

Traffic Impact Analysis

Powhatan Commercial

Powhatan County, Virginia

August 20, 2009

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INTRODUCTION AND SUMMARY

Purpose of Report and Study Objectives

This report presents the finding of a traffic impact study conducted for a proposed commercial development located in Powhatan County, Virginia. The proposed development consists of approximately 170,000 square feet of commercial use on approximately 25 acres of land. To allow flexibility for minor modifications to the site plan, the square footage listed above was rounded off for purposes of the traffic study. The development is scheduled to be completed in 2011.

The following tasks were completed as part of this study.

- A scoping meeting was held on September 23, 2008 with representatives from Powhatan County and the Virginia Department of Transportation (VDOT), which included discussions about the parameters of the study and relevant background information. A copy of the scoping document confirming the parameters and assumptions used is included in the Technical Appendix.
- Field reconnaissance in the vicinity of the site was performed to collect information related to the existing traffic controls, roadway geometry, and traffic flow characteristics.
- Traffic counts were conducted on October 8, 2008 during the morning and afternoon peak hours at intersections located within the study area. Traffic counts were also performed on Saturday, October 25 from 11:00 am to 2:00 pm.
- Future traffic conditions were projected based on inherent traffic growth of 2 percent compounded annually to account for regional growth along the roadway network, with added traffic produced by approved background developments within the vicinity of the study area.
- Proposed site traffic volumes were generated based on the methodology outlined in the Institute of Transportation Engineers' (ITE) Trip Generation, 7th Edition.
- Intersection capacity analyses were performed using the software package *Synchro, Version 6.0* based on the Highway Capacity Manual (HCM) methodology. Traffic analyses were performed for the existing conditions (2008), future conditions (2011) without development, future conditions (2011) with development, and horizon conditions (2017) at the intersections contained within the study area.

Sources of data for this traffic study include Powhatan County, VDOT, and the office files and field reconnaissance efforts of Gorove/Slade Associates, Inc.

This report presents the findings of the analyses performed for the following conditions.

- Existing Conditions (2008): Consider existing traffic volumes and existing roadway configurations during the weekday morning and afternoon peak hours.



- Future Conditions (2011) without Development: Consider future traffic conditions resulting from inherent traffic growth, background sites, but do not included volumes generated by proposed commercial use.
- Future Conditions (2011) with Development: Consider future traffic volumes with the proposed development for the year 2011 and traffic generated by the proposed office use.
- Horizon Year (2017): Consider future traffic volumes resulting from inherent growth, background sites, and the proposed development for planning purposes.

The results of the analysis and the traffic impacts with the proposed development plan are presented in the Conclusion section of this report.

Executive Summary

Site Location and Study Area

The proposed development will be located north of Route 60 (Anderson Highway) and west of Route 675 (Page Road) in Powhatan County, Virginia. The site driveways will be located on Route 60 west of the intersection with Luck Stone Quarry/Stavemill Road and on Luck Stone Quarry north of Route 60.

The following intersections were identified in the scoping meeting for inclusion in this traffic study.

- 1) Route 60 and Dorset Road
- 2) Route 60 and New Dorset Road
- 3) Route 60 and Judes Ferry Road
- 4) Route 60 and South Creek One
- 5) Route 60 and Luck Stone Quarry/Stavemill Road
- 6) Route 60 and Page Road/Urbine Road
- 7) Route 60 and Holly Hills Road
- 8) Route 60 and Page Road/County Line Road
- 9) Route 60 and Old Hundred Road
- 10) Route 60 and Huguenot Springs Road
- 11) Route 60 and West Project Driveway
- 12) Luck Stone Quarry and Project Driveway



Description of the Proposed Development

The proposed development consists of approximately 170,000 square feet of commercial use located adjacent to Luck Stone Quarry. The site contains approximately 25 acres of land on a 53.34-acre parcel, divided into the proposed retail center and the parking area. Access to the site will be provided via two driveways. To allow flexibility for minor modifications to the site plan, the square footage listed above was rounded off for purposes of the traffic study. The primary access is proposed to be located on Luck Stone Quarry, approximately 600 feet north of Route 60. The secondary access is proposed to be a right-in/right-out/left-in access on Route 60 approximately 1000 feet west of the Luck Stone Quarry/Stavemill Road intersection. The intersection of Luck Stone Quarry/Stavemill Road and Route 60 is proposed to be signalized. The project is scheduled to be complete by 2011.

Principal Findings, Conclusions, and Recommendations

The analysis presented in this report supports the following major conclusions.

Existing Conditions (2008)

In order to determine the peak hour turning movement traffic volumes, traffic counts were performed in October 2008 during the weekday morning and afternoon peak periods, as well as the Saturday peak period. Intersection capacity analyses was performed for the study intersections, of which the following have movements that operate below an acceptable level of service (LOS) 'D' under the existing conditions:

- Route 60 and Dorset Road
- Route 60 and New Dorset Road
- Route 60 and Judes Ferry Road
- Route 60 and Luck Stone Quarry/Stavemill Road
- Route 60 and Page Road/Urbine Road
- Route 60 and Holly Hills Road
- Route 60 and Page Road/County Line Road
- Route 60 and Old Hundred Road
- Route 60 and Huguenot Springs Road

As there are currently no road improvements being constructed in this area, there were no mitigation measures assumed in the existing conditions analysis.



Future Conditions without Development (2011)

Traffic volumes were projected for the year 2011 without the proposed development. The construction of the Watkins Center (assumed to be half complete in 2011), the US 60 Commercial Development, and a new elementary school were accounted for in the background development. An inherent regional growth rate of two percent per year was applied to the existing volumes to determine the background condition volumes.

Background improvements are also included with the construction of the Route 60 Development. This consists of adding a traffic signal to the intersection of Route 60 and Page Road/County Line Road, as well as adding northbound left- and right-turn lanes and a second westbound left-turn lane. The following intersections continue to have movements that do not meet acceptable operating levels:

- Route 60 and Dorset Road
- Route 60 and New Dorset Road
- Route 60 and Judes Ferry Road
- Route 60 and South Creek One
- Route 60 and Luck Stone Quarry/Stavemill Road
- Route 60 and Page Road
- Route 60 and Holly Hills Road
- Route 60 and Page Road/County Line Road
- Route 60 and Old Hundred Road
- Route 60 and Huguenot Springs Road

Future Conditions with Development (2011)

The proposed site contains a 170,000 square foot retail center on a 53.34 acre site. The site will be accessed by one right-in/right-out/left-in driveway on Route 60 and by one full access driveway on Luck Stone Quarry.

The proposed development will generate approximately 162 trips during the weekday morning peak hour, 667 trips during the weekday afternoon peak hour, and 7,192 trips in an entire week day. There are also a total of 916 trips generated during a Saturday peak hour.

Intersection capacity analyses were performed for the future conditions with the proposed development at the intersections contained within the study area during the morning and afternoon peak hours. *Synchro, Version 6.0* was used to analyze the study intersections based on the Highway Capacity Manual methodology. It is desirable to achieve a level of service “D” or better for each lane group.



The following improvements are recommended under this condition.

Intersection of Route 60 and Luck Stone Quarry/Stavemill Road:

- *Installation of a traffic signal;*
- *Addition of a third through lane for the eastbound movement;*
- *Construction of a new left-turn lane for the eastbound movement;*
- *Addition of a third through lane for the westbound movement;*
- *Construction of a new right-turn lane for the westbound movement;*
- *Addition of two southbound left-turn lanes;*

Intersection of Route 60 and the West Project Driveway:

- *Addition of a third through lane for the westbound movement;*

The following intersections have movements that operate at unacceptable LOS during one or more peak periods.

- Route 60 and Judes Ferry Road
- Route 60 and Dorset Road
- Route 60 and New Dorset Road
- Route 60 and South Creek One
- Route 60 and Luck Stone Quarry/Stavemill Road
- Route 60 and Page Road/Urbine Road
- Route 60 and Holly Hills Road
- Route 60 and Page Road/County Line Road
- Route 60 and Old Hundred Road
- Route 60 and Huguenot Springs Road
- Route 60 and the West Project Driveway

Other intersections in the study area do not experience large detrimental effects due to the proposed development. These intersections experience poor operation under signalized and unsignalized conditions for the existing traffic volumes. These deficiencies are largely the result of a lack of traffic capacity on Route 60. Because of the capacity constraint, even significant improvements to the minor approaches would not improve the overall operation of the study intersections.

Future Conditions with Development (2017)

The construction of the proposed development is anticipated to have a horizon year of 2017. For planning purposes, a future 2017 scenario was investigated. The traffic generated by additional nearby development and inherent growth on the roadways within the study area were accounted for in traffic projections. The completion of the Watkins Center and the construction of the Shady Oak Development were accounted for in the background development. The following intersections have movements that operate at unacceptable LOS during one or more peak periods.

- Route 60 and Judes Ferry Road
- Route 60 and Dorset Road
- Route 60 and New Dorset Road
- Route 60 and South Creek One
- Route 60 and Luck Stone Quarry/Stavemill Road
- Route 60 and Page Road/Urbine Road
- Route 60 and Holly Hills Road
- Route 60 and Page Road/County Line Road
- Route 60 and Old Hundred Road
- Route 60 and Huguenot Springs Road
- Route 60 and the West Project Driveway



BACKGROUND INFORMATION: PROPOSED DEVELOPMENT (SITE AND NEARBY)

Assumed Transportation Improvements

It is assumed in the analysis that the programmed improvements for Route 60 (Anderson Highway) would be constructed in the background condition before the proposed site is completed. This consists of the construction of Stavemill Road opposite Luck Stone Quarry, which will provide a connection between Route 60 and Urbine Road. A traffic signal at the intersection of Route 60 and Stavemill Road/Luck Stone Quarry is proposed. This also includes the realignment of Route 675 (Page Road) to approximately 600 feet east of the existing intersection with Route 60. The existing portion of Urbine Road east of Stavemill Road will be removed. Background improvements are also included with the construction of the Route 60 Development. This consists of adding a traffic signal to the intersection of Route 60 and Page Road/County Line Road, as well as adding northbound left- and right-turn lanes and a second westbound left-turn lane.

For the future with development scenario, improvements to the intersection of Route 60 and Stavemill Road/Luck Stone Quarry are assumed. This includes the addition of a third through lane to the east- and westbound movements, the construction of a northbound right-turn lane, and the construction of two southbound left-turn lanes.

There are also background improvements assumed for the horizon year 2017 scenario. These improvements follow the construction of the Stavemill Development, including upgrades to the intersection of Route 60 and Stavemill Road/Luck Stone Quarry. This consists of the extension of the eastbound right-turn lane, the addition of a second westbound left-turn lane, and the construction of a second northbound left-turn lane.

Description of On-Site Development

The proposed development will be located north of Route 60 (Anderson Highway), west of Route 675 (Page Road) in Powhatan County, Virginia. A map of the site location is included as Figure 1. A site driveway is proposed along Route 60 that would allow left- and right-turns inbound and only right-turns outbound from the site. This entrance is proposed approximately 1,000 feet west of Luck Stone Quarry. An additional site driveway is proposed along Luck Stone Quarry, approximately 600 feet north of Route 60. It is proposed that this intersection be signalized.

The parcel is comprised of approximately 53.34 acres of land. The proposed development consists of approximately 25 acres of the 53-acre parcel. A parcel map is included as Figure 2. The site is divided into the proposed retail center and the parking area. The general terrain of the site is flat.

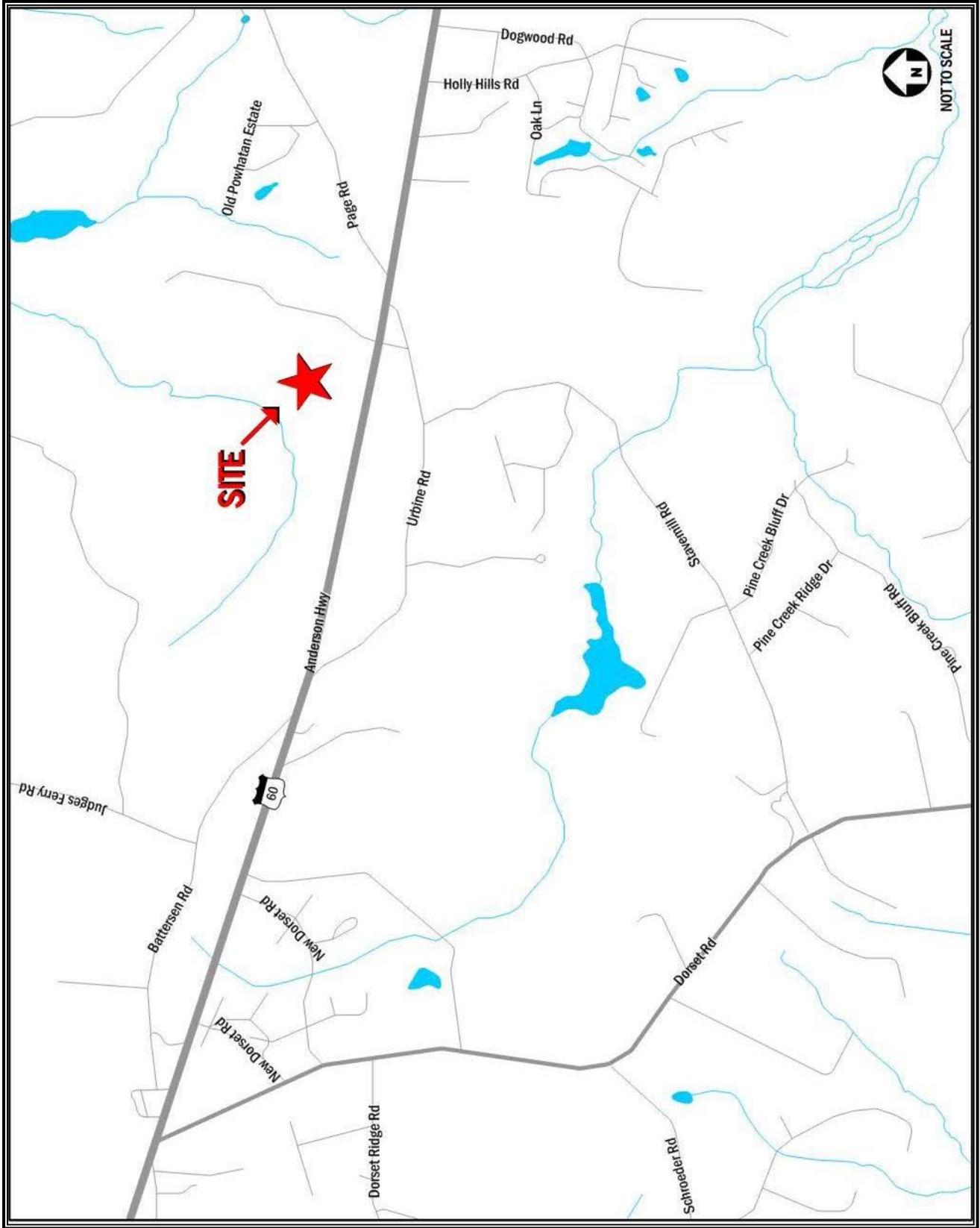


Figure 1: Site Location



Figure 2: Parcel Map



The site is located in Powhatan County, Virginia. The proposed development is consistent with the Powhatan County Comprehensive Plan Update from January 2003. The Comprehensive Plan outlines the growth of commercial activity along Route 60 between Academy Road and Route 522. The site is currently zoned I-1 (Light Industrial District) and R/C (Residential/Commercial District) for the northern and southern portions of the site, respectively.

A plan of the proposed site use is included as Figure 3.

Description of Geographic Scope and Limits of Study Area

The geographic scope of the study area is defined as the area within 2,000 feet of the site and any roadway on which 10% or more of the new vehicle trips generated by the proposed development are distributed, not to exceed two miles. The study area is located along Route 60 (Anderson Hwy) between Dorset Road to the west and Huguenot Springs Road to the east.

The following intersections were identified in the scoping meeting for inclusion in this traffic study.

- 1) Route 60 and Dorset Road
- 2) Route 60 and New Dorset Road
- 3) Route 60 and Judes Ferry Road
- 4) Route 60 and South Creek One
- 5) Route 60 and Luck Stone Quarry/Stavemill Road
- 6) Route 60 and Page Road/Urbine Road
- 7) Route 60 and Holly Hills Road
- 8) Route 60 and Page Road/County Line Road
- 9) Route 60 and Old Hundred Road
- 10) Route 60 and Huguenot Springs Road
- 11) Route 60 and East Project Driveway
- 12) Route 60 and West Project Driveway

Description of Nearby Uses

The properties located immediately adjacent to the site are zoned I-1 (Light Industrial District) or R/C (Residential/Commercial District). The properties beyond the proposed development are zoned Rural Conservation District. A map of nearby uses is included as Figure 4.

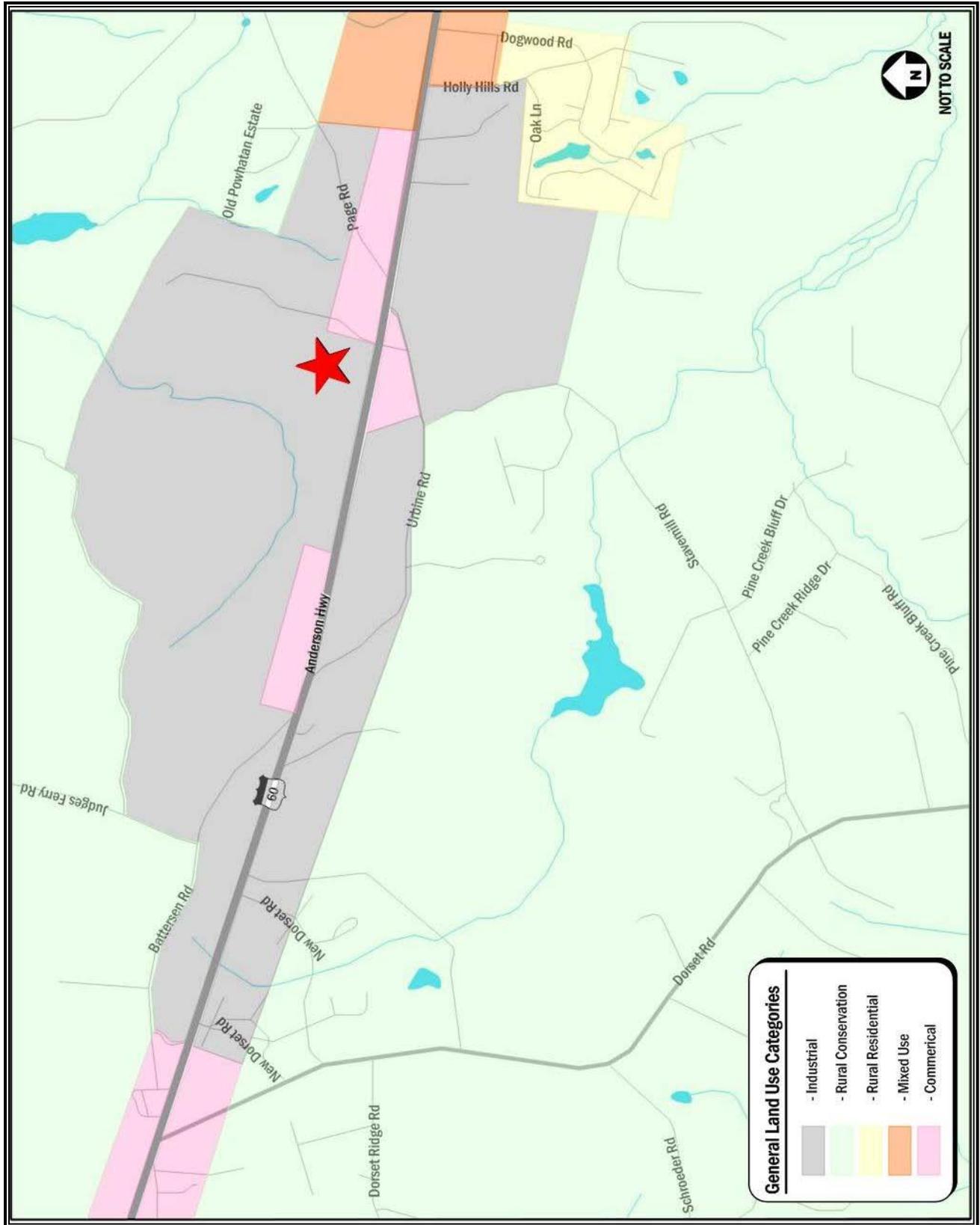


Figure 4: Nearby Uses



Description of Existing Roadways

Route 60 (Anderson Highway) is a 4-lane divided east-west highway that runs through Powhatan County. Within the limits of the study area, Route 60 runs from Dorset Road to Huguenot Springs Road. Route 60 is classified by Powhatan County as a major arterial. It has an estimated average annual daily traffic of 25,000 vehicles west of Urbine Road and 30,000 vehicles east of Urbine Road, according to VDOT data from 2007. The posted speed limit in the vicinity of the site is 55 mph.

Huguenot Springs Road is a 2-lane north-south roadway. Within the limits of the study area, Huguenot Springs Road runs north from Route 60. Huguenot Springs Road is classified by Powhatan County as a major collector. It has an estimated average annual daily traffic of 610 vehicles, according to VDOT data from 2007. The posted speed limit in the vicinity of the site is 45 mph.

Old Hundred Road is a 2-lane north-south roadway. Within the limits of the study area, Old Hundred Road runs south from Route 60. Old Hundred Road is classified by Powhatan County as a local road. It has an estimated average annual daily traffic of 2,400 vehicles, according to VDOT data from 2007. The posted speed limit in the vicinity of the site is 45 mph.

Page Road is a 2-lane U-shaped roadway. Within the limits of the study area, Page Road runs from Route 60 at the intersection with County Line Road to Urbine Road. It is classified by Powhatan County as a local road with an estimated average annual daily traffic of 1,000 vehicles, according to VDOT data from 2007. The posted speed limit in the vicinity of the site is 45 mph.

County Line Road is a 2-lane north-south roadway that runs between Route 60 and Mt. Herman Road. Within the limits of the study area, County Line Road runs south from Route 60 at the intersection with Page Road. It has an estimated average annual daily traffic of 670 vehicles, according to VDOT data from 2007. The posted speed limit in the vicinity of the site is 45 mph.

Holly Hills Road is a 2-lane north-south roadway. Within the limits of the study area, Holly Hills Road runs between Route 60 and Dogwood Road. Holly Hills Road is classified by Powhatan County as a local road. It has an estimated average annual daily traffic of 1,100 vehicles, according to VDOT data from 2006. The posted speed limit in the vicinity of the site is 25 mph.

Urbine Road is a 2-lane U-shaped roadway. Within the limits of the study area, Urbine Roads runs between the intersection with Page Road to Batterson Road. It is classified by Powhatan County as a local road with an estimated average annual daily traffic 4,000 vehicles, according to VDOT data from 2007. The posted speed limit in the vicinity of the site is 45 mph.

Luck Stone Quarry is a 2-lane north-south roadway. Within the limits of the study area, Luck Stone Quarry runs north of Urbine Road. Luck Stone Quarry is classified by Powhatan County as a local road.



Stavemill Road is a 2-lane north-south roadway. Within the limits of the study area, Stavemill Road runs between Urbine Road and Dorset Road. Stavemill Road is classified by Powhatan County as a local road. It has an estimated average annual daily traffic of 3,700 vehicles, according to VDOT data from 2007.

South Creek One is a 4-lane north-south roadway. Within the limits of the study area, South Creek One runs north from Route 60. South Creek One is classified by Powhatan County as a local road. There is no average annual daily traffic data available from VDOT because the roadway was recently constructed.

Judes Ferry Road is a 2-lane north-south roadway. Within the limits of the study area, Judes Ferry Road runs north from Route 60. Judes Ferry Road is classified by Powhatan County as a major collector. It has an estimated average annual daily traffic of 5,400 vehicles south of Batterson Road and 4,300 vehicles north of Batterson Road, according to VDOT data from 2007.

New Dorset Road is a 2-lane divided north-south roadway. Within the limits of the study area, New Dorset Road runs between Route 60 and Dorset Road. New Dorset Road is classified by Powhatan County as a local road. It has an estimated average annual daily traffic of 3,700 vehicles north of New Dorset Circle and 3,400 vehicles south of New Dorset Circle, according to VDOT data from 2007.

Dorset Road is a 2-lane north-south roadway. Within the limits of the study area, Dorset Road runs south of Route 60. Dorset Road is classified by Powhatan County as a major collector. It has an estimated average annual daily traffic of 6,900 vehicles, according to VDOT data from 2007.

A map of the existing roadways is included as Figure 5.

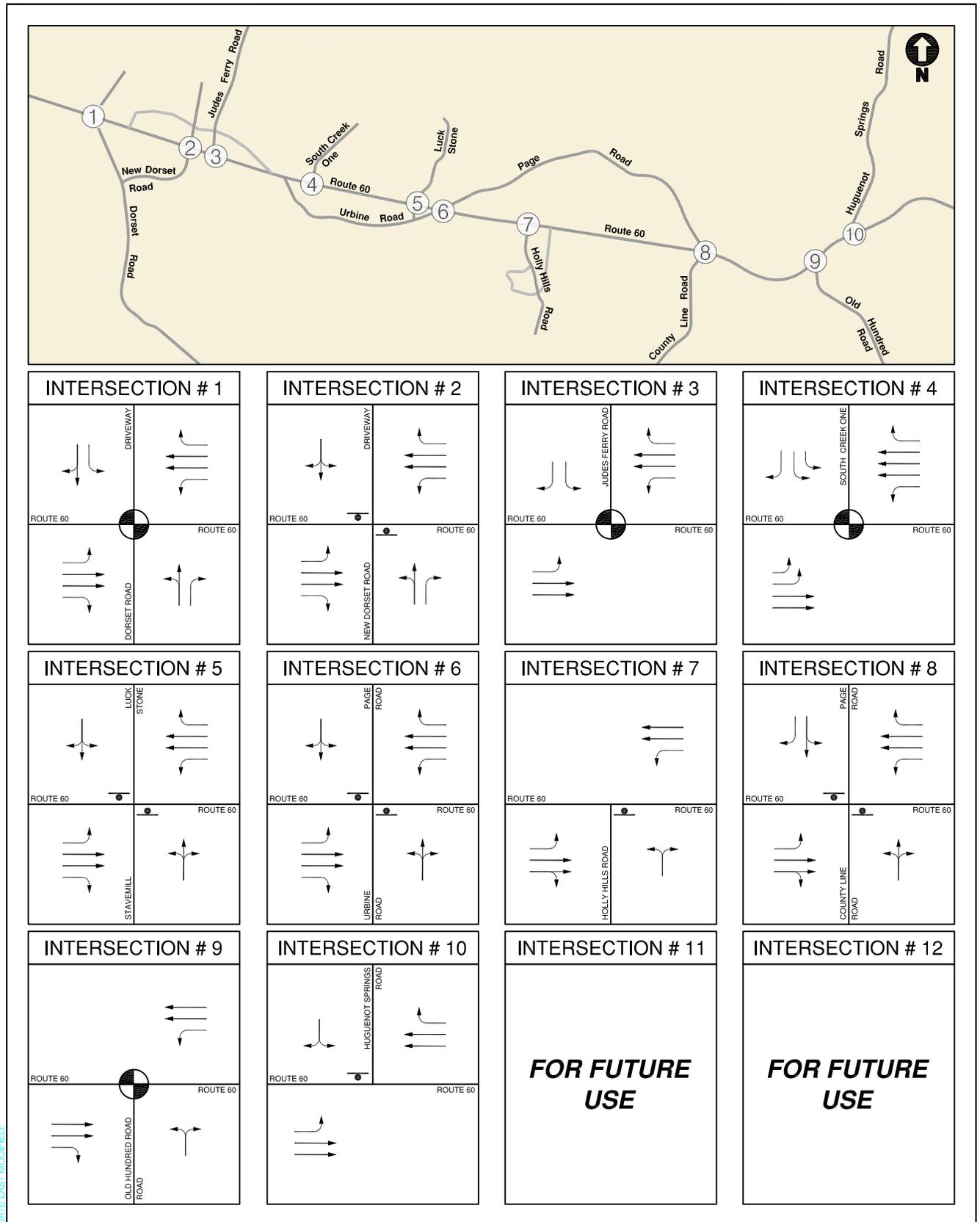
Programmed Improvements within Study Area

The following improvements are planned within the study area in the 2031 Long-Range Transportation Plan for the Richmond Regional Planning District Commission. A diagram of the programmed improvements is included as Figure 6.

Page Road currently intersects Route 60 at Urbine Road. The existing intersection will be reconfigured into 2 separate intersections. Page Road will be realigned approximately 600 feet east of the existing intersection.

Stavemill Road is currently under construction opposite Luck Stone Quarry. Stavemill Road will provide connection between Route 60 and Urbine Road. The existing section of Urbine Road between Stavemill Road and Route 60 will be removed.

Dorset Road currently intersects Route 60 west of the proposed development. The existing intersection is planned to be realigned to improve site distance. Turn lanes will also be added.



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Figure 5
Existing Roadways and Lane Configurations

Legend

- Lane Configuration
- STOP Sign
- Traffic Signal

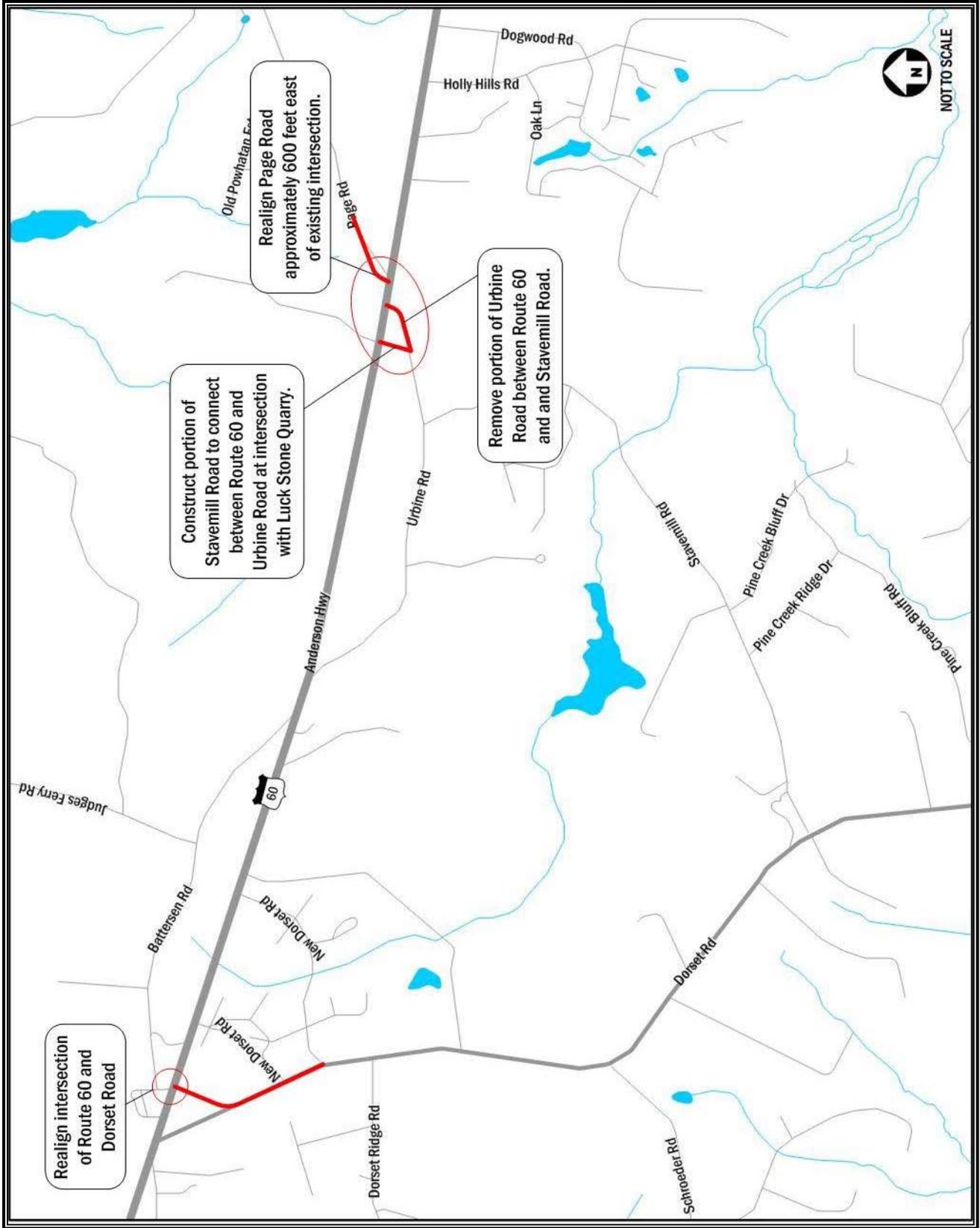


Figure 6: Planned Improvements to Roadway Network



ANALYSIS OF EXISTING CONDITIONS

Existing Volumes

In order to determine the weekday peak hour turning movement traffic volumes, traffic counts were performed on October 8, 2008 from 6:00 to 9:00 am and from 4:00 to 7:00 pm. Existing traffic volumes from the Route 60 Commercial Study were also used in the analysis to account for intersections where data was not counted. Traffic counts were also performed on Saturday, October 25 from 11:00 am to 2:00 pm. The existing traffic volumes for the intersections contained within the study area are shown on Figure 7 and tabulated in Table 1. The intersection of Luck Stone Quarry and East Project Driveway and Route 60 and West Project Driveway are not included because the roadways are not currently constructed. Analysis of the existing traffic data determined that the weekday morning peak hour is from 7:15 am to 8:15 am, the weekday afternoon peak hour is from 5:00 pm to 6:00 pm, and the Saturday peak hour is from 11:30 am – 12:30 pm. The existing turning movement counts are included in the Technical Appendix.

Table 1: Existing (2008) Traffic Volumes

Intersection (Approach)	Existing Traffic Volumes								
	AM Peak Hour			PM Peak Hour			Saturday Peak Hour		
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Route 60 and Dorset Road									
Eastbound	123	1,386	62	87	585	68	104	778	93
Westbound	26	470	65	71	1,428	158	69	669	118
Northbound	87	64	59	112	31	20	79	47	35
Southbound	157	22	25	81	46	59	103	48	39
Route 60 and New Dorset Road									
Eastbound	7	1,478	66	0	506	25	0	801	15
Westbound	56	0	--	246	0	--	108	822	0
Northbound	15	--	265	95	--	146	39	0	179
Route 60 and Judes Ferry Road									
Eastbound	598	1,254	7	129	612	4	133	862	0
Westbound	1	465	40	1	1,735	104	0	798	138
Southbound	236	0	152	64	0	152	98	0	91
Route 60 and South Creek One									
Eastbound	43	1,666	--	150	640	--	157	797	--
Westbound	--	491	62	--	1,587	245	--	753	159
Southbound	76	--	25	78	--	291	71	--	228
Route 60 and Luck Stone Quarry/Stavemill Road									
Eastbound	17	0	0	1	0	0	2	838	5
Westbound	2	561	12	11	1,935	8	8	841	2
Northbound	0	9	0	0	1	0	8	0	9
Southbound	21	9	11	11	2	12	4	0	4
Route 60 and Page Road/Urbine Road									
Eastbound	17	1,811	1	18	812	5	31	831	10
Westbound	36	574	3	312	1,751	8	78	806	6
Northbound	1	1	291	2	0	52	3	1	88
Southbound	1	8	34	4	0	34	3	4	21
Route 60 and Holly Hills Road									



Intersection (Approach)	Existing Traffic Volumes								
	AM Peak Hour			PM Peak Hour			Saturday Peak Hour		
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Eastbound	3	2,097	6	11	830	24	0	901	10
Westbound	8	589	..	33	2,052	..	30	927	..
Northbound	24	..	29	19	..	14	23	..	17
Route 60 and Page Road/County Line Road									
Eastbound	56	2,065	5	52	772	20	11	991	7
Westbound	11	583	28	31	2,059	76	5	887	32
Northbound	5	0	18	13	4	13	6	1	6
Southbound	55	7	13	95	1	9	27	5	3
Route 60 and Old Hundred Road									
Eastbound	..	2,080	97	..	758	82	..	966	42
Westbound	25	555	..	29	2,029	..	30	904	..
Northbound	67	..	48	134	..	25	62	..	32
Route 60 and Huguenot Springs Road									
Eastbound	10	2,118	..	19	764	..	21	918	..
Westbound	..	568	11	..	2,043	35	..	880	31
Southbound	33	..	15	36	..	12	16	..	17

Examination of the turning movement counts indicated some possible errors in the volumes. In order to account for possible error, the turning movement counts were adjusted to balance along Route 60. These adjusted existing traffic volumes are shown on Figure 8 and tabulated in Table 2.

Table 2: Adjusted Existing (2008) Traffic Volumes

Intersection (Approach)	Existing Traffic Volumes								
	AM Peak Hour			PM Peak Hour			Saturday Peak Hour		
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Route 60 and Dorset Road									
Eastbound	123	1,487	62	87	654	68	104	778	93
Westbound	26	520	65	71	1,428	156	69	669	118
Northbound	87	64	59	112	31	20	79	47	35
Southbound	157	22	25	81	46	59	103	48	39
Route 60 and New Dorset Road									
Eastbound	7	1,605	66	..	705	25	0	801	15
Westbound	56	561	..	246	1,525	5	108	822	0
Northbound	15	..	265	95	..	146	39	0	179
Route 60 and Judes Ferry Road									
Eastbound	398	1,465	..	129	718	..	133	862	0
Westbound	1	465	40	1	1,640	104	0	798	138
Southbound	236	..	152	64	..	130	98	0	91
Route 60 and South Creek One									
Eastbound	43	1,749	..	150	747	..	157	797	..
Westbound	..	544	62	..	1,535	245	..	753	159
Southbound	76	..	25	78	..	291	71	..	228
Route 60 and Luck Stone/Stavemill Road									
Eastbound	17	1,808	0	1	824	0	2	838	5
Westbound	2	595	12	11	1,768	8	8	841	2
Northbound	0	9	0	0	1	0	8	0	9
Southbound	21	9	11	11	2	12	4	0	4



Intersection (Approach)	Existing Traffic Volumes								
	AM Peak Hour			PM Peak Hour			Saturday Peak Hour		
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Route 60 and Page Road/Urbine Road									
Eastbound	17	1,811	1	18	812	5	31	831	10
Westbound	36	574	3	312	1,751	8	78	806	6
Northbound	1	1	291	2	0	52	3	1	88
Southbound	4	0	34	1	8	34	3	4	21
Route 60 and Holly Hills Road									
Eastbound	3	2,097	6	11	830	24	0	901	10
Westbound	8	589	--	33	2,052	--	30	927	--
Northbound	24	--	29	19	--	14	23	--	17
Route 60 and Page Road/County Line Road									
Eastbound	56	2,065	5	52	772	20	11	991	7
Westbound	11	583	28	31	2,059	76	5	887	32
Northbound	5	0	18	13	4	13	6	1	6
Southbound	95	1	9	55	7	13	27	5	3
Route 60 and Old Hundred Road									
Eastbound	--	2,080	97	--	758	82	--	966	42
Westbound	25	555	--	29	2,029	--	30	904	--
Northbound	67	--	48	137	--	25	62	--	32
Route 60 and Huguenot Springs Road									
Eastbound	10	2,118	--	19	764	--	21	918	--
Westbound	--	568	11	--	2,043	35	--	880	31
Southbound	36	--	12	33	--	15	16	--	17

Existing Conditions Capacity Analysis

Intersection capacity analyses were performed for the existing conditions at the intersections contained within the study area during the morning and afternoon peak hours. *Synchro, Version 6.0* was used to analyze the study intersections based on the Highway Capacity Manual (HCM) methodology.

The results of the intersection capacity analysis are presented in Table 3 and shown on Figure 9. They are expressed in level of service (LOS) and delay (seconds per vehicle) per lane group for each approach. The results of a queuing analysis are presented in Table 4, expressed in queue length (feet).

Table 3: Existing (2008) Capacity Analysis

Intersection (Approach)	Existing Level of Service					
	AM Peak Hour		PM Peak Hour		Saturday Peak Hour	
	LOS	Delay	LOS	Delay	LOS	Delay
Route 60 and Dorset Road	C	28.0	C	33.8	C	24.2
Eastbound Left	D	38.2	E	74.7	D	43.4
Eastbound Through	C	23.6	B	17.1	B	18.9
Eastbound Right	B	18.0	B	13.7	B	13.8
Westbound Left	D	41.1	E	64.4	D	42.1
Westbound Through	C	27.5	C	32.5	B	18.6
Westbound Right	C	21.5	B	15.2	B	15.0
Northbound Left/Through	C	30.9	E	66.3	D	45.0



Intersection (Approach)	Existing Level of Service					
	AM Peak Hour		PM Peak Hour		Saturday Peak Hour	
	LOS	Delay	LOS	Delay	LOS	Delay
Northbound Right	C	27.4	D	50.5	D	36.8
Southbound Left	D	40.5	E	56.0	D	42.6
Southbound Through/Right	C	32.3	E	60.2	D	39.9
Route 60 and New Dorset Road (Unsignalized)	--	--	--	--	--	--
Eastbound Left	B	11.2	A	0.0	A	0.0
Westbound Left	B	10.1	B	11.7	B	10.3
Northbound	C	20.6	F	**	D	31.9
Southbound	A	0.0	A	0.0	A	0.0
Route 60 and Judes Ferry Road	C	25.0	D	39.9	B	10.8
Eastbound Left	D	39.9	D	47.4	C	28.0
Eastbound Through	B	13.6	A	4.5	A	3.3
Westbound U-Turn	D	44.2	D	48.3	A	0.0
Westbound Through	C	30.3	B	17.8	B	11.4
Westbound Right	C	25.5	A	7.6	A	8.8
Southbound Left	D	43.9	F	278.0	C	29.7
Southbound Right	C	30.1	D	42.1	C	26.8
Route 60 and South Creek One	A	6.9	B	15.0	A	9.9
Eastbound Left	D	42.3	C	31.8	B	18.8
Eastbound Through	A	4.9	A	5.3	A	4.2
Westbound Through	A	4.3	B	15.1	B	10.8
Westbound Right	A	3.9	B	10.5	A	9.4
Southbound Left	D	38.7	C	24.5	B	17.3
Southbound Right	D	37.5	C	30.1	B	17.6
Route 60 and Luck Stone/Stavemill Road (Unsignalized)	--	--	--	--	--	--
Eastbound Left	A	9.3	C	17.4	A	10.0
Westbound Left	C	17.5	A	9.9	B	10.1
Northbound	F	554.0	F	257.6	D	31.8
Southbound	F	**	F	673.7	D	30.5
Route 60 and Page Road/Urbine Road (Unsignalized)	--	--	--	--	--	--
Eastbound Left	A	9.3	C	18.7	B	10.1
Westbound Left	C	20.8	B	14.4	B	10.6
Northbound	F	301.6	F	**	C	19.4
Southbound	F	**	F	**	E	46.8
Route 60 and Holly Hills Road (Unsignalized)	--	--	--	--	--	--
Westbound Left	C	22.3	B	10.4	B	10.2
Northbound	F	699.7	F	128.0	E	38.9
Route 60 and Page Road/County Line Road (Unsignalized)	--	--	--	--	--	--
Eastbound Left	A	10.0	D	27.3	B	10.2
Westbound Left	C	22.1	A	9.8	B	10.9
Northbound	F	435.4	F	**	F	52.1
Southbound	F	**	F	**	F	109.0
Route 60 and Old Hundred Road	F	96.4	B	12.0	A	8.0
Eastbound Through	F	122.1	A	7.9	A	8.6
Eastbound Right	A	5.2	A	5.8	A	5.8
Westbound Left	D	47.8	D	47.8	C	33.0
Westbound Through	A	2.7	B	11.1	A	4.0
Northbound	D	43.3	D	42.4	C	26.7
Route 60 and Huguenot Springs Road	--	--	--	--	--	--
Eastbound Left	A	9.2	C	22.7	B	10.4
Southbound	F	154.1	F	953.0	D	30.0

** Error: Volume greatly exceeds capacity. Delay is too large to be calculated for approach.



Table 4: Existing (2008) Queuing Analysis

Intersection (Approach)	Turn Bay Length	Existing Queues					
		AM Peak Hour		PM Peak Hour		Saturday Peak Hour	
		Average Queue	95% Queue	Average Queue	95% Queue	Average Queue	95% Queue
Route 60 and Dorset Road							
Eastbound Left	200'	52	95	90	#132	51	#130
Eastbound Through		162	241	165	216	183	273
Eastbound Right	300'	0	20	0	16	0	23
Westbound Left	210'	19	39	60	105	31	84
Westbound Through		142	213	540	631	136	215
Westbound Right	200'	0	28	20	44	0	29
Northbound Left/Through		94	137	127	138	62	130
Northbound Right	50'	23	43	9	22	6	31
Southbound Left		77	159	64	113	50	110
Southbound Through/Right		13	40	82	104	32	81
Route 60 and New Dorset Road (Unsignalized)							
Eastbound Left	250'	..	3	..	0	..	0
Westbound Left	250'	..	7	..	30	..	10
Northbound		..	55	..	**	..	81
Southbound		..	0	..	0	..	0
Route 60 and Judes Ferry Road							
Eastbound Left	380'	276	229	85	122	33	80
Eastbound Through		230	397	40	90	45	63
Westbound U-Turn	250'	1	4	2	3	0	0
Westbound Through		119	184	360	445	95	154
Westbound Right	225'	0	8	0	14	0	22
Southbound Left	400'	129	209	~213	#327	29	71
Southbound Right		0	13	20	57	0	26
Route 60 and South Creek One							
Eastbound Left	200'	10	22	36	68	15	41
Eastbound Through		163	237	61	130	34	77
Westbound Through		29	43	171	310	48	91
Westbound Right	200'	0	m10	0	34	0	26
Southbound Left		14	34	13	34	8	21
Southbound Right		0	17	54	122	0	33
Route 60 and Luck Stone/Stavemill Road (Unsignalized)							
Eastbound Left	200'	..	2	..	0	..	0
Westbound Left	250'	..	1	..	2	..	1
Northbound		..	58	..	4	..	14
Southbound		..	**	..	108	..	7
Route 60 and Page Road/Urbine Road (Unsignalized)							
Eastbound Left	250'	..	1	..	5	..	3
Westbound Left	250'	..	12	..	53	..	8
Northbound		..	392	..	**	..	28
Southbound		..	**	..	**	..	30
Route 60 and Holly Hills Road							
Westbound Left	250'	..	3	..	3	..	3
Northbound		..	151	..	53	..	28
Route 60 and Page Road/County Line Road (Unsignalized)							
Eastbound Left	250'	..	5	..	20	..	1
Westbound Left	250'	..	4	..	3	..	1
Northbound		..	75	..	**	..	15



Intersection (Approach)	Turn Bay Length	Existing Queues					
		AM Peak Hour		PM Peak Hour		Saturday Peak Hour	
		Average Queue	95% Queue	Average Queue	95% Queue	Average Queue	95% Queue
Southbound		..	**	..	**	..	55
Route 60 and Old Hundred Road							
Eastbound Through		~995	#816	120	147	57	187
Eastbound Right	125'	11	21	0	11	0	11
Westbound Left	150	13	38	15	42	6	31
Westbound Through		31	56	337	551	46	94
Northbound		48	96	78	140	19	56
Route 60 and Huguenot Springs Road (Unsignalized)							
Eastbound Left	250'	..	1	..	6	..	2
Southbound		..	87	..	133	..	17

~ Volume exceeds capacity, queue is theoretically infinite. Queue shown is maximum after two cycles.
 # 95th percentile volume exceeds capacity, queue may be longer. Queue shown is maximum after two cycles
 m Volume for 95th percentile queue is metered by upstream signal

For the purpose of this analysis, it is desirable to achieve a level of service “D” or better on each approach. The following intersections have movements that operate at unacceptable LOS during one or more peak periods.

- Route 60 and Dorset Road
- Route 60 and New Dorset Road
- Route 60 and Judes Ferry Road
- Route 60 and Luck Stone Quarry/Stavemill Road
- Route 60 and Page Road/Urbine Road
- Route 60 and Holly Hills Road
- Route 60 and Page Road/County Line Road
- Route 60 and Old Hundred Road
- Route 60 and Huguenot Springs Road

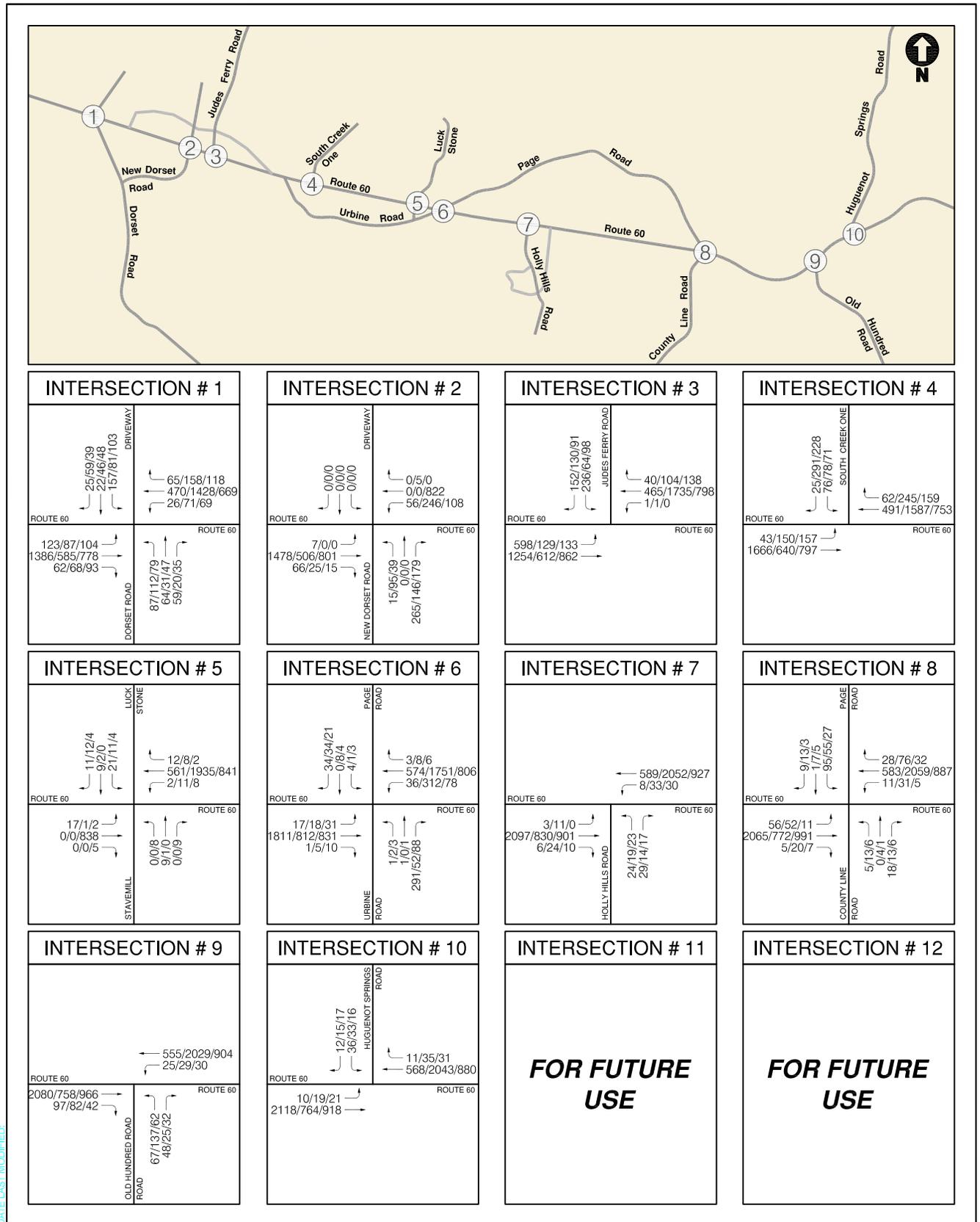
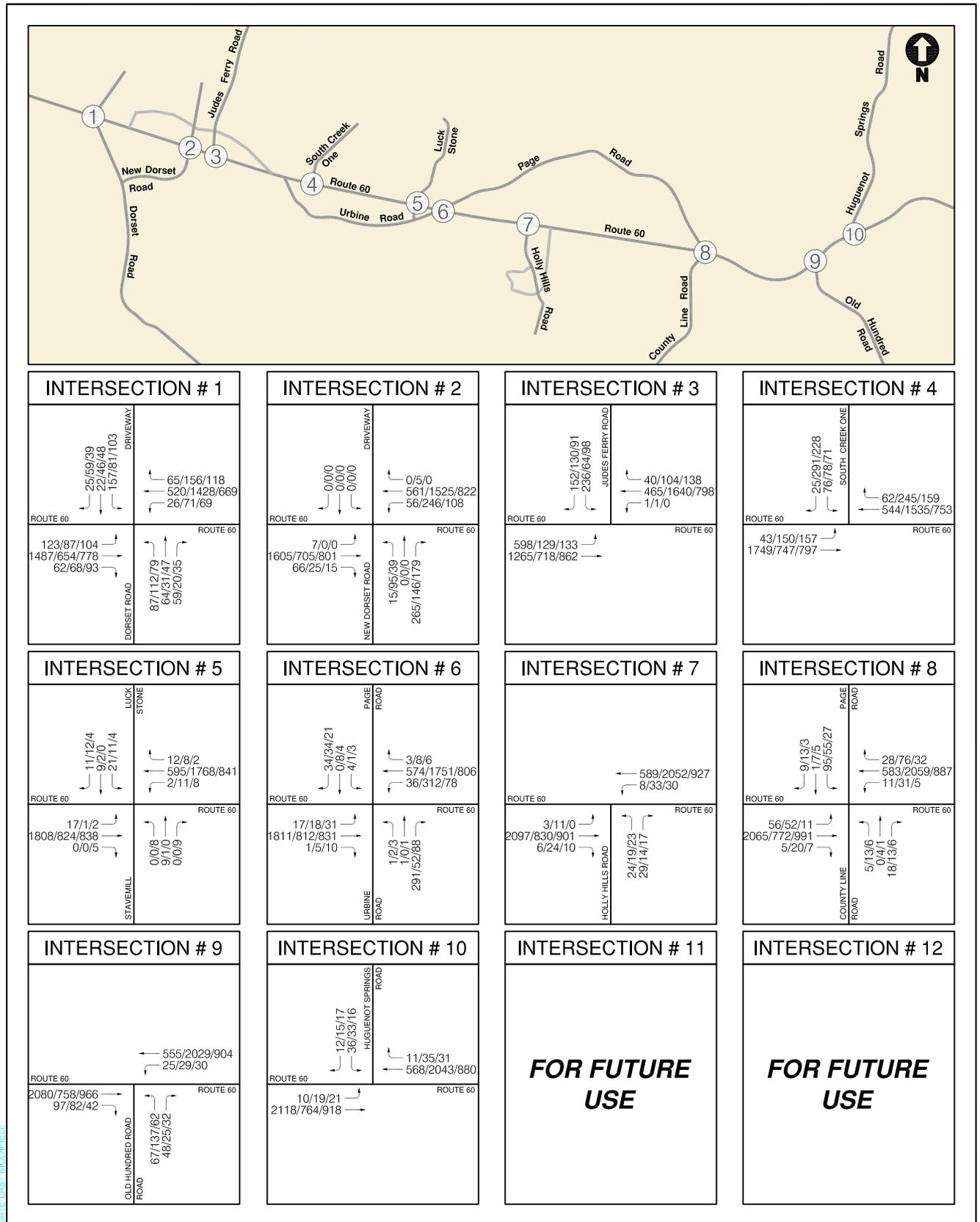


Figure 7
Existing (2008) Traffic Volumes

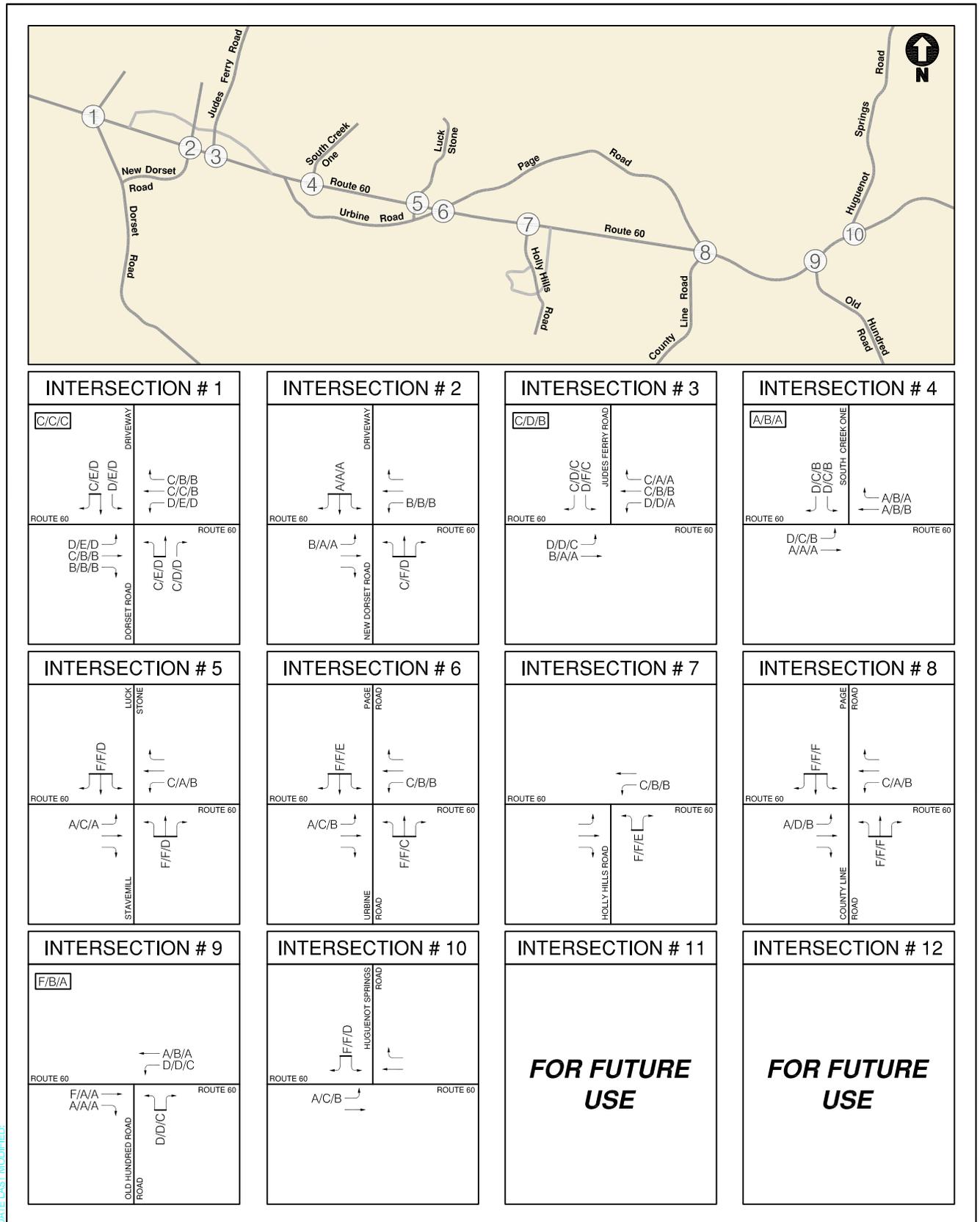


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Figure 8
Adjusted Existing (2008) Traffic Volumes

Legend

- Existing Roadway Network
- AM/PW/SAT
- AM/PW/SAT
- Peak Hour Traffic Volumes



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Figure 9
Existing (2008) Level of Service

Legend

- Existing Roadway Network
- AM/PW/SAT Peak Hour Level of Service



ANALYSIS OF FUTURE CONDITIONS (2011) WITHOUT DEVELOPMENT

Future without Development (2011) Traffic Volumes

The construction of the proposed development is anticipated to have a build-out year of 2011. The traffic generated by nearby development and inherent growth on the roadways within the study area were accounted for in traffic projections. The construction of the Watkins Center (half complete in 2011), the US 60 Commercial Development, and a new elementary school were accounted for in the background development.

The Watkins Center will be located near the intersection of Route 60 and Route 288. A traffic impact analysis was performed by Volkert and Associates, Inc. in May 2007. Upon completion, the development will consist of 2,064,900 square feet of retail development, 2,674,400 square feet of office development, 726,400 square feet of industrial development, 1,600 residential units, and a 100-room hotel. For the 2011 analysis, it was assumed that approximately half of the total site trips would be assigned to the roadway. The remaining trips are assumed under the 2017 conditions.

The US 60 Commercial Development will be located near the intersection of Route 60 and County Line Road/Page Road. A traffic impact analysis was performed by Ramey Kemp and Associates of Richman in March 2008. Upon completion, the development will consist of approximately 90,000 square feet of retail space, a 100,000 square foot supermarket, a convenience store with 16 fueling positions, and a 4,000 square foot drive-in bank. It was assumed that the site would be fully completed by 2011.

The new elementary school will be located near the intersection of Route 60 and Batterson Road. Upon completion, the school is expected to consist of approximately 900 students. It was assumed that the elementary school would be fully completed by 2011.

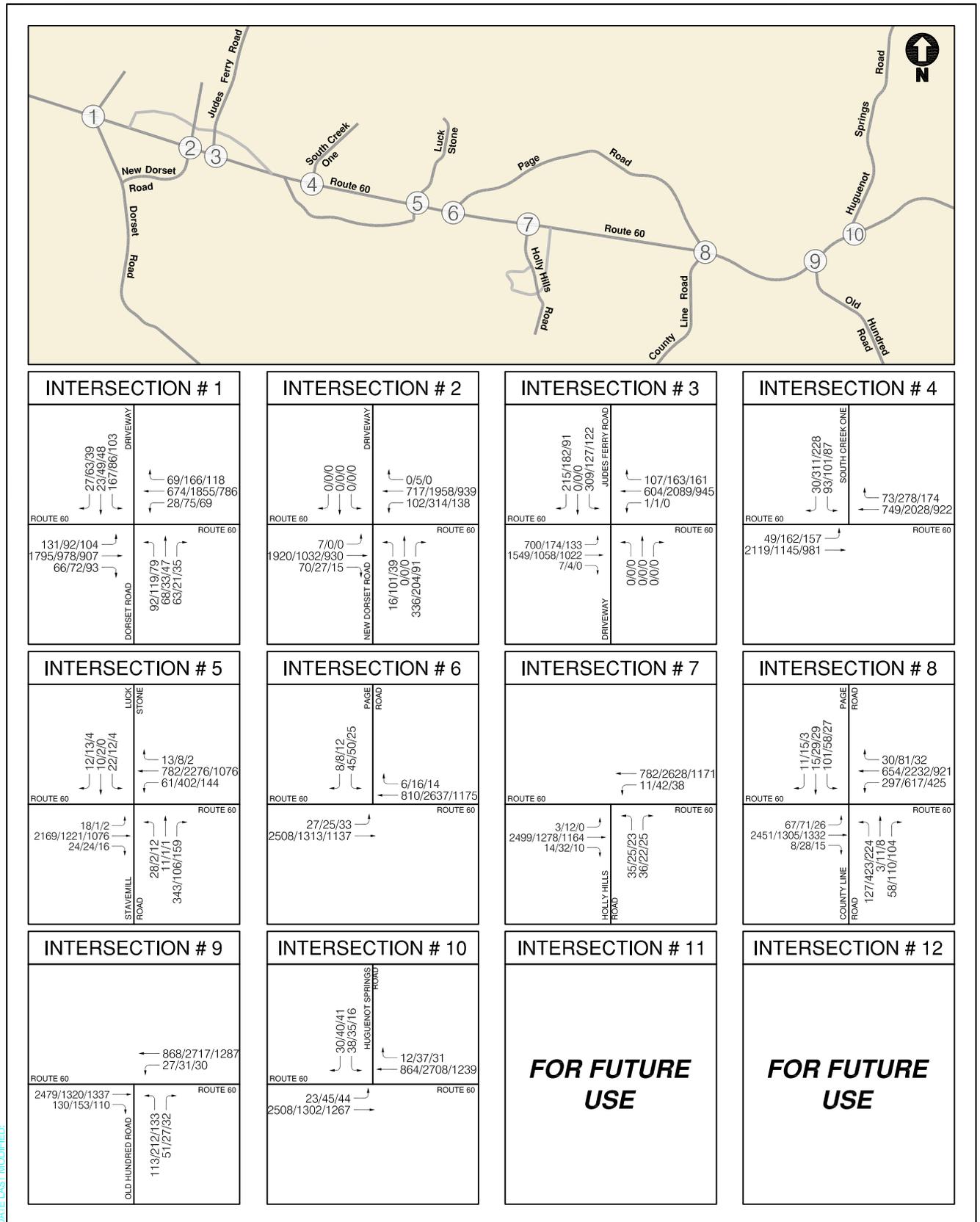
Trip generation and distribution for the Watkins Center and the US 60 Commercial Development were for the background development was calculated based on methodology outlined in the Institute of Transportation Engineers' (ITE) Trip Generation, 7th Edition. Other traffic increases were accounted for with a 2 percent growth rate compounded annually over the 3-year period for all study intersections.

Table 5 presents the trips generated by the background developments. The future background inherent traffic growth was added to the existing (2008) volumes in order to establish the future (2011) traffic volumes without the proposed development. The future (2011) traffic volumes without the proposed development are shown on Figure 10 and presented in Table 6.



Table 5: Background Site Trip Generation (2011)

Land Use	ITE Code	Size	Units	Weekday Trip Generation						
				AM Peak Hour			PM Peak Hour			Daily Total
				In	Out	Total	In	Out	Total	
Watkins Center	Varies	Varies	Varies	2,269	792	3,061	1,737	2,897	4,634	--
Route 60 Commercial	Varies	Varies	Varies	625	453	1,078	1,002	1,006	2,008	24,098
Elementary School	520	900	Students	186	152	338	105	127	232	1,161



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Figure 10
Future (2011) without Development Traffic Volumes

Legend

- Existing Roadway Network
- AM/PM/SAT
- AM/PM/SAT
- AM/PM/SAT



Table 6: Future (2011) Traffic Volumes without Development

Intersection (Approach)	Future Background Traffic Volumes								
	AM Peak Hour			PM Peak Hour			Saturday Peak Hour		
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Route 60 and Dorset Road									
Eastbound	131	1,795	66	92	978	72	104	907	93
Westbound	28	674	69	75	1,855	166	69	786	118
Northbound	92	68	63	119	33	21	79	47	35
Southbound	167	23	27	86	49	63	103	48	39
Route 60 and New Dorset Road									
Eastbound	7	1,920	70	0	1,032	27	0	930	15
Westbound	102	717	0	314	1,958	5	138	939	0
Northbound	16	0	336	101	0	204	39	0	211
Route 60 and Judes Ferry Road									
Eastbound	487	1,762	7	174	1,058	4	133	1,022	0
Westbound	1	604	107	1	2,089	163	0	945	161
Southbound	309	0	215	127	0	182	122	0	91
Route 60 and South Creek One									
Eastbound	49	2,119	--	162	1,145	--	157	981	--
Westbound	--	749	73	--	2,028	278	--	922	174
Southbound	93	--	90	101	--	311	87	--	228
Route 60 and Luck Stone/Stavemill Road									
Eastbound	18	2,169	24	1	1,221	24	2	1,079	16
Westbound	61	782	13	402	2,276	8	144	1,076	2
Northbound	28	11	343	2	1	106	12	1	159
Southbound	22	10	12	12	2	13	4	0	4
Route 60 and Page Road/Urbine Road									
Eastbound	27	2,508	--	25	1,313	--	33	1,137	--
Westbound	--	810	6	--	2,637	16	--	1,175	14
Southbound	8	--	45	8	--	50	12	--	25
Route 60 and Holly Hills Road									
Eastbound	3	2,499	14	12	1,278	32	0	1,164	10
Westbound	11	782	--	42	2,628	--	38	1,171	--
Northbound	35	--	36	25	--	22	23	--	25
Route 60 and Page Road/County Line Road									
Eastbound	67	2,451	8	71	1,305	28	26	1,332	15
Westbound	297	654	30	617	2,232	81	425	921	32
Northbound	127	3	58	423	11	110	224	8	104
Southbound	101	15	11	58	29	15	27	29	3
Route 60 and Old Hundred Road									
Eastbound	--	2,479	130	--	1,320	153	--	1,337	110
Westbound	27	868	--	31	2,717	--	30	1,287	--
Northbound	113	--	51	212	--	27	133	--	32
Route 60 and Huguenot Springs Road									
Eastbound	23	2,508	--	45	1,302	--	44	1,267	--
Westbound	--	864	12	--	2,708	37	--	1,239	31
Southbound	38	--	30	35	--	40	16	--	41



Future without Development Capacity Analysis

It is assumed in the analysis that the programmed improvements for Route 60 (Anderson Highway) would be constructed in the background condition. This consists of the construction of Stavemill Road opposite Luck Stone Quarry, which will provide a connection between Route 60 and Urbine Road. A traffic signal at the intersection of Route 60 and Stavemill Road/Luck Stone Quarry is proposed. This also includes the realignment of Route 675 (Page Road) to approximately 600 feet east of the existing intersection with Route 60. The existing portion of Urbine Road east of Stavemill Road will be removed.

As previously mentioned, background improvements are also included with the construction of the Route 60 Development. This consists of adding a traffic signal to the intersection of Route 60 and Page Road/County Line Road, as well as adding northbound left- and right-turn lanes and a second westbound left-turn lane.

The future background roadways and lane configurations are shown in Figure 11.

Intersection capacity analyses were performed for the future background conditions at the intersections contained within the study area during the morning and afternoon peak hours. *Synchro, Version 6.0* was used to analyze the study intersections based on the Highway Capacity Manual methodology. The detailed analysis worksheets are contained in the Technical Appendix.

The results of the intersections capacity analyses are shown on Figure 12 and presented in Table 7. They are expressed in level of service (LOS) and delay (seconds per vehicle) per lane group for each approach. The results of a queuing analysis are presented in Table 8, expressed in queue length (feet).

Table 7: Future (2011) Capacity Analysis without Development

Intersection (Approach)	Future Background Level of Service					
	AM Peak Hour		PM Peak Hour		Saturday Peak Hour	
	LOS	Delay	LOS	Delay	LOS	Delay
Route 60 and Dorset Road	D	46.6	D	43.0	C	23.4
Eastbound Left	E	79.3	F	121.9	E	55.9
Eastbound Through	D	47.4	B	19.2	B	18.6
Eastbound Right	B	14.0	B	13.4	B	13.2
Westbound Left	E	79.7	E	67.4	D	44.2
Westbound Through	C	24.0	D	49.9	B	17.0
Westbound Right	B	19.4	B	12.9	B	13.1
Northbound Left/Through	E	79.6	E	71.1	D	45.2
Northbound Right	E	63.1	E	55.1	D	38.5
Southbound Left	E	76.1	E	62.9	D	43.5
Southbound Through/Right	E	60.6	E	62.9	D	41.4
Route 60 and New Dorset Road (Unsignalized)	--	--	--	--	--	--
Eastbound Left	A	9.3	A	0.0	A	0.0
Westbound Left	D	31.5	C	18.5	B	11.9
Northbound	F	**	F	**	F	77.0
Southbound	A	0.0	A	0.0	A	0.0



Intersection (Approach)	Future Background Level of Service					
	AM Peak Hour		PM Peak Hour		Saturday Peak Hour	
	LOS	Delay	LOS	Delay	LOS	Delay
Route 60 and Judes Ferry Road	C	29.5	C	28.7	B	11.4
Eastbound Left	D	40.3	F	91.1	C	30.0
Eastbound Through	C	22.9	A	4.2	A	4.2
Westbound U-Turn	D	45.3	E	69.1	A	0.0
Westbound Through	C	30.7	C	29.6	B	13.1
Westbound Right	C	24.1	A	6.9	A	9.3
Southbound Left	D	49.2	F	97.6	C	29.1
Southbound Right	C	29.7	E	72.5	C	26.2
Route 60 and South Creek One	A	8.8	B	19.9	B	10.2
Eastbound Left	D	46.1	E	58.4	B	19.7
Eastbound Through	A	7.7	A	8.4	A	5.0
Westbound Through	A	4.6	B	18.9	B	11.6
Westbound Right	A	4.0	B	10.8	A	9.6
Southbound Left	D	41.6	C	33.9	B	17.0
Southbound Right	D	40.1	D	51.8	B	18.1
Route 60 and Luck Stone/Stavemill Road (Unsignalized)	E	79.5	C	31.1	B	14.6
Eastbound Left	E	77.9	E	66.7	D	40.7
Eastbound Through	F	90.2	C	28.5	B	14.4
Eastbound Right	A	2.5	B	12.0	A	5.6
Westbound Left	F	159.9	E	72.3	D	39.3
Westbound Through	B	13.7	C	23.7	A	7.9
Westbound Right	A	8.4	A	2.9	A	4.2
Northbound	F	145.5	E	60.8	D	36.2
Southbound	F	101.9	E	68.7	D	41.2
Route 60 and Page Road/Urbine Road (Unsignalized)	--	--	--	--	--	--
Eastbound Left	A	9.9	E	41.3	B	12.3
Southbound	F	562.7	F	**	F	60.9
Route 60 and Holly Hills Road (Unsignalized)	--	--	--	--	--	--
Westbound Left	D	32.1	B	13.4	B	12.2
Northbound	F	**	F	1123.3	F	88.6
Route 60 and Page Road/County Line Road	F	149.9	F	104.5	C	33.6
Eastbound Left	E	67.2	F	173.7	E	67.5
Eastbound Through/Right	F	206.9	E	63.2	C	34.7
Westbound Left	F	105.7	F	93.9	E	56.1
Westbound Through	B	14.2	F	141.4	B	12.1
Westbound Right	B	11.3	B	12.9	A	8.6
Northbound Left	E	59.6	F	81.9	E	57.1
Northbound Through	E	59.8	F	89.9	E	58.0
Northbound Right	E	55.7	D	50.3	D	49.8
Southbound Through/Left	E	61.1	E	61.2	E	58.8
Southbound Right	D	52.8	E	56.0	D	54.8
Route 60 and Old Hundred Road	E	73.3	D	47.3	B	10.1
Eastbound Through	F	103.1	A	8.4	B	11.1
Eastbound Right	A	6.1	A	5.1	A	6.1
Westbound Left	D	49.8	F	87.1	D	40.5
Westbound Through	A	4.0	E	61.1	A	6.0
Northbound	D	46.2	F	127.8	C	30.2
Route 60 and Huguenot Springs Road (Unsignalized)	--	--	--	--	--	--
Eastbound Left	B	10.2	F	57.9	B	13.1
Southbound	F	434.0	F	**	F	74.0

** Error: Volume greatly exceeds capacity. Delay is too large to be calculated for approach.



Table 8: Future (2011) Queuing Analysis without Development

Intersection (Approach)	Turn Bay Length	Future Background Queues					
		AM Peak Hour		PM Peak Hour		Saturday Peak Hour	
		Average Queue	95% Queue	Average Queue	95% Queue	Average Queue	95% Queue
Route 60 and Dorset Road							
Eastbound Left	200'	121	192	76	#178	49	#158
Eastbound Through		~963	#1147	262	340	194	316
Eastbound Right	300'	8	31	0	20	0	26
Westbound Left	210'	26	59	60	111	31	85
Westbound Through		203	271	~845	#1011	153	245
Westbound Right	200'	0	26	24	57	0	27
Northbound Left/Through		148	227	120	#196	56	131
Northbound Right	50'	28	71	6	30	4	31
Southbound Left		155	230	68	116	46	110
Southbound Through/Right		19	56	62	117	29	82
Route 60 and New Dorset Road (Unsignalized)							
Eastbound Left	250'	..	1	..	0	..	0
Westbound Left	250'	..	44	..	71	..	17
Northbound		..	**	..	**	..	270
Southbound		..	0	..	0	..	0
Route 60 and Judes Ferry Road							
Eastbound Left	380'	234	330	136	#242	42	98
Eastbound Through		323	565	76	152	73	95
Westbound U-Turn	250'	0	5	1	6	0	0
Westbound Through		151	#248	752	#981	136	210
Westbound Right	225'	0	36	5	24	0	24
Southbound Left	400'	155	#322	101	#196	38	97
Southbound Right		0	51	59	#159	0	34
Route 60 and South Creek One							
Eastbound Left	200'	11	26	53	#21	18	47
Eastbound Through		256	413	173	207	52	119
Westbound Through		45	64	346	386	60	105
Westbound Right	200'	0	11	0	26	0	25
Southbound Left		21	40	26	55	9	24
Southbound Right		0	21	159	#351	12	57
Route 60 and Luck Stone/Stavemill Road (Unsignalized)							
Eastbound Left	200'	16	40	1	6	1	9
Eastbound Through		~1130	#1229	412	553	141	363
Eastbound Right	175'	0	2	1	11	0	5
Westbound Left	250'	53	m#136	276	#444	43	144
Westbound Through		172	m208	528	#1151	52	246
Westbound Right	275'	0	m6	0	m3	0	2
Northbound		~318	#492	2	51	4	64
Southbound		31	#85	10	40	1	16
Route 60 and Page Road/Urbine Road (Unsignalized)							
Eastbound Left	250'	..	2	..	16	..	4
Southbound		..	125	..	**	..	32
Route 60 and Holly Hills Road							
Westbound Left	250'	..		..	6	..	5
Northbound		..		..	135	..	53
Route 60 and Page Road/County Line Road (Unsignalized)							
Eastbound Left	250'	49	97	~58	#152	19	48

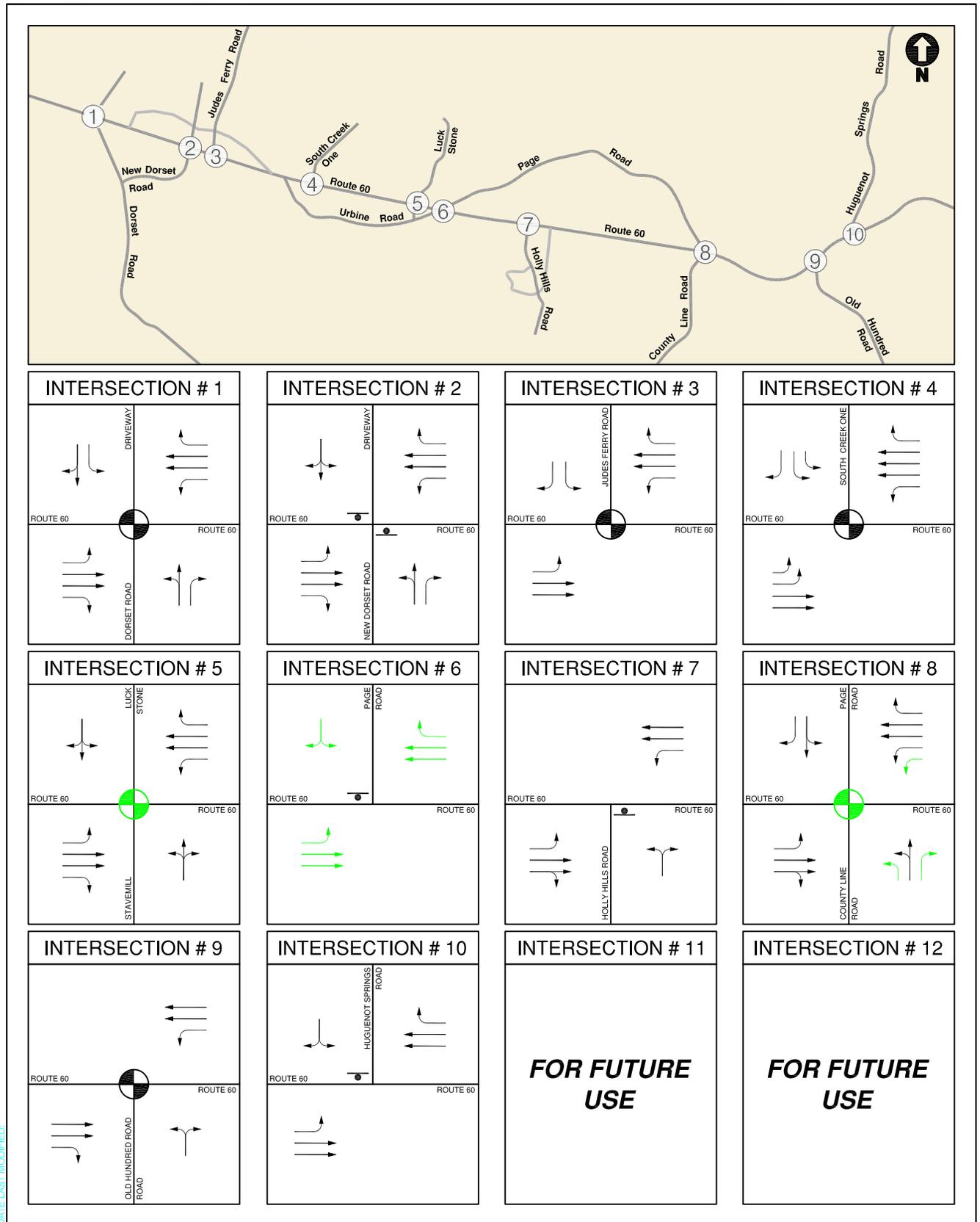


Intersection (Approach)	Turn Bay Length	Future Background Queues					
		AM Peak Hour		PM Peak Hour		Saturday Peak Hour	
		Average Queue	95% Queue	Average Queue	95% Queue	Average Queue	95% Queue
Eastbound Through/Right		~1320	#1540	~547	#731	478	#711
Westbound Left	250'	118	#213	~258	#382	151	214
Westbound Through		136	195	~1149	#1320	186	270
Westbound Right	150'	0	13	17	40	1	14
Northbound Left		48	93	173	#314	82	145
Northbound Through		50	96	184	#336	86	150
Northbound Right		0	36	0	47	0	45
Southbound Through/Left		84	144	66	115	39	80
Southbound Right	200'	0	17	0	19	0	8
Route 60 and Old Hundred Road							
Eastbound Through		~943	#1092	233	277	118	301
Eastbound Right	125'	12	32	3	18	1	18
Westbound Left	150	16	41	25	56	9	42
Westbound Through		73	106	~1275	#1364	111	193
Northbound		83	141	~197	#342	40	134
Route 60 and Huguenot Springs Road (Unsignalized)							
Eastbound Left	250'	..	2	..	36	..	6
Southbound		..	140	..	**	..	54

~ Volume exceeds capacity, queue is theoretically infinite. Queue shown is maximum after two cycles.
 # 95th percentile volume exceeds capacity, queue may be longer. Queue shown is maximum after two cycles
 m Volume for 95th percentile queue is metered by upstream signal

For the purpose of this analysis, it is desirable to achieve a level of service “D” or better on each approach. The following intersections have movements that operate at unacceptable LOS during one or more peak periods.

- Route 60 and Dorset Road
- Route 60 and New Dorset Road
- Route 60 and Judes Ferry Road
- Route 60 and South Creek One
- Route 60 and Luck Stone Quarry/Stavemill Road
- Route 60 and Page Road
- Route 60 and Holly Hills Road
- Route 60 and Page Road/County Line Road
- Route 60 and Old Hundred Road
- Route 60 and Huguenot Springs Road



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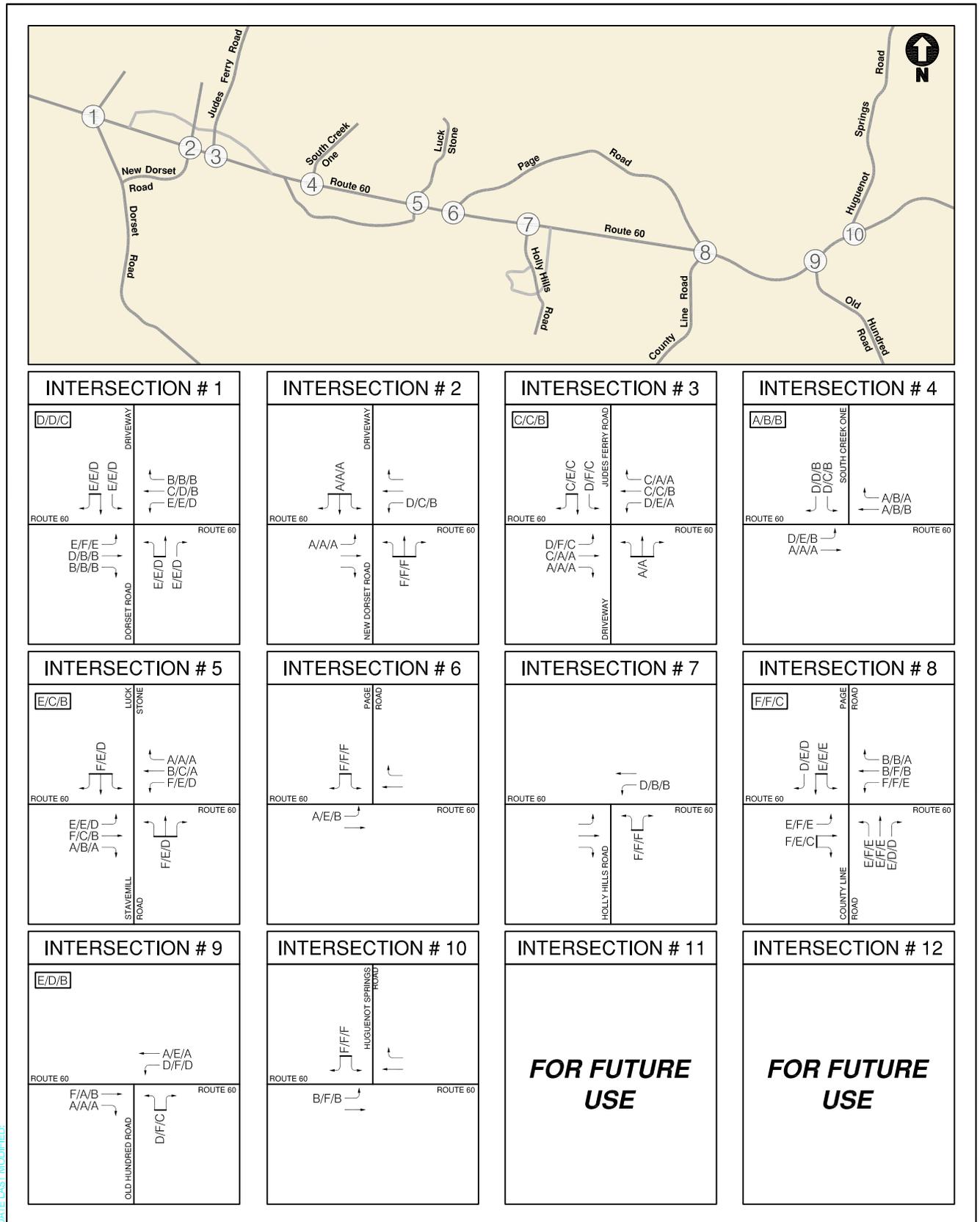


Figure 12
 Future (2011) without Development Level of Service

Legend

- Existing Roadway Network
- ↔ AM/PM/SAT
- ↔ AM/PM/SAT
- ↔ AM/PM/SAT
- ↔ Peak Hour Level of Service



TRIP GENERATION

The proposed site contains a 170,000 square foot retail center on a 53.34 acre site. To allow flexibility for minor modifications to the site plan, the square footage listed above was rounded off for purposes of the traffic study. Trip generation for the proposed development was calculated based on the methodology outlined in the Institute of Transportation Engineers’ (ITE) Trip Generation, 7th Edition. This was used to determine the trips into and out of the proposed site. A pass-by reduction of 25% was applied to the calculated trip generation in order to account for vehicles already on the roadway network. As shown in Table 9, the proposed development will generate approximately 162 trips during the weekday morning peak hour, 667 trips during the weekday afternoon peak hour, and 7,192 trips in an entire week day. There are also a total of 916 trips generated during a Saturday peak hour.

Table 9: Site Trip Generation (2011)

	ITE Code	Size	Trip Generation								
			AM Peak Hour			PM Peak Hour			Saturday Peak Hour		
			In	Out	Total	In	Out	Total	In	Out	Total
Shopping Center	820	170 kSF	132	84	216	427	462	889	635	587	1,222
Pass-by Reduction			<u>-.33</u>	<u>-.21</u>	<u>-.54</u>	<u>-.107</u>	<u>-.115</u>	<u>-.222</u>	<u>-.159</u>	<u>-.147</u>	<u>-.306</u>
Total Primary Trips			99	63	162	320	347	667	476	440	916

SITE TRAFFIC DISTRIBUTION AND ASSIGNMENT

The nature of the proposed retail development and regional traffic patterns were analyzed in order to determine the trip distribution for vehicles accessing the site. In addition, an assessment of future roadway conditions was used to determine the routes that will provide the most convenient access to the development. Pass-by site trip distribution percentages used were based on the existing daily directional eastbound and westbound traffic flow patterns along Route 60. Based on this review, the distribution for the site traffic is shown in Table 10 and the resulting trip assignment is presented on Figure 13. The pass-by trips are shown on Figure 14.



Table 10: Site Trip Distribution (2011)

Roadway Link	Trip Distribution
To/From Route 60 East	24%
To/From Huguenot Springs Road	3%
To/From Old Hundred Road	9%
To/From County Line Road	9%
To/From Page Road (East)	1%
To/From Holly Hills Road	1%
To/From Page Road (West)	4%
To/From Urbine Road	8%
To/From South Creek One	5%
To/From New Dorset Road	8%
To/From Judes Ferry Road	6%
To/From Route 60 West	22%
Total	100%

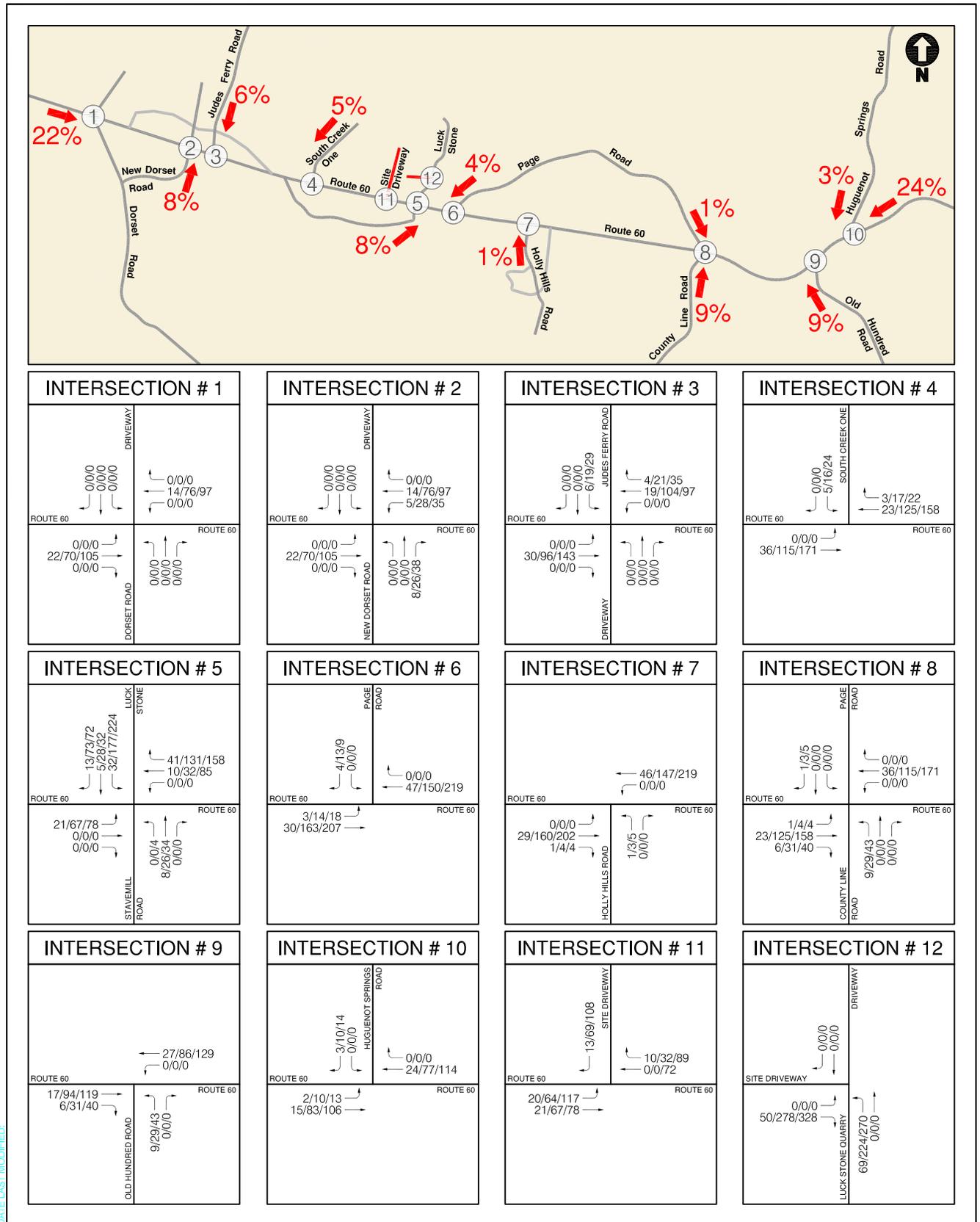
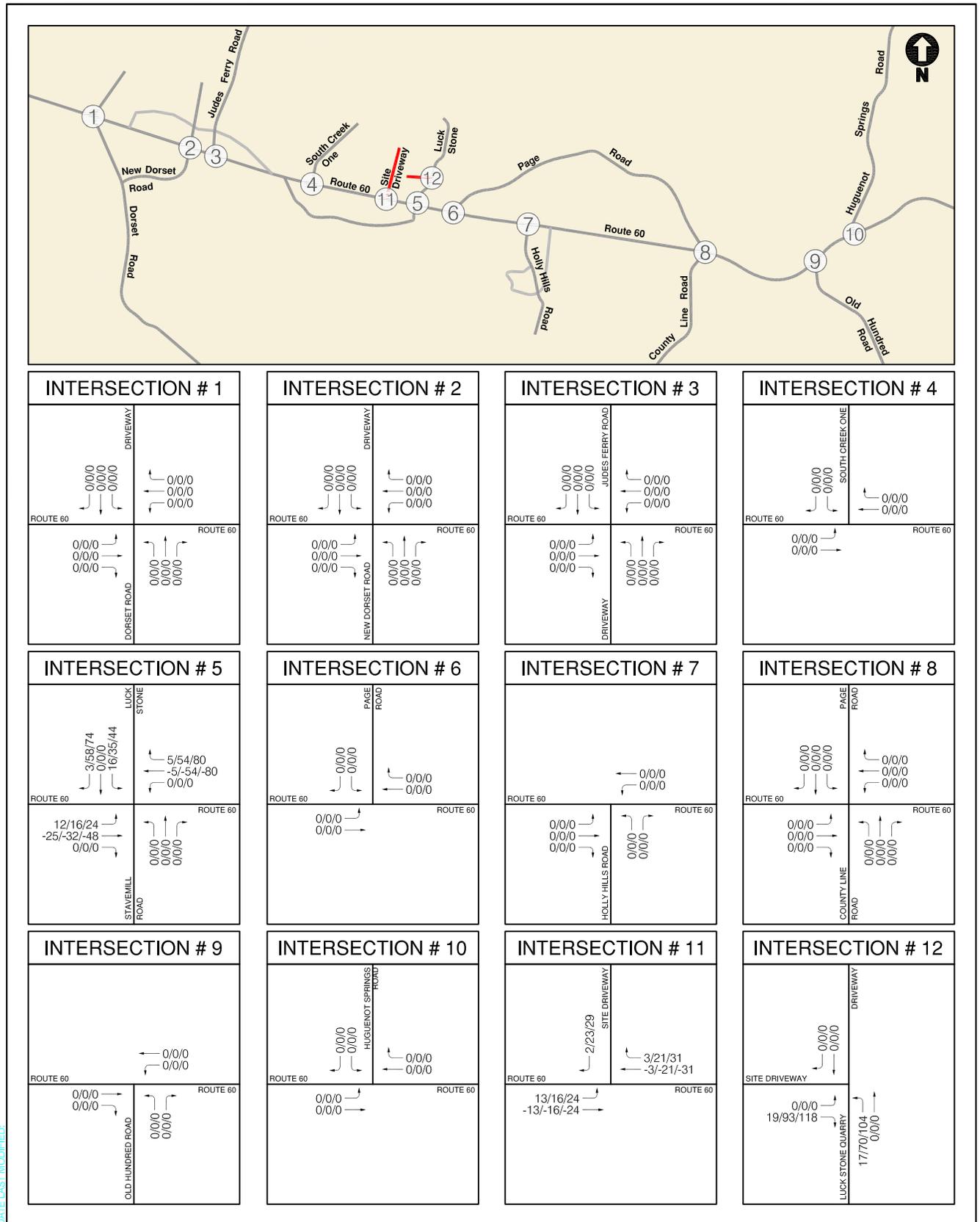


Figure 13
Site Generated Traffic Volumes

Legend

- Existing Roadway Network
- AM/PM/SAT
- AM/PM/SAT
- AM/PM/SAT
- Peak Hour Traffic Volumes



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Figure 14
Site Generated Pass-By Traffic Volumes

Legend

- Existing Roadway Network
- AM/PM/SAT
- AM/PM/SAT
- Peak Hour Traffic Volumes



ANALYSIS OF FUTURE CONDITIONS (2011) WITH DEVELOPMENT

Future with Development (2011) Traffic Volumes

In order to determine the traffic volumes present on the roadways in the vicinity of the development site under the build 2011 condition, the proposed development traffic volumes were added to the 2011 future background traffic volumes. The traffic volumes for the total future traffic conditions are shown on Figure 15 and tabulated in Table 11.

Table 11: Future (2011) Traffic Volumes with Development

Intersection (Approach)	Total Future Traffic Volumes								
	AM Peak Hour			PM Peak Hour			Saturday Peak Hour		
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Route 60 and Dorset Road									
Eastbound	131	1,817	66	92	1,048	72	104	1,011	93
Westbound	28	687	69	75	1,932	166	69	882	118
Northbound	92	68	63	119	33	21	79	47	35
Southbound	167	23	27	86	49	63	103	48	39
Route 60 and New Dorset Road									
Eastbound	7	1,942	70	0	1,102	27	0	1,034	15
Westbound	107	731	0	342	2,035	5	173	1,035	0
Northbound	16	0	344	101	0	230	39	0	249
Route 60 and Judes Ferry Road									
Eastbound	487	1,791	7	174	1,154	4	133	1,165	0
Westbound	1	623	111	1	2,193	184	0	1,077	187
Southbound	315	0	215	146	0	182	150	0	91
Route 60 and South Creek One									
Eastbound	49	2,154	--	162	1,260	--	157	1,152	--
Westbound	--	772	76	--	2,153	295	--	1,081	196
Southbound	98	--	30	117	--	311	111	--	228
Route 60 and Luck Stone/Stavemill Road									
Eastbound	50	2,145	24	84	1,189	24	104	1,031	20
Westbound	61	786	58	402	2,254	193	144	1,084	240
Northbound	28	19	343	2	27	106	16	35	159
Southbound	70	15	28	223	30	143	272	32	151
Route 60 and Page Road/Urbine Road									
Eastbound	29	2,537	--	39	1,476	--	51	1,344	--
Westbound	--	857	6	--	2,787	16	--	1,398	14
Southbound	8	--	49	8	--	63	12	--	44
Route 60 and Holly Hills Road									
Eastbound	3	2,528	15	12	1,437	36	0	1,367	14
Westbound	11	827	--	42	2,775	--	38	1,390	--
Northbound	36	--	36	29	--	22	28	--	25
Route 60 and Page Road/County Line Road									
Eastbound	68	2,474	14	75	1,430	59	30	1,491	54
Westbound	297	690	30	617	2,347	81	425	1,092	32
Northbound	136	3	58	452	11	110	266	8	104
Southbound	101	15	12	58	29	18	27	29	8
Route 60 and Old Hundred Road									
Eastbound	--	2,496	136	--	1,414	184	--	1,456	149



Intersection (Approach)	Total Future Traffic Volumes									
	AM Peak Hour			PM Peak Hour			Saturday Peak Hour			
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	
Westbound	27	894	--	31	2,804	--	30	1,416	--	
Northbound	122	--	51	241	--	27	176	--	32	
Route 60 and Huguenot Springs Road										
Eastbound	5	2,523	--	55	1,385	--	57	1,372	--	
Westbound	--	888	12	--	2,785	37	--	1,353	31	
Southbound	38	--	33	35	--	50	16	--	55	
Route 60 and West Project Driveway										
Eastbound	33	2,219	--	80	1,297	--	141	1,122	--	
Westbound	--	815	13	--	2,285	53	--	1,130	120	
Southbound	0	--	15	0	--	92	0	--	137	
Luck Stone Quarry and East Project Driveway										
Eastbound	0	--	69	0	--	370	0	--	446	
Northbound	86	41	--	294	11	--	374	4	--	
Southbound	--	44	0	--	27	0	--	8	0	

Future with Development (2011) Capacity Analysis

For the future with development scenario, improvements to the intersection of Route 60 and Stavemill Road/Luck Stone Quarry are assumed. This includes the addition of a third through lane to the east- and westbound movements, the construction of a northbound right-turn lane, and the construction of two southbound left-turn lanes.

The future background roadways and lane configurations are shown in Figure 16.

Intersection capacity analyses were performed for the future conditions with the proposed development at the intersections contained within the study area during the morning and afternoon peak hours. *Synchro, Version 6.0* was used to analyze the study intersections based on the Highway Capacity Manual methodology. The detailed analysis worksheets are contained in the Technical Appendix.

The results of the intersection capacity analyses are presented in Table 12 and shown on Figure 17. They are expressed in level of service (LOS) and delay (seconds per vehicle) per lane group for each approach. The results of a queuing analysis are presented in Table 13, expressed in queue length (feet).

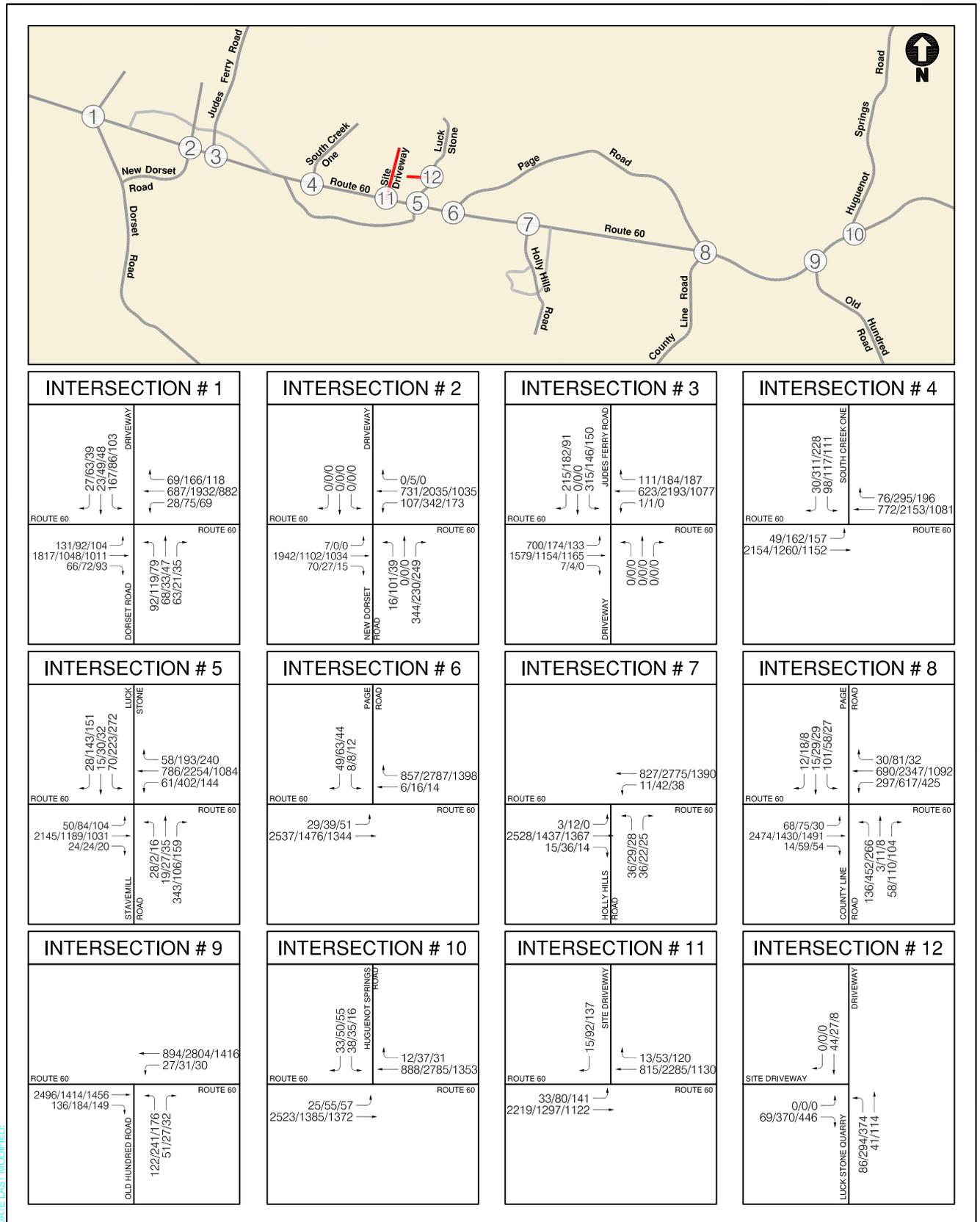
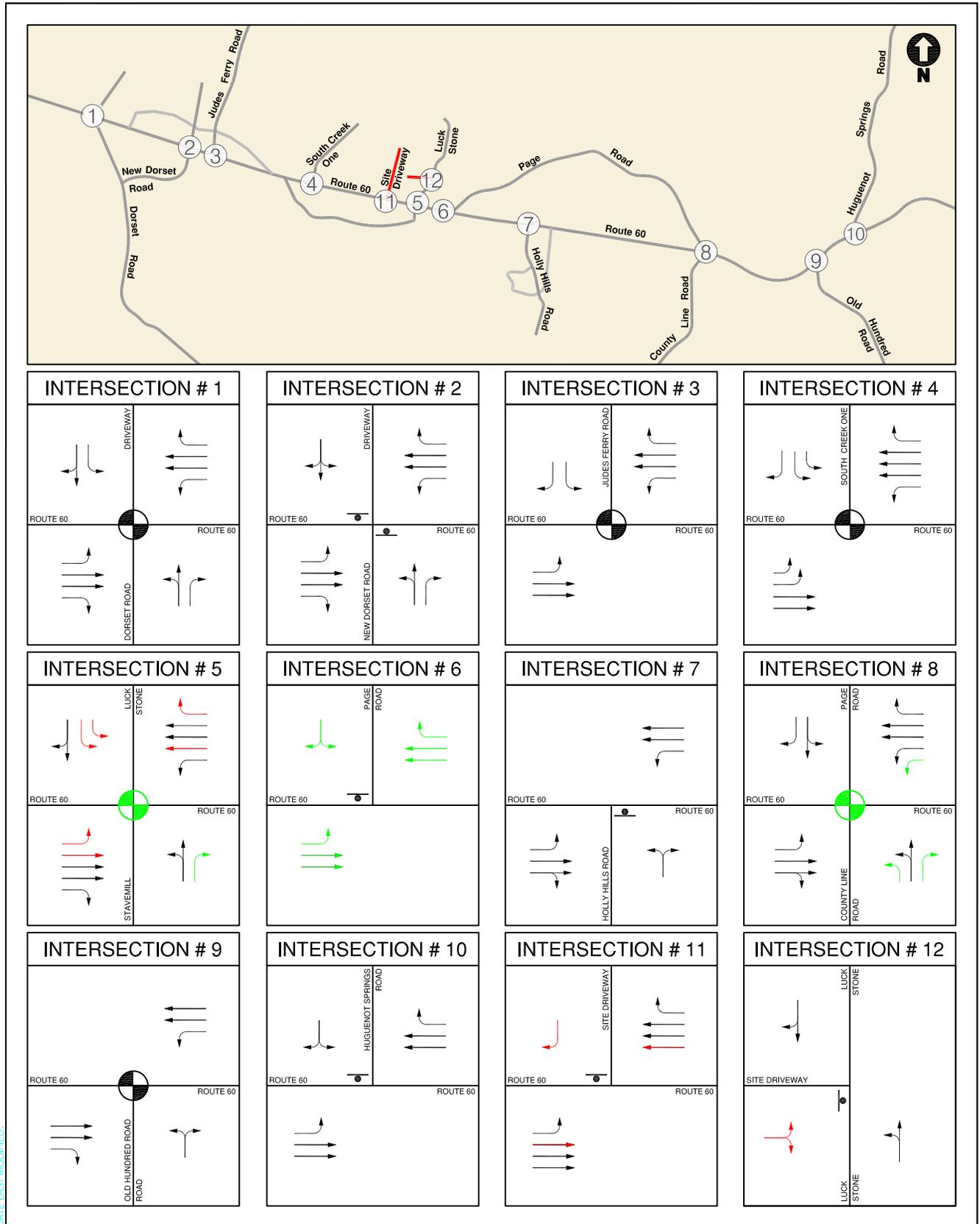


Figure 15
Future (2011) with Development Traffic Volumes

Legend

- Existing Roadway Network
- AM/PM/SAT Peak Hour Traffic Volumes
- AM/PM/SAT Peak Hour Traffic Volumes
- AM/PM/SAT Peak Hour Traffic Volumes



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Figure 16
Future (2011) with Development Roadways and Lane Configuration

Legend

- Lane Configuration
- STOP Sign
- Traffic Signal
- Background Improvement
- Proposed Improvement



Table 12: Future (2011) Capacity Analysis with Development

Intersection (Approach)	Total Future Level of Service					
	AM Peak Hour		PM Peak Hour		Saturday Peak Hour	
	LOS	Delay	LOS	Delay	LOS	Delay
Route 60 and Dorset Road	D	49.0	D	49.2	C	23.3
Eastbound Left	E	65.1	F	121.9	E	55.7
Eastbound Through	E	56.1	C	20.0	B	18.6
Eastbound Right	B	13.0	B	13.4	B	12.5
Westbound Left	E	77.6	E	67.4	D	45.3
Westbound Through	C	24.0	E	62.1	B	17.2
Westbound Right	B	19.0	B	12.9	B	12.6
Northbound Left/Through	E	69.7	E	71.1	D	47.0
Northbound Right	D	53.7	E	55.1	D	39.3
Southbound Left	E	61.7	E	62.9	D	45.0
Southbound Through/Right	D	50.5	E	62.9	D	42.3
Route 60 and New Dorset Road (Unsignalized)	--	--	--	--	--	--
Eastbound Left	A	9.3	A	0.0	A	0.0
Westbound Left	D	33.6	C	22.9	B	13.5
Northbound	F	**	F	..	F	754.9
Southbound	A	0.0	A	0.0	A	0.0
Route 60 and Judes Ferry Road	C	32.4	D	35.9	B	12.3
Eastbound Left	D	47.7	F	91.7	C	32.4
Eastbound Through	C	24.5	A	4.4	A	4.9
Westbound U-Turn	D	53.1	E	69.9	A	0.0
Westbound Through	C	34.0	D	40.5	B	14.5
Westbound Right	C	26.8	A	7.0	A	9.5
Southbound Left	D	51.4	F	137.1	C	30.8
Southbound Right	C	33.6	E	75.4	C	26.7
Route 60 and South Creek One	A	8.7	C	20.8	B	11.0
Eastbound Left	E	56.3	E	66.1	C	22.4
Eastbound Through	A	7.1	A	8.7	A	5.9
Westbound Through	A	3.9	B	19.2	B	12.3
Westbound Right	A	3.4	B	10.6	A	9.7
Southbound Left	D	49.5	D	37.4	B	18.6
Southbound Right	D	47.6	E	60.6	C	20.3
Route 60 and Luck Stone/Stavemill Road	B	18.0	C	31.7	C	21.4
Eastbound Left	D	50.0	D	48.5	D	35.3
Eastbound Through	B	19.9	C	33.1	C	21.2
Eastbound Right	A	6.0	B	18.8	B	12.1
Westbound Left	D	49.8	D	46.3	D	36.6
Westbound Through	B	11.2	C	29.6	C	20.4
Westbound Right	A	4.5	A	4.6	A	6.1
Northbound Through/Left	D	49.9	D	49.6	D	38.0
Northbound Right	A	0.4	A	0.1	A	0.1
Southbound Left	D	48.4	D	43.4	C	30.3
Southbound Through/Right	D	47.8	D	41.4	C	29.2
Route 60 and Page Road/Urbine Road (Unsignalized)	--	--	--	--	--	--
Eastbound Left	B	10.3	F	58.3	B	14.6
Southbound	F	468.5	F	**	F	185.4
Route 60 and Holly Hills Road (Unsignalized)	--	--	--	--	--	--
Westbound Left	D	33.0	C	15.0	B	14.0
Northbound	F	**	F	**	F	312.1
Route 60 and Page Road/County Line Road	F	154.4	F	129.0	D	45.4
Eastbound Left	E	68.0	F	193.3	E	75.7
Eastbound Through/Right	F	215.4	F	103.4	E	61.4



Intersection (Approach)	Total Future Level of Service					
	AM Peak Hour		PM Peak Hour		Saturday Peak Hour	
	LOS	Delay	LOS	Delay	LOS	Delay
Westbound Left	F	106.6	F	92.3	E	56.7
Westbound Through	B	14.5	F	169.4	B	13.9
Westbound Right	B	11.4	B	12.9	A	8.9
Northbound Left	E	59.7	F	94.2	E	59.2
Northbound Through	E	60.0	F	103.8	E	61.2
Northbound Right	E	55.6	D	50.3	D	49.4
Southbound Through/Left	E	61.4	E	61.2	E	59.5
Southbound Right	D	52.9	E	56.1	E	55.5
Route 60 and Old Hundred Road	E	76.4	E	58.2	B	12.5
Eastbound Through	F	108.5	A	9.0	B	14.1
Eastbound Right	A	6.2	A	5.2	A	7.1
Westbound Left	D	50.1	F	87.1	D	43.3
Westbound Through	A	4.1	E	75.4	A	7.6
Northbound	D	47.1	F	171.4	C	34.8
Route 60 and Huguenot Springs Road (Unsignalized)	..	..	..	..	..	..
Eastbound Left	B	10.3	F	75.8	B	14.5
Southbound	F	479.2	F	**	F	131.0
Route 60 and West Project Driveway (Unsignalized)	..	..	..	..	..	..
Eastbound Left	A	9.7	D	34.8	B	13.8
Southbound	A	9.1	B	12.6	A	9.8
Luck Stone Quarry and East Project Driveway (Unsignalized)	..	..	..	..	..	..
Eastbound	A	8.8	B	10.6	B	11.1
Northbound Left	A	5.2	A	7.6	A	7.9

** Error: Volume greatly exceeds capacity. Delay is too large to be calculated for approach.

Table 13: Future (2011) Queuing Analysis with Development

Intersection (Approach)	Turn Bay Length	Total Future Queues					
		AM Peak Hour		PM Peak Hour		Saturday Peak Hour	
		Average Queue	95% Queue	Average Queue	95% Queue	Average Queue	95% Queue
Route 60 and Dorset Road							
Eastbound Left	200'	101	167	76	#178	53	#171
Eastbound Through		~843	#1040	291	375	233	365
Eastbound Right	300'	6	27	0	20	0	25
Westbound Left	210'	22	53	60	111	34	89
Westbound Through		196	273	~915	#1081	183	283
Westbound Right	200'	0	26	26	59	0	26
Northbound Left/Through		124	#212	120	#196	61	140
Northbound Right	50'	20	61	6	30	5	33
Southbound Left		128	195	68	116	50	117
Southbound Through/Right		16	48	62	117	31	86
Route 60 and New Dorset Road (Unsignalized)							
Eastbound Left	250'	..	1	..	0	..	0
Westbound Left	250'	..	49	..	97	..	26
Northbound		..	**	..	**	..	555
Southbound		..	0	..	0	..	0
Route 60 and Judes Ferry Road							
Eastbound Left	380'	287	439	136	#242	47	106
Eastbound Through		430	750	87	173	88	114
Westbound U-Turn	250'	1	6	1	6	0	0



Intersection (Approach)	Turn Bay Length	Total Future Queues					
		AM Peak Hour		PM Peak Hour		Saturday Peak Hour	
		Average Queue	95% Queue	Average Queue	95% Queue	Average Queue	95% Queue
Westbound Through		191	303	~966	#1068	168	250
Westbound Right	225'	0	41	8	27	0	25
Southbound Left	400'	188	#332	117	#236	53	#138
Southbound Right		0	54	61	#162	0	35
Route 60 and South Creek One							
Eastbound Left	200'	13	35	57	#124	20	54
Eastbound Through		282	440	203	240	76	175
Westbound Through		46	64	386	431	79	139
Westbound Right	200'	0	10	3	29	0	27
Southbound Left		27	56	33	63	13	32
Southbound Right		0	26	175	#364	23	79
Route 60 and Luck Stone/Stavemill Road (Unsignalized)							
Eastbound Left	200'	28	61	49	97	45	114
Eastbound Through		379	#581	254	#404	150	263
Eastbound Right	175'	1	5	1	11	0	6
Westbound Left	250'	34	m72	225	348	62	147
Westbound Through		86	131	~495	#742	154	267
Westbound Right	275'	0	m12	0	m20	0	25
Northbound Through/Left		26	59	17	44	22	67
Northbound Right		0	0	0	0	0	0
Southbound Left		20	40	66	105	59	123
Southbound Through/Right		8	38	17	75	21	90
Route 60 and Page Road/Urbine Road (Unsignalized)							
Eastbound Left	250'	..	3	..	32	..	9
Southbound		..	125	..	**	..	88
Route 60 and Holly Hills Road							
Westbound Left	250'	..	5	..	8	..	6
Northbound		..	**	..	**	..	104
Route 60 and Page Road/County Line Road (Unsignalized)							
Eastbound Left	250'	50	99	~66	#162	22	55
Eastbound Through/Right		~1358	#1583	~712	#873	~683	#886
Westbound Left	250'	119	#214	~254	#379	154	214
Westbound Through		147	210	~1248	#1421	251	344
Westbound Right	150'	0	13	17	41	2	15
Northbound Left		52	98	188	#346	98	168
Northbound Through		54	101	197	#363	105	175
Northbound Right		0	36	0	47	0	45
Southbound Through/Left		85	144	66	115	40	80
Southbound Right	200'	0	17	0	21	0	15
Route 60 and Old Hundred Road							
Eastbound Through		~964	#1103	264	312	278	344
Eastbound Right	125'	13	33	5	22	5	23
Westbound Left	150	16	41	25	56	15	45
Westbound Through		79	110	~1351	#1438	182	224
Northbound		89	149	~247	#399	90	#200
Route 60 and Huguenot Springs Road (Unsignalized)							
Eastbound Left	250'	..	2	..	53	..	10
Southbound		..	149	..	**	..	89
Route 60 and West Project Driveway							

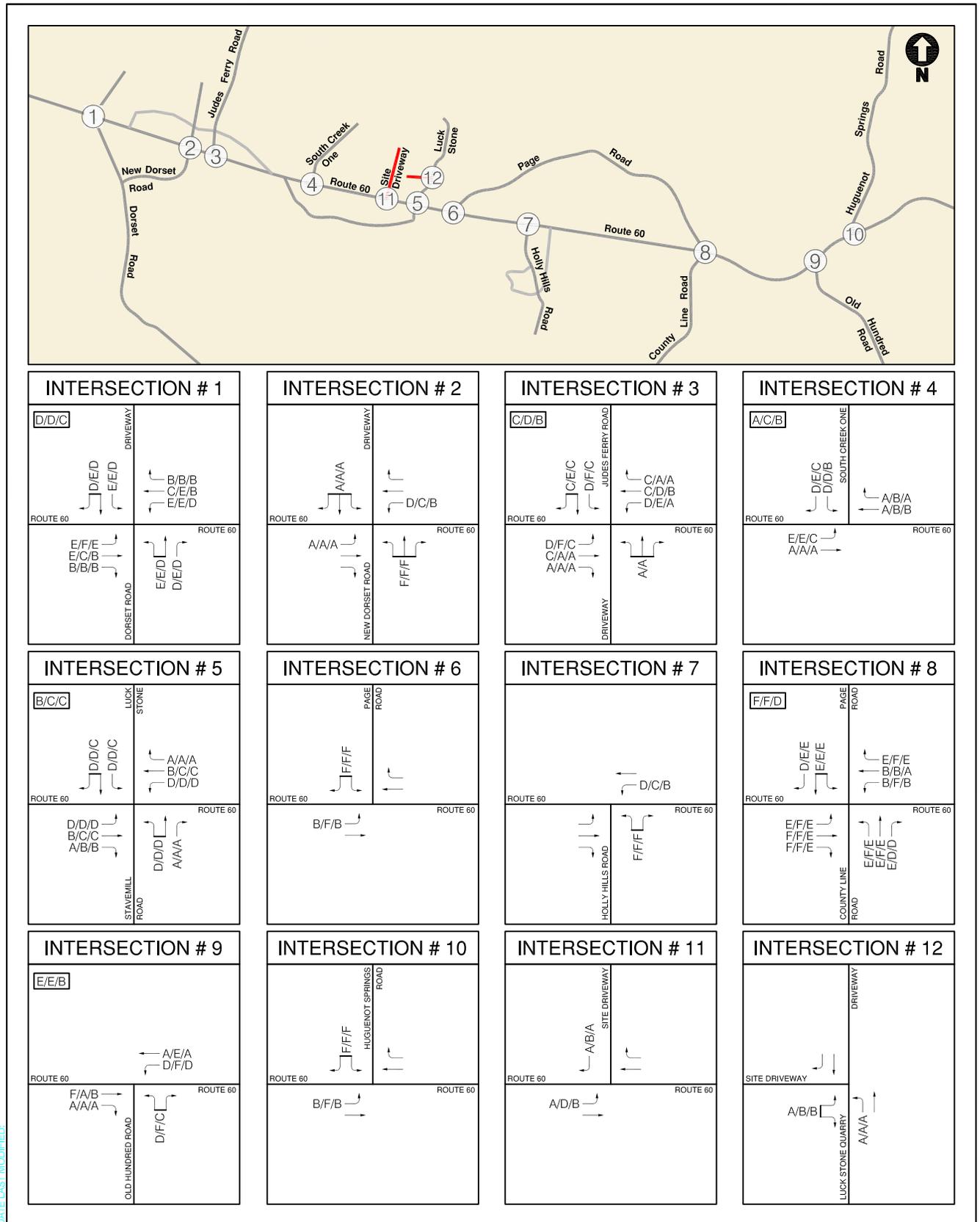


Intersection (Approach)	Turn Bay Length	Total Future Queues					
		AM Peak Hour		PM Peak Hour		Saturday Peak Hour	
		Average Queue	95% Queue	Average Queue	95% Queue	Average Queue	95% Queue
(Unsignalized)							
Eastbound Left		..	3	..	39	..	22
Southbound		..	1	..	13	..	12
Luck Stone Quarry and East Project Driveway (Unsignalized)							
Eastbound		..	5	..	37	..	48
Northbound Left		..	4	..	15	..	20

~ Volume exceeds capacity, queue is theoretically infinite. Queue shown is maximum after two cycles.
 # 95th percentile volume exceeds capacity, queue may be longer. Queue shown is maximum after two cycles
 m Volume for 95th percentile queue is metered by upstream signal

For the purpose of this analysis, it is desirable to achieve a level of service “D” or better on each approach. The following intersections have movements that operate at unacceptable LOS during one or more peak periods.

- Route 60 and Judes Ferry Road
- Route 60 and Dorset Road
- Route 60 and New Dorset Road
- Route 60 and South Creek One
- Route 60 and Page Road/Urbine Road
- Route 60 and Holly Hills Road
- Route 60 and Page Road/County Line Road
- Route 60 and Old Hundred Road
- Route 60 and Huguenot Springs Road
- Route 60 and the West Project Driveway



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Figure 17
Future (2011) with Development Level of Service

Legend

- Existing Roadway Network
- AM/PM/SAT
- AM/PM/SAT
- AM/PM/SAT



ANALYSIS OF FUTURE CONDITIONS (2017) WITH DEVELOPMENT

Future with Development (2017) Traffic Volumes

The construction of the proposed development is anticipated to have a horizon year of 2017. For planning purposes, a future 2017 scenario was investigated. The traffic generated by additional nearby development and inherent growth on the roadways within the study area were accounted for in traffic projections. The completion of the Watkins Center and the construction of the Shady Oak Development were accounted for in the background development.

The Watkins Center will be located near the intersection of Route 60 and Route 288. A traffic impact analysis was performed by Volkert and Associates, Inc. in May 2007. Upon completion, the development will consist of 2,064,900 square feet of retail development, 2,674,400 square feet of office development, 726,400 square feet of industrial development, 1,600 residential units, and a 100-room hotel. For the 2011 analysis, it was assumed that approximately half of the total site trips would be assigned to the roadway. The remaining trips are assumed under the 2017 conditions.

The Shady Oak Development will be located south of Route 60 near the intersection with Stavemill Road. A traffic impact analysis was performed by Balzer and Associates, Inc. in January 2007. Upon completion, the development will consist of approximately 43 acres of commercial land use, 33 acres of industrial land use, and 85 acres of residential land use. The proposed development is expected to be completed by 2017.

Trip generation for the background development was calculated based on methodology outlined in the Institute of Transportation Engineers’ (ITE) Trip Generation, 7th Edition. Other traffic increases were accounted for with a 2 percent growth rate compounded annually over the 6-year period for all study intersections.

Table 14 presents the trips generated by the background developments. The future background inherent traffic growth was added to the total future (2011) volumes in order to establish the horizon year (2017) traffic volumes. The horizon year (2017) traffic volumes are shown on Figure 18 and presented in Table 15.

Table 14: Background Site Trip Generation (2017)

Land Use	ITE Code	Size	Units	Weekday						
				AM Peak Hour			PM Peak Hour			Daily
				In	Out	Total	In	Out	Total	Total
Watkins Center	Varies	Varies	Varies	2,269	792	3,061	1,737	2,897	4,634	--
Shady Oak Development	Varies	Varies	Varies	545	372	917	848	952	1,800	20,256

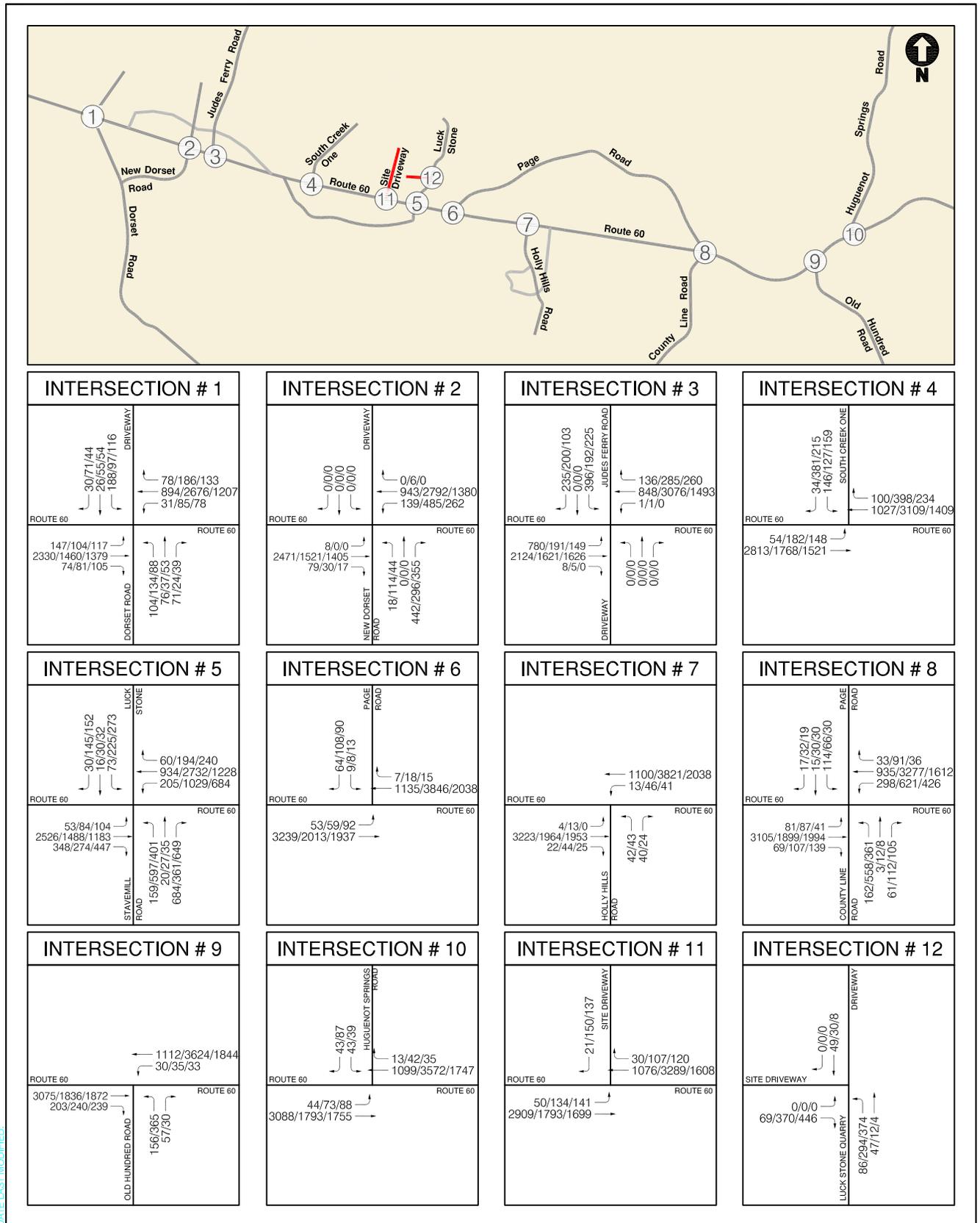


Figure 18
Horizon Year (2017) Traffic Volumes

Legend

- Existing Roadway Network
- ↔ AM/PM/SAT Peak Hour Traffic Volumes
- ↔ AM/PM/SAT Peak Hour Traffic Volumes
- ↔ AM/PM/SAT Peak Hour Traffic Volumes



Table 15: Horizon Year (2017) Traffic Volumes

Intersection (Approach)	Horizon Year Traffic Volumes								
	AM Peak Hour			PM Peak Hour			Saturday Peak Hour		
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Route 60 and Dorset Road									
Eastbound	147	2,330	74	104	1,460	81	117	1,379	105
Westbound	31	894	78	85	2,676	186	78	1,207	133
Northbound	104	76	71	134	37	24	88	53	39
Southbound	188	26	30	97	55	71	116	54	44
Route 60 and New Dorset Road									
Eastbound	8	2,471	79	0	1,521	30	0	1,405	17
Westbound	139	943	0	485	2,792	6	262	1,380	0
Northbound	18	0	442	114	0	296	44	0	355
Route 60 and Judes Ferry Road									
Eastbound	541	2,364	8	191	1,621	5	149	1,626	0
Westbound	1	848	136	1	3,076	285	0	1,493	260
Southbound	396	--	235	192	--	200	225	--	103
Route 60 and South Creek One									
Eastbound	182	1,768	--	182	1,768	--	148	1,521	--
Westbound	--	1,027	100	--	3,109	398	--	1,409	234
Southbound	146	--	34	127	--	381	159	--	215
Route 60 and Luck Stone/Stavemill Road									
Eastbound	53	2,526	348	84	1,488	274	104	1,183	447
Westbound	205	934	60	1029	2,732	194	684	1,228	240
Northbound	159	20	684	597	27	361	401	35	649
Southbound	73	16	30	225	30	145	273	32	152
Route 60 and Page Road/Urbine Road									
Eastbound	53	3,239	--	59	2,013	--	92	1,937	--
Westbound	--	1,135	7	--	3,846	18	--	2,038	15
Southbound	9	--	64	8	--	108	13	--	90
Route 60 and Holly Hills Road									
Eastbound	4	3,223	22	13	1,964	44	0	1,953	25
Westbound	13	1,100	--	46	3,821	--	41	2,019	--
Northbound	42	--	40	43	--	24	41	--	27
Route 60 and Page Road/County Line Road									
Eastbound	87	3,105	69	87	1,899	107	41	1,994	139
Westbound	298	935	33	621	3,277	91	426	1,612	36
Northbound	162	3	61	558	12	112	361	8	105
Southbound	114	15	17	66	30	32	30	30	19
Route 60 and Old Hundred Road									
Eastbound	--	3,075	203	--	1,836	240	--	1,872	239
Westbound	30	1,112	--	35	3,624	--	33	1,844	--
Northbound	156	--	57	365	--	30	277	--	36
Route 60 and Huguenot Springs Road									
Eastbound	44	3,088	--	73	1,793	--	88	1,755	--
Westbound	--	1,099	13	--	3,572	42	--	1,747	35
Southbound	43	--	43	39	--	87	18	--	88
Route 60 and West Project Driveway									
Eastbound	50	2,909	--	134	1,793	--	141	1,699	--
Westbound	--	1,076	30	--	3,289	107	--	1,608	120
Southbound	--	--	21	--	--	150	--	--	137



Intersection (Approach)	Horizon Year Traffic Volumes								
	AM Peak Hour			PM Peak Hour			Saturday Peak Hour		
	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Luck Stone Quarry and East Project Driveway									
Eastbound	0	--	69	0	--	370	0	--	446
Northbound	86	47	--	294	12	--	374	4	--
Southbound	--	49	0	--	30	0	--	8	0

Future with Development (2017) Capacity Analysis

Background improvements assumed for the horizon year 2017 scenario. These improvements follow the construction of the Watkins Center development, including upgrades to the intersection of Route 60 and Stavemill Road/Luck Stone Quarry. This consists of the extension of the eastbound right-turn lane, the addition of a second westbound left-turn lane, and the construction of a second northbound left-turn lane.

The horizon year roadways and lane configurations are shown on Figure 19.

For planning purposes, intersection capacity analyses were performed for the future background conditions at the intersections contained within the study area during the morning and afternoon peak hours. Synchro, Version 6.0 was used to analyze the study intersections based on the Highway Capacity Manual methodology. The detailed analysis worksheets are contained in the Technical Appendix.

The results of the intersections capacity analyses are shown on Figure 20 and presented in Table 16. They are expressed in level of service (LOS) and delay (seconds per vehicle) per lane group for each approach. The results of a queuing analysis are presented in Table 17, expressed in queue length (feet).

Table 16: Horizon Year (2017) Capacity Analysis

Intersection (Approach)	Horizon Year Level of Service					
	AM Peak Hour		PM Peak Hour		Saturday Peak Hour	
	LOS	Delay	LOS	Delay	LOS	Delay
Route 60 and Dorset Road	F	125.4	F	149.3	C	29.8
Eastbound Left	E	69.3	F	161.2	F	103.2
Eastbound Through	F	186.2	C	29.1	C	24.4
Eastbound Right	B	14.0	B	14.1	B	12.7
Westbound Left	F	90.7	E	71.4	E	63.2
Westbound Through	C	28.8	F	242.8	C	21.3
Westbound Right	C	20.6	B	13.9	B	13.1
Northbound Left/Through	E	76.8	E	77.5	E	56.3
Northbound Right	D	54.6	E	55.3	D	46.9
Southbound Left	E	64.1	E	64.3	E	62.2
Southbound Through/Right	D	50.5	E	65.3	D	53.6
Route 60 and New Dorset Road (Unsignalized)	--	--	--	--	--	--
Eastbound Left	B	10.5	A	0.0	A	0.0
Westbound Left	F	162.6	F	225.5	D	29.0
Northbound	F	**	F	**	F	**
Southbound	A	0.0	A	0.0	A	0.0



Intersection (Approach)	Horizon Year Level of Service					
	AM Peak Hour		PM Peak Hour		Saturday Peak Hour	
	LOS	Delay	LOS	Delay	LOS	Delay
Route 60 and Judes Ferry Road	E	74.7	F	133.1	B	18.9
Eastbound Left	E	63.7	F	108.1	D	41.8
Eastbound Through	F	88.9	A	6.1	A	5.7
Westbound U-Turn	E	67.5	E	70.0	A	0.0
Westbound Through	D	51.8	F	208.3	B	19.2
Westbound Right	C	35.0	A	7.7	A	9.5
Southbound Left	F	86.9	F	244.8	F	99.4
Southbound Right	D	41.9	F	101.4	D	36.6
Route 60 and South Creek One	D	43.3	D	50.8	B	12.6
Eastbound Left	E	59.9	F	132.9	C	28.4
Eastbound Through	E	57.9	B	12.2	A	8.1
Westbound Through	A	4.8	E	59.0	B	13.2
Westbound Right	A	3.9	B	10.6	A	9.5
Southbound Left	D	53.1	D	46.8	C	23.1
Southbound Right	D	50.0	F	167.5	C	25.4
Route 60 and Luck Stone/Stavemill Road	C	21.4	F	80.8	D	37.2
Eastbound Left	E	68.2	F	189.2	E	62.7
Eastbound Through	B	24.3	F	80.8	D	46.0
Eastbound Right	A	5.5	C	20.1	C	21.8
Westbound Left	E	67.9	F	103.3	E	56.6
Westbound Through	A	9.7	E	70.2	C	27.3
Westbound Right	A	4.8	A	7.9	B	11.2
Northbound Left	E	58.6	F	132.0	E	64.4
Northbound Through	E	58.9	F	132.9	E	64.2
Northbound Right	A	1.0	A	0.4	A	0.9
Southbound Left	E	66.9	F	107.4	E	63.5
Southbound Through/Right	E	64.0	F	186.9	E	56.7
Route 60 and Page Road/Urbine Road (Unsignalized)	..	..	..	..	..	..
Eastbound Left	B	12.2	F	607.2	D	32.3
Southbound	F	**	F	**	F	**
Route 60 and Holly Hills Road (Unsignalized)	..	..	..	..	..	..
Westbound Left	F	70.3	C	23.9	C	22.8
Northbound	F	**	F	**	F	**
Route 60 and Page Road/County Line Road	F	280.8	F	300.8	F	131.2
Eastbound Left	E	66.6	F	251.8	F	86.3
Eastbound Through/Right	F	408.3	F	276.5	F	247.0
Westbound Left	F	108.8	F	97.1	E	57.7
Westbound Through	B	18.3	F	404.5	C	24.5
Westbound Right	B	12.8	B	13.3	B	10.3
Northbound Left	E	59.6	F	161.8	E	67.6
Northbound Through	E	59.9	F	176.7	E	71.0
Northbound Right	D	54.9	D	50.6	D	48.5
Southbound Through/Left	E	62.9	E	61.9	E	60.5
Southbound Right	D	52.6	E	55.9	E	56.2
Route 60 and Old Hundred Road	F	164.2	F	161.4	C	22.2
Eastbound Through	F	241.0	B	14.0	B	19.9
Eastbound Right	A	7.0	A	5.8	A	7.0
Westbound Left	D	51.3	E	79.6	E	67.8
Westbound Through	A	5.1	F	221.4	B	10.9
Northbound	D	52.9	F	398.0	F	109.6
Route 60 and Huguenot Springs Road (Unsignalized)	..	..	..	..	..	..
Eastbound Left	B	11.9	F	522.1	C	22.6



Intersection (Approach)	Horizon Year Level of Service					
	AM Peak Hour		PM Peak Hour		Saturday Peak Hour	
	LOS	Delay	LOS	Delay	LOS	Delay
Southbound	F	**	F	**	F	**
Route 60 and West Project Driveway (Unsignalized)	..	..	..	..	..	..
Eastbound Left	B	11.3	F	1215.5	D	25.7
Southbound	A	9.7	B	14.5	B	10.1
Luck Stone Quarry and East Project Driveway (Unsignalized)	..	..	..	..	..	..
Eastbound	A	8.8	B	10.6	B	11.1
Northbound Left	A	5.0	A	7.6	A	7.9

** Error: Volume greatly exceeds capacity. Delay is too large to be calculated for approach.

Table 17: Horizon Year (2017) Queuing Analysis

Intersection (Approach)	Turn Bay Length	Horizon Year Queues					
		AM Peak Hour		PM Peak Hour		Saturday Peak Hour	
		Average Queue	95% Queue	Average Queue	95% Queue	Average Queue	95% Queue
Route 60 and Dorset Road							
Eastbound Left	200'	115	188	~92	#204	~96	#232
Eastbound Through		~1321	#1510	517	643	460	580
Eastbound Right	300'	11	35	0	22	0	24
Westbound Left	210'	25	#61	69	121	57	113
Westbound Through		294	382	~1602	#1754	341	435
Westbound Right	200'	4	31	40	79	5	31
Northbound Left/Through		144	#255	139	#238	101	181
Northbound Right	50'	26	70	8	33	10	42
Southbound Left		146	217	77	129	83	150
Southbound Through/Right		18	52	74	134	54	112
Route 60 and New Dorset Road (Unsignalized)							
Eastbound Left	250'	..	1	..	0	..	0
Westbound Left	250'	..	165	..	529	..	96
Northbound		..	**	..	**	..	**
Southbound		..	0	..	0	..	0
Route 60 and Judes Ferry Road							
Eastbound Left	380'	376	509	152	#274	77	160
Eastbound Through		~1044	#1268	162	319	163	197
Westbound U-Turn	250'	1	6	1	6	0	0
Westbound Through		337	#480	~1730	#1809	326	409
Westbound Right	225'	10	55	29	56	0	23
Southbound Left	400'	296	#486	~192	#325	~139	#337
Southbound Right		16	79	83	#207	0	45
Route 60 and South Creek One							
Eastbound Left	200'	19	38	~76	#144	24	70
Eastbound Through		~155	#1305	392	464	147	327
Westbound Through		73	98	~989	#1043	125	215
Westbound Right	200'	0	12	37	77	0	27
Southbound Left		49	77	43	68	24	60
Southbound Right		0	26	~330	#502	40	125
Route 60 and Luck Stone/Stavemill Road (Signalized)							
Eastbound Left	200'	40	81	~74	#169	85	140
Eastbound Through		555	685	~464	#541	342	391
Eastbound Right	175'	12	23	44	79	58	105
Westbound Left	250'	79	m#129	~470	m#579	285	348



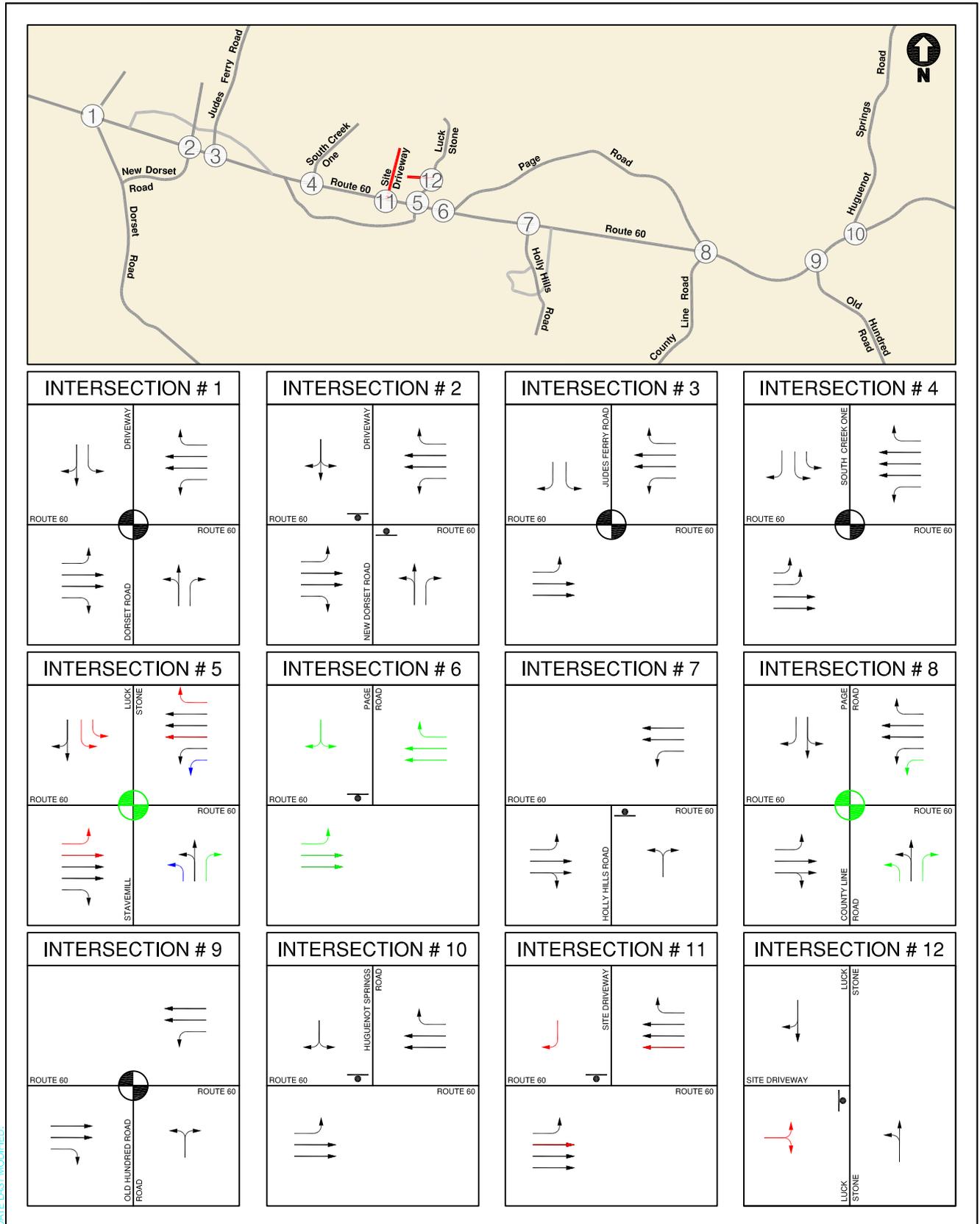
Intersection (Approach)	Turn Bay Length	Horizon Year Queues					
		AM Peak Hour		PM Peak Hour		Saturday Peak Hour	
		Average Queue	95% Queue	Average Queue	95% Queue	Average Queue	95% Queue
Westbound Through	275'	107	m141	~879	m#942	278	320
Westbound Right		0	m11	0	m20	0	29
Northbound Left		68	118	~289	#454	185	#271
Northbound Through		69	120	~292	#458	185	270
Northbound Right		0	0	0	0	0	0
Southbound Left		28	52	93	#163	118	160
Southbound Through/Right		12	48	~116	#245	52	127
Route 60 and Page Road/Urbine Road (Unsignalized)							
Eastbound Left	250'	..	7	..	139	..	41
Southbound		..	**	..	**	..	**
Route 60 and Holly Hills Road							
Westbound Left	250'	..	14	..	15	..	13
Northbound		..	**	..	**	..	**
Route 60 and Page Road/County Line Road							
Eastbound Left	250'	62	#119	~87	#190	32	#82
Eastbound Through/Right		~1989	#2210	~1175	#1338	~1228	#1404
Westbound Left	250'	121	#219	~270	#387	162	215
Westbound Through		232	315	~2067	#2230	536	684
Westbound Right	150'	2	17	23	49	5	20
Northbound Left		63	113	~275	#452	142	#242
Northbound Through		66	115	~293	#474	149	#258
Northbound Right		0	37	0	48	0	46
Southbound Through/Left		96	160	74	124	45	85
Southbound Right	200'	0	20	0	27	0	22
Route 60 and Old Hundred Road							
Eastbound Through		~1387	#1484	457	542	480	569
Eastbound Right	125'	26	50	17	37	18	38
Westbound Left	150	18	44	28	#64	23	#58
Westbound Through		121	151	~2060	#2122	318	376
Northbound		116	#198	~461	#634	~261	#482
Route 60 and Huguenot Springs Road (Unsignalized)							
Eastbound Left	250'	..	5	..	157	..	27
Southbound		..	**	..	**	..	**
Route 60 and West Project Driveway (Unsignalized)							
Eastbound Left		..	4	..	**	..	48
Southbound		..	1	..	16	..	13
Luck Stone Quarry and East Project Driveway (Unsignalized)							
Eastbound		..	5	..	37	..	48
Northbound Left		..	4	..	15	..	20

~ Volume exceeds capacity, queue is theoretically infinite. Queue shown is maximum after two cycles.
 # 95th percentile volume exceeds capacity, queue may be longer. Queue shown is maximum after two cycles
 m Volume for 95th percentile queue is metered by upstream signal



For the purpose of this analysis, it is desirable to achieve a level of service “D” or better on each approach. The following intersections have movements that operate at unacceptable LOS during one or more peak periods.

- Route 60 and Judes Ferry Road
- Route 60 and Dorset Road
- Route 60 and New Dorset Road
- Route 60 and South Creek One
- Route 60 and Luck Stone Quarry/Stavemill Road
- Route 60 and Page Road/Urbine Road
- Route 60 and Holly Hills Road
- Route 60 and Page Road/County Line Road
- Route 60 and Old Hundred Road
- Route 60 and Huguenot Springs Road
- Route 60 and the West Project Driveway



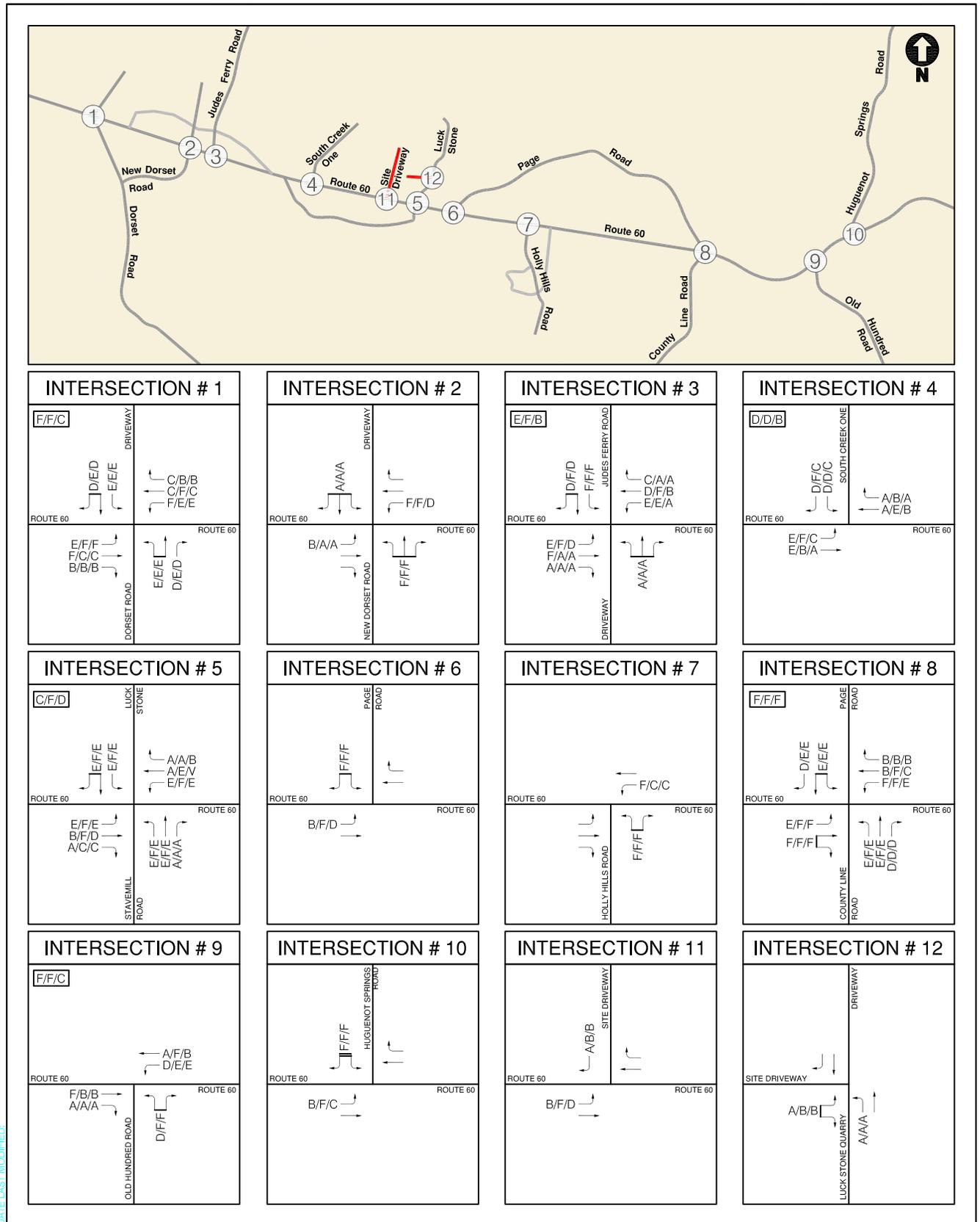
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Figure 19
Horizon Year (2017) Roadways
and Lane Configuration

August 20, 2009

Legend

- Lane Configuration
- STOP Sign
- Traffic Signal
- 2011 Background Improvement
- 2011 Proposed Improvement
- 2017 Background Improvement



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Figure 20
Horizon Year (2017) Level of Service

Legend

- Existing Roadway Network
- AM/PW/SAT
- AM/PW/SAT
- AM/PW/SAT
- AM/PW/SAT
- AM/PW/SAT
- AM/PW/SAT



RECOMMENDED IMPROVEMENTS

Based on planned improvements and improvements proffered by nearby background developments, the following changes to the roadway network were included in the future background (2011) scenario.

Intersection of Route 60 and Luck Stone Quarry/Stavemill Road:

- *Installation of a traffic signal.*

Intersection of Route 60 and Page Road:

- *Remove existing section of northbound Urbine Road south of Page Road;*
- *Remove existing eastbound right-turn lane;*
- *Remove existing westbound left-turn lane;*
- *Remove existing southbound through lane.*

Intersection of Route 60 and Page Road/County Line Road:

- *Installation of traffic signal;*
- *Addition of northbound left-turn lane;*
- *Addition of northbound right-turn lane;*
- *Addition of second westbound left-turn lane.*

Based on the analysis results, certain geometric and traffic control improvements were identified and included in the proposed development plan for the total future (2011) scenario. Impacts of site generated traffic at the study intersections of Route 60 and Luck Stone Quarry/Stavemill Road and Route 60 and the West Project Driveway are mitigated with the construction of the following improvements. Cost estimates are included from recent VDOT construction data.

Intersection of Route 60 and Luck Stone Quarry/Stavemill Road:

- *Installation of a traffic signal;*
Approximate Cost: \$300,000
- *Addition of a third through lane for the eastbound movement;*



Construction of a third through lane from approximately 900 feet west of Luck Stone Quarry/Stavemill Road to the intersection would have an approximate cost of \$360,000.

- *Construction of a new left-turn lane for the eastbound movement;*
Construction of an eastbound left-turn lane with 150 feet for storage and 385 feet for deceleration with a 100-foot taper would have an approximate cost of \$260,000.
- *Addition of a third through lane for the westbound movement;*
Construction of a third through lane from approximately 500 feet east of Luck Stone Quarry/Stavemill Road to the intersection with a 200-foot taper would have an approximate cost of \$240,000
- *Construction of a new right-turn lane for the westbound movement;*
Construction of a westbound right-turn lane with 100 feet for storage and 385 feet for deceleration with a 100-foot taper would have an approximate cost of \$200,000.
- *Addition of two southbound left-turn lanes.*
The construction of two southbound left-turn lanes with 125 full feet for storage and 70 feet for deceleration with a 200-foot taper would have an approximate cost of \$320,000.

Intersection of Route 60 and the West Project Driveway:

- *Addition of a third through lane for the westbound movement.*
Construction of a third through lane from Luck Stone Quarry/Stavemill Road with a total length of 2,000 feet would have an approximate cost of \$800,000
- *Construction of a new right-turn lane for the westbound movement;*
Construction of a westbound right-turn lane with 100 feet for storage and 385 feet for deceleration with a 100-foot taper would have an approximate cost of \$240,000.
- *Construction of a new left-turn lane for the eastbound movement;*
Construction of an eastbound left-turn lane with 100 feet for storage and 385 feet for deceleration with a 100-foot taper would have an approximate cost of \$240,000.

Other intersections in the study area do not experience large detrimental effects due to the proposed development. These intersections experience poor operation under signalized and unsignalized conditions for the existing traffic volumes. These deficiencies are largely the result of a lack of traffic capacity on Route 60. Because of the capacity constraint, even significant improvements to the minor approaches would not improve the overall operation of the study intersections.



SIGNAL WARRANT ANALYSIS

The purpose of this analysis was to determine if the installation of a traffic control signal would be justified at the intersection of Route 60 and Luck Stone Quarry/Stavemill Road under future conditions with the proposed development (2011). A summary of the evaluation of the warrant criteria from the Manual on Traffic Signal Design (MTSD), 2nd Edition is presented in Table 18. A detailed signal warrant analysis is presented in the technical appendix.

Table 18: Traffic Signal Warrant Analysis – Future Conditions (2011)

URBAN				RURAL			X		
1. Minimum Vehicular Volume				<i>Minimum Required Estimated Average Daily Traffic</i>					
Urban		Rural	Satisfied	<i>Vehicles per day on major street (total of both directions)</i>			<i>Vehicles per day on higher-volume minor street (one direction only)</i>		
<i>Number of lanes for moving traffic on each approach</i>									
Major Street		Minor Street		Urban	Rural	Actual	Urban	Rural	Actual
1	.....	1	.....	8,000	5,600		2,400	1,680	
2 or more	.....	1	.....	9,600	6,720		2,400	1,680	
2 or more	.....	2 or more	.....	9,600	6,720	41,460	3,200	2,240	3,960
1	.....	2 or more	.....	8,000	5,600		3,200	2,240	
2. Interruption of Continuous Traffic				<i>Vehicles per day on major street (total of both directions)</i>					
Urban		Rural	Satisfied	<i>Vehicles per day on major street (total of both directions)</i>			<i>Vehicles per day on higher-volume minor street (one direction only)</i>		
<i>Number of lanes for moving traffic on each approach</i>									
Major Street		Minor Street		Urban	Rural	Actual	Urban	Rural	Actual
1	.....	1	.....	12,000	8,400		1,200	850	
2 or more	.....	1	.....	14,400	10,080		1,200	850	
2 or more	.....	2 or more	.....	14,400	10,080	41,460	1,600	1,120	3,960
1	.....	2 or more	.....	12,000	8,400		1,600	1,120	
3. Combination of Warrants 1 and 2				<i>Must satisfy 80% of Warrants 1 and 2</i>					
Urban		Rural	Satisfied	<i>Must satisfy 80% of Warrants 1 and 2</i>			<i>Must satisfy 80% of Warrants 1 and 2</i>		

* Form is based on the sample form found in the Manual on Traffic Signal Design (MTSD) page 20.

Table 19: Summary of Warrant Analysis for Future Conditions (2011)

Warrant No.	Warrant Description	Future Conditions
1	Minimum Vehicular Volume	Satisfied
2	Interruption of Continuous Traffic	Satisfied
3	Combinations of Warrants 1 and 2	Satisfied

According to the MTSD, only one warrant needs to be satisfied to allow for the installation of a traffic control signal. As shown in Table 19, all of the three warrants are satisfied under the future conditions with the proposed development (2011). Hence, a traffic control signal is warranted at the intersection of Route 60 and Luck Stone Quarry/Stavemill Road.



CONCLUSIONS

This report contains the findings of a traffic impact study conducted for the proposed Powhatan Commercial Development in Powhatan County, Virginia. The development will be located north of Route 60 (Anderson Highway) near the intersection with Luck Stone Quarry/Stavemill Road. The proposed development contains approximately 170,000 square feet of retail space. To allow flexibility for minor modifications to the site plan, the square footage listed above was rounded off for purposes of the traffic study. Access to the development will be provided along Route 60 and along Luck Stone Quarry. The project is scheduled to be completed in 2011.

The following intersections were identified in the scoping meeting for inclusion in this traffic study.

- 1) Route 60 and Dorset Road
- 2) Route 60 and New Dorset Road
- 3) Route 60 and Judes Ferry Road
- 4) Route 60 and South Creek One
- 5) Route 60 and Luck Stone Quarry/Stavemill Road
- 6) Route 60 and Page Road/Urbine Road
- 7) Route 60 and Holly Hills Road
- 8) Route 60 and Page Road/County Line Road
- 9) Route 60 and Old Hundred Road
- 10) Route 60 and Huguenot Springs Road
- 11) Route 60 and East Project Driveway
- 12) Route 60 and West Project Driveway

The analysis presented in this report supports the following major conclusions.

Existing Conditions (2008)

Traffic counts were performed in October of 2008 during the morning and afternoon peak periods. The existing volumes were adjusted balance the volumes along Route 60. An intersection capacity analysis was performed for the study intersections, with a desired level of service (LOS) of D. Of the study intersections, 4 operated at acceptable LOS during the morning peak period and 2 during the afternoon peak period. Many of the study intersections operated at acceptable overall LOS conditions but had individual movements that operated at unaccepted LOS conditions.

Future Conditions (2011) without Development

Traffic volumes were projected for the year 2011 without the proposed development. Inherent



regional growth and individual background developments were included in the projections. Roadway improvements from background developments were also included in the analysis. A capacity analysis was performed for the study intersections, with a desired LOS of D. Of the study intersections, 2 operated at acceptable LOS during the morning peak period and none during the afternoon peak period. Many of the study intersections operated at acceptable overall LOS conditions but had individual movements that operated at unaccepted LOS conditions.

Future Conditions (2011) with Development

The proposed development will contain approximately 170,000 square feet of office space. One access point will be provided on Route 60 with an additional access point provided on Luck Stone Quarry. The site-generated volumes were added to the future without development volumes to project the future with development conditions in 2011.

After analyzing the future with development volumes for intersection capacity, it was found that 4 study intersections—including the site driveways—operate at acceptable LOS during the morning peak period and that 1 study intersection—a site driveway—operates at acceptable LOS during the afternoon peak period. Many of the study intersections operated at acceptable overall LOS conditions but had individual movements that operated at unacceptable LOS conditions. Improvements to the roadway network were included in order to mitigate the impacts of the site-generated traffic.

- *Intersection of Route 60 and Luck Stone Quarry/Stavemill Road:*
 - Installation of a traffic signal;
 - Addition of a third through lane for the eastbound movement;
 - Construction of a new left-turn lane for the eastbound movement;
 - Addition of a third through lane for the westbound movement;
 - Construction of a new right-turn lane for the westbound movement; and
 - Addition of two southbound left-turn lanes.
- *Intersection of Route 60 and the West Project Driveway:*
 - Addition of a third through lane for the westbound movement;
 - Construction of a new right-turn lane for the westbound movement; and
 - Construction of a new left-turn lane for the eastbound movement.

Future Conditions (2017) with Development

The construction of the proposed development is anticipated to have a horizon year of 2017. For



planning purposes, a future 2017 scenario was investigated. The traffic generated by additional nearby development and inherent growth on the roadways within the study area were accounted for in traffic projections. The completion of the Watkins Center and the construction of the Shady Oak Development were accounted for in the background development. For the horizon year scenario, 1 study intersection—a site driveway—operates at acceptable overall LOS for the morning and afternoon peak periods. All other study intersections operate at unacceptable LOS during 1 or more peak period.