SOLWAY ROAD SUBDIVISION
Knox County

TRAFFIC IMPACT STUDY

ENGINEERS
PLANNERS
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June 2004

SOLWAY ROAD SUBDIVISION

KNOX COUNTY, TENNESSEE

TRAFFIC IMPACT STUDY

Prepared for

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June 2004

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INTRODUCTION

Wilbur Smith Associates (WSA) is pleased to submit this report to address the impact and access of a proposed residential development located on Solway Road in northwest Knox County. The basis for this study required the collection of traffic data, generation of anticipated traffic volumes from the proposed site and development of projected traffic volumes from normal growth and from the potential site. Analyses of the resulting traffic projections were conducted to determine the capacity and levels of service for the site accesses and adjacent intersections. This study will develop measures necessary to mitigate traffic impacts including improved roadway geometrics and traffic control devices within the environs of the proposed residential development.

According to the Knoxville-Knox County Metropolitan Planning Commission's Administrative Rules and Procedures, the proposed residential development site is identified for a Level 2 Traffic Impact Study. WSA discussed with Knox County Department of Engineering and Public Works and MPC to define the study area and address specific concerns relative to the proposed residential development. Therefore, this study will address the anticipated traffic impacts of the proposed residential development site access on Solway Road.

Project Description

The proposed project is a residential development. The proposed site is approximately 167.0 acres. Current zoning is Business Park (BP), and proposed zoning is Planned Residential (PR). The development is for 286 single-family units on 144 acres and the remaining 23 acres proposed for a 3 unit per acre density. This tract is bounded by Sam Lee Road to the north and west and Solway Road to the east. Site access streets are proposed to Sam Lee Road and Solway Road. Site access to Solway Road would use a street that was constructed to serve the property but not currently open to traffic. Figure 1 shows the proposed site plan.

Site Location

The location of the proposed residential development is in the southwest quadrant of the Solway Road and Sam Lee Road intersection in northwest Knox County, Tennessee, and northwest of the Knoxville central business district (CBD). Figure 2 illustrates the site location relative to local and regional access.

SITE PLAN

Solway Road Subdivision

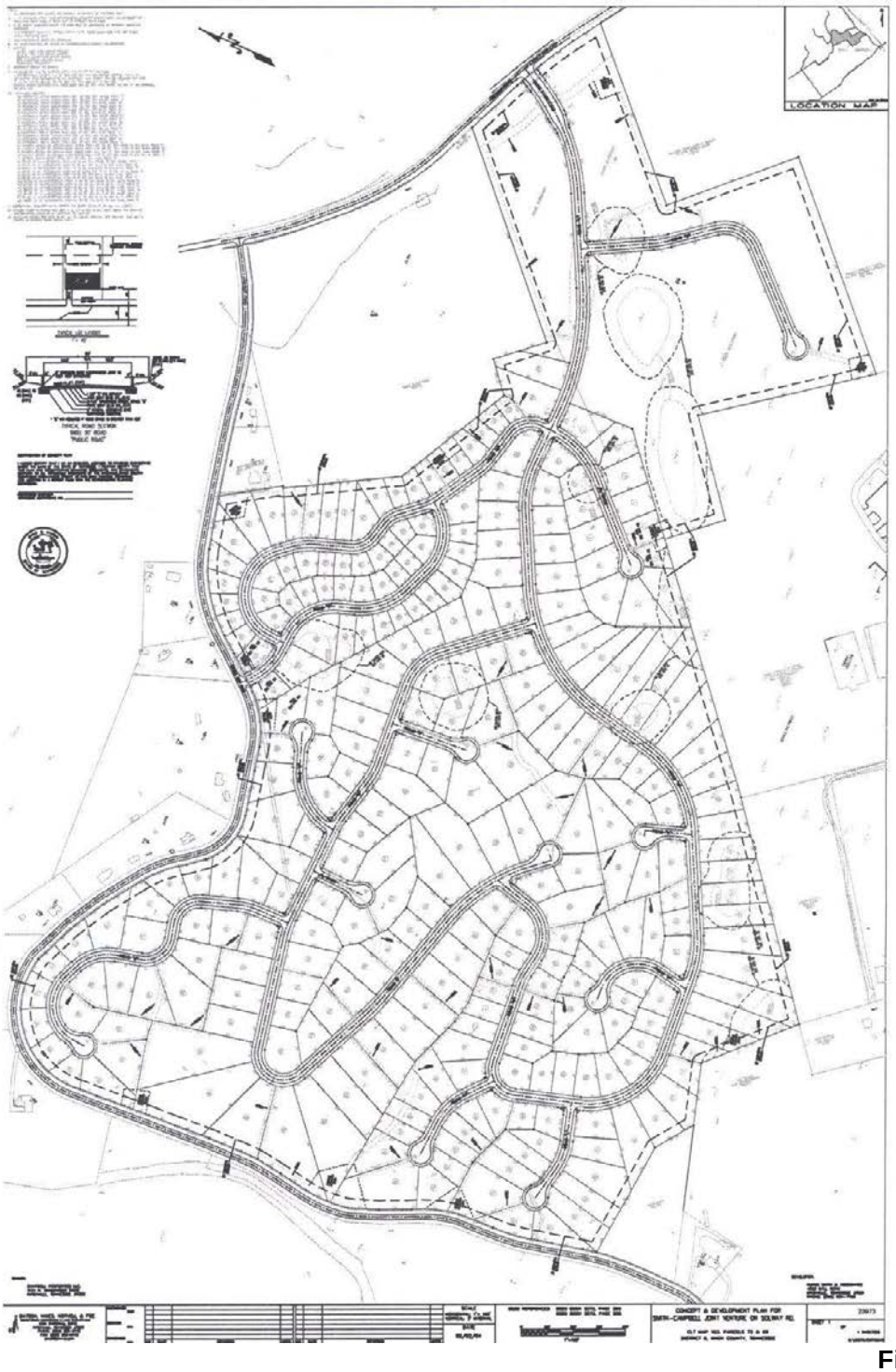


Figure 1

VICINITY MAP
Solway Road Subdivision

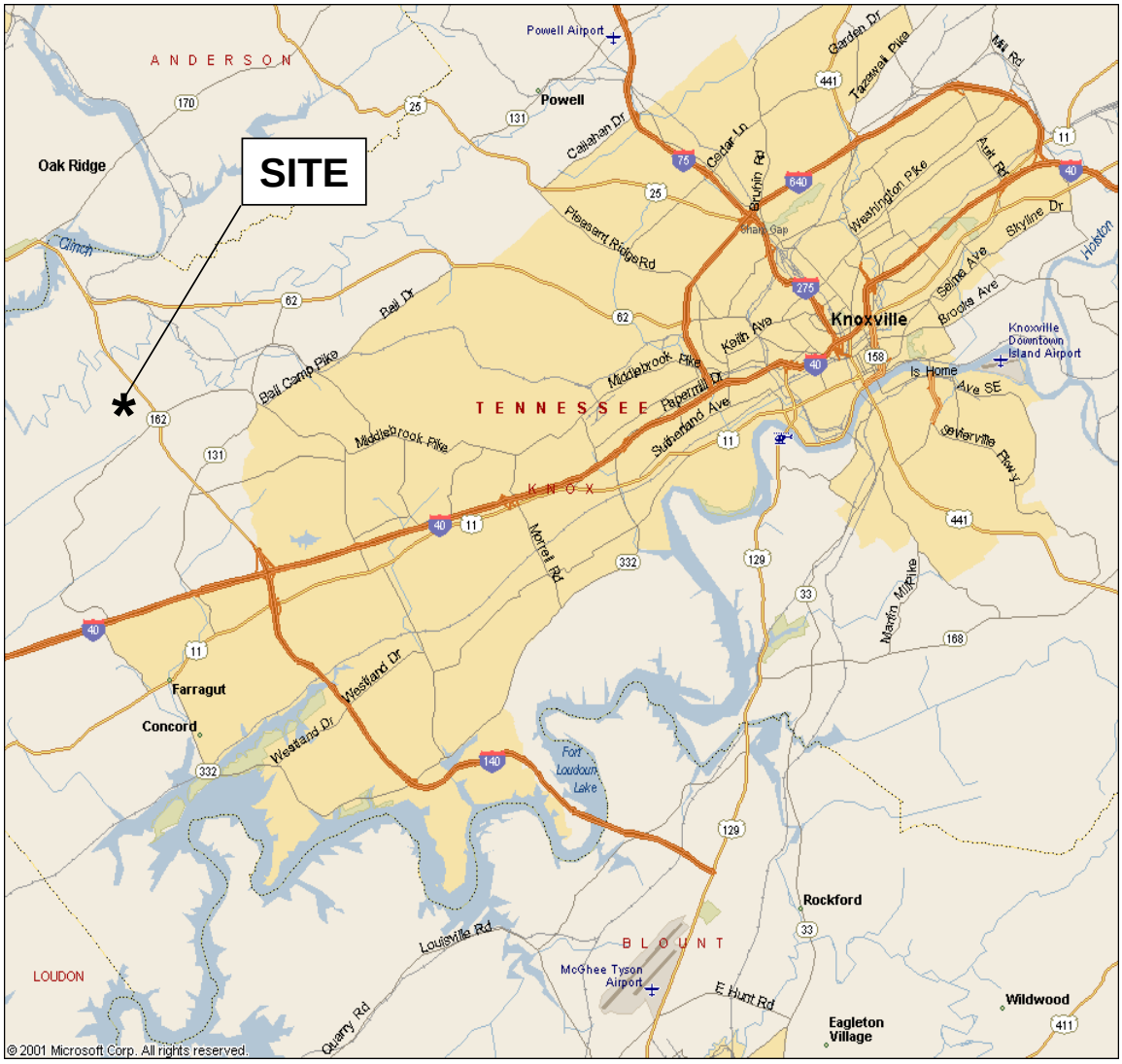


Figure 2

LOCAL AND REGIONAL ACCESS

Local Access

Solway Road is a 23-foot wide, two-lane collector with paved shoulders approximately one foot wide, extending north and south paralleling Pellissippi Parkway (S.R. 162). Solway Road, south of Sam Lee Road, is classified a major collector terminating at Hardin Valley Road opposite the entrance to Pellissippi Parkway. The 2003 average daily traffic (ADT) on Solway Road, between Sam Lee Road and Hardin Valley Road, is 6,850. North of Sam Lee Road, Solway Road is classified a minor collector and extends to Oak Ridge Highway (S.R. 62).

Sam Lee Road is a two-lane major collector with 22-foot width at the intersection with Solway Road while tapering to a 19-foot continuous cross-section extending west from Solway Road to Coach Mill Road. The 2003 ADT on Sam Lee Road is 360.

Regional Access

Regional access is provided by Pellissippi Parkway, paralleling Solway Road; Oak Ridge Highway, north of the proposed development; and Hardin Valley Road to the south. Accesses to these facilities are provided at the termini of Solway Road and two other connections one being Coward Mill Road and the second George Lightfoot Road. Oak Ridge Highway, with a 2003 ADT of 49,740, extends east and west between Oak Ridge and Knoxville. Pellissippi Parkway extends south intersecting Interstate 40 and terminating at Alcoa Highway (U.S. 129) near the Knoxville Airport. Pellissippi Parkway has a 2003 ADT of 41,870 north of Hardin Valley Road and 48,960 south of Dutchtown Road. To the east, Hardin Valley becomes Middlebrook Pike and intersects S.R. 131 (Lovell Road). Hardin Valley Road, to the southwest, terminates at I-40 and Campbell Station Road. Hardin Valley Road has a 2003 ADT of approximately 7,530 west of Pellissippi Parkway.

Interstate 40 provides significant east and west regional access throughout Tennessee. To the east, Interstate 40 connects to Interstate 81, which extends into the Tri-Cities area of Tennessee and Virginia. Westbound Interstate 40 connects to Interstate 75, providing north- and southbound connections into neighboring states such as Kentucky and Georgia, respectively. Interstate 40 provides significant east and west regional access throughout Tennessee. South of the site, I-40/75 has a 2003 ADT of 106,960 and 96,830 east and west of Lovell Road

EXISTING TRAFFIC CONDITIONS

Existing Traffic Control

The Sam Lee Road approach to Solway Road is STOP controlled, and Solway Road is signalized at Hardin Valley Road. The posted speed limit for Solway Road is 40mph and 30mph for Sam Lee Road. Hardin Valley has a posted speed limit of 45mph.

Existing Traffic Volumes

WSA conducted peak-hour turning movement counts at the intersections of Solway Road at Sam Lee Road and Hardin Valley Road in May of 2004. The hours counted were from 7:00a.m. to 9:00a.m. and 4:00p.m. to 6:00p.m. Figure 3 presents the AM and PM peak-hour traffic volumes for the study intersections.

Existing Capacity and Level of Service

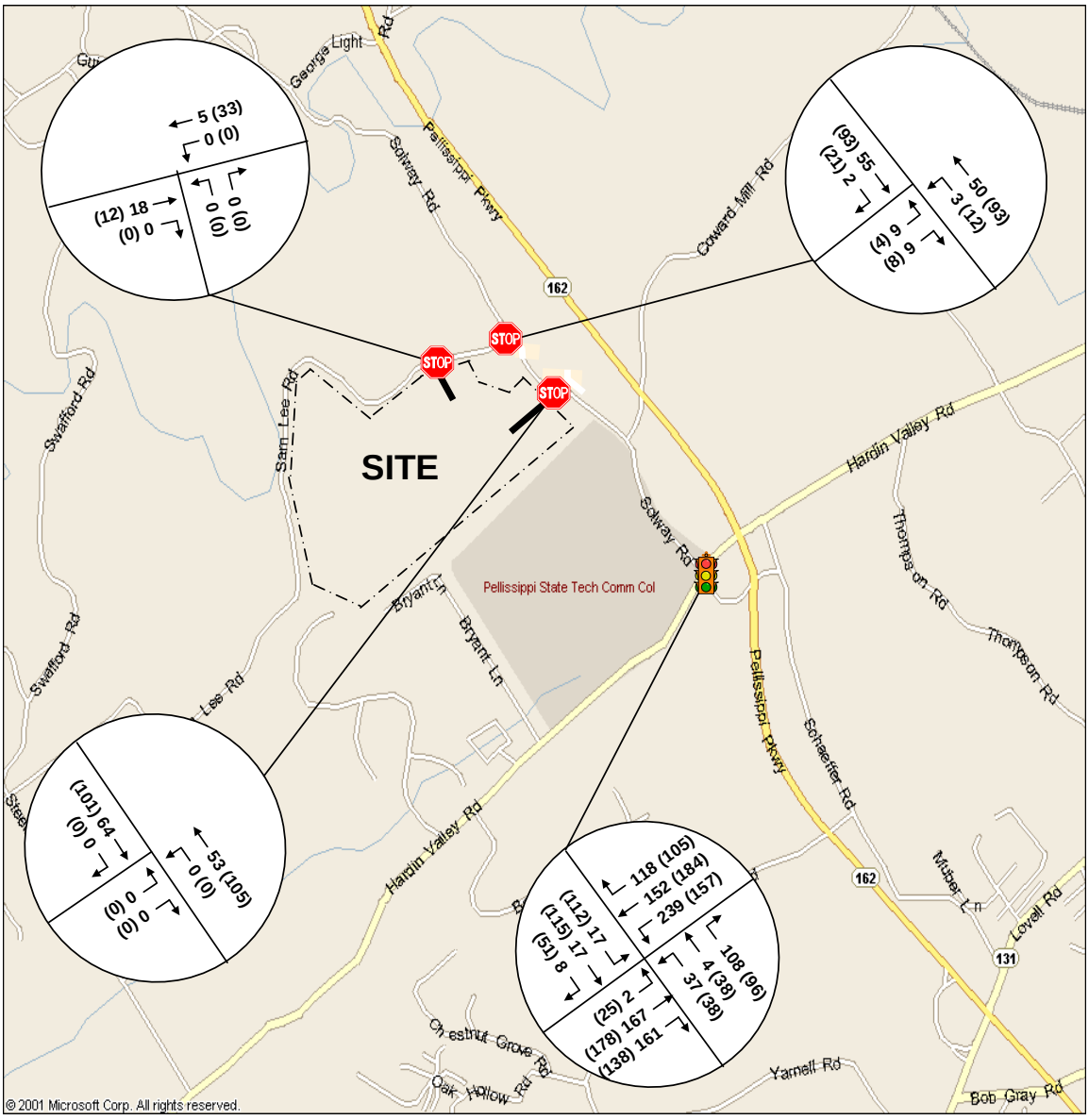
In order to evaluate the current operations of the traffic control devices, capacity and level of service were calculated using the **2000 Highway Capacity Manual, Special Report 209** published by the Transportation Research Board (TRB). Signalized and unsignalized intersections are evaluated based on estimated intersection delays, which may be related to level of service (LOS).

Level of service and capacity are the measurements of an intersection's ability to accommodate traffic volumes. Levels of service for intersections range from A to F. A LOS A is the best, and LOS F is failing.

For signalized intersections, a LOS of A has an average estimated intersection delay of less than 10 seconds, and LOS F has an estimated delay of greater than 80 seconds. A LOS of C and D are typical design values. Within urban areas, a LOS D, delay between 35 and 55 seconds, is considered acceptable by the Institute of Transportation Engineers (ITE) for signalized intersections.

Unsignalized intersections levels of service have lower thresholds of delays. A LOS of F exceeds estimated delays of 50 seconds. For urban arterials, minor approaches may frequently experience levels of service E. A full level of service description for unsignalized and signalized intersections is presented in Tables 1 and 2, respectively.

2004 EXISTING TRAFFIC
Solway Road Subdivision



N

LEGEND
XXX AM PEAK
(XXX) PM PEAK

Figure 3

TABLE 1. LEVEL OF SERVICE (LOS) DESCRIPTION FOR TWO-WAY STOP INTERSECTIONS

Level of Service	Average Control Delay per Vehicle (seconds)
A	≤ 10.0
B	> 10.0 and ≤ 15.0
C	> 15.0 and ≤ 25.0
D	> 25.0 and ≤ 35.0
E	> 35.0 and ≤ 50.0
F	> 50.0

SOURCE: Highway Capacity Manual, TRB Special Report 209

TABLE 2. LEVEL-OF-SERVICE (LOS) DESCRIPTION FOR SIGNALIZED INTERSECTIONS

LOS	Average Control Delay per Vehicle (seconds)	Description
A	≤ 10.0	Very low delay with extremely favorable progression. Most vehicles don't stop.
B	> 10.0 and ≤ 20.0	Generally good progression. Increase number of stops from that described for LOS "A" resulting in higher delays
C	> 20.0 and ≤ 35.0	Fair progression with increased delay. Number of stopping vehicles become significant; however, many still pass through the intersection without stopping. Stable flow.
D	> 35.0 and ≤ 55.0	The influence of congestion becomes more noticeable. Longer delays resulting from unfavorable progression, longer cycles, or high V/C ratios. Approaching unstable flow.
E	> 55.0 and ≤ 80.0	Limit of acceptable delay. Long delays associated with poor progression, long cycles, or high V/C ratios.
F	> 80.0	Unacceptable operation resulting from oversaturation (flow rates exceed capacity). Poor progression, long cycles, and high V/C ratios.

SOURCE: Highway Capacity Manual, TRB Special Report 209

Analyses were conducted using the Synchro Software, developed by Trafficware. Table 3 presents the analyses of the study intersections. The data shows that operations of the signalized and unsignalized intersection are very good and acceptable.

TABLE 3. 2004 TRAFFIC CAPACITY AND LEVEL OF SERVICE

INTERSECTION	TRAFFIC CONTROL	PEAK PERIOD	V/C	2004 TRAFFIC DELAY	LOS
Sam Lee Road & Solway Road	STOP EB/NB-L	AM	-	8.9/.4	A/A
		PM	-	9.2/.9	A/A
Hardin Valley Road & Solway Road	SIGNAL	AM	0.56	26.70	C
		PM	0.59	25.1	C

Note: Average vehicle delay estimated in seconds. STOP control analyses presented by total minor approach and major approach left-turn.

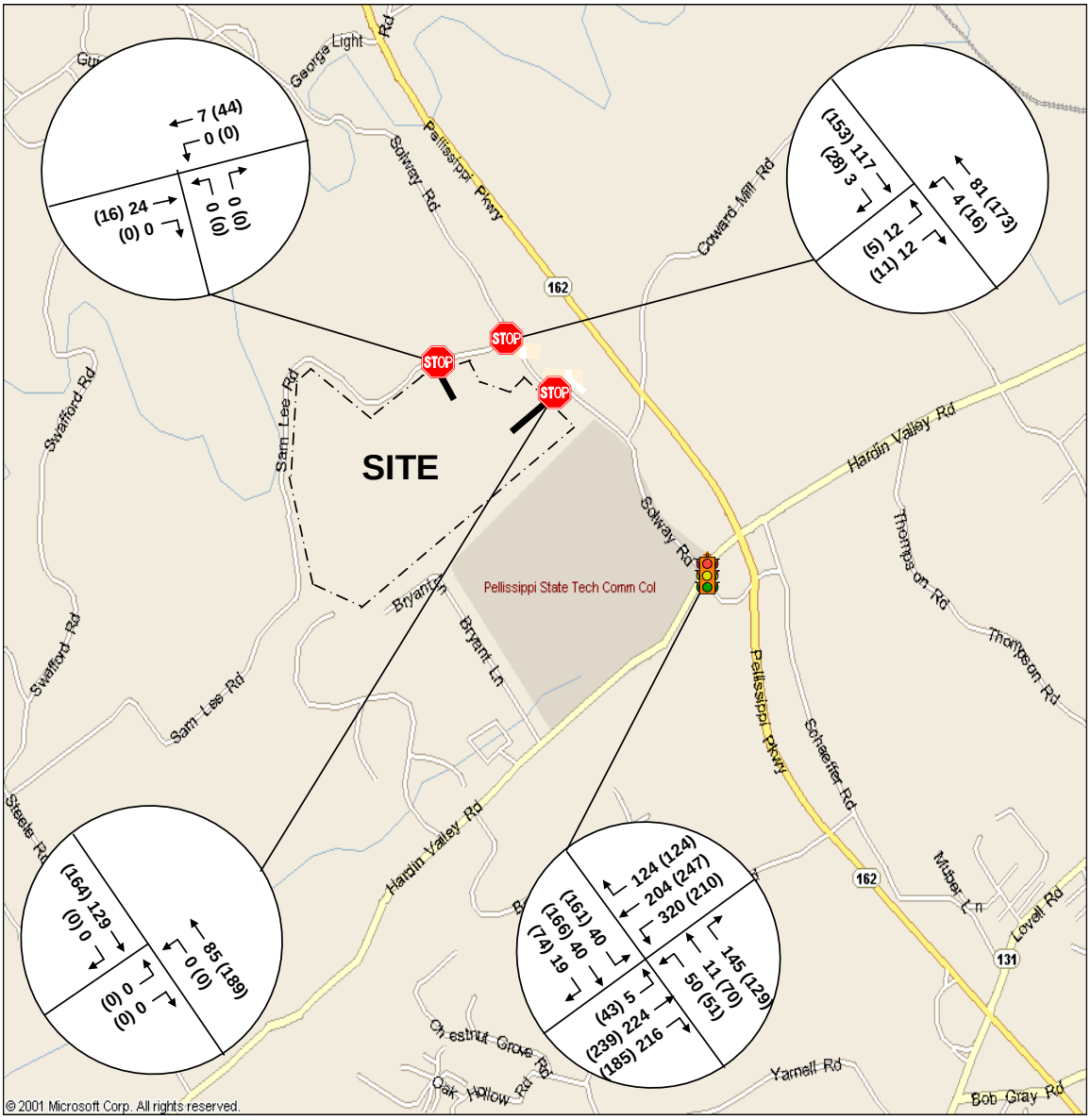
BACKGROUND TRAFFIC CONDITIONS

Background traffic is traffic that can be anticipated regardless of the proposed development. Traffic within the study area should continue to grow due to other developments as well as the continued growth within the surrounding area. This background traffic must be analyzed and evaluated for the purpose of establishing a baseline. In addition, the background traffic reflects the historical traffic volumes in the area of the proposed development.

Background Traffic Volumes

Historical traffic data were reviewed to determine traffic growth trends in the study area. Based on the lack of long-term past data from MPC Count Station #22, annual traffic growth on Solway Road is assumed to be 5.0%. Studies conducted by WSA in the vicinity of Solway Road and Pellissippi Parkway have indicated annual growth rates of 5% to 6%. Therefore, the 2004 traffic count volumes were increased by a factor of 1.34 (5% per year) to estimate traffic volumes in 2010 without Solway Road Development's traffic. In addition to the growth rate applied, this background traffic included trips associated with a residential development of 150 single-family units, located north of this proposed site. This development generates 1,510 daily trips with 114 and 154 trips occurring in the AM and PM peak-hours, respectively. Figure 5 presents the resulting Year 2010 AM and PM peak-hour traffic volumes without the proposed development.

2010 BACKGROUND TRAFFIC
Solway Road Subdivision



LEGEND
XXX AM PEAK
(XXX) PM PEAK

Figure 4

Background Capacity and Level of Service

Analysis was performed with the grown traffic volumes and is displayed in Table 4. The levels of service are measured to be acceptable for the signalized and unsignalized study intersections with background conditions.

TABLE 4. 2010 BACKGROUND TRAFFIC CAPACITY AND LEVEL OF SERVICE

INTERSECTION	TRAFFIC CONTROL	PEAK PERIOD	2010 BACKGROUND V/C	DELAY	LOS
Sam Lee Road & Solway Road	STOP EB/NB-L	AM	-	9.5/.04	A/A
		PM	-	9.9/.7	A/A
Hardin Valley Road & Solway Road	SIGNAL	AM	0.42	16.4	B
		PM	0.51	16.7	B

Note: Average vehicle delay estimated in seconds. STOP control analyses presented by total minor approach and major approach left-turn.

PROJECT IMPACTS

Project conditions are developed by generating traffic based on the proposed land uses, distributing the trips to the transportation network, and again conducting analyses for capacity and level of service.

Trip Generation

Project traffic was determined using the publication, **Trip Generation, 7th Edition**. This reference is published by the Institute of Transportation Engineers (ITE) and represents national data collected for many different land uses including industrial, residential and commercial uses. **Trip Generation** is an essential tool in calculating the traffic, which may be generated by a proposed development. The study will generate traffic for 356 single-family units. From the trip generation calculations, the proposed site may generate approximately 3,340 daily trips. Table 5 presents the trip generation of this proposed site.

Trip Distribution and Assignment

Using the turning-movement counts for the study intersections, trips are distributed to the adjacent streets with 50- and 45-percent of the generated trips distributed south and north on Solway Road, respectively. The remaining 5-percent was assigned to the west on Sam Lee Road. Figure 5 illustrates this distribution and assignment.

TABLE 5. TRIP GENERATION

LAND USE	L.U.C.	Units	DAILY TRIPS	AM PEAK ENTER	AM PEAK EXIT	PM PEAK ENTER	PM PEAK EXIT
Single Family	210	286	3,344	65	194	215	121

Project Traffic Volumes

By multiplying the trips generated by the distribution percentages, the project traffic volumes were determined. Figure 6 illustrates the resulting project traffic volumes associated with the proposed project.

Total Projected Traffic Volumes

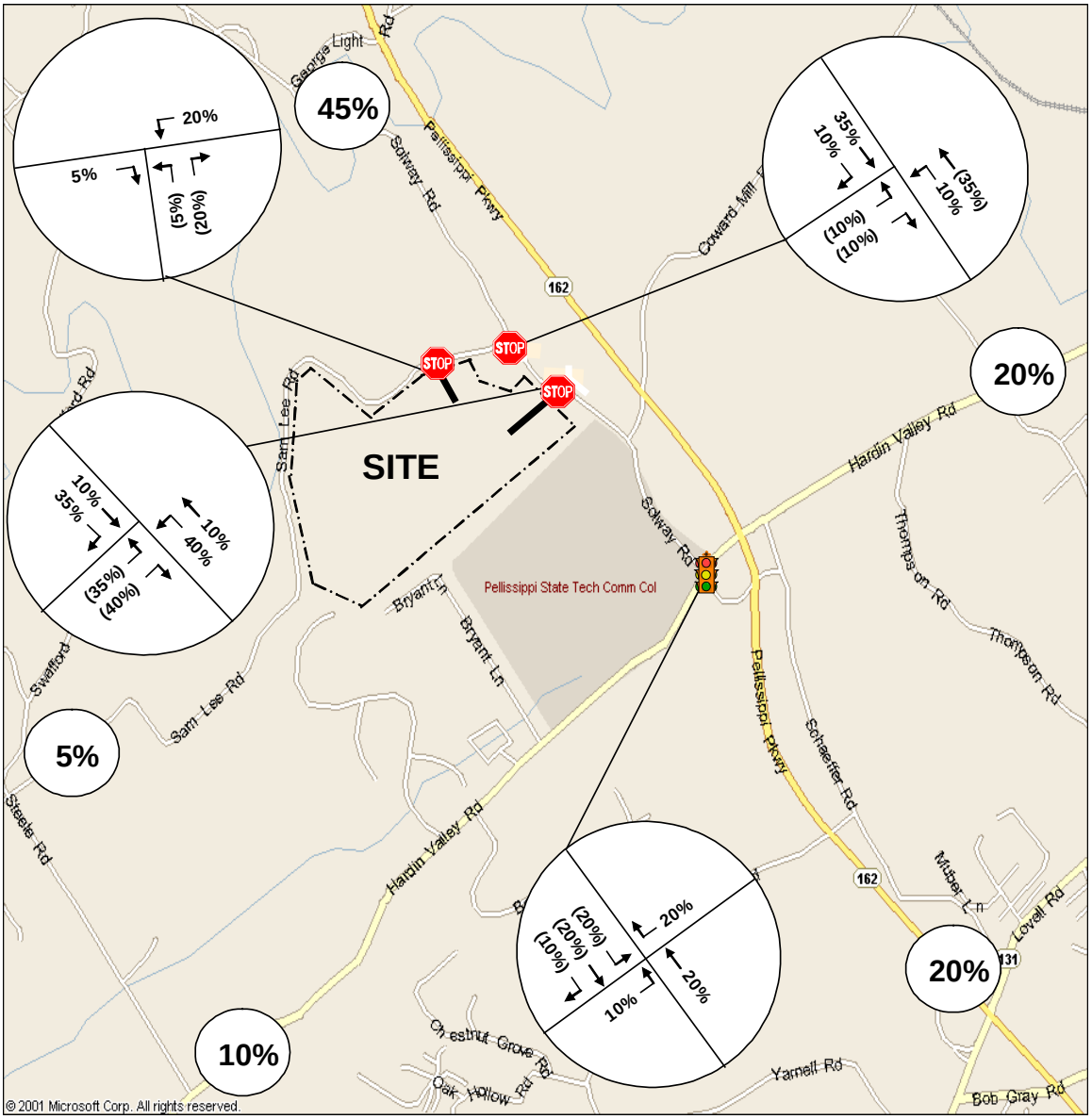
Background and project traffic volumes were added together to develop post-development traffic volumes for the year 2010. Figure 7 illustrates this 2010 projection. Projected daily traffic of 2,508 on the proposed access street from Solway Road reflects a traffic volume typical for a collector street.

Using these projections, mitigation measures including traffic control devices and roadway and intersection geometry can be evaluated. The requirements of left- and right-turn lanes were evaluated using the criteria adopted by the MPC. The access from Solway Road has a northbound PM peak-hour projected left-turn volume of 86, exceeding the threshold volume of 75, thereby requiring a northbound left-turn lane.

Signal Warrant Analyses

For the study intersections of Solway Road with Sam Lee Road and the proposed access street, an evaluation for a traffic control signal was conducted. There are eight warrants published in the **Manual on Uniform Traffic Control Devices, 2000 Edition**. For prevailing speeds in excess of 40mph on Solway Road, signal warrant volumes for each of the warrants can be reduced. Three traffic volume warrants were examined of which were the Eight-Hour Traffic Volume Warrant consisting of the Minimum Volume (Warrant 1A), Interruption to Continuous Traffic Flow (Warrant 1B), Combination (Warrant 1A & B); Four-Hour (Warrant 2); and Peak-Hour Volume (Warrant 3B). Any part of Warrant 1 must be met for a minimum of eight hours.

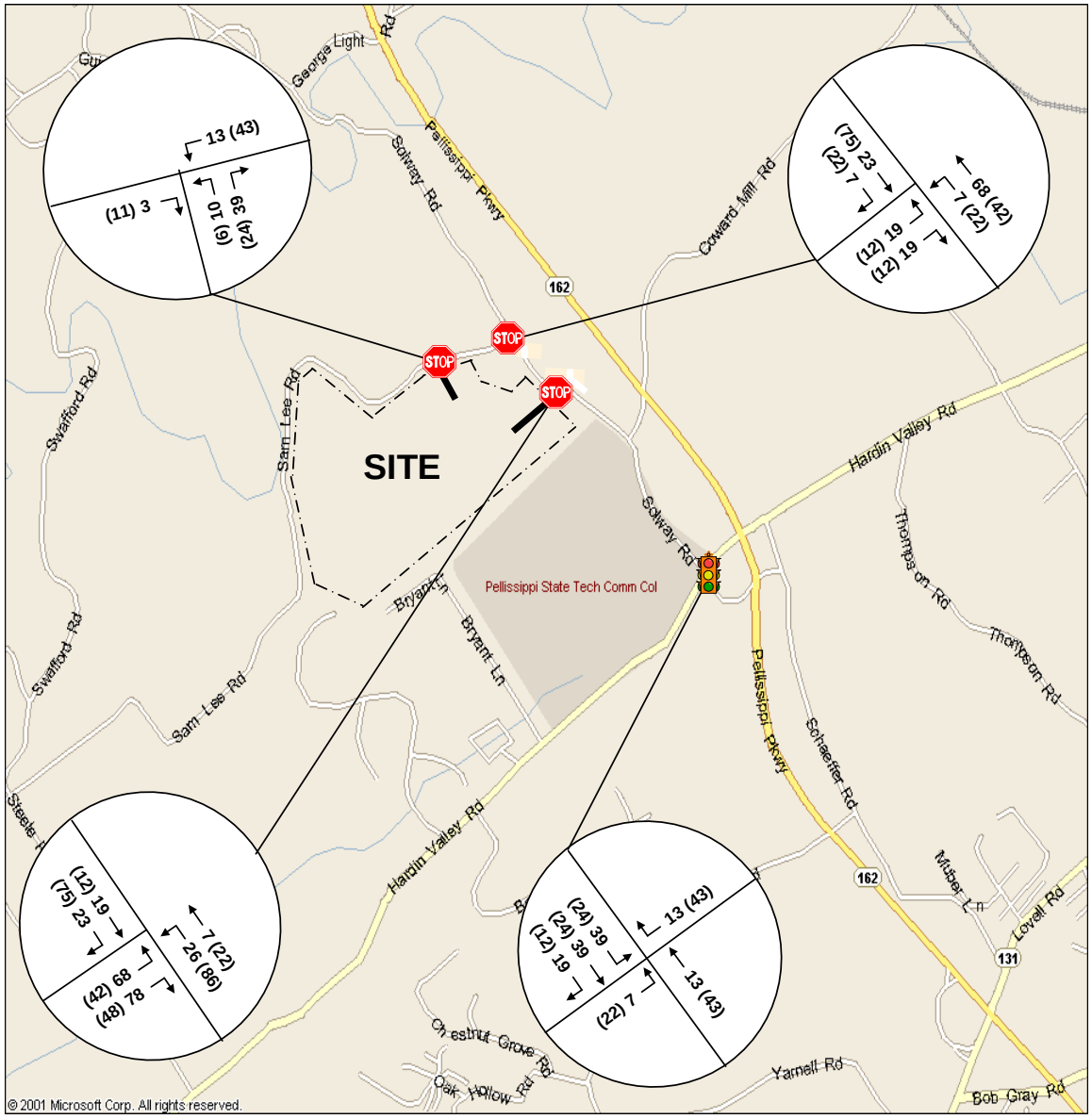
DISTRIBUTION AND ASSIGNMENT
Solway Road Subdivision



LEGEND
XXX ENTERINGTRIPS
(XXX) EXITING TRIPS

Figure 5

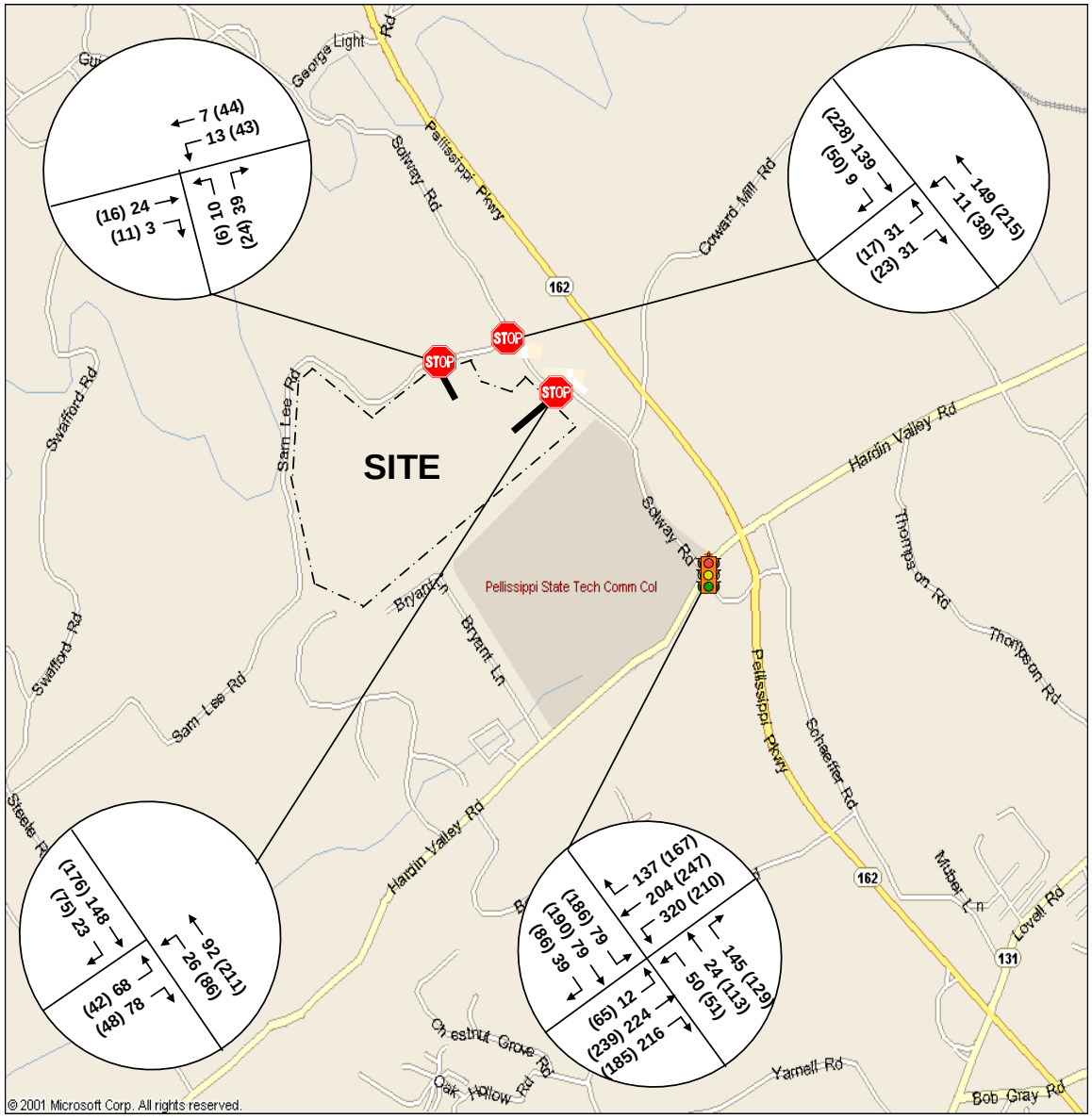
PROJECT TRIPS
Solway Road Subdivision



LEGEND
XXX AM PEAK
(XXX) PM PEAK

Figure 6

2010 PROJECTED TRAFFIC
Solway Road Subdivision



LEGEND
XXX AM PEAK
(XXX) PM PEAK

Figure 7

Warrant 2 must be met for four hours, and one hour must be met for the Peak-Hour Warrant (Warrant 3B).

For the projected traffic conditions, volume warrants are not met for either intersection. The analyses are summarized as follows:

		Sam Lee Rd	Site Access
Warrant 1A	Minimum Volume	0 hours	0 (1) hours
Warrant 1B	Interruption to Continuous Traffic Flow	0 hours	0 (1) hours
Warrant 1C	Combination of Parts A & B	0 hours	0 hours
Warrant 2	Four Hour	0 hours	0 hours
Warrant 3B	Peak-hour Volume	0 hours	0 hour

Note: (X) represents hours exceeding 90%.

Projected Capacity and Level of Service

The development of the site has an insignificant impact on the study intersections. The summarized analysis is shown in Table 6. Results conclude that the study intersections would operate at a very acceptable level of service for projected traffic volumes and patterns. To recap the analysis performed for this study Table 7 summaries the volume to capacity ratio, delay and LOS measured and projected for this development.

TABLE 6. 2010 PROJECTED TRAFFIC CAPACITY AND LEVEL OF SERVICE

INTERSECTION	TRAFFIC CONTROL	PEAK PERIOD	V/C	2010 PROJECTED DELAY	LOS
Sam Lee Road &	STOP	AM	-	10.3/.6	B/A
Solway Road	EB/NB-L	PM	-	11.6/1.5	B/A
Site Access &	STOP	AM	-	11.1/1.8	B/A
Solway Road	EB/NB-L	PM	-	13.0/2.8	B/A
Hardin Valley Road &	SIGNAL	AM	0.46	17.0	B
Solway Road		PM	0.60	17.3	B
Site Access &	STOP	AM	-	8.7/4.8	A/A
Sam Lee Road	NB/WB-L	PM	-	8.8/3.7	A/A

Note: Average vehicle delay estimated in seconds. STOP control analyses presented by total minor approach and major approach left-turn.

TABLE 7. SUMMARY
CAPACITY AND LEVEL OF SERVICE

INTERSECTION	TRAFFIC CONTROL	PEAK PERIOD	2004 TRAFFIC V/C	2004 TRAFFIC DELAY	2004 TRAFFIC LOS	2010 BACKGROUND V/C	2010 BACKGROUND DELAY	2010 BACKGROUND LOS	2010 PROJECTED V/C	2010 PROJECTED DELAY	2010 PROJECTED LOS
Sam Lee Road & Solway Road	STOP EB/NB-L	AM	-	8.9/.4	A/A	-	9.5/.04	A/A	-	10.3/.6	B/A
		PM	-	9.2/.9	A/A	-	9.9/.7	A/A	-	11.6/1.5	B/A
Site Access & Solway Road	STOP EB/NB-L	AM	-	-	-	-	-	-	-	11.1/1.8	B/A
		PM	-	-	-	-	-	-	-	13.0/2.8	B/A
Hardin Valley Road & Solway Road	SIGNAL	AM	0.56	26.7	C	0.42	16.4	B	0.46	17.0	B
		PM	0.59	25.1	C	0.51	16.7	B	0.60	17.3	B
Site Access & Sam Lee Road	STOP NB/WB-L	AM	-	-	-	-	-	-	-	8.7/4.8	A/A
		PM	-	-	-	-	-	-	-	8.8/3.7	A/A

Note: Average vehicle delay estimated in seconds. STOP control analyses presented by total minor approach and major approach left-turn.

Sight Distance

The project is proposed to access Solway Road and Sam Lee Road. Solway Road has a posted speed limit of 40mph, and measured sight distance for its access is over 600 feet and less than 300 feet looking left and right, respectively. Sight-distance to the right is restricted by overgrowth of the vegetation. Removal of the overgrowth would improve sight-distance to approximately 450 feet. The required sight-distance is 305 feet to meet the minimum stopping sight-distance for American Association of State Highway and Transportation Officials (AASHTO) and 400 feet to meet the Knox County Minimum Corner Sight-distance Standard.

The proposed access street to Sam Lee Road, with a posted speed limit of 30mph, has a measured sight distance of approximately 325 feet and 300 feet looking left and right, respectively. Sam Lee Road requires a minimum sight-distance of 200 feet and 300 feet to meet the AASHTO minimum stopping sight-distance and the Knox County Minimum Corner Sight-distance Standard, respectively.

With some maintenance of the overgrowth to the south of the Solway Road access, the proposed site accesses meet both criteria to be acceptable for safe intersection operations.

RECOMMENDATIONS

The analyses conducted and the review of the traffic volumes identified the following recommendations:

- Provide a 100-foot minimum northbound left-turn lane on Solway Road at the proposed site access.
- The proposed access street from Solway Road should be constructed to a collector standard between Solway Road and first intersection within the subdivision.
- Provide separate left and right-turn lanes for the proposed access street to Solway Road.
- Minimize landscaping, using low growing vegetation, and signing at the proposed street accesses to insure that safe sight distance is maintained.
- Use a minimum intersection radius of 30-foot for the efficient and safe ingress and egress of the site.
- Post the proposed streets with STOP signs (R1-1) at Solway Road and Sam Lee Road.
- Intersection design should conform to the recommended standards and practices of the American Association of State Highway and Transportation Officials, the Institute of Transportation Engineers, and the Knox County Public Works Department.

CONCLUSION

The study of this proposed residential development evaluated the projected traffic conditions. Background traffic was determined using a 5-percent annual compounded growth rate until the year 2010. Traffic associated with the proposed project was then generated and distributed to the proposed site access. Using the identified turning movements for the projected traffic conditions, unsignalized and signalized capacity and level of service analyses were conducted using the **2000 Highway Capacity Manual**. Unsignalized levels of service were found to be acceptable for the existing traffic conditions, and continued to be acceptable for background with and without the proposed development for the study intersections. With the recommendations of this report, the efficient and safe flow of traffic should be maintained.

APPENDIX

Trip Generation

Signal Warrants

HCS Unsignalized Analyses

HCS Signalized Analyses

Traffic Counts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