LORTON ROAD

WIDENING PROJECT

TRAFFIC SIGNAL WARRANT ANALYSIS STUDY

Prepared for:

Prepared by:

Kimley-Horn and Associates, Inc.

FEBRUARY 2010

Final Report

Lorton Road Widening Project
Traffic Signal Warrant Analysis Study

Prepared for:

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EXECUTIVE SUMMARY

This study presents the results of traffic signal warrant analyses at three intersections along Lorton Road in Fairfax County, Virginia. This study was performed for Fairfax County Transportation Design Branch, Planning and Design Division in association with the Lorton Road Widening Project to determine whether traffic signal warrants are satisfied at any of the three future improved intersections:

- Realigned Lorton Road and Furnace Road (west junction)
- Lorton Road and Realigned Furnace Road (east junction)
- Lorton Road and Windermere Hill Drive

The study was prepared in accordance with scoping discussions with the Fairfax County Transportation Design Branch, Planning and Design Division and with the Virginia Department of Transportation (VDOT) Traffic Engineering staff. The traffic signal warrants were performed in accordance with the 2003 Manual on Uniform Traffic Control Devices (MUTCD). This study summarizes the existing conditions, future intersection configurations, traffic data collection, traffic volume forecasts for 2013 (anticipated date of roadway improvement project completion) and 2030 (design year), and analysis of signal warrants.

The traffic volumes used in this warrant study are 2009 existing volumes, forecasted 2013 volumes, and forecasted 2030 volumes. Traffic counts were performed in November 2009 to establish the existing volumes. The counts were classified as passenger vehicles and trucks. The 2013 traffic volumes were calculated based on a 4 percent yearly growth rate. This growth rate was developed by reviewing the VDOT historical traffic data from 2001 to 2008. The 2030 traffic volumes were developed based on forecasts from the 2005 Laurel Hill Traffic Analysis Study.

The traffic signal warrants considered in this study are:

Warrant 1 – Eight-Hour Vehicular Volume
Warrant 2 – Four-Hour Vehicular Volume
Warrant 3 – Peak Hour
Warrant 8 – Roadway Network

Using the future intersection configurations and the 2013 and 2030 traffic volumes, the traffic signal warrant analyses were performed at the three study intersections. The results of the analysis and recommendations are summarized below:

Realigned Lorton Road and Furnace Road (west junction)

At the intersection of Realigned Lorton Road and Furnace Road, the results of the analyses show that Warrants 2, 3, and 8 are satisfied under 2013 conditions. Warrant 1 also is satisfied when the 2013 traffic volumes are adjusted for truck volumes. Under 2030 conditions, all four applicable traffic signal warrants are satisfied. Therefore, it is recommended that the Realigned Lorton Road and Furnace Road intersection be signalized with the completion of the roadway improvements in 2013.

Lorton Road and Realigned Furnace Road (east junction)

At the intersection of Lorton Road and Realigned Furnace Road, the analyses results show none of the applicable traffic signal warrants are satisfied under 2013 conditions. Under 2013 traffic volumes with adjustments for truck volumes, Warrant 3 is also satisfied. Under 2030 conditions, Warrants 1, 2, and 3 (Warrant 8 isn't applicable for this intersection) are satisfied. Based on the 2030 traffic volume forecasts, the traffic signal warrants will be satisfied sometime between 2013 and 2030.

At the Lorton Road and Realigned Furnace Road intersection, it is recommended to program future funding for the installation of a new traffic signal and to perform an updated traffic signal warrant study at this intersection at periodic intervals after the roadway improvements are open to traffic.

Lorton Road and Windermere Hill Drive

At the intersection of Lorton Road and Windermere Hill Drive, the results of the analyses show none of the applicable traffic signal warrants are satisfied under 2013 or 2030 conditions. The majority of traffic along Windermere Hill Drive approaching Lorton Road turns right to travel east. The separate right turn lane will allow these turning movements to occur with minimal conflict. It is recommended to perform an updated traffic signal warrant study at periodic intervals after the roadway improvements are open to traffic to determine if traffic patterns change as a result of the improvements.

It is also recommended to coordinate with the Fairfax County Park Authority to encourage exploring the feasibility of realigning the park access roadway opposite Windermere Hill Drive. This realignment will create a four approach intersection and manage access along Lorton Road. Traffic signal warrants should be revisited if this realigned is pursued to determine if signalization is appropriate.

Other Recommendations

Other recommendations for the Lorton Road Widening Project are to preserve right-of-way or traffic signal easements at each intersection corner for future traffic signal equipment. It is also recommended to incorporate a conduit run along the roadway frontage in the roadway design plans for future traffic signal communication cable.

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1. INTRODUCTION

This study presents the results of traffic signal warrant analyses at three intersections along Lorton Road in Fairfax County, Virginia. This study was performed for Fairfax County Transportation Design Branch, Planning and Design Division in association with the Lorton Road Widening Project to determine whether traffic signal warrants are satisfied at any of the three future improved intersections.

The Lorton Road Widening Project involves the improvement of the existing two-lane roadway to a four-lane divided cross-section to include medians, shared use paths, on-road bike lanes and low impact development storm water management between Furnace Road and Silverbrook Road. The resulting roadway will provide improved horizontal and vertical alignment, dedicated turn lanes, and realignment/consolidation of each of the two existing intersections of Lorton Road and Furnace Road to improve traffic operations. This project is part of the Fairfax County Transportation Plan and will provide improved connectivity between Route 123 (Ox Road), Interstate 95, and Route 1 (Richmond Highway) in the Laurel Hill Area. The project is scheduled to be open to traffic in 2013 and the design year is 2030.

The following study was prepared in accordance with scoping discussions with the Fairfax County Transportation Design Branch, Planning and Design Division and with the Virginia Department of Transportation (VDOT) Traffic Engineering staff. The traffic signal warrants were performed in accordance with the 2003 Manual on Uniform Traffic Control Devices (MUTCD). This study summarizes the existing conditions, future intersection configurations, traffic data collection, traffic volume forecasts for 2013 and 2030, and analysis of signal warrants.

2. EXISTING CONDITIONS

Lorton Road (VA Route 642) provides an east-west connection between Ox Road (VA Route 123) and Richmond Highway (US Route 1) in the Laurel Hills area of southern Fairfax County. Lorton Road currently is a two-lane roadway from its junction with Ox Road (VA Route 123) to Silverbrook Road (VA Route 600). At its intersection with Silverbrook Road, the Lorton Road cross-section widens to six lanes (three in each direction) to its junction with Richmond Highway.

Furnace Road (VA Route 611) is a local north-south collector that connects Ox Road (VA Route 123) with Richmond Highway (US Route 1). Furnace Road is a primarily a two-lane roadway

except near Ox Road where it widens to four lanes. South of Lorton Road, Furnace Road also provides access to the Fairfax County Energy Resource Recovery Facility, also commonly referred to as the "Lorton Landfill."

3. LORTON ROAD WIDENING PROJECT

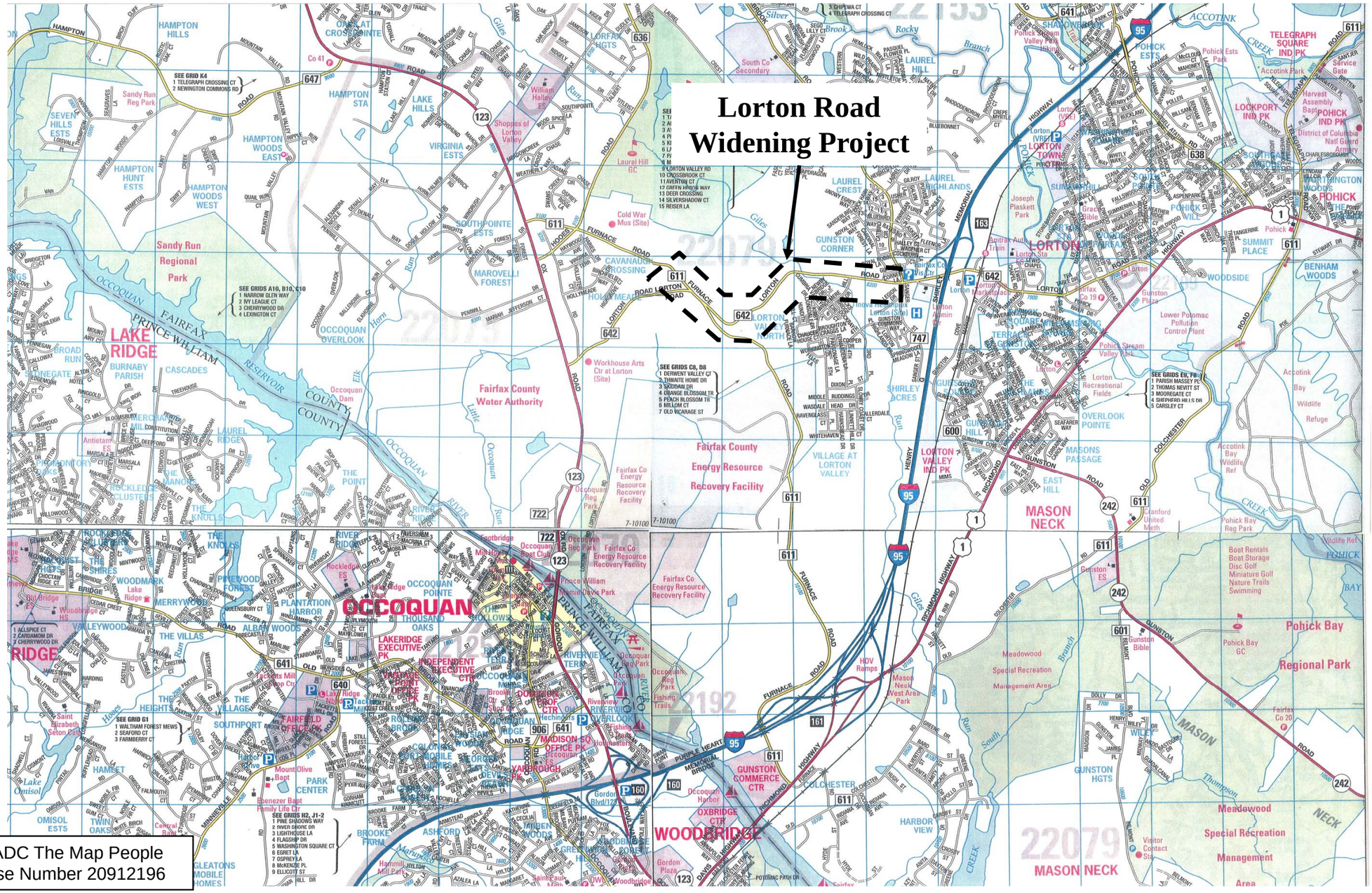
The Lorton Road Widening Project involves the improvement of the existing two-lane roadway to a four-lane divided cross-section to include medians, shared use paths, on-road bike lanes and low impact development storm water management between Furnace Road and Silverbrook Road. The planned improvements will provide improved horizontal and vertical alignment, dedicated turn lanes, and realignment/consolidation of each of the two existing intersections of Lorton Road and Furnace Road to improve traffic operations. This project is part of the Fairfax County Transportation Plan and will provide improved connectivity between Route 123 (Ox Road), Interstate 95, and Route 1 (Richmond Highway) in the Laurel Hill Area. The project is scheduled to be completed and open to traffic in 2013 and the design year is 2030. **Figure 1** shows the location of the Lorton Road Widening Project.

Three intersections will be improved as a part of the Lorton Road Widening Project. These intersections are the focus of this study:

- Realigned Lorton Road and Furnace Road (west junction)
- Lorton Road and Realigned Furnace Road (east junction)
- Lorton Road and Windermere Hill Drive

The future intersection of Realigned Lorton Road and Furnace Road will consolidate the existing west junction of Lorton Road and Furnace Road with the intersection of Furnace Road and Burma Road (private road) to form a four-way intersection. The future intersection of Lorton Road and Realigned Furnace Road will consolidate the existing east junction of Lorton Road and Furnace Road with the junction of Lorton Road with Apple Orchard Road to form a T-intersection.

Figure 2 shows the proposed alignment and intersection lane configurations based on the current design plans.



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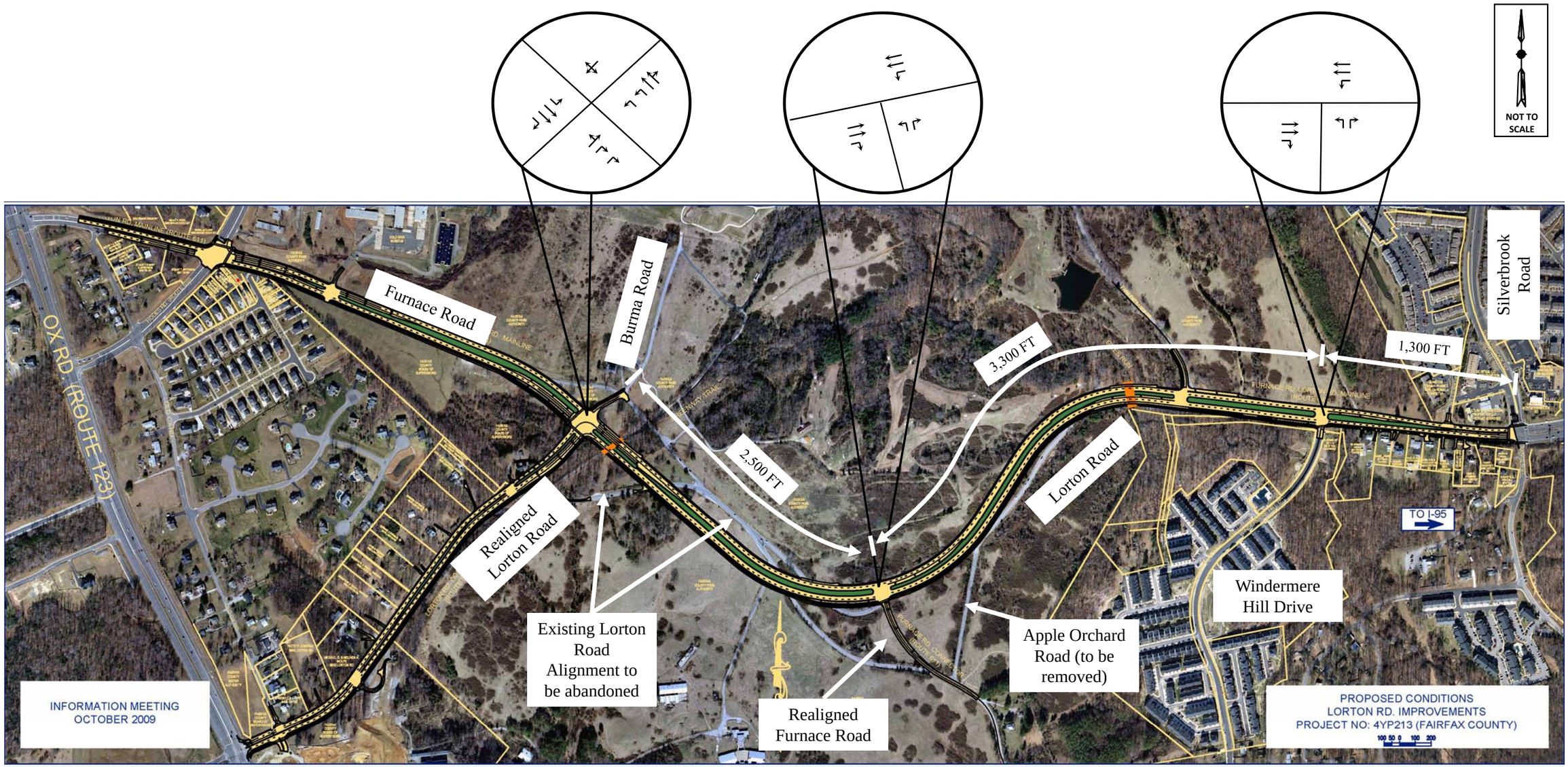
Lorton Road Widening Project Location Map

Lorton Road Widening Project – Traffic Signal Warrant Analysis Study
Fairfax County, VA

Figure 1



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Future Alignment and Intersection Lane Designations

Lorton Road Widening Project – Traffic Signal Warrant Analysis Study
Fairfax County, VA

Figure 2

4. FUTURE DEVELOPMENT IN THE PROJECT VICINITY

There are several ongoing development projects under consideration in the vicinity of the Lorton Road Widening Project. These projects are:

Laurel Hill Park Master Plan: The Laurel Hill Park Master Plan includes 3,200 acres at Laurel Hill and surrounds the Lorton Road Widening Project. Only a portion of the land in the master plan was identified for redevelopment for private, commercial use (see Fairfax County Adaptive Reuse Area below). The majority of the remaining parcel land units are designated for adaptive re-use of historic and non-historic buildings (approximately 140 acres), parkland and open space (approximately 1,600 acres), high school and middle school sites (approximately 120 acres), and existing uses such as the continued operation of the Resource Recovery Facility and adaptive re-use of a former landfill (approximately 500 acres). The park currently has direct access to Lorton Road at two locations from the north. The Lorton Road Widening Project will consolidate the two park access roads to the existing driveway west of Windermere Hill Drive. There is also the possibility of realigning the consolidated park access roadway opposite Windermere Hill Drive.

Fairfax County Adaptive Reuse Area: This development consists of approximately 59,000 SF of retail, 153 townhomes, 198 multi-family dwelling units, and 114,000 SF of office and is located at the southwest corner of the Silverbrook Road (VA Route 600) and White Spruce Way intersection north of Lorton Road. The vehicle access to this development is oriented towards Silverbrook Road and a traffic analysis prepared in 2008[1] showed the forecast site traffic will primarily use Silverbrook Road to reach Lorton Road. The study also showed that no traffic volume is expected to use the park roadways to access Lorton Road.

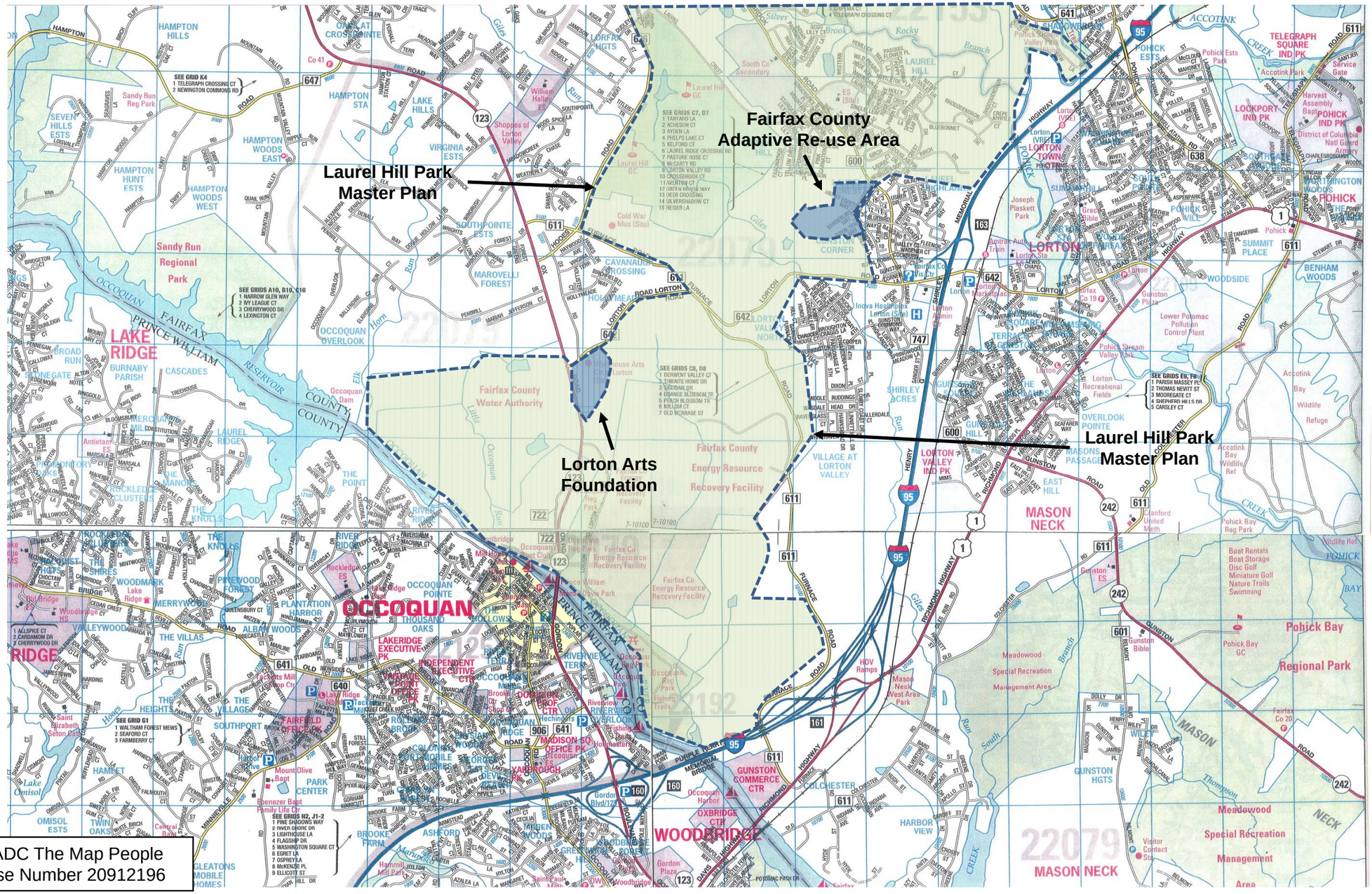
Lorton Workhouse Arts Center: This development consists of 94,000 SF of event, gallery, and other specialty space, approximately 104,600 SF of classroom and studio space, 17,180 SF of restaurant space, a baseball field, and 43 residential units and is located at the southeast corner of the Ox Road (VA Route 123) and Lorton Road intersection. The Lorton Workhouse Arts Center's vehicle access is oriented towards Ox Road with driveways along Ox Road and Lorton Road. A traffic analysis prepared in 2009[2] showed that the majority of the forecast site traffic

[1] Lorton Town Center Preliminary Traffic Assessment. Prepared by Wells and Associates, Inc. Dated October 31, 2008.

[2] Lorton Workhouse Arts Center Traffic Impact Study. Prepared by Kimley-Horn and Associates, Inc. Dated July 2008, Updated May 2009.

will access the site from Ox Road and that less than 40 vehicles per hour will be added to Lorton Road during the peak weekday hour in any direction.

Figure 3 shows the location of these developments in relation to the Lorton Road Widening Project.



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Development in the Project Vicinity

Lorton Road Widening Project – Traffic Signal Warrant Analysis Study
Fairfax County, VA

Figure
3

5. TRAFFIC VOLUMES

The traffic volumes used in this warrant study are 2009 existing volumes, forecasted 2013 volumes, and forecasted 2030 volumes. The following sections describe the counts and traffic volumes used for the traffic signal warrant analyses.

Existing Traffic Volumes

Existing 13-hour intersection turning movement traffic counts were conducted from 6:00 AM to 7:00 PM on Wednesday, November 4 and Thursday, November 5, 2009 at the following intersections:

- West junction of Lorton Road and Furnace Road
- East junction of Lorton Road and Furnace Road
- Lorton Road and Apple Orchard Road
- Lorton Road and Windermere Hill Drive

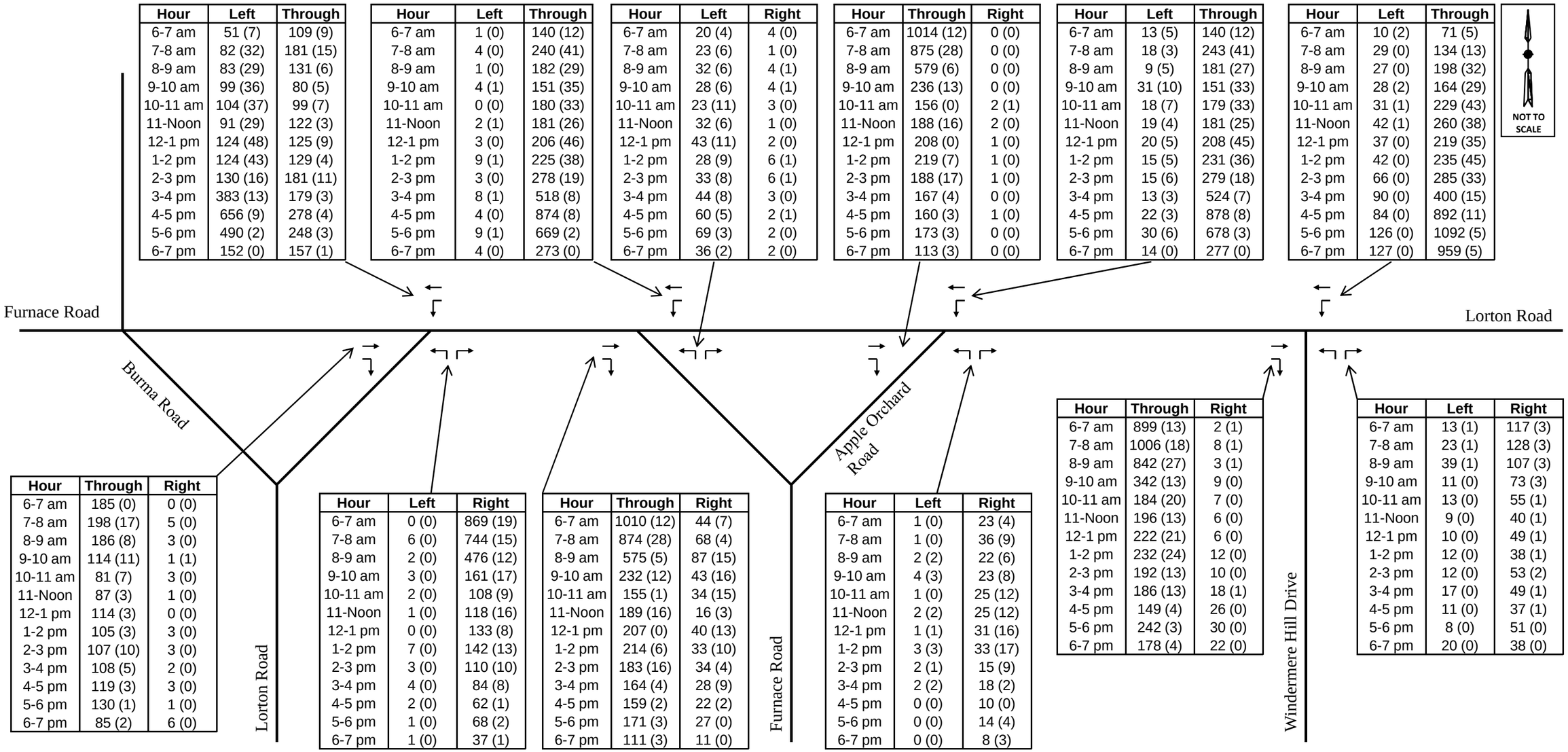
It should be noted that Burma Road, which is part of the west junction, is private and carries an insignificant traffic volume; therefore the intersection of Furnace Road and Burma Road was not counted for this study.

The turning movement counts were classified as passenger vehicles and trucks. A separate traffic volume calculation was performed to adjust truck traffic to passenger car equivalents.

Figure 4 shows a summary of the existing hourly turning movement volumes and truck volumes at the study area intersections.

Existing Traffic Volumes with Adjustments for Intersection Improvements

The existing traffic volumes were adjusted based on the future intersection consolidations resulting from the Lorton Road Widening Project. The turning movements at the east junction of Lorton Road and Furnace Road were combined with the turning movements at the Lorton Road and Apple Orchard Road intersection. **Figure 5** shows the resulting traffic volumes after the adjustments were made for the intersection consolidation.



Hour	Left	Through
6-7 am	51 (7)	109 (9)
7-8 am	82 (32)	181 (15)
8-9 am	83 (29)	131 (6)
9-10 am	99 (36)	80 (5)
10-11 am	104 (37)	99 (7)
11-Noon	91 (29)	122 (3)
12-1 pm	124 (48)	125 (9)
1-2 pm	124 (43)	129 (4)
2-3 pm	130 (16)	181 (11)
3-4 pm	383 (13)	179 (3)
4-5 pm	656 (9)	278 (4)
5-6 pm	490 (2)	248 (3)
6-7 pm	152 (0)	157 (1)

Hour	Left	Through
6-7 am	1 (0)	140 (12)
7-8 am	4 (0)	240 (41)
8-9 am	1 (0)	182 (29)
9-10 am	4 (1)	151 (35)
10-11 am	0 (0)	180 (33)
11-Noon	2 (1)	181 (26)
12-1 pm	3 (0)	206 (46)
1-2 pm	9 (1)	225 (38)
2-3 pm	3 (0)	278 (19)
3-4 pm	8 (1)	518 (8)
4-5 pm	4 (0)	874 (8)
5-6 pm	9 (1)	669 (2)
6-7 pm	4 (0)	273 (0)

Hour	Left	Right
6-7 am	20 (4)	4 (0)
7-8 am	23 (6)	1 (0)
8-9 am	32 (6)	4 (1)
9-10 am	28 (6)	4 (1)
10-11 am	23 (11)	3 (0)
11-Noon	32 (6)	1 (0)
12-1 pm	43 (11)	2 (0)
1-2 pm	28 (9)	6 (1)
2-3 pm	33 (8)	6 (1)
3-4 pm	44 (8)	3 (0)
4-5 pm	60 (5)	2 (1)
5-6 pm	69 (3)	2 (0)
6-7 pm	36 (2)	2 (0)

Hour	Through	Right
6-7 am	1014 (12)	0 (0)
7-8 am	875 (28)	0 (0)
8-9 am	579 (6)	0 (0)
9-10 am	236 (13)	0 (0)
10-11 am	156 (0)	2 (1)
11-Noon	188 (16)	2 (0)
12-1 pm	208 (0)	1 (0)
1-2 pm	219 (7)	1 (0)
2-3 pm	188 (17)	1 (0)
3-4 pm	167 (4)	0 (0)
4-5 pm	160 (3)	1 (0)
5-6 pm	173 (3)	0 (0)
6-7 pm	113 (3)	0 (0)

Hour	Left	Through
6-7 am	13 (5)	140 (12)
7-8 am	18 (3)	243 (41)
8-9 am	9 (5)	181 (27)
9-10 am	31 (10)	151 (33)
10-11 am	18 (7)	179 (33)
11-Noon	19 (4)	181 (25)
12-1 pm	20 (5)	208 (45)
1-2 pm	15 (5)	231 (36)
2-3 pm	15 (6)	279 (18)
3-4 pm	13 (3)	524 (7)
4-5 pm	22 (3)	878 (8)
5-6 pm	30 (6)	678 (3)
6-7 pm	14 (0)	277 (0)

Hour	Left	Through
6-7 am	10 (2)	71 (5)
7-8 am	29 (0)	134 (13)
8-9 am	27 (0)	198 (32)
9-10 am	28 (2)	164 (29)
10-11 am	31 (1)	229 (43)
11-Noon	42 (1)	260 (38)
12-1 pm	37 (0)	219 (35)
1-2 pm	42 (0)	235 (45)
2-3 pm	66 (0)	285 (33)
3-4 pm	90 (0)	400 (15)
4-5 pm	84 (0)	892 (11)
5-6 pm	126 (0)	1092 (5)
6-7 pm	127 (0)	959 (5)

Hour	Through	Right
6-7 am	185 (0)	0 (0)
7-8 am	198 (17)	5 (0)
8-9 am	186 (8)	3 (0)
9-10 am	114 (11)	1 (1)
10-11 am	81 (7)	3 (0)
11-Noon	87 (3)	1 (0)
12-1 pm	114 (3)	0 (0)
1-2 pm	105 (3)	3 (0)
2-3 pm	107 (10)	3 (0)
3-4 pm	108 (5)	2 (0)
4-5 pm	119 (3)	3 (0)
5-6 pm	130 (1)	1 (0)
6-7 pm	85 (2)	6 (0)

Hour	Left	Right
6-7 am	0 (0)	869 (19)
7-8 am	6 (0)	744 (15)
8-9 am	2 (0)	476 (12)
9-10 am	3 (0)	161 (17)
10-11 am	2 (0)	108 (9)
11-Noon	1 (0)	118 (16)
12-1 pm	0 (0)	133 (8)
1-2 pm	7 (0)	142 (13)
2-3 pm	3 (0)	110 (10)
3-4 pm	4 (0)	84 (8)
4-5 pm	2 (0)	62 (1)
5-6 pm	1 (0)	68 (2)
6-7 pm	1 (0)	37 (1)

Hour	Through	Right
6-7 am	1010 (12)	44 (7)
7-8 am	874 (28)	68 (4)
8-9 am	575 (5)	87 (15)
9-10 am	232 (12)	43 (16)
10-11 am	155 (1)	34 (15)
11-Noon	189 (16)	16 (3)
12-1 pm	207 (0)	40 (13)
1-2 pm	214 (6)	33 (10)
2-3 pm	183 (16)	34 (4)
3-4 pm	164 (4)	28 (9)
4-5 pm	159 (2)	22 (2)
5-6 pm	171 (3)	27 (0)
6-7 pm	111 (3)	11 (0)

Hour	Left	Right
6-7 am	1 (0)	23 (4)
7-8 am	1 (0)	36 (9)
8-9 am	2 (2)	22 (6)
9-10 am	4 (3)	23 (8)
10-11 am	1 (0)	25 (12)
11-Noon	2 (2)	25 (12)
12-1 pm	1 (1)	31 (16)
1-2 pm	3 (3)	33 (17)
2-3 pm	2 (1)	15 (9)
3-4 pm	2 (2)	18 (2)
4-5 pm	0 (0)	10 (0)
5-6 pm	0 (0)	14 (4)
6-7 pm	0 (0)	8 (3)

Hour	Through	Right
6-7 am	899 (13)	2 (1)
7-8 am	1006 (18)	8 (1)
8-9 am	842 (27)	3 (1)
9-10 am	342 (13)	9 (0)
10-11 am	184 (20)	7 (0)
11-Noon	196 (13)	6 (0)
12-1 pm	222 (21)	6 (0)
1-2 pm	232 (24)	12 (0)
2-3 pm	192 (13)	10 (0)
3-4 pm	186 (13)	18 (1)
4-5 pm	149 (4)	26 (0)
5-6 pm	242 (3)	30 (0)
6-7 pm	178 (4)	22 (0)

Hour	Left	Right
6-7 am	13 (1)	117 (3)
7-8 am	23 (1)	128 (3)
8-9 am	39 (1)	107 (3)
9-10 am	11 (0)	73 (3)
10-11 am	13 (0)	55 (1)
11-Noon	9 (0)	40 (1)
12-1 pm	10 (0)	49 (1)
1-2 pm	12 (0)	38 (1)
2-3 pm	12 (0)	53 (2)
3-4 pm	17 (0)	49 (1)
4-5 pm	11 (0)	37 (1)
5-6 pm	8 (0)	51 (0)
6-7 pm	20 (0)	38 (0)

Legend

XX (XX) – Total Volume (Heavy Vehicle Volume), vehicles per hour

Kimley-Horn and Associates, Inc.

KHA Project # 110213002

2009 Existing Hourly Turning Movement Traffic Volumes

Lorton Road Widening Project – Traffic Signal Warrant Analysis Study
Fairfax County, VA

Figure 4

NOT TO SCALE

Furnace Road

Hour	Left	Through
6-7 am	51 (7)	109 (9)
7-8 am	82 (32)	181 (15)
8-9 am	83 (29)	131 (6)
9-10 am	99 (36)	80 (5)
10-11 am	104 (37)	99 (7)
11-Noon	91 (29)	122 (3)
12-1 pm	124 (48)	125 (9)
1-2 pm	124 (43)	129 (4)
2-3 pm	130 (16)	181 (11)
3-4 pm	383 (13)	179 (3)
4-5 pm	656 (9)	278 (4)
5-6 pm	490 (2)	248 (3)
6-7 pm	152 (0)	157 (1)

Hour	Left	Through
6-7 am	14 (5)	139 (12)
7-8 am	22 (3)	239 (41)
8-9 am	10 (5)	180 (27)
9-10 am	35 (11)	147 (32)
10-11 am	18 (7)	179 (33)
11-Noon	21 (5)	179 (24)
12-1 pm	23 (5)	205 (45)
1-2 pm	24 (6)	222 (35)
2-3 pm	18 (6)	276 (18)
3-4 pm	21 (4)	516 (6)
4-5 pm	26 (3)	874 (8)
5-6 pm	39 (7)	669 (2)
6-7 pm	18 (0)	273 (0)

Hour	Left	Through
6-7 am	10 (2)	71 (5)
7-8 am	29 (0)	134 (13)
8-9 am	27 (0)	198 (32)
9-10 am	28 (2)	164 (29)
10-11 am	31 (1)	229 (43)
11-Noon	42 (1)	260 (38)
12-1 pm	37 (0)	219 (35)
1-2 pm	42 (0)	235 (45)
2-3 pm	66 (0)	285 (33)
3-4 pm	90 (0)	400 (15)
4-5 pm	84 (0)	892 (11)
5-6 pm	126 (0)	1092 (5)
6-7 pm	127 (0)	959 (5)

Lorton Road

Hour	Through	Right
6-7 am	185 (0)	0 (0)
7-8 am	198 (17)	5 (0)
8-9 am	186 (8)	3 (0)
9-10 am	114 (11)	1 (1)
10-11 am	81 (7)	3 (0)
11-Noon	87 (3)	1 (0)
12-1 pm	114 (3)	0 (0)
1-2 pm	105 (3)	3 (0)
2-3 pm	107 (10)	3 (0)
3-4 pm	108 (5)	2 (0)
4-5 pm	119 (3)	3 (0)
5-6 pm	130 (1)	1 (0)
6-7 pm	85 (2)	6 (0)

Realigned Lorton Road

Hour	Left	Right
6-7 am	0 (0)	869 (19)
7-8 am	6 (0)	744 (15)
8-9 am	2 (0)	476 (12)
9-10 am	3 (0)	161 (17)
10-11 am	2 (0)	108 (9)
11-Noon	1 (0)	118 (16)
12-1 pm	0 (0)	133 (8)
1-2 pm	7 (0)	142 (13)
2-3 pm	3 (0)	110 (10)
3-4 pm	4 (0)	84 (8)
4-5 pm	2 (0)	62 (1)
5-6 pm	1 (0)	68 (2)
6-7 pm	1 (0)	37 (1)

Hour	Through	Right
6-7 am	1010 (12)	44 (7)
7-8 am	874 (28)	68 (4)
8-9 am	575 (5)	87 (15)
9-10 am	232 (12)	43 (16)
10-11 am	153 (0)	36 (16)
11-Noon	187 (16)	18 (3)
12-1 pm	206 (0)	41 (13)
1-2 pm	213 (6)	34 (10)
2-3 pm	182 (16)	35 (4)
3-4 pm	164 (4)	28 (9)
4-5 pm	158 (2)	23 (2)
5-6 pm	171 (3)	27 (0)
6-7 pm	111 (3)	11 (0)

Realigned Furnace Road

Hour	Left	Right
6-7 am	21 (4)	27 (4)
7-8 am	24 (6)	37 (9)
8-9 am	34 (8)	26 (7)
9-10 am	32 (9)	27 (9)
10-11 am	24 (11)	28 (12)
11-Noon	34 (8)	26 (12)
12-1 pm	44 (12)	33 (16)
1-2 pm	31 (12)	39 (18)
2-3 pm	35 (9)	21 (10)
3-4 pm	46 (10)	21 (2)
4-5 pm	60 (5)	12 (1)
5-6 pm	69 (3)	16 (4)
6-7 pm	36 (2)	10 (3)

Hour	Through	Right
6-7 am	899 (13)	2 (1)
7-8 am	1006 (18)	8 (1)
8-9 am	842 (27)	3 (1)
9-10 am	342 (13)	9 (0)
10-11 am	184 (20)	7 (0)
11-Noon	196 (13)	6 (0)
12-1 pm	222 (21)	6 (0)
1-2 pm	232 (24)	12 (0)
2-3 pm	192 (13)	10 (0)
3-4 pm	186 (13)	18 (1)
4-5 pm	149 (4)	26 (0)
5-6 pm	242 (3)	30 (0)
6-7 pm	178 (4)	22 (0)

Windermere Hill Drive

Hour	Left	Right
6-7 am	13 (1)	117 (3)
7-8 am	23 (1)	128 (3)
8-9 am	39 (1)	107 (3)
9-10 am	11 (0)	73 (3)
10-11 am	13 (0)	55 (1)
11-Noon	9 (0)	40 (1)
12-1 pm	10 (0)	49 (1)
1-2 pm	12 (0)	38 (1)
2-3 pm	12 (0)	53 (2)
3-4 pm	17 (0)	49 (1)
4-5 pm	11 (0)	37 (1)
5-6 pm	8 (0)	51 (0)
6-7 pm	20 (0)	38 (0)

Legend

XX (XX) – Total Volume (Heavy Vehicle Volume), vehicles per hour

Kimley-Horn and Associates, Inc.

KHA Project # 110213002

2009 Existing Hourly Turning Movement Traffic Volumes Adjusted Based on Future Alignment

Lorton Road Widening Project – Traffic Signal Warrant Analysis Study
Fairfax County, VA

Figure 5

2013 Traffic Volumes

The 2013 traffic volumes represent the future traffic volumes that are anticipated to travel through the study area when the Lorton Road Widening Project is complete. The 2013 future traffic volumes were calculated by applying a growth factor to the existing traffic volumes. The growth rate was derived from a review of the VDOT published Annual Average Daily Traffic (AADT) volume data for the area roadways from 2001 to 2008. The data review showed that traffic volumes increased by almost 4 percent per year during the seven year period (see Appendix for data comparison). For this study, it was assumed that that the annual traffic growth in the study area is 4 percent per year for forecasting future year traffic volumes. The 4 percent per year growth rate was applied to all traffic volumes with the exception of the turning movements in and out of Windermere Hill Drive since the land along Windermere Hill Drive is developed and there are no future development plans on the horizon.

The nearby developments of the Laurel Hill Park Master Plan, Fairfax County Adaptive Reuse Area, and Lorton Workhouse Arts Center are not projected to generate significant amounts of traffic along Lorton Road. As a result, it is assumed that the yearly growth rate will include these trips. **Figure 6** shows the resulting 2013 hourly turning movement volumes at the study intersections.

To evaluate the impact of the heavy vehicle traffic in 2013, a separate signal warrant analysis was conducted. The truck volumes were multiplied by 2.5[3] to account for the larger vehicle dimensions and slower acceleration/deceleration times. **Figure 7** shows the resulting 2013 hourly passenger car equivalent traffic volumes.

2030 Traffic Volumes

To assist Fairfax County in planning for potential future traffic signalization improvements, a 2030 analysis was also conducted at these study intersections. The 2030 traffic volume forecasts were based on the traffic volumes contained in the 2005 Laurel Hill Traffic Analysis[4]. Comparing the two-way AM and PM peak hour link volumes from the 2009 traffic counts with the 2030 forecasts, the traffic volumes appeared to increase by 4 percent per year, similar to the

[3] The 2.5 factor was based on Exhibit 21-8 Passenger-Car Equivalents on Extended General Highway Segments, in the 2000 Edition of the Highway Capacity Manual (HCM) assuming rolling terrain.
[4] Laurel Hill Traffic Analysis Study. Prepared by HNTB. Dated November 15, 2005.

growth rate found between 2001 and 2008. Therefore, the same 4 percent per year traffic growth rate was applied to the existing traffic counts to obtain 2030 hourly traffic volumes for this study.

Figure 8 shows the 2030 hourly turning movement volumes at the study intersections. Truck traffic was shown on this figure but was not considered for the 2030 signal warrant analyses.

NOT TO SCALE

Furnace Road

Hour	Left	Through
6-7 am	60 (8)	128 (11)
7-8 am	96 (37)	212 (18)
8-9 am	97 (34)	153 (7)
9-10 am	116 (42)	94 (6)
10-11 am	122 (43)	116 (8)
11-Noon	106 (34)	143 (4)
12-1 pm	145 (56)	146 (11)
1-2 pm	145 (50)	151 (5)
2-3 pm	152 (19)	212 (13)
3-4 pm	448 (15)	209 (4)
4-5 pm	767 (11)	325 (5)
5-6 pm	573 (2)	290 (4)
6-7 pm	178 (0)	184 (1)

Hour	Through	Right
6-7 am	216 (0)	0 (0)
7-8 am	232 (20)	6 (0)
8-9 am	218 (9)	4 (0)
9-10 am	133 (13)	1 (1)
10-11 am	95 (8)	4 (0)
11-Noon	102 (4)	1 (0)
12-1 pm	133 (4)	0 (0)
1-2 pm	123 (4)	4 (0)
2-3 pm	125 (12)	4 (0)
3-4 pm	126 (6)	2 (0)
4-5 pm	139 (4)	4 (0)
5-6 pm	152 (1)	1 (0)
6-7 pm	99 (2)	7 (0)

Realigned Lorton Road

Hour	Left	Right
6-7 am	0 (0)	1017 (22)
7-8 am	7 (0)	870 (18)
8-9 am	2 (0)	557 (14)
9-10 am	4 (0)	188 (20)
10-11 am	2 (0)	126 (11)
11-Noon	1 (0)	138 (19)
12-1 pm	0 (0)	156 (9)
1-2 pm	8 (0)	166 (15)
2-3 pm	4 (0)	129 (12)
3-4 pm	5 (0)	98 (9)
4-5 pm	2 (0)	73 (1)
5-6 pm	1 (0)	80 (2)
6-7 pm	1 (0)	43 (1)

Hour	Through	Right
6-7 am	1182 (14)	51 (8)
7-8 am	1022 (33)	80 (5)
8-9 am	673 (6)	102 (18)
9-10 am	271 (14)	50 (19)
10-11 am	179 (0)	42 (19)
11-Noon	219 (19)	21 (4)
12-1 pm	241 (0)	48 (15)
1-2 pm	249 (7)	40 (12)
2-3 pm	213 (19)	41 (5)
3-4 pm	192 (5)	33 (11)
4-5 pm	185 (2)	27 (2)
5-6 pm	200 (4)	32 (0)
6-7 pm	130 (4)	13 (0)

Realigned Furnace Road

Lorton Road

Hour	Left	Through
6-7 am	16 (6)	163 (14)
7-8 am	26 (4)	280 (48)
8-9 am	12 (6)	211 (32)
9-10 am	41 (13)	172 (37)
10-11 am	21 (8)	209 (39)
11-Noon	25 (6)	209 (28)
12-1 pm	27 (6)	240 (53)
1-2 pm	28 (7)	260 (41)
2-3 pm	21 (7)	323 (21)
3-4 pm	25 (5)	604 (7)
4-5 pm	30 (4)	1022 (9)
5-6 pm	46 (8)	783 (2)
6-7 pm	21 (0)	319 (0)

Hour	Left	Right
6-7 am	25 (5)	32 (5)
7-8 am	28 (7)	43 (11)
8-9 am	40 (9)	30 (8)
9-10 am	37 (11)	32 (11)
10-11 am	28 (13)	33 (14)
11-Noon	40 (9)	30 (14)
12-1 pm	51 (14)	39 (19)
1-2 pm	36 (14)	46 (21)
2-3 pm	41 (11)	25 (12)
3-4 pm	54 (12)	25 (2)
4-5 pm	70 (6)	14 (1)
5-6 pm	81 (4)	19 (5)
6-7 pm	42 (2)	12 (4)

Hour	Through	Right
6-7 am	1052 (15)	2 (1)
7-8 am	1177 (21)	8 (1)
8-9 am	985 (32)	3 (1)
9-10 am	400 (15)	9 (0)
10-11 am	215 (23)	7 (0)
11-Noon	229 (15)	6 (0)
12-1 pm	260 (25)	6 (0)
1-2 pm	271 (28)	12 (0)
2-3 pm	225 (15)	10 (0)
3-4 pm	218 (15)	18 (1)
4-5 pm	174 (5)	26 (0)
5-6 pm	283 (4)	30 (0)
6-7 pm	208 (5)	22 (0)

Windermere Hill Drive

Hour	Left	Right
6-7 am	13 (1)	117 (3)
7-8 am	23 (1)	128 (3)
8-9 am	39 (1)	107 (3)
9-10 am	11 (0)	73 (3)
10-11 am	13 (0)	55 (1)
11-Noon	9 (0)	40 (1)
12-1 pm	10 (0)	49 (1)
1-2 pm	12 (0)	38 (1)
2-3 pm	12 (0)	53 (2)
3-4 pm	17 (0)	49 (1)
4-5 pm	11 (0)	37 (1)
5-6 pm	8 (0)	51 (0)
6-7 pm	20 (0)	38 (0)

Legend

XX (XX) – Total Volume (Heavy Vehicle Volume), vehicles per hour

Kimley-Horn and Associates, Inc.

KHA Project # 110213002

2013 Hourly Turning Movement Traffic Volumes

Lorton Road Widening Project – Traffic Signal Warrant Analysis Study
Fairfax County, VA

Figure 6

NOT TO SCALE

Furnace Road

Hour	Left	Through
6-7 am	72	145
7-8 am	152	239
8-9 am	148	164
9-10 am	179	103
10-11 am	187	128
11-Noon	157	149
12-1 pm	229	163
1-2 pm	220	159
2-3 pm	181	232
3-4 pm	471	215
4-5 pm	784	333
5-6 pm	576	296
6-7 pm	178	186

Hour	Left	Through
6-7 am	25	184
7-8 am	32	352
8-9 am	21	259
9-10 am	61	228
10-11 am	33	268
11-Noon	34	251
12-1 pm	36	320
1-2 pm	39	322
2-3 pm	32	355
3-4 pm	33	615
4-5 pm	36	1036
5-6 pm	58	786
6-7 pm	21	319

Hour	Left	Through
6-7 am	13	92
7-8 am	29	180
8-9 am	27	288
9-10 am	31	243
10-11 am	33	343
11-Noon	44	370
12-1 pm	37	318
1-2 pm	42	355
2-3 pm	66	392
3-4 pm	90	495
4-5 pm	84	1064
5-6 pm	126	1286
6-7 pm	127	1131

Lorton Road

Realigned Lorton Road

Hour	Through	Right
6-7 am	216	0
7-8 am	262	6
8-9 am	232	4
9-10 am	153	3
10-11 am	107	4
11-Noon	108	1
12-1 pm	139	0
1-2 pm	129	4
2-3 pm	143	4
3-4 pm	135	2
4-5 pm	145	4
5-6 pm	154	1
6-7 pm	102	7

Hour	Left	Right
6-7 am	0	1050
7-8 am	7	897
8-9 am	2	578
9-10 am	4	218
10-11 am	2	143
11-Noon	1	167
12-1 pm	0	170
1-2 pm	8	189
2-3 pm	4	147
3-4 pm	5	112
4-5 pm	2	75
5-6 pm	1	83
6-7 pm	1	45

Hour	Through	Right
6-7 am	1203	63
7-8 am	1072	88
8-9 am	682	129
9-10 am	292	79
10-11 am	179	71
11-Noon	248	27
12-1 pm	241	71
1-2 pm	260	58
2-3 pm	242	49
3-4 pm	200	50
4-5 pm	188	30
5-6 pm	206	32
6-7 pm	136	13

Realigned Furnace Road

Hour	Left	Right
6-7 am	33	40
7-8 am	39	60
8-9 am	54	42
9-10 am	54	49
10-11 am	48	54
11-Noon	54	51
12-1 pm	72	68
1-2 pm	57	78
2-3 pm	58	43
3-4 pm	72	28
4-5 pm	79	16
5-6 pm	87	27
6-7 pm	45	18

Hour	Through	Right
6-7 am	1075	4
7-8 am	1209	10
8-9 am	1033	5
9-10 am	423	9
10-11 am	250	7
11-Noon	252	6
12-1 pm	298	6
1-2 pm	313	12
2-3 pm	248	10
3-4 pm	241	20
4-5 pm	182	26
5-6 pm	289	30
6-7 pm	216	22

Windermere Hill Drive

Hour	Left	Right
6-7 am	15	122
7-8 am	25	133
8-9 am	41	112
9-10 am	11	78
10-11 am	13	57
11-Noon	9	42
12-1 pm	10	51
1-2 pm	12	40
2-3 pm	12	56
3-4 pm	17	51
4-5 pm	11	39
5-6 pm	8	51
6-7 pm	20	38

Legend

XX – Passenger Car Equivalent Traffic Volume (vehicles per hour)

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KHA Project # 110213002

2013 Hourly Passenger Car Equivalent Traffic Volumes

Lorton Road Widening Project – Traffic Signal Warrant Analysis Study
Fairfax County, VA

Figure 7

NOT TO SCALE

Furnace Road

Hour	Left	Through
6-7 am	116 (16)	248 (21)
7-8 am	187 (73)	412 (34)
8-9 am	189 (66)	299 (14)
9-10 am	226 (82)	182 (11)
10-11 am	237 (84)	226 (16)
11-Noon	207 (66)	278 (7)
12-1 pm	283 (109)	285 (21)
1-2 pm	283 (98)	294 (9)
2-3 pm	296 (36)	412 (25)
3-4 pm	873 (30)	408 (7)
4-5 pm	1495 (21)	633 (9)
5-6 pm	1117 (5)	565 (7)
6-7 pm	346 (0)	358 (2)

Hour	Through	Right
6-7 am	422 (0)	0 (0)
7-8 am	451 (39)	11 (0)
8-9 am	424 (18)	7 (0)
9-10 am	260 (25)	2 (2)
10-11 am	185 (16)	7 (0)
11-Noon	198 (7)	2 (0)
12-1 pm	260 (7)	0 (0)
1-2 pm	239 (7)	7 (0)
2-3 pm	244 (23)	7 (0)
3-4 pm	246 (11)	5 (0)
4-5 pm	271 (7)	7 (0)
5-6 pm	296 (2)	2 (0)
6-7 pm	194 (5)	14 (0)

Realigned Lorton Road

Hour	Left	Right
6-7 am	0 (0)	1980 (43)
7-8 am	14 (0)	1695 (34)
8-9 am	5 (0)	1085 (27)
9-10 am	7 (0)	367 (39)
10-11 am	5 (0)	246 (21)
11-Noon	2 (0)	269 (36)
12-1 pm	0 (0)	303 (18)
1-2 pm	16 (0)	324 (30)
2-3 pm	7 (0)	251 (23)
3-4 pm	9 (0)	191 (18)
4-5 pm	5 (0)	141 (2)
5-6 pm	2 (0)	155 (5)
6-7 pm	2 (0)	84 (2)

Hour	Through	Right
6-7 am	2302 (27)	100 (16)
7-8 am	1992 (64)	155 (9)
8-9 am	1310 (11)	198 (34)
9-10 am	529 (27)	98 (36)
10-11 am	349 (0)	82 (36)
11-Noon	426 (36)	41 (7)
12-1 pm	469 (0)	93 (30)
1-2 pm	485 (14)	77 (23)
2-3 pm	415 (36)	80 (9)
3-4 pm	374 (9)	64 (21)
4-5 pm	360 (5)	52 (5)
5-6 pm	390 (7)	62 (0)
6-7 pm	253 (7)	25 (0)

Realigned Furnace Road

Lorton Road

Hour	Left	Through
6-7 am	32 (11)	317 (27)
7-8 am	50 (7)	545 (93)
8-9 am	23 (11)	410 (62)
9-10 am	80 (25)	335 (73)
10-11 am	41 (16)	408 (75)
11-Noon	48 (11)	408 (55)
12-1 pm	52 (11)	467 (103)
1-2 pm	55 (14)	506 (80)
2-3 pm	41 (14)	629 (41)
3-4 pm	48 (9)	1176 (14)
4-5 pm	59 (7)	1992 (18)
5-6 pm	89 (16)	1524 (5)
6-7 pm	41 (0)	622 (0)

Hour	Left	Right
6-7 am	48 (9)	62 (9)
7-8 am	55 (14)	84 (21)
8-9 am	77 (18)	59 (16)
9-10 am	73 (21)	62 (21)
10-11 am	55 (25)	64 (27)
11-Noon	77 (18)	59 (27)
12-1 pm	100 (27)	75 (36)
1-2 pm	71 (27)	89 (41)
2-3 pm	80 (21)	48 (23)
3-4 pm	105 (23)	48 (5)
4-5 pm	137 (11)	27 (2)
5-6 pm	157 (7)	36 (9)
6-7 pm	82 (5)	23 (7)

Hour	Through	Right
6-7 am	2049 (30)	2 (1)
7-8 am	2292 (41)	8 (1)
8-9 am	1919 (62)	3 (1)
9-10 am	779 (30)	9 (0)
10-11 am	419 (46)	7 (0)
11-Noon	447 (30)	6 (0)
12-1 pm	506 (48)	6 (0)
1-2 pm	529 (55)	12 (0)
2-3 pm	438 (30)	10 (0)
3-4 pm	424 (30)	18 (1)
4-5 pm	340 (9)	26 (0)
5-6 pm	551 (7)	30 (0)
6-7 pm	406 (9)	22 (0)

Windermere Hill Drive

Hour	Left	Right
6-7 am	10 (2)	162 (11)
7-8 am	29 (0)	305 (30)
8-9 am	27 (0)	451 (73)
9-10 am	28 (2)	374 (66)
10-11 am	31 (1)	522 (98)
11-Noon	42 (1)	592 (87)
12-1 pm	37 (0)	499 (80)
1-2 pm	42 (0)	536 (103)
2-3 pm	66 (0)	649 (75)
3-4 pm	90 (0)	912 (34)
4-5 pm	84 (0)	2033 (25)
5-6 pm	126 (0)	2488 (11)
6-7 pm	127 (0)	2185 (11)

Hour	Left	Right
6-7 am	13 (1)	117 (3)
7-8 am	23 (1)	128 (3)
8-9 am	39 (1)	107 (3)
9-10 am	11 (0)	73 (3)
10-11 am	13 (0)	55 (1)
11-Noon	9 (0)	40 (1)
12-1 pm	10 (0)	49 (1)
1-2 pm	12 (0)	38 (1)
2-3 pm	12 (0)	53 (2)
3-4 pm	17 (0)	49 (1)
4-5 pm	11 (0)	37 (1)
5-6 pm	8 (0)	51 (0)
6-7 pm	20 (0)	38 (0)

Legend

XX (XX) – Total Volume (Heavy Vehicle Volume), vehicles per hour

Kimley-Horn and Associates, Inc.

KHA Project # 110213002

2030 Hourly Turning Movement Traffic Volumes

Lorton Road Widening Project – Traffic Signal Warrant Analysis Study
Fairfax County, VA

Figure 8

6. REVIEW OF SIGNAL WARRANTS

A traffic signal may be justified if one or more of the traffic signal warrants in the 2003 Edition of the Manual of Uniform Traffic Control Devices (MUTCD) is met. The signal warrants are listed below:

Warrant 1 – Eight-Hour Vehicular Volume
Warrant 2 – Four-Hour Vehicular Volume
Warrant 3 – Peak Hour
Warrant 4 – Pedestrian Volume
Warrant 5 – School Crossing
Warrant 6 – Coordinated Signal System
Warrant 7 – Crash Experience
Warrant 8 – Roadway Network

Warrants 1, 2, and 3 were the signal warrants evaluated in this study, as agreed to during scoping discussions with VDOT. In addition, Warrant 8 was considered since this project includes roadway network improvements. There are currently no pedestrian facilities or school crossings within the study area, therefore Warrants 4 (Pedestrian Volume) and Warrant 5 (School Crossings) do not apply. Warrant 6 was not considered because the study area is situated between different coordinated systems. Warrant 7 does not apply because the crash data is based on the existing intersection geometry and therefore does not apply to the improved geometrics.

Warrant 1

Warrant 1, the eight hour vehicle warrant, is met under three conditions. If any of the three conditions is met, the warrant is satisfied.

Condition A: Minimum Vehicular Volume
This warrant is intended for application where a large volume of intersecting traffic is the principal reason to consider installing a traffic signal.

Condition B: Interruption of Continuous Traffic
This warrant is intended for application where the traffic volume on a major street is so heavy that traffic on a minor intersecting street suffers excessive delay or conflict in entering or crossing the major street.

Combination Warrant

This warrant is intended for application where a combination of a large volume of intersecting traffic on the minor intersecting street suffers excessive delay or conflict in entering or crossing the major street is the reason to consider installing a traffic signal.

Warrant 2

Warrant 2 is intended to be applied where the volume of intersecting traffic is the principal reason to consider installing a traffic signal.

Warrant 2 is satisfied when, for each of any four hours of an average day, the plotted points representing the vehicles per hour on both approaches of the major street and the corresponding vehicles per hour on the higher volume minor street approach all fall above the curve provided in Figures 4C-1 or 4C-2 of the 2003 MUTCD.

Warrant 3

Warrant 3 is intended to be applied where minor street traffic suffers undue delay when entering or crossing the major street. Warrant 3 is met under two conditions:

Condition A

Condition A is met when all three of the following statements are true for the same one hour period of an average day.

1. The total stopped time delay experienced by the stop controlled minor street approach (one approach) exceeds 4 vehicle hours for a one-lane approach or 5 vehicle hours for a two-lane approach,
2. The volume on the same minor street approach equals or exceeds 100 vehicles per hour for one moving lane of traffic or 150 vehicles per hour for two moving lanes, and
3. The total entering volume serviced during the hour equals or exceeds 650 vehicles per hour for intersections with three approaches or 800 vehicles per hour for intersections with four or more approaches

Condition A does not apply for this study.

Condition B

Condition B is satisfied when, for any one hour of an average day, the plotted point representing the vehicles per hour on both approaches of the major street and the corresponding vehicles per hour on the higher volume minor street approach falls above the curve provided in Figures 4C-3 or 4C-4 of the 2003 MUTCD.

Warrant 8

Warrant 8 is intended to be applied to a location where a traffic control signal might be justified to encourage concentration and organization of traffic flow on a roadway network. This warrant is typically applied at an intersection of two or more major routes. This warrant applies to either of the following situations:

A. The total volume entering the intersection is 1,000 vehicles per hour or greater during the peak hour of a typical weekday and one or more of Warrants 1, 2, and 3 are satisfied.
B. The total entering volume is at least 1,000 vehicles per hour for each of any five hours of a nonnormal business day (Saturday or Sunday).

Condition A applies to this project. Lorton Road and Furnace Road are both designated as arterials on the Fairfax County Transportation Plan and therefore are considered major routes.

7. SIGNAL WARRANT ANALYSES

The following sections summarize the 2013, 2013 with adjustments for truck traffic, and 2030 traffic signal warrant analyses.

2013 Signal Warrant Analyses

Traffic signal warrant analyses were performed on the three study intersections using the future intersection lane designations shown in Figure 2 and the 2013 traffic volumes shown in Figure 6. Lorton Road was assumed to be the major roadway with two or more lanes since it will have a consistent four-lane divided cross-section with turn lanes. More specifically, the assumptions for minor streets are:

Realigned Lorton Road and Furnace Road (west junction):

- Minor street is the northbound Realigned Lorton Road approach
- Two or more lanes (shared left/thru lane and two right turn lanes)
- Left- plus right-turn traffic volumes (no through volumes were considered)

Lorton Road and Realigned Furnace Road (east junction):

- Minor street is the Realigned Furnace Road approach
- One lane (left-turn only)
- Left turn traffic volumes (assumes that right turning traffic has minimal conflict)

Lorton Road and Windermere Hill Drive:

- Minor street is the Windermere Hill Drive approach
- One lane (left-turn only)
- Left turn traffic volumes (assumes that right turning traffic has minimal conflict)

The current roadway design plans are based on a design speed of 45 miles per hour (mph), therefore the signal warrant analyses were based on the volume thresholds for roadways where the 85th percentile speed is above 40 mph.

Table 1 shows the results of the traffic signal warrant analysis for the 2013 hourly traffic volumes at the study intersections. The Appendix contains summary worksheets of the traffic volumes, volume thresholds, and analysis results.

Table 1 – 2013 Traffic Signal Warrant Analysis				
Intersection	**Warrant 1 – Eight-Hour Vehicular Volume**	**Warrant 2 – Four-Hour Vehicular Volume**	**Warrant 3 – Peak Hour Vehicular Volume**	**Warrant 8 – Roadway Network**
Realigned Lorton Road and Furnace Road (west junction)	N	Y	Y	Y
Lorton Road and Realigned Furnace Road (east junction)	N	N	N	N/A
Lorton Road and Windermere Hill Drive	N	N	N	N/A

Y – Warrant is satisfied
N – Warrant is not satisfied
N/A – Not applicable

Table 1 shows that at the Realigned Lorton Road and Furnace Road (west junction) intersection, the 2013 traffic volumes satisfy Warrant 2 (four-hour volume) and Warrant 3 (peak hour volume). For Warrant 1 (eight-hour volume), the traffic volumes are above the minimum thresholds for only four hours under Condition A, three hours for Condition B, and 1 hour for the Combination A and B. For Warrant 8, the total intersection entering traffic volume exceeds 1,000 vehicles per hour during five hours:

- 6:00 AM – 7:00 AM
- 7:00 AM – 8:00 AM
- 8:00 AM – 9:00 AM
- 4:00 PM – 5:00 PM
- 5:00 PM – 6:00 PM

Warrant 8 is satisfied because the total entering volume exceeds 1,000 vehicles per hour during at least one peak hour of a typical day and because Warrants 2 and 3 are satisfied.

The traffic volumes at the Lorton Road and Realigned Furnace Road (east junction) intersection do not satisfy any of the traffic signal warrants. For Warrant 1 (eight-hour volume), the traffic volumes are above the minimum thresholds for no hours under Condition A, three hours under Condition B, and no hours for the Combination A and B. For Warrant 2 (four-hour volume), the traffic volumes are above the minimum thresholds for two hours. For Warrant 3 (peak hour

volume), the traffic volumes are above the minimum thresholds for no hours. Warrant 8 does not apply because the Furnace Road in this location primarily serves as an access road to the County landfill facility and does not carry large amounts of through and commuter traffic.

The traffic volumes at the Lorton Road and Windermere Hill Drive intersection do not satisfy any of the traffic signal warrants. The minor street traffic volumes are below the minimum thresholds during all hours for Warrant 1 (eight-hour volume), Warrant 2 (four-hour volume), and Warrant 3 (peak hour volume). Warrant 8 does not apply to this intersection because Windermere Hill Drive is not considered a major road.

2013 Signal Warrant Analyses with Adjustments for Truck Traffic

The 2013 traffic signal warrant analyses were performed again using the passenger car equivalent traffic volumes to account for the truck activity. **Table 2** shows the results of the traffic signal warrant analyses using the 2013 passenger car equivalent traffic volumes shown in Figure 7.

Table 2 – 2013 Traffic Signal Warrant Analysis
Passenger Car Equivalent Traffic Volumes

Intersection	Warrant 1 – Eight-Hour Vehicular Volume	Warrant 2 – Four-Hour Vehicular Volume	Warrant 3 – Peak Hour Vehicular Volume	Warrant 8 – Roadway Network
Realigned Lorton Road and Furnace Road (west junction)	Y*	Y	Y	Y
Lorton Road and Realigned Furnace Road (east junction)	N	N	Y*	N/A
Lorton Road and Windermere Hill Drive	N	N	N	N/A

Y – Warrant is satisfied
N – Warrant is not satisfied
N/A – Not applicable
*- Warrant was not satisfied without adjustments for heavy trucks

Table 2 shows that by adjusting the 2013 traffic volumes for heavy trucks using the passenger car equivalent factor, one additional traffic signal warrant is satisfied at two intersections.

At the Realigned Lorton Road and Furnace Road intersection, Warrant 1 (eight-hour volume) is now satisfied in addition to Warrant 2 (four-hour), Warrant 3 (peak hour), and Warrant 8 (roadway network), which were satisfied without adjusting the traffic volumes.

At the Lorton Road and Realigned Furnace Road intersection, Warrant 3 (peak hour volume) is now satisfied. For Warrant 1 (eight-hour volume), the traffic volumes continue to be below the minimum thresholds for all hours under Condition A, are above for four hours under Condition B, and are above one hour for the Combination A and B. For Warrant 2 (four-hour volume), the traffic volumes are above the minimum thresholds for three hours. For Warrant 3 (peak hour volume), the traffic volumes are above the minimum thresholds for one hour. Warrant 8 still does not apply to this intersection.

At the Lorton Road and Windermere Hill Drive intersection, none of the traffic signal warrants are satisfied. The minor street traffic volumes are below the minimum thresholds during all hours for Warrant 1 (eight-hour volume), Warrant 2 (four-hour volume), and Warrant 3 (peak hour volume). Warrant 8 still does not apply to this intersection.

2030 Signal Warrant Analyses

Traffic signal warrant analyses were performed with the 2030 traffic volumes shown in Figure 8 at the three study intersections. The same assumptions were maintained from 2013 analysis regarding the roadway speeds, lane configurations, and consideration of minor street approach turning movements.

Table 3 shows the results of the traffic signal warrant analysis for the 2030 hourly traffic volumes at the study intersections. The Appendix contains the summary worksheets of the traffic volumes, volume thresholds, and analysis results.

Table 3 – 2030 Traffic Signal Warrant Analysis				
Intersection	**Warrant 1 – Eight-Hour Vehicular Volume**	**Warrant 2 – Four-Hour Vehicular Volume**	**Warrant 3 – Peak Hour Vehicular Volume**	**Warrant 8 – Roadway Network**
Realigned Lorton Road and Furnace Road (west junction)	Y	Y	Y	Y
Lorton Road and Realigned Furnace Road (east junction)	Y	Y	Y	N/A
Lorton Road and Windermere Hill Drive	N	N	N	N/A

Y – Warrant is satisfied
N – Warrant is not satisfied
N/A – Not applicable

Table 3 shows that under the 2030 traffic volumes, all applicable traffic signal warrants are satisfied at the Realigned Lorton Road and Furnace Road (west junction) intersection and the Lorton Road and Realigned Furnace Road (east junction) intersection.

At the Lorton Road and Windermere Hill Drive intersection, the 2030 traffic volumes do not satisfy any of the traffic signal warrants. The minor street traffic volumes are below the minimum thresholds during all hours for Warrant 1 (eight-hour volume), Warrant 2 (four-hour volume), and Warrant 3 (peak hour volume). Warrant 8 still does not apply to this intersection.

8. CONCLUSIONS AND RECOMMENDATIONS

The following summarizes the traffic signal warrant analyses results for each intersection and the corresponding recommendations:

Realigned Lorton Road and Furnace Road (west junction)

The results of the analyses show that at the intersection of Realigned Lorton Road and Furnace Road, Warrant 2 (four-hour volume), Warrant 3 (peak hour), and Warrant 8 (roadway network) are satisfied under 2013 conditions. Warrant 1 (eight-hour volume) also is satisfied when the 2013 traffic volumes are adjusted for truck volumes. Under 2030 conditions, all four applicable traffic signal warrants are satisfied. Therefore, the Realigned Lorton Road and Furnace Road intersection should be signalized with the completion of the roadway improvements in 2013.

Lorton Road and Realigned Furnace Road (east junction)

The results of the analyses show that at the intersection of Lorton Road and Realigned Furnace Road, none of the traffic signal warrants under 2013 conditions are satisfied. Under 2013 traffic volumes with adjustments for truck volumes, Warrant 3 (peak hour volume) is satisfied. Under 2030 conditions, Warrants 1 (eight-hour volume), 2 (four-hour volume), and 3 (peak hour volume) are satisfied. Warrant 8 isn't applicable for this intersection.

Warrant 3 typically applies to unusual cases where there is a facility that attracts or discharges a large amount of traffic over a short time. The traffic data shows a relatively steady volume of traffic turning on and off Realigned Furnace Road throughout the day, therefore a traffic signal is not recommended at this intersection when the roadway improvements are completed in 2013. Based on the 2030 traffic volume forecasts, traffic signal warrants will be satisfied sometime between 2013 and 2030. Therefore it is recommended to program future funding for the installation of a new traffic signal and to perform an updated traffic signal warrant study at this intersection at periodic intervals after the roadway improvements are open to traffic.

Lorton Road and Windermere Hill Drive

The results of the analyses at the Lorton Road and Windermere Hill Drive intersection show that none of the applicable traffic signal warrants are satisfied under 2013 or 2030 conditions. The majority of traffic along Windermere Hill Drive approaching Lorton Road turns right to travel east. The separate right turn lane will allow these turning movements to occur with minimal conflict. It is also recommended to perform an updated traffic signal warrant study at periodic intervals after the roadway improvements are open to traffic to determine if traffic patterns change as a result of the improvements.

It is also recommended to coordinate with the Fairfax County Park Authority to encourage exploring the feasibility of realigning the park access roadway opposite Windermere Hill Drive. This realignment will create a four approach intersection and manage access along Lorton Road. Traffic signal warrants should be revisited if this realigned is pursued to determine if signalization is appropriate.

Other Recommendations

Other recommendations for the Lorton Road Widening Project are to preserve right-of-way or traffic signal easements at each intersection corner for future traffic signal equipment. It is also recommended to incorporate a conduit run along the roadway frontage in the roadway design plans for future traffic signal communication cables.

APPENDIX