Fairfax County Department of Transportation

SEVEN CORNERS TRANSPORTATION STUDY PHASE II

June 2014

KITTELSON & ASSOCIATES, INC.
TRANSPORTATION ENGINEERING/PLANNING

MOVING**FORWARD**THINKING™

Seven Corners Transportation Study - Phase 2

Fairfax County, Virginia

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Section 1
Executive Summary

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1. EXECUTIVE SUMMARY

This report documents Phase 2 of the Seven Corner Transportation Study. The initial study in Phase 1 was the S*even Corners Transportation Study Existing Traffic Conditions Report*. The objective of the Phase 2 study is to evaluate the Seven Corners interchange, land use plans, and transportation mobility, access, and connectivity needs for future year scenarios and to recommend the most appropriate conceptual design for the Seven Corners area.

After incorporating feedback from Fairfax County Department of Transportation (FCDOT), the Department of Planning and Zoning (DPZ), the Seven Corners Task Force, members of the public and other key stakeholders, six conceptual interchange designs were initially developed for the Seven Corners interchange after the completion of a transportation design charrette. A comprehensive evaluation at the sketch planning level reduced the initial set of six conceptual design alternatives to three. In parallel to the conceptual design work, year 2040 traffic volumes were developed based on the County's Comprehensive Plan and the Seven Corners Task Force Land Use Plan scenarios. The Comprehensive Plan and the three conceptual design alternatives were then further evaluated using more detailed traffic operation, multimodal, and geometric analyses at a horizon year of 2040.

The traffic operational analysis used a combination of Synchro and Highway Capacity Software (HCS), which are consistent with analysis procedures from the *Highway Capacity Manual* (HCM). The traffic analysis, the robustness of the potential pedestrian, bicycle and transit networks, and an assessment of the opportunities and ease for construction phasing, narrowed the three conceptual design alternatives to a single recommendation (Concept B – Two Half Diamonds) to move forward.

Lastly, Concept B was furthered analyzed using SimTraffic, a microscopic traffic model that uses a stochastic process based on individual vehicles to produce intersection operational and queuing results. The intersection/approach level of service, queuing, and volume-to-capacity ratios were determined for Concept B and compared with the base Comprehensive Plan scenario.

A summary of the main findings of the study are provided, organized by the four primary components of the project: 1) Conceptual design alternative development and initial screening of six conceptual designs, 2) Project analysis methodology including travel demand modeling, future volume development, and network assignment, 3) Traffic results for three selected conceptual designs, including potential project phasing, and 4) Final traffic analysis of Concept B.

1.1 CONCEPTUAL DESIGN DEVELOPMENT

A transportation planning charrette was held during the Seven Corners Task Force meeting on November 12, 2013 to begin the initial discussion about the conceptual design development. Key topics that were covered during the charrette included:

- Develop the Seven Corners transportation network to support the Seven Corners Task Force Land Use Plan
- Balance the needs of regional through traffic (mobility considerations) and local traffic (accessibility considerations)

- Maintain the roadway functional character of Route 50 as a through corridor and develop Route 7 as the "Main Street" through the study area
- Increase pedestrian and bicycle facilities throughout the Seven Corners area (including over Route 50 to better connect both sides of the study area) to facilitate non-motorized trips, increase safety for users, increase connectivity to transit facilities, and to "activate" a denser urbanized environment
- Provide a direct connection from Route 7 south of Route 50 to Roosevelt Boulevard to improve access to the East Falls Church Metro station and to create a better connection for transit
- Maintain access to businesses

Based on the results of the planning charrette, input from FCDOT, DPZ, the Seven Corners Task Force, and members of the pubic, six conceptual design alternatives were developed for the Seven Corners interchange that incorporate best practices geometric design principles and provide a wide range of options.

- **Concept 1 - Diverging Diamond Interchange**: Promotes regional movement; can accommodate high traffic volumes; maintains direct connection between Route 50 and Route 7; reduces overall connectivity in the interchange area, unusual interchange type; would not provide comfortable pedestrian or bicycle connectivity across Route 50. A sketch of Concept 1 can be seen in Figure 2 in Section 3.
- C**oncept 2 - Split Diamond with Couplet:** Promotes regional movement and can accommodate high traffic volumes via two one-way roads through the interchange area; maintains direct connection between Route 50 and Route 7; reduces some connectivity in the interchange area, maintains some frontage roads; facilitates implementation of the Seven Corners Task Force Land Use Plan; would provide direct transit connection to east Falls Church Metro station, improves pedestrian and bicycle connectivity. A sketch of Concept 2 can be seen in Figure 3 in Section 3.
- **Concept 3 - Single Point Interchange:** Promotes regional movement and can accommodate the highest traffic volumes of all the interchange types; maintains direct connection between Route 50 and Route 7, but at the cost of removing connectivity from the other roadways in the interchange area; most impacts to right-of-way, businesses, and neighborhoods of all the conceptual designs; would not provide comfortable pedestrian or bicycle connectivity across Route 50. A sketch of Concept 3 can be seen in Figure 4 in Section 3.
- **Concept 4 - Two Half Diamond Interchanges:** Promotes a balance of regional movement and local accessibility; can accommodate year 2040 volumes and the Task Force Land Use scenario in the interchange area; provides connectivity between Route 50 and Route 7 via a new roadway as part of a "ring road"; maintains connections between other major roadways in the area; would have four crossings of Route 50, including a new crossing on the west side of the Seven Corners Interchange, to promote pedestrian and bicycle use; provides a direct connection from Route 7 to Roosevelt Boulevard and East Falls Church metro station. A sketch of Concept 4 can be seen in Figure 5 in Section 3.
- **Concept 5 - Four Corners:** Promotes a balance of regional movement and local accessibility; provides direct connectivity between Route 50 and Route 7 on the west side of the interchange area, eastside connection would be via a ramp terminal over Route 50; maintains connections between other major roadways in the area, except for Hillwood Avenue; would have two crossings of Route 50 to promote pedestrian and bicycle use; provides a direct connection from Route 7 to Roosevelt Boulevard and East Falls Church metro station. A sketch of Concept 5 can be seen in Figure 6 in Section 3.
- **Concept 6 - Jughandles:** Promotes a balance of regional movement and local accessibility to Route 50; connectivity between Route 50 and Route 7 would be through two pairs of "jughandles", one on either side of the interchange area that provide redundancy to the

network, Route 50 would have four "half-signals" (two on the eastbound side and two on the westbound side) stopping traffic on one side of Route 50 at the "jughandle" intersections; maintains connections between other major roadways in the area, except for Hillwood Avenue; would have two crossings of Route 50 to promote pedestrian and bicycle use. A sketch of Concept 6 can be seen in Figure 7 in Section 3.

The six conceptual designs were evaluated and reduced to the top three conceptual designs, using the following evaluation criteria: vehicle mobility; existing land use and the Task Force Land Use scenario; constructability; right-of-way impacts; and transit, pedestrian, and bicycle mobility. The three conceptual designs that were advanced to the initial traffic analysis evaluation were:

- Concept 2 - Split Diamond with Couplet
- Concept 4 - Two Half Diamond Interchanges
- Concept 6 - Jughandles

Note that when these three conceptual designs alternatives were advanced to the initial traffic analysis evaluation, they are referred to as ***Concept A - Split Diamond with Couplet (Concept 2), Concept B - Two Half Diamond Interchanges (Concept 4), and Concept C – Jughandles (Concept 6).***

1.2 PROJECT ANALYSIS METHODOLOGY

The study team used the Fairfax County travel demand model and procedures from the National Cooperative Highway Research Program Report 255 to produce forecasted future traffic volumes for the year 2040 scenarios. The first scenario modeled was the base Comprehensive Plan development level at a horizon year of 2040 combined with the existing transportation network, with exception of Route 50, which would be three lanes in each direction per the Fairfax County Transportation Plan Map. The remaining three scenarios used the Seven Corners Task Force Land Use Plan and the three conceptual designs networks (Concepts A, B, and C) that were advanced past the initial screening evaluation. Highlights and results from the travel demand modeling, year 2040 volume development, and manual traffic assignment include:

- The linear annual growth rates for the Comprehensive Plan at a horizon year of 2040 would be approximately 0.8 percent (p.m. peak hour) and 1.0 percent (a.m. peak hour)
- The linear annual growth rates for the Seven Corners Task Force Land Use Plan would be approximately 1.1 percent for both the a.m. and p.m. peak hours
- Year 2040 link volumes for the eight entry roadways in the study area were combined with the existing origin-destination (O-D) data from Phase 1 of the Seven Corners Transportation Study to produce a new set of O-D traffic volumes
- The year 2040 O-D volumes were manually assigned to the Comprehensive Plan roadway network and the three conceptual design (Concepts A, B, and C) roadway networks

1.3 TRAFFIC RESULTS OF THREE CONCEPTUAL ALTERNATIVES

FCDOT and the Seven Corners Task Force reviewed the results of the traffic results for Concepts A, B, and C, a set of pedestrian and bicycle measures of effectiveness, transit connectivity, proposed construction phasing, and a general order of magnitude cost estimates to help make a decision to move one conceptual design forward. Highlights of the traffic results from the evaluation of Concepts A, B, and C include:

- Synchro traffic models were developed by creating cross-sections that correspond to Virginia Department of Transportation (VDOT) functional classifications. Turn lane and appropriate

storage lengths were added at intersections. Signal timing parameters, including pedestrian timings, were added to the models, and closely spaced signals were coordinated

- HCM results produced using Synchro included per-vehicle delay, level-of-service, and queuing. Figures and data that show the results of the analysis may be found in Section 5.2.1
- HCS was used to produce results for a merge/diverge analysis (only applicable to Concepts A and B) for the proposed on-ramp and off-ramp connections to/from Route 50 - all merge/diverge segments would operate at LOS C or better in either the a.m. or p.m. peak hours
- A travel time analysis of the top four O-D pairs based on volume indicated that Concepts A, B, and C would, in general, provide substantial improvement over the Comprehensive Plan scenario in the year 2040
- Concepts A, B, and C would reduce per-vehicle system-wide delay by more than 50 percent compared with the Comprehensive Plan scenario
- Both Concept B and Concept C would be constructible. It is proposed that either concept would have the roadways outside the interchange area constructed first
- An analysis of the potential walkshed and bikeshed for Concept B and Concept C indicate that Concept B provides- better access, more options, and shorter travel times to more destinations than Concept C
- The transit analysis showed the Concept B would provide the most direct connection from Route 7 to the East Falls Church Metrorail station
- The proposed phasing for Concept B would begin by improving the existing roadways and constructing new connections outside the interchange area so that traffic can be diverted during the construction of the other elements of the interchange area. Subsequent phases of construction would construct the eastern and western half-diamond interchanges. The final construction phase would be to complete the interchange area and remaining project tie-ins.

After this analysis was completed, Concept B was selected to move forward as the recommended alternative by both Fairfax County staff and the Seven Corners Task Force for further evaluation.

1.4 RECOMMENDATION OF CONCEPT B

As the recommended conceptual design, Concept B was further analyzed using SimTraffic for comparison against the Comprehensive Plan scenario. In support of the potential construction of Concept B, a set of mitigation projects that could improve existing conditions in the study area, and not preclude construction of Concept B was developed. The highlights of the final analyses include:

- SimTraffic analysis was conducted on Concept B and showed similar results to the HCM analysis and substantial improvement over the Comprehensive Plan scenario
- Short term and long term mitigation projects were identified for the interchange area, for Route 50 east of the interchange area, and for Patrick Henry Drive

Section 2
Introduction

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2. INTRODUCTION

This study aims to improve the quality of life in the Seven Corners area of Fairfax County by increasing mobility and access for all travel modes through coordinated changes to the transportation system and current land uses. The primary objective of this study is to support the Seven Corners Task Force in evaluating the interchange and connectivity for the future year scenarios at a horizon year of 2040 (i.e., Comprehensive Plan and Seven Corners Task Force Land Use Plan) and to recommend the most appropriate conceptual design for the Seven Corners area.

Kittelson & Associates, Inc. (KAI), in partnership with Fairfax County Department of Transportation (FCDOT), the Seven Corners Task Force, members of the public, and other stakeholders, developed conceptual interchange and roadway network designs, future year 2040 travel forecasts, and analyzed the future scenarios in terms of traffic operations, multimodal performance, geometric design, and construction phasing.

The Seven Corners Transportation study area is located in Fairfax County, Virginia and extends into the City of Falls Church and Arlington County. The Seven Corners Community Business Center (CBC) consists of a complex and unique arrangement of arterials and local streets that includes the following: Arlington Boulevard (Route 50), Leesburg Pike (Route 7), Wilson Boulevard, Hillwood Avenue, Roosevelt Boulevard, and Sleepy Hollow Road. The study area is shown in Figure 1.

2.1 PRIOR WORK

In 2013, KAI conducted an existing conditions and origin-destination analysis for the Seven Corners area that serves as Part 1 of this current transportation study. The S*even Corners Transportation Study Existing Traffic Conditions Report* describes the traffic and origin-destination data collection and the existing conditions analysis of the Seven Corners Central Business Center. The objective of that study was to support the Task Force in evaluating the existing conditions for the area, and to provide the foundation for the current transportation study that provides a conceptual transportation network design recommendation.

2.2 ORGANIZATION OF THE REPORT

This report is organized into six parts; it begins with the Executive Summary followed by this Introduction. Section 3 covers the conceptual design development for the Seven Corners study area and initial screening evaluation. Section 4 describes the project analysis methodology, including travel demand modeling, the development of future traffic volumes, and the manual trip assignment process. Section 5 describes the analysis for the three conceptual designs advanced past the initial screening evaluation, and identifies Concept B as the recommended alternative. Section 6 reviews the results of the SimTraffic analysis for Concept B and a set of proposed mitigation projects.

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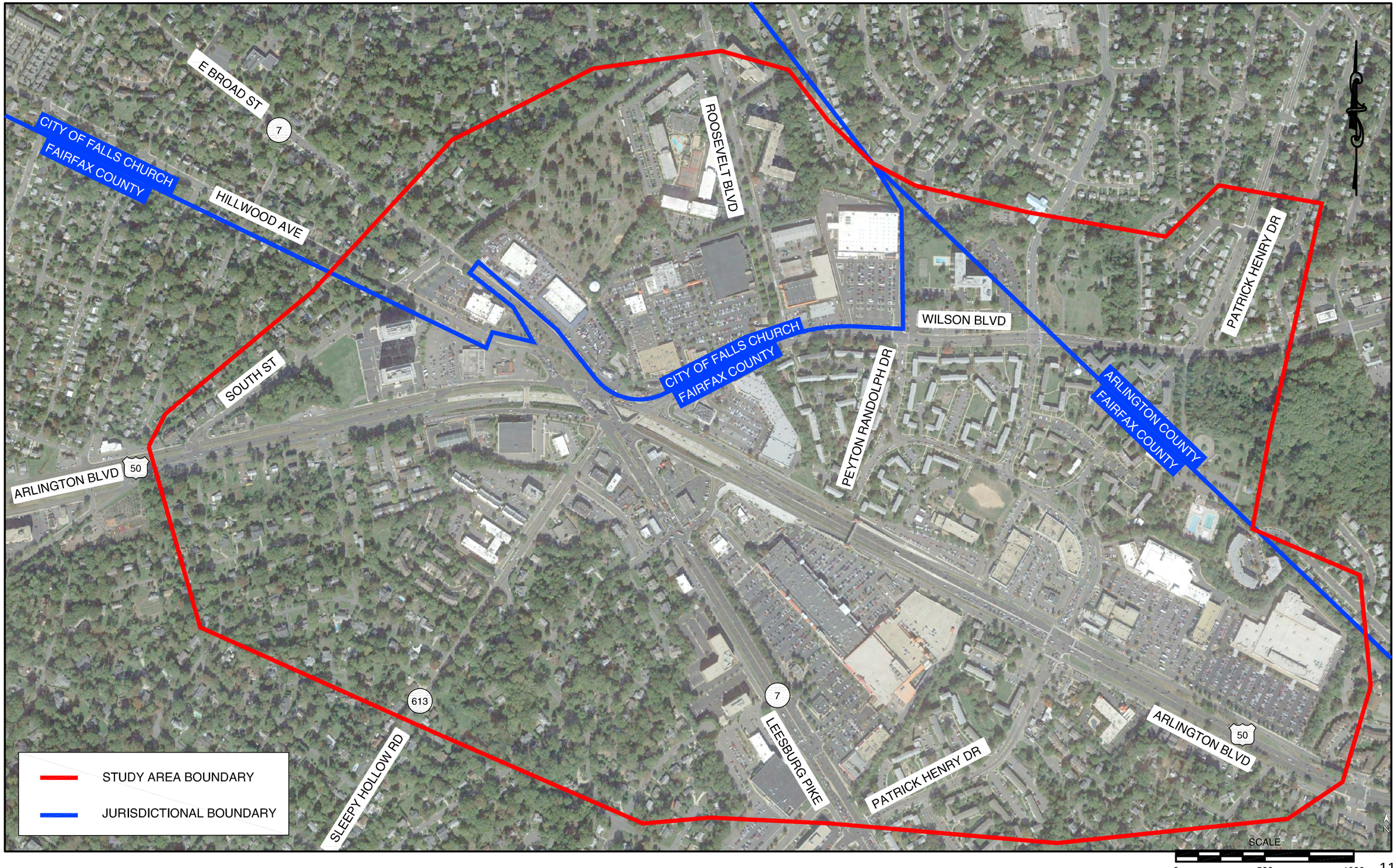
Figure 1. Seven Corners Transportation Study Area



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Section 3
Conceptual Design Development

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3. CONCEPTUAL DESIGN DEVELOPMENT

The first task of this study was to develop six conceptual interchange designs for the Seven Corners area. The process for developing the conceptual designs included the following steps: a transportation planning charrette with the Seven Corners Task Force, development of six conceptual designs (which was an iterative process that incorporated feedback from Fairfax County and project stakeholders), a qualitative evaluation of the conceptual designs, and finally, selection of three conceptual designs to move forward to be evaluated in more detail. This chapter of the report explains each step of the conceptual design development process.

3.1 TRANSPORTATION CHARRETTE

A planning charrette was held during the Seven Corners Task Force meeting on November 12, 2013 to kick-off the initial discussion about the study area in terms of conceptual designs for the future Seven Corners interchange area. Topics covered during the charrette included discussions of the future land use, the interchange/roadway network, as well as bike, pedestrian, and transit considerations in the study area.

3.1.1 Big Picture Ideas Regarding the Future Seven Corners Area

To help facilitate the discussion of the future of the Seven Corners area, Fairfax County brought four planning-level drawings (shown in Appendix A) to the charrette. These drawings helped spur the conversation about the context of the major roadways through the study area, the possibilities of implementing future land use changes such as the Seven Corners Task Force Land Use Plan and Fairfax County's Comprehensive Plan, and the fact that these objectives should be reflected in the conceptual designs.

Route 7 and Route 50 are the main routes that cross through the Seven Corners interchange area. In general, participants in the charrette expressed the opinion that Route 7 is an important street in the study area and in the future should serve as a "main street" in the area. With regards to the cross-section and functionality of Route 50, it was noted that Route 50 in Arlington County and Fairfax County has different operating characteristics such as grade-separated and at-grade intersections. Charrette participants felt strongly about maintaining grade-separation of Route 50 in the interchange area as a way to separate regional and local traffic.

Another key point brought up during the charrette was a desire to create a street grid within the study area to help support future land use plans, improve pedestrian and bicycle connectivity, and improve access control. The addition of new streets and new connections also raised concerns about traffic diversion and increased traffic on local streets.

Specific ideas about the interchange and roadway network; pedestrian, bicycle, and transit improvements, and general design considerations are discussed below.

3.1.2 Interchange and Roadway Network

During the charrette, the concept of separating local and regional traffic within the study area was discussed as an important consideration in developing the conceptual designs. For example, participants expressed the desire to maintain connectivity between Route 50 and Route 7 to facilitate the flow of regional traffic. In

addition, creating alternative routes and connections for roadways such as Wilson Boulevard, Sleepy Hollow Road, and Roosevelt Boulevard would support local accessibility and businesses.

Potential network alternatives that focus on regional mobility that were suggested are higher capacity interchange types such as single point or tight diamonds, the addition of a "ring road" to help move traffic around the interchange area, converting the section of Route 7 where it crosses over Route 50 into a one-way couplet, and closing some of the "Seven Corners" roads such as Hillwood Avenue to increase capacity for the other connections. Ideas that focus on local connectivity and accessibility were maintaining access to commercial and residential parcels, designs that would separate regional traffic from local movements, and extending Patrick Henry Drive from Wilson Boulevard to Route 50 would provide alternative routes.

A new connection proposed at the charrette included relocating the signal on Route 50 east of Patrick Henry Drive to align with Olin Drive and the eastern entrance to the Target store on the north side of Route 50. The intersection would operate with full movements in all directions and protected left turn lanes would be added on Route 50 in both directions. Moving the signal would allow the frontage road in front of Target to operate as a two-way road. The new roadway would also allow the businesses near Target to front a local roadway that faces the community rather than Route 50. Doing this would improve access to the buildings, promote walkability, and possibly promote the redevelopment.

3.1.3 Bicycle, Pedestrian, and Transit Considerations

One focus of the charrette was on potential pedestrian, bicycle, and transit improvements. There is an interest to improve overall bicycle and pedestrian safety within the study area and to increase transit connectivity. Key considerations included where people are traveling (or would be likely to travel in the future) in the Seven Corners area and how transit improvements could increase ridership. Fairfax County staff indicated that the Virginia Department of Rail and Public Transportation (DRPT) Multimodal urban design street standards would be applied.

In terms of improving transit connections, there was an interest in creating a direct connection from Route 7, crossing over Route 50, to Roosevelt Boulevard to provide a relatively direct connection to the East Falls Church Metro station

Participants expressed interest in a new overcrossing of Route 50 to enable pedestrians and bicyclists to travel from one side of Route 50 to the other. Removing the frontage roads along Route 50 would provide ample space for future separated pedestrian and bicycle facilities such as a wide multi-use path. A multi-use path (as shown in DRPT standards) would be preferred on both sides of Route 50. Additional discussion points included the importance of bicycle route connectivity from Route 7 to Route 50 and between the intersection of Route 50/Patrick Henry Drive and Arlington County. Route 7 is also an important bike corridor in the area and could be improved with bicycle facilities (e.g. cycle tracks). There were suggestions to provide much better pedestrian infrastructure such as sidewalks and pedestrian signals, to increase ADA compliance, and to make safety improvements throughout the study area.

3.1.4 Design Considerations and Next Steps

Initial engineering design considerations were discussed at the charrette, including the possibility of grade separation, incorporating safety improvements into the designs, and the removal of the frontage roads

along Route 50. Due to the proximity of the Route 50/Patrick Henry Drive intersection to the existing Seven Corners interchange a few particular design considerations were noted. The ability to achieve attainable ramp profiles, acceptable roadway grades, and necessary ramp lengths will play a role in the feasibility of potential interchange design concepts. Operation of diverge and merge areas and maintaining required distances between proposed ramps and intersections played a role in the development of potential interchange designs concepts.

3.2 SIX CONCEPTUAL INTERCHANGE DESIGNS

The development of the six designs incorporated discussions from the charrette and included feedback from FCDOT, DPZ, the Seven Corners Task Force, VDOT, and other stakeholders through an iterative process. In addition, the conceptual designs took into account the future "vision" for the Seven Corners area and basic geometric design principles.

A key starting point in developing the conceptual designs included determining the roadway functionality of Route 50 and Route 7 in relation to the proposed future land uses in the Seven Corners area. Main discussion topics associated with determining the functionality of Route 50 included grade separations versus signalization, and how that would dictate the operation of the roadway. Discussions about Route 7 included potential future roadway cross-sections, access to residential/commercial parcels, and designing with the context of Route 7 serving as a "main street". Land use associated with the Comprehensive Plan and the Seven Corners Task Force Land Use Plan was considered during the design process for the Seven Corners interchange area.

Some of the elements considered while sketching the conceptual designs include the following: removal of frontage roads, identifying merge/diverge areas, on- and off-ramp locations and lengths, re-routing of traffic within the study area, secondary road connectivity, and non-motorized/transit mobility. The six concepts that were developed are described in the following sections. In general, Concepts 1, 2, and 3 would provide more regional mobility, while Concepts 4, 5, and 6 would provide more local connectivity. All six conceptual designs would provide a new overcrossing of Route 50 to facilitate the implementation of the Seven Corners Task Force Land Use Plan.

3.2.1 Concept 1 - Diverging Diamond Interchange

The Diverging Diamond Interchange concept promotes regional movement because it can accommodate high traffic volumes and preserves the direct connection between Route 50 and Route 7. Hillwood Road, Wilson Boulevard and Sleepy Hollow Road would all become cul-de-sacs which hinders local accessibility. A new connection from Roosevelt Boulevard to Route 7 would be incorporated into this design and support transit. The frontage roads east of the interchange would continue to primarily serve internal land uses. A sketch of Concept 1 can be seen in Figure 2.

3.2.2 Concept 2 (Concept A) - Split Diamond with Couplet on Route 7

The Split Diamond with Couplet on Route 7 concept promotes regional movement and would support the Seven Corners Task Force Land Use Plan. This concept would create a one-way couplet on Route 7 and a split diamond interchange with Route 50 that would be able to accommodate high traffic volumes at the interchange area. Concept 2 would provide opportunities to create a small local grid network near the

interchange. This conceptual design would provide two new overcrossings of Route 50, however, there would be some loss of local connectivity as Wilson Boulevard would become a cul-de-sac and Hillwood Avenue would terminate at South Street. The frontage roads on the east and west of the interchange would remain and primarily serve internal land uses. A sketch of Concept 2 can be seen in Figure 3.

3.2.3 Concept 3 - Single Point Interchange

The Single Point Interchange concept promotes regional movement and can accommodate high traffic volumes. This conceptual design would provide a new overcrossing of Route 50. Wilson Boulevard, Sleepy Hollow Road, and Hillwood Avenue would continue to provide access to parcels but would not connect to the interchange. Frontage roads to the east of the interchange would remain and primarily serve internal land uses. A Single Point Interchange can be more challenging to accommodate pedestrian and bicycle movements. A sketch of Concept 3 can be seen in Figure 4.

3.2.4 Concept 4 (Concept B) - Two Half Diamond Interchanges

The Two Half Diamond Interchange conceptual design would provide a measure of network redundancy because a “ring road” around the central interchange creates multiple opportunities to enhance local accessibility and regional mobility. As a result, some of the Route 50 and Route 7 traffic volume would be diverted away from the interchange area intersection. Ramp terminals would provide access from Route 50 to Route 7 (and vice-versa) indirectly and provides two overcrossings of Route 50. The interchange area intersection would become the intersection of Route 7 and Wilson Boulevard/Sleepy Hollow Road and provide another grade-separated way to cross Route 50. The frontage roads to the east of the interchange would remain and primarily serve internal land uses. A sketch of Concept 4 can be seen in Figure 5.

3.2.5 Concept 5 - Four Corners

The Four Corners conceptual design provides a balance of local accessibility and regional mobility. The Route 50 eastbound off-ramp connects to Sleepy Hollow Road west of Route 7. The interchange area intersection would be formed by the connection between Route 7 and Wilson Boulevard/Sleepy Hollow Road. This “Four Corners” intersection would provide access from Route 7 to Route 50 via ramps. Route 50 access to local roads would be through ramps to Sleepy Hollow Road (eastbound) and Wilson Boulevard (westbound). This concept requires additional design considerations regarding the ramp profiles and integration with the downstream signals on Route 50. The eastbound on-ramp to Route 50 would require channelization and would not be allowed to turn left turn at Patrick Henry Drive. Frontage roads to the east of the interchange would remain and primarily serve internal land uses. A sketch of Concept 5 can be seen in Figure 6.

3.2.6 Concept 6 (Concept C) - Jughandle Configuration

The Jughandle conceptual design would promote a combination of local accessibility and regional movement. Having four “jughandle” ramps in this conceptual design would create redundant access opportunities in the network. Vehicle movements to/from Route 50 would occur on the edges of the interchange area which would be formed by the intersection of Route 7 and Wilson Boulevard/Sleepy Hollow Road. Access to/from Route 50 would be via new signalized intersections on Route 50. Hillwood Avenue would connect to local parcels and westbound Route 50 via South Street. The redundant nature of the “jughandle” configuration in Concept 6 would provide opportunities to be phased and maintain traffic

flow during constructions with fewer impacts than other concepts. A sketch of Concept 6 can be seen in Figure 7.

3.3 EVALUATION CRITERIA

The six interchange conceptual designs underwent an evaluation screening to reduce the number of conceptual designs the top three to be advanced toward the first phase on traffic analysis. The evaluation was qualitative and "high-level", yet comprehensive. The evaluation criteria, shown in Table 1, were based on key themes established in the charrette and in follow-up discussions with Fairfax County. Additionally, the criteria included some elements that were considered to be "fatal flaws," for example, impacts to stable single family neighborhood or the Oakwood Cemetery. The evaluation was conducted in a consumer reports style with each criterion receiving an open circle (low, least desirable), half-filled in circle (medium), or full circle (high, most desirable). Table 2 shows the results of the screening evaluation.

Table 1. Conceptual Design Evaluation Screening Criteria

Theme	Evaluation Objectives
Vehicle Mobility	Include a new overcrossing of Route 50
	Provide local roadway connectivity
	Minimizes impacts to high volume origin-destination routes
	Improve vehicle mobility
Land Use	Facilitate implementation of Seven Corners Task Force Land Use plan
	Minimizes impacts to Eden Center (physical and/or access)
	Minimize impedance of ramps on parcel
Constructability	Ability to phase and maintain traffic during construction
	Minimize construction costs
Right-of-way Impacts	Minimize right-of-way impacts
	Minimize impacts to Oakwood Cemetery
	Minimize impacts to Sleepy Hollow neighborhoods (physical and/or access)
Transit, Pedestrian, and Bicycle Mobility	Accommodate transit services
	Enable comfortable and safe pedestrian and bicycle travel on Route 7

3.4 SELECTION OF THREE CONCEPTS TO MOVE FORWARD

Using the results of the evaluation criteria screening, discussions with FCDOT, and the outcomes of the Task Force meeting on December 10, 2013, three conceptual design alternatives were selected to move forward to the initial traffic analysis: Concept 2, Concept 4, and Concept 6. Out of the six concepts, it was desired to include at least one regional mobility concept (Concepts 1, 2 or 3) and at least one local connectivity concept (Concepts 4, 5, and 6). Concepts 2, 4, and 6 were recommended because of the following main points:

Concept 2 (Concept A):

- Primarily serves regional movement and maintains a direct connection between Route 7 and Route 50

- Includes a direct connection from Route 7 to Roosevelt Boulevard

Concept 4 (Concept B):

- Provides balance between regional and local movement
- Includes three overcrossings of Route 50 in addition to the central intersection
- Highest possibility to expand bicycle and pedestrian connectivity

Concept 6 (Concept C):

- Provides a mix of regional and local movement
- The "jughandle" ramps would provide redundancy in the transportation network
- This conceptual design would provide benefits in terms of the relative ease of construction phasing

Table 2. Evaluation of Six Conceptual Interchange Design Alternatives

Theme		Evaluation Criteria	Alt 1: Diverging Diamond	Alt 2: Split Diamond with Couplet	Alt 3: Single Point Interchange	Alt 4: Two Half Diamonds	Alt 5: Four Corners	Alt 6: Jughandle Configuration
1	**Vehicle Mobility**							
	A	Includes a new overcrossing of US-50	●	●	●	●	●	●
	B	Provides local roadway connectivity	○	◐	○	●	◐	●
	C	Impacts to high volume origin-destination routes	○	◐	○	◐	◐	◐
	D	Improve vehicle mobility	◐	●	◐	◐	◐	◐
2	**Land Use**							
	A	Facilitates implementation of Seven Corners Task Force Land Use plan	◐	●	◐	●	◐	●
	B	Impacts to Eden Center (physical and/or access)	◐	◐	○	◐	◐	◐
	C	Ramp locations impede parcel access	◐	◐	○	●	○	●
3	**Constructability**							
	A	Ability to phase and maintain traffic during construction	○	◐	○	●	◐	●
	B	Construction costs	○	○	○	○	◐	○
4	**Right-of-way Impacts**							
	A	Right-of-way impacts	◐	○	○	●	●	●
	B	Impacts to Oakwood Cemetery	◐	◐	○	◐	◐	◐
	C	Impacts to Sleepy Hollow neighborhoods (physical and/or access)	○	◐	○	◐	●	◐
5	**Transit, Pedestrian, and Bicycle Mobility**							
	A	Ability to accommodate transit services	◐	●	◐	●	◐	◐
	B	Pedestrian and bicycle travel on VA 7	○	◐	○	●	◐	●

○ Low (undesirable) ◐ Medium ● High (desirable)

Figure 2

Concept 1 - Diverging Diamond Interchange

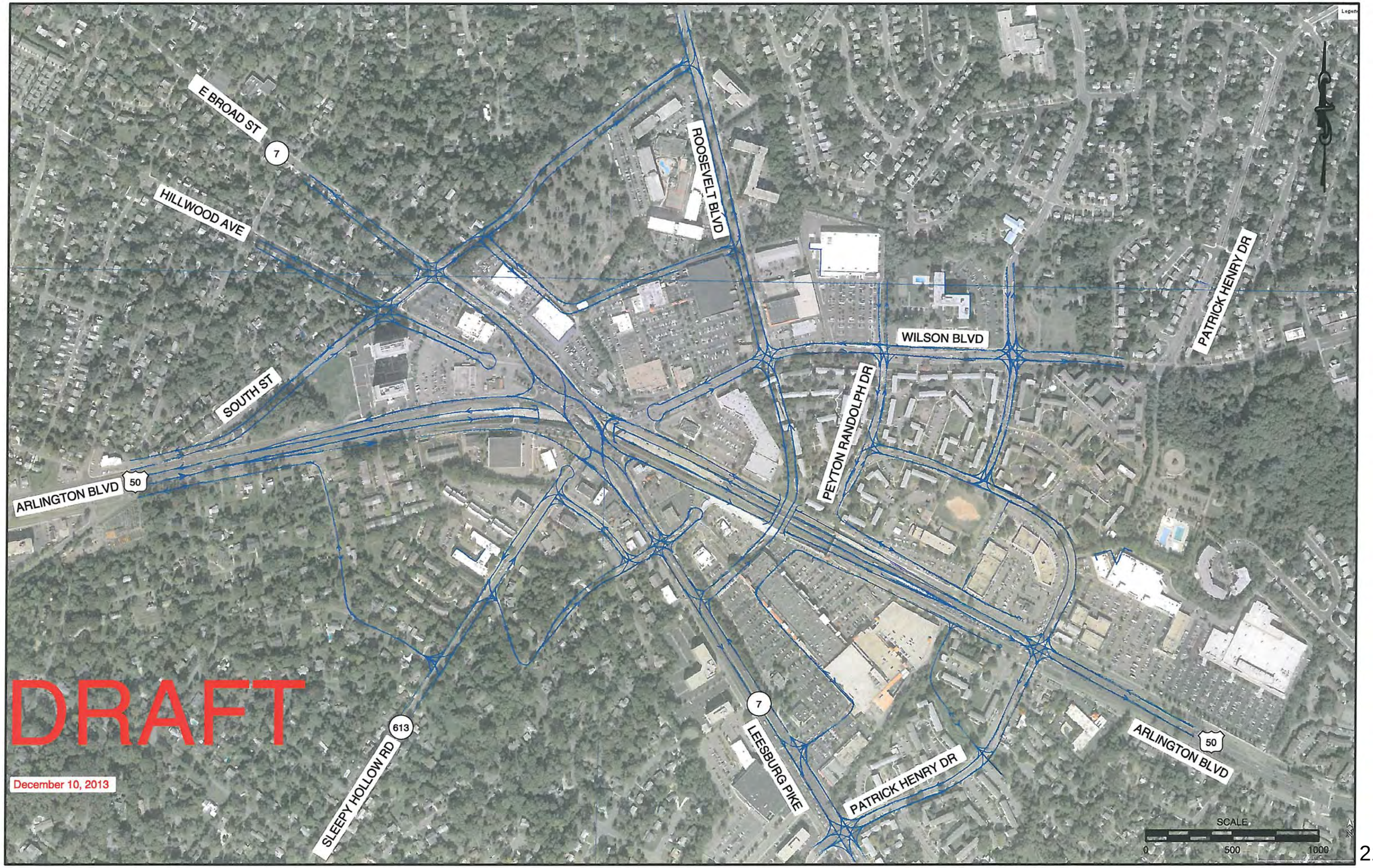


Figure 3

Concept 2 (Concept A) - Split Diamond with Couplet

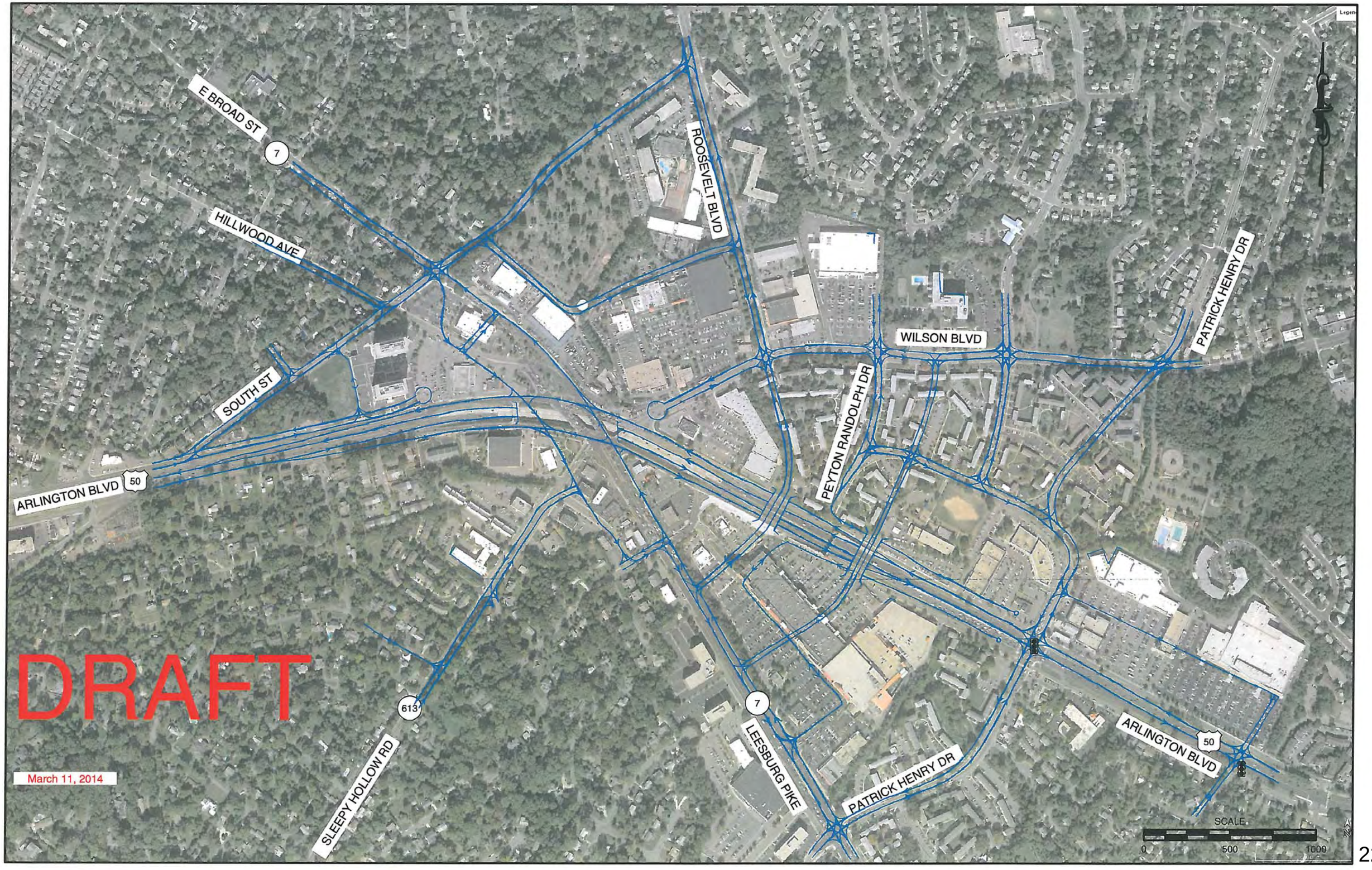


Figure 4

Concept 3 - Single Point Interchange

Figure 5

Concept 4 (Concept B) - Two Half Diamonds

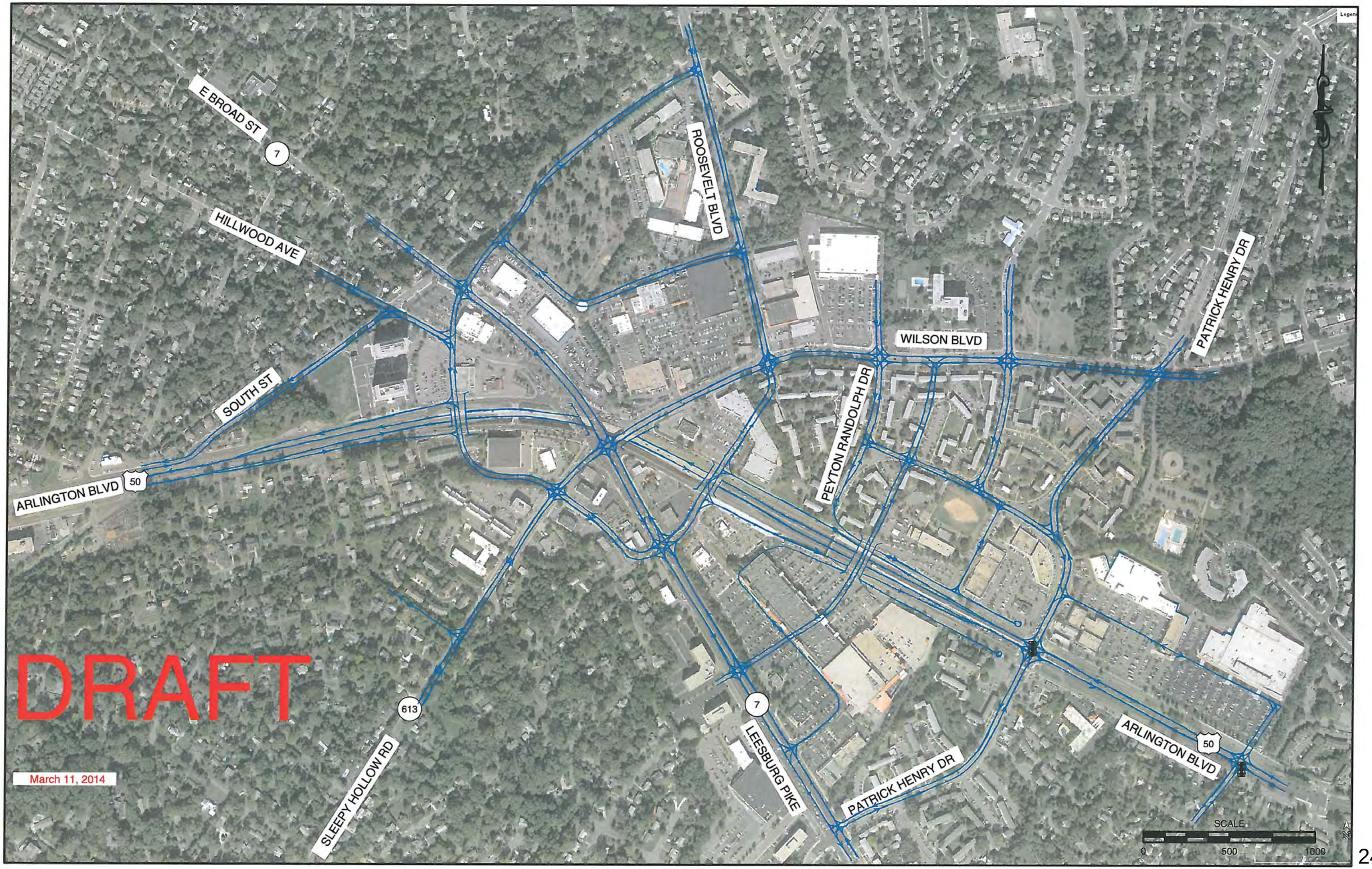


Figure 6

Conceptual Design 5 - Four Corners

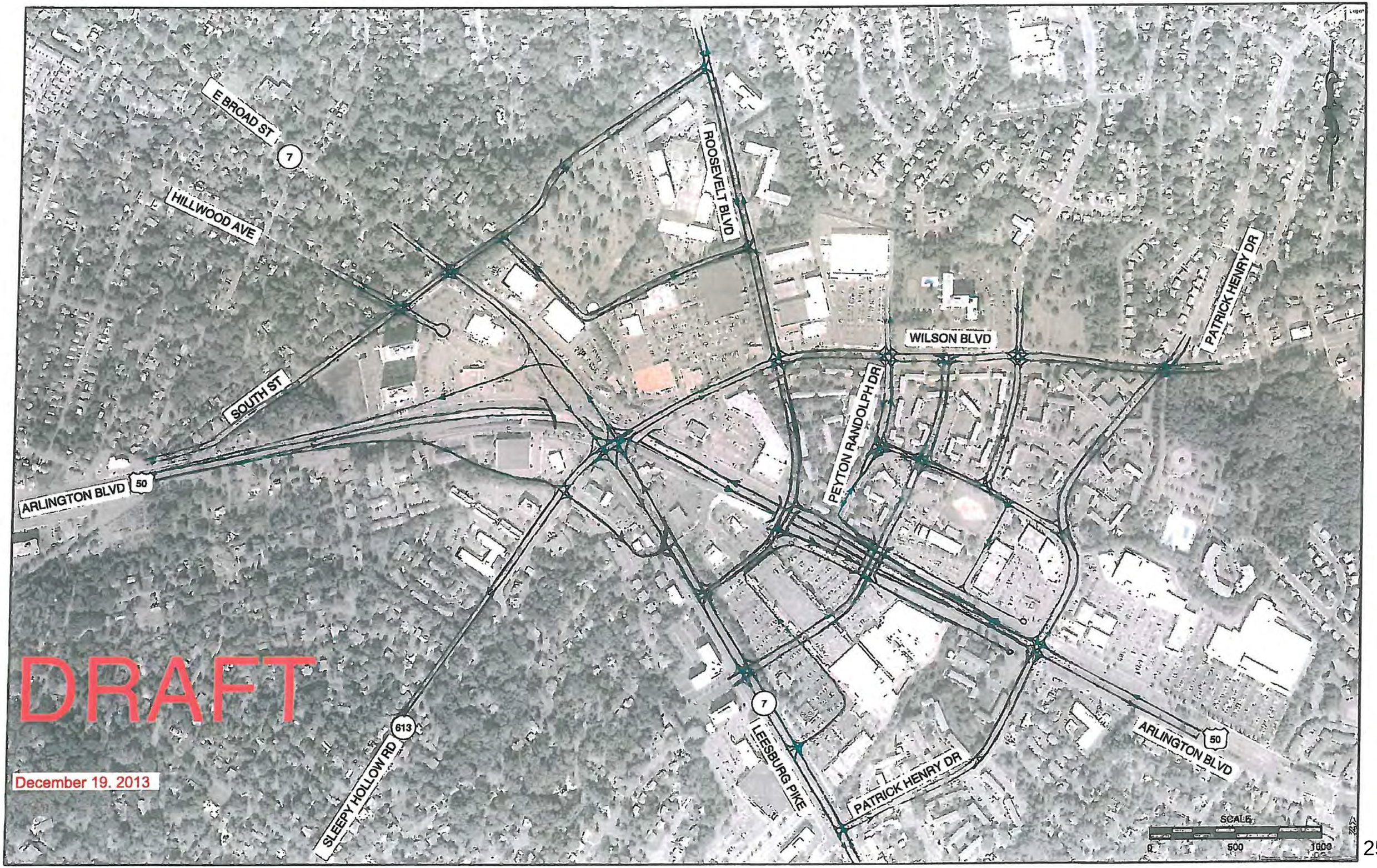
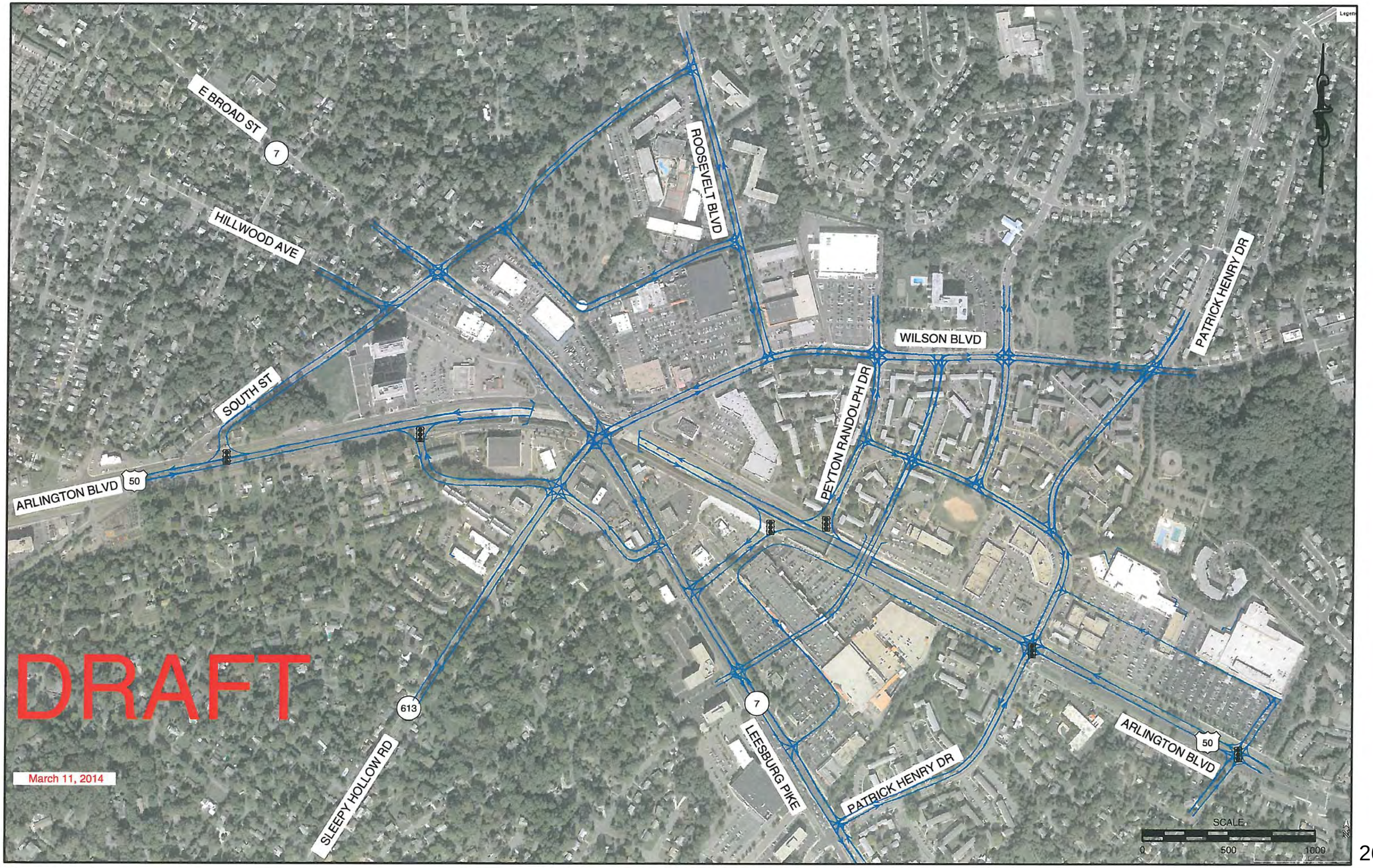


Figure 7

Concept 6 (Concept C) - Jughandles



Section 4
Project Analysis Methodology

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4. PROJECT ANALYSIS METHODOLOGY

Travel demand modeling and forecasting is a major component of this phase of the Seven Corners Transportation Study. The study team used the Fairfax County travel demand model and procedures from the *Highway Traffic Data for Urbanized Area Project Planning and Design* (National Cooperative Highway Research Program Report 255, 1982) to produce forecasted future traffic volumes for four, year 2040, scenarios. The first scenario modeled was the Comprehensive Plan land use plan combined with the existing transportation network and six lanes on Route 50 per the Transportation Plan Map. The remaining three scenarios used the Seven Corners Task Force Land Use Plan and the three conceptual designs networks (Concepts 2, 4, and 6) that were advanced past the initial screening evaluation

This chapter describes the Fairfax County travel demand model, travel demand modeling methodology and approach, the NHCRP 255 process that was applied to the raw outputs from the Fairfax County model to produce the year 2040 future forecast volumes, the application of the new entering link volumes to the existing origin-destination (O-D) matrix to create the year 2040 O-D pairings, and the process to manual assignment the O-D pairs to the Comprehensive Plan and conceptual design networks.

4.1 FAIRFAX COUNTY TRAVEL DEMAND MODEL

Fairfax County's travel demand model was used, in part, to forecast future traffic volumes for this study. The County's model uses the Cube operating environment, which is the same travel demand modeling software package used by the Metropolitan Washington Council of Governments (MWCOG). Fairfax County's model was originally developed from MWCOG's.

The latest version of Fairfax County's model was updated in 2013 and includes:

- Calibration and validation based on the year 2007/2008 Transportation Planning Board Household Travel Survey, several transit on-board surveys, and recent traffic counts. A technical memorandum describing the validation can be found in Appendix B
- Socio-economic data from the MWCOG 8.1 land use forecast for the area outside of Fairfax County and the MWCOG 8.2 forecast within Fairfax County

Fairfax County's model has four time periods:

- AM Peak Period – 3 hours, 6-9 a.m.
- MD Off Peak Period – 6 hours, 9 a.m. – 3 p.m.
- PM Peak Period – 4 hours, 3-7 p.m.
- Night Off Peak Period – 9 hours, 7 p.m. – 6 a.m.

The peak hour factors for the a.m. and p.m. peak periods were used to determine the peak hour model volumes.

4.2 METHODOLOGY AND APPROACH

The year 2040 transportation network in Fairfax County's Transportation Plan and land use data from the Comprehensive Plan constituted the inputs into the year 2040 Comprehensive Plan travel demand model

scenario. This scenario, referred to as the "Comprehensive Plan Scenario", is the basis of comparison for the other scenarios that incorporate the Seven Corners Task Force Land Use Plan and the three conceptual design roadway networks. Within the study area, the only transportation project that is part of the Transportation Plan is to widen Route 50 to six lanes throughout the study area. The three scenarios that use the conceptual design roadway networks, for the purpose of the travel demand forecasting, were developed by modifying the future Comprehensive Plan scenario to include the Seven Corners Task Force Land Use Plan assumptions.

An abbreviated description of the modeling methodology and approach is described below. A technical memorandum in Appendix B provides a more complete explanation of the steps used in the modeling work.

For the year 2040 scenarios, the following steps were used to obtain the adjusted study roadway segment volumes and intersection turning movement volumes for operational analyses:

1. Conduct a review of the 2007 model. The elements of the model review included:
    a. A review of the study area link speeds, capacities, and number of lanes
    b. Comparison of the a.m. peak hour, p.m. peak hour, and daily (24-hour) period model volume assignments with 2013 tube count data
    c. Comparison of the 2013 origin-destination data from the Seven Corners Transportation Study – Phase 1 report with the select link (also referred to as flow bundles) results for the eight main roadways in the study area. A technical memorandum that describes the results of this analysis is included in Appendix B
    d. Modification of the network and updates to the travel demand model based on the results of the review
    e. Application of the corresponding modifications to the future models, as appropriate

2. Run the travel demand model for the Comprehensive Plan scenario based on modifications (geometry, capacity, number of lanes, speed) from the existing model validation review
3. Develop land use inputs for the Seven Corners Task Force Land Use Plan scenario. The table in Appendix B summarizes the land use data for the TAZs within the study area for year 2007 and 2040
4. Run the travel demand model for the Seven Corners Task Force Land Use Plan scenario
5. Develop the peak hour volumes from the Fairfax County travel demand model based on the travel demand model's peak hour factor
6. Post-process travel demand model link assignment results using procedures in the NCHRP Report 255 as described below:

There are two common procedures for adjusting link volumes from a model: the difference (or increment) method or the ratio method. The link volumes reported from the Fairfax County travel demand model will be adjusted based on either one of these methods. The selection of either method depends on the calculated results and the experience of the modeler. Both methods may be applied during the analysis, but only one method is selected for each link.

Difference Method: The growth increment from the base year model to the forecast year model is added to the base year traffic count to create the adjusted model forecast.

Ratio Method: This method applies the ratio of the forecast year model volume to the base year model volume to the base year traffic count to create the adjusted model forecast.

The assumption used is that the discrepancy between a base year count and a base year assignment is likely to be of the same magnitude in the future year. Given this assumption, the future year model volumes can be modified by comparing the relative ratios or differences between base year links. Therefore, adjustments will be applied to model results prior to traffic operation analysis. The result of this step will be the forecasted future link volumes for the Comprehensive Plan scenario and the Seven Corners Task Force Land Use Plan scenario at horizon year of 2040.

1. Apply the existing conditions origin-destination demand patterns to the future forecast traffic demand for the eight entry links of the Seven Corners study area to generate future forecast origin-destination demand patterns for all the origin-destination pairs within the study area
2. Future forecast traffic demand for the eight entry links of the Seven Corners study area is manually-assigned to the Comprehensive Plan roadway network and the three conceptual design networks. The details of hand-assignment are discussed in the section 4.5 below

4.3 LAND USE

The proposed change in land use for the Seven Corners CBC encourages redevelopment that will increase the residential population as well as the number and variety of jobs, while encouraging a high-quality, pedestrian-oriented environment. The proposed change promotes a vibrant mix of land uses to enhance the quality of life for residents, while enabling business to prosper and actively contribute to the economic and social vitality of Seven Corners. The concept envisions a variety of housing types, employment options, and shopping and entertainment within walking distance of area residents.

The ultimate goal for the Seven Corners CBC is to create a cohesive whole of its many neighborhoods and commercial centers. The sub-areas are separated by two major roadways, Route 50 (Arlington Boulevard) and Route 7 (Leesburg Pike), which, without a proper north-to-south vehicular and pedestrian connection, act as barriers to the integration of the CBC. The plan concept envisions three densely developed Opportunity Areas, each with a different character, to serve the greater Seven Corners area. Table 3 below shows the total proposed development potential envisioned for the three Opportunity Areas. A breakdown of the land uses by Opportunity Area and a map are located in Appendix B.

Table 3. Existing and Proposed Land Use

Development Type	Existing / Comprehensive Plan	Seven Corners Task Force Land Use Plan
Residential (units)	589	5,563
Retail (square feet)	1,009,552	1,121,200
Office[1] (square feet)	124,266	1,105,450

[1] Hotel is combined with Office, but the Comprehensive Plan will not call out hotel as a separate land use. It is not expected that all the proposed office use will be developed as office, and would be developed with hotel uses instead.

4.4 DEVELOPMENT OF FUTURE YEAR 2040 VOLUMES

Based on the procedures in NCHRP Report 255, year 2040 volumes for the eight entry links of the Seven Corners study area were developed for both a.m. and p.m. peak hour for the Comprehensive Plan scenario and the Seven Corners Task Force Land Use Plan scenario. Although year 2007 traffic count data was not available, Fairfax County (and other local data) confirm that year 2013 traffic volumes are similar to year 2007 volumes, therefore year 2013 traffic volumes can be used as reasonable substitutes for year 2007 traffic volumes.

As discussed above, the difference method and the ratio method were used to develop the future year 2040 volumes. Table 4 and Table 5 summarize the development of year 2040 volumes for the Comprehensive Plan scenario volumes for the a.m. and p.m. peak hours, respectively. As shown in Table 4 and Table 5, in many cases the year 2040 volumes developed by using the difference method are similar to the ones developed by using the ratio method. Based on engineering judgment, either the difference or the ratio method result was selected to represent the year 2040 volume for the specified link. The final volumes were rounded to the nearest one hundred vehicles.

An overall growth rate in terms of total entering vehicles for the sum of the eight roadway links may be calculated for using the comparable data for the year 2013 (existing counts) and year 2040 (post-processed volumes). For the Comprehensive Plan in the a.m. peak hour, the total growth rate is 26 percent over 27 years, which equates to a linear growth rate of just less than one percent per year. For the p.m. peak hour, the total growth rate is 22 percent over 27 years, which equates to a linear growth rate of approximately 0.8 percent per year.

Table 4. Volume Development for the Comprehensive Plan Scenario (AM Peak Hour)

Roadway	Year 2013 Count	Year 2007 Model	Year 2040 Model[1]	2013 Count + Difference[2]	2013 Count * Ratio[3]	Final Year 2040 Volume
Route 50 (west)	3,130	3,166	4,207	4,171	4,159	4,200
Hillwood	725	457	394	662	625	700
Route 7 (west)	670	1,247	1,227	650	659	700
Roosevelt	495	742	893	646	596	600
Wilson	680	681	768	767	767	800
Route 50 (east)	2,210	1,508	2,296	2,998	3,365	3,000
Route 7 (east)	1,575	1,527	1,995	2,043	2,058	2,000
Sleepy Hollow	605	523	603	685	698	700
Total	**10,090**	**9,851**	**12,383**	**12,622**	**12,926**	**12,700**

[1] 2040 Comprehensive Plan Travel Demand Model

[2] 2013 Count + Difference = Year 2040 Model – Year 2007 Model + Year 2013 Count

[3] 2013 Count * Ratio = (Year 2040 Model/Year 2007 Model) * Year 2013 Count

Cells in green indicate which method result was selected

Table 5. Volume Development for the Comprehensive Plan Scenario (PM Peak Hour)

Roadway	Year 2013 Count	Year 2007 Model	Year 2040 Model[1]	2013 Count + Difference[2]	2013 Count * Ratio[3]	Final Year 2040 Volume
Route 50 (west)	2,260	1,907	2,972	3,325	3,522	3,300
Hillwood	715	404	427	738	756	700
Route 7 (west)	630	1,402	1,372	600	617	600
Roosevelt	880	905	1,127	1,102	1,096	1,100
Wilson	1,010	1,276	1,310	1,044	1,037	1,000
Route 50 (east)	3,155	2,629	3,277	3,803	3,933	3,800
Route 7 (east)	1,435	1,915	2,289	1,809	1,715	1,700
Sleepy Hollow	305	166	390	529	717	500
Total	**10,390**	**10,604**	**13,164**	**12,950**	**13,392**	**12,700**

[1] 2040 Comprehensive Plan Travel Demand Model
[2] 2013 Count + Difference = Year 2040 Model – Year 2007 Model + Year 2013 Count
[3] 2013 Count * Ratio = (Year 2040 Model/Year 2007 Model) * Year 2013 Count
Cells in green indicate which method result was selected

Table 6 and Table 7 summarize the development of the 2040 Seven Corners Task Force Land Use Plan scenario volumes for the a.m. and p.m. peak hours, respectively. As shown in Table 4 and Table 5, in many cases the year 2040 volumes developed by using the difference method are similar to the ones developed by using the ratio method. Either the difference or the ratio method result was selected to represent the year 2040 volume for the specified link. The final volumes were rounded to the nearest one hundred vehicles.

An overall growth rate in terms of total entering vehicles for the sum of the eight roadway links may be calculated for using the comparable data for the year 2013 (existing counts) and year 2040 (post-processed volumes). For the Comprehensive Plan in the a.m. peak hour, the total growth rate is 31 percent over 27 years, which equates to a linear growth rate of approximately 1.1 percent per year. For the p.m. peak hour, the total growth rate is 31 percent over 27 years, which equates to a linear growth rate of approximately 1.1 percent per year.

Table 6. Volume Development of the Seven Corner Lane Use Scenario (AM Peak Hour)

Roadway	Year 2013 Count	Year 2007 Model	Year 2040 Model[1]	2013 Count + Difference[2]	2013 Count * Ratio[3]	Final Year 2040 Volume
Route 50 (west)	3,130	3,166	4,192	4,156	4,144	4,200
Hillwood	725	457	392	660	622	700
Route 7 (west)	670	1,247	1,238	661	665	700
Roosevelt	495	742	912	665	608	700
Wilson	680	681	801	800	800	800
Route 50 (east)	2,210	1,508	2,346	3,048	3,438	3,400
Route 7 (east)	1,575	1,527	1,908	1,956	1,968	2,000
Sleepy Hollow	605	523	610	692	706	700
Total	**10,090**	**9,851**	**12,399**	**12,638**	**12,951**	**13,200**

[1] 2040 Seven Corners Task Force Land Use Plan Travel Demand Model
[2] 2013 Count + Difference = Year 2040 Model – Year 2007 Model + Year 2013 Count
[3] 2013 Count * Ratio = (Year 2040 Model/Year 2007 Model) * Year 2013 Count
Cells in green indicate which method result was selected

Table 7. Volume Development of the Seven Corner Lane Use Scenario (PM Peak Hour)

Roadway	Year 2013 Count	Year 2007 Model	Year 2040 Model[1]	2013 Count + Difference[2]	2013 Count * Ratio[3]	Final Year 2040 Volume
Route 50 (west)	2,260	1,907	3,100	3,453	3,674	3,700
Hillwood	715	404	399	710	706	700
Route 7 (west)	630	1,402	1,387	615	623	600
Roosevelt	880	905	1,130	1,105	1,099	1,100
Wilson	1,010	1,276	1,388	1,122	1,099	1,100
Route 50 (east)	3,155	2,629	3,326	3,852	3,991	4,000
Route 7 (east)	1,435	1,915	2,158	1,678	1,617	1,700
Sleepy Hollow	305	166	383	522	704	700
Total	**10,390**	**10,604**	**13,271**	**13,057**	**13,513**	**13,600**

[1] 2040 Seven Corners Task Force Land Use Plan Travel Demand Model
[2] 2013 Count + Difference = Year 2040 Model – Year 2007 Model + Year 2013 Count
[3] 2013 Count * Ratio = (Year 2040 Model/Year 2007 Model) * Year 2013 Count
Cells in green indicate which method result was selected

Figure 8 and Figure 9 on the following pages show the a.m. and p.m. peak hour volumes for the existing conditions, Comprehensive Plan, and the Seven Corners Task Force Land Use travel demand models, at the cordon lines used for the future traffic volume development. Figure 10 and Figure 11 on the following pages show the a.m. and p.m. peak hour link volume-to-capacity (v/c) ratios for the existing conditions, Comprehensive Plan, and the Seven Corners Task Force Land Use travel demand models, at the cordon lines. The v/c ratios are calculated by dividing the peak hour travel demand model link volumes by the pre-determined link capacities.

Figure 8

Travel Demand Model AM Peak Hour Link Volumes

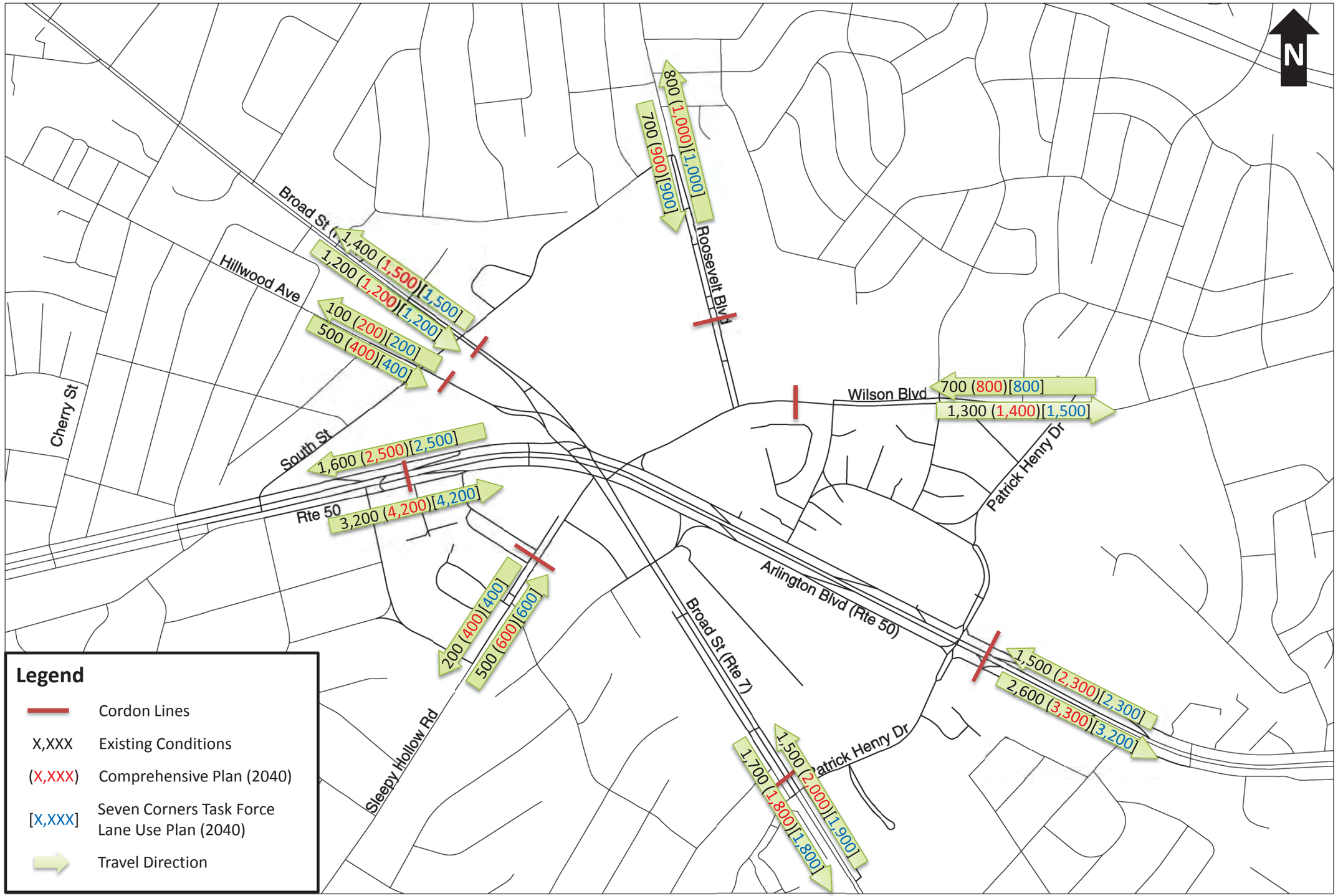


Figure 9

Travel Demand Model PM Peak Hour Link Volumes

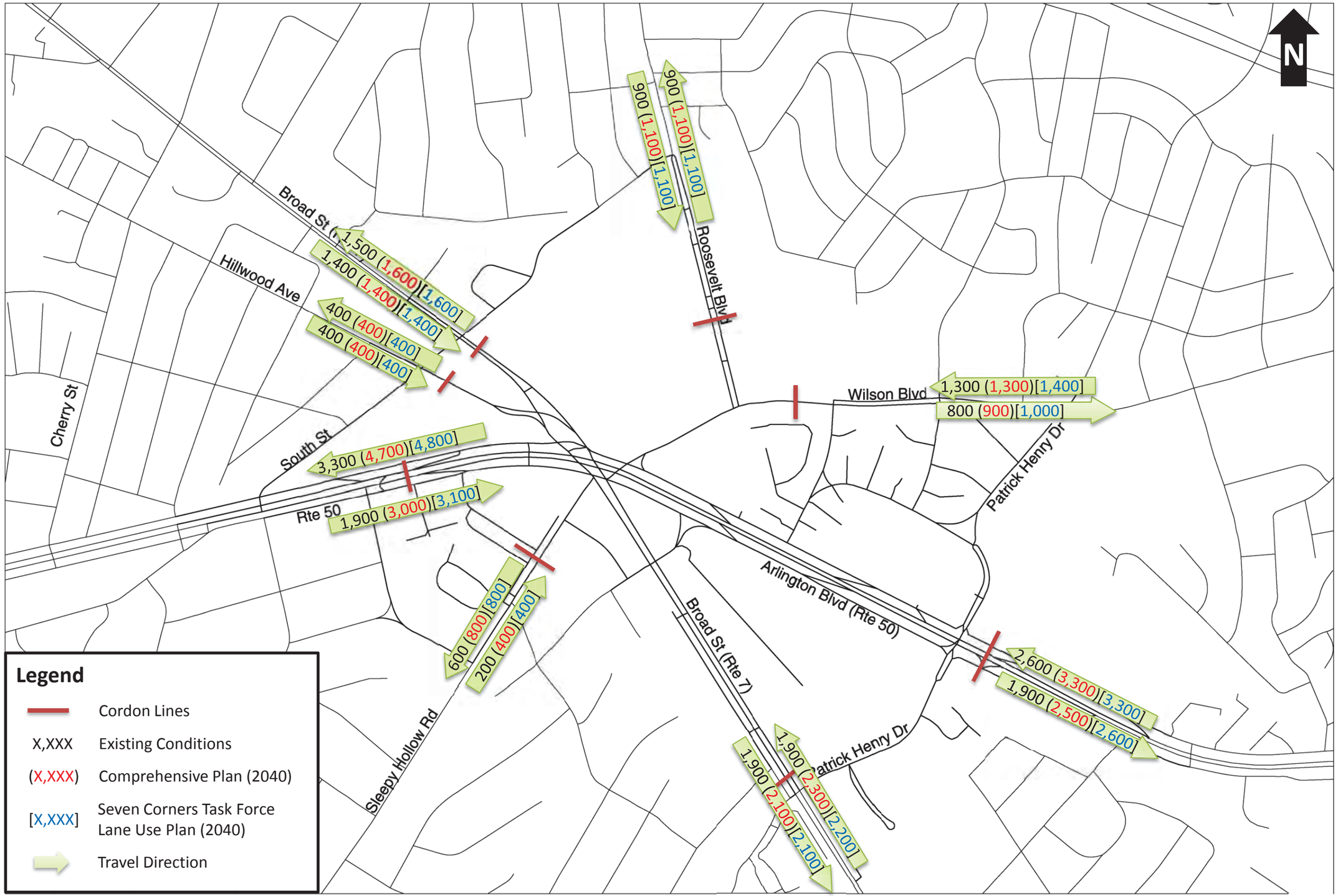


Figure 10

Travel Demand Model AM Peak Hour V/C Ratios

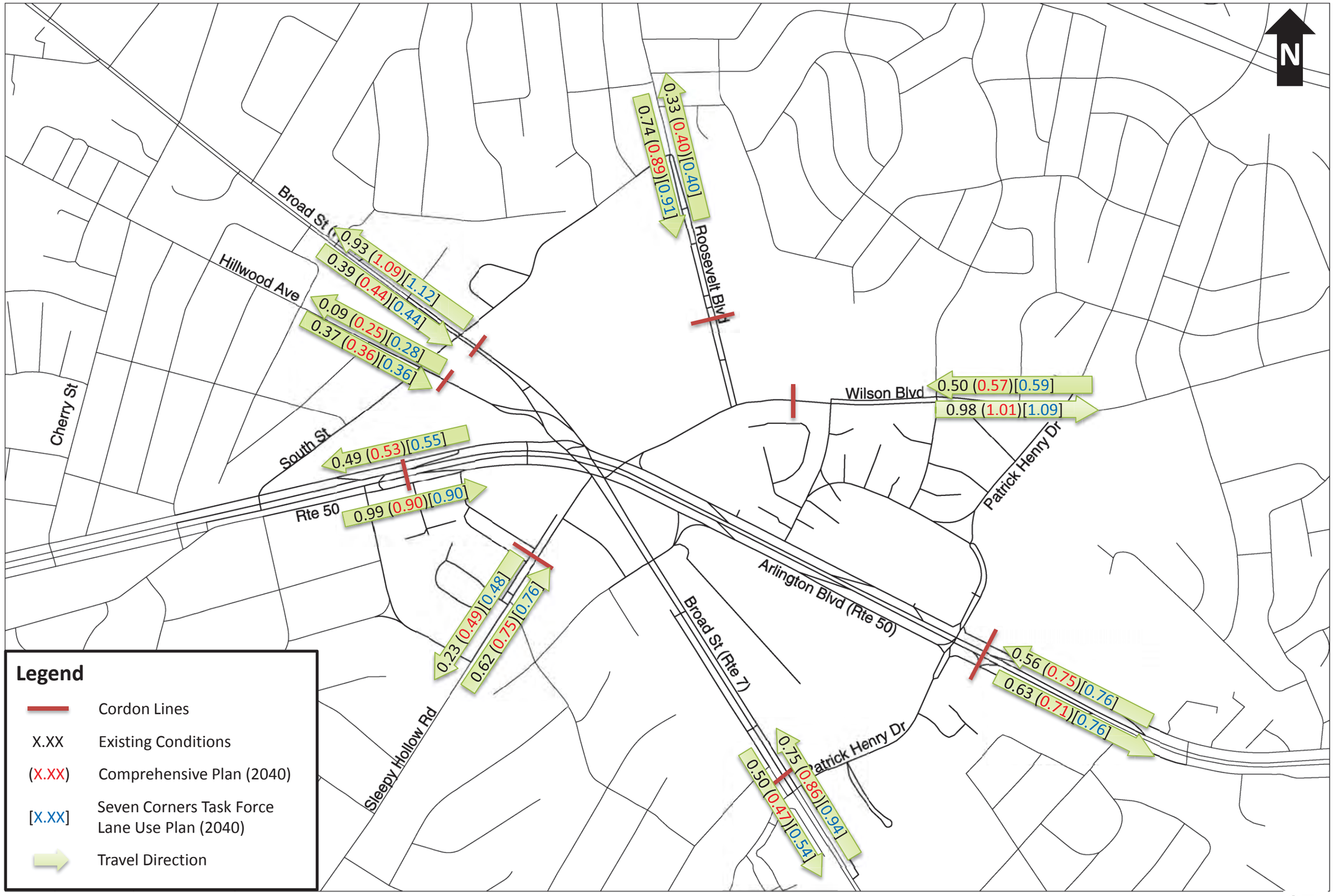
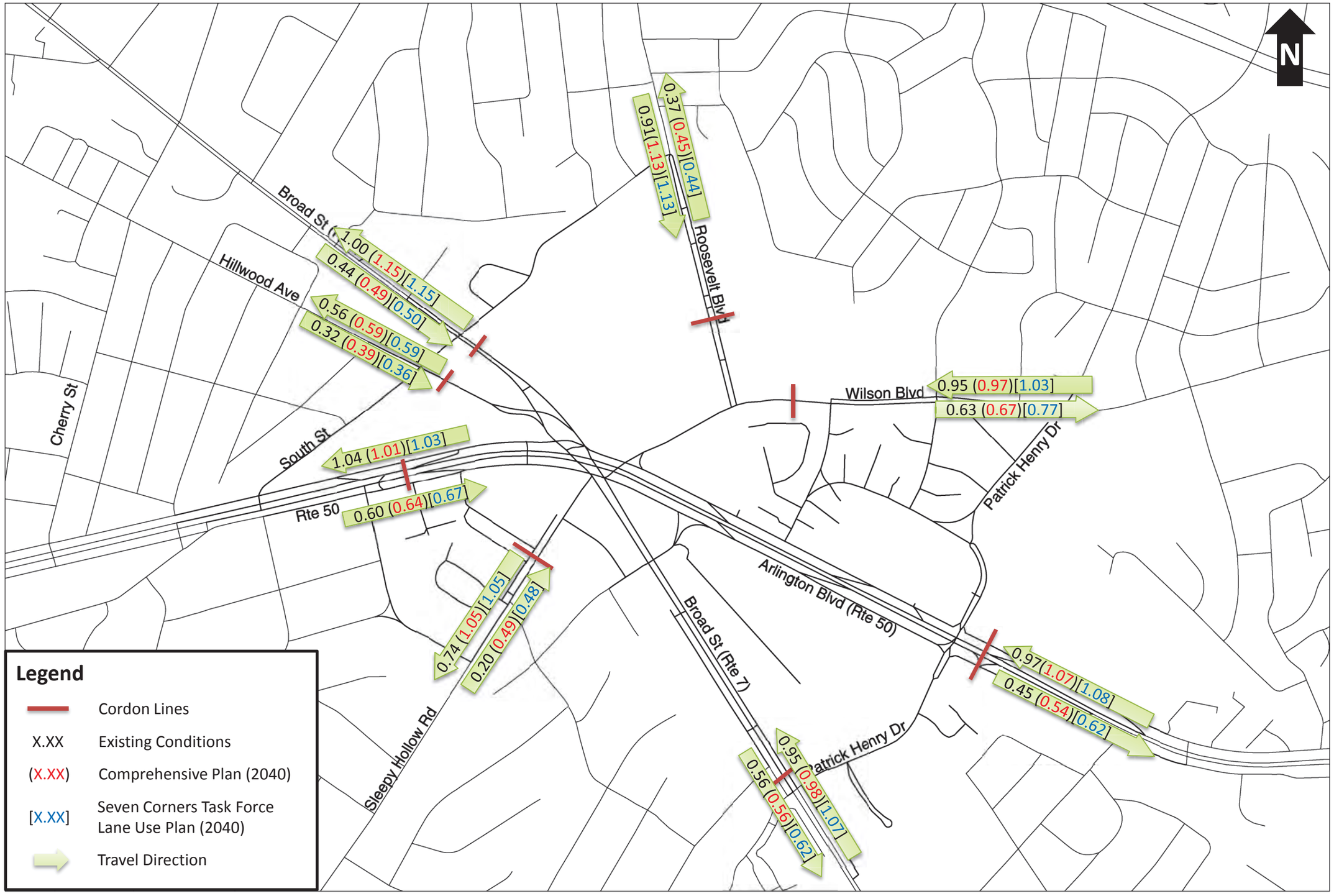


Figure 11

Travel Demand Model PM Peak Hour V/C Ratios



4.5 ORIGIN-DESTINATION MATRIX DEVELOPMENT

After developing the traffic volumes for the eight entry roadways as described in Section 4.3, the Origin-destination (O-D) travel demand matrix was created for the Comprehensive Plan and Seven Corner Task Force Land Use Plan scenarios for the a.m. and p.m. peak hours. The a.m. and p.m. peak hour demand matrices for the year 2013 existing conditions, year 2040 Comprehensive Plan, and year 2040 Seven Corner Task Force Land Use Plan scenarios are summarized in Appendix C. The entry and exit links, and external and internal zones can be seen in the map in Figure 13 on the next page following.

4.6 TRAFFIC VOLUME ASSIGNMENT

Once the origin-destination volumes were developed as described in Section 4.4, the resultant O-D volumes for the Comprehensive Plan and Seven Corners Task Force Land Use Plan scenarios were manually assigned to the roadway networks based on the following guiding principles:

- Regional movements will use roadways with the highest functional classification to avoid the local network
- Vehicles will take the fastest path between two points and travel in a manner that is consistent with existing travel behaviors, the result will reflect overall roadway and intersection network equilibrium
- Non-regional or local access movements may seek alternate paths (including local roads) to avoid congestion caused by heavy regional movements
- Vehicles will not cut-through private business access roads
- Vehicles will try to minimize the number of stops and signalized intersections to travel through, and will choose to make right-turns rather than left-turns

Figure 12 shows a simplified example of the manual assignment approach. In this example, the traffic from origin “A” to destination “B”, would only travel along a single route (highlighted in green), because that O-D route is regional movement. Traffic would also remain on Route 50 because of its functional class as a major arterial and that it has few signalized intersections. In comparison, traffic from origin “A” to destination “C” would have two likely choices of routes (highlighted in red). For the two routes between “A” and “C”, the trip using Route 50 would have fewer stops and signalized intersections to travel through. Therefore, more traffic will be assigned to that route.

After each O-D route was assigned to the network, the volumes for each route were summed together to create the turning movements at each intersection. After inputting the turning movements into Synchro, the traffic volumes were balanced and adjusted to provide a level of network equilibrium. As part of the QA/QC process, the traffic volumes at the eight primary exiting points were also developed by using NCHRP 255 methodology. The final results of the manual assignment and volume balancing was checked against the exiting volumes for the eight primary roadways, and adjustments were made if needed.

Figure 12. Example of Traffic Manual Assignment

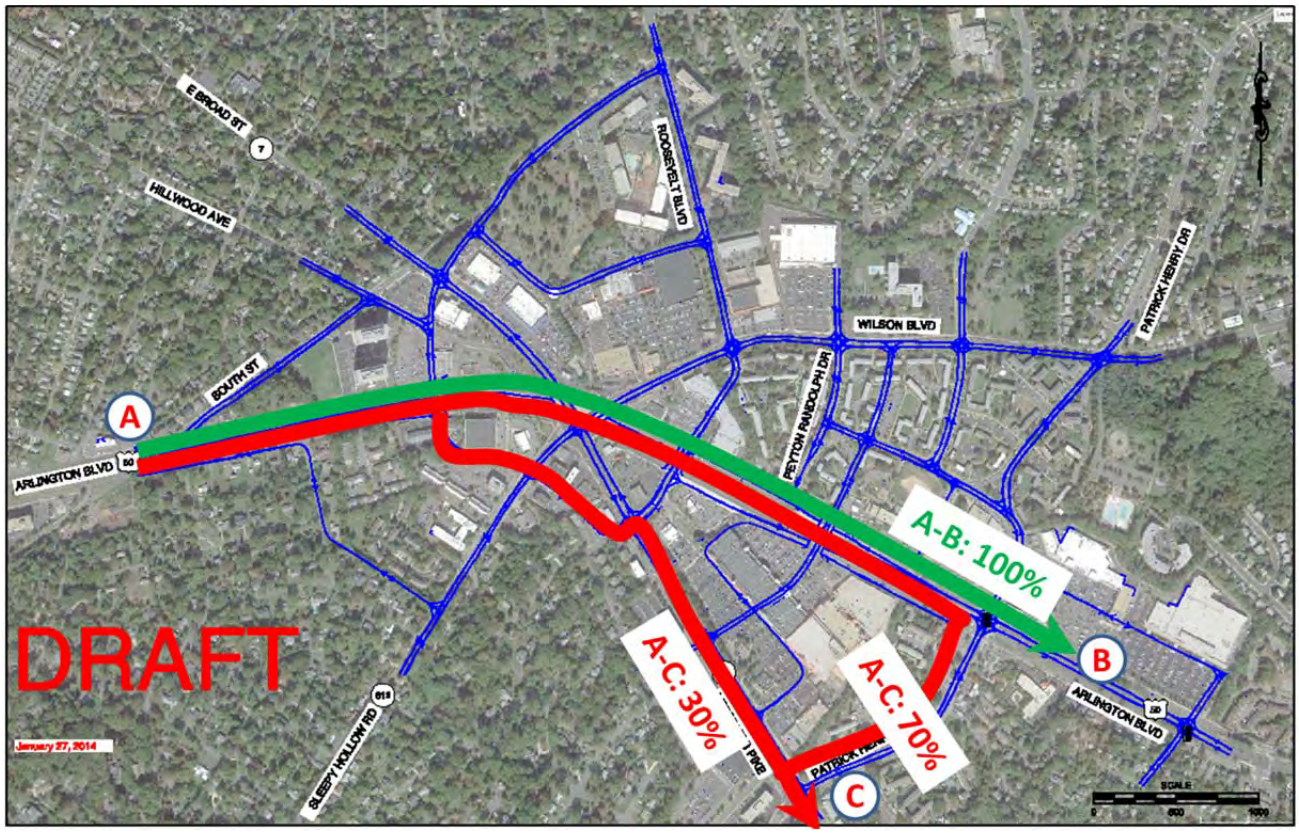


Figure 13. Origin-Destination Zone Map

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Section 5
Conceptual Design Analysis

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5. CONCEPTUAL DESIGN ANALYSIS

The three conceptual designs that advanced from the preliminary evaluation were modeled in Synchro using procedures from the HCM to evaluate their operational effectiveness with year 2040 traffic volumes. The three concepts evaluated are: Concept A - Split Diamond with Couplet (formerly Concept 2), Concept B - Two Half Diamond Interchanges (formerly Concept 4), and Concept C – Jughandles (formerly Concept 6). The Synchro analysis constituted an initial examination of traffic operations and includes: intersection operations, travel time estimates, and system-wide per-vehicle delay as a measure of effectiveness. In addition, HCS was used to evaluate merge and diverge areas on Route 50 for Concept A and Concept B. The "jughandle" intersections in Concept C would not produce equivalent merge and diverge areas because they would be signalized.

Based on the initial traffic operations results, travel time estimates, system-wide per-vehicle delay, merge/diverge analysis, and other factors (overall system connectivity, for example) identified by the Seven Corners Task Force, Concept A was removed from further evaluation during the Seven Corners Task Force meeting on March 11, 2014.

At the end of the March 11th Task Force meeting, Fairfax County staff and the Seven Corners Task Force requested that Concept B and Concept C move forward for more detailed analysis on pedestrian and bicycle mobility, transit network connectivity, and construction phasing. The detailed analysis of Concept B and Concept C formed the basis of the final recommendation from Fairfax County staff and the Seven Corners Task Force: to advance Concept B as the most appropriate conceptual design for the Seven Corners area.

5.1 DEVELOPMENT OF SYNCHRO FILES

The single-line sketches for the three conceptual designs were modeled in Synchro with the year 2040 traffic volumes retrieved from the manual assignment results. The Synchro models were designed to represent typical or expected configurations for each of the conceptual designs. Parameters such as the number of lanes, lane assignments, presence and storage length of turn lanes were determined by the assigned traffic volumes for intersection movements and street segments. Traffic speeds were assigned based on FCDOT's functional classification in accordance with VDOT guidelines. Other parameters set in Synchro were heavy vehicle percentage and peak hour factors.

For the conceptual designs, signal timing settings and phasing information hewed closely to existing parameters that are typical in the field and at intersections in the Seven Corners study area. Signal control types for permissive or protective phasing were influenced by turning volumes. Cycle lengths, coordination, and intersection offsets were based upon optimized values that would enhance corridor throughput and expected travel patterns such as westbound Route 7 during the a.m. peak hour or westbound Route 50 in the p.m. peak hour. Yellow and all-red intervals, pedestrian walk and don't walk timing were based on intersection widths and used similar values to equivalent signals in the study area today.

Figure 14, Figure 15, and Figure 16 show diagrams of the Synchro network for each conceptual design, including the number of lanes and lane assignments for Concept A, Concept B, and Concept C, respectively.

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Figure 14. Synchro Network for Concept A with Lane Assignments

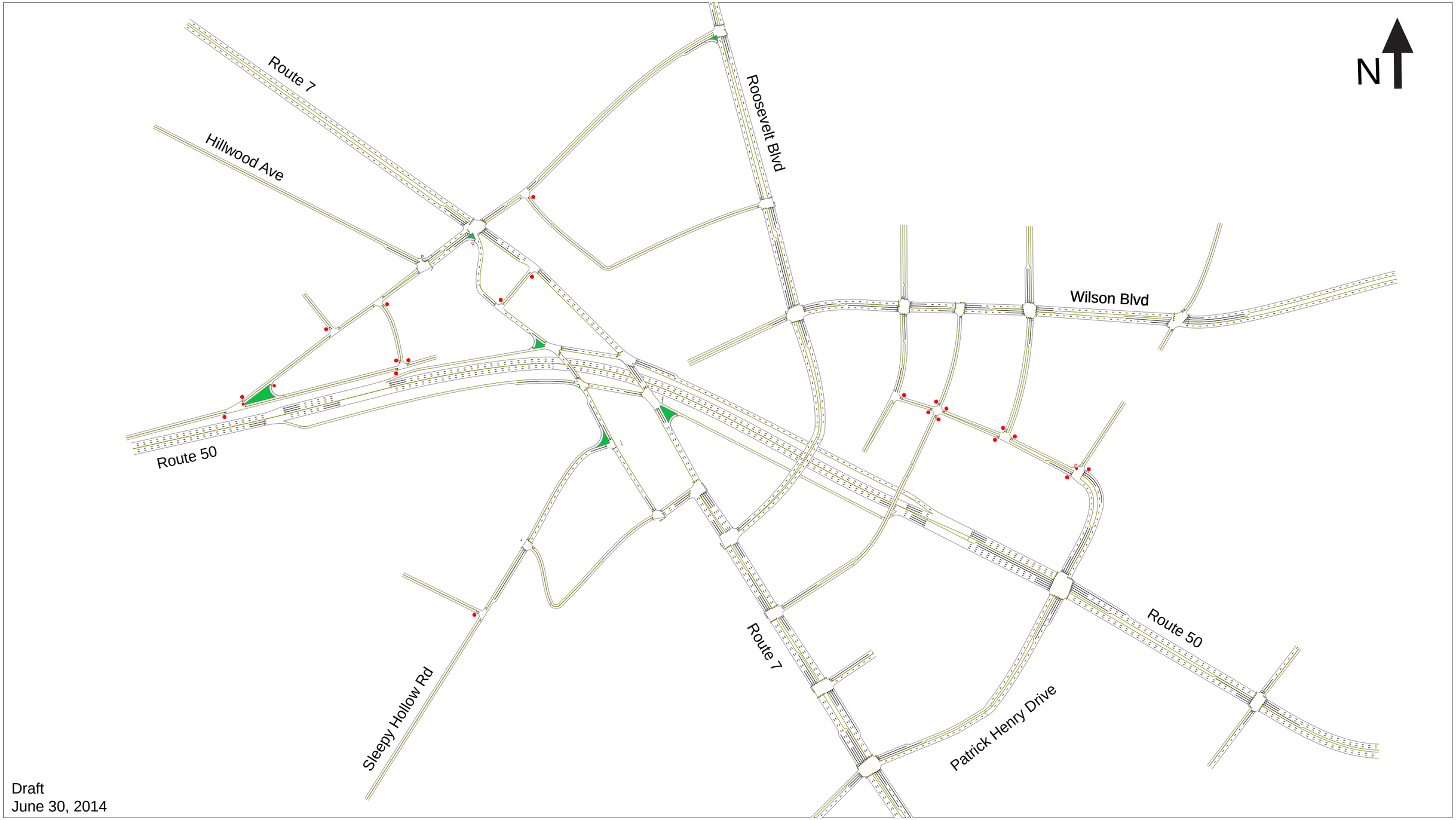


Figure 15. Synchro Network for Concept B with Lane Assignments

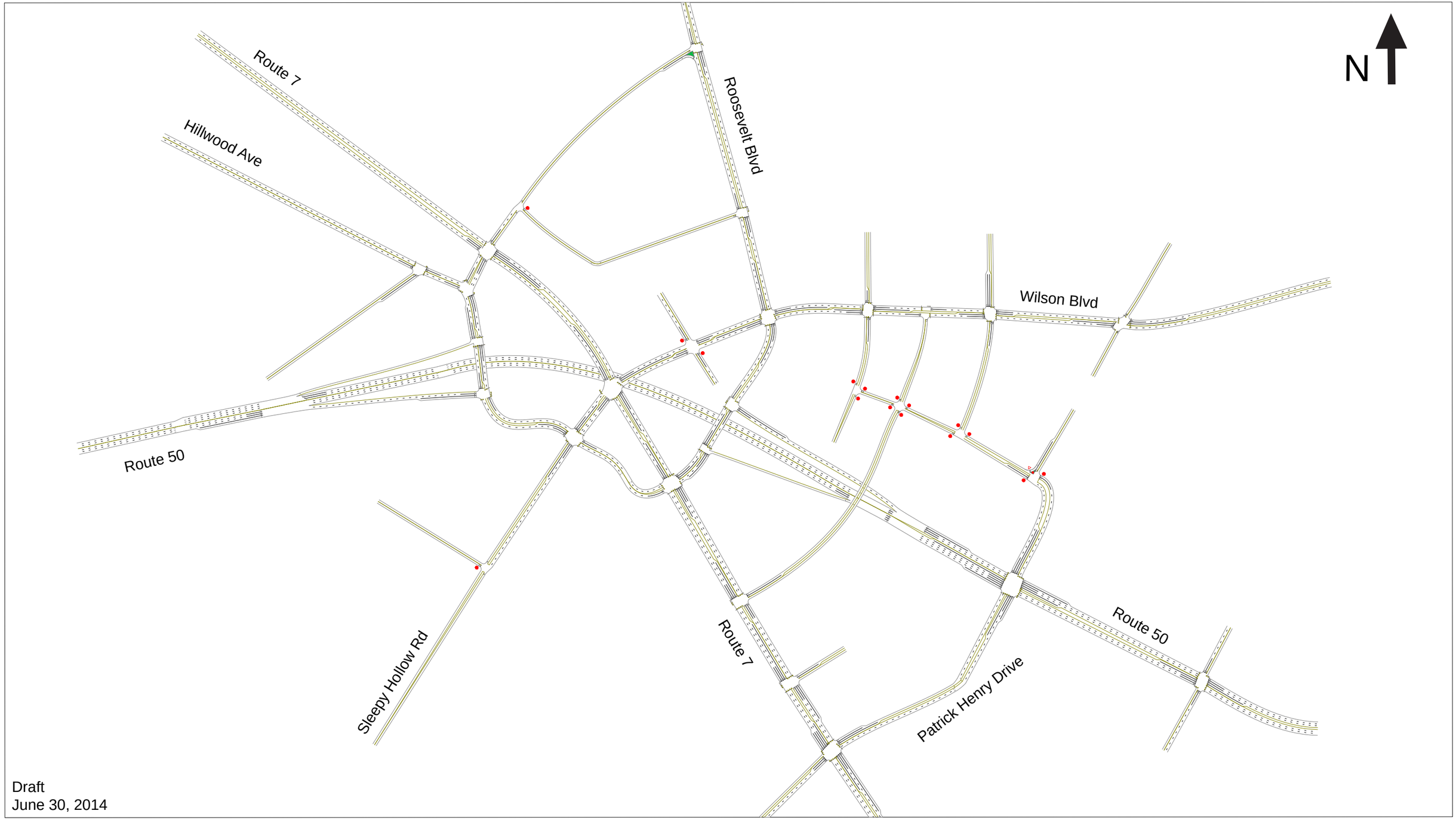
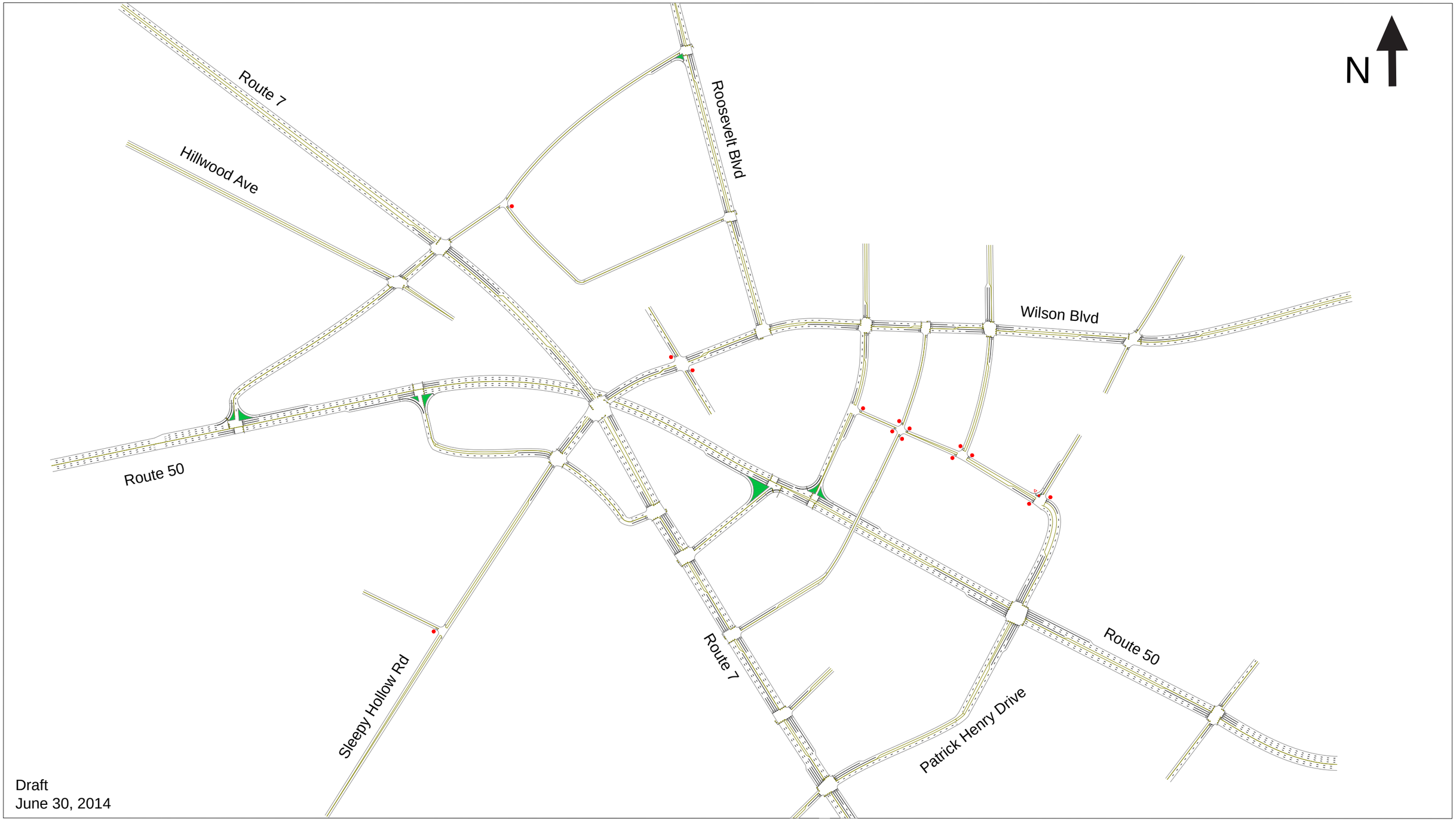


Figure 16. Synchro Network for Concept C with Lane Assignments



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5.2 TRAFFIC ANALYSIS RESULTS

The initial review of the three conceptual designs focuses on the traffic operations analysis and measures of effectiveness (MOEs) as shown below. This analysis seeks to identify movements that would be over-capacity and locations that would experience excessive queuing, as well as route travel times and overall system performance. The initial analyses evaluated the following four areas:

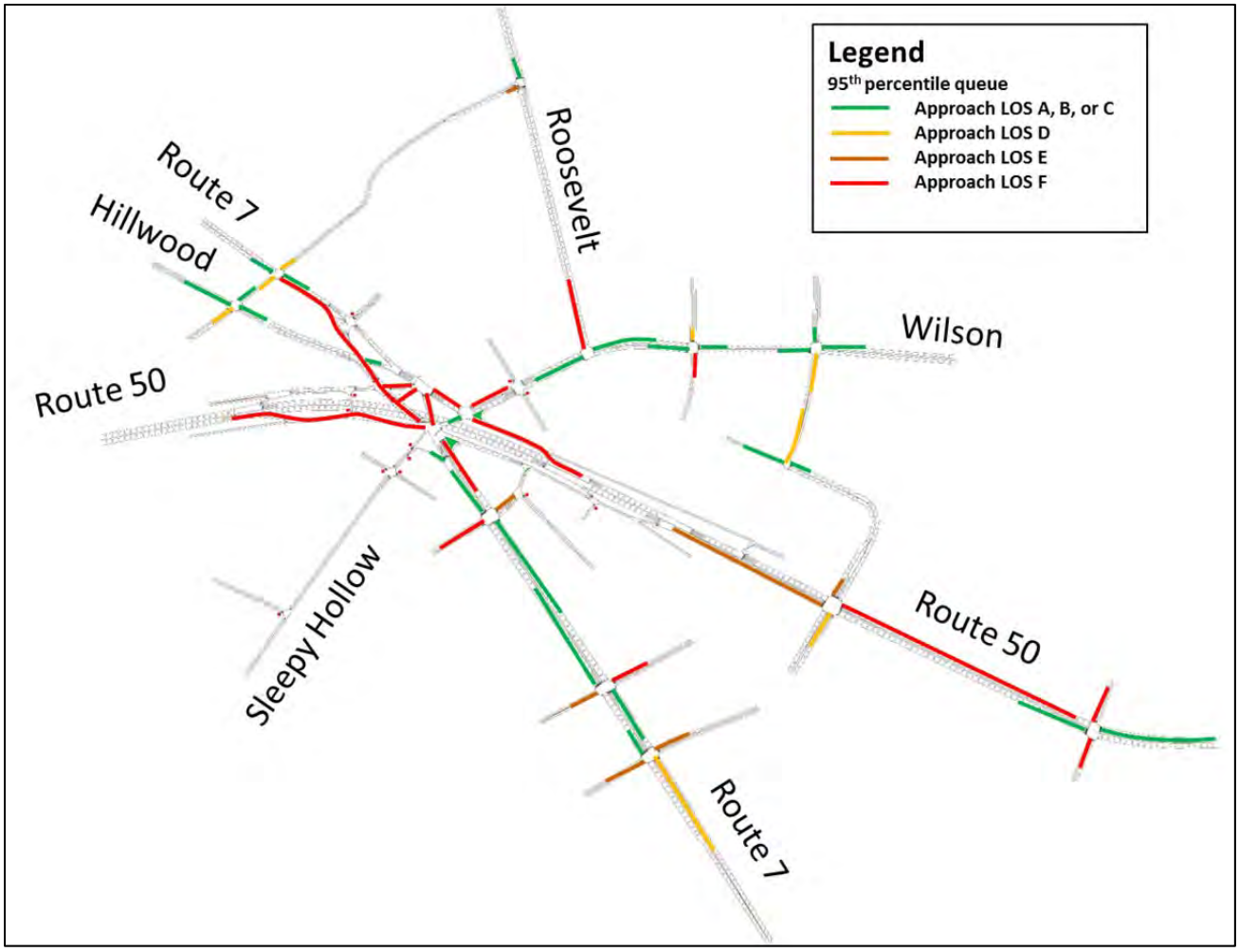
- **Intersections and queuing**: Evaluated using Synchro to develop MOEs that include: queue length and movement level of service (LOS).
- **Merge/diverge areas**: Evaluated using HCS to report level-of-service results based on density calculations
- **Roadway segments**: Travel times were measured for a subset of origin-destination pairs for each of the three conceptual designs
- **System-wide:** Summarized average system-wide per-vehicle delay by summing the per-vehicle delay at each signalized intersection

5.2.1 Intersections and Queuing

For each intersection within the study area, the 95th percentile queue and LOS by approach were evaluated. Figure 17, Figure 18, Figure 19, and Figure 20 on the following pages show the 95th percentile queue and LOS of each approach for the year 2040 Comprehensive Plan, Concept A, Concept B, and Concept C, respectively. The combination of the 95th percentile queue and approach LOS demonstrates the operational performance of the approach at the signalized intersection because it relates the level of delay with the number of vehicles experiencing the delay. The length of the different colors lines represents the 95th percentile queue for the approach. The colors represent different LOS for the approaches, with green representing LOS “A”, “B” or “C” operations, yellow LOS “D”, brown LOS “E” and red LOS “F”. All the analyses were conducted for the p.m. peak hour because the traffic demand is higher than the a.m. peak hour, and this level of detail was sufficient at the preliminary level of traffic analysis.

5.2.1.1 Year 2040 Comprehensive Plan

Figure 17. 95th Percentile Queues and LOS by Approach for the Comprehensive Plan (PM Peak Hour)

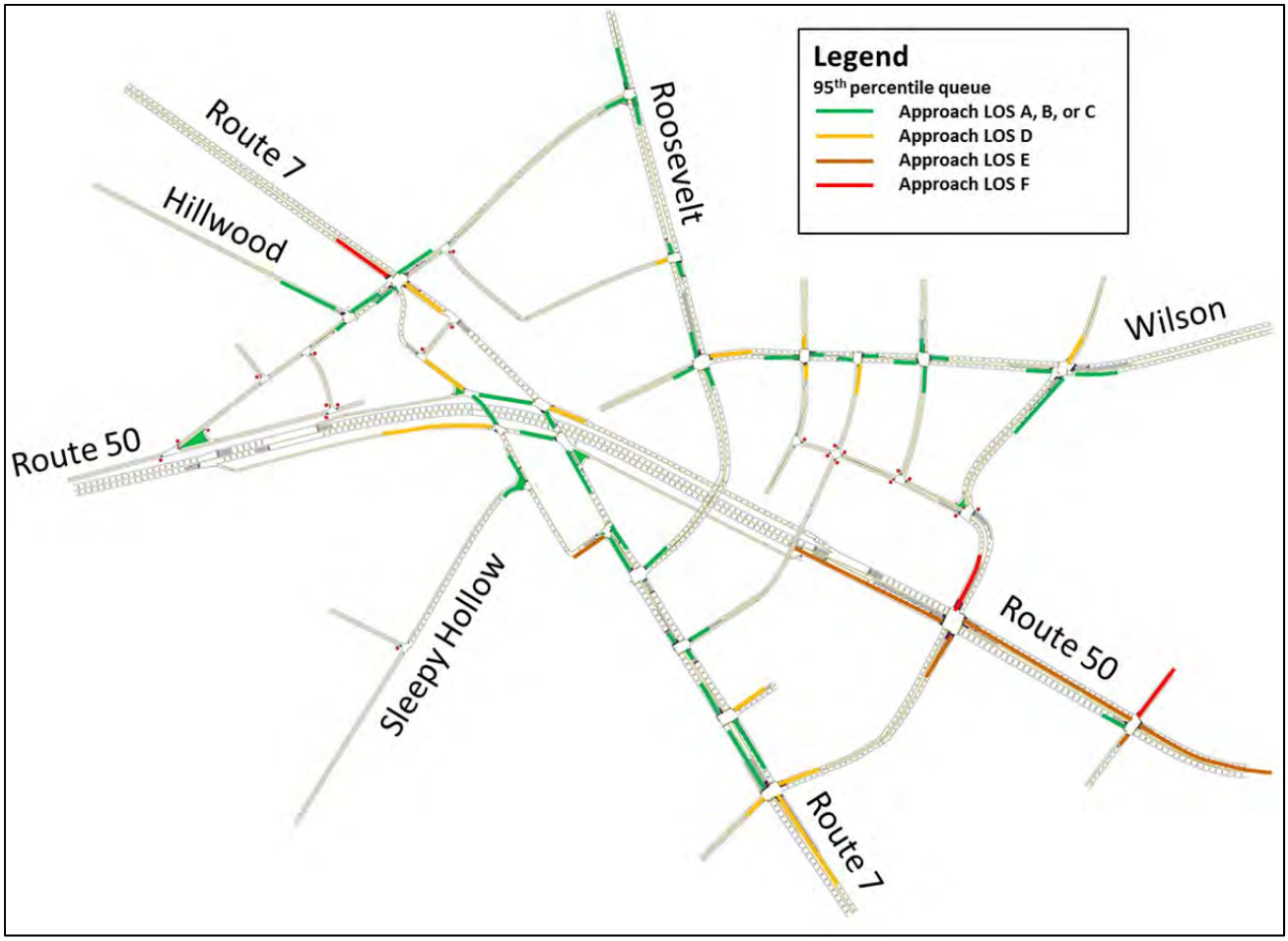


Based on Figure 17, the key highlights of the Comprehensive Plan scenario are summarized as follows:

- Vehicle congestion would be worse than existing conditions
- Demand would substantially exceeds the capacity of the interchange area
- Off-ramp queuing would extend onto Route 50
- Both Route 50 and Route 7 would experience extensive congestion
- The intersection of Route 50/Patrick Henry Drive would operate above capacity and queuing would spillback to adjacent intersections and ramps
- Queues would block driveways and access points

5.2.1.2 Year 2040 Concept A

Figure 18. 95th Percentile Queues and LOS by Approach for Concept A (PM Peak Hour)

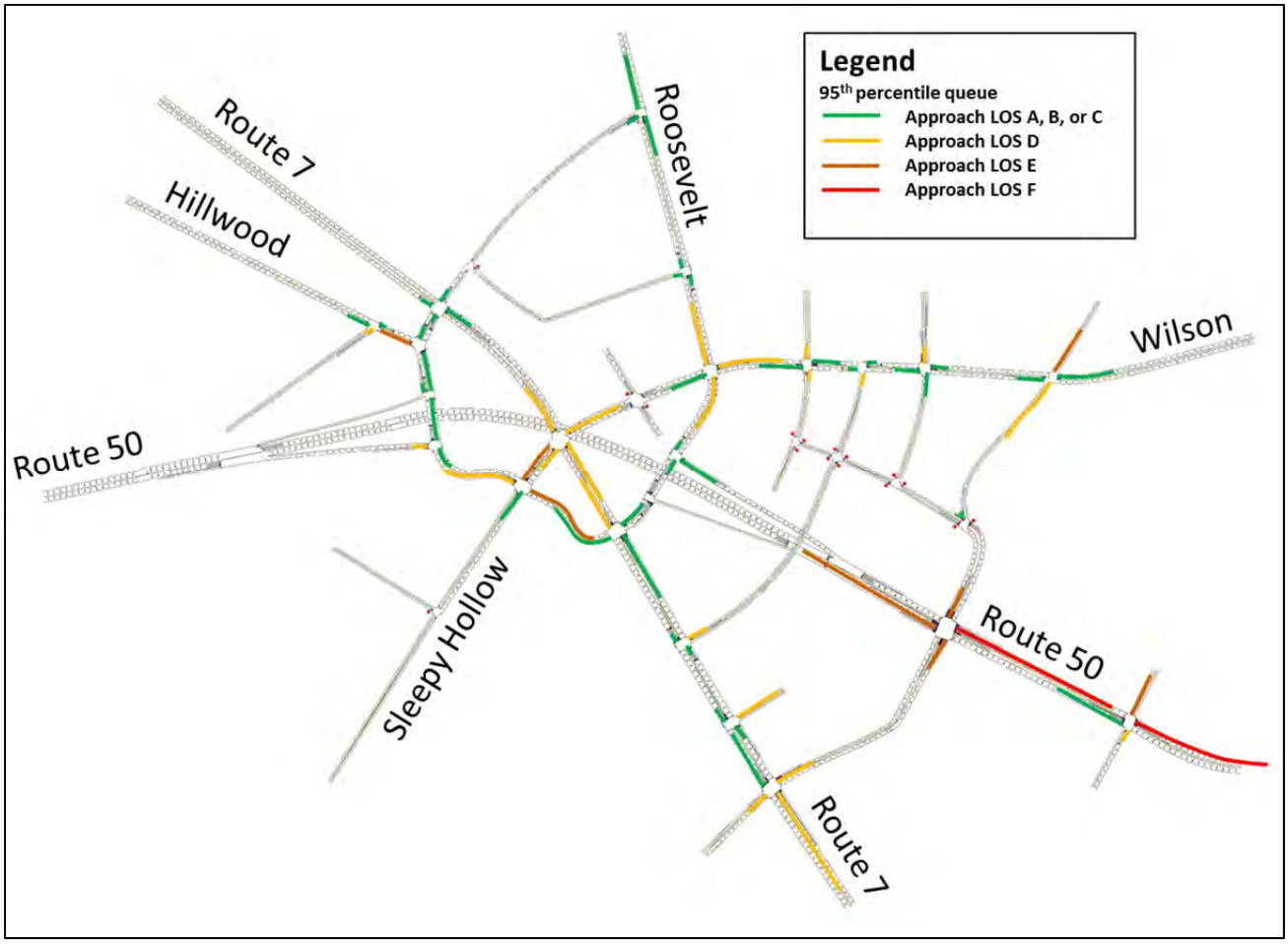


Based on Figure 18, the key highlights of Concept A are summarized as follows:

- The new interchange provides a direct connection between Route 50 and Route 7 that would operate at LOS D or better and not experience queuing that substantially affected adjacent intersections
- The intersection of Route 50/Patrick Henry Drive would operate above capacity and queuing would spillback to adjacent intersections and ramps
- Eastbound Route 7 would experience LOS “F” operations and queuing

5.2.1.3 Year 2040 Concept B

Figure 19. 95th Percentile Queues and LOS by Approach for Concept B (PM Peak Hour)

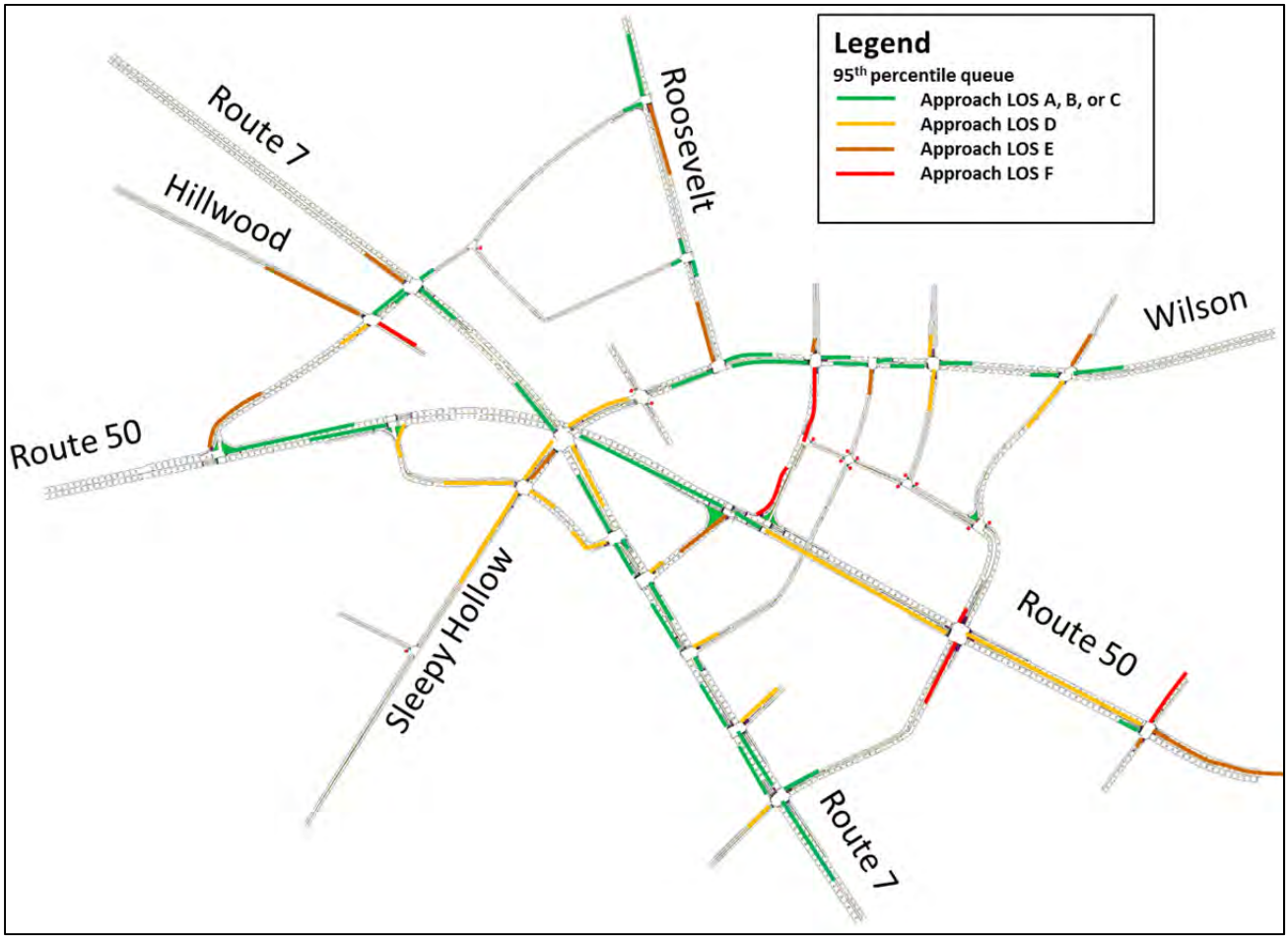


Based on Figure 19, the key highlights of Concept B are summarized as follows:

- The new interchange ramp terminals would not operate at capacity or experience substantial queuing
- The intersection of Route 50/Patrick Henry Drive would operate above capacity and queuing would spillback to adjacent intersections and ramps
- The connection between westbound Route 7 and the Route 50 westbound on-ramp would experience LOS "E" operations and queuing that would spillback to adjacent intersections
- The "Ring road" and new overcrossings would be able to accommodate forecasted traffic volumes
- There would be congestion at the Sleepy Hollow Drive/Castle Road intersection
- The intersections along the direct connection between Route 7 and Roosevelt Boulevard would operate at LOS "D" or better

5.2.1.4 Year 2040 Concept C

Figure 20. 95th Percentile Queues and LOS by Approach for Concept C (PM Peak Hour)



Based on Figure 20, the key highlights of Concept C are summarized as follows:

- Three of the "jughandle" ramp terminals would operate at LOS "E" or "F" and experience spillback queuing that could affect upstream intersections
- All Route 50 half signalized intersections at the "jughandle" ramp terminals would experience delay for vehicles on Route 50
- The intersection of Route 50/Patrick Henry Drive would operate above capacity and queuing would spillback to adjacent intersections.
- Eastbound Sleepy Hollow Road would experience LOS "E" operations and spillback queuing at the intersection at Wilson Boulevard
- The intersection of Sleepy Hollow Drive/Castle Road would experience congestion
- The eastbound approaches to the South Street/Hillwood Ave and South Street/Route intersections would operate at LOS "E"

5.2.2 Travel Time of Roadway Segments

The travel time for the four highest volume origin-destination pairs is summarized in Table 8 for the year 2013 existing conditions, Comprehensive Plan, Concept A, Concept B, and Concept C. The travel time comparison identifies the effects of different conceptual designs on the primary O-D pairs, if any. The travel time results are the sum of the travel time between intersections and the intersection delay for the movement in the direction of travel.

Table 8. Travel Time of Four Highest Volume O-D Pairs

Scenario	Origin-Destination Route Travel Time (minutes)			
	#1	#2	#3	#4
	From Route 50/Patrick Henry	From Route 50/South St	From Route 7/South St	From Route 50/South St
	To Route 50/South St	To Route 50/Patrick Henry	To Route 7/Patrick Henry	To Route 7/Patrick Henry
Existing (2013)	4.4	2.7	6.1	5.7
Comprehensive Plan (2040)	4.7	2.7	9.5	9.6
Concept A (2040)	3.2	3.2	5.9	5.6
Concept B (2040)	3.3	3.1	3.2	4.4
Concept C (2040)	3.5	3.2	3.8	3.8

Travel times for the Comprehensive Plan generally increase relative to existing conditions. All three conceptual designs are an improvement over the year 2040 Comprehensive Plan, with the exception of the route #2. A comparison among the three conceptual designs shows that Concept B and Concept C perform much better for O-D routes #3 and #4.

5.2.3 System-wide Performance

The system-wide average vehicle delay is summarized as follows for year 2013 existing conditions, and the Comprehensive Plan, Concept A, Concept B, and Concept C. The average vehicle delay comparison identifies the effects of different conceptual designs on mobility within the entire study area. System-wide average vehicle delay was calculated as the weighted average of the average vehicle delay per intersection and the total entering vehicles per intersection. The results are as follows:

- Existing condition (year 2013): **42.5** seconds/vehicle
- Comprehensive Plan (year 2040): **98.3** seconds/vehicle
- Concept A (year 2040): **40.2** seconds/vehicle
- Concept B (year 2040): **31.9** seconds/vehicle
- Concept C (year 2040): **30.7** seconds/vehicle

The results indicate the system-wide delay in the Comprehensive Plan scenario is more than twice as high as during existing conditions. All three of the conceptual design scenarios improve upon the performance of

the Comprehensive Plan scenario and would have results similar or better than existing conditions, with Concept B and Concept C performing the best of the three conceptual designs.

5.2.4 Merge/Diverge Areas

The merge and diverge segments for the off- and on-ramp connections to/from Route 50 for Concept A and Concept B were evaluated. The "jughandles" in Concept C do not have equivalent merge/diverge areas. The HCM 2010 does not have methodologies available for merge/diverge segments on signalized arterial roadways with posted speeds of 45 mph or less. As suggested by the HCM 2010, the methodologies for freeway merge/diverge segments can be applied in an approximate manner to uncontrolled ramp terminals on other facilities, such as multilane two-lane highways. The use of the freeway methodologies for the signalized sections of Route 50 does not fully represent the expected operational performance of the merge/diverge segments because the methodologies are developed for freeway ramps. However, this methodology does provide a good indication of any potential operational issues.

The HCM 2010 uses vehicle densities to evaluate the operational performance (i.e., level of service) of the freeway merge/diverge segments using the criteria from Exhibit 13-2 in the HCM 2010. Table 9 and Table 10 summarize the operational performance of the merging and diverging segments for Concept A and Concept B; all merge/diverge segments would operate at LOS C or better. A technical memorandum describing the merge/diverge analysis in detail can be found in Appendix D.

Table 9. Summary of Operational Results for Merge and Diverge Segments (AM Peak Hour)

Type	Location	Concept A		Concept B	
		Density (pc/mi/ln)	LOS	Density (pc/mi/ln)	LOS
On-ramp merge	To Route 50 westbound	16.4	B	19.2	B
Off-ramp diverge	From Route 50 eastbound	26.4	C	6.5	A
On-ramp merge	To Route 50 eastbound	23.4	C	20.1	C
Off-ramp diverge	From Route 50 westbound	8.4	A	7.6	A

Table 10. Summary of Operational Results for Merge and Diverge Segments (PM Peak Hour)

Type	Location	Concept A		Concept B	
		Density (pc/mi/ln)	LOS	Density (pc/mi/ln)	LOS
On-ramp merge	To Route 50 westbound	19.9	B	22.5	C
Off-ramp diverge	From Route 50 eastbound	22.8	C	4.8	A
On-ramp merge	To Route 50 eastbound	18.8	B	15.9	B
Off-ramp diverge	From Route 50 westbound	10.3	B	10.0	B

5.3 BICYCLE, PEDESTRIAN, AND TRANSIT ANALYSES

Fairfax County staff met with the following public agencies: VDOT, Arlington County, City of Falls Church, and the Fairfax County Supervisors from the Mason and Providence districts for their input and feedback on Concept B and Concept C. At the final Seven Corners Task Force presentation on April 8, 2014, the project team and County staff presented further data on the potential for the bicycle networks, the opportunities to increase pedestrian usage within the study area, and the potential transit network for Concept B and Concept C. The following section details the bicycle, pedestrian, and transit results presented at the final Seven Corners Task Force meeting.

5.3.1 Bicycle Network Analysis

Fairfax County's Bicycle Master Plan includes bicycle facility recommendations within the study area, as shown in Figure 21, but is limited to the existing roadway network. Feedback throughout the study indicated that it is desirable to expand bicycle connectivity in the future as part of any changes to transportation network. Expanded bicycle connectivity can be implemented through the addition of bicycle lanes, cycletracks, multiuse trails, dedicated bicycle routes or other treatments on or parallel to existing and new roads. Concept B or Concept C allow for the expansion of the bicycle master plan as shown in Figure 22 and Figure 23, respectively, on the following page, and would provide more opportunities for direct paths within the new roadway network. However, with a new Route 50 crossing on the west side of the Seven Corners Interchange and a direct connection from Route 7 to Roosevelt Boulevard, and to the East Falls Church Metrorail Station, Concept B provides greater bicycle connectivity when compared to Concept C.

Figure 21. Seven Corners Bicycle Master Plan

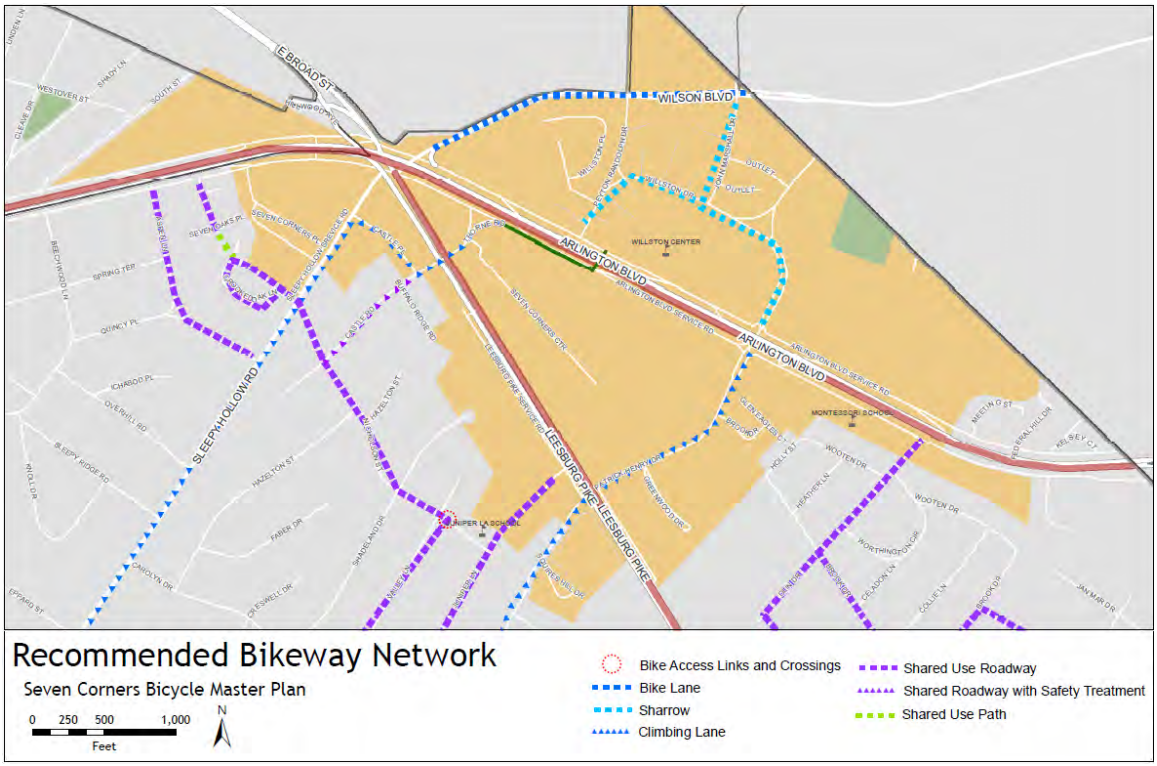


Figure 22. Concept B Proposed Bicycle and Pedestrian Facilities

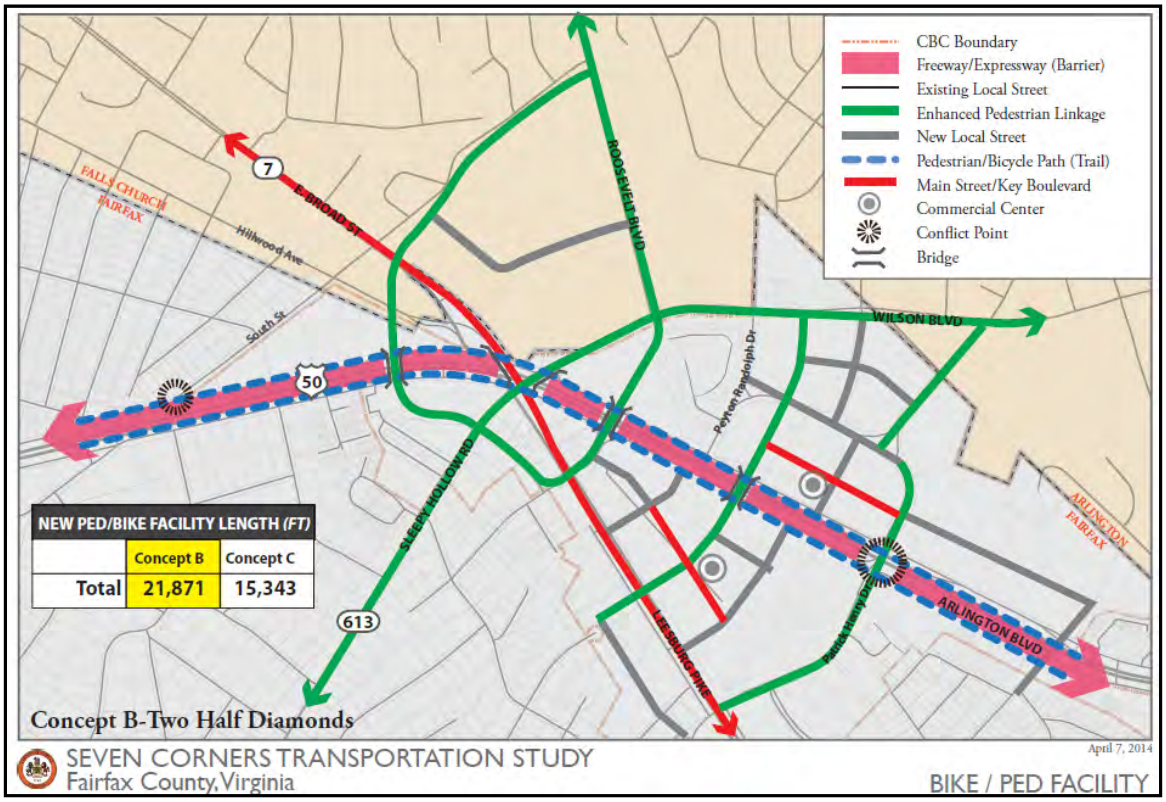
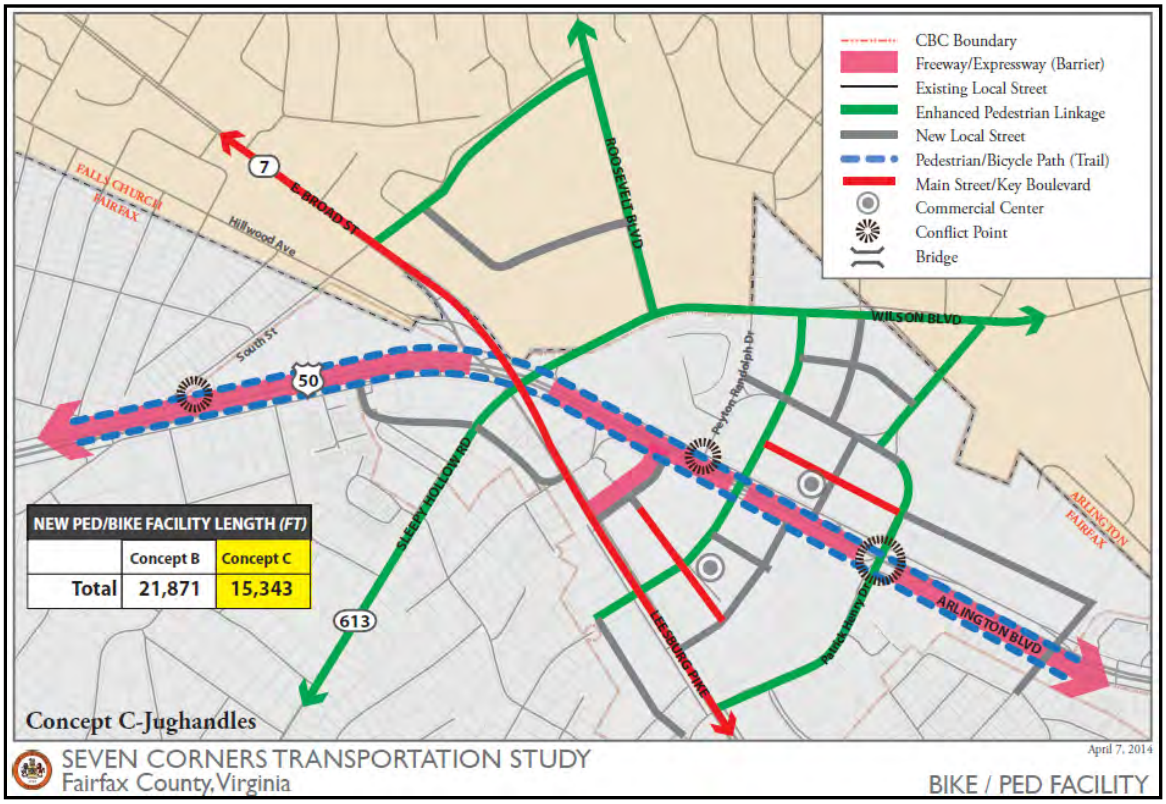


Figure 23. Concept C Proposed Bicycle and Pedestrian Facilities



5.3.2 Pedestrian Walkshed Analysis

Improving pedestrian connectivity is essential to supporting the transformation of the Seven Corners transportation network. For this reason, pedestrian walkshed analyses were conducted for Concept B and Concept C and compared with the Comprehensive Plan network, to determine each concept's contribution toward expanding pedestrian connectivity in Seven Corners. The walkshed was measured using the location of the existing Seven Corners transit center south of Route 50, a central point for the proposed neighborhood north of Route 50, and a point west of the interchange area. Five- and ten-minute walksheds were developed based on an assumed average walking distance/speed of 4.4 feet per second using the existing and proposed links in each Concept. The walkshed maps can be seen below and on the following page in Figure 24, Figure 25, and Figure 26.

The Comprehensive Plan walkshed shows that within a ten-minute walk from the Seven Corners Transit Center, a pedestrian would not be able to reach the north side of Route 50 and would only have access to the Seven Corners Shopping Center and some businesses along Route 7. Concept B includes three new crossings of Route 50, including one on the west side of the Seven Corners Interchange, which greatly improves pedestrian connectivity in Seven Corners. The Concept B walkshed shows that within a ten-minute walk from the Seven Corners Transit Center, a pedestrian would be able to reach a fair distance up Roosevelt Boulevard, areas west of the Seven Corners Interchange and as far east as Patrick Henry Drive. With only one new Route 50 crossing, Concept C improves pedestrian connectivity when compared with the Comprehensive Plan, but does not provide as much connectivity as Concept B. With Concept C, areas only separated from the Seven Corners Transit Center by Route 50 are more than a ten minute walk.

Figure 24. Pedestrian Walkshed: Comprehensive Plan

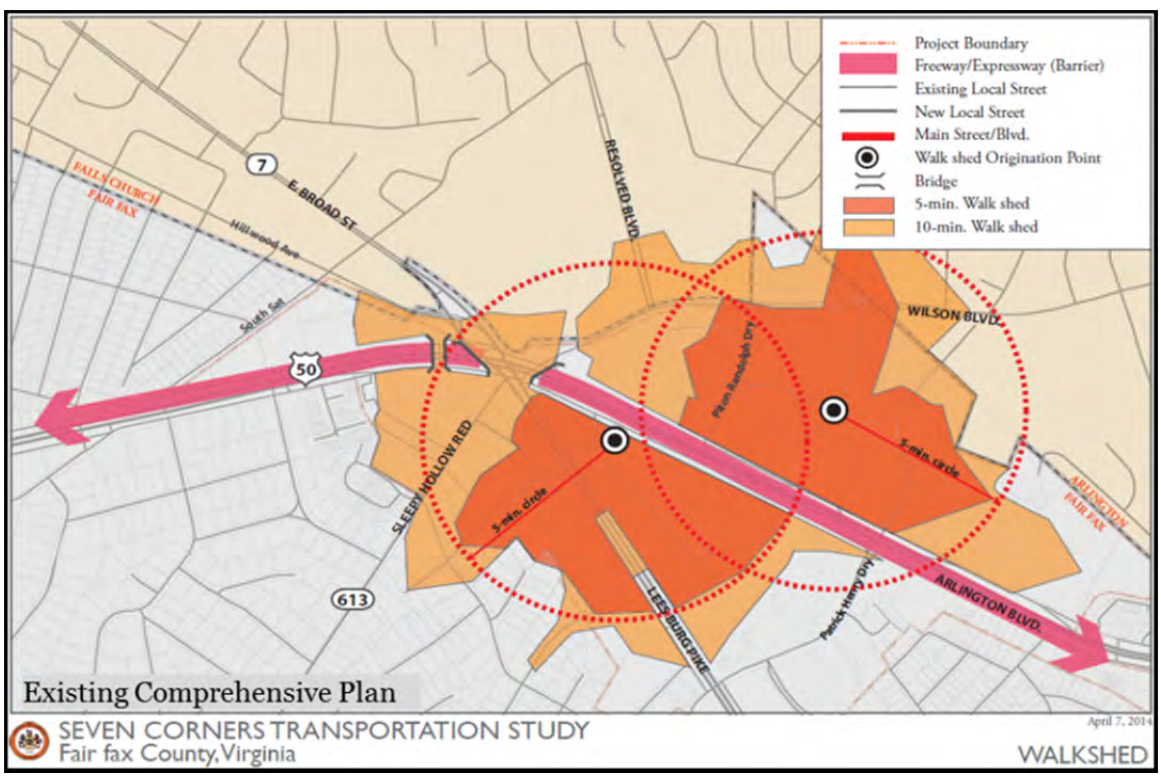


Figure 25. Pedestrian Walkshed: Concept B

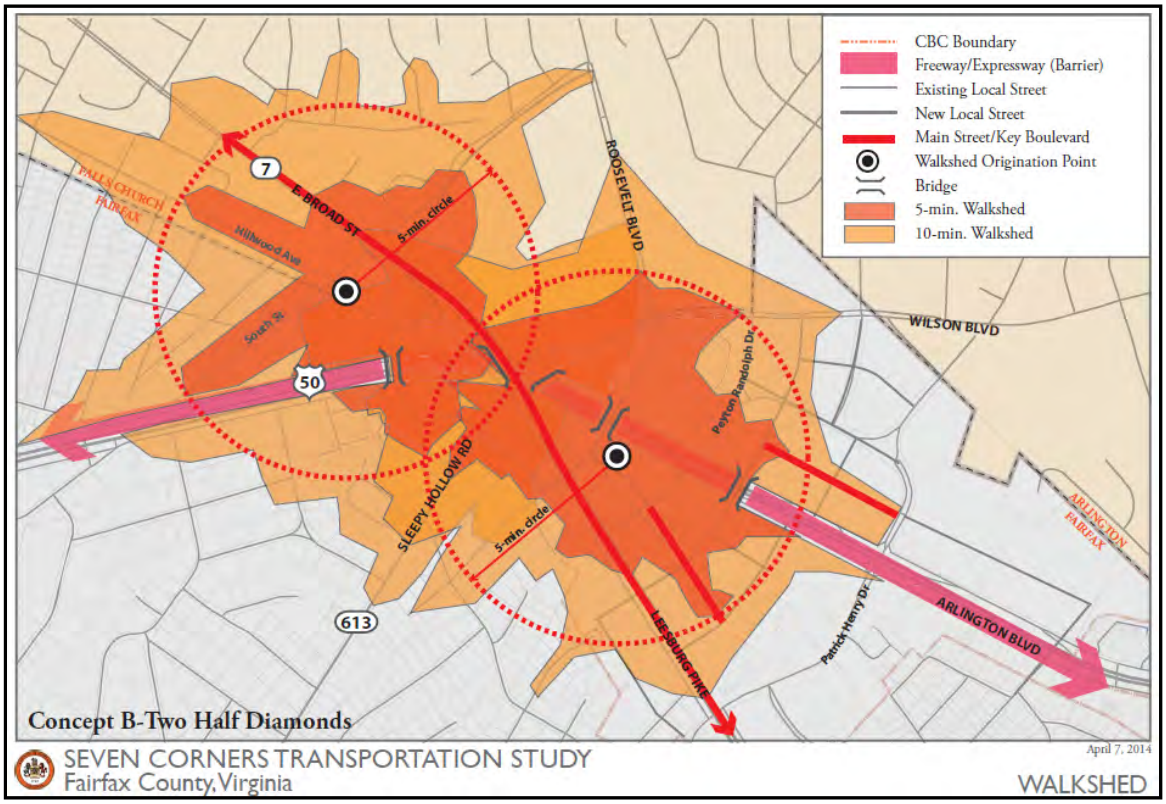
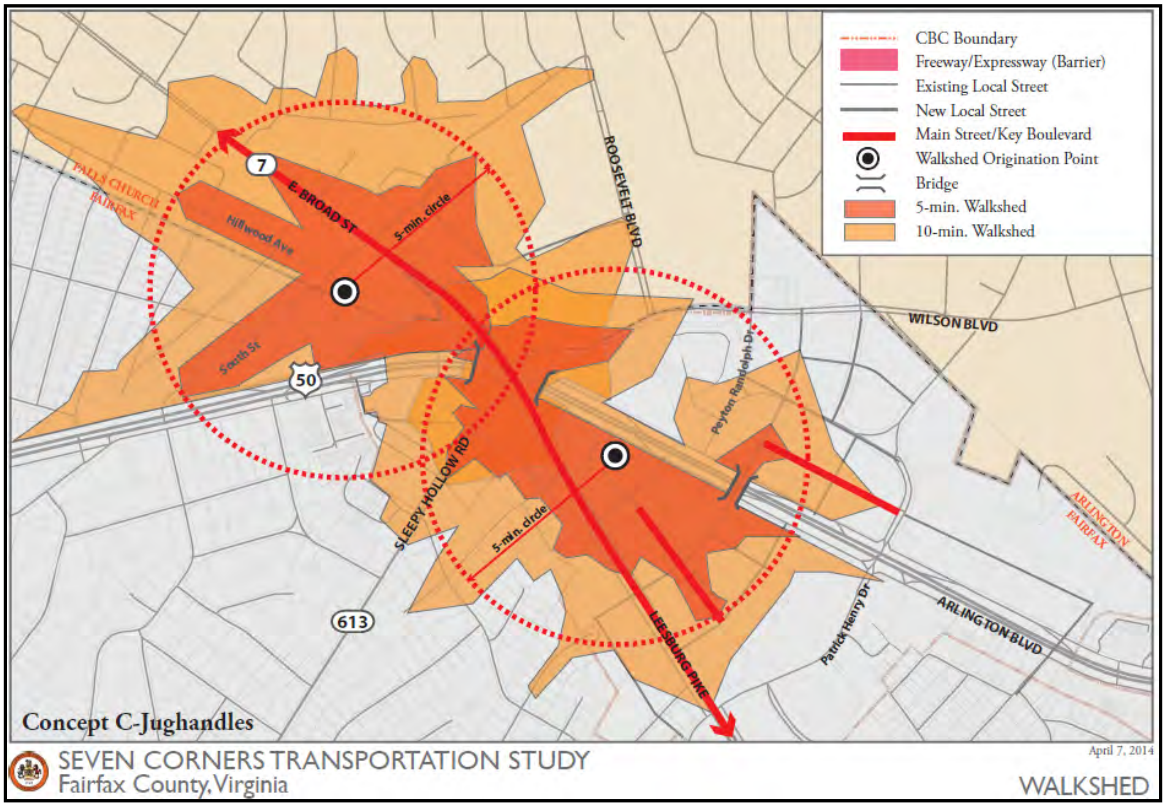


Figure 26. Pedestrian Walkshed: Concept C



5.3.3 Transit Analysis

The potential for improvement to the Seven Corners area transit network and service was evaluated at a qualitative level, and focused on a planning-level assessment of the following: opportunity for Bus Rapid Transit (BRT) or Light Rail Transit (LRT) service, introduction of a local area circulator system, local bus service, transit center relocation options, and transit integration with the larger multimodal system. In addition, feedback from the planning charrette and the Seven Corners Task Force was incorporated. This primarily includes the desire that the transit system provide superior service to and from the East Falls Church Metrorail Station and that buses should provide opportunities to travel to, from, and within Seven Corners.

Both Concept B and Concept C have the ability to accommodate either BRT or LRT service along Route 7, in accordance with the findings from the Fairfax County Countywide Transit Network Study. The direct connection from Route 7 to Roosevelt Boulevard (and thus the East Falls Metro Station) would be a substantial asset in Concept B for circulator service to/from the station. Both Concept B and Concept C provide multiple opportunities for improvements to local bus service, integration with other modes, and coordination with other transit service in the Seven Corners area. Both Concepts have the ability to accommodate a bus circulator service within the Seven Corners area, though the additional connections over Route 50 in Concept B would provide more flexibility in network routing.

The existing transit center currently is a major regional stop and transfer point for all regional bus routes passing through the Seven Corners area as well as a major destination. As redevelopment of the area occurs, the potential to relocate this transit center from the Thorne Road/Arlington Boulevard eastbound area to Thorne Road/Leesburg Pike area should be evaluated. This would bring the transit center adjacent to planned high quality transit on Route 7, allowing for easier transfers and would further activate Route 7 as a main street within the study area. In addition, a transit center north of Arlington Boulevard and south of Wilson Boulevard should also be considered to accommodate increased density planned for this area. Both Concept B and Concept C are supportive of these options for transit centers, but Concept B, with four crossings of Route 50 compared with two crossings of Route 50 in Concept C, would provide more flexibility to leverage multimodal connections to the transit centers.

5.4 CONSTRUCTION PHASING

The constructability, ease of phasing, traffic control plans for both Concept B and Concept C were examined to determine if there would be fatal flaws in building either concept. The construction phasing of the interchange network was developed by reviewing the three-dimensional aspects of the conceptual designs and taking into account considerations for the maintenance of traffic during construction. The proposed phasing diagrams detailed in this section represent one option for phasing construction – it is possible that there are other options.

In general, the following principles guided the phasing development. For each concept the outside roads surrounding the interchange were first constructed to provide alternative routes for vehicles during subsequent construction phases. Constructing the outer roadway network roads would remove many vehicles from the interchange area and would create redundancy in the system to re-route vehicles. Next, the three-dimensional aspects such as grade differentials within the interchange area, combined with potential scheduling of existing ramp removal and proposed ramp construction, were reviewed. The final construction phases include constructing the remaining connections throughout the network and reconstructing the interchange. The construction phasing of Concept B is explained in the remainder of this section. Details regarding the construction phasing of Concept C are included in Appendix E.

Four phases were developed for both Concept B and Concept C. The phases do not constitute separate projects – they are steps to complete the implementation of each conceptual design. The description of each phase includes steps as part of a construction plan and a detour and traffic control plan. For each step, there is a figure that shows the construction completed during the phase highlighted in yellow, the existing roadway in red, and the proposed improvements on new and existing roads in blue.

The proposed construction phasing for Concept B is as follows:

- Phase 1 - Improve existing roads and new connections outside the interchange area
- Phase 2 - Complete eastern half diamond interchange
- Phase 3 - Complete western half diamond interchange
- Phase 4 - Complete Route 7/Wilson Boulevard intersection and project tie-ins

The proposed construction phasing for Concept C is as follows:

- Phase 1 - Improve existing roads and new connections outside interchange area and construct “jughandle” in northwest quadrant
- Phase 2 - Construct “jughandle” in southwest quadrant
- Phase 3 - Complete Route 7/Wilson Boulevard intersection and project tie-ins
- Phase 4 - Construct “jughandles” in east quadrants

5.4.1 Concept B – Phase 1: Improve Existing Roads and New Connections Outside the Interchange Area

As shown in Figure 27, Phase 1 for Concept B includes improving the existing roads and providing new connections outside the interchange area.

5.4.1.1 Construction Plan

Construct the outer roads first to provide alternative routes for future phases.

- Upgrade/improve existing facilities
- Provide new connections
- Consider identifying subprojects within this phase to systemically improve the "outer roads"

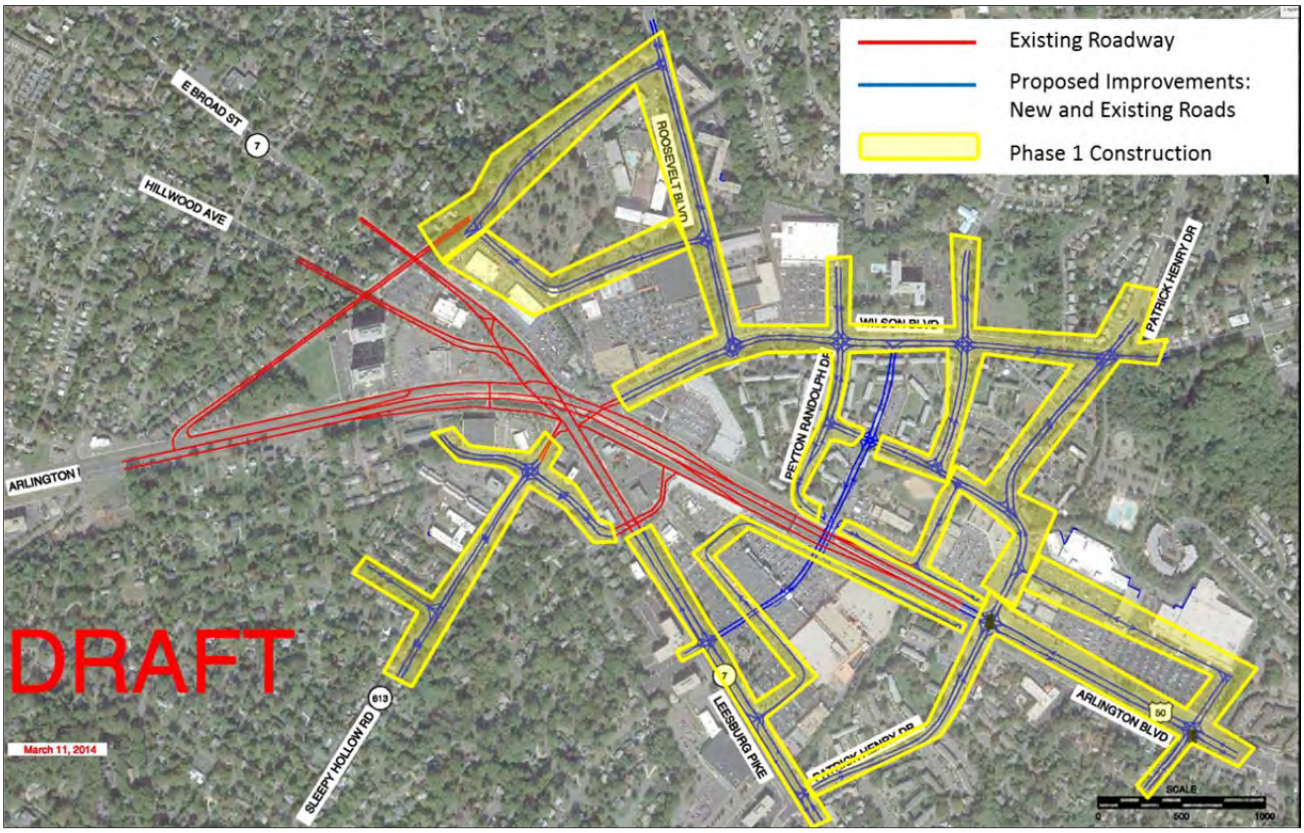
Construct the bridge that connects Wilson Boulevard to Route 7 over Route 50.

- The profile of the overcrossing needs to take into account the existing and future ramps and frontage roads

5.4.1.2 Detour and Traffic Control Plan

Maintain existing travel patterns along existing facilities.

Figure 27. Concept B - Phase 1



5.4.2 Concept B - Phase 2: Complete Eastern Half Diamond Interchange

As shown in Figure 28, Phase 2 for Concept B includes completing the construction of the eastern half diamond interchange.

5.4.2.1 Construction

Close the ramps to/from Route 50 to the east and detour traffic as shown in Figure 28.

- Construct the Route 50 eastbound on-ramp, Route 50 westbound off-ramp, and eastern ramp terminal overcrossing over Route 50

5.4.2.2 Detour and Traffic Control Plan

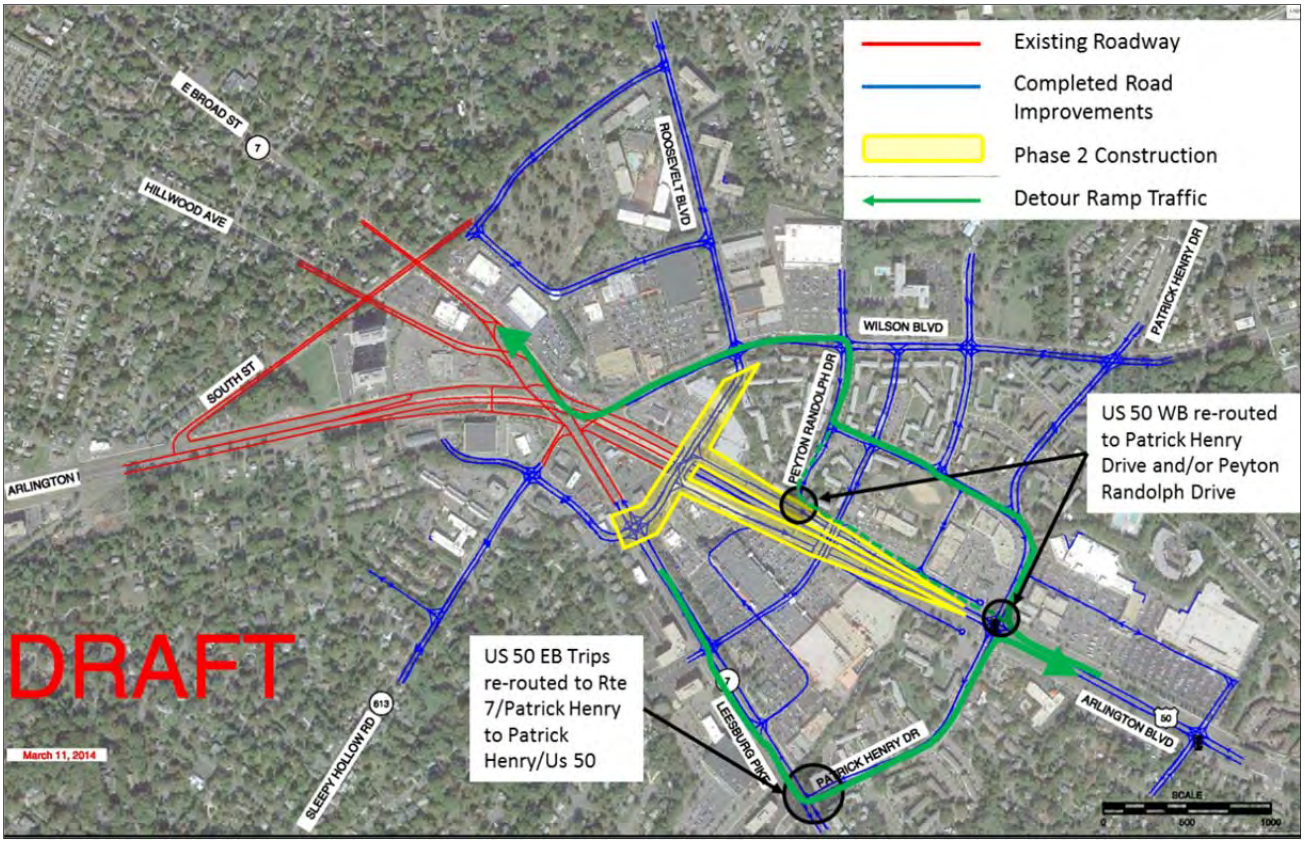
Route 50 Westbound Off-Ramp

- Use the existing frontage road and create a detour at Peyton Randolph Drive or Patrick Henry Drive while the new westbound off-ramp is being constructed.

Route 50 Eastbound On-Ramp

- Use the Route 7 and the Route 50/Patrick Henry Drive intersection to reroute eastbound on-ramp traffic

Figure 28. Concept B - Phase 2



5.4.3 Concept B - Phase 3: Complete Western Half Diamond Interchange

As shown in Figure 29, Phase 3 for Concept B includes completing the construction of the western half diamond interchange.

5.4.3.1 Construction

Construct the Route 50 westbound on-ramp, Route 50 eastbound off-ramp, and the western ramp terminal overcrossing over Route 50.

5.4.3.2 Detour and Traffic Control Plan

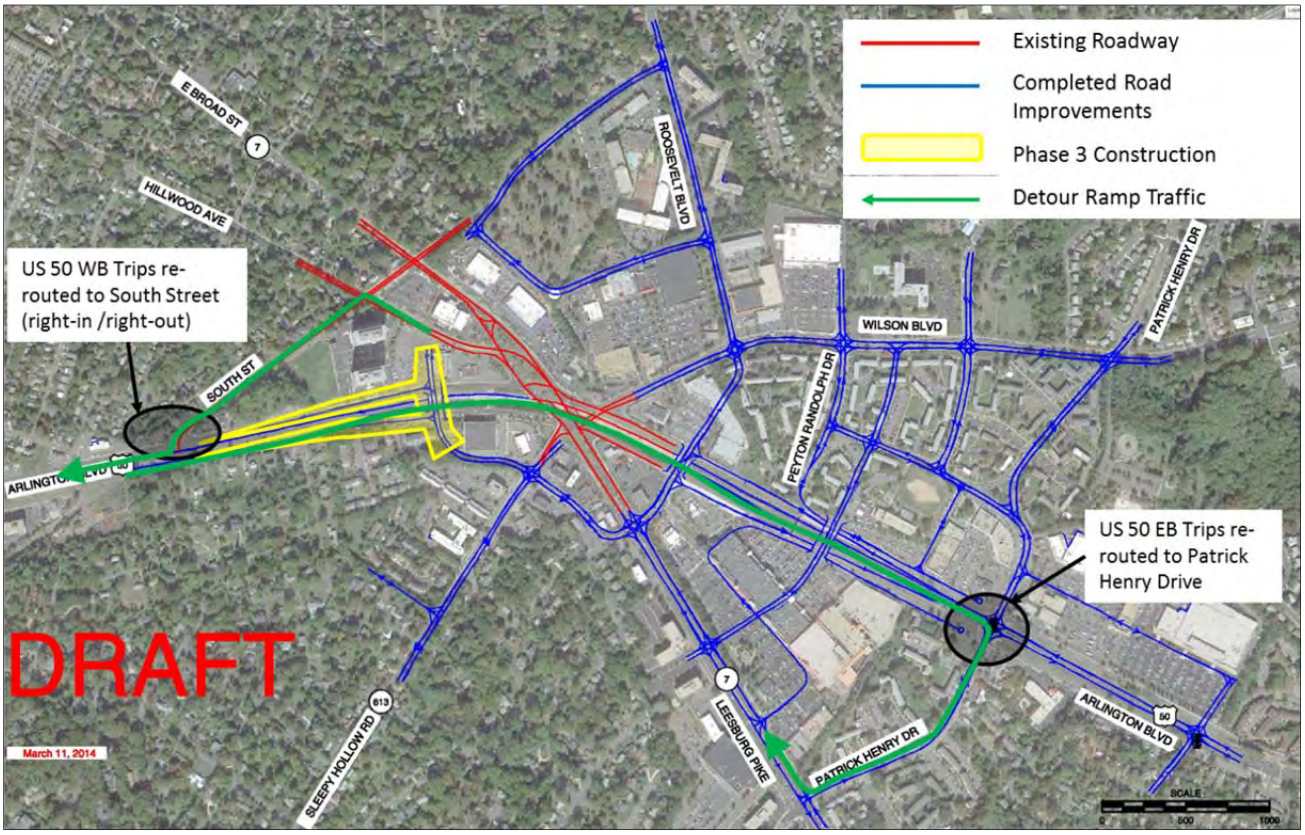
Route 50 Westbound On-Ramp

- Close the existing westbound on-ramp and use the existing South Street connection (with right-in/right-out operation) while the westbound ramp terminal overcrossing is constructed

Route 50 Eastbound Off-Ramp

- Reroute traffic to use the Route 50/Patrick Henry Drive intersection to access Route 7

Figure 29. Concept B - Phase 3



5.4.4 Concept B - Phase 4: Complete Route 7/Wilson Boulevard Intersection and Project Tie-Ins

As shown in Figure 30, Phase 4 of Concept B includes completing the Route 7/Wilson Boulevard/Sleepy Hollow Road intersection and remaining project tie-ins.

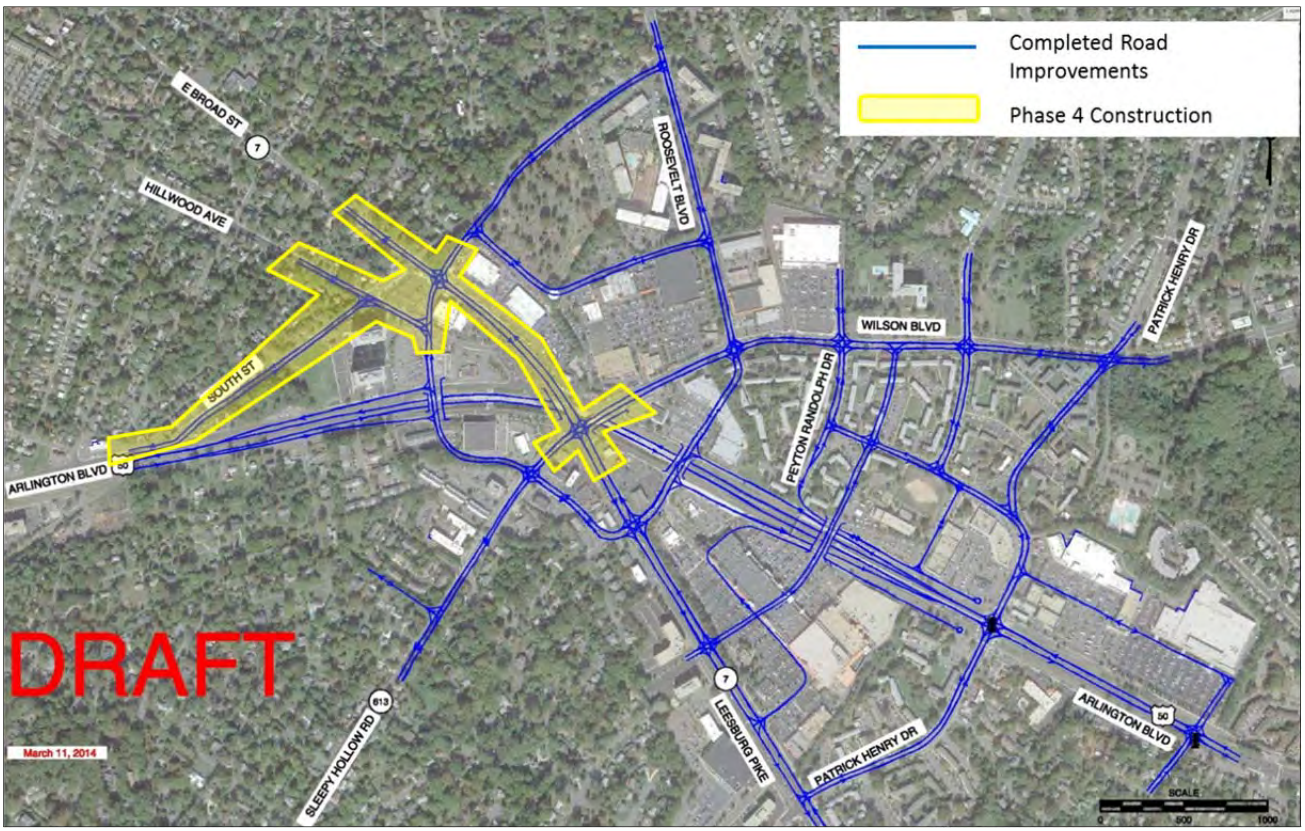
5.4.4.1 Construction

Modify the Route 7/Wilson Boulevard/Sleepy Hollow Road intersection and demolish any remaining unnecessary infrastructure. Complete the remaining intersections.

5.4.4.2 Detour and Traffic Control Plan

Divert traffic to newly constructed roadways.

Figure 30. Concept B - Phase 4



5.5 FINAL CONCEPTUAL DESIGN RECOMMENDATION – CONCEPT B

After review of the traffic results, multimodal analysis, the proposed construction phasing, a question-and-answer period, and a discussion during the April 8, 2014 Seven Corners Task Force meeting, Fairfax County staff and the Seven Corners Task Force reached consensus to recommend Concept B as the most appropriate conceptual design for the Seven Corners area. The reasons given for the selection of Concept B was that it performed as well as Concept C in terms of traffic operational performance and showed superior opportunities to improve bicycle and pedestrian connectivity. Additionally, with the Roosevelt Bridge connection, Concept B also increased transit connectivity and provided a direct link to the East Falls Church Metro station.

In addition, Fairfax County and the Seven Corners Task Force noted that Concept B would improve local connectivity and thus meet the desire from residents who live near Seven Corners to be able to get to and through the area without having to get on Route 7 or Route 50. The additional overcrossings of Route 50 in Concept B would help to break down a barrier for community cohesiveness. Agency partners and members of the Seven Corners Task Force felt that the transportation network in Concept B was easier to understand than the “jughandle” configuration in Concept C. It was also identified that the “jughandles” in Concept C would require two additional signals along Route 50 in either direction; this would impede the functionality of Route 50 in terms of serving through regional traffic.

The result of the April 8 Seven Corners Task Force meeting was to recommend Concept B as the preferred conceptual design for a new interchange and roadway network in the Seven Corners area.

Section 6
Concept B Analysis

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6. CONCEPT B ANALYSIS

The initial traffic evaluation described in Section 5 dropped Concept A and Concept C from consideration and advanced Concept B forward. The decision of Fairfax County and the Seven Corners Task Force to move forward with Concept B provides the basis for comparison of the traffic operational performance of Concept B with the Comprehensive Plan using the HCM methodology. In addition, Concept B was evaluated using SimTraffic software to determine its operational performance using microsimulation. An examination of the conceptual eastern ramp terminal ramp profiles (provided in Appendix F), weaving analysis on Route 50, and identification of potential mitigation projects that would improve the existing interchange and support the future construction of Concept B completes the analysis for this project. The results of these analyses are described in this section of the report.

6.1 HCM COMPARISON BETWEEN COMPREHENSIVE PLAN AND CONCEPT B

A traffic operation analysis was conducted for Concept B by using the HCM method (macro-level) to compare the traffic operational performance with the Comprehensive Plan during both a.m. and p.m. peak hours. The analysis focuses on the level-of-service (LOS), per-vehicle delay, and the V/C ratio for each signalized intersection; the results are summarized in the following sections.

6.1.1 Year 2040 AM Peak Hour HCM Results

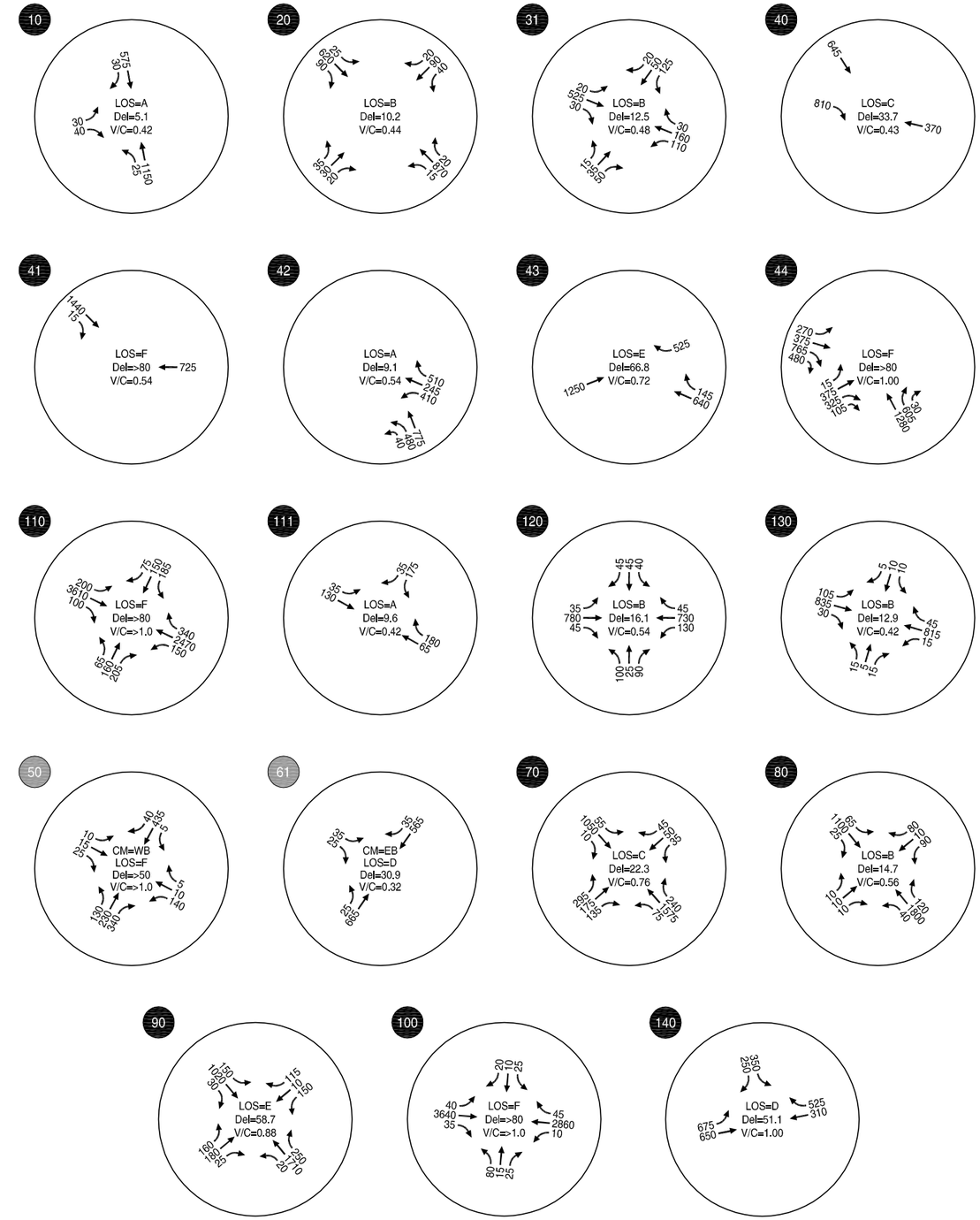
Table 11 on the following page summarizes and compares the operational performance of the Comprehensive Plan and Concept B during the a.m. peak hour. The intersection IDs refer to the intersections shown in Figure 31 and Figure 32. Each row in Table 11 represents an equivalent intersection between the two scenarios. Because Concept B would reconfigure the existing interchange, the five signalized intersections that form the current Interchange Area are compared with the five new intersections that form the two half diamonds and the central intersection of Route 7, Wilson Boulevard, and Sleepy Hollow Road. This comparison can be seen in the rows highlighted in green. Figure 33 and Figure 34 provide the lane configuration and level of service by movement for each intersection in the Comprehensive Plan and Concept B during the a.m. peak hour, respectively.

As shown in Table 11, several intersections would operate at LOS “F” in the Comprehensive Plan scenario during the a.m. peak hour. Concept B would substantially improve intersection operational performance: all the intersections would operate at LOS “E” or better during the a.m. peak hour. Comparing the Comprehensive Plan interchange area with the equivalent ramp terminals in Concept B shows improvement in the a.m. peak hour; three of five intersections would operate at LOS “F” in the Comprehensive Plan scenario; while all of intersections would operate at LOS “D” or better in Concept B. The complete HCM results for the Comprehensive Plan and Concept B scenarios for the a.m. peak hour can be found in Appendix G.

Table 11. HCM Results for the Comprehensive Plan and Concept B (AM Peak Hour)

Year 2040 Comprehensive Plan					Year 2040 Concept B				
Intersection Name	ID #	LOS	Delay (s)	V/C	Intersection Name	ID #	LOS	Delay (s)	V/C
Roosevelt Blvd/ N Roosevelt St	10	A	5.1	0.42	Roosevelt Blvd/ N Roosevelt St	10	C	30.8	0.36
Route 7/N Roosevelt St	20	B	10.2	0.44	Route 7/N Roosevelt St	20	B	13.0	0.49
Sleepy Hollow Rd/Castle Rd	*50*	*F*	*> 50*	*> 1.00*	*Sleepy Hollow Rd/Castle Rd*	50	C	25.9	0.69
Route 7/Castle Rd	70	C	22.3	0.76	Route 7/Castle Rd	70	C	26.8	> 1.00
Route 7/Seven Corners Center entrance	80	B	14.7	0.56	Route 7/Seven Corners Center entrance	80	A	9.3	0.63
Route 7/Patrick Henry Dr	90	E	58.7	0.88	Route 7/Patrick Henry Dr	90	D	41.2	0.83
Route 50/ Olin Dr	100	F	> 80	> 1.00	Route 50/Olin Dr	100	C	29.1	1.00
Route 50/Patrick Henry Dr	110	F	> 80	> 1.00	Route 50/Patrick Henry Dr	110	E	58.9	> 1.00
Wilson Blvd/ John Marshall Dr	120	B	16.1	0.54	Wilson Blvd/ John Marshall Dr	120	B	12.6	0.45
Wilson Blvd/ Peyton Randolph Dr	130	B	12.9	0.42	Wilson Blvd/ Peyton Randolph Dr	130	A	4.7	0.48
Wilson Blvd/Roosevelt Blvd	140	D	51.1	1.00	Wilson Blvd/Roosevelt Blvd	140	C	31.6	0.75
Route 7/Wilson Blvd/Sleepy Hollow Rd	44	F	> 80	> 1.00	Route 7/Wilson Blvd/Sleepy Hollow Rd	45	D	35.5	0.86
Wilson Blvd/Route 50 Westbound Off-ramp	43	E	66.8	0.72	Roosevelt Blvd/Route 50 Westbound Off-ramp	46	B	16.2	0.24
Route 7/Route 50 Westbound On-ramp	41	F	> 80	0.54	Roosevelt Blvd/Route 50 Eastbound On-ramp	47	A	0.2	0.29
Route 7/Arlington Blvd	42	A	9.1	0.54	S Roosevelt St/ Route 50 Westbound On-ramp	48	B	15.0	0.41
Route 7/Hillwood Ave	40	C	33.7	0.43	S Roosevelt St/ Route 50 Eastbound Off-ramp	49	B	18.3	0.26

Unsignalized intersections are in italics
Intersections shown in green constitute the Interchange Area for each scenario



LEGEND

CM = CRITICAL MOVEMENT (UNSIGNALIZED)
LOS = INTERSECTION LEVEL OF SERVICE (SIGNALIZED)/CRITICAL MOVEMENT LEVEL OF SERVICE (UNSIGNALIZED)
Del = INTERSECTION AVERAGE CONTROL DELAY (SIGNALIZED)/CRITICAL MOVEMENT CONTROL DELAY (UNSIGNALIZED)
V/C = CRITICAL VOLUME-TO-CAPACITY RATIO

XX SIGNALIZED INTERSECTION

XX UNSIGNALIZED INTERSECTION

HCM RESULTS FOR THE COMPREHENSIVE PLAN
WEEKDAY AM PEAK HOUR
FAIRFAX COUNTY, VIRGINIA

FIGURE 31

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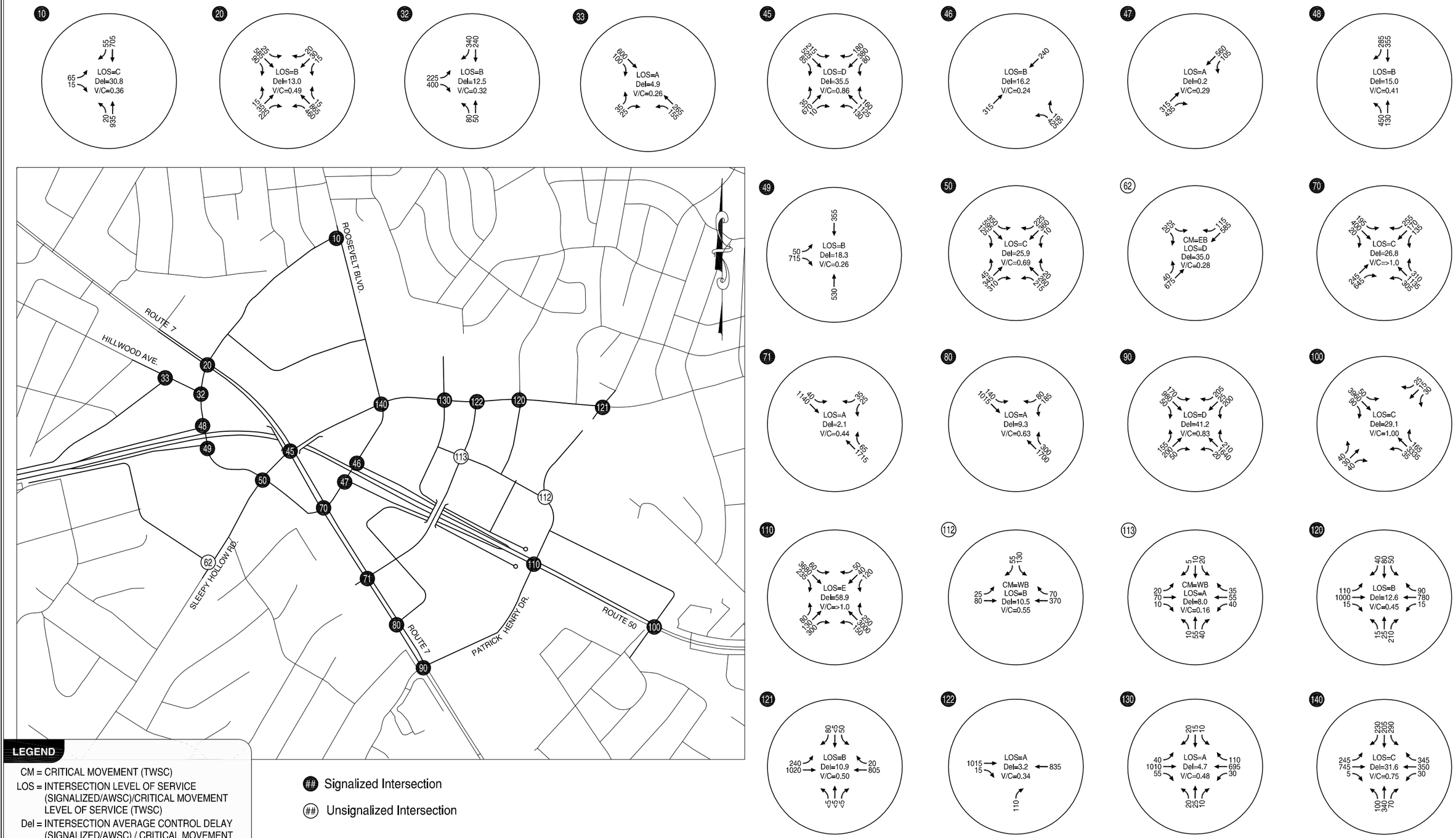

LEGEND

CM = CRITICAL MOVEMENT (TWSC)
LOS = INTERSECTION LEVEL OF SERVICE (SIGNALIZED/AWSC)/CRITICAL MOVEMENT LEVEL OF SERVICE (TWSC)
Del = INTERSECTION AVERAGE CONTROL DELAY (SIGNALIZED/AWSC) / CRITICAL MOVEMENT CONTROL DELAY (TWSC)
V/C = CRITICAL VOLUME-TO-CAPACITY RATIO
TWSC = TWO-WAY STOP CONTROL
AWSC = ALL-WAY STOP CONTROL

Signalized Intersection

Unsignalized Intersection

HCM RESULTS FOR CONCEPT B
WEEKDAY AM PEAK HOUR
FAIRFAX COUNTY, VIRGINIA

FIGURE 32

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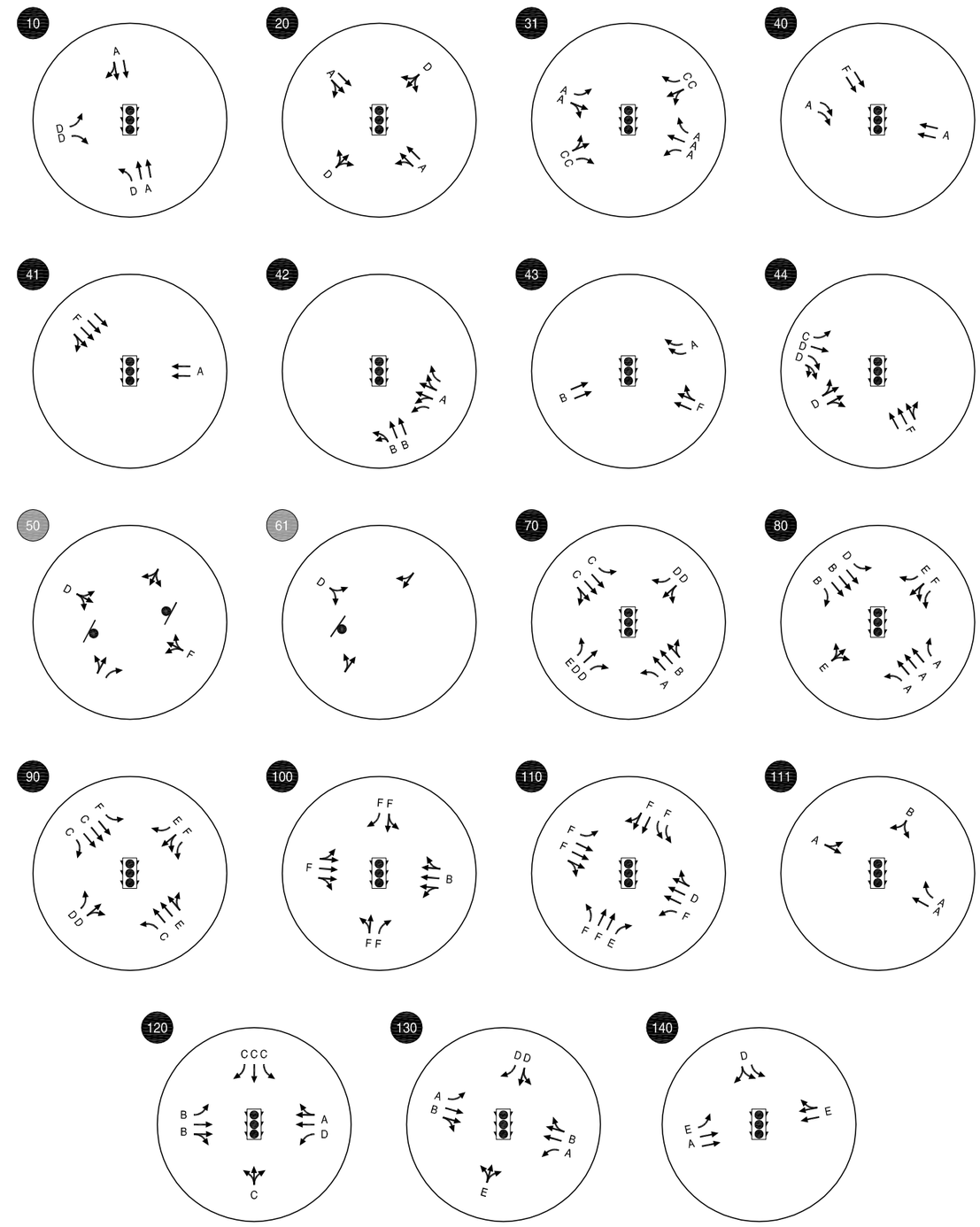

LEGEND

CM = CRITICAL MOVEMENT (UNSIGNALIZED)
LOS = INTERSECTION LEVEL OF SERVICE (SIGNALIZED)/CRITICAL MOVEMENT LEVEL OF SERVICE (UNSIGNALIZED)
Del = INTERSECTION AVERAGE CONTROL DELAY (SIGNALIZED)/CRITICAL MOVEMENT CONTROL DELAY (UNSIGNALIZED)
V/C = CRITICAL VOLUME-TO-CAPACITY RATIO

XX SIGNALIZED INTERSECTION

XX UNSIGNALIZED INTERSECTION

HCM LOS BY MOVEMENT/LANE CONFIGURATIONS FOR THE COMPREHENSIVE PLAN
WEEKDAY AM PEAK HOUR
FAIRFAX COUNTY, VIRGINIA

FIGURE 33

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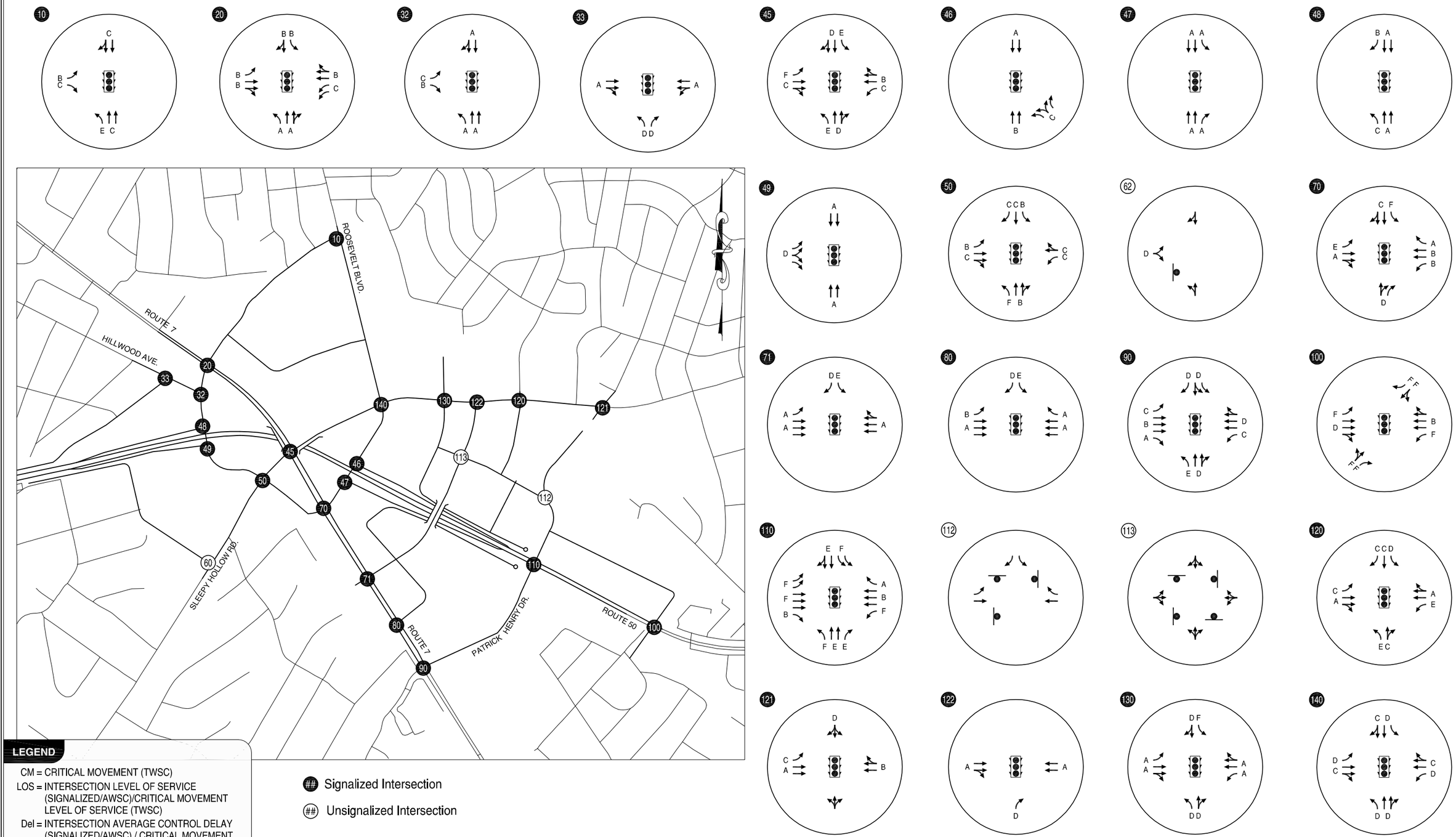

HCM LOS BY MOVEMENT/LANE CONFIGURATIONS FOR CONCEPT B
WEEKDAY AM PEAK HOUR
FAIRFAX COUNTY, VIRGINIA

FIGURE 34

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6.1.2 Year 2040 PM Peak Hour HCM Results

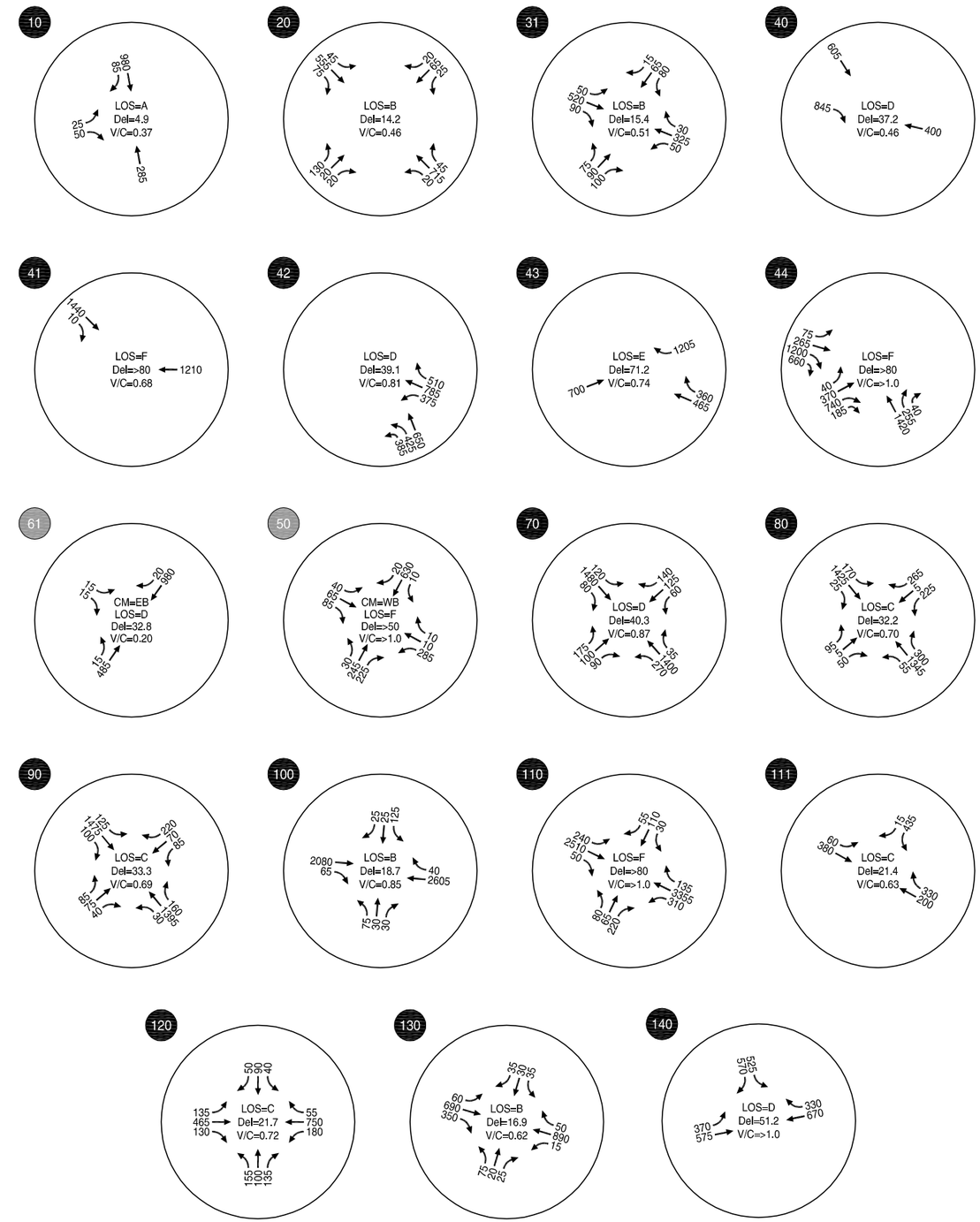
Table 12 on the following page summarizes and compares the operational performance of the Comprehensive Plan and Concept B during the p.m. peak hour. The intersection IDs refer to the intersections shown in Figure 35 and Figure 36. Each row in Table 12 represents an equivalent intersection between the two scenarios. Because Concept B would reconfigure the existing interchange, the five signalized intersections that form the current Interchange Area are compared with the five new intersections that form the two half diamonds and the central intersection of Route 7, Wilson Boulevard, and Sleepy Hollow Road. This comparison can be seen in the rows highlighted in green. Figure 37 and Figure 38 provide the lane configuration and level of service by movement for each intersection in the 2040 Comprehensive Plan and Concept B during the p.m. peak hour, respectively.

Similar to the a.m. peak hour, several intersections would operate at LOS “F” in the Comprehensive Plan scenario during the p.m. peak hour. Concept B would substantially improve intersection operational performance: all the intersections would operate at LOS “D” or better during the p.m. peak hour. Comparing the year 2040 Comprehensive Plan interchange area with the equivalent ramp terminals in Concept B show improvement in the p.m. peak hour; three intersections would operate at LOS “E” or “F” in the Comprehensive Plan scenario while all of the intersections would operate at LOS “D” or better in Concept B. The complete HCM results for the Comprehensive Plan and Concept B for the p.m. peak hour can be found in Appendix G.

Table 12. HCM Results for the Comprehensive Plan and Concept B (PM Peak Hour)

Year 2040 Comprehensive Plan					Year 2040 Concept B				
Intersection Name	**ID #**	**LOS**	**Delay (s)**	**V/C**	**Intersection Name**	**ID #**	**LOS**	**Delay (s)**	**V/C**
Roosevelt Blvd/ N Roosevelt St	10	A	4.9	0.37	Roosevelt Blvd/ N Roosevelt St	10	C	25.3	0.40
Route 7/N Roosevelt St	20	B	14.2	0.46	Route 7/N Roosevelt St	20	B	10.8	0.57
Sleepy Hollow Rd/Castle Rd	*50*	*F*	*> 50*	*> 1.00*	*Sleepy Hollow Rd/Castle Rd*	*50*	D	48.8	0.97
Route 7/Castle Rd	70	D	40.3	0.87	Route 7/Castle Rd	70	D	49.6	0.92
Route 7/Seven Corners Center entrance	80	C	32.2	0.70	Route 7/Seven Corners Center entrance	80	B	16.0	0.67
Route 7/Patrick Henry Dr	90	C	33.3	0.69	Route 7/Patrick Henry Dr	90	C	27.9	0.84
Route 50/ Olin Dr	100	B	18.7	0.85	Route 50/Olin Dr	100	D	38.7	> 1.00
Route 50/Patrick Henry Dr	110	F	> 80	> 1.00	Route 50/Patrick Henry Dr	110	D	45.5	0.91
Wilson Blvd/ John Marshall Dr	120	C	21.7	0.72	Wilson Blvd/ John Marshall Dr	120	C	20.3	0.66
Wilson Blvd/ Peyton Randolph Dr	130	B	16.9	0.62	Wilson Blvd/ Peyton Randolph Dr	130	B	12.2	0.45
Wilson Blvd/Roosevelt Blvd	140	D	51.2	> 1.00	Wilson Blvd/Roosevelt Blvd	140	C	34.9	0.75
Route 7/Wilson Blvd/Sleepy Hollow Rd	44	F	> 80	> 1.00	Route 7/Wilson Blvd/Sleepy Hollow Rd	45	D	44.4	0.81
Wilson Blvd/Route 50 Westbound Off-ramp	43	E	71.2	0.74	Roosevelt Blvd/Route 50 Westbound Off-ramp	46	C	23.9	0.33
Route 7/Route 50 Westbound On-ramp	41	F	> 80	0.68	Roosevelt Blvd/Route 50 Eastbound On-ramp	47	A	0.2	0.26
Route 7/Arlington Blvd	42	D	39.1	0.81	S Roosevelt St/ Route 50 Westbound On-ramp	48	B	13.0	0.62
Route 7/Hillwood Ave	40	D	37.2	0.46	S Roosevelt St/ Route 50 Eastbound Off-ramp	49	B	18.5	0.39

Unsignalized intersections are in italics
Intersections shown in green constitute the Interchange Area for each scenario



LEGEND

CM = CRITICAL MOVEMENT (UNSIGNALIZED)
LOS = INTERSECTION LEVEL OF SERVICE (SIGNALIZED)/CRITICAL MOVEMENT LEVEL OF SERVICE (UNSIGNALIZED)
Del = INTERSECTION AVERAGE CONTROL DELAY (SIGNALIZED)/CRITICAL MOVEMENT CONTROL DELAY (UNSIGNALIZED)
V/C = CRITICAL VOLUME-TO-CAPACITY RATIO

XX SIGNALIZED INTERSECTION

XX UNSIGNALIZED INTERSECTION

HCM RESULTS FOR THE COMPREHENSIVE PLAN
WEEKDAY PM PEAK HOUR
FAIRFAX COUNTY, VIRGINIA

FIGURE 35

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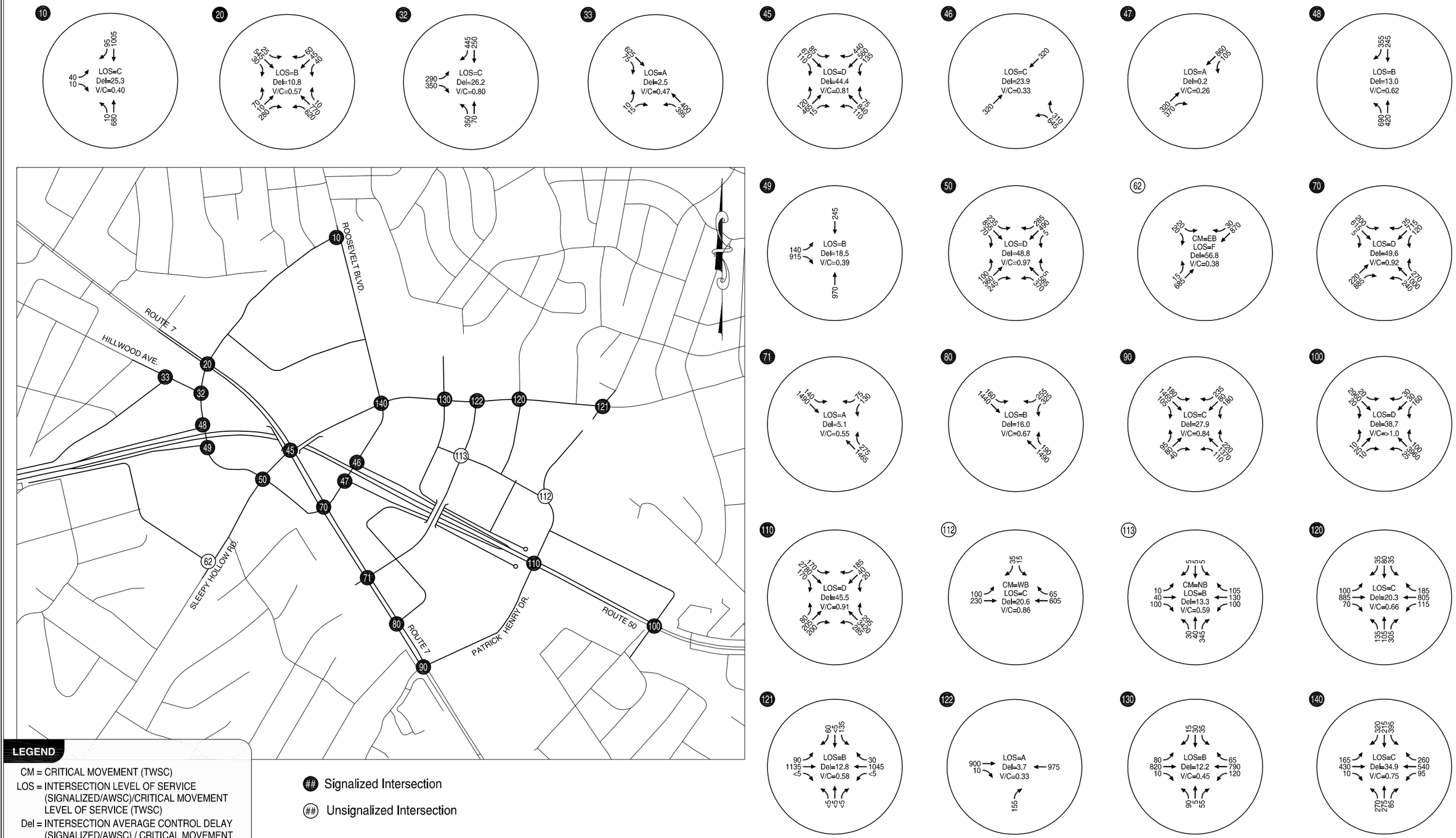

LEGEND

CM = CRITICAL MOVEMENT (TWSC)
LOS = INTERSECTION LEVEL OF SERVICE (SIGNALIZED/AWSC)/CRITICAL MOVEMENT LEVEL OF SERVICE (TWSC)
Del = INTERSECTION AVERAGE CONTROL DELAY (SIGNALIZED/AWSC) / CRITICAL MOVEMENT CONTROL DELAY (TWSC)
V/C = CRITICAL VOLUME-TO-CAPACITY RATIO
TWSC = TWO-WAY STOP CONTROL
AWSC = ALL-WAY STOP CONTROL

Signalized Intersection

Unsignalized Intersection

HCM RESULTS FOR CONCEPT B
WEEKDAY PM PEAK HOUR
FAIRFAX COUNTY, VIRGINIA

FIGURE 36

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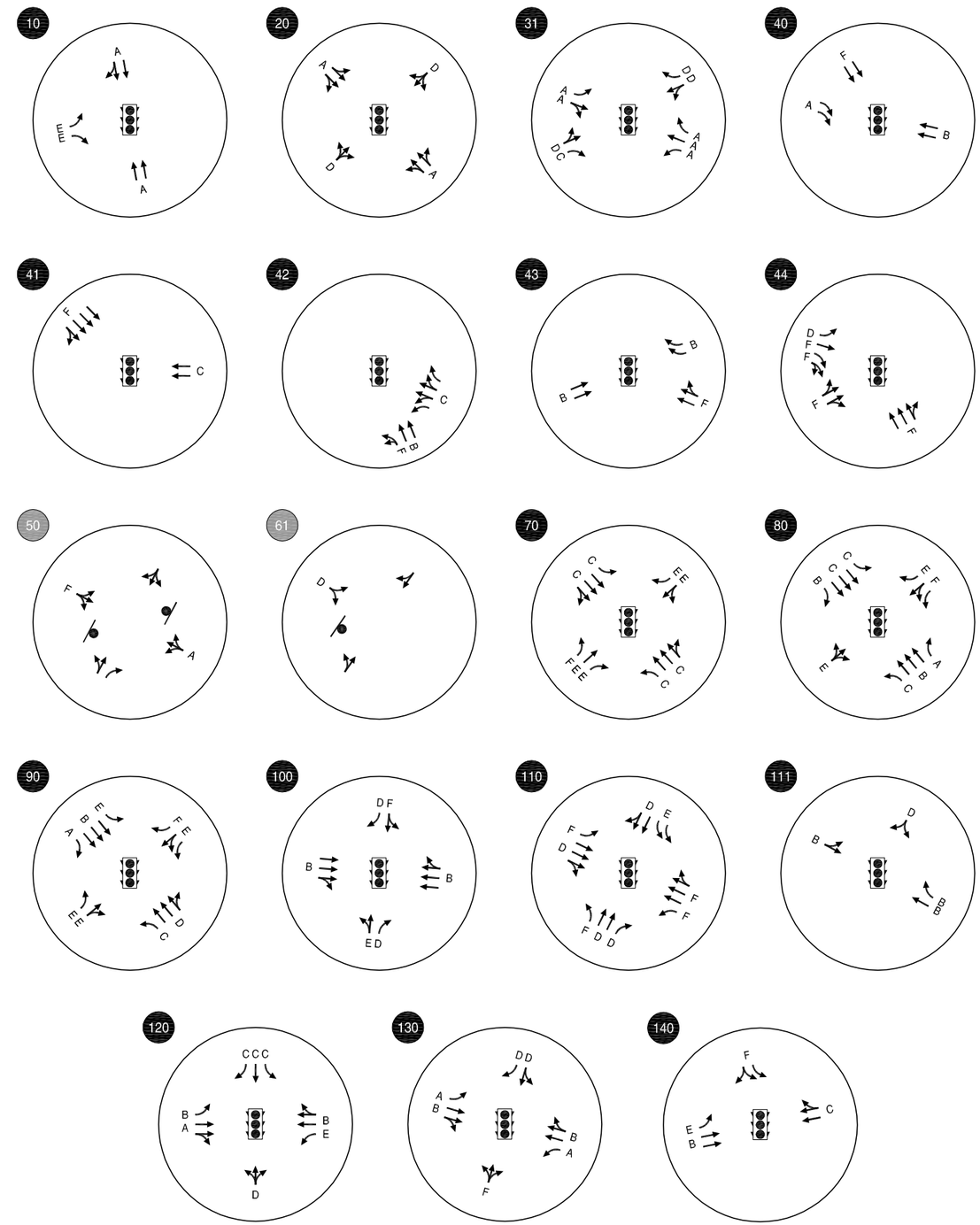

LEGEND

CM = CRITICAL MOVEMENT (UNSIGNALIZED)
LOS = INTERSECTION LEVEL OF SERVICE (SIGNALIZED)/CRITICAL MOVEMENT LEVEL OF SERVICE (UNSIGNALIZED)
Del = INTERSECTION AVERAGE CONTROL DELAY (SIGNALIZED)/CRITICAL MOVEMENT CONTROL DELAY (UNSIGNALIZED)
V/C = CRITICAL VOLUME-TO-CAPACITY RATIO

XX SIGNALIZED INTERSECTION

XX UNSIGNALIZED INTERSECTION

HCM LOS BY MOVEMENT/LANE CONFIGURATIONS FOR THE COMPREHENSIVE PLAN
WEEKDAY PM PEAK HOUR
FAIRFAX COUNTY, VIRGINIA

FIGURE 37

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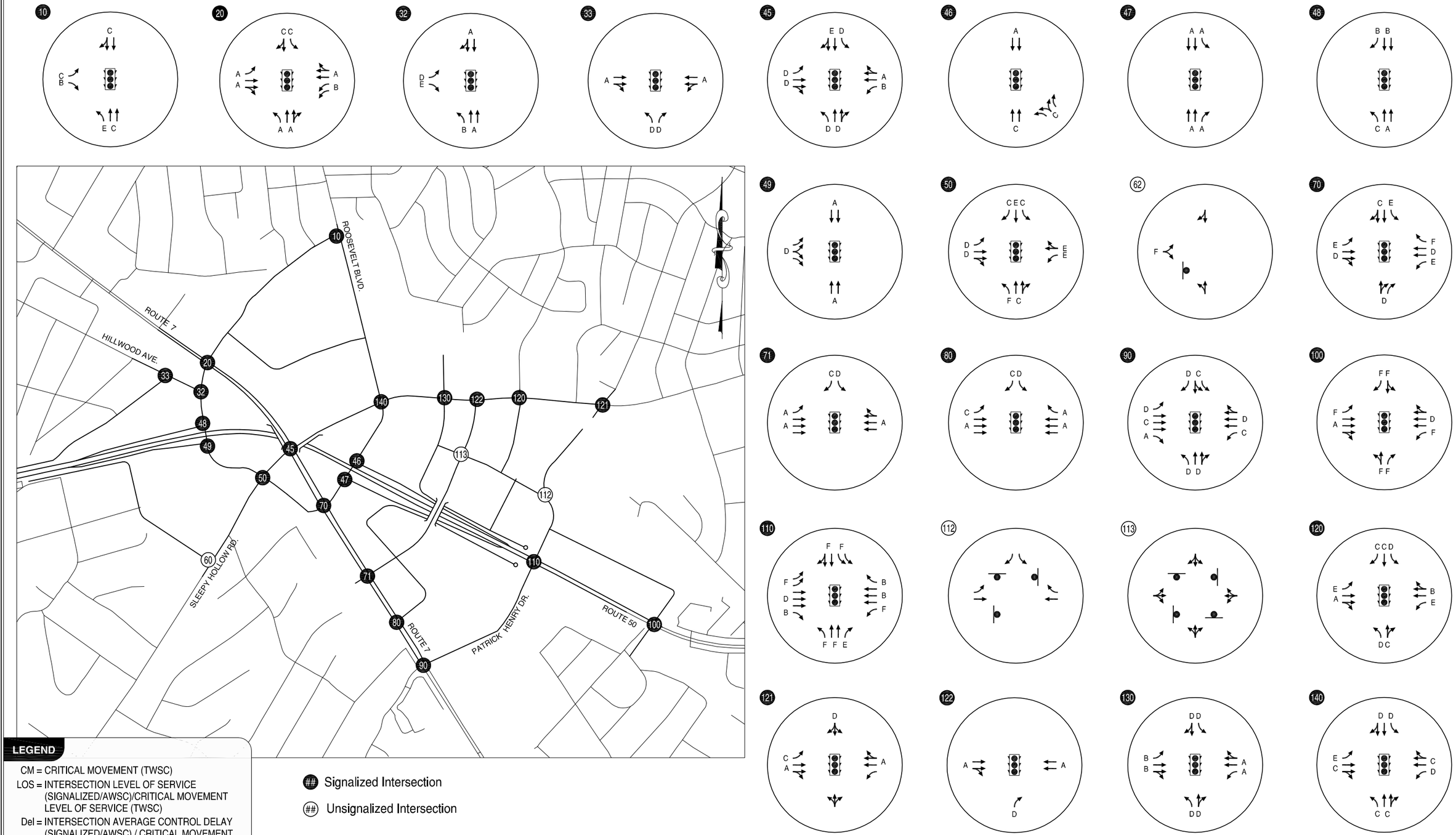

HCM LOS BY MOVEMENT/LANE CONFIGURATIONS FOR CONCEPT B
WEEKDAY PM PEAK HOUR
FAIRFAX COUNTY, VIRGINIA

FIGURE 38

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6.2 SIMTRAFFIC ANALYSIS

Concept B was furthered analyzed using SimTraffic, a microscopic traffic model that uses a stochastic process based on individual vehicles to produce intersection operational and queuing results. The SimTraffic analysis was completed to determine the effects, if any, of queue spillback, to identify any differences between the HCM results, and to observe the traffic simulation.

6.2.1 SimTraffic Calibration

Although traffic results can be obtained from an uncalibrated model, these results may not accurately reflect actual conditions. The SimTraffic model was previously calibrated during the Phase 1 study using field observations to produce results that most accurately reflect real world conditions in accordance with procedures described in VDOT's VDOT *Traffic Operations Analysis Tool Guidebook*.

6.2.2 Simulation Sample Size

There are several outputs produced by SimTraffic that will be used to determine what existing and future conditions in the road network may be like. As SimTraffic is a stochastic model with traffic behavior based on random distributions of driver behavior, the results are likely to change in every run of the model. Therefore, to ensure the outputs are relatively consistent the number of runs in the SimTraffic analysis needs to be a sufficient sample size. The VDOT *Traffic Operations Analysis Tool Guidebook* provides a way for determining whether the number of SimTraffic runs will produce reliable results. The equation below is from the guidebook and it can be used for determining an appropriate sample size. This analysis only considers one Measure of Effectiveness (MOE).

$$N = \frac{(Z)^2 (S_S)^2}{(E)^2}$$

In this equation, "N" represents the necessary sample size, "Z" represents the number of standard deviations away from the mean corresponding to the required confidence level (assuming a normal distribution and confidence interval of 95th percentile, which corresponds to a value of 1.96), "S" represents the sample standard deviation, and "E" represents the tolerable error in terms of the sample mean. For the purposes of this analysis, tolerable error was assumed to be ten percent. Both the a.m. and p.m. SimTraffic models were run a minimum of ten times and the resultant sample sizes values were less than five in both instances.

6.2.3 Year 2040 AM Peak Hour SimTraffic Results

Table 13 summarizes the comparison between HCM analysis and SimTraffic analysis during the a.m. peak hour for Concept B. For most signalized intersections, the two methods result in similar results; a few intersections have higher delay in the SimTraffic analysis. The discrepancy is likely related to the measureable effects of downstream queuing that is accounted for in SimTraffic compared with the HCM results. Considering the fundamental difference between these two analyses, such discrepancy is reasonable.

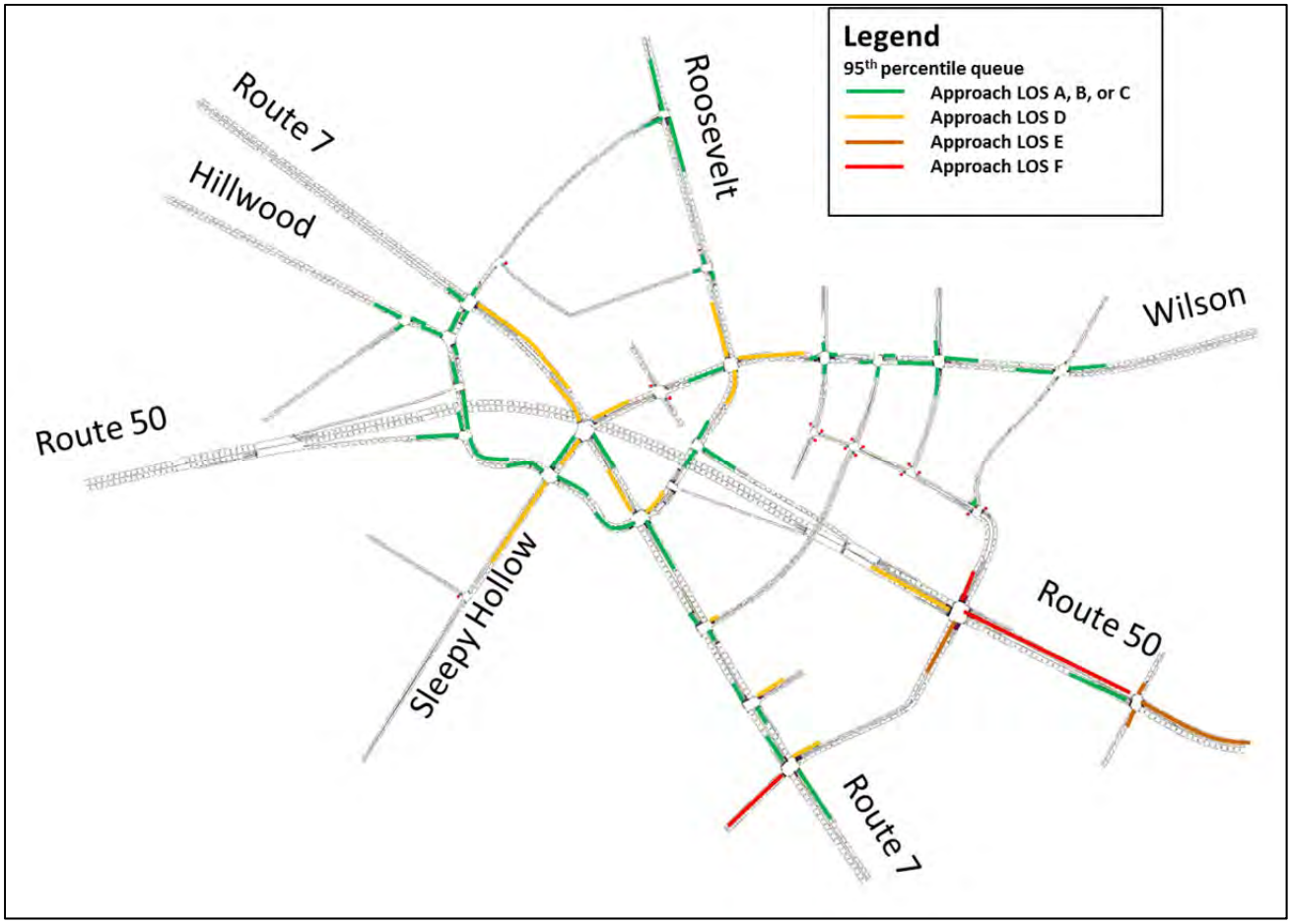
Table 13. Comparison of HCM Analysis and SimTraffic Analysis for Concept B (AM Peak Hour)

Intersection Name	Intersection ID	HCM Analysis			SimTraffic Analysis		
		LOS	Delay (s)	V/C	LOS	Delay (s)	V/C
Roosevelt Blvd/N Roosevelt St	10	C	30.8	0.36	C	32.3	0.36
Route 7/N Roosevelt St	20	B	13.0	0.49	C	27.4	0.49
Sleepy Hollow Rd/Castle Pl	*50*	C	25.9	0.69	C	34.2	0.69
Route 7/Castle Rd	70	C	26.8	> 1.00	C	27.0	1.00
Route 7/Seven Corners Center entrance	80	A	9.3	0.63	B	10.5	0.63
Route 7/Patrick Henry Dr	90	D	41.2	0.83	E	69.8	0.83
Route 50/Olin Dr	100	C	29.1	1.00	D	43.2	1.00
Route 50/Patrick Henry Dr	110	E	58.9	1.00	E	73.5	1.00
Wilson Blvd/John Marshall Dr	120	B	12.6	0.45	B	14.9	0.45
Wilson Blvd/Peyton Randolph Dr	130	A	4.7	0.48	A	5.9	0.48
Wilson Blvd/Roosevelt Blvd	140	C	31.6	0.75	D	35.3	0.75
Route 7/Wilson Blvd/Sleepy Hollow Rd	45	D	35.5	0.86	C	34.3	0.86
Roosevelt Blvd/Route 50 Westbound Off-ramp	46	B	16.2	0.24	B	17.5	0.24
Roosevelt Blvd/Route 50 Eastbound On-ramp	47	A	0.2	0.29	A	2.6	0.29
S Roosevelt St/Route 50 Westbound On-ramp	48	B	15.0	0.41	B	19.4	0.41
S Roosevelt St/Route 50 Eastbound Off-ramp	49	B	18.3	0.26	B	18.6	0.26

Unsignalized intersections are in italics
Intersections shown in green constitute the Interchange Area for each scenario

Similar as the traffic analysis conducted in Chapter 5, the 95th percentile queue and level-of-service by approach were evaluated for each intersection. Figure 39 shows the 95th percentile queue and level-of-service of each approach for Concept B during the a.m. peak hour. The combination of the 95th percentile queue and approach level-of-service demonstrates the operational performance of the approach at the signalized intersection because it relates the level of delay with the number of vehicles experiencing the delay. The length of the different colors lines represents the 95th percentile queue for the approach. The colors represent different level-of-service for the approaches, with green representing LOS “A”, “B” or “C” operations, yellow LOS “D”, brown LOS “E”, and red LOS “F”.

Figure 39. SimTraffic 95th Percentile Queues and LOS by Approach for Concept B (AM Peak Hour)



The key highlights of Concept B during the a.m. peak hour are summarized as follows:

- The new interchange ramp terminals would operate below capacity
- The intersection of Route 50/Patrick Henry Drive would operate above capacity and queuing would spillback to adjacent intersections and ramps
- The "ring road" and new overcrossings would be able to accommodate forecasted traffic volumes
- The intersections along the direct connection between Route 7 and Roosevelt Boulevard would operate at LOS "D" or better

Summary traffic operations results for the SimTraffic analysis for Concept B for the a.m. peak hour can be seen in Figure 40. Figure 41 provides the level of service by movement for each intersection in Concept B during the a.m. peak hour. The complete SimTraffic results for Concept B for the a.m. peak hour can be found in Appendix G.

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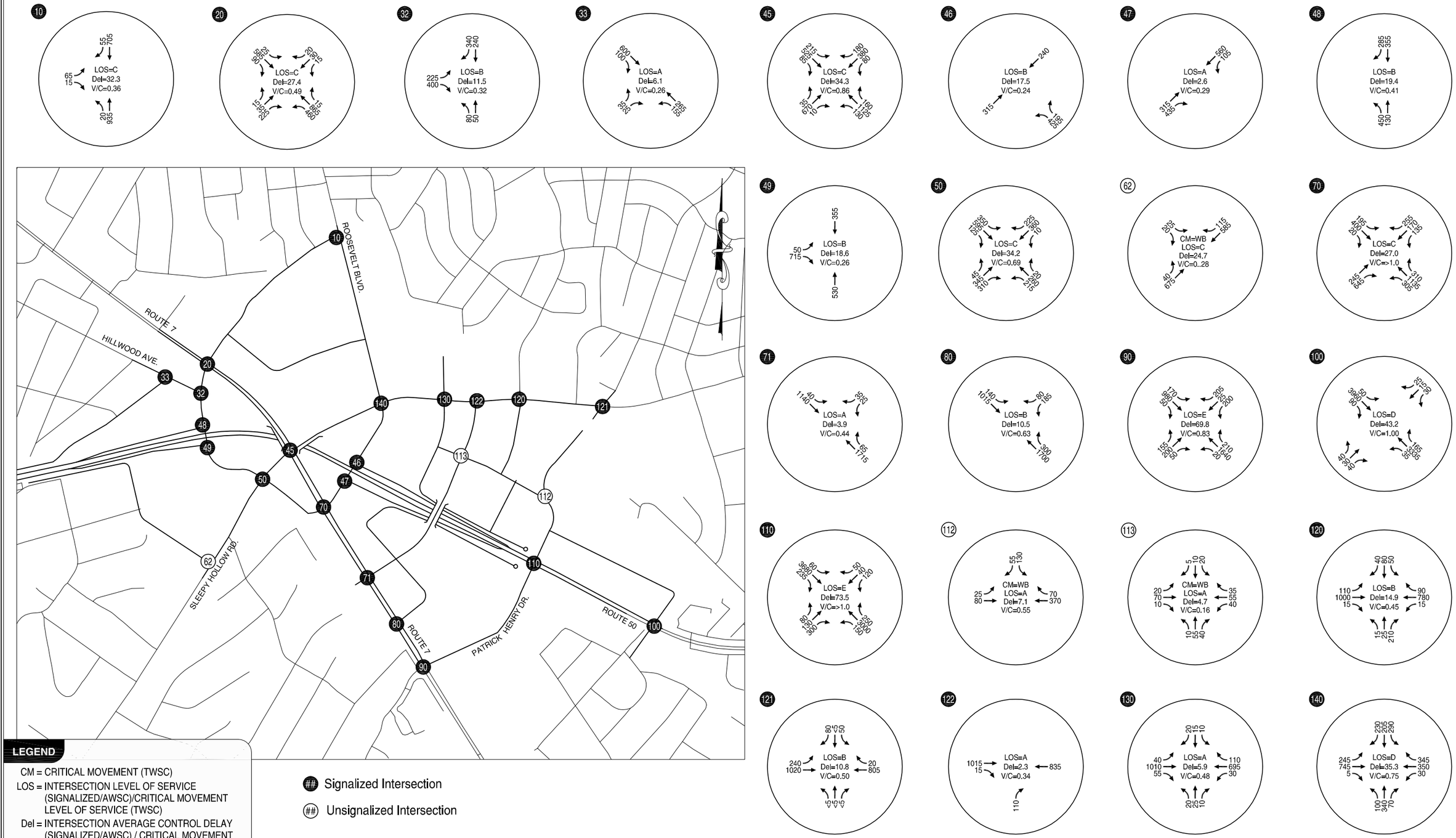

SIMTRAFFIC RESULTS FOR CONCEPT B
WEEKDAY AM PEAK HOUR
FAIRFAX COUNTY VIRIGNIA

FIGURE 40

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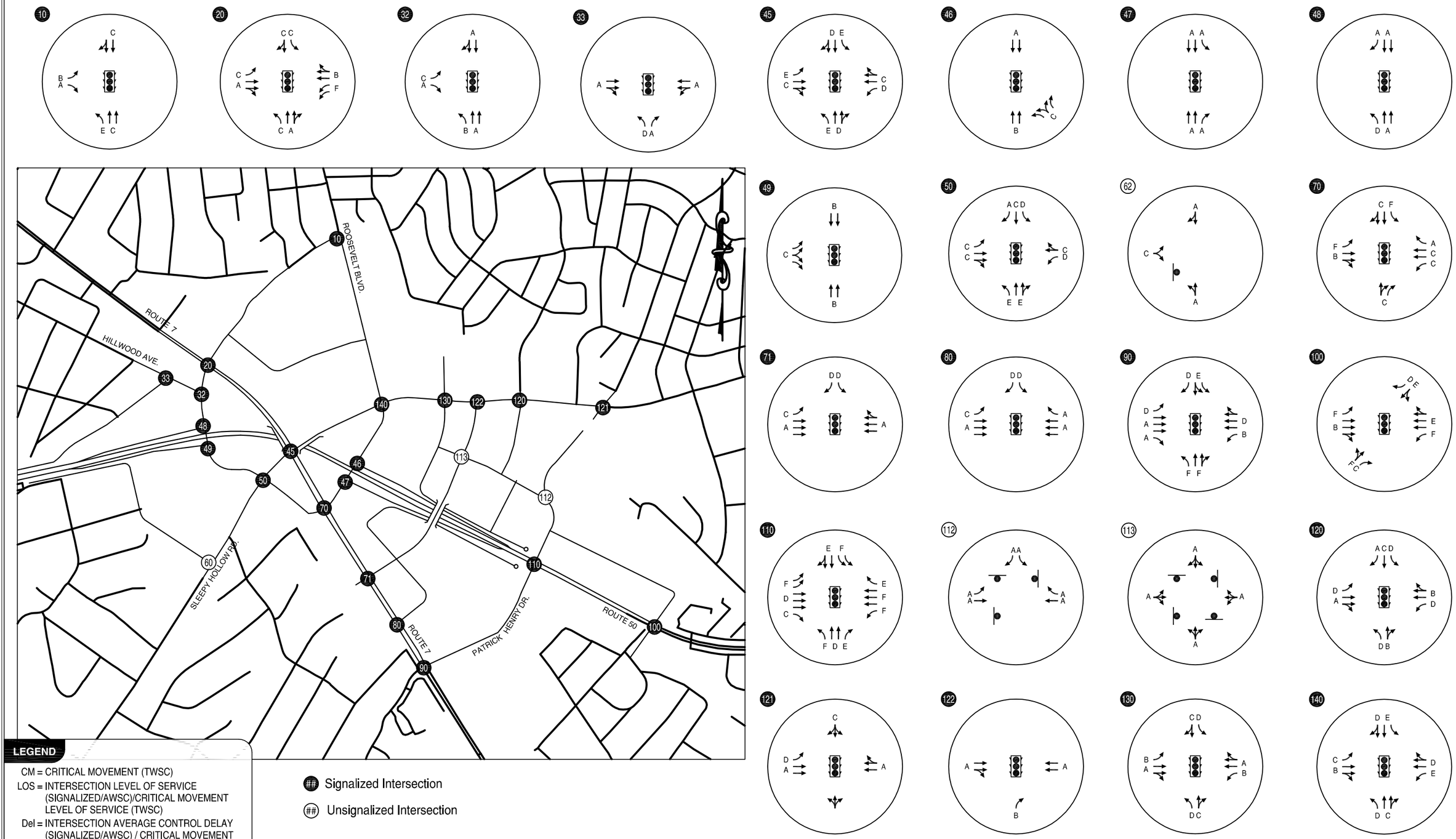

SIMTRAFFIC LOS BY MOVEMENT RESULTS FOR CONCEPT B
WEEKDAY AM PEAK HOUR
FAIRFAX COUNTY, VIRGINIA

FIGURE 41

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6.2.4 Year 2040 PM Peak Hour SimTraffic Results

Table 14 summarizes the comparison between HCM analysis and SimTraffic analysis during the p.m. peak hour for Concept B. In general, the SimTraffic analysis results in higher intersection delay than the HCM analysis. The discrepancy between the two methods during the p.m. peak hour is larger than that during the a.m. peak hour; primarily because the more congested afternoon traffic conditions are capturing the impacts of queue spillback, which is better modeled in SimTraffic.

Table 14. Comparison of HCM Analysis and SimTraffic Analysis for Concept B (PM Peak Hour)

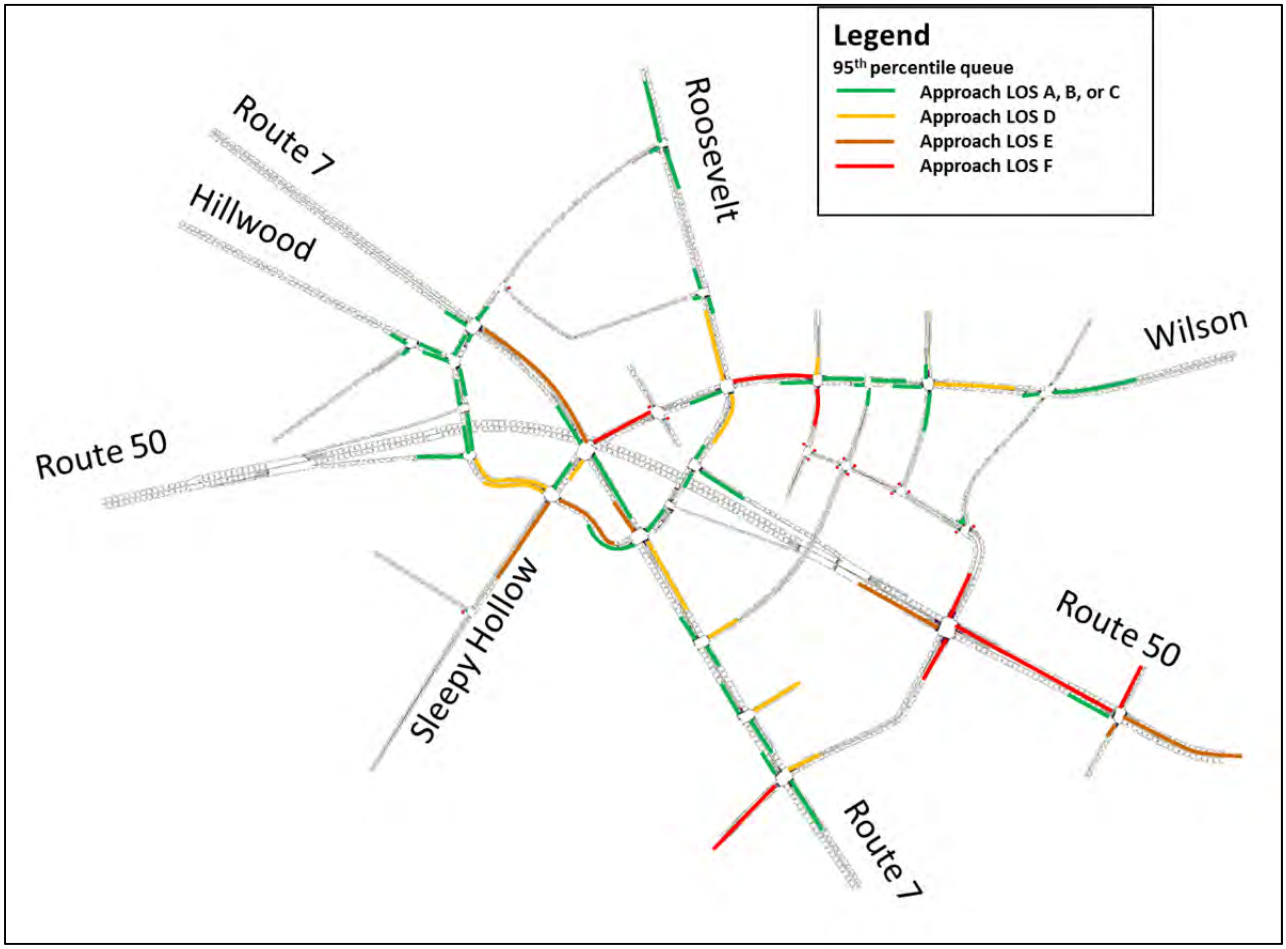
Intersection Name	Intersection ID	HCM Analysis			SimTraffic Analysis		
		LOS	Delay (s)	V/C	LOS	Delay (s)	V/C
Roosevelt Blvd/N. Roosevelt St	10	C	25.3	0.40	C	27.6	0.40
Route 7/N Roosevelt St	20	B	10.8	0.57	D	41.4	0.57
Sleepy Hollow Rd/Castle Pl	*50*	D	48.8	0.97	D	48.4	0.97
Route 7/Castle Rd	70	D	49.6	0.92	D	37.2	0.92
Route 7/Seven Corners Center entrance	80	B	16.0	0.67	B	17.9	0.67
Route 7/Patrick Henry Dr	90	C	27.9	0.84	E	60.4	0.84
Route 50/Olin Dr	100	D	38.7	> 1.00	D	45.0	> 1.00
Route 50/Patrick Henry Dr	110	D	45.5	0.91	F	87.0	0.91
Wilson Blvd/John Marshall Dr	120	C	20.3	0.66	D	35.4	0.66
Wilson Blvd/Peyton Randolph Dr	130	B	12.2	0.45	C	28.3	0.45
Wilson Blvd/Roosevelt Blvd	140	C	34.9	0.75	E	59.1	0.75
Route 7/Wilson Blvd/Sleepy Hollow Rd	45	D	44.4	0.81	D	49.6	0.81
Roosevelt Blvd/Route 50 Westbound Off-ramp	46	C	23.9	0.33	C	25.7	0.33
Roosevelt Blvd/Route 50 Eastbound On-ramp	47	A	0.2	0.26	A	2.2	0.26
S. Roosevelt St/Route 50 Westbound On-ramp	48	B	13.0	0.62	B	17.8	0.62
S. Roosevelt St/Route 50 Eastbound Off-ramp	49	B	18.5	0.39	D	35.2	0.39

Unsignalized intersections are in italics
Intersections shown in green constitute the Interchange Area for each scenario

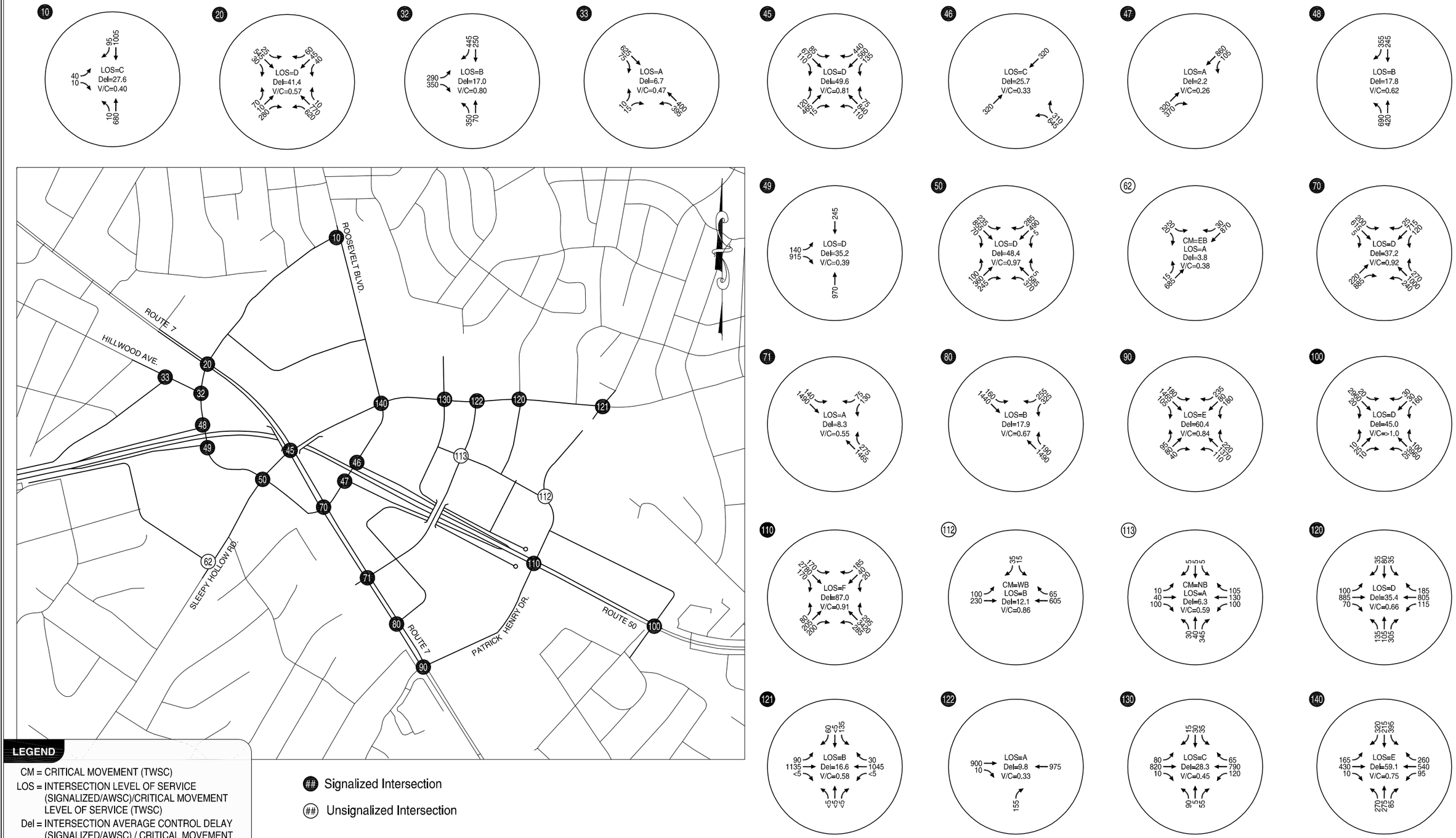
Figure 42 on the following page shows the 95th percentile queue and level-of-service of each approach for Concept B during the p.m. peak hour. The key highlights of Concept B during the p.m. peak hour are summarized as follows:

- More congestion would be expected during the p.m. peak hour compared with the a.m. peak hour
- The new interchange ramp terminals would operate below or close to capacity
- The intersection of Route 50/Patrick Henry Drive would operate above capacity and queuing would spillback to adjacent intersections and ramps
- The “ring road” and new overcrossings would be able to accommodate forecasted traffic volumes much better than existing interchange
- The intersections along the direct connection between Route 7 and Roosevelt Boulevard would operate at LOS “D” or better

Figure 42. SimTraffic 95th Percentile Queues and LOS by Approach for Concept B (PM Peak Hour)



Summary traffic operations results for the SimTraffic analysis for Concept B for the p.m. peak hour can be seen in Figure 43. Figure 44 provides the level of service by movement for each intersection in Concept B during the p.m. peak hour. The complete SimTraffic results for Concept B for the p.m. peak hour can be found in Appendix G.

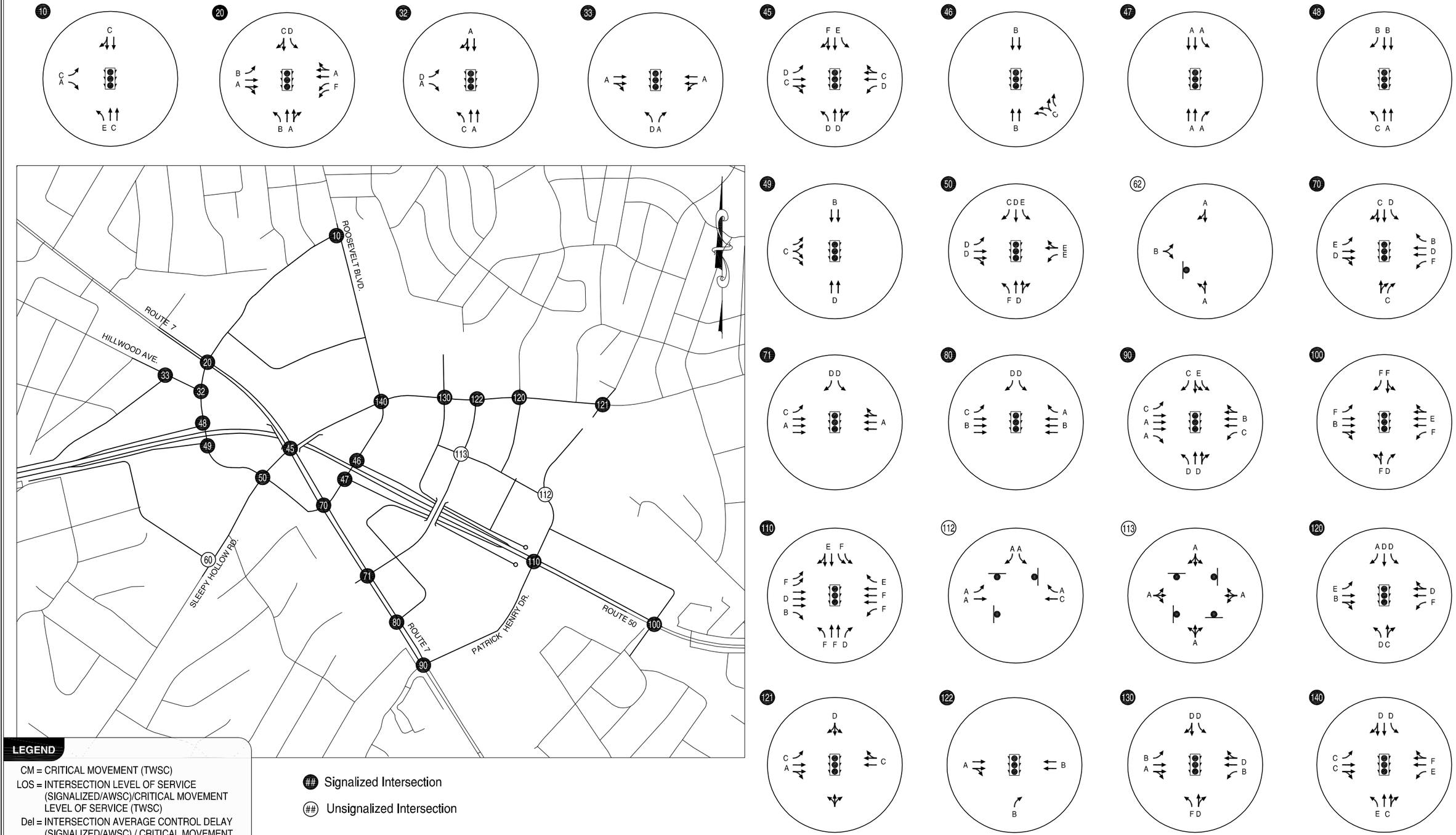


SIMTRAFFIC RESULTS FOR CONCEPT B
WEEKDAY PM PEAK HOUR
FAIRFAX COUNTY, VIRGINIA

FIGURE 43

H:\profile\13942 - Seven Corners Transportation Study Part 2\dwgs\figs\JSM\13942_Seven_Corners - AJB.dwg Jul 07, 2014 - 1:53pm - abutsick Layout Tab: Fig_34

Kittelson & Associates, Inc.
TRANSPORTATION ENGINEERING / PLANNING



SIMTRAFFIC LOS BY MOVEMENT RESULTS FOR CONCEPT B
WEEKDAY PM PEAK HOUR
FAIRFAX COUNTY, VIRGINIA

FIGURE 44

H:\profile\13942 - Seven Corners Transportation Study Part 2\dwgs\figs\JSM\13942_Seven_Corners - AJB.dwg Jul 07, 2014 - 1:55pm - abutsick Layout Tab: Fig_F

6.3 CONCEPT B WEAVING ANALYSIS

The proposed on-ramp to eastbound Route 50 would create a weaving area between the on-ramp merge area and the signalized intersection with Patrick Henry Drive. The weaving conflict would include the eastbound on-ramp traffic continuing through on Route 50 weaving with vehicles turning right onto Patrick Henry Drive from eastbound Route 50. It is proposed that vehicles entering Route 50 from the on-ramp would not be allowed to make a left a Patrick Henry Drive – doing so would eliminate that weaving maneuver. Fairfax County requested the weaving segment on Route 50 to be studied to determine the level-of-service. This weaving analysis must be considered planning-level and preliminary, and further work is required before conclusions can be confirmed.

Based on the proposed location of the ramp and the geometric design standards in the VDOT Design Manual (page A-16 in Appendix A of the VDOT Design Manual), the minimum length for the weaving area on Route 50 would be approximately 1,600 feet. As determined by the microsimulation runs from the SimTraffic analysis, the weaving area between the Route 50 eastbound on-ramp and the Patrick Henry Drive intersection would operate at LOS "F" based on the traffic speed (as determined by SimTraffic) in relation to the free-flow speed. This is in accordance with procedures from the HCM 2010 for freeway segments, which are not entirely applicable because Route 50 is a signalized arterial and not a freeway. However, this procedure makes a good approximation, as the resulting speeds from SimTraffic (approximately 7 mph) are well below the minimum threshold for LOS "E" (approximately 14 mph).

A paper[1] published by Joel Leisch in 1996 describes a process for determining minimum weaving distances on arterials. Leisch's approach uses three components to determine the minimum weaving distance, one of which is the downstream through movement queue (the queue for the eastbound Route 50 through movement at Patrick Henry Drive). In the worst case for Concept B (the a.m. peak period), the eastbound queue would be in excess of 1,600 feet (the 95th percentile queue for existing conditions exceeds 1,600 feet as well). This indicates the minimum weaving distance (by this method) would need to be much longer than 1,600 feet.

The microsimulation results and the methodology from the Leisch paper show that a 1,600 foot weaving section would operate at LOS "F" (microsimulation) or be below the minimum distance (Leisch methodology) needed during the a.m. peak period. However, that section of eastbound Route 50 would operate with low vehicle speeds in the Comprehensive Plan scenario without the weaving area present because of the high traffic volumes and downstream traffic signal at Patrick Henry Drive. Comparing operations between the Comprehensive Plan and Concept B scenarios, it is likely that the addition of the on-ramp and weaving segment in Concept B would not create additional congestion over the Comprehensive Plan scenario. The on-ramp location in Concept B would add an additional eastbound lane when it joins Route 50, which would increase capacity in the weaving area.

In conclusion, the eastbound Route 50 on-ramp needs further geometric analysis and input from FCDOT, VDOT, property owners, and stakeholders.

[1] Procedure for Design Analysis of Frontage Road Weaving Sections

6.4 MITIGATION PROJECTS IN SUPPORT OF CONCEPT B

There are several projects within the study area that could be implemented in the interim while further analysis and design is completed for the interchange. While these projects would mitigate some congestion in the study area, and be constructed relatively quickly and for costs much lower than a complete redesign of the interchange, they would only provide spot improvements. The main concern from a traffic engineering perspective with the interchange is that almost all traffic volume flowing through the study (except for traffic that passes through and remains on Route 50) is required to travel through the cluster of intersections in the interchange area. Until the interchange is modified through a new reconfiguration project, there is little to be done to alleviate the majority of congestion within a short time frame or for minimal construction costs. However, there are some potential mitigation projects within the interchange area and at the nearby intersections of Route 50/Patrick Henry Road and Route 50/Olin Road that would provide some improvement.

Mitigation projects that could be completed in the short term and long term within the interchange area are shown in Figure 45 and described below.

- Short term mitigations are:
  - Improve roadway striping, signing, and pavement markings
  - Restripe westbound Route 7 to allow dual left-turns onto Route 50
  - Optimize signals and retime signals within the interchange area
- Medium term mitigations are:
  - Add a pedestrian crossing at the westbound Route 7/Wilson Boulevard intersection (pedestrian signals, sidewalks)
  - Close westbound Route 7 right-turn to frontage road
  - Add right-turn lane to Route 50 eastbound off-ramp
  - Close eastbound Hillwood Road access to Route 7
  - Close eastbound Route 7 access to Sleepy Hollow Road

Mitigation projects that could be completed at the Route 50/Patrick Henry Drive and Route 50/Olin Drive intersections are described below and shown in Figure 46.

- Add dual eastbound/westbound left-turn lanes at the Patrick Henry Dive intersection
  - Improves capacity for left-turn and through movements
  - Improves capacity for Patrick Henry Drive
  - Encourage diversion from Interchange area
  - Supports future Concept B or C
- Relocate the Olin Drive signal to the Target entrance and add protected left turn lanes on Route 50
  - Potential safety improvement and additional connection
  - Supports future Concept B or C

Figure 45. Mitigation Options – Interchange Area

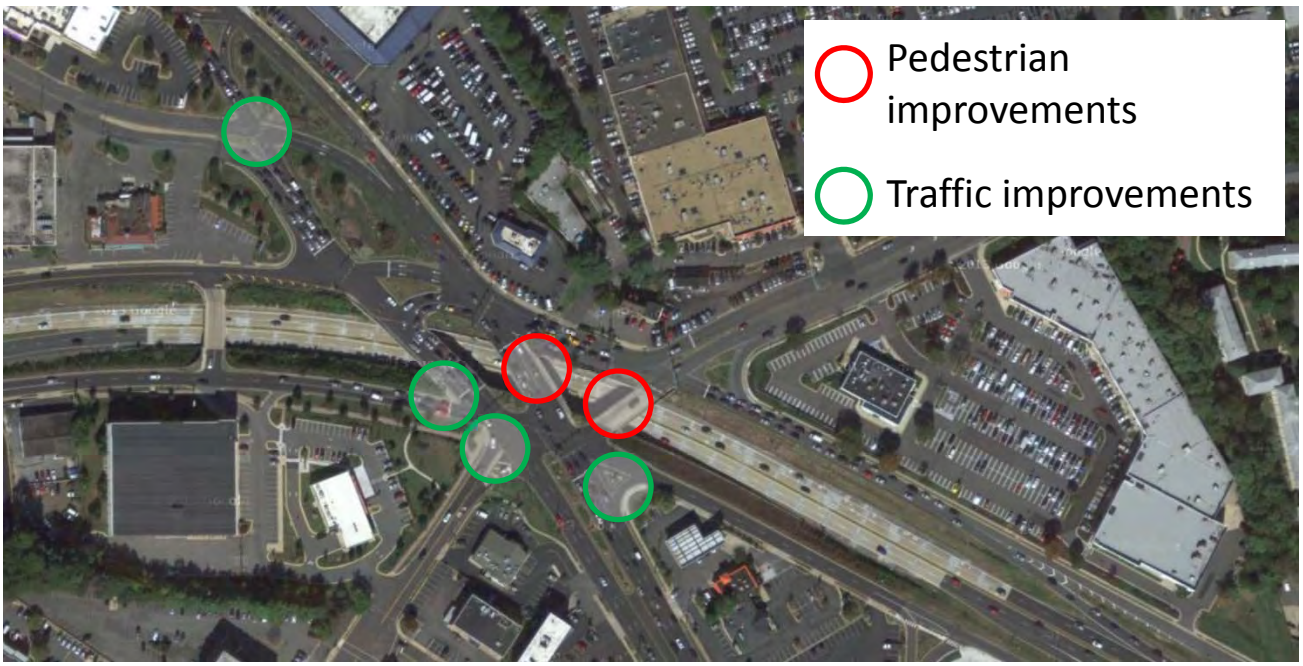
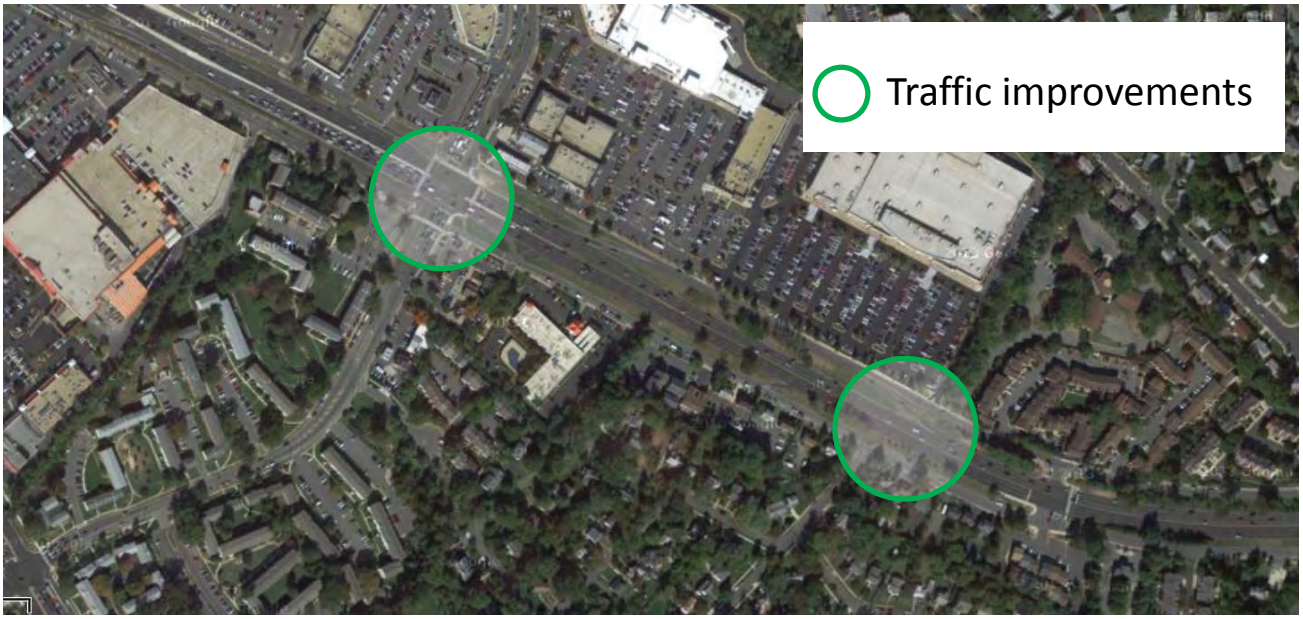


Figure 46. Mitigation Options – Route 50/Patrick Henry Drive and Route 50/Olin Drive



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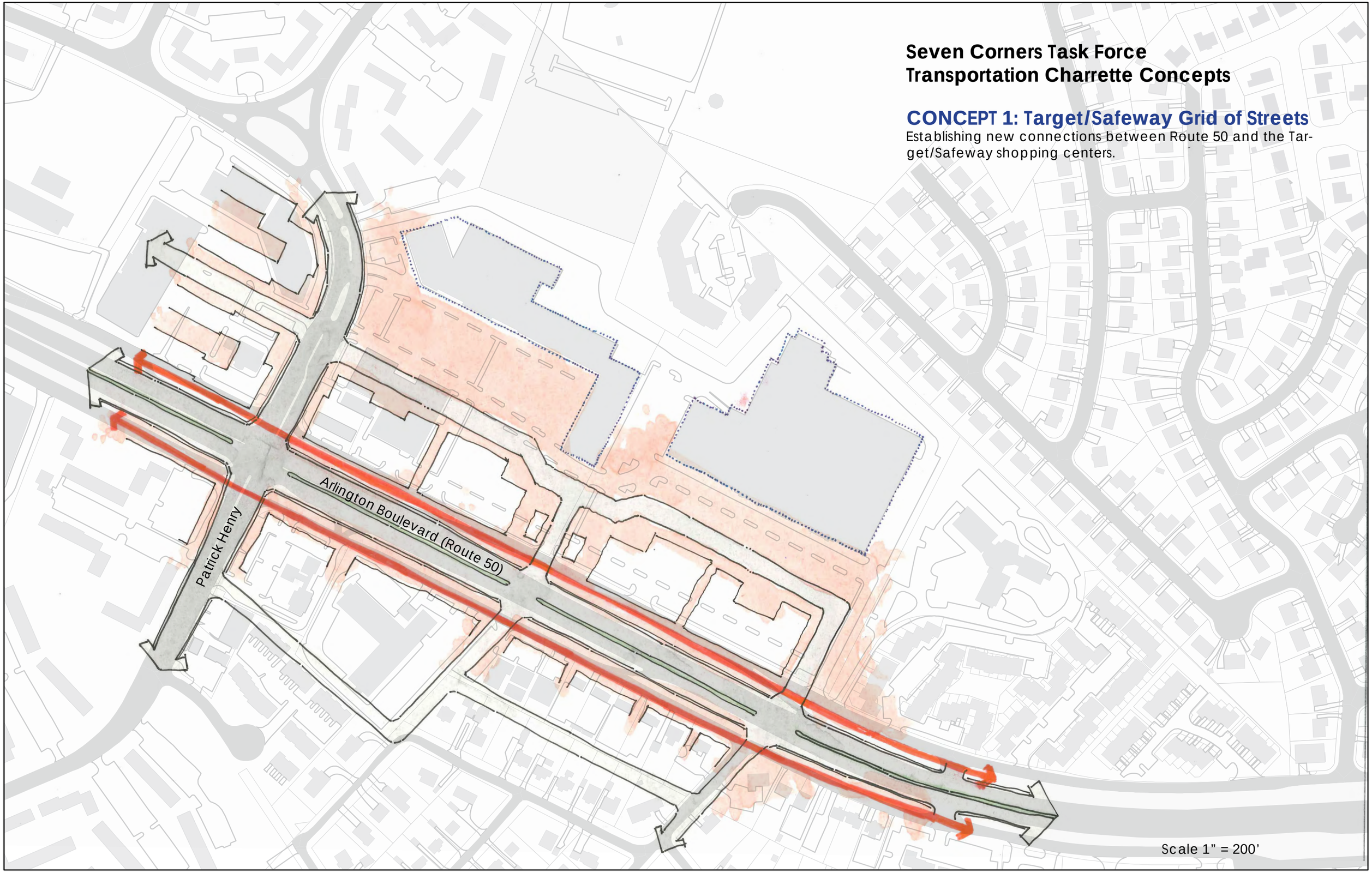
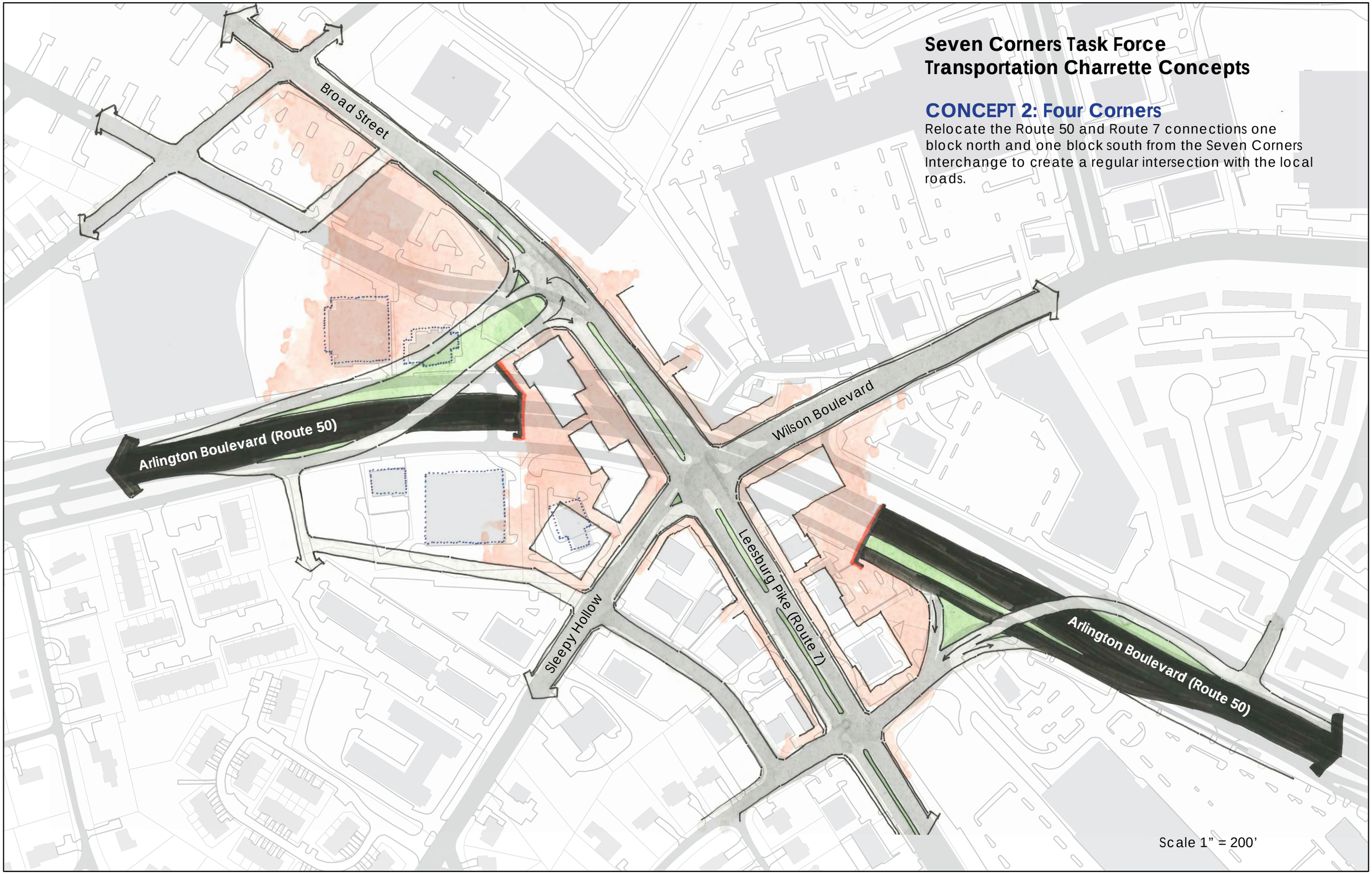
Appendix A
Preliminary Sketches for Task Force Charrette

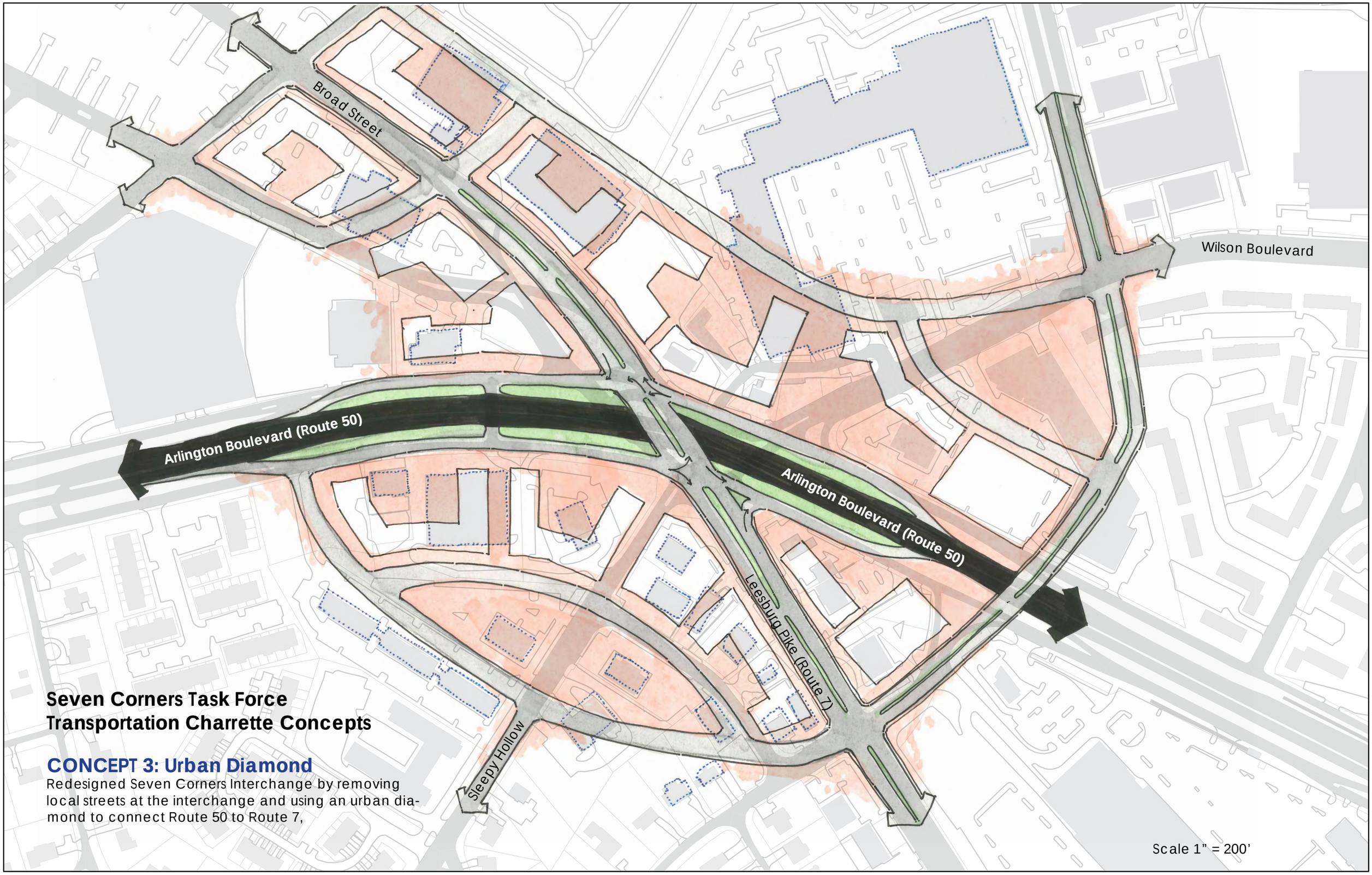

Seven Corners Task Force
Transportation Charrette Concepts
CONCEPT 1: Target/Safeway Grid of Streets
Establishing new connections between Route 50 and the Target/Safeway shopping centers.
Patrick Henry
Arlington Boulevard (Route 50)
Scale 1" = 200'



Seven Corners Task Force
Transportation Charrette Concepts

CONCEPT 2: Four Corners

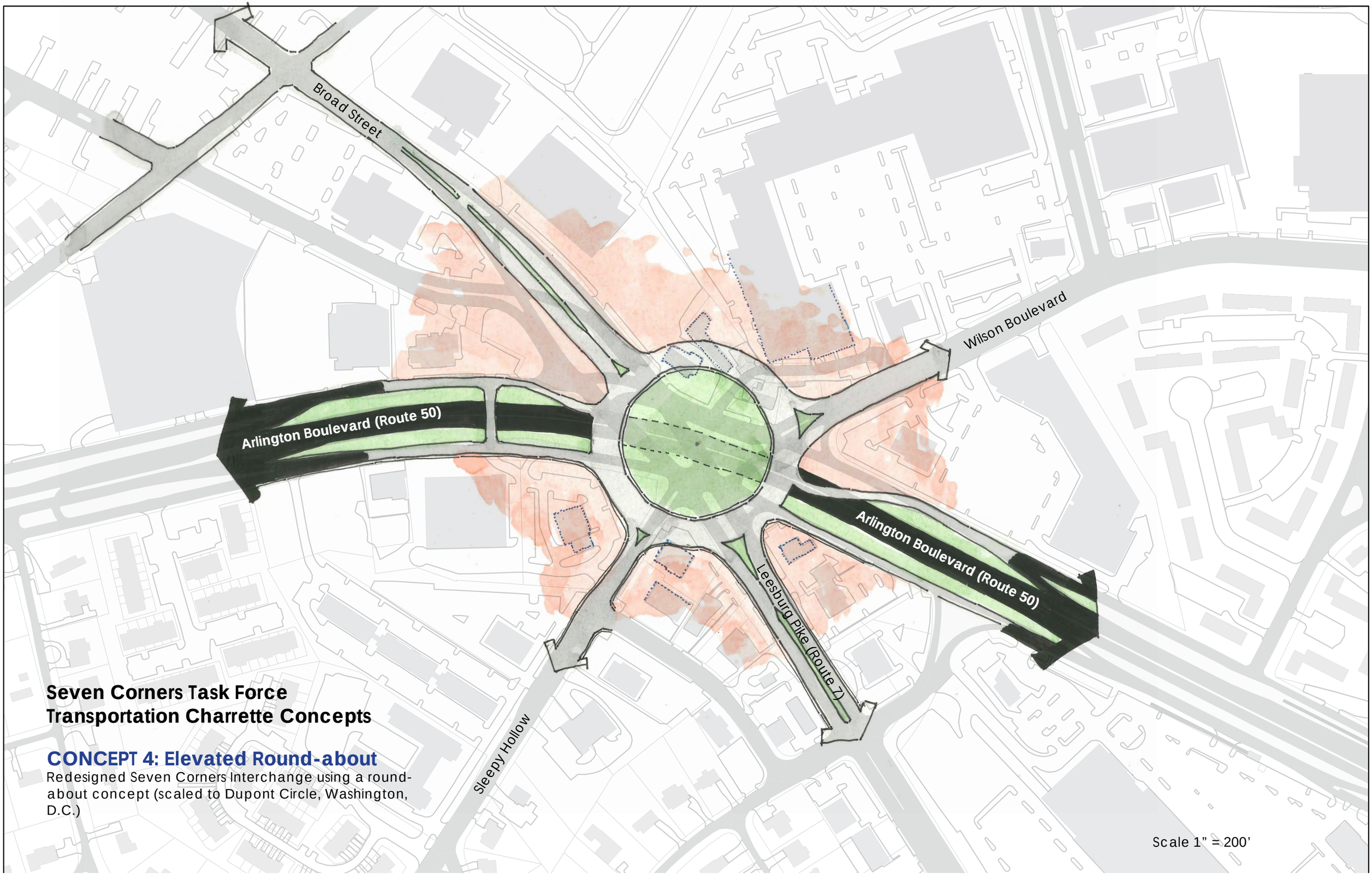
Relocate the Route 50 and Route 7 connections one block north and one block south from the Seven Corners Interchange to create a regular intersection with the local roads.



Seven Corners Task Force
Transportation Charrette Concepts

CONCEPT 3: Urban Diamond

Redesigned Seven Corners Interchange by removing local streets at the interchange and using an urban diamond to connect Route 50 to Route 7,



Seven Corners Task Force
Transportation Charrette Concepts

CONCEPT 4: Elevated Round-about

Redesigned Seven Corners Interchange using a round-about concept (scaled to Dupont Circle, Washington, D.C.)

Scale 1" = 200'

Appendix B
Land Use Data and Travel Demand Modeling

TRAVEL DEMAND MODELING AND FORECASTING PLAN METHODOLOGY FOR ALTERNATIVE ANALYSES

Seven Corners Transportation Analysis – Phase 2

January 15, 2014

DRAFT

Prepared by:

KITTELSON & ASSOCIATES, INC.
TRANSPORTATION ENGINEERING/PLANNING

1850 Centennial Park Drive, Suite 130
Reston, VA 20191

Introduction

Travel demand modeling and forecasting is a major component in the Seven Corners Transportation Study – Phase 2. The study team will use this process to produce forecasted future traffic issues for a set of proposed conceptual design and land use scenarios. These scenarios will include land use composition and road improvements for the future forecast year 2040. Once the traffic volumes forecasts are produced, they will serve as the inputs to an analysis of traffic conditions at critical locations, which will be principal component of the overall vehicular traffic evaluation. This memo documents the travel demand model that will be used for the Seven Corners Transportation Study – Phase 2 and the method for producing the future year forecasts.

Existing Model

Fairfax County's travel demand model will be used to forecast future traffic volumes for this study. The model uses the Cube operating environment. This is the same travel modeling software package used by the Metropolitan Washington Council of Governments (MWCOG) and Fairfax County's model was originally developed from MWCOG's.

The latest version of Fairfax County's model was updated in 2013 and includes:

- Calibration and validation using the 2007/2008 Transportation Planning Board Household Travel Survey, several transit on-board surveys, and recent traffic counts
- Socio-economic data from the MWCOG 8.1 land use forecast for the area outside of Fairfax County and the 8.2 forecast within Fairfax County
- The Jones Falls transportation network in Tysons Corner

Fairfax County's model has four time periods:

- AM Peak Period – 3 hours, 6-9 a.m.
- MD Off Peak Period – 6 hours, 9 a.m. – 3 p.m.
- PM Peak Period – 4 hours, 3-7 p.m.
- Night Off Peak Period – 9 hours, 7 p.m. – 6 a.m.

Data is also available for the 24-hour period.

Year 2007 Existing Conditions Travel Demand Model Review

Kittelson & Associates (KAI) and Cambridge Systematics conducted a review of the 2007 model. The elements of the model review included:

- Study area link speeds, capacities, and number of lanes
- Compared a.m., p.m., and daily period model volume assignments with 2013 tube count data
- Compared the 2013 origin-destination data from the Seven Corners Transportation Study – Phase 1 report with the select link (also referred to as flow bundles) results for the eight main roadways in the study area (see Select Link technical memorandum for results)

As the result of the review, Cambridge Systematics made network changes, updated the travel demand model, and reran the assignment for the existing conditions model.

Developing Future Year 2040 Travel Demand Modeling Scenarios

The future transportation network in the LRTP and the future land use scenario derived from the Comprehensive Plan constitutes the No-Build scenario, which will be used as the basis of comparison for all the other future scenarios. Within the study area, the only future year transportation project that is part of the

Long Range Transportation Plan (LRTP) is to widen US-50 to six lanes throughout the study area. The future "Build" scenario for the purpose of the travel demand forecasting will be developed by modifying the "No Build" model to include one of the three selected conceptual designs and inputting the Seven Corner's Task Force's new land use assumptions.

Methodology for Future Model Development, Future Volume Forecasting, Traffic Assignment, and Operational Analysis

For the future scenarios, the following are the steps that will be used to obtain the adjusted study roadway segment volumes and intersection turning movement volumes for operational analyses:

1. Run the 2040 No-Build travel demand model (with Comprehensive Plan land use data) based on modifications (geometry, capacity, number of lanes, speed) from the existing model validation review
2. Develop land use inputs for the Seven Corners Task Force Land Use Scenario
3. Cambridge Systematics will perform model runs for the No-Build and Seven Corners Task Force Land Use scenarios and provide outputs to KAI
4. To develop the peak hour volumes from the Fairfax County travel demand model, we will use the travel demand model's peak hour factor
5. Post-process travel demand model link assignment results using procedures in the "Highway Traffic Data for Urbanized Area Project Planning and Design" (National Cooperative Highway Research Program Research Report 255, 1982) as described below:

   There are two common procedures for adjusting link volumes from a model: the difference (or increment) method or the ratio method. The link volumes reported from the Fairfax County travel demand model will be adjusted based on either one of these methods. The selection of either method depends on engineering judgment and the experience of the modeler. Both methods may be applied during the analysis, but only one method is selected for each link.

   > **Difference Method:** The growth increment from the base year model to the forecast year model is added to the base year traffic count to create the adjusted model forecast.
   >
   > **Ratio Method:** This method applies the ratio of the forecast year model volume to the base year model volume to the base year traffic count to create the adjusted model forecast.

   The assumption used is that the discrepancy between a base year count and a base year assignment is likely to be of the same magnitude in the future year. Given this assumption, the future year model volumes can be modified by comparing the relative ratios or differences between base year links. Therefore, adjustments will be applied to model results prior to traffic operation analysis.

   The result of this step will be the forecasted future link volumes for each scenario.

6. Apply the existing conditions origin-destination routing results to the future forecast volumes for the eight entry links to the Seven Corners study area to generate forecast traffic volumes for all routes within the study area
7. Future forecast volumes will be hand-assigned to the three conceptual networks using the following guiding principles:
   a. Regional movements will use roadways with the highest functional classification to avoid the local network

b. Vehicles will take the fastest path between two points and travel in a manner that is consistent with existing conditions travel behaviors and the results will reflect overall roadway and intersection network equilibrium
c. Non-regional or local access movements may seek alternate paths (including local roads) to avoid congestion caused by heavy regional movements
d. Vehicles will not cut-through private business access roads
e. Vehicles will try to minimize the number of stops and signalized intersections to travel through, and will choose to make right-turns rather than left-turns

Record-keeping of the individual movement hand assignments will be kept so that the assumptions can be reviewed.

8. The traffic operations analysis and measures of effectiveness (MOEs) below describes the methodology for the initial review of the volume assignment results on the conceptual design networks. This analysis seeks to identify movements that would be over-capacity, locations that would experience excessive queuing, inadequate lane geometry, and improper lane assignments, among other potential concerns. The initial results will provide further information to inform necessary modifications to the conceptual designs. For results that are inconclusive and need further investigation or for locations that cannot be properly evaluated using deterministic tools, a more detailed analysis will employ microsimulation.

    a. **Intersections**: Evaluate using Synchro to develop MOEs that include: queue length, delay, and v/c. Calibration data from the Seven Corners Transportation Study – Phase 1 will be used. In the absence of data, default values will be used in accordance with the VDOT Traffic Operations Analysis Tool Guidebook, version 1.1
    b. **Weaving segment and merge/diverge areas**: Evaluate using HCS to report level-of-service results based on density calculations. Calibration data from the Seven Corners Transportation Study – Phase 1 will be used. In the absence of data, default values will be used in accordance with the VDOT Traffic Operations Analysis Tool Guidebook, version 1.1
    c. **Roadway segments**: Travel times will be developed for a subset of origin-destination pairs for each of the three conceptual designs for scenario comparison purposes

9. The results of the analysis will be presented in accordance with VDOT requirements and in report format.

ORIGIN-DESTINATION/SELECT LINK COMPARISON ANALYSIS TECHNICAL MEMORANDUM

Seven Corners Transportation Analysis – Phase 2

January 15, 2014

DRAFT

Prepared by:

KITTELSON & ASSOCIATES, INC.
TRANSPORTATION ENGINEERING/PLANNING

1850 Centennial Park Drive, Suite 130
Reston, VA 20191

Introduction

This technical memorandum describes the results of a comparison analysis between the origin-destination data collected by Skycomp, Inc. in April, 2013 and the select link (flow bundle) results from the validated year 2007 Fairfax County existing conditions travel demand model. A summary of the highlights of the comparison analysis are presented first, after which the memorandum is organized as follows: a description of the Skycomp origin-destination and select link travel demand model data; a comparison (including vehicle volumes) of the two data sets; and the conclusions that can be drawn from the results.

Analysis Highlights

The highlights of the comparison analysis are:

- The updated Fairfax County model provided reasonable traffic assignment for over 90 percent of the primary origin-destination pairs
- The comparison between the model and collected tube data indicates that the model provides an excellent estimation of the total traffic volumes in the study area
- There are discrepancies in the model in volume assignment and routing on Wilson Boulevard
- Use of the existing origin-destination data, tube counts, turning movement counts, and the ability to post-process forecast volumes will be able to account for any differences between the model and field data

Skycomp Origin-Destination Data

In April 2013, Skycomp used a hovering helicopter over the Seven Corners study area in Fairfax County, Virginia to record 75 minutes of traffic flow data during each of the peak morning and evening survey periods. Skycomp then analyzed the time-lapse aerial photography to determine the origin-destination travel patterns in the vicinity of the US-50/VA-7 interchange area.

As shown in Figure 1, the survey area was centered on the Seven Corners interchange area. Skycomp devised a camera coverage plan such that the entire survey area (red boundary) was monitored by a pair of cameras mounted aboard the helicopter.

Figure 1. Skycomp Study Boundaries

Table 1 and Table 2 summarize the origin-destination results from Skycomp for the a.m. and p.m. peak hours, respectively. The data in the table represents the percentages of the volume at the eight primary origin points shown in Figure 2. The origin and destination IDs can be seen on the zone map in Appendix A.

Table 1. Origin-Destination Results for the AM Peak Hour

	Destination ID									
Origination ID	101	102	103	104	105	106	107	108	External (Other than 101-108)	Internal (131-166)
101	0%	0%	0%	0%	5%	72%	6%	0%	10%	7%
102	0%	2%	2%	0%	20%	18%	22%	0%	9%	28%
103	0%	2%	0%	0%	9%	20%	37%	4%	8%	20%
104	2%	3%	0%	0%	29%	5%	11%	8%	21%	22%
105	13%	3%	2%	34%	0%	3%	0%	5%	23%	16%
106	59%	2%	7%	2%	0%	0%	0%	2%	17%	10%
107	21%	7%	31%	13%	2%	1%	1%	2%	12%	13%
108	0%	1%	3%	14%	16%	19%	11%	0%	8%	29%

Table 2. Origin-Destination Analysis Results for the PM Peak Hour

	Destination ID									
Origination ID	101	102	103	104	105	106	107	108	External (Other than 101-108)	Internal (131-166)
101	0%	0%	0%	0%	4%	55%	19%	0%	12%	9%
102	0%	0%	0%	0%	5%	20%	31%	2%	17%	26%
103	0%	0%	0%	1%	2%	12%	48%	9%	9%	19%
104	1%	0%	0%	1%	18%	6%	13%	11%	26%	25%
105	15%	8%	6%	2%	0%	0%	3%	10%	24%	32%
106	43%	6%	4%	1%	0%	0%	1%	4%	32%	10%
107	15%	9%	20%	5%	1%	2%	0%	5%	20%	22%
108	3%	3%	8%	3%	0%	10%	10%	0%	25%	40%

Figure 2. Locations of Primary Originations and Destinations

Travel Demand Model Results

The Fairfax County year 2007 existing conditions travel demand model was reviewed and modified to better represent real-world conditions. The following revisions were made to the model:

- The number of lanes for several links in the study area were corrected
- The lane configurations of several intersections (for example, the number of left-turn lanes) were modified
- The speed limits of the roadway links in the study area were updated based on posted speeds

Table 3 and Table 4 summarize the select-link analysis for the a.m. and p.m. peak hours, respectively. The data in the table represents the percentages of the volume at the eight primary origin points shown in Figure 2.

Table 3. Select-Link Analysis Results for the AM Peak Hour

	Destination ID									
Origination ID	101	102	103	104	105	106	107	108	External (Other than 101-108)	Internal (131-166)
101	0%	0%	0%	1%	33%	58%	3%	0%	0%	5%
102	0%	0%	0%	0%	17%	13%	20%	0%	9%	41%
103	0%	0%	0%	0%	1%	19%	50%	0%	1%	29%
104	14%	0%	1%	0%	2%	3%	34%	6%	0%	39%
105	38%	3%	2%	8%	0%	1%	8%	7%	4%	29%
106	49%	1%	8%	7%	1%	0%	0%	0%	4%	29%
107	15%	2%	24%	26%	2%	0%	0%	0%	11%	19%
108	0%	0%	0%	25%	18%	9%	0%	0%	8%	39%

Table 4. Select-Link Analysis Results for the PM Peak Hour

	Destination ID									
Origination ID	101	102	103	104	105	106	107	108	External (Other than 101-108)	Internal (131-166)
101	0%	0%	0%	7%	18%	42%	12%	0%	0%	21%
102	0%	0%	0%	0%	8%	7%	26%	0%	0%	59%
103	0%	0%	0%	0%	0%	12%	50%	0%	1%	36%
104	5%	1%	2%	0%	1%	10%	26%	13%	1%	41%
105	55%	7%	4%	1%	0%	1%	2%	10%	3%	18%
106	71%	3%	8%	2%	0%	0%	0%	1%	1%	14%
107	8%	7%	27%	20%	3%	0%	0%	0%	11%	24%
108	0%	0%	0%	5%	9%	12%	0%	0%	8%	66%

Data Set Comparisons

The origin-destination and the select-link results for the Fairfax County year 2007 existing conditions travel demand model are compared in Table 5 and Table 6. The tables summarize the results in terms of the difference between the travel model select-link results and the Skycomp origin-destination data (model output data minus Skycomp data) for the a.m. and p.m. peak hours, respectively. Data highlighted in yellow show routes which differ more than 25 percent between the two data sets. As the external and internal zone network for the Skycomp analysis was far more disaggregate than the TAZ network for the travel model data, the external and internal results are not comparable and the data is shown for discussion purposes only.

Table 5. Comparison between Travel Demand Model (Select Link) and Skycomp (Origin-Destination) for the AM Peak Hour

	Destination ID									
Origination ID	101	102	103	104	105	106	107	108	External(Other than 101-108)	Internal (131-166)
101	0%	0%	0%	1%	28%	-14%	-3%	0%	-10%	-2%
102	0%	-2%	-2%	0%	-3%	-5%	-2%	0%	0%	13%
103	0%	-2%	0%	0%	-8%	-1%	13%	-4%	-7%	9%
104	12%	-3%	1%	0%	-27%	-2%	23%	-2%	-21%	17%
105	25%	0%	0%	-26%	0%	-2%	8%	2%	-19%	13%
106	-10%	-1%	1%	5%	1%	0%	0%	-2%	-13%	19%
107	-6%	-5%	-7%	13%	0%	-1%	-1%	-2%	-1%	6%
108	0%	-1%	-3%	11%	2%	-10%	-11%	0%	0%	10%

XX% Indicates a difference (model – Skycomp) greater than 25%. Positive values indicate larger model percentages; negative values indicate larger Skycomp percentages

As shown in Table 5, the select link results are similar to the Skycomp origin-destination data for the majority of the route pairs. Among the 64 primary (IDs 101-108) origin-destination pairs, 57 (89 percent) pairs have a difference less than ten percent and 61 (95 percent) pairs have the difference less than 20 percent. Routes which show a difference greater than 25 percent are:

- Route 101-105: Eastbound US-50 to eastbound Wilson Boulevard (28 percent)
- Route 104-105: Eastbound US-50 to northbound Roosevelt Street (-27 percent)
- Route 105-101: Westbound Wilson Boulevard to westbound US-50 (25 percent)
- Route 105-104: Westbound Wilson to northbound Roosevelt Street (-26 percent)

Table 6. Comparison between Travel Demand Model (Select Link) and Skycomp (Origin-Destination) for the PM Peak Hour

	Destination ID									
Origination ID	101	102	103	104	105	106	107	108	External (Other than 101-108)	Internal (131-166)
101	0%	0%	0%	7%	14%	-13%	-7%	0%	-12%	12%
102	0%	0%	0%	0%	3%	-13%	-5%	-2%	-17%	33%
103	0%	0%	0%	-1%	-2%	0%	2%	-9%	-8%	17%
104	4%	1%	2%	-1%	-17%	4%	13%	2%	-25%	16%
105	40%	-1%	-2%	-1%	0%	1%	-1%	0%	-21%	-14%
106	28%	-3%	4%	1%	0%	0%	-1%	-3%	-31%	4%
107	-7%	-2%	7%	15%	2%	-2%	0%	-5%	-9%	2%
108	-3%	-3%	-8%	2%	9%	2%	-10%	0%	-17%	26%

XX% Indicates a difference (model – Skycomp) greater than 25%. Positive values indicate larger model percentages; negative values indicate larger Skycomp percentages

As shown in Table 6, the select link results are similar to the Skycomp origin-destination data for the majority of the route pairs. Among the 64 primary (IDs 101-108) origin-destination pairs, 59 (92 percent) have a difference less than 10 percent and 62 (97 percent) have a difference less than 20 percent. Routes which show a difference greater than 25 percent are:

- Route 105-101: Westbound Wilson Boulevard to westbound US-50 (40 percent)
- Route 106-101: Westbound US-50 to westbound US-50 (28 percent)

Traffic Volume Data Comparisons

The results of the daily volume assignment for the Fairfax County year 2007 existing conditions travel demand model are compared with six corresponding locations with field measurements collected in April, 2013 with pneumatic road tubes. Table 7 summarizes the results.

Table 7. Comparison between Model Volumes and Tube Counts (24-Hour Volumes)

Location	Tube Counts (2013)	Model Volume (2007)	Difference
Hillwood Ave west of Seven Corners	10,300	5,900	-43%
E Broad St between Seven Corners and Roosevelt St	27,800	34,700	25%
Wilson Blvd north of Seven Corners	20,800	35,200	69%
Arlington Blvd east of Seven Corners	76,300	46,100	-40%
E Broad St between Seven Corners and Thorne Rd	30,500	44,900	47%
Sleepy Hollow Rd south of Seven Corners	4,900	4,100	-16%
Total	**170,600**	**170,900**	**0%**

The comparison results show that there discrepancies at all six locations, with model volumes ranging from -40 percent to 69 percent of measured field volumes. While it is likely that the six-year gap between the data sets accounts for some of the difference, the discrepancy is slight given how substantially the travel demand model assignment at the six locations is different than the field data. Summing the entry totals for all six locations and examining the results in the aggregate, the results show a much clearer picture in terms of the model data, with the volume difference less than one percent or 300 vehicles. This indicates that the travel demand model is performing well in terms of the overall trip generation, trip distribution, and modal split steps, and that the discrepancies lie within the assignment step. In this regard, the model is routing vehicles quite differently than the field data indicates; this may be related to effects in the model that lie upstream or downstream of the study area or in the model's accounting for intersection delay in and around the interchange area.

The volume differences shown in Table 7 are helpful in confirming some of the differences seen in Table 5 and Table 6. The larger model volume on Wilson Boulevard accounts for some of the identified disparities in all origin-destination routes that include ID 105 (Wilson Boulevard), and would likely have an effect on route pairs that include ID 106 (Roosevelt Street). The effects of volume over-assignment (relative to the field data) to Wilson Boulevard also impacts results for US-50, which parallels Wilson Boulevard.

Conclusions

The Fairfax County travel demand model provides reasonable traffic assignment for almost all of primary origin-destination pairs. The differences between the travel demand model select-link data and the Skycomp origin-destination data are less than 10 percent for approximately 90 percent of the primary origin-destination pairs for the a.m. and p.m. peak hours. Several Wilson Boulevard origin-destination pairs in both time periods have traffic assignments that exceed 25 percent of collected field data. This discrepancy aligns with an over-assignment of traffic volumes to Wilson Boulevard relative to tube count data. Despite differences in daily volume assignments on the roadways in the study area, the overall traffic assignment is less than one percent different than the measured tube counts, which indicates that the travel demand model performs well in the trip generation, trip distribution, and mode split steps.

The NCHRP 255 process allows for volume growth using relative changes between existing and future models, which helps to reduce a source of potential error in the assignment step (under the assumption that the error would be present in both the existing and future models). The ability to use tube count and origin-destination data provides two additional data sets to develop future forecast volumes. Therefore, the differences seen in the travel demand model in the assignment step (for example, on Wilson Boulevard) will be able to be post-processed when forecasting future volumes and hand-assigning trips to the conceptual design networks.

Appendix A: Origin-Destination ID Overlay Guide

Land Use data for Transportation Analysis Zones (TAZ) for the Seven Corners Study Area

	TAZ	HH	HHPOP	GQPOP	TOTPOP	TOTEMP	INDEMP	RETEMP	OFFEMP	OTHEMP
2007 Existing Conditions	1942	0	0	0	0	736	262	13	461	0
	1943	0	0	0	0	1,701	0	730	971	0
	1944	1,259	2,928	0	2,928	1,420	0	1,251	146	23
	1945	577	1,331	0	1,331	1,287	0	1,105	156	26
	Sum	**1,836**	**4,259**	**0**	**4,259**	**5,144**	**262**	**3,099**	**1,734**	**49**
2040 Comprehensive Plan	1942	0	0	0	0	792	262	43	487	0
	1943	5	13	0	13	1,484	0	503	980	1
	1944	1,207	2,659	0	2,659	1,153	0	953	177	23
	1945	614	1,481	42	1,523	1,382	0	1,186	166	30
	Sum	**1,826**	**4,153**	**42**	**4,195**	**4,811**	**262**	**2,685**	**1,810**	**54**
2040 Seven Corners Task Force Land Use Plan	1942	0	0	0	0	800	262	156	382	0
	1943	299	689	0	689	1,660	0	561	1,098	1
	1944	2,414	5,435	0	5,435	2,310	0	1,762	525	23
	1945	3,341	7,753	42	7,795	3,357	0	1,170	2,035	152
	Sum	**6,054**	**13,877**	**42**	**13,919**	**8,127**	**262**	**3,649**	**4,040**	**176**

Travel Demand Forecasting

The framework for evaluation used for the analysis of the Seven Corner Area Transportation and Land Use Planning Study is presented below. Section 1.0 details the model methodology used for the evaluation, with a description of each component. Section 2.0 describes the model calibration and validation results.

1.0 Model Methodology

Description of Framework

This section presents a brief overview of the travel demand forecasting methodology used for the Seven Corners Transportation Analysis. For this analysis, a combination of model tools was chosen to best match the modeling needs of the study. Regional models, such as the National Capital Region Transportation Planning Board (TPB) model, are used for applications such as long-term, travel demand forecasting type situations. The model being used to evaluate the impacts of land use changes on the transportation network and scenarios to mitigate the potential impacts on the transportation network is the TPB Version 2.3 model. The output from the TPB Model is used as input to the Fairfax County subzone highway assignment.

This modeling system was set up to make a full use of the regional model development and take advantage of the refined units of analysis and transportation network for Fairfax County. When this modeling system was prepared, the then officially adopted version is the Version 2.3 model. This Version 2.3.39 model was recently used in the Air Quality Conformity Determination of the 2012 Financially Constrained Long Range Transportation Plan (CLRP) and FY 2013-2018 Transportation Improvement Program (TIP), reflecting the latest planning assumptions at the beginning of this corridor study.

The TPB Version 2.3 model set covers the entire metropolitan region. To look closer at the Seven Corners Area, the TPB Version 2.3 model output was used with the Fairfax County Subarea model to assign traffic at a more detailed level within Fairfax County.

Regional Forecasting Tool Details

The TPB travel demand forecasting model uses a series of submodels or steps to produce potential travel demand given the future land use and transportation networks. The regional transportation options are represented in terms of a network. The network represents all of the transportation services and infrastructure, including transit and highway facilities. The regional area is divided into traffic analysis zones (TAZs). For the Washington Metropolitan Area, there are a total of 3,722 TAZs in the TPB Version 2.3

modeling domain. In the denser populated areas, there are a greater number of TAZs and in less dense areas the TAZs are larger. At the boundaries of the modeled areas the TAZs are larger and the highway network is less detailed. In the primary modeled jurisdictions, the highway network is more detailed and the corresponding number of TAZs is greater.

Two major inputs to the TPB Version 2.3.39 model include: 1) the transportation network that represents the 2012 CLRP and FY 2013-2018 TIP 2) land use – MWCOG Round 8.1 Cooperative Forecasts. For this study, MWCOG Round 8.2 Cooperative Forecasts were officially adopted in the summer of 2013 and now used to replace the Round 8.1 forecasts.

The Version 2.3.39 is a sophisticated, conventional trip-based travel demand model with six major steps:

• Demographic models with market stratifications by four household income groups, four household size groups, and four vehicle availability groups;

• Trip generation models for five personal trip purposes, a commercial vehicle trip purpose, and two truck trip types;

• Trip distribution model with doubly-constrained gravity model formulation with a composite impedance of transit and highway travel times;

• Mode choice model with nested logit structure for five trip purposes and two time periods;

• Time of day model with four time periods – AM peak, midday, PM peak, and night time/early morning; and

• Traffic assignment with six user classes and equilibrium assignment methodology.

Trip generation answers the question, "how much travel and for what purpose?" The trip generation model produces trips by purpose by TAZ. The output from the trip generation model is the number of trips produced at a production or origin end and trips attracted by purpose at an attraction or destination end. In the TPB model process, there are five primary purposes:

1. **Home-Based Work (HBW) –** HBW trips originate at home and travel to a place of work and back again.

2. **Home-Based Shop (HBS) –** HBS trips originate at home and travel to a place of shopping and return home again.

3. **Home-Based Other (HBO) –** HBO trips include all trips from a home not associated with work or shopping.

4. **Non-Home-Based Work (NHBW) –** NHB trips are trips that do not originate or end at a home but originate or end at a place of work. These can include trips from the place of work which return to the place of work or other similar type of trips.

5. **Non-Home-Based Other (NHBO)** – NHB trips are trips that do not originate or end at a home and a place of work.

The TPB trip generation models use assumptions about the number of trips typically made by each type of household and to each type of destination in the region. Special factors are used to account for different rates of trip-making that are characteristic of different parts of the region. These assumptions and special factors are included in the equations used to derive the trips for each zone in the region. For example, a household in an inner suburb with one car is assumed to make fewer shopping trips than a household in the outer suburbs with two cars. In general, the level of auto ownership has been found to be a good predictor of household trip rates. These relationships are based on locally-derived observations, primarily from the household travel survey.

The second step in the process is trip distribution. Trip distribution answers the question, "where do trips travel?" The trip distribution model determines the origin and destination of the productions and attractions from the trip generation step. The trip distribution model estimates the distribution of trips based on travel time and/or other travel impedance, matching productions and attractions. As future congestion increases, the trip length tends to decrease, while the travel time distribution tends to remain constant.

The third step in the process is the mode choice model. This step answers the question, "how travel will be done?" The mode choice model produces the probability of a specific mode for a specific origin-destination pair. The model determines the probability based on elements such as in-vehicle travel time, out of vehicle wait time, the number of transfers, and other relevant choice criteria. The end product of the model choice model is a set of trip tables with origins and destinations by mode.

The fourth step in the process is the assignment. The assignment answers the question, "what route will a trip travel given an origin and destination?" There are two assignments – a highway assignment and a transit assignment. The highway assignment captures vehicle trips on the network, while the transit assignment captures person trips on transit modes through the network. The networks cover large geographic areas and, therefore, are less detailed representations of real world highway and transit facilities and services. Paths are determined based on weighted travel time and cost. For highway assignment, an equilibrium concept is used to route vehicles between their origins and destinations. Typically for transit assignment the shortest path through the network (based on the perceived travel time and cost which is a weighted combination of in-vehicle, out-of-vehicle time, and cost elements) is taken.

The model set is calibrated for a base year data set, such as a household travel survey which captures the travel characteristics of the modeled region. The TPB model set was calibrated to the 2007/8 household travel survey. The assignment was validated to the base year traffic counts and the base year transit ridership.

Subarea Forecasting Tool Details

The Fairfax County subarea model is based upon, and is an extension of, the regional travel demand model developed by TPB staff for regional transportation planning and air quality conformity analysis. The subarea model disaggregates the Fairfax County portion of the regional trip table and assigns that trip table to a highway network that has much greater highway and TAZ detail in the Fairfax County portion of the region than does the regional model. This additional detail produces more accurate estimates of traffic volumes at a smaller scale of resolution than has been available previously.

Specifically, the Fairfax County subarea model provides more useful information at the functional classification level of arterials and collectors. This is because the additional zone and network detail enable a more evenly distributed pattern of traffic loading points on the non-freeway components of the highway network, and because the additional detail provides route choice options more closely resembling those actually available to travelers in Fairfax County. Less detailed highway networks can easily produce too much traffic on major facilities in comparison to traffic counts, simply because of the lack of lower functional classification routes in the highway networks. The addition of lower functional classification routes can distribute traffic away from the primary routes for a significant portion of a traveler's route.

The Fairfax County subarea model also incorporates consideration of the type of traffic control devices used at intersections to inform the traffic assignment step. That is, whether an at-grade intersection approach is controlled by a stop sign or by a traffic signal is information which is considered in the assignment step. This too is done to help achieve more accurate model assignment results within the Fairfax County subarea.

The transportation network in the study area and vicinity areas was reviewed and enhanced to better represent the existing condition and planned improvements as documented in the regional Constrained Long Range Plan (CLRP) and previous and current studies in the study area. The highway network was added with more detail to be consistent with the refined TAZ structure and the intersections under study. Network attributes such as facility types and the number of lanes were reviewed and refined in the study area and its vicinity. The refined network was then reviewed by Kittelson & Associates, Inc., and the Fairfax County DOT.

Land use data were checked within the study area for consistency with those in the TPB model. TAZs within the study area were grouped into multiple subzones for both the subarea model and the TPB model such that the outer boundaries of corresponding zone groups match. Ratios between the corresponding zone groups from the two models were derived respectively for total population and total employment data. They were used as the adjustment factors that were applied to the population and employment data of all the subzones in the subarea model such that the land use data in the study area match those in the TPB model.

2.0 Model Validation

Cambridge Systematics uses the Federal Highway Administration Travel Model Improvement Program (TMIP) Model Validation and Reasonableness Checking Manual as a guide when performing study area validation of models. One aspect of the validation was that traffic assignment volumes from the base year model run were compared against traffic counts in the Seven Corners area to ensure that the model results were accurate.

Table 1.1 shows comparisons of percent difference of estimated versus observed daily volumes before and after model validation in the base year. Table 1.2 shows comparisons of percent root mean square errors of estimated versus observed daily volumes before and after model validation in the base year. Major findings are as follows:

- Overall, estimated volumes compared well with daily traffic counts for the base year, with a slight overestimation by 7.6 percent after model validation, a significant improvement over the before model validation; and

- Percent root mean square errors of estimated versus observed daily volumes were also improved considerably after the model validation.

Table 1.1: Percent Difference of Estimated versus Observed Daily Volumes Before and After Model Validation

Facility Type	Before Model Validation	After Model Validation
Major Arterial	25.6%	13.1%
Minor Arterial	-9.2%	-11.4%
Collector	-26.3%	-26.3%
Total	17.9%	7.6%

Table 1.2: Percent Root Mean Square Errors of Estimated versus Observed Daily Volumes Before and After Model Validation

Facility Type	Before Model Validation	After Model Validation
Major Arterial	37.4%	27.4%
Minor Arterial	41.2%	37.0%
Collector	47.9%	47.3%
Total	40.6%	30.6%

Another data source for the base year model validation is the Seven Corners Origin-Destination (OD) Survey, which was conducted by Skycomp in April 2013. The surveys include external-to-external, external-to-internal, and internal-to-external trips for the study area in the AM and PM peak hours. The observed origin-destination flow tables were re-organized to be roughly comparable with the estimated origin-destination flow tables. The estimated trip OD tables were checked against the observed trip OD table to inform the model validation. Table 1.3 shows the differences in percentage of origination flows between estimated and observed OD trips. While most differences are small, a few OD flows indicate model overestimations such as those between WB Wilson Boulevard and WB US 50 and between EB US 50 and EB Wilson Boulevard. However, it should be recognized that the origins and destinations as defined in the Skycomp survey do not exactly match with those defined in the model network. In addition, the Skycomp OD results were based on the one-day survey conducted in April 16, 2013, while the model reflects average weekday OD flows in 2007. These differences need to be kept in mind when interpreting the comparisons between the two.

Based on these checks, overall for the study area the model appears to be performing within an acceptable range of error and is deemed valid for use for the forecasting work involved in this study. The remaining errors are taken into account in the post-processing procedure, based on the NCHRP 255 methodology, to derive the traffic volumes necessary for evaluating the intersection performances in the study area.

Table 1.3: Difference of Estimated versus Observed Percentages of Origination Flows

AM	101 WB US 50	102 WB Hilwood Ave	103 WB Broad St	104 NB Roosevelt Blvd	105 EB Wilson Blvd	106 EB US 50	107 SB VA 7	108 SB Sleepy Hollow Rd	Other External Destinations	Internal Destinations (131-166)
101 - EB US 50	0%	0%	0%	1%	28%	-14%	-3%	0%	-10%	-2%
102 - EB Hilwood Ave	0%	-2%	-2%	0%	-3%	-5%	-2%	0%	0%	13%
103 - EB Broad St	0%	-2%	0%	0%	-8%	-1%	13%	-4%	-7%	9%
104 - SB Roosevelt Blvd	12%	-3%	1%	0%	-27%	-2%	23%	-2%	-21%	17%
105 - WB Wilson Blvd	25%	0%	0%	-26%	0%	-2%	8%	2%	-19%	13%
106 - WB US 50	-10%	-1%	1%	5%	1%	0%	0%	-2%	-13%	19%
107 - NB VA 7	-6%	-5%	-7%	13%	0%	-1%	-1%	-2%	-1%	6%
108 - NB Sleepy Hollow Rd	0%	-1%	-3%	11%	2%	-10%	-11%	0%	0%	10%
PM										
101 - EB US 50	0%	0%	0%	7%	14%	-13%	-7%	0%	-12%	12%
102 - EB Hilwood Ave	0%	0%	0%	0%	3%	-13%	-5%	-2%	-17%	33%
103 - EB Broad St	0%	0%	0%	-1%	-2%	0%	2%	-9%	-8%	17%
104 - SB Roosevelt Blvd	4%	1%	2%	-1%	-17%	4%	13%	2%	-25%	16%
105 - WB Wilson Blvd	40%	-1%	-2%	-1%	0%	1%	-1%	0%	-21%	-14%
106 - WB US 50	28%	-3%	4%	1%	0%	0%	-1%	-3%	-31%	4%
107 - NB VA 7	-7%	-2%	7%	15%	2%	-2%	0%	-5%	-9%	2%
108 - NB Sleepy Hollow Rd	-3%	-3%	-8%	2%	9%	2%	-10%	0%	-17%	26%

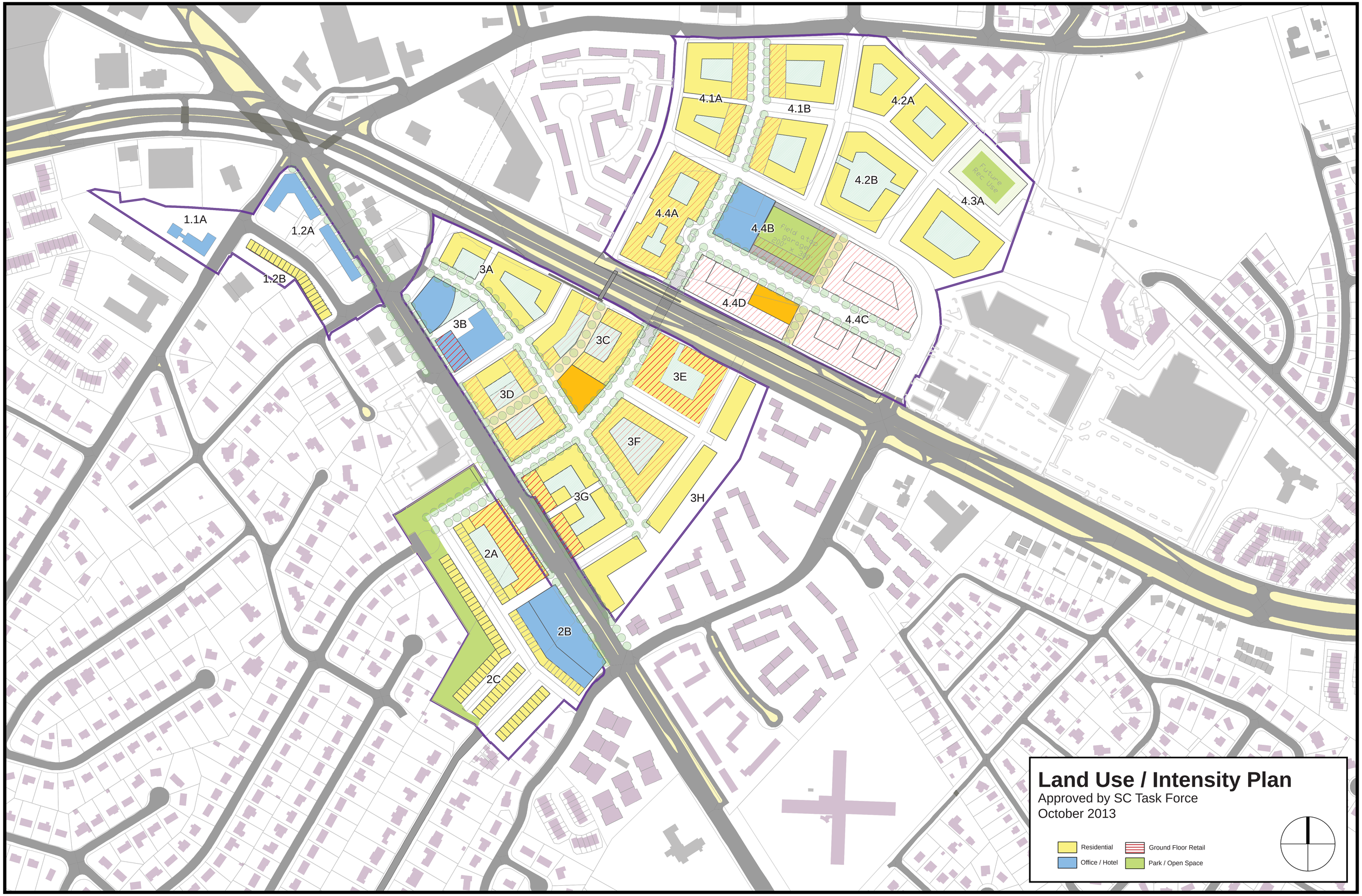
Plan Quantifications - Seven Corners Special Study

Impact Analysis; Round 1 Testing

REV November 19, 2013

Opp Site	Owner	Existing		Block	Approximate Land Area (ac)	PROPOSED OPTION 1				PROPOSED OPTION 2*				# of Floors (incl structured parking)
		Res	Non-Res			Res Units	Retail	Office/Hotel	Special Uses/Considerations	Res Units	Retail	Office/Hotel	Special Uses/Considerations	
Medical Offices	A & A INVESTMENT LLC	---	31,620 sf	**1.1A**	---	0	45,000 sf	0 sf			45,000 sf	0 sf		3
	CHALINS RES LLC, KEWAR ASSOCIATES, DOCTORS BUILDING AT SEVEN CORNERS LLC, KEWAR ASSOCIATES, STANFORD 913 LLC, CHAN FAMILY LLC, SEVEN CORNERS CORP, KEWAR ASSOCIATES	---	39,692 sf	**1.2A**	---	0	62,000 sf	0 sf			62,000 sf	0 sf		3
	ROCK CREEK SEVEN CORNERS MEDICAL LLC	---	32,080 sf	**1.2B**	---	19 Townhouses	0 sf	0 sf		19 Townhouses	0 sf	0 sf		3
			103,392 sf	**Opportunity Site 1 Total**		**19 DU**	**107,000 sf**	**0 sf**		19 DU	107,000 sf	0 sf		
Sears	POPPELMAN RAYMOND J 1978, KJD MCILVAINE LLC, MARK BUILDING ASSOCIATES	---	265,869 sf	**2A**	3.8	165 Res Units 18 Townhouses	60,000 sf	0 sf	0.64ac Park	165 Res Units 18 Townhouses	60,000 sf	0 sf	0.64ac Park	5
				2B	2.6	22 Townhouses	74,000 sf	200,000 sf Office		22 Townhouses	74,000 sf	200,000 sf Office		5
				2C	5.1	70 Townhouses	0 sf	0 sf	Buffer/park to SFR	70 Townhouses	0 sf	0 sf	Transition to lower density Res	3
			265,869 sf	**Opportunity Site 2 Total**	**11.5**	**275 DU**	**134,000 sf**	**200,000 sf**	**0.64ac Park**	275 DU	134,000 sf	200,000 sf	0.64ac Park	
SC Shopping Center	SEVEN CORNERS CENTER LLC	---	630,199 sf	**3A**	2.7	600	0 sf	0 sf	Transit Center (sf not accounted for)	600	0 sf	0 sf	Transit Center (sf not accounted for)	10
				3B	2.6	0	0 sf	725,450 sf [hotel 164,850; office 560,600]			0 sf	725,450 sf [hotel 164,850; office 560,600]		10
				3C	3.6	520	95,000 sf	0 sf	0.53ac Plaza/Park	520	95,000 sf	0 sf	0.53ac Plaza/Park	8
				3D	3.1	370	170,000 sf	0 sf	Pedestrian Alley/Plaza	370	170,000 sf	0 sf	Pedestrian Alley/Plaza	8
				3E	2.3	330	115,000 sf	0 sf		330	115,000 sf	0 sf		4 to 6 (4 stories facing 2 over 2)
				3F	3.0	340	128,200 sf	0 sf		340	128,200 sf	0 sf		4 to 6 (4 stories facing 2 over 2)
				3G	3.3	337	115,000 sf	0 sf	Pedestrian Alley/Plaza	337	115,000 sf	0 sf	Pedestrian Alley/Plaza	4 to 6 (4 stories facing 2 over 2)
				3H	4.7	230	0 sf	0 sf	Transitions needed to existing MF	230	0 sf	0 sf	Transition to lower density Res	4
			630,199 sf	**Opportunity Site 3 Total**	**25.3**	**2727**	**623,200 sf**	**725,450 sf**	**0.53ac Park**	2727	623,200 sf	725,450 sf	0.53ac Park	
Willston/ Apartments	WESTOVER 305 LLC	225 DU	---	**4.1A**	3.4	350	33,350 sf	0 sf		384	0 sf	0 sf		6 (up to 10 along Wilson Blvd)
				4.1B	4.6	410	33,350 sf	0 sf		456	0 sf	0 sf		6 (up to 10 along Wilson Blvd)
	SEVEN CORNERS APARTMENTS LLC	284 DU	---	**4.2A**	3.6	380	0 sf	0 sf		380	0 sf	0 sf		6 (up to 10 along Wilson Blvd)
				4.2B	3.2	340	0 sf	0 sf		340	0 sf	0 sf		6
				4.3A	5.8	272	0 sf	0 sf	1.4ac Field	272	0 sf	0 sf	1.4ac Field	6
	WESTOVER 305 LLC	80 DU		**4.4A**	3.1	280	110,000 sf	0 sf		360	0 sf	0 sf		6
	BOS FAIRFAX COUNTY, SEVEN CORNERS CENTER LLC	---	20,874 Public Facility	**4.4B**	3.3	0	0 sf	180,000 sf Public Facility	1.3ac Park on top of parking garage	0	0 sf	180,000 sf Public Facility	1.3ac Park on top of parking garage	7
				4.4C	3.5 Opt 1 2.8 Opt 2	125	87,000 sf	0 sf	Pedestrian Plaza	125	87,000 sf	0 sf	Pedestrian Plaza	6
	FIRST WASHINGTON REALTY LP	---	113,484 Non-Res	**4.4D**	4.0 Opt 1 4.7 Opt 2	225	170,000 sf	0 sf	Pedestrian Alley Connection	225	170,000 sf	0 sf	Pedestrian Alley Connection	6
		589 DU	**134,358 sf**	**Opportunity Site 4 Total**	**34.5**	**2382**	**433,700 sf**	**180,000 sf**	**2.7ac Park/Fie**	**2542**	**257,000 sf**	**180,000 sf**	**2.7ac Park/Fie**	
		589 DU	**1,133,818 sf**	**Grand Total**	**71.3**	**5403**	**1,297,900 sf**	**1,105,450 sf**	**3.87 ac**	**5563**	**1,121,200 sf**	**1,105,450 sf**	**3.87 ac**	

* changes highlighted


1.1A
1.2A
1.2B
3A
3B
3C
3D
3E
3F
3G
3H
2A
2B
2C
4.1A
4.1B
4.2A
4.2B
4.3A
4.4A
4.4B
4.4C
4.4D
Future Rec Use
Field at the garages 200' x 330'
Land Use / Intensity Plan
Approved by SC Task Force
October 2013
Residential
Office / Hotel
Ground Floor Retail
Park / Open Space

Appendix C
Origin-Destination Route Traffic Volumes

AM Entry O-D Data
Existing Condition

ENTRY ORIGINS	External Destinations								Total Volume
	101	102	103	104	105	106	107	108	
101 - EB US 50	0	0	0	11	142	2,268	196	0	2,617
102 - EB Hillwood	0	9	9	0	113	104	122	0	356
103 - EB Broad	0	16	0	0	72	167	303	32	589
104 - SB Roosevelt	8	16	0	0	141	24	55	39	283
105 - WB Wilson	61	15	8	160	0	15	0	23	282
106 - WB US 50	1,314	51	162	34	0	0	9	34	1,604
107 - WB VA 7	318	98	462	197	23	8	8	30	1,144
108 - NB Sleepy Hollow	0	10	30	139	159	199	109	0	647

ENTRY ORIGINS	External Destinations (other than 101-108)													Total Volume
	101A	101B	106A	106B	121	122	123	124	125	126	127	128	129	
101 - EB US 50	0	11	11	11	11	0	11	0	44	109	87	11	0	305
102 - EB Hillwood	9	0	0	0	9	0	0	0	0	9	26	0	0	52
103 - EB Broad	0	0	0	0	0	0	24	0	16	16	8	0	0	64
104 - SB Roosevelt	0	0	0	0	0	0	8	24	16	31	8	8	8	102
105 - WB Wilson	8	0	0	0	0	0	0	0	53	38	0	0	8	107
106 - WB US 50	26	43	0	0	0	0	9	0	17	205	26	0	60	384
107 - WB VA 7	8	8	0	0	8	0	38	0	0	68	38	15	0	182
108 - NB Sleepy Hollow	0	0	0	0	0	0	10	0	20	20	30	0	0	80

ENTRY ORIGINS	Internal Destinations (131-166)																			Total Volume
	131	132	133	136	137	138	139	141	142	143	146	147	148	153	156	157	158	159	166	
101 - EB US 50	0	0	0	0	11	0	22	22	0	22	11	87	11	0	0	0	0	22	0	207
102 - EB Hillwood	9	0	0	0	0	9	0	43	9	17	17	17	17	0	0	9	0	9	0	156
103 - EB Broad	0	24	8	8	0	0	0	64	16	0	0	32	8	0	0	8	0	0	0	167
104 - SB Roosevelt	0	0	24	8	0	0	8	24	0	16	0	8	8	0	8	0	0	8	0	110
105 - WB Wilson	0	0	0	8	0	0	8	15	0	0	0	23	0	0	23	0	0	0	0	76
106 - WB US 50	9	9	17	9	0	0	9	34	0	9	17	60	9	9	9	9	0	17	0	222
107 - WB VA 7	0	0	0	0	0	0	15	15	8	0	23	83	8	0	8	23	8	0	0	189
108 - NB Sleepy Hollow	0	0	0	20	10	0	10	20	0	60	10	60	10	0	0	40	10	50	0	299

PM Entry O-D Data
Existing Condition

ENTRY ORIGINS	External Destinations								Total Volume
	101	102	103	104	105	106	107	108	
101 - EB US 50	0	0	0	8	108	1,732	150	0	1,999
102 - EB Hillwood	0	7	7	0	93	86	100	0	293
103 - EB Broad	0	16	0	0	73	169	306	32	596
104 - SB Roosevelt	14	28	0	0	251	42	98	70	503
105 - WB Wilson	120	30	15	315	0	30	0	45	555
106 - WB US 50	1,876	73	231	49	0	0	12	49	2,290
107 - WB VA 7	305	94	442	189	22	7	7	29	1,095
108 - NB Sleepy Hollow	0	3	9	44	50	63	35	0	205

ENTRY ORIGINS	External Destinations (other than 101-108)													Total Volume
	101A	101B	106A	106B	121	122	123	124	125	126	127	128	129	
101 - EB US 50	0	8	8	8	8	0	8	0	33	83	67	8	0	233
102 - EB Hillwood	7	0	0	0	7	0	0	0	0	7	21	0	0	43
103 - EB Broad	0	0	0	0	0	0	24	0	16	16	8	0	0	64
104 - SB Roosevelt	0	0	0	0	0	0	14	42	28	56	14	14	14	182
105 - WB Wilson	15	0	0	0	0	0	0	0	105	75	0	0	15	210
106 - WB US 50	37	61	0	0	0	0	12	0	24	292	37	0	85	548
107 - WB VA 7	7	7	0	0	7	0	36	0	0	65	36	15	0	174
108 - NB Sleepy Hollow	0	0	0	0	0	0	3	0	6	6	9	0	0	25

ENTRY ORIGINS	Internal Destinations (131-166)																			Total Volume
	131	132	133	136	137	138	139	141	142	143	146	147	148	153	156	157	158	159	166	
101 - EB US 50	0	0	0	0	8	0	17	17	0	17	8	67	8	0	0	0	0	17	0	158
102 - EB Hillwood	7	0	0	0	0	7	0	36	7	14	14	14	14	0	0	7	0	7	0	129
103 - EB Broad	0	24	8	8	0	0	0	64	16	0	0	32	8	0	0	8	0	0	0	169
104 - SB Roosevelt	0	0	42	14	0	0	14	42	0	28	0	14	14	0	14	0	0	14	0	196
105 - WB Wilson	0	0	0	15	0	0	15	30	0	0	0	45	0	0	45	0	0	0	0	150
106 - WB US 50	12	12	24	12	0	0	12	49	0	12	24	85	12	12	12	12	0	24	0	317
107 - WB VA 7	0	0	0	0	0	0	15	15	7	0	22	80	7	0	7	22	7	0	0	181
108 - NB Sleepy Hollow	0	0	0	6	3	0	3	6	0	19	3	19	3	0	0	13	3	16	0	95

AM Entry O-D Data
2040 Comprehensive Plan

ENTRY ORIGINS	External Destinations								Total Volume
	101	102	103	104	105	106	107	108	
101 - EB US 50	0	0	0	15	190	3,044	263	0	3,512
102 - EB Hillwood	0	11	11	0	140	129	151	0	442
103 - EB Broad	0	14	0	0	61	143	258	27	503
104 - SB Roosevelt	10	19	0	0	171	29	67	48	343
105 - WB Wilson	105	26	13	275	0	26	0	39	485
106 - WB US 50	1,784	69	220	46	0	0	12	46	2,178
107 - WB VA 7	420	130	610	260	30	10	10	40	1,510
108 - NB Sleepy Hollow	0	7	20	95	109	136	75	0	442

ENTRY ORIGINS	External Destinations (other than 101-108)													Total Volume
	101A	101B	106A	106B	121	122	123	124	125	126	127	128	129	
101 - EB US 50	0	15	15	15	15	0	15	0	59	146	117	15	0	410
102 - EB Hillwood	11	0	0	0	11	0	0	0	0	11	32	0	0	65
103 - EB Broad	0	0	0	0	0	0	20	0	14	14	7	0	0	54
104 - SB Roosevelt	0	0	0	0	0	0	10	29	19	38	10	10	10	124
105 - WB Wilson	13	0	0	0	0	0	0	0	92	66	0	0	13	184
106 - WB US 50	35	58	0	0	0	0	12	0	23	278	35	0	81	521
107 - WB VA 7	10	10	0	0	10	0	50	0	0	90	50	20	0	240
108 - NB Sleepy Hollow	0	0	0	0	0	0	7	0	14	14	20	0	0	54

ENTRY ORIGINS	Internal Destinations (131-166)																			Total Volume
	131	132	133	136	137	138	139	141	142	143	146	147	148	153	156	157	158	159	166	
101 - EB US 50	0	0	0	0	15	0	29	29	0	29	15	117	15	0	0	0	0	29	0	278
102 - EB Hillwood	11	0	0	0	0	11	0	54	11	22	22	22	22	0	0	11	0	11	0	194
103 - EB Broad	0	20	7	7	0	0	0	54	14	0	0	27	7	0	0	7	0	0	0	143
104 - SB Roosevelt	0	0	29	10	0	0	10	29	0	19	0	10	10	0	10	0	0	10	0	133
105 - WB Wilson	0	0	0	13	0	0	13	26	0	0	0	39	0	0	39	0	0	0	0	131
106 - WB US 50	12	12	23	12	0	0	12	46	0	12	23	81	12	12	12	12	0	23	0	301
107 - WB VA 7	0	0	0	0	0	0	20	20	10	0	30	110	10	0	10	30	10	0	0	250
108 - NB Sleepy Hollow	0	0	0	14	7	0	7	14	0	41	7	41	7	0	0	27	7	34	0	204

PM Entry O-D Data
2040 Comprehensive Plan

ENTRY ORIGINS	External Destinations								Total Volume
	101	102	103	104	105	106	107	108	
101 - EB US 50	0	0	0	11	149	2,392	207	0	2,760
102 - EB Hillwood	0	11	11	0	140	129	151	0	442
103 - EB Broad	0	12	0	0	52	122	221	23	431
104 - SB Roosevelt	17	35	0	0	314	52	122	87	629
105 - WB Wilson	131	33	16	344	0	33	0	49	607
106 - WB US 50	2,259	88	279	59	0	0	15	59	2,758
107 - WB VA 7	357	111	519	221	26	9	9	34	1,284
108 - NB Sleepy Hollow	0	5	15	68	78	97	53	0	316

ENTRY ORIGINS	External Destinations (other than 101-108)													Total Volume
	101A	101B	106A	106B	121	122	123	124	125	126	127	128	129	
101 - EB US 50	0	11	11	11	11	0	11	0	46	115	92	11	0	322
102 - EB Hillwood	11	0	0	0	11	0	0	0	0	11	32	0	0	65
103 - EB Broad	0	0	0	0	0	0	17	0	12	12	6	0	0	47
104 - SB Roosevelt	0	0	0	0	0	0	17	52	35	70	17	17	17	227
105 - WB Wilson	16	0	0	0	0	0	0	0	115	82	0	0	16	230
106 - WB US 50	44	73	0	0	0	0	15	0	29	352	44	0	103	660
107 - WB VA 7	9	9	0	0	9	0	43	0	0	77	43	17	0	204
108 - NB Sleepy Hollow	0	0	0	0	0	0	5	0	10	10	15	0	0	39

ENTRY ORIGINS	Internal Destinations (131-166)																			Total Volume
	131	132	133	136	137	138	139	141	142	143	146	147	148	153	156	157	158	159	166	
101 - EB US 50	0	0	0	0	11	0	23	23	0	23	11	92	11	0	0	0	0	23	0	218
102 - EB Hillwood	11	0	0	0	0	11	0	54	11	22	22	22	22	0	0	11	0	11	0	194
103 - EB Broad	0	17	6	6	0	0	0	47	12	0	0	23	6	0	0	6	0	0	0	122
104 - SB Roosevelt	0	0	52	17	0	0	17	52	0	35	0	17	17	0	17	0	0	17	0	244
105 - WB Wilson	0	0	0	16	0	0	16	33	0	0	0	49	0	0	49	0	0	0	0	164
106 - WB US 50	15	15	29	15	0	0	15	59	0	15	29	103	15	15	15	15	0	29	0	381
107 - WB VA 7	0	0	0	0	0	0	17	17	9	0	26	94	9	0	9	26	9	0	0	213
108 - NB Sleepy Hollow	0	0	0	10	5	0	5	10	0	29	5	29	5	0	0	19	5	24	0	146

AM Entry O-D Data
2040 Seven Corners
Lane Use Scenario

ENTRY ORIGINS	External Destinations								Total Volume
	101	102	103	104	105	106	107	108	
101 - EB US 50	0	0	0	15	190	3,044	263	0	3,512
102 - EB Hillwood	0	11	11	0	140	129	151	0	442
103 - EB Broad	0	14	0	0	61	143	258	27	503
104 - SB Roosevelt	11	22	0	0	200	33	78	56	400
105 - WB Wilson	105	26	13	275	0	26	0	39	485
106 - WB US 50	2,022	79	249	53	0	0	13	53	2,468
107 - WB VA 7	420	130	610	260	30	10	10	40	1,510
108 - NB Sleepy Hollow	0	7	20	95	109	136	75	0	442

ENTRY ORIGINS	External Destinations (other than 101-108)													Total Volume
	101A	101B	106A	106B	121	122	123	124	125	126	127	128	129	
101 - EB US 50	0	15	15	15	15	0	15	0	59	146	117	15	0	410
102 - EB Hillwood	11	0	0	0	11	0	0	0	0	11	32	0	0	65
103 - EB Broad	0	0	0	0	0	0	20	0	14	14	7	0	0	54
104 - SB Roosevelt	0	0	0	0	0	0	11	33	22	44	11	11	11	144
105 - WB Wilson	13	0	0	0	0	0	0	0	92	66	0	0	13	184
106 - WB US 50	39	66	0	0	0	0	13	0	26	315	39	0	92	591
107 - WB VA 7	10	10	0	0	10	0	50	0	0	90	50	20	0	240
108 - NB Sleepy Hollow	0	0	0	0	0	0	7	0	14	14	20	0	0	54

ENTRY ORIGINS	Internal Destinations (131-166)																			Total Volume
	131	132	133	136	137	138	139	141	142	143	146	147	148	153	156	157	158	159	166	
101 - EB US 50	0	0	0	0	15	0	29	29	0	29	15	117	15	0	0	0	0	29	0	278
102 - EB Hillwood	11	0	0	0	0	11	0	54	11	22	22	22	22	0	0	11	0	11	0	194
103 - EB Broad	0	20	7	7	0	0	0	54	14	0	0	27	7	0	0	7	0	0	0	143
104 - SB Roosevelt	0	0	33	11	0	0	11	33	0	22	0	11	11	0	11	0	0	11	0	156
105 - WB Wilson	0	0	0	13	0	0	13	26	0	0	0	39	0	0	39	0	0	0	0	131
106 - WB US 50	13	13	26	13	0	0	13	53	0	13	26	92	13	13	13	13	0	26	0	341
107 - WB VA 7	0	0	0	0	0	0	20	20	10	0	30	110	10	0	10	30	10	0	0	250
108 - NB Sleepy Hollow	0	0	0	14	7	0	7	14	0	41	7	41	7	0	0	27	7	34	0	204

PM Entry O-D Data
2040 Seven Corners
Lane Use Scenario

ENTRY ORIGINS	External Destinations								Total Volume
	101	102	103	104	105	106	107	108	
101 - EB US 50	0	0	0	13	168	2,682	232	0	3,094
102 - EB Hillwood	0	11	11	0	140	129	151	0	442
103 - EB Broad	0	12	0	0	52	122	221	23	431
104 - SB Roosevelt	17	35	0	0	314	52	122	87	629
105 - WB Wilson	144	36	18	379	0	36	0	54	667
106 - WB US 50	2,378	93	293	62	0	0	15	62	2,903
107 - WB VA 7	357	111	519	221	26	9	9	34	1,284
108 - NB Sleepy Hollow	0	7	20	95	109	136	75	0	442

ENTRY ORIGINS	External Destinations (other than 101-108)													Total Volume
	101A	101B	106A	106B	121	122	123	124	125	126	127	128	129	
101 - EB US 50	0	13	13	13	13	0	13	0	52	129	103	13	0	361
102 - EB Hillwood	11	0	0	0	11	0	0	0	0	11	32	0	0	65
103 - EB Broad	0	0	0	0	0	0	17	0	12	12	6	0	0	47
104 - SB Roosevelt	0	0	0	0	0	0	17	52	35	70	17	17	17	227
105 - WB Wilson	18	0	0	0	0	0	0	0	126	90	0	0	18	252
106 - WB US 50	46	77	0	0	0	0	15	0	31	371	46	0	108	695
107 - WB VA 7	9	9	0	0	9	0	43	0	0	77	43	17	0	204
108 - NB Sleepy Hollow	0	0	0	0	0	0	7	0	14	14	20	0	0	54

ENTRY ORIGINS	Internal Destinations (131-166)																			Total Volume
	131	132	133	136	137	138	139	141	142	143	146	147	148	153	156	157	158	159	166	
101 - EB US 50	0	0	0	0	13	0	26	26	0	26	13	103	13	0	0	0	0	26	0	245
102 - EB Hillwood	11	0	0	0	0	11	0	54	11	22	22	22	22	0	0	11	0	11	0	194
103 - EB Broad	0	17	6	6	0	0	0	47	12	0	0	23	6	0	0	6	0	0	0	122
104 - SB Roosevelt	0	0	52	17	0	0	17	52	0	35	0	17	17	0	17	0	0	17	0	244
105 - WB Wilson	0	0	0	18	0	0	18	36	0	0	0	54	0	0	54	0	0	0	0	180
106 - WB US 50	15	15	31	15	0	0	15	62	0	15	31	108	15	15	15	15	0	31	0	402
107 - WB VA 7	0	0	0	0	0	0	17	17	9	0	26	94	9	0	9	26	9	0	0	213
108 - NB Sleepy Hollow	0	0	0	14	7	0	7	14	0	41	7	41	7	0	0	27	7	34	0	204

Appendix D
Merge and Diverge Analysis

KITTELSON & ASSOCIATES, INC.
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MEMORANDUM

Date: March 26, 2014

Project #: 13942

To: Michael Garcia and Kris Morley-Nikfar
Fairfax County Department of Transportation

From: Zachary Horowitz, P.E. and Anxi Jia, PhD
Project: Seven Corners Transportation Study Part 2
Subject: Merge and Diverge Analysis for Concept A and Concept B

This memorandum summarizes the results of the analysis of the merge and diverge segments on Route 50 for Concept A: Split Diamond with Couplet and Concept B: Two Half Diamonds. The Highway Capacity Manual (HCM) 2010 does not have methodologies available for merge and diverge segments on a signalized roadway. As suggested by the HCM 2010, the methodologies can be applied in an approximate manner to uncontrolled ramp terminals on other facilities, such as multilane highways and two-lane highways. The use of the freeway methodologies for the signalized sections of Route 50 will not fully accurately represent the operational performance of the merge and diverge segments since the methodologies are developed for freeway ramps. However, they do provide a good indication of any potential operational issues.

SUMMARY OF OPERATIONAL RESULTS FOR MERGE AND DIVERGE SEGMENTS

The HCM 2010 uses vehicle density to evaluate the operational performance (i.e., level of service) of the freeway merge and diverge segments using the criteria from Exhibit 13-2 in the HCM 2010. Table 2 and Table 2 summarize the operational performance of the merging and diverging segments for Concept A and Concept B; All merge/diverge segments would operate at LOS C or higher. The detailed calculation procedure is discussed in the next sections for merge and diverge segments, respectively.

Table 1. Summary of Operational Results for Merge and Diverge Segments in the AM Peak Hour

Type	Location	Concept A		Concept B	
		Density (pc/mi/ln)	LOS	Density (pc/mi/ln)	LOS
On-ramp merge	To Route 50 westbound	16.4	B	19.2	B
Off-ramp diverge	From Route 50 eastbound	26.4	C	6.5	A
On-ramp merge	To Route 50 eastbound	23.4	C	20.1	C
Off-ramp diverge	From Route 50 westbound	8.4	A	7.6	A

Table 2. Summary of Operational Results for Merge and Diverge Segments in the PM Peak Hour

Type	Location	Concept A		Concept B	
		Density (pc/mi/ln)	LOS	Density (pc/mi/ln)	LOS
On-ramp merge	To Route 50 westbound	19.9	B	22.5	C
Off-ramp diverge	From Route 50 eastbound	22.8	C	4.8	A
On-ramp merge	To Route 50 eastbound	18.8	B	15.9	B
Off-ramp diverge	From Route 50 westbound	10.3	B	10.0	B

INPUTS AND ASSUMPTIONS FOR MERGE AND DIVERGE ANALYSIS

Most of the required inputs for the analysis were retrieved from the corresponding Synchro file for Concept A and Concept B, including the number of lanes of mainline (three lanes for both concepts), the off-ramps (two lanes for both concepts), the on-ramps (one lane for both concepts), the Route 50 on- and off-ramp volumes, the lengths of the acceleration/deceleration lanes, and the free-flow speed of the on- and off-ramps.

In addition, several assumptions were made for the analysis and are as follows:

- Terrain: Level
- Percentage of trucks and buses: Two percent
- No closely-spaced adjacent upstream/downstream on- or off-ramps
- Free-flow speed of Route 50: 55 mph

It was assumed that mainline Route 50 would have a posted and free-flow speed of 45 mph, even though vehicles typically travel along Route 50 at speeds higher than 45 mph. The minimum free-flow speed of mainline allowed in the HCM 2010 methodology is 55 mph, which lies outside the lower bounds of the HCM analysis procedure. Using a free-flow speed of 55 mph for the analysis rather than 45 mph produces results that show a better LOS than would be obtained with a lower free-flow speed.

MERGE ANALYSIS

According to the HCM 2010, the density in the on-ramp (merge) influence area is calculated as:

$$D_R = 5.475 + 0.00734 v_R + 0.0078 v_{12} - 0.00627 L_A$$

Where,

D_R : The density in the ramp influence area (pc/mi/ln)
v_R : Flow rate on the on-ramp
v_{12} : Flow rate in mainline lanes 1 and 2 immediately upstream of the on-ramp influence area
L_A : Length of acceleration lane

The variable v_{12} is calculated as:

$$v_{12} = v_F \times P_{FM}$$

Where,

v_F : Flow rate on mainline immediately upstream of the ramp influence area
P_{FM} : Proportion of mainline vehicles remaining in lanes 1 and 2 immediately upstream of the on-ramp influence area

As there are three lanes on Route 50, according to HCM 2010, the variable P_{FM} is calculated as:

$$P_{FM} = 0.5775 + 0.000028L_A$$

Based on the above equations, it is clear that the calculation of density in the on-ramp influence area does not depend on the free-flow speed of mainline because the free-flow speed is not included as a variable in the density equations. According to the HCM 2010 Exhibit 13-9, the capacity of a highway with three lanes in one direction and a 45 mph free-flow speed is 5,700 pc/hr, which is substantially greater than the mainline through traffic on Route 50 where the maximum hourly flow is approximately 3,800 pc/hr.

Therefore, it is reasonable to conclude that the results presented in Table 1 and Table 2 are valid, with the caveat that the merge areas were evaluated with a higher free-flow speed (i.e., 55 mph) than would exist on the mainline. The minimum density for merge segments to perform at LOS "F" is greater than 35.0 pc/mi/ln, which is substantially higher than the maximum density determined for either concept which would be 23.4 pc/mi/ln for Concept A in the a.m. peak hour as shown in Table 1.

DIVERGE ANALYSIS

According to the HCM 2010, the density in the off-ramp (diverge) influence area is calculated as:

$$D_R = 4.252 + 0.0086v_{12} - 0.009L_D$$

Where,

D_R : The density in the ramp influence area (pc/mi/ln)
v_{12} : Flow rate in mainline lanes 1 and 2 immediately upstream of the off-ramp influence area
L_D : Length of deceleration lane

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The variable v_{12} is calculated as:

$$v_{12} = v_R + (v_F - v_R)P_{FD}$$

Where,

v_F : Flow rate on mainline immediately upstream of the ramp influence area
v_R : Flow rate on the off-ramp
P_{FD} : Proportion of diverging traffic remaining in lanes 1 and 2 immediately upstream of the deceleration lane.

Because there are three lanes on Route 50, according to the HCM 2010, the variable P_{FD} is calculated as:

$$P_{FM} = 0.760 - 0.000025v_F - 0.000046v_R$$

Based on the above equations, it is clear that the calculation of density in the off-ramp influence area does not depend on the free-flow speed of mainline because the free-flow speed is not included as a variable in the density equations. It is reasonable to conclude that the results presented in Table 1 and Table 2 are valid, with the caveat that the diverge areas were evaluated with a higher free-flow speed (i.e., 55 mph) than would exist on the mainline. The minimum density for diverge segments to perform at LOS "F" is greater than 35.0 pc/mi/ln, which is substantially higher than the maximum density determined for either concept which would be 26.4 pc/mi/ln for Concept A in the a.m. peak hour as shown in Table 1.

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Appendix E
Concept C Construction Phasing

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MEMORANDUM

Date: July 7, 2014

Project #: 13942

To: Michael Garcia and Kris Morley-Nikfar
Fairfax County Department of Transportation

From: Zachary Horowitz, P.E. and Alexandra Jahnle
Project: Seven Corners Transportation Study Part 2
Subject: Proposed Construction Phasing for Concept C

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The constructability, ease of phasing, traffic control plans for Concept C was examined to determine if there would be fatal flaws in building the concept. The construction phasing of the interchange network was developed by reviewing the three-dimensional aspects of the conceptual design and taking into account considerations for the maintenance of traffic during construction. The proposed phasing diagrams detailed in this section represent one option for phasing construction – it is possible that there are other options.

In general, the following principles guided the phasing development. For Concept C the outside roads surrounding the interchange were first constructed to provide alternative routes for vehicles during subsequent construction phases. Constructing the outer roadway network roads would remove many vehicles from the interchange area and would create redundancy in the system to re-route vehicles. Next, the three-dimensional aspects such as grade differentials within the interchange area, combined with potential scheduling of existing ramp removal and proposed ramp construction, were reviewed. The final construction phases include constructing the remaining connections throughout the network and reconstructing the interchange.

Four phases were developed for Concept C. The phases do not constitute separate projects – they are steps to complete the implementation of each conceptual design. The description of each phase includes steps as part of a construction plan and a detour and traffic control plan. For each step, there is a figure that shows the construction completed during the phase highlighted in yellow, the existing roadway in red, and the proposed improvements on new and existing roads in blue. The proposed construction phasing for Concept C is as follows:

- Phase 1 - Improve existing roads and new connections outside interchange area and construct “jughandle” in northwest quadrant
- Phase 2 - Construct “jughandle” in southwest quadrant
- Phase 3 - Complete Route 7/Wilson Boulevard intersection and project tie-ins
- Phase 4 - Construct “jughandles” in east quadrants

Concept C - Phase 1: Improve Existing Roads and New Connections outside Interchange Area and Construct "Jughandle" in Northwest Quadrant

As shown in Figure 1, Phase 1 for Concept C would improve the existing roads, provide new connections outside the interchange area, and construct the first "jughandle" connection in the northwest quadrant.

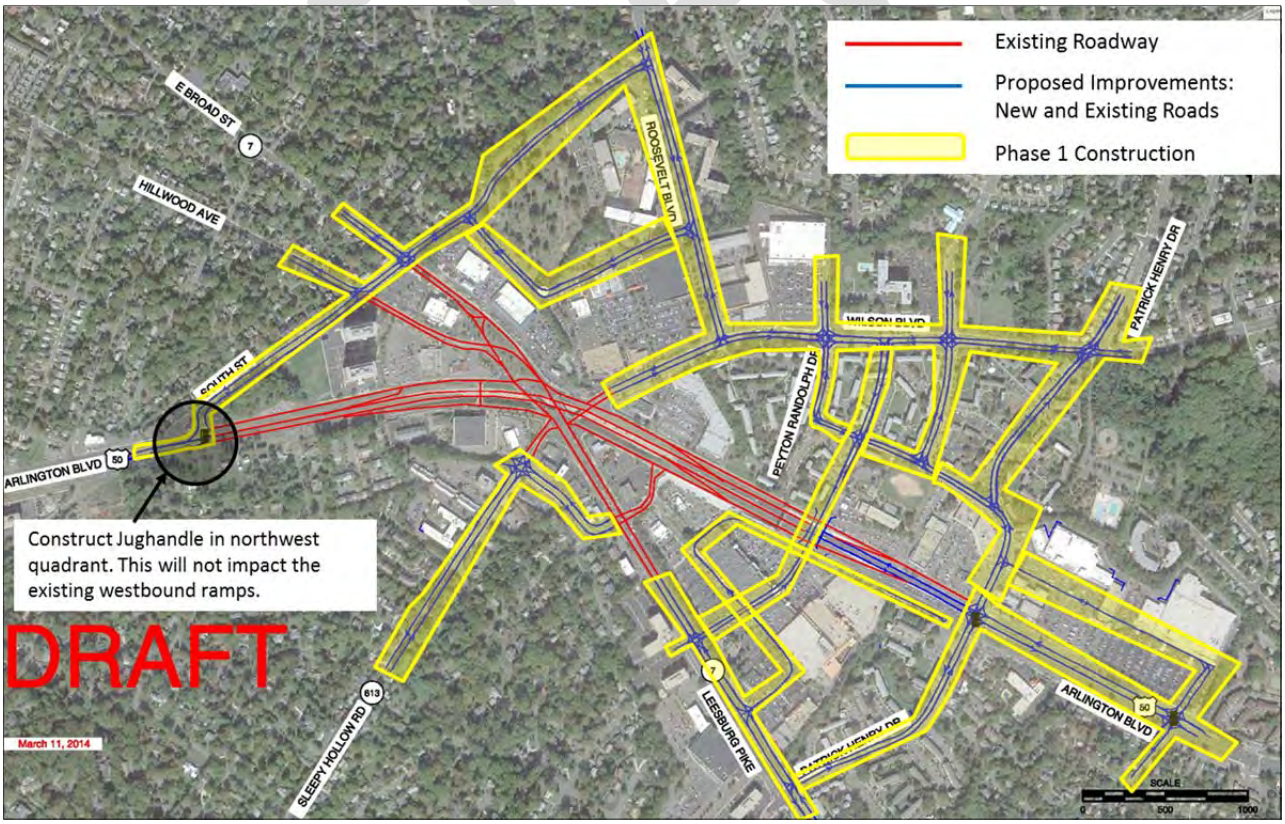
Construction

- Construct the outer roads first to provide alternative routes for future construction phases.
  - Upgrade/improve existing facilities
  - Provide new connections
  - Consider identifying subprojects within this phase to systemically improve the "outer roads"
- Construct the "jughandle" in the northwest quadrant at South Street
- Construct the Seven Corners Task Force overcrossing and ensure that the vertical profile takes into account the existing and future ramps and frontage roads

Detour and Traffic Control Plan

Maintain existing travel patterns along existing facilities. South Street trips can be directed to existing interchange. Keep the existing westbound ramps open until the "jughandle" in northwest quadrant is constructed.

Figure 1. Concept C - Phase 1



Concept C - Phase 2: Construct "Jughandle" in Southwest Quadrant

As shown in Figure 2, Phase 2 for Concept C is to construct the "jughandle" in the southwest quadrant.

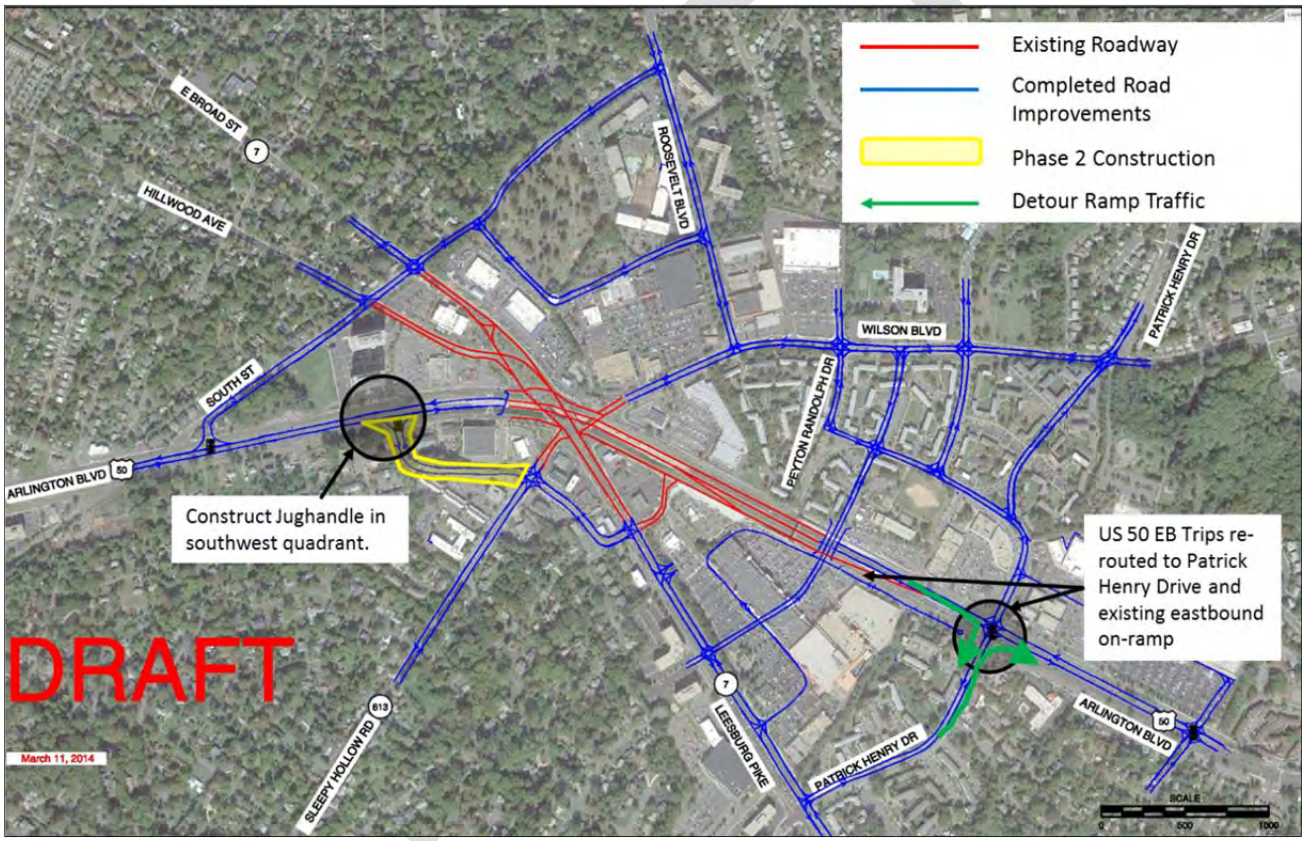
Construction

Construct the "jughandle" in the southwest quadrant. Remove the westbound Route 50 on-ramps and the eastbound Route 50 off-ramp.

Detour and Traffic Control

Re-route traffic to use the Route 50/Patrick Henry Drive intersection and existing eastbound on-ramp. Close the existing westbound ramps while these are being constructed.

Figure 2. Concept C - Phase 2



Concept C - Phase 3: Complete Route 7/Wilson Boulevard Intersection and Project Tie-Ins

As shown in Figure 3, Phase 3 for Concept C is to complete the Route 7/Wilson Boulevard/Sleepy Hollow Road intersection and remaining project tie-ins.

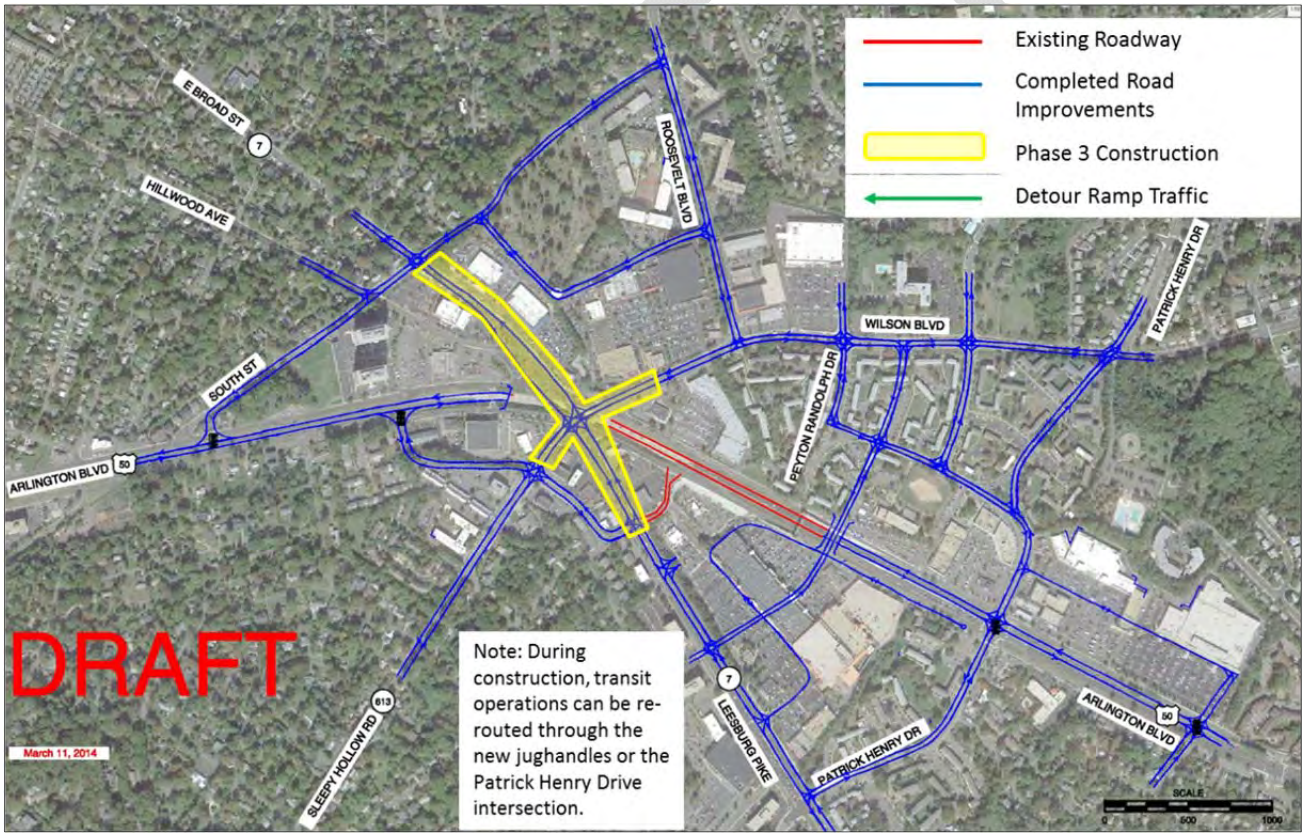
Construction

Modify the Route 7/Wilson Boulevard/Sleepy Hollow Road intersection and complete the remaining intersections.

Detour and Traffic Control Plan

Divert traffic to newly constructed roadways. Transit operations can divert through the new "jughandle" or Patrick Henry Drive.

Figure 3. Concept C - Phase 3



Concept C - Phase 4: Construct "Jughandles" in East Quadrants

As shown in Figure 4, Phase 4 for Concept C is to construct the "jughandles" in the east quadrants.

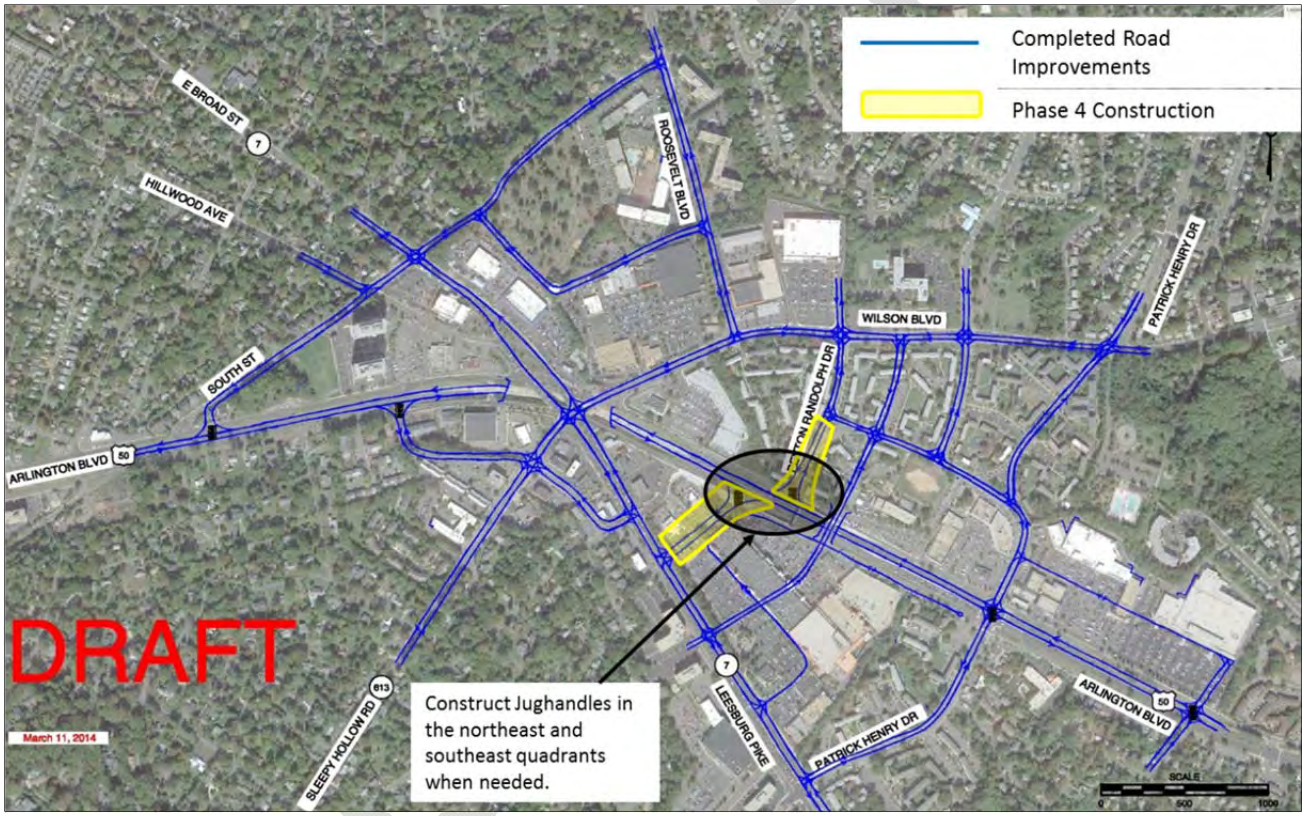
Construction

The "jughandles" in the northeast and southeast quadrants can be constructed when needed.

Detour and Traffic Control

No detours needed because there is full access via the "jughandles" in the northwest and southwest quadrants and at the Patrick Henry Drive signal.

Figure 4. Concept C - Phase 4



Appendix F
Concept B Eastern Ramp Terminal
On- and Off-Ramp Profiles

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MEMORANDUM

Date: June 27, 2014

Project #: 13942

To: Michael Garcia and Kris Morley-Nikfar
Fairfax County Department of Transportation

From: Zachary Horowitz, P.E. and Alexandra Jahnle

Project: Seven Corners Transportation Study Part 2

Subject: Concept B Eastern Ramp Terminal On- and Off-ramp Profiles

DRAFT

This memorandum summarizes the results of the preliminary analysis of the location of the eastern ramp terminal on- and off-ramps to Route 50.

Some members of the Seven Corners Task Force raised a concern about the proposed location of the overcrossing (shown in Figure 1 as Alt. 1 in green) from Route 7 to Roosevelt Boulevard because the roadway would most likely require the demolition of the Seven Corners Center shopping center on the north side of Route 50. The location of the ramp terminal overcrossing was studied further to determine if it could be moved further east (shown in Figure 1 as Alt. 2 in blue) to avoid the shopping center. The controlling factors used to make the determination are:

- The required length of the westbound off-ramp and eastbound on-ramp (shown in red in Figure 1) to meet grade between the ramp terminal and Route 50 and to accommodate queuing
- The maximum grade allowed for the westbound off-ramp and the eastbound on-ramp based on the design speed for the ramps to meet required acceleration and deceleration distances

Note that this review of the potential ramp alignments is preliminary and was done without benefit of a formal survey of the area (topographic information was provided in GIS format from Fairfax County is not deemed reliable enough for a final determination). Further study is required to make a final recommendation on the location of the ramp terminal and ramps.

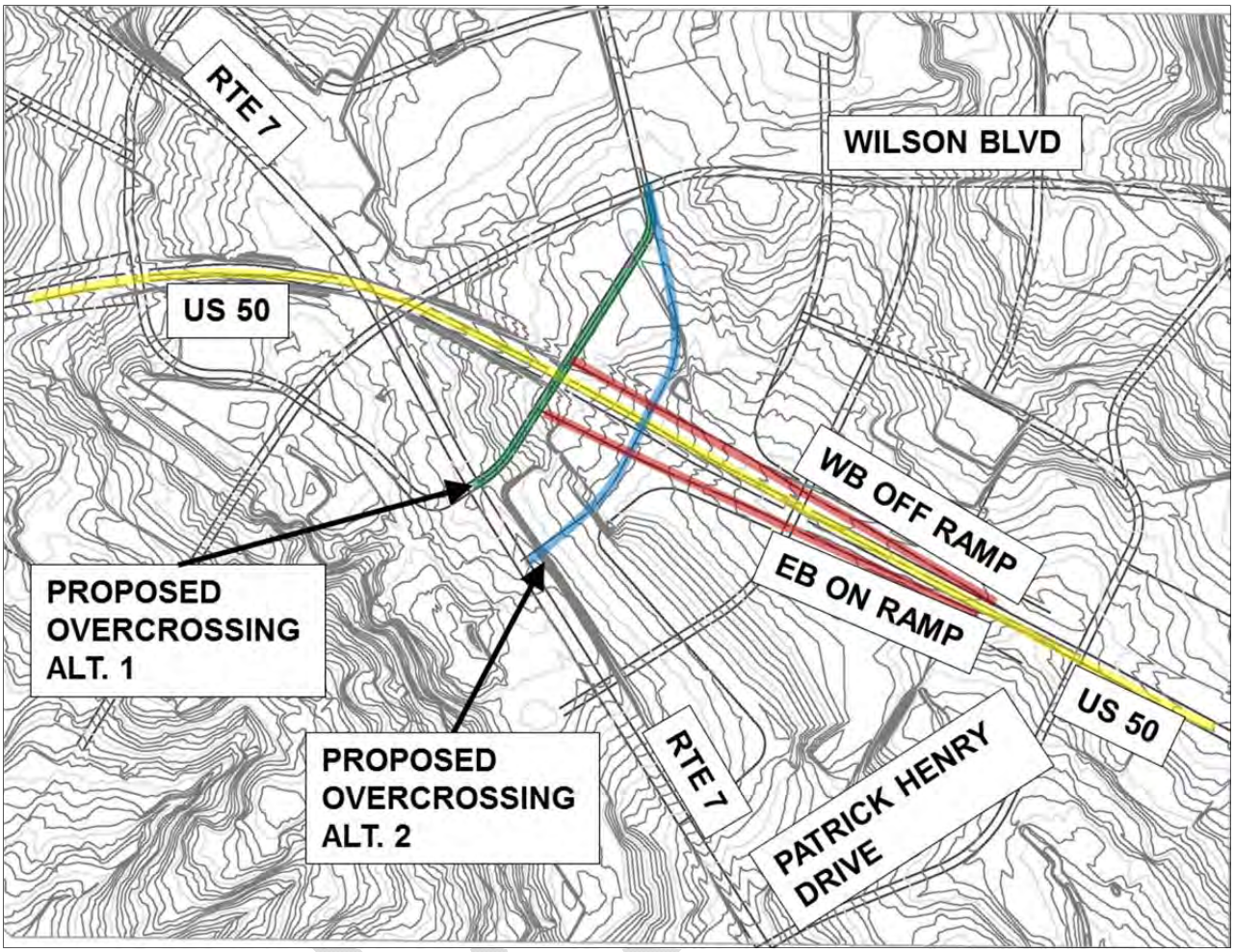

Figure 1. Proposed Alignment Options for the Eastern Ramp Terminal

Profile alignments were created using AutoCAD Civil3D. Key design criteria assumed for the ramp profiles, transition areas lengths, and maximum grades for ramps are listed below:

- Approximately 25 foot from the overcrossing top of pavement level to the top of pavement on Route 50
- A length of approximately 150 to 200 feet for the transition from the eastbound on-ramp terminal roadway to the beginning of the on-ramp downgrade
- A length of approximately 350 feet to 400 feet for the transition from off-ramp upgrade for vehicle queue storage and sight distance
- A maximum of six percent grade[1] on ramps based on an estimated design speed of 35-40 mph.

The resulting ramp profiles for Alt. 1 indicate that the minimum eastbound on-ramp grade would need to be approximately 4.27 percent and the minimum westbound off-ramp grade would need to be

[1] VDOT Road Design Manual, Appendix A, Page A-16 under general notes

approximately 4.49 percent. Assuming some level of error with these preliminary results, based on their planning-level nature and lack of survey data, the ramp profiles indicate that the location of the overcrossing (as shown in Figure 1 as Alt. 1 in green) may be viable. Further study is necessary to confirm these results.

The resulting ramp profiles for Alt. 2 indicate that the minimum eastbound on-ramp grade would need to be approximately 5.87 percent and the minimum westbound off-ramp grade would need to be approximately 5.03 percent. Assuming some level of error with these preliminary results, based on their planning-level nature and lack of survey data, the ramp profiles indicate that the location of the overcrossing (as shown in Figure 1 as Alt. 1 in blue) is unlikely to be viable. Further study is necessary to confirm these results.

Other concerns with moving the eastern ramp terminal further east to avoid the shopping center include:

- The proximity of the Route 50/Patrick Henry Drive intersection to the proposed eastbound off-ramp and westbound on-ramp
- Moving the ramp terminal further east would require the proposed Seven Corners overcrossing to be raised much higher to provide clearance for the eastbound on-ramp and westbound off-ramp. Raising the profile of the Seven Corners overcrossing would require the touchdown points to be much further north and south of Route 50 and would affect connectivity with other street
- The desire to maintain a direct connection for transit (and other vehicles) between Route 7 and Roosevelt Boulevard

Adding an additional signal further east on Route 7 from the intersection of Route 7/Castle Road would cause congestion on Route 7 and require a much wider cross-section on Route, including dual left-turn lanes.

DRAFT

Appendix G
HCM and SimTraffic Results

Intersection Name	Synchro ID		New ID
	Comprehensive Plan	Concept B	
Roosevelt Blvd/N Roosevelt St	1900	130	10
Route 7/N Roosevelt St	700	120	20
Hillwood Ave/South St	600	-	31
Hillwood Ave/N Roosevelt St	-	115	32
Hillwood Ave/South St (New alignment)	-	110	33
Route 7/Hillwood Ave	5140	-	40
Route 7/Route 50 Westbound On-ramp	5120	-	41
Route 7/Arlington Blvd	5100	-	42
Wilson Blvd/Route 50 Westbound Off-ramp	5080	-	43
Route 7/Wilson Blvd/Sleepy Hollow Rd	5090	-	44
Route 7/Sleepy Hollow Rd	-	170	45
Route 7/Wilson Blvd/Sleepy Hollow Rd	-	195	46
Roosevelt Blvd/Route 50 Westbound Off-ramp	-	190	47
Roosevelt Blvd/Route 50 Eastbound On-ramp	-	140	48
S Roosevelt St/ Route 50 Westbound On-ramp	-	145	49
S Roosevelt St/ Route 50 Eastbound Off-ramp	900	160	50
Sleepy Hollow Rd/Aspen Lane		-	61
Sleepy Hollow Rd/Aspen Lane	-		62
Route 7/Castle Rd	1000	180	70
Route 7/7 Corners Task Force Overcrossing	-	200	71
Route 7/Seven Corners Center entrance	1100	210	80
Route 7/Patrick Henry Dr	1200	220	90
Route 50/ Olin Dr	1300	310	100
John Marshall Dr/Willston Dr	1500	-	111
Patrick Henry Dr/Willston Dr	-	295	112
7 Corners Task Force Overcrossing/Willston Dr	-	275	113
Route 50/Patrick Henry Dr	1400	300	110
Wilson Blvd/John Marshall Dr	1600	280	120
Wilson Blvd/Patrick Henry Dr	-	290	121
Wilson Blvd/7 Corners Task Force Overcrossing	-	270	122
Wilson Blvd/Peyton Randolph Dr	1700	260	130
Wilson Blvd/Roosevelt Blvd	1800	250	140

HCM Signalized Intersection Capacity Analysis
600: South St/S Roosevelt St & Hillwood Ave

5/21/2014

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Volume (vph)	20	525	30	110	160	30	15	35	50	125	50	20
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0		4.0	4.0		4.0	4.0
Lane Util. Factor	1.00	1.00		1.00	1.00	1.00		1.00	1.00		1.00	1.00
Frt	1.00	0.99		1.00	1.00	0.85		1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00		0.98	1.00		0.97	1.00
Satd. Flow (prot)	1770	1848		1770	1863	1583		1835	1583		1799	1583
Flt Permitted	0.65	1.00		0.39	1.00	1.00		0.89	1.00		0.76	1.00
Satd. Flow (perm)	1214	1848		730	1863	1583		1650	1583		1407	1583
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	21	547	31	115	167	31	16	36	52	130	52	21
RTOR Reduction (vph)	0	1	0	0	0	8	0	0	42	0	0	17
Lane Group Flow (vph)	21	577	0	115	167	23	0	52	10	0	182	4
Turn Type	Perm	NA		Perm	NA	Perm	Perm	NA	Perm	Perm	NA	Perm
Protected Phases		2			2			4			4	
Permitted Phases	2			2		2	4		4	4		4
Actuated Green, G (s)	70.6	70.6		70.6	70.6	70.6		17.4	17.4		17.4	17.4
Effective Green, g (s)	72.6	72.6		72.6	72.6	72.6		19.4	19.4		19.4	19.4
Actuated g/C Ratio	0.73	0.73		0.73	0.73	0.73		0.19	0.19		0.19	0.19
Clearance Time (s)	6.0	6.0		6.0	6.0	6.0		6.0	6.0		6.0	6.0
Vehicle Extension (s)	2.0	2.0		2.0	2.0	2.0		2.0	2.0		2.0	2.0
Lane Grp Cap (vph)	881	1341		529	1352	1149		320	307		272	307
v/s Ratio Prot		c0.31			0.09							
v/s Ratio Perm	0.02			0.16		0.01		0.03	0.01		c0.13	0.00
v/c Ratio	0.02	0.43		0.22	0.12	0.02		0.16	0.03		0.67	0.01
Uniform Delay, d1	3.8	5.5		4.5	4.1	3.8		33.5	32.7		37.3	32.6
Progression Factor	1.00	1.00		1.00	1.00	1.00		1.00	1.00		0.76	0.82
Incremental Delay, d2	0.0	1.0		0.9	0.2	0.0		0.1	0.0		4.6	0.0
Delay (s)	3.9	6.5		5.4	4.3	3.8		33.6	32.7		32.8	26.7
Level of Service	A	A		A	A	A		C	C		C	C
Approach Delay (s)		6.4			4.7			33.2			32.2	
Approach LOS		A			A			C			C	

Intersection Summary			
HCM 2000 Control Delay	12.5	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.48		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	64.0%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Movement	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Volume (vph)	25	620	90	15	870	20	35	30	20	40	90	20
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		10.0			4.0			4.0			4.0	
Lane Util. Factor		0.95			0.95			1.00			1.00	
Frt		0.98			1.00			0.97			0.98	
Flt Protected		1.00			1.00			0.98			0.99	
Satd. Flow (prot)		3468			3525			1768			1805	
Flt Permitted		0.89			0.94			0.75			0.90	
Satd. Flow (perm)		3104			3305			1351			1643	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	26	653	95	16	916	21	37	32	21	42	95	21
RTOR Reduction (vph)	0	8	0	0	1	0	0	0	0	0	7	0
Lane Group Flow (vph)	0	766	0	0	952	0	0	90	0	0	151	0
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		2			2			4			4	
Permitted Phases	2			2			4			4		
Actuated Green, G (s)		72.2			72.2			13.8			13.8	
Effective Green, g (s)		69.2			75.2			16.8			16.8	
Actuated g/C Ratio		0.69			0.75			0.17			0.17	
Clearance Time (s)		7.0			7.0			7.0			7.0	
Vehicle Extension (s)		2.0			2.0			2.0			2.0	
Lane Grp Cap (vph)		2147			2485			226			276	
v/s Ratio Prot												
v/s Ratio Perm		0.25			c0.29			0.07			c0.09	
v/c Ratio		0.36			0.38			0.40			0.55	
Uniform Delay, d1		6.3			4.3			37.1			38.1	
Progression Factor		1.00			1.00			1.21			1.00	
Incremental Delay, d2		0.5			0.4			0.4			1.2	
Delay (s)		6.8			4.8			45.2			39.3	
Level of Service		A			A			D			D	
Approach Delay (s)		6.8			4.8			45.2			39.3	
Approach LOS		A			A			D			D	

Intersection Summary			
HCM 2000 Control Delay	10.2	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.44		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	14.0
Intersection Capacity Utilization	59.5%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	35	25	25	665	565	35
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91
Hourly flow rate (vph)	38	27	27	731	621	38
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	1426	640	659			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1426	640	659			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	73	94	97			
cM capacity (veh/h)	145	475	929			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	66	758	659
Volume Left	38	27	0
Volume Right	27	0	38
cSH	204	929	1700
Volume to Capacity	0.32	0.03	0.39
Queue Length 95th (ft)	33	2	0
Control Delay (s)	30.9	0.8	0.0
Lane LOS	D	A	
Approach Delay (s)	30.9	0.8	0.0
Approach LOS	D		

Intersection Summary			
Average Delay	1.8		
Intersection Capacity Utilization	65.4%	ICU Level of Service	C
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	10	15	25	140	10	5	130	230	340	5	435	40
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	11	17	28	156	11	6	144	256	378	6	483	44
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)											403	
pX, platoon unblocked												
vC, conflicting volume	1072	1439	506	1097	1083	256	528			633		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1072	1439	506	1097	1083	256	528			633		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	93	85	95	0	94	99	86			99		
cM capacity (veh/h)	167	114	567	143	186	783	1039			950		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1
Volume Total	56	172	400	378	533
Volume Left	11	156	144	0	6
Volume Right	28	6	0	378	44
cSH	212	150	1039	1700	950
Volume to Capacity	0.26	1.15	0.14	0.22	0.01
Queue Length 95th (ft)	25	239	12	0	0
Control Delay (s)	27.9	179.9	4.2	0.0	0.2
Lane LOS	D	F	A		A
Approach Delay (s)	27.9	179.9	2.2		0.2
Approach LOS	D	F			

Intersection Summary				
Average Delay		22.3		
Intersection Capacity Utilization		70.1%	ICU Level of Service	C
Analysis Period (min)		15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	55	1050	10	75	1575	240	295	175	135	35	50	45
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		-2%			-2%			-3%			7%	
Total Lost time (s)	7.0	6.5		7.0	6.5		7.0	7.0	7.0		7.0	7.0
Lane Util. Factor	1.00	0.91		1.00	0.91		1.00	1.00	1.00		1.00	1.00
Frt	1.00	1.00		1.00	0.98		1.00	1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00	1.00		0.98	1.00
Satd. Flow (prot)	1787	5129		1787	5034		1796	1891	1607		1762	1522
Flt Permitted	0.05	1.00		0.18	1.00		0.70	1.00	1.00		0.81	1.00
Satd. Flow (perm)	95	5129		342	5034		1317	1891	1607		1464	1522
Peak-hour factor, PHF	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Adj. Flow (vph)	60	1154	11	82	1731	264	324	192	148	38	55	49
RTOR Reduction (vph)	0	0	0	0	12	0	0	0	96	0	0	35
Lane Group Flow (vph)	60	1165	0	82	1983	0	324	192	52	0	93	14
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	1
Turn Type	pm+pt	NA		pm+pt	NA		Perm	NA	Perm	Perm	NA	Perm
Protected Phases	5	2		1	6			8			4	
Permitted Phases	2			6			8		8	4		4
Actuated Green, G (s)	85.2	79.6		89.4	81.7		42.2	42.2	42.2		42.2	42.2
Effective Green, g (s)	85.2	79.6		89.4	81.7		42.2	42.2	42.2		42.2	42.2
Actuated g/C Ratio	0.57	0.53		0.60	0.54		0.28	0.28	0.28		0.28	0.28
Clearance Time (s)	7.0	6.5		7.0	6.5		7.0	7.0	7.0		7.0	7.0
Vehicle Extension (s)	3.0	4.0		3.0	4.0		3.0	3.0	3.0		5.0	5.0
Lane Grp Cap (vph)	117	2721		278	2741		370	532	452		411	428
v/s Ratio Prot	c0.02	0.23		0.02	c0.39			0.10				
v/s Ratio Perm	0.27			0.16			c0.25		0.03		0.06	0.01
v/c Ratio	0.51	0.43		0.29	0.72		0.88	0.36	0.11		0.23	0.03
Uniform Delay, d1	21.7	21.4		14.1	25.7		51.4	43.1	40.0		41.4	39.1
Progression Factor	1.00	1.00		0.54	0.35		1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	3.8	0.5		0.5	1.5		20.0	0.4	0.1		0.6	0.1
Delay (s)	25.5	21.9		8.1	10.4		71.4	43.5	40.1		42.0	39.2
Level of Service	C	C		A	B		E	D	D		D	D
Approach Delay (s)		22.0			10.4			56.4			41.0	
Approach LOS		C			B			E			D	

Intersection Summary			
HCM 2000 Control Delay	22.3	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.76		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	20.5
Intersection Capacity Utilization	87.5%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	65	1100	25	40	1800	120	10	10	10	90	10	80
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		-5%			5%			0%			0%	
Total Lost time (s)	7.0	6.5	6.5	7.0	6.5	6.5		7.0		7.0	7.0	7.0
Lane Util. Factor	1.00	0.91	1.00	1.00	0.91	1.00		1.00		0.95	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85		0.95		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00		0.98		0.95	0.96	1.00
Satd. Flow (prot)	1814	5212	1623	1725	4958	1538		1750		1681	1701	1583
Flt Permitted	0.08	1.00	1.00	0.22	1.00	1.00		0.98		0.95	0.96	1.00
Satd. Flow (perm)	150	5212	1623	392	4958	1538		1750		1681	1701	1583
Peak-hour factor, PHF	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Adj. Flow (vph)	66	1122	26	41	1837	122	10	10	10	92	10	82
RTOR Reduction (vph)	0	0	0	0	0	47	0	0	0	0	0	78
Lane Group Flow (vph)	66	1122	26	41	1837	75	0	30	0	51	51	4
Bus Blockages (#/hr)	0	0	0	0	0	1	0	0	0	0	0	0
Turn Type	pm+pt	NA	Prot	pm+pt	NA	Perm	Split	NA		Split	NA	Perm
Protected Phases	5	2	2	1	6		4 7	4 7		3	3	
Permitted Phases	2			6		6						3
Actuated Green, G (s)	99.5	93.1	93.1	98.5	92.6	92.6		16.5		7.0	7.0	7.0
Effective Green, g (s)	99.5	93.1	93.1	98.5	92.6	92.6		16.5		7.0	7.0	7.0
Actuated g/C Ratio	0.66	0.62	0.62	0.66	0.62	0.62		0.11		0.05	0.05	0.05
Clearance Time (s)	7.0	6.5	6.5	7.0	6.5	6.5				7.0	7.0	7.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0				3.0	3.0	3.0
Lane Grp Cap (vph)	170	3234	1007	309	3060	949		192		78	79	73
v/s Ratio Prot	c0.02	0.22	0.02	0.01	c0.37			c0.02		c0.03	0.03	
v/s Ratio Perm	0.24			0.08		0.05						0.00
v/c Ratio	0.39	0.35	0.03	0.13	0.60	0.08		0.16		0.65	0.65	0.05
Uniform Delay, d1	12.7	13.8	11.0	9.4	17.4	11.5		60.4		70.3	70.3	68.3
Progression Factor	2.99	1.38	1.59	0.44	0.26	0.04		1.00		1.00	1.00	1.00
Incremental Delay, d2	1.4	0.3	0.0	0.1	0.3	0.1		0.4		18.0	16.7	0.3
Delay (s)	39.2	19.3	17.4	4.2	4.9	0.6		60.8		88.3	87.0	68.6
Level of Service	D	B	B	A	A	A		E		F	F	E
Approach Delay (s)		20.3			4.6			60.8			79.2	
Approach LOS		C			A			E			E	

Intersection Summary			
HCM 2000 Control Delay	14.7	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.56		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	34.5
Intersection Capacity Utilization	66.1%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	150	1020	30	20	1710	250	160	180	25	150	10	115
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		-3%			2%			-4%			6%	
Total Lost time (s)	7.0	6.5	6.5	7.0	6.5		7.0	7.0		7.0	7.0	7.0
Lane Util. Factor	1.00	0.91	1.00	1.00	0.91		1.00	1.00		0.95	0.95	1.00
Frt	1.00	1.00	0.85	1.00	0.98		1.00	0.98		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00		0.95	0.96	1.00
Satd. Flow (prot)	1796	5162	1607	1752	4931		1805	1866		1631	1644	1530
Flt Permitted	0.06	1.00	1.00	0.22	1.00		0.95	1.00		0.95	0.96	1.00
Satd. Flow (perm)	105	5162	1607	408	4931		1805	1866		1631	1644	1530
Peak-hour factor, PHF	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Adj. Flow (vph)	165	1121	33	22	1879	275	176	198	27	165	11	126
RTOR Reduction (vph)	0	0	0	0	12	0	0	0	0	0	0	0
Lane Group Flow (vph)	165	1121	33	22	2142	0	176	225	0	87	89	126
Bus Blockages (#/hr)	0	0	0	0	1	1	0	0	0	0	0	1
Turn Type	pm+pt	NA	Prot	pm+pt	NA		Split	NA		Split	NA	pt+ov
Protected Phases	5	2	2	1	6		4 7	4 7		3	3	3 5
Permitted Phases	2			6								
Actuated Green, G (s)	86.2	75.0	75.0	69.0	64.8		35.3	35.3		8.0	8.0	22.4
Effective Green, g (s)	86.2	75.0	75.0	69.0	64.8		35.3	35.3		8.0	8.0	22.4
Actuated g/C Ratio	0.57	0.50	0.50	0.46	0.43		0.24	0.24		0.05	0.05	0.15
Clearance Time (s)	7.0	6.5	6.5	7.0	6.5					7.0	7.0	
Vehicle Extension (s)	2.0	4.0	4.0	2.0	4.0					3.0	3.0	
Lane Grp Cap (vph)	222	2581	803	225	2130		424	439		86	87	228
v/s Ratio Prot	c0.07	0.22	0.02	0.00	c0.43		0.10	c0.12		0.05	c0.05	0.08
v/s Ratio Perm	0.35			0.04								
v/c Ratio	0.74	0.43	0.04	0.10	1.01		0.42	0.51		1.01	1.02	0.55
Uniform Delay, d1	43.8	24.0	19.1	22.3	42.6		48.6	49.9		71.0	71.0	59.2
Progression Factor	1.66	1.33	1.28	1.00	1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	10.8	0.5	0.1	0.1	20.8		0.7	1.0		100.3	102.9	2.9
Delay (s)	83.5	32.4	24.5	22.3	63.4		49.3	50.9		171.3	173.9	62.0
Level of Service	F	C	C	C	E		D	D		F	F	E
Approach Delay (s)		38.5			63.0			50.2			126.5	
Approach LOS		D			E			D			F	

Intersection Summary			
HCM 2000 Control Delay	58.7	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	0.88		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	34.5
Intersection Capacity Utilization	86.7%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	40	3640	35	10	2860	45	80	15	25	25	10	20
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0			4.0			4.0	4.0		4.0	4.0
Lane Util. Factor		0.91			0.91			1.00	1.00		1.00	1.00
Frt		1.00			1.00			1.00	0.85		1.00	0.85
Flt Protected		1.00			1.00			0.96	1.00		0.97	1.00
Satd. Flow (prot)		5075			5073			1788	1583		1799	1583
Flt Permitted		0.70			0.81			0.73	1.00		0.63	1.00
Satd. Flow (perm)		3579			4100			1366	1583		1171	1583
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	43	3872	37	11	3043	48	85	16	27	27	11	21
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	19	0	0	19
Lane Group Flow (vph)	0	3952	0	0	3102	0	0	101	8	0	38	2
Turn Type	Perm	NA		Perm	NA		Perm	NA	Perm	Perm	NA	Perm
Protected Phases		2			6			8			4	
Permitted Phases	2			6			8		8	4		4
Actuated Green, G (s)		170.5			170.5			20.5	20.5		20.5	20.5
Effective Green, g (s)		173.5			173.5			23.5	23.5		23.5	23.5
Actuated g/C Ratio		0.85			0.85			0.11	0.11		0.11	0.11
Clearance Time (s)		7.0			7.0			7.0	7.0		7.0	7.0
Vehicle Extension (s)		0.2			0.2			4.0	4.0		4.0	4.0
Lane Grp Cap (vph)		3029			3470			156	181		134	181
v/s Ratio Prot												
v/s Ratio Perm		c1.10			0.76			c0.07	0.01		0.03	0.00
v/c Ratio		1.30			0.89			0.65	0.05		0.28	0.01
Uniform Delay, d1		15.8			9.9			86.8	80.8		83.0	80.5
Progression Factor		1.00			1.00			1.00	1.00		1.00	1.00
Incremental Delay, d2		139.6			4.0			9.9	0.1		1.6	0.0
Delay (s)		155.4			14.0			96.7	80.9		84.6	80.5
Level of Service		F			B			F	F		F	F
Approach Delay (s)		155.4			14.0			93.4			83.2	
Approach LOS		F			B			F			F	

Intersection Summary			
HCM 2000 Control Delay	93.1	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.23		
Actuated Cycle Length (s)	205.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	117.5%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	200	3610	100	150	2470	340	65	160	205	185	150	75
Ideal Flow (vphpl)	1920	1920	1920	1920	1920	1920	1920	1920	1920	1920	1920	1920
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	0.91		1.00	0.91		1.00	0.95	1.00	0.97	0.95	
Frt	1.00	1.00		1.00	0.98		1.00	1.00	0.85	1.00	0.95	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1788	5118		1788	5045		1788	3576	1600	3469	3397	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1788	5118		1788	5045		1788	3576	1600	3469	3397	
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Adj. Flow (vph)	215	3882	108	161	2656	366	70	172	220	199	161	81
RTOR Reduction (vph)	0	1	0	0	8	0	0	0	78	0	32	0
Lane Group Flow (vph)	215	3989	0	161	3014	0	70	172	142	199	210	0
Turn Type	Prot	NA		Prot	NA		Prot	NA	pm+ov	Prot	NA	
Protected Phases	5	2		1	6		7	4	1	3	8	
Permitted Phases									4			
Actuated Green, G (s)	22.0	134.6		13.0	125.6		6.0	22.9	35.9	6.0	22.9	
Effective Green, g (s)	25.0	138.1		16.0	129.1		9.0	25.9	41.9	9.0	25.9	
Actuated g/C Ratio	0.12	0.67		0.08	0.63		0.04	0.13	0.20	0.04	0.13	
Clearance Time (s)	7.0	7.5		7.0	7.5		7.0	7.0	7.0	7.0	7.0	
Vehicle Extension (s)	3.0	0.2		3.0	0.2		2.0	4.0	3.0	2.0	4.0	
Lane Grp Cap (vph)	218	3447		139	3177		78	451	358	152	429	
v/s Ratio Prot	0.12	c0.78		c0.09	0.60		c0.04	0.05	0.03	c0.06	c0.06	
v/s Ratio Perm									0.06			
v/c Ratio	0.99	1.16		1.16	0.95		0.90	0.38	0.40	1.31	0.49	
Uniform Delay, d1	89.8	33.5		94.5	34.9		97.5	82.2	70.6	98.0	83.4	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	56.5	74.4		125.2	7.8		66.4	0.7	0.7	178.3	1.2	
Delay (s)	146.4	107.8		219.7	42.7		163.9	82.9	71.3	276.3	84.6	
Level of Service	F	F		F	D		F	F	E	F	F	
Approach Delay (s)		109.8			51.7			89.7			171.1	
Approach LOS		F			D			F			F	

Intersection Summary			
HCM 2000 Control Delay	89.6	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.09		
Actuated Cycle Length (s)	205.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	103.4%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	35	130	65	180	175	35
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)		6.5	6.5	6.5	7.0	
Lane Util. Factor		1.00	1.00	1.00	1.00	
Frt		1.00	1.00	0.85	0.98	
Flt Protected		0.99	1.00	1.00	0.96	
Satd. Flow (prot)		1843	1863	1583	1748	
Flt Permitted		0.91	1.00	1.00	0.96	
Satd. Flow (perm)		1692	1863	1583	1748	
Peak-hour factor, PHF	0.83	0.83	0.83	0.83	0.83	0.83
Adj. Flow (vph)	42	157	78	217	211	42
RTOR Reduction (vph)	0	0	0	148	8	0
Lane Group Flow (vph)	0	199	78	69	245	0
Turn Type	Perm	NA	NA	Perm	Prot	
Protected Phases		2	6		4	
Permitted Phases	2			6		
Actuated Green, G (s)		11.2	11.2	11.2	10.5	
Effective Green, g (s)		11.2	11.2	11.2	10.5	
Actuated g/C Ratio		0.32	0.32	0.32	0.30	
Clearance Time (s)		6.5	6.5	6.5	7.0	
Vehicle Extension (s)		3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)		538	592	503	521	
v/s Ratio Prot			0.04		c0.14	
v/s Ratio Perm		c0.12		0.04		
v/c Ratio		0.37	0.13	0.14	0.47	
Uniform Delay, d1		9.3	8.5	8.6	10.1	
Progression Factor		1.00	1.00	1.00	1.00	
Incremental Delay, d2		0.4	0.1	0.1	0.7	
Delay (s)		9.7	8.6	8.7	10.7	
Level of Service		A	A	A	B	
Approach Delay (s)		9.7	8.7		10.7	
Approach LOS		A	A		B	

Intersection Summary			
HCM 2000 Control Delay	9.6	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.42		
Actuated Cycle Length (s)	35.2	Sum of lost time (s)	13.5
Intersection Capacity Utilization	38.5%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	35	780	45	130	730	45	100	25	90	40	45	45
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0			4.0		4.0	4.0	4.0
Lane Util. Factor	1.00	0.95		1.00	0.95			1.00		1.00	1.00	1.00
Frt	1.00	0.99		1.00	0.99			0.94		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00			0.98		0.95	1.00	1.00
Satd. Flow (prot)	1770	3510		1770	3508			1717		1770	1863	1583
Flt Permitted	0.34	1.00		0.95	1.00			0.83		0.54	1.00	1.00
Satd. Flow (perm)	624	3510		1770	3508			1453		1015	1863	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	38	848	49	141	793	49	109	27	98	43	49	49
RTOR Reduction (vph)	0	3	0	0	4	0	0	33	0	0	0	38
Lane Group Flow (vph)	38	894	0	141	838	0	0	201	0	43	49	11
Turn Type	Perm	NA		Prot	NA		Perm	NA		Perm	NA	Perm
Protected Phases		2		1	6			4			8	
Permitted Phases	2						4			8		8
Actuated Green, G (s)	44.7	44.7		9.3	60.0			17.0		17.0	17.0	17.0
Effective Green, g (s)	46.7	46.7		11.3	62.0			20.0		20.0	20.0	20.0
Actuated g/C Ratio	0.52	0.52		0.13	0.69			0.22		0.22	0.22	0.22
Clearance Time (s)	6.0	6.0		6.0	6.0			7.0		7.0	7.0	7.0
Vehicle Extension (s)	2.0	2.0		0.2	3.0			2.0		2.0	2.0	2.0
Lane Grp Cap (vph)	323	1821		222	2416			322		225	414	351
v/s Ratio Prot		c0.25		c0.08	0.24						0.03	
v/s Ratio Perm	0.06							c0.14		0.04		0.01
v/c Ratio	0.12	0.49		0.64	0.35			0.62		0.19	0.12	0.03
Uniform Delay, d1	11.1	14.0		37.4	5.7			31.6		28.4	28.0	27.4
Progression Factor	1.00	1.00		1.00	1.00			1.00		1.00	1.00	1.00
Incremental Delay, d2	0.7	0.9		4.3	0.4			2.7		0.2	0.0	0.0
Delay (s)	11.8	14.9		41.7	6.1			34.3		28.6	28.0	27.4
Level of Service	B	B		D	A			C		C	C	C
Approach Delay (s)		14.8			11.2			34.3			28.0	
Approach LOS		B			B			C			C	

Intersection Summary			
HCM 2000 Control Delay	16.1	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.54		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	59.2%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	105	835	30	15	815	45	15	5	15	10	10	5
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	7.0	7.0		7.0	7.0			7.0			7.0	7.0
Lane Util. Factor	1.00	0.95		1.00	0.95			1.00			1.00	1.00
Frt	1.00	0.99		1.00	0.99			0.94			1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00			0.98			0.98	1.00
Satd. Flow (prot)	1770	3521		1770	3512			1717			1817	1583
Flt Permitted	0.25	1.00		0.30	1.00			0.98			0.98	1.00
Satd. Flow (perm)	460	3521		555	3512			1717			1817	1583
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Adj. Flow (vph)	113	898	32	16	876	48	16	5	16	11	11	5
RTOR Reduction (vph)	0	1	0	0	2	0	0	15	0	0	0	4
Lane Group Flow (vph)	113	929	0	16	922	0	0	22	0	0	22	1
Turn Type	pm+pt	NA		pm+pt	NA		Split	NA		Split	NA	pm+ov
Protected Phases	5	2		1	6		4	4		3	3	5
Permitted Phases	2			6								3
Actuated Green, G (s)	79.0	71.7		68.4	66.4			3.6			4.7	12.0
Effective Green, g (s)	79.0	71.7		68.4	66.4			3.6			4.7	12.0
Actuated g/C Ratio	0.72	0.65		0.62	0.60			0.03			0.04	0.11
Clearance Time (s)	7.0	7.0		7.0	7.0			7.0			7.0	7.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0			3.0			3.0	3.0
Lane Grp Cap (vph)	417	2295		367	2119			56			77	172
v/s Ratio Prot	c0.02	c0.26		0.00	c0.26			c0.01			c0.01	0.00
v/s Ratio Perm	0.18			0.03								0.00
v/c Ratio	0.27	0.40		0.04	0.43			0.38			0.29	0.00
Uniform Delay, d1	5.8	9.1		8.0	11.7			52.1			51.0	43.7
Progression Factor	1.42	1.18		1.00	1.00			1.00			1.00	1.00
Incremental Delay, d2	0.3	0.5		0.0	0.7			4.3			2.0	0.0
Delay (s)	8.6	11.2		8.0	12.4			56.5			53.1	43.7
Level of Service	A	B		A	B			E			D	D
Approach Delay (s)		10.9			12.3			56.5			51.3	
Approach LOS		B			B			E			D	

Intersection Summary			
HCM 2000 Control Delay	12.9	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.42		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	28.0
Intersection Capacity Utilization	56.0%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	675	650	310	525	350	250
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.5	7.0	7.0		7.0	
Lane Util. Factor	1.00	0.95	0.95		0.97	
Frt	1.00	1.00	0.91		0.94	
Flt Protected	0.95	1.00	1.00		0.97	
Satd. Flow (prot)	1770	3539	3206		3292	
Flt Permitted	0.12	1.00	1.00		0.97	
Satd. Flow (perm)	225	3539	3206		3292	
Peak-hour factor, PHF	0.91	0.91	0.91	0.91	0.91	0.91
Adj. Flow (vph)	742	714	341	577	385	275
RTOR Reduction (vph)	0	0	266	0	122	0
Lane Group Flow (vph)	742	714	652	0	538	0
Turn Type	pm+pt	NA	NA		Prot	
Protected Phases	1	6	2		4	
Permitted Phases	6					
Actuated Green, G (s)	74.6	74.6	26.6		21.4	
Effective Green, g (s)	74.6	74.6	26.6		21.4	
Actuated g/C Ratio	0.68	0.68	0.24		0.19	
Clearance Time (s)	6.5	7.0	7.0		7.0	
Vehicle Extension (s)	2.0	5.0	5.0		2.0	
Lane Grp Cap (vph)	735	2400	775		640	
v/s Ratio Prot	c0.38	0.20	0.20		c0.16	
v/s Ratio Perm	c0.30					
v/c Ratio	1.01	0.30	0.84		0.84	
Uniform Delay, d1	28.9	7.1	39.7		42.7	
Progression Factor	1.00	1.00	1.60		1.00	
Incremental Delay, d2	35.6	0.3	10.1		9.4	
Delay (s)	64.4	7.5	73.6		52.0	
Level of Service	E	A	E		D	
Approach Delay (s)		36.5	73.6		52.0	
Approach LOS		D	E		D	

Intersection Summary			
HCM 2000 Control Delay	51.1	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	1.00		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	20.5
Intersection Capacity Utilization	97.8%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	30	40	25	1150	575	30
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	1.00	1.00	0.95	0.95	
Frt	1.00	0.85	1.00	1.00	0.99	
Flt Protected	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	1770	1583	1770	3539	3513	
Flt Permitted	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (perm)	1770	1583	1770	3539	3513	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	32	42	26	1211	605	32
RTOR Reduction (vph)	0	0	0	0	2	0
Lane Group Flow (vph)	32	42	26	1211	635	0
Turn Type	Prot	Perm	Prot	NA	NA	
Protected Phases	4		1	6	2	
Permitted Phases		4		6		
Actuated Green, G (s)	7.3	7.3	3.4	81.7	72.8	
Effective Green, g (s)	8.8	8.8	4.9	83.2	74.3	
Actuated g/C Ratio	0.09	0.09	0.05	0.83	0.74	
Clearance Time (s)	5.5	5.5	5.5	5.5	5.5	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	155	139	86	2944	2610	
v/s Ratio Prot	0.02		0.01	c0.34	0.18	
v/s Ratio Perm		c0.03				
v/c Ratio	0.21	0.30	0.30	0.41	0.24	
Uniform Delay, d1	42.4	42.7	45.9	2.1	4.0	
Progression Factor	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	0.7	1.2	2.0	0.1	0.2	
Delay (s)	43.0	44.0	47.9	2.2	4.3	
Level of Service	D	D	D	A	A	
Approach Delay (s)	43.5			3.2	4.3	
Approach LOS	D			A	A	

Intersection Summary			
HCM 2000 Control Delay	5.1	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.42		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	45.1%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations												
Volume (vph)	0	1250	0	0	0	525	0	0	0	0	640	145
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		7.0				7.0					6.0	
Lane Util. Factor		0.95				*1.00					0.95	
Frt		1.00				0.85					0.97	
Flt Protected		1.00				1.00					1.00	
Satd. Flow (prot)		3505				3106					3429	
Flt Permitted		1.00				1.00					1.00	
Satd. Flow (perm)		3505				3106					3429	
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	0	1302	0	0	0	547	0	0	0	0	667	151
RTOR Reduction (vph)	0	0	0	0	0	6	0	0	0	0	0	0
Lane Group Flow (vph)	0	1302	0	0	0	541	0	0	0	0	818	0
Heavy Vehicles (%)	0%	3%	0%	0%	0%	4%	0%	0%	0%	0%	2%	4%
Turn Type		NA				custom					NA	
Protected Phases		2 3 4				2 3 4					1	
Permitted Phases												
Actuated Green, G (s)		124.0				124.0					32.0	
Effective Green, g (s)		118.0				118.0					32.0	
Actuated g/C Ratio		0.70				0.70					0.19	
Clearance Time (s)											6.0	
Vehicle Extension (s)											3.0	
Lane Grp Cap (vph)		2461				2181					653	
v/s Ratio Prot		c0.37				0.17					c0.24	
v/s Ratio Perm												
v/c Ratio		0.53				0.25					1.25	
Uniform Delay, d1		11.8				9.0					68.0	
Progression Factor		0.93				1.00					1.00	
Incremental Delay, d2		0.1				0.1					126.0	
Delay (s)		11.0				9.1					194.0	
Level of Service		B				A					F	
Approach Delay (s)		11.0			9.1			0.0			194.0	
Approach LOS		B			A			A			F	

Intersection Summary			
HCM 2000 Control Delay	66.8	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	0.72		
Actuated Cycle Length (s)	168.0	Sum of lost time (s)	25.0
Intersection Capacity Utilization	67.7%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	EBR2	NBT	NBR	NBR2	SEL	SET	SER	SER2
Lane Configurations											
Volume (vph)	15	375	325	105	1280	605	30	270	375	765	480
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1995	1900	1900
Total Lost time (s)		6.0			6.0			2.0	2.0	2.0	
Lane Util. Factor		0.95			0.91			1.00	1.00	*1.00	
Frt		0.92			0.95			1.00	1.00	0.85	
Flt Protected		1.00			1.00			0.95	1.00	1.00	
Satd. Flow (prot)		3268			4802			1703	1956	3141	
Flt Permitted		1.00			1.00			0.95	1.00	1.00	
Satd. Flow (perm)		3268			4802			1703	1956	3141	
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	16	391	339	109	1333	630	31	281	391	797	500
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	855	0	0	1994	0	0	281	391	1297	0
Heavy Vehicles (%)	0%	2%	0%	6%	3%	2%	0%	6%	2%	4%	1%
Turn Type	Split	NA			NA			Split	NA	custom	
Protected Phases	1 2	1 2			3			4	4	3 4	
Permitted Phases											
Actuated Green, G (s)		58.0			57.0			34.0	34.0	97.0	
Effective Green, g (s)		58.0			57.0			38.0	38.0	101.0	
Actuated g/C Ratio		0.35			0.34			0.23	0.23	0.60	
Clearance Time (s)					6.0			6.0	6.0		
Vehicle Extension (s)					4.0			4.0	4.0		
Lane Grp Cap (vph)		1128			1629			385	442	1888	
v/s Ratio Prot		c0.26			c0.42			0.17	c0.20	0.41	
v/s Ratio Perm											
v/c Ratio		0.76			1.22			0.73	0.88	0.69	
Uniform Delay, d1		48.8			55.5			60.2	62.9	22.8	
Progression Factor		1.00			1.00			0.44	0.43	1.80	
Incremental Delay, d2		3.0			106.5			3.0	8.8	0.5	
Delay (s)		51.7			162.0			29.6	36.1	41.5	
Level of Service		D			F			C	D	D	
Approach Delay (s)		51.7			162.0				38.7		
Approach LOS		D			F				D		

Intersection Summary			
HCM 2000 Control Delay	92.1	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.00		
Actuated Cycle Length (s)	168.0	Sum of lost time (s)	21.0
Intersection Capacity Utilization	95.7%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

Movement	WBL	WBT	WBR	NWL2	NWL	NWT
Lane Configurations						
Volume (vph)	410	245	510	40	480	775
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0	6.0		6.0	6.0
Lane Util. Factor	*1.00	*1.00	0.91		1.00	0.95
Frt	1.00	0.94	0.85		1.00	1.00
Flt Protected	0.95	0.99	1.00		0.95	1.00
Satd. Flow (prot)	1805	3438	1413		1726	3505
Flt Permitted	0.95	0.99	1.00		0.95	1.00
Satd. Flow (perm)	1805	3438	1413		1726	3505
Peak-hour factor, PHF	0.96	0.96	0.96	0.91	0.96	0.96
Adj. Flow (vph)	427	255	531	44	500	807
RTOR Reduction (vph)	0	19	19	0	69	0
Lane Group Flow (vph)	316	597	262	0	475	807
Heavy Vehicles (%)	0%	3%	4%	0%	5%	3%
Turn Type	Split	NA	Prot	Split	Split	NA
Protected Phases	1 2 4	1 2 4	1 2 4	3	3	3
Permitted Phases						
Actuated Green, G (s)	98.0	98.0	98.0		57.0	57.0
Effective Green, g (s)	98.0	98.0	98.0		57.0	57.0
Actuated g/C Ratio	0.58	0.58	0.58		0.34	0.34
Clearance Time (s)					6.0	6.0
Vehicle Extension (s)					4.0	4.0
Lane Grp Cap (vph)	1052	2005	824		585	1189
v/s Ratio Prot	0.18	0.17	c0.19		c0.28	0.23
v/s Ratio Perm						
v/c Ratio	0.30	0.30	0.32		0.81	0.68
Uniform Delay, d1	17.7	17.7	17.9		50.6	47.6
Progression Factor	0.40	0.36	0.30		0.19	0.25
Incremental Delay, d2	0.1	0.0	0.1		0.9	0.2
Delay (s)	7.2	6.5	5.5		10.7	12.0
Level of Service	A	A	A		B	B
Approach Delay (s)		6.4				11.5
Approach LOS		A				B

Intersection Summary			
HCM 2000 Control Delay	9.1	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.54		
Actuated Cycle Length (s)	168.0	Sum of lost time (s)	25.0
Intersection Capacity Utilization	54.9%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	450	0	0	0	0	1440
Sign Control	Yield		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96
Hourly flow rate (vph)	469	0	0	0	0	1500
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)			263			118
pX, platoon unblocked	0.80					
vC, conflicting volume	375	0			0	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	0	0			0	
tC, single (s)	6.9	6.9			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	42	100			100	
cM capacity (veh/h)	815	1091			1636	

Direction, Lane #	WB 1	WB 2	SB 1	SB 2	SB 3	SB 4
Volume Total	234	234	375	375	375	375
Volume Left	234	234	0	0	0	0
Volume Right	0	0	0	0	0	0
cSH	815	815	1700	1700	1700	1700
Volume to Capacity	0.29	0.29	0.22	0.22	0.22	0.22
Queue Length 95th (ft)	30	30	0	0	0	0
Control Delay (s)	11.2	11.2	0.0	0.0	0.0	0.0
Lane LOS	B	B				
Approach Delay (s)	11.2		0.0			
Approach LOS	B					

Intersection Summary			
Average Delay	2.7		
Intersection Capacity Utilization	40.4%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations												
Volume (vph)	0	0	0	0	725	0	0	1440	15	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)					6.0			6.0				
Lane Util. Factor					0.95			0.86				
Frt					1.00			1.00				
Flt Protected					1.00			1.00				
Satd. Flow (prot)					3471			6266				
Flt Permitted					1.00			1.00				
Satd. Flow (perm)					3471			6266				
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	0	0	0	0	755	0	0	1500	16	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	0	0	1	0	0	0	0
Lane Group Flow (vph)	0	0	0	0	755	0	0	1515	0	0	0	0
Heavy Vehicles (%)	0%	0%	0%	0%	4%	0%	0%	4%	17%	0%	0%	0%
Turn Type					NA			NA				
Protected Phases					1 2 3			4				
Permitted Phases												
Actuated Green, G (s)					122.0			34.0				
Effective Green, g (s)					115.0			34.0				
Actuated g/C Ratio					0.68			0.20				
Clearance Time (s)								6.0				
Vehicle Extension (s)								4.0				
Lane Grp Cap (vph)					2375			1268				
v/s Ratio Prot					c0.22			c0.24				
v/s Ratio Perm												
v/c Ratio					0.32			1.19				
Uniform Delay, d1					10.7			67.0				
Progression Factor					0.73			0.64				
Incremental Delay, d2					0.1			94.5				
Delay (s)					7.9			137.2				
Level of Service					A			F				
Approach Delay (s)		0.0			7.9			137.2			0.0	
Approach LOS		A			A			F			A	

Intersection Summary			
HCM 2000 Control Delay	94.2	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	0.54		
Actuated Cycle Length (s)	168.0	Sum of lost time (s)	25.0
Intersection Capacity Utilization	51.2%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations												
Volume (vph)	0	0	810	0	370	0	0	645	0	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)			4.0		6.0			6.0				
Lane Util. Factor			*1.00		0.95			0.95				
Frt			1.00		1.00			1.00				
Flt Protected			1.00		1.00			1.00				
Satd. Flow (prot)			3654		3505			3471				
Flt Permitted			1.00		1.00			1.00				
Satd. Flow (perm)			3654		3505			3471				
Peak-hour factor, PHF	0.94	0.94	0.96	0.94	0.96	0.94	0.94	0.96	0.94	0.94	0.94	0.94
Adj. Flow (vph)	0	0	844	0	385	0	0	672	0	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	0	844	0	385	0	0	672	0	0	0	0
Heavy Vehicles (%)	0%	0%	4%	0%	3%	0%	0%	4%	0%	0%	0%	0%
Turn Type			Free		NA			NA				
Protected Phases					1 2 3			4				
Permitted Phases			Free									
Actuated Green, G (s)			168.0		122.0			34.0				
Effective Green, g (s)			168.0		115.0			34.0				
Actuated g/C Ratio			1.00		0.68			0.20				
Clearance Time (s)								6.0				
Vehicle Extension (s)								4.0				
Lane Grp Cap (vph)			3654		2399			702				
v/s Ratio Prot					0.11			c0.19				
v/s Ratio Perm			c0.23									
v/c Ratio			0.23		0.16			0.96				
Uniform Delay, d1			0.0		9.4			66.3				
Progression Factor			1.00		0.91			1.00				
Incremental Delay, d2			0.1		0.0			23.8				
Delay (s)			0.1		8.6			90.1				
Level of Service			A		A			F				
Approach Delay (s)		0.1			8.6			90.1			0.0	
Approach LOS		A			A			F			A	

Intersection Summary			
HCM 2000 Control Delay	33.7	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.43		
Actuated Cycle Length (s)	168.0	Sum of lost time (s)	25.0
Intersection Capacity Utilization	51.5%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
600: South St/S Roosevelt St & Hillwood Ave

5/21/2014

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Volume (vph)	50	520	90	50	325	30	75	90	100	80	65	15
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0		4.0	4.0		4.0	4.0
Lane Util. Factor	1.00	1.00		1.00	1.00	1.00		1.00	1.00		1.00	1.00
Frt	1.00	0.98		1.00	1.00	0.85		1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00	1.00		0.98	1.00		0.97	1.00
Satd. Flow (prot)	1770	1821		1770	1863	1583		1821	1583		1813	1583
Flt Permitted	0.55	1.00		0.37	1.00	1.00		0.68	1.00		0.59	1.00
Satd. Flow (perm)	1016	1821		687	1863	1583		1275	1583		1108	1583
Peak-hour factor, PHF	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
Adj. Flow (vph)	51	525	91	51	328	30	76	91	101	81	66	15
RTOR Reduction (vph)	0	5	0	0	0	8	0	0	81	0	0	12
Lane Group Flow (vph)	51	611	0	51	328	22	0	167	20	0	147	3
Turn Type	Perm	NA		Perm	NA	Perm	Perm	NA	Perm	Perm	NA	Perm
Protected Phases		2			2			4			4	
Permitted Phases	2			2		2	4		4	4		4
Actuated Green, G (s)	70.2	70.2		70.2	70.2	70.2		17.8	17.8		17.8	17.8
Effective Green, g (s)	72.2	72.2		72.2	72.2	72.2		19.8	19.8		19.8	19.8
Actuated g/C Ratio	0.72	0.72		0.72	0.72	0.72		0.20	0.20		0.20	0.20
Clearance Time (s)	6.0	6.0		6.0	6.0	6.0		6.0	6.0		6.0	6.0
Vehicle Extension (s)	2.0	2.0		2.0	2.0	2.0		4.0	4.0		4.0	4.0
Lane Grp Cap (vph)	733	1314		496	1345	1142		252	313		219	313
v/s Ratio Prot		c0.34			0.18							
v/s Ratio Perm	0.05			0.07		0.01		0.13	0.01		c0.13	0.00
v/c Ratio	0.07	0.47		0.10	0.24	0.02		0.66	0.06		0.67	0.01
Uniform Delay, d1	4.1	5.8		4.2	4.7	3.9		37.0	32.6		37.1	32.2
Progression Factor	1.00	1.00		1.00	1.00	1.00		1.00	1.00		0.77	1.24
Incremental Delay, d2	0.2	1.2		0.4	0.4	0.0		7.0	0.1		8.3	0.0
Delay (s)	4.3	7.0		4.6	5.1	3.9		44.0	32.7		36.9	39.9
Level of Service	A	A		A	A	A		D	C		D	D
Approach Delay (s)		6.8			5.0			39.8			37.2	
Approach LOS		A			A			D			D	

Intersection Summary			
HCM 2000 Control Delay	15.4	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.51		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	63.8%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Movement	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Volume (vph)	45	555	75	20	715	45	130	20	20	25	65	20
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		10.0			4.0			4.0			4.0	
Lane Util. Factor		0.95			0.95			1.00			1.00	
Frt		0.98			0.99			0.98			0.98	
Flt Protected		1.00			1.00			0.96			0.99	
Satd. Flow (prot)		3469			3504			1766			1797	
Flt Permitted		0.83			0.93			0.66			0.92	
Satd. Flow (perm)		2899			3252			1208			1664	
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	47	578	78	21	745	47	135	21	21	26	68	21
RTOR Reduction (vph)	0	7	0	0	3	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	696	0	0	810	0	0	177	0	0	115	0
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		2			2			4			4	
Permitted Phases	2			2			4			4		
Actuated Green, G (s)		67.7			67.7			18.3			18.3	
Effective Green, g (s)		64.7			70.7			21.3			21.3	
Actuated g/C Ratio		0.65			0.71			0.21			0.21	
Clearance Time (s)		7.0			7.0			7.0			7.0	
Vehicle Extension (s)		2.0			2.0			2.0			2.0	
Lane Grp Cap (vph)		1875			2299			257			354	
v/s Ratio Prot												
v/s Ratio Perm		0.24			c0.25			c0.15			0.07	
v/c Ratio		0.37			0.35			0.69			0.32	
Uniform Delay, d1		8.2			5.7			36.3			33.3	
Progression Factor		1.00			1.00			1.33			1.29	
Incremental Delay, d2		0.6			0.4			5.9			0.2	
Delay (s)		8.8			6.1			54.2			43.1	
Level of Service		A			A			D			D	
Approach Delay (s)		8.8			6.1			54.2			43.1	
Approach LOS		A			A			D			D	

Intersection Summary			
HCM 2000 Control Delay	14.2	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.46		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	14.0
Intersection Capacity Utilization	72.0%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	15	15	15	485	980	20
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94
Hourly flow rate (vph)	16	16	16	516	1043	21
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	1601	1053	1064			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1601	1053	1064			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	86	94	98			
cM capacity (veh/h)	114	275	655			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	32	532	1064
Volume Left	16	16	0
Volume Right	16	0	21
cSH	161	655	1700
Volume to Capacity	0.20	0.02	0.63
Queue Length 95th (ft)	18	2	0
Control Delay (s)	32.8	0.7	0.0
Lane LOS	D	A	
Approach Delay (s)	32.8	0.7	0.0
Approach LOS	D		

Intersection Summary			
Average Delay	0.9		
Intersection Capacity Utilization	62.8%	ICU Level of Service	B
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	40	65	85	285	10	10	30	245	225	10	630	20
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	43	71	92	310	11	11	33	266	245	11	685	22
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	1065	1293	696	1177	1060	266	707			511		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1065	1293	696	1177	1060	266	707			511		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	76	54	79	0	95	99	96			99		
cM capacity (veh/h)	183	155	442	83	214	772	892			1054		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1
Volume Total	207	332	299	245	717
Volume Left	43	310	33	0	11
Volume Right	92	11	0	245	22
cSH	229	87	892	1700	1054
Volume to Capacity	0.90	3.81	0.04	0.14	0.01
Queue Length 95th (ft)	188	Err	3	0	1
Control Delay (s)	81.6	Err	1.4	0.0	0.3
Lane LOS	F	F	A		A
Approach Delay (s)	81.6	Err	0.7		0.3
Approach LOS	F	F			

Intersection Summary			
Average Delay	1852.4		
Intersection Capacity Utilization	80.2%	ICU Level of Service	D
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	120	1480	80	270	1400	35	175	100	90	60	125	140
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		-2%			-2%			-3%			7%	
Total Lost time (s)	7.0	6.5		7.0	6.5		7.0	7.0	7.0		7.0	7.0
Lane Util. Factor	1.00	0.91		1.00	0.91		1.00	1.00	1.00		1.00	1.00
Frt	1.00	0.99		1.00	1.00		1.00	1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00	1.00		0.98	1.00
Satd. Flow (prot)	1787	5097		1787	5117		1796	1891	1607		1769	1522
Flt Permitted	0.14	1.00		0.07	1.00		0.46	1.00	1.00		0.81	1.00
Satd. Flow (perm)	262	5097		126	5117		874	1891	1607		1450	1522
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	130	1609	87	293	1522	38	190	109	98	65	136	152
RTOR Reduction (vph)	0	2	0	0	1	0	0	0	76	0	0	118
Lane Group Flow (vph)	130	1694	0	293	1559	0	190	109	22	0	201	34
Bus Blockages (#/hr)	0	0	0	0	0	0	0	0	0	0	0	1
Turn Type	pm+pt	NA		pm+pt	NA		Perm	NA	Perm	Perm	NA	Perm
Protected Phases	5	2		1	6			8			4	
Permitted Phases	2			6			8		8	4		4
Actuated Green, G (s)	100.9	90.4		126.8	109.3		39.7	39.7	39.7		39.7	39.7
Effective Green, g (s)	100.9	90.4		126.8	109.3		39.7	39.7	39.7		39.7	39.7
Actuated g/C Ratio	0.56	0.50		0.70	0.61		0.22	0.22	0.22		0.22	0.22
Clearance Time (s)	7.0	6.5		7.0	6.5		7.0	7.0	7.0		7.0	7.0
Vehicle Extension (s)	3.0	4.0		3.0	4.0		3.0	3.0	3.0		5.0	5.0
Lane Grp Cap (vph)	235	2559		360	3107		192	417	354		319	335
v/s Ratio Prot	0.03	0.33		c0.13	0.30			0.06				
v/s Ratio Perm	0.28			c0.44			c0.22		0.01		0.14	0.02
v/c Ratio	0.55	0.66		0.81	0.50		0.99	0.26	0.06		0.63	0.10
Uniform Delay, d1	19.0	33.4		51.2	20.0		69.9	58.0	55.4		63.5	55.9
Progression Factor	1.00	1.00		0.33	1.56		1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	2.8	1.4		10.3	0.4		61.3	0.3	0.1		5.5	0.3
Delay (s)	21.8	34.8		27.4	31.7		131.2	58.4	55.5		69.0	56.2
Level of Service	C	C		C	C		F	E	E		E	E
Approach Delay (s)		33.8			31.0			92.5			63.5	
Approach LOS		C			C			F			E	

Intersection Summary			
HCM 2000 Control Delay	40.3	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.87		
Actuated Cycle Length (s)	180.0	Sum of lost time (s)	20.5
Intersection Capacity Utilization	87.8%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	170	1425	25	55	1345	300	95	5	50	225	5	265
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		-5%			5%			0%			0%	
Total Lost time (s)	7.0	6.5	6.5	7.0	6.5	6.5		7.0		7.0	7.0	7.0
Lane Util. Factor	1.00	0.91	1.00	1.00	0.91	1.00		1.00		0.95	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85		0.95		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00		0.97		0.95	0.95	1.00
Satd. Flow (prot)	1814	5212	1623	1725	4958	1538		1724		1681	1689	1583
Flt Permitted	0.09	1.00	1.00	0.11	1.00	1.00		0.97		0.95	0.95	1.00
Satd. Flow (perm)	169	5212	1623	195	4958	1538		1724		1681	1689	1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	185	1549	27	60	1462	326	103	5	54	245	5	288
RTOR Reduction (vph)	0	0	0	0	0	113	0	0	0	0	0	244
Lane Group Flow (vph)	185	1549	27	60	1462	213	0	162	0	125	125	44
Bus Blockages (#/hr)	0	0	0	0	0	1	0	0	0	0	0	0
Turn Type	pm+pt	NA	Prot	pm+pt	NA	Perm	Split	NA		Split	NA	Perm
Protected Phases	5	2	2	1	6		4 7	4 7		3	3	
Permitted Phases	2			6		6						3
Actuated Green, G (s)	106.8	91.2	91.2	90.1	81.5	81.5		34.7		18.0	18.0	18.0
Effective Green, g (s)	106.8	91.2	91.2	90.1	81.5	81.5		34.7		18.0	18.0	18.0
Actuated g/C Ratio	0.59	0.51	0.51	0.50	0.45	0.45		0.19		0.10	0.10	0.10
Clearance Time (s)	7.0	6.5	6.5	7.0	6.5	6.5				7.0	7.0	7.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0				3.0	3.0	3.0
Lane Grp Cap (vph)	267	2640	822	170	2244	696		332		168	168	158
v/s Ratio Prot	c0.07	c0.30	0.02	0.02	0.29			c0.09		c0.07	0.07	
v/s Ratio Perm	c0.34			0.16		0.14						0.03
v/c Ratio	0.69	0.59	0.03	0.35	0.65	0.31		0.49		0.74	0.74	0.28
Uniform Delay, d1	31.5	31.2	22.3	25.4	38.2	31.3		64.7		78.8	78.8	75.0
Progression Factor	0.59	1.00	0.53	0.84	0.44	0.04		1.00		1.00	1.00	1.00
Incremental Delay, d2	5.9	0.7	0.1	0.9	1.1	0.8		1.1		16.3	16.3	1.0
Delay (s)	24.5	31.9	11.8	22.4	17.9	2.1		65.9		95.0	95.0	76.0
Level of Service	C	C	B	C	B	A		E		F	F	E
Approach Delay (s)		30.8			15.2			65.9			84.8	
Approach LOS		C			B			E			F	

Intersection Summary			
HCM 2000 Control Delay	32.2	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.70		
Actuated Cycle Length (s)	180.0	Sum of lost time (s)	34.5
Intersection Capacity Utilization	68.1%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	125	1475	100	30	1395	160	85	75	40	85	70	220
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		-3%			2%			-4%			6%	
Total Lost time (s)	7.0	6.5	6.5	7.0	6.5		7.0	7.0		7.0	7.0	7.0
Lane Util. Factor	1.00	0.91	1.00	1.00	0.91		1.00	1.00		0.95	0.95	1.00
Frt	1.00	1.00	0.85	1.00	0.98		1.00	0.95		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00		0.95	0.99	1.00
Satd. Flow (prot)	1796	5162	1607	1752	4950		1805	1800		1631	1706	1530
Flt Permitted	0.07	1.00	1.00	0.11	1.00		0.95	1.00		0.95	0.99	1.00
Satd. Flow (perm)	126	5162	1607	195	4950		1805	1800		1631	1706	1530
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	133	1569	106	32	1484	170	90	80	43	90	74	234
RTOR Reduction (vph)	0	0	0	0	7	0	0	0	0	0	0	0
Lane Group Flow (vph)	133	1569	106	32	1647	0	90	123	0	80	84	234
Bus Blockages (#/hr)	0	0	0	0	1	1	0	0	0	0	0	1
Turn Type	pm+pt	NA	Prot	pm+pt	NA		Split	NA		Split	NA	pt+ov
Protected Phases	5	2	2	1	6		4 7	4 7		3	3	3 5
Permitted Phases	2			6								
Actuated Green, G (s)	107.1	94.4	94.4	92.1	86.4		30.6	30.6		21.8	21.8	35.5
Effective Green, g (s)	107.1	94.4	94.4	92.1	86.4		30.6	30.6		21.8	21.8	35.5
Actuated g/C Ratio	0.59	0.52	0.52	0.51	0.48		0.17	0.17		0.12	0.12	0.20
Clearance Time (s)	7.0	6.5	6.5	7.0	6.5					7.0	7.0	
Vehicle Extension (s)	2.0	4.0	4.0	2.0	4.0					3.0	3.0	
Lane Grp Cap (vph)	202	2707	842	149	2376		306	306		197	206	301
v/s Ratio Prot	0.05	c0.30	0.07	0.01	c0.33		0.05	c0.07		0.05	0.05	c0.15
v/s Ratio Perm	0.34			0.10								
v/c Ratio	0.66	0.58	0.13	0.21	0.69		0.29	0.40		0.41	0.41	0.78
Uniform Delay, d1	31.0	29.2	21.8	23.9	36.5		65.3	66.5		73.1	73.1	68.5
Progression Factor	2.39	0.33	0.41	1.00	1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	4.7	0.7	0.2	0.3	1.7		0.5	0.9		1.4	1.3	11.9
Delay (s)	78.9	10.3	9.1	24.2	38.2		65.8	67.4		74.5	74.4	80.4
Level of Service	E	B	A	C	D		E	E		E	E	F
Approach Delay (s)		15.3			37.9			66.7			78.0	
Approach LOS		B			D			E			E	

Intersection Summary			
HCM 2000 Control Delay	33.3	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.69		
Actuated Cycle Length (s)	180.0	Sum of lost time (s)	34.5
Intersection Capacity Utilization	67.6%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	5	2080	65	5	2605	40	75	30	30	125	25	25
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0			4.0			4.0	4.0		4.0	4.0
Lane Util. Factor		0.91			0.91			1.00	1.00		1.00	1.00
Frt		1.00			1.00			1.00	0.85		1.00	0.85
Flt Protected		1.00			1.00			0.97	1.00		0.96	1.00
Satd. Flow (prot)		5062			5073			1798	1583		1788	1583
Flt Permitted		0.91			0.93			0.47	1.00		0.57	1.00
Satd. Flow (perm)		4616			4699			879	1583		1057	1583
Peak-hour factor, PHF	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87
Adj. Flow (vph)	6	2391	75	6	2994	46	86	34	34	144	29	29
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	21	0	0	21
Lane Group Flow (vph)	0	2472	0	0	3046	0	0	120	13	0	173	8
Turn Type	Perm	NA		Perm	NA		Perm	NA	Perm	Perm	NA	Perm
Protected Phases		2			6			8			4	
Permitted Phases	2			6			8		8	4		4
Actuated Green, G (s)		121.3			121.3			29.7	29.7		29.7	29.7
Effective Green, g (s)		124.3			124.3			32.7	32.7		32.7	32.7
Actuated g/C Ratio		0.75			0.75			0.20	0.20		0.20	0.20
Clearance Time (s)		7.0			7.0			7.0	7.0		7.0	7.0
Vehicle Extension (s)		0.2			0.2			4.0	4.0		4.0	4.0
Lane Grp Cap (vph)		3477			3539			174	313		209	313
v/s Ratio Prot												
v/s Ratio Perm		0.54			c0.65			0.14	0.01		c0.16	0.01
v/c Ratio		0.71			0.86			0.69	0.04		0.83	0.03
Uniform Delay, d1		10.8			14.3			61.4	53.5		63.4	53.3
Progression Factor		1.00			1.00			1.00	1.00		1.00	1.00
Incremental Delay, d2		1.3			3.0			11.7	0.1		23.7	0.0
Delay (s)		12.1			17.3			73.1	53.6		87.2	53.4
Level of Service		B			B			E	D		F	D
Approach Delay (s)		12.1			17.3			68.8			82.3	
Approach LOS		B			B			E			F	

Intersection Summary			
HCM 2000 Control Delay	18.7	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.85		
Actuated Cycle Length (s)	165.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	76.2%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	240	2510	50	310	3355	135	80	65	220	30	110	55
Ideal Flow (vphpl)	1920	1920	1920	1920	1920	1920	1920	1920	1920	1920	1920	1920
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	0.91		1.00	0.91		1.00	0.95	1.00	0.97	0.95	
Frt	1.00	1.00		1.00	0.99		1.00	1.00	0.85	1.00	0.95	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1788	5124		1788	5109		1788	3576	1600	3469	3398	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1788	5124		1788	5109		1788	3576	1600	3469	3398	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	253	2642	53	326	3532	142	84	68	232	32	116	58
RTOR Reduction (vph)	0	1	0	0	3	0	0	0	100	0	45	0
Lane Group Flow (vph)	253	2694	0	326	3671	0	84	68	132	32	129	0
Turn Type	Prot	NA		Prot	NA		Prot	NA	pm+ov	Prot	NA	
Protected Phases	5	2		1	6		7	4	1	3	8	
Permitted Phases									4			
Actuated Green, G (s)	12.0	75.1		15.0	78.1		6.0	22.8	37.8	3.6	20.4	
Effective Green, g (s)	15.0	78.6		18.0	81.6		9.0	25.8	43.8	6.6	23.4	
Actuated g/C Ratio	0.10	0.54		0.12	0.56		0.06	0.18	0.30	0.05	0.16	
Clearance Time (s)	7.0	7.5		7.0	7.5		7.0	7.0	7.0	7.0	7.0	
Vehicle Extension (s)	3.0	0.2		3.0	0.2		2.0	4.0	3.0	2.0	4.0	
Lane Grp Cap (vph)	184	2777		221	2875		110	636	527	157	548	
v/s Ratio Prot	c0.14	0.53		c0.18	c0.72		c0.05	0.02	0.03	0.01	c0.04	
v/s Ratio Perm									0.05			
v/c Ratio	1.38	0.97		1.48	1.28		0.76	0.11	0.25	0.20	0.23	
Uniform Delay, d1	65.0	32.1		63.5	31.7		67.0	49.9	38.2	66.7	53.0	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	199.1	11.4		236.6	127.5		24.1	0.1	0.3	0.2	0.3	
Delay (s)	264.1	43.4		300.1	159.2		91.1	50.0	38.5	66.9	53.3	
Level of Service	F	D		F	F		F	D	D	E	D	
Approach Delay (s)		62.4			170.7			52.0			55.4	
Approach LOS		E			F			D			E	

Intersection Summary			
HCM 2000 Control Delay	119.1	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.07		
Actuated Cycle Length (s)	145.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	102.7%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	60	380	200	330	435	15
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)		6.5	6.5	6.5	7.0	
Lane Util. Factor		1.00	1.00	1.00	1.00	
Frt		1.00	1.00	0.85	1.00	
Flt Protected		0.99	1.00	1.00	0.95	
Satd. Flow (prot)		1850	1863	1583	1769	
Flt Permitted		0.92	1.00	1.00	0.95	
Satd. Flow (perm)		1722	1863	1583	1769	
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93
Adj. Flow (vph)	65	409	215	355	468	16
RTOR Reduction (vph)	0	0	0	164	1	0
Lane Group Flow (vph)	0	474	215	191	483	0
Turn Type	Perm	NA	NA	Perm	Prot	
Protected Phases		2	6		4	
Permitted Phases	2			6		
Actuated Green, G (s)		53.7	53.7	53.7	32.8	
Effective Green, g (s)		53.7	53.7	53.7	32.8	
Actuated g/C Ratio		0.54	0.54	0.54	0.33	
Clearance Time (s)		6.5	6.5	6.5	7.0	
Vehicle Extension (s)		3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)		924	1000	850	580	
v/s Ratio Prot			0.12		c0.27	
v/s Ratio Perm		c0.28		0.12		
v/c Ratio		0.51	0.21	0.22	0.83	
Uniform Delay, d1		14.8	12.1	12.2	31.1	
Progression Factor		1.00	1.00	1.00	0.89	
Incremental Delay, d2		2.0	0.1	0.1	9.0	
Delay (s)		16.8	12.2	12.3	36.5	
Level of Service		B	B	B	D	
Approach Delay (s)		16.8	12.3		36.5	
Approach LOS		B	B		D	

Intersection Summary			
HCM 2000 Control Delay	21.4	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.63		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	13.5
Intersection Capacity Utilization	75.5%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	135	465	130	180	750	55	155	100	135	40	90	50
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0			4.0		4.0	4.0	4.0
Lane Util. Factor	1.00	0.95		1.00	0.95			1.00		1.00	1.00	1.00
Frt	1.00	0.97		1.00	0.99			0.95		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00			0.98		0.95	1.00	1.00
Satd. Flow (prot)	1770	3423		1770	3503			1741		1770	1863	1583
Flt Permitted	0.32	1.00		0.95	1.00			0.83		0.45	1.00	1.00
Satd. Flow (perm)	599	3423		1770	3503			1468		843	1863	1583
Peak-hour factor, PHF	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Adj. Flow (vph)	148	511	143	198	824	60	170	110	148	44	99	55
RTOR Reduction (vph)	0	24	0	0	5	0	0	20	0	0	0	37
Lane Group Flow (vph)	148	630	0	198	879	0	0	408	0	44	99	18
Turn Type	Perm	NA		Prot	NA		Perm	NA		Perm	NA	Perm
Protected Phases		2		1	6			4			8	
Permitted Phases	2						4			8		8
Actuated Green, G (s)	39.9	39.9		11.8	57.7			29.3		29.3	29.3	29.3
Effective Green, g (s)	41.9	41.9		13.8	59.7			32.3		32.3	32.3	32.3
Actuated g/C Ratio	0.42	0.42		0.14	0.60			0.32		0.32	0.32	0.32
Clearance Time (s)	6.0	6.0		6.0	6.0			7.0		7.0	7.0	7.0
Vehicle Extension (s)	2.0	2.0		0.2	3.0			2.0		2.0	2.0	2.0
Lane Grp Cap (vph)	250	1434		244	2091			474		272	601	511
v/s Ratio Prot		0.18		c0.11	0.25						0.05	
v/s Ratio Perm	c0.25							c0.28		0.05		0.01
v/c Ratio	0.59	0.44		0.81	0.42			0.86		0.16	0.16	0.03
Uniform Delay, d1	22.4	20.7		41.8	10.8			31.8		24.2	24.2	23.2
Progression Factor	0.49	0.43		1.00	1.00			0.94		1.00	1.00	1.00
Incremental Delay, d2	8.4	0.8		17.3	0.6			13.7		0.1	0.0	0.0
Delay (s)	19.4	9.7		59.2	11.5			43.6		24.3	24.3	23.2
Level of Service	B	A		E	B			D		C	C	C
Approach Delay (s)		11.5			20.2			43.6			24.0	
Approach LOS		B			C			D			C	

Intersection Summary			
HCM 2000 Control Delay	21.7	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.72		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	68.7%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	60	690	350	15	890	50	75	20	25	35	30	35
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	7.0	7.0		7.0	7.0			7.0			7.0	7.0
Lane Util. Factor	1.00	0.95		1.00	0.95			1.00			1.00	1.00
Frt	1.00	0.95		1.00	0.99			0.97			1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00			0.97			0.97	1.00
Satd. Flow (prot)	1770	3360		1770	3511			1756			1814	1583
Flt Permitted	0.20	1.00		0.18	1.00			0.97			0.97	1.00
Satd. Flow (perm)	364	3360		336	3511			1756			1814	1583
Peak-hour factor, PHF	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Adj. Flow (vph)	66	758	385	16	978	55	82	22	27	38	33	38
RTOR Reduction (vph)	0	43	0	0	3	0	0	9	0	0	0	33
Lane Group Flow (vph)	66	1100	0	16	1030	0	0	122	0	0	71	5
Turn Type	pm+pt	NA		pm+pt	NA		Split	NA		Split	NA	pm+ov
Protected Phases	5	2		1	6		4	4		3	3	5
Permitted Phases	2			6								3
Actuated Green, G (s)	57.8	53.8		53.8	51.8			8.0			8.2	12.2
Effective Green, g (s)	57.8	53.8		53.8	51.8			8.0			8.2	12.2
Actuated g/C Ratio	0.58	0.54		0.54	0.52			0.08			0.08	0.12
Clearance Time (s)	7.0	7.0		7.0	7.0			7.0			7.0	7.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0			3.0			3.0	3.0
Lane Grp Cap (vph)	266	1807		209	1818			140			148	193
v/s Ratio Prot	c0.01	c0.33		0.00	0.29			c0.07			c0.04	0.00
v/s Ratio Perm	0.13			0.04								0.00
v/c Ratio	0.25	0.61		0.08	0.57			0.87			0.48	0.02
Uniform Delay, d1	10.7	15.9		11.8	16.4			45.5			43.9	38.7
Progression Factor	0.64	0.63		0.83	0.68			1.00			1.00	1.00
Incremental Delay, d2	0.4	1.2		0.1	1.2			39.8			2.4	0.1
Delay (s)	7.3	11.2		9.9	12.3			85.2			46.3	38.7
Level of Service	A	B		A	B			F			D	D
Approach Delay (s)		11.0			12.3			85.2			43.7	
Approach LOS		B			B			F			D	

Intersection Summary			
HCM 2000 Control Delay	16.9	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.62		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	28.0
Intersection Capacity Utilization	65.3%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	370	575	670	330	525	570
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.5	7.0	7.0		7.0	
Lane Util. Factor	1.00	0.95	0.95		0.97	
Frt	1.00	1.00	0.95		0.92	
Flt Protected	0.95	1.00	1.00		0.98	
Satd. Flow (prot)	1770	3539	3364		3254	
Flt Permitted	0.10	1.00	1.00		0.98	
Satd. Flow (perm)	195	3539	3364		3254	
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93
Adj. Flow (vph)	398	618	720	355	565	613
RTOR Reduction (vph)	0	0	61	0	195	0
Lane Group Flow (vph)	398	618	1014	0	983	0
Turn Type	pm+pt	NA	NA		Prot	
Protected Phases	1	6	2		4	
Permitted Phases	6					
Actuated Green, G (s)	57.0	57.0	31.8		29.0	
Effective Green, g (s)	57.0	57.0	31.8		29.0	
Actuated g/C Ratio	0.57	0.57	0.32		0.29	
Clearance Time (s)	6.5	7.0	7.0		7.0	
Vehicle Extension (s)	2.0	5.0	5.0		2.0	
Lane Grp Cap (vph)	405	2017	1069		943	
v/s Ratio Prot	c0.18	0.17	0.30		c0.30	
v/s Ratio Perm	c0.38					
v/c Ratio	0.98	0.31	0.95		1.04	
Uniform Delay, d1	30.0	11.2	33.3		35.5	
Progression Factor	1.00	1.00	0.44		1.25	
Incremental Delay, d2	39.8	0.4	15.7		40.4	
Delay (s)	69.8	11.6	30.2		84.9	
Level of Service	E	B	C		F	
Approach Delay (s)		34.4	30.2		84.9	
Approach LOS		C	C		F	

Intersection Summary			
HCM 2000 Control Delay	51.2	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	1.04		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	20.5
Intersection Capacity Utilization	99.6%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	25	50	10	285	980	85
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00		0.95	0.95	
Frt	1.00	0.85		1.00	0.99	
Flt Protected	0.95	1.00		1.00	1.00	
Satd. Flow (prot)	1770	1583		3533	3497	
Flt Permitted	0.95	1.00		0.92	1.00	
Satd. Flow (perm)	1770	1583		3254	3497	
Peak-hour factor, PHF	0.99	0.99	0.99	0.99	0.99	0.99
Adj. Flow (vph)	25	51	10	288	990	86
RTOR Reduction (vph)	0	0	0	0	4	0
Lane Group Flow (vph)	25	51	0	298	1072	0
Turn Type	Prot	Perm	Perm	NA	NA	
Protected Phases	4			6	2	
Permitted Phases		4	6	6		
Actuated Green, G (s)	7.7	7.7		81.3	81.3	
Effective Green, g (s)	9.2	9.2		82.8	82.8	
Actuated g/C Ratio	0.09	0.09		0.83	0.83	
Clearance Time (s)	5.5	5.5		5.5	5.5	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	162	145		2694	2895	
v/s Ratio Prot	0.01				c0.31	
v/s Ratio Perm		c0.03		0.09		
v/c Ratio	0.15	0.35		0.11	0.37	
Uniform Delay, d1	41.8	42.6		1.6	2.1	
Progression Factor	1.34	1.31		0.03	1.00	
Incremental Delay, d2	0.4	1.4		0.0	0.4	
Delay (s)	56.3	57.1		0.1	2.5	
Level of Service	E	E		A	A	
Approach Delay (s)	56.9			0.1	2.5	
Approach LOS	E			A	A	

Intersection Summary			
HCM 2000 Control Delay	4.9	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.37		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	43.1%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations												
Volume (vph)	0	700	0	0	0	1205	0	0	0	0	465	360
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		7.0				7.0					6.0	
Lane Util. Factor		0.95				*1.00					0.95	
Frt		1.00				0.85					0.93	
Flt Protected		1.00				1.00					1.00	
Satd. Flow (prot)		3574				3167					3344	
Flt Permitted		1.00				1.00					1.00	
Satd. Flow (perm)		3574				3167					3344	
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	0	722	0	0	0	1242	0	0	0	0	479	371
RTOR Reduction (vph)	0	0	0	0	0	26	0	0	0	0	0	0
Lane Group Flow (vph)	0	722	0	0	0	1216	0	0	0	0	850	0
Heavy Vehicles (%)	0%	1%	0%	0%	0%	2%	0%	0%	0%	0%	0%	2%
Turn Type		NA				custom					NA	
Protected Phases		2 3 4				2 3 4					1	
Permitted Phases												
Actuated Green, G (s)		132.0				132.0					36.0	
Effective Green, g (s)		126.0				126.0					36.0	
Actuated g/C Ratio		0.70				0.70					0.20	
Clearance Time (s)											6.0	
Vehicle Extension (s)											3.0	
Lane Grp Cap (vph)		2501				2216					668	
v/s Ratio Prot		0.20				c0.38					c0.25	
v/s Ratio Perm												
v/c Ratio		0.29				0.55					1.27	
Uniform Delay, d1		10.2				13.2					72.0	
Progression Factor		1.14				1.00					1.00	
Incremental Delay, d2		0.0				0.4					134.1	
Delay (s)		11.6				13.5					206.1	
Level of Service		B				B					F	
Approach Delay (s)		11.6			13.5			0.0			206.1	
Approach LOS		B			B			A			F	

Intersection Summary			
HCM 2000 Control Delay	71.2	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	0.74		
Actuated Cycle Length (s)	180.0	Sum of lost time (s)	25.0
Intersection Capacity Utilization	77.4%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	EBR2	NBT	NBR	NBR2	SEL	SET	SER	SER2
Lane Configurations											
Volume (vph)	40	370	740	185	1420	255	40	75	265	1200	660
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		6.0			6.0			6.0	6.0	6.0	
Lane Util. Factor		0.95			0.91			1.00	1.00	0.88	
Frt		0.90			0.97			1.00	1.00	0.85	
Flt Protected		1.00			1.00			0.95	1.00	1.00	
Satd. Flow (prot)		3229			4964			1752	1881	2796	
Flt Permitted		1.00			1.00			0.95	1.00	1.00	
Satd. Flow (perm)		3229			4964			1752	1881	2796	
Peak-hour factor, PHF	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72
Adj. Flow (vph)	56	514	1028	257	1972	354	56	104	368	1667	917
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	1855	0	0	2382	0	0	104	368	2584	0
Heavy Vehicles (%)	1%	0%	0%	0%	2%	1%	0%	3%	1%	2%	1%
Turn Type	Split	NA			NA			Split	NA	custom	
Protected Phases	1 2	1 2			3			4	4	3 4	
Permitted Phases											
Actuated Green, G (s)		60.0			68.0			33.0	33.0	107.0	
Effective Green, g (s)		60.0			68.0			33.0	33.0	107.0	
Actuated g/C Ratio		0.33			0.38			0.18	0.18	0.59	
Clearance Time (s)					6.0			6.0	6.0		
Vehicle Extension (s)					4.0			4.0	4.0		
Lane Grp Cap (vph)		1076			1875			321	344	1662	
v/s Ratio Prot		c0.57			0.48			0.06	0.20	c0.92	
v/s Ratio Perm											
v/c Ratio		2.31dr			1.27			0.32	1.07	1.55	
Uniform Delay, d1		60.0			56.0			63.8	73.5	36.5	
Progression Factor		1.00			1.00			0.80	0.77	1.53	
Incremental Delay, d2		329.7			126.0			0.6	62.9	252.0	
Delay (s)		389.7			182.0			51.4	119.4	307.7	
Level of Service		F			F			D	F	F	
Approach Delay (s)		389.7			182.0				276.3		
Approach LOS		F			F				F		

Intersection Summary			
HCM 2000 Control Delay	274.4	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.74		
Actuated Cycle Length (s)	180.0	Sum of lost time (s)	25.0
Intersection Capacity Utilization	116.3%	ICU Level of Service	H
Analysis Period (min)	15		

dr Defacto Right Lane. Recode with 1 though lane as a right lane.
c Critical Lane Group

Movement	WBL	WBT	WBR	NWL2	NWL	NWT
Lane Configurations						
Volume (vph)	375	785	510	385	425	650
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0	6.0		6.0	6.0
Lane Util. Factor	*1.00	*1.00	0.91		1.00	0.95
Frt	1.00	0.98	0.85		1.00	1.00
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1770	3658	1455		1768	3539
Flt Permitted	0.95	1.00	1.00		0.95	1.00
Satd. Flow (perm)	1770	3658	1455		1768	3539
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	387	809	526	397	438	670
RTOR Reduction (vph)	0	6	47	0	60	0
Lane Group Flow (vph)	348	952	369	0	775	670
Heavy Vehicles (%)	2%	2%	1%	0%	4%	2%
Turn Type	Split	NA	Prot	Split	Split	NA
Protected Phases	1 2 4	1 2 4	1 2 4	3	3	3
Permitted Phases						
Actuated Green, G (s)	99.0	99.0	99.0		68.0	68.0
Effective Green, g (s)	99.0	99.0	99.0		68.0	68.0
Actuated g/C Ratio	0.55	0.55	0.55		0.38	0.38
Clearance Time (s)					6.0	6.0
Vehicle Extension (s)					4.0	4.0
Lane Grp Cap (vph)	973	2011	800		667	1336
v/s Ratio Prot	0.20	c0.26	0.25		c0.44	0.19
v/s Ratio Perm						
v/c Ratio	0.36	0.47	0.46		1.16	0.50
Uniform Delay, d1	22.7	24.6	24.4		56.0	43.0
Progression Factor	1.10	1.08	1.12		0.24	0.24
Incremental Delay, d2	0.1	0.1	0.3		74.3	0.0
Delay (s)	25.2	26.7	27.6		87.8	10.4
Level of Service	C	C	C		F	B
Approach Delay (s)		26.6				53.4
Approach LOS		C				D

Intersection Summary			
HCM 2000 Control Delay	39.1	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.81		
Actuated Cycle Length (s)	180.0	Sum of lost time (s)	25.0
Intersection Capacity Utilization	80.2%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Movement	SEL	SET	NWT	NWR	SWL	SWR
Lane Configurations						
Volume (veh/h)	0	1440	0	0	760	0
Sign Control		Free	Free		Yield	
Grade		0%	0%		0%	
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97
Hourly flow rate (vph)	0	1485	0	0	784	0
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)		118	263			
pX, platoon unblocked					0.82	
vC, conflicting volume	0				371	0
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	0				0	0
tC, single (s)	4.1				6.8	6.9
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				7	100
cM capacity (veh/h)	1636				839	1091

Direction, Lane #	SE 1	SE 2	SE 3	SE 4	SW 1	SW 2
Volume Total	371	371	371	371	392	392
Volume Left	0	0	0	0	392	392
Volume Right	0	0	0	0	0	0
cSH	1700	1700	1700	1700	839	839
Volume to Capacity	0.22	0.22	0.22	0.22	0.47	0.47
Queue Length 95th (ft)	0	0	0	0	63	63
Control Delay (s)	0.0	0.0	0.0	0.0	13.0	13.0
Lane LOS					B	B
Approach Delay (s)	0.0				13.0	
Approach LOS					B	

Intersection Summary			
Average Delay	4.5		
Intersection Capacity Utilization	49.2%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations												
Volume (vph)	0	0	0	0	1210	0	0	1440	10	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)					6.0			6.0				
Lane Util. Factor					0.95			0.86				
Frt					1.00			1.00				
Flt Protected					1.00			1.00				
Satd. Flow (prot)					3505			6396				
Flt Permitted					1.00			1.00				
Satd. Flow (perm)					3505			6396				
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	0	0	0	0	1247	0	0	1485	10	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	0	0	1	0	0	0	0
Lane Group Flow (vph)	0	0	0	0	1247	0	0	1494	0	0	0	0
Heavy Vehicles (%)	0%	0%	0%	0%	3%	0%	0%	2%	14%	0%	0%	0%
Turn Type					NA			NA				
Protected Phases					1 2 3			4				
Permitted Phases												
Actuated Green, G (s)					135.0			33.0				
Effective Green, g (s)					128.0			33.0				
Actuated g/C Ratio					0.71			0.18				
Clearance Time (s)								6.0				
Vehicle Extension (s)								4.0				
Lane Grp Cap (vph)					2492			1172				
v/s Ratio Prot					c0.36			c0.23				
v/s Ratio Perm												
v/c Ratio					0.50			1.27				
Uniform Delay, d1					11.7			73.5				
Progression Factor					1.72			0.67				
Incremental Delay, d2					0.1			129.3				
Delay (s)					20.2			178.6				
Level of Service					C			F				
Approach Delay (s)		0.0			20.2			178.6			0.0	
Approach LOS		A			C			F			A	

Intersection Summary			
HCM 2000 Control Delay	106.6	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	0.68		
Actuated Cycle Length (s)	180.0	Sum of lost time (s)	25.0
Intersection Capacity Utilization	64.5%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations												
Volume (vph)	0	0	845	0	400	0	0	605	0	0	0	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)			4.0		6.0			6.0				
Lane Util. Factor			*1.00		0.95			0.95				
Frt			0.85		1.00			1.00				
Flt Protected			1.00		1.00			1.00				
Satd. Flow (prot)			3198		3574			3505				
Flt Permitted			1.00		1.00			1.00				
Satd. Flow (perm)			3198		3574			3505				
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	0	0	889	0	421	0	0	637	0	0	0	0
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	0	889	0	421	0	0	637	0	0	0	0
Heavy Vehicles (%)	0%	0%	1%	0%	1%	0%	0%	3%	0%	0%	0%	0%
Turn Type			Free		NA			NA				
Protected Phases					1 2 3			4				
Permitted Phases			Free									
Actuated Green, G (s)			180.0		135.0			33.0				
Effective Green, g (s)			180.0		128.0			33.0				
Actuated g/C Ratio			1.00		0.71			0.18				
Clearance Time (s)								6.0				
Vehicle Extension (s)								4.0				
Lane Grp Cap (vph)			3198		2541			642				
v/s Ratio Prot					0.12			c0.18				
v/s Ratio Perm			c0.28									
v/c Ratio			0.28		0.17			0.99				
Uniform Delay, d1			0.0		8.5			73.4				
Progression Factor			1.00		1.19			1.00				
Incremental Delay, d2			0.2		0.0			33.4				
Delay (s)			0.2		10.1			106.8				
Level of Service			A		B			F				
Approach Delay (s)		0.2			10.1			106.8			0.0	
Approach LOS		A			B			F			A	

Intersection Summary			
HCM 2000 Control Delay	37.2	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.46		
Actuated Cycle Length (s)	180.0	Sum of lost time (s)	25.0
Intersection Capacity Utilization	46.1%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (vph)	600	100	155	265	35	25
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0			4.0	4.0	4.0
Lane Util. Factor	0.95			0.95	1.00	1.00
Frt	0.98			1.00	1.00	0.85
Flt Protected	1.00			0.98	0.95	1.00
Satd. Flow (prot)	3464			3475	1770	1583
Flt Permitted	1.00			0.61	0.95	1.00
Satd. Flow (perm)	3464			2155	1770	1583
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	632	105	163	279	37	26
RTOR Reduction (vph)	9	0	0	0	0	23
Lane Group Flow (vph)	728	0	0	442	37	3
Turn Type	NA		Perm	NA	pm+pt	Perm
Protected Phases	2			6	3	
Permitted Phases			6		8	3
Actuated Green, G (s)	71.0			73.0	9.0	9.0
Effective Green, g (s)	71.0			73.0	9.0	9.0
Actuated g/C Ratio	0.79			0.81	0.10	0.10
Clearance Time (s)	6.0			4.0	4.0	4.0
Vehicle Extension (s)	2.0			3.0	3.0	3.0
Lane Grp Cap (vph)	2732			1747	177	158
v/s Ratio Prot	c0.21				c0.02	
v/s Ratio Perm				0.21		0.00
v/c Ratio	0.27			0.25	0.21	0.02
Uniform Delay, d1	2.5			2.0	37.2	36.5
Progression Factor	1.00			1.77	1.00	1.00
Incremental Delay, d2	0.2			0.3	0.6	0.0
Delay (s)	2.8			3.9	37.8	36.6
Level of Service	A			A	D	D
Approach Delay (s)	2.8			3.9	37.3	
Approach LOS	A			A	D	

Intersection Summary			
HCM 2000 Control Delay	4.9	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.27		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	46.6%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	225	400	80	50	240	340
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	1.00	1.00	0.95	0.95	
Frt	1.00	0.85	1.00	1.00	0.91	
Flt Protected	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	1770	1583	1770	3539	3228	
Flt Permitted	0.95	1.00	0.41	1.00	1.00	
Satd. Flow (perm)	1770	1583	763	3539	3228	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	237	421	84	53	253	358
RTOR Reduction (vph)	0	336	0	0	104	0
Lane Group Flow (vph)	237	85	84	53	507	0
Turn Type	Prot	Perm	Perm	NA	NA	
Protected Phases	4			2	6	
Permitted Phases		4	2			
Actuated Green, G (s)	18.1	18.1	63.9	63.9	63.9	
Effective Green, g (s)	18.1	18.1	63.9	63.9	63.9	
Actuated g/C Ratio	0.20	0.20	0.71	0.71	0.71	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	355	318	541	2512	2291	
v/s Ratio Prot	c0.13			0.01	c0.16	
v/s Ratio Perm		0.05	0.11			
v/c Ratio	0.67	0.27	0.16	0.02	0.22	
Uniform Delay, d1	33.2	30.3	4.3	3.8	4.5	
Progression Factor	0.91	0.63	0.74	0.80	0.26	
Incremental Delay, d2	4.6	0.4	0.6	0.0	0.2	
Delay (s)	34.8	19.4	3.7	3.1	1.4	
Level of Service	C	B	A	A	A	
Approach Delay (s)	25.0			3.5	1.4	
Approach LOS	C			A	A	

Intersection Summary			
HCM 2000 Control Delay	12.6	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.32		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	49.0%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	25	585	90	460	865	15	15	35	225	15	30	20
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	0.95		0.97	0.95		1.00	0.95		1.00	1.00	
Frt	1.00	0.98		1.00	1.00		1.00	0.87		1.00	0.94	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	3468		3433	3530		1770	3080		1770	1752	
Flt Permitted	0.24	1.00		0.33	1.00		0.72	1.00		0.57	1.00	
Satd. Flow (perm)	440	3468		1184	3530		1346	3080		1056	1752	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	26	616	95	484	911	16	16	37	237	16	32	21
RTOR Reduction (vph)	0	21	0	0	2	0	0	149	0	0	13	0
Lane Group Flow (vph)	26	690	0	484	925	0	16	125	0	16	40	0
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	48.7	48.7		48.7	48.7		33.3	33.3		33.3	33.3	
Effective Green, g (s)	48.7	48.7		48.7	48.7		33.3	33.3		33.3	33.3	
Actuated g/C Ratio	0.54	0.54		0.54	0.54		0.37	0.37		0.37	0.37	
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	238	1876		640	1910		498	1139		390	648	
v/s Ratio Prot		0.20			0.26			c0.04			0.02	
v/s Ratio Perm	0.06			c0.41			0.01			0.02		
v/c Ratio	0.11	0.37		0.76	0.48		0.03	0.11		0.04	0.06	
Uniform Delay, d1	10.1	11.8		16.0	12.8		18.1	18.6		18.1	18.3	
Progression Factor	1.00	1.00		1.00	1.00		0.34	0.03		1.00	1.00	
Incremental Delay, d2	0.2	0.1		5.1	0.2		0.1	0.2		0.2	0.2	
Delay (s)	10.3	12.0		21.1	13.0		6.2	0.7		18.3	18.5	
Level of Service	B	B		C	B		A	A		B	B	
Approach Delay (s)		11.9			15.8			1.0			18.4	
Approach LOS		B			B			A			B	

Intersection Summary			
HCM 2000 Control Delay	13.0	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.49		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	54.6%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	5	10	70	5	15	60
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	5	11	74	5	16	63
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)			346			
pX, platoon unblocked						
vC, conflicting volume	171	76			79	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	171	76			79	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	99	99			99	
cM capacity (veh/h)	811	985			1519	

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	16	79	79
Volume Left	5	0	16
Volume Right	11	5	0
cSH	919	1700	1519
Volume to Capacity	0.02	0.05	0.01
Queue Length 95th (ft)	1	0	1
Control Delay (s)	9.0	0.0	1.5
Lane LOS	A		A
Approach Delay (s)	9.0	0.0	1.5
Approach LOS	A		

Intersection Summary			
Average Delay	1.5		
Intersection Capacity Utilization	20.7%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	65	15	20	935	705	55
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	1.00	1.00	0.95	0.95	
Frt	1.00	0.85	1.00	1.00	0.99	
Flt Protected	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	1770	1583	1770	3539	3501	
Flt Permitted	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (perm)	1770	1583	1770	3539	3501	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	68	16	21	984	742	58
RTOR Reduction (vph)	0	0	0	0	9	0
Lane Group Flow (vph)	68	16	21	984	791	0
Turn Type	Prot	Perm	Prot	NA	NA	
Protected Phases	2		1	8	4	
Permitted Phases		4		8		
Actuated Green, G (s)	54.7	45.5	3.3	45.5	45.5	
Effective Green, g (s)	56.2	47.0	4.8	47.0	47.0	
Actuated g/C Ratio	0.47	0.39	0.04	0.39	0.39	
Clearance Time (s)	5.5	5.5	5.5	5.5	5.5	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	828	620	70	1386	1371	
v/s Ratio Prot	c0.04		c0.01	c0.28	0.23	
v/s Ratio Perm		0.01				
v/c Ratio	0.08	0.03	0.30	0.71	0.58	
Uniform Delay, d1	17.6	22.4	56.0	30.8	28.7	
Progression Factor	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	0.2	0.0	2.4	1.7	0.6	
Delay (s)	17.8	22.4	58.4	32.5	29.3	
Level of Service	B	C	E	C	C	
Approach Delay (s)	18.7			33.0	29.3	
Approach LOS	B			C	C	

Intersection Summary			
HCM 2000 Control Delay	30.8	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.36		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	37.5%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	0	0	450	130	355	285
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)			4.0	4.0	4.0	4.0
Lane Util. Factor			1.00	0.95	0.95	1.00
Frt			1.00	1.00	1.00	0.85
Flt Protected			0.95	1.00	1.00	1.00
Satd. Flow (prot)			1770	3539	3539	1583
Flt Permitted			0.95	1.00	1.00	1.00
Satd. Flow (perm)			1770	3539	3539	1583
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	0	0	474	137	374	300
RTOR Reduction (vph)	0	0	0	0	0	133
Lane Group Flow (vph)	0	0	474	137	374	167
Turn Type			Prot	NA	NA	Perm
Protected Phases			5	2	6	
Permitted Phases						6
Actuated Green, G (s)			31.9	90.0	50.1	50.1
Effective Green, g (s)			31.9	90.0	50.1	50.1
Actuated g/C Ratio			0.35	1.00	0.56	0.56
Clearance Time (s)			4.0	4.0	4.0	4.0
Vehicle Extension (s)			3.0	3.0	3.0	3.0
Lane Grp Cap (vph)			627	3539	1970	881
v/s Ratio Prot			c0.27	0.04	c0.11	
v/s Ratio Perm						0.11
v/c Ratio			0.76	0.04	0.19	0.19
Uniform Delay, d1			25.6	0.0	9.9	9.9
Progression Factor			0.87	1.00	0.86	0.99
Incremental Delay, d2			5.1	0.0	0.2	0.5
Delay (s)			27.4	0.0	8.7	10.3
Level of Service			C	A	A	B
Approach Delay (s)	0.0			21.3	9.4	
Approach LOS	A			C	A	

Intersection Summary			
HCM 2000 Control Delay	15.1	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.41		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	49.2%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	50	715	0	530	355	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	
Lane Util. Factor	0.97	0.91		0.95	0.95	
Frt	0.87	0.85		1.00	1.00	
Flt Protected	0.99	1.00		1.00	1.00	
Satd. Flow (prot)	3119	1441		3539	3539	
Flt Permitted	0.99	1.00		1.00	1.00	
Satd. Flow (perm)	3119	1441		3539	3539	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	53	753	0	558	374	0
RTOR Reduction (vph)	267	267	0	0	0	0
Lane Group Flow (vph)	163	109	0	558	374	0
Turn Type	Prot	Prot		NA	NA	
Protected Phases	4	4		2	6	
Permitted Phases						
Actuated Green, G (s)	13.2	13.2		68.8	68.8	
Effective Green, g (s)	13.2	13.2		68.8	68.8	
Actuated g/C Ratio	0.15	0.15		0.76	0.76	
Clearance Time (s)	4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	457	211		2705	2705	
v/s Ratio Prot	0.05	c0.08		c0.16	0.11	
v/s Ratio Perm						
v/c Ratio	0.36	0.52		0.21	0.14	
Uniform Delay, d1	34.6	35.5		3.0	2.8	
Progression Factor	1.00	1.00		1.00	0.75	
Incremental Delay, d2	0.5	2.1		0.2	0.1	
Delay (s)	35.1	37.6		3.1	2.2	
Level of Service	D	D		A	A	
Approach Delay (s)	36.2			3.1	2.2	
Approach LOS	D			A	A	

Intersection Summary			
HCM 2000 Control Delay	18.3	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.26		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	49.2%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	10	10	10	920	715	5
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0	4.0	4.0	
Lane Util. Factor	1.00		1.00	0.95	0.95	
Frt	0.93		1.00	1.00	1.00	
Flt Protected	0.98		0.95	1.00	1.00	
Satd. Flow (prot)	1695		1770	3539	3536	
Flt Permitted	0.98		0.36	1.00	1.00	
Satd. Flow (perm)	1695		678	3539	3536	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	11	11	11	968	753	5
RTOR Reduction (vph)	11	0	0	0	0	0
Lane Group Flow (vph)	11	0	11	968	758	0
Turn Type	Prot		Perm	NA	NA	
Protected Phases	2			8	4	
Permitted Phases			8			
Actuated Green, G (s)	1.0		29.1	29.1	29.1	
Effective Green, g (s)	1.0		29.1	29.1	29.1	
Actuated g/C Ratio	0.03		0.76	0.76	0.76	
Clearance Time (s)	4.0		4.0	4.0	4.0	
Vehicle Extension (s)	3.0		3.0	3.0	3.0	
Lane Grp Cap (vph)	44		517	2703	2700	
v/s Ratio Prot	c0.01			c0.27	0.21	
v/s Ratio Perm			0.02			
v/c Ratio	0.26		0.02	0.36	0.28	
Uniform Delay, d1	18.2		1.1	1.5	1.4	
Progression Factor	1.00		1.00	1.00	1.00	
Incremental Delay, d2	3.1		0.0	0.1	0.1	
Delay (s)	21.3		1.1	1.5	1.4	
Level of Service	C		A	A	A	
Approach Delay (s)	21.3			1.5	1.4	
Approach LOS	C			A	A	

Intersection Summary			
HCM 2000 Control Delay	1.7	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.35		
Actuated Cycle Length (s)	38.1	Sum of lost time (s)	8.0
Intersection Capacity Utilization	35.4%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	350	595	125	215	260	20	45	345	310	10	360	225
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
Lane Util. Factor	1.00	0.95		1.00	1.00		1.00	0.95		1.00	1.00	1.00
Frt	1.00	0.97		1.00	0.99		1.00	0.93		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1770	3447		1770	1843		1770	3288		1770	1863	1583
Flt Permitted	0.37	1.00		0.95	1.00		0.95	1.00		0.35	1.00	1.00
Satd. Flow (perm)	687	3447		1770	1843		1770	3288		653	1863	1583
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	368	626	132	226	274	21	47	363	326	11	379	237
RTOR Reduction (vph)	0	19	0	0	3	0	0	193	0	0	0	170
Lane Group Flow (vph)	368	739	0	226	292	0	47	496	0	11	379	67
Turn Type	pm+pt	NA		Prot	NA		Prot	NA		Perm	NA	Perm
Protected Phases	7	4		3	8		5	2			6	
Permitted Phases	4									6		6
Actuated Green, G (s)	37.1	21.5		14.5	20.4		2.0	27.1		21.1	21.1	21.1
Effective Green, g (s)	37.1	21.5		14.5	20.4		2.0	27.1		21.1	21.1	21.1
Actuated g/C Ratio	0.49	0.29		0.19	0.27		0.03	0.36		0.28	0.28	0.28
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	564	986		341	500		47	1186		183	523	444
v/s Ratio Prot	c0.14	c0.21		0.13	0.16		c0.03	0.15			c0.20	
v/s Ratio Perm	0.19									0.02		0.04
v/c Ratio	0.65	0.75		0.66	0.58		1.00	0.42		0.06	0.72	0.15
Uniform Delay, d1	12.8	24.4		28.0	23.7		36.5	18.1		19.7	24.4	20.3
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	2.7	3.2		4.8	1.7		131.3	0.2		0.1	4.9	0.2
Delay (s)	15.5	27.5		32.8	25.4		167.8	18.3		19.9	29.3	20.4
Level of Service	B	C		C	C		F	B		B	C	C
Approach Delay (s)		23.6			28.6			27.9			25.8	
Approach LOS		C			C			C			C	

Intersection Summary			
HCM 2000 Control Delay	26.0	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.74		
Actuated Cycle Length (s)	75.1	Sum of lost time (s)	16.0
Intersection Capacity Utilization	70.4%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	25	20	40	675	585	115
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	26	21	42	711	616	121
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)					987	
pX, platoon unblocked	0.82	0.82	0.82			
vC, conflicting volume	1471	676	737			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1465	494	568			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	76	96	95			
cM capacity (veh/h)	110	471	822			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	47	753	737
Volume Left	26	42	0
Volume Right	21	0	121
cSH	167	822	1700
Volume to Capacity	0.28	0.05	0.43
Queue Length 95th (ft)	28	4	0
Control Delay (s)	35.0	1.3	0.0
Lane LOS	D	A	
Approach Delay (s)	35.0	1.3	0.0
Approach LOS	D		

Intersection Summary			
Average Delay	1.7		
Intersection Capacity Utilization	78.2%	ICU Level of Service	D
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	215	525	85	130	1125	160	35	670	10	80	380	180
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	0.95		1.00	0.95	
Frt	1.00	0.98		1.00	0.98		1.00	1.00		1.00	0.95	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1805	3535		1770	3444		1805	3601		1805	3414	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1805	3535		1770	3444		1805	3601		1805	3414	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	226	553	89	137	1184	168	37	705	11	84	400	189
RTOR Reduction (vph)	0	11	0	0	9	0	0	1	0	0	42	0
Lane Group Flow (vph)	226	631	0	137	1343	0	37	715	0	84	547	0
Heavy Vehicles (%)	0%	0%	0%	2%	3%	2%	0%	0%	2%	0%	0%	2%
Turn Type	Prot	NA		Prot	NA		Prot	NA		Prot	NA	
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases												
Actuated Green, G (s)	16.7	49.6		17.0	49.9		5.5	27.7		9.7	31.9	
Effective Green, g (s)	16.7	49.6		17.0	49.9		5.5	27.7		9.7	31.9	
Actuated g/C Ratio	0.14	0.41		0.14	0.42		0.05	0.23		0.08	0.27	
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	4.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	251	1461		250	1432		82	831		145	907	
v/s Ratio Prot	c0.13	0.18		0.08	c0.39		0.02	c0.20		0.05	c0.16	
v/s Ratio Perm												
v/c Ratio	0.90	0.43		0.55	0.94		0.45	0.86		0.58	0.60	
Uniform Delay, d1	50.8	25.1		47.9	33.6		55.8	44.3		53.2	38.5	
Progression Factor	1.00	1.00		0.52	0.30		1.00	1.00		1.00	1.00	
Incremental Delay, d2	31.8	0.9		1.7	9.7		3.9	9.1		5.5	1.1	
Delay (s)	82.7	26.1		26.7	19.7		59.7	53.4		58.7	39.7	
Level of Service	F	C		C	B		E	D		E	D	
Approach Delay (s)		40.8			20.4			53.7			42.0	
Approach LOS		D			C			D			D	

Intersection Summary			
HCM 2000 Control Delay	35.5	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.89		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	84.7%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	75	950	20	40	620	20	10	5	35	10	5	10
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	79	1000	21	42	653	21	11	5	37	11	5	11
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)		554			508							
pX, platoon unblocked				0.82			0.82	0.82	0.82	0.82	0.82	
vC, conflicting volume	674			1021			1592	1926	511	1445	1926	337
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	674			576			1275	1685	0	1095	1685	337
tC, single (s)	4.1			4.1			7.5	6.5	6.9	7.5	6.5	6.9
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	91			95			87	92	96	91	92	98
cM capacity (veh/h)	913			811			84	66	885	111	66	659

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3	NB 1	NB 2	SB 1	SB 2
Volume Total	79	667	354	42	435	239	11	42	11	16
Volume Left	79	0	0	42	0	0	11	0	11	0
Volume Right	0	0	21	0	0	21	0	37	0	11
cSH	913	1700	1700	811	1700	1700	84	346	111	165
Volume to Capacity	0.09	0.39	0.21	0.05	0.26	0.14	0.13	0.12	0.09	0.10
Queue Length 95th (ft)	7	0	0	4	0	0	10	10	8	8
Control Delay (s)	9.3	0.0	0.0	9.7	0.0	0.0	54.0	16.8	40.8	29.2
Lane LOS	A			A			F	C	E	D
Approach Delay (s)	0.7			0.6			24.3		33.8	
Approach LOS							C		D	

Intersection Summary			
Average Delay	1.7		
Intersection Capacity Utilization	47.5%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	195	400	20	305	1135	310	25	245	645	135	170	255
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		-2%			-2%			-3%			0%	
Total Lost time (s)	4.0	6.5		7.0	6.5	6.5		4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00		0.95	0.95	1.00	0.95	
Frt	1.00	0.99		1.00	1.00	0.85		0.94	0.85	1.00	0.91	
Flt Protected	0.95	1.00		0.95	1.00	1.00		1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1787	3549		1787	3575	1599		1675	1527	1770	3221	
Flt Permitted	0.11	1.00		0.38	1.00	1.00		0.96	1.00	0.18	1.00	
Satd. Flow (perm)	201	3549		706	3575	1599		1615	1527	329	3221	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	205	421	21	321	1195	326	26	258	679	142	179	268
RTOR Reduction (vph)	0	3	0	0	0	160	0	25	271	0	161	0
Lane Group Flow (vph)	205	439	0	321	1195	166	0	476	191	142	286	0
Turn Type	pm+pt	NA		pm+pt	NA	Perm	Perm	NA	Perm	Perm	NA	
Protected Phases	5	2		1	6			8			4	
Permitted Phases	2			6		6	8		8	4		
Actuated Green, G (s)	53.6	42.4		65.4	50.2	50.2		44.1	44.1	44.1	44.1	
Effective Green, g (s)	53.6	42.4		65.4	50.2	50.2		44.1	44.1	44.1	44.1	
Actuated g/C Ratio	0.45	0.35		0.55	0.42	0.42		0.37	0.37	0.37	0.37	
Clearance Time (s)	4.0	6.5		7.0	6.5	6.5		4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	4.0		3.0	4.0	4.0		3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	237	1253		528	1495	668		593	561	120	1183	
v/s Ratio Prot	c0.08	0.12		0.08	c0.33						0.09	
v/s Ratio Perm	c0.30			0.25		0.10		0.29	0.12	c0.43		
v/c Ratio	0.86	0.35		0.61	0.80	0.25		0.80	0.34	1.18	0.24	
Uniform Delay, d1	25.4	28.6		16.1	30.5	22.7		34.1	27.4	37.9	26.3	
Progression Factor	1.94	0.32		0.56	0.26	0.27		1.00	1.00	0.97	0.93	
Incremental Delay, d2	24.3	0.7		1.8	4.2	0.8		7.7	0.4	139.4	0.1	
Delay (s)	73.6	10.0		10.8	12.0	6.9		41.8	27.8	176.2	24.7	
Level of Service	E	A		B	B	A		D	C	F	C	
Approach Delay (s)		30.1			10.9			35.1			61.2	
Approach LOS		C			B			D			E	

Intersection Summary			
HCM 2000 Control Delay	27.1	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	1.00		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	17.5
Intersection Capacity Utilization	97.9%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	0	0	315	435	105	560
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)			4.0	4.0	4.0	4.0
Lane Util. Factor			0.95	1.00	1.00	0.95
Frt			1.00	0.85	1.00	1.00
Flt Protected			1.00	1.00	0.95	1.00
Satd. Flow (prot)			3539	1583	1770	3539
Flt Permitted			1.00	1.00	0.55	1.00
Satd. Flow (perm)			3539	1583	1027	3539
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	0	0	332	458	111	589
RTOR Reduction (vph)	0	0	0	0	0	0
Lane Group Flow (vph)	0	0	332	458	111	589
Turn Type			NA	Perm	Perm	NA
Protected Phases			2			6
Permitted Phases				2	6	
Actuated Green, G (s)			60.0	60.0	60.0	60.0
Effective Green, g (s)			60.0	60.0	60.0	60.0
Actuated g/C Ratio			1.00	1.00	1.00	1.00
Clearance Time (s)			4.0	4.0	4.0	4.0
Lane Grp Cap (vph)			3539	1583	1027	3539
v/s Ratio Prot			0.09			0.17
v/s Ratio Perm				c0.29	0.11	
v/c Ratio			0.09	0.29	0.11	0.17
Uniform Delay, d1			0.0	0.0	0.0	0.0
Progression Factor			1.00	1.00	1.00	1.00
Incremental Delay, d2			0.0	0.4	0.2	0.1
Delay (s)			0.0	0.4	0.2	0.1
Level of Service			A	A	A	A
Approach Delay (s)	0.0		0.2			0.1
Approach LOS	A		A			A

Intersection Summary			
HCM 2000 Control Delay	0.2	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.31		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	4.0
Intersection Capacity Utilization	57.7%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Movement	NBT	NBR	SBL	SBT	NWL	NWR
Lane Configurations						
Volume (vph)	315	0	0	240	425	195
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0			4.0	4.0	4.0
Lane Util. Factor	0.95			0.95	0.97	0.91
Frt	1.00			1.00	0.99	0.85
Flt Protected	1.00			1.00	0.95	1.00
Satd. Flow (prot)	3539			3539	3426	1441
Flt Permitted	1.00			1.00	0.95	1.00
Satd. Flow (perm)	3539			3539	3426	1441
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	332	0	0	253	447	205
RTOR Reduction (vph)	0	0	0	0	8	141
Lane Group Flow (vph)	332	0	0	253	460	43
Turn Type	NA			NA	Prot	Perm
Protected Phases	4!			6	8!	
Permitted Phases						8
Actuated Green, G (s)	14.0			38.0	14.0	14.0
Effective Green, g (s)	14.0			38.0	14.0	14.0
Actuated g/C Ratio	0.23			0.63	0.23	0.23
Clearance Time (s)	4.0			4.0	4.0	4.0
Vehicle Extension (s)	3.0			3.0	3.0	3.0
Lane Grp Cap (vph)	825			2241	799	336
v/s Ratio Prot	0.09			c0.07	c0.13	
v/s Ratio Perm						0.03
v/c Ratio	0.40			0.11	0.58	0.13
Uniform Delay, d1	19.5			4.3	20.4	18.2
Progression Factor	0.84			1.00	1.00	1.00
Incremental Delay, d2	0.3			0.1	1.0	0.2
Delay (s)	16.7			4.4	21.4	18.3
Level of Service	B			A	C	B
Approach Delay (s)	16.7			4.4	20.5	
Approach LOS	B			A	C	

Intersection Summary			
HCM 2000 Control Delay	16.2	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.24		
Actuated Cycle Length (s)	60.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	57.7%	ICU Level of Service	B
Analysis Period (min)	15		

! Phase conflict between lane groups.
c Critical Lane Group

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	40	1140	1715	65	25	35
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Grade (%)		-5%	-2%		0%	
Total Lost time (s)	4.0	4.0	4.0		4.0	4.0
Lane Util. Factor	1.00	0.91	0.91		1.00	1.00
Frt	1.00	1.00	0.99		1.00	0.85
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1814	5212	5108		1770	1583
Flt Permitted	0.09	1.00	1.00		0.95	1.00
Satd. Flow (perm)	179	5212	5108		1770	1583
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	42	1200	1805	68	26	37
RTOR Reduction (vph)	0	0	2	0	0	25
Lane Group Flow (vph)	42	1200	1871	0	26	12
Turn Type	pm+pt	NA	NA		Prot	pt+ov
Protected Phases	5	2	6		4	4 5
Permitted Phases	2					
Actuated Green, G (s)	105.8	105.8	97.1		6.2	14.9
Effective Green, g (s)	105.8	105.8	97.1		6.2	14.9
Actuated g/C Ratio	0.88	0.88	0.81		0.05	0.12
Clearance Time (s)	4.0	4.0	4.0		4.0	
Vehicle Extension (s)	3.0	3.0	3.0		3.0	
Lane Grp Cap (vph)	221	4595	4133		91	196
v/s Ratio Prot	0.01	c0.23	c0.37		c0.01	0.01
v/s Ratio Perm	0.16					
v/c Ratio	0.19	0.26	0.45		0.29	0.06
Uniform Delay, d1	1.9	1.1	3.4		54.8	46.4
Progression Factor	2.00	1.67	0.05		1.00	1.00
Incremental Delay, d2	0.3	0.1	0.3		1.7	0.1
Delay (s)	4.1	1.9	0.5		56.5	46.5
Level of Service	A	A	A		E	D
Approach Delay (s)		2.0	0.5		50.6	
Approach LOS		A	A		D	

Intersection Summary			
HCM 2000 Control Delay	2.1	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.44		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	44.6%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	140	1015	1700	300	185	80
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Grade (%)		-5%	5%		0%	
Total Lost time (s)	7.0	6.5	6.5	7.0	7.0	7.0
Lane Util. Factor	1.00	0.91	0.91	1.00	1.00	1.00
Frt	1.00	1.00	1.00	0.85	1.00	0.85
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1814	5212	4958	1538	1770	1583
Flt Permitted	0.07	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	142	5212	4958	1538	1770	1583
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	147	1068	1789	316	195	84
RTOR Reduction (vph)	0	0	0	82	0	71
Lane Group Flow (vph)	147	1068	1789	234	195	13
Bus Blockages (#/hr)	0	0	0	1	0	0
Turn Type	pm+pt	NA	NA	pm+ov	Prot	Prot
Protected Phases	5	2	6	4	4	4
Permitted Phases	2			6		
Actuated Green, G (s)	87.6	87.6	70.1	89.0	18.9	18.9
Effective Green, g (s)	87.6	87.6	70.1	89.0	18.9	18.9
Actuated g/C Ratio	0.73	0.73	0.58	0.74	0.16	0.16
Clearance Time (s)	7.0	6.5	6.5	7.0	7.0	7.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	249	3804	2896	1140	278	249
v/s Ratio Prot	c0.05	0.20	c0.36	0.03	c0.11	0.01
v/s Ratio Perm	0.38			0.12		
v/c Ratio	0.59	0.28	0.62	0.21	0.70	0.05
Uniform Delay, d1	15.5	5.5	16.2	4.7	47.9	42.9
Progression Factor	1.05	0.85	0.35	0.00	1.00	1.00
Incremental Delay, d2	3.6	0.2	0.4	0.0	7.8	0.1
Delay (s)	19.9	4.9	6.1	0.0	55.6	43.0
Level of Service	B	A	A	A	E	D
Approach Delay (s)		6.7	5.2		51.8	
Approach LOS		A	A		D	

Intersection Summary			
HCM 2000 Control Delay	9.3	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.63		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	20.5
Intersection Capacity Utilization	67.9%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	170	980	50	20	1640	210	155	200	50	200	25	205
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		-3%			2%			-4%			6%	
Total Lost time (s)	7.0	6.5	6.5	7.0	6.5		7.0	7.0		7.0	7.0	7.0
Lane Util. Factor	1.00	0.91	1.00	1.00	0.91		1.00	0.95		0.95	0.95	1.00
Frt	1.00	1.00	0.85	1.00	0.98		1.00	0.97		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00		0.95	0.96	1.00
Satd. Flow (prot)	1796	5162	1607	1752	4942		1805	3501		1631	1652	1530
Flt Permitted	0.07	1.00	1.00	0.27	1.00		0.95	1.00		0.95	0.00	1.00
Satd. Flow (perm)	139	5162	1607	489	4942		1805	3501		1631	0	1530
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	179	1032	53	21	1726	221	163	211	53	211	26	216
RTOR Reduction (vph)	0	0	0	0	11	0	0	0	0	0	0	0
Lane Group Flow (vph)	179	1032	53	21	1936	0	163	264	0	118	119	216
Bus Blockages (#/hr)	0	0	0	0	1	1	0	0	0	0	0	1
Turn Type	pm+pt	NA	pt+ov	pm+pt	NA		Prot	NA		Prot	NA	pt+ov
Protected Phases	5	2	2 3	1	6		3	8		7	4	4 5
Permitted Phases	2			6								
Actuated Green, G (s)	67.3	57.5	80.2	50.2	47.4		16.2	13.9		18.3	18.3	35.9
Effective Green, g (s)	67.3	57.5	80.2	50.2	47.4		16.2	13.9		18.3	18.3	35.9
Actuated g/C Ratio	0.56	0.48	0.67	0.42	0.39		0.13	0.12		0.15	0.15	0.30
Clearance Time (s)	7.0	6.5		7.0	6.5		7.0	7.0		7.0	7.0	
Vehicle Extension (s)	2.0	4.0		2.0	4.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	256	2473	1074	234	1952		243	405		248	251	457
v/s Ratio Prot	c0.08	0.20	0.03	0.00	c0.39		c0.09	0.08		0.07	0.07	c0.14
v/s Ratio Perm	0.32			0.04								
v/c Ratio	0.70	0.42	0.05	0.09	0.99		0.67	0.65		0.48	0.47	0.47
Uniform Delay, d1	30.1	20.3	6.8	20.5	36.1		49.4	50.7		46.5	46.5	34.3
Progression Factor	0.77	0.67	0.92	1.00	1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	6.3	0.5	0.0	0.1	18.5		7.1	3.7		1.4	1.4	0.8
Delay (s)	29.5	14.1	6.3	20.6	54.6		56.5	54.5		47.9	47.9	35.1
Level of Service	C	B	A	C	D		E	D		D	D	D
Approach Delay (s)		15.9			54.2			55.2			41.8	
Approach LOS		B			D			E			D	

Intersection Summary			
HCM 2000 Control Delay	41.2	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.83		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	27.5
Intersection Capacity Utilization	83.5%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Sign Control	Stop		Stop			Stop
Volume (vph)	10	50	15	10	95	20
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	11	53	16	11	100	21

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total (vph)	63	26	121
Volume Left (vph)	11	0	100
Volume Right (vph)	53	11	0
Hadj (s)	-0.43	-0.21	0.20
Departure Headway (s)	3.8	3.9	4.3
Degree Utilization, x	0.07	0.03	0.14
Capacity (veh/h)	910	882	831
Control Delay (s)	7.1	7.1	8.0
Approach Delay (s)	7.1	7.1	8.0
Approach LOS	A	A	A

Intersection Summary			
Delay	7.6		
Level of Service	A		
Intersection Capacity Utilization	23.3%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	245	745	5	30	350	345	100	340	70	290	205	230
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.5	7.0		4.0	7.0		4.0	4.0		4.0	7.0	
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	0.95		1.00	0.95	
Frt	1.00	1.00		1.00	0.93		1.00	0.97		1.00	0.92	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	3536		1770	3276		1770	3448		1770	3259	
Flt Permitted	0.18	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	327	3536		1770	3276		1770	3448		1770	3259	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	258	784	5	32	368	363	105	358	74	305	216	242
RTOR Reduction (vph)	0	1	0	0	187	0	0	20	0	0	182	0
Lane Group Flow (vph)	258	788	0	32	544	0	105	412	0	305	277	0
Turn Type	pm+pt	NA		Prot	NA		Prot	NA		Prot	NA	
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases	2											
Actuated Green, G (s)	34.7	34.7		3.0	23.3		7.8	14.7		18.6	22.5	
Effective Green, g (s)	34.7	34.7		3.0	23.3		7.8	14.7		18.6	22.5	
Actuated g/C Ratio	0.39	0.39		0.03	0.26		0.09	0.16		0.21	0.25	
Clearance Time (s)	6.5	7.0		4.0	7.0		4.0	4.0		4.0	7.0	
Vehicle Extension (s)	2.0	5.0		3.0	5.0		3.0	3.0		3.0	2.0	
Lane Grp Cap (vph)	316	1363		59	848		153	563		365	814	
v/s Ratio Prot	c0.11	0.22		c0.02	0.17		0.06	c0.12		c0.17	0.08	
v/s Ratio Perm	c0.21											
v/c Ratio	0.82	0.58		0.54	0.64		0.69	0.73		0.84	0.34	
Uniform Delay, d1	22.0	21.9		42.8	29.6		39.9	35.8		34.2	27.7	
Progression Factor	1.00	1.00		0.85	0.73		1.00	1.00		1.00	1.00	
Incremental Delay, d2	14.2	1.8		9.4	3.6		12.0	4.9		15.1	0.1	
Delay (s)	36.2	23.7		45.8	25.2		52.0	40.7		49.4	27.8	
Level of Service	D	C		D	C		D	D		D	C	
Approach Delay (s)		26.8			26.1			42.9			36.4	
Approach LOS		C			C			D			D	

Intersection Summary			
HCM 2000 Control Delay	31.7	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.82		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	24.5
Intersection Capacity Utilization	79.9%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	40	1010	55	30	695	110	20	25	10	10	15	20
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	7.0	7.0		7.0	7.0		7.0	7.0		7.0	7.0	
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	1.00		1.00	1.00	
Frt	1.00	0.99		1.00	0.98		1.00	0.96		1.00	0.91	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	3512		1770	3467		1770	1780		1770	1704	
Flt Permitted	0.24	1.00		0.24	1.00		0.73	1.00		0.95	1.00	
Satd. Flow (perm)	454	3512		453	3467		1365	1780		1770	1704	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	42	1063	58	32	732	116	21	26	11	11	16	21
RTOR Reduction (vph)	0	3	0	0	10	0	0	10	0	0	20	0
Lane Group Flow (vph)	42	1118	0	32	838	0	21	27	0	11	17	0
Turn Type	pm+pt	NA		pm+pt	NA		pm+pt	NA		Prot	NA	
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases	2			6			8					
Actuated Green, G (s)	50.9	50.9		50.9	50.9		10.6	7.1		1.0	4.6	
Effective Green, g (s)	50.9	50.9		50.9	50.9		10.6	7.1		1.0	4.6	
Actuated g/C Ratio	0.57	0.57		0.57	0.57		0.12	0.08		0.01	0.05	
Clearance Time (s)	7.0	7.0		7.0	7.0		7.0	7.0		7.0	7.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	300	1986		300	1960		176	140		19	87	
v/s Ratio Prot	0.00	c0.32		0.00	c0.24		0.00	c0.02		c0.01	0.01	
v/s Ratio Perm	0.07			0.06			0.01					
v/c Ratio	0.14	0.56		0.11	0.43		0.12	0.19		0.58	0.20	
Uniform Delay, d1	9.7	12.5		10.1	11.2		35.6	38.8		44.3	40.9	
Progression Factor	0.20	0.19		0.12	0.10		1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.2	0.9		0.2	0.7		0.3	0.7		36.3	1.1	
Delay (s)	2.2	3.3		1.3	1.8		35.9	39.4		80.6	42.0	
Level of Service	A	A		A	A		D	D		F	D	
Approach Delay (s)		3.2			1.8			38.1			50.9	
Approach LOS		A			A			D			D	

Intersection Summary			
HCM 2000 Control Delay	4.6	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.53		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	28.0
Intersection Capacity Utilization	52.7%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (vph)	1015	15	0	835	0	110
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0			4.0		4.0
Lane Util. Factor	0.95			0.95		1.00
Frt	1.00			1.00		0.86
Flt Protected	1.00			1.00		1.00
Satd. Flow (prot)	3531			3539		1611
Flt Permitted	1.00			1.00		1.00
Satd. Flow (perm)	3531			3539		1611
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	1068	16	0	879	0	116
RTOR Reduction (vph)	0	0	0	0	0	109
Lane Group Flow (vph)	1084	0	0	879	0	7
Turn Type	NA			NA		Perm
Protected Phases	2			6		
Permitted Phases						8
Actuated Green, G (s)	76.5			76.5		5.5
Effective Green, g (s)	76.5			76.5		5.5
Actuated g/C Ratio	0.85			0.85		0.06
Clearance Time (s)	4.0			4.0		4.0
Vehicle Extension (s)	3.0			3.0		3.0
Lane Grp Cap (vph)	3001			3008		98
v/s Ratio Prot	c0.31			0.25		
v/s Ratio Perm						c0.00
v/c Ratio	0.36			0.29		0.07
Uniform Delay, d1	1.5			1.3		39.8
Progression Factor	0.18			0.93		1.00
Incremental Delay, d2	0.3			0.2		0.3
Delay (s)	0.6			1.5		40.2
Level of Service	A			A		D
Approach Delay (s)	0.6			1.5	40.2	
Approach LOS	A			A	D	

Intersection Summary			
HCM 2000 Control Delay	3.2	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.34		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	42.0%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	20	70	10	40	55	35	10	55	40	20	10	5
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	21	74	11	42	58	37	11	58	42	21	11	5

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total (vph)	105	137	111	37
Volume Left (vph)	21	42	11	21
Volume Right (vph)	11	37	42	5
Hadj (s)	0.01	-0.07	-0.18	0.06
Departure Headway (s)	4.4	4.3	4.3	4.6
Degree Utilization, x	0.13	0.16	0.13	0.05
Capacity (veh/h)	783	797	785	720
Control Delay (s)	8.1	8.1	8.0	7.9
Approach Delay (s)	8.1	8.1	8.0	7.9
Approach LOS	A	A	A	A

Intersection Summary			
Delay	8.0		
Level of Service	A		
Intersection Capacity Utilization	25.5%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	110	1000	15	15	780	90	15	25	210	50	80	40
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	2.0	4.0		4.0	4.0		4.0	4.0		1.0	4.0	4.0
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	1.00		1.00	1.00	1.00
Frt	1.00	1.00		1.00	0.98		1.00	0.87		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1770	3531		1770	3484		1770	1613		1770	1863	1583
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	1770	3531		1770	3484		1770	1613		1770	1863	1583
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	116	1053	16	16	821	95	16	26	221	53	84	42
RTOR Reduction (vph)	0	1	0	0	7	0	0	186	0	0	0	35
Lane Group Flow (vph)	116	1068	0	16	909	0	16	61	0	53	84	7
Turn Type	Prot	NA		Prot	NA		Prot	NA		Prot	NA	Perm
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases												4
Actuated Green, G (s)	10.0	50.6		2.0	44.6		1.6	11.2		3.2	12.8	12.8
Effective Green, g (s)	12.0	52.6		4.0	46.6		1.6	14.2		6.2	15.8	15.8
Actuated g/C Ratio	0.13	0.58		0.04	0.52		0.02	0.16		0.07	0.18	0.18
Clearance Time (s)	4.0	6.0		6.0	6.0		4.0	7.0		4.0	7.0	7.0
Vehicle Extension (s)	3.0	2.0		0.2	3.0		3.0	2.0		3.0	2.0	2.0
Lane Grp Cap (vph)	236	2063		78	1803		31	254		121	327	277
v/s Ratio Prot	0.07	c0.30		0.01	c0.26		0.01	0.04		c0.03	c0.05	
v/s Ratio Perm												0.00
v/c Ratio	0.49	0.52		0.21	0.50		0.52	0.24		0.44	0.26	0.03
Uniform Delay, d1	36.2	11.1		41.5	14.2		43.8	33.2		40.2	32.0	30.7
Progression Factor	0.57	0.50		1.56	0.42		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	1.5	0.9		0.4	0.9		13.7	0.2		2.5	0.2	0.0
Delay (s)	22.2	6.5		64.9	6.9		57.6	33.4		42.8	32.2	30.7
Level of Service	C	A		E	A		E	C		D	C	C
Approach Delay (s)		8.0			7.9			34.8			35.0	
Approach LOS		A			A			C			C	

Intersection Summary			
HCM 2000 Control Delay	12.6	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.49		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	63.2%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Sign Control		Stop	Stop		Stop	
Volume (vph)	35	80	150	245	40	60
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	37	84	158	258	42	63

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total (vph)	121	416	105
Volume Left (vph)	37	0	42
Volume Right (vph)	0	258	63
Hadj (s)	0.09	-0.34	-0.25
Departure Headway (s)	4.7	4.0	4.8
Degree Utilization, x	0.16	0.46	0.14
Capacity (veh/h)	738	879	682
Control Delay (s)	8.5	10.3	8.6
Approach Delay (s)	8.5	10.3	8.6
Approach LOS	A	B	A

Intersection Summary			
Delay	9.7		
Level of Service	A		
Intersection Capacity Utilization	45.0%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	240	1020	0	0	805	20	0	0	0	50	0	80
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0			4.0						4.0	
Lane Util. Factor	1.00	0.95			0.95						1.00	
Frt	1.00	1.00			1.00						0.92	
Flt Protected	0.95	1.00			1.00						0.98	
Satd. Flow (prot)	1770	3539			3526						1676	
Flt Permitted	0.95	1.00			1.00						0.87	
Satd. Flow (perm)	1770	3539			3526						1491	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	253	1074	0	0	847	21	0	0	0	53	0	84
RTOR Reduction (vph)	0	0	0	0	1	0	0	0	0	0	71	0
Lane Group Flow (vph)	253	1074	0	0	867	0	0	0	0	0	66	0
Turn Type	Prot	NA			NA					Perm	NA	
Protected Phases	5	2			6			8			4	
Permitted Phases							8			4		
Actuated Green, G (s)	18.0	72.6			50.6						9.4	
Effective Green, g (s)	18.0	72.6			50.6						9.4	
Actuated g/C Ratio	0.20	0.81			0.56						0.10	
Clearance Time (s)	4.0	4.0			4.0						4.0	
Vehicle Extension (s)	3.0	3.0			3.0						3.0	
Lane Grp Cap (vph)	354	2854			1982						155	
v/s Ratio Prot	c0.14	0.30			c0.25							
v/s Ratio Perm											c0.04	
v/c Ratio	0.71	0.38			0.44						0.43	
Uniform Delay, d1	33.6	2.4			11.4						37.8	
Progression Factor	0.64	0.77			1.00						1.00	
Incremental Delay, d2	6.1	0.3			0.7						1.9	
Delay (s)	27.7	2.2			12.1						39.7	
Level of Service	C	A			B						D	
Approach Delay (s)		7.1			12.1			0.0			39.7	
Approach LOS		A			B			A			D	

Intersection Summary			
HCM 2000 Control Delay	10.9	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.50		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	53.9%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Sign Control		Stop	Stop		Stop	
Volume (vph)	25	80	370	70	130	55
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	26	84	389	74	137	58

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	SB 1	SB 2
Volume Total (vph)	26	84	389	74	137	58
Volume Left (vph)	26	0	0	0	137	0
Volume Right (vph)	0	0	0	74	0	58
Hadj (s)	0.53	0.03	0.03	-0.67	0.23	-0.57
Departure Headway (s)	5.9	5.4	5.1	4.4	5.4	3.2
Degree Utilization, x	0.04	0.13	0.55	0.09	0.21	0.05
Capacity (veh/h)	585	639	696	802	613	1121
Control Delay (s)	7.9	7.9	12.8	6.6	9.8	6.4
Approach Delay (s)	7.9		11.8		8.8	
Approach LOS	A		B		A	

Intersection Summary			
Delay	10.5		
Level of Service	B		
Intersection Capacity Utilization	34.6%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	60	3680	235	150	3000	250	80	130	300	120	40	50
Ideal Flow (vphpl)	1920	1920	1920	1920	1920	1920	1920	1920	1920	1920	1920	1920
Total Lost time (s)	4.0	4.0	7.0	4.0	4.0	7.0	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	0.97	0.91	1.00	1.00	0.91	1.00	1.00	0.95	1.00	0.97	0.95	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.92	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	3469	5139	1600	1788	5139	1600	1788	3576	1600	3469	3277	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	3469	5139	1600	1788	5139	1600	1788	3576	1600	3469	3277	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	63	3874	247	158	3158	263	84	137	316	126	42	53
RTOR Reduction (vph)	0	0	31	0	0	48	0	0	79	0	46	0
Lane Group Flow (vph)	63	3874	216	158	3158	215	84	137	237	126	49	0
Turn Type	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	pt+ov	Prot	NA	
Protected Phases	5	2	3	1	6	7	3	8	8 1	7	4	
Permitted Phases			2			6						
Actuated Green, G (s)	6.0	132.3	138.3	11.0	137.3	143.3	6.0	22.2	40.2	6.0	22.2	
Effective Green, g (s)	9.0	135.8	138.3	14.0	140.8	143.3	9.0	25.2	43.2	9.0	25.2	
Actuated g/C Ratio	0.04	0.68	0.69	0.07	0.70	0.72	0.04	0.13	0.22	0.04	0.13	
Clearance Time (s)	7.0	7.5	7.0	7.0	7.5	7.0	7.0	7.0		7.0	7.0	
Vehicle Extension (s)	3.0	0.2	2.0	3.0	0.2	2.0	2.0	4.0		2.0	4.0	
Lane Grp Cap (vph)	156	3489	1106	125	3617	1146	80	450	345	156	412	
v/s Ratio Prot	0.02	c0.75	0.01	c0.09	0.61	0.01	c0.05	0.04	c0.15	c0.04	0.01	
v/s Ratio Perm			0.13			0.13						
v/c Ratio	0.40	1.11	0.20	1.26	0.87	0.19	1.05	0.30	0.69	0.81	0.12	
Uniform Delay, d1	92.9	32.1	11.0	93.0	22.7	9.3	95.5	79.4	72.2	94.6	77.5	
Progression Factor	1.00	1.00	1.00	0.86	0.47	0.34	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	1.7	54.4	0.0	143.4	1.4	0.0	115.0	0.5	6.0	24.2	0.2	
Delay (s)	94.6	86.5	11.0	223.6	12.1	3.2	210.5	80.0	78.2	118.9	77.7	
Level of Service	F	F	B	F	B	A	F	E	E	F	E	
Approach Delay (s)		82.2			20.8			99.3			101.2	
Approach LOS		F			C			F			F	

Intersection Summary			
HCM 2000 Control Delay	57.9	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.08		
Actuated Cycle Length (s)	200.0	Sum of lost time (s)	19.0
Intersection Capacity Utilization	102.9%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Volume (vph)	50	3960	90	35	3335	165	40	30	40	30	15	25
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0			4.0	4.0		4.0	4.0
Lane Util. Factor	1.00	0.91		1.00	0.91			1.00	1.00		1.00	1.00
Frt	1.00	1.00		1.00	0.99			1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00			0.97	1.00		0.97	1.00
Satd. Flow (prot)	1770	5068		1770	5049			1811	1583		1803	1583
Flt Permitted	0.95	1.00		0.95	1.00			0.76	1.00		0.65	1.00
Satd. Flow (perm)	1770	5068		1770	5049			1413	1583		1212	1583
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	53	4168	95	37	3511	174	42	32	42	32	16	26
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	38	0	0	23
Lane Group Flow (vph)	53	4263	0	37	3685	0	0	74	4	0	48	3
Turn Type	Prot	NA		Prot	NA		Perm	NA	Perm	Perm	NA	Perm
Protected Phases	5	2		1	6			8			4	
Permitted Phases							8		8	4		4
Actuated Green, G (s)	7.1	155.8		9.7	158.4			16.5	16.5		16.5	16.5
Effective Green, g (s)	7.1	158.8		9.7	161.4			19.5	19.5		19.5	19.5
Actuated g/C Ratio	0.04	0.79		0.05	0.81			0.10	0.10		0.10	0.10
Clearance Time (s)	4.0	7.0		4.0	7.0			7.0	7.0		7.0	7.0
Vehicle Extension (s)	3.0	0.2		3.0	0.2			4.0	4.0		4.0	4.0
Lane Grp Cap (vph)	62	4023		85	4074			137	154		118	154
v/s Ratio Prot	0.03	c0.84		0.02	c0.73							
v/s Ratio Perm								c0.05	0.00		0.04	0.00
v/c Ratio	0.85	1.06		0.44	0.90			0.54	0.03		0.41	0.02
Uniform Delay, d1	95.9	20.6		92.5	13.8			86.0	81.7		84.8	81.6
Progression Factor	0.75	0.45		1.00	1.00			1.00	1.00		1.00	1.00
Incremental Delay, d2	10.1	27.5		3.5	3.8			5.4	0.1		3.1	0.1
Delay (s)	82.5	36.8		96.0	17.6			91.3	81.8		87.9	81.6
Level of Service	F	D		F	B			F	F		F	F
Approach Delay (s)		37.4			18.4			87.9			85.7	
Approach LOS		D			B			F			F	

Intersection Summary			
HCM 2000 Control Delay	29.9	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	1.00		
Actuated Cycle Length (s)	200.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	96.8%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (vph)	625	75	395	400	10	15
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0			4.0	4.0	4.0
Lane Util. Factor	0.95			0.95	1.00	1.00
Frt	0.98			1.00	1.00	0.85
Flt Protected	1.00			0.98	0.95	1.00
Satd. Flow (prot)	3482			3453	1770	1583
Flt Permitted	1.00			0.56	0.95	1.00
Satd. Flow (perm)	3482			1998	1770	1583
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	658	79	416	421	11	16
RTOR Reduction (vph)	6	0	0	0	0	15
Lane Group Flow (vph)	731	0	0	837	11	1
Turn Type	NA		Perm	NA	pm+pt	Perm
Protected Phases	2			6	3	
Permitted Phases			6		8	3
Actuated Green, G (s)	73.0			75.0	7.0	7.0
Effective Green, g (s)	73.0			75.0	7.0	7.0
Actuated g/C Ratio	0.81			0.83	0.08	0.08
Clearance Time (s)	6.0			4.0	4.0	4.0
Vehicle Extension (s)	2.0			3.0	3.0	3.0
Lane Grp Cap (vph)	2824			1665	137	123
v/s Ratio Prot	0.21				c0.01	
v/s Ratio Perm				c0.42		0.00
v/c Ratio	0.26			0.50	0.08	0.01
Uniform Delay, d1	2.0			2.2	38.5	38.3
Progression Factor	1.00			0.31	1.00	1.00
Incremental Delay, d2	0.2			0.9	0.3	0.0
Delay (s)	2.3			1.6	38.8	38.3
Level of Service	A			A	D	D
Approach Delay (s)	2.3			1.6	38.5	
Approach LOS	A			A	D	

Intersection Summary			
HCM 2000 Control Delay	2.5	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.49		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	57.2%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	290	350	350	70	250	445
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	1.00	1.00	0.95	0.95	
Frt	1.00	0.85	1.00	1.00	0.90	
Flt Protected	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	1770	1583	1770	3539	3199	
Flt Permitted	0.95	1.00	0.36	1.00	1.00	
Satd. Flow (perm)	1770	1583	661	3539	3199	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	305	368	368	74	263	468
RTOR Reduction (vph)	0	292	0	0	138	0
Lane Group Flow (vph)	305	76	368	74	593	0
Turn Type	Prot	Perm	Perm	NA	NA	
Protected Phases	4			2	6	
Permitted Phases		4	2			
Actuated Green, G (s)	18.5	18.5	63.5	63.5	63.5	
Effective Green, g (s)	18.5	18.5	63.5	63.5	63.5	
Actuated g/C Ratio	0.21	0.21	0.71	0.71	0.71	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	363	325	466	2496	2257	
v/s Ratio Prot	c0.17			0.02	0.19	
v/s Ratio Perm		0.05	c0.56			
v/c Ratio	0.84	0.23	0.79	0.03	0.26	
Uniform Delay, d1	34.3	29.8	8.8	4.0	4.8	
Progression Factor	0.95	2.25	0.73	0.40	0.50	
Incremental Delay, d2	15.7	0.4	12.7	0.0	0.2	
Delay (s)	48.2	67.4	19.2	1.6	2.6	
Level of Service	D	E	B	A	A	
Approach Delay (s)	58.7			16.2	2.6	
Approach LOS	E			B	A	

Intersection Summary			
HCM 2000 Control Delay	26.3	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.80		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	66.7%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	25	545	30	620	770	10	70	10	280	40	45	60
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	0.95		0.97	0.95		1.00	0.95		1.00	1.00	
Frt	1.00	0.99		1.00	1.00		1.00	0.86		1.00	0.91	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	3511		3433	3532		1770	3027		1770	1703	
Flt Permitted	0.30	1.00		0.40	1.00		0.68	1.00		0.52	1.00	
Satd. Flow (perm)	554	3511		1427	3532		1274	3027		969	1703	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	26	574	32	653	811	11	74	11	295	42	47	63
RTOR Reduction (vph)	0	6	0	0	1	0	0	206	0	0	44	0
Lane Group Flow (vph)	26	600	0	653	821	0	74	100	0	42	66	0
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	54.8	54.8		54.8	54.8		27.2	27.2		27.2	27.2	
Effective Green, g (s)	54.8	54.8		54.8	54.8		27.2	27.2		27.2	27.2	
Actuated g/C Ratio	0.61	0.61		0.61	0.61		0.30	0.30		0.30	0.30	
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	337	2137		868	2150		385	914		292	514	
v/s Ratio Prot		0.17			0.23			0.03			0.04	
v/s Ratio Perm	0.05			c0.46			c0.06			0.04		
v/c Ratio	0.08	0.28		0.75	0.38		0.19	0.11		0.14	0.13	
Uniform Delay, d1	7.2	8.3		12.7	9.0		23.3	22.7		22.9	22.8	
Progression Factor	1.00	1.00		1.00	1.00		0.28	0.12		1.00	1.00	
Incremental Delay, d2	0.1	0.1		3.7	0.1		0.9	0.2		1.0	0.5	
Delay (s)	7.3	8.4		16.4	9.1		7.4	2.9		23.9	23.3	
Level of Service	A	A		B	A		A	A		C	C	
Approach Delay (s)		8.3			12.3			3.7			23.5	
Approach LOS		A			B			A			C	

Intersection Summary			
HCM 2000 Control Delay	10.8	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.57		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	59.7%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	50	35	15	30	10	95
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	53	37	16	32	11	100
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)			346			
pX, platoon unblocked						
vC, conflicting volume	153	32			47	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	153	32			47	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	94	96			99	
cM capacity (veh/h)	833	1042			1560	

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	89	47	111
Volume Left	53	0	11
Volume Right	37	32	0
cSH	908	1700	1560
Volume to Capacity	0.10	0.03	0.01
Queue Length 95th (ft)	8	0	1
Control Delay (s)	9.4	0.0	0.7
Lane LOS	A		A
Approach Delay (s)	9.4	0.0	0.7
Approach LOS	A		

Intersection Summary			
Average Delay	3.7		
Intersection Capacity Utilization	23.8%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	40	10	10	680	1005	95
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	1.00	1.00	0.95	0.95	
Frt	1.00	0.85	1.00	1.00	0.99	
Flt Protected	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	1770	1583	1770	3539	3493	
Flt Permitted	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (perm)	1770	1583	1770	3539	3493	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	42	11	11	716	1058	100
RTOR Reduction (vph)	0	0	0	0	10	0
Lane Group Flow (vph)	42	11	11	716	1148	0
Turn Type	Prot	Perm	Prot	NA	NA	
Protected Phases	2		1	8	4	
Permitted Phases		4		8		
Actuated Green, G (s)	48.0	54.0	1.5	54.0	54.0	
Effective Green, g (s)	49.5	55.5	3.0	55.5	55.5	
Actuated g/C Ratio	0.41	0.46	0.02	0.46	0.46	
Clearance Time (s)	5.5	5.5	5.5	5.5	5.5	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	730	732	44	1636	1615	
v/s Ratio Prot	c0.02		c0.01	0.20	c0.33	
v/s Ratio Perm		0.01				
v/c Ratio	0.06	0.02	0.25	0.44	0.71	
Uniform Delay, d1	21.2	17.5	57.4	21.7	25.8	
Progression Factor	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	0.2	0.0	3.0	0.2	1.5	
Delay (s)	21.4	17.5	60.4	21.9	27.3	
Level of Service	C	B	E	C	C	
Approach Delay (s)	20.6			22.5	27.3	
Approach LOS	C			C	C	

Intersection Summary			
HCM 2000 Control Delay	25.3	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.40		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	44.1%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	0	0	690	420	245	355
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)			4.0	4.0	4.0	4.0
Lane Util. Factor			1.00	0.95	0.95	1.00
Frt			1.00	1.00	1.00	0.85
Flt Protected			0.95	1.00	1.00	1.00
Satd. Flow (prot)			1770	3539	3539	1583
Flt Permitted			0.95	1.00	1.00	1.00
Satd. Flow (perm)			1770	3539	3539	1583
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	0	0	726	442	258	374
RTOR Reduction (vph)	0	0	0	0	0	130
Lane Group Flow (vph)	0	0	726	442	258	244
Turn Type			Prot	NA	NA	Perm
Protected Phases			5	2	6	
Permitted Phases						6
Actuated Green, G (s)			45.5	90.0	36.5	36.5
Effective Green, g (s)			45.5	90.0	36.5	36.5
Actuated g/C Ratio			0.51	1.00	0.41	0.41
Clearance Time (s)			4.0	4.0	4.0	4.0
Vehicle Extension (s)			3.0	3.0	3.0	3.0
Lane Grp Cap (vph)			894	3539	1435	641
v/s Ratio Prot			c0.41	0.12	0.07	
v/s Ratio Perm						c0.15
v/c Ratio			0.81	0.12	0.18	0.38
Uniform Delay, d1			18.7	0.0	17.2	18.8
Progression Factor			0.87	1.00	0.73	0.57
Incremental Delay, d2			5.4	0.1	0.2	1.6
Delay (s)			21.5	0.1	12.7	12.3
Level of Service			C	A	B	B
Approach Delay (s)	0.0			13.4	12.5	
Approach LOS	A			B	B	

Intersection Summary			
HCM 2000 Control Delay	13.1	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.62		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	66.9%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	140	915	0	970	245	0
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	
Lane Util. Factor	0.97	0.91		0.95	0.95	
Frt	0.89	0.85		1.00	1.00	
Flt Protected	0.99	1.00		1.00	1.00	
Satd. Flow (prot)	3161	1441		3539	3539	
Flt Permitted	0.99	1.00		1.00	1.00	
Satd. Flow (perm)	3161	1441		3539	3539	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	147	963	0	1021	258	0
RTOR Reduction (vph)	409	408	0	0	0	0
Lane Group Flow (vph)	220	73	0	1021	258	0
Turn Type	Prot	Prot		NA	NA	
Protected Phases	4	4		2	6	
Permitted Phases						
Actuated Green, G (s)	13.7	13.7		68.3	68.3	
Effective Green, g (s)	13.7	13.7		68.3	68.3	
Actuated g/C Ratio	0.15	0.15		0.76	0.76	
Clearance Time (s)	4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	481	219		2685	2685	
v/s Ratio Prot	c0.07	0.05		c0.29	0.07	
v/s Ratio Perm						
v/c Ratio	0.46	0.33		0.38	0.10	
Uniform Delay, d1	34.8	34.1		3.7	2.8	
Progression Factor	1.00	1.00		1.00	1.36	
Incremental Delay, d2	0.7	0.9		0.4	0.1	
Delay (s)	35.5	35.0		4.1	3.9	
Level of Service	D	C		A	A	
Approach Delay (s)	35.3			4.1	3.9	
Approach LOS	D			A	A	

Intersection Summary			
HCM 2000 Control Delay	18.5	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.39		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	66.9%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (vph)	5	35	15	685	895	70
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0	4.0	4.0	
Lane Util. Factor	1.00		1.00	0.95	0.95	
Frt	0.88		1.00	1.00	0.99	
Flt Protected	0.99		0.95	1.00	1.00	
Satd. Flow (prot)	1632		1770	3539	3501	
Flt Permitted	0.99		0.27	1.00	1.00	
Satd. Flow (perm)	1632		512	3539	3501	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	5	37	16	721	942	74
RTOR Reduction (vph)	34	0	0	0	2	0
Lane Group Flow (vph)	8	0	16	721	1014	0
Turn Type	Prot		Perm	NA	NA	
Protected Phases	2			8	4	
Permitted Phases			8			
Actuated Green, G (s)	3.4		32.0	32.0	32.0	
Effective Green, g (s)	3.4		32.0	32.0	32.0	
Actuated g/C Ratio	0.08		0.74	0.74	0.74	
Clearance Time (s)	4.0		4.0	4.0	4.0	
Vehicle Extension (s)	3.0		3.0	3.0	3.0	
Lane Grp Cap (vph)	127		377	2609	2581	
v/s Ratio Prot	c0.00			0.20	c0.29	
v/s Ratio Perm			0.03			
v/c Ratio	0.06		0.04	0.28	0.39	
Uniform Delay, d1	18.5		1.5	1.9	2.1	
Progression Factor	1.00		1.00	1.00	1.00	
Incremental Delay, d2	0.2		0.0	0.1	0.1	
Delay (s)	18.7		1.6	1.9	2.2	
Level of Service	B		A	A	A	
Approach Delay (s)	18.7			1.9	2.2	
Approach LOS	B			A	A	

Intersection Summary			
HCM 2000 Control Delay	2.5	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.36		
Actuated Cycle Length (s)	43.4	Sum of lost time (s)	8.0
Intersection Capacity Utilization	37.0%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	235	855	70	370	585	5	100	360	245	5	490	285
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Util. Factor	1.00	0.95		1.00	1.00		1.00	0.95		1.00	1.00	1.00
Frt	1.00	0.99		1.00	1.00		1.00	0.94		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1770	3499		1770	1860		1770	3324		1770	1863	1583
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.40	1.00	1.00
Satd. Flow (perm)	1770	3499		1770	1860		1770	3324		739	1863	1583
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	247	900	74	389	616	5	105	379	258	5	516	300
RTOR Reduction (vph)	0	7	0	0	0	0	0	134	0	0	0	217
Lane Group Flow (vph)	247	967	0	389	621	0	105	503	0	5	516	83
Turn Type	Prot	NA		Prot	NA		Prot	NA		Perm	NA	Perm
Protected Phases	7	4		3	8		5	2			6	
Permitted Phases										6		6
Actuated Green, G (s)	15.7	26.9		20.0	31.2		6.0	34.0		25.0	25.0	25.0
Effective Green, g (s)	15.7	26.9		20.0	31.2		6.0	34.0		25.0	25.0	25.0
Actuated g/C Ratio	0.17	0.30		0.22	0.35		0.07	0.38		0.28	0.28	0.28
Clearance Time (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	309	1046		393	645		118	1257		205	518	440
v/s Ratio Prot	0.14	0.28		c0.22	c0.33		c0.06	0.15			c0.28	
v/s Ratio Perm										0.01		0.05
v/c Ratio	0.80	0.92		0.99	0.96		0.89	0.40		0.02	1.00	0.19
Uniform Delay, d1	35.6	30.5		34.8	28.8		41.6	20.5		23.6	32.4	24.7
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	13.5	13.2		42.2	26.3		49.7	0.2		0.0	38.3	0.2
Delay (s)	49.0	43.7		77.1	55.1		91.3	20.7		23.6	70.7	24.9
Level of Service	D	D		E	E		F	C		C	E	C
Approach Delay (s)		44.8			63.5			30.7			53.7	
Approach LOS		D			E			C			D	

Intersection Summary			
HCM 2000 Control Delay	49.0	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	1.00		
Actuated Cycle Length (s)	89.9	Sum of lost time (s)	12.0
Intersection Capacity Utilization	91.0%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	20	20	15	685	870	30
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	21	21	16	721	916	32
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)					987	
pX, platoon unblocked	0.74	0.74	0.74			
vC, conflicting volume	1684	932	947			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1749	730	752			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	69	93	98			
cM capacity (veh/h)	68	312	634			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	42	737	947
Volume Left	21	16	0
Volume Right	21	0	32
cSH	112	634	1700
Volume to Capacity	0.38	0.02	0.56
Queue Length 95th (ft)	39	2	0
Control Delay (s)	55.6	0.7	0.0
Lane LOS	F	A	
Approach Delay (s)	55.6	0.7	0.0
Approach LOS	F		

Intersection Summary			
Average Delay	1.7		
Intersection Capacity Utilization	58.1%	ICU Level of Service	B
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	85	670	110	110	840	75	120	465	15	135	590	440
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	0.95		1.00	0.95	
Frt	1.00	0.98		1.00	0.99		1.00	1.00		1.00	0.94	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1805	3533		1770	3464		1805	3591		1805	3350	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1805	3533		1770	3464		1805	3591		1805	3350	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	89	705	116	116	884	79	126	489	16	142	621	463
RTOR Reduction (vph)	0	11	0	0	5	0	0	2	0	0	122	0
Lane Group Flow (vph)	89	810	0	116	958	0	126	503	0	142	962	0
Heavy Vehicles (%)	0%	0%	0%	2%	3%	2%	0%	0%	2%	0%	0%	2%
Turn Type	Prot	NA		Prot	NA		Prot	NA		Prot	NA	
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases												
Actuated Green, G (s)	9.4	36.6		13.8	41.0		12.6	21.0		22.6	31.0	
Effective Green, g (s)	9.4	36.6		13.8	41.0		12.6	21.0		22.6	31.0	
Actuated g/C Ratio	0.09	0.33		0.13	0.37		0.11	0.19		0.21	0.28	
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Vehicle Extension (s)	3.0	3.0		3.0	4.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	154	1175		222	1291		206	685		370	944	
v/s Ratio Prot	0.05	c0.23		0.07	c0.28		c0.07	0.14		0.08	c0.29	
v/s Ratio Perm												
v/c Ratio	0.58	0.69		0.52	0.74		0.61	0.73		0.38	1.02	
Uniform Delay, d1	48.4	31.8		45.0	29.9		46.4	41.9		37.7	39.5	
Progression Factor	1.00	1.00		0.35	0.08		1.00	1.00		1.00	1.00	
Incremental Delay, d2	5.2	3.3		1.4	2.5		5.3	4.1		0.7	34.1	
Delay (s)	53.6	35.1		17.2	5.0		51.7	45.9		38.4	73.6	
Level of Service	D	D		B	A		D	D		D	E	
Approach Delay (s)		36.9			6.3			47.1			69.6	
Approach LOS		D			A			D			E	

Intersection Summary			
HCM 2000 Control Delay	40.4	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.82		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	80.7%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	115	485	25	70	915	145	40	0	40	80	0	180
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	121	511	26	74	963	153	42	0	42	84	0	189
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)		554			508							
pX, platoon unblocked	0.85			0.89			0.90	0.90	0.89	0.90	0.90	0.85
vC, conflicting volume	1116			537			1584	2029	268	1726	1966	558
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	777			238			890	1383	0	1047	1313	118
tC, single (s)	4.1			4.1			7.5	6.5	6.9	7.5	6.5	6.9
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	83			94			69	100	96	35	100	75
cM capacity (veh/h)	708			1183			134	100	967	130	110	772

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3	NB 1	NB 2	SB 1	SB 2
Volume Total	121	340	196	74	642	474	42	42	84	189
Volume Left	121	0	0	74	0	0	42	0	84	0
Volume Right	0	0	26	0	0	153	0	42	0	189
cSH	708	1700	1700	1183	1700	1700	134	967	130	772
Volume to Capacity	0.17	0.20	0.12	0.06	0.38	0.28	0.31	0.04	0.65	0.25
Queue Length 95th (ft)	15	0	0	5	0	0	31	3	86	24
Control Delay (s)	11.1	0.0	0.0	8.2	0.0	0.0	43.7	8.9	73.0	11.2
Lane LOS	B			A			E	A	F	B
Approach Delay (s)	2.0			0.5			26.3		30.2	
Approach LOS							D		D	

Intersection Summary			
Average Delay	5.6		
Intersection Capacity Utilization	64.1%	ICU Level of Service	C
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	200	615	5	240	1000	270	0	220	885	120	715	25
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		-2%			-2%			-3%			0%	
Total Lost time (s)	4.0	6.5		7.0	6.5	6.5		4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00		0.95	0.95	1.00	0.95	
Frt	1.00	1.00		1.00	1.00	0.85		0.91	0.85	1.00	0.99	
Flt Protected	0.95	1.00		0.95	1.00	1.00		1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1787	3570		1787	3575	1599		1632	1527	1770	3521	
Flt Permitted	0.23	1.00		0.16	1.00	1.00		1.00	1.00	0.10	1.00	
Satd. Flow (perm)	441	3570		301	3575	1599		1632	1527	177	3521	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	211	647	5	253	1053	284	0	232	932	126	753	26
RTOR Reduction (vph)	0	1	0	0	0	182	0	51	272	0	2	0
Lane Group Flow (vph)	211	651	0	253	1053	102	0	544	297	126	777	0
Turn Type	pm+pt	NA		pm+pt	NA	Perm		NA	Perm	pm+pt	NA	
Protected Phases	5	2		1	6			8		7	4	
Permitted Phases	2			6		6			8	4		
Actuated Green, G (s)	33.5	31.0		39.5	39.5	39.5		38.0	38.0	47.0	47.0	
Effective Green, g (s)	33.5	31.0		39.5	39.5	39.5		38.0	38.0	47.0	47.0	
Actuated g/C Ratio	0.30	0.28		0.36	0.36	0.36		0.35	0.35	0.43	0.43	
Clearance Time (s)	4.0	6.5		7.0	6.5	6.5		4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	4.0		3.0	4.0	4.0		3.0	3.0	3.0	3.0	
Lane Grp Cap (vph)	244	1006		303	1283	574		563	527	148	1504	
v/s Ratio Prot	c0.07	0.18		0.11	c0.29			c0.33		c0.04	0.22	
v/s Ratio Perm	c0.19			0.19		0.06			0.19	0.32		
v/c Ratio	0.86	0.65		0.83	0.82	0.18		0.97	0.56	0.85	0.52	
Uniform Delay, d1	38.3	34.7		28.4	32.0	24.1		35.4	29.3	26.5	23.1	
Progression Factor	1.14	1.34		1.83	1.14	5.22		1.00	1.00	1.00	1.00	
Incremental Delay, d2	21.2	2.5		15.7	5.2	0.6		29.3	1.4	34.8	0.3	
Delay (s)	64.7	48.9		67.6	41.8	126.6		64.6	30.7	61.3	23.5	
Level of Service	E	D		E	D	F		E	C	E	C	
Approach Delay (s)		52.8			61.1			48.0			28.7	
Approach LOS		D			E			D			C	

Intersection Summary			
HCM 2000 Control Delay	49.7	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.95		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	21.5
Intersection Capacity Utilization	90.4%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	0	0	320	370	105	860
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)			4.0	4.0	4.0	4.0
Lane Util. Factor			0.95	1.00	1.00	0.95
Frt			1.00	0.85	1.00	1.00
Flt Protected			1.00	1.00	0.95	1.00
Satd. Flow (prot)			3539	1583	1770	3539
Flt Permitted			1.00	1.00	0.55	1.00
Satd. Flow (perm)			3539	1583	1022	3539
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	0	0	337	389	111	905
RTOR Reduction (vph)	0	0	0	0	0	0
Lane Group Flow (vph)	0	0	337	389	111	905
Turn Type			NA	Perm	Perm	NA
Protected Phases			2			6
Permitted Phases				2	6	
Actuated Green, G (s)			90.0	90.0	90.0	90.0
Effective Green, g (s)			90.0	90.0	90.0	90.0
Actuated g/C Ratio			1.00	1.00	1.00	1.00
Clearance Time (s)			4.0	4.0	4.0	4.0
Lane Grp Cap (vph)			3539	1583	1022	3539
v/s Ratio Prot			0.10			c0.26
v/s Ratio Perm				0.25	0.11	
v/c Ratio			0.10	0.25	0.11	0.26
Uniform Delay, d1			0.0	0.0	0.0	0.0
Progression Factor			1.00	1.00	1.00	1.00
Incremental Delay, d2			0.1	0.4	0.2	0.2
Delay (s)			0.1	0.4	0.2	0.2
Level of Service			A	A	A	A
Approach Delay (s)	0.0		0.2			0.2
Approach LOS	A		A			A

Intersection Summary			
HCM 2000 Control Delay	0.2	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.27		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	4.0
Intersection Capacity Utilization	63.4%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Movement	NBT	NBR	SBL	SBT	NWL	NWR
Lane Configurations						
Volume (vph)	320	0	0	320	645	310
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0			4.0	4.0	4.0
Lane Util. Factor	0.95			0.95	0.97	0.91
Frt	1.00			1.00	0.99	0.85
Flt Protected	1.00			1.00	0.95	1.00
Satd. Flow (prot)	3539			3539	3425	1441
Flt Permitted	1.00			1.00	0.95	1.00
Satd. Flow (perm)	3539			3539	3425	1441
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	337	0	0	337	679	326
RTOR Reduction (vph)	0	0	0	0	6	207
Lane Group Flow (vph)	337	0	0	337	706	86
Turn Type	NA			NA	Prot	Perm
Protected Phases	4!			6	8!	
Permitted Phases						8
Actuated Green, G (s)	26.3			55.7	26.3	26.3
Effective Green, g (s)	26.3			55.7	26.3	26.3
Actuated g/C Ratio	0.29			0.62	0.29	0.29
Clearance Time (s)	4.0			4.0	4.0	4.0
Vehicle Extension (s)	3.0			3.0	3.0	3.0
Lane Grp Cap (vph)	1034			2190	1000	421
v/s Ratio Prot	0.10			c0.10	c0.21	
v/s Ratio Perm						0.06
v/c Ratio	0.33			0.15	0.71	0.20
Uniform Delay, d1	24.9			7.2	28.4	24.0
Progression Factor	1.00			1.11	1.00	1.00
Incremental Delay, d2	0.2			0.1	2.3	0.2
Delay (s)	25.1			8.1	30.7	24.2
Level of Service	C			A	C	C
Approach Delay (s)	25.1			8.1	28.8	
Approach LOS	C			A	C	

Intersection Summary			
HCM 2000 Control Delay	23.9	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.33		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	63.4%	ICU Level of Service	B
Analysis Period (min)	15		

! Phase conflict between lane groups.
c Critical Lane Group

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	140	1490	1465	275	130	75
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Grade (%)		-5%	-2%		0%	
Total Lost time (s)	4.0	4.0	4.0		4.0	4.0
Lane Util. Factor	1.00	0.91	0.91		1.00	1.00
Frt	1.00	1.00	0.98		1.00	0.85
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1814	5212	5015		1770	1583
Flt Permitted	0.08	1.00	1.00		0.95	1.00
Satd. Flow (perm)	159	5212	5015		1770	1583
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	147	1568	1542	289	137	79
RTOR Reduction (vph)	0	0	17	0	0	17
Lane Group Flow (vph)	147	1568	1814	0	137	62
Turn Type	pm+pt	NA	NA		Prot	pt+ov
Protected Phases	5	2	6		4	4 5
Permitted Phases	2					
Actuated Green, G (s)	88.2	88.2	74.7		13.8	27.3
Effective Green, g (s)	88.2	88.2	74.7		13.8	27.3
Actuated g/C Ratio	0.80	0.80	0.68		0.13	0.25
Clearance Time (s)	4.0	4.0	4.0		4.0	
Vehicle Extension (s)	3.0	3.0	3.0		3.0	
Lane Grp Cap (vph)	270	4179	3405		222	392
v/s Ratio Prot	c0.05	0.30	0.36		c0.08	0.04
v/s Ratio Perm	c0.39					
v/c Ratio	0.54	0.38	0.53		0.62	0.16
Uniform Delay, d1	8.5	3.1	8.9		45.6	32.4
Progression Factor	1.25	0.96	0.14		1.00	1.00
Incremental Delay, d2	1.4	0.2	0.5		5.0	0.2
Delay (s)	12.1	3.1	1.7		50.6	32.5
Level of Service	B	A	A		D	C
Approach Delay (s)		3.9	1.7		44.0	
Approach LOS		A	A		D	

Intersection Summary			
HCM 2000 Control Delay	5.1	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.57		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	59.4%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

EBL		EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	160	1440	1490	190	325	255
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Grade (%)		-5%	5%		0%	
Total Lost time (s)	7.0	6.5	6.5	7.0	7.0	7.0
Lane Util. Factor	1.00	0.91	0.91	1.00	1.00	1.00
Frt	1.00	1.00	1.00	0.85	1.00	0.85
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1814	5212	4958	1538	1770	1583
Flt Permitted	0.08	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	157	5212	4958	1538	1770	1583
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	168	1516	1568	200	342	268
RTOR Reduction (vph)	0	0	0	56	0	185
Lane Group Flow (vph)	168	1516	1568	144	342	83
Bus Blockages (#/hr)	0	0	0	1	0	0
Turn Type	pm+pt	NA	NA	pm+ov	Prot	Prot
Protected Phases	5	2	6	4	4	4
Permitted Phases	2			6		
Actuated Green, G (s)	70.4	70.4	53.0	79.1	26.1	26.1
Effective Green, g (s)	70.4	70.4	53.0	79.1	26.1	26.1
Actuated g/C Ratio	0.64	0.64	0.48	0.72	0.24	0.24
Clearance Time (s)	7.0	6.5	6.5	7.0	7.0	7.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	257	3335	2388	1105	419	375
v/s Ratio Prot	c0.06	0.29	0.32	0.03	c0.19	0.05
v/s Ratio Perm	c0.36			0.06		
v/c Ratio	0.65	0.45	0.66	0.13	0.82	0.22
Uniform Delay, d1	17.4	10.1	21.6	4.8	39.7	33.8
Progression Factor	1.10	0.49	0.34	0.02	1.00	1.00
Incremental Delay, d2	5.5	0.4	0.8	0.0	11.6	0.3
Delay (s)	24.6	5.4	8.2	0.1	51.3	34.1
Level of Service	C	A	A	A	D	C
Approach Delay (s)		7.3	7.3		43.7	
Approach LOS		A	A		D	

Intersection Summary			
HCM 2000 Control Delay	12.8	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.72		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	20.5
Intersection Capacity Utilization	72.7%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	180	1465	105	110	1370	220	95	80	40	180	80	235
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Grade (%)		-3%			2%			-4%			6%	
Total Lost time (s)	7.0	6.5	6.5	7.0	6.5		7.0	7.0		7.0	7.0	7.0
Lane Util. Factor	1.00	0.91	1.00	1.00	0.91		1.00	0.95		0.95	0.95	1.00
Frt	1.00	1.00	0.85	1.00	0.98		1.00	0.95		1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00		0.95	0.98	1.00
Satd. Flow (prot)	1796	5162	1607	1752	4923		1805	3430		1631	1683	1530
Flt Permitted	0.09	1.00	1.00	0.09	1.00		0.95	1.00		0.95	0.85	1.00
Satd. Flow (perm)	164	5162	1607	172	4923		1805	3430		1631	1462	1530
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	189	1542	111	116	1442	232	100	84	42	189	84	247
RTOR Reduction (vph)	0	0	0	0	16	0	0	0	0	0	0	0
Lane Group Flow (vph)	189	1542	111	116	1658	0	100	126	0	134	139	247
Bus Blockages (#/hr)	0	0	0	0	1	1	0	0	0	0	0	1
Turn Type	pm+pt	NA	pt+ov	pm+pt	NA		Prot	NA		Prot	NA	pt+ov
Protected Phases	5	2	2 3	1	6		3	8		7	4	4 5
Permitted Phases	2			6								
Actuated Green, G (s)	58.2	46.1	57.6	51.8	42.9		11.5	9.4		18.1	34.1	28.1
Effective Green, g (s)	58.2	46.1	57.6	51.8	42.9		11.5	9.4		18.1	34.1	28.1
Actuated g/C Ratio	0.53	0.42	0.52	0.47	0.39		0.10	0.09		0.16	0.31	0.26
Clearance Time (s)	7.0	6.5		7.0	6.5		7.0	7.0		7.0	7.0	
Vehicle Extension (s)	2.0	4.0		2.0	4.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	266	2163	841	208	1919		188	293		268	489	390
v/s Ratio Prot	c0.08	c0.30	0.07	0.04	c0.34		0.06	0.04		c0.08	0.05	c0.16
v/s Ratio Perm	0.30			0.22							0.04	
v/c Ratio	0.71	0.71	0.13	0.56	0.86		0.53	0.43		0.50	0.28	0.63
Uniform Delay, d1	23.8	26.5	13.4	19.2	30.9		46.7	47.8		41.8	28.7	36.4
Progression Factor	1.64	0.73	0.67	1.00	1.00		1.00	1.00		0.66	0.66	1.13
Incremental Delay, d2	6.4	1.8	0.1	1.8	5.5		2.9	1.0		1.0	0.2	2.3
Delay (s)	45.4	21.0	9.0	21.1	36.3		49.6	48.8		28.7	19.2	43.4
Level of Service	D	C	A	C	D		D	D		C	B	D
Approach Delay (s)		22.8			35.4			49.1			33.2	
Approach LOS		C			D			D			C	

Intersection Summary			
HCM 2000 Control Delay	30.5	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.78		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	27.5
Intersection Capacity Utilization	72.2%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Sign Control	Stop		Stop			Stop
Volume (vph)	25	140	10	15	135	25
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	26	147	11	16	142	26

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total (vph)	174	26	168
Volume Left (vph)	26	0	142
Volume Right (vph)	147	16	0
Hadj (s)	-0.44	-0.33	0.20
Departure Headway (s)	3.9	4.1	4.5
Degree Utilization, x	0.19	0.03	0.21
Capacity (veh/h)	880	820	763
Control Delay (s)	7.8	7.3	8.7
Approach Delay (s)	7.8	7.3	8.7
Approach LOS	A	A	A

Intersection Summary			
Delay	8.2		
Level of Service	A		
Intersection Capacity Utilization	32.2%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	165	430	10	95	540	260	270	275	85	395	215	320
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.5	7.0		4.0	7.0		4.0	4.0		4.0	7.0	
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	0.95		1.00	0.95	
Frt	1.00	1.00		1.00	0.95		1.00	0.96		1.00	0.91	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	3527		1770	3366		1770	3414		1770	3221	
Flt Permitted	0.16	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	292	3527		1770	3366		1770	3414		1770	3221	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	174	453	11	100	568	274	284	289	89	416	226	337
RTOR Reduction (vph)	0	1	0	0	62	0	0	33	0	0	215	0
Lane Group Flow (vph)	174	463	0	100	780	0	284	345	0	416	348	0
Turn Type	pm+pt	NA		Prot	NA		Prot	NA		Prot	NA	
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases	2											
Actuated Green, G (s)	31.4	25.5		7.0	24.1		21.5	14.4		24.1	14.0	
Effective Green, g (s)	31.4	25.5		7.0	24.1		21.5	14.4		24.1	14.0	
Actuated g/C Ratio	0.35	0.28		0.08	0.27		0.24	0.16		0.27	0.16	
Clearance Time (s)	6.5	7.0		4.0	7.0		4.0	4.0		4.0	7.0	
Vehicle Extension (s)	2.0	5.0		3.0	5.0		3.0	3.0		3.0	2.0	
Lane Grp Cap (vph)	198	999		137	901		422	546		473	501	
v/s Ratio Prot	c0.06	0.13		0.06	0.23		c0.16	0.10		c0.24	0.11	
v/s Ratio Perm	c0.25											
v/c Ratio	0.88	0.46		0.73	0.87		0.67	0.63		0.88	0.69	
Uniform Delay, d1	24.0	26.6		40.6	31.4		31.1	35.3		31.6	36.0	
Progression Factor	1.00	1.00		0.80	0.76		0.55	0.55		1.00	1.00	
Incremental Delay, d2	31.9	1.5		16.3	10.1		4.1	2.3		16.8	3.4	
Delay (s)	55.9	28.1		48.9	33.9		21.1	21.7		48.4	39.3	
Level of Service	E	C		D	C		C	C		D	D	
Approach Delay (s)		35.7			35.5			21.5			43.2	
Approach LOS		D			D			C			D	

Intersection Summary			
HCM 2000 Control Delay	35.0	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.92		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	24.5
Intersection Capacity Utilization	84.0%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	80	820	10	120	790	65	90	5	55	35	30	15
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	7.0	7.0		7.0	7.0		7.0	7.0		7.0	7.0	
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	1.00		1.00	1.00	
Frt	1.00	1.00		1.00	0.99		1.00	0.86		1.00	0.95	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	3533		1770	3499		1770	1606		1770	1770	
Flt Permitted	0.19	1.00		0.32	1.00		0.73	1.00		0.95	1.00	
Satd. Flow (perm)	345	3533		605	3499		1352	1606		1770	1770	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	84	863	11	126	832	68	95	5	58	37	32	16
RTOR Reduction (vph)	0	1	0	0	5	0	0	54	0	0	15	0
Lane Group Flow (vph)	84	873	0	126	895	0	95	9	0	37	33	0
Turn Type	pm+pt	NA		pm+pt	NA		pm+pt	NA		Prot	NA	
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases	2			6			8					
Actuated Green, G (s)	42.3	42.3		47.2	47.2		9.8	5.6		3.7	5.1	
Effective Green, g (s)	42.3	42.3		47.2	47.2		9.8	5.6		3.7	5.1	
Actuated g/C Ratio	0.47	0.47		0.52	0.52		0.11	0.06		0.04	0.06	
Clearance Time (s)	7.0	7.0		7.0	7.0		7.0	7.0		7.0	7.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	249	1660		451	1835		166	99		72	100	
v/s Ratio Prot	0.02	c0.25		0.03	c0.26		c0.03	0.01		0.02	0.02	
v/s Ratio Perm	0.14			0.11			c0.04					
v/c Ratio	0.34	0.53		0.28	0.49		0.57	0.09		0.51	0.33	
Uniform Delay, d1	14.8	16.8		12.9	13.7		38.3	39.8		42.3	40.8	
Progression Factor	0.68	0.73		0.26	0.25		1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.6	0.9		0.3	0.9		4.7	0.4		6.1	1.9	
Delay (s)	10.7	13.2		3.6	4.2		43.0	40.2		48.3	42.7	
Level of Service	B	B		A	A		D	D		D	D	
Approach Delay (s)		13.0			4.2			41.9			45.2	
Approach LOS		B			A			D			D	

Intersection Summary			
HCM 2000 Control Delay	12.2	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.55		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	28.0
Intersection Capacity Utilization	58.8%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (vph)	900	10	0	975	0	155
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0			4.0		4.0
Lane Util. Factor	0.95			0.95		1.00
Frt	1.00			1.00		0.86
Flt Protected	1.00			1.00		1.00
Satd. Flow (prot)	3533			3539		1611
Flt Permitted	1.00			1.00		1.00
Satd. Flow (perm)	3533			3539		1611
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	947	11	0	1026	0	163
RTOR Reduction (vph)	1	0	0	0	0	150
Lane Group Flow (vph)	957	0	0	1026	0	13
Turn Type	NA			NA		Perm
Protected Phases	2			6		
Permitted Phases						8
Actuated Green, G (s)	74.7			74.7		7.3
Effective Green, g (s)	74.7			74.7		7.3
Actuated g/C Ratio	0.83			0.83		0.08
Clearance Time (s)	4.0			4.0		4.0
Vehicle Extension (s)	3.0			3.0		3.0
Lane Grp Cap (vph)	2932			2937		130
v/s Ratio Prot	0.27			c0.29		
v/s Ratio Perm						c0.01
v/c Ratio	0.33			0.35		0.10
Uniform Delay, d1	1.8			1.8		38.3
Progression Factor	0.54			0.12		1.00
Incremental Delay, d2	0.3			0.3		0.3
Delay (s)	1.2			0.5		38.7
Level of Service	A			A		D
Approach Delay (s)	1.2			0.5	38.7	
Approach LOS	A			A	D	

Intersection Summary			
HCM 2000 Control Delay	3.7	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.33		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	41.5%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Volume (vph)	10	40	100	100	130	105	30	40	345	5	5	5
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	11	42	105	105	137	111	32	42	363	5	5	5

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total (vph)	158	353	437	16
Volume Left (vph)	11	105	32	5
Volume Right (vph)	105	111	363	5
Hadj (s)	-0.35	-0.09	-0.45	-0.10
Departure Headway (s)	5.3	5.2	4.8	5.9
Degree Utilization, x	0.23	0.51	0.59	0.03
Capacity (veh/h)	612	649	704	501
Control Delay (s)	9.9	13.6	14.4	9.1
Approach Delay (s)	9.9	13.6	14.4	9.1
Approach LOS	A	B	B	A

Intersection Summary			
Delay	13.3		
Level of Service	B		
Intersection Capacity Utilization	63.5%	ICU Level of Service	B
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	100	885	70	115	805	185	135	105	305	35	80	35
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	2.0	4.0		4.0	4.0		4.0	4.0		1.0	4.0	4.0
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	1.00		1.00	1.00	1.00
Frt	1.00	0.99		1.00	0.97		1.00	0.89		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1770	3500		1770	3440		1770	1655		1770	1863	1583
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)	1770	3500		1770	3440		1770	1655		1770	1863	1583
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	105	932	74	121	847	195	142	111	321	37	84	37
RTOR Reduction (vph)	0	6	0	0	18	0	0	111	0	0	0	31
Lane Group Flow (vph)	105	1000	0	121	1024	0	142	321	0	37	84	6
Turn Type	Prot	NA		Prot	NA		Prot	NA		Prot	NA	Perm
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases												4
Actuated Green, G (s)	4.0	37.2		5.0	40.2		14.3	22.4		2.4	10.5	10.5
Effective Green, g (s)	6.0	39.2		7.0	42.2		14.3	25.4		5.4	13.5	13.5
Actuated g/C Ratio	0.07	0.44		0.08	0.47		0.16	0.28		0.06	0.15	0.15
Clearance Time (s)	4.0	6.0		6.0	6.0		4.0	7.0		4.0	7.0	7.0
Vehicle Extension (s)	3.0	2.0		0.2	3.0		3.0	2.0		3.0	2.0	2.0
Lane Grp Cap (vph)	118	1524		137	1612		281	467		106	279	237
v/s Ratio Prot	0.06	0.29		c0.07	c0.30		0.08	c0.19		c0.02	0.05	
v/s Ratio Perm												0.00
v/c Ratio	0.89	0.66		0.88	0.64		0.51	0.69		0.35	0.30	0.02
Uniform Delay, d1	41.7	20.1		41.1	18.1		34.6	28.8		40.6	34.1	32.6
Progression Factor	0.70	0.34		0.75	0.48		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	48.5	2.1		39.3	1.7		1.4	3.3		2.0	0.2	0.0
Delay (s)	77.6	9.0		70.0	10.4		36.0	32.1		42.6	34.3	32.6
Level of Service	E	A		E	B		D	C		D	C	C
Approach Delay (s)		15.5			16.6			33.1			35.8	
Approach LOS		B			B			C			D	

Intersection Summary			
HCM 2000 Control Delay	20.3	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.69		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	72.8%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Sign Control		Stop	Stop		Stop	
Volume (vph)	185	205	260	360	145	95
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	195	216	274	379	153	100

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total (vph)	411	653	253
Volume Left (vph)	195	0	153
Volume Right (vph)	0	379	100
Hadj (s)	0.13	-0.31	-0.08
Departure Headway (s)	5.9	5.1	6.5
Degree Utilization, x	0.67	0.93	0.45
Capacity (veh/h)	592	653	526
Control Delay (s)	19.8	41.7	14.7
Approach Delay (s)	19.8	41.7	14.7
Approach LOS	C	E	B

Intersection Summary			
Delay	29.7		
Level of Service	D		
Intersection Capacity Utilization	80.6%	ICU Level of Service	D
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	90	1135	0	0	1045	30	0	0	0	135	0	60
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0			4.0						4.0	
Lane Util. Factor	1.00	0.95			0.95						1.00	
Frt	1.00	1.00			1.00						0.96	
Flt Protected	0.95	1.00			1.00						0.97	
Satd. Flow (prot)	1770	3539			3524						1726	
Flt Permitted	0.95	1.00			1.00						0.79	
Satd. Flow (perm)	1770	3539			3524						1416	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	95	1195	0	0	1100	32	0	0	0	142	0	63
RTOR Reduction (vph)	0	0	0	0	2	0	0	0	0	0	94	0
Lane Group Flow (vph)	95	1195	0	0	1130	0	0	0	0	0	111	0
Turn Type	Prot	NA		Prot	NA					Perm	NA	
Protected Phases	5	2		1	6			8			4	
Permitted Phases							8			4		
Actuated Green, G (s)	8.5	69.8			57.3						12.2	
Effective Green, g (s)	8.5	69.8			57.3						12.2	
Actuated g/C Ratio	0.09	0.78			0.64						0.14	
Clearance Time (s)	4.0	4.0			4.0						4.0	
Vehicle Extension (s)	3.0	3.0			3.0						3.0	
Lane Grp Cap (vph)	167	2744			2243						191	
v/s Ratio Prot	c0.05	0.34			c0.32							
v/s Ratio Perm											c0.08	
v/c Ratio	0.57	0.44			0.50						0.58	
Uniform Delay, d1	39.0	3.4			8.7						36.5	
Progression Factor	0.60	0.21			1.00						1.00	
Incremental Delay, d2	3.5	0.4			0.8						4.2	
Delay (s)	26.7	1.1			9.6						40.7	
Level of Service	C	A			A						D	
Approach Delay (s)		3.0			9.6			0.0			40.7	
Approach LOS		A			A			A			D	

Intersection Summary			
HCM 2000 Control Delay	8.8	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.52		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	56.0%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Sign Control		Stop	Stop		Stop	
Volume (vph)	100	230	605	65	15	35
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	105	242	637	68	16	37

Direction, Lane #	EB 1	EB 2	WB 1	WB 2	SB 1	SB 2
Volume Total (vph)	105	242	637	68	16	37
Volume Left (vph)	105	0	0	0	16	0
Volume Right (vph)	0	0	0	68	0	37
Hadj (s)	0.53	0.03	0.03	-0.67	0.23	-0.57
Departure Headway (s)	5.6	5.1	4.9	4.2	6.3	3.2
Degree Utilization, x	0.16	0.34	0.86	0.08	0.03	0.03
Capacity (veh/h)	624	689	732	837	530	1121
Control Delay (s)	8.5	9.6	29.4	6.3	9.5	6.3
Approach Delay (s)	9.3		27.1		7.3	
Approach LOS	A		D		A	

Intersection Summary			
Delay	20.6		
Level of Service	C		
Intersection Capacity Utilization	50.7%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	170	2780	170	285	3420	295	80	205	200	20	40	185
Ideal Flow (vphpl)	1920	1920	1920	1920	1920	1920	1920	1920	1920	1920	1920	1920
Total Lost time (s)	4.0	4.0	7.0	4.0	4.0	7.0	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	0.97	0.91	1.00	1.00	0.91	1.00	1.00	0.95	1.00	0.97	0.95	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.88	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	3469	5139	1600	1788	5139	1600	1788	3576	1600	3469	3135	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	3469	5139	1600	1788	5139	1600	1788	3576	1600	3469	3135	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	179	2926	179	300	3600	311	84	216	211	21	42	195
RTOR Reduction (vph)	0	0	47	0	0	32	0	0	41	0	47	0
Lane Group Flow (vph)	179	2926	132	300	3600	279	84	216	170	21	190	0
Turn Type	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	pt+ov	Prot	NA	
Protected Phases	5	2	3	1	6	7	3	8	8 1	7	4	
Permitted Phases			2			6						
Actuated Green, G (s)	7.0	128.8	135.8	32.0	153.8	160.7	7.0	23.8	55.8	6.9	23.7	
Effective Green, g (s)	10.0	132.3	135.8	35.0	157.3	160.7	10.0	26.8	61.8	9.9	26.7	
Actuated g/C Ratio	0.05	0.60	0.62	0.16	0.72	0.73	0.05	0.12	0.28	0.05	0.12	
Clearance Time (s)	7.0	7.5	7.0	7.0	7.5	7.0	7.0	7.0		7.0	7.0	
Vehicle Extension (s)	3.0	0.2	2.0	3.0	0.2	2.0	2.0	4.0		2.0	4.0	
Lane Grp Cap (vph)	157	3090	987	284	3674	1168	81	435	449	156	380	
v/s Ratio Prot	0.05	0.57	0.00	c0.17	c0.70	0.01	c0.05	c0.06	0.11	0.01	c0.06	
v/s Ratio Perm			0.08			0.17						
v/c Ratio	1.14	0.95	0.13	1.06	0.98	0.24	1.04	0.50	0.38	0.13	0.50	
Uniform Delay, d1	105.0	40.6	17.6	92.5	29.8	9.7	105.0	90.3	63.7	100.9	90.4	
Progression Factor	1.00	1.00	1.00	1.22	0.61	1.08	0.94	0.91	1.17	1.00	1.00	
Incremental Delay, d2	114.5	7.8	0.0	33.5	1.8	0.0	94.2	0.9	0.5	0.1	1.4	
Delay (s)	219.5	48.4	17.6	146.6	19.9	10.5	192.7	83.2	75.2	101.1	91.8	
Level of Service	F	D	B	F	B	B	F	F	E	F	F	
Approach Delay (s)		56.1			28.3			97.9			92.6	
Approach LOS		E			C			F			F	

Intersection Summary			
HCM 2000 Control Delay	45.6	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.96		
Actuated Cycle Length (s)	220.0	Sum of lost time (s)	19.0
Intersection Capacity Utilization	94.9%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	20	2960	20	25	3960	100	10	25	10	160	30	30
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0			4.0	4.0		4.0	4.0
Lane Util. Factor	1.00	0.91		1.00	0.91			1.00	1.00		1.00	1.00
Frt	1.00	1.00		1.00	1.00			1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00			0.99	1.00		0.96	1.00
Satd. Flow (prot)	1770	5080		1770	5067			1835	1583		1788	1583
Flt Permitted	0.95	1.00		0.95	1.00			0.58	1.00		0.73	1.00
Satd. Flow (perm)	1770	5080		1770	5067			1083	1583		1367	1583
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	21	3116	21	26	4168	105	11	26	11	168	32	32
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	10	0	0	28
Lane Group Flow (vph)	21	3137	0	26	4273	0	0	37	1	0	200	4
Turn Type	Prot	NA		Prot	NA		Perm	NA	Perm	Perm	NA	Perm
Protected Phases	5	2		1	6			8			4	
Permitted Phases							8		8	4		4
Actuated Green, G (s)	3.2	169.7		6.3	172.8			26.0	26.0		26.0	26.0
Effective Green, g (s)	3.2	172.7		6.3	175.8			29.0	29.0		29.0	29.0
Actuated g/C Ratio	0.01	0.78		0.03	0.80			0.13	0.13		0.13	0.13
Clearance Time (s)	4.0	7.0		4.0	7.0			7.0	7.0		7.0	7.0
Vehicle Extension (s)	3.0	0.2		3.0	0.2			4.0	4.0		4.0	4.0
Lane Grp Cap (vph)	25	3987		50	4048			142	208		180	208
v/s Ratio Prot	c0.01	0.62		0.01	c0.84							
v/s Ratio Perm								0.03	0.00		c0.15	0.00
v/c Ratio	0.84	0.79		0.52	1.06			0.26	0.01		1.11	0.02
Uniform Delay, d1	108.1	13.3		105.4	22.1			85.9	83.0		95.5	83.1
Progression Factor	0.96	0.41		1.00	1.00			1.00	1.00		1.00	1.00
Incremental Delay, d2	60.8	0.7		9.4	31.7			1.3	0.0		100.0	0.1
Delay (s)	164.4	6.1		114.8	53.8			87.2	83.0		195.5	83.2
Level of Service	F	A		F	D			F	F		F	F
Approach Delay (s)		7.1			54.1			86.2			180.0	
Approach LOS		A			D			F			F	

Intersection Summary			
HCM 2000 Control Delay	38.9	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	1.06		
Actuated Cycle Length (s)	220.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	102.5%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

100: Route 50 & US 50 WB On-Ramp Performance by movement

Movement	EBT	EBR	WBT	SWT	SWR	All
Denied Del/Veh (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Del/Veh (s)	44.2	13.1	2.4	0.7	3.3	22.6
Vehicles Entered	2911	648	2122	1	698	6380
Vehicles Exited	2865	646	2124	1	698	6334
Hourly Exit Rate	2865	646	2124	1	698	6334
Input Volume	3435	765	2510	1	735	7446
% of Volume	83	84	85	133	95	85

110: South St & Hillwood Ave Performance by movement

Movement	EBT	EBR	WBL	WBT	NBL	NBR	All
Denied Del/Veh (s)	0.2	0.2	0.0	0.0	0.2	3.3	0.2
Total Del/Veh (s)	4.3	3.9	13.4	2.5	38.3	6.2	6.1
Vehicles Entered	590	105	139	246	34	29	1143
Vehicles Exited	591	106	140	247	35	29	1148
Hourly Exit Rate	591	106	140	247	35	29	1148
Input Volume	600	100	155	266	35	25	1180
% of Volume	99	106	90	93	101	115	97

115: Performance by movement

Movement	EBL	EBT	EBR	NBL	NBT	SBT	SBR	All
Denied Del/Veh (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Del/Veh (s)	29.2	2.6	8.1	13.8	4.6	8.2	6.0	11.5
Vehicles Entered	220	2	399	76	47	225	311	1280
Vehicles Exited	221	2	400	76	47	224	309	1279
Hourly Exit Rate	221	2	400	76	47	224	309	1279
Input Volume	225	1	400	80	50	240	340	1337
% of Volume	98	200	100	95	94	93	91	96

120: Route 7 & N Roosevelt St Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Denied Del/Veh (s)	1.3	0.2	0.2	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Del/Veh (s)	24.4	8.9	5.9	100.8	12.8	10.3	20.4	9.2	5.3	31.4	26.9	12.9
Vehicles Entered	22	604	88	417	807	14	16	35	217	14	31	21
Vehicles Exited	22	602	88	416	809	14	15	36	218	15	31	21
Hourly Exit Rate	22	602	88	416	809	14	15	36	218	15	31	21
Input Volume	25	585	90	460	876	15	15	35	225	15	30	20
% of Volume	87	103	98	90	92	92	98	104	97	98	104	104

120: Route 7 & N Roosevelt St Performance by movement

Movement	All
Denied Del/Veh (s)	0.1
Total Del/Veh (s)	27.4
Vehicles Entered	2286
Vehicles Exited	2287
Hourly Exit Rate	2287
Input Volume	2392
% of Volume	96

125: N Roosevelt St Performance by movement

Movement	WBL	WBR	NBT	NBR	SBL	SBT	All
Denied Del/Veh (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Del/Veh (s)	4.7	2.8	0.7	0.6	2.3	0.9	1.1
Vehicles Entered	4	9	68	5	15	62	163
Vehicles Exited	4	9	68	5	14	62	162
Hourly Exit Rate	4	9	68	5	14	62	162
Input Volume	5	10	71	5	15	60	167
% of Volume	80	88	95	100	92	103	97

130: Roosevelt Blvd & N Roosevelt St Performance by movement

Movement	EBL	EBT	EBR	NBL	NBT	SBT	SBR	All
Denied Del/Veh (s)	0.0		0.0	0.2	0.0	0.3	0.3	0.1
Total Del/Veh (s)	14.8		1.6	55.6	34.1	32.5	20.9	32.3
Vehicles Entered	61	0	15	19	892	702	57	1746
Vehicles Exited	61	0	15	19	889	702	58	1744
Hourly Exit Rate	61	0	15	19	889	702	58	1744
Input Volume	65	0	15	20	935	705	55	1796
% of Volume	94	0	98	94	95	100	105	97

140: US 50 WB On-Ramp Performance by movement

Movement	NBL	NBT	SBT	SBR	All
Denied Del/Veh (s)	0.0	0.0	0.0	0.0	0.0
Total Del/Veh (s)	39.6	2.3	8.5	9.9	19.4
Vehicles Entered	413	124	341	282	1160
Vehicles Exited	416	124	341	282	1163
Hourly Exit Rate	416	124	341	282	1163
Input Volume	450	131	355	285	1221
% of Volume	92	95	96	99	95

145: Castle Rd & US 50 EB Off-Ramp Performance by movement

Movement	EBL	EBT	EBR	NBT	SBT	All
Denied Del/Veh (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Del/Veh (s)	24.0	0.4	25.3	15.3	11.1	18.6
Vehicles Entered	39	1	606	495	341	1482
Vehicles Exited	40	1	608	497	341	1487
Hourly Exit Rate	40	1	608	497	341	1487
Input Volume	50	1	715	530	355	1651
% of Volume	80	133	85	94	96	90

150: Roosevelt Blvd Performance by movement

Movement	EBL	EBR	NBL	NBT	SBT	SBR	All
Denied Del/Veh (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Del/Veh (s)	8.5	5.6	12.1	2.0	5.6	4.9	3.7
Vehicles Entered	10	10	8	878	712	5	1623
Vehicles Exited	10	11	9	878	714	5	1627
Hourly Exit Rate	10	11	9	878	714	5	1627
Input Volume	10	10	10	921	716	5	1672
% of Volume	98	107	88	95	100	100	97

160: Sleepy Hollow Rd & Castle Rd/Castle Pl Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Denied Del/Veh (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Del/Veh (s)	24.5	28.3	21.8	35.2	28.7	22.2	59.8	56.5	59.6	46.3	26.5	9.2
Vehicles Entered	308	530	113	199	232	19	43	342	315	10	355	220
Vehicles Exited	310	531	113	197	231	19	44	343	317	10	356	220
Hourly Exit Rate	310	531	113	197	231	19	44	343	317	10	356	220
Input Volume	350	596	125	215	260	20	45	345	310	10	368	225
% of Volume	89	89	90	92	89	94	98	99	102	98	97	98

160: Sleepy Hollow Rd & Castle Rd/Castle Pl Performance by movement

Movement	All
Denied Del/Veh (s)	0.0
Total Del/Veh (s)	34.2
Vehicles Entered	2686
Vehicles Exited	2691
Hourly Exit Rate	2691
Input Volume	2870
% of Volume	94

165: Sleepy Hollow Rd & Aspen Ln Performance by movement

Movement	EBL	EBR	NBL	NBT	SBT	SBR	All
Denied Del/Veh (s)	0.1	0.1	0.5	0.6	0.0	0.0	0.3
Total Del/Veh (s)	31.8	13.0	9.3	3.8	4.6	3.2	4.9
Vehicles Entered	26	20	39	674	549	111	1419
Vehicles Exited	26	20	39	674	548	110	1417
Hourly Exit Rate	26	20	39	674	548	110	1417
Input Volume	25	20	40	675	586	115	1462
% of Volume	103	99	98	100	93	96	97

170: Sleepy Hollow Rd/Wilson Blvd & Route 7 Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Denied Del/Veh (s)	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.4	0.0	0.0	0.1
Total Del/Veh (s)	74.2	24.1	17.4	37.6	22.3	20.4	57.5	43.1	36.4	63.6	43.0	32.4
Vehicles Entered	219	550	81	113	1043	144	31	647	9	78	391	166
Vehicles Exited	217	551	81	113	1043	144	31	646	10	77	392	166
Hourly Exit Rate	217	551	81	113	1043	144	31	646	10	77	392	166
Input Volume	215	542	85	130	1137	160	35	684	10	80	388	180
% of Volume	101	102	95	87	92	90	89	94	98	96	101	92

170: Sleepy Hollow Rd/Wilson Blvd & Route 7 Performance by movement

Movement	All
Denied Del/Veh (s)	0.1
Total Del/Veh (s)	34.3
Vehicles Entered	3472
Vehicles Exited	3471
Hourly Exit Rate	3471
Input Volume	3645
% of Volume	95

175: Commercial Ent. & Wilson Blvd Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Denied Del/Veh (s)	0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1
Total Del/Veh (s)	8.6	3.3	2.7	9.0	2.1	2.2	21.9	27.8	7.6	23.0	24.9	5.9
Vehicles Entered	70	923	19	41	606	21	11	5	36	10	5	10
Vehicles Exited	70	923	19	41	607	21	10	5	36	10	5	10
Hourly Exit Rate	70	923	19	41	607	21	10	5	36	10	5	10
Input Volume	75	966	20	40	621	20	10	5	35	10	5	10
% of Volume	93	96	94	103	98	104	98	100	104	98	100	98

175: Commercial Ent. & Wilson Blvd Performance by movement

Movement	All
Denied Del/Veh (s)	0.0
Total Del/Veh (s)	3.7
Vehicles Entered	1757
Vehicles Exited	1757
Hourly Exit Rate	1757
Input Volume	1818
% of Volume	97

180: Castle Rd & Route 7 Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Denied Del/Veh (s)	0.3	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0
Total Del/Veh (s)	80.4	19.8	9.3	33.8	21.6	6.6	38.6	37.1	14.0	100.6	27.1	19.4
Vehicles Entered	200	411	21	276	1037	291	23	230	606	118	152	229
Vehicles Exited	200	412	21	276	1037	291	23	231	607	118	152	230
Hourly Exit Rate	200	412	21	276	1037	291	23	231	607	118	152	230
Input Volume	195	412	20	305	1136	310	25	246	645	135	170	255
% of Volume	102	100	104	90	91	94	91	94	94	87	89	90

180: Castle Rd & Route 7 Performance by movement

Movement	All
Denied Del/Veh (s)	0.0
Total Del/Veh (s)	27.0
Vehicles Entered	3594
Vehicles Exited	3598
Hourly Exit Rate	3598
Input Volume	3856
% of Volume	93

190: Castle Rd Performance by movement

Movement	NBT	NBR	SBL	SBT	All
Denied Del/Veh (s)	0.0	0.0	0.0	0.0	0.0
Total Del/Veh (s)	1.1	1.9	8.6	3.1	2.6
Vehicles Entered	303	418	86	500	1307
Vehicles Exited	303	419	86	499	1307
Hourly Exit Rate	303	419	86	499	1307
Input Volume	316	435	105	560	1416
% of Volume	96	96	82	89	92

195: Castle Rd Performance by movement

Movement	NBT	SBT	NWL	NWT	NWR	All
Denied Del/Veh (s)	0.0	0.0	0.0		0.0	0.0
Total Del/Veh (s)	12.5	9.4	30.4		10.0	17.5
Vehicles Entered	302	233	350	0	168	1053
Vehicles Exited	302	233	353	0	169	1057
Hourly Exit Rate	302	233	353	0	169	1057
Input Volume	315	240	425	0	195	1176
% of Volume	96	97	83	0	87	90

200: Route 7 & Task Force Bridge Performance by movement

Movement	EBL	EBT	WBT	WBR	SBL	SBT	SBR	All
Denied Del/Veh (s)	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0
Total Del/Veh (s)	25.3	2.7	2.7	1.6	53.4	0.8	52.6	3.9
Vehicles Entered	41	1084	1576	58	22	2	28	2811
Vehicles Exited	40	1083	1576	58	22	2	28	2809
Hourly Exit Rate	40	1083	1576	58	22	2	28	2809
Input Volume	40	1141	1715	65	25	1	35	3022
% of Volume	101	95	92	89	87	160	81	93

210: Route 7 & Seven Corners Ctr Performance by movement

Movement	EBL	EBT	WBT	WBR	SBL	SBR	All
Denied Del/Veh (s)	0.0	0.0	0.0	0.0	3.8	0.7	0.2
Total Del/Veh (s)	28.2	5.1	7.3	4.3	48.4	44.3	10.5
Vehicles Entered	126	979	1553	282	183	84	3207
Vehicles Exited	125	981	1550	281	182	84	3203
Hourly Exit Rate	125	981	1550	281	182	84	3203
Input Volume	140	1025	1700	300	185	80	3431
% of Volume	89	96	91	94	98	105	93

220: Patrick Henry Drive & Route 7 Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Denied Del/Veh (s)	0.0	0.0	0.0	2.2	1.3	2.5	1949.8	1961.5	2046.8	0.0	0.0	0.1
Total Del/Veh (s)	39.4	3.7	3.2	16.1	18.8	16.7	3578.9	3569.2	3333.3	56.9	57.2	35.9
Vehicles Entered	172	934	48	21	1670	213	0	0	0	150	19	158
Vehicles Exited	172	934	48	21	1676	212	0	0	0	150	18	159
Hourly Exit Rate	172	934	48	21	1676	212	0	0	0	150	18	159
Input Volume	170	981	50	20	1640	210	155	200	50	200	25	205
% of Volume	101	95	96	104	102	101	0	0	0	75	71	78

220: Patrick Henry Drive & Route 7 Performance by movement

Movement	All
Denied Del/Veh (s)	227.9
Total Del/Veh (s)	69.8
Vehicles Entered	3385
Vehicles Exited	3390
Hourly Exit Rate	3390
Input Volume	3905
% of Volume	87

230: Route 50 Performance by movement

Movement	EBT	WBT	WBR	All
Denied Del/Veh (s)	0.0	0.0	0.0	0.0
Total Del/Veh (s)	4.1	6.4	7.6	5.3
Vehicles Entered	3181	2110	516	5807
Vehicles Exited	3181	2111	518	5810
Hourly Exit Rate	3181	2111	518	5810
Input Volume	3976	2511	620	7106
% of Volume	80	84	84	82

231: Route 50 Performance by movement

Movement	EBT	WBT	NET	NER	All
Denied Del/Veh (s)	0.0	0.0		0.0	0.0
Total Del/Veh (s)	283.1	0.9		1.4	150.3
Vehicles Entered	2792	2111	0	505	5408
Vehicles Exited	2677	2111	0	504	5292
Hourly Exit Rate	2677	2111	0	504	5292
Input Volume	3435	2510	0	540	6486
% of Volume	78	84	0	93	82

245: Peyton Randolph/Peyton Randolph Dr Performance by movement

Movement	WBL	WBT	WBR	NBT	NBR	SBL	SBT	All
Denied Del/Veh (s)	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.0
Total Del/Veh (s)	6.0	1.9	4.5	5.7	2.7	5.0	6.5	4.9
Vehicles Entered	8	8	45	18	11	90	22	202
Vehicles Exited	8	8	45	17	11	90	22	201
Hourly Exit Rate	8	8	45	17	11	90	22	201
Input Volume	10	10	50	15	10	95	20	211
% of Volume	78	80	90	111	107	95	109	95

250: Castle Rd/Roosevelt Blvd & Wilson Blvd Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Denied Del/Veh (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Del/Veh (s)	28.3	19.4	15.5	57.8	37.9	47.1	47.3	35.4	28.5	58.0	39.6	31.7
Vehicles Entered	226	723	5	26	356	347	92	315	65	295	202	227
Vehicles Exited	226	723	5	26	359	346	92	314	65	297	203	228
Hourly Exit Rate	226	723	5	26	359	346	92	314	65	297	203	228
Input Volume	245	745	5	30	362	345	100	340	70	290	206	230
% of Volume	92	97	100	87	99	100	92	92	93	102	99	99

250: Castle Rd/Roosevelt Blvd & Wilson Blvd Performance by movement

Movement	All
Denied Del/Veh (s)	0.0
Total Del/Veh (s)	35.3
Vehicles Entered	2879
Vehicles Exited	2884
Hourly Exit Rate	2884
Input Volume	2968
% of Volume	97

260: Peyton Randolph Dr/Shopping Center & Wilson Blvd Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Denied Del/Veh (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.1	0.2	0.1
Total Del/Veh (s)	16.7	3.8	3.2	13.6	4.5	4.0	42.2	29.3	12.8	54.1	50.3	12.7
Vehicles Entered	39	988	57	27	687	106	19	34	9	9	14	21
Vehicles Exited	39	988	57	27	687	106	20	34	9	9	14	21
Hourly Exit Rate	39	988	57	27	687	106	20	34	9	9	14	21
Input Volume	40	1010	55	30	696	110	20	35	10	10	15	20
% of Volume	98	98	104	91	99	96	99	98	88	88	92	104

260: Peyton Randolph Dr/Shopping Center & Wilson Blvd Performance by movement

Movement	All
Denied Del/Veh (s)	0.0
Total Del/Veh (s)	5.9
Vehicles Entered	2010
Vehicles Exited	2011
Hourly Exit Rate	2011
Input Volume	2052
% of Volume	98

270: Task Force Bridge & Wilson Blvd Performance by movement

Movement	EBT	EBR	WBT	NBR	All
Denied Del/Veh (s)	0.0	0.0	0.0	0.0	0.0
Total Del/Veh (s)	1.2	0.9	2.6	11.8	2.3
Vehicles Entered	989	16	820	101	1926
Vehicles Exited	988	16	820	100	1924
Hourly Exit Rate	988	16	820	100	1924
Input Volume	1015	15	835	110	1975
% of Volume	97	105	98	91	97

275: Task Force Bridge & Willston Dr Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Denied Del/Veh (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1
Total Del/Veh (s)	4.6	5.7	3.3	5.9	3.8	4.4	5.3	6.0	4.0	4.5	4.9	2.8
Vehicles Entered	18	72	11	30	120	30	8	52	38	20	10	6
Vehicles Exited	18	72	11	30	120	30	8	52	39	20	10	7
Hourly Exit Rate	18	72	11	30	120	30	8	52	39	20	10	7
Input Volume	20	74	10	40	135	35	10	55	40	20	10	5
% of Volume	89	97	107	75	89	86	78	95	98	99	98	140

275: Task Force Bridge & Willston Dr Performance by movement

Movement	All
Denied Del/Veh (s)	0.0
Total Del/Veh (s)	4.7
Vehicles Entered	415
Vehicles Exited	417
Hourly Exit Rate	417
Input Volume	455
% of Volume	92

280: John Marshall Dr/N McKinley Rd & Wilson Blvd Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Denied Del/Veh (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.9	0.4	3.7
Total Del/Veh (s)	44.4	9.4	8.3	50.7	12.9	12.9	45.5	17.7	15.3	43.6	34.6	7.2
Vehicles Entered	108	964	17	14	771	90	12	45	171	50	80	41
Vehicles Exited	108	963	17	14	769	90	12	45	171	50	80	41
Hourly Exit Rate	108	963	17	14	769	90	12	45	171	50	80	41
Input Volume	110	1000	15	15	781	90	15	55	210	50	80	40
% of Volume	98	96	111	92	98	100	79	82	82	100	100	103

280: John Marshall Dr/N McKinley Rd & Wilson Blvd Performance by movement

Movement	All
Denied Del/Veh (s)	0.2
Total Del/Veh (s)	14.9
Vehicles Entered	2363
Vehicles Exited	2360
Hourly Exit Rate	2360
Input Volume	2461
% of Volume	96

285: Willston Dr/Willston Dr. & John Marshall Dr Performance by movement

Movement	EBL	EBT	WBT	WBR	SBL	SBT	SBR	All
Denied Del/Veh (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Del/Veh (s)	5.7	5.2	8.4	7.9	7.3	1.5	5.9	7.1
Vehicles Entered	31	97	143	197	40	12	60	580
Vehicles Exited	31	97	143	197	40	12	60	580
Hourly Exit Rate	31	97	143	197	40	12	60	580
Input Volume	35	96	180	245	40	11	60	667
% of Volume	89	101	79	80	101	109	100	87

290: Patrick Henry & Wilson Blvd Performance by movement

Movement	EBL	EBT	WBT	WBR	SBL	SBR	All
Denied Del/Veh (s)	0.0	0.0	0.2	0.2	0.2	0.2	0.1
Total Del/Veh (s)	35.5	3.7	9.6	7.2	40.7	21.0	10.8
Vehicles Entered	219	966	797	20	51	77	2130
Vehicles Exited	219	965	798	20	51	77	2130
Hourly Exit Rate	219	965	798	20	51	77	2130
Input Volume	240	1020	805	20	50	80	2216
% of Volume	91	95	99	99	102	96	96

295: Willston Dr./Patrick Henry Dr & Patrick Henry Performance by movement

Movement	EBL	EBT	WBT	WBR	SBL	SBR	All
Denied Del/Veh (s)	0.0	0.0	0.0	0.0	0.3	3.9	0.4
Total Del/Veh (s)	6.5	6.7	9.8	3.6	5.3	1.1	7.1
Vehicles Entered	24	97	287	53	121	54	636
Vehicles Exited	24	97	287	53	121	54	636
Hourly Exit Rate	24	97	287	53	121	54	636
Input Volume	25	95	371	70	130	55	746
% of Volume	95	102	77	75	93	98	85

300: Patrick Henry Dr & Route 50 Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Denied Del/Veh (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Del/Veh (s)	92.8	37.1	21.1	672.7	87.8	64.1	134.5	47.6	72.1	130.4	65.9	56.0
Vehicles Entered	45	2949	187	120	2552	209	50	133	202	117	38	50
Vehicles Exited	44	2947	188	96	2526	209	51	133	200	113	38	50
Hourly Exit Rate	44	2947	188	96	2526	209	51	133	200	113	38	50
Input Volume	60	3680	235	150	3001	250	80	199	300	120	40	50
% of Volume	73	80	80	64	84	84	64	67	67	94	94	100

300: Patrick Henry Dr & Route 50 Performance by movement

Movement	All
Denied Del/Veh (s)	0.0
Total Del/Veh (s)	73.5
Vehicles Entered	6652
Vehicles Exited	6595
Hourly Exit Rate	6595
Input Volume	8166
% of Volume	81

310: Olin Drive & Route 50 Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NEL	NET	NER	SWL	SWT	SWR
Denied Del/Veh (s)	0.0	0.0	0.0	181.6	193.2	198.4	0.1	0.1	0.1	0.1	0.2	0.1
Total Del/Veh (s)	98.1	17.0	20.8	145.7	67.3	72.3	82.9	86.7	31.7	83.4	74.0	52.3
Vehicles Entered	41	3149	70	33	2859	142	44	31	40	29	17	25
Vehicles Exited	40	3145	70	34	2814	141	43	31	40	29	17	25
Hourly Exit Rate	40	3145	70	34	2814	141	43	31	40	29	17	25
Input Volume	50	3961	90	35	3335	165	40	30	40	30	15	25
% of Volume	80	79	78	98	84	85	108	104	101	97	111	99

310: Olin Drive & Route 50 Performance by movement

Movement	All
Denied Del/Veh (s)	97.2
Total Del/Veh (s)	43.2
Vehicles Entered	6480
Vehicles Exited	6429
Hourly Exit Rate	6429
Input Volume	7815
% of Volume	82

Total Network Performance

Denied Del/Veh (s)	153.0
Total Del/Veh (s)	218.1
Vehicles Entered	13604
Vehicles Exited	13273
Hourly Exit Rate	13273
Input Volume	119292
% of Volume	11

Intersection: 100: Route 50 & US 50 WB On-Ramp

Movement	EB	EB	EB	EB	B101	B101	B101	WB	WB	SW
Directions Served	T	T	TR	R	T	T	T	T	T	R
Maximum Queue (ft)	600	597	602	425	659	665	673	15	2	91
Average Queue (ft)	390	390	391	278	383	428	430	1	0	11
95th Queue (ft)	815	811	814	610	867	923	928	8	2	58
Link Distance (ft)	491	491	491		624	624	624	809	809	1109
Upstream Blk Time (%)	49	44	37		9	26	47			
Queuing Penalty (veh)	0	0	0		0	0	0			
Storage Bay Dist (ft)				400						
Storage Blk Time (%)			33	1						
Queuing Penalty (veh)			124	21						

Intersection: 110: South St & Hillwood Ave

Movement	EB	EB	WB	WB	NB	NB
Directions Served	T	TR	LT	T	L	R
Maximum Queue (ft)	107	180	122	94	57	39
Average Queue (ft)	28	59	57	26	20	7
95th Queue (ft)	81	141	105	70	47	23
Link Distance (ft)	1757	1757	235	235	1116	
Upstream Blk Time (%)						
Queuing Penalty (veh)						
Storage Bay Dist (ft)						250
Storage Blk Time (%)						
Queuing Penalty (veh)						

Intersection: 115:

Movement	EB	EB	NB	NB	NB	SB	SB
Directions Served	L	R	L	T	T	T	TR
Maximum Queue (ft)	231	204	92	21	50	105	181
Average Queue (ft)	113	84	35	1	9	22	92
95th Queue (ft)	197	150	76	10	35	69	167
Link Distance (ft)	235	235		267	267	177	177
Upstream Blk Time (%)	0	0				0	1
Queuing Penalty (veh)	1	0				0	2
Storage Bay Dist (ft)			200				
Storage Blk Time (%)							
Queuing Penalty (veh)							

Intersection: 120: Route 7 & N Roosevelt St

Movement	EB	EB	EB	WB	WB	WB	WB	NB	NB	NB	SB	SB
Directions Served	L	T	TR	L	L	T	TR	L	T	TR	L	TR
Maximum Queue (ft)	90	191	192	362	375	732	663	37	37	131	52	100
Average Queue (ft)	18	84	65	173	282	283	221	7	7	43	14	32
95th Queue (ft)	58	158	135	425	437	753	628	28	27	100	41	76
Link Distance (ft)		2206	2206			1071	1071	177	177	177	252	252
Upstream Blk Time (%)							0					
Queuing Penalty (veh)							0					
Storage Bay Dist (ft)	100			350	350							
Storage Blk Time (%)	0	4		1	25	0						
Queuing Penalty (veh)	0	1		3	109	2						

Intersection: 125: N Roosevelt St

Movement	WB	SB
Directions Served	LR	LT
Maximum Queue (ft)	33	17
Average Queue (ft)	9	1
95th Queue (ft)	30	9
Link Distance (ft)	546	1420
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 130: Roosevelt Blvd & N Roosevelt St

Movement	EB	NB	NB	NB	SB	SB
Directions Served	L	L	T	T	T	TR
Maximum Queue (ft)	84	160	401	416	412	343
Average Queue (ft)	26	30	229	242	231	194
95th Queue (ft)	66	103	362	372	348	301
Link Distance (ft)	1420		1010	1010	510	510
Upstream Blk Time (%)					0	
Queuing Penalty (veh)					0	
Storage Bay Dist (ft)		150				
Storage Blk Time (%)		0	24			
Queuing Penalty (veh)		0	5			

Intersection: 140: US 50 WB On-Ramp

Movement	NB	NB	SB	SB	SB
Directions Served	L	T	T	T	R
Maximum Queue (ft)	250	315	133	157	185
Average Queue (ft)	209	111	55	43	82
95th Queue (ft)	280	343	111	107	154
Link Distance (ft)		270	267	267	
Upstream Blk Time (%)		8		0	
Queuing Penalty (veh)		23		0	
Storage Bay Dist (ft)	225				200
Storage Blk Time (%)	17	1			0
Queuing Penalty (veh)	11	3			1

Intersection: 145: Castle Rd & US 50 EB Off-Ramp

Movement	EB	EB	EB	NB	NB	SB	SB
Directions Served	L	LR	R	T	T	T	T
Maximum Queue (ft)	67	291	215	313	72	156	122
Average Queue (ft)	24	161	115	149	17	62	44
95th Queue (ft)	57	248	188	283	53	126	95
Link Distance (ft)	1031	1031		590	590	270	270
Upstream Blk Time (%)							
Queuing Penalty (veh)							
Storage Bay Dist (ft)			350				
Storage Blk Time (%)		0					
Queuing Penalty (veh)		0					

Intersection: 150: Roosevelt Blvd

Movement	EB	NB	NB	NB	SB	SB
Directions Served	LR	L	T	T	T	TR
Maximum Queue (ft)	46	33	72	88	146	123
Average Queue (ft)	15	5	12	19	12	10
95th Queue (ft)	42	23	46	64	69	56
Link Distance (ft)	900		590	590	1010	1010
Upstream Blk Time (%)						
Queuing Penalty (veh)						
Storage Bay Dist (ft)		125				
Storage Blk Time (%)			0			
Queuing Penalty (veh)			0			

Intersection: 160: Sleepy Hollow Rd & Castle Rd/Castle Pl

Movement	EB	EB	EB	WB	WB	NB	NB	NB	SB	SB	SB
Directions Served	L	T	TR	L	TR	L	T	TR	L	T	R
Maximum Queue (ft)	224	361	301	222	242	170	618	760	167	290	156
Average Queue (ft)	146	167	151	114	124	45	132	404	15	177	68
95th Queue (ft)	243	294	258	192	206	113	526	775	66	295	126
Link Distance (ft)		590	590	333	333		909	909		277	277
Upstream Blk Time (%)					0		0	1		1	
Queuing Penalty (veh)					0		0	2		4	
Storage Bay Dist (ft)	200					250			200		
Storage Blk Time (%)	2	3				0	0			9	
Queuing Penalty (veh)	6	12				0	0			1	

Intersection: 165: Sleepy Hollow Rd & Aspen Ln

Movement	EB	NB	SB
Directions Served	LR	LT	TR
Maximum Queue (ft)	90	266	17
Average Queue (ft)	35	49	1
95th Queue (ft)	71	161	8
Link Distance (ft)	755	1274	909
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 170: Sleepy Hollow Rd/Wilson Blvd & Route 7

Movement	EB	EB	EB	WB	WB	WB	NB	NB	NB	SB	SB	SB
Directions Served	L	T	TR	L	T	TR	L	T	TR	L	T	TR
Maximum Queue (ft)	348	319	245	214	294	285	78	292	292	177	318	334
Average Queue (ft)	187	146	125	65	129	120	32	218	195	70	157	181
95th Queue (ft)	322	256	214	154	252	243	69	289	275	137	268	295
Link Distance (ft)		1071	1071		581	581	277	277	277		458	458
Upstream Blk Time (%)								1	0		0	0
Queuing Penalty (veh)								2	1		0	0
Storage Bay Dist (ft)	400			250						350		
Storage Blk Time (%)	1	0			1						0	
Queuing Penalty (veh)	2	0			2						0	

Intersection: 175: Commercial Ent. & Wilson Blvd

Movement	EB	EB	WB	WB	WB	NB	NB	SB	SB
Directions Served	L	TR	L	T	TR	L	TR	L	TR
Maximum Queue (ft)	67	2	56	18	17	34	72	40	47
Average Queue (ft)	26	0	15	1	1	9	25	9	13
95th Queue (ft)	58	3	41	10	9	30	56	31	38
Link Distance (ft)		458		415	415	221	221	337	337
Upstream Blk Time (%)									
Queuing Penalty (veh)									
Storage Bay Dist (ft)	75		75						
Storage Blk Time (%)	0		0	0					
Queuing Penalty (veh)	1		0	0					

Intersection: 180: Castle Rd & Route 7

Movement	EB	EB	EB	WB	WB	WB	WB	NB	NB	B181	B181	SB
Directions Served	L	T	TR	L	T	T	R	LTR	R	T	T	L
Maximum Queue (ft)	125	393	335	224	435	371	167	316	242	137	32	195
Average Queue (ft)	111	168	92	138	207	200	67	235	112	14	1	116
95th Queue (ft)	147	363	231	245	373	351	132	337	210	73	19	205
Link Distance (ft)		581	581		768	768	768	243	243	333	333	
Upstream Blk Time (%)								11	0			
Queuing Penalty (veh)								52	1			
Storage Bay Dist (ft)	100			200								175
Storage Blk Time (%)	52	2		3	4							15
Queuing Penalty (veh)	104	5		16	14							13

Intersection: 180: Castle Rd & Route 7

Movement	SB	SB
Directions Served	T	TR
Maximum Queue (ft)	243	241
Average Queue (ft)	75	125
95th Queue (ft)	208	229
Link Distance (ft)	223	223
Upstream Blk Time (%)	7	1
Queuing Penalty (veh)	19	3
Storage Bay Dist (ft)		
Storage Blk Time (%)	2	
Queuing Penalty (veh)	2	

Intersection: 190: Castle Rd

Movement	NB	NB	SB	SB	SB
Directions Served	T	R	L	T	T
Maximum Queue (ft)	4	55	87	92	97
Average Queue (ft)	0	9	35	12	6
95th Queue (ft)	3	33	75	72	43
Link Distance (ft)	223			263	263
Upstream Blk Time (%)					0
Queuing Penalty (veh)					0
Storage Bay Dist (ft)		175	225		
Storage Blk Time (%)					
Queuing Penalty (veh)					

Intersection: 195: Castle Rd

Movement	NB	NB	SB	SB	NW	NW	NW
Directions Served	T	T	T	T	L	LR	R
Maximum Queue (ft)	103	114	173	167	230	265	88
Average Queue (ft)	53	59	38	38	102	122	37
95th Queue (ft)	89	101	115	111	180	211	69
Link Distance (ft)	263	263	525	525	1153	1153	
Upstream Blk Time (%)							
Queuing Penalty (veh)							
Storage Bay Dist (ft)							350
Storage Blk Time (%)							
Queuing Penalty (veh)							

Intersection: 200: Route 7 & Task Force Bridge

Movement	EB	EB	EB	EB	WB	WB	WB	SB	SB
Directions Served	L	T	T	T	T	T	TR	L	R
Maximum Queue (ft)	75	104	93	105	58	57	54	68	77
Average Queue (ft)	27	28	27	39	13	14	10	23	26
95th Queue (ft)	63	81	73	95	42	43	38	57	65
Link Distance (ft)		768	768	768	524	524	524		1528
Upstream Blk Time (%)									
Queuing Penalty (veh)									
Storage Bay Dist (ft)	250							250	
Storage Blk Time (%)									
Queuing Penalty (veh)									

Intersection: 210: Route 7 & Seven Corners Ctr

Movement	EB	EB	EB	EB	WB	WB	WB	WB	SB	SB
Directions Served	L	T	T	T	T	T	T	R	L	R
Maximum Queue (ft)	179	120	131	148	238	228	149	66	174	274
Average Queue (ft)	72	54	66	79	69	69	46	16	125	82
95th Queue (ft)	132	107	115	134	158	153	107	49	189	196
Link Distance (ft)		524	524	524	411	411	411			331
Upstream Blk Time (%)										0
Queuing Penalty (veh)										0
Storage Bay Dist (ft)	400							250	150	
Storage Blk Time (%)									9	1
Queuing Penalty (veh)									7	2

Intersection: 220: Patrick Henry Drive & Route 7

Movement	EB	EB	EB	EB	EB	WB	WB	WB	WB	NB	NB	NB
Directions Served	L	T	T	T	R	L	T	T	TR	L	T	TR
Maximum Queue (ft)	164	107	75	88	23	143	431	414	404	111	529	494
Average Queue (ft)	91	14	25	33	2	16	239	203	223	111	529	494
95th Queue (ft)	154	63	63	72	11	75	372	347	352	143	579	578
Link Distance (ft)		411	411	411			872	872			545	545
Upstream Blk Time (%)											89	33
Queuing Penalty (veh)											0	0
Storage Bay Dist (ft)	150				100	250			425	100		
Storage Blk Time (%)	2			0			5	0	1	89	56	
Queuing Penalty (veh)	8			0			1	0	3	89	86	

Intersection: 220: Patrick Henry Drive & Route 7

Movement	SB	SB	SB
Directions Served	L	LT	R
Maximum Queue (ft)	175	237	194
Average Queue (ft)	65	96	105
95th Queue (ft)	126	172	186
Link Distance (ft)		804	
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)	275		175
Storage Blk Time (%)		0	2
Queuing Penalty (veh)		0	5

Intersection: 230: Route 50

Movement	EB	EB	EB	EB	WB	WB	WB
Directions Served	T	T	T	T	T	TR	R
Maximum Queue (ft)	2	57	60	66	7	108	62
Average Queue (ft)	0	10	16	16	0	4	7
95th Queue (ft)	2	40	50	51	5	73	35
Link Distance (ft)	44	44	44	44	644	644	
Upstream Blk Time (%)		1	1	1		0	
Queuing Penalty (veh)		6	9	11		0	
Storage Bay Dist (ft)							300
Storage Blk Time (%)							
Queuing Penalty (veh)							

Intersection: 231: Route 50

Movement	EB	EB	EB	B103	B103	B103	NE
Directions Served	T	T	T	T	T	T	R
Maximum Queue (ft)	2771	2770	2770	817	820	816	106
Average Queue (ft)	2602	2615	2615	560	572	574	14
95th Queue (ft)	3129	3108	3102	1072	1089	1092	66
Link Distance (ft)	2657	2657	2657	809	809	809	849
Upstream Blk Time (%)	64	78	80	0	0	0	
Queuing Penalty (veh)	741	900	915	2	4	3	
Storage Bay Dist (ft)							
Storage Blk Time (%)							
Queuing Penalty (veh)							

Intersection: 245: Peyton Randolph/Peyton Randolph Dr

Movement	WB	NB	SB
Directions Served	LR	TR	LT
Maximum Queue (ft)	46	34	59
Average Queue (ft)	27	20	34
95th Queue (ft)	48	44	54
Link Distance (ft)	219	325	432
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 250: Castle Rd/Roosevelt Blvd & Wilson Blvd

Movement	EB	EB	EB	WB	WB	WB	NB	NB	NB	SB	SB	SB
Directions Served	L	T	TR	L	T	TR	L	T	TR	L	T	TR
Maximum Queue (ft)	229	262	258	109	432	504	138	187	218	324	414	365
Average Queue (ft)	111	139	141	29	147	252	74	99	124	231	135	185
95th Queue (ft)	189	245	240	90	336	450	130	158	187	351	327	317
Link Distance (ft)		415	415		548	548		525	525		590	590
Upstream Blk Time (%)					0	2						
Queuing Penalty (veh)					2	6						
Storage Bay Dist (ft)	300			325			250			300		
Storage Blk Time (%)	0	0			1			0		7	0	
Queuing Penalty (veh)	0	0			0			0		7	0	

Intersection: 260: Peyton Randolph Dr/Shopping Center & Wilson Blvd

Movement	EB	EB	EB	WB	WB	WB	NB	NB	SB	SB
Directions Served	L	T	TR	L	T	TR	L	TR	L	TR
Maximum Queue (ft)	74	98	102	78	155	187	62	86	44	67
Average Queue (ft)	25	21	28	20	22	42	19	28	11	28
95th Queue (ft)	59	64	76	59	104	142	51	65	35	59
Link Distance (ft)		548	548		298	298		432		438
Upstream Blk Time (%)					0	0				
Queuing Penalty (veh)					0	2				
Storage Bay Dist (ft)	175			225			150		75	
Storage Blk Time (%)		0			0					1
Queuing Penalty (veh)		0			0					0

Intersection: 270: Task Force Bridge & Wilson Blvd

Movement	EB	EB	WB	WB	NB
Directions Served	T	TR	T	T	R
Maximum Queue (ft)	22	28	84	101	92
Average Queue (ft)	1	1	5	7	44
95th Queue (ft)	13	12	40	53	77
Link Distance (ft)	298	298	329	329	538
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (ft)					
Storage Blk Time (%)					
Queuing Penalty (veh)					

Intersection: 275: Task Force Bridge & Willston Dr

Movement	EB	WB	NB	SB
Directions Served	LTR	LTR	LTR	LTR
Maximum Queue (ft)	52	59	69	39
Average Queue (ft)	31	33	32	23
95th Queue (ft)	45	48	56	46
Link Distance (ft)	219	345	1528	538
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 280: John Marshall Dr/N McKinley Rd & Wilson Blvd

Movement	EB	EB	EB	WB	WB	WB	NB	NB	SB	SB	SB
Directions Served	L	T	TR	L	T	TR	L	TR	L	T	R
Maximum Queue (ft)	164	223	196	58	242	268	67	176	102	122	72
Average Queue (ft)	69	98	97	15	74	110	13	82	40	57	22
95th Queue (ft)	134	185	177	45	170	211	46	147	85	109	55
Link Distance (ft)		329	329		734	734		697		452	
Upstream Blk Time (%)											
Queuing Penalty (veh)											
Storage Bay Dist (ft)	150			100			150		200		200
Storage Blk Time (%)	1	2			2			1			
Queuing Penalty (veh)	4	2			0			0			

Intersection: 285: Willston Dr/Willston Dr. & John Marshall Dr

Movement	EB	WB	SB
Directions Served	LT	TR	LR
Maximum Queue (ft)	63	82	91
Average Queue (ft)	34	46	44
95th Queue (ft)	51	70	77
Link Distance (ft)	345	472	697
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 290: Patrick Henry & Wilson Blvd

Movement	EB	EB	EB	WB	WB	SB
Directions Served	L	T	T	T	TR	LTR
Maximum Queue (ft)	216	138	149	191	202	150
Average Queue (ft)	108	33	52	89	103	59
95th Queue (ft)	183	98	121	166	184	123
Link Distance (ft)		734	734	1274	1274	513
Upstream Blk Time (%)						
Queuing Penalty (veh)						
Storage Bay Dist (ft)	250					
Storage Blk Time (%)	0					
Queuing Penalty (veh)	1					

Intersection: 295: Willston Dr./Patrick Henry Dr & Patrick Henry

Movement	EB	EB	WB	WB	SB	SB
Directions Served	L	T	T	R	L	R
Maximum Queue (ft)	49	65	147	57	55	34
Average Queue (ft)	18	32	65	27	26	2
95th Queue (ft)	45	52	114	51	48	18
Link Distance (ft)		472	634	634	383	
Upstream Blk Time (%)						
Queuing Penalty (veh)						
Storage Bay Dist (ft)	150					200
Storage Blk Time (%)						
Queuing Penalty (veh)						

Intersection: 300: Patrick Henry Dr & Route 50

Movement	EB	EB	EB	EB	EB	EB	WB	WB	WB	WB	WB	NB
Directions Served	L	L	T	T	T	R	L	T	T	T	R	L
Maximum Queue (ft)	85	168	656	664	671	275	275	1260	1279	1284	325	156
Average Queue (ft)	35	18	514	531	529	105	268	1057	1074	1082	125	69
95th Queue (ft)	75	101	755	758	763	305	300	1603	1616	1607	365	140
Link Distance (ft)		644	644	644	644			1229	1229	1229		
Upstream Blk Time (%)			1	1	1			4	6	6		
Queuing Penalty (veh)			7	9	12			45	69	70		
Storage Bay Dist (ft)	500					250	250				300	275
Storage Blk Time (%)					26	0	84	8		22	0	
Queuing Penalty (veh)					60	0	836	12		56	1	

Intersection: 300: Patrick Henry Dr & Route 50

Movement	NB	NB	NB	SB	SB	SB	SB
Directions Served	T	T	R	L	L	T	TR
Maximum Queue (ft)	171	348	175	158	177	93	120
Average Queue (ft)	59	123	144	74	99	35	49
95th Queue (ft)	117	311	204	140	160	80	102
Link Distance (ft)	601	601				634	634
Upstream Blk Time (%)							
Queuing Penalty (veh)							
Storage Bay Dist (ft)			150	300	300		
Storage Blk Time (%)	0	0	26				
Queuing Penalty (veh)	0	1	17				

Intersection: 310: Olin Drive & Route 50

Movement	EB	EB	EB	EB	WB	WB	WB	WB	NE	NE	SW	SW
Directions Served	L	T	T	TR	L	T	T	TR	LT	R	LT	R
Maximum Queue (ft)	128	236	471	393	274	796	791	802	189	80	127	80
Average Queue (ft)	47	121	169	181	95	676	692	711	79	28	51	22
95th Queue (ft)	105	235	365	355	262	974	963	959	153	65	105	60
Link Distance (ft)		1229	1229	1229		751	751	751	416	416	341	341
Upstream Blk Time (%)			0	0		21	30	48				
Queuing Penalty (veh)			0	0		0	0	0				
Storage Bay Dist (ft)	250				250							
Storage Blk Time (%)		0			0	43						
Queuing Penalty (veh)		0			0	15						

Network Summary

Network wide Queuing Penalty: 4600

100: Route 50 & US 50 WB On-Ramp Performance by movement

Movement	EBT	EBR	WBT	SWR	All
Denied Del/Veh (s)	0.0	0.0	0.0	0.0	0.0
Total Del/Veh (s)	7.6	3.6	3.0	5.2	5.2
Vehicles Entered	3237	1285	2655	1098	8275
Vehicles Exited	3189	1275	2655	1090	8209
Hourly Exit Rate	2551	1020	2124	872	6567
Input Volume	2636	1051	2720	1042	7449
% of Volume	97	97	78	84	88

110: South St & Hillwood Ave Performance by movement

Movement	EBT	EBR	WBL	WBT	NBL	NBR	All
Denied Del/Veh (s)	0.2	0.2	0.0	0.0	0.2	3.5	0.1
Total Del/Veh (s)	4.1	2.6	16.4	1.4	45.1	6.0	6.7
Vehicles Entered	767	96	407	408	14	17	1709
Vehicles Exited	757	95	405	407	13	17	1694
Hourly Exit Rate	606	76	324	326	10	14	1355
Input Volume	623	75	394	399	10	15	1515
% of Volume	97	101	82	82	102	89	89

115: Performance by movement

Movement	EBL	EBT	EBR	NBL	NBT	SBT	SBR	All
Denied Del/Veh (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Del/Veh (s)	41.9	4.2	8.2	24.3	1.9	9.1	7.1	17.0
Vehicles Entered	354	2	419	363	72	263	459	1932
Vehicles Exited	353	2	418	359	72	261	455	1920
Hourly Exit Rate	282	2	334	287	58	209	364	1536
Input Volume	289	1	349	349	70	250	443	1751
% of Volume	98	160	96	82	82	84	82	88

120: Route 7 & N Roosevelt St Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Denied Del/Veh (s)	1.3	0.2	0.1	2.6	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Del/Veh (s)	18.7	8.3	4.5	143.3	9.8	7.3	16.0	9.4	4.4	36.5	32.3	14.3
Vehicles Entered	29	669	35	669	834	11	81	12	332	47	58	73
Vehicles Exited	29	660	34	630	824	11	80	12	329	47	57	73
Hourly Exit Rate	23	528	27	504	659	9	64	10	263	38	46	58
Input Volume	25	543	30	618	774	10	70	10	279	40	45	60
% of Volume	92	97	92	82	85	86	91	94	94	95	102	98

120: Route 7 & N Roosevelt St Performance by movement

Movement	All
Denied Del/Veh (s)	0.8
Total Del/Veh (s)	41.4
Vehicles Entered	2850
Vehicles Exited	2786
Hourly Exit Rate	2229
Input Volume	2503
% of Volume	89

125: N Roosevelt St Performance by movement

Movement	WBL	WBT	WBR	NBT	NBR	SBL	SBT	All
Denied Del/Veh (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Del/Veh (s)	4.8	0.1	3.0	0.9	0.8	2.9	0.7	2.0
Vehicles Entered	59	3	42	18	33	12	120	287
Vehicles Exited	59	3	41	18	33	12	119	285
Hourly Exit Rate	47	2	33	14	26	10	95	228
Input Volume	50	2	35	16	30	10	94	236
% of Volume	95	133	95	90	89	94	101	96

130: Roosevelt Blvd & N Roosevelt St Performance by movement

Movement	EBL	EBR	NBL	NBT	SBT	SBR	All
Denied Del/Veh (s)	0.0	0.0	0.0	0.0	0.4	0.4	0.3
Total Del/Veh (s)	26.1	1.6	61.4	24.2	30.0	22.1	27.6
Vehicles Entered	46	11	11	699	1256	122	2145
Vehicles Exited	46	11	11	688	1244	121	2121
Hourly Exit Rate	37	9	9	550	995	97	1697
Input Volume	40	10	10	678	1001	94	1833
% of Volume	93	86	86	81	99	103	93

140: US 50 WB On-Ramp Performance by movement

Movement	NBL	NBT	SBT	SBR	All
Denied Del/Veh (s)	0.0	0.0	0.0	0.0	0.0
Total Del/Veh (s)	29.4	3.6	14.4	15.0	17.8
Vehicles Entered	709	435	278	401	1823
Vehicles Exited	700	435	278	399	1812
Hourly Exit Rate	560	348	222	319	1450
Input Volume	688	419	244	354	1705
% of Volume	81	83	91	90	85

145: Castle Rd & US 50 EB Off-Ramp Performance by movement

Movement	EBL	EBR	NBT	SBT	All
Denied Del/Veh (s)	0.0	0.0	0.0	0.0	0.0
Total Del/Veh (s)	35.1	27.7	48.1	19.2	35.2
Vehicles Entered	180	1098	983	278	2539
Vehicles Exited	179	1091	967	275	2512
Hourly Exit Rate	143	873	774	220	2010
Input Volume	140	912	967	244	2264
% of Volume	102	96	80	90	89

150: Roosevelt Blvd Performance by movement

Movement	EBL	EBT	EBR	NBL	NBT	SBT	SBR	All
Denied Del/Veh (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Del/Veh (s)	9.3	0.0	6.5	16.2	2.1	7.3	6.2	5.5
Vehicles Entered	6	1	38	15	707	1166	89	2022
Vehicles Exited	6	1	38	15	703	1162	89	2014
Hourly Exit Rate	5	1	30	12	562	930	71	1611
Input Volume	5	0	35	15	683	941	70	1749
% of Volume	96	400	88	79	82	99	102	92

160: Sleepy Hollow Rd & Castle Rd/Castle Pl Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Denied Del/Veh (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0
Total Del/Veh (s)	49.1	37.3	31.6	67.4	59.4	51.4	190.4	42.0	35.3	66.3	37.8	21.1
Vehicles Entered	272	1010	86	381	595	4	128	466	307	5	504	277
Vehicles Exited	267	994	84	372	589	4	117	456	300	5	501	276
Hourly Exit Rate	214	795	67	298	471	3	94	365	240	4	401	221
Input Volume	234	852	70	369	583	5	99	360	244	5	502	284
% of Volume	91	93	96	81	81	64	94	101	98	80	80	78

160: Sleepy Hollow Rd & Castle Rd/Castle Pl Performance by movement

Movement	All
Denied Del/Veh (s)	0.0
Total Del/Veh (s)	48.4
Vehicles Entered	4035
Vehicles Exited	3965
Hourly Exit Rate	3172
Input Volume	3608
% of Volume	88

165: Sleepy Hollow Rd & Aspen Ln Performance by movement

Movement	EBL	EBR	NBL	NBT	SBT	SBR	All
Denied Del/Veh (s)	0.1	0.1	0.6	0.6	0.0	0.0	0.3
Total Del/Veh (s)	22.4	10.3	9.7	3.2	3.6	2.8	3.8
Vehicles Entered	25	29	22	881	912	31	1900
Vehicles Exited	24	29	21	876	905	30	1885
Hourly Exit Rate	19	23	17	701	724	24	1508
Input Volume	20	20	15	683	897	30	1665
% of Volume	95	115	111	103	81	81	91

170: Sleepy Hollow Rd/Wilson Blvd & Route 7 Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Denied Del/Veh (s)	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	9.6	9.5	16.8
Total Del/Veh (s)	51.9	29.3	23.7	45.9	31.7	20.6	53.0	36.3	26.0	58.0	88.3	106.9
Vehicles Entered	99	832	127	118	958	86	151	572	18	137	564	433
Vehicles Exited	99	829	127	114	947	85	150	565	18	134	544	418
Hourly Exit Rate	79	663	102	91	758	68	120	452	14	107	435	334
Input Volume	85	685	110	110	844	75	120	476	15	135	572	438
% of Volume	93	97	93	83	90	91	100	95	95	80	76	76

170: Sleepy Hollow Rd/Wilson Blvd & Route 7 Performance by movement

Movement	All
Denied Del/Veh (s)	3.4
Total Del/Veh (s)	49.6
Vehicles Entered	4095
Vehicles Exited	4030
Hourly Exit Rate	3224
Input Volume	3664
% of Volume	88

175: Commercial Ent. & Wilson Blvd Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBR	SBL	SBR	All
Denied Del/Veh (s)	0.0	0.0	0.1	0.0	0.0	0.0	16.3	22.2	843.2	858.2	115.2
Total Del/Veh (s)	34.7	4.0	2.5	17.5	37.9	51.9	231.6	8.7	106.8	566.0	56.0
Vehicles Entered	127	584	32	82	1012	164	49	47	48	95	2240
Vehicles Exited	125	583	32	82	1000	162	44	46	47	80	2201
Hourly Exit Rate	100	466	26	66	800	130	35	37	38	64	1761
Input Volume	115	495	25	70	912	144	40	40	80	179	2100
% of Volume	87	94	102	94	88	90	89	93	47	36	84

180: Castle Rd & Route 7 Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBT	NBR	SBL	SBT	SBR	All
Denied Del/Veh (s)	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Del/Veh (s)	76.4	48.9	57.3	80.3	38.1	11.6	45.5	20.4	45.9	25.1	25.4	37.2
Vehicles Entered	231	742	5	266	1167	299	273	1022	120	724	29	4878
Vehicles Exited	227	731	5	261	1154	297	268	1013	118	719	29	4822
Hourly Exit Rate	182	585	4	209	923	238	214	810	94	575	23	3858
Input Volume	199	630	5	239	1026	269	220	882	120	712	25	4327
% of Volume	91	93	80	87	90	88	97	92	79	81	92	89

190: Castle Rd Performance by movement

Movement	NBT	NBR	SBL	SBT	All
Denied Del/Veh (s)	0.0	0.0	0.0	0.0	0.0
Total Del/Veh (s)	1.2	1.9	7.7	2.1	2.2
Vehicles Entered	356	435	106	875	1772
Vehicles Exited	354	433	105	872	1764
Hourly Exit Rate	283	346	84	698	1411
Input Volume	319	369	105	857	1650
% of Volume	89	94	80	81	86

195: Castle Rd Performance by movement

Movement	NBT	SBT	NWL	NWT	NWR	All
Denied Del/Veh (s)	0.0	0.0	0.0		0.0	0.0
Total Del/Veh (s)	16.6	19.8	37.8		18.4	25.7
Vehicles Entered	353	362	627	0	306	1648
Vehicles Exited	351	360	621	0	303	1635
Hourly Exit Rate	281	288	497	0	242	1308
Input Volume	319	319	643	0	309	1590
% of Volume	88	90	77	0	78	82

200: Route 7 & Task Force Bridge Performance by movement

Movement	EBL	EBT	WBT	WBR	SBL	SBR	All
Denied Del/Veh (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Del/Veh (s)	23.4	5.0	6.0	5.9	47.6	36.2	8.3
Vehicles Entered	164	1688	1658	317	141	88	4056
Vehicles Exited	163	1674	1653	316	139	87	4032
Hourly Exit Rate	130	1339	1322	253	111	70	3226
Input Volume	140	1485	1466	274	130	75	3569
% of Volume	93	90	90	92	86	93	90

210: Route 7 & Seven Corners Ctr Performance by movement

Movement	EBL	EBT	WBT	WBR	SBL	SBR	All
Denied Del/Veh (s)	0.0	0.0	0.0	0.0	6.4	4.5	0.9
Total Del/Veh (s)	28.9	12.0	12.1	4.6	46.3	46.6	17.9
Vehicles Entered	173	1640	1687	210	392	319	4421
Vehicles Exited	170	1628	1681	210	390	317	4396
Hourly Exit Rate	136	1302	1345	168	312	254	3517
Input Volume	159	1455	1504	190	324	254	3886
% of Volume	85	89	89	89	96	100	90

220: Patrick Henry Drive & Route 7 Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Denied Del/Veh (s)	0.0	0.0	0.0	2.4	1.2	2.5	1518.1	1429.7	1502.7	0.0	0.0	0.0
Total Del/Veh (s)	32.6	5.8	6.0	23.2	19.2	18.3	4164.0	4015.5	3892.5	57.8	61.2	20.8
Vehicles Entered	214	1662	120	139	1691	284	20	20	10	190	87	226
Vehicles Exited	212	1656	119	139	1674	282	0	0	0	187	84	224
Hourly Exit Rate	170	1325	95	111	1339	226	0	0	0	150	67	179
Input Volume	179	1476	105	110	1365	219	94	80	40	179	80	234
% of Volume	95	90	91	101	98	103	0	0	0	83	84	77

220: Patrick Henry Drive & Route 7 Performance by movement

Movement	All
Denied Del/Veh (s)	79.7
Total Del/Veh (s)	60.4
Vehicles Entered	4663
Vehicles Exited	4577
Hourly Exit Rate	3662
Input Volume	4161
% of Volume	88

230: Route 50 Performance by movement

Movement	EBT	WBT	WBR	All
Denied Del/Veh (s)	0.0	0.0	0.0	0.0
Total Del/Veh (s)	4.0	6.3	8.7	5.5
Vehicles Entered	3383	2704	941	7028
Vehicles Exited	3377	2689	932	6998
Hourly Exit Rate	2702	2151	746	5598
Input Volume	3110	2721	951	6782
% of Volume	87	79	78	83

231: Route 50 Performance by movement

Movement	EBT	WBT	NER	All
Denied Del/Veh (s)	0.0	0.0	0.0	0.0
Total Del/Veh (s)	191.0	1.1	4.2	94.5
Vehicles Entered	3105	2688	539	6332
Vehicles Exited	2849	2684	535	6068
Hourly Exit Rate	2279	2147	428	4854
Input Volume	2636	2720	474	5830
% of Volume	86	79	90	83

245: Peyton Randolph/Peyton Randolph Dr Performance by movement

Movement	WBL	WBT	WBR	NBT	NBR	SBL	SBT	All
Denied Del/Veh (s)	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.0
Total Del/Veh (s)	9.0	3.2	6.6	9.7	2.7	6.3	7.2	6.6
Vehicles Entered	25	1	144	11	22	160	30	393
Vehicles Exited	25	1	142	11	22	159	29	389
Hourly Exit Rate	20	1	114	9	18	127	23	311
Input Volume	25	0	140	10	15	135	25	351
% of Volume	79	400	81	86	116	94	91	89

250: Castle Rd/Roosevelt Blvd & Wilson Blvd Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Denied Del/Veh (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Del/Veh (s)	34.2	25.0	16.8	65.6	99.1	130.5	64.0	27.9	19.1	54.6	38.8	42.3
Vehicles Entered	174	477	12	108	618	283	287	279	87	495	251	388
Vehicles Exited	173	474	12	107	597	270	284	278	87	480	245	378
Hourly Exit Rate	138	379	10	86	478	216	227	222	70	384	196	302
Input Volume	164	430	10	94	539	259	269	274	85	394	215	319
% of Volume	84	88	94	91	89	83	85	81	82	98	91	95

250: Castle Rd/Roosevelt Blvd & Wilson Blvd Performance by movement

Movement	All
Denied Del/Veh (s)	0.0
Total Del/Veh (s)	59.1
Vehicles Entered	3459
Vehicles Exited	3385
Hourly Exit Rate	2708
Input Volume	3051
% of Volume	89

260: Peyton Randolph Dr/Shopping Center & Wilson Blvd Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Denied Del/Veh (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.1	0.2	0.3
Total Del/Veh (s)	19.6	8.1	4.6	17.9	35.8	44.5	157.1	52.0	35.2	43.6	44.7	21.2
Vehicles Entered	99	926	13	142	923	81	90	7	56	40	35	20
Vehicles Exited	98	920	13	142	903	81	86	7	55	39	34	20
Hourly Exit Rate	78	736	10	114	722	65	69	6	44	31	27	16
Input Volume	80	817	10	120	787	65	89	6	55	35	30	15
% of Volume	98	90	102	95	92	100	77	97	80	90	92	105

260: Peyton Randolph Dr/Shopping Center & Wilson Blvd Performance by movement

Movement	All
Denied Del/Veh (s)	0.1
Total Del/Veh (s)	28.3
Vehicles Entered	2432
Vehicles Exited	2398
Hourly Exit Rate	1918
Input Volume	2109
% of Volume	91

270: Task Force Bridge & Wilson Blvd Performance by movement

Movement	EBT	EBR	WBT	NBT	NBR	All
Denied Del/Veh (s)	0.0	0.0	0.0		0.0	0.0
Total Del/Veh (s)	1.9	1.3	16.5		11.3	9.8
Vehicles Entered	1004	10	1165	0	162	2341
Vehicles Exited	1002	10	1148	0	160	2320
Hourly Exit Rate	802	8	918	0	128	1856
Input Volume	897	10	972	0	154	2034
% of Volume	89	78	94	0	83	91

275: Task Force Bridge & Willston Dr Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Denied Del/Veh (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
Total Del/Veh (s)	5.3	6.8	4.1	7.1	7.2	5.4	8.1	8.2	6.2	4.8	5.6	3.3
Vehicles Entered	11	47	123	102	148	106	34	50	397	5	6	7
Vehicles Exited	11	47	122	101	147	106	33	49	394	5	6	7
Hourly Exit Rate	9	38	98	81	118	85	26	39	315	4	5	6
Input Volume	10	40	99	99	149	105	30	41	344	5	5	5
% of Volume	86	93	98	81	79	81	89	95	92	80	96	112

275: Task Force Bridge & Willston Dr Performance by movement

Movement	All
Denied Del/Veh (s)	0.0
Total Del/Veh (s)	6.3
Vehicles Entered	1036
Vehicles Exited	1028
Hourly Exit Rate	822
Input Volume	933
% of Volume	88

280: John Marshall Dr/N McKinley Rd & Wilson Blvd Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Denied Del/Veh (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.9	0.3	3.9
Total Del/Veh (s)	57.0	17.6	13.6	125.5	44.7	35.9	38.3	30.9	21.2	49.3	39.1	9.8
Vehicles Entered	100	985	79	132	1001	238	139	112	294	46	98	47
Vehicles Exited	99	981	79	125	982	234	135	110	290	46	98	46
Hourly Exit Rate	79	785	63	100	786	187	108	88	232	37	78	37
Input Volume	99	882	70	115	802	185	135	105	304	35	80	35
% of Volume	80	89	90	87	98	101	80	84	76	106	98	106

280: John Marshall Dr/N McKinley Rd & Wilson Blvd Performance by movement

Movement	All
Denied Del/Veh (s)	0.1
Total Del/Veh (s)	35.4
Vehicles Entered	3271
Vehicles Exited	3225
Hourly Exit Rate	2580
Input Volume	2846
% of Volume	91

285: Willston Dr/Willston Dr. & John Marshall Dr Performance by movement

Movement	EBL	EBT	WBT	WBR	SBL	SBT	SBR	All
Denied Del/Veh (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Del/Veh (s)	8.6	8.3	16.0	14.3	10.0	1.0	8.3	11.4
Vehicles Entered	210	235	266	338	159	28	114	1350
Vehicles Exited	209	234	263	335	156	28	113	1338
Hourly Exit Rate	167	187	210	268	125	22	90	1070
Input Volume	185	204	278	359	144	26	94	1290
% of Volume	91	92	76	75	87	86	96	83

290: Patrick Henry & Wilson Blvd Performance by movement

Movement	EBL	EBT	WBT	WBR	SBL	SBR	All
Denied Del/Veh (s)	0.0	0.0	3.8	2.1	0.3	0.3	1.8
Total Del/Veh (s)	33.0	4.1	23.2	16.1	40.4	30.2	16.6
Vehicles Entered	99	1217	1320	36	158	81	2911
Vehicles Exited	98	1215	1291	35	155	80	2874
Hourly Exit Rate	78	972	1033	28	124	64	2299
Input Volume	89	1131	1042	30	135	60	2486
% of Volume	88	86	99	95	92	107	92

295: Willston Dr./Patrick Henry Dr & Patrick Henry Performance by movement

Movement	EBL	EBT	WBT	WBR	SBL	SBR	All
Denied Del/Veh (s)	0.0	0.0	0.0	0.0	0.2	4.1	0.2
Total Del/Veh (s)	7.3	7.3	17.5	4.5	5.0	0.9	12.1
Vehicles Entered	115	276	562	66	18	46	1083
Vehicles Exited	115	274	559	66	18	46	1078
Hourly Exit Rate	92	219	447	53	14	37	862
Input Volume	99	249	603	65	15	35	1066
% of Volume	93	88	74	81	95	106	81

300: Patrick Henry Dr & Route 50 Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Denied Del/Veh (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0
Total Del/Veh (s)	679.9	39.4	19.9	248.0	84.3	70.4	320.0	88.5	48.7	91.4	79.9	79.7
Vehicles Entered	187	3006	183	293	3459	287	87	211	202	21	45	200
Vehicles Exited	143	2972	181	278	3375	281	73	204	198	20	44	197
Hourly Exit Rate	114	2378	145	222	2700	225	58	163	158	16	35	158
Input Volume	169	2770	169	284	3408	294	80	204	199	20	40	185
% of Volume	68	86	85	78	79	76	73	80	80	79	89	85

300: Patrick Henry Dr & Route 50 Performance by movement

Movement	All
Denied Del/Veh (s)	0.0
Total Del/Veh (s)	87.0
Vehicles Entered	8181
Vehicles Exited	7966
Hourly Exit Rate	6373
Input Volume	7823
% of Volume	81

310: Apartments & Route 50 Performance by movement

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Denied Del/Veh (s)	0.0	0.0	0.0	324.8	347.2	348.0	0.2	0.1	0.1	36.9	41.6	27.9
Total Del/Veh (s)	114.3	12.4	14.4	164.9	60.7	64.0	81.6	87.4	37.3	174.7	195.7	83.7
Vehicles Entered	24	3150	18	25	4044	104	14	33	12	195	30	42
Vehicles Exited	24	3115	18	25	3985	102	13	32	12	189	29	41
Hourly Exit Rate	19	2492	14	20	3188	82	10	26	10	151	23	33
Input Volume	20	2951	20	25	3946	99	10	25	10	159	30	30
% of Volume	95	84	71	79	81	82	102	102	94	95	78	111

310: Apartments & Route 50 Performance by movement

Movement	All
Denied Del/Veh (s)	205.8
Total Del/Veh (s)	45.0
Vehicles Entered	7691
Vehicles Exited	7585
Hourly Exit Rate	6068
Input Volume	7326
% of Volume	83

Total Network Performance

Denied Del/Veh (s)	126.1
Total Del/Veh (s)	214.6
Vehicles Entered	18281
Vehicles Exited	16564
Hourly Exit Rate	13251
Input Volume	126450
% of Volume	10

Intersection: 100: Route 50 & US 50 WB On-Ramp

Movement	EB	EB	EB	EB	B101	B101	B101	WB	WB	WB	SW
Directions Served	T	T	TR	R	T	T	T	T	T	T	R
Maximum Queue (ft)	417	419	431	255	501	635	653	1	35	14	181
Average Queue (ft)	50	50	49	24	18	63	67	0	2	0	36
95th Queue (ft)	279	281	279	178	176	367	380	0	15	5	117
Link Distance (ft)	491	491	491		623	623	623	809	809	809	1109
Upstream Blk Time (%)	2	2	2		0	1	2				
Queuing Penalty (veh)	0	0	0		0	0	0				
Storage Bay Dist (ft)				400							
Storage Blk Time (%)			2	0							
Queuing Penalty (veh)			8	1							

Intersection: 101: Bend

Movement	WB	WB
Directions Served	T	T
Maximum Queue (ft)	102	203
Average Queue (ft)	6	6
95th Queue (ft)	94	95
Link Distance (ft)	491	491
Upstream Blk Time (%)	0	0
Queuing Penalty (veh)	0	0
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 110: South St & Hillwood Ave

Movement	EB	EB	WB	WB	NB	NB
Directions Served	T	TR	LT	T	L	R
Maximum Queue (ft)	157	180	242	123	39	14
Average Queue (ft)	34	36	108	17	6	3
95th Queue (ft)	108	113	198	79	24	12
Link Distance (ft)	1757	1757	235	235	1116	
Upstream Blk Time (%)			0	0		
Queuing Penalty (veh)			1	0		
Storage Bay Dist (ft)						250
Storage Blk Time (%)						
Queuing Penalty (veh)						

Intersection: 115:

Movement	EB	EB	NB	NB	NB	SB	SB
Directions Served	L	R	L	T	T	T	TR
Maximum Queue (ft)	248	190	220	179	36	99	196
Average Queue (ft)	168	82	110	8	5	20	119
95th Queue (ft)	258	143	197	74	24	63	203
Link Distance (ft)	235	235		267	267	177	177
Upstream Blk Time (%)	4			1			1
Queuing Penalty (veh)	12			1			5
Storage Bay Dist (ft)			200				
Storage Blk Time (%)			2				
Queuing Penalty (veh)			1				

Intersection: 120: Route 7 & N Roosevelt St

Movement	EB	EB	EB	WB	WB	WB	WB	NB	NB	NB	SB	SB
Directions Served	L	T	TR	L	L	T	TR	L	T	TR	L	TR
Maximum Queue (ft)	72	157	156	362	375	1104	1082	95	28	103	80	146
Average Queue (ft)	16	68	55	255	328	567	310	27	1	37	29	54
95th Queue (ft)	48	126	114	507	470	1247	924	67	11	78	65	112
Link Distance (ft)		2206	2206			1071	1071	177	177	177	252	252
Upstream Blk Time (%)						2	0					
Queuing Penalty (veh)						12	2					
Storage Bay Dist (ft)	100			350	350							
Storage Blk Time (%)		3		1	54	1						
Queuing Penalty (veh)		1		4	206	6						

Intersection: 125: N Roosevelt St

Movement	WB	SB
Directions Served	LR	LT
Maximum Queue (ft)	73	19
Average Queue (ft)	30	1
95th Queue (ft)	55	7
Link Distance (ft)	546	1420
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 130: Roosevelt Blvd & N Roosevelt St

Movement	EB	NB	NB	NB	SB	SB
Directions Served	L	L	T	T	T	TR
Maximum Queue (ft)	82	72	268	280	521	497
Average Queue (ft)	27	10	118	135	294	258
95th Queue (ft)	66	43	221	239	447	409
Link Distance (ft)	1420		1010	1010	510	510
Upstream Blk Time (%)					1	0
Queuing Penalty (veh)					0	0
Storage Bay Dist (ft)		150				
Storage Blk Time (%)			5			
Queuing Penalty (veh)			1			

Intersection: 140: US 50 WB On-Ramp

Movement	NB	NB	SB	SB	SB
Directions Served	L	T	T	T	R
Maximum Queue (ft)	250	341	132	180	210
Average Queue (ft)	202	167	50	44	105
95th Queue (ft)	304	417	105	123	197
Link Distance (ft)		270	267	267	
Upstream Blk Time (%)		15		0	
Queuing Penalty (veh)		81		0	
Storage Bay Dist (ft)	225				200
Storage Blk Time (%)	21	0			1
Queuing Penalty (veh)	44	1			1

Intersection: 145: Castle Rd & US 50 EB Off-Ramp

Movement	EB	EB	EB	NB	NB	SB	SB
Directions Served	L	LR	R	T	T	T	T
Maximum Queue (ft)	226	385	350	608	463	140	138
Average Queue (ft)	87	215	184	427	54	69	60
95th Queue (ft)	168	310	281	708	274	129	113
Link Distance (ft)	1031	1031		590	590	270	270
Upstream Blk Time (%)				4	0		
Queuing Penalty (veh)				18	1		
Storage Bay Dist (ft)			350				
Storage Blk Time (%)		0	0				
Queuing Penalty (veh)		2	1				

Intersection: 150: Roosevelt Blvd

Movement	EB	NB	NB	NB	SB	SB
Directions Served	LR	L	T	T	T	TR
Maximum Queue (ft)	60	40	63	75	180	176
Average Queue (ft)	23	6	10	19	34	33
95th Queue (ft)	51	27	41	59	120	115
Link Distance (ft)	900		590	590	1010	1010
Upstream Blk Time (%)						
Queuing Penalty (veh)						
Storage Bay Dist (ft)		125				
Storage Blk Time (%)						
Queuing Penalty (veh)						

Intersection: 160: Sleepy Hollow Rd & Castle Rd/Castle Pl

Movement	EB	EB	EB	WB	WB	B181	B181	NB	NB	NB	SB	SB
Directions Served	L	T	TR	L	TR	T	T	L	T	TR	L	T
Maximum Queue (ft)	225	440	402	419	429	273	301	259	539	635	113	297
Average Queue (ft)	171	253	237	248	315	55	81	133	141	284	7	209
95th Queue (ft)	276	436	402	437	505	206	252	274	493	566	50	338
Link Distance (ft)		590	590	333	333	243	243		909	909		277
Upstream Blk Time (%)		1	0	14	29	1	3		1	1		7
Queuing Penalty (veh)		3	1	66	141	6	17		2	2		26
Storage Bay Dist (ft)	200							250			200	
Storage Blk Time (%)	3	17						16	0			19
Queuing Penalty (veh)	14	41						28	0			1

Intersection: 160: Sleepy Hollow Rd & Castle Rd/Castle Pl

Movement	SB
Directions Served	R
Maximum Queue (ft)	242
Average Queue (ft)	100
95th Queue (ft)	197
Link Distance (ft)	277
Upstream Blk Time (%)	0
Queuing Penalty (veh)	1
Storage Bay Dist (ft)	
Storage Blk Time (%)	
Queuing Penalty (veh)	

Intersection: 165: Sleepy Hollow Rd & Aspen Ln

Movement	EB	NB
Directions Served	LR	LT
Maximum Queue (ft)	71	366
Average Queue (ft)	27	35
95th Queue (ft)	57	159
Link Distance (ft)	755	1274
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 170: Sleepy Hollow Rd/Wilson Blvd & Route 7

Movement	EB	EB	EB	WB	WB	WB	NB	NB	NB	SB	SB	SB
Directions Served	L	T	TR	L	T	TR	L	T	TR	L	T	TR
Maximum Queue (ft)	150	299	297	274	461	426	200	252	203	375	503	504
Average Queue (ft)	62	177	164	99	249	224	96	152	115	143	396	432
95th Queue (ft)	122	280	262	250	446	413	169	229	179	359	610	594
Link Distance (ft)		1071	1071		581	581	277	277	277		458	458
Upstream Blk Time (%)								0			20	42
Queuing Penalty (veh)								0			115	239
Storage Bay Dist (ft)	400			250						350		
Storage Blk Time (%)				0	10					0	14	
Queuing Penalty (veh)				0	11					0	19	

Intersection: 175: Commercial Ent. & Wilson Blvd

Movement	EB	EB	EB	WB	WB	WB	NB	NB	SB	SB
Directions Served	L	T	TR	L	T	TR	L	TR	L	TR
Maximum Queue (ft)	100	246	41	100	455	445	184	98	356	361
Average Queue (ft)	55	26	0	24	233	273	74	31	240	268
95th Queue (ft)	102	132	4	79	507	542	181	102	464	476
Link Distance (ft)		458	458		415	415	221	221	337	337
Upstream Blk Time (%)					3	8	8	4	60	67
Queuing Penalty (veh)					20	46	0	0	0	0
Storage Bay Dist (ft)	75			75						
Storage Blk Time (%)	12			0	17					
Queuing Penalty (veh)	29			0	12					

Intersection: 180: Castle Rd & Route 7

Movement	EB	EB	EB	WB	WB	WB	WB	NB	NB	B181	B181	SB
Directions Served	L	T	TR	L	T	T	R	TR	R	T	T	L
Maximum Queue (ft)	256	284	283	225	684	630	171	333	305	230	74	200
Average Queue (ft)	145	163	159	167	279	232	69	259	181	37	6	71
95th Queue (ft)	251	268	266	276	537	450	133	372	302	144	67	152
Link Distance (ft)		581	581		768	768	768	243	243	333	333	
Upstream Blk Time (%)					0	0		21	2			
Queuing Penalty (veh)					1	0		114	13			
Storage Bay Dist (ft)	250			200								175
Storage Blk Time (%)	1	2		14	20							0
Queuing Penalty (veh)	4	4		71	48							0

Intersection: 180: Castle Rd & Route 7

Movement	SB	SB
Directions Served	T	TR
Maximum Queue (ft)	239	260
Average Queue (ft)	137	156
95th Queue (ft)	238	259
Link Distance (ft)	222	222
Upstream Blk Time (%)	1	3
Queuing Penalty (veh)	4	12
Storage Bay Dist (ft)		
Storage Blk Time (%)	4	
Queuing Penalty (veh)	5	

Intersection: 190: Castle Rd

Movement	NB	SB	SB	SB
Directions Served	R	L	T	T
Maximum Queue (ft)	40	83	118	131
Average Queue (ft)	6	30	5	9
95th Queue (ft)	25	65	44	58
Link Distance (ft)			264	264
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)	175	225		
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 195: Castle Rd

Movement	NB	NB	SB	SB	NW	NW	NW
Directions Served	T	T	T	T	L	LR	R
Maximum Queue (ft)	143	112	171	175	331	326	183
Average Queue (ft)	67	53	73	64	168	186	39
95th Queue (ft)	120	97	148	135	280	299	101
Link Distance (ft)	264	264	525	525	1166	1166	
Upstream Blk Time (%)							
Queuing Penalty (veh)							
Storage Bay Dist (ft)							350
Storage Blk Time (%)						0	0
Queuing Penalty (veh)						0	0

Intersection: 200: Route 7 & Task Force Bridge

Movement	EB	EB	EB	EB	WB	WB	WB	SB	SB
Directions Served	L	T	T	T	T	T	TR	L	R
Maximum Queue (ft)	148	138	148	168	157	148	164	202	133
Average Queue (ft)	66	49	63	76	57	43	51	87	51
95th Queue (ft)	127	113	127	143	122	107	117	162	105
Link Distance (ft)		768	768	768	528	528	528		1528
Upstream Blk Time (%)									
Queuing Penalty (veh)									
Storage Bay Dist (ft)	250							250	
Storage Blk Time (%)								0	
Queuing Penalty (veh)								0	

Intersection: 210: Route 7 & Seven Corners Ctr

Movement	EB	EB	EB	EB	WB	WB	WB	WB	SB	SB
Directions Served	L	T	T	T	T	T	T	R	L	R
Maximum Queue (ft)	166	183	191	207	325	328	289	146	175	386
Average Queue (ft)	71	98	117	123	129	114	101	25	163	266
95th Queue (ft)	134	168	178	194	263	243	207	86	201	421
Link Distance (ft)		528	528	528	407	407	407			341
Upstream Blk Time (%)						0				11
Queuing Penalty (veh)						0				0
Storage Bay Dist (ft)	400							250	150	
Storage Blk Time (%)							0	0	25	14
Queuing Penalty (veh)							0	0	62	46

Intersection: 220: Patrick Henry Drive & Route 7

Movement	EB	EB	EB	EB	EB	WB	WB	WB	WB	NB	NB	NB
Directions Served	L	T	T	T	R	L	T	T	TR	L	T	TR
Maximum Queue (ft)	162	99	116	145	88	239	307	440	409	107	568	497
Average Queue (ft)	89	25	43	49	6	55	176	162	202	91	504	441
95th Queue (ft)	155	67	93	105	33	121	286	315	368	149	707	636
Link Distance (ft)		407	407	407			872	872			545	545
Upstream Blk Time (%)											82	31
Queuing Penalty (veh)											0	0
Storage Bay Dist (ft)	150				100	250			425	100		
Storage Blk Time (%)	2			1	0	0	1	0	1	58	39	
Queuing Penalty (veh)	8			1	0	0	1	0	3	23	37	

Intersection: 220: Patrick Henry Drive & Route 7

Movement	SB	SB	SB
Directions Served	L	LT	R
Maximum Queue (ft)	186	236	200
Average Queue (ft)	75	110	73
95th Queue (ft)	145	196	156
Link Distance (ft)		804	
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)	275		175
Storage Blk Time (%)		2	0
Queuing Penalty (veh)		7	1

Intersection: 230: Route 50

Movement	EB	EB	EB	EB	WB	WB	WB
Directions Served	T	T	T	T	T	TR	R
Maximum Queue (ft)	37	101	93	60	9	81	109
Average Queue (ft)	9	23	20	14	0	20	45
95th Queue (ft)	33	70	58	44	6	63	99
Link Distance (ft)	30	30	30	30	584	584	
Upstream Blk Time (%)	17	9	5	5			
Queuing Penalty (veh)	134	67	39	36			
Storage Bay Dist (ft)							300
Storage Blk Time (%)							
Queuing Penalty (veh)							

Intersection: 231: Route 50

Movement	EB	EB	EB	B103	B103	B103	NE
Directions Served	T	T	T	T	T	T	R
Maximum Queue (ft)	2497	2510	2523	660	674	660	279
Average Queue (ft)	1405	1469	1475	138	141	140	36
95th Queue (ft)	3122	3112	3113	614	625	619	156
Link Distance (ft)	2697	2697	2697	809	809	809	890
Upstream Blk Time (%)	19	21	21	1	1	1	
Queuing Penalty (veh)	162	181	181	7	9	6	
Storage Bay Dist (ft)							
Storage Blk Time (%)							
Queuing Penalty (veh)							

Intersection: 245: Peyton Randolph/Peyton Randolph Dr

Movement	WB	NB	SB
Directions Served	LR	TR	LT
Maximum Queue (ft)	83	40	95
Average Queue (ft)	35	19	45
95th Queue (ft)	64	44	74
Link Distance (ft)	219	325	432
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 250: Castle Rd/Roosevelt Blvd & Wilson Blvd

Movement	EB	EB	EB	WB	WB	WB	NB	NB	NB	SB	SB	SB
Directions Served	L	T	TR	L	T	TR	L	T	TR	L	T	TR
Maximum Queue (ft)	171	222	230	350	598	589	274	400	252	325	576	518
Average Queue (ft)	79	90	95	136	392	437	168	97	101	248	217	228
95th Queue (ft)	147	174	181	345	717	711	292	277	189	386	509	415
Link Distance (ft)		415	415		548	548		525	525		590	590
Upstream Blk Time (%)					14	22			0		0	0
Queuing Penalty (veh)					63	99			0		2	0
Storage Bay Dist (ft)	300			325			250			300		
Storage Blk Time (%)				0	19		8	0		14	0	
Queuing Penalty (veh)				0	18		11	0		15	0	

Intersection: 260: Peyton Randolph Dr/Shopping Center & Wilson Blvd

Movement	EB	EB	EB	WB	WB	WB	NB	NB	SB	SB
Directions Served	L	T	TR	L	T	TR	L	TR	L	TR
Maximum Queue (ft)	120	214	207	230	301	327	169	253	84	112
Average Queue (ft)	40	75	87	81	144	164	88	75	29	38
95th Queue (ft)	86	167	177	224	360	361	175	269	63	86
Link Distance (ft)		548	548		298	298		432		438
Upstream Blk Time (%)					15	19		3		
Queuing Penalty (veh)					75	90		4		
Storage Bay Dist (ft)	175			225			150		75	
Storage Blk Time (%)		0		0	21		18	0	1	4
Queuing Penalty (veh)		0		0	25		11	0	1	1

Intersection: 270: Task Force Bridge & Wilson Blvd

Movement	EB	EB	WB	WB	NB
Directions Served	T	TR	T	T	R
Maximum Queue (ft)	48	53	291	284	114
Average Queue (ft)	4	3	73	78	50
95th Queue (ft)	24	24	278	283	89
Link Distance (ft)	298	298	329	329	538
Upstream Blk Time (%)			3	4	
Queuing Penalty (veh)			16	17	
Storage Bay Dist (ft)					
Storage Blk Time (%)					
Queuing Penalty (veh)					

Intersection: 275: Task Force Bridge & Willston Dr

Movement	EB	WB	NB	SB
Directions Served	LTR	LTR	LTR	LTR
Maximum Queue (ft)	63	78	119	36
Average Queue (ft)	35	42	61	13
95th Queue (ft)	55	64	98	38
Link Distance (ft)	219	345	1528	538
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)				
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 280: John Marshall Dr/N McKinley Rd & Wilson Blvd

Movement	EB	EB	EB	WB	WB	WB	NB	NB	SB	SB	SB
Directions Served	L	T	TR	L	T	TR	L	TR	L	T	R
Maximum Queue (ft)	165	259	267	125	652	680	174	366	99	136	60
Average Queue (ft)	63	109	119	90	258	269	86	152	31	55	23
95th Queue (ft)	132	197	213	151	613	620	170	282	73	104	52
Link Distance (ft)		329	329		726	726		697		452	
Upstream Blk Time (%)		0	0		3	4					
Queuing Penalty (veh)		0	0		18	20					
Storage Bay Dist (ft)	150			100			150		200		200
Storage Blk Time (%)	0	3		29	22		1	8			
Queuing Penalty (veh)	1	3		116	25		3	11			

Intersection: 285: Willston Dr/Willston Dr. & John Marshall Dr

Movement	EB	WB	SB
Directions Served	LT	TR	LR
Maximum Queue (ft)	144	226	142
Average Queue (ft)	63	107	73
95th Queue (ft)	110	199	118
Link Distance (ft)	345	471	697
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Intersection: 290: Patrick Henry & Wilson Blvd

Movement	EB	EB	EB	WB	WB	SB
Directions Served	L	T	TR	T	TR	LTR
Maximum Queue (ft)	125	148	165	486	491	235
Average Queue (ft)	39	31	45	167	167	102
95th Queue (ft)	89	99	114	543	538	189
Link Distance (ft)		726	726	1274	1274	513
Upstream Blk Time (%)				2	2	
Queuing Penalty (veh)				0	0	
Storage Bay Dist (ft)	250					
Storage Blk Time (%)				4		
Queuing Penalty (veh)				0		

Intersection: 295: Willston Dr./Patrick Henry Dr & Patrick Henry

Movement	EB	EB	WB	WB	SB	SB
Directions Served	L	T	T	R	L	R
Maximum Queue (ft)	62	66	366	71	28	43
Average Queue (ft)	32	35	135	28	7	1
95th Queue (ft)	51	55	256	56	23	14
Link Distance (ft)		471	635	635	437	
Upstream Blk Time (%)						
Queuing Penalty (veh)						
Storage Bay Dist (ft)	150					200
Storage Blk Time (%)						
Queuing Penalty (veh)						

Intersection: 300: Patrick Henry Dr & Route 50

Movement	EB	EB	EB	EB	EB	EB	WB	WB	WB	WB	WB	NB
Directions Served	L	L	T	T	T	R	L	T	T	T	R	L
Maximum Queue (ft)	523	590	616	618	619	275	275	1258	1283	1249	325	279
Average Queue (ft)	350	366	469	479	477	101	263	982	1024	1021	162	161
95th Queue (ft)	620	693	752	746	744	306	309	1470	1515	1513	415	315
Link Distance (ft)		584	584	584	584			1228	1228	1228		
Upstream Blk Time (%)		19	4	4	4			0	1	1		
Queuing Penalty (veh)		147	29	28	32			6	13	14		
Storage Bay Dist (ft)	500					250	250				300	275
Storage Blk Time (%)	28	29			28	0	58	7		24	0	14
Queuing Penalty (veh)	24	25			47	0	662	19		71	1	14

Intersection: 300: Patrick Henry Dr & Route 50

Movement	NB	NB	NB	SB	SB	SB	SB
Directions Served	T	T	R	L	L	T	TR
Maximum Queue (ft)	378	384	175	30	52	127	346
Average Queue (ft)	148	103	108	5	16	38	162
95th Queue (ft)	314	258	192	22	42	91	294
Link Distance (ft)	601	601				635	635
Upstream Blk Time (%)							
Queuing Penalty (veh)							
Storage Bay Dist (ft)			150	300	300		
Storage Blk Time (%)	0	1	7				
Queuing Penalty (veh)	0	2	8				

Intersection: 310: Apartments & Route 50

Movement	EB	EB	EB	EB	WB	WB	WB	WB	NB	NB	SB	SB
Directions Served	L	T	T	TR	L	T	T	TR	LT	R	LT	R
Maximum Queue (ft)	89	393	594	183	274	797	793	788	118	40	359	138
Average Queue (ft)	22	52	80	72	47	664	688	699	44	10	280	39
95th Queue (ft)	60	226	303	173	180	997	995	984	98	34	403	94
Link Distance (ft)		1228	1228	1228		744	744	744	429	429	322	322
Upstream Blk Time (%)		0	0			18	25	37			31	
Queuing Penalty (veh)		0	0			0	0	0			0	
Storage Bay Dist (ft)	250				250							
Storage Blk Time (%)					0	26						
Queuing Penalty (veh)					0	7						

Network Summary

Network wide Queuing Penalty: 4332