

TRAFFIC IMPACT ANALYSIS

for

THE OAKS III

Rezoning

Prince William County, Virginia

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June 28, 2010

TABLE OF CONTENTS

	<u>Page</u>
EXECUTIVE SUMMARY	1
INTRODUCTION	
Scope of Study	2
Methodology	2
Assumptions	2
EXISTING 2010 TRAFFIC CONDITIONS	
Area Roadway Network	4
Existing 2010 Traffic Volumes	5
Existing 2010 Intersection Capacity Analysis	5
FUTURE "BACKGROUND" TRAFFIC CONDITIONS (YEAR 2013)	
Planned Roadway Network	8
Traffic Growth Trends/"Grown" Traffic Volumes	8
"Other" Planned Developments	8
Future "Background" Traffic Volumes	8
Future "Background" Intersection Capacity Analysis	10
PROPOSED "THE OAKS III" SITE DEVELOPMENT	
Site Development Plan/Access	12
Development Densities	12
Site Trip Generation	12
Site Trip Distribution	12
Site Traffic Volumes	12
FUTURE "TOTAL" TRAFFIC CONDITIONS <i>WITH</i> SITE (YEAR 2013)	
Future "Total" Traffic Volumes	17
Future "Total" Intersection Capacity Analysis	17
INCREMENTAL IMPACT ANALYSIS	20
RECOMMENDED TRANSPORTATION IMPROVEMENTS	20
QUEUING ANALYSIS	21
RIGHT TURN LANE WARRANT ANALYSES – (VDOT METHOD)	21
CONCLUSIONS	21
APPENDICES	26

LIST OF FIGURES

<u>Figure</u>		<u>Page</u>
1	Site Location	3
2	Existing 2010 Road Network and Daily & AM/PM Peak Hour Traffic Volumes	6
3	Existing 2010 AM/PM Peak Hour Intersection Geometry & Levels Of Service	7
4	Yr. 2013 “Grown/Background” Daily & AM/PM Peak Hour Traffic Volumes	9
5	Yr. 2013 “Background” AM/PM Peak Hour Intersection Geometry & Levels Of Service . . .	11
6	“The Oaks III” General Development Plan	13
7	Yr. 2013 Generalized “Site” Directional Trip Distributions	15
8	Yr. 2013 “Site” Daily & AM/PM Peak Hour Trip Assignments	16
9	Yr. 2013 “Total” (with site traffic) Daily & AM/PM Peak Hour Traffic Volumes	18
10	Yr. 2013 “Total” (with site traffic) AM/PM Peak Hour Intersection Geometry & LOS	19
11a	Right Turn Lane Warrant Nomograph – Old Bridge Rd./Site Ent. (RI only) – AM	22
11b	Right Turn Lane Warrant Nomograph – Old Bridge Rd./Site Ent. (RI only) – PM	23
12a	Right Turn Lane Warrant Nomograph – Tanyard Hill Rd./Site Ent. (Full) – AM	24
12b	Right Turn Lane Warrant Nomograph – Tanyard Hill Rd./Site Ent. (Full) – PM	25

LIST OF TABLES

<u>Table</u>		<u>Page</u>
1	Existing 2010 Intersection Level Of Service Summary	5
2	Year 2013 “Background” Intersection Level Of Service Summary	10
3	“Site” Development Densities & Trip Generation	14
4	Year 2013 “Total” Intersection Level Of Service Summary	17
5	Comparison of Yr. 2013 “Background” vs. “Total” Intersection Levels Of Service	20

LIST OF APPENDICES

Appendix

- A TIA Scoping Correspondence
- B Existing (June 2010) Traffic Counts & 2008 VDOT Counts
- C Level Of Service (LOS) Information and Criteria
- D Existing 2010 AM/PM Peak Hour Intersection
Synchro Analysis Printouts
- E Yr. 2013 "Background" AM/PM Peak Hour Intersection
Synchro Analysis Printouts
- F Yr. 2013 "Total" AM/PM Peak Hour Intersection
Synchro Analysis Printouts

EXECUTIVE SUMMARY

This Traffic Impact Analysis (TIA) examined the expected traffic impact of the proposed 3.2755-acre "The Oaks III" (site) office project upon the future area road network. The "site", located at the northwest quadrant of Old Bridge Rd. (Rt.641) and Tanyard Hill Rd. (Rt.2100) in eastern Prince William County, is under a Rezoning application to O(L) on 3.2755 acres for commercial use (low-rise general office building).

This TIA analyzed "worst-case" future (Year 2013) AM and PM peak hour traffic conditions at three (3) key intersections (one existing plus two future) along Old Bridge Rd. and Tanyard Hill Road. Proposed "worst-case" land uses and associated traffic for The Oaks III "site", as well as for ambient traffic growth, were included within the analyses. Traffic impact was determined by comparing, via standard intersection capacity analyses, the future "background" (without site-generated traffic) and future "total" (with site traffic) intersection conditions. Daily traffic (VPD) volumes were also provided for the roadway sections adjacent to the proposed commercial site. All scope, methodology, and assumption parameters within this TIA are in strict adherence to those originally set by County & VDOT staff in a June 2, 2010 scoping meeting and affirmed in a June 21, 2010 revised final scoping package.

Existing intersection analyses (utilizing the Synchro analysis package) show that the analyzed *unsignalized* (stop-controlled) intersection of Old Bridge Rd./Tanyard Hill Rd. currently operates at an "excellent" (LOS=A) Level Of Service during the AM peak hour (6:30-7:30am), but at a "poor/failing" (LOS=E) during the PM peak hour (4:30-5:30pm).

Assuming no nearby "other" developments and no improvements to the area roadway network, **Yr. 2013 "Background"** (without site traffic) intersection capacity analyses indicate the same (as existing) AM peak hour Levels Of Service condition (LOS=A) with increased delays at the *unsignalized* Old Bridge Rd./Tanyard Hill Rd. intersection. However, the PM peak hour LOS will further worsen (from existing LOS=E) to a "very poor/failing" condition (LOS=F). These changes are due to the increased ambient "background" (grown) traffic.

The Oaks III "site" is proposed to utilize two (2) access points: 1) a "Right In only" entrance along Old Bridge Rd. west of Tanyard Hill Rd., and 2) a "Full access" entrance along Tanyard Hill Rd. north of Old Bridge Rd. and Herndon Drive. Both site entrances will operate as *unsignalized* 3-leg ("T") intersections. No functional interparcel accesses are proposed. As a "worst-case" scenario, The Oaks III "site" (32,500 gross square foot General Office building) is expected to generate 561 vehicle-trips (382 vehicles visiting the site) per day with 76 AM peak hour and 115 PM peak hour trips. No internal or pass-by trip discounts have been utilized.

Future **Year 2013 "Total"** (with site traffic) intersection analyses reveal that with the addition of "site" traffic, all three (3) key intersections analyzed as part of this TIA will remain at "background" Levels Of Service or operate at "acceptable" Levels Of Service. With "site" traffic, the *unsignalized* Old Bridge Rd./Tanyard Hill Rd. intersection will continue to operate at "excellent" LOS=A Level Of Service in the AM peak hour and at "very poor/failing" LOS=F conditions in the PM peak hour. Both of the new *unsignalized* (stop-controlled) Site Entrances (on Old Bridge Rd. and on Tanyard Hill Rd.) will operate at "excellent" (LOS=A) Levels Of Service during both the AM & PM peak hours.

Incremental impact analysis (comparing "background" vs. "total" Levels Of Service), reveals that the addition of site traffic will not cause any significant traffic impact at the three (3) *unsignalized* intersections along Old Bridge Rd. (Rt.641) and Tanyard Hill Rd. (Rt.2100). All intersections will remain at "background" levels or operate at "excellent" Levels Of Service. Thus, no traffic impact is indicated and no impact "mitigation measures" (improvements) are warranted or recommended.

Based upon the assumed "scoped" parameters, the analytical evaluations and comparisons within this TIA have shown that the proposed development of "The Oaks III" commercial project will not significantly impact the area network and can be easily accommodated within the future road network.

INTRODUCTION

Scope Of Study

This Traffic Impact Analysis (TIA) examined the expected traffic impact of the proposed 3.2755-acre "The Oaks III" (site) office project upon the future area road network. The "site", located at the northwest quadrant of Old Bridge Rd. (Rt.641) and Tanyard Hill Rd. (Rt.2100) in eastern Prince William County, is under a Rezoning application to O(L) on 3.2755 acres for commercial use (low-rise general office building) -- see **Figure 1** for the site location.

This TIA analyzed "worst-case" future (Year 2013) AM and PM peak hour traffic conditions at three (3) key intersections (one existing plus two future) along Old Bridge Rd. and Tanyard Hill Road. Proposed "worst-case" land uses and associated traffic for The Oaks III "site", as well as for ambient traffic growth, were included within the analyses. Traffic impact was determined by comparing, via standard intersection capacity analyses, the future "background" (without site-generated traffic) and future "total" (with site traffic) intersection conditions.

Daily traffic (VPD) volumes were also provided for the roadway sections adjacent to the proposed commercial site. All scope, methodology, and assumption parameters within this TIA are in strict adherence to those originally set by County & VDOT staff in a June 2, 2010 scoping meeting and affirmed in a June 21, 2010 revised final scoping package -- see **Appendix A** for the final scoping documents.

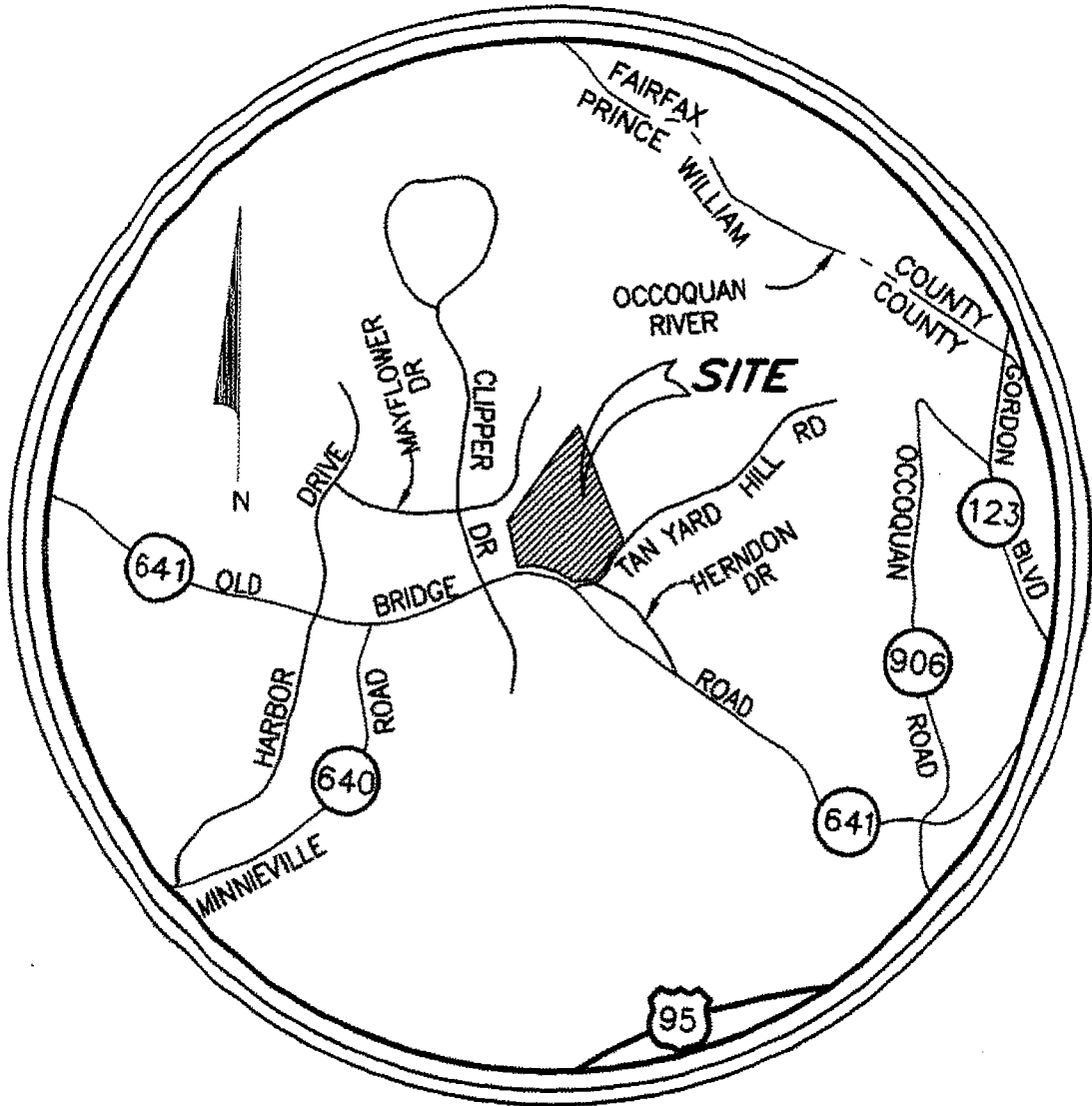
Methodology

The AM/PM peak hour analyses and evaluations of all *signalized* and *unsignalized* intersections are in accordance with 2000 Highway Capacity Manual (HCM) methodology (acceptable @ LOS "D") utilizing the Synchro (version 6) software package. All weekday trip generation rates are based on the ITE Trip Generation Manual (8th Edition) -- 2008. Future trip distributions are based on expected traffic patterns/distributions provided by the applicant with empirical data from adjacent office buildings.

Assumptions

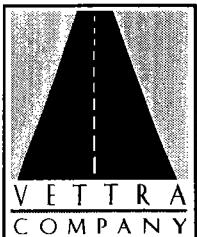
The following general assumptions, agreed by County & VDOT staff at and after the scoping meeting, are incorporated within this study (see **Appendix A** for more detail):

- Non-phased development: commercial (32,500 gsf gen. office bldg.) -- Rezoning
- Non-527 TIA
- One (1) site buildout year -- Yr. 2013
- Assume two (2) future site access points (entrances):
 - a full-access (all movements) T intersection on Tanyard Hill Rd. (Rt.2100)
 - a "Right-in" movement only entrance on Old Bridge Rd. (Rt.641)
- Two (2) weekday classified commuter AM (6-9am) & PM (4-7pm) peak period movement traffic counts to be collected at following intersection:
 - 1) Old Bridge Rd./Tanyard Hill Rd.
- Two (2) weekday 24-hour traffic counts to be collected at following roads (links):
 - 1) Tanyard Hill Rd. (along site frontage)
 - 2) Herndon Dr. (just east of Tanyard Hill Rd.)
- Existing (2010) & 2013 "Background" AM & PM pk. Hr. Synchro 6 LOS int. analyses at:
 - 1) Old Bridge Rd./Tanyard Hill Rd. -- (*unsignalized*) -- *stop-controlled side street*



Source: BC Consultants, June 2010.

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Site Location

FIGURE
 1

- Assume following annual "growth" rates (compounded to buildout year "background/total"):
 - 2% per annum growth rate for all roads
- No (0) "other" area developments to be included in "background/total" traffic conditions
- No public or private transportation improvements assumed in study area
- Utilize traffic distributions for "site" as follows:
 - 65% to/from east via Old Bridge Rd. (60% to "RI only" ent.; 5% to Tanyard Hill ent.)
 - 33% to/from west via Old Bridge Rd. (all into Tanyard Hill Rd. ent. due to no U-turns)
 - 2% (minimum 1 veh.) to/from north via Tanyard Hill Rd. (all into Tanyard Hill ent.)
- Utilize 8th Edition ITE Trip Generation rates:
 - ITE Land Use Code 710 (fitted curve equation rates)
- One (1) "background" & "total" road network scenario to be tested (same as existing)
- Yr. 2013 "Total" (with site traffic) AM & PM pk. hr. Synchro 6 LOS int. analyses at:
 - 1) Old Bridge Rd./Tanyard Hill Rd. -- (*unsignalized*) – *stop-controlled side street*
 - 2) Tanyard Hill Rd./Main Site Entrance -- (*unsignalized*) – *stop-controlled side street*
 - 3) Old Bridge Rd./"Right In only" entrance
- No road links to be analyzed (only counted)
- Maintain "minimum acceptable" intersection LOS=D Level Of Service
- Utilize latest Synchro v.6 w/defaults (use field-collected PHF & heavy veh. %)
- Provide Yr.2013 "Total" Synchro 95% BOQ "Queuing Analyses" to determine adequacy of lane lengths at all analyzed intersections/entrances
- Provide Yr.2013 "Total" "Right Turn Lane Warrant" Analysis (VDOT method) for Old Bridge Rd./Right-in only entrance & Tanyard Hill Rd./Full access Site Entrance
- Provide existing intersection distances & turn lane lengths on GDP exhibit in TIA
- Provide three (3) final non-527 TIA's to County (1 of which goes to VDOT) w/CD's

EXISTING 2010 TRAFFIC CONDITIONS

Area Roadway Network

The study area, as outlined by County & VDOT staff at the scoping meeting, includes Old Bridge Rd. (Rt.641) and Tanyard Hill Rd. (Rt.2100). Brief descriptions of the roads with the study area follow:

- o **Old Bridge Rd. (Rt.641)**: Within the vicinity, Old Bridge Rd. is currently a six (6) lane, divided principal arterial traversing in a predominant east-west direction between Prince William Parkway several miles to the west and Rt.123 to the east. It currently has 12-foot travel lanes on curb and gutter section with good-to-excellent geometrics. Within the study area, this road has a 45 mph posted speed limit. The latest (2008) VDOT-published ADT count for this road within the study area is 49,000-52,000 vehicles per day.
- o **Tanyard Hill Rd. (Rt.2100)**: Tanyard Hill Rd. is a two (2) lane local roadway running north of Old Bridge Rd. connecting with the Town of Occoquan. Along the section of Tanyard Hill Rd. along the "site" frontage, this paved roadway exhibits fair to good geometrics with 11-foot lanes and 1-2 foot gravel shoulders on an approximate 6-foot ditch section. The road has a posted speed limit of 25 mph. Current 24-hour traffic counts conducted by VETTRA Company show 4,495 vehicles per day – see count printouts in **Appendix B**.

Existing 2010 Intersection Traffic Volumes

Existing AM and PM peak period “intersection turn movement” counts were conducted by VETTRA Company personnel on Tuesday, June 8, 2010 (while County schools were still in full session) for the existing Old Bridge Rd./Tanyard Hill Rd. intersection in the study area -- see **Appendix B** for the AM/PM “intersection turn movement” count data. The AM peak hour was measured to occur from 6:30am to 7:30 am and the PM peak hour occurred 4:30-5:30pm. **Figure 2** presents the Existing 2010 AM/PM Peak Hour Turn Movement Volumes. The latest (2008) published VDOT 24-hour count along the section of Old Bridge Rd. along the proposed site frontage is 52,000 vehicles per day (vpd). Actual 24-hour counts on June 8, 2010 by VETTRA Company for Tanyard Hill Rd. and Herndon Dr. show 4,495 VPD (vehicles per day) and 92 VPD, respectively -- (see printouts in **Appendix B**).

Existing 2010 Intersection Capacity Analysis

Based on the above intersection volumes, existing intersection geometric conditions and observed operations, the existing *unsignalized* (stop-controlled) Old Bridge Rd./Tanyard Hill Rd. intersection was analyzed via the Synchro v.6 capacity analysis package. **Table 1** and **Figure 3** present the results of the capacity analyses, showing the computed Levels Of Service (LOS) and overall Intersection Delay for the AM and PM peak hours. Synchro 95% BOQ (Back-Of-Queues) lengths are also provided. **Appendix C** provides general LOS information and criteria while **Appendix D** includes the Synchro summary printouts for this *unsignalized* intersection.

Existing intersection analyses (utilizing the Synchro analysis package) show that the analyzed *unsignalized* (stop-controlled) intersection of Old Bridge Rd./Tanyard Hill Rd. currently operates at an “excellent” (LOS=A) Level Of Service during the AM peak hour (6:30-7:30am), but at a “poor/failing” (LOS=E) during the PM peak hour (4:30-5:30pm).

TABLE 1

Existing 2010 Intersection Level Of Service Summary

<u>Intersections</u>	AM PEAK HOUR					PM PEAK HOUR				
	<u>Intersection</u>		<u>Lane Group</u>			<u>Intersection</u>		<u>Lane Group</u>		
	<u>LOS/Delay</u>	<u>Aprch.</u>	<u>LOS/Dly.</u>	<u>LOS/Dly.</u>	<u>LOS/Dly.</u>	<u>Aprch.</u>	<u>LOS/Dly.</u>	<u>LOS/Dly.</u>	<u>LOS/Dly.</u>	
<u>Unsignalized</u>	<i>(Avail.Stack.)</i>		<i>(95% BOQ)</i>			<i>(95% BOQ)</i>				
Old Bridge/Tanyard Hill	(225')	A/1.9	(90')	EBL	B/13.2	E/40.8	(44')	EBL	F/55.4	
	(inf.)		(0')	EBT	A/0.0		(0')	EBT	A/0.0	
	(inf.)		(0')	WBTR	A/0.0		(0')	WBTR	A/0.0	
	(inf.)		(21')	SBL	D/28.7		(778')	SBL	F/413.1	
	(inf.)		(21')	SBR	D/28.7		(778')	SBR	F/413.1	


Legend:

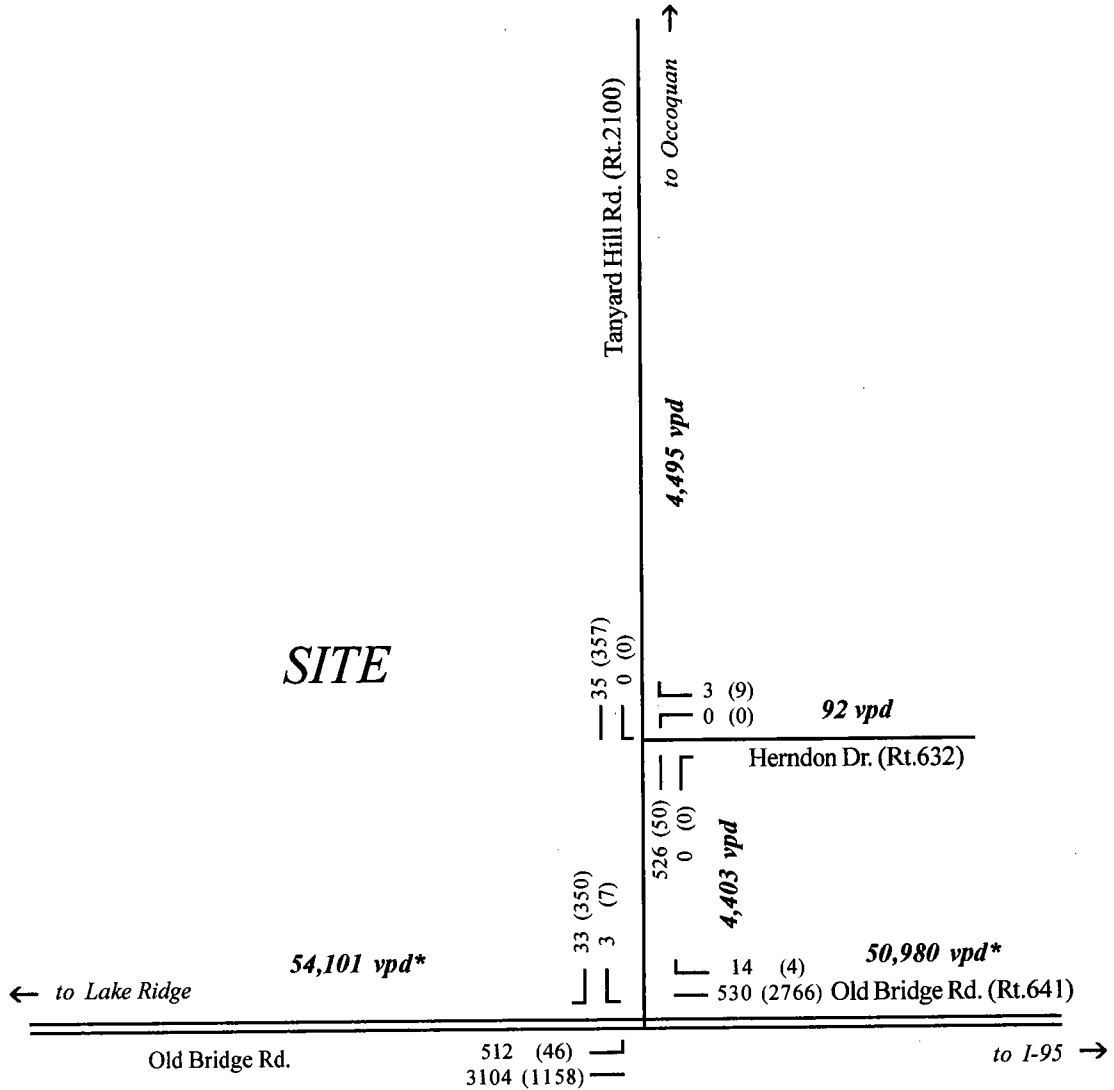
- LOS = Level Of Service -- See Appendix C
- LOS/Delay = Level Of Service & Avg. Vehicular Delay (seconds) - for “Critical Lane Group”
- LOS/Dly. = Level Of Service & Avg. Vehicular Delay (seconds) - for “Critical Movement”
- 95% BOQ = 95% Back-Of-Queue length (ft.)
- inf. = infinite (length of link)

LEGEND

123 (123) = AM (PM) Pk.Hr. Traffic Volumes

1,234 vpd = Daily Traffic Volume (veh. per day) -- * 2008 VDOT count factored to 2010

 = Traffic Signal



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Existing 2010 Road Network and Daily & AM/PM Peak Hour Traffic Volumes

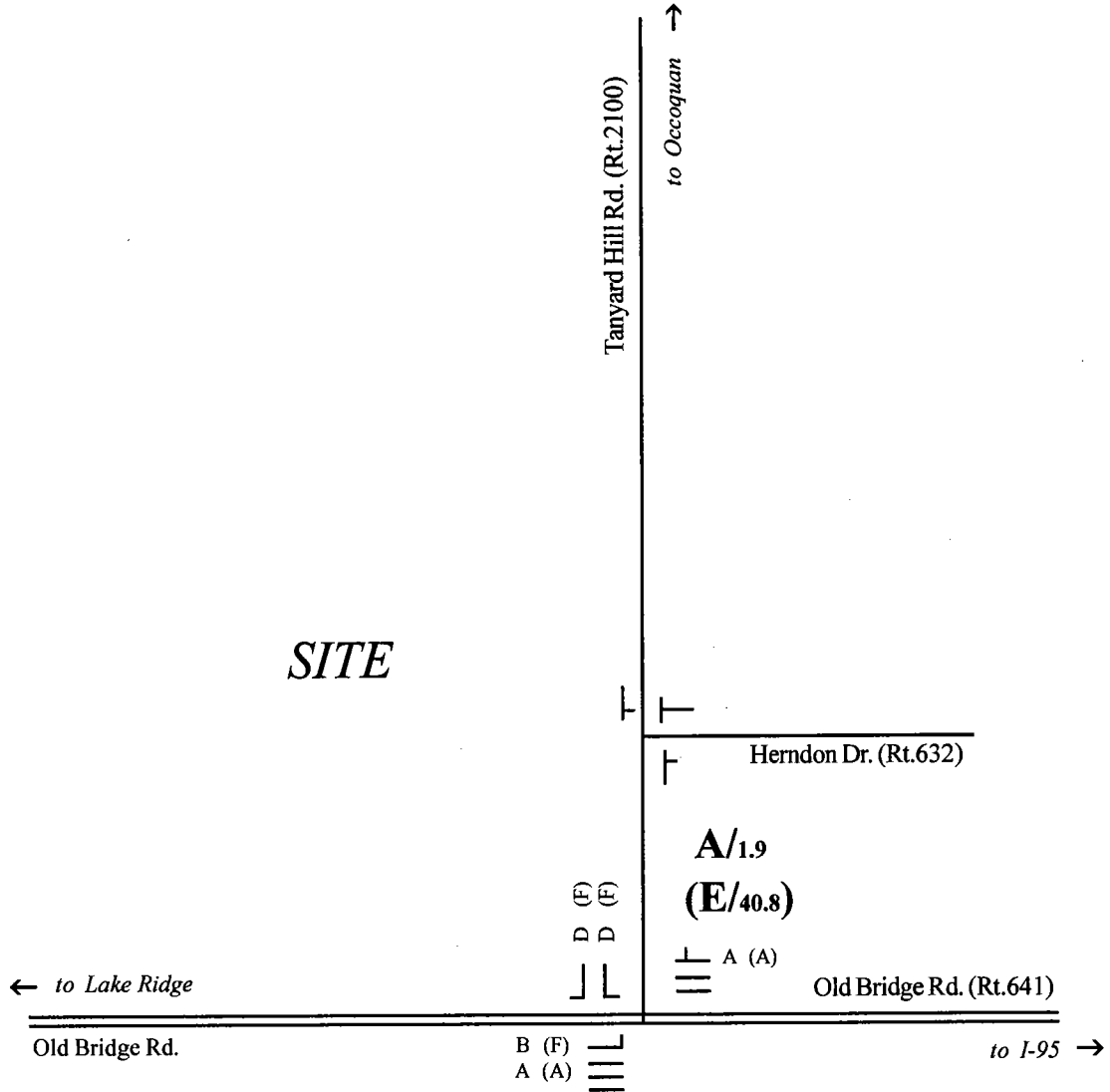
FIGURE 2

LEGEND

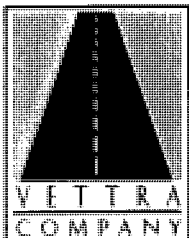
 = Traffic Signal

A/1.2 = AM Pk.Hr. LOS/Delay (sec.)

(A/1.2) = PM Pk.Hr. LOS/Delay (sec.)



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**Existing 2010 AM/PM Peak Hour
 Intersection Geometry & Levels Of Service**

**FIGURE
 3**

FUTURE "BACKGROUND" TRAFFIC CONDITIONS (YEAR 2013)

Planned Roadway Network

In accordance with the latest Prince William County Comprehensive Plan, Virginia Department of Transportation (VDOT) Six-Year Primary and Secondary Road Plans, and as directed by County & VDOT staff, the future Year 2013 area roadway network was assumed to be the same as the existing network. No public or private improvements are anticipated or assumed to be built by Yr. 2013.

Traffic Growth Trends/"Grown" Traffic Volumes

In order to project future traffic volumes, the existing volumes must first be "grown" (or factored) to the future design year. This is performed prior to adding (to the network) the traffic associated with the "other" planned developments. As calculated from VDOT historic counts and concurred with County & VDOT staff, a two (2) percent per annum increase was utilized for all ambient, background traffic.

Figure 4 presents the Year 2013 "Grown" AM/PM peak hour turn movement volumes derived from the factored Year 2010 "Existing" volumes, based on the above average annual growth rate, compounded to the future year.

"Other" Area Planned Developments


No (0) "other" planned/approved development projects within the immediate vicinity were identified by staff. The purpose of identifying and analyzing "other" developments is to add the traffic associated with each of these development projects to the future "grown" traffic volumes. The addition of the "grown" and "other" traffic to the road network comprises the future "background" traffic. However, no "other" development traffic is assumed in this TIA.

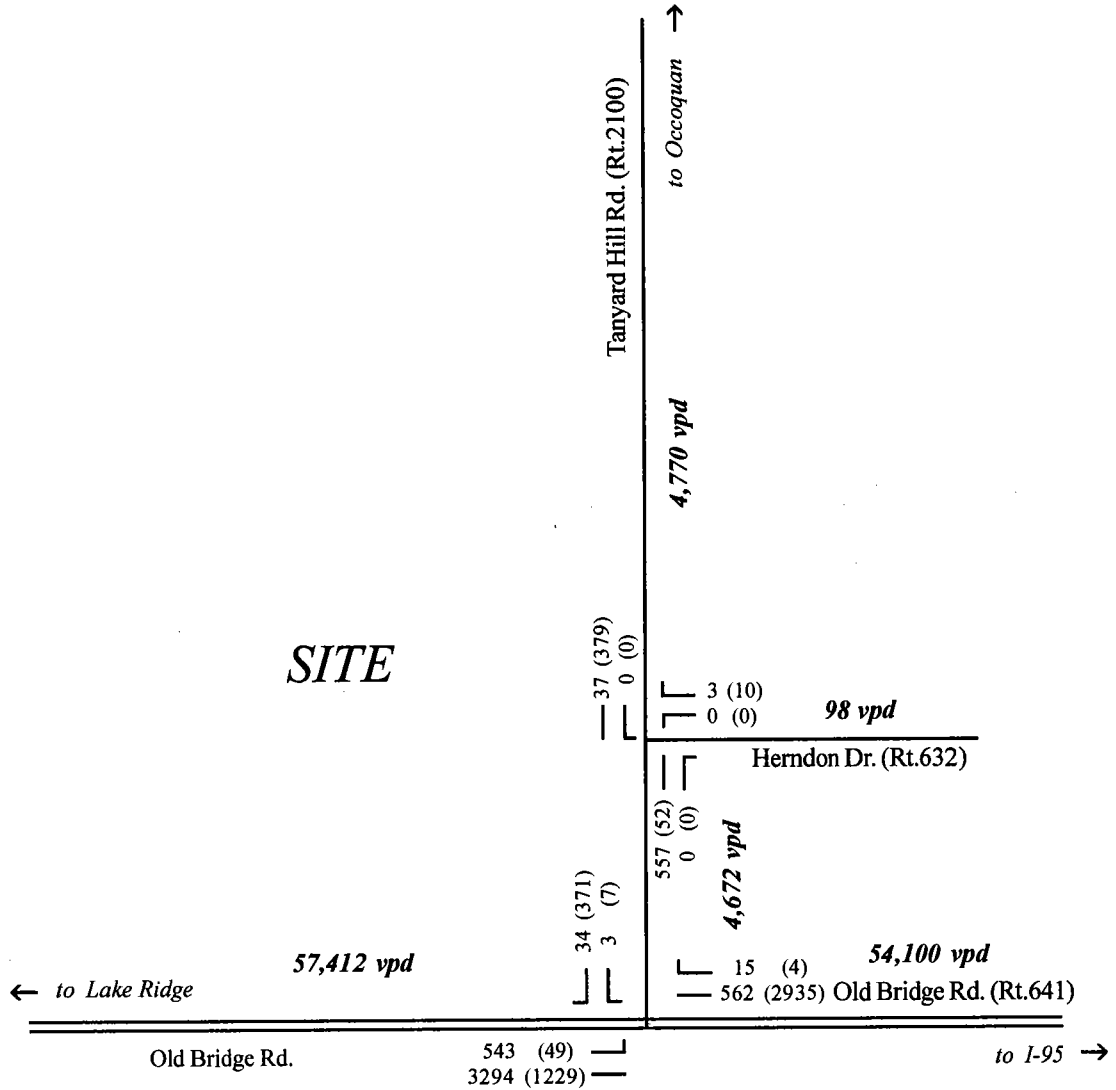
Future "Background" Traffic Volumes

Typically the summation of the Yr. 2013 "grown" plus "other" development traffic comprise the future "background" traffic volumes. However, since no "other" development traffic is assumed, the "grown" traffic is the same as the "background" traffic volumes – as shown on **Figure 4**. Two-way, daily traffic projections for the adjacent roadways are also provided.

LEGEND

123 (123) = AM (PM) Pk.Hr. Traffic Volumes
 1,234 vpd = Daily Traffic Volume (veh. per day)

 = Traffic Signal



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Yr. 2013 "Grown/Background" Daily & AM/PM Peak Hour Traffic Volumes

FIGURE 4

Future "Background" Intersection Capacity Analysis

The derived "background" traffic volumes, with assumed geometrics, were subjected to the Synchro *unsignalized* intersection capacity analyses. **Table 2** and **Figure 5** present the results of the "background" capacity analyses, showing the computed Levels Of Service (LOS) and vehicular delays at the one (1) "background" intersection (Old Bridge Rd./Tanyard Hill Rd.) for AM and PM peak hours, as well as Synchro 95% BOQ (Back-Of-Queue) lengths. **Appendix E** includes the Synchro printouts for both peak hours at the "background" intersection. All Synchro analyses in this TIA utilize default variables where appropriate.

Assuming no nearby "other" developments and no improvements to the area roadway network, **Yr. 2013 "Background"** (without site traffic) intersection capacity analyses indicate the same (as existing) AM peak hour Levels Of Service condition (LOS=A) with increased delays at the *unsignalized* Old Bridge Rd./Tanyard Hill Rd. intersection. However, the PM peak hour LOS will further worsen (from existing LOS=E) to a "very poor/failing" condition (LOS=F). These changes are due to the increased ambient "background" (grown) traffic.

TABLE 2
Year 2013 "Background" Intersection Level Of Service Summary

<u>Intersections</u>	<u>AM PEAK HOUR</u>				<u>PM PEAK HOUR</u>			
	<u>Intersection</u>		<u>Lane Group</u>		<u>Intersection</u>		<u>Lane Group</u>	
	<u>LOS/Delay</u>	<u>Aprch. LOS/Dly.</u>	<u>LOS/Dly.</u>	<u>Aprch. LOS/Dly.</u>	<u>LOS/Delay</u>	<u>Aprch. LOS/Dly.</u>	<u>LOS/Dly.</u>	<u>Aprch. LOS/Dly.</u>
<u>Unsignalized</u>	<i>(Avail.Stack.)</i>	<i>(95% BOQ)</i>			<i>(95% BOQ)</i>			
Old Bridge/Tanyard Hill	(225')	A/2.2	(109')	EBL B/14.6	F/53.8	(59')	EBL F/75.0	
	(inf.)		(0')	EBT A/0.0		(0')	EBT A/0.0	
	(inf.)		(0')	WBTR A/0.0		(0')	WBTR A/0.0	
	(inf.)		(31')	SBL E/35.8		(918')	SBL F/545.6	
	(inf.)		(31')	SBR E/35.8		(918')	SBR F/545.6	

Legend:

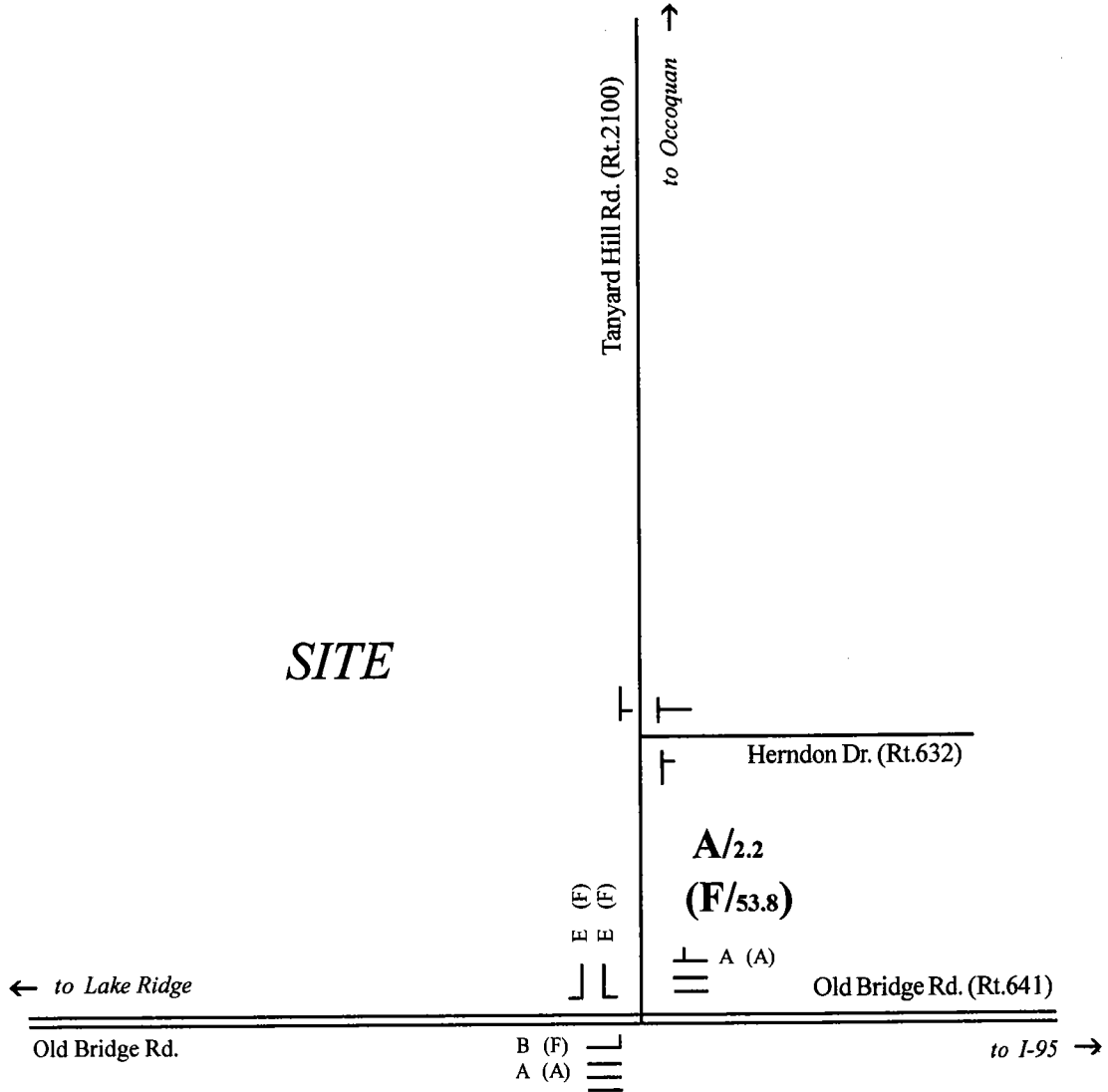
- LOS = Level Of Service -- See Appendix C
- LOS/Delay = Level Of Service & Avg. Vehicular Delay (seconds) - for "Critical Lane Group"
- LOS/Dly. = Level Of Service & Avg. Vehicular Delay (seconds) - for "Critical Movement"
- 95% BOQ = 95% Back-Of-Queue length (ft.)
- inf. = infinite (length of link)

LEGEND

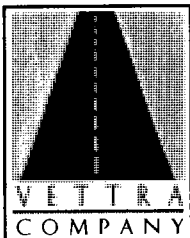
 = Traffic Signal

A/1.2 = AM Pk.Hr. LOS/Delay (sec.)

(A/1.2) = PM Pk.Hr. LOS/Delay (sec.)



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Yr. 2013 “Background” AM/PM Peak Hour Intersection Geometry & Levels Of Service

FIGURE 5

PROPOSED “THE OAKS III” SITE DEVELOPMENT

Site Development Plan/Access

The Oaks III “site” is proposed to utilize two (2) access points: 1) a “Right In only” entrance along Old Bridge Rd. west of Tanyard Hill Rd., and 2) a “Full access” entrance along Tanyard Hill Rd. north of Old Bridge Rd. and Herndon Drive. Both site entrances will operate as *unsignalized* 3-leg (“T”) intersections. No functional interparcel accesses are proposed. **Figure 6** presents the “The Oaks III” General Development Plan.

Development Densities

“The Oaks III” general office building is expected to be “built out” (occupied) by Year 2013.

Site Trip Generation

Table 3 presents the expected Year 2013 Daily and Peak Hour (AM/PM) trip generations for the proposed “The Oaks III” development. These calculations are based on ITE Trip Generation – 8th Edition (2008) “adjacent street” trip rates.

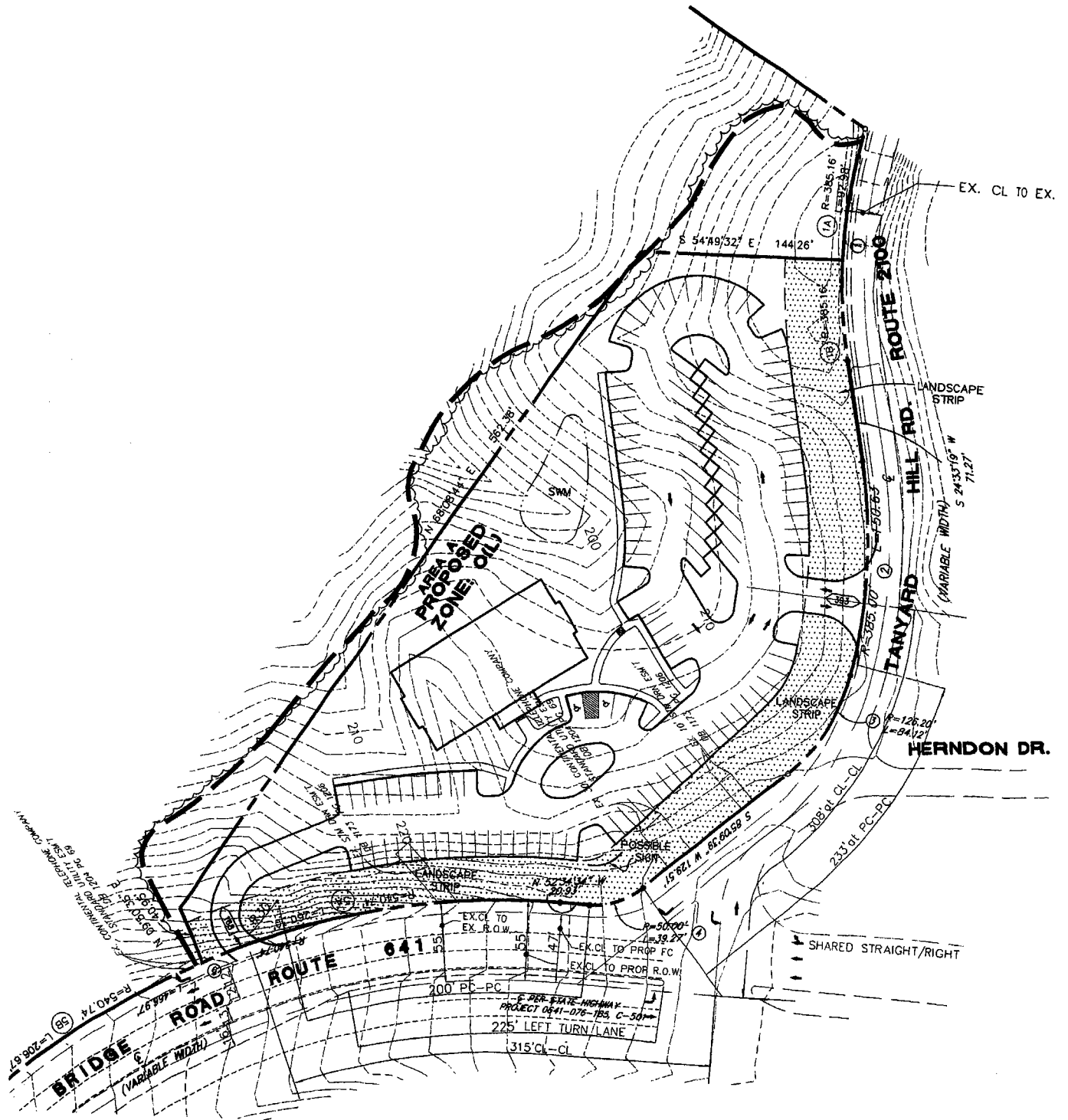
As a “worst-case” scenario, The Oaks III “site” (32,500 gross square foot General Office building) is expected to generate 561 vehicle-trips (382 vehicles visiting the site) per day with 76 AM peak hour and 115 PM peak hour trips. No internal or pass-by trip discounts have been utilized.

Site Trip Distribution

Year 2013 site-generated trips were assigned to the road network based on pre-approved (by County & VDOT staff) site trip distributions provided by the applicant based on empirical data from adjacent office buildings. Generalized “site” trip distributions for the site uses are shown on **Figure 7**.

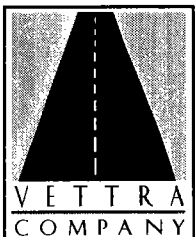
Site Traffic Volumes

Based on the abovementioned site trip generation and distributions, site traffic volumes are assigned to the roadway network. **Figure 8** shows the Year 2013 site-related AM/PM Peak Hour Intersection Movement Volumes.



Source: BC Consultants, June 2010.

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**“The Oaks III”
 General Development Plan**

**FIGURE
 6**

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TABLE 3

"SITE" DEVELOPMENT DENSITIES & TRIP GENERATION

PROPOSED DENSITIES AND TRIP RATES

Land Uses & Densities	Quantity	Unit	ITE Avg. "Adj.St." Trip Rates (8th Edition -- 2008)			
			ITE (Code)	AM Pk.Hr.	PM Pk.Hr.	Weekday VPD
<u>THE OAKS III</u>						
32,500 gsf Gen. Office building -- use fitted curve equations	32.5	gsf	(710)	2.35	3.55	17.28

Notes:

gsf = gross square feet


GENERATED TRIPS

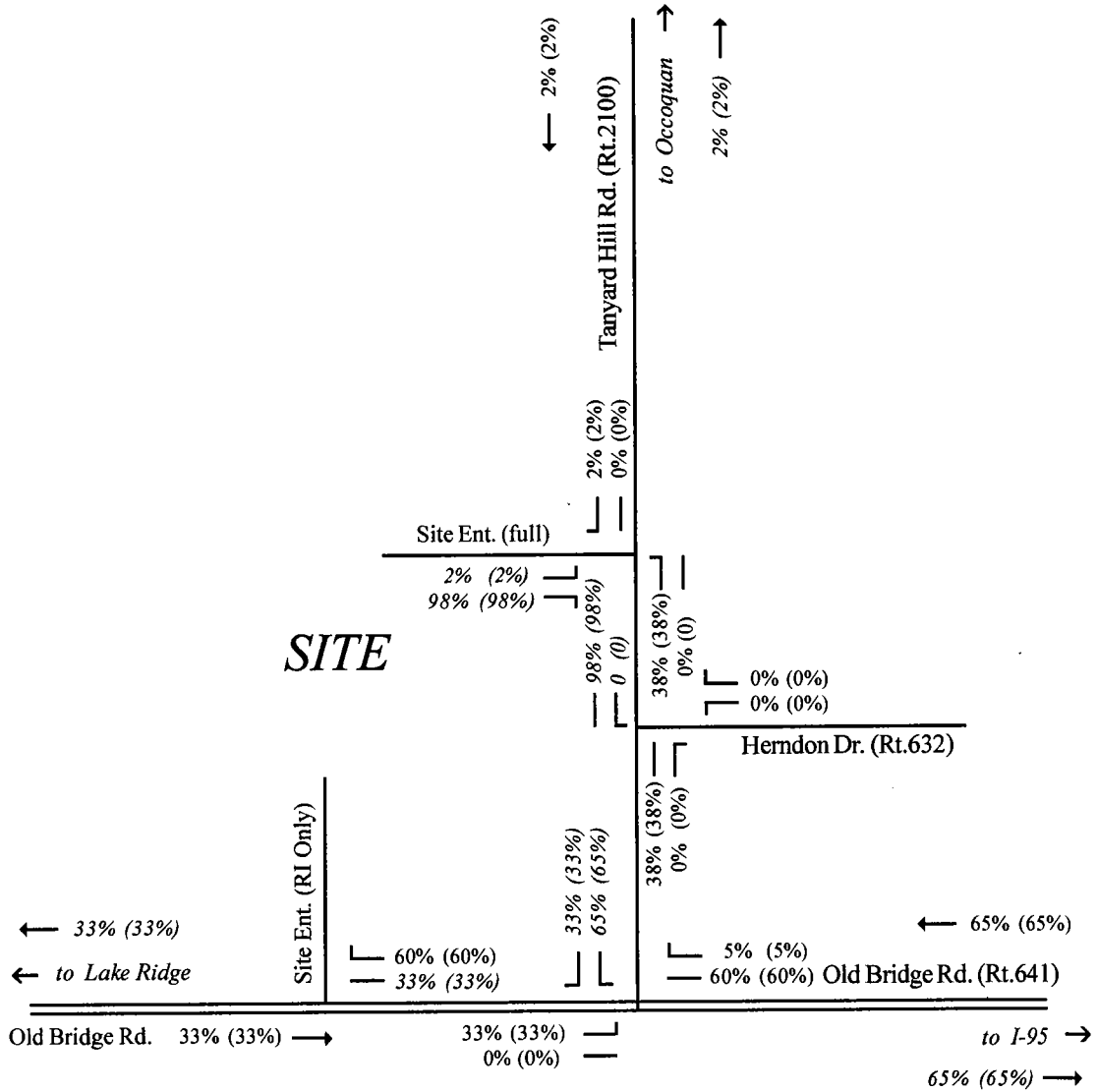
Land Uses & Densities	AM Pk.Hr.			PM Pk.Hr.			Weekday VPD
	In	Out	Total	In	Out	Total	
<u>THE OAKS III</u>							
32,500 gsf Gen. Office building -- use fitted curve equations	67	9	76	20	96	115	561

Note: All computations are automatically rounded.

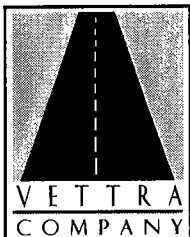
LEGEND

12% (12%) = AM (PM) Pk.Hr. Trip Distributions
 -- "outbound" shown in italics --

 = Traffic Signal



6/28/10



N


 No Scale

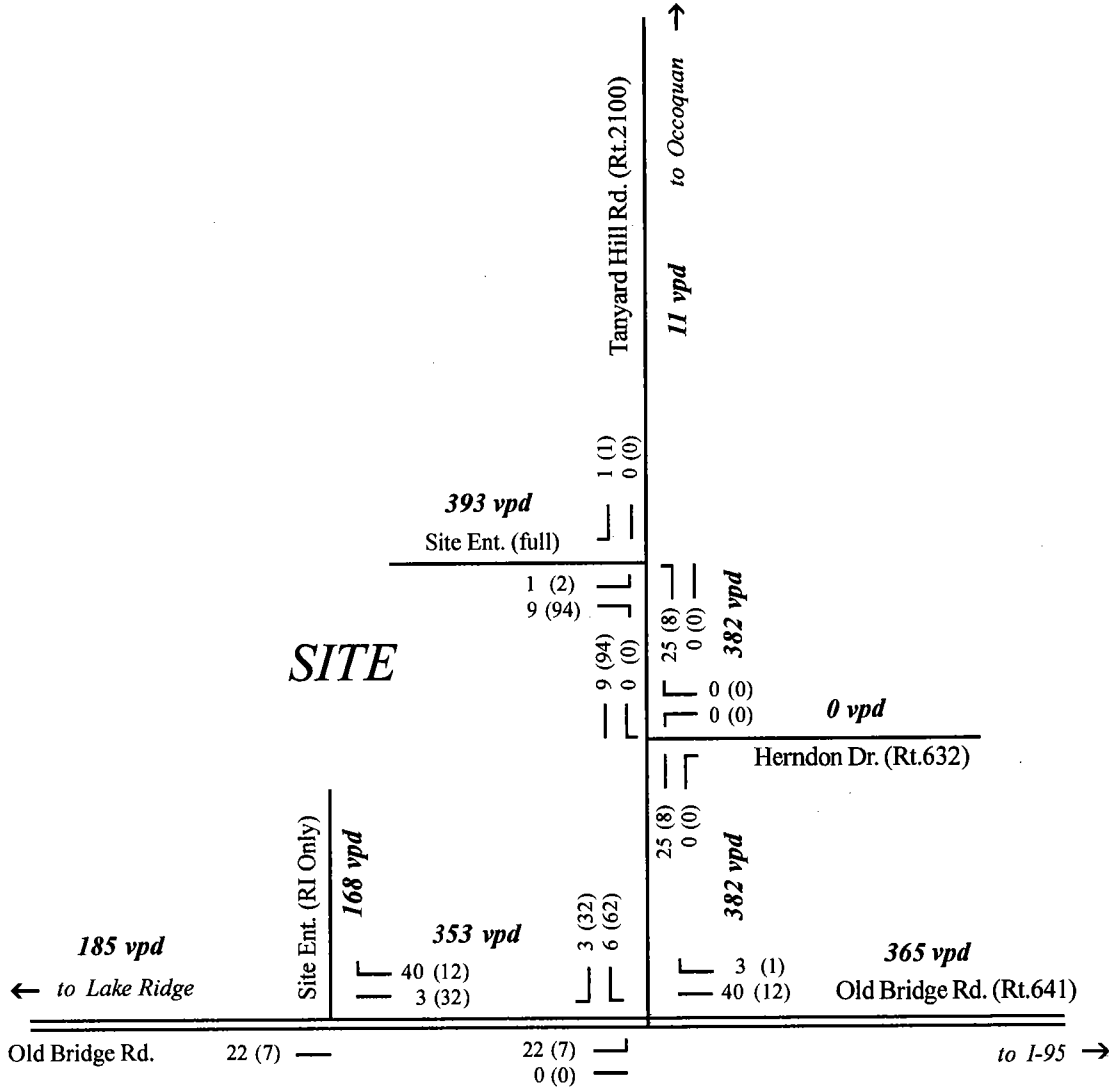
Yr. 2013 Generalized "Site" Directional Trip Distributions

FIGURE 7

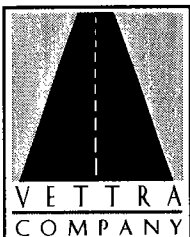
LEGEND

123 (123) = AM (PM) Pk.Hr. Traffic Volumes
 1,234 vpd = Daily Traffic Volume (veh. per day)

 = Traffic Signal



6/28/10



N

 No Scale

**Yr. 2013 "Site" Daily & AM/PM
 Peak Hour Trip Assignments**

**FIGURE
 8**

FUTURE "TOTAL" TRAFFIC CONDITIONS WITH SITE (YEAR 2013)

Future "Total" Traffic Volumes

By totaling the future "background" (Figure 4) and "site" (Figure 8) traffic volumes, future "total" volumes are developed. Figure 9 shows the Yr. 2013 "Total" AM/PM peak hour volumes, as well as two-way, daily traffic estimates for the adjacent roadways, respectively.

Future "Total" Intersection Capacity Analysis

These "total" traffic volumes, with assumed geometrics, were again subjected to the Synchro *unsignalized* (stop-controlled) intersection analysis procedures (as done for "background" conditions). Table 4 presents the results of the analyses showing the computed Levels Of Service (LOS) and vehicular delays for the AM/PM peak hours at the analyzed intersections, as well as 95% Back-of-Queue (BOQ) lengths. Figure 10 presents the LOS information in graphic format. Appendix F includes the Year 2013 AM/PM Peak Hour Synchro printouts. Intersection spacing and other network information and parameters are provided at the end of Appendix F.

Future Year 2013 "Total" (with site traffic) intersection analyses reveal that with the addition of "site" traffic, all three (3) key intersections analyzed as part of this TIA will remain at "background" Levels Of Service or operate at "acceptable" Levels Of Service. With "site" traffic, the *unsignalized* Old Bridge Rd./Tanyard Hill Rd. intersection will continue to operate at "excellent" LOS=A Level Of Service in the AM peak hour and at "very poor/failing" LOS=F conditions in the PM peak hour. Both of the new *unsignalized* (stop-controlled) Site Entrances (on Old Bridge Rd. and on Tanyard Hill Rd.) will operate at "excellent" (LOS=A) Levels Of Service during both the AM & PM peak hours.


TABLE 4
Year 2013 "Total" Intersection Level Of Service Summary

<u>Intersections</u>	AM PEAK HOUR					PM PEAK HOUR				
	<u>Intersection</u>		<u>Lane Group</u>			<u>Intersection</u>		<u>Lane Group</u>		
	<u>LOS/Delay</u>	<u>Aprch. LOS/Dly.</u>	<u>LOS/Delay</u>	<u>Aprch. LOS/Dly.</u>	<u>LOS/Delay</u>	<u>Aprch. LOS/Dly.</u>	<u>LOS/Delay</u>	<u>Aprch. LOS/Dly.</u>		
<u>Unsignalized</u>	<i>(Avail.Stack.)</i>	<i>(95% BOQ)</i>				<i>(95% BOQ)</i>				
Old Bridge/Tanyard Hill	(225')	A/4.2	(131')	EBL C/16.4		F/1183.5	(71')	EBL F/84.7		
	(inf.)		(0')	EBT A/0.0			(0')	EBT A/0.0		
	(inf.)		(0')	WBTR A/0.0			(0')	WBTR A/0.0		
	(inf.)		(142')	SBL F/148.5			(*)	SBL F/*		
	(inf.)		(142')	SBR F/148.5			(*)	SBR F/*		
Old Bridge/Site Ent. (RI)	(inf.)	A/0.0	(0')	EBT A/0.0		A/0.0	(0')	EBT A/0.0		
	(inf.)		(0')	WBTR A/0.0			(0')	WBTR A/0.0		
Tanyard Hill/Site Ent.	(70')	A/0.6	(1')	EBLR A/9.6		A/2.4	(20')	EBLR B/12.9		
	(inf.)		(2')	NBLT A/0.6			(1')	NBLT A/1.0		
	(inf.)		(0')	SBTR A/0.0			(0')	SBTR A/0.0		

Legend:

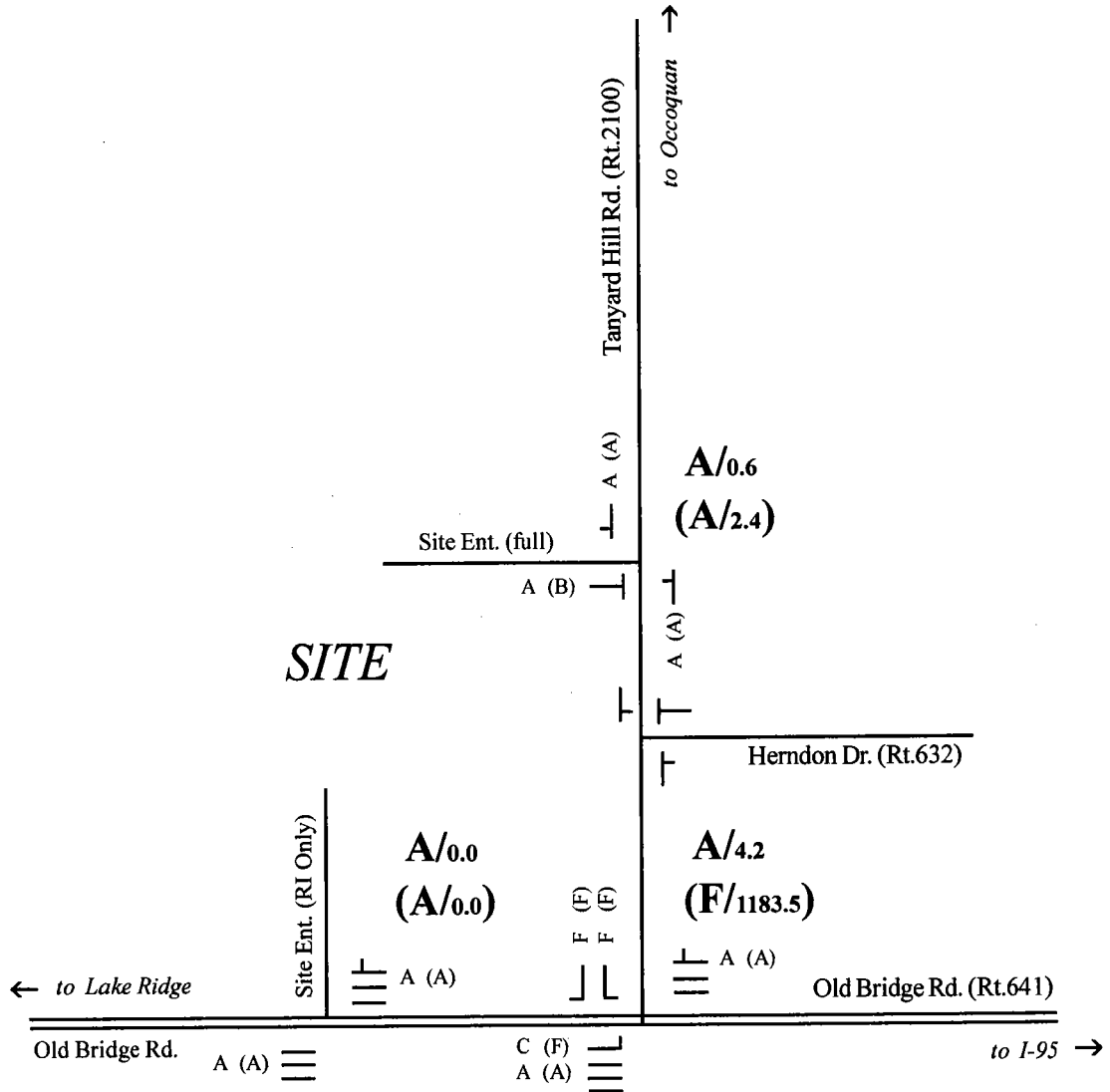
- LOS = Level Of Service -- See Appendix C
- LOS/Delay = Level Of Service & Avg. Vehicular Delay (seconds) - for "Critical Lane Group"
- LOS/Dly. = Level Of Service & Avg. Vehicular Delay (seconds) - for "Critical Movement"
- * = beyond meaningful interpretation
- 95% BOQ = 95% Back-Of-Queue length (ft.)
- inf. = infinite (length of link)

LEGEND

 = Traffic Signal

A/1.2 = AM Pk.Hr. LOS/Delay (sec.)

(A/1.2) = PM Pk.Hr. LOS/Delay (sec.)



6/28/10



N

 No Scale

**Yr. 2013 "Total" (w/site) AM/PM
 Peak Hour Intersection Geometry & LOS**

**FIGURE
 10**

INCREMENTAL IMPACT ANALYSIS

By comparing the "Background" intersection LOS's (**Table 2**) against the "Total" intersection LOS's (**Table 4**), any changes in Levels Of Service at the analyzed intersections can be seen. **Table 5** provides a side-by-side comparison of the Year 2013 Summary of "Background" vs. "Total" LOS's for the analyzed intersections.

Incremental impact analysis (comparing "background" vs. "total" Levels Of Service), reveals that the addition of site traffic will not cause any significant traffic impact at the three (3) *unsignalized* intersections along Old Bridge Rd. (Rt.641) and Tanyard Hill Rd. (Rt.2100). All intersections will remain at "background" levels or operate at "excellent" Levels Of Service. Thus, no traffic impact is indicated and no impact "mitigation measures" (improvements) are warranted or recommended.

TABLE 5

Comparison of Yr. 2013 "Background" vs. "Total" Intersection LOS's

<u>Intersection</u>	<u>Ln.Grp.</u>	<u>AM PEAK HOUR</u>			<u>PM PEAK HOUR</u>		
		<u>Bkgrd.</u>	<u>Total</u>	<u>LOS Change?</u>	<u>Bkgrd.</u>	<u>Total</u>	<u>LOS Change?</u>
<i>Unsignalized</i>							
Old Bridge/Tanyard Hill	=	A	A	no	F	F	no
	EBL	B	C	no*	F	F	no
	EBT	A	A	no	A	A	no
	WBTR	A	A	no	A	A	no
	SBL	E	F	no*	F	F	no
	SBR	E	F	no*	F	F	no
Old Bridge/Site Ent. (RI)	=	--	A	no	--	A	no
	EBT	--	A	no	--	A	no
	WBTR	--	A	no	--	A	no
Tanyard Hill/Site Ent.	=	--	A	no	--	A	no
	EBLR	--	A	no	--	B	no
	NBLT	--	A	no	--	A	no
	SBTR	--	A	no	--	A	no

* - not a significant change – still within same (as background) "acceptable" or "failing" categories.

RECOMMENDED TRANSPORTATION IMPROVEMENTS

Since no traffic impact is indicated at any of the intersections for either peak hour analyzed, no additional impact "mitigation measures" are warranted or recommended.

QUEUING ANALYSIS

Synchro 95% Back-of-Queues (BOQ's) for all lane groups at all analyzed intersections are presented within **Tables 1, 2, and 4**. Nearly all 95% BOQ's are minimal and well within available storage lengths, thus indicating no delay or queuing problems. Only the SB approach at the Old Bridge Rd./Tanyard Hill Rd. intersection during the PM peak hour experiences excessive queues, which currently exist.

RIGHT TURN LANE WARRANT ANALYSES – (VDOT METHOD)

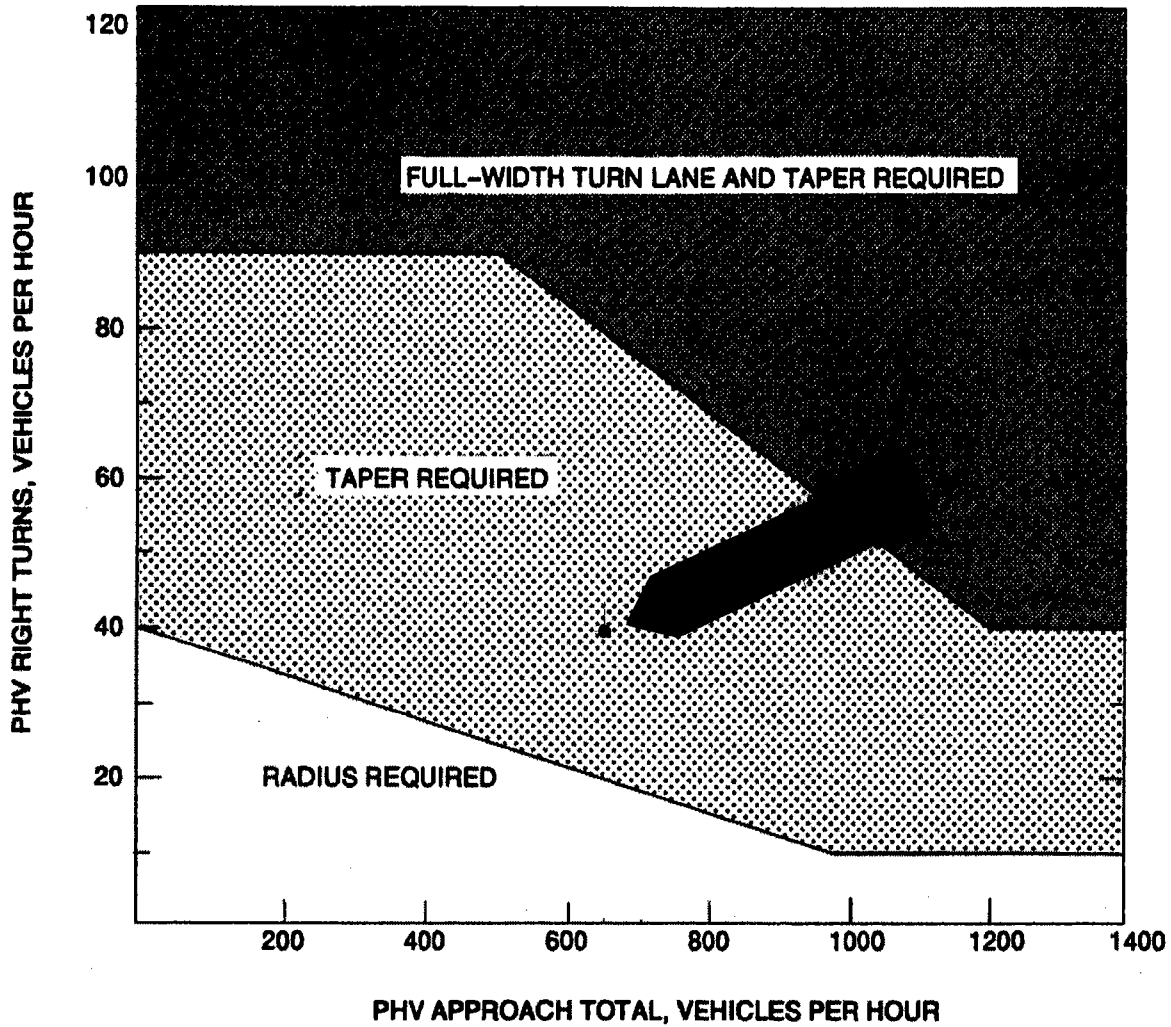
As requested by staff, Right Turn Lane Warrant analysis was conducted at the Old Bridge Rd./Site Entrance (Right-In only) to determine whether a taper is warranted. **Figures 11a & 11b** provide the AM & PM peak hour analyses, respectively, for this entrance showing that a taper is warranted.

Right Turn Lane Warrant analysis was also conducted at the Tanyard Hill Rd./Site Entrance (full access) to determine whether a taper or turn lane is warranted. **Figures 12a & 12b** provide the AM & PM peak hour analyses, respectively, for this entrance showing that neither are warranted.

CONCLUSIONS

Traffic impact via intersection capacity analysis has been analyzed for existing and future Year 2013 conditions - "Background" (without site traffic) and "Total" (with site traffic).

Based upon the assumed "scoped" parameters, the analytical evaluations and comparisons within this TIA have shown that the proposed development of "The Oaks III" commercial project will not significantly impact the area network and can be easily accommodated within the future road network.



LEGEND

PHV- - Peak Hour Volume (also Design Hourly Volume equivalent)

Adjustment for Right Turns

If PHV is not known use formula: $PHV = ADT \times K \times D$

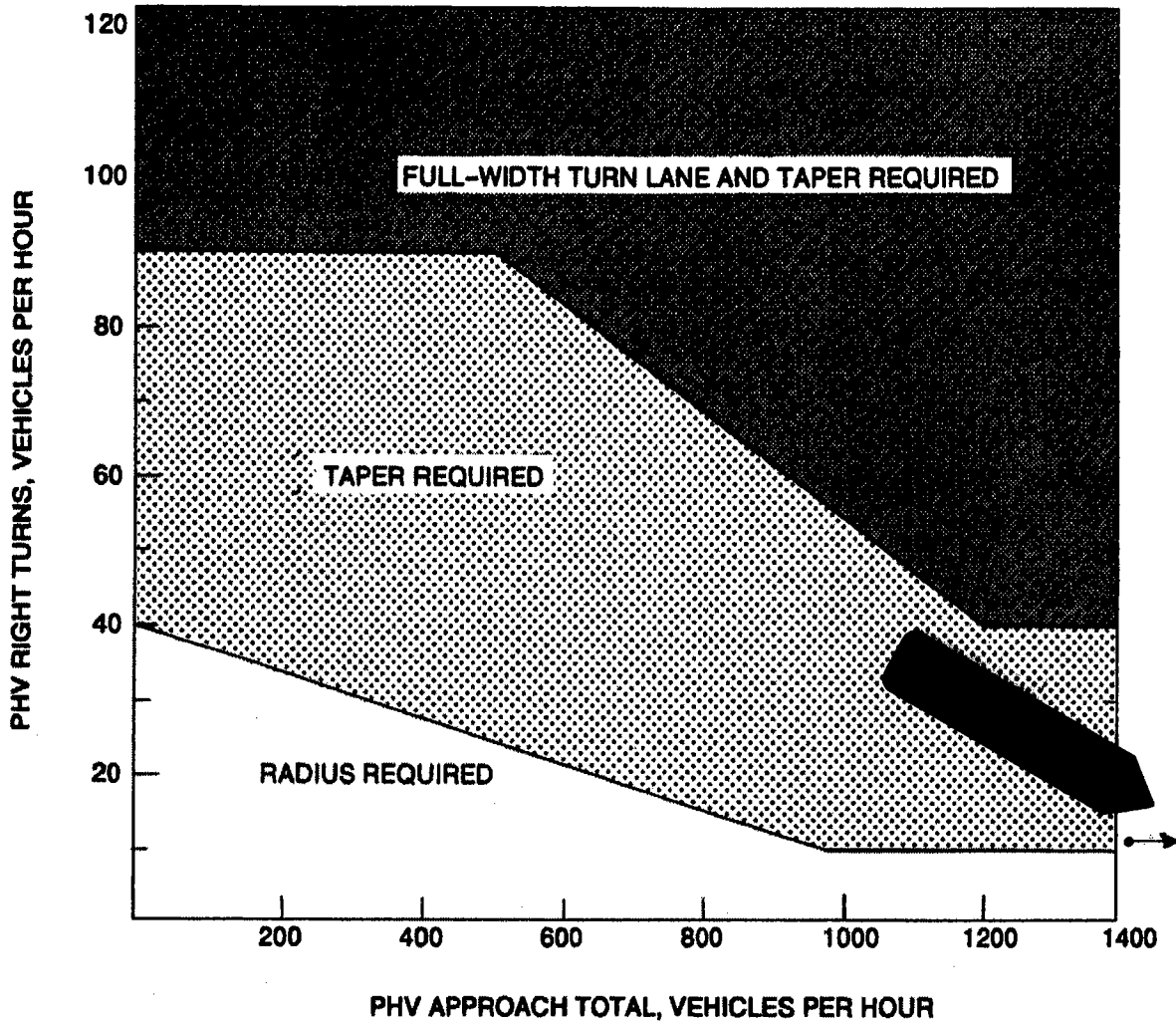
K = the percent of AADT occurring in the peak hour

D = the percent of traffic in the peak direction of flow

Note: An average of 11% for K x D will suffice.

FIGURE C-1-9 GUIDELINES FOR RIGHT TURN TREATMENT (4-LANE HIGHWAY)

FIGURE 11a



LEGEND

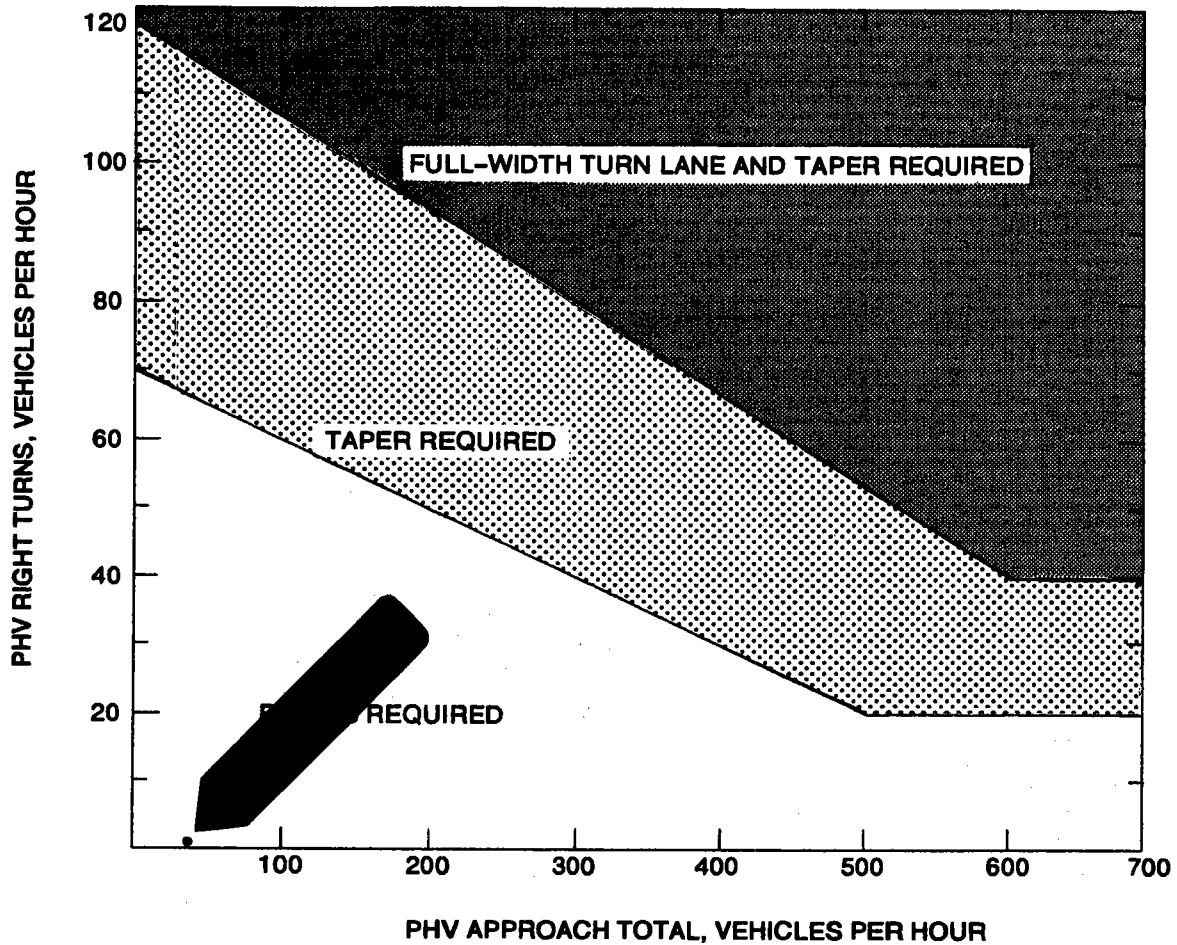
PHV- - Peak Hour Volume (also Design Hourly Volume equivalent)

Adjustment for Right Turns

If PHV is not known use formula: $PHV = ADT \times K \times D$
 K = the percent of AADT occurring in the peak hour
 D = the percent of traffic in the peak direction of flow
 Note: An average of 11% for K x D will suffice.

FIGURE C-1-9 GUIDELINES FOR RIGHT TURN TREATMENT (4-LANE HIGHWAY)

FIGURE 11b



LEGEND

PHV - Peak Hour Volume (also Design Hourly Volume equivalent)

Adjustment for Right Turns

For posted speeds at or under 70 km/h (45 mph), PHV right turns > 40, and PHV total < 300.

Adjusted right turns = PHV Right Turns - 20

If PHV is not known use formula: $PHV = ADT \times K \times D$

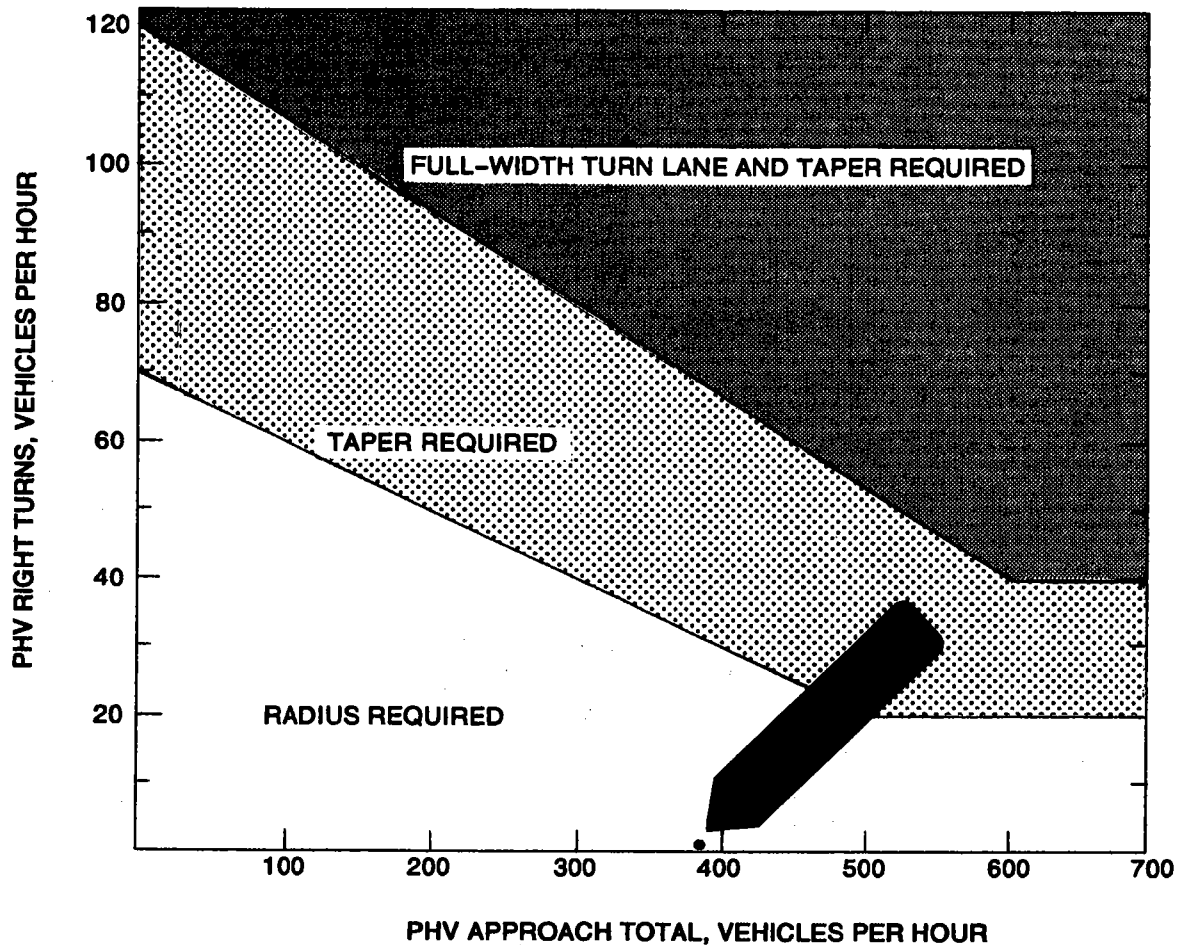
K = the percent of AADT occurring in the peak hour

D = the percent of traffic in the peak direction of flow

Note: An average of 11% for K x D will suffice.

FIGURE C-1-8 GUIDELINES FOR RIGHT TURN TREATMENT (2-LANE HIGHWAY)

FIGURE 12a



LEGEND

PHV - Peak Hour Volume (also Design Hourly Volume equivalent)

Adjustment for Right Turns

For posted speeds at or under 70 km/h (45 mph), PHV right turns > 40, and PHV total < 300.

Adjusted right turns = PHV Right Turns - 20

If PHV is not known use formula: $PHV = ADT \times K \times D$

K = the percent of AADT occurring in the peak hour

D = the percent of traffic in the peak direction of flow

Note: An average of 11% for K x D will suffice.

FIGURE C-1-8 GUIDELINES FOR RIGHT TURN TREATMENT (2-LANE HIGHWAY)

FIGURE 12b

APPENDICES

APPENDIX A

TIA Scoping Correspondence



PRE-SCOPE OF WORK MEETING FORM

Information on the Project and the Traffic Impact Analysis Base Assumptions

The applicant is responsible for entering the relevant information and submitting the form to VDOT and the locality no less than three (3) business days prior to the meeting. If a form is not received by this deadline, the scope of work meeting may be postponed.

Contact Information	
Consultant Name: Tele: E-mail:	VETTRA Company 703/590-4932 <i>vettra@aol.com</i>
Developer/Owner Name: Telephone: E-mail:	Clipper II Associates, L.P. 202/288-1389 <i>kthompson@kenthompsoninc.com</i>

Project Information			
Project Name:	The Oaks III	Locality/County:	Prince William County
Project Location: (Attach regional and site specific location map)	West of Tanyard Hill Rd. (Rt.2100) & north of Old Bridge Rd. (Rt.641) – see attached Vicinity Map		
Submission Type:	Comp Plan <input type="checkbox"/>	Rezoning <input checked="" type="checkbox"/>	Site Plan <input type="checkbox"/> Subd Plat <input type="checkbox"/>
Project Description: (Including details on the land use, acreage, phasing, access location, etc. Attach additional sheet if necessary)	<p>Current Zoning: A-1 -- proposed for O (L) 18.55 acres; Parcel ID: 8393-32-7695 (develop only 3.5 acres) Buildout @ Yr. 2013 Access: 2 site entrances: 1) on Old Bridge Rd. (RI only) 2) on Tanyard Hill Rd. (full) Proposed Uses: -- see attached GDP -- Buildout: (Yr.2013) – 32,500 gsf General Office building</p>		
	Residential <input type="checkbox"/>	Commercial <input checked="" type="checkbox"/>	Mixed Use <input type="checkbox"/> Other <input type="checkbox"/>
	<p>Residential Use(s) Number of Units: _____ ITE LU Code(s): 1. _____ 2. _____</p> <p>Commercial Use(s) ITE LU Code(s): 1. 710 2. _____ Square Feet or Other Variable: 1. 32,500 gsf 2. _____</p>		<p>Other Uses: ITE LU Code(s): 1. _____ 2. _____ 3. _____ 4. _____ Independent Variable(s): 1. _____ 2. _____</p>

Total Peak Hour Trip Projection	Less than 100 <input type="checkbox"/>	100 - 499 <input checked="" type="checkbox"/>	500 - 999 <input type="checkbox"/>	1,000 or more <input type="checkbox"/>
Traffic Impact Analysis Assumptions				
Study Period	Existing Year: 2010	Build-out Year: 2013	Design Year: _____	
Study Area Boundaries (Attach map)	North: Town of Occoquan	South: Old Bridge Rd. (Rt.641)		
	East: Herndon Rd. (Rt.632)	West: Clipper Dr. (Rt.2116)		
External Factors That Could Affect Project (Planned road improvements, other nearby developments)	None known			
Consistency With Comprehensive Plan (Land Use, Transportation Plan)	Yes			
Available Traffic Data (Historical, forecasts)	Old Bridge Rd. = 52,000 ADT (VDOT 2007 ADT) Tanyard Hill Rd. = 4,495 ADT (VETTRA June 9, 2010 count)			
Trip Distribution (Attach Sketch) - per shown empirical data	Road Name: <u>Old Bridge Rd.</u> : 65% to/from east (60% to RI only & 5% to TH Rd.); 33% to/from west		Road Name: <u>Tanyard Hill Rd.</u> : 2% to/from north (min. 1 veh.pk.hr.)	
	Road Name: _____		Road Name: _____	
Annual Vehicle Trip Growth Rate:	2%/yr. compounded	Peak Period for Study	<input checked="" type="checkbox"/> AM <input checked="" type="checkbox"/> PM <input type="checkbox"/> SAT <input type="checkbox"/> SUN	
		Peak Hour of the Generator	76/115 (AM/PM) - see attached "Table 1"	
Study Intersections and/or Road Segments (Attach additional sheets as necessary)	1. Old Bridge Rd. @ Tanyard Hill Rd. (full access)		4.	
	2. Old Bridge Rd. @ Site Ent. (RI only)		5.	
	3. Tanyard Hill Rd. @ Site Ent. (full access)		6.	
	4.			
Trip Adjustment Factors	Internal allowance: <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No Reduction: ___% trips		Pass-by allowance: <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No Reduction: ___% trips	
	Software Methodology <input checked="" type="checkbox"/> Synchro (v.6) <input type="checkbox"/> HCS <input type="checkbox"/> aaSIDRA <input type="checkbox"/> CORSIM <input type="checkbox"/> Other _____			

APPENDIX B

Existing (June 2010) Traffic Counts & 2008 VDOT Counts

VETTRA Co. -- Traffic Planning & Engineering

11535 Gunner Ct. -- Woodbridge, VA 22192

(tel) 703.590.4932 (fax) 703.590.1277

(email) vettra@aol.com

- . Peak Period(s): Weekday AM & PM
- . Intersection: Old Bridge/Tanyard Hill
- . by/Board #: jham/D1-0989
- . Weather: Fair, Warm

File Name : ob10ewth
 Site Code : 00020091
 Start Date : 6/8/2010
 Page No : 1

Groups Printed- Unshifted

Start Time	Tanyard Hill Rd. (Rt.2100) Southbound				Old Bridge Rd. (Rt.641) Eastbound				Old Bridge Rd. (Rt.641) Westbound				Exclu. Total	Inclu. Total	Int. Total
	Left	Right	Heavy	App. Total	Left	Thru	Heavy	App. Total	Thru	Right	Heavy	App. Total			
06:00 AM	0	1	0	1	106	831	12	937	59	3	9	62	21	1000	1021
06:15 AM	0	2	0	2	98	749	8	847	55	3	8	58	16	907	923
06:30 AM	0	5	0	5	131	838	13	969	122	2	14	124	27	1098	1125
06:45 AM	1	7	0	8	123	812	13	935	122	3	12	125	25	1068	1093
Total	1	15	0	16	458	3230	46	3688	358	11	43	369	89	4073	4162
07:00 AM	0	8	0	8	128	742	4	870	140	5	15	145	19	1023	1042
07:15 AM	2	12	0	14	130	712	14	842	146	4	5	150	19	1006	1025
07:30 AM	2	6	0	8	127	777	17	904	150	1	2	151	19	1063	1082
07:45 AM	2	19	0	21	97	800	13	897	158	3	7	161	20	1079	1099
Total	6	45	0	51	482	3031	48	3513	594	13	29	607	77	4171	4248
08:00 AM	3	5	0	8	87	735	16	822	172	3	9	175	25	1005	1030
08:15 AM	0	9	0	9	73	745	16	818	171	3	12	174	28	1001	1029
08:30 AM	0	14	1	14	61	747	16	808	176	1	11	177	28	999	1027
08:45 AM	0	9	0	9	40	596	9	636	172	2	10	174	19	819	838
Total	3	37	1	40	261	2823	57	3084	691	9	42	700	100	3824	3924
*** BREAK ***															
04:00 PM	1	45	0	46	12	270	11	282	620	6	21	626	32	954	986
04:15 PM	0	80	1	80	16	298	14	314	632	1	16	633	31	1027	1058
04:30 PM	0	64	1	64	8	278	2	286	703	0	11	703	14	1053	1067
04:45 PM	6	109	0	115	12	312	4	324	647	1	11	648	15	1087	1102
Total	7	298	2	305	48	1158	31	1206	2602	8	59	2610	92	4121	4213
05:00 PM	0	88	0	88	9	267	3	276	735	1	14	736	17	1100	1117
05:15 PM	1	89	0	90	17	301	7	318	681	2	12	683	19	1091	1110
05:30 PM	1	61	0	62	11	284	6	295	669	1	5	670	11	1027	1038
05:45 PM	1	50	0	51	10	320	3	330	599	1	7	600	10	981	991
Total	3	288	0	291	47	1172	19	1219	2684	5	38	2689	57	4199	4256
06:00 PM	0	51	0	51	6	254	6	260	547	1	8	548	14	859	873
06:15 PM	2	64	0	66	2	264	3	266	668	2	9	670	12	1002	1014
06:30 PM	1	56	0	57	6	250	3	256	685	2	8	687	11	1000	1011
06:45 PM	1	17	0	18	12	250	3	262	655	1	8	656	11	936	947
Total	4	188	0	192	26	1018	15	1044	2555	6	33	2561	48	3797	3845
Grand Total	24	871	3	895	1322	12432	216	13754	9484	52	244	9536	463	24185	24648
Apprch %	2.7	97.3			9.6	90.4			99.5	0.5					
Total %	0.1	3.6		3.7	5.5	51.4		56.9	39.2	0.2		39.4	1.9	98.1	

VETTRA Co. -- Traffic Planning & Engineering

11535 Gunner Ct. -- Woodbridge, VA 22192

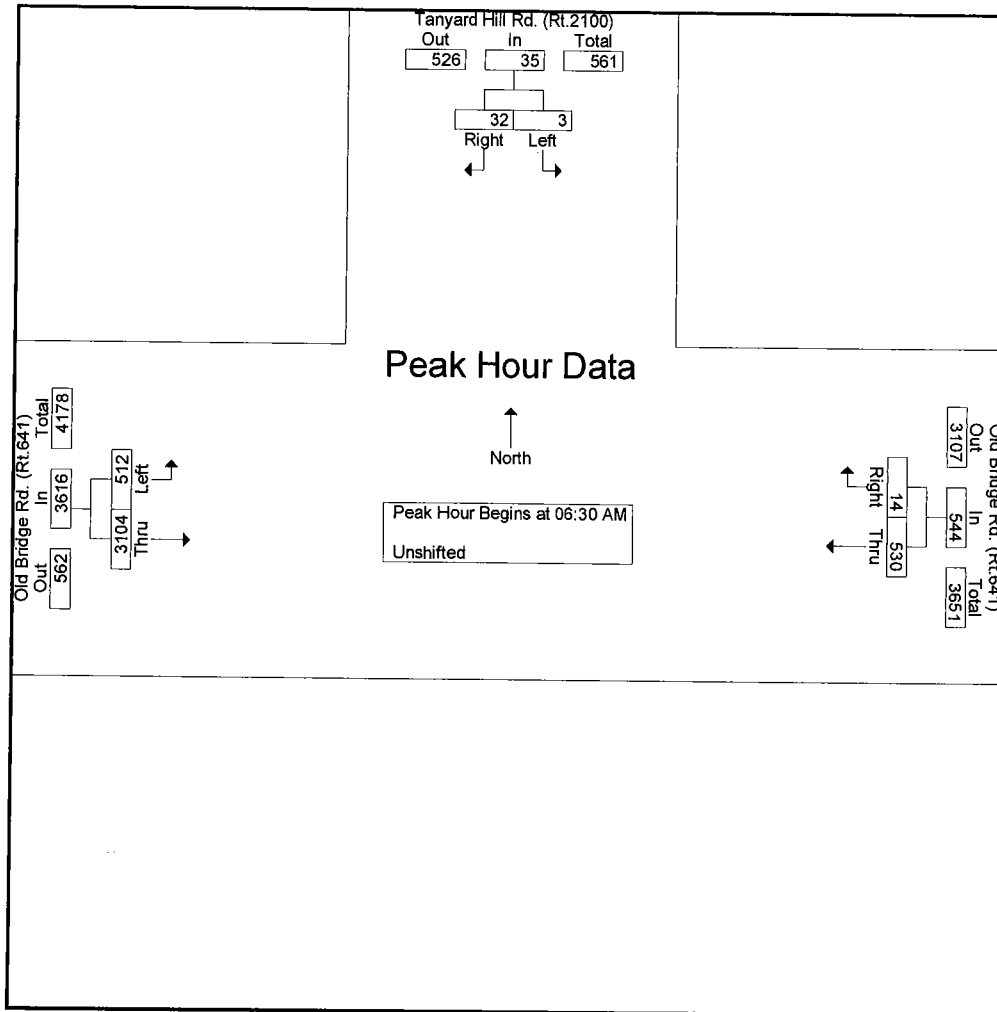
(tel) 703.590.4932 (fax) 703.590.1277

(email) vettra@aol.com

- . Peak Period(s): Weekday AM & PM
- . Intersection: Old Bridge/Tanyard Hill
- . by/Board #: jham/D1-0989
- . Weather: Fair, Warm

File Name : ob10ewth
 Site Code : 00020091
 Start Date : 6/8/2010
 Page No : 2

Start Time	Tanyard Hill Rd. (Rt.2100) Southbound			Old Bridge Rd. (Rt.641) Eastbound			Old Bridge Rd. (Rt.641) Westbound			Int. Total
	Left	Right	App. Total	Left	Thru	App. Total	Thru	Right	App. Total	
Peak Hour Analysis From 06:00 AM to 11:45 AM - Peak 1 of 1										
Peak Hour for Entire Intersection Begins at 06:30 AM										
06:30 AM	0	5	5	131	838	969	122	2	124	1098
06:45 AM	1	7	8	123	812	935	122	3	125	1068
07:00 AM	0	8	8	128	742	870	140	5	145	1023
07:15 AM	2	12	14	130	712	842	146	4	150	1006
Total Volume	3	32	35	512	3104	3616	530	14	544	4195
% App. Total	8.6	91.4		14.2	85.8		97.4	2.6		
PHF	.375	.667	.625	.977	.926	.933	.908	.700	.907	.955



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- . Peak Period(s): Weekday AM & PM
- . Intersection: Old Bridge/Tanyard Hill
- . by/Board #: jham/D1-0989
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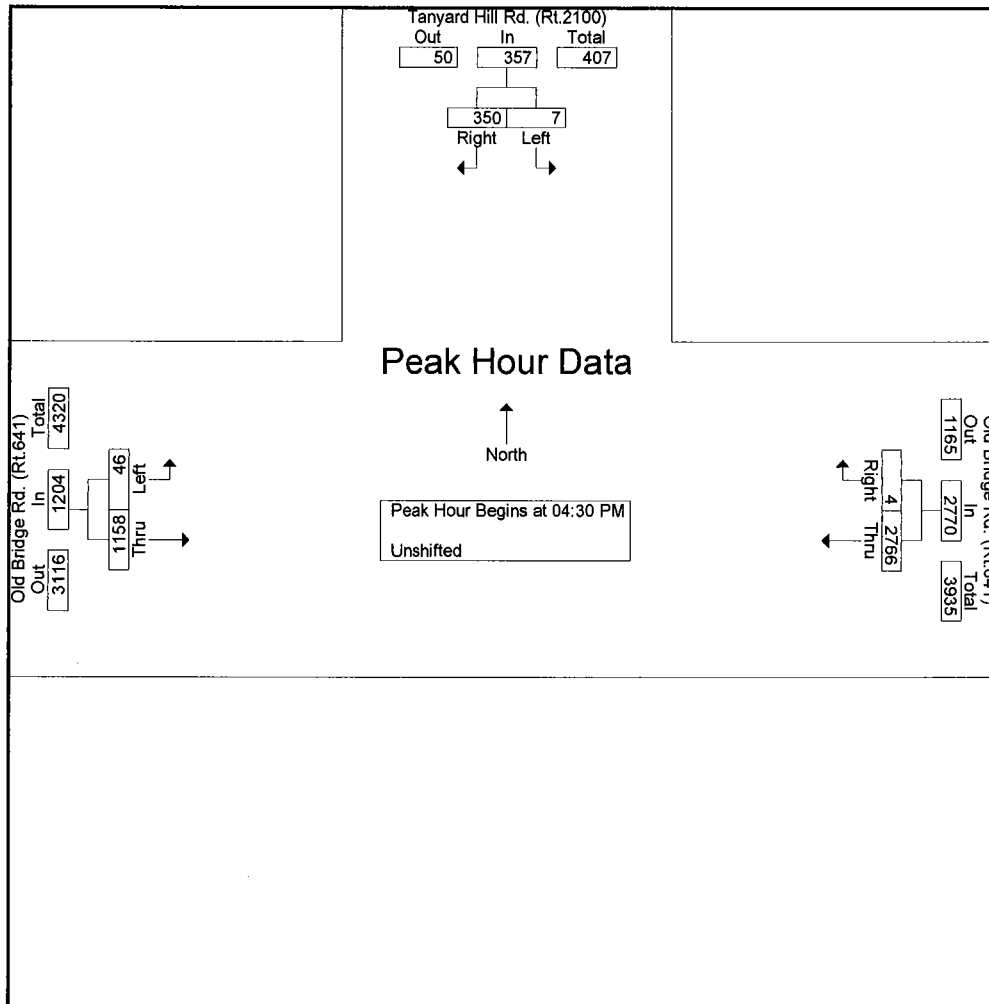
File Name : ob10ewth

Site Code : 00020091

Start Date : 6/8/2010

Page No : 3

Start Time	Tanyard Hill Rd. (Rt.2100) Southbound			Old Bridge Rd. (Rt.641) Eastbound			Old Bridge Rd. (Rt.641) Westbound			Int. Total
	Left	Right	App. Total	Left	Thru	App. Total	Thru	Right	App. Total	
Peak Hour Analysis From 12:00 PM to 06:45 PM - Peak 1 of 1										
Peak Hour for Entire Intersection Begins at 04:30 PM										
04:30 PM	0	64	64	8	278	286	703	0	703	1053
04:45 PM	6	109	115	12	312	324	647	1	648	1087
05:00 PM	0	88	88	9	267	276	735	1	736	1100
05:15 PM	1	89	90	17	301	318	681	2	683	1091
Total Volume	7	350	357	46	1158	1204	2766	4	2770	4331
% App. Total	2	98		3.8	96.2		99.9	0.1		
PHF	.292	.803	.776	.676	.928	.929	.941	.500	.941	.984



Date/Time/Volume/Average Speed/Temperature Report

HI-Star ID: 1275 Street: Tanyard Hill Rd. State: VA City: Woodbridge County: Prince William	Begin: Jun/08/2010 12:00:00 AM Lane: 2-way Oper: vet Posted: 25 AADT Factor: 1	End: Jun/09/2010 12:00:00 AM Hours: 24.00 Period: 15 Raw Count: 4495 AADT Count: 4,495		
Date And Time Range	Period Volume	Average Speed	Roadway Temperature	Roadway Surface Wet/Dry

Tue, Jun/08/2010

Date And Time Range	Period Volume	Average Speed	Roadway Temperature	Roadway Surface Wet/Dry
[00:00-00:15]	3	29 MPH	74 F	Dry
[00:15-00:30]	2	25 MPH	74 F	Dry
[00:30-00:45]	2	35 MPH	74 F	Dry
[00:45-01:00]	2	23 MPH	74 F	Dry
[01:00-01:15]	1	22 MPH	74 F	Dry
[01:15-01:30]	1	22 MPH	72 F	Dry
[01:30-01:45]	1	28 MPH	72 F	Dry
[01:45-02:00]	0	0 MPH	72 F	Dry
[02:00-02:15]	1	32 MPH	72 F	Dry
[02:15-02:30]	2	30 MPH	72 F	Dry
[02:30-02:45]	2	28 MPH	72 F	Dry
[02:45-03:00]	0	0 MPH	72 F	Dry
[03:00-03:15]	2	28 MPH	72 F	Dry
[03:15-03:30]	0	0 MPH	70 F	Dry
[03:30-03:45]	0	0 MPH	70 F	Dry
[03:45-04:00]	2	33 MPH	70 F	Dry
[04:00-04:15]	0	0 MPH	70 F	Dry
[04:15-04:30]	0	0 MPH	70 F	Dry
[04:30-04:45]	4	30 MPH	70 F	Dry
[04:45-05:00]	7	23 MPH	70 F	Dry
[05:00-05:15]	13	29 MPH	70 F	Dry
[05:15-05:30]	16	28 MPH	70 F	Dry
[05:30-05:45]	33	27 MPH	68 F	Dry
[05:45-06:00]	61	28 MPH	68 F	Dry
[06:00-06:15]	107	28 MPH	68 F	Dry
[06:15-06:30]	102	28 MPH	68 F	Dry
[06:30-06:45]	141	28 MPH	68 F	Dry
[06:45-07:00]	136	28 MPH	68 F	Dry
[07:00-07:15]	136	29 MPH	68 F	Dry
[07:15-07:30]	158	29 MPH	68 F	Dry
[07:30-07:45]	148	28 MPH	68 F	Dry
[07:45-08:00]	119	28 MPH	68 F	Dry
[08:00-08:15]	106	28 MPH	68 F	Dry
[08:15-08:30]	91	28 MPH	70 F	Dry
[08:30-08:45]	78	29 MPH	70 F	Dry
[08:45-09:00]	51	27 MPH	70 F	Dry

Date/Time/Volume/Average Speed/Temperature Report

HI-Star ID: 1275 Street: Tanyard Hill Rd. State: VA City: Woodbridge County: Prince William	Begin: Jun/08/2010 12:00:00 AM Lane: 2-way Oper: vet Posted: 25 AADT Factor: 1	End: Jun/09/2010 12:00:00 AM Hours: 24.00 Period: 15 Raw Count: 4495 AADT Count: 4,495		
Date And Time Range	Period Volume	Average Speed	Roadway Temperature	Roadway Surface Wet/Dry

Tue, Jun/08/2010

[09:00-09:15]	44	29 MPH	72 F	Dry
[09:15-09:30]	32	28 MPH	72 F	Dry
[09:30-09:45]	44	28 MPH	72 F	Dry
[09:45-10:00]	35	29 MPH	74 F	Dry
[10:00-10:15]	29	27 MPH	76 F	Dry
[10:15-10:30]	33	28 MPH	76 F	Dry
[10:30-10:45]	32	28 MPH	80 F	Dry
[10:45-11:00]	41	28 MPH	78 F	Dry
[11:00-11:15]	42	29 MPH	78 F	Dry
[11:15-11:30]	33	27 MPH	78 F	Dry
[11:30-11:45]	50	28 MPH	78 F	Dry
[11:45-12:00]	47	29 MPH	85 F	Dry
[12:00-12:15]	46	28 MPH	85 F	Dry
[12:15-12:30]	27	28 MPH	83 F	Dry
[12:30-12:45]	34	29 MPH	83 F	Dry
[12:45-13:00]	47	28 MPH	85 F	Dry
[13:00-13:15]	45	27 MPH	91 F	Dry
[13:15-13:30]	52	29 MPH	99 F	Dry
[13:30-13:45]	44	28 MPH	105 F	Dry
[13:45-14:00]	35	28 MPH	99 F	Dry
[14:00-14:15]	35	28 MPH	95 F	Dry
[14:15-14:30]	56	27 MPH	91 F	Dry
[14:30-14:45]	39	30 MPH	89 F	Dry
[14:45-15:00]	59	30 MPH	89 F	Dry
[15:00-15:15]	53	29 MPH	89 F	Dry
[15:15-15:30]	55	29 MPH	87 F	Dry
[15:30-15:45]	55	29 MPH	87 F	Dry
[15:45-16:00]	79	28 MPH	87 F	Dry
[16:00-16:15]	80	29 MPH	85 F	Dry
[16:15-16:30]	109	26 MPH	85 F	Dry
[16:30-16:45]	105	24 MPH	85 F	Dry
[16:45-17:00]	127	22 MPH	87 F	Dry
[17:00-17:15]	139	24 MPH	91 F	Dry
[17:15-17:30]	131	24 MPH	91 F	Dry
[17:30-17:45]	102	26 MPH	89 F	Dry
[17:45-18:00]	86	15 MPH	89 F	Dry

Date/Time/Volume/Average Speed/Temperature Report

HI-Star ID: 1275 Street: Tanyard Hill Rd. State: VA City: Woodbridge County: Prince William	Begin: Jun/08/2010 12:00:00 AM Lane: 2-way Oper: vet Posted: 25 AADT Factor: 1	End: Jun/09/2010 12:00:00 AM Hours: 24.00 Period: 15 Raw Count: 4495 AADT Count: 4,495		
Date And Time Range	Period Volume	Average Speed	Roadway Temperature	Roadway Surface Wet/Dry

Tue, Jun/08/2010

[18:00-18:15]	134	22 MPH	89 F	Dry
[18:15-18:30]	136	22 MPH	89 F	Dry
[18:30-18:45]	104	23 MPH	89 F	Dry
[18:45-19:00]	69	28 MPH	85 F	Dry
[19:00-19:15]	44	28 MPH	85 F	Dry
[19:15-19:30]	38	27 MPH	83 F	Dry
[19:30-19:45]	29	28 MPH	82 F	Dry
[19:45-20:00]	30	28 MPH	82 F	Dry
[20:00-20:15]	32	28 MPH	80 F	Dry
[20:15-20:30]	28	27 MPH	80 F	Dry
[20:30-20:45]	30	28 MPH	78 F	Dry
[20:45-21:00]	22	27 MPH	78 F	Dry
[21:00-21:15]	23	28 MPH	78 F	Dry
[21:15-21:30]	28	28 MPH	78 F	Dry
[21:30-21:45]	16	27 MPH	76 F	Dry
[21:45-22:00]	20	29 MPH	76 F	Dry
[22:00-22:15]	19	32 MPH	76 F	Dry
[22:15-22:30]	13	26 MPH	76 F	Dry
[22:30-22:45]	14	29 MPH	76 F	Dry
[22:45-23:00]	10	28 MPH	76 F	Dry
[23:00-23:15]	9	31 MPH	76 F	Dry
[23:15-23:30]	9	27 MPH	76 F	Dry
[23:30-23:45]	4	33 MPH	76 F	Dry
[23:45-00:00]	4	24 MPH	76 F	Dry

Jun/08/2010 12:00:00 AM		
Jun/09/2010 12:00:00 AM	4495	28 MPH 78 F

==== [Report #1 DATE/TIME/VOLUME Report]=====

Survey #: 413 Begi06/08/2010 00:00 End:06/09/2010 00:00
 Route: Herndon Rd. Lane: 2-way Hours : 24 hrs
 Loc/Sta west of Tanyard Hill Oper: vet AdjF: 0.000 Period: 15 min
 City: Lake Ridge, VA Posted: 25 mph Raw Count: 92
 County: Prince William AADT Factor: 1.00 AADT Count: 92

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Day	Date	Time	Count
Tue	06/08/2010	00:00	0
Tue	06/08/2010	00:15	0
Tue	06/08/2010	00:30	0
Tue	06/08/2010	00:45	0
Tue	06/08/2010	01:00	0
Tue	06/08/2010	01:15	0
Tue	06/08/2010	01:30	0
Tue	06/08/2010	01:45	0
Tue	06/08/2010	02:00	0
Tue	06/08/2010	02:15	0
Tue	06/08/2010	02:30	0
Tue	06/08/2010	02:45	0
Tue	06/08/2010	03:00	0
Tue	06/08/2010	03:15	0
Tue	06/08/2010	03:30	0
Tue	06/08/2010	03:45	0
Tue	06/08/2010	04:00	0
Tue	06/08/2010	04:15	0
Tue	06/08/2010	04:30	0
Tue	06/08/2010	04:45	0
Tue	06/08/2010	05:00	0
Tue	06/08/2010	05:15	0
Tue	06/08/2010	05:30	0
Tue	06/08/2010	05:45	2
Tue	06/08/2010	06:00	2
Tue	06/08/2010	06:15	1
Tue	06/08/2010	06:30	1
Tue	06/08/2010	06:45	2
Tue	06/08/2010	07:00	0
Tue	06/08/2010	07:15	0
Tue	06/08/2010	07:30	2
Tue	06/08/2010	07:45	2
Tue	06/08/2010	08:00	2
Tue	06/08/2010	08:15	1
Tue	06/08/2010	08:30	0
Tue	06/08/2010	08:45	1
Tue	06/08/2010	09:00	1
Tue	06/08/2010	09:15	0
Tue	06/08/2010	09:30	2
Tue	06/08/2010	09:45	1
Tue	06/08/2010	10:00	0
Tue	06/08/2010	10:15	0
Tue	06/08/2010	10:30	3
Tue	06/08/2010	10:45	1

=====
 [Report #1 DATE/TIME/VOLUME Report]=====
 Survey #: 413 Begin: 06/08/2010 00:00 End: 06/09/2010 00:00
 Route: Herndon Rd. Lane: 2-way Hours : 24 hrs
 Loc/Sta west of Tanyard Hill Oper: vet AdjF: 0.000 Period: 15 min
 City: Lake Ridge, VA Posted: 25 mph Raw Count: 92
 County: Prince William AADT Factor: 1.00 AADT Count: 92
 =====

Day	Date	Time	Count
Tue	06/08/2010	11:00	2
Tue	06/08/2010	11:15	1
Tue	06/08/2010	11:30	1
Tue	06/08/2010	11:45	4
Tue	06/08/2010	12:00	1
Tue	06/08/2010	12:15	0
Tue	06/08/2010	12:30	1
Tue	06/08/2010	12:45	3
Tue	06/08/2010	13:00	1
Tue	06/08/2010	13:15	3
Tue	06/08/2010	13:30	2
Tue	06/08/2010	13:45	1
Tue	06/08/2010	14:00	4
Tue	06/08/2010	14:15	3
Tue	06/08/2010	14:30	2
Tue	06/08/2010	14:45	2
Tue	06/08/2010	15:00	2
Tue	06/08/2010	15:15	0
Tue	06/08/2010	15:30	0
Tue	06/08/2010	15:45	0
Tue	06/08/2010	16:00	1
Tue	06/08/2010	16:15	0
Tue	06/08/2010	16:30	1
Tue	06/08/2010	16:45	4
Tue	06/08/2010	17:00	2
Tue	06/08/2010	17:15	2
Tue	06/08/2010	17:30	2
Tue	06/08/2010	17:45	1
Tue	06/08/2010	18:00	3
Tue	06/08/2010	18:15	2
Tue	06/08/2010	18:30	5
Tue	06/08/2010	18:45	5
Tue	06/08/2010	19:00	1
Tue	06/08/2010	19:15	0
Tue	06/08/2010	19:30	0
Tue	06/08/2010	19:45	2
Tue	06/08/2010	20:00	1
Tue	06/08/2010	20:15	1
Tue	06/08/2010	20:30	0
Tue	06/08/2010	20:45	0
Tue	06/08/2010	21:00	0
Tue	06/08/2010	21:15	0
Tue	06/08/2010	21:30	1
Tue	06/08/2010	21:45	0

=====
 [Report #1 DATE/TIME/VOLUME Report]=====

Survey #: 413 Begi06/08/2010 00:00 End:06/09/2010 00:00
 Route: Herndon Rd. Lane: 2-way Hours : 24 hrs
 Loc/Sta west of Tanyard Hill Oper: vet AdjF: 0.000 Period: 15 min
 City: Lake Ridge, VA Posted: 25 mph Raw Count: 92
 County: Prince William AADT Factor: 1.00 AADT Count: 92

=====
 =====

Day	Date	Time	Count
Tue	06/08/2010	22:00	0
Tue	06/08/2010	22:15	0
Tue	06/08/2010	22:30	0
Tue	06/08/2010	22:45	0
Tue	06/08/2010	23:00	0
Tue	06/08/2010	23:15	1
Tue	06/08/2010	23:30	0
Tue	06/08/2010	23:45	0

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 =====

Virginia Department of Transportation
Traffic Engineering Division
2008
Annual Average Daily Traffic Volume Estimates By Section of Route
Prince William Maintenance Area

Route	Length	AADT	QA	4Tire	Bus	Truck				QC	K Factor	QK	Dir Factor	AAWDT	QW	Year
						2Axle	3+Axle	1Trail	2Trail							
Prince William County																
(640) Minnieville Rd	0.26	33000	G	98%	0%	1%	0%	0%	0%	F	0.078	F	0.658	35000	G	2008
						From: 76-892 Elm Farm Rd										
(640) Minnieville Rd	2.38	25000	G	98%	1%	1%	1%	0%	0%	F	NA		28000	G	2008	
						From: 76-2000 Smoketown Rd										
						To: 76-641 Old Bridge Rd										
(641) Old Bridge Rd	1.27	35000	G	98%	0%	1%	0%	0%	0%	C	0.088	F	0.515	38000	G	2008
						From: 76-3000 Pr Win Pkwy										
(641) Old Bridge Rd	0.31	36000	G	98%	0%	0%	0%	0%	0%	F	0.085	F	0.641	39000	G	2008
						From: 76-2217 Cricket Lane										
(641) Old Bridge Rd	0.19	37000	G	98%	0%	0%	0%	0%	0%	F	0.087	F	0.668	40000	G	2008
						From: 76-2220 Hedges Run Dr										
(641) Old Bridge Rd	1.50	45000	G	98%	0%	0%	0%	0%	0%	C	0.087	F	0.727	49000	G	2008
						From: 76-2234 Cavalier Dr										
(641) Old Bridge Rd	0.37	46000	G	98%	0%	0%	0%	0%	0%	F	0.087	F	0.733	49000	G	2008
						From: 76-2125 Colby Rd										
(641) Old Bridge Rd	0.33	52000	G	98%	1%	1%	1%	0%	0%	F	0.081	F	0.716	56000	G	2008
						From: 76-640 Minnieville Rd										
(641) Old Bridge Rd	0.73	49000	G	98%	1%	1%	1%	0%	0%	F	0.079	F	0.699	53000	G	2008
						From: 76-2100 Tanyard Hill Rd										
(641) Old Bridge Rd	0.33	44000	G	98%	1%	1%	1%	0%	0%	C	0.077	F	0.744	48000	G	2008
						From: 76-906 Occoquan Rd <Old SR 253>										
						To: SR 123 Gordon Blvd										
(642) Hoadly Rd	1.35	12000	G	97%	0%	1%	1%	0%	0%	F	0.089	F	0.533	13000	G	2008
						From: SR 234 Dumfries Rd										
(642) Hoadly Rd	1.24	14000	G	97%	0%	1%	1%	0%	0%	F	0.088	F	0.561	15000	G	2008
						From: 76-631 Kahns Rd										
						To: 76-643; 76-784										
(642) Hoadly Rd	2.13	23000	G	97%	0%	1%	1%	0%	0%	C	0.099	F	0.695	24000	G	2008
						From: 76-643 Dale Blvd										
						To: 76-3000 Pr Win Pkwy; 76-663										
(643) Purcell Rd	3.26	4500	G	99%	0%	1%	0%	0%	0%	C	0.089	F	0.511	4900	G	2008
						From: SR 234 Dumfries Rd										
						To: 76-642 Hoadly Rd										
(643) Spriggs Rd	4.67	8800	G	97%	0%	1%	1%	0%	0%	C	0.086	F	0.608	9500	G	2008
						From: 76-642 W, Hoadly Rd										
(643) Spriggs Rd	0.27	NA									NA		NA			
						From: SR 234 S, Dumfries Rd										
						To: 76-3121 Fincastle Dr										
(644) Free St	0.16	100	R								NA		NA		10/20/2004	
						From: 76-772 Marsteller Dr										
						To: 76-718 Nokes St										
(645) Hazelwood Dr	2.20	340	R								NA		NA		10/19/2004	
						From: 76-607 Carriage Ford Rd										
						To: 76-611 S, Fleetwood Rd										
(645) Deepwood Lane	1.20	170	R								NA		NA		10/19/2004	
						From: 76-611 N, Fleetwood Dr										
						To: Dead End										
(646) Aden Rd	0.47	2300	G	94%	1%	3%	1%	1%	0%	F	0.092	F	0.549	2500	G	2008
						From: SR 28 Nokesville Rd										
(646) Aden Rd	0.47	2000	G	94%	1%	3%	1%	1%	0%	F	0.094	F	0.532	2200	G	2008
						From: 76-772 Marsteller Dr										
(646) Aden Rd	1.13	5400	G	94%	1%	3%	1%	1%	0%	C	0.079	F	0.512	5800	G	2008
						From: 76-671 Colvin Lane										
						To: 76-653 W, Parkgate Dr										

APPENDIX C

Level Of Service (LOS) Information and Criteria

Exhibit 16-2. Level-of-Service Criteria for Signalized Intersections

Level Of Service (LOS)	Stopped Delay per Vehicle (sec.)
A	≤ 10.0
B	> 10.0 and ≤ 20.0
C	> 20.0 and ≤ 35.0
D	> 35.0 and ≤ 55.0
E	> 55.0 and ≤ 80.0
F	> 80.0

Exhibit 17-2. Level-of-Service Criteria for TWSC (Unsignalized) Intersections

Level Of Service (LOS)	Average Total Delay (sec./veh.)
A	≤ 10.0
B	> 10.0 and ≤ 15.0
C	> 15.0 and ≤ 25.0
D	> 25.0 and ≤ 35.0
E	> 35.0 and ≤ 50.0
F	> 50.0

Source: 2000 Highway Capacity Manual

Level of Service for Signalized Intersections

Level of service for signalized intersections is defined in terms of *delay*. Delay is a measure of driver discomfort, frustration, fuel consumption, and lost travel time. Specifically, Level-Of-Service criteria are stated in terms of the average stopped delay per vehicle for a 15-minute analysis period. The criteria are given in Table 9-1.

- Level-Of-Service A (LOS=A) describes operations with very low delay, i.e., less than 10.0 seconds per vehicle. This occurs when progression is extremely favorable, and most vehicles arrive during the green phase. Most vehicles do not stop at all. Short cycle lengths may also contribute to low delay.
- Level-Of-Service B (LOS=B) describes operations with delay in the range of 10.1 to 20.0 seconds per vehicle. This generally occurs with good progression and/or short cycle lengths. More vehicles stop than for LOS=A, causing higher levels of average delay.
- Level-Of-Service C (LOS=C) describes operations with delay in the range of 20.1 to 35.0 seconds per vehicle. These higher delays may result from fair progression and/or longer cycle lengths. Individual cycle failures may begin to appear in this level. The number of vehicles stopping is significant at this level, although many still pass through the intersection without stopping.
- Level-Of-Service D (LOS=D) describes operations with delay in the range of 35.1 to 55.0 seconds per vehicle. At LOS=D, the influence of congestion becomes more noticeable. Longer delays may result from some combination of unfavorable progression, long cycle lengths, or high v/c ratios. Many vehicles stop, and the proportion of vehicles not stopping declines. Individual cycle failures are noticeable.
- Level-Of-Service E (LOS=E) describes operations with delay in the range of 55.1 to 80.0 seconds per vehicle. This is considered to be the limit of acceptable delay. These high delay values generally indicate poor progression, long cycle lengths, and high v/c ratios. Individual cycle failures are frequent occurrences.
- Level-Of-Service F (LOS=F) describes operations with delay in excess of 80.0 seconds per vehicle. This is considered to be unacceptable to most drivers. This condition often occurs with oversaturation, i.e., when arrival flow rates exceed the capacity of the intersection. It may also occur at high v/c ratios below 1.00 with many individual cycle failures. Poor progression and long cycle lengths may also be major contributing causes to such delay levels.

Source: 2000 Highway Capacity Manual

General descriptions of operating conditions for each of the levels of service are as follows:

1. *Level-of-service A*—Level A describes primarily free flow operations. Average travel speeds near 60 mph generally prevail on 70-mph freeway elements. Vehicles are almost completely unimpeded in their ability to maneuver within the traffic stream. The average spacing between vehicles is about 440 ft, or 22 car-lengths, with a maximum density of 12 pc/mi/ln. This affords the motorist a high level of physical and psychological comfort. The effects of minor incidents or breakdowns are easily absorbed at this level. Although they may cause a deterioration in LOS in the vicinity of the incident, standing queues will not form, and traffic quickly returns to LOS A on passing the disruption.

2. *Level-of-service B*—Level B also represents reasonably free-flow conditions, and speeds of over 57 mph are maintained on 70-mph freeway elements. The average spacing between vehicles is about 260 ft, or 13 car-lengths, with a maximum density of 20 pc/mi/ln. The ability to maneuver within the traffic stream is only slightly restricted, and the general level of physical and psychological comfort provided to drivers is still high. The effects of minor incidents and breakdowns are still easily absorbed, though local deterioration in service would be more severe than for LOS A.

3. *Level-of-service C*—Level C provides for stable operations, but flows approach the range in which small increases in flow will cause substantial deterioration in service. Average travel speeds are still over 54 mph. Freedom to maneuver within the traffic stream is noticeably restricted at LOS C, and lane changes require additional care and vigilance by the driver. Average spacings are in the range of 175 ft, or 9 car-lengths, with a maximum density of 30 pc/mi/ln. Minor incidents may still be absorbed, but the local deterioration in service will be substantial. Queues may be expected to form behind any significant blockage. The driver now experiences a noticeable increase in tension due to the additional vigilance required for safe operation.

4. *Level-of-service D*—Level D borders on unstable flow. In this range, small increases in flow cause substantial deterioration in service. Average travel speeds of 46 mph or more can still be maintained on 70-mph freeway elements. Freedom to maneuver within the traffic stream is severely limited, and the driver experiences drastically reduced physical and psychological comfort levels. Even minor incidents can be expected to create substantial queuing, because the traffic stream has little space to absorb disruptions. Average spacings are about 125 ft, or 6 car-lengths, with a maximum density of 42 pc/mi/ln.

5. *Level-of-service E*—The boundary between LOS D and LOS E describes operation at capacity. Operations in this level are extremely unstable, because there are virtually no usable gaps in the traffic stream. Vehicles are spaced at approximately 80 ft, or 4 car-lengths, at relatively uniform headways. This, however, represents the minimum spacing at which stable flow can be accommodated. Any disruption to the traffic stream, such as a vehicle entering from a ramp, or a vehicle changing lanes, causes following vehicles to give way to admit the vehicle. This condition establishes a disruption wave which propagates through the upstream traffic flow. At capacity, the traffic stream has no ability to dissipate even the most minor disruptions. Any incident can be expected to produce a serious breakdown with extensive queuing. The range of flows encompassed by LOS E is relatively small compared to other levels, but reflects a sub-

stantial deterioration in service. Maneuverability within the traffic stream is extremely limited, and the level of physical and psychological comfort afforded to the driver is extremely poor. Average travel speeds at capacity are approximately 30 mph.

6. *Level-of-service F*—Level F describes forced or breakdown flow. Such conditions generally exist within queues forming behind breakdown points. Such breakdowns occur for a number of reasons:

a. Traffic incidents cause a temporary reduction in the capacity of a short segment, such that the number of vehicles arriving at the point is greater than the number of vehicles that can traverse it.

b. Recurring points of congestion exist, such as merge or weaving areas and lane drops, where the number of vehicles arriving is greater than the number of vehicles traversing the point.

c. In forecasting situations, any location presents a problem when the projected peak hour (or other) flow rate exceeds the estimated capacity of the location.

It is noted that in all cases, breakdown occurs when the ratio of actual arrival flow rate to actual capacity or the forecasted flow rate to estimated capacity exceeds 1.00. Operations at such a point will generally be at or near capacity, and downstream operations may be better as vehicles pass the bottleneck (assuming that there are no additional downstream problems). The LOS F operations observed within a queue are the result of a breakdown or bottleneck at a downstream point. The designation "LOS F" is used, therefore, to identify the point of the breakdown or bottleneck, as well as the operations within the queue which forms behind it.

The extent of queuing, and the delays caused by queuing, are of great interest in the analysis of congested freeway segments. Chapter 6 contains a methodology for estimating the queue length and delays behind a bottleneck with known arrival and discharge rates. The procedure allows a rough quantification of the extent of congestion created by a LOS F situation.

BASIC RELATIONSHIPS

Maximum Service Flow Rate Per Lane

Table 3-1 presents criteria for maximum service flow rate, MSF_i , under ideal conditions, for 70-mph, 60-mph, and 50-mph design speed elements. These values are computed from the volume-to-capacity ratios, v/c , as follows, then rounded to the nearest 50 pcphpl.

$$MSF_i = c_j \times (v/c), \quad (3-1)$$

where:

MSF_i = maximum service flow rate per lane for LOS i under ideal conditions, in pcphpl;

$(v/c)_i$ = maximum volume-to-capacity ratio associated with LOS i ;

c_j = capacity under ideal conditions for freeway element of design speed j ; 2,000 pcphpl for 60-mph and 70-mph freeway elements, 1,900 pcphpl for 50-mph freeway elements; the value of c_j is synonymous with the maximum service flow rate for LOS E in Table 3-1.

Note that all values of MSF given in Table 3-1 have been rounded to the nearest 50 pcphpl.

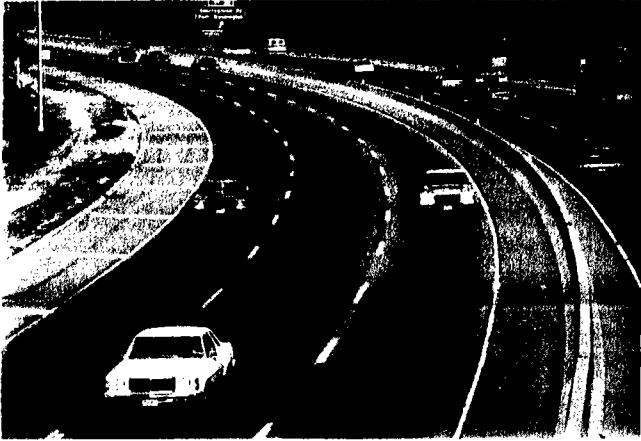


Illustration 3-5. Level-of-service A.



Illustration 3-8. Level-of-service D.



Illustration 3-6. Level-of-service B.



Illustration 3-9. Level-of-service E.



Illustration 3-7. Level-of-service C.



Illustration 3-10. Level-of-service F.

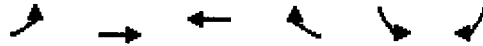
APPENDIX D

Existing 2010 AM/PM Peak Hour Intersection

Synchro Analysis Printouts

HCM Unsignalized Intersection Capacity Analysis
 3: Old Bridge Rd. (Rt.641) & Tanyard Hill Rd. (Rt.2100)

6/24/2010



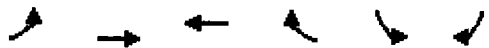
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations	↵	↑↑↑	↑↑↑		↵	↵
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Volume (veh/h)	512	3104	530	14	3	32
Peak Hour Factor	0.93	0.93	0.91	0.91	0.65	0.65
Hourly flow rate (vph)	551	3338	582	15	5	49
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						4
Median type					Raised	
Median storage (veh)					0	
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	598				2804	202
vC1, stage 1 conf vol					590	
vC2, stage 2 conf vol					2214	
vCu, unblocked vol	598				2804	202
tC, single (s)	4.1				6.8	6.9
tC, 2 stage (s)					5.8	
tF (s)	2.2				3.5	3.3
p0 queue free %	44				77	94
cM capacity (veh/h)	982				20	808

Direction Lane #	EB 1	EB 2	EB 3	EB 4	WB 1	WB 2	WB 3	SB 1
Volume Total	551	1113	1113	1113	233	233	132	54
Volume Left	551	0	0	0	0	0	0	5
Volume Right	0	0	0	0	0	0	16	49
cSH	982	1700	1700	1700	1700	1700	1700	235
Volume to Capacity	0.56	0.65	0.65	0.65	0.14	0.14	0.08	0.23
Queue Length 95th (ft)	90	0	0	0	0	0	0	21
Control Delay (s)	13.2	0.0	0.0	0.0	0.0	0.0	0.0	28.7
Lane LOS	B							D
Approach Delay (s)	1.9				0.0			28.7
Approach LOS								D

Intersection Summary	
Average Delay	1.9 A
Intersection Capacity Utilization	70.0%
ICU Level of Service	C
Analysis Period (min)	15

HCM Unsignalized Intersection Capacity Analysis
 3: Old Bridge Rd. (Rt.641) & Tanyard Hill Rd. (Rt.2100)

6/24/2010



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations	↖	↑↑↑	↑↑↑		↘	↗
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Volume (veh/h)	46	1158	2766	4	7	350
Peak Hour Factor	0.93	0.93	0.94	0.94	0.78	0.78
Hourly flow rate (vph)	49	1245	2943	4	9	449
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)	4					
Median type	Raised					
Median storage veh	0					
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	2947				3459	983
vC1, stage 1 conf vol	2945					
vC2, stage 2 conf vol	514					
vCu, unblocked vol	2947				3459	983
tC, single (s)	4.1				6.8	6.9
tC, 2 stage (s)	5.8					
tF (s)	2.2				3.5	3.3
p0 queue free %	58				47	0
cM capacity (veh/h)	119				17	248

Direction, Lane #	EB 1	EB 2	EB 3	EB 4	WB 1	WB 2	WB 3	SB 1
Volume Total	49	415	415	415	1177	1177	593	458
Volume Left	49	0	0	0	0	0	0	9
Volume Right	0	0	0	0	0	0	4	449
cSH	119	1700	1700	1700	1700	1700	1700	253
Volume to Capacity	0.42	0.24	0.24	0.24	0.69	0.69	0.35	1.81
Queue Length 95th (ft)	44	0	0	0	0	0	0	778
Control Delay (s)	55.4	0.0	0.0	0.0	0.0	0.0	0.0	413.1
Lane LOS	F							F
Approach Delay (s)	2.1				0.0			413.1
Approach LOS							F	

Intersection Summary			
Average Delay	40.8 s		
Intersection Capacity Utilization	81.9%	ICU Level of Service D	
Analysis Period (min)	15		

APPENDIX E

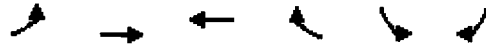
Yr. 2013 "Background" AM/PM Peak Hour Intersection

Synchro Analysis Printouts

HCM Unsignalized Intersection Capacity Analysis

3: Old Bridge Rd. (Rt.641) & Tanyard Hill Rd. (Rt.2100)

6/24/2010



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations	↖	↑↑↑	↑↑↑		↖	↗
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Volume (veh/h)	543	3294	562	15	3	34
Peak Hour Factor	0.93	0.93	0.91	0.91	0.65	0.65
Hourly flow rate (vph)	584	3542	618	16	5	52
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						4
Median type				Raised		
Median storage (veh)					0	
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	634				2974	214
vC1, stage 1 conf vol					626	
vC2, stage 2 conf vol					2348	
vCu, unblocked vol	634				2974	214
tC, single (s)	4.1				6.8	6.9
tC, 2 stage (s)					5.8	
tF (s)	2.2				3.5	3.3
p0 queue free %	39				69	93
cM capacity (veh/h)	952				15	794

Direction Lane #	EB 1	EB 2	EB 3	EB 4	WB 1	WB 2	WB 3	SB 1
Volume Total	584	1181	1181	1181	247	247	140	57
Volume Left	584	0	0	0	0	0	0	5
Volume Right	0	0	0	0	0	0	16	52
cSH	952	1700	1700	1700	1700	1700	1700	185
Volume to Capacity	0.61	0.69	0.69	0.69	0.15	0.15	0.08	0.31
Queue Length 95th (ft)	109	0	0	0	0	0	0	31
Control Delay (s)	14.6	0.0	0.0	0.0	0.0	0.0	0.0	35.8
Lane LOS	B							E
Approach Delay (s)	2.1				0.0			35.8
Approach LOS								E

Intersection Summary	
Average Delay	2.2 A
Intersection Capacity Utilization	73.6%
ICU Level of Service	D
Analysis Period (min)	15

HCM Unsignalized Intersection Capacity Analysis
 3: Old Bridge Rd. (Rt.641) & Tanyard Hill Rd. (Rt.2100)

6/24/2010



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations	↶	↶↶↶	↶↶↶		↷	↷
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Volume (veh/h)	49	1229	2935	4	7	371
Peak Hour Factor	0.93	0.93	0.94	0.94	0.78	0.78
Hourly flow rate (vph)	53	1322	3122	4	9	476
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						4
Median type					Raised	
Median storage veh					0	
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	3127				3670	1043
vC1, stage 1 conf vol					3124	
vC2, stage 2 conf vol					546	
vCu, unblocked vol	3127				3670	1043
tC, single (s)	4.1				6.8	6.9
tC, 2 stage (s)					5.8	
tF (s)	2.2				3.5	3.3
p0 queue free %	48				32	0
cM capacity (veh/h)	100				13	226

Direction, Lane #	EB 1	EB 2	EB 3	EB 4	WB 1	WB 2	WB 3	SB 1
Volume Total	53	441	441	441	1249	1249	629	485
Volume Left	53	0	0	0	0	0	0	9
Volume Right	0	0	0	0	0	0	4	476
cSH	100	1700	1700	1700	1700	1700	1700	230
Volume to Capacity	0.52	0.26	0.26	0.26	0.73	0.73	0.37	2.10
Queue Length 95th (ft)	59	0	0	0	0	0	0	918
Control Delay (s)	75.0	0.0	0.0	0.0	0.0	0.0	0.0	545.6
Lane LOS	F							F
Approach Delay (s)	2.9				0.0			545.6
Approach LOS								F

Intersection Summary

Average Delay	53.8	F
Intersection Capacity Utilization	86.4%	ICU Level of Service E
Analysis Period (min)	15	

APPENDIX F

Yr. 2013 "Total" AM/PM Peak Hour Intersection

Synchro Analysis Printouts

HCM Unsignalized Intersection Capacity Analysis
 3: Old Bridge Rd. (Rt.641) & Tanyard Hill Rd. (Rt.2100)

6/24/2010



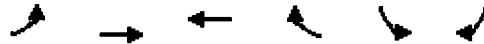
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations	↖	↑↑↑	↑↑↗		↘	↖
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Volume (veh/h)	565	3294	603	18	9	37
Peak Hour Factor	0.93	0.93	0.91	0.91	0.65	0.65
Hourly flow rate (vph)	608	3542	663	20	14	57
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						4
Median type				Raised		
Median storage veh				0		
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	682				3068	231
vC1, stage 1 conf vol					673	
vC2, stage 2 conf vol					2396	
vCu, unblocked vol	682				3068	231
tC, single (s)	4.1				6.8	6.9
tC, 2 stage (s)					5.8	
tF (s)	2.2				3.5	3.3
p0 queue free %	33				0	93
cM capacity (veh/h)	913				12	775

Direction Lane #	EB 1	EB 2	EB 3	EB 4	WB 1	WB 2	WB 3	SB 1
Volume Total	608	1181	1181	1181	265	265	152	71
Volume Left	608	0	0	0	0	0	0	14
Volume Right	0	0	0	0	0	0	20	57
cSH	913	1700	1700	1700	1700	1700	1700	62
Volume to Capacity	0.67	0.69	0.69	0.69	0.16	0.16	0.09	1.13
Queue Length 95th (ft)	131	0	0	0	0	0	0	142
Control Delay (s)	16.4	0.0	0.0	0.0	0.0	0.0	0.0	148.5
Lane LOS	C							F
Approach Delay (s)	2.4				0.0			148.5
Approach LOS								F

Intersection Summary	
Average Delay	4.2 A
Intersection Capacity Utilization	73.6% ICU Level of Service D
Analysis Period (min)	15

HCM Unsignalized Intersection Capacity Analysis
 3: Old Bridge Rd. (Rt.641) & Tanyard Hill Rd. (Rt.2100)

6/24/2010



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations	↖	↑↑↑	↑↑↑		↖	↗
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Volume (veh/h)	55	1229	2947	5	70	403
Peak Hour Factor	0.93	0.93	0.94	0.94	0.78	0.78
Hourly flow rate (vph)	59	1322	3135	5	90	517
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						4
Median type					Raised	
Median storage veh					0	
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	3140				3697	1048
vC1, stage 1 conf vol					3138	
vC2, stage 2 conf vol					559	
vCu, unblocked vol	3140				3697	1048
tC, single (s)	4.1				6.8	6.9
tC, 2 stage (s)					5.8	
tF (s)	2.2				3.5	3.3
p0 queue free %	40				0	0
cM capacity (veh/h)	99				13	224

Direction Lane #	EB 1	EB 2	EB 3	EB 4	WB 1	WB 2	WB 3	SB 1
Volume Total	59	441	441	441	1254	1254	632	606
Volume Left	59	0	0	0	0	0	0	90
Volume Right	0	0	0	0	0	0	5	517
cSH	99	1700	1700	1700	1700	1700	1700	66
Volume to Capacity	0.60	0.26	0.26	0.26	0.74	0.74	0.37	9.20
Queue Length 95th (ft)	71	0	0	0	0	0	0	Err
Control Delay (s)	84.7	0.0	0.0	0.0	0.0	0.0	0.0	Err
Lane LOS	F							F
Approach Delay (s)	3.6				0.0			Err
Approach LOS								F

Intersection Summary	
Average Delay	1183.5 F
Intersection Capacity Utilization	88.7% ICU Level of Service E
Analysis Period (min)	15

HCM Unsignalized Intersection Capacity Analysis
 9: Old Bridge Rd. (Rt.641) & Site Ent. (RI only)

6/24/2010



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↑↑↑	↑↑↑			
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Volume (veh/h)	0	3859	599	40	0	0
Peak Hour Factor	0.93	0.93	0.91	0.80	0.80	0.80
Hourly flow rate (vph)	0	4149	658	50	0	0
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type					None	
Median storage (veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	708				2066	244
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	708				2066	244
tC, single (s)	4.1				6.8	6.9
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				100	100
cM capacity (veh/h)	893				47	756

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3
Volume Total	1383	1383	1383	263	263	182
Volume Left	0	0	0	0	0	0
Volume Right	0	0	0	0	0	50
cSH	1700	1700	1700	1700	1700	1700
Volume to Capacity	0.81	0.81	0.81	0.15	0.15	0.11
Queue Length 95th (ft)	0	0	0	0	0	0
Control Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0
Lane LOS						
Approach Delay (s)	0.0			0.0		
Approach LOS						

Intersection Summary						
Average Delay			0.0	A		
Intersection Capacity Utilization			77.9%		ICU Level of Service	D
Analysis Period (min)			15			

HCM Unsignalized Intersection Capacity Analysis
 9: Old Bridge Rd. (Rt.641) & Site Ent. (RI only)

6/24/2010



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↑↑↑	↑↑↑			
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Volume (veh/h)	0	1284	3338	12	0	0
Peak Hour Factor	0.93	0.93	0.94	0.80	0.80	0.80
Hourly flow rate (vph)	0	1381	3551	15	0	0
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None		
Median storage (veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	3566				4019	1191
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	3566				4019	1191
tC, single (s)	4.1				6.9	7.0
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				100	100
cM capacity (veh/h)	66				2	177

Direction Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3
Volume Total	460	460	460	1420	1420	725
Volume Left	0	0	0	0	0	0
Volume Right	0	0	0	0	0	15
cSH	1700	1700	1700	1700	1700	1700
Volume to Capacity	0.27	0.27	0.27	0.84	0.84	0.43
Queue Length 95th (ft)	0	0	0	0	0	0
Control Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0
Lane LOS						
Approach Delay (s)	0.0			0.0		
Approach LOS						

Intersection Summary		
Average Delay	0.0	A
Intersection Capacity Utilization	68.1%	ICU Level of Service C
Analysis Period (min)	15	

HCM Unsignalized Intersection Capacity Analysis
 7: Site Ent. (full) & Tanyard Hill Rd. (Rt.2100)

6/24/2010



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	T			L	L	
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Volume (veh/h)	1	9	25	561	37	1
Peak Hour Factor	0.80	0.80	0.80	0.65	0.65	0.80
Hourly flow rate (vph)	1	11	31	863	57	1
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None					
Median storage veh						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	983	58	58			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	983	58	58			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	100	99	98			
cM capacity (veh/h)	270	1009	1546			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	12	894	58
Volume Left	1	31	0
Volume Right	11	0	1
cSH	792	1546	1700
Volume to Capacity	0.02	0.02	0.03
Queue Length 95th (ft)	1	2	0
Control Delay (s)	9.6	0.6	0.0
Lane LOS	A	A	
Approach Delay (s)	9.6	0.6	0.0
Approach LOS	A		

Intersection Summary			
Average Delay	0.6 A		
Intersection Capacity Utilization	47.6%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
 7: Site Ent. (full) & Tanyard Hill Rd. (Rt.2100)

6/24/2010



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations	↘			↕	↕	
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Volume (veh/h)	2	94	8	63	379	1
Peak Hour Factor	0.80	0.80	0.80	0.78	0.78	0.80
Hourly flow rate (vph)	2	118	10	81	486	1
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type	None					
Median storage veh						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	587	487	487			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	587	487	487			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	99	80	99			
cM capacity (veh/h)	464	577	1066			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	120	91	487
Volume Left	2	10	0
Volume Right	118	0	1
cSH	574	1066	1700
Volume to Capacity	0.21	0.01	0.29
Queue Length 95th (ft)	20	1	0
Control Delay (s)	12.9	1.0	0.0
Lane LOS	B	A	
Approach Delay (s)	12.9	1.0	0.0
Approach LOS	B		

Intersection Summary			
Average Delay		2.4	A
Intersection Capacity Utilization	32.6%	ICU Level of Service	A
Analysis Period (min)	15		

