

ALTERNATIVES

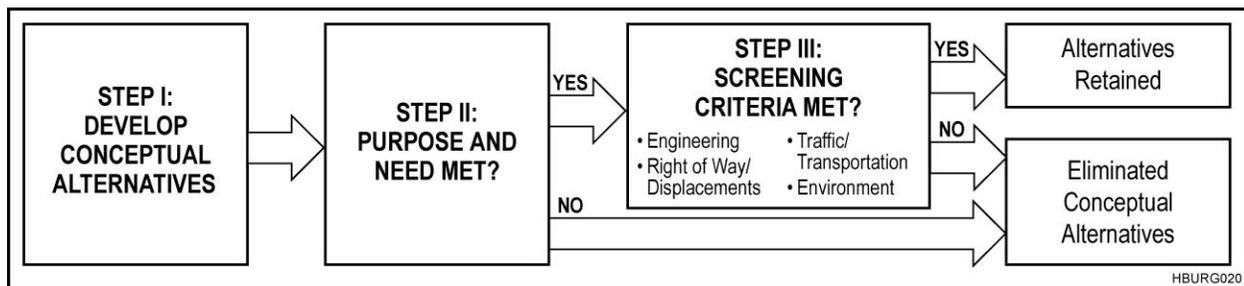
2.1 INTRODUCTION

This chapter presents the range of alternatives evaluated for the study, the process used to identify and screen the alternatives, and comparative discussions of the alternatives that were carried forward for detailed evaluation. The No-action, or No-build, Alternative was retained for detailed study consistent with National Environmental Policy Act regulations and to serve as a baseline for alternatives comparison. A wide range of other alternatives was considered initially, based on the identified purpose and need, suggestions received from citizens, proposals included in other local and regional planning efforts, and the conditions and constraints of the study area. A screening process was used to identify the alternatives to consider in detail, based on purpose and need, citizen input, environmental concerns, and engineering issues. Thus, the range of alternatives considered in detail in the Draft EIS includes the No-build Alternative and five Candidate Build Alternatives. Potential combinations of multiple Candidate Build Alternatives also are addressed in this chapter.

2.2 ALTERNATIVES DEVELOPMENT AND SCREENING

2.2.1 Alternatives Development Process

Figure 2-1 illustrates the step-by-step process used to identify and screen alternatives. This process involved developing a full range of alternatives that potentially could meet the identified transportation needs and then narrowing the options to a set of Candidate Build Alternatives for further consideration. Preliminary alternative concepts were presented at a Citizen Information Meeting held in March 2005. Input received at this meeting was taken into consideration in determining which alternatives were eliminated and which merited further study.



2.2.2 Review of Other Studies and Plans

Several other studies were reviewed to help identify conceptual alternatives that might meet the needs discussed in Chapter 1. The following bullets summarize these other studies; **Figure 2-2** illustrates highway facilities they recommended within the study area:

- The Harrisonburg Area Transportation Study (HATS) was the regional transportation plan prior to adoption of the current plan. It identified deficiencies in transportation mobility and capacity to the year 2015. The study recommended several new or upgraded highways, among them a southeastern bypass connecting the I-81/Route 257/Route 682 interchange with the intersection of U.S. Route 33 and State Route 276.
- In 2000/2001, the Harrisonburg-Rockingham Highway Advisory Committee (HRHAC) comprised of local citizens and community leaders studied transportation needs and alternatives to meet those needs in the study area. The HRHAC recommended a system of new and widened highways referred to as the “506 Plan.”
- Rockingham County’s Board of Supervisors adopted a comprehensive plan in 2004 (*Comprehensive Plan for 2020 and Beyond*), which calls for a transportation system that “will reinforce the pattern of new development” and a “connector road system around Harrisonburg ... to accommodate future traffic demand and provide a safe and efficient means of moving through and around the City[.]”
- The City Council of Harrisonburg similarly adopted a comprehensive plan (*Comprehensive Plan 2004 Update*), which includes implementation of a Master Transportation Plan that coordinates transportation facilities with land uses.
- The Harrisonburg-Rockingham Metropolitan Planning Organization (HRMPO), the regional transportation planning body, adopted a long-range multimodal transportation plan (*2030 Transportation Plan*) in August 2005. This plan replaces the HATS plan. Because the plan is financially constrained based on expected allocations of transportation funding, and because levels of expected funding will not meet all the transportation infrastructure needs in the region, there are relatively few projects in the study area that are currently funded for construction. However, the “Vision Plan” element identifies a number of new or widened roadways in the study area that would be included if adequate funding were available.

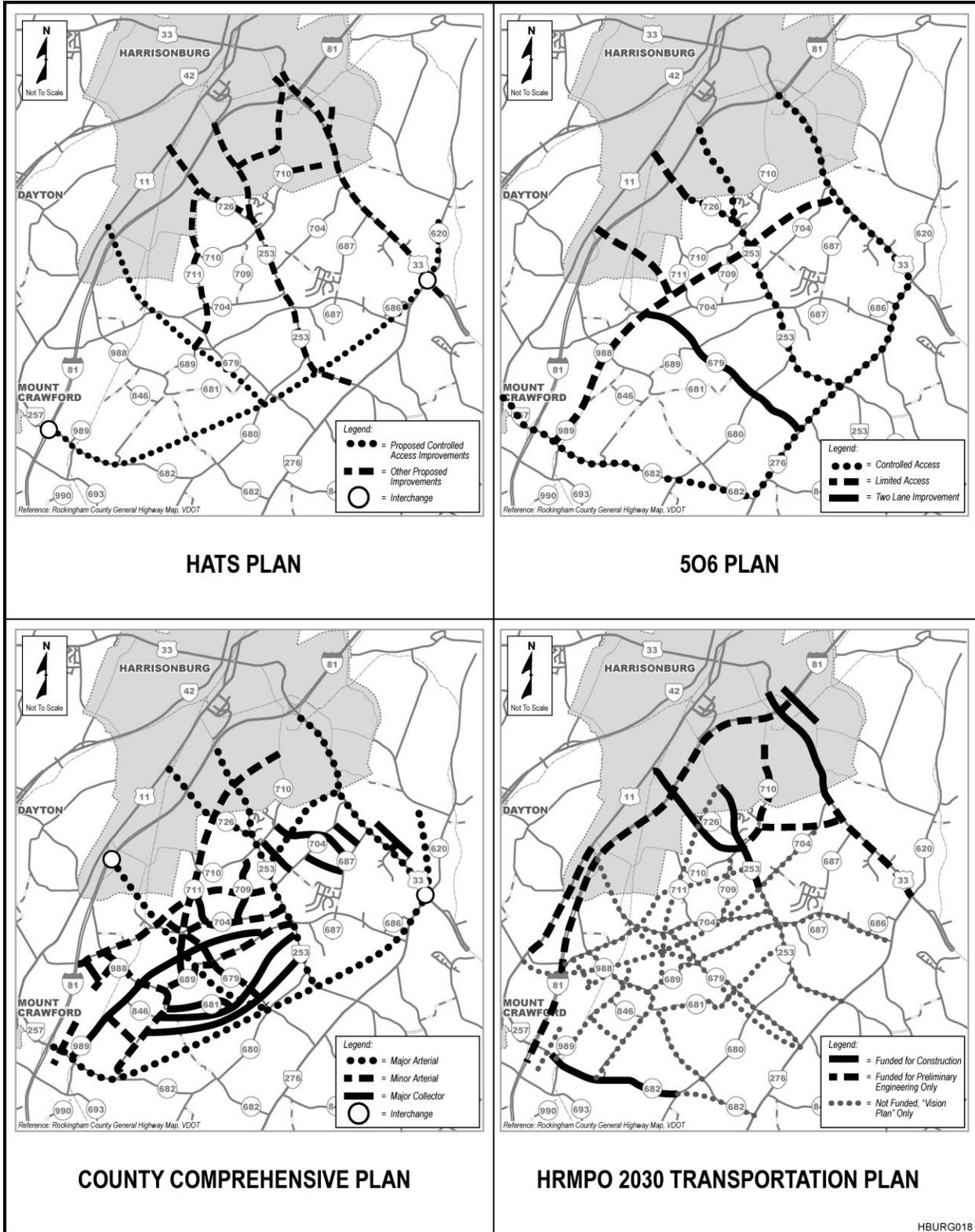
2.2.3 Scoping

The scoping process helped to identify the range of alternatives for study. During scoping, the following issues regarding alternatives were discussed:

- Non-highway alternatives, such as transit.
- Widening existing roads versus building new roads.
- Possible road alignment locations.
- Design criteria, typical cross section options, design features, and levels of access control (e.g., inclusion of bike trails or sidewalks, context-sensitive design, uncontrolled access versus limited access).

2.2.4 Preliminary Alternatives Development

Using aerial photo-base mapping, overlays of environmental constraints, citizen suggestions, and the results of previous studies, the study team developed preliminary alternative segments (see **Figure 2-3**). By connecting these segments, 37 end-to-end Preliminary Alternatives were possible.



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Harrisonburg Southeast Connector
 Location Study

OTHER STUDIES
 Figure 2-2

2.2.5 Screening Criteria

After reviewing the preliminary segments with citizens at a March 2005 Citizen Information Meeting, the study team used the criteria in **Table 2-1** to identify which segments to retain, eliminate, or modify:

Table 2-1
ALTERNATIVES SCREENING CRITERIA

Criteria related to purpose and need (see Chapter 1).	1. Improves east-west mobility. 2. Accommodates travel demand.
Criteria related to traffic operations and engineering.	3. Connects to existing roads or land uses at desirable locations; intersection patterns acceptable; constructible without excessive disruption of traffic flow. 4. Design criteria and standards for engineering features (curvature, grades) can be met; amount of earthwork not excessive; access to properties can be acceptably maintained.
Community impacts criterion.	5. Minimizes intrusion into or through neighborhoods; minimizes displacements of homes and businesses.
Historic property impacts criterion.	6. Minimizes impacts to historic properties, particularly the Cross Keys Battlefield.
Other environmental issues criterion.	7. Minimizes impacts to farmland and farming operations, streams and wetlands, and floodplains.
Criterion related to consistency with citizen recommendations and concerns.	8. Reflects citizen recommendations received at citizen information meetings and other sources.

2.3 ALTERNATIVES ELIMINATED FROM DETAILED STUDY

Through the alternatives screening, several concepts and alternatives were eliminated from further consideration and not carried forward in the environmental process for detailed study. **Table 2-2** lists the eliminated alternatives and reasons for their elimination.

Table 2-2
ALTERNATIVES ELIMINATED FROM DETAILED STUDY

Alternative or Segment(s)	Basis for Elimination
Transportation System Management (TSM) Alternative	“TSM” generally means implementation of relatively low-cost actions to improve efficiency of existing transportation systems. Examples include traffic controls, signal synchronization, turn lanes, parking management, access management, operational modifications, flexible work hours, van pools, transit scheduling, bicycle and pedestrian improvements, modifying driver behavior with incentives, pricing, or restrictions. Although such actions are important elements in the overall transportation plan for any urbanized area, there are none that would meet the identified needs for this study because the magnitude of the mobility needs and travel demands cannot be met with such minor actions. However, HRMPO’s <i>2030 Transportation Plan</i> includes several TSM-type projects in the study area (e.g., signal synchronization and access management along Route 33) that will contribute to the overall efficiency of the system.

**Table 2-2
 ALTERNATIVES ELIMINATED FROM DETAILED STUDY**

Alternative or Segment(s)	Basis for Elimination
Mass Transit Alternative	The population and employment densities and travel behavior within the study area are such that mass transit alone would not satisfy the identified needs. Furthermore, transit services need adequate infrastructure (i.e., roads) to run on. As discussed in Chapter 1, existing roads across the study are not adequate to serve passenger vehicles, let alone the buses that would be needed to implement transit. Transit services do serve important roles in the overall regional transportation system, but mainly in the more urbanized portions of the region where the JMU student population comprises a major portion of the ridership. HRMPO's <i>2030 Transportation Plan</i> includes several transit-related projects for the region.
HATS Alternative ¹	This conceptual alignment depicted in HATS begins at the I-81/Route 257/Route 682 interchange and curves across the southeastern portion of the study area (generally on new location and closely paralleling the county's urban growth boundary), and ends at the intersection of Routes 276 and 33. Investigations early in this study quickly showed that this alternative would have unjustifiable environmental consequences (e.g., major impacts to the Cross Keys Battlefield) and would require massive earthwork and landscape disturbance due to terrain crossed.
Segments 103, 104, 105, 107, and 114	These segments would serve more of a north-south than an east-west travel pattern and therefore do not adequately address east-west mobility. Furthermore, these segments would have large impacts to farming operations and were not supported by citizens.
Segment 115	The impacts of this segment on the Cross Keys Battlefield appear unwarranted in comparison to other available alternatives and the alignment has a "dogleg" that would require travelers to go south along 253 before being able to go east, resulting in a circuitous movement. A variation of this segment suggested by a citizen also was eliminated.
Segment 117	Although the alignment is direct, the impacts to the residential communities along Shen Lake Drive (Route 689) would be too severe.
Segments 110 and 113	These segments would have undesirable intersections with Route 33.
Segment 300	This segment requires a circuitous movement southward around the regional sanitary landfill before turning east, thereby not adequately serving the east-west pattern that is the focus of this study.

2.4 NO-BUILD ALTERNATIVE

The No-build Alternative is not a do-nothing alternative. Rather, it includes all transportation improvements in the study area that are funded for construction in the Harrisonburg-Rockingham Metropolitan Planning Organization's *2030 Transportation Plan* (adopted August 18, 2005) and in VDOT's current Six-year Improvement Program (see **Figure 2-4**). They include:

- **Friedens Church Road (Route 682).** Reconstruction and realignment of Friedens Church Road to a standard two-lane rural roadway from the I-81 interchange to Route 995 (Koiner Ford Road).

¹ The HATS alignment was a conceptual alignment, drawn without benefit of detailed mapping or knowledge of the Cross Keys Battlefield boundaries. It was part of a regional transportation plan as a concept, and never was intended as an actual proposed location for the highway. Nevertheless, the alignment was interpreted by some as the planned location for a major highway and it generated intense opposition from many in the community.

- **Stone Spring Road - Erickson Avenue Connector and Stone Spring Extension (Route 726).** This series of projects will create a continuous four-lane divided highway from existing Erickson Avenue on the west side of Harrisonburg to the intersection of Port Republic Road (Route 253) and Reservoir Street (Route 710) in Rockingham County on the east side of Harrisonburg. The city portion of the project includes bicycle and pedestrian facilities and reconstruction of the Pear Street railroad crossing.
- **Port Republic Road (Route 253).** In the city and the county, from Neff Avenue to Boyers Road (Route 704), Port Republic Road will be widened to four lanes. The city portion of the project will include pedestrian and bicycle facilities.
- **East Market Street (Route 33) Improvements.** Two projects will improve East Market Street, including six-lane widening from Cantrell Avenue to the existing six-lane section and bicycle, pedestrian, and turning lane enhancements from Cantrell Avenue to the eastern city limits.
- **Country Club Road.** A center turn lane will be added to Country Club Road from Linda Lane to Vine Street.
- **Transportation System Management (TSM).** Conduct an access management study along Route 33 east and coordinate traffic signals along Route 33, Route 11, and Route 253.
- **Transit Services.** Extend Harrisonburg Transit service to Bridgewater, conduct a regional transit study, and fulfill transit capital needs for bus replacements, transit shelters, and bus maintenance facilities.

In addition, the No-build Alternative includes transportation improvements proffered by Rockingham Memorial Hospital as part the site approval process for its proposed relocation to a 254-acre site in the north central part of the study area. Those improvements include the following:

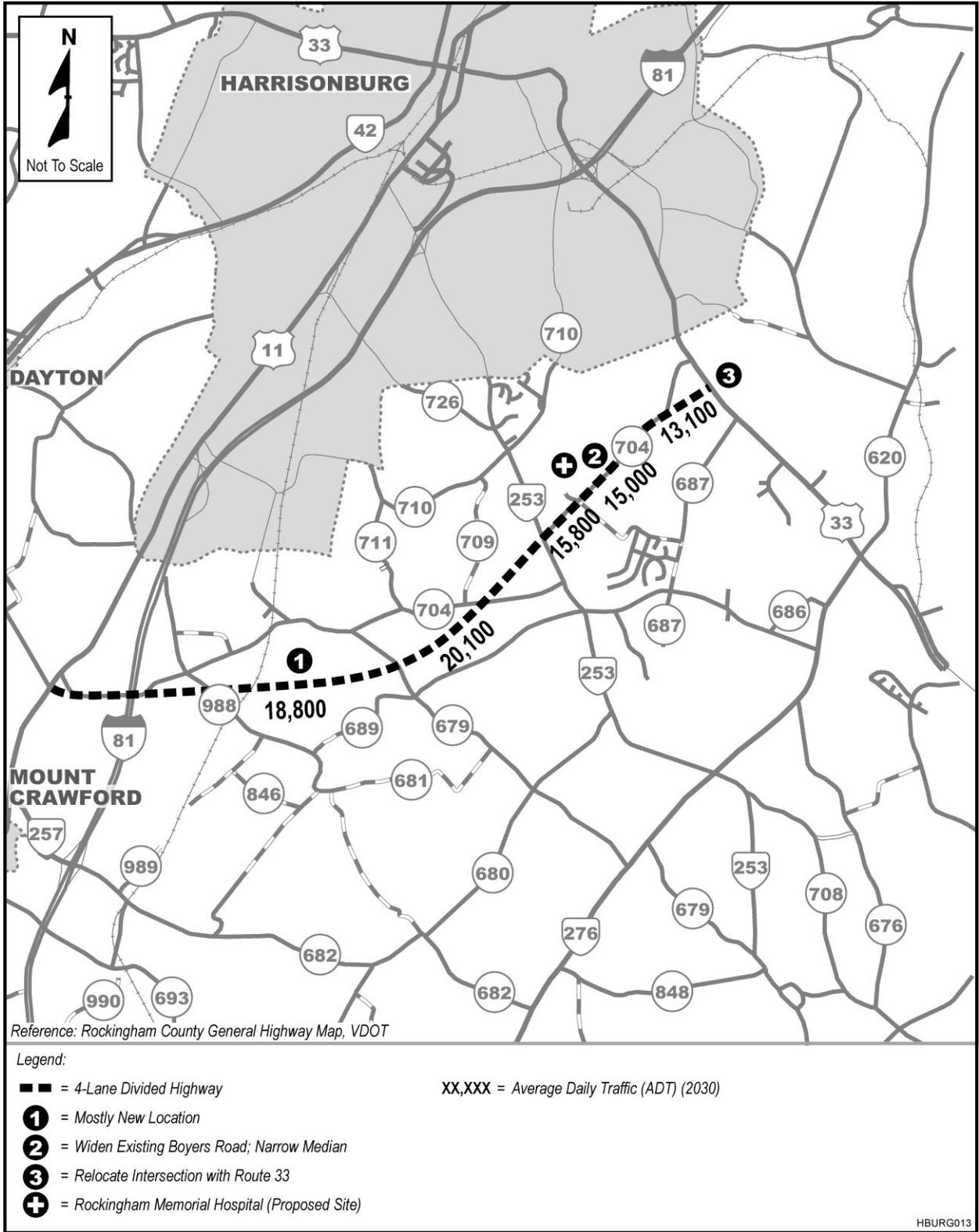
- Design and construction of an intersection including signalization at Port Republic Road and Stone Spring Road Extension.
- Design and construction of approximately 2,600 lineal feet (within a 200-foot right of way) of two lanes of a Stone Spring Road Extension from Port Republic Road to a point approximately 100 feet beyond the intersection with a realigned Reservoir Street. This includes a deceleration lane for entry to the hospital site and all rights of way and easements over the hospital property necessary for the construction of this 2,600-foot portion of the Stone Spring Road Extension.
- The design of a two-lane road for the Stone Spring Road Extension from Associated Developers' property to Port Republic Road.
- Design and construction of approximately 1,635 lineal feet of two lanes for an extension/realignment of Reservoir Street and an intersection (including deceleration lanes, turning lanes, and signalization) where the Stone Spring Road Extension and the Reservoir Street realignment intersect.
- Continuous dedicated turning movement (75-foot right of way) of approximately 1,400 lineal feet along the hospital property boundary with Port Republic Road.
- A deceleration lane on Boyers Road (Route 704) (35-foot right of way).
- Sidewalks for pedestrian mobility within the hospital site and safe and convenient connections for pedestrians to adjacent public roadways.

2.5 BUILD ALTERNATIVES CARRIED FORWARD

Figures 2-5 through 2-9 show the five Candidate Build Alternatives (CBAs) retained for detailed evaluation. Figure 2-10 shows typical cross sections for the CBAs used for planning purposes; however, the design elements of these cross sections are subject to change. Table 2-3 gives a summary comparison of the CBAs and the following text provides details. Section 2.7 discusses the traffic operations characteristics of the CBAs.

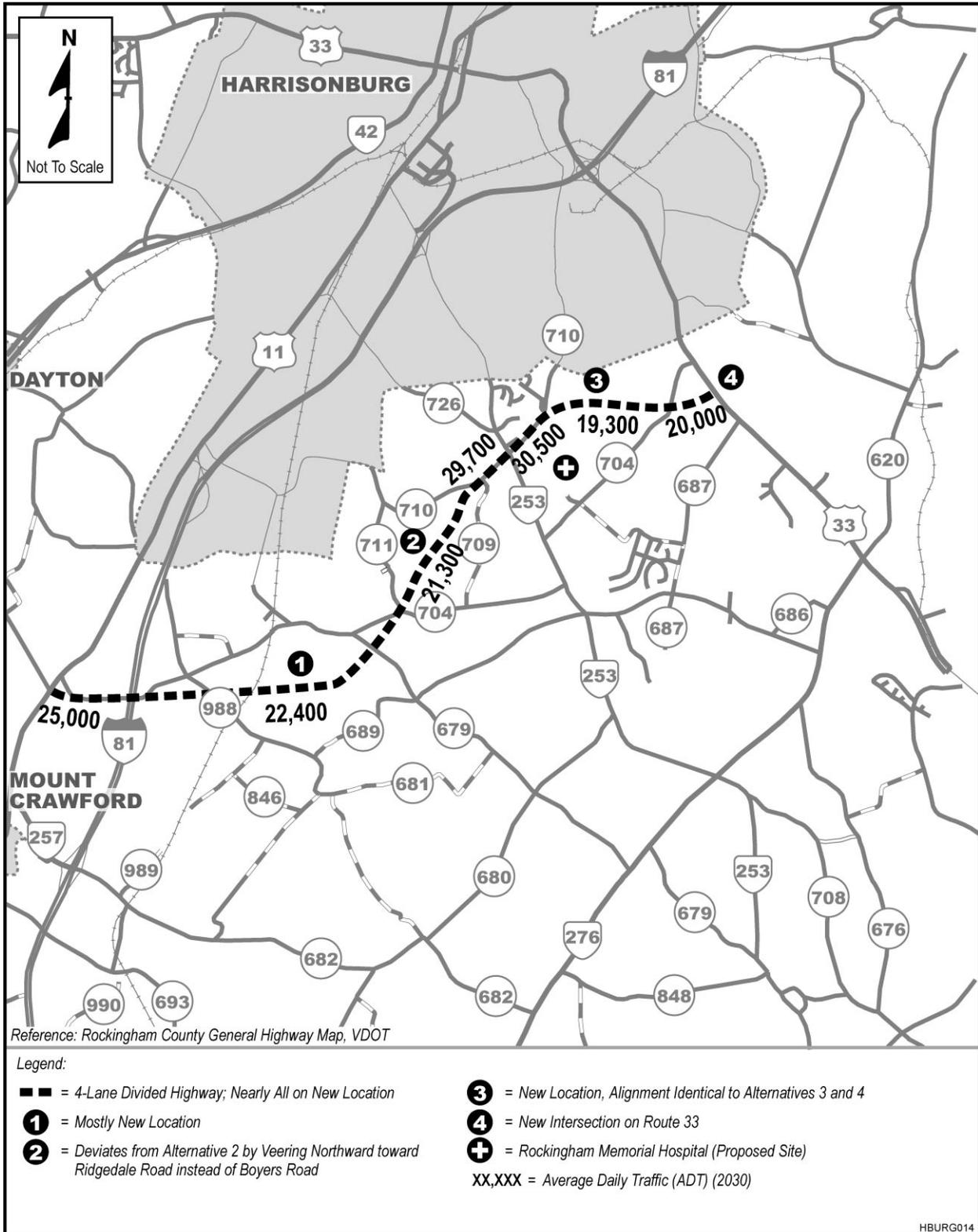
**Table 2-3
GENERAL DESCRIPTION OF CANDIDATE BUILD ALTERNATIVES**

	CBA 1	CBA 2	CBA 2A	CBA 3	CBA 4
General Location	Southern portion of study area, Rte 682 and Rte 276	Middle portion of study area, Rte 704 vicinity	Middle portion of study area, Rte 704 vicinity	Northern portion of Study Area, Rte 710/704 vicinity	Northern portion of Study Area, Rte 726/710/704 vicinity
From	I-81 at Exit 240, Rtes 257 and 682	U.S. Route 11 south of Rte 704	U.S. Route 11 south of Rte 704	U.S. Rte 11 at Exit 243, I-81 interchange	Route 726 near the Harrisonburg city limits
To	U.S. Rte 33 at Rte 276	U.S. Route 33 south of Rte 704			
Cross Section	4 lanes & median I-81 to Rte 681; 2 lanes from Rte 681 to Rte 276; 2 lanes within existing right of way from Rte 682 to Rte 689; 4 lanes & median from Rte 689 to Rte 33	4 lanes with median			
Level of Access Control	Controlled access, except for short limited-access section on new location, access management plan	Controlled access	Controlled access	Controlled access	Controlled access
Planning Corridor Width	500 feet I-81 to Rte 276; 80 feet along Rte 276 from Rte 682 to Rte 689; 500 feet from Rte 689 to Rte 33	500 feet	500 feet	500 feet	500 feet
Design Corridor Width	240 feet I-81 to 681; 120 feet 681 to 276; 80 feet along 276 from 682 to 689; 240 feet from 689 to 33	240 feet Rte 11 to Rte 253; 120 feet from Rte 253 to Rte 33	240 feet	240 feet	240 feet
Length of Corridor	8.6 miles	6.2 miles	6.5 miles	6.0 miles	3.1 miles
Right of Way Cost	\$52.8 million (Planning Corridor) \$31.2 million (Design Corridor)	\$67.3 million (Planning Corridor) \$31.1 million (Design Corridor)	\$46.0 million (Planning Corridor) \$24.3 million (Design Corridor)	\$58.7 million (Planning Corridor) \$39.4 million (Design Corridor)	\$17.6 million (Planning Corridor) \$10.9 million (Design Corridor)
Engineering/Construction Cost	\$41.4 million	\$47.2 million	\$49.8 million	\$57.1 million	\$24.1 million



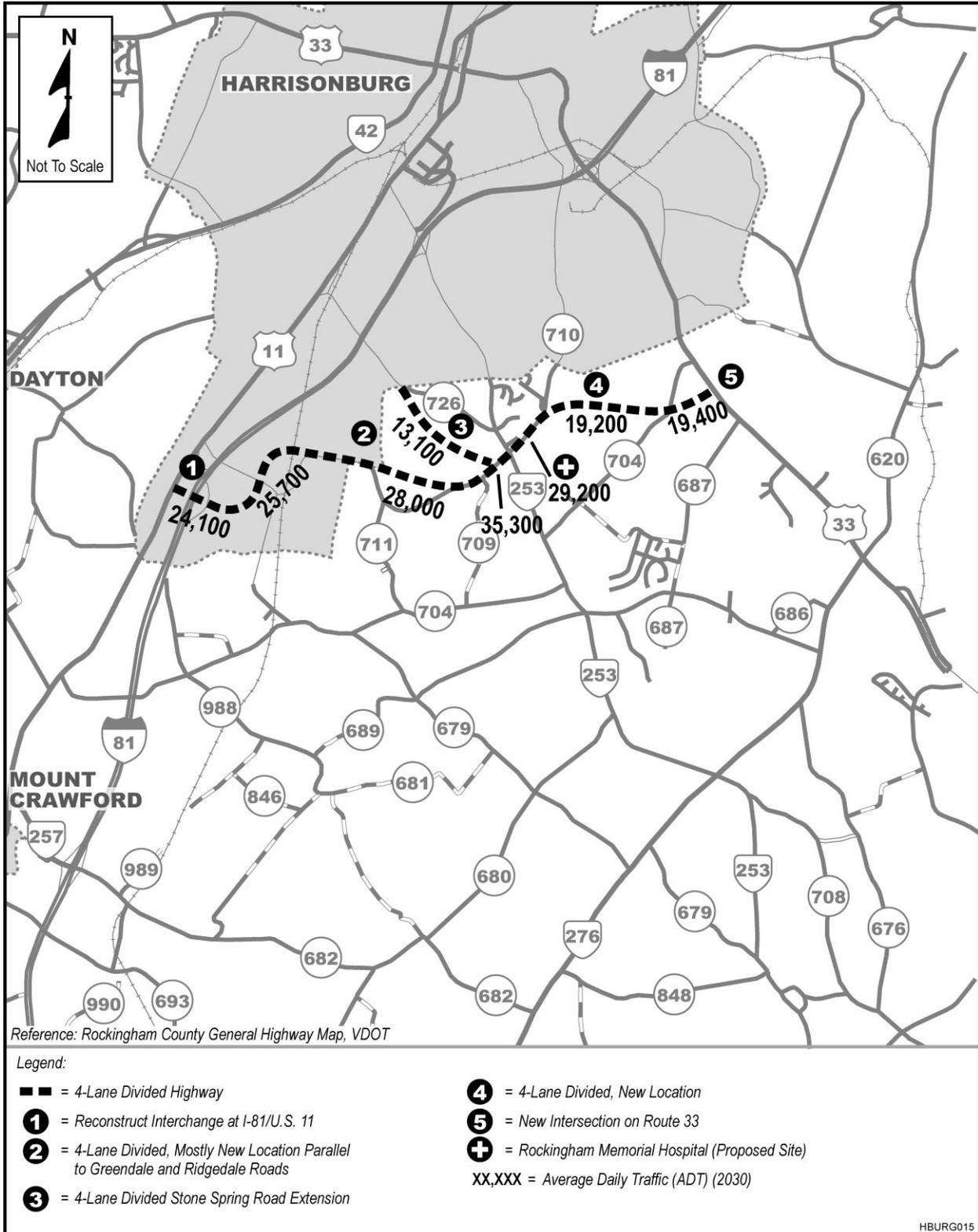
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CANDIDATE BUILD
 ALTERNATIVE 2
 Figure 2-6



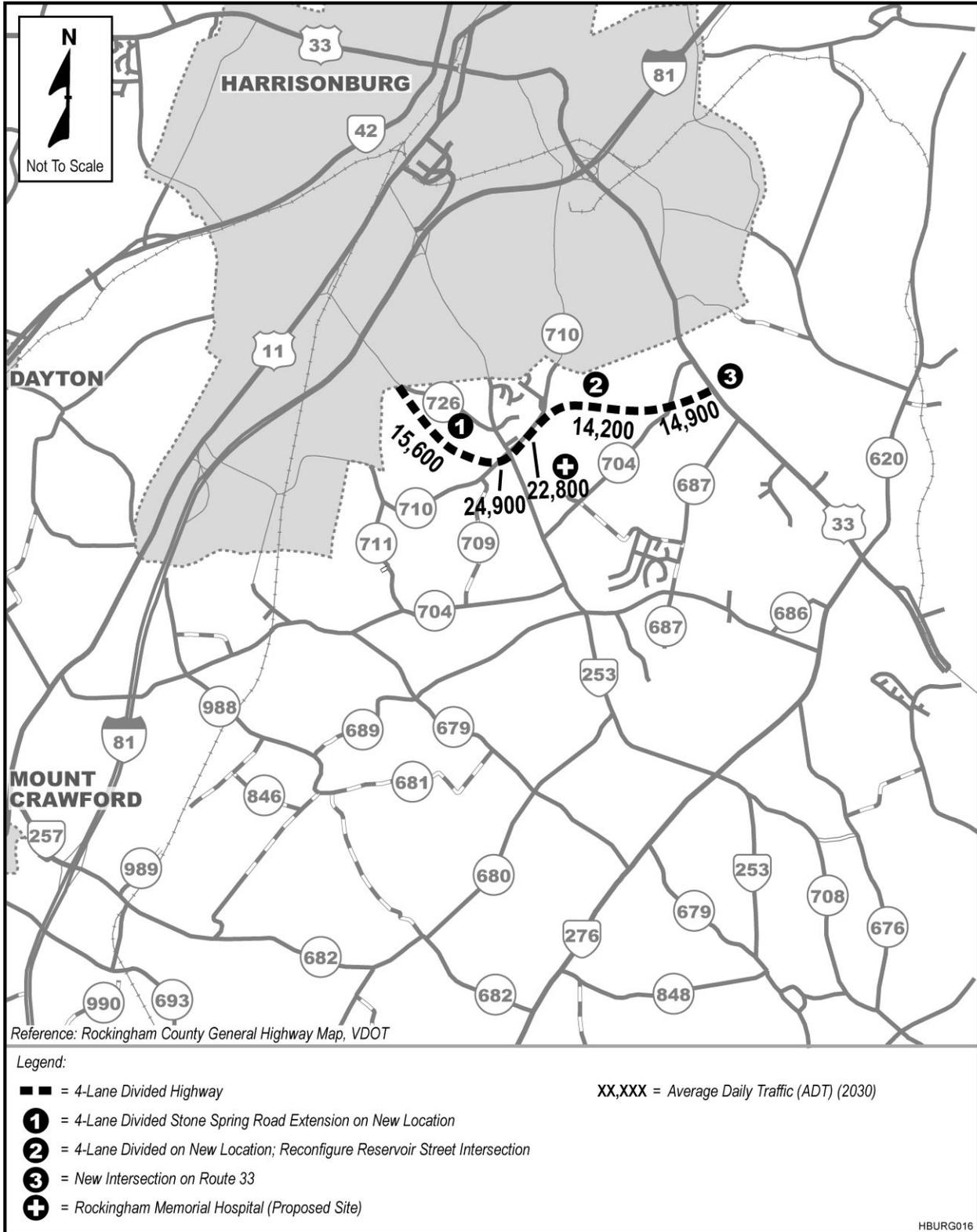
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CANDIDATE BUILD
 ALTERNATIVE 2A
 Figure 2-7



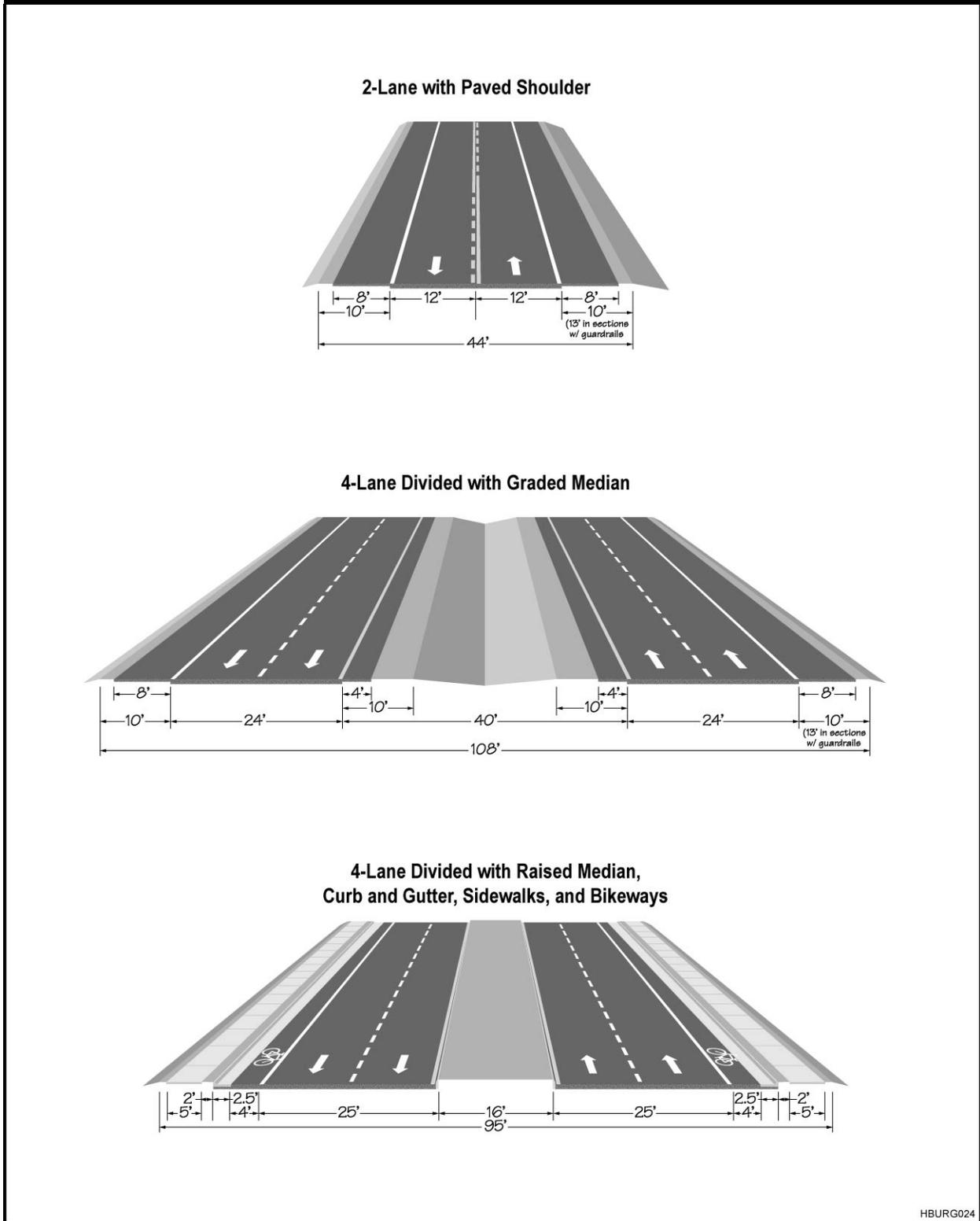
Harrisonburg Southeast Connector
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CANDIDATE BUILD
ALTERNATIVE 3
Figure 2-8



Harrisonburg Southeast Connector
 Location Study

CANDIDATE BUILD
 ALTERNATIVE 4
 Figure 2-9



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TYPICAL CROSS SECTIONS
Figure 2-10

2.5.1 Candidate Build Alternative 1 (CBA 1)

Beginning at the Bridgewater Route 257/682 interchange with I-81 (Exit 240) and ending at Route 33, CBA 1 follows an alignment along existing Route 682 (Friedens Church Road) and Route 276 (Cross Keys Road), except for a short section that would bypass the corner at Friedens Church. This alternative would involve widening the existing road to four lanes with a median and paved shoulders between I-81 and Route 681 (South Whitesel Church Road). From Route 681 to Route 276, the existing road would be widened and upgraded to a two-lane highway meeting rural minor arterial design standards, which provide for paved shoulders and alignment features to improve safety. Additionally, it is recommended that Route 682 be reclassified as a primary highway, similar to what was done with Port Republic Road recently. Route 276 would remain two lanes within the existing 80-foot-wide right of way to avoid and minimize effects on the Cross Keys Battlefield, but would be upgraded to provide paved shoulders and with possible spot improvements to improve safety. Between Route 689 (Shen Lake Drive) and Route 33, the existing road would be widened to four lanes with a raised median, curb and gutter, bike lanes, and sidewalks. Connections with all existing intersecting roads would be maintained; however, possibilities would be investigated for an access management plan to help reduce long-term proliferation of access points into individual properties. The section on new location near Friedens Church would have “limited access,” that is, no direct access to adjoining properties.

Basis for retaining CBA 1 for further study:

- Existing routes underlying this alternative already are used for substantial east-west travel in order to avoid congested conditions on Route 33 and I-81 and because it is convenient for the travel pattern between the southwest and northeast corners of the study area. However, the potential for these routes is limited by road design features not commensurate with the travel demand, particularly along Route 682.
- Conforms to recommendations from citizens during scoping and public involvement activities.
- Because of the sensitivity of the Cross Keys Battlefield, the planning and design corridor for this alternative through the Battlefield have been constrained to the existing 80-foot-wide right of way on Route 276.
- Forecasted traffic volumes for this alternative do not seem to justify four lanes for the entire length of the alternative over the planning period (to the year 2030). Thus, four-lane segments are limited to the ends closest to major transportation arteries (i.e., near I-81 and Route 33) where development is expected to be more intense, and thus traffic volumes higher.
- A portion of this alternative overlaps a project along Route 682 that is funded for construction in HRMPO’s *2030 Transportation Plan*. However, that project would leave Route 682 as a secondary road, whereas this alternative would upgrade it to a primary road connecting another primary road (Route 276) with I-81 and Route 11.
- The section of this alternative on new location would bypass a serious “dogleg” in existing Route 682 at Friedens Church.
- The access management features that would be developed should this alternative be selected would be consistent with the Battlefield Preservation Plan adopted by Rockingham County’s

Board of Supervisors and with the goals of the county's comprehensive plan to discourage intensive development outside the designated urban growth boundary.

- The paved shoulders provided for in the typical cross section would serve not only their normal safety and other functions, but could also be used by bicyclists.

2.5.2 Candidate Build Alternative 2 (CBA 2)

CBA 2 begins at Route 11 and follows existing Route 704 (Cecil Wampler Road) to just east of I-81. From there, it continues on new location, crossing Pleasant Run and curving northeastward to the intersection of Route 253 (Port Republic Road) and Route 704 (Boyers Road). The reasons for new location include avoiding the Pleasant Valley historic district and stream impacts to Pleasant Run. From Port Republic Road, the alternative follows existing Route 704 before veering off to connect with Route 33 at a location roughly 1,200 feet south of the present Route 704 intersection at Route 33. This alternative would involve constructing a four-lane road with a median (40 feet wide west of Port Republic Road, 16 feet wide east of Port Republic Road). It would not have an interchange with I-81, primarily because of the spacing relative to other existing interchanges and the remote probability of gaining approval for a new interstate access. It would have "controlled access," that is, access only at intersecting roadways and at property entrances to be determined.

Basis for retaining CBA 2 for further study:

- Provides a central route through the study area that would improve mobility between Route 11 and Route 33, as well as between industrial/commercial areas adjacent to Route 11 and I-81 and residential and commercial areas between Routes 253 and 33. Provides additional transportation capacity through the center of an area designated by the County for future growth, connecting with several secondary roads and providing access near the approved site for the relocation of the regional hospital.
- Parallels or overlaps Route 704, which, though it is discontinuous, already is used for substantial east-west travel through the study area. Much of this alignment is on new location to avoid disruption of residences and a historic district and to avoid a linear involvement with Pleasant Run, which drains much of the study area.
- Conforms to recommendations from citizens during scoping and public involvement activities.
- The alignment for this alternative overlaps a similar project in the "Vision Plan" portion of HRMPO's *2030 Transportation Plan*. Though current allocations of available transportation money do not permit funding at this time in the *Plan* for construction, or even preliminary engineering, the *Plan* nevertheless identifies it as a long-range transportation need to help address regional deficiencies.
- The paved shoulders provided for in the typical cross section would serve not only their normal safety and other functions, but could also be used by bicyclists.

2.5.3 Candidate Build Alternative 2A (CBA 2A)

CBA 2A is a variation of CBA 2. It begins at Route 11 and follows existing Route 704 (Cecil Wampler Road) to just east of I-81. From there, it continues on new location, crossing Pleasant Run and continuing toward Route 679 (Pleasant Valley Road). At Route 679 it veers northward, crosses Pleasant Run again and Route 704 (Osceola Springs Road), and continues to Route 710

(Ridgedale Road) near its intersection with Route 709 (Autumn Lane). From there, it follows the same alignment as CBAs 3 and 4 across Port Republic Road and extends to Route 33 at a location roughly 1,200 feet south of the present Route 704 intersection with Route 33. This alternative would involve constructing a four-lane road with a median. It would not have an interchange with I-81, primarily because of the spacing relative to other existing interchanges and the remote probability of gaining approval for a new interstate access. It would have “controlled access,” that is, access only at intersecting roadways and at property entrances to be determined.

Basis for retaining CBA 2A for further study:

- Same as for CBA 2, except that this alternative would provide more-direct access into the approved site for the relocation of the regional hospital.
- This alternative also would avoid displacements of homes along the Boyers Road portion of Route 704 between Route 253 and Route 33.

2.5.4 Candidate Build Alternative 3 (CBA 3)

CBA 3, beginning at Route 11 and ending at Route 33, follows portions of Route 710 (Greendale and Ridgedale Roads), but otherwise would be on new location. This alternative would involve constructing a four-lane road with a median 16 feet wide. The existing interchange at I-81 (Exit 243) would be reconstructed. [If CBA 3 is the selected alternative, additional traffic operational analysis will be needed to determine the best configuration for the interchange that will be acceptable to FHWA.] East of Port Republic Road, the alignment skirts the northern boundary of property to which Rockingham Memorial Hospital plans to relocate. The road would have “controlled access,” that is, access only at intersecting roadways and at property entrances to be determined. As with CBA 2, the intersection of Route 704 (Boyers Road) with Route 33 would be relocated southward about 1,200 feet. In addition, this alternative would include a spur connecting the new road with Route 726 (Stone Spring Road) to the north (i.e., a Stone Spring Road Extension on new location). Existing intersections of Stone Spring Road and Reservoir Street with Port Republic Road would be eliminated, with both connecting to the new road instead.

Basis for retaining CBA 3 for further study:

- The main line of this alternative in combination with the spur to Route 726 provides routes that would improve mobility across the northern portion of the study area between Route 11 and Route 33. A connection to I-81 also would be provided within a developed industrial/commercial area, and the more-direct route eastward from that connection would facilitate travel between it and other developed residential and commercial areas. Provides additional transportation capacity within the northern portion of the study area that already has experienced substantial growth, but will continue to grow in the future.
- Provides access to the approved site for the relocation of the regional hospital.
- Conforms to recommendations from citizens during scoping and public involvement activities.
- Portions of this alternative overlap a project to widen and relocate a section of Route 726, making it a four-lane divided facility between Route 11 and Route 253, that is funded for construction in HRMPO’s *2030 Transportation Plan*. Another portion of this alternative overlaps a section of road that Rockingham Memorial Hospital proposes to build for access to the hospital along the northern perimeter of its new site.

- The raised median/curb-and-gutter cross section proposed for this alternative reflects the more urbanized conditions in areas closer to Harrisonburg. The bikeways and sidewalks included in the cross section would facilitate bicycle and pedestrian movement through the corridor.
- The alignment configuration in the I-81 interchange area reflects avoidance of Pleasant Valley Elementary School and other site constraints.

2.5.5 Candidate Build Alternative 4 (CBA 4)

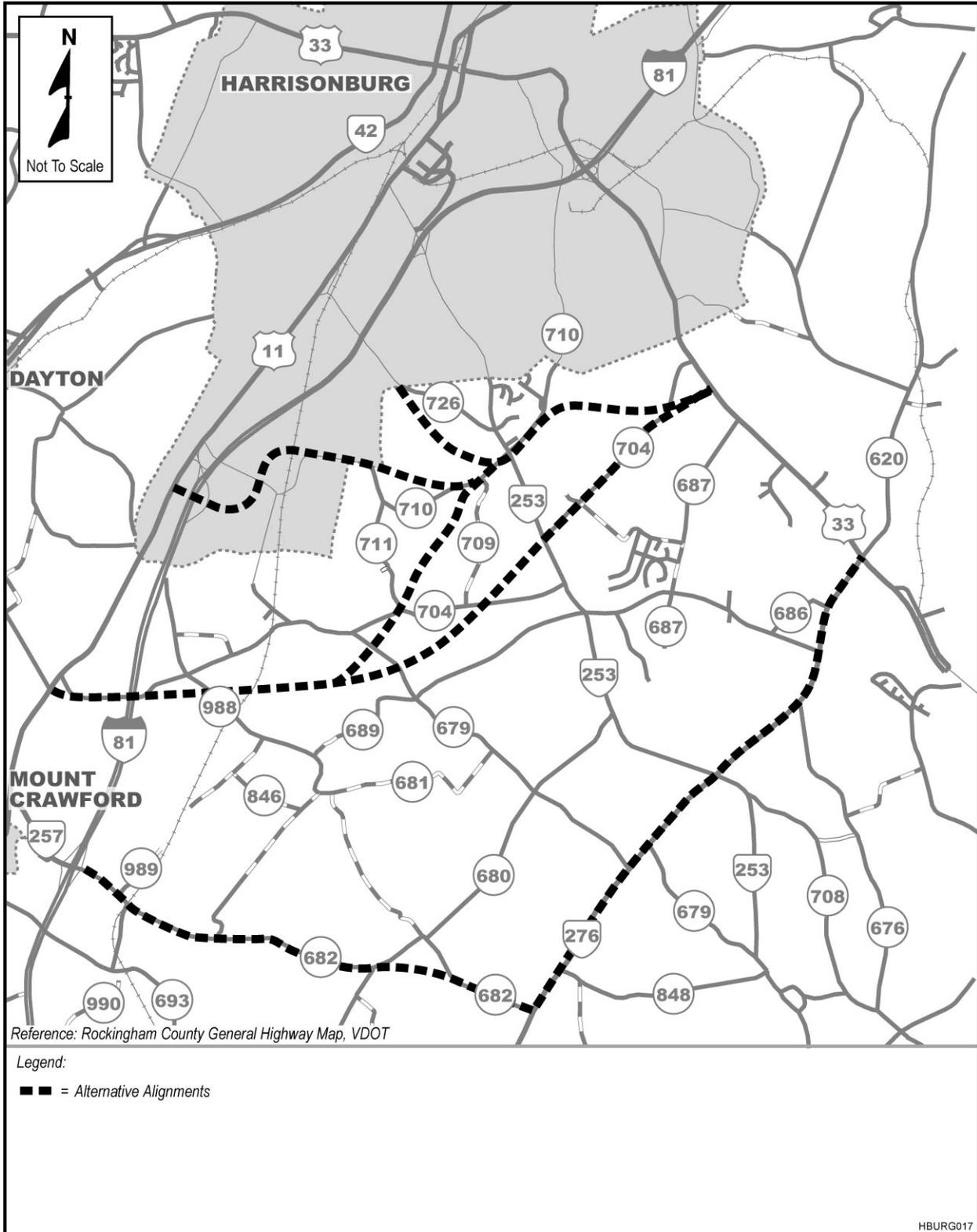
CBA 4, beginning on existing Route 726 (Stone Spring Road) near the City of Harrisonburg limits and ending at Route 33, would be mostly on new location. This alternative would involve constructing a four-lane road with a median 16 feet wide, which would connect with the City of Harrisonburg's proposed upgrade of Stone Spring Road. There would be no interchange with I-81. The road would have "controlled access," that is, access only at intersecting roadways and at property entrances to be determined. As with CBA 2 and CBA 3, the intersection of Route 704 (Boyers Road) with Route 33 would be relocated southward about 1,200 feet. Existing intersections of Stone Spring Road and Reservoir Street with Port Republic Road would be eliminated, with both connecting to the new road instead.

Basis for retaining CBA 4 for further study:

- Provides route that would improve mobility across the northern portion of the study area between Route 11 and Route 33 and between downtown Harrisonburg and commercial areas along Route 33. Provides additional transportation capacity within the northern portion of the study area that already has experienced substantial growth, but will continue to grow in the future.
- Provides access to the approved site for the relocation of the regional hospital.
- Conforms to recommendations from citizens during scoping and public involvement activities.
- Portions of this alternative overlap a project to widen and relocate a section of Route 726, making it a four-lane divided facility between Route 11 and Route 253, that is funded for construction in HRMPO's *2030 Transportation Plan*. Another portion of this alternative overlaps a section of road that Rockingham Memorial Hospital proposes to build for access to the hospital along the northern perimeter of its new site.
- The raised median/curb-and-gutter cross section proposed for this alternative reflects the more urbanized conditions in areas closer to Harrisonburg. The bikeways and sidewalks included in the cross section would facilitate bicycle and pedestrian movement through the corridor.

2.6 COMBINATION ALTERNATIVES

Combinations of the alternatives also are possible. Theoretically, all five alternatives could be implemented, as shown on **Figure 2-11**. However, a more likely combination might be something like CBA 1 plus CBA 4, which would provide both outer and inner connecting routes across the study area. For simplicity, all possible combinations have not been examined in detail in this document, but four possible combinations were tested to determine the potential traffic impacts of combining improvements across several alternatives. The tested combinations are as follows:



Harrisonburg Southeast Connector
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ALTERNATIVE COMBINATIONS
Figure 2-11

- Combination Alternative 1 + 4: Combination of CBA 1 and CBA 4.
- Combination Alternative 2 + 4: Combination of CBA 2 and CBA 4.
- Combination Alternative 1 + 2 + 4: Combination of CBA 1, CBA 2, and CBA 4.
- Combination Alternative 1 + 3: Combination of CBA 1 and CBA 3.

Traffic analyses using the regional transportation model indicate that the Candidate Build Alternatives would provide varying levels of transportation benefits. For example, the alternatives closer to the City of Harrisonburg and I-81 (CBA 3 and CBA 4) would add needed capacity in those areas but would not provide the same level of traffic relief to congested facilities farther from Harrisonburg, whereas CBA 1, CBA 2, and CBA 2A would provide those capacity benefits to the outer portion of the study area. In general, the combination alternatives would provide benefits throughout the study area. These benefits are discussed and quantified more fully in the next section.

2.7 TRAFFIC BENEFITS AND IMPACTS OF ALTERNATIVES

Based on traffic forecasts for the year 2030, each of the Candidate Build Alternatives would carry substantial volumes of traffic, as depicted in Figures 2-5 through 2-9 and as listed below. Depending on the section of road:

- CBA 1 would carry from 9,700 to 15,700 vehicles per day,
- CBA 2 would carry from 13,100 to 20,100 vehicles per day.
- CBA 2A would carry from 19,300 to 30,500 vehicles per day.
- CBA 3 would carry from 19,400 to 35,300 vehicles per day.
- CBA 4 would carry from 14,200 to 24,900 vehicles per day.

One way to judge the effectiveness of the alternatives is to look at the levels of service expected with each alternative compared to the levels of service presented in Chapter 1 (see Section 2.7.1 for explanation of the level of service concept). **Table 2-4** shows the levels of service on roadways that meet the deficiency threshold (i.e., level of service D or worse) if no transportation improvements at all are provided (the “Do Nothing” column in the table) and then, for those same roadways, it compares the levels of service expected for the No-build Alternative (the set of improvements provided for in HRMPO’s “2030 [Financially] Constrained Long Range Plan”), for each Candidate Build Alternative, and for several potential combinations of Candidate Build Alternatives.

As reflected in the table, the Candidate Build Alternatives, alone or in combination with other Candidate Build Alternatives, would affect traffic operations on study area roadways by providing more-direct routes for many east-west trips across the study area and by providing additional transportation capacity within the study area. However, in order to draw a more comprehensive picture of the transportation benefits and impacts of the alternatives, additional analyses were conducted. Study area mobility depends on the extent to which transportation improvements minimize travel times by providing a more direct route and/or a less congested route. Other transportation benefits result from the diversion of traffic from congested roadways in the study area. The analyses and comparisons described in the next subsections are focused on the extent to which the alternatives serve study area mobility and accommodate traffic volumes generated by existing and future development. The analyses are based on traffic forecasts from the approved regional transportation computer model, which incorporates estimates of future development, including the proposed Rockingham Memorial Hospital.

**Table 2-4
 LEVELS OF SERVICE**

Roadway	From	To	Level of Service												
			Do Nothing*	No-build**	CBA 1	CBA 2	CBA 2A	CBA 3	CBA 4	1 + 4	2+4	1+2+4	1+3		
Rte 682 (Friedens Church Rd)	I-81	N. River Rd	D	C	A	C	C	C	C	C	C	A	C	A	A
Rte 682 (Friedens Church Rd)	N. River Rd	S. Whitesel Ch Rd	D	C	A	A	A	A	B	A	A	A	A	A	A
Rte 682 (Friedens Church Rd)	S. Whitesel Ch Rd	Koaner Ford Rd	D	C	C	C	C	C	D	C	C	C	C	B	B
Rte 276 (Cross Keys Rd)	Friedens Ch Rd	Port Republic Rd	D	D	C	B	B	B	B	C	B	C	B	B	C
Rte 276 (Cross Keys Rd)	Port Republic Rd	Shen Lake Dr	F	F	C	B	B	B	B	C	B	C	B	C	C
Rte 276 (Cross Keys Rd)	Shen Lake Dr	Woods Rd	F	F	B	B	B	B	B	B	B	B	B	A	A
Rte 276 (Cross Keys Rd)	Woods Rd	Spotswood Tr	F	F	B	B	B	B	C	B	B	B	B	B	B
Rte 704 (Cecil Wampler Rd)	Valley Pike	Early Rd	E	E	C	B	B	B	B	C	C	C	B	B	B
I-81	Friedens Ch Rd	S. Main St	D	D	D	C	C	C	D	D	D	D	C	C	D
I-81	S. Main St	Port Republic Rd	D	D	D	D	D	D	D	D	D	D	D	D	D
I-81	Port Republic Rd	E. Market St	D	D	D	D	D	D	D	D	D	D	C	C	D
Rte 253 (Port Republic Rd)	Cross Keys Rd	Boyers Rd	E	E	E	E	E	E	E	E	E	E	E	E	E
Rte 253 (Port Republic Rd)	Boyers Rd	Ridgedale Rd	E	C	C	C	C	B	C	B	C	B	C	C	B
Rte 253 (Port Republic Rd)	Ridgedale Rd	Stone Spring Rd	E	C	C	C	C	D	B	B	B	B	B	B	B
Route 689 (Shen Lake Dr)	Port Republic Rd	Massanetta Springs Rd	D	D	D	D	D	D	D	D	D	D	D	D	D
Rte 704 (Boyers Rd)	Port Republic Rd	Spotswood Tr	C	D	A	B	A	A	A	A	A	A	B	A	A
Rte 710 (Ridgedale Rd)	Grassy Creek Rd	Autumn Lane	D	D	D	D	D	E	C	E	C	E	E	E	C
Rte 726 (Stone Spring Rd)	S. Main St	Port Republic Rd	D	C	B	B	B	B	B	C	B	C	B	B	B
Rte 710 (Reservoir St)	Port Republic Rd	Neff Ave	E	E	E	E	E	E	E	E	E	E	E	E	E
Rte 33 (Spotswood Tr)	Boyers Rd	Cross Keys Rd	D	D	C	C	C	C	C	C	C	C	C	C	C
CBA 2 (new-location section)	Cecil Wampler Rd	Port Republic Rd				A									
CBA 2A (new-location section)	Cecil Wampler Rd	Spotswood Tr						A							
CBA 3	S. Main St	Spotswood Tr									B				
CBA 4	Peach Grove Ave	Spotswood Tr												A	

NOTES: * Levels of Service from Technical appendix of HRMPO's 2030 Transportation Plan.
 **Levels of Service if construction projects in Constrained Long Range Plan are implemented (i.e., the No-build alternative for this study).

2.7.1 Analysis Methods

The transportation benefits of the alternatives would accrue at both the micro and macro level. Benefits at the micro level would be those related to detailed roadway and intersection/interchange operations as measured by standard traffic engineering level of service analyses. With detailed level of service analyses, traffic engineers assess operations based on detailed information including peak-hour traffic volumes, peaking characteristics, as well as roadway specifics such as lane configurations and widths, shoulder configurations, etc. This detailed analysis, where roadway operations are graded using a scale from A to F, with A representing excellent traffic flow with minimal delays and F representing failure in traffic operations and very high levels of delay, is typically used to support specific design features. While this analysis was used to assist in developing design features of the Candidate Build Alternatives, the level of detail associated with such analysis is typically not practical or useful to assess alternatives at a broad, study area scale.

For purposes of assessing the traffic impacts of the Candidate Build Alternatives at a study-area-wide scale, macro-level measures are more practical and informative. The macro-level mobility benefits of the Candidate Build Alternatives would accrue from two factors:

1. The extent to which the alternatives would provide more direct routes that support regional travel demand patterns; and,
2. The extent to which they would divert traffic from congested roads and thereby improve overall traffic operations in the study area.

The first factor can be quantified by the volumes of traffic that are forecast to use an alternative. For this analysis, year 2030 average daily traffic volumes on each segment of each Candidate Build Alternative were tabulated and the total number of vehicle-miles (one vehicle-mile is one vehicle traveling one mile) served by all segments of the alternative was calculated. While this provides a measure of total travel, this figure is skewed by the length of the alternative (i.e., longer alternatives would be expected to result in more vehicle-miles). Controlling for the length of the alternative, the average daily traffic volumes were calculated by weighting the volume on each segment by the length of the segment. This provides a good measure of the extent to which each alternative serves travel demands.

The second factor can be estimated by identifying the roadways from which traffic would be diverted and the extent to which these diversions would be from congested roads. To quantify this second factor, two measures of effectiveness were developed and calculated. The first identified roadway segments in the study area that are anticipated to experience congestion in 2030 (volume to capacity ratios of 1.0 or greater on the No-build network) and that would experience increases or decreases in daily traffic volumes of more than 1,000 vehicles per day as a result of the Candidate Build Alternative. This provides a proxy measure of the overall congestion effects, on an area-wide basis, of the various alternatives.

The second measure of effectiveness gauges the effects on all study area roads and weights these roads by the extent to which they are congested under the No-build Alternative. The number of vehicle-miles added or removed from study area roads by each of the Candidate Build Alternatives was calculated. The changes in vehicle-miles then were weighted by the expected level of congestion, based on roadway capacity conditions (under-, near-, or over-capacity). For those roadways expected to be operating at over-capacity conditions, the estimated change in vehicle-miles was multiplied by 1.0; for those roadways expected to be operating at near-

capacity conditions, the factor was 0.7; and for those roadways expected to be operating at under-capacity conditions, the factor was 0.1.² The factored changes in vehicle-miles then were summed for all roadway segments in the study area, resulting in a net factored change in vehicle-miles across the study area. This methodology allows for the effects of congestion to be accounted for in an overall weighting of the expected shifts in traffic within the study area.

2.7.2 Travel Demand for Candidate Build and Combination Alternatives

The average daily traffic volumes that would be served by each of the alternatives in the year 2030, as shown in **Table 2-5**, ranges from a low of approximately 11,500 vehicles per day to a high of approximately 21,600 vehicles per day. In general, those alternatives that are closer to the City of Harrisonburg and connect to the major retail areas in the southeast quadrant of Route 33 and I-81 are expected to carry higher traffic volumes. The highest average volumes of traffic are expected on CBA 2A and CBA 3. CBA 2A provides connections to Route 11 south of the City of Harrisonburg as well as the Route 33 retail areas. CBA 3 makes the same connections, but closer to the city. Forecasted traffic volumes for 2030 by segment for each of the Candidate Build Alternatives were displayed in Figures 2-5 through 2-9.

Table 2-5
TRAFFIC VOLUMES AND VEHICLE-MILES

Candidate Build Alternative	Approximate Length of Alternative (miles) *	Daily 2030 Volume (Weighted Average)**	Total 2030 Daily Vehicle-Miles
CBA 1	8.8	11,600	102,540
CBA 2	6.4	16,900	107,548
CBA 2A	6.6	21,600	142,719
CBA 3	5.7	21,600	121,902
CBA 4	3.1	16,800	51,773
Combination Alternative 1 + 4	11.9	12,200	145,448
Combination Alternative 2 + 4	9.5	16,600	149,471
Combination Alternative 1 + 2 + 4	18.3	11,500	205,113
Combination Alternative 1 + 3	14.5	13,100	189,200

* Approximate number of road-miles included in all segments of the alternative (including new and upgraded facilities). Note: these lengths do not necessarily match those in Table 2-3 because of slight differences in construction termini and traffic analysis termini.

** This is the average traffic served on all segments of the alternatives, weighted by the lengths of the segments. This provides a measure of traffic served per mile of alternative. Because of the weighting by segment length, the combination alternatives that make use of Alternative 1 (which includes longer sections of roadway relative to the closer-in alignments) will have average volumes closer to CBA 1 than could be expected using an unweighted average.

² The weighting factors were estimated based on the range of volume to capacity ratios included in each condition (under, near, and over-capacity) as well as analyses of congestion versus volume-to-capacity ratios. Mirroring the relationship between traffic volumes and congestion, the factors highlight the fact that an additional vehicle on an under-capacity roadway has a much smaller effect on roadway congestion than it would on an over-capacity roadway, and that the effect of an additional vehicle on a near-capacity roadway is closer to that which would be experienced on an over-capacity roadway than an under-capacity roadway.

2.7.3 Traffic Diversions for Candidate Build and Combination Alternatives

One of the primary benefits of all the Candidate Build Alternatives as compared to the No-build Alternative is the diversion of traffic from congested roadways in the study area to new facilities that would be designed to accommodate the forecasted demand. **Table 2-6** summarizes this diversion from congested roads for each of the Candidate Build and Combination Alternatives. Note that for some of the alternatives, traffic would increase on some over-capacity roadways in order to get to and from the roadways that comprise the alternatives. As Table 2-6 shows, CBA 2A would result in substantial traffic volumes (1,000 or more vehicles per day) diverting from the largest number of congested miles of road in the study area, 8.87 miles. CBA 3 and CBA 4, while providing additional capacity within the more congested roadways closer to the City of Harrisonburg and I-81, would not divert traffic away from these congested roads to the extent that the other alternatives would. The end result is that these alternatives are not expected to provide the same level of study-area traffic relief as CBAs 1, 2, and 2A would.

Combination Alternative 1 + 4, by providing improvements that are located both close to the City of Harrisonburg (CBA 4) and farther out (CBA 1), would reduce traffic on the second largest amount of congested roadway miles in the region (8.49 miles) while not creating substantial traffic increases on any congested roadways in the region. This indicates that it would provide a good mix of facilities to divert shorter, more localized trips occurring closer to the city as well as longer trips traveling to and from the edges of the study area. Combination Alternative 2 + 4, by contrast, would provide a higher degree of improvement within the busier, closer-in parts of the study area where traffic volumes are higher. The result would be greater overall volumes of traffic shifting from congested to uncongested roads, but because the improvements in this combination would be more geographically focused, the traffic would remain more concentrated, resulting in fewer congested roadway miles that would experience decreases of 1,000 or more vehicles per day.

Table 2-6
MEASURES OF EFFECTIVENESS

Alternative	Congested Miles of Road ¹ in Study Area With:		Congested VMT Factor ² (Rank)
	Traffic Reductions of 1,000 vpd or more	Traffic Increases of 1,000 vpd or more	
CBA 1	7.48	0.00	-19,148 (8)
CBA 2	8.15	1.29	-35,558 (4)
CBA 2A	8.87	0.56	-52,210 (1)
CBA 3	5.18	3.67	-23,742 (6)
CBA 4	3.79	0.00	-4,629 (9)
Combination Alternative 1 + 4	8.49	0.00	-23,691 (7)
Combination Alternative 2 + 4	8.15	0.96	-43,019 (3)
Combination Alternative 1 + 2 + 4	8.15	0.56	-43,284 (2)
Combination Alternative 1 + 3	5.91	3.67	-30,661 (5)

Notes:

[1] -- A congested road is defined as one operating at an over-capacity condition based on the planning-level service levels (developed using volume-to-capacity ratios).

[2] The congested VMT factor is the net number of vehicle-miles removed from congested facilities. The change in VMT for each link was factored based on the level of congestion in the No-build Alternative to reflect the extent to which facilities are congested. The factors used are: under-capacity=0.1, near-capacity=0.7, over-capacity=1.0.

The analysis associated with the measure of net change in vehicle-miles on congested facilities provides a composite measure of the congestion effects of diverting traffic on both near- and over-capacity roadways. This measure of effectiveness provides a good picture of the traffic impacts of the various alternatives, particularly the Combination Alternatives. The largest net decrease in factored vehicle-miles in the study area would result from the construction of Candidate Build Alternative 2A: a decrease of more than 52,000 daily factored vehicle-miles. Combination Alternative 2 + 4 and Combination Alternative 1 + 2 + 4 would provide net decreases of just over 43,000 daily factored vehicle-miles. While all of the alternatives are expected to provide net decreases, the lowest level of decrease would result from the construction of Candidate Build Alternative 4.

2.7.4 Summary of Traffic Benefits

Each of the Candidate Build Alternatives and Combination Alternatives would provide additional roadway capacity in the study area to support mobility demands and would support the transportation needs of existing and future development. The analysis of traffic utilization of the alternatives highlights the extent to which each would serve the study area’s transportation needs. CBAs 2A and 3 would be expected to carry the highest average daily traffic volumes in 2030, indicating that they would provide the highest degree of mobility for the study area. On an area-wide basis, CBA 2A also would provide the highest degree of overall net relief to the study area’s congested roadways, providing a substantial benefit to overall mobility. **Table 2-7** summarizes the key advantages and disadvantages of each alternative from a traffic and transportation standpoint.

Table 2-7
SUMMARY OF KEY TRANSPORTATION ADVANTAGES AND DISADVANTAGES

CBA 1	<ul style="list-style-type: none"> • Low end in terms of regional traffic volume served. • Reduces traffic on congested regional facilities including I-81 & Route 33 (2,000-2,500 vehicles per day). • Also diverts traffic from the south end of Route 253 and Route 704 (1,500-2,500 vehicles per day).
CBA 2	<ul style="list-style-type: none"> • Average traffic served is in the middle of the range for all alternatives (16,200 vehicles per day). • Middle of the range in terms of net reduction of traffic on congested study area roadways. • Reduces traffic on I-81 and Route 33 (north of Route 704), Route 689, Route 682, and Route 276. • Increases traffic on Route 11 south of Route 704 (traffic accessing the new facility) and on Route 33 south of Route 704 (diverted from Route 689).
CBA 2A	<ul style="list-style-type: none"> • Tied with CBA 3 for highest weighted average daily traffic volume served. • High in terms of providing relief to congested regional roadways. • Reduces traffic on I-81 & Route 33 (north of Route 704), 689, Route 682, and Route 276. • Increases traffic on Route 11 south of Route 704 (traffic accessing the new facility), on Route 33 south of Route 704 (diverted from Route 689), and on Route 253 and Route 710 for traffic getting to the new facility.
CBA 3	<ul style="list-style-type: none"> • High end in terms of regional traffic served. • Low in terms of reducing traffic on congested facilities. • Reduces traffic on Route 11 south of Route 704, Route 704, and Route 11 and I-81 north of where this alternative would connect to Route 11 and I-81. • Increases traffic on I-81 south of the project tie-in and on Route 33 south of Route 704. • Substantial localized benefit for Route 33 near I-81.

Table 2-7
SUMMARY OF KEY TRANSPORTATION ADVANTAGES AND DISADVANTAGES

CBA 4	<ul style="list-style-type: none"> • Mid-level in terms of average daily traffic volume served. • Benefits in terms of reducing traffic on other roadways is the most localized of all alternatives; traffic reductions on Neff Avenue, University Boulevard, East Market Street (Route 33), and I-81 north of Route 253.
Combination Alternative 1 + 4	<ul style="list-style-type: none"> • Combination of close-in CBA 4 and CBA 1 at the edge of the study area results in decreased traffic on almost all other study area roadways. This is reflected in the high ranking in terms of net reduction in congested vehicle-miles in the study area.
Combination Alternative 2 + 4	<ul style="list-style-type: none"> • Similar to Combination Alternative 1 + 4 in diverting traffic from most roadways in the study area. • As with CBA 2, this alternative would provide a high level of relief to I-81; traffic accessing the CBA 2 alignment, however, has the potential to increase congestion on Route 11 south of Route 704 and on Route 33 south of Route 704.
Combination Alternative 1 + 2 + 4	<ul style="list-style-type: none"> • Similar to Combination Alternative 2 + 4, but the addition of the improvements to Routes 682 and 276 of CBA 1 would lessen the pressures on Route 11 south of Route 704 and on Route 33 south of Route 704 that the previous alternative could create.
Combination Alternative 1 + 3	<ul style="list-style-type: none"> • CBA 3 alone is expected to increase traffic volumes on congested I-81 south of Exit 243. This Combination Alternative also would add volumes on congested I-81, but the increases would be lessened by providing the CBA 1 improvements on Routes 682 and 276.