Route 7 BRT – Tysons Study

Final Report

October 2021

FCDOT
Fairfax County
Department of Transportation

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Background and Study Process

Fairfax County Department of Transportation (FCDOT) initiated the Route 7 BRT - Tysons Study in 2018 to develop and evaluate Bus Rapid Transit (BRT) alternatives on Route 7 in Tysons, Fairfax County, Virginia. This study builds on work by the Northern Virginia Transportation Commission (NVTC), which explored transit alternatives on Route 7 between Mark Center in Alexandria and Tysons. This Tysons BRT study follows up on that Envision Route 7 study by reviewing route alignment and street cross-section alternatives as well as station locations and platform configurations. The study area encompasses the Tysons Urban District with its four WMATA Silver Line Metrorail stations, and stretches southeast on Route 7 to the I-66 interchange.

BRT's reliability and travel time improvements will benefit transit users traveling on the corridor, which is currently, and expected to remain, at capacity. BRT offers an alternative for non-automobile travel options within the corridor for those who might otherwise use single occupant vehicles. There will continue to be high- density development due to upcoming land use changes in the Tysons study area. These high-density developments attract people that are more inclined not to use an automobile for trip making and for whom premium, frequent, reliable transit, such as BRT, is an important component in their travel choices, and is an important element in their decisions about where to live. Additionally, BRT:

- Increases corridor throughput capacity without widening roadways, thus addressing the current capacity challenges along the corridor;
- Improves service for existing transit passengers;
- Incentivizes transit usage with improved service; and
- Supports land use and economic development goals through regional transit connections and increased capacity for growth.

This study relies on a robust technical analysis, public engagement, and extensive stakeholder engagement which supports a data-driven decision framework. The two phased approach, as shown in **Figure ES- 1**, is comprised of broad assessment and evaluation phases.

What is BRT?

BRT is an efficient, comfortable, and cost-effective bus service with:

- Dedicated bus running-way and transit signal priority
- Enhanced stations
  - Off-board fare collection
  - Level boarding
  - Real-time passenger information
  - Other amenities
- Service
  - Frequent and reliable
  - Easily understood routes
  - Limited stops (0.25 to 0.50 mile spacing)
  - Branded vehicle and station identity
- BRT ridership and experience are comparable to light rail, but with lower capital costs.

The project team developed nine alternatives in the assessment phase which stakeholders qualitatively reduced to three final alternatives. In the evaluation phase, the project team and stakeholders quantitatively examined the three final alternatives and a no-build baseline scenario utilizing demographic analysis and modeling tools. This analysis highlighted advantages, disadvantages, and trade-offs for each alternative.

Figure ES- 1 | Study Process Diagram

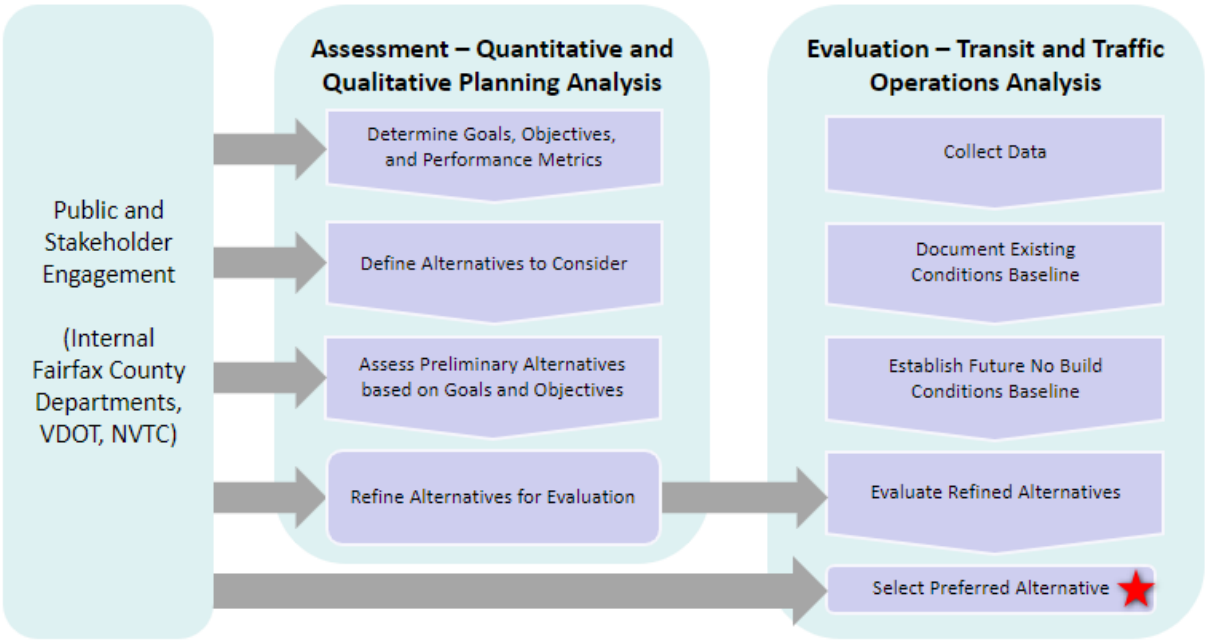
Questions Considered in Study Process

Routing – What roadway does BRT travel on? What is the terminal station?

Alignment – What is the appropriate BRT running-way: mixed traffic, BAT (bus and turn lane only) exclusive curb busway, exclusive median busway, or combination?

Cross-sections – What is the roadway configuration considering BRT and planned roadway widening?

Station locations – Where are the stations located, considering adjacent land use, trip generators, and stop spacing?



Prior to the COVID-19 Pandemic, FCDOT held a meeting in early March 2020 to gain feedback and comments from stakeholders in the study area and present the project findings and processes followed to date, including the study's established goals, objectives and performance metrics and results of the alternatives assessment phase.. Then, FCDOT defined and assessed preliminary alternatives based on

the goals and objectives and refined the alternatives for evaluation. The evaluation phase included detailed transit and traffic operations analysis in coordination with stakeholders and other agencies, including the Virginia Department of Transportation (VDOT) and Northern Virginia Transportation Commission (NVTC) for the selected alternatives. The study team collected data, such as traffic counts for the corridor, and conducted the existing and future no-build conditions baseline analysis. Finally, the refined alternatives were evaluated for 2045 conditions and FCDOT selected the preferred alternative based upon the comparative analysis of the alternatives. The preferred alternative is Alternative 1/International Drive, and the following document explains the rationale for its selection.

Goals, Objectives, and Performance Metrics

FCDOT undertook a multi-step, data-driven process to ensure BRT alternatives considered and selected fit within the project goals. The process began by determining goals and objectives utilizing a review of previous studies and working with stakeholders to develop accompanying measures of effectiveness (MOEs) for both transit and roadway users.

Goals and Objectives were determined to be:

- **Access and Mobility:** Provide choices through accessible transit service
- **Mode Share/Efficiency:** Increase transit usage and reduce Single Occupancy Vehicle (SOV) usage to ensure efficient movement of people and goods
- **Land Use/Economic Vitality:** Support economic development and land use goals
- **Equity:** Meet the needs of all users- residents, workers, visitors, and disadvantaged populations
- **Safety:** Improve safety for all users and the general public
- **Environmental Concerns:** Minimize environmental impacts and improve air quality
- **Financial Feasibility:** Make sustainable, cost-effective investments in transit

Existing Conditions

To evaluate the need for transit improvement, the study compared the Existing Conditions to the forecasted 2045 traffic conditions and transit use. This comparison scenario is referred to as the "No Build" scenario. Route 7 is at its throughput capacity, meaning that no more vehicles and passengers can travel along the corridor without degraded operations, even considering widening.

Meanwhile, the residential and employment population is expected to increase significantly due to land use changes that encourage and support high-density development, focused around the Metrorail stations within Tysons. By 2045, the Tysons residential population is forecasted to grow approximately 175 percent (+60,000 residents), households are expected to grow 197 percent (+32,000 households), and employment is forecast to grow approximately 70 percent (+67,000 jobs). This growth will result in more people traveling along the corridor and in its vicinity as well as an increase in transit riders. In fact, overall transit ridership is expected to increase 290 percent (+27,000 riders) by 2045.

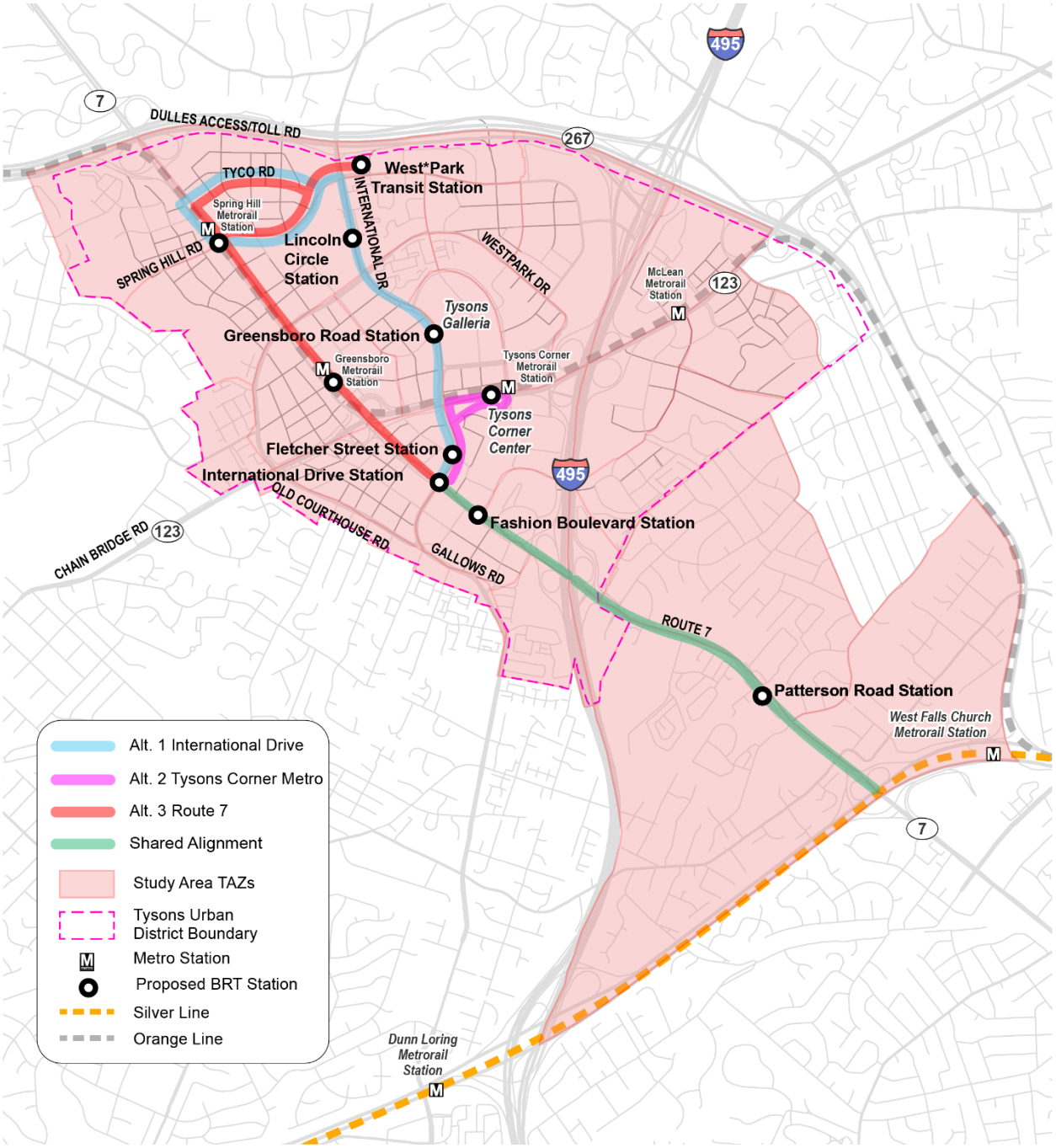
Without making any changes to transit or traffic patterns, the forecast indicated there will be slower corridor travel times and greater delays at intersections, with five failing intersections (LOS F) in the AM peak and six in the PM peak.

These traffic conditions combined with the expected population growth require an effective, frequent, reliable transit option that BRT provides. This will both serve existing and future transit passengers and increase throughput capacity in the area without adding congestion that comes with single occupancy vehicles.

Alternatives Evaluation

As noted, the assessment phase led to nine preliminary alternatives that were considered and then narrowed down to three for further evaluation. These three alternatives are described below. The map seen in **Figure ES- 2** shows the three alternatives.

Figure ES- 2 | Map of Three Evaluated Alternatives

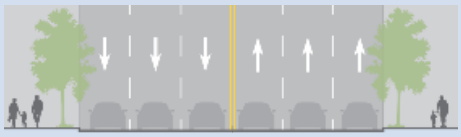
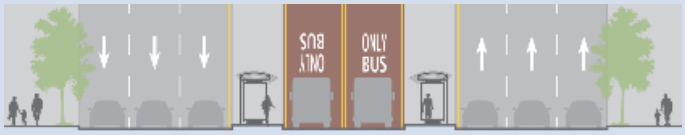


Alternative 1/International Drive

Alternative 1/International Drive follows north along Route 7, turning right onto northbound International Drive, and then turning left onto westbound Spring Hill Road, with a terminus at Spring Hill Metrorail station, with a return route looping around Tyco Road until reaching Spring Hill Road and International Drive, as seen in **Figure ES- 2**. This alternative consists of a median busway on Route 7 and International Drive followed by a bus and turn (BAT) lane on Spring Hill Road and Tyco Road, which form a one-way couplet through the terminus. The six proposed BRT stations are Patterson Road Station, Fashion Boulevard Station, Fletcher Street Station, Greensboro-International Station, Lincoln Circle Station, and at the Spring Hill Metrorail station. The one-way route length is 3.7 miles. **Figure ES- 3** shows the roadway cross-sections and descriptions for Alternative 1.

Within the half mile walking distance (walkshed) of the route and stations, there are: 8,250 households, a population of 16,650, and 68,250 jobs. This alternative covers the greatest population, households, and jobs. The forecasted daily ridership is approximately 6,700, and the area serves residential, retail and transit-oriented land uses along International Drive.

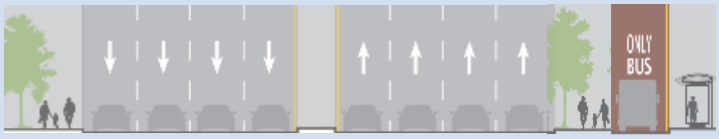
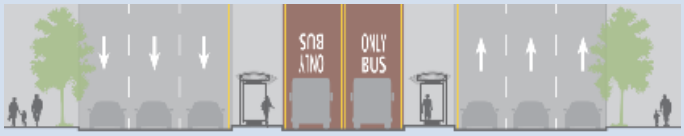
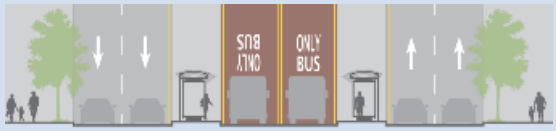
Figure ES- 3 | Cross Section Diagram for Alternative 1/International Drive

Street Name and Section	Description
Tyco Road 	Eastbound BAT lane and two general traffic lanes in each direction
Spring Hill Road 	Westbound BAT lane and two general traffic lanes in each direction
International Drive – Lincoln Circle to Spring Hill Road 	Mixed traffic in both directions to facilitate transition to/from median busway
International Drive – Route 7 to Lincoln Circle 	Median busway and two general traffic lanes in each direction
Route 7 – International Drive to I-495 	Median busway and three general traffic lanes in each direction
Route 7 – I-495 to I-66 	Median busway and two general traffic lanes in each direction

Alternative 2/Tysons Metro

Alternative 2/Tysons Metro also travels in a median busway along Route 7, but turns right/northbound on International Drive and then right /eastbound on Chain Bridge Road to terminate at the Tysons Corner Metrorail Station as seen in **Figure ES- 2**. It is a median busway on Route 7 and a BAT lane on International Drive, and mixed traffic during the remainder of its short and direct 2.3 mile route, as seen in the cross sections in **Figure ES- 4**. The three proposed BRT stations along the route are: Patterson Road Station, International Drive Station, and Tysons Corner Metrorail Station. Within the half mile walking distance (walkshed) of the route and stations, there are: 5,550 households, a population of 11,500, and 61,683 jobs with a forecasted daily ridership of approximately 3,500. The most important benefit of this route is that it serves the Tysons Corner Metrorail Station.

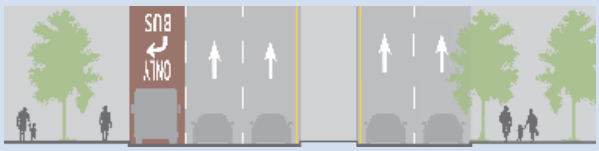
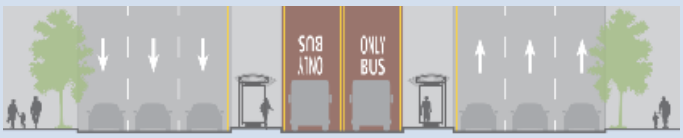
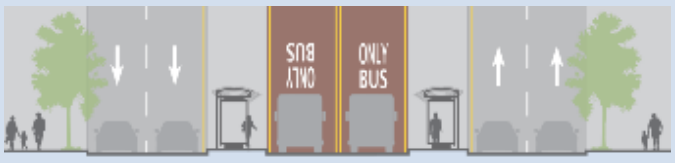
Figure ES- 4 | Cross Section Diagram of Alternative 2/Tysons Metro

Street name and Section	Description
Chain Bridge Road 	Four general traffic lanes in each direction; BRT operates in mixed traffic in the eastbound direction to bus loop
Tysons One Place 	One general traffic lane in each direction; BRT operates in mixed traffic in the westbound direction
International Drive – Route 7 to Chain Bridge Road 	Northbound BAT lane and two general traffic lanes, three southbound general traffic lanes; BRT operates in mixed traffic in southbound direction
Route 7 – International Drive to I-495 	Median busway and three general traffic lanes in each direction
Route 7 – I-495 to I-66 	Median busway and two general traffic lanes in each direction

Alternative 3/Route 7

Alternative 3/Route 7 travels northbound on Route 7, makes a right turn at Tyco Road and continues to Spring Hill Road, terminating at the West*Park Transit Station. Along the southern segment of Route 7 (south of International Drive), there is a median busway alignment, but north of International Drive, the bus travels in a BAT lane, with the exception of a small mixed-traffic segment on Spring Hill Road to connect to the West*Park Transit Station, as seen in **Figure ES- 5 .** The five proposed BRT stations along this 3.8-mile route are: Patterson Road Station, International Drive Station, Greensboro Metrorail Station, Spring Hill Road Metrorail Station, and West*Park Transit Station. Within the half mile walking distance (walkshed) of the route and stations, there are: 7,400 households, a population of 15,000, and 66,200 jobs with a forecasted daily ridership of approximately 7,000. This route serves the transit-oriented mixed use around the existing Metrorail stations along Route 7.

Figure ES- 5 | Cross Section Diagram of Alternative 3/Route 7

Street Name and Section	Description
Tyco Road	Eastbound BAT lane and two general traffic lanes in each direction
	
Spring Hill Road	Westbound BAT lane and two general traffic lanes in each direction
	
Route 7 – Spring Hill Road to International Drive	Curb BAT lanes and three general traffic lanes in each direction
	
Route 7 – International Drive to I-495	Median busway lane and three general traffic lanes in each direction
	
Route 7 – I-495 to I-66	Median busway and two general traffic lanes in each direction
	

Comparison Metrics

In addition to the comparison metrics mentioned above, such as access to the number of households, population, and jobs within a half-mile walking radius, that were utilized as part of the assessment phase, the team also evaluated detailed traffic and transit operational performance metrics. These important multimodal metrics documented the benefits, impacts, and trade-offs in order to quantify and understand both the benefits of reliable BRT and bus speed opportunities in the study area, as well as potential negative impacts to traffic conditions.

Travel Speed Comparison

During the evaluation of travel speed, BRT in all alternatives exceeded local bus speeds. Alternative 2 had the highest travel speed of the alternatives with a speed of 14.9 miles per hour (mph), with Alternative 1 as the lowest at 13.5mph, but even Alternative 1 was only approximately 1.5 mph slower than Alternative 2, and almost twice as fast as the local bus, which only travels at 7.2 mph.

In terms of decreased automobile speeds resulting from BRT implementation, Alternative 3 had the greatest impact to automobile travel speed averages, especially along Route 7 and International Drive. Alternative 2 had smaller decreases in auto travel speed, especially along Route 7. For Alternative 1, there was a slight auto travel speed decrease on International Drive and a slight auto travel speed increase along Route 7.

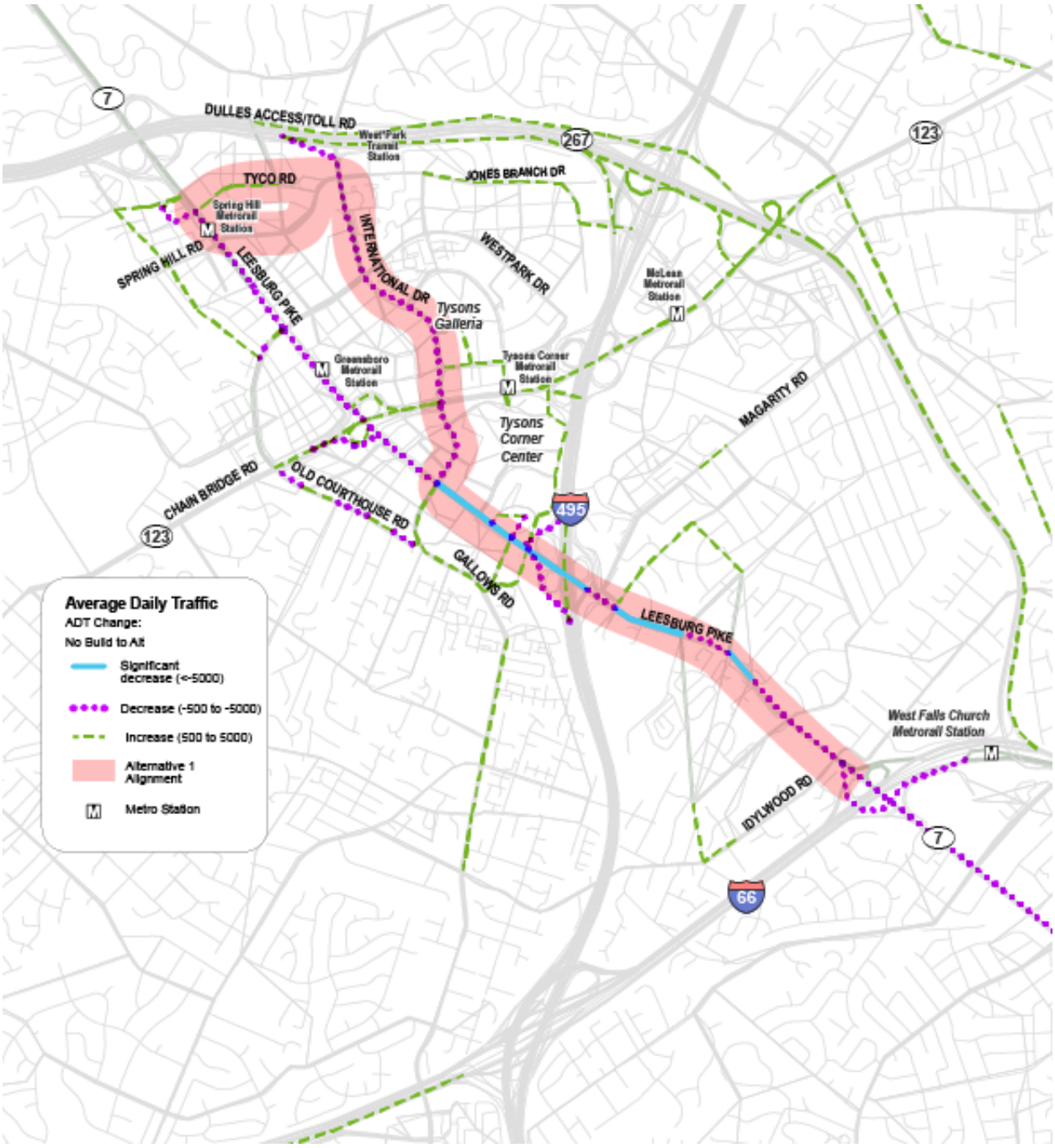
BRT Reliability

Transit travel time reliability was measured using the 95th percentile bus travel times as a proxy to represent "near-worst case" travel conditions. The 95th percentile represents a point along a cumulative distribution graph that 95% of the vehicles fall under. For example, if the 95th percentile travel time for passenger cars is 10 minutes, 95% of all passenger cars will experience a travel time of 10 minute or faster.

Overall, BRT is considerably more reliable, with much lower 95th percentile travel times compared to local buses on median running segments. For Alternative1, BRT on International Drive is less reliable compared to BRT on Route 7, especially in the mixed traffic segments. There are significant reliability issues in the segment between Chain Bridge Rd and Westpark Dr. For Alternative 3, certain segments of the BAT lanes (e.g., Fashion Boulevard to Westpark Drive) have unreliable operations with high 95th percentile travel times. This can be attributed to the high right turn volumes along these segments causing friction for BRT vehicles and delaying buses at intersections. Traffic Volume Changes

BRT decreases traffic volume along its routes and slightly increases the traffic volume along less frequently traveled side roads. Alternative 1 had the fewest negative impacts to traffic. For Alternative 1, the specific traffic volume changes range in a decrease of 1,000-5,000 average daily traffic (ADT) for most of International Drive and Route 7, with some segments of Route 7, south of International Drive, having a decrease of 5,000-10,000 ADT. The increases ranged from 100-1,000 ADT for the limited impacted roads, with a few roads, such as Gallows Road and Old Courthouse Road having some increases up to 5,000 ADT. This can be seen in the map below in **Figure ES- 6**.

Figure ES- 6 | Map of Traffic Volume Changes with Alternative 1



Traffic Conditions

Level of Service (LOS) is a measure referring to whether the traffic flow can be adequately served at a location. LOS and queue delays at the study area intersections were used as measures to evaluate the traffic patterns and delays for overall traffic flow and the challenges on these roads. This was measured at both the morning and evening rush hours. LOS A, B, or C is considered good or adequate traffic operations, whereas LOS E or F is considered in need of improvement and represent failing intersections. These definitions can be seen in **Table ES- 1**.

Table ES- 1 | Level of Service Definitions

Level of Service (LOS) Index			
LOS	**Traffic Flow Conditions**	**Signalized Intersection Delay (seconds)**	**Unsignalized Intersection Delay (seconds)**
A	Progression is extremely favorable, and most vehicles do not stop at all	≤ 10	≤ 10
B	Good progression, some delay.	> 10 - 20	> 10 - 15
C	Fair Progression, higher delay.	> 20 - 35	> 15 - 25
D	Unfavorable progression, congestion becomes apparent.	> 35 - 55	> 25 - 35
E	Poor Progression, substantial delay.	> 55 - 80	> 35 - 50
F	Poor progression, extreme delay.	> 80	> 50

Source: Highway Capacity Manual

As seen in **Table ES- 2,** Alternative 1 had the fewest failing intersections with three in the morning and six in the evening. This alternative and creates the greatest improvements compared to the No-Build scenario, which has five failing intersections in the morning and eight in the evening. Alternative 2 also provides slight improvements over the No-Build scenario in the evening, but Alternative 3 performs worse than the No-Build for both morning and evening. Most of the failing intersections are found not on the BRT route itself, but on adjacent side streets (see **Table ES-3**). This change in side street traffic operations may be occurring because vehicles are shifting to parallel streets, but it does suggest positive results for BRT reliability.

Table ES- 2 | Failing Intersections Level of Service (LOS F)

	Existing Conditions	No Build	Alt 1	Alt 2	Alt 3
AM	0	5	3	6	6
PM	3	8	6	6	9

Table ES- 3 | Failing Intersections on and off BRT Route

	Alt 1	Alt 2	Alt 3
# Intersections on BRT Route	28	18	26
# Failing intersections on BRT route (AM)	0	2	3
# Failing intersections on BRT route (PM)	1	2	2
% failing (Total on BRT route)	4%	22%	19%
# Intersections not on BRT route	12	21	13
# Failing intersections not on BRT route (AM)	3	4	4
# Failing intersections not on BRT route (PM)	2	5	7
% Failing (Total not on BRT route)	42%	43%	85%

In terms of vehicle intersection delays (in seconds), on average, Alternative 1 had the shortest delays of 35.6 seconds in the morning and 39.9 seconds in the evening. This translates to the greatest improvement over the No-Build scenario, which had 41 seconds and 43.7 seconds of vehicle delay, respectively. See **Table ES- 4** for details.

Table ES- 4 | Vehicle Intersection Delay Average (seconds)

	Existing Conditions	No Build	Alt 1	Alt 2	Alt 3
AM	22.7	41.0	35.6	39.7	46.2
PM	33.6	43.7	39.9	42.6	51.5

Average of all the individual intersection average delays

Public Feedback

In March 2021, FCDOT held a second round of public meetings with information about these three alternatives and the preferred Alternative 1. Feedback was solicited through the meetings and a survey circulated after these meetings to gather more detailed input. Overall, the feedback from the public supports a strong desire for high quality BRT and better connectivity both within Tysons and to the region as whole. A snapshot summary of this feedback can be seen in the word cloud, **Figure ES- 7**. Alternative 1/International Drive was confirmed to match public preference through the selection of alternatives as well as the selection of stations respondents were most likely to use. In fact, slightly more than half of the survey respondents were likely or very likely to change their travel behavior to use Alternative 1/International Drive, if implemented. Survey respondents' confirmation of bus frequency, speed, and reliability as being the most important priorities further support the interest in high quality BRT.

Many individuals were invested and took the time to write detailed comments with thoughtful input. These open comments demonstrated that the top two priorities for survey respondents are to have effective dedicated bus lanes with high bus frequency, speed and reliability and broader regional transit connectivity in terms of service coverage and coordination with other transit options.

This sentiment is also supported by a stakeholder letter from Tysons Partnership, a diverse collection of local stakeholders, which supports Alternative 1/International Drive due to its ability to create greater internal connectivity in Tysons and because it has the highest number of projected jobs within a half mile walkshed of the route (68,250). The Tysons Partnership also encouraged high speed BRT, building pedestrian refuges, and prioritizing pedestrian safety and convenience.

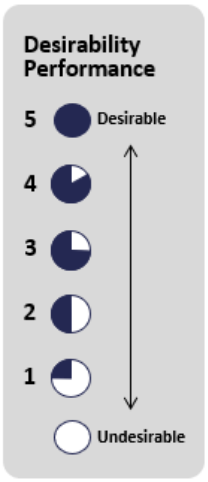
Figure ES- 7 | Word Cloud Reflecting Common Words in Public Survey's Open Comments

Preferred Alternative

FCDOT recommended Alternative 1/International Drive as the preferred alternative because it serves the greatest number of people, jobs, and households in Tysons, creates a robust inter-connected transit network within the area, and minimizes negative impacts on the study area transportation network as a whole. . The summary matrix below (**Figure ES- 8**) illustrates the greater positive impacts on access, pedestrian crossing times, comparable local bus speeds, moderately high BRT ridership and BRT reliability in the 95th percentile, and the minimal impacts to automobile travel speeds and automobile intersection delay that are found in Alternative 1. This preferred alternative also reflects the preferences and desires identified by the public regarding both overall priorities and the specific preferred alternative route alignment and station location.

Figure ES- 8 | Summary Matrix of Measures of Effectiveness for Evaluation of Alternatives

Measure of Effectiveness	Alternatives		
	Alternative 1 International Dr	Alternative 2 Tysons Corner Metro	Alternative 3 Route 7
Goal: Access and Mobility – Provide choices through accessible transit service			
Objective: Serve population, employment, and activity centers with BRT			
Demographics (HH, Pop, Emp)	5	1	3
Goal: Transportation Network Performance – Ensure efficient movement of people and goods			
Objective: Improve Transit Operations in Corridor			
BRT Ridership	4	2	5
Local Bus Travel Speed in Study Area	2	2	2
BRT Reliability 95th Percentile Travel Times	3	5	2
Average Automobile Travel Speed	5	3	1
Automobile Intersection Delay	5	3	1
Pedestrian Crossing Times	3	3	2



Route 7 BRT – Tysons Study

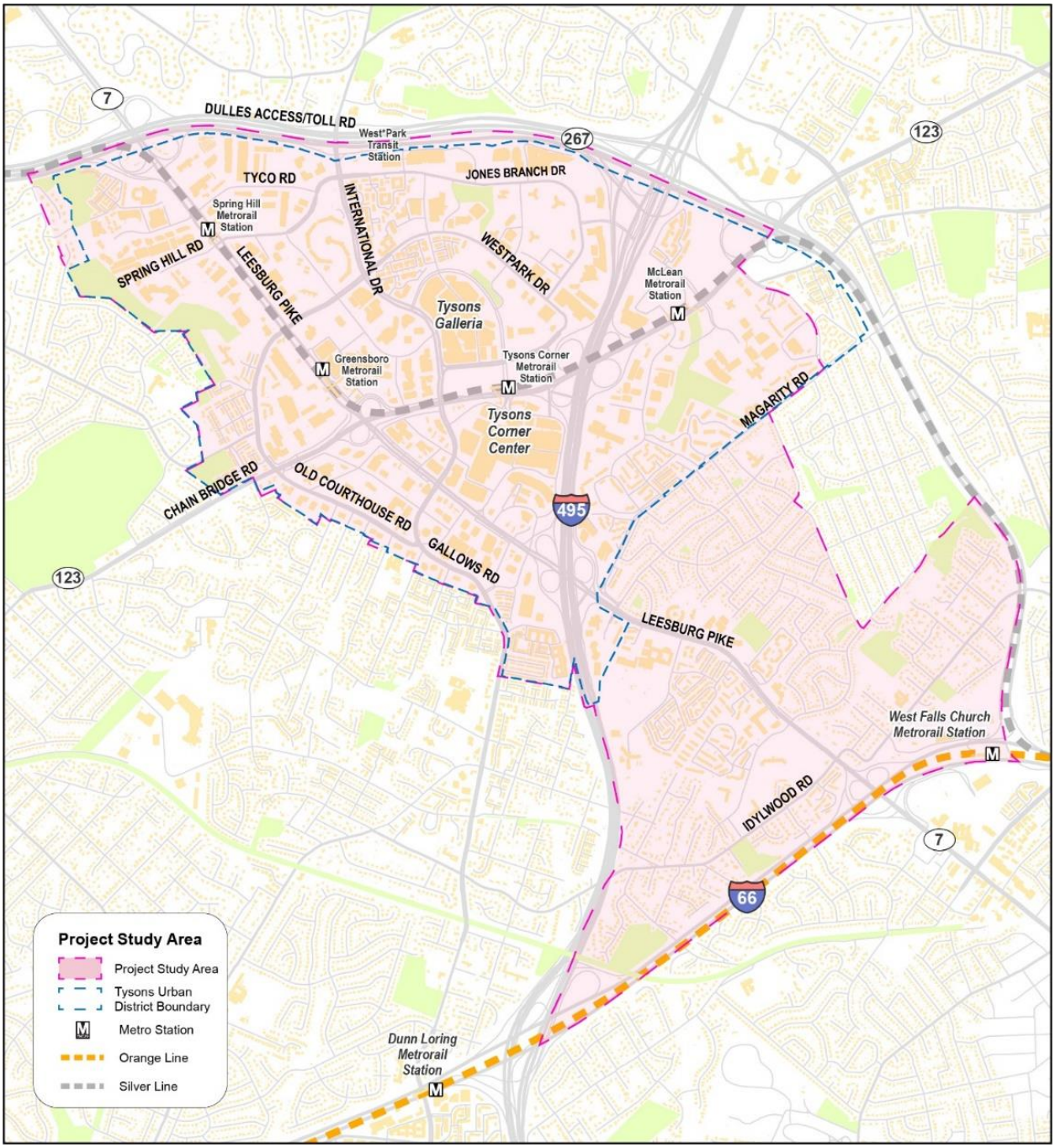
1 Introduction

Fairfax County Department of Transportation (FCDOT) initiated the Route 7 BRT – Tysons Study in 2018 to develop and evaluate Bus Rapid Transit (BRT) alternatives on Route 7 in Tysons, Fairfax County, Virginia.

BRT is an efficient, comfortable, and cost-effective bus service with dedicated bus running-way and transit signal priority, enhanced stations with real-time passenger information and off-board fare collection, frequent and reliable service with easily understood routes and limited stops, and branded vehicles and station identity. Essentially, BRT ridership and experience are comparable to light rail, but with lower capital costs.

This study builds on work by the Northern Virginia Transportation Commission (NVTC), which explored transit alternatives on Route 7 between the Mark Center in Alexandria and Tysons. Fairfax County's Route 7 BRT – Tysons Study follows up on NVTC's Envision Route 7 study by reviewing route alignment and street cross-section alternatives as well as station locations and platform configurations within Tysons. The study area, seen in **Figure 1- 1** below, encompasses the Tysons Urban Center with its four WMATA Silver Line Metrorail stations, and stretches southeast to the I-66 interchange.

Figure 1- 1 | Study Area Map

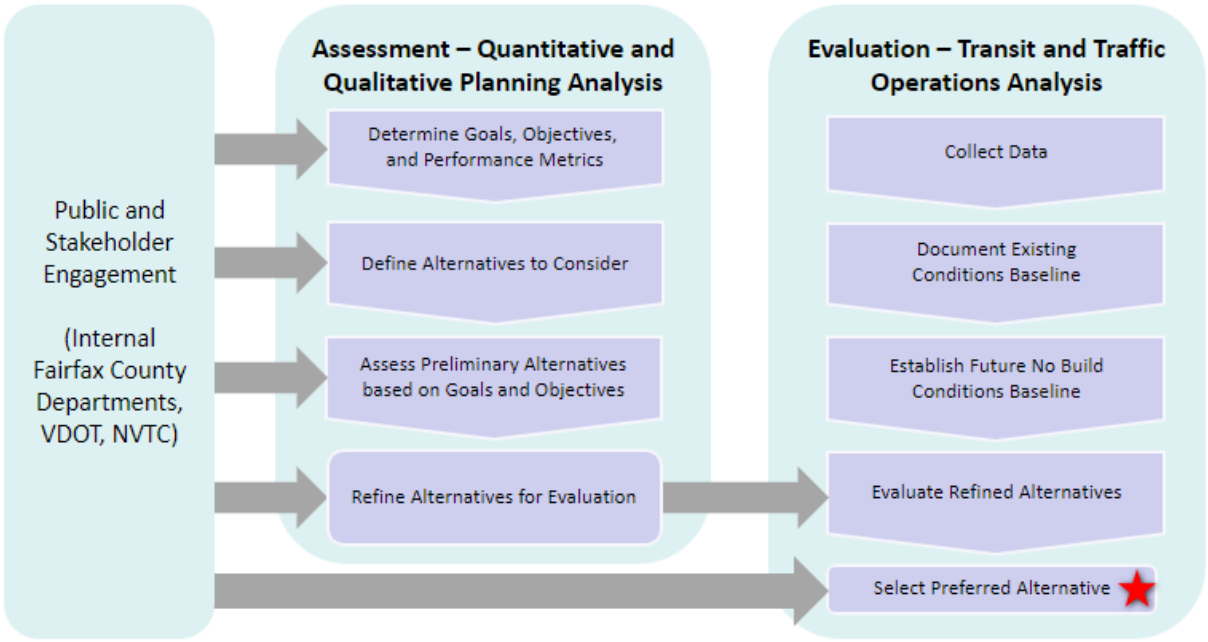


2 Study Process

This study relied on robust technical analysis, public engagement, and extensive stakeholder engagement, which supported a data-driven decision framework.

After documenting existing conditions in the study area, the project team developed nine BRT alternatives for assessment which were ultimately reduced to three final alternatives. The remaining three alternatives were evaluated against a No-Build baseline scenario which highlighted advantages, disadvantages, and trade-offs for each alternative. **Figure 2-1** shows a diagram demonstrating this study process.

Figure 2-1 | Study Process Diagram



The study included a two-phased approach with an assessment phase and an evaluation phase. The Assessment phase included both quantitative and qualitative planning analysis to pare down nine preliminary alternatives considered (assessment phase) to ultimately three alternatives using travel demand and traffic simulation modeling tools during the Evaluation phase.

Prior to the COVID-19 Pandemic, FCDOT held a meeting in early March 2020 to gain feedback and comments from stakeholders along the route and present performance metrics on how the alternatives were being evaluated. During the assessment phase, the study team established goals, objectives and performance metrics for the study. FCDOT then defined and assessed preliminary alternatives based on the goals and objectives and refined the alternatives for evaluation. The evaluation phase included detailed transit and traffic operations analysis in coordination with stakeholders and other agencies, including the Virginia Department of Transportation (VDOT) and Northern Virginia Transportation Commission (NVTC) for the selected alternatives. The study team collected data, such as traffic counts, travel speeds, and bus ridership for the study area, and conducted the existing and future No-Build

conditions baseline analysis. Finally, the refined alternatives were evaluated for 2045 conditions and FCDOT ultimately recommended the preferred alternative based upon the comparative analysis of the alternatives.

3 Goals, Objectives, and Measures of Effectiveness

The purpose of this section is to document the process and rationale for the development of a set of meaningful, measurable, and appropriate Goals, Objectives, and Measures of Effectiveness (MOEs) for the study. Many MOEs were calculated within the boundaries of the study area (**Figure 1- 1**) which is generally defined by the Transportation Analysis Zones (TAZs) that were most likely be impacted by the BRT. The establishment of Goals, Objectives and MOEs for the study helped define the parameters for identifying a preferred alternative and guided all future tasks to ensure that the recommended alignments and cross sections provided the best solution for the Tysons community and the Northern Virginia region at large. As noted, the MOEs developed were used in a two phased approach; first an Assessment to cull the number of preliminary alternatives to three and a more detailed evaluation of the final set of alternatives. The MOEs were a combination of both qualitative and quantitative measures.

3.1 Goals and Objectives

The team first reviewed previous relevant studies to identify common goal themes. These previous relevant studies included:

- Fairfax County Comprehensive Plan – Policy Plan: Transportation (2017)
- Fairfax County Comprehensive Plan – Tysons Urban Center Transportation Recommendations (2017)
- Fairfax County Transit Development Plan (2016)
- Fairfax County Countywide Transit Network Study (2016)
- NVTC Transit Alternatives Analysis of Route 7 Corridor (2015)
- DRPT Route 1 Multimodal Alternatives Analysis (2015)

Goal and objective themes found to be common among these studies are as follows:

- **Access and Mobility:** Provide choices through accessible transit service
- **Mode Share/Efficiency:** Increase transit usage and reduce Single Occupancy Vehicle (SOV) usage to ensure efficient movement of people and goods
- **Land Use/Economic Vitality:** Support economic development and land use goals
- **Equity:** Meet the needs of all users- residents, workers, visitors, and disadvantaged populations
- **Safety:** Improve safety for all users and the general public
- **Environmental Concerns:** Minimize environmental impacts and improve air quality
- **Financial Feasibility:** Make sustainable, cost effective investments in transit

The study team compiled MOEs relevant to these goal themes, aligning them to specific study objectives. Working with the project team stakeholders, the team reviewed the Draft Goals, Objectives,

and MOEs to identify those that should be carried forward, and where new or somewhat altered MOEs were appropriate. Throughout the study process, some MOEs were evolved based on the data available and how best to provide a comparison between scenarios.

3.2 Measures of Effectiveness (MOEs)

Measures of Effectiveness (MOEs) are used to quantify progress towards specific goals and objectives and should always be measurable using the tools available, capture the whole range of potential project impacts, and be easily explained to decision-makers and the general public. The project team worked together with FCDOT to develop the MOEs outlined in the following tables. Based on these discussions, the MOEs were multimodal in nature, and captured the impacts of different options from both the perspective of transit and roadway users, but also from the management, operational, and construction perspective of Fairfax County. As previously stated, the MOEs were used in a two-phased approach to 1) Assess and narrow down the larger set of alternatives, and 2) Evaluate the smaller set of final alternatives. Separate lists of MOEs were used for each phase and are shown separately in the tables below.

3.2.1 Phase 1: Assessment

The analysis and MOEs in the Assessment phase were used to narrow cull the number of alternatives to three. These MOEs are both quantitative and qualitative in nature and could be scored without the need for travel demand forecasting or traffic modeling.

Measure of Effectiveness	Cross-Section (C); Routing (R); Both (B)	Rationale	Methodology/Tools
Goal: Access and Mobility - Provide choices through accessible transit service			
Objective: Serve population, employment, and activity centers with BRT			
Population within ½ mile walking distance and 15-minute walk of station	R	Measures population access to BRT	GIS analysis of Land Use and pedestrian network in 2030 and 2045
Employment within ½ mile walking distance and 15-minute walk of station	R	Measures employment access to BRT	GIS analysis of Land Use and pedestrian network in 2030 and 2045
Objective: Provide connections to larger transit network			
Number of Metrorail Stations served	R	Measures access to regional transit	Route Planning
Goal: Transportation Network Performance - Ensure efficient movement of people and goods			
Objective: Improve Transit Operations in Corridor			
Percent of Corridor with dedicated BRT lanes	B	Proxy for BRT speed and reliability at the assessment stage	Cross section design, route planning
Goal: Land Use/Economic Vitality – Support economic development and land use goals			
Objective: Minimize impacts to private property			

Measure of Effectiveness	Cross-Section (C); Routing (R); Both (B)	Rationale	Methodology/Tools
Approximate square footage of land required for right-of-way	C	Measures impact to private property	GIS analysis
Goal: Meet the needs of all users – residents, workers, visitors, and disadvantaged populations			
Objective: Serve areas with transit dependent populations			
Number of transit dependent/transit inclined households and jobs within ½ mile of stations	R	Measures low-income, zero-car households, and service-sector jobs	GIS land use and pedestrian network analysis for 2045
Goal: Improve safety for all roadway users			
Objective: Improve the pedestrian environment in the study corridor			
Pedestrian Crossing Time at Key Intersections	C	Crossing times identify the scale of pedestrian barriers for different multiple cross sections	Cross section distance / average pedestrian walking speed
Number of BRT - Mixed Traffic Conflict Points	C	Proxy for safety concerns related to BRT Safety	Identification of conflict points where BRT exits exclusive running way or passes through intersection without exclusive transit phase
Safety and comfort of biking environment in the corridor	B	Qualitatively measures the impacts of different cross section and routing choices on the safety and experience of cyclists in the corridor	Qualitative analysis
Goal: Protect and Improve Environmental Resources			
Objective: Minimize negative impacts to the natural environment			
Qualitative environmental impacts to parklands, cultural resources, wetlands, woodlands, etc.	C	Desktop review to identify approximate square footage of potential impacts	GIS analysis
Goal: Make sustainable, cost-effective investments in transit			
Objective: Prove financial feasibility of BRT			
Constructability	B	Identification of any major barriers to construction	Qualitative Rating (High/Med/Low)

3.2.2 Phase 2: Evaluation

The analysis and MOEs in the Evaluation phase were used to evaluate the alternative cross-sections and alignments successfully passing the Assessment phase. These MOEs were used to identify and recommend a preferred alternative. MOEs for the evaluation phase were more quantifiable and utilized data results from the travel demand forecasting and traffic modeling efforts.

Measure of Effectiveness	Cross-Section; Routing; Both	Rationale	Methodology/Tools
Goal: Transportation Network Performance - Ensure efficient movement of people and goods			
Objective: Increase Corridor Transit Usage			
BRT Ridership in Study Area	B	Measures variance in ridership among BRT alternatives	Changes in ridership forecasts as compared to Phase 2 forecast results
Total Transit Ridership in Study Area	B	Measures variance of total transit ridership among BRT alternatives	Changes in ridership forecasts as compared to Phase 2 forecast results
Number of New Transit Riders	B	Measures effectiveness of BRT alternatives in attracting new transit riders	Changes in ridership forecasts as compared to Phase 2 forecast results
Objective: Improve Transit Operations in Corridor			
Boardings per Revenue Hour	B	Measures efficiency of BRT operations	BRT Ridership in Study Area/ BRT Revenues Hours in Study Area
BRT Travel Speed in the Corridor	B	Measures BRT Travel Speed	VISSIM analysis
BRT Reliability/Headway Adherence	B	Measures BRT Travel Time Reliability	VISSIM analysis
Objective: Maintain acceptable transportation network performance for all modes			
Automobile Travel Time by Segment	B	Measures auto travel times for specific corridor segments	VISSIM analysis - segments need to be defined
Automobile Intersection Level of Service	B	VDOT Requirement - LOS E acceptable within Tysons Urban Boundary, LOS D elsewhere	VISSIM analysis
Total Corridor Person Throughput	B	Measure of overall corridor efficiency	Travel Demand Forecasting analysis - need to identify locations for measure
Goal: Improve safety for all roadway users			
Objective: Improve the pedestrian environment in the study corridor			
Pedestrian Delay	C	Measure of pedestrian delay given multiple cross sections to be evaluated	VISSIM analysis

Measure of Effectiveness	Cross-Section; Routing; Both	Rationale	Methodology/Tools
Goal: Protect and Improve Environmental Resources			
Objective: Minimize negative impacts to the natural environment			
Change in VMT in Study Area	B	VMT is a proxy for environmental impacts such as tailpipe emissions	Travel Demand Forecasting
Goal: Make sustainable, cost-effective investments in transit			
Objective: Prove financial feasibility of BRT			
Estimated Capital Cost	B	Understanding of costs required to achieve other MOE results	High Level Planning Estimate
Annual O&M cost	B	Understanding of costs required to achieve other MOE results	High Level Planning Estimate as compared to Phase 2 estimates

4 Data Collection and Calibration

This section documents the data collection and model calibration efforts for the study. This multimodal analysis of the existing transportation conditions was based on readily available information, observed field data, and the calibrated travel demand and traffic simulation existing conditions models. The Travel Demand Model and Traffic Simulation Model Calibration Memos are attached in **Appendix A** and **Appendix B**, respectively.

4.1 Data Collection

The data supporting the travel demand traffic simulation modeling and model calibrations were collected as part of the project's data collection efforts, which were completed in the Spring of 2018, including:

- 24-hour roadway segment volume counts;
- Peak-period (6:00 AM – 10:00 AM and 3:00 PM – 7:00 PM) intersection turning movement counts (TMCs);
- Weekday peak period travel time data collected using the floating-car method; and
- Pedestrian count data collected at Metro stations.

The daily and peak period traffic counts were used to help review and calibrate the outputs from the Fairfax County travel model. The travel time data was used to validate and justify travel speed adjustments in the model calibration efforts. The pedestrian count data was primarily used as a general reference, as they are not equivalent to passenger boardings. Where necessary, this data was supplemented with other sources, as detailed below.

- WMATA Metrorail short-term ridership forecasts for 2018. The lower bound and upper bound station boarding forecasts by time period were averaged for model calibration.
- The 2018 entry and exit counts from WMATA's LineLoad software were used to quantify boardings and alightings at each station by time of day.
- Boarding and alighting counts at the stop level for Fairfax Connector and WMATA bus routes.
- The WMATA and Fairfax Circulator data was used to calibrate the MWCOG model's transit ridership volumes.

While vehicle travel times were collected using the floating car technique, the project team decided to use INRIX speed data for the calibration purposes due to the following reasons:

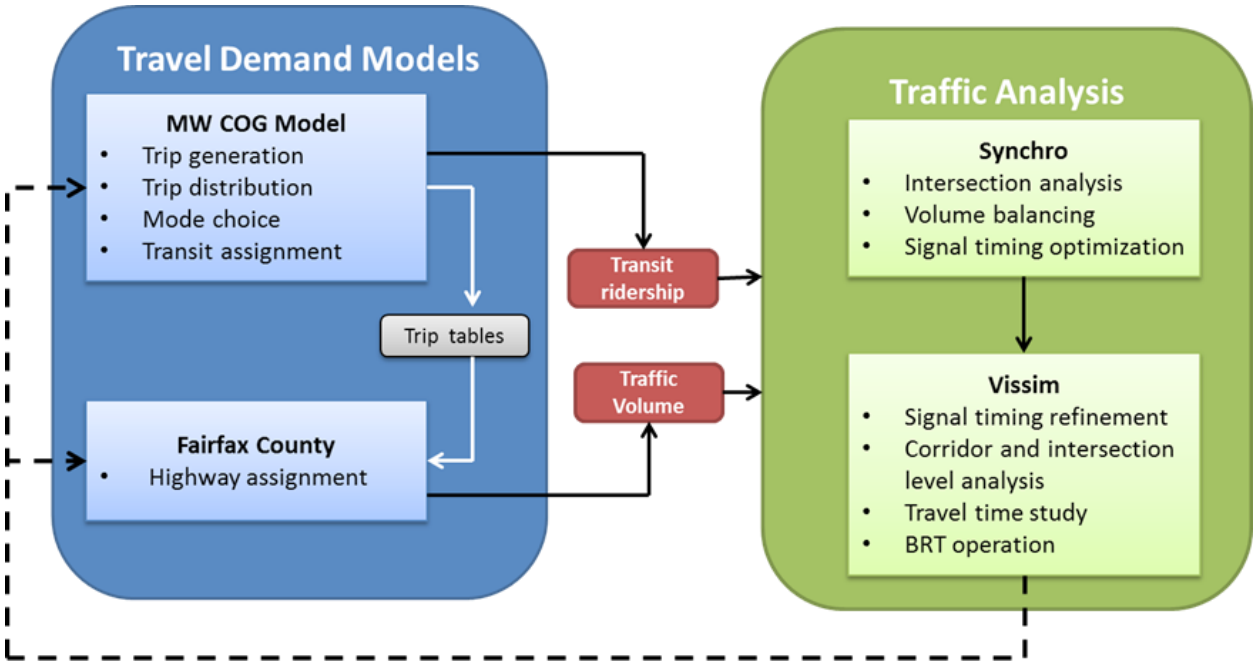
- The Route 7 study area experiences congestion and oversaturated conditions along certain segments of the corridor during peak periods. As a result, travel times throughout the study area vary greatly from day to day, which requires a larger sample size to increase the precision and reduce the margin of error. Therefore, INRIX probe data was used to provide a better representation of the field travel times.
- The turning movement data collection and field travel time runs were performed on different days, making the comparison more complicated. To address this issue, the INRIX speed data was

collected during the month of May 2018, which also included the dates in which the turning movement data was collected.

4.2 Model Calibration

The overall travel demand modeling process adopted for the study used the MWCOG Regional Travel Demand model and the Fairfax County Travel Demand model to forecast transit and highway demands, which were then fed into the traffic simulation process that combined Synchro signal timing plans with microscopic operational simulations using VISSIM, as illustrated in **Figure 4-1**.

Figure 4-1 | Overall Modeling Process



4.2.1 Travel Demand Model

The Travel Demand Model calibration efforts were focused on developing existing conditions models capable of recreating observed transit ridership and traffic highway volumes reasonably well. Transit calibration was focused on the Metropolitan Washington Council of Governments (MWCOG) model. This study was not designed to accurately predict transit ridership for the whole Route 7 BRT corridor but was focused on understanding the potential changes to ridership in Tysons based on specific alternatives. Transit calibration efforts were limited in order to adequately meet these needs. Highway calibration focused on the Fairfax County model and, where necessary, its interactions with the MWCOG model. Perfect highway calibration at this level was not the goal, as more detailed traffic calibration was addressed through the VISSIM microsimulation work.

The travel demand model calibration effort for this study improved the accuracy of both the MWCOG and Fairfax County Travel Demand models in the Tysons area. Specifically, selected parameters in the

MWCOG and Fairfax County models were refined and calibrated to achieve a closer match between model estimates for existing conditions and observed transit ridership and traffic levels.

4.2.2 Traffic Simulation (VISSIM)

The development of existing conditions simulation models requires a proper calibration effort to closely replicate real-world conditions and accurately reflect field conditions. This section describes the calibration efforts followed for the development of the VISSIM microsimulation model for the study. The calibration efforts were conducted focusing on the following elements, per guidance from the Virginia Department of Transportation (VDOT) Traffic Operations and Safety Analysis Manual (TOSAM).[1]

- ***Simulated Traffic Volume*** – compares the traffic volumes at critical links within the model to field counts.
- ***Simulated Vehicle Travel Time*** – compares simulated vehicle travel times to those collected in the field along specified segments.
- ***Simulated Transit Speed*** – compares simulated transit speed to those collected in the field for the specified transit routes. Note that speed was used instead of travel time since the length of the segment in which the transit travel time was collected is different than the simulated segment length.
- ***Simulated Queue Length*** – compares average and maximum queue lengths at critical links to field measurements.

[1] http://www.virginiadot.org/business/resources/TOSAM.pdf

5 Existing Conditions and Future No-Build Conditions (2045) Comparison

This section documents and provides a comparison of the Existing Conditions and the Future (2045) No-Build transportation conditions for the study. This multimodal analysis of the future transportation conditions was is based on the travel demand and traffic simulation Future No-Build models. The selected performance measures, or Measures of Effectiveness (MOEs), provide a comparison between the Existing Conditions and the 2045 No-Build baseline. The Existing Conditions section documented the 2018 existing multi-modal transportation conditions in the study area, including results from data collection efforts as well as travel demand and traffic simulation model calibration. The 2045 Future No-Build baseline was also used to compare for comparison against the three Build alternatives in order to evaluate the effectiveness of the future-build alternatives in achieving the project goals and objectives.

5.1 Existing Conditions

5.1.1 Transit

Eighteen bus routes and the Metrorail Silver Line serve Tysons and the surrounding area. These transit options generally converge around the Spring Hill and Tysons Corner Metrorail stations, providing connections to regional destinations via Metrorail. These routes traverse major roadways—on Route 7 and I-495—and neighborhood streets, connecting people to surrounding housing, jobs, and retail. Additionally, transit service in Tysons provides access to major regional employment and activity centers.

The study area is served by Metrorail, Metrobus, and the Fairfax Connector, as shown in **Figure 5-1**. The Metrorail Silver Line Phase 1 opened in July 2014 and connects Washington, D.C. to Tysons and Reston. There are four existing Silver Line Metrorail stations in the study area: McLean, Tysons Corner, Greensboro, and Spring Hill Metrorail stations. The West Falls Church Metrorail station is served by the Orange Line and is located at the southeast corner of the study area. Phase 2 will extend the Silver Line west to Herndon, Dulles International Airport, and Ashburn. The extension is projected to be completed in 2021 and will provide six additional stations from Reston Town Center to Ashburn.

Bus service in the study area generally feeds into one of the Metrorail stations. The West*Park Transit Station also serves as a major terminus/transfer station.

WMATA rail and bus service operates nearly every day, except for the 3T on Sundays[2] as shown in **Table 5-1**. Fairfax Connector provides service with a number of routes that have a variety of headways and service days, as shown in **Table 5-2**.

[2] Fairfax Connector has taken over WMATA Metrobus 3T and will resume operation of that line in July 2021.

Table 5-1 | WMATA Transit Service in Study Area

Route	Direction	Terminals	Service Days M-F/SAT/SUN	Headway Peak (min)	Headway Off-Peak (min)
OR	E/W	Vienna / New Carrolton	Y / Y / Y	8	12
SV	E/W	Wiehle-Reston East / Largo Town Center	Y / Y / Y	8	12
23A	E/W	Tysons Corner Center / Crystal City	Y / Y / Y	40	–
23T	E/W	Tysons Corner Center / Shirlington Transit Center	Y / Y / Y	25	30
28A	E/W	King Street - Old Town Station / Tysons Corner Station	Y / Y / Y	20	20
3T	E/W	McLean Station / East Falls Church Station	Y / Y / N	25	40

Source: WMATA Rail and Bus Published Timetables, October 2019

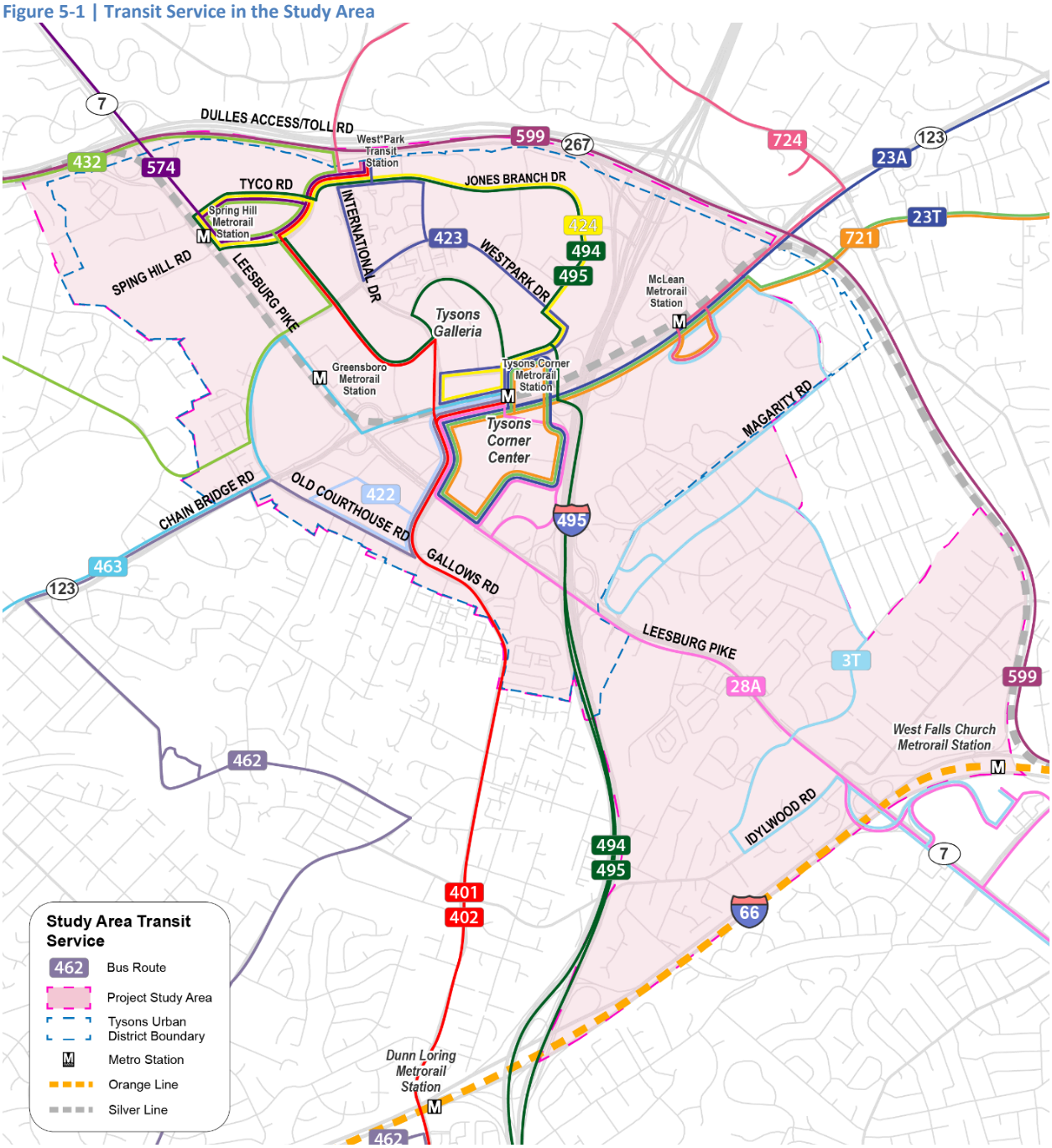
Table 5-2 | Fairfax Connector Routes Serving Study Area

Route	Direction	Terminals	Service Days M-F / SAT / SUN	Headway Peak (min)	Headway Off-Peak (min)
401 402	N/S	Franconia-Springfield Station / Tysons Westpark Transit Station	Y/Y/Y	15	20
422	Circulator	Tysons Corner Station (South) / Howard Ave	N/Y/Y	20	20
423	Circulator	Tysons Corner Station (North) / Tysons Westpark Transit Station	Y/Y/Y	13	14+
424	Circulator	Tysons Corner Station (North) / Spring Hill Station	Y/Y/N	13	13+
432	Circulator	Spring Hill Station / Spring Hill Station	Y*/N/N	40	–
462 467	N/S	Dunn Loring Station / Tysons Corner Station (South)	Y/Y/N	30	40+
463	N/S	Vienna Station (North) / Tysons Corner Station (North)	Y/Y/Y	25-30	30
494	N/S	Lorton VRE Station / Tysons Westpark Transit Station	Y/N/N	25	30+
495	N/S	Burke Centre VRE Station / Tysons Westpark Transit Station	Y/N/N	30	30+
574	E/W	Reston Town Center Transit Station / Tysons Westpark Transit Station	Y/Y/Y	30	30-40
721	E/W	Tysons Corner Center / Beverly Dr	Y/Y/Y	–	30
724	E/W	Tysons West Park Transit Station / McLean Station	Y*/N/N	25-30	–

** Peak Period service only.*

Source: Fairfax County Connector Published Timetables, October 2019

Figure 5-1 | Transit Service in the Study Area



Source: WMATA, Fairfax County Published Bus Routes, October 2019

5.2 Future No-Build (2045)

This section describes the anticipated changes in the transportation network within the study area. These changes include new roadway and transit services as defined in the National Capital Region Transportation Planning Board 2016 Constrained Long Range Plan (CLRP), the Fairfax County Comprehensive Plan, and other priority projects identified by Fairfax County project staff. The following provides a brief summary of the changes that have been included for study. Note, for the purposes of this study, only significant roadway changes relevant to the Travel Demand and Traffic models are included.

5.2.1 New Roadway Changes

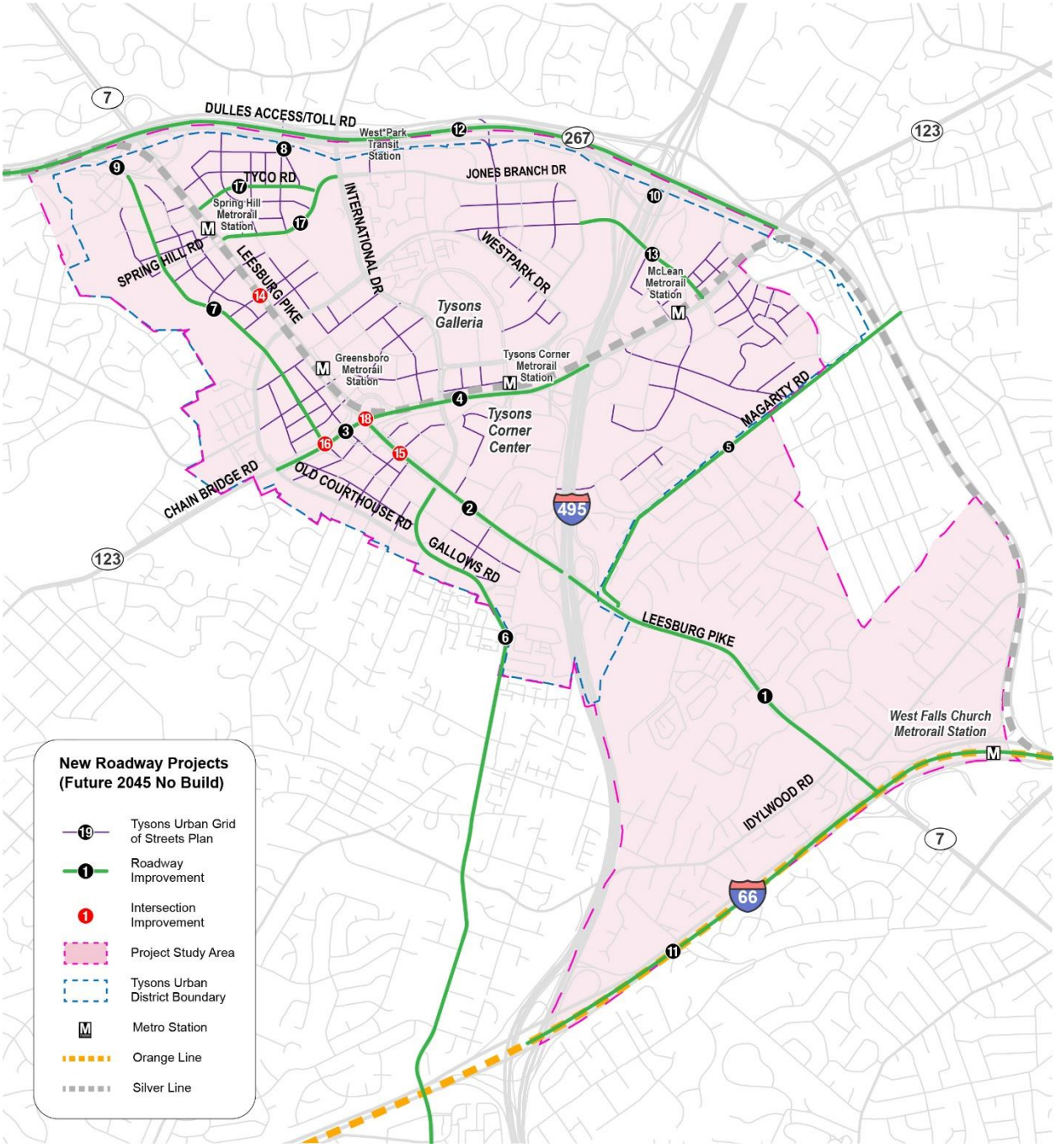
The planned roadway projects include road widening, new toll road ramps, and the built-out Tysons urban street grid. **Table 5-3** and **Figure 5-2** provide a summary of the new roadway changes incorporated into the No-Build Travel Demand and Traffic models for this study. All the projects listed below are included in the study's Travel Demand Model to determine specific travel volumes and other measures, but not all the projects are included in the Traffic model as they are located outside of the model limits.

Table 5-3 | New Roadway Projects (Future No-Build)

No.	Facility	Limits	Description
1	VA 7 Leesburg Pike	I-495 to I-66	Widen from 4 lanes to 6 lanes
2	VA 7 Leesburg Pike	VA 123 to I-495	Widen from 6 lanes to 8 lanes
3	VA 123	Old Courthouse Road to Leesburg Pike	Widen from 4 lanes to 6 lanes
4	VA 123	Leesburg Pike to I-495	Widen from 6 lanes to 8 lanes
5	Magarity Road	Leesburg Pike to Great Falls Street	Widen from 2 lanes to 4 lanes
6	Gallows Road	Leesburg Pike to Prosperity Ave	Widen from 4 lanes to 6 lanes
7	Boone Boulevard	VA 123 to Dulles Toll Road	Construct new road and extend the existing Boone Boulevard to the Dulles Toll Road
8	VA 267 Dulles Toll Road Ramp	Tyco Road	Construct new toll road entrance/exit ramp at Tyco Road
9	VA 267 Dulles Toll Road Ramp	Boone Boulevard	Construct new toll road entrance/exit ramp at Boone Boulevard (extended)
10	I-495 Ramps	Dulles Airport Access Highway Dulles Toll Road HOT – General Purpose Lanes	Relocate, widen, and construct new ramps connecting I-495 to the Dulles Airport Access Highway, Dulles Toll Road, and NB and SB HOT Lanes from the General purpose lanes
11	I-66	I-495 to US 29	Revise operations for HOT 3 in both directions during peak periods
12	Dulles Airport Access Road	VA 123 to Dulles Airport	Widen from 4 lanes to 6 lanes
13	VA 7 Leesburg Pike	Between Spring Hill Road and Westpark Road	Construct new full movement intersection per Tysons Urban Grid of Streets plan
14	VA 7 Leesburg Pike	Between VA 123 and International Drive	Construct new right-in/right-out intersection per Tysons Urban Grid of Streets plan
15	VA 123	At Boone Boulevard	Construct new full movement intersection per Tysons Urban Grid of Streets plan
16	Tyco Road and Spring Hill Road	Leesburg Pike and International Drive	Construct new bus and turn (BAT) lanes on Tyco Road and Spring Hill Road
17	VA 7 Leesburg Pike and VA 123	Leesburg Pike at VA 123	Reconstruct existing interchange as an at-grade Two-Quadrant intersection
18	Tysons Urban Grid of Streets	Tysons Urban District	Grid system of smaller, connected streets to provide alternative pathways for traffic flow

Source: TPB CLRP, Fairfax County Comprehensive Plan, FCDOT

Figure 5-2 | New Roadway Projects (Future No-Build)



Source: TPB CLRP, Fairfax County Comprehensive Plan, FCDOT

5.2.2 New Transit Service

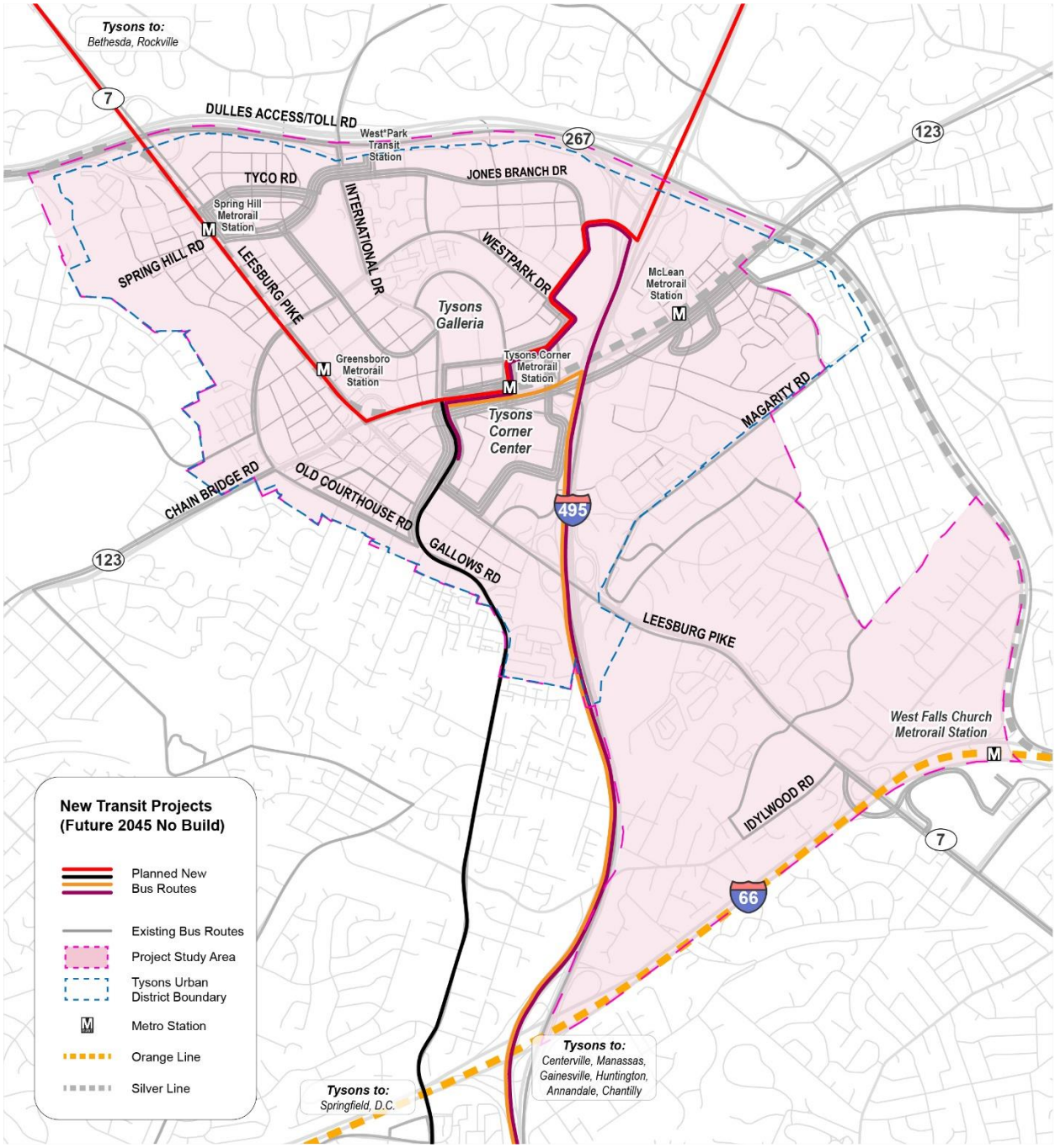
In addition to the planned roadway projects, new transit services are also planned for the study area and are included in the CLRP. These new transit services include the expanded Metrorail Silverline to Loudoun County and new bus services that generally provide peak period express bus services connecting Tysons to regional locations utilizing the Express lanes on I-66 and I-495. The new transit services are included in the study's Travel Demand model in order to provide an estimate for transit demand. The Traffic model also incorporates the new bus services to operate within the roadway environment, considering routing, service frequencies, and dwell times at stations. (dwell time refers to the time a bus is stopped for passengers to board and alight from the vehicle). **Table 5-4** below shows the new bus routes included in the Future No Build Travel Demand model.

Table 5-4 | New Bus Transit Services (Future No-Build)

Route Destinations	Frequency	Operates on Relevant Roadways
Tysons–Bethesda 1	15	VA 7 Leesburg Pike; VA 123
Tysons–Bethesda 2	15	VA 7 Leesburg Pike; VA 123
Tysons–Rockville 1	15	VA 7 Leesburg Pike; VA 123
Tysons–Rockville 2	15	VA 7 Leesburg Pike; VA 123
Tysons–Annandale	15	International Drive; VA 123
Tysons–Chantilly	15	International Drive; VA 123
Tysons–Springfield	15	International Drive; Gallows Road
Tysons–DC 1	24	International Drive; Gallows Road
Tysons–DC 2	24	International Drive; Gallows Road

Source: TPB CLRP

Figure 5-3 | Planned Bus Routes



Source: TPB CLRP

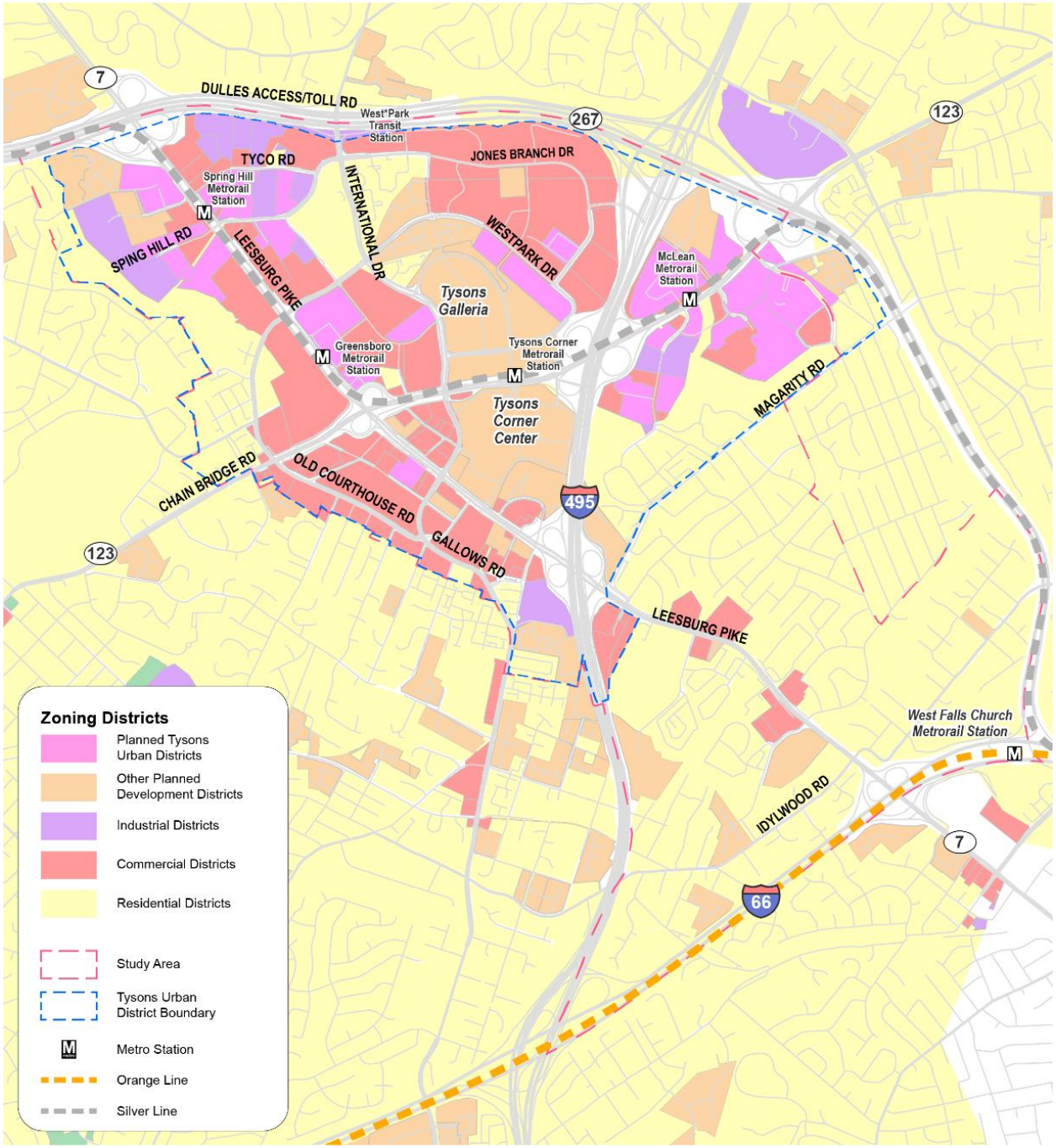
5.3 Land Use and Demographics

Noteworthy demographic shifts are projected to take place in the study area, which will impact transportation planning decisions. The following section describes the residential, household, and employment data from MWCOG in 2045 aggregated at the TAZ level. In general, projected population, household, and employment growth rates are comparable within a given TAZ, leading to higher development densities by 2045.

5.3.1 Land Use

The study area has over 30 sub-districts which are aggregated to residential, commercial, industrial, and planned development districts (see Figure 5-4). Zoning districts, in the study area, tend to favor higher density and more mixed use, especially in planned development districts that are primarily concentrated within the Tysons Urban District Boundary. Lower-density residential districts are more prevalent outside the Tysons Urban District Boundary, particularly in locations farther away from Route 7.

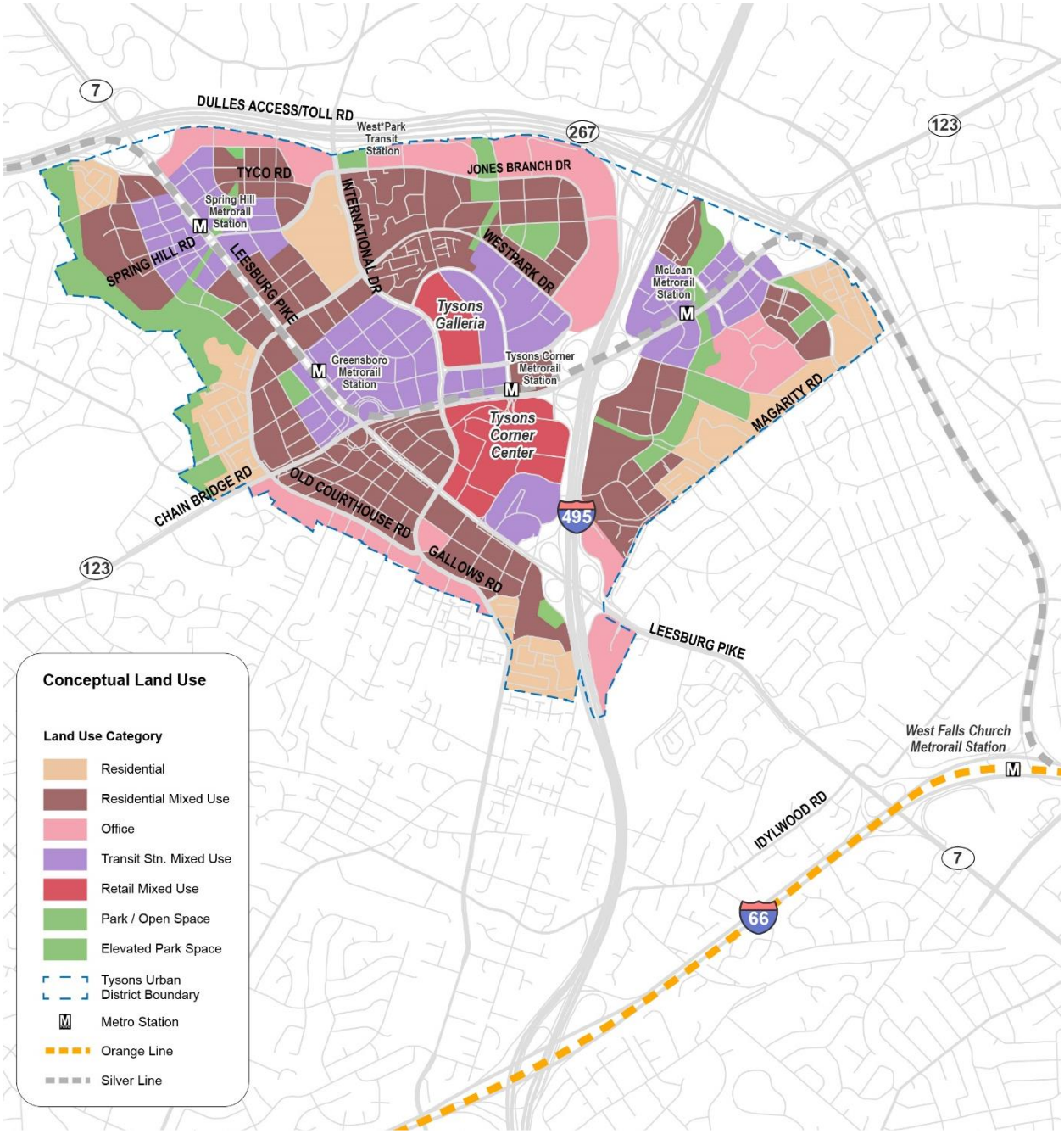
Figure 5-4 | Zoning Districts in Tysons



Source: Fairfax County

As per the Fairfax County Comprehensive Plan, the future vision of Tysons is that of clusters of high density, mixed-use buildings surrounding the four Metrorail stations; transforming from a large suburban office park into a 24/7 urban center with a mix of workers and residents. Most of the new office uses are intended to be concentrated in mixed use developments within ¼ mile of the Metrorail stations. The areas beyond ¼ mile of the Metrorail stations are anticipated to be developed primarily with multifamily housing units. The proposed conceptual land use pattern is shown in **Figure 5-5**.

Figure 5-5 | Study Area Conceptual Land Use in 2045



Source: Fairfax County Comprehensive Plan

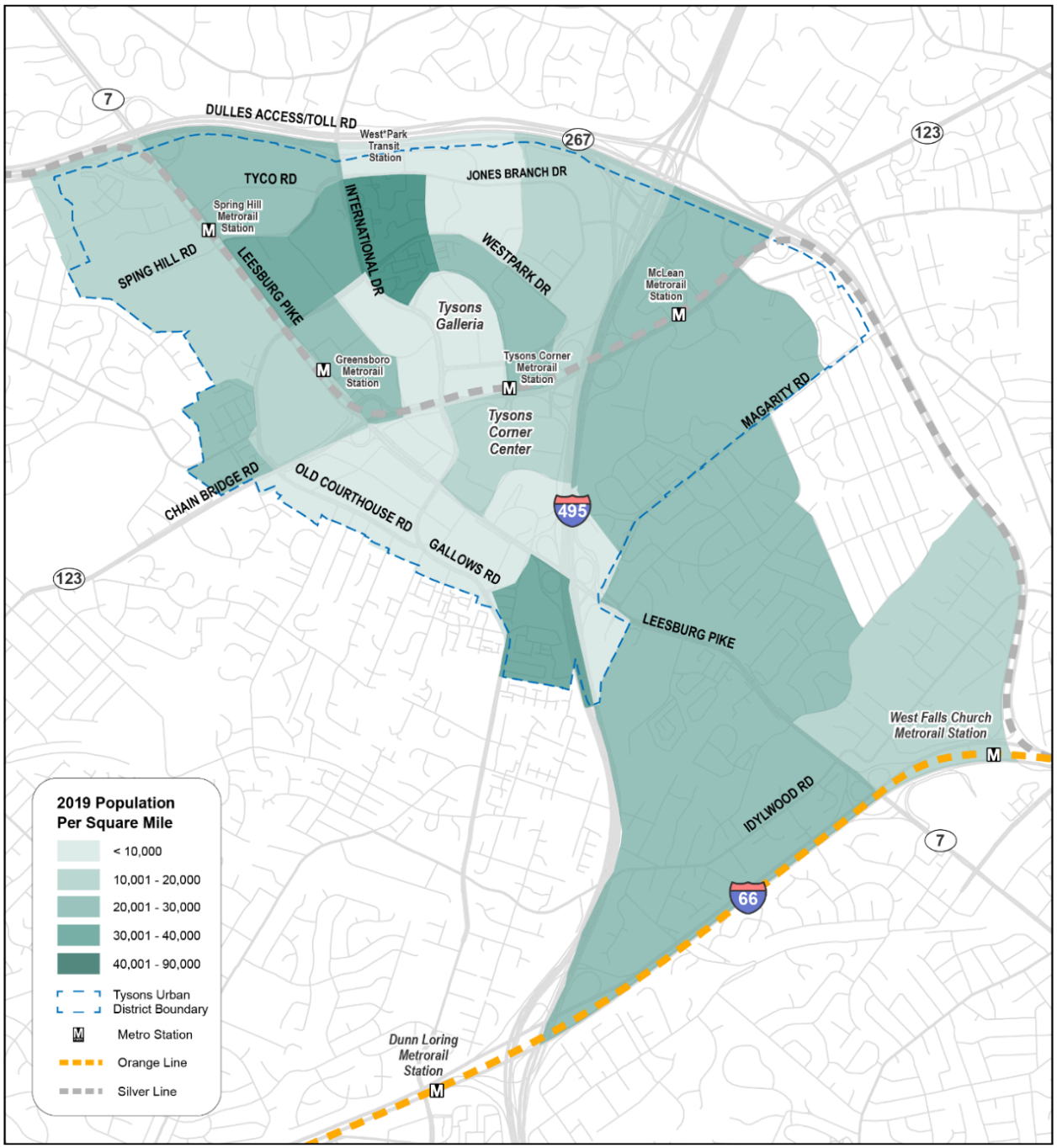
5.3.2 Population

There are approximately 35,600 people living in the study area as of 2019. **Figure 5-6** shows that the population is concentrated in the southern and eastern portions of the study area between I-495 and Chain Bridge Road. A small portion of the northern part of the study area, directly east of Route 7, also maintains higher densities. Most of the population exists east of I-495.

The residential population is projected to grow, by 175 percent, to approximately 100,000 residents by 2045. **Figure 5-7** shows that much of the residential growth is projected to occur along the Silver Line Metrorail corridor, especially adjacent to Route 7. The highest projected population growth TAZs are 1846 and 1849, with an expected growth of 3,248 percent (near the existing Tysons Galleria) and 1,379 percent (adjacent to the Greensboro Metrorail station) respectively.

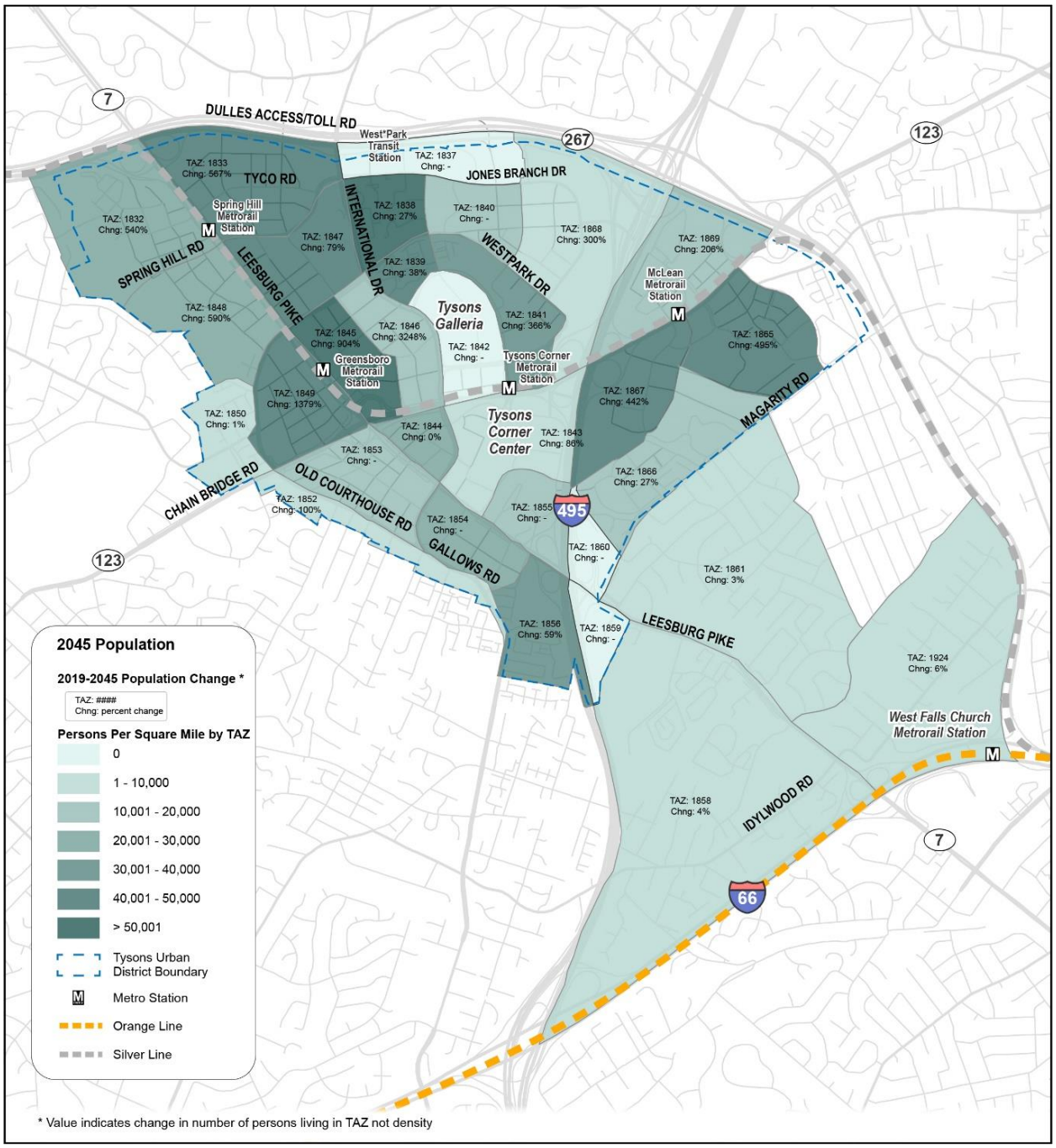
Most of the TAZs are projected to experience population growth by 2045. The exception is a north-to-south collection of TAZs that run through the general center of the study area. These areas, from north to south, are composed of: TAZ 1837 (directly south of the Dulles Toll Road between International Drive and an access road off Jones Branch Drive); Tysons Galleria, TAZ 1842 (projected to maintain zero population); and the two TAZs directly east of I-495 and adjacent to Route 7, TAZ 1860 and 1859, are also projected to see no residential development by 2045. These low or no-growth areas are composed mainly of office buildings, large retail, smaller office complexes, or transportation infrastructure (e.g., limited-access highway on-ramps).

Figure 5-6 | Population in Study Area, 2019



Source: MWCOG Round 9.1 Cooperative Land Use Forecasts

Figure 5-7 | 2045 Projected Population Density and Population Change



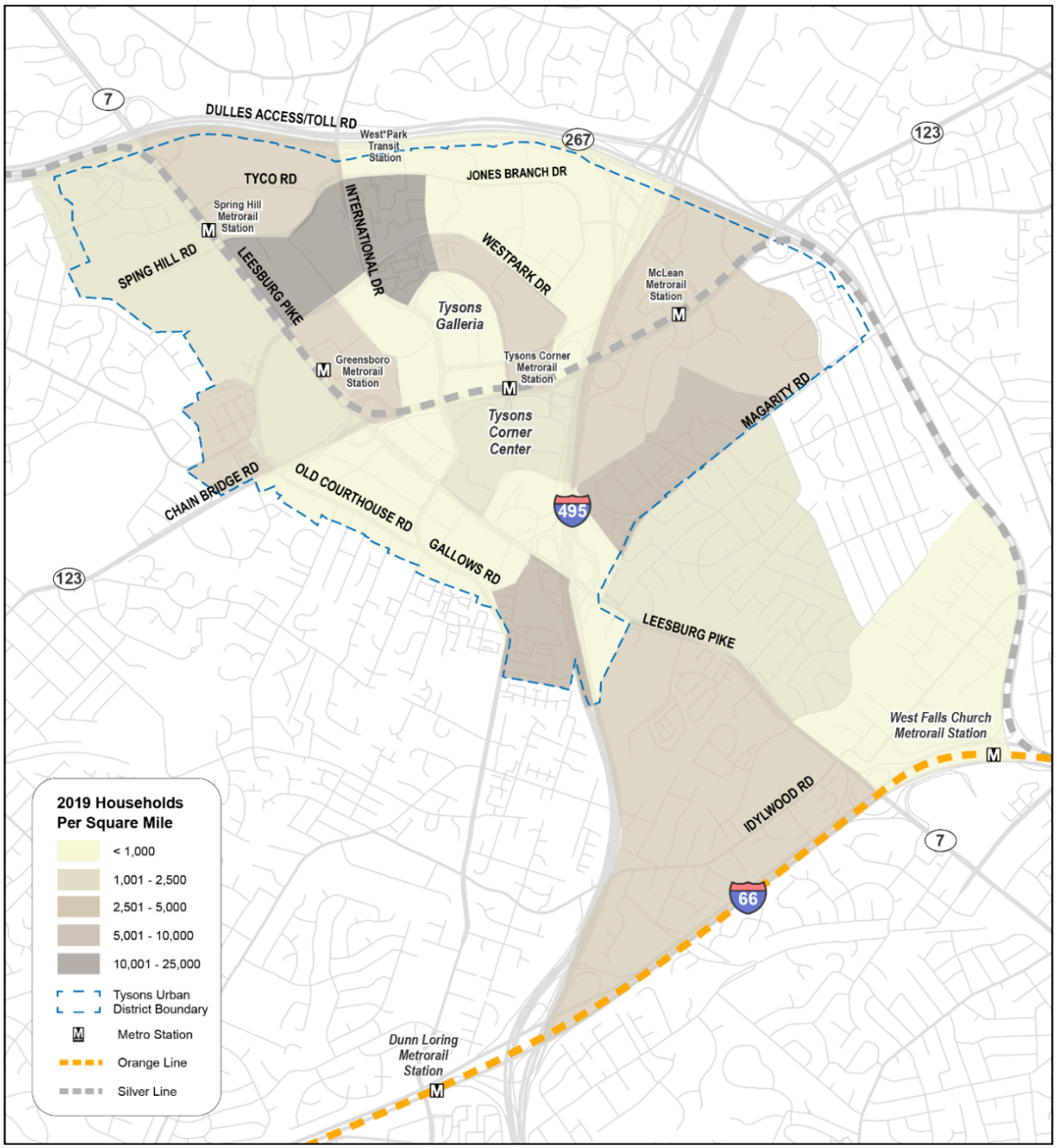
Source: MWCOG Cooperative Land Use Forecast v. 2.3.75

5.3.3 Households

There are approximately 16,400 households in the study area as of 2019. **Figure 5-8** shows households generally correspond with the population distribution. Households are generally concentrated in the southeastern, eastern, and northwestern portions of the study area.

The number of households in the study area is projected to grow by approximately 197 percent, slightly greater than the projected population growth rate which suggests a decrease in the average household size. **Figure 5-9** shows the estimated number of households per square mile in 2019 followed by the projected households per square mile in 2045 aggregated by TAZ. The highest projected population growth TAZs are 1846 and 1849, with an expected growth of 3,268 percent (near the existing Tysons Galleria) and 1,374 percent (adjacent to the Greensboro Metrorail station) respectively.

Figure 5-8 | Households in Study Area, 2019



Source: MWCOG Round 9.1 Cooperative Land Use Forecasts

Figure 5-9 | Projected Households in Study Area, 2045

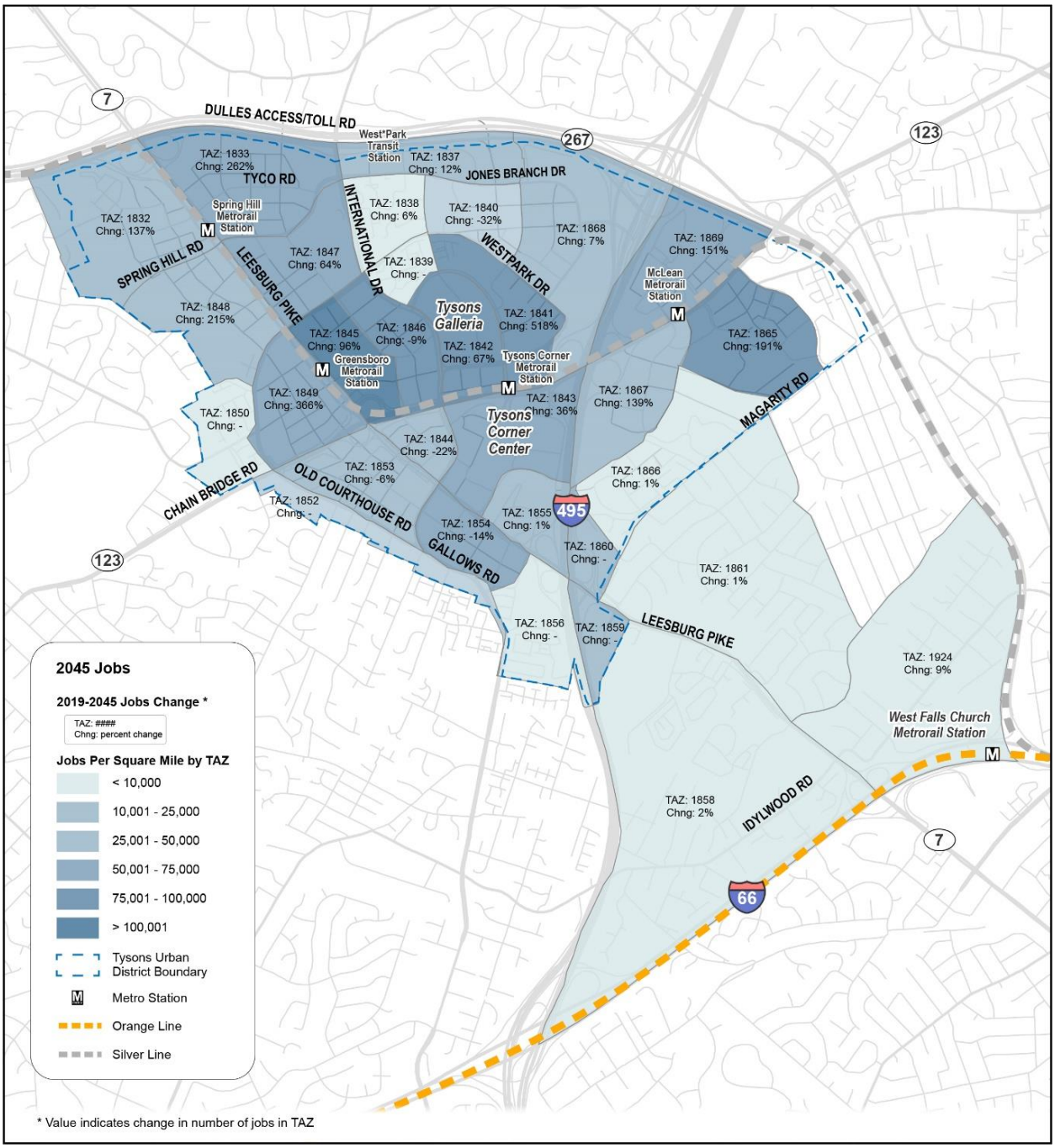
Source: MWCOG Cooperative Land Use Forecast v. 2.3.75

5.3.4 Employment

There are an estimated 96,000 jobs in the study area in 2019, with jobs concentrated in the areas without large numbers of residents as shown in **Figure 5-10** Employment density is concentrated within the Tysons Urban District boundary, primarily west of I-495. The highest concentration of employment is found in TAZs that correspond with the Tysons Corner Center, the area bounded by Chain Bridge Road, International Drive, and Greensboro Drive (adjacent to Tysons Galleria), and the area bounded by I-495, Dulles Toll Road, and Westpark Drive. Employment data indicates that the number of jobs is projected to grow almost 70 percent to approximately 165,500 jobs by 2045 (see **Figure 5-10**).

While employment is expected to grow at a lower rate than either population or households, the 2045 employment projections indicate there will still be substantially more jobs in the study area than residents. Employment growth is also inconsistent across TAZs, with some areas far outpacing others in both percentage and numerical job growth. This demonstrates employment growth is likely to be concentrated in several specific TAZs throughout the study area.

Figure 5-10 | Projected Employment in Study Area, 2045



Source: MWCOG Cooperative Land Use Forecast v. 2.3.75

5.3.5 Demographics Summary

Population and employment forecasts indicate a more integrated mix of uses in the study area in 2045. For example, the northwest TAZs show strong additions of both employment and population. The central TAZs, surrounding Tysons Galleria and directly north and south of Route 123, also show strong growth of employment and population. These projections point toward a more integrated land use, as well as substantial development within the study area. **Table 5-5** provides a summary of the study area demographics by TAZ.

Table 5-5 | Study Area Demographics

	Demographics			
	2019	**2045**	**Change**	**%**
Population	35,588	97,796	62,208	175%
Households	16,355	48,529	32,174	197%
Employment-Jobs	96,030	163,424	67,394	70%

Source: MWCOG Cooperative Land Use Forecast v. 2.3.75

5.4 Transit Conditions

This section provides the results of the MOEs related to transit service for the Future No-Build and a comparison to the Existing Conditions. As discussed in Section 2, there are several new transit services added to the transportation network for the Future No-Build condition, including the full build-out of the Metrorail Silver Line and additional bus routes.

5.4.1 Ridership

Daily bus and Metrorail boardings are shown in **Table 5-6**. Overall, transit ridership is expected to increase from approximately 9,500 daily boardings within the study area to nearly 37,000 daily boardings, an increase of 290 percent. This increase in ridership is attributed to the forecasted land use changes around the Metrorail stations. These land use changes encourage and support high-density residential and employment centers focused around the Metrorail stations, which in turn yield more daily riders. Metrorail remains the largest share of overall transit ridership (an increase in 230 percent); however, bus transit, which includes Metrobus and Fairfax Connector, is expected to increase by more than 550 percent.

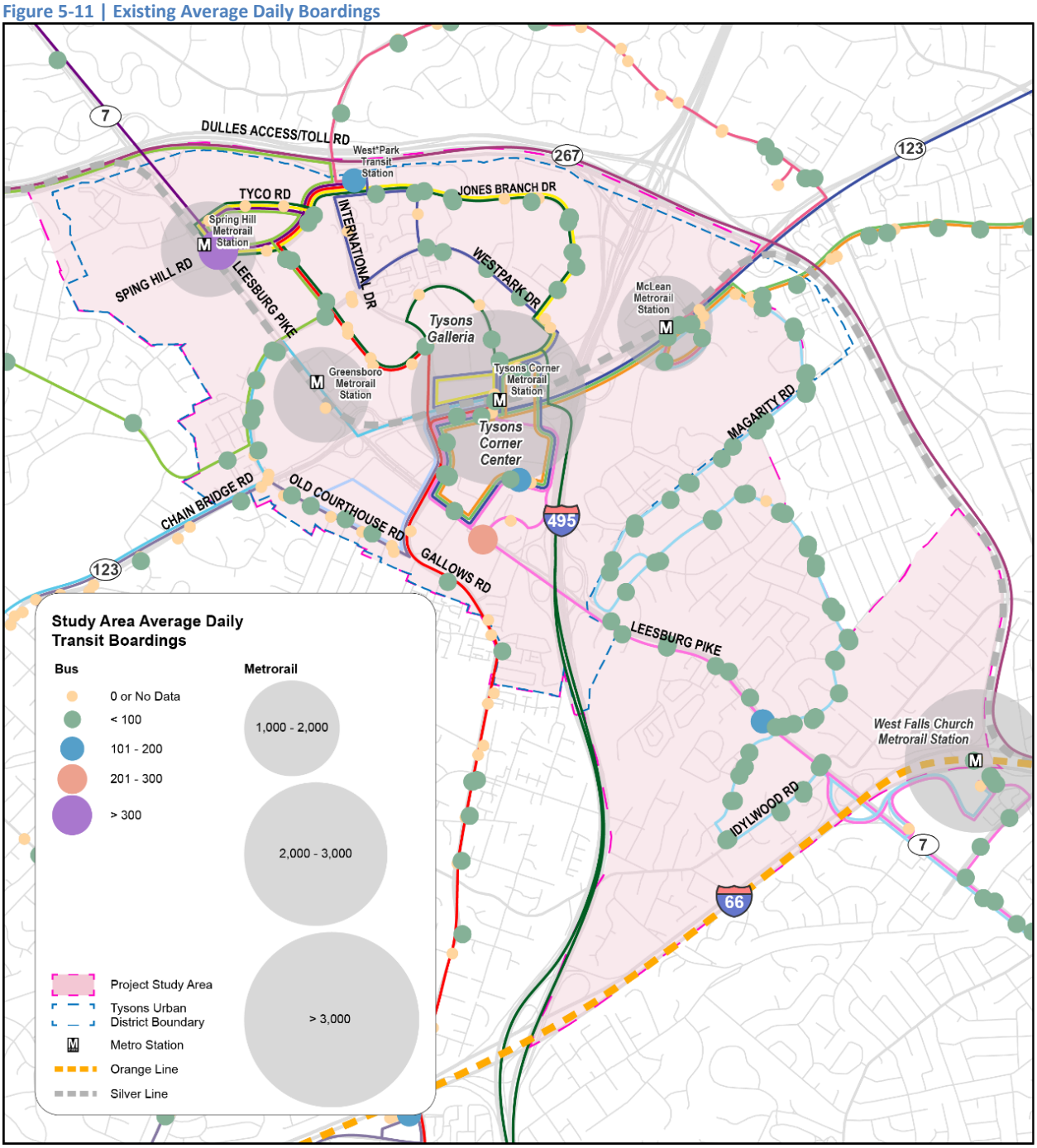
Table 5-6 | Total Daily Transit Boardings in the Study Area

Mode	Existing Conditions	Future No Build	Percent Change (%)
Metrorail	7,778	25,498	228%
Metrobus	1,140	8,641	658%
Fairfax Connector	563	2,540	351%
Total	**9,481**	**36,679**	**287%**

Sources: WMATA, Fairfax County DOT; Future No Build Travel Demand Models

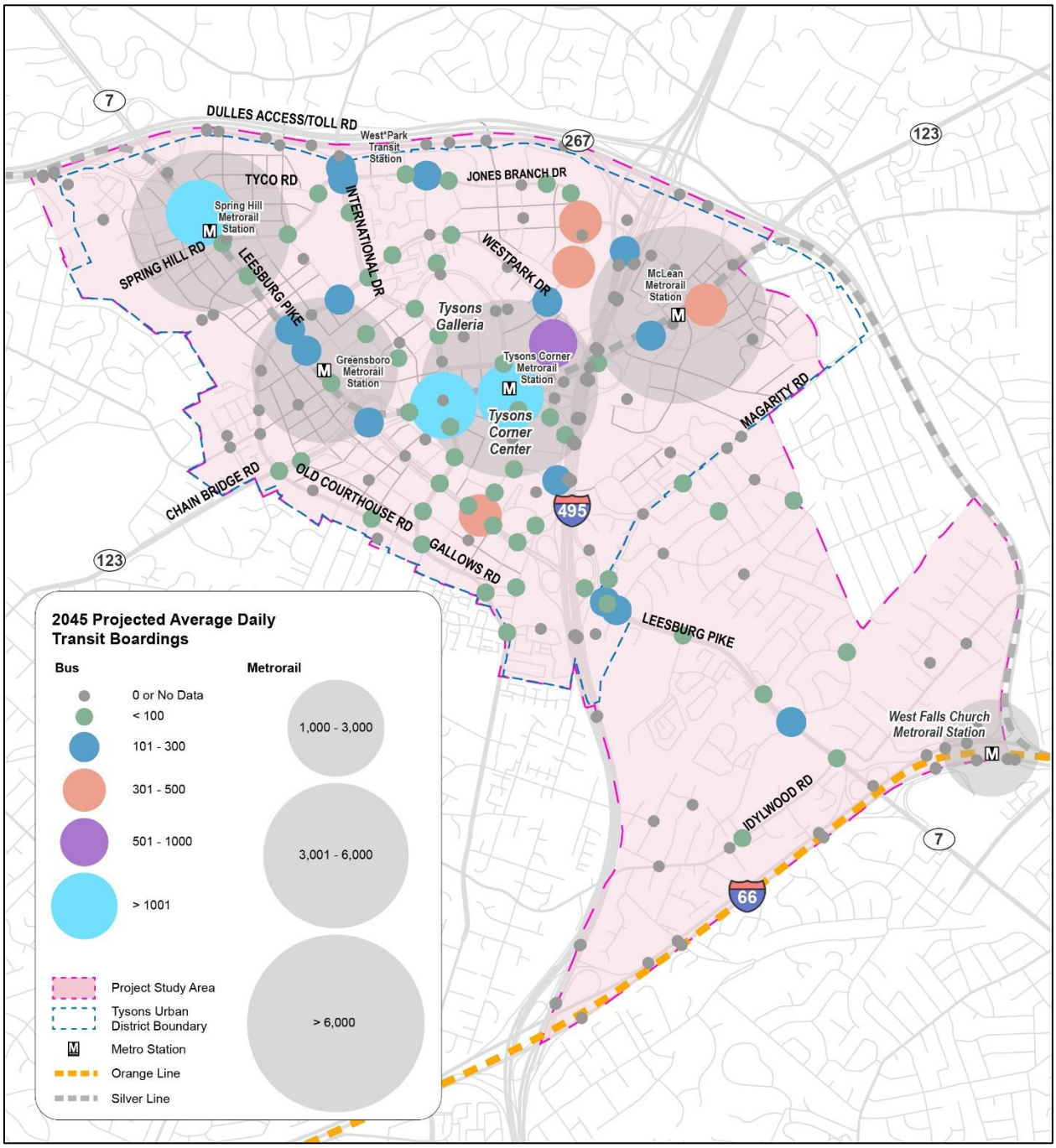
Figure 5-11 and **Figure 5-12** shows the general distribution of transit boardings in the study area in the existing and future No-Build conditions, respectively. As expected, most transit ridership is generated at the Metrorail stations. Of the Metrorail stations, Tysons Corner Metrorail Station experiences the highest level of daily boardings. The bus stops with the highest number of daily bus boardings are located at Spring Hill Metrorail Station, Fashion Boulevard on Route 7, Tysons Corner Center Mall, West*Park Transit Station, and Pimmit Drive on Route 7. Fairfax Connector primarily serves the core within the Tysons Urban District Boundary. Bus ridership is generally distributed along the major corridors of Route 7, Route 123, International Drive, and Jones Branch Drive.

Figure 5-11 | Existing Average Daily Boardings



Source: WMATA Metrorail (May 2018), Metrobus (October 2018), Fairfax Connector (August 2017) Transit Ridership

Figure 5-12 | 2045 Projected Average Daily Transit Boardings



Source: Future No Build Travel Demand Model

5.4.2 Transit Mode Share

Approximately five percent of trips originating in the study area are made by transit. During the peak period, this is even higher, with almost 15 percent of trips being made by transit, see **Table 5-7**. **Table 5-8** shows the mode share for transit trips generated in the study area; notably more than 90 percent of these trips are walk access.

As seen in **Table 5-7**, compared to the Existing Conditions, transit mode share is anticipated to increase from 4.9 to 8.6 percent daily, however itis expected to decrease from 14.8 to 11.0 percent during peak period. Trips made by driving remain the predominate mode within the study area. **Table 5-8** shows the mode share for transit trips generated in the study area. Compared with the Existing Conditions, walking remains the predominate mode for accessing transit. Park & Ride and Kiss & Ride slightly decrease during the peak period trips, however, increases for off-peak period trips. Daily averages remain about the same as the Existing Conditions.

Table 5-7 | Mode Share in Study Area

Mode	Existing Conditions		Future No-Build	
	Peak Period*	Daily	Peak Period*	Daily
Drive	85.2%	95.1%	89.0%	91.4%
Transit	14.8%	4.9%	11.0%	8.6%

**Peak Period: (6:00 – 9:00 AM,3:30 – 7:30 PM)*

Source: Existing Conditions and Future No Build Travel Demand Models

Table 5-8 | Transit Ridership Access Mode Share in Study Area

Mode	Existing Conditions			Future No-Build		
	Peak Period*	Off Peak Period	Daily	Peak Period*	Off Peak Period	Daily
Walk	87%	96%	91%	90.2%	92.0%	90.9%
Park & Ride	9%	3%	6%	7.0%	5.7%	6.5%
Kiss & Ride	4%	1%	3%	2.8%	2.3%	2.6%

**Peak Period: (6:00 – 9:00 AM,3:30 – 7:30 PM)*

Source: Existing Conditions and Future No Build Travel Demand Models

5.4.3 Transit Travel Speed

Table 5-9 shows a comparison of bus travels speeds between the Existing Conditions and the Future No-Build traffic simulations. Bus travel speeds factor in dwell time at bus stops for passenger boarding and alightings. To capture dwell time, bus stops were categorized as low, medium, and high for projected boardings and assigned increasing dwell times for each. Compared to the Existing Conditions, the transit travel speeds in the Future No-Build are generally slower. The Future No-Build simulation shows that travel speeds in the morning peak are generally faster than the afternoon peak in most cases, except for the north- and southbound directions between Ramada Road to Idylwood Road (between I-66 and I-495). Northbound International Drive from Route 7 to Chain Bridge Road includes the slowest transit travel speeds.

Table 5-9 | Simulated Peak Period Average Transit Travel Speeds (mph)

Direction	Segment	Existing Condition		Future No Build	
		AM	PM	AM	PM
Southbound Route 7	Spring Hill Rd to Westpark Dr	--	--	7.9	6.8
	Fashion Blvd to Ramada Rd	21.7	21.2	19.2	17.4
	Ramada Rd to Idylwood Rd	11.7	14.0	7.7	14.5
Northbound Route 7	Idlywood Rd to Ramada Rd	11.2	14.0	9.4	12.5
	Ramada Rd to Fashion Blvd	29.6	29.4	14.6	29.6
	Westpark Dr to Spring Hill Rd	--	--	11.3	5.7
Northbound International Dr	Route 7 to Chain Bridge Rd	8.5	4.3	3.8	3.4
Southbound International Dr	Chain Bridge Rd to Route 7	10.8	6.6	8.2	4.6

Source: Existing and Future No Build Traffic Models

5.4.4 Transit Reliability

Table 5-10 shows the standard deviation of bus travel times within the identified corridor segments. The higher the standard deviation, the wider the range of travel times relative to the average. The Future No-Build simulation results indicate less reliable bus travel times than the Existing Conditions. While the morning peak period has the fastest transit travel speeds, the Future No Build simulation also shows that generally the variation in transit travel speeds are the highest during this period. Segments with the highest standard deviation include southbound Route 7 from Ramada Road to Idylwood Road in the AM, northbound Route 7 from Westpark Drive to Spring Hill Road in both AM and PM, and northbound International Drive from Route 7 to Chain Bridge Road in both the AM and PM peaks.

Table 5-10 | Transit Reliability

Direction	Segment	Existing Condition		Future No Build	
		AM	PM	AM	PM
Southbound Route 7	Spring Hill Rd to Westpark Dr	--	--	0.6	0.6
	Fashion Blvd to Ramada Rd	0.3	0.4	0.1	0.4
	Ramada Rd to Idylwood Rd	0.6	0.8	1.5	0.5
Northbound Route 7	Idlywood Rd to Ramada Rd	0.3	0.4	0.9	0.4
	Ramada Rd to Fashion Blvd	0.1	0.1	0.7	0.1
	Westpark Dr to Spring Hill Rd	--	--	0.2	0.9
Northbound International Dr	Route 7 to Chain Bridge Rd	0.1	0.5	1.4	0.7
Southbound International Dr	Chain Bridge Rd to Route 7	0.1	0.2	0.2	0.3

Note: Higher standard deviation numbers are equal to a wider range of travel times relative to the average. These higher numbers mean that the transit is less reliable.

Source: Existing Conditions and Future No Build Traffic Models

5.4.5 Transit Person Throughput

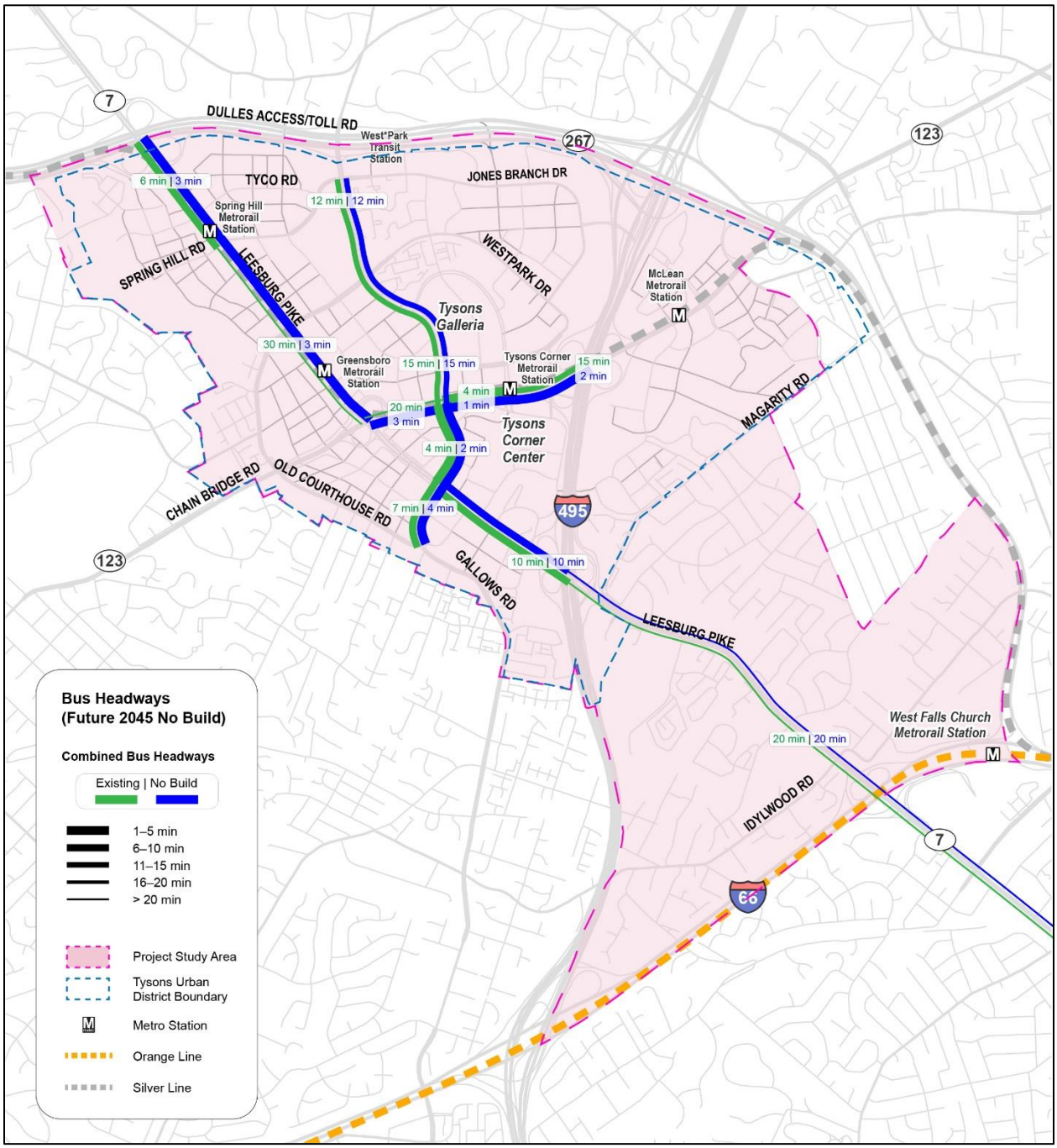
Transit person throughput quantifies the number of people on board a transit vehicle at certain points along the corridor. **Table 5-11** shows the projected number of persons using bus transit along the major corridors in the study area, excluding Metrorail. The locations listed below show a combined transit throughput in both directions. Further, **Figure 5-13** shows the projected combined peak period bus headways for all bus routes operating on the selected corridors. The segments where combined peak period bus headways are expected to be the highest coincide with the segments with the largest transit throughput. The segment along Route 7, between International Drive and Spring Hill Road, is expected to see a large increase in bus transit services and is the segment with the largest transit person throughput in the study area. The other three segments are expected to see a 50 to 100 percent increase in transit person throughput.

Table 5-11 | Combined Transit Person Daily Throughput (both directions)

Location	Existing Conditions	Future No Build	Percent Change (%)
Route 7 near Westpark Drive	--	3,062	N/A
International Drive near Tysons Blvd	920	1,645	79%
Route 7 near Fashion Boulevard	725	1,424	96%
Route 7 near Dominion Drive	1,525	2,385	56%

Source: Existing Conditions and Future No Build Travel Demand Models

Figure 5-13 | Existing and Future No-Build Combined Bus Headways on Select Corridors



Source: Existing WMATA and Fairfax Connector Timetables; CLRP

5.5 Traffic Conditions

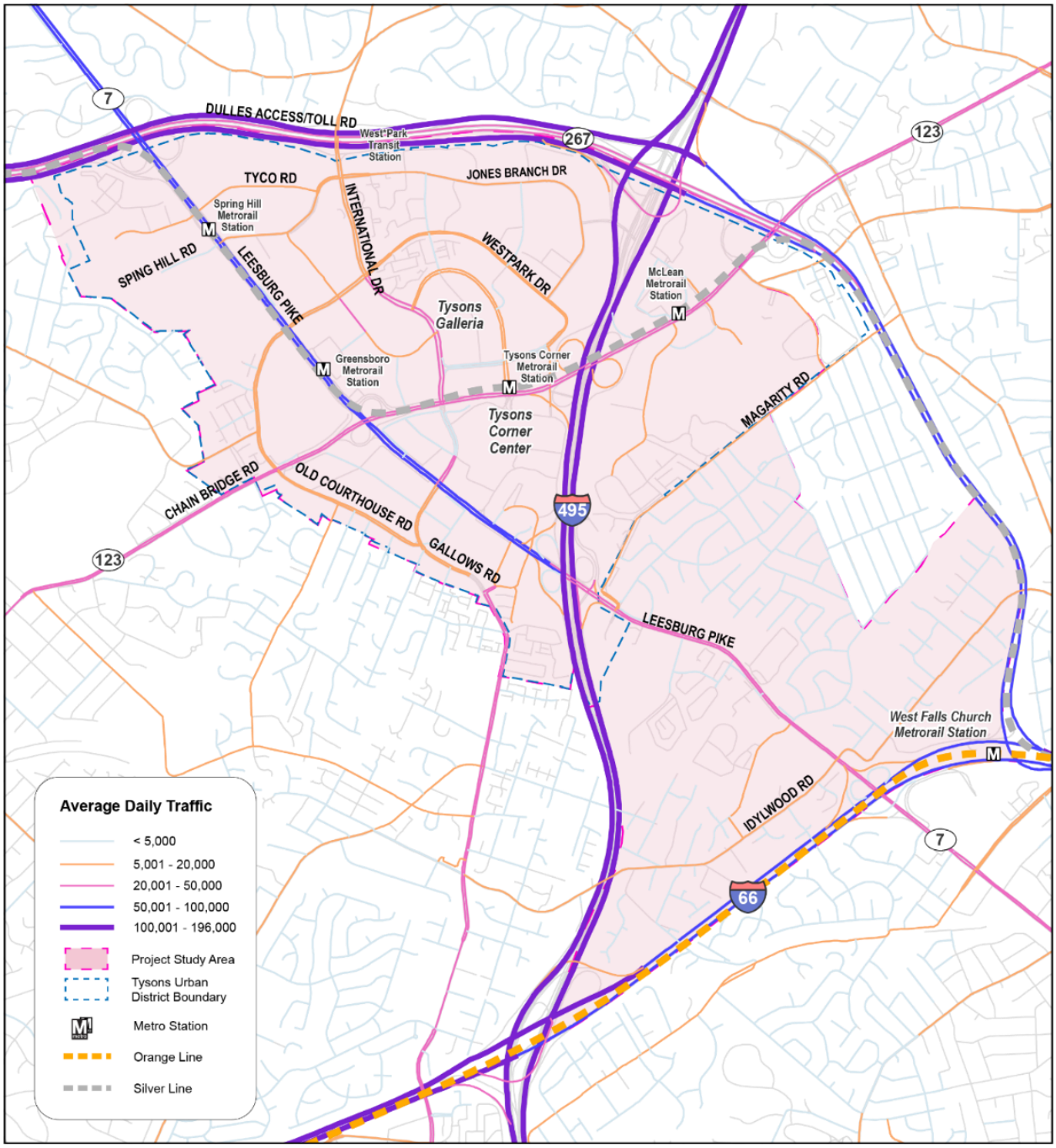
This section describes the Future No-Build traffic conditions for the study area. Vehicle speeds, intersection delay, and several other MOEs provide a full picture of traffic conditions in the study area.

5.5.1 Average Daily Traffic Volumes

Roadways within the study area range from highly trafficked arterials and highways to low and medium-trafficked local streets and collectors. High-traffic-volume roads (greater than 50,000 ADT) include I-495, Dulles Toll Road, I-66 and the northern half of Route 7. Route 7 has a higher average volume north of I-495 than south of I-495. Roads within the Tysons Urban District Boundary show a mix of medium volume (20,000 – 50,000 ADT) roadways and some lower volume (less than 20,000 ADT) roadways. The neighborhoods surrounding the project study area have lower volumes, with the exception of some collector roads.

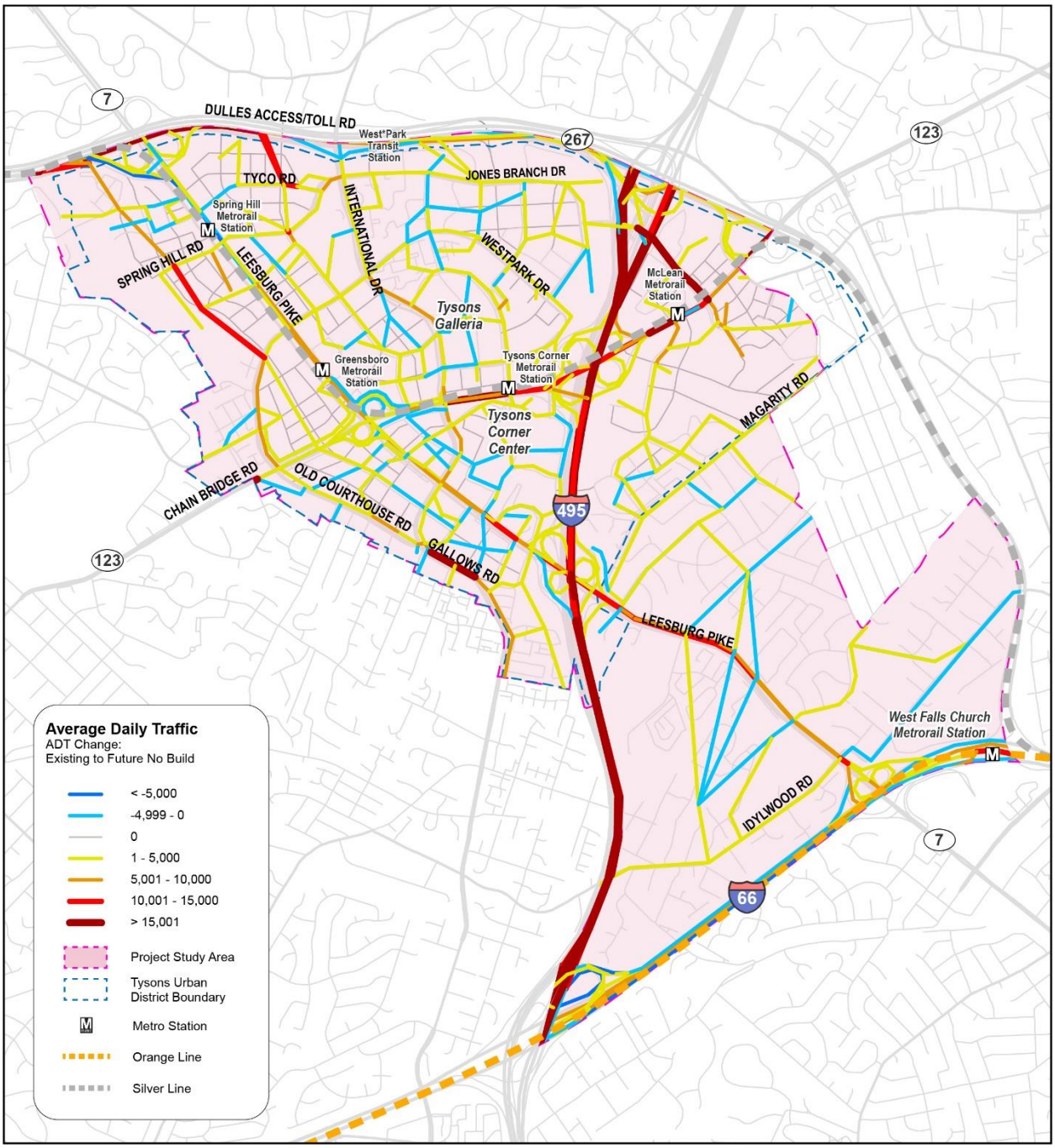
A comparison of the Existing Conditions and Future No-Build traffic volumes suggests the new grid of streets, specifically the Boone Boulevard extension and the Greensboro Drive extension and toll ramp, disperses travel volumes from Route 7 to these new parallel corridors, particularly near the Spring Hill Road intersection. Roadways such as I-495, Chain Bridge Road, and Leesburg Pike (near the beltway) gain significant traffic volumes. Other minor roadways see a slight decrease in traffic volumes (less than 5,000 vehicles per day). Future No-Build daily traffic volumes are seen in **Figure 5-14** and changes from the Existing Conditions are seen in **Figure 5-15.**

Figure 5-14 | Average Daily Traffic Volumes - July 2019



Source: Virginia Department of Transportation (VDOT), July 2019

Figure 5-15 | Daily Traffic Volumes Change from Existing



Source: Existing Conditions and Future No Build Travel Demand Models

5.5.2 Person Throughput

Person throughput is an MOE used to quantify the number of people being moved on a corridor during a specific time period. This MOE accounts for people traveling in automobiles (as either drivers or passengers) and in buses. **Table 5-12** shows a comparison of the daily person throughput at four key locations in the study area for the Existing Conditions and the Future No-Build. Additionally, **Table 5-13** shows the average peak hour directionality of the person throughput.

Overall, person throughput increases during both peak periods as well as in the off-peak for both southbound and northbound directions. The largest percentage increases occur on Southbound Route 7, near Fashion Boulevard (59% - AM; 39% - PM) and Northbound Route 7, near Dominion Drive (62% - AM; 70% - PM). International Drive, near Tysons Boulevard, experiences an overall 23 percent decrease in total daily throughput, which is likely a result of new grid of street connections providing alternative route options, particularly for southbound PM peak trips.

Table 5-12 | Daily Person Throughput for Selected Locations

Location	Existing	Future No Build	Change From Existing
Route 7 near Westpark Drive	97,850	108,045	10,195 (10%)
International Drive near Tysons Blvd	48,010	36,944	-11,066 (-23%)
Route 7 near Fashion Boulevard	89,080	111,707	22,627 (25%)
Route 7 near Dominion Drive	58,720	71,407	12,687 (22%)

Source: Existing Conditions and Future No Build Travel Demand Models

Table 5-13 | Average Peak Hour Person Throughput by Direction

Location	Existing			Future No Build (% change)		
	Southbound	Northbound	Total	Southbound	Northbound	Total
	AM Peak Hour					
Route 7 near Westpark Drive	2,441	2,405	4,846	2,827 (16%)	2,736 (14%	5,563 (15%)
International Drive near Tysons Blvd	629	1,446	2,075	706 (12%)	1,719 (19%)	2,425 (17%)
Route 7 near Fashion Boulevard	1,619	2,860	4,479	2,567 (59%)	2,960 (3%)	5,527 (23%)
Route 7 near Dominion Drive	1,481	1,417	2,898	2,007 (36%)	2,296 (62%)	4,303 (48%)
	PM Peak Hour					
Route 7 near Westpark Drive	2,808	2,461	5,269	2,930 (4%)	2,918 (19%)	5,848 (11%)
International Drive near Tysons Blvd	2,617	1,192	3,809	1,864 (-29%)	1,513 (27%)	3,377 (-11%)
Route 7 near Fashion Boulevard	2,462	2,534	4,996	3,416 (39%)	2,977 (17%)	6,393 (28%)
Route 7 near Dominion Drive	2,404	1,501	3,905	2,619 (9%)	2,553 (70%)	5,172 (32%)

Source: Existing Conditions and Future No Build Travel Demand Models

5.5.3 Corridor Auto Travel Speed

Average corridor auto travel speeds were simulated for each direction during the AM and PM peak periods for Route 7 and International Drive. As seen in **Table 5-14**, average corridor travel speeds are slower in the Future No-Build compared to the Existing Conditions, except for southbound Route 7 in the PM peak period, which may be due to the planned road widening. AM travel speeds decrease ranging from 5 to 10 mph.

Table 5-14 | Average Auto Travel Speeds (mph)

Direction	Existing Condition		Future No Build	
	AM	PM	AM	PM
Southbound Route 7	22.9	15.0	15.8	16.1
Northbound Route 7	23.6	17.5	14.5	17.7
Northbound International Dr	19.1	13.8	10.8	8.1
Southbound International Dr	23.1	19.2	18.1	12.3

Source: Existing Condition and Future No Build Traffic Models

5.5.4 Intersection Operations

Intersection Level of Service is calculated based on the amount of vehicle delay occurring at an intersection. Within the Tysons Urban District Boundary, intersection LOS of E or better is deemed to be acceptable; outside of this area, LOS D or better is deemed acceptable. Thirty-three (33) critical intersections were selected in the study area based on their proximity to Route 7, their traffic volume, and their likelihood of being part of the future BRT route alignment. Based on field data collected in May 2018, these intersections were evaluated for morning peak and afternoon peak traffic operations. These measurements provide multiple evaluations that may provide crucial insight for future decisions on design alternatives such as bus lane placement, bus and turn lanes (as a reminder, BAT lanes are lanes dedicated to buses, right-turn movements, or business entrance only), or areas for the BRT alignment to avoid.

The map in **Figure 5-16** shows the morning and evening peak hour level of service (LOS) for critical intersections in the study area. The intersection of Route 7 at Gosnell Road/Westpark Drive is the only location to experience a LOS[3] of E or F during the morning peak hour. More intersections operate at LOS E or F during the evening peak hour, although all are within the Tysons Urban District Boundary. The LOS for each intersection is also highlighted in **Figure 5-17.**

For the Future No-Build analysis, six additional intersections were added to the study beyond the Existing Conditions evaluation to thoroughly evaluate the plan and to reflect the more urban street grid in Tysons. The intersection operations results comparing the Existing Conditions to the Future No-Build are provided in **Table 5-15**, **Table 5-16**, **Figure 5-16**, **Figure 5-17**, **Figure 5-18**. Detailed intersection turning movement results including delay, LOS, and maximum queue lengths can be found in **Appendix C**.

In the Future No-Build scenario, intersection delay generally increases at most intersections, resulting in degraded LOS for some intersections. Even at intersections in which the through volumes on Route 7 decrease (due to the additional streets and a more enhanced grid), intersection LOS deteriorates due to considerable increase in volumes on the minor roads crossing Route 7.

During the AM peak hour for the Existing Conditions, none of the intersections operate with LOS F compared to five intersections in the Future No-Build. Intersections operating with LOS F are generally located in the northwest of the study area along Leesburg Pike, Westpark Drive, Westpark Drive and Greensboro Drive, and along Chain Bridge Road at Old Courthouse Road, International Drive, and Pimmit Drive.

During the PM peak hour, the increase in the number of intersections operating with LOS F is less pronounced compared to the AM peak hour (three intersections in the Existing Conditions and six in the Future No-Build). These intersections are generally in the same area as in the AM – near Route 7 and Spring Hill Road, Tyco Road, Westpark Drive, and along International Drive and Chain Bridge Road.

[3] LOS values correspond to Highway Capacity Manual LOS for calculated VISSIM delays.

Table 5-15 | Study Area Intersection Average Vehicle Delay and Level of Service in 2045

Intersection Number	Intersection Cross Streets	Existing		Future No Build	
		AM	PM	AM	PM
1	Rt 7 & Tyco Rd	46.8	62.5	67.2	78.4
2	Rt 7 & Spring Hill Rd	36.1	62.7	39.5	78.6
3	Rt 7 & Westpark Dr	48.4	84.0	138.6	129.0
4	Rt 7 & Chain Bridge Rd SB	5.7	12.9	21.3	27.3
5	Rt 7 & Chain Bridge Rd NB	5.0	13.4	13.5	3.8
6	Rt 7 & International Dr	48.5	79.6	60.6	59.8
7	Rt 7 & Fashion Blvd	17.9	41.1	30.9	38.2
8	Rt 7 & Old Gallows Rd	6.0	18.4	8.7	11.7
9	Rt 7 & I-495 SB*	2.1	17.0	13.5	11.3
10	Rt 7 & I-495 NB	19.4	11.0	18.7	19.7
11	Rt 7 & Lisle Ave/Ramada Rd	35.0	32.9	39.1	44.9
12	Rt 7 & Marshall HS Driveway*	2.1	3.9	6.4	2.4
13	Rt 7 & George Marshall Dr	22.9	24.2	22.7	16.0
14	Rt 7 & Dominion Dr	3.0	2.6	16.3	1.7
15	Rt 7 & Patterson Rd	10.1	10.0	28.6	7.8
16	Rt 7 & Pimmit Dr	27.2	28.4	82.4	27.4
17	Rt 7 & Idylwood Rd	39.8	34.2	42.0	27.1
18	Rt 7 & I-66 SB*	15.9	12.1	14.8	11.4
19	Rt 7 & I-66 NB*	10.1	4.2	3.3	4.8
20	Gallows Rd & Old Court House Rd	23.3	73.2	33.2	93.7
21	International Rd & Tysons One Pl	7.4	42.0	69.3	56.0
22	International Dr & Chain Bridge Rd	46.1	59.6	99.8	57.3
23	International Dr & Galleria Dr*	7.0	3.2	6.5	4.2
24	International Dr & Greensboro Dr	26.4	24.9	24.0	25.2
25	International Dr & Tysons Blvd	18.1	17.6	20.1	24.6
26	International Dr & Westpark Dr	36.5	80.6	43.2	81.3
27	International Dr & Jones Branch Dr	43.6	45.8	61.9	87.8
28	Spring Hill & Tyco Rd	9.9	13.0	26.9	34.6
29	Spring Hill Rd & Greensboro Dr	24.1	32.2	51.3	94.3
30	Chain Bridge Rd & Old Courthouse Rd	48.2	63.4	105.0	117.8
31	Tysons and Chain Bridge Rd	23.2	44.5	79.0	98.8
32	International Dr & Fletcher St	9.0	21.2	18.6	38.9
33	Westpark Dr & Greensboro Dr	33.1	90.5	161.8	109.9
34	Rt 7 & New Street*	--	--	8.0	1.4
35	Rt 7 & Broad Street	--	--	34.7	36.9
36	Chain Bridge Rd & Rt 7 South	--	--	7.8	22.0
37	Chain Bridge Rd & Rt 7 North	--	--	21.2	28.6
38	Chain Bridge Rd & Rt 7	--	--	27.7	14.3
39	Tyco Rd & Greensboro Dr	--	--	30.0	76.4

LOS: Green – A, B, C; Yellow – D; Orange – E Red - F

---- Tysons Urban District Boundary Intersections

*Unsignalized Intersection

Source: Existing Conditions and Future No-Build Traffic Models

Table 5-16 | Study Area Intersection Average Vehicle Delay and Level of Service in 2045

Intersection Number	Intersection Cross Streets	Existing		Future No Build	
		AM	PM	AM	PM
1	Rt 7 & Tyco Rd	D	E	E	E
2	Rt 7 & Spring Hill Rd	D	E	D	E
3	Rt 7 & Westpark Dr	D	F	F	F
4	Rt 7 & Chain Bridge Rd SB	A	B	C	C
5	Rt 7 & Chain Bridge Rd NB	A	B	B	A
6	Rt 7 & International Dr	D	E	E	E
7	Rt 7 & Fashion Blvd	B	D	C	D
8	Rt 7 & Old Gallows Rd	A	B	A	B
9	Rt 7 & I-495 SB*	A	B	B	B
10	Rt 7 & I-495 NB	B	B	B	B
11	Rt 7 & Lisle Ave/Ramada Rd	C	C	D	D
12	Rt 7 & Marshall HS Driveway*	A	A	A	A
13	Rt 7 & George Marshall Dr	C	C	C	B
14	Rt 7 & Dominion Dr	A	A	B	A
15	Rt 7 & Patterson Rd	B	A	C	A
16	Rt 7 & Pimmit Dr	C	C	F	C
17	Rt 7 & Idylwood Rd	D	C	D	C
18	Rt 7 & I-66 SB*	B	B	B	B
19	Rt 7 & I-66 NB*	B	A	A	A
20	Gallows Rd & Old Court House Rd	C	E	C	F
21	International Rd & Tysons One Pl	A	D	E	E
22	International Dr & Chain Bridge Rd	D	E	F	E
23	International Dr & Galleria Dr*	A	A	A	A
24	International Dr & Greensboro Dr	C	C	C	C
25	International Dr & Tysons Blvd	B	B	C	C
26	International Dr & Westpark Dr	D	F	D	F
27	International Dr & Jones Branch Dr	D	D	E	F
28	Spring Hill & Tyco Rd	A	B	C	C
29	Spring Hill Rd & Greensboro Dr	C	C	D	F
30	Chain Bridge Rd & Old Courthouse Rd	D	E	F	F
31	Tysons and Chain Bridge Rd	C	D	E	F
32	International Dr & Fletcher St	A	C	B	D
33	Westpark Dr & Greensboro Dr	C	F	F	F
34	Rt 7 & New Street*	--	--	A	A
35	Rt 7 & Broad Street	--	--	C	D
36	Chain Bridge Rd & Rt 7 South	--	--	A	C
37	Chain Bridge Rd & Rt 7 North	--	--	C	C
38	Chain Bridge Rd & Rt 7	--	--	C	B
39	Tyco Rd & Greensboro Dr	--	--	C	E

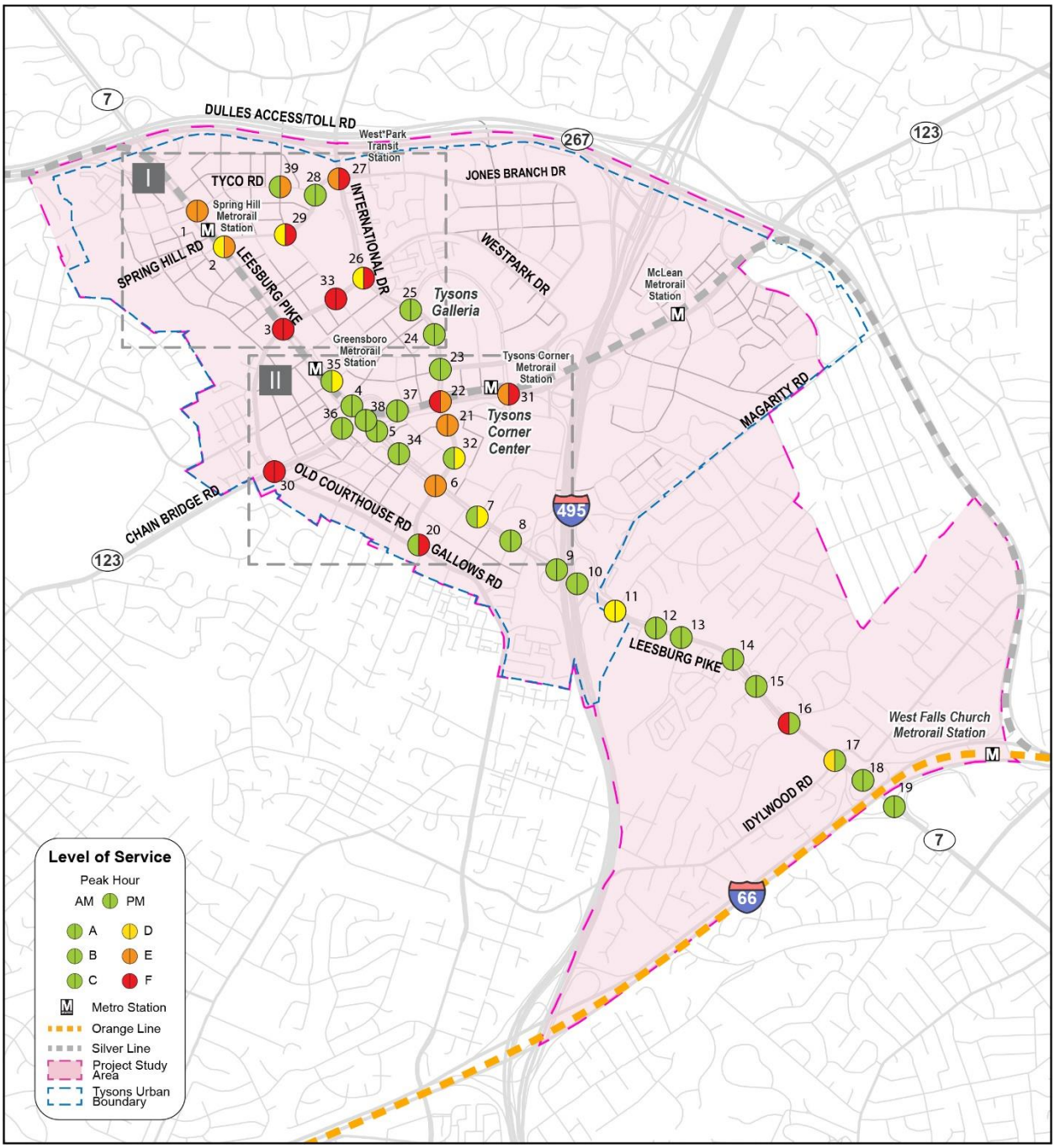
LOS: Green – A, B, C; Yellow – D; Orange – E Red - F

---- Tysons Urban District Boundary Intersections

* Unsignalized Intersection

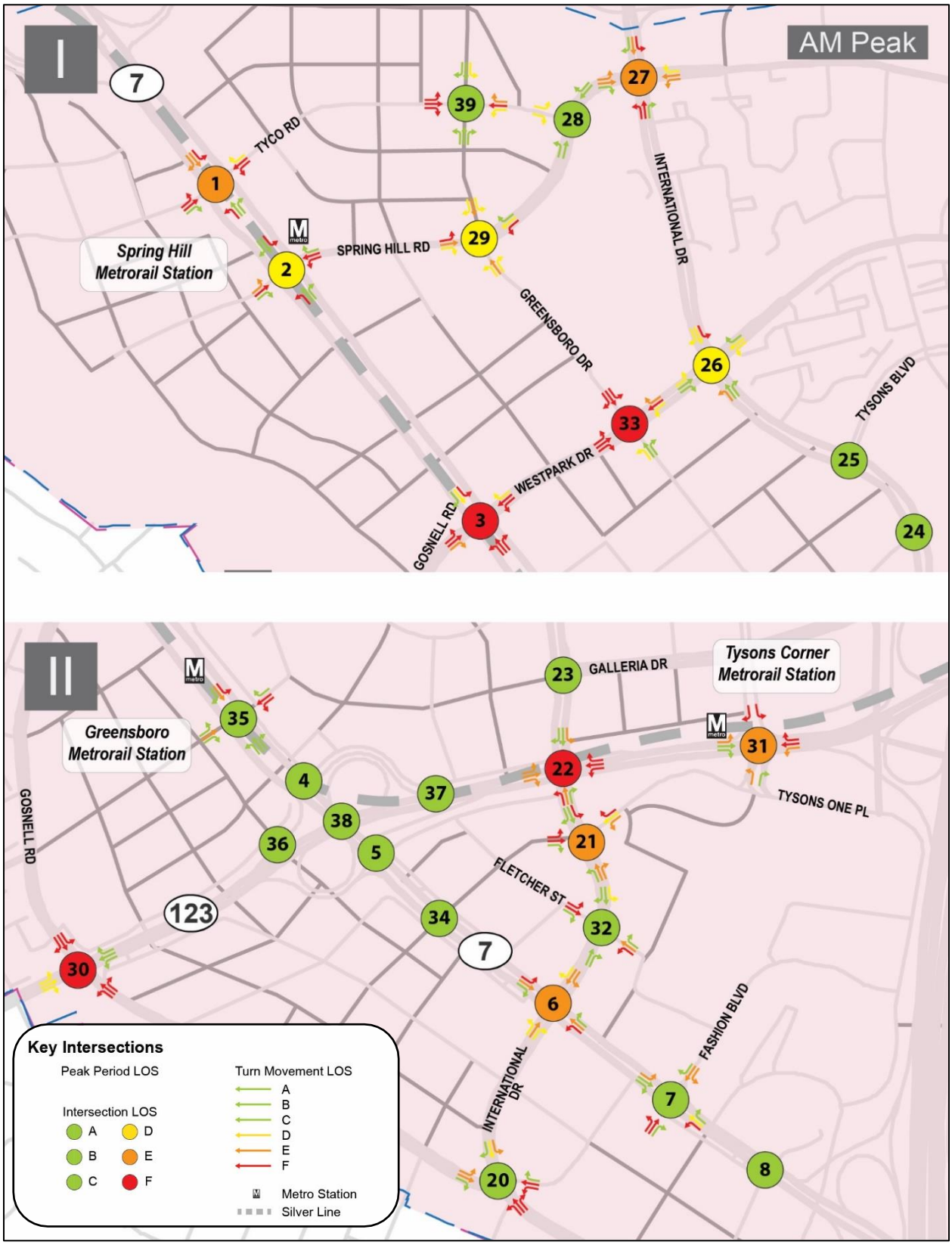
Source: Existing Conditions and Future No-Build Traffic Models

Figure 5-16 | Future No-Build Level of Service (LOS)



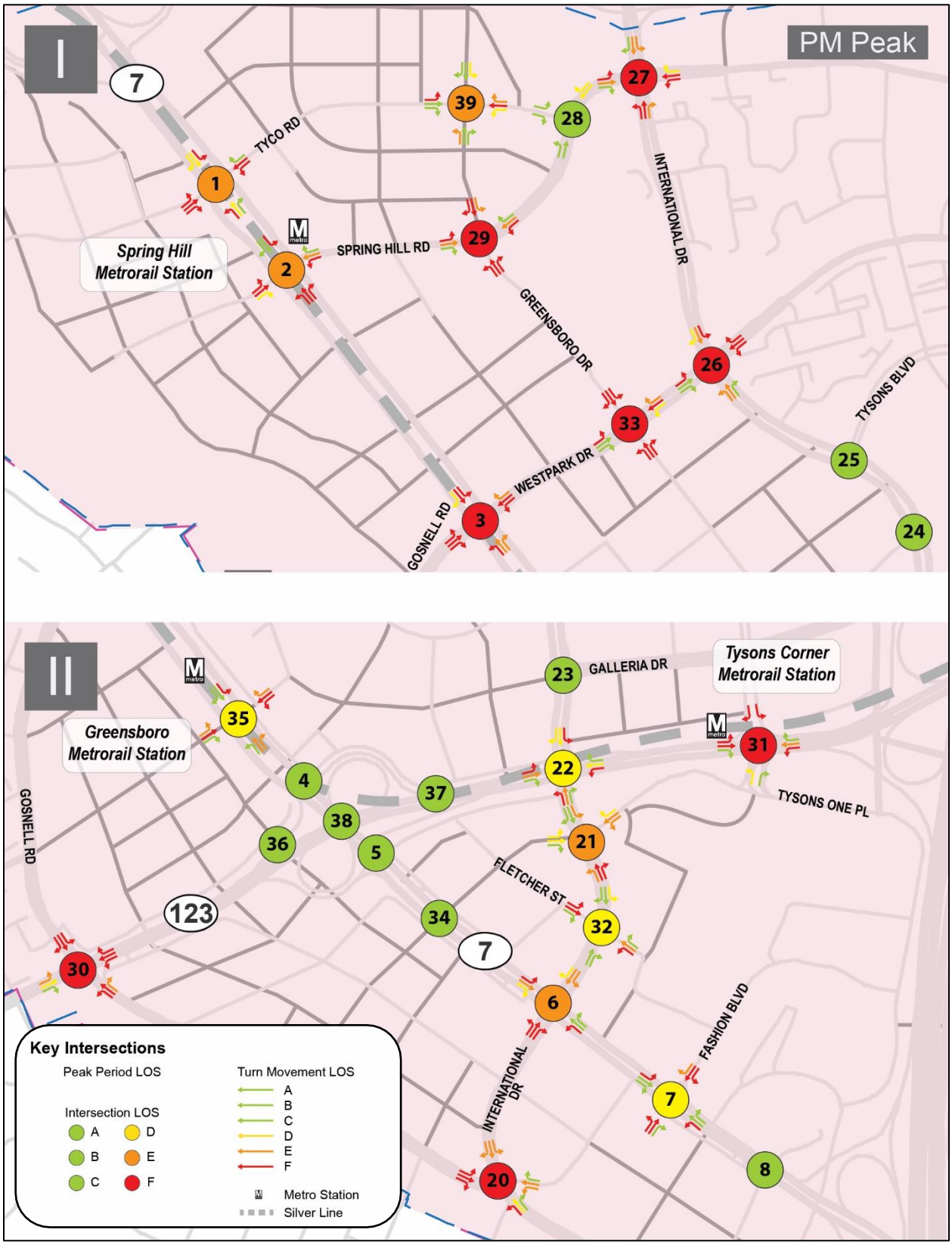
Source: Future No-Build Traffic Models

Figure 5-17 | Future No-Build Intersection LOS Inset Maps (AM Peak)



Source: Future No-Build Traffic Models

Figure 5-18 | Future No-Build Intersection LOS Inset Maps (PM Peak)



Source: Future No-Build Traffic Models

5.5.5 Vehicle Miles Traveled (VMT) and Vehicle Hours Traveled (VHT)

Table 5-17 shows the daily vehicle miles traveled (VMT) and vehicle hours traveled (VHT) for the study area over one 24-hour period for the Future No-Build. Overall, daily total VMT increase by 15 percent and VHT increases by 28 percent.

Table 5-17 | Vehicle Miles Traveled and Vehicle Hours Traveled for the Study Area, 24-hour period

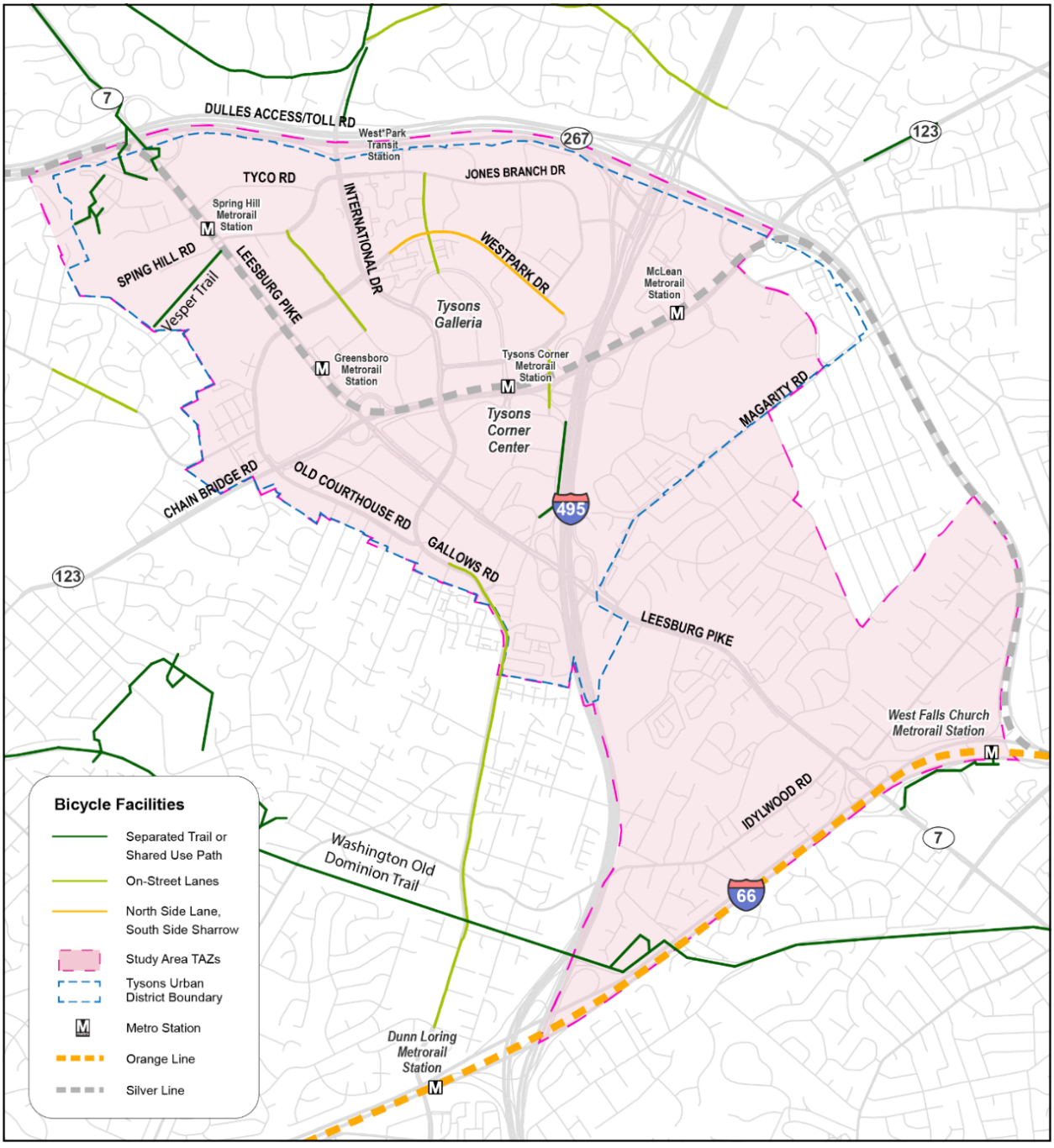
		AM Peak Period	PM Peak Period	Off Peak Period	Daily Total
VMT	Existing Conditions	308,200	439,370	771,400	1,518,970
	Future No Build	340,624	463,679	945,003	1,749,306
VHT	Existing Conditions	11,060	15,120	25,050	51,230
	Future No Build	14,840	18,842	31,859	65,541

Source: Existing Conditions and Future No-Build Travel Demand Models

5.6 Bicycle and Pedestrian Facilities

Tysons and the surrounding area currently have few bicycle facilities as shown in **Figure 5-19**. The most substantial facilities exist to the south and north of the study area, where separated trails connect neighborhoods, schools, and parks. Several roadways feature on-street lanes, but these are not consistent, nor are they connected. These facilities do not constitute a bicycle network; cyclists in the study area likely rely heavily on vehicular lanes and sidewalks for completing trips.

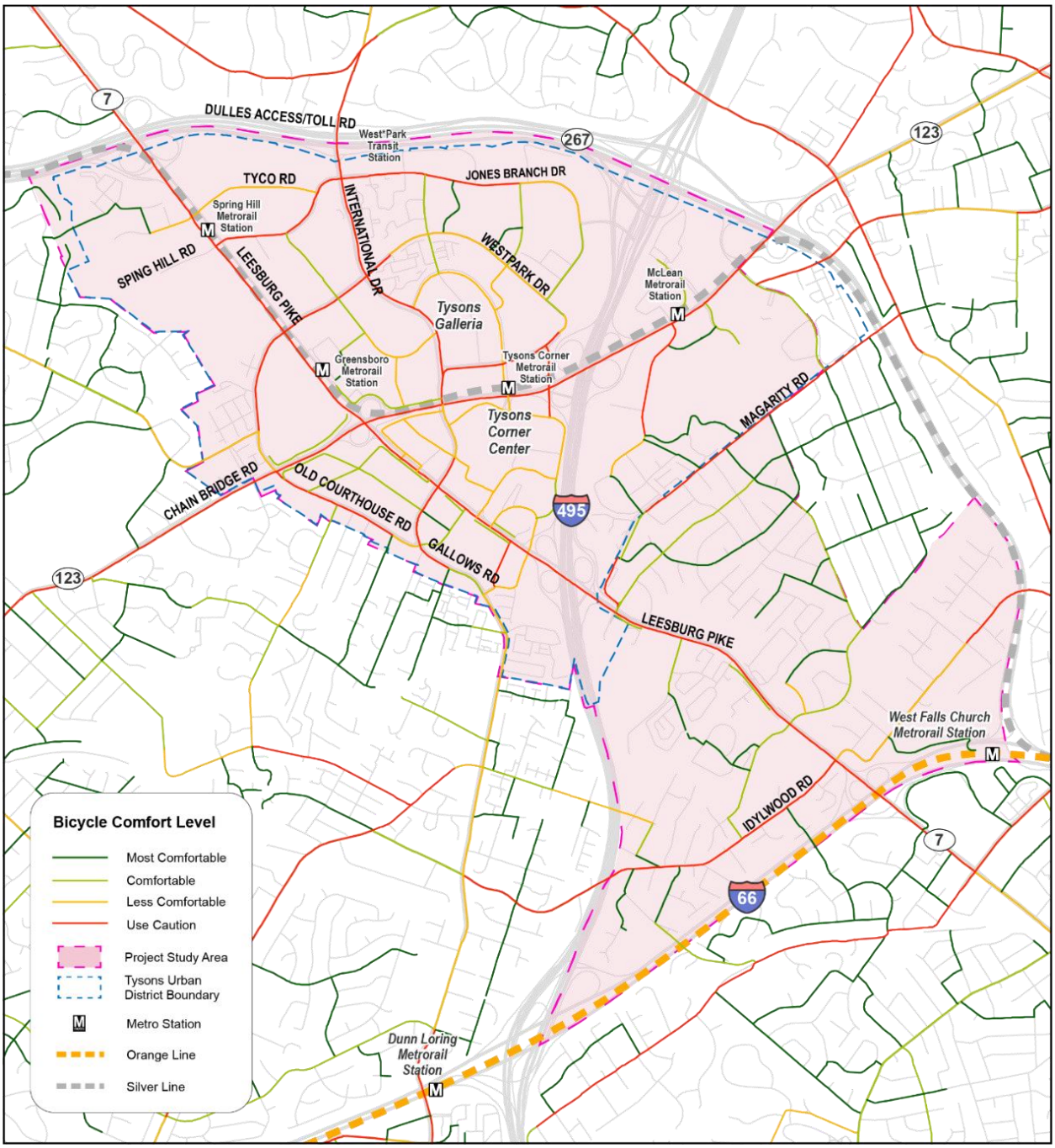
Figure 5-19 | Study Area Bicycle Facilities



Source: Fairfax County, Google Maps

Figure 5-20 shows cyclist comfort level on the roadway as identified by Fairfax County Department of Transportation. Cyclist comfort is not synonymous with the presence of dedicated bicycle facilities. For example, some roads with adjacent shared paths are labeled as uncomfortable because there is no dedicated bicycle facility on the roadway specifically. Additionally, some of the most comfortable roads have no bicycle facilities, but have fewer lanes, lower speed limits, and less traffic. Most roadways within the study area are at a low comfort level for cyclists.

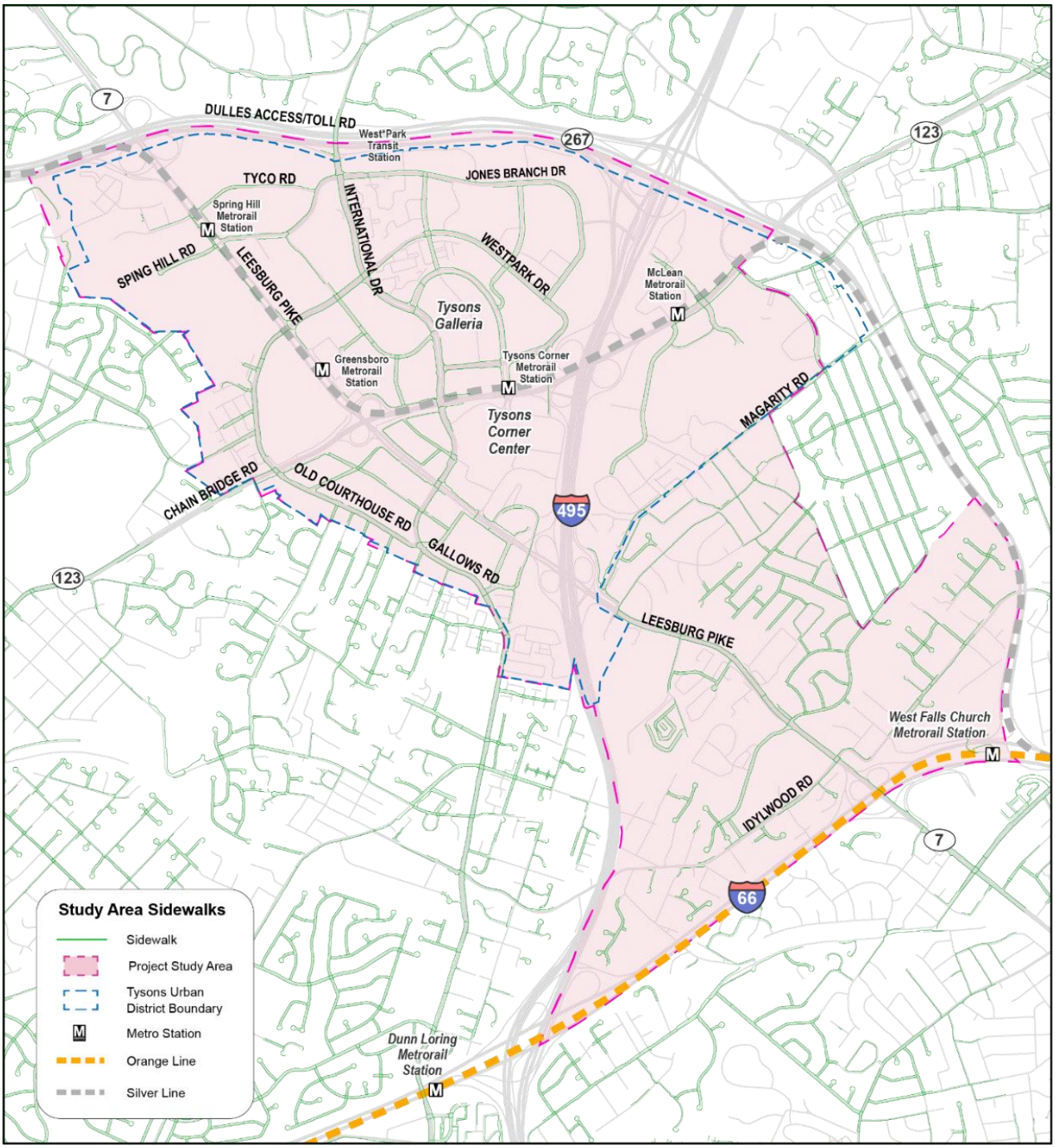
Figure 5-20 | Study Area Roadway Cycling Comfort Level



Source: Fairfax County DOT

Figure 5-21 shows the sidewalk coverage in comparison to the existing roadway network. While mostly complete, some specific neighborhoods and areas more central to the study area are currently missing substantial sidewalk coverage.

Figure 5-21 | Study Area Sidewalk Coverage



Source: Fairfax County DOT

5.6.1 Pedestrian Crossing Times

Pedestrian crossing times were obtained from the traffic simulation model for the Existing and Future No- Build Conditions at seven key intersections along Route 7 and International Drive as listed below:

- Route 7 & Patterson Road,
- Route 7 & Fashion Boulevard,
- Route 7 & International Drive,
- Route 7 & Westpark Drive
- Route 7 & Spring Hill Road
- International Drive & Fletcher Street
- International Drive & Greensboro Drive

These intersections were chosen due to their high pedestrian activity and potential BRT station locations. **Table 5-18** provides a summary of the average pedestrian crossing distances and crossing times across the mainline (i.e., Route 7 or International Drive) for the Existing and the Future No-Build Conditions. Crossing times include both the experienced signal delay and the actual time to cross the mainline. Note that some crossing distances have increased in the Future No-Build due to planned roadway widening projects. In general, shorter cycle lengths (ideally less than 90 seconds) and longer walk intervals provide better service to pedestrians, encourage better signal compliance, and improve pedestrian safety. Existing and Future No-Build pedestrian crossing times on Route 7, approach or exceed 2.5 minutes in both the AM and PM at all locations, with the Spring Hill Road and Westpark Drive intersections having the longest average crossing time. The Existing and Future No-Build pedestrian crossing times for International Drive range from 1.5 to 2 minutes.

Table 5-18 | Corridor Pedestrian Crossing Times

Corridor	Intersection	Existing			Future No Build		
		Crossing Distance (ft)	AM (mins)	PM (mins)	Crossing Distance (ft)	AM (mins)	PM (mins)
Route 7	Patterson Rd	120	2.2	2.2	130	2.4	2.2
	Fashion Blvd	165	2.3	2.3	175	2.3	2.4
	International Dr	165	2.2	2.4	175	2.3	2.4
	Westpark Dr	225	2.7	2.9	225	2.6	2.4
	Spring Hill Rd	230	2.6	2.7	230	2.7	2.7
International Dr	Fletcher St	105	1.3	1.6	105	2.3	2.1
	Greensboro Dr	145	2.0	2.1	145	1.6	2.1

Source: Existing Conditions and Future No- Build Traffic Models

5.7 Existing Conditions and No Build Summary

Table 5-19 compares the Future No-Build scenario against the Existing Conditions within the study area. The following provides a summary of the major findings from the comparison of the two scenarios:

- The study area residential population is forecast to grow approximately 175 percent (+60,000 residents) by 2045 in the Future No-Build scenario. Growth is concentrated along the Silver Line Metrorail corridor, especially adjacent to Route 7. Low residential population growth is characteristic of areas that currently comprise office buildings, retail destinations, and transportation infrastructure such as highways.
- The number of study area households is forecast to grow approximately 197 percent (+32,000 households) by 2045 in the Future No-Build scenario. Household growth is slightly greater than population growth, which suggests a decrease in the average household size.
- Study area Employment is forecast to grow approximately 70 percent (+67,000 jobs) by 2045 in the Future No- Build scenario. Employment growth is inconsistent throughout the study area, but job density is concentrated along the Silver Line Metrorail corridor and Route 7.
- Likely a result of an integrated land use policy, population and employment density will increase in the same areas, notably around the four Metrorail stations.
- Overall study area transit ridership is expected to increase 290 percent (+27,000 riders) by 2045 in the Future No-Build scenario. This coincides with a 3.7 percent increase in transit mode share. Approximately two-thirds of transit ridership growth is attributable to the increase in Metrorail ridership. Proposed new bus services support significant growth in bus ridership.
- The Future No-Build scenario suggests slower transit travel speeds and less reliable service compared to Existing Conditions. Overall, transit person throughput will increase between 50 to 100 percent.
- A comparison of traffic volumes suggests the new grid of streets, specifically the Boone Boulevard extension and the Greensboro Drive extension and toll ramp, disperses travel volumes from Route 7 to these new parallel corridors. Even with through volumes on Route 7 decreasing, intersection LOS deteriorates due to significant increases in volumes on the minor roads crossing Route 7.
- Person throughput on automobiles and buses increases approximately 15 percent (+15,000 persons) during both peak periods. This is despite corridor travel times slowing and the study area experiencing greater intersection delays in the Future No-Build scenario (five intersections at LOS F in AM Peak and six intersections at LOS F in PM Peak).
- Greater vehicle volumes lead to increases in VMT and VHT in the Future No-Build scenario. Vehicle hours increase at a higher rate than vehicle miles, indicating slower vehicle speeds and increased congestion.
- Pedestrian crossing times for Route 7 generally approach or exceed 2.5 minutes at all locations, with Spring Hill Road having the longest average pedestrian crossing time. Pedestrian crossing times for International Drive are lower at around 1.5 to 2 minutes on average.

Table 5-19 | Existing - Future No-Build Comparison Summary Matrix

Measure of Effectiveness	Scenario Comparison	
	Existing Conditions	Future No Build 2045
Goal: Access and Mobility – Provide choices through accessible transit service		
Objective: Serve population, employment, and activity centers with BRT		
Population in Study Area	35,600	97,800
Households in Study Area	16,400	48,500
Employment in Study Area	96,000	163,400
Land Use/Activity Centers	--	Clusters of high density, mixed-use surrounding four Metrorail stations
Goal: Transportation Network Performance - Ensure efficient movement of people and goods		
Objective: Increase Corridor Transit Usage		
Transit Ridership in Study Area	9,500	37,000
Transit Mode Share	4.9%	8.6%
Objective: Improve Transit Operations in Corridor		
Bus Travel Speeds (mph) – min / max	AM: 8.5 / 29.6 PM: 4.3 / 29.4	AM: 3.8 / 19.2 PM: 3.4 / 29.6
Bus Reliability (st. dev) – min / max	AM: 0.1 / 0.6 PM: 0.1 / 0.8	AM: 0.1 / 1.5 PM: 0.1 / 0.9
Transit Throughput (max persons)	1,525 (Route 7 at Dominion Dr)	3,062 (Route 7 at Westpark Dr)
Objective: Maintain acceptable transportation network performance for all modes		
Total Corridor Person Throughput (max persons)	97,850 (Route 7 at Westpark Dr)	111,707 (Route 7 at Fashion Blvd)
Automobile Travel Speed (mph) – min / max	AM: 16.0 / 30.6 PM: 10.8 / 31.0	AM: 10.8 / 18.1 PM: 8.1 / 17.7
Automobile Intersection Delay – Average	AM: 23.0 PM: 35.4	AM: 41.0 PM: 43.7
Automobile Intersection LOS – No. Failing Intersections	AM: 0 PM: 3	AM: 5 PM: 6
Goal: Protect and improve environmental resources		
Objective: Minimize negative impacts to the natural environment		
Change in VMT/VHT in Study Area	VMT: 1,518,970 VHT: 51,230	VMT: 1,749,306 (+15%) VHT: 65,541 (+28%)
Goal: Improve safety for all roadway users		
Objective: Improve the pedestrian environment in the study corridor		
Pedestrian Crossing Times (Avg Corridor Crossing – AM/PM)	Route 7: 2.4 / 2.5 mins International Dr: 1.7 / 1.9 mins	Route 7: 2.5 / 2.4 mins International Dr: 1.5 / 2.1 mins

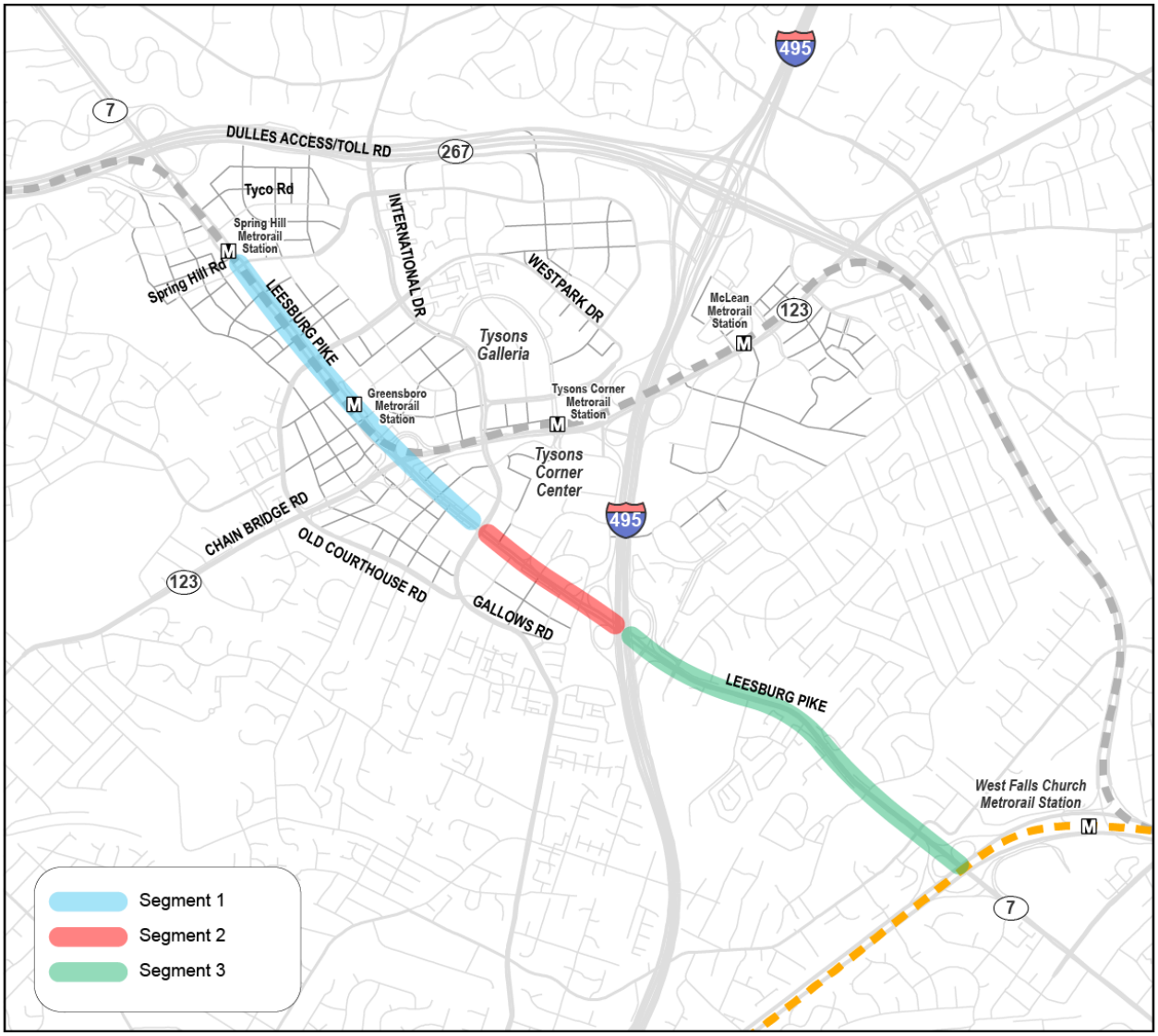
6 Alternatives Development

As an initial phase in the analysis of alternatives for the study, FCDOT and the project team brainstormed a large number of potential alternatives to ensure that the full range of possible options related to routing, alignment, and cross-sections were considered. Nine of the most promising alternatives were carried into the Assessment Phase, during which each was analyzed across several Measures of Effectiveness (MOEs). This analysis was used to help narrow the number of possible alternatives and develop and refine three complete end-to-end alternatives that were carried forward to the study's Evaluation Phase. The Assessment Phase included qualitative and quantitative analyses on the potential costs and benefits of each alternative. More detailed analysis, including travel demand modeling and VISSIM traffic simulation were conducted as part of the Evaluation Phase. The results of the Alternatives Assessment are presented in the following section.

The project team held an Alternatives Development Workshop in April 2019 to discuss the options for developing a range of BRT alternatives for the study. Together, with FCDOT and other project stakeholders, the project team developed nine alternatives for study that included options for routing, alignment, and street cross-sections. Details of the discussion and results of that workshop are documented in the Alternatives Development Workshop Meeting Minutes (May 2019). These meeting minutes can be found in **Appendix D**.

The corridor alternatives are separated by segment as shown in **Figure 6-1**. Alternatives 1 through 6 are for Segment 1 and Alternatives 7 through 9 are for Segments 2 and 3. At the culmination of the Assessment Phase, the preferred features - including routing, alignment, and cross-sections - were combined to create three end-to-end alternatives across these segments. Transitions between different alignments and cross-sections were studied in greater detail in the Evaluation Phase.

Figure 6-1 | Alignment Segments



6.1 Alternative 1/Segment 1

Route 7 from International Drive to Spring Hill Station Terminus (Curb Busway)

Alternative 1 proposed an alignment on Route 7 with a dedicated BRT curb busway. Station locations are near the existing Spring Hill Road and Greensboro Metrorail stations. **Figure 6-2** shows the alignment and approximate station locations proposed for Alternative 1. The alternative included a non-revenue turnaround along Tyco Road and Spring Hill Road.

Figure 6-3 shows the potential cross-section for the Route 7 portion of the alignment, which included three general traffic lanes and an exclusive curb-running BRT lane in each direction on Route 7 from International Drive to the Spring Hill Station terminus. **Figure 6-4** shows the Alternative 1 cross-section of Tyco Road from Route 7 to Spring Hill Road. This cross-section shows two general traffic lanes in each direction. **Figure 6-5** shows the Alternative 1 cross-section of Spring Hill Road from Tyco Road to Route 7. This cross-section also shows two general traffic lanes in each direction.

Figure 6-2 | Alternative 1 Alignment

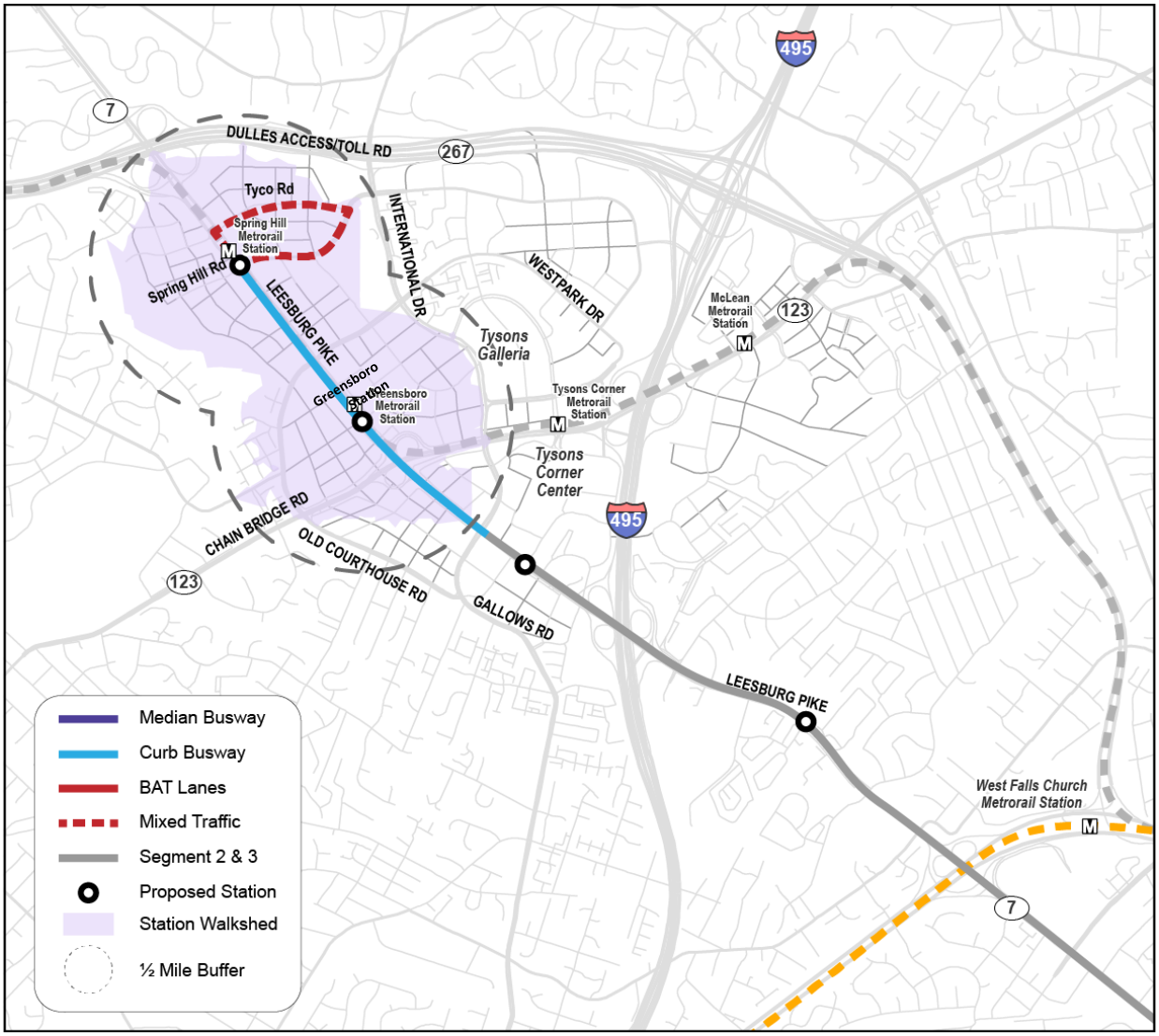


Figure 6-3 | Alternative 1 cross-section of Route 7 from International Drive to Spring Hill Road Station terminus

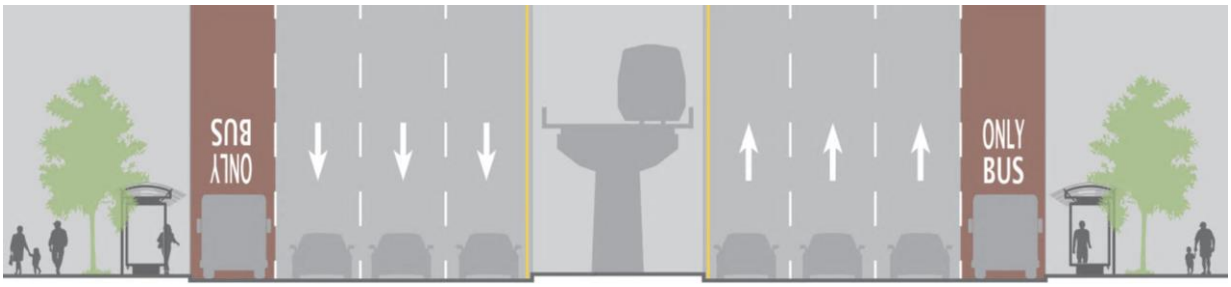


Figure 6-4 | Alternative 1 cross-section of Tyco Road from Route 7 to Spring Hill Road

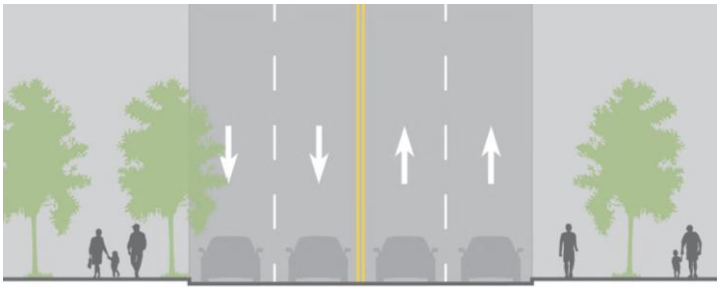
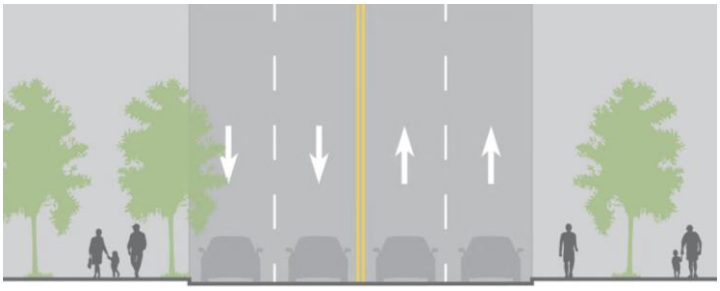


Figure 6-5 | Alternative 1 cross-section of Spring Hill Road from Tyco Road to Route 7



6.2 Alternative 2/Segment 1

Route 7 from International Drive to Spring Hill Metrorail Station Terminus (Mixed Traffic)

Alternative 2, proposed the same alignment and station locations as Alternative 1 but does not provide exclusive bus lanes. Station locations are near the existing Spring Hill and Greensboro Metrorail stations. **Figure 6-6** shows the alignment and station locations proposed for Alternative 2. The alternative includes a non-revenue turnaround along Tyco Road and Spring Hill Road.

Figure 6-7 shows the potential street cross-section for Alternative 2 for the Route 7 portion of the alignment. This cross-section features four general traffic lanes in each direction along Route 7. **Figure 6-8** shows the street cross-section for Alternative 2 on Tyco Road from Route 7 to Spring Hill Road. This cross-section features two general traffic lanes in each direction. **Figure 6-9** shows the street cross-section for Alternative 2 on Spring Hill Road from Tyco Road to Route 7. This cross-section also features two general traffic lanes in each direction.

Figure 6-6 | Alternative 2 Alignment

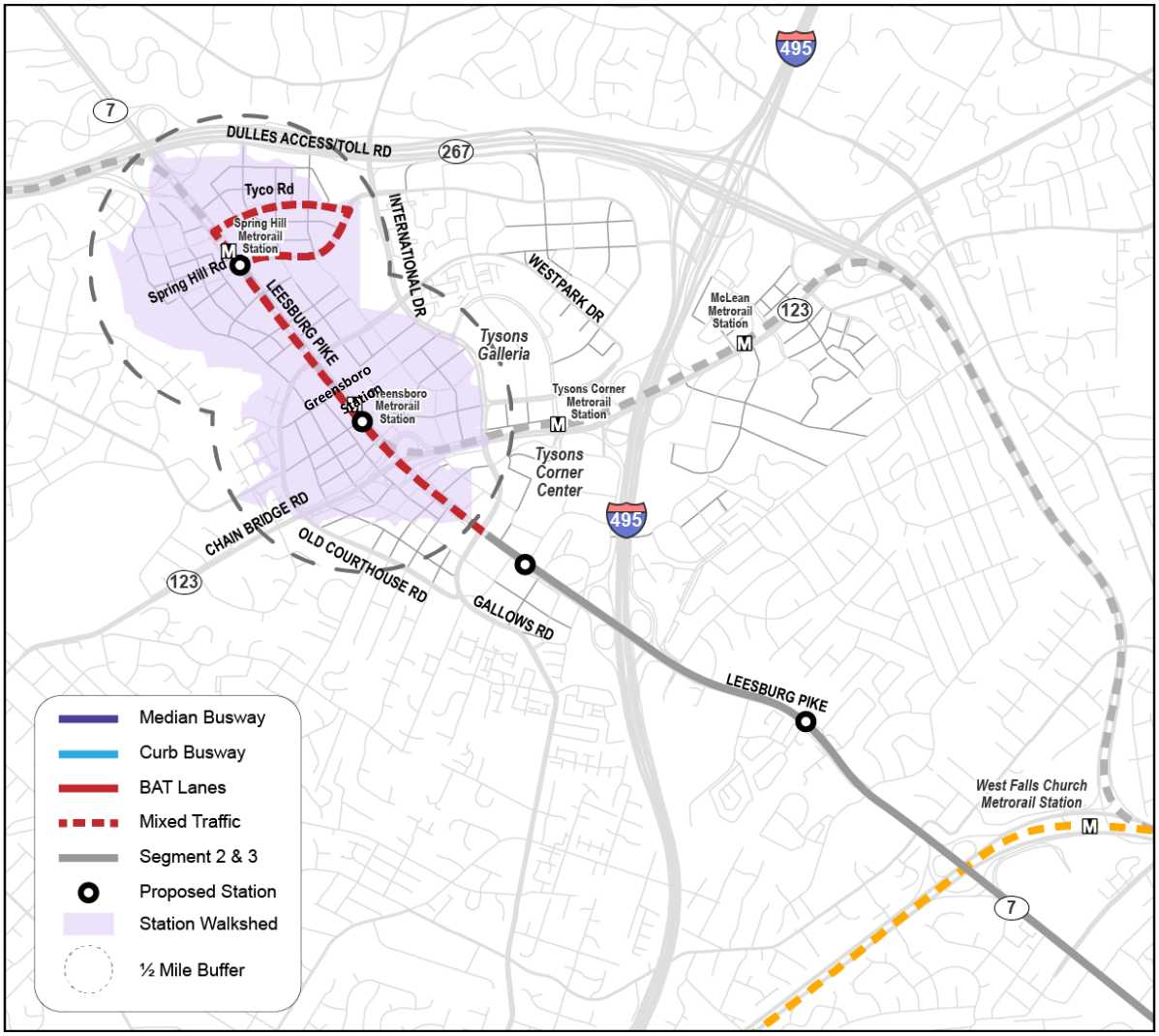


Figure 6-7 | Alternative 2 cross-section of Route 7 from International Drive to Spring Hill Metrorail Station terminus

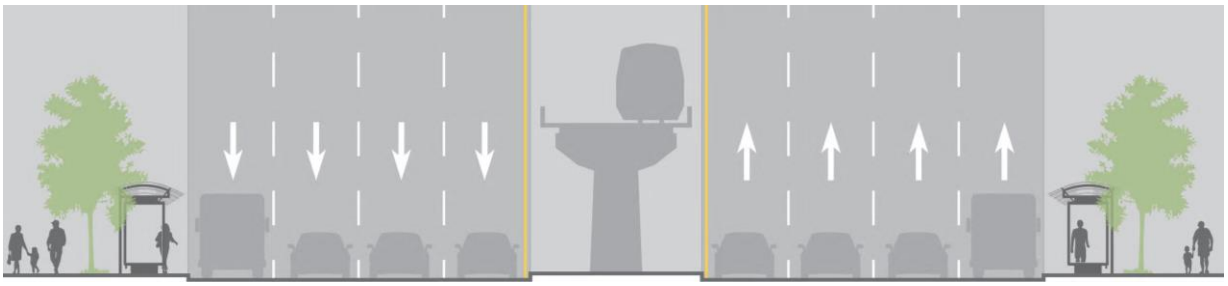


Figure 6-8 | Alternative 2 cross-section of Tyco Road from Route 7 to Spring Hill Road

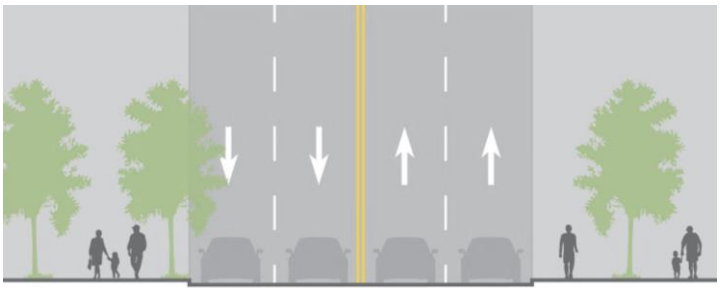
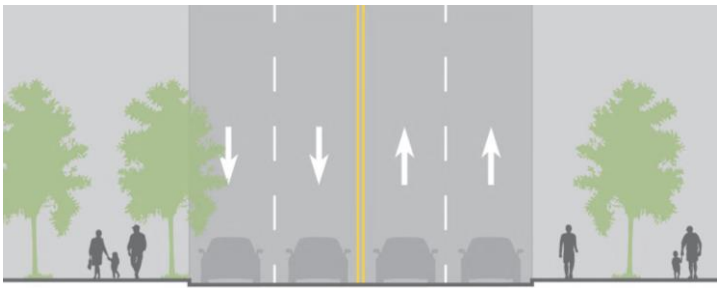


Figure 6-9 | Alternative 2 cross-section of Spring Hill Road from Tyco Road to Route 7



6.3 Alternative 3/Segment 1

Route 7 from International Drive to West*Park Transit Station Terminus via Spring Hill Station

Alternative 3 proposes a similar alignment to Alternative 1 with an extension to the West*Park Transit Station via Tyco Road and Spring Hill Road. BRT would operate in BAT lanes along Route 7 from International Drive to Spring Hill Road via Tyco Road and in mixed traffic on Spring Hill Road. Station locations would be located at the West*Park Transit Station, Spring Hill Metrorail Station, and at the Westpark Drive and Route 7 intersection. **Figure 6-10** shows the alignment and station locations for Alternative 3.

Figure 6-11, **Figure 6-12**, and **Figure 6-13** show the street cross-sections for Alternative 3. **Figure 6-11** shows the cross-section on Route 7 from International Drive to Tyco Road and features three general traffic lanes and one BAT lane in each direction. **Figure 6-12** shows the cross-section on Tyco Road from Route 7 to Spring Hill Road, and **Figure 6-13** shows the cross-section on Spring Hill Road from Tyco Road to the terminus.

Figure 6-10 | Alternative 3 Alignment

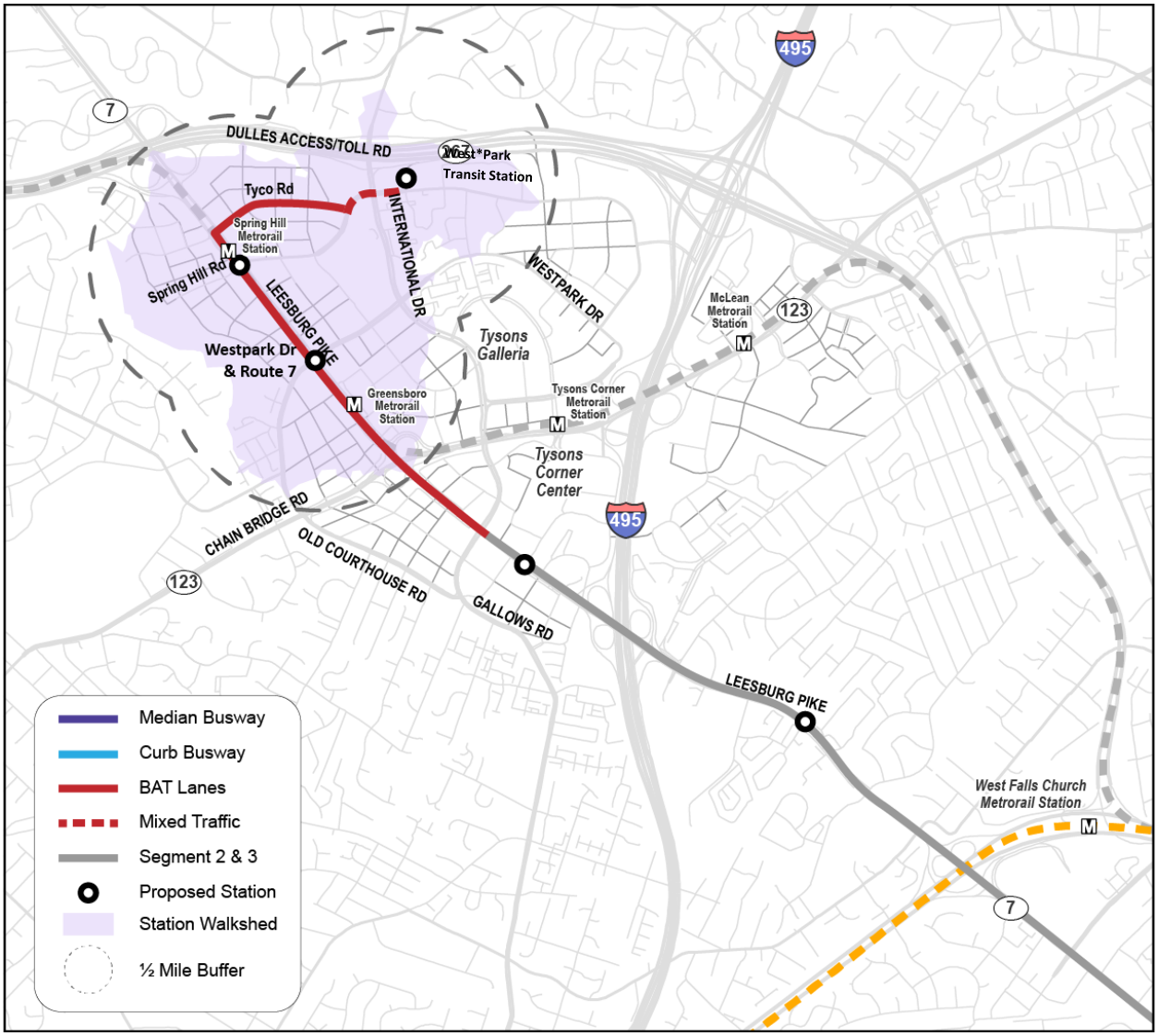


Figure 6-11 | Alternative 3 cross-section of Route 7 from International Drive to Tyco Road

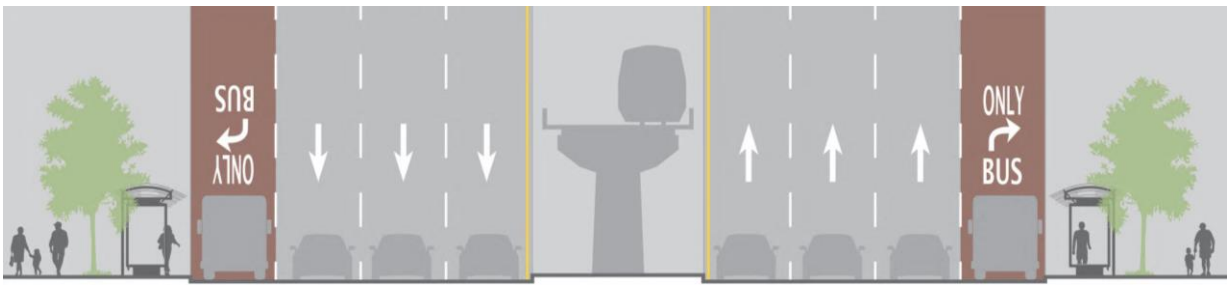


Figure 6-12 | Alternative 3 cross-section of Tyco Road from Route 7 to Spring Hill Road

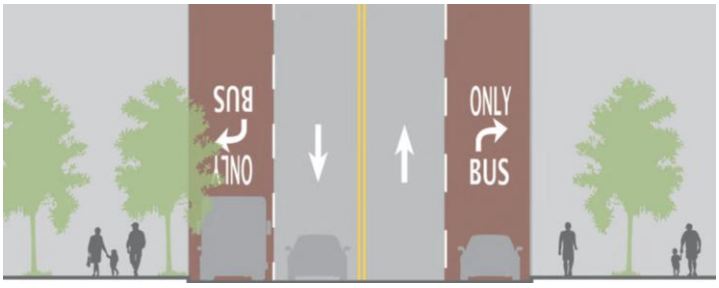
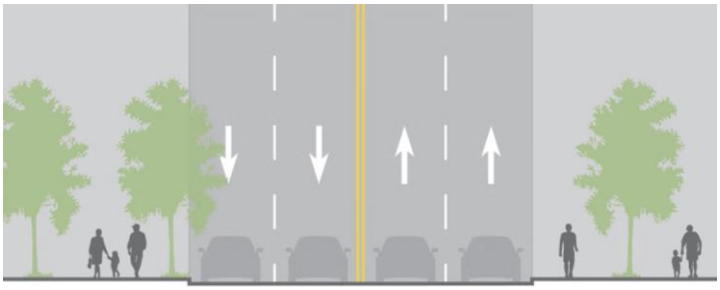


Figure 6-13 | Alternative 3 cross-section of Spring Hill Road from Tyco Road to West*Park Transit Station Terminus



6.4 Alternative 4/Segment 1

International Drive from Route 7 to Tysons Corner Metrorail Station Terminus

Alternative 4 proposes a shorter alignment with a terminal station at the Tysons Corner Metrorail station. BRT would operate in BAT lanes on International Drive from Route 7 to Chain Bridge Road and in a curb busway on Chain Bridge Road from International Drive to the terminus station at Tysons Corner intermodal facility, which is adjacent to the existing Metrorail station. This Alternative adds a new exclusive BRT lane in the segment on Chain Bridge Road from International Drive to the existing bus bays to accommodate additional space for layover. The remaining portion of the route will operate in mixed traffic from the Metrorail station to Route 7 on Tysons Boulevard and Tysons One Place, and International Drive before rejoining the median busway on Route 7. **Figure 6-14** shows the alignment and station locations for Alternative 4.

Figure 6-15,, **Figure 6-16**, and **Figure 6-17** show the street cross-sections for Alternative 4. **Figure 6-15** shows the cross-section on International Drive from Route 7 to Chain Bridge Road and features two general traffic lanes and one BAT lane in the northbound direction and three general purpose lanes in the southbound direction. **Figure 6-16** shows the cross-section on Chain Bridge Road and **Figure 6-17** shows the cross-section on Tysons One Place.

Figure 6-14 | Alternative 4 Alignment

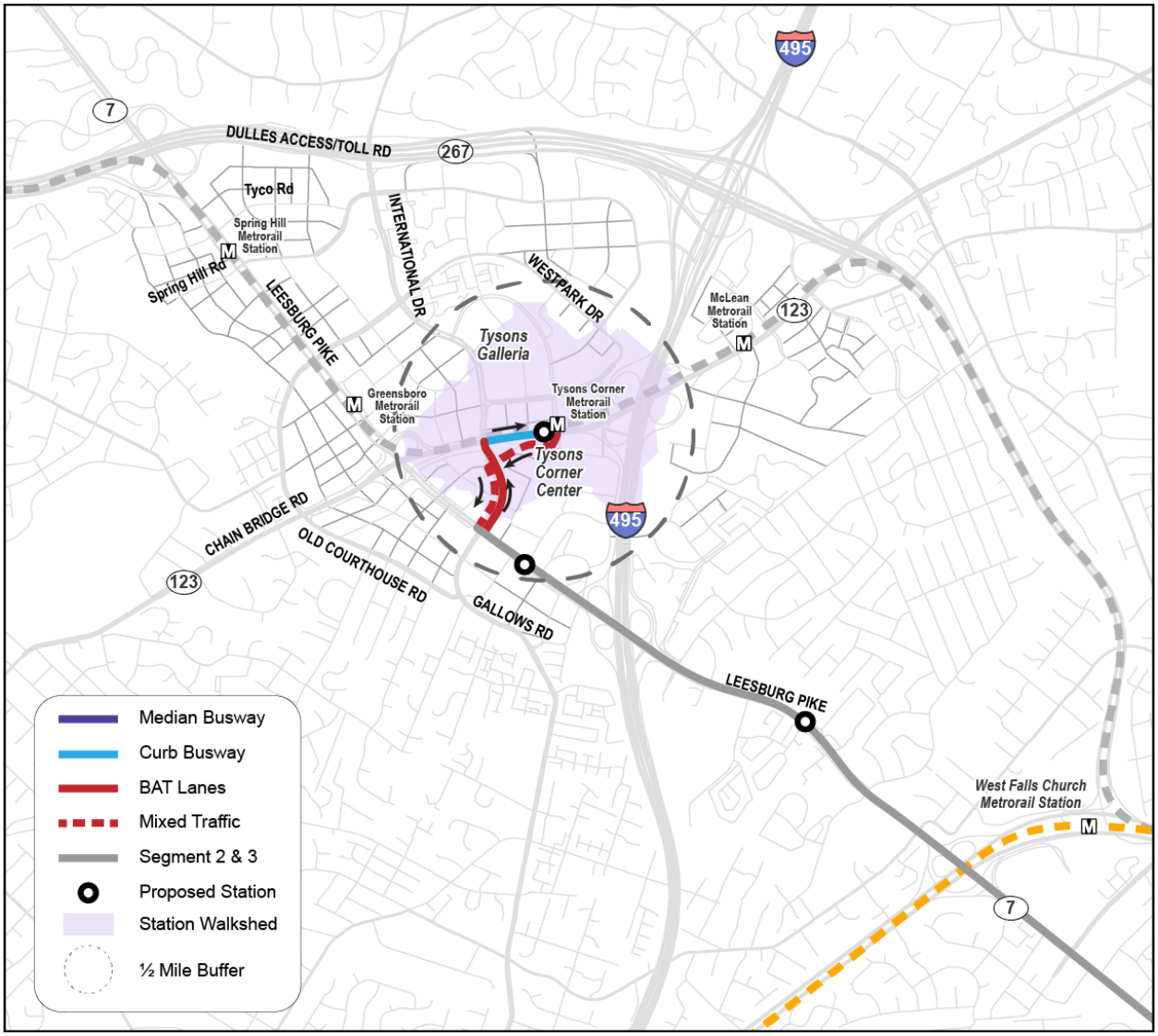


Figure 6-15 | Alternative 4 cross-section of International Drive from Route 7 to Chain Bridge Road

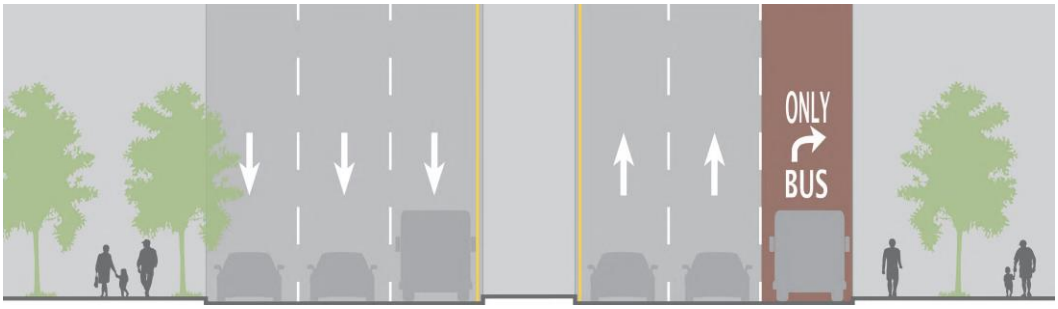


Figure 6-16 | Alternative 4 cross-section of Chain Bridge Road from International Drive to Tysons One Place

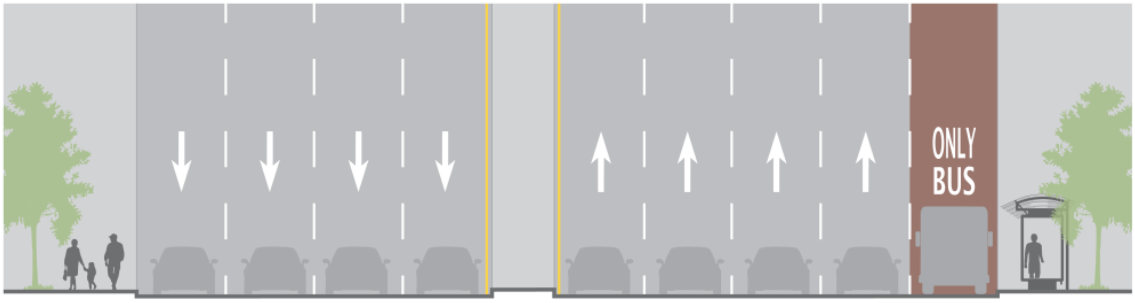
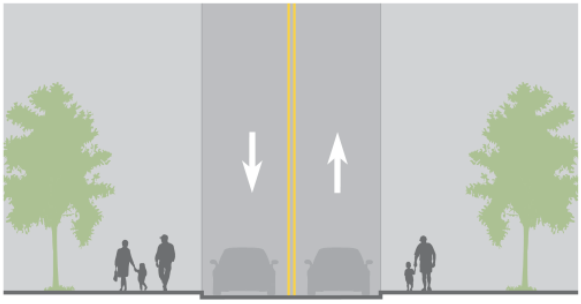


Figure 6-17 | Alternative 4 cross-section of Tysons One Place from Tysons Corner Metrorail Station to International Drive.



6.5 Alternative 5/Segment 1

International Drive from Route 7 to Spring Hill Station Terminus via International Drive

The alignment proposed for Alternative 5 follows International Drive to its terminus at Spring Hill Metrorail station instead of Route 7, as shown in in **Figure 6-18**. This alternative provides BAT lanes on International Drive, Spring Hill Road, and Tyco Road. BAT lanes were chosen for this Alternative due to the number of driveway access points and open median left-turns through the corridor. Stations are located at Chain Bridge Road, Westpark Drive, and Spring Hill Road on International Drive, with a terminal station at Spring Hill Metrorail station.

Figure 6-19 shows the roadway cross-section for Alternative 5 on International Drive from Route 7 to Spring Hill Road. This cross-section features BAT lanes in both northbound and southbound directions. **Figure 6-20** shows the roadway cross-section of Alternative 5 on Spring Hill Road from International Drive to Route 7. This cross-section features a westbound BAT lane. **Figure 6-21** shows the roadway cross-section of Alternative 5 on Tyco Road from Route 7 to Spring Hill Road. This cross-section features an eastbound BAT lane.

Figure 6-18 | Alternative 5 Alignment

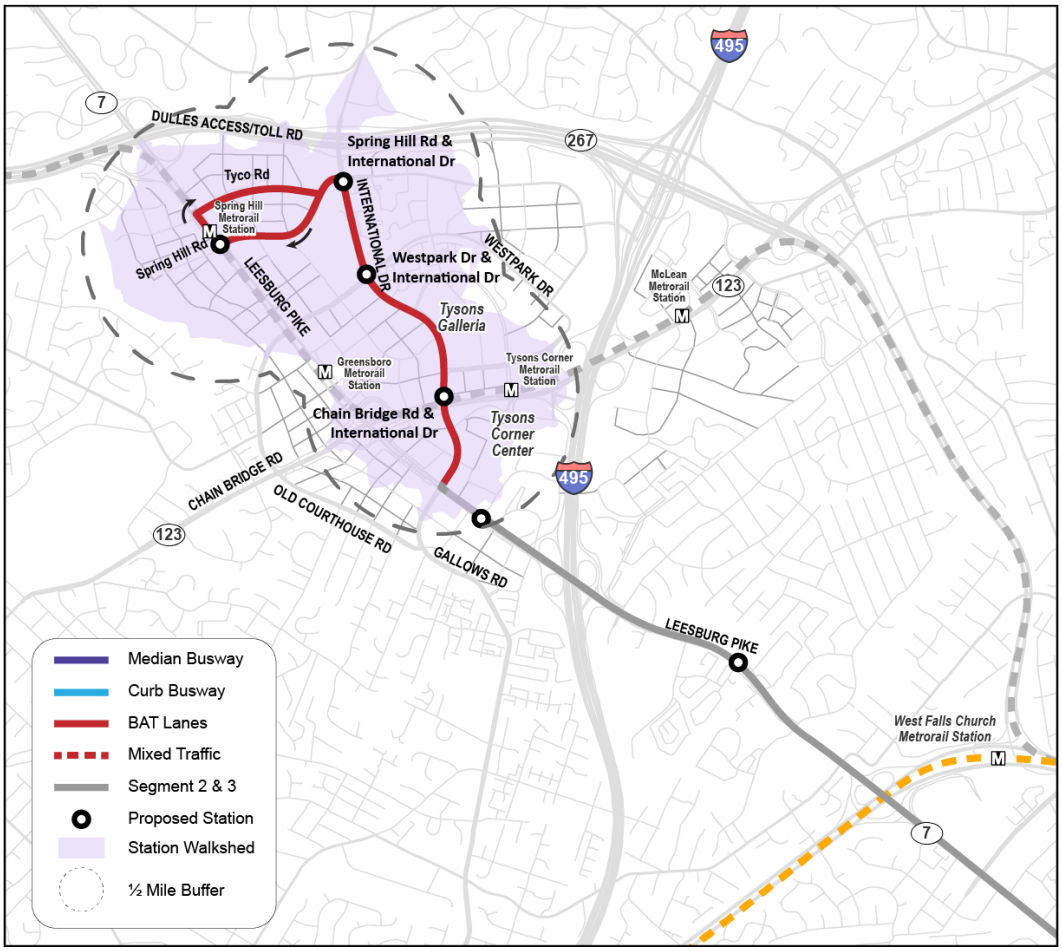


Figure 6-19 | Alternative 5 Cross-section of International Drive from Route 7 to Spring Hill Road

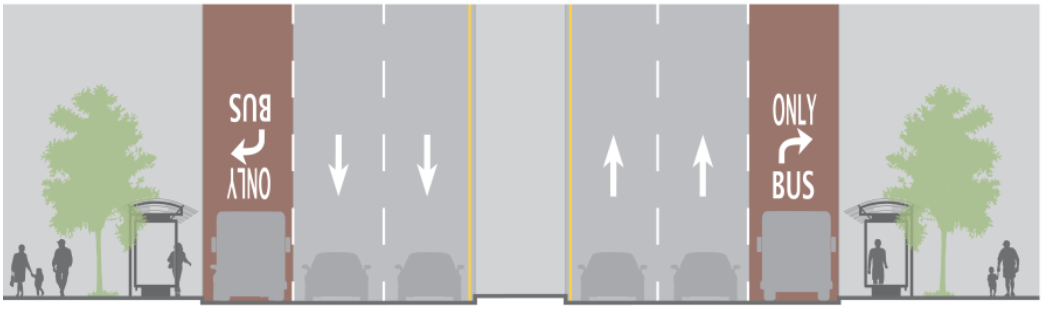


Figure 6-20 | Alternative 5 Cross-section of Spring Hill Road from International Drive to Route 7

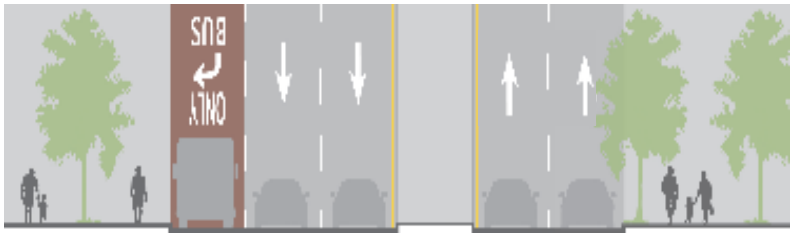


Figure 6-21 | Alternative 5 Cross-section of Tyco Road from Route 7 to Spring Hill Road

6.6 Alternative 6/Segment 1

International Drive and Boone Boulevard Loop (Includes Comp Plan Extension for Boone Blvd)

Alternative 6 proposes a one-way loop alignment with stations located at Chain Bridge Road, Westpark Drive, and Spring Hill Road, along International Drive, Spring Hill Metrorail station, Boone Boulevard and Gosnell Road, and on Chain Bridge Road at Route 7. BRT would operate in BAT lanes on International Drive and Spring Hill Road, a curb busway on Boone Boulevard and Chain Bridge Road, and in BAT lanes when rejoining Route 7. **Figure 6-22** shows the alignment and station locations for Alternative 6.

Figure 6-23 shows the roadway cross-section for Alternative 6 on International Drive from Route 7 to Spring Hill Road. This cross-section features a northbound BAT lane. **Figure 6-24** shows the roadway cross-section for Alternative 6 on Spring Hill Road from International Drive to Boone Boulevard. This cross-section features a westbound BAT lane. **Figure 6-25** shows the roadway cross-section for Alternative 6 on Boone Boulevard from Spring Hill Road to Chain Bridge Road. This cross-section includes a southbound curb busway. **Figure 6-26** shows the roadway cross-section for Alternative 6 on Chain Bridge Road from Boone Boulevard to Route 7. This cross-section shows an eastbound curb busway.

Figure 6-22 | Alternative 6 Alignment

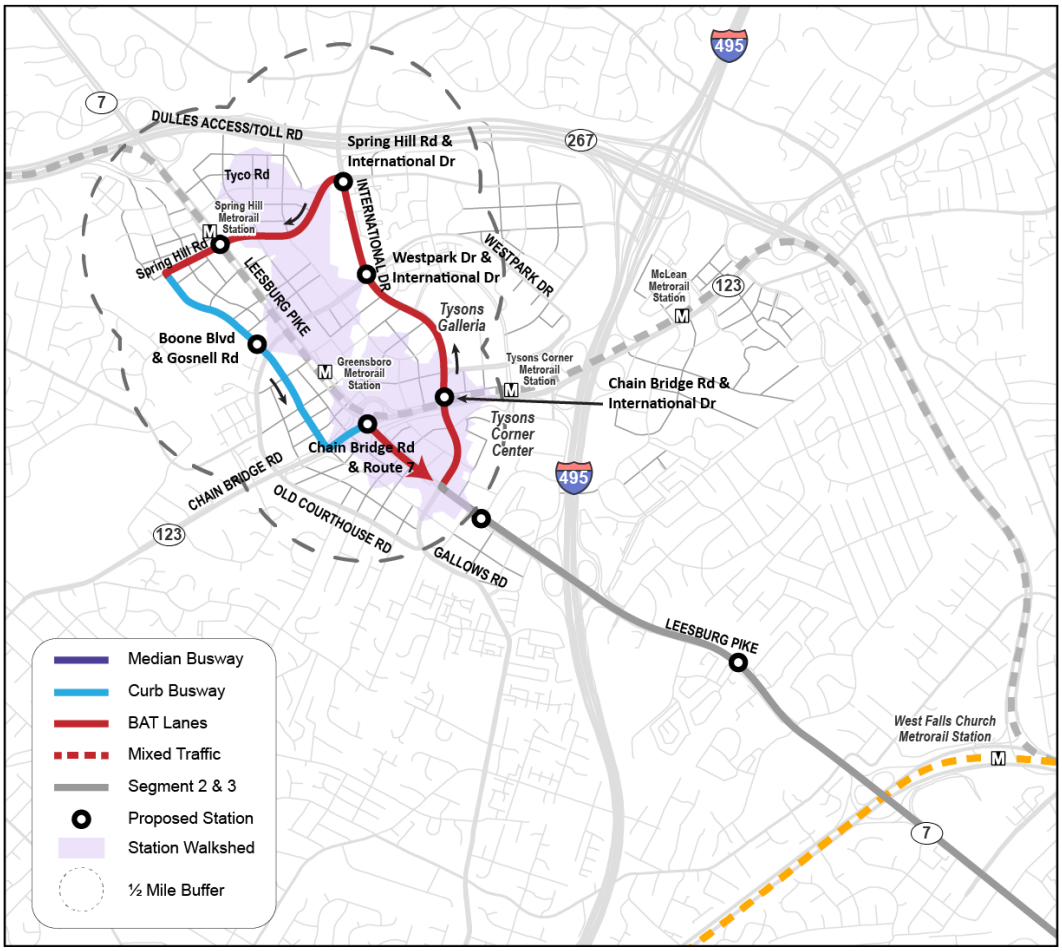


Figure 6-23 | Alternative 6 Cross-section of International Drive from Route 7 to Spring Hill Road

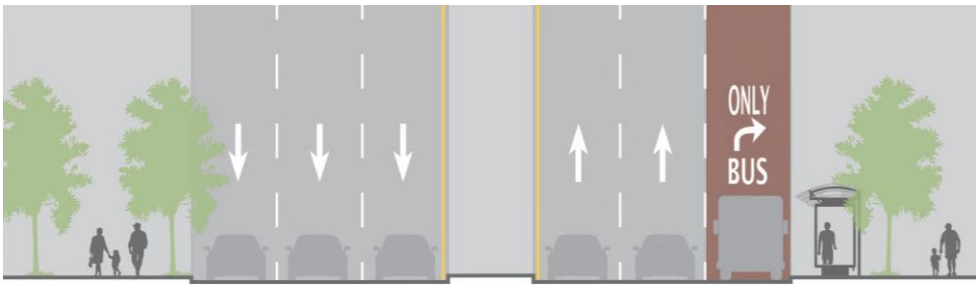


Figure 6-24 | Alternative 6 Cross-section of Spring Hill Road from International Drive to Boone Boulevard

Figure 6-25 | Alternative 6 Cross-section of Boone Boulevard from Spring Hill Road to Chain Bridge Road

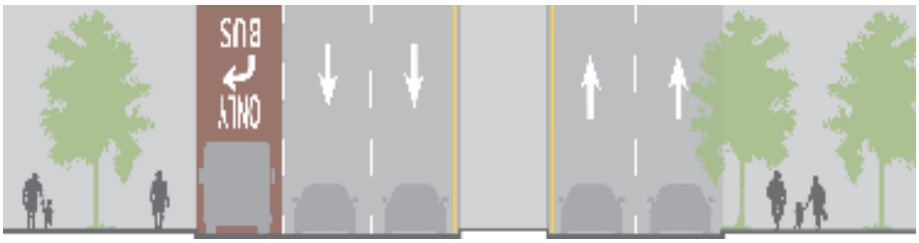
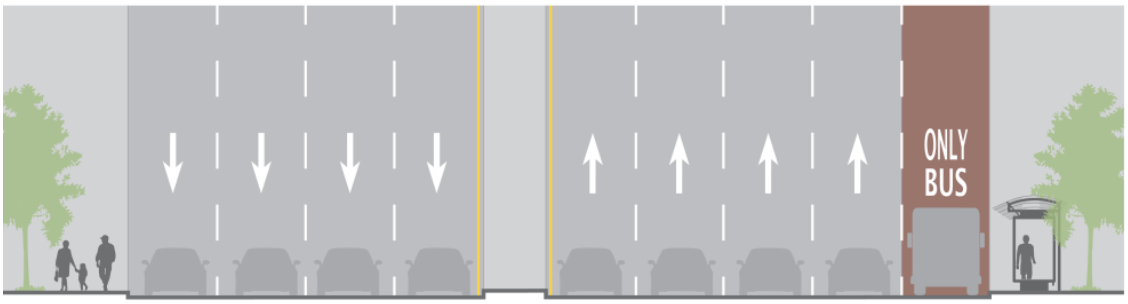


Figure 6-26 | Alternative 6 Cross-section of Chain Bridge Road from Boone Boulevard to Route 7



6.7 Alternative 7/Segments 2 and 3

Route 7 between International Drive and I-66, Median Busway (Includes Comp Plan Widening for Transit)

Alternative 7 proposes a median busway on Route 7 from International Drive to I-66, as shown in **Figure 6-27**. Segment 2 from International Drive to I-495 will include a cross-section of three general traffic lanes and one dedicated BRT lane in each direction. **Figure 6-28** shows the proposed cross-section for Segment 2. Segment 3 from I-495 to I-66 will have a cross-section of two general traffic lanes and one dedicated BRT lane in each direction. **Figure 6-29** shows the cross-section for Segment 3. This alternative maintains the number of lanes planned for Route 7 (four lanes in each direction west of I-495; three lanes in each direction east of I-495) per the County's Comprehensive Plan.

Figure 6-27 | Alternative 7 Alignment

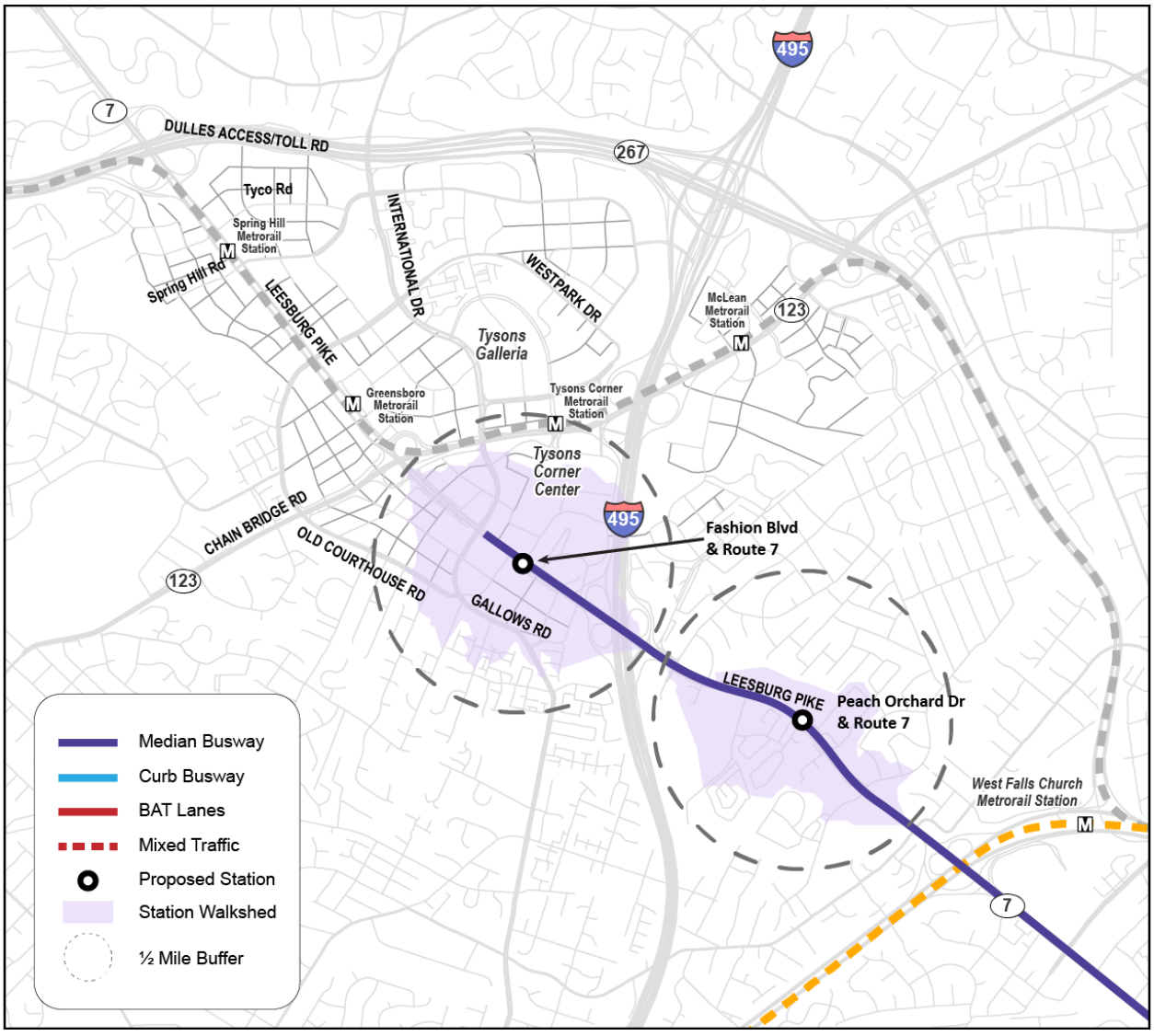


Figure 6-28 | Segment 2 Cross-section of Route 7 from International Drive to I-495

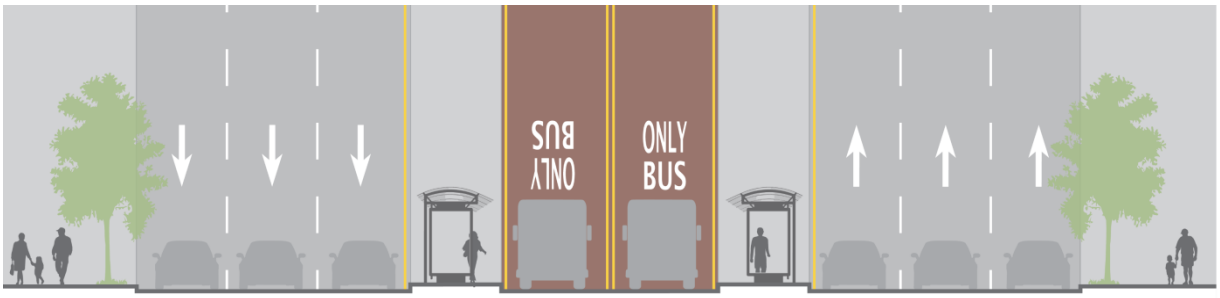
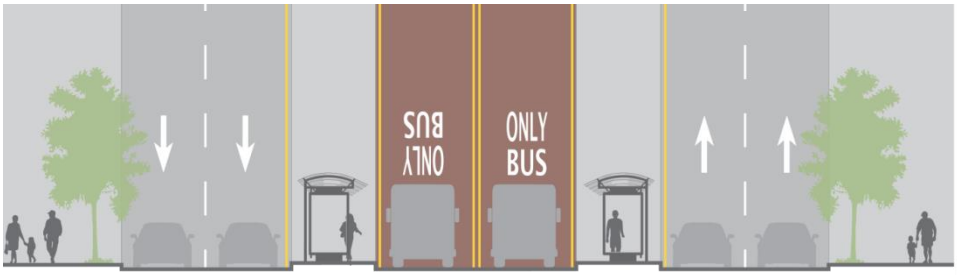


Figure 6-29 | Segment 3 Cross-section of Route 7 from I-495 to I-66



6.8 Alternative 8/Segments 2 and 3

Route 7 between International Drive and I-66, Median Busway with Widening (Includes Comp Plan Widening + Additional Lane for Transit)

Alternative 8 proposes a median busway on Route 7 from International Drive to I-66, as shown in **Figure 6-30**. Segment 2 from International Drive to I-495 will have a cross-section of four general traffic lanes and one BRT lane in each direction. **Figure 6-31** shows the proposed cross-section for Segment 2. Segment 3 from I-495 to I-66 will have a cross-section of three general traffic lanes and one BRT lane in each direction. **Figure 6-32** shows the proposed cross-section for Segment 3. This alternative adds BRT lanes in addition to the Route 7 widening included in the County's Comprehensive Plan.

Figure 6-30 | Alternative 8 Alignment

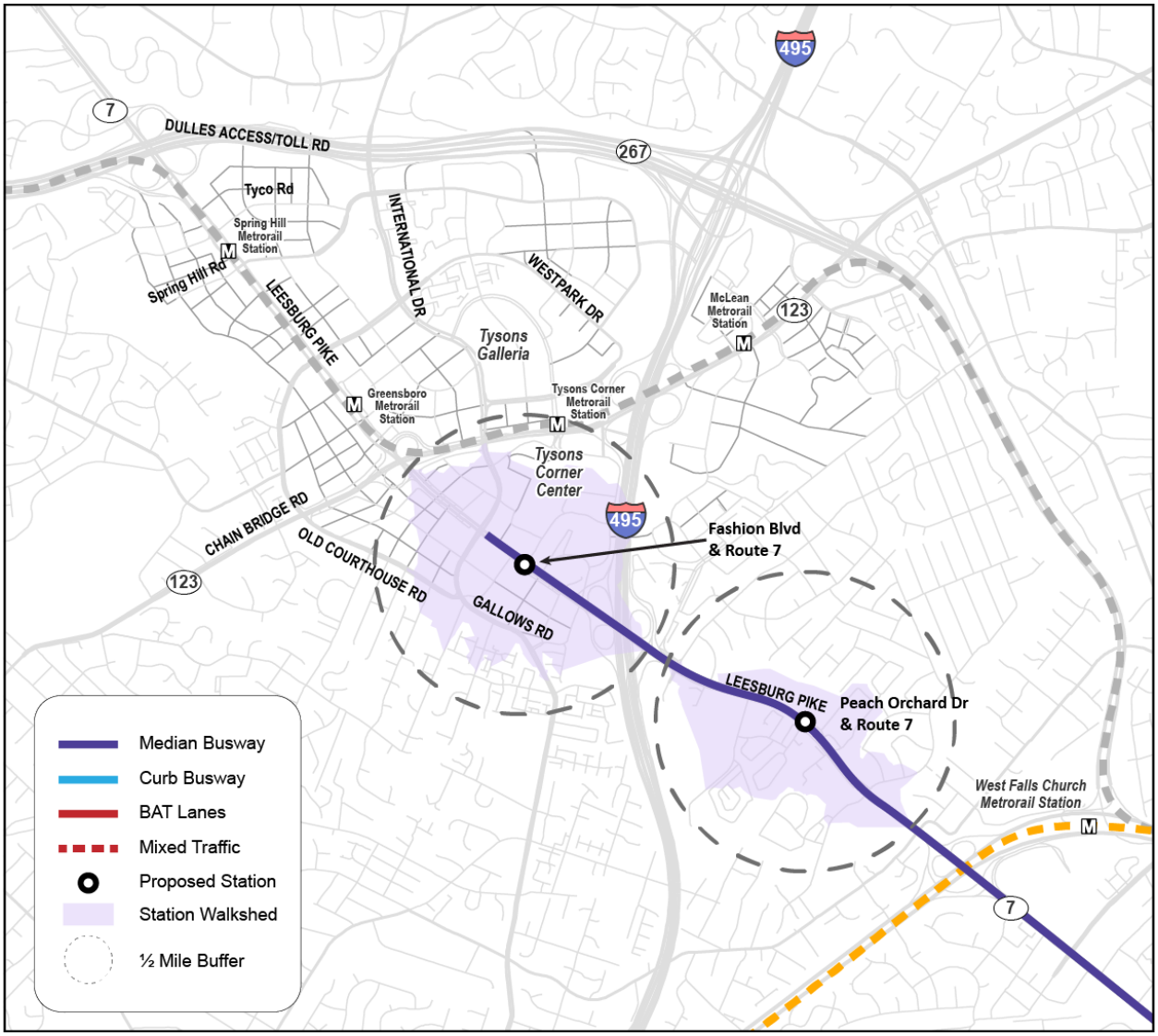
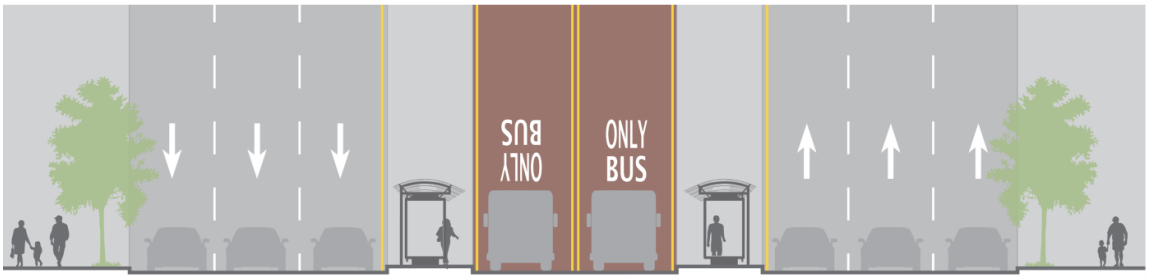


Figure 6-31 | Segment 2 Cross-section of Route 7 from International Drive to I-495

Figure 6-32 | Segment 3 Cross-section of Route 7 from I-495 to I-66



6.9 Alternative 9/Segments 2 and 3

Route 7 between International Drive and I-66, Median Busway Consistent Cross-section (Includes Comp Plan Widening + Additional Lane for Transit in Segment 3)

Alternative 9 proposes a median busway on Route 7 from International Drive to I-66, as shown in **Figure 6-33** with a consistent cross-section of three general traffic lanes and one dedicated BRT lane in each direction. Segment 3 from I-495 to I-66 will require one lane beyond the Comprehensive Plan. **Figure 6-34** shows the cross-section through both segments.

Figure 6-33 | Alternative 9 Alignment

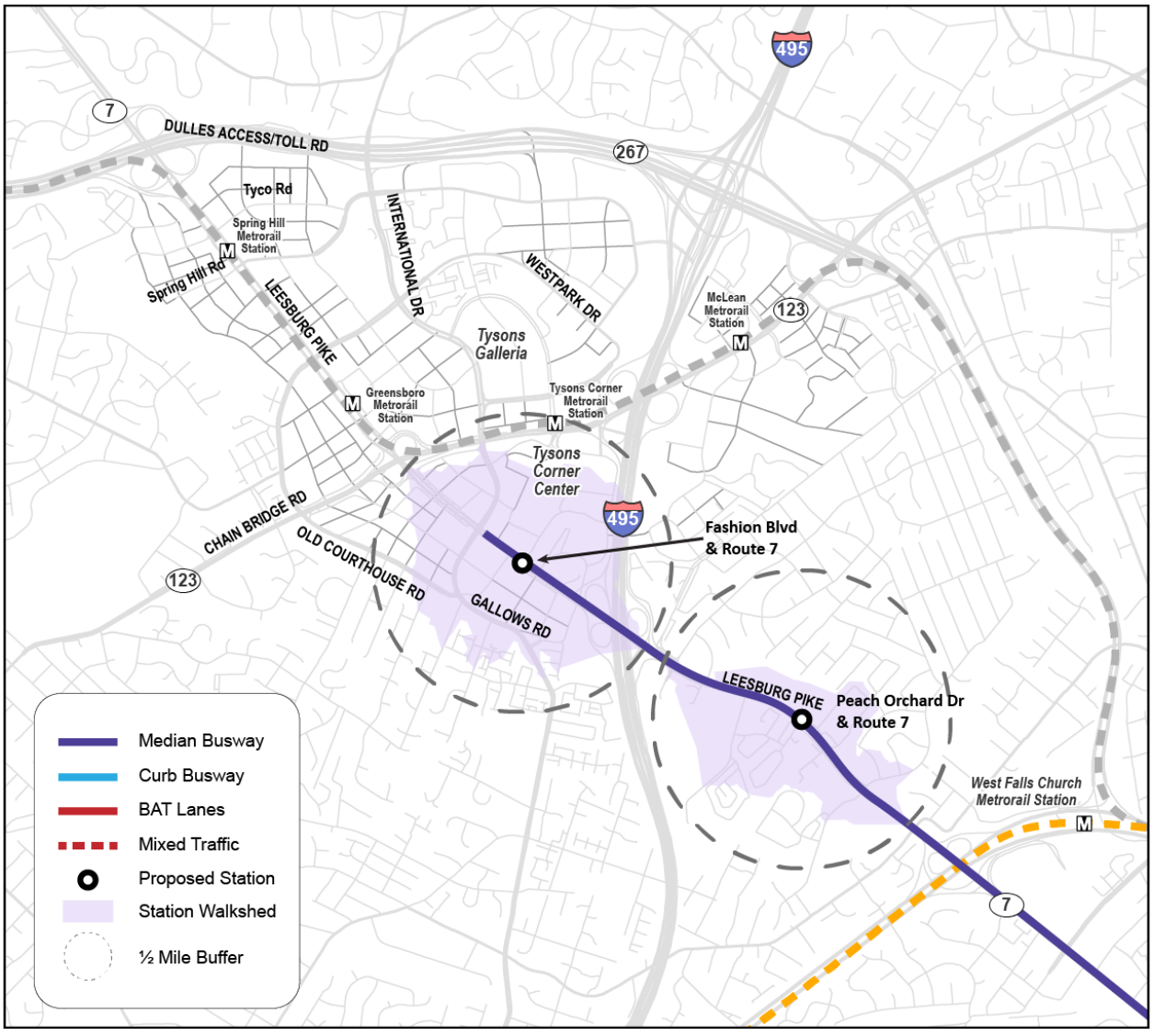
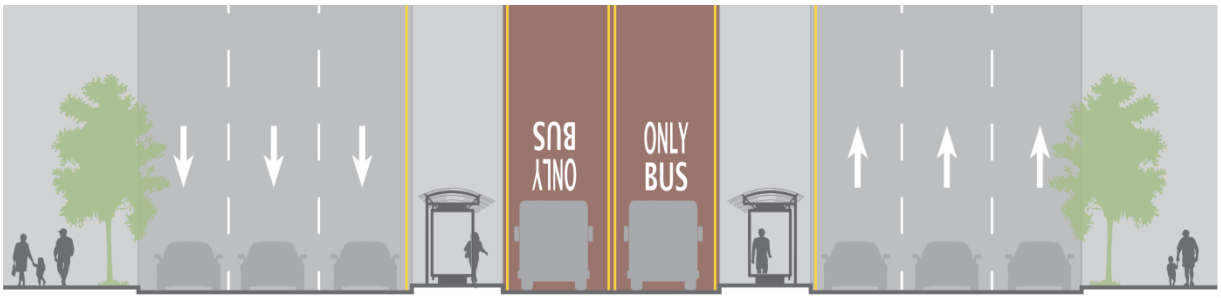


Figure 6-34 | Segment 2 and 3 Cross-section of Route 7 from International Drive to I-66



7 Alternatives Assessment

This section provides the results of the various MOEs for the Alternatives Assessment phase. These measures provide both qualitative and quantitative analysis for each alternative described in the previous section. For this analysis, alternatives in Segment 1 (Alternatives 1 through 6) were compared against each other, while alternatives in Segment 2/3 (Alternatives 7 through 9) were compared against each other. Note that for Segment 2/3, the routing does not change, so the analysis only included MOEs that provided comparative differences between the alternatives.

7.1 Goal: Access and Mobility

The first objective of this goal was to provide choices through accessible transit service. For the assessment analysis, population and employment estimates were used to calculate the number of residents and jobs within a ½ mile walkshed (½ mile walking path distance) of the BRT stations for existing and future conditions. These MOEs provided an approximate measure of ridership potential and access to transit.

As shown in **Table 7-1** below, the alternatives that have longer routings and more stations provide greater access to population and employment. Alternative 5 along International Drive provides the greatest access to employment centers. While Alternative 6 may seem to offer the greatest coverage and access, the true walkshed, the area within ½ mile walk of stations with service in both directions, is much smaller because of the one-way loop split starting at International Drive.

Table 7-1 | Population and Jobs in Station Walksheds

Alternatives – Segment 1	Route Length (mi)	Population			Employment		
		2015	2030	2045	2015	2030	2045
1 – Spring Hill Station Term. (curb busway)	2.5	7,300	23,200	40,400	45,300	49,200	73,400
2 – Spring Hill Station Term. (mixed traffic)	2.5	7,300	23,200	40,400	45,300	49,200	73,400
3 – West*Park Transit Station Term.	4.0	11,200	26,500	43,900	42,800	48,700	72,100
4 – Tysons Corner Metrorail Station Term.	1.0	4,000	9,700	15,300	34,000	38,400	45,900
5 – Spring Hill station Term. via International Dr	3.8	11,300	25,900	41,100	52,200	61,400	80,600
6 – Boone Boulevard Loop	3.4	5,500	15,700	24,700	34,200	36,300	47,200

Source: Metropolitan Washington Council of Governments Round 9.1 Cooperative Land Use Forecasts

The second objective of this goal was to provide connections to the regional transit network. For this analysis, connections to Metrorail Stations and Transit Stations were identified for each alternative. **Table 7-2** below shows the number of connections to the larger regional transit network for each alternative. Alternatives that stay on Route 7 have greater access to the Metrorail system at Greensboro and Spring Hill Metrorail Stations. The West*Park Transit Station also provided a logical terminus and connections to other regional bus routes.

Table 7-2 | Regional Transit Network Connections

Alternatives – Segment 1	Number of Metrorail Stations / Transit Centers Served
1 – Spring Hill Station Term. (curb busway)	2
2 – Spring Hill Station Term. (mixed traffic)	2
3 – West*Park Transit Station Term.	2
4 – Tysons Corner Metrorail Station Term.	1
5 – Spring Hill station Term. Via International Dr	1
6 – Boone Boulevard Loop	1

7.2 Goal: Transportation Network Performance - Ensure Efficient Movement of People and Goods

The objective of this goal was to improve corridor performance with better transit operations. Two MOEs were used to demonstrate the possible improvement of transit operations: Percentage of BRT Lanes in Corridor and Route Directness. Both MOEs are used as proxies to measure the potential improvements to transit operations, including speed and reliability. A detailed transit operations analysis was completed during the Evaluation Phase using traffic micro-simulation models.

The percentage of exclusive BRT lanes and BAT lanes in the corridor were calculated for each alternative. Alternatives with a higher percentage of exclusive BRT lanes have a greater likelihood of providing reliable BRT service to passengers. BAT lanes allow for right turning traffic to access right turn pockets while maintaining through operations for transit. Enforcement of BAT lane restrictions is critical for effective operations of BRT on these lanes. Effective enforcement includes stationary cameras or cameras on-board buses that can identify and ticket vehicles violating BAT or BRT lanes. This is becoming more widely used by transit agencies across the country. Another effective means of enforcement is the use of personnel or law enforcement at strategic locations.

Route Directness is a measure of the efficiency of travel between a transit route's origin and destination. Generally, more direct routes are easier to operate and maintain reliable service, while less direct routes include more deviations and turns and are subject to delay and other traffic conflicts.

As shown in **Table 7-3** below, Alternative 1 has the greatest percentage of BRT Lanes in the corridor and is also among the alternatives with the most direct routing. Alternative 6 also has a relatively large

percentage of exclusive BRT lanes, however it has the lowest route directness. In addition to its impacts on operations, the large one-way loop in Alternative 6 may be inconvenient for passengers, requiring either a long walk to access service going in their desired direction, or a ride out of their desired direction of travel.

Table 7-3 | Transportation Network Performance by Alternative

Alternatives – Segment 1	Route Length (mi)	Percentage of Exclusive BRT Lanes (revenue Service)	Percentage of BAT Lanes	Route Directness[1]
1 – Spring Hill Station Term. (curb busway)	2.5	100%	0%	100%
2 – Spring Hill Station Term. (mixed traffic)	2.5	0%	0%	100%
3 – West*Park Transit Station Term.	4.0	0%	88%	76%
4 – Tysons Corner Metrorail Station Term.	1.0	28%	37%	100%
5 – Spring Hill station Term. Via International Dr	3.8	0%	100%	65%
6 – Boone Boulevard Loop	3.4	32%	68%	34%

All calculations only include the portion of the routing running in revenue service.

[1] Calculation equation: $1/\left(\frac{r1+r2}{l}\right)$ where:

- *r1* equals the length of the proposed westbound route
- *r2* equals the length of the proposed eastbound route
- *l* equals the length of the most direct route

7.3 Goal: Land Use/Economic Vitality – Support Economic Development and Land Use Goals

The objective for this goal was to minimize the impacts to private property. This assessment provided a qualitative analysis of the ROW needs for each BRT alignment alternative along the corridor. Generally, there are little to no private property impacts for any of the alternatives since existing or available ROW would be repurposed for BRT. The few alternatives that require widening outside of the Comprehensive Plan limits have the most significant ROW impacts, specifically Alternatives 6 and 8. **Table 7-4** below details the ROW needs for each alternative. More detailed analysis on this MOE was conducted as part of the Evaluation Phase for the selected alternatives.

Table 7-4 | Right-of-Way Needs for Alignment Alternatives

Alternatives – Segments 1, 2 and 3	ROW Needs for Alignment Alternatives	Notes
1 – Spring Hill Station Term. (curb busway)	None – General purpose lanes repurposed to curb busway	
2 – Spring Hill Station Term. (mixed traffic)	None – BRT runs in mixed traffic	
3 – West*Park Transit Station Term.	None – General purpose lane repurposed to BAT Lane shared by right turning vehicles	
4 – Tysons Corner Metrorail Station Term.	Low – ROW needed on south side of Chain Bridge Road to access Bus Loop	
5 – Spring Hill station Term. Via International Dr	None – General purpose lane repurposed to BAT Lane shared by right turning vehicles	
6 – Boone Boulevard Loop	High – BRT Lanes to be included in construction of new Boone Boulevard	Construction of approximately 0.5 miles of new roadway.
7 – Median Busway with Lane for Transit	Low – Repurpose lanes from planned lane widening to accommodate median busway	Approximately 0.75 acres land acquisition required
8 – Median Busway with Widening +1	High – Additional ROW needed for widening and median busway	Approximately 2.5 acres land acquisition required
9 – Median Busway with Lane Repurposing and Widening (Consistent Cross-section)	Medium – Planned widening and additional ROW needed to accommodate median busway	Approximately 2.5 acres land acquisition required

7.4 Goal: Meet the Needs of All Users - Residents, workers, visitors, and disadvantaged populations

This goal measured how well the alternatives served areas with transit-dependent or transit-inclined populations. For this MOE, the number of low-wage jobs, zero-car households, and households below the poverty line were estimated for the ½ mile station walkshed for each alternative. Similar to the general population and employment estimates, the alternatives that have longer routings and more stations provide greater access to transit-dependent/inclined populations (see **Table 7-5**). Alternative 5 along International Drive provides the greatest access to low-wage jobs. The number of low-wage jobs and low-income households is lowest for Alternative 6, due to the smaller walkshed that is able to access bi-directional service.

Table 7-5 | Transit Dependent/Transit Inclined Populations within ½ Mile of Stations

Alternatives – Segment 1	Route Length (mi)	Low-Wage Jobs	Zero Car Households	Households below Poverty Line
1 – Spring Hill Station Term. (curb busway)	2.5	7,020	110	210
2 – Spring Hill Station Term. (mixed traffic)	2.5	7,020	110	210
3 – West*Park Transit Station Term.	4.0	6,460	150	260
4 – Tysons Corner Metrorail Station Term.	1.0	5,900	80	125
5 – Spring Hill station Term. Via International Dr	3.8	8,530	135	170
6 – Boone Boulevard Loop	3.4	5,840	165	90

Source: American Community Survey (ACS), 2013-2018 and Longitudinal Employer Household Dynamics (LEHD), 2015

7.5 Goal: Improve Safety for All Roadway Users

The objective for this goal was to improve the pedestrian environment in the study corridor. Two key MOEs were used to compare the alternatives, including Pedestrian Crossing Times at Key Intersections, and the Number of BRT Mixed-Traffic Conflict Points. Additional MOEs were used as part of the Evaluation Phase for the selected Alternatives.

Crossing distances and crossing times were calculated for major pedestrian crossings in the study area. At locations with a pedestrian refuge or median, distance was measured from the curb to the pedestrian refuge area. Average crossing times were calculated for each alternative assuming a walking speed of 3.5 feet per second as per Manual on Uniform Traffic Control Devices (MUTCD). Additionally, the number of "extreme" crossings of 60 seconds or greater were identified as crossings that pose a major barrier to pedestrians. In general, the pedestrian environment for all of the BRT routing alternatives being considered presents challenges to access and comfort. The proposed alternatives do not reduce any existing cross-sections but increase the already wide cross-sections at few intersections along Route 7, south of International Drive. Pedestrian accommodations (e.g., protected median refuge islands, extended and advance walk phases, high visibility markings) should be prioritized at these intersections and station locations.

The number of conflict points between BRT and general-purpose traffic in the mixed-traffic environment can also be used as a qualitative proxy for concerns related to BRT safety. A conflict point has been defined as a turn, alignment transition, intersection, driveway, or any distance spent traveling in mixed traffic. As shown in **Table 7-6,** the alternatives that deviate from Route 7 contain the highest number of turns, transitions, intersections, and driveway conflict points. Alternative 2 includes the longest mixed-traffic segment. It is important to note that the number of driveway conflicts can be reduced as the area is redeveloped and parcel access points are consolidated or relocated to side streets.

Table 7-6 | Conflict Points

Alternatives – Segment 1	Route Turns	Alignment Transitions	Intersections	Driveways	Mixed Traffic Segment
1 – Spring Hill Station Term. (curb busway) [1]	-	1	3	30	-
2 – Spring Hill Station Term. (mixed traffic) [1]	-	1	3	30	2.0 mi
3 – West*Park Transit Station Term.	2	2	7	52	.5 mi
4 – Tysons Corner Metrorail Station Term.	4	4	4	8	.5 mi
5 – Spring Hill station Term. Via International Dr	4	1	12	48	-
6 – Boone Boulevard Loop [2]	5	3	25	44	-

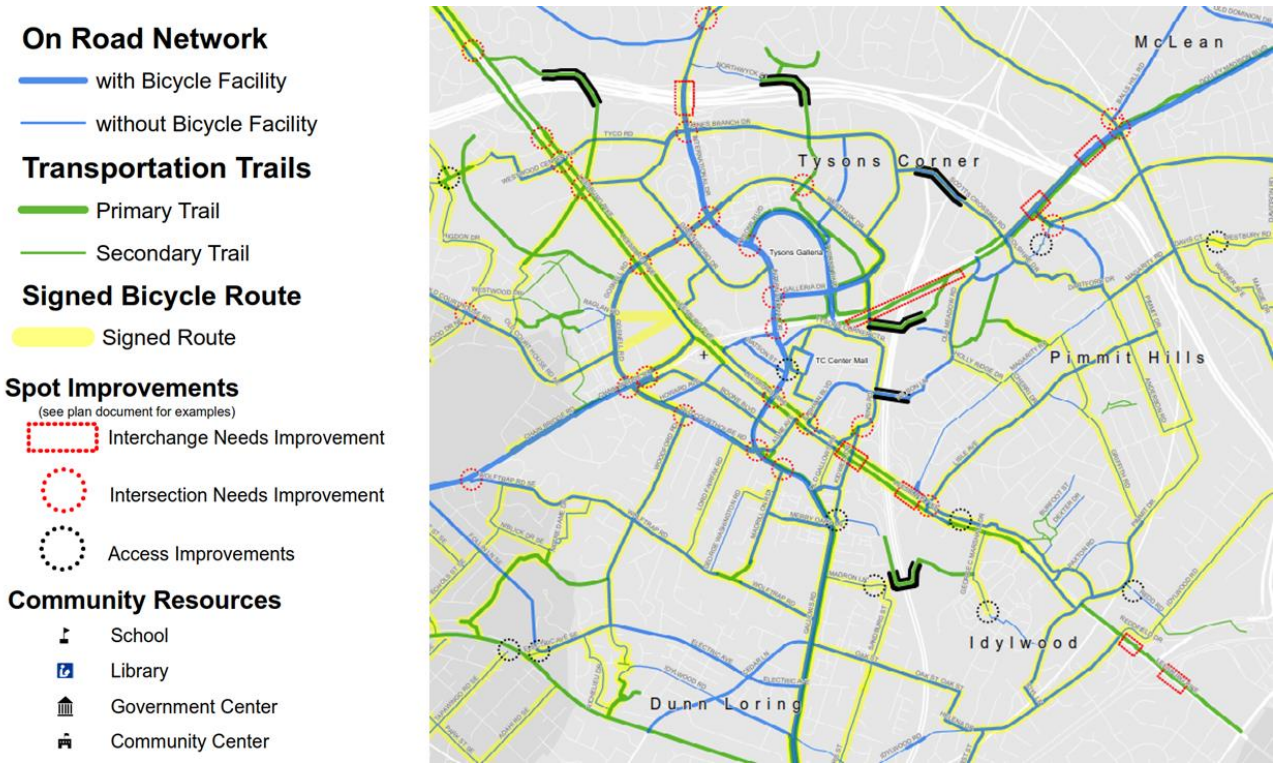
[1] Excludes non-revenue service loop on Tyco Road and Spring Hill Road

[2] Does not account for unbuilt driveways on new Boone Boulevard

The Fairfax County Bicycle Master Plan calls for bicycle facilities on Route 7, International Drive, Tyco Road, and Spring Hill Road (see **Figure 7-1**). Generally, the "Primary Trail" planned for Route 7 provides greater benefit for bicycle access and comfort than on-street facilities planned for International Drive, Tyco Road, and Spring Hill Road. The signed bicycle route and secondary trail connects best to Alternatives 1, 2, and 3 that are aligned along Leesburg Pike, or Route 7. However, this route includes multiple intersections in need of improvement for better cycling safety, such as Spring Hill Road, Tyco Road, and Greensboro Drive, all locations under consideration for station locations.

Alternatives 4, 5, and 6 that run along International Drive also have bicycle access. This is through an on-road network with bicycle facilities. There are also intersections in need of improvement along this stretch, such as at Fashion Boulevard, Greensboro Drive and the West*Park Transit Station.

Figure 7-1 | Planned Bicycle Facilities



7.6 Goal: Protect and Improve Environmental Resources

The goal sought to minimize impacts to the natural and social environments. For this MOE, a preliminary review identified the environmental and social resources within the study area and assessed the potential impact to those resources. Alternative 6 has the highest impact to environmental resources due to the proximity of the new Boone Boulevard segment to a Resource Protection Area and the Difficult Run Stream 100-year Floodplain. Other potential social resources that may be impacted include the Tysons-Pimmit Regional Library, Marshall High School, and St. Paul's Lutheran Church on Segments 2 and 3 of Route 7.

Table 7-7 | Potential Environmental Impacts

Alternatives – Segments 1, 2, 3	Potential Environmental Impacts
1 – Spring Hill Station Term. (curb busway)	None
2 – Spring Hill Station Term. (mixed traffic)	None
3 – West*Park Transit Station Term.	None
4 – Tysons Corner Metrorail Station Term.	Impact Potential Low Resource: Scotts Run Stream Branch
5 – Spring Hill station Term. Via International Dr	Impact Potential Low Resource: Floodplain near International Drive and Westpark Drive
6 – Boone Boulevard Loop	Impact Potential High Resources: Resource Protection Area; Difficult Run Stream 100 Year Floodplain
7 – Median Busway with Lane for Transit	Impact Potential Low Resources: Tysons-Pimmit Regional Library; Marshall High School; St Paul's Lutheran Church
8 – Median Busway with Widening +1	Impact Potential Medium Resources: Tysons-Pimmit Regional Library; Marshall High School; St Paul's Lutheran Church
9 – Median Busway with Lane Repurposing and Widening (Consistent Cross-section)	Impact Potential Medium Resources: Tysons-Pimmit Regional Library; Marshall High School; St Paul's Lutheran Church

7.7 Goal: Make Sustainable, Cost Effective Investments in Transit

The objective of this goal was to assess the financial feasibility of BRT. **Table 7-8** highlights the differences in construction difficulty which was used as a proxy for capital costs: high construction difficulty will likely result in higher construction costs. While all alternatives will require some construction costs to build elements such as stations, signage, and intersection improvements, some alternatives will require a significantly higher investment. Alternatives where the alignment and routing are using existing or planned travel lanes are considered easier to construct than those that require the construction of additional lanes. The ratings for Alternatives 1-6 are exclusive to Segment 1 and the ratings for Alternatives 7-9 are exclusive to Segments 2 and 3.

Table 7-8 | Construction Difficulty

Alternatives – Segments 1, 2, 3	Construction Difficulty (Low, Medium, High)
1 – Spring Hill Station Term. (curb busway)	Medium – Repurposing of general purpose lane to exclusive curb busway
2 – Spring Hill Station Term. (mixed traffic)	None
3 – West*Park Transit Station Term.	Low – Repurposing of general purpose lanes to BAT lanes
4 – Tysons Corner Metrorail Station Term.	Low – Repurposing of general purpose lanes to BAT lanes
5 – Spring Hill station Term. Via International Dr	Low – Repurposing of general purpose lanes to BAT lanes
6 – Boone Boulevard Loop	High – Construction of new roadway; station at Route 123 interchange redesign
7 – Route 7 Median Busway with Lane Repurposing	Low-High – Reconfiguration of roadway to accommodate median busway
8 – Route 7 Median Busway with Widening +1	High – Reconfiguration of roadway to accommodate widening and median busway
9 – Route 7 Median Busway with Lane Repurposing and Widening (Consistent Cross-section)	Medium-High – Reconfiguration of roadway to accommodate widening and median busway

7.8 Summary Matrix

Measure of Effectiveness	Segment 1 Alternatives						Segment 2/3 Alternatives		
	1 Spring Hill Station Term. (curb busway)	2 Spring Hill Station Term. (mixed traffic)	3 West*Park Transit Station Term.	4 Tysons Corner Metrorail Station Term.	5 Spring Hill Station Term. Via International Dr	6 Boone Boulevard Loop	7 Median Busway with Lane Repurposing (Comprehensive Plan Widening)	8 Median Busway with Widening (Comprehensive Plan Widening +1)	9 Median Busway with Lane Repurposing and Widening (Consistent Cross-section)
Goal: Access and Mobility - Provide choices through accessible transit service									
Objective: Serve population, employment, and activity centers with BRT									
Population within ½ mile walking distance	Pop: 40,400	Pop: 40,400	Pop: 43,900	Pop: 15,300	Pop: 52,200	Pop: 24,700	N/A	N/A	N/A
Employment within ½ mile walking distance	Emp: 73,400	Emp: 73,400	Emp: 72,100	Emp: 45,900	Emp: 80,600	Emp: 47,200	N/A	N/A	N/A
Objective: Provide connections to larger transit network									
Number of Metrorail Stations served	2	2	2	1	1	1	0	0	0
Goal: Transportation Network Performance - Ensure efficient movement of people and goods									
Objective: Improve Transit Operations in Corridor									
Percent of Corridor with Dedicated BRT lanes	100%	0%	0%	28%	0%	32%	100%	100%	100%
Percent of Corridor with BAT Lanes	0%	0%	88%	37%	100%	68%	0%	0%	0%
Route Directness	100%	100%	76%	100%	65%	34%	100%	100%	100%
Goal: Land Use/Economic Vitality – Support economic development and land use goals									
Objective: Minimize impacts to private property									
Qualitative assessment for ROW Needs for BRT Alignment	None	None	None	Low	None	High	Low	High	Medium
Goal: Meet the needs of all users – residents, workers, visitors, and disadvantaged populations									
Objective: Serve areas with transit dependent populations									
Number of transit dependent/transit inclined households and jobs within ½ mile of stations	Low-Wage Jobs: 7,020 Zero Car HH: 110 Poverty HH: 210	Low-Wage Jobs: 7,020 Zero Car HH: 110 Poverty HH: 210	Low-Wage Jobs: 6,460 Zero Car HH: 150 Poverty HH: 260	Low-Wage Jobs: 5,900 Zero Car HH: 80 Poverty HH: 125	Low-Wage Jobs: 8,530 Zero Car HH: 135 Poverty HH: 160	Low-Wage Jobs: 5,840 Zero Car HH: 170 Poverty HH: 90	N/A	N/A	N/A
Goal: Improve safety for all roadway users									
Objective: Improve the pedestrian environment in the study corridor									
Average Pedestrian Crossing Time at Intersections (Walking Speed = 3.5 feet/second)	34	34	42	52	46	45	29	37	34
Percentage of "Uncomfortable" Intersection Crossings (59+ Seconds)	--	--	--	50%	25%	40%	30%	--	--
Number of BRT - Mixed Traffic Conflict Points	36	36 + 2.0 Mile Mixed Traffic Segment	63 + ½ Mile Mixed Traffic Segment	20 + ½ Mile Mixed Traffic Segment	65	77	N/A	N/A	N/A
Safety and comfort of biking environment in the corridor	Primary Trail	Primary Trail	Primary Trail; On-Road Facility	On-Road Facility	On-Road Facility	On-Road Facility; Street Grid	Primary Trail	Primary Trail	Primary Trail
Goal: Protect and Improve Environmental Resources									
Objective: Minimize negative impacts to the natural environment									
Qualitative environmental impacts to parklands, cultural resources, wetlands, woodlands, etc.	None	None	None	Impact Potential Low Resource: Scotts Run Stream Branch	Impact Potential Low Resource: Floodplain near International Drive and Westpark Drive	Impact Potential High Resources: Resource Protection Area; Difficult Run Stream 100 Year Floodplain	Impact Potential Low Resources: Tysons-Pimmit Regional Library; Marshall High School; St Paul's Lutheran Church	Impact Potential Medium Resources: Tysons-Pimmit Regional Library; Marshall High School; St Paul's Lutheran Church	Impact Potential Medium Resources: Tysons-Pimmit Regional Library; Marshall High School; St Paul's Lutheran Church
Goal: Make sustainable, cost effective investments in transit									
Objective: Prove financial feasibility of BRT									
Construction Difficulty (Low, Medium, High)	Medium	None	Low	Low	Low	High	Low-High	High	Medium-High

Summary Matrix

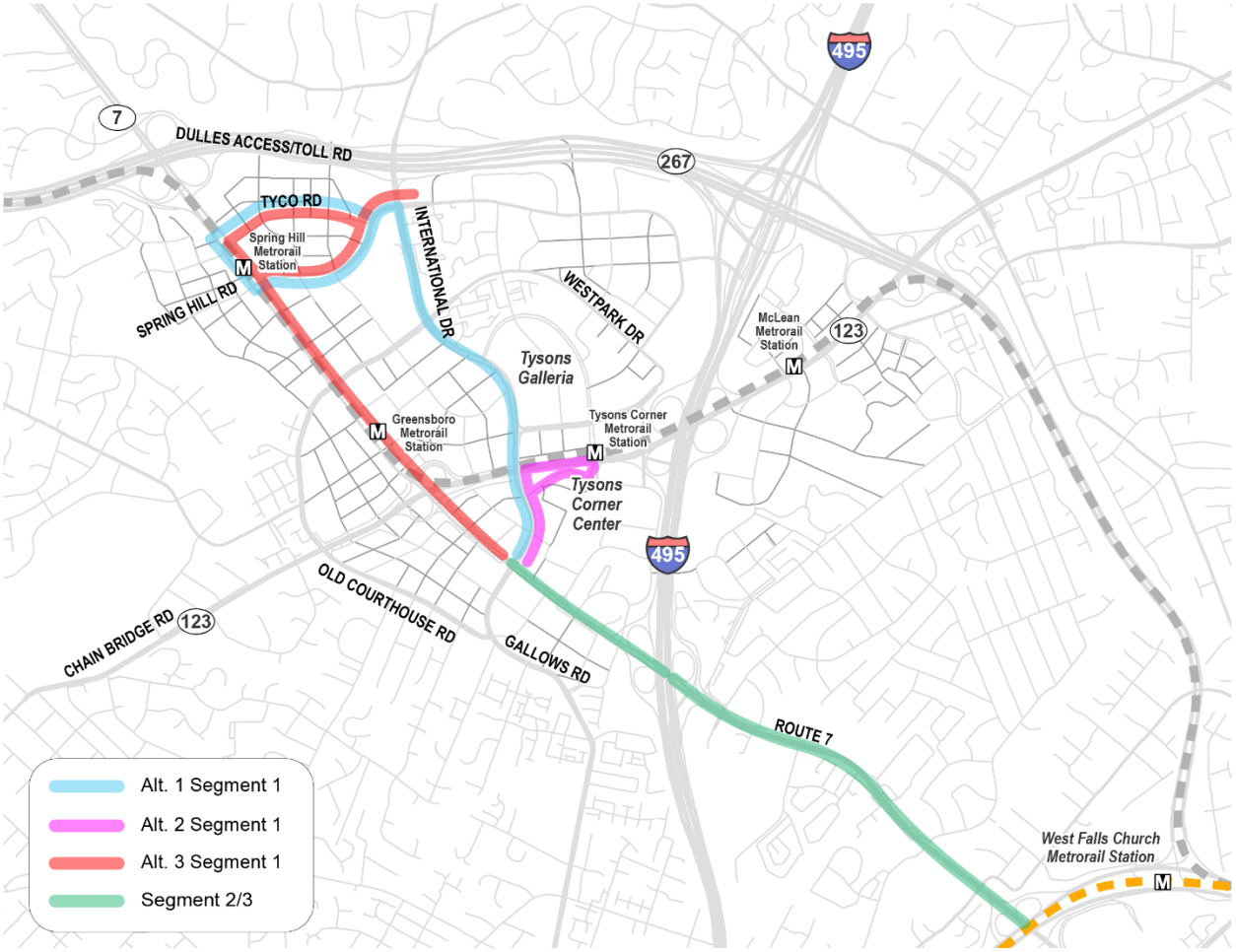
Undesirable Performance ○ ⇨ ◑ ⇨ ● Desirable Performance Measure of Effectiveness	Segment 1 Alternatives						Segment 2/3 Alternatives		
	1	2	3	4	5	6	7	8	9
	Spring Hill Station Term. (curb busway)	Spring Hill Station Term. (mixed traffic)	West*Park Transit Station Term.	Tysons Corner Station Term.	Spring Hill Station Term. Via International Dr	Boone Boulevard Loop	Median Busway with Lane Repurposing (Comprehensive Plan Widening)	Median Busway with Widening (Comprehensive Plan Widening +1)	Median Busway with Lane Repurposing and Widening (Consistent Cross Section)
Goal: Access and Mobility - Provide choices through accessible transit service									
Objective: Serve population, employment, and activity centers with BRT									
Population within ½ mile walking distance	◕	◕	◕	○	●	◔	N/A	N/A	N/A
Employment within ½ mile walking distance	◕	◕	◕	○	●	○	N/A	N/A	N/A
Objective: Provide connections to larger transit network									
Number of Metrorail Stations served	●	●	●	◑	◑	◑	○	○	○
Goal: Transportation Network Performance - Ensure efficient movement of people and goods									
Objective: Improve Transit Operations in Corridor									
Percent of Corridor with Dedicated BRT lanes	●	○	○	◔	○	◔	●	●	●
Percent of Corridor with BAT Lanes	○	○	●	◔	●	◕	○	○	○
Route Directness	●	●	◕	●	◕	◔	●	●	●
Goal: Land Use/Economic Vitality – Support economic development and land use goals									
Objective: Minimize impacts to private property									
Qualitative assessment for ROW Needs for BRT Alignment	●	●	●	◕	●	○	◕	○	◔
Goal: Meet the needs of all users – residents, workers, visitors, and disadvantaged populations									
Objective: Serve areas with transit dependent populations and low-wage jobs									
Number of low-wage jobs within ½ mile of stations	◑	◑	◔	○	●	○	N/A	N/A	N/A
Number of households with no vehicle within ½ mile of stations	◔	◔	◕	○	◕	●	N/A	N/A	N/A
Number of households below the poverty line within ½ mile of stations	◕	◕	●	◔	◑	○	N/A	N/A	N/A
Goal: Improve safety for all roadway users									
Objective: Improve the pedestrian environment in the study corridor									
Average Pedestrian Crossing Time at Intersections (Walking Speed = 3.5 feet/second)	◕	◕	◑	○	◔	◔	●	◕	◕
Percentage of "Uncomfortable" Intersection Crossings (59+ Seconds)	●	●	●	○	◑	○	◔	●	●
Number of BRT - Mixed Traffic Conflict Points	◕	◑	○	●	◔	○	N/A	N/A	N/A
Safety and comfort of biking environment in the corridor	●	●	◕	◔	◔	○	●	●	●
Goal: Protect and Improve Environmental Resources									
Objective: Minimize negative impacts to the natural environment									
Qualitative environmental impact potential	●	●	●	◕	◕	○	◕	◔	◔
Goal: Make sustainable, cost effective investments in transit									
Objective: Prove financial feasibility of BRT									
Construction Difficulty (Low, Medium, High)	◕	None	●	●	●	○	◑	○	◔

8 Build Alternatives Refinement

In August 2019, the study team conducted a second Alternatives Development Workshop to review the results of the Alternatives Assessment and discuss the alternatives to advance to the Evaluation Phase. Details of the discussion and results of that workshop are documented in the Alternatives Development Workshop Meeting Minutes (August 2019). These meeting minutes can be found in **Appendix E**. The Assessment Phase determined three end-to-end alternatives out of the initial nine alternatives for further analysis in the Build Alternatives Evaluation Phase of the project (see **Figure 8-1**. The three alignment alternatives are composed of segments which delineate changes in street cross-section configuration and are known now as the following:

- **Alternative 1:** International Drive to Spring Hill Metrorail Station
- **Alternative 2:** International Drive to Tysons Corner Metrorail Station
- **Alternative 3:** Route 7 to West*Park Transit Station

Figure 8-1 | Tysons BRT Build Alternatives



8.1 BRT Assumptions

The three BRT alternatives, including running way configurations, routing, stations, headways, operational speeds, and vehicles were coded into the Travel Demand and Traffic Simulation (VISSIM) models for the purpose of supporting analysis during the Build Alternatives Evaluation Phase of the project.

8.1.1 Bus Operations

The BRT service was assumed to operate on 10 minute peak and 15 minute off-peak headways at an operational speed of 35 mph. BRT station platforms were assumed to be designed to accommodate level boarding and alighting, all-door boarding, and off-board fare collection, resulting in a 1.5 second/passenger boarding and alighting time and 2 seconds for door closure. BRT was assumed to utilize articulated buses with a passenger capacity of 110 people (combined seated and standing load).

8.1.2 Transit Signal Priority

Transit Signal Priority (TSP) was assumed for the BRT service at each intersection the BRT travels through and for both directions of travel. The TSP works by extending a phase's green time, to allow a BRT vehicle to pass through the intersection before the phase turns to red. This operation provides right of way to BRT buses while truncating phases that provide right of way to conflicting movements. TSP was incorporated into the Traffic micro-simulation models. While coding in VISSIM, BRT detector loops were placed before the intersection on BRT lanes. BRT phases were coded using Transit priority in VISSIM RBC controller. The transit phases were run concurrently with the main through movement phases. If there was a bus presence, the through movement was extended by 10 seconds if it was on green. If the through movement was on red, 10 seconds were taken away from the minor street approaches to bring on the through movement green signal sooner.

8.1.3 BRT Ridership

The recommended alternative (or default alternative) from the 2017 NVTC Envision Route 7 Study was analyzed using the adopted modeling data and methodology for the study. Due to differing travel demand modeling methodologies and tools, the default alternative ridership does not match the previously estimated ridership in the NVTC Route 7 study. An adjustment factor of 1.57 was determined by comparing the Fairfax County Route 7 BRT Tysons Study estimated ridership to the previously developed ridership estimate. This adjustment factor was applied to each BRT alternative to provide stop-level ridership estimates that are consistent with the previous NVTC Envision Route 7 study.

8.2 Build Alternative 1 – International Drive to Spring Hill Metrorail Station

The proposed alignment in Alternative 1 follows Route 7 and International Drive to the terminus at Spring Hill Metrorail station, see **Figure 8-2**. This alternative consists of a median busway on Route 7 and International Drive followed by a bus and turn (BAT) lane on Spring Hill Road and Tyco Road which form a one-way couplet through the terminus. Proposed stations are located at Patterson Road, Fletcher Street, Greensboro Drive, Lincoln Circle, and at Spring Hill Metrorail station. The one-way route length is 3.7 miles. **Figure 8-3** shows the roadway cross-sections and descriptions for Alternative 1. **Figure 8-4** through **Figure 8-10** show the individual station locations and platform configurations.

Figure 8-2 | Proposed Alternative 1 Alignment

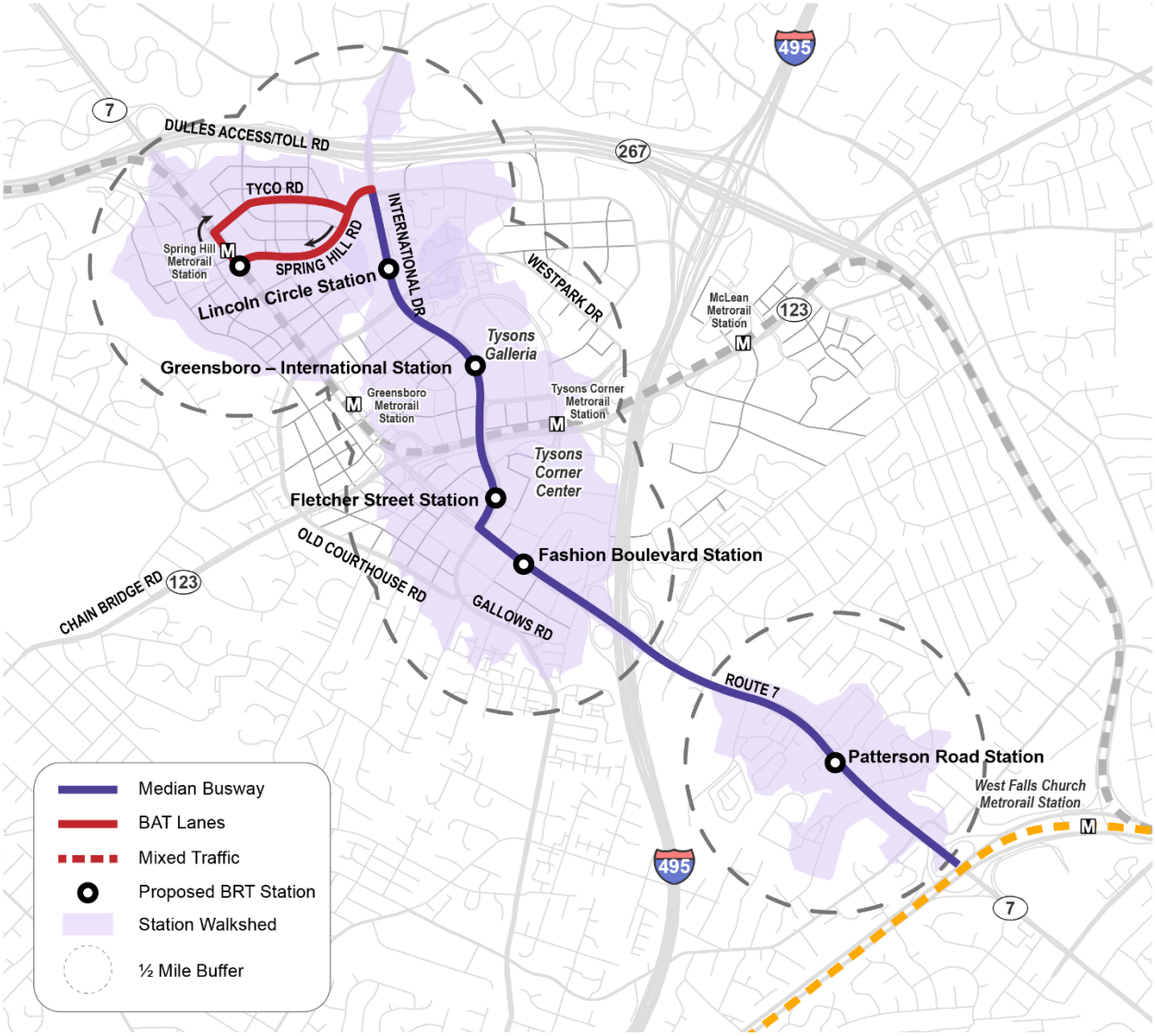


Figure 8-3 | Alternative 1 Street Cross-Sections

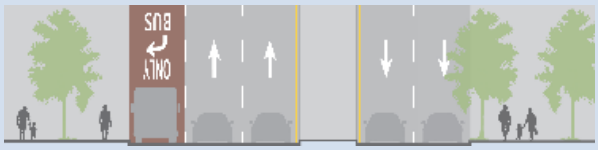
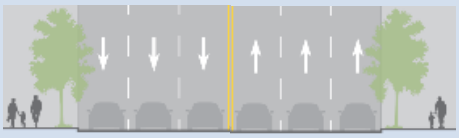
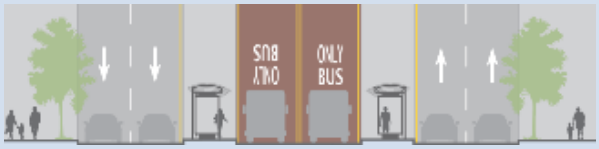
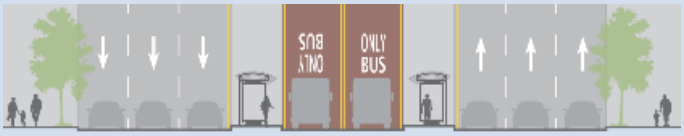
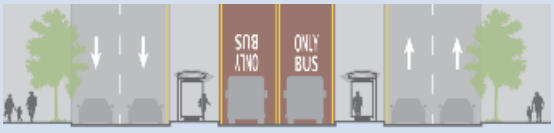
Street Name and Section	Description
Tyco Road 	Eastbound BAT lane and two general traffic lanes in each direction
Spring Hill Road 	Westbound BAT lane and two general traffic lanes in each direction
International Drive – Lincoln Circle to Spring Hill Road 	Mixed traffic in both directions to facilitate transition to/from median busway
International Drive – Route 7 to Lincoln Circle 	Median busway and two general traffic lanes in each direction
Route 7 – International Drive to I-495 	Median busway and three general traffic lanes in each direction
Route 7 – I-495 to I-66 	Median busway and two general traffic lanes in each direction

Figure 8-4 | Patterson Road Station Location and Platform Configuration

Figure 8-5 | Fashion Boulevard Station Location and Platform Configuration

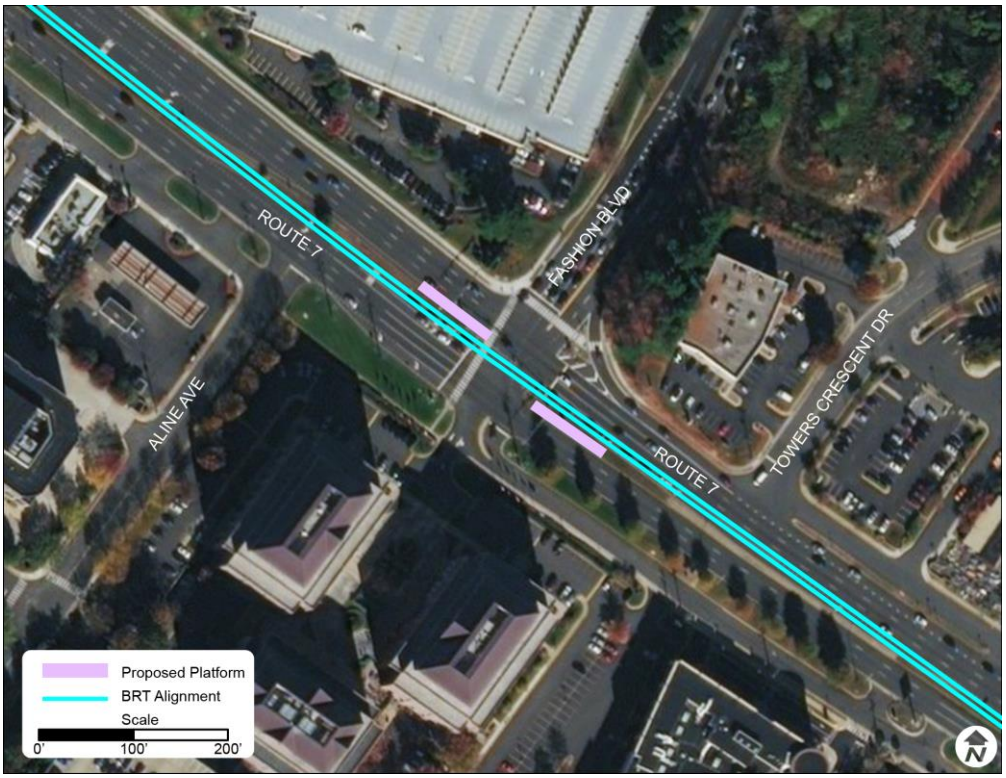


Figure 8-6 | Fletcher Street (Option 2) Station Location and Platform Configuration

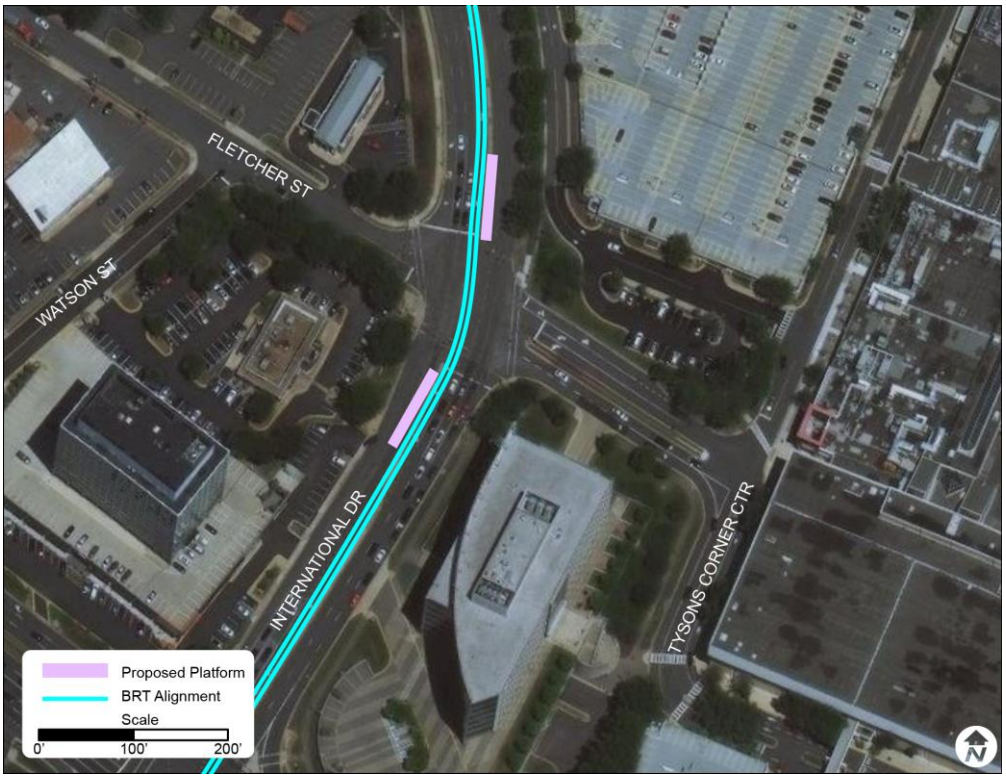


Figure 8-7 | Greensboro Drive Station Location and Platform Configuration

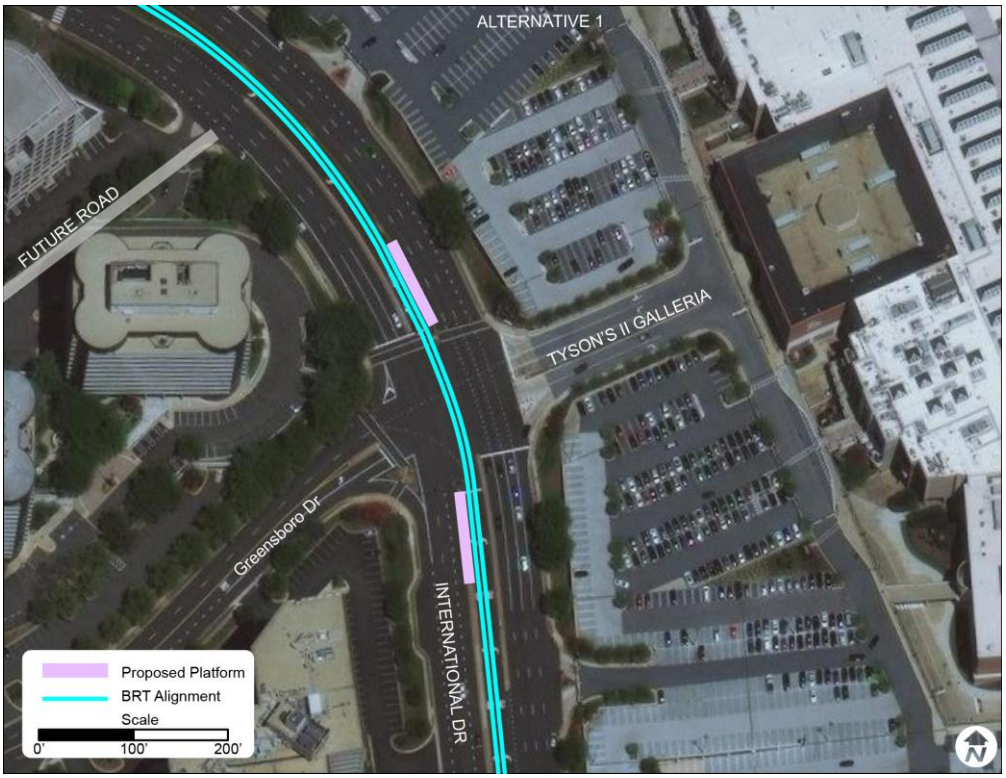
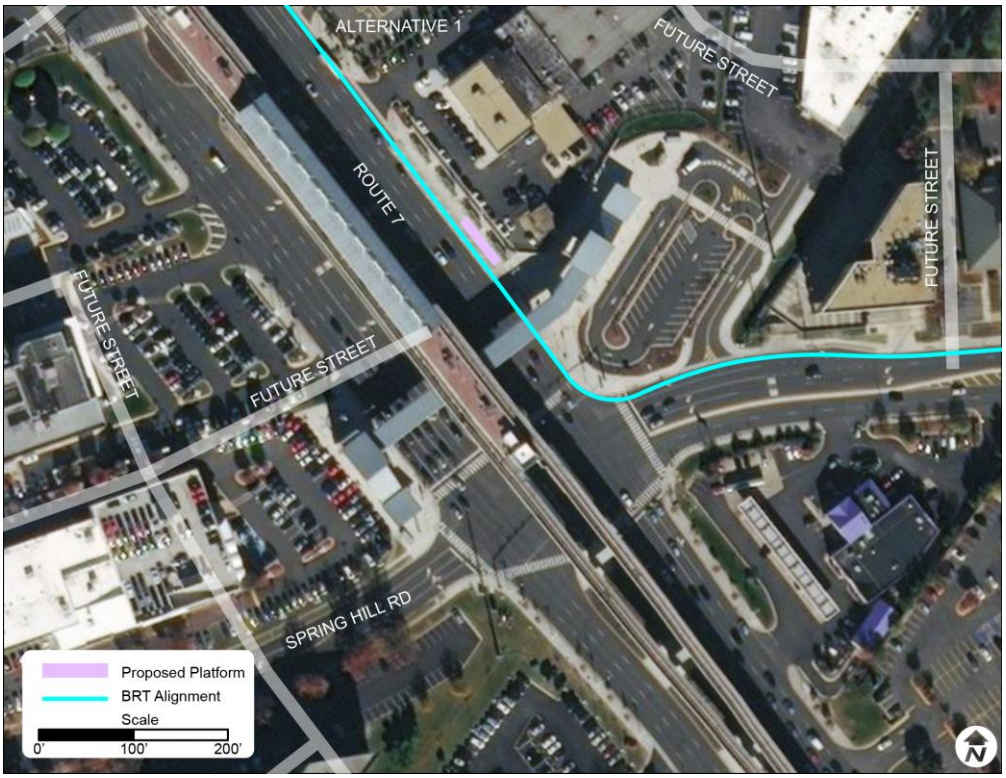


Figure 8-8 | International Drive and Lincoln Circle Station Platform Configuration

Figure 8-9 |Spring Hill Metrorail Station Location and Platform Configuration



8.3 Build Alternative 2 – International Drive to Tysons Corner Metrorail Station

Alternative 2 proposed a shorter alignment with the terminal station at Tysons Corner Metrorail Station (see **Figure 8-10**. This alternative consists of a median busway on Route 7 followed by BAT lanes (northbound and mixed traffic southbound) on International Drive from Route 7 to Chain Bridge Road, and in mixed traffic on Chain Bridge Road from International Drive to the terminus adjacent to the existing Metrorail Station. BRT vehicles will then operate in mixed traffic from the Metrorail station to Route 7 on Tysons Boulevard and Tysons One Place, and International Drive before rejoining the median busway on Route 7. The one-way route length is 2.3 miles. **Figure 8-11** shows the street cross-sections for Alternative 2. **Figure 8-12** through **Figure 8-14** show the individual station locations and platform configurations.

Figure 8-10 | Proposed Alternative 2 Alignment

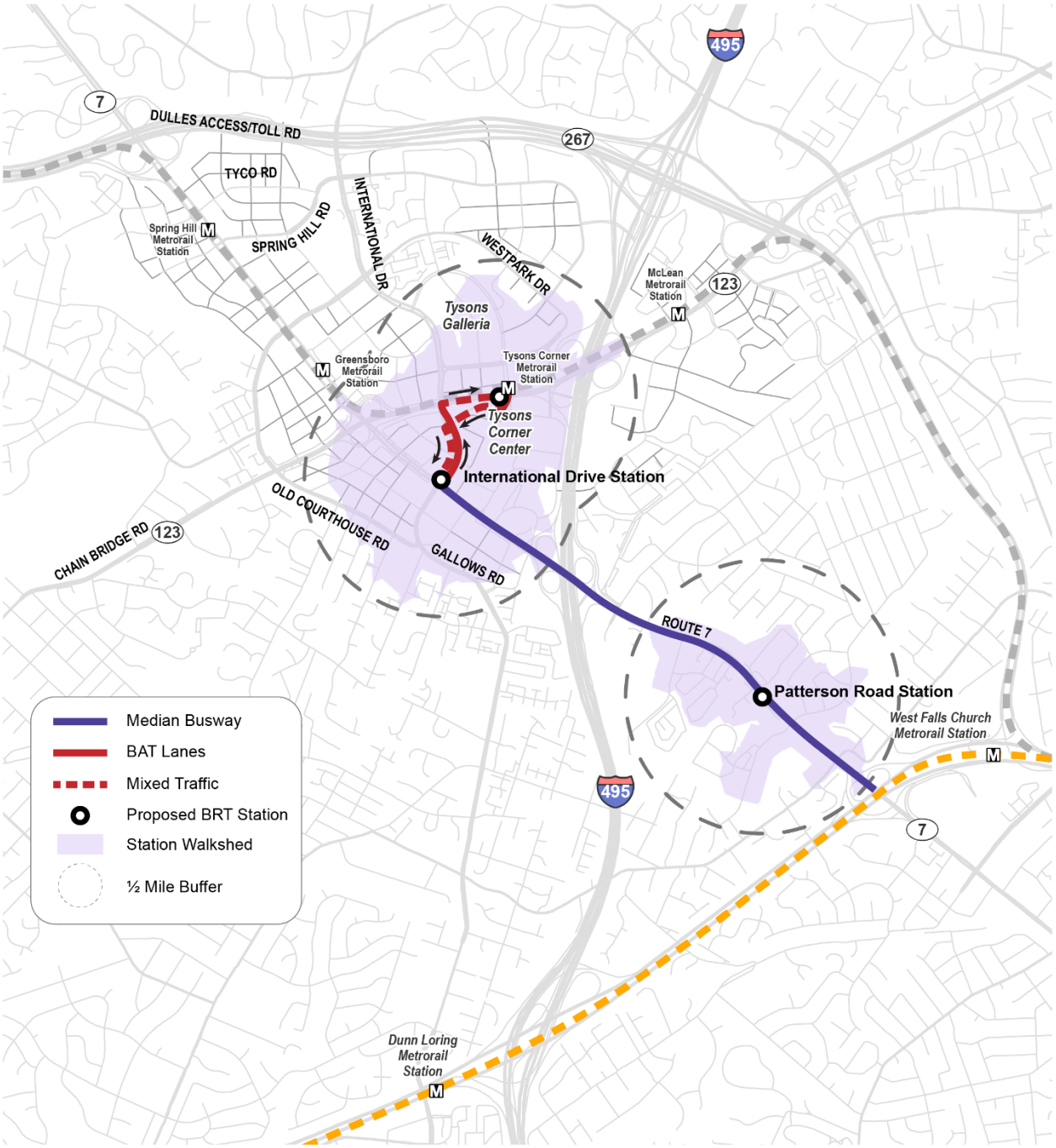


Figure 8-11 | Alternative 2 Street Cross-Sections

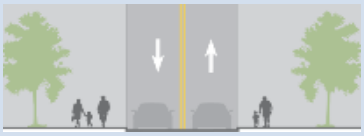
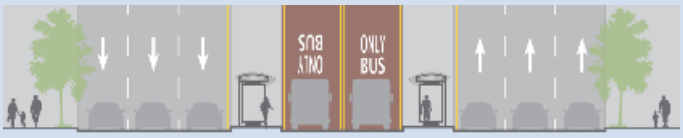
Street Name and Section	Description
Chain Bridge Road 	Four general traffic lanes in each direction; BRT operates in mixed traffic in the EB direction to bus loop
Tysons One Place 	One general traffic lane in each direction; BRT operates in mixed traffic in the WB direction
International Drive – Route 7 to Chain Bridge Road 	Northbound BAT lane and two general traffic lanes, three southbound general traffic lanes; BRT operates in mixed traffic in SB direction
Route 7 – International Drive to I-495 	Median busway and three general traffic lanes in each direction
Route 7 – I-495 to I-66 	Median busway and two general traffic lanes in each direction

Figure 8-12 | Patterson Road Station Location and Platform Configuration

Figure 8-13 | International Drive Station Location and Platform Configuration

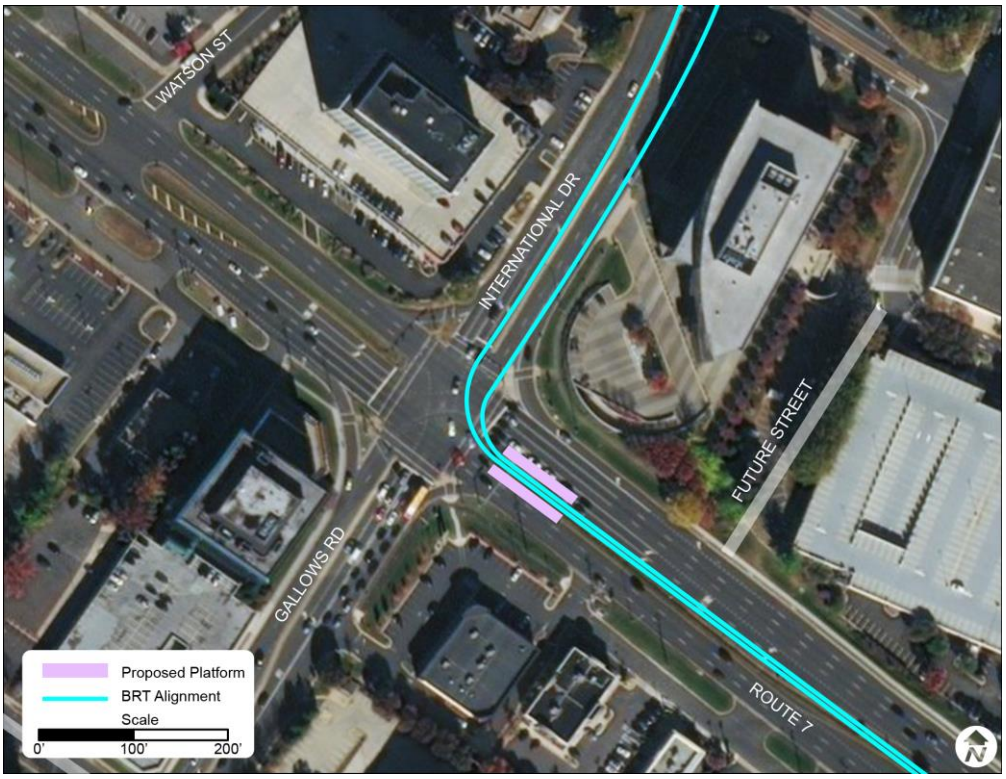
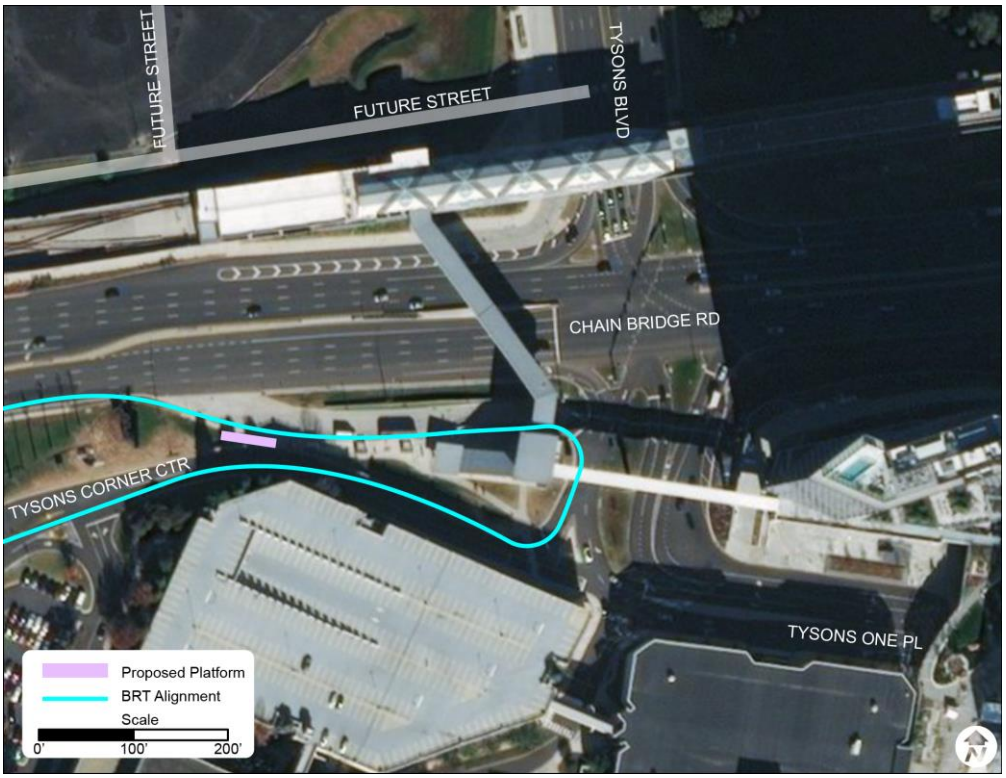


Figure 8-14 | Tysons Corner Metrorail Station Location and Platform Configuration



8.4 Build Alternative 3 – Route 7 to West*Park Transit Station

The proposed alignment in Alternative 3 follows Route 7 to Spring Hill Metrorail station before utilizing Tyco Road to the terminus at West*Park Transit Station, returning to Route 7 along Spring Hill Road, see **Figure 8-15**. This alternative consists of a median busway on Route 7 before transitioning to a curb BAT lane after the International Drive Station, and eastbound and westbound BAT lanes on Tyco Road and Spring Hill Road, respectively. Proposed stations are located at Patterson Road, International Drive, Greensboro Metrorail Station, Spring Hill Metrorail Station, and West*Park Transit Station. The one-way route length is 3.8 miles. **Figure 8-16** shows the roadway cross-sections and descriptions for Alternative 3. **Figure 8-17** through **Figure 8-21** show the individual station locations and platform configurations.

Figure 8-15 | Proposed Alternative 3 Alignment

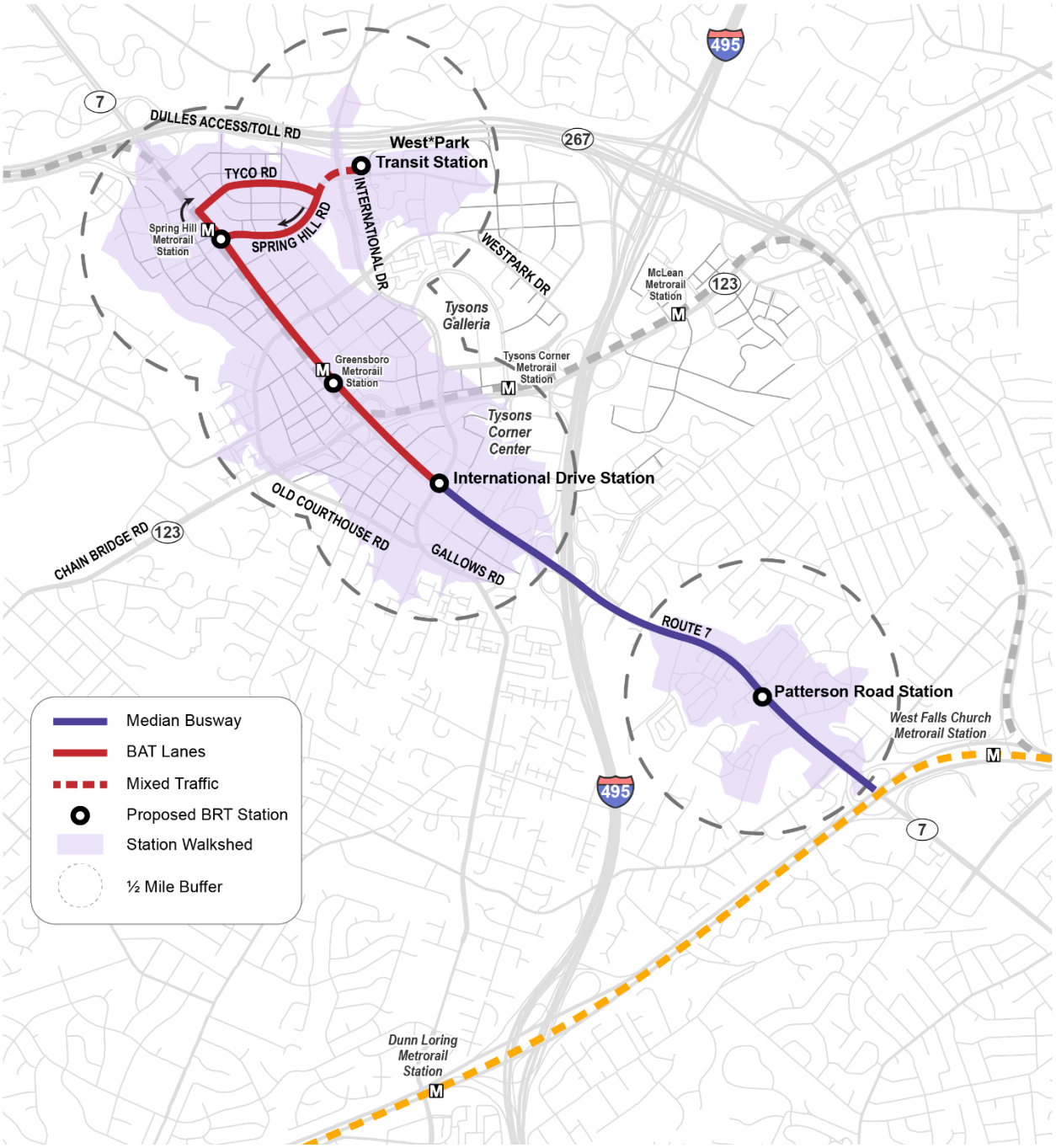


Figure 8-16 | Alternative 3 Street Cross-Sections

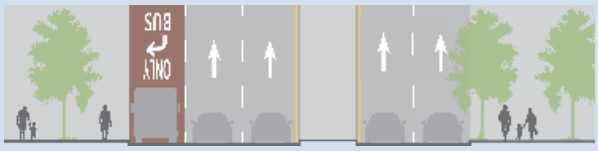
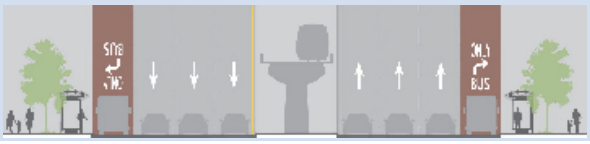
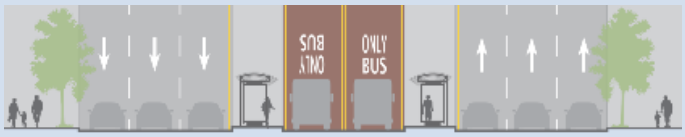
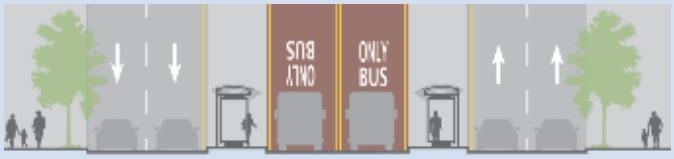
Street Name and Section	Description
Tyco Road	Eastbound BAT lane and two general traffic lanes in each direction
	
Spring Hill Road	Westbound BAT lane and two general traffic lanes in each direction
	
Route 7 – Spring Hill Road to International Drive	Curb BAT lanes and three general traffic lanes in each direction
	
Route 7 – International Drive to I-495	Median busway and three general traffic lanes in each direction
	
Route 7 – I-495 to I-66	Median busway and two general traffic lanes in each direction
	

Figure 8-17 | Patterson Road Station Location and Platform Configuration

Figure 8-18 | International Drive / Gallows Road Station Location and Platform Configuration

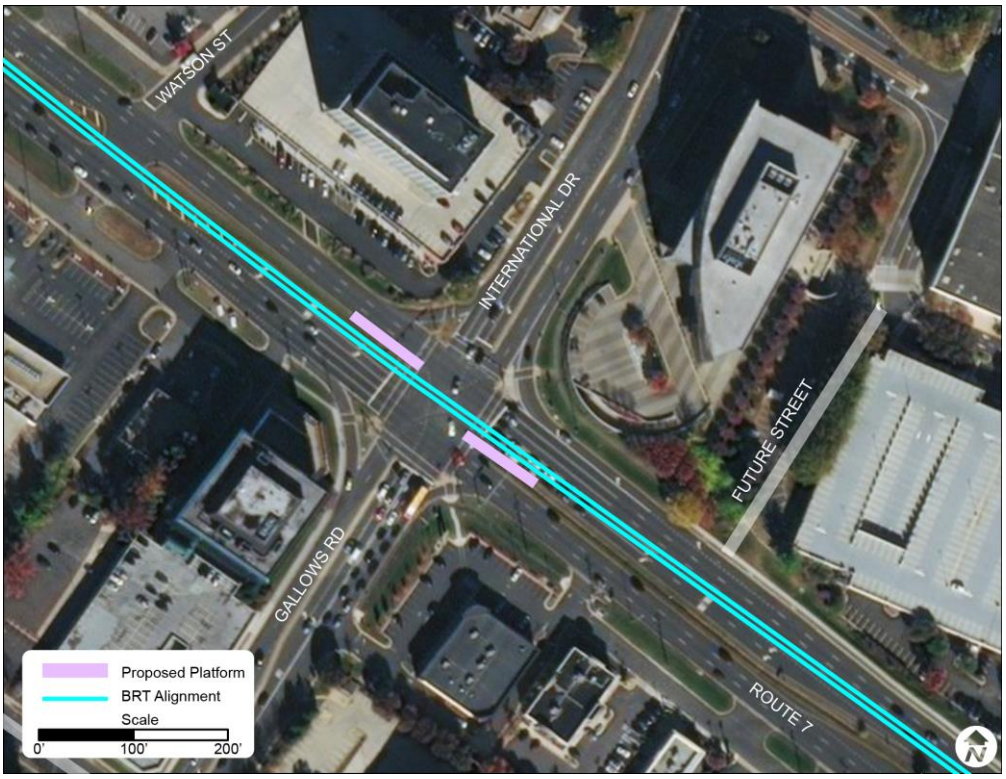


Figure 8-19 | Greensboro Metrorail Station Location and Platform Configuration

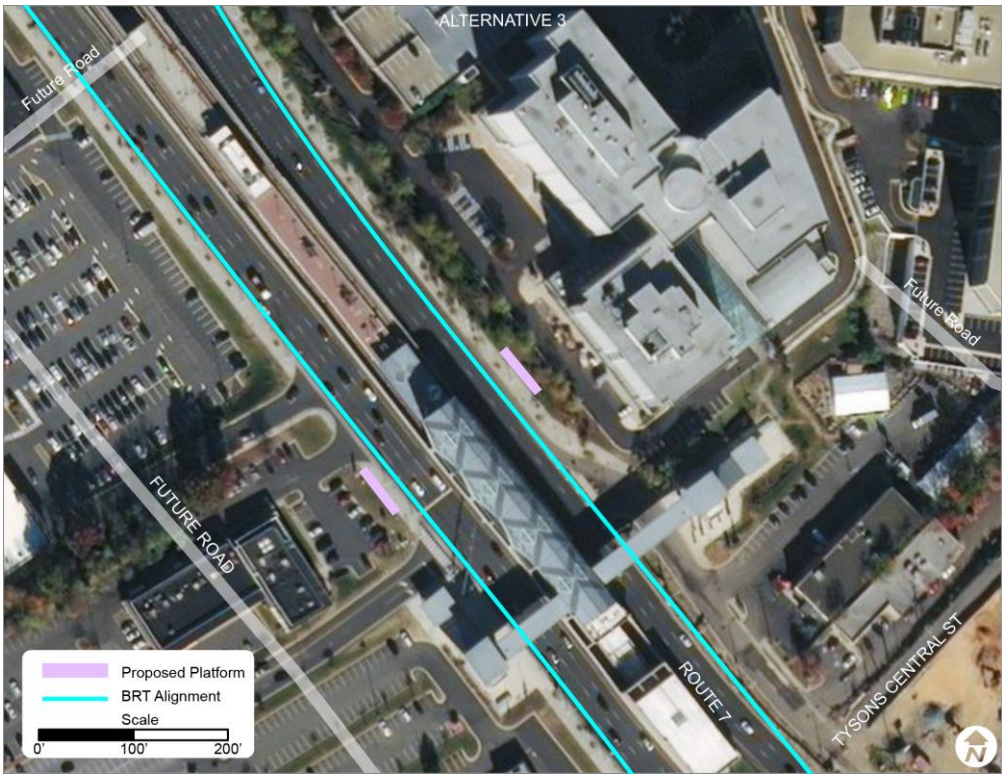


Figure 8-20 | Spring Hill Metrorail Station Location and Platform Configuration

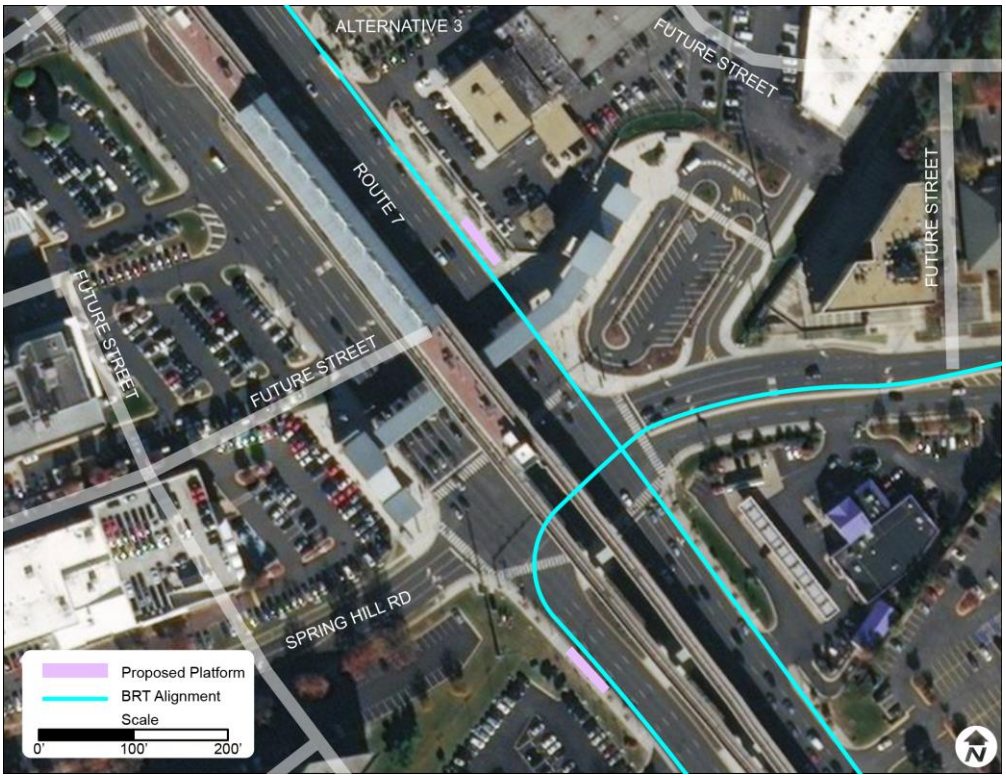
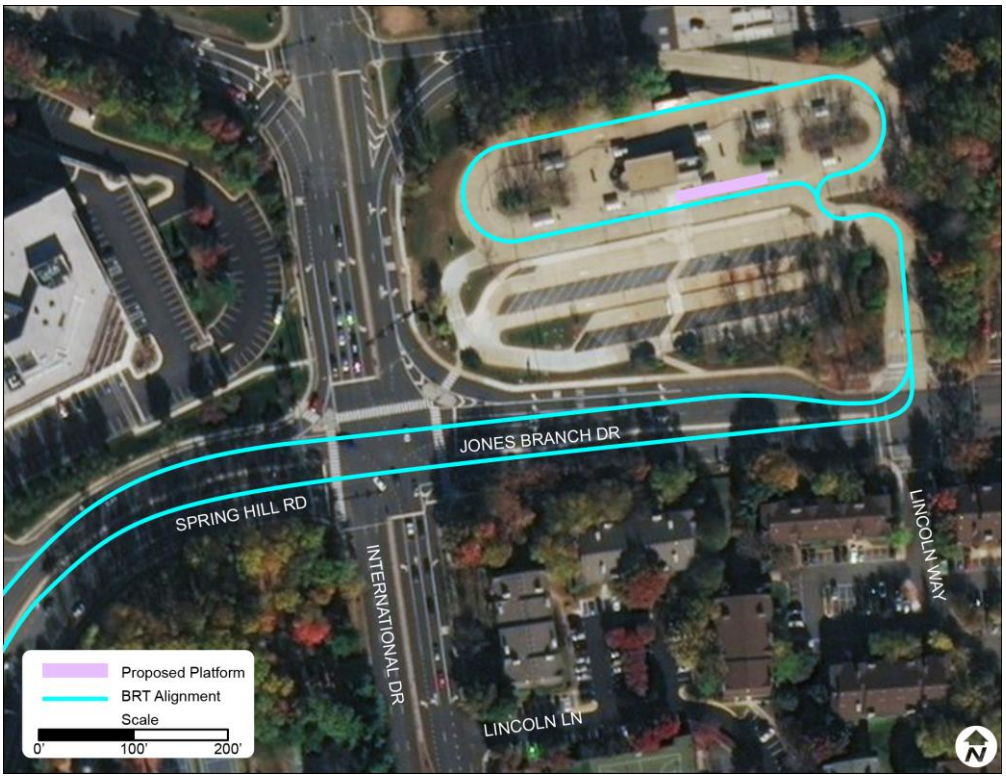


Figure 8-21 | West*Park Transit Station Location and Platform Configuration



9 Build Alternatives Evaluation

The purpose of this Build Alternatives Evaluation section is to document the evaluation results including the Measures of Effectiveness (MOEs) and comparison of the three alternatives against the 2045 Future No-Build baseline in order to determine the alternatives' effectiveness in achieving the project goal and objectives. The multimodal analysis of the future transportation conditions is based on the travel demand and traffic simulation Future-Build models.

9.1 Land Use and Demographics

Land use and demographics are one of the main set of MOEs used to quantify the impact of the three end-to-end alternatives as part of the Build Alternatives Evaluation Phase. Impact is measured in terms of the level of access each alternative provides to different types of land uses, number of households, population, and employment.

9.1.1 Land Use

The proposed conceptual land use pattern for Tysons includes clusters of high density, mixed-use buildings surrounding the four Metrorail stations; transforming from a large suburban office park into a 24/7 urban center with a mix of workers and residents. Alternative 1 provides the highest access to different types of land uses as compared to the other two alternatives including residential mixed-use, retail mixed-use, transit station mixed-use, residential as well as open space (see **Figure 9-1**. Alternative 2 provides the least access to different types of land use including only residential mixed-use, retail mixed-use and transit station mixed-use(see **Figure 9-2.** For Alternative 3, the access to different types of land use is similar to Alternative 1 in addition to providing access to office land use (see Table 9-1 for demographic access for each alternative).

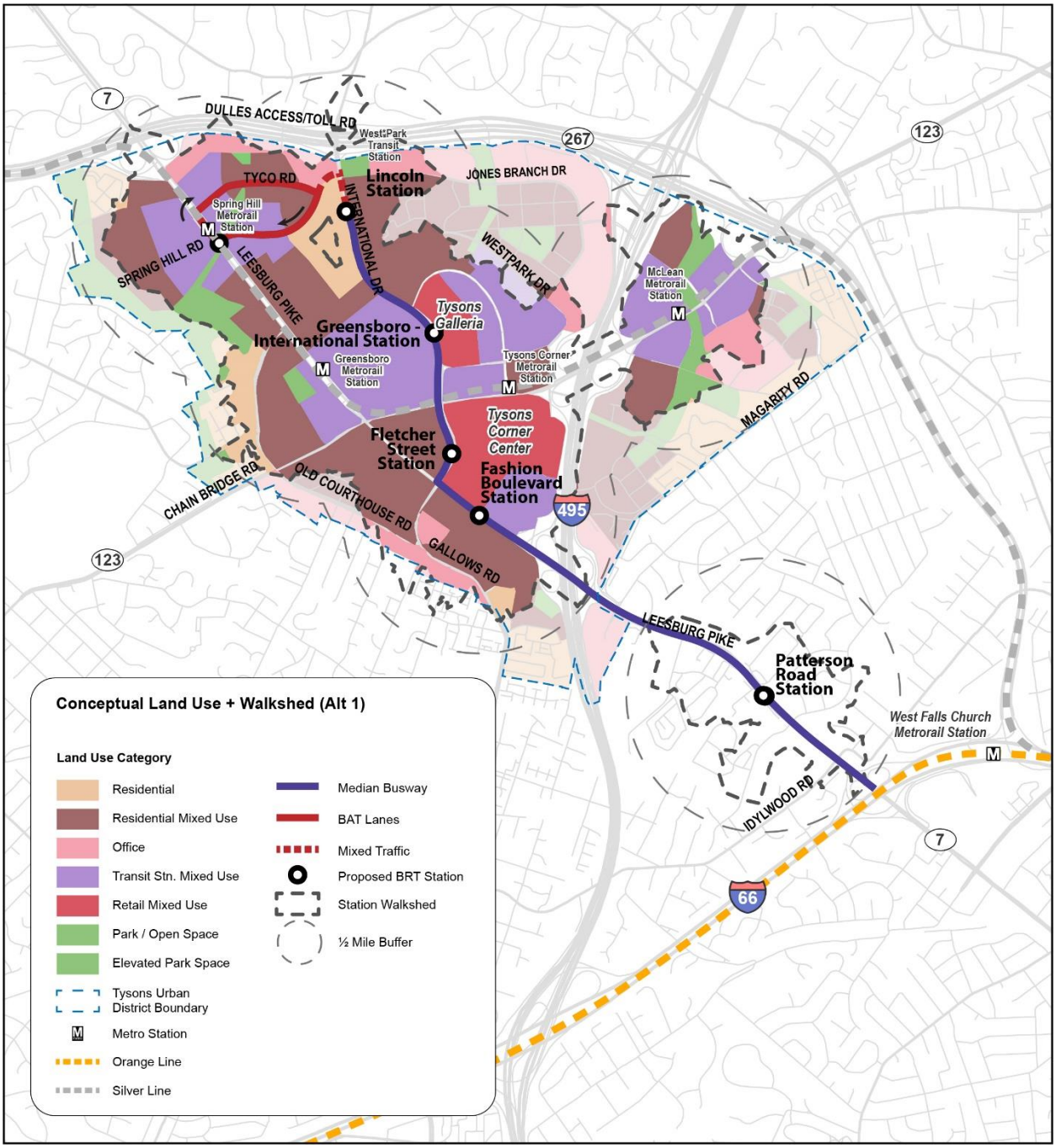
A GIS analysis was conducted for the ½-mile combined BRT and Metrorail station walkshed to capture the demographic metrics for each alternative as an indicator for potential ridership and access to premium transit service. As it relates to demographic metrics of households, population and employment, Alternative 1 provides the greatest access overall. Alternative 1 provides the greatest access to Households (+872), Population (+1,694), and Employment (+2,045) when compared to Alternative 3. Alternative 2 provides the least access to households, population, and employment of the three alternatives. The level of access of the alternatives to households, population and employment is summarized in **Table 9-1**.

Table 9-1 | Demographics Metrics for Build Alternatives

Demographic Metric	Alt 1	Alt 2	Alt 3
Households	8,248	5,495	7,376
Population	16,651	11,504	14,957
Employment	68,257	61,683	66,212

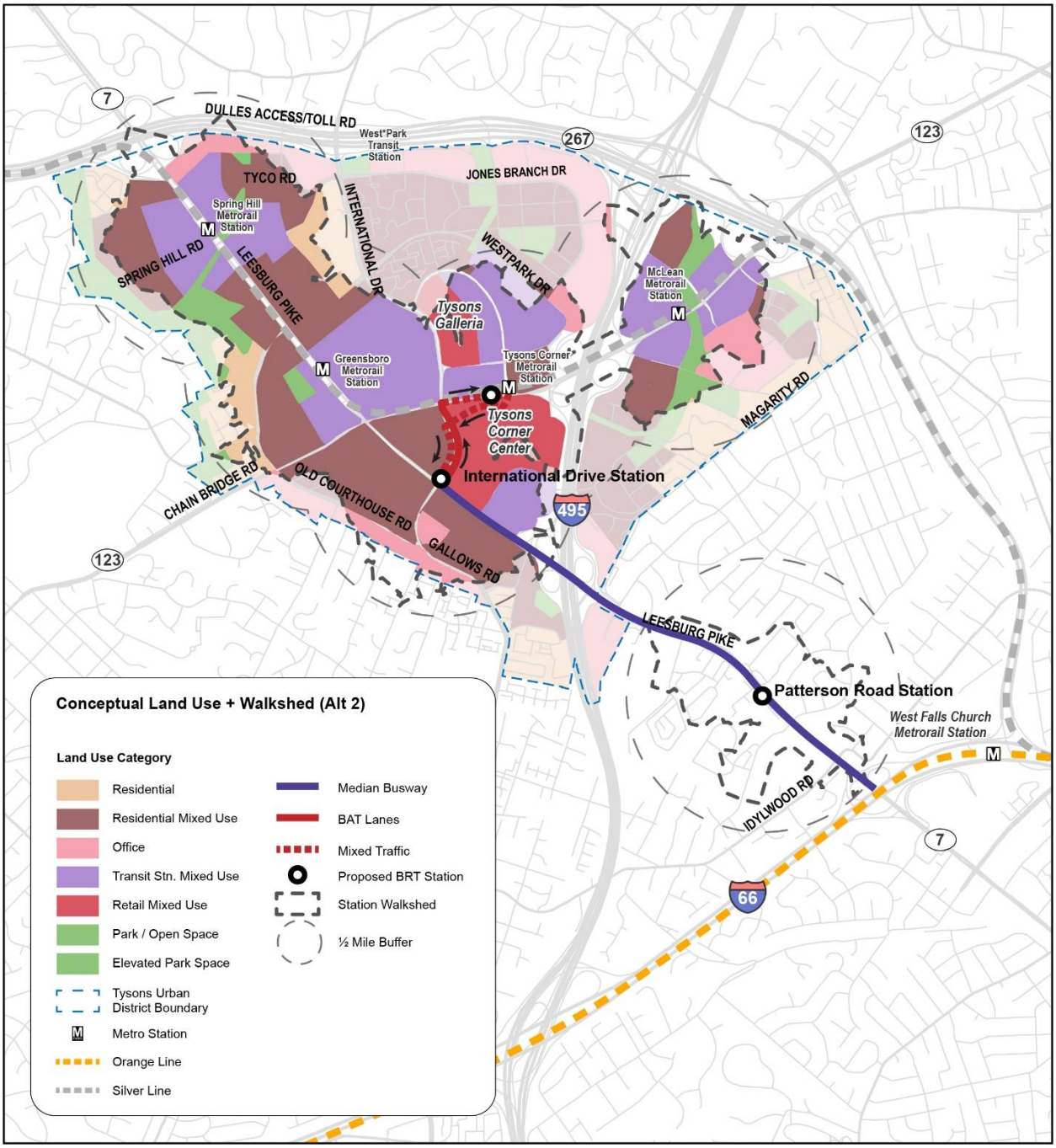
Source: MWCOG

Figure 9-1 | Alternative 1 with Study Area Conceptual Land Use in 2045



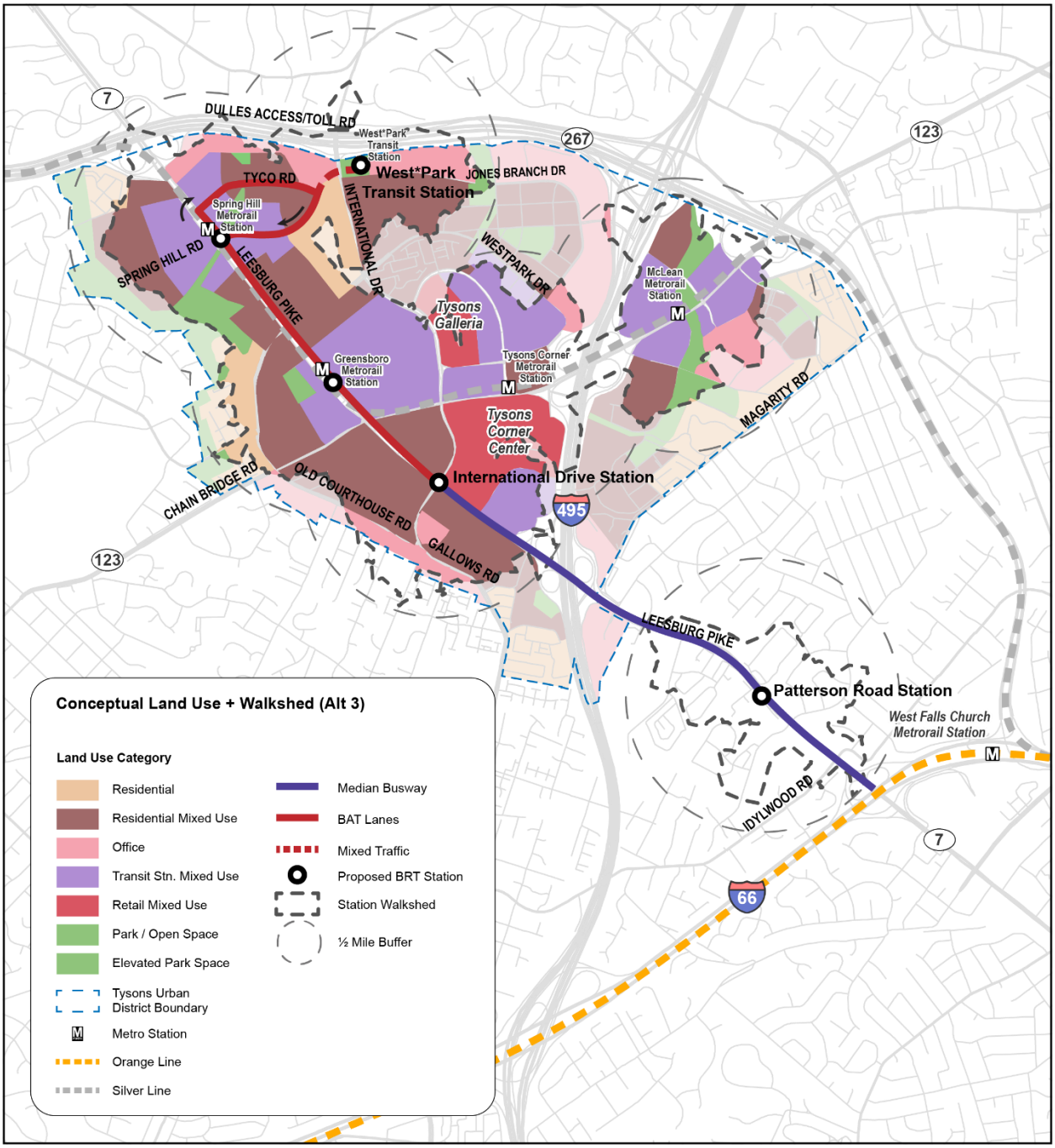
Source: Fairfax County - Tysons Conceptual Land use Plan

Figure 9-2 | Alternative 2 with Study Area Conceptual Land Use in 2045



Source: Fairfax County - Tysons Conceptual Land use Plan

Figure 9-3 | Alternative 3 with Study Area Conceptual Land Use in 2045



Source: Fairfax County - Tysons Conceptual Land use Plan

9.2 Transit

There were several transit MOEs that were considered for quantifying the impact of the three end-to-end alternatives on transit, including access to other transit services along the routes, frequency, ridership, mode share, travel speeds, and reliability. For the study, the evaluation assumed several new transit services would be added to the transportation network including the full build-out of the Metrorail Silver Line as well as additional bus routes.

In terms of access to major transit services, Alternative 1 serves the Spring Hill Metrorail station and Alternative 2 serves the Tysons Corner Metrorail station. In comparison, Alternative 3 provides more access to major transit services than both Alternative 1 and Alternative 2. Alternative 3 provides access to both the Spring Hill Metrorail station and the Greensboro Metrorail station, as well as the Tysons West*Park Transit Station, which is served by Fairfax Connector Route 401, 402, 423, 494, and 574.

9.2.1 Ridership

In the study area, the total daily transit boardings for BRT were evaluated for all three alternatives as well as ridership for Metrobus, Metrorail and other transit modes. The total transit ridership for each of the three alternatives was greater than the No-Build condition with BRT representing 8 – 17 percent of total daily transit boardings. **Table 9-2** provides ridership by mode for each of the alternatives.

Table 9-2 | Total Daily Transit Boardings in Study Area

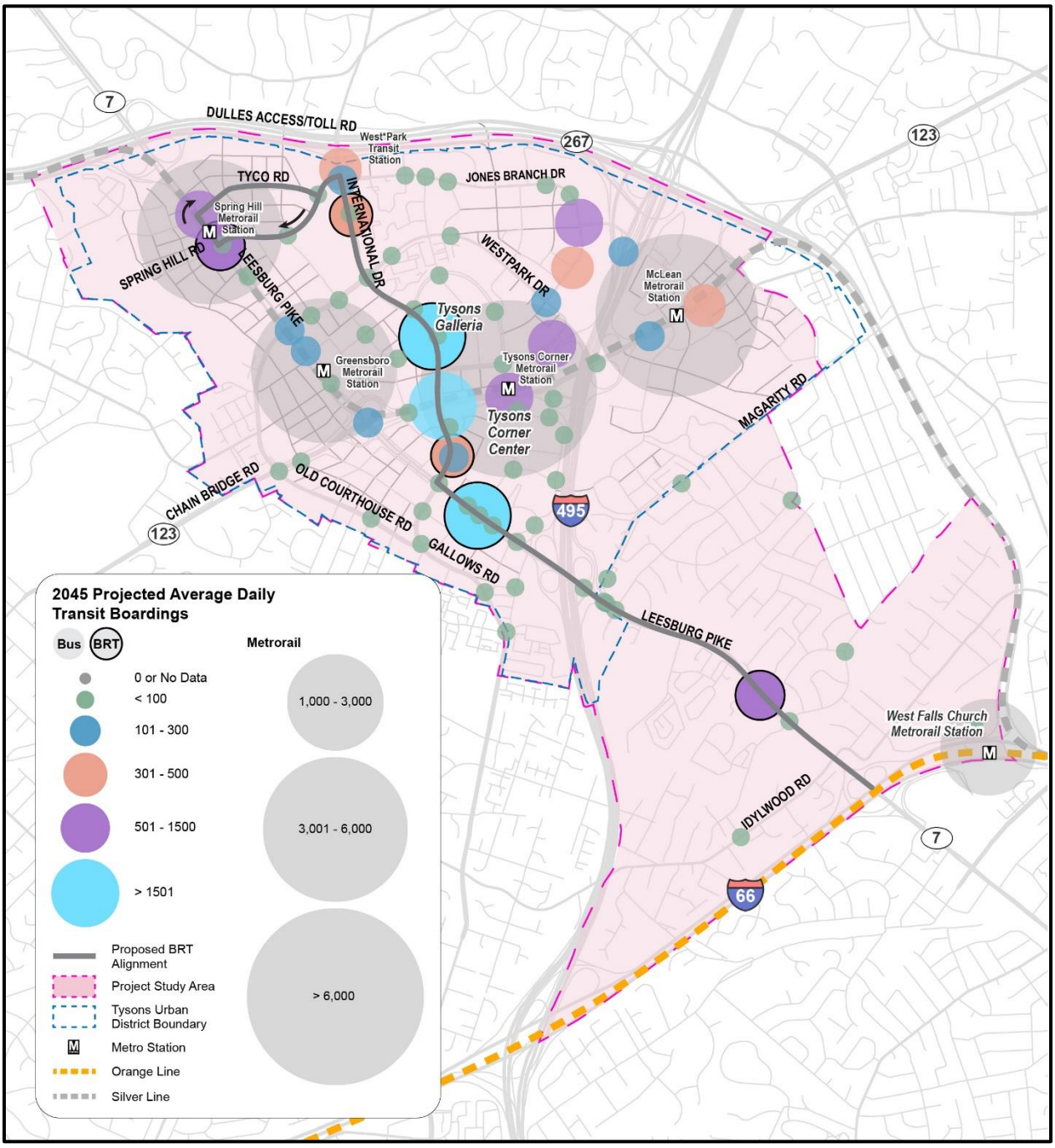
Mode	No Build	Alt 1	Alt 2	Alt 3
BRT	--	6,709	3,526	6,985
Metrobus	8,641	6,381	7,647	6,344
Metrorail	25,498	25,320	25,372	25,211
Other	4,188	3,067	3,588	3,223
Total	38,327	41,477	40,133	41,763

Source: Tysons BRT Study Travel Demand Model

When comparing alternatives, Alternative 3 provided the greatest BRT ridership as well as the greatest overall transit ridership in the study area. Alternative 1 provided slightly lower BRT ridership compared to Alternative 3, and Alternative 2 had the lowest BRT ridership of all three. However, in terms of impact of BRT on the ridership of other transit modes, Alternatives 2 resulted in the least amount of ridership being attracted away from other transit options.

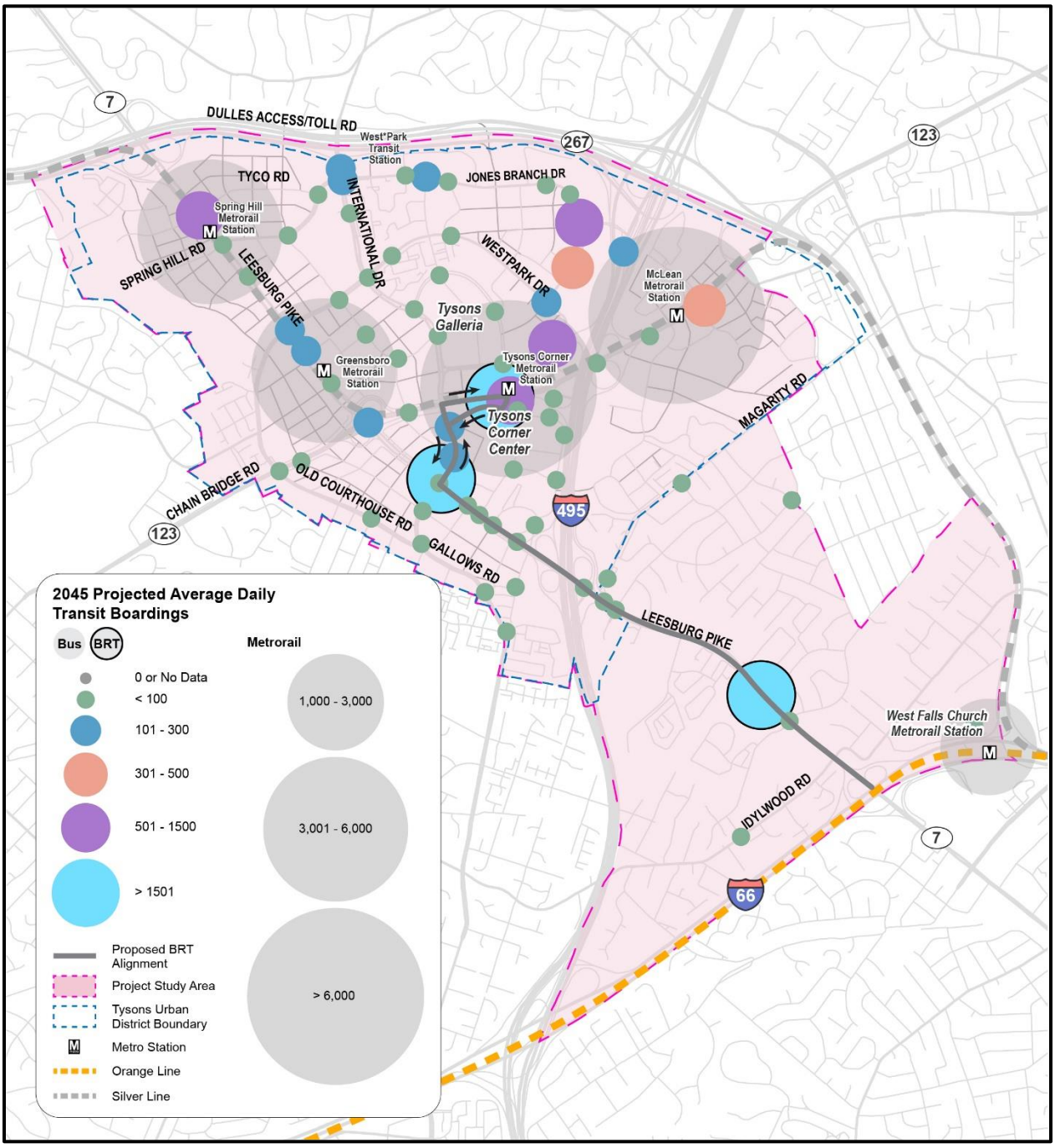
For each of the three alternatives, the areas with the strongest demand for BRT are shown in **Figure 9-4, Figure 9-5**, and **Figure 9-6** respectively. For Alternative 1, the areas with the strongest demand for BRT are Tysons Galleria and Fashion Blvd / Gallows Rd along Route 7. For Alternative 2, the areas with the strongest demand for BRT are Tysons Corner Metrorail station, Gallows Rd along Route 7 as well as the proposed Patterson Road station. Then for Alternative 3, the areas with the strongest demand for BRT are Greensboro Metrorail station and Gallows Road along Route 7. While Alternative 2 had the lowest overall transit ridership and the lowest BRT ridership, it did benefit from having the most area where the demand for BRT is greater than 1,501 average daily transit boardings.

Figure 9-4 | Alternative 1 – 2045 Projected Average Daily Transit Boardings



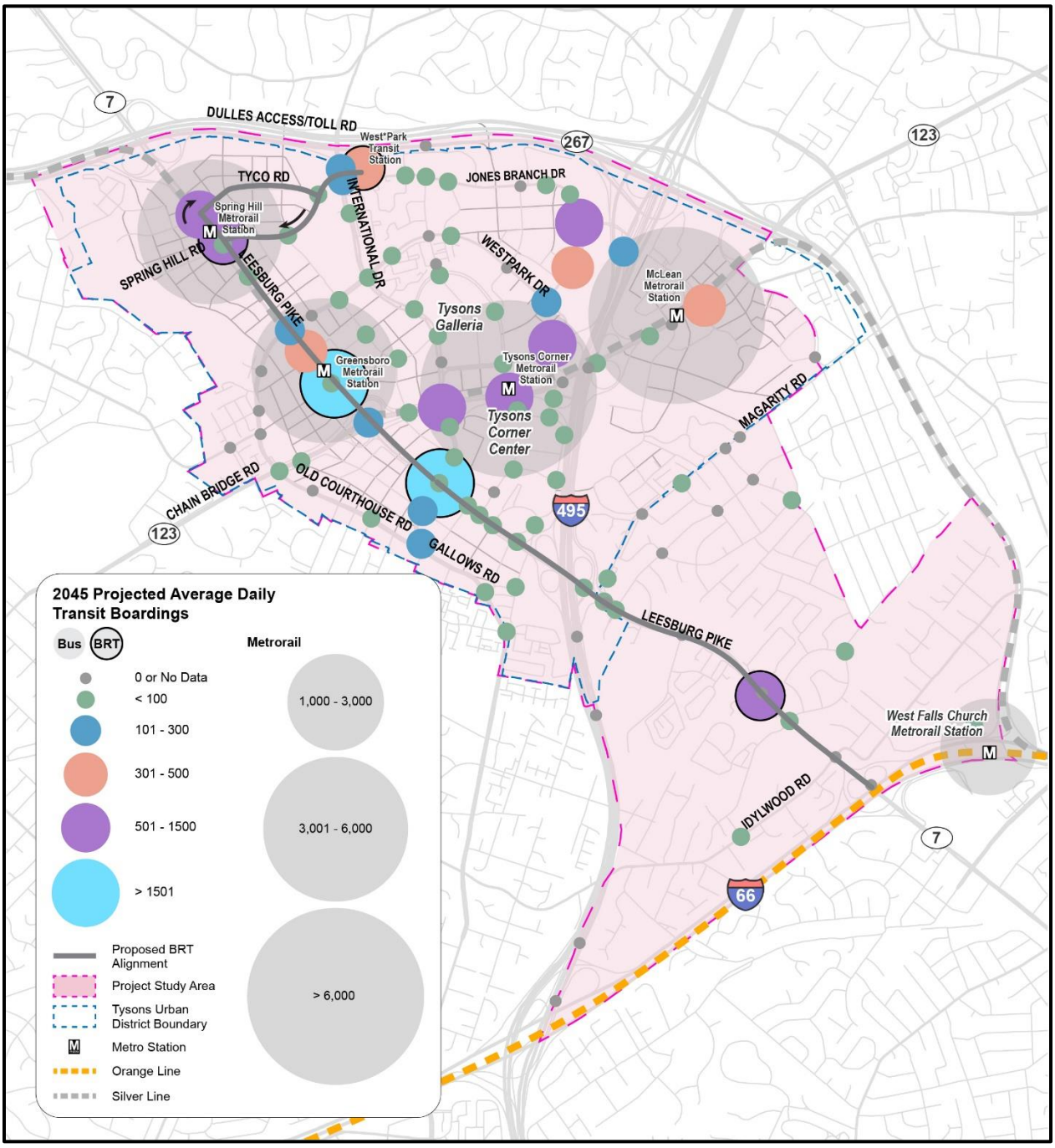
Source: Tysons BRT Study Travel Demand Model

Figure 9-5 | Alternative 2 – 2045 Projected Average Daily Transit Boardings



Source: Tysons BRT Study Travel Demand Model

Figure 9-6 | Alternative 3 – 2045 Projected Average Daily Transit Boardings



Source: Tysons BRT Study Travel Demand Model

9.2.2 Transit Mode Share

Peak and daily transit mode share increased by 0.3 percent for all alternatives resulting in negligible difference between transit mode share shift when comparing each of the alternatives to the No-Build condition as seen in **Table 9-3**. In terms of peak and daily drive mode share, there was a slight decrease of 0.3 percent for each of the alternatives. As such, there is also negligible difference between drive mode share shift when comparing each of the alternatives.

Table 9-3 | Mode Share in Study Area

Mode	No Build		Alt 1 International Dr to Spring Hill Metro		Alt 2 International Dr to Tysons Corner Metro		Alt 3 Route 7 to West*Park Transit Station	
	Peak Period	Daily	Peak Period	Daily	Peak Period	Daily	Peak Period	Daily
Drive	89.0%	91.4%	88.7%	91.1%	88.7%	91.2%	88.7%	91.1%
Transit	11.0%	8.6%	11.3%	8.9%	11.3%	8.8%	11.3%	8.9%

Source: Tysons BRT Study Travel Demand Model

Note: Peak period 6:00 - 9:00 AM, 3:30 - 7:30 PM

In terms of shifts for peak and daily walk mode share as seen in **Table 9-4**. Alternative 1 and Alternative 3 both had an increase of 0.4 percent for the peak period and daily mode share as compared to the No-Build condition. Alternative 2 only had an increase of 0.2 percent for the peak period and daily mode share. The increases across each of the alternatives are negligible.

For Walk & Ride mode share, all three alternatives showed a decrease for both the peak period and daily mode share, with Alternative 3 having the highest decrease of 0.3 percent for both the peak period and daily mode share. However, across all alternatives the differences in the Walk and Ride mode shift was negligible.

For the Kiss & Ride mode share, all three alternatives showed a decrease for both the peak period and daily mode share, but as with walk mode share and Walk & Ride mode share the differences are negligible. Overall, there were increases in walk mode share, but decreases in both Walk & Ride as well as Kiss & Ride mode share for all three alternatives for peak and daily periods. In terms of the off-peak period, alternatives followed the same trend as peak and daily cross walk, Walk & Ride, and Kiss & Ride mode shares.

Table 9-4 | Transit Ridership Mode Share in Study Area

Mode	No Build			Alt 1 International Dr to Spring Hill Metro			Alt 2 International Dr to Tysons Corner Metro			Alt 3 Route 7 to West*Park Transit Station		
	Peak	Off Peak	Daily	Peak	Off Peak	Daily	Peak	Off Peak	Daily	Peak	Off Peak	Daily
Walk	90.2%	92.0%	90.9%	90.6%	92.3%	91.3%	90.4%	92.2%	91.1%	90.6%	92.4%	91.3%
Walk & Ride	7.0%	5.7%	6.5%	6.8%	5.5%	6.3%	6.9%	5.5%	6.3%	6.7%	5.4%	6.2%
Kiss & Ride	2.8%	2.3%	2.6%	2.7%	2.2%	2.5%	2.7%	2.2%	2.5%	2.6%	2.2%	2.5%

Source: Tysons BRT Study Travel Demand Model

Note: Peak period 6:00 - 9:00 AM, 3:30 - 7:30 PM

While BRT is not expected to increase transit mode share, the reliability and travel time improvements will benefit transit users traveling on the corridor, which is currently, and is expected, to remain at capacity. BRT increases offers the number of non-automobile travel options in the corridor for those who might otherwise use single occupant vehicles. There will be high density development due to upcoming land use changes. These high-density developments typically attract people that are more inclined not to drive and for whom premium, frequent, reliable transit, such as BRT, is an important component of available travel choices and can play a key role in making housing location choices. Additionally, BRT:

- Increases corridor throughput capacity without widening roadways, thus addressing the current capacity challenges along the corridor;
- Improves service for existing transit passengers;
- Incentivizes transit usage with improved service; and
- Supports land use and economic development goals through improved regional transit connections and increased capacity for growth.

9.2.3 Bus Travel Speed

To analyze transit conditions, bus speed in the study area was analyzed using VISSIM for both local bus routes and the BRT service. The following sections provide the results of the analysis for the local bus and BRT routes.

9.2.3.1 Local Bus Travel Speed

Table 9-5 summarizes average transit travel speed by segment for the AM peak and the PM peak hours for local buses. Key findings are summarized as follows:

- During the PM peak period, local bus travel speed on Route 7 for all the Build Alternatives tends to be lower compared to the future No-Build scenario. For the AM peak period, findings were overall mixed where local bus speed improved along certain segments and decreased on others. The mixed findings can be attributed to the differences in traffic volumes for each scenario as

well as the signal timing adjustments, which may impact AM and PM traffic conditions differently.

- Along International Drive, one important finding was that local bus speeds remain very low (less than 5 mph) during the PM peak hour for all the scenarios including the future No-Build scenario. In the AM peak hour, local bus speed improved in the northbound direction considerably while speed reductions were observed in the southbound direction.

Table 9-5 | Simulated Peak Average Transit Travel Speeds (mph) for Local Routes

Direction	Segment	No Build – Local Bus		Alt 1 Local Bus		Alt 2 Local Bus		Alt 3 Local Bus	
		AM	PM	AM	PM	AM	PM	AM	PM
Northbound Route 7	Idlywood Rd to Ramada Rd	9.4	12.5	7.0	11.7	7.9	8.1	7.3	6.7
	Ramada Rd to Fashion Blvd	14.6	29.6	25.1	19.3	19.4	15.7	15.9	15.9
	Fashion Blvd to Westpark Dr	--	--	--	--	--	--	--	--
	Westpark Dr to Spring Hill Rd	11.3	5.7	9.8	29.6	10.3	29.4	13.0	13.6
Southbound Route 7	Spring Hill Rd to Westpark Dr	7.9	6.8	8.4	4.0	7.9	8.2	9.9	6.9
	Westpark Dr to Fashion Blvd	--	--	--	--	--	--	--	--
	Fashion Blvd to Ramada Rd	19.2	17.4	22.0	9.9	20.6	8.0	19.0	11.8
	Ramada Rd to Idylwood Rd	7.7	14.5	10.9	16.2	10.2	13.9	10.6	13.7
Northbound International Dr	Route 7 to Chain Bridge Rd	3.8	3.4	8.1	2.7	9.5	3.3	7.8	1.5
	Chain Bridge Rd to Lincoln Circle	--	--	--	--	--	--	--	--
	Lincoln Circle to Spring Hill Rd	--	--	--	--	--	--	--	--
Southbound International Dr	Spring Hill Rd to Lincoln Circle	--	--	--	--	--	--	--	--
	Lincoln Circle to Chain Bridge Rd	--	--	--	--	--	--	--	--
	Chain Bridge Rd to Route 7	8.2	4.6	4.8	4.6	2.9	4.7	7.3	4.2

Source: Tysons BRT Study VISSIM Traffic Models

9.2.3.2 Bus Rapid Transit (BRT) Travel Speed

Table 9-6 shows the average BRT travel speed for the AM peak and the PM peak hours. Speeds for the local buses for the No-Build condition are also displayed to provide a baseline for comparison. Compared to local buses, BRT operates substantially faster in both AM and PM peak hours, especially on segments with median running bus lanes, which avoid queuing at intersections and allow for uncongested travel. Along segments with median running bus lanes and no BRT stations, speeds over 20 mph were observed in each scenario, indicating the effectiveness of median running bus lanes. Segments with mixed running traffic resulted in the lowest speeds (typically 5 to 10 mph). This is not surprising since BRT buses experience traffic delays along these segments, in addition to the delay that occurs during passenger boarding and alighting.

BAT lanes resulted in higher speeds than the mixed traffic conditions, however, did not perform as well as the median running lanes. This can be explained by the delay due to the right turning vehicles that are also allowed on the BAT lanes, resulting in lower bus speeds, especially at intersections with high turn volumes. Overall, Alternative 1 operated with lower BRT speeds compared to Alternative 2 and Alternative 3 as a result of the mixed traffic segments on International Drive. Alternative 2 operated with higher BRT speeds, although its coverage is much more limited compared to the other two alternatives.

Table 9-6 | Simulated Peak Average BRT Travel Speeds (mph)

Direction	Segment	No Build – Local Bus		Alt 1 BRT		Alt 2 BRT		Alt 3 BRT	
		AM	PM	AM	PM	AM	PM	AM	PM
Northbound Route 7	Idlywood Rd to Ramada Rd	9.4	12.5	22.9	27.1	24.7	18.9	21.4	24.0
	Ramada Rd to Fashion Blvd	14.6	29.6	27.8	29.3	29.9	28.9	30.1	25.1
	Fashion Blvd to Westpark Dr	--	--	--	--	--	--	9.4	10.7
	Westpark Dr to Spring Hill Rd	11.3	5.7	--	--	--	--	14.0	33.2
Southbound Route 7	Spring Hill Rd to Westpark Dr	7.9	6.8	--	--	--	--	22.3	8.5
	Westpark Dr to Fashion Blvd	--	--	--	--	--	--	15.4	9.4
	Fashion Blvd to Ramada Rd	19.2	17.4	19.8	20.5	23.7	21.5	25.2	22.8
	Ramada Rd to Idylwood Rd	7.7	14.5	23.7	26.2	19.4	24.4	25.0	26.1
Northbound International Dr	Route 7 to Chain Bridge Rd	3.8	3.4	11.0	15.5	11.1	9.7	--	--
	Chain Bridge Rd to Lincoln Circle	--	--	9.8	14.3	--	--	--	--
	Lincoln Circle to Spring Hill Rd	--	--	7.0	5.5	--	--	--	--
Southbound International Dr	Spring Hill Rd to Lincoln Circle	--	--	16.1	11.9	--	--	--	--
	Lincoln Circle to Chain Bridge Rd	--	--	10.3	7.8	--	--	--	--
	Chain Bridge Rd to Route 7	8.2	4.6	14.1	7.9	12.1	5.8	--	--

Source: Tysons BRT Study VISSIM Traffic Simulation Models

Notes: Mixed Traffic segments shown in **purple;** BAT Lanes segment shown in **orange**

9.2.4 Transit Travel Time Reliability

This section evaluates transit travel time reliability for BRT buses for each alternative. The local bus travel time reliability for the No-Build scenario was also included as a comparison. Transit travel time reliability was measured using the 95th percentile bus travel times as a proxy to represent "near-worst case" travel conditions. The 95th percentile represents a point along a cumulative distribution graph that 95% of the vehicles fall under. For example, if the 95th percentile travel time for passenger cars is 10 minutes, 95% of all passenger cars will experience a travel time of 10 minute or faster. The 95th percentile is a function of the average travel time and the standard deviation. The further apart the 95th percentile travel time and the average travel time are, the less reliable the service is. For this study, the expected travel times were assumed to be the average travel times. The study team determined this measure of travel time reliability better communicated the concept than the travel time standard deviation that was previously used for the Existing Conditions analysis, particularly when comparing the BRT alternatives which all showed similar travel time standard deviations.

Table 9-7 shows the 95th percentile BRT travel times for the AM and PM peak hours, respectively. Key findings from the reliability analysis are summarized as follows:

- Overall, BRT is considerably more reliable, with much lower 95th percentile travel times compared to local buses on median running segments.
- For Alternative1, BRT on International Drive is less reliable compared to BRT on Route 7, especially in the mixed traffic segments. There are significant reliability issues in the segment between Chain Bridge Rd and Westpark Dr.
- For Alternative 3, certain segments of the BAT lanes (e.g., Fashion Boulevard to Westpark Drive) cause unreliable operations with high 95th percentile travel times. This can be attributed to the high right turn volumes along these segments causing friction for BRT vehicles and delaying buses at intersections.

Table 9-7 | Bus Rapid Transit 95th Percentile Travel Times during the AM and PM Peak Hours

Direction	Segment	No Build – Local Bus		Alt 1 BRT		Alt 2 BRT		Alt 3 BRT	
		AM	PM	AM	PM	AM	PM	AM	PM
Northbound Route 7	Idlywood Rd to Ramada Rd	7.8	5.4	2.9	3.0	2.6	3.3	3.0	3.2
	Ramada Rd to Fashion Blvd	2.8	1.0	1.4	1.3	1.4	1.5	1.4	1.5
	Fashion Blvd to Westpark Dr	-	-	-	-	-	-	6.9	6.4
	Westpark Dr to Spring Hill Rd	3.1	6.8	-	-	-	-	2.3	0.8
Southbound Route 7	Spring Hill Rd to Westpark Dr	5.0	5.7	-	-	-	-	1.9	4.5
	Westpark Dr to Fashion Blvd	-	-	-	-	-	-	4.6	6.9
	Fashion Blvd to Ramada Rd	1.6	2.3	2.0	2.9	1.9	2.2	1.7	2.2
	Ramada Rd to Idylwood Rd	9.4	4.7	2.8	2.7	3.6	2.7	3.0	2.6
Northbound International Dr	Route 7 to Chain Bridge Rd	5.5	5.0	1.8	1.8	1.5	3.0	-	-
	Chain Bridge Rd to Lincoln Circle	-	-	4.2	3.0	-	-	-	-
	Lincoln Circle to Spring Hill Rd	-	-	4.0	6.7	-	-	-	-
Southbound International Dr	Spring Hill Rd to Lincoln Circle	-	-	1.7	2.1	-	-	-	-
	Lincoln Circle to Chain Bridge Rd	-	-	4.1	5.0	-	-	-	-
	Chain Bridge Rd to Route 7	1.7	2.8	1.4	2.4	1.2	3.9	-	-

Source: Tysons BRT Study VISSIM Traffic Models

Notes: Mixed Traffic segments shown in **purple;** BAT Lanes segment shown in orange

9.3 Traffic

This section describes the comparison of the No-Build and the three BRT alternatives traffic conditions. Vehicle speeds, intersection delay, and several other MOEs give a full picture of traffic conditions in the study area under each BRT Alternative scenario.

9.3.1 Corridor Travel Speed

This section presents corridor average vehicle travel speeds obtained from VISSIM on Route 7 and International Drive. **Table 9-8** and **Table 9-9** show the corridor average vehicle travel speed for the AM and PM peak hours, respectively. Simulation results show that International Drive has lower vehicle speeds compared to Route 7 in all analysis scenarios. This can be attributed to the signal timing effects, which typically provide longer green time and enhanced signal progression for Route 7, thereby supporting higher vehicle speeds. Another important finding is that, excluding Alternative 3, the alternatives generally resulted in comparable speeds to the No-Build conditions. Specifically, the only exception is for Alternative 3 during the PM peak hour in which average vehicle speeds are considerably lower both along Route 7 and International Drive. This can be explained by the potential reduction in vehicle capacity as a result of lane repurposing that occurred in Alternative 3 for the BAT lanes segment, which converted one of the general-purpose lanes in each direction into curb side bus only lanes. The effects are more pronounced in the PM peak compared to the AM peak, since the PM peak conditions are more critical with less extra capacity on Route 7, leading to slower speeds.

Table 9-8 | Average Vehicle Travel Speeds (mph) for the AM Peak Hour

Direction/Corridor	No Build	Alt 1	Alt 2	Alt 3
Northbound Route 7	14.5	14.2	13.7	12.6
Southbound Route 7	15.8	17.9	17.1	17.7
Average Route 7	**15.2**	**16.1**	**15.4**	**15.2**
Northbound International Dr	10.8	12.2	12.8	12.2
Southbound International Dr	18.1	15.7	15.5	18.6
Average International Dr	**14.5**	**14.0**	**14.2**	**15.4**

Table 9-9 | Average Vehicle Travel Speeds (mph) for the PM Peak Hour

Direction/Corridor	No Build	Alt 1	Alt 2	Alt 3
Northbound Route 7	17.7	17.6	15.7	10.6
Southbound Route 7	16.1	16.1	14.8	13.1
Average Route 7	**16.9**	**16.9**	**15.3**	**11.9**
Northbound International Dr	8.1	8.9	10.0	6.8
Southbound International Dr	12.3	10.0	10.8	8.0
Average International Dr	**10.2**	**9.5**	**10.4**	**7.4**

9.3.2 Intersection Operations

This section provides operations results for intersections from the study based on VISSIM outputs, with a focus on intersection level of service (LOS) and vehicle delay. Detailed intersection operation results such as delay and LOS by movement and vehicle queues are provided in **Appendix C**. **Table 9-10** provides a summary of the total number of intersections operating within each LOS category for each alternative during the AM and PM peak hours. The results show that Alternative 3 has the most significant impact on vehicle operations compared to the other scenarios during both peak hours. This can mostly be attributed to the reduction in vehicle capacity along Route 7 because of lane repurposing for the BAT lanes segment, which converted one of the general-purpose lanes into curb side bus only lanes in each direction. This lane reduction also led to higher traffic volumes on International Drive since it serves as an alternate route to Route 7, increasing vehicle delay along certain intersections.

Table 9-10 | Number of Intersections Operating within each LOS Category for AM and PM Peak Hours

Level of Service	No Build	Alt 1	Alt 2	Alt 3
AM Peak Hour				
LOS A-C	25	25	22	20
LOS D	5	9	9	10
LOS E	5	3	3	4
LOS F	5	3	6	6
PM Peak Hour				
LOS A-C	22	22	24	21
LOS D	4	7	4	5
LOS E	6	5	6	5
LOS F	8	6	6	9

Table 9-11 shows LOS for each study intersection for the AM and PM peak hours. Key findings are summarized as follows:

- As noted previously, Alternative 3 generally resulted in higher vehicle delay and degraded operations both on Route 7 and International Drive intersections both for the AM and PM peak hours. This is consistent with the vehicle corridor travel time savings and can be attributed to the reduction in vehicle capacity along Route 7 north of International Drive.
- Alternative 1 and Alternative 2 performed similarly compared to each other and compared to the Future No-Build scenario. This is because these two alternatives have the same number of general-purpose lanes both on Route 7 and International Drive compared to the No Build scenario. The differences in vehicle delay compared to the No Build scenario can be attributed

to the signal timing effects of BRT. Where BRT is running in the median, all left turn signals that operate with permitted left turns converted to protected only left turn with the future alternatives. Additionally, Transit Signal Priority (TSP) was assumed and modeled in VISSIM to improve BRT speed, which might have increased vehicle delay at signalized intersections.

- Finally, several intersections experienced high vehicle delay in all scenarios, especially during the PM peak. With a few exceptions, this is mostly due to the capacity issues in the No-Build scenario rather than the effect of BRT since vehicle delays are also high in the No-Build scenario.

Table 9-12 shows vehicle delay for each study intersection for the AM and PM peak hours. Overall, findings were similar to the LOS results discussed above. The results showed that the effect of BRT on intersection delay is negligible with Alternative 1 and Alternative 2 compared to the No-Build scenario. Alternative 3 increased delay at a few intersections, especially during the PM peak hour as a result of reduction in vehicle capacity on Route 7 and increased vehicle traffic on International Drive.

Table 9-11 | Study Area Intersection LOS for AM and PM Peak Hours

Int No.	Intersection Cross Streets	No Build		Alt 1		Alt 2		Alt 3	
		AM	PM	AM	PM	AM	PM	AM	PM
1	Rt 7 & Tyco Rd	E	E	E	D	E	D	E	E
2	Rt 7 & Spring Hill Rd	D	E	D	D	D	D	D	E
3	Rt 7 & Westpark Dr	F	F	F	F	F	F	F	F
4	Rt 7 & Chain Bridge Rd SB	C	C	C	B	C	B	C	B
5	Rt 7 & Chain Bridge Rd NB	B	A	B	A	A	A	C	A
6	Rt 7 & International Dr	E	E	E	E	E	F	E	E
7	Rt 7 & Fashion Blvd	C	D	C	D	D	D	D	D
8	Rt 7 & Old Gallows Rd	A	B	A	B	B	B	B	B
9	Rt 7 & I-495 SB	B	B	A	A	B	B	C	C
10	Rt 7 & I-495 NB	B	B	B	C	B	C	C	C
11	Rt 7 & Lisle Ave/Ramada Rd	D	D	D	E	D	E	D	E
12	Rt 7 & Marshall HS Driveway	A	A	C	B	C	C	B	C
13	Rt 7 & George Marshall Dr	C	B	D	C	D	C	D	D
14	Rt 7 & Dominion Dr	B	A	C	A	C	A	C	C
15	Rt 7 & Patterson Rd	C	A	C	B	C	B	B	C
16	Rt 7 & Pimmit Dr	F	C	D	C	D	C	D	D
17	Rt 7 & Idylwood Rd	D	C	C	C	D	C	D	C
18	Rt 7 & I-66 SB	B	B	C	B	C	B	C	B
19	Rt 7 & I-66 NB	A	A	E	A	F	A	F	C
20	Gallows Rd & Old Court House Rd	C	F	D	F	E	F	D	F
21	International Rd & Tysons One Pl	E	E	C	D	C	E	D	F
22	International Dr & Chain Bridge Rd	F	E	D	E	F	E	F	F
23	International Dr & Galleria Dr	A	A	A	D	A	B	A	C
24	International Dr & Greensboro Dr	C	C	C	E	C	C	C	D
25	International Dr & Tysons Blvd	C	C	C	C	C	C	B	C
26	International Dr & Westpark Dr	D	F	D	D	C	E	C	F
27	International Dr & Jones Branch Dr	E	F	D	F	F	F	F	F
28	Spring Hill & Tyco Rd	C	C	C	C	D	C	E	B
29	Spring Hill Rd & Greensboro Dr	D	F	D	D	D	D	D	C
30	Chain Bridge Rd & Old Courthouse Rd	F	F	F	F	F	F	F	F
31	Tysons and Chain Bridge Rd	E	F	C	F	D	E	E	F
32	International Dr & Fletcher St	B	D	B	E	A	E	B	E
33	Westpark Dr & Greensboro Dr	F	F	F	F	F	F	F	F
34	Rt 7 & New Street (except Alternative 3)	A	A	A	A	A	A	C	A
35	Rt 7 & Broad Street	C	D	B	B	B	C	B	D
36	Chain Bridge Rd & Rt 7 South	A	C	A	C	A	C	A	C
37	Chain Bridge Rd & Rt 7 North	C	C	B	C	C	C	B	C
38	Chain Bridge Rd & Rt 7	C	B	C	C	C	C	C	B
39	Tyco Rd & Greensboro Dr	C	E	C	C	C	C	D	C
40	International Dr & Lincoln Circle*	-	-	B	C	-	-	-	-

LOS: Green – A, B, C; Yellow – D; Orange – E Red – F **Indicates Unsignalized Intersection**

---- Tysons Urban District Boundary Intersections

*International Drive and Lincoln Circle was converted to a signalized intersection in Alternative 1 to allow for BRT transition

Table 9-12 | Study Area Intersection Average Vehicle Delay (seconds) for AM and PM Peak Hours

Int No.	Intersection Cross Streets	No Build		Alt 1		Alt 2		Alt 3	
		AM	PM	AM	PM	AM	PM	AM	PM
1	Rt 7 & Tyco Rd	67.2	78.4	65.2	49.6	64.3	52.5	58.6	74.6
2	Rt 7 & Spring Hill Rd	39.5	78.6	44.2	46.4	37.7	50.0	38.6	64.3
3	Rt 7 & Westpark Dr	138.6	129.0	116.3	101.0	141.0	96.5	144.5	115.5
4	Rt 7 & Chain Bridge Rd SB	21.3	27.3	26.3	14.2	23.7	18.1	27.0	15.2
5	Rt 7 & Chain Bridge Rd NB	13.5	3.8	10.2	5.3	7.3	5.6	26.2	5.0
6	Rt 7 & International Dr	60.6	59.8	65.9	78.3	74.1	92.1	63.5	76.6
7	Rt 7 & Fashion Blvd	30.9	38.2	28.1	36.2	36.3	37.5	36.9	40.9
8	Rt 7 & Old Gallows Rd	8.7	11.7	9.3	11.4	12.9	11.2	13.0	15.3
9	Rt 7 & I-495 SB	13.5	11.3	6.2	8.7	11.4	10.7	16.8	21.9
10	Rt 7 & I-495 NB	18.7	19.7	17.2	21.9	18.3	28.5	22.1	26.0
11	Rt 7 & Lisle Ave/Ramada Rd	39.1	44.9	49.7	59.1	49.7	72.4	47.7	78.7
12	Rt 7 & Marshall HS Driveway	6.4	2.4	15.3	12.8	16.1	16.7	12.7	20.2
13	Rt 7 & George Marshall Dr	22.7	16.0	44.7	21.3	53.9	31.4	43.4	50.3
14	Rt 7 & Dominion Dr	16.3	1.7	28.3	4.1	24.5	3.8	20.5	24.4
15	Rt 7 & Patterson Rd	28.6	7.8	27.8	10.8	24.1	10.6	15.7	25.1
16	Rt 7 & Pimmit Dr	82.4	27.4	49.5	26.1	50.0	32.9	54.4	54.0
17	Rt 7 & Idylwood Rd	42.0	27.1	31.3	30.4	40.0	31.3	40.5	30.6
18	Rt 7 & I-66 SB	14.8	11.4	21.9	14.4	21.7	13.7	24.5	19.3
19	Rt 7 & I-66 NB	3.3	4.8	43.3	5.2	57.2	5.2	64.7	28.0
20	Gallows Rd & Old Court House Rd	33.2	93.7	51.7	106.6	72.3	118.6	39.6	104.0
21	International Rd & Tysons One Pl	69.3	56.0	23.0	38.6	22.1	62.5	36.8	100.7
22	International Dr & Chain Bridge Rd	99.8	57.3	55.0	64.9	90.3	72.1	94.7	82.1
23	International Dr & Galleria Dr	6.5	4.2	7.8	34.4	7.8	11.5	5.2	25.3
24	International Dr & Greensboro Dr	24.0	25.2	25.3	63.0	24.8	25.4	24.2	39.2
25	International Dr & Tysons Blvd	20.1	24.6	28.0	23.3	23.9	23.9	19.5	24.7
26	International Dr & Westpark Dr	43.2	81.3	39.1	48.6	34.1	68.7	34.8	108.7
27	International Dr & Jones Branch Dr	61.9	87.8	54.5	100.9	83.6	88.0	80.3	100.9
28	Spring Hill & Tyco Rd	26.9	34.6	28.7	28.6	49.3	31.4	67.8	18.7
29	Spring Hill Rd & Greensboro Dr	51.3	94.3	42.2	42.0	39.4	53.0	40.1	33.0
30	Chain Bridge Rd & Old Courthouse Rd	105.0	117.8	111.6	98.2	84.4	101.2	103.6	97.6
31	Tysons and Chain Bridge Rd	79.0	98.8	29.1	85.8	44.0	67.2	65.7	149.7
32	International Dr & Fletcher St	18.6	38.9	17.5	61.7	9.8	71.8	11.1	62.9
33	Westpark Dr & Greensboro Dr	161.8	109.9	100.5	94.6	100.1	105.0	134.3	136.8
34	Rt 7 & New Street (except Alternative 3)	8.0	1.4	4.3	2.5	2.1	6.1	20.8	3.5
35	Rt 7 & Broad Street	34.7	36.9	15.3	12.3	12.7	24.3	18.5	48.9
36	Chain Bridge Rd & Rt 7 South	7.8	22.0	6.8	27.6	7.3	29.5	9.6	21.0
37	Chain Bridge Rd & Rt 7 North	21.2	28.6	16.4	25.4	21.8	30.7	19.5	27.8
38	Chain Bridge Rd & Rt 7	27.7	14.3	26.3	22.5	27.2	24.1	31.5	14.9
39	Tyco Rd & Greensboro Dr	30.0	76.4	27.5	33.0	27.8	27.5	42.9	20.9
40	International Dr & Lincoln Circle*	-	-	11.4	25.1	-	-	-	-

LOS: Green – A, B, C; Yellow – D; Orange – E Red – F **Indicates Unsignalized Intersection**

---- Tysons Urban District Boundary Intersections

*International Drive and Lincoln Circle was converted to a signalized intersection in Alternative 1 to allow for BRT transition

9.3.3 VMT/VHT

Vehicle Miles Traveled (VMT) and Vehicle Hours Traveled (VHT) are other MOEs for analyzing the impact of each of the alternatives on traffic. Overall, each of the alternatives resulted in a decrease in VMT and VHT over a 24-hour period. When comparing the individual alternatives, Alternative 3 had the highest decrease in VMT and VHT as seen in **Table 9-13**. On average, the alternatives provided a reduction of approximately 22,300 VMT and 520 VHT as compared to the No-Build condition.

Table 9-13 | Vehicle Miles Traveled and Vehicle Hours Traveled for the Study Area, 24-hour period

Miles/Hours Traveled	No Build	Alt 1	Alt 2	Alt 3
VMT	1,749,306	1,727,519 (-1.2%)	1,729,042 (-1.2%)	1,724,398 (-1.4%)
VHT	65,541	65,008 (-0.8%)	65,209 (-0.5%)	64,834 (-1.1%)

Source: AECOM –Travel Demand Model

9.4 Person Throughput

Person throughput is an MOE used to quantify the number of people being moved on a corridor during a specific time period. This MOE accounts for people traveling in automobiles (as either drivers or passengers) and in buses. **Table 9-14**shows a comparison of the daily person throughput at eight key locations in the study area, while **Figure 9-7** is a map showing where these locations are for the No-Build and the three BRT Alternatives. Note that the numbers in the table below correspond to the numbers on the map for the throughput locations.

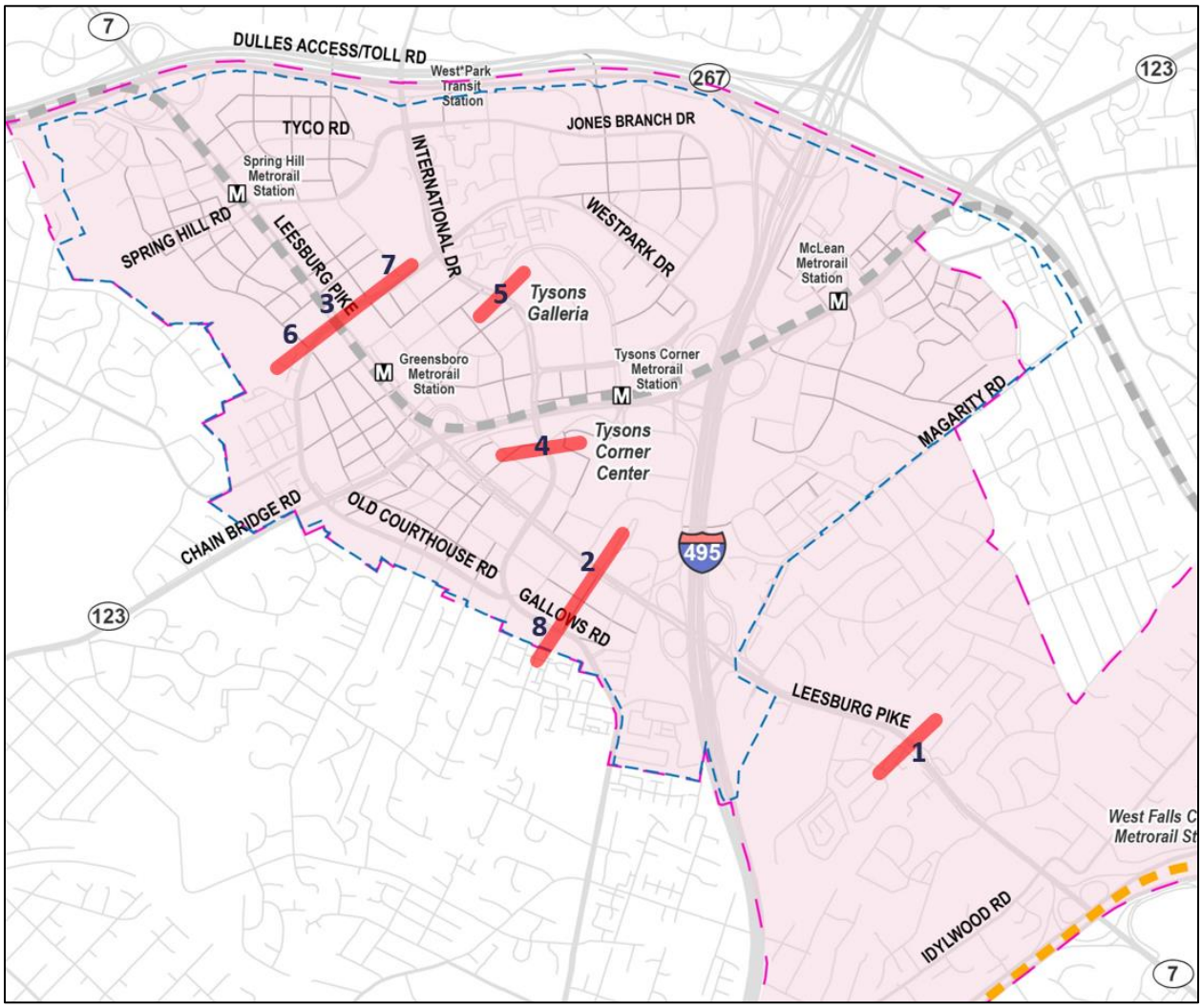
The analysis indicates that for locations on Route 7, the repurposing of a general travel lane for BRT results in a person throughput reduction of approximately 15,000 total people; however, parallel streets in the new urban street grid experience an approximate 5% increase in total person throughput, suggesting that the new grids of streets are taking on some traffic as drivers alter their travel patterns. Locations on International Drive where lanes are repurposed for BRT show a smaller reduction of total person throughput by approximately 1% to 7% (or less than 3,000 people).

Table 9-14 | Person Throughput

Location	No Build	Alt 1 International Dr to Spring Hill Metro	Alt 2 International Dr to Tysons Corner Metro	Alt 3 Route 7 to West*Park Transit Station
1) Route 7 at Dominion Dr	71,400	64,400 (-10%)	63,300 (-11%)	64,100 (-10%)
2) Route 7 at Fashion Blvd	111,700	97,300 (-13%)	96,300 (-14%)	96,600 (-14%)
3) Route 7 at Westpark Dr	107,900	104,600 (-3%)	105,200 (-3%)	95,600 (-11%)
4) International Dr at Tysons One Pl	36,600	36,100 (-1%)	35,400 (-3%)	34,300 (-6%)
5) International Dr at Tysons Corner Blvd	45,200	42,000 (-7%)	44,000 (-3%)	45,900 (+2%)
6) Boones Blvd at Westpark Dr	5,200	5,400 (+4%)	5,200 (0%)	5,500 (+6%)
7) Greensboro Dr at Westpark Dr	13,500	13,500 (0%)	13,700 (+1%)	13,400 (-1%)
8) Gallows Rd at Madrillion Rd	58,200	61,000 (+5%)	61,800 (+6%)	61,100 (+5%)

Source: Tysons BRT Study Travel Demand Model

Figure 9-7 | Person Throughput Analysis Locations



9.4.1 Transit Person Throughput

Transit person throughput quantifies the number of people on transit vehicles at specific along the corridor. **Table 9-15** and **Figure 9-8** shows the projected number of persons using local bus and BRT along the major corridors in the study area, excluding Metrorail. For all alternatives, Route 7 at Locations #1 and #2 (between International Drive and I-66) experience the greatest increase in transit person throughput of any locations evaluated, indicating BRT is meeting the transit demand in/out of Tysons.

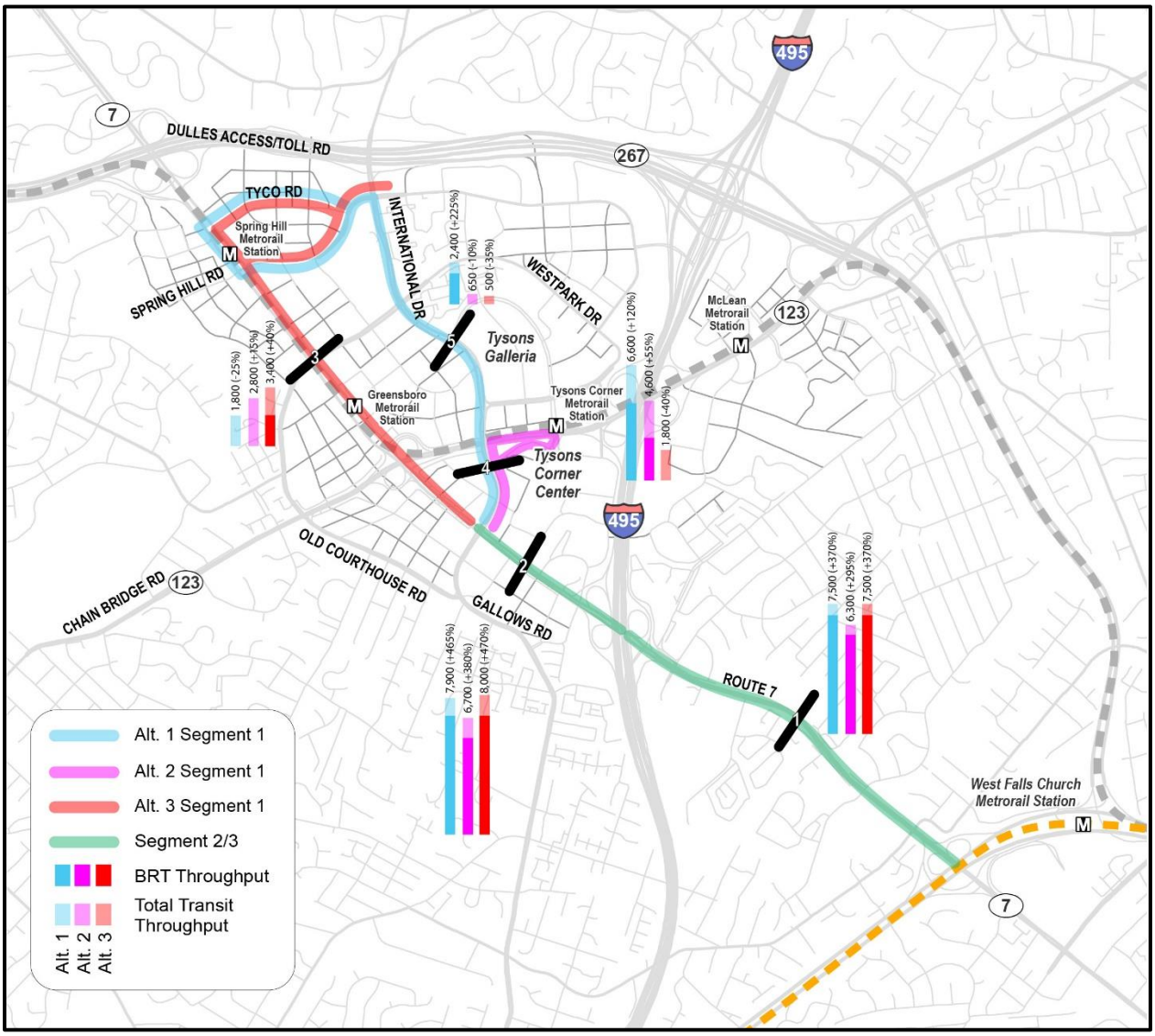
For the BRT alignments, total transit person throughput increases by 40% to 225% over the No-Build. Alternative 1 experiences the greatest transit person throughput at the two locations (#4 and #5) of the three alternatives. Transit person throughput for Alternative 1 and Alternative 2 indicate that there is a strong demand for transit along International Drive, particularly at Tysons One Place. At all locations with a BRT alignment, BRT makes up the large majority of the total transit person throughput. Generally, this is because customers are choosing BRT rather than other local bus options, changing the transit throughput on various roadway segments depending on BRT alignment.

Table 9-15 | Transit and BRT Person Throughput at Select Locations

Location	No Build	Alt 1 International Dr to Spring Hill Metro	Alt 2 International Dr to Tysons Corner Metro	Alt 3 Route 7 to West*Park Transit Station
1) Route 7 at Dominion Drive	1,600	BRT: 6,900 Total: 7,500 (+370%)	BRT: 5,700 Total: 6,300 (+295%)	BRT: 6,900 Total: 7,500 (+370%)
2) Route 7 at Fashion Blvd	1,400	BRT: 6,900 Total: 7,900 (+465%)	BRT: 5,600 Total: 6,700 (+380%)	BRT: 6,900 Total: 8,000 (+470%)
3) Route 7 at Westpark Drive	2,400	Total: 1,800 (-25%)	Total: 2,800 (+15%)	BRT: 1,900 Total: 3,400 (+40%)
4) International Dr at Tysons One Pl	3,000	BRT: 4,500 Total: 6,600 (+120%)	BRT: 2,500 Total: 4,600 (+55%)	Total: 1,800 (-40%)
5) International Dr at Tysons Blvd	750	BRT: 1,900 Total: 2,400 (+225%)	Total: 650 (-10%)	Total: 500 (-35%)

Source: Tysons BRT Study Travel Demand Model

Figure 9-8 | Transit and BRT Person Throughput at Select Locations

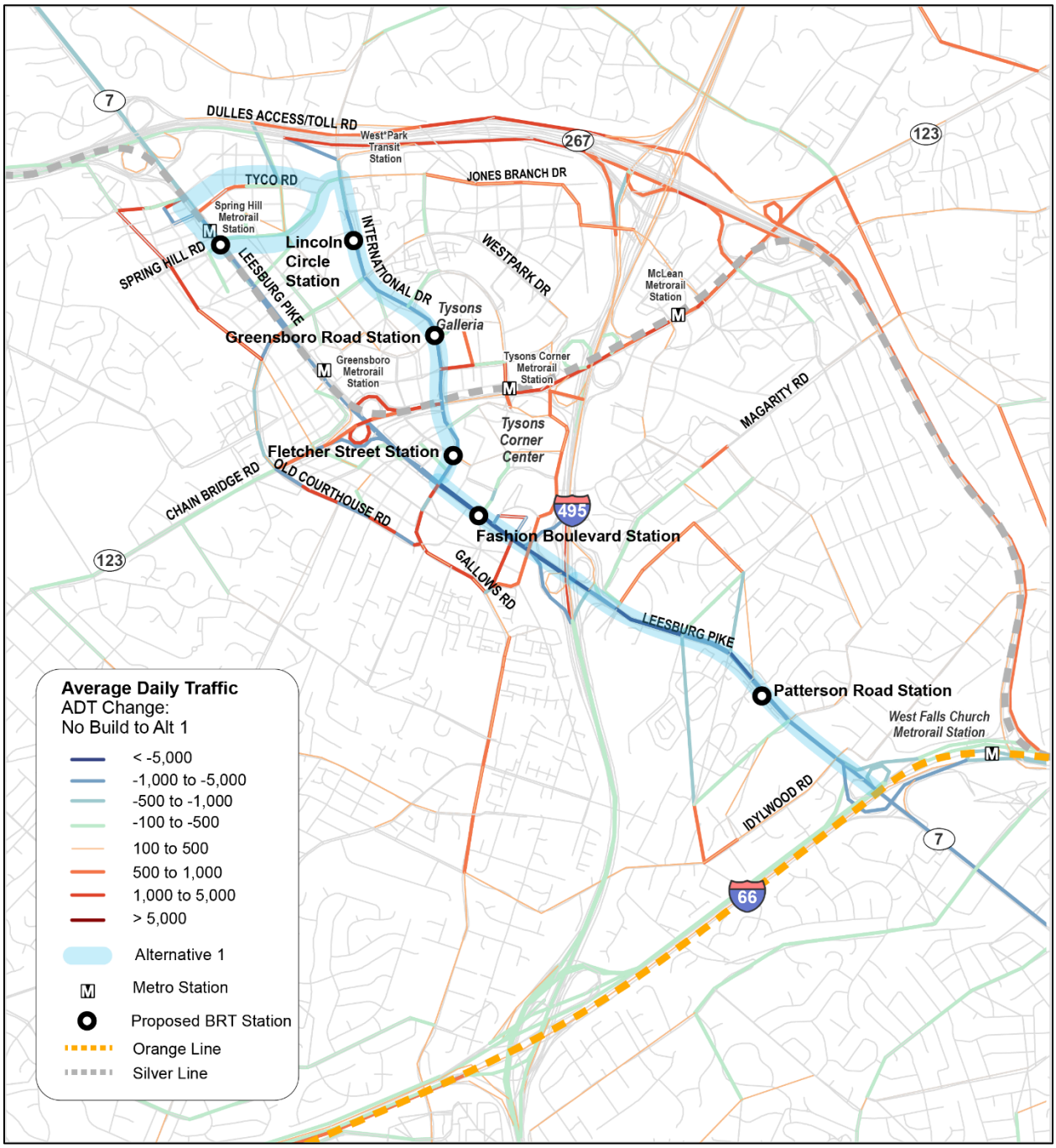


Source: Tysons BRT Study Travel Demand Model

9.4.2 Travel Behavior Changes

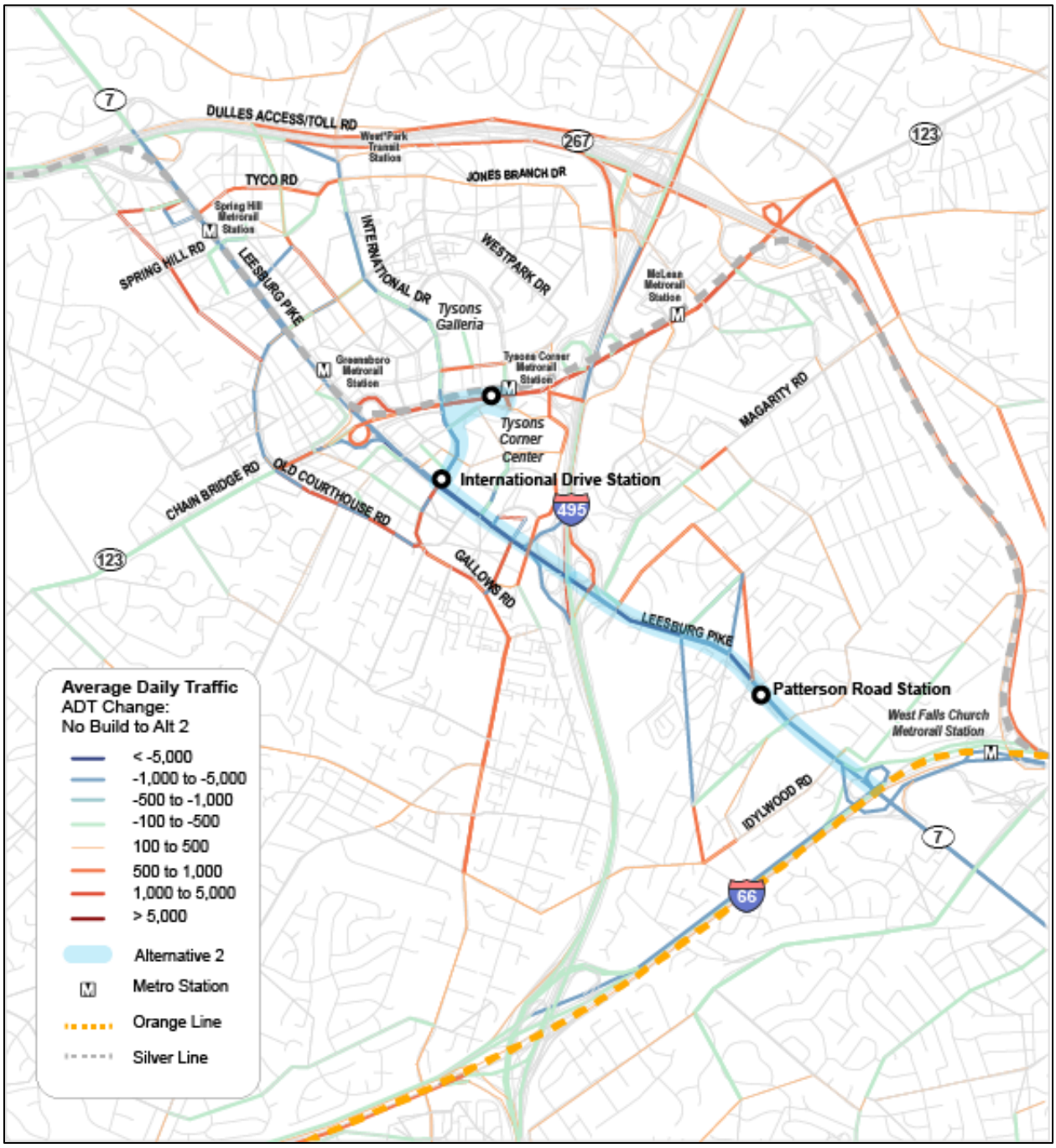
A comparison of traffic volumes and a Select Link Analysis was conducted to better understand the changing travel patterns. The comparison of traffic volumes between the No-Build and the three Alternatives presented a similar pattern of reduced traffic volumes on Route 7 and increased volumes on parallel facilities, including within the new urban street grid, Gallows Road, Chain Bridge Road, and the Dulles Toll Road. Alternative 1 showed a decrease of volumes on International Drive while Alternative 3 sees an increase of volumes. Alternative 2 showed a decrease in volumes on the southern portion of International Drive only. This pattern corresponds to where the BRT alignment is running. See **Figure 9-9** through **Figure 9-11** for the traffic volume changes for each BRT Alternative scenario. These figures include the alternative alignment to better highlight how travel patterns adjust, often to parallel roads, in response to the presence of BRT alignment on the main road.

Figure 9-9 | Traffic Volumes Changes - Alternative 1



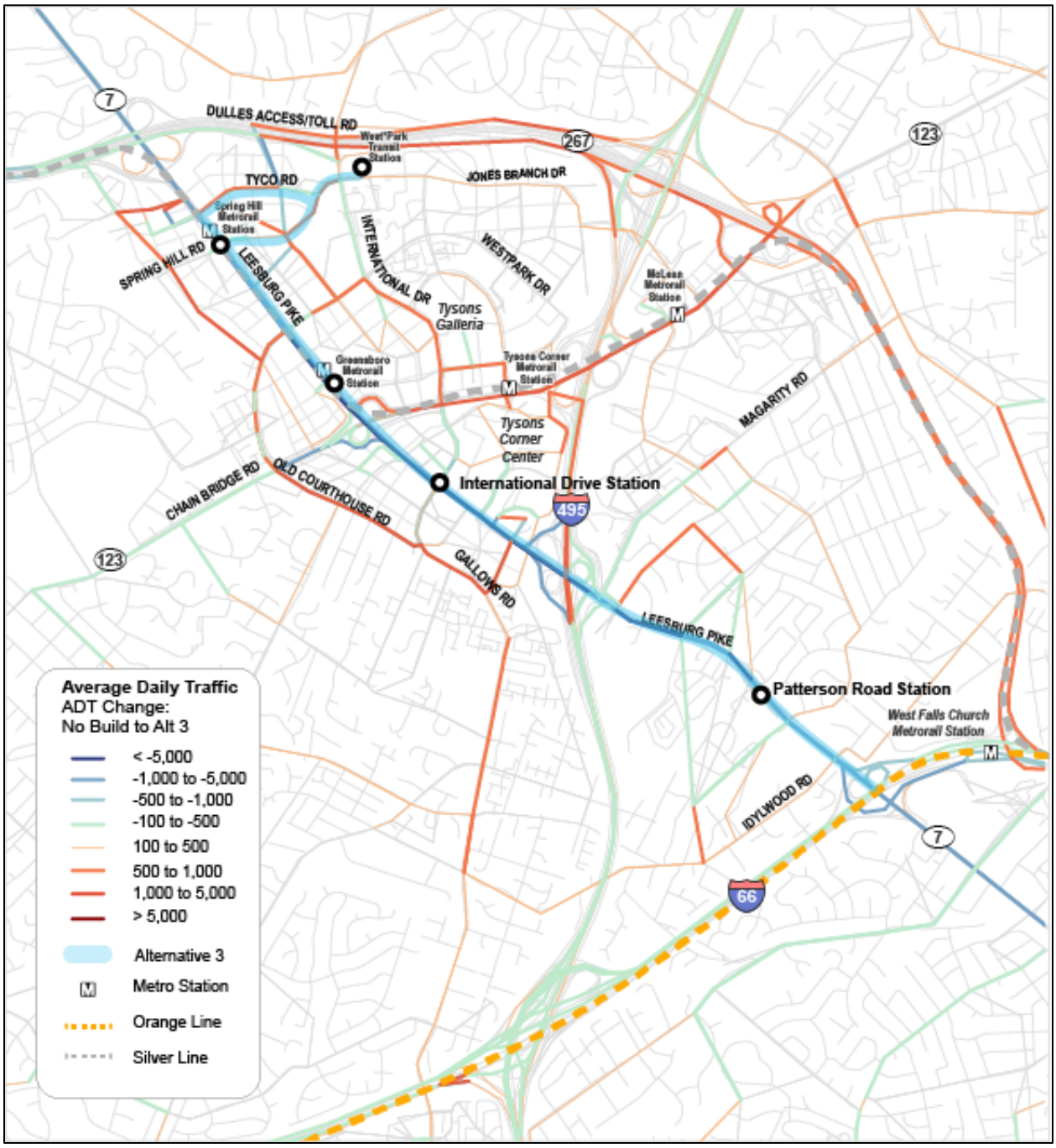
Source: Tysons BRT Study Travel Demand Model

Figure 9-10 | Traffic Volumes Changes - Alternative 2



Source: Tysons BRT Study Travel Demand Model

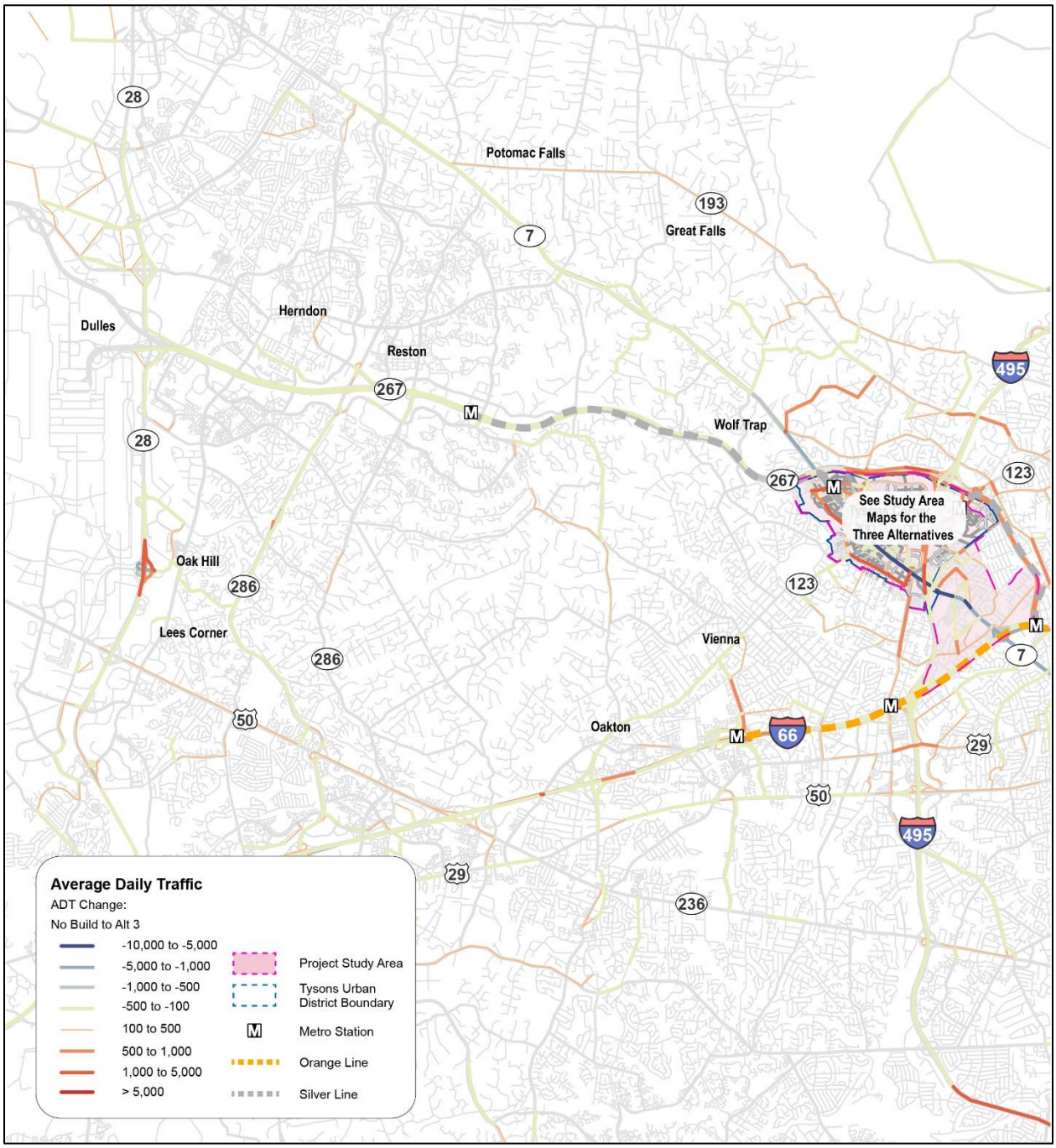
Figure 9-11 | Traffic Volumes Changes - Alternative 3



Source: Tysons BRT Study Travel Demand Model

Looking at traffic volumes at a larger extent outside of the study area showed less variation between the BRT Alternatives, but some changes from the No-Build. A Select Link Analysis for a central point in the study area showed that Dulles Toll Road and Route 7 on the north end of the study area, and Route 7, I-495 and I-66 in the south continue to act as the major collectors and distributors for the traffic. The reduction of a traffic lane in the study area to accommodate the BRT operations does not change the major function of the Route 7 Corridor in the study area, in that travelers whose origin/destination are along Route 7 continue to use Route 7. However, some travelers that previously used Route 7 in the study area as a pass-through to other destinations, have shifted their travel behaviors to use alternative routes (e.g. Route 50, Route 28, and Georgetown Pike) to avoid the congestion worsened by traffic lane reduction on Route 7. **Figure 9-12** shows the increases and decreases in average daily traffic volume in the greater western Fairfax County area for the BRT Alternative 3 scenario as an example of the changed travel patterns.

Figure 9-12 | Western Fairfax County Average Daily Traffic Changes from No Build - Alternative 3



9.5 Pedestrian Conditions

This section presents the pedestrian conditions evaluated for each of the BRT alternatives including pedestrian crossing times and station walkshed walkability.

9.5.1 Pedestrian Crossing Times

Table 9-16 summarizes the average pedestrian crossing times at critical intersections crossing Route 7 and crossing International Drive during both peak hours. The selected intersections have relatively higher pedestrian demand and experience longer vehicular delay. The pedestrian crossing time is calculated as the average time for pedestrians to cross the main streets (i.e., Route 7 and International Drive), including both pedestrian signal delay (the time from when a pedestrian arrives until the Walk signal is displayed) and the time to cross an intersection.

Overall, the pedestrian crossing time at selected intersections show a similar pattern across all alternatives. Crossing Route 7 typically requires a longer crossing time (more than two minutes on average) due to the larger cross-sections along with the long red light duration for pedestrians, increasing pedestrian delay. Crossing International Drive is slightly faster compared to crossing Route 7 as a result of relatively shorter crossings and shorter cycle lengths. For example, cycle length at the intersection of International Drive and Greensboro Drive is 140 seconds during the PM peak period compared to the 210 seconds cycle length at Route 7 and Westpark Drive, leading to shorter pedestrian delays and crossing times.

Table 9-16 | Corridor Pedestrian Crossing Times (minutes) at Critical Locations

Corridor	Intersection	No Build		Alt 1		Alt 2		Alt 3	
		AM	PM	AM	PM	AM	PM	AM	PM
Route 7	Patterson Rd	2.4	2.2	2.3	2.1	2.4	2.1	2.4	2.2
	Fashion Blvd	2.3	2.4	2.4	2.4	2.3	2.4	2.4	2.4
	International Dr	2.3	2.4	2.3	2.3	2.2	2.3	2.3	2.3
	Westpark Dr	2.6	2.4	2.6	2.6	2.6	2.6	2.6	2.6
	Spring Hill Rd	2.7	2.7	2.7	2.5	2.7	2.5	2.7	2.9
International Dr	Fletcher St	2.3	2.1	2.3	2.3	2.3	2.3	2.3	2.2
	Greensboro Dr	1.6	2.1	1.7	1.5	1.6	1.5	1.8	1.5

Source: Tysons BRT Study – VISSIM Traffic Simulation Models

9.5.2 Walkshed Walkability

Station area walkshed walkability is a measure used to determine the walkability of an area within a ½ mile radius of a station. This is measured by the percentage of the area within the ½ mile station radius that is accessible by walking. This walkshed walkability is used because not all areas within a ½ mile radius of a station are truly accessible for pedestrians due to the nature of street networks. Generally, smaller street blocks increase the number of street network connections that shorten the actual walking distance from a point to the station. Conversely, the presence of cul-de-sacs or meandering roads lengthen actual walking distance to the station. The higher the percentage, the more the station radius is deemed to be walkable. **Table 9-17** below shows the combined station walkshed walkability percentage for each BRT Alternative. Overall, there is not much difference between the Alternatives, but Alternative 1 does perform the best. Increasing the number of network connections, including interior walking paths between street blocks and street crossing opportunities across major thoroughfares, within each station area, will improve the walkshed walkability.

Table 9-17 | Station Walkshed Walkability

Alternative	Walkshed Walkability
Alternative 1	55.5%
Alternative 2	55.4%
Alternative 3	55.3%

9.6 Build Alternatives Cost Estimates

This section provides estimates for both Capital and Operations and Maintenance (O&M) costs for the Tysons section of Fairfax County's Route 7 BRT Study. Note this is for analysis and evaluation between the three Tysons BRT study alternatives only; a more detailed analysis for the entire alignment for NVTC's Envision Route 7 Study is needed in future phases of the study. See **Appendix D** for the cost estimate details.

9.6.1 Capital Costs

Table 9-18 provides a breakdown of the capital costs for the three alternatives. Two scenarios are presented based on the type of vehicle propulsion ultimately chosen. The following assumptions were considered in preparation of this capital cost estimate:

- Signal priority at all intersections along alignment
- 25 articulated vehicles for all three alternatives
- Stations equipped with seating, signage, electronic signs, bike racks, power, emergency phone, ticket vending machine and validators
- Electric bus scenario includes two in-route fast charging stations
- Minimal ROW needed at station locations (120' x 10' per station platform)
- 33% Professional Services
- 10% Unallocated Contingency
- 5% to 25% Allocated Contingency
- Unit Prices based on Pittsburgh BRT 100% Design Estimate (2020)
- Inflation to Year of Expenditure (YOE) 2030

Table 9-18 | Capital Costs (2030)

	Alt 1 International Dr to Spring Hill Metro		Alt 2 International Dr to Tysons Corner Metro		Alt 3 Route 7 to Westpark Transit Station	
	Diesel	**Electric**	**Diesel**	**Electric**	**Diesel**	**Electric**
Construction Costs	$102.4	$117.9	$67.3	$82.7	$95.0	$110.4
ROW	$2.5	$2.5	$1.2	$1.2	$2.1	$2.1
Professional Services	$33.1	$38.1	$21.7	$26.7	$30.7	$35.7
Unallocated Contingencies	$14.6	$16.9	$9.6	$11.9	$13.5	$15.8
Construction Subtotal	**$152.6**	**$175.4**	**$99.8**	**$122.5**	**$141.3**	**$164.0**
Vehicles	$29.0	$58.1	$29.0	$58.1	$29.0	$58.1
Total	**$181.6 M**	**$233.5 M**	**$128.8 M**	**$180.6 M**	**$170.3 M**	**$222.1 M**

9.6.2 Operations and Maintenance (O&M)

Table 9-19 provides a summary of the O&M costs associated with operating each BRT alternative as well as other financial performance measures are also presented. As seen in the table below, Alternative 1 performs the best in terms of the financial and operational performance with the most boardings per revenue hour and lowest operating cost per rider.

The following assumptions were considered in preparation of the O&M costs:

- Operating year: 2045
- Unit costs and growth rates based on Fairfax Connector historical data:
    - Operating Cost per Hour: $149.59
    - Maintenance Cost Per Mile: $4.09
    - G&A Cost per Peak Vehicle: $158,629.38
- Headway: 10 minute peak; 15 minute off-peak
- Span:
    - Weekday: 5 AM – 1 AM
    - Weekend: 6 AM – 12 AM
- Layover Time: 15% of Travel Time

Table 9-19 | Operations and Maintenance Costs (2045)

	Alt 1 International Dr to Spring Hill Metro	Alt 2 International Dr to Tysons Corner Metro	Alt 3 Route 7 to Westpark Transit Station
Annual Ridership	2,012,700	1,057,800	2,095,500
Annual Revenue Hours	18,293	13,067	21,952
Annual Revenue Miles	232,064	144,256	238,336
Peak Buses	4	3	5
Annual O&M Costs	$4.32 M	$3.02 M	$5.05 M
Boardings per Revenue Hour	110	81	95
Boardings per Revenue Mile	8.7	7.3	8.8
Operating Cost per Rider	$2.15	$2.86	$2.41

9.7 Summary

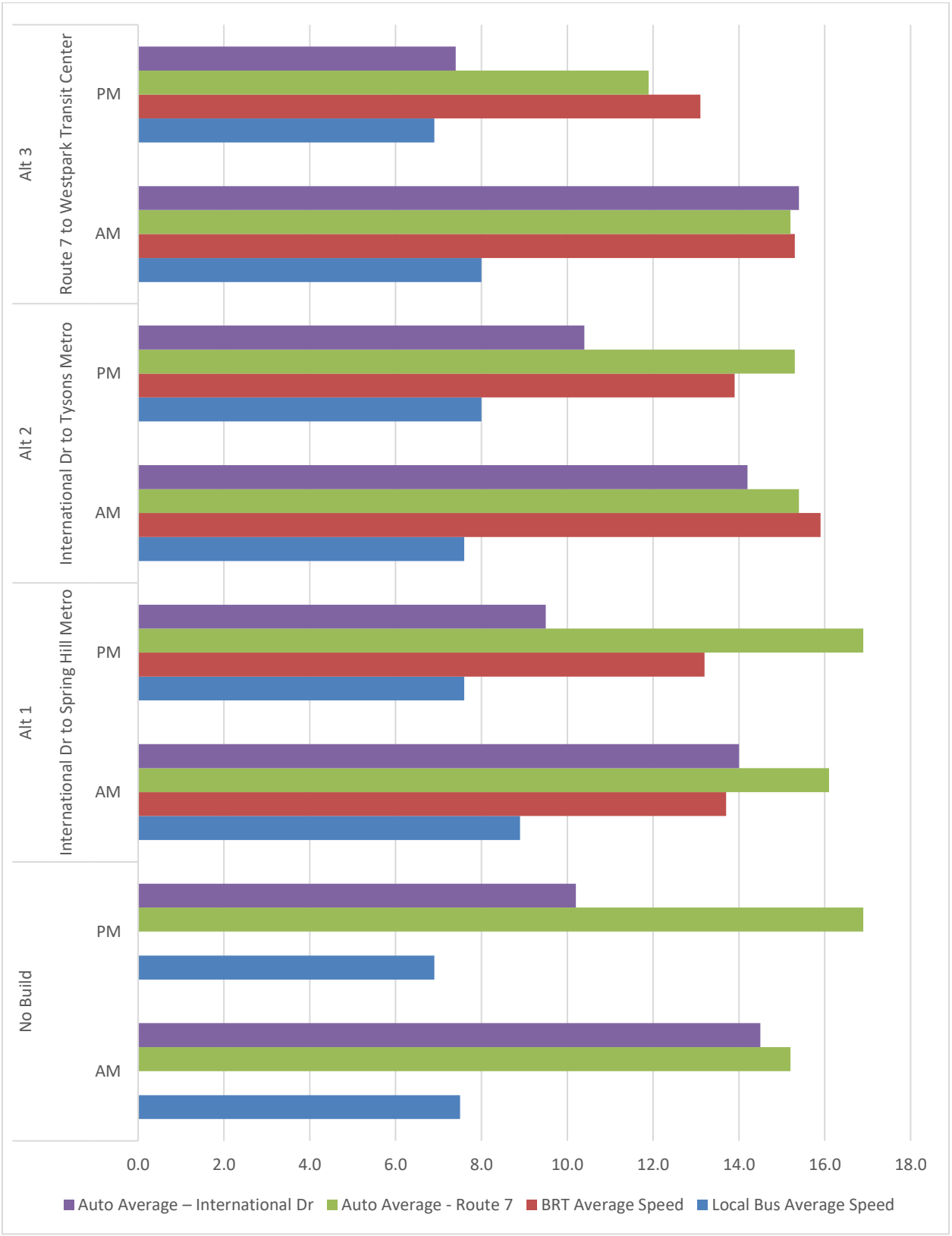
This section provides a summary of the key findings from the Alternatives Evaluation.

9.7.1 Travel Speed Comparison

Key findings from a comparison of the travel speeds for automobiles, local bus, and BRT are seen below:

- Average travel speeds are compared across modes for each alternative (**Figure 9-13**)
- Average BRT Travel speeds exceed Local Bus speeds for all Alternatives
- Alternative 1 - BRT travel speeds exceed average auto speeds on Route 7 and fall below average auto speeds on International Drive, particularly during the AM (both directions)
- Alternative 2 - Average BRT travel speeds exceed auto average travel speeds in all segments, except on International Drive between Route 7 and Chain Bridge Road in the AM peak period in the Northbound direction (BAT Lane); this is likely due to right-turning vehicles slowing BRT travel speed down
- Alternative 3 - Average BRT travel speeds exceed or are similar to average auto travel speeds in all segments of the alignment both in the AM and PM peak periods.

Figure 9-13 | Average Travel Speed Comparison



Source: Tysons BRT Study VISSIM Traffic Simulation Models

9.7.2 Summary Matrix

After evaluating all the MOEs, the ones that had the greatest impact on determining the preferred alternative were the goals of access and mobility and improvement of the transportation networks. The other MOEs initially discussed were valuable metrics, but did not yield as many differences in outcome, therefore they did not affect the selection of the preferred outcome. The summary matrix is shown below for the most influential MOEs.

Measure of Effectiveness	Alternatives		
	Alternative 1 International Dr	**Alternative 2 Tysons Corner Metro**	**Alternative 3 Route 7**
Goal: Access and Mobility – Provide choices through accessible transit service			
Objective: Serve population, employment, and activity centers with BRT			
Demographics (HH, Pop, Emp)	**5**	**1**	**3**
Goal: Transportation Network Performance – Ensure efficient movement of people and goods			
Objective: Improve Transit Operations in Corridor			
BRT Ridership	**4**	**2**	**5**
Local Bus Travel Speed in Study Area	**2**	**2**	**2**
BRT Reliability 95th Percentile Travel Times	**3**	**5**	**2**
Average Automobile Travel Speed	**5**	**3**	**1**
Automobile Intersection Delay	**5**	**3**	**1**
Pedestrian Crossing Times	**3**	**3**	**2**

Desirability Performance

5 Desirable

4

3

2

1 Undesirable

10 Public Involvement

The purpose of this Public Involvement section is to document the actions, feedback, and findings of the public involvement efforts conducted for the Tysons BRT Study.

10.1 Public Meetings

Two rounds of public meetings were held to provide information about the Route 7 Bus Rapid Transit (BRT) Study and how a BRT system would function in Tysons from Spring Hill Metrorail Station to the I-66 interchange.

On March 11, 2020, FCDOT staff held a stakeholder meeting in the Marshall High School Cafeteria, located at 7731 Leesburg Pike, Falls Church. Eight people attended this meeting and provided valuable feedback to inform FCDOT staff as to the priorities and needs that must be considered when determining which of the six alternatives to further evaluate.

In March 2021, two virtual public meetings were held to present three alternatives for potential alignment along with station locations and to seek public feedback and comments. The two public meeting times listed below were selected to provide multiple options:

- Friday, March 19, 2021 at 12 noon
- Wednesday, March 24, 2021 at 7pm

The meeting recording is also available to view on the project website and was available immediately following the meeting for those who could not attend.

Thirty-one people attended and participated in the Friday lunchtime meeting and 27 people attended and participated in the Wednesday evening meeting.

Public comments were open, and a survey was circulated for three weeks following the meeting, until Friday, April 16.

Figure 10-1 | Public Notification Flier for March 2020 Public Meeting

Route 7 BRT Study Stakeholder Meeting

Wednesday March 11 at 7:30 p.m.
Marshall High School, 7731 Leesburg Pike in Falls Church

The Fairfax County Department of Transportation (FCDOT) invites you to a community information meeting on the **Route 7 BRT Study**. The presentation will include an update on the status of the study, discuss three alternatives that the county has chosen to further test for traffic simulation and explain the process by which the alternatives were chosen.

RSVP to Sean Schweitzer at Sean.Schweitzer@fairfaxcounty.gov

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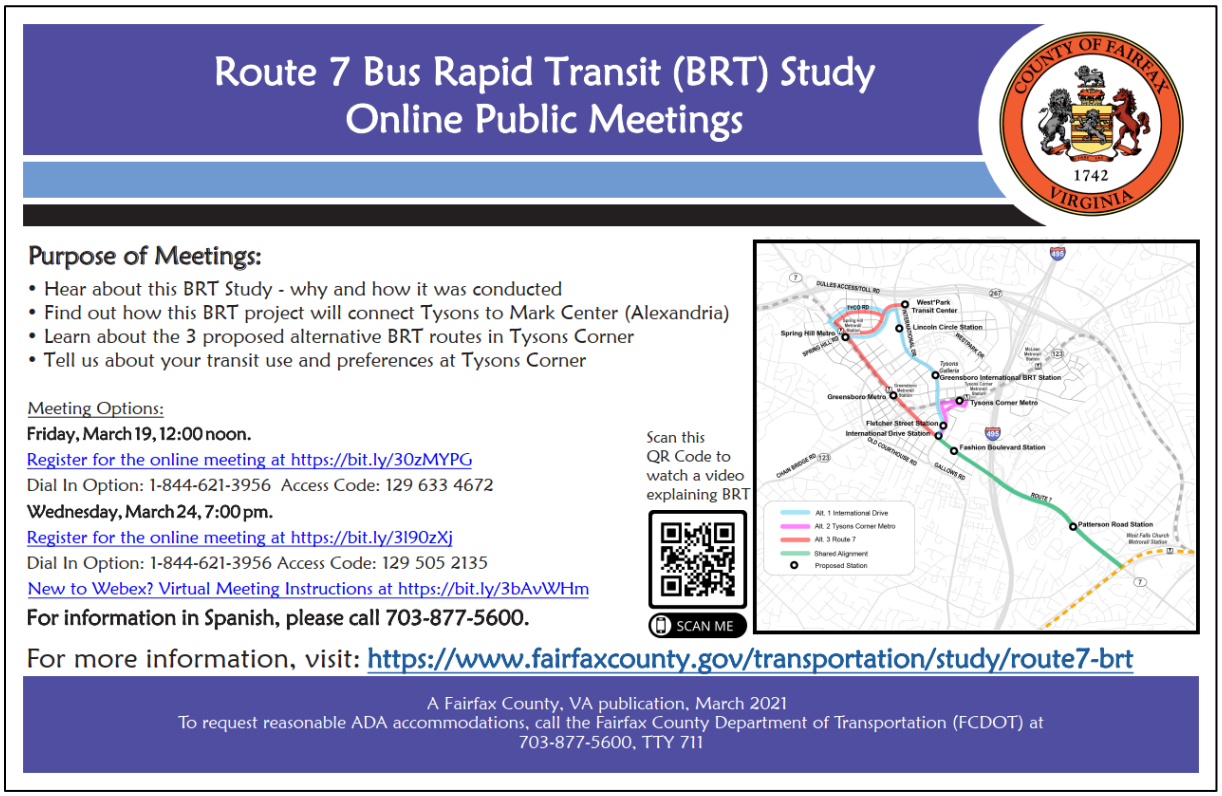
10.2 Public meeting notification for March 2021

Notification for the public meeting was provided in multiple media -including:

- Social media flier image in both English and Spanish was posted on: FCDOT Facebook Page, Fairfax Alerts
- FCDOT directly notified local communities and local media through the FCDOT Media List, including over 300 community non-profits from the FCDOT Equity Office, employers in Tysons, Tysons Partnership, and all the Supervisors, some of whom shared it in their own newsletter.
- Media Coverage Included:
    - (2021, March 12). Rt. 7 Bus Rapid Transit Study Virtual Meetings. *Northern Virginia Transportation Authority*. https://thenovaauthority.org/event/rt-7-bus-rapid-transit-study-virtual-meetings-march-19-and-24-2021-2/.
    - Woolsey, A. (2021, March 15). Three routes under consideration for proposed Tysons bus rapid transit. *Tysons Reporter*. https://www.tysonsreporter.com/2021/03/15/three-routes-under-consideration-for-proposed-tysons-bus-rapid-transit/.
    - (2021, March 15). Forum coming on Route 7 BRT proposal. *Inside Nova*. https://www.insidenova.com/news/transportation/forum-coming-on-route-7-brt-proposal/article_c0673fd4-8588-11eb-8e16-c70658d79bf1.html.
    - (2021,March 24) Study moves forward for Bus Rapid Transit in Tysons along Route 7. *Eastern Union Blog.* https://easternunionblog.com/study-moves-forward-for-bus-rapid-transit-in-tysons-along-route-7/.

Figure 10-2 | Public Notification Flier for March 2021 Public Meeting



Press coverage following the meeting included the survey links, prompting additional responses.

- DeVoe, J. (2021, March 26). Fairfax County selects preferred bus rapid transit route through Tysons. *Tysons Reporter*. https://www.tysonsreporter.com/2021/03/26/fcdot-selects-preferred-route-for-bus-rapid-transit-through-tysons/.
- Solomon, L. (2021, March 24). Study moves forward for Bus Rapid Transit in Tysons along Route 7. *Greater Greater Washington*. https://ggwash.org/view/80811/study-moves-forward-for-bus-rapid-transit-in-tysons-along-route-7.

The Public Information Presentation that was presented at this public meeting can be seen in **Appendix F**.

10.3 Survey

At the end of the March public meetings, a survey was presented to obtain feedback from residents about the Tysons BRT alternatives, how residents currently use bus transit, and what needs they prioritize in their transit use.

The survey was circulated through social media, post-meeting press coverage and press releases, and through the local Fairfax Alerts. It was available for three weeks following the meeting, garnering a total of 46 responses. Most of the responses came in during the immediate three days following the March 24, 2021 meeting.

10.3.1 Main Survey Takeaways

In general, survey respondents prioritized bus frequency, speed and reliability, factors that are improved by BRT access.

Respondents also preferred the station locations found on Alternative 1/International Drive and preferred Alternative 1/International Drive.

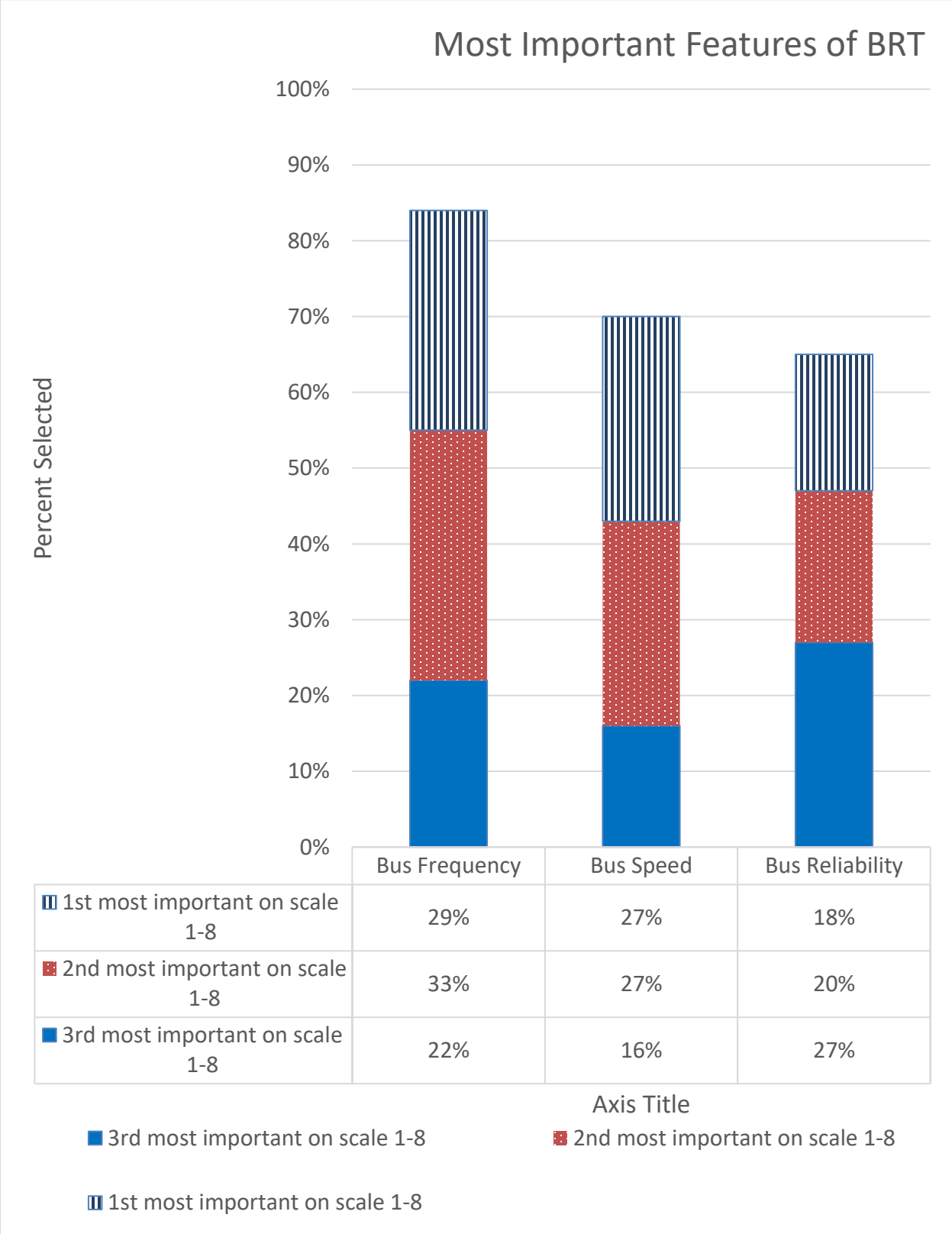
One-third of respondents were current frequent, and one-third were current occasional bus riders. About half noted they were likely or somewhat likely to change their behavior to use Alternative 1/International Drive BRT.

10.3.2 Survey Responses for Each Question

10.3.2.1 Most Important Features of BRT

The most important features of BRT for respondents are bus frequency, bus speed and bus reliability. Almost all the respondents ranked one of these as the first, second or third most important feature when provided with eight choices. Other features available to be chosen were: Coverage, Route Directness, Bicycle and Pedestrian Connections to BRT, Comfort, and Environmental Considerations.

Figure 10-3 | Most Important Features of BRT



10.3.2.2 Station Selection Preference

Alternative 1/International Drive has the highest number of stations that were selected as likely to be used by approximately half of respondents.

Along the Alternative 1/International Drive route, respondents selected multiple stations that they would likely use, including approximately half choosing each of the top four selected stations: Greensboro International BRT Station (57%), Spring Hill Road Metro (53%), Fashion Boulevard Station (50%), and Fletcher Street Station (48%).

Figure 10-4 | Respondents' Preferred Stations on Alternative 1/International Drive

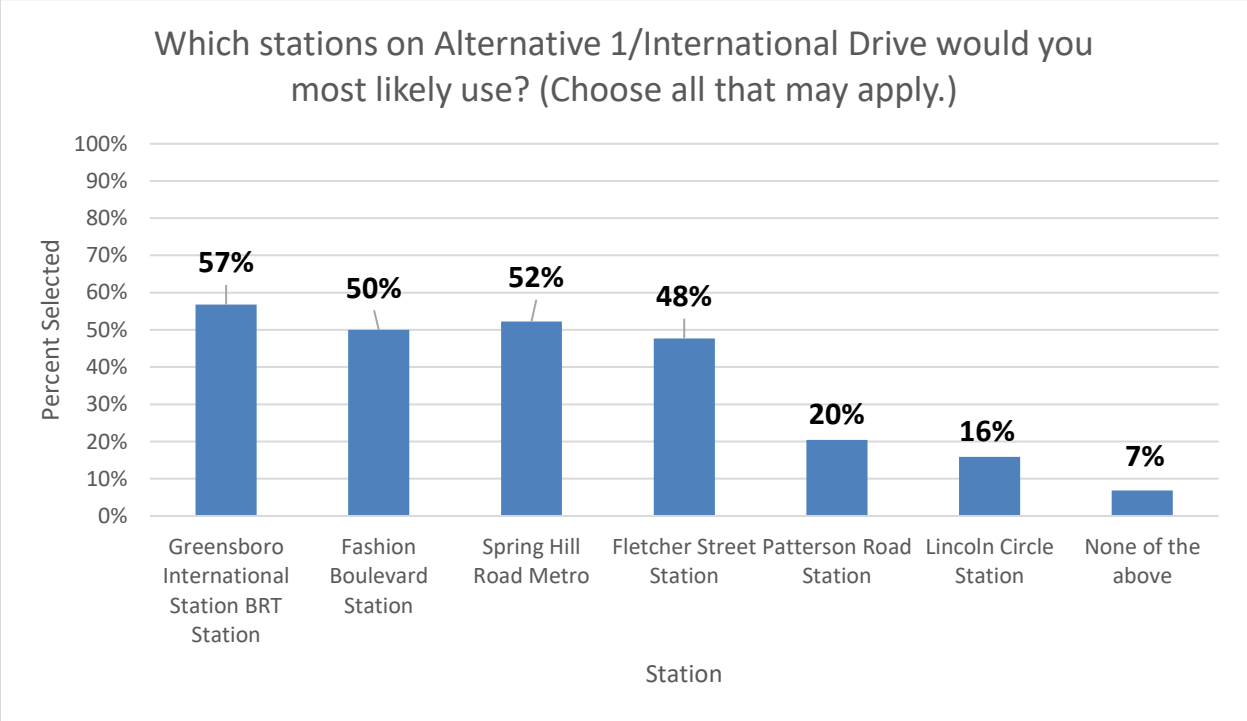


Table 10-1 | Respondents' Preferred Stations on Alternative 1/International Drive

Answer Choice	Responses %	Responses #
None of the above	6.82%	3
Spring Hill Road Metro	52.27%	23
Lincoln Circle Station	15.91%	7
Greensboro International BRT Station	56.82%	25
Fletcher Street Station	47.73%	21
Fashion Boulevard Station	50.00%	22
Patterson Road Station	20.45%	9

When determining which BRT stations riders would likely use on Alternative 2/Tysons Corner Metrorail, an overwhelming majority (86%) of respondents chose Tysons Corner Metrorail with 43% choosing International Drive Station, and 22% choosing Patterson Road Station. Only two respondents said they would not use any of the stations, but four respondents also skipped this question.

Figure 10-5 | Respondents' Preferred Stations on Alternative 2/Tysons Corner Center Metro

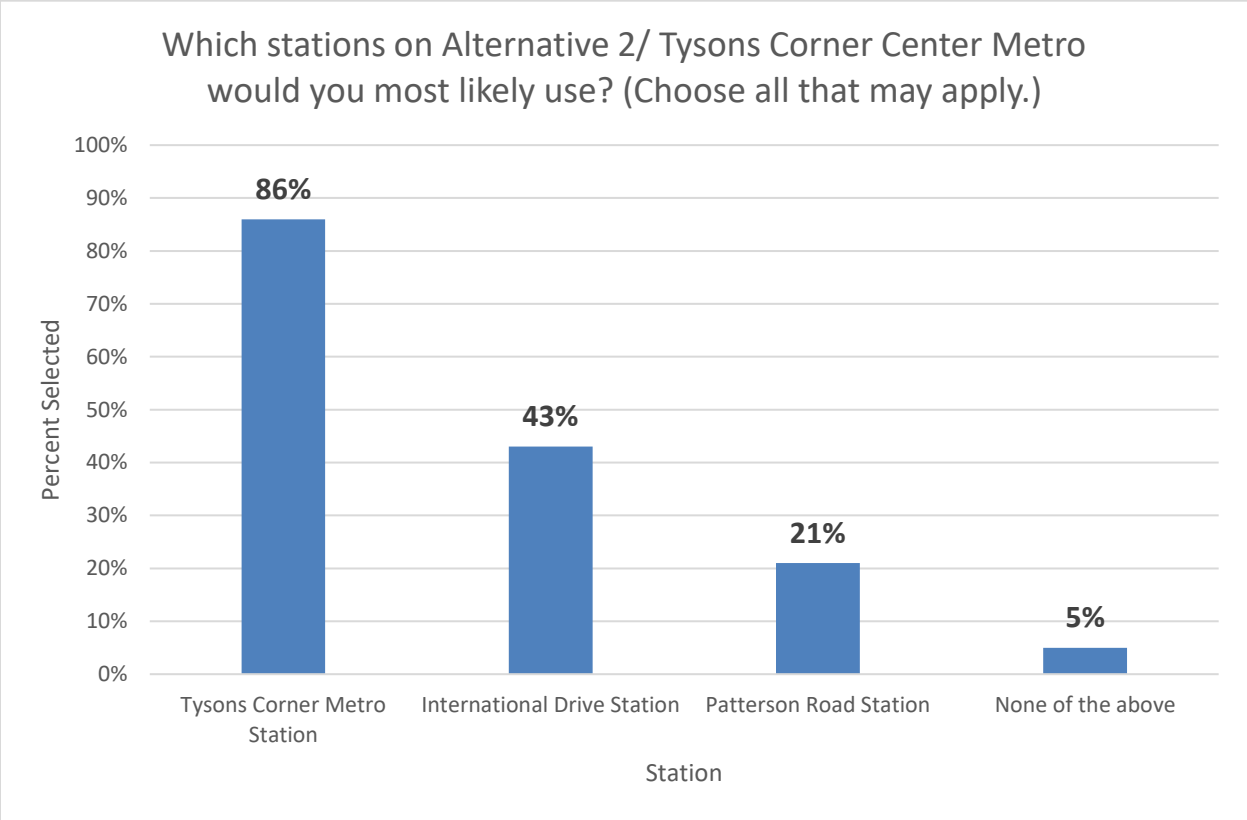


Table 10-2 | Respondents' Preferred Stations on Alternative 2/Tysons Corner Center Metro

Answer Choice	Responses %	Responses #
None of the above	4.76%	2
Tysons Corner Metro Station	85.71%	36
International Drive Station	42.86%	18
Patterson Road Station	21.43%	9

When determining which BRT stations riders would likely use on Alternative 3/Route 7 about half selected three as most likely to be used, and those are: Greensboro Metro (57%), International Drive Station (52%), and Spring Hill Road Metro (47%). The least desirable stations were Patterson Road Station (selected by 24% of respondents) and West*Park Transit Station (selected by 17% of respondents).

Four respondents said they would not use any of the stations, but four respondents also skipped this question. Interestingly, the stations respondents selected as most likely to use – Greensboro Metro and Spring Hill Road Metro are also found on Alternative 1. In terms of using Patterson Road Station (also found on Alternative 1 and 2) 10 people (24%) selected it when looking at Alternative 3 stations, and 9 people selected it when looking at Alternative 1 and 2 stations.

Figure 10-6 | Respondents' Preferred Stations on Alternative 3/Route 7

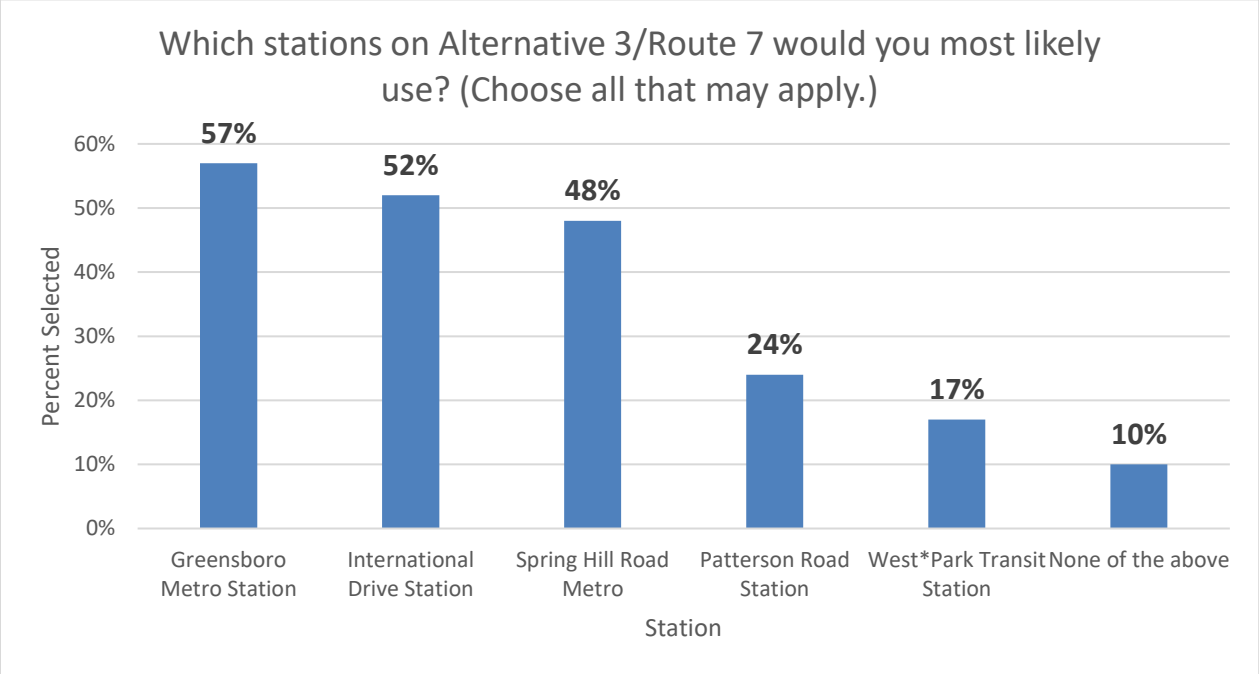


Table 10-3 | Respondents' Preferred Stations on Alternative 3/Route 7

Answer Choice	Responses (%)	Responses (#)
None of the above	9.52%	4
West*Park Transit Station	16.67%	7
Spring Hill Road Metro	47.62%	20
Greensboro Metro	57.14%	24
International Drive Station	52.38%	22
Patterson Road Station	23.81%	10

10.3.2.3 Preferred BRT Routing Alternative

Most of the respondents (67%) preferred Alternative 1/International Drive. The third of respondents that preferred the other alternatives were evenly split between Alternative 2/Tysons Corner Metro (16%, 7 people) and Alternative 3/Route 7 (18%, 8 people).

Figure 10-7 | Respondents' Preferred BRT Routing Alternative

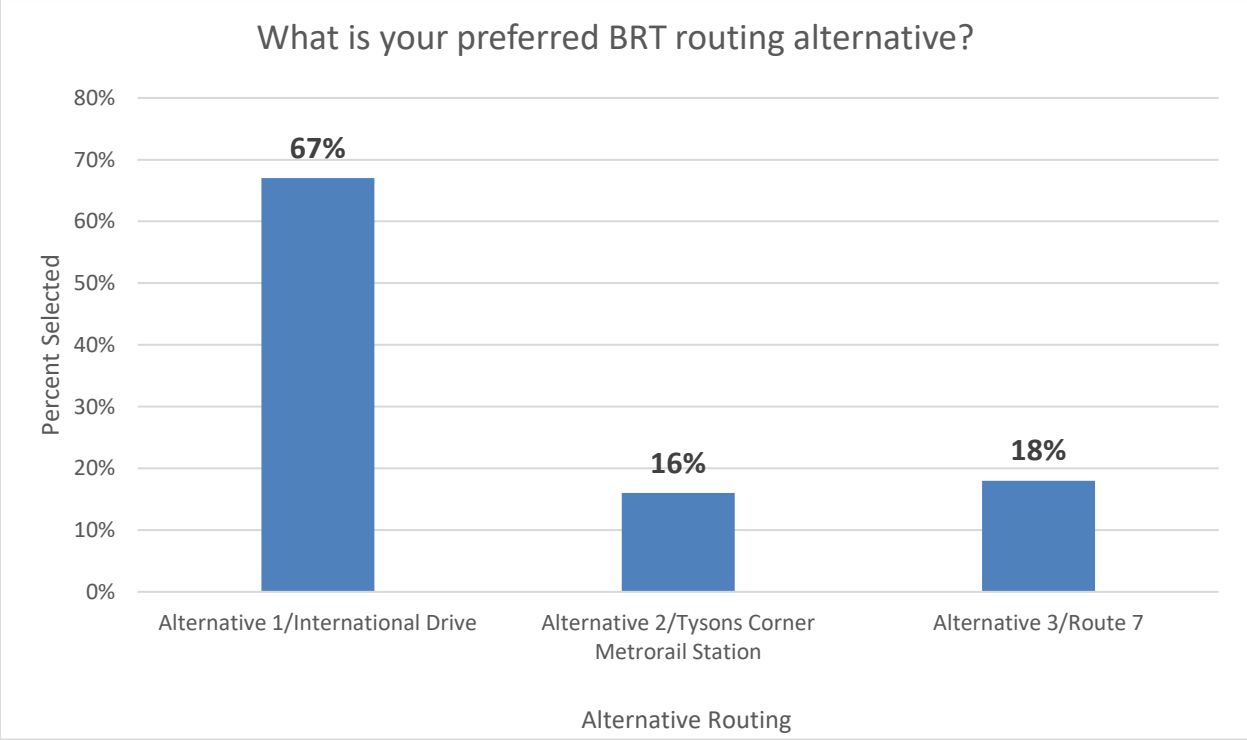


Table 10-4 | Respondents' Preferred BRT Routing Alternative

Answer Choice	Responses %	Responses #
Alternative 1/International Drive	66.67%	30
Alternative 2/Tysons Corner Metrorail Station	15.56%	7
Alternative 3/Route 7	17.78%	8

10.3.2.4 Likelihood of Behavior Change to Use BRT

In terms of behavior change, slightly more than half of respondents (56%) would be very likely (15%) or likely (41%) to change current travel behavior to use Alternative 1/International Drive.

Approximately one-third (35%) are neutral and would not be more or less likely to change travel behavior to use Alternative 1, while 9% are unlikely to change their current travel patterns to use Alternative 1/International Drive. No respondents said they would never use BRT.

Figure 10-8 | Respondents' Likelihood of using Preferred Alternative 1

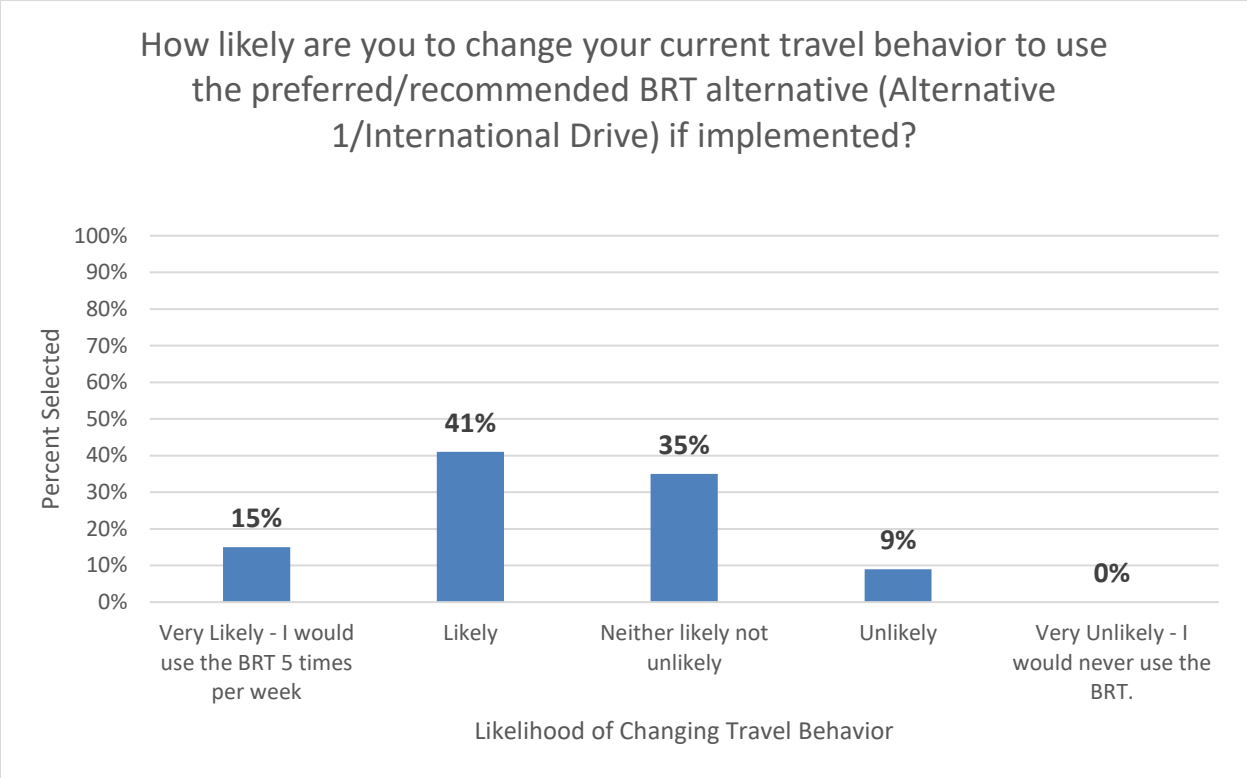


Table 10-5 | Respondents' Likelihood of using Preferred Alternative 1

Answer Choice	Responses %	Responses #
Very likely – I would use the BRT 5 times per week.	15.22%	7
Likely	41.30%	19
Neither likely not unlikely	34.78%	16
Unlikely	8.70%	4
Very unlikely – I would never use the BRT.	0.00%	0

10.3.3 Specific Detailed Comments

Slightly more than half of respondents (24 out of 46, or 52%) included detailed comments in their survey. Other methods of accepting comments included calling and emailing FCDOT directly. Comments included broad input regarding pedestrian access and BRT use, and specific recommendations, such as station locations.

The four common themes that came up in the comments were: dedicated BRT infrastructure, access to multimodal infrastructure, station location recommendations, and extending route connections and coverage. Some comments included multiple recommendations and points, so the total comments described below add up to more than the total 24 comments received.

Figure 10-9 | Word Cloud Reflecting Common Words in Open Comments

10.3.3.1 Dedicated BRT Infrastructure and Operations

Fifteen of 24 comments (63%) specifically mentioned BRT infrastructure or operations, including nine comments specifically requesting a dedicated bus lane, with two comments specifically requesting the center median lane. Comments related to operations included wanting high speed, frequency, reliability, off-board fare collection, Traffic Signal Priority, and operating hours throughout the day and on weekends.

> "Prioritizing bus speed and reliability should always be prioritized over travel time and delay for SOVs [Single Occupancy Vehicles]/general purpose lanes."
>
> "It actually has to run! Throughout the day and on weekends."

10.3.3.2 Multimodal Access

Four comments of 24 (17%) expressed interest in having bicycle and pedestrian access, connection, and infrastructure to the BRT stations. One comment requested a bicycle lane and one comment requested level platforms for BRT for easy bus access for all users.

> "Improve and enhance pedestrian and bike connections to BRT stations and where BRT connects with Metro stations to make transfer as seamless as possible."
>
> "Why are three lanes required on International between Route 7 and International. Three lanes plus BRT is not pedestrian friendly."

10.3.3.3 Station Location Recommendations

Six of the 24 (25%) comments mentioned station locations. Of these, four comments requested that West*Park Transit Station be included as a station, in particular because it includes connections to other transit options, such as a proposed express bus between Tysons, VA and Bethesda, MD. This reflects the broader desire throughout the survey comments to have better connectivity throughout the study area and region as a whole. Other comments about stations included adding a stop near Marshall High School, noting that Fletcher Road Station is inconvenient, and that stations should be prioritized around retail and commercial centers.

> "A stop near Marshall High School should be included. It's not just for students, but also for extracurricular activities and sporting events. There are many community uses there too."
>
> "Alignment of the proposed future Bethesda-Tysons express bus along new MD beltway HOT lanes. Will terminus of that bus be at Westpark Transit Station Rt 7 BRT should coordinate alignment with that bus."

10.3.3.4 Regional Transit Network Connectivity

Eight of 24 (33%) comments discussed a broader desire to have regional transit network connectivity. These comments included comments related to the bus coverage area and connects to other current or proposed transit networks. In terms of coverage, the areas people wanted connects and service to were: Alexandria (2), Great Falls, VA, Reston, VA (2), Loudoun County, VA, Falls Church, Seven Corners, Bailey's Crossroads. In terms of connections with other transit systems, in addition to coordination with the proposed Tysons-Bethesda connections, there is also an interest in syncing up the Fairfax Connector service with the proposed BRT and better connections to the Metro and employment centers, such as the Capital One and MITRE/Lockheed Complex.

In taking these 8 comments and the 4 comments wanting West*Park Transit Station to be a station on the selected alignment, this demonstrates that one of the most important aspects of BRT and one of the most important desires for survey respondents is to have regional transit network connectivity. This means being able to make fewer or quicker transfers and use transit to connect to other areas in the region.

"I think the BRT would also be better served if it could run under the metro tracks to Capital One and up to the MITRE / Lockheed Complex. As-is those communities would be forced to do an inefficient transfer to Metrorail which for those users, makes this kind of not a thing."

"The project is not as beneficial if it doesn't connect through to the jobs center Alexandria by King Street. This would fill a huge gap in transit connectivity."

"Given the presented potential impact on traffic in these surrounding areas, if attention is paid to syncing up Fairfax Connector service with the BRT service, it could make more sense for families like mine to take the bus into Tysons, to take the bus to the Metro, to businesses along the Route 7 corridor, and even to Falls Church and Alexandria."

10.3.4 About the Survey Respondents

Most of the respondents were white (70%), male (81%), and between the ages of 31-50 (56%). Most respondents skipped answering about the language primarily spoken at home, but of the 21 that answered, almost all spoke English, apart from one respondent in each of the following languages: Urdu, Korean, and Cantonese.

The survey respondents were split between those that were frequent riders/a few times per week (30%), occasional riders/a few times per month (35%), and those who used the bus only when their primary mode was not available (28%).

Figure 10-10 | Respondents' Frequency of Bus Use Prior to the Pandemic

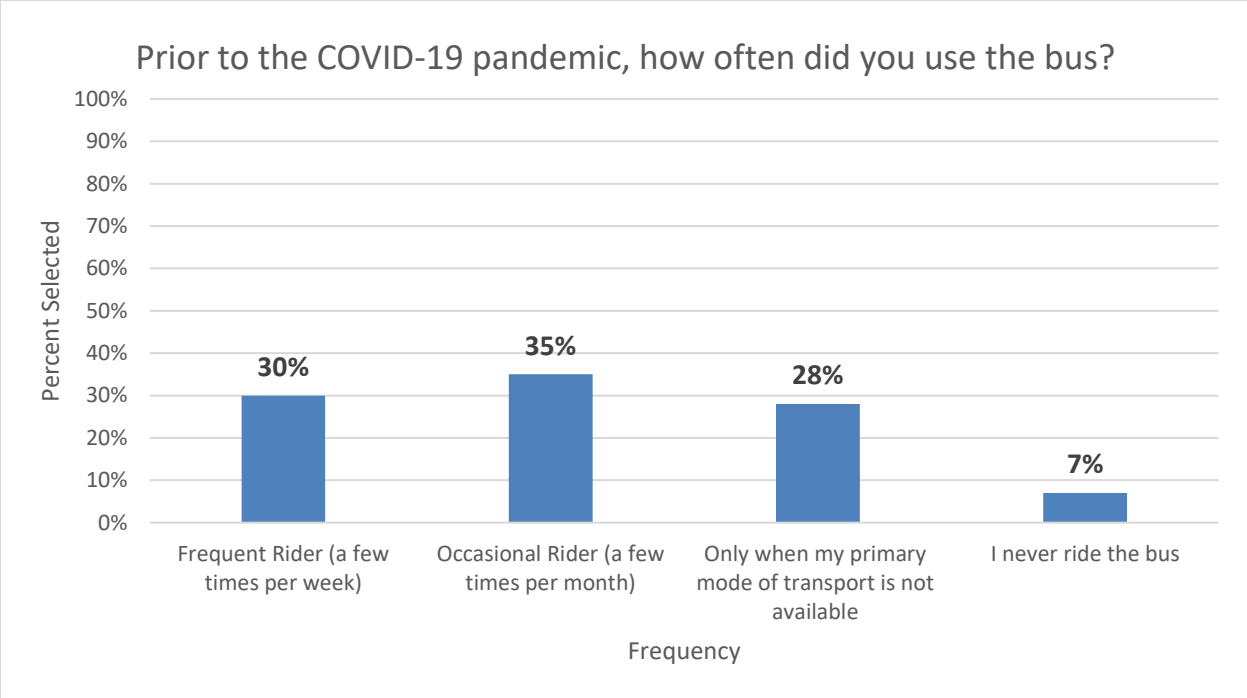


Table 10-6 | Respondents' Frequency of Bus Use Prior to the Pandemic

Answer Choice	Responses %	Responses #
Frequent rider (a few times per week)	30.43%	14
Occasional rider (a few times per month)	34.78%	16
Only when my primary mode or transport is not available	28.26%	13
I never ride the bus	6.52%	3

Most of the respondents traveled to and from Tysons for leisure activities (78%) and to conduct errands (62%). About half (46%) of the respondents traveled to and from Tysons to transfer to the Metrorail. Multiple choices could be selected.

Figure 10-11 | Respondents' Purpose for Traveling to Tysons

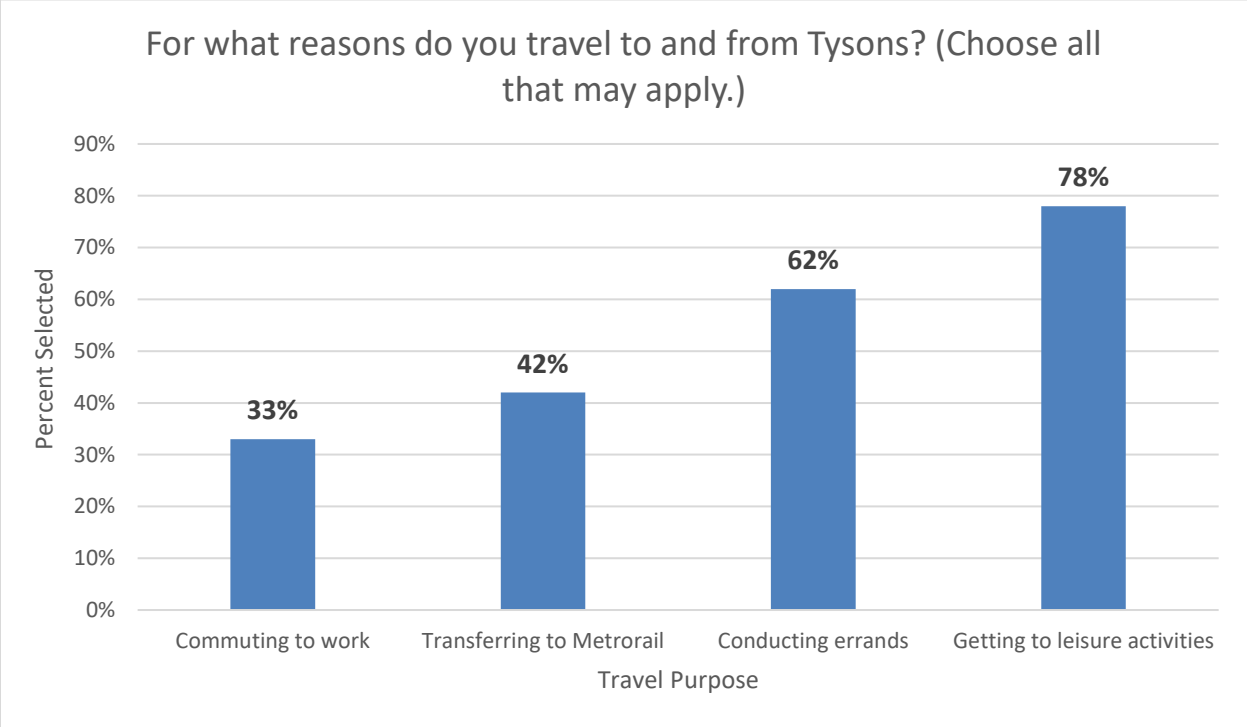


Table 10-7 | Respondents' Purpose for Traveling to Tysons

Answer Choice	Responses %	Responses #
Commuting to work	33.33%	15
Transferring to Metrorail	42.22%	19
Conducting errands (e.g. dry cleaning, grocery shopping, etc.)	62.22%	28
Getting to leisure activities (e.g. movies, dining, shopping, etc.)	77.78%	35

10.4 Stakeholder Comments

In addition to the survey gathering comments from the public, stakeholders had the option of submitting formal comments as well.

Tysons Partnership, a diverse collection of stakeholders including property owners, businesses/employers, and residential organizations in the Tysons area that are committed to growth and change in Tysons. Tysons Partnership submitted a letter supporting Alternative 1/International Drive due to its ability to create greater internal connectivity in Tysons and because it has the highest number of projected jobs within a half mile walkshed of the route (68,250).

Tysons Partnership also encouraged high speed BRT, building pedestrian refuges, and prioritizing pedestrian safety and convenience. The letter in support of the BRT project can be found in **Appendix G**.

10.5 Conclusion

Overall, the feedback from the public supports a strong desire for high quality BRT and better connectivity both within Tysons and to the region as whole. Alternative 1/International Drive was confirmed to match public preference through the selection of alternatives as well as the selection of stations respondents were most likely to use. In fact, slightly more than half of the survey respondents were likely or very likely to change their travel behavior to use Alternative 1/International Drive, if implemented. Survey respondents' confirmation of bus frequency, speed, and reliability as being the most important priorities further support the interest in high quality BRT.

Many individuals were invested and took the time to write detailed comments with thoughtful input. These open comments demonstrated that the top two priorities for survey respondents are to have effective dedicated bus lanes with high bus frequency, speed and reliability and broader regional transit connectivity in terms of service coverage and coordination with other transit options.

11 Preferred Alternative

BRT's reliability and travel time improvements will benefit transit users traveling on the corridor, which is currently and expected to remain at capacity. BRT offers greater choices for non-automobile travel options in the corridor for those who might otherwise use single occupant vehicles. There will be high density development due to upcoming land use changes. These high-density developments attract people that are more inclined not to drive and for whom premium, frequent, reliable transit, such as BRT, is an important component of both transit access and attractiveness to the area. Additionally, BRT:

- Increases corridor throughput capacity without widening roadways, thus addressing the current and future capacity challenges along the corridor;
- Improves service for existing transit passengers;
- Incentivizes transit usage with improved service; and
- Supports land use and economic development goals with regional transit connections and increased capacity for growth.

FCDOT recommended Alternative 1/International Drive as the preferred alternative because it serves the greatest number of people, jobs, and households in Tysons, creates a robust inter-connected transit network within the area, and minimizes negative impacts on transportation as a whole in the study area. The summary matrix in section 9.7.2 illustrates the greater positive impacts on access, pedestrian crossing times, comparable local bus speeds, moderately high BRT ridership and BRT reliability in the 95th percentile, and shows minimal impacts to automobile travel speeds and automobile intersection delay that are found in Alternative 1. The public engagement feedback supports this preferred alternative as well.