Final Report

Millwood Avenue Traffic Diversion Study

Winchester, VA

Final Draft

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EXECUTIVE SUMMARY

This study began as an effort to determine the short- and long-term traffic impacts associated with the proposed closure of Millwood Avenue to vehicular traffic between East Jubal Early Drive and Apple Blossom Drive. It assumed the project would evaluate two alternatives, (1) the closure of the section of Millwood Avenue under review, or (2) keep it open, basically a 'no build' option.

The study proceeded by researching existing transportation polices, conducting an analysis of existing conditions and meeting with stakeholders, including a public meeting held September 20, 2010. After the conclusion of these early tasks, two things were apparent:

(1) *The goals of the project should include traditional concepts, as well as stress the need to incorporate ways to measure sustainability and multi-modalism. Safety was stressed by all stakeholders as the primary focus.*

To address this concern the project set the goals of the study as Safety, Convenience, Appearance and Balance. The evaluation criteria used to compare the alternatives was based from these goals and included measures of effectiveness both traditional and state-of-the-art with an emphasis on including all modes of transportation.

(2) *Evaluating only two alternatives may not be sufficient to fully address the concerns of all stakeholders and determine the best set of recommendations.*

The project addressed this concern by expanding the amount of alternatives, to a total of eight that fell into two categories; those based on the closure of the section of Millwood Avenue being studied, and those with the section in question remaining open.

The eight alternatives studied included:

- Alternative 1: No Build Scenario
- Alternative 1a: Pedestrian Overpass
- Alternative 1b: Millwood Avenue Tees into Apple Blossom Drive
- Alternative 1c: Apple Blossom Drive Tees into Millwood Avenue
- Alternative 1d: Close Apple Blossom Drive
- Alternative 1e: Close Jubal Early Drive
- Alternative 2: Close Millwood Avenue
- Alternative 2a: Close Millwood Avenue and Install Right Turn Lane

The project took these eight alternatives and evaluated them based on Measures of Effectiveness (MOEs) developed based on the study goals. The MOEs used to evaluate the alternatives included:

- <u>*Safety*</u>

  Safety was given the top priority when setting study goals. The existing policy and opinions of the Steering Committee along with stakeholder comments were that all users of the transportation system should be as safe as possible. The objectives toward achieving this goal are summarized as:

  - Reduce speeds

- Improve geometry
- Eliminate ambiguous pavement
- Improve sight lines and distances
- Shorten pedestrian crossings
- Eliminate weave movement

- *Convenience*

  Next to safety, convenience was the second highest priority among goals. The study needs to ensure that the needs of all users of the system are met by the selected alternative. The objectives of this goal are summarized as:

  - Minimize vehicular delay
  - Minimize pedestrian/bike delay
  - Improve/maintain site access
  - Maintain access to downtown

- *Appearance*

  Also important are the appearance and aesthetics of the study recommendations. Not necessarily just the actual roadway environment, but the ability to provide a framework for the City to create a gateway that provides an intuitive and aesthetically pleasing experience entering the City. The objectives of this goal are summarized as:

  - Improve intuitiveness
  - Improve conditions for wayfinding
  - Provide gateway opportunity

- *Balance*

  The study needs to ensure that the selected alternative strives to meet the needs of all users, as there are a variety of modes, user groups and land owners that are affected. The existing transportation documents and plans all reflect balance in their stated goals and objectives for the study area. The objectives of this goal are summarized as:

  - Think multimodal, sustainable practices
  - Consider physical feasibility
  - Consider costs
  - Consider short-term vs. long-term wants/needs

While the study area consists of a much larger area, the eight expanded alternatives were evaluated considering the key intersections local to the section of Millwood Avenue considered for closure. From this the Preferred Alternative was selected and the entire study area was evaluated under existing and future conditions.

Based on the evaluation of alternatives and input from stakeholders during two October 19, 2010 public workshop meetings, Alternative 2a was chosen as the Preferred Alternative. This Alternative includes closing Millwood Avenue between Jubal Early Drive and Apple Blossom Drive and constructing a westbound right turn lane from Jubal Early Drive to Apple Blossom Drive/Millwood Avenue. Alternative 2a was selected because:

- It improves safety by eliminating ambiguous geometries, reducing vehicular conflict points, reducing curb radii and intersection skew, and creates a signalized crossing for pedestrians.
- It increases convenience by decreasing overall vehicular delay, decreasing the time it takes for pedestrians to cross Millwood Avenue, accommodates the Green Circle Trail, and improves access to the University. It should be noted that while it improves overall vehicular delay in the study area, the travel time for the Millwood Avenue inbound (westbound) to downtown pattern is increased by a few seconds.
- It improves appearance by creating a space for a gateway treatment in the line-of-sight for drivers approaching from the east, and allows for a more intuitive wayfinding system for the same drivers.
- It is well balanced because it helps both pedestrians and vehicles, shows improvements under both existing and future traffic models, and has a lower cost than several of the other alternatives.

The intent of the public workshops was to gain a broad understanding from all of the affected stakeholders. From the comments it was apparent that there were strong opinions among different groups and interests that participated. There was also concern expressed by some participants that opponents to Millwood Avenue closure were not well represented. It was encouraged that those who attended the meeting make it known to those who did not participate that their comments are still desired as an input to the study. Although comments would be better informed if their authors had the benefit of participating in the workshops, they are still desired nonetheless and would be collected by the MPO. Only two additional comments were received. The majority of the comments from the public sessions concluded that Alternative 2a had the most merit.

This report recommends implementation of Alternative 2a, with the following refinements:

- That the Green Circle Trail be routed south on University Drive, then across Millwood Avenue to the western side of Apple Blossom Drive before heading south to Jubal Early Drive. The new free-flow right turn lane will increase the crossing distance of Jubal Early Drive and given the volume of traffic that will use the right turn, the west side of Apple Blossom Drive is the preferred location.
- That the University use internal roadways to consolidate all access along Millwood Avenue to the new intersection of University Drive/Apple Blossom Drive/Millwood Avenue.
- That an updated, comprehensive signing, wayfinding and pavement marking plan be developed to take advantage of the consolidation of University access and increased distance between decision points for drivers approaching from the east and help alleviate concerns about the change in traffic patterns.
- That the portion of Apple Blossom Drive north of Jubal Early Drive be renamed to Millwood Avenue so that Millwood Avenue has a continuous designation from Jubal Early Drive as it does today.
- That the City work with Allen Properties to engage VDOT to seek a right in/right out access point on Jubal Early Drive to access the Hampton Inn.
- That the City consider performing additional study to look at near-term solutions that may help improve existing conditions until Alternative 2a is designed, funded, and constructed.

INTRODUCTION

This report presents the findings of a traffic study performed for the Millwood Avenue project located in the City of Winchester, Virginia. This study reviewed two options for the future of a section of Millwood Avenue; 1) its closure to traffic, and 2) it remaining open to traffic. The following chapters detail the purpose and goals of the study, the evaluation of alternatives, and the selection and refinement of a preferred alternative. The appendix to this report contains technical details and materials from the public stakeholder meetings.

Purpose

The purpose of the study is to determine the short- and long-term traffic impacts associated with the proposed closure of Millwood Avenue to vehicular traffic between East Jubal Early Drive and Apple Blossom Drive. The study also outlines alternate vehicular access locations to Shenandoah University, which is located adjacent to the proposed portion of Millwood Avenue to be closed; analyzes improvements necessary to address the impacts of the proposed closure of Millwood Avenue; and proposes options for improved pedestrian and bicycle attractiveness and viability in the study area.

Figure 1 identifies the scope of the study area and the section of Millwood Avenue under review for closure. The study area for the traffic study includes South Pleasant Valley Road to the west, East Jubal Early Drive/Millwood Avenue to the south, Princeton Drive/Tulane Drive to the east, and Hollingsworth Drive/Lowry Drive and Winchester Country Club to the north. The study area does not include any freeway segments along Interstate 81 (I-81) but does include the ramps to and from I-81.

Participants

Gorove/Slade Associates performed this study, under the direction of the Win-Fred Metropolitan Planning Organization (MPO). The Steering Committee for the project include representatives from:

- City of Winchester
- Frederick County
- Town of Stephens City
- Virginia Department of Transportation (VDOT)

There are also several community stakeholders including residents of the City of Winchester, local businesses and landowners, Shenandoah University and motorists who travel through the study area. During the course of this project, meetings with the MPO Steering Committee were held to gain input and consensus on project direction. Two public meetings were held with the purpose of obtaining input from the community stakeholders.

Process & Report Outline

The following outlines the steps taken during the study process. This report is organized to follow the progression of the study.

- *Study Goals*

  The study goals are an essential component of the project, since they set the table for selecting which evaluation criteria to judge alternatives. This study assembled the project goals after researching existing local jurisdiction transportation policies and meeting with stakeholders and the steering committee.

- *Existing Conditions*

  The study analyzed existing conditions based on data collected by members of the steering committee and observations. During this portion of the effort, a public meeting was held on September 20, 2010 to gain input into the process and guide the study.

- *Alternatives Development and Evaluation*

  Based on the results of the existing conditions analysis, the study goals and input from stakeholders, sub-alternatives were developed based on the two original alternatives. The criteria used to evaluate the alternatives, the Measures of Effectiveness (MOEs), were also selected. How the alternatives where chosen and the pros and cons of how each alternative compared after being evaluated by the MOEs is discussed later in this report. In addition, this report reviews the second public meeting, held on October 19, 2010, where the evaluation process was described and input received on the public's thoughts on the alternatives.

- *Preferred Alternative*

  Based on the evaluation of alternatives and input from the stakeholders, a preferred alternative was chosen. The refinements made to the preferred alternative, the detailed technical analysis of existing and future conditions of the preferred alternative versus the no-build alternative, and steps towards implementation are discussed in this report.

Figure 1: Study Area

STUDY GOALS

The study goals are an essential component of the project since they guide the selection of evaluation criteria to judge alternatives. This study assembled the project goals after researching local transportation policies, receiving guidance from the Steering Committee, and meeting with stakeholders.

Existing Local Transportation Policies

The following documents were used to guide the development of the study goals.

Win-Fred Metropolitan Planning Organization 2030 Transportation Plan

The Win-Fred MPO 2030 Transportation Plan is a document that addresses a 20 year planning horizon that includes both long-range and short-range strategies/actions that led to the development of an integrated intermodal transportation system that facilitates the efficient movement of people and good.

The plan contains a statement of goals and objectives; the following are several that relate to the purpose of this study:

- Provide a safe and efficient road system within the MPO region.
- Encourage growth by providing convenient parking and a system of sidewalks and walking paths.
- Encourage the use of alternate modes of transportation such as bicycle, pedestrian, carpooling and ridesharing, public transit, air, and rail.

Bicycle and Pedestrian Mobility Plan for the Win-Fred MPO

The Bicycle and Pedestrian Mobility Plan for the Win-Fred MPO provides a coordinated and strategic approach to the development of a transportation system that accommodates and encourages walking and bicycling throughout the region. The plan identifies a network of walking and bicycling facilities to improve non-motorized access for residents and visitors.

The vision statement of the plan is for the Winchester-Frederick region to become a place where, (1) bicycle and pedestrian facilities serve a dual purpose as recreation and transportation corridors, and (2) people have the convenient and safe option of traveling on foot and by bicycle throughout the region.

City of Winchester 2010 Comprehensive Plan Update

The City of Winchester 2010 Comprehensive Plan Update, currently in draft form, contains the following policy statements regarding the transportation network:

- Create and maintain a safe, efficient, and environmentally sustainable transportation network that is interconnected, multi-modal, and that facilitates walkable urban land use patterns less dependent upon personal vehicle use.
- Encourage the use of alternate modes of transportation to reduce the dependency upon private automobile use.
- Alter street standards by encouraging layouts of interconnected grid streets.
- Increase safety on streets and bike and pedestrian trails.
- Encourage growth of the City by providing convenient parking and a system of sidewalks and walking paths.

Route 522 Multi-Modal Corridor Study

The *Route 522 Multi-Modal Corridor Study* was prepared by Michael Baker Jr., Inc. with assistance from the Renaissance Planning Group. This study is currently in draft form. The project is a cooperative effort between the Northern Shenandoah Valley Regional Commission (NSVRC), the Winchester-Frederick MPO (Win-Fred), and the localities of the City of Winchester, Frederick County, Clarke County, and Warren County. The purpose of the study was to analyze the existing and future planned development and travel demand along the Route 522 corridor to address future transportation needs. This study incorporates some of the data collected and analyses performed from this study, but not its findings and recommendations. The conclusions and recommendations of this study (*Millwood Avenue Traffic Diversion Study*) will replace those identified in the *Route 522 Multi-Modal Corridor Study* for the section of Millwood Avenue between E. Jubal Early Drive and South Pleasant Valley Road.

Goals & Objectives

The policies reviewed in the local planning documents follows a trend in the transportation planning industry towards sustainability and accommodation of multiple modes. These policy goals extend beyond the local area, and recently became national via the *US Department of Transportation Policy Statement on Bicycle and Pedestrian Accommodation Regulations and Recommendations,* signed on March 11, 2010:

"The DOT policy is to incorporate safe and convenient walking and bicycling facilities into transportation projects. Every transportation agency, including DOT, has the responsibility to improve conditions and opportunities for walking and bicycling and to integrate walking and bicycling into their transportation systems. Because of the numerous individual and community benefits that walking and bicycling provide — including health, safety, environmental, transportation, and quality of life — transportation agencies are encouraged to go beyond minimum standards to provide safe and convenient facilities for these modes."

Combined with the local policies, the project team decided to use both traditional and state-of-the-art multimodal planning principles for the study. This report follows the stated policies by setting project goals that reflect the need for sustainability and multi-modalism along with traditional goals. The evaluation criteria used to judge the alternatives are based on these goals, allowing for stated policies to have an effect on the outcome of the study and final recommendations. Many of these goals, principles and evaluation criteria focus on the movement of people and not just vehicles.

After reviewing the existing policies and purpose of the study, the following study goals were selected: Safety, Convenience, Appearance, and Balance.

- <u>*Safety*</u>
  Safety was given the top priority when setting study goals. The existing policy and opinions of the Steering Committee along with stakeholder comments were that all users of the transportation system should be as safe as possible. The objectives toward achieving this goal are summarized as:
  - Reduce speeds
  - Improve geometry
  - Eliminate ambiguous pavement
  - Improve sight lines and distances

- Shorten pedestrian crossings
- Eliminate weave movement

- *Convenience*

  Next to safety, convenience was the second highest priority among goals. The study needs to ensure that the needs of all users of the system are met by the selected alternative. The objectives of this goal are summarized as:

  - Minimize vehicular delay
  - Minimize pedestrian/bike delay
  - Improve/maintain site access
  - Maintain access to downtown

- *Appearance*

  Also important are the appearance and aesthetics of the study recommendations. Not necessarily just the actual roadway environment, but the ability to provide a framework for the City to create a gateway that provides an intuitive and aesthetically pleasing experience entering the City. The objectives of this goal are summarized as:

  - Improve intuitiveness
  - Improve conditions for wayfinding
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- *Balance*

  The study needs to ensure that the selected alternative strives to meet the needs of all users, as there are a variety of modes, user groups and land owners that are affected. The existing transportation documents and plans all reflect balance in their stated goals and objectives for the study area. The objectives of this goal are summarized as:

  - Think multimodal, sustainable practices
  - Consider physical feasibility
  - Consider costs
  - Consider short-term vs. long-term wants/needs

EXISTING CONDITIONS

The study analyzed existing conditions based on data provided to Gorove/Slade and observations made in the field. During this portion of the effort, Steering committee and public meetings were held on September 20, 2010 to gain input into the process. All of this information was used to analyze the existing conditions.

Study Area

The broader study area includes South Pleasant Valley Road to the west, East Jubal Early Drive/Millwood Avenue to the south, Princeton Drive/Tulane Drive to the east, and Hollingsworth Drive/Lowry Drive and Winchester Country Club to the north. The study area does not include any freeway segments along Interstate 81 (I-81) but does include the ramps to and from I-81. The broader study area is evaluated in this study, however, the early evaluation of the alternatives focused on the local area around the section of Millwood Avenue considered for closure.

Traffic Patterns

The City provided Gorove/Slade with traffic counts, signal timing information and other roadway data recently collected for and incorporated into other transportation projects. This information was used to develop conclusions on the traffic patterns and congestion levels of the study area[1].

Figure 2 and Figure 3 show a summary of traffic volumes and flows at key intersections within the study area, during the morning and evening commuter peak hours. These key intersections are within or are immediately adjacent to the section of Millwood Avenue considered for closure.

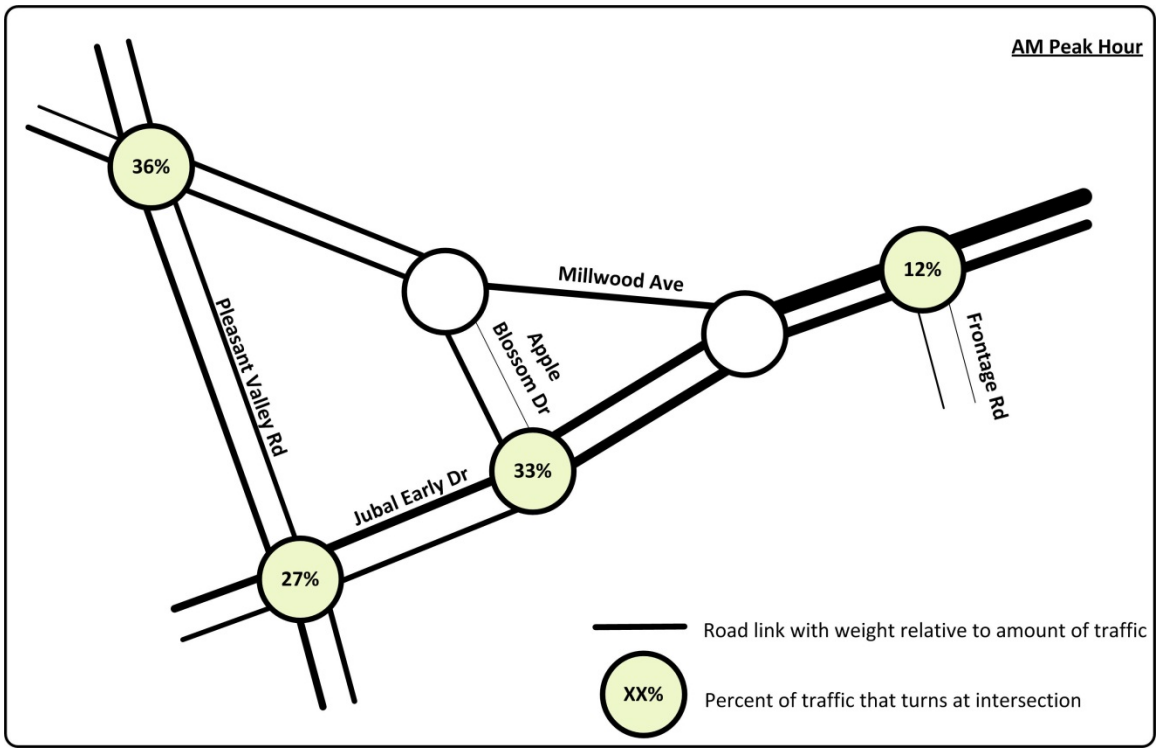


Figure 2: AM Peak Hour Traffic Flow at Key Intersections

[1] A detailed analysis of traffic capacity is included in this report, within the Preferred Alternative chapter.

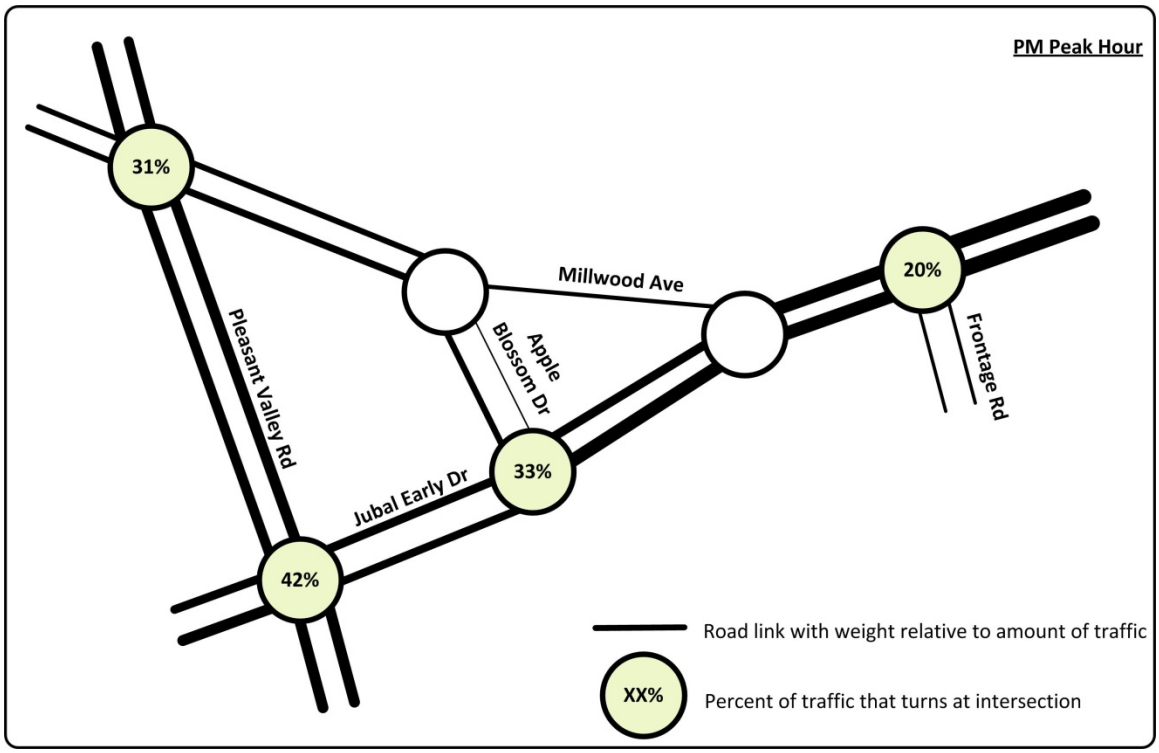


Figure 3: PM Peak Hour Traffic Flow at Key Intersections

These graphics show that traffic in the study area is generally heading to or coming from the interchange with I-81. In the morning, traffic enters towards the City and dissipates over the study area, and the reverse occurs in the evening.

Figure 2 and Figure 3 also show the percentage of traffic that makes a turn at each intersection. High levels of percent turning traffic (over 40%) can be a sign that there is too much strain at each traffic signal, as high levels of turning traffic can lead to protected turns (green arrows) at traffic signals, which can decrease efficiency. The percent turning levels at these key intersections show that a significant amount of traffic turns at most intersections, which although may not be problematic at a specific point, likely makes it difficult to coordinate signal timing between signals to progress traffic along a single corridor. The PM peak hour data shows a higher amount of non-commuter traffic and higher turning percentages. This is likely due to the overlap of commuter and local retail-based traffic, which does not occur in the morning commuter peak hour.

The potential closure of Millwood Avenue could impact traffic flow on the commuter route between the I-81 Interchange or arterial streets east of the City and downtown Winchester. The traffic data was used to identify how much traffic turns onto the section of Millwood Avenue under review and how much traffic takes the reverse movement, turning at the intersection of Jubal Early Drive and Apple Blossom Drive. Figure 4 and Figure 5 show these splits as percentages.

These graphics show that in the morning commuter peak hour, the amount of traffic that uses Millwood Avenue between Jubal Early Drive and Apple Blossom Drive is significant, representing 44% of the traffic traveling into the City on Millwood Avenue. A slightly less percentage is seen in the reverse movement from downtown towards the East. The evening split is not as high to downtown, which is likely due to the influence of retail-based traffic on overall traffic patterns.

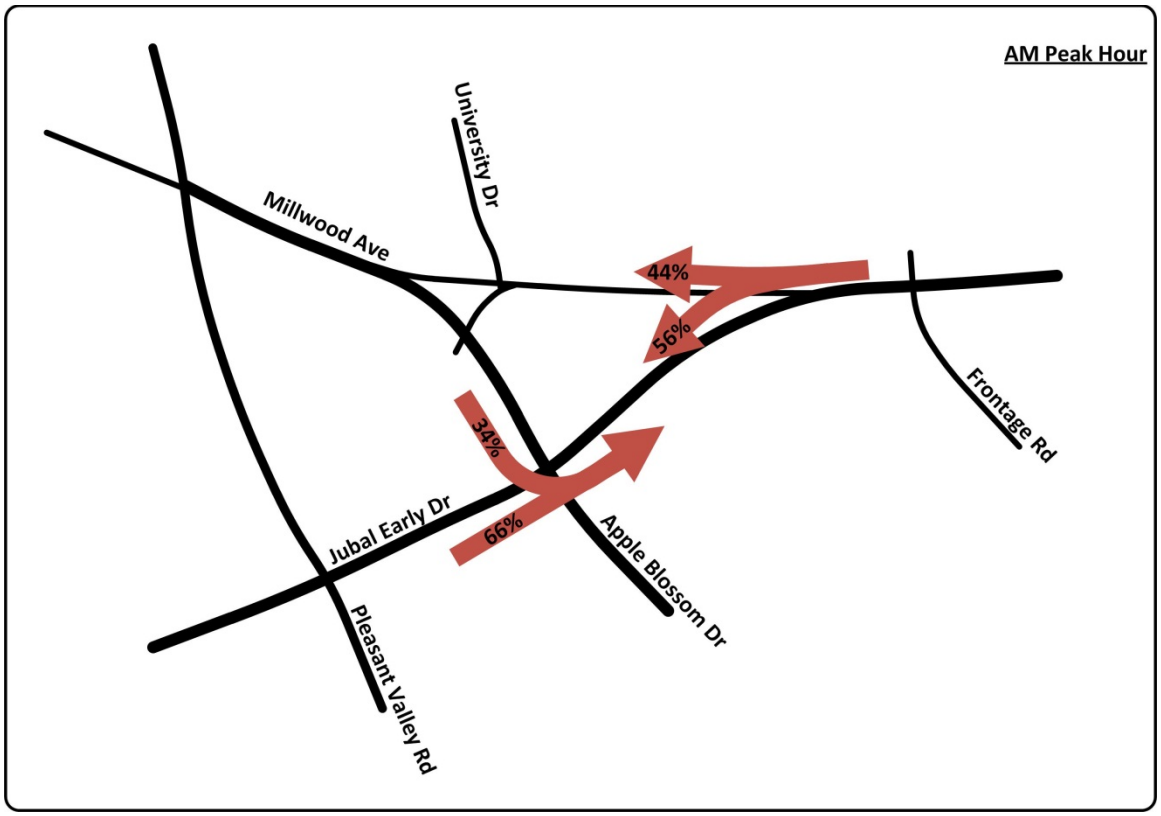


Figure 4: 2007 AM Peak Hour, Split onto and from Millwood Avenue

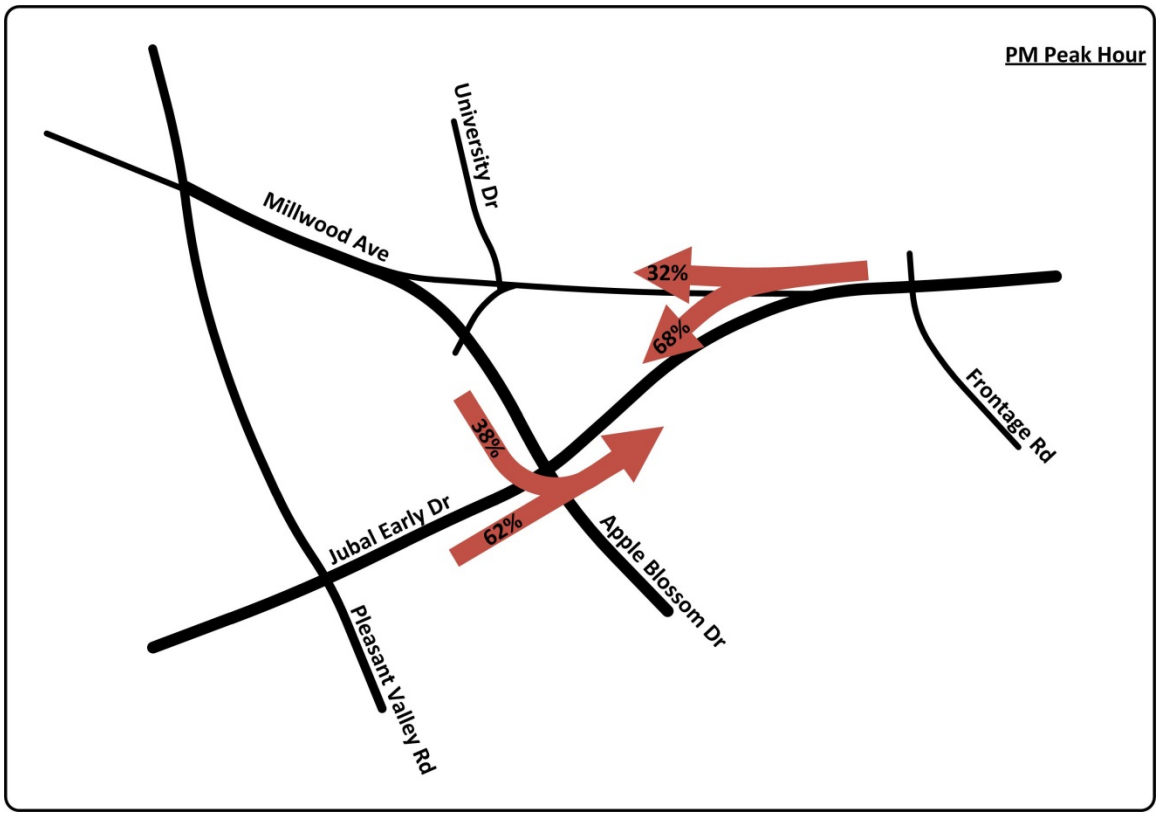


Figure 5: 2007 PM Peak Hour, Split onto and from Millwood Avenue

Figure 6 shows Level of Service grades for key intersections with traffic signals within the study area, based on traffic counts collected during 2007. Level of Service (LOS) is a letter grade assigned to an intersection to help describe the level of congestion and delay experienced by drivers. During commuter peak hours, a grade of "E" is considered to be at capacity and "F" is considered unacceptable.

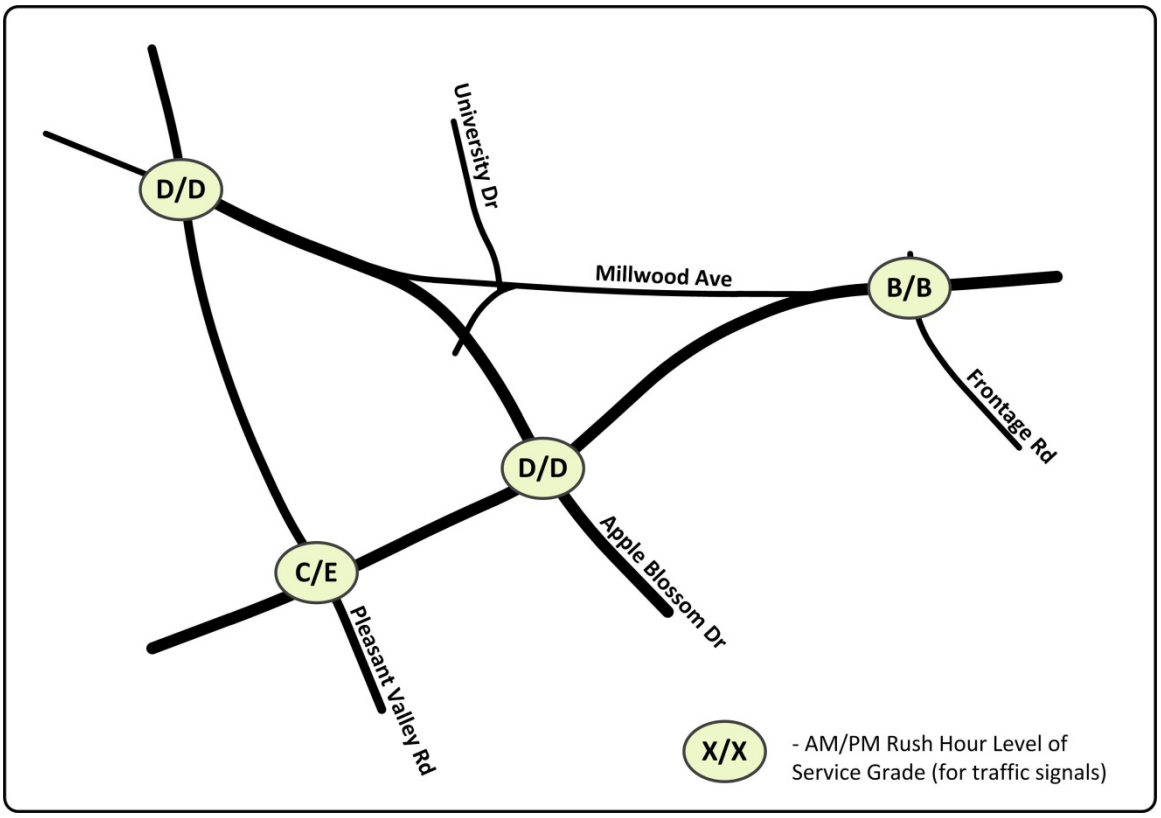


Figure 6: LOS Grades at Key Study Area Intersections

The graphic shows that although no intersections reach an unacceptable LOS grade, several intersections reach LOS D in the commuter peak hours, and the intersection of Pleasant Valley Road and Jubal Early Drive reaches capacity in the evening peak hour. Due to the close proximity of these intersections and the amount of vehicles turning, there are often queues and congestion spots at these locations. A detailed analysis of existing capacity, including LOS grades of all traffic signals in the study area, broken down by direction and approach is included in the Preferred Alternative chapter of this report.

The review of existing traffic patterns shows that the potential closure of Millwood Avenue could lead to increases in delay at these key intersections, since a significant amount of drivers travelling toward downtown use the section under study. The alternative analysis includes evaluation criteria to examine this potential increase in vehicular delay.

Pedestrian and Bicycle Data

Data of pedestrian and bicycle crossings of Millwood Avenue was provided by the City of Winchester. This information is summarized in Figure 7. The area identified on the graphic shows where the data was collected; within this stretch of roadway a moderate amount of pedestrian crossing overlaps with the morning and evening vehicular peak hours.

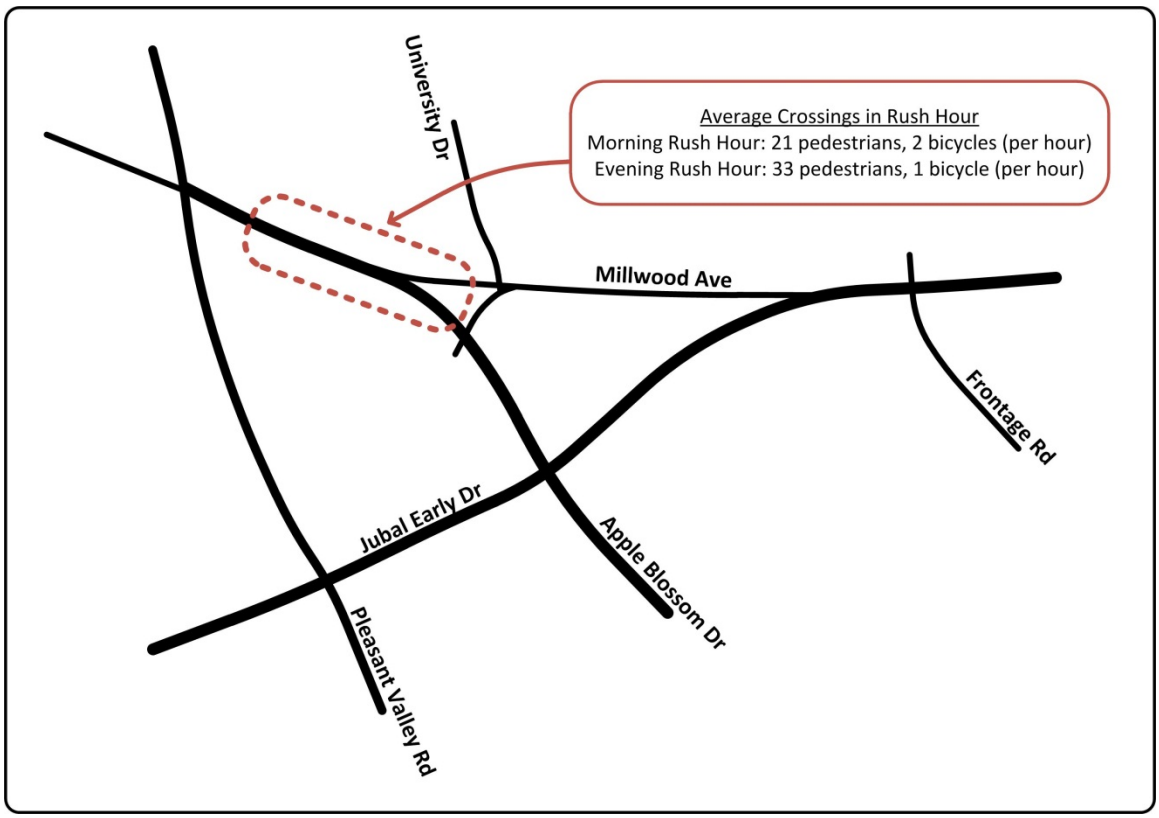


Figure 7: Summary of Pedestrian and Bicycle Data

The amount of pedestrians crossing the area along the stretch of Millwood Avenue under consideration for closure was not collected, as observations indicate that few pedestrians cross in this area. The pedestrian data shows that the evaluation criteria used to judge the alternatives needs to take into account the expected speeds of traffic on Millwood Avenue between Apple Blossom Drive and Pleasant Valley Road, and other factors that influence pedestrian safety.

In addition, the planned Green Circle Trail is anticipated to cross Millwood Avenue at this area. The proposed route would follow University Drive South, and then Apple Blossom Drive towards the mall. The exact route has not been selected; its accommodation was incorporated as evaluation criteria in this report.

Transit

Winchester Transit's Apple Blossom Mall – Route 3 has a stop at Millwood Avenue at Beltone, which is at the intersection of Millwood Avenue and Apple Blossom Drive. Route 3 departs hourly from City Hall Monday to Friday from 6:00 AM to 7:00 PM and Saturday 9:00 AM to 4:00 PM. It connects the study area with downtown Winchester and the Apple Blossom Mall along with the retail to the south on Pleasant Valley Road. With the exception of bus stop location signage, there are no amenities such as shelters or routing information for transit users in the study area.

The Winchester-Frederick County Transit Services Plan includes an extension of Route 3 that would serve the area east of I-81 and south on US 522 down to Airport Road. This would connect the study area with additional employers, retail and residential uses increasing ridership on the transit route.

Crash Data

Figure 8 shows a summary of crash data provided by the City. Two sets of data were provided; the first was a summation of crashes for intersections within the study, for a four year period between 2006 and 2009. This data was used to identify the total number of crashes, and develop a crash rate per intersection. Crash rates were developed using the turning movement count data provided from the City, and are presented in Figure 8 as crashes per million entering vehicles. Generally, transportation engineers consider a crash rate over 1.0 a concern and over 2.0 as a significantly high rate where further study is needed. The second set of data was police reports for a selection of crashes over the course of 2008 through 2010. These police reports were used to help identify the general patterns of location and type of crashes within the study area. Figure 8 shows the type and location of crashes for each police report reviewed, as best as could be interpreted from the reports. The crash data shows that the vast majority of crashes occur at intersections, with rear end collisions representing the majority of accident types. No pedestrian or fatal accidents were among the police reports provided by the City.

The intersections with the highest crash rates are Millwood Avenue/Pleasant Valley Road (rate = 3.0) and Jubal Early Drive/Pleasant Valley Road (rate = 2.0). As previously stated, rates over 2.0 would indicate further study is needed. This report does not constitute a detailed safety study of these intersections but begins to try to interpret the data.

The principal crashes at these intersections are rear end collisions. This is typical at signalized intersections, where rear end collisions are a large percentage of the total crashes. Rear end collisions are generally caused by following too closely or by driver distraction. Speed certainly plays a factor in rear end collisions as the higher the speed, the larger the following distance that is required to stop without collision and the greater the potential severity of the crash.

Left turn crashes are the next highest crash type at these intersections. Failure to yield was noted in many of the crash reports as the reason for the crash. The skewed geometry of the Millwood Avenue/Pleasant Valley Road intersection could be a factor in the very high crash rate at this intersection. Skewed geometry results in longer turning distances, so turning vehicles are in the path of oncoming traffic longer and turning drivers may misjudge the appropriateness of the gap in oncoming traffic for making the turn. For this reason, along with others, skewed intersection geometry should be avoided.

Most crashes in the study area occurred at the intersections outside of the immediate area of the Millwood Avenue section contemplated for closure. The crash history showed nine total crashes during the 2006 to 2009 period at Millwood Avenue/Apple Blossom Drive with a rate of 0.5. This does not mean that the skewed intersection of Millwood Avenue/Apple Blossom Drive is a desirable condition. The Millwood Avenue/Pleasant Valley Road intersection is a good example of why skewed geometry should be avoided and vehicle speeds should be calmed by design features. With growth in vehicular traffic due to growth in the study area and growth in pedestrian and bicycle traffic as a result of the University's growth and the introduction of the Green Circle Trail in this area, the intersection of Millwood Avenue/Apple Blossom Drive will likely pose future safety and operational challenges.

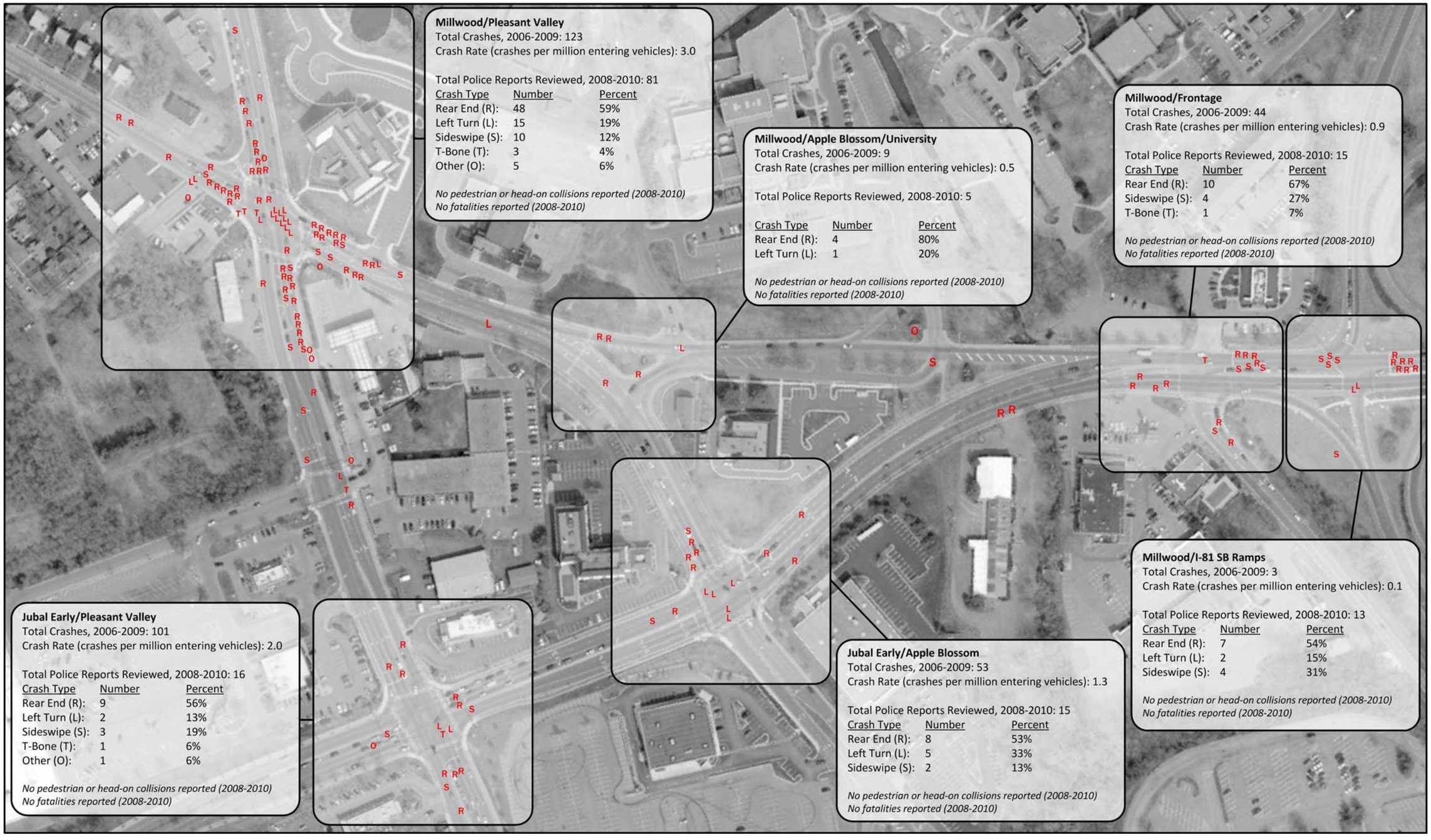


Figure 8: Summary of Crash Data at Key Intersections

First Public Meeting

Format & Topics

The first public meeting for this project was held on September 20, 2010. A full room of approximately 80 members of the public participated and provided a significant amount of input to the process. A copy of the materials presented and generated during the first public meeting are included in the Appendix.

The meeting presentation covered the following topics:

- Introduced the team and Steering committee participants
- Described the purpose of the study and the study area
- Reviewed the alternatives and possible goals of the project

The meeting then changed to a breakout format, with tables of 6 to 8 people asked to provide their responses on the following:

- The pros and cons of the transportation network
- The pros and cons of closing the section of Millwood Avenue under review
- Thoughts on the proposed goals and their priority

Public Comments

The following summarizes the most common responses from the breakout tables. All input received from the breakout tables is provided in the appendix.

- People drive too fast
- Millwood/Jubal Early split is confusing for unfamiliar users
- Millwood yield at Apple Blossom merge not obeyed followed by awkward traffic weave movement
- Pedestrian crossing unsafe
- Need better signage/wayfinding and gateway for City
- Concerns about impact for direct access to downtown
- Concerns about congestion if Millwood is closed
- Safety was the most important goal followed by convenience

The comments received showed that people were concerned about safety, but were equally concerned about any changes to the roadway network that would decrease access to downtown and local businesses. The overwhelming majority of breakout tables recommended that safety be given the highest priority among the four project goals.

A significant result of the public meeting was the questioning of several people on the selection of only two alternatives. Ideas were generated regarding other possible solutions, such as a grade-separated pedestrian crossing, or the closure of other roadways. As explained in the following chapter, these comments prompted the development of additional sub-alternatives for review.

ALTERNATIVES DEVELOPMENT AND EVALUATION

Based on the results of the existing conditions analysis, the study goals and input from stakeholders, sub-alternatives were developed based on the two original alternatives. The criteria used to evaluate the alternatives, the Measures of Effectiveness (MOEs) were also selected. This chapter discusses how the alternatives where chosen, and provides the pros and cons of how each alternative compared after being evaluated by the MOEs. In addition, this chapter reviews the second public stakeholder meeting held on October 19, 2010, where the evaluation process was described and input received on the alternatives.

Development of Alternatives

A significant result of the first public meeting was the questioning by several breakout tables with regard to the selection of only two alternatives. Ideas were brought up regarding other potential solutions. Based on this input, the following alternatives were developed. The first group is based on Alternative 1, which maintains the section of Millwood Avenue under review, and the second on Alternative 2, which closes the same section.

For each alternative, an estimate of probable cost is provided for the physical improvements contained in the alternatives, such as roadway removal, new pavement, traffic signals, etc. The estimates do not include costs for right-of-way acquisition or any costs related to utility relocation. The estimates are offered as input to evaluating the alternatives, and are presented for comparative purposes only.

The estimates of probable cost were assembled by measuring the amount of physical improvements needed for each alternative based on their sketches and concepts. Due to the preliminary nature of alternative designs, an accurate accounting of all relevant factors is infeasible. Instead, this report examined measurable items such as approximate pavement widths, length of affected roadways, the need to install or modify traffic signals, and maintenance of traffic costs. Maintenance of traffic costs are those related to ensuring that the existing roads remain in operation and access to all properties is maintained throughout construction. Costs for the improvements were compiled from recent roadway construction projects. Where multiple costs per unit of improvement were available, this report took a conservative approach and used the higher ones.

Alternative 1: No Build

Figure 9: Alternative 1

This is a "No Build" alternative that contains no changes to the existing infrastructure, and represents the original alternative of keeping Millwood Avenue from the study purpose. The next five alternatives represent variations that keep Millwood Avenue between Jubal Early Drive and Apple Blossom Drive open.

Alternative 1a: Pedestrian Overpass

Figure 10: Alternative 1a

This alternative proposes a pedestrian overpass be constructed over the section with the highest pedestrian activity along Millwood Avenue. No other changes to traffic operations or infrastructure are proposed.

The approximate cost of this alternative is $1.54 million and could be more depending on what vertical transportation elements could ultimately be required to meet American Disability Act (ADA) requirements.

Component	Amount	Unit	Cost per Unit	Cost for Component
Pedestrian Bridge	1	EA	$1,500,000	$1,500,000
Maintenance of Traffic*	1	Per Int.	$40,000	$40,000
Alternative Cost				**$1,540,000**

** Costs related to ensuring that existing roads remain in operation and access to all properties is maintained throughout construction*

Alternative 1b: Millwood Avenue Tees into Apple Blossom Drive

Figure 11: Alternative 1b

This alternative proposes that Millwood Avenue bend into Apple Blossom Drive, which helps improve intersection geometry, reduces ambiguous pavement, improves sight lines, lengthens weave distance and eliminates awkward merge geometry for westbound Millwood Avenue at Apple Blossom Drive. It also calms traffic speeds on westbound Millwood Avenue. It includes the addition of a traffic signal at the intersection of Millwood Avenue and Apple Blossom Drive to control traffic and aid pedestrian crossings, and a channelized right turn from Millwood Avenue toward downtown.

The approximate cost of this alternative is $1.29 million.

Component	Amount	Unit	Cost per Unit	Cost for Component
Traffic Signal	1	EA	$250,000.00	$250,000.00
Roadway Improvements	2000	LF	$500.00	$1,000,000.00
Maintenance of Traffic*	1	Per Int.	$40,000.00	$40,000.00
Alternative Cost				**$1,290,000.00**

** Costs related to ensuring that existing roads remain in operation and access to all properties is maintained throughout construction*

Alternative 1c: Apple Blossom Drive Tees into Millwood Avenue

Figure 12: Alternative 1c

This alternative proposes that Apple Blossom Drive bend and meets University Drive at a new traffic signal on Millwood Avenue. This alternative improves intersection geometry by creating right angle intersections, reduces ambiguous geometry, improves sight lines and eliminates the weaving movements.

The approximate cost of this alternative is $3.38 million.

Component	Amount	Unit	Cost per Unit	Cost for Component
Traffic Signal	1	EA	$250,000	$250,000
Roadway Improvements	6250	LF	$500	$3,125,000
Maintenance of Traffic*	1	Per Int.	$40,000	$40,000
Alternative Cost				**$3,415,000**

** Costs related to ensuring that existing roads remain in operation and access to all properties is maintained throughout construction*

Alternative 1d: Close Apple Blossom Drive

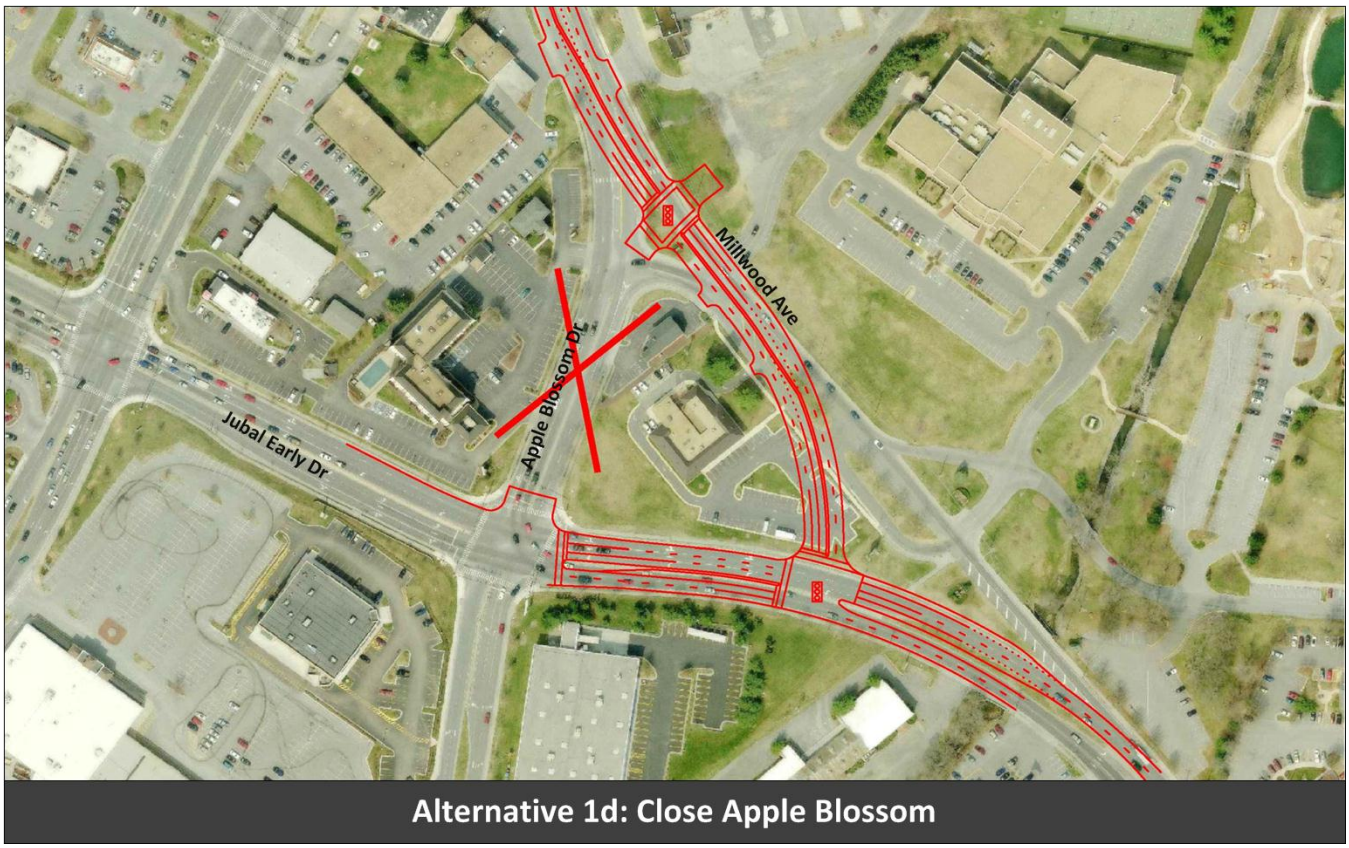


Figure 13: Alternative 1d

This alternative proposes the closure of Apple Blossom Drive, to help remove ambiguous geometry and simplify the roadway network. Millwood Avenue is returned to two-way operation and includes a new intersection with Jubal Early Drive to achieve acceptable intersection geometry. It practically eliminates any weaving condition because of the distance between Jubal Early Drive and Pleasant Valley Road.

The approximate cost of this alternative is $4.81 million.

Component	Amount	Unit	Cost per Unit	Cost for Component
Traffic Signal	2	EA	$250,000	$500,000
Traffic Signal Modification	1	EA	$150,000	$150,000
Roadway Improvements	8000	LF	$500	$4,000,000
Maintenance of Traffic*	4	Per Int.	$40,000	$160,000
Alternative Cost				**$4,810,000**

** Costs related to ensuring that existing roads remain in operation and access to all properties is maintained throughout construction*

Alternative 1e: Close Jubal Early Drive

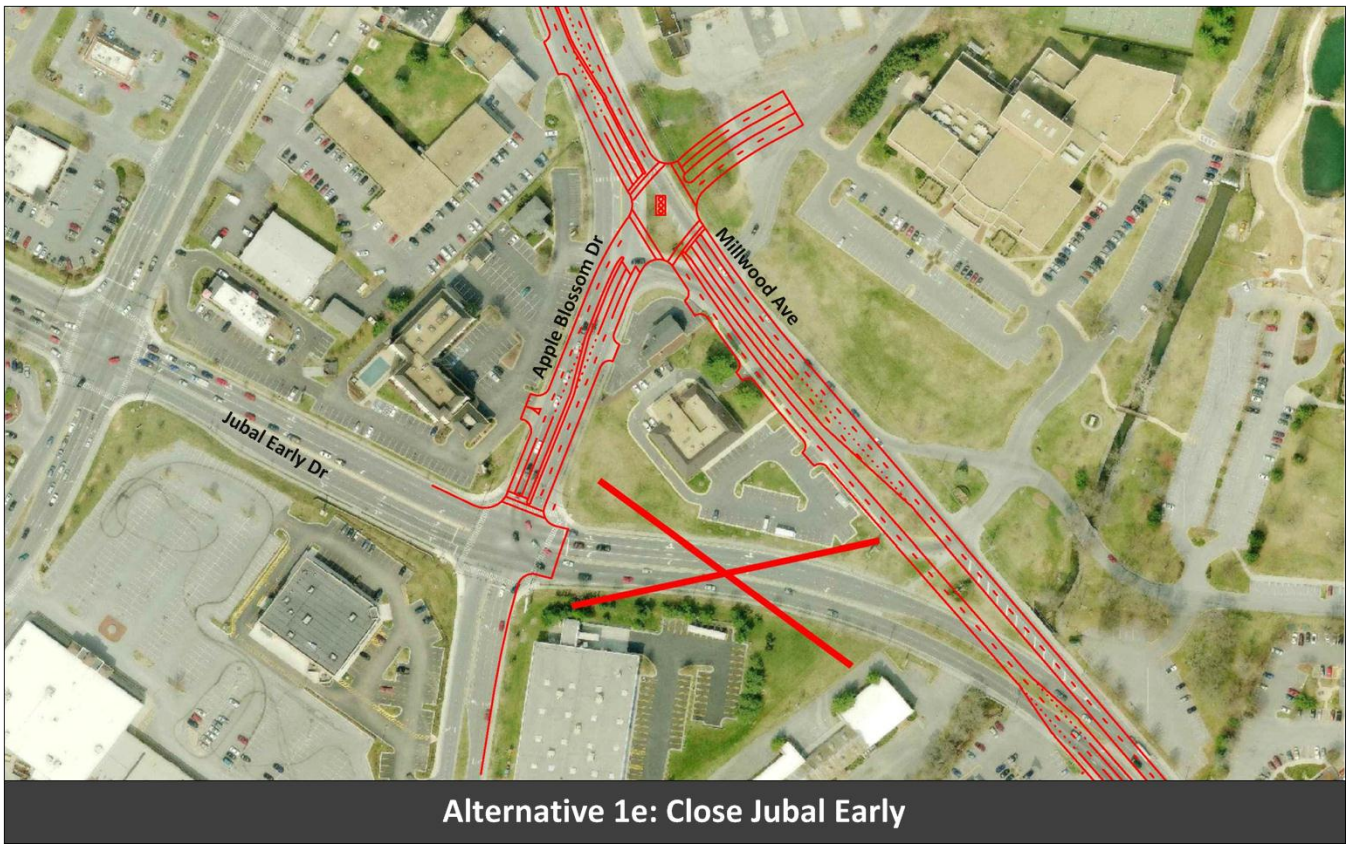


Figure 14: Alternative 1e

This alternative proposes the closure of Jubal Early Drive to help remove ambiguous geometry, simplify the roadway network, and eliminate weave movements.

The approximate cost of this alternative is $4.46 million.

Component	Amount	Unit	Cost per Unit	Cost for Component
Traffic Signal	1	EA	$250,000	$250,000
Traffic Signal Modification	2	EA	$150,000	$300,000
Roadway Improvements	7500	LF	$500	$3,750,000
Maintenance of Traffic*	4	Per Int.	$40,000	$160,000
Alternative Cost				**$4,460,000**

** Costs related to ensuring that existing roads remain in operation and access to all properties is maintained throughout construction*

Alternative 2: Close Millwood Avenue

Figure 15: Alternative 2

This alternative proposes the closure of Millwood Avenue, as proposed in the original purpose of this study. This alternative incorporates a traffic signal at the intersection of Apple Blossom Drive, Millwood Avenue, and University Drive to serve as the main access point to the University and to aid in pedestrian crossings of the intersection. Like the other alternatives it improves intersection geometry by reducing ambiguous pavement and bringing intersections to right angles. The potential for a weave condition is practically eliminated because familiar motorists turning onto northbound Apple Blossom Drive will select the appropriate lane with significant additional distance before the Pleasant Valley Drive intersection.

The approximate cost of this alternative is $0.79 million.

Component	Amount	Unit	Cost per Unit	Cost for Component
Traffic Signal	1	EA	$250,000	$250,000
Roadway Improvements	1000	LF	$500	$500,000
Maintenance of Traffic*	1	Per Int.	$40,000	$40,000
Alternative Cost				**$790,000**

** Costs related to ensuring that existing roads remain in operation and access to all properties is maintained throughout construction*

Alternative 2a: Close Millwood Avenue and Install New Free-Flowing Right Turn Lane

Figure 16: Alternative 2a

This alternative proposes the closure of Millwood Avenue, as proposed in the original purpose of this study, but also includes a new free-flowing right turn lane from westbound Jubal Early Drive to Apple Blossom Drive. This idea was suggested by the stakeholders to help alleviate potential increases to vehicular delay from drivers traveling towards downtown. This alternative also incorporates a traffic signal at the intersection of Apple Blossom Drive, Millwood Avenue, and University Drive to serve as the main access point to the University and to aid in pedestrian crossings of the intersection.

The approximate cost of this alternative is $1.73 million.

Component	Amount	Unit	Cost per Unit	Cost for Component
Traffic Signal	1	EA	$250,000	$250,000
Traffic Signal Modification	1	EA	$150,000	$150,000
Roadway Improvements	2500	LF	$500	$1,250,000
Maintenance of Traffic*	2	Per Int.	$40,000	$80,000
Alternative Cost				**$1,730,000**

** Costs related to ensuring that existing roads remain in operation and access to all properties is maintained throughout construction*

Measures of Effectiveness

This section of the report reviews the Measures of Effectiveness (MOEs) used to evaluate the alternatives. Several qualitative and quantitative MOEs were selected based on the goals defined earlier taking into account guiding policy documents and the need to accommodate all modes of transportation. The alternatives were evaluated versus these MOEs to aid in the selection of the preferred alternative.

While the study area consists of a much larger area, the expanded alternatives were evaluated considering the key intersections adjacent to or within the section of Millwood Avenue considered for closure. From this a Preferred Alternative was selected and the entire study area was evaluated under existing and future conditions.

Figure 17 shows a matrix of all of the MOEs evaluated and summarized for each alternative. The following sections describe the MOEs selected for each goal.

Multi-Modal Analysis

Gorove/Slade recommended when responding to the project scope that the evaluation of the alternatives should include a multi-modal approach, going beyond the basic Level of Service (LOS) intersection criteria. LOS has been the traditional metric by which intersections and roadway networks have been evaluated; however, this is only indicative of how the transportation system serves vehicular traffic. A good intersection LOS only means cars experience an acceptable level of delay according to industry standards. At the same time pedestrians, cyclists and transit users may or may not be served well by a system that operates with a good LOS. Intersection LOS is also not a measure of quality, safety, good design or system intuitiveness.

Reflecting upon the guidance of the policy documents and looking toward more sustainable transportation practices, this study incorporated multi-modal MOEs for each goal. Examples of this are the length of pedestrian crossings along Millwood Avenue (under safety), and the pedestrian vs. vehicular orientation of the alternative (under balance). One quantitative multi-modal MOE was used to help evaluate convenience, the average crossing time for pedestrians at Millwood Avenue, which is based on methodologies contained in Chapter 18 of the *Highway Capacity Manual*. The metrics were chosen so that when all were considered there was a complete evaluation of how the alternatives achieved the established goals. Traditional metrics from the Highway Capacity Manual were included along with guidance from other sources such as the NCHRP Multi-Modal Level of Service for Urban Streets, LEED Neighborhood Development Criteria and the Florida DOT Quality/Level of Service Handbook.

Safety MOEs

The transportation planning industry does not have a direct measure of expected crash reduction, although research has shown that certain factors influence crash rates within a transportation network. Since safety is a difficult item to measure, the MOEs selected represent a review of how the alternatives influence these factors. The safety MOEs take into account all modes of transportation and in large part seek to make the area safer for pedestrians and bicycles, not just motorists. These safety metrics inherently evaluate the improvement of walking and biking conditions.

- *Reduction of Curb Radii & Intersection Skew*

  This MOE looks at how the alternatives reduces curb radii and intersection skew. Large curb radii allow for turns to be made at greater speeds, which negatively impacts safety. The higher the speed the greater the chance a crash will result in a serious injury or fatality. Larger radii also increase the length of the pedestrian crossings which increase the amount of time pedestrians are exposed to traffic and increase the amount of time the pedestrian

phase takes in the signal cycle which reduces overall efficiency. Intersections with skewed approaches (approaches do not meet at right angles) decrease safety because it is difficult for drivers to see oncoming traffic. In addition, while turning the driver needs to look over his/her left shoulder and while doing so possible pedestrian crossings are out of peripheral view. Proper intersection design uses right angles and the smallest possible curb radii to reduce speeds and help reduce conflicts between drivers, pedestrians and cyclists.

- *Removal of Ambiguous Geometry*
  This MOE reviews how each alternative reduces ambiguous geometry. Ambiguous geometry can take the driver's focus away from the roadway by confusing them or leading them to the wrong conclusion on the traffic controls and direction. It creates a situation that is usually less intuitive creating hazard for all users.

- *Pedestrian Crossing of Millwood Avenue near Apple Blossom Drive*
  This MOE compares how each alternative handles pedestrian crossings at the intersection of Apple Blossom Drive and Millwood Avenue, and the approximate distance of the crosswalk. Unsignalized crossings rely on approaching vehicles to yield and work best when a pedestrian only has to cross two lanes of traffic at most between refuges (24 feet). A signalized intersection introduces delay to vehicles, but allows for pedestrians to wait for a "Walk" sign instead of for vehicles to yield when they enter the crosswalk.

- *Removal of Weaving Areas*
  This MOE reviews how each alternative handles weaving maneuvers. A weaving area is a location on a roadway where traffic is required to cross another stream of traffic to make a desired turn, or reach a desired lane.

- *Change in Vehicular Conflict Points at Intersections*
  This MOE measures the difference in conflict points between each alternative and the existing condition. Conflict points are locations where driving paths intersect at an intersection; they measure the number of ways vehicles can conflict/potentially hit each other within an intersection. Simplifying intersections and removing the overall amount of potential turns leads to a reduction in conflict points.

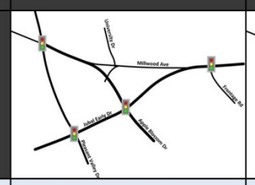
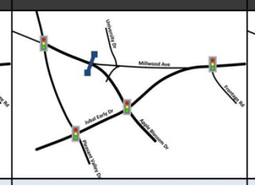
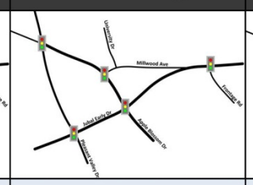
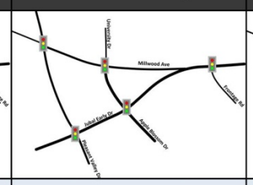
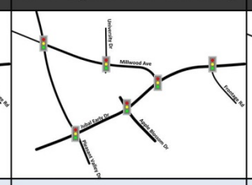
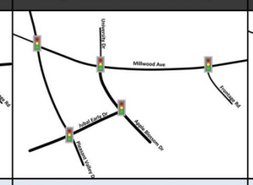
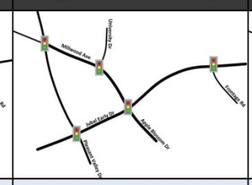
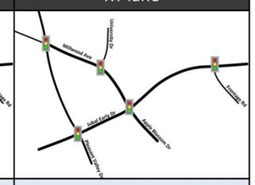
	Alternatives	1 No Build	1a Overpass	1b Millwood tees into Apple Blossom with Signal	1c Apple Blossom tees into Millwood with Signal	1d Close Apple Blossom, new signal at University	1e Close Jubal Early, new signal at University	2 Close Millwood, new signal at University	2a Close Millwood , new signal at University and install WB RT lane
	Sketch								
SAFETY	Reduction of curb radii & intersection skew	None	None	Yes, at Millwood/A.Blossom	Yes, at Millwood/A.Blossom	Yes, at Millwood/A.Blossom	Yes, at Millwood/A.Blossom and Millwood/J.Early	Yes, at Millwood/A.Blossom and Millwood/J.Early	Yes, at Millwood/A.Blossom and Millwood/J.Early
	Removal of ambiguous geometry	None	None	Yes, at Millwood/A.Blossom	Yes, at Millwood/A.Blossom	Yes, at Millwood/A.Blossom, and Millwood ajd. to SU	Yes, at Millwood/A.Blossom, and Millwood ajd. to SU	Yes, at Millwood/A.Blossom, and Millwood ajd. to SU	Yes, at Millwood/A.Blossom, and Millwood ajd. to SU
	Pedestrian crossing of Millwood near intersection with Apple Blossom	Unsignalized, 95'	Overpass	Signalized, approx. 60'	Signalized, approx. 60'	Signalized, approx. 60'	Signalized, approx. 60'	Signalized, approx. 60'	Signalized, approx. 60'
	Removal of weaving areas	None	None	Yes, Millwood approach to P. Valley. Adding weave near Millwood/A. Blossom.	Yes, Millwood approach to P. Valley	Yes, Millwood approach to P. Valley	Yes, Millwood approach to P. Valley.	Yes, Millwood approach to P. Valley.	Yes, Millwood approach to P. Valley.
	Change in vehicular conflict points (+/- compared to existing)	No change	No change	-14 vehicular conflicts	-22 vehicular conflicts	-24 vehicular conflicts	-31 vehicular conflicts	-33 vehicular conflicts	-33 vehicular conflicts
CONVENIENCE	Change in number of intersections at or over vehicular capacity	0	0	-1	-1	0	+2	-1	-1
	Change to vehicular travel time (compared to existing conditions)	0%	0%	-2%	-1%	+7%	+126%	+3%	-4%
	Ped travel time crossing Millwood Ave (at existing crosswalk location)	131 seconds	85 seconds	51 seconds	48 seconds	55 seconds	62 seconds	56 seconds	56 seconds
	Can alternative accommodate Green Circle Trail	No controlled crossing of Millwood Ave	No bicycle accommodation	Yes	Yes	Yes, can run in former A. Blossom right-of-way	Yes	Yes	Yes
	Access: • Downtown • Mall • Other Businesses • University	• Same • Same • Same • Same	• Same • Same • Same • Same	• Impact • Same • Impact • Impact	• Same • Same • Impact • Improvement	• Impact • Impact • Major impact • Improvement	• Same • Major impact • Major impact • Improvement	• Impact • Same • Impact • Improvement	• Impact • Same • Impact • Improvement
APPEARANCE	Intuitiveness (compared to existing)	No change	No change	No change	No change	Impact - Same link to/from downtown, but one more decision point	Major impact - Same link to/ from downtown, all others heavily impacted	Improved - Same link to/ from downtown and fewer decision points with better spacing	Improved – Same link to/ from downtown and fewer decision points with better spacing
	From I-81 and decision point heading westbound (distance / time)	325 feet / 5.5 seconds	325 feet / 5.5 seconds	325 feet / 5.5 seconds	325 feet / 5.5 seconds	725 feet / 12 seconds	1250 feet / 21 seconds	1150 feet / 19 seconds	1150 feet / 19 seconds
	Provision for gateway feature	Poor	Poor	Poor	Poor	Somewhat improved	Somewhat improved	Improved	Improved
BALANCE	Multi-modal / vehicular convenience	Vehicle oriented	Vehicle oriented	Balanced at MW/AB, veh-oriented on MW adj. to SU	Balanced at MW/AB, veh-oriented on MW adj. to SU	More improvement for alt. modes than vehicles	More improvement for alt. modes than vehicles	More improvement for alt. modes than vehicles	Balanced benefits to all modes
	Local access / commuter convenience	No difference	No difference	Slightly more indirect access for both. 1 more signal inbound and outbound.	Favors commuters. 1 more signal inbound and outbound.	More impacts to local access. 2 new signals inbound, 1 new signal outbound.	Favors downtown commuters, poor for all others. 1 new signal inbound.	One more turn to downtown, some impacts to local access. 1 more signal inbound and outbound.	One more turn to downtown, some impacts to local access. 1 more signal inbound and outbound.
	Short-term / long-term solution	Neither	Short-term (doesn't solve issues behind problems)	Short-term (limits development opportunities)	Short-term (limits development opportunities)	Short-term (can't handle increase in traffic well)	Short-term (can't handle increase in traffic well)	Short-term, will have issues with future J.Early traffic.	Balanced
	Preliminary Cost Estimate (design, utilities & ROW not included)	$0	$1.54mil	$1.29mil	$3.42mil	$4.81mil, needs right-of-way	$4.46mil	$0.79mil	$1.73mil

Figure 17: MOE Results Matrix

Convenience MOEs

The convenience MOEs measure how well each alternative accommodates the different users of the transportation network. They include quantitative measures of traffic congestion, projected crossing times for pedestrians, and accommodations for local access.

- *Change in Number of Intersections at or over Vehicular Capacity*

  This MOE measures the difference in highly congested intersections between alternatives, by comparing the number of LOS E of F grades that each alternative is projected to experience combined between the AM and PM peak hours, within the entire study area. The results are shown as the difference between the alternative and existing conditions, using existing volumes. These results were compiled using a planning level simulation of key intersections within the study area. The traffic analysis files provided by the City, in Synchro software format, were adjusted to reflect each alternative and the simulation package SimTraffic was used to calculate driver delay, which was translated into LOS grades based on thresholds contained within the Highway Capacity Manual (HCM).

- *Change in Vehicular Travel Time*

  This MOE measures overall travel time at key intersections within the study area, combined for both AM and PM peak hours. The simulation models of key intersections were used to generate this MOE. The overall vehicular travel time within the simulation was used as an MOE because it reflects changes to delay generated by elimination of weaves, longer travel times due to elimination of roadways, and better reflects changes in traffic signal spacing and coordination.

- *Pedestrian Travel Time Crossing Millwood Avenue*

  This MOE measures the average time it is projected for a pedestrian to cross Millwood Avenue near the current crosswalk at its intersection with Apple Blossom Drive. For unsignalized intersections, this calculation is based on the wait time for a sufficient gap in traffic for a pedestrian to cross, and the length of the crosswalk. For signalized intersections this calculation is based on the average wait for a "Walk" signal at the crosswalk plus the length of the crosswalk.

- *Accommodation of Green Circle Trail*

  The Green Circle Trail is a planned multi-use pathway (pedestrian and bicycle) that, within the study area, will connect the University area with the retail areas across Jubal Early Drive, but will ultimately continue on with regional connections. The planned route will enter the study area from the north along University Drive, and travel south towards Millwood Avenue, following along Apple Blossom Drive towards the Apple Blossom Mall.

  This MOE reviews the ability of each alternative to accommodate the Green Circle Trail.

- *Local Access*

  This MOE reviews how each alternative aids or hinders access to Downtown, the Apple Blossom Mall, other local business and the University. This review is mainly based on the number of turns or intuitiveness of access required compared to existing conditions. The MOE matrix lists 'impact' for any situation where access will be more difficult, and 'improvement' where access should be easier.

Appearance MOEs

The appearance MOEs were selected to help compare how each alternative can serve as a gateway to the City, University and retail-based traffic entering from the east.

- *Intuitiveness*
  This MOE reviews how each alternative compares to the existing conditions on the intuitiveness of travelling to and from the City (including downtown and major retail areas) and areas east of the City, including the interchange with I-81.

- *Distance between I-81 and First Decision Point Heading Westbound*
  This MOE measures the amount of time drivers have between the I-81 interchange and where their first turn would need to be to reach the University, Mall and Downtown. The longer this distance/time, the more time a driver will have to orient himself/herself, read and comprehend directional or wayfinding signage, and maneuver in a safe manner.

- *Provision for Gateway Feature*
  This MOE compares how each alternative would allow a feature to be placed in a manner that traffic entering the City from the east would be able to see it and create a gateway presence on the approach. This MOE does not take into account what the feature would be, but rather if the alternative changes the roadway network in such a way that the driver's line-of-sight would intersect a location for a potential feature.

Balance MOEs

The balance MOEs compare the alternatives on how well they accommodate all other MOEs, instead of focusing on one specific MOE or goal.

- *Multi-modal/Vehicular Balance*
  This MOE reviews how well the alternatives meet both the multi-modal and vehicular project goals and objectives. An alternative is considered to perform better under this MOE if it improves all modes, even if one alternative shows a great improvement in one mode alone.

- *Local Access/Commuter Convenience*
  This MOE compares the alternatives for how they help both commuters and local access. An alternative that can accommodate both is preferable, but often the traffic patterns are somewhat at conflict with each other.

- *Short-Term/Long-Term Solution*
  This MOE compares the alternatives on how well they are expected to handle existing patterns while accommodating future growth in the study area.

- *Preliminary Cost Estimate*
  This MOE is an estimate of probable cost for the physical improvements contained in the alternatives, such as roadway removal, new roadways, traffic signals, etc. It does not include costs for right-of-way acquisition or any costs related to utility relocation.

Alterative Evaluation

This section compares the alternatives to the MOEs and summaries the pros and cons of each alternative.

Alternative 1: No Build

- *Pros*
  The no-build alternative has the lowest cost among all alternatives as there would be no change to existing infrastructure.

- *Cons*
  The alternative does not meet the goals of the project, as it would not positively impact safety, pedestrian convenience, appearance, or balance within the study area.

Alternative 1a: Pedestrian Overpass

- *Pros*
  The addition of the pedestrian overpass can separate pedestrians and vehicles at a key crossing in the study area.

- *Cons*
  Generally, for grade-separated crossings to be effective there cannot be a grade change at both ends of the crossing. Many existing examples have shown that pedestrians will ignore grade-separated crossings constructed to solve conflicts, as the solution requires more delay and physical exertion than the prior situation of crossing at-grade. Successful examples of grade-separated pedestrian crossings are those that are at locations where the topography allows for no changes in grades at either end (ie. a sunken roadway) or where there is a grade change at only one end. Forcing pedestrians to use a grade-separated crossing by constructing fences would negatively impact the convenience and appearance goals of this study. It elevates vehicles to the highest priority rather than seeking a balanced approach to mobility through better urban design.

  A pedestrian overpass would not be able to incorporate bicycles easily and thus would not be the best solution to accommodate the Green Circle Trail crossing.

Alternative 1b: Millwood Avenue Tees into Apple Blossom Drive

- *Pros*
  This alternative eliminates awkward merge geometry, reduces speeds, shortens crossings, and has no noticeable change to travel time.

- *Cons*
  This alternative requires westbound traffic heading toward downtown to turn right at a new intersection and does not improve the diverge of westbound traffic between Millwood Avenue and Jubal Early Drive. There is still the same short distance for drivers to make decisions travelling westbound. There is also a short distance between University Drive and Apple Blossom Drive, creating a problematic access point for the University that would not operate well especially considering this would be the primary access point.

Alternative 1c: Apple Blossom Drive Tees into Millwood Avenue

- *Pros*

  This alternative eliminates awkward merge geometry, eliminates weaves, shortens crossings, and has no noticeable change to travel time while maintaining a direct westbound connection toward downtown.

- *Cons*

  This alternative does not improve the diverge of westbound traffic between Millwood Avenue and Jubal Early Drive. There is still a short distance for drivers to make decisions travelling westbound. This alternative also increases the amount of turns a driver needs to make heading from downtown Winchester toward I-81/points east. It could also be expected that some Millwood eastbound traffic could miss the turn at Apple Blossom and end up unintentionally on the stretch in front of the University with no choice but to turn around.

Alternative 1d: Close Apple Blossom Drive

- *Pros*

  This alternative eliminates the diverge of westbound traffic between Millwood Avenue and Jubal Early Drive, eliminates awkward merge geometry, eliminates weaves, shortens crossings, and has a more intuitive access to downtown, as entering and exiting the City use the same link.

- *Cons*

  This alternative significantly impacts access to local business and the Apple Blossom Mall. The results from traffic modeling show an increase in vehicular delay. In addition, the short signal spacing along Jubal Early Drive on this alternative would not be able to handle future growth as well as the other alternatives. This option is the second most expensive of the Alternative 1 sub options at $3.38 million.

Alternative 1e: Close Jubal Early Drive

- *Pros*

  This alternative eliminates the diverge of westbound traffic between Millwood Avenue and Jubal Early Drive, eliminates awkward merge geometry, eliminates weaves, shortens crossings, and has a more intuitive access to downtown, as entering and exiting the City use the same link.

- *Cons*

  This alternative does not fit with prevailing travel patterns, and would force many drivers to re-route their usual paths. The results from traffic modeling show a very significant increase in vehicular delay. In addition, the elimination of a link along Jubal Early Drive does not align with other planned MPO improvements for the corridor (future growth on Jubal Early Drive). This option is the most expensive of the Alternative 1 sub options at $4.15 million and it will also need new right-of-way.

Alternative 2: Close Millwood Avenue

- *Pros*

  This alternative, eliminates the diverge of westbound traffic between Millwood Avenue and Jubal Early Drive, eliminates awkward merge geometry, eliminates a weaving condition, shortens crossings, allows drivers to use the

same link to/from downtown, significantly increases time between decision points, and provides opportunity for a gateway treatment.

- *Cons*
  This alternative creates the need for an additional right turn to reach downtown, and traffic models show an increase in travel time for that movement compared to existing conditions. This alternative also impacts access to the Hampton Inn on the Allen Properties site as the parcel's most direct access from I-81 is to use the existing section of Millwood Avenue.

Alternative 2a: Close Millwood Avenue and Install Right Turn Lane

- *Pros*
  This alternative, eliminates the diverge of westbound traffic between Millwood Avenue and Jubal Early Drive, eliminates awkward merge geometry, eliminates a weaving condition, shortens crossings, allows drivers to use the same link to/from downtown, significantly increases time between decision points, and provides opportunity for a gateway treatment.

- *Cons*
  This alternative creates the need for an additional right turn to reach downtown. This alternative also impacts access to the Hampton Inn on the Allen Properties site as the parcel's most direct access from I-81 is to use the existing section of Millwood Avenue.

Second Public Meeting

Format & Topics

The second public meeting for this project was held on October 19, 2010. Due to the large attendance of the first meeting, two identical meetings where held, one in the afternoon and one in the evening. Copies of the materials presented and generated during the second public meeting are included in the Appendix.

The meeting presentation covered the following topics:

- Recapped the existing conditions analysis and first public meeting
- Reviewed study goals and related MOEs for each goal
- Showed each alternative and described pros and cons

Public Comments

The meeting then changed to a breakout format, with tables of 6 to 8 people asked to provide their thoughts on how well each alternative met the project goals, with each table directed to present their one or two favorite alternatives, based on the information presented that evening.

After the breakout sessions, each table elected a representative to relay their discussion. Most tables reached a consensus on an alternative, although some tables had a disagreement and presented their thoughts on several alternatives. No alternative was a consensus favorite, but the majority of tables listed Alternative 2a as the one with the most merit.

The intent of the public workshops was to gain a broad understanding from all of the affected stakeholders and as such the MPO advertised the meetings through various media sources. From the comments it was apparent that there were strong opinions among different groups and interests that participated, which was expected given the variety of users that traverse Millwood Avenue on a daily basis and many who have done so for many years. There was also concern expressed about certain interests, particularly Shenandoah University, having more representation at the public meeting while others who would oppose closure were not as well represented. It was encouraged that those who attended the meeting make it known to those who did not participate that their comments are still desired as an input to the study. The comments would be better informed having the benefit of participating in the workshop but the comments are still desired nonetheless and would be collected by the MPO. Only two additional comments were received on the alternatives.

PREFERRED ALTERNATIVE

Based on the evaluation of alternatives and input from stakeholders, Alternative 2a was selected as a candidate to become the Preferred Alternative. This includes closing Millwood Avenue between Jubal Early Drive and Apple Blossom Drive and constructing a westbound right turn lane from Jubal Early Drive to Apple Blossom Drive/Millwood Avenue. Alternative 2a was the best at addressing the study goals at an anticipated cost that was on the order of the other less expensive alternatives. Although not unanimously supported, it received the most support of any of the alternatives during the public workshops and feedback.

This chapter describes the refinements made to Alternative 2a, details the technical analysis of Year 2007 and Year 2035 conditions of Alternative 2a versus the no-build alternative for the broader study area, and discusses steps towards implementation.

Detailed Traffic Modeling

Although Alternative 2a performed well against the MOEs selected to reflect the project goals, a detailed technical analysis was performed before it could be confirmed as the preferred alternative.. This analysis tests how the alternative performs in the broader context of the entire study area, compared against a no-build scenario (Alternative 1) in both Year 2007 and Year 2035 scenarios.

This study evaluated the preferred alternative's roadway network by conducting intersection capacity analyses of the Year 2007 and Year 2035 conditions at the intersections contained within the study area during the morning and afternoon peak hours. The *Synchro, Version 7.0* software package was used to compile a traffic model with the existing volumes and data obtained from the City of Winchester and from the Draft Route 522 Multimodal Corridor Study prepared by Michael Baker Jr., Inc. *Synchro* files for the Year 2007 conditions were provided for the morning and afternoon peak hour periods, which were used as a base for the alternative analyses. The Synchro files were provided by Sabra, Wang & Associates and included peak hour traffic volumes collected on Tuesday-Thursday, April 24-26, 2007. The traffic volume sheets obtained from Sabra, Wang & Associates are included in the Appendix. The Year 2007 lane configurations, traffic controls, and signal timings were also included in the *Synchro* model, as confirmed by Sabra, Wang & Associates for the morning and afternoon peak hours.

The Year 2007 traffic model was modified in order to include only the study area intersections as shown in Figure 18. The files provided only incorporate intersections with traffic signals, so Gorove/Slade inputted the unsignalized intersections along Millwood Avenue between Jubal Early Drive and Apple Blossom Drive into the model. The existing traffic volumes are shown on Figure 19 and Figure 20.

Traffic volumes for the preferred alternative were generated by rerouting the Year 2007 traffic volumes along the portion of Millwood Avenue that would be removed. Vehicles traveling along westbound Jubal Early Drive that previously turned right on the portion of Millwood Avenue to be removed were rerouted to the intersection with Apple Blossom Drive where they turned right on to northbound Apple Blossom Drive/Millwood Avenue. Vehicles accessing the uses along the portion of Millwood Avenue to be removed were rerouted to the intersection of Apple Blossom Drive/Millwood Avenue and University Drive. In order to isolate the impact of the proposed closure of Millwood Avenue, no other traffic volume changes were assumed. The Year 2007 traffic volumes for the preferred alternative are shown on Figure 21 and Figure 22.

In addition to the Year 2007 analysis, an analysis was performed for the future Year 2035 to compare the no-change alternative to the preferred alternative. In order to determine the Year 2035 traffic volumes, the Draft Route 522 Multimodal Corridor Study prepared by Michael Baker Jr., Inc. was reviewed. The Year 2035 traffic volumes from the study

were calculated by applying a growth rate to the existing traffic volumes, which was obtained from the VDOT Winchester Region Travel Demand Model. In addition to the growth rates applied to the different sections of the Route 522 corridor, trips generated by four large planned developments in the vicinity of the corridor were also added to traffic volumes in order to obtain the Year 2035 traffic volumes. Volumes from the study were used for the intersections that overlap the two studies. Traffic volumes for the other study intersections for the Year 2035 analysis were calculated by applying a growth rate to the existing traffic volumes. The traffic volumes for the future Year 2035 are shown on Figure 23 and Figure 24.

As outlined previously, the future Year 2035 volumes for the preferred alternative were generated by rerouting the traffic volumes along the portion of Millwood Avenue that would be removed. The Year 2035 volumes for the preferred alternative are shown in Figure 25 and Figure 26.

Intersection capacity analyses were performed for the four scenarios: Year 2007 conditions, Year 2007 preferred alternative, Year 2035 conditions, and Year 2035 preferred alternative at the intersections contained within the study area during the morning and afternoon peak hours. *Synchro, Version 7.0* was used to analyze the study intersections based on the Highway Capacity Manual (HCM) methodology. The results of the capacity analyses are expressed in level of service (LOS) and delay (seconds per vehicle) for each approach. A LOS grade is a letter grade based on the average delay (in seconds) experienced by motorists traveling through an intersection. LOS results range from "A" being the best to "F" being the worst. For the purpose of this analysis, LOS D is used as the acceptable LOS threshold.

The LOS capacity analyses were based on: (1) the Year 2007 and preferred alternative lane use and traffic controls; (2) the peak hour turning movement volumes as described previously; and (3) the Highway Capacity Manual (HCM) methodologies (using *Synchro 7* software). Additionally, it was assumed that the preferred alternative would include signal timing improvements at the intersection of Jubal Early Drive and Apple Blossom Drive in conjunction with the addition of the free-flow right-turn lane. For the Year 2035 analyses, it was assumed that the signalized intersections in the study area would be retimed in order to account for future projected growth. An average delay (of each approach) and LOS for the signalized intersections is also shown for an overall intersection LOS grade. The HCM does not give guidelines for calculating the average delay for a two-way stop-controlled intersection, as the approaches without stop signs would technically have no delay. The Year 2007 lane use and traffic controls are shown on Figure 27 and Figure 28. The lane use and traffic controls for the preferred alternative are shown on Figure 29 and Figure 30.

Results of the capacity analyses are shown in Table 1. Results for the Year 2007 conditions, Year 2007 preferred alternative, Year 2035 conditions, and Year 2035 preferred alternative at the intersections contained within the study area are shown on Figure 31 and Figure 32; Figure 33 and Figure 34; Figure 35 and Figure 36; and Figure 37 and Figure 38, respectively.

Table 1: Intersection Capacity Analysis Results

Intersection	Approach	Year 2007 Conditions				Year 2035 Conditions			
		AM Peak Hour		*PM Peak Hour*		*AM Peak Hour*		*PM Peak Hour*	
		Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS
Hollingsworth Dr & Pleasant Valley Rd	**Overall**	**9.6**	**A**	**7.3**	**A**	**10.0**	**A**	**13.1**	**B**
	Eastbound	32.2	C	38.4	D	31.6	C	35.8	D
	Westbound	33.0	C	42.0	D	35.0	C	46.2	D
	Northbound	8.4	A	1.7	A	6.6	A	8.4	A
	Southbound	5.5	A	7.5	A	7.6	A	13.1	B
Millwood Ave & Pleasant Valley Rd	**Overall**	**44.1**	**D**	**54.8**	**D**	**48.6**	**D**	**98.3**	**F**
	Eastbound	69.3	E	75.1	E	52.0	D	105.2	F

Intersection	Approach	Year 2007 Conditions				Year 2035 Conditions			
		AM Peak Hour		*PM Peak Hour*		*AM Peak Hour*		*PM Peak Hour*	
		Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS
	Westbound	49.2	D	75.3	E	43.3	D	74.6	E
	Northbound	37.7	D	43.9	D	62.4	E	99.3	F
	Southbound	26.2	C	42.7	D	38.8	D	106.2	F
K-Mart & Pleasant Valley Rd	**Overall**	**4.2**	**A**	**9.1**	**A**	**5.2**	**A**	**14.3**	**B**
	Eastbound	70.6	E	77.9	E	68.4	E	74.6	E
	Westbound	76.1	E	90.0	F	72.2	E	89.7	F
	Northbound	0.6	A	2.8	A	2.1	A	6.6	A
	Southbound	0.8	A	1.1	A	1.2	A	8.7	A
Jubal Early Dr & Pleasant Valley Rd	**Overall**	**33.9**	**C**	**56.3**	**E**	**33.8**	**C**	**101.9**	**F**
	Eastbound	58.4	E	86.1	F	49.0	D	134.1	F
	Westbound	49.2	D	94.3	F	36.6	D	135.6	F
	Northbound	18.3	B	19.3	B	26.5	C	62.7	E
	Southbound	11.7	B	35.5	D	23.9	C	84.9	F
Hampton Inn & Millwood Ave	**Overall**	--	--	--	--	--	--	--	--
	Eastbound	13.5	B	14.6	B	19.6	C	19.7	C
	Westbound	13.2	B	14.0	B	17.0	C	21.1	C
	Northbound Left	3.0	A	0.4	A	3.4	A	0.7	A
	Southbound Left	7.4	A	7.6	A	7.5	A	7.8	A
Hampton Inn & Millwood Ave	**Overall**	**4.6**	**A**	**8.4**	**A**	**4.7**	**A**	**9.5**	**A**
(Preferred Alternative)	Eastbound	34.5	C	45.9	D	35.0	D	56.7	E
	Westbound	28.8	C	33.9	C	28.8	C	33.3	C
	Northbound	3.7	A	5.4	A	4.2	A	6.2	A
	Southbound	2.9	A	3.1	A	2.2	A	4.5	A
Jubal Early Dr & Apple Blossom Dr	**Overall**	**45.2**	**D**	**35.9**	**D**	**105.4**	**F**	**87.0**	**F**
	Eastbound	52.9	D	35.3	D	49.7	D	121.5	F
	Westbound	27.8	C	23.8	C	178.4	F	73.4	E
	Northbound	26.6	C	32.5	C	30.4	C	78.1	E
	Southbound	62.4	E	55.7	E	50.1	D	61.4	E
Jubal Early Dr & Apple Blossom Dr	**Overall**	**34.7**	**C**	**28.0**	**C**	**77.2**	**E**	**68.5**	**E**
(Preferred Alternative)	Eastbound	41.0	C	32.8	C	51.4	D	121.5	F
	Westbound	13.3	B	13.6	B	95.2	F	36.8	D
	Northbound	26.6	C	32.2	C	30.4	C	78.1	E
	Southbound	94.7	F	57.5	E	52.5	D	73.6	E
Lowry Dr & Millwood Ave	Westbound	13.6	B	12.1	B	18.1	C	19.9	C
	Southbound Left	9.5	A	8.5	A	11.2	B	10.4	B
Millwood Ave/Jubal Early Dr & Bob Evans	**Overall**	**13.5**	**B**	**16.5**	**B**	**74.6**	**E**	**226.0**	**F**
	Eastbound	22.1	C	23.3	C	88.1	F	354.5	F
	Westbound	6.4	A	5.4	A	68.8	E	61.4	E
	Northbound	39.6	D	38.7	D	38.8	D	362.6	F

Intersection	Approach	Year 2007 Conditions				Year 2035 Conditions			
		AM Peak Hour		*PM Peak Hour*		*AM Peak Hour*		*PM Peak Hour*	
		Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS
	Southbound	38.8	D	37.0	D	37.8	D	36.7	D
Millwood Ave & I-81 SB Off-Ramp	**Overall**	**12.0**	**B**	**12.6**	**A**	**109.3**	**E**	**153.4**	**F**
	Eastbound	3.6	A	6.7	A	37.0	D	175.1	F
	Westbound	8.5	A	9.7	A	118.8	F	104.4	F
	Southbound	54.2	D	54.2	D	236.1	F	246.8	F
Millwood Pike & I-81 NB Off-Ramp	**Overall**	**20.9**	**C**	**23.8**	**C**	**59.5**	**E**	**228.2**	**F**
	Eastbound	21.3	C	26.7	C	39.7	D	241.7	F
	Westbound	22.3	C	22.3	C	86.9	F	139.7	F
	Northbound	23.5	C	21.8	C	81.9	F	294.5	F
	Southbound	15.5	B	20.4	C	38.5	D	75.3	E
Millwood Pike & Tulane Dr	**Overall**	**8.3**	**A**	**10.7**	**B**	**11.4**	**B**	**35.6**	**D**
	Eastbound	6.2	A	7.5	A	7.4	A	12.7	B
	Westbound	6.8	A	5.7	A	12.2	B	43.3	D
	Northbound	42.0	D	40.0	D	40.9	D	92.7	F
	Southbound	40.4	D	40.4	D	41.1	D	56.8	E

The detailed capacity analyses of the No Build and the Preferred Alternatives came to the following conclusions:

- The Preferred Alternative will only change traffic patterns significantly at two intersections, Millwood Avenue and Apple Blossom Drive, and Jubal Early Drive and Apple Blossom Drive.
- At both of these locations, the Preferred Alternative shows similar or improved levels of congestion.
- The same conclusions hold for the analysis under future conditions, although the expected amount of traffic growth does generate unacceptable levels of congestion at six of the twelve intersections in the study area.
- These results show that Alternative 2a can be confirmed as the Preferred Alternative as it will offer similar or better intersection LOS.

Simulation Analysis

In addition to the traditional vehicular capacity analysis, a simulation analysis was performed in order to analyze the study area intersections under the Preferred Alternative. The *SimTraffic* portion of the *Synchro, Version 7* software package was used to analyze the study intersections. *SimTraffic* modeling using simulation was chosen because it is especially useful for analyzing complex situations that are not easily modeled on a macroscopic scale. *SimTraffic* modeling evaluates the effect of signalized intersections on nearby unsignalized intersections and driveways, delays generated by pedestrians crossing roadways, the operation of intersections under heavy congestions, and closely spaced intersections with blocking and lane change problems. *SimTraffic* results typically match queues and observations of intersections in the field.

The simulation analysis was performed using the *Synchro* model described previously. The simulation analysis was performed for the Year 2007 analysis to compare the no-change alternative to the Preferred Alternative. The simulation summary sheets are included in the Appendix.

The results of the simulation analysis show that the overall system delay decreases from 84.9 seconds per vehicle to 74.8 seconds during the morning peak period and from 132.7 seconds per vehicle to 118.2 seconds during the afternoon peak period when comparing the Year 2007 no-change alternative and the preferred alternative. This is a system wide measure of delay and the reduction is attributable to an overall system signal optimization. In practical terms, this change in delay would not have much of a noticeable difference to users.

To better understand the impact to the change in the inbound traffic pattern heading toward downtown Winchester altered by the Preferred Alternative, the travel time inbound (westbound) on Millwood Avenue from Frontage Road through Pleasant Valley was calculated. The travel time for this pattern marginally increases from 104.4 seconds to 111.1 seconds in the morning peak hour and from 105.8 seconds to 108.2 seconds during the afternoon peak hour. This slight increase in travel time is expected due to the increase in distance travelled for the Preferred Alternative.

Additionally, no operational difficulties, particularly the merge and weave, were identified in the Preferred Alternative along Apple Blossom Drive/Millwood Avenue between Jubal Early Drive and the proposed traffic signal at the Hampton Inn.

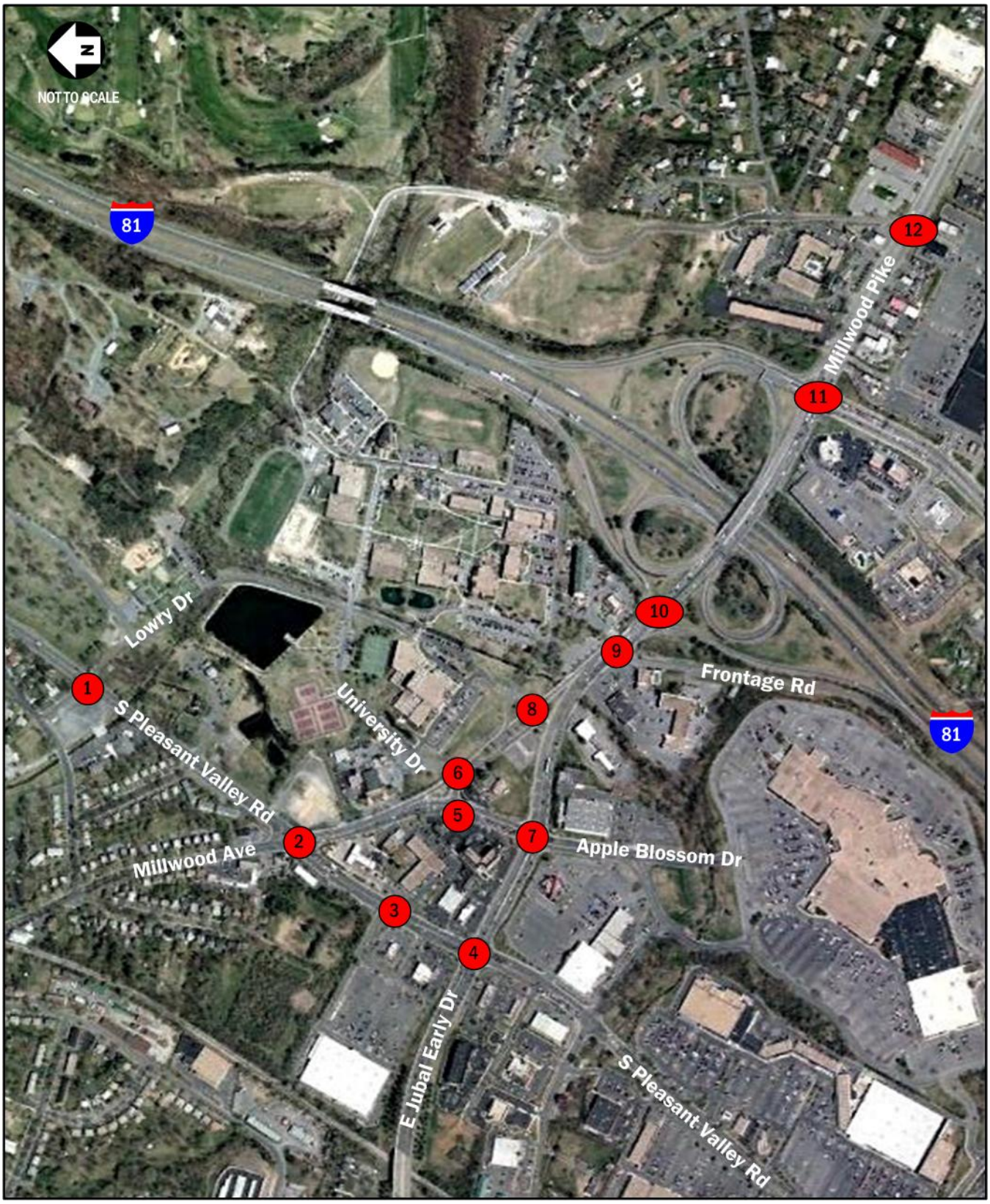


Figure 18: Study Area Intersections

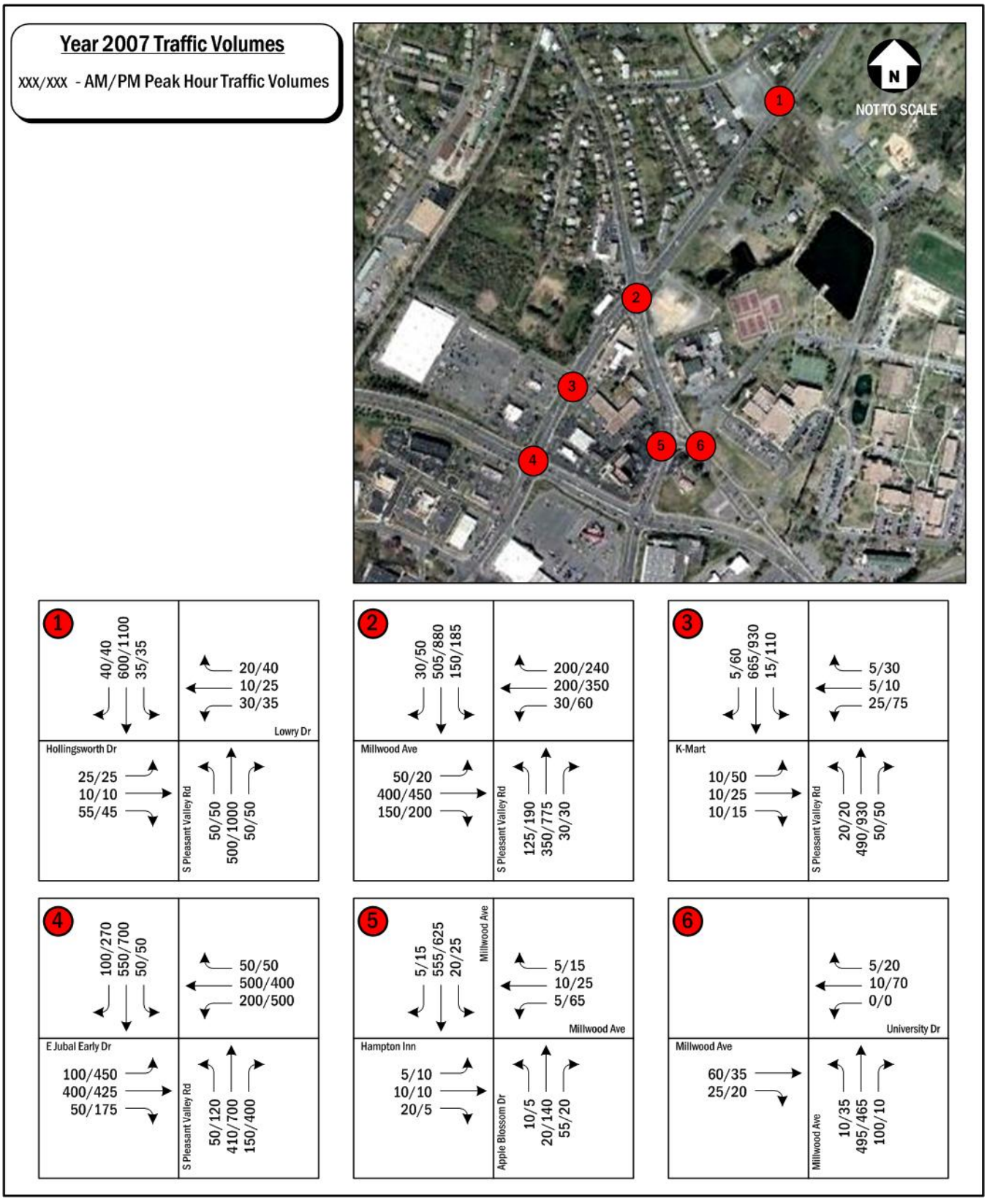


Figure 19: Year 2007 Traffic Volumes (1 of 2)

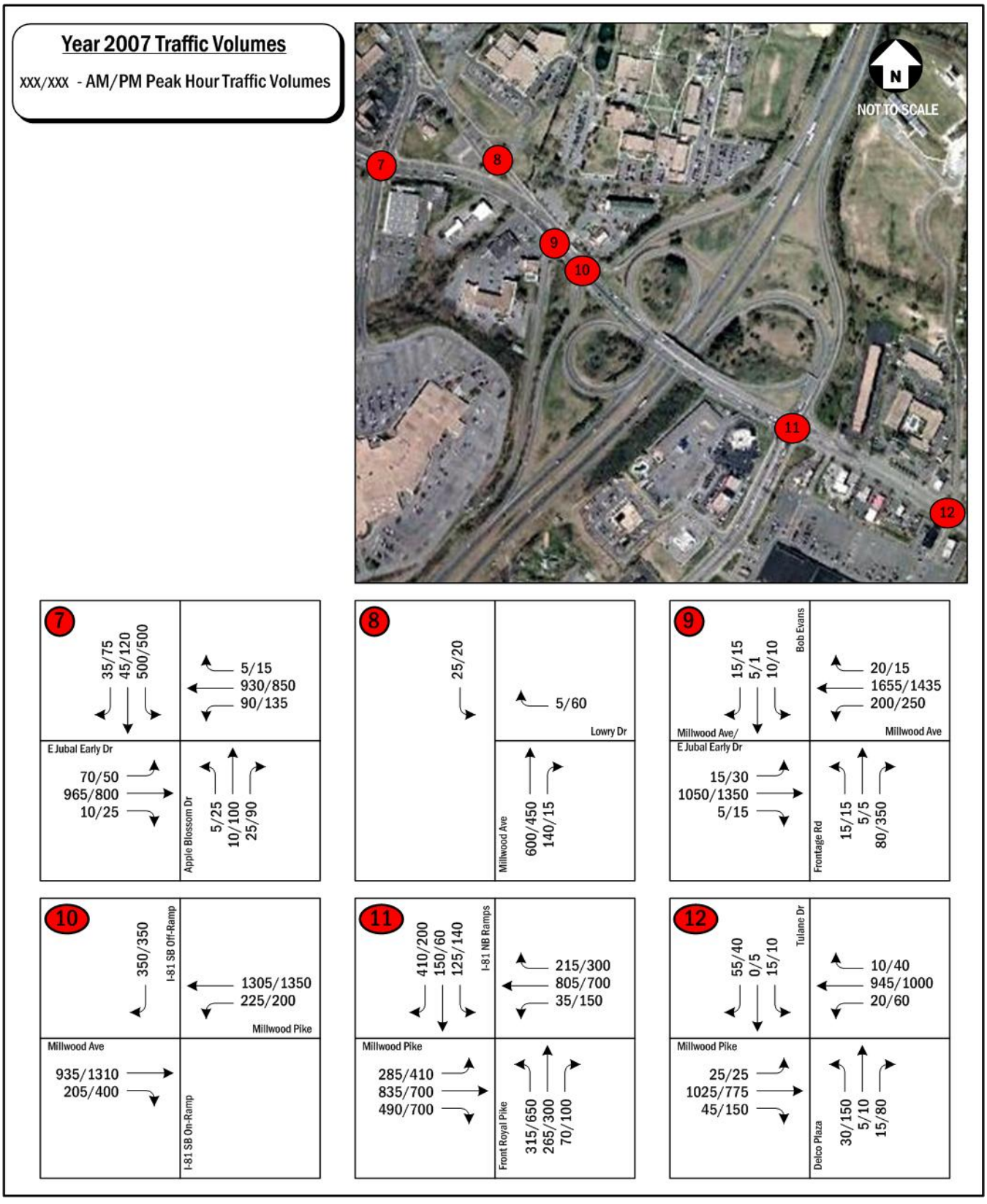


Figure 20: Year 2007 Traffic Volumes (2 of 2)

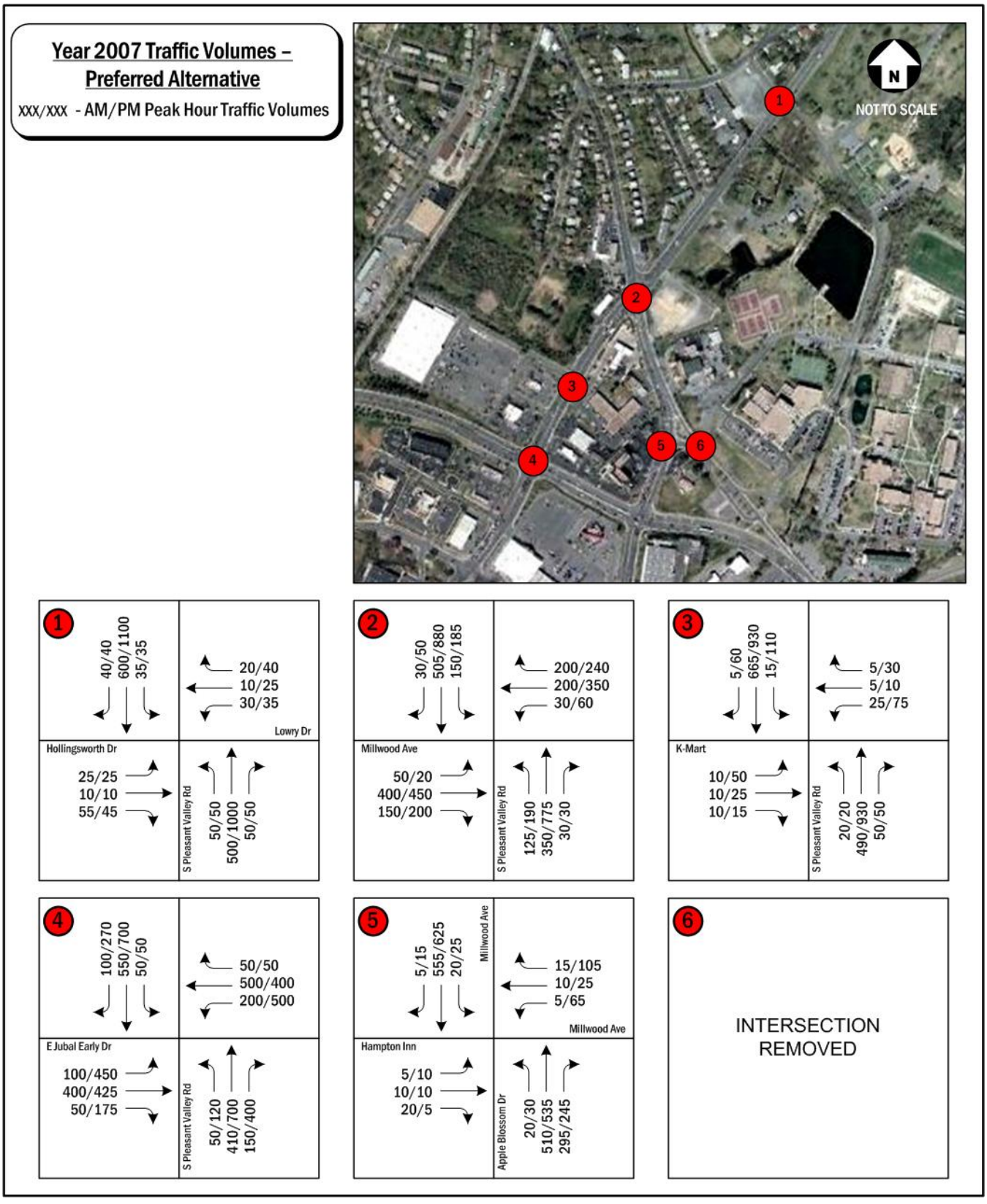


Figure 21: Year 2007 Traffic Volumes, Preferred Alternative (1 of 2)

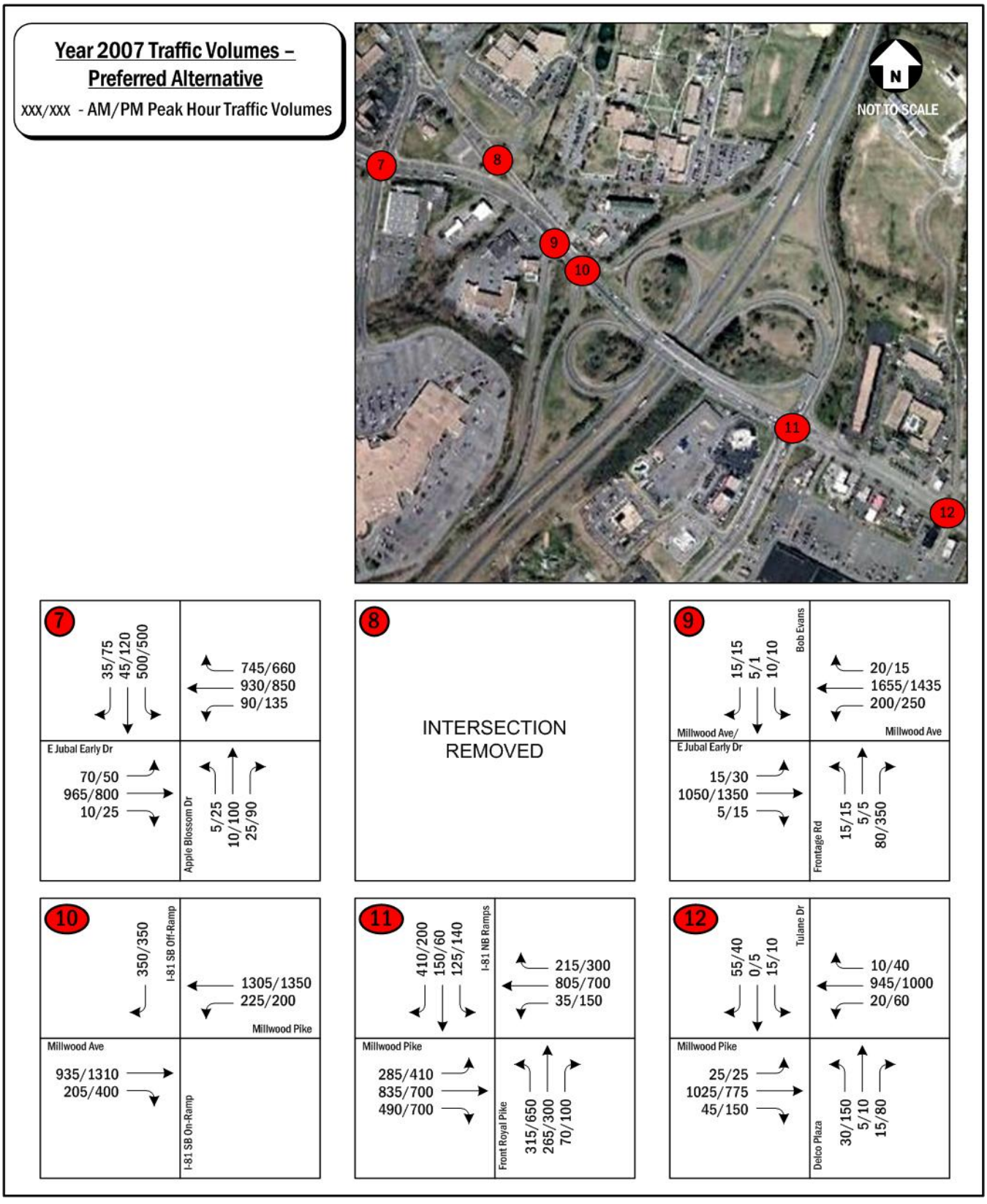


Figure 22: Year 2007 Traffic Volumes, Preferred Alternative (2 of 2)

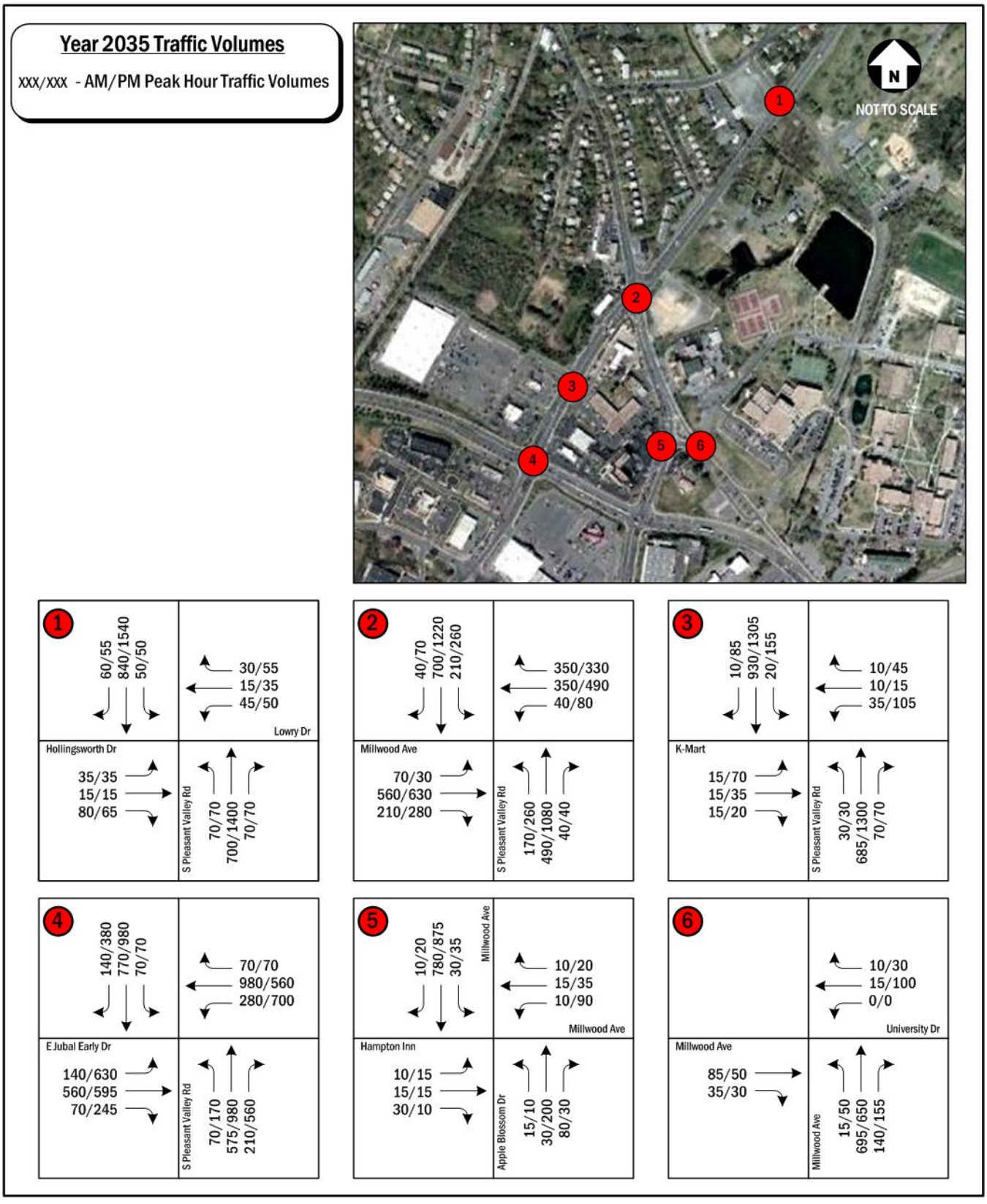


Figure 23: Year 2035 Conditions Traffic Volumes, No-Build (1 of 2)

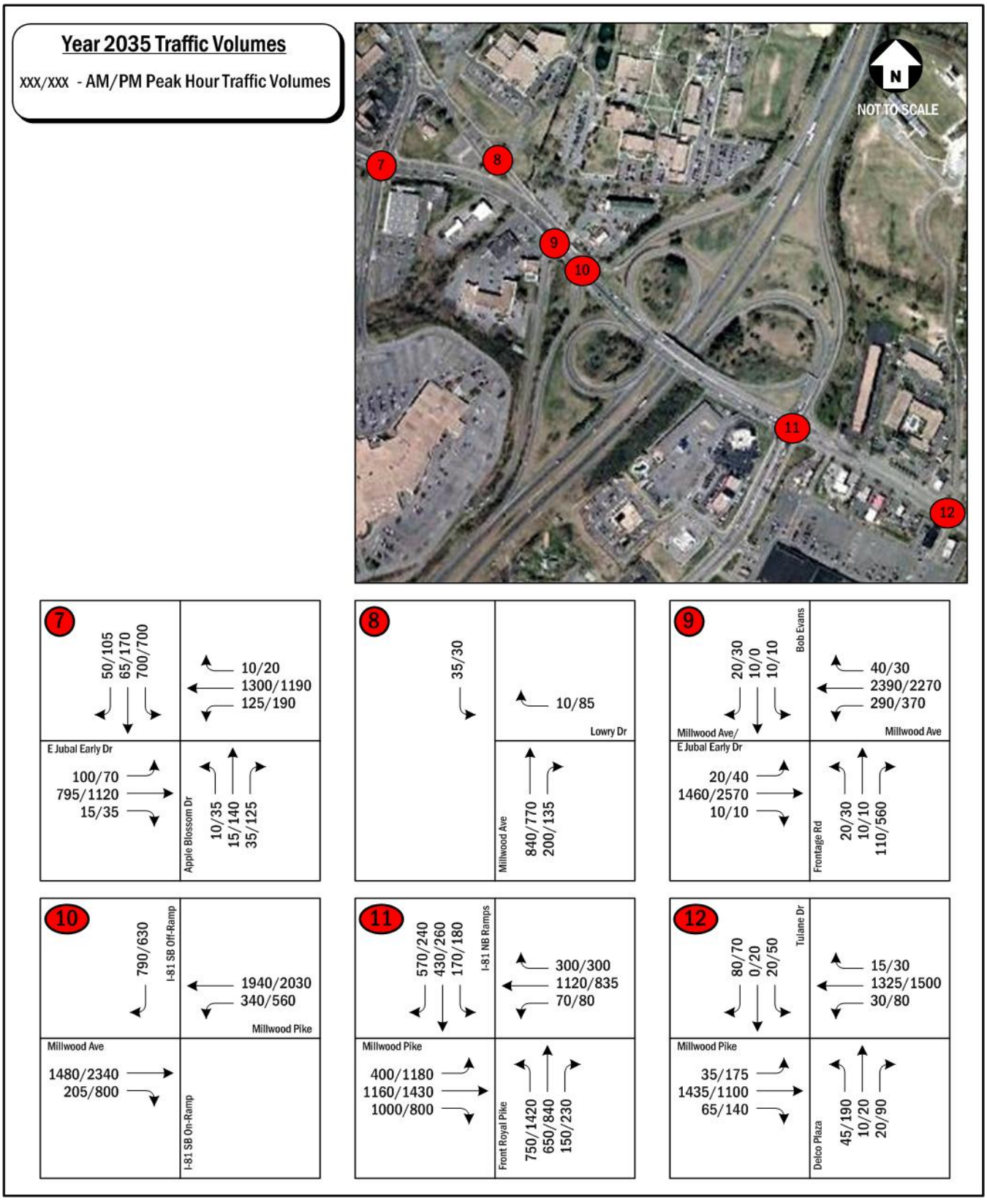


Figure 24: Year 2035 Conditions Traffic Volumes, No-Build (2 of 2)

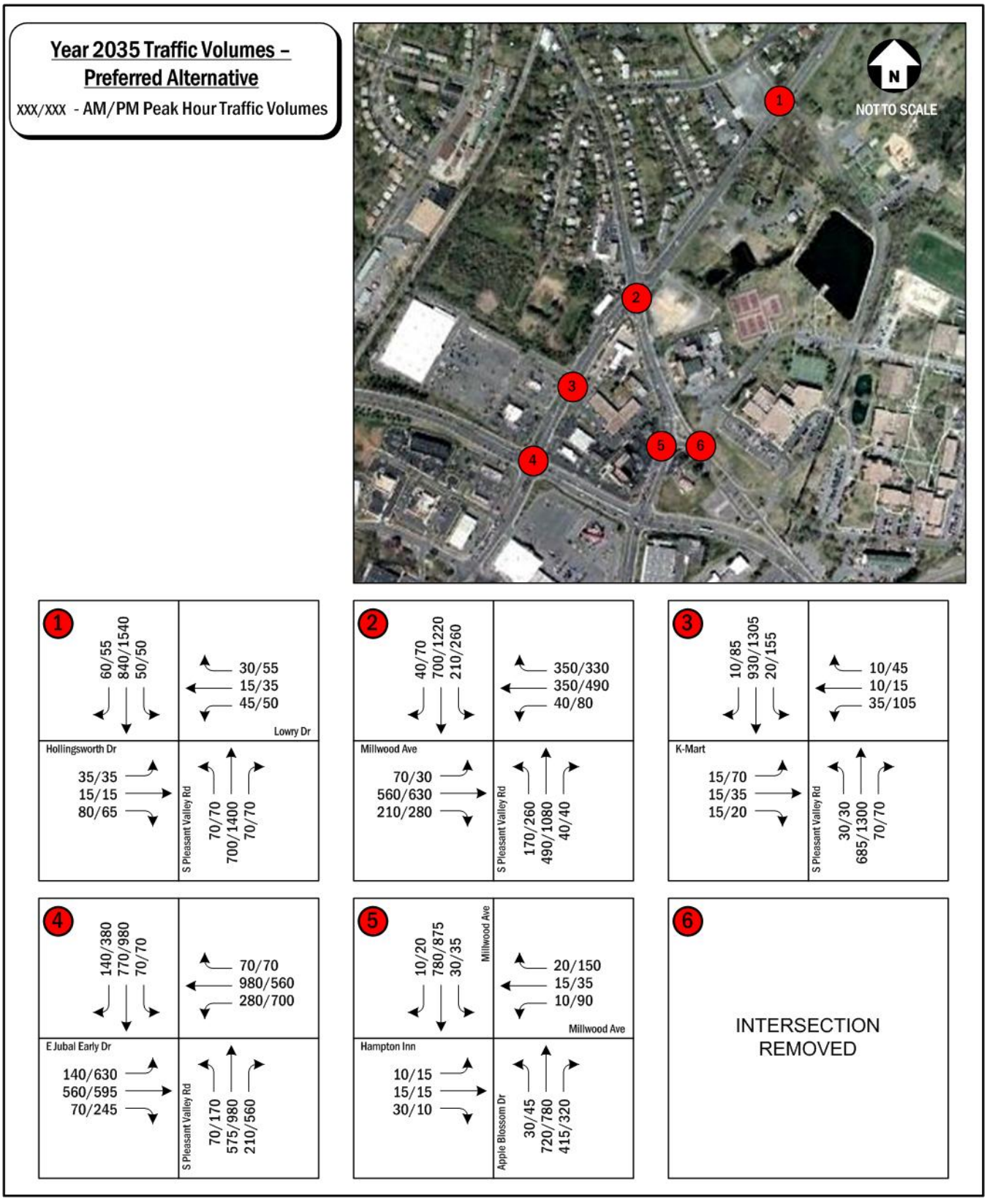


Figure 25: Year 2035 Conditions Traffic Volumes, Preferred Alternative (1 of 2)

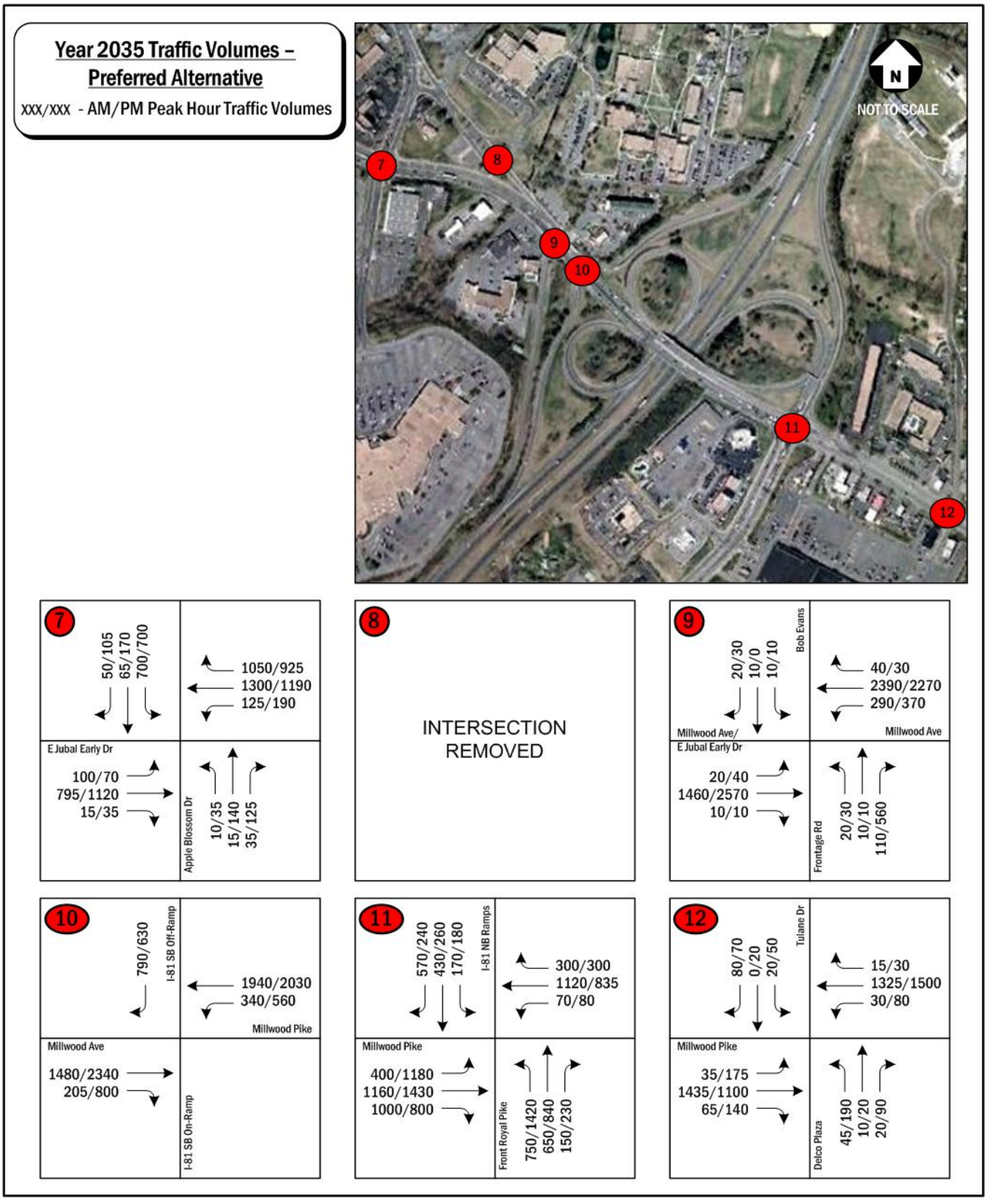


Figure 26: Year 2035 Conditions Traffic Volumes, Preferred Alternative (2 of 2)

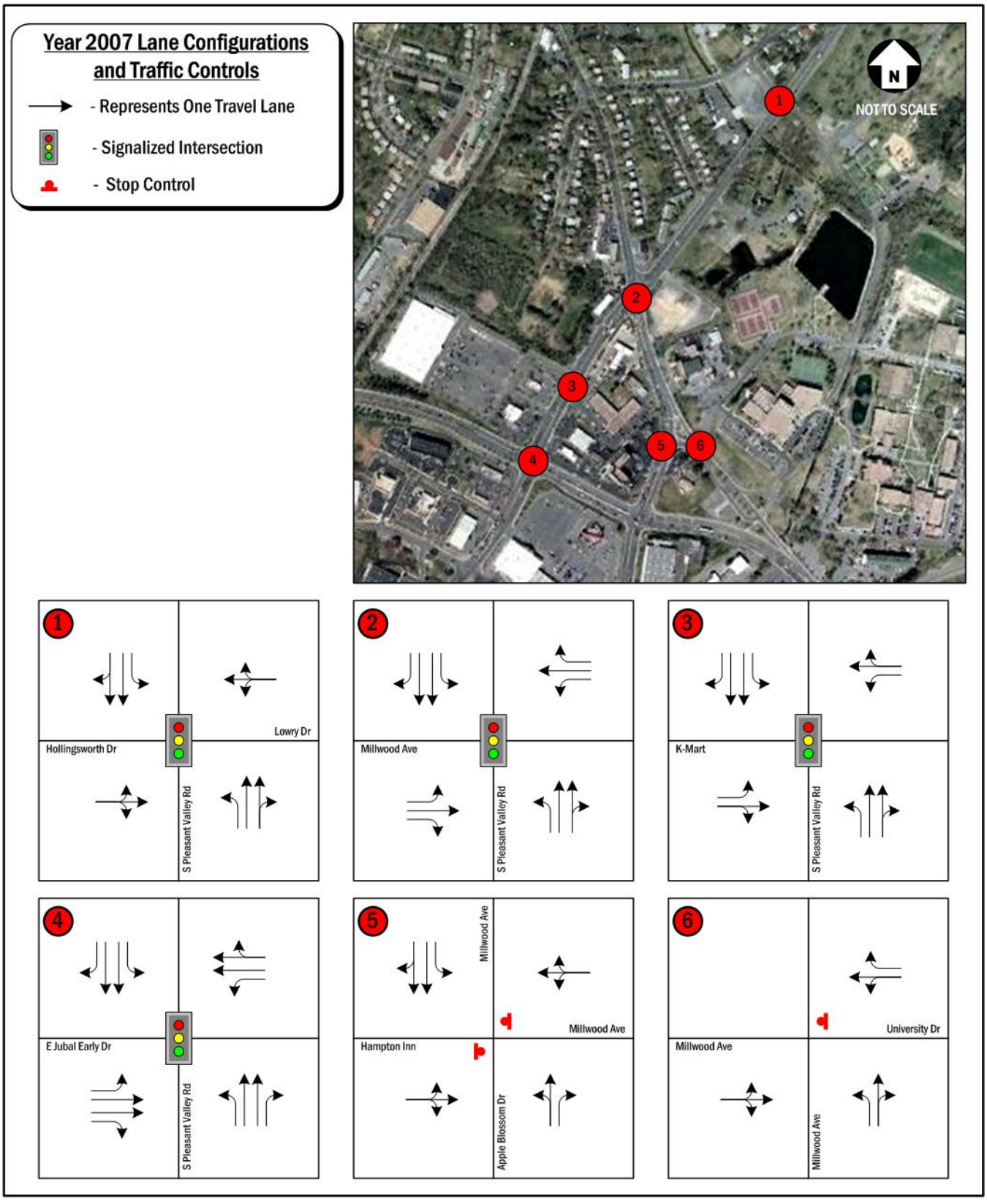


Figure 27: Year 2007 Lane Configurations and Traffic Controls (1 of 2)

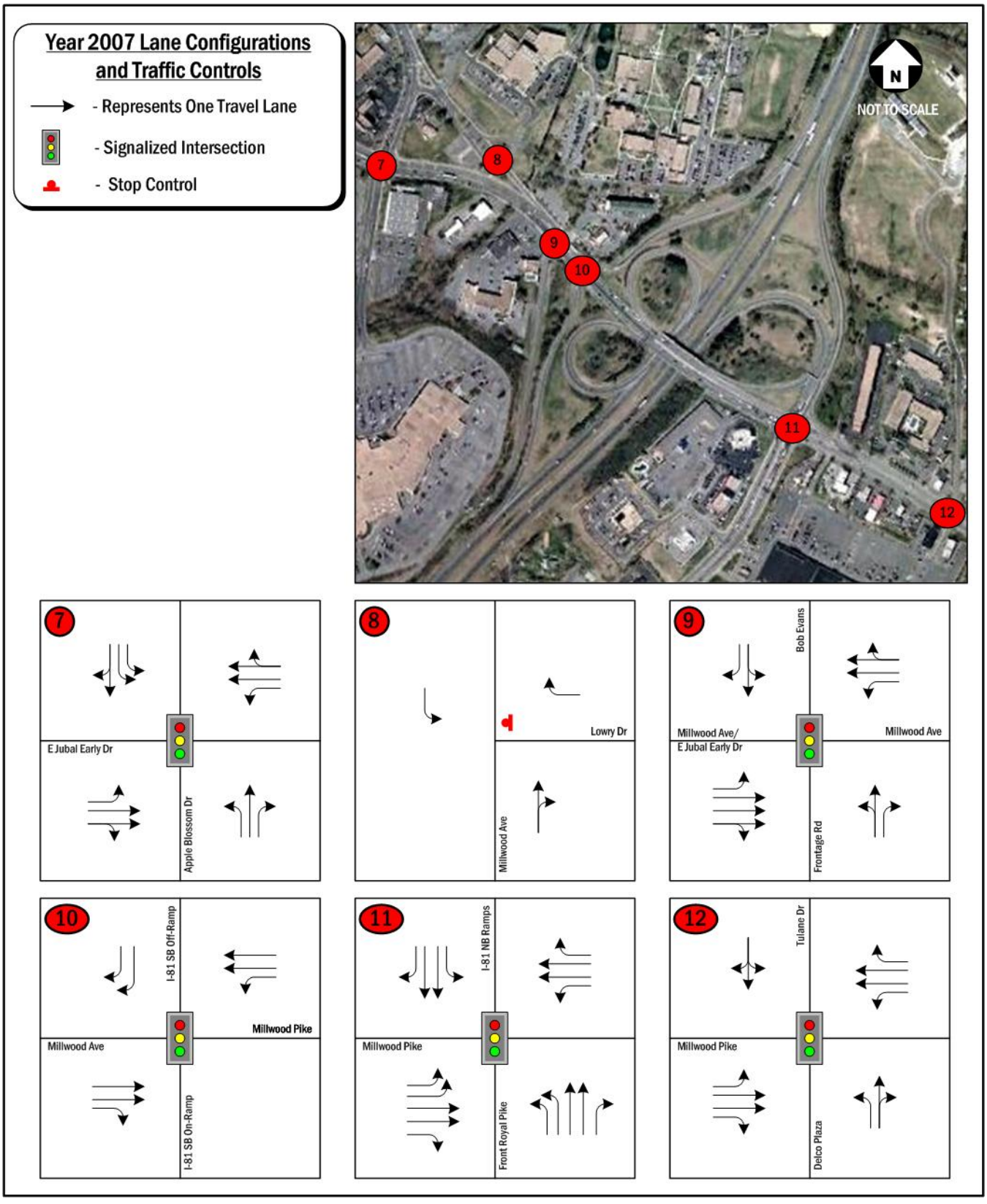


Figure 28: Year 2007 Lane Configurations and Traffic Controls (2 of 2)

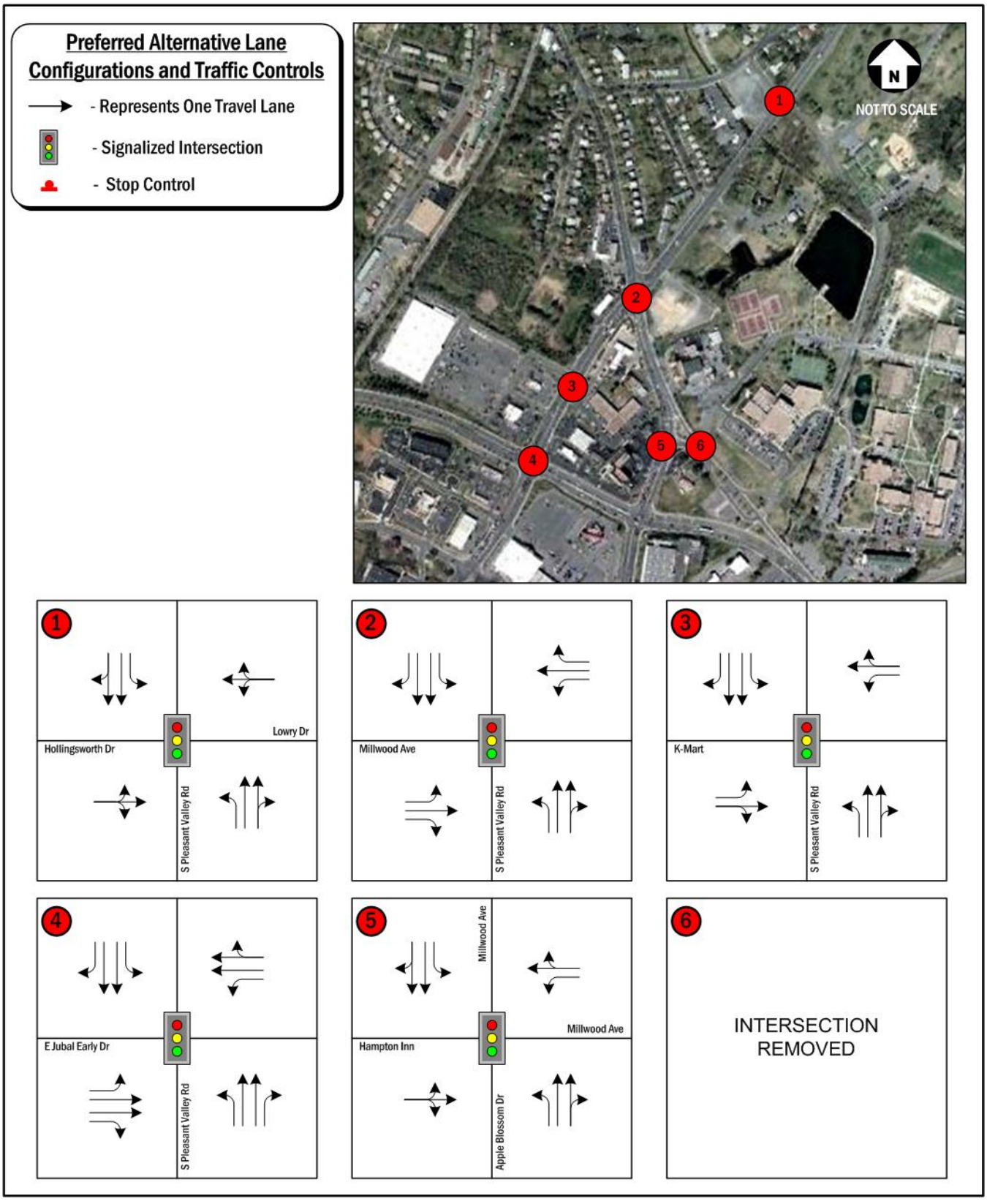


Figure 29: Year 2007 Lane Configurations and Traffic Controls, Preferred Alternative (1 of 2)

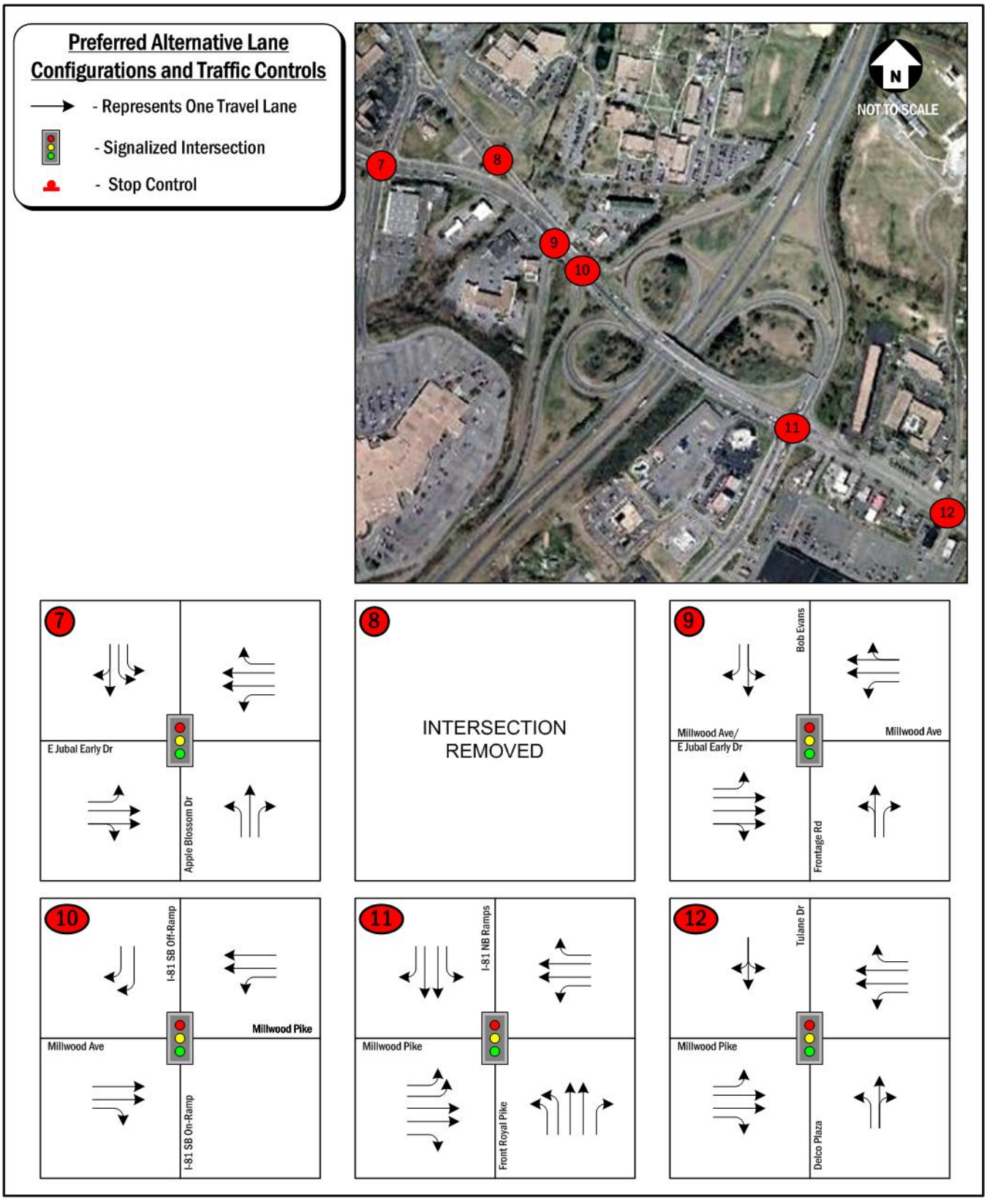


Figure 30: Year 2007 Lane Configurations and Traffic Controls, Preferred Alternative (2 of 2)

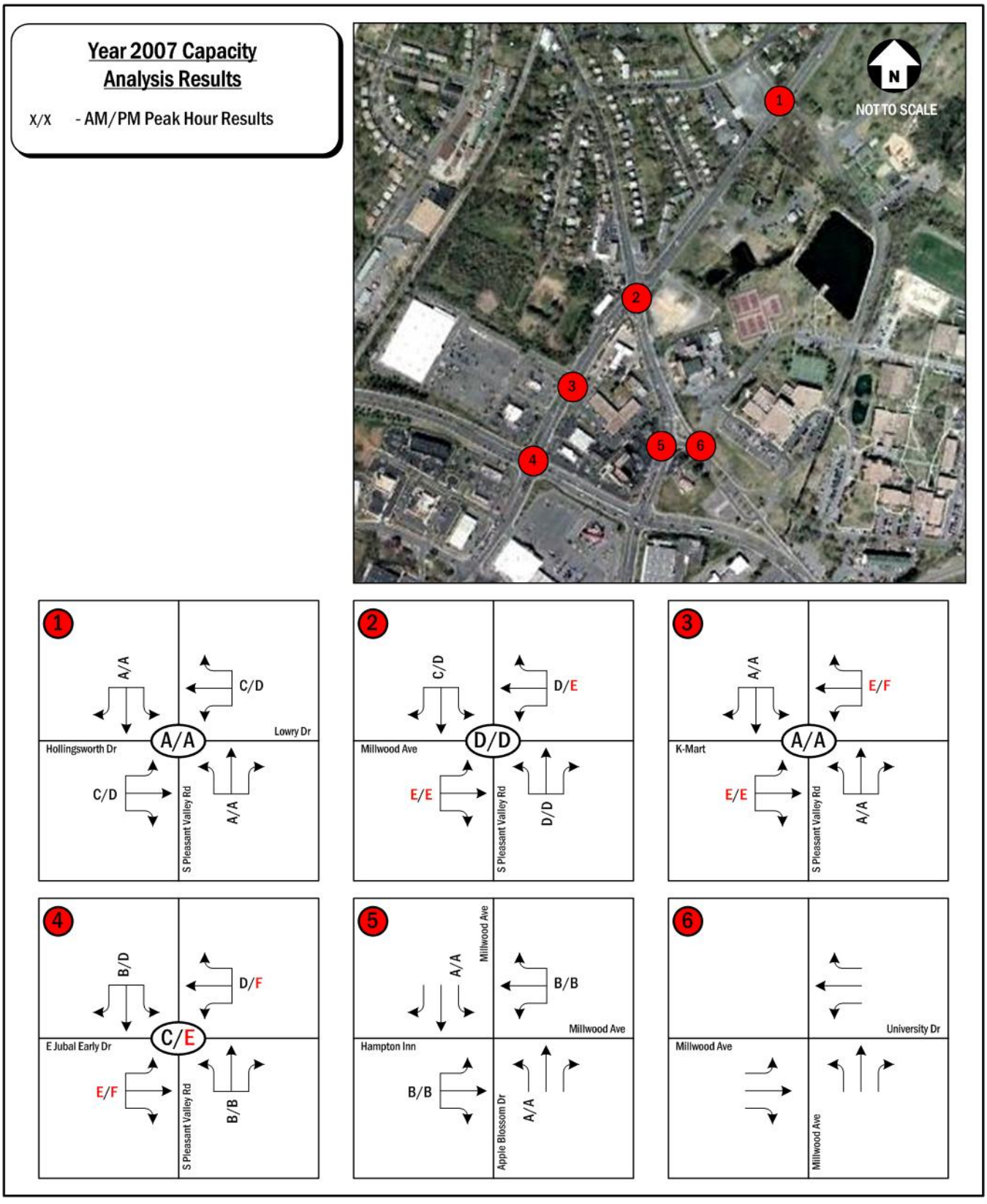


Figure 31: Year 2007 Level of Service Results (1 of 2)

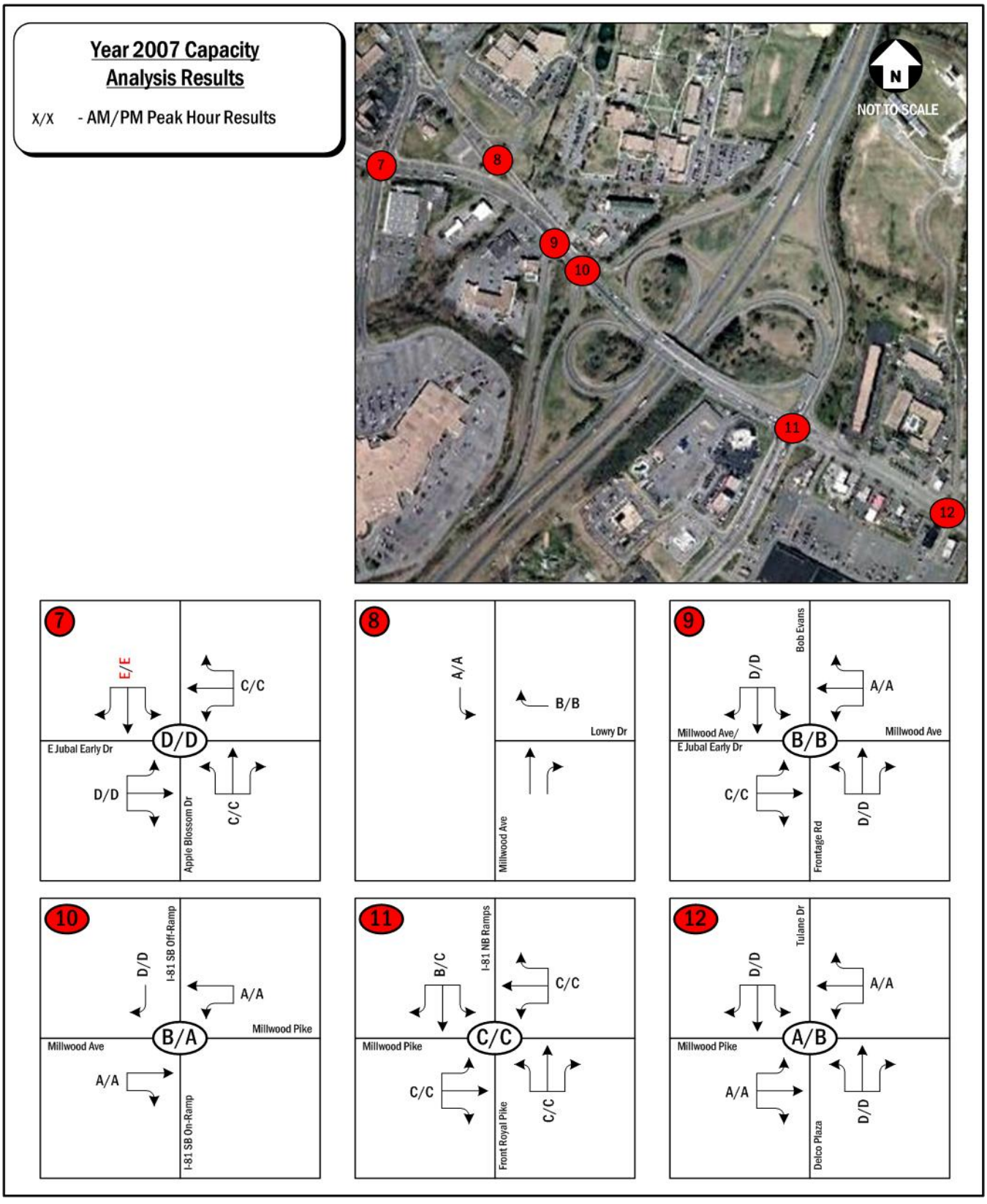


Figure 32: Year 2007 Level of Service Results (2 of 2)

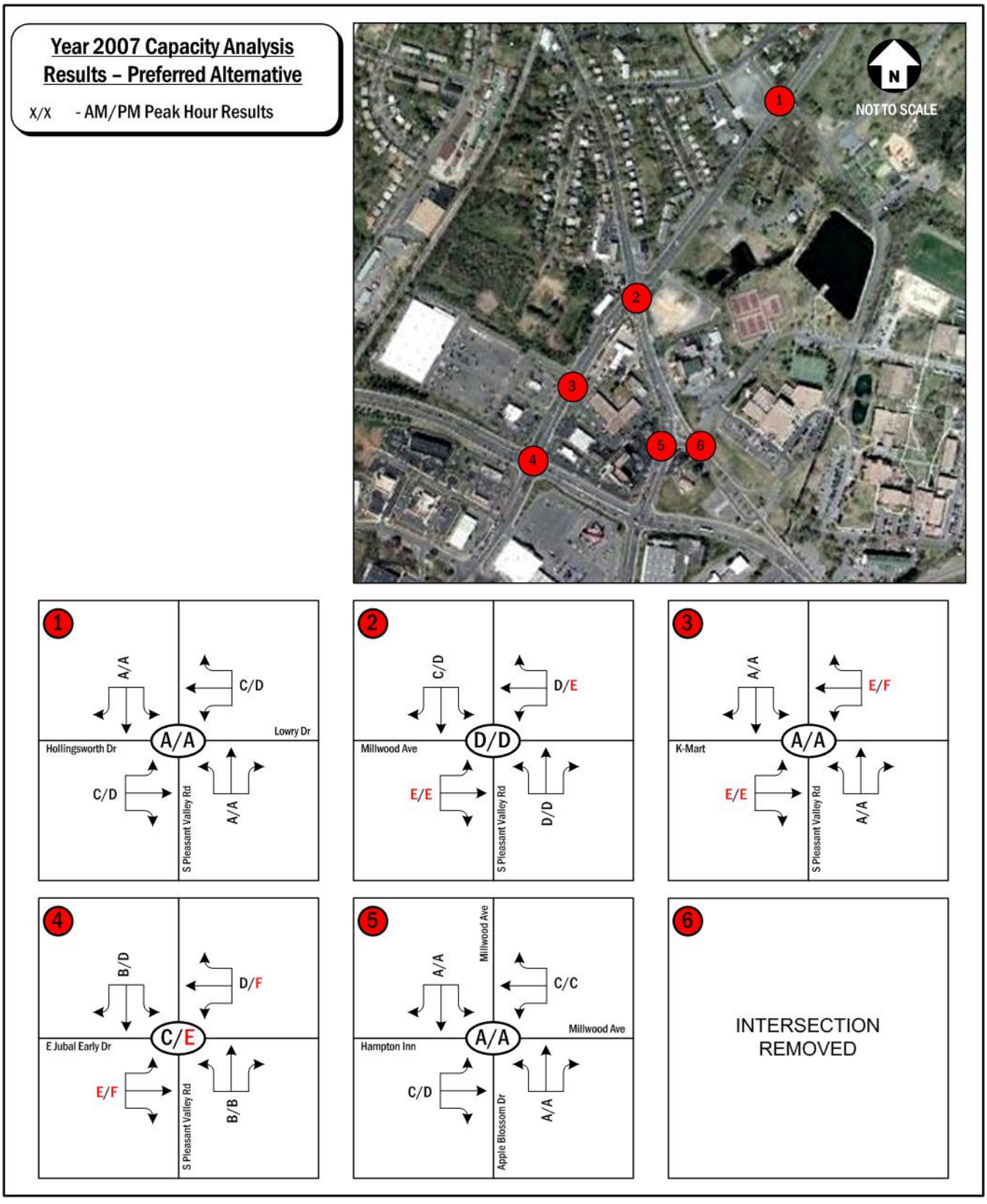


Figure 33: Year 2007 Level of Service Results, Preferred Alternative (1 of 2)

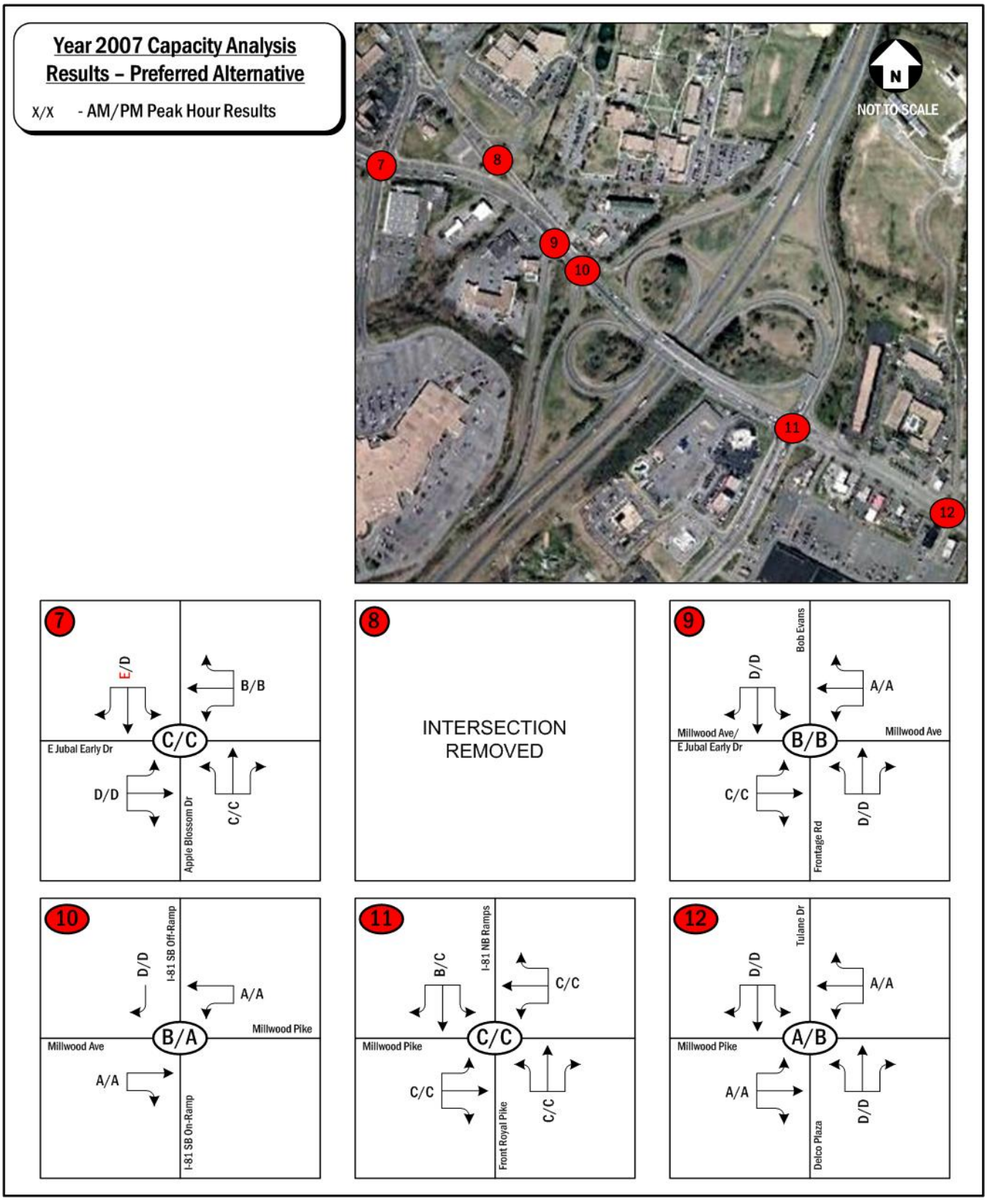


Figure 34: Year 2007 Level of Service Results, Preferred Alternative (2 of 2)

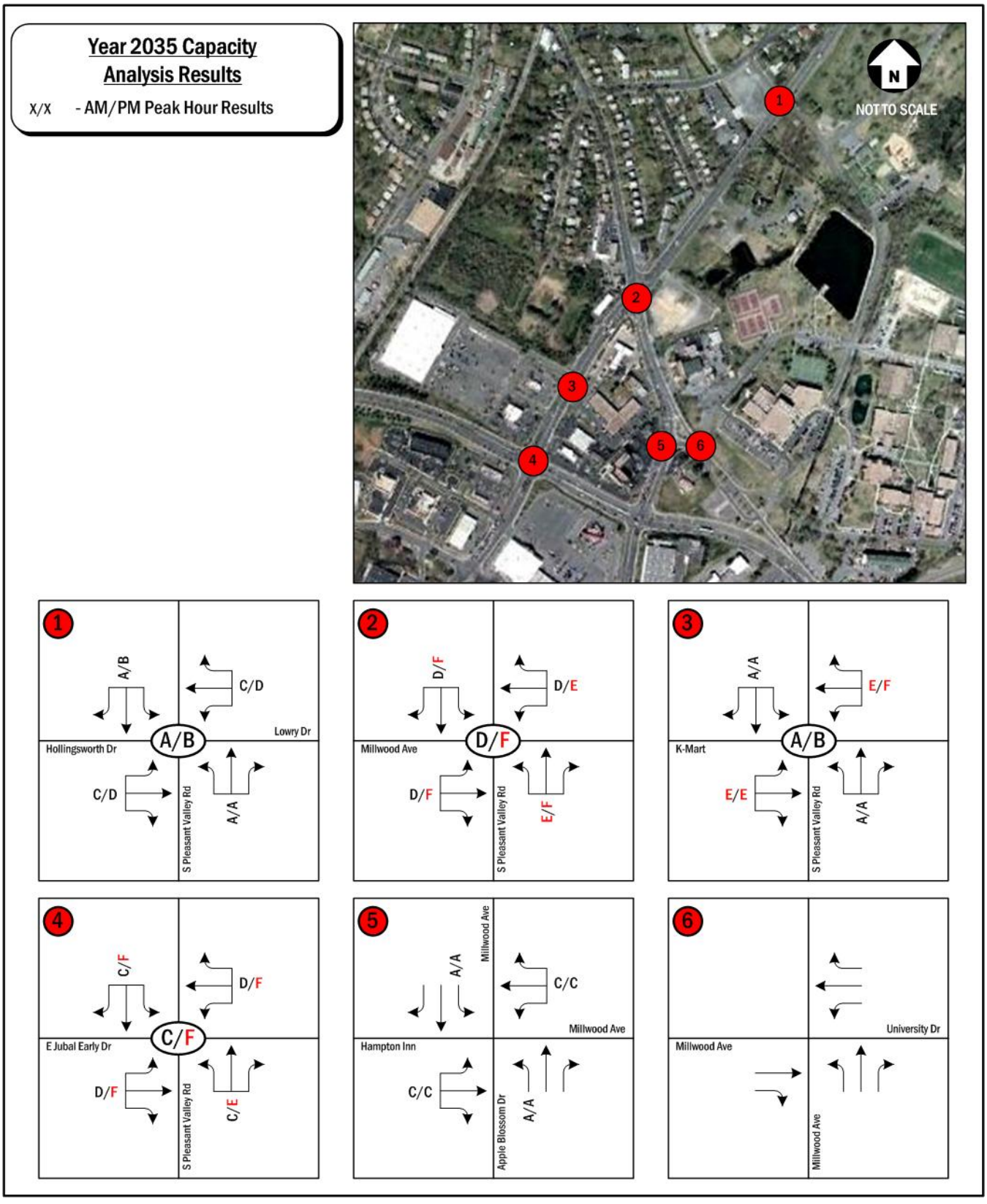


Figure 35: Year 2035 Conditions Level of Service Results, No-Build (1 of 2)

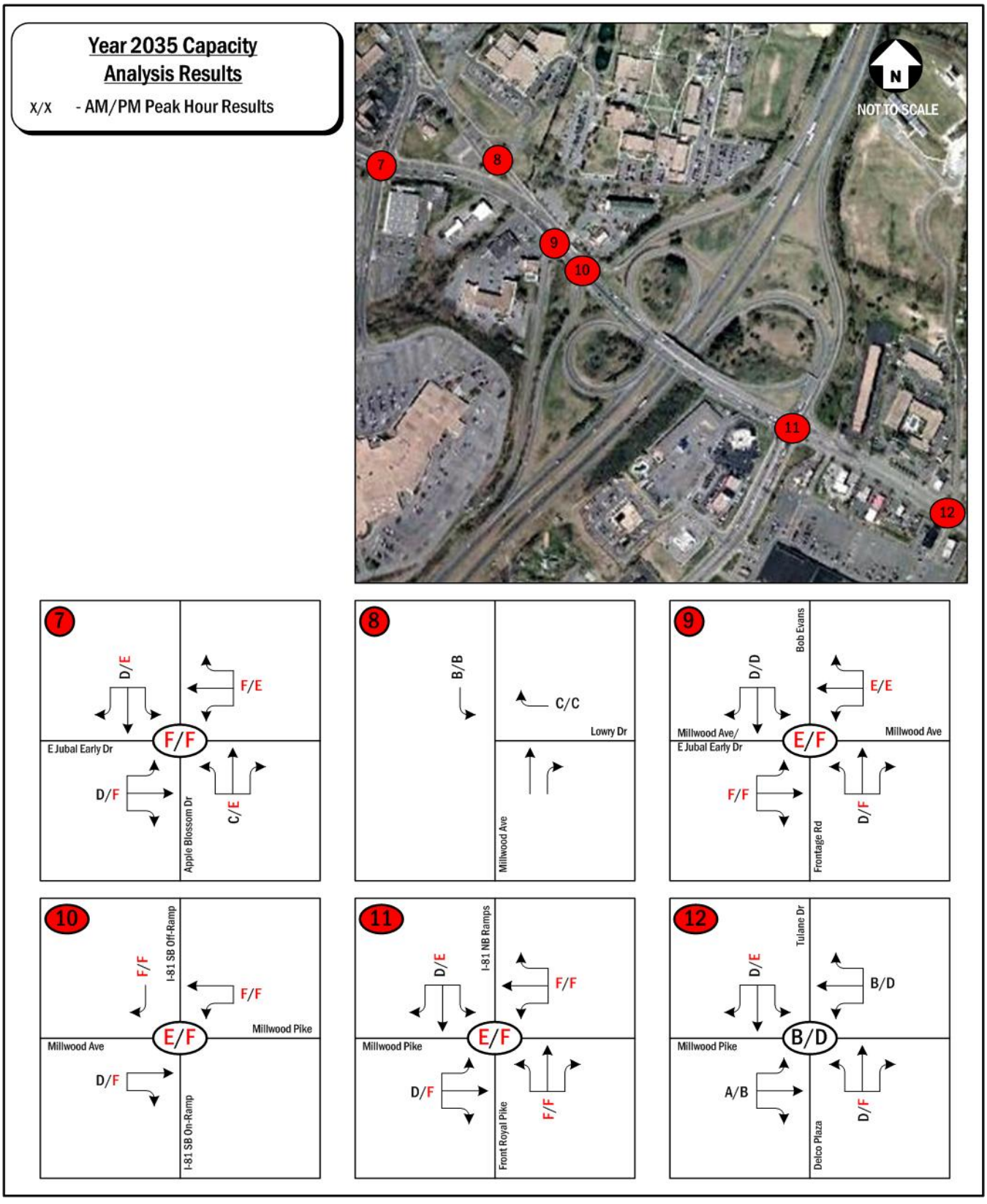


Figure 36: Year 2035 Conditions Level of Service Results, No-Build (2 of 2)

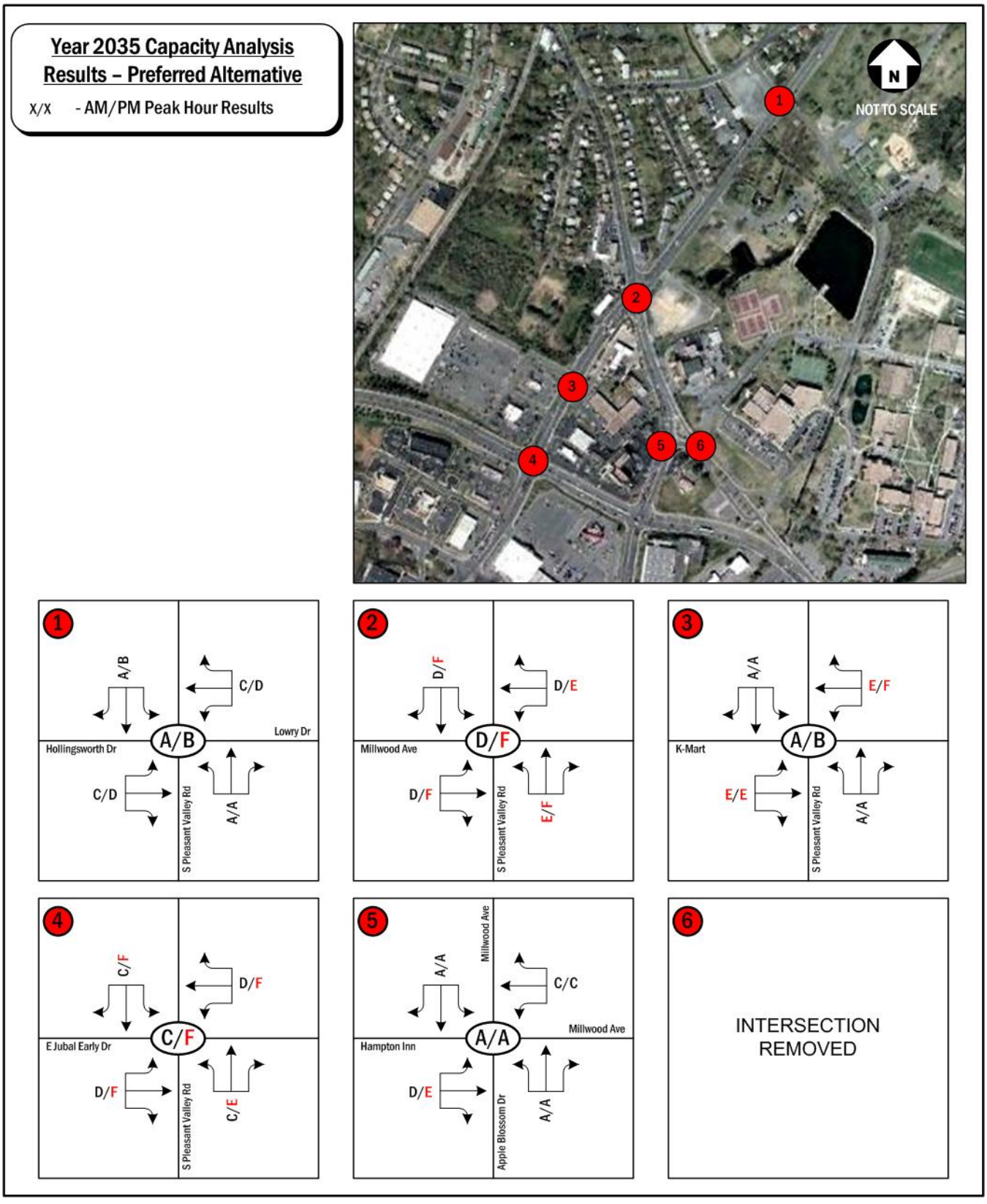


Figure 37: Year 2035 Conditions Level of Service Results, Preferred Alternative (1 of 2)

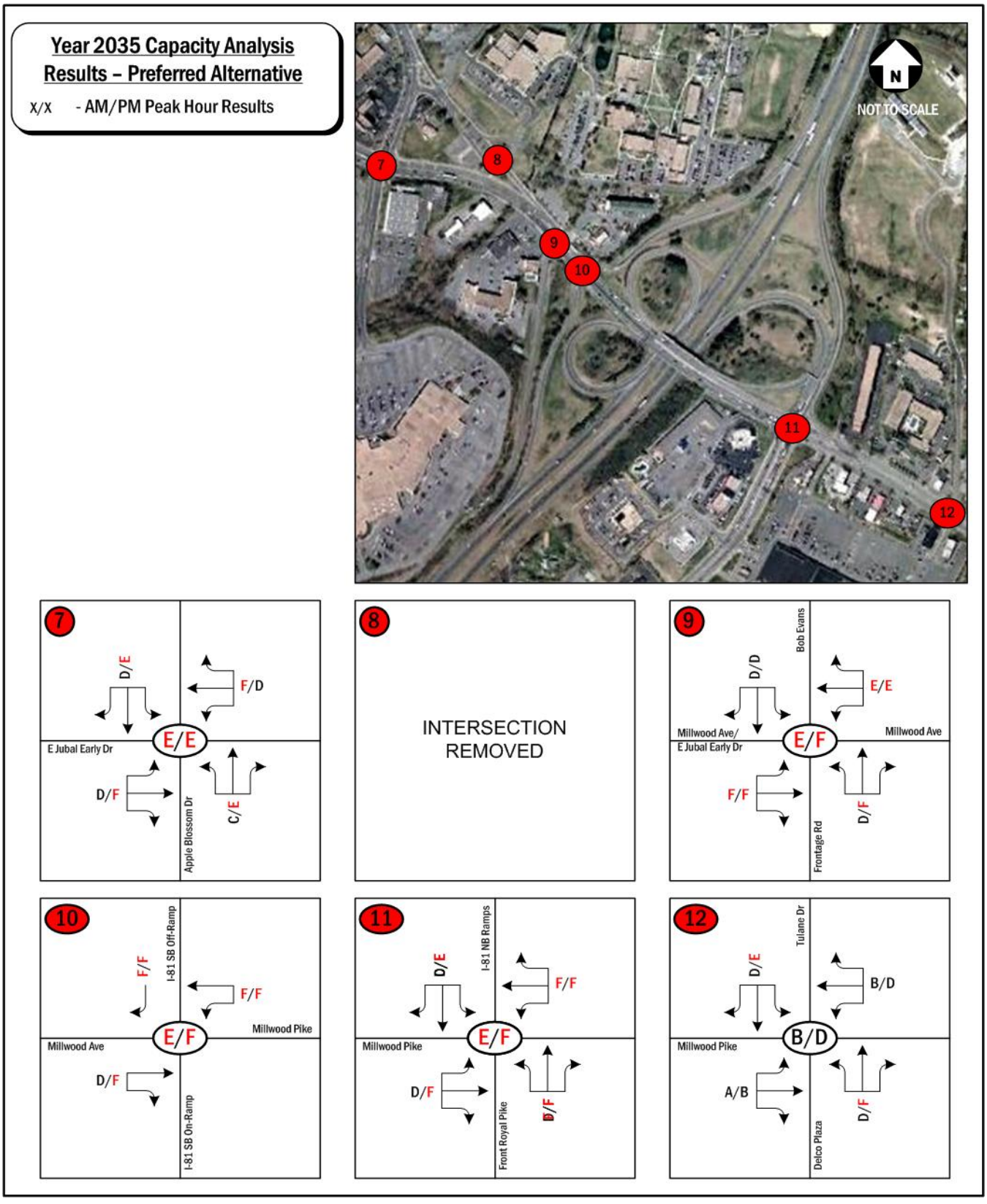


Figure 38: Year 2035 Conditions Level of Service Results, Preferred Alternative (2 of 2)

Refinements to Preferred Alternative

Several refinements to the preferred alternative are recommended for further study. These recommendations are included to help meet the project purpose and goals, and were developed based on public and Steering Committee input. Figure 39 contains a refined Preferred Alternative concept with the refinements described as follows:

- *Green Circle Trail*

  This report recommends that the Green Circle Trail be routed south on University Drive, then across Millwood Avenue to the western side of Apple Blossom Drive before heading south to Jubal Early Drive. This is because the intersection of Apple Blossom Drive and Jubal Early Drive has a significant amount of southbound left turns and westbound right turns (with the implementation of the preferred alternative). The signal timings at this intersection would allow for a "Walk" sign for the trail to occur at the same time as the green arrow for the southbound left turns. If the trail were to cross on the eastern side of the intersection, the left turns and the "Walk" signal would conflict. This would lead to a much less efficient signal timing pattern, as two separate phases would be needed.

- *University Access*

  The new traffic signal at the reconfigured intersection of Apple Blossom Drive/Millwood Avenue/University Drive creates the possibility to unify Shenandoah University access along Millwood Avenue to a single location. This report recommends that the University use internal roadways to consolidate all access along Millwood Avenue to this new intersection. This could remove several curb cuts, notably those on Millwood Avenue between University Drive and Pleasant Valley Road, which would further reduce conflicts and improve the pedestrian environment.

  The University access modifications shown in Figure 39 are a concept that shows the potential alignment of the Green Circle trail along University Drive. The modifications need to fit with the University's master plan for internal circulation and therefore additional study is necessary to determine what the internal changes need to be.

- *Route Guidance and Wayfinding Signage*

  The new roadway configuration will allow for a longer period for westbound drivers to orient themselves and make a decision about where to turn to reach their destinations. This report recommends a comprehensive review of the route guidance, wayfinding signage and associated pavement marking plans to take advantage of this change as part of implementation of the preferred alternative. It should be very clear that the new right turn lane on westbound Jubal Early Drive is essentially the replacement of what was the westbound movement on Millwood Avenue. Pavement markings and signage should make this distinction.

  In addition, with the consolidation of University driveways, signs can be used to direct traffic to the intersection of Apple Blossom Drive/Millwood Avenue/University Drive for Shenandoah University traffic. The exception for this would be athletics based traffic, which should enter via Tulane Drive east of I-81. This report recommends the local jurisdictions work together to create a wayfinding scheme on I-81 and major arterials to direct traffic appropriately and help alleviate concerns about traffic patterns being impacted by the closure of Millwood Avenue.

- *Rename Apple Blossom Drive to Millwood Avenue*

  Millwood Avenue has long been identified as the way into downtown. This report recommends that the portion of Apple Blossom Drive north of Jubal Early Drive be renamed to Millwood Avenue so that Millwood Avenue has a continuous designation from Jubal Early Drive as it does today.

- *Create Right In/Right Out on Jubal Early Drive for Allen Properties Parcel*

  To mitigate the impact caused to the Hampton Inn located on the Allen Properties parcel this report recommends that the City work with Allen Properties to engage VDOT to seek a right in/right out access point on Jubal Early Drive as shown in Figure 39. The concept for such an access has been broached with VDOT in the past, but is further justified now as a mitigation measure associated with the closure of the existing section of Millwood Avenue.

- *Consider Near-Term Improvements*

  It is recommended that the City consider additional study that would look at near-term improvements that could be implemented to improve existing conditions in the interim before the Preferred Alternative is constructed. Such improvements could include signing and marking adjustments, pedestrian crossing warning lights, minor geometric changes or other low cost treatments.

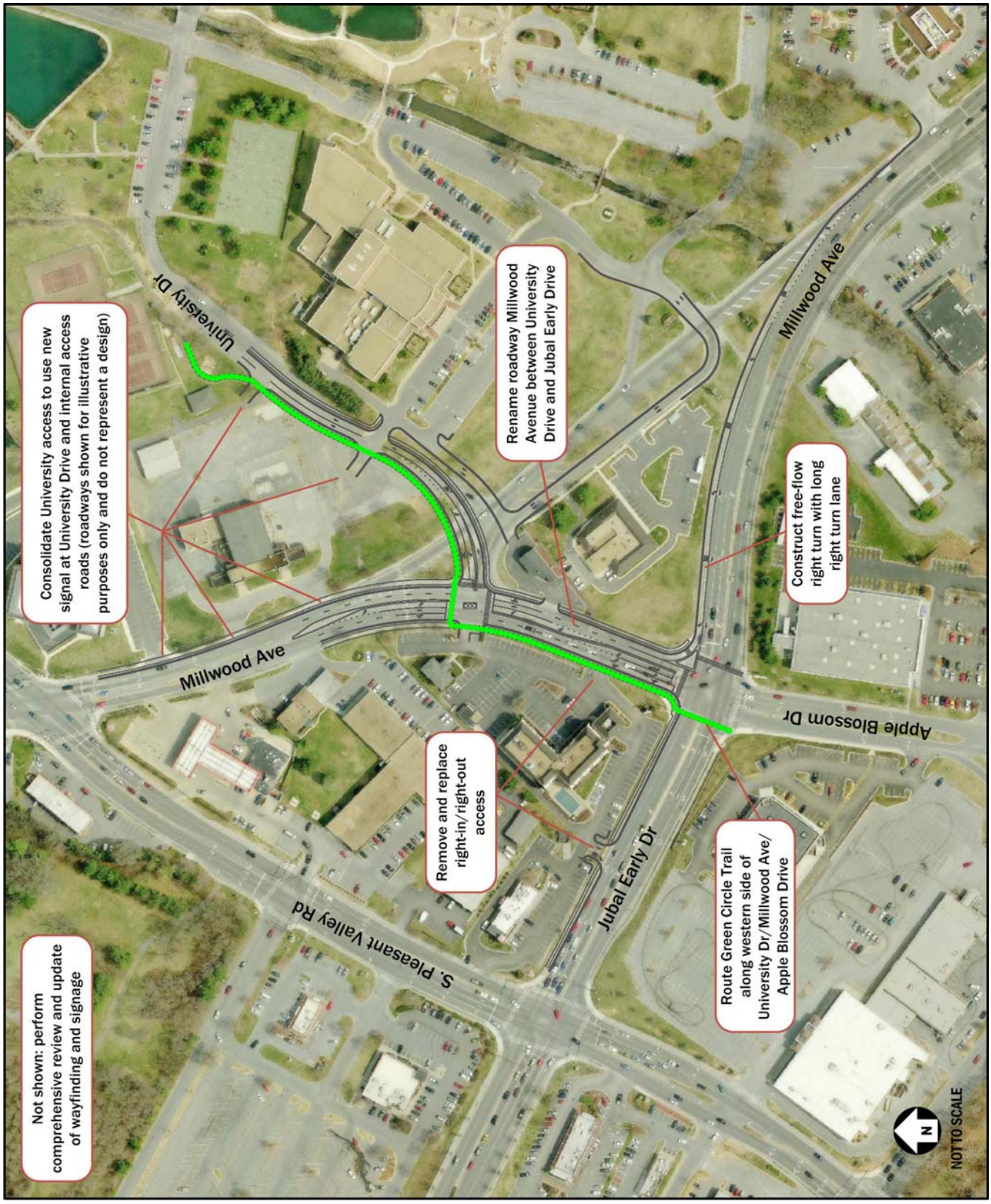


Figure 39: Refined Preferred Alternative

SUMMARY

This study began as an effort to determine the short- and long-term traffic impacts associated with the proposed closure of Millwood Avenue to vehicular traffic between East Jubal Early Drive and Apple Blossom Drive. It assumed the project would evaluate two alternatives, (1) the closure of the section of Millwood Avenue under review, or (2) keep it open, basically a 'no build' option.

The study proceeded by researching existing transportation polices, conducting an analysis of existing conditions and meeting with stakeholders, including a public meeting held September 20, 2010. After the conclusion of these early tasks, two things were apparent:

(1) The goals of the project should include traditional concepts, as well as stress the need to incorporate ways to measure sustainability and multi-modalism. Safety was stressed by all stakeholders as the primary focus.

To address this concern the project set the goals of the study as Safety, Convenience, Appearance and Balance. The evaluation criteria used to compare the alternatives was based from these goals and included measures of effectiveness both traditional and state-of-the-art with an emphasis on including all modes of transportation.

(2) Evaluating only two alternatives may not be sufficient to fully address the concerns of all stakeholders and determine the best set of recommendations.

The project addressed this concern by expanding the amount alternatives, to a total of eight that fell into two categories; those based on the closure of the section of Millwood Avenue being studied, and those with the section in question remaining open.

The project took these eight alternatives and evaluated them based on Measures of Effectiveness (MOEs) developed based on the study goals. While the study area consists of a much larger area, the expanded alternatives were evaluated considering the key intersections local to the section of Millwood Avenue considered for closure. From this a Preferred Alternative was selected and the entire study area was evaluated under existing and future conditions.

Based on the evaluation of alternatives and input from stakeholders during a second set of October 19, 2010 public workshop meetings, Alternative 2a was chosen as the Preferred Alternative. This Alternative includes closing Millwood Avenue between Jubal Early Drive and Apple Blossom Drive and constructing a westbound right turn lane from Jubal Early Drive to Apple Blossom Drive/Millwood Avenue. Alternative 2a was selected because:

- It improves safety by eliminating ambiguous geometries, reducing vehicular conflict points, reducing curb radii and intersection skew, and creates a signalized crossing for pedestrians.
- It increases convenience by decreasing overall vehicular delay, decreasing the time it takes for pedestrians to cross Millwood Avenue, accommodates the Green Circle Trail, and improves access to the University. It should be noted that while it improves overall vehicular delay in the study area, the travel time for the Millwood Avenue inbound (westbound) to downtown pattern is increased by a few seconds.
- It improves appearance by creating a space for a gateway treatment in the line-of-sight for drivers approaching from the east, and allows for a more intuitive wayfinding system for the same drivers.
- It is well balanced because it seeks a more sustainable solution by improving conditions for all modes, shows improvements under both existing and future traffic models, and has lower cost than several of the other alternatives.

The intent of the public workshops was to gain a broad understanding from all of the affected stakeholders. From the comments it was apparent that there were strong opinions among different groups and interests that participated. There was also concern expressed by some participants that opponents to Millwood Avenue closure were not well represented. It was encouraged that those who attended the meeting make it known to those who did not participate that their comments are still desired as an input to the study. The comments would be better informed having the benefit of participating in the workshops but the comments are still desired nonetheless and would be collected by the MPO. Only two additional comments were received.

This report recommends implementation of Alternative 2a, with the following refinements:

- That the Green Circle Trail be routed south on University Drive, then across Millwood Avenue to the western side of Apple Blossom Drive before heading south to Jubal Early Drive. The new free-flow right turn lane will increase the crossing distance of Jubal Early Drive and given the volume of traffic that will use the right turn, the west side of Apple Blossom Drive is the preferred location.
- That the University use internal roadways to consolidate all access along Millwood Avenue to the new intersection of University Drive/Apple Blossom Drive/Millwood Avenue.
- That an updated, comprehensive signing, wayfinding and pavement marking plan be developed to take advantage of the consolidation of University access and increased distance between decision points for drivers approaching from the east and help alleviate concerns about the change in traffic patterns.
- That the portion of Apple Blossom Drive north of Jubal Early Drive be renamed to Millwood Avenue so that Millwood Avenue has a continuous designation from Jubal Early Drive as it does today.
- That the City work with Allen Properties to engage VDOT to seek a right in/right out access point on Jubal Early Drive to access the Hampton Inn.
- That the City consider performing additional study to look at near-term solutions that may help improve existing conditions until Alternative 2a is designed, funded, and constructed.