Dulles Corridor Study

Transportation Study – Final Report

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Fairfax County Department of Transportation

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Acknowledgements

Fairfax County Department of Planning and Zoning

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Reston Master Plan Special Study Task Force

Route 28 Station South Working Group

Table of Contents

List of Figures

List of Figures

Appendix

ATTACHMENT #1 – TRANSPORTATION INTERSECTION RESULTS – DETAILED TABLES
ATTACHMENT #2 – ROADWAY VOLUME-TO-CAPACITY RATIOS
ATTACHMENT #3 – MODEL METRO RIDERSHIP ESTIMATES
ATTACHMENT #4 – SYNCHRO FILES FOR EXISTING (2013), 2030 COG ROUND 8 SCENARIO, SCENARIO G
ATTACHMENT #5 – TRANSIT DEVELOPMENT PLAN RECOMMENDATIONS

1.0 Introduction

1.1 Report Structure

Section 1 provides an overview of the Dulles Corridor Study including purpose, location, and study process. Section 2 describes the land scenarios that are included in this report. Section 3 describes the methodology that was used in the transportation analysis. Section 4 contains the study findings and summary of the recommendations, including next steps.

1.2 Purpose

This transportation study is to support the proposed land use changes to the Fairfax County Comprehensive Plan for Land Unit A of the Dulles Suburban Center and for the Reston-Herndon Suburban Center and Transit Station Areas in the Upper Potomac section of the Comprehensive Plan. These two plan amendments are the Route 28 Station - South Study (Route 28) and the Reston Master Plan Special Study (Reston).

The Plan Amendments are proposed in anticipation of the opening of the Wiehle-Reston East Metrorail station at the end of 2013 and the opening of the Reston Town Center, Herndon, and Innovation Center Metrorail stations in 2018. The plan amendments propose changes to the Fairfax County Comprehensive Plan to update existing Plan guidance regarding transit-oriented development to be more consistent with the County's Transit Oriented Development (TOD) policies adopted in 2007. In addition, the new recommendations will better reflect the community's desire, as expressed through a community Task Force for Reston and Working Group for Route 28, to facilitate the evolution of the areas closest to the station into true mixed-use, walkable, transit-oriented areas.

The transportation study is evaluating the land use impacts of three scenarios: existing (2013) development, a future base year development (2030 Metropolitan Washington Council of Governments (COG) Round 8), and the proposed change to the Comprehensive Plan (Scenario G). For purposes of the transportation study, the two plan amendments have been combined so that County staff could evaluate the impacts of both plan changes together. The study is called the Dulles Corridor Study.

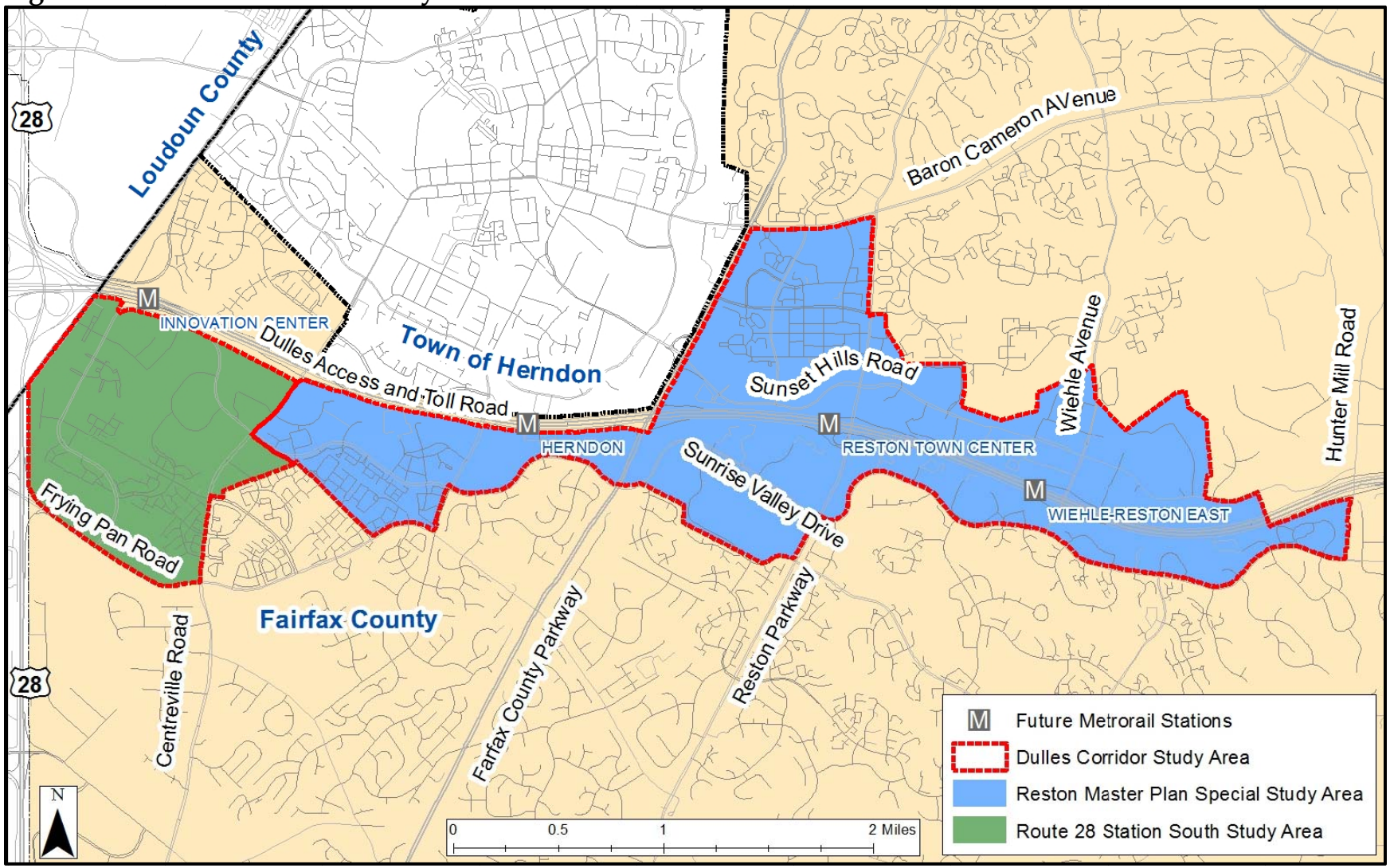
1.3 Study Area

The Dulles Corridor Study area is located in the northern half of Fairfax County. It is bounded by Hunter Mill Road on the east; Route 28 on the west; Baron Cameron Avenue, the Town of Herndon, and Sunset Hills Road on the north; and Sunrise Valley Drive and Frying Pan Road on the south. The study area is traversed by the Dulles Airport Access Highway (DAAH) and the Dulles Toll Road (DTR). A map showing the Dulles Corridor Study area (outlined in red) along with the study area of the two Plan Amendments is shown in Figure 1.1.

The Route 28 Station South Study area (Route 28), shown in green in Figure 1.1, is generally bounded by the Dulles Toll Road on the north, Route 28 on the west, Frying Pan Road on the south, and Centreville Road on the east. The Reston Master Plan Special Study area (Reston), shown in blue in Figure 1.1, is generally bounded by Centreville Road on the west, Sunrise Valley Drive on the south, Hunter Mill Road on the east, and the Town of Herndon/Baron Cameron Avenue/Sunset Hills Road on the north.

Major roads in the study area are Centreville Road (Route 657), Fairfax County Parkway (Route 286), Reston Parkway (Route 602), Wiehle Avenue (Route 828), Hunter Mill Road (Route 674), Sunset Hills Road (675), and Sunrise Valley Drive (Route 5320). A majority of the land access in the Dulles Corridor Study area will be from Sunrise Valley Drive and Sunset Hills Road.

Figure 1.1 – Dulles Corridor Study Area



1.4 Study Process

To evaluate the impact of a change in the land use in the Comprehensive Plan, the Fairfax County Department of Transportation (FCDOT) had intersection counts collected at 21 intersections in the Reston Study Area in 2010. It was later determined that the Route 28 Study Area should be added to the transportation analysis since these two Plan Amendments were adjacent to each other. FCDOT supplemented the 21 intersection counts with three intersection counts from studies that were conducted the previous year. Due to the downturn in the economy, it was determined that a growth rate did not need to be applied to the three intersections added to the original 21 intersections counted. The 24 intersections became the basis for evaluating the impacts of proposed land uses on the transportation network.

FCDOT presented the existing conditions to the Reston Task Force in May 2010 and the future base year (2030) land use conditions in October 2010. This same information was presented to the Route 28 Working Group in June 2010 (existing conditions) and in October 2010 (future base year land use conditions). Over the next two and half years FCDOT gave multiple presentations to both community groups and updated the future base year land use from 2030 COG Round 7.2 to 2030 COG Round 8. The final analysis results were presented in April 2013.

During the two and half years after the existing conditions and future base land use were presented to the community groups, FCDOT analyzed four different future land use scenarios in the Dulles Corridor Study. The first land use scenario, Scenario E, had a higher nonresidential component, mainly office, compared to the scenario that is included in this report. The second land use scenario, Scenario F, tested a much higher residential component to understand the impacts of a more balanced jobs-to-household ratio. The third scenario, Scenario E Modified, looked at the impact of shifting land uses from locations in the study area where the transportation network had significant delays to locations where the transportation network could accommodate more traffic. Scenario E Modified plus a more balanced jobs-to-household ratio (the office land use was lowered and the residential land use was increased) is the basis for the proposed land use scenario, Scenario G, which is presented in this report.

2.0 Development of Land Use Scenarios

Land Uses Tested

Two future year land use scenarios are included in the transportation study. They are the 2030 COG Round 8 (Round 8) also known as the Future Base and the recommended 2030 Scenario G (Scenario G). The Round 8 land use represents a future base level of land use. The existing land use (Section 2.1) is shown in order to provide context for the amount and type of development being proposed in Scenario G, which is the proposed land use for adoption in the County's Comprehensive Plan. The horizon year for the study is 2030. The Round 8 future land use was developed by the Metropolitan Washington Council of Governments (COG), using input from all the regional localities in order to derive forecasts for the region. The methodology used to develop Scenario G is described under Section 2.3.

The future year background land use has been increased for the 2030 Scenario G (beyond COG Round 8 land use for areas outside the study area) to account for the Town of Herndon's recent Metro Plan adoption by the Town Council in 2012 and for the increase in development associated with the Tysons Corners Comprehensive Plan development.

2.1 Existing Land Use and Transportation Network

Table 2.1 shows the development by land use for the Reston area, Route 28 area, and the Total Study Area, which is the Dulles Corridor Study area. The land use development levels reported are 2010 for Reston and 2012 for Route 28 but are considered to be approximately what exists today. For the existing residential development, the actual number of units was multiplied by a factor of 1,000 square feet per dwelling unit to estimate the total residential square footage for the Reston area. A factor of 1,200 square feet per residential unit was applied in the Route 28 area to generate the residential square footage.

Table 2.1 – Existing Development by Land Use

Land Use	Reston[1]	Route 28[2]	Total Study Area
Residential (units)	5,860	3,309	9,169
Residential (sf)	5,860,000	3,971,000	9,831,000
Office (sf)	20,982,169	4,755,000	25,737,169
Retail (sf)	1,094,476	4,000	1,098,476
Industrial (sf)	841,957	35,000	876,957
Institutional (sf)	2,096,840	150,000	2,246,840
Hotel (sf)	936,782	858,000	1,794,782
Total Nonresidential	**25,952,224**	**5,802,000**	**31,754,224**
Total Development	**31,812,224**	**9,773,000**	**41,585,224**

Note 1: 2010 development total

Note 2: 2012 development total

Traffic counts from 2010 were used to calibrate the National Capital Region Transportation Planning Board (TPB) Version 2.2 Model (the model) and to report existing conditions. Table 2.1 is intended to show the approximate development that exists today. It is shown to explain the net change in land use from what exists today compared to Round 8 and from what is being proposed in Scenario G.

2.2 2030 COG Round 8 Land Use Scenario and Transportation Network

Table 2.2 shows the 2030 COG Round 8 (current Comprehensive Plan development by 2030) development by land use for the Reston area, Route 28 area, and the Total Study Area, which is the Dulles Corridor Study area. The Table 2.3 shows the net change in land use from Existing to Round 8. The residential units were multiplied by a factor of 1,200 SF to generate the total residential square footage. This unit size was selected based on the expectation that there will be some urban townhouse development in the TSAs in addition to multi-family units.

Table 2.2 – 2030 COG Round 8 Scenario – Development by Land Use

Land Use	Reston	Route 28	Total Study Area
Residential (units)	16,382	7,002	23,384
Residential (sf) [1]	19,658,400	8,402,400	28,060,800
Office (sf)	22,612,598	5,419,357	28,031,955
Retail (sf)	999,118	205,146	1,204,264
Industrial (sf)	704,700	0	704,700
Institutional (sf)	1,744,200	281,100	2,025,300
Hotel (sf)	1,537,105	694,181	2,231,286
Total Nonresidential	**27,597,721**	**6,599,784**	**34,197,505**
Total Development	**47,256,121**	**15,002,184**	**62,258,305**

Note 1: A factor of 1,200 square feet per unit was applied

Note 2: COG Rd 8 forecast combined hotel and retail jobs under the retail category. A % split was applied to the retail jobs using a previous land use scenario to break out hotel and retail square footage. This did not affect the model results.

Table 2.3 – Net Change in Land Use – Existing to 2030 COG Round 8

Land Use	Difference Round 8 -Existing		
	Reston	Route 28	Total Study Area
Residential (units)	10,522	3,693	14,215
Residential (sf)	13,798,400	4,431,400	18,229,800
Office (sf)	1,630,429	664,357	2,294,786
Retail (sf)	-95,358	201,146	105,788
Industrial (sf)	-137,257	-35,000	-172,257
Institutional (sf)	-352,640	131,100	-221,540
Hotel (sf)	600,323	-163,819	436,504
Total Nonresidential	**1,645,497**	**797,784**	**2,443,281**
Total Development	**15,443,897**	**5,229,184**	**20,673,081**

The Round 8 land use and a future transportation network were evaluated by applying the model. The Round 8 land use is the future year "base", which the proposed Scenario G land use is assessed against. The future transportation network associated with Round 8 is a combination

of the Constrained Long Range Plan (CLRP) plus the Fairfax County Transportation Plan Map. It is described in more detail in Section 4.4.

2.3 2030 Scenario G Land Use and Transportation Network

Table 2.4 shows the Scenario G development by land use for the Reston area, Route 28 area, and the Total Study Area, which is the Dulles Corridor Study area. Table 2.5 shows the net change in land use from Existing to Scenario G. The residential units were multiplied by a factor of 1,200 SF to generate the total residential square footage. This unit size was selected based on the expectation that there will be some urban townhouse development in the TSAs in addition to multi-family units.

Table 2.4 - 2030 Scenario G Development by Land Use

Land Use	Reston	Route 28	Total Study Area
Residential (units)	24,559	9,289	33,848
Residential (sf) [1]	29,470,800	11,146,800	40,617,600
Office (sf)	27,321,826	8,379,847	35,701,673
Retail (sf)	1,632,657	785,960	2,418,617
Industrial (sf)	512,930	0	512,930
Institutional (sf)	2,094,300	149,173	2,243,473
Hotel (sf)	2,997,703	1,181,269	4,178,972
Total Nonresidential	**34,559,416**	**10,496,249**	**45,055,665**
Total Development	**64,030,216**	**21,643,049**	**85,673,265**

Note 1: A factor of 1,200 square feet per unit was applied

Table 2.5 - Net Change in Land Use Existing to 2030 Scenario G

Land Use	Reston	Route 28	Total Study Area
Residential (units)	24,559	9,289	33,848
Residential (sf) [1]	29,470,800	11,146,800	40,617,600
Office (sf)	27,321,826	8,379,847	35,701,673
Retail (sf)	1,632,657	785,960	2,418,617
Industrial (sf)	512,930	0	512,930
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Total Nonresidential	**34,559,416**	**10,496,249**	**45,055,665**
Total Development	**64,030,216**	**21,643,049**	**85,673,265**

Note 1: A factor of 1,200 square feet per unit was applied

The future transportation network associated with Scenario G is the transportation network used in the analysis of the Round 8 scenario as described above (CLRP network and Fairfax County's Transportation Plan Map) plus additional improvements that are described in more detail in Section 4.4. The Scenario G land use and its associated future transportation network were evaluated using the model.

Methodology

Since the study is composed of two plan amendments, there are two different, but similar methodologies used to develop Scenario G that were tested in the Dulles Corridor Study.

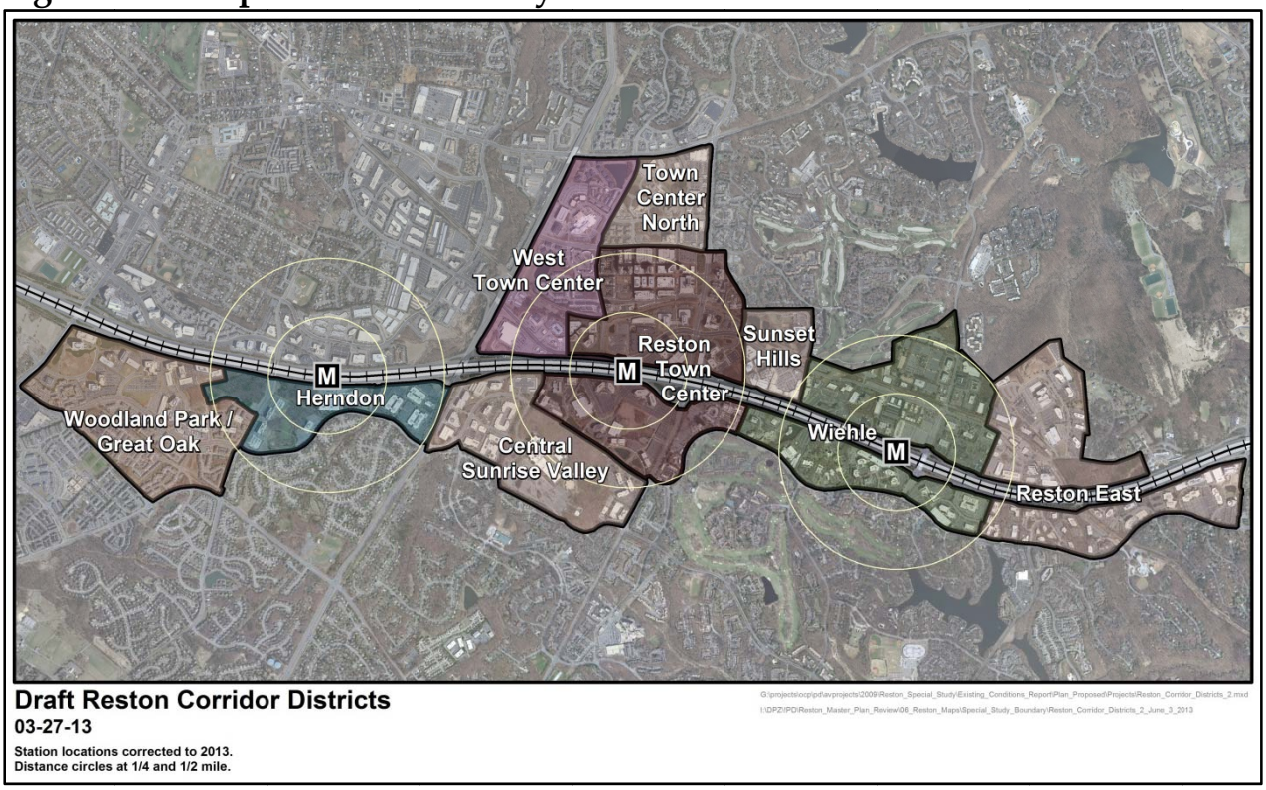
Reston Area

A specific amount of planned future development for the three Transit Station Areas (TSAs) will be identified in the Plan. The total amount of non-residential development planned (including existing, zoned, and planned) is 35 million square feet, of which 27.5 million square feet (s.f.) is planned as office use, 3 million s.f. is planned as hotel use and 1.6 million s.f. is planned as retail with the balance planned as institutional, civic and cultural uses. The total amount of residential development planned is 24,500 dwelling units (approximately 29 million s.f.) for an overall total of 64 million square feet of development (existing, zoned and planned). The resulting jobs-to-household ratio for the three TSAs is projected to be approximately four to one (4:1) as compared to the existing jobs-to-household ratio of approximately 14:1.

The Plan will also specify an amount of development planned for each TOD district (Wiehle, Reston Town Center, and Herndon). The planned TOD development is based on a range of floor area ratios (FARs) with the highest FARs available to the parcels closest to the transit station platforms and the low end to mid-point of the FAR range available to the parcels located further away from the platforms. To calculate the amount of development potential for the TOD Districts, the Wiehle and Reston Town Center districts were further divided into a north and south sub-districts (located north and south of the Dulles Toll Road). The Herndon TOD District is only located south of the Dulles Toll Road so no sub-districts were needed. The mid-point of the FAR range planned for each district/sub-district was used to generate the development potential. For parcels in the TOD Districts located within ¼ mile of the station platform, the mix of uses planned includes new office and non-office commercial uses as well as new residential. For parcels in the TOD Districts that are between ¼-½ mile from the station platform, the mix of uses includes primarily existing office (with very limited opportunity for new office uses), new residential uses, and new non-office commercial uses primarily retail and hotel.

The FAR range in the Wiehle North Sub-district varies from 1.5-3.0 FAR and in the South Sub-district from 1.5-2.5 FAR. In the Reston Town Center North Sub-district, the range is 3.0-4.0 FAR and in the South Sub-district, it varies from 1.5-3.0 FAR. The Herndon TOD District is planned for 0.5-2.5 FAR. Figure 2.1 shows the proposed new Comprehensive Plan Districts along with a quarter mile and half mile ring from the Metro Station platform.

Figure 2.1 - Proposed Reston Study Area Plan Districts



Route 28 Area

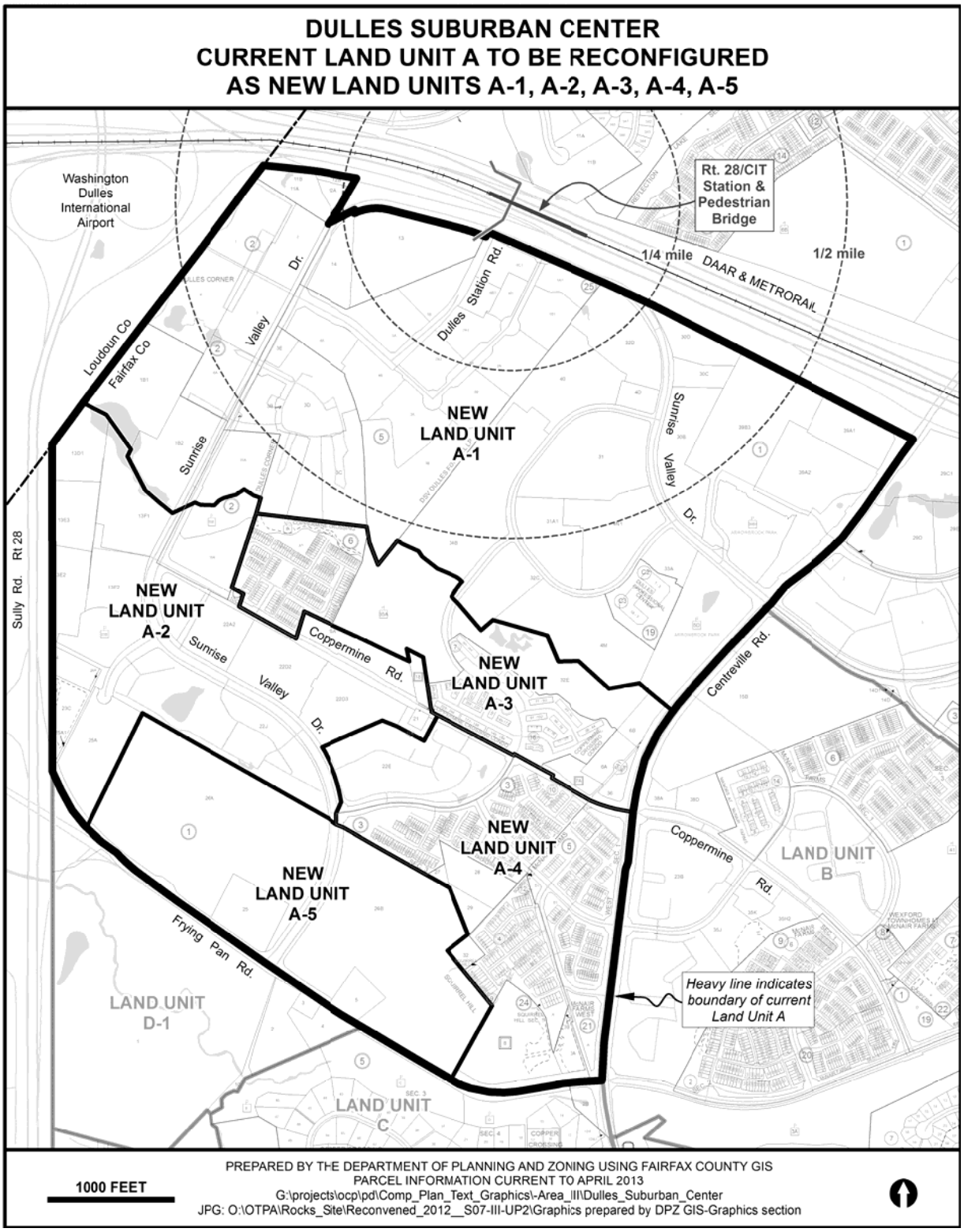
The proposed land use focuses most growth, and the greatest intensities, within walking distance of the Innovation Center Metrorail station. This focused growth is planned for Land Unit A-1, the Transit Station Area for the station's south side, as shown in Figure 2.2. In order to provide guidance on how intensity should gradually decrease with distance from the station, Land Unit A-1 is divided into three areas as shown in Table 2.6 below. For purposes of tiered planned intensity, the distance from the Metrorail station is measured from the center of the platform where it connects to the Metrorail pedestrian bridges. The proposed land use for the areas outside of Land Unit A-1, Land Units A-2, A-3, A-4, and Land Unit B, will generally reflect existing conditions or zoning approvals. Land Unit A-5 is an exception to this and is vacant and planned for up to a 1.0 FAR.

Table 2.6 - Route 28 Area – Land Unit A1 Tiered Planned Intensity

Distrance from Metrorail Station	Range of Intensity (FAR)
Tier 1: Within 1/4 mile	2.0 to 3.0 FAR
Tier 2: 1/4 to 1/2 mile	1.0 to 2.0 FAR
Beyond 1/2 mile	0.75 to 1.5 FAR

Land Unit A-1 is primarily developed with office uses. The proposed land uses within Land Unit A-1 consist of a mix of office and residential uses to take advantage of proximity to transit. Other complementary uses, like retail, hotel and institutional uses are anticipated to be a part of the mix of uses. The other area envisioned to change, Land Unit A-5, is planned for a mix of uses including office, retail, hotel, and residential. For the overall study area, the proposed land use would result in jobs-to-household ratio of approximately 3.5 to one (3.5:1). To calculate the amount of development potential specified in the proposed Plan text, the mid-point of the FAR range in each sub-district was used for redevelopment sites.

Figure 2.2 - Proposed Route 28 Study Area Land Units



3.0 Framework for Evaluation

This section of the report presents the framework for evaluation used for the analysis of the Dulles Corridor Study. Section 3.1 details the model methodology used for the evaluation, with a description of each component. Section 3.2 describes the Measures of Effectiveness (MOE) that were developed for the analysis process.

3.1 Model Methodology

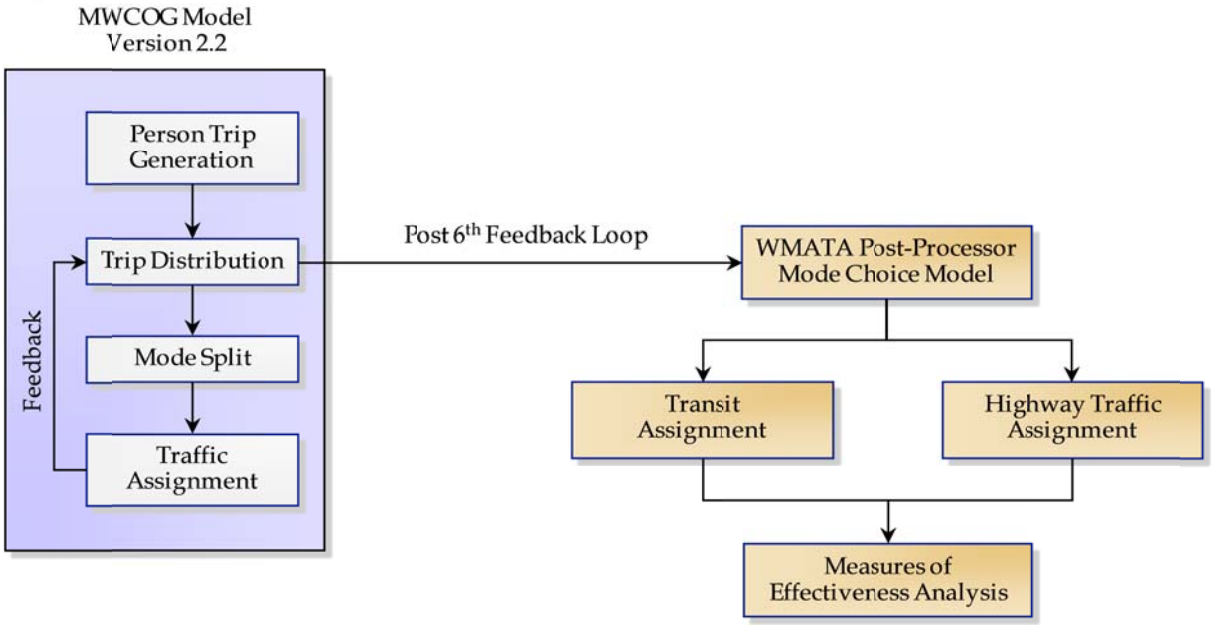
Description of Framework

This section presents a brief overview of the travel demand forecasting methodology used for the Dulles Corridor Study 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 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 2.2 model with WMATA Post-Processor Mode Choice Model. The output from the (Washington Metropolitan Area Transit Authority (WMATA) Post-Processor Mode Choice Model (WMATA Post-Processor) is used as input to the Fairfax County subzone highway assignment. Figure 3.1 illustrates the structure of the model framework.

This modeling system was set up to make full use of the regional model development and take advantage of the smaller traffic analysis zones and refined transportation network for Fairfax County. When this modeling system was prepared, Version 2.2 of the TPB model was the adopted version (adopted November 2008). The WMATA Post-Processor has since been integrated into the TPB Version 2.3 model. The WMATA Post-Processor is applied at the end of the model chain similar to traditional post processors used for highway link refinement or MOE calculations. The WMATA Post-Processor represents a more-advanced tool as compared with the mode choice model imbedded in Version 2.2 because it provides mode shares at the submode level. Specifically, the WMATA Post-Processor predicts mode shares for bus, bus to rail, rail, and commuter rail. It also predicts the mode shares by access to transit, including walk to transit, drive to transit, and kiss-n-ride.

Both the TPB Version 2.2 model set and the WMATA Post-Processor cover the entire metropolitan region. To look closer at the Dulles Corridor Study Area, the WMATA Post-Processor output was used with the Fairfax County Subarea model to assign traffic at a more detailed level within Fairfax County.

Figure 3.1 - Model Framework



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 2,191 TAZs in the TPB Version 2.2 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.

The TPB model is a four-step model. 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 four 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 (NHB) –** NHB trips are trips that do not originate or end at a home. These can include trips from the place of work which return to the place of work or other similar type of trips.

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 mode 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 1994 household travel survey. The assignment was validated to the base year traffic counts and the base year transit ridership.

Subarea Forecasting Tool Details

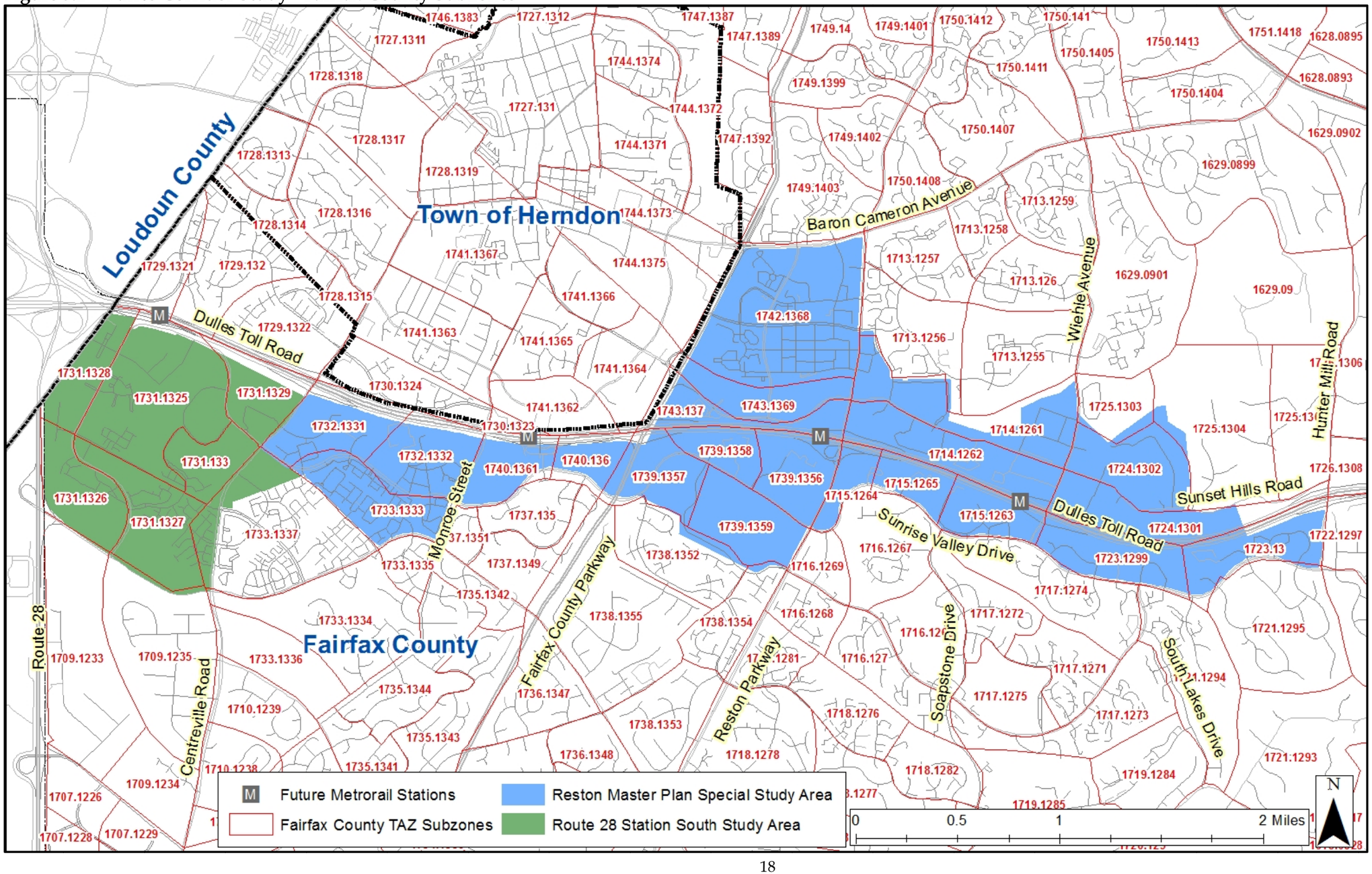
The Fairfax County subarea model is based upon, and is an extension of, the regional travel demand model developed by TPB staff for regional transportation planning and air quality conformity analysis. The subarea model disaggregates the Fairfax County portion of the regional trip table and assigns that 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. The Fairfax County subzones are shown in Figure 3.2.

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.

Cambridge Systematics (CS), FCDOT's consultant used for assistance with the Dulles Corridor Study, 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 a Year 2005 model run were compared against traffic counts in the Dulles Corridor Study area to ensure that the model results were accurate.

Figure 3.2 - Dulles Corridor Study - Fairfax County Subzones



Post-Processing

Post-processing refers to analytical procedures to adjust the raw outputs that are produced by the travel demand forecasting model to account for variations of the model estimates from the true values. Currently, the guide for post-processing travel demand model forecasts is the National Cooperative Highway Research Program Report 255 (NCHRP Report 255), Highway Traffic Data for Urbanized Area Project Planning and Design. Although this report was published in 1982 and its update is underway, it is still the current nationally recognized technical resource for post-processing and was cited in the Federal Highway Administration (FHWA) guidance published in 2010 on application of travel and land use forecasting for National Environmental Policy Act (NEPA) studies.

Post-processing is necessary because the travel demand forecasting model process is macroscopic in nature. Aggregation errors are typical of the traditional trip-based model. As a result of the travel demand forecasting model network limitations and the macroscopic characteristics, certain adjustments may need to be made to the link volumes. The highway network that is used in a travel demand model is a simplified representation of the actual roadway network and does not include all the roads, intersections or access points (e.g., curb cuts, driveways) in the actual roadway system. Therefore, the results that are produced from the assignment need to be adjusted to compensate for these missing roadways and biased assignment to certain links in the model. Post-processing also makes adjustments for capacity limitations which are not fully represented in the model.

The post-process refinement applies a set of procedures using spreadsheets as outlined in NCHRP Report 255. Correcting for model bias is based on the difference between the count data and the model output for the validation year. The difference in the count and model results is applied to the future year forecast. The estimated model volumes for AM and PM peak periods were converted to peak hour volumes using peaking factors. The base year counts were used as the basis for the post-processing refinements in conjunction with the model estimates for the future year (2030). The refined peak hour approach volumes were used to grow the base year turning movements at the intersections. This process was done first for the Round 8 model runs, and the changes between Round 8 and other scenarios were used to derive approach volumes and turning movements for these other scenarios.

As part of calibrating the model and for quality control and assurance, minimum time highway path trees were produced. These paths were produced for a select number of origin and destination pairs, including:

- Proposed Silver Line Metro station areas to select locations in and near the study area;
- Study area zones to zones within 3 miles
- Study area zones to zones between 3 and 10 miles
- Study area zones to zones between 10 and 15 miles
- Study area zones to zones beyond 15 miles

Trip Reductions

Peak period vehicle trip reductions due to the use of transit, walking, biking, and Transportation Demand Management (TDM) as well as TDM programs and TDM proffers by developers are accounted for the in the model.

In order to maximize transit use of the CLRP bus network, FCDOT increased the frequency of bus service in the model, for Scenario G, to match the headways in the Fairfax County's Transit Development Plan (TDP) and added two express bus routes and one bus rapid transit route to the network. The relevant sections of the TDP are included in the Appendix as Attachment #5. The County therefore modeled, to the fullest extent possible, all the transit service that is planned in and around the Dulles Corridor Study area. TDM factors were not post-processed because the TDM reductions produced by the model have been calibrated with survey data collected from the Washington Metropolitan region.

Traffic Operation Analysis

The traffic operation analysis was conducted based on established procedures and standards. Traffic operations at the 24 selected intersections in the study area were identified and analyzed using Synchro Version 7. The Virginia Department of Transportation (VDOT) has existing Synchro models containing the intersections to be evaluated as part of this project. Fairfax County obtained these Synchro networks and provided them to CS.

CS revised the Synchro models to represent different land use and transportation scenarios. For each of the proposed scenarios, traffic operations at these intersections were modeled and analyzed and then optimized in terms of the intersection signal splits and offsets. These intersections were evaluated using Measures of Effectiveness (MOEs) including level of service (LOS), intersection delay (seconds of delay (SOD)), queue lengths, and Volume/Capacity (v/c) ratios. Using the base network analysis results, and on the basis of both the intersection LOS by movement and the v/c criteria, mitigation strategies were developed and applied to the various scenarios with a focus on improving those signalized intersections with an LOS of F. Two sets of mitigation strategies were implemented: low mitigation, which includes signal adjustment and the addition of some turning lanes, and high mitigation, which includes the addition of both turning and through lanes.

Tiered Approach

A tiered approach was used when mitigation problem traffic movements at intersections resulting from the intersection analyses. The reason for applying the tiered approach is to first apply and exhaust mitigation measures with the lowest cost and impact. If problems still persist, further mitigation measures are applied. The following sequential steps were applied in the tiered approach:

1. Signal Optimization: Before turn lanes were added or other improvements considered, the phasing of signals were optimized.

2. Lane Function: Using the existing right-of-way and approach lanes at an intersection, the lane configuration was evaluated to see if changing the approach lanes could alleviate a failing intersection or a severely failing movement at an intersection.

3. Intersection Control: The intersection control was evaluated to see if an unsignalized intersection can be signalized to mitigate problem movements. However, all the intersections analyzed were signalized so this step in the tiered approach was not applied.

4. Additional Lanes: If the first three steps did not mitigate a failing intersection, then the addition of one or more exclusive turn lanes were evaluated for inclusion. At some intersections, particularly those close to Metro stations, not all turn lanes that could alleviate a failing intersection were added as mitigation measures. The reason is to maintain a balance between walkability and the movement and speed of vehicles and to accommodate all modes of transportation.

5. If an intersection is still failing, another approach that will be evaluated is the addition of links of the grid of streets which might be able to divert some traffic away from the problematic intersection by creating alternative paths for vehicles. The conceptual grids of streets in the study area will be further analyzed and finalized in a finer grain study which will be conducted after the adoption of the plan amendment.

3.2 Measures of Effectiveness

The Measures of Effectiveness (MOE) for the Dulles Corridor Study were developed to provide quantitative results that can be used to evaluate various scenarios and help inform decision-makers, professional staff, appointed community groups, and citizens.

Definitions of Measures

The following MOEs were produced as part of the modeling effort for each individual scenario:

- The total number of peak period and daily trips by mode entering, exiting, and staying within the study area.
- The mode shares with respect to Single Occupancy Vehicle (SOV), High Occupancy Vehicle (HOV), and transit was reported.
- With respect to transit, the transit trips and transit shares were summarized for the four transit-oriented development (TOD) areas as defined by half-mile and 1-mile buffers.
- The vehicle hours of travel and vehicle miles of travel for the study area were summarized by congestion levels (under-, near- and over-capacity).

- Through vehicle trips were calculated at select locations in the study area, using the select link analysis procedure in the highway assignment, to determine the impact of trips that drive through the Dulles Corridor Study area, but neither originate or are destined for the study area.

- Synchro results were summarized for both morning and evening periods for the 24 intersections included in the study area. The Synchro results include overall intersection Level of Service (LOS), seconds of delay, turning movement LOS with seconds of delay, and queue for each movement at the 24 intersections for the AM and PM peak hour. Intersection LOS was defined based on the Highway Capacity Manual (HCM) (Table 3.1.)

- Seven intersections were identified as gateway intersections (described in Section 4.4) when the results of Scenario E were presented. They are:

    - Centreville Road/Frying Pan Road
    - Fairfax County Parkway/Sunrise Valley Drive
    - Fairfax County Parkway/Sunset Hills Road
    - Reston Parkway/Sunrise Valley Drive
    - Reston Parkway/Sunset Hills Road
    - Wiehle Avenue/Sunrise Valley Drive
    - Wiehle Avenue/Sunset Hills Road

Synchro results were averaged together to show the peak delay at the gateway intersections. The remaining intersections also were averaged together. Then all intersections were averaged to show the average intersection delay for an intersection within the study area.

- Intersection peak spreading was conducted to show how long an intersection was failing for five intersections selected by Fairfax County. The intersections are:

    - Fairfax County Parkway/Sunrise Valley Drive
    - Reston Parkway/Sunset Hills Road
    - Reston Parkway/Sunrise Valley Drive
    - Centreville Road/Sunrise Valley Drive
    - Wiehle Avenue/Sunset Hills Road

The above metric was used to help inform the community groups about the impact of each scenario. It is not included in this transportation report.

Table 3.1 - Level of Service (LOS) Criteria for Signalized Intersections

LOS	Delay per Vehicle (sec)	Expected Conditions at Intersection
A	≤10	Negligible delay
B	> 10 and ≤ 20	Short delays
C	> 20 and ≤ 35	Number of vehicles stopping is significant
D	> 35 and ≤ 55	Influence of congestion becomes more noticeable
E	> 55 and ≤ 80	Significant delays causing long queues
F	> 80	Oversaturated; Vehicles wait through multiple signal cycles

Source: *Highway Capacity Manual 2010*, Transportation Research Board

4.0 Assessment of Land Use Scenarios

The analysis results of the Dulles Corridor Study, using the Measures of Effectiveness (MOEs) described in Section 3.0, are presented in this section of the report. Section 4.1 details how much travel is generated by each land use analyzed. Section 4.2 examines where that travel occurs, and Section 4.3 details the modes used. Section 4.4 details highway facilities used for travel, as well as the road system performance in each scenario. Section 4.5 discusses transit travel associated with transit-oriented developments in Scenario G.

4.1 How Much Travel by Scenario

As noted in Section 2.0, the tested land use scenarios represent development levels with different magnitudes and different mixes of development. As expected, travel varies with the magnitude and mix of development in the study area. One measure of travel is the number of "production" and "attraction" trips generated under each land use scenario. For all home based trips, "productions" occur at the home end of the trip regardless of the direction of the trip (i.e., either to or from the non-home location) and "attractions" occur at the non-home end of the trip regardless of the direction of the trip (i.e., either to or from the home). For non-home based trips, the production end of the trip is the same as the origin of the trip, and the attraction end of the trip is the same as the destination of the trip. The magnitude of productions and attractions represents trip making associated with planned or existing development in the Study Area.

The TPB travel demand modeling framework incorporates multidimensional relationships between development levels and trip making. In general, higher levels of residential development lead to a higher level of home-based trip making. The combination of both higher employment and higher residential development leads to a lower number of non-home based trips due, in part, to the phenomenon of internal trip capture, whereby non-home based travel needs can be met without the need for a motorized trip. The complicated relationships between development levels and trip making rates contained in the model are reflected in the trip making forecast.

The model is calibrated to 2005 and this is considered the Existing Base. The results shown below have not been factored up to existing conditions using the existing development reported in Section 2. This is because the existing conditions are based on actual intersection counts, and the results are reported in Section 4.4. The following information is presented in order to assess and show how the proposed Scenario G compares to the Existing Base (2005) and 2030 Round 8.

Table 4.1 details the motorized trip making by trip purpose by the land use scenario. The total daily motorized person trips (vehicle and transit) beginning and/or ending in the Study Area are 37 percent higher in Scenario G versus Round 8 and more than double those in the 2005 Base. Higher levels of home-based trips are seen in Scenario G versus the Round 8 scenario, largely due to the higher levels of residential development in Scenario G.

Table 4.1 - Daily Motorized (Automobile and Transit) Person Trips by Trip Purpose with Production and/or Attraction within Dulles Reston

Scenario	HBW Trips	HBO/HBS Trips	NHB Trips	Total Trips
2005 Base	78,512	85,183	89,577	253,272
2030 COG Round 8	103,344	151,451	122,810	377,606
2030 Scenario G	130,488	237,758	150,891	519,136

HBW – Home Based Work
HBO – Home Based Other
HBS – Home Based Shopping
NHB – Non-Home Based

4.2 Where Travel Occurs by Land Use

As noted in Section 4.1, higher levels of development are associated with higher levels of trip making. The evolving development levels also lead to changes in travel patterns over time. Proportions of person trips beginning or ending in the Study Area are higher in Scenario G versus Round 8 and 2005, 22% for Scenario G versus 15% for Round 8 and 10% for the 2005 Base. A more balanced jobs-to-housing ratio is present as development is intensified, leading to a higher proportion of travel internal to the Study Area. Internal trips are almost 12 percentage points higher in Scenario G versus the 2005 Base (Table 4.2).

The trip generation effects discussed for all of the Dulles Corridor Study trips can be seen in greater detail in Tables 4.3 through 4.5, which show the trips into, out of, and within the Study Area by land use analyzed and purpose. Internal Home Based Work (HBW) trips, and HBW trips produced within the Study Area that are attracted elsewhere, increase for Scenario G (30% of total HBW) versus Round 8, as shown in Table 4.3. Scenario G has the highest share of internal HBW trips.

Two-thirds of Scenario G's Home Based Shopping (HBS) and Home Based Other (HBO) trips stay within the Study Area or are produced in the Study Area and attracted destinations outside of the Dulles Corridor Study Area compared to 49% for Round 8 and 33% for the 2005 Base (Table 4.4). Scenario G also has the highest share of internal trips (27%) compared to 20% for Round 8 and 12% for 2005 Base.

As shown in Table 4.5, Scenario G has higher Non-Home Based (NHB) trips compared to Round 8 and the 2005 Base and the highest proportion of internal NHB trips. The proportion of NHB trips produced elsewhere but attracted to the Study Area is lowest in Scenario G, compared with Round 8 and 2005, but the percentage difference is small.

Table 4.2 - Total Daily Person Trips with Production and/or Attraction End in the Study Area

	2005 Base	2030 COG Round 8	2030 Scenario G
Trips with Production and Attraction Ends in the Study Area	26,052	57,382	111,845
Trips Produced in the Study Area and Attracted Elsewhere	61,434	110,715	172,782
Trips Attracted to the Study Area and Produced Elsewhere	165,785	209,510	234,509
Total	**253,272**	**377,606**	**519,137**
Percent of Internal Trips	**10.3%**	**15.2%**	**21.5%**

Note: Figures reflect daily motorized (automobile and transit) person trips.

Table 4.3 - Home Based Work Daily Person Trips with Production and/or Attraction End in the Study Area

	2005 Base	2030 COG Round 8	2030 Scenario G
Trips with Production and Attraction Ends in the Study Area	2,032	5,540	13,403
Trips Produced in the Study Area and Attracted Elsewhere	5,438	14,748	26,368
Trips Attracted to the Study Area and Produced Elsewhere	71,042	83,057	90,717
Total	**78,512**	**103,345**	**130,488**

Note: Figures reflect daily motorized (automobile and transit) person trips.

Table 4.4 - Home Based Shopping and Home Based Other Daily Person Trips with Production and/or Attraction End in the Study Area

	2005 Base	2030 COG Round 8	2030 Scenario G
Trips with Production and Attraction Ends in the Study Area	10,671	29,699	64,505
Trips Produced in the Study Area and Attracted Elsewhere	17,543	45,251	87,656
Trips Attracted to the Study Area and Produced Elsewhere	56,969	76,502	85,597
Total	**85,183**	**151,451**	**237,758**

Note: Figures reflect daily motorized (automobile and transit) person trips.

Table 4.5 - Non-Home Based Daily Person Trips with Production and/or Attraction End in the Study Area

	2005 Base	2030 COG Round 8	2030 Scenario G
Trips with Production and Attraction Ends in the Study Area	13,349	22,143	33,937
Trips Produced in the Study Area and Attracted Elsewhere	38,453	50,716	58,758
Trips Attracted to the Study Area and Produced Elsewhere	37,774	49,951	58,195
Total	**89,577**	**122,810**	**150,891**

Note: Figures reflect daily motorized (automobile and transit) person trips.

In summary, the overall number of trips increases from Scenario G compared to Round 8 but the number of internal trips and percentage also increases significantly. This leads to shorter trips even though the total number has increased.

4.3 Mode Used for Travel by Scenario

This section presents the mode choice results for the Dulles Corridor Study, and Section 4.5 discusses transit shares and distinguishes between the TOD and Non-TOD areas. In Section 4.5, the TOD focus offers a finer-grain depiction of the impact of density closest to the Metrorail Stations and highlights travel patterns in the Dulles Corridor Study area.

Tables 4.6 and 4.7 detail the mode share results for home based work trips. These results are reported based on all motorized trips (automobile and transit) that originate in and/or are destined to the Study Area. Table 4.6 reports the mode share for trips with either production end or attraction end in the Study Area. Table 4.7 shows the differences between the transit percentages for the production and attraction end of trips. Scenario G has the highest transit shares and lowest single occupancy vehicle (SOV) and High Occupancy Vehicle (HOV) shares of the HBW trips.

Table 4.6 - Mode Share for Home Based Work Daily Person Trips with Production and/or Attraction End in the Study Area

	2005 Base	2030 COG Round 8	2030 Scenario G
SOV	78.4%	73.1%	72.2%
HOV 2+	18.9%	18.8%	17.9%
Transit	2.7%	8.2%	9.9%

Note: Figures reflect share of daily motorized (automobile and transit) person trips.
SOV – Single Occupancy Vehicle
HOV – High Occupancy Vehicle

Table 4.7 - Transit Mode Share for Home Based Work Daily Person Trips with Production End and/or Attraction End in the Study Area

Trip End	2005 Base	2030 COG Round 8	2030 Scenario G
Production	6.8%	17.2%	16.6%
Attraction	2.3%	6.2%	7.5%
Combined	2.7%	8.2%	9.9%

Daily transit trips are shown in Table 4.8, which shows the dramatic increase of transit trips in Scenario G versus Round 8 and the 2005 Base.

Table 4.8 - Dulles Corridor Study Daily Total Transit Trips

	Existing 2013	2030 COG Round 8	2030 Scenario G
Transit Trips	2,367	9,367	13,879

Tables 4.6 through 4.8 show that the percent of transit trips are increasing from the 2005 Base to Round 8, and are the highest for Scenario G.

4.4 Highway Facilities Used and Road System Performance by Scenario

Measures of highway facility use and road system performance were included among the MOEs considered in the assessment. This section summarizes findings from the intersection analysis and vehicle hours of congestions in the study area.

Intersection Analysis

Twenty-four intersections were identified for intersection analysis (Figure 4.1), seven of which are classified as "gateway intersections". The 24 intersections chosen are on major north–south and east-west roads and where the most impact can be expected due to the proposed land use changes. The seven gateway intersections, shown in Figure 4.1, are along Sunrise Valley Drive at Centreville Road, Fairfax County Parkway, Reston Parkway, and Wiehle Avenue and along Sunset Hills Road at Fairfax County Parkway, Reston Parkway, and Wiehle Avenue. These intersections are considered "gateway intersections" as these are major intersections where vehicular traffic enters or leaves the study area, excluding the intersections at the Dulles Toll Road on/off ramps.

As discussed in Section 3, several MOEs were used to evaluate the operational performance of these intersections, including intersection LOS, seconds of delay, queue length at the 50th percentile and 95th percentile, and seconds of delay by movement. Intersection seconds of delay were averaged for the gateway intersections, as well as for the non-gateway intersections. Intersection LOS was defined based on the 2010 Highway Capacity Manual. Tables showing the queue lengths with lane storage, volumes with lane storage, and level of service and seconds of delay by movement for Existing 2013, Round 8, and Scenario G for the AM and PM peak hour are included in the Appendix as Attachment #1.

Roadway Volume-to-Capacity Results

Roadway volume-to-capacity (v/c) ratios were sparingly used mainly to understand if a roadway was drawing any vehicular volume. However, they are included in Attachment #2 in the Appendix. They represent key roadway links in the Study area. Two sets of roadway volume-to-capacity ratios are included in the Appendix; freeway v/c ratios and non-freeway v/c ratios. The first set of v/c ratios in the Appendix are the freeway v/c ratios. The results are taken directly out of the model.

The freeway traffic assignments are considered "raw" traffic assignments, meaning that there is no *post processing* applied to the volumes after the model traffic assignment step. The *intersection* volumes, which are presented later in this section, went through a post processing and thus may be different from the intersection "raw" traffic assignments. These freeway volumes will provide useful information even in their "raw" state. They still went through a rigorous traffic assignment process and are helpful to show the differences in volumes, speeds, v/c ratios and other attributes between scenarios.

Capacity changes in the model and used to determine the v/c ratio: The model link capacity may change between scenarios even though we don't change link input. The link capacity is influenced by the land use density. If we increase population and employment in a zone(s) in a test scenario, the link capacity in that immediate area would decrease (an inverse relationship). A suburban area would have higher capacity links compared to an urban area.

The second set of v/c ratios presented in the Appendix is the non-freeway v/c ratios. The volumes used for these are directly from the intersection analysis that has been post-processed. The capacities are from the model. Thus caution should be used when evaluating the freeway and non-freeway v/c ratios included in the Appendix.

Level of Service Standard

The current acceptable overall intersection level of service (LOS) for this area is LOS D. This is the County Policy in areas where there is no specific mention of a LOS standard. The County is proposing to change the LOS standard to an overall intersection LOS E within a half-mile of a Metro Station, which is a TOD area as defined in the Policy Section of the Comprehensive Plan. The proposed change in the LOS standard is for the area located within the Dulles Corridor Study. The County is moving towards a LOS E standard for all TOD areas within the County to promote slower speeds and encourage the use of alternative transportation modes other than an automobile.

2013 Existing Conditions

Results

The intersection counts for the study area were collected in 2010 and have been factored up to 2013 using 3% growth over three years. Tables 4.9 and 4.10 show the existing year (2013) intersection LOS for the morning and evening peak hour. As shown in Table 4.9, three intersections in the morning have a LOS E and six intersections have a LOS F. Four of the six failing intersections are located where a major road meets the Dulles Toll Road on/off ramps. All failing intersections are located on Fairfax County Parkway and Reston Parkway. Two of the six failing intersections are among the seven gateway intersections. In the evening three intersections have a LOS E and seven have a LOS F, as shown in Table 4.10. Four of the seven gateway intersections are failing in the evening peak hour. Both tables show that, on average, the gateway and non-gateway intersections operate at LOS E. Table 4.11 shows the levels of service by movement for the morning and evening peak hour.

Figures 4.2A-C and 4.3A**-C** show Existing lane configurations along with the volumes by movement and levels of service by movement for the 24 intersections analyzed in the study, respectively. In Figures 4.3A-C and Table 4.11, when there is a shared lane, such as when a through lane and right turn lane are shared, the LOS is reported with the heaviest movement.

Figure 4.1 - Intersections Analyzed

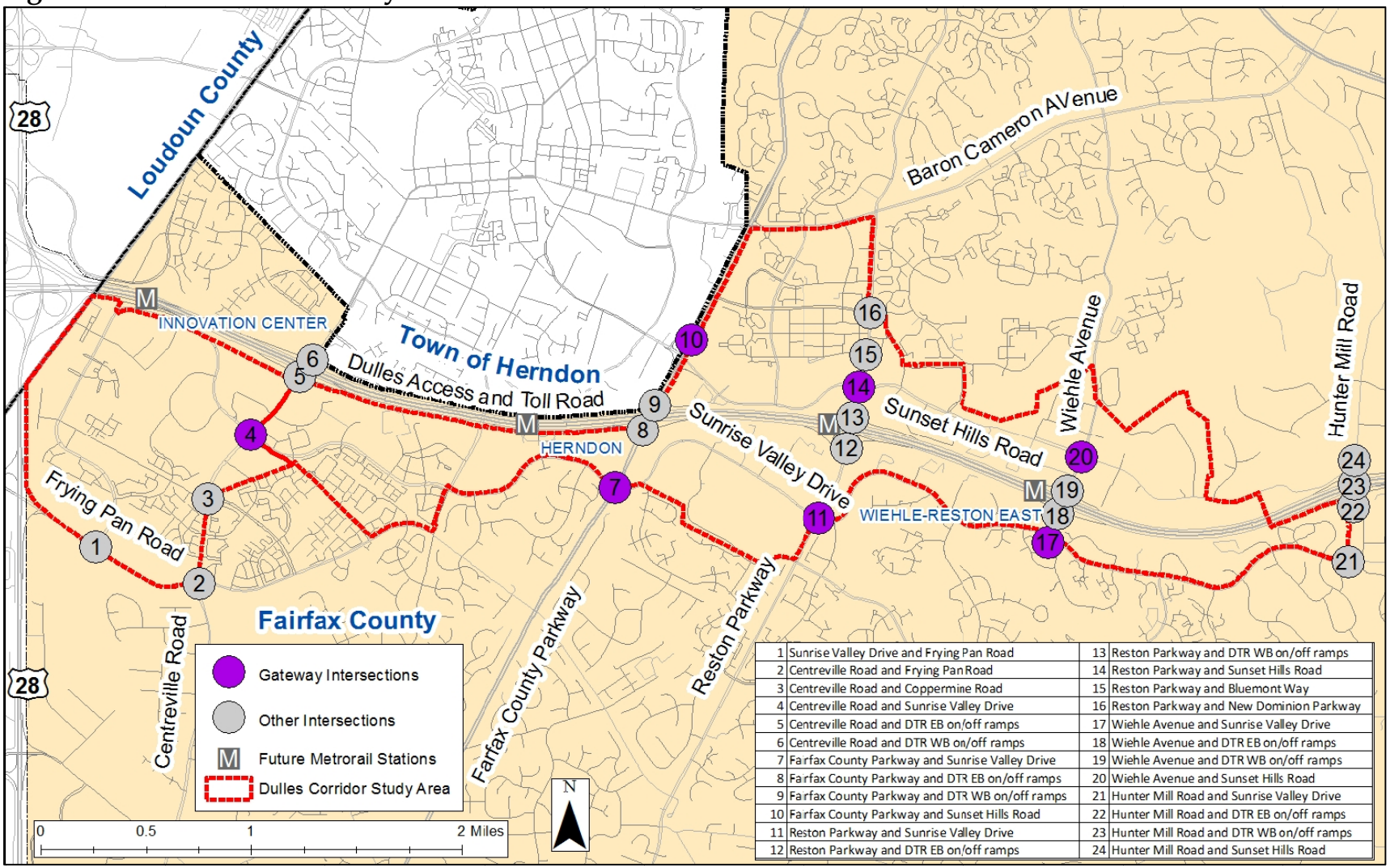


Table 4.9 - Existing (2013) Morning –Peak Hour Intersection Levels of Service

	Inter. ID #	Major Street	Cross Street	Total Intersection Approach Volume	Before Optimization	
					Int. Delay (sec/veh)	LOS
Gateway Intersections	2	Centreville Road	Frying Pan Rd	3,840	37.9	D
	7	Fairfax County Pkwy	Sunrise Valley	6,656	106	F
	10	Fairfax County Pkwy	Spring St	6,299	26.7	C
	11	Reston Pkwy	Sunrise Valley	4,955	64.4	E
	14	Reston Pkwy	Sunset Hills	6,890	93.3	F
	17	Wiehle Avenue	Sunrise Valley	4,121	41.6	D
	20	Wiehle Avenue	Sunset Hills	5,175	47.6	D
Non-Gateway Intersections	1	Sunrise Valley Drive	Frying Pan Rd	3,631	38.7	D
	3	Centreville Road	Coppermine Rd	3,535	28	C
	4	Centreville Road	Sunrise Valley	5,889	56.4	E
	5	Centreville Road	DTR EB On/Off ramps	4,715	20	C
	6	Centreville Road	DTR WB On/Off ramps	4,092	45.3	D
	8	Fairfax County Pkwy	DTR EB On/Off ramps	6,545	117	F
	9	Fairfax County Pkwy	DTR WB On/Off ramps	7,225	179.8	F
	12	Reston Pkwy	DTR EB On/Off ramps	4,874	235.5	F
	13	Reston Pkwy	DTR WB On/Off ramps	5,557	126.8	F
	15	Reston Pkwy	Bluemont Way	3,695	28	C
	16	Reston Pkwy	New Dominion Pkwy	3,889	59	E
	18	Wiehle Avenue	DTR EB On/Off ramps	3,705	25.7	C
	19	Wiehle Avenue	DTR WB On/Off ramps	3,630	20.5	C
	21	Hunter Mill Road	Sunrise Valley	3,116	32	C
	22	Hunter Mill Road	DTR EB On/Off ramps	2,425	13.9	B
	23	Hunter Mill Road	DTR WB On/Off ramps	2,032	42.9	D
	24	Hunter Mill Road	Sunset Hills	2,266	52.8	D
Gateway Intersections Weighted Average					63.2	E
Non-Gateway Intersections Weighted Average					79.2	E
All Intersections Weighted Average					73.7	E

Table 4.10 - Existing (2013) Evening –Peak Hour Intersection Levels of Service

	Inter. ID #	Major Street	Cross Street	Total Intersection Approach Volume	Before Optimization	
					Int. Delay (sec/veh)	LOS
Gateway Intersections	2	Centreville Road	Frying Pan Rd	4,173	33.7	C
	7	Fairfax County Pkwy	Sunrise Valley	6,986	100.7	F
	10	Fairfax County Pkwy	Spring St	5,813	19.5	B
	11	Reston Pkwy	Sunrise Valley	5,653	86.1	F
	14	Reston Pkwy	Sunset Hills	7,770	125.2	F
	17	Wiehle Avenue	Sunrise Valley	4,311	31.3	C
	20	Wiehle Avenue	Sunset Hills	5,642	89	F
Non-Gateway Intersections	1	Sunrise Valley Drive	Frying Pan Rd	3,853	190.2	F
	3	Centreville Road	Coppermine Rd	3,615	25.1	C
	4	Centreville Road	Sunrise Valley	6,285	76.1	E
	5	Centreville Road	DTR EB On/Off ramps	5,152	16.1	B
	6	Centreville Road	DTR WB On/Off ramps	4,951	58.2	E
	8	Fairfax County Pkwy	DTR EB On/Off ramps	5,987	48.8	D
	9	Fairfax County Pkwy	DTR WB On/Off ramps	6,882	67	E
	12	Reston Pkwy	DTR EB On/Off ramps	5,322	340.2	F
	13	Reston Pkwy	DTR WB On/Off ramps	6,070	148.5	F
	15	Reston Pkwy	Bluemont Way	4,563	27.9	C
	16	Reston Pkwy	New Dominion Pkwy	4,643	44.6	D
	18	Wiehle Avenue	DTR EB On/Off ramps	4,116	18.3	B
	19	Wiehle Avenue	DTR WB On/Off ramps	4,476	20.1	C
	21	Hunter Mill Road	Sunrise Valley	2,821	29.1	C
	22	Hunter Mill Road	DTR EB On/Off ramps	2,338	13.7	B
	23	Hunter Mill Road	DTR WB On/Off ramps	2,096	41.2	D
	24	Hunter Mill Road	Sunset Hills	2,026	36.4	D
Gateway Intersections Weighted Average					75.7	E
Non-Gateway Intersections Weighted Average					78.6	E
All Intersections Weighted Average					77.6	E

Table 4.11 - Existing (2013) –Peak Hour Intersection Levels of Service by Movement

AM PEAK HOUR

Inter. ID #	Major Street	Cross Street	Eastbound			Westbound			Northbound			Southbound			Int. Delay (sec/veh)	LOS
			Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right		
1	Sunrise Valley Drive	Frying Pan Rd	E	A			E	A				D		C	38.7	D
2	Centreville Road	Frying Pan Rd	E	E	A	E	E	C	E	C	A	E	B	A	37.9	D
3		Coppermine Rd	D	D	A	C	E	B	E	C		E	B	A	28	C
4		Sunrise Valley	E	E		E	E	B	F	D	B	E	C	F	56.4	E
5		DTR EB On/Off ramps	E		A					A	A	E	B		20	C
6		DTR WB On/Off ramps				F	F	E	C	C			C	A	45.3	D
7	Fairfax County Pkwy	Sunrise Valley	F	F	C	F	F	F	F	F	B	F	C	A	106	F
8		DTR EB On/Off ramps	F		C					F	A	E	C		117	F
9		DTR WB On/Off ramps				D		F	D	B			A	A	179.8	F
10		Spring St	D		A				F	A			C	A	26.7	C
11	Reston Pkwy	Sunrise Valley	F	F		F	F	E	F	D	A	F	C	A	64.4	E
12		DTR EB On/Off ramps	D		E					B	A		F		235.5	F
13		DTR WB On/Off ramps				E	E	F	F	D			C	A	126.8	F
14		Sunset Hills	F	F	C	F	E	A	F	C	F	F	C	A	93.3	F
15		Bluemont Way	F	F	C	F	F		F	A	A	F	C	A	28	C
16		New Dominion Pkwy	D	F	C	E	E	A	F	B	A	F	D	C	59	E
17	Wiehle Avenue	Sunrise Valley	E	B			D	D				D		A	41.6	D
18		DTR EB On/Off ramps	E	E	E					B	A	D	B		25.7	C
19		DTR WB On/Off ramps				E	E	E	D	B			A	A	20.5	C
20		Sunset Hills	C	E	B	D	D		E	C	D	D	D		47.6	D
21	Hunter Mill Road	Sunrise Valley	E	B			D	B				D		A	32	C
22		DTR EB On/Off ramps	E		B					B	A	D	A		13.9	B
23		DTR WB On/Off ramps				E		F	B	C			A	A	42.9	D
24		Sunset Hills	F		B				F	A			E	A	52.8	D

PM PEAK HOUR

Inter. ID #	Major Street	Cross Street	Eastbound			Westbound			Northbound			Southbound			Int. Delay (sec/veh)	LOS
			Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right		
1	Sunrise Valley Drive	Frying Pan Rd	E	C			F	C				C		F	190.2	F
2	Centreville Road	Frying Pan Rd	E	E	C	E	E	B	E	A	A	D	D	B	33.7	C
3		Coppermine Rd	D	D	B	C	E	A	E	B		E	C	A	25.1	C
4		Sunrise Valley	E	D		F	E	F	E	E	B	F	D	B	76.1	E
5		DTR EB On/Off ramps	F		A					B	B	F	A		16.1	B
6		DTR WB On/Off ramps				E	E	F	F	C			E	B	58.2	E
7	Fairfax County Pkwy	Sunrise Valley	F	F	E	F	F	F	F	F	B	F	E	B	100.7	F
8		DTR EB On/Off ramps	F		D					C	A	C	B		48.8	D
9		DTR WB On/Off ramps				D		F	C	D			D	A	67	E
10		Spring St	E		A				D	A			C	A	19.5	B
11	Reston Pkwy	Sunrise Valley	F	F		F	F	F	F	E	A	F	E	A	86.1	F
12		DTR EB On/Off ramps	F		A					A	A		F		340.2	F
13		DTR WB On/Off ramps				E	E	F	F	B			F	C	148.5	F
14		Sunset Hills	F	E	F	F	E	D	F	E	A	F	F	A	125.2	F
15		Bluemont Way	F	F	D	E	E		F	A	A	F	C	A	27.9	C
16		New Dominion Pkwy	E	F	B	E	F	D	F	C	A	F	C	B	44.6	D
17	Wiehle Avenue	Sunrise Valley	E	B			D	C				C		B	31.3	C
18		DTR EB On/Off ramps	E	E	E					B	A	D	A		18.3	B
19		DTR WB On/Off ramps				E	E	E	E	A			A	A	20.1	C
20		Sunset Hills	F	E	F	E	E		E	D	A	D	D		89	F
21	Hunter Mill Road	Sunrise Valley	D	C			D	B				D		A	29.1	C
22		DTR EB On/Off ramps	D		C					B	A	D	A		13.7	B
23		DTR WB On/Off ramps				F		F	D	C			B	A	41.2	D
24		Sunset Hills	F		B				C	A			F	A	36.4	D

Figure 4.2A - Existing (2013) –Lane Configuration, Peak Hour Volume, and Intersection Level of Service – West Area

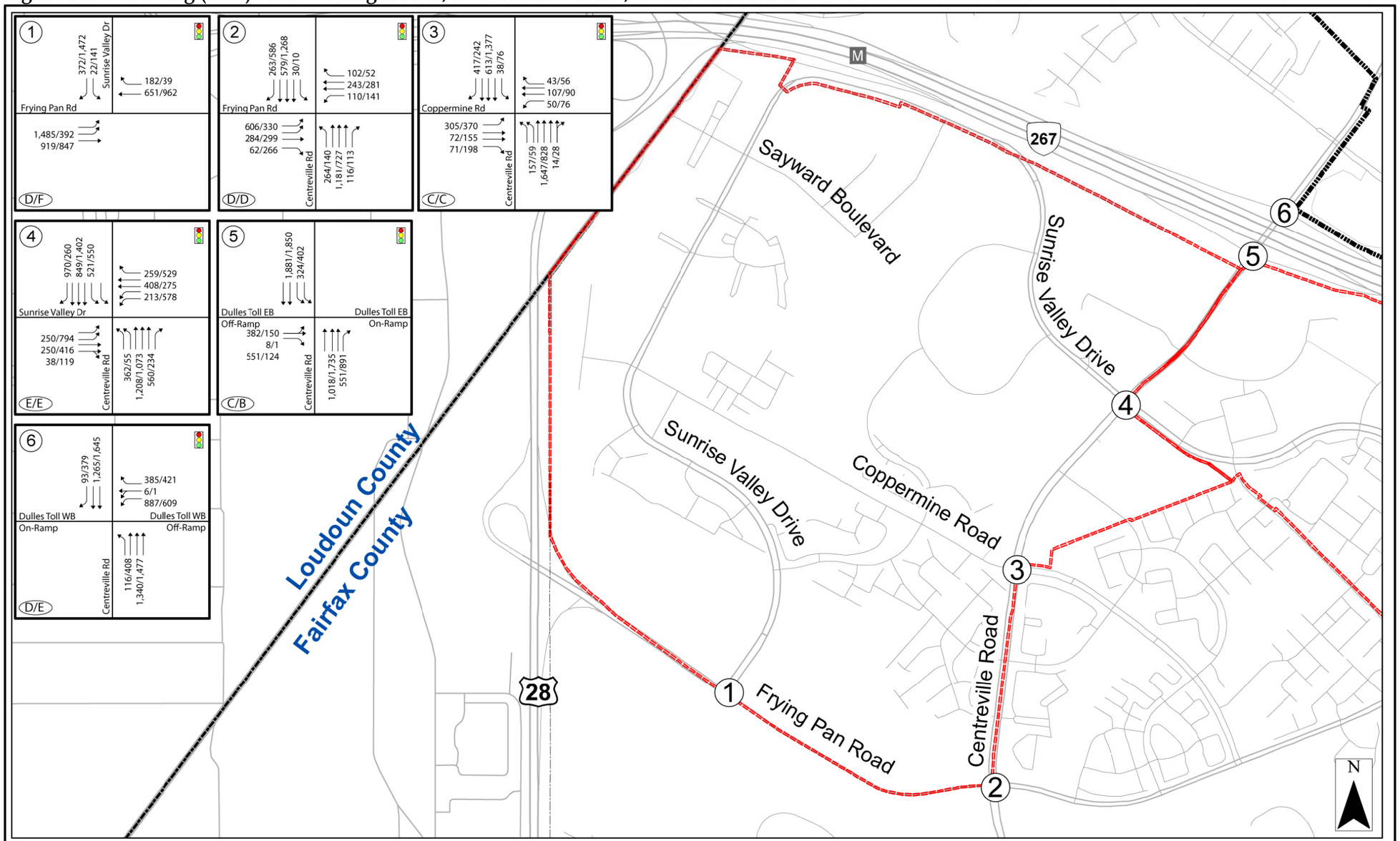


Figure 4.2B - Existing (2013) –Lane Configuration, Peak Hour Volume, and Intersection Level of Service – Central Area

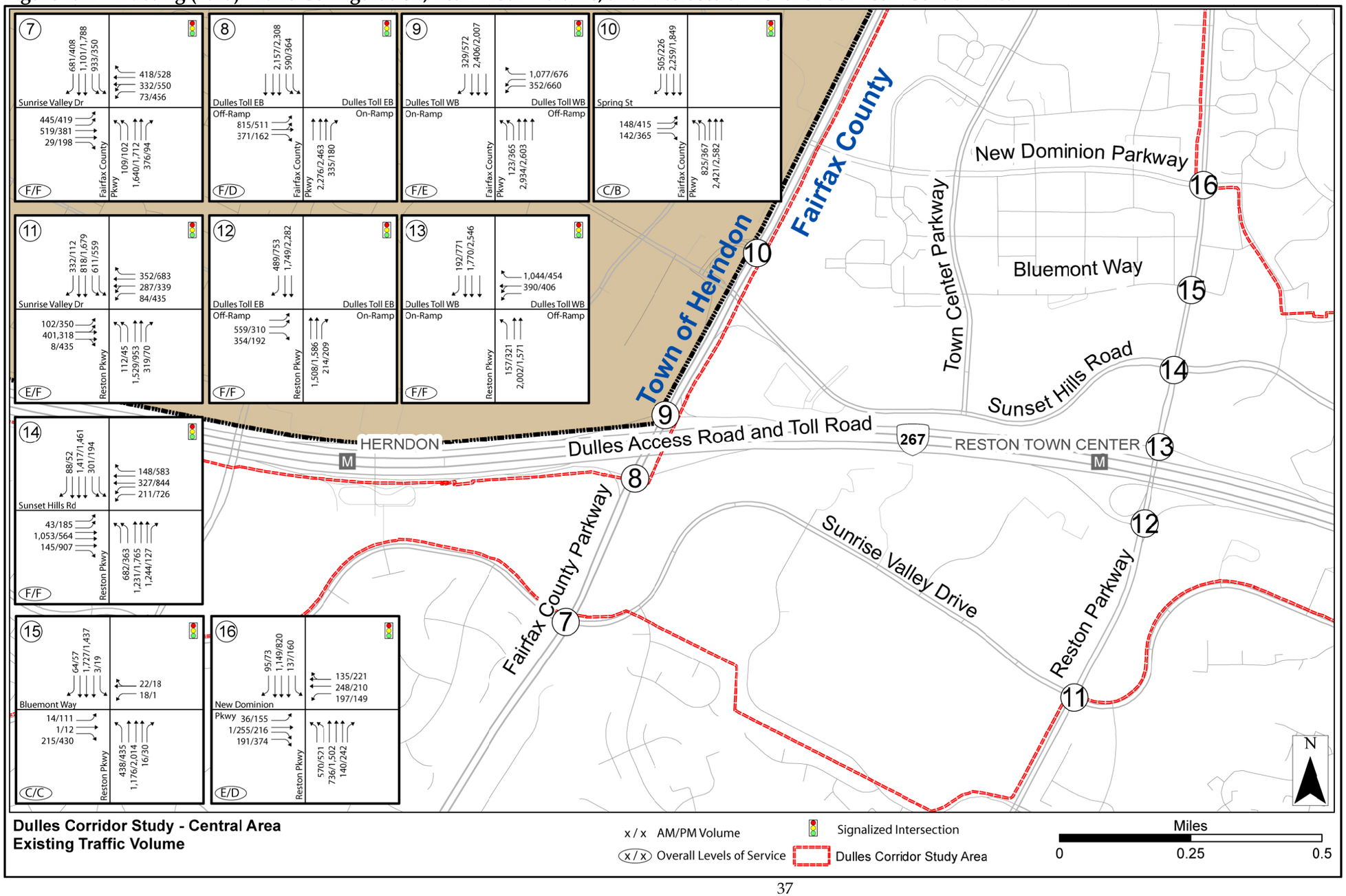


Figure 4.2C - Existing (2013) –Lane Configuration, Peak Hour Volume, and Intersection Level of Service – East Area

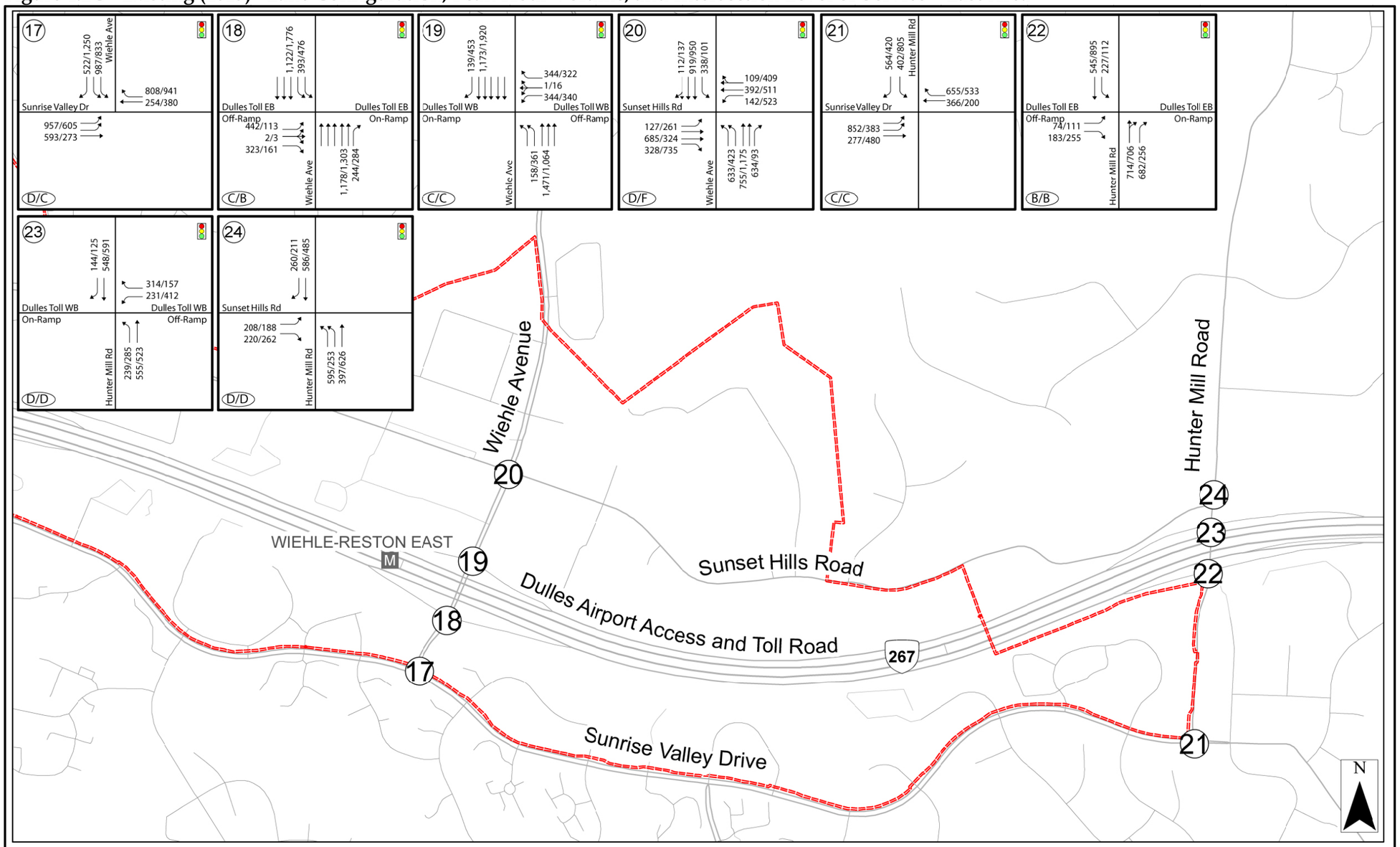


Figure 4.3A – Existing (2013) - Lane Configuration and Intersection Level of Service by Movement – West Area

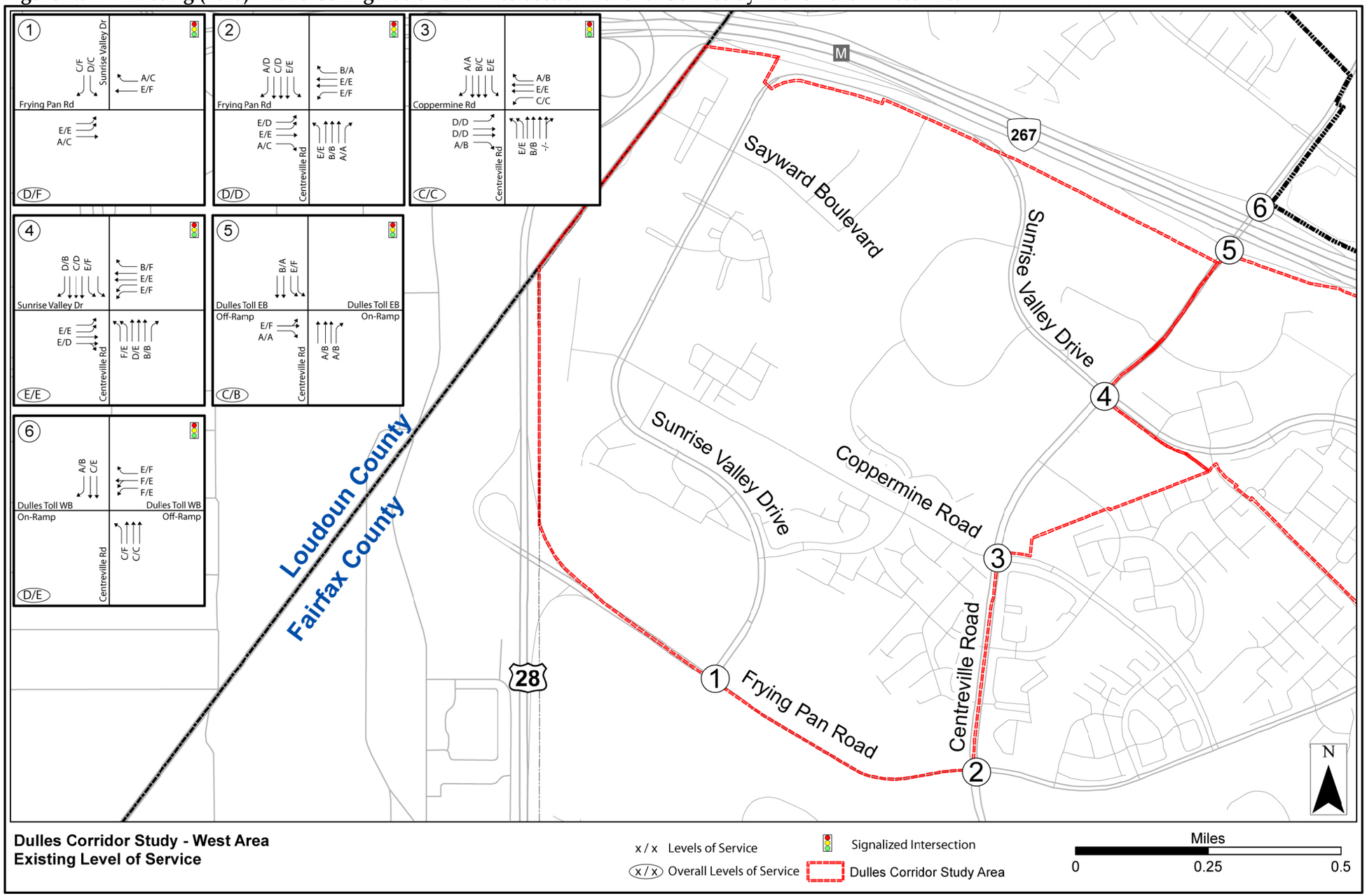


Figure 4.3B - Existing (2013) - Lane Configuration and Intersection Level of Service by Movement – Central Area

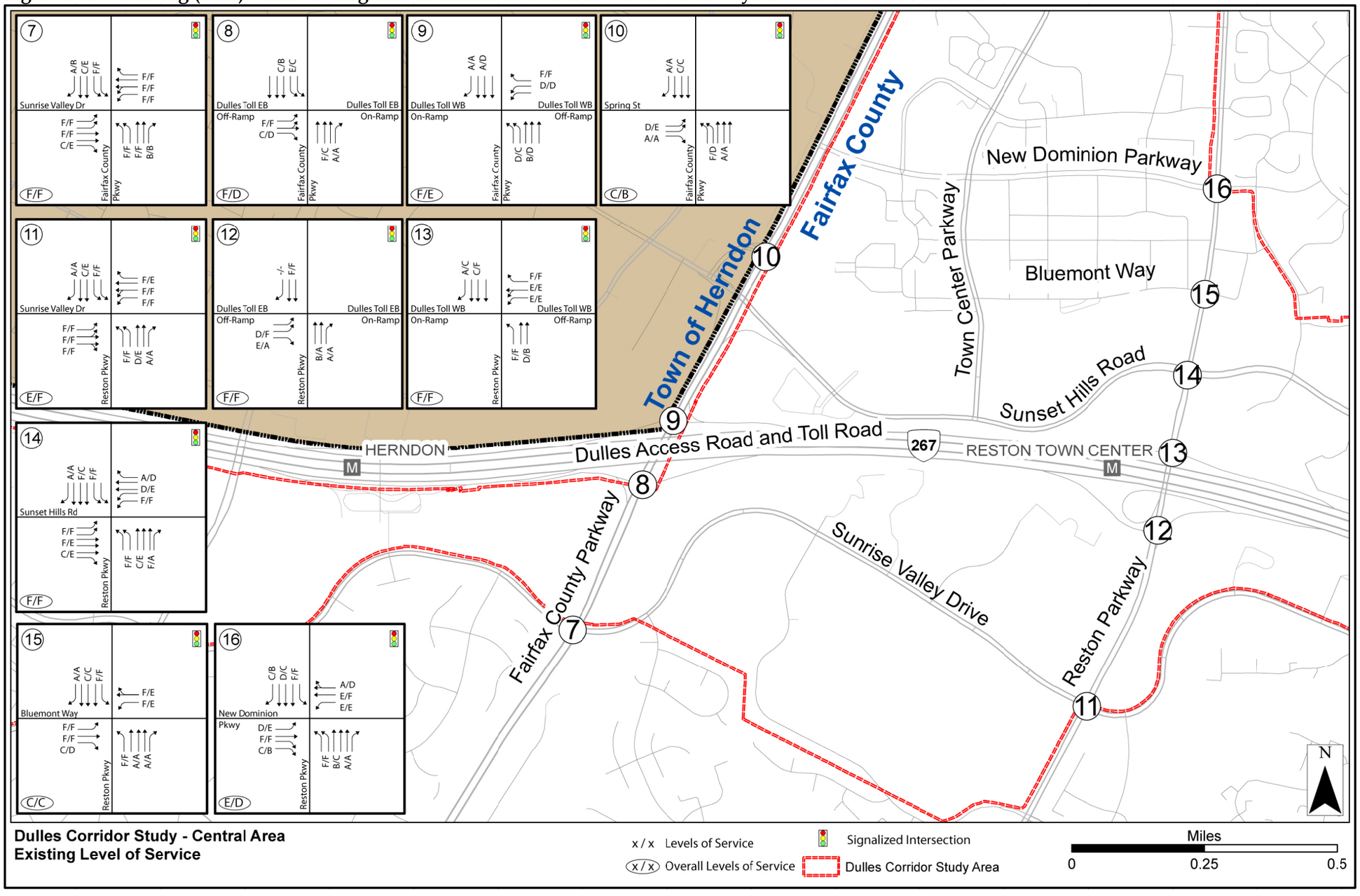
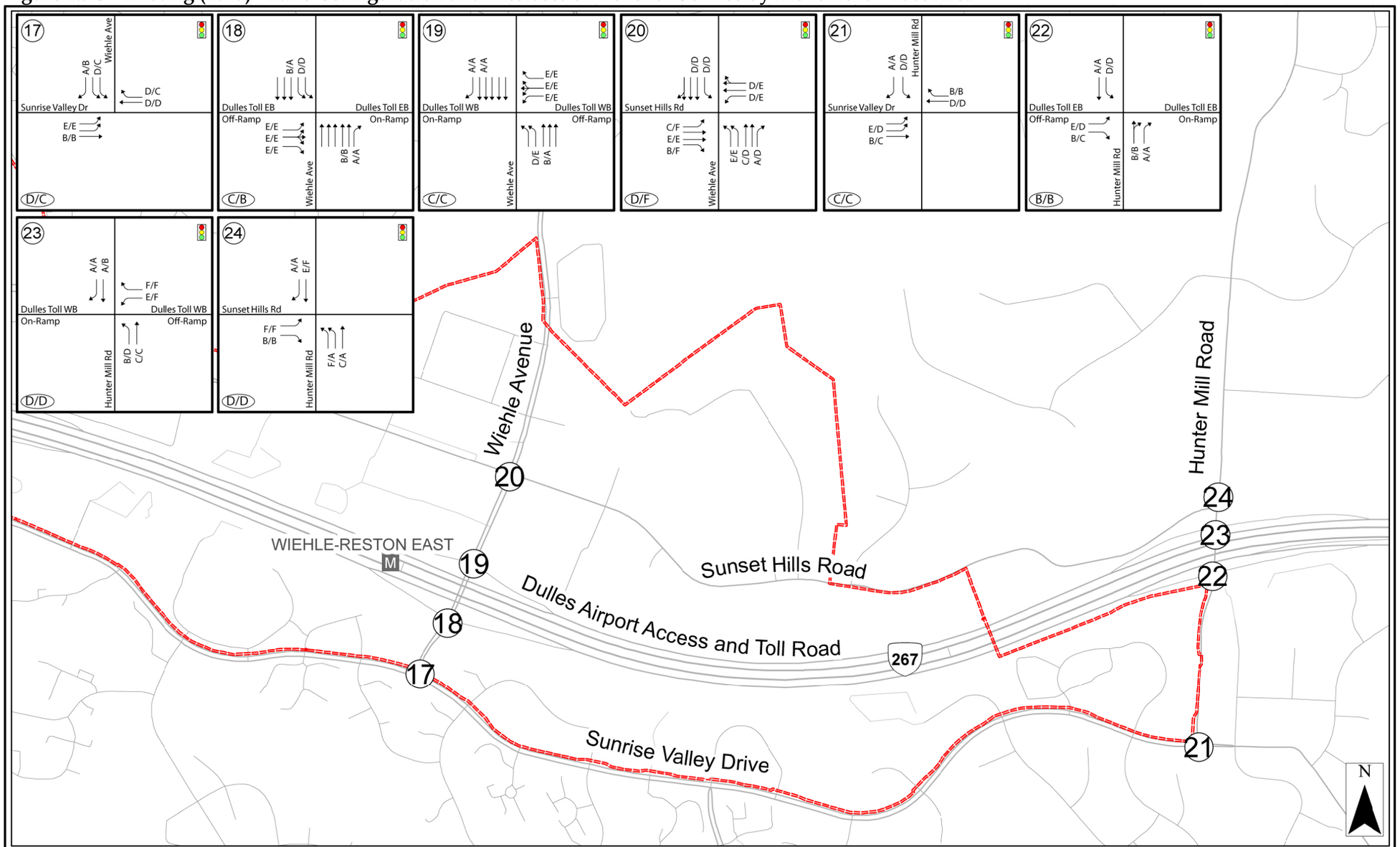


Figure 4.3C - Existing (2013) - Lane Configuration and Intersection Level of Service by Movement – East Area



2030 COG Round 8 Scenario– Future Year Base

Transportation Network

The 2030 COG Round 8 Scenario (also called the 2030 Base) consists of the 2030 COG Round 8 land use and a combination of the Constrained Long Range Plan network and Fairfax County's Transportation Plan Map. The one improvement not included from the Transportation Plan Map is the Town Center Parkway Underpass. At the time the 2030 Base network was established, it was unknown if the underpass was going to remain on the Transportation Plan Map due to extenuating circumstances. The issue has since been resolved and the Town Center Parkway Underpass is included in the future transportation network associated with Scenario G. All of the transportation improvements listed below are shown on Figure 4.4, expect for the CLRP bus network. The improvements are as follows:

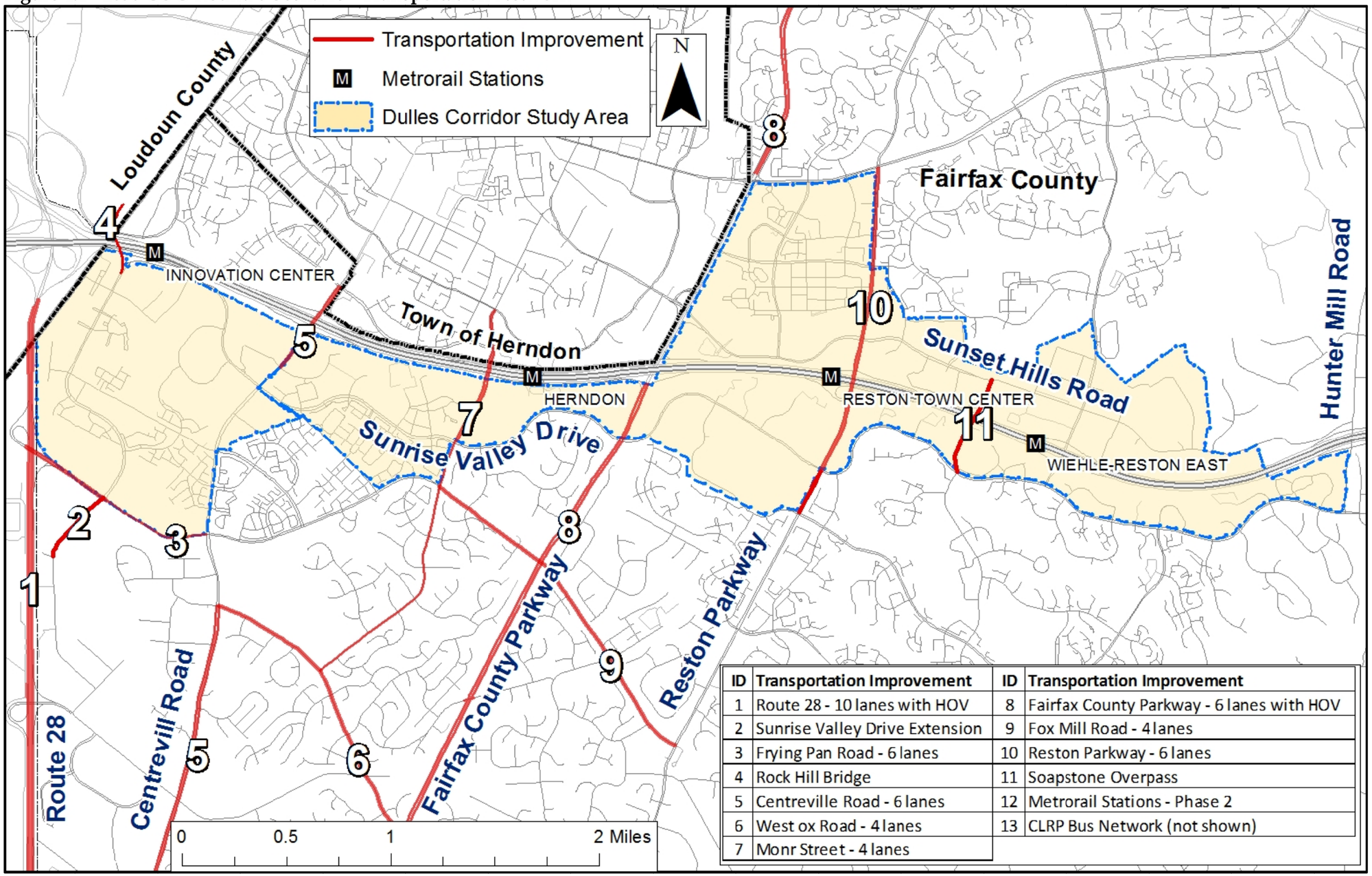
Roadway

1. Widen Route 28 to 10 lanes with HOV. There is one HOV lane per direction and it is included within the ten lane proposed width
2. Extend Sunrise Valley south of Frying Pan Road
3. Widen Frying Pan Road to six lanes between Route 28 and Centreville Road
4. Rock Hill Road Overpass (bridge)
5. Widen Centreville Road to six lanes south of Dulles Toll Road (already built)
6. Widen West Ox Road to four lanes from Lawyers Road to Centreville Road
7. Widen Monroe Street to four lanes from West Ox Road to the Town of Herndon
8. Widen Fairfax County Parkway to six lanes with HOV
9. Widen Fox Mill Road to four lanes from Reston Parkway to Monroe Street
10. Widen Reston Parkway to six lanes from Sunrise Valley Drive to Baron Cameron Avenue
11. Soapstone Overpass (bridge)

Transit

12. Metrorail Stations in Phase 2 open (from Reston Town Center to Route 772 in Loudoun County)
13. CLRP bus network

Figure 4.4 - 2030 COG Round 8 Scenario - Transportation Network



ID	Transportation Improvement	ID	Transportation Improvement
1	Route 28 - 10 lanes with HOV	8	Fairfax County Parkway - 6 lanes with HOV
2	Sunrise Valley Drive Extension	9	Fox Mill Road - 4 lanes
3	Frying Pan Road - 6 lanes	10	Reston Parkway - 6 lanes
4	Rock Hill Bridge	11	Soapstone Overpass
5	Centreville Road - 6 lanes	12	Metrorail Stations - Phase 2
6	West ox Road - 4 lanes	13	CLRP Bus Network (not shown)
7	Monr Street - 4 lanes		

Results

Tables 4.12 and 4.13 show the 2030 COG Round 8 Scenario projected intersection LOS for the morning and evening peak hours. As shown in Table 4.12, intersection congestion in the morning is projected to deteriorate under the 2030 COG Round 8 Scenario, with four intersections operating at LOS E and eleven intersections operating at LOS F. Five of the eleven failing intersections are gateways intersections. Compared to the existing conditions, the average intersection delay at the gateway intersections is projected to increase by 85% and increase by 24% for the non-gateway intersections.

In the evening five intersections are projected to have a LOS E and ten are projected to have a LOS F, as shown in Table 4.13. Four of the ten failing intersections in the evening peak hour are gateway intersections. Compared to the existing conditions, the average intersection delay at the gateway intersections is projected to increase by 88% and increase by 23% for the non-gateway intersections.

The weighted average of all intersection delays combined, under the Round 8 Scenario is 42% higher than the existing conditions in the morning and 47% higher than the existing conditions in the evening peak.

Figures 4.5A-C provides the 2030 COG Round 8 lane configurations along with the projected volumes by movement and overall levels of service for the 24 intersections analyzed in the study. Figures 4.6A-C provides the lane configuration and levels of service by movement for the 24 intersections analyzed. In Figures 4.6A-C and Table 4.14, when there is a shared lane, such as when a through lane and right turn lane are shared, the LOS is reported with the heavy movement. The CLRP and Transportation Plan Map improvements that are assumed as part of the future base network (Figure 4.4) associated with the Round 8 Scenario are shown with green arrows in Figures 4.5A-C and 4.6A-C, which shows the intersection lane configurations.

Table 4.12 - 2030 COG Round 8 Scenario - Morning Peak Hour Intersection Levels of Service (before signal optimization and mitigation)

	Inter. ID #	Major Street	Cross Street	Total Intersection Approach Volume	Before Optimization	
					Int. Delay (sec/veh)	LOS
Gateway Intersections	2	Centreville Road	Frying Pan Rd	5,050	92	F
	7	Fairfax County Pkwy	Sunrise Valley	8,300	156.4	F
	10	Fairfax County Pkwy	Spring St	7,050	53.3	D
	11	Reston Pkwy	Sunrise Valley	6,365	174.5	F
	14	Reston Pkwy	Sunset Hills	8,700	148.8	F
	17	Wiehle Avenue	Sunrise Valley	4,950	87.4	F
	20	Wiehle Avenue	Sunset Hills	6,100	79.8	E
Non-Gateway Intersections	1	Sunrise Valley Drive	Frying Pan Rd	5,350	321.3	F
	3	Centreville Road	Coppermine Rd	4,600	31.7	C
	4	Centreville Road	Sunrise Valley	7,350	89.3	F
	5	Centreville Road	DTR EB On/Off ramps	5,325	42.5	D
	6	Centreville Road	DTR WB On/Off ramps	4,465	60.1	E
	8	Fairfax County Pkwy	DTR EB On/Off ramps	7,575	98.6	F
	9	Fairfax County Pkwy	DTR WB On/Off ramps	8,300	232.3	F
	12	Reston Pkwy	DTR EB On/Off ramps	5,300	29.8	C
	13	Reston Pkwy	DTR WB On/Off ramps	5,860	146.8	F
	15	Reston Pkwy	Bluemont Way	4,640	38.8	D
	16	Reston Pkwy	New Dominion Pkwy	5,225	101.2	F
	18	Wiehle Avenue	DTR EB On/Off ramps	4,515	28.5	C
	19	Wiehle Avenue	DTR WB On/Off ramps	4,415	23.7	C
	21	Hunter Mill Road	Sunrise Valley	3,700	77	E
	22	Hunter Mill Road	DTR EB On/Off ramps	3,150	34.7	C
	23	Hunter Mill Road	DTR WB On/Off ramps	2,610	31.3	C
	24	Hunter Mill Road	Sunset Hills	2,700	78.5	E
Gateway Intersections Weighted Average					117.4	F
Non-Gateway Intersections Weighted Average					98.0	F
All Intersections Weighted Average					104.9	F

Table 4.13 - 2030 COG Round 8 Scenario - Evening Peak Hour Intersection Levels of Service (before signal optimization and mitigation)

	Inter. ID #	Major Street	Cross Street	Total Intersection Approach Volume	Before Optimization	
					Int. Delay (sec/veh)	LOS
Gateway Intersections	2	Centreville Road	Frying Pan Rd	5,875	76.3	E
	7	Fairfax County Pkwy	Sunrise Valley	8,925	209.2	F
	10	Fairfax County Pkwy	Spring St	6,750	23.3	C
	11	Reston Pkwy	Sunrise Valley	6,800	160.8	F
	14	Reston Pkwy	Sunset Hills	9,350	211.6	F
	17	Wiehle Avenue	Sunrise Valley	5,100	49.7	D
	20	Wiehle Avenue	Sunset Hills	7,000	183.5	F
Non-Gateway Intersections	1	Sunrise Valley Drive	Frying Pan Rd	6,600	297	F
	3	Centreville Road	Coppermine Rd	4,750	34.5	C
	4	Centreville Road	Sunrise Valley	7,950	135.7	F
	5	Centreville Road	DTR EB On/Off ramps	5,775	26.4	C
	6	Centreville Road	DTR WB On/Off ramps	5,415	79.3	E
	8	Fairfax County Pkwy	DTR EB On/Off ramps	7,100	205.9	F
	9	Fairfax County Pkwy	DTR WB On/Off ramps	8,150	143.4	F
	12	Reston Pkwy	DTR EB On/Off ramps	5,650	13.6	B
	13	Reston Pkwy	DTR WB On/Off ramps	6,450	83.3	F
	15	Reston Pkwy	Bluemont Way	5,760	86.7	F
	16	Reston Pkwy	New Dominion Pkwy	6,100	73.2	E
	18	Wiehle Avenue	DTR EB On/Off ramps	4,765	23.7	C
	19	Wiehle Avenue	DTR WB On/Off ramps	5,175	22.8	C
	21	Hunter Mill Road	Sunrise Valley	3,350	56	E
	22	Hunter Mill Road	DTR EB On/Off ramps	2,860	43.2	D
	23	Hunter Mill Road	DTR WB On/Off ramps	2,510	68.4	E
	24	Hunter Mill Road	Sunset Hills	2,550	48.2	D
Gateway Intersections Weighted Average					142.2	F
Non-Gateway Intersections Weighted Average					96.9	F
All Intersections Weighted Average					113.0	F

Table 4.14 - 2030 COG Round 8 Scenario - Peak Hour Intersection Levels of Service by Movement (before signal optimization and mitigation)

AM PEAK HOUR

Inter. ID #	Major Street	Cross Street	Eastbound			Westbound			Northbound			Southbound			Int. Delay (sec/veh)	LOS
			Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right		
1	Sunrise Valley Drive	Frying Pan Rd	F	F		E	F	A			A	D	D	A	321.3	F
2	Centreville Road	Frying Pan Rd	F	F	B	E	F	D	F	C	A	E	C	A	92	F
3		Coppermine Rd	E	D	A	C	E	C	D	C		E	C	A	31.7	C
4		Sunrise Valley	F	F		E	F	D	F	D	C	F	C	F	89.3	F
5		DTR EB On/Off ramps	F		A					B	A	E	D		42.5	D
6		DTR WB On/Off ramps				F	F	F	C	D			D	A	60.1	E
7	Fairfax County Pkwy	Sunrise Valley	F	F	C	F	F	F	F	F	B	F	D	F	156.4	F
8		DTR EB On/Off ramps	F		F					F	A	E	B		98.6	F
9		DTR WB On/Off ramps				D		F	D	C			E	A	232.3	F
10		Spring St	D		A				F	A			F	B	53.3	D
11	Reston Pkwy	Sunrise Valley	F	F		F	F	F	F	E	A	F	B	B	174.5	F
12		DTR EB On/Off ramps	E		F					B	A		C	A	29.8	C
13		DTR WB On/Off ramps				E	E	F	F	E			C	B	146.8	F
14		Sunset Hills	F	F	D	F	E	B	F	D	F	F	C	A	148.8	F
15		Bluemont Way	F	F	D	F	F		F	A	A	F	D	A	38.8	D
16		New Dominion Pkwy	E	F	D	F	F	B	F	C	A	F	D	C	101.2	F
17	Wiehle Avenue	Sunrise Valley	F	C			E	F				D		A	87.4	F
18		DTR EB On/Off ramps	E	E	E					C	A	C	B		28.5	C
19		DTR WB On/Off ramps				E	E	E	D	B			A	A	23.7	C
20		Sunset Hills	D	E	C	E	D		F	D	F	F	D		79.8	E
21	Hunter Mill Road	Sunrise Valley	E	A			D		F	D		F	F		77	E
22		DTR EB On/Off ramps	E		B					E	A	F	B		34.7	C
23		DTR WB On/Off ramps				F		C	C	B			C	A	31.3	C
24		Sunset Hills	F		B				F	A			F	B	78.5	E

PM PEAK HOUR

Inter. ID #	Major Street	Cross Street	Eastbound			Westbound			Northbound			Southbound			Int. Delay (sec/veh)	LOS
			Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right		
1	Sunrise Valley Drive	Frying Pan Rd	D	F		E	F	A		D	A	E	D	F	297	F
2	Centreville Road	Frying Pan Rd	F	F	D	F	F	B	E	B	A	D	D	B	76.3	E
3		Coppermine Rd	F	D	C	C	E	C	E	C		E	C	A	34.5	C
4		Sunrise Valley	F	E		F	E	F	E	F	B	F	D	B	135.7	F
5		DTR EB On/Off ramps	F		A					B	D	E	A		26.4	C
6		DTR WB On/Off ramps				E	E	F	F	C			F	B	79.3	E
7	Fairfax County Pkwy	Sunrise Valley	F	F	F	F	F	F	F	F	C	F	F	B	209.2	F
8		DTR EB On/Off ramps	F		D					F	A	B	B		205.9	F
9		DTR WB On/Off ramps				D		F	C	F			F	A	143.4	F
10		Spring St	F		A				D	B			C	A	23.3	C
11	Reston Pkwy	Sunrise Valley	F	F		F	F	F	F	F	B	F	F	A	160.8	F
12		DTR EB On/Off ramps	F		A					A	A		B	A	13.6	B
13		DTR WB On/Off ramps				E	E	F	F	A			F	C	83.3	F
14		Sunset Hills	F	E	F	F	E	F	F	E	A	F	F	B	211.6	F
15		Bluemont Way	F	F	F	E	E		F	A	A	F	F	A	86.7	F
16		New Dominion Pkwy	F	F	D	E	F	D	F	C	A	F	D	B	73.2	E
17	Wiehle Avenue	Sunrise Valley	E	B			E	D				E		B	49.7	D
18		DTR EB On/Off ramps	E	E	E					B	A	D	B		23.7	C
19		DTR WB On/Off ramps				E	E	E	E	A			B	A	22.8	C
20		Sunset Hills	F	E	F	F	F		F	F	A	E	D		183.5	F
21	Hunter Mill Road	Sunrise Valley	E	E			C		F	D		E	D		56	E
22		DTR EB On/Off ramps	D		E					D	A	C	D		43.2	D
23		DTR WB On/Off ramps				F		A	F	B			D	A	68.4	E
24		Sunset Hills	F		B				C	A			F	A	48.2	D

The results for the 2030 COG Round 8 Scenario project higher level of delay on the transportation network than what currently exists. Mitigation measures (including land use density and type) were identified based on the results for the 2030 Round 8 Scenario. These mitigation measures were carried forwarded to the proposed Scenario G.

Figure 4.5A – 2030 COG Round 8 Scenario - Lane Configuration, Peak Hour Volume, and Intersection Level of Service (before signal optimization and mitigation) – West Area

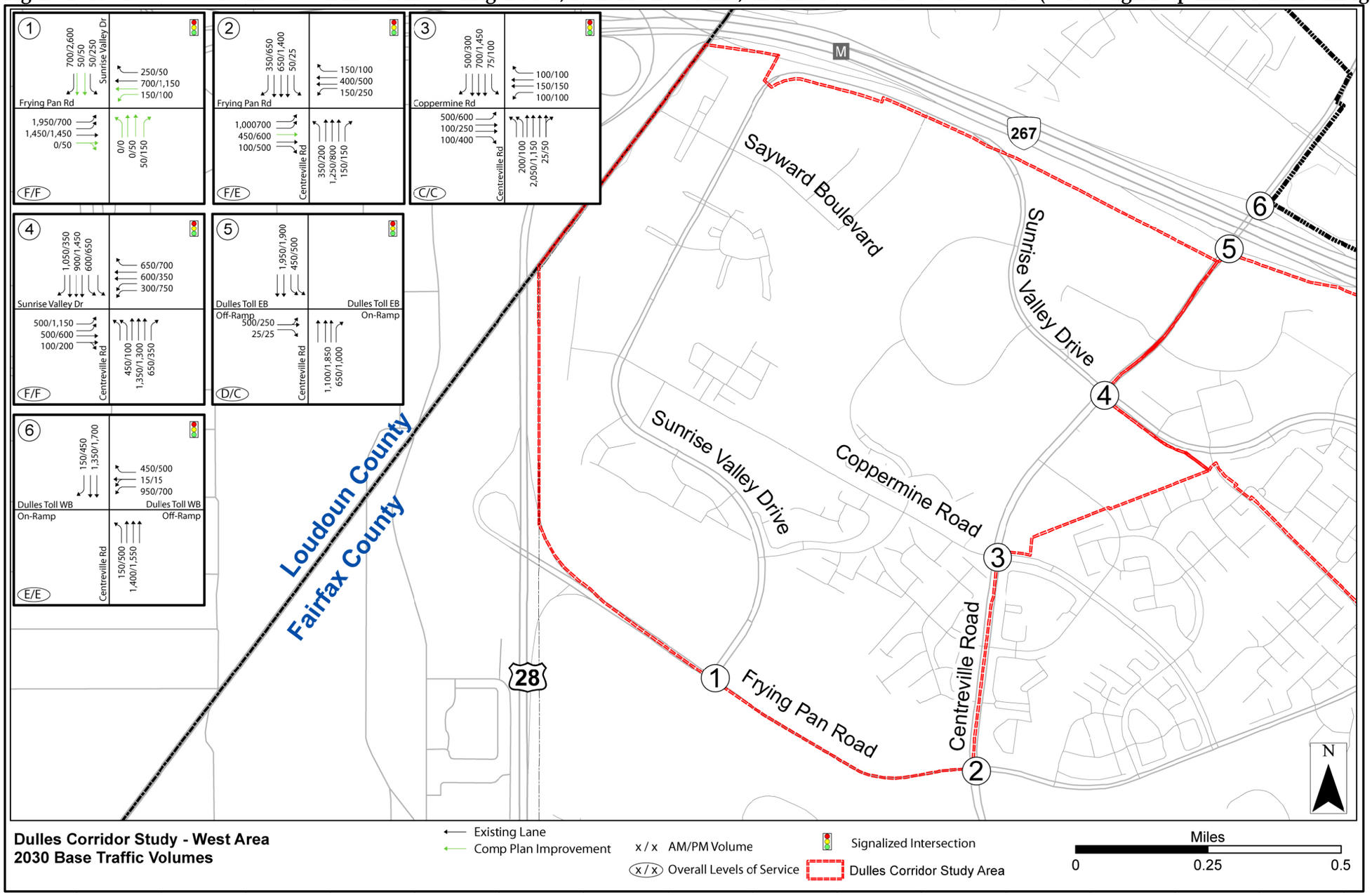


Figure 4.5B – 2030 COG Round 8 Scenario - Lane Configuration, Peak Hour Volume, and Intersection Level of Service (before signal optimization and mitigation) – Central Area

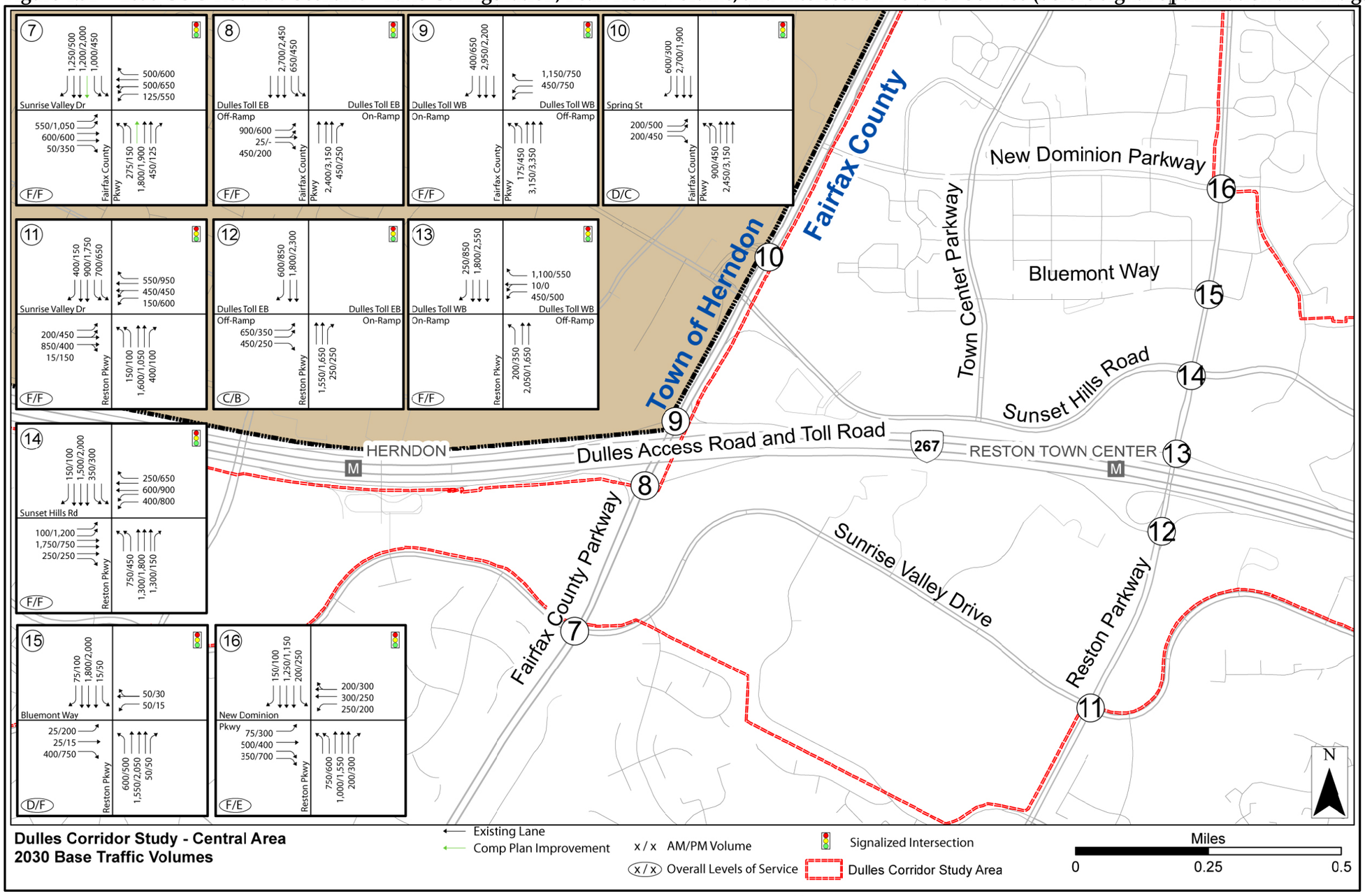


Figure 4.5C – 2030 COG Round 8 Scenario - Lane Configuration, Peak Hour Volume, and Intersection Level of Service (before signal optimization and mitigation) – East Area

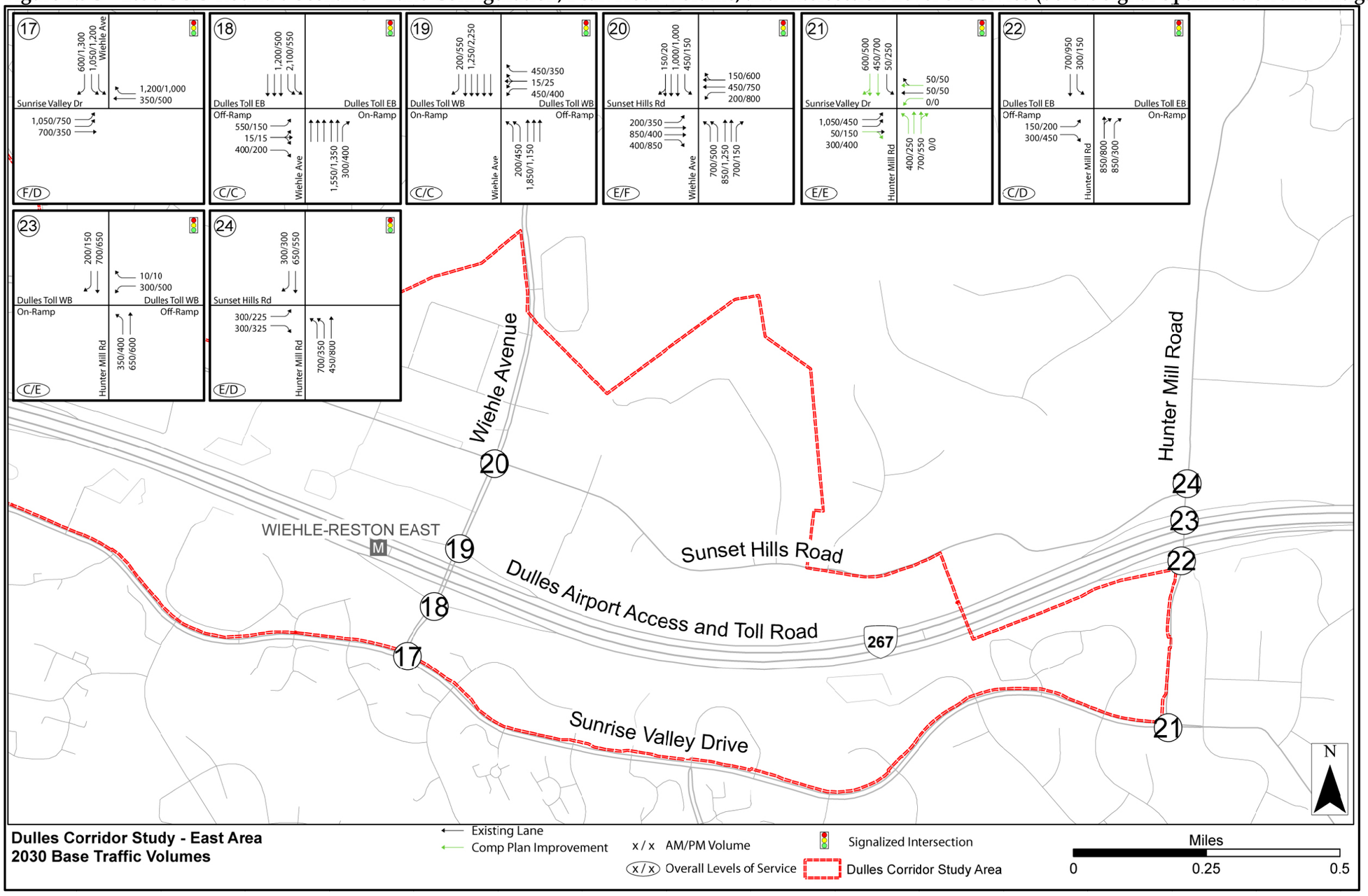


Figure 4.6A – 2030 COG Round 8 Scenario - Lane Configuration and Intersection Level of Service by Movement – West Area

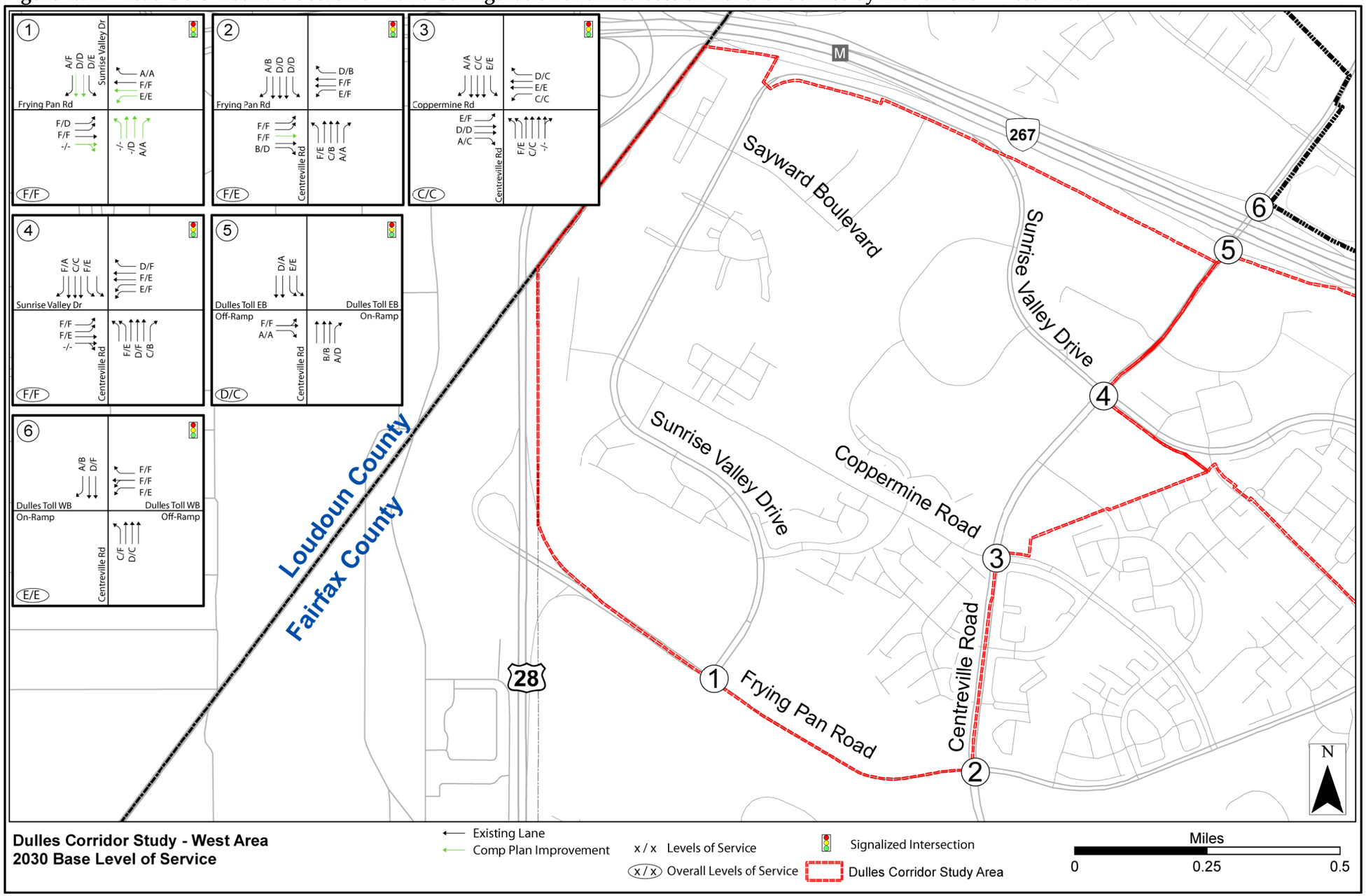


Figure 4.6B – 2030 COG Round 8 Scenario - Lane Configuration and Intersection Level of Service by Movement – Central Area

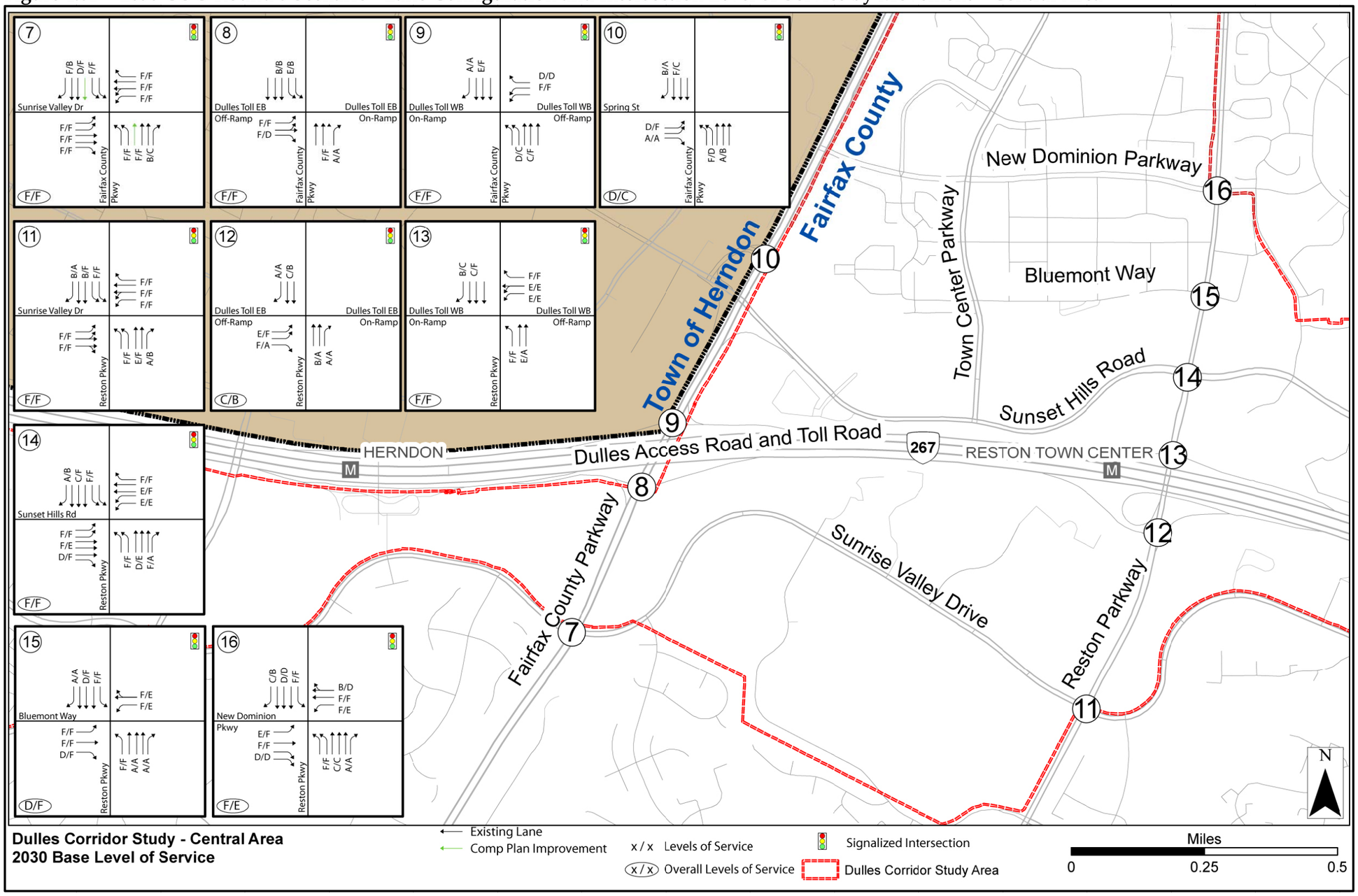
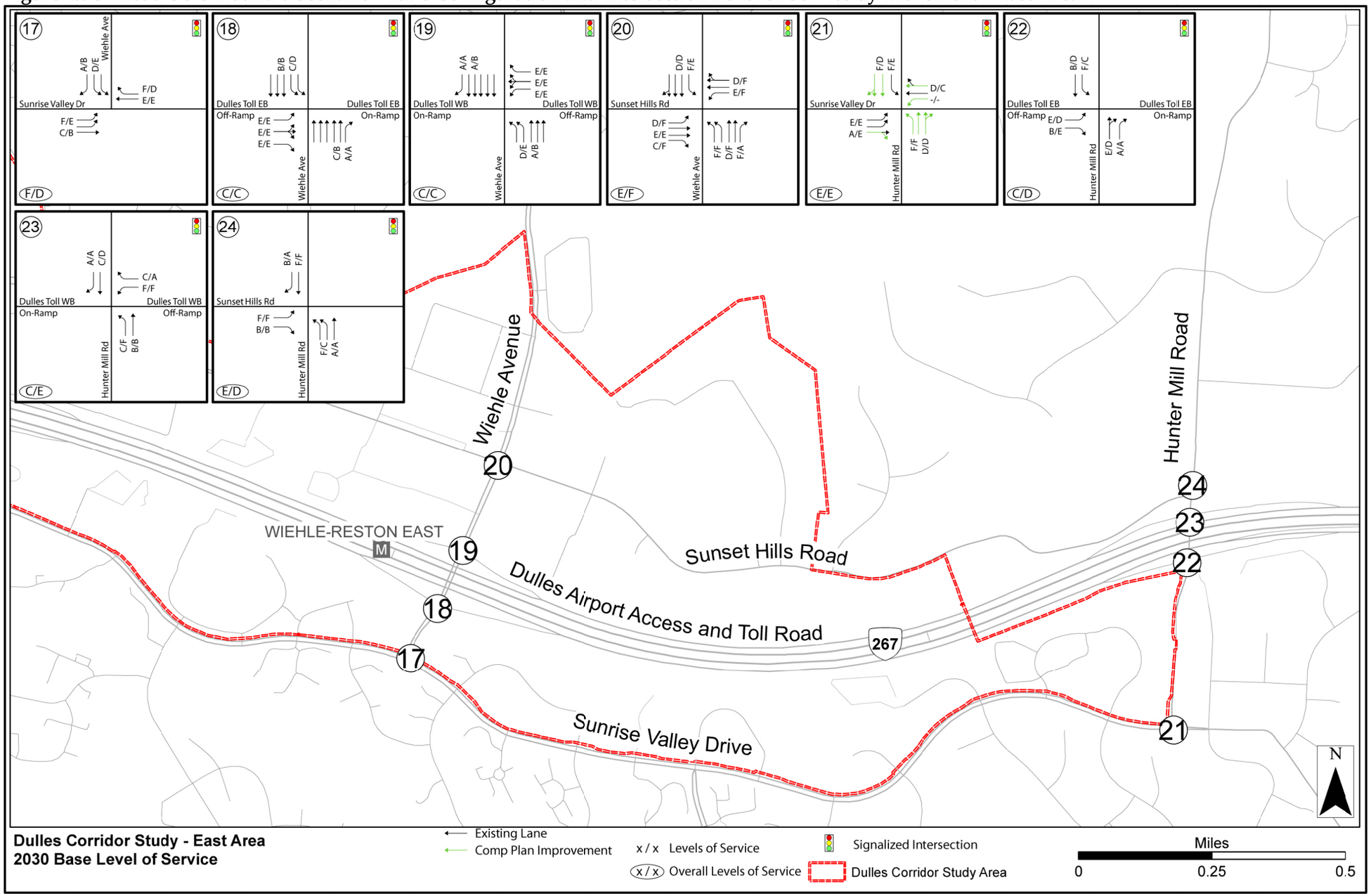


Figure 4.6C – 2030 COG Round 8 Scenario - Lane Configuration and Intersection Level of Service by Movement – East Area



2030 Scenario G

Transportation Network

The 2030 Scenario G land use was evaluated in the model along with an enhanced future transportation network. The transportation network associated with Scenario G is the 2030 COG Round 8 Scenario transportation network (CLRP network and the County's Transportation Plan Map) plus additional improvements that are listed below. All of the transportation improvements listed below are shown on Figures 4.7 and 4.8. Figure 4.8 shows the transit network from the model along with the added express bus and bus rapid transit routes. A list of the improvements is as follows:

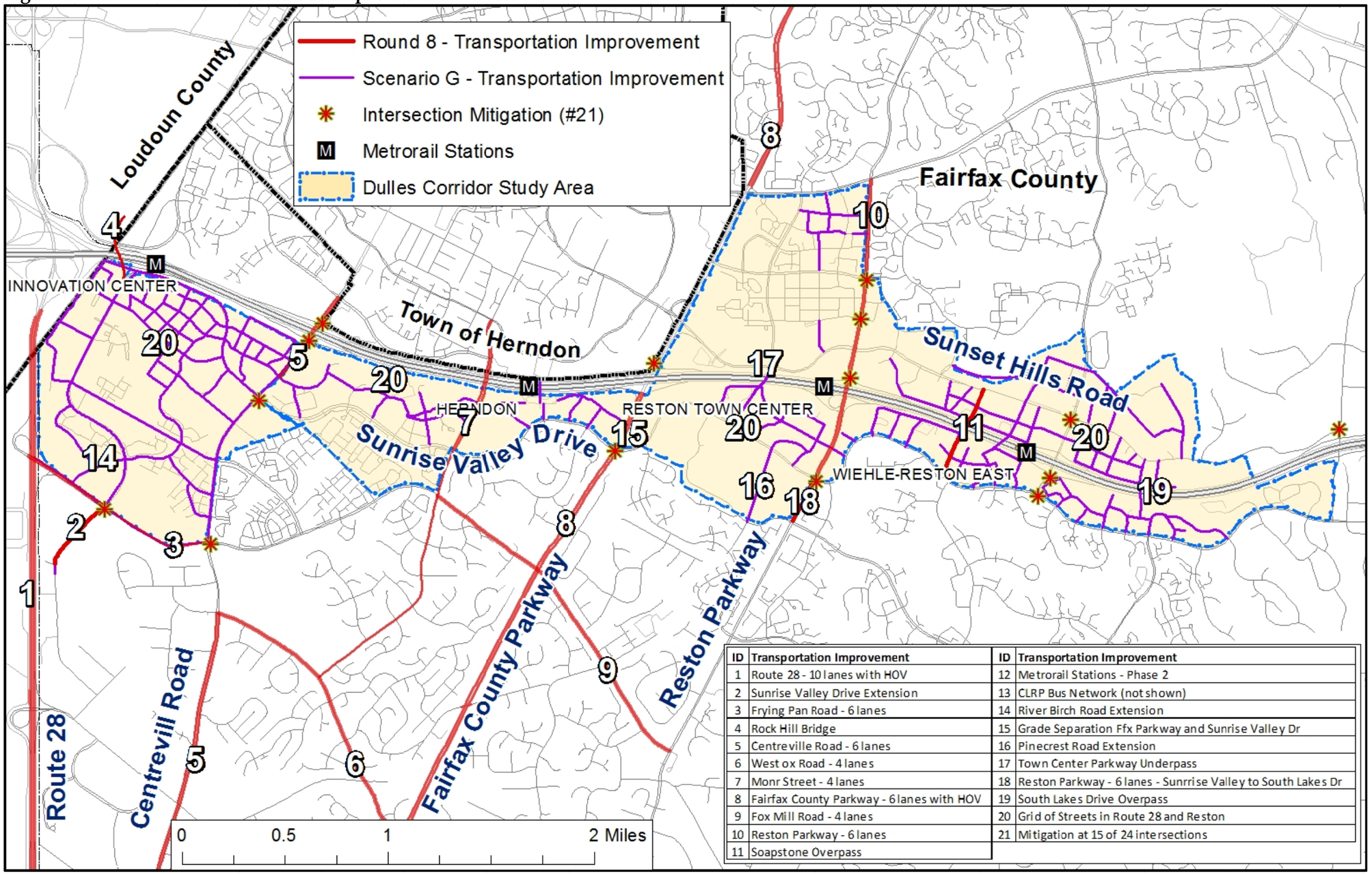
Roadway

14. Extension of River Birch Road from Sunrise Valley Drive to Frying Pan Road
15. Grade separation at Fairfax County Parkway and Sunrise Valley Drive
16. Extension of Pinecrest Road from South Lakes Drive to Sunrise Valley Drive
17. Town Center Parkway Underpass (tunnel)
18. Widen Reston Parkway to six lanes from Sunrise Valley Drive to South Lakes Drive
19. South Lakes Overpass (bridge)
20. Grid of Streets in the Reston and Route 28 Study areas
21. Intersection Mitigation at 15 of the 24 intersections analyzed in the study (includes the grade separation at Fairfax County Parkway an Sunrise Valley Drive)

Transit

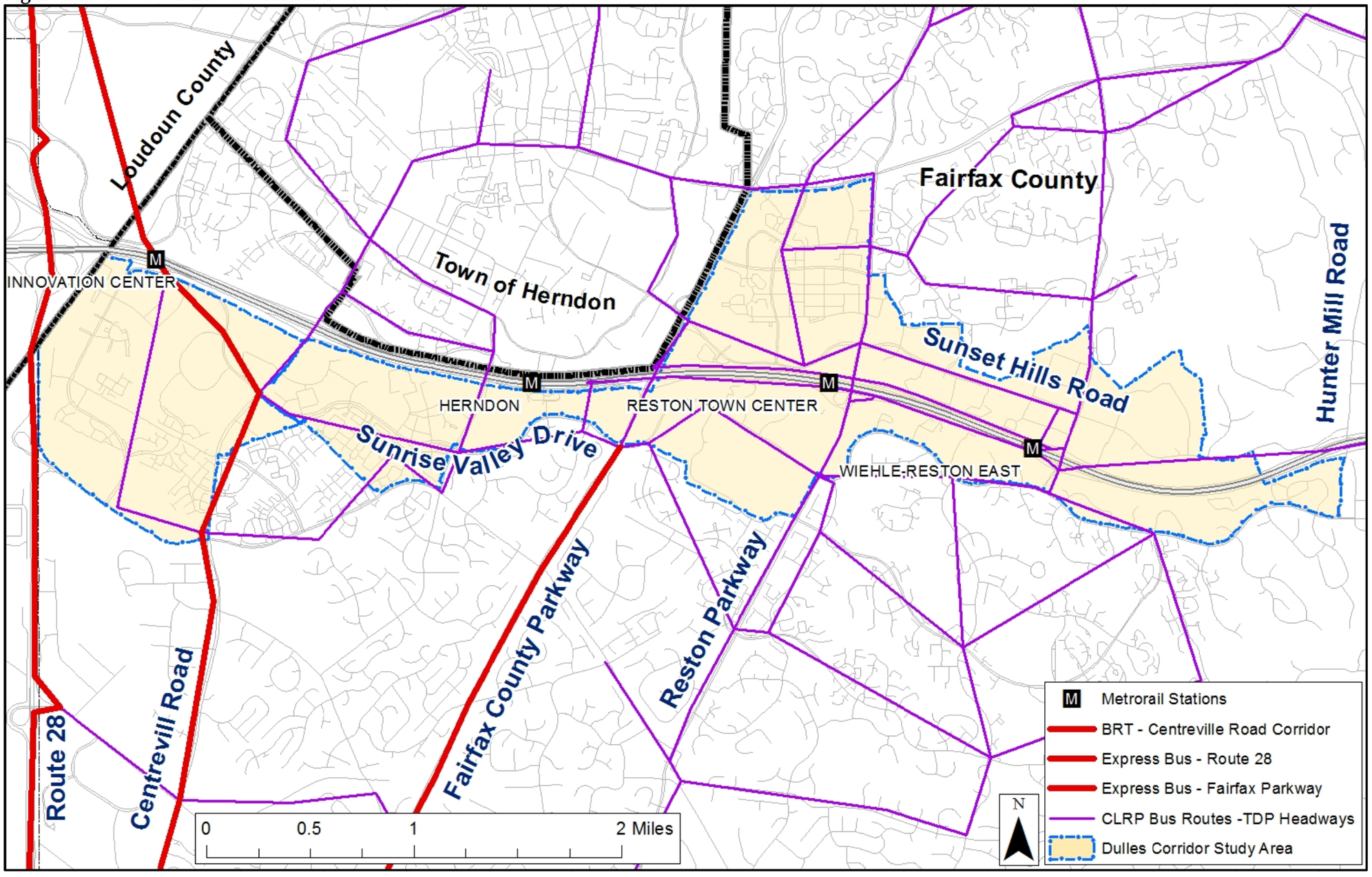
22. Frequencies in the model match those recommended in the Fairfax County Transit Development Plan
23. Bus Rapid Transit along the Centreville Road corridor from I-66 to the Innovation Center Metrorail Station and into Loudoun County with 10 minute frequencies
24. Express Bus on Route 28 from I-66 to Route 7 in Loudoun County with 30 minute frequencies
25. Express Bus on Fairfax County Parkway from the Fairfax Center area to the Herndon Metrorail Station with 30 minute frequencies.

Figure 4.7 - 2030 Scenario G – Road Transportation Network



ID	Transportation Improvement	ID	Transportation Improvement
1	Route 28 - 10 lanes with HOV	12	Metrorail Stations - Phase 2
2	Sunrise Valley Drive Extension	13	CLRP Bus Network (not shown)
3	Frying Pan Road - 6 lanes	14	River Birch Road Extension
4	Rock Hill Bridge	15	Grade Separation Ffx Parkway and Sunrise Valley Dr
5	Centreville Road - 6 lanes	16	Pinecrest Road Extension
6	West ox Road - 4 lanes	17	Town Center Parkway Underpass
7	Monr Street - 4 lanes	18	Reston Parkway - 6 lanes - Sunrrise Valley to South Lakes Dr
8	Fairfax County Parkway - 6 lanes with HOV	19	South Lakes Drive Overpass
9	Fox Mill Road - 4 lanes	20	Grid of Streets in Route 28 and Reston
10	Reston Parkway - 6 lanes	21	Mitigation at 15 of 24 intersections
11	Soapstone Overpass		

Figure 4.8 - 2030 Scenario G – Transit Network



Results

Tables 4.15 and 4.16 show intersection LOS projections for Scenario G in the morning and evening peak hours. Also shown in the tables is signal optimization, which was mainly used to adjust the intersections with failing levels of service. As shown in Table 4.15, intersection congestion is projected to do better in 2030 under Scenario G compared to the COG Round 8 Scenario, with four intersections in the morning operating at LOS E and six intersections operating at LOS F after signal optimization. Three of the six failing intersections are gateway intersections; however, the gateway intersections, as a whole, perform better on average, in Scenario G compared to the COG Round 8 Scenario by approximately 14%. The non-gateway intersections under Scenario G are 57% improved, on average, compared to the COG Round 8 Scenario. In the evening three intersections have a LOS E and six are projected to have a LOS F, as shown in Table 4.16, after optimization. Two of the six failing intersections in the evening peak hour are gateway intersections. Compared to the COG Round 8 Scenario, Scenario G is projected to have an 18% improvement in LOS at the gateway intersections and 37% improvement in LOS at the non-gateway intersections in the evening peak hour. After optimization, the weighted average of all intersections combined, under Scenario G, produces a LOS E in the morning peak hour and a borderline LOS F in the evening peak hour.

Figures 4.9A-C show the Scenario G lane configurations along with the projected peak hour volumes and overall intersection level of service for the 24 intersections analyzed in the study. Figures 4.10A-C show the Scenario G lane configurations along with the levels of service by movement for the 24 intersections analyzed. In Figures 4.10A-C and Table 4.17, when there is a shared lane, such as when a through lane and right turn lane are shared, the LOS is reported with the heavy movement. The CLRP and Transportation Plan Map improvements that are assumed as part of the future base network (Figure 4.5) associated with the COG Round 8 Scenario are still shown with green arrows in Figures 4.9A-C and 4.10A-C. The blue arrows are improvements that can be attributed to others. These are Dulles Toll Road ramp improvements that have been suggested by the Metropolitan Washington Airports Authority (MWAA). They have not been approved and adopted by MWAA. The red arrows show intersection improvements to mitigate the impacts of Scenario G. At the time of rezoning or when major transportation projects are constructed, these intersections will be evaluated further and with the proposed grid of streets.

Table 4.15 - 2030 Scenario G Morning – Peak Hour Intersection Levels of Service (with mitigation measures)

	Inter. ID #	Major Street	Cross Street	Total Intersection Approach Volume	Before Optimization		After Optimization[1]	
					Int. Delay (sec/veh)	LOS	Int. Delay (sec/veh)	LOS
Gateway Intersections	2	Centreville Road	Frying Pan Rd	4,533	35.9	D	36.1	D
	7	Fairfax County Pkwy	Sunrise Valley	5,236	56.2	E	54.7	D
	10	Fairfax County Pkwy	Spring St	7,528	65.2	E	66.5	E
	11	Reston Pkwy	Sunrise Valley	7,068	125.9	F	70.6	E
	14	Reston Pkwy	Sunset Hills	8,811	152.4	F	153.1	F
	17	Wiehle Avenue	Sunrise Valley	5,587	147.7	F	139.7	F
	20	Wiehle Avenue	Sunset Hills	7,609	146.3	F	145.2	F
Non-Gateway Intersections	1	Sunrise Valley Drive	Frying Pan Rd	5,348	27.9	C	27.9	C
	3	Centreville Road	Coppermine Rd	4,205	22.4	C	22.6	C
	4	Centreville Road	Sunrise Valley	7,014	53.4	D	54.7	D
	5	Centreville Road	DTR EB On/Off ramps	5,343	89	F	86.5	F
	6	Centreville Road	DTR WB On/Off ramps	4,028	11.6	B	11.2	B
	8	Fairfax County Pkwy	DTR EB On/Off ramps	6,365	34.5	C	35.6	D
	9	Fairfax County Pkwy	DTR WB On/Off ramps	6,982	11.2	B	9.8	A
	12	Reston Pkwy	DTR EB On/Off ramps	4,862	34.3	D	34.5	D
	13	Reston Pkwy	DTR WB On/Off ramps	5,181	55.2	E	48.6	D
	15	Reston Pkwy	Bluemont Way	4,990	38.4	D	28.2	C
	16	Reston Pkwy	New Dominion Pkwy	5,401	68.6	E	67.4	E
	18	Wiehle Avenue	DTR EB On/Off ramps	4,667	24.1	C	24	C
	19	Wiehle Avenue	DTR WB On/Off ramps	4,125	16.9	B	15.5	B
	21	Hunter Mill Road	Sunrise Valley	3,480	220.9	F	94.2	F
	22	Hunter Mill Road	DTR EB On/Off ramps	2,449	21.4	C	21.4	C
	23	Hunter Mill Road	DTR WB On/Off ramps	2,985	112.8	F	102.1	F
	24	Hunter Mill Road	Sunset Hills	2,954	60.5	E	70.1	E
Gateway Intersections Weighted Average					110.4	F	101.0	F
Non-Gateway Intersections Weighted Average					49.4	D	42.6	D
All Intersections Weighted Average					71.7	E	64.0	E

[1] Splits and offsets were optimized.

Table 4.16 - 2030 Scenario G Evening – Peak Hour Intersection Levels of Service (with mitigation measures)

	Inter. ID #	Major Street	Cross Street	Total Intersection Approach Volume	Before Optimization		After Optimization[1]	
					Int. Delay (sec/veh)	LOS	Int. Delay (sec/veh)	LOS
Gateway Intersections	2	Centreville Road	Frying Pan Rd	5,726	41.1	D	36	D
	7	Fairfax County Pkwy	Sunrise Valley	5,242	52.3	D	49.7	D
	10	Fairfax County Pkwy	Spring St	7,149	25.1	C	26	C
	11	Reston Pkwy	Sunrise Valley	7,315	164	F	78.8	E
	14	Reston Pkwy	Sunset Hills	9,403	218	F	217.1	F
	17	Wiehle Avenue	Sunrise Valley	5,244	52.8	D	53.4	D
	20	Wiehle Avenue	Sunset Hills	8,278	272.2	F	253.1	F
Non-Gateway Intersections	1	Sunrise Valley Drive	Frying Pan Rd	8,484	181.9	F	174.4	F
	3	Centreville Road	Coppermine Rd	4,523	26.7	C	28.6	C
	4	Centreville Road	Sunrise Valley	7,799	81.0	F	85.0	F
	5	Centreville Road	DTR EB On/Off ramps	5,639	39.2	D	37.2	D
	6	Centreville Road	DTR WB On/Off ramps	3,679	25.2	C	24.6	C
	8	Fairfax County Pkwy	DTR EB On/Off ramps	6,254	42	D	43.4	D
	9	Fairfax County Pkwy	DTR WB On/Off ramps	7,847	40.8	D	29.8	C
	12	Reston Pkwy	DTR EB On/Off ramps	5,476	35.1	D	33.8	C
	13	Reston Pkwy	DTR WB On/Off ramps	6,148	62.9	E	56.7	E
	15	Reston Pkwy	Bluemont Way	5,897	37.2	D	40.1	D
	16	Reston Pkwy	New Dominion Pkwy	7,078	86.1	F	82.7	F
	18	Wiehle Avenue	DTR EB On/Off ramps	5,302	31.3	C	23.8	C
	19	Wiehle Avenue	DTR WB On/Off ramps	5,520	37.8	D	36.6	D
	21	Hunter Mill Road	Sunrise Valley	3,678	107.1	F	65.3	E
	22	Hunter Mill Road	DTR EB On/Off ramps	2,664	18.4	B	18.4	B
	23	Hunter Mill Road	DTR WB On/Off ramps	3,073	152	F	140.8	F
	24	Hunter Mill Road	Sunset Hills	2,946	46.8	D	54.4	D
Gateway Intersections Weighted Average					133.8	F	116.7	F
Non-Gateway Intersections Weighted Average					65.5	E	61.3	E
All Intersections Weighted Average					89.0	F	80.4	F

[1] Splits and offsets were optimized.

Table 4.17 - 2030 Scenario G –Peak Hour Intersection Levels of Service by Movement (with mitigation measures)

AM PEAK HOUR

Inter. ID #	Major Street	Cross Street	Eastbound			Westbound			Northbound			Southbound			Int. Delay (sec/veh)	LOS
			Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right		
1	Sunrise Valley Drive	Frying Pan Rd	C	B		E	E	B	D	D	A	D	D	A	27.9	C
2	Centreville Road	Frying Pan Rd	E	D	A	E	E	A	E	C	A	E	D	B	36.1	D
3		Coppermine Rd	D	D	A	C	D	A	E	B		E	B	A	22.6	C
4		Sunrise Valley	D	D		D	E	E	F	D	B	F	D	A	54.7	D
5		DTR EB On/Off ramps	F		A					A	A	E	B		86.5	F
6		DTR WB On/Off ramps				E	E	A	A	A			B	A	11.2	B
7	Fairfax County Pkwy	Sunrise Valley	D	F	A	D	F	B	F		B	F		B	54.7	D
8		DTR EB On/Off ramps	E		D					D	A	E	B		35.6	D
9		DTR WB On/Off ramps				D	C	C	E	A			A	A	9.8	A
10		Spring St	F		A				F	A			F	B	66.5	E
11	Reston Pkwy	Sunrise Valley	D	F		F	E	E	C	F	C	F	B	A	70.6	E
12		DTR EB On/Off ramps	F		F					A	A		B	A	34.5	C
13		DTR WB On/Off ramps				E	F	F	F	E			A	A	48.6	D
14		Sunset Hills	F	F	C	F	E	C	F	D	F	F	D	A	153.1	F
15		Bluemont Way	F	E	C	F	F		F	A		F	C	A	28.2	C
16		New Dominion Pkwy	E	F	C	F	E	B	F	C	A	F	E	A	67.4	E
17	Wiehle Avenue	Sunrise Valley	F	C			D	F				F		A	139.7	F
18		DTR EB On/Off ramps	D	E	E					B	A	D	B		24	C
19		DTR WB On/Off ramps				E	E	E	E	A			A	A	15.5	B
20		Sunset Hills	D	F	D	F	D	A	F	D	F	F	D		145.2	F
21	Hunter Mill Road	Sunrise Valley	F	A			C		D	D		D	F		94.2	F
22		DTR EB On/Off ramps	F		C					A	A	D	A		21.4	C
23		DTR WB On/Off ramps				F		F	B	F			A	A	102.1	F
24		Sunset Hills	F		B				F	B			C		70.1	E

PM PEAK HOUR

Inter. ID #	Major Street	Cross Street	Eastbound			Westbound			Northbound			Southbound			Int. Delay (sec/veh)	LOS
			Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right		
1	Sunrise Valley Drive	Frying Pan Rd	C	C		F	F	A	F	E	A	F	D	F	174.4	F
2	Centreville Road	Frying Pan Rd	E	E	C	E	D	A	E	B	A	E	C	B	36	D
3		Coppermine Rd	E	D	C	C	D	A	E	C		E	C	A	28.6	C
4		Sunrise Valley	F	E		F	D	F	F	D	A	F	D	A	85.0	F
5		DTR EB On/Off ramps	E		A					A	B	E	E		37.2	D
6		DTR WB On/Off ramps				F	F	A	A	A					24.6	C
7	Fairfax County Pkwy	Sunrise Valley	E	D	A	F	E	B	F		A	D		A	49.7	D
8		DTR EB On/Off ramps	F		C					D	A	F	B		43.4	D
9		DTR WB On/Off ramps				E	F	E	F	B			B	A	29.8	C
10		Spring St	E		A				D	C			C	A	26	C
11	Reston Pkwy	Sunrise Valley	E	F		F	E	F	D	F	A	C	C	A	78.8	E
12		DTR EB On/Off ramps	F		F					A	A		A	A	33.8	C
13		DTR WB On/Off ramps				F	F	E	F	B			E	B	56.7	E
14		Sunset Hills	F	D	F	F	D	D	F	F	A	F	F	B	217.1	F
15		Bluemont Way	F	D	D	E	D		E	C		F	C	B	40.1	D
16		New Dominion Pkwy	F	D	F	F	E	C	F	F	B	F	E	B	82.7	F
17	Wiehle Avenue	Sunrise Valley	F	C			F	C				E		B	53.4	D
18		DTR EB On/Off ramps	D	E	E					C	A	C	B		23.8	C
19		DTR WB On/Off ramps				E	E	E	D	C			C	B	36.6	D
20		Sunset Hills	F	C	F	F	E	C	F	F	A	F	D		253.1	F
21	Hunter Mill Road	Sunrise Valley	E	F			C		E	D		D	D		65.3	E
22		DTR EB On/Off ramps	E		E					B	A	C	A		18.4	B
23		DTR WB On/Off ramps				F		B	D	F			B	A	140.8	F
24		Sunset Hills	F		B				C	B			C		54.4	D

Figure 4.9A - 2030 Scenario G - Lane Configuration, Peak Hour Volume, and Intersection Level of Service (with mitigation measures) – West Area

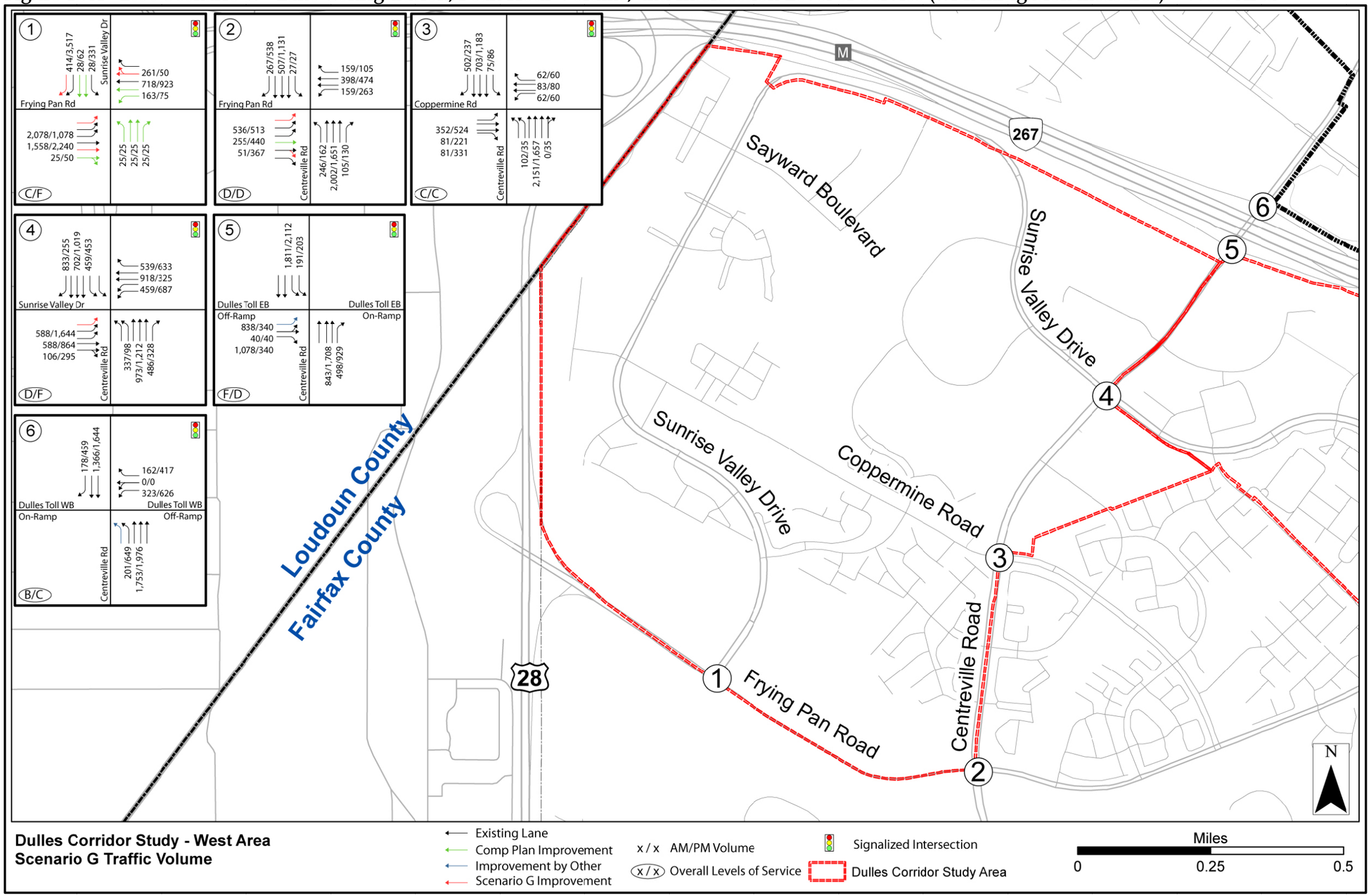


Figure 4.9B - 2030 Scenario G - Lane Configuration, Peak Hour Volume, and Intersection Level of Service (with mitigation measures) – Central Area

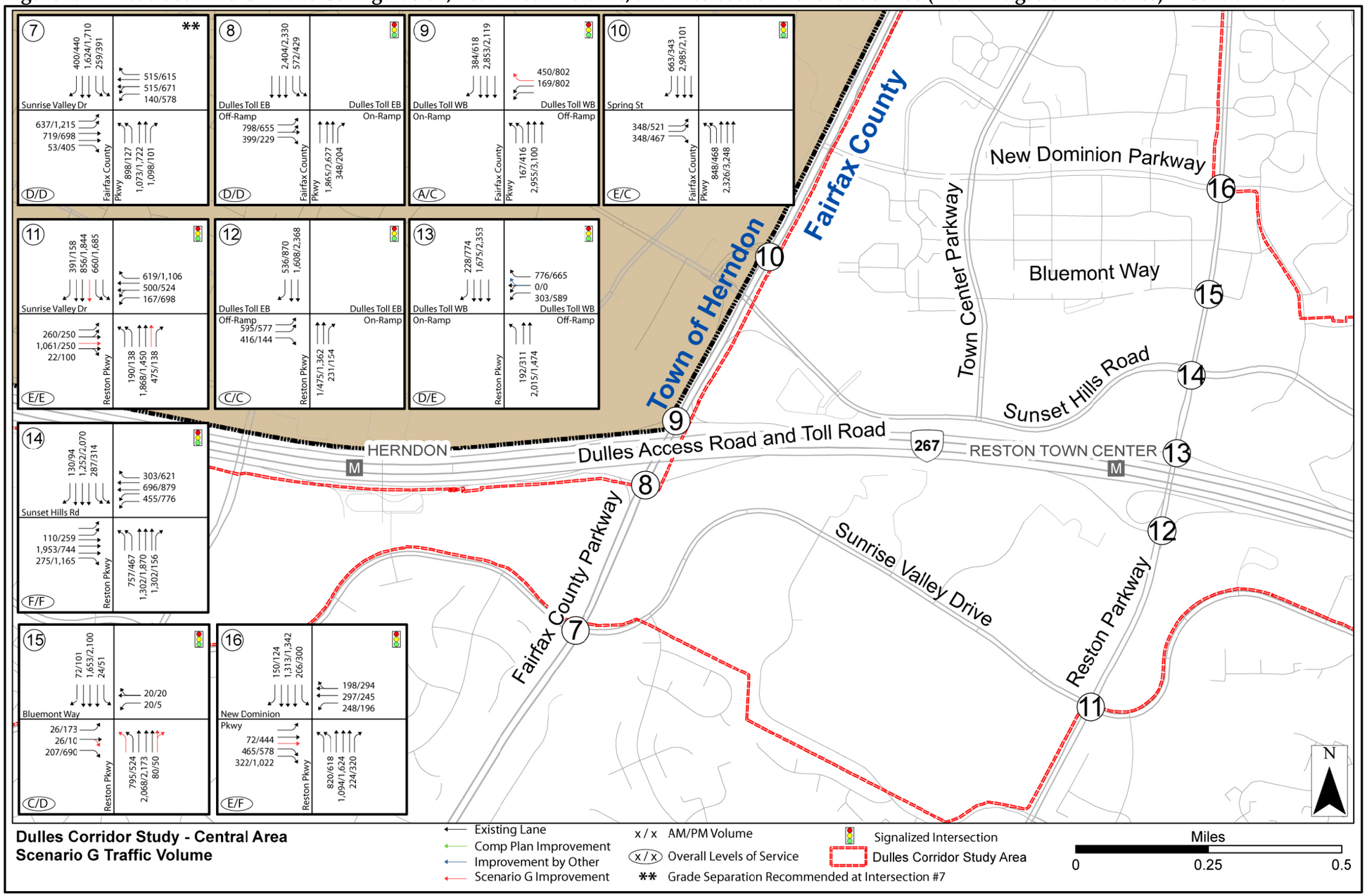


Figure 4.9C - 2030 Scenario G - Lane Configuration, Peak Hour Volume, and Intersection Level of Service (with mitigation measures) – East Area

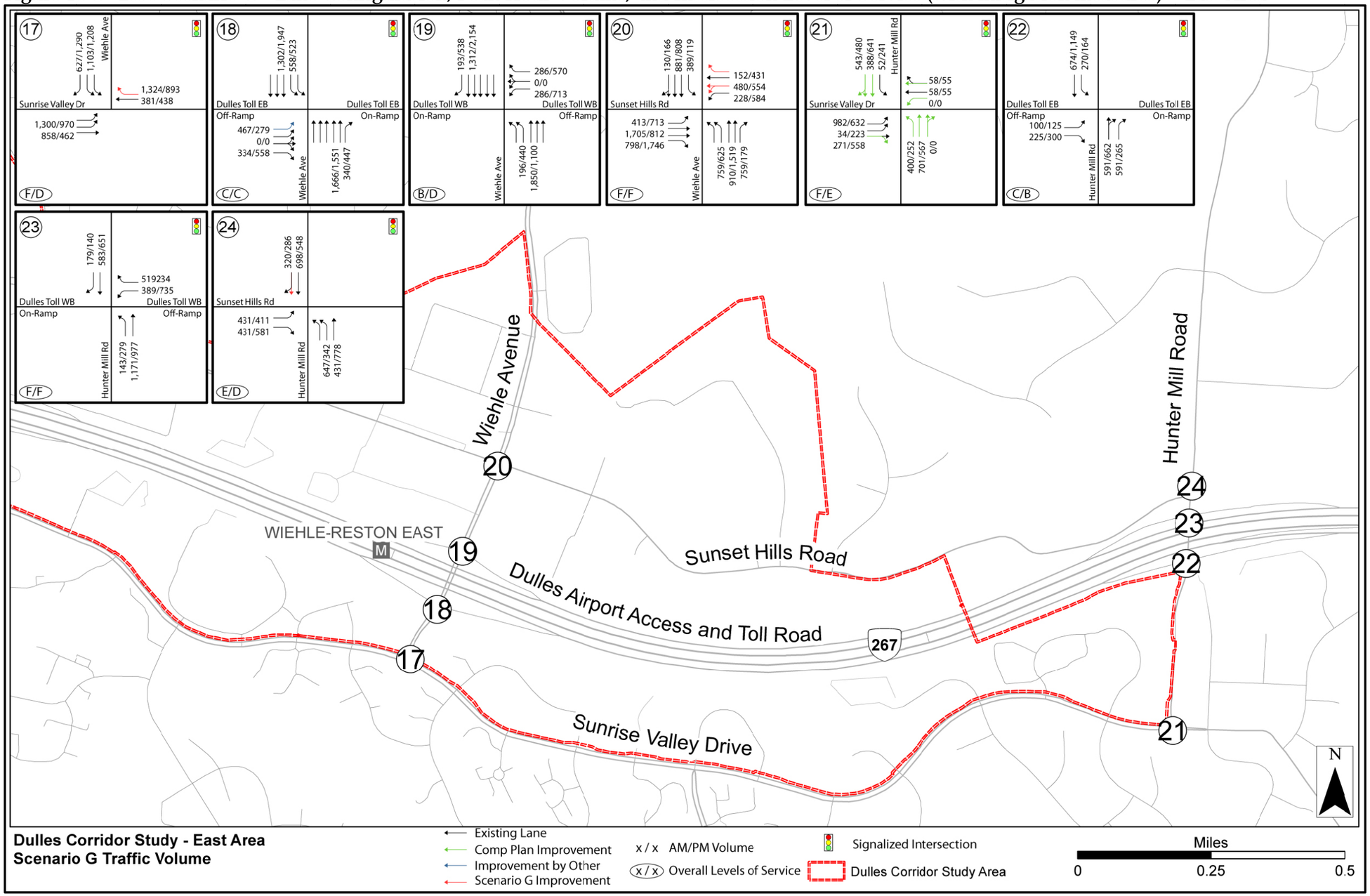


Figure 4.10A - 2030 Scenario G - Lane Configuration and Intersection Level of Service by Movement – West Area

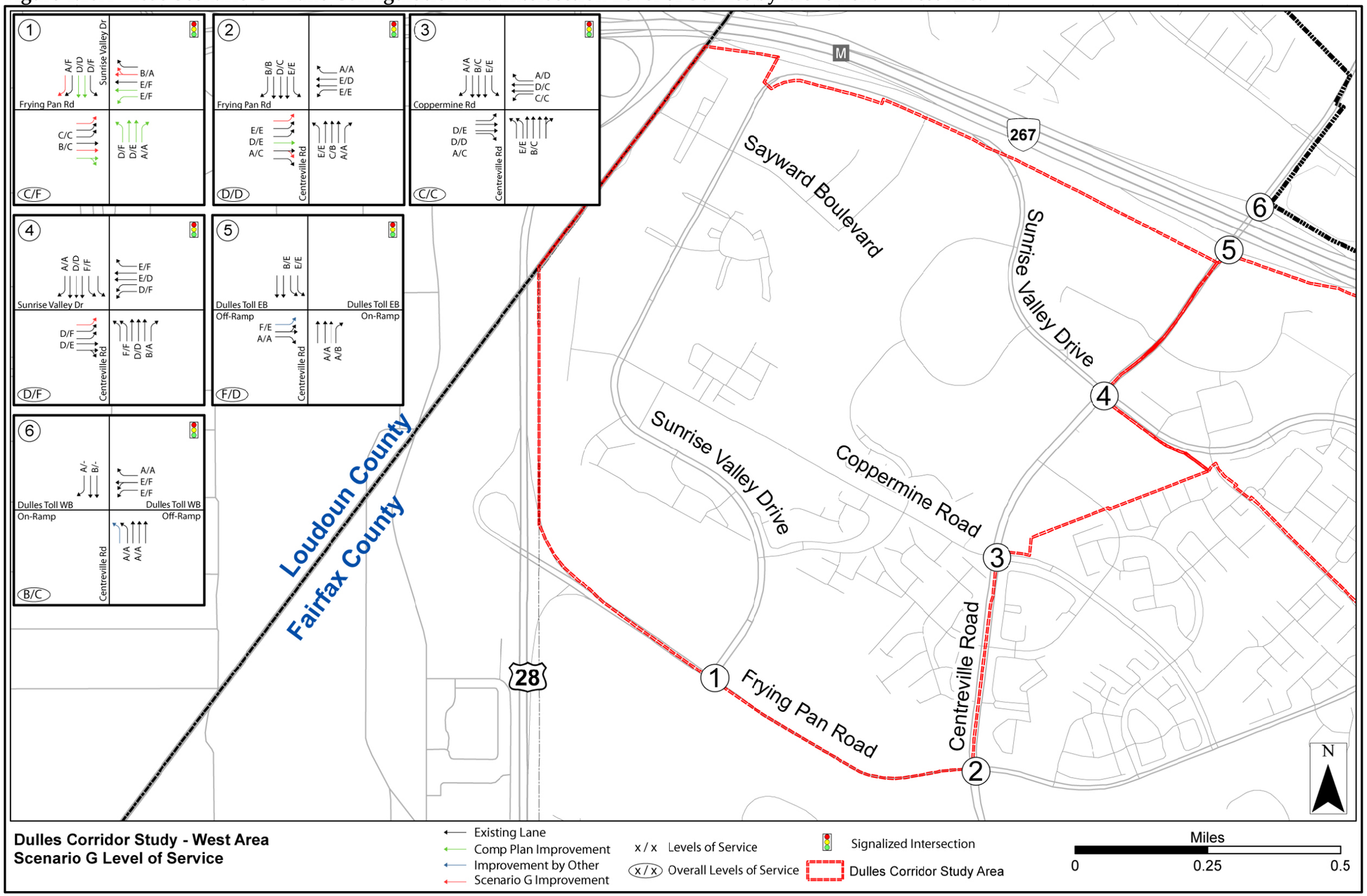


Figure 4.10B - 2030 Scenario G - Lane Configuration and Intersection Level of Service by Movement – Central Area

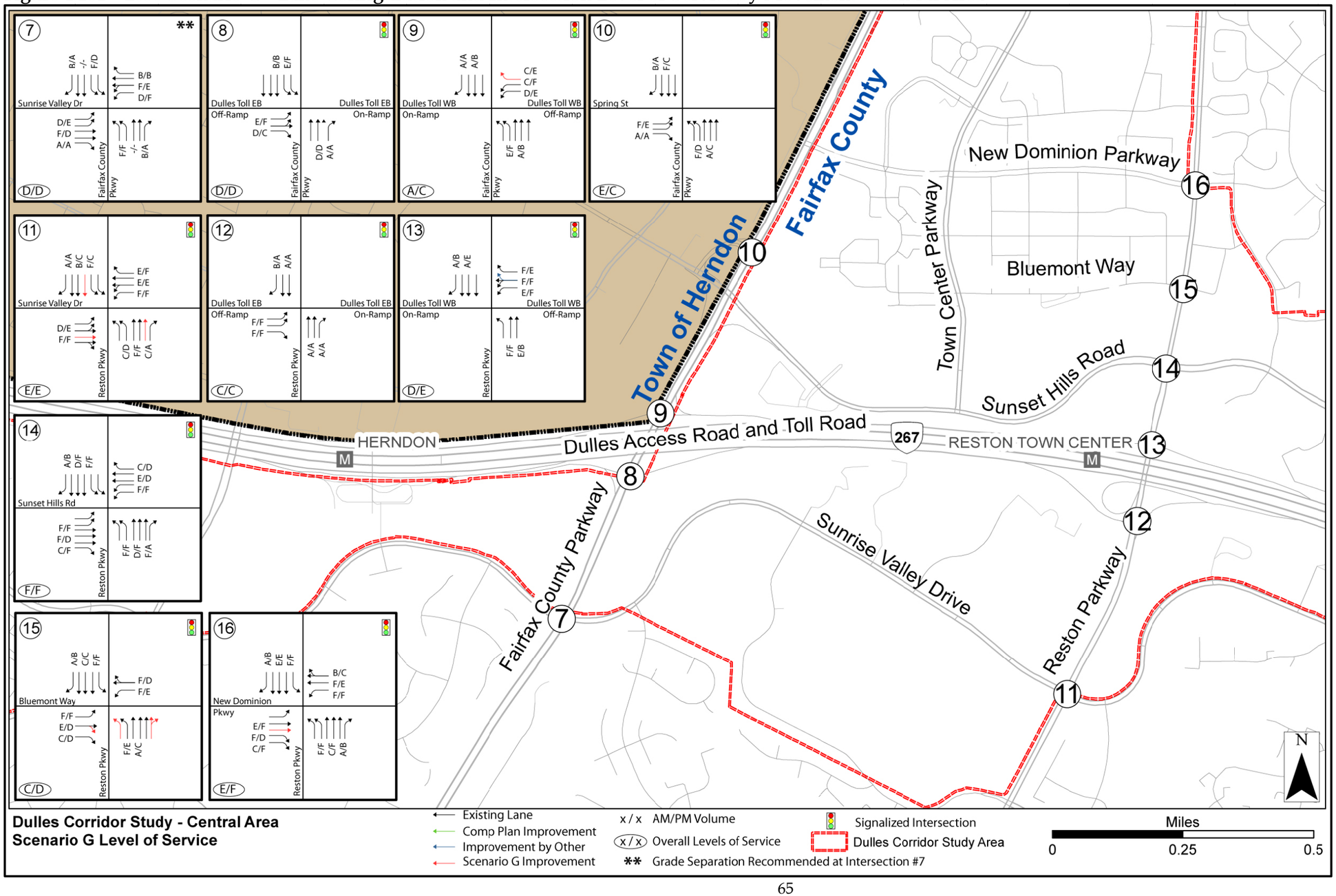
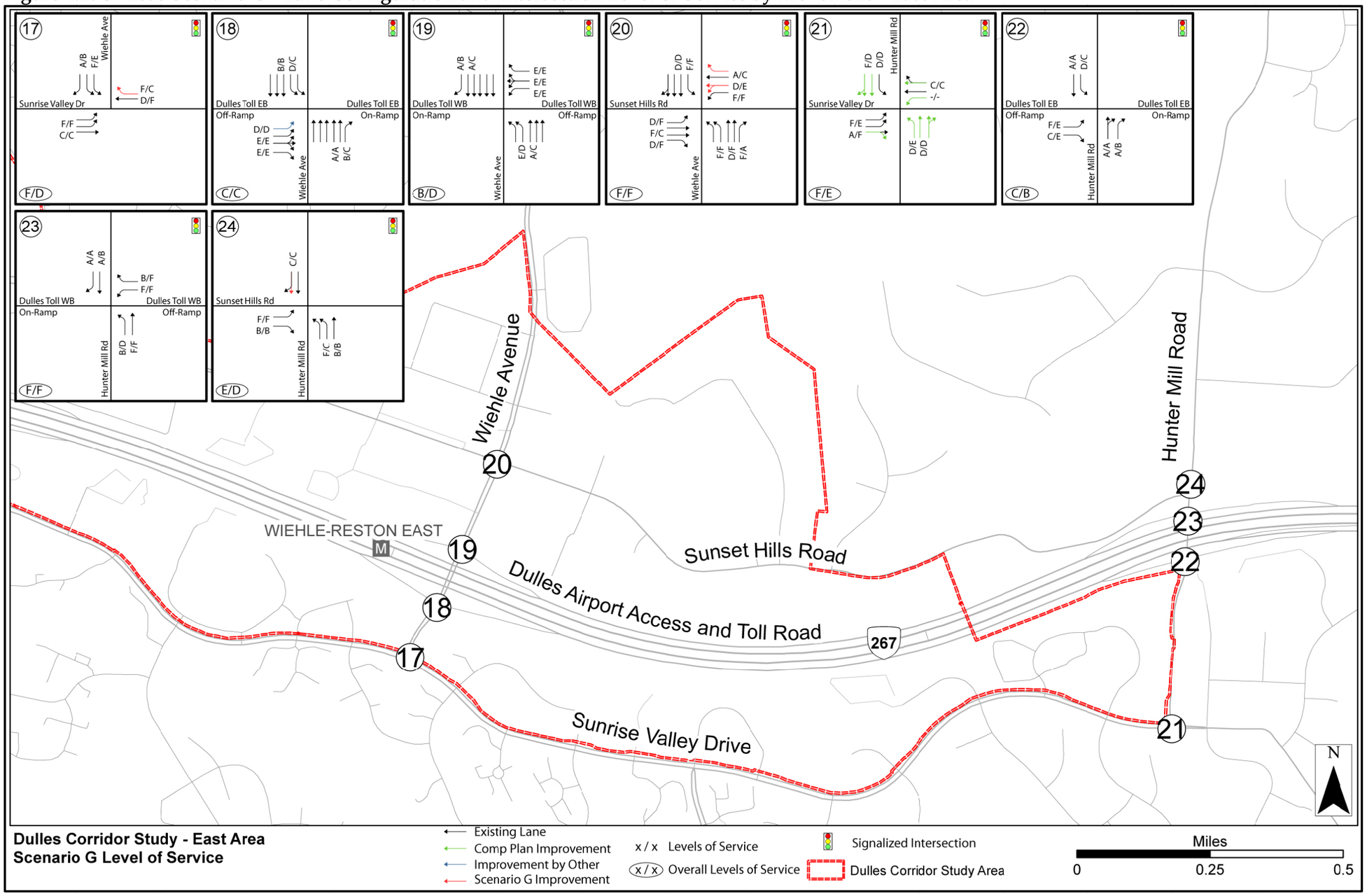


Figure 4.10C - 2030 Scenario G - Lane Configuration and Intersection Level of Service by Movement – East Area



Full Mitigation of Scenario G

Intersections that were still projected to fail in Scenario G, after all the mitigation measures described above were applied, were evaluated further to see what level of investment would be needed to bring them to at least a LOS E. Table 4.18 generally describes mitigation measures that would be needed to fully mitigate failing intersections. Not all of these intersection improvements are recommended as there needs to be a balance between all modes of transportation in the study area. Three of the six failing intersections in the morning would require additional right-of-way to mitigate to a LOS E and three would either need a signal or lane adjustment. Five of the six failing intersections in the evening peak hour would require right-of-way to mitigate to a LOS E.

Fairfax County's policy is to create a multimodal, walkable environment particularly in TOD locations. To fully mitigate the impact of Scenario G on the failing intersections, additional traffic lanes are needed. However, recommending additional lanes runs counter to County policy; therefore, this is not suggested for inclusion in the study. The intersections that need a lane or signal adjustment would be considered for implementation when a more detailed analysis of the road network is conducted either with rezoning applications, when there is a major public investment, or when the Fairfax County Department of Transportation is able to assess the recommended grid of streets with a more detailed study.

Table 4.18 - 2030 Scenario G – Further Improvements for Full Mitigation – Not Recommended

AM PEAK HOUR

Int. #	Intersection	Improvement
6	Centreville Road and DTR EB on/off ramps	Lane Adjustment
14	Reston Parkwy and Sunset Hills Road	Signal and Right-of-way
17	Wiehle Avenue and Sunset Hills Road	Right-of-Way
20	Wiehle Avenue and Sunrise Valley Drive	Signal
21	Hunter Mill Road and Sunrise Valley Drive	Signal
23	Hunter Mill Road and DTR WB on/off ramps	Right-of-Way

PM PEAK HOUR

Int. #	Intersection	Improvement
1	Sunrise Valley Drive and Frying Pan Road	Right-of-Way
4	Centreville Road and Sunrise Valley Drive	Signal
14	Reston Parkwy and Sunset Hills Road	Signal and Right-of-way
16	Reston Parkway and New Dominion Pkwy	Right-of-Way
20	Wiehle Avenue and Sunset Hills Road	Right-of-Way
23	Hunter Mill Road and DTR WB on/off ramps	Right-of-Way

Vehicle Hours of Congestion

Because Scenario G has higher total travel than the COG Round 8 Scenario, it is expected that Scenario G will have higher vehicle hours of travel than the Round 8 Scenario in the study area. Vehicle hours of travel were tabulated for three categories of congestion on roadways -- under capacity, near capacity, and over capacity. While Scenario G has higher values for the under-capacity and over-capacity categories than Round 8, it has a lower value for the near-capacity category. The share of the over-capacity category, which represents the vehicle hours of congestion, is slightly higher in Scenario G than Round 8.

4.5 Transit Analysis of Transit Oriented Developments

Four Metro stations of the Silver Line are located in the study area— Wiehle-Reston East, Reston Town Center, Herndon, and Innovation Center. As discussed in Section 2, Scenario G was developed to represent transit oriented developments and incorporate other Smart Growth principles such as mixing land use, so as to reduce the travel by automobile.

An enhanced mode share allocation method was developed for determining the mode splits for TOD and non-TOD locations within Dulles Corridor Study area. This process was applied as a post-processor to the mode choice model. Data was used along with models from the technical report TCRP 95 Chapter 17 Transit-Oriented Development as the basis for this work. The report contains a set of models which relate mode share changes to distance from heavy rail stations. These models assisted in refining the allocation of transit trips from the 2,191 zone structure to subzones. The refinements were based on the location of the subzones relative to the Metrorail stations. The total number of transit trips for zones did not change; it was simply an allocation tool.

The approach used for the reallocation assigned the bulk of forecasted rail trips destined to the Dulles Corridor Study area to the TOD areas, and was sensitive to the subzone employment forecast. The approach similarly assigned the bulk of forecasted walk-to-rail trips from Dulles Corridor Study to the TOD areas, and was sensitive to the subzone residential forecast. As demonstrated in Figure 4.11, the Dulles Corridor Study can be split into TOD and non-TOD subzones, with the general definition for a TOD subzone being any subzone with a centroid within (1) one-quarter of a mile of a Metrorail station (2) one-quarter to half-mile of a Metrorail station.

Based on the development-related ridership survey conducted in 2005, two rail ridership models were developed for the Washington, D.C. area and are listed in the technical report TCRP Report 95. These models represent an average for the sites explored in the underlying development-related ridership study; higher or lower shares might occur in the Dulles Corridor Study area for a variety of reasons, including variations in travel markets for each station, specific development density levels, station area parking constraints, and site design. Standard formulations were used, but an adjustment factor was developed to bring them into line with the WMATA post-processor mode choice model output for the study area. This was deemed prudent given the range of variation in possible future conditions.

The allocation of transit trips from the MWCOG/TPB zone structure to subzones was conducted based on the factored employment and population data in subzones. For half mile buffers, the office site TOD factor of 9.0 was applied to total employment on the attraction side for all Metrorail-only trips and the residential site TOD factor of 1.5 was applied to total population on the production side for all walk-access Metrorail trips. A factor of 1.0 was used in the non-TOD zones. The transit mode shares for TOD area and non-TOD area were then calculated based on the allocation results.

The WMATA post-processor estimates Metro ridership by stations based on the trip tables from the TPB model Version 2.2. The latest TPB model Version 2.3 also estimates Metro ridership by stations. These two estimates were compared, and the estimates from the WMATA post-processor in conjunction with the TPB Version 2.2 model appear to be low for the four stations in the study area. Adjustment factors were developed based on the ratios of these two estimates and were applied to the model results. The results are shown in Table 4.12.

Figure 4.11 - Metro Stations and Their Buffers Relative to TAZs

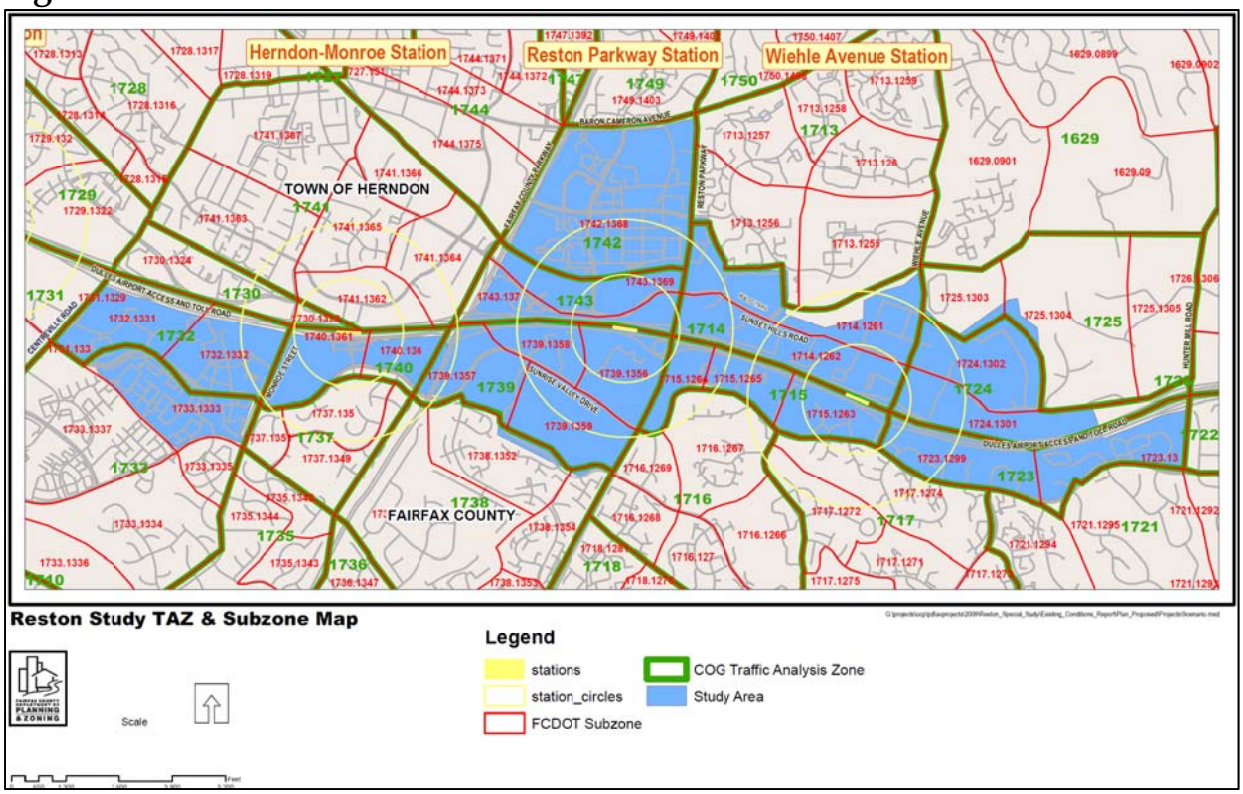


Table 4.12 - Transit Shares in by Station TOD

	Production Transit Share	Attraction Transit Share
Route 28 Quarter Mile TOD	26%	18%
Herndon Quarter Mile TOD	37%	19%
Reston Quarter Mile TOD	26%	15%
Wiehle Quarter Mile TOD	38%	18%
Route 28 Half Mile TOD	20%	12%
Herndon Half Mile TOD	25%	12%
Reston Half Mile TOD	24%	12%
Wiehle Half Mile TOD	30%	12%

Note: *The ratios of Metro Silver Line ridership from Version 2.3 Model to those from Version 2.2 were used to adjust transit shares.

The model was used to identify maximum loading volumes. Based on the model (TPB Version 2.2), the maximum load for the six-hour peak period was identified to be between the Reston Town Center and Wiehle-Reston East stations at 4,300 passengers, which averages about 700 passengers per hour. There is still sufficient capacity in the system after applying a factor to reflect the current TPB Version 2.3 model passenger riders. Attachment #3 in the Appendix shows the boardings and alightings by Station.

4.6 Summary and Next Steps

Summary

Scenario G, based on the analysis provided in this report, performs better than the COG Round 8 Scenario on the transportation network. Part of the improvement is due to the reallocation of land use density and land use type to other locations of the study area that are better able to accommodate additional development, the densification of the whole study area (i.e. highest density closest to the Metro stations), and additional improvements to the transportation network.

FCDOT is recommending the following transportation improvements be included in the Comprehensive Plan to address the transportation impacts associated with Scenario G:

- Route 28 - 10 lanes with HOV. One HOV lane per direction is included within the ten-lane proposed width.

- Extend Sunrise Valley south of Frying Pan Road to Park Center Road
- Frying Pan Road - 6 lanes between Route 28 and Centreville
- Extend River Birch Road from Sunrise Valley Drive to Frying Pan Road (new improvement to be added to the Comprehensive Plan)
- Rock Hill Road Overpass (4-lane bridge) from realigned Innovation Avenue in Loudoun County to the intersection of Sunrise Valley Drive and Sayward Boulevard in Fairfax County
- Fairfax County Parkway - 6 lanes with HOV
- Grade separation at Fairfax County Parkway and Sunrise Valley Drive. An alternative improvement can be considered as identified through a more detailed study. (new improvement to be added to the Comprehensive Plan)
- Fox Mill Road - 4 lanes from Reston Parkway to Monroe Street
- West Ox Road - 4 lanes from Lawyers Road to Centreville Road
- Monroe Street - 4 lanes from West Ox Road to the Town of Herndon
- Town Center Parkway Underpass (4-lane tunnel) from Town Center Parkway and Sunset Hills Road to Sunrise Valley Drive west of Edmund Halley Drive
- Extend Pinecrest Road from South Lakes Drive to Sunrise Valley Drive (new improvement to be added to the Comprehensive Plan)
- Reston Parkway – 6 lanes from South Lakes Drive to Baron Cameron Avenue (new segment from Sunrise Valley Drive to South Lakes to be added to the Comprehensive Plan)
- Overpass (4-lane bridge) across the Dulles Toll Road from Sunset Hills Road to Sunrise Valley Drive approximately at Soapstone Drive. Referred to as the Soapstone Overpass
- Overpass (4-lane bridge) across the Dulles Toll Road from Sunset Hills Road to Sunrise Valley Drive approximately at South Lakes Drive. Referred to as the South Lakes Overpass (new improvement to be added to the Comprehensive Plan)
- Grid of Streets in the Reston and Route 28 Study areas, as shown in Figure 4.7 (new improvement to be added to the Comprehensive Plan)
- Intersection improvements (new improvement to be added to the Comprehensive Plan)

The transit improvements included in the COG Round 8 Scenario and Scenario G transportation networks are either in the County's Transit Development Plan or are being studied with the County's ongoing Countywide Transit Network Study (CTNS). The CTNS will contain recommendations for transit improvements on select corridors, which is to be completed in the winter 2013/spring 2014.

A LOS E is recommended for intersections that are located within a half-mile of a Metrorail Station in the Dulles Corridor Study area. The tiered approach, as outline in Section 3, will be used to assess mitigation strategies when rezoning applications are submitted or when additional detailed analyses occur.

Trip reduction goals are shown in Table 4.13. These goals are backed up with empirical data collected by Fairfax County.

Table 4.13 - Trip Reduction Goals

Development		TOD Locations		Non-TOD Locations (More than 1/2 Mile
		0 to 1/4 Mile from the Station	1/4 to 1/2 Mile from the Station	
Office	Baseline*	30%	25%	20%
	TDM Goal**	45%-35%	40%-30%	35%-25%
Residential	Baseline	30%	25%	15%-10%
	TDM Goal	45%-35%	40%-30%	25%-15%

*Baseline refers to the inherent reduction from ITE trip rates observed in Fairfax County without any formal TDM program elements in place. These reductions include the following: vehicle trip reduction due to transit use, peak hour spreading and existing TDM activities (prior to a formal TDM program)

**Use of the higher end of the reduction range should be considered especially for developments in areas of high existing or planned urban accessibility, located close to and with easy and convenient pedestrian access to transit stations (<1/4 mile for rail, <1/8 mile for bus service), and in a walkable, mixed-use environment. Mixed-use development supports higher levels of vehicle trip reduction due to internal trip capture and as well as to walk and bicycle trips within the development or to adjacent developments. A project with TDM that is part of a larger mixed-use development may, therefore, support greater vehicle trip reductions than a smaller, single-use, stand-alone project that implements the same site-level TDM measures.

Next Steps

After the plan amendments are adopted, the Fairfax County Department of Transportation will begin a more detailed analysis of the grid networks assumed in the Reston and Route 28 study areas. A detailed analysis has already been started for the Route 28 area. These analyses will be used to take the proposed grid of streets from a conceptual network to a network that can assist with rezoning applications as well as determining which aspects of the grid are important for the functioning of the transportation network. These results will be shared the Virginia Department of Transportation (VDOT) and others as requested.

Appendix

Attachment #1 – Transportation Intersection Results – Detailed Tables

Attachment #2 – Roadway Volume-to-Capacity Ratios

Attachment #3 – Model Metro Ridership Estimates

Attachment #4 – Synchro Files for Existing (2013), 2030 COG Round 8 Scenario, Scenario G

Attachment #5 – Transit Development Plan Recommendations