

Traffic Impact Study

Bob Kirby Road Development Knox County, Tennessee

00700-0000



April 10, 2006

Prepared for:
Chesney Hill Partnership



Cannon & Cannon, Inc.
Civil Engineering • Field Surveying

9724 Kingston Pike, Suite 1100 • Knoxville, Tennessee 37922
Tel No. (865) 670-8555 • Fax No. (865) 670-8866

TABLE OF CONTENTS

	Page
EXECUTIVE SUMMARY	1
INTRODUCTION AND PURPOSE OF STUDY	2
EXISTING CONDITIONS	5
BACKGROUND CONDITIONS	8
PROPOSED CONDITIONS	10
CONCLUSIONS AND RECOMMENDATIONS	15
APPENDIX	16

Figures and Tables

FIGURE 1 – SITE LOCATION MAP	3
FIGURE 2 – SITE DEVELOPMENT PLAN	4
TABLE 1 – AVERAGE DAILY TRAFFIC COUNT SUMMARY	5
FIGURE 3 – EXISTING BACKGROUND TRAFFIC DATA.....	6
FIGURE 4 – BACKGROUND TRAFFIC DATA (YEAR 2009).....	9
TABLE 2 – TRIP GENERATION SUMMARY	10
FIGURE 5 – TRIP DISTRIBUTION PERCENTAGES	11
FIGURE 6 – TRIP ASSIGNMENT	12
FIGURE 7 – COMBINED VOLUMES FOR ANALYSIS (YEAR 2009)	13
TABLE 3 – CAPACITY ANALYSES SUMMARY.....	15

EXECUTIVE SUMMARY

This report provides a summary of the traffic impact study that was performed for a proposed residential development to be located off Bob Kirby Road in West Knox County. The project site is approximately 2 miles north of the Interstate 40/75 at Pellissippi Parkway (Interstate 140) interchange, on Bob Kirby Road just south of Middlebrook Pike (State Route 169).

The concept plan for this project proposes a subdivision development with a total of 88 single family dwelling units at full build-out. The development entrance will modify the existing three-leg intersection of Delle Meade Drive at Bob Kirby Road to a four-leg intersection with two-way stop control.

The purpose of this study was the evaluation of the traffic operational and safety impact of the proposed development upon the adjacent portion of Bob Kirby Road. Of particular interest was the intersection of Bob Kirby Road and Delle Meade Drive with the single access roadway that is proposed for this development. The evaluation was performed assuming full build-out of all units of the subdivision.

It was the primary conclusion of this study that no major negative traffic volume related impacts will result from construction of the Bob Kirby Road Development. In fact, capacity analyses of proposed side street (2-way) stop traffic control, indicates that good operational conditions (LOS "B" or better) can be expected during all time periods.

An evaluation of the potential need for separate left and right turn lanes at the proposed subdivision entrance intersection was performed. It was determined that no separate turn lanes will be warranted, based on anticipated peak hour traffic conditions.

Intersection corner sight distance was also evaluated for the proposed subdivision access roadway intersection. This evaluation found that the existing sight distance is well in excess of 500 feet looking south and in excess of 400 feet looking north. Tree and brush cover, as well as an embankment near the site, has the potential to obstruct the sight lines of drivers entering or leaving the proposed development. Therefore, vegetation and/or embankment removal should be undertaken in order to maximize sight distance. The posted speed limit is 30 mph, which, in accordance with Knox County regulations, requires a minimum 300 foot sight distance. However, because of high traffic speeds and steep grades, it is recommended that sight lines be maintained at the maximum distances physically possible, given the existing roadway geometric configuration.

INTRODUCTION AND PURPOSE OF STUDY

This report provides a summary of the traffic impact study that was performed for a proposed residential development to be located off Bob Kirby Road in West Knox County. The project site is approximately 2 miles north of the Interstate 40/75 at Pellissippi Parkway (Interstate 140) interchange, on Bob Kirby Road just south of Middlebrook Pike (State Route 169). 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 88 single family dwelling units at full build-out. FIGURE 2 is a site development plan detailing the proposed subdivision layout. The project entrance will be a four-leg intersection on Bob Kirby Road at Delle Meade Road, south of Middlebrook Pike.

The purpose of this study was the evaluation of the traffic operational and safety impact of the proposed development upon the adjacent portion of Bob Kirby Road. Of particular interest was the intersection of Bob Kirby Road and Delle Meade Drive with the single access roadway that is proposed for this development. The evaluation was performed assuming full build-out of all units of the subdivision.

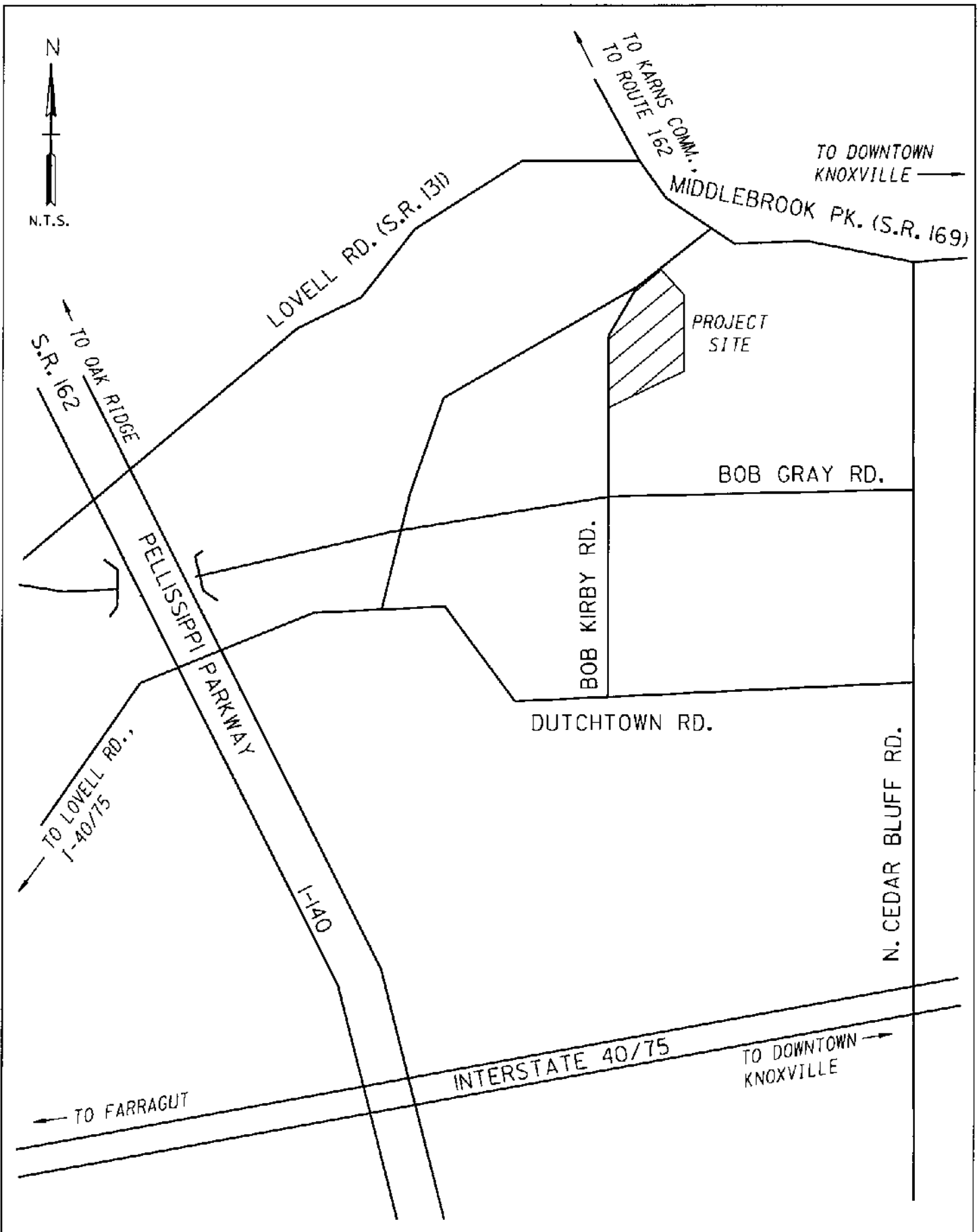


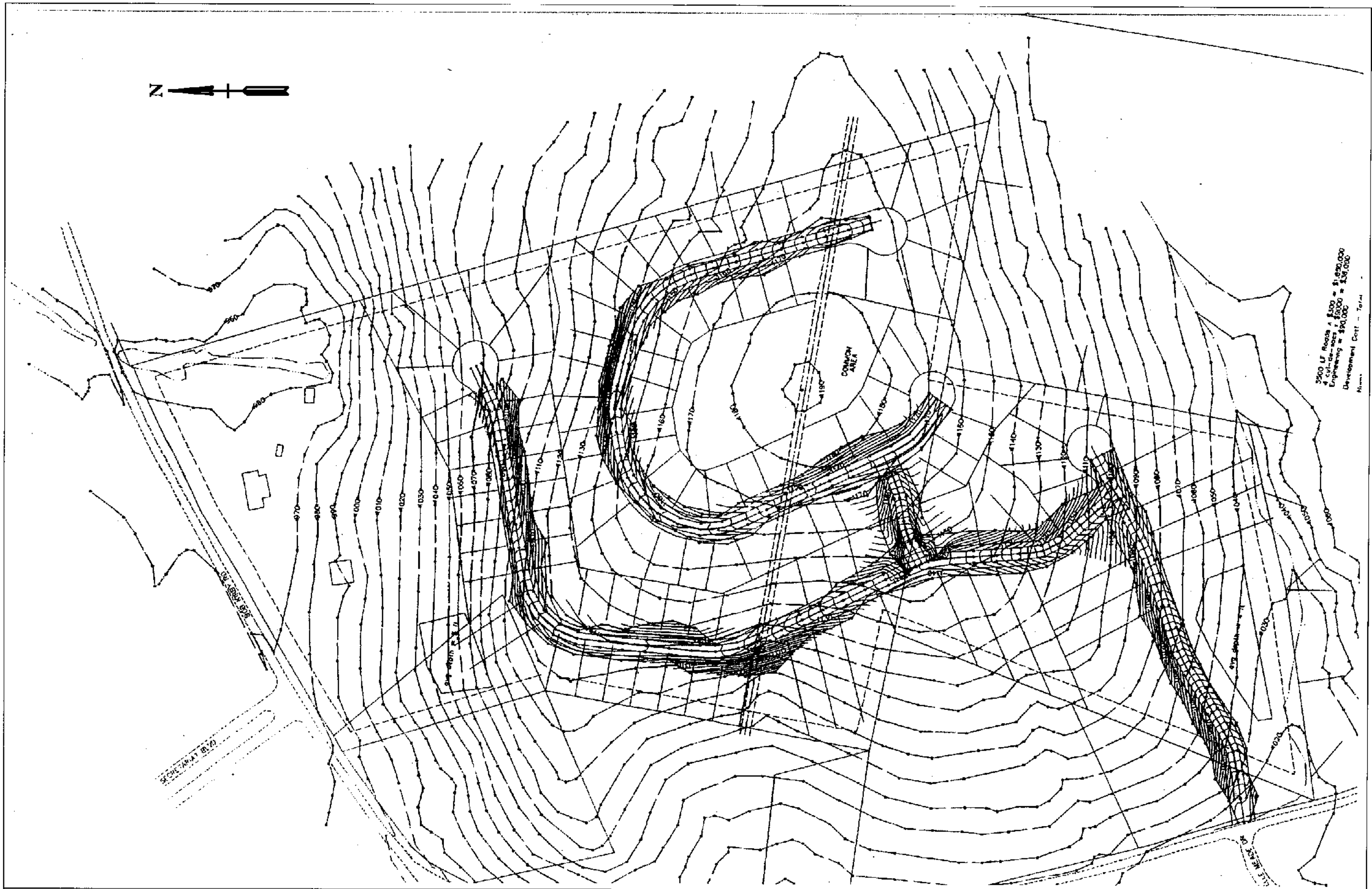
FIGURE 1
SITE LOCATION MAP

BOB KIRBY RD. DEVELOPMENT
TRAFFIC IMPACT STUDY



Cannon & Cannon, Inc.
Civil Engineering • Field Surveying

9724 Kingston Pike
Suite 3100, Franklin Square
Knoxville, Tennessee 37922
Telephone: (865) 670-8555
Fax: (865) 670-8866



Cannon & Cannon, Inc.
 Civil Engineering • Field Surveying

5724 Kingston Pike
 Suite 1100, Franklin Square
 Knoxville, Tennessee 37922
 Telephone: (865) 670-8555
 Fax: (865) 670-8866

FIGURE 2
SITE DEVELOPMENT PLAN
BOB KIRBY RD. DEVELOPMENT
TRAFFIC IMPACT STUDY

EXISTING CONDITIONS

Existing Roadway Conditions

Bob Kirby Road is a two-lane road that is maintained by Knox County. The roadway pavement consists of two traffic lanes of approximately nine feet in width, with minimal shoulders located beyond the white pavement edgelines. The study section of Bob Kirby Road was constructed under older design standards, and thus possesses significant vertical and horizontal curvature and non-standard roadside ditches. The speed limit is posted as 30 mph.

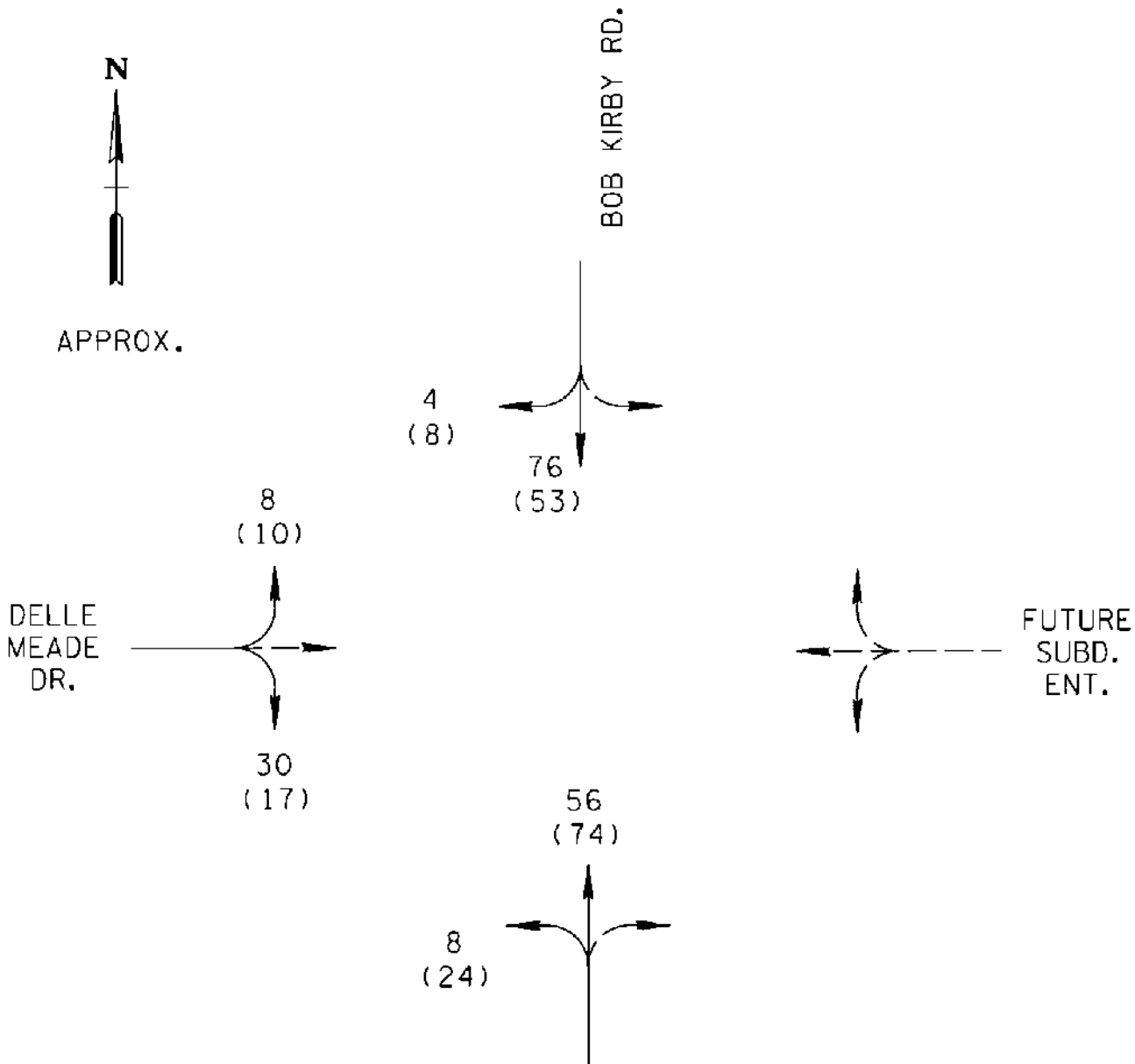
Existing Traffic Data

Traffic count stations for collecting average daily traffic data (ADT) are located in the project area; on Bob Kirby Road, north of the project site and just south of Middlebrook Pike (MPC Count Station No. 269), and on Campbell Station Road, south of the project site (MPC Count Station No. 270). The most recent data from these stations were provided by the Metropolitan Planning Commission (MPC), with resulting ADTs shown in TABLE 1.

Count Year	MPC ADT STATION 269 BOB KIRBY ROAD SOUTH OF MIDDLEBROOK PIKE	MPC ADT STATION 270 BOB KIRBY ROAD NORTH OF DUTCHTOWN ROAD
2005	2,227	1,722
2004	Not available	Not available
2003	2,000	1,850

In order to collect more refined data, and to establish a basis for trip distribution patterns, turning movement traffic counts were collected at the existing three-leg intersection of Bob Kirby Road and Delle Meade Drive, which will become a four-leg intersection with the construction of the new subdivision access roadway. These counts were conducted during the A.M. and P.M. peak traffic hours. Raw data count summaries 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. Specifically, the north, south, and west leg volumes from the counted intersection were used for this, as displayed on FIGURE 3. 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 MARCH. SEE APPENDIX FOR RAW COUNT DATA AND FACTOR TABLE.

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



Cannon & Cannon, Inc.
Civil Engineering, Field Surveying

9724 Kingston Pike
Suite 1100, Franklin Square
Knoxville, Tennessee 37922
Telephone: (865) 670-8855
(865) 670-8856

FIGURE 3
EXISTING BACKGROUND TRAFFIC DATA

BOB KIRBY RD. DEVELOPMENT
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 Bob Kirby Road at Delle Meade Drive for the existing roadway and traffic conditions. The results indicate that all traffic movements are currently operating at level-of-service "A" during both peak hours. These results are summarized in detail on the "Two Way Stop Control Summary" printouts contained in the APPENDIX. Also see the APPENDIX for a discussion of Intersection Capacity and Level of Service Concepts.

BACKGROUND CONDITIONS

Background Traffic Growth

The anticipated time for full build-out of the Bob Kirby Road Development is estimated as 3 years, with the project beginning in 2006. Therefore, year 2009 was established as the appropriate design/analysis year for this study. In order to determine traffic volumes resulting solely from background traffic growth to year 2009, it was necessary to establish an annual growth rate for existing traffic. The MPC ADT values along with engineering judgment were used to arrive at a rate of 6 percent for this development. FIGURE 4 contains the background traffic volumes that would result from this 6 percent annual growth to year 2009.

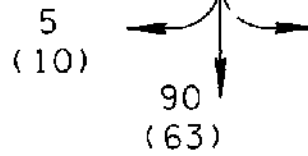
Background Level of Service Evaluation

Intersection Capacity Analyses employing the methods of the Highway Capacity Manual (HCM 2000) were used to evaluate the study intersection of Bob Kirby Road at Delle Meade Drive for the background (2009) traffic conditions, shown on FIGURE 4. The results indicate that all traffic movements would be expected to operate at level-of-service "A" during both peak hours, if the proposed development is not constructed. These results are summarized in detail on the "Two-Way Stop Control Summary" printouts contained in the APPENDIX. Also see the APPENDIX for a discussion of intersection capacity and level-of-service concepts.

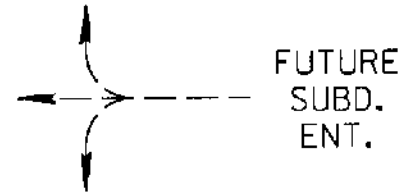
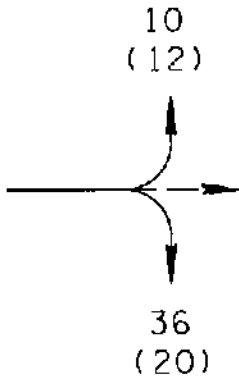


APPROX.

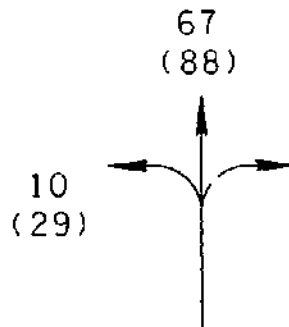
BOB KIRBY RD.



DELLE
MEADE
DR.



FUTURE
SUBD.
ENT.



VOLUME LEGEND

TOP NO. - A.M. PEAK HOUR

(BOTTOM NO.) - P.M. PEAK HOUR

PROJECTION BASED ON 6 PERCENT ANNUAL GROWTH

FULL BUILDOUT IN 2009



Cannon & Cannon, Inc.
Civil Engineering • Field Surveying

9724 Kingston Pike
Suite 1100, Franklin Square
Knoxville, Tennessee 37922
Telephone: (865) 670-8555
(865) 670-8866

FIGURE 4
BACKGROUND TRAFFIC DATA (YEAR 2009)

BOB KIRBY RD. DEVELOPMENT
TRAFFIC IMPACT STUDY

PROPOSED CONDITIONS

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 trip generation rates for single-family detached housing (Land Use Code 210, Volume 2, pages 268 to 271). As noted earlier in this report, the anticipated number of units upon full build-out is 88, which was used to determine the number of new trips generated. TABLE 2 summarizes the number and directional split of entering and exiting trips for peak periods for the proposed development.

SINGLE FAMILY DETACHED HOUSING – 88 UNITS					
	Total New Trips	% Entering	% Exiting	Number Entering	Number Exiting
Weekday	842	50%	50%	421	421
A.M. Peak	66	25%	75%	17	49
P.M. Peak	89	63%	37%	56	33

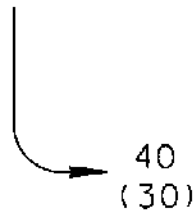
Trip Distribution

FIGURE 5 provides a summary of the trip generation patterns developed for the development intersection with Bob Kirby Road, which were derived from the existing traffic patterns at the intersection of Delle Meade Drive and Bob Kirby Road. Because the traffic from the new development will use the same intersection, it was assumed that trip distribution patterns with engineering judgment could be projected for the proposed development entrance. In addition, FIGURE 6 provides the generated traffic volumes as assigned to the local roadway network in accordance with these patterns. FIGURE 7 shows the combined year 2009 volumes reflecting the existing traffic, the background traffic growth, and the newly generated traffic from the Bob Kirby Road Development. These are the volumes used in the analysis of full build-out conditions.



APPROX.

BOB KIRBY RD.

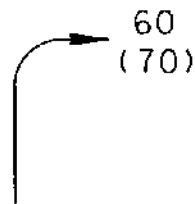


30
(40)



SUBD.
ENT.

70
(60)



VOLUME LEGEND

XX - AM % TRIPS
(YY) - PM % TRIPS



Cannon & Cannon, Inc.
Civil Engineering • Field Surveying

9724 Kingston Pike
Suite 1100, Franklin Square
Knoxville, Tennessee 37922
Telephones (865) 670-8555
(865) 670-8866

FIGURE 5
TRIP DISTRIBUTION PERCENTAGES

BOB KIRBY RD. DEVELOPMENT
TRAFFIC IMPACT STUDY

N



APPROX.

BOB KIRBY RD.

7
(17)

15
(13)

SUBD.
ENT.

34
(20)

10
(39)

VOLUME LEGEND

XX - AM TRIPS
(YY) - PM TRIPS



Cannon & Cannon, Inc.
Civil Engineering - Field Surveying

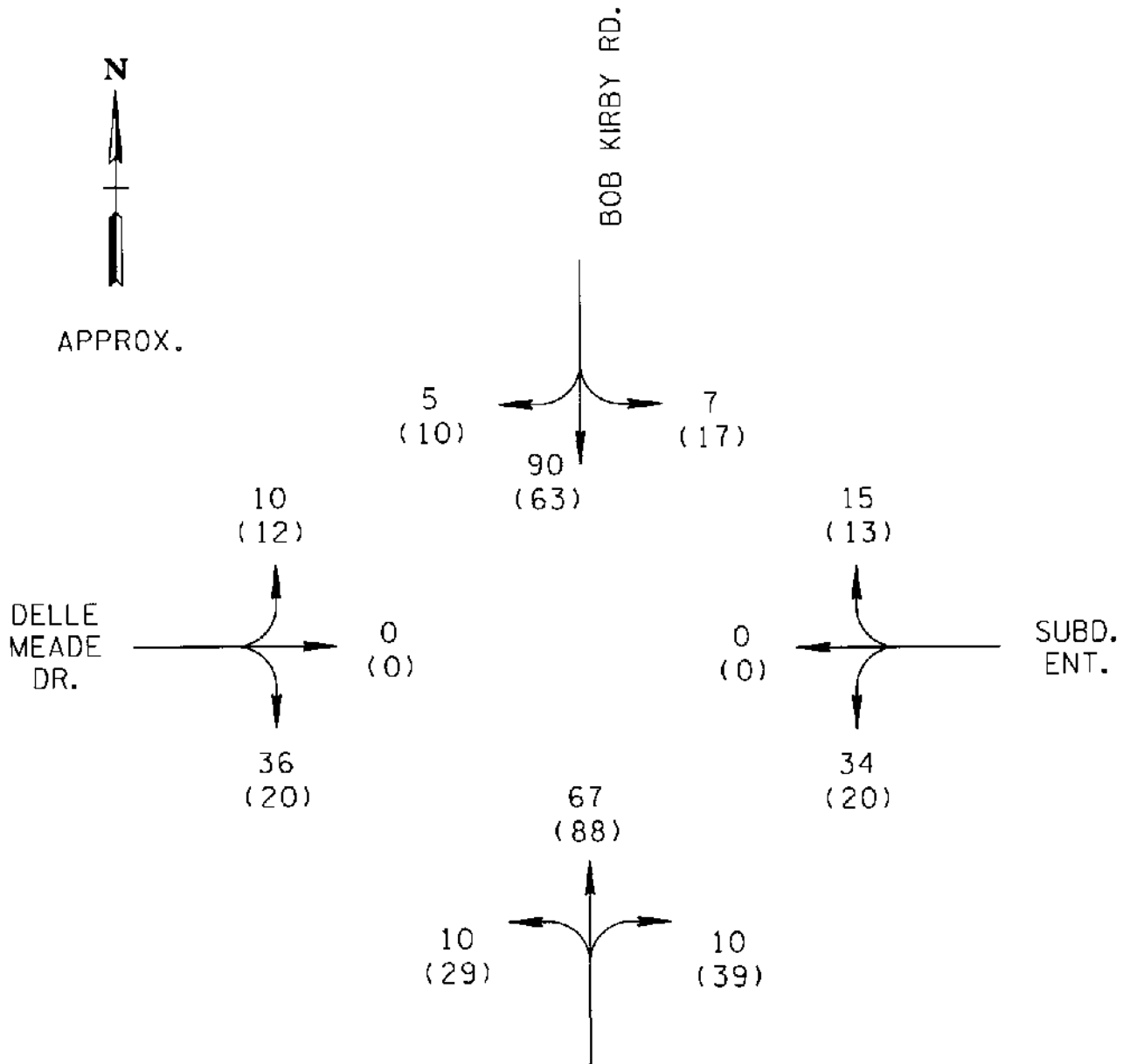
9724 Kingston Pike
Suite 1100, Franklin Square
Memphis, Tennessee 37922
Telephones: (901) 670-8555
(901) 670-8866

FIGURE 6
TRIP ASSIGNMENT

BOB KIRBY RD. DEVELOPMENT
TRAFFIC IMPACT STUDY



APPROX.



VOLUME LEGEND

XX - AM TRIPS
(YY) - PM TRIPS

NOTE:

VOLUMES SHOWN ARE PROJECTED FULL
BUILD-OUT VOLUMES FOR YEAR 2009.



Cannon & Cannon, Inc.
Civil Engineering • Field Surveying

3124 Kingston Pike
Suite 1100, Franklin Square
Knoxville, Tennessee 37922
Telephone: (865) 670-8555
18651 670-8866

FIGURE 7
COMBINED VOLUMES FOR ANALYSIS (YEAR 2009)

BOB KIRBY RD. DEVELOPMENT
TRAFFIC IMPACT STUDY

Proposed Level-of-Service Evaluation

Intersection Capacity Analyses employing the methods of the Highway Capacity Manual were used to evaluate the study intersection of Bob Kirby Road, Delle Meade Drive, and the new development access roadway, for the year 2009 combined traffic volume conditions (FIGURE 7). The results indicate that all traffic movements will be expected to operate at levels-of-service no worse than "B" during both peak hours. These results are summarized in detail on the "Two-Way Stop Control Summary" printouts contained in the APPENDIX. Also see the APPENDIX for a discussion of intersection capacity and level-of-service concepts.

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 Bob Kirby Road is 30 mph. For a 30 mph speed, the required sight distance is 300 feet. From the field review, there is well in excess of 500 feet of sight distance to the south and more than 400 feet to the north. However, it should be noted that tree and brush cover, as well as a small embankment near the roadside could negatively impact sight distance. Therefore it is recommended that prior to opening the new roadway to traffic, these features be trimmed and/or removed as necessary to maximize sight distance. Because traffic speeds are high and some steep grades are present, it is very important that sight distances exceed the minimum requirements, being maintained at the maximum distances physically possible, given the existing roadway geometric configuration.

- 2) Auxiliary Lanes for Proposed Development Intersection:
Turn lane warrant analyses were conducted for the proposed development intersection. These analyses employed Tables 5A and 5B from the Knox County Design Standards, which are based on turn lane warrants developed by Harmelink. The results were that no turn lanes are expected to be warranted during the peak traffic hours. Copies of Tables 5A and 5B are located in the APPENDIX for review.

CONCLUSIONS AND RECOMMENDATIONS

It was the primary conclusion of this study that no major negative traffic volume related impacts will result from the construction of the Bob Kirby Road Development. In fact, capacity analyses of proposed side street (2-way) stop traffic control, indicates that very good operational conditions (LOS "B" or better) can be expected during all time periods upon full build-out of this project. See TABLE 3 for a summary of all project capacity analyses.

TABLE 3				
CAPACITY ANALYSES SUMMARY				
EVALUATION CONDITION	LEVELS-OF-SERVICE			
	Northbound	Southbound	Eastbound	Westbound
Existing Background (2006) - AM	A	-	A	-
Existing Background (2006) - PM	A	-	A	-
Future Background (2009) - AM	A	-	A	-
Future Background (2009) - PM	A	-	A	-
Combined/Build-Out (2009) - AM	A	A*	A	B**
Combined/Build-Out (2009) - PM	A	A*	A	B**

* Includes left-turn traffic into proposed subdivision.
 ** Proposed subdivision access roadway approach.

An evaluation of the potential need for separate left and right turn lanes at the proposed subdivision entrance intersection was performed. This evaluation determined that no separate turn lanes will be warranted, based on anticipated peak hour traffic conditions.

Intersection corner sight distance was also evaluated for the proposed subdivision access roadway intersection. This evaluation found that the existing sight distance is well in excess of 500 feet looking south and in excess of 400 feet looking north. Tree and brush cover, as well as an embankment near the site, has the potential to obstruct the sight lines of drivers entering or leaving the proposed development. Therefore, vegetation and/or embankment removal should be undertaken in order to maximize sight distance. The posted speed limit is 30 mph which, in accordance with Knox County regulations, requires a minimum 300 foot sight distance. However, because of high traffic speeds and steep grades, it is recommended that sight lines be maintained at the maximum distances physically possible given the existing roadway geometric configuration.

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.

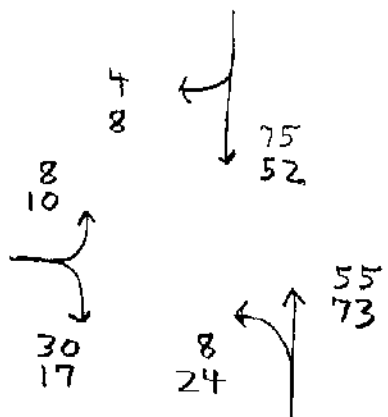
Default Titles
Change These in The Preferences Window

Default Comments
 Change These in The Preferences Window
 Select File/Preference in the Main Scree
 Then Click the Titles Tab

File Name : untitled1
 Site Code : 00000000
 Start Date : 03/30/2006
 Page No : 1

Groups Printed- Unshifted

Start Time Factor	BOB KIRBY ROAD From North				DELLE MEADE DRIVE From East				BOB KIRBY ROAD From South				DELLE MEADE DRIVE From West				Int. Total
	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	Right	Thru	Left	Peds	
07:00 AM	0	12	0	0	0	0	0	0	0	6	1	0	8	0	2	0	29
07:15 AM	1	15	0	0	0	0	0	0	0	10	1	0	6	0	3	0	36
07:30 AM	1	20	0	0	0	0	0	0	0	9	1	0	9	0	3	0	43
07:45 AM	1	27	0	0	0	0	0	0	0	15	2	0	10	0	1	0	56
Total	3	74	0	0	0	0	0	0	0	40	5	0	33	0	9	0	164
08:00 AM	1	13	0	0	0	0	0	0	0	21	4	0	5	0	1	0	45
08:15 AM	0	6	0	0	0	0	0	0	0	5	1	0	2	0	2	0	16
*** BREAK ***																	
Total	1	19	0	0	0	0	0	0	0	26	5	0	7	0	3	0	61
*** BREAK ***																	
04:15 PM	5	8	0	0	0	0	0	0	0	12	3	0	4	0	1	0	33
04:30 PM	1	10	0	0	0	0	0	0	0	7	8	0	6	0	2	0	34
04:45 PM	3	10	0	0	0	0	0	0	0	13	5	0	2	0	0	0	33
Total	9	28	0	0	0	0	0	0	0	32	16	0	12	0	3	0	100
05:00 PM	1	16	0	0	0	0	0	0	0	31	2	0	5	0	2	0	57
05:15 PM	2	10	0	0	0	0	0	0	0	8	5	0	6	0	3	0	34
05:30 PM	2	14	0	0	0	0	0	0	0	18	8	0	2	0	2	0	46
05:45 PM	3	12	0	0	0	0	0	0	0	16	9	0	4	0	3	0	47
Total	8	52	0	0	0	0	0	0	0	73	24	0	17	0	10	0	184
Grand Total	21	173	0	0	0	0	0	0	0	171	50	0	69	0	25	0	509
Approch %	10.8	89.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	77.4	22.6	0.0	73.4	0.0	26.6	0.0	
Total %	4.1	34.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	33.6	9.8	0.0	13.6	0.0	4.9	0.0	



Peak Hours PHF
 7:15 - 8:15 - 0.80
 5:00 - 6:00 - 0.80

TRAFFIC VOLUME ADJUSTMENT FACTORS TO BE USED WITH "TRAFFIC SIGNAL WARRANT ANALYSIS - VOLUME WARRANTS"
 Prepared and Distributed by the Tennessee Transportation Assistance Program

TABLE A

 Month/Day of Week Urban Area Adjustment Factors¹ - Average Day
 (Multiply actual count by given factor to obtain estimated average day volumes for a similar time period²)

	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	1.36	1.37	1.48
Monday	1.54	1.00	0.97	0.94	0.93	0.91	0.92	0.93	0.94	0.98	0.98	1.03
Tuesday	1.00	0.99	0.95	0.94	0.93	0.91	0.91	0.92	0.93	0.94	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	0.91	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 Factors¹ - Average Weekday
 (Multiply actual count by given factor to obtain estimated average weekday volumes for a similar time period²)

	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	0.98	0.98	1.00	1.01	1.01
Friday	0.99	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 Factors² - Average Friday
 (Multiply actual count by given factor to obtain estimated average Friday volumes for a similar time period¹)

	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	0.96	0.97	0.97	1.00	1.07	1.00

Notes: 1. "Traffic Signal Warrant Analysis - Volume Warrants" is a Lotus[®] 1-2-3[®] 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.

TWO-WAY STOP CONTROL SUMMARY

Analyst: Scott Boles
 Agency/Co.: Cannon & Cannon
 Date Performed: 4/5/2006
 Analysis Time Period: AM Peak (2009 Combined)
 Intersection: Bob Kirby at New Ent.
 Jurisdiction: Knox County
 Units: U. S. Customary
 Analysis Year: 2009
 Project ID: Bob Kirby Rd. Development (700-001)
 East/West Street: New Subd. Entrance
 North/South Street: Bob Kirby Rd.
 Intersection Orientation: NS Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street: Approach Movement	Northbound			Southbound		
	1 L	2 T	3 R	4 L	5 T	6 R
Volume	10	67	10	7	90	5
Peak-Hour Factor, PHF	0.80	0.80	0.80	0.80	0.80	0.80
Hourly Flow Rate, HFR	12	83	12	8	112	6
Percent Heavy Vehicles	0	--	--	0	--	--
Median Type/Storage	Undivided			/		
RT Channelized?						
Lanes	0	1	0	0	1	0
Configuration	LTR			LTR		
Upstream Signal?	No			No		

Minor Street: Approach Movement	Westbound			Eastbound		
	7 L	8 T	9 R	10 L	11 T	12 R
Volume	34	0	15	10	0	36
Peak Hour Factor, PHF	0.80	0.80	0.80	0.80	0.80	0.80
Hourly Flow Rate, HFR	42	0	18	12	0	44
Percent Heavy Vehicles	0	0	0	0	0	0
Percent Grade (%)	0			0		
Flared Approach: Exists?/Storage	No			/		
Lanes	0	1	0	0	1	0
Configuration	LTR			LTR		

Delay, Queue Length, and Level of Service

Approach Movement Lane Config	NB	SB	Westbound			Eastbound			
	1 LTR	4 LTR	7 LTR	8 LTR	9 LTR	10 LTR	11 LTR	12 LTR	
v (vph)	12	8	60			56			
C(m) (vph)	1483	1512	724			872			
v/c	0.01	0.01	0.08			0.08			
95% queue length	0.02	0.02	0.27			0.21			
Control Delay	7.4	7.4	10.4			9.4			
LOS	A	A	B			A			
Approach Delay				10.4			9.4		
Approach LOS				B			A		

TWO-WAY STOP CONTROL SUMMARY

Analyst: Scott Boles
 Agency/Co.: Cannon & Cannon
 Date Performed: 4/5/2006
 Analysis Time Period: PM Peak (2009 Combined)
 Intersection: Bob Kirby at New Ent.
 Jurisdiction: Knox County
 Units: U. S. Customary
 Analysis Year: 2009
 Project ID: Bob Kirby Rd. Development (700-001)
 East/West Street: New Subd. Entrance
 North/South Street: Bob Kirby Rd.
 Intersection Orientation: NS Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street:	Approach Movement	Northbound			Southbound		
		1 L	2 T	3 R	4 L	5 T	6 R
Volume		29	88	39	17	63	10
Peak-Hour Factor, PHF		0.80	0.80	0.80	0.80	0.80	0.80
Hourly Flow Rate, HFR		36	109	48	21	78	12
Percent Heavy Vehicles		0	--	--	0	--	--
Median Type/Storage		Undivided			/		
RT Channelized?							
Lanes		0	1	0	0	1	0
Configuration		LTR			LTR		
Upstream Signal?		No			No		

Minor Street:	Approach Movement	Westbound			Eastbound		
		7 L	8 T	9 R	10 L	11 T	12 R
Volume		20	0	13	12	0	20
Peak Hour Factor, PHF		0.80	0.80	0.80	0.80	0.80	0.80
Hourly Flow Rate, HFR		24	0	16	14	0	24
Percent Heavy Vehicles		0	0	0	0	0	0
Percent Grade (%)			0			0	
Flared Approach: Exists?/Storage				No	/		No
Lanes		0	1	0	0	1	0
Configuration		LTR			LTR		

Delay, Queue Length, and Level of Service

Approach Movement	NB	SB	Westbound			Eastbound		
	1	4	7	8	9	10	11	12
Lane Config	LTR	LTR	LTR			LTR		
v (vph)	36	21	40			38		
C(m) (vph)	1518	1435	682			788		
v/c	0.02	0.01	0.06			0.05		
95% queue length	0.07	0.04	0.19			0.15		
Control Delay	7.4	7.5	10.6			9.8		
LOS	A	A	B			A		
Approach Delay			10.6			9.8		
Approach LOS			B			A		

TABLE 5A

LEFT-TURN LANE VOLUME THRESHOLDS
FOR TWO-LANE ROADWAYS WITH A PREVAILING SPEED OF 36 TO 45 MPH

(If the left-turn volume exceeds the table value a left -turn lane is needed)

OPPOSING VOLUME	THROUGH VOLUME PLUS RIGHT-TURN VOLUME *					
	100 - 149	150 - 199	200 - 249	250 - 299	300 - 349	350 - 399
100 - 149	250	180	140	110	80	70
150 - 199	200	140	105	90	70	60
200 - 249	160	115	85	75	65	55
250 - 299	130	100	75	65	60	50
300 - 349	110	90	70	60	55	45
350 - 399	100	80	65	55	50	40
400 - 449	90	70	60	50	45	35
450 - 499	80	60	50	45	40	30
500 - 549	70	60	45	35	35	25
550 - 599	65	55	40	35	30	25
600 - 649	60	45	35	30	25	25
650 - 699	55	35	35	30	25	20
700 - 749	50	35	30	25	20	20
750 or More	45	35	25	25	20	20

OPPOSING VOLUME	THROUGH VOLUME PLUS RIGHT-TURN VOLUME *					
	350 - 399	400 - 449	450 - 499	500 - 549	550 - 599	=/ > 600
100 - 149	70	60	50	45	40	35
150 - 199	60	55	45	40	35	30
200 - 249	55	50	40	35	30	30
250 - 299	50	45	35	30	30	30
300 - 349	45	40	35	30	25	25
350 - 399	40	35	30	25	25	20
400 - 449	35	30	30	25	20	20
450 - 499	30	25	25	20	20	20
500 - 549	25	25	20	20	20	15
550 - 599	25	20	20	20	20	15
600 - 649	25	20	20	20	20	15
650 - 699	20	20	20	20	20	15
700 - 749	20	20	20	15	15	15
750 or More	20	20	20	15	15	15

* Or through volume only if a right-turn lane exists

* All thru plus RT for SB are less than 100 vehicles, therefore no left turn lane is warranted.

TABLE 5B

RIGHT-TURN LANE VOLUME THRESHOLDS
FOR TWO-LANE ROADWAYS WITH A PREVAILING SPEED OF 36 TO 45 MPH

RIGHT-TURN VOLUME	THROUGH VOLUME PLUS LEFT-TURN VOLUME *					
	< 100	100 - 199	200 - 249	250 - 299	300 - 349	350 - 399
Fewer Than 25 25 - 49 50 - 99	* AM	* PM				
100 - 149 150 - 199						
200 - 249 250 - 299					Yes	Yes Yes
300 - 349 350 - 399			Yes	Yes Yes	Yes Yes	Yes Yes
400 - 449 450 - 499		Yes	Yes Yes	Yes Yes	Yes Yes	Yes Yes
500 - 549 550 - 599	Yes	Yes Yes	Yes Yes	Yes Yes	Yes Yes	Yes Yes
600 or More	Yes	Yes	Yes	Yes	Yes	Yes

RIGHT-TURN VOLUME	THROUGH VOLUME PLUS LEFT-TURN VOLUME *					
	350 - 399	400 - 449	450 - 499	500 - 549	550 - 600	+ / > 600
Fewer Than 25 25 - 49 50 - 99				Yes	Yes Yes	Yes Yes
100 - 149 150 - 199		Yes	Yes Yes	Yes Yes	Yes Yes	Yes Yes
200 - 249 250 - 299	Yes Yes	Yes Yes	Yes Yes	Yes Yes	Yes Yes	Yes Yes
300 - 349 350 - 399	Yes Yes	Yes Yes	Yes Yes	Yes Yes	Yes Yes	Yes Yes
400 - 449 450 - 499	Yes Yes	Yes Yes	Yes Yes	Yes Yes	Yes Yes	Yes Yes
500 - 549 550 - 599	Yes Yes	Yes Yes	Yes Yes	Yes Yes	Yes Yes	Yes Yes
600 or More	Yes	Yes	Yes	Yes	Yes	Yes

* Or through volume only if a left-turn lane exists.

* No Right turn lane is warranted for NBRT into development.