Braddock Metro Small Area Plan

Transportation Impact Study

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Chapter 1
Introduction and Summary

This report presents the transportation impacts associated with the agglomeration of seven sites proposed in Alexandria, Virginia. These sites are all located north of Pendleton Street between the Metro tracks and Henry Street. The primary purpose of this study is to identify potential transportation impacts and improvements required to adequately serve the surrounding transportation system based on future traffic volumes generated by the proposed development.

The following traffic analysis considers off-site traffic safety, connectivity and operating conditions on the surrounding public roadways. Traffic volumes and conditions were reviewed during the morning and evening peak hours for the current year 2006 and the build-out year 2015 under three scenarios. In addition, the study evaluates circulation into and out of the study area to ensure adequate peak hour operations.

Project Description

The proposed projects would develop seven sites and include approximately 85,000 square feet of retail (including a nationally recognized grocery store), 70,000 square feet of office space and 2 million square feet of residential development. The Braddock Road Metro Station Small Area is located in the eastern section of the City of Alexandria and is generally bounded by the Metro railroad to the west, Route 1 to the north, Washington Street to the east and King Street to the south. The area is currently a mix of residential and light industrial uses with larger scale commercial office space located near the northern and southern boundaries.

Existing Conditions

An area-wide transportation impact assessment was identified for evaluating the potential system impacts associated with the proposed projects.

Intersection turning movement counts at all but four locations were provided by the City of Alexandria for the morning peak period (7:00 AM to 9:00 AM) and evening peak period (4:00 PM to 6:00 PM). The remaining four intersections were counting in early November, 2006.

Currently, all study intersections operate at LOS C or better during the AM and PM peak hours.

Project Traffic Impacts

Comparing the Permitted Density under Current Zoning regulations to the area build out with the proposed projects would generate approximately 240 additional AM peak hour trips and 270 additional PM peak hour trips on local roadways. Signal timings were optimized under each alternative as traffic volumes varied by scenario. With optimized signals, most intersections operate better than LOS E. Several exceptions include the Route 1/Slaters Lane and Patrick Street/Cameron

Street intersections in the AM peak, mostly due to heavy through volumes conflicting with large turning movements.

Site Access and Circulation

The projects located north of Wythe Street have limited access. In particular, the development proposed north of First Street between the Metro right-of-way and Route 1 is dependent mainly on the intersections of First Street/Henry Street and Madison Street/Henry Street in accessing the surrounding roadway network. Additional access points to this area will be important in alleviating the potential operational degradation of the aforementioned intersections once the sites have been built.

One such access location should be a right-in right-out connection that would be offset north of the current Montgomery Street/Henry Street intersection and be approximately 22' wide. Additionally, a signal at the Route 1/Fayette Street intersection will need to be added to the network and several turning restrictions will need to be enacted at the Route 1/Fayette Street intersection and the Henry Street/Patrick Street intersection.

A robust pedestrian network is also important to reduce the amount of auto trips generated by the proposed development. Additions to the pedestrian network by developers at the time of construction will provide parcel connectivity between the proposed projects and the existing pedestrian network and should be completed in order to provide adequate pedestrian circulation throughout the study area.

Recommended Improvements

In order to improve vehicular connectivity and operations for the study parcels, and lessen impacts on existing intersection operations in the surrounding roadway network, several mitigation measures are suggested.

A northbound left turn bay at the intersection of First Street/Patrick Street is recommended and an eastbound left turn prohibition should be implemented. Concurrently, a signal should be installed at the Fayette Street/Route 1 intersection and northbound left turns from Route 1 should be prohibited at this location. This will essentially provide egress access at the Fayette Street/Route 1 intersection for northbound traffic from the area, and provide northbound ingress movement at the First Street/Route 1 intersection for traffic traveling to the area. Additionally, signals throughout the corridor should be coordinated and optimized to provide progression and acceptable gaps for turning movements. The current pedestrian crossing timings and cycle lengths do not need to be adjusted in order to provide an efficient network.

Frontage improvements that include the City of Alexandria's cross section standards for pedestrian streets should be provided for all development in the study area, connecting the proposed developments with the current pedestrian network. In addition, the existing multi-use trail connecting King Street and Braddock Street Metro stations should be extended north through the northern section of the study area, under the new Route 1 bridge and onto Potomac Yard. Pedestrian access should also be considered linking the proposed signal at Fayette Street/Route 1 with Douglas Street and Colonial Avenue.

The current bus circulation at the Braddock Road Metro station could be realigned to provide two way operation and ten bus bays. Kiss and Ride could still be provided, either along West Street or at a small turn around area north of Madison Street.

Chapter 2
Existing Conditions

This chapter documents existing transportation conditions for the proposed agglomeration of projects around the Braddock Road Metro station located in Alexandria, Virginia. Existing transportation conditions in the study area include roadway network, intersection traffic controls and geometries, traffic volumes, intersection operations, and pedestrian/bicycle/transit facilities.

The intersections selected for this study were based on input from the City of Alexandria and are comprised of those intersections that are expected to be most greatly impacted by the development within the study area during the morning and evening peak hours. The study area is shown in Figure 1.

Roadway Network

The project site is located within the City of Alexandria. Route 1 (Henry Street in the southbound direction and Patrick Street northbound) is divided into a three lane, one-way couplet and serves as the major north/south route. Braddock Road/Wythe Street serves as the only east/west route traversing the entire study area.

The planning area north of Madison Street, east of the Metro tracts and west of Henry Street has few access points. Consequently, the intersections of First Street/Henry Street, Madison Street/Henry Street and Madison Street/Patrick Street have a degraded level of service (LOS) as vehicles entering and exiting this area can only utilize the above mentioned intersections. More connectivity should be provided to this area.

All of the study intersections are controlled by traffic signals. Detailed characteristics of the significant roadways within the study area are listed in Table 1.

Table 1: Existing Roadway Characteristics

Roadway	*Width*	*Posted Speed (mph)*	*Number of Travel Lanes*	*Approximate Average Daily Traffic*
Henry Street (Route 1)	37’	25	3	25,000
Patrick Street (Route 1)	44’	25	3	25,000
Braddock Road	34’	25	2	8,000
Wythe Street	37’	25	2	5,500
West Street	36’	25	2	7,000
Columbus Street	38’	25	2	3,500

Figure 1: Study Area

Existing Intersection Performance

Intersection turn movement counts were provided by the City of Alexandria at all of the intersections in the study area except four, which were counted during the AM and PM peak periods early in November 2006 to determine existing levels of service (LOS) based on the *2000 Highway Capacity Manual* methodology for signalized intersections.[1] Additionally, a lane utilization count was conducted for northbound vehicles on Patrick Street in order to determine if the AM HOV restrictions were having an effect on traffic distribution. It was found that approximately 25% of vehicles use the HOV lane (some violators, but most were observing the HOV-2 restrictions), while 75% use the remaining two general purpose lanes.

Level of Service (LOS) is used as a measure of effectiveness for intersection operation. It is similar to a "report card" rating based upon average vehicle delay. Level of service A, B and C indicate conditions where vehicles can move freely. Level of service D and E are progressively worse. Level of service F represents conditions where traffic volumes exceed the capacity of an entire intersection, resulting in long queues and delays.

All study intersections currently operate at LOS C or better during both the AM and PM peak hours. However, PM peak hour operations are significantly impacted at the southern end of the corridor by ongoing Woodrow Wilson Bridge construction activity. The results of the existing operational analysis at the study intersections are summarized in Table 2 and shown in Figure 2 (AM) and Figure 3 (PM).

Table 2: Existing Conditions Intersection Level of Service

Study Intersection	AM Peak Hour	PM Peak Hour
	LOS	LOS
Signalized		
Braddock Road/Mount Vernon Avenue	B	B
Braddock Road/West Street	B	B
West Street/Pendleton Street	A	B
West Street/Cameron Street	B	B
Henry Street/Slators Lane	C	B
Henry Street/Patrick Street	B	A
Henry Street/Montgomery Street	A	B
Henry Street/Madison Street	A	B
Henry Street/Wythe Street	A	A
Henry Street/Pendleton Street	A	A
Henry Street/Oronoco Street	A	A
Henry Street/Princess Street	A	A
Henry Street/Queen Street	A	A
Henry Street/Cameron Street	A	A
Patrick Street/Montgomery Street	A	A
Patrick Street/Madison Street	A	A
Patrick Street/Wythe Street	A	A
Patrick Street/Pendleton Street	A	A

[1] *Highway Capacity Manual*, Transportation Research Board, 2000, Chapters 16 and 17.

Patrick Street/Oronoco Street	A	A
Patrick Street/Princess Street	A	A
Patrick Street/Queen Street	A	A
Patrick Street/Cameron Street	A	A
Columbus Street/Montgomery Street	B	A
Columbus Street/Madison Street	C	B
Columbus Street/Wythe Street	B	B
Columbus Street/Pendleton Street	C	B
Alfred Street/Cameron Street	B	B

Pedestrian/Bicycle

In general, the study area is made up of a robust urban grid network that provides sidewalks and on street, shared bike lanes. Sidewalks are lacking in the northern planning segment of the study area, but are planned to be provided once development occurs.

While sidewalks are provided along the majority of roads within the study area, the width of the sidewalks varies from 2-3 feet along some segments to 8-10 feet or more along others. Thus, the effective sidewalk width for the entire network is compromised by the narrowing along some segments. Striped, designated crosswalks are provided at all signalized intersections within the study area and many of the non-signalized intersections as well.

Shared bicycle facilities are currently available along many of the roadways within the study area as traffic volumes are low enough to safely allow for shared vehicle and bicycle use operation. Additionally, there is an existing multi-use path that connects the Braddock Road Metro station with the King Street Metro station.

The existing pedestrian network is shown in Figure 4.

Figure 2: LOS Existing Conditions AM Peak Hour

Figure 3: LOS Existing Conditions PM Peak Hour

Figure 4: Pedestrian Infrastructure Map

Public Transit

The Braddock Road Metro station supports two heavy rail Metro lines, the Yellow and Blue lines, providing frequent, high-quality transit service to a multitude of areas and destinations throughout the Washington D.C. metropolitan area.

Additionally, four DASH bus routes and three WMATA bus routes serve the study area and the Metro station. The available study area transit routes and scheduled headways (time between bus arrivals) are summarized in Table 3.

Table 3: Transit Service in the Study Area

Route	*Destinations*	*Travel within Study Area*	*Approximate Headway (minutes)*
Metro Blue Line	Franconia and Largo Town Center	Rail Tracks	Frequent service
Metro Yellow Line	Huntington and Mount Vernon Square	Rail Tracks	Frequent service
AT 2	Braddock Metro, Old Town, Van Dorn Metro and Eisenhower Metro	Columbus Street, Montgomery Street, Maidson Street	20 weekdays during peak and 30 off-peak
AT 3	Parkfairfax, Pentagon Metro, Hunting Towers	Pendleton Street, Braddock Road	20 weekdays 5AM-10AM and 3PM-8PM
AT 4	Parkfairfax, Pentagon Metro, Hunting Towers, Old Town	Pendleton Street, Braddock Road	20 weekdays during peak and 60 off-peak
AT 5	Landmark, Van Dorn Metro, Old Town	Madison Street, Montgomery Street	30 weekdays
10A	Hunting Towers, Pentagon Metro	Pendleton Street, Braddock Road, West Street	30 weekdays
10B	Hunting Towers, Ballston Metro	Pendleton Street, Braddock Road, West Street	30 weekdays
10E	Hunting Towers, Pentagon Metro	Pendleton Street, Braddock Road, West Street	30 weekdays

Chapter 3
Transportation Impacts

This chapter reviews the impact of the proposed projects on the study area transportation system. The analysis includes trip generation, trip distribution, operating conditions of study intersections for the current year 2006 and the build-out year 2015 including turn lane needs, pedestrian/bicycle needs and recommended roadway improvements.

Project Description

The proposed projects would develop seven sites and include approximately 85,000 square feet of retail (including a nationally recognized grocery store), 70,000 square feet of office space and 2 million square feet of residential development.

Trip Generation

Trip generation for the proposed developments was calculated based on the industry standard Institute of Transportation Engineers (ITE) *Trip Generation Manual* per respective land use.

Table 5 summarizes the trip generation estimates utilized for the transportation impact analysis. Although the project would generate traffic throughout the day, the weekday AM and PM peak hours were analyzed to focus on the period when traffic is highest on adjacent streets.

Table 4: Estimated Project Trip Generation

Development	*Quantity*	*Land Use*	*AM Peak Hour*			*PM Peak Hour*		
			In	Out	Total	In	Out	Total
Jaguar	729 d.u.	Residential	72	289	361	272	147	419
	3,000’	Retail	12	7	19	13	16	29
	77,000’	Office	134	18	152	28	137	165
Elm Street	110 d.u.	Residential	12	46	78	51	27	78
	1,500’	Retail	8	5	13	11	14	25
Madison	290 d.u.	Residential	29	117	146	115	62	177
	55,000’	Retail	67	43	109	68	86	153

Braddock Place	124 d.u.	Residential	12	53	65	36	22	58
Braddock Metro	273 d.u.	Residential	28	110	138	109	59	168
	15,000'	Retail	31	20	50	25	32	57
Metro East	410 d.u.	Residential	41	164	205	158	85	243
	10,000'	Retail	24	15	39	20	25	45
K. Hovanian	140 d.u.	Residential	11	56	68	53	26	79
Total			**481**	**943**	**1443**	**959**	**738**	**1696**

Internal Capture Reduction

Several reduction factors were applied to the trip generation numbers. For the purposes of this study, the internally captured trips have been defined as those person trips that will not leave or enter the study area because the mixed use nature of the area will provide opportunities for non-auto trip-making inducing walk trips and dissuading vehicle trips, especially for home-retail, home-office and office-retail trip purposes. A 10% internal capture rate was applied to all of the scenarios to account for this mixed-use developmental pattern within the study area.

Transit Reduction

Two transit reduction factors were developed to account for the wide variability of transit reduction factors found in a number of resources consulted for this analysis. One factor has been labeled as a "conventional factor" which reflects conventional assumptions, and the other labeled as an "aggressive factor" that makes more qualitative assumptions relative to aggressive transportation demand management (TDM) programs. The "conventional factor" is based on current U.S. Census statistics for non-automobile travel, and was assumed to be 30%.

The "aggressive" transit reduction factor was calculated assuming that future travel patterns will change with a more congested vehicle network and an aggressive TDM strategy. This scenario, while aggressive, is realistic based on the 2005 Development-Related Ridership Survey developed for WMATA (March 2006), which noted that approximately 50% of residential trips taken by individuals at locations near a metro stop within the beltway are by transit. Thus, the future "aggressive" transit reduction factor assumes that 50% of new residents to the study area will use transit for their peak hour trips.

Trip Distribution

Trip distribution represents the forecast of where vehicle trips go to and come from. It is based upon predicted patterns from the Metropolitan Washington Council of Governments (MWCOG) regional travel demand forecast model. The distribution is represented as a percentage of the trips generated by a specific zone (or land use activity) to another location. These zones reflect the transportation activity within the study area.

It was assumed the trip distribution would be the same for both the AM and PM peak hours. Trip assignments were selected by evaluating trip distribution from previous Transportation Impact Studies (TIS) submitted to the City.

Traffic Forecasts

The agglomeration of development proposed for the study area provides the opportunity to leverage regional transportation investment dollars in the Metro system to increase the sustainability and livability of the local Braddock Small Area neighborhood through an increase in density and mix of uses. However, regardless of the transit oriented design, and intent, development will invariably add traffic and its associated impacts to the existing vehicle network.

In order to determine how much traffic will be added and what its impact will be on the operations of the existing intersections, several scenarios were developed to gauge the incremental impacts associated with the intersection operations in 2015.

2015 No-build

Regardless of growth or re-development in the area, it is acknowledged that there will be an increase in the volume of traffic on the study area's roadways. Since certain roadways are more likely to experience an increase in traffic than others, a universal growth factor for this study was determined to be inappropriate. Based on our knowledge of the area, a background growth factor was applied to Route 1 (Patrick and Henry Streets) and the east-west through route of Braddock Road/Wythe Street.

Historically, Route 1 traffic in the study area has increased 1-2% per year. However, within the next 5-10 years traffic growth on Route 1 is expected to grow at a higher rate due to Potomac Yard and Crystal City development. This development is expected to add approximately 1.8 million square feet of office space, 325,000 square feet of retail and 1,700 residential dwelling units adjacent to Route 1 just north of the study area. With the 2015 planning horizon, the following growth factors have been used in the following traffic impact analysis scenarios:

- 3% annual growth factor on Route 1
- 2% annual growth factor on the Braddock Road/Wythe Street routes.

Through volumes on the Braddock Road/Wythe Street corridor were increased 2%, compounded annually, over the nine year study period to account for development outside the study area and provide an increase in east/west demand.

In addition to the current counts and the through volume growth factors described above, traffic generated by the Monarch (168 dwelling units) and the Prescott (64 dwelling units) developments was estimated using ITE and distributed through the network. Both of these developments are located south of Pendleton Street and are currently being constructed.

In order to gage the capacity and operational impacts associated with the proposed development on the 2015 roadway network, several scenarios were analyzed and compared to the 2015 No-build analysis described above. These scenarios include:

- 2015 with Permitted Density under Current Zoning
- 2015 "conventional" transit reduction
- 2015 "aggressive" transit reduction

2015 with Permitted Density under Current Zoning

Assumptions made in the 2015 No-build scenario were carried forward and analyzed with the addition of Special Use Permit (SUP) zoning trip generation associated with the build out of parcels to currently permitted zoning density, essentially reflecting expected 2015 intersection operational conditions if the study area was built out without the increase in density of the proposed projects. Additionally, projects within 1,500' of the Braddock Road Metro station received a 30% reduction in trips as it is assumed that vehicle trips will be diverted to rail trips. Additionally, a 10% internal capture was applied as well, as the mixed use nature of the study area is assumed to reduce vehicle trips

The trip distribution associated with this, and remaining scenario's, is based on the general distribution patterns observed in previously submitted Transportation Impact Study (TIS) reports for proposed development in the area and were based on realistic transit reduction factors. This distribution was then used for each ensuing scenario. Under this particular scenario the total trip generation to the study area is approximately 630 AM peak hour trips and approximately 760 trips in the PM.

2015 "Conventional" Transit Reduction

This scenario assumed the same base network and traffic patterns found in the 2015 No-build scenario, but increased the trip generation of projects in the study area to the proposed square feet of development submitted for analysis within the Braddock Road Metro Small Area. The same trip distribution was assumed from the previous scenario, and projects within 1,500' of the Braddock Road Metro station received a 30% reduction in trips as it is assumed that vehicle trips will be diverted to rail trips. Additionally, a 10% internal capture was applied since the mixed use nature of the study area is assumed to reduce vehicle trips. Total AM peak trips generated under this scenario is 865 and PM peak trips are approximately 1,030. Consequently, approximately 230 trips were added in the AM peak and 270 trips were added in the PM peak period over generated trips under the 2015 with Permitted Density under Current Zoning scernio described above.

2015 "Aggressive" Transit Reduction

The aggressive scenario is identical to the conventional scenario described above, however it reduces the overall trip generation based on a 50% transit reduction and assumes a more aggressive TDM plan.

Roadway Improvements

All scenarios assumed that a new access point (approximately 22' wide) will be provided between Henry Street and Fayette Street, just north of the current Montgomery Street intersection. This new access point is expected to provide right-in and right-out access on Henry Street. Additionally, all scenarios, except the 2015 No-build, assumed that a traffic signal would be installed at Henry Street/Fayette Street and that eastbound left turns would be prohibited at First Street/Henry Street and northbound left turns from Route 1 would be prohibited at Fayette Street/Route 1. In addition, signals were optimized and their off-sets adjusted to account for the varying traffic volumes in each scenario investigated.

Study Intersection Performance

The forecasted traffic volumes for the baseline and total volume scenarios were evaluated during the morning and evening peak hours to assess the incremental changes to intersection operations within the study area for each scenario as identified above. Specifically, the increment of change in the peak hour level of service attributed to the proposed project was identified. The findings are summarized in Table 5 and explained in the following sections.

The background growth traffic had major effects on all of the study intersections along Route 1 during both peak hours. All study intersections along Route 1 experienced an increase in delay due to the addition of background growth compared to existing operating conditions. The permitted densities under current zoning scenario produces' slightly better LOS at the majority of intersections than does the "aggressive" transit reduction factor scenario. The "conventional" transit reduction factors produce the aggregate lowest LOS of all study scenarios, as can be seen in the table below. Figures 5, 6 and 7 visually show the difference in AM peak operations between Permitted Density under Current Zoning, "conventional" transit reduction and "aggressive" transit reduction while Figures 8, 9 and 10 show PM peak operations.

Table 5: 2015 Intersection Level of Service

Study Intersection	AM Peak Hour			PM Peak Hour		
	C.Z.	Conv.	Agg	C.Z.	Conv.	Agg
Signalized						
Braddock Road/Mount Vernon Avenue	B	B	B	B	B	B
Braddock Road/West Street	C	C	C	C	C	C
West Street/Pendleton Street	A	A	A	A	A	A
West Street/Cameron Street	B	B	B	B	B	B
Henry Street/Slators Lane	F	F	F	D	D	D
Henry Street/Fayette Street	A	D	B	B	B	B
Henry Street/Patrick Street	A	A	B	A	A	A
Henry Street/Montgomery Street	A	A	B	B	C	B
Henry Street/Madison Street	B	B	B	E	F	E
Henry Street/Wythe Street	A	B	A	B	C	B
Henry Street/Pendleton Street	A	A	A	B	B	B
Henry Street/Oronoco Street	A	A	A	A	B	A
Henry Street/Princess Street	A	A	A	A	A	A
Henry Street/Queen Street	A	A	A	A	A	A
Henry Street/Cameron Street	A	B	A	C	C	B
Patrick Street/Montgomery Street	F	F	F	B	B	B
Patrick Street/Madison Street	A	A	A	A	A	A
Patrick Street/Wythe Street	F	F	B	B	B	B
Patrick Street/Pendleton Street	A	C	A	A	A	A
Patrick Street/Oronoco Street	B	C	B	A	A	A
Patrick Street/Princess Street	A	B	A	A	A	A
Patrick Street/Queen Street	A	A	A	A	A	A
Patrick Street/Cameron Street	F	F	F	A	A	A
Columbus Street/Montgomery Street	A	A	A	A	A	A
Columbus Street/Madison Street	B	B	B	A	A	A
Columbus Street/Wythe Street	C	C	C	B	B	B
Columbus Street/Pendleton Street	C	C	C	B	B	B
Alfred Street/Cameron Street	B	B	B	B	B	B

C.Z. – 2015 Permitted Densities under with Permitted Density under Current Zoning

Conv. – 2015 Redevelopment with Conventional TDM

Agg. – 2015 Redevelopment with Aggressive TDM

Figure 5: LOS 2015 with Permitted Density Under Current Zoning AM Peak Hour

Figure 6: LOS 2015 Conventional Scenario AM Peak Hour

Figure 7: LOS 2015 Aggressive Scenario AM Peak Hour

Figure 8: LOS 2015 with Permitted Density Under Current Zoning PM Peak Hour

Figure 9: LOS 2015 Conventional Scenario PM Peak Hour

Figure 10: LOS 2015 Aggressive Scenario PM Peak Hour

Total Traffic Conditions

Table 6 depicts the amount of trips that originate, terminate, or pass through the study area during the AM and PM peak periods for each of the scenarios investigated. As the table shows, the planning area currently experiences approximately 4,900 trips for the AM and PM peak periods combined, while Route 1 supports a demand of approximately 7,200 vehicles during this same period. The only contiguous east/west route through the study area, Braddock Road/Wythe Street, is expected to grow 2% annually due to demand from outside the study area, resulting in an approximate increase of 100 through vehicles over current conditions. Similarly, Route 1 is expected to experience a 3% annual growth rate, equating to an approximate 30% increase in volume over the next 10 years. While this is a higher annual growth rate than has historically been documented, development projects outside the study area such as Potomac Yard and the completion of the Woodrow Wilson Bridge interchange are expected to induce more regional vehicle trips along the Route 1 than observed in previous years.

Table 6: Trip Generation Comparison

Scenario	*Planning Area Trips**	*Route 1 Trips**
Existing Conditions	4,900	7,200
2015 No Build	5,000	9,600
2015 Current Zoning	6,100	10,000
2015 "Conventional"	6,600	10,200
2015 "Aggressive"	6,000	9,700

*Combined AM and PM Peak Trips

The approximately 2,400 vehicle increase along Route 1 attributed to external study area developments is five times more than the number of vehicle trips being generated by the proposed increase in density for the planning area (as seen when comparing the 2015 Current Zoning scenario vs. the 2015 "Conventional" scenario). Thus, even with increased demand from the study area, Route 1 will see a negligible increase in comparable volume from the study area development.

If the City implements aggressive TDM strategies (producing a 50% transit trip share), the number of vehicle trips into, out of, or through the area is expected to be close to, if not less than, area build out under Current Zoning.

In summary, comparing permitted densities under current zoning regulations to area build out with the proposed projects would generate the equivalent of approximately a fifth of the trips being added along Route 1 as background growth. Signal timings were optimized under each alternative as traffic volumes varied by scenario. With optimized signals, most intersections operate better than LOS D. Several exceptions include the Route 1/Slaters Lane and Patrick Street/Cameron Street intersections in the AM, which are mostly due to heavy through volumes conflicting with a large amount of turning movements.

Site Access and Circulation

The projects located north of Wythe Street have limited access. In particular the development proposed north of First Street between the Metro right-of-way and Route 1 is dependent mainly on the intersections of First Street/Henry Street and Madison Street/Henry Street to access the surrounding roadway network. The additional access points to this area are imperative in order to

decrease the operational degradation of the afore-mentioned intersections once the sites have been built.

In order to address some of these concerns, a new access location would be constructed as part of the development projects connecting Henry Street to Fayette Street. The proposed access location would be a right-in right-out connection that would be off set north of the current Montgomery Street/Henry Street intersection and be approximately 22' wide.

A robust pedestrian network is also important to reduce the amount of auto trips generated by the proposed development. Additions to the pedestrian network by developers at the time of construction will provide parcel connectivity between the proposed projects and the existing pedestrian network and needs to be completed in order to provide adequate pedestrian circulation throughout the study area.

In an effort to increase vehicle circulation in the study area, an operational analysis was completed of converting the current one-way couplet of Montgomery Street/Madison Street one-way pair to two-way operations. The results of this analysis identified this change would cause several intersections to have worse LOS, namely Patrick Street/Madison Street in both the AM and PM peak hour, and Patrick Street/Wythe Street in the AM peak hour as the increase in left turning vehicles would create greater delays. However, several intersections would have a better LOS as the through volumes would be reduced. These locations include Henry Street/Madison Street and Patrick Street/Montgomery Street.

Conceptually, switching from a one-way operation to a two-way operation has positives and negatives that need to be carefully considered. An intersection where two of the four legs have a one-way operation produces fewer theoretical conflict points (created from vehicles crossing paths due to turning or through movements). Thus overall vehicular safety along Madison Street and Montgomery Street under current, one-way operation is considered advantageous over two-way operation as the likelihood of vehicle crashes decreases.

In addition to vehicular safety, pedestrian safety, both perceived and actual, is optimal under one-way operation. Pedestrians only need to look in one direction when crossing one-way streets and have more acceptable gaps with conflicting vehicle movements.

Conversely, two-way operation also has notable benefits. Greater vehicle access is provided as individuals do not have to travel around the block in order to access parcels. Additionally, driver confusion is reduced as one-way operation can prove to be frustrating, especially for drivers from outside the area that do not know how to navigate the one-way traffic flow patterns.

Neighborhood Cut-Through Traffic

As Route 1 becomes more congested in the future and additional access points connecting the redevelopment area with the surrounding infrastructure are constructed, there is the possibility that local and through traffic will look for less congested alternatives to Route 1 within the local road system.

Several measures can be considered to dissuade or restrict traffic from this option. Travel restrictions on local roads, such as the current restriction of southbound traffic during the PM peak period for Fayette Street and Payne Street south of Oronoco Street, will prohibit through traffic from using local streets. However, this measure will also prohibit local traffic from the same movements. This measure restricts (as opposed to other policies that attempt to enhance) full utilization of the current robust grid roadway network.

A less invasive option that will allow continued use of the network is the improvement of Route 1 congestion levels, negating the need for traffic to divert to travel on local side streets. This can be accomplished by the continual monitoring of traffic patterns that will prompt traffic signal optimization to allow for the shortest possible queues on Route 1 and decrease delay for through traffic. Signal timings and off-sets should be reevaluated often in order to best serve changing travel patterns. In addition, the completion of the Woodrow Wilson bridge project should reduce queuing and capacity issues currently experienced along Route 1 in the study area. Finally, enhanced transit service, such as the planned Bus Rapid Transit (BRT) and/or dedicated transit corridor, will induce travelers to switch to transit.

Pedestrian/Bicycle

Future development within the study area should be completed with wide sidewalks, street furniture and pedestrian amenities based on the enhanced pedestrian corridor standards advocated by the city along the several study area streets identified as "pedestrian streets". The main focus of these streets is to provide a pedestrian system that link trip generating locations (such as grocery stores and the Metro station) with residential land use.

In addition to the overall streetscape and pedestrian enhancement improvements, the extension of the King Street/Braddock Road multi-use trail should be extended from its current terminus, north through the study area and under the Route 1 bridge to the Potomac Yard development. A second external pedestrian connection should be considered at the Fayette Street/Route 1 intersection, in conjunction with the recommended traffic signal, that will provide east/west access to the northwest neighborhoods across Route 1.

Transit

Redevelopment of the bus access to, routing from, and flow patterns within, the Braddock Road Metro station should be considered. The operations of the bus bays and internal access road should become two-way, allowing for additional bus service to the area as well as providing a more functional use of the space. Future bus ridership should increase as a shift of several bus routes from the King Street Metro station to Braddock Road Metro station is planned.

Externally to the station area, current bus routes are not permitted to make a southbound left turn on Braddock Road when exiting the station area, and are instead routed back up to the Madison Street intersection to access the surrounding street network. All routes continuing east of West Street should be routed along Pendleton Street or Wythe Street to Braddock Road, where they can make a right turn into the station area and then exit along Madison Street. Routes heading west of West Street should enter the station area using West Street and/or Madison Street and can then make a right turn on Braddock Road. If the routes are not restructured to require strictly right-in and right-out access on Braddock Road, then a signal will need to be installed at the intersection to safely accommodate left turning buses. The close proximity to the Wythe Street/West Street signal and the Metro track overpass will make this a challenge to position a signal.

Final route designation of the DASH and WMATA bus routes will ultimately need to be integrated with the proposed BRT route. Current plans call for the BRT alignment to travel along Route 1 in mixed traffic, turning westbound onto First Street, southbound on Fayette Street and westbound on Madison Street to enter the Braddock Road Metro station area. One alternative to take advantage of is the proposed two-way flow of the new station area and to continue the BRT southbound on Fayette Street, turn westbound on Wythe Street, then make a right into the station area. Once passengers have

boarded and alighted, the BRT would head eastbound on Madison Street and northbound on Fayette Street until intersecting with Route 1 at the proposed signal.

Chapter 4
Mitigation

In order to improve vehicular connectivity and operations for the study parcels, and lessen impacts on existing intersection operations in the surrounding roadway network, several mitigation measures are suggested.

Infrastructure Improvements

A northbound left turn bay at the intersection of First Street/Patrick Street is recommended and an eastbound left turn prohibition should be enacted. Concurrently, a signal should be installed at the Fayette Street/Route 1 intersection and northbound left turners from Route 1 should be prohibited at this location. This will essentially provide egress access at the Fayette Street/Route 1 intersection for northbound traffic from the area, and provide northbound ingress movement at the First Street/Route 1 intersection for traffic traveling into the area. Additionally, signals throughout the corridor should be continually optimized. However, current pedestrian crossing timings and cycle lengths do not need to be adjusted in order to provide an efficient network.

Frontage improvements that include the City of Alexandria's cross section standards for pedestrian streets should be provided for all development in the study area, connecting the proposed developments with the current pedestrian network. Additionally, the existing multi-use trail connecting King Street and Braddock Street Metro stations should be extended north through the northern section of the study area, under the new Route 1 bridge and onto Potomac Yard. Pedestrian access should also be considered linking the proposed signal at Fayette Street/Route 1 with Douglas Street and Colonial Avenue.

The current bus circulation at the Braddock Road Metro station could be realigned to provide two way operation and ten bus bays. Kiss and Ride must still be provided, either along West Street or at a small turn around area north of Madison Street.

TDM Strategies

Traditional Transportation Demand Management Strategies (TDM) focus on reducing single occupant vehicle (SOV) trips to destination sites (i.e. office land uses). These strategies typically involve employers removing parking subsides, reimbursing employees for transit trips, etc. As the redevelopment being proposed for the area is dominated by residential use, not office use, a successfully TDM strategy for this area will require a different approach, modeled to encourage origin sites (residential land use) through the promotion of HOV and transit usage by residents.

For residential uses, there are four groups of strategies that can be employed:

- The provision of physical structures that encourage mode shift
- The distribution of transit and rideshare information
- The collection of information on commute behavior, and

- Transit subsidies

Structural requirements relate to the provision of a fully connected set of sidewalks that lead from the development(s) to the Metro station and other transit stops. While sidewalks themselves do not guarantee a shift in mode choice, convenient and aesthetically pleasing pedestrian access to transit can encourage the use of alternative modes. The study area currently has an acceptable grid pattern of pedestrian infrastructure and it is expected to be enhanced with developmental build-out as developments should be required to connect fronting sidewalks to the adjacent infrastructure.

Additionally, secure bicycle storage provisions at the residential trip end makes the use of biking easier and can help to make this mode of travel more attractive.

Distributing transit and rideshare information can be done by installing a commuter information center (CIC) in the lobbies of developments or for the entire developmental area in a very visible place, such as the proposed green space on Fayette Street. The CIC should provide bus and metro maps, time schedules and can coordinate ride sharing groups through the provision of a travel board that other potential commuters could consult to identify car/van pool sharing opportunities.

To ensure that the local and regional transit options are meeting residents needs, surveys should be conducted to verify commuting behavior. Future transit service updates can be based in part on resident stated preferences.

To encourage transit use, developments could be required to provide discounted bus/rail passes to each unit.