

**Traffic Impact Study**  
**Creek Stone Subdivision**  
**Knox County, TN**

**February 10, 2006**



**CCI Project File No. 00525-0002**

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## EXECUTIVE SUMMARY

This report provides a summary of the traffic impact study that was performed for a proposed residential development to be located off Bud Hawkins Road in Northeast Knox County, tentatively called Creek Stone Subdivision. The project is approximately six miles northeast of Interstate 640, east of Washington Pike. The concept plan for this project proposes a subdivision development with a total of 92 single family dwelling units at full build-out. The development entrance will be at a new three-leg intersection on Bud Hawkins Road, located just to the east of Shipe Road.

The purpose of this study was the evaluation of the traffic operational and safety impact of the proposed development upon the adjacent portion of Bud Hawkins Road. Of particular interest was the intersection of Bud Hawkins Road with Shipe Road. The evaluation was performed assuming full build-out of the subdivision.

The following summarizes the study conclusions and recommendations:

- 1.) No major negative traffic volume related impacts will result from construction of the proposed Creek Stone Subdivision. In fact, capacity analyses of anticipated full build-out conditions for the Bud Hawkins Road and Shipe Road intersection indicated excellent operational conditions (LOS "A") for all time periods.
- 2.) The roadway width on Bud Hawkins Road varies from approximately 16.5 to 18 feet between Shipe Road and the proposed subdivision entrance. Widening this section of Bud Hawkins Road to 18 feet, per Knox County standards, should be considered.
- 3.) Intersection corner sight distance for the proposed subdivision access intersection on Bud Hawkins Road was found to be in excess of 400 feet looking both directions. The posted speed limit is 30 mph, so the Knox County requirement for a minimum 300 foot sight distance is adequately satisfied.
- 4) It is recommended that the intersection of Bud Hawkins Road and Shipe Road be converted to all-way stop traffic control. This recommendation is a result of roadway geometry and sight distance considerations, as opposed to traffic volume considerations.

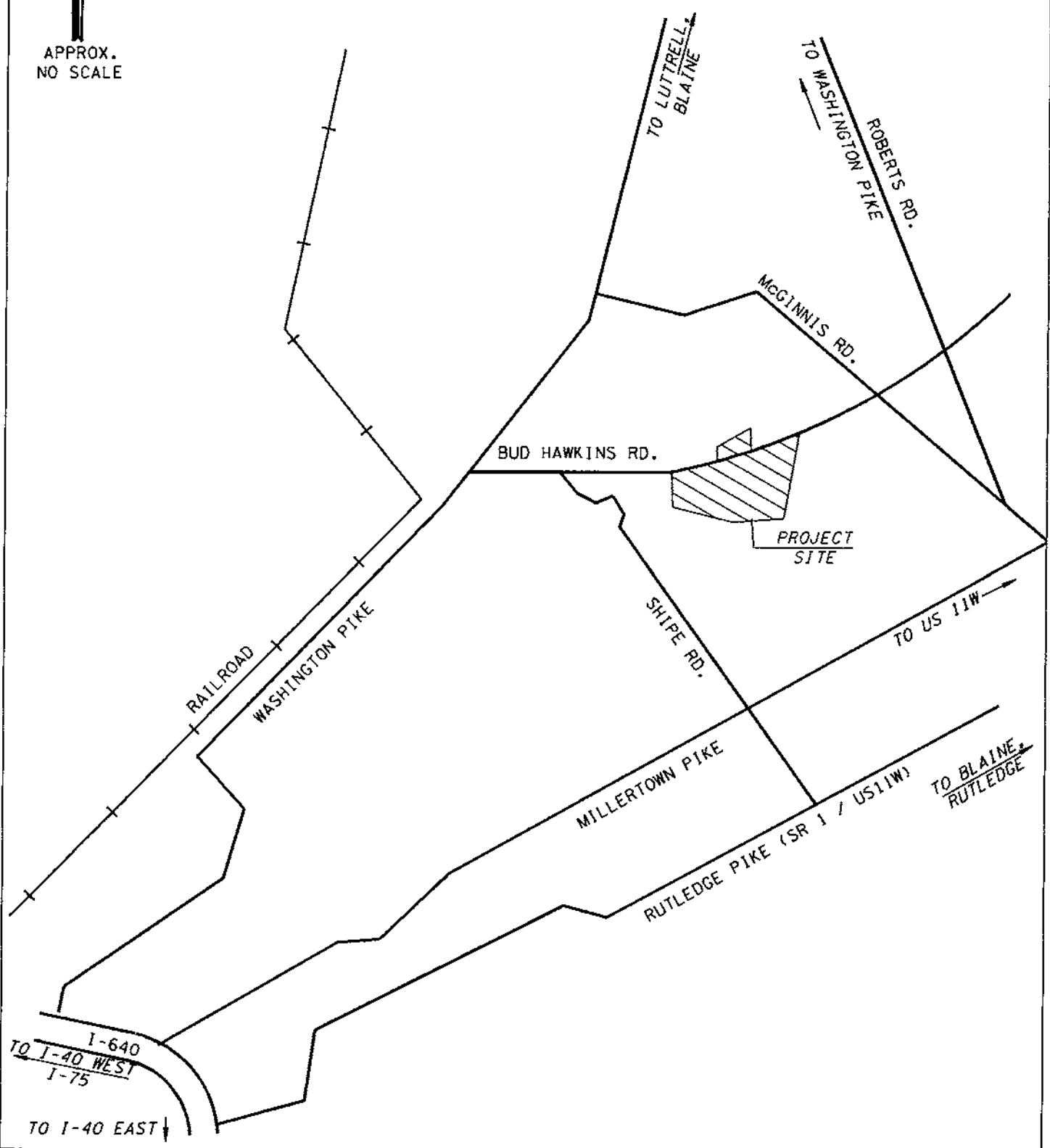
## INTRODUCTION AND PURPOSE OF STUDY


This report provides a summary of the traffic impact study that was performed for the proposed development to be located off Bud Hawkins Road in Northeast Knox County, tentatively called Creek Stone subdivision. The project is approximately six miles northeast of Interstate 640, east of Washington Pike. FIGURE 1 is a location map that identifies the project site in relation to the roadways in the vicinity of the proposed development.

The concept plan for this project proposes a subdivision development with a total of 92 single family dwelling units at full build-out. A site plan showing the lot layout is included in the pocket at the rear of this report. The development entrance will be a three-leg intersection on Bud Hawkins Road, just to the east of Shipe Road. The project plan developed by Kenneth D. Church may be referenced for more details on the proposed project site.

The purpose of this study was the evaluation of the traffic operational and safety impact of the proposed development upon the adjacent portion of Bud Hawkins Road. Of particular interest was the intersection of Bud Hawkins Road with Shipe Road. The evaluation was performed assuming full build-out of the subdivision.

N  
  
 APPROX.  
 NO SCALE



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FIGURE 1  
 SITE LOCATION MAP

CREEK STONE SUBDIVISION  
 TRAFFIC IMPACT STUDY

## EXISTING CONDITIONS

### Existing Roadway Conditions

Bud Hawkins Road is a two-lane, minor collector roadway that is maintained by Knox County. The roadway pavement consists of two traffic lanes, with minimal shoulders. The total roadway width was found to vary from approximately 16 feet to approximately 18 feet. The speed limit is posted as 30 mph, and a double yellow centerline is present.

Shipe Road is a two-lane, major collector roadway that is maintained by Knox County. The roadway pavement consists of two traffic lanes, with minimal shoulders. The speed limit is posted as 30 mph, and a double yellow centerline is present.

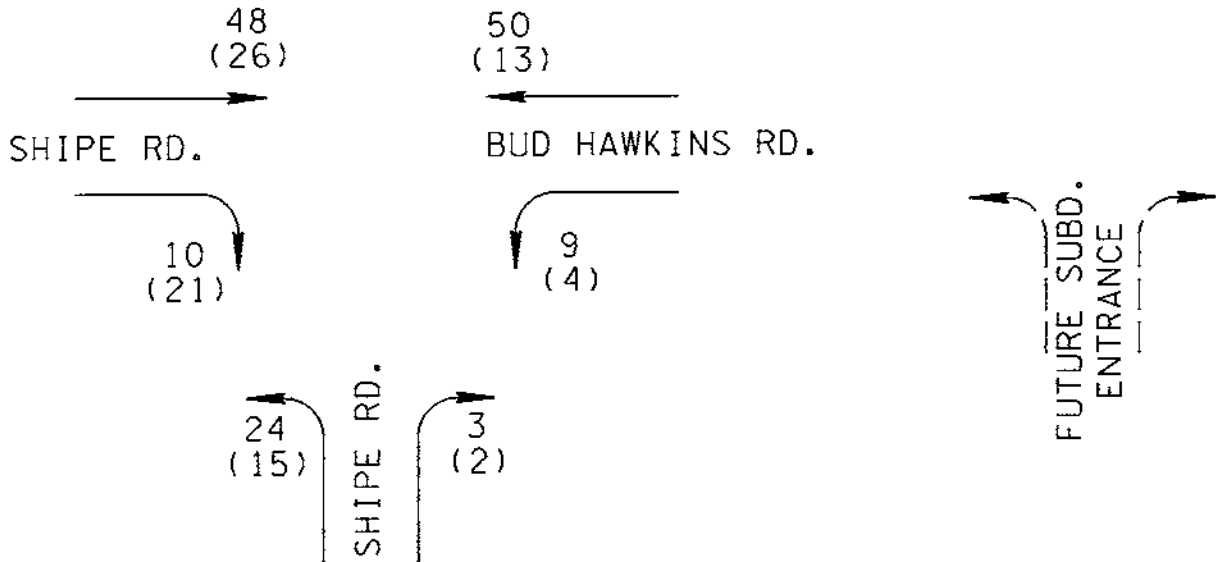
### Existing Traffic Data

The Knox County Metropolitan Planning Commission (MPC) collects and publishes average daily traffic (ADT) data at count station locations throughout Knox County. The nearest count station for Shipe Road was just to the north of Millertown Pike, and the nearest count station for Bud Hawkins Road was west of McGinnis Road. The 2002 volumes were 210 for Bud Hawkins Road and 400 for Shipe Road. No data was published for Bud Hawkins Road in 2004, and Shipe Road showed a daily volume of 420 vehicles.

In order to collect more refined data, and to establish a basis for trip distribution patterns, turning movement traffic counts were collected at the intersection of Bud Hawkins Road and Shipe Road, west of the proposed subdivision. These counts were conducted during the A.M. and P.M. peak traffic hours. Raw data summary sheets for these counts are contained in the APPENDIX.

In addition to helping establish trip distribution patterns, these turning movement counts were used to establish the existing background traffic volumes for this study. FIGURE 2 shows the background traffic at the intersection of Bud Hawkins Road and Shipe Road, which has been determined to be the critical intersection impacted by the Creek Stone

subdivision development. These volumes are the count data adjusted to an average weekday basis using adjustment factors developed by the University of Tennessee Transportation Research Center (see APPENDIX).



VOLUME LEGEND

TOP NO. - A.M. PEAK HOUR (7:15 - 8:15 A.M.)

(BOTTOM NO.) - P.M. PEAK HOUR (5:00 - 6:00 P.M.)

THE DATA SHOWN ARE THE RAW TRAFFIC COUNT DATA TIMES A FACTOR TO ADJUST TO AN AVERAGE WEEKDAY VOLUME FROM COUNTS TAKEN IN FEBRUARY. SEE APPENDIX FOR RAW COUNT DATA AND FACTOR TABLE.

(FACTORS DEVELOPED BY THE UNIVERSITY OF TENNESSEE TRANSPORTATION RESEARCH CENTER).



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FIGURE 2  
EXISTING BACKGROUND TRAFFIC

CREEK STONE SUBDIVISION  
TRAFFIC IMPACT STUDY



### Existing Level-of-Service Evaluation

Intersection Capacity Analyses employing the methods of the Highway Capacity Manual (HCM 2000) were used to evaluate the study intersection of Bud Hawkins Road and Shipe Road under existing background conditions. Please see the APPENDIX for a discussion of Intersection Capacity and Level of Service Concepts. The level-of-service evaluation for existing conditions indicated excellent levels of service (LOS "A").

## PROPOSED CONDITIONS

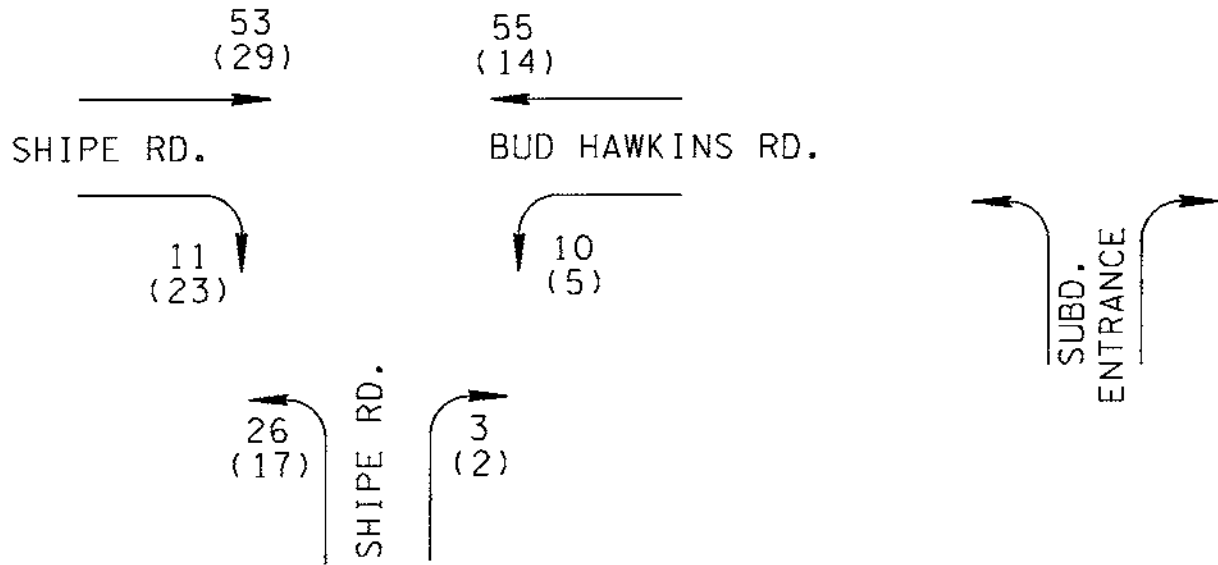
### Background Traffic Growth

The anticipated time for full build-out of the Creek Stone Subdivision development is 3 years, with the project beginning in 2006. Therefore, year 2008 was established as the appropriate design/analysis year for this study. In order to determine traffic volumes resulting solely from background traffic growth to the year 2009, it was necessary to establish an annual growth rate for existing traffic. This is a relatively low growth area of Knox County, and thus a 3 percent annual growth rate was assumed. FIGURE 3 contains the background traffic volumes that would result from this 3 percent annual growth from year 2006, when counts were conducted, to year 2009.

### Trip Generation

In order to estimate the expected traffic volumes to be generated by full build-out of the proposed development, the data and procedures of *Trip Generation, Seventh Edition* (Institute of Transportation Engineers, 2003) were utilized. The generated traffic volumes were determined based on the total weekday morning and evening peak hour of adjacent street traffic regression equations for single-family detached housing development (Land Use Code 210, Volume 1, pages 268 to 271). As noted earlier in this report, the anticipated number of units upon full build-out is 92, which was used to determine the number of new trips generated. TABLE 1 summarizes the number and directional split of entering and exiting trips for peak periods for the proposed development.

TABLE 2					
TRIP GENERATION SUMMARY FOR CREEK STONE SUBDIVISION					
RATES FOR SINGLE FAMILY DETACHED HOUSING – I.T.E. CODE 210					
SINGLE FAMILY DETACHED HOUSING – 92 UNITS					
	Total New Trips	% Entering	% Exiting	Number Entering	Number Exiting
Weekday	881	50%	50%	440	441
A.M. Peak	69	25%	75%	17	52
P.M. Peak	93	63%	37%	59	34



**VOLUME LEGEND**

TOP NO. - A.M. PEAK HOUR  
 (BOTTOM NO.) - P.M. PEAK HOUR  
 PROJECTION BASED ON 3 PERCENT GROWTH  
 FULL BUILDOUT IN 2009



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**FIGURE 3**  
 BACKGROUND TRAFFIC, PROJECTED 2009

**CREEK STONE SUBDIVISION**  
 TRAFFIC IMPACT STUDY

### Trip Distribution

FIGURE 4 provides a summary of the trip distribution patterns developed for the proposed site entrance at Bud Hawkins Road and for the intersection of Bud Hawkins Road with Shipe Road. These patterns were developed from field knowledge of the study area, utilizing reasonable assumptions and the trip patterns indicated by the traffic counts. FIGURE 4 also provides the generated traffic volumes as assigned to the local network in accordance with these patterns. FIGURE 5 shows the combined year 2009 volumes reflecting the existing traffic, the background traffic growth, and the newly generated traffic from the Creek Stone Subdivision development. These are the volumes used in the analysis of full build-out conditions.

### Proposed Level-of Service

Unsignalized intersection capacity analyses were conducted utilizing the combined traffic volumes of FIGURE 5, at the intersection of Bud Hawkins Road and Shipe Road. The methods utilized are those discussed in the APPENDIX on the sheet entitled "Intersection Capacity and Level of Service Concepts." Proposed year 2009 conditions were analyzed at the intersection for three separate stop-control options. Those options were 1) retain the stop sign on westbound Bud Hawkins Road (the existing condition), 2) move the stop sign to northbound Shipe Road, or 3) sign the intersection for traffic on all approaches to stop. Analysis of each condition for the morning and afternoon peak hours indicated that the intersection would operate at LOS "A", regardless of the stop sign configuration. These results are summarized in detail on the "Two-Way Stop Control Summary" and "All Way Stop Control (AWSC) Analysis" printouts contained in the APPENDIX.

### Intersection Sight Distance and Other Issues

A field review was conducted to identify any sight distance problems, geometric problems or other issues of concern that could impact the proposed development. The results of this review are summarized below:

- 1) The posted speed limit on Bud Hawkins Road is 30 mph. For a 30 mph speed, Knox County requirements are for a minimum sight distance of 300 feet. From the field

review, there is at least 400 feet of sight distance in each direction from the proposed subdivision entrance on Bud Hawkins Road. Therefore, Knox County requirements are more than adequately satisfied.

2) Auxiliary Lanes for Proposed Study Intersections:

Since it has been determined that the intersection of Bud Hawkins Road and Shipe Road will operate at a level-of-service "A" upon full build-out, regardless of stop control, it was concluded that turn lane warrant analyses were not necessary. Additionally, building setbacks and other constraints limit the feasibility of adding turn lanes to any leg of that intersection. It was also determined that the proposed development intersection on Bud Hawkins Road will possess volumes far below any criteria for installation of additional traffic lanes.

3) Lane widths were measured at points along Bud Hawkins Road. The total width was found to be 18 feet near the proposed site entrance, but at the horizontal curve near the church the road narrows to just over 16 feet. Additionally, to the east of the proposed development, Bud Hawkins Road narrows to just over 16 feet near the stream crossing. No lane widths were measured on Shipe Road, but it was found that Shipe Road substantially narrows and becomes more rolling and winding just to the south of a stream crossing south of the Bud Hawkins Road intersection.



13-77  
(45-77%)

SHIPE RD.

40-77  
(26-77%)

BUD HAWKINS RD.

2-10%  
(6-10%)

2-13%  
(8-13%)

SHIPE RD.

2-13%  
(8-13%)

SUBD.  
ENTRANCE

5-10%  
(3-10%)

**VOLUME LEGEND**

TOP NO. - A.M. PEAK HOUR - PERCENT OF TRIPS  
(BOTTOM NO.) - P.M. PEAK HOUR - PERCENT OF TRIPS



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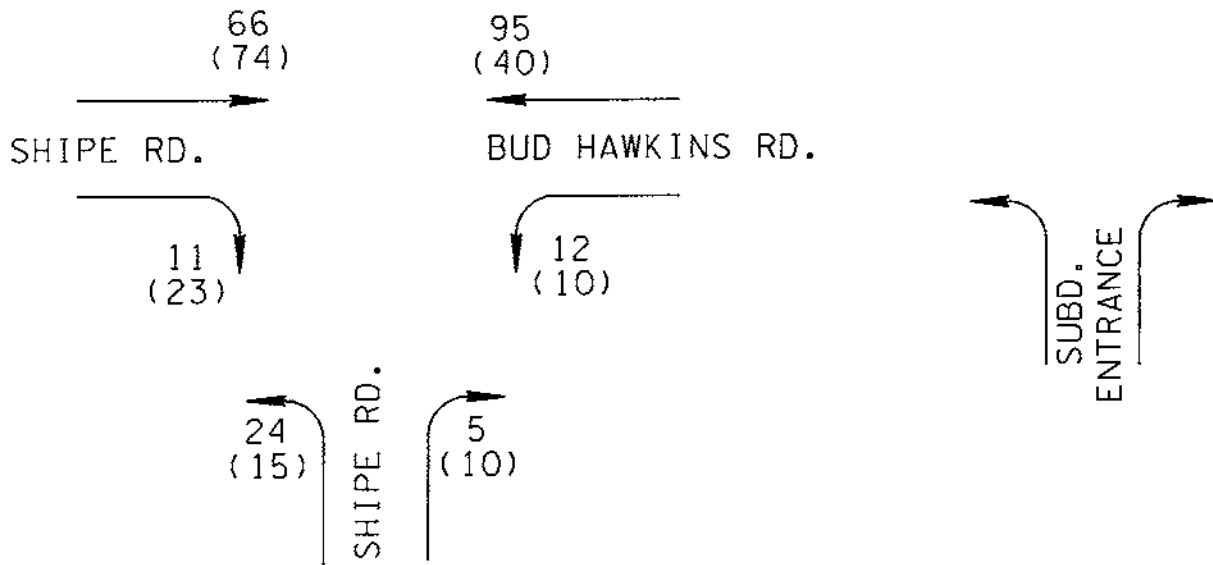
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**FIGURE 4**  
**TRIP DISTRIBUTION PERCENTAGES AND TRIP ASSIGNMENT**

**CREEK STONE SUBDIVISION**  
**TRAFFIC IMPACT STUDY**



APPROX.  
NO SCALE



VOLUME LEGEND

TOP NO. - A.M. PEAK HOUR  
(BOTTOM NO.) - P.M. PEAK HOUR  
PROJECTION BASED ON 3 PERCENT GROWTH  
FULL BUILDOUT IN 2009



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FIGURE 5  
COMBINED VOLUMES FOR ANALYSIS

CREEK STONE SUBDIVISION  
TRAFFIC IMPACT STUDY



## CONCLUSIONS AND RECOMMENDATIONS

The following is a listing and discussion of the primary conclusions and recommendations that resulted from this study of the proposed Creek Stone Subdivision.

1.) No major negative traffic volume related impacts will result from construction of the Creek Stone subdivision. In fact, capacity analyses of the Bud Hawkins Road and Shipe Road intersection indicated excellent operational conditions (LOS "A") for both peak hour time periods for the anticipated full build-out conditions. This assessment and results are consistent for three different intersection traffic control scenarios; Bud Hawkins stopping for Shipe (existing), Shipe northbound stopping, and an all-way stop with all approaches stopping.

2.) The roadway width on Bud Hawkins Road varies from approximately 16.5 to 18 feet between Shipe Road and the proposed subdivision entrance. Widening this section of Bud Hawkins Road to 18 feet, per Knox County standards, should be considered.

3.) The intersection corner sight distance was also evaluated for the proposed subdivision access roadway intersection on Bud Hawkins Road. This evaluation found that sight distance will be greater than 400 feet looking both directions from the proposed subdivision entrance. The posted speed limit is 30 mph, so the Knox County requirement for a minimum 300 foot sight distance is more than adequately satisfied.

4.) It is recommended that the intersection of Bud Hawkins Road and Shipe Road be converted to all-way stop traffic control. This recommendation is a result of roadway geometry and sight distance considerations, as opposed to traffic volume considerations. Specifically, restricted corner sight distance due to horizontal and vertical curvature on the approaching roadways makes any other traffic control scheme a safety concern.

5.) The parking areas for the church and school immediately east of the intersection should be further evaluated to ensure safe and efficient conditions.

## APPENDIX

## Intersection Capacity and Level of Service Concepts

In a general sense, a roadway is similar to a pipeline or other material-carrying conduit in that it has a certain capacity for the amount of material (vehicles) that it can efficiently carry. As the number of vehicles in a given time period gradually increases, the quality of traffic flow gradually decreases. On roadway sections this results in increasing turbulence in the traffic stream, and at intersections it results in increasing stops and delay. As the volumes begin to approach the capacity of the facility, these problems rapidly magnify, with resulting serious levels of congestions, stops, delay, excess fuel consumption, pollutant emissions, etc.

The Federal Highway Administration has published the Year 2000 Highway Capacity Manual (HCM2000), which establishes theoretical techniques to quantify the capacity conditions on all types of roadways, intersections, ramps, pedestrian facilities, etc. A basic concept that is applicable to most of these techniques is the idea of level of service (LOS). This concept establishes a rating system that quantifies the quality of traffic flow, as perceived by motorists and/or passengers. The general system is similar to a school grade scale, and is outlined as follows:

<u>Level of Service(LOS)</u>	<u>General Quality of Traffic Flow</u>	<u>Description of Corresponding Conditions</u>
A	Excellent	Roadways – Free flow, high maneuverability Intersections – Very few stops, very low delay
B	Very Good	Roadways – Free flow, slightly lower maneuverability Intersections – Minor stops, low delay
C	Good	Roadways – Stable flow, restricted maneuverability Intersections – Significant stops, significant delay
D	Fair	Roadways – Marginally stable flow, congestion seriously restricts maneuverability Intersections – High stops, long but tolerable delay
E	Poor	Roadways – Unstable flow*, lower operating speeds, congestion severely restricts maneuverability Intersections – All vehicles stop, very long queues and very long intolerable delay
F	Very Poor	Roadways – Forced flow, stoppages may be lengthy, congestion severely restricts maneuverability Intersections – All vehicles stop, extensive queues and extremely long intolerable delay

\*Unstable flow is such that minor fluctuations or disruptions can result in rapid degradation to LOS F.

Additional parameters that may be used to evaluate intersection operations:

$v/c$  – Volume to capacity ratio – A parameter which is an approximate indicator of the overall sufficiency of a roadway or intersection ( $v/c = 1.00$  equals a condition where the capacity of the facility is 100 percent saturated)

$x/c$  – Critical  $v/c$  ratio for a signalized intersection – A parameter which reflects the  $v/c$  ratio for the critical lane groups for a signalized intersection.

$v/c$  or  $x/c$  values greater than 0.90 often reflect conditions where some congestion and increasing delays are likely, while values greater than 1.00 reflect conditions where volumes exceed capacity, and if these consist persist for long periods of time, very serious congestion and long delays will be unavoidable.

**TRAFFIC VOLUME ADJUSTMENT FACTORS TO BE USED WITH TRAFFIC SIGNAL WARRANT ANALYSIS - VOLUME WARRANTS<sup>1</sup>**  
 Prepared and Distributed by the Tennessee Transportation Assistance Program

**TABLE A**  
 ---  
 Month/Day of Week Urban Area Adjustment Factors<sup>2</sup> - Average Friday  
 (Multiply actual count by given factor to obtain estimated average day volumes for a similar time period<sup>3</sup>)

	January	February	March	April	May	June	July	August	September	October	November	December
Sunday	1.60	1.49	1.40	1.37	1.34	1.25	1.30	1.32	1.35	1.3	1.37	1.48
Monday	1.04	1.00	0.97	0.94	0.93	0.91	0.92	0.93	0.94	0.93	0.98	1.03
Tuesday	1.00	0.99	0.95	0.94	0.93	0.91	0.91	0.92	0.93	0.91	0.96	0.97
Wednesday	1.01	0.99	0.95	0.92	0.92	0.90	0.91	0.92	0.93	0.94	0.95	0.94
Thursday	0.99	0.97	0.93	0.90	0.89	0.88	0.89	0.90	0.90	0.92	0.93	0.93
Friday	0.81	0.89	0.87	0.85	0.83	0.81	0.84	0.83	0.83	0.86	0.92	0.86
Saturday	1.22	1.15	1.09	1.11	1.10	1.04	1.06	1.07	1.11	1.11	1.16	1.15

**TABLE B**  
 ---  
 Month/Day of Week Urban Area Adjustment Factors<sup>2</sup> - Average Weekday  
 (Multiply actual count by given factor to obtain estimated average weekday volumes for a similar time period<sup>3</sup>)

	January	February	March	April	May	June	July	August	September	October	November	December
Monday	1.13	1.08	1.05	1.02	1.01	0.99	1.00	1.01	1.02	1.06	1.06	1.12
Tuesday	1.08	1.07	1.03	1.02	1.01	0.99	0.99	1.00	1.01	1.02	1.04	1.05
Wednesday	1.09	1.07	1.03	1.00	1.00	0.98	0.99	1.00	1.01	1.02	1.03	1.02
Thursday	1.07	1.05	1.01	0.98	0.96	0.95	0.96	0.96	0.98	1.00	1.01	1.01
Friday	0.98	0.96	0.94	0.92	0.90	0.88	0.91	0.90	0.90	0.93	1.00	0.93

**TABLE C**  
 ---  
 Month/Day of Week Urban Area Adjustment Factors<sup>2</sup> - Average Friday  
 (Multiply actual count by given factor to obtain estimated average Friday volumes for a similar time period<sup>3</sup>)

	January	February	March	April	May	June	July	August	September	October	November	December
Monday	1.21	1.17	1.13	1.10	1.09	1.06	1.07	1.09	1.10	1.14	1.14	1.20
Tuesday	1.17	1.16	1.11	1.10	1.09	1.06	1.06	1.07	1.09	1.10	1.12	1.13
Wednesday	1.18	1.16	1.11	1.07	1.07	1.05	1.06	1.07	1.09	1.10	1.11	1.10
Thursday	1.16	1.13	1.09	1.05	1.04	1.03	1.04	1.05	1.05	1.07	1.09	1.09
Friday	1.06	1.04	1.02	0.99	0.97	0.95	0.98	0.97	0.97	1.00	1.07	1.00

Notes: 1. "Traffic Signal Warrant Analysis - Volume Warrants" is a Lotus<sup>1</sup> 1-2-3<sup>2</sup> template distributed by the Tennessee Transportation Assistance Program (TTAP).  
 2. Factors should be applied to State highway and major street volumes only. They should not be applied to volumes on driveways (shopping centers, etc.) or minor streets.  
 3. Counts made on holidays should not be used as a basis for estimating average day, average weekday or average Friday volumes.

Source: TABLE A - Tennessee Department of Transportation (based on 1988 through 1992 data)  
 TABLES B & C - Data compiled by T. Dewey Sullivan, P.E. based on TABLE A data

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Project Name : 00525-0002 - Shipe Bud\_Hawkins A.M.

Site Code : 00000000

Start Date : 02/08/2006

Page No : 1

Groups Printed- Unshifted

Start Time Factor	SHIPE						BUD HAWKINS						B									
	From North			From East			From South			From West			From South			From West						
	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Int. Total	
07:15 AM	0	0	0	0	0	2	2	2	1.0	1.0	1.0	1.0	0	0	2	0	0	1	2	0	0	11
07:30 AM	1	0	0	1	0	10	4	0	0	2	4	7	0	0	7	0	2	8	0	0	0	35
07:45 AM	1	0	0	0	0	18	1	0	0	0	1	7	0	0	7	0	1	18	2	0	0	48
Total	2	0	0	1	0	30	7	2	2	2	0	16	0	0	16	0	4	28	2	0	0	94
08:00 AM	1	0	0	0	0	17	1	0	1	1	0	6	0	0	6	0	5	17	0	0	0	48
Grand Total	3	0	0	1	0	47	8	2	3	3	0	22	0	0	22	0	9	45	2	0	0	142
Approch %	75.0	0.0	0.0	25.0	0.0	82.5	14.0	3.5	12.0	0.0	88.0	0.0	0.0	0.0	88.0	0.0	16.1	80.4	3.6	0.0	0.0	
Total %	2.1	0.0	0.0	0.7	0.0	33.1	5.6	1.4	2.1	0.0	15.5	0.0	0.0	0.0	15.5	0.0	6.3	31.7	1.4	0.0	0.0	







TWO-WAY STOP CONTROL SUMMARY

Analyst: Scott Boles  
 Agency/Co.: Cannon & Cannon  
 Date Performed: 2/9/2006  
 Analysis Time Period: PM Peak  
 Intersection: Shipe Rd @ Bud Hawkins Rd  
 Jurisdiction: Knox Co.  
 Units: U. S. Customary  
 Analysis Year: 2006  
 Project ID: Creek Stone Sub. - 525-02  
 East/West Street: Shipe Rd  
 North/South Street: Bud Hawkins Rd.  
 Intersection Orientation: EW Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street:	Approach Movement	Eastbound				Westbound		
		1 L	2 T	3 R	4 L	5 T	6 R	
Volume		26	21			15	2	
Peak-Hour Factor, PHF		1.00	1.00			1.00	1.00	
Hourly Flow Rate, HFR		26	21			15	2	
Percent Heavy Vehicles		0	--	--		--	--	
Median Type/Storage		Undivided				/		
RT Channelized?								
Lanes		0	1			1	0	
Configuration		LT				TR		
Upstream Signal?		No				No		

Minor Street:	Approach Movement	Northbound				Southbound		
		7 L	8 T	9 R	10 L	11 T	12 R	
Volume					4		13	
Peak Hour Factor, PHF					1.00		1.00	
Hourly Flow Rate, HFR					4		13	
Percent Heavy Vehicles					0		0	
Percent Grade (%)		0					0	
Flared Approach: Exists?/Storage						/	No /	
Lanes					0		0	
Configuration						LR		

Delay, Queue Length, and Level of Service **Bud Hawkins Rd.**

Approach Movement	EB	WB	Northbound			Southbound		
			7	8	9	10	11	12
Lane Config	1	4					LR	
v (vph)	26						17	
C(m) (vph)	1613						1024	
v/c	0.02						0.02	
95% queue length	0.05						0.05	
Control Delay	7.3						8.6	
LOS	A						A	
Approach Delay							8.6	
Approach LOS							A	









## TWO-WAY STOP CONTROL SUMMARY

Analyst: Scott Boles  
 Agency/Co.: Cannon & Cannon  
 Date Performed: 2/9/2006  
 Analysis Time Period: AM Peak - (Comb-ShipeStop)  
 Intersection: Shipe Rd. @ Bud Hawkins Rd.  
 Jurisdiction: Knox Co.  
 Units: U. S. Customary  
 Analysis Year: 2009  
 Project ID: Creek Stone Sub. - 525-02  
 East/West Street: Bud Hawkins Rd.  
 North/South Street: Shipe Rd.  
 Intersection Orientation: EW Study period (hrs): 0.25

## Vehicle Volumes and Adjustments

Major Street:	Approach Movement	Eastbound			Westbound		
		1 L	2 T	3 R	4 L	5 T	6 R
Volume		66	11	12	95		
Peak-Hour Factor, PHF		1.00	1.00	1.00	1.00		
Hourly Flow Rate, HFR		66	11	12	95		
Percent Heavy Vehicles		--	--	0	--	--	
Median Type/Storage		Undivided			/		
RT Channelized?							
Lanes		1	0		0	1	
Configuration			TR		LT		
Upstream Signal?		No				No	

Minor Street:	Approach Movement	Northbound			Southbound		
		7 L	8 T	9 R	10 L	11 T	12 R
Volume		24		5			
Peak Hour Factor, PHF		1.00		1.00			
Hourly Flow Rate, HFR		24		5			
Percent Heavy Vehicles		0		0			
Percent Grade (%)			0			0	
Flared Approach: Exists?/Storage				No	/		/
Lanes		0		0			
Configuration			LR				

## Delay, Queue Length, and Level of Service

Approach Movement	EB 1	WB 4	Northbound (Shipe)			Southbound		
			7	8	9	10	11	12
Lane Config		LT		LR				
v (vph)		12		29				
C(m) (vph)		1535		825				
v/c		0.01		0.04				
95% queue length		0.02		0.11				
Control Delay		7.4		9.5				
LOS		A		A				
Approach Delay				9.5				
Approach LOS				A				

TWO-WAY STOP CONTROL SUMMARY

Analyst: Scott Boles  
 Agency/Co.: Cannon & Cannon  
 Date Performed: 2/9/2006  
 Analysis Time Period: AM Peak - (Comb-ShipeStop)  
 Intersection: Shipe Rd. @ Bud Hawkins Rd.  
 Jurisdiction: Knox Co.  
 Units: U. S. Customary  
 Analysis Year: 2009  
 Project ID: Creek Stone Sub. - 525-02  
 East/West Street: Bud Hawkins Rd.  
 North/South Street: Shipe Rd.  
 Intersection Orientation: EW Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street:	Approach Movement	Eastbound			Westbound		
		1 L	2 T	3 R	4 L	5 T	6 R
Volume		74	23	10	40		
Peak-Hour Factor, PHF		1.00	1.00	1.00	1.00		
Hourly Flow Rate, HFR		74	23	10	40		
Percent Heavy Vehicles		--	--	0	--	--	
Median Type/Storage		Undivided			/		
RT Channelized?							
Lanes		1	0		0	1	
Configuration			TR		LT		
Upstream Signal?		No			No		

Minor Street:	Approach Movement	Northbound			Southbound		
		7 L	8 T	9 R	10 L	11 T	12 R
Volume		15		10			
Peak Hour Factor, PHF		1.00		1.00			
Hourly Flow Rate, HFR		15		10			
Percent Heavy Vehicles		0		0			
Percent Grade (%)			0			0	
Flared Approach: Exists?/Storage				No	/		/
Lanes		0		0			
Configuration			LR				

Delay, Queue Length, and Level of Service

Approach Movement	EB	WB	Northbound (Shipe)			Southbound		
			7	8	9	10	11	12
Lane Config	1	4	LT	LR				
v (vph)		10		25				
C(m) (vph)		1509		894				
v/c		0.01		0.03				
95% queue length		0.02		0.09				
Control Delay		7.4		9.1				
LOS		A		A				
Approach Delay				9.1				
Approach LOS				A				

HCS2000: Unsignalized Intersections Release 4.1d

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ALL-WAY STOP CONTROL (AWSC) ANALYSIS

Analyst: Scott Boles  
Agency/Co.: Cannon & Cannon  
Date Performed: 2/9/2006  
Analysis Time Period: PM Peak - (Comb. - All Way)  
Intersection: Shipe Rd. @ Bud Hawkins Rd.  
Jurisdiction: Knox Co.  
Units: U. S. Customary  
Analysis Year: 2009  
Project ID: Creek Stone Subd. 525-02  
East/West Street: Bud Hawkins Rd.  
North/South Street: Shipe Rd.

Worksheet 2 - Volume Adjustments and Site Characteristics

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
Volume	0	74	23	10	40	0	15	0	10	0	0	0

% Thrus Left Lane

	Eastbound		Westbound		Northbound		Southbound	
	L1	L2	L1	L2	L1	L2	L1	L2
Configuration	TR		LT		LR			
PHF	1.00		1.00		1.00			
Flow Rate	97		50		25			
% Heavy Veh	0		0		0			
No. Lanes		1		1		1		
Opposing-Lanes		1		1		0		
Conflicting-lanes		1		1		1		
Geometry group		1		1		1		
Duration, T	0.25	hrs.						

Worksheet 3 - Saturation Headway Adjustment Worksheet

	Eastbound		Westbound		Northbound		Southbound	
	L1	L2	L1	L2	L1	L2	L1	L2
Flow Rates:								
Total in Lane	97		50		25			
Left-Turn	0		10		15			
Right-Turn	23		0		10			
Prop. Left-Turns	0.0		0.2		0.6			
Prop. Right-Turns	0.2		0.0		0.4			
Prop. Heavy Vehicle	0.0		0.0		0.0			
Geometry Group		1		1		1		
Adjustments Exhibit 17-33:								
hLT-adj		0.2		0.2		0.2		





Scott Boles  
Cannon Cannon

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----- ALL-WAY STOP CONTROL (AWSC) ANALYSIS -----

Analyst: Scott Boles  
Agency/Co.: Cannon & Cannon  
Date Performed: 2/9/2006  
Analysis Time Period: AM Peak - (Comb. - All Way)  
Intersection: Shipe Rd. @ Bud Hawkins Rd.  
Jurisdiction: Knox Co.  
Units: U. S. Customary  
Analysis Year: 2009  
Project ID: Creek Stone Subd. 525-02  
East/West Street: Bud Hawkins Rd.  
North/South Street: Shipe Rd.

----- Worksheet 2 - Volume Adjustments and Site Characteristics -----

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
Volume	0	66	11	12	95	0	24	0	5	0	0	0

% Thrus Left Lane

	Eastbound		Westbound		Northbound		Southbound	
	L1	L2	L1	L2	L1	L2	L1	L2
Configuration	TR		LT		LR			
PHF	1.00		1.00		1.00			
Flow Rate	77		107		29			
% Heavy Veh	0		0		0			
No. Lanes		1		1		1		
Opposing-Lanes		1		1		0		
Conflicting-lanes		1		1		1		
Geometry group		1		1		1		
Duration, T	0.25	hrs.						

----- Worksheet 3 - Saturation Headway Adjustment Worksheet -----

	Eastbound		Westbound		Northbound		Southbound	
	L1	L2	L1	L2	L1	L2	L1	L2
Flow Rates:								
Total in Lane	77		107		29			
Left-Turn	0		12		24			
Right-Turn	11		0		5			
Prop. Left-Turns	0.0		0.1		0.8			
Prop. Right-Turns	0.1		0.0		0.2			
Prop. Heavy Vehicle	0.0		0.0		0.0			
Geometry Group		1		1		1		
Adjustments Exhibit 17-33:								
hLT-adj		0.2		0.2		0.2		

hRT-adj	-0.6	-0.6	-0.6
hHV-adj	1.7	1.7	1.7
hadj, computed	-0.1	0.0	0.1

Worksheet 4 - Departure Headway and Service Time

	Eastbound		Westbound		Northbound		Southbound	
	L1	L2	L1	L2	L1	L2	L1	L2
Flow rate	77		107		29			
hd, initial value	3.20	3.20	3.20	3.20	3.20	3.20	3.20	3.20
x, initial	0.07		0.10		0.03			
hd, final value	3.98		4.06		4.35			
x, final value	0.09		0.12		0.04			
Move-up time, m		2.0		2.0		2.0		
Service Time	2.0		2.1		2.4			

Worksheet 5 - Capacity and Level of Service

	<b>Shipe Rd.</b>		<b>Bud Hawkins Rd.</b>		<b>Shipe Rd.</b>		Southbound	
	Eastbound		Westbound		Northbound		L1	L2
	L1	L2	L1	L2	L1	L2		
Flow Rate	77		107		29			
Service Time	2.0		2.1		2.4			
Utilization, x	0.09		0.12		0.04			
Dep. headway, hd	3.98		4.06		4.35			
Capacity	327		357		279			
Delay	7.36		7.62		7.51			
LOS	A		A		A			
Approach:								
Delay		7.36		7.62		7.51		
LOS		A		A		A		
Intersection Delay	7.51							
								Intersection LOS A