
TRAFFIC IMPACT LETTER

ALPINE MEADOW – UNIT 5B

KNOXVILLE, TENNESSEE

-Prepared For-

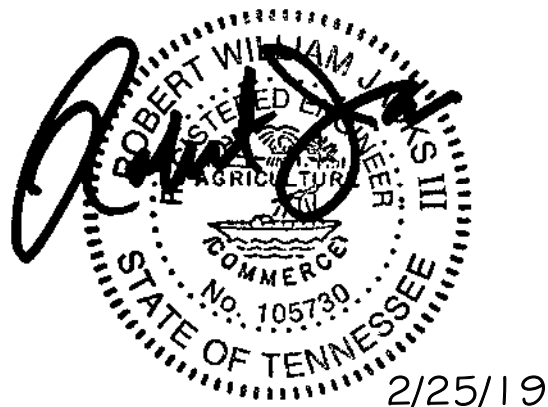


Turner Homes, LLC
11543 Kingston Pike
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-Prepared By-



Ajax Engineering, LLC
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February 2019



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February 25, 2019

TO: Ms. Tarren Barrett, EIT
Transportation Engineer, Knoxville-Knox County Planning

RE: Alpine Meadow - Unit 5B / Traffic Impact Letter
Knoxville, Tennessee

This Traffic Impact Letter (TIL) was prepared for “Alpine Meadow - Unit 5B” which will involve constructing 55 single-family residential attached homes to the rear of the existing Alpine Meadow Subdivision. This residential development is in north Knoxville, Tennessee off East Beaver Creek Drive. This letter provides the requirements and scope as outlined in your email addressed to David Harbin, PE and dated February 13th, 2019.

The presented information in this TIL includes the proposed layout for the development, data from field reviews, traffic counts, and data presented in the original traffic impact study that was performed by Wilbur Smith Associates in 2002.

If you have any questions or comments about this submittal, please feel free to contact me at any time. I look forward to your review and approval.

Sincerely,

Ajax Engineering, LLC

A handwritten signature in black ink, appearing to read "Robert W. Jacks". The signature is stylized with large, flowing loops and a prominent initial "R".

Robert W. Jacks, P.E.

INTRODUCTION

The purpose of this traffic impact letter is to review the potential impacts of additional homes being constructed in Alpine Meadow Subdivision. The proposed additional residential development on 11.3 acres is named “Alpine Meadow – Unit 5B”. This development will be located on property located to the rear of the existing Alpine Meadow Subdivision off East Beaver Creek Drive in Knoxville, TN. This 11.3-acre section was left undeveloped in the Alpine Meadow residential development that was originally proposed in 2002. This letter includes a brief review of the original traffic impact study for the development, the current traffic operations, and the projected traffic operations once the Alpine Meadow – Unit 5B residential development is constructed and added to the existing Alpine Meadow Subdivision.

PROJECT DESCRIPTION

■ GENERAL DESCRIPTION

Alpine Meadow – Unit 5B will consist of 55 single-family attached residential homes on 11.3 acres and is expected to be constructed and fully occupied by the year 2022. The development will include homes, walking trails, and open common areas. This subsequent phase of Alpine Meadow will also construct a road extension of Long Shot Lane and construct one new internal roadway. The extension of Long Shot Lane will be approximately 575 feet and the new internal road, Road “A”, will be approximately 500 feet.

■ LOCATION

Alpine Meadow – Unit 5B will be located to the rear (north) of the existing Alpine Meadow Subdivision in Knoxville, TN. The existing Alpine Meadow Subdivision currently has 128 single-family attached residential homes. The location of this proposed development is shown in Figure 1. Figure 2 shows the proposed layout plan for Alpine Meadow – Unit 5B. Interstate 75 is located adjacent to the west of Alpine Meadow Subdivision and Allison Park Condominiums are adjacent to the east.

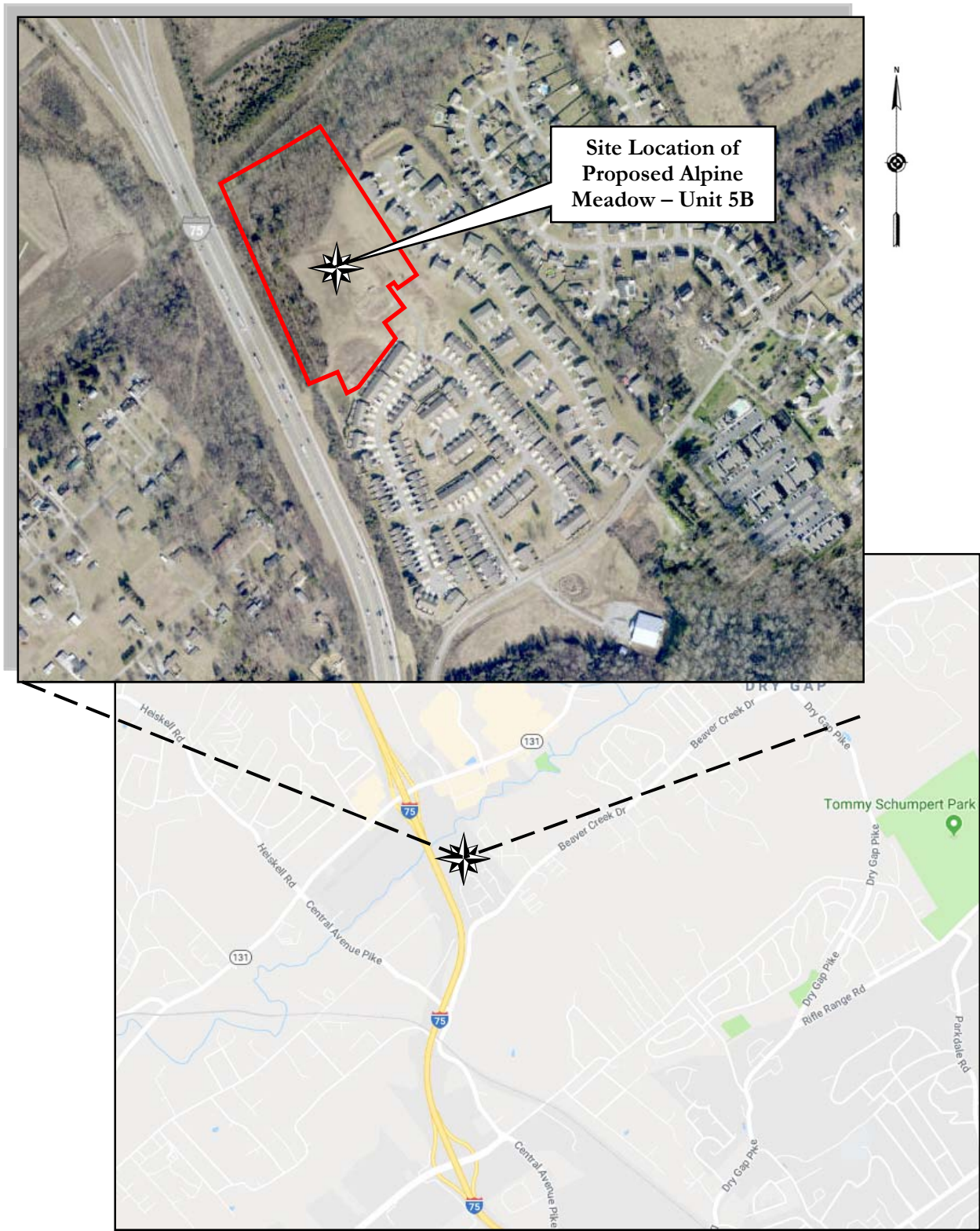


Figure 1
Location Map

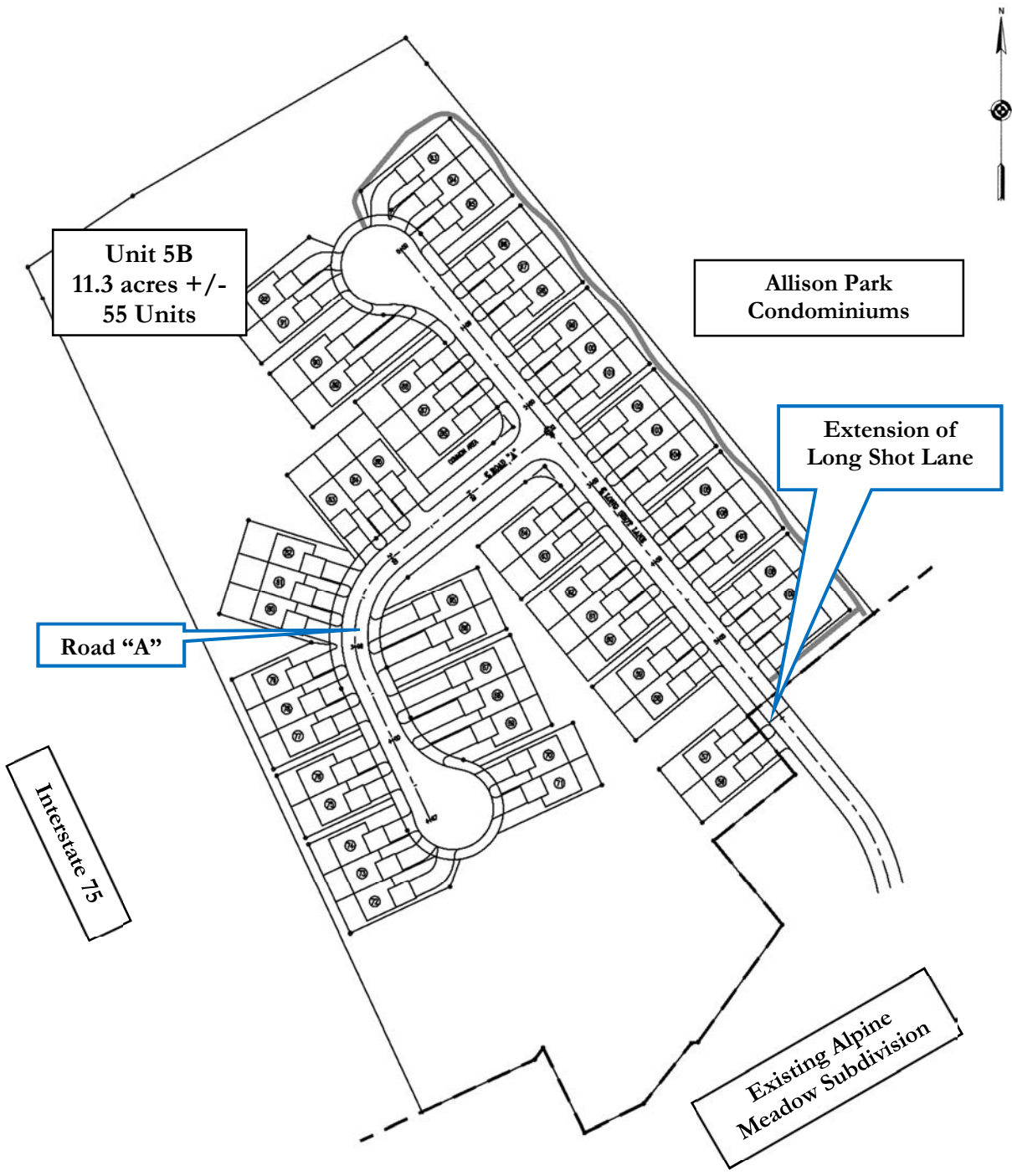


Figure 2
Plan Layout
Alpine Meadow – Unit 5B

ORIGINAL AND CURRENT DEVELOPMENT

■ ORIGINAL ALPINE MEADOW SUBDIVISION DEVELOPMENT (2002)

Alpine Meadow – Unit 5B will be located on an 11.3-acre property to the rear of the existing Alpine Meadow Subdivision that was originally part of a 33.54-acre residential development proposed in 2002. As part of the development process in 2002, a Level 1 Traffic Impact Study was completed by Wilbur Smith Associates. This traffic impact study analyzed the development with 238 single-family residential lots.

The trip generation calculations from the report in 2002 by Wilbur Smith Associates were calculated using the Institute of Transportation Engineer’s (ITE) Trip Generation Manual, 6th Edition. The projected trip generation for the original Alpine Meadow Subdivision by Wilbur Smith Associates is shown in Table 1.

TABLE 1
TRIP GENERATION FOR ORIGINAL ALPINE MEADOW DEVELOPMENT FOR YEAR 2005
by Wilbur Smith Associates

TYPE DEVELOPMENT	UNITS	ITE LAND USE CODE	DAILY TRIPS	AM PEAK		PM PEAK	
				ENTER	EXIT	ENTER	EXIT
Single-Family Residential	238	#210	2,302	44	132	150	84

ITE Trip Generation Manual, 6th Edition

The proposed concept plan that was used for the 2002 traffic impact study is shown in Figure 3. The traffic impact study determined that the overall development would generate 2,302 trips on an average weekday. Of these trips, 176 of these trips were estimated to occur during the AM peak hour and 234 trips in the PM peak hour at full build-out in the year 2005. The original study assumed that the development would be constructed in one phase. However, over the past 17 years, the Alpine Meadow Subdivision was developed in several phases on 22.2 acres of the original 33.54-acre tract. It is now proposed to be fully built-out on the remaining 11.3 acres and overall will include 55 fewer homes than originally proposed in 2002.

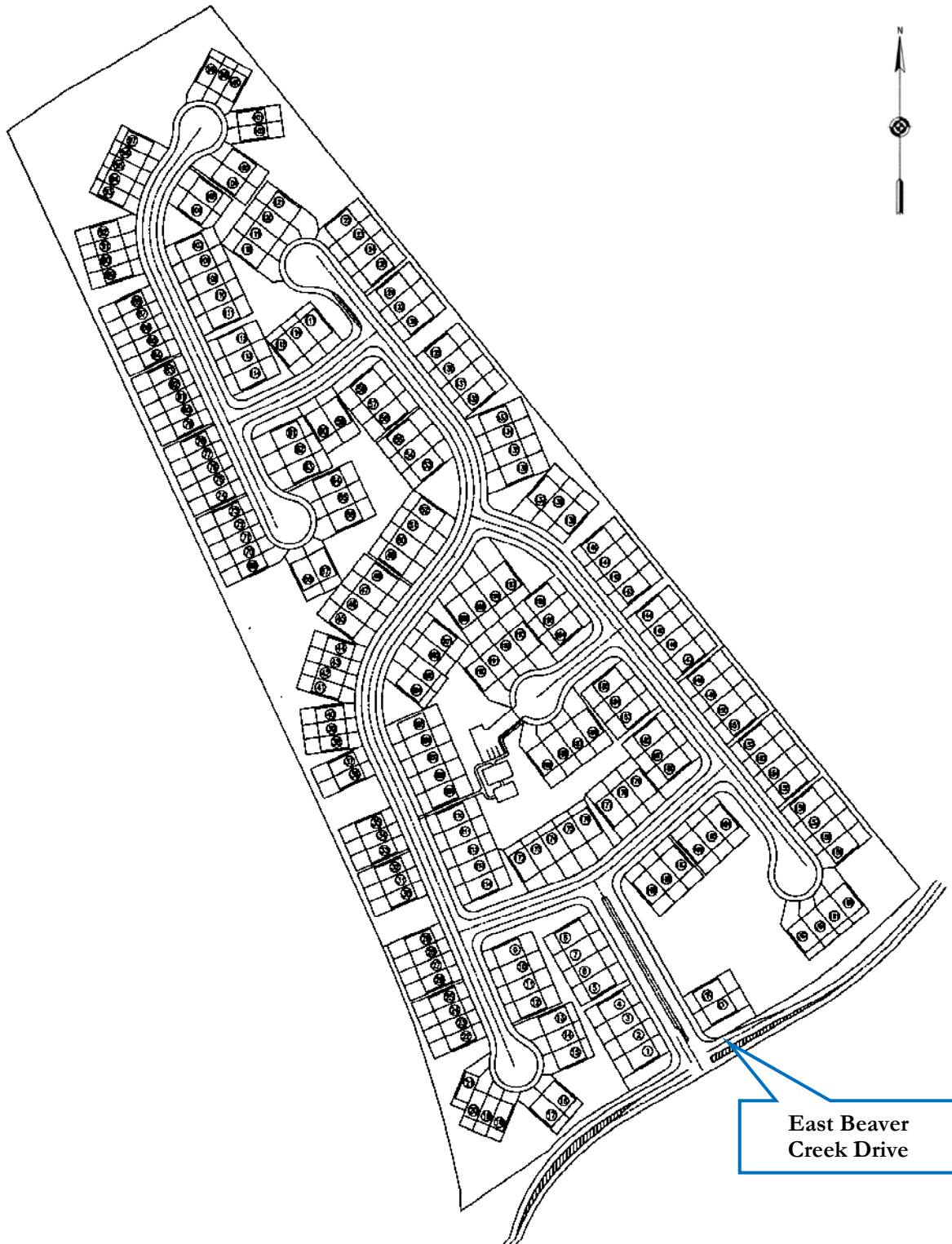


Figure 3
Concept Plan from 2002
Alpine Meadow

■ **CURRENT ALPINE MEADOW SUBDIVISION DEVELOPMENT**

The current existing residential land use does not exactly match the proposed residential land uses that were analyzed in the original traffic impact study from 2002. The original traffic impact study analyzed the developer constructing single-family detached homes. However, the actual homes that were constructed are single-family attached homes.

Trip Generation calculations were conducted based on the current residential land use in Alpine Meadow by utilizing the Knoxville/Knox County Metropolitan Planning Commission (MPC) Local Trip Generation Rates from December 1999. The trip rates that were used for this study were based on the MPC rates for Apartment land uses that include condominiums and townhouses. These trip generation calculations are shown in Appendix A.

The number of trips projected to be generated by the current 128 residences in Alpine Meadow Subdivision is shown in Table 2. Based on the MPC trip generation rates, the calculations show that the current residences would be expected to generate approximately 1,192 trips on an average weekday. Of these trips, 68 are estimated to occur during the AM peak hour and 96 trips in the PM peak hour.

TABLE 2
TRIP GENERATION FOR CURRENT ALPINE MEADOW (2019)
 128 single-family attached homes (apartments)

EXISTING LAND USE	MPC LAND USE DESCRIPTION	SIZE ^a	GENERATED DAILY TRAFFIC	GENERATED TRAFFIC AM PEAK HOUR			GENERATED TRAFFIC PM PEAK HOUR		
				ENTER	EXIT	TOTAL	ENTER	EXIT	TOTAL
Attached Residential Homes	Apartments	128 units	1,192	22%	78%		55%	45%	
				15	53	68	53	43	96
Total New Volume Site Trips			1,192	15	53	68	53	43	96

MPC Trip Generation Study, December 1999

^a From KGIS Website

As compared to the original 2002 traffic impact study, the current development that was constructed for Alpine Meadow is calculated to generate far fewer trips than what was originally calculated. Based on constructing single-family detached homes, the 2002 traffic impact study determined that the overall development would generate 2,302 trips on an

average weekday. Of these trips, 176 were estimated to occur during the AM peak hour and 234 trips in the PM peak hour at full build-out.

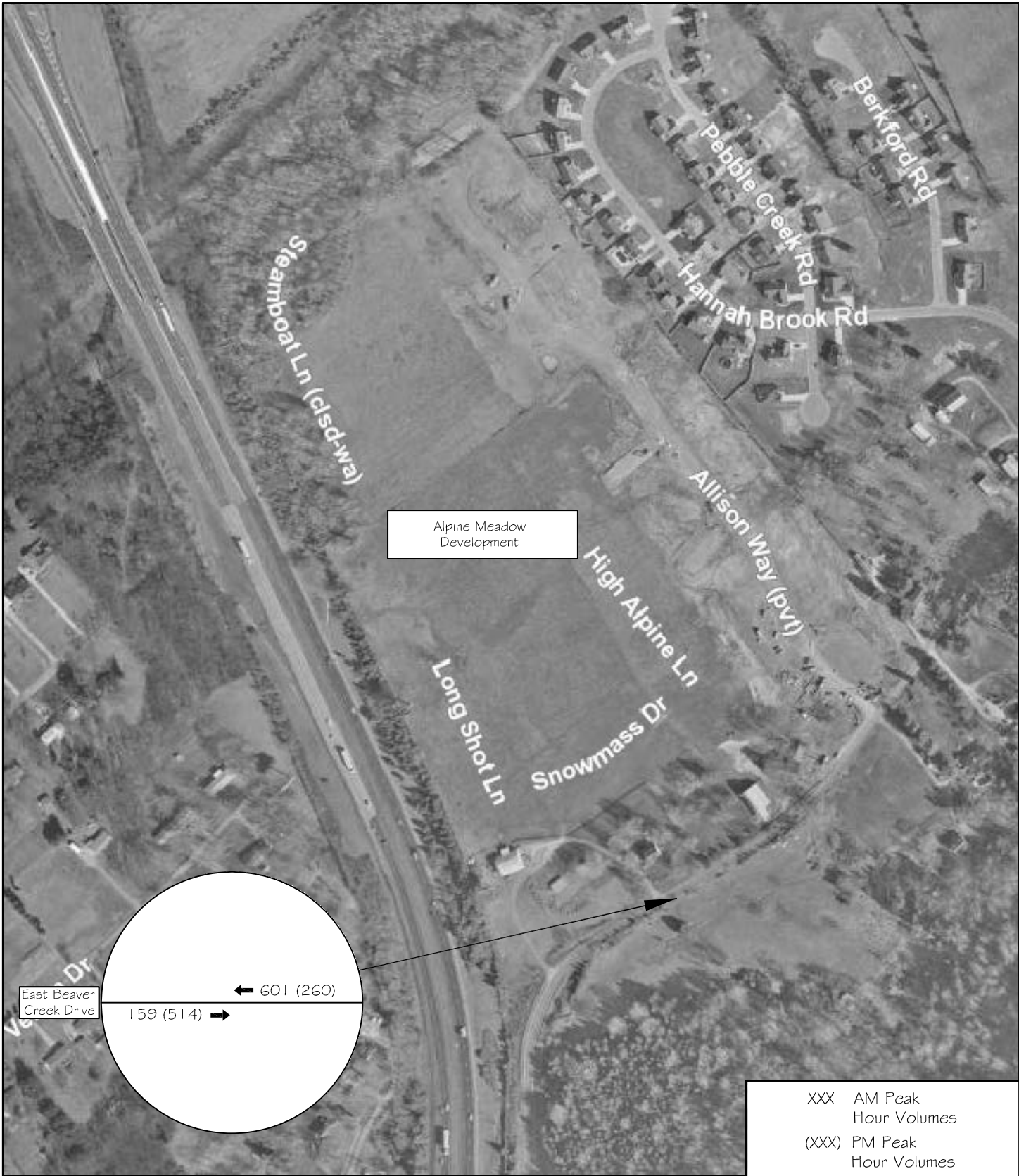
However, the original 2002 traffic impact study also assumed that the Alpine Meadow Subdivision would be constructed in one phase and would be fully built-out on the land that is now being proposed for Alpine Meadow – Unit 5B. Later in this report the projected new trips for Alpine Meadow – Unit 5B will be calculated, added to the current Alpine Meadow trips calculated in Table 2, and compared to the original 2002 traffic impact study trip generation calculations (Table 1) to make a valid comparison.

PAST AND CURRENT TRAFFIC VOLUMES

■ **PAST TRAFFIC VOLUMES (2002)**

The original traffic impact study by Wilbur Smith Associates in 2002 conducted a couple of traffic counts around the proposed Alpine Meadow Subdivision. One of the traffic counts was conducted on East Beaver Creek Drive near the now 3-way intersection of East Beaver Creek Drive at Rocky Mountain High Boulevard. The present-day 3-way intersection is controlled by a Stop Sign for the southbound approach of Rocky Mountain High Boulevard. East Beaver Creek Drive consists of the east and west approaches and traffic operates freely for these approaches.

The 2002 traffic impact study traffic counts for the AM and PM peak hour along East Beaver Creek Drive are shown in Figure 4. In that study, the projected traffic volumes were calculated for the future intersection of East Beaver Creek Drive at Rocky Mountain High Boulevard for the year 2005. The year 2005 was assumed to be when the Alpine Meadow Subdivision would be fully constructed and occupied. These projected volumes by Wilbur Smith Associates for the year 2005 are shown in Figure 5.



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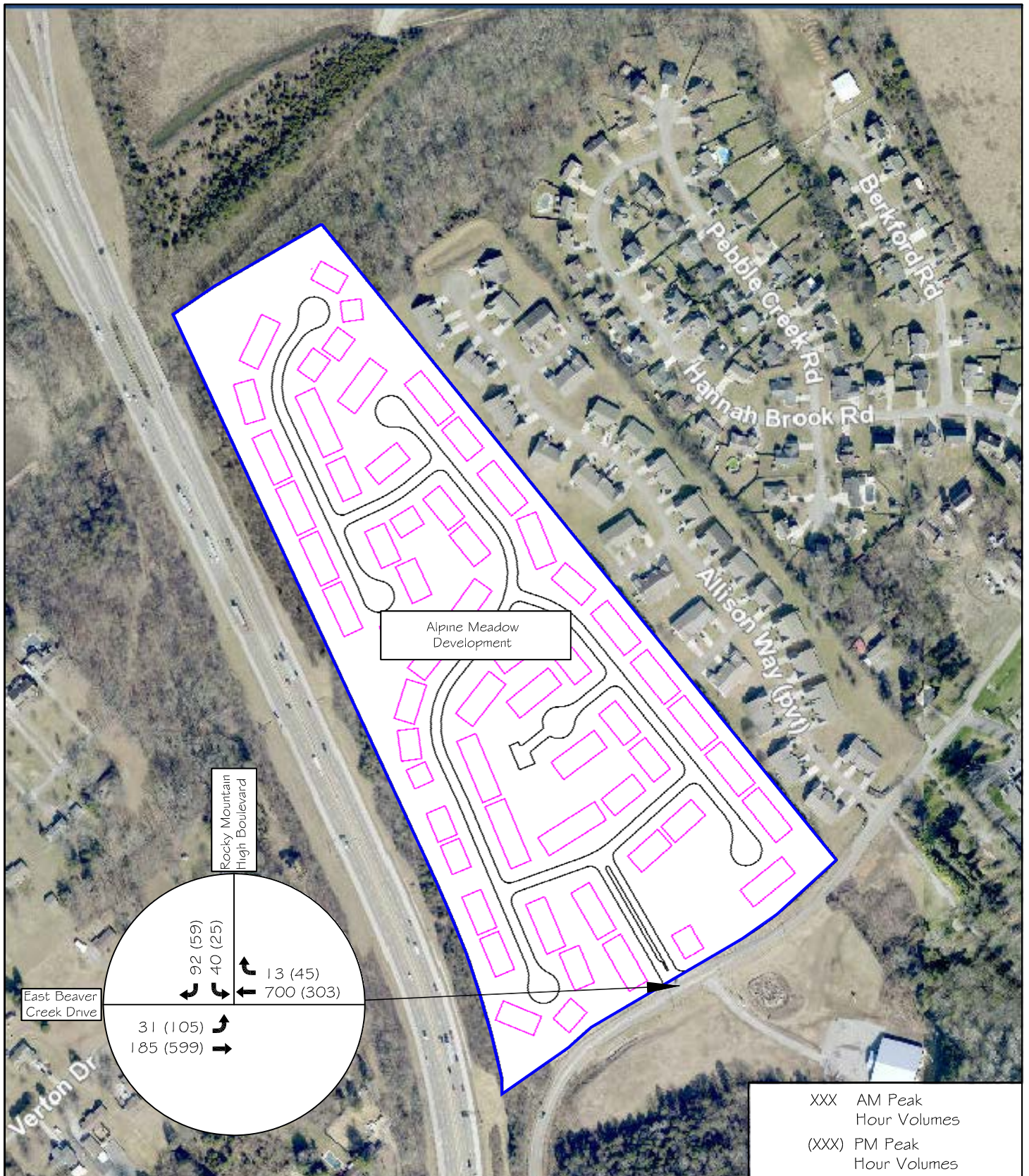
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FIGURE 4

Alpine Meadow - Unit 5B

2002 Peak Hour Traffic Volumes
 by Wilbur Smith Associates



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FIGURE 5

Alpine Meadow - Unit 5B

2005 Projected Peak Hour Traffic Volumes by Wilbur Smith Associates

■ **CURRENT TRAFFIC VOLUMES (2019)**

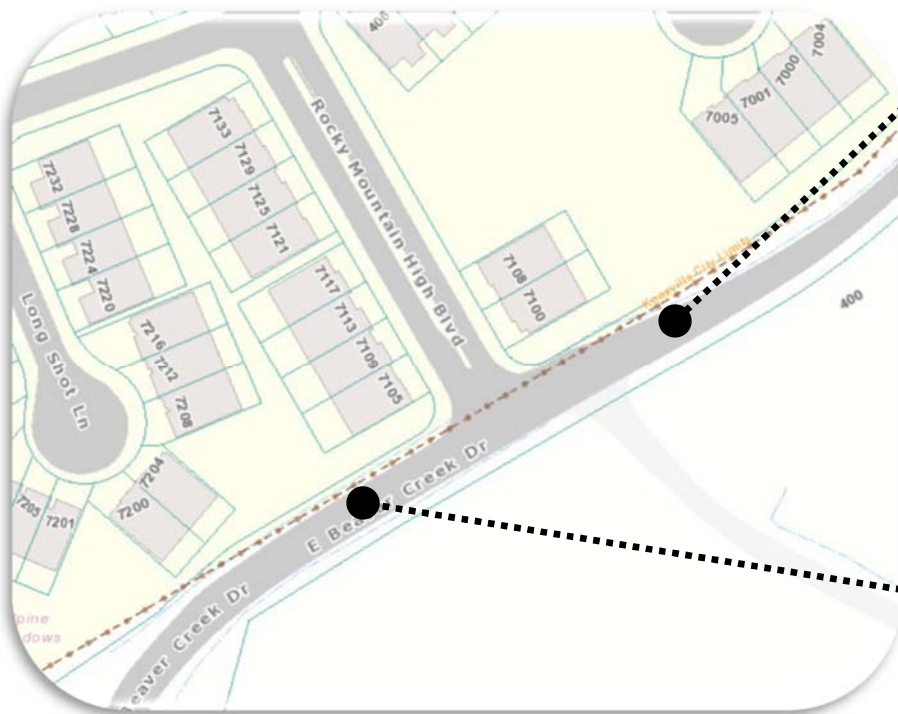
Traffic counts for this updated study were conducted on Thursday, February 21st, 2019. Local schools were in session when the traffic counts were conducted. The traffic counts were conducted at the intersection of East Beaver Creek Drive at Rocky Mountain High Boulevard during the peak AM and PM hours between 7 – 9 am and 3 – 6 pm. The following pages give an overview of the traffic count study intersection and the study area with photographs.

Figure 6 shows the lane configurations of the study area and location where the traffic counts were conducted. The results of the intersection traffic counts are shown in Figure 7 and in Appendix B. In Figure 7, the volumes shown are from the current traffic counts during the AM and PM peak hours observed at the intersection.

Based on the traffic volumes counted, the AM peak hour was observed from 7:15 – 8:15 am and the PM peak hour of traffic was observed from 5:00 – 6:00 pm. The volumes that were tabulated at the intersection showed that the current entering and exiting volumes from the Alpine Meadow Subdivision were much less than what was projected would occur for the current 128 homes based on the trip generation calculations shown in Table 2.

PHOTO EXHIBITS

12



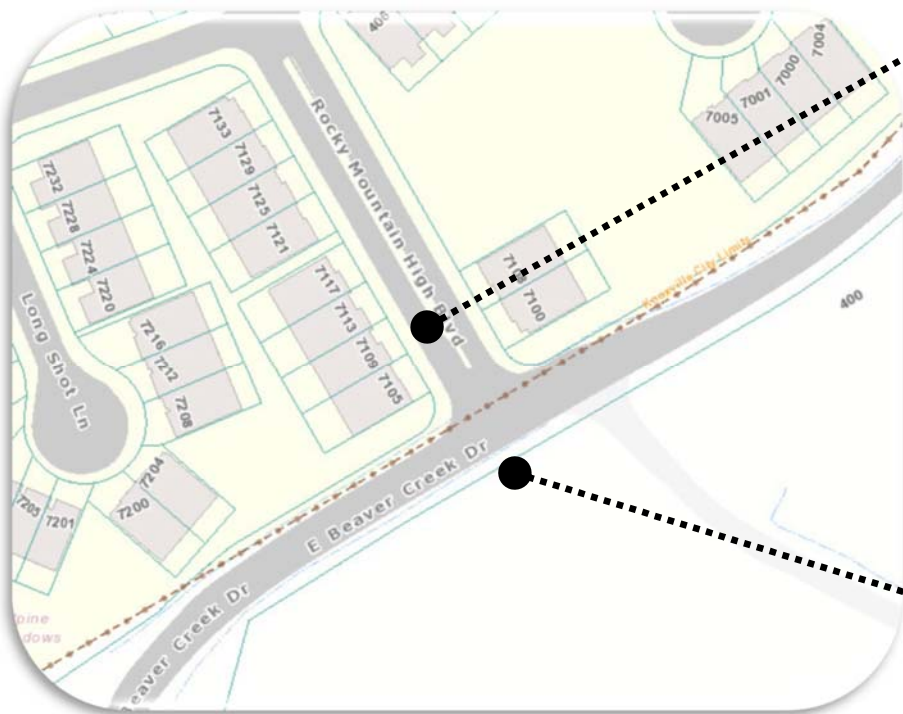
East Beaver Creek Drive at Rocky Mountain High Boulevard



View of East Beaver Creek Drive at Rocky Mountain High Boulevard (Looking Southwest)



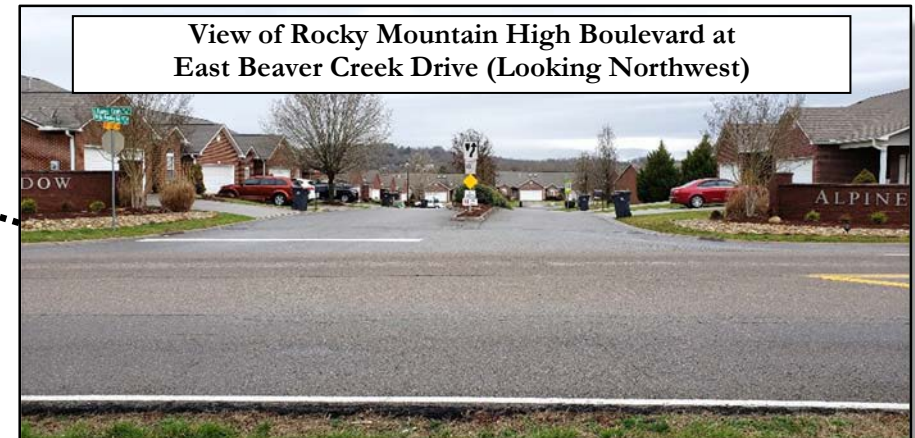
View of East Beaver Creek Drive at Rocky Mountain High Boulevard (Looking Northeast)



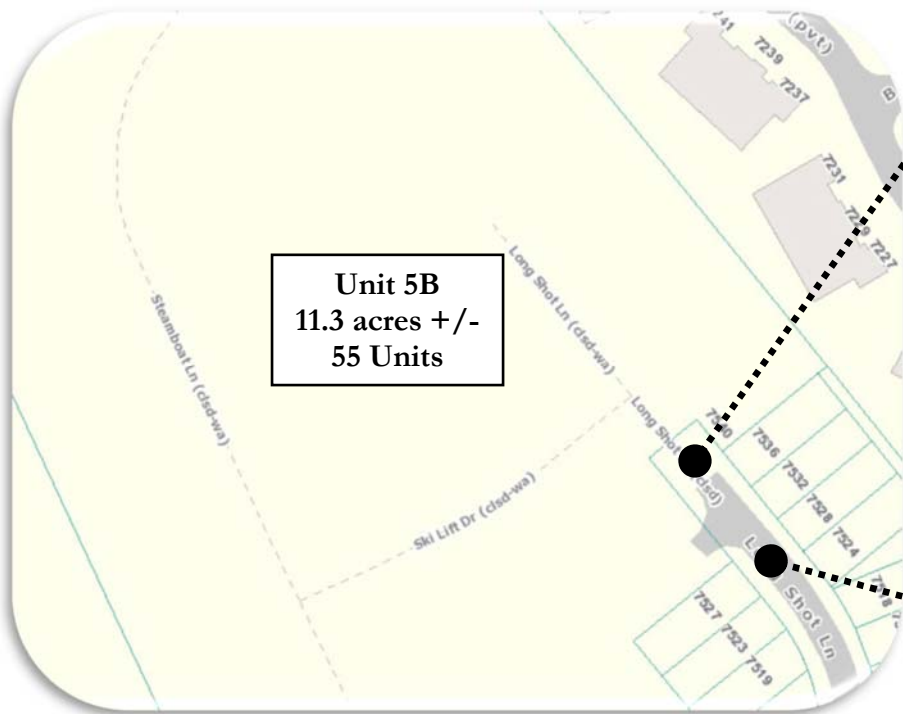
East Beaver Creek Drive at Rocky Mountain High Boulevard



View of Rocky Mountain High Boulevard at East Beaver Creek Drive (Looking Southeast)



View of Rocky Mountain High Boulevard at East Beaver Creek Drive (Looking Northwest)



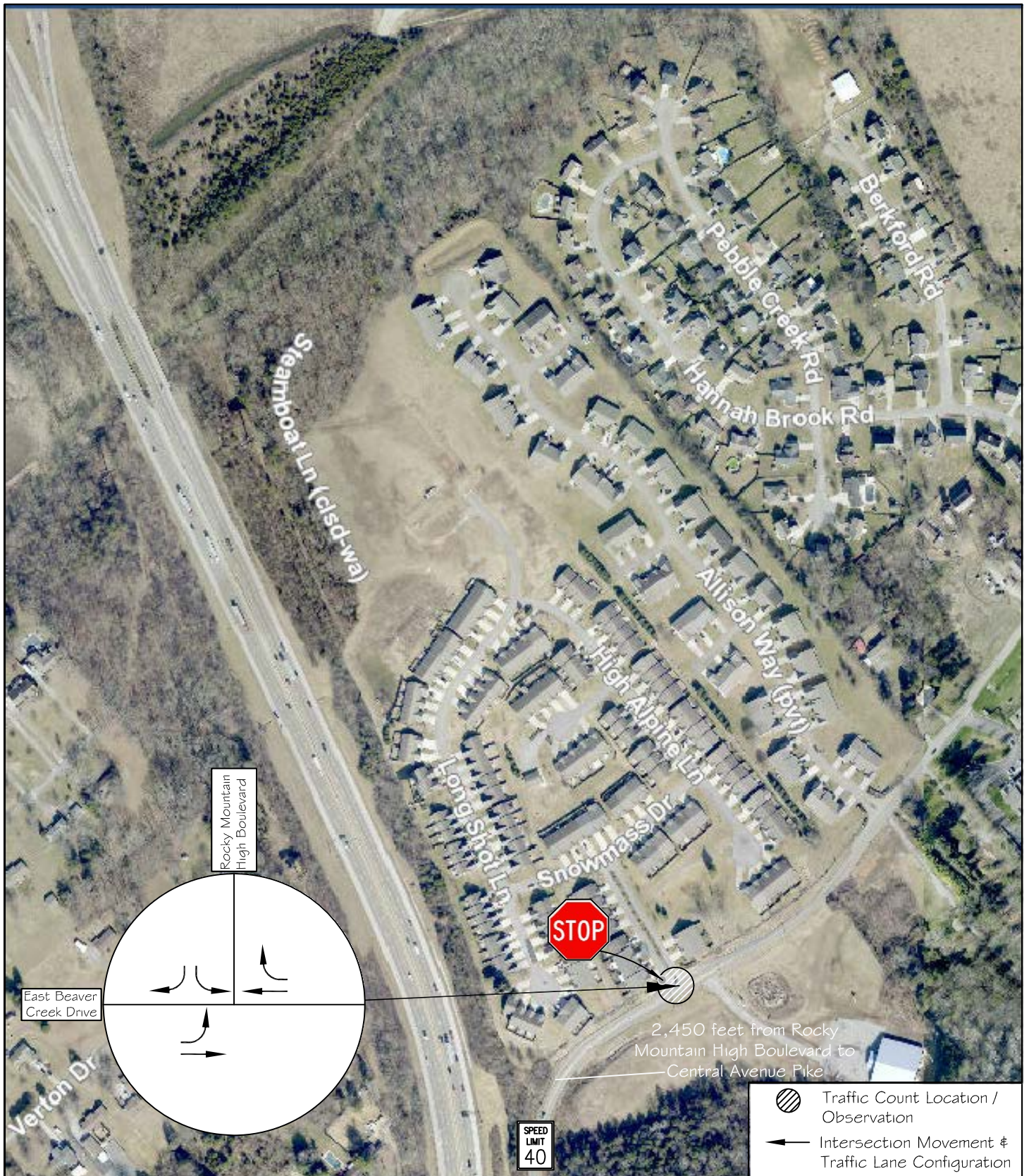
Current End of Long Shot Lane & Future Development Area



View of Proposed Development Area (Looking Northwest)



View of Current End of Alpine Meadow Subdivision at Long Shot Lane (Looking Northwest)



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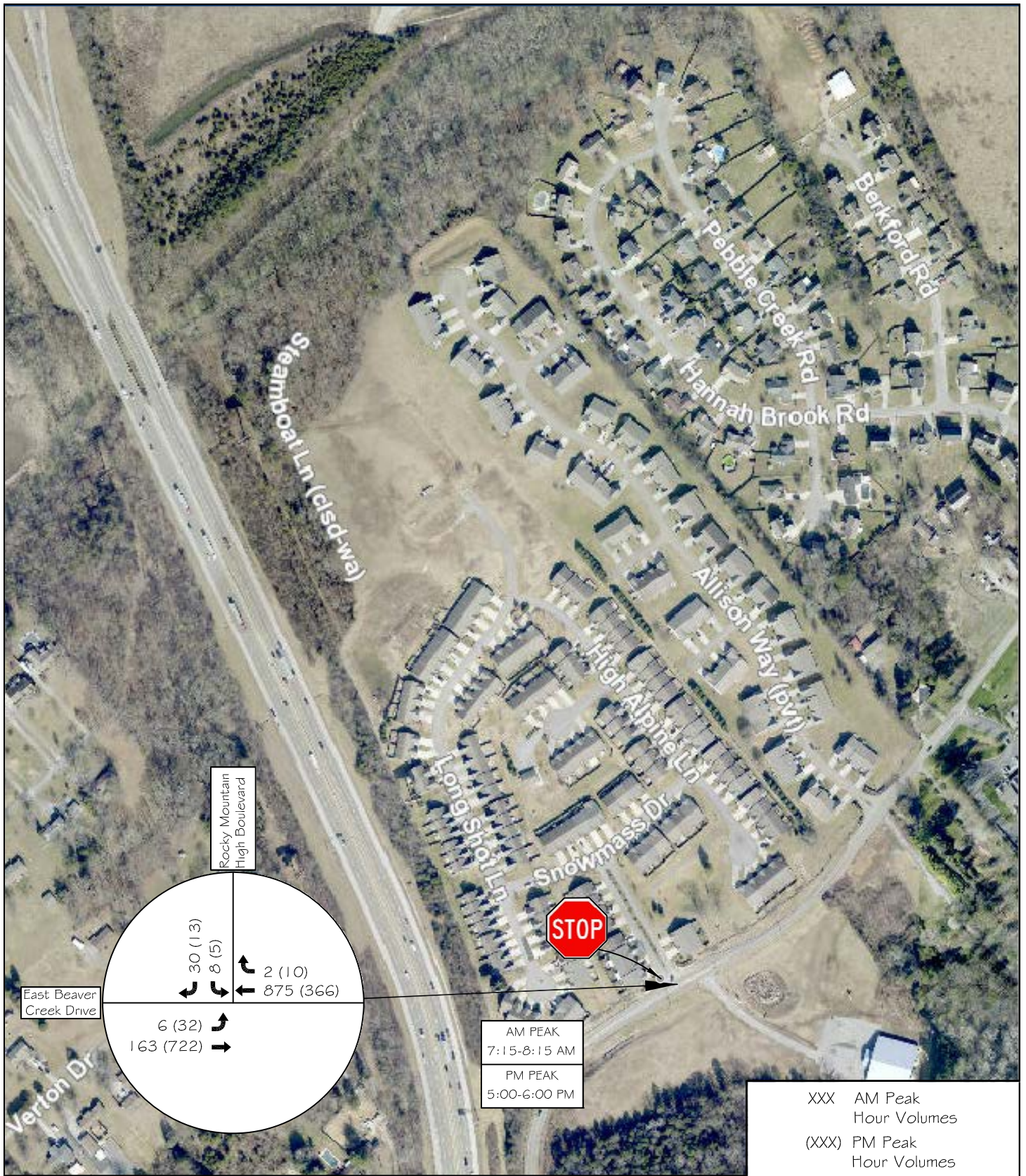
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FIGURE 6

Alpine Meadow - Unit 5B

Traffic Count Location & Existing Lane Configurations



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FIGURE 7
 Alpine Meadow - Unit 5B
 2019 Peak Hour Traffic Volumes - EXISTING TRAFFIC CONDITIONS

Capacity analyses were undertaken to determine the existing Level of Service (LOS) for the studied intersection during the AM and PM peak hour with respect to vehicular traffic. The capacity analyses were calculated by following the methods outlined in the Highway Capacity Manual and using Synchro Traffic Software (Version 8). LOS is a qualitative measurement developed by the transportation profession of how well an intersection or roadway performs based on a driver's perception. LOS designations include LOS A through LOS F. The designation of LOS A signifies a roadway or intersection operating at best, while LOS F signifies road operations at the worst. This grading system provides a reliable straightforward means to communicate road operations to the public. The Highway Capacity Manual (HCM) lists the level of service criteria for unsignalized intersections and signalized intersections.

A/B



C/D



E/F



(Source: FDOT)

For unsignalized intersections, Level of Service is measured in terms of delay (in seconds). This measure is an attempt to quantify delay that includes travel time, driver discomfort, and fuel consumption. The LOS for a two-way stop (or yield) controlled intersection is defined by the delay for each minor approach and major street left-turn movement. Table 3 lists the level of service criteria for unsignalized intersections.

From the capacity calculations, the results from the existing peak hour vehicular traffic can be seen in Table 4 for the intersection. The intersection in the table is shown with a LOS designation, delay (in seconds), and v/c ratio (volume/capacity) for the AM and PM peak hours. A v/c ratio of 1 would indicate that the traffic volumes are at the roadway capacity. Appendix C includes the worksheets from the capacity analyses for the current AM and PM peak hour vehicular traffic.

The studied intersection was shown to operate at a good level with respect to Level of Service during the current AM and PM peak hours for vehicular traffic except for the southbound left turn movement. This turning movement had few vehicles but higher delays due to high thru volumes on East Beaver Creek Drive.

TABLE 3



LEVEL OF SERVICE AND DELAY FOR UNSIGNALIZED INTERSECTIONS



LEVEL OF SERVICE	DESCRIPTION	DELAY RANGE (seconds/vehicle)
A	Little or no delay	≤ 10
B	Short Traffic Delays	>10 and ≤15
C	Average Traffic Delays	>15 and ≤25
D	Long Traffic Delays	>25 and ≤35
E	Very Long Traffic Delays	>35 and ≤50
F	Extreme Traffic Delays	>50

Source: Highway Capacity Manual

TABLE 4
2019 PEAK HOUR LEVEL OF SERVICE & DELAY - EXISTING TRAFFIC CONDITIONS

INTERSECTION	TRAFFIC CONTROL	APPROACH	AM PEAK			PM PEAK		
			LOS	DELAY (seconds)	V/C	LOS	DELAY (seconds)	V/C
East Beaver Creek Drive at Rocky Mountain High Boulevard	Unsignalized	Eastbound Left	B	10.7	0.019	A	8.2	0.034
		Southbound Left	D	29.1	0.074	D	26.5	0.045
		Southbound Right	C	21.7	0.157	B	10.7	0.030

Note: All analyses were calculated in Synchro 8 software and reported with HCM 2010 methodology for intersections

FUTURE PROPOSED DEVELOPMENT

▪ TRIP GENERATION FOR PROPOSED ALPINE MEADOW

The estimated amount of traffic that will be generated by Alpine Meadow Subdivision was calculated based upon rates and equations for peak hour trips as a result of local traffic rates provided by the MPC. The estimated number of generated trips for Alpine Meadow Subdivision was calculated and included the existing homes (128 units) and the proposed homes in Alpine Meadow – Unit 5B (55 homes) for a total of 183 homes. The data and calculations from the MPC trip rates for the existing and proposed homes are shown in Appendix A. A summary of this information is presented in the following table:

TABLE 5
TRIP GENERATION FOR PROPOSED ALPINE MEADOW FOR YEAR 2022
 183 single-family attached homes (apartments)

EXISTING LAND USE	MPC LAND USE DESCRIPTION	SIZE ^a	GENERATED DAILY TRAFFIC	GENERATED TRAFFIC AM PEAK HOUR			GENERATED TRAFFIC PM PEAK HOUR		
				ENTER	EXIT	TOTAL	ENTER	EXIT	TOTAL
Attached Residential Homes	Apartments	183 units	1,643	22%	78%		55%	45%	
				21	73	94	73	60	133
Total New Volume Site Trips			1,643	21	73	94	73	60	133

MPC Trip Generation Study, December 1999

^a From KGIS Website

For the entire Alpine Meadow Subdivision, that includes the existing and proposed homes, it is estimated that 21 vehicles will enter and 73 will exit for a total of 94 generated trips during the AM Peak Hour when it is fully occupied in the year 2022. Similarly, it is estimated that 73 vehicles will enter and 60 will exit for a total of 133 generated trips during the PM Peak Hour in the year 2022. The calculated trips generated for an average weekday is projected to be 1,643 vehicles for the residential development in the year 2022.


▪ **OPENING YEAR TRAFFIC CONDITIONS (WITHOUT PROJECT)**

Opening year traffic volume estimates represent the potential future condition the proposed study area is subject to without the proposed project being developed (no-build option). As previously stated, the build-out and full occupancy for the entire Alpine Meadow Subdivision is assumed to occur in the year 2022.

Traffic growth on East Beaver Creek Drive has shown overall flat growth over the past 7 years according to a TDOT count station located to the east of the site (historical traffic data is shown in Appendix D). From 2010 thru 2017, the average annual growth rate was calculated to be -0.02%. Currently, there are no known other relevant significant upcoming developments adjacent to the site on East Beaver Creek Drive that would indicate large future increased traffic volumes in the study area in the short term. To ensure a conservative estimate for this study, a 3% annual growth rate was used to consider any future development in the area and potential rising traffic volumes on East Beaver Creek Drive. The results of this growth rate applied to the existing thru traffic volumes on East Beaver Creek Drive can be seen in Figure 8 for the year 2022. The volumes shown in Figure 8 could potentially exist in the future even without further development in the Alpine Meadow Subdivision.

The capacity analysis for the intersection was calculated with these additional thru volumes on East Beaver Creek Drive for the year 2022. As shown in Table 6 (and in Appendix C), for vehicular traffic in the year 2022, the intersection was calculated to operate similarly to the current conditions during the AM and PM peak hours.

TABLE 6
2022 PEAK HOUR LEVEL OF SERVICE & DELAY - PROJECTED TRAFFIC CONDITIONS (WITHOUT PROJECT)

INTERSECTION	TRAFFIC CONTROL	APPROACH	AM PEAK			PM PEAK		
			LOS	DELAY (seconds)	V/C	LOS	DELAY (seconds)	V/C
East Beaver Creek Drive at Rocky Mountain High Boulevard	 Unsignalized	Eastbound Left	B	11.2	0.020	A	8.3	0.035
		Southbound Left	D	34.2	0.088	D	30.3	0.053
		Southbound Right	C	24.7	0.180	B	10.9	0.032

Note: All analyses were calculated in Synchro 8 software and reported with HCM 2010 methodology for intersections



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FIGURE 8

Alpine Meadow - Unit 5B

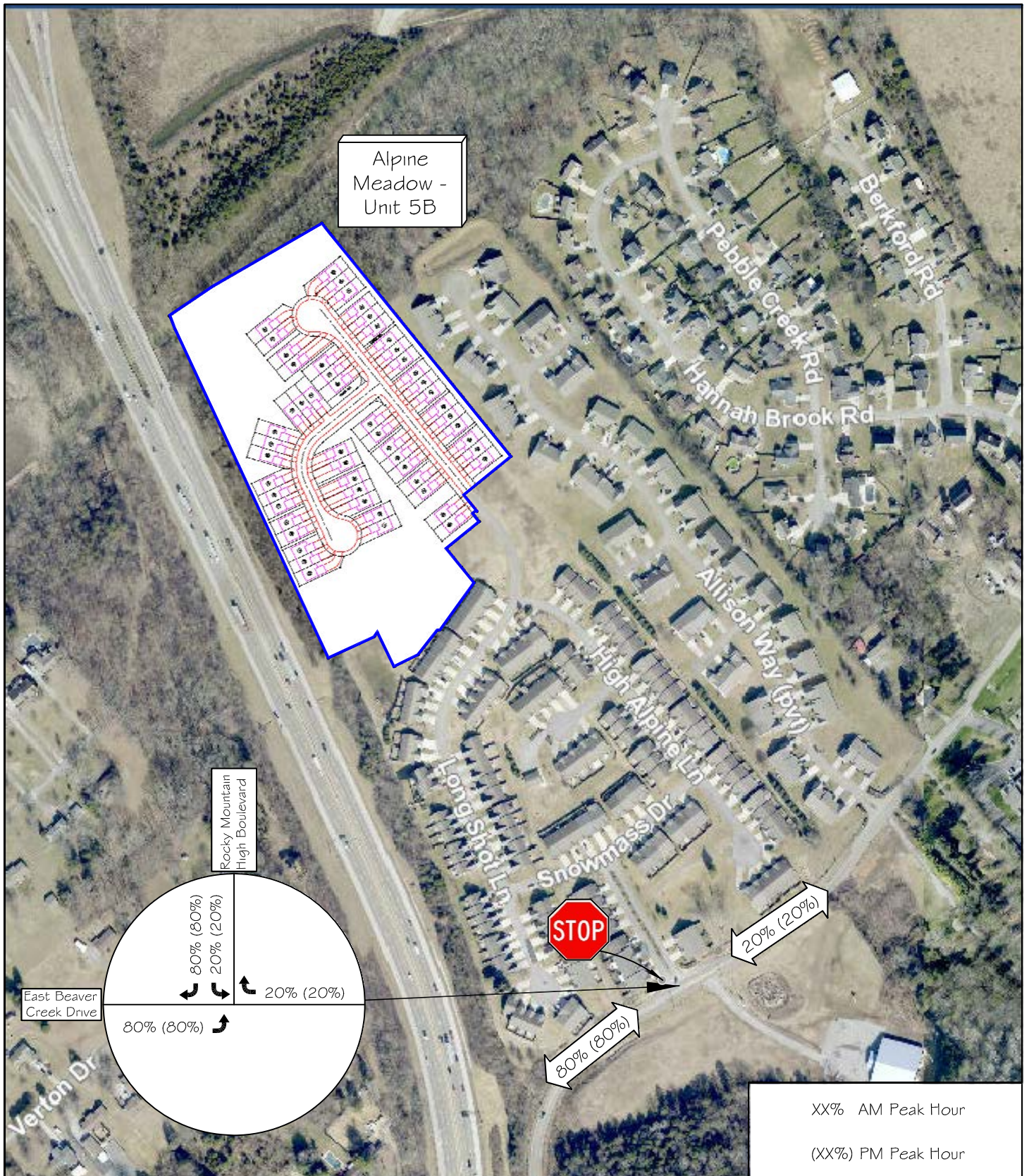
2022 Peak Hour Traffic Volumes -
OPENING YEAR TRAFFIC (WITHOUT
PROJECT)

- **TRIP DISTRIBUTION AND ASSIGNMENT**

Based on the existing traffic count movements at the intersection of East Beaver Creek Drive at Rocky Mountain High Boulevard, it is assumed for the projected conditions that 80% of all traffic generated by the Alpine Meadow Subdivision will travel to and from the west. It is assumed that the other 20% of traffic generated by Alpine Meadow Subdivision will travel to and from the east. The assumption made in the original 2002 traffic impact study by Wilbur Smith Associates was a 70/30 split.

Figure 9 shows the projected distribution of traffic entering and exiting the development during the year 2022 AM and PM peak hour at the study intersection. The percentages shown in the figure only pertain to the trips generated by the Alpine Meadow Subdivision.

Figure 10 shows the traffic assignment of the calculated generated trips by the Alpine Meadow Subdivision at the studied intersection for traffic entering and exiting the development during the year 2022 AM and PM peak hour. This is based on the assumed distribution of trips shown in Figure 9.



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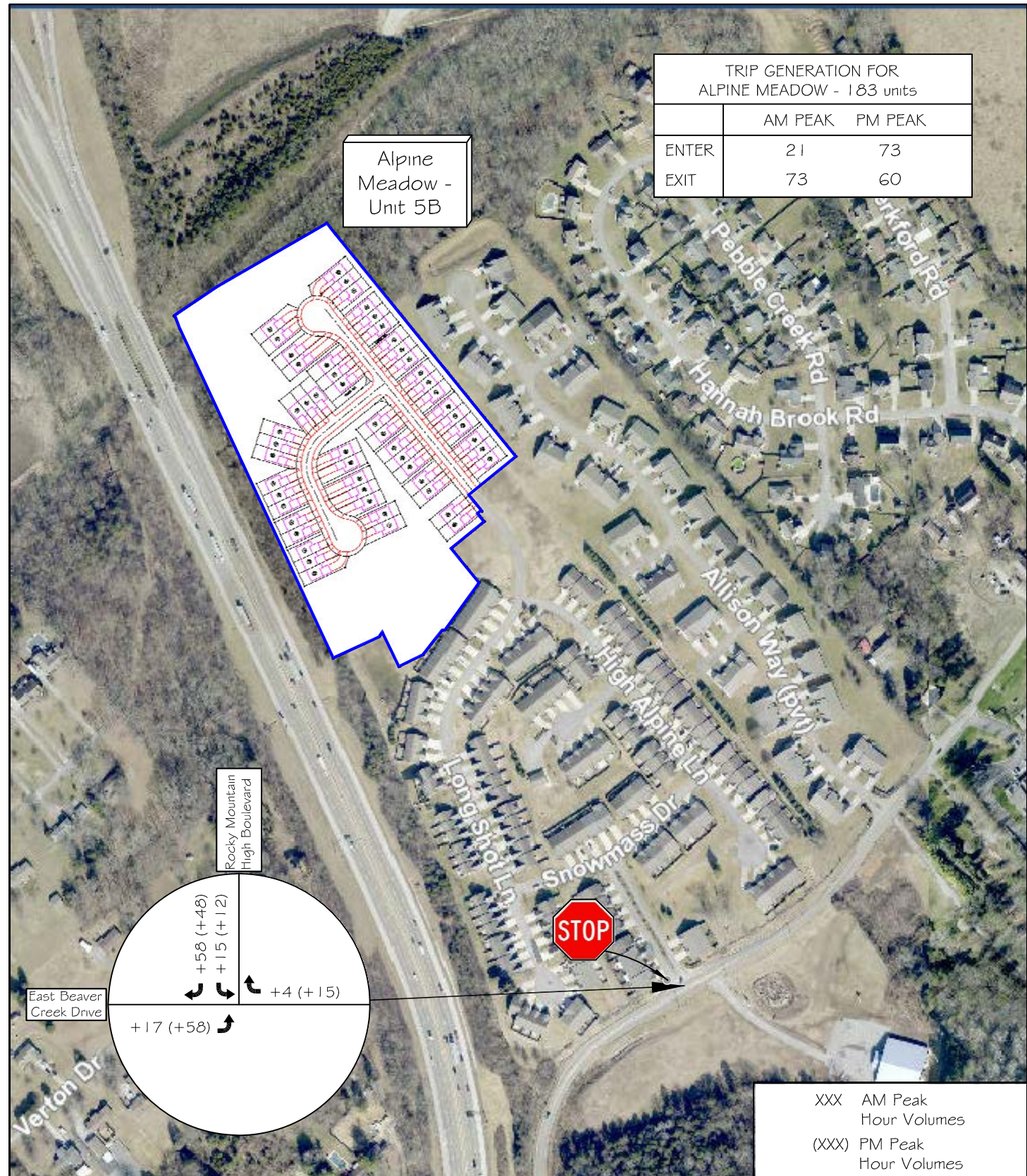
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FIGURE 9


Alpine Meadow - Unit 5B

Directional Distribution of Generated Traffic during AM and PM Peak Hour




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FIGURE 10
Alpine Meadow - Unit 5B
Traffic Assignment of Generated Traffic during AM and PM Peak Hour

▪ **OPENING YEAR TRAFFIC CONDITIONS (WITH PROJECT)**

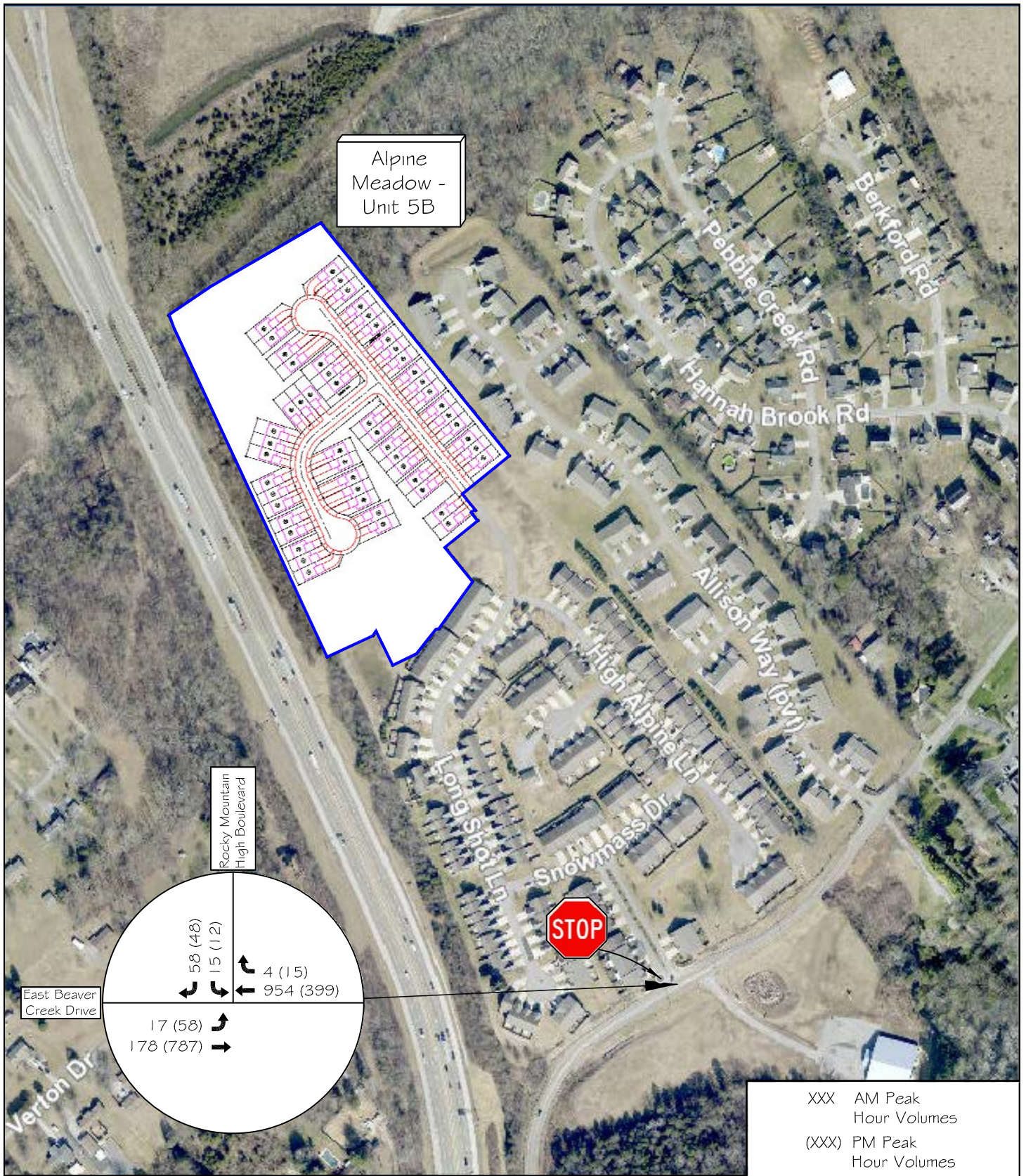
To determine the total projected traffic volumes at the studied intersection in the year 2022, the entering and exiting calculated trips generated by the entire Alpine Meadow Subdivision (183 units) were added to the projected thru on East Beaver Creek Drive traffic volumes for the year 2022 (shown in Figure 8). This is in accordance with the predicted directional distributions and assignments (shown in Figures 9 and 10). This procedure was necessary to obtain the total projected traffic volumes at the intersection during the AM and PM peak hours at the time the entire subdivision is fully built-out and occupied in the year 2022. Figure 11 shows the projected AM and PM peak hour volumes at the studied intersection for the year 2022.

Capacity analyses were conducted to determine the projected Level of Service for vehicles at the studied intersection in the year 2022 for the entire Alpine Meadow Subdivision traffic. Appendix C includes the worksheets for these capacity analyses. The results of the capacity calculations for the projected 2022 AM and PM peak hour vehicular traffic volumes at the studied intersections can be seen in Table 7. As can be seen in the table, the studied intersections are calculated to operate similarly with respect to vehicular delay as was calculated in the existing traffic conditions. Southbound left turns are calculated to operate with slightly higher delays in the AM and PM peak hours than is occurring in the current conditions.

TABLE 7
2022 PEAK HOUR LEVEL OF SERVICE & DELAY - PROJECTED TRAFFIC CONDITIONS (WITH PROJECT)

INTERSECTION	TRAFFIC CONTROL	APPROACH	AM PEAK			PM PEAK		
			LOS	DELAY (seconds)	V/C	LOS	DELAY (seconds)	V/C
East Beaver Creek Drive at Rocky Mountain High Boulevard	 Unsignalized	Eastbound Left	B	11.5	0.057	A	8.4	0.063
		Southbound Left	E	40.7	0.182	E	36.8	0.144
		Southbound Right	D	29.6	0.348	B	11.5	0.118

Note: All analyses were calculated in Synchro 8 software and reported with HCM 2010 methodology for intersections



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FIGURE 11
Alpine Meadow - Unit 5B
2022 Peak Hour Traffic Volumes -
OPENING YEAR TRAFFIC (WITH
PROJECT)

COMPARISON OF TRIP GENERATION AND TRAFFIC VOLUMES

A comparison of the calculated trip generation rates for the Alpine Meadow traffic impact study by Wilbur Smith Associates for the year 2002 and the projected Alpine Meadow development in the year 2022 is presented in Table 8. As can be seen in the table, the original 2002 traffic impact study projected nearly 700 more daily trips for the entire development than what is projected to occur by the year 2022 once the Alpine Meadow – Unit 5B is constructed, occupied and added to the existing Alpine Meadow Subdivision.

**TABLE 8
TRIP GENERATION CALCULATION COMPARISONS**

	GENERATED DAILY TRAFFIC	GENERATED TRAFFIC AM PEAK HOUR			GENERATED TRAFFIC PM PEAK HOUR		
		ENTER	EXIT	TOTAL	ENTER	EXIT	TOTAL
Trip Generation Calculation for Original Alpine Meadow for Year 2005	2,302	44	132	176	150	84	234
Trip Generation Calculation for Current Alpine Meadow (2019) - 128 units	1,192	15	53	68	53	43	96
Trip Generation Calculation for Proposed Alpine Meadow for Year 2022 - 183 units	1,643	21	73	94	73	60	133
Trip Generation Calculation Amounts - Comparison between 2002 and 2022	-659	-23	-59	-82	-77	-24	-101
Trip Generation Calculation Percentage - Comparison between 2002 and 2022	-28.6%	-52.3%	-44.7%	-46.6%	-51.3%	-28.6%	-43.2%

A comparison of the traffic counts for Alpine Meadow in 2002 (conducted by Wilbur Smith Associates), the projected traffic counts for 2005 (calculated by Wilbur Smith Associates), the existing traffic counts (2019), and the projected traffic in the year 2022 when the entire Alpine Meadow Subdivision is constructed and occupied is presented in Table 9.

**TABLE 9
INTERSECTION TRAFFIC VOLUME COMPARISONS**

East Beaver Creek Drive at Rocky Mountain High Boulevard

	Rocky Mountain High Blvd. Southbound		East Beaver Creek Drive Westbound		East Beaver Creek Drive Eastbound	
	LT	RT	THRU	RT	LT	THRU
2002 Traffic Count (Wilbur Smith)						
AM Peak	-	-	260	-	-	159
PM Peak	-	-	601	-	-	514
2005 Projected Traffic (Wilbur Smith)						
AM Peak	40	92	700	13	31	185
PM Peak	25	59	303	45	105	599
2019 Traffic Count						
AM Peak	8	30	875	2	6	163
PM Peak	5	13	366	10	32	722
2022 Projected Traffic						
AM Peak	15	58	954	4	17	178
PM Peak	12	48	399	15	58	787
% Change in Actual Traffic between 2002 & 2019						
AM Peak	n/a	n/a	+236.5%	n/a	n/a	+2.5%
PM Peak	n/a	n/a	-33.6%	n/a	n/a	+53.1%
% Change in Projected Traffic between 2005 & 2022						
AM Peak	-62.5%	-37.0%	+36.3%	-69.2%	-45.2%	-3.8%
PM Peak	-52.0%	-18.6%	+31.7%	-66.7%	-44.8%	+31.4%

RECOMMENDATIONS FOR ORIGINAL ALPINE MEADOW SUBDIVISION (2002)

The original traffic impact study recommendations for Alpine Meadow Subdivision in 2002 by Wilbur Smith Associates were the following:

- Minimize landscaping, using low growing vegetation, and signing at the street access to insure that safe sight distance is maintained.
- Use a minimum intersection radius of 25-foot for the efficient and safe ingress and egress of the site.
- Provide separate left- and right-turn lanes for the site access.
- Provide a 100-foot left-turn and 50-foot right-turn lanes on E. Beaver Creek Drive at the site access street.
- Post the proposed street with a STOP sign (R1-1) at E. Beaver Creek Drive.
- 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 City of Knoxville Public Works Department.
- Provide signalization and left-turn lanes for the intersection of E. Beaver Creek Drive and Central Avenue Pike. Left-turn storage on E. Beaver Creek should be approximately 250 feet and approximately 500 feet on Central Avenue Pike. The signal design must consider any sight distance limitations.

All of these recommendations appear to have been constructed. As seen above, the original traffic impact study recommended that the intersection of East Beaver Creek Drive at Central Avenue Pike be reconstructed with a traffic signal. This intersection is located approximately a half mile to the southwest of Alpine Meadow Subdivision. Based on historical aerial mapping at kgis.org, this intersection was reconstructed with a traffic signal around 2008.

RECOMMENDATIONS FOR MITIGATION OF PROPOSED DEVELOPMENT

The following is an overview of recommendations for Alpine Meadow Subdivision based on the existing and projected conditions assessment:

- It is recommended that a white right turn arrow be installed on the pavement of the westbound right turn lane on East Beaver Creek Drive as shown in the photograph. Installing this turn arrow will improve the delineation of the turn lane from the westbound thru lane.



Proposed White Right Turn Arrow at Westbound Right Turn Lane on East Beaver Creek Drive (Looking Northeast)

- It is recommended that a white lane line with left and right turn arrows be installed on the pavement of the southbound approach of Rocky Mountain High Boulevard at East Beaver Creek Drive as shown in the photograph. Installing these markings will



Proposed White Lane Line and Turn Arrows on Rocky Mountain High Boulevard at East Beaver Creek Drive (Looking Southeast)

improve the delineation of the turn lanes and reduce the possibility of a vehicle straddling both lanes while attempting to turn. Based on the geometry and dimensions of the approach at East Beaver Creek Drive, the white lane line dividing the left and right turn lanes should be approximately 45 feet in length. The width of the pavement at this exit approach is 23 feet and sufficient to delineate two exiting lanes.

- To reduce the possibility of eastbound left turns from turning into the southbound exiting boulevard lane of Rocky Mountain High Boulevard at East Beaver Creek Drive, it is recommended that yellow center



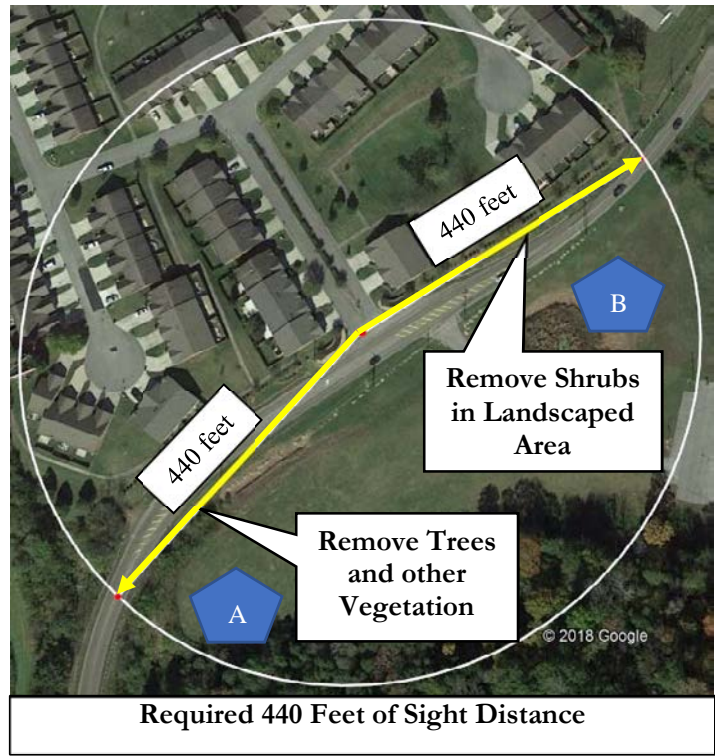
Proposed Yellow Pavement Markings in Front of Existing Raised Median on Rocky Mountain High Boulevard at East Beaver Creek Drive (Looking Northwest)

pavement markings be applied to the pavement in between the white stop bar line and the existing raised median. The raised median nose currently has a Keep Right (R4-7) sign but should be complemented with yellow markings as shown in the photograph. Installing these markings will improve the delineation between the boulevard entrance and exit lanes and reduce the possibility of a vehicle entering the wrong way.

- A spot speed study was conducted to determine if the available sight distance is adequate from Rocky Mountain High Boulevard with the existing horizontal curves located to the east and west on East Beaver Creek Drive. Vehicle speeds were sampled and tabulated using a Bushnell Speedster III Radar Speed Gun. The vehicles that were tabulated for the spot speed study were the eastbound and westbound motorists along East Beaver Creek Drive.

As expected, the results of the spot speed study indicate that most of the traffic along East Emory Road travels at a slightly higher speed than the posted speed limit. The posted speed limit on East Beaver Creek Drive is 40 mph. The results of the spot speed study indicate that the observed 85th percentile speed was 44 mph. The spot speed field observations are provided in Appendix E. Based on this result, the required intersection sight distance would be 440 feet according to a policy of requiring 10 feet of sight distance per 1 mph of speed.

Based on the results of the spot speed study, it is recommended that the existing vegetation be removed where shown in the following photographs to provide a minimum of 440 feet of sight distance. Spring and summer vegetation growth will exacerbate what is shown in the photographs. Vegetation control will also need to be maintained in the future. Vegetation that needs to be removed is located to the northeast and is on the Alpine Meadow Subdivision property and the vegetation to the southwest is located on the public right-of-way.



This vegetation is currently suspected of limiting the required sight distance of 440 feet. Sight distance needs to be confirmed and verified by a licensed land surveyor.





- Due to the projected longer delays at the southbound approach of the intersection of East Beaver Creek Drive at Rocky Mountain High Boulevard, the projected queue lengths were calculated for the year 2022 in the AM and PM peak hours.

To estimate the projected queue length, SimTraffic (Version 8) software was employed. SimTraffic performs micro-simulation and animation of vehicular traffic and calculates various vehicle parameters such as intersection vehicle queue lengths. Based on the projected volumes during the PM peak hour, the 95th percentile queue lengths were calculated. The 95th percentile queue is the recognized measurement in the traffic engineering profession as the design standard used when considering vehicle queue lengths. A 95th percentile queue means that there is a 95% certainty the queue will not extend beyond that point. The calculated queue results were based on averaging the outcome obtained during 10 traffic simulations. The queue results from the SimTraffic software are in Appendix F and in Table 10.

These results would indicate that even though the level of service will be poor during the AM and PM peak hour for the southbound approach, the estimated queue lengths are reasonably contained within the existing available turn lane lengths and will be relatively short in nature.

**TABLE 10
TURN LANE STORAGE & QUEUE SUMMARY**

2022 AM Projected Peak Hour Traffic Volumes

Intersection Name/Turn Lane	Volume (vph) *	Existing Storage Length (ft)	Sim Traffic 95% Queue (ft)
East Beaver Creek Drive at Rocky Mountain High Boulevard			
Eastbound Left	17	110	31
Southbound Left	15	40	33
Southbound Right	58	n/a	53

2022 PM Projected Peak Hour Traffic Volumes

Intersection Name/Turn Lane	Volume (vph) *	Existing Storage Length (ft)	Sim Traffic 95% Queue (ft)
East Beaver Creek Drive at Rocky Mountain High Boulevard			
Eastbound Left	58	110	43
Southbound Left	12	40	30
Southbound Right	48	n/a	39

- The existing internal intersections were reviewed and determined to be sufficient. The addition of 55 homes to the rear of the existing subdivision will result in additional traffic volumes. Based on the existing layout of the subdivision, it is expected that most of these volumes will occur on the east side of Snowmass Drive and High Alpine Lane.

For the proposed roads in Alpine Meadow – Unit 5B, it is recommended that a Stop Sign (R1-1) be installed at the Road “A” approach at the extension of Long Shot Lane.

APPENDIX A

MPC TRIP GENERATION RATES

Local Apartment Trip Generation Study

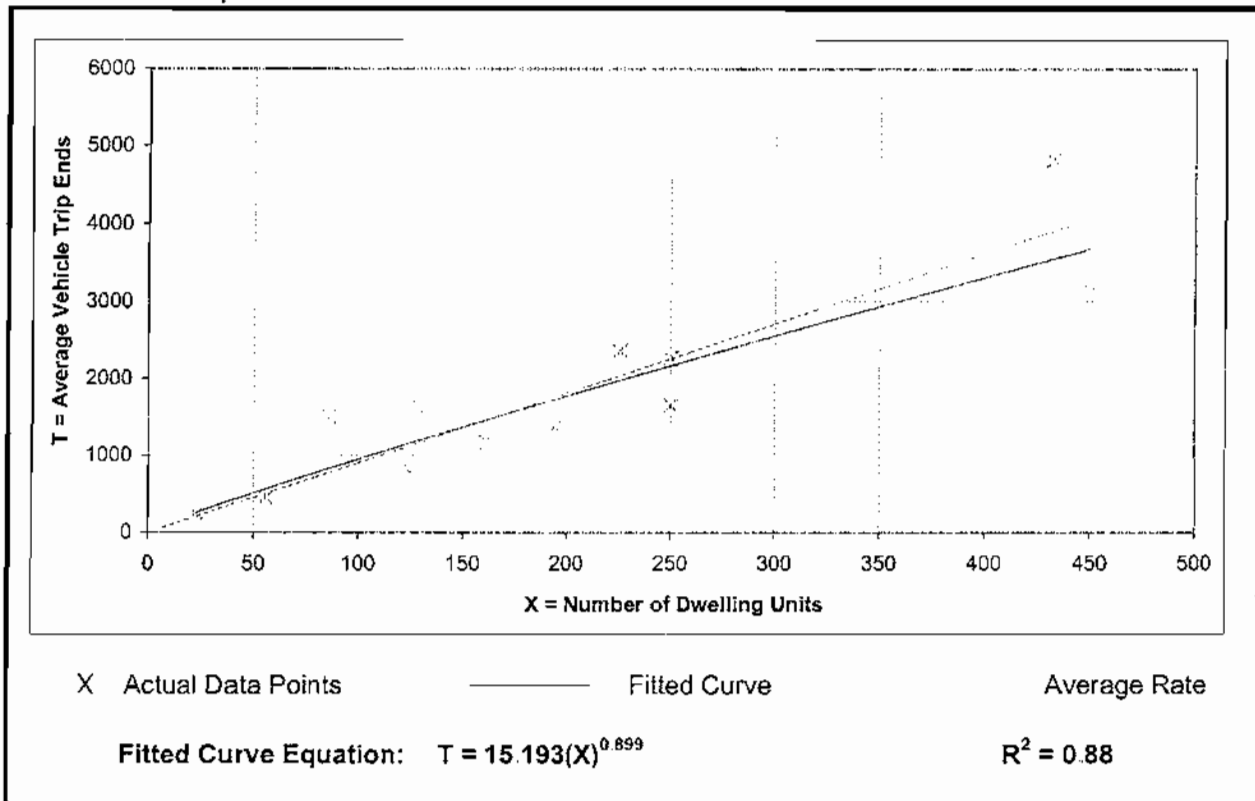
Average Vehicle Trip Ends vs: Dwelling Units
On a: Weekday

Number of Studies: 13
Average Number of Dwelling Units: 193
Directional Distribution: 50% entering, 50% exiting

Trip Generation Per Dwelling Unit

Average Rate	Ranges of Rates	Standard Deviation
9.03	6.59 - 17.41	2.47

Data Plot and Equation



Local Apartment Trip Generation Study

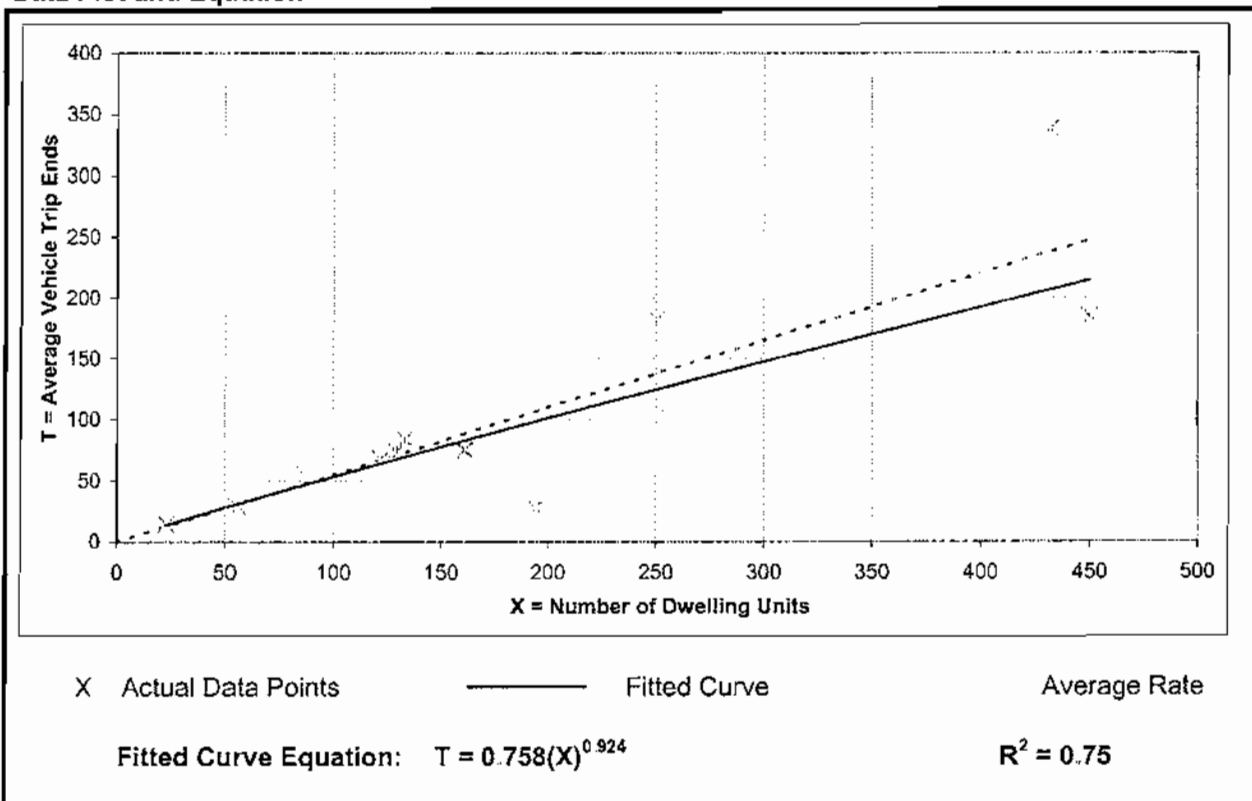
Average Vehicle Trip Ends vs: Dwelling Units
 On a: Weekday,
 Peak Hour of Adjacent Street Traffic,
 One Hour Between 7 and 9 a.m.

Number of Studies: 13
 Average Number of Dwelling Units: 193
 Directional Distribution: 22% entering, 78% exiting

Trip Generation Per Dwelling Unit

Average Rate	Ranges of Rates	Standard Deviation
0.55	0.14 - 0.78	0.18

Data Plot and Equation



Local Apartment Trip Generation Study

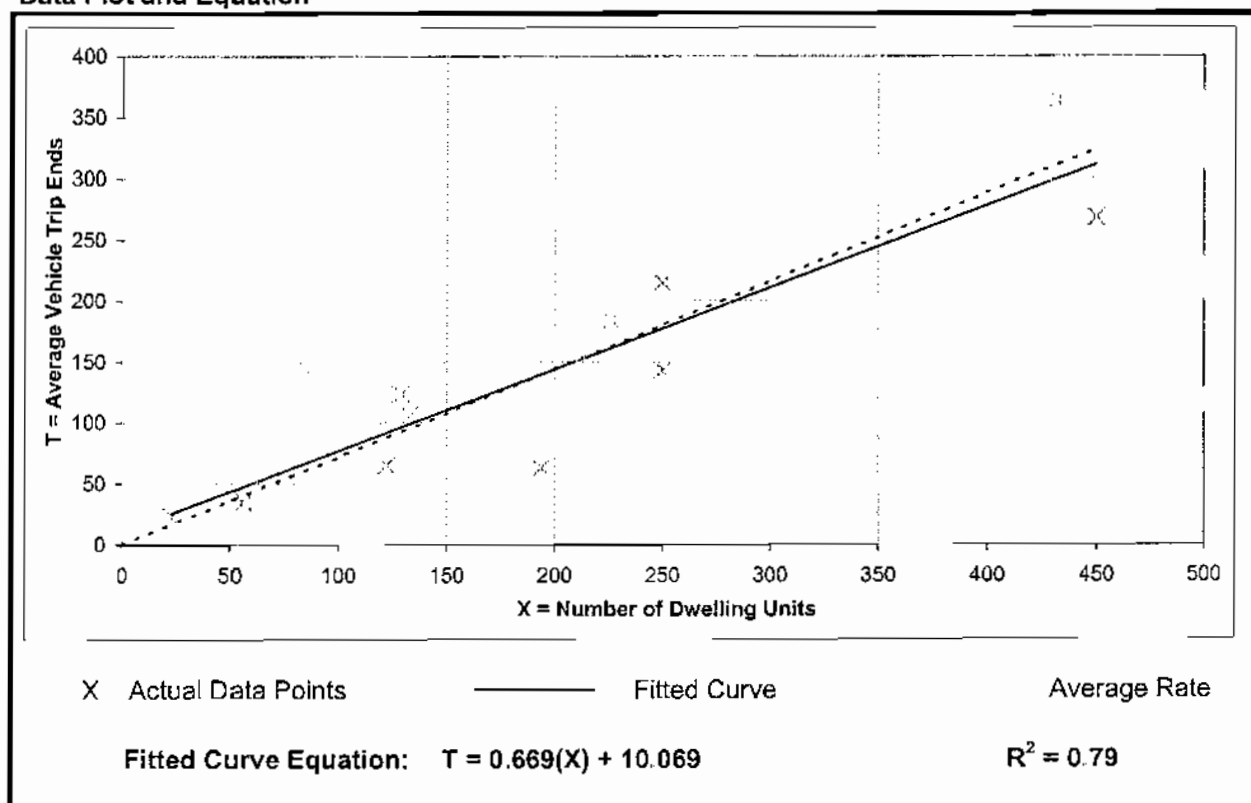
Average Vehicle Trip Ends vs: Dwelling Units
 On a: Weekday,
 Peak Hour of Adjacent Street Traffic,
 One Hour Between 4 and 6 p.m.

Number of Studies: 13
 Average Number of Dwelling Units: 193
 Directional Distribution: 55% entering, 45% exiting

Trip Generation Per Dwelling Unit

Average Rate	Ranges of Rates	Standard Deviation
0.72	0.32 - 1.66	0.25

Data Plot and Equation



TRIP GENERATION FOR CURRENT ALPINE MEADOWS (2019)
 128 single-family attached homes (apartments)

EXISTING LAND USE	MPC LAND USE DESCRIPTION	SIZE ^a	GENERATED DAILY TRAFFIC	GENERATED TRAFFIC AM PEAK HOUR			GENERATED TRAFFIC PM PEAK HOUR		
				ENTER	EXIT	TOTAL	ENTER	EXIT	TOTAL
Attached Residential Homes	Apartments	128 units	1,192	22%	78%		55%	45%	
				15	53	68	53	43	96
Total New Volume Site Trips			1,192	15	53	68	53	43	96

MPC Trip Generation Study, December 1999

TRIP GENERATION FOR CURRENT ALPINE MEADOWS (2019)
128 single-family attached homes (apartments)

128 Residential Units = X

Weekday:

Fitted Curve Equation: $T = 15.193(X)^{0.899}$

$$T = 15.193 * 78.412$$
$$T = 1,192 \text{ trips}$$

Peak Hour of Adjacent Traffic between 7 and 9 am:

Fitted Curve Equation: $T = 0.758(X)^{0.924}$

$$T = 0.758 * 88.524$$
$$T = 68 \text{ trips}$$

Peak Hour of Adjacent Traffic between 4 and 6 pm:

Fitted Curve Equation: $T = 0.669(X)+10.069$

$$T = 0.669 * 128 + 10.069$$
$$T = 96 \text{ trips}$$

TRIP GENERATION FOR PROPOSED ALPINE MEADOWS FOR YEAR 2022
183 single-family attached homes (apartments)

EXISTING LAND USE	MPC LAND USE DESCRIPTION	SIZE ^a	GENERATED DAILY TRAFFIC	GENERATED TRAFFIC AM PEAK HOUR			GENERATED TRAFFIC PM PEAK HOUR		
				ENTER	EXIT	TOTAL	ENTER	EXIT	TOTAL
Attached Residential Homes	Apartments	183 units	1,643	22%	78%		55%	45%	
				21	73	94	73	60	133
Total New Volume Site Trips			1,643	21	73	94	73	60	133

MPC Trip Generation Study, December 1999

TRIP GENERATION FOR PROPOSED ALPINE MEADOWS FOR YEAR 2022
183 single-family attached homes (apartments)

183 Residential Units = X

Weekday:

Fitted Curve Equation: $T = 15.193(X)^{0.899}$

$$T = 15.193 * 108.129$$
$$\underline{\underline{T = 1,643 \text{ trips}}}$$

Peak Hour of Adjacent Traffic between 7 and 9 am:

Fitted Curve Equation: $T = 0.758(X)^{0.924}$

$$T = 0.758 * 123.170$$
$$\underline{\underline{T = 94 \text{ trips}}}$$

Peak Hour of Adjacent Traffic between 4 and 6 pm:

Fitted Curve Equation: $T = 0.669(X)+10.069$

$$T = 0.669 * 183 + 10.069$$
$$\underline{\underline{T = 133 \text{ trips}}}$$

APPENDIX B

MANUAL TRAFFIC COUNT DATA

TRAFFIC COUNT DATA

Major Street: East Beaver Creek Drive (WB - EB)
 Minor Street: Rocky Mountain High Boulevard (SB)
 Traffic Control: Stop Control on Rocky Mountain High Boulevard

2/21/2019 (Thursday)
 Overcast
 Conducted by: Ajax Engineering

TIME BEGIN	Rocky Mountain High Boulevard		East Beaver Creek Drive		East Beaver Creek Drive		VEHICLE TOTAL	PEAK HOUR
	SOUTHBOUND		WESTBOUND		EASTBOUND			
	LT	RT	THRU	RT	LT	THRU		
7:00 AM	1	8	153	0	0	26	188	
7:15 AM	2	7	208	0	3	35	255	7:15 AM - 8:15 AM
7:30 AM	1	8	275	1	1	34	320	
7:45 AM	2	5	227	1	1	49	285	
8:00 AM	3	10	165	0	1	45	224	
8:15 AM	0	4	117	0	0	43	164	
8:30 AM	0	8	97	2	1	33	141	
8:45 AM	0	4	110	0	2	42	158	
TOTAL	9	54	1352	4	9	307	1735	
3:00 PM	0	5	80	2	5	107	199	
3:15 PM	1	2	79	0	4	118	204	
3:30 PM	1	5	100	1	2	134	243	
3:45 PM	0	2	69	0	5	122	198	
4:00 PM	1	2	98	2	5	145	253	
4:15 PM	2	2	97	1	8	154	264	
4:30 PM	0	4	73	1	7	160	245	
4:45 PM	2	3	98	1	7	153	264	
5:00 PM	2	0	92	5	8	183	290	5:00 PM - 6:00 PM
5:15 PM	1	3	97	0	6	194	301	
5:30 PM	1	5	89	3	10	177	285	
5:45 PM	1	5	88	2	8	168	272	
TOTAL	12	38	1060	18	75	1815	3018	

2019 AM Peak Hour **7:15 AM - 8:15 AM**

TIME BEGIN	Rocky Mountain High Boulevard		East Beaver Creek Drive		East Beaver Creek Drive	
	SOUTHBOUND		WESTBOUND		EASTBOUND	
	LT	RT	THRU	RT	LT	THRU
7:15 AM	2	7	208	0	3	35
7:30 AM	1	8	275	1	1	34
7:45 AM	2	5	227	1	1	49
8:00 AM	3	10	165	0	1	45
TOTAL	8	30	875	2	6	163
PHF	0.67	0.75	0.80	0.50	0.50	0.83

2019 PM Peak Hour **5:00 PM - 6:00 PM**

TIME BEGIN	Rocky Mountain High Boulevard		East Beaver Creek Drive		East Beaver Creek Drive	
	SOUTHBOUND		WESTBOUND		EASTBOUND	
	LT	RT	THRU	RT	LT	THRU
5:00 PM	2	0	92	5	8	183
5:15 PM	1	3	97	0	6	194
5:30 PM	1	5	89	3	10	177
5:45 PM	1	5	88	2	8	168
TOTAL	5	13	366	10	32	722
PHF	0.63	0.65	0.94	0.50	0.80	0.93

APPENDIX C

CAPACITY ANALYSES – HCM WORKSHEETS (SYNCHRO 8)

Intersection

Int Delay, s/veh 1

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Vol, veh/h	6	163	875	2	8	30
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	110	-	-	35	40	0
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	2	-2	-	1	-
Peak Hour Factor	50	83	80	50	67	75
Heavy Vehicles, %	0	0	0	0	0	0
Mvmt Flow	12	196	1094	4	12	40

Major/Minor	Major1	Major2	Minor2
Conflicting Flow All	1094	0	1314
Stage 1	-	-	1094
Stage 2	-	-	220
Critical Hdwy	4.1	-	6.6
Critical Hdwy Stg 1	-	-	5.6
Critical Hdwy Stg 2	-	-	5.6
Follow-up Hdwy	2.2	-	3.5
Pot Cap-1 Maneuver	645	-	164
Stage 1	-	-	305
Stage 2	-	-	811
Platoon blocked, %	-	-	-
Mov Cap-1 Maneuver	645	-	161
Mov Cap-2 Maneuver	-	-	161
Stage 1	-	-	305
Stage 2	-	-	796

Approach	EB	WB	SB
HCM Control Delay, s	0.6	0	23.4
HCM LOS			C

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	645	-	-	-	161	255
HCM Lane V/C Ratio	0.019	-	-	-	0.074	0.157
HCM Control Delay (s)	10.7	-	-	-	29.1	21.7
HCM Lane LOS	B	-	-	-	D	C
HCM 95th %tile Q(veh)	0.1	-	-	-	0.2	0.5

Intersection

Int Delay, s/veh 0.6

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Vol, veh/h	32	722	366	10	5	13
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	110	-	-	35	40	0
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	2	-2	-	1	-
Peak Hour Factor	80	93	94	50	63	65
Heavy Vehicles, %	0	0	0	0	0	0
Mvmt Flow	40	776	389	20	8	20

Major/Minor	Major1	Major2	Minor2
Conflicting Flow All	389	0	1245
Stage 1	-	-	389
Stage 2	-	-	856
Critical Hdwy	4.1	-	6.6
Critical Hdwy Stg 1	-	-	5.6
Critical Hdwy Stg 2	-	-	5.6
Follow-up Hdwy	2.2	-	3.5
Pot Cap-1 Maneuver	1181	-	181
Stage 1	-	-	674
Stage 2	-	-	400
Platoon blocked, %	-	-	-
Mov Cap-1 Maneuver	1181	-	175
Mov Cap-2 Maneuver	-	-	175
Stage 1	-	-	674
Stage 2	-	-	386

Approach	EB	WB	SB
HCM Control Delay, s	0.4	0	15.2
HCM LOS			C

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	1181	-	-	-	175	657
HCM Lane V/C Ratio	0.034	-	-	-	0.045	0.03
HCM Control Delay (s)	8.2	-	-	-	26.5	10.7
HCM Lane LOS	A	-	-	-	D	B
HCM 95th %tile Q(veh)	0.1	-	-	-	0.1	0.1

Intersection

Int Delay, s/veh 1

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Vol, veh/h	6	178	954	2	8	30
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	110	-	-	35	40	0
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	2	-2	-	1	-
Peak Hour Factor	50	83	80	50	67	75
Heavy Vehicles, %	0	0	0	0	0	0
Mvmt Flow	12	214	1192	4	12	40

Major/Minor	Major1	Major2	Minor2
Conflicting Flow All	1193	0	1431
Stage 1	-	-	1193
Stage 2	-	-	238
Critical Hdwy	4.1	-	6.6
Critical Hdwy Stg 1	-	-	5.6
Critical Hdwy Stg 2	-	-	5.6
Follow-up Hdwy	2.2	-	3.5
Pot Cap-1 Maneuver	592	-	138
Stage 1	-	-	272
Stage 2	-	-	796
Platoon blocked, %	-	-	-
Mov Cap-1 Maneuver	592	-	135
Mov Cap-2 Maneuver	-	-	135
Stage 1	-	-	272
Stage 2	-	-	780

Approach	EB	WB	SB
HCM Control Delay, s	0.6	0	26.9
HCM LOS			D

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	592	-	-	-	135	222
HCM Lane V/C Ratio	0.02	-	-	-	0.088	0.18
HCM Control Delay (s)	11.2	-	-	-	34.2	24.7
HCM Lane LOS	B	-	-	-	D	C
HCM 95th %tile Q(veh)	0.1	-	-	-	0.3	0.6

Intersection

Int Delay, s/veh 0.6

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Vol, veh/h	32	787	399	10	5	13
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	110	-	-	35	40	0
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	2	-2	-	1	-
Peak Hour Factor	80	93	94	50	63	65
Heavy Vehicles, %	0	0	0	0	0	0
Mvmt Flow	40	846	424	20	8	20

Major/Minor	Major1	Major2	Minor2
Conflicting Flow All	424	0	424
Stage 1	-	-	424
Stage 2	-	-	926
Critical Hdwy	4.1	-	6.6
Critical Hdwy Stg 1	-	-	5.6
Critical Hdwy Stg 2	-	-	5.6
Follow-up Hdwy	2.2	-	3.5
Pot Cap-1 Maneuver	1146	-	627
Stage 1	-	-	649
Stage 2	-	-	369
Platoon blocked, %	-	-	-
Mov Cap-1 Maneuver	1146	-	627
Mov Cap-2 Maneuver	-	-	150
Stage 1	-	-	649
Stage 2	-	-	356

Approach	EB	WB	SB
HCM Control Delay, s	0.4	0	16.4
HCM LOS			C

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	1146	-	-	-	150	627
HCM Lane V/C Ratio	0.035	-	-	-	0.053	0.032
HCM Control Delay (s)	8.3	-	-	-	30.3	10.9
HCM Lane LOS	A	-	-	-	D	B
HCM 95th %tile Q(veh)	0.1	-	-	-	0.2	0.1

Intersection

Int Delay, s/veh 2.3

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Vol, veh/h	17	178	954	4	15	58
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	110	-	-	35	40	0
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	2	-2	-	1	-
Peak Hour Factor	50	83	80	50	67	75
Heavy Vehicles, %	0	0	0	0	0	0
Mvmt Flow	34	214	1192	8	22	77

Major/Minor	Major1	Major2	Minor2
Conflicting Flow All	1193	0	1475
Stage 1	-	-	1193
Stage 2	-	-	282
Critical Hdwy	4.1	-	6.6
Critical Hdwy Stg 1	-	-	5.6
Critical Hdwy Stg 2	-	-	5.6
Follow-up Hdwy	2.2	-	3.5
Pot Cap-1 Maneuver	592	-	130
Stage 1	-	-	272
Stage 2	-	-	758
Platoon blocked, %	-	-	-
Mov Cap-1 Maneuver	592	-	123
Mov Cap-2 Maneuver	-	-	123
Stage 1	-	-	272
Stage 2	-	-	714

Approach	EB	WB	SB
HCM Control Delay, s	1.6	0	32.1
HCM LOS			D

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	592	-	-	-	123	222
HCM Lane V/C Ratio	0.057	-	-	-	0.182	0.348
HCM Control Delay (s)	11.5	-	-	-	40.7	29.6
HCM Lane LOS	B	-	-	-	E	D
HCM 95th %tile Q(veh)	0.2	-	-	-	0.6	1.5

Intersection

Int Delay, s/veh 1.5

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Vol, veh/h	58	787	399	15	12	48
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	110	-	-	35	40	0
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	2	-2	-	1	-
Peak Hour Factor	80	93	94	50	63	65
Heavy Vehicles, %	0	0	0	0	0	0
Mvmt Flow	72	846	424	30	19	74

Major/Minor	Major1	Major2	Minor2
Conflicting Flow All	424	0	424
Stage 1	-	-	424
Stage 2	-	-	991
Critical Hdwy	4.1	-	6.6
Critical Hdwy Stg 1	-	-	5.6
Critical Hdwy Stg 2	-	-	5.6
Follow-up Hdwy	2.2	-	3.5
Pot Cap-1 Maneuver	1146	-	627
Stage 1	-	-	649
Stage 2	-	-	343
Platoon blocked, %	-	-	-
Mov Cap-1 Maneuver	1146	-	627
Mov Cap-2 Maneuver	-	-	-
Stage 1	-	-	649
Stage 2	-	-	321

Approach	EB	WB	SB
HCM Control Delay, s	0.7	0	16.7
HCM LOS			C

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	1146	-	-	-	132	627
HCM Lane V/C Ratio	0.063	-	-	-	0.144	0.118
HCM Control Delay (s)	8.4	-	-	-	36.8	11.5
HCM Lane LOS	A	-	-	-	E	B
HCM 95th %tile Q(veh)	0.2	-	-	-	0.5	0.4

APPENDIX D

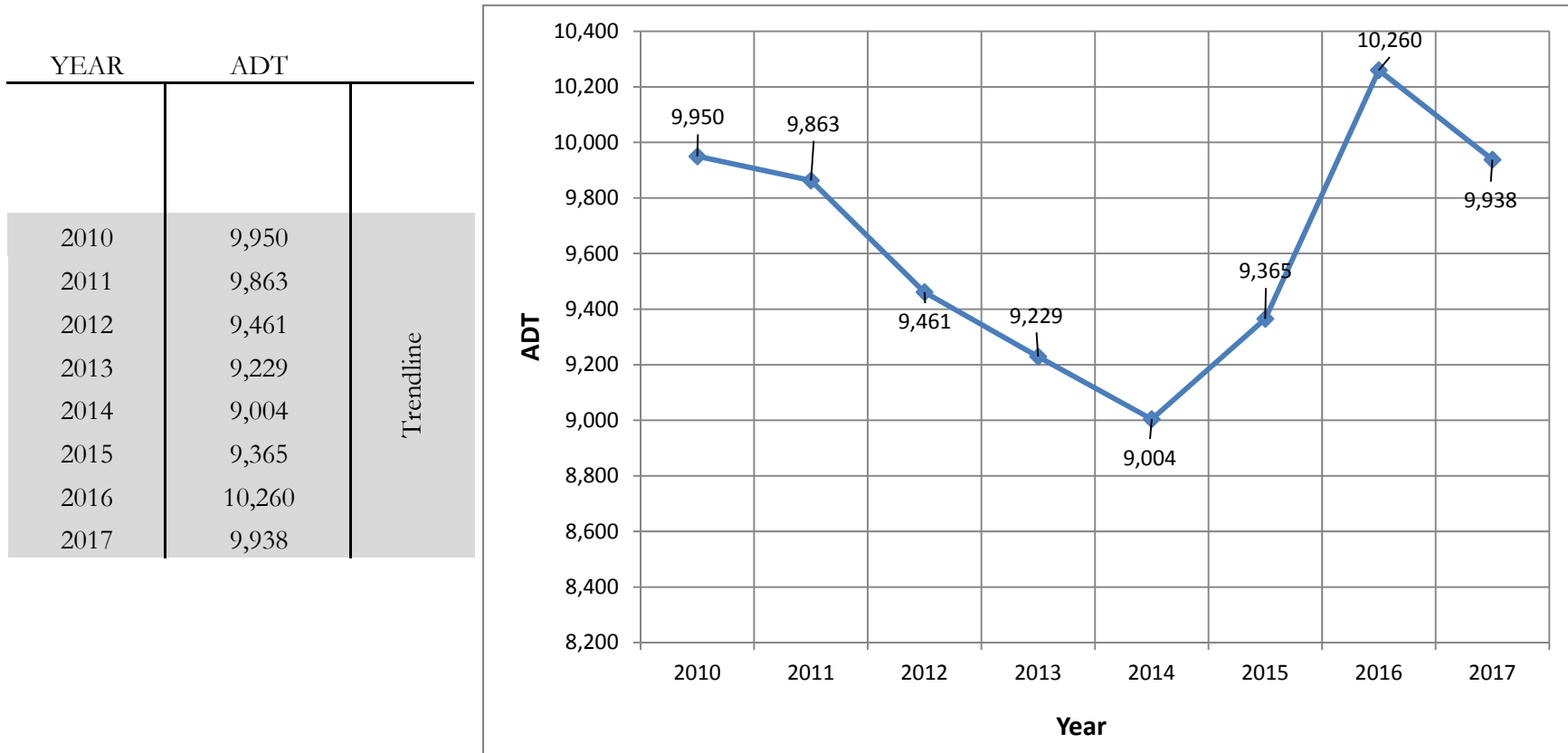
TDOT HISTORICAL TRAFFIC COUNT DATA

Historical Traffic Counts

Organization: TDOT

Station ID #: 000467

Location: Beaver Creek Drive - North of Central Avenue

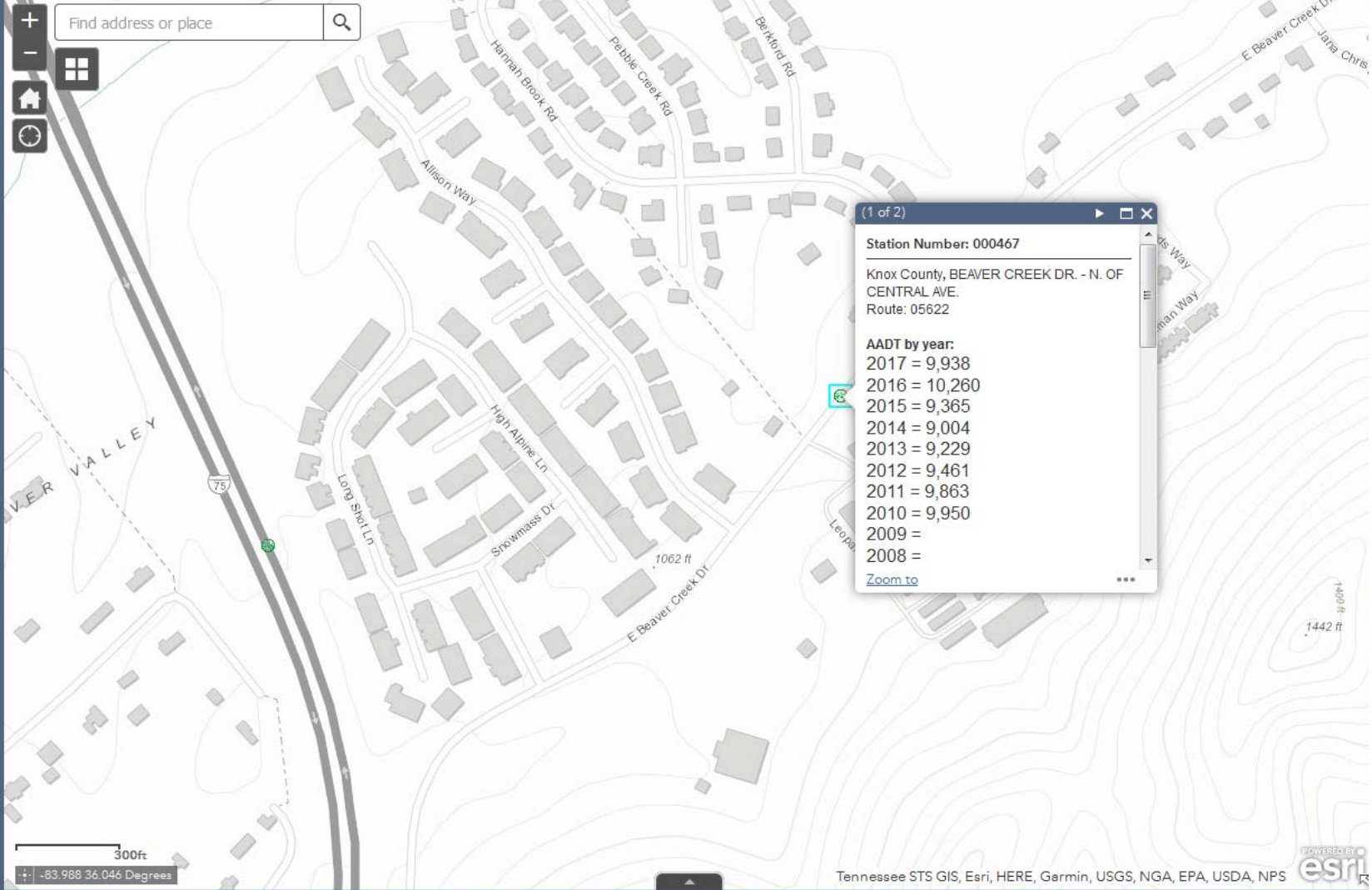


2010 - 2017 Growth Rate = -0.1%

Average Annual Growth Rate = -0.02%

Find address or place

Navigation icons: Home, Refresh, Layers, Download



(1 of 2)

Station Number: 000467

Knox County, BEAVER CREEK DR. - N. OF CENTRAL AVE.
Route: 05622

AADT by year:

2017	= 9,938
2016	= 10,260
2015	= 9,365
2014	= 9,004
2013	= 9,229
2012	= 9,461
2011	= 9,863
2010	= 9,950
2009	=
2008	=

[Zoom to](#)

300ft
-83.988 36.046 Degrees

APPENDIX E
SPOT SPEED STUDY

SPOT SPEED STUDY

Location: East Beaver Creek Drive at Rocky Mountain High Boulevard
 Posted Speed Limit: 40 mph
 Equipment: Bushnell Speedster III Radar Speed Gun
 Direction: Westbound and Eastbound

Date: 2/20/19
 Weather: Overcast
 Time: 12:30 PM
 Pavement Conditions: Dry

Vehicle #	Speed (mph)
1	39
2	41
3	44
4	41
5	39
6	34
7	36
8	40
9	37
10	44
11	38
12	40
13	43
14	38
15	34
16	40
17	43
18	37
19	43
20	38
21	42
22	40
23	43
24	40
25	43

Vehicle #	Speed (mph)
26	39
27	44
28	42
29	42
30	38
31	43
32	45
33	44
34	43
35	43
36	38
37	40
38	42
39	43
40	39
41	40
42	40
43	44
44	48
45	45
46	38
47	38
48	35
49	43
50	49

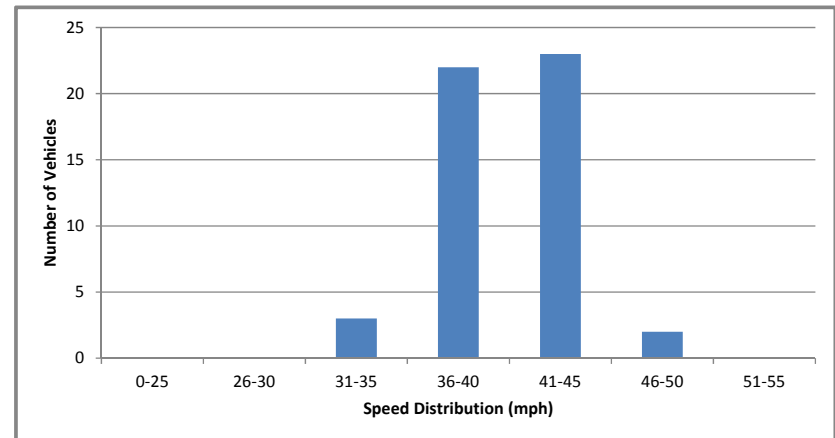
Sample Size Requirements (*ITE Manual of Transportation Engineering Studies*)

$$N = (S * K / E)^2$$

where: N = minimum number of measured speeds
 S = estimated sample standard deviation (mph)
 K = constant corresponding to desired confidence level
 E = permitted error in the average speed estimate (mph)

S = 5 mph (Table 3-2, page 38)
 K = 2.58 (Confidence level of 99% - Table 3-3, page 38)
 E = 2 mph assumed error range

Therefore, N = 42 observations needed



Average speed = 40.8 mph
 50th percentile speed = 40.5 mph
 85th percentile speed = 44.0 mph

APPENDIX F

PROJECTED VEHICLE QUEUE LENGTHS

Intersection: 3: East Beaver Creek Drive & Rocky Mountain High Boulevard

Movement	EB	SB	SB
Directions Served	L	L	R
Maximum Queue (ft)	43	45	68
Average Queue (ft)	9	10	26
95th Queue (ft)	31	33	53
Link Distance (ft)			562
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)	110	40	
Storage Blk Time (%)		1	3
Queuing Penalty (veh)		0	1

Network Summary

Network wide Queuing Penalty: 1

Intersection: 3: East Beaver Creek Drive & Rocky Mountain High Boulevard

Movement	EB	SB	SB
Directions Served	L	L	R
Maximum Queue (ft)	48	34	43
Average Queue (ft)	17	8	20
95th Queue (ft)	43	30	39
Link Distance (ft)			562
Upstream Blk Time (%)			
Queuing Penalty (veh)			
Storage Bay Dist (ft)	110	40	
Storage Blk Time (%)		0	1
Queuing Penalty (veh)		0	0

Network Summary

Network wide Queuing Penalty: 0