate U.S. Route 220	44,800	27,200	44,700	45,600	44,700	44,700	46,500	46,400
U.S. Route 460 – West of Alternate U.S. Route 220	20,200	12,200	20,100	20,500	20,100	20,100	20,200	20,100
Route 24 – East of U.S. Route 220	33,400	33,600	33,700	33,100	33,200	33,700	41,600	41,900
U.S. Route 221 – West of U.S. Route 220	21,200	21,100	21,200	21,100	20,900	21,200	21,900	21,900
Route 40 – West of Rocky Mount	4,800	4,800	4,700	4,900	6,000	4,900	4,900	5,000
Route 40 – East of Rocky Mount	9,900	11,800	2,900	9,000	8,100	9,000	10,400	9,500
Route 122 at Route 40 – East of Rocky Mount	6,400	3,800	6,300	6,800	6,600	6,800	6,600	7,100
Route 57 – West of U.S. Route 220	12,500	12,400	11,000	10,800	10,000	11,800	12,500	11,800
Route 57 – East of Martinsville	9,700	10,600	7,600	9,300	10,200	7,400	9,700	7,400
U.S. Route 58 – West of U.S. Route 220 Bypass	9,500	9,600	9,500	9,500	9,000	8,600	9,900	8,900
U.S. Route 58 – East of U.S. Route 220 Bypass	16,600	12,900	10,200	18,100	18,000	9,700	16,600	9,700

* Indicates roadway section is part of Build Alternative

As shown in the existing traffic conditions, the section of I-581 in downtown Roanoke has the highest ADT volume, while the lowest ADT volumes are forecast for the sections of U.S. Route 220 south of Rocky Mount. ADT volumes in the sections of U.S. Route 220 north and south of Martinsville range from 20,100 to 22,000. At the southern end of the study area, 19,200 vehicles are forecast to be traveling along U.S. Route 220 along the section at the North Carolina border for No-Build conditions.

4.1.3.2 TSM Alternative

Traffic volumes forecast for roadways in the study area under the TSM Alternative, are anticipated to be similar to those forecast under the No-Build Alternative. Since the TSM Alternative would not have significant highway capacity or operational increases, the alternative would not attract additional traffic from other roadways in the study area as compared to any Build Alternative.

4.1.3.3 Build Alternative

The ADT volumes on the proposed Build Alternative options and the ALC Alternative are shown in Table 4.1-2. A discussion of the ADT volumes for the ALC is included in this section following the table.

**Table 4.1-2
BUILD ALTERNATIVE 2020 AND 2025 ADT VOLUMES**

Option 1	2020 ADT
I-81 to U.S. Route 460	29,400
U.S. Route 460 to Route 122	12,900
Route 122 to Route 40	12,600
Route 40 to Route 57	18,300
Route 57 to U.S. Route 58	14,900
U.S. Route 58 to North Carolina state line	17,600
Option 2	2020 ADT
South of I-81 (I-581)	99,600
North of U.S. Route 460 (I-581)	106,400
U.S. Route 460 to Route 122	37,100
Route 122 to Route 40	30,600
Route 40 to U.S. Route 220 Connection	30,400
U.S. Route 220 Connection to Route 57	24,300
Route 57 to U.S. Route 58	18,400
U.S. Route 58 to North Carolina state line	16,500
Option 3	2020 ADT
South of I-81 (I-581)	99,800
North of U.S. Route 460 (I-581)	106,600
Route 419 to Route 40	36,500
Route 40 to U.S. Route 220 Connection	32,400
U.S. Route 220 Connection to Route 57/U.S. Route 58	28,500
Route 57/U.S. Route 58 to North Carolina state line	16,500

Option 4	2020 ADT
I-81 to U.S. Route 220/Route 419	19,600
U.S. Route 220/Route 419 to Route 40	28,100
Route 40 to U.S. Route 220 Connection	29,900
U.S. Route 220 Connection to Route 57/U.S. Route 58	28,600
Route 57/U.S. Route 58 to North Carolina state line	32,900

ALC	2020 ADT
South of I-81 (I-581)	99,800
North of U.S. Route 460 (I-581)	106,600
U.S. Route 460 to U.S. Route 11	126,900
U.S. Route 11 to Route 24	108,200
Route 24 to Wonju Street	98,700
Wonju Street to Route 419	69,300
Route 419 to U.S. Route 220 Connector	51,800
U.S. Route 220 Connector to Route 122	36,500
Route 122 to Route 40	32,600
Route 40 to U.S. Route 220 Connector	32,400
U.S. Route 220 Connector to Route 57	23,500
Route 57 to U.S. Route 58	20,400
U.S. Route 58 to NC state line	16,800

ALC	2025 ADT
South of I-81 (I-581)	107,800
North of U.S. Route 460 (I-581)	115,100
U.S. Route 460 to U.S. Route 11	137,100
U.S. Route 11 to Route 24	116,900
Route 24 to Wonju Street	106,600
Wonju Street to Route 419	74,800
Route 419 to U.S. Route 220 Connector	53,100
U.S. Route 220 Connector to Route 122	37,700
Route 122 to Route 40	33,800
Route 40 to U.S. Route 220 Connector	33,800
U.S. Route 220 Connector to Route 57	24,100
Route 57 to U.S. Route 58	20,900
U.S. Route 58 to NC state line	17,400

Adopted Location Corridor

The ALC Alternative volumes along I-73 range from 16,800 to 126,900 for the year 2020 and 20,900 to 137,100 for the year 2025. The lowest ADT volumes occur in the southern end south of Martinsville, while the highest occur on the combined I-581 and I-73 section between U.S. Route 460 (Orange Ave.) and Route 24 (Elm Ave.) north of Route 419 in Roanoke. ADT volumes along the ALC Alternative in the central sections of the study area would be in the range of 23,500 to 36,500 for the year 2020 and 33,800 to 37,700 for the year 2025.

4.1.4 Highway LOS and Capacity

The 2020 peak hour LOS for the highway segments for each alternative was evaluated within the study area. The No-Build and ALC peak hour LOS was re-evaluated for the year 2025. The LOS is an indication of the operation and performance of a facility. Highway capacity and overall operational performance are typically directly related to the traffic volume-to-capacity, design speed of the facility, profile grades, distance to obstructions, shoulder widths and percentage of heavy vehicle traffic. The LOS is calculated for each facility to describe its expected quality of operation. Service levels are defined by the conventional grades A through F. A description of each LOS grade is provided in Section 3.1, Transportation Setting, Table 3.1-4.

LOS calculations, unless otherwise noted, were developed for the highway segments according to each project alternative using HCS. LOS for 1997, 2020 No-Build, and Build Options 1 through 4 were evaluated using previous versions of HCS, whereas 2025 No-Build as well as 2020 and 2025 non-urban sections of the ALC were evaluated using HCS 2000, which is an automated version to the techniques documented in the 2000 Highway Capacity Manual (HCM). The urbanized portions of the ALC (through the City of Roanoke) were evaluated using CORSIM to provide a more detailed urban corridor analysis for the years 2020 and 2025. The traffic operations analysis of the ALC included previously recommended improvements to the mainline (adding auxiliary lanes) as well as interchange improvements, which are described in more detail in Section 4.1.15. Table 4.1-3 summarizes the service levels for 1997 Existing Conditions and for each alternative on the highway network in the study area.

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**Table 4.1-3
LOS ANALYSIS FOR STUDY AREA ROADWAYS**

Route and Location	Peak Hour LOS (Peak Hour Direction)								
	2020							2025	
	1997	No-Build	Option 1	Option 2	Option 3	Option 4	ALC	No-Build	ALC
I-81 - South of I-581 ¹	D	B	C	C	C	B	C	C	C
I-81 - North of I-581 ¹	E	C	C	C	C	C	C	C	C
I-81 - North of U.S. Route 220 ¹	C	B	C	C	C	C	C	B	C
I-581 - South of I-81	C	C	D	D ²	C ²	D	D ³	D	D ³
I-581 - North of U.S. Route 460	C	D	D	D ²	C ²	D	D ³	F	D ³
I-581 - U.S. Route 460 to U.S. Route 11	D	F	E	D ²	D ²	E	C ³	F	C ³
I-581 - U.S. Route 11 to Route 24	D	F	D	E ²	E ²	D	C ³	F	C ³
U.S. Route 220 - Route 24 to Wonju Street	D	E	E	E ²	E ²	E	D ³	F	D ³
U.S. Route 220 - Wonju Street to Route 419	B	C	C	B ²	D ²	C	C ³	D	C ³
U.S. Route 220 - South of Clearbrook / I-73 Diverge	C	C	C	A	A	C	A	D	B
U.S. Route 220 - South of Boones Mill	B	B	B	A	A	A	A	C	A
U.S. Route 220 - South of Rocky Mount	A	A	A	A	N/A	A	A	A	A
U.S. Route 220 - South of Sydnersville	A	A	A	A	A	A	A	A	A
U.S. Route 220 - South of Franklin County	A	A	A	A	A	A	A	B	A
U.S. Route 220 - South of Bassett Forks	A	A	A	A	A	A	A	B	A
U.S. Route 220 - North of Ridgeway	A	A	A	A	A	B	A	B	A
U.S. Route 220 - North of North Carolina state line	A	A	A	A	A	A	A	B	A
U.S. Route 460 - East of Alternate U.S. Route 220	C	C	B	C	C	C	C	D	D
U.S. Route 460 - West of Alternate U.S. Route 220	B	B	B	B	B	B	B	B	B
Route 24 - East of U.S. Route 220	A	C	C	C	C	C	C	D	D
U.S. Route 221 - West of U.S. Route 220	E	E	E	E	E	E	E	E	E
Route 40 - West of Rocky Mount	C	C	C	C	C	D	C	E	E
Route 40 - East of Rocky Mount	D	E	E	C	E	E	C	E	E
Route 122 - at Route 40 East of Rocky Mount	C	C	C	D	D	D	C	C	C
Route 57 - West of U.S. Route 220	E	E	E	E	E	E	E	E	E
Route 57 - East of Martinsville	D	D	E	D	E	E	C	D	C
U.S. Route 58 - West of U.S. Route 220 Bypass	A	A	A	A	A	A	A	A	A
U.S. Route 58 - East of U.S. Route 220 Bypass	A	A	A	A	A	A	A	B	A

Note: ¹ Improvements to I-81 in the vicinity of Roanoke are currently being evaluated as part of another study. For the purposes of this analysis, it was assumed that I-81 would be improved from 4 to 8 lanes after the year 2003.

² Assumes an eight-lane total cross-section for Options 2 and 3.

³ These segments were analyzed using a more detailed CORSIM analysis. Assumes a six-lane basic freeway section plus additional auxiliary lanes as needed between interchanges, creating eight lanes between some interchanges and in some instances ten-lane sections (between U.S. Route 460 (Orange Avenue) and Route 24 (Elm Avenue)). Includes recommended improvements to interchanges from I-81 to Route 419.

4.1.4.1 No-Build Alternative

Existing and No-Build LOS for roadways in the study area was analyzed using HCS, and results are summarized in Table 4.1-4. By the year 2025, the majority of I-581 through Roanoke is expected to operate at unacceptable levels of service. Operating conditions for the year 2025 indicate that the LOS for U.S. Route 220, U.S. Route 460, U.S. Route 221, Route 57, and U.S. Route 58 would deteriorate in the No-Build

Alternative compared to existing conditions, but still be acceptable in many instances in terms of LOS. The Route 40 LOS is anticipated to be LOS E for 2025 and Route 24 is expected to experience a reduction in operating conditions from LOS A to LOS D. This does not include the intersection of Route 24 (Elm Avenue) with I-581 which experiences frequent peak hour traffic congestion.

**Table 4.1-4
NO-BUILD LOS ANALYSIS SUMMARY**

Route and Location	Peak Hour LOS (Peak Hour Directional)		
	1997 Conditions	2020 No-Build Alternative	2025 No-Build Alternative
I-81 - South of I-581 ¹	D	B	C
I-81 - North of I-581 ¹	E	C	C
I-81 - North of U.S. Route 220 ¹	C	B	B
I-581 - South of I-81	C	C	D
I-581 - North of U.S. Route 460	C	D	F
I-581 - U.S. Route 11 to U.S. Route 460	D	F	F
I-581 - Route 24 to U.S. Route 11	D	F	F
U.S. Route 220 - Route 24 to Wonju Street	D	E	F
U.S. Route 220 - Wonju Street to Route 419	B	C	D
U.S. Route 220 - South of Route 419	C	C	D
U.S. Route 220 - South of Boones Mill	B	B	C
U.S. Route 220 - South of Rocky Mount	A	A	A
U.S. Route 220 - South of Sydnorsville	A	A	A
U.S. Route 220 - South of Route 605	A	A	B
U.S. Route 220 - South of Bassett Forks	A	A	B
U.S. Route 220 - Martinsville Bypass South of U.S. Route 58	A	A	B
U.S. Route 220 - North of Ridgeway	A	A	B
U.S. Route 460 - East of Alternate U.S. Route 220	C	C	D
U.S. Route 460 - West of Alternate U.S. Route 220	B	B	B
Route 24 - East of U.S. Route 220	A	C	D
U.S. Route 221 - West of U.S. Route 220	E	E	E
Route 40 - West of Rocky Mount	C	C	E
Route 40 - East of Rocky Mount	D	E	E
Route 122 - at Route 40 East of Rocky Mount	C	C	C
Route 57 - West of U.S. Route 220	E	E	E
Route 57 - East of Martinsville	E	D	D
U.S. Route 58 - West of U.S. Route 220 Bypass	A	A	A
U.S. Route 58 - East of U.S. Route 220 Bypass	A	A	B

Note: ¹Improvements to I-81 in the vicinity of Roanoke are currently being evaluated as part of another study. For the purposes of this analysis, it was assumed that I-81 would be improved from 4 to 8 lanes after the year 2003.

4.1.4.2 TSM Alternative

Traffic forecasts for the TSM Alternative are the same as the No-Build Alternative. As mentioned previously, the TSM Alternative does not propose any improvements on roadways other than U.S. Route 220. As a result, the LOS along roadways in the study area are expected to be the same as those found under the No-Build Alternative.

4.1.4.3 Build Alternative

The 2020 peak hour LOS on the proposed Build Alternative options, including 2020 and 2025 LOS results for the ALC Alternative, are shown in Table 4.1-5. LOS calculations, unless otherwise noted, were developed for the highway segments according to each project alternative using HCS. LOS for Build Options 1 through 4 were evaluated using previous versions of HCS, whereas 2020 and 2025 non-urban sections of the ALC were evaluated using HCS 2000, which is an automated version to the techniques documented in the HCM. The urbanized portions of the ALC (through the City of Roanoke) were evaluated using CORSIM to provide a more detailed urban corridor analysis for the years 2020 and 2025. A discussion of the future peak hour LOS for the ALC is included in this section following the table.

**Table 4.1-5
BUILD ALTERNATIVE FUTURE PEAK HOUR LOS**

Option 1	2020 LOS (Peak Hour)
I-81 to U.S. Route 460	C
U.S. Route 460 to Route 122	A
Route 122 to Route 40	A
Route 40 to Route 57	B
Route 57 to U.S. Route 58	A
U.S. Route 58 to North Carolina state line	B
Option 2	2020 LOS (Peak Hour)
South of I-81 (I-581) ¹	D
North of U.S. Route 460 (I-581) ¹	D
U.S. Route 460 (Orange Avenue) to Route 24 (Elm Avenue) ¹	E
I-581 to Route 122	C
Route 122 to Route 40	C
Route 40 to U.S. Route 220 Connection	C
U.S. Route 220 Connection to Route 57	B
Route 57 to U.S. Route 58	B
U.S. Route 58 to North Carolina state line	A
Option 3	2020 LOS (Peak Hour)
South of I-81 (I-581) ¹	C
North of U.S. Route 460 (I-581) ¹	C
U.S. Route 460 (Orange Avenue) to Route 24 (Elm Avenue) ¹	E
Route 24 (Elm Avenue) to Wonju Street ¹	E
Wonju Street to Route 419 (Franklin Road) ¹	D
Route 419 to Route 40	C
Route 40 to U.S. Route 220 Connection	C
U.S. Route 220 Connection to Route 57/U.S. Route 58	C
Route 57/U.S. Route 58 to North Carolina state line	A
Option 4	2020 LOS (Peak Hour)
I-81 to U.S. Route 220/Route 419	B
U.S. Route 220/Route 419 to Route 40	C
Route 40 to U.S. Route 220 Connection	C
U.S. Route 220 Connection to Route 57/U.S. Route 58	C
Route 57/U.S. Route 58 to North Carolina state line	C

ALC	2020 LOS (Peak Hour)
South of I-81 (I-581) ²	D
North of U.S. Route 460 (I-581) ²	D
U.S. Route 460 (Orange Avenue) to Route 24 (Elm Avenue) ²	C
Route 24 (Elm Avenue) to Wonju Street ²	D
Wonju Street to Route 419 (Franklin Road) ²	C
Route 419 to Route 40 ³	C
Route 40 to U.S. Route 220 Connector	C
U.S. Route 220 Connector to Route 57	B
Route 57 to U.S. Route 58	B
U.S. Route 58 to North Carolina state line	A

ALC	LOS (Peak Hour) 2025
South of I-81 (I-581) ²	D
North of U.S. Route 460 (I-581) ²	D
U.S. Route 460 (Orange Avenue) to Route 24 (Elm Avenue) ²	C
Route 24 (Elm Avenue) to Wonju Street ²	D
Wonju Street to Route 419 (Franklin Road) ²	C
Route 419 to Route 40 ³	C
Route 40 to U.S. Route 220 Connector	C
U.S. Route 220 Connector to Route 57	B
Route 57 to U.S. Route 58	B
U.S. Route 58 to North Carolina state line	B

Note: ¹ These segments were analyzed using a more detailed CORSIM analysis. Assumes a six-lane basic freeway section plus additional auxiliary lanes as needed between interchanges, creating eight lanes between some interchanges and in some instances ten-lane sections (between U.S. Route 460 (Orange Avenue) and Route 24 (Elm Avenue)). Includes recommended improvements to interchanges from I-81 to Route 419.

² South of I-73 diverge at the Town of Clearbrook.

Adopted Location Corridor

Under the ALC Alternative in 2025, sections of I-73 would operate at a peak period LOS between B and D. These levels of service reveal how the facility operates when designed with the necessary auxiliary lanes between interchanges as well as interchange improvements. The sections of the ALC Alternative located in the southern portion of the corridor indicated better LOS than in the northern sections. The sections of I-73 / I-581 south of I-81 to Route 419 are estimated to range from LOS C to LOS D. South of Route 419 (south of the City of Roanoke) to the North Carolina state line is forecast to range from LOS B to LOS C.

The section of the ALC Alternative through downtown Roanoke assumes a six-lane basic freeway cross-section from I-81 to Route 419. Additional auxiliary lanes and extended acceleration / deceleration lanes, however, are also required between interchanges, creating eight lanes between some interchanges, and in some instances ten lanes (between U.S. Route 460 [Orange Avenue] and Route 24 [Elm Avenue]) in order for the roadway design to conform to AASHTO standards as well as to maintain an acceptable level of service for the merge and diverge movements to and from the interchanges. In addition to the additional auxiliary lanes along the mainline, interchange improvements are needed to provide acceptable traffic operations through the year 2025, given the projected volumes. A description of all the improvements required for acceptable traffic operations along the urban corridor is included in Section 4.1.15.

4.1.5 Interchange Discussion

Option 1

The Option 1 alignment includes 15 potential interchanges. Of these, five main interchanges were included in the analysis model runs. These included U.S. Route 460, Routes 122, 40 and 57 and U.S. Route 58. Out of the main interchanges identified in the analysis, the interchange at U.S. Route 460 is anticipated to have the highest ramp volume in Option 1. U.S. Route 460 is anticipated to have an ADT volume reduction of 17,800 vehicles through the interchange complex. Forecast ADT volumes on U.S. Route 460 east and west of the proposed I-73 are 27,200 and 12,200 respectively. These ADT volumes for U.S. Route 460 are lower than those for the No-Build Alternative west of I-73, which indicates that a substantial amount of traffic is forecast to divert from this roadway to the proposed interstate.

Traffic volumes and service level impacts to roadways in the vicinity of the 15 potential interchange locations as identified in Option 1a would be expected to be similar to those anticipated in Option 1. This is a result of the similar traffic conditions and interchange locations associated with each alternative option. Interchanges in Option 1a that are different from Option 1 are U.S. Route 220 between the junctions of Route 697 near Wirtz, Route 641 northwest of Gogginsville, Route 40 west of the Pigg River Crossing, and U.S. Route 220 at Route 605. Interchanges not included in Option 1a are Route 122 southwest of Burnt Chimney, Route 40 east of Redwood, Route 619 south of Patti, and U.S. Route 220 at Route 618. ADT volumes at the Option 1a proposed interchanges would be expected to be relatively minor due to the low amounts of traffic forecast on the intersecting roadway. Route 641 and Route 605, two alternative interchange crossroads, are forecast to have 2020 ADT volumes of less than 5,000 and resulting interchange ramp volumes would be anticipated to be light.

Option 2

Option 2 proposes 22 potential interchange locations throughout the study area. Five interchanges outside of the Roanoke area were analyzed in detail as part of this option. This included Routes 122, 40, 605, 57 and U.S. Route 58. Out of these five interchanges, the highest ramp volume was at the U.S. Route 58 interchange. Forecast ADT volumes on U.S. Route 58 east and west of the proposed I-73 are 10,200 and 9,500, respectively. Volumes east of I-73 are approximately 40 percent less than those anticipated for the No-Build Alternative, indicating that Option 2 would improve traffic conditions on this roadway east of Martinsville.

Traffic volumes and service level impacts to roadways in the vicinity of interchange locations as identified in Option 2a, 2b, and 2c would be expected to be similar to those anticipated in Option 2. This is a result of the similar traffic conditions and interchange locations associated with each alternative option. The Route 679 interchange in Option 2b, which is not included in Option 2, is expected to have an ADT of 11,500. Remaining potential interchanges included in Option 2b that are not included in Option 2, have ADT volumes, which would be expected to be relatively minor. For example, Route 668 is forecast to have an ADT volume less than 5,000. The interchange in Option 2c that is different from Option 2 is U.S. Route 220 at the Route 718 intersection. This additional interchange is expected to have ADT volumes, which are relatively minor due to the light ADT anticipated along Route 718.

Option 3

Option 3 proposes 25 potential interchange locations throughout the study area. Three interchanges outside of the Roanoke area were analyzed in detail as part of the Option 3 analysis. These roadways included Routes 40, 605 and 57. Out of these, the interchange at Route 40 is forecast to have the highest ramp volumes in Option 3. The forecast ADT on Route 40 east and west of I-73 is 9,000 and 4,900, respectively. Volumes east of I-73 are approximately 10 percent less than those anticipated for the No-Build Alternative indicating that Option 3 would improve traffic on this roadway.

Traffic volumes and service level impacts to roadways in the vicinity of interchange locations as identified in Option 3a, 3b, and 3c would be expected to be similar to those anticipated in Option 3. This is a result of the similar traffic conditions and interchange locations associated with each alternative option. The western alignment of Option 3a avoids the interchanges on U.S. Route 220 at Routes 419, 679, and near Route 668. The interchange added to Option 3a is U.S. Route 220 north of Route 419. The additional interchanges included in Option 3a that is not included in Option 3, are expected to have ADT volumes which are relatively minor since the interchange ramps would be located on local and county roadways with relatively low ADT volumes. Interchanges in Option 3b are the same as Option 3. There is only a slight variation in the route alignment between these two options from the U.S. Route 220 at Route 668 interchange to the U.S. Route 220 north of Boones Mill interchange. As a result, it is anticipated that the volumes along the interchange ramps to and from these roadways would be similar. One interchange in Option 3c that is different from Option 3 is U.S. Route 220 at Route 619 where Option 3c deviates to the west of Option 3. This alignment shift eliminates the interchange at U.S. Route 220 at Route 618. The additional interchange roadways are expected to have ADT volumes, which are relatively minor. As a result, it is anticipated that the volumes along the interchange ramps to and from these roadways also would be relatively minor.

Option 4

Option 4 proposes 14 potential interchange locations throughout the study area. Four interchanges were analyzed in detail as part of this option. The interchanges were at U.S. Route 220 and Routes 40, 605 and 57. Out of these, the highest volumes on the ramps are forecast for the Route 57 interchange. The forecast ADT volumes on Route 57 east and west of this interchange are 10,200 and 10,000, respectively. These ADT volumes show a 20 percent decrease in the amount of traffic on Route 57 west of U.S. Route 220, as compared to the No-Build Alternative. East of Martinsville, the ADT volumes are expected to be slightly higher than those forecast for the No-Build Alternative.

ALC

The ALC Alternative proposes 21 potential interchange locations throughout the study area. Of these 21 interchanges, eight are existing interchanges located along I-581, 13 are planned along the new ALC Alternative roadway. Of the 21, three interchanges outside the Roanoke area were analyzed in greater detail as part of this option. These interchanges included those at Routes 40, 57 and U.S. Route 58. The highest daily ramp volumes under the ALC Alternative are forecast at the U.S. Route 58 interchange with 2,700 vehicles forecast to exit southbound I-73 to U.S. Route 58 and 2,800 vehicles forecast to enter I-73 northbound from U.S. Route 58. Forecast ADT volumes on U.S. Route 58 east and west of the proposed I-73 are 9700 and 8,900 respectively in the year 2025. These volumes are approximately 40 percent less than those anticipated for the No-Build Alternative, indicating that the ALC Alternative would improve traffic conditions on this roadway east of Martinsville.

4.1.6 Travel Patterns in and around the Study Area

An investigation into the forecast ADT Build Alternative options on the parallel non-study area roadways of I-77 and U.S. Route 29 was conducted as part of the I-73 Location Study analysis. The forecast 2020 and 2025 ADT volumes along these roadways are summarized in Table 4.1-6. As indicated, year 2025 forecast ADT volumes on I-77 and U.S. Route 29 remain similar between all Build Alternative options. Forecast ADT volumes on I-77 range from 26,000 to 61,600 under the ALC Alternative. These volumes are approximately 4,000 vehicles less than the volumes anticipated under the No-Build Alternative in the year 2025.

Thus, the inclusion of I-73 in the interstate highway network reduces the ADT on I-77 by approximately 7 to 13 percent. The reduction of traffic along I-77 is similar between the four options and the ALC Alternative. Forecast ADT volumes along U.S. Route 29 also indicate a reduction with the inclusion of I-73. The volume reductions are generally 100 to 4,000 vehicles less than the volumes anticipated under the No-Build Alternative, however, forecast ADT volumes are anticipated to be reduced by a maximum of approximately 17 percent in the section between Route 57 and Route 40 for both the Option 2 and ALC Alternative. The

inclusion of I-73 into the interstate highway network, therefore, would not significantly affect the anticipated traffic volumes along other primary routes like I-77 and U.S. Route 29.

**Table 4.1-6
FORECAST ADT VOLUMES
FOR PARALLEL NON-STUDY AREA ROADWAYS**

Route and Segment	2020					2025		
	No-Build	Option 1	Option 2	Option 3	Option 4	ALC	No-Build	ALC
I-77								
Route 42 to West Virginia	30,700	27,000	27,000	27,000	27,000	27,000	32,500	28,600
I-81 to Route 42	28,900	25,100	25,100	25,100	25,200	25,100	29,900	26,000
I -81/I -77	63,700	59,700	59,700	59,700	59,700	59,700	65,700	61,600
U.S. Route 58 to I-81	43,900	45,500	45,500	45,500	45,500	45,500	45,000	46,600
North Carolina to U.S. Route 58	32,600	34,200	34,200	34,200	34,200	34,200	33,800	35,500
U.S. Route 29								
U.S. Route 501 to U.S. Route 60	47,100	46,900	46,900	47,000	47,000	47,000	51,700	51,600
Route 24 to U.S. Route 501	56,700	58,500	58,500	56,600	56,700	56,600	63,400	63,300
Route 40 to Route 24	14,900	14,100	14,500	14,700	14,800	14,700	15,500	15,300
Route 57 to Route 40	19,900	20,900	19,100	19,800	19,900	16,500	22,700	18,800
U.S. Route 58 to Route 57	21,300	19,700	16,500	18,700	18,000	19,100	20,700	18,600
North Carolina to U.S. Route 58	15,000	15,000	15,000	15,000	15,000	15,000	16,300	16,300

4.1.7 Screenline Analysis

An analysis of the traffic generated through the study area was conducted via a screenline analysis. In this type of analysis, the study area is subdivided into large sections by imaginary screenlines. The screenlines can be natural or man-made barriers, such as rivers, railway tracks, or in the case of this large-scale corridor study, interchanges/intersections. Each section is analyzed using the specific traffic, roadway and land-use characteristics of that particular section. A screenline was evaluated at the northern end of the study area with I-73 and I-581 and at a second location across I-73 and U.S. Route 220 south of Rocky Mount. This analysis indicated that the ALC Alternative attracted the highest volumes to the central portion of the study area. The eastern alignment, Option 1, attracted the highest volume of traffic to the northern portions of the study area.

Table 4.1-7 summarizes the identified screenline volumes for comparative purposes. ADT volumes associated with the Build Alternatives, including the ALC Alternative, would be higher than those forecast under the No-Build Alternative. While the total study area volumes are higher with a new interstate as compared to the No-Build Alternative, traffic would be reduced on U.S. Route 220 south of Roanoke. For example, future ADT volumes south of Rocky Mount along existing U.S. Route 220 would range from 4,800 to 15,200 vehicles under the ALC Alternative due to the shift of traffic to I-73. These volumes compare to forecast volumes of 18,200 and 20,800 for similar sections under the No-Build Alternative.

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**Table 4.1-7
2020 AND 2025 SCREENLINE FORECASTS COMPARISON ANALYSIS**

Alternatives	Analysis Year	Northern Screenline with I-73 and I-581 (Total ADT)	Central Screenline with I-73 and U.S. Route 220 south of Rocky Mount (Total ADT)
Option 1	2020	118,200	31,700
Option 2	2020	106,400	35,200
Option 3	2020	106,600	32,400
Option 4	2020	109,300	36,300
ALC	2020	106,600	37,200
No-Build/TSM	2020	91,300	18,100
ALC	2025	115,100	52,000
No-Build/TSM	2025	95,300	18,200

4.1.8 U.S. Route 220 Traffic Comparison

A comparison of forecast traffic along U.S. Route 220 under the four options and the ALC Alternative also was conducted. This analysis indicates that the ALC Alternative would provide a traffic reduction in 2025 between 4,000 and 20,900 vehicles over central portions of existing U.S. Route 220. This traffic reduction will improve the safety and operations of the existing U.S. Route 220 roadway. Table 4.1-8 summarizes the forecast traffic volumes along U.S. Route 220 under the No-Build Alternative, the four various build alternatives, and the ALC Alternative.

**Table 4.1-8
COMPARISON OF 2020 AND 2025 FORECAST ADT ON EXISTING U.S. ROUTE 220**

U.S. Route 220 Segment Location	2020						2025	
	No-Build/TSM	Option 1	Option 2	Option 3	Option 4	ALC	No-Build/TSM	ALC
South of Route 419	36,100	37,500	18,800	18,800	34,700	18,800*	37,000	19,300*
South of Boones Mill	27,200	28,200	6,300	6,300	17,300	6,300	27,200	6,300
South of Rocky Mount	18,100	13,400	4,800	0	6,400	4,800	18,200	4,800
South of Bassett Forks	20,700	15,800	16,900	10,000	10,700	15,200	20,800	15,200
North of Ridgeway	18,600	14,000	15,100	15,100	32,900	14,900	20,100	16,100

*South of the I-73 diverge.

A comparison of forecast LOS along U.S. Route 220 under the four build options and the ALC Alternative was conducted and results were shown previously in Table 4.1-3. The LOS along existing U.S. Route 220 will be similar between the Build Alternatives, the ALC Alternative and the No-Build Alternative. All LOS forecast along U.S. Route 220 south of Roanoke will be within acceptable ranges. Minor fluctuations in LOS do occur along the roadway in the Roanoke area depending on the various options.

4.1.9 Travel Time Analysis

A summary of the forecast U.S. Interstate travel times under the No-Build, TSM and a New Interstate I-73 (Build) Alternative conditions is shown in Table 4.1-9. This analysis was limited to an interstate-only route assumption unless no direct interstate connection is available. While common routes may utilize state and local roadways and highways, the interstate-only assumption may be more indicative of any restrictive goods or commodity movement and was used for comparative purposes. The analysis under the Build condition assumes a completed I-73 roadway facility from Michigan to Charleston, SC. The analysis assumes a speed of 60 MPH for travel on an interstate facility. This speed is intended to represent a typical commodity movement speed along this type of facility.

**Table 4.1-9
TRAVEL TIME COMPARISON**

Origin City	Destination City	2025 No-Build/TSM		2025 Build Alternative		Savings (minutes)
		TT ¹ (hr)	Route	TT ¹ (hr)	Route	
Flint, MI	Roanoke, VA	11.31	I-75 to I-80 to I-77 to I-81	10.25	I-75 to I-73	63.6
Flint, MI	Greensboro, NC	12.74	I-75 to I-80 to I-77 to I-40	11.85	I-75 to I-73	53.4
Toledo, OH	Roanoke, VA	9.06	I-75 to I-80 to I-77 to I-81	8.00	I-75 to I-73	63.6
Toledo, OH	Greensboro, NC	10.49	I-75 to I-80 to I-77 to I-40	9.60	I-75 to I-73	53.4
Roanoke, VA	Greensboro, NC	1.94	*U.S. Route 220	1.60	I-73	20.4
Roanoke, VA	Charleston, SC	6.68	I-81 to I-77 to I-26	5.94	I-73	44.4
Roanoke, VA	Raleigh, NC	3.39	*U.S. Route 220 to U.S. Route 29 to I-40	3.05	I-73 to I-85 to I-40	20.4
Martinsville, VA	Greensboro, NC	0.83	*U.S. Route 220	0.68	I-73	9.0
Martinsville, VA	Charleston, SC	5.55	*U.S. Route 220 to NC 68 to I-40 to U.S. Route 52 to I-85 to I-77 to I-26	5.02	I-73	31.8

Source: I-73 Traffic/Transportation Technical; Memorandum.

Note: *No direct U.S. interstate connection. No-Build travel time estimated.

¹ TT = Travel Time.

As indicated, a vehicular trip from Roanoke to Raleigh, North Carolina is anticipated to take approximately 3.39 hours using a route of U.S. Route 220, U.S. Route 29, and I-40 under the No-Build Alternative. The addition of I-73 to the roadway network would reduce the travel time on this trip by 20.4 minutes, to 3.05 hours. A vehicular trip from Toledo, Ohio to Roanoke would be expected to take approximately 9.06 hours using the existing interstate highway system. The same trip with the inclusion of a Build Alternative in the interstate highway network would reduce this trip by 63.6 minutes, to 8.00 hours overall. Vehicular trips from Roanoke under the No-Build Alternative would likely use the current interstate system and not travel through Martinsville in route to Charleston, SC. As indicated, the inclusion of I-73 in the interstate highway network could produce significant travel time savings for interstate highway trips originating in Roanoke or Martinsville, and for those trips passing through the study area.

A summary of the forecast Virginia statewide travel times under the No-Build Alternative conditions and the Build Alternative options, including the ALC Alternative, is shown in Table 4.1-10. As indicated, a vehicular trip from Roanoke to Martinsville is anticipated to take approximately 1.10 hours (66 minutes) using a route of I-581 to U.S. Route 220 under the No-Build Alternative. This same trip would be expected to take approximately 0.92 hours (55 minutes) with the inclusion of any of the Build Alternative options in the roadway network, a savings of nearly 11 minutes. A vehicular trip from Roanoke to the Smith Mountain Lake area would be expected to take approximately 0.83 hours (50 minutes) on U.S. Route 220 under the No-Build Alternative. This same trip would be expected to take approximately 0.71 hours (43 minutes) with the inclusion of any of the Build Alternative options in the roadway network, a savings of 7 minutes. The travel time savings are a result of a combination of improved travel speeds along the new I-73 facility and the opportunity for a more direct route between the identified locations.

**Table 4.1-10
STUDY AREA STATEWIDE TRAVEL TIMES COMPARISON**

Origin City	Destination City	2025 No-Build/TSM		2025 Build Alternative		Savings (min)
		TT ¹ (hr)	Route	TT (hr)	Route	
Roanoke, VA	Martinsville, VA	1.10	U.S. Route 220	0.92	I-581 to I-73 to U.S. Route 220	10.8
Roanoke, VA	Rocky Mount, VA	0.50	U.S. Route 220	0.42	I-581 to I-73 to Route 122	4.8
Roanoke, VA	Smith Mountain Lake, VA	0.83	I-581 to U.S. Route 220 to Route 122	0.71	I-581 to I-73 to Route 122	7.2

Source: Traffic/Transportation Technical Memorandum.

Note: ¹TT = Travel Time - The interstate travel times are based on an average free flow speed of 60 MPH with travel limited to interstates only. The Virginia statewide travel times are based on congested speeds along major roadways through Virginia. Origin to destination travel times is shown in hours. Travel-time savings are shown in minutes.

4.1.10 Congested Flow Speed Comparison

An analysis of congested flow speeds along U.S. Route 220 and other study area roadways was conducted as part of the I-73 alternatives analysis. As summarized in Table 4.1-11, congested flow speeds along existing U.S. Route 220 range from 47.3 mph to 57.5 mph (76.1 km/h to 92.5 km/h) with an average speed of 51.9 mph (83.5 km/h). Future 2020 No-Build conditions indicate that travel speeds will remain constant to those currently experienced. This would be expected as south of Roanoke, U.S. Route 220 traffic volumes and future LOS are anticipated to be similar to current conditions. TSM improvements along U.S. Route 220 would slightly increase travel speeds along existing U.S. Route 220 and the corridor average travel speed along U.S. Route 220 would increase to 53.1 mph (85.5 km/h). Forecast travel speeds along existing U.S. Route 220 under the Build Alternative options and the ALC Alternative would be similar to those currently identified along the roadway in 2020 and 2025. This is a result of similar operating LOS anticipated along the roadway as compared to existing conditions south of Roanoke.

**Table 4.1-11
CONGESTED FLOW SPEED MPH (Km/h)**

Route and Location	1997	2020							2025	
	Existing	No-Build	TSM	Option 1	Option 2	Option 3	Option 4	ALC	No-Build	ALC
U.S. Route 220 – Route 419 to Route 684	51.6 (83.0)	51.6 (83.0)	53.0 (85.3)	51.4 (82.7)	51.6 (83.0)	51.6 (83.0)	51.6 (83.0)	51.6 (83.0)	51.6 (83.0)	51.6 (83.0)
U.S. Route 220 – Route 684 to Rocky Mount	51.6 (83.0)	51.6 (83.0)	53.9 (86.7)	51.4 (82.7)	51.6 (83.0)	51.6 (83.0)	51.6 (83.0)	51.6 (83.0)	51.6 (83.0)	51.6 (83.0)
U.S. Route 220 – Rocky Mount to Sydnorsville	53.2 (85.6)	53.2 (85.6)	54.9 (88.4)	53.2 (85.6)	53.2 (85.6)	53.2 (85.6)	53.2 (85.6)	53.2 (85.6)	53.2 (85.6)	53.2 (85.6)
U.S. Route 220 – Sydnorsville to Route 605	53.2 (85.6)	53.2 (85.6)	55.5 (89.3)	53.2 (85.6)	53.2 (85.6)	53.2 (85.6)	53.2 (85.6)	53.2 (85.6)	53.2 (85.6)	53.2 (85.6)
U.S. Route 220 – Route 605 to Reed Creek	53.2 (85.6)	53.2 (85.6)	54.7 (88.0)	53.2 (85.6)	53.2 (85.6)	53.2 (85.6)	53.2 (85.6)	53.2 (85.6)	53.2 (85.6)	53.2 (85.6)
U.S. Route 220 – Reed Creek to Martinsville	57.5 (92.5)	57.5 (92.5)	58.3 (93.8)	57.5 (92.5)	57.5 (92.5)	57.5 (92.5)	57.5 (92.5)	57.5 (92.5)	57.5 (92.5)	57.5 (92.5)
U.S. Route 220 – Martinsville to Ridgeway	47.3 (76.1)	47.3 (76.1)	47.4 (76.3)	47.3 (76.1)	47.3 (76.1)	47.3 (76.1)	65.0 (104.6)	47.3 (76.1)	47.3 (76.1)	47.3 (76.1)
U.S. Route 220 – Ridgeway to North Carolina state line	47.3 (76.1)	47.3 (76.1)	47.3 (76.1)	47.3 (76.1)						
U.S. Route 220 Average	51.9 (83.5)	51.9 (83.5)	53.1 (85.5)	51.8 (83.4)	51.9 (83.5)	51.9 (83.5)	54.1 (87.1)	51.9 (83.5)	51.9 (83.5)	51.9 (83.5)
Study Area Average (Existing Roadways and I-73)	51.2 (82.4)	50.2 (80.8)	50.6 (81.4)	52.5 (84.5)	51.9 (83.5)	51.1 (82.2)	53.3 (85.8)	51.1 (82.2)	49.9 (80.3)	50.8 (81.8)

A study area average of congested flow travel speeds along main roadways was identified for comparative purposes. Average travel speeds are highest under Build Alternative Options 1 and 4 and lowest under a No-Build Alternative. The ALC Alternative indicates average travel speeds similar to Option 3. The study area roadway average indicates that all Build Alternatives, including the ALC Alternative, will have a higher travel speed than either the No-Build or TSM Alternatives.

4.1.11 VMT Comparison

An analysis of forecast VMT (vehicle kilometers traveled (VKT)) through the study area was conducted for use in comparing the alternatives. The results of the VMT analysis are summarized in Table 4.1-12. As indicated, along study area roadways, VMT currently stands at 4.42 million vehicle miles (7.11 million VKT) per day. Future No-Build and TSM conditions indicate that VMT will increase to 5.25 million vehicle miles (8.45 million VKT) per day in 2025. Under the ALC Alternative, VMT along the study area roadways will be reduced to 3.08 million vehicle miles (4.95 million VKT) per day, while the I-73 VMT value will be

approximately 2.90 million vehicle miles (4.66 million VKT) per day in 2025. Overall, VMT values are higher under the Build Alternative options as compared to existing conditions and future No-Build conditions in the study area.

The estimated 2025 daily VMT indicates I-73 will divert travel away from other regions to and through the Roanoke - Rocky Mount - Martinsville corridor. The eastern and western alternatives (Options 1 and 4 respectively) will attract and direct more regional and through trips while the ALC Alternative and Options 2 and 3 will attract and divert more local trips.

**Table 4.1-12
VEHICLE MILES (KILOMETERS) TRAVELED**

Measured VMT (VKT) ¹									
	1997	2020						2025	
	Existing Conditions	No-Build/TSM	Option 1 ³	Option 2 ³	Option 3 ³	Option 4 ³	ALC	No-Build/TSM	ALC
Study Area Roadways ²	4.42 (7.11)	5.09 (8.19)	5.09 (8.19)	3.07 (4.94)	3.27 (5.26)	5.13 (8.25)	2.97 (4.78)	5.25 (8.45)	3.08 (4.95)
I-73	N/A	N/A	1.47 (2.37)	2.61 (4.20)	2.57 (4.14)	1.85 (2.98)	2.76 (4.44)	N/A	2.90 (4.66)
Total	4.42 (7.11)	5.09 (8.19)	6.56 (10.56)	5.68 (9.14)	5.84 (9.40)	6.98 (11.23)	5.73 (9.22)	5.25 (8.45)	5.98 (9.61)

Notes: ¹per million vehicle miles (kilometers) per day.
²not including I-581 on Option 2 and 3
³average of all sub-options

The ALC Alternative and Build Alternative Options 2 and 3 have the advantage of absorbing more local travel due to their centralized location in the travel network. The reduction in study area VMT, as compared to Build Alternative Options 1 and 4, is due to the proposed Build Alternative facility attracting a larger number of local trips. This behavior favors the urbanized areas in Roanoke, Rocky Mount, and Martinsville as it relieves congested or near congested conditions by removing VMT from the local roadway network and placing it on the new highway facility.

4.1.12 VHT Comparison

An analysis of forecast VHT throughout the study area was conducted. VHT is an indication of the congested travel times multiplied by the traffic volumes along the roadways within a defined study area. As indicated in Table 4.1-13, 2020 VHT values are similar between the ALC Alternative and all four Build Alternative options. This value is in the range of 68,700 hours to 68,900 hours in 2020. The 2025 VHT will increase by approximately 41 percent from existing to No-Build conditions and 33 percent under the ALC and Build Alternatives compared to existing conditions. Thus, the duration of travel time for motorists within the study area would decrease if the I-73 facility were constructed.

**Table 4.1-13
COMPARISON OF FORECAST VHT**

	1997	2020						2025	
	Existing Conditions	No-Build/TSM	Option 1	Option 2	Option 3	Option 4	ALC	No-Build/TSM	ALC
Study Area	54,100	72,300	68,900	68,900	68,800	68,700	68,800	76,300	72,100

Notes: Values shown in vehicle hours traveled per day.

4.1.13 Origin - Destination Analysis

As part of the traffic analysis conducted for the I-73 Location Study, a select link origin and destination analysis for selected roadway links was conducted for each Build Alternative option and the ALC Alternative within the study area. The analysis was conducted for two locations along proposed I-73, just north of Martinsville and south of Roanoke. The results of the analysis are depicted in Table 4.1-14. These results are summarized below for the ALC Alternative while the results for all of the Build Alternative options were summarized in the draft EIS.

The ALC alternative would exhibit a similar origin and destination pattern as that found for the Build Alternative Option 2 and Option 3. North of Martinsville (between Route 57 and Route 605), 60 percent of the northbound traffic would originate from I-73 south. The northbound traffic was estimated to have 38 percent with a destination north of the study area. Thirty-nine (39) percent of the southbound I-73 traffic originates from outside of the study area, while 16 percent originates from I-81 and about 61 percent of the southbound I-73 traffic north of Martinsville would be forecast to continue on I-73 south of the study area as a destination.

At a screenline south of Roanoke, 37 percent of the northbound traffic along I-73 would originate from areas south of the study area. Thirty-one percent of the traffic would originate from the Rocky Mount area with 13 percent of the northbound I-73 traffic forecast to originate from the Martinsville area. The Roanoke and Salem areas are the most popular destinations for northbound vehicles with 45 percent going to these locations. Of the southbound traffic (south of Roanoke), 46 percent would originate from the Roanoke and Salem areas and 28 percent from further north on I-73. The highest percentage of southbound traffic (40 percent) is destined for areas further south than I-73, while 31 percent is destined for Rocky Mount and 13 percent for Martinsville.

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**Table 4.1-14
ORIGIN – DESTINATION ANALYSIS**

Screenline North of Martinsville — Northbound I-73											
Origins						Destinations					
I-73 South	Martinsville	Surrounding Other Areas	I-73 North	I-81 N.W.	Roanoke/Salem	Rocky Mount	Surrounding Area	I-73 North	I-81 N.W.	Roanoke/Salem	Martinsville
Option 1	24%	6%	50%	21%	5%		24%	25%	11%		
Option 2	15%	25%	38%	16%	12%		20%	24%	10%		2%
Option 3	28%	22%	35%	15%	18%		16%	28%	12%		
Option 4	27%	23%	38%	13%	17%		18%	55%	14%		
ALC	15%	25%	38%	16%	12%		20%	28%	12%		2%
Screenline South of Roanoke — Northbound I-73											
Origins						Destinations					
Central Virginia	I-73 South	Martinsville	Surrounding Areas	Rocky Mount	Roanoke/Salem	I-81 N.W.	Surrounding Area	I-73 North	I-81 N.W.	Roanoke/Salem	Surrounding Area
Option 1	45%	33%	22%			11%	38%	25%	11%		
Option 2		39%	16%	33%		10%	26%	24%	10%		38%
Option 3		40%	16%	31%		12%	40%	28%	12%		26%
Option 4		55%	13%	10%	14%		45%	55%			15%
ALC		40%	16%	31%		12%	45%	28%	12%		34%
											15%
Screenline North of Martinsville — Southbound I-73											
Origins						Destinations					
I-73 W. Va.	I-81 N.W.	Rocky Mount	Surrounding Areas	Roanoke/Salem	I-73 South	Surrounding Area	I-73 South	Surrounding Areas	I-81 N.W.	Roanoke/Salem	Roanoke/Salem
Option 1	50%	10%	10%		19%	6%	70%	19%			6%
Option 2	39%	12%	12%	12%	21%	15%	61%	21%			24%
Option 3	37%	15%	15%	18%	15%	20%	51%	15%			24%
Option 4	39%	14%	14%	17%	17%	23%	50%	17%			20%
ALC	39%	12%	12%	12%	21%	24%	61%	21%			23%
											24%
Screenline South of Roanoke — Southbound I-73											
Origins						Destinations					
I-73 N.W.	I-81 N.W.	Roanoke/Salem	Surrounding Areas	I-73 South	Martinsville	Rocky Mount	Surrounding Area	I-73 South	Martinsville	Rocky Mount	Roanoke/Salem
Option 1	24%	6%	33%	58%	7%	9%	26%	58%	7%	9%	26%
Option 2	28%	40%	26%	36%	11%	30%	23%	36%	11%	30%	23%
Option 3	55%	46%	14%	40%	13%	31%	16%	40%	13%	31%	16%
Option 4	28%	11%	34%	56%	7%	10%	14%	56%	7%	10%	14%
ALC		46%	14%	40%	13%	31%	16%	40%	13%	31%	16%

4.1.14 Safety Effects of Alternatives

There are a number of safety concerns along existing U.S. Route 220. These concerns include issues of closely spaced and narrow median openings, the lack of left turn lanes at median openings, the lack of access control along the roadway in many locations, increased daily traffic volumes, antiquated design standards, and high vehicle speeds traveling along the roadway.

No-Build Alternative

The No-Build Alternative provides no improvements to the safety issues outlined above. As the traffic volumes on the existing roadways in the study area, especially on existing U.S. Route 220, safety situations could be expected to worsen.

TSM Alternative

The TSM Alternative proposes a number of sight distance improvements, median improvements, and horizontal and vertical geometry improvements along U.S. Route 220. Details of these improvements can be found in Chapter 2. The improvements were identified to address safety concerns and to upgrade U.S. Route 220 to design standards for a rural principal arterial. The TSM elements along U.S. Route 220 range from spot improvements at specific locations to the rebuilding of roadway sections of several thousand feet in length.

Build Alternative

A limited access facility, as currently proposed under the Build Alternative, including the ALC Alternative, would have a lower accident rate as compared to existing U.S. Route 220 and would divert motorists from U.S. Route 220 to I-73. As a result, reductions in traffic volumes along the existing U.S. Route 220 roadway would result in a reduction in the number of accidents forecast to occur along the roadway. All of the Build Alternative options reduce the forecast traffic volumes along existing U.S. Route 220 south of Route 419 as compared to the No-Build and TSM Alternatives. The Build Alternative would improve the safety of existing U.S. Route 220 by reducing the traffic traveling on the roadway and therefore, reduce the overall number of accidents in the corridor.

Accident, injury and fatality reductions would be anticipated under the TSM Alternative. This data is presented in Table 4.1-15. However, the estimate of occurrences for TSM cannot be determined using a correlation to the roadway functional classification statewide accident rate. This is due to the fact that the functional classification, and the related statewide accident rate, of U.S. Route 220 would not change with TSM improvements. The accident, injury and fatality rate would improve but would not change as substantially as any Build Alternative option or the ALC Alternative. The Build and ALC alternatives represent a major upgrade in design and safety standards.

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**Table 4.1-15
PROJECTED ACCIDENT, INJURY, AND FATALITY COMPARISON ON EXISTING U.S. ROUTE 220**

U.S. Route 220 – Route 419 to North Carolina State Line	1997	2020						2025	
	Existing	No-Build/ TSM	Option 1 ¹	Option 2 ¹	Option 3 ¹	Option 4 ¹	ALC ¹	No-Build/ TSM	ALC ¹
Accidents	278	410	360 (-50)	215 (-195)	155 (-255)	270 (-140)	201 (-209)	427	208 (-218)
Injuries	208	325	285 (-40)	170 (-155)	120 (-205)	215 (-110)	160 (-165)	341	166 (-175)
Fatalities	3	4	3 (-1)	2 (-2)	1 (-3)	3 (-1)	2 (-2)	4	2 (-2)

Sources: VDOT, Traffic Engineering Division, 1995 Summary of Crash Data, 1995.
VDOT, Transportation Planning Division, 1995, 1996, 1997, Accident Summary and Accident Rate Information, U.S. Route 220 from SCL
Roanoke to North Carolina State Line, June 1999.

Notes: ¹ 360 (-50) = forecast # accidents, injuries, and fatalities (amount less than No-Build Alternative)

A decrease in annual accidents, injuries, and fatalities on U.S. Route 220 between Route 419 and the North Carolina state line is estimated under all proposed Build Alternative options. The greatest reduction in accidents, injuries, and fatalities would be expected under Option 3. This is a result of Option 3 diverting the greatest amount of traffic from existing U.S. Route 220. Of all of the alternatives, the ALC alternative results in the second greatest reduction in accidents, injuries and fatalities. Option 1 would have the lowest reduction in accidents, injuries, and fatalities along U.S. Route 220.

4.1.15 ALC Evaluation using 2025 Traffic Forecasts

An analysis of the forecast traffic volumes and the resulting LOS and transportation measures of effectiveness was conducted for the year 2025 in order to assess the traffic and transportation impacts of the ALC in the urban portion of the study area. This 2025 analysis of the ALC was performed in order to satisfy FHWA practice to match the horizon or forecast year to the forecast year in the regional long range transportation plan (Roanoke Valley Area MPO 2025 Long Range Transportation Plan)

The 2025 peak hour LOS for the highway segments for each alternative was evaluated within the urban portion of the study area, which provides an indication of the operation and performance of a facility. Highway capacity and overall operational performance are typically directly related to the traffic volume-to-capacity, design speed of the facility, profile grades, distance to obstructions, shoulder widths and percentage of heavy vehicle traffic. The LOS is calculated for each facility to describe its expected quality of operation. Service levels are defined by the conventional grades A through F. A description of each LOS grade is provided in Section 3.1, Transportation Setting, Table 3.1-4.

A detailed CORSIM traffic analysis of the I-581 / U.S. 220 corridor was conducted in mid year 2000 (Appendix C, Addendum to the DEIS Traffic and Transportation Technical Memorandum). This analysis included recommendations for geometric improvements for the year 2020 if I-73 was located along the I-581 / U.S. 220 corridor.

An updated CORSIM traffic analysis has been performed in order to assess traffic operations along the combined corridor of I-73, I-581 and Roy Weber Freeway (U.S. 220) in the year 2025. The extent of the updated CORSIM analysis covers the same ground as the prior study, I-81 to Route 419. The purpose of the

2025 analysis was to determine the ability of the 2020 recommendations to accommodate an additional 5 years of traffic growth.

Year 2025 traffic volumes were determined by examining 1997 traffic counts as well as 2020 projected volumes, both listed in the I-73 DEIS. A growth rate of approximately 1.6% per year was determined for the corridor according to the 2020 projections. This growth rate was carried forward from 2020 projections to the year 2025 to determine the new analysis volumes. All previous assumptions were utilized in this study (terrain, peak hour factor, free flow speed) with the exception of truck percentage, which was 11 percent for the mainline. Truck percentages along I-81 as well as U.S. 220 south of the city are higher than reported in the DEIS as 19%. However, due to the additional passenger car traffic through the city, truck percentages are actually lower along this highly urbanized portion of the corridor. This analysis does not include an interchange along I-73 to provide access to the Riverside Centre or Biomedical Park. However, it does include previously projected traffic volumes included in a preliminary analysis of trips generated by the Biomedical Park. Access to the Riverside site is anticipated to be provided on the existing street network. Of the traffic that was previously planned to utilize I-581 / U.S. 220 to access Riverside Centre, half of this traffic was routed to utilize Elm Avenue and half to Wonju Street.

Roadway geometry includes all improvements recommended in the previous study, with a few additional improvements at Elm Avenue. The improvements are listed below.

- Route 101 (Hershberger Road) Interchange – Remove SB on-loop in NW quadrant, widen SB on-ramp to two lanes and develop a two lane merge area on the mainline; introduce WB Route 101 left turn to SB on-ramp.
- U.S. Route 460 (Orange Avenue) – Add auxiliary lane SB between Valley View SB on-ramp and Orange Avenue SB off-ramp and add left turn from SB off-ramp to EB U.S Route 460; improve SB on-loop geometry; remove SB off-loop and SB on-ramp in SW quad, replace with one lane SB directional ramp, extend SB auxiliary lane through interchange and introduce second auxiliary lane beyond new SB ramp entry; remove NB off-loop and NB on-ramp in NE quad, replace with one lane NB directional ramp, introduce auxiliary lane NB and extend to NB off-ramp at Route 101 interchange: widen existing NB off-ramp to two lanes, add two auxiliary lanes at I-73 exit and a left turn lane from the NB off-ramp to WB U.S. Route 460.
- U.S. Route 11 (Williamson Road) – Extend the SB auxiliary lane through the interchange to the SB off-ramp at Elm Avenue and modify SB of-ramp junction for lane balance; extend NB auxiliary lane back to NB off-ramp at Elm Avenue.
- Route 24 (Elm Avenue) – Widen SB off-ramp to four lanes (two left turn and two right turn); widen NB off-ramp to three lanes (one left turn, one left/right center lane, and one right turn); lengthen acceleration lanes on both on-ramps and widen NB on-ramp to 2 lanes. Additional improvements beyond previous study: Widen the bridge over I-581 to eight lanes (two throughs and two left turn lanes each direction); widen SB on-ramp to two lanes. The intersection of Elm Avenue and Williamson Road will also need geometric improvements in the year 2025, which is beyond the scope of this study.
- Franklin Road – Add SB auxiliary lane from SB on-ramp to SB off-ramp at Wonju Street (Colonial Avenue).
- Wonju Street – In the SW quad improve SB off-loop geometry; in NE quad remove the NB on-ramp, the SB off-loop and replace with a two lane NB diamond on-ramp; in the SE quad remove the NB on-loop and replace with a one lane NB diamond off-ramp. As opposed to removing the NB on-ramp, retain and upgrade to two lanes. The new diamond SB off-ramp would be aligned to the NB on-ramp intersection. The analysis includes a signal at the intersection of Colonial Avenue and the I-73 southbound on-ramp (located near the Wonju Street interchange) in order to allow traffic from Colonial Avenue to turn left onto the ramp. A more detailed analysis should be performed to verify the improvement options at this intersection. Although a signal is one option, it requires careful consideration since it would be located very close to the traffic signal at Wonju Street / Colonial Avenue. Modifications to intersection / ramp geometry (such as providing designated / separate left and right turn ramp receiving lanes) may also improve intersection operations.

- Route 419 – In the NW quad the two lane SB off-ramp diverge area and two lane ramp are in place today; in the SE quad remove the NB on-loop; add a two lane directional NB on-ramp from EB Route 419; lengthen the acceleration lane on the SB on-ramp.

Upon examining the I-73 corridor through the City of Roanoke using CORSIM, all levels of service along the interstate are acceptable (D or better) through 2025 with the above proposed improvements in place. Table 4.1-16 shows the 2025 levels of service along the I-73 corridor through Roanoke with the above recommended improvements in place.

**Table 4.1-16
2025 LOS ALONG I-73 ALC THROUGH ROANOKE**

ALC 2025	Peak Hour LOS in2025
I-81 to Rt. 117 (Peter's Creek)	D
Route 117 (Peter's Creek) to Route 101 (Hershberger)	D
Route 101 (Hershberger) to U.S. Route 460 (Orange Avenue)	D
U.S. Route 460 (Orange Avenue) to Route 24 (Elm Avenue)	C
Route 24 (Elm Avenue) to Wonju Street	D
Wonju Street to Route 419 (Franklin Road)	C

Notes: These segments were analyzed using a more detailed CORSIM analysis. Assumes a six-lane basic freeway section plus additional auxiliary lanes as needed between interchanges, creating eight and in some instances ten-lane sections (between U.S. Route 460 (Orange Avenue) and Route 24 (Elm Avenue)). Includes recommended improvements to interchanges.

Under the ALC Alternative, sections of I-73 would operate at a peak period LOS between C and D. The freeway segments in the northern end of the corridor operate at LOS D. Between U.S. Route 460 and Route 24, the additional auxiliary lanes required amount to an eight-lane section from Route 24 to U.S. Route 11, and a ten-lane section from U.S Route 11 to U.S. Route 460. This accounts for the improved LOS of C along this section.

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4.2 LAND USE, SOCIOECONOMIC, AND FARMLANDS

Effected land uses, socioeconomic conditions, and public facilities in the corridor are described below. Each alternative's compatibility with local government plans is presented. Each alternative's effects on minority and low-income populations are described to determine if federal priorities regarding compliance with environmental justice concerns are met. Economic effects are identified and each alternative's potential economic benefits and displacements are compared. Effects on farm and forested lands also are described.

The development of alternatives balanced the project's stated purpose and need with the priority to avoid or minimize direct effects on environmental, social, and agricultural sensitive areas. Where direct effects would result, mitigation has been identified to reduce the effect. Many of the proposed mitigation measures would be implemented during the subsequent design or construction phases under the Build Alternative. Design guidelines are recommended for consideration during that phase.

4.2.1 Land Use and Public Facility Consequences

4.2.1.1 No-Build Alternative

Land Use Consequences

No change in the existing land use would result from the No-Build Alternative. No lands would be removed, and no changes in access to existing land uses would occur beyond those resulting from the identified No-Build improvements. Site distances would not be improved along existing U.S. Route 220, and planned growth on U.S. Route 220 would result in additional access points, cross traffic and traffic on U.S. Route 220.

Public Facilities Effects

Access for police, fire, emergency, and utility services and schools, colleges and libraries in the study area would not change. Response times in the urbanized areas may deteriorate due to increased congestion. Otherwise rural response times may incur only minor delay. There would be no utility service interruptions or rerouting of existing water, sewer or electric lines. Access to solid waste collection points and disposal sites would not change. Access to the landfill on U.S. Route 220 in Franklin County would not be affected.

4.2.1.2 TSM Alternative

Land Use Consequences

In Roanoke City, Botetourt and Bedford counties, no TSM improvements are proposed. There would be no land use consequences on these jurisdictions. In Roanoke County, the median and outside shoulder widening on U.S. Route 220 in the southern county from Route 789 to Route 930 would remove narrow amounts of forested, open or vacant land on either side of the existing highway. Widening in Clearbrook at the intersection of Route 679, to accommodate a new turn lane, would include the removal of a narrow band of landscaping or parking area and the relocation of existing light poles and some fencing.

In Franklin County, Boones Mill and Rocky Mount, there would be a limited effect on land uses between the county line and the Maggoodee Creek crossing of U.S. Route 220. In Boones Mill, improvements would be within the existing right-of-way and prevent removal of all but one business fronting on U.S. Route 220. Between Boones Mill and Rocky Mount, improvements would not result in the removal of structures, however driveways, parking areas and outside display areas would be shortened. In Rocky Mount, improvements to U.S. Route 220 through the Rocky Mount Bypass would result in minor land use acquisition on either side of the road.

In Henry County, Martinsville and Ridgeway, median and shoulder widening in the Oak Level and Reed Creek areas of Henry County would affect limited land uses (existing residences and businesses). Median and shoulder widening through Bassett Forks would remove frontage property on either side of U.S. Route 220. Existing businesses are set back from the roadway so improvements would remove portions of parking areas. Some signage would be affected. Access across U.S. Route 220 for the Sheffield Terrace and Glen Court residential areas would be affected by the median closures proposed between Route 1301 and Route 902. The addition of a right turn lane is intended to improve safety. Median closings proposed at 4.05 miles north of the Virginia State line would affect direct access to properties on U.S. Route 220, but would not add appreciably to travel time.

Public Facilities Consequences

Public service access would remain the same for a majority of the facilities under the TSM Alternative. In some cases, response times would be decreased by proposed improvements. Increased safety improvements would be expected to result in a decrease in the incidence of emergencies. Only predicted impacts to public facilities are discussed below.

Police, Fire and Emergency Services

The proposed improvements between the Blue Ridge Parkway and Route 715 would result in slight decreases in response times north of the Clearbrook Fire and Rescue Station. Boones Mill Fire Station and Boones Mill Volunteer Rescue would be affected by median closings across U.S. Route 220 between Naff Road and the Maggodee Creek crossing. Travel time would be added, as access across U.S. Route 220 would be limited to the crossings at Route 824 and at Route 613. Grade reduction, median and shoulder widening on U.S. Route 220 would result in temporary delays in response time for the Fork Mountain Fire Department and Fork Mountain Rescue.

No police stations have direct access onto U.S. Route 220 in the study area. Median closings could result in longer response times depending on the direction of the call from a station, the access roads used and the location of the call. As improvements are made and the residences and emergency personnel become more familiar with the changes to access, delays would be reduced.

Schools, Colleges and Libraries

No TSM Alternative improvements are proposed north of Route 419 in Roanoke City or County. The median and shoulder widening in the Clearbrook area of Route 679 and U.S. Route 220 will reduce frontage property at the Clearbrook Elementary School. This portion of the site is an open area and not part of the buildings or play areas of the school. Access to the school is via Route 679 and Tall Pine Road, not directly from U.S. Route 220. Median and shoulder widening would not affect schools in Franklin County. In Henry County, median closings between the Franklin County Line and Route 1310 would effect bus routing. Additional travel-time to remaining median openings and signalized intersections would occur as a result of these median closings. The Drewry Mason Middle School is adjacent to the TSM Alternative improvement that includes the addition of a right turn lane at the school to provide for a safer bus entry. School bus routing would be affected by the median closings proposed between Route 1301 and Route 902.

Utilities

Solid waste collection and drop off would not be changed. The landfill on the eastern side of U.S. Route 220 at Route 755 in Franklin County would not be affected. Temporary delays would occur during construction. However, access would be maintained throughout the construction period.

4.2.1.3 Build Alternative

Table 4.2-1 indicates the number of acres (hectares) of land by land use category that would be converted to a new transportation use by each option. In summary, Build Alternative Option 3 would affect the largest acreage of residential properties (at 1,001 acres), Option 3a would affect the largest acreage of commercial/industrial properties (at 1,624 acres); Option 3c would affect the largest acreage of public facilities (at 40 acres); Option 2a would affect the largest acreage of agricultural lands and open areas (at 2,241 acres); and Option 1a would affect the largest acreage of forestlands (at 4,487 acres).

Option 1, 1a

As the easternmost Build Alternative option, Option 1 generally avoids concentrations of development. Option 1 would result in improved regional access to schools and to public libraries. Also, response times will improve for Red Valley Rescue and Burnt Chimney Volunteer Fire Department, as they would be able to use the new interstate instead of Route 116. Option 1 provides the closest access to Smith Mountain Lake in Franklin County.

Option 1a would affect the largest amount of forestlands of any option. Compared to the other options Option 1a, like Option 1, would convert a low amount of commercial and residential property.

In Botetourt County, the Blue Ridge Fire and Rescue volunteers would be able to assist emergencies on I-81 faster than the Read Mountain Fire station during certain times of the day. Fork Mountain Fire and Rescue in Henry County would have improved access and decreased response times to the Figsboro area. The Dyers Store Fire Station in Henry County would be taken. The Axton Fire and Rescue would have decreased response times and improved access to the area around the proposed Route 650 interchange south of Martinsville.

Option 2, 2a, 2b, 2c

Southeastern Roanoke City, the community of Mount Pleasant in Roanoke County, and the community of Red Valley in Franklin County are served by Option 2.

Compared to other Build Alternative Options, Option 2a would affect the largest amount of farmland. Southeastern Roanoke City, the communities of Red Valley, Windy Gap, and Mountain View in Franklin County, and the community of Carlisle in Henry County are served by this option.

Option 2b would follow existing I-581 and U.S. Route 220 throughout the City of Roanoke. Option 2b serves the communities of Clearbrook in Roanoke County; Red Valley and Mountain View in Franklin County; and Carlisle in Henry County.

The southeastern section of Roanoke City and the communities of Mount Pleasant in Roanoke County; Red Valley and Mountain View in Franklin County; and Carlisle in Henry County are served by Option 2c.

For Options 2, 2a, and 2c, access to public services and amenities in downtown Roanoke off of I-581 would not change. In Franklin County, Fork Mountain Fire and Rescue would have better access to the Sontag area and would possibly be able to assist emergencies on Route 619 faster than Snow Creek Fire and Rescue. Both Fork Mountain Fire and Rescue in Henry County would have improved access and decreased response times to the Figsboro area. The Dyers Store Fire Station in Henry County would be taken. In Henry County, the proposed interchange at Figsboro Road would improve access to the Figsboro Elementary School. For Options 2, 2a, and 2c, the Roanoke City Fire Station Number 11 would be relocated.

Under Option 2b, the elimination of the Franklin Road interchange in Roanoke may disrupt regular routes. Access would change for businesses and residences just south of Route 419 where U.S. Route 220 becomes a limited access roadway. Four interchanges and several frontage roads would be added to mitigate the new interstate where the access is changed. The Clearbrook Elementary School in Roanoke County south of the

proposed Route 679 (Buck Mountain Road) interchange would have access from Buck Mountain Road, but the property would abut the new interstate right of way. Access for the Clearbrook Fire and Rescue Station would be from Buck Mountain Road and from a new frontage road to be constructed along with the new interstate. The proposed interchange at Buck Mountain Road would promote access onto the interstate and faster response times to areas north and south of the station. Several proposed interchanges immediately to the north and south of the Buck Mountain Road interchange would allow access for emergencies. Response times may improve to emergencies in and around Roanoke County, but would otherwise remain the same or decrease due to the new access roads.

Option 3, 3a, 3b, 3c

Option 3 would affect the largest amount of residential land. Option 3 would follow existing I-581 and U.S. Route 220 throughout the City of Roanoke. Eleven communities would be served by Option 3. Clearbrook in Roanoke County; Boones Mill, Rocky Mount, Henry Fork, Sydnorsville, Fork Mountain, and Mountain View in Franklin County; and Oak Level, Bassett Forks, Grassy Creek, and Ridgeway in Henry County. Option 3 avoids the City of Martinsville.

Option 3a would affect the largest amount of commercial land of any option. Option 3a would follow existing I-581 and U.S. Route 220 throughout most of the City of Roanoke. Option 3 also serves the following communities: Boones Mill, Rocky Mount, Henry Fork, Sydnorsville, Fork Mountain, and Mountain View in Franklin County; and Oak Level, Bassett Forks, Grassy Creek, and Ridgeway in Henry County. Option 3a avoids the City of Martinsville.

Option 3b would follow existing I-581 and U.S. Route 220 throughout the City of Roanoke. Option 3b would also serve the following communities: Clearbrook in Roanoke County; Boones Mill, Rocky Mount, Henry Fork, Sydnorsville, Fork Mountain, and Mountain View in Franklin County; and Oak Level, Bassett Forks, Grassy Creek, and Ridgeway in Henry County. Option 3b avoids the City of Martinsville.

Option 3c would follow existing I-581 and U.S. Route 220 throughout the City of Roanoke. Option 3c would also serve the following communities: Clearbrook in Roanoke County; Boones Mill, Rocky Mount, Henry Fork, and Mountain View in Franklin County; and Oak Level, Bassett Forks, Grassy Creek, and Ridgeway in Henry County. The option avoids the City of Martinsville.

Under options 3, 3a, 3b, and 3c, access to public services and amenities in downtown Roanoke off of I-581 would not change. The elimination of the Franklin Road interchange may disrupt regular routes.

Under Options 3, 3b, and 3c, access would change for businesses and residences in the area just south of Route 419 where U.S. Route 220 becomes a limited access roadway. Four interchanges and several frontage roads would be added here to mitigate the new interstate where current access is changed. The Clearbrook Elementary School in Roanoke County south of the proposed Route 679 interchange would continue to have access from Buck Mountain Road, but its property would abut the new interstate right of way. Access for the Clearbrook Fire and Rescue Station would be from Buck Mountain Road and from a new frontage road to be constructed along with the new interstate. The proposed interchange at Buck Mountain Road would promote access onto the interstate and faster response times to areas north and south of the station. Several proposed interchanges immediately to the north and south of the Buck Mountain Road interchange would allow access for emergencies. Response times may improve when responding to emergencies in and around Roanoke County, but would otherwise remain the same or decrease due to the new access roads.

Under options 3, 3a, 3b, and 3c, increased response times are expected for Fork Mountain Fire and Rescue when assisting the Oak Level and Reed Creek areas of Henry County. Access would be changed for both the Morehead Family Clinic and the Ridgeway Medical Center, located on U.S. Route 220 north of Ridgeway. Increased response times are also expected for Ridgeway Fire and Rescue because U.S. Route 220 unlimited access would be removed and the proposed interchanges are inconvenient for quick access because of reduced opportunity for access. Alternate routes would have to be taken to reach those areas between the U.S. Route 220/U.S. Route 58 interchange and the U.S. Route 220/U.S. Route 220 Business

interchange north of Ridgeway. The Franklin County Public Landfill located on the eastern side of U.S. Route 220 would have property taken as a result of Options 3, 3a, and 3b.

Option 4

Option 4 would affect the fewest number of commercial and residential areas of all the options. Although Option 4 passes through the western section of Stanleytown and the eastern part of Grassy Creek in Henry County, it generally avoids major concentrations of residential properties.

No public facilities would be affected directly by takings; however, Option 4 could indirectly affect some public facilities along the route. In Franklin County, Red Valley Rescue and Burnt Chimney Volunteer Fire Department would be able to assist emergencies on U.S. Route 220 faster than the Boones Mill Fire and Rescue team during certain times of the day. Travel time to Henry Elementary School would increase for people to the east of the proposed interstate. When U.S. Route 220 becomes a limited access highway, many of the side streets that currently access U.S. Route 220 directly would change and cause families to find another route to the school. Build Alternative Option 4 (as well as Option 1a) is the closest option to Ferrum College.

In Henry County, Option 4 provides the best access to recreational amenities at Philpott Reservoir. This option avoids a general aviation landing strip on Pace Airport Road in southern Henry County; however, the compatibility of a new highway facility with current flight paths may require further study.

Adopted Location Corridor

The ALC would extend along the currently urbanized I-581 and U.S. Route 220 corridor throughout Roanoke City. South of its divergence from the U.S. Route 220 corridor, the ALC primarily would extend through less densely populated areas in southern Roanoke County and northern Franklin County. Since the ALC follows a more rural alignment for most of the route south of Roanoke City, effects to residential properties are less than other Build Alternative Options. In addition to portions of Roanoke City, the communities of Clearbrook in Roanoke County and Red Valley in Franklin County would be served by the ALC.

Under the ALC, access to public services and amenities in downtown Roanoke off I-581 would not change. In Franklin County, Fork Mountain Fire and Rescue would have better access to the Sontag area and would possibly be able to assist emergencies on Route 619 faster than Snow Creek Fire and Rescue. Fork Mountain Fire and Rescue in Henry County would have improved access and decreased response times to the Figsboro area. The Axton Fire and Rescue would have decreased response times and improved access to the area around the proposed Route 650 interchange south of Martinsville. Fire Station Number 11 in Roanoke City and the Dyers Store Fire Station in Henry County would be relocated. In Henry County, the proposed interchange at Figsboro Road would improve access to the Figsboro Elementary School.

4.2.1.4 Potential Mitigation

The following mitigation is recommended to be applicable to all Build Alternative options.

- Avoidance is considered to be the first crucial step towards effectively mitigating environmental impacts. During the conceptual engineering phase conducted during preparation of the Location Study Report (VDOT, 2000), a concerted effort was made to avoid or minimize impacts to public facilities. Preliminary design plans for the ALC will consider practicable measures to avoid or further reduce impacts to public facilities. Where permits, approvals, or memoranda of agreement are required, minimization measures for unavoidable impacts will be developed. Site-specific mitigation measures will become part of the final design plans.

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**Table 4.2-1
LAND USE ACREAGE BY OPTION**

Option	Residential		Commercial/ Industrial		Public Facilities		Agriculture, Pasture and Open Areas		Forest		Total	
	Acres	Hectares	Acres	Hectares	Acres	Hectares	Acres	Hectares	Acres	Hectares	Acres	Hectares
Build Alternative Options												
1	463	187	95	38	0	0	2,177	881	4,392	1,777	7,127	2,883
1a	495	200	131	53	0	0	2,122	859	4,487	1,816	7,235	2,928
2	647	262	931	377	0	0	2,161	875	3,403	1,376	7,142	2,890
2a	735	297	931	377	1	0	2,241	907	3,210	1,298	7,118	2,879
2b	884	358	1,275	516	12	5	2,079	841	3,179	1,286	7,429	3,006
2c	653	264	950	384	1	0	2,106	852	3,229	1,305	6,939	2,805
3	1,001	405	1,589	643	34	14	1,237	501	2,063	834	5,924	2,397
3a	910	368	1,624	657	34	14	1,229	498	2,242	905	6,039	2,442
3b	986	399	1,589	643	34	14	1,237	501	2,160	873	6,006	2,430
3c	976	395	1,588	643	40	16	1,282	519	2,015	815	5,901	2,388
4	427	173	200	81	7	3	1,586	642	3,413	1,380	5,633	2,279
ALC	756	304	1,193	483	12	5	1,715	693	3,370	1,364	7,046	2,849

Note: All numbers rounded to nearest whole number.

Source of Agriculture and Forest Land Cover Data: U.S. Environmental Protection Agency, Office of Water/OST, 1998.

Sources of Residential, Commercial/Industrial, and Public Facilities Information: Bedford County Comprehensive Plan, 1988; Botetourt County Comprehensive Plan, 1998; City of Martinsville Comprehensive Plan Update, 1996; City of Roanoke Comprehensive Development Plan for 1985-2005, 1985; City of Salem Comprehensive Plan, 1993; Franklin County Comprehensive Plan, 1995; Henry County Comprehensive Plan, 1995; Roanoke County Land Use Plan, Comprehensive Development Plan, 1985; Town of Rocky Mount Comprehensive Plan, 1992; Town of Vinton Comprehensive Plan, 1994; U.S. Geological Survey Orthophotography (1"=1,000'), 1997.

4.2.2 Social Consequences

No direct social consequences are identified for the No-Build and TSM Alternatives.

4.2.2.1 **Build Alternative**

Tables 4.2-2 and 4.2-3 present the number of residential units and non-profit organizations that would be displaced under each option of the Build Alternative. By following mainly along the existing I-581/U.S. Route 220 corridor in the north and bypassing development concentrations to the south, the fewest number of displacements would occur under the ALC. The greatest number of displacements would occur under Option 3a. These displacements were calculated using the limits of construction rather than the 600' corridor. Therefore, if the corridor width is reduced further during final design, there should not be a significant reduction in relocations. Most of the houses taken are owner occupied. This comes from the 2000 Census data that indicates the average number of owner occupied houses is approximately 87% for Bedford, 88% for Botetourt, 77% for Roanoke County, 81% for Franklin, 77% for Henry, and 56% for Roanoke City. This last figure is due to a larger number of apartment buildings and condominiums. There are few non-profit organizations relocated in the study area. Options 3, 3b, and 3c relocate the most non-profit organizations while Options 1, 1a and 4 relocate the least. The ALC will relocate seven non-profit organizations.

Impacts to social groups as a result of the Build Alternative, under any of the alignment options, would fall into several general categories: displacements of residential units; noise, altered views; loss of public services or facilities; and altered access.

**Table 4.2-2
RESIDENTIAL UNITS AND NON-PROFIT ORGANIZATIONS DISPLACED BY OPTION**

Option	Number of Residential Units Relocated	Number of Non-Profit Organizations Relocated
1	340	3
1a	420	3
2	466	7
2a	490	7
2b	373	8
2c	482	7
3	486	16
3a	707	11
3b	458	13
3c	460	15
4	344	2
ALC	249	7

¹ According to the 2000 Census, the average household size for each County is as follows: Henry County 2.40 persons per household, Franklin County 2.44 persons per household, Bedford County 2.52 persons per household, Botetourt County 2.56 persons per household, Roanoke County 2.41 persons per household, Roanoke City 2.20 persons per county.

² Every residential unit within the estimated limits of construction is considered a residential unit relocation. Units located close to, but not inside of the construction limits, or land-locked units, were considered in the damages estimate but not included in the total number of relocated residential units.

Additionally, specific social groups would experience impacts as a result of a new interstate project; this section also addresses the potential for impacts to elderly persons (aged 65 and over), including changes in access to elderly services. The following discussion addresses the social impacts anticipated for each alternative, and allows a comparison among the various alternatives and options.

**Table 4.2-3
NON-PROFIT ORGANIZATION DISPLACEMENTS BY OPTION**

Option	Churches	Fire Stations	Other Non-Profit
1	Blue Ridge Baptist Church	Dryers Fire Department	VDOT Area Headquarters
1a	Blue Ridge Baptist Church	Dryers Fire Department	VDOT Area Headquarters
2	Child Evangelism, Family Worship Center, Ridgeway Church of God	Roanoke City # 11 Fire Station, Dryers Fire Department	Rescue Mission Thrift Store
2a	Child Evangelism, Family Worship Center, Ridgeway Church of God	Roanoke City # 11 Fire Station, Dryers Fire Department	Rescue Mission Thrift Store
2b	Child Evangelism, Family Worship Center, Calvary Memorial Church, Restoration Fellowship Church, Ridgeway Church of God	Dryers Fire Department	Rescue Mission Thrift Store, Clearbrook Civic League
2c	Child Evangelism, Family Worship Center, Ridgeway Church of God	Roanoke City # 11 Fire Station, Dryers Fire Department	Rescue Mission Thrift Store
3	Child Evangelism, Family Worship Center, Calvary Memorial Church, Restoration Fellowship Church, Clearbrook Brethren Church, Red Hill Church of Brethren, Red Hill Baptist Church, Faith Fellowship Church, United Assembly of God, Morningside Church, Fort Trail Christian Church, Evangelistic Tabernacle, Ridgeway Church of God	(None)	Rescue Mission Thrift Store, Clearbrook Civic League, Franklin County Social Services Department
3a	Child Evangelism, Family Worship Center, Calvary Memorial Church, Faith Fellowship Church, United Assembly of God, Morningside Church, Fort Trail Christian Church, Evangelistic Tabernacle, Ridgeway Church of God	(None)	Rescue Mission Thrift Store, Franklin County Social Services Department
3b	Child Evangelism, Family Worship Center, Calvary Memorial Church, Restoration Fellowship Church, Faith Fellowship Church, United Assembly of God, Morningside Church, Fort Trail Christian Church, Evangelistic Tabernacle, Ridgeway Church of God	(None)	Rescue Mission Thrift Store, Clearbrook Civic League, Franklin County Social Services Department
3c	Child Evangelism, Family Worship Center, Calvary Memorial Church, Restoration Fellowship Church, Clearbrook Brethren Church, Red Hill Church of Brethren, Red Hill Baptist Church, Faith Fellowship Church, United Assembly of God, Fort Trail Christian Church, Evangelistic Tabernacle, Ridgeway Church of God	(None)	Rescue Mission Thrift Store, Clearbrook Civic League, Franklin County Social Services Department
4	Big Hill Baptist Church,–Ridgeway Church of God	(None)	(None)
ALC	Child Evangelism, Family Worship Center, Calvary Memorial Church, Restoration Fellowship Church	Dryers Fire Department	Rescue Mission Thrift Store, Clearbrook Civic League

Options 1, 1a

Option 1 passes through areas that are primarily mountainous, forested or open, with low residential densities. This option would displace 340 units, half of which live in Botetourt, Bedford and northeastern Franklin County. The option passes through four concentrations of development. In other areas, the option avoids the greatest concentration of development, thus minimizing the potential for loss of cohesion. One church, the Blue Ridge Baptist Church, would be taken.

Option 1a avoids major concentrations of development but encroaches on five small development clusters: one in Botetourt County; and four in Franklin County. Approximately half of the 420 displacements would occur in Botetourt, Bedford, and northeastern Franklin County. Although there will be many displacements, it will only be fringe impacts. The remainder of people in these neighborhoods will still have access to nearby

towns and each other even with the proposed interstate. The cohesion of the area is not affected, the size of the subdivisions are merely reduced. One church, the Blue Ridge Baptist Church, would be taken.

Options 1 and 1a go through an area with the least number of elderly persons; the only area with an identified (by census data) concentration of elderly persons is in the southeastern portion of Henry County. These options cross several routes that are a part of the Franklin County fixed route transit service and are used by service providers, but no adverse impacts are anticipated to elderly persons.

Option 2, 2a, 2b, 2c

Options 2, 2a, 2b, and 2c avoid most major concentrations of development except where it passes through the City of Roanoke and suburban area. Through Franklin and Henry counties, the options follow a primarily eastern route, passing to the east of Rocky Mount and Martinsville, although they follow the existing U.S. Route 220 alignment for several segments in southern Franklin and Henry counties. The only difference in the alignment for Option 2c occurs in between Sydnorsville and Mountain View.

Three concentrations of development are bisected by Option 2: two in Roanoke County; and one in Franklin County. Five concentrations of development are bisected by Option 2a. A total of 490 residential units would be displaced; more than one third of those would be in Roanoke City and Mount Pleasant. Six concentrations of development are bisected by Option 2b. A total of 373 residential units would be displaced with this option; the displaced residential units are distributed relatively evenly throughout the option. Five concentrations of development are bisected by Option 2c. A total of 482 residential units would be displaced, compared with 466 units for Option 2. Three churches, Child Evangelism, Family Worship Center, and the Ridgeway Church of God, would be taken in Options 2, 2a, and 2c. Option 2b would take five churches: Child Evangelism, Family Worship Center, Calvary Memorial Church, Restoration Fellowship Church, and Ridgeway Church of God.

In the City of Roanoke, all options use the existing alignment of I-581, which tends to minimize impacts of barriers to social interaction since a major freeway is already present. For Options 2, 2a, and 2c, where the option's alignment leaves I-581, it would encroach upon the neighborhood on the north bank of the Roanoke River, resulting in several residential unit displacements. Options 2 and 2c would affect the edge of Red Valley, taking five residential units.

A segment in Option 2b passes through the City of Roanoke neighborhoods and three Roanoke County neighborhoods. Through this area, the option is primarily centered on the existing U.S. Route 220 alignment, which would result in the displacement of commercial enterprises on both sides of the roadway.

In Franklin and Henry counties, where mostly rural areas are traversed, Options 2, 2a, and 2c would result in some displacements and would separate some residential units from the main body of the concentration of development. The largest subdivision impacts, 44 residential units, would occur to the English Village Subdivision on U.S. Route 220 (Martinsville Bypass) at U.S. Route 220.

With the build alternative of Option 2, cohesion will be lost for two subdivisions. In Henry County, along U.S. Route 58, Options 2, 2a, 2b, and 2c split a subdivision in half. The cohesion of this area, called "A Place in the Country", will suffer due to the separation of the two halves from each other. However, residents of this neighborhood must already commute to local towns. Therefore, if access roads were provided, new I-73 would not be a hindrance in terms of isolation from other areas. In addition, Option 2a splits an area called "Windy Hills East". This is an upscale subdivision close to Route 116 on the Roanoke/Franklin County line. This area was specially developed so that the owners could enjoy the view of Roanoke City from the mountaintop; however, because of the mountainous terrain, residents of "Windy Hills East" will lose access to nearby towns, Roanoke City, as well as each other.

These options intersect areas that have concentrations of elderly persons, (based on census data and local agencies). In Franklin County, all options cross roadways that are used by the counties' fixed route transit service, but access to the transit service should not be adversely affected. Potential impacts to elderly

persons would be loss of residential units by relocation. In Henry County, these options would intersect routes used by service providers, but no adverse impacts are anticipated to elderly persons. Overall, the options present the opportunity to improve travel times to regional elderly services.

Options 3, 3a, 3b, 3c

Option 3 would bisect 12 concentrations of development. Numerous small neighborhoods are affected also. The option avoids the City of Martinsville, but it bisects several subdivisions on the west and south sides of Martinsville. It is expected that bisecting them could disrupt their cohesion as subdivisions. However, viable concentrations of development will continue to exist on each side of the proposed alignment. A total of 486 residential units would be displaced by this option. Option 3a appears to have the most social impact of all the options, with the highest number of residential displacements, 707 units. This option also splits two apartment complexes in Roanoke City. "Windy Hill Key" and "Stonehinge", are a group of apartment buildings and condominiums located on Route 416. The residents will still have access to the city of Roanoke but the cohesion among the buildings themselves is lost. Option 3b has a very similar alignment to Option 3; the variation occurs in the southern portion of Roanoke County, where Option 3b follows a slightly more southern alignment, set back from and southeast of U.S. Route 220. Option 3b would displace 458 residential units. Option 3c takes a cross-country route west of U.S. Route 220 enroute to Mountain View, however, it does not effect the rest home in Mountain View. Option 3c would displace a total of 460 residential units. All Options 3, 3a, 3b, and 3c would take eight churches. These churches include the following: Child Evangelism, Family Worship Center, Calvary Memorial Church, Faith Fellowship Church, United Assembly of God, Fort Trail Christian Church, Evangelistic Tabernacle, and the Ridgeway Church of God. Options 3, 3a, and 3b take the Morningside Church. In addition, Options 3, 3b, and 3c take the Restoration Fellowship Church. Options 3 and 3c also take the Clearbrook Brethren Church, Red Hill Baptist Church, and the Red Hill Church of Brethren.

Similar to Options 2, 2a, 2b, and 2c, these options through the City of Roanoke would use the existing alignment if I-581 and U.S. Route 220 and likewise, would minimize barriers to social interaction as a major freeways already is present. The option passes through two Roanoke City neighborhoods and three Roanoke County neighborhoods. Access patterns to schools, churches, businesses and public facilities across the roadway would be more restricted, although planned interchanges would help ease the needs for east-west connections.

Franklin County is a relatively rural county, and much of its population and its commercial development are concentrated in and around Rocky Mount. Commercial and residential unit relocations would occur along this option, as new right-of-way is taken for the widened facility. Additionally, the remaining residences and businesses along the roadway would lose direct access to the north-south roadway, and reduction in access to properties on the opposite side of U.S. Route 220. In Henry County, the new facility also would be a barrier to social interaction between the east and west sides of U.S. Route 220 where the pattern of development is primarily along the frontage of existing U.S. Route 220. Existing U.S. Route 220 Bypass already serves as a barrier to social interaction between the two sides of the roadway.

These options appear to encounter several potential areas of elderly concentrations, based on census data and coordination with local agencies. These areas occur in the northern portion of the corridor, in Roanoke City in the Southeast neighborhood, where there are concentrations of elderly on both sides of I-581 and in the Roanoke County neighborhoods of Cave Spring, Pinkard Court and Clearbrook, as well as in the area south of Martinsville. In Franklin County, Henry Fork south of Rocky Mount has been identified as the western end of an area where elderly persons are concentrated. Access to the Franklin County fixed route transit service should not be adversely affected by this segment. In Henry County, the options also would intersect routes used by service providers, but no adverse impacts are anticipated to elderly persons. Overall, the options present the opportunity to improve travel times to regional services for elderly persons, including the dialysis clinic in Rocky Mount from areas to the south and north.

Option 4

Because of its path through western portions of Roanoke, Franklin and Henry counties where residential development is low density, Option 4 minimizes social impacts. This option passes through areas that are primarily forested, with mountainous terrain and would have the least number of total residential unit displacements, 344 units. Two churches would be acquired and relocated, Big Hill Baptist Church and the Ridgeway Church of God.

There are two areas where the option would have a potential social effect. Barfoot, in Franklin County, would have some housing units lost. In Henry County, the option would pass through Sherwood Forest, where the alignment and an interchange encroach into the western edge of the subdivision. The location of the alignment at the edge of the subdivision reduces fragmentation. Any concentrations of development or subdivisions affected by Option 4 will experience only fringe impacts.

While, the overall potential for adverse impacts to elderly persons should be minimal because of the dispersed nature of the settlement in this area, an examination of census block group data and coordination with local officials has indicated the concentration of elderly along this option. Four specific areas where elderly concentrations appear to be are in the vicinity of Barfoot, Grassy Creek and Fieldale, and the towns of Stanleytown and Bassett. There are several other areas in western Roanoke County and northern Franklin County where census data indicate general concentration of 15 to 20 percent. In Franklin County, the option crosses several roadways that are used by the counties fixed route transit service, but access to the transit service should not be adversely affected by the alternative. Overall, the option presents the opportunity to improve travel times to regional services for elderly persons.

Adopted Location Corridor

The ALC would avoid most major concentrations of development. Through Franklin and Henry counties, this option follows a primarily eastern route, passing to the east of Rocky Mount and Martinsville. Three concentrations of development would be bisected by this option. A total of 249 residential units would be displaced. Four churches, Child Evangelism, Family Worship Center, Calvary Memorial Church, and Restoration Fellowship Church, would be taken.

In the City of Roanoke, use of the existing alignment of I-581 and U.S. Route 220, tends to minimize impacts of barriers to social interaction since a major freeway is already present. The ALC would affect the edge of Red Valley, taking five residential units, where the alignment leaves the U.S. Route 220 corridor. In Franklin County, where mostly rural areas are traversed, this option would result in minimal displacements and would separate some residential units from the main body of development. In Henry County, this option avoids the greatest concentration of development, thus minimizing the potential for loss of cohesion.

This option intersects areas in which there are concentrations of elderly persons (based on census data and local agencies). In Franklin County, all options cross roadways that are used by the counties' fixed route transit service, but access to the transit service should not be adversely affected. Potential impacts to elderly persons would be acquisition and relocation of residential units. Overall, the options present the opportunity to improve travel times to regional elderly services. In Henry County; the only area with an identified (by census data) concentration of elderly persons is in the southeastern portion of the County.

Oak Hill Old German Baptist Brethren Community

The Oak Hill Old German Baptist Brethren Community located in Franklin County will be impacted by the adopted location corridor. Much of the following has been adapted from the report, Independent Evaluation of Oak Hill Old German Baptist Brethren Community as a Rural Historic Landscape and a Traditional Cultural Property, Franklin County, Virginia, prepared by Parsons Brinckerhoff for the Virginia Department of Transportation pursuant to Section 106 of the National Historic Preservation Act for the I-73 Location Study. Information in the report that has been taken from other sources has been appropriately referenced in the report. This information, as well as the report, is also based on interviews of four of the elders of the Oak Hill

congregation that were conducted on three different occasions. The elders reviewed the Parsons' report and did not find "any major inaccuracies".

The Oak Hill Old German Baptist Brethren community or congregation is located in Franklin County approximately four miles east of Boones Mill and one mile west of Burnt Chimney. It is one of four German Baptist congregations located in Virginia (all of them in study area) and one of three located in Franklin County. The other congregations are the Pigg River and Mountain View congregations located west of Route 220 and the Peters Creek congregation located in Roanoke. In total, there are approximately 6,300 members of the Brethren located in the United States. Of this total number, approximately 600 reside in Virginia and 475 of these reside in Franklin County. Approximately 200 of those living in Franklin County are members of the Oak Hill congregation.

The Oak Hill congregation, as well as the other Brethren congregations, were founded with the intent of having smaller, more intimate congregations that are more closely tied to the location of the members. Hence, membership in the different congregations is primarily based on proximity and convenience. This is evidenced by the division of the Oak Hill congregation and the Pigg River/Mountain View congregation. The Pigg River/Mountain View congregation has further subdivided because of its size to form two smaller, yet separate congregations. The geographic boundary between the Oak Hill congregation and the Pigg River and Mountain View congregations, Route 220, was established by committee, and new members are assigned to a specific congregation based on the location of their residence relative to the road.

Some of the defining characteristics of the Old German Baptist Brethren congregations are that they retain the plain garb, and they do not participate in war, government, secret societies, and other "worldly amusements". The Brethren also do not believe in higher education for their children (beyond 12th grade in this case) and selectively use technology. The Old German Baptist Brethren have traditionally settled and lived in rural areas, where they can establish a close-knit community, without "modern" interferences. It is not necessary to be a farmer to be a Brethren. Farming has traditionally attracted the Brethren because the simple rural existence and lack of worldly distractions that went with farming has been seen as a positive benefit in maintaining a "simple life" and fostering traditional Brethren values. Notwithstanding, a wide range of careers have been successfully pursued by Brethren today and an agricultural life is not seen as critical in maintaining one's faith. This can have a negative effect, however. Because many Brethren young adults now work in occupations off of the farm, there has been a decline of the family farm. Some worry that the decline of the family farm could create a domino effect leading more of the Brethren into other professions that could eventually "contribute to the weakening of the community." One can begin to see evidence of this in those farms that have traditionally been in the hands of the Brethren but have been sold to non-Brethren and subdivided for modern houses and subdivisions. Consequently, the close-knit farm nucleus associated with the Oak Hill congregation is dispersing.

The Brethren strike a careful balance between maintenance of their orthodox religious practice and the necessity to allow for some level of adaptation to the changing world. Local control over appropriate social behavior and consistent religious practice provide for a remarkably homogenous expression of shared religious beliefs and practices among the different congregations. This has had the effect of providing for the easy mobility and integration between members of the different churches. This allows members to comfortably venture outside of their home congregation in the search for appropriate marriage partners within other church groups. This continuity of fellowship also provides a network of safe and secure communities ready to welcome new members who have decided to leave less than ideal circumstances.

Through their long history, the Old German Baptist Brethren has repeatedly relocated (between regions, states, counties, and local congregations) without a direct effect on their unique religious beliefs or cultural identity. One of the special strengths of the Brethren communities is their ability to adapt to changing local, social, and economic conditions while maintaining their close-knit traditional cultural community. The historic process of relocation continues today, as current members of one congregation (like the suburban Peters Creek group) relocate to Oak Hill, and Oak Hill members relocate further west in search of more affordable farmland. Increasing property values and taxes, changes in local zoning, and a relative scarcity of new agricultural land make it difficult to pursue the traditional farming lifestyle. Many have successfully adopted other non-agricultural occupations, which still allow them to maintain their unique way of life. However, the

increasing elements of modern sprawl (with the development around Smith Mountain Lake specifically cited as an example) have resulted in an environment that is less conducive to a simple life focused on faith and family. These increasing worldly distractions have made it more difficult for parents to raise their children while keeping them on the straight path of the faithful. If a Brethren family decided to move, they would try to move to an area that had an active Old German Baptist Brethren congregation. Because of the similarities in all church practices, the move would not require a significant change to the way they worshipped. The elders interviewed for the report cited numerous examples of individual families making the decision to relocate to areas with less expensive land and greater agricultural opportunities in order to maintain a traditional way of life.

Through their past actions and statements in interviews, the church leadership reinforced the fact that the groups primary religious and cultural association is with the larger Old German Baptist Brethren faith and then to a lesser extent, with a specific congregation or geographic community. Despite assertions made by non-Brethren that certain sites within the Oak Hill German Baptist community (Clement (Piedmont) Mill Complex, Germantown School, Little Ellie Creek Baptismal Site) have direct and significant association with the Oak Hill Brethren, the elders in their interviews stated clearly that these sites were only linked to their group through historic proximity and convenience and were not exclusive. Toward the end of the second interview, the elders were asked if there was any specific place or building in their community that had a special religious or cultural importance. They unanimously stated that they could not think of such a place. Likewise, none of the four elders could identify any special attribute that made Franklin County attractive to the Brethren. Instead, they noted that the area was considered marginal farming land and only good for “blackberries, briars, and broom sage”. Many came to the area and kept traveling south. It’s likely that the early Brethren may have been attracted to Franklin County by the inexpensive marginal land and that later Brethren travelers may have been drawn to stay because of the growing community.

In the words of one elder, the location corridor for Interstate 73 approved by the Commonwealth Transportation Board “meanders through the area of the Oak Hill Old German Baptist Brethren Church district.” The location of Interstate 73 will bisect the Oak Hill community creating a physical and visual barrier. The existing secondary roads that the Oak Hill Old German Baptists rely upon to move about will be maintained and accommodated by the new roadway (i.e. with overpasses or underpasses). In some instances, relocated German Baptists may not be able to find property within the vicinity of their existing congregation that would allow them to maintain the traditional farming lifestyle, and they may have to look outside their community and near other congregations for land that allows them to maintain the traditional lifestyle. If this happens, it could further add to or accelerate the dispersal of the close-knit farm nucleus associated with the Old German Baptist Brethren spoken of above.

4.2.2.2 Potential Mitigation

Due to minimal impacts, no social consequences mitigation is proposed for the No-Build or the TSM Alternative. The following mitigation is recommended to be applicable to all Build Alternative options.

- VDOT’s right-of-way acquisition and relocation program will be conducted in accordance with the Federal Uniform Relocation Assistance and Real Property Acquisition Act of 1970, as amended and with the Surface Transportation and Uniform Relocation and Assistance Act of 1987 (STURRA). A relocation assistance and payment program is available through VDOT to aid displaced residents. Relocation and advisory assistance are offered in addition to the state’s payment for real property. The construction authorization for this project will not be granted until all property to be acquired has been cleared and all residents to be relocated have been relocated to comparable replacement housing that is decent, safe, and sanitary. Likewise, any non-profit organizations that are displaced will be relocated in accordance with the Uniform Act and STURRA.
- Minimization of impacts to neighborhoods will be given further consideration during final design and could include, but not be limited to, screening such as privacy fences, landscaping, and berms; noise barriers where determined to be reasonable and feasible; and alignment shifts to move the roadway

further away from impacted neighborhoods. In addition, existing trees and vegetation will be retained wherever feasible.

4.2.3 Environmental Justice Consequences

Executive Order 12898 requires Federal agencies to “achieve environmental justice by identifying and addressing disproportionately high and adverse human health and environmental effects, including the interrelated social and economic effects of their programs, policies, and activities on minority populations and low-income populations in the United States.” According to Federal guidelines, disproportionately high and adverse effect means “an adverse effect that (1) is predominately borne by a minority population and/or a low-income population; or (2) will be suffered by the minority population and/or low-income population and is appreciably more severe or greater in magnitude than the adverse effect that will be suffered by the non minority population and/or non low-income population.”

4.2.3.1 No-Build Alternative

No direct effects on low-income or minority populations have been identified for the No-Build Alternative.

4.2.3.2 TSM Alternative

The TSM Alternative would improve the safety of all travelers on U.S. Route 220, including low-income and minority occupied residential units or travelers through the area. This is a positive effect and does not disproportionately effect either the low-income or minority concentrations or individuals in the study area.

4.2.3.3 Build Alternative

Table 4.2-4 lists the estimated number of minority and low-income occupied residential units and businesses relocated by option. These minority and low-income occupied residential units were tabulated using information from the Planning District Commissions, Chambers of Commerce, the 2000 Census, and visual observation. All sources indicate that minority and low-income occupied residential units are scattered throughout the corridor study area, therefore the effects of the build alternative are not unfair to any particular group.

Options 2, 2a and 2c relocate the greatest amount of minority and low-income occupied residential units relocated. Options 1 and 4a relocate the least amount of minority occupied residential units. Options 1 and 4a also relocate the least amount of low-income occupied residential units. Options 3, 3a, 3b, and 3c relocate the greatest amount of minority businesses of the alternatives. Options 2a and 2c relocate the highest percentage of minority businesses of the total amount of businesses for each option. Options 1, 1a and 4 relocate the least amount of minority businesses. The ALC, which is a derivative of Options 1 and 2b, has a lower displacement of minority and low-income residential units compared to Option 2b due to the more rural alignment in Henry County. Just north of Henry County, the ALC switches from the Option 2b alignment to the Option 1 alignment and follows the Option 1 alignment throughout Henry County. While having a reduced impact on minority and low-income residential units, this combination of options does not significantly change the number of total and minority business relocated compared to Option 2b.

**Table 4.2-4
MINORITY AND LOW INCOME RELOCATIONS BY OPTION**

Option	Total Residential Units Relocated	Minority Residential Units Relocated	Low Income Residential Units Relocated	Total Businesses Relocated	Minority Businesses Relocated
1	340	39	17	22	2
1a	420	40	22	23	2
2	466	98	41	42	9
2a	490	99	42	42	9
2b	373	68	26	63	9
2c	482	96	42	42	9
3	486	67	30	147	18
3a	707	74	35	135	18
3b	458	66	28	144	18
3c	460	59	29	145	17
4	344	30	21	12	2
ALC	249	46	18	60	8

¹ Every business or residential unit within the estimated limits of construction is considered a relocation. Structures located close to, but not inside of the construction limits, or land-locked structures, were considered in the damages estimate but not included in the total number of relocations.

Tables 4.2-5 and 4.2-6 identify the 2000 Census block groups that have minority populations and poverty populations with a greater percentage than the overall study area. There are 273 block groups within the study area. Of those, 93 block groups are crossed by or are in close proximity to at least one of the Build Alternative Option corridors.

There is only a slight variance between the minorities percentage for block groups representing the Build Alternative Option corridors (19.2 percent) and all the block groups identified for the study area (18.7 percent). Bedford County and Botetourt County have no block groups associated with any of the build option (Options 1 and 1a) with minority percentages greater than the study area. Henry County and the City of Roanoke show several block groups with minority percentages higher than the study area; however, Henry County and the City of Roanoke have higher percentages of minority populations at the jurisdictional level compared to most other jurisdictions in the study area. The City of Martinsville has the highest percentage of minority of all jurisdictions in the study area (45.9 percent) but there are no Build options that traverse this jurisdiction.

Similar to the figures provided for minorities, there is only a slight variance between the percentage of poverty population for block groups representing the Build Alternative Option corridors (10.6 percent) and all the block groups identified for the study area (10.2 percent). No block groups with poverty percentages greater than the study area are associated with Build Alternative Options 1 and 1a in Bedford County and Botetourt County. Henry County and the City of Roanoke show several block groups with poverty population percentages higher than the study area. This is expected since these jurisdictions have higher percentages of persons below the poverty level at the jurisdictional level than most of the other jurisdictions in the study area. City of Martinsville has the highest percent poverty population (19.2 percent) in the study area; however, there are no Build Alternative Options that traverse the city.

Table 4.2-7 provides a comparison by Build Alternative Option of the percentage of minority populations that may be affected in the defined study area. The minority representation for the entire study area is 18.7 percent. Build Alternative Option 2a has the greatest “adverse” variance of 6.1 percent from the study area minority representation (24.8 percent versus 18.7 percent). The greatest “adverse” variance in the percentage of minorities between a jurisdiction and any given option is 8.1 percent (Option 3a at 39.3 percent versus 31.2 percent in Roanoke City). Note that jurisdictions Martinsville and Salem City do not contain affected populations and are included for reference only. Based on this information, it does not appear that any of the Build Alternative Options would have an adverse impact that is predominately borne by a minority population nor would the effects experienced by the minority population be appreciably more severe or of

greater magnitude than for non-minorities. While both positive and negative variances exist, the magnitude identified from these data is marginal.

Table 4.2-8 provides a comparison by Build Alternative Option of the percent persons below the poverty level that may be affected in the defined study area. The low-income representation for the entire study area is 10.2 percent. Although marginal, Build Alternative Option 2a has the greatest “adverse” variance of 2.4 percent from the study area low-income representation (12.6 percent versus 10.2 percent). The greatest “adverse” variance in the percent low-income between a jurisdiction and any given option is 3.7 percent (Option 3a at 19.6 percent versus 15.9 percent in Roanoke City). Note that jurisdictions Martinsville and Salem City do not contain affected populations and are included for reference only. Based on this information, it does not appear that any of the Build options would have an adverse impact that is predominately borne by low-income populations nor would the effects experienced by low-income populations be appreciably more severe or of greater magnitude than non-low-income populations. While both positive and negative variances exist, the magnitude identified from this data is marginal.

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**Table 4.2-5
MINORITY POPULATION BY BLOCK GROUP**

(Corridor Block Groups with Minority Population Percentages Greater Than Study Area)

Block Group	Population For Whom Poverty Status Is Determined	Population Below Poverty	Percent Poverty	Option
Franklin County (4 Block Groups)				
020800-1	697	213	30.6%	3c, 3b, 3a, 3
020800-2	1,397	616	44.1%	4, 1a
020800-4	1,169	364	31.1%	3c, 3b, 3a, 3
020900-2	1,817	652	35.9%	ALC, 3c, 3b, 3a, 3, 2c, 2b, 2a, 2, 1
Henry County (17 Block Groups)				
010300-2	1,884	592	31.4%	ALC, 2c, 2b, 2a, 2, 1a, 1
010300-3	561	451	80.4%	ALC, 2c, 2b, 2a, 2, 1a, 1
010400-2	1,030	644	62.5%	ALC, 2c, 2b, 2a, 2, 1a, 1
010400-3	1,567	907	57.9%	ALC, 2c, 2b, 2a, 2, 1a, 1
010500-1	1,595	481	30.2%	ALC, 2c, 2b, 2a, 2, 1a, 1
010600-1	760	164	21.6%	3c, 3b, 3a, 3, 2c, 2b, 2a, 2
010600-3	1,595	564	35.4%	4, 3c, 3b, 3a, 3
010600-6	1,477	278	18.8%	ALC, 4, 3c, 3b, 3a, 3, 2c, 2b, 2a, 2, 1a, 1
010700-1	1,237	327	26.4%	4, 3c, 3b, 3a, 3
010700-2	648	309	47.7%	4, 3c, 3b, 3a, 3
010700-3	598	134	22.4%	ALC, 4, 3c, 3b, 3a, 3, 2c, 2b, 2a, 2, 1a, 1
010800-2	1,256	767	61.1%	4, 3c, 3b, 3a, 3
010800-3	1,125	832	74.0%	4, 3c, 3b, 3a, 3
010900-1	1,390	380	27.3%	4, 3c, 3b, 3a, 3
011000-1	3,462	1,245	36.0%	4, 3c, 3b, 3a, 3
011100-2	838	198	23.6%	4, 3c, 3b, 3a, 3
011300-2	1,850	766	41.4%	4, 3c, 3b, 3a, 3
Roanoke County (1 Block Group)				
031000-4	602	128	21.3%	2c, 2a, 2
Roanoke City (13 Block Groups)				
000200-2	2,389	2,053	85.9%	ALC, 3c, 3b, 3a, 3, 2c, 2b, 2a, 2
000300-1	2,210	618	28.0%	ALC, 3c, 3b, 3a, 3, 2c, 2b, 2a, 2
000300-3	1,065	233	21.9%	ALC, 3c, 3b, 3a, 3, 2c, 2b, 2a, 2
000500-4	360	91	25.3%	ALC, 3c, 3b, 3a, 3, 2c, 2b, 2a, 2
000500-5	1,565	352	22.5%	ALC, 3c, 3b, 3a, 3, 2c, 2b, 2a, 2
000600-1	977	210	21.5%	ALC, 3c, 3b, 3a, 3, 2c, 2b, 2a, 2
000700-1	513	497	96.9%	ALC, 3c, 3b, 3a, 3, 2c, 2b, 2a, 2
000700-2	1,234	988	80.1%	ALC, 3c, 3b, 3a, 3, 2c, 2b, 2a, 2
000700-4	985	892	90.6%	ALC, 3c, 3b, 3a, 3, 2c, 2b, 2a, 2
001100-1	874	484	55.4%	ALC, 3c, 3b, 3a, 3, 2c, 2b, 2a, 2
001200-3	1,260	240	19.1%	ALC, 3c, 3b, 3a, 3, 2b
001500-2	1,435	309	21.5%	2c, 2a, 2
002300-1	1,125	717	63.7%	ALC, 3c, 3b, 3a, 3, 2c, 2b, 2a, 2
Total (41 Block Groups)	44,547	18,696	42.0%	
Remaining Corridor (58 Block Groups): Poverty Percentage Less Than Study Area				
Total	87,876	6,762	7.7%	
Total Corridor (93 Block Groups)				
Total	132,423	25,458	19.2%	
Study Area (273 Block Groups)				
Total	362,889	67,894	18.7%	

. Source: Census 2000 Summary File 1 (SF 1) 100-Percent Data, U.S. Census Bureau, June 2001.

**Table 4.2-6
POVERTY POPULATION BY BLOCK GROUP**

(Corridor Block Groups with Poverty Population Percentages Greater Than Study Area)

Block Group	Population For Whom Poverty Status Is Determined	Population Below Poverty	Percent Poverty	Option
Bedford County (2 Block Groups)				
030602-1	1,557	203	13.0%	1a, 1
030602-2	1,303	140	10.7%	1a, 1
Franklin County (9 Block Groups)				
020200-3	1,851	232	12.5%	ALC, 3c, 3b, 3a, 3, 2c, 2b, 2a, 2, 1
020400-3	963	100	10.4%	ALC, 3c, 3b, 3a, 3, 2c, 2b, 2a, 2
020500-3	1,753	320	18.3%	4, 1a
020700-3	1,238	146	11.8%	4, 3c, 3b, 3a, 3, 2c, 2b, 2a, 2, 1a
020700-4	1,068	167	15.6%	4, 3c, 3b, 3a, 3, 2c, 2b, 2a, 2, 1a
020800-2	1,318	335	25.4%	4, 1a
020800-4	1,039	283	27.2%	3c, 3b, 3a, 3
020900-2	1,818	253	13.9%	ALC, 3c, 3b, 3a, 3, 2c, 2b, 2a, 2, 1
020900-3	1,732	204	11.8%	ALC, 3c, 3b, 3a, 3, 2c, 2b, 2a, 2, 1a, 1
Henry County (13 Block Groups)				
010300-1	887	144	16.2%	ALC, 2c, 2b, 2a, 2, 1a, 1
010400-3	1,548	252	16.3%	ALC, 2c, 2b, 2a, 2, 1a, 1
010600-3	1,631	299	18.3%	4, 3c, 3b, 3a, 3
010600-5	1,667	176	10.6%	3c, 3b, 3a, 3
010600-6	1,473	173	11.7%	ALC, 4, 3c, 3b, 3a, 3, 2c, 2b, 2a, 2, 1a, 1
010700-1	1,172	123	10.5%	4, 3c, 3b, 3a, 3
010700-3	602	93	15.5%	ALC, 4, 3c, 3b, 3a, 3, 2c, 2b, 2a, 2, 1a, 1
010800-1	777	144	18.5%	4, 3c, 3b, 3a, 3
010800-2	1,055	248	23.5%	4, 3c, 3b, 3a, 3
010900-1	1,445	184	12.7%	4, 3c, 3b, 3a, 3
011000-1	3,551	503	14.2%	4, 3c, 3b, 3a, 3
011100-1	2,167	375	17.3%	4, 3c, 3b, 3a, 3
011300-2	1,819	273	15.0%	4, 3c, 3b, 3a, 3
Roanoke County (1 Block Group)				
030900-4	585	78	13.3%	ALC, 3c, 3b, 3, 2b
Roanoke City (16 Block Groups)				
000200-2	2,316	462	20.0%	ALC, 3c, 3b, 3a, 3, 2c, 2b, 2a, 2
000300-3	1,130	117	10.4%	ALC, 3c, 3b, 3a, 3, 2c, 2b, 2a, 2
000500-4	359	100	27.9%	ALC, 3c, 3b, 3a, 3, 2c, 2b, 2a, 2
000600-1	1,030	269	26.1%	ALC, 3c, 3b, 3a, 3, 2c, 2b, 2a, 2
000700-1	522	252	48.3%	ALC, 3c, 3b, 3a, 3, 2c, 2b, 2a, 2
000700-2	1,054	194	18.4%	ALC, 3c, 3b, 3a, 3, 2c, 2b, 2a, 2
000700-4	986	462	46.9%	ALC, 3c, 3b, 3a, 3, 2c, 2b, 2a, 2
001100-1	218	88	40.4%	ALC, 3c, 3b, 3a, 3, 2c, 2b, 2a, 2
001200-1	773	259	33.5%	ALC, 3c, 3b, 3a, 3, 2b
001200-3	1,175	197	16.8%	ALC, 3c, 3b, 3a, 3, 2b
001300-4	1,162	477	41.1%	ALC, 3c, 3b, 3a, 3, 2c, 2b, 2a, 2
001300-5	1,007	203	20.2%	ALC, 3c, 3b, 3a, 3, 2c, 2b, 2a, 2
001400-3	568	122	21.5%	2c, 2a, 2
001400-4	990	182	18.4%	ALC, 3c, 3b, 3a, 3, 2c, 2b, 2a, 2
001500-1	518	81	15.6%	2c, 2a, 2
001500-2	1,345	287	21.3%	2c, 2a, 2
Total (41 Block Groups)	51,172	9,200	18.0%	
Remaining Corridor (52 Block Groups): Poverty Percentage Less Than Study Area				
Total	78,332	4,577	5.8%	
Total Corridor (93 Block Groups)				
Total	129,504	13,777	10.6%	
Study Area (273 Block Groups)				
Total	354,078	36,220	10.2%	
Source: Census 2000 Summary File 3 (SF 3) – Sample Data, U.S. Census Bureau, August 2002.				
*Population for whom poverty status is determined excludes persons in group quarters.				

**Table 4.2-7
MINORITY POPULATION PERCENTAGES BY BUILD OPTIONS**

	Option 1	Option 1a	Option 2	Option 2a	Option 2b	Option 2c	Option 3	Option 3a	Option 3b	Option 3c	Option 4	ALC	Jurisdiction
Bedford County ¹	2.1%	2.1%											3.2%
Botetourt County ¹	6.4%	6.4%											5.5%
Franklin County	11.7%	11.0%	11.7%	11.7%	11.7%	11.7%	13.8%	13.8%	13.8%	13.8%	13.6%	11.9%	11.7%
Henry County	28.4%	28.4%	27.1%	27.1%	27.1%	27.1%	26.7%	26.7%	26.7%	26.7%	32.3%	28.4%	27.3%
Roanoke County			8.3%	9.3%	10.2%	8.3%	10.7%	8.7%	10.7%	10.7%	4.0%	10.2%	7.0%
Martinsville													45.9%
Roanoke City			37.4%	37.4%	37.2%	37.4%	37.2%	39.3%	37.2%	37.2%		37.2%	31.2%
Salem City													8.7%
Total	14.9%	14.3%	24.1%	24.8%	23.5%	24.1%	24.1%	23.5%	24.1%	24.1%	19.6%	24.2%	18.7%

Source: Census 2000 Summary File 1 (SF 1) 100-Percent Data, U.S. Census Bureau, June 2001.
¹ Only the southwestern portions of Bedford County and Botetourt County were included as part of the study area for this analysis.

**Table 4.2-8
BELOW POVERTY LEVEL POPULATION PERCENTAGES BY BUILD OPTIONS**

	Option 1	Option 1a	Option 2	Option 2a	Option 2b	Option 2c	Option 3	Option 3a	Option 3b	Option 3c	Option 4	ALC	Jurisdiction
Bedford County ¹	8.1%	8.1%											7.8%
Botetourt County ¹	4.2%	4.2%											4.6%
Franklin County	9.7%	10.7%	10.3%	10.3%	10.3%	10.3%	11.0%	11.0%	11.0%	11.0%	12.8%	9.8%	9.7%
Henry County	9.6%	9.6%	9.4%	9.4%	9.4%	9.4%	12.2%	12.2%	12.2%	12.2%	14.0%	9.6%	11.7%
Roanoke County			4.3%	3.7%	4.6%	4.3%	4.3%	2.9%	4.3%	4.3%	3.8%	4.6%	4.5%
Martinsville													19.2%
Roanoke City			19.5%	19.5%	18.3%	19.5%	18.3%	19.6%	18.3%	18.3%		18.3%	15.9%
Salem City													6.7%
Total	8.4%	8.9%	12.3%	12.6%	11.6%	12.3%	12.4%	12.0%	12.4%	12.4%	11.1%	11.6%	10.2%

Source: Census 2000 Summary File 3 (SF 3) – Sample Data, U.S. Census Bureau, August 2002.
¹ Only the southwestern portions of Bedford County and Botetourt County were included as part of the study area for this analysis.

After the selection of the ALC, follow-up meetings were held with local planning officials in November 2002 (Roanoke City, Roanoke County, and Henry County) and in June 2004 (Franklin County). The purpose of these meetings was to verify that the ALC and any of the other Build Alternative Options that were considered in the DEIS would not disproportionately effect either the low-income or minority concentrations or individuals in the study area. These meetings included the review of recently released 2000 Census data on low-income and minority populations.

Due to the low percentages of minority and poverty populations identified in Bedford County and Botetourt County based on the census, no follow-up meetings were scheduled in these localities. Meetings were also not scheduled for the City of Salem and the City of Martinsville since none of the build options would travel through either jurisdiction. Below is a summary of the discussions and conclusions reached.

Roanoke City

The 2000 census data is consistent with local officials' knowledge of the location of low-income and minority populations in Roanoke City. The highest concentration of low-income and minority populations is located to the west of I-581. The ALC and all other Build Alternative Options that pass through the City of Roanoke (Options 2, 2a, 2b, 2c, 3, 3a, 3b, and 3c) follow I-581 and would follow the existing right-of-way. Of the 44 residential units being displaced along this segment, it is estimated that six would be low-income and 11 would be minority. A HOPE VI project is currently planned in the Lincoln Heights area north of U.S. Route 460 (Orange Avenue) and west of I-581. The HOPE VI Program was developed as a result of recommendations by the National Commission on Severely Distressed Public Housing, which was charged with proposing a National Action Plan to eradicate severely distressed public housing. This project would house mainly low-income and minority populations. The one concern raised by local officials regarding this project is the additional noise levels that may be generated by I-73. However, the HOPE VI project will likely decrease the number of residential units in this area according to local officials. It was estimated that less than a quarter acre of Lincoln Terrace property may be acquired as a result of the proposed action. No Lincoln Terrace dwelling units will be affected by the proposed action.

South of I-581, there are lower concentrations of low-income and minority populations. Along U.S. Route 220 (Options 2b, 3, 3a, 3b, 3c, and the ALC) there are only a few "pockets" of minority populations. The Southern Hills neighborhood was identified as one minority community that may be affected by the ALC. This neighborhood was also identified as a low-income area although not evident from the 2000 census block group data. The concern by local officials was primarily accessibility to U.S. Route 220. This issue, however, if not mitigated, would impact all residents along this corridor and would not disproportionately affect either the low-income or minority concentrations or individuals in the study area. The ALC and other associated Build Alternative Options (Options 2, 2a, 2b, 2c) south of I-581 would impact predominately non-minority residents.

Roanoke County

All Build Alternative Options (except Options 1 and 1a) and the ALC extend through Roanoke County. Local officials indicated that the 2000 census data is consistent with their knowledge of the location of minority populations in Roanoke County. Areas of low-income populations not evident from the 2000 census data are located near the Dixie Caverns interchange and in Dundee, Virginia. These areas would not be affected by any of the Build Alternative Options. There are only a few locations where any of the build options cross through areas identified as having low-income or minority populations. Options 2, 2a, and 2c cross through a census block south of the Blue Ridge Parkway that is identified as having a high percent minority according to the Census. Local officials indicated, however, that this area is very sparse in population and that very few housing units would be affected by any of the Build Alternative Options.

Along the west side of U.S. Route 220 corridor (Options 2b, 3, 3b, 3c and the ALC) south of Tanglewood Mall there was a concentration of minority population that may be impacted by one of the Build Alternative Options utilizing this corridor; however, a Lowes home improvements store recently has been constructed that included the purchase and demolition of several minority homes. Other minority occupied homes are located

further back from this corridor but do not have access to U.S. Route 220. Option 3a south of U.S. Route 220 does not impact any areas identified as low-income or minority.

Franklin County

The ALC and all other Build Alternative Options considered in the DEIS traverse Franklin County. The percentages of low-income and minority population in Franklin County are below the study area as a whole. Overall, there is no indication that the ALC or any of the other Build Alternative Options that were under consideration would disproportionately affect either the low-income or minority concentrations or individuals in Franklin County.

The 2000 census data indicates that there are higher percentages of minority populations in the vicinity of Rocky Mount and in areas southeast of Rocky Mount than in other areas of the County. The percentage of populations below poverty level also is higher in the Rocky Mount vicinity. Discussions with local officials confirm that most of the areas representing higher percentages of minority and low-income populations are sparsely developed. There are higher housing densities near Rocky Mount, but most of the Build Alternative Options avoid these areas. Where the majority of displacements would occur (east and west of Rocky Mount), there were no concentrations of minority or below poverty populations identified by the local officials. It is estimated that the ALC will have the least number of minority and low-income displacements in Franklin County of all Build Alternative Options considered.

Henry County

The ALC and all other Build Alternative Options considered in the DEIS traverse Henry County. The percent low-income and minority population in Henry County is higher than the study area as a whole and higher than Virginia; however, most of the Build Alternative Options avoid impacts to these populations. Based on discussions with local officials and review of available data, there are no indications that the ALC or any of the other Build Alternative Options under consideration would disproportionately effect either the low-income or minority concentrations or individuals in Henry County.

The southern portion of the ALC, which shares a common alignment with Option 1 and Option 1a, cross through two block groups that are identified as having a high percent low-income and minority population compared to the overall study area based on the 2000 census. Block group 0103001, located north of Martinsville, is very sparsely developed and is anticipated to have only one low-income household displacement and five minority displacements out of 21 household displacements. Block group 0104003, located along the U.S. Route 58 corridor east of Martinsville, has a larger population base (1,599) but the alignment of the ALC avoids most of the residential developments including those of identified as low-income and minority.

Build Alternative Options 2, 2a, 2b, and 2c share a common alignment through Henry County and cross the same two block groups identified above. The number of displacements associated with the crossing of block group 0103001 is slightly higher (eight low-income and two minority). These options also follow routes that avoid most residential developments north of Ridgeway. The section of these options that merges onto the U.S. Route 58 corridor has areas identified as minority based on the census but most of the impacts to residents are avoided. South of Ridgeway, these options parallel U.S. Route 220 and are routed close to areas identified by local officials as low-income and minority. The Right of Way Technical Memorandum (VDOT, 2000), however, indicates that only 21 homes would be displaced in this area.

Build Alternative Options 3, 3a, 3b, and 3c share a common alignment in Henry County and follow predominantly the U.S. Route 220 corridor, avoiding most concentrations of low-income and minority populations. The one block group (0108002) associated with these options, which is identified as having a high percent of low-income and minorities, is located between Martinsville and U.S. Route 58/220. In this area, the alignment of these options would follow the existing right-of-way along U.S. Route 58/220 and would avoid impacting low-income and minority populations. South of Ridgeway, these options parallel U.S. Route

220 and are routed close to areas identified by local officials as low-income and minority. The Right of Way Technical Memorandum, however, indicates that only 21 homes would be displaced in this area.

Option 4 follows a more rural route north of Martinsville and avoids most residential homes in this area. South of Route 57, Option 4 joins with the U.S. Route 220 corridor and follows the same alignment as Options 3, 3a, 3b, and 3c. Issues with Option 4 along U.S. Route 220 are the same as those stated for Options 3, 3a, 3b, and 3c above.

4.2.3.4 Potential Mitigation

Based on the foregoing discussion, it appears that the difference between the percent of minorities and low income individuals in each locality and the percent of minorities and low income individuals that will bear impacts is marginal. Therefore, considering the data and discussions with the localities, it does not appear that there are any minority or low-income populations that will bear a disproportionate impact; the percent that will bear the impacts is similar to the percent of the overall population that these groups comprise. Accordingly, no special mitigation has been considered as a result of environmental justice. Notwithstanding,

- VDOT's right-of-way acquisition and relocation program will be conducted in accordance with the Federal Uniform Relocation Assistance and Real Property Acquisition Act of 1970, as amended and with the Surface Transportation and Uniform Relocation and Assistance Act of 1987 (STURRA). A relocation assistance and payment program is available through VDOT to aid displaced residents. Relocation and advisory assistance are offered in addition to the state's payment for real property. The construction authorization for this project will not be granted until all property to be acquired has been cleared and all residents to be relocated have been relocated to comparable replacement housing that is decent, safe, and sanitary. Likewise, any non-profit organizations that are displaced will be relocated in accordance with the Uniform Act and STURRA.
- Minimization of impacts to neighborhoods and individual populations will be given further consideration during final design and could include, but not be limited to, screening such as privacy fences, landscaping, and berms; noise barriers where determined to be reasonable and feasible; and alignment shifts to move the roadway further away from impacted neighborhoods. In addition, existing trees and vegetation will be retained wherever feasible.

4.2.4 Economic Consequences

4.2.4.1 No-Build Alternative

The No-Build Alternative would not improve regional access to any of the identified activity centers, industrial parks, enterprise zones, tourist attractions or other economic incentive areas within the study area. No relocation or loss of local property tax revenues would occur as a result of the No-Build Alternative. Travel time between economic growth incentive areas will increase because of increased congestion.

4.2.4.2 TSM Alternative

The TSM Alternative would not improve regional access to any of the identified activity centers, industrial parks, enterprise zones or other economic incentive areas within the study area. The TSM Alternative improvements would not improve local or regional access to tourist attractions within the study area. One business in northern Franklin County would be removed. Effects to existing signage, parking and access will occur to additional businesses along U.S. Route 220. These effects should not result in the closing or relocation of any other businesses. At those improvement locations which crossover access would be removed, patronage may change. These effects should not result in a significant loss of business.

Removal of property from tax rolls will result in a loss of real estate taxes to local jurisdictions. TSM Alternative improvements in Roanoke County will result in an estimated \$8,887 annual loss in tax revenues. Franklin County is predicted to lose approximately \$10,600 and Henry County is predicted to lose

approximately \$1,113 in annual tax revenues. No loss in real estate tax revenues would occur in Roanoke City, Botetourt or Bedford counties.

Construction effects would include the temporary disruption of business access, including those with direct frontage on U.S. Route 220 and from side streets along the areas to be widened. Businesses that have direct access onto the highway would suffer temporary business losses as a result of the construction.

4.2.4.3 Build Alternative

Segment effects were aggregated for each Build Alternative option. Table 4.2-9 presents economic opportunity area summaries by option. The enterprise zones, growth areas, and tourist attractions in Table 4.2-9 represent opportunity areas that are near the various options. The corresponding options would provide improved access to these locations. The combined effects of individual segments result in a regional snapshot of what would benefit and what would not benefit if a new interstate were introduced.

The economic effects expected from the Build Alternative options include a tradeoff between the loss of fewer existing businesses with the proximity of a proposed option to existing and planned industrial and commercial growth areas. Improvement in travel time within the study area is expected. The traffic and transportation technical memorandum provides a regional and interstate travel time saving analysis for No-Build and a generic Build Alternative. Savings are realized within the study area and across state lines with the provision of a Build Alternative. Additionally, daily VHT in the study area are reduced approximately 5% by the introduction of any Build Alternative options.

Lost tax revenue for each option is considered a temporary effect. All impacted businesses will be relocated as part of the project cost.

Option 1 and 1a

Option 1 and 1a would relocate the fewest number of businesses but would also provide access to the least amount of activity centers. These Build options do not pass through the main urban areas in Botetourt, Bedford, Franklin, and Henry counties, and is the most rural of all Build options.

Several tourist attractions are served by these options. In Botetourt County, the Blue Ridge Parkway can be accessed from U.S. Route 460, 1.5 miles (2.4 kilometers) west of the proposed interchange. Explore Park can be accessed from the proposed interchange at Route 634. These options would provide the most direct and quicker access to Smith Mountain Lake and Booker T. Washington National Monument. For Option 1a in the west, Ferrum College and the Blue Ridge Institute are located on Route 40 a few miles west of the proposed interchange at Route 40.

Options 2, 2a, 2b, and 2c

Options 2, 2a, 2b, and 2c would relocate a larger number of businesses than Options 1, 1a and 4, but they are less compared to the other alternatives. Half of the activity centers affected by this option are located in Roanoke, and one of the enterprise zones is also located in Roanoke. The options go through downtown Roanoke, the most urban portion of the study corridor. It then goes through rural portions of Franklin and Henry counties where activity centers are farther away from the Build Alternative. Activity centers are also found near the City of Martinsville and the Town of Ridgeway, both near portions of the Build Alternative.

In Roanoke, Mill Mountain Zoological Park and Star Overlook would be accessible at the Elm Avenue interchange. Although Options 2, 2a, 2b, and 2c in Franklin County do not provide the closest access of all of the options to Smith Mountain Lake and Booker T. Washington National Monument, it is closer than all other options except Option 1 and 1a. Options 2, 2a, 2b, and 2c would provide quicker north-south travel for these attractions from the proposed interchange in Red Valley, and it would be a shorter trip than from U.S. Route 220. In Henry County, the Martinsville Speedway is a short 0.5 miles (0.8 kilometers) from the proposed U.S. Route 220 Business interchange.

**Table 4.2-9
SUMMARY OF ECONOMIC OPPORTUNITY AREAS BY OPTION**

Option	Number of Activity Centers	Enterprise Zones and Growth Areas	Tourist Attractions	Number of Businesses Relocated	Lost Tax Revenue
Build Alternative Options					
1	9	Rural Village Center (Burnt Chimney), West Piedmont Economic Growth Center in Martinsville	Blue Ridge Parkway access, Explore Park, Smith Mountain Lake, Booker T. Washington National Monument	22	\$530,312
1a	20	West Piedmont Economic Growth Center in Rocky Mount and Martinsville	Blue Ridge Parkway access, Explore Park, Smith Mountain Lake, Booker T. Washington National Monument, Ferrum College, Blue Ridge Institute	23	\$601,499
2	38	Roanoke Enterprise Zone, West Piedmont Economic Growth Center in Rocky Mount and Martinsville, Martinsville – Henry County Enterprise Zone	Mill Mountain Zoological Park and Star Overlook, Smith Mountain Lake, Booker T. Washington National Monument, Martinsville Speedway	42	\$984,181
2a	38	Roanoke Enterprise Zone, West Piedmont Economic Growth Center in Rocky Mount and Martinsville, Martinsville – Henry County Enterprise Zone	Booker T. Washington National Monument, Smith Mountain Lake, Explore Park, Blue Ridge Parkway access, Mill Mountain Zoological Park and Star Overlook, Martinsville Speedway	42	\$1,038,993
2b	42	Roanoke Enterprise Zone, West Piedmont Economic Growth Center in Rocky Mount and Martinsville, Martinsville – Henry County Enterprise Zone	Booker T. Washington National Monument, Smith Mountain Lake, Blue Ridge Parkway access, Martinsville Speedway	63	\$1,280,419
2c	38	Roanoke Enterprise Zone, West Piedmont Economic Growth Center in Rocky Mount and Martinsville, Martinsville – Henry County Enterprise Zone	Mill Mountain Zoological Park and Star Overlook, Martinsville Speedway	42	\$985,516
3	48	Roanoke Enterprise Zone, West Piedmont Economic Growth Center in Rocky Mount and Martinsville, Martinsville – Henry County Enterprise Zone	Blue Ridge Parkway access, Martinsville Speedway	147	\$1,591,653
3a	49	Roanoke Enterprise Zone, West Piedmont Economic Growth Center in Rocky Mount and Martinsville, Martinsville – Henry County Enterprise Zone	Martinsville Speedway	135	\$1,576,496
3b	48	Roanoke Enterprise Zone, West Piedmont Economic Growth Center in Rocky Mount and Martinsville, Martinsville – Henry County Enterprise Zone	Blue Ridge Parkway access, Martinsville Speedway	144	\$1,521,830
3c	48	Roanoke Enterprise Zone, West Piedmont Economic Growth Center (Martinsville), Martinsville - Henry County Enterprise Zone	Blue Ridge Parkway access, Martinsville Speedway	145	\$1,566,419
4	29	West Piedmont Economic Growth Center (Martinsville), Martinsville – Henry County Enterprise Zone	Dixie Caverns, Blue Ridge Institute, Ferrum College, Fairy Stone State Park, Philpott Lake, Martinsville Speedway	12	\$674,098
ALC	35	Roanoke Enterprise Zone, West Piedmont Economic Growth Center in Rocky Mount and Martinsville	Booker T. Washington National Monument, Smith Mountain Lake, Blue Ridge Parkway access	60	\$1,122,401

Options 3, 3a, 3b, 3c

Options 3, 3a, 3b, and 3c would relocate the greatest number of businesses. These options would also provide access to the greatest amount of activity centers in the study corridor and pass through the greatest amount of enterprise zones/growth areas. Option 3a affects many of the same economic opportunity areas that Options 3, 3b, and 3c effect but has the least number of business relocation (135) among these options. This option contains the largest amount of activity centers of all of the Build Alternatives and passes through the greatest amount of enterprise zones/growth areas. Option 3a contains one more activity center than Option 3, located in the Cave Springs area. Options 3b and 3c affect the second and third highest amount of relocations for all Build Alternative options. These options primarily follow U.S. Route 220 and traverse the main urban areas in Roanoke, Franklin and Henry counties, providing more efficient travel than currently available.

In Roanoke County, all economic opportunity areas currently accessed by but not on U.S. Route 220 would be accessed by these options. In Franklin County, these options are the closest in proximity of all Build Alternative options to downtown Rocky Mount and its economic indicators. In Henry County this alternative goes through the western side of Martinsville, where the bulk of the economic opportunity areas in Henry County and Martinsville are located.

In Henry County, access to Fairy Stone State Park and Phillipott Lake would remain the same as they exist now, and out-of-county visitors would have the benefit of a limited access highway to decrease their north-south travel time to these attractions. The Martinsville Speedway would have the same access 0.5 miles (0.8 kilometers) from the proposed U.S. Route 220/U.S. Route 58 interchange. Out-of-county visitors would also benefit from the decreased north-south travel time provided by a limited access highway. For Options 3, 3b, and 3c, the Blue Ridge Parkway, currently accessed by an interchange at U.S. Route 220 in Roanoke, would retain access in this area. However, a Build Alternative would require the addition of an access route onto the Blue Ridge Parkway.

Option 4

Option 4 is the alternative that follows the most westerly path. Like Options 1 and 1a, this alternative does not enter any urban areas. Option 4 relocates a small number of businesses, and accesses only two enterprise zones/growth areas. This option primarily accesses rural Roanoke, Franklin counties and a few portions of industrial Henry County.

Option 4 serves the second highest number of tourist attractions in the study area. It is the only option that accesses Dixie Caverns, located near the Roanoke County/Montgomery County line off of I-81. It is the closest Build Alternative to Ferrum College and the Blue Ridge Institute off of Route 40 in Franklin County. It is the closest Build Alternative to Fairy Stone State Park and Philpott Lake, located in the northwest corner of Henry County. Just south of Martinsville, the Martinsville Speedway can be accessed from U.S. Route 220, approximately 1.5 miles (2.4 kilometers) from the proposed interchange.

Adopted Location Corridor

The ALC would relocate 60 businesses. More than half of the activity centers affected by this option are located in Roanoke. An enterprise zones also located in Roanoke is impacted. The options go through downtown Roanoke, the most urban portion of the study corridor. It then goes through rural portions of Franklin and Henry counties where activity centers are farther away from the ALC. This option does not pass through the main urban areas in Henry County as the alignment is the most rural of all Build options.

In Roanoke, Mill Mountain Zoological Park and Star Overlook would be accessible at the Elm Avenue interchange. Although the ALC in Franklin County does not provide the closest access of all of the options to Smith Mountain Lake and Booker T. Washington National Monument, only Options 1 and 1a are closer. The

ALC would provide quicker north-south travel for these attractions from the proposed interchange in Red Valley, and it would be a shorter trip than from U.S. Route 220.

4.2.4.4 Potential Mitigation

No mitigation is proposed for the No-Build Alternative. Mitigation for the TSM and Build Alternatives include the following:

- VDOT's right-of-way acquisition and relocation program will be conducted in accordance with the Federal Uniform Relocation Assistance and Real Property Acquisition Act of 1970, as amended and in accordance with the STURRA. All effected businesses will be given the option of being compensated for search, moving and reestablishment expenses or be given an in-lieu of payment should effected business owners elect not to relocate and re-establish their business.
- Avoidance is considered to be the first crucial step towards effectively mitigating environmental effects. During the conceptual engineering phase conducted during preparation of the Location Study Report (VDOT, 2000), a concerted effort was made to avoid or minimize impacts to economic incentive areas. Preliminary design plans for the ALC will consider practicable measures to avoid or further minimize impacts to economic incentive areas and improve access. Where permits, approvals, or memoranda of agreement are required, minimization measures for unavoidable impacts will be developed. Site-specific mitigation measures will be included in the final design plans.

4.2.5 Farmland and Forestry Consequences

There are more forested lands than farmlands in the study area that have the potential to be impacted. In Roanoke County, the segments furthest east and west of U.S. Route 220 primarily impact forested lands. In Franklin County, the longer segments to the east of U.S. Route 220 impact a large amount of both farmlands and forested lands. The segments to the west of U.S. Route 220 in Franklin County primarily impact forested lands. In Henry County, the segments furthest east and west impact forested lands. The segments that generally follow U.S. Route 220 tend to have the least amount of impact on farmlands and forested lands.

4.2.5.1 No-Build Alternative

No impacts to farmlands are forested lands are expected.

4.2.5.2 TSM Alternative

Minimal amounts of acreage(edge impacts to existing tracts) would be removed from farmland production due to the improvements along U.S. Route 220 as a result of the TSM Alternative.

4.2.5.3 Build Alternative

Farmland and Forestry Effects by Option

Table 4.2-10 identifies the acreage of farmland and forestry expected to be removed from production as a result of each Build Alternative option. Option 2a has the greatest acreage impacts on farmlands, followed closely by Options 1, 1a, 2, 2b, and 2c. These options impact fewer acres of farmland because they traverse through the forested lands in the study corridor. Options 3, 3a and 3b also have a lower impact on farmlands because they generally follow U.S. Route 220 in the more urbanized portion of the study corridor.

**Table 4.2-10
FARM AND FOREST CONSEQUENCES BY OPTION**

Alternative	Total Farmland		Prime Farmland		Farmland Production Value Lost ¹ (1997 \$)	Farm Parcels With Less Than 10 Acre Residual	Forest		Forest Parcels With Less Than 10 Acre Residual ²
	Acres	Hectares	Acres	Hectares			Acres	Hectares	
Build Alternative									
Option 1	2,177	881	142	58	\$3,363,352	127	4,392	1,777	439
Option 1a	2,118	857	107	43	\$3,280,567	151	4,487	1,816	509
Option 2	2,161	875	150	61	\$3,299,361	159	3,403	1,376	355
Option 2a	2,241	907	149	60	\$3,379,234	163	3,210	1,298	326
Option 2b	2,071	838	126	51	\$3,094,394	156	3,179	1,286	357
Option 2c	2,106	852	166	67	\$3,214,076	150	3,229	1,305	353
Option 3	1,203	487	94	38	\$1,884,475	123	2,063	834	505
Option 3a	1,203	487	79	32	\$1,864,163	122	2,242	905	491
Option 3b	1,203	487	73	30	\$1,884,475	121	2,160	873	506
Option 3c	1,247	505	129	52	\$1,953,083	112	2,015	815	480
Option 4	1,520	615	75	30	\$2,581,160	121	3,413	1,380	552
ALC	1,707	691	82	33	\$2,588,200	111	3,370	1,364	326

Sources: U.S. Department of Forestry, USDA 1997 Census of Agriculture. Virginia Department of Agriculture's website: www.nass.usda.gov/va

¹ Farmland values of production loss based on the 1997 dollar per acre market value by county from the 1997 U.S. Census of Agriculture. Segments, which are located within multiple counties, have acreage calculated by county, then each is multiplied by the specific county value and then summed for a total segment value.

² Forest acreage where remaining or residual parcels are less than or equal to 10 acres are generally not considered economically feasible for timber companies to harvest. Virginia Department of Forestry, Franklin County. Phone conversation, July 5, 2000.

The Farmland Protection Policy Act (FPPA) (7 CFR 658) requires that federal actions identify and consider adverse affects on the protection of farmland. According to FHWA's Technical Advisory T6640.8A, protected farmland includes prime farmland soils, unique soils or statewide or locally important soils. In Virginia, the NRCS makes no distinction between prime farmland soils and unique, statewide or locally important soils. VDOT has coordinated with the Natural Resources Conservation Service (NRCS) to assess the impacts of the project to farmlands in the study area. NRCS-CPA-106 forms have been completed to determine the Farmlands Conversion Impact Rating for the project (See Appendix D). The Farmland Conversion Impact Rating is based on an assessment of the quality of the prime farmland soils in the area of the project and an assessment of the suitability of the land in the corridor for protection of farmland. The FPPA states that "increasingly higher levels of consideration for protection" be given to farmlands impacted by projects that have a Farmland Conversion Impact Rating exceeding a total score of 160. Options 1, 1a and 4 exceed a score of 160. All other options were below 160 and need not be further evaluated for farmland protection. Avoidance for Options 1, 1a and 4 was not considered an appropriate strategy to mitigate or reduce the Farmland Conversion Impact Rating due to prevalence of prime soils throughout the study area.

Options 1 and 1a impact over 4,300 acres (1,740 hectares) of forested land each, with Option 1 having the greatest impact of 4,392 acres (1,777 hectares). Option 3c impacts only 2,015 acres (815 hectares), which is the least amount of forested lands impacted by these options. Options 3, 3a, and 3b also have low impacts. The remaining options (2, 2a, 2b, 2c, and the ALC) impact approximately 3,200 to 3,400 acres (1,295 to 1,376 hectares) of forested lands.

4.2.5.4 Potential Mitigation

- VDOT's right-of-way acquisition and relocation program will be conducted in accordance with the Federal Uniform Relocation Assistance and real Property Acquisition Act of 1970, as amended and in accordance with the STURRA. Any farmland or forested land acquired for the project will be acquired at fair market value. Impacts to farms that affect the business operations of the farm are addressed the same way impacts to a business are addressed.
- Avoidance is considered to be the first crucial step towards effectively mitigating environmental effects. During the conceptual engineering phase conducted during preparation of the Location Study Report (VDOT, 2000), a concerted effort was made to avoid or minimize impacts to farmland and forested land. Preliminary design plans for the ALC will consider practicable measures to avoid or further minimize impacts to farmland and forested land. Where permits, approvals, or memoranda of agreement are required, minimization measures for unavoidable impacts will be developed. Site-specific mitigation measures will be included in the final design plans.

4.2.6 Adopted Goals and Policies

4.2.6.1 Compatibility with Adopted Goals and Policies

Compatibility with area's adopted or pending comprehensive plan goals, policies and objectives are evaluated for each alternative and not individual segments.

No-Build Alternative

The No-Build Alternative includes all planned minor intersections, interchange, and roadway improvements that address local problems, as well as routine maintenance improvements that maintain the continuing operation of the existing roadway network. It also includes committed and funded roadway and transit projects recommended in the Six Year Improvement Program approved June 2002 and Virginia's State Transportation Improvement Plan. The projects identified in the No-Build Alternative would provide limited support for the adopted goals and polices of the local comprehensive and transportation plans.

In the northern portion of the study area, the Roanoke Valley Area MPO, lists 68 financially constrained projects to support the goals and objectives of the Long Range Transportation Plan 2025 (February 26, 2004). This Plan also has a list of "Vision" projects that includes I-73. The No-Build Alternative would not be compatible with the transportation goals and objectives of this Plan by not supporting its vision.

The No-Build Alternative would not negatively or positively effect the Botetourt County comprehensive Plan's goals to provide an adequate and safe transportation network to serve residents, businesses, industry or the motoring public. It would not contribute to "an appropriate transportation system to serve the rapidly urbanizing southern portion of the county contiguous to Roanoke County." It would not contribute to or contradict the goals and policies of the Bedford County Comprehensive Plan or the recently adopted zoning ordinance, nor support the goals of the Roanoke County Draft Community Plan Update to provide safe, convenient and efficient modes of transportation. Safety concerns on U.S. Route 220 in Roanoke County and the concerns of the City of Roanoke's Vision plan or the downtown plans and policies of Outlook are not addressed by this alternative. This alternative would not provide for improved access to the downtown and no improvements to help reduce congestion on I-581 would be provided.

West Piedmont PDC was an early promoter and supporter of the I-73 project, urging the designation and location of a corridor through the district. The No-Build Alternative would not be consistent with the District's plan goals to support the I-73 Location Study to ensure a transportation system that compliments, and promotes social, economic and environmental goals of the region.

The Franklin County Comprehensive Plan identifies two alternative alignments for a new interstate. The No-Build Alternative would not be consistent with the adopted goal to "proactively plan and develop a safe, efficient, and accessible transportation network," as the I-73 project is listed as a priority under this goal. It

would not be consistent with the County of Henry Comprehensive Plan (June 26, 1995) goal to provide for an efficient and safe transportation system or its adopted strategies, which specifically support routing I-73 through the Martinsville/Henry County area.

TSM Alternative

TSM Alternative improvements proposed on U.S. Route 220 in Roanoke County, would address the Roanoke Valley Area MPO's transportation objectives of increased safety in the Hunting Hills and Clearbrook portions of the existing corridor. The improvements would meet the Roanoke Valley Area MPO's objectives to provide changes to existing road operations, to improve safety, to improve the efficiency of goods movement, and to reduce the need for high cost construction. The TSM Alternative would improve existing road operations on U.S. Route 220 in the following locations in Roanoke County:

- Rebuild at Route 789 South to improve sight distance,
- Widen the median and introduce a center turn lane between Route 930 and Route 679 in Clearbrook,
- Close all median openings and widen median between Route 668 and Route 930,
- Close all median openings and widen median between Back Creek Road and Route 668 except at Route 676 and Route 668,
- Close all median openings and widen median between Route 715 North and Route 668 except at Route 657, and
- Rebuild the intersection of Route 677 and U.S. Route 220 to improve sight distances.

The TSM Alternative does not include the Roanoke Valley Area MPO's recommended improvements to widen U.S. Route 220 from Elm Street to south of Route 419. The TSM Alternative would not meet the commission's objectives to revitalize the central business district and to separate through and local traffic.

The TSM Alternative would not support or conflict with the transportation goals and objectives of either the Botetourt County Comprehensive Plan or the Bedford County Comprehensive Plan and newly adopted zoning ordinance. The TSM Alternative would not support or contradict the City of Roanoke's Vision Plan or the downtown plans and policies of Outlook.

The TSM Alternative would support the 1998 Roanoke County Community Plan goal to improve transportation services with particular sensitivity to safety, quality of life, and scenic beauty and resource protection by eliminating unsafe crossovers, reducing grades and widening shoulders. All TSM improvements are designed to improve safety on U.S. Route 220. These improvements do not change the present configuration of the interchange of the Blue Ridge Parkway and U.S. Route 220. Closing of the median crossings in the Clearbrook area would modify some local traffic patterns into and out of the area on U.S. Route 220, focusing traffic and turn movements onto Routes 676, 668 and 657.

A goal of the West Piedmont PDC is to continue to provide and encourage development of a transportation network that will give access to industrial sites and link the District to major trade centers. The TSM Alternative improvements are not compatible with this goal because it would provide only local improvements. Regional, statewide and interstate access would not be improved.

Within Franklin County, the TSM Alternative improvements support the goal to develop a safe, efficient and accessible transportation network by eliminating unsafe crossover locations, adding turn lanes, widening the roadway median and shoulders, providing safe locations for vehicles to pull over and improving sight distances. The TSM improvements do not address the needs of improved access to Smith Mountain Lake as identified in the Smith Mountain Lake Corridor's Study and does not implement either of the alternative alignments of the Franklin County Comprehensive Plan.

The TSM Alternative in northern Henry County would be located in the U.S. Route 220 growth area designated in the Henry County plan. These growth areas seek to "direct development to allow the efficient use of county and public resources, encouraging redevelopment and infill development" and to help "divert

development from environmentally sensitive areas.” New development is planned for these growth areas, preferably on existing or planned roadways. The northwestern TSM Alternative would be in the Bassett/Stanleytown Growth Area, and the eastern side would be in the Fieldale/Collinsville Growth Area. The central portion of the alternative would be located within the Horsepasture Growth Area, and the southern portion of the alternative would be located within the Ridgeway Growth Area. This alternative would be located on an existing road network and in designated growth areas, which would be consistent with the plan.

Build Alternative

Compatibility of a complete Build Alternative option with the comprehensive plans of all jurisdictions crossed by a proposed alignment is unlikely. It is also difficult to generalize the compatibility of a proposed alignment across the length of an entire county, as the alignment crosses several land use designations. Table 4.2-11 summarizes the compatibility of each of the Build Alternative options with a single jurisdictional statement of compatibility for each jurisdiction. The more detailed nuances of the compatibility discussion for each Build Alternative option are described below.

**Table 4.2-11
BUILD ALTERNATIVE OPTION COMPATIBILITY WITH COMPREHENSIVE PLANS**

Option	Jurisdiction					
	Roanoke City	Botetourt County	Bedford County	Roanoke County	Franklin County	Henry County
Option 1	-----	No	Yes	-----	Yes	Yes
Option 1a	-----	No	Yes	-----	No	Yes
Option 2	No	-----	-----	Yes	Yes	Yes
Option 2a	No	-----	-----	Yes	No	Yes
Option 2b	Yes	-----	-----	Yes	Yes	Yes
Option 2c	No	-----	-----	Yes	Yes	Yes
Option 3	Yes	-----	-----	No	Yes	No
Option 3a	Yes	-----	-----	Yes	Yes	No
Option 3b	Yes	-----	-----	No	Yes	No
Option 3c	Yes	-----	-----	No	Yes	No
Option 4	-----	-----	-----	No	No	No
ALC	Yes	-----	-----	Yes	Yes	Yes

Note: Compatibility is based on the majority of the segmental compatibility determinations within a single jurisdiction.

Options 1 and 1a

In the north, interchanges for Options 1 and 1a in Botetourt and Bedford counties would be located within designated growth areas. However, the Botetourt County Planning Staff and the Botetourt County Board of Supervisors have gone on record opposing any alternative through the county. In Franklin County, the majority of Option 1 would be located along the recommended eastern alignment. The proposed interchanges would also be located in areas recommended by Franklin County, within growth areas or currently developed areas. Option 1a does not follow the recommended alignments and traverses west of Rocky Mount. In Henry County, Options 1 and 1a would be located east of Martinsville, and the Henry County Board of Supervisors and the Martinsville City Council endorse an eastern location. However, the alignment would occur in an unplanned and generally undeveloped area, most of which would be located outside of the Henry County Growth Areas. The proposed interchange near Figsboro would be outside of a designated growth area, but near several industrial areas. The other proposed interchanges at Route 57, U.S. Route 58, Route 87 and U.S. Route 220 would be in designated Henry County growth areas.

Options 2, 2a, 2b, and 2c

In Roanoke, Options 2, 2a, 2b, and 2c are located in the major transportation corridor designation in Roanoke City and would be consistent in that regard. Options 2, 2a and 2c are not consistent with the neighborhood

designation in the area traversed by Segment 376 southeast of Elm Avenue (Route 24). Option 2c would be the most compatible with Roanoke County, with the exception of Segment 376. In southeastern Roanoke County for Options 2, 2a and 2c, no interchanges would be introduced and although the road would not be located in an appropriate land use designation for this area, the limited access nature of proposed I-73 has limited interaction with the surrounding land uses. Option 2a would be less compatible than Options 2 and 2c, because Option 2a travels through a more developed area than the other options and would be more disruptive. Options 2, 2b and 2c are compatible with both Roanoke and Franklin County at the county line because they cross in the area of the recommended alignment. Option 2a would be in proximity to, but not in, the eastern recommended alignment. In Franklin County, all of the Option 2 series follows closely, but not on, the recommended eastern alignment through most of the county. Option 1 follows the Franklin County Plan's eastern alignment most closely, but Options 2, 2a, 2b, and 2c are parallel and share the same proposed interchanges as those recommended by Franklin County. At the southern point of Franklin County, there is some variation from the county plan. Options 2, 2a, 2b, and 2c would be located west of Fork Mountain but on or near U.S. Route 220. The proposed interchange at Route 605 is not recommended by the County.

In Henry County, Options 2, 2a, 2b, and 2c would be the most compatible of all of the options. The Henry County Board of Supervisors and the Martinsville City Council endorsed an eastern alternative. These options follow portions of an existing or planned roadway and are generally located within a growth area. The northern portion of these options (near Figsboro) would not be located on an existing or planned corridor, nor would be it located in a growth area, but the proposed interchange here would be in close proximity to several industrial sites.

Options 3, 3a, 3b, and 3c

Through Roanoke County, Options 3, 3a, 3b, and 3c would be located within the major transportation corridor designation in Roanoke City. South of Roanoke City, Options 3, 3b and 3c follow U.S. Route 220 and are the least consistent with the County's plan. Specifically, this portion of proposed I-73 is not compatible with Clearbrook's goals. South of Roanoke City, Option 3a would be located west of U.S. Route 220 and would be the most consistent option. Option 3a generally follows the Norfolk Southern rail line and goes through some industrial growth areas. Option 3a would cross the Blue Ridge Parkway at an existing crossing, minimizing disruption to Blue Ridge Parkway users.

In the northern part of Franklin County, Options 3, 3a, 3b, and 3c follow close to the county's recommended alternative. The Boones Mill Growth Area would be accessed by these options, and frontage roads would be needed for the businesses along U.S. Route 220 in the "Commercial Highway Corridor" designation. Options 3, 3a, 3b, and 3c are on the recommended alignment directly west of Rocky Mount. The proposed interchanges for Options 3, 3a, 3b, and 3c are the same as those recommended by Franklin County, through the outskirts of Rocky Mount and until these options continue on U.S. Route 220 for 2 miles to the south of Rocky Mount. Here, Option 3c closely follows the western recommended alignment while the other options stay on U.S. Route 220. At the southern end of Franklin County, the western recommended alignment is followed closely. However, Options 3, 3a, 3b and 3c have an interchange proposed at Route 605. Franklin County does not recommend an interchange at this location because it would not be in a growth area and it would not be located in a rural, undeveloped area.

In Henry County, Options 3, 3a, 3b, and 3c are consistent with the plan, because they are located completely within growth areas and on existing or planned roads. However, the Henry County Board of Supervisors and the Martinsville City Council endorsed an eastern, not a western alignment.

Option 4

Option 4 is not anticipated in the Roanoke County Comprehensive Plan update, nor is it anticipated in either Glenvar or Back Creek planning area plans. The proposed interchange with the existing Dixie Caverns interchange on I-81 is consistent with the Glenvar plan's land use designations "core" and primary industrial". This area is one of Roanoke County's designated economic growth areas, which would be enhanced by the introduction of a new interstate. However, its location adjacent to I-81 already provides an incentive for

economic development in the area. The County plan identifies views of and from the Poor Mountain and the Parkway as particular resources to preserve. The views from this proposed Build Alternative alignment would be opened up to travelers on the road. Residents within this portion of the study area would experience views of the road while viewing the identified resources. Option 4 is inconsistent with the Roanoke County Comprehensive Plan for the majority of its proposed alignment in Roanoke County.

In Franklin County, Option 4 enters the county just east and very close to the recommended western alignment. Option 4 would be the most inconsistent with the Franklin County plan, because this alignment would be located much further west than recommended by Franklin County. The proposed interchanges on Route 641 near Gogginsville and at Route 605 in the south are inconsistent with the plan because they are not located within an area designated for growth. In Henry County, Option 4 is generally located within one of the growth areas. However, Option 4 would be inconsistent in some places within Henry County because in the north and in the south, Option 4 does not follow an existing or planned roadway. In addition, the Henry County Board of Supervisors and the Martinsville City Council have endorsed an eastern, not a western alignment.

Adopted Location Corridor

In the City of Roanoke, the ALC is located in the major transportation corridor designation in the City and would be consistent in that regard. The ALC is compatible with both Roanoke and Franklin County at the county line. The ALC would be in proximity to, but not in, the eastern recommended alignment. Option 1 follows the Franklin County Plan's eastern alignment most closely, but the ALC is parallel and shares the same proposed interchanges as those recommended by Franklin County.

In Henry County, the ALC would be located east of Martinsville, and the Henry County Board of Supervisors and the Martinsville City Council endorse an eastern location. However, the alignment would occur in an unplanned and generally undeveloped area, most of which would be located outside of the Henry County Growth Areas. The proposed interchange near Figsboro would be outside of a designated growth area, but near several industrial areas. The other proposed interchanges at Route 57, U.S. Route 58, Route 87 and U.S. Route 220 would be in designated Henry County growth areas.

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4.3 AIR QUALITY

4.3.1 Methods

Pollutants that can be traced principally to motor vehicles that are regulated by EPA include hydrocarbons (HC), NO_x, O₃, PM₁₀, PM_{2.5} and CO. Transportation sources account for a very small percentage of regional emissions of SO_x and Pb, and thus are not evaluated in conjunction with highway projects

HC and NO_x emissions from automotive sources are of concern because of their role as precursors in the formation of Ozone . Ozone is formed through a series of complex chemical reactions that take place in the atmosphere in the presence of sunlight. Since the reactions are slow and occur as the pollutants are diffusing downwind, elevated levels of Ozone are often found many miles from sources of the precursor pollutants. The effects of HC and NO_x are therefore generally examined on a regional or “mesoscale” basis through the metropolitan planning process in those areas that have been designated nonattainment by EPA. While EPA has indicated that PM₁₀ and PM_{2.5} are pollutants of concern for mobile source projects, they have only developed hot spot analysis requirements for PM₁₀ nonattainment areas; the EPA is currently developing hot spot analysis requirements for PM_{2.5} nonattainment areas.

CO is a colorless and odorless gas, associated primarily with the incomplete combustion of fossil fuels in motor vehicles. CO concentrations can vary greatly over comparatively short distances - relatively high concentrations are typically found near crowded intersections, along heavily traveled and congested roadways, and at relatively low elevations. Consequently, it is important to predict concentrations of CO on a small area, or “microscale” basis.

Microscale air quality modeling was performed using VDOT's VACAL*5A program. Emission factors within VACAL*5A are based on the EPA mobile source emission factor model (MOBILE 5A). Dispersion parameters within the program are based on EPA's CALINE3 air quality dispersion model. Following the guidelines set forth in VDOT's Air Quality Analysis Consultants Guide, Revision 7, CO levels in the project area were estimated at 12 locations. Sites were selected on the basis of existing and estimated future traffic conditions. The analysis sites are listed in Table 4.3-1 and are shown in Figure 4.1.-1 of the Air Quality Technical Memorandum (VDOT, October 2000).

**Table 4.3-1
AIR QUALITY ANALYSIS SITE LOCATIONS**

Site #	Site Description
1A	North of U.S. Route 460 (I-581) – Options 1 and 4
1B	I-81 to U.S. Route 460 – Options 2 and 3
2	U.S. Route 460 to Route 122
3	Route 122 to Route 40 – All options
4	U.S. Route 220 to Route 57/U.S. Route 58
5	Route 57/U.S. Route 58 to NC State line
6	I-81 – South of I-581
7	I-581 – North of U.S. Route 460
8	Route 24 – East of U.S. Route 220
9	U.S. Route 220 – I-581 to Route 419
10	U.S. Route 220 – Route 684 to Rocky Mount
11	U.S. Route 58 East of U.S. Route 220 Bypass
12	U.S. Route 220 – Martinsville to Ridgeway

Maximum one-hour and eight-hour CO levels were estimated at the 12 analysis sites for the existing year (1997), completion year (2008 build and No-Build scenarios) and the design year (2020 build and No-Build scenarios).

Microscale modeling is used to predict CO concentrations resulting from emissions from motor vehicles using roadways immediately adjacent to the location at which predictions are being made. A CO “background level” must be added to this value to account for CO entering the area from environmental and other non-mobile sources upwind of the receptors. Based upon VDOT recommendations, a one-hour background and eight-hour background concentrations of 6 ppm and 3 ppm, respectively, were applied to all analysis sites.

Emission factors within the VACAL*5A program are based on EPA’s MOBILE5A mobile source emission factor model. Emission estimates account for three possible vehicle-operating conditions: cold-vehicle operation, hot-start operation and hot stabilized operation. CO emissions are greatest when engines are cold (cold-vehicle operation) and when engines are restarted shortly after they were shut off (hot-start operation). Vehicular operating conditions used in this analysis (20.6 percent cold, 27.3 percent hot and 52.1 percent hot stabilized) were recommended by VDOT. Based on 30 years worth of data, a temperature of 30°F was used to represent the average temperature for the coldest month in Virginia. Traffic data used for the air quality analysis was developed as part of an overall traffic analysis for this study. The microscale CO analysis was performed for the peak one-hour (Tables 4.3-2 & 4.3-3) and eight-hour traffic periods (Tables 4.3-4 & 4.3-5). These are the periods when the greatest air quality effects of the proposed project are expected. The average number of vehicles per hour during the peak eight-hour period was calculated as 6.5 percent of the average daily traffic. This persistence factor was recommended by VDOT.

4.3.2 Impacts

Maximum one-hour and eight-hour CO levels predicted at the 12 analysis sites for the ALC are shown in Tables 4.3-2 thru Table 4.3-5. These tables also include the predicted CO levels expected to occur for the other Build Alternatives. All predicted concentrations are well below EPA’s National Ambient Air Quality Standard for carbon monoxide for the one and eight-hour standard. In fact, predicted concentrations are composed primarily of existing background levels demonstrating that I-73 would contribute very little to overall CO levels

The highest predicted one and eight-hour CO concentrations occurred at I-81 south of I-581 (Site 6). The receptor for this site is relatively close to the roadway; 40 feet (12 meters) from the edge of the roadway and 100 feet (30 meters) from the roadway’s centerline. This location also has the highest hourly volume of vehicles (over 4,000 in all future scenarios) of all sites analyzed.

The ALC would generally enhance air quality by reducing contaminant levels in the region by diverting traffic from other study area roadways and by increasing the average travel speed. Air quality was predicted to decline slightly on I-581 and I-81 with the ALC, due to increased vehicular volume seeking to enter or exit the I-73 corridor but still remain within the applicable standards established by EPA. This is also expected for the other Build Alternatives that include I-581. It is also projected that some I-81 northbound traffic would use I-581 to access portions of Option 1 or 1a south of Roanoke rather than bypassing I-581 to reach the Option 1 or 1a connection with I-81. Conversely, some southbound I-81 traffic would likely use I-581 to access portions of Option 4 south of Roanoke rather than bypassing I-581 to reach the Option 4 connection with I-81.

All predicted concentrations are below the applicable Federal and State Standards. The project is not predicted to cause or exacerbate a violation of the NAAQS.

4.3.3 Mobile Source Air Toxics

Since the draft Environmental Impact Statement was approved for public availability in 2000, FHWA, through consultation with the EPA, has issued interim guidance on addressing mobile source air toxics in NEPA documents. This guidance, released on February 3, 2006, establishes a three-tiered approach to addressing mobile source air toxics in NEPA documents depending upon the scope of the project and its stage of

development. As a result, this EIS includes a basic qualitative analysis of the likely MSAT emission impacts of the project. However, available technical tools do not enable us to predict the project-specific health impacts of the emission changes associated with the alternatives in this EIS, including the ALC. Due to these limitations, the following discussion is included in accordance with CEQ regulations (40 CFR 1502.22(b)) regarding incomplete or unavailable information:

Evaluating the environmental and health impacts from MSATs on a proposed highway project would involve several key elements, including emissions modeling, dispersion modeling in order to estimate ambient concentrations resulting from the estimated emissions, exposure modeling in order to estimate human exposure to the estimated concentrations, and then final determination of health impacts based on the estimated exposure. Each of these steps is encumbered by technical shortcomings or uncertain science that prevents a more complete determination of the MSAT health impacts of this project.

1. Emissions: The EPA tools to estimate MSAT emissions from motor vehicles are not sensitive to key variables determining emissions of MSATs in the context of highway projects. While MOBILE 6.2 is used to predict emissions at a regional level, it has limited applicability at the project level. MOBILE 6.2 is a trip-based model--emission factors are projected based on a typical trip of 7.5 miles, and on average speeds for this typical trip. This means that MOBILE 6.2 does not have the ability to predict emission factors for a specific vehicle operating condition at a specific location at a specific time. For particulate matter, the model results are not sensitive to average trip speed, although the other MSAT emission rates do change with changes in trip speed. Also, the emissions rates used in MOBILE 6.2 for both particulate matter and MSATs are based on a limited number of tests of mostly older-technology vehicles. Lastly, in its discussions of PM under the conformity rule, EPA has identified problems with MOBILE6.2 as an obstacle to quantitative analysis. Consequently, these deficiencies compromise the capability of MOBILE 6.2 to estimate MSAT emissions.
2. Dispersion. The tools to predict how MSATs disperse are also limited. The EPA's current regulatory models, CALINE3 and CAL3QHC, were developed and validated more than a decade ago for the purpose of predicting episodic concentrations of carbon monoxide to determine compliance with the NAAQS. The performance of dispersion models is more accurate for predicting maximum concentrations that can occur at some time at some location within a geographic area. This limitation makes it difficult to predict accurate exposure patterns at specific times at specific highway project locations across an urban area to assess potential health risk. The NCHRP is conducting research on best practices in applying models and other technical methods in the analysis of MSATs. This work also will focus on identifying appropriate methods of documenting and communicating MSAT impacts in the NEPA process and to the general public. Along with these general limitations of dispersion models, FHWA is also faced with a lack of monitoring data in most areas for use in establishing project-specific MSAT background concentrations.
3. Exposure Levels and Health Effects. Finally, even if emission levels and concentrations of MSATs could be accurately predicted, shortcomings in current techniques for exposure assessment and risk analysis preclude us from reaching meaningful conclusions about project-specific health impacts. Exposure assessments are difficult because it is difficult to accurately calculate annual concentrations of MSATs near roadways, and to determine the portion of a year that people are actually exposed to those concentrations at a specific location. These difficulties are magnified for 70-year cancer assessments, particularly because unsupportable assumptions would have to be made regarding changes in travel patterns and vehicle technology (which affects emissions rates) over a 70-year period. There are also considerable uncertainties associated with the existing estimates of toxicity of the various MSATs, because of factors such as low-dose extrapolation and translation of occupational exposure data to the general population. Because of these shortcomings, any calculated difference in health impacts between alternatives is likely to be much smaller than the uncertainties associated with calculating the impacts. Consequently, the results of such assessments would not be useful to decision makers, who would need to weigh this information against other project impacts that are better suited for quantitative analysis.

Research into the health impacts of MSATs is ongoing. For different emission types, there are a variety of studies that show that some either are statistically associated with adverse health outcomes through epidemiological studies (frequently based on emissions levels found in occupational settings) or that animals demonstrate adverse health outcomes when exposed to large doses.

Exposure to toxics has been a focus of a number of EPA efforts. Most notably, the agency conducted the National Air Toxics Assessment (NATA) in 1996 to evaluate modeled estimates of human exposure applicable to the county level. While not intended for use as a measure of or benchmark for local exposure, the modeled estimates in the NATA database best illustrate the levels of various toxics when aggregated to a national or State level.

The EPA is in the process of assessing the risks of various kinds of exposures to these pollutants. The EPA Integrated Risk Information System (IRIS) is a database of human health effects that may result from exposure to various substances found in the environment. The IRIS database is located at <http://www.epa.gov/iris>. The following toxicity information for the six priority MSATs was taken from the IRIS database *Weight of Evidence Characterization* summaries. This information is taken verbatim from EPA's IRIS database and represents the Agency's most current evaluations of the potential hazards and toxicology of these chemicals or mixtures.

- **Benzene** is characterized as a known human carcinogen.
- The potential carcinogenicity of acrolein cannot be determined because the existing data are inadequate for an assessment of human carcinogenic potential for either the oral or inhalation route of exposure.
- **Formaldehyde** is a probable human carcinogen, based on limited evidence in humans, and sufficient evidence in animals.
- **1,3-butadiene** is characterized as carcinogenic to humans by inhalation.
- **Acetaldehyde** is a probable human carcinogen based on increased incidence of nasal tumors in male and female rats and laryngeal tumors in male and female hamsters after inhalation exposure.
- **Diesel exhaust** (DE) is likely to be carcinogenic to humans by inhalation from environmental exposures. Diesel exhaust as reviewed in this document is the combination of diesel particulate matter and diesel exhaust organic gases.
- **Diesel exhaust** also represents chronic respiratory effects, possibly the primary noncancer hazard from MSATs. Prolonged exposures may impair pulmonary function and could produce symptoms, such as cough, phlegm, and chronic bronchitis. Exposure relationships have not been developed from these studies.

There have been other studies that address MSAT health impacts in proximity to roadways. The Health Effects Institute, a non-profit organization funded by EPA, FHWA, and industry, has undertaken a major series of studies to research near-roadway MSAT hot spots, the health implications of the entire mix of mobile source pollutants, and other topics. The final summary of the series is not expected for several years.

Some recent studies have reported that proximity to roadways is related to adverse health outcomes -- particularly respiratory problems. Much of this research is not specific to MSATs, instead surveying the full spectrum of both criteria and other pollutants. The FHWA cannot evaluate the validity of these studies, but more importantly, they do not provide information that would be useful to alleviate the uncertainties listed above and enable us to perform a more comprehensive evaluation of the health impacts specific to this project.

Because of the uncertainties outlined above, a quantitative assessment of the effects of air toxic emissions impacts on human health cannot be made at the project level. While available tools do allow us to reasonably predict relative emissions changes between alternatives for large projects, the amount of MSAT emissions from each of the project alternatives and MSAT concentrations or exposures created by each of the project alternatives cannot be predicted with enough accuracy to be useful in estimating health impacts. (As noted above, the current emissions model is not capable of serving as a meaningful emissions analysis tool for smaller projects.) Therefore, the relevance of the unavailable or incomplete information is that it is not

possible to make a determination of whether any of the alternatives would have "significant adverse impacts on the human environment."

Below is a qualitative assessment of MSAT emissions relative to the various alternatives. FHWA acknowledged that the project alternatives may result in increased exposure to MSAT emissions in certain locations, however, the concentrations and duration of exposures are uncertain, and because of this uncertainty, the health effects from these emissions cannot be estimated.

This qualitative mobile source air toxic (MSAT) analysis focuses on the differences between the build alternatives for Interstate 73 and the impact that these differences may have on MSATs in the vicinity of the City of Roanoke. When it comes to MSATs, we are more concerned about alternatives located in proximity to urbanized areas versus alternatives located in rural, less populated areas. Likewise, we are concerned with alternatives that will have ADTs in excess of 140,000. In this respect, there are substantial differences in traffic (ADT) between the alternatives under consideration; the portion of the alternatives located within the City of Roanoke are projected to carry upwards of six times as much traffic as the portion of those alternatives that bypass the City to the north and the south. Further, the alternatives located within the City limits will see a substantial reduction in projected traffic south of the City to the North Carolina border. For example, once you get south of the City, ADT on the alternatives located within the City will drop off up to 70% when compared to the highest ADT on those alternatives within the City. With this drop-off, there is limited variation between the alternatives south of the City; none of the alternatives are projected to carry more than 37,000 ADT in 2020 south of the City to the North Carolina state line. In addition, the portion of the study area located south of the City of Roanoke is primarily rural in nature with limited concentrations of people, making it unnecessary to consider MSAT emissions along this section of the alternatives.

The EIS considered four primary options or alignments for a build alternative with several variations, bringing to eleven the number of options considered. Option 1 and its variations would be located north of the City of Roanoke in Botetourt County and would pass the City of Roanoke to the east. It was projected to only have an ADT of 30,000 in 2020 in the vicinity of Roanoke. Option 2 and its variations would be located on the same alignment as I-581 through the City of Roanoke to Route 220 where it would veer off to the southeast on new location and leave the City. It was projected to have an ADT in excess of 106,000 along a portion of this section in 2020. Option 3 and its variations, including the preferred alternative (ALC), would be located on the same alignment as I-581 and Route 220 through the City and follow a southerly alignment out of the City. It is projected to carry an ADT in excess of 126,000 along a portion of this section in 2020. Option 4 and its variations take off from I-81 at exit 132, following an easterly alignment for a couple of miles before turning to the southeast. It would be located approximately two miles south of the City limits at its closest point.

The amount of MSATs emitted for an alternative would be proportional to the vehicle miles traveled (VMT), assuming that other variables such as fleet mix are the same for each alternative. A review of Table 4.1-12 shows that Option 1 would have the lowest daily VMT in 2020 with 1.47 million vehicle miles traveled daily. This is followed by Option 4 (1.85 million), Option 3 (2.57 million), Option 2 (2.61 million), and then the ALC (2.76 million). However, given the magnitude of the project and the limited knowledge that we have regarding the dispersion of MSATs, it is appropriate to not only consider VMT associated with each alternative but VMT associated with the entire study area roadway network. If we consider this context, then the study area roadway network with Option 2 would have the lowest daily VMT in 2020 with 5.68 million vehicle miles traveled. This is followed by the study area roadway network with the ALC (5.73 million), Option 3 (5.84 million), Option 1 (6.56 million), and Option 4 (6.98 million). In contrast, the study area roadway network under the No-Build alternative would have 5.09 million vehicle miles. Therefore, the estimated VMT for each alternative will be between 10 to 27 percent higher than the No-Build Alternative with the ALC being 11 percent higher. This increase in VMT can be expected because the additional capacity provided by the ALC will increase the efficiency of the transportation system and attract rerouted trips from elsewhere in the transportation network. As one of the links in the I-73 high priority corridor from Michigan to South Carolina, the proposed project is intended to enhance general mobility and transportation linkage, not only in the study area but also through the study area in the context of this greater Michigan to South Carolina travel shed.

Therefore, from a regional VMT perspective, the ALC is one of the better alternatives when compared to the other alternatives under consideration. Consequently, since MSAT emissions are proportional to VMT, the MSAT emissions for the ALC will be lower than most of the other alternatives under consideration. Also, when compared to the no-build alternative, MSAT emission increases for the ALC would be offset somewhat by lower MSAT emission rates due to increased speeds and reduced congestion; according to EPA's Mobile6 emissions model, emissions of all of the priority MSATs except for diesel particulate matter decreases as speed increases. Also, regardless of the alternative selected and the increase in VMT, emissions in the design year are expected to be lower than present levels as a result of EPA's national control programs that are projected to reduce MSAT emissions by 57 to 87 percent between 2000 and 2020. Local conditions may differ from these national projections in terms of fleet mix and turnover, VMT growth rates, and local control measures. However, the magnitude of the EPA-projected reductions is so great (even after accounting for VMT growth) that MSAT emissions in the study area are likely to be lower in the future in nearly all cases.

Although retaining walls will be used along I-581 to minimize the amount of right-of-way that will be acquired by the project in this corridor, additional travel lanes proposed as part of the project under Option 2, Option 3, and the ALC will have the effect of moving traffic closer to homes, apartments, schools and businesses. Therefore, under Option 2, Option 3, and the ALC, there may be localized areas where ambient concentrations of MSATs could be higher when compared to the No-build scenario and the other options that were considered since Option 2, Option 3, and the ALC will be located along I-581 through the City. In contrast, Option 1 and Option 4 would be located north and south of the City, respectively, avoiding the heavily populated areas. Further, Option 3 and the ALC have the potential for higher localized areas of MSAT concentrations than Option 2 since they would follow the alignment of Route 220 through the City in addition to I-581; Option 2 would follow I-581 before veering off to the southeast on new location. However, as was the case above, the magnitude and the duration of these potential increases compared to the No-Build Alternative and the other alternatives that have been considered cannot be accurately quantified due to the inherent deficiencies of current models. In sum, when a highway facility is widened and as a result, moves closer to receptors, the localized level of MSAT emissions for Option 2, Option 3, and the ALC could be higher relative to the No-build alternative, but this could be offset by increases in speed and reductions in congestion and level of service (which are associated with lower MSAT levels). Finally, on a regional basis, EPA's vehicle and fuel regulations, coupled with fleet turnover, will over time cause substantial reductions that, in almost all cases, will cause region-wide as well as local MSAT emission levels to decline significantly over time.

4.3.4 Project-Level Conformity

The purpose and need of the study focuses on meeting the current and future regional transportation needs of the area. The study is located in an area designated attainment for carbon monoxide, the 1-hour ozone standard, and particulate matter (both the PM10 and PM2.5 standard); therefore, the project is not subject to the conformity requirements of the Clean Air Act for these standards. It should be noted that for pollutants like ozone and particulate matter, EPA has established both a primary and secondary standard. The primary standard has been established to protect public health. The secondary standard has been established to protect the nation's welfare and account for pollutant effects on the environment such as soil, water, visibility, and vegetation including crops. Since the study area is in attainment for the 1-hour ozone standard and particulate matter based on monitoring data, these pollutants do not raise any concerns with respect to environmental impacts.

In 1997, EPA developed the 8-hour standard for ozone, which was intended to be more sensitive to the public health effects of ozone over a greater period of time than the 1-hour standard. Recently, EPA found that the Cities of Roanoke and Salem and the Counties of Roanoke and Botetourt had monitoring data that exceeded the 8-hour standard. Instead of designating these areas nonattainment, EPA has deferred the designation because the area has developed and is in the process of implementing an early action compact. The compact is an agreement among the localities to implement voluntary control measures to reduce ozone. If the localities continue to implement the control measures and meet required milestones and the area has three years of clean monitoring data leading up to the December 31, 2007, attainment demonstration, then EPA will designate the area in attainment for the 8-hour ozone standard.

In comments on the draft EIS, some have suggested that the project should be subjected to the conformity requirements of nonattainment areas and a regional ozone analysis performed on the project. However, EPA's preamble to the 8-hour final rule states that conformity is not a control measure to be used like the voluntary measures that are included in early action compacts. Rather, conformity establishes a process in nonattainment areas for state and local governments to consider the broader emission impacts of their transportation decisions. In addition, the early action compact protocol developed by EPA specifically excuses early action compact areas from meeting the transportation conformity requirements since the conformity requirements only kick in one year after areas are designated nonattainment. Consistent with 40 CFR 93.102(d) and section 176(c)(6) of the Clean Air Act, conformity for the 8-hour standard, including a regional ozone analysis, does not apply in early compact areas provided the area meets all of the terms and milestones of its early action compact. Failure to meet these terms or milestones will invoke the nonattainment designation requiring conformity for the 8-hour standard within one year of the nonattainment designation by EPA.

Further, the Clean Air Act Amendments of 1990 established a conformity process in nonattainment areas that recognizes that transportation-related air quality issues must be analyzed on a system-wide basis and be controlled through regional strategies in order to be effective. Consequently, projects in transportation plans and improvement programs are analyzed in the aggregate, rather than individually where assessment of regional impacts cannot be measured with any degree of accuracy. For this reason, transportation conformity is performed on programs of projects, instead of individual projects, and the results compared to the state Implementation Plan. Accordingly, performing a regional ozone analysis on I-73 in a vacuum would not be practical for a couple reasons. First, DEQ has not developed a State Implementation Plan (SIP) for the region because it has not been designated nonattainment by EPA, therefore, conformity cannot be demonstrated against the SIP. Second, the results of a build/no-build analysis on an individual project would be meaningless outside the context of a regional network. Even if an analysis were able to generate credible estimates of whether ozone would increase or decrease, we would still not be able to determine whether the resulting ozone levels are likely to adversely impact human health because we would not have any information on the corresponding impact on ozone levels on the remainder of the transportation network; only when considered in the context of a regional network and regional ozone levels is it possible for one to begin to determine whether a change could be potentially adverse. Third, MPOs are responsible for performing regional ozone analyses during the planning process to address the conformity requirements, and the Roanoke Area MPO is not currently set-up to do so.

4.3.5 2025 Reevaluation

Since the circulation of the DEIS in October of 2000, VDOT has extended the design year for the project from 2020 to 2025. As a result, the traffic data used for this analysis has been revised to reflect the new design year. The predicted 2025 traffic volumes for the ALC will only increase by 2.51 to 8.04 percent over the volumes used in the DEIS. However, this increase will have little or no effect on the one-hour or eight-hour CO levels predicted for the project because the VACAL*5A program is not sensitive to minor fluctuations in traffic volumes as it is to changes in speeds which will remain the same. In addition, emission factors within the VACAL program have been updated with the introduction of MOBILE6 by EPA in January of 2002. MOBILE6 emission factors are lower than corresponding MOBILE5 emission factors due to improvements in vehicle emission control devices and engine technologies. Therefore, the increase in future traffic volumes forecast for the 2025 design year will not exceed the air quality standard for CO and no reanalysis is warranted.

**Table 4.3-2
VACAL*5A 1-HOUR PREDICTED CO CONCENTRATIONS (ppm)**

Site No.	Description	Receptor Distance	Existing 1997	2008 No-Build	2008 Build				ALC
					Option 1	Option 2	Option 3	Option 4	
1A	I-81 to U.S. Route 460	200'	6.0	6.0	6.3	--	--	6.2	--
1B	North of U.S. Route 460 (along I-581)	160'	7.4	7.2	--	8.0	8.0	--	8.0
2	U.S. Route 460 – Route 122	200'	6.0	6.0	6.1	6.3	6.3	6.3	6.3
3	Route 122 to Route 40/U.S. Route 220	200'	6.0	6.0	6.1	6.3	6.3	6.3	6.3
4	Route 40 to Route 57	200'	6.0	6.0	6.2	6.3	6.3	6.3	6.3
5	Route 57 to U.S. Route 58	200'	6.0	6.0	6.2	6.2	6.2	6.3	6.2
6	I-81 South of I-581	100'	10.0	8.9	9.7	9.7	9.8	9.0	9.7
7	I-581 North of U.S. Route 460	160'	7.4	7.2	7.4	8.0	8.0	9.2	8.0
8	Route 24 East of U.S. Route 220	100'	6.5	7.8	8.0	7.9	7.7	7.7	7.9
9	U.S. Route 220– I-581 to Route 419	100'	7.2	6.8	6.9	6.4	6.4	6.8	6.4
10	U.S. Route 220 – Route 684 to Rocky Mount	100'	6.7	6.5	6.5	6.1	6.1	6.2	6.1
11	U.S. Route 58 East of U.S. Route 220 Bypass	100'	6.7	6.4	6.3	6.2	6.4	6.4	6.3
12	U.S. Route 220 Martinsville to Ridgeway	100'	6.5	6.4	6.3	6.3	6.3	6.7	6.3

Source: National and State eight-hour standard = 35 ppm
Values include eight-hour background = 6.0 ppm

**Table 4.3-3
VACAL*5A 1-HOUR PREDICTED CO CONCENTRATIONS (ppm)**

Site No.	Description	Receptor Distance	Existing 1997	2020 No-Build	2020 Build				ALC
					Option 1	Option 2	Option 3	Option 4	
1A	I-81 to U.S. Route 460	200'	6.0	6.0	6.3	--	--	6.2	--
1B	North of U.S. Route 460 (along I-581)	160'	7.4	7.2	--	7.9	7.9	--	7.9
2	U.S. Route 460 – Route 122	200'	6.0	6.0	6.1	6.3	6.3	6.2	6.3
3	Route 122 to Route 40/U.S. Route 220	200'	6.0	6.0	6.1	6.3	6.3	6.2	6.3
4	Route 40 to Route 57	200'	6.0	6.0	6.2	6.2	6.2	6.3	6.2
5	Route 57 to U.S. Route 58	200'	6.0	6.0	6.2	6.1	6.1	6.3	6.2
6	I-81 South of I-581	100'	10.0	8.6	9.4	9.4	9.4	8.7	9.4
7	I-581 North of U.S. Route 460	160'	7.4	7.2	7.4	7.9	7.9	9.0	7.9
8	Route 24 East of U.S. Route 220	100'	6.5	7.8	7.9	7.9	7.6	7.7	7.9
9	U.S. Route 220– I-581 to Route 419	100'	7.2	6.8	6.8	6.4	6.4	6.7	6.4
10	U.S. Route 220 – Route 684 to Rocky Mount	100'	6.7	6.4	6.5	6.1	6.1	6.2	6.1
11	U.S. Route 58 East of U.S. Route 220 Bypass	100'	6.7	6.4	6.3	6.2	6.4	6.4	6.3
12	U.S. Route 220 Martinsville to Ridgeway	100'	6.5	6.4	6.30	6.3	6.3	6.7	6.3

Source: National and State eight-hour standard = 35 ppm
Values include eight-hour background = 6.0 ppm

**Table 4.3-4
VACAL*5A 8-HOUR PREDICTED CO CONCENTRATIONS (ppm)**

Site No.	Description	Receptor Distance	Existing 1997	2008 No-Build	2008 Build				ALC
					Option 1	Option 2	Option 3	Option 4	
1A	I-81 to U.S. Route 460	200'	3.0	3.0	3.2	--	--	3.2	--
1B	North of U.S. Route 460 (along I-581)	160'	4.2	4.0	--	4.6	4.6	--	4.6
2	U.S. Route 460 – Route 122	200'	3.0	3.0	3.1	3.3	3.3	3.2	3.3
3	Route 122 to Route 40/U.S. Route 220	200'	3.0	3.0	3.1	3.2	3.3	3.2	3.2
4	Route 40 to Route 57	200'	3.0	3.0	3.1	3.2	3.2	3.2	3.2
5	Route 57 to U.S. Route 58	200'	3.0	3.0	3.1	3.1	3.1	3.3	3.1
6	I-81 South of I-581	100'	6.5	5.5	6.3	6.3	6.3	5.6	6.3
7	I-581 North of U.S. Route 460	160'	4.0	3.9	4.0	4.5	4.5	5.3	4.5
8	Route 24 East of U.S. Route 220	100'	3.4	4.5	4.6	4.5	4.4	4.4	4.5
9	U.S. Route 220– I-581 to Route 419	100'	4.0	3.7	3.7	3.4	3.4	3.7	3.4
10	U.S. Route 220 – Route 684 to Rocky Mount	100'	3.6	3.4	3.4	3.1	3.1	3.2	3.1
11	U.S. Route 58 East of U.S. Route 220 Bypass	100'	3.5	3.3	3.2	3.2	3.4	3.3	3.2
12	U.S. Route 220 Martinsville to Ridgeway	100'	3.4	3.4	3.3	3.3	3.3	3.7	3.3

Source: National and State eight-hour standard = 9 ppm
Values include eight-hour background = 3.0 ppm

**Table 4.3-5
VACAL*5A 8-HOUR PREDICTED CO CONCENTRATIONS (ppm)**

Site No.	Description	Receptor Distance	Existing 1997	2020 No-Build	2020 Build				ALC
					Option 1	Option 2	Option 3	Option 4	
1A	I-81 to U.S. Route 460	200'	3.0	3.0	3.2	--	--	3.1	--
1B	North of U.S. Route 460 (along I-581)	160'	4.2	4.0	--	4.6	4.6	--	4.6
2	U.S. Route 460 – Route 122	200'	3.0	3.0	3.1	3.3	3.2	3.2	3.3
3	Route 122 to Route 40/U.S. Route 220	200'	3.0	3.0	3.1	3.2	3.2	3.2	3.2
4	Route 40 to Route 57	200'	3.0	3.0	3.1	3.2	3.2	3.2	3.2
5	Route 57 to U.S. Route 58	200'	3.0	3.0	3.1	3.1	3.1	3.2	3.1
6	I-81 South of I-581	100'	6.5	5.3	6.0	6.0	6.0	5.4	6.0
7	I-581 North of U.S. Route 460	160'	4.0	3.8	4.0	4.4	4.4	5.2	4.4
8	Route 24 East of U.S. Route 220	100'	3.4	4.4	4.6	4.5	4.3	4.3	4.5
9	U.S. Route 220– I-581 to Route 419	100'	4.0	3.7	3.7	3.3	3.3	3.6	3.3
10	U.S. Route 220 – Route 684 to Rocky Mount	100'	3.6	3.4	3.4	3.1	3.1	3.2	3.1
11	U.S. Route 58 East of U.S. Route 220 Bypass	100'	3.5	3.3	3.2	3.2	3.3	3.3	3.2
12	U.S. Route 220 Martinsville to Ridgeway	100'	3.4	3.3	3.3	3.3	3.3	3.6	3.3

Source: National and State eight-hour standard = 9 ppm
Values include eight-hour background = 3.0 ppm

4.4 NOISE

4.4.1 Evaluation of Future Noise Levels

To facilitate a comparison of the future No-Build, the TSM and the Build Alternatives, including the ALC, predicted noise levels under all alternatives were calculated using the FHWA noise prediction computer model (STAMINA 2.0) (Table 4.4-1). Computer modeling accounts for such factors as ground absorption, roadway geometry, receptor distance, vehicle volume, operating speed, and volumes of medium trucks (vehicles with two axles/six tires) and heavy trucks (three axles or more).

Assessment of traffic noise impact requires the following three comparisons:

- The noise levels under existing conditions must be compared to those under build conditions. This comparison shows the noise level that will occur between the present time and the design year.
- The noise levels under the design year no-build conditions must be compared to those under build conditions. This comparison shows how much of the change in levels can actually be attributed to the proposed I-73 Location Study.
- The noise levels under the build conditions must be compared to the applicable NAC. This comparison determines the applicability of noise levels under present as well as eligible proposed land uses.

Noise impacts from future I-73 traffic were identified as FHWA “Category B” land uses using VDOT and FHWA criteria for assessing impacts. Where impacts were identified, VDOT’s criteria were used to evaluate and recommend feasible and reasonable traffic noise mitigation measures. The following steps were followed to achieve the above objectives.

- Based on a corridor wide inspection of aerial photographs and U.S. Geological Survey maps, and from overlay of future estimated traffic noise contours, an approximate count was made of the total number of residences that would experience traffic noise impacts from proposed I-73. This count was obtained for each of the twelve alternatives, and the results are reported in Table 4.4-2 (see row 4 of the Table).
- For each of the twelve alternatives, the total corridor wide count as determined in step 1 was separated into two sets: one set of numbers represents the number of residences that would experience traffic noise impacts as defined by FHWA and VDOT NAC (row 1 of Table 4.4-2), and a second set of numbers represents the number of residences that would experience a substantial increase (SI) impact as defined by FHWA and VDOT criteria (areas where the future traffic noise levels would be 10 dBA above the existing noise levels – see rows 1, 2 and 3 of Table 4.4-2). All of these properties would qualify for abatement considerations.
- The third and final step consisted of determining the feasibility and reasonableness of erecting noise barriers along the highway to protect clusters of impacted properties (using VDOT guidelines). The number of properties recommended for noise barrier protection is given in row 6 of Table 4.4-2. Noise barrier recommendations for each alternative are summarized in Table 4.4-13.

Estimated impacts for each Build Alternative option, including the ALC, are summarized in Table 4.4-2.

4.4.2 Discussion of Impacts

Based on the evaluation of alternatives, Table 4.4-2 shows that Options 1, 1a, 4, and the ALC would have the least number of impacts (approximately 400 to 600) on category “B” sites. Options 2, 2a, 2b, and 2c would have impacts in the range of approximately 1,300 to 2,100 properties. Options 3, 3a, 3b, and 3c would experience the highest number of properties with impacts ranging from 2,800 to 3,300 properties.

**Table 4.4-1
DESIGN YEAR PREDICTED NOISE LEVELS (FROM STAMINA 2.0 MODEL)**

Site No.	Land Use Description and Site Location	Map Segment No.	Options	1996 Existing L_{eq} (1-HR) dBA	Future No-Build L_{eq} (1-HR) dBA	Future Build L_{eq} (1-HR) dBA
R1*	Residences on the north side of Segment 372 From Station 1140+00 to Station 1160+00	372	1, 1a	56	56	58
R2*	Residences on both sides of Segment 372 from Station 640+00 to Station 650+50	372	1, 1a	51	51	63
R3	Residences on the west side of Segment 374 from Station 300+00 to Station 315+00	374	2, 2a, 2b, 2c, 3, 3a, 3b, 3c, ALC	72	72	76
R4	Residences on the south side of Segment 374 from Station 268+00 to Station 295+00	374	2, 2a, 2b, 2c, 3, 3a, 3b, 3c, ALC	72	72	76
R5	Residences on the south side of Segment 374 from Station 202+00 to Station 215+00	374	2, 2a, 2b, 2c, 3, 3a, 3b, 3c, ALC	72	73	77
R6	Residences on the north side of Segment 374 from Station 180+00 to Station 220+00	374	2, 2a, 2b, 2c, 3, 3a, 3b, 3c, ALC	72	72	76
R7	Residences on the south side of Segment 374 from Station 191+00 to Station 202+00	374	2, 2a, 2b, 2c, 3, 3a, 3b, 3c, ALC	67	68	72
R8	Residences on the east side of Segment 374 from Station 90+00 to Station 180+00	374	2, 2a, 2b, 2c, 3, 3a, 3b, 3c, ALC	70	70	74
R8a	Residences on the east side of Segment 376 in Historic District station 250+00 to 270+00	376	2, 2a, 2c	61	62	64
R8b	Residences on the west side of Segment 376 opposite Historic District 240+00 to 280+00	376	2, 2a, 2c	58	60	70
R9	Residences on both sides of Segment 372 from Station 488+00 to Station 510+00	372	1, 1a	46	50	60
R10*	Residences in Stewartsville	372	1, 1a	69	70	70
R11	Residences on the west side of Segment 375 from Station 200+00 to Station 214+00	375	2b, 3, 3a, 3b, 3c, ALC	70	72	73
R12	Residences on the west side of Segment 375 from Station 173+00 to Station 192+00	375	2b, 3, 3a, 3b, 3c, ALC	68	68	69
R13	Residences on the west side of Segment 375 from Station 214+00 to Station 235+00	375	2b, 3, 3a, 3b, 3c, ALC	74	74	75
R14*	Residences on the west side of Segment 371 from Station 510+00 to Station 520+00	371	4	40	40	59
R15	Residences on the west side of Segment 375 from Station 130+00 to Station 152+00	375	2b, 3, 3a, 3b, 3c, ALC	74	74	77
R16	Residences on the south side of Segment 375 from Station 180+00 to Station 192+00	375	2b, 3, 3a, 3b, 3c, ALC	75	75	78
R17	Residences on the east side of Segment 118c from Station 272+00 to Station 300+00	118C	2b, 3, 3b, 3c, ALC	69	69	73
R18	Residences on both sides of Segment 118c from Station 234+00 to Station 250+00	118C	2b, 3, 3b, 3c, ALC	72	73	74
R19*		105	3a	47	47	59
R20	Residences on the east side of Segment 118c from Station 200+00 to Station 260+00	118C	2b, 3, 3b, 3c, ALC	67	67	68
R21	Residences on both sides of Segment 118c from Station 160+00 to Station 185+00	118C	2b, 3, 3b, 3c, ALC	68	69	72
R23*	Residences on the east side of Segment 118	118	2b, 3b, ALC	46	46	57
R24*	Residences on the east side of Segment 378 from Station 230+00 to Station 270+00	378	3a, 4	54	54	54
R25*	Residences on Boone Mill Rd East of Segment 118B	118B	2, 2b, 2c, ALC	57	57	59

**TABLE 4.4-1 (CONT.)
DESIGN YEAR PREDICTED NOISE LEVELS (FROM STAMINA 2.0 MODEL)**

Site No.	Land Use Description and Site Location	Map Segment No.	Options	1996 Existing L_{eq} (1-HR) dBA	Future No-Build L_{eq} (1-HR) dBA	Future Build L_{eq} (1-HR) dBA
R26*	Residences on the east side of Segment 152 from Station 1090+00 to Station 1110+00	152	1	64	70	69
R27	Residences on the south side of Segment 380 from Station 170+00 to Station 190+00	380	3, 3a, 3b, 3c	62	62	68
R28*	Residences on both sides of Segment 116B from Station 230+00 to Station 260+00	116B	4	51	51	58
R29	Residences on both sides of Segment 382 from Station 1320+00 to Station 1370+00	382	3, 3a, 3b, 3c	64	64	68
R30	Residences on both sides of Segment 382 from Station 1260+00 to Station 1300+00	382	3, 3a, 3b, 3c	64	66	67
R31	Residences on both sides of Segment 382 from Station 1218+00 to Station 1235+00	382	3, 3a, 3b, 3c	64	66	68
R32*	Residences on the east side of Segment 152 from Station 724+00 to Station 750+00	152	1	52	52	53
R33	Residences on the east side of Segment 192A from Station 696+00 to Station 740+00	192A	1a, 4	44	44	61
R34	Residences on the west side of Segment 382 from Station 1030+00 to Station 1075+00	382	3, 3a, 3b, 3c	60	60	65
R35	Residences on the east side of Segment 382 from Station 1005+00 to Station 1042+00	382	3, 3a, 3b, 3c	64	64	67
R36*	Residences on both sides of Segment 321 from Station 200+00 to Station 230+00	321	1a, 3c, 4	61	65	63
R37*	Residences on the east side of Segment 152 from Station 375+00 to Station 400+00	152	1	37	49	52
R38*	Residences on the west side of Segment 321 from Station 125+00 to Station 160+00	321	1a, 3c, 4	57	57	59
R39*	Residences on the west side of Segment 326 from Station 210+00 to Station 240+00	326	2c	47	51	71
R40	Residences on the south side of Segment 386 from Station 126+00 to Station 165+00	386	2, 2a, 2b, 3, 3a, 3b	74	74	74
R41*	Residences on the west side of Segment 369 from Station 447+00 to Station 490+00	369	1, ALC	56	60	60
R42	Residences on the west side of Segment 388 from Station 450+00 to Station 485+00	388	3, 3a, 3b, 3c	73	73	73
R43	Residences on both sides of Segment 388 from Station 410+00 to Station 450+00	388	3, 3a, 3b, 3c	73	73	73
R44*	Residences on the east side of Segment 237B from Station 440+00 to Station 470+00	237B	4	60	60	61
R45*	Residences on both sides of Segment 369 from Station 260+00 to Station 300+00	369	1, ALC	55	55	55
R46	Residences on the east side of Segment 237B from Station 290+00 to Station 320+00	237B	4	56	56	56
R47	Residences on the west side of Segment 388 from Station 235+00 to Station 272+00	388	3, 3a, 3b, 3c	63	63	65
R48	Residences on the east side of Segment 388 from Station 225+00 to Station 255+00	388	3, 3a, 3b, 3c	62	62	66
R49*	Residences on the east side of Segment 373 from Station 210+00 to Station 260+00	373	1, 1a, 2, 2a, 2b, 2c, ALC	56	56	57
R50*	Residences on the west side of Segment 389 from Station 390+00 to Station 420+00	389	3, 3a, 3b, 3c, 4	37	43	49
R51	Residences on both sides of Segment 389 from Station 205+00 to Station 226+00	389	3, 3a, 3b, 3c, 4	58	59	64

**TABLE 4.4-1 (CONT.)
DESIGN YEAR PREDICTED NOISE LEVELS (FROM STAMINA 2.0 MODEL)**

Site No.	Land Use Description and Site Location	Map Segment No.	Options	1996 Existing L_{eq} (1-HR) dBA	Future No-Build L_{eq} (1-HR) dBA	Future Build L_{eq} (1-HR) dBA
R52	Residences on the south side of Segment 391 from Station 280+00 to Station 300+00	391	2, 2a, 2b, 2c	62	62	65
R53	Residences on the east side of Segment 333 from Station 615+00 to Station 650+00	333	1, 1a, ALC	46	48	60
R54	Residences on the west side of Segment 392 from Station 258+00 to Station 130+00 (Segment 390)	392	3, 3a, 3b, 3c	63	65	67
R55	Residences on the east side of Segment 392 from Station 270+00 to Station 138+00 (Segment 391)	392	3, 3a, 3b, 3c	62	64	66
R56	Residences on the east side of Segment 392 from Station 252+00 to Station 270+00	392	3, 3a, 3b, 3c	62	64	66
R57	Residences on the west side of Segment 392 from Station 235+00 to Station 252+00	392	3, 3a, 3b, 3c	61	63	65
R58	Residences on the west side of Segment 392 from Station 205+00 to Station 235+00	392	3, 3a, 3b, 3c	61	61	65
R59	Residences on the east side of Segment 392 from Station 200+00 to Station 222+00	392	3, 3a, 3b, 3c	61	61	65
R60	Residences on the west side of Segment 392 from Station 160+00 to Station 205+00	392	3, 3a, 3b, 3c	63	63	67
R61	Residences on the east side of Segment 392 from Station 158+00 to Station 188+00	392	3, 3a, 3b, 3c	60	62	65
R62	Residences on the west side of Segment 349 from Station 114+00 to Station 142+00	349	2, 2a, 2b, 2c, 4	53	55	55
R63*	Residences on both sides of Segment 333 from Station 340+00 to Station 390+00	333	1, 1a, ALC	56	58	58
R64	The Appalachian Trail (Most Easterly Overlook Point)	372	1, 1a	45	49	51
R65	The Appalachian Trail (Central Overlook Point)	372	1, 1a	47	47	47
R66	The Appalachian Trail (Most Westerly Overlook Point)	372	1, 1a	46	46	47

(This area left blank intentionally).

**Table 4.4-2
FUTURE NOISE IMPACTS WITH NOISE BARRIER RECOMMENDATION**

No.	TYPE OF IMPACT	OPTION											ALC
		1	1a	2	2a	2b	2c	3	3a	3b	3c	4	
1	Number of impacted properties with noise levels approaching or exceeding (67 dBA) *	221	291	419	762	747	456	715	1096	935	749	256	747
2	Number of impacted properties with substantial increases	190	290	860	1210	1315	975	2120	2220	2120	2095	335	1315
3	Number of impacted properties with noise levels approaching or exceeding (67 dBA) and with substantial increases	0	0	86	86	0	86	0	0	0	0	1	0
4	Total number of impacted properties (1+2+3)	411	581	1365	2058	2062	1517	2835	3316	3055	2844	592	2062
5	Number of impacted properties possible to protect (5 dBA) with barrier	0	9	194	194	231	187	426	395	426	425	11	231
6	Number of impacted properties for which barriers appear to be cost-effective	0	0	179	179	174	155	148	183	183	183	0	174

* Estimated quantities captured from overlay of future noise contours and aerial photography.

4.4.3 Traffic Noise Mitigation

All sites at which impacts were identified were considered for mitigation. The procedures for abating traffic noise impacts are based on the following considerations:

- Primary consideration is to be given to exterior areas (abatement will usually be necessary only where frequent human use occurs and a lowered noise level would be of benefit);
- Reasonable effort should be made to obtain substantial noise reductions (defined as a 5 dBA reduction or greater).

4.4.4 Evaluation of Alternative Abatement Measures

Alternative abatement measures were evaluated to determine their effectiveness in substantially reducing the predicted design year noise levels in the I-73 Location Study corridor. Alternative abatement measures include:

- Traffic management procedures
- Alteration of roadway horizontal or vertical alignments
- Installation of noise barriers within the right-of-way.

Traffic management measures include enforcing lower speed limits and/or limiting the highway to automobiles and medium trucks. Speeds would have to be lowered 15 to 20 mph for operating speeds to achieve a noticeable (5 dBA) reduction. A reduction of posted speed would create a dramatic reduction in the level of service for this roadway. The restriction of through truck traffic is also not feasible as I-73 is intended to be a primary link in the National Highway System that would extend between Sault Ste. Marie, Michigan and Myrtle Beach, South Carolina.

As discussed previously in this EIS, impacts have been assessed based on a 600-foot location corridor. This was done to account for cut and fill slopes, to allow for the location of possible stormwater management features, and to allow for shifts in the alignment of the roadway to minimize impacts to environmental resources. Therefore, it is expected that the actual right-of-way that will be needed to construct the roadway will be less than the 600-foot location corridor used to assess environmental impacts. At this time, it has not been determined whether shifting the horizontal or vertical alignment will reduce noise impacts because the level of design necessary to make that determination cannot be performed during the environmental process. Accordingly, shifts in the horizontal and vertical alignment for purposes of minimizing noise impacts will be explored during final design. As a rule of thumb, shifting an alignment one-half the distance away from an impacted receptor will reduce noise levels at the receptor approximately 3 dB(A).

The most reasonable available abatement measure consists of erecting noise barriers within the right-of-way. Sound barriers are only effective when there are no openings for vehicular or pedestrian access. In order for the barrier to be effective, it must be continuous along the roadway adjacent to the impacted sites.

Noise abatement measures should be feasible and reasonable in that they provide a substantial reduction in noise levels and can be implemented in a practical manner without limiting accessibility. A discussion as to the feasibility of the barrier is included for each barrier under consideration. The cost effectiveness of each barrier is based on VDOT's \$30,000 per protected residential property criteria. This criteria assumes that potential sound barrier costs will be \$16 per square foot (\$174 per square meter) and includes only barrier materials and installation costs. To remain in compliance with the State Noise Abatement Policy an effective barrier must: provide a minimum of 5 dBA noise reduction in design year noise levels.

Another important abatement consideration is the third party funding provision. This provision of the policy allows a barrier that exceeds VDOT's \$30,000 per protected residential receptor criteria to be constructed if a third party, such as the local government or affected property owners, contribute the amount above the

\$30,000 ceiling. Sound barriers to protect public-use, non-profit facilities do not fall into the \$30,000 per protected property cost criteria and are considered on a case-by-case basis. To remain in compliance with FHWA policy and guidance, the Department must also include properties in their calculations which are not impacted but would realize a “benefit” from the construction of the sound barrier by receiving a 5dB(A) reduction. This I-73 Location Study has not identified any properties that would benefit from this provision. This assessment is preliminary in nature and the conclusions can change once final design is initiated and traffic updated. All feasible barriers associated with the selected alternative will receive further consideration during final design.

4.4.4.1 Barrier Discussions

Tables 4.4-3 – 4.4-13 list acoustically effective barriers for all options. The data presented in these tables were based on the following:

- Noise Barriers were considered at all locations where future traffic noise levels would substantially increase over existing noise levels or approach or exceed the VDOT Noise Abatement Criterion level for Category B sites of 67 dBA Leq (1 hour).
- To facilitate the preliminary assessment of barriers, all barriers were assumed to be 16 feet high. This height may increase or decrease depending upon specific sight conditions and once final design is carried out.
- For a noise barrier to be acoustically effective, a minimum of 5 decibels of noise reduction is required for abatement.

Table 4.4-14 provides a summary of cost-effective sound barriers for each alternative. Recommended sound barrier locations for the ALC are illustrated in Figure 4.4-1.

Option 1

No barriers satisfied the 5 dBA noise reduction requirement and therefore none appears to be feasible.

Option 1a

One barrier in Franklin County was considered for this alternative (option) to protect 9 residential receptors in the vicinity of R33. An 18-foot (5.5 meters) tall barrier with a length of 2,400 feet (732 meters) would approximately cost \$ 691,200. This barrier failed to satisfy VDOT's cost-effectiveness criterion. All feasible barriers associated with the chosen alternative (option) will receive further consideration.

Option 2

Six sound barriers were considered for this alternative in the vicinity of six sites where existing noise levels were predicted. All of the six barriers are located in Roanoke County (R3, R4, R5, R6, R8 and R8b). The total length of 16 feet (4.9 meters) tall barriers would be 22,500 feet (6,860 meters). At an approximate cost of \$5.76 million these barriers would protect 194 properties. Of the 194 homes protected, 179 homes would satisfy both acoustic and cost-effectiveness criteria. All feasible barriers associated with the chosen alternative (option) will receive further consideration.

Option 2a

Six sound barriers were considered for this alternative in the vicinity of six sites where existing noise levels were predicted. All of the six barriers are located in Roanoke County (R3, R4, R5, R6, R8 and R8b). The total length of 16 feet (4.9 meters) tall barriers would be 22,500 feet (6,860 meters). At an approximate cost of \$5.76 million these barriers would protect 194 properties. Of the 194 homes protected, 179 homes would satisfy both acoustic and cost-effectiveness criteria. All feasible barriers associated with the chosen alternative (option) will receive further consideration.

Option 2b

Fourteen noise barriers were considered for this alternative in the vicinity of fourteen sites (R3, R4, R5, R6, R8, R11, R12, R13, R15, R16, R17, R18, R20 and R21) where existing noise levels were predicted. All of the fourteen barriers considered are located in Roanoke County. The total length of the 16-foot (4.9-meters) tall barriers would be 39,700 feet (12,104 meters). At an approximate cost of \$10.2 million, these barriers would protect 231 properties. Of the 231 homes protected 174 homes would satisfy both acoustic and cost-effectiveness criteria. All feasible barriers associated with the chosen alternative (option) will receive further consideration.

Option 2c

Six sound barriers were considered for this alternative in the vicinity of six sites where existing noise levels were predicted. All of the six barriers are located in Roanoke County (R3, R4, R5, R6, R8 and R8b). The total length of 16 feet (4.9 meters) tall barriers would be 22,500 feet (6,860 meters). At an approximate cost of \$5.76 million these barriers would protect 187 properties. Of the 187 homes protected, 155 homes would satisfy both acoustic and cost-effectiveness criteria. All feasible barriers associated with the chosen alternative (option) will receive further consideration.

**Table 4.4-3
SUMMARY OF ACOUSTICALLY-EFFECTIVE BARRIERS - Option 1A**

Segment	Site	County	Stationing
192A	R33	Franklin	696+00 to 740+00 E
Total Estimated Cost Of Acoustically-Effective Barriers			
691,200			

**Table 4.4-4
SUMMARY OF ACOUSTICALLY-EFFECTIVE BARRIERS - Option 2**

Segment	Site	County	Stationing
374	R3	Roanoke	300+00 to 315+00 W
374	R4	Roanoke	268+00 to 295+00 W
374	R5	Roanoke	202+00 to 215+00 W
374	R6	Roanoke	180+00 to 220+00 E
374	R8	Roanoke	90+00 to 180+00 W
376	R8b	Roanoke	240+00 to 280+00 W
Total Estimated Cost Of Acoustically-Effective Barriers			
\$5,760,000			

**Table 4.4-5
SUMMARY OF ACOUSTICALLY-EFFECTIVE BARRIERS - Option 2A**

Segment	Site	County	Stationing
374	R3	Roanoke	300+00 to 315+00 W
374	R4	Roanoke	268+00 to 295+00 W
374	R5	Roanoke	202+00 to 215+00 W

Segment	Site	County	Stationing
374	R6	Roanoke	180+00 to 220+00 E
374	R8	Roanoke	90+00 to 180+00 W
376	R8b	Roanoke	240+00 to 280+00 W
Total Estimated Cost Of Acoustically-Effective Barriers			
\$5,760,000			

**Table 4.4-6
SUMMARY OF ACOUSTICALLY-EFFECTIVE BARRIERS - Option 2B**

Segment	Site	County	Stationing
374	R3	Roanoke	300+00 to 315+00 W
374	R4	Roanoke	268+00 to 295+00 W
374	R5	Roanoke	202+00 to 215+00 W
374	R6	Roanoke	180+00 to 220+00 E
374	R8	Roanoke	90+00 to 180+00 W
375	R11	Roanoke	200+00 to 214+00 W
375	R12	Roanoke	173+00 to 192+00 W
375	R13	Roanoke	214+00 to 235+00 W
375	R15	Roanoke	146+00 to 168+00 W
375	R16	Roanoke	180+00 to 192+00 E
118C	R17	Roanoke	272+00 to 300+00 E
118C	R18	Roanoke	234+00 to 250+00 E
118C	R20	Roanoke	200+00 to 260+00 W
118C	R21	Roanoke	120+00 to 140+00 E
Total Estimated Cost Of Acoustically-Effective Barriers			
\$10,163,200			

**Table 4.4-7
SUMMARY OF ACOUSTICALLY-EFFECTIVE BARRIERS - Option 2C**

Segment	Site	County	Stationing
374	R3	Roanoke	300+00 to 315+00 W
374	R4	Roanoke	268+00 to 295+00 W
374	R5	Roanoke	202+00 to 215+00 W
374	R6	Roanoke	180+00 to 220+00 E
374	R8	Roanoke	90+00 to 180+00 W
376	R8b	Roanoke	240+00 to 280+00 W
Total Estimated Cost Of Acoustically-Effective Barriers			
\$5,760,000			

**Table 4.4-8
SUMMARY OF ACOUSTICALLY-EFFECTIVE BARRIERS - Option 3**

Segment	Site	County	Stationing
374	R3	Roanoke	300+00 to 315+00 W
374	R4	Roanoke	268+00 to 295+00 W
374	R5	Roanoke	202+00 to 215+00 W
374	R6	Roanoke	180+00 to 220+00 E
374	R8	Roanoke	90+00 to 180+00 W
375	R11	Roanoke	200+00 to 214+00 W
375	R12	Roanoke	173+00 to 192+00 W
375	R13	Roanoke	214+00 to 235+00 W
375	R15	Roanoke	146+00 to 168+00 W
375	R16	Roanoke	180+00 to 192+00 E
118C	R17	Roanoke	272+00 to 300+00 E
118C	R18	Roanoke	234+00 to 250+00 E
118C	R20	Roanoke	200+00 to 260+00 W
118C	R21	Roanoke	160+00 to 185+00 W
380	R27	Franklin	170+00 to 190+00 W
382	R29	Franklin	1320+00 to 1370+00 W
382	R30	Franklin	1260+00 to 1300+00 W
382	R31	Franklin	1218+00 to 1235+00 E
382	R35	Franklin	1005+00 to 1042+00 E
388	R42	Henry	450+00 to 850+00 W
388	R43	Henry	410+00 to 450+00 E
388	R47	Henry	235+00 to 272+00 W
388	R48	Henry	225+00 to 255+00 E
392/390	R54	Henry	258+00 to 130+00 W
392/390	R55	Henry	270+00 to 138+00 E
392	R56	Henry	252+00 to 270+00 E
392	R60	Henry	160+00 to 205+00 W
Total Estimated Cost Of Acoustically-Effective Barriers			
\$23,843,200			

**Table 4.4-9
SUMMARY OF ACOUSTICALLY-EFFECTIVE BARRIERS - Option 3A**

Segment	Site	County	Stationing
374	R3	Roanoke	300+00 to 315+00 W
374	R4	Roanoke	268+00 to 295+00 W
374	R5	Roanoke	202+00 to 215+00 W
374	R6	Roanoke	180+00 to 220+00 E
374	R8	Roanoke	90+00 to 180+00 W
375	R11	Roanoke	200+00 to 214+00 W
375	R12	Roanoke	173+00 to 192+00 W
375	R13	Roanoke	214+00 to 235+00 W
375	R15	Roanoke	146+00 to 168+00 W
375	R16	Roanoke	180+00 to 192+00 E
380	R27	Franklin	170+00 to 190+00 W
382	R29	Franklin	1320+00 to 1370+00 W
382	R30	Franklin	1260+00 to 1300+00 W
382	R31	Franklin	1218+00 to 1235+00 E
382	R35	Franklin	1005+00 to 1042+00 E
388	R42	Henry	450+00 to 850+00 W
388	R43	Henry	410+00 to 450+00 E
388	R47	Henry	235+00 to 272+00 W
388	R48	Henry	225+00 to 255+00 E
392/390	R54	Henry	258+00 to 130+00 W
392/390	R55	Henry	270+00 to 138+00 E
392	R56	Henry	252+00 to 270+00 E
392	R60	Henry	160+00 to 205+00 W
Total Estimated Cost Of Acoustically-Effective Barriers			
\$20,540,800			

**Table 4.4-10
SUMMARY OF ACOUSTICALLY-EFFECTIVE BARRIERS - Option 3B**

Segment	Site	County	Stationing
374	R3	Roanoke	300+00 to 315+00 W
374	R4	Roanoke	268+00 to 295+00 W
374	R5	Roanoke	202+00 to 215+00 W
374	R6	Roanoke	180+00 to 220+00 E
374	R8	Roanoke	90+00 to 180+00 W
375	R11	Roanoke	200+00 to 214+00 W
375	R12	Roanoke	173+00 to 192+00 W
375	R13	Roanoke	214+00 to 235+00 W
375	R15	Roanoke	146+00 to 168+00 W
375	R16	Roanoke	180+00 to 192+00 E
118C	R17	Roanoke	272+00 to 300+00 E
118C	R18	Roanoke	234+00 to 250+00 E
118C	R20	Roanoke	200+00 to 260+00 W
118C	R21	Roanoke	160+00 to 185+00 W
380	R27	Franklin	170+00 to 190+00 W
382	R29	Franklin	1320+00 to 1370+00 W
382	R30	Franklin	1260+00 to 1300+00 W
382	R31	Franklin	1218+00 to 1235+00 E
382	R35	Franklin	1005+00 to 1042+00 E
388	R42	Henry	450+00 to 850+00 W
388	R43	Henry	410+00 to 450+00 E
388	R47	Henry	235+00 to 272+00 W
388	R48	Henry	225+00 to 255+00 E
392/390	R54	Henry	258+00 to 130+00 W
392/390	R55	Henry	270+00 to 138+00 E
392	R56	Henry	252+00 to 270+00 E
392	R60	Henry	160+00 to 205+00 W
Total Estimated Cost Of Acoustically-Effective Barriers			
\$23,843,200			

**Table 4.4-11
SUMMARY OF ACOUSTICALLY-EFFECTIVE BARRIERS - Option 3C**

Segment	Site	County	Stationing
374	R3	Roanoke	300+00 to 315+00 W
374	R4	Roanoke	268+00 to 295+00 W
374	R5	Roanoke	202+00 to 215+00 W
374	R6	Roanoke	180+00 to 220+00 E
374	R8	Roanoke	90+00 to 180+00 W
375	R11	Roanoke	200+00 to 214+00 W
375	R12	Roanoke	173+00 to 192+00 W
375	R13	Roanoke	214+00 to 235+00 W
375	R15	Roanoke	146+00 to 168+00 W
375	R16	Roanoke	180+00 to 192+00 E
118C	R17	Roanoke	272+00 to 300+00 E
118C	R18	Roanoke	234+00 to 250+00 E
118C	R20	Roanoke	200+00 to 260+00 W
118C	R21	Roanoke	160+00 to 185+00 W
380	R27	Franklin	170+00 to 190+00 W
382	R29	Franklin	1320+00 to 1370+00 W
382	R30	Franklin	1260+00 to 1300+00 W
382	R31	Franklin	1218+00 to 1235+00 E
382	R35	Franklin	1005+00 to 1042+00 E
388	R42	Henry	450+00 to 850+00 W
388	R43	Henry	410+00 to 450+00 E
388	R47	Henry	235+00 to 272+00 W
388	R48	Henry	225+00 to 255+00 E
392/390	R54	Henry	258+00 to 130+00 W
392/390	R55	Henry	270+00 to 138+00 E
392	R56	Henry	252+00 to 270+00 E
392	R60	Henry	160+00 to 205+00 W
Total Estimated Cost Of Acoustically-Effective Barriers			
\$23,843,200			

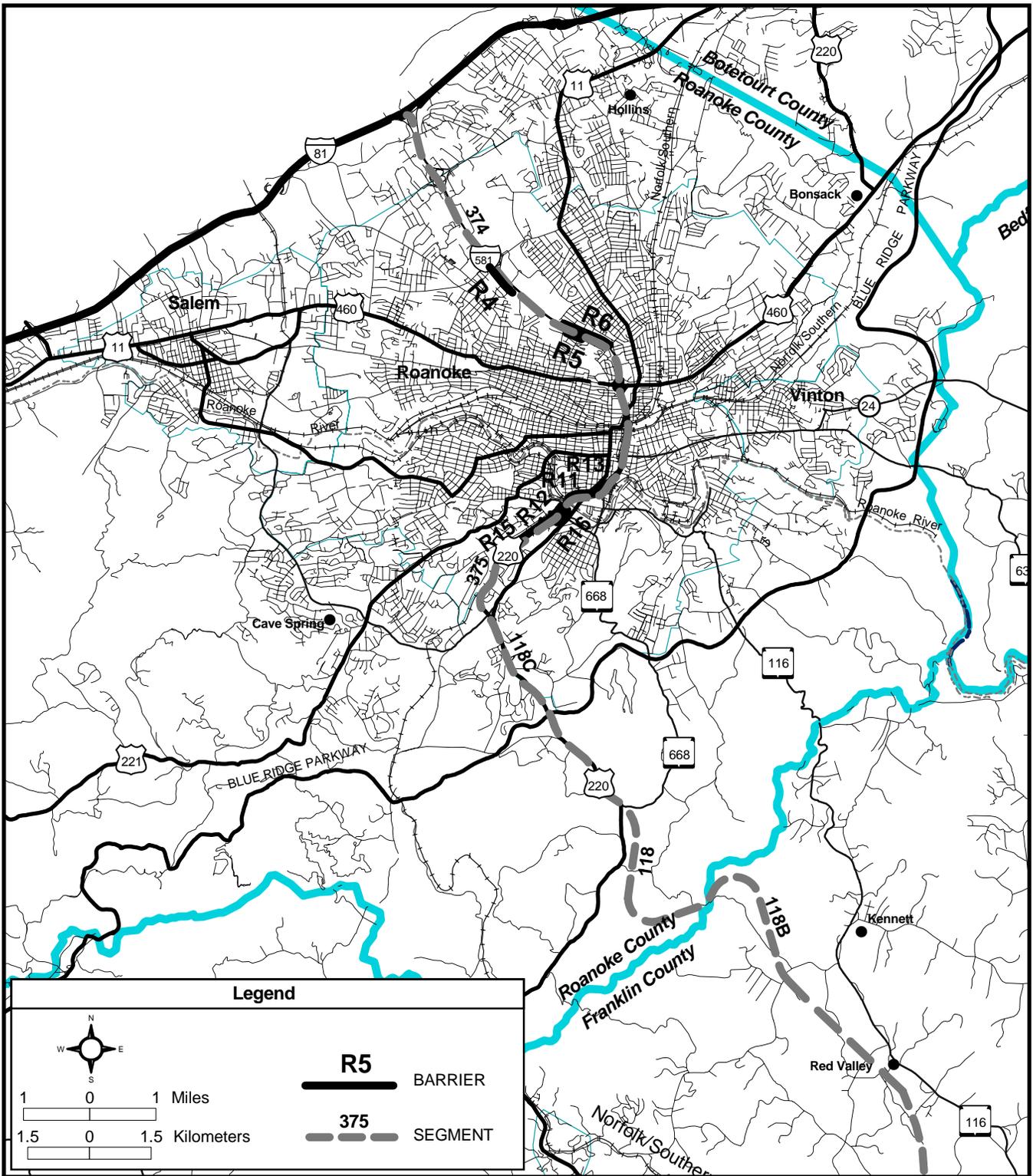
**Table 4.4-12
SUMMARY OF ACOUSTICALLY-EFFECTIVE BARRIERS - Option 4**

Segment	Site	County	Stationing
192A	R33	Franklin	696+00 to 740+00 E
349	R62	Henry	114+00 to 142+00 W
Total Estimated Cost Of Acoustically-Effective Barriers			
\$1,664,000			

**Table 4.4-13
SUMMARY OF ACOUSTICALLY-EFFECTIVE BARRIERS - ALC**

Segment	Site	County	Stationing
374	R3	Roanoke	300+00 to 315+00 W
374	R4	Roanoke	268+00 to 295+00 W
374	R5	Roanoke	202+00 to 215+00 W
374	R6	Roanoke	180+00 to 220+00 E
374	R8	Roanoke	90+00 to 180+00 W
375	R11	Roanoke	200+00 to 214+00 W
375	R12	Roanoke	173+00 to 192+00 W
375	R13	Roanoke	214+00 to 235+00 W
375	R15	Roanoke	146+00 to 168+00 W
375	R16	Roanoke	180+00 to 192+00 E
118C	R17	Roanoke	272+00 to 300+00 E
118C	R18	Roanoke	234+00 to 250+00 E
118C	R20	Roanoke	200+00 to 260+00 W
118C	R21	Roanoke	120+00 to 140+00 E
Total Estimated Cost Of Acoustically-Effective Barriers			
\$10,163,200			

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**FIGURE 4.4-1
NOISE BARRIER LOCATIONS
ADOPTED LOCATION CORRIDOR**



I-73 Location Study

Option 3

Twenty-seven sound barriers were considered for abatement evaluation pursuant to this option in the vicinity of R3, R4, R5, R6, R8, R11, R12, R13, R15, R16, R17, R18, R20, R21, R27, R29, R30, R31, R35, R42, R43, R47, R48, R54, R55, R56 and R60). These barriers are located in Roanoke, Franklin, and Henry counties. At an approximate cost of \$23.8 million, the 16-foot (4.9-meters) tall barriers with a total length of 86,900 feet (26,494 meters) would protect 426 residential properties. Of the 426 homes protected 148 homes would satisfy both acoustic and cost-effectiveness criteria. All feasible barriers associated with the chosen alternative (option) will receive further consideration.

Option 3a

Twenty-four sound barriers were considered for abatement evaluation pursuant to this option in the vicinity of R3, R4, R5, R6, R8, R11, R12, R13, R15, R16, R27, R29, R30, R31, R35, R42, R43, R47, R48, R54, R55, R56 and R60). These barriers are located in Roanoke, Franklin, and Henry counties. At an approximate cost of \$20.5 million, the 16-foot (4.9-meters) tall barriers with a total length of 77,900 feet (23,750 meters) would protect 395 residential properties. Of the 395 homes protected 183 homes would satisfy both acoustic and cost-effectiveness criteria. All feasible barriers associated with the chosen alternative (option) will receive further consideration.

Option 3b

Twenty-seven sound barriers were considered for abatement evaluation pursuant to this option in the vicinity of R3, R4, R5, R6, R8, R11, R12, R13, R15, R16, R17, R18, R20, R21, R27, R29, R30, R31, R35, R42, R43, R47, R48, R54, R55, R56 and R60). These barriers are located in Roanoke, Franklin, and Henry counties. At an approximate cost of \$23.8 million, the 16-foot (4.9-meters) tall barriers with a total length of 86,900 feet (26,494 meters) would protect 426 residential properties. Of the 426 homes protected, 148 homes would satisfy both acoustic and cost-effectiveness criteria. All feasible barriers associated with the chosen alternative (option) will receive further consideration.

Option 3c

Twenty-seven sound barriers were considered for abatement evaluation pursuant to this option in the vicinity of R3, R4, R5, R6, R8, R11, R12, R13, R15, R16, R17, R18, R20, R21, R27, R29, R30, R31, R35, R42, R43, R47, R48, R54, R55, R56 and R60). These barriers are located in Roanoke, Franklin, and Henry counties. At an approximate cost of \$23.8 million, the 16-foot (4.9-meters) tall barriers with a total length of 86,900 feet (26,494 meters) would protect 426 residential properties. Of the 426 homes protected 148 homes would satisfy both acoustic and cost-effectiveness criteria. All feasible barriers associated with the chosen alternative (option) will receive further consideration.

Option 4

Two sound barriers were considered for abatement evaluation pursuant to this option in the vicinity of R33 and R62. These barriers are located in Franklin, and Henry counties. At an approximate cost of \$1.7 million, the two barriers with a total length of 5,800 feet (1,768 meters) would protect 11 residential properties. Of the 11 homes protected none would satisfy both acoustic and cost-effectiveness criteria. All feasible barriers associated with the chosen alternative (option) will receive further consideration.

ALC

Fourteen noise barriers were considered for this alternative in the vicinity of fourteen sites (R3, R4, R5, R6, R8, R11, R12, R13, R15, R16, R17, R18, R20 and R21) where existing noise levels were predicted. All of the fourteen barriers considered are located in Roanoke County. The total length of the 16-foot (4.9-meters) tall barriers would be 39,700 feet (12,104 meters). At an approximate cost of \$10.2 million, these barriers would

protect 231 properties. Of the 231 homes protected 174 homes would satisfy both acoustic and cost-effectiveness criteria. All feasible barriers associated with the chosen alternative will receive further consideration during final design.

4.4.5 2025 Revaluation

Since the circulation of the DEIS in October of 2000, VDOT has extended the design year for the project from 2020 to 2025. As a result, the traffic data used for this analysis has been revised to reflect the new design year. The predicted 2025 traffic volumes for the ALC will only increase by 2.51 to 8.04 percent over the volumes used in the DEIS. However, this increase will have little or no effect on the noise levels predicted for the project because traffic volumes would need to double (100 percent increase) to result in a 3dBA increase in the predicted noise level. A 3 dBA increase is a barely perceptible increase of the predicted noise levels. Notwithstanding, when final design moves forward for the selected alternative, the design year will be extended again to ensure a minimum 20-year design and the traffic data and noise analysis updated as necessary.

4.4.5.1 Appalachian Trail Sites

Receptor sites R64, R65 and R66 are potentially affected by Options 1 and 1a. The noise analysis indicates that these sites would not experience noise impacts from the alternatives as defined by FHWA regulations. Therefore, no mitigation is required at these sites. Since the three sites are located at distances of 3,000 to 5,000 feet (915 to 1,524 meters) from Options 1 and 1a, noise from I-73 would dissipate to ambient or existing levels and not impact the Appalachian Trail. Instead, noise levels at the Trail will continue to be dominated by existing traffic from I-81.

4.4.5.2 Interior Noise

Schools, churches, libraries, museums and auditoriums have been evaluated for interior noise impacts in accordance with FHWA Noise Abatement Criteria applicable to Activity Category "E" sites which is 52 dBA L_{eq} (1 hour) under open window conditions. The following Category E sites (Table 4.4-15) along the I-73 corridor would exceed the FHWA interior NAC. However, since interior noise impacts are determined upon closed window conditions, any site currently equipped with air conditioning would be measured under closed window conditions. It is FHWA policy to subtract noise reduction factors, at least 20 dBA depending on the building material (e.g. frame, masonry, etc.), from the predicted exterior noise levels for those receptors that can maintain closed window conditions. For those sites that cannot maintain closed window conditions, retrofitting the impacted receptor with air conditioning will be considered during final design.

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**Table 4.4-15
IMPACTED CATEGORY "E" SITES**

Segment	Name	Options	County	Distance from Centerline (feet)	Noise Level (dBA)
105	Morningside Elementary School	3a	Roanoke	665	62
152	Burnt Chimney Elementary	1	Franklin	220	66
319	Morningside Church	3c	Franklin	330	66
374	Art Museum of Western Virginia Roanoke Valley Historical Society Science Museum of Western Virginia	2, 2a, 2b, 2c, 3, 3a, 3b, 3c, ALC	Roanoke	700	63
	Law Library Branch	2, 2a, 2b, 2c, 3, 3a, 3b, 3c, ALC	Roanoke	660	64
	Roanoke City Main Library	2, 2a, 2b, 2c, 3, 3a, 3b, 3c, ALC	Roanoke	750	63
382	Mount Calvary Church	3, 3a, 3b, 3c	Franklin	370	66
383	Bethlehem Church	3, 3a, 3b, 3c	Franklin	13	80
	Calvary Church	3, 3a, 3b, 3c	Franklin	330	66
388	Riverside Church	3, 3a, 3b, 3c	Henry	200	70
392	Grace Baptist Church	3, 3a, 3b, 3c	Henry	60	76

4.4.6 Construction-Noise

Project area noise levels will increase during construction of the proposed improvements. Construction noise differs from that generated by normal traffic due to differences in the spectral and temporal characteristics of the noise. The degree of construction noise impact will be a function of the number and types of equipment being used, and the distances between the construction equipment and the noise sensitive areas.

Generally, construction activity will occur during normal working hours on weekdays. Therefore, noise impact experienced by local residents as a result of construction activities should not occur during sleeping hours. Some impact will occur in the project vicinity where outdoor recreation takes place during normal working hours. As a result, parks and recreation areas in closest proximity to the project will be most affected.

A number of measures can be utilized in order to minimize noise resulting from construction activities. Such measures include, but are not limited to, the following:

- Equip any internal combustion engine used for any purpose on or related to the job with a properly operating muffler;
- Conduct truck loading, unloading and hauling so that noise is kept to a minimum;
- Route construction equipment and vehicles in areas that will cause the least disturbance to nearby receptors where possible; and
- Place continuously operated diesel-powered equipment, such as compressors and generators, in areas as far as possible from or shielded from noise-sensitive locations.
- Wherever possible, noise barriers to be constructed as part of the project will be constructed as soon as possible to allow the barriers to protect noise-sensitive areas from construction noise.

VDOT has developed a specification concerning construction noise that is applicable to this project. In summary, the specification requires the Contractor to limit construction noise levels to 80 decibels in noise-sensitive areas adjacent to the project area. Further, VDOT may monitor construction noise and require noise

abatement where exterior noise levels from construction operations exceed 80 decibels. Also, VDOT may prohibit or restrict work that produces objectionable noise between 10 P.M. and 6 A.M. Construction equipment cannot be altered such that noise levels will be greater than that of the original equipment. These provisions are contained in Section 107.14(b) 3 Noise⁽⁹⁾ and are reproduced below:

- “The Contractor’s operations shall be performed so that exterior noise levels measured during a noise-sensitive activity shall be not more than 80 decibels. Noise sensitive activity is any activity for which lowered noise levels are essential if the activity is to serve its intended purposes. Such activities include, but are not limited to, those associated with residences, hospitals, nursing homes, churches, schools, libraries, parks, and recreational areas.”
- “The Department may monitor construction-related noise. If construction noise levels exceed 80 decibels, the Contractor shall take corrective action before proceeding with operations. The Contractor shall be responsible for costs associated with the abatement of construction noise and the delay of operations attributable to noncompliance with these requirements.”
- “The Department may prohibit or restrict to certain portions of the project, any work that produces objectionable noise between 10 P.M. and 6 A.M. If other hours are established by local ordinance, the ordinance shall govern.”
- “Equipment shall in no way be altered so as to result in noise levels that are greater than those produced by the original equipment.”
- “When feasible, the Contractor shall establish haul routes that direct his vehicles away from developed areas and ensure that noise from hauling operations is kept to a minimum.”
- “These requirements are not applicable if the noise produced by sources other than the Contractor’s operation at the point of reception is greater than the noise from the Contractor’s operation at the same point.”

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