



February 18, 2009

Scott Jenkins Memorial Park
Loudoun County, VA
Traffic Impact Analysis

(Prepared for: Loudoun County Office of Capital Construction)



Patton Harris Rust & Associates
Engineers. Surveyors. Planners. Landscape Architects.

**Scott Jenkins Memorial Park
Traffic Impact Analysis**

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FEBRUARY 18, 2009

EXECUTIVE SUMMARY

The Loudoun County Office of Capital Construction, representing the County Board of Supervisors, are proposing to reactivate the development plans for the public recreational uses for the Scott Jenkins Memorial Park east of the Town of Hamilton on East Colonial Highway (Va. Business Route 7). The proposed special exception plan proposes 5 recreational fields (4 baseball/softball fields and one rectangular field) and a 250 space regional park and ride lot, located adjacent to the Route 7 bypass in the Catoctin Election District of Loudoun County. The property is approximately 35 acres designated as parcels Pin # 346-35-3765 and 346-36-7436.

Based on the site activities and PHR+A's understanding of the VDOT Traffic Impact Analysis Regulations (VDOT Chapter 527) in Chapter 155 of the Code (section 24VAC30-155-50), the technical analysis is modeled per the VDOT Chapter 527 rezoning guidelines. The County proposes to construct the 250 space park and ride lot and one baseball field for use in 2010. A scoping meeting with County and VDOT staff occurred in December 2008. Based on PHR+A's calculations, the build-out site traffic generation would satisfy the VDOT 527 volume thresholds for the peak hour (250 VPH) and daily trips (2,500 VPD) for non-residential development. Initial uses for the site plan would not trigger a VDOT 527 review.

For this analysis, the traffic study focused on the traffic changes in the study area and highlights:

- Evaluation of existing conditions for the AM, PM and Saturday peak hours on Business Route 7 and relevant intersections in the study area,
- Site Trip Generation derivation based on the methodology in the Institute of Transportation Engineers (ITE) *Trip Generation Manual 8th Edition*, including defaults to higher rates for park uses, reflecting local data,
- Projection of traffic volumes for a design year of 2010 and 2020 with and without the site, and
- Comparison of site access with the collector road requirements in the VDOT Road Design Manual.

The conclusions of this traffic study are as follows:

1. The proposed development generates 199 AM peak period trips and 295 PM peak period trips. Saturday counts are estimated at 168 peak hour trips under full site development.
2. Daily site trip generation would be 1,606 vehicles per day (two-way) and 1,200 VPD on Saturday.
3. Initial site development would generate 184 trips (two-way) and 1,221 daily trips weekday.
4. A single site access north of East Colonial Highway is proposed. A separate right turn slip lane for the bus access is also shown east of the site driveway. Separate left turn lanes are warranted for site access. Signalization is not required.
5. The study area intersections operate at acceptable intersection conditions for the weekday

and weekend peaks except for the Route 9 interchange ramps and the Business Route 7 /Dry Mill Road intersection. These locations have existing LOS deficiencies which will continue with growth and with the proposed land use activities. Mitigation measures are evaluated for the 2020 scenario at on-site and off-site locations based on the subject site impacts. Improvements at the Route 9 interchange ramps are not suggested in conjunction with the proposed application.

6. Off-site intersections will deteriorate in traffic operations with growth and the proposed site activities. The Business Route 7 unsignalized intersection at Dry Mill Road/Route 9 will continue to experience LOS "F" conditions for southbound left turns to Dry Mill Road with or without development. However, the proposed site trips turning at this intersection will operate at LOS "C" or better for the southbound rights on Route 9 (into the site) or eastbound lefts on East Colonial Highway (exiting the site). The Dry Mill Road intersection would require an all-way stop and separate turn lanes to achieve acceptable LOS "D" during the AM peak hour with or without the subject site. The PM peak volumes on westbound Dry Mill Road are high due to traffic bypassing Route 7. If implemented by others, a contribution to turn lanes may be considered as a pro-rata share based on the site impacts to the intersection as part of the second phase of development. If off-site road improvements are implemented.
7. To address increases in traffic to the west, a pro-rata contribution with the full site activities may be considered at the Route 704/Business Route 7 intersection for the long-term conditions. As an option, the analysis considered a mini-roundabout at Route 704/Business Route 7 to satisfy LOS requirements, but would require additional R-O-W and approval by the Town of Hamilton and VDOT. Improvements are not required for the short-term site activities.
8. The two-way Daily link on the site entrance is 1,600 VPD at build-out and 1220 in Phase 1 initial usage. Traffic volumes on Business Route 7 are estimated at 8,700 VPD based on field counts, growth, and site trips.
9. The site impacts at the Route 9 interchange comprise less than 2 percent of the future peak hour volumes. Site impacts at the Route 7 /704 interchange are less than 15 percent.
10. The site access includes turn lanes designed at a 45 MPH speed limit. With the proposed uses, the opportunity to reduce the speed limit from the 45-55 MPH existing designation would be appropriate. The existing designation as a state scenic highway and the 25 MPH speed limit in the town of Hamilton suggest that a reduce design speed should be considered with site design.



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Introduction and Summary

PHR+A has evaluated the intersection operations, site access and site impacts for the proposed development of a 5 field recreational facility and a 250 space park and ride lot. The proposed public park is designated as Scott Jenkins Memorial park. Loudoun County is planning to develop the existing vacant parcel (Pin # 346-35-3765 and 346-36-7436) located north of East Colonial Highway in Loudoun County. The general location of the proposed development is shown in Figure 1. The purpose of the report is to document the site impacts of the proposed uses at the park, with the site characteristics summarized in Table 1. The Scott Jenkins Memorial Park is proposed to be open in 2010 with the park and ride lot and one baseball field.

TABLE 1: SITE DENSITIES

Use	
Current Use	Vacant
Proposed Use	Recreational & Institutional
Current Zoning	AR1
Proposed Density	5 Athletic Fields and 250 Space Commuter Parking Lot

Background Information

The following sections describe the roadway network, site land use and roadway access issues, which are incorporated into the technical analyses. A scoping meeting was held on Wednesday December 3, 2008 at VDOT District offices. PHR+A had prepared a pre-scoping meeting, and Loudoun county provided their traffic study checklist. Supplemental material on growth and trip distribution is also included in Appendix A along with the copy of the VDOT typical pre scoping meeting form.

Previous Studies

The following reports and resources were used to determine traffic growth patterns on the study area roadway network:

- PHR+A, letter to G. Phillips, Loudoun County OTS, "Hamilton Sports Park Special Exception Traffic Impact Study," April 29, 2005.
- VDOT, Traffic Engineering Division, Daily Traffic Volume Estimates including Vehicle Classification Estimates: Jurisdiction Report 53, and
- Loudoun County EDA, 2007Fiscal Impact Committee Guidelines, Table 5

Transportation Improvement Assumptions

At this time, no infrastructure improvements are programmed for the study area roads with public sector funds.

Site Description

The proposed development is located north of East Colonial Highway and opposite the Mount Olive Baptist Church and Gable Farm Lane. The site is east of the Town of Hamilton and west of Canby Road. The site is approximately 35 acres in size. The existing site is vacant with an existing hedgerow bisecting the property. The site context and adjoining parcels are shown in Figure 2.

Comprehensive Plan

The site is designated for rural development. No changes to the existing Comprehensive Plan or County's Transportation Plan are proposed with this development.

Site Zoning

The site is zoned AR1 for low density agricultural uses.

Study Area

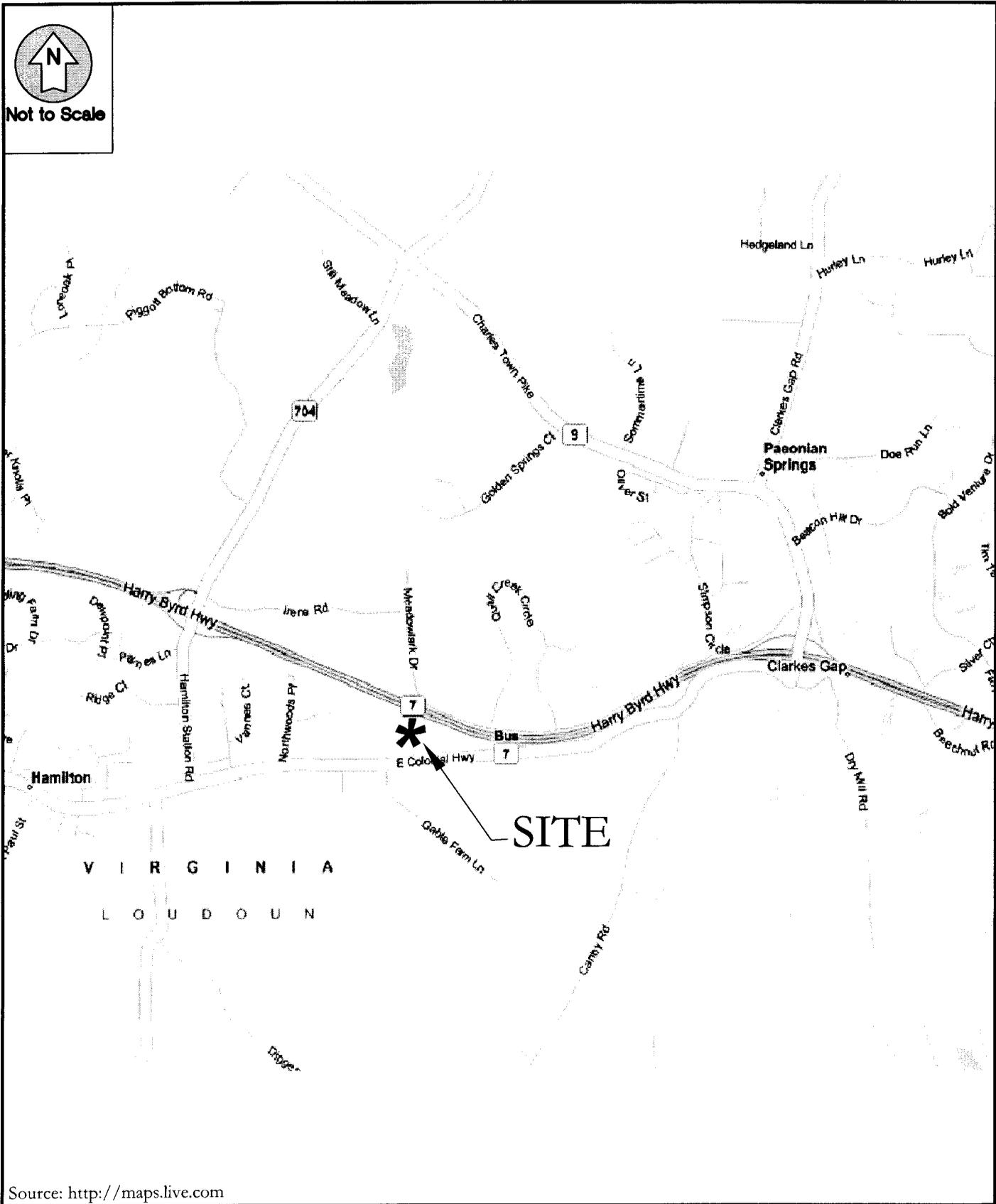
As defined by the scoping study for the property, the through collector road public street intersections on Business Route 7 adjacent to the property were identified as the study area. Additional analysis was requested for the Route 9 interchange ramps to the east at Route 7. Based on the site impacts with the proposed land use activities, PHR+A included the Route 7/Route 704 interchange ramps north of Hamilton, as shown in Figure 3. With site access and two internal intersections, with a total of 10 locations identified as study area intersections.

Site Access Plan

The proposed development is planned with a private driveway north of Business Route 7 to access two parking lots:

- A 250 space commuter lot on the eastern portion of the site, and
- A 261 space parking lot on the western portion of the site for the athletic fields.

Both lots are adjacent to Business Route 7. A separate bus pull off areas is located adjacent to the commuter lot with storage of 2 bus bays. A separate asphalt trail is shown linking the parking lots to the athletic fields on-site. The site access and overall site development plan is depicted in Figure 4.

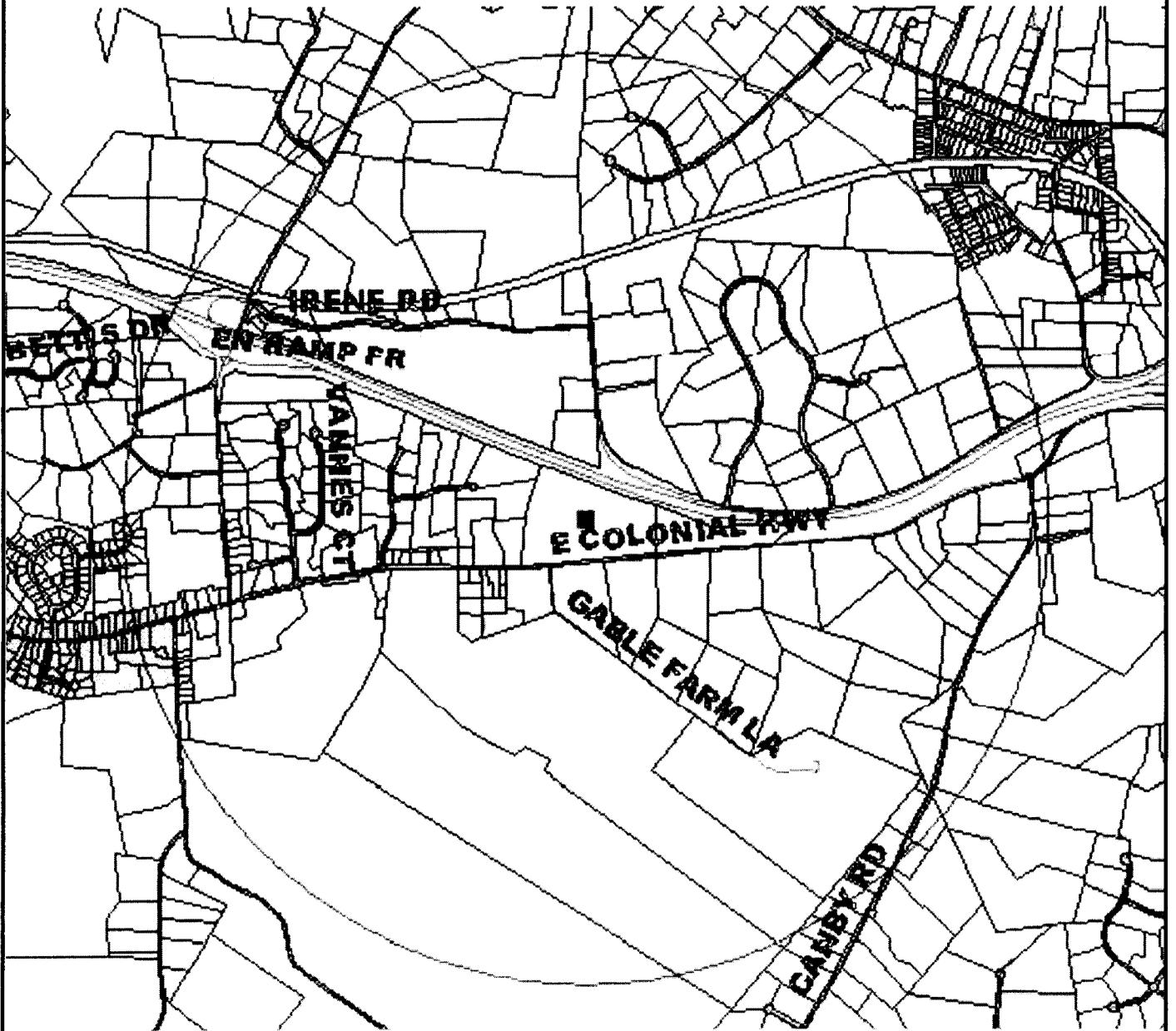
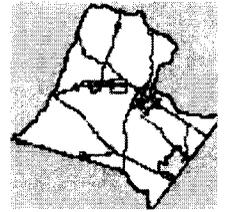


Site Location
Scott Jenkins Memorial Park

FIGURE 1
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Not to Scale



Source: Loudoun County Mapping System



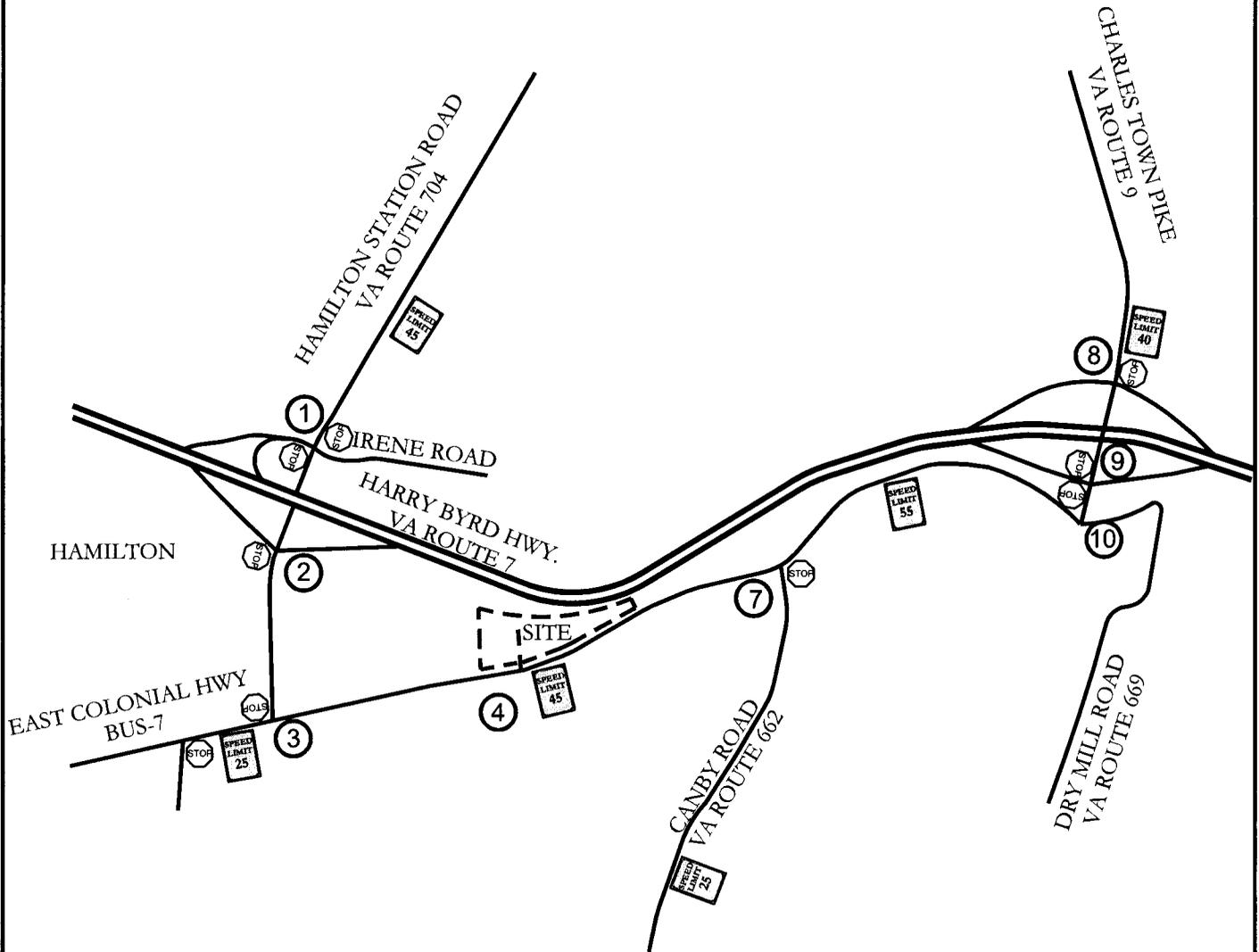
Site Tax Map Scott Jenkins Memorial Park

FIGURE 2

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Not to Scale



LEGEND

-  INTERSECTION NUMBER
-  FUTURE SITE DRIVEWAY
-  STOP SIGN
-  POSTED SPEED LIMIT



Study Area Intersections Scott Jenkins Memorial Park

FIGURE 3

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Nearby Uses

As described in the site description, the immediate vicinity is low density rural residential development. To the west, there are commercial businesses in Hamilton on Business Route 7. The Mount Olive Baptist Church is on the south side of Business Route 7 west of the proposed site. Based on coordination with County OTS staff, no programmed development is envisioned.

Existing Roadway Conditions

The following public roadways are located within the study area and are included in this traffic analysis:

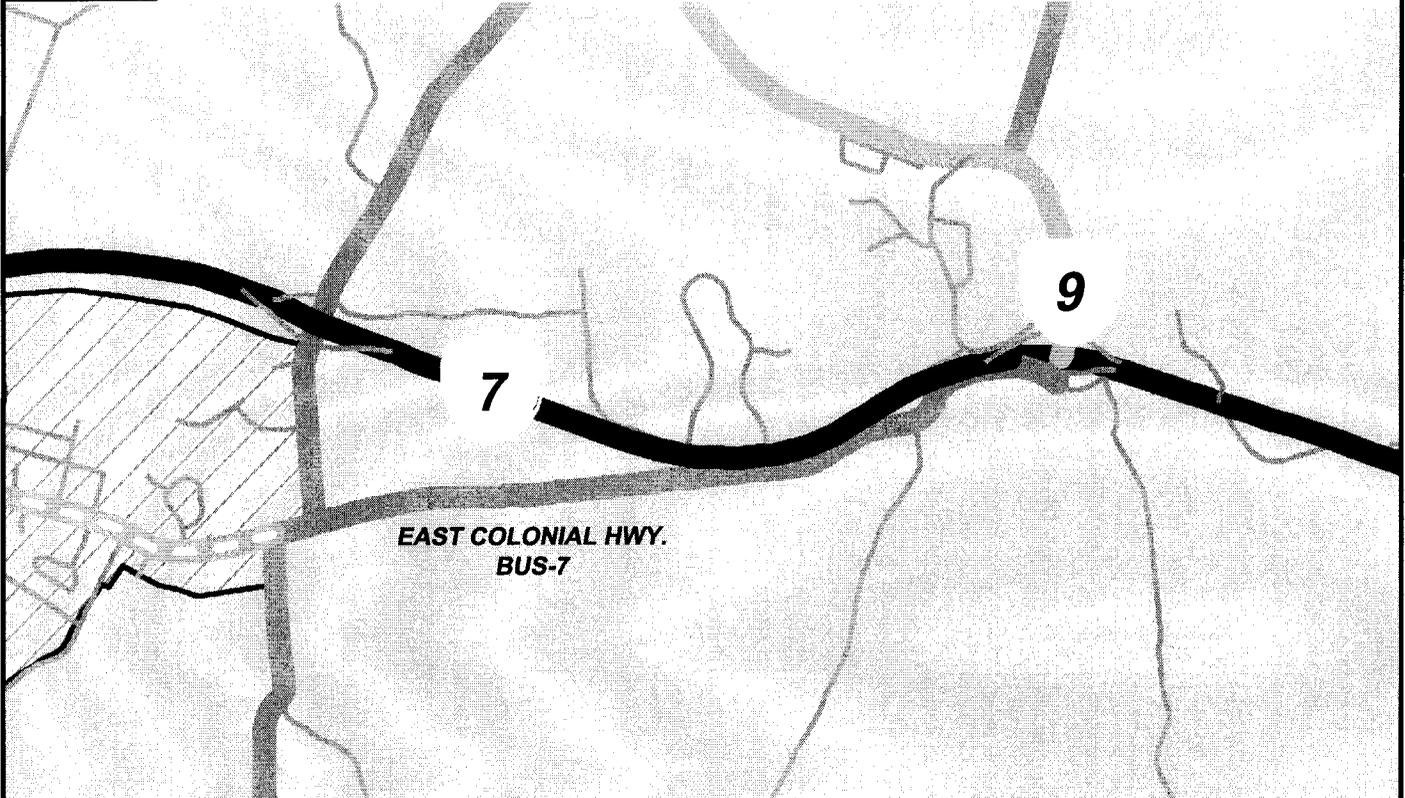
- East Colonial Highway (Business Route 7) – A two lane collector with a posted 55 MPH speed adjacent to the site with a speed reduction to 45 MPH at the middle of the property. To the west of the property line within the town limits, the speed limit 25 MPH. West of Dry Mill Road, the link is designated as a state scenic highway. East of Canby Road, there is an advisory curve signs for 2 curves at 35 MPH. No additional turn lanes are provided and the road is a shoulder section without sidewalks.
- Hamilton Station (Rte 704) – Is a 2 lane collector with a posted 45 MPH speed limit north of Business Route 7. The roadway has a diamond interchange with a NW loop ramp at the VA Route 7 interchange as a two lane section rural section extending to US Route 9.
- Charles Town Pike (Rte 9) – Is a two lane principal arterial north of the study area connecting to Route 7 with a grade separated interchange East of Paeonian Springs. The Route 9 interchange is a diamond configuration with a four lane overpass on Route 9 over Route 7. Route 9 transitions to a 2 lane roadway with turn lanes prior to the signal at Clarks Gap Road (Route 662). To the south, the Dry Mill Road intersection with Business Route 7 is immediately adjacent to the southern ramps (Westbound Route 7 off and on ramps) with stop control on Route 9 (north legs). The W&OD Regional Trail crosses Route 9 at the Dry Mill Road intersection with a high intensity (ladder crosswalk) crosswalk and continues over Route 7 on the west side of Route 9 prior to turning west to Purcellville.
- Harry Byrd Highway (Rte 7) – Is a four lane divided limited access principal arterial north of the site. The lane is programmed in the Countywide CTP for six lanes. Route 7 has a 55 MPH speed limit and has approximately 78 feet of dedication from the eastbound lanes to the site property. No access to the site is provided.

Programmed Improvements/Transportation Facilities

No additional roadway improvements are currently funded or planned. The existing VDOT functional classification of the study area roads are shown in Figure 5. The existing traffic operations are shown in Figure 6. No signals are operating within the study area.



Not to Scale

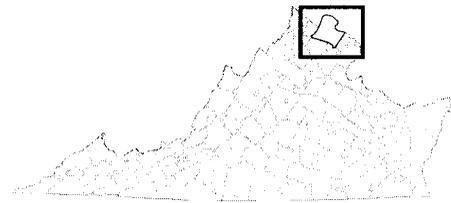


**EAST COLONIAL HWY.
BUS-7**

Proposed	Existing	
		FUNCTIONAL CLASSIFICATIONS
		Urban Interstate
		Urban Freeway & Expressway
		Urban Other Principal Arterial
		Urban Minor Arterial
		Urban Collector
		Rural Interstate
		Rural Other Principal Arterial
		Rural Minor Arterial
		Rural Major Collector
		Rural Minor Collector
		Not Classified, Urban Local, Rural Local
		HIGHWAY ROUTE SIGNS
		Interstate
		US Highway
		VA Primary
		VA Secondary

VIRGINIA HIGHWAY FUNCTIONAL CLASSIFICATION

**LOUDOUN COUNTY
2005 FUNCTIONAL CLASSIFICATION**



Source: VDOT Highway Functional Classification (2005)

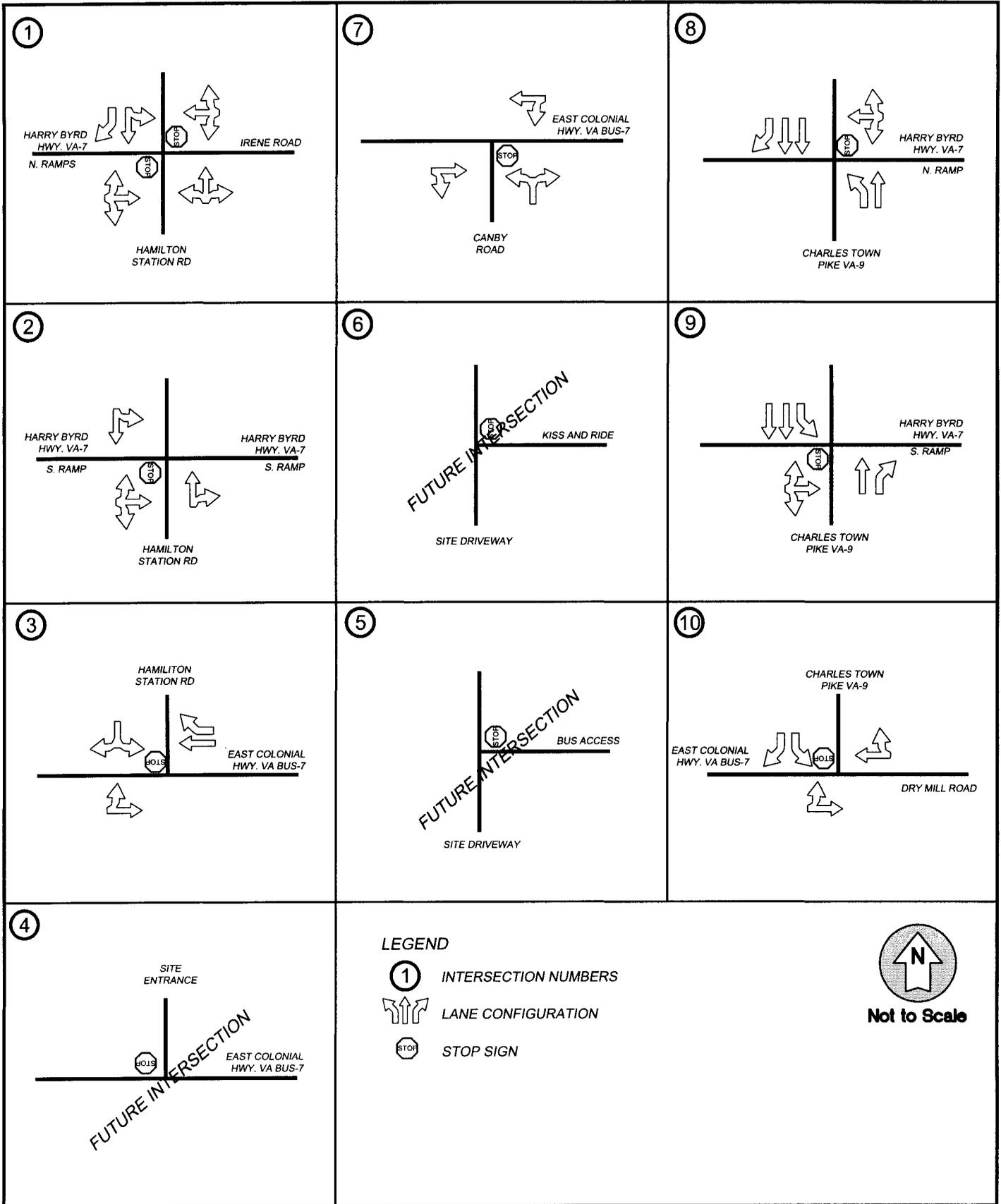


VDOT Roadway Functional Classification
Scott Jenkins Memorial Park

FIGURE 5

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Existing (2008) Roadway Lane Geometry
Scott Jenkins Memorial Park

FIGURE 6
February 2009
13608 2-0

Existing Conditions

Intersection Traffic Volumes

PHR+A collected weekday AM/PM peak period intersection turning movement volumes on East Colonial Highway on Wednesday, December 3, 2008 and Thursday, December 4, 2008 between 6:30 – 9:00 AM and 4:00 – 6:30 PM. Saturday counts were collected between 10:00 AM and 1:00 PM on Saturday, December 6, 2008. The intersection turning movement volumes are included in Appendix B for the following locations:

- Business Route 7/Canby Road,
- Business Route 7/Dry Mill Road/Route 9,
- Charles Town Pike/Route 7 Interchange Ramps (2 locations),
- East Colonial Highway/Hamilton Station Road,
- Route 704/Route 7 Interchange Ramps (2 locations).

Additionally, a road tube was installed during the week of December 8, 2008 to verify daily traffic volumes. The existing traffic conditions are shown in Figure 7A with the peak hour traffic volumes for the study area intersections summarized in Figure 7B. The Saturday volumes are shown in brackets.

Note that the daily volumes for Business Route 7 are less than the VDOT published counts. This is consistent with the PHR+A 2005 counts for the site. However, note that the PM traffic volumes on Dry Mill Road are significantly higher than VDOT published Daily trips, reflecting vehicles diverted from Route 7 for westbound destinations. PHR+A checked an hour spot count on Thursday, December 11, 2008 to clarify if the diversion was typical. Without recorded incidents on Route 7, the PM volumes on Dry Mill Road were consistent with the earlier December counts, which included almost 300 vehicles per hour on westbound Dry Mill Road making a right to northbound Route 9.

Saturday counts on Route 7 were approximately 150 cars less than the weekday peaks on Business Route 7.

Existing 2008 Levels of Service

PHR+A evaluated the intersection operations for the Business Route 7 and study area intersections for the AM, and PM, and Saturday peak period, using the Synchro 7.0 Software with the Highway Capacity Manual (HCM) methodology. The study area intersections operate with a Level of Service (LOS) “D” during the peak periods except for the following side street lane groups.

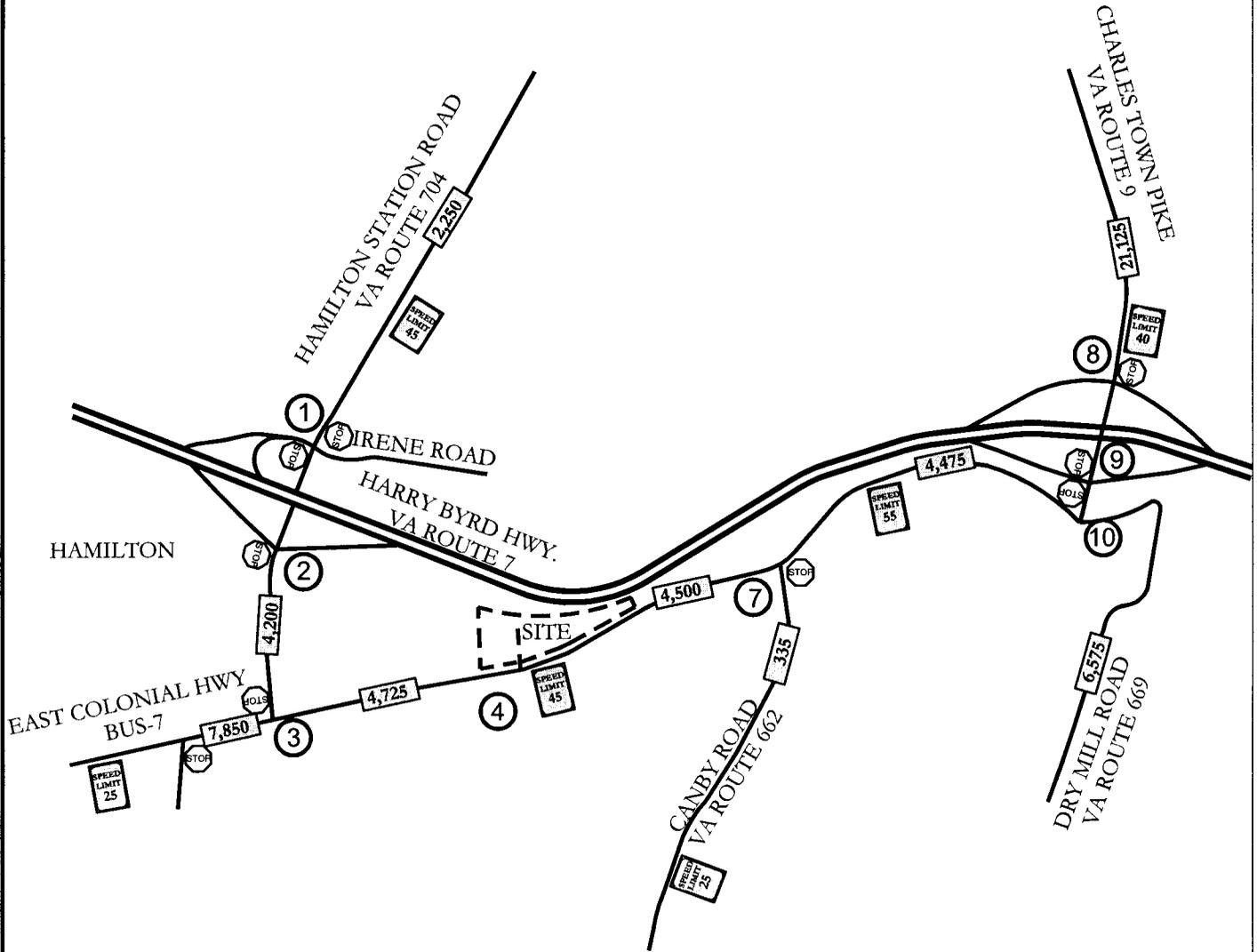
PHR+Δ

- PM peak at the Route 7 westbound exit ramp at Route 9 with a LOS “F” for the ramp. Delay for the single lane ramp is shown even though the right turns are free-flow to Northbound Route 9.
- AM and Saturday peak at LOS “F” for the Route 7 Eastbound exit ramp South of Route 7 at Route 9. The PM peak is at LOS “E”.
- The AM peak Southbound exit at the Business Route 7/Dry Mill Road intersection operated at LOS “F” for the Southbound lefts from Route 9 to Dry Mill Road Eastbound.

The intersection operations including the LOS and delay at the intersection are summarized in Table 2, as well as shown graphically in Figure 7C. The LOS worksheets are included in Appendix C for the existing conditions.



Not to Scale



LEGEND

① INTERSECTION NUMBER

--- FUTURE SITE DRIVEWAY

STOP STOP SIGN

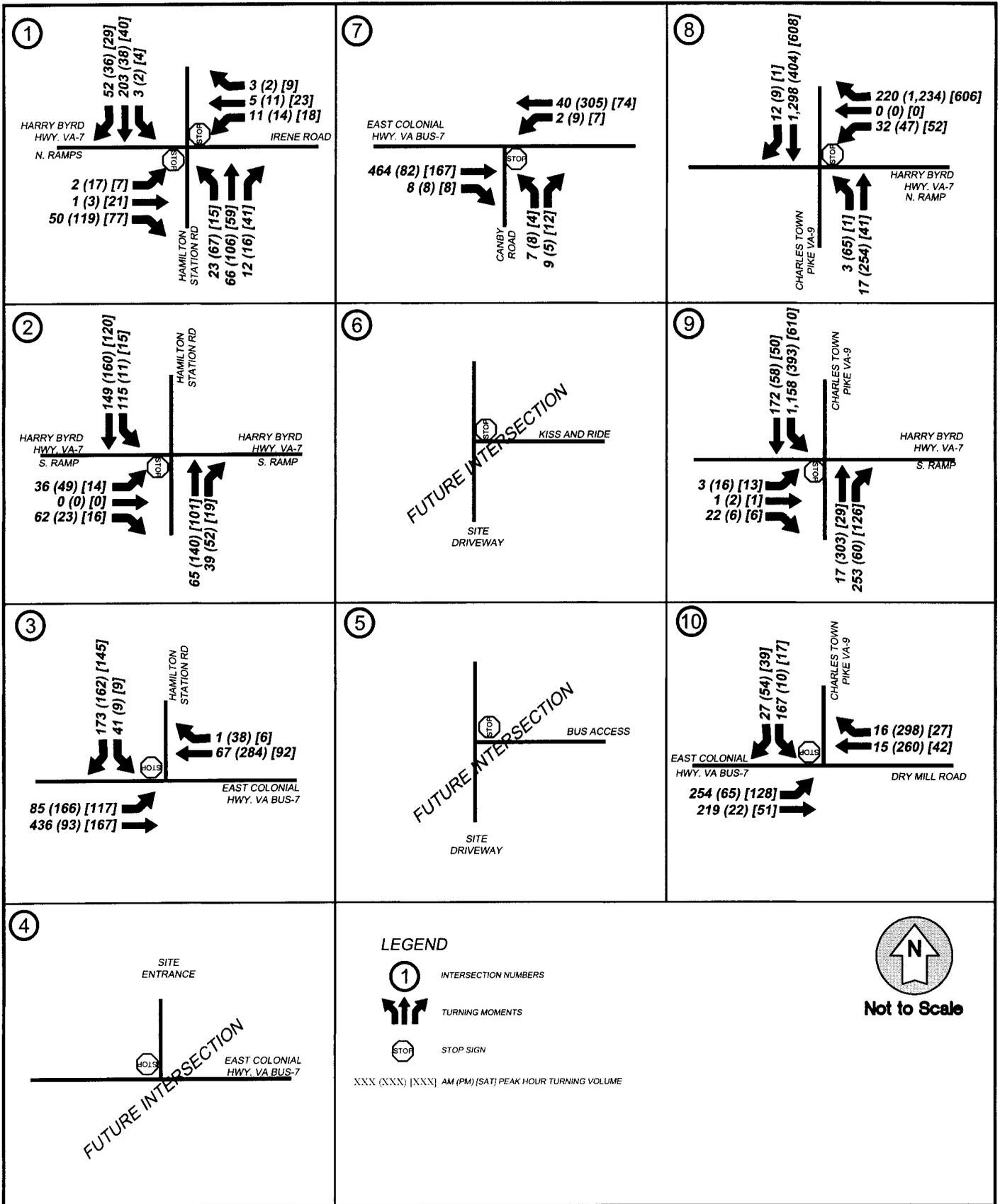
SPEED LIMIT 45 POSTED SPEED LIMIT

ADT 4000 AVERAGE DAILY TRAFFIC VOLUME



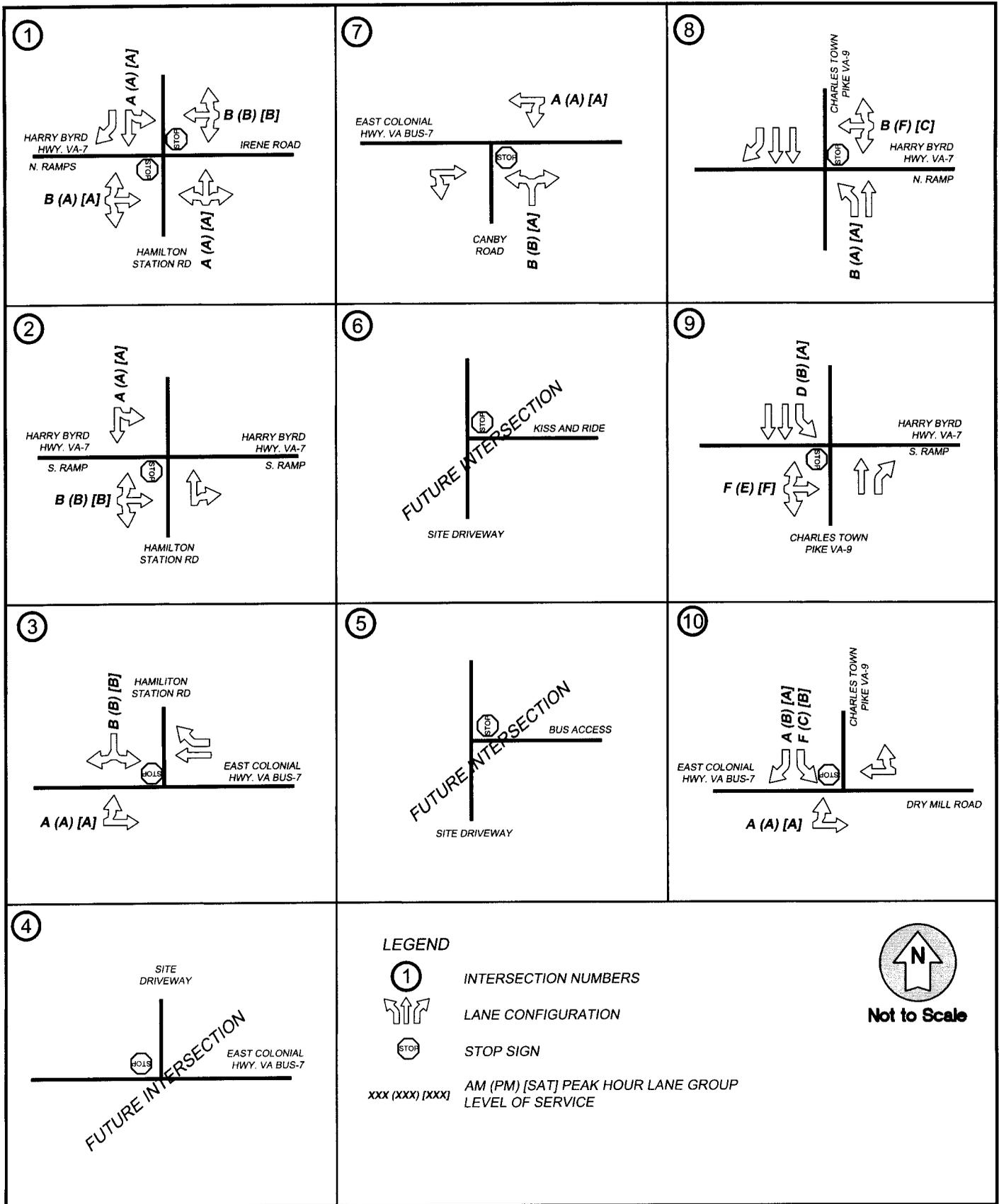
Existing (2008) Traffic Conditions
Scott Jenkins Memorial Park

FIGURE 7A
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Existing Traffic Volumes (2008)
 Scott Jenkins Memorial Park

FIGURE 7B
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Existing (2008) Level of Service
Scott Jenkins Memorial Park

FIGURE 7C
February 2009
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Existing 2008 Intersection Level of Service

Scenario		2008		2008		2008	
Intersection	Lane Group	AM Peak Existing		PM Peak Existing		Sat Peak Existing	
		LOS	Delay	LOS	Delay	LOS	Delay
1 VA RT 7 N Ramps/Irene Rd/Hamilton Station Rd <i>Unsignalized</i>	EBLTR	B	10.1	A	9.8	A	9.6
	EB	B	10.1	A	9.8	A	9.6
	WBLTR	B	12.2	B	13.1	B	10.8
	WB	B	12.2	B	13.1	B	10.8
	NBLTR	A	1.9	A	2.9	A	1
	NB	A	1.9	A	2.9	A	1
SBLT	A	0.1	A	0.4	A	0.7	
2 VA RT 7 S Ramps/Hamilton Station Rd <i>Unsignalized</i>	EBLTR	B	12.1	B	11.7	B	10.1
	EB	B	12.1	B	11.7	B	10.1
	SBLT	A	3.7	A	0.6	A	0.9
	SB	A	3.7	A	0.6	A	0.9
3 E Colonial Hwy/Hamilton Station Rd <i>Unsignalized</i>	EBLT	A	1.8	A	6	A	3.7
	EB	A	1.8	A	6	A	3.7
	SBLR	B	12.3	B	12.6	B	10
	SB	B	12.3	B	12.6	B	10
7 E Colonial Hwy/Canby Road <i>Unsignalized</i>	WBLT	A	0.4	A	0.3	A	0.7
	WB	A	0.4	A	0.3	A	0.7
	NBLR	B	13.8	B	10.7	A	9.8
	NB	B	13.8	B	10.7	A	9.8
8 VA RT 7 N Ramps/VA RT 9 <i>Unsignalized</i>	WBLTR	B	12.2	F	556.7	C	18.7
	WB	B	12.2	F	556.7	C	18.7
	NBL	B	12.2	A	8.6	A	9
9 VA RT 7 S Ramps/VA RT 9 <i>Unsignalized</i>	EBLTR	F	N/A	E	48.1	F	61.3
	EB	F	N/A	E	48.1	F	61.3
	SBL	D	34.9	B	10.3	A	9.8
10 E Colonial Hwy/Dry Mill Rd/VA RT 9 <i>Unsignalized</i>	EBLT	A	5.1	A	7.3	A	5.7
	SBL	F	66.2	C	15.3	B	12
	SBR	A	8.5	B	12.5	A	8.8
	SB	F	58.2	B	13	A	9.8

Alternative Transportation Modes

East Colonial Highway does not have a sidewalk adjacent to the site. The W&OD Regional Bike Trail is north of Route 7 in the study area, with a crossing at the Route 9/Business Route 7/Dry Mill Road intersection east of the site.

Existing Traffic Operations

No additional speed or accident analyses were conducted for this traffic study.

Future Conditions without Development

Description of Methodology for Future Forecasts

Based on the input during the scoping meeting with Loudoun County Transportation staff in consultation with VDOT, the analysis proposed includes the local public street intersections. The following traffic volume changes were factored into the future year design scenario, selected for the design years of 2010 and 2020:

- Ambient Traffic Growth.

Traffic Growth

Based on the averages of growth from previous traffic counts and VDOT Daily growth trends, a 4.0 annual percent growth rate for the through volumes along Business Route 7 was assumed. The growth rate would account for increases in through trips associated with other development. Business Route 7 peak hour historical growth trends are included in Table 3A which show a negative growth in PM peak and Saturday counts. A comparison of turning volumes on East Colonial Highway (Business Route 7) from 2005 to 2008 shows a negative three percent growth over the last 3 years at Canby Road. As shown in Table 3B, the VDOT trends for Routes 7, Route 9, Business Route 7, and Route 704 and average effective growth rates of 10% over 4-6 years. Based on request by Loudoun County OTS staff, PHR+A also reviewed the housing growth trends in the Route 7 corridor west of Leesburg, from the County's Department of Economic Development, as shown in Table 3C. The effective growth residential rate between 2005 and 2008 was 4 percent per years, with long-term growth estimated at 3 percent per year between 2005 and 2020. The combination of the multiple growth resources is less than 3 percent, so the application of an annual growth of 4 percent between 2008 and the future years was assumed.

PHR+A

Since the tube counts resulted in lower Daily trips than VDOT published counts and the previous analyses for the site confirmed the variances in daily counts, PHR+A calculated the K factors for Business Route 7. The calculations from the counts are shown in Table 3D show an effective ratio of 8.9 percent between the PM peak hour and daily trips. PHR+A assumed a 9 percent K factor for this study; noting that the proposed site trips were assigned based on the derived peak hour and daily trip rates.

For the future condition, the ambient growth rate was calculated and added to the roadway volume as shown in Figures 8A (2010) for the initial site access with Scott Jenkins Memorial Park Phase 1 development. The long-term traffic scenario incremental growth is shown in Figure 8B for 2020.

**Business Route 7
Traffic Volume Comparison**

**Peak Hour Intersection Traffic Volume Comparisons
Bus. Rte 7 (East Colonial Hwy) @ Canby Road**

PHR+A 2008 Vs 2005 Traffic Volumes

<u>Year</u>	<u>PM PEAK Traffic (1)</u>	<u>Average Growth %</u>	<u>Year</u>	<u>SAT PEAK Traffic (1)</u>	<u>Average Growth %</u>
2008 (2)	377	-5.0%	2008 (2)	259	-0.5%
2005 (3)	440		2005 (3)	263	

Notes: (1) Peak Hour Canby Road Intersection Traffic Volumes at BUS-7/Canby Road
 (2) PHR+A December 2008 Traffic Counts at Canby Road on 12/3/08 and 12/6/08
 (3) Source: PHR+A April 2005 Traffic Counts at Canby Road and BUS Route-7 Intersection

**Peak Hour Intersection Traffic Volumes
At BUS Rte-7 (East Colonial Hwy), West of Canby Road**

PHR+A 2008 Vs 2005 Intersection Traffic Volumes

<u>Year</u>	<u>PM PEAK Traffic (1)</u>	<u>Growth %</u>
2008 (1)	394	-2.9%
2005 (2)	431	

Notes: (1) Peak Hour RT 7/West of Canby Road Tube Intersection Traffic Volumes
 (2) PHR+A December 2008 Tube Counts on 12/10/08
 (2) Source: PHR+A April 2005 Tube Counts at RT 7/West of Canby Road

Table 3B
Historical Daily Traffic Volumes

Daily Traffic Growth Trends
VA Route 7 Harry Flood Byrd Hwy
between Hamilton Station Road & VA9/Bus Route 7 Clarkes Gap, Loudoun County

YEAR	AADT	Effective Growth Rate	Effective Growth Rate (5YR)	Effective Growth Rate (4YR)
2007	39,000	-2.5%	5.4%	6.8%
2006	40,000	2.6%	10.8%	7.5%
2005	39,000	11.4%		12.9%
2004	35,000	16.7%		
2003	30,000	0.0%		
2002	30,000	25.0%		
2001	24,000			
Average Growth Rate		8.9%	8.1%	9.0%

Daily Traffic Growth Trends
Route 9 Charles Town Pike
between Hamilton Station Road & Bus Route 7, Loudoun County

YEAR	AADT	Effective Growth Rate	Effective Growth Rate (5YR)	Effective Growth Rate (4YR)
2007	24,000	9.1%	8.4%	7.5%
2006	22,000	4.8%	9.5%	8.3%
2005	21,000	10.5%		10.7%
2004	19,000	5.6%		
2003	18,000	12.5%		
2002	16,000	14.3%		
2001	14,000			
Average Growth Rate		9.5%	9.0%	8.8%

Daily Traffic Growth Trends
Bus Route 7 West Colonial Hwy
between ECL Hamilton VA Route 9 Clarkes Gap, Loudoun County

YEAR	AADT	Effective Growth Rate	Effective Growth Rate (5YR)	Effective Growth Rate (4YR)
2007	12,000	9.1%	13.0%	14.4%
2006	11,000	10.0%	16.2%	14.1%
2005	10,000	31.6%		17.8%
2004	7,600	8.6%		
2003	7,000	7.7%		
2002	6,500	25.0%		
2001	5,200			
Average Growth Rate		15.3%	14.6%	15.4%

Daily Traffic Growth Trends
Route 704 Hamilton Station Road
between SR Bus 7-East and Ramp to SR-7, Loudoun County

YEAR	AADT	Effective Growth Rate	Effective Growth Rate (5YR)	Effective Growth Rate (4YR)
2007	5,100	8.5%	7.8%	6.9%
2006	4,700	4.4%	9.4%	7.6%
2005	4,500	7.1%		10.7%
2004	4,200	7.7%		
2003	3,900	11.4%		
2002	3,500	16.7%		
2001	3,000			
Average Growth Rate		9.3%	8.6%	8.4%

SOURCE: VDOT, Traffic Engineering Division, VDOT Average Daily Volume Estimates Including Vehicle Classification Estimates, Jurisdiction Report 53.
Average of data points 10.4%

Table 3C Route 7 West Housing Growth Trends

Housing Trends Route 7 Sub Area

YEAR	Census Data	Effective Growth Rate (2005 to 2008)	Effective Growth Rate (2008 to 2010)	Effective Growth Rate (2008 to 2015)	Effective Growth Rate (2008 to 2020)
2020	10,250				2.7%
2015	8,567			2.0%	
2010	7,657		1.5%		
2008	7,437	4.2%			
2005	6,565				

SOURCE: Loudoun County Government, 2007 Fiscal Impact Committee Guidelines, Table 5

Average of data points 2.6%
 Effective Growth 2005-2020 3.0%

Average of data points (peak hour counts, VDOT historical trends, County housing trends) 2.8%

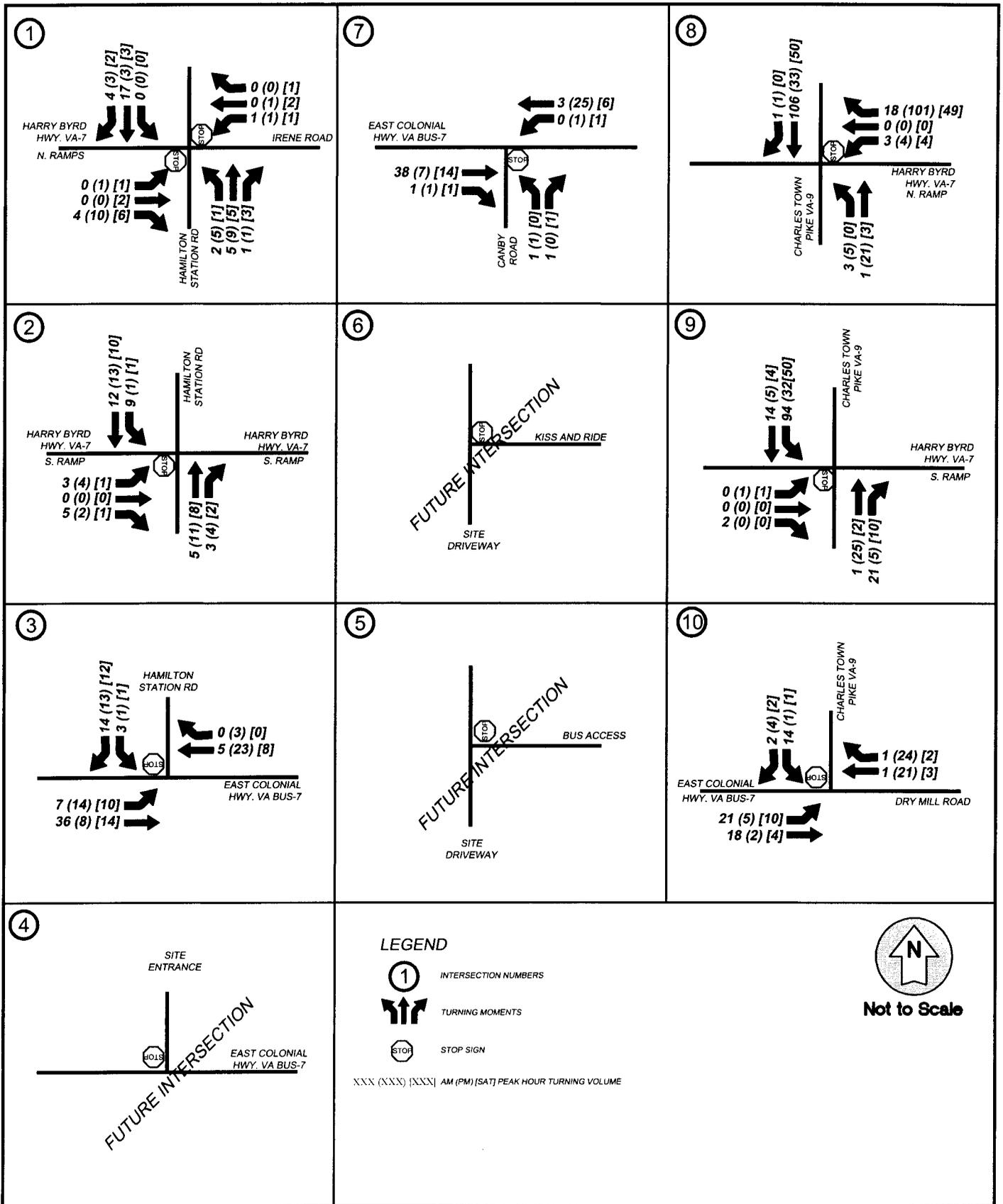
Proposed annual traffic growth 4.0%

Table 3D
East Colonial Hwy K Factors

Rte 7 Peak Hour K-Factor Calculations

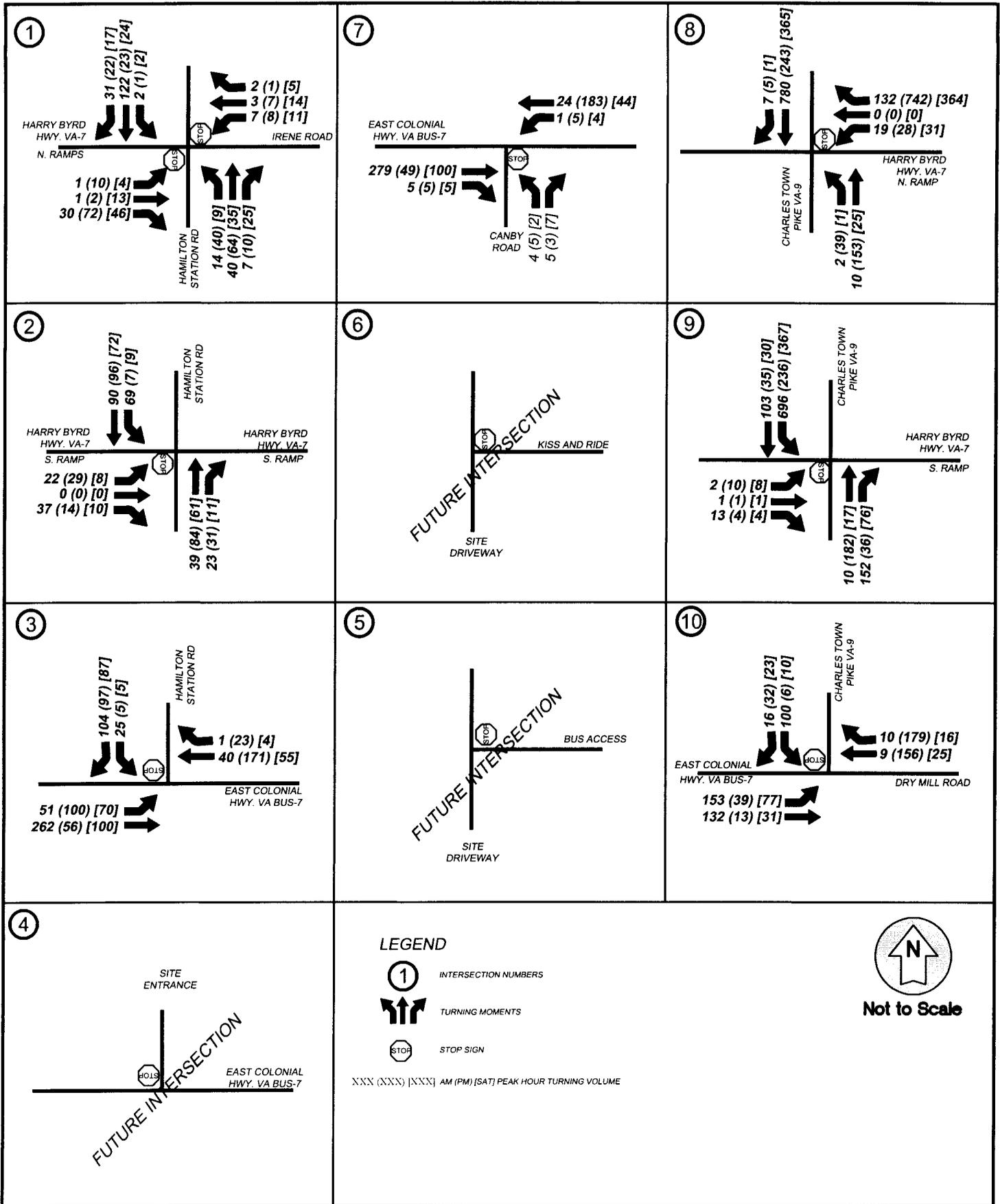
YEAR		Peak Counts	Daily Volume	K-Factor
2008	(1)	394	3994	9.9%
2005	(2)	431	4673	9.2%
2008	(3)	308	3994	7.7%
			Average	8.9%

- SOURCE:**
- (1) PHR+A Tube Traffic Counts at BUS Rte-7 Wednesday, Dec 10, 2008
 PM Peak Between 6:15- 7:15 PM, raw data
 - (2) PHR+A Tube Traffic Counts at BUS Rte-7 April, 2005
 - (3) PHR+A Tube Traffic Counts at BUS Rte-7 Dec, 2008
 PM Peak Between 5:15- 6:15 PM (Manual count roadway peak)



Incremental Growth - 2010
 Scott Jenkins Memorial Park

FIGURE 8A
 February 2009
 13608 2-11



Incremental Growth - 2020
 Scott Jenkins Memorial Park

FIGURE 8B
 February 2009
 13608-2.0

Background 2010 Levels of Service without Development

With growth, the future daily traffic volumes are shown in Figure 9A for the 2010 design scenario. The background peak hour turning volumes for the AM/PM peaks for the weekday and Saturday peak for the weekends are summarized in Figure 9B.

The effective intersection operations are summarized in Figure 9C for 2010 without the subject site. Based on the HCM Methodology in Synchro 7.0 Software, all intersection lane groups operate at LOS “C” or better except for the following:

- PM peak and secondary peak lefts in the Westbound exit at Route 7/9 interchange (LOS “F”);
- All lefts at the South ramp at the Route 7/9 interchange; and
- AM Southbound lefts at the Route 9/Route 7/Dry Mill Road intersection (LOS “F”).

The LOS grades reflect existing conditions. The capacity worksheets are shown in Appendix D.

Background 2020 Levels of Service without Development

To determine the impact of the proposed uses, traffic conditions were projected for the next 12 years (from 2008). It was assumed that the site build-out year would be 2020. The background 2020 daily traffic volumes are shown in Figure 10A with the peak volumes with Saturday peaks shown in Figure 10B.

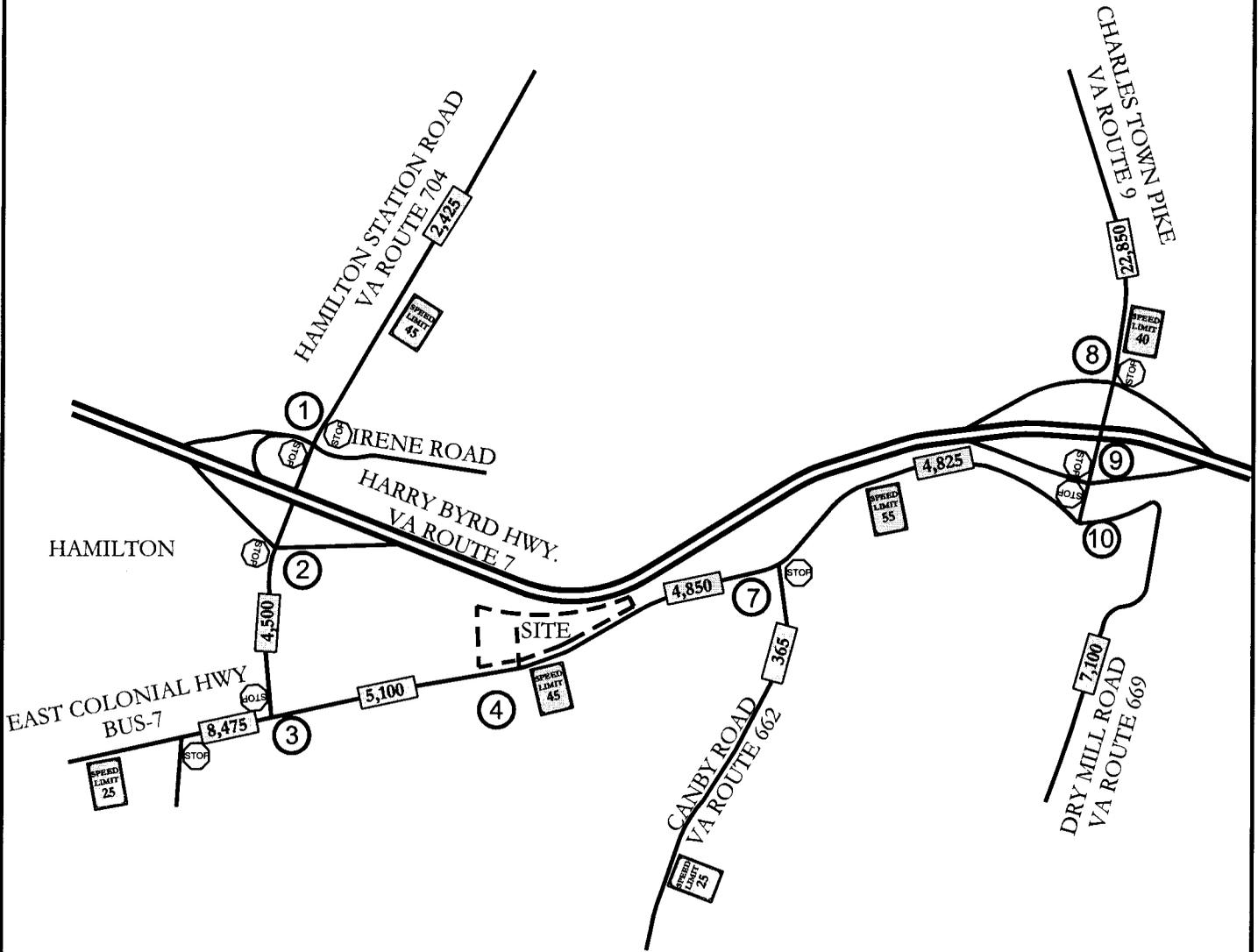
PHR+A evaluated the intersection operations for the study area intersections for the AM, PM and Saturday peak period, using the Synchro 7.0 Software with the Highway Capacity Manual (HCM) methodology. The Route 9 interchange ramps continues to operate below capacity with a Level of Service (LOS) “F” during both the peak periods and the side street lane group delays of over 800 seconds for the existing left turns at the ramp. The AM southbound left at Dry Mill Road operates at LOS “F” at Business Route 7. All other intersection lane groups operate with a LOS “C” or better for the public street turns. The analysis results are summarized in Table 4B and are also included in Figure 10C. The capacity worksheets are included as Appendix E.

Background 2010 Intersection Level of Service

Scenario		2010		2010		2010	
Intersection	Lane Group	AM Peak Background		PM Peak Background		Sat Peak Background	
		LOS	Delay	LOS	Delay	LOS	Delay
1 VA RT 7 N Ramps/Irene Rd/Hamilton Station Rd <i>Unsignalized</i>	EBLTR	B	10.2	A	9.9	A	9.7
	EB	B	10.2	A	9.9	A	9.7
	WBLTR	B	12.6	B	13.7	B	11
	WB	B	12.6	B	13.7	B	11
	NBLTR	A	2	A	2.9	A	1
	NB	A	2	A	2.9	A	1
SBLT	A	0.1	A	0.4	A	0.7	
2 VA RT 7 S Ramps/Hamilton Station Rd <i>Unsignalized</i>	EBLTR	B	12.7	B	12	B	10.2
	EB	B	12.7	B	12	B	10.2
	SBLT	A	3.8	A	0.6	A	0.9
	SB	A	3.8	A	0.6	A	0.9
3 E Colonial Hwy/Hamilton Station Rd <i>Unsignalized</i>	EBLT	A	1.9	A	6.2	A	3.8
	EB	A	1.9	A	6.2	A	3.8
	SBLR	B	13	B	13.3	B	10.2
	SB	B	13	B	13.3	B	10.2
7 E Colonial Hwy/Canby Road <i>Unsignalized</i>	WBLT	A	0.4	A	0.3	A	0.8
	WB	A	0.4	A	0.3	A	0.8
	NBLR	B	14.3	B	11	A	9.9
	NB	B	14.3	B	11	A	9.9
8 VA RT 7 N Ramps/VA RT 9 <i>Unsignalized</i>	WBLTR	B	13	F	679.1	C	22.6
	WB	B	13	F	679.1	C	22.6
	NBL	B	12.9	A	8.8	A	9.2
9 VA RT 7 S Ramps/VA RT 9 <i>Unsignalized</i>	EBLTR	F	N/A	F	64.8	F	88.3
	EB	F	N/A	F	64.8	F	88.3
	SBL	F	60.7	B	10.8	B	10.2
10 E Colonial Hwy/Dry Mill Rd/VA RT 9 <i>Unsignalized</i>	EBLT	A	5.2	A	7.5	A	5.7
	SBL	F	105.8	C	16.2	B	12.3
	SBR	A	8.6	B	13	A	8.8
	SB	F	92.4	B	13.5	A	9.9



Not to Scale



LEGEND

① INTERSECTION NUMBER

--- FUTURE SITE DRIVEWAY

STOP SIGN

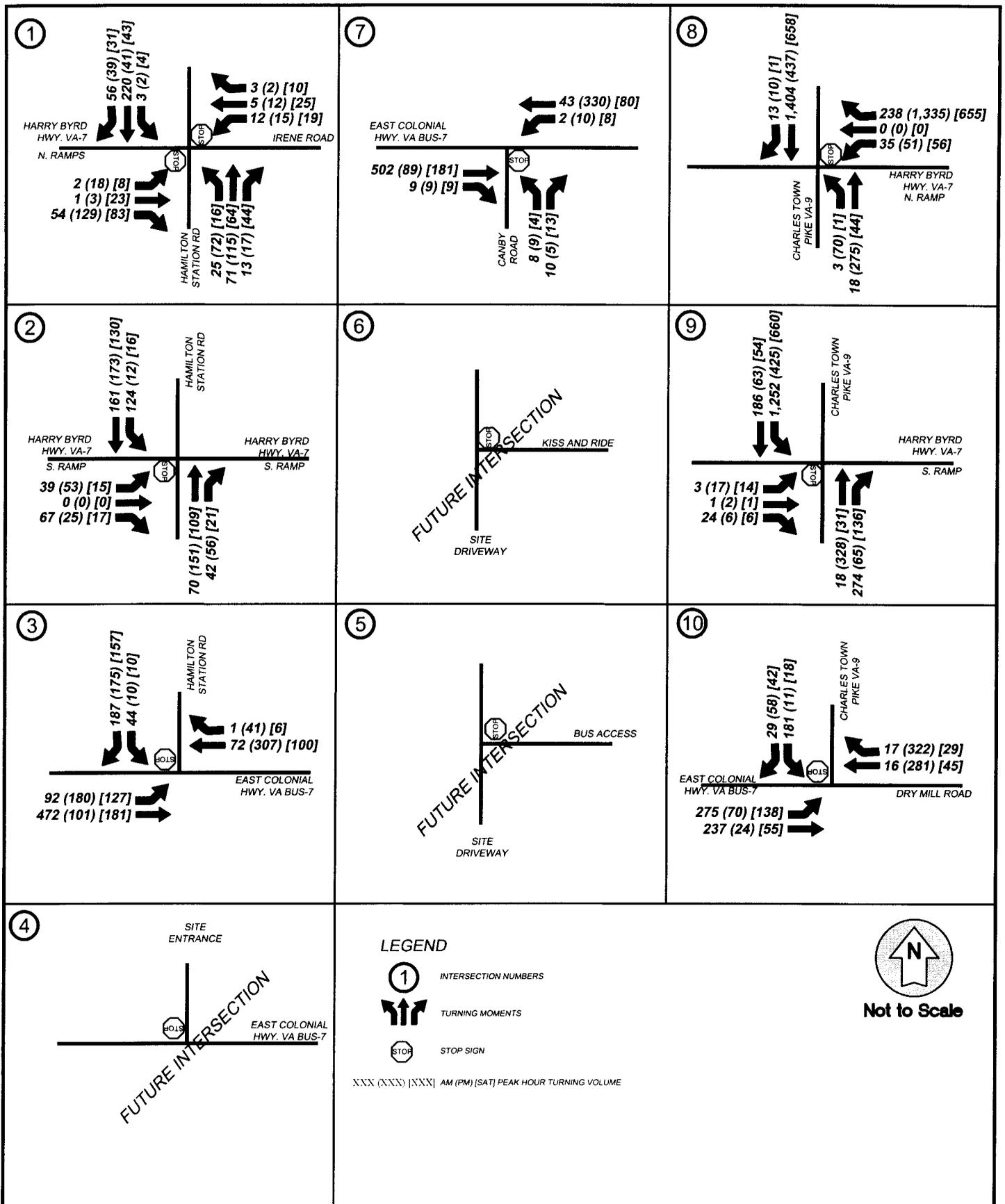
SPEED LIMIT 45 POSTED SPEED LIMIT

ADT 4000 AVERAGE DAILY TRAFFIC VOLUME



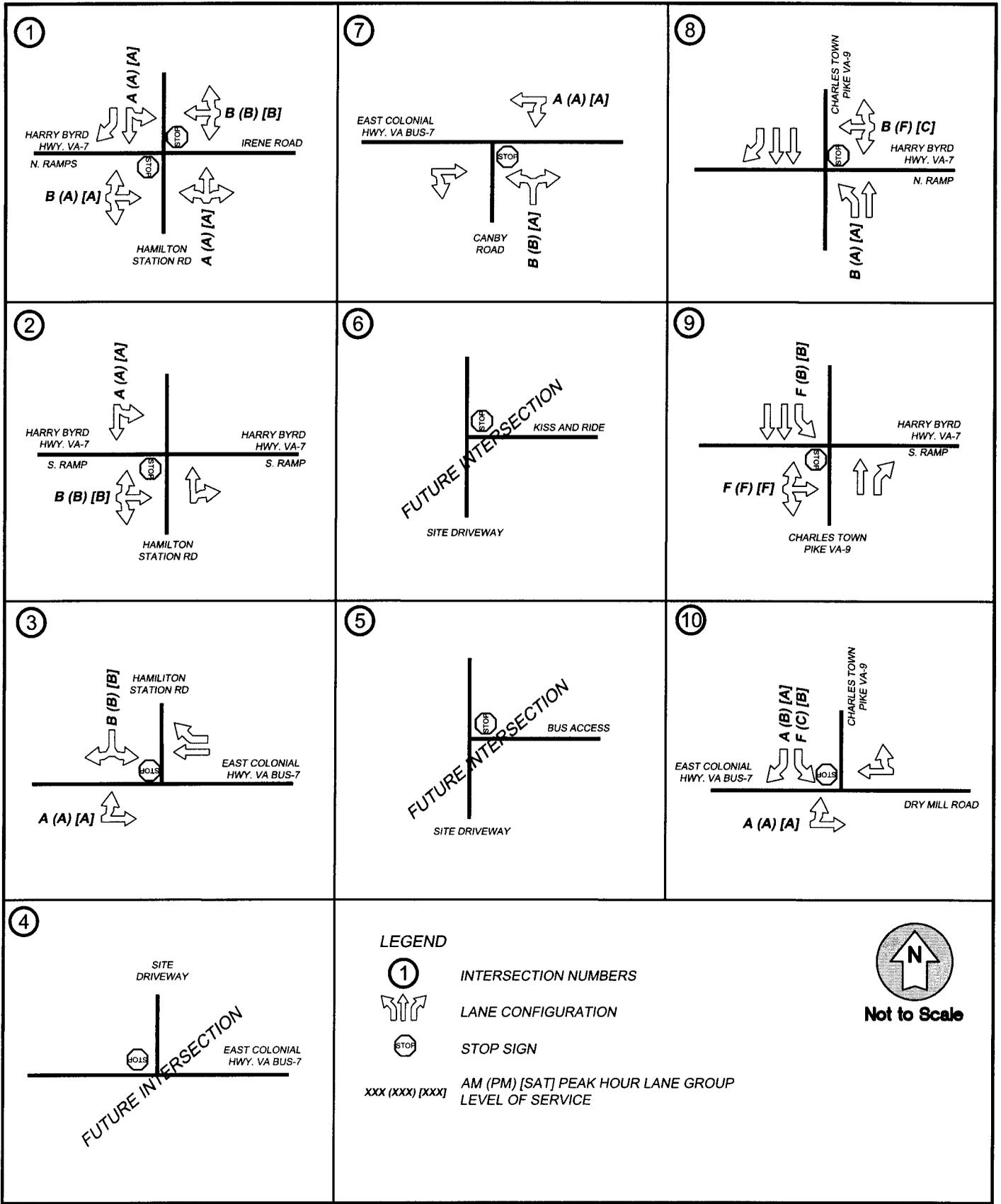
Background (2010) Traffic Conditions
Scott Jenkins Memorial Park

FIGURE 9A
February 2009
13608-2-0



Background (2010) Traffic Volumes
Scott Jenkins Memorial Park

FIGURE 9B
February 2009
13608-2-0



Background (2010) Level of Service
Scott Jenkins Memorial Park

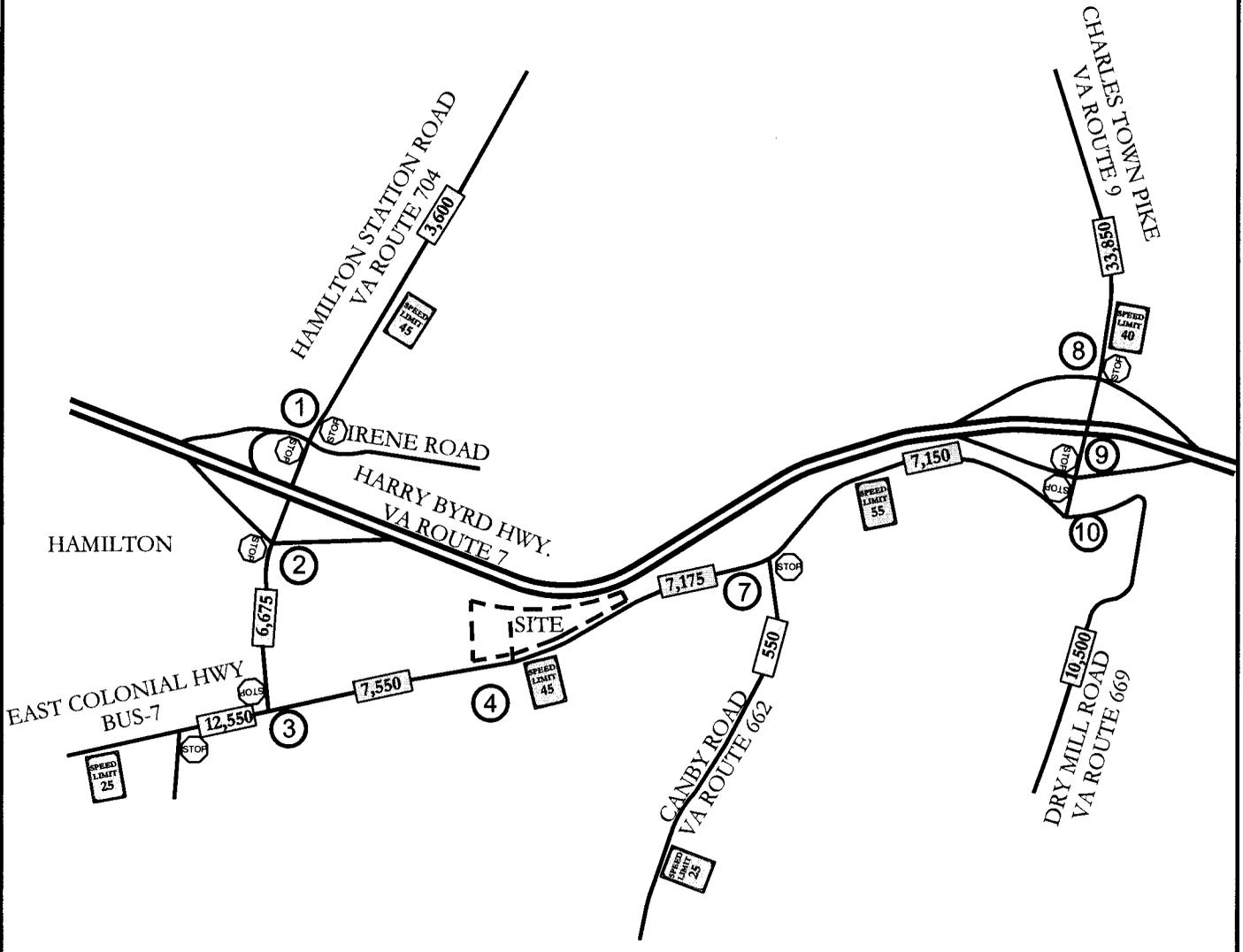
FIGURE 9C
February 2009
13608-2-0

Background 2020 Intersection Level of Service

Scenario		2020		2020		2020	
Intersection	Lane Group	AM Peak Background		PM Peak Background		Sat Peak Background	
		LOS	Delay	LOS	Delay	LOS	Delay
1 VA RT 7 N Ramps/Irene Rd/Hamilton Station Rd <i>Unsignalized</i>	EBLTR	B	11.5	B	11.3	B	10.5
	EB	B	11.5	B	11.3	B	10.5
	WBLTR	C	16.1	C	18.7	B	12.9
	WB	C	16.1	C	18.7	B	12.9
	NBLTR	A	2.1	A	3.1	A	1.1
	NB	A	2.1	A	3.1	A	1.1
	SBLT	A	0.2	A	0.4	A	0.7
2 VA RT 7 S Ramps/Hamilton Station Rd <i>Unsignalized</i>	EBLTR	C	18.7	C	15.7	B	11.3
	EB	C	18.7	C	15.7	B	11.3
	SBLT	A	4.1	A	0.6	A	1
	SB	A	4.1	A	0.6	A	1
3 E Colonial Hwy/Hamilton Station Rd <i>Unsignalized</i>	EBLT	A	2.5	A	7.6	A	4.2
	EB	A	2.5	A	7.6	A	4.2
	SBLR	D	26.2	C	23.4	B	12
	SB	D	26.2	C	23.4	B	12
7 E Colonial Hwy/Canby Road <i>Unsignalized</i>	WBLT	A	0.5	A	0.3	A	0.8
	WB	A	0.5	A	0.3	A	0.8
	NBLR	C	18.9	B	12.7	A	10.7
	NB	C	18.9	B	12.7	A	10.7
8 VA RT 7 N Ramps/VA RT 9 <i>Unsignalized</i>	WBLTR	D	28.7	F	N/A	F	155.3
	WB	D	28.7	F	N/A	F	155.3
	NBL	C	20.1	A	9.9	B	10.6
9 VA RT 7 S Ramps/VA RT 9 <i>Unsignalized</i>	EBLTR	F	N/A	F	1061.3	F	N/A
	EB	F	N/A	F	1061.3	F	N/A
	SBL	F	364.2	C	18.7	C	17.8
10 E Colonial Hwy/Dry Mill Rd/VA RT 9 <i>Unsignalized</i>	EBLT	A	6	A	9.3	A	6
	SBL	F	881.6	C	24.8	C	15.6
	SBR	A	8.7	C	17.4	A	9.1
	SB	F	760.5	C	18.6	B	11.1



Not to Scale



LEGEND

① INTERSECTION NUMBER

--- FUTURE SITE DRIVEWAY

STOP STOP SIGN

SPEED LIMIT 45 POSTED SPEED LIMIT

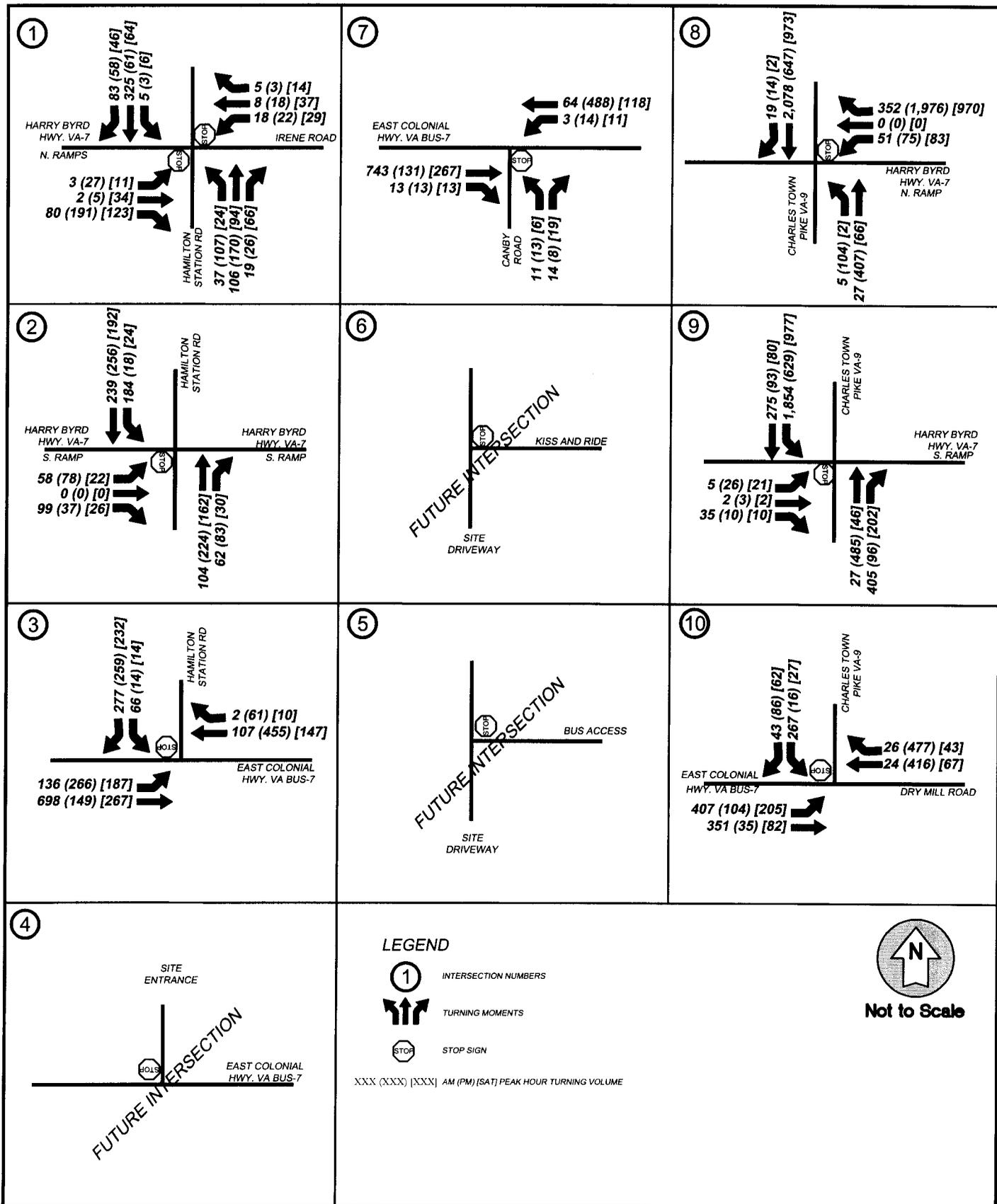
ADT 4000 AVERAGE DAILY TRAFFIC VOLUME



Background (2020) Traffic Conditions
Scott Jenkins Memorial Park

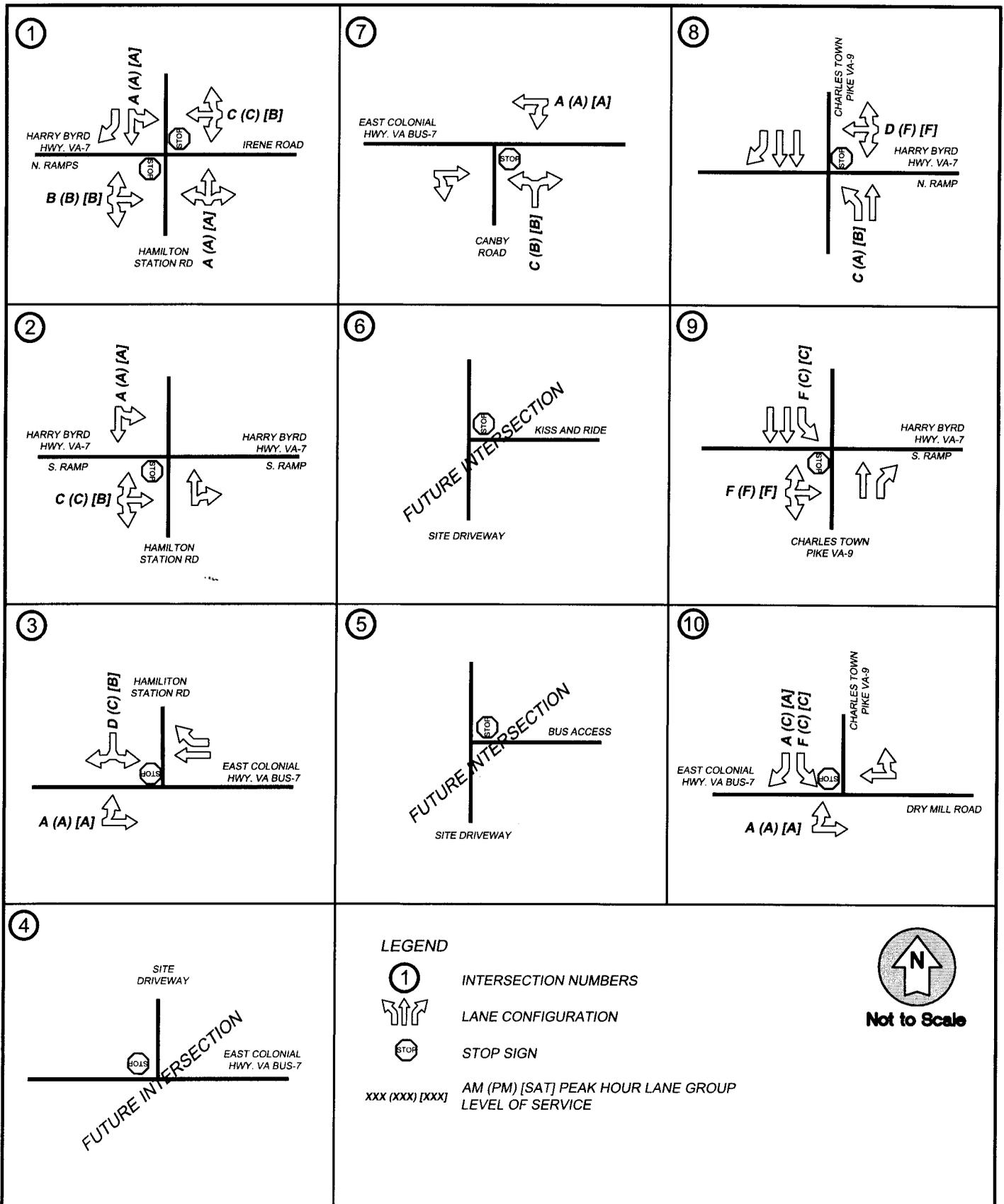
FIGURE 10A

February 2009
13608.2-0



Background (2020) Traffic Volumes Scott Jenkins Memorial Park

FIGURE 10B
February 2009
13608.2.0



Background (2020) Level of Service
Scott Jenkins Memorial Park

FIGURE 10C
February 2009
13408-2-0

Site Trip Generation

Trip generation for the site is based on the maximum development of the site with 5 athletic fields and 250 commuter parking spaces.

The ITE (Institute of Transportation Engineers) Trip Generation Manual – 8th Edition does include trip generation rates for parks, City Parks, County Parks, regional parks, recreation centers and soccer fields. The effective trip rates are often expressed in terms of variables based on acreages, employees, or picnic sites. The effective rates for County or regional parks generate lower than anticipated traffic volumes, based on the expected use for sports fields. Since ITE does not have a use designation for sports park, PHR+A identified the need to develop trips based on the unique traffic activities associated with similar land uses. Based on our professional experience, field counts, and review of our local data, including traffic counts for similar facilities in Fairfax County, and review of traffic studies by others for sites in Loudoun County, and Maryland, PHR+A derived a trip rate based on the number of fields, which is proportional to the potential turnover of the proposed on-site parking spaces for the site. Table 5 shows a comparison of trip rates for comparable land use types from various sources.

In order to evaluate the PM peak period trips and daily trips for the facility, PHR+A utilized the trip rates from the traffic impact study for the Fauquier Northern Area Park, prepared by Kellerco, near Marshall, Virginia, which included field counts at Franklin Park, located West of Purcellville in Loudoun County, Virginia. Saturday peak period trips and daily trips for the facility was incorporated based on ITE trip rates for Saturday peak periods.

The application of the highest trip rates per field accounts for peak usage for both PM and Saturday conditions. The effective trip rates account for the ITE trip generation rates for soccer fields, which are higher than the trip rates per field in ITE for County or regional parks. Note that the proposed use is for 1 large baseball, 3 small softball fields, and 1 rectangular field, so the peak trips are conservative to maximize trips and evaluate turn lane requirements.

Based on the VDOT Chapter 527 Trip Generation requirements, PHR+A reviewed the R² values for the independent variables data in the *Trip Generation*, 8th Edition, published by the Institute of Transportation Engineers (ITE). Based on the R² values and the standard deviation values, PHR+A utilized the average trip rates for AM, PM and Saturday peak periods. Saturday daily trip rates are based on the ratio in favor of 0.14 based on the Saturday maximum for soccer fields. This equates to approximately 4.0 trips per parking spaces.

For the Park and Ride uses, ITE Code 90 was used. Based on the site spaces, the parking lot use development generates 180 AM peak period, 155 PM peak period and 1,125 daily trips (both in and out). Saturday trips are estimated at zero. The commuter lot could be used by park users on the weekend. Total trips are 199 AM, 295 PM, and 168 trips (2 way) on Saturday.

PHR+A also evaluated the VDOT Chapter 527 requirement based on peak period volumes and daily traffic conditions from the 'VDOT Revised Traffic Impact Analysis Regulations Administrative Guidelines (24VAC30-155)' dated July 2008. A Chapter 527 study is warranted based on the peak period increase for a rezoning/site plan submittal for non-residential uses at full build-out of the special exception. PHR+A summarized the peak hour calculations for 527 compliance in Table 6. Even if PHR+A had defaulted to the average soccer complex rate (PM trips at 103 vehicles), the combination of trips with the park and ride lot would satisfy the 527 requirements at build-out.

The trips for the park assume approximate 30 acres of athletic fields to calculate the trips based on the average variable. However, we suggest the fields variable is the best trip indicator.

The trips for the park and ride lot show a breakdown of peak period bus trips. The site is designed to accommodate two on-site bus bays and the Loudoun County Office of Transportation Services (OTS) expect to run 12 trips to the East between 4:55 AM and 7:35 AM with 2-15 minute headway before 7:00 AM.

PM trips account for 18 bus arrivals between 5:00 PM and 8:25 PM with headways of between 4-20 minutes to 7:30 PM. To be conservative, PHR+A included 6 AM and 8 PM directional trips and subtracted the bus trips from the ITE trip rates to get the net car counts for the park and ride lot. Note that the peak hour of the park and ride lot is assumed to overlap with the peak hour of the roadways to be conservative.

Short-Term Trip Generation

The site plan for initial activities envisions the construction of the large baseball field with parking plus the 250 space park and ride lot.

Using the same methodology to develop the trips (i.e., determine max peak hour rates for the recreational facility), the Phase 1 site plan trip generation is summarized in Table 7. The effective site impacts for 1 field and the commuter parking lot would equate to 184 AM trips, 183 PM trips, and 1,221 daily trips. (Two-way both in and out). The Saturday counts are 34 trips in the peak and 243 daily trips, with one field.

Table 5
Trip Generation Variables

<i>ITE Land Use (1)</i>				<i>AM PEAK HOUR</i>			<i>PM PEAK HOUR</i>			<i>DAILY</i>	
<i>CODE</i>	<i>CODE</i>	<i>DENSITY</i>	<i>Var.</i>	<i>USE</i>	<i>IN</i>	<i>OUT</i>	<i>TOTAL</i>	<i>IN</i>	<i>OUT</i>	<i>TOTAL</i>	<i>(2-way)</i>
Weekday											
488	488.0	5 fields		Soccer Complex	4	3	7	71	32	103	357
488	488.1	5 fields		Soccer Complex (Factored)	5	4	9	97	43	140	481
488	488.2	5 fields		Soccer Complex (Max rates)	5	4	9	86	38	124	454
488	488.3	5 fields		Soccer (Generator Max)	10	9	19	44	89	133	454
412	412.000	30.1005 acres		County Park	0	0	0	1	1	2	69
412	412.100	30.1005 acres		County Park (Max)	1	0	1	1	1	2	1,608
412	412.200	30.1005 acres		County Park (Generator)	11	5	16	6	12	18	281
417	417.000	30.1005 acres		Regional Park	0	0	0	3	3	6	138
417	417.100	30.1005 acres		Regional Park (Max)	0	0	0	14	19	33	1,176
417	417.200	30.1005 acres		Regional Park (Generator)	3	2	5	4	4	8	439
Max Trips (Park)					10	9	19	97	43	140	1,608
Average Trips (Soccer Park)					6	5	11	75	50	125	437
Average Trips (County Park)					4	2	6	3	5	7	653
Total Trips (Proposed SPEX)											
90	90.2	250 spaces		Athletic Fields	10	9	19	97	43	140	481
				Park & Ride Lot	146	34	180	36	119	155	1,125
Total Trips (Proposed SPEX)					156	43	199	133	162	295	1,606

<i>Saturday</i>				<i>SAT PEAK HOUR</i>			<i>SAT DAILY</i>	
<i>CODE</i>	<i>CODE</i>	<i>DENSITY</i>	<i>Var.</i>	<i>USE</i>	<i>IN</i>	<i>OUT</i>	<i>TOTAL</i>	<i>(2-way)</i>
488	488.400	5 fields		Soccer Complex (Sat)	0	0	0	587
488	488.800	5 fields		Soccer (Sat)	69	75	144	0
488	488.900	5 fields		Soccer (Sat Generator Max)	81	87	168	0
412	412.300	30.1005 acres		County Park (Sat)	40	27	67	365
412	412.400	30.1005 acres		County Park (Sat Max)	57	39	96	745
Max Trips (Park)					81	87	168	745
Average Trips (Park)					62	57	119	566
5 fields ^^ Athletic Fields (Saturday)					81	87	168	1,200
250 spaces Park and Ride (Saturday)					0	0	0	0
Total Trips (Proposed SPEX)					81	87	168	1,200

<i>Effective Trip Rates (3)</i>		<i>AM Peak Hour</i>	<i>PM Peak Hour</i>	<i>Daily</i>			
<i>ITE Land Use Code</i>	<i>Trip rate per</i>	<i>(2-way)</i>	<i>(2-way)</i>	<i>Weekday</i>			
		<i>Inbound</i>	<i>Inbound</i>	<i>(2-way)</i>			
		<i>%</i>	<i>%</i>				
	Athletic Fields	fields	3.80	53%	28.00	69%	96.20
90	Park & Ride Lot	spaces	0.72	81%	0.62	23%	4.50
	Athletic Fields (Saturday)	fields			33.60	48%	240.00
488	Soccer Complex	fields	1.40	57%	20.60	69%	71.40
488	Soccer Complex (Sat)	fields			28.80	48%	117.40
412	County Park	acres	0.00		0.07	50%	2.29
417	Regional Park (Generator)	acres	0.17	60%	0.27	50%	14.58

TRIP RATE SOURCE:

Trip Generation Manual (8th Edition). Institute of Transportation Engineers, 2008.

Average trip rates used, unless noted with * then equations used.

(1) ITE Land Code shown as the first 3 digits. Decimal shown for internal use by PHR+A for lookup table for trip rate variable

^^ Saturday Average of max trips and average soccer park, derived based on K=0.14 to allow for peak use at 4.0 trips/space

Trip rate calculation = 2-way Trips (In + Out) / (Density) ; % inbound = trips in / (Total Peak Hour Trips)

(3) Effective trip rates calculated by land use:

For average rates =

Density * ave. trip rate = 2-way Trips ; * inbound percentage for Trips In

For ITE equations =

Density * trip equation = 2-way Trips ; * inbound percentage for Trips In

**

Trip Rate equations used to determine trips, effective rate Shown

Table 6
VDOT 527 Summary

ITE Land Use (1)

<u>CODE</u>	<u>CODE</u>	<u>DENSITY</u>	<u>Var.</u>	<u>USE</u>	<u>AM PEAK HOUR</u>			<u>PM PEAK HOUR</u>			<u>DAILY</u>
					<u>IN</u>	<u>OUT</u>	<u>TOTAL</u>	<u>IN</u>	<u>OUT</u>	<u>TOTAL</u>	<u>(2-way)</u>
Weekday											
488	488.0	5 fields		Soccer Complex	4	3	7	71	32	103	357
488	488.1	5 fields		Soccer Complex (Factored)	5	4	9	97	43	140	481
488	488.3	5 fields		Soccer (Generator Max)	10	9	19	44	89	133	454
412	412.000	30.1005 acres		County Park	0	0	0	1	1	2	69
417	417.000	30.1005 acres		Regional Park	0	0	0	3	3	6	138

Assumed for analyses

90	90.2	250 spaces		Atheletic Fields	10	9	19	97	43	140	481
				Park & Ride Lot	146	34	180	36	119	155	1,125
Total Trips (Proposed SPEX)					156	43	199	133	162	295	1,606

Park & Ride Lot Trips

250 spaces	BUS Trips**	6	6	12	8	8	16	60
250 spaces	Effective Vehicle Trips	140	28	168	28	111	139	1,065
Total Park & Ride Lot Trips		146	34	180	36	119	155	1,125

Saturday

					<u>SAT PEAK HOUR</u>			<u>SAT DAILY</u>
					<u>IN</u>	<u>OUT</u>	<u>TOTAL</u>	<u>(2-way)</u>
488	488.400	5 fields		Soccer Complex (Sat)	0	0	0	587
488	488.800	5 fields		Soccer (Sat)	69	75	144	0
412	412.300	30.1005 acres		County Park (Sat)	40	27	67	365
417	417.300	30.1005 acres		Regional Park (Sat)	5	5	10	170
		5 fields	^^	Atheletic Fields (Saturday)	81	87	168	1,200
		250 spaces		Park and Ride (Saturday)	0	0	0	0
Total Trips (Proposed SPEX)					81	87	168	1,200

**Bus Trip Source: Loudoun County Office of Transportation Services. Approximate bus timings:

AM: 4:53, 5:05, 5:25, 5:27, 5:45, 6:13, 6:15, 6:25, 6:30, 6:45, 6:50, 7:35. (Peak Hour of Generator: 6:00 - 7:00 AM; 6 Trips)

PM: 5:04, 5:10, 5:24, 5:30, 5:43, 5:50, 6:05, 6:09, 6:13, 6:25, 6:25, 6:32, 6:45, 7:05, 7:10, 7:20, 7:30, 8:25. (Peak Hour of Generator: 5:30 - 6:30 PM; 8 Trips)

Total Daily Bus Trips: 30 Inbound + 30 Outbound = 60 Daily Trips

**Table 7
Phase 1 Trip Generation**

<i>ITE Land Use (1)</i>				<i>AM PEAK HOUR</i>			<i>PM PEAK HOUR</i>			<i>DAILY</i>	
<i>CODE</i>	<i>CODE</i>	<i>DENSITY</i>	<i>Var.</i>	<i>USE</i>	<i>IN</i>	<i>OUT</i>	<i>TOTAL</i>	<i>IN</i>	<i>OUT</i>	<i>TOTAL</i>	<i>(2-way)</i>
Weekday											
488	488.0	1	fields	Soccer Complex	1	0	1	14	7	21	71
488	488.1	1	fields	Soccer Complex (Factored)	1	1	2	19	9	28	96
488	488.2	1	fields	Soccer Complex (Max rates)	1	1	2	17	8	25	91
488	488.3	1	fields	Soccer (Generator Max)	2	2	4	9	18	27	91
				Max Trips (Park)	2	2	4	19	9	28	96
Average Trips (Soccer Park)					1	1	2	15	10	25	87
<hr/>											
90	90.2	250	spaces	Atheletic Fields	2	2	4	19	9	28	96
				Park & Ride Lot	146	34	180	36	119	155	1,125
Total Trips (Proposed SPEX)					148	36	184	55	128	183	1,221

Park & Ride Lot Trips

250	spaces	BUS Trips**	6	6	12	8	8	16	60
250	spaces	Effective Vehicle Trips	140	28	168	28	111	139	1,065
Total Park & Ride Lot Trips			146	34	180	36	119	155	1,125

Saturday				<i>SAT PEAK HOUR</i>			<i>SAT DAILY</i>				
				<i>IN</i>	<i>OUT</i>	<i>TOTAL</i>	<i>(2-way)</i>				
488	488.400	1	fields	Soccer Complex (Sat)	0	0	0	117			
488	488.800	1	fields	Soccer (Sat)	14	15	29	0			
488	488.900	1	fields	Soccer (Sat Generator Max)	16	18	34	0			
412	412.300	10	acres	County Park (Sat)	13	9	22	121			
412	412.400	10	acres	County Park (Sat Max)	19	13	32	247			
				Max Trips (Park)	19	18	34	247			
Average Trips (Park)					16	13	29	162			
<hr/>											
		1	fields	^^ Atheletic Fields (Saturday)	16	18	34	243			
		250	spaces	Park and Ride (Saturday)	0	0	0	0			
Total Trips (Proposed SPEX)					16	18	34	243			

<i>Effective Trip Rates (3)</i>	ITE Land Use Code	Trip rate per	<i>AM Peak Hour</i>		<i>PM Peak Hour</i>		<i>Daily</i>
			<i>(2-way)</i>	<i>Inbound %</i>	<i>(2-way)</i>	<i>Inbound %</i>	<i>Weekday (2-way)</i>
	Atheletic Fields	fields	4.00	50%	28.00	68%	96.00
	90 Park & Ride Lot	spaces	0.72	81%	0.62	23%	4.50
	Atheletic Fields (Saturday)	fields			34.00	47%	243.00
	488 Soccer Complex	fields	1.00	100%	21.00	67%	71.00
	488 Soccer Complex (Sat)	fields			29.00	48%	117.00

TRIP RATE SOURCE:

Trip Generation Manual (8th Edition). Institute of Transportation Engineers: 2008.

Average trip rates used, unless noted with * then equations used.

(1) ITE Land Code shown as the first 3 digits. Decimal shown for internal use by PHR+A for lookup table for trip rate variable.

^^ Saturday Average of max trips and average soccer park. derived based on K=0.14 to allow for peak use at 4.0 trips/space

Trip rate calculation = 2-way Trips (In + Out) / (Density) ; % inbound = trips in / (Total Peak Hour Trips)

(3) Effective trip rates calculated by land use:

For average rates =

Density * ave. trip rate = 2-way Trips ; * inbound percentage for Trips In

For ITE equations =

Density * trip equation = 2-way Trips ; * inbound percentage for Trips In

**

Trip Rate equations used to determine trips, effective rate Shown

Site Trip Distribution

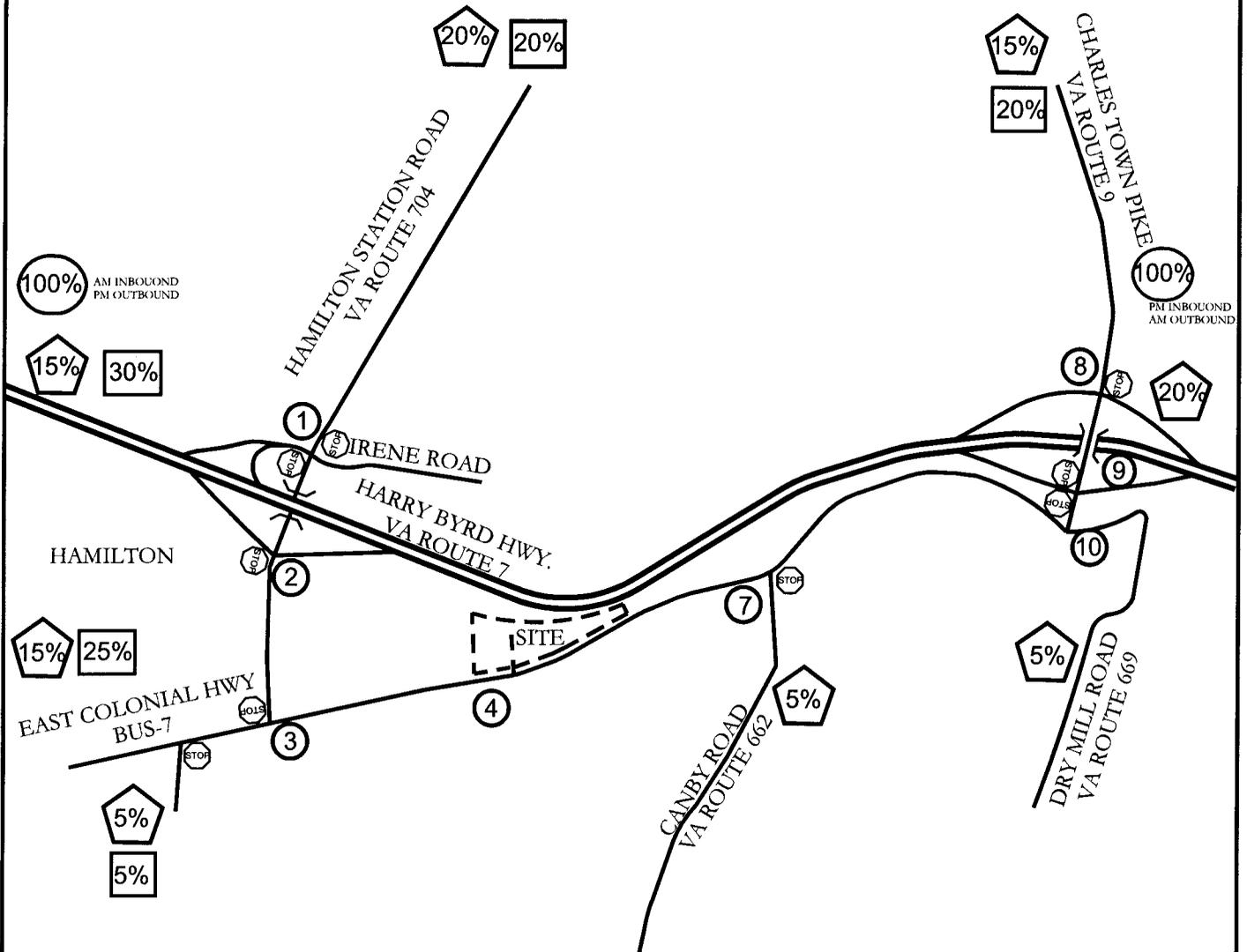
PHR+A derived the site trip distributions based on the previous traffic studies, existing traffic pattern and input from Loudoun County OTS staff regarding the bus operations for the park and ride lot. The site trips distribution are shown by use in Figure 11 with the following justification:

- Recreational uses – shown based on existing traffic splits from Business Route 7 and distribution from the previous study for the property. A majority of the trips are shown from the west to maximize left turn lane sizing.
- Part and Ride lot, Vehicles- The trip distributions were derived from the existing OTS data surveys in 2007 for existing lots in Purcellville and Hamilton. County staff performed vehicle origins surveys in 2007 and 2008, with an address location survey for the Hamilton Church lot in 2007. PHR+A matched the 88 samples from the Hamilton lot in 2007 with zip code information and general street location to derive the origins and assigned the car counts to the collectors and distributors in the study area. The car counts are shown in Appendix F with the support calculations. For the proposed lot, the majority of the site traffic is oriented to the west on Business Route 7, Route 7, and Route 704.
- Park and Ride lot, Buses- The trip distributions were derived from the County OTS staff routing, which envisioned all buses to access the site from the west via Route 7 exiting at the Route 9 interchange and accessing the property from Route 7 Business on the east side of the site at the bus slip ramp. Exiting buses in the morning will turn left out of the site and travel east to the Route 9 interchange to proceed to destinations east of Loudoun. In the PM peak, the buses will arrive from the east via the Route 9 interchange ramp, and approach the site via the westbound approach on Business Route 7 to access the right turn slip ramp. PM buses will exit right out of the site and proceed to Purcellville via Business Route 7, turning right to Route 704 and accessing the Route 7 interchange at intersection #1 to travel west. The site trip distributions for the buses were shown separately to account for the bus access. Note that left turns from the west into the bus lane are prohibited.

For the peak hour and Daily trips, the new site trips associated with the site are shown on the study areas roadway network in Figures 12A, 12B, 13A and 13B. The 12A trips reflect the short-term Daily traffic for the weekdays with one field and the entire 250 space park and ride lot constructed. The 2010 scenario assumes the park and ride lot will be filled with the initial opening. Peak hour turning volumes for the AM, PM and Saturday peaks are shown in Figure 12B. Actual occupancy may be less with initial construction. The long-term site traffic volumes are included in Figures 13A and 13B with the full build-out of the park and the full occupancy of the park and ride lot.



Not to Scale



DISTRIBUTIONS



RECREATIONAL % IN/OUT



PARK AND RIDE % IN/OUT



BUS TRIP DISTRIBUTIONS

NOTE:
INBOUND/OUTBOUND TRIPS DISTRIBUTIONS
FOR BUSES VARY BASED ON TIME OF DAY.
SEE APPENDIX FOR DETAILED DISTRIBUTIONS.

LEGEND



INTERSECTION NUMBER



FUTURE SITE DRIVEWAY



STOP SIGN



INTERCHANGE BRIDGE



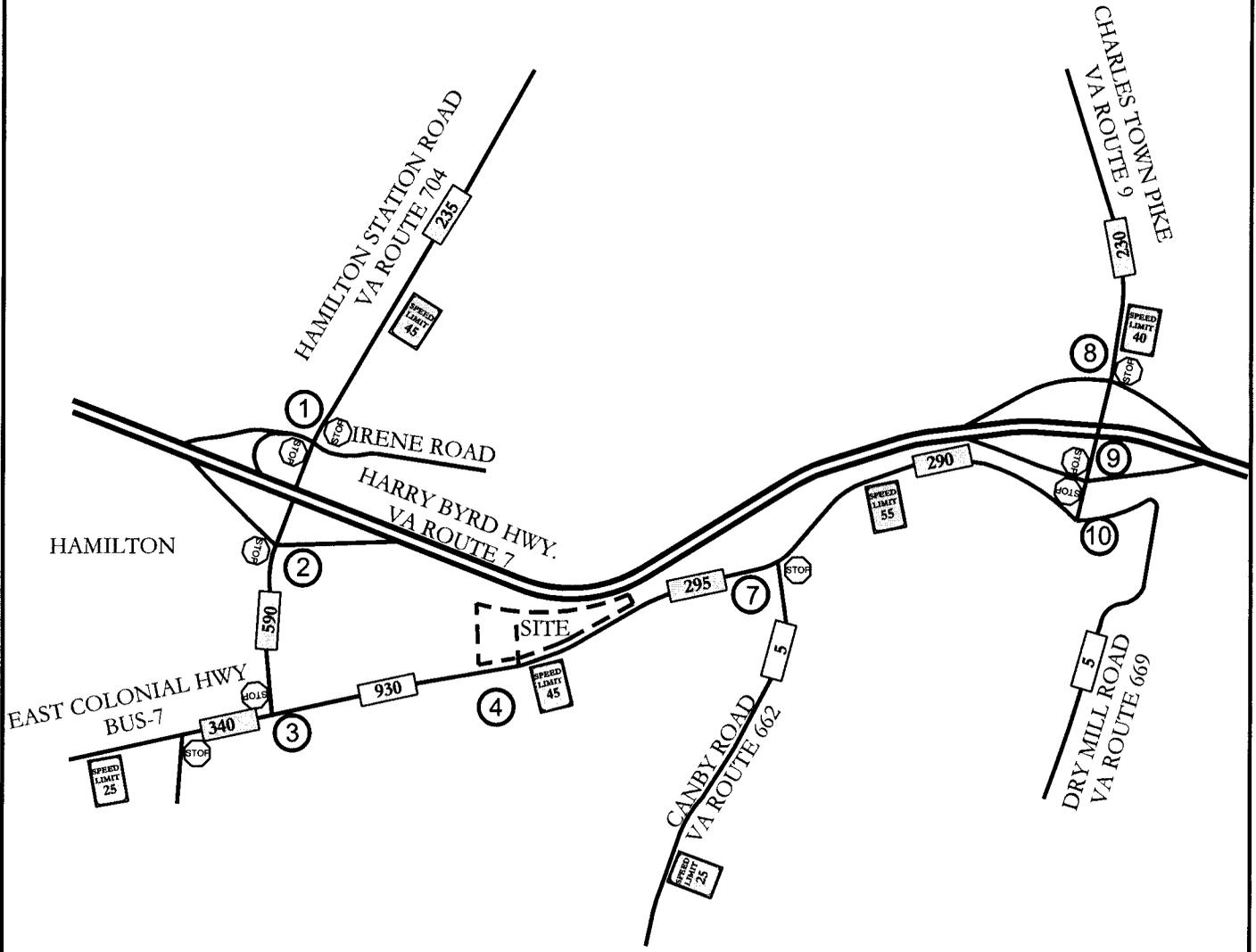
Site Trip Distributions
Scott Jenkins Memorial Park

FIGURE 11

February 2009
13608-2-0



Not to Scale



LEGEND

① INTERSECTION NUMBER

--- FUTURE SITE DRIVEWAY

STOP STOP SIGN

SPEED LIMIT 45 POSTED SPEED LIMIT

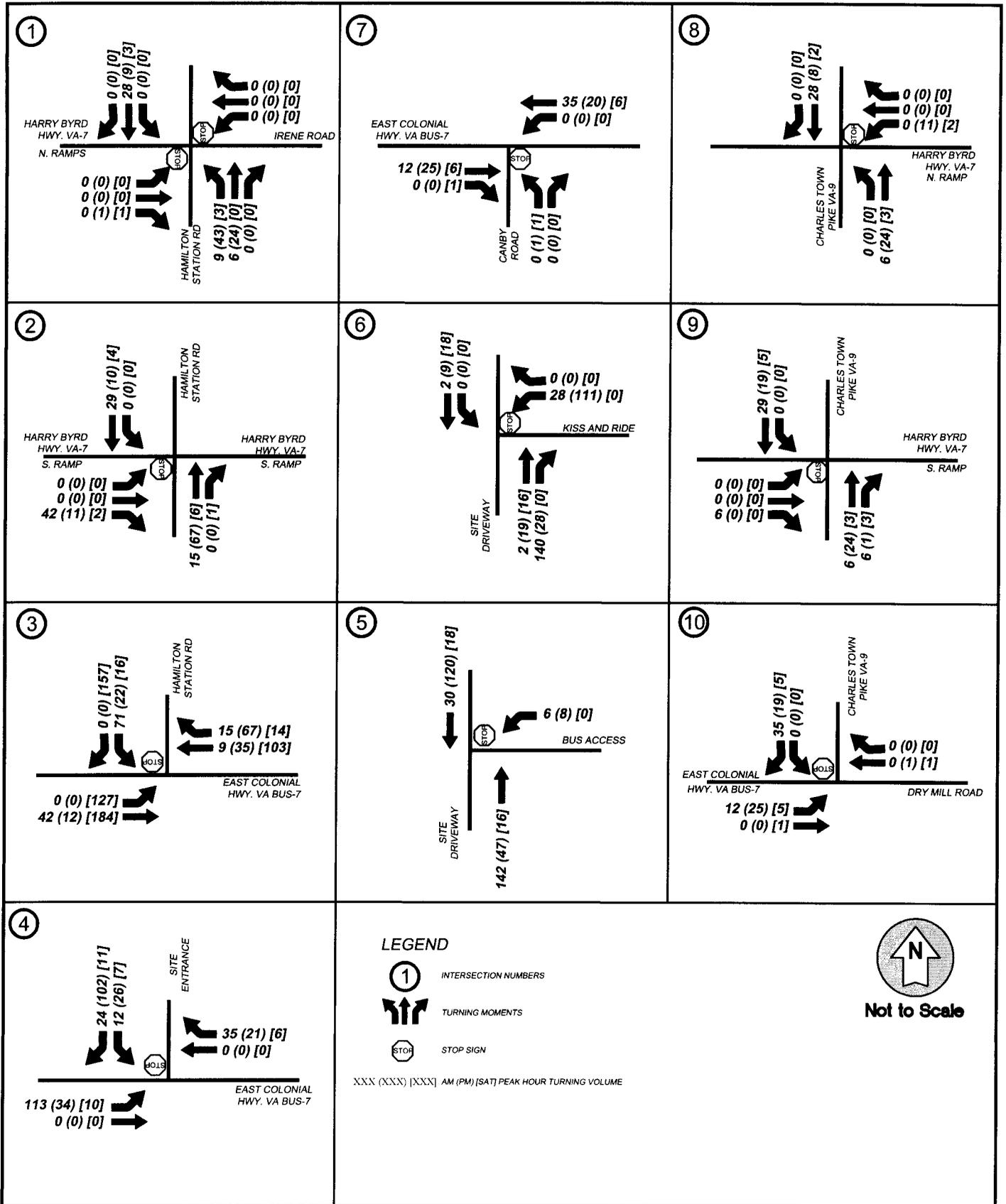
ADT 4000 AVERAGE DAILY TRAFFIC VOLUME



Site Traffic Volumes-Phase 1 (2010)
Scott Jenkins Memorial Park

FIGURE 12A

February 2009
13608 2-0

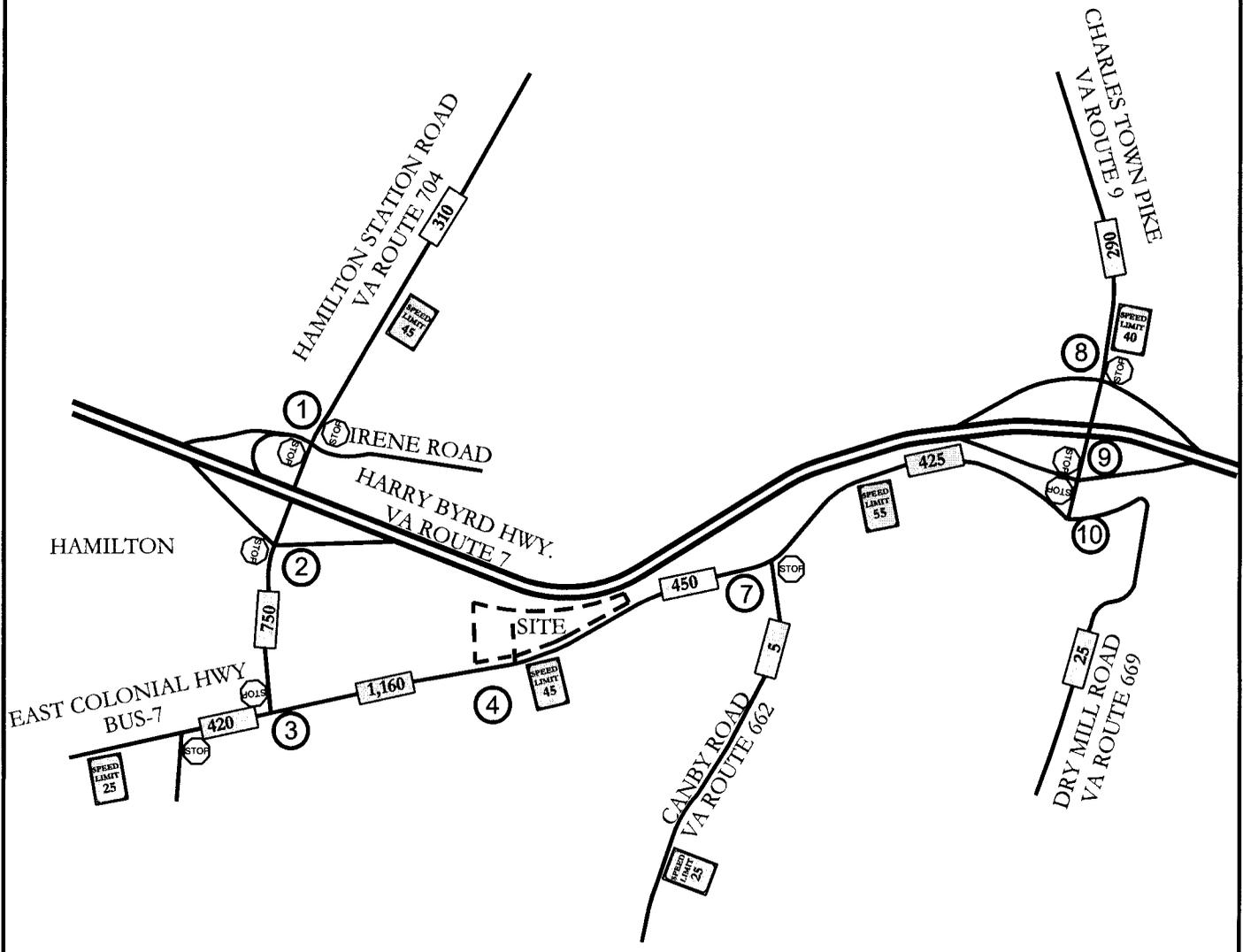


Site Traffic Assignment- Phase 1 (2010)
 Scott Jenkins Memorial Park

FIGURE 12B
 February 2009
 13608-2-0



Not to Scale



LEGEND

① INTERSECTION NUMBER

- - - FUTURE SITE DRIVEWAY

STOP SIGN

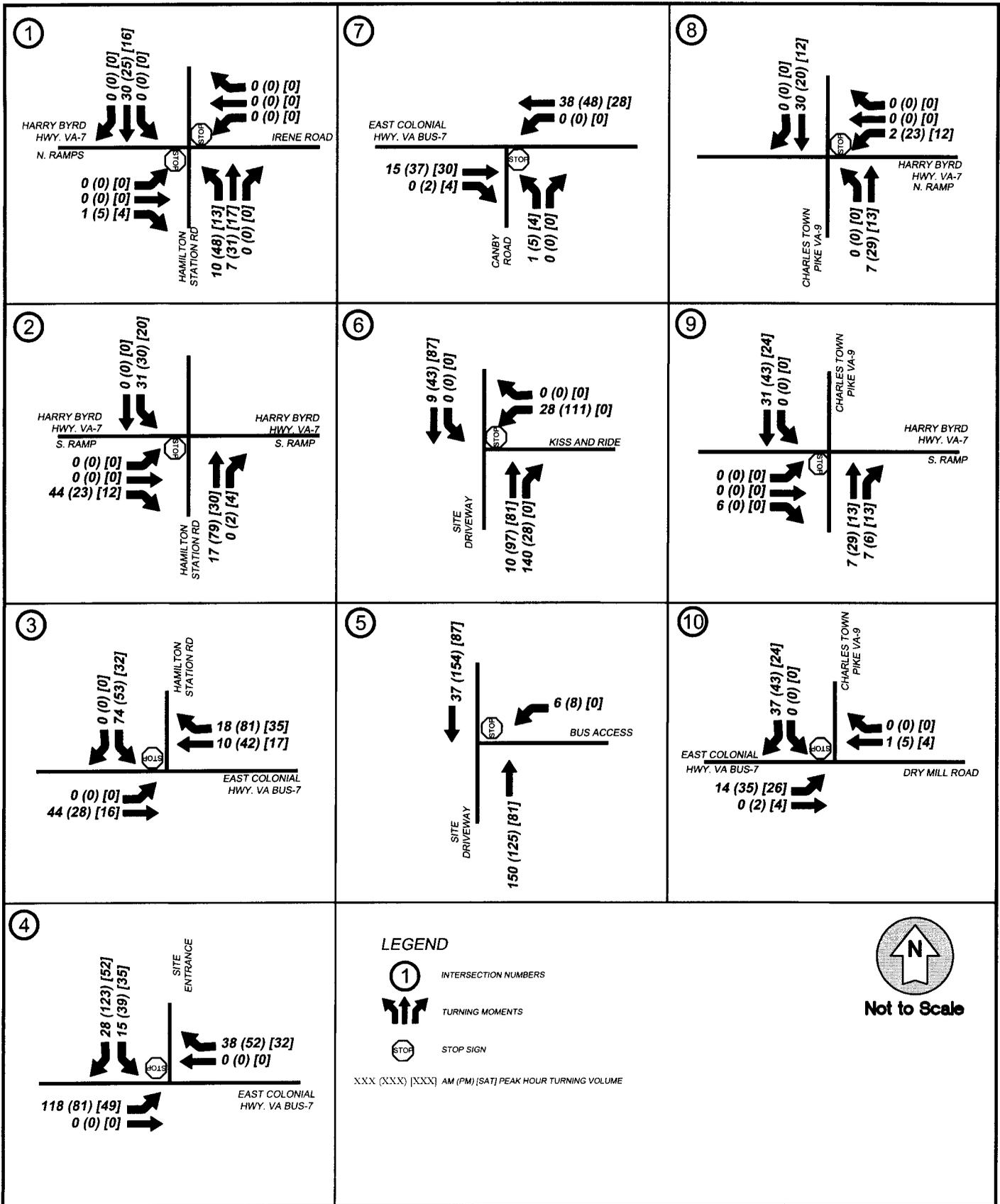
SPEED LIMIT 45 POSTED SPEED LIMIT

ADT 4000 AVERAGE DAILY TRAFFIC VOLUME



Site Traffic Volumes-Build-Out (2020)
Scott Jenkins Memorial Park

FIGURE 13A
February 2009
13008-2.0



Site Traffic Assignment- Build-Out (2020)
 Scott Jenkins Memorial Park

FIGURE 13B
 February 2009
 13608-2-0

Future Conditions with Site Development

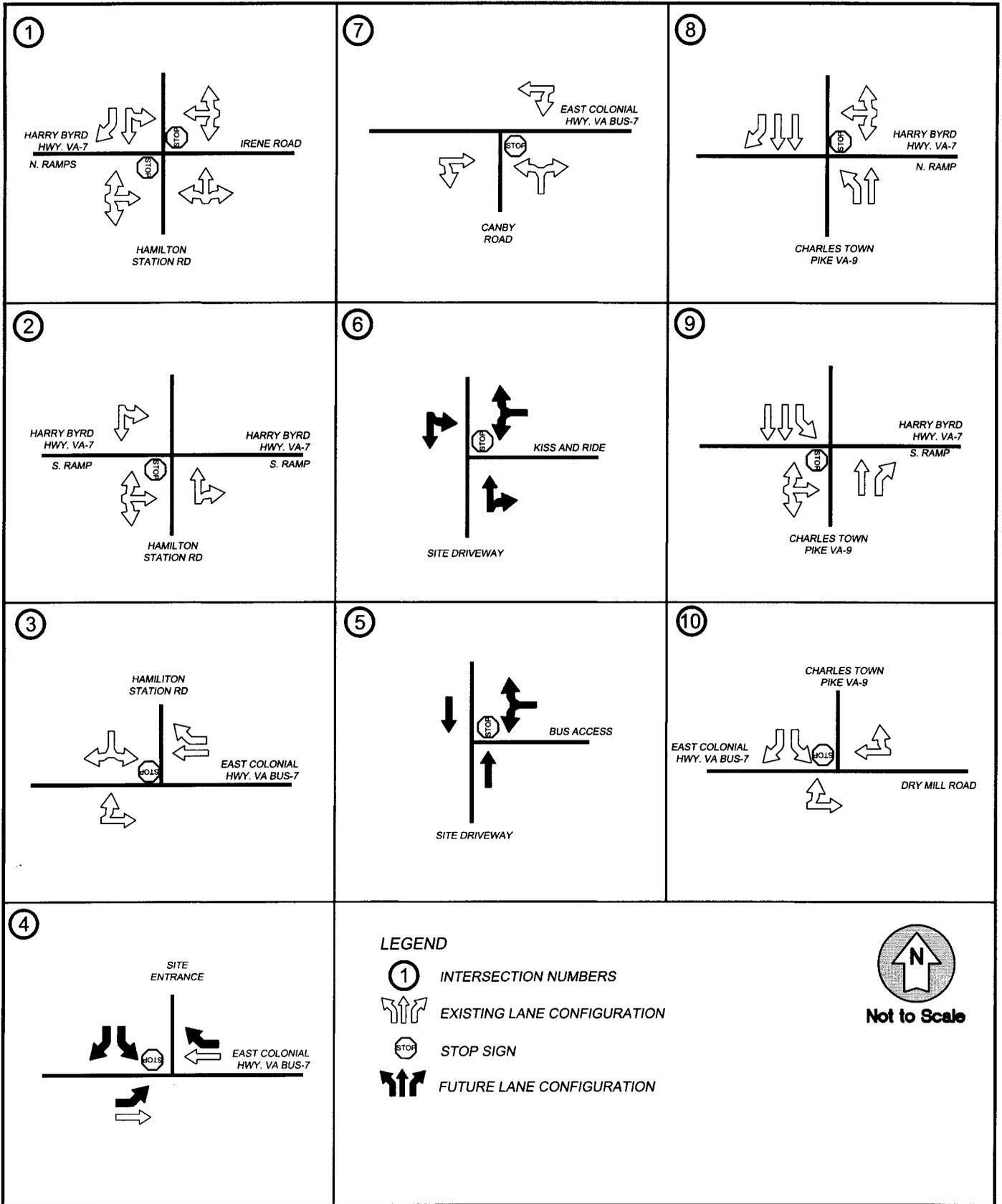
The following sections combine the site trips (Figures 12A and B in the short-term and Figures 13A and 13B in the long –term) with the background traffic volumes in Figures 9B and 10B. The future roadway geometries are shown in Figure 14 which highlight the following improvements to the roadway network:

- Added Site access as intersection #4
- Added separate left and right turn lanes at the site entrance at intersection #4
- Shown internal intersections # 5 and #6 for egress from the bus loading area and from the parking and ride lot on-site.

No other improvements are identified with the site, beyond the proposed elements described in the mitigation section.

Total 2010 Levels of Service with Scott Jenkins Memorial Park Phase 1

For the short-term conditions, the future traffic operations are shown in Figure 15A with the site. The additional site access was added to the network. The site traffic was combined with the background trips for the short-term to derive the total traffic volumes in 2010, as shown in Figure 15B.

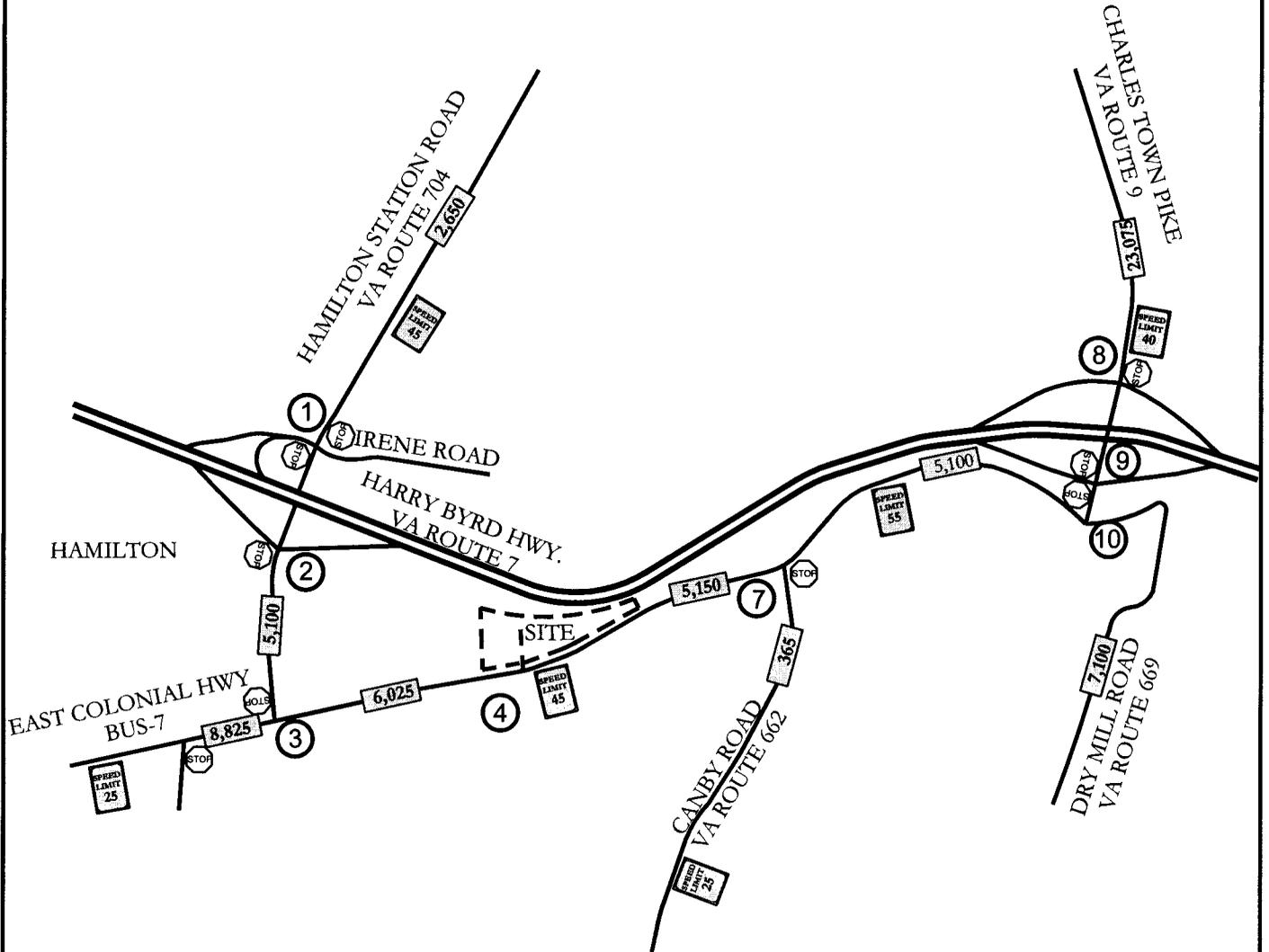


Future Roadway Lane Geometry
Scott Jenkins Memorial Park

FIGURE 14
February 2009
13608-2.0



Not to Scale



LEGEND

① INTERSECTION NUMBER

--- FUTURE SITE DRIVEWAY

STOP STOP SIGN

SPEED LIMIT 45 POSTED SPEED LIMIT

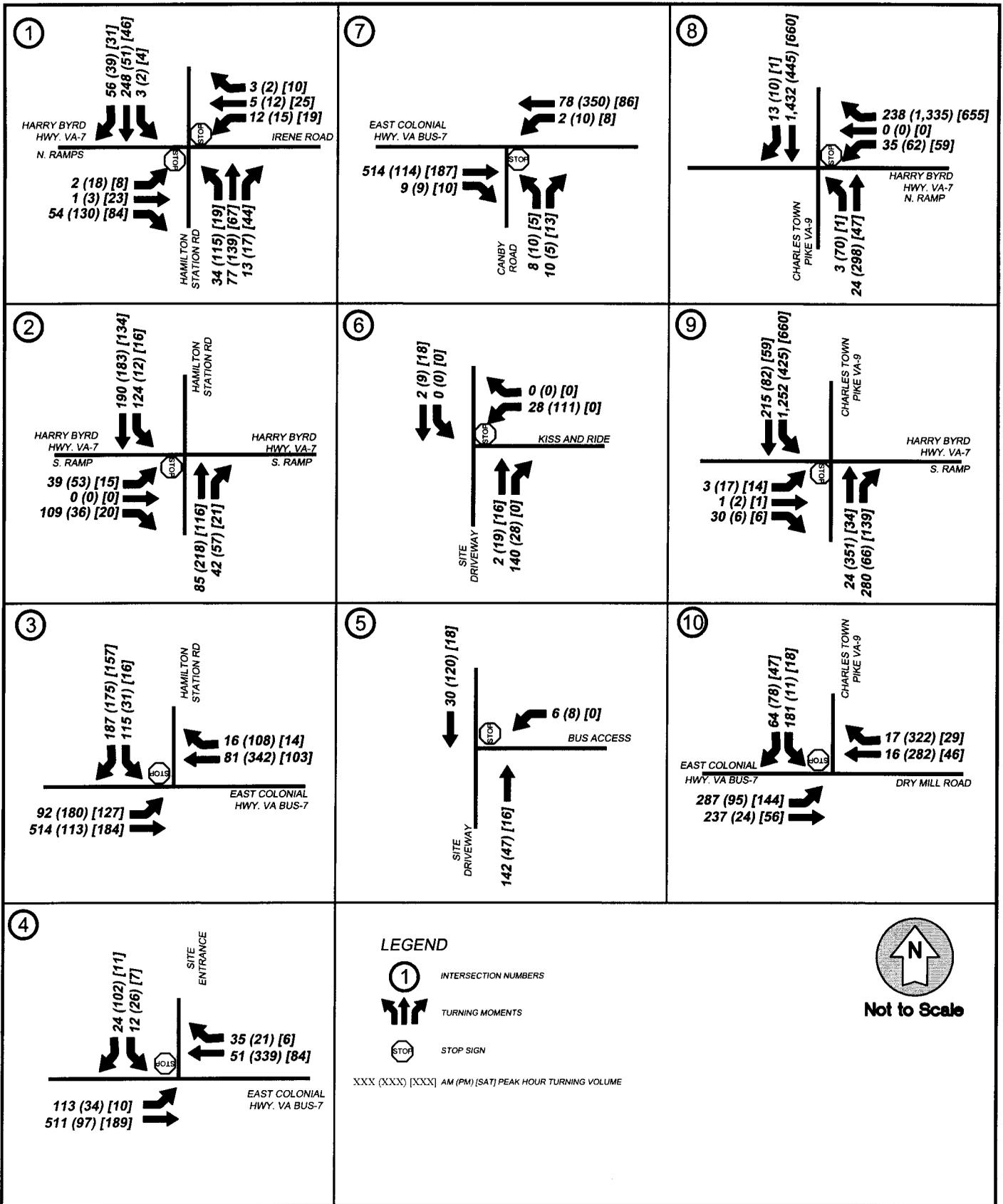
ADT 4000 AVERAGE DAILY TRAFFIC VOLUME



Total Build-Out-(2010) Traffic Conditions
Scott Jenkins Memorial Park

FIGURE 15A

February 2009
13608 2-0



Total Build-Out-(2010) Traffic Volumes
 Scott Jenkins Memorial Park

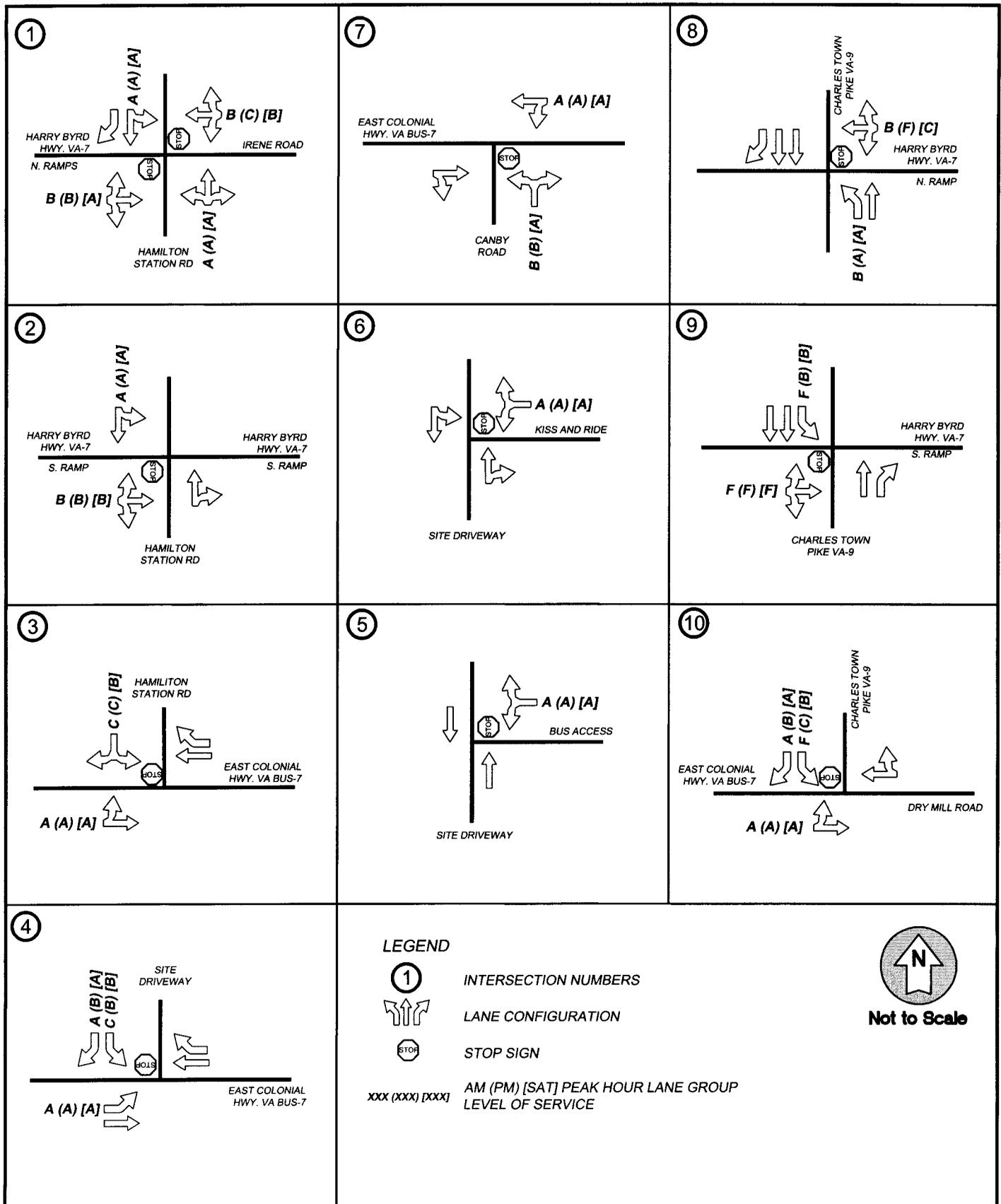
FIGURE 15B
 February 2009
 13608-2-0

PHR+A

PHR+A evaluated the intersection operations for the study area intersections for the AM, PM and Saturday peak periods, using the Synchro 7.0 Software with the Highway Capacity Manual (HCM) methodology. Route 9 interchange operations at the exit ramps continues to operate below capacity with a Level of Service (LOS) "F" during the PM peak period at the northern ramp (Intersection #8) and LOS "F" for the westbound ramps for the AM, PM, and Saturday conditions at the south ramp (intersection #9). These conditions reflect the same LOS grade as documented in the Background conditions without site development. The Business Route 7 intersection at Dry Mill Road and Route 9 experiences a LOS "F" for the southbound left in the AM peak from Route 9 to turn eastbound on Dry Mill Road. Site traffic does not execute this maneuver. All other movements with the short-term site traffic operate at LOS "C" or better for 2010 with a LOS "D" in the AM peak exiting the eastbound Route 7 off ramp at Route 9 and for the PM peak southbound left at the Business Route 7/Dry Mill Road/Route 9 intersection.

The site entrance operate at a LOS "B" on the exiting approach with a LOS "A" for the left turns on Business Route 7. For the AM peak, the southbound left turns exiting the site experience a LOS "C."

The traffic operations are summarized in Figure 15C for the 2010 conditions. The lane group LOS for the 3 peak periods are summarized in Table 8A for the 2010 conditions. The LOS outputs are including in Appendix G for the 2010 conditions.



Total Build-Out (2010) Level of Service
Scott Jenkins Memorial Park

FIGURE 15C
February 2009
13608.2-0

Total 2010 Intersection Level of Service

Scenario		2010		2010		2010	
Intersection	Lane Group	AM Peak Total		PM Peak Total		Sat Peak Total	
		LOS	Delay	LOS	Delay	LOS	Delay
1 VA RT 7 N Ramps/Irene Rd/Hamilton Station Rd <i>Unsignalized</i>	EBLTR	B	10.5	B	10.3	A	9.8
	EB	B	10.5	B	10.3	A	9.8
	WBLTR	B	13.3	C	16	B	11.2
	WB	B	13.3	C	16	B	11.2
	NBLTR	A	2.4	A	3.7	A	1.2
	NB	A	2.4	A	3.7	A	1.2
SBLT	A	0.1	A	0.3	A	0.6	
2 VA RT 7 S Ramps/Hamilton Station Rd <i>Unsignalized</i>	EBLTR	B	13	B	12.8	B	10.2
	EB	B	13	B	12.8	B	10.2
	SBLT	A	3.5	A	0.6	A	0.9
	SB	A	3.5	A	0.6	A	0.9
3 E Colonial Hwy/Hamilton Station Rd <i>Unsignalized</i>	EBLT	A	1.8	A	6.4	A	3.7
	EB	A	1.8	A	6.4	A	3.7
	SBLR	C	22.4	C	16.9	B	10.6
	SB	C	22.4	C	16.9	B	10.6
4 E Colonial Hwy/Site Entrance <i>Unsignalized</i>	EBL	A	7.6	A	8.2	A	7.4
	SBL	C	23.8	B	13	B	10.7
	SBR	A	8.7	B	11.5	A	8.8
	SB	B	13.7	B	11.8	A	9.5
5 Site Entrance/Bus Access <i>Unsignalized</i>	WBLR	A	9.5	A	9.5	A	0
	WB	A	9.5	A	9.5	A	0
6 Site Entrance/Kiss & Ride Access <i>Unsignalized</i>	WBLR	A	9	A	9.3	A	0
	WB	A	9	A	9.3	A	0
	SBLT	A	0	A	0	A	0
7 E Colonial Hwy/Canby Road <i>Unsignalized</i>	WBLT	A	0.3	A	0.3	A	0.7
	WB	A	0.3	A	0.3	A	0.7
	NBLR	B	14.8	B	11.5	A	10
	NB	B	14.8	B	11.5	A	10
8 VA RT 7 N Ramps/VA RT 9 <i>Unsignalized</i>	WBLTR	B	13.2	F	743.7	C	23.4
	WB	B	13.2	F	743.7	C	23.4
	NBL	B	13.1	A	9.1	A	9.2
9 VA RT 7 S Ramps/VA RT 9 <i>Unsignalized</i>	EBLTR	F	N/A	F	72.3	F	90.6
	EB	F	N/A	F	72.3	F	90.6
	SBL	F	63.6	B	11	B	10.3
10 E Colonial Hwy/Dry Mill Rd/VA RT 9 <i>Unsignalized</i>	EBLT	A	5.3	A	8.2	A	5.8
	SBL	F	117.3	C	17.5	B	12.5
	SBR	A	8.8	B	13.8	A	8.9
	SB	F	89	B	14.2	A	9.9

Total 2020 Levels of Service with Scott Jenkins Memorial Park

For the long-term conditions, the future traffic operations are shown in Figure 16A with the site. No change is assumed prior to mitigation by others from the 2010 conditions. The additional site access was added to the network. The site traffic was combined with the background trips for the short-term to derive the total traffic volumes in 2020, as shown in Figure 16B.

PHR+A evaluated the intersection operations for the study area intersections for the AM, PM and Saturday peak periods, using the Synchro 7.0 Software with the Highway Capacity Manual (HCM) methodology. Route 9 interchange operations at the exit ramps continues to operate below capacity with a Level of Service (LOS) “F” during the PM and Saturday peak periods at the northern ramp (Intersection #8) and LOS “F” for the westbound ramps for the AM, PM, and Saturday conditions at the south ramp (intersection #9). These conditions reflect the same LOS grade as documented in the Background conditions without site development. The Business Route 7 intersection at Dry Mill Road and Route 9 experiences a LOS “F” for the southbound left in the AM peak from Route 9 to turn eastbound on Dry Mill Road. Site traffic does not execute this maneuver. With additional growth over the 2010 conditions, the Route 704 intersection at Business Route 7 exceeds the existing capacity, with LOS “F”: on the north leg at the existing stop sign. The effective LOS as a single lane is associated with growth, as documented in the background conditions.

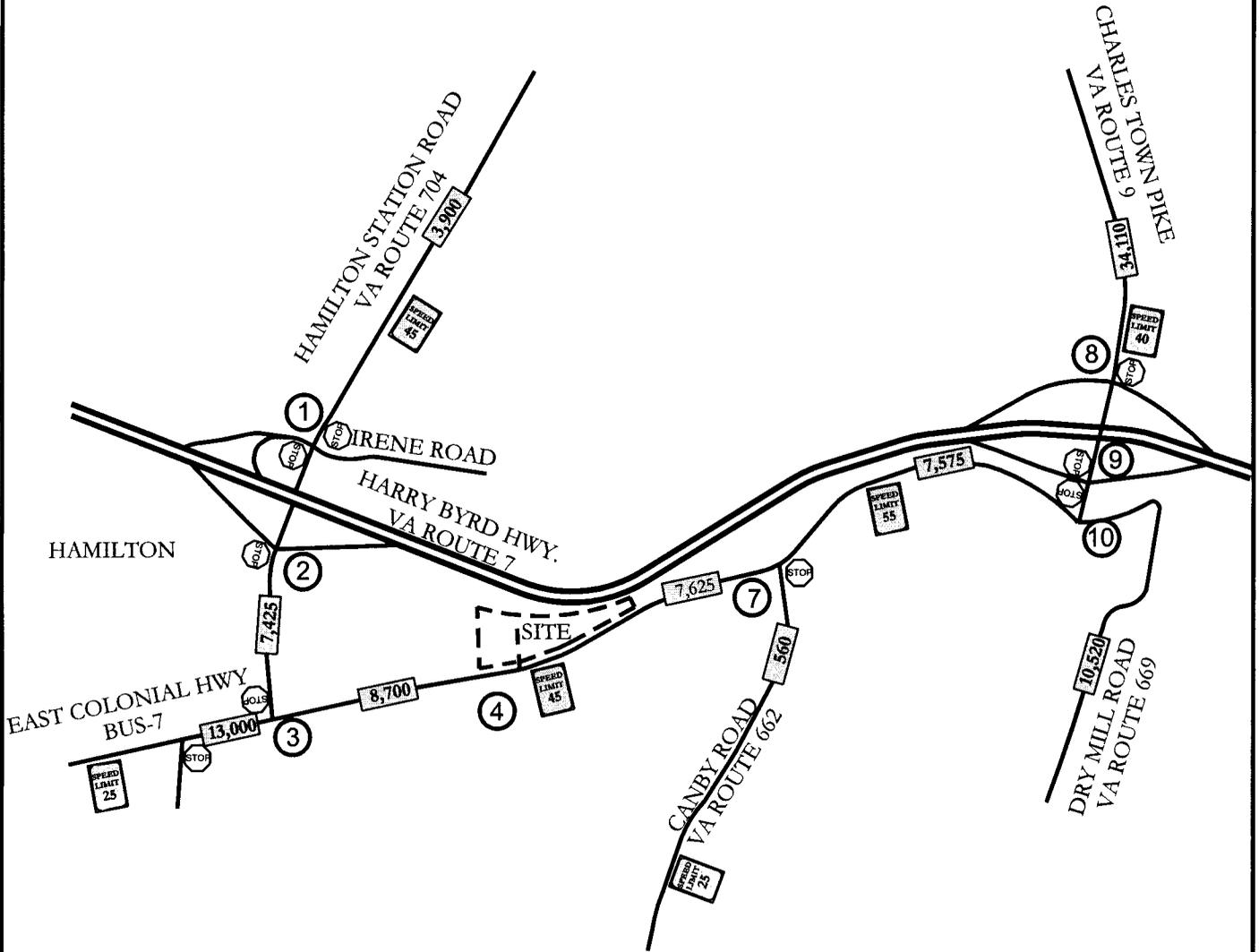
All other movements with the build-out site traffic operate at LOS “C” or better for 2020 with a LOS “D” in the AM peak exiting the eastbound Route 7 off ramp at Route 9 and for the PM peak southbound left at the Business Route 7/Dry Mill Road/Route 9 intersection.

The site entrance operate at a LOS “C” on the exiting approach with a LOS “A” for the left turns on Business Route 7. For the AM peak with site build-out, the southbound left turns exiting the site experience a LOS “E” unsignalized with average delay over 35 seconds (at 35.4 seconds) beyond the LOS “D” threshold. However, the overall approach LOS is at LOS “C” with the right turns. PHR+A recommends the proposed lane operations be maintained at the site, and no additional traffic control proposed.

The traffic operations are summarized in Figure 16C for the 2020 conditions. The lane group LOS for the 3 peak periods are summarized in Table 8B for the total 2020 conditions with site build-out. The LOS outputs are including in Appendix H for the 2020 conditions.



Not to Scale



LEGEND

① INTERSECTION NUMBER

--- FUTURE SITE DRIVEWAY

STOP STOP SIGN

SPEED LIMIT 45 POSTED SPEED LIMIT

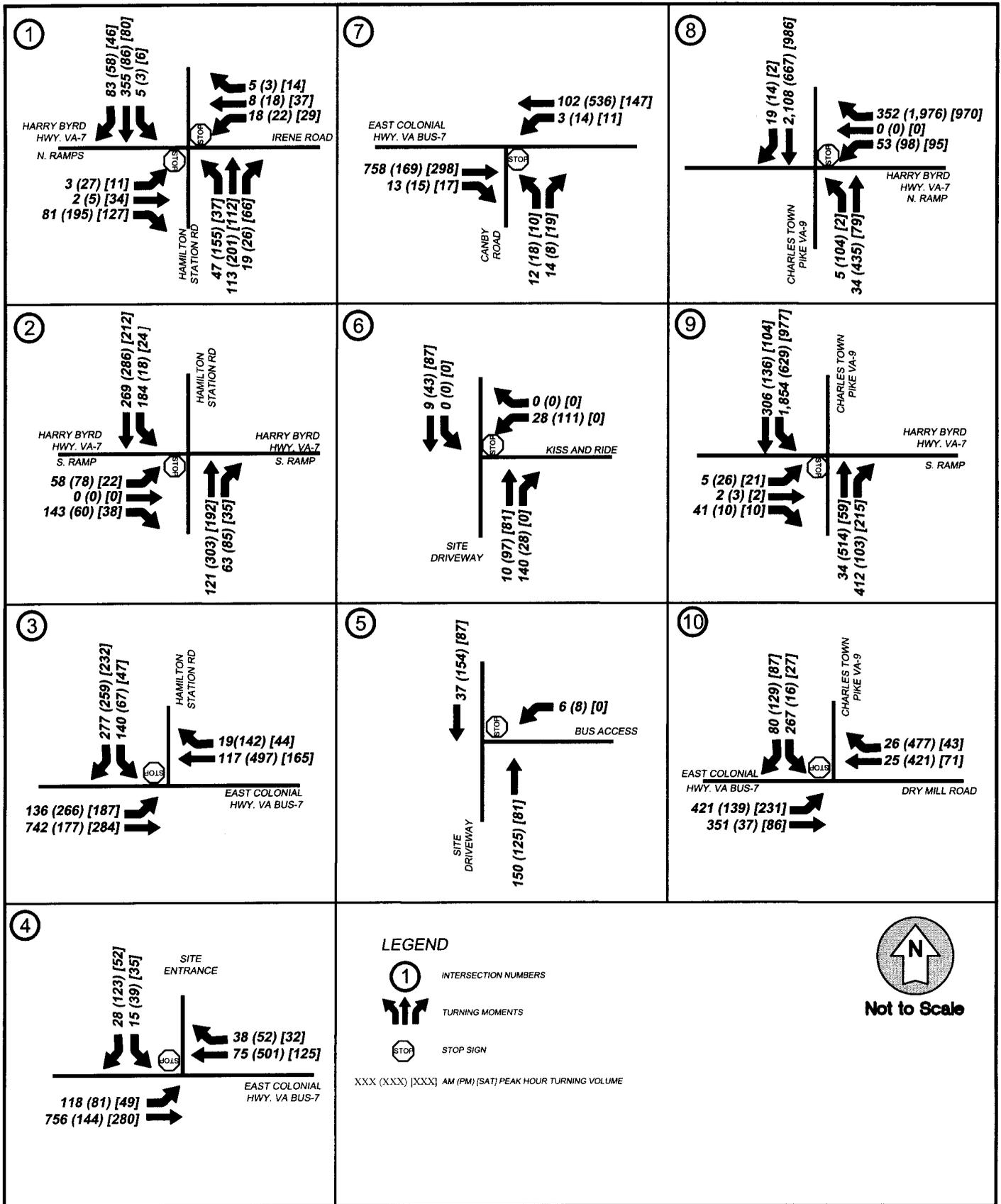
ADT 4000 AVERAGE DAILY TRAFFIC VOLUME



Total Build-Out-(2020) Traffic Conditions
Scott Jenkins Memorial Park

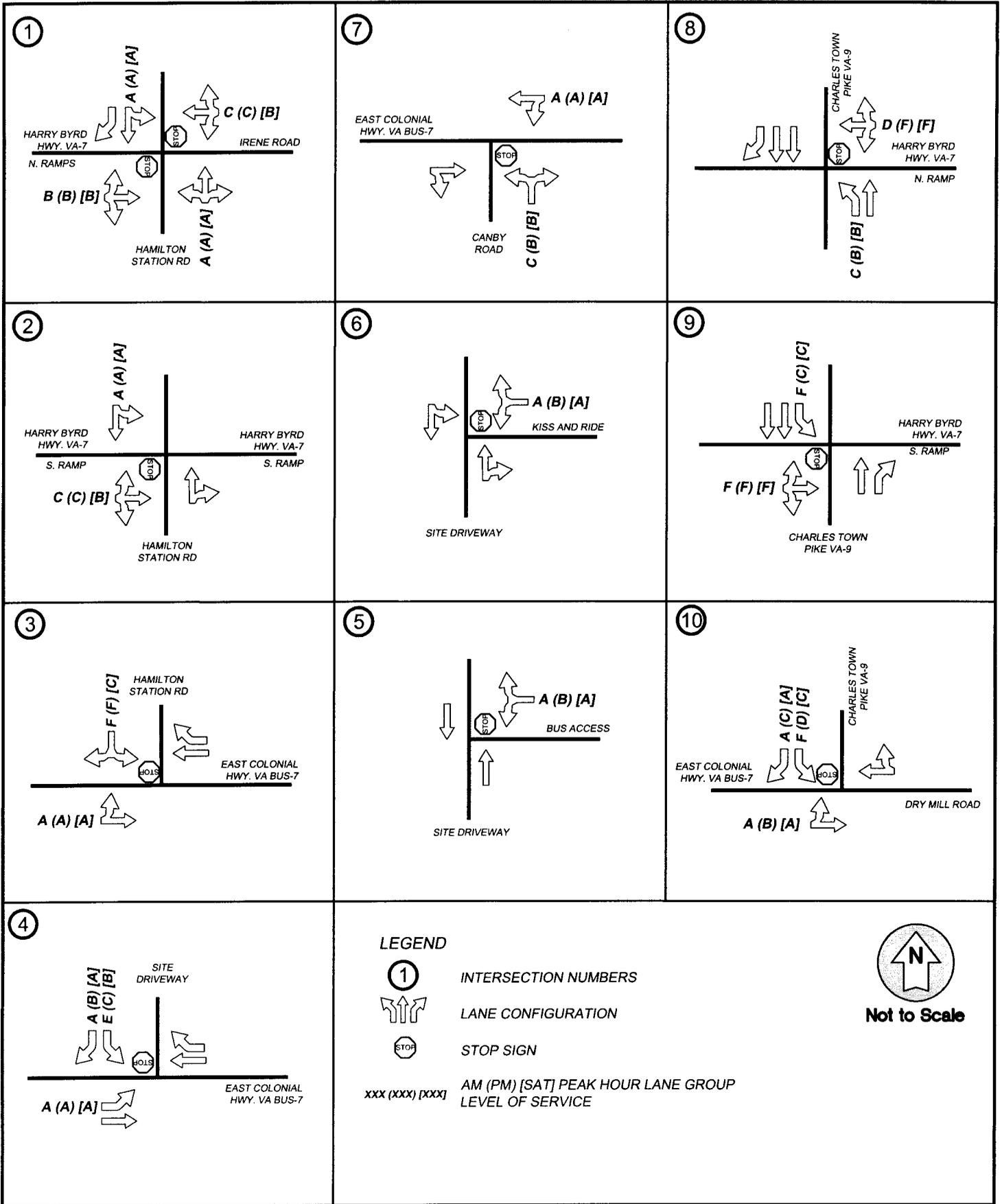
FIGURE 16A

February 2009
13608-2-0



Total Build-Out-(2020) Traffic Volumes
 Scott Jenkins Memorial Park

FIGURE 16B
 February 2009
 13608-2-0



PHRA Total Build-Out (2020) Level of Service Scott Jenkins Memorial Park **FIGURE 16C**
 February 2009
 13019-2.01

Total 2020 Intersection Level of Service

Scenario		2020		2020		2020	
Intersection	Lane Group	AM Peak Total		PM Peak Total		Sat Peak Total	
		LOS	Delay	LOS	Delay	LOS	Delay
1 VA RT 7 N Ramps/Irene Rd/Hamilton Station Rd <i>Unsignalized</i>	EBLTR	B	11.9	B	12.4	B	10.9
	EB	B	11.9	B	12.4	B	10.9
	WBLTR	C	17.3	C	24.7	B	13.9
	WB	C	17.3	C	24.7	B	13.9
	NBLTR	A	2.5	A	3.8	A	1.5
	NB	A	2.5	A	3.8	A	1.5
	SBLT	A	0.1	A	0.3	A	0.6
2 VA RT 7 S Ramps/Hamilton Station Rd <i>Unsignalized</i>	EBLTR	C	20.2	C	17.9	B	11.5
	EB	C	20.2	C	17.9	B	11.5
	SBLT	A	4	A	0.6	A	0.9
	SB	A	4	A	0.6	A	0.9
3 E Colonial Hwy/Hamilton Station Rd <i>Unsignalized</i>	EBLT	A	2.5	A	8.2	A	4.3
	EB	A	2.5	A	8.2	A	4.3
	SBLR	F	141.8	F	140.9	C	16.6
	SB	F	141.8	F	140.9	C	16.6
4 E Colonial Hwy/Site Entrance <i>Unsignalized</i>	EBL	A	7.7	A	9	A	7.7
	SBL	E	35.4	C	19.3	B	13.3
	SBR	A	8.8	B	14	A	9.2
	SB	C	18.1	C	15.3	B	10.9
5 Site Entrance/Bus Access <i>Unsignalized</i>	WBLR	A	9.6	B	10.3	A	0
	WB	A	9.6	B	10.3	A	0
6 Site Entrance/Kiss & Ride Access <i>Unsignalized</i>	WBLR	A	9.1	B	10.1	A	0
	WB	A	9.1	B	10.1	A	0
	SBLT	A	0	A	0	A	0
7 E Colonial Hwy/Canby Road <i>Unsignalized</i>	WBLT	A	0.3	A	0.3	A	0.6
	WB	A	0.3	A	0.3	A	0.6
	NBLR	C	19.9	B	14.3	B	11.3
	NB	C	19.9	B	14.3	B	11.3
8 VA RT 7 N Ramps/VA RT 9 <i>Unsignalized</i>	WBLTR	D	32.6	F	N/A	F	183.5
	WB	D	32.6	F	N/A	F	183.5
	NBL	C	20.5	B	10.5	B	10.7
9 VA RT 7 S Ramps/VA RT 9 <i>Unsignalized</i>	EBLTR	F	N/A	F	1390.5	F	N/A
	EB	F	N/A	F	1390.5	F	N/A
	SBL	F	374.7	C	20.8	C	19.2
10 E Colonial Hwy/Dry Mill Rd/VA RT 9 <i>Unsignalized</i>	EBLT	A	6.2	B	10.3	A	6.2
	SBL	F	955.6	D	29.2	C	16.8
	SBR	A	9	C	20.8	A	9.2
	SB	F	737.4	C	21.7	B	11

Levels of Service of Future Conditions with Scott Jenkins Memorial Park

For both design horizons, the intersection operations in the study are compared in Table 9. The following operational summaries are associated with the comparisons.

The effective intersection operations with and without the subject site are at LOS “C” or better at the study area intersections for the future conditions except for the following lane groups:

- PM peak and Saturday peak lefts in the Westbound exit at Route 7/9 interchange (LOS “F”) at intersection # 8;
- All lefts at the South ramp at the Route 7/9 interchange Intersection #9);
- AM Southbound lefts at the Route 9/Route 7/Dry Mill Road intersection (LOS “F”), shown as intersection #10;
- For the long-term conditions, the southbound approach at intersection #3 (Business Route 7/Route 704) operates at a LOS “F” in the total conditions; and
- The site entrance (Intersection #4) operate at a LOS “E” in the AM peak hour for southbound left turns exiting the site.

The operations at the Route 7 interchange at Route 9 experiences undesirable LOS for conditions with and without the site development with growth.

Table 9
Intersection Level of Service Comparison

Scenario	Lane Group	2008		2010		2010		2010		2010		2010		2010		2010		2010	
		AM Peak Existing	LOS Delay	AM Peak Background	LOS Delay	AM Peak Total	LOS Delay	PM Peak Existing	LOS Delay	PM Peak Background	LOS Delay	PM Peak Total	LOS Delay	Sat Peak Existing	LOS Delay	Sat Peak Background	LOS Delay	Sat Peak Total	LOS Delay
1 VA RT 7 N Ramps/Irene Rd/Hamilton Station Rd	EBLTR	B 10.1	B 10.2	B 10.5	B 11.5	B 11.9	A 9.8	B 11.3	B 12.4	A 9.6	A 9.7	A 9.8	A 9.6	A 9.7	A 9.8	B 10.5	B 10.9		
	EB	B 10.1	B 10.2	B 10.5	B 11.5	B 11.9	A 9.8	B 11.3	B 12.4	A 9.6	A 9.7	A 9.8	A 9.6	A 9.7	A 9.8	B 10.5	B 10.9		
	WBLTR	B 12.2	B 12.8	B 13.3	C 16.1	C 17.3	B 13.1	C 18.7	C 24.7	B 10.8	B 11	B 11.2	B 10.8	B 11	B 11.2	B 12.9	B 13.9		
	WB	B 12.2	B 12.8	B 13.3	C 16.1	C 17.3	B 13.1	C 18.7	C 24.7	B 10.8	B 11	B 11.2	B 10.8	B 11	B 11.2	B 12.9	B 13.9		
2 VA RT 7 S Ramps/Hamilton Station Rd	NBLTR	A 1.9	A 2	A 2.4	A 2.1	A 2.5	A 2.9	A 3.1	A 3.8	A 1	A 1.2	A 1.5	A 1	A 1.2	A 1.1	A 1.5			
	NB	A 1.9	A 2	A 2.4	A 2.1	A 2.5	A 2.9	A 3.1	A 3.8	A 1	A 1.2	A 1.5	A 1	A 1.2	A 1.1	A 1.5			
3 E Colonial Hwy/Hamilton Station Rd	SBLTR	B 12.1	B 12.7	B 13	C 18.7	C 20.2	B 11.7	B 12	B 12.8	B 12.8	C 15.7	C 17.9	B 10.1	B 10.2	B 11.3	B 11.5			
	EB	B 12.1	B 12.7	B 13	C 18.7	C 20.2	B 11.7	B 12	B 12.8	B 12.8	C 15.7	C 17.9	B 10.1	B 10.2	B 11.3	B 11.5			
4 E Colonial Hwy/Site Entrance	SBL	A 3.7	A 3.8	A 4.1	A 4.1	A 4.4	A 4.6	A 4.8	A 5.1	A 5.4	A 5.7	A 6.0	A 6.3	A 6.6	A 6.9	A 7.2			
	SB	A 3.7	A 3.8	A 4.1	A 4.1	A 4.4	A 4.6	A 4.8	A 5.1	A 5.4	A 5.7	A 6.0	A 6.3	A 6.6	A 6.9	A 7.2			
5 Site Entrance/Bus Access	EBLTR	A 1.8	A 1.9	A 2.1	A 2.1	A 2.4	A 2.6	A 2.8	A 3.1	A 3.4	A 3.7	A 4.0	A 4.3	A 4.6	A 4.9	A 5.2			
	EB	A 1.8	A 1.9	A 2.1	A 2.1	A 2.4	A 2.6	A 2.8	A 3.1	A 3.4	A 3.7	A 4.0	A 4.3	A 4.6	A 4.9	A 5.2			
6 Site Entrance/Kiss & Ride Access	SBLTR	B 12.3	B 13	C 22.4	D 26.2	F 141.8	B 12.6	C 16.9	C 23.4	F 140.9	B 10	B 10.2	B 10.6	B 10.6	B 12	C 16.6			
	SB	B 12.3	B 13	C 22.4	D 26.2	F 141.8	B 12.6	C 16.9	C 23.4	F 140.9	B 10	B 10.2	B 10.6	B 10.6	B 12	C 16.6			
7 E Colonial Hwy/Canby Road	EBLTR	A 0.4	A 0.4	A 0.4	A 0.5	A 0.5	A 0.3	A 0.3	A 0.3	A 0.3	A 0.3	A 0.3	A 0.7	A 0.8	A 0.8	A 0.6			
	EB	A 0.4	A 0.4	A 0.4	A 0.5	A 0.5	A 0.3	A 0.3	A 0.3	A 0.3	A 0.3	A 0.3	A 0.7	A 0.8	A 0.8	A 0.6			
8 VA RT 7 N Ramps/VA RT 9	NBLTR	B 13.8	B 14.3	B 14.8	C 18.9	C 19.9	B 10.7	B 11.5	B 12.7	B 14.3	A 9.8	A 9.9	A 10	A 10.7	B 11.3				
	NB	B 13.8	B 14.3	B 14.8	C 18.9	C 19.9	B 10.7	B 11.5	B 12.7	B 14.3	A 9.8	A 9.9	A 10	A 10.7	B 11.3				
9 VA RT 7 S Ramps/VA RT 9	EBLTR	B 12.2	B 13	B 13.2	D 28.7	D 32.6	F 556.7	F 679.1	F 743.7	F 818.7	C 22.6	C 23.4	C 23.4	C 23.4	F 155.3	F 183.5			
	EB	B 12.2	B 13	B 13.2	D 28.7	D 32.6	F 556.7	F 679.1	F 743.7	F 818.7	C 22.6	C 23.4	C 23.4	C 23.4	F 155.3	F 183.5			
10 E Colonial Hwy/Dry Mill Rd/VA RT 9	SBLTR	F 58.2	F 92.4	F 89	F 760.5	F 737.4	B 13	B 13.5	B 14.2	C 18.6	C 21.7	A 9.8	A 9.8	A 9.9	B 11.1	B 11			
	SB	F 58.2	F 92.4	F 89	F 760.5	F 737.4	B 13	B 13.5	B 14.2	C 18.6	C 21.7	A 9.8	A 9.8	A 9.9	B 11.1	B 11			

Recommended Improvements

To assess the site operations and mitigation measures, PHR+A evaluated the following traffic elements associated with the proposed development:

Turn Lane Warrants
Intersection LOS Mitigation
Site Impacts

The following sections summarize our findings for recommended with respect to the VDOT 527 guidelines.

Turn Lane Warrants

For the site access, the VDOT Road Design Manual guidelines were utilized to verify turn lane requirements., The warrants for the left and right urns are shown in Figures 17A and 17B for the 2010 conditions. The left turn warrants are satisfied for the peak conditions. The right turn volumes do not warrant a separate turn lane but operations and driver expectations would suggest a separate turn lane be provided, which also would accommodate the long-term volumes. Therefore, PHR+A would recommend turn lanes be provided for site access.

The length of the turn lanes are evaluated based on our understanding of the VDOT Road Design Manual and previous experience with VDOT and AASHTO guidelines. The Road Design Manual suggests a 200 foot turn lane with 200 foot taper, subject to capacity analyses. The proposed concept plan satisfies the total design elements (at 400 feet) but also proposes additional storage and transition to allow for improved ingress and be consistent with driver expectations in Loudoun County.

Previous Northern Virginia VDOT guidelines evaluated turn lane bays based on design speed for deceleration, and included a 100 foot taper. Based on AASHTO guidelines and VDOT Access Management requirements, the turns lanes are suggested to evaluate storage. As shown in Table 10, the turn lanes for the rights and lefts for full build-out were compared to AASHTO guidelines (Storage, deceleration and taper) for three design scenarios:

- 55 MPH design Speed
- 50 MPH design Speed (posted at 45 MPH)
- 50 MPH design speed (previous NOVA application)

Table 10
Turn Lane Calculations

Site Entrance on Business Route 7
Turn Bay Length Requirements and Accommodations

Location	Storage Length (95% Queue)*	Deceleration Length	Taper	Maximum Length (Storage + Deceleration + Taper)	Alternative Length (Storage + Deceleration)	Provided**	Comments
<i>East Colonial Hwy/Site Entrance</i>							
Design Speed		55 MPH					
EBL	100 ft.	485 ft.	180 ft.	765 ft.	585 ft.	510 ft.	Substandard @ 55 MPH
WBR	25 ft.	485 ft.	180 ft.	690 ft.	510 ft.	600 ft.	Substandard @ 55 MPH
<i>Site Entrance</i>							
SBL	40 ft.	170	0	210 ft.	210 ft.	120 ft.	Substandard @ < 30 MPH
SBR	25 ft.	170	100	295 ft.	195 ft.	120 ft.	Substandard @ < 30 MPH
<i>Transition Left turn lane @ MUTCD shift</i>							
EBL			660			600 ft.	

600 ft. Substandard Provided vs. Alternative Storage length

**Taper included in Deceleration Length.

Location	Storage Length (95% Queue)*	Deceleration Length	Taper	Maximum Length (Storage + Deceleration + Taper)	Alternative Length (Storage + Deceleration)	Provided**	Comments
<i>East Colonial Hwy/Site Entrance</i>							
Design Speed		50 MPH					
WBL	100 ft.	410 ft.	180 ft.	690 ft.	510 ft.	510 ft.	Proposed Design Speed Reduction from 55 MPH, proximity to Town, State Scenic Hwy
EBR	25 ft.	410 ft.	180 ft.	615 ft.	435 ft.	600 ft.	
<i>Site Entrance</i>							
SBL	40 ft.	170	0	210 ft.	210 ft.	120 ft.	Substandard @ < 30 MPH
SBR	25 ft.	170	100	295 ft.	195 ft.	120 ft.	Substandard @ < 30 MPH
<i>Transition Left turn lane @ MUTCD shift</i>							
EBL			600			600 ft.	

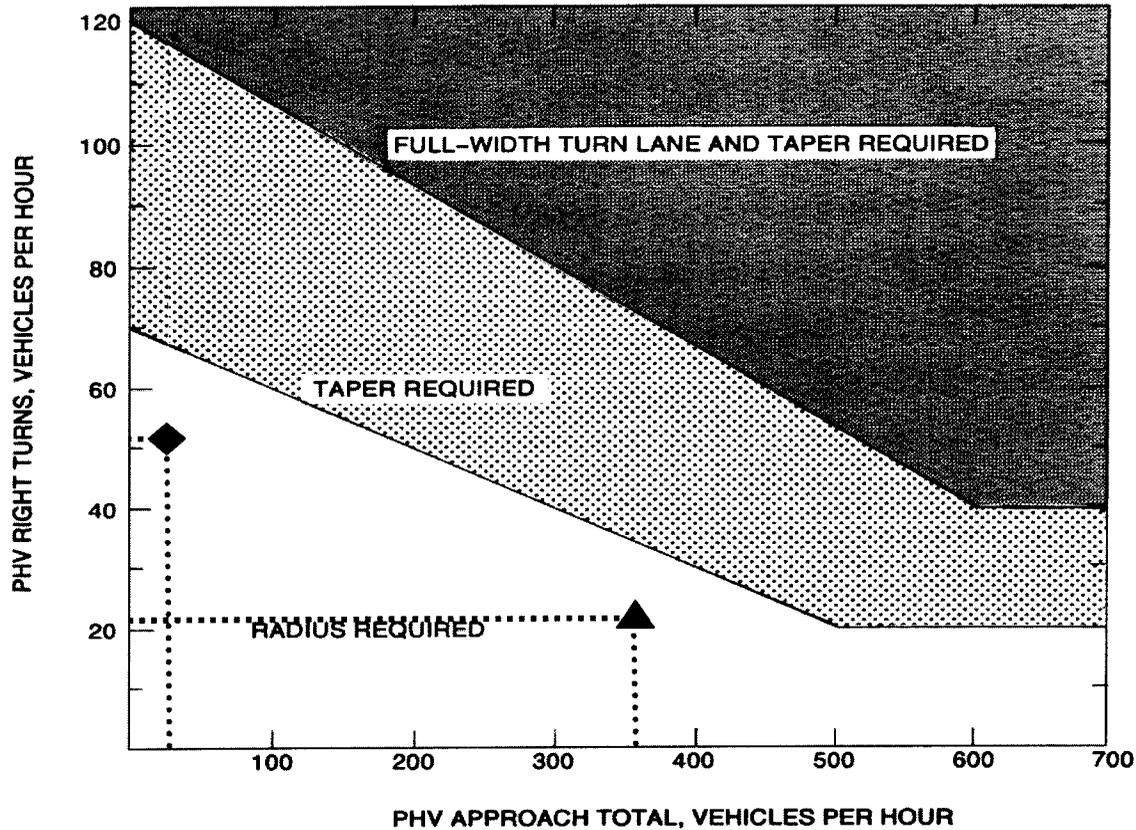
Location	Storage Length (95% Queue)*	Deceleration Length	Taper	Maximum Length (Storage + Deceleration + Taper)	Alternative Length (Storage + Deceleration)	Provided**	Comments
<i>East Colonial Hwy/Site Entrance</i>							
Design Speed		50 MPH					
WBL	100 ft.	350 ft.	100 ft.	550 ft.	450 ft.	510 ft.	BASED ON OLD VDOT SPECS FOR NORTHERN VIRGINIA
EBR	25 ft.	350 ft.	100 ft.	475 ft.	375 ft.	600 ft.	

Left Turns In AM 156 Actual Distribution (Park&Ride/Fields) 75.6%
 Left Turns Out AM 162 Actual Distribution (Park&Ride/Fields) 24.1%

165.

Total (2010) Right Turn Warrant @ E Colonial Hwy/Site Driveway

Design Year: 2010



	Peak Hour:	AM ▲	PM ◆
E Colonial Hwy Westbound Approach:	51 VPH		360 VPH
Right Turns	35 VPH		21 VPH
% Right Turns	68.6%		5.8%

Figure Source: VDOT Road Design Manual, Calculations by PHR+A

Right Turn Lane Warrant - Not Satisfied

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 x K x D

K = the percent of AADT occurring in the peak hour

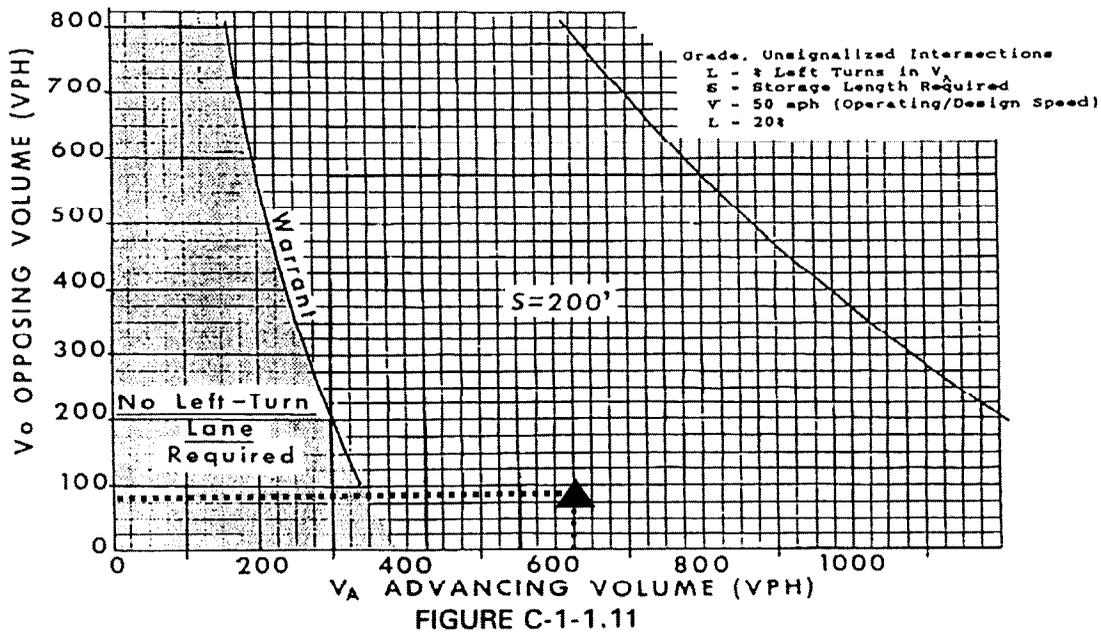
D = the percent of traffic in the peak direction of flow

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

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

Total (2010) Left Turn Warrant @ E Colonial Hwy/Site Driveway

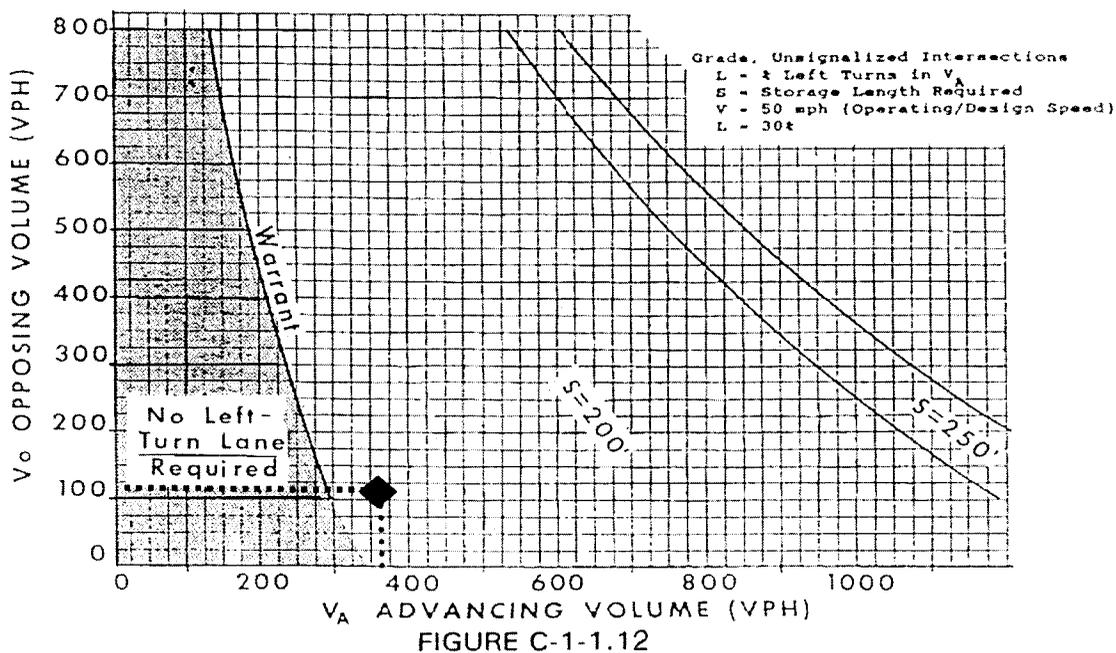
Design Year: 2010 - Design Speed 50MPH



	Peak Hour:	AM ▲	PM ◆
E Colonial Hwy	Advancing Vol (V_A):	624 VPH	131 VPH
Advancing - EB	Opposing Vol (V_o):	86 VPH	360 VPH
Opposing - WB	Left Turns:	113 VPH	34 VPH
	% Left Turns (L):	18.1%	26.0%

Figure Source: VDOT Road Design Manual, Calculations by PHR+A

Left Turn Lane Warrant - Satisfied



The road transitions to a 45 MPH speed limit at the site frontage east of the driveway at Gable Farm Lane (east of the existing Mount Olive Baptist Church) and is posted at 25 MPH at the Town limits. East of Canby Road, there are two warning signs for curves at 35 MPH on Business Route 7. The road is also designated as a state scenic highway. With the increase in site activities proposed with the development, PHR+A suggests that the 45 MPH posted speed be utilized to assess the turn lane lengths in relation to the AASSHTO guidelines. If the storage and deceleration lengths are considered, the left turn lane should be 510 feet consisting of 100 feet of storage, 410 feet of deceleration, assuming the taper can be included with the lane transitions. The turn lane lengths at a 55 MPH posted speed would increase turn lane requirements by 75 feet for the left turns, assuming the taper and deceleration area can be combined.

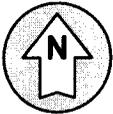
The bottom part of the table reflects the previous design guidelines based on speed, which shows the recommended turn lanes exceed the previous standards. Road transitions for the left turn lane pocket are shown based on a 50 MPH design speed, since the transition occurs where the existing speed limit is 45 for the eastbound approach. The right turn lane lengths are based on the beginning of the right turn lane into the bus bays, even though car trips will turn at the main entrance. Deceleration lengths are compatible with AASHTO guidance.

Intersection Mitigation

For locations where the LOS changed from existing acceptable conditions, PHR+A evaluated the *Manual of Uniform Traffic Control Devices* (MUTCD 2003) peak period signal warrant, to test if a signal is warranted at the on site and off-site locations. For Business Route 7, signalization is not suggested to address deficiencies in intersection operations, since the likelihood of traffic volumes satisfying the four hour or 8 hour warrants are limited. However, in order to mitigate the changes in site trips, the following mitigation measures were evaluated, as shown in Figure 18.

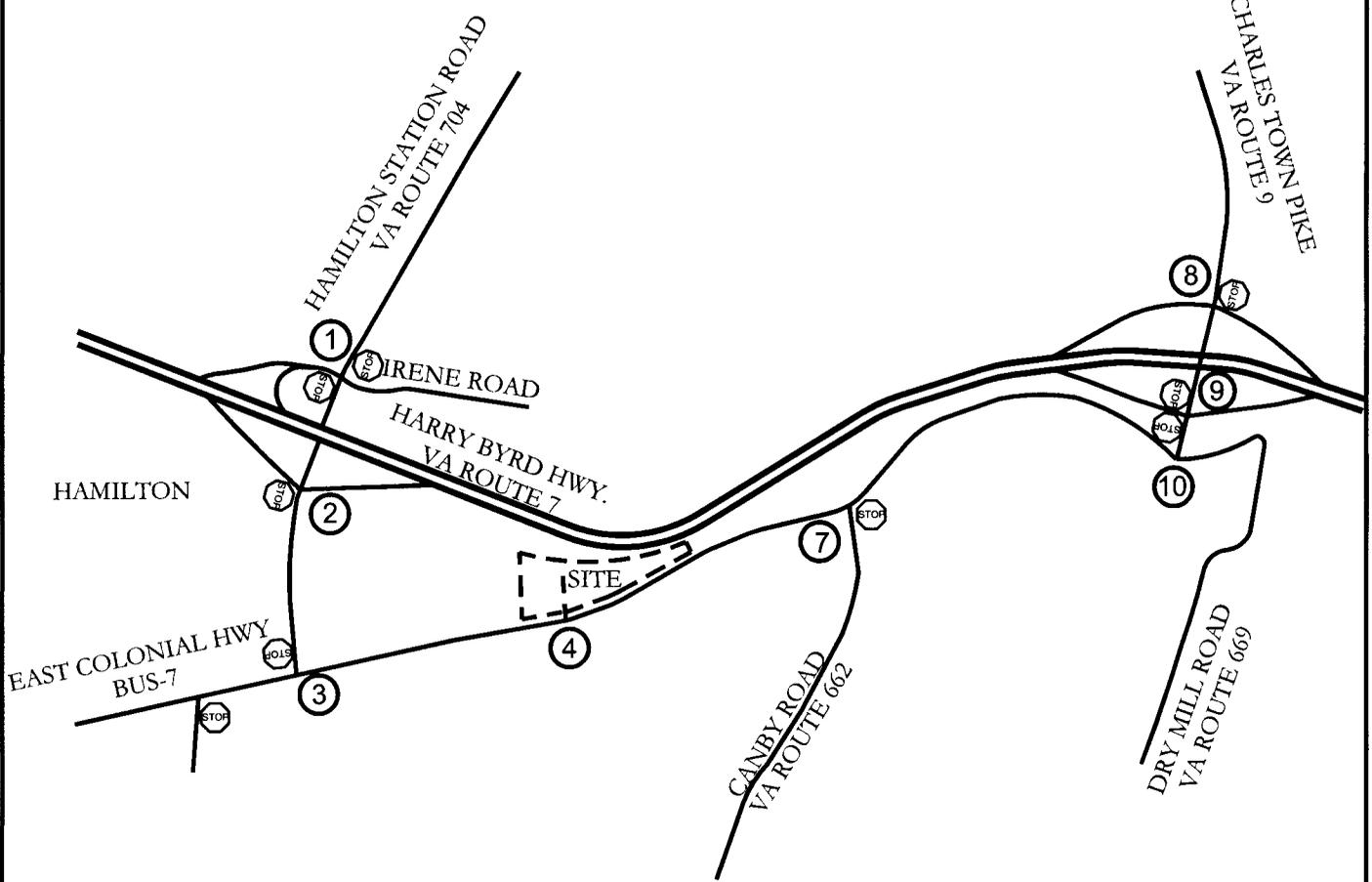
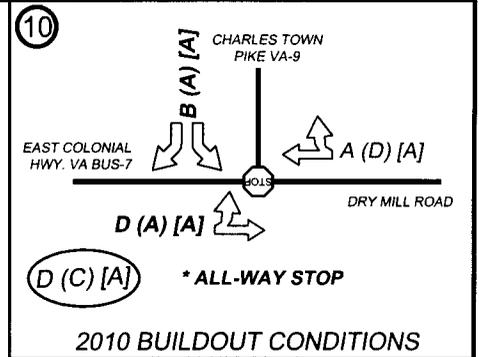
Short-Term

- The Dry Mill intersection with Business Route 7 (Intersection #10) operate at a LOS “F” in the AM peak. Added traffic on the southbound right and eastbound lefts operate at LOS “C” or better during the peaks. Since site traffic volumes are turning left from Business Route 7 adds delay to the southbound lefts, PHR+A evaluated if implementing an all-way stop would improve traffic operations. Subject to VDOT review, adding stop signs on the east-west approach would increase overall delay but achieve LOS “D” in the AM peak and LOS “C” in the PM peak. The improvements should be evaluated by VDOT with a contribution from the applicant for signing. Site impacts are less than 6 percent of the PM peak hour 2010 traffic volumes, so installation of signing should not be a requirement for site occupancy in the short-term.

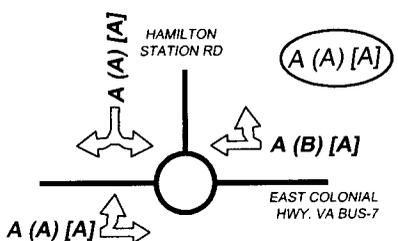


Not to Scale

* For site intersection 4 E Colonial Highway/Site Driveway
Please see Figure 14 for lane configuration and Table 8A/8B for Level of Service.

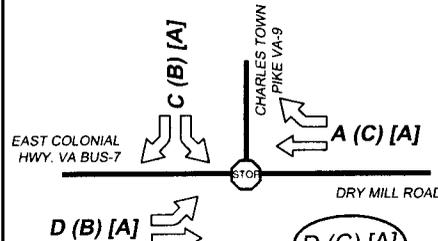


3 2020 BUILDOUT CONDITIONS



* ROUNDABOUT
(60' INSCRIBED CIRCLE)

10 2020 BUILDOUT CONDITIONS



* ALL-WAY STOP
W/ SEPARATE TURN LANE

LEGEND

- ① INTERSECTION NUMBERS
- ↑↑↑ LANE CONFIGURATION
- STOP STOP SIGN
- XXX (XXX) [XXX] AM (PM) [SAT] PEAK HOUR APPROACH LEVEL OF SERVICE
- X (X) [X] AM (PM) [SAT] OVERALL INTERSECTION LEVEL OF SERVICE



Mitigation Measures
Scott Jenkins Memorial Park

FIGURE 18
February 2009
13608-2-0

Long -term

- The Site entrance (Intersection #4) operate at LOS “E” for the AM exit. PHRA reviewed the LOS with a shared left and through exiting the site to achieve acceptable LOS “D” conditions. The intersection operations by lane group improves, but the impacts to buses suggest that the separate turn lane remain.
- The Dry Mill intersection with Business Route 7 (Intersection #10) operate at a LOS “F” in the AM peak. As in the short-term conditions, added traffic on the southbound right and eastbound lefts operate at LOS “C” or better during the peaks. Since site traffic volumes are turning left from Business Route 7 adds delay to the southbound lefts, PHR+A evaluated if implementing an all-way stop would improve traffic operations. For the long-term conditions, the additional growth would require all-way stop conditions with a separate left and right turn lane on Business Route 7 and Dry Mill Road, respectively. Subject to VDOT review, adding stop signs on the east-west approach would increase overall delay but achieve LOS “D” in the AM peak and LOS “C” in the PM peak, but the construction and R-O-W costs would need to be calculated. Addition of a right turn lane on the Dry Mill Road approach would significantly aid driver decisions on the north leg, but impact the existing bike usage on the W&OD Trail and involve significant earthwork to widen. Since site impacts are less than 15 percent of the Business Route 7 link volumes during the weekday peaks and site trips are not added to the existing turn deficiencies in the AM peak, funding for the turn lanes is not recommended with site development. Site impacts are less than 7 percent of the PM peak hour 2020 traffic volumes, so installation of signing should not be a requirement for site occupancy in the long-term.
- The Hamilton Station (Route 704) intersection with Business Route 7 (Intersection #3) operate at a LOS “F” in the AM and PM peaks. Additional site trips with the build-out of the park add turns at this location. PHR+A evaluated if implementing an all-way stop would improve traffic operations, but LOS “D” operations are not achieved with the existing lane operations. With the constrained R-O-W, an option to add a mini-roundabout was checked, and the resultant LOS is at “A” with a LOS “B” on the east leg in the PM peak. Since the intersection is in the Town, implementation of turn lanes or a roundabout needs additional coordination. Since site impacts are less than 15 percent of the intersection, a contribution to the intersection with the full build-out of the park is suggested.

Additional mitigation at the Route 7/Route 9 ramps are not included, since LOS deficiencies are a function existing traffic and growth and not the additional trips associated with the subject property.

The changes in LOS are summarized in Table 11 while the LOS worksheets are shown in Appendix I.

Site Impacts

The proposed Scott Jenkins Park development can be accommodated with the existing transportation infrastructure, with minimal impacts. The site impacts are summarized as a change in traffic volumes in Table 12 for the short-term and in Table 13 for the long-term scenarios. Overall impacts are less than 12 percent of the public street approaches adjacent to the Route 7/Route 9 interchange. Within the Town, the site impacts are at approximately 14 percent, and impacts at the Route 7/704 interchange are at 6-18 percent. The Business Route 7 impacts are at 6-23 percent adjacent to the property, with a higher impact to the west.

The site impacts are shown to provide an overall change of traffic with the development, and to verify the study area boundaries within the County traffic study guidelines. Site impacts with the initial phase on East Colonial Highway are proportional to the long-term conditions, with less initial development.

Table 11

Total Intersection Level of Service w/ Potential Mitigation

Scenario		2010		2010		2010	
Intersection	Lane Group	AM Peak Mitigation		PM Peak Mitigation		Sat Peak Mitigation	
		LOS	Delay	LOS	Delay	LOS	Delay
10 E Colonial Hwy/Dry Mill Rd/VA RT 9 All-Way Stop	EB - Appr	D	33.4	A	9.6	A	8.9
	WB - Appr	A	8.8	D	28.9	A	7.6
	SB - Appr	B	11.9	A	8.9	A	7
	Overall	D	25.9	C	24.1	A	8.3

Scenario		2020		2020		2020	
Intersection	Lane Group	AM Peak Mitigation		PM Peak Mitigation		Sat Peak Mitigation	
		LOS	Delay	LOS	Delay	LOS	Delay
3 E Colonial Hwy/Hamilton Station Rd Roundabout	EB - Appr	A	8.2	A	3.3	A	2.9
	WB - Appr	A	3.9	B	11.3	A	4.4
	SB - Appr	A	3.7	A	9.5	A	3.9
	Overall	A	6.5	A	8.3	A	3.4
10 E Colonial Hwy/Dry Mill Rd/VA RT 9 All-Way Stop	EB - Appr	D	30.4	B	10.9	A	9.8
	WB - Appr	A	9.1	C	20.1	A	7.3
	SB - Appr	C	17.7	B	10.6	A	7.7
	Overall	D	25.7	C	17.7	A	8.8

* E Colonial Hwy/Dry Mill Rd/VA RT 9 w/ separate turn lanes in all directions

**Table 12
Phase 1
Site Impacts**

	20120			2010		
	2010 Site Traffic	Total 2010 Traffic	Site Impacts	2010 Site Traffic	Total 2010 Traffic	Site Impacts
AM Peak Hour Site Impacts						
VA RT 704 Hamilton Station Rd North of VA RT 7 N Ramps	34	390	8.7%	33	251	13.1%
VA RT 704 Hamilton Station Rd North of E Colonial Hwy	86	410	21.0%	89	494	18.0%
E Colonial Hwy West of Hamilton Station Rd	51	874	5.8%	47	810	5.8%
E Colonial Hwy West of Site Driveway	137	698	19.6%	136	572	23.8%
E Colonial Hwy East of Site Driveway	47	609	7.7%	47	483	9.7%
Dry Mill Rd East of VA RT 9 Charles Town Pike	0	451	0.0%	1	640	0.2%
VA RT 9 Charles Town Pike North of E Colonial Hwy	47	549	8.6%	44	506	8.7%
VA RT 9 Charles Town Pike North of VA RT 7 N Ramps	34	1,707	2.0%	32	2,088	1.5%
PM Peak Hour Site Impacts						
VA RT 704 Hamilton Station Rd/E Colonial Hwy Overall Intersection	77	543	14.2%	77	543	14.2%
VA RT 704 Hamilton Station Rd/E Colonial Hwy Overall Intersection	136	949	14.3%	136	949	14.3%
VA RT 9 Charles Town Pike/E Colonial Hwy/Dry Mill Rd Overall Intersection	46	812	5.7%	46	812	5.7%
VA RT 9 Charles Town Pike/VA RT 7 S Ramps Overall Intersection	44	951	4.6%	44	951	4.6%
VA RT 9 Charles Town Pike/VA RT 7 N Ramps Overall Intersection	43	2,220	1.9%	43	2,220	1.9%
Daily Site Impacts						
	232	2,648	8.8%	232	2,648	8.8%
	589	5,096	11.6%	589	5,096	11.6%
	339	8,811	3.8%	339	8,811	3.8%
	928	5,771	16.1%	928	5,771	16.1%
	293	5,137	5.7%	293	5,137	5.7%
	5	7,095	0.1%	5	7,095	0.1%
	284	5,415	5.2%	284	5,415	5.2%
	227	23,073	1.0%	227	23,073	1.0%
PM Peak Hour Intersection Impacts						
VA RT 704 Hamilton Station Rd/E Colonial Hwy Overall Intersection	77	543	14.2%	77	543	14.2%
VA RT 704 Hamilton Station Rd/E Colonial Hwy Overall Intersection	136	949	14.3%	136	949	14.3%
VA RT 9 Charles Town Pike/E Colonial Hwy/Dry Mill Rd Overall Intersection	46	812	5.7%	46	812	5.7%
VA RT 9 Charles Town Pike/VA RT 7 S Ramps Overall Intersection	44	951	4.6%	44	951	4.6%
VA RT 9 Charles Town Pike/VA RT 7 N Ramps Overall Intersection	43	2,220	1.9%	43	2,220	1.9%

**Table 13
Build-Out
Site Impacts**

	2020		
	2020 Site Traffic	Total 2020 Traffic	Site Impacts
AM Peak Hour Site Impacts			
VA RT 704 Hamilton Station Rd North of VA RT 7 N Ramps	37	564	6.6%
VA RT 704 Hamilton Station Rd North of E Colonial Hwy	92	572	16.1%
E Colonial Hwy West of Hamilton Station Rd	54	996	5.4%
E Colonial Hwy West of Site Driveway	146	977	14.9%
E Colonial Hwy East of Site Driveway	53	884	6.0%
Dry Mill Rd East of VA RT 9 Charles Town Pike	1	669	0.1%
VA RT 9 Charles Town Pike North of E Colonial Hwy	51	794	6.4%
VA RT 9 Charles Town Pike North of VA RT 7 N Ramps	36	2,513	1.4%
PM Peak Hour Site Impacts			
2020 Site Traffic	56	378	14.8%
Total 2020 Traffic	134	734	18.3%
Site Impacts	70	1,198	5.8%
	203	848	23.9%
	92	737	12.5%
	7	952	0.7%
	78	761	10.2%
	49	3,092	1.6%
Daily Site Impacts			
2020 Site Traffic	309	3,885	8.0%
Total 2020 Traffic	743	7,414	10.0%
Site Impacts	416	12,957	3.2%
	1,159	8,328	13.9%
	447	7,616	5.9%
	24	10,520	0.2%
	399	7,985	5.0%
	285	34,103	0.8%
PM Peak Hour Intersection Impacts			
2020 Site Traffic	108	798	13.5%
Total 2020 Traffic	203	1,407	14.4%
Site Impacts	85	1,220	7.0%
	78	1,419	5.5%
	71	3,294	2.2%
Overall Intersection			
VA RT 704 Hamilton Station Rd/VA RT 7 N Ramps			
Overall Intersection			
VA RT 704 Hamilton Station Rd/E Colonial Hwy			
Overall Intersection			
VA RT 9 Charles Town Pike/E Colonial Hwy/Dry Mill Rd			
Overall Intersection			
VA RT 9 Charles Town Pike/VA RT 7 S Ramps			
Overall Intersection			
VA RT 9 Charles Town Pike/VA RT 7 N Ramps			
Overall Intersection			

174

Conclusions

The conclusions of this traffic study are as follows:

1. The proposed development generates 199 AM peak period trips and 295 PM peak period trips. Saturday counts are estimated at 168 peak hour trips under full site development.
2. Daily site trip generation would be 1,606 vehicles per day (two-way) and 1,200 VPD on Saturday.
3. Initial site development would generate 184 trips (two-way) and 1,221 daily trips weekday.
4. A single site access north of East Colonial Highway is proposed. A separate right turn slip lane for the bus access is also shown east of the site driveway. Separate left turn lanes are warranted for site access. Signalization is not required.
5. The study area intersections operate at acceptable intersection conditions for the weekday and weekend peaks except for the Route 9 interchange ramps and the Business Route 7 /Dry Mill Road intersection. These locations have existing LOS deficiencies which will continue with growth and with the proposed land use activities. Mitigation measures are evaluated for the 2020 scenario at on-site and off-site locations based on the subject site impacts. Improvements at the Route 9 interchange ramps are not suggested in conjunction with the proposed application.
6. Off-site intersections will deteriorate in traffic operations with growth and the proposed site activities. The Business Route 7 unsignalized intersection at Dry Mill Road/Route 9 will continue to experience LOS "F" conditions for southbound left turns to Dry Mill Road with or without development. However, the proposed site trips turning at this intersection will operate at LOS "C" or better for the southbound rights on Route 9 (into the site) or eastbound lefts on East Colonial Highway (exiting the site). The Dry Mill Road intersection would require an all-way stop and separate turn lanes to achieve acceptable LOS "D" during the AM peak hour with or without the subject site. The PM peak volumes on westbound Dry Mill Road are high due to traffic bypassing Route 7. If implemented by others, a contribution to turn lanes may be considered as a pro-rata share based on the site impacts to the intersection as part of the second phase of development. if off-site road improvements are implemented.
7. To address increases in traffic to the west, a pro-rata contribution with the full site activities may be considered at the Route 704/Business Route 7 intersection for the long-term conditions. As an option, the analysis considered a mini-roundabout at Route 704/Business Route 7 to satisfy LOS requirements, but would require additional R-O-W and approval by the Town of Hamilton and VDOT. Improvements are not required for the short-term site activities.
8. The two-way Daily link on the site entrance is 1,600 VPD at build-out and 1220 in Phase 1 initial usage. Traffic volumes on Business Route 7 are estimated at 8,700 VPD based on field counts, growth, and site trips.
9. The site impacts at the Route 9 interchange comprise less than 2 percent of the future peak hour volumes. Site impacts at the Route 7 /704 interchange are less than 15 percent.
10. The site access includes turn lanes designed at a 45 MPH speed limit. With the proposed

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uses, the opportunity to reduce the speed limit from the 45-55 MPH existing designation would be appropriate. The existing designation as a state scenic highway and the 25 MPH speed limit in the town of Hamilton suggest that a reduce design speed should be considered with site design.