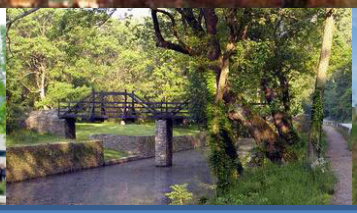
# East Gateway
# Land Use Vision Study

## *Transportation Component*


***Prepared for***

*Hagerstown / Eastern Panhandle Metropolitan Planning Organization*
*Hagerstown, Maryland*

***Prepared by***

*Michael Baker Jr., Inc.*
*Linthicum, Maryland*

***Draft***
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# Table of Contents

**Study Overview and Work Tasks ..... 1**

**Existing Conditions – Transportation Component ..... 3**

Overview ..... 3

Travel Characteristics ..... 4

Current Traffic Conditions ..... 6

Assessing Current Conditions ..... 8

**Issues Identification and Concerns – Transportation Component ..... 9**

Overview ..... 9

Transportation Safety ..... 9

Existing Traffic Congestion ..... 12

Future Traffic Congestion ..... 13

Other Transportation Modal Needs ..... 16

**Plan Recommendations – Transportation Component ..... 18**

Overview ..... 18

The Project Development Process ..... 18

Process for Identifying Conceptual Projects ..... 19

Strategy Recommendations - Overview ..... 21

Short Term Highway Project Recommendations ..... 23

Recommendations for Additional Travel Lanes ..... 26

Recommendations for New Integrated Road System ..... 27

Recommendations for a New Interchange ..... 32

Recommendations for Other Intersection Improvements ..... 33

Recommendations for Transit Improvements ..... 35

Addressing Access Management ..... 37

Roadway Streetscape and Beautification ..... 38

Transportation Project Funding Issues ..... 39

**Appendix A: East Gateway Corridor Transportation System**

**Appendix B: East Gateway Corridor Recommended Roadway Improvement Projects**

**Appendix C: East Gateway Study – Traffic Operations Analysis**

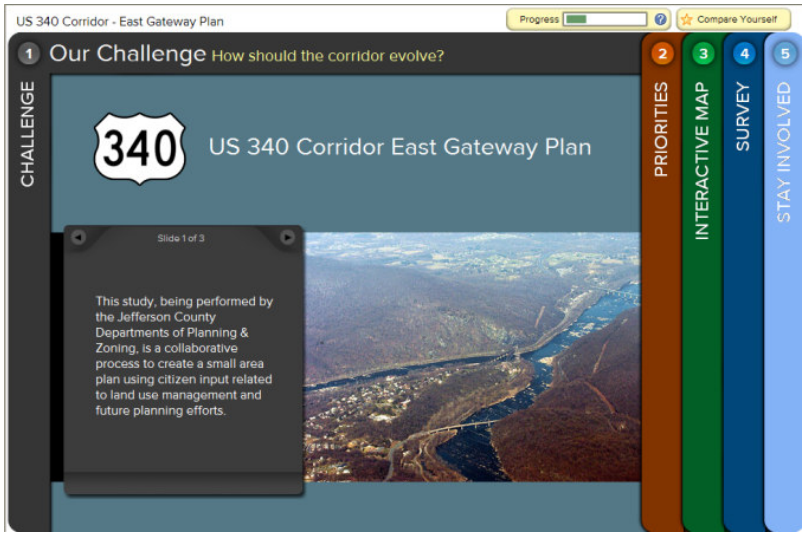
# List of Exhibits

Exhibit 1: Worker Inflow/Outflow for the East Gateway Corridor....4
Exhibit 2: HEPMPO US 340 Cordon Survey (October 2002)....5
Exhibit 3: Summary of East Gateway Study Survey Responses....6
Exhibit 4: Existing Average Daily Traffic Volumes....7
Exhibit 5: Summary of US 340 Traffic Speeds by Season and Time Period....8
Exhibit 6: Priority Levels for Transportation Needs....9
Exhibit 7: US 340 Fatalities Within The East Gateway Corridor....10
Exhibit 8: Un-Signalized Intersection Approaches of Concern....11
Exhibit 9: Peak Congested Speeds and Traffic Queuing on US 340....12
Exhibit 10: HEMPO Regional Travel Demand Model....14
Exhibit 11: Analysis Results of Future Traffic Growth Scenario....15
Exhibit 12: Benefits of Transportation Options....16
Exhibit 13: The Transportation Planning Process....19
Exhibit 14: Public Input for Transportation Needs and Strategies....20
Exhibit 15: Improvements Most Needed Along the US 340 Corridor....20
Exhibit 16: Harpers Ferry Bridge (Susquehanna River)....21
Exhibit 17: Summary of Recommended Roadway Improvement Projects....22
Exhibit 18: Examples of Advanced Warning Flashers....23
Exhibit 19: Improvement Project Types for Un-Signalized Intersections....24
Exhibit 20: Example RCUT Intersections....25
Exhibit 21: USCPB Proposed Intersection Improvements – Option 1....26
Exhibit 22: US 340 Turning Lane Extension (WV 9 to Jefferson Terrace Road)....27
Exhibit 23: Stressing Options and Attractiveness for New Roadway Design....28
Exhibit 24: Potential US340 Right-of-Way....28
Exhibit 25: Recommended Improvements Near US 340 and Millville-Bakerton Intersection....29
Exhibit 26: Additional Frontage Roads on Western Portion of US 340....30
Exhibit 27: Alternative East-West Roadway Linkages in Northern Sections of Corridor....31
Exhibit 28: Additional Access Roads to Shenandoah Springs....32
Exhibit 29: US 340 and Country Club Road Intersection....33
Exhibit 30: Flowing Springs / East 5th Avenue / WV 9....34
Exhibit 31: Bakerton Road Railroad Underpass....35
Exhibit 32: Transit Improvement Recommendations....36
Exhibit 33: Where Workers Are Employed Who Live in East Gateway Corridor....36
Exhibit 34: Components of Streetscape Design....38
Exhibit 35: Estimated Cost of Recommended Improvements....39

# Study Overview and Work Tasks

The purpose of this work effort was to assist the Hagerstown/Eastern Panhandle Metropolitan Planning Organization (HEPMPO) and the Jefferson County Planning Department in assessing future transportation needs in support of the East Gateway Land Use Vision Plan for the US 340 corridor. Michael Baker Jr. Inc. (Baker) performed the following tasks as part of this study:

1. Developed a Phase I interactive website to collect public input on corridor priorities, strengths and weaknesses, and insights on project improvements. The website was active for two months and was followed by a summary of the data and responses obtained through the effort. Comments received through the interactive map section of the website were summarized as GIS "shape" files.

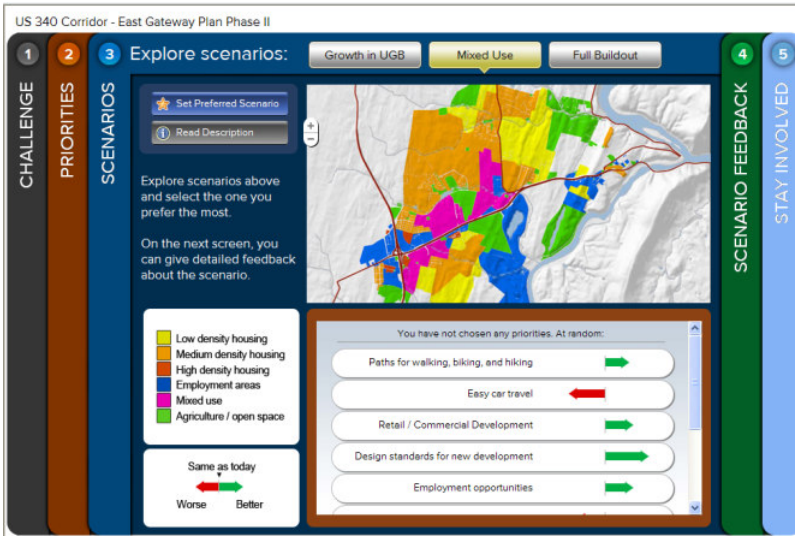



*Phase 1 Metroquest-based Interactive Website*

2. Provided support materials and data for stakeholder and public meetings. Baker conducted an evaluation of current traffic conditions that included the acquisition and summary of TomTom GPS historical travel speeds, collection of WVDOT traffic counts, field visits and manual counts at select locations, and review of CENSUS employment records.

3. Performed an initial evaluation of alternative land use scenarios using the regional travel demand model. This included translating land use scenarios into demographic forecasts for input to the model, enhancing the regional travel model network and zone structure within the study area, conducting travel model runs, and producing summaries of land use impacts on regional vehicle miles of travel (VMT) and congestion.

4. Developed a Phase II interactive website to collect public input on three alternative land use scenarios for the corridor including scenario preference and specific comments through an interactive map overlay. Results from regional travel modeling were incorporated as key performance measures comparing each scenario. Similar to Phase I, comments received through the interactive map section of the website were summarized as GIS files.




*Phase I1 Metroquest-based Interactive Website*

5. Conducted more detailed traffic and simulation analyses on existing and future conditions along US340 based on the preferred land use scenario developed by the Jefferson County Planning Department. The analyses utilized the Highway Capacity Software (HCS), Synchro and Simtraffic analysis tools. Future conditions were estimated based on traffic volume growth forecasted by the regional travel demand model runs. Summaries of existing and future corridor performance measures were prepared and evaluated to determine the need for transportation improvement projects.

6. Prepared and led a January 19th public work session in Charles Town to identify and evaluate transportation improvement projects within the corridor. These work efforts included working closely with the Jefferson County Planning Department to develop a draft project list and preparing presentation and meeting materials.

7. Developed a final project list based on project public involvement, stakeholder input, and technical analyses. Performed additional modeling and traffic analyses to address potential impact of safety improvements at unsignalized intersection locations.

8. Provided support to Jefferson County Planning Department in preparing documentation for the East Gateway Land Use Vision Study. Baker was responsible for preparing documentation for the transportation component including sections on existing conditions, issues and concerns, and recommendations.

This report includes documentation on the transportation component of the land use study. The report summarizes corridor traffic conditions for current and future conditions and provides a summary of the key data used within the traffic analyses. Based on the analyses and public input, project recommendations are summarized and evaluated. Additional issues regarding the project development process and funding are also addressed within the recommendations section. Most of the text provided in this document was incorporated into the final report prepared by Jefferson County.

# Existing Conditions – Transportation Component

***Overview***

This section discusses the transportation system within the East Gateway corridor including key roadways and available transit bus and rail service. Although they can have an impact on regional transportation, bike and pedestrian trails are not addressed within this section. Such improvements and associated discussions are included within the *Parks, Trails and Greenways* section of the full study document prepared by Jefferson County.

**Appendix A** provides a fold-out map illustrating the key roadways within the corridor. The map illustrates signalized intersections, speed limits and travel lanes along U.S. Route 340 (US 340), the primary roadway within the corridor and part of the U.S. Highway System. The highway links Frederick, County Maryland with Harpers Ferry and Charles Town and continues south to the West Virginia/Virginia state border. The east-west stretch of US 340 between Charles Town and Harpers Ferry is designated the William L. Wilson Freeway, although it does not share the same characteristics as a traditional freeway and includes traffic lights, at-grade intersections, and speed limits ranging from 45-60 miles per hour (mph). Within the East Gateway corridor, US 340 is primarily a four-lane facility; however, there are key capacity constraints at the eastern and western termini. On the eastern side, a partial-cloverleaf interchange facilitates the movements between US 340, WV 9, and West Virginia 51. On the western side of the corridor, US 340 crosses the Shenandoah River at the Harpers Ferry Bridge. The bridge crossing and roadway sections in Virginia and Maryland currently have two travel lanes.

**BRUNSWICK LINE EASTBOUND** Monday through Friday only

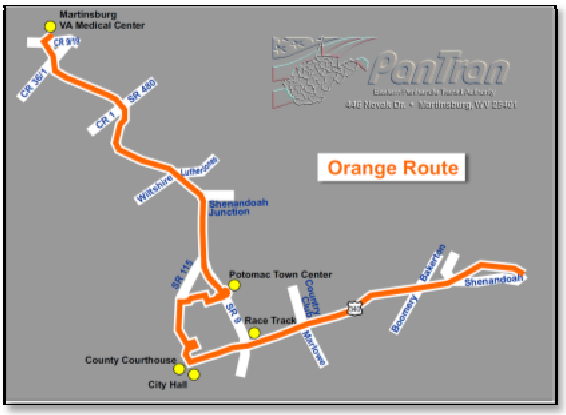
| TRAIN NUMBER | | P870 | P890 | P872 | P874 | P892 | P876 | P878 | P894 | P880 |
|---|---|---|---|---|---|---|---|---|---|---|
| | AR/ | S/O | Q | Q | S/O | S/O | Q | S/O | S/O | S/O |
| City/AM-PM | DP | AM | AM | AM | AM | AM | AM | AM | AM | AM |
| Martinsburg, WV ♿ | DP | | | | 5:25 | | | 6:30 | | |
| Duffields | DP | | | | 5:41 | | | 6:46 | | |
| Harpers Ferry, WV | DP | | | | 5:51 | | | 6:56 | | |
| Brunswick, MD ♿ | DP | 5:00 | | 5:38 | 6:02 | | 6:33 | 7:07 | | 7:40 |
| Frederick ♿ | DP | | 5:12 | | | 6:05 | [redacted] | [redacted] | 7:10 | |
| Monocacy ♿ | DP | | 5:18 | | | 6:11 | | | 7:16 | |
| Point of Rocks ♿ | DP | 5:10 | | 5:48 | 6:13 | | 6:43 | 7:17 | | 7:50 |
| Dickerson | DP | | 5:43 | | | | 6:51 | | | 7:58 |
| Barnesville | DP | 5:21 | | 5:58 | | 6:39 | 6:55 | | 7:44 | 8:03 |
| Boyds | DP | | 5:51 | | | | 7:02 | | | 8:09 |
| Germantown ♿ | DP | 5:30 | 5:55 | 6:08 | 6:33 | 6:49 | 7:07 | 7:36 | 7:54 | 8:14 |
| Metropolitan Grove | DP | 5:35 | 6:01 | 6:13 | 6:39 | 6:55 | 7:13 | 7:42 | 8:00 | 8:20 |
| Gaithersburg ♿ | DP | 5:41 | 6:06 | 6:18 | 6:43 | 7:01 | 7:19 | 7:47 | 8:06 | 8:26 |
| Washington Grove | DP | | | 6:21 | | | 7:22 | | | 8:29 |
| Rockville ♿ | DP | 5:49 | 6:13 | 6:26 | 6:52 | 7:08 | 7:28 | 7:58 | 8:13 | 8:34 |
| Garrett Park | DP | 5:54 | | | | 7:13 | 7:33 | | | 8:40 |
| Kensington | DP | 5:58 | | 6:33 | | 7:17 | 7:38 | | 8:21 | 8:44 |
| Silver Spring ♿ | DP | L6:06 | L6:27 | L6:42 | L7:08 | L7:27 | L7:47 | L8:14 | L8:29 | L8:54 |
| Washington Union Station ♿ | AR | 6:25 | 6:45 | 7:00 | 7:28 | 7:45 | 8:05 | 8:30 | 8:47 | 9:12 |

The north-south roadways within the East Gateway Corridor are provided by lower class roadway facilities. County Route 17 (Flowing Springs Road) and West Virginia 230 (Shepherdstown Pike) provide connections from Shepherdstown in the north to WV 9 and US 340 respectively. Other north-south roadways provide access from residential and rural areas within the corridor to commercial development along US 340.

The East Gateway corridor includes access to several transit alternatives. The Duffields station lies just north of the corridor on the MARC Brunswick line and includes nearly 300 parking spaces. The MARC train service is a commuter rail system whose service areas include counties in West Virginia, Maryland, and Washington D.C. The MARC train service only operates Monday through Friday. The Brunswick Line operates between Brunswick, Maryland and Washington Union Station. This line also

includes an extension to Frederick, Maryland and Martinsburg. The Harpers Ferry station (on Potomac Street) also provides access to the MARC Brunswick line as well as AMTRAK's Capital Limited train. The Capitol Limited train runs daily between Washington, D.C. and Chicago. These trains typically stop only once per day at the station and are not useful for daily commuting or shopping trips to Maryland or Washington, D.C. The National Parks Service may initiative special train service during peak seasonal periods to assist in accessing the Harpers Ferry National Park.

The Eastern Panhandle Transit Authority (EPTA), known more popularly as "PanTran," operates bus routes in Martinsburg and in surrounding Berkeley and Jefferson counties. PanTran's Orange "Charles Town" route includes several service stops in or near the East Gateway corridor including the Hollywood Casino Race Track, Walmart (Patrick Henry Way) and the Harpers Ferry rail station. Bus service headways vary by the service stop location but typically range from 2-3 hours with no available nightly service.




***Travel Characteristics***

Understanding the current regional travel patterns is important in evaluating and addressing future transportation improvements in the corridor. The West Virginia Department of Highways (WVDOH) will be conducting future studies to identify operational issues and travel usage characteristics along the US 340 corridor, which may include an origin-destination survey. These studies and results will further improve the planning and evaluation process as they become available. Until then, other available data sources can be used to provide insights into regional travel patterns. The Longitudinal Employment Household Dynamics On-the-Map (LEHD-OTM) tool synthesizes the home to work commuting patterns for specified areas based on the Quarterly Census of Employment and Wages (QCEW) records. This data has some documented inaccuracies but can still serve as a valuable tool in understanding commuting patterns at levels lower than the county. **Exhibit 1** provides a summary of the LEHD-OTM data and illustrates that only a small share of work commuting includes both origins and destinations within the East Gateway Corridor. Future growth within the corridor may significantly alter these results as more jobs may become available for residents within the corridor.

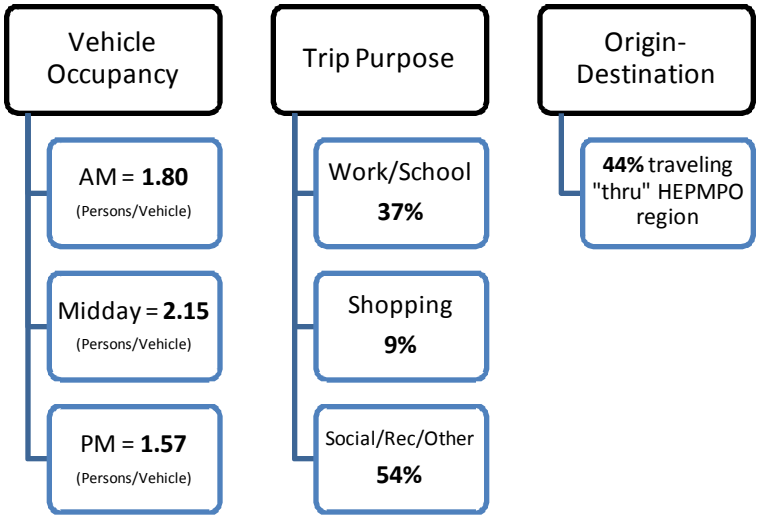
**Exhibit 1: Worker Inflow/Outflow for the East Gateway Corridor**

| Category | Share (%) |
|---|---|
| **INFLOW** | |
| Employed in the Corridor but Living outside Corridor | **95.8%** |
| Employed and Living in the Corridor | **4.2%** |
| | *100%* |
| **OUTFLOW** | |
| Living in the Corridor but Employed outside Corridor | **96.5%** |
| Living and Employed in the Corridor | **3.5%** |
| | *100%* |

** Source: U.S. Census Bureau, OnTheMap Application and LEHD Origin-Destination Employment Statistics (Beginning of Quarter Employment, 2nd Quarter of 2009)*

In October 2002, the HEPMPO conducted a cordon survey at select border locations in the 3-county MPO area (Berkeley and Jefferson counties in West Virginia, and Washington County in Maryland). The survey was developed to support regional planning and the development of the MPO travel demand model. A video data collection and mail-out survey was conducted at the Harpers Ferry Bridge to identify characteristics of travelers using US 340 during a sample weekday. For this location, 860 surveys were obtained and used to estimate vehicle occupancies, trip purposes, and the amount of trips "through" the MPO (3-county) area. **Exhibit 2** summarizes the survey results.

**Exhibit 2: HEPMPO US 340 Cordon Survey (October 2002)**




** Source: Chapter 3.3 from Long-Range Multimodal Transportation Plan, HEPMPO March 2005*

The origin-destination information from the above survey does not provide sufficient detail to estimate the number of US 340 travelers driving "through" the East Gateway Corridor. The information does indicate that nearly 45% of US 340 travelers at this location have both an origin and destination outside of Berkeley and Jefferson counties. Of these travelers most are traveling long distances to/from the southern end of US 340 and I-81 at the West Virginia/Virginia border. Based on these results, it may be inferred that a much greater percentage of travelers are simply traveling "through" the East Gateway Corridor section of US 340. As expected, recreational and social trips are a high percentage at this location due to the various recreational opportunities and the Harpers Ferry National Park. In addition, work commuters are using US 340 on a daily basis, with the primary work destinations being outside the East Gateway Corridor.

As part of this study, public input was obtained using an interactive web site. The website included several questions to obtain travel characteristics of those who responded to the survey (approximately 160 responses obtained) including the location of residence/work and travel frequencies within the corridor. The results of these survey questions are summarized in **Exhibit 3**. The majority of survey respondents regularly travel on US 340 and provided useful comments and corridor improvement recommendations that have been integrated within other sections of this plan document.

**Exhibit 3: Summary of East Gateway Study Survey Responses**

| | Which option best describes where you live? | Percent of Total Responses |
|---|---|---|
| Where do you live? | *Within the East Gateway Corridor* | 30% |
| | *In Jefferson County* | 58% |
| | *In West Virginia* | 6% |
| | *Outside of West Virginia* | 5% |
| | **Which option best describes where you work?** | **Percent of Total Responses** |
| Where do you work? | *Along the 340 East Gateway cor* | 8% |
| | *In Jefferson County* | 26% |
| | *In West Virginia* | 7% |
| | *Outside of West Virginia* | 59% |
| | **How often do you travel within the East Gateway Corridor?** | **Percent of Total Responses** |
| Travel frequency | *5 or more days / week* | 60% |
| | *1 to 4 days / week* | 26% |
| | *Less than once / week* | 9% |
| | *Less than once / month* | 4% |
| | *Never* | 1% |

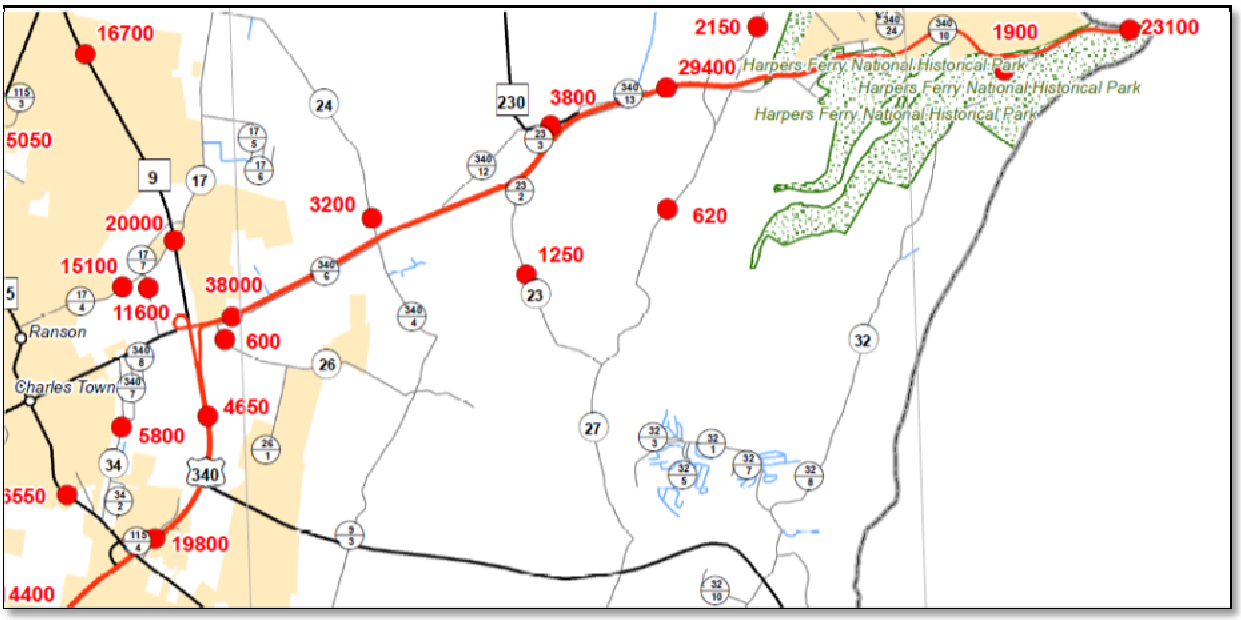
** Based on input received from 2011 interactive MetroQuest-based study website*

### *Current Traffic Conditions*

As illustrated in **Exhibit 4**, the East Gateway Corridor section of US 340 has the highest traffic volume as compared to any other roadway in Jefferson County. Just east of the interchange with WV 9, US 340 carries its highest traffic volume, approximately 38,000 average daily traffic (ADT). This section is influenced by a high level of commercial traffic (e.g. Walmart, strip malls, etc.) mixed with regional "through" travel. On the eastern sections of the corridor, US 340 carries approximately 29,000 ADT and is influenced heavily by traffic at the National Park especially during peak seasonal periods. These high traffic volumes, mixed with at-grade signalized intersections and lane reductions west of the Harpers Ferry Bridge, cause congestion and queuing during peak hours both on weekdays and weekends. Traffic volumes on the north-south roadways within the corridor are much lower than on US 340 and are generally lower than 4,000 ADT.

As part of this study, intersection traffic counts for weekday peak periods were also collected for all key intersections on US 340. These counts were used for traffic analyses. This included WVDOH intersection counts and several consultant counts at select intersection locations. The highest US 340 PM peak period count is at the Patrick Henry Way intersection, where the hourly count is over 2,600 vehicles per hour (about 7% of the daily volume) with truck percentages less than 5% of the total traffic. At this same intersection during the AM peak period, US 340 hourly counts are about 1,500 vehicles per hour. An evaluation and analysis of traffic count data is discussed in later sections within this study.

**Exhibit 4: Existing Average Daily Traffic Volumes**



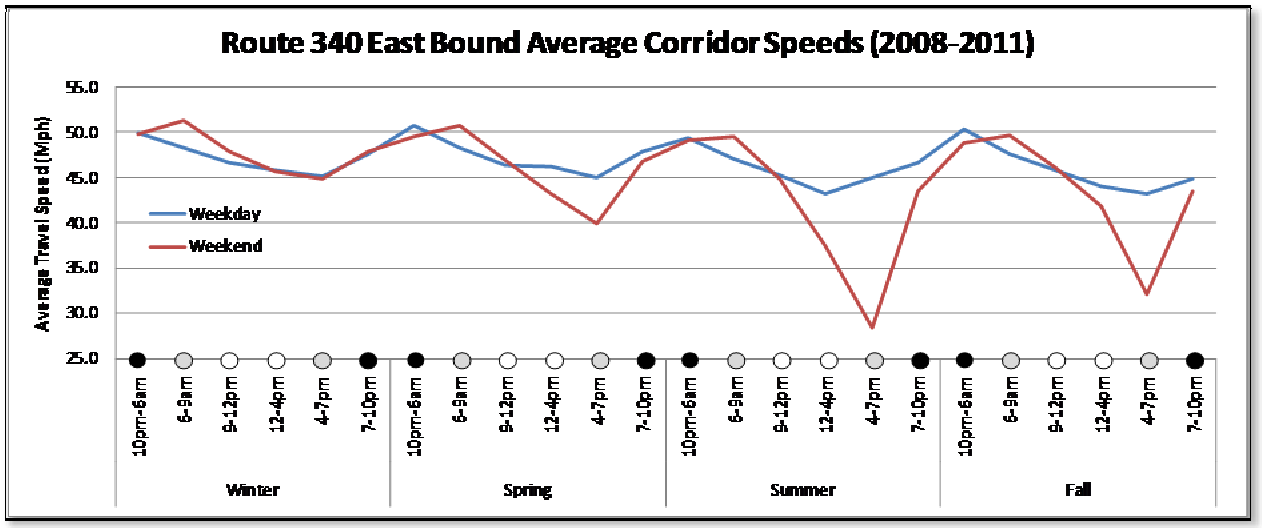

** 2008 Average Daily Traffic Volumes (from Portable Count Machines) as prepared by WVDOH*
(http://www.transportation.wv.gov/highways/programplanning/preliminary_engineering/traffic_analysis/trafficvolume/dists_4_5_6/)

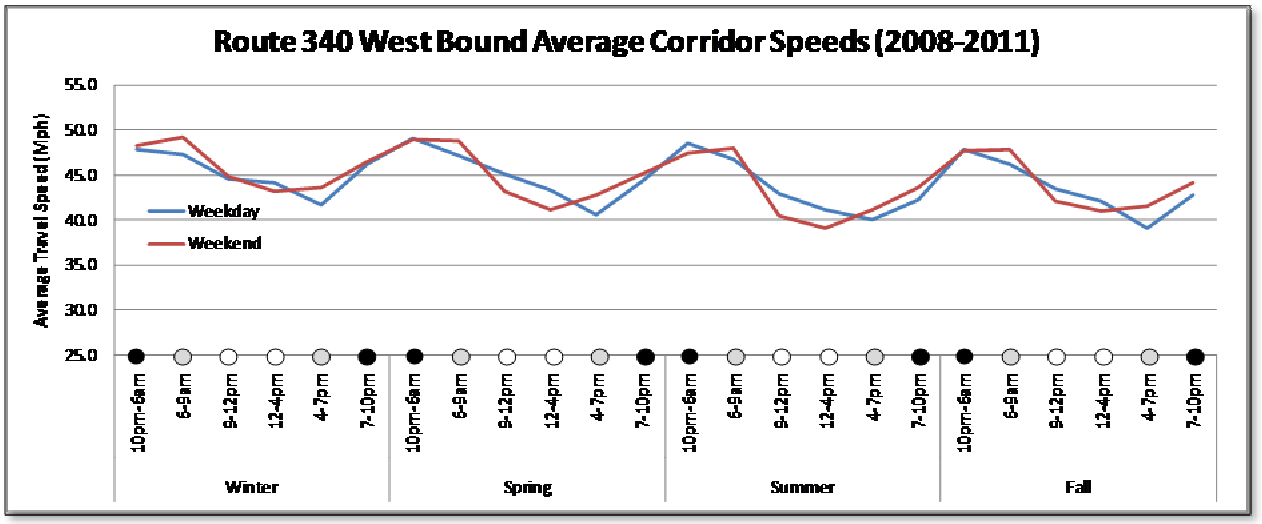
TomTom GPS speed data (2008-2011) was obtained for US 340 from Charles Town to the state border as an alternative to conducting travel time runs. The speed data was used to assess current congestion and served as a primary data source for the calibration of traffic analysis tools. The nearly 25,000 observations obtained from TomTom allowed for the assessment of travel speed variations across the corridor by season, day and time period. In addition, the level of detail of the data allowed for the evaluation of typical traffic queue lengths at individual intersections.

**Exhibit 5** illustrates the variances of the average corridor speed on US 340 by season and time period. For the eastbound direction, the highest travel times (lowest speeds) typically occur during the summer weekends between 4-7 PM. This includes extensive traffic queueing from the Harpers Ferry Bridge back to as far as the Millville/Bakerton Road intersection. During weekdays, worst case conditions typically occur during the Fall PM peak period. The TomTom data did not indicate substantial queuing during this period as averaged over the 2008-2011 years. However, public comments indicated that significant traffic queues often do occur on the weekday and may extend back to the Washington Street intersection.

For the US 340 westbound direction, the highest travel times within the East Gateway Corridor occurred during midday hours on summer weekends. The travel times are significantly better than the eastbound direction since much of the traffic queues occur outside of the corridor. Typical traffic queues on the weekend can extend back to the interchange with MD67 in Frederick County, Maryland. Similar conditions occur during peak weekday conditions in the Fall PM peak periods. For those time periods traffic queues have also typically extended east of the MD67 interchange.

**Exhibit 5: Summary of US 340 Traffic Speeds by Season and Time Period**




* Based on TomTom Traffic Stats Custom Travel Times (2008-2011 average conditions)

### *Assessing Current Conditions*

An evaluation of the current transportation system is an important first step in identifying potential transportation needs and projects. This section has reviewed the transportation network, typical travel patterns, travel demand, and typical travel congestion in the corridor. The following sections of this study will evaluate these current conditions with future forecasts of demand and congestion based on the land use vision for the corridor. Those assessments will lead to an evaluation of transportation needs and priorities within the East Gateway Corridor.

# Issues Identification and Concerns – Transportation Component

***Overview***

This section discusses key operational issues and needs as related to the transportation system within the East Gateway corridor. The transportation needs have been identified based on input from key stakeholders, public involvement meetings, interactive website responses, and technical traffic analyses. Issues are addressed for both current and future conditions based on the corridor land use vision. The traffic analyses have been conducted using existing traffic count data, assumptions on regional demographic growth, forecasts from the HEPMPO regional travel demand model, and other traffic analysis and simulation tools. Future efforts to be conducted by the WVDOH will supplement the analyses and recommendations provided in this report. Such efforts include a tri-state (West Virginia, Maryland, Virginia) US 340 operational study that will focus on operational needs along the entire stretch of US 340 including the 2-lane portion between the bridge crossings. This will include evaluating and addressing capacity restraints at the bridge crossings and at-grade intersections with Chestnut Hill Road and Virginia State Route 671.

Prioritizing transportation needs ultimately depends on weighing factors that include the importance of addressing current and future congestion, providing access to regional employment and commercial sites for residents within the corridor, safety issues, meeting the capacity needs of special events and peak seasonal traffic, reducing vehicle trips within the region, and preserving the character of the corridor. In this section, transportation needs for the East Gateway corridor have been prioritized into the levels as illustrated in **Exhibit 6**. These general priority levels may also be used to assist in evaluating the priority and timing of potential regional transportation projects as identified in the recommendations section of this report.

**Exhibit 6: Priority Levels for Transportation Needs**

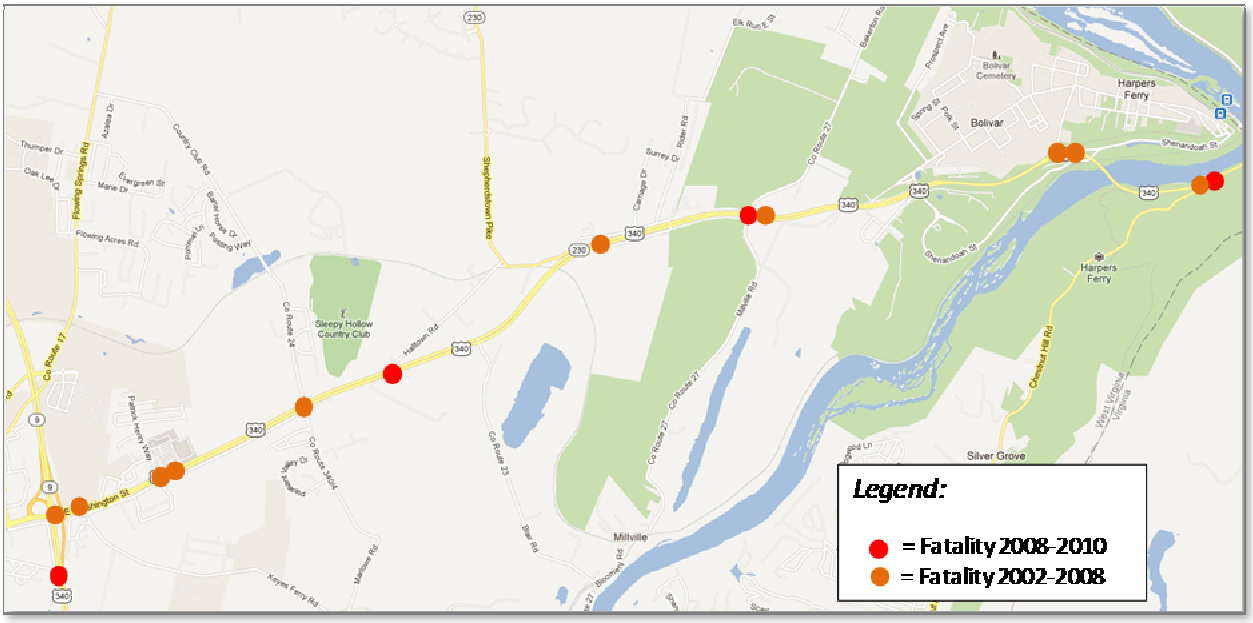
| | Priority Level |
|---|---|
| 1 | Short Term Safety Needs |
| 2 | Existing Congestion & Access Issues |
| 3 | Future Congestion |

***Transportation Safety***

Increasing the safety of the transportation system for motorized and non-motorized users is one of the eight planning factors required for metropolitan transportation planning, and is a component of the regional HEMPO Long Range Transportation Plan (LRTP). The rate and type of vehicle traffic incidents are important transportation system performance measures that are directly affected by the design and construction of the transportation system. Vehicle crashes represent a major source of congestion, are a major health concern, and result in significant costs to society.

As a condition for obligating federal Highway Safety Improvement Program (HSIP) funds, states are required to prepare an annual report to FHWA that describes public road locations exhibiting the most severe safety needs (top 5 percent). In 2007, WVDOH listed US 340 as a high priority need noting safety concerns due to excessive speeds, aggressive driving and at-grade intersections. In addition, the US 340 intersection with Chestnut Hill Road (outside the East Gateway study area) was also noted as a significant safety concern. These roadway sections were each highlighted as safety priority sections within the HEPMPO LRTP, *Direction 2035*. **Exhibit 7** illustrates a summary of fatality information from the National Highway Traffic Safety Administration (NHTSA) within the East Gateway Corridor. The fatalities have primarily occurred at or near intersections along US 340. Recent fatalities (since 2008) have occurred at US 340 intersections with Halltown, Millville, and Chestnut Hill roads.

**Exhibit 7: US 340 Fatalities Within The East Gateway Corridor**




* *Base Map from Google Maps*
* *Source accident data from NHTSA Fatality Analysis Reporting System (FARS) as summarized in following weblinks:*
* *http://www-nrd.nhtsa.dot.gov/departments/nrd-30/ncsa/stsi/54_WV/2010/West%20Virginia_Map_11_GIS_DATA_2010.HTM*
* *http://map.itoworld.com/road-casualties-usa*

As part of this land use vision study and associated public input, the study team has worked to identify specific safety concerns that may need to be addressed with short-term solutions until larger capacity enhancement projects can be planned, designed and completed. Supporting technical analyses have been developed using accepted traffic tools (e.g. Highway Capacity Software, SYNCHRO) and current traffic volume turning movements to assess intersection and approach level-of-service (LOS) during peak periods. LOS is a measure used by traffic engineers to determine the effectiveness of elements of transportation infrastructure. At intersections, LOS equates to acceptable vehicle delays corresponding with safe driving conditions. LOS is measured on a qualitative scale from A (best) to F (worst). Based on an assessment of current conditions, several key areas of concern have been identified:

- ***US 340 Westbound Approaching Patrick Henry Way Intersection*** – According to observations and technical analyses, the intersection of US 340 and Patrick Henry Way is the most congested intersection in the study area due to commercial areas in the vicinity of the intersection. US 340 westbound traffic queues typically extend from WV 9 back to east of the intersection. Although, the speed limit is reduced on US 340 westbound to 45mph (just west of Country Club Road), aggressive driving in combination with the roadway down-slope create dangerous conditions approaching vehicle traffic queues. Local residents have stressed the need for better speed control in the area or possible flashing signs warning of the approaching intersection.

- ***Un-signalized Intersection Approaches to US 340*** - With high traffic volumes and speeds (60mph speed limit) on mainline portions of US 340, most of the un-signalized intersections create potential safety concerns during peak periods. Although the side road approaches to these intersections do not have significantly high traffic volumes, there are often limited traffic "gaps" needed to make left-turns, which require crossing two lanes of US 340 and merging with on-coming vehicles. Additional concerns also exist for vehicles turning right out of these intersections due to the speed of approaching vehicles and some locations of limited sight distance. The un-signalized approaches of concern include those in **Exhibit 8**.

**Exhibit 8: Un-Signalized Intersection Approaches of Concern**

| US 340 Intersection Approach | PM Peak Approach LOS | Primary Concerns |
|---|---|---|
| Halltown Road | F | Left turns |
| Blair Road | E | Left turns |
| Frontage Road (East of US340/230 Intersection) | F | Left turns |
| Shipley School Road* (Left turns currently prohibited) | ---- | Right turns due to high speeds of oncoming traffic; school buses |
| Bakerton / Millville Road | E/C | Left turns<br>Millville has increased turning movements during summer weekends |
| Access to Quality Inn* | ---- | Left turns |
| Union Street | F | Left turns, no merge lane for right turns up hill |
| Shenandoah Street | D | Left turns |

** Noted intersections were not specifically analyzed due to limited data*

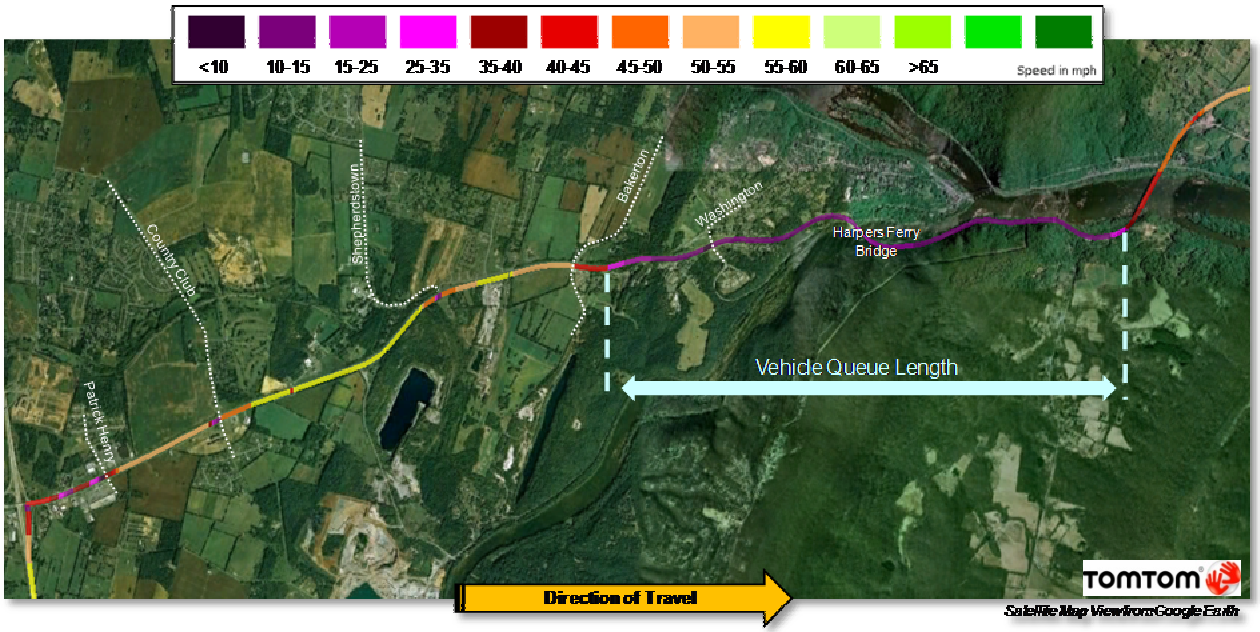
The above safety concerns currently exist during peak periods of travel. The technical analyses were conducted for a typical weekday PM peak period but some intersections (e.g. Millville northbound approach to US 340) encounter greater turning movements during the summer peak season due to the recreational opportunities in the region.

### *Existing Traffic Congestion*

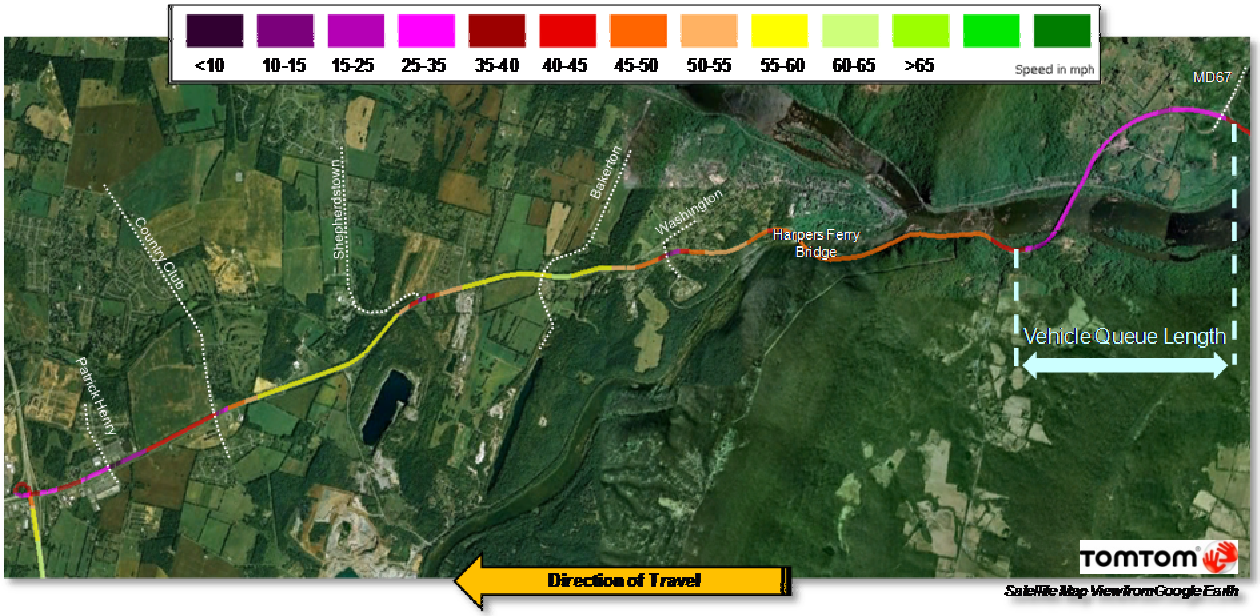
Traffic congestion is a key concern for residents within the region and those traveling US 340 for other purposes. As described in the existing conditions section, significant traffic queuing occurs during the PM peak periods and during summer season weekends. The congestion during these time periods can be significant. **Exhibit 9** illustrates the average 2008-2011 queue lengths that have been estimated from TomTom GPS travel time data. Based on an assessment of current conditions, several key areas of concern have been identified:

**Exhibit 9: Peak Congested Speeds and Traffic Queuing on US 340**

*US 340 Eastbound Summer Weekend (4-7pm)*




*US 340 Westbound Fall Weekday (4-7pm)*



- ***US 340 River Crossings*** - A primary bottleneck affecting traffic operations in the East Gateway corridor are the bridge crossings over the Shenandoah and Potomac rivers. The bridges and the stretch of US 340 between them consist of two lanes of travel (1-lane per direction). The remaining sections of US 340 both in Maryland and West Virginia operate as a four lane facility. Within this section of roadway (outside of the East Gateway study area), several intersections also affect US 340 operations: Chestnut Hill Road (in West Virginia) and State Route 671 (in Virginia).

- ***US 340 between WV 9 Interchange and Patrick Henry Way*** – The intersection with Patrick Henry Way is currently the most congested intersection within the corridor. During peak period traffic queues can extend from this intersection west to the WV 9 off/on-ramp signals in both directions. Both Patrick Henry Way and the intersection at Jefferson Terrace Road are used to access commercial and shopping destinations including Walmart. The commercial traffic when combined with regional "through" travel on US 340 can create delays within the section.

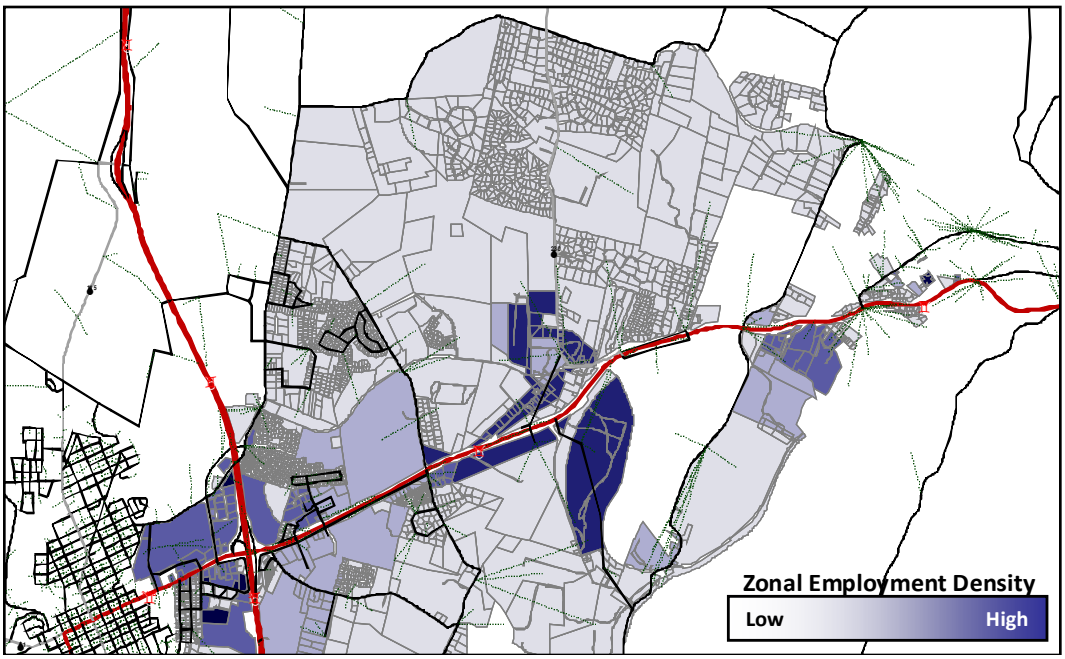
- ***Alternative Parallel Roadways and Access to Commercial Areas*** – The current transportation system in the East Gateway corridor provides limited alternatives to US 340. Access to existing commercial areas require utilizing the western portions of US 340 during congested time periods. Although, portions of US 340 have frontage roads, an integrated system of roads does not exist that would allow residents to travel east-west through the corridor without accessing US 340. An integrated frontage road system would also provide options for eliminating left turns at un-signalized approaches within the corridor.

### *Future Traffic Congestion*

Estimating future congestion is a difficult exercise considering the unknowns related to the type and timing of future development. A modeling exercise has been conducted to evaluate the ability of existing intersections in the study area to handle potential traffic growth if significant development were to occur.

Based on the land use vision for the corridor, land use types were translated to future demographics (e.g. population and employment) and input to the HEPMPO regional travel demand model (as illustrated in **Exhibit 10**). Analyses were conducted for a 2035 horizon year assuming a 60% build-out of the land use areas. The travel model estimates vehicle trips based on the forecasted land use and assigns them to the highway network. The future scenario also includes growth outside the East Gateway corridor and a continued growth in regional "external" traffic from/to Maryland and Virginia.

**Exhibit 10: HEMPO Regional Travel Demand Model**




The growth in traffic volumes forecast from the travel demand model were used to grow existing turning movement traffic counts for each intersection along US 340. These forecasted intersection counts were analyzed using available analysis tools (Highway Capacity Software, Synchro, Simtraffic) to identify key LOS and operational criteria for the PM peak period. **Exhibit 11** summarizes the results of the analyses. As discussed for existing conditions, LOS is measured on a qualitative scale from A (best) to F (worst).

The analysis of future year conditions indicates several key issues that should be considered in planning for future longer term transportation improvements within the corridor:

- ***Increase in North-South Vehicle Trips*** – Continued growth in residential developments will significantly increase traffic on many of the corridor's north-south roadways. Un-signalized intersections, which are already considered a safety concern during peak periods, will not have the capacity to handle the future demand, resulting in significant delays. The timing and location of future development will determine which intersections will be of the most concern over the next 10 years. Identified commercial development south of US 340, including that at the Old Standard Quarry, could dramatically increase the traffic at the Millville and Blair Road intersections, which currently have very low traffic volumes. Signalized intersections will also be impacted by future growth. The intersection at Old Country Club Road may see future traffic growth that may alter signal timings creating less capacity on the US 340 mainline.

## Exhibit 11: Analysis Results of Future Traffic Growth Scenario

***Intersection Capacity Analysis – Future No-Build PM Peak (2035)***

| ID | INTERSECTION with US 340 | Sig/ Unsig | Approach LOS | | | | Intersection | |
|---|---|---|---|---|---|---|---|---|
| | | | EB | WB | NB | SB | LOS* | Delay** |
| 1 | Shenandoah St | | C | - | - | F | F | 2.6 |
| 2 | Union Street | | C | - | - | F | F | 15.9 |
| 3 | W. Washington St / Shoreline Dr | | F | A | E | E | E | 57.9 |
| 4 | Bakerton Rd / Millville Rd | | C | B | F | F | D | - |
| 5 | Co Rt 340/13 / Shipley School Rd | | C | B | F | F | F | - |
| 6 | Shepherdstown Pike / S. Frontage | | B | C | D | E | C | 21.4 |
| 7 | Blair Rd | | - | B | F | - | D | 1144.3 |
| 8 | Halltown Rd / Rion Hall Farm | | D | D | F | F | F | - |
| 9 | Old Country Club / Marlow Rd | | F | F | F | E | F | 138.5 |
| 10 | Patrick Henry Way | | F | F | F | F | F | 221.2 |
| 11 | Jefferson Terrace Rd | | B | C | F | C | E | 78 |
| 12 | Ramps to/from NB WV9 | | E | A | F | - | D | 48.2 |
| 13 | Ramps to/from SB WV9 | | F | C | - | F | F | 111.7 |
| 14 | Flowing Springs Rd & E. Wash.St | | B | A | D | D | B | 18.6 |

** Signalized Intersection LOS = HCM; Unsignalized Intersection LOS = ICU (Synchro)*
*** Average delay in seconds per vehicle averaged over all approaches*

***Simulation Travel Speeds – Future No-Build Peak (2035)***

| ID | INTERSECTION with US 340 | Sig/ Unsig | Simulation Travel Time (sec) | | | |
|---|---|---|---|---|---|---|
| | | | Eastbound | | Westbound | |
| | | | AM | PM | AM | PM |
| 1 | Shenandoah St | | 40 | 32 | 46 | 28 |
| 2 | Union Street | | 40 | 28 | 41 | 31 |
| 3 | W. Washington St / Shoreline Dr | | 43 | 25 | 24 | 24 |
| 4 | Bakerton Rd / Millville Rd | | 55 | 51 | 56 | 57 |
| 5 | Co Rt 340/13 / Shipley School Rd | | 53 | 59 | 51 | 52 |
| 6 | Shepherdstown Pike / S. Frontage | | 29 | 34 | 22 | 28 |
| 7 | Blair Rd | | 53 | 57 | 57 | 52 |
| 8 | Halltown Rd / Rion Hall Farm | | 48 | 53 | 52 | 51 |
| 9 | Old Country Club / Marlow Rd | | 8 | 34 | 10 | 12 |
| 10 | Patrick Henry Way | | 16 | 17 | 28 | 18 |
| 11 | Jefferson Terrace Rd | | 16 | 4 | 31 | 23 |
| 12 | Ramps to/from NB WV9 | | 26 | 5 | 30 | 34 |
| 13 | Ramps to/from SB WV9 | | 17 | 7 | 17 | 20 |
| 14 | Flowing Springs Rd & E. Wash.St | | 24 | 10 | 21 | 26 |

- ***More Turning Vehicles on US 340*** – Increased development within the East Gateway Corridor will create more turning vehicles for those traveling on US 340. This, in turn, will require signal timing changes that will degrade mainline "through" operations. During peak periods, additional capacity or alternative parallel roadway facilities (e.g. frontage roads) may be needed to provide access to commercial areas along US 340.

***Other Transportation Modal Needs***

Addressing the transportation needs related to future land use growth should consider other modal options including transit, walking and biking. The potential benefits of transportation options within the East Gateway corridor are summarized in **Exhibit 12.**

**Exhibit 12: Benefits of Transportation Options**

| Benefit | Description |
|---|---|
| Traffic Congestion Reduction | Helps reduce traffic congestion, facility costs, and environmental impacts. |
| Consumer Benefits | Provides consumers with choices to choose the most efficient option for each trip. |
| Equity | Allows transportation options for people who are physically, economically or socially disadvantaged. |
| Livability | Helps communities become more "livable", resulting in increased property values and commercial activity. |
| Security and Resilience | Results in a more diverse and flexible transportation system that can accommodate variable and unpredictable conditions. |

** Source: Victoria Transport Policy Institute (TDM Encyclopedia)*

PanTran is the public transportation service of the Eastern Panhandle Transit Authority serving Berkeley and Jefferson counties. PanTran operates two different bus services – flex-route service and demand-response service. PanTran's Orange "Charles Town" route includes several service stops in or near the East Gateway corridor including the Hollywood Casino Race Track, Walmart (Patrick Henry Way) and the Harpers Ferry rail station. Bus service headways vary by the service stop location but typically range from 2-3 hours with no available nightly service.

The HEPMPO LRTP, *Direction 2035* includes a transit component that has identified key regional transit needs for PanTran. For the LRTP, various transit demand estimation techniques were used to determine overall existing and future transit needs. Additional needs have been identified through stakeholder and public input. Key issues that relate the East Gateway Corridor include the following:

- ***No Demand-Response Service*** – The East Gateway Corridor is not currently covered by PanTran's demand response service. The primary service coverage only includes areas in Berkeley County.

- ***Limited Fixed-Route Service to Activity Centers*** – PanTran's Orange Route has a long route length since it is functioning both as a regional service and local route. Key issues include headways greater

than 45 minutes (considered ideal), limited weekend service, running delays, and limited stops at major employment and shopping centers.

- ***Limited Fixed-Route Service to Regional Rail and Commuter Bus Service –*** The PanTran Orange route does provide service to Harpers Ferry Station, though additional service runs and reduced headways would allow for more connections with MARC and AMTRAK service schedules. There is currently no PanTran service that provides connections to other bus services in Maryland and Virginia.

- ***Additional MARC Service and Possible Station Relocation –*** Future residential and commercial development in the corridor will increase demand for additional MARC service from Martinsburg to Washington, D.C. This may include expansion of midday service schedules. The relocation of the existing Duffields train station has been included in long range planning efforts for the City of Ranson to improve regional access and promote transit-oriented development.

In addition to transit, bike and pedestrian trails/paths have been identified as an important need within the East Gateway Corridor. Although covered under separate sections in the County's report, they potentially serve as an alternative transportation option that can reduce vehicle trips within the region, especially in combination with compact and mixed-use development. Specific needs related to this mode include:

- ***Integrated Bike/Pedestrian Trail System from Charles Town to Harpers Ferry*** – An integrated east-west bike and pedestrian trail has been indicated as a primary need within the corridor. The trail would serve recreational purposes but also provide access to Harpers Ferry, key commercial areas along US 340, and to the casino/racetrack. Spur trails/paths with linkages to key residential areas may be useful in reducing peak hour vehicle trips, improving air quality and promoting a healthy lifestyle.

- ***Bike and Pedestrian Access to Transit Stations and Stops*** - In city after city, transit agencies are rediscovering that good bicycle and pedestrian access is a critical component of the success of the transit system. Walking is the most environmentally friendly and low–cost way to get people to and from public transportation. When given sidewalks, "traffic–calmed" streets to walk along, safe and convenient ways to cross streets, and a comfortable and attractive environment, most people are willing to walk farther to reach public transportation.

# Plan Recommendations – Transportation Component

***Overview***

This section provides transportation improvement projects that address both current and future safety, congestion and transportation mobility needs within the East Gateway Corridor. Specific recommendations for trails and bike paths are not provided in this section, but will ultimately play a key role in providing alternative transportation options that can address mobility and congestion needs. The projects were identified through a collaborative process involving regional planning staff, public involvement, and consultant recommendations. The projects outlined in this section are intended to serve as key input to future local and regional planning efforts, initiate further discussions and evaluations of project alternatives, and lead to more detailed project-level feasibility studies. Several of the projects are conceptual in nature, particularly the recommendations for new roads. Although alignments have been provided on maps, more detailed examination will be needed to address difficulties associated with right-of-way, environmental considerations, and other public concerns. Some of these key issues are discussed for certain projects based on input received during the public involvement process for this study.

The projects identified, as a whole, represent a significant financial cost that exceeds the past amount of federal and state transportation funds that have been allocated to this corridor. As a result, a prioritization process is useful to evaluate which projects are most important to the residents and travelers within the corridor. For this study, a preliminary effort has been conducted to gain stakeholder and public input into project priorities and needs. Such information has been used to classify projects into short- and long-term categories.

***The Project Development Process***

The transportation recommendations provided in this study will serve as key inputs to other regional and state planning processes. **Exhibit 13** illustrates the key steps in the transportation planning process. At the state level, the West Virginia Department of Transportation (WVDOT) is required to develop and maintain a statewide, multimodal transportation planning process. Broad categories of highway improvement needs are defined based, primarily, on ongoing examinations of roadway pavement conditions and estimates of current and future traffic demand. The state selects improvement projects based on regional long range plans and includes them in the Statewide Transportation Improvement Program (STIP).

State efforts are supplemented in urbanized areas through the metropolitan transportation planning process. The Hagerstown Eastern Panhandle Metropolitan Planning Organization (HEPMPO) is responsible for developing a regional Long Range Transportation Plan (LRTP) for Berkeley, Jefferson and Washington (Maryland) counties. The LRTP is updated every four years incorporating the latest data and information. The next update is anticipated in the Spring of 2014. The plan not only defines the region's multimodal transportation needs, but also identifies the funding sources that will be needed to implement the identified projects. The HEPMPO also uses this information to prepare a shorter, more detailed listing and prioritization of projects for which work is anticipated within the next 3 to 5 years.

The listing of these projects is referred to as the Transportation Improvement Program (TIP), which becomes incorporated into the STIP.

**Exhibit 13: The Transportation Planning Process**

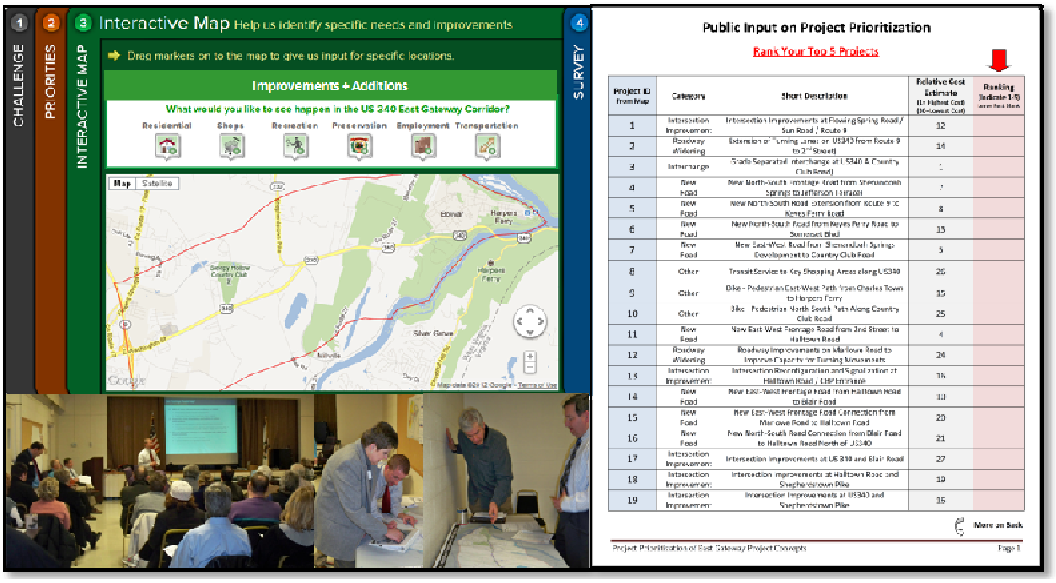

** Source: Figure 1, The Transportation Planning Process: Key Issues, FHWA-HEP-07-039*

This county initiated land use study provides a local level assessment of transportation needs within the East Gateway Corridor. The study and its recommendations do not represent a commitment or obligation of funds by either the HEPMPO or WVDOT; however, it will serve as key input to future regional and state planning efforts including the update of HEPMPO's LRTP.

***Process for Identifying Conceptual Projects***

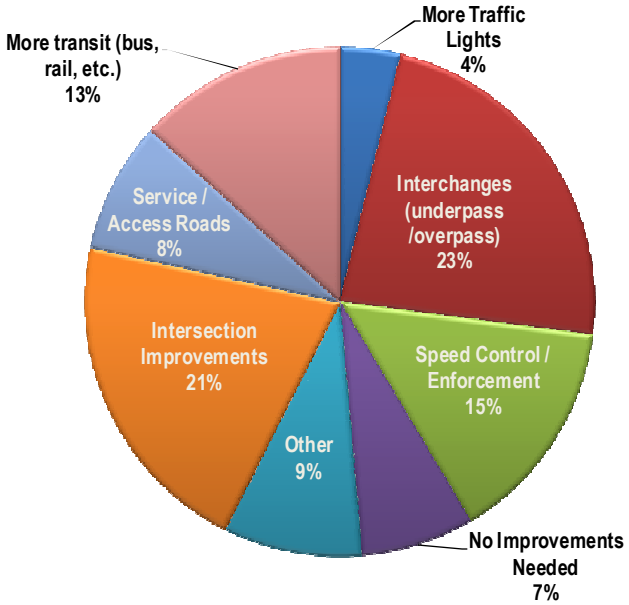
Strategies have been developed to address the transportation needs identified within the East Gateway Corridor (see the Issues Identification and Concerns section of this report). The process used to identify these strategies has included input from local and regional planning agencies, consultant staff and public involvement activities. **Exhibit 14** illustrates public involvement efforts related to the transportation component of the plan. This has included an assessment of regional priorities, the development of an interactive website to collect insights on transportation needs and improvement strategies, a January 19th public work session to identify transportation strategies, and a prioritization worksheet aimed at identifying what projects are most important to the region.

**Exhibit 14: Public Input for Transportation Needs and Strategies**




The website data surveys and public work session were valuable in obtaining important insights on general strategy recommendations and specific comments regarding safety concerns, right-of-way issues, and the alignments of proposed new roads. **Exhibit 15** illustrates input on recommended strategy types obtained through the website.

**Exhibit 15: Improvements Most Needed Along the US 340 Corridor**




An evaluation of the public responses was conducted and used to identify a final project list. Some identified project types, like US 340 roundabouts, were not considered due to high traffic volumes, high

speed limits, right-of-way issues and safety concerns with double-lane roundabouts. Additional analyses were conducted by the consultant to determine alternative intersection configurations to address the possible removal of left-turns to improve immediate safety concerns at key locations.

***Strategy Recommendations - Overview***

As indicated in the transportation needs section, the US 340 river crossings are primary bottlenecks just outside the East Gateway Corridor study area. The existing two-lane bridges (**Exhibit 16** illustrates the Harpers Ferry Bridge) are a source of significant peak period congestion that affects regional access. Although very important to corridor operations, studies of alternative bridge crossings, which require substantial data collection efforts and a detailed assessment of environmental and construction options, were beyond the scope of this land use vision plan. West Virginia will be working with Maryland and Virginia in conducting future studies to address these, and other operational issues along US 340. Due to the excessive costs and environmental concerns, such projects, even if planned, may not be built for many years.

**Exhibit 16: Harpers Ferry Bridge (Susquehanna River)**

** Source: Google Maps StreetView*

This study focuses on addressing key transportation operation, safety and mobility options within the East Gateway Corridor as related to future land use growth. Recommended transportation strategies were identified for the corridor. These strategies include lower-cost safety improvements, intersection signalization and reconfiguration, additional lanes on existing facilities, new road construction to improve regional connectivity and transit service improvements. A short description of each specific roadway improvement project is provided in **Exhibit 17**. These roadway improvement projects are also summarized on a map in **Appendix B**. Transit projects are discussed and summarized in a separate section below. Strategies focused on bike and pedestrian trails are a key priority in this corridor with significant public support. These strategies are discussed in the *Parks, Trails and Greenways* portion of the County's full document, though it is expected that these modes will need to be addressed in the design and upgrade of the roadway system and intersections within the corridor.

In addition to the specific projects presented in **Exhibit 17**, other more general strategies are recommended to address identified transportation and mobility goals for the corridor. These include future efforts to develop access management standards, speed control options to improve safety, and highway beautification to promote and preserve the nature of the corridor.

## Exhibit 17: Summary of Recommended Roadway Improvement Projects

***Project ID Relates to Location in Corridor (Numbering Starts on Western Portion)***
***Project ID is not based on project ranking or priority***

| Project ID Appendix B | Project Type | Project Description |
|---|---|---|
| **1** | Roadway Widening | Extension of turn lanes on US 340 between the WV 9 interchange and Jefferson Terrace Road |
| **2** | New Road Construction | North-South roadway from Shenandoah Springs development connecting to Jefferson Terrace. |
| **3** | Intersection Improvement | Improvements at Flowing Springs Road / East 5th Avenue/ WV 9. Includes possible signalization and merge lanes |
| **4** | New Road Construction | North-South roadway connecting US 340 (south of WV 9 interchange) with Keyes Ferry Road. |
| **5** | New Road Construction | North-South roadway connecting Keyes Ferry Road to Somerset Blvd. |
| **6** | New Road Construction | East-West frontage road on northern side of US 340 from Jefferson Terrace Road to Halltown Road. |
| **7** | New Road Construction | Road connections from Shenandoah Springs to Old Country Club Road and Walmart. |
| **8** | Safety Improvement | Signal flashers warning of approaching intersection on west-bound US 340 approaching Patrick Henry Way and Shepherdstown Pike (230) |
| **9** | New Road Construction | East-West frontage road on southern side of US 340 from Marlowe Road to Rion Hall Farm Road. |
| **10** | New Interchange | Construct interchange at US 340 and Country Club Road. Interchange may be located west of current intersection requiring roadway reconfiguration. |
| **11** | New Road Construction | East-West road north of the rail line connecting Old Country Club Road and Shepherdstown Pike. |
| **12** | Intersection Improvement | Intersection reconfiguration and/or signalization at US 340 and Halltown Road. Address concerns for left-turn vehicles during peak periods. |
| **13** | New Road Construction | East-West frontage road on southern side of US340 from Rion Hall Farm entrance to Blair Road. |
| **14** | Intersection Improvement | Intersection reconfiguration and/or signalization at US 340 and Blair Road. Address concerns for left-turn vehicles during peak periods. |
| **15** | Intersection Improvement | Intersection signalization at Halltown Road and Shepherdstown Pike. |
| **16, 17, 18** | Intersection Improvement | Intersection reconfiguration and signalization at intersections in vicinity of the US Customs & Border Protection relocated entrance. |
| **19** | New Road Construction | East-West frontage road from Shipley School Road to Bakerton Road. |
| **20** | Intersection Improvement | Intersection reconfiguration and/or signalization at US 340 and Bakerton-Millville Road. Address concerns for left-turn vehicles during peak periods. |
| **21** | New Road Construction | North-South roadway from Alstadts Hill Road to Bakerton Road. The roadway Includes an underpass under US 340. |
| **22** | New Road Construction | East-West frontage road on northern side of US 340 from Bakerton Road to West Washington Street. |
| **23** | New Road Construction | East-West frontage road on southern side of US 340 from Alstadts Hill Road to Old Taylor Lane. |
| **24** | Railroad Underpass | Widening of Bakerton Road railroad underpass. |
| **25** | Roadway Widening | Extension of US 340 westbound truck climbing lane from Shenandoah Street to the existing two lane section. |

***Short Term Highway Project Recommendations***

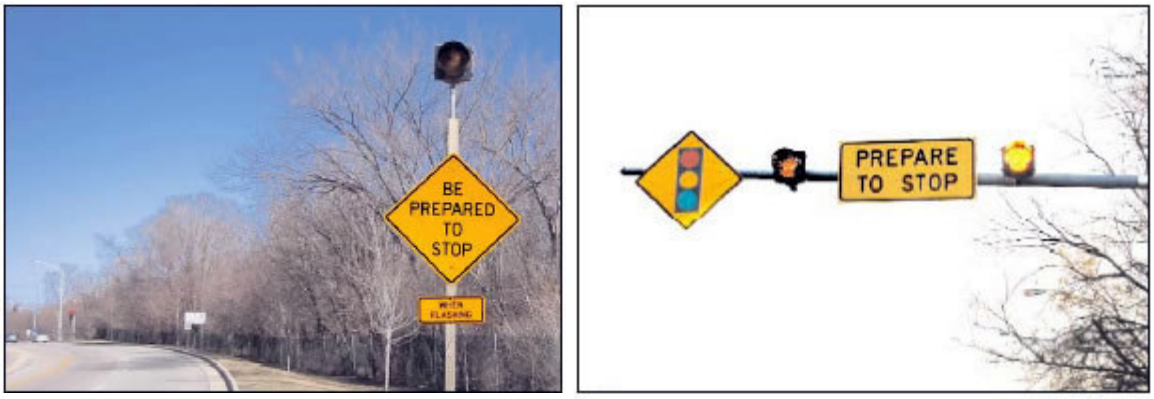
Several corridor safety and operational concerns were identified as priority needs that will only worsen with future traffic growth. These include aggressive driving approaching signalized intersections on US 340, left-turns and through movements at un-signalized intersections on US 340, and intersection improvements to accommodate the proposed entrance relocation for the US Customs & Border Protection (USCBP) Advanced Training Center. These concerns were identified through analytical analyses, field observations and public involvement efforts associated with this study.

Intersection Approach Warnings

Aggressive driving and high speed limits on portions of US 340 create safety concerns at several signalized intersections along the corridor. In particular, westbound approaches to both the Patrick Henry Way and Shepherdstown Pike intersections were highlighted as major concerns by the public. Vehicles approach these particular intersections at high speeds, resulting in quick decelerations. This becomes an even greater concern as traffic queues develop during peak periods from WV 9 to east of the Patrick Henry Way intersection. Quick truck decelerations also create noise disturbances in and around these intersections.

Low-cost solutions, including the addition of signage, may assist in addressing these safety concerns. Advance-warning flashers, as illustrated in **Exhibit 18**, can forewarn drivers when a traffic signal is about to change to the yellow and red phases. These warning signs can also be operated to flash continuously, and in these cases do not need to be connected to the signal controller. Research indicates that warning flashers are effective in reducing approach speeds to intersections and reducing accidents.

**Exhibit 18: Examples of Advanced Warning Flashers**




** Source: Making Intersections Safer: A Toolbox of Engineering Countermeasures to Reduce Red-Light Running; ITE 2003*

Intersection Improvements at Un-Signalized Locations

During peak periods, making left-turns or through movements at the un-signalized intersection approaches to US 340 becomes very difficult and even un-safe. Key un-signalized approaches which allow such movements include Blair Road, Halltown Road, and Millville-Bakerton Road. Although these approaches to US 340 do not carry significant traffic volumes, limited gaps and high speeds (e.g. 60mph speed limit) on US 340 make it difficult to safely conduct such movements.

Improvement projects at the US 340 and Millville/Bakerton intersection were rated as the highest priority projects in the corridor (per public input received from meetings and website). This intersection has higher traffic volumes during the summer season as it is used for access to river recreation opportunities. Future growth along Millville, including Old Standard Quarry, will severely degrade intersection operations.

As shown in **Exhibit 19**, several project types were considered as possible improvements for the un-signalized intersection locations. At the US 340 and Millville/Bakerton intersection, an underpass is identified as a solution to increase safety. However, public comments have stressed that if funding is not currently available for an underpass, then shorter term options should be considered until such a project can be completed.

**Exhibit 19: Improvement Project Types for Un-Signalized Intersections**

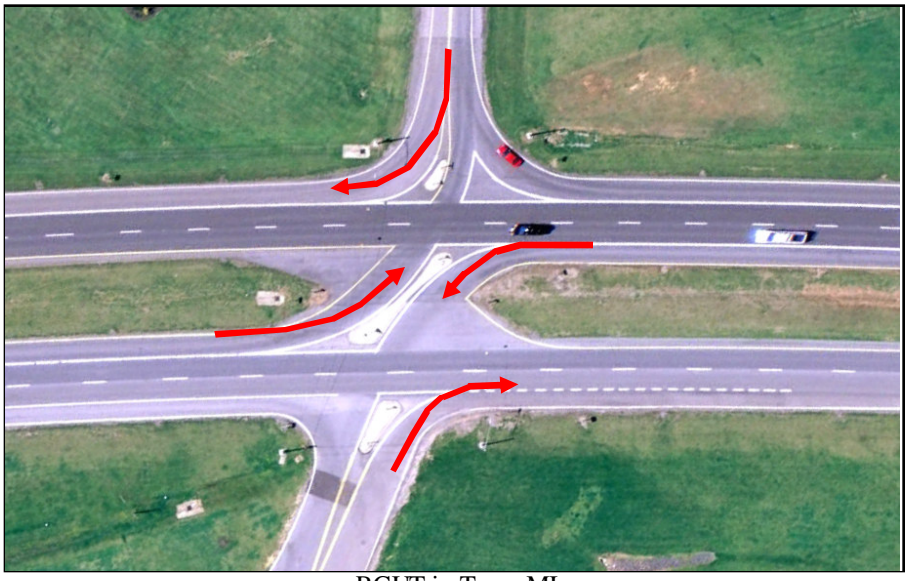
| Project Type | Positive | Negative |
|---|---|---|
| **Signs to Prohibit Left-Turns / Through Movements** | Low-Cost | Does not prohibit illegal movements; Requires U-Turn downstream of intersection |
| **Signalization** | Low-Cost; Safe Left Turn and Through Movements | Degrades traffic flow on mainline US 340 |
| **Intersection Reconfiguration (RCUT)** | Clearly directs vehicles ; separates movements for additional safety | Medium Cost; Requires U-Turn downstream of intersection |
| **Underpass / Overpass** | Restricts Left-turns; Safe through movements | High Cost Completion Schedule |

Restricted Crossing U-Turn (RCUT) intersection design has been successfully used for conditions similar to US 340 (e.g. arterial roadways with more dominant flows on the major road). The RCUT intersection works by redirecting left-turn and through movements from the side street approaches. Instead of allowing those movements directly through the intersection, as in a conventional design, a RCUT intersection accommodates those movements by requiring drivers to turn right onto the main road and then make a u-turn either at the next downstream intersection or at a one-way median opening 400-1,000 feet downstream. If traffic volumes warrant signalization, traffic signal control on a RCUT intersection requires fewer phases to accommodate a higher throughput of through vehicles. **Exhibit 20** provides several examples of RCUT intersections including one with additional median openings to accommodate u-turns.

A traffic analysis was conducted at the US 340 intersections with Millville and Blair roads based on forecast turning movements related to the land use vision growth scenario. The analysis eliminated left turns at each intersection forcing travelers to make a u-turn at the next downstream intersection. The results indicated that downstream intersection operations were not significantly worsened by these additional u-turns, indicating that an additional median opening on US 340 may not be required.

**Exhibit 20: Example RCUT Intersections**

RCUT in Emmitsburg, MD



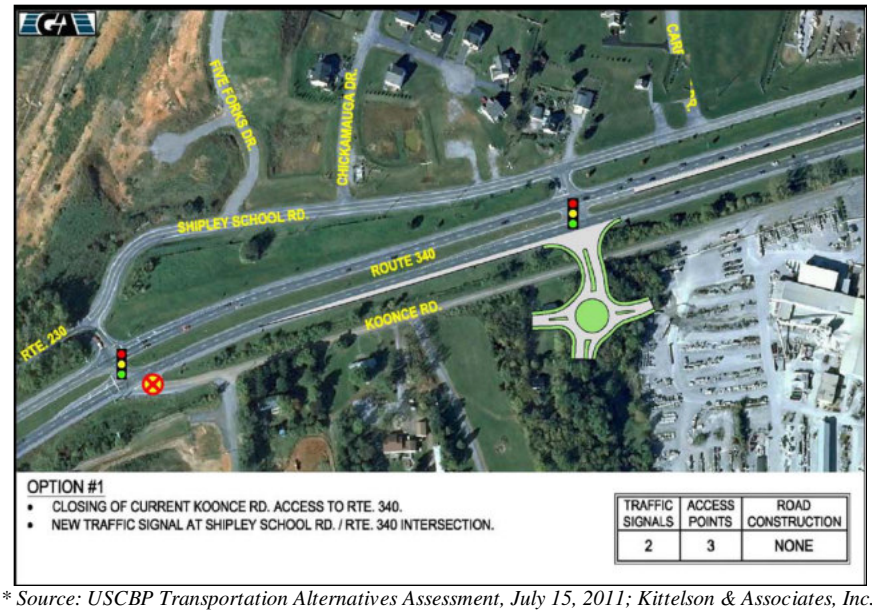
RCUT in Troy, MI


** Source: Google Earth*

US 340 Improvements at USCBP Entrance

A recent study, conducted by the USCBP, examines transportation improvement strategies for the US 340 intersections near the proposed entrance to the USCBP training center. Operational and safety concerns are forecasted at the current un-signalized intersection based on projected peak hour traffic volumes. **Exhibit 21** illustrates one of the four options that were examined. All of the options include the addition of a new traffic signal at the USCBP access location, which is anticipated to occur in the near future. The improvements are focused on providing safe access to US 340 from the expanded training facility and from the Shipley School Road approach. Additional alternatives are being evaluated for traffic routing options for Shipley School Road.

**Exhibit 21: USCPB Proposed Intersection Improvements – Option 1**




** Source: USCBP Transportation Alternatives Assessment, July 15, 2011; Kittelson & Associates, Inc.*

Improvements may also be considered just east of the new USCBP access intersection where Shipley School Road intersects with US 340 near the elementary school. At this location, left turns are currently prohibited due to limited sight distance and high speeds on US 340. A new downstream traffic signal may also warrant closing this intersection for right turns.

***Recommendations for Additional Travel Lanes***

Traffic demand will increase with new residential and commercial development and more capacity will be needed along the US 340 corridor to address peak period demand. However, the addition of through lanes has not been recommended for the entire stretch of US 340 within the East Gateway Corridor. The primary reasons include:

- There is little benefit of US 340 end to end mainline capacity increases until the bridge crossing capacity deficiencies are addressed.
- There is limited right-of-way for US 340 expansion near the Patrick Henry Way intersection.
- The largest projected increase in traffic movements will be turning vehicles on US 340. Addressing such demand could include intersection reconfiguration, signalization or the possible integration of a frontage road system.
- Additional travel lanes on mainline US 340 may degrade the character of the corridor.

However, several sections of US 340 were identified for possible capacity expansion. Further studies may be needed to identify key right-of-way and construction issues with each conceptual project. **Exhibit 22** illustrates the possible extension of existing turning lanes between WV 9 and Jefferson Terrace Road.

**Exhibit 22: US 340 Turning Lane Extension (WV 9 to Jefferson Terrace Road)**


** Image Background from Google Earth*

This project would provide additional capacity for turning movements and may provide some reduction in vehicle queuing between the two intersections. Further considerations may include carrying these additional turn lanes through to the intersection with Patrick Henry Way. This may be particularly valuable for the westbound direction, allowing a dedicated lane from Patrick Henry Way to the US 340 ramp to WV 9 North.

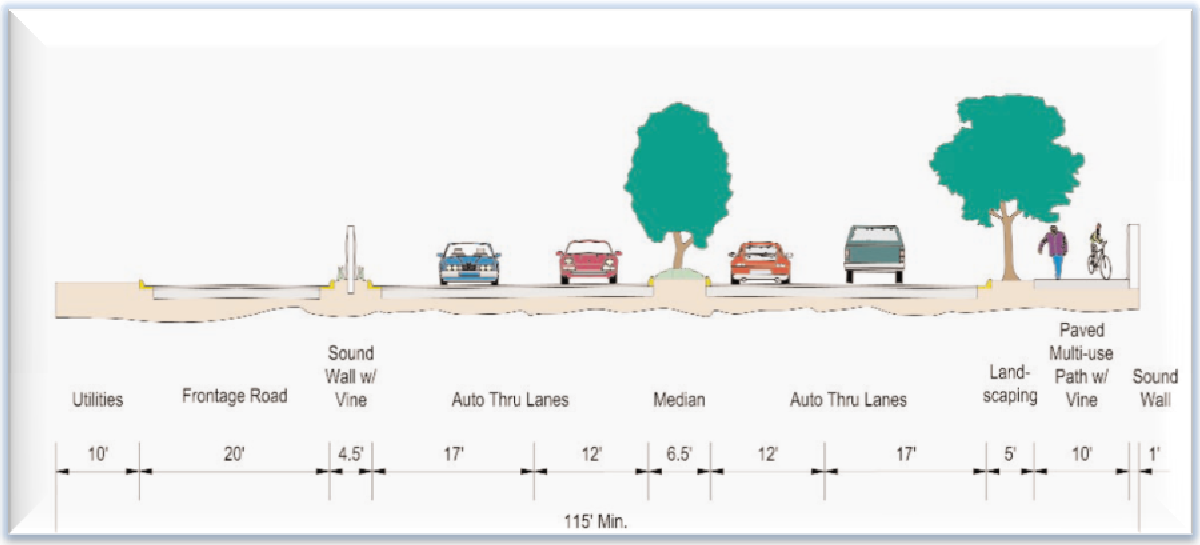
An additional travel lane may also be considered on the section of US 340 westbound just after the Harpers Ferry Bridge crossing. An existing truck climbing lane starts about 0.3 miles after Shenandoah Street. Field observations and public comments have noted slow truck speeds ascending the hill and resulting in some traffic queuing. A project is included to extend the truck climbing lane back to the Shenandoah Street intersection. Key issues regarding available right-of-way and the possible need for a turning lane at Union Street may affect the viability of this project.

### *Recommendations for New Integrated Road System*

In lieu of capacity increases on US 340, many stakeholders and public comments have expressed support for an integrated frontage road system. The recommended new roads primarily provide additional east-west options to travel through the corridor. A frontage road system may also be important in providing access to regional commercial and employment centers during peak hours, providing more flexibility to limit left turns at un-signalized intersections with safety concerns, and integrating with a bike and pedestrian trail system.

Through the project identification and evaluation process for this study, all parties have stressed the need for attractive street design. These designs can be integrated with frontage roads as illustrated in **Exhibit 23**. Following the *Complete Streets* concepts being stressed by the City of Ranson, new roads should focus on roadway connectivity and allow everyone, whether on foot, bike, or public transportation, to reach community focal points. Those types of roadway designs will ensure that new roads help communicate the community's vision and ensure a safe, accessible, and attractive transportation system.

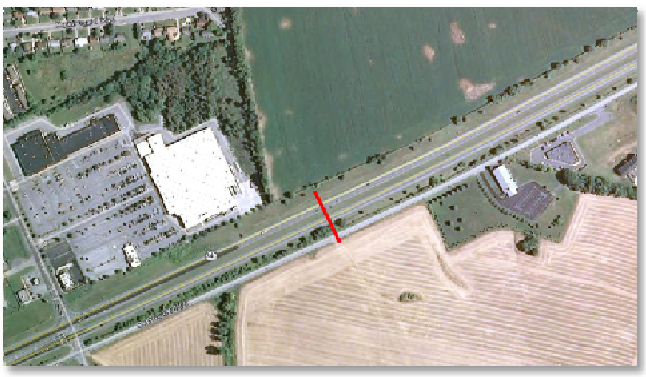
**Exhibit 23: Stressing Options and Attractiveness for New Roadway Design**




*Source: Jessop Parkway Concept Plan, Solano Transportation Authority*

Such road designs may require a large amount of right-of-way especially when integrated with frontage roads and multi-use paths. The example provided in **Exhibit 23** illustrates a design requiring about 115 feet of right-of-way. **Exhibit 24** illustrates a portion of US340 near Patrick Henry Way. This particular section (as illustrated by the red line in the figure) has about 280 feet of width, which may allow for frontage roads on each side of US 340 and beautification efforts. Future planning and design efforts will need to assess existing property lines and state-owned right of way associated with the US340 corridor.

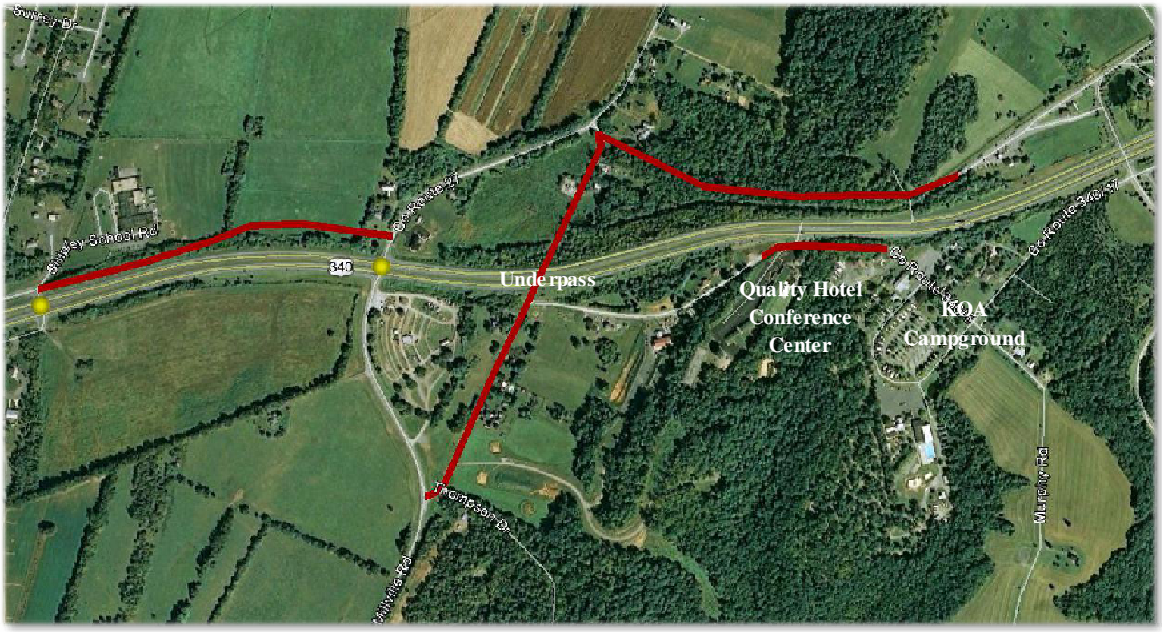
**Exhibit 24: Potential US340 Right-of-Way**



Bakerton-Millville Road Connections

**Exhibit 25** illustrates proposed new roadways near the intersection with US 340 and Millville/Bakerton Road. This intersection and the associated projects were the highest prioritized projects at the January 19th public work session. Short term improvements have already been discussed for this intersection.

**Exhibit 25: Recommended Improvements Near US 340 and Millville-Bakerton Intersection**




** Source: Google Earth*

Longer-term solutions include constructing a new portion of Millville Road as an underpass connecting to Bakerton Road. This would allow for the elimination of left turns and through movements at the current at-grade intersection and provide a safe north-south connection under US 340. There are several optional alignments for the underpass and further studies may be needed to identify potential costs and right-of-way issues with each alternative.

New frontage road connections from Bakerton Road east to Washington Street and west to Shipley School Road provide alternative access to Harper Ferry. With these connections, traffic to/from areas north or south of the corridor can access Harpers Ferry without traveling on US340. Portions of these east-west frontage roads border on National Park Service property.

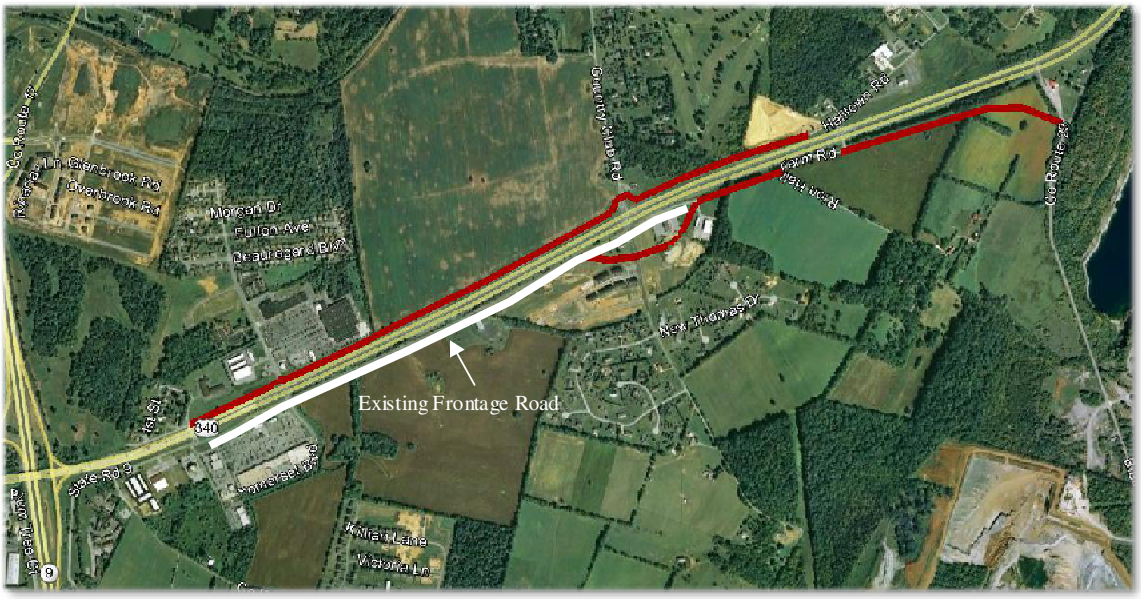
A frontage road linkage is also recommended to connect Alstadts Hill Road and Old Taylor Lane near the Quality Inn and KOA Campground. This connection would provide alternative access to the Millville underpass and Harpers Ferry National Park. Several public comments have addressed the safety concerns in making left turns out of the Quality Inn parking lot onto US 340 westbound. These safety concerns could be alleviated by providing alternative access options.

<u>Frontage Roads on Western Portion of US 340</u>

As part of the land use vision for the corridor, much of the corridor's future commercial, office and mixed use development will be focused on the western portion of US 340 (west of Blair Road). To ensure accessibility and to provide congestion relief on existing portions of US 340, a frontage road system has been recommended.

The existing and recommended frontage roads are illustrated in **Exhibit 26.** Frontage roads currently exist on the southern side of US 340 from Jefferson Terrace Road to just east of Old Country Club Road. A recommended project is to extend the existing frontage road to Blair Road. The extension may also include a relocation of existing portions of the roadway. This frontage road extension would provide additional access to land use growth along the corridor and provide some alternative intersection strategies at Blair Road. For example, the new frontage road would provide options for access to the US 340 and Old Country Club Road intersection if left-turns were restricted at Blair Road.

**Exhibit 26: Additional Frontage Roads on Western Portion of US 340**




** Source: Google Earth*

A frontage road is also recommended on the northern side of US 340 based on the corridor land use vision. The frontage road would extend and connect to Halltown Road providing an east-west route parallel to US 340. The design and construction of this frontage road may include a portion of the bike and pedestrian trail from Charles Town to Harpers Ferry.

The design and operation of these frontage roads may serve as an important access to existing commercial development near Patrick Henry Way. This roads may serve an even greater importance if larger scale investments are made to construct an interchange near the existing US 340 and Old Country Club Road intersection (as discussed later). That scenario could include closing the US 340 at-grade intersections at Patrick Henry Way and Jefferson Terrace Road, while providing access directly from the frontage roads.

Other New Road Connections

Other new roads were recommended to provide residential linkages to commercial areas and to support regional access. A connection between Old Country Club Road and Shepherdstown Pike is recommended on the northern section of the East Gateway Corridor, as illustrated in **Exhibit 27**. This new road would provide an east-west connection to support future development and to provide

alternatives to the frontage road system along US 340. During the public workshops there were some discussions on creating an east-west route to Harpers Ferry along the northern section of the corridor. This incorporated the use of existing roadways including, Oregon Trail, Surrey Drive, Rider Road and Elk Run Drive. However, such alignments are not currently recommended strategies and would need additional study and evaluation.

**Exhibit 27: Alternative East-West Roadway Linkages in Northern Sections of Corridor**


** Source: Google Earth*

Additional roadways connecting Keyes Ferry Road to US 340 (South of the WV 9 interchange) and to Somerset Boulevard would provide access to commercial areas on the western portion of the corridor. These projects could provide some traffic congestion reductions at the WV 9 interchange and the US 340 intersections with Jefferson Terrace Road and Patrick Henry Way.

Shenandoah Springs is a large development of townhouses and single family homes on the western portion of the corridor**. Exhibit 28** provides several new roads that are recommended to provide direct access from this development to commercial areas on US 340. This includes a north-south roadway abutting WV 9 that would connect to Jefferson Terrace Road. In addition, a recommendation is provided for an east-west roadway connecting to Old Country Club Road.

**Exhibit 28: Additional Access Roads to Shenandoah Springs**


** Source: Google Earth*

At the public work session, potential options regarding connections to existing roadways within the Patrick Henry Estates development were also discussed. This would provide direct access to the Walmart and other commercial sites on US 340. However, the Patrick Henry Estates Homeowner's Association is opposed to such options and has sued their developer to obtain the deeds to the roads and common areas in the development. The homeowners association is concerned that such access would severely increase traffic and decrease safety on the residential streets in the community. As an alternative, a possible north-south roadway is identified just east of the Walmart. This roadway could link to a future east-west frontage road on US 340 and provide additional access to new development in the area.

### *Recommendations for a New Interchange*

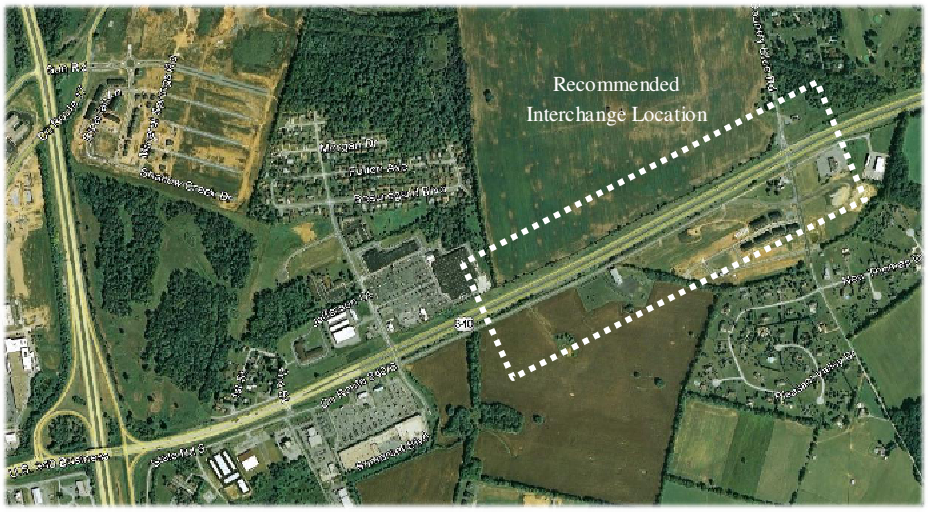
An interchange represents a grade-separated junction of two roads. Along US 340 within the East Gateway Corridor, the only current interchange exists at WV 9. The addition of new interchanges can be valuable in addressing intersection traffic congestion and delays; however, such grade-separated junctions are very space-intensive and costly, due to the need for large physical structures such as tunnels, ramps and bridges.

An interchange is recommended at or near the intersection of US 340 and Old Country Club Road as a replacement to the existing at-grade intersection. Per the land use vision plan, future commercial and other employment growth will be concentrated along the western portions of US 340. The interchange

can serve as a valuable basis to develop transportation system options to address future traffic congestion. It can be integrated with other projects including a frontage road system and possible intersection closures to address long-term growth in the region. The interchange was identified in the past as a long-term transportation need and is included in the financially constrained portion of the HEPMPO LRTP, *Direction 2035*, which was completed in 2010.

If an interchange is determined to be a priority long term need, then efforts must begin now to preserve the right-of-way needed to construct the interchange. **Exhibit 29** illustrates potential locations of the interchange near Old Country Club Road. Development has already occurred at corners of the existing intersection limiting the right-of-way needed for construction. It is currently recommended that if relocated, the interchange be placed west of Old Country Club Road to ensure it is in proximity of the primary current and future commercial development along the corridor.

**Exhibit 29: US 340 and Country Club Road Intersection**




** Source: Google Earth*

With an interchange in place near Old Country Club Road, additional options are available to address future congestion at the Jefferson Terrace Road and Patrick Henry Way intersections. These intersection locations currently have limited right-of-way to make significant improvements and their proximity to WV 9 prohibits an additional interchange being considered. With the addition of frontage roads along US 340, the Jefferson Terrace and Patrick Henry Way intersections could be closed and all traffic directed to the interchange. The frontage roads would be used to access the commercial areas. This strategy is often seen in commercial areas near highways. The linkages between the interchange and frontage road system would require additional right of way north and south of US 340.

### *Recommendations for Other Intersection Improvements*

Un-signalized intersection improvements are addressed in the short-term recommendations section. Other key intersection improvements are also recommended. These include the intersection with Flowing Springs Road / East 5th Avenue / WV 9, which is impacted by recent and future development within the

corridor including Shenandoah Springs. **Exhibit 30** provides images of the current intersection configuration

**Exhibit 30: Flowing Springs / East 5th Avenue / WV 9**

*Flowing Springs / East 5th Avenue*

*WV 9/ East 5th Avenue*

** Source: Google Maps Street View*

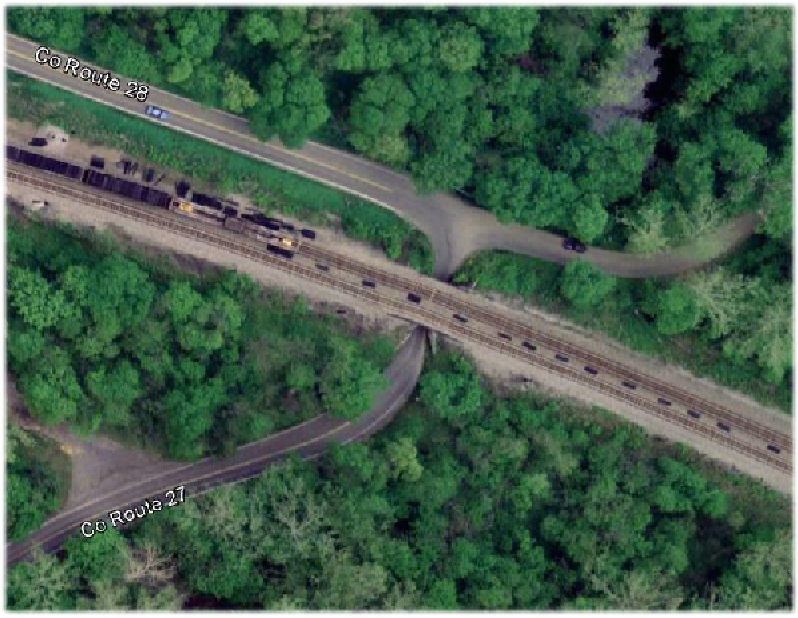
With future increases in traffic on Flowing Springs Road, a traffic signal may be warranted at the Flowing Springs and East 5th Avenue intersection. Just west of this intersection, East 5th Avenue intersects with WV 9 northbound as a stop-controlled approach. With future increases in WV 9 traffic and high speeds along this corridor, a merge lane has been recommended. These improvements have also been addressed in long range planning efforts conducted by the City of Ranson.

Future improvements are also recommended for the intersection with Halltown Road and Shepherdstown Pike if an integrated east-west frontage road system is developed. In that case, Halltown Road may experience greater traffic volumes. Currently, Halltown Road has a stop sign at the intersection with Shepherdstown Pike, and there is limited right-of-way to reconfigure the intersection or add lanes. However, a traffic signal may be warranted with increased traffic volumes to ensure safe turning movements and to reduce potential traffic queues at the stop sign.

Another recommended improvement involves addressing the current Bakerton Road railroad underpass in the northeastern section of the East Gateway Corridor. The current underpass is shown in **Exhibit 31** and

includes very narrow lanes. As future residential development expands to the north, projected traffic volumes will increase on Bakerton Road. The current railroad underpass represents a significant bottleneck and potential safety concern if such an increase in traffic volume were to occur. The project would need to include a widening of the underpass and the possible reconfiguration of the approaches.

**Exhibit 31: Bakerton Road Railroad Underpass**




** Source: Google Earth*

***Recommendations for Transit Improvements***

Significant public support was voiced for improving other transportation modal choices within the East Gateway Corridor. Within the Issues Identification and Concerns section of this report, transit needs have been identified. Determining recommended improvement strategies will require close coordination with transit providers including PanTran, MARC and AMTRAK.

PanTran has undertaken planning efforts to identify potential service improvements within Berkeley and Jefferson counties. This study stresses those recommendations that are applicable to the East Gateway Corridor and provides additional strategy ideas obtained through stakeholder and public involvement efforts. The viability of these transit improvement strategies will be affected by available funding, capital investments, and potential ridership. Further studies will need to be conducted by each transit agency to address these concerns and the details and framework of each conceptual strategy.

**Exhibit 32** summarizes transit strategy recommendations for the corridor. Several of these strategies were addressed in the HEPMPO LRTP and in other PanTran service planning efforts. PanTran's existing Orange Route currently has stops at the Walmart (Patrick Henry Way) and the Harper's Ferry Rail station. Future evaluations will be needed to determine if additional stops may be needed. Such stops could include new commercial or office centers within the corridor. Discussions with the USCBP may determine whether a stop at that location may generate transit riders.

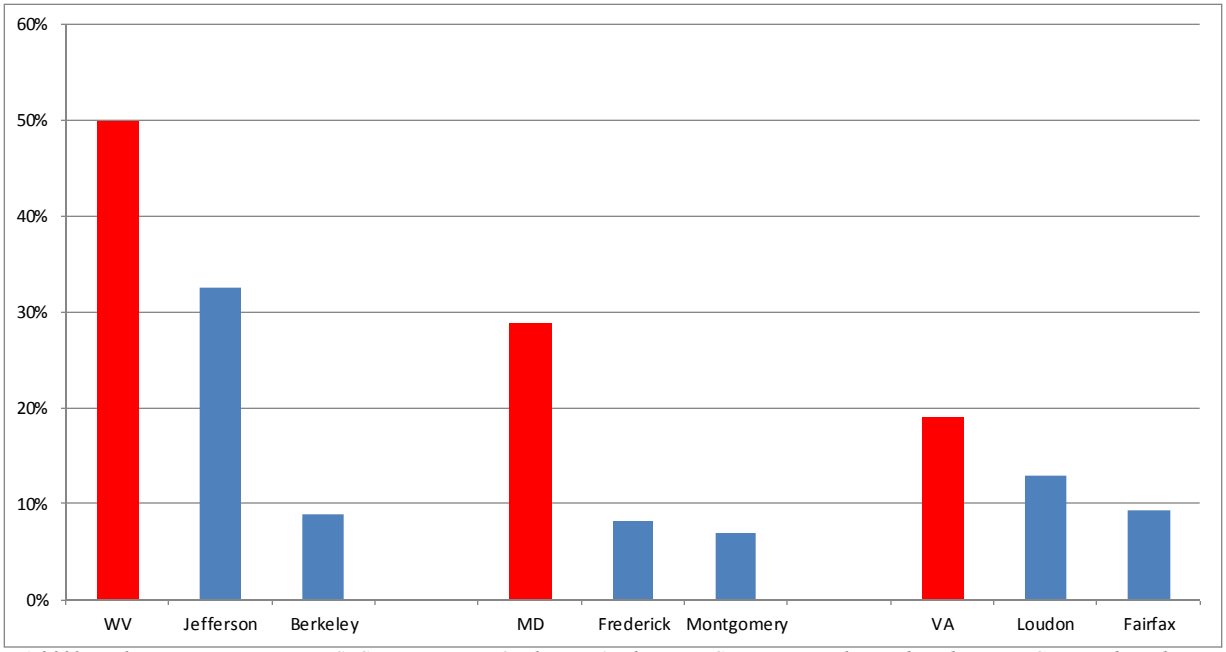
**Exhibit 32: Transit Improvement Recommendations**

| Provider | Strategy / Need Addressed | Addressed in HEPMPO LRTP |
|---|---|---|
| **PanTran** | **Add demand-response service for areas within the East Gateway Corridor. /** There is currently no demand responsive service in the corridor and other areas of Jefferson County. Provides transportation options for physically, economically or socially disadvantaged. | YES |
| | **Restructure the PanTran Orange Route, improve headways to 45 minutes, and add service to MARC stations. /** Current headways range from 2-3 hours. Some MARC train departures are not supported by the Orange Route. In addition, reliability issues due to long route lengths create concerns for meeting train schedules. | YES |
| | **Provide new service linkages to other county commuter bus services in Maryland or Virginia. /** Provides additional options for residents working in Maryland or the Washington D.C. region. | NO |
| **MARC** | **Provide additional MARC service between Martinsburg and Washington D.C. including enhanced midday service schedules**. | YES |
| | **Investigate other locations for MARC stations to increase accessibility and promote transit-oriented development**. | NO (Addressed in Ranson Planning) |

Identifying new potential transit service will provide additional transportation options for the region. **Exhibit** 33 illustrates typical work locations for residents within the East Gateway Corridor based on the CENSUS Longitudinal Employment Household Dynamics On-the-Map (LEHD-OTM) tool.

**Exhibit 33: Where Workers Are Employed Who Live in East Gateway Corridor**

Red = States
Blue = Two Highest Employment Counties in that State




** 2009 Work Destination Report; U.S. Census Bureau, OnTheMap Application; Custom area selection based on East Gateway boundary*

The data indicates that 50% of the corridor residents work outside of West Virginia, in Maryland and Virginia. Such data supports recommendations for additional transit service linkages to other county bus or regional transit services. For example, Loudon County has an extensive commuter bus system that includes stops from Purcellville to Washington, D.C. Thus, opportunities may exist to coordinate PanTran shuttle service with other available service in nearby counties.

### *Addressing Access Management*

The extent to which the access points (driveways and intersections) are controlled or managed in a corridor dramatically impacts the capacity and character of the roadway. On state-owned roadways (like US 340), the state must balance the requirement to provide access to property with the need to maintain roadway function. The WVDOT provides guidelines for access management, including the spacing of intersections to optimize traffic flow and driveway spacing to avoid reductions in capacity due to traffic turning directly into and out of travel lanes. A variety of strategies, including dedicated turning lanes, signal coordination, and frontage roads, can minimize the negative impacts of new development on existing roads. In West Virginia, only interstates have full access control and some high-level U.S. or State highways, such as the WV 9 bypass, are designed with partial control of access. Other facilities depend on local planning and development review processes to protect the capacity of existing roads. Adherence to the access management guidelines in the design of new development and in local comprehensive planning can improve the ability of existing roads to serve traffic as development occurs in the future.

Any municipality may, in cooperation and coordination with WVDOT, develop an access management plan for a specified state highway segment for the purposes of preserving or enhancing that highway's safe and efficient operation. Once adopted by the affected agencies, such plans will form the basis for all future access connection locations. The plan should include a combination of policy, design, and improvement actions aimed at achieving access management objectives. A corridor access management plan may include the following elements:

- Existing and future access locations,
- All major access-related roadway design elements,
- Lots or parcels currently having frontage on the highway segment,
- Pedestrian and bicycle amenities and associated safety implication,
- Transit facility considerations; and
- All supporting technical materials, if applicable.

Within this land use vision study, many of the identified transportation projects have focused on limiting additional access points along US 340. This has included an enhanced frontage road system to provide access to current and future residential and commercial developments along the corridor. Several new traffic signals have been identified within the corridor. This includes possible short term improvements at the Millville intersection and intersection improvements related to the new CBP entrance near Halltown Road. However, additional traffic signals and/or new intersection approaches are not recommended west of Old Country Club Road. Longer term solutions including a possible interchange at Old Country Club Road have focused on limiting access to US 340 and providing primary access points to a frontage road system.

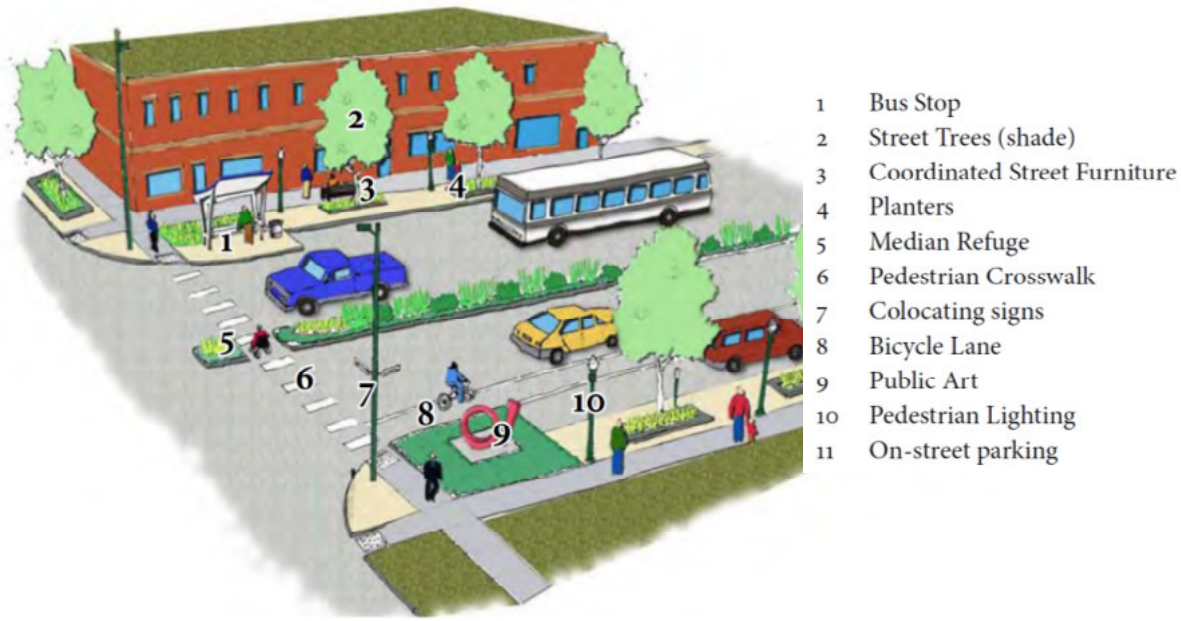
***Roadway Streetscape and Beautification***

The importance of preserving the character and nature of the corridor has been identified as a key priority within the stakeholder and public involvement efforts conducted for this study. Complete Street concepts have been stressed for new roadway designs incorporating landscaping to improve attractiveness and function of the roadway system. Additional comments have focused on improving the landscaping along existing portions US 340. Enhancements to the existing roadway system may include separate studies to identify the types and locations of streetscape improvements that would promote business growth and community pride within the area and address public safety issues such as drainage, infrastructure, and pedestrian access. Such efforts could include the following principles:

- Implement sustainable practices
- Develop complete streets using cohesive design elements
- Promote security and safety
- Coordinate maintenance with design and implementation
- Protect and enhance historic character

**Exhibit 34** illustrates examples of key components in streetscape design which will vary based on the location and types of roadways.

**Exhibit 34: Components of Streetscape Design**

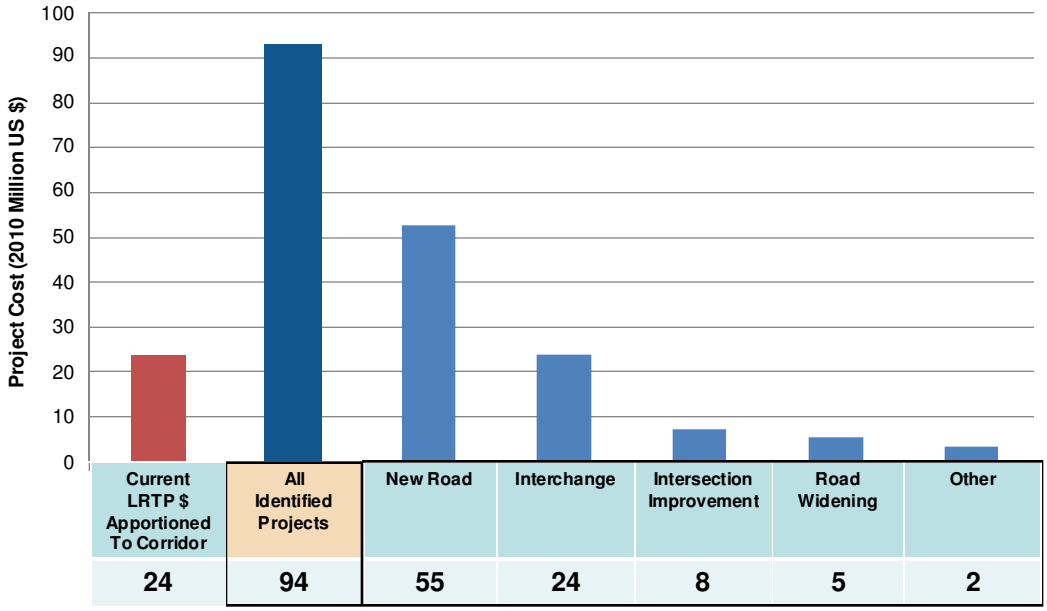



*Example from Omaha Streetscape Handbook*

### *Transportation Project Funding Issues*

This plan provides recommendations for a variety of transportation improvement projects; **Exhibit 35** illustrates that the estimated cost of all these improvements would exceed $90 million. These costs are estimates based on typical project costs; and can vary based on right-of-way and excavation issues. In addition, constructing projects with "Complete Street" concepts may escalate costs based on the need to accommodate other modes (bike trails), attractive roadway design, and extensive landscaping.

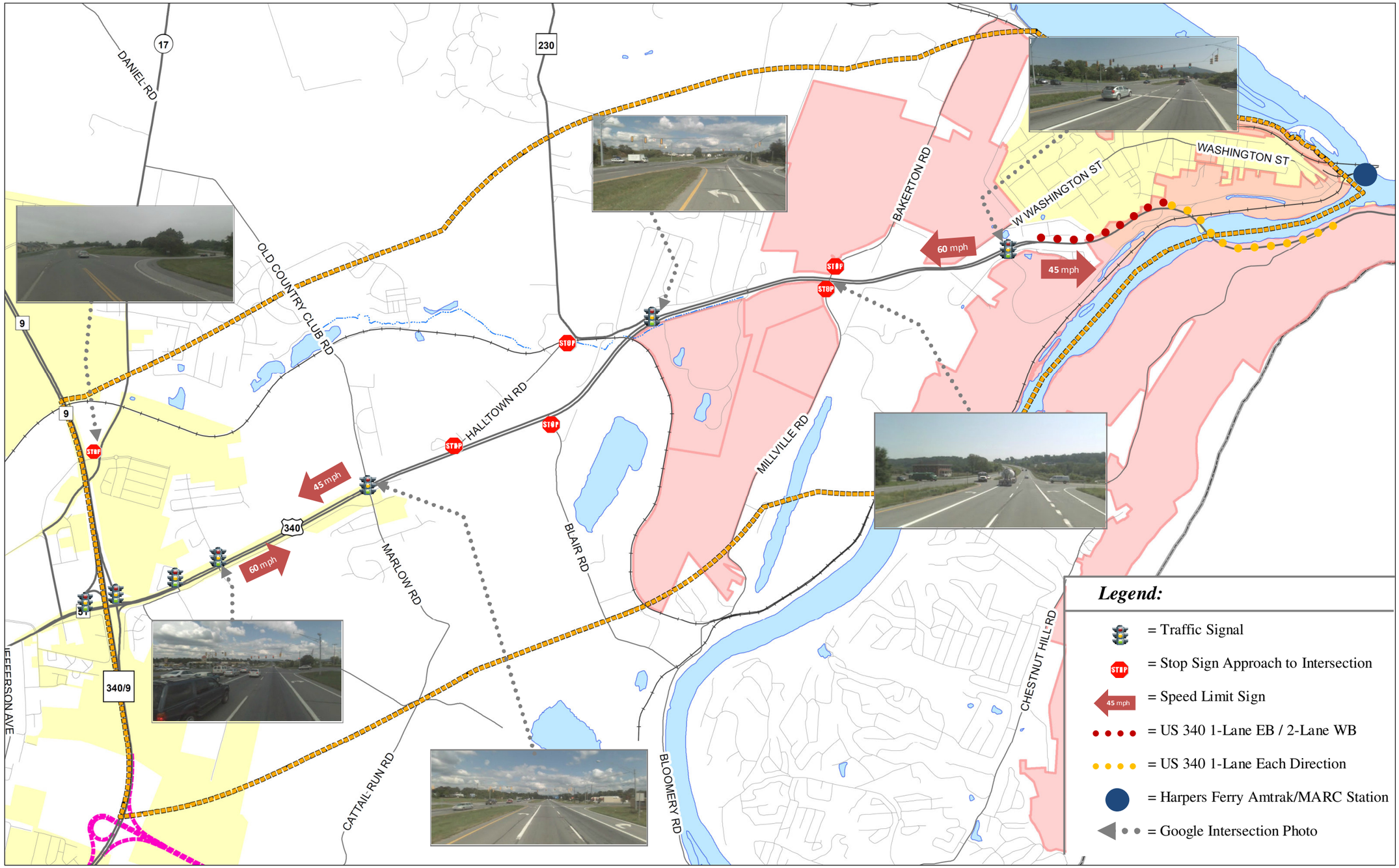
**Exhibit 35: Estimated Cost of Recommended Improvements**




Only one project within the corridor is included in the financially constrained portion of the current HEPMPO LRTP. That project is the interchange at US 340 and Country Club Road, which carries an estimated cost of $24 million. Total federal and state funding for Berkeley and Jefferson counties (combined) was forecast to be $354 million. These funding constraints indicate that it may not be possible to fund many of the identified projects. These issues have prompted the HEPMPO to include a more robust prioritization process as part of the LRTP development process. As future updates are made to the LRTP, these project recommendations will be evaluated and prioritized. This process will utilize this study as key input in combination with stakeholder and public comments and other more focused project studies.

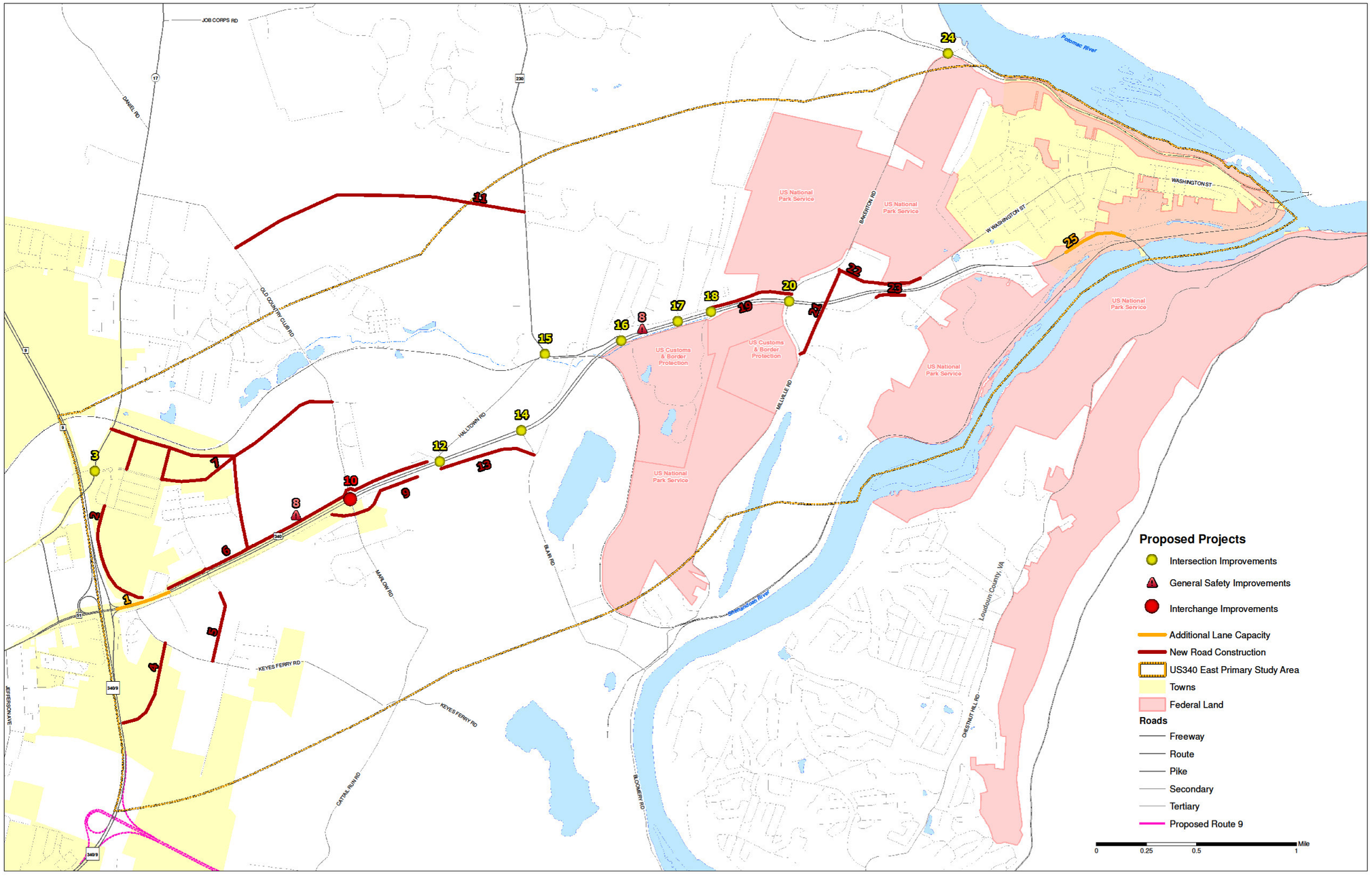
As Jefferson County continues to assess regional transportation strategies, other potential funding mechanisms will need to be evaluated. These may include public-private partnerships, developer funded projects or land donation, or development fees and tolls. The County will also need to work closely with WVDOH to identify whether federal and state dollars may be used for certain projects. WVDOH is responsible for many of the state and county routes; however, they may not accept the responsibility for all new roads. As a result, future coordination will be needed as projects are progressed through the planning phases.

# Appendix A: East Gateway Corridor Transportation System




** Intersection Images were created from Google Maps – Street View, May 2009 Images*

# Appendix B: East Gateway Corridor Recommended Roadway Improvement Projects



# Appendix C: East Gateway Study – Traffic Operations Analysis

***Overview***

This appendix summarizes the traffic operational analyses and results conducted for the East Gateway Land Use Vision Study. The analyses were undertaken to evaluate the impact of the proposed land-use improvements on traffic operations along US 340 using the regional travel demand model, Synchro and the Simtraffic simulation tool. The objectives of this study were to:

- Assess the existing traffic operations along US 340 within the study area and develop a base network to evaluate future conditions;
- Evaluate the impact of the growth in vehicular traffic as a result of a preferred land use scenario; and
- Propose improvements to mitigate congestion.

***Study Area***

Figure 1 illustrates the US340 traffic analysis study area that includes:

- US 340 from the Shenandoah River in the east to the intersection of US 340 Business and Flowing Springs Rd (Co Rt-17) in the west.
- The ramp junctions at the interchange of US 340 and to WV 9 were also included as a part of the Synchro model.
- The signalized and unsignalized intersections along US 340 that were modeled include:

**Table 1: Study Area Intersections**

| ID | INTERSECTION with US 340 | Signalized/ Unsignalized |
|---|---|---|
| 1 | Shenandoah St | |
| 2 | Union Street | |
| 3 | W. Washington St / Shoreline Dr | |
| 4 | Bakerton Rd / Millville Rd | |
| 5 | Co Rt 340/13 / Shipley School Rd | |
| 6 | Shepherdstown Pike / S. Frontage Rd | |
| 7 | Blair Rd | |
| 8 | Halltown Rd / Rion Hall Farm Entrance | |
| 9 | Old Country Club Rd / Marlow Rd | |
| 10 | Patrick Henry Way | |
| 11 | Jefferson Terrace Rd | |
| 12 | Ramps to/from NB WV9 | |
| 13 | Ramps to/from SB WV9 | |
| 14 | Flowing Springs Rd & E. Washington St | |

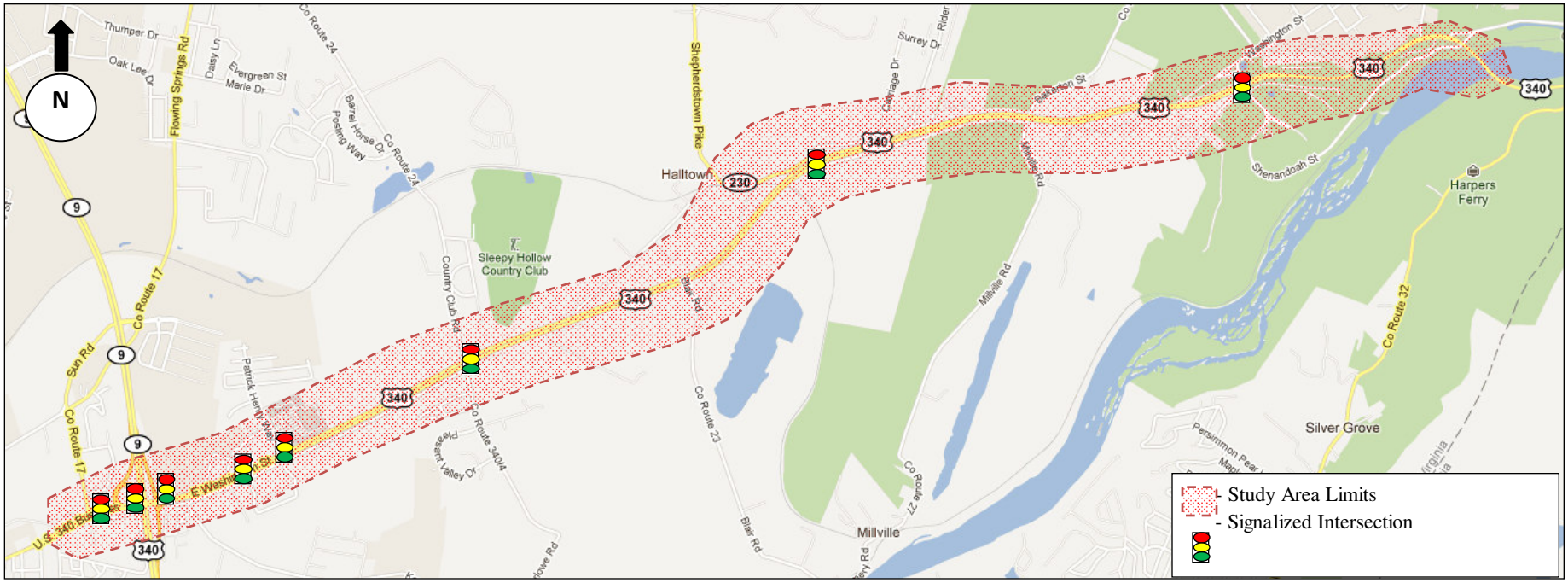



**Figure 1: Study Area**

***Data Collection***

A base Synchro network of the entire corridor including all the intersections listed in Table 1 was developed for the AM and PM peak hours. The data collection effort to develop the Synchro models for the operational analysis included:

- Turning Movement Counts: Morning and evening peak-period weekday turning-movement counts were received from WV DOT at the following intersections along US 340:
  - *W. Washington St / Shoreline Dr*
  - *Bakerton Rd / Millville Rd*
  - *Shepherdstown Pike / S. Frontage Rd*
  - *Blair Rd*
  - *Old Country Club Rd / Marlow Rd*
  - *Jefferson Terrace*
  - *Ramps to/from NB WV9*
  - *Ramps to/from SB WV9*
  - *Flowing Springs Rd & E. Washington St*

  The turning-movement counts at most of the intersections with missing count data were collected as a part of field visits conducted during this study. For the remaining intersections with missing count data, the turning movements were projected based on the upstream and downstream intersection count data.

  Based on the peak-period count data, a system peak hour for AM and PM was established for the corridor. The AM system peak hour was established as 8 AM to 9 AM and the PM system peak hour was from 5 PM to 6 PM.

  Truck (heavy vehicles) percentages were also developed for each intersection approach based on available classification count data and from the travel forecast model outputs for the future conditions.

- Base Mapping: A GIS shape file was used to scale the background images. Aerial images were downloaded from Google Earth and scaled over the shape file to establish a base-map to be used as background image for the Synchro network.
- Signal Timing Data: Signal timing data was also requested and received from WVDOT for the signalized study intersections. The timing data was also verified in the field.
- Field Data: Other data was collected in the field to develop the Synchro models and included lane configuration, geometry, speed limits, etc.
- Travel Time & Speed Data: Traffic statistics such as average travel speeds within the corridor and the travel time were obtained from the TomTom. Existing congested speeds were used to validate the peak hour model results and to calibrate the simulation models.

***Base Model Calibration***

A base scenario reflects current year infrastructure and traffic conditions within the study area. The base year for this analysis was assumed as 2011, the year when turning movement volumes, speeds and travel time data were collected in the field. It is standard traffic engineering practice to account for mid-block sinks and sources by balancing turning movement volumes. Therefore, the base scenario turning movement volumes were balanced and input into the models. The AM and PM peak hour balanced traffic volumes are shown in Table 2 and Table 3 respectively.

To reflect current operations, the base year microsimulation model is compared to field observations. This is accomplished through an iterative calibration process that involves checking the model outputs against the available data. The key measures used for the calibration process of this model were speeds and travel times along US 340 within the corridor. The SimTraffic microsimulation model was run multiple times (five runs) for each peak hour and the results from all runs were averaged to develop the system performance measures. The SimTraffic parameters such as link speeds, turning speeds and/or signal timing were adjusted to achieve results from the microsimulation model that are reasonably comparable to the field conditions.

Table 4 through Table 7 shows a comparison between the output generated by the microsimulation model and the field data. The calibration efforts focused on the end-to-end travel time fit in each direction as well as the travel speeds within each segment. It can be seen that the model reflects a good fit compared to the existing conditions. The difference between the travel times and speeds for most of the segments within the corridor is within 20 percentage points. The US 340 corridor travel times in both eastbound and westbound directions in the AM and PM peak are within 15 percent of that observed in the field.

Once the results of the calibrated model were validated against the field data, they were used to evaluate the existing conditions operations and then used as the base models to develop the future conditions networks.

**Table 2: AM Peak Hour Balanced Traffic Counts – Existing Conditions (2011)**

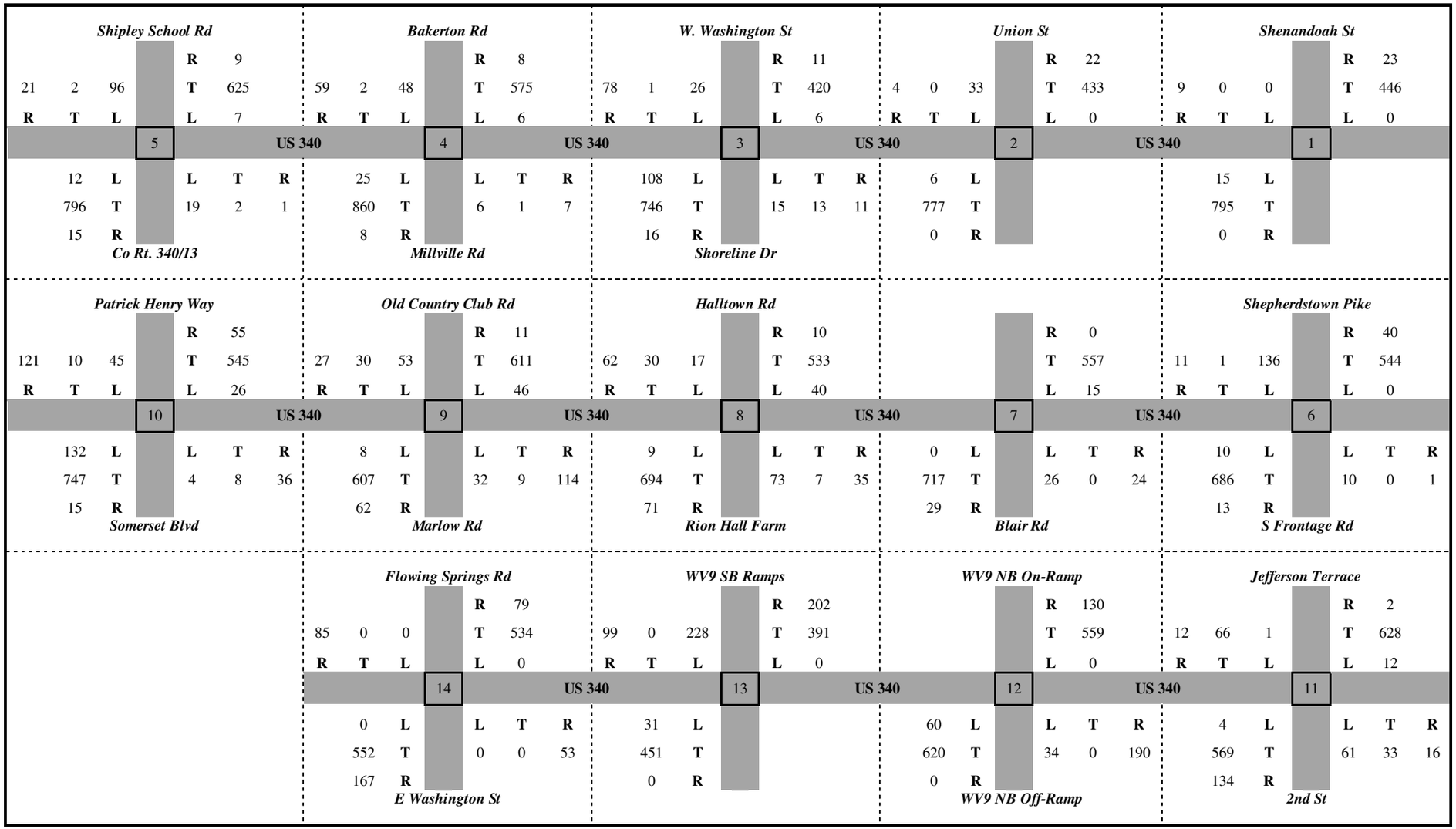


**Table 3: PM Peak Hour Balanced Traffic Counts – Existing Conditions (2011)**

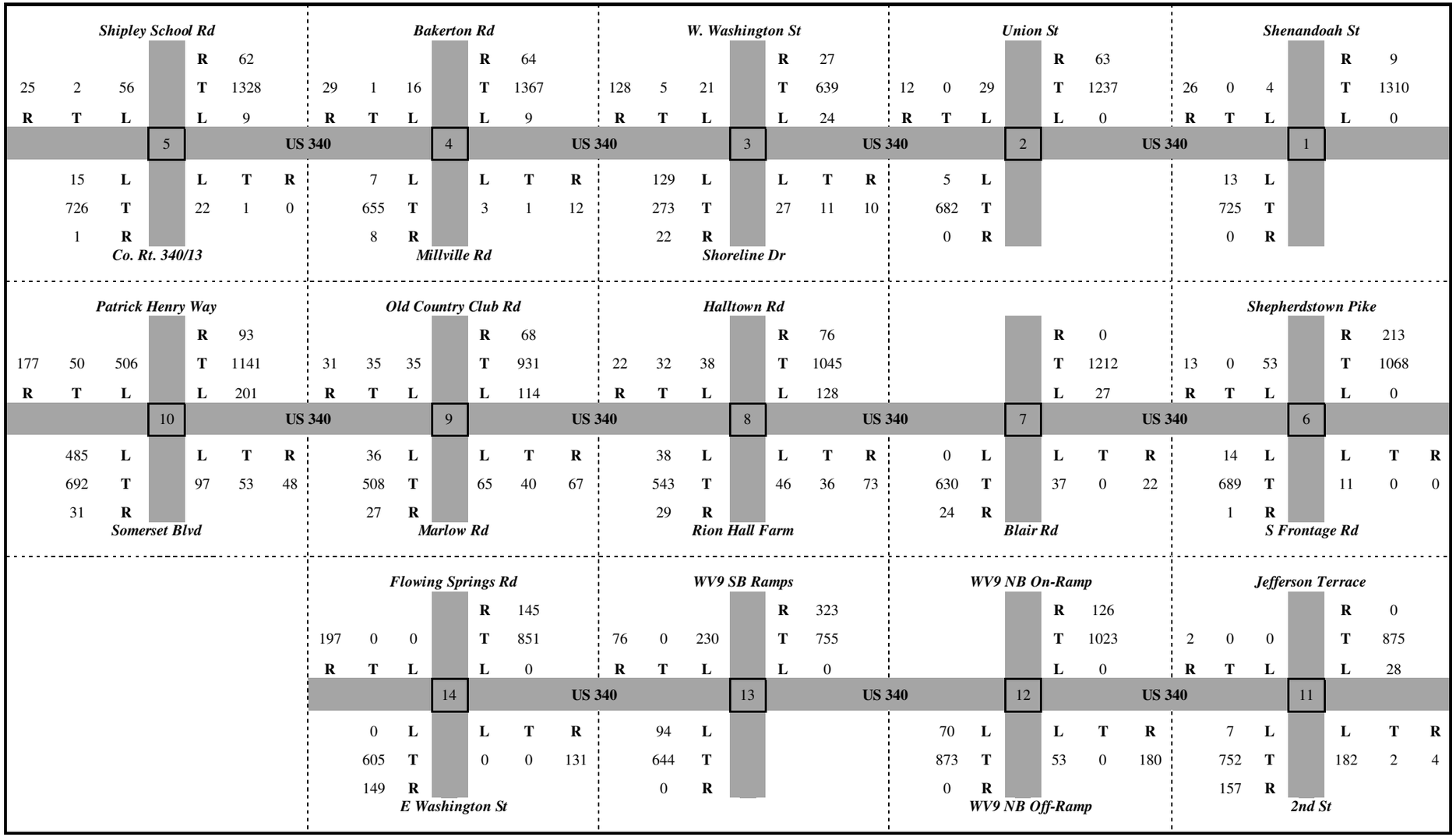


**Table 4: AM Peak Hour Calibration Results [Westbound Direction)**

| Dir WB | ID | INTERSECTION | TT (s) | Sim. TT (s) | Diff (%) | Avg. Speed | Sim. Speed | Diff (mph) |
|---|---|---|---|---|---|---|---|---|
| | | Study Limit East | - | - | - | 49 | - | - |
| | 1 | Shenandoah St | 17 | 25 | -43% | 48 | 48 | 0 |
| | 2 | Union Street | 10 | 10 | 1% | 46 | 43 | 3 |
| | 3 | W. Wash. St/Shoreline Dr | 67 | 71 | -6% | 18 | 36 | -18 |
| | 4 | Bakerton Rd/Millville Rd | 57 | 57 | 1% | 62 | 56 | 6 |
| | 5 | 340/13 / Shipley Sch. Rd | 24 | 28 | -17% | 59 | 52 | 7 |
| | 6 | Sheph. Pike/S. Front. Rd | 38 | 43 | -15% | 29 | 41 | -12 |
| | 7 | Blair Rd | 43 | 47 | -9% | 61 | 52 | 9 |
| | 8 | Halltown Rd/Rion Hall | 26 | 31 | -18% | 58 | 51 | 7 |
| | 9 | C. Club Rd/Marlow Rd | 40 | 44 | -9% | 30 | 41 | -11 |
| | 10 | Patrick Henry Way | 81 | 90 | -12% | 19 | 32 | -13 |
| | 11 | Jefferson Terrace | 22 | 26 | -19% | 40 | 31 | 9 |
| | 12 | Ramps to/from NB Rt-9 | 25 | 31 | -25% | 39 | 36 | 4 |
| | | **TOTAL:** | **450** | **502** | **-12%** | | | |

**Table 5: PM Peak Hour Calibration Results [Westbound Direction)**

| Dir WB | ID | INTERSECTION | TT (s) | Sim. TT (s) | Diff (%) | Avg. Speed | Sim. Speed | Diff (mph) |
|---|---|---|---|---|---|---|---|---|
| | | Study Limit East | - | - | - | 47 | - | - |
| | 1 | Shenandoah St | 18 | 24 | -35% | 45 | 51 | -6 |
| | 2 | Union Street | 11 | 11 | 3% | 44 | 40 | 4 |
| | 3 | W. Wash. St/Shoreline Dr | 71 | 84 | -19% | 19 | 25 | -6 |
| | 4 | Bakerton Rd/Millville Rd | 58 | 59 | -1% | 60 | 59 | 1 |
| | 5 | 340/13 / Shipley Sch. Rd | 24 | 27 | -13% | 60 | 54 | 6 |
| | 6 | Sheph. Pike/S. Front. Rd | 39 | 43 | -10% | 29 | 36 | -7 |
| | 7 | Blair Rd | 44 | 47 | -9% | 59 | 56 | 3 |
| | 8 | Halltown Rd/Rion Hall | 27 | 29 | -8% | 57 | 54 | 3 |
| | 9 | C. Club Rd/Marlow Rd | 44 | 46 | -4% | 23 | 28 | -5 |
| | 10 | Patrick Henry Way | 135 | 127 | 6% | 14 | 23 | -9 |
| | 11 | Jefferson Terrace | 28 | 27 | 3% | 26 | 30 | -4 |
| | 12 | Ramps to/from NB Rt-9 | 34 | 30 | 10% | 31 | 35 | -4 |
| | | **TOTAL:** | **531** | **554** | **-4%** | | | |

**Table 6: AM Peak Hour Calibration Results [Eastbound Direction)**

| Dir EB | ID | INTERSECTION | TT (s) | Sim. TT (s) | Diff (%) | Avg. Speed | Sim. Speed | Diff (mph) |
|---|---|---|---|---|---|---|---|---|
| | 12 | Ramps to/from NB Rt-9 | - | - | - | 44 | 37 | 7 |
| | 11 | Jefferson Terrace | 35 | 42 | -19% | 20 | 26 | -6 |
| | 10 | Patrick Henry Way | 27 | 27 | 2% | 23 | 30 | -7 |
| | 9 | C. Club Rd/Marlow Rd | 73 | 74 | -2% | 30 | 39 | -9 |
| | 8 | Halltown Rd/Rion Hall | 32 | 37 | -15% | 61 | 49 | 13 |
| | 7 | Blair Rd | 25 | 28 | -11% | 61 | 55 | 6 |
| | 6 | Sheph. Pike/S. Front. Rd | 47 | 57 | -21% | 29 | 43 | -14 |
| | 5 | 340/13/Shipley Sch. Rd | 31 | 34 | -10% | 60 | 50 | 11 |
| | 4 | Bakerton Rd/Millville Rd | 23 | 26 | -14% | 61 | 55 | 6 |
| | 3 | W. Wash. St/Shoreline Dr | 62 | 67 | -8% | 28 | 47 | -18 |
| | 2 | Union Street | 59 | 67 | -14% | 44 | 38 | 5 |
| | 1 | Shenandoah St | 10 | 11 | -10% | 44 | 40 | 4 |
| | | Study Limit East | 10 | - | - | - | - | - |
| | | **TOTAL:** | **425** | **470** | **-11%** | | | |

**Table 7: PM Peak Hour Calibration Results [Eastbound Direction)**

| Dir EB | ID | INTERSECTION | TT (s) | Sim. TT (s) | Diff (%) | Avg. Speed | Sim. Speed | Diff (mph) |
|---|---|---|---|---|---|---|---|---|
| | 12 | Ramps to/from NB Rt-9 | - | - | - | - | 33 | |
| | 11 | Jefferson Terrace | 43.04 | 33.5 | 22% | 19 | 24 | -5 |
| | 10 | Patrick Henry Way | 33.40 | 40.8 | -22% | 17 | 19 | -2 |
| | 9 | C. Club Rd/Marlow Rd | 86.79 | 79.6 | 8% | 26 | 34 | -8 |
| | 8 | Halltown Rd/Rion Hall | 33.75 | 38.1 | -13% | 56 | 50 | 6 |
| | 7 | Blair Rd | 25.89 | 28.2 | -9% | 60 | 51 | 9 |
| | 6 | Sheph. Pike/S. Front. Rd | 46.48 | 67.9 | -46% | 31 | 33 | -2 |
| | 5 | 340/13/Shipley Sch. Rd | 31.32 | 33.8 | -8% | 59 | 55 | 4 |
| | 4 | Bakerton Rd/Millville Rd | 24.78 | 26.8 | -8% | 52 | 48 | 4 |
| | 3 | W. Wash. St/Shoreline Dr | 73.13 | 82.8 | -13% | 22 | 34 | -12 |
| | 2 | Union Street | 62.60 | 58.4 | 7% | 41 | 45 | -4 |
| | 1 | Shenandoah St | 10.14 | 9.4 | 7% | 42 | 44 | -2 |
| | | Study Limit East | 10.93 | - | 22% | | 33 | |
| | | **TOTAL:** | **471** | **499** | **-6%** | | | |

***Future Traffic Forecasts***

The future traffic forecasts were developed based on the HEPMPO (Hagerstown Eastern Panhandle MPO) Travel Demand Model runs for 2035. A Preferred Land-Use scenario for 2035 was evaluated for this study.

Traffic volume growth rates were developed based on the model runs for each of the study intersection approaches. Using these growth rates, the future traffic volumes were developed by factoring base year count data. Once the future intersection turning movement volumes were established, they were balanced and input into the base models. The signal timing splits and offsets were optimized for the corridor. No other geometric changes were assumed for the No-Build future conditions.

An additional Build scenario was evaluated for this study that assumed the following developments for the preferred land-use scenario:

- Frontage road along US 340 from Rt-9 up to Blair Road.
- Right-in/Right-out only for side streets at the intersection of US 340 with Bakerton Rd/Millville Rd
- North leg at intersection of US 340 with Blair Rd

For the Build scenario, the traffic volumes were also developed based on the HEPMPO model runs and were balanced along both directions of US 340 within the corridor. Table 8 through Table 11 show the AM and PM peak hour balanced traffic volumes for the future No-Build and Build scenarios. These volumes were input into the Synchro network to conduct the traffic operations analysis for the future conditions scenarios. The signal timing splits and offsets were optimized for the corridor.

The following sections detail the findings of the operations analysis.

**Table 8: AM Peak Hour Balanced Traffic Counts - Future (2035) No-Build Conditions**

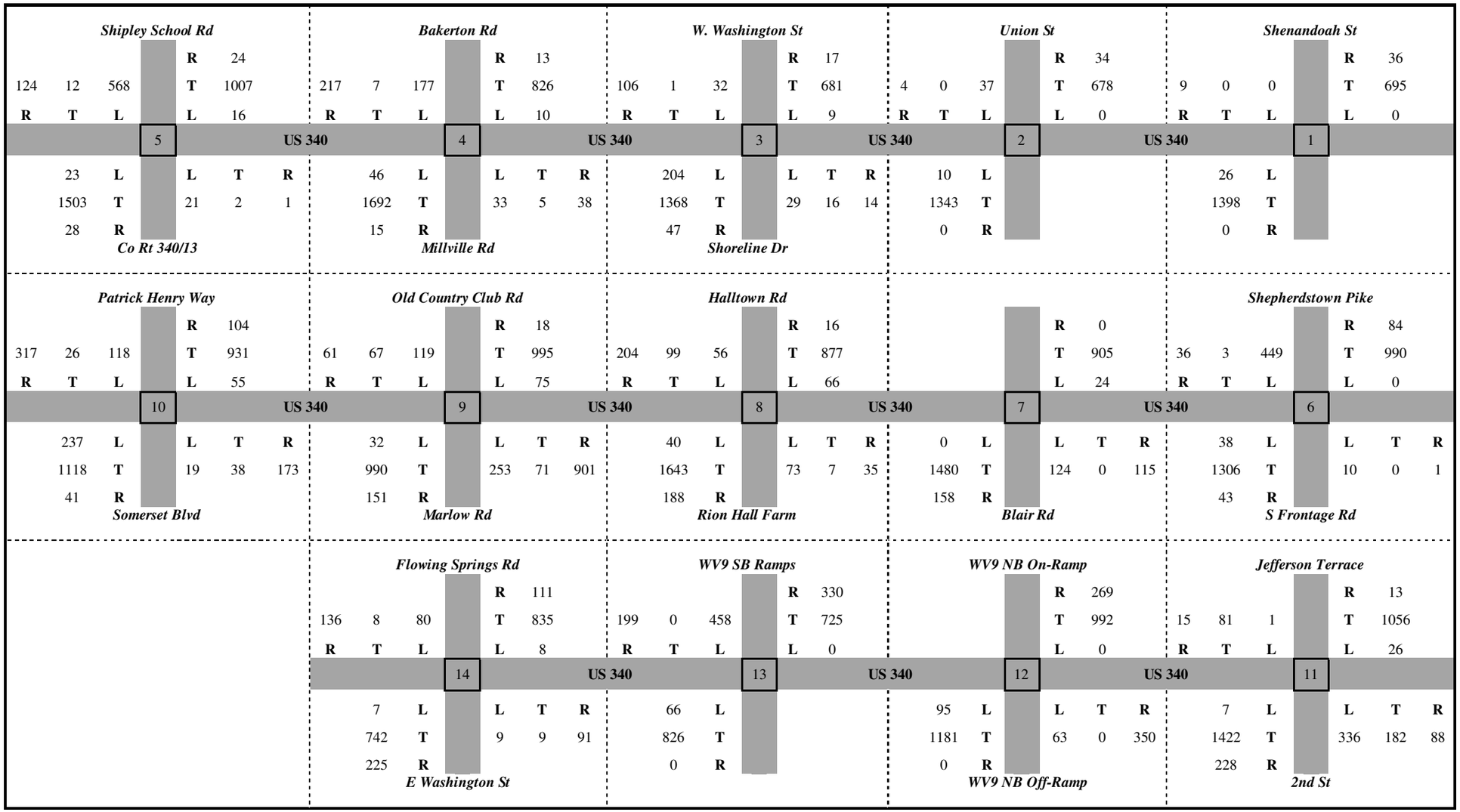


**Table 9: PM Peak Hour Balanced Traffic Counts - Future (2035) No-Build Conditions**

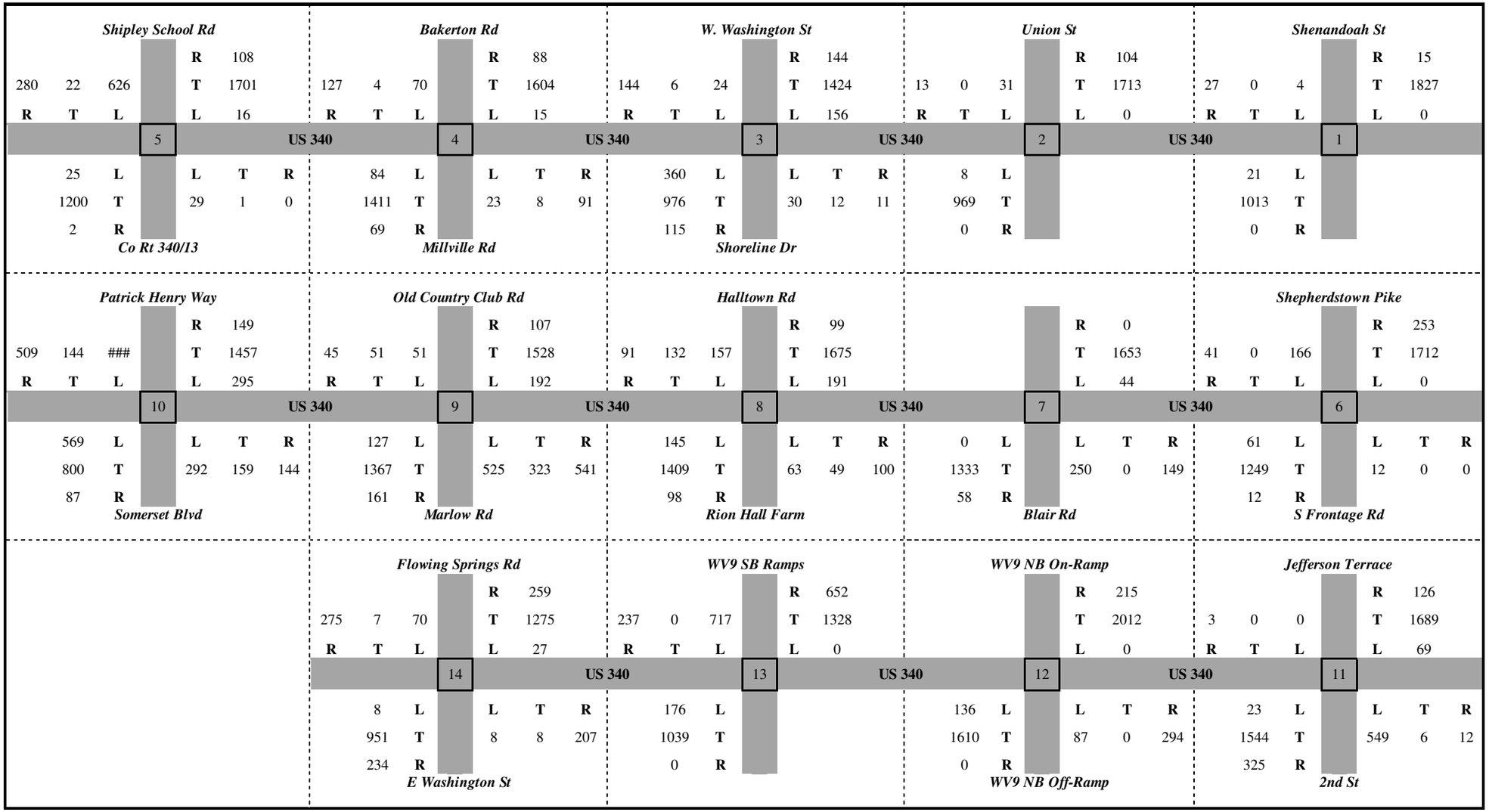


**Table 10: AM Peak Hour Balanced Traffic Counts - Future (2035) Build Conditions**

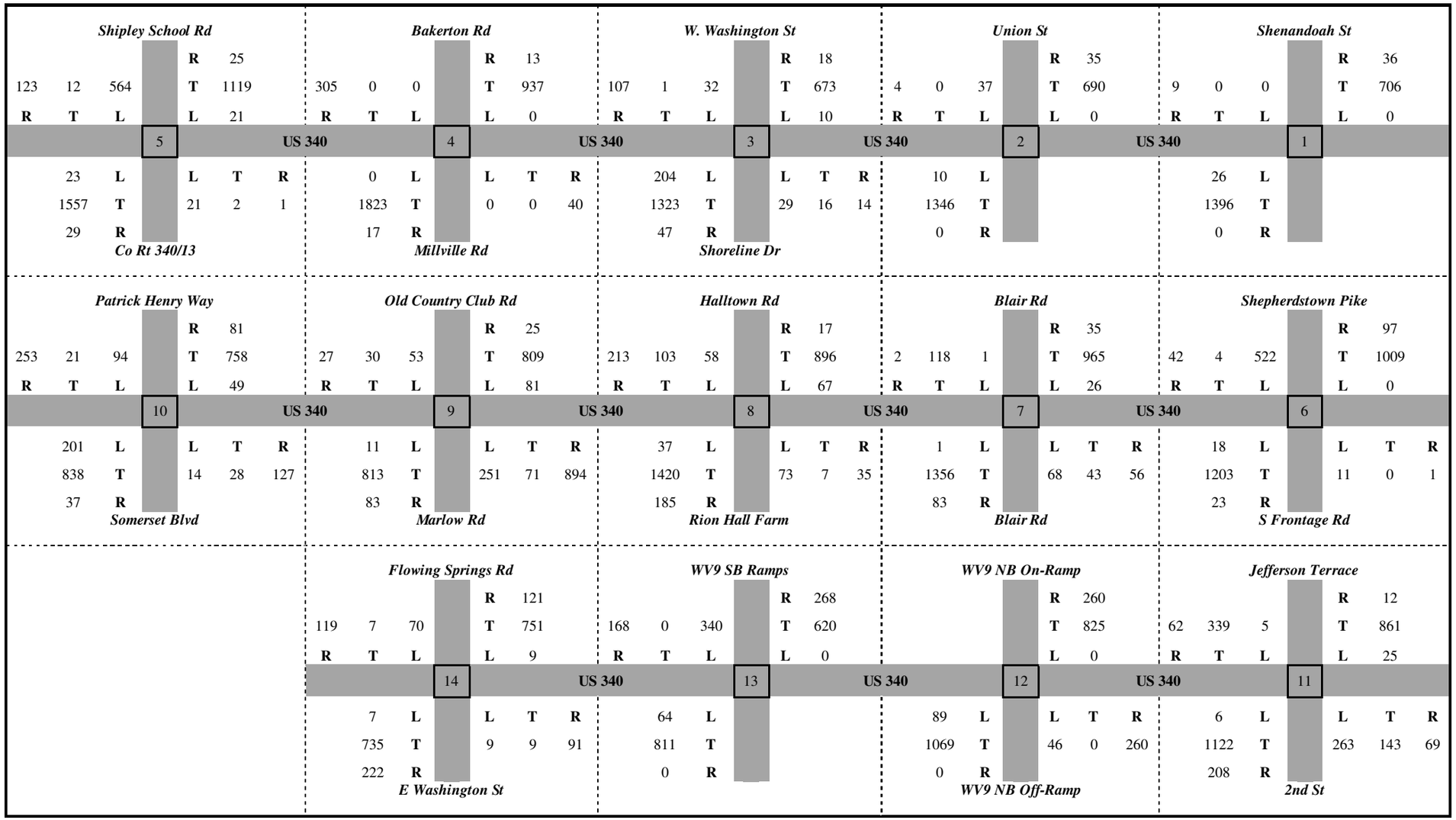
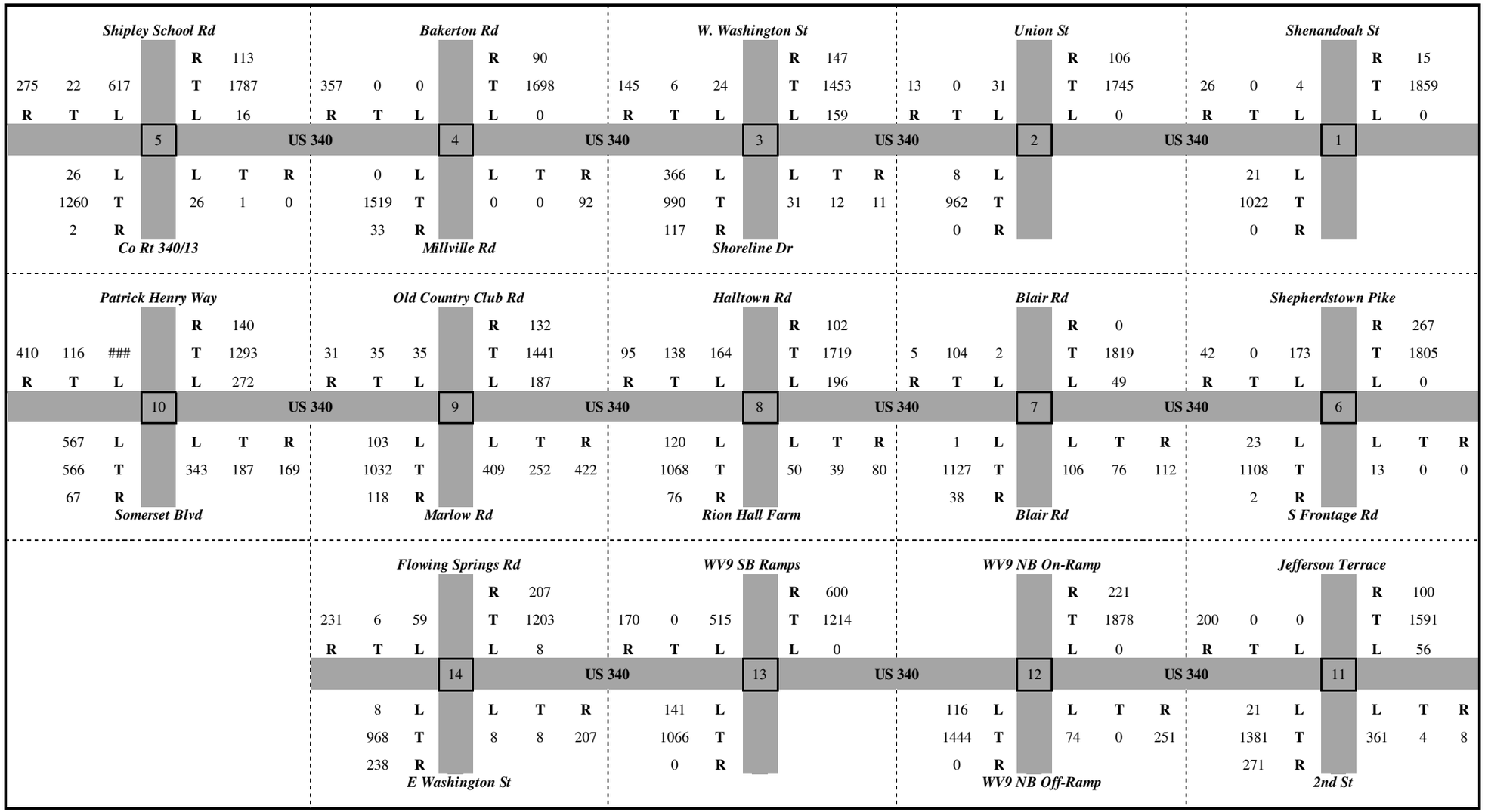


**Table 11: PM Peak Hour Balanced Traffic Counts - Future (2035) Build Conditions**



### *Traffic Operations Analysis*

The intersection capacity analysis including Level of Service (LOS) and queuing analyses for the peak hours was conducted using the Synchro/SimTraffic simulation software. The capacity analysis results reported here are from the HCM Signalized and Unsignalized Intersection Capacity Analysis Report generated from Synchro. To conduct the queuing analysis, multiple (five) runs were conducted in SimTraffic using an incremental random number seed for each run. A seeding time of five (5) minutes followed by an hour of simulation interval was recorded for each run and an average of the results of the multiple runs was reported.

*Existing Conditions:*

The results of the existing conditions capacity analysis are listed in Table 12 and Table 13 below for AM and PM peak hours respectively. The results of the SimTraffic simulation for the existing conditions are listed in Table 14.

The results show that under existing conditions all signalized and unsignalized intersections operate at LOS D or better in both AM and PM peak hours. At two of the unsignalized intersections of US 340, Shipley School Rd and Rion Hall Farm, the side street approaches are operating at failed level of service conditions. However the analysis does not take into account the median storage refuge that left-turning vehicles (from each side-street) can make use of to complete the turn in two-step process. Overall the operating conditions within the study corridor are acceptable during both peak hour conditions.

**Table 12: Intersection Capacity Analysis - Existing Conditions AM Peak (2011)**

| ID | INTERSECTION with US 340 | Sig/ Unsig | Approach LOS | | | | Intersection | |
|---|---|---|---|---|---|---|---|---|
| | | | EB | WB | NB | SB | LOS* | Delay |
| 1 | Shenandoah St | | A | - | - | B | A | 0.2 |
| 2 | Union Street | | A | - | - | D | A | 0.9 |
| 3 | W. Washington St / Shoreline Dr | | A | A | B | B | A | 8.6 |
| 4 | Bakerton Rd / Millville Rd | | A | B | D | E | A | 2.9 |
| 5 | Co Rt 340/13 / Shipley School Rd | | A | B | E | F | A | 7.1 |
| 6 | Shepherdstown Pike / S. Frontage | | A | B | B | C | B | 12.1 |
| 7 | Blair Rd | | - | A | C | - | A | 0.9 |
| 8 | Halltown Rd / Rion Hall Farm | | A | B | F | E | A | 20.2 |
| 9 | Old Country Club / Marlow Rd | | B | A | D | D | B | 13.8 |
| 10 | Patrick Henry Way | | A | B | D | D | B | 15.2 |
| 11 | Jefferson Terrace Rd | | A | A | D | D | B | 10.3 |
| 12 | Ramps to/from NB WV9 | | A | A | D | - | B | 11.1 |
| 13 | Ramps to/from SB WV9 | | A | A | - | C | A | 8.7 |
| 14 | Flowing Springs Rd & E. Wash.St | | B | A | D | D | B | 13.5 |

** Signalized Intersection LOS = HCM; Unsignalized Intersection LOS = ICU (Synchro)*

**Table 13: Intersection Capacity Analysis - Existing Conditions PM Peak (2011)**

| ID | INTERSECTION with US 340 | Sig/ Unsig | Approach LOS | | | | Intersection | |
|---|---|---|---|---|---|---|---|---|
| | | | EB | WB | NB | SB | LOS* | Delay |
| 1 | Shenandoah St | | B | - | - | D | C | 0.6 |
| 2 | Union Street | | B | - | - | F | C | 1.5 |
| 3 | W. Washington St / Shoreline Dr | | A | A | D | D | A | 9.5 |
| 4 | Bakerton Rd / Millville Rd | | B | A | C | E | A | 1.5 |
| 5 | Co Rt 340/13 / Shipley School Rd | | B | A | F | F | A | 6.7 |
| 6 | Shepherdstown Pike / S. Frontage | | A | A | C | C | A | 9.6 |
| 7 | Blair Rd | | - | A | E | - | A | 1.3 |
| 8 | Halltown Rd / Rion Hall Farm | | B | B | F | F | A | - |
| 9 | Old Country Club / Marlow Rd | | B | B | D | D | B | 14 |
| 10 | Patrick Henry Way | | D | C | D | D | D | 40.2 |
| 11 | Jefferson Terrace Rd | | C | A | E | D | B | 17.6 |
| 12 | Ramps to/from NB WV9 | | A | A | D | - | B | 10.6 |
| 13 | Ramps to/from SB WV9 | | A | A | - | D | B | 11.4 |
| 14 | Flowing Springs Rd & E. Wash.St | | B | A | D | D | B | 16.6 |

** Signalized Intersection LOS = HCM; Unsignalized Intersection LOS = ICU (Synchro)*

**Table 14: Simulation Travel Times - Existing Conditions (2011)**

| ID | INTERSECTION with US 340 | Sig/ Unsig | Simulation Travel Time (sec) | | | |
|---|---|---|---|---|---|---|
| | | | Eastbound | | Westbound | |
| | | | AM | PM | AM | PM |
| 1 | Shenandoah St | | 11 | 9 | 25 | 24 |
| 2 | Union Street | | 67 | 58 | 10 | 11 |
| 3 | W. Washington St / Shoreline Dr | | 67 | 83 | 71 | 84 |
| 4 | Bakerton Rd / Millville Rd | | 26 | 27 | 57 | 59 |
| 5 | Co Rt 340/13 / Shipley School Rd | | 34 | 34 | 28 | 27 |
| 6 | Shepherdstown Pike / S. Frontage | | 57 | 68 | 43 | 43 |
| 7 | Blair Rd | | 28 | 28 | 47 | 47 |
| 8 | Halltown Rd / Rion Hall Farm | | 37 | 38 | 31 | 29 |
| 9 | Old Country Club / Marlow Rd | | 74 | 80 | 44 | 46 |
| 10 | Patrick Henry Way | | 27 | 41 | 90 | 127 |
| 11 | Jefferson Terrace Rd | | 42 | 34 | 26 | 27 |
| 12 | Ramps to/from NB WV9 | | 15 | 15 | 31 | 30 |
| 13 | Ramps to/from SB WV9 | | 13 | 14 | 21 | 23 |
| 14 | Flowing Springs Rd & E. Wash.St | | 14 | 14 | 12 | 15 |
| | **TOTAL:** | | **470** | **499** | **502** | **554** |

*Future No-Build Conditions:*

The Syncrho network for the future No-Build conditions was developed using the Existing conditions calibrated base network and the future forecast balanced volumes for 2035. The signal timing splits and offsets were optimized for the corridor. No other geometry changes were assumed for the No-Build scenario. Table 15 and Table 16 list the results of the capacity analysis for the future No-Build conditions and Table 17 contains the simulation travel times from SimTraffic. In the AM peak hour the intersection of US 340 with Old Country Club/Marlow Rd operates at a LOS F while five other intersections operate at LOE E. In the PM peak hour conditions are much worse with seven intersections operating at failed LOS F while two other intersections are at LOS E operating conditions.

The degraded conditions under the future No-Build conditions also result in an increase in travel times for the corridor. As per Table 17, the travel times in the eastbound direction will go up by almost 5.8 minutes in the AM and 3.8 minutes in the PM peak hour. In the westbound direction, the travel times increase by approximately 1.6 minutes in the AM peak hour and 5.6 minutes in the PM peak hour.

From the results it is clear that if no action is taken and if the proposed land-use improvements are implemented, it will result in a corridor-wide degradation of the operating conditions of the traffic flow.

**Table 15: Intersection Capacity Analysis – Future No-Build AM Peak (2035)**

| ID | INTERSECTION with US 340 | Sig/ Unsig | Approach LOS | | | | Intersection | |
|---|---|---|---|---|---|---|---|---|
| | | | EB | WB | NB | SB | LOS* | Delay |
| 1 | Shenandoah St | | A | - | - | B | E | 0.2 |
| 2 | Union Street | | A | - | - | F | D | 4.6 |
| 3 | W. Washington St / Shoreline Dr | | A | B | C | C | A | 9.6 |
| 4 | Bakerton Rd / Millville Rd | | B | C | F | F | E | 1549.3 |
| 5 | Co Rt 340/13 / Shipley School Rd | | B | C | F | F | E | 2186.8 |
| 6 | Shepherdstown Pike / S. Frontage | | C | D | E | E | D | 39.2 |
| 7 | Blair Rd | | - | C | F | - | B | 851.8 |
| 8 | Halltown Rd / Rion Hall Farm | | B | C | F | F | E | Err |
| 9 | Old Country Club / Marlow Rd | | F | F | F | F | F | 215.6 |
| 10 | Patrick Henry Way | | C | C | D | D | C | 29.4 |
| 11 | Jefferson Terrace Rd | | B | A | F | C | E | 79.4 |
| 12 | Ramps to/from NB WV9 | | B | A | F | - | C | 24.7 |
| 13 | Ramps to/from SB WV9 | | B | C | - | C | C | 24.1 |
| 14 | Flowing Springs Rd & E. Wash.St | | B | B | D | D | B | 18.6 |

** Signalized Intersection LOS = HCM; Unsignalized Intersection LOS = ICU (Synchro)*

**Table 16: Intersection Capacity Analysis – Future No-Build PM Peak (2035)**

| ID | INTERSECTION with US 340 | Sig/ Unsig | Approach LOS | | | | Intersection | |
|---|---|---|---|---|---|---|---|---|
| | | | EB | WB | NB | SB | LOS* | Delay** |
| 1 | Shenandoah St | | C | - | - | F | F | 2.6 |
| 2 | Union Street | | C | - | - | F | F | 15.9 |
| 3 | W. Washington St / Shoreline Dr | | F | A | E | E | E | 57.9 |
| 4 | Bakerton Rd / Millville Rd | | C | B | F | F | D | - |
| 5 | Co Rt 340/13 / Shipley School Rd | | C | B | F | F | F | - |
| 6 | Shepherdstown Pike / S. Frontage | | B | C | D | E | C | 21.4 |
| 7 | Blair Rd | | - | B | F | - | D | 1144.3 |
| 8 | Halltown Rd / Rion Hall Farm | | D | D | F | F | F | - |
| 9 | Old Country Club / Marlow Rd | | F | F | F | E | F | 138.5 |
| 10 | Patrick Henry Way | | F | F | F | F | F | 221.2 |
| 11 | Jefferson Terrace Rd | | B | C | F | C | E | 78 |
| 12 | Ramps to/from NB WV9 | | E | A | F | - | D | 48.2 |
| 13 | Ramps to/from SB WV9 | | F | C | - | F | F | 111.7 |
| 14 | Flowing Springs Rd & E. Wash.St | | B | A | D | D | B | 18.6 |

** Signalized Intersection LOS = HCM; Unsignalized Intersection LOS = ICU (Synchro)*

*** Average delay in seconds per vehicle averaged over all approaches*

**Table 17: Simulation Travel Times – Future No-Build Conditions (2035)**

| ID | INTERSECTION with US 340 | Sig/ Unsig | Simulation Travel Time (sec) | | | |
|---|---|---|---|---|---|---|
| | | | Eastbound | | Westbound | |
| | | | AM | PM | AM | PM |
| 1 | Shenandoah St | | 11 | 15 | 26 | 252 |
| 2 | Union Street | | 68 | 73 | 11 | 14 |
| 3 | W. Washington St / Shoreline Dr | | 68 | 109 | 76 | 86 |
| 4 | Bakerton Rd / Millville Rd | | 27 | 27 | 60 | 61 |
| 5 | Co Rt 340/13 / Shipley School Rd | | 38 | 33 | 29 | 28 |
| 6 | Shepherdstown Pike / S. Frontage | | 68 | 67 | 59 | 51 |
| 7 | Blair Rd | | 30 | 27 | 51 | 52 |
| 8 | Halltown Rd / Rion Hall Farm | | 44 | 40 | 30 | 31 |
| 9 | Old Country Club / Marlow Rd | | 365 | 86 | 95 | 84 |
| 10 | Patrick Henry Way | | 48 | 46 | 104 | 164 |
| 11 | Jefferson Terrace Rd | | 54 | 210 | 26 | 34 |
| 12 | Ramps to/from NB WV9 | | 21 | 120 | 34 | 34 |
| 13 | Ramps to/from SB WV9 | | 25 | 69 | 32 | 28 |
| 14 | Flowing Springs Rd & E. Wash.St | | 19 | 57 | 19 | 16 |
| | **TOTAL:** | | **820** | **732** | **600** | **890** |

*Future Build Conditions:*

The future Build conditions Synchro network was developed using the Existing conditions calibrated base network and the future forecast balanced volumes as shown in Table 10 and Table 11. The Build scenario does not include all proposed projects identified through the county land use study process. Instead a sample set of projects were used to determine the potential impact on corridor operations. The Build scenario assumed the following developments for the preferred land-use scenario:

- Frontage road along US 340 from Rt-9 up to Blair Road.
- Right-in/Right-out only for side streets at intersection of US 340 with Bakerton St/Millville Rd
- North leg at intersection of US 340 with Blair Rd

The signal timing splits and offsets were optimized for the corridor. No other geometry changes were assumed for the Build scenario. Table 18 and Table 19 list the results of the capacity analysis for the AM and PM peak hours and Table 20 contains the simulation travel times from the SimTraffic analysis.

The results indicate that the operating conditions within the corridor improve from the No-Build conditions as a result of the Build conditions developments. However there is one intersection in the AM peak hour and five intersections in the PM peak hour that are still operating under failed LOS F. Travel times also improve as compared to the No-Build scenario. The most significant improvement in travel times was observed to be in the AM peak hour in the eastbound direction of the corridor where the total corridor travel times improves by almost 3.6 minutes.

**Table 18: Intersection Capacity Analysis – Future Build AM Peak (2035)**

| ID | INTERSECTION with US 340 | Sig/ Unsig | Approach LOS | | | | Intersection | |
|---|---|---|---|---|---|---|---|---|
| | | | EB | WB | NB | SB | LOS* | Delay |
| **1** | Shenandoah St | | A | - | - | B | E | 0.2 |
| **2** | Union Street | | A | - | - | **F** | D | 4.7 |
| **3** | W. Washington St / Shoreline Dr | | A | B | C | C | A | 9.6 |
| **4** | Bakerton Rd / Millville Rd | | - | - | C | D | B | 2.9 |
| **5** | Co Rt 340/13 / Shipley School Rd | | B | C | **F** | **F** | E | - |
| **6** | Shepherdstown Pike / S. Frontage | | C | D | E | E | D | 42.3 |
| **7** | Blair Rd | | B | C | **F** | **F** | B | - |
| **8** | Halltown Rd / Rion Hall Farm | | B | C | **F** | **F** | D | - |
| **9** | Old Country Club / Marlow Rd | | **F** | E | **F** | E | **F** | 157.5 |
| **10** | Patrick Henry Way | | A | C | D | D | B | 19.6 |
| **11** | Jefferson Terrace Rd | | E | C | **F** | C | E | 57.6 |
| **12** | Ramps to/from NB WV9 | | A | A | E | - | B | 12.1 |
| **13** | Ramps to/from SB WV9 | | B | B | - | C | B | 18.3 |
| **14** | Flowing Springs Rd & E. Wash.St | | B | B | D | D | B | 17.9 |

** Signalized Intersection LOS = HCM; Unsignalized Intersection LOS = ICU (Synchro)*

**Table 19: Intersection Capacity Analysis – Future Build PM Peak (2035)**

| ID | INTERSECTION with US 340 | Sig/ Unsig | Approach LOS | | | | Intersection | |
|---|---|---|---|---|---|---|---|---|
| | | | EB | WB | NB | SB | LOS* | Delay |
| 1 | Shenandoah St | | C | - | - | F | F | 2.8 |
| 2 | Union Street | | C | - | - | F | F | 16.6 |
| 3 | W. Washington St / Shoreline Dr | | F | A | E | E | E | 63.5 |
| 4 | Bakerton Rd / Millville Rd | | - | - | C | F | D | 24.7 |
| 5 | Co Rt 340/13 / Shipley School Rd | | C | B | F | F | F | - |
| 6 | Shepherdstown Pike / S. Frontage | | A | C | D | E | C | 21.4 |
| 7 | Blair Rd | | C | B | F | F | D | - |
| 8 | Halltown Rd / Rion Hall Farm | | D | C | F | F | F | - |
| 9 | Old Country Club / Marlow Rd | | D | F | F | C | E | 74.7 |
| 10 | Patrick Henry Way | | F | F | F | F | F | 171.5 |
| 11 | Jefferson Terrace Rd | | C | E | F | C | E | 58.1 |
| 12 | Ramps to/from NB WV9 | | D | A | F | - | C | 31.6 |
| 13 | Ramps to/from SB WV9 | | F | A | - | F | D | 54.7 |
| 14 | Flowing Springs Rd & E. Wash.St | | B | A | D | D | B | 16.6 |

** Signalized Intersection LOS = HCM; Unsignalized Intersection LOS = ICU (Synchro)*

**Table 20: Simulation Travel Times – Future Build Conditions (2035)**

| ID | INTERSECTION with US 340 | Sig/ Unsig | Simulation Travel Time (sec) | | | |
|---|---|---|---|---|---|---|
| | | | Eastbound | | Westbound | |
| | | | AM | PM | AM | PM |
| 1 | Shenandoah St | | 11 | 10 | 26 | 303 |
| 2 | Union Street | | 68 | 59 | 11 | 14 |
| 3 | W. Washington St / Shoreline Dr | | 68 | 97 | 77 | 87 |
| 4 | Bakerton Rd / Millville Rd | | 27 | 27 | 60 | 62 |
| 5 | Co Rt 340/13 / Shipley School Rd | | 38 | 34 | 29 | 28 |
| 6 | Shepherdstown Pike / S. Frontage | | 70 | 68 | 59 | 49 |
| 7 | Blair Rd | | 29 | 28 | 53 | 52 |
| 8 | Halltown Rd / Rion Hall Farm | | 44 | 38 | 31 | 31 |
| 9 | Old Country Club / Marlow Rd | | 141 | 80 | 69 | 68 |
| 10 | Patrick Henry Way | | 27 | 37 | 100 | 178 |
| 11 | Jefferson Terrace Rd | | 81 | 256 | 47 | 36 |
| 12 | Ramps to/from NB WV9 | | 19 | 142 | 34 | 35 |
| 13 | Ramps to/from SB WV9 | | 20 | 96 | 28 | 27 |
| 14 | Flowing Springs Rd & E. Wash.St | | 18 | 57 | 17 | 16 |
| | **TOTAL:** | | **604** | **733** | **594** | **942** |

*Mitigation:*

The Build conditions improve the operating conditions of the traffic flow in the corridor but there are still locations where conditions are degraded. To mitigate these conditions various low-cost improvements were evaluated for the Build conditions along the corridor. Strategies such as providing additional left-turn or right-turn pockets for approaches with heavy delay, improving signal timing/phasing, restricting through and left-turns from side streets, etc. were evaluated.

The results of the capacity analysis are shown in Table 21 and Table 22 and the SimTraffic simulation results are shown in

Table 23. In the AM peak hour all study intersections operate at LOS E or better. In the PM peak hour the five intersections operating at LOS F in the Build conditions are still operating under LOS F; however, the delay is significantly reduced. Also, there are three intersections operating at LOS E in the Build conditions while only one intersection operates at LOS E as a result of the mitigation measures.

In the AM peak hour the corridor travel time is reduced by approximately half a minute in both the eastbound and westbound directions. In the PM peak hour there is an increase of 0.7 minutes in the eastbound direction and a decrease of 0.2 minutes in the westbound direction.

The low-cost mitigation measures applied along the corridor are effective to improve conditions but are not sufficient to make the operating conditions acceptable especially in the PM peak hour. It is recommended that additional improvements be evaluated to further improve operating conditions in the study area.

**Table 21: Intersection Capacity Analysis – Future Build with Mitigation AM Peak (2035)**

| ID | INTERSECTION with US 340 | Sig/ Unsig | Approach LOS | | | | Intersection | |
|---|---|---|---|---|---|---|---|---|
| | | | EB | WB | NB | SB | LOS* | Delay |
| 1 | Shenandoah St | | A | - | - | B | E | 0.2 |
| 2 | Union Street | | A | - | - | F | D | 4.7 |
| 3 | W. Washington St / Shoreline Dr | | A | B | C | C | A | 9.6 |
| 4 | Bakerton Rd / Millville Rd | | - | - | C | D | B | 2.9 |
| 5 | Co Rt 340/13 / Shipley School Rd | | B | C | F | F | E | - |
| 6 | Shepherdstown Pike / S. Frontage | | C | C | E | F | D | 40.5 |
| 7 | Blair Rd | | B | C | F | F | B | - |
| 8 | Halltown Rd / Rion Hall Farm | | - | C | F | F | D | - |
| 9 | Old Country Club / Marlow Rd | | F | D | F | C | E | 79 |
| 10 | Patrick Henry Way | | B | C | D | D | C | 22.1 |
| 11 | Jefferson Terrace Rd | | D | B | D | F | D | 44.6 |
| 12 | Ramps to/from NB WV9 | | A | A | E | - | B | 13 |
| 13 | Ramps to/from SB WV9 | | B | B | - | C | B | 18.3 |
| 14 | Flowing Springs Rd & E. Wash.St | | B | B | D | D | B | 17.9 |

** Signalized Intersection LOS = HCM; Unsignalized Intersection LOS = ICU (Synchro)*

**Table 22: Intersection Capacity Analysis – Future Build with Mitigation PM Peak (2035)**

| ID | INTERSECTION with US 340 | Sig/ Unsig | Approach LOS | | | | Intersection | |
|---|---|---|---|---|---|---|---|---|
| | | | EB | WB | NB | SB | LOS* | Delay |
| 1 | Shenandoah St | | C | - | - | F | F | 2.8 |
| 2 | Union Street | | C | - | - | F | F | 16.6 |
| 3 | W. Washington St / Shoreline Dr | | C | D | E | E | C | 32 |
| 4 | Bakerton Rd / Millville Rd | | - | - | C | F | D | 24.7 |
| 5 | Co Rt 340/13 / Shipley School Rd | | C | B | F | F | F | - |
| 6 | Shepherdstown Pike / S. Frontage | | A | C | D | E | C | 21.4 |
| 7 | Blair Rd | | C | B | F | F | D | - |
| 8 | Halltown Rd / Rion Hall Farm | | - | C | F | F | F | - |
| 9 | Old Country Club / Marlow Rd | | D | F | F | C | E | 74.7 |
| 10 | Patrick Henry Way | | F | F | D | F | F | 105.6 |
| 11 | Jefferson Terrace Rd | | B | B | F | C | C | 34.2 |
| 12 | Ramps to/from NB WV9 | | D | A | F | - | C | 26.9 |
| 13 | Ramps to/from SB WV9 | | F | B | - | E | D | 52.1 |
| 14 | Flowing Springs Rd & E. Wash.St | | B | A | D | D | B | 16 |

** Signalized Intersection LOS = HCM; Unsignalized Intersection LOS = ICU (Synchro)*

**Table 23: Simulation Travel Times – Future Build with Mitigation Conditions (2035)**

| ID | INTERSECTION with US 340 | Sig/ Unsig | Simulation Travel Time (sec) | | | |
|---|---|---|---|---|---|---|
| | | | Eastbound | | Westbound | |
| | | | AM | PM | AM | PM |
| 1 | Shenandoah St | | 11 | 29 | 26 | 329 |
| 2 | Union Street | | 69 | 148 | 11 | 14 |
| 3 | W. Washington St / Shoreline Dr | | 68 | 98 | 77 | 96 |
| 4 | Bakerton Rd / Millville Rd | | 27 | 27 | 59 | 65 |
| 5 | Co Rt 340/13 / Shipley School Rd | | 39 | 34 | 29 | 28 |
| 6 | Shepherdstown Pike / S. Frontage | | 68 | 68 | 57 | 48 |
| 7 | Blair Rd | | 30 | 28 | 52 | 51 |
| 8 | Halltown Rd / Rion Hall Farm | | 45 | 39 | 30 | 30 |
| 9 | Old Country Club / Marlow Rd | | 117 | 80 | 61 | 70 |
| 10 | Patrick Henry Way | | 36 | 59 | 100 | 140 |
| 11 | Jefferson Terrace Rd | | 70 | 165 | 31 | 26 |
| 12 | Ramps to/from NB WV9 | | 18 | 49 | 35 | 33 |
| 13 | Ramps to/from SB WV9 | | 20 | 25 | 28 | 30 |
| 14 | Flowing Springs Rd & E. Wash.St | | 17 | 20 | 17 | 14 |
| | **TOTAL:** | | **578** | **775** | **566** | **931** |

*RCUT (Restricted Crossing U-Turn Intersection) Evaluation:*

In addition to the mitigation strategies discussed earlier, a partial intersection closure was evaluated at the intersections of US 340 with Bakerton Rd / Millville Rd and with Blair Rd. Both intersections are unsignalized intersections resulting in heavy delay along the side streets due to high through and left-turn volumes and fewer gaps due to growth along US 340 in the future conditions. To mitigate this, a partial closure of these intersections is proposed by implementing the Restricted Crossing U-Turn (RCUT) intersection design. The RCUT intersection accommodates the left-turn and through movements from the side street approaches by requiring drivers to turn right onto the main road (US 340) and then make a U-turn maneuver at a one-way median opening more than 1,000 feet after the intersection or at the next downstream intersection. An example of RCUT intersection design as implemented in Emmitsburg, Maryland is shown in Figure 2. For this study it was assumed that the diverted vehicles will make a U-turn at the next downstream intersection to complete their maneuver as shown in Figure 3.

Also, the Synchro Unsignalized intersection report does not account for the median storage refuge that vehicles going through and making left will use to make a two-step turn. Hence the Highway Capacity Software (HCS) was used to evaluate the unsignalized intersections for this analysis. The diverted traffic was accounted for by adding the volumes to the approach movements of all the maneuvers made to complete the movement. The upstream/downstream intersections were also re-evaluated to identify the impact of the diversions. The analysis was conducted using the No-Build conditions scenario and the results of the capacity analysis with and without the RCUT are listed in

Table 24 through Table 27.

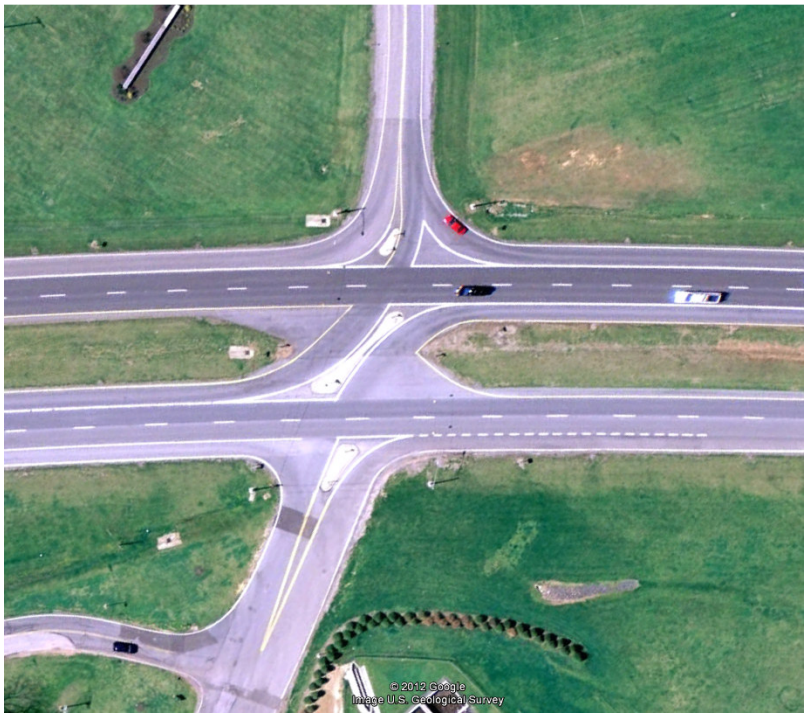



**Figure 2: RCUT intersection in Emmitsburg, MD (Source: Google Earth)**

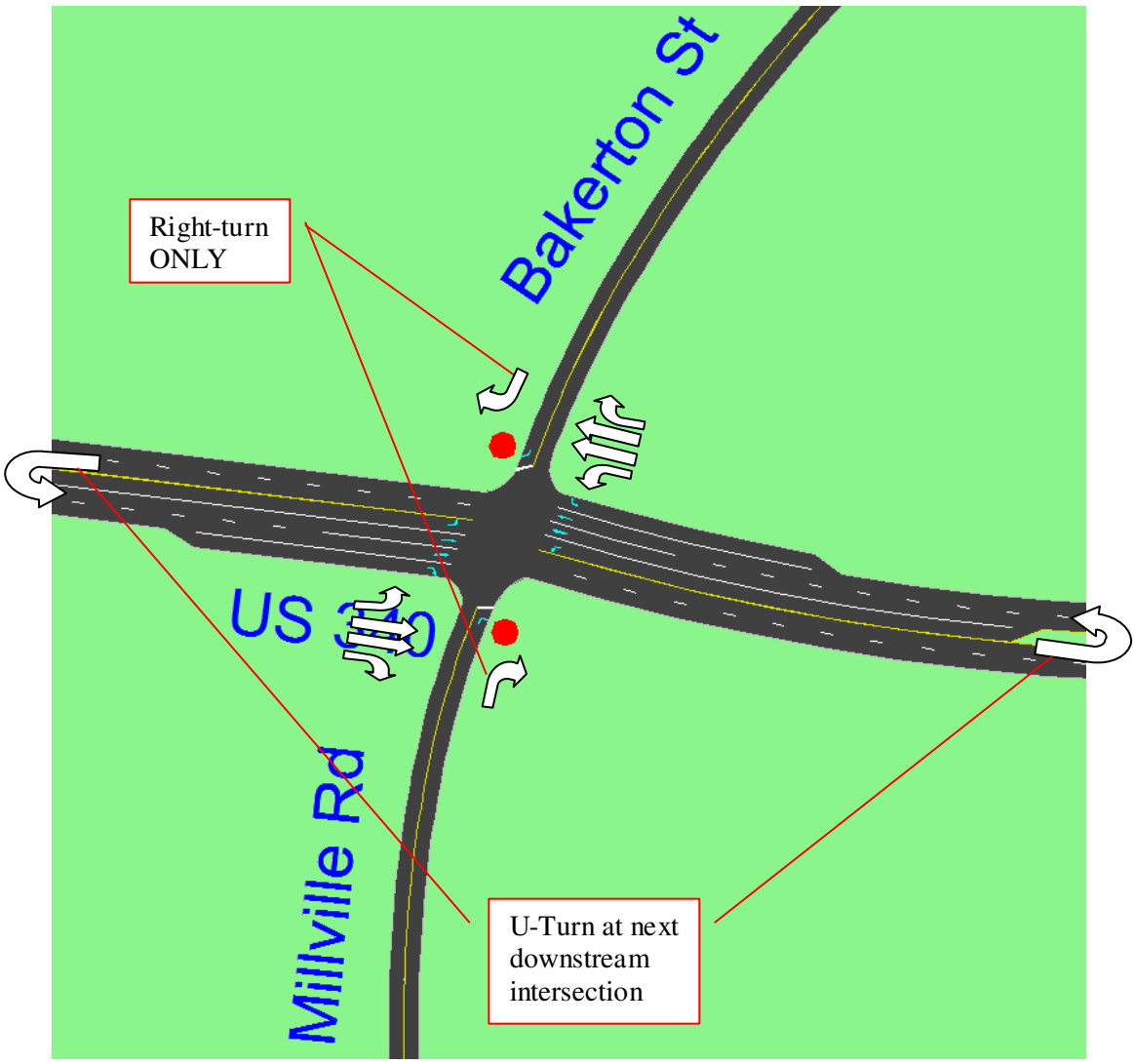



**Figure 3: RCUT intersection evaluated using Synchro**

**Table 24: Intersection Capacity Analysis – No Build conditions AM Peak (2035)**

| ID | INTERSECTION with US 340 | Sig/ Unsig | Approach LOS* (Delay sec/veh) | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | Major St | | Minor St | | Intersection | |
| | | | EB | WB | NB | SB | LOS | Delay |
| **3** | W. Washington / Shoreline Dr | | A (6.3) | B (12) | C (27.7) | C (27) | A | 9.6 |
| **4** | Bakerton Rd / Millville Rd | | B (10.3) | C (16.8) | F (159.4) | F (581.0) | - | - |
| **5** | Co Rt 340/13 / Shipley School | | B (11.2) | C (15.1) | F (82.6) | F (2085) | - | - |
| **6** | Shepherd Pike / S. Frontage Rd | | C (33.8) | D (38.5) | E (64.2) | E (55.8) | D | 39.2 |
| **7** | Blair Rd | | - | C (16.6) | F (306.0) | - | - | - |
| **8** | Halltown Rd / Rion Hall Farm | | B (10.5) | C (22.3) | F (1331) | F (3997) | - | - |

** Signalized Intersection LOS = Synchro HCM report; Unsignalized Intersection LOS = HCS*

**Table 25: Intersection Capacity Analysis – RCUT conditions AM Peak (2035)**

| ID | INTERSECTION with US 340 | Sig/ Unsig | Approach LOS* (Delay sec/veh) | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | Major St | | Minor St | | Intersection | |
| | | | EB | WB | NB | SB | LOS | Delay |
| 3 | W. Washington / Shoreline Dr | Sig | A (6.5) | B (12.7) | C (27.7) | C (26.4) | A | 9.8 |
| 4 | Bakerton Rd / Millville Rd | Unsig | B (10.5) | C (19.3) | C (22.8) | D (26.4) | - | - |
| 5 | Co Rt 340/13 / Shipley School | Unsig | B (11.2) | D (27.1) | F | F | - | - |
| 6 | Shepherd Pike / S. Frontage Rd | Sig | D (36.3) | D (42.4) | E (64.2) | E (55.8) | D | 41.6 |
| 7 | Blair Rd | Unsig | - | C (16.6) | D (33.3) | - | - | - |
| 8 | Halltown Rd / Rion Hall Farm | Unsig | B (10.5) | C (22.3) | F (1331) | F (3997) | - | - |

** Signalized Intersection LOS = Synchro HCM report; Unsignalized Intersection LOS = HCS*

**Table 26: Intersection Capacity Analysis – No Build conditions PM Peak (2035)**

| ID | INTERSECTION with US 340 | Sig/ Unsig | Approach LOS* (Delay sec/veh) | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | Major St | | Minor St | | Intersection | |
| | | | EB | WB | NB | SB | LOS | Delay |
| 3 | W. Washington / Shoreline Dr | Sig | F (117.3) | A (5.5) | E (67.8) | E (79.1) | E | 57.9 |
| 4 | Bakerton Rd / Millville Rd | Unsig | C (20.7) | B (14.5) | F (327.3) | F (631.8) | - | - |
| 5 | Co Rt 340/13 / Shipley School | Unsig | C (19.0) | B (12.2) | F | F | - | - |
| 6 | Shepherd Pike / S. Frontage Rd | Sig | B (12.5) | C (22.2) | D (43.6) | E (69.9) | C | 21.4 |
| 7 | Blair Rd | Unsig | - | B (14.4) | F (910.3) | - | - | - |
| 8 | Halltown Rd / Rion Hall Farm | Unsig | D (30.4) | C (24.9) | - | - | - | - |

** Signalized Intersection LOS = Synchro HCM report; Unsignalized Intersection LOS = HCS*

**Table 27: Intersection Capacity Analysis – RCUT conditions PM Peak (2035)**

| ID | INTERSECTION with US 340 | Sig/ Unsig | Approach LOS* (Delay sec/veh) | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | Major St | | Minor St | | Intersection | |
| | | | EB | WB | NB | SB | LOS | Delay |
| 3 | W. Washington / Shoreline Dr | Sig | F (143.0) | A (5.5) | E (67.8) | E (79.4) | E | 69.6 |
| 4 | Bakerton Rd / Millville Rd | Unsig | C (21.4) | C (15.9) | C (20.7) | D (33.1) | - | - |
| 5 | Co Rt 340/13 / Shipley School | Unsig | C (19.0) | C (15.1) | F | F | - | - |
| 6 | Shepherd Pike / S. Frontage Rd | Sig | C (27.2) | D (37.2) | D (50.3) | F (109.1) | D | 37 |
| 7 | Blair Rd | Unsig | - | B (14.4) | F (84.8) | - | - | - |
| 8 | Halltown Rd / Rion Hall Farm | Unsig | D (30.4) | C (24.9) | - | - | - | - |

** Signalized Intersection LOS = Synchro HCM report; Unsignalized Intersection LOS = HCS*

The results show that there is a significant improvement in the operating conditions of the side streets at the intersections where the RCUT is implemented in both the AM and PM peak hours. There is a slight increase in the delay at the downstream intersections where the diverted traffic makes a U-turn, but this is negligible and does not degrade the operating conditions. Apart from the improvement in the operating conditions and delay, the RCUT also improves safety at the intersections.

***Other Supporting Tables***

In addition to the Synchro and simulation tables provided above, some additional summaries were needed to support documentation efforts for the East Gateway Land Use Vision Study. Tables 28-30 provide additional summaries of the simulation results for the future no-build and build conditions.

**Table 28: Simulation Speeds – Future No-Build Conditions (2035)**

| ID | INTERSECTION with US 340 | Sig/ Unsig | Simulation Travel Time (sec) | | | |
|---|---|---|---|---|---|---|
| | | | Eastbound | | Westbound | |
| | | | AM | PM | AM | PM |
| 1 | Shenandoah St | | 40 | 32 | 46 | 28 |
| 2 | Union Street | | 40 | 28 | 41 | 31 |
| 3 | W. Washington St / Shoreline Dr | | 43 | 25 | 24 | 24 |
| 4 | Bakerton Rd / Millville Rd | | 55 | 51 | 56 | 57 |
| 5 | Co Rt 340/13 / Shipley School Rd | | 53 | 59 | 51 | 52 |
| 6 | Shepherdstown Pike / S. Frontage | | 29 | 34 | 22 | 28 |
| 7 | Blair Rd | | 53 | 57 | 57 | 52 |
| 8 | Halltown Rd / Rion Hall Farm | | 48 | 53 | 52 | 51 |
| 9 | Old Country Club / Marlow Rd | | 8 | 34 | 10 | 12 |
| 10 | Patrick Henry Way | | 16 | 17 | 28 | 18 |
| 11 | Jefferson Terrace Rd | | 16 | 4 | 31 | 23 |
| 12 | Ramps to/from NB WV9 | | 26 | 5 | 30 | 34 |
| 13 | Ramps to/from SB WV9 | | 17 | 7 | 17 | 20 |
| 14 | Flowing Springs Rd & E. Wash.St | | 24 | 10 | 21 | 26 |

**Table 29: Simulation Speeds – Future Build Conditions (2035)**

| ID | INTERSECTION with US 340 | Sig/ Unsig | Simulation Travel Time (sec) | | | |
|---|---|---|---|---|---|---|
| | | | Eastbound | | Westbound | |
| | | | AM | PM | AM | PM |
| 1 | Shenandoah St | | 40 | 45 | 46 | 27 |
| 2 | Union Street | | 40 | 46 | 41 | 31 |
| 3 | W. Washington St / Shoreline Dr | | 42 | 28 | 23 | 24 |
| 4 | Bakerton Rd / Millville Rd | | 58 | 52 | 57 | 55 |
| 5 | Co Rt 340/13 / Shipley School Rd | | 53 | 55 | 52 | 52 |
| 6 | Shepherdstown Pike / S. Frontage | | 27 | 34 | 22 | 29 |
| 7 | Blair Rd | | 53 | 55 | 54 | 51 |
| 8 | Halltown Rd / Rion Hall Farm | | 48 | 55 | 50 | 51 |
| 9 | Old Country Club / Marlow Rd | | 21 | 36 | 16 | 16 |
| 10 | Patrick Henry Way | | 29 | 21 | 29 | 16 |
| 11 | Jefferson Terrace Rd | | 8 | 4 | 17 | 22 |
| 12 | Ramps to/from NB WV9 | | 30 | 4 | 33 | 32 |
| 13 | Ramps to/from SB WV9 | | 21 | 5 | 20 | 21 |
| 14 | Flowing Springs Rd & E. Wash.St | | 27 | 9 | 24 | 26 |

**Table 30: Simulation Speeds – Future Build with Mitigation Conditions (2035)**

| ID | INTERSECTION with US 340 | Sig/ Unsig | Simulation Travel Time (sec) | | | |
|---|---|---|---|---|---|---|
| | | | Eastbound | | Westbound | |
| | | | AM | PM | AM | PM |
| 1 | Shenandoah St | | 40 | 23 | 46 | 27 |
| 2 | Union Street | | 39 | 15 | 41 | 31 |
| 3 | W. Washington St / Shoreline Dr | | 42 | 27 | 23 | 16 |
| 4 | Bakerton Rd / Millville Rd | | 58 | 52 | 58 | 55 |
| 5 | Co Rt 340/13 / Shipley School Rd | | 52 | 55 | 52 | 52 |
| 6 | Shepherdstown Pike / S. Frontage | | 29 | 34 | 23 | 30 |
| 7 | Blair Rd | | 52 | 55 | 54 | 52 |
| 8 | Halltown Rd / Rion Hall Farm | | 47 | 54 | 51 | 51 |
| 9 | Old Country Club / Marlow Rd | | 25 | 36 | 19 | 15 |
| 10 | Patrick Henry Way | | 22 | 14 | 29 | 21 |
| 11 | Jefferson Terrace Rd | | 10 | 5 | 26 | 30 |
| 12 | Ramps to/from NB WV9 | | 30 | 11 | 30 | 33 |
| 13 | Ramps to/from SB WV9 | | 21 | 17 | 20 | 18 |
| 14 | Flowing Springs Rd & E. Wash.St | | 28 | 24 | 24 | 29 |