



TECHNICAL MEMORANDUM

Date: Thursday, March 14, 2024

To: Adam Culpepper
Town of Zebulon Planning Department
Senior Planner

From: Brittany Chase, P.E.
Senior Traffic Engineer
Exult Engineering

Subject: Zebulon RV Campground
Trip Generation Comparison (Revised)

BACKGROUND

Exult Engineering has been contracted to perform traffic engineering services for the proposed RV Campground located in Zebulon, North Carolina. As shown on the Vicinity Map on Figure 1, the proposed 35.4-acre site is located on the east side of Shepard School Road south of the Tippet Road intersection. The proposed development is to consist of approximately 81 campsites (approximately 50 RV sites, 11 glamping sites, 8 yurt sites, and 12 tent sites) as shown on the Proposed Site Plan on Figure 2. The access for the proposed site consists of one full movement driveway on Shepard School Road. The proposed site is to be developed by summer of 2025. The proposed development does require rezoning. The purpose of this letter is to discuss the trip generation of the proposed site and how this compares to the trip generation of the maximum allowable use under the current zoning. This letter is a revised version of a previously submitted letter dated May 15, 2023. This letter has been updated to incorporate supplemental trip generation data and to account for a minor reduction in the number of campsites.

TRIP GENERATION

The proposed Zebulon RV Campground is to consist of approximately 81 campsites comprised of approximately 50 RV sites, 11 glamping sites, 8 yurt sites, and 12 tent sites. The trip generation for the proposed site was based on rates and equations published in the Institute of Transportation Engineers (ITE) *Trip Generation Manual*, 11th Edition. The current version of the NCDOT Congestion Management Rates vs. Equations spreadsheet was used for guidance.

The ITE *Trip Generation Manual* provides rates and equations for the AM and PM peak hour trip generation of a campground but does not provide data for weekday trip generation. Therefore, data available within the *Base Camp – Eagle Traffic Impact Study* (SGM, Inc., December 30, 2020) was used to supplement the rates and equations provided in the *Trip Generation Manual*. Traffic count data was obtained from a similar campground site in Silt, Colorado (KOA Campground) to determine the rate used for the daily trip generation within the *Base Camp – Eagle Traffic Impact Study*. At the time of traffic count data collection, the KOA Campground consisted of 73 campsites and resulted in a rate of 1.51 daily trips per campsite during the weekday in the peak summer months. The *Base Camp – Eagle Traffic Impact Study* is included as an Attachment to this letter.

Applying the AM and PM peak hour rates and equations presented in the ITE *Trip Generation Manual* as well as the daily rate obtained for traffic count data collection, the proposed development is expected to generate 123 daily trips, 17 AM peak hour trips (6 entering, 11 exiting), and 22 PM peak hour trips (14 entering, 8 exiting).

The AM and PM peak hour trip generation presented in the table below is expected to represent a conservative estimate because the independent variable used to calculate the site trips is listed as “occupied campsites” within the ITE *Trip Generation Manual* rather than “total campsites.” Therefore, trip generation presented herein for the AM and PM peak hours assumes 100% occupancy.

It is important to note that because the proposed site requires rezoning, a comparison between the trip generation potential of the maximum allowable use under current zoning and the trip generation potential of the proposed development is required. The site is currently zoned as Residential Suburban (R2) on the Town of Zebulon’s *Official Zoning Map*. If the site were developed under current zoning designations, a maximum of 70 single family dwelling units would be permitted based on the allowable 2 units/acre density. Under current zoning, the development is expected to generation 728 daily trips, 54 AM peak hour trips (13 entering, 41 exiting), and 71 PM peak hour trips (45 entering, 26 exiting).

Table 1: Trip Generation for Zebulon RV Campground

Land Use			Daily	AM Peak Hour			PM Peak Hour		
				Total	Enter	Exit	Total	Enter	Exit
416: Campground/ RV Park	81	Occupied Sites	123	17	6	11	22	14	8
Total Proposed Site Trips			123	17	6	11	22	14	8
<i>Current Zoning: LUC 210 Single Family Detached 70 d.u.</i>			728	54	13	41	71	45	26
Additional Site Trips due to Rezoning			-605	-37	-7	-30	-49	-31	-18

References: *Trip Generation Manual*, 11th Edition, Institute of Transportation Engineers, September 2021 and *Base Camp – Eagle Traffic Impact Study* (SGM, Inc., December 30, 2020)

Based on the trip generation potential presented in Table 1, the proposed site is expected to generate less trips when compared to the maximum allowable use under current zoning. The proposed RV Campground is expected to generate 605 fewer daily trips, 37 fewer AM peak hour trips, and 49 fewer PM peak hour trips than the 70 single family dwelling units allowed under the R-2 zoning designation.

As published in the Town of Zebulon’s *Unified Development Ordinance*, a Traffic Impact Analysis (TIA) is required for site plan approval if the proposed development is expected to generate 50 peak hour trips and for rezoning cases if the proposed development is expected to generate 150 peak hour trips. The purpose of a TIA is to analyze the impact of the proposed site during the AM and PM peak hours. The projected AM and PM peak hour site trips presented in Table 1 are well below the Town’s TIA threshold. With the proposed trip generation of the site being less than the Town’s TIA threshold for both site plan submittal and rezoning, a TIA is not necessary to determine impacts of the proposed site.

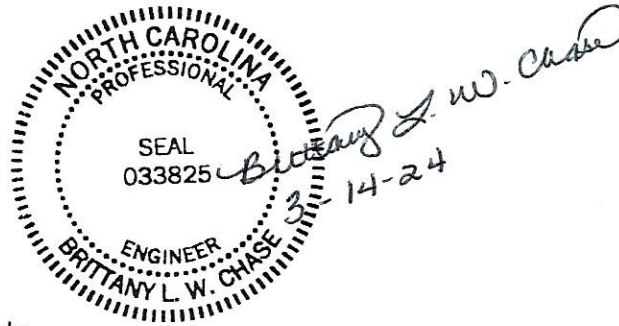
CONCLUSION

Based on the anticipated trip generation presented herein, the proposed site is expected to have minimal impact on the surrounding roadway network.

Please let me know if you have any questions or comments.

Sincerely,

Brittany Chase, P.E.
Exult Engineering



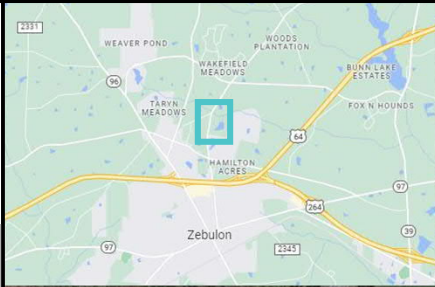
cc: Ryan Rimmele
Matthew Nolfo, NCDOT Senior Assistant District Engineer, Division 5, District 1

Attachments: Figures 1 & 2
Base Camp – Eagle Traffic Impact Study (SGM, Inc., December 30, 2020)

Zebulon RV
Campground

Vicinity Map

Figure 1



Zebulon RV Campground

Proposed Site Plan

Figure 2



MEMORANDUM

DATE: February 25, 2019
REVISED August 1, 2019
REVISED December 30, 2020

TO: Tambi Katieb

CC: Shawn Colby

FROM: Dan Cokley, PE, PTOE, SGM

RE: Traffic Impact Study
Base Camp – Eagle
Eagle County, CO



This Traffic Impact Study addresses an Eagle County engineering request for a Traffic Impact Study (TIS) for this proposed Campground / RV Park to be located at 3220 Brush Creek Road, Eagle County, CO. The Eagle County Land Use Regulations Section 4-620.G require Traffic Impact Studies for proposed developments that are expected to generate more than four hundred (400) vehicle trips per day. This development will generate less traffic, but we are providing an abbreviated TIS that includes the following scope:

- Existing Roadway Conditions
- Existing Traffic Volumes
- Sight distance analysis
- Trip Generation and anticipated vehicle sizes
- Directional Distribution/Traffic Assignment
- Internal Circulation
- Future Traffic Volumes
- Anticipated non-vehicular traffic routes & connections to the Town of Eagle
- Auxiliary turn lane analysis
- Summary of Findings

This study will provide recommendations for the development of a safe driveway access to Brush Creek Road.

Existing Site and Roadway Conditions

The proposed Base Camp Eagle will be located at 3220 Brush Creek Road, southeast of the Town of Eagle. The site is currently residential / agricultural use and shown shaded in red in the Google Earth image on the following page.



Figure 1. Project Area

Access to the site will be provided using an improved access located slightly south of the existing driveway and aligned with the main driveway for the property across Brush Creek Road (Butter Crunch Farm second driveway). The access is located approximately 2.5 miles southeast of downtown Eagle. No turn lanes or pedestrian facilities exist along Brush Creek Road at the access intersection.

Brush Creek Road is a two-lane asphalt collector roadway, approximately 20-22 feet in width, with 1-2-foot gravel shoulders and a posted speed of 40 mph in the vicinity of the access. Brush Creek Road is classified as a Rural Major Collector per Eagle County Article 4. For the purposes of this study and application of the State Highway Access Code, it is classified as a rural highway, R-B using CDOT Access Category standards.

Recent development applications within the Brush Creek Road corridor have resulted in several associated Traffic Impact Studies, the most recent being Frost Creek TIS by McDowell Engineering, latest revision 1/24/17. This study will use the Frost Creek TIS as a reference for existing and future traffic volumes.

Existing Traffic Volumes

Peak hour traffic volumes (2015) from the Frost Creek TIS were reviewed and estimated near the site access along Brush Creek Road. The peak hour two-way volumes are approximately 70 vph AM, 75 vph PM, and 125 vph Saturday. Those values were obtained by interpolating between the Sylvan Lake Rd and Frost Creek Road intersections with Brush Creek Road, the volumes and the interpolation are provided in the Appendix.

Existing Access Sight Distance

The sight distance was analyzed for the access driveway intersection with Brush Creek Road. The analysis reviewed the access as one-way stop-controlled intersection and was based upon the guidance of AASHTO, A Policy on Geometric Design of Highways and Streets, 2018, 7th Edition, (Ch 9, Intersections). The Policy provides for guidance on decision point and construction of the sight triangle. Using Table 9-7 (Left Turn, Case B1) and Table 9-9 (Right Turn, Case B2), the sight distance requirements for the 40-mph posted speed are 445 ft and 385 ft respectively. The current sight distance is at least 600 feet.

The Policy states that the vertex of the sight triangle (decision point) should be located 14.5 ft from the edge of traveled way, the decision point typically represents the location of the driver's eye (at a height of 3.5 ft) when stopped at a major road intersection. The driver should have the ability to see a 6" high object at the center of the travel lane. The sight triangle is constructed using these parameters, and objects that could obscure the driver's vision should be located outside of this sight triangle. The sight distance in each direction at the access is documented below.



Sight Access looking southeast



Sight Access looking northwest

Trip Generation

The proposed campground development consists of 29 RV sites, 20 tent sites and 4 group tent sites (8 equivalent single tent sites) for a total of 57 camp sites as shown in the conceptual site plan provided below. The dump station shown in the site plan will be available to campground users only.



ITE's *Trip Generation (10th Edition)* provides trip generation rates for a Campground and RV Park facility (ITE Code 416) that have 3-6 associated studies for weekday AM and PM peak hour for locations in Rhode Island, Vermont, and Washington from 1990-2010.

Local and more recent trip generation information, including weekend volumes are more useful and preferred for use in this study. It was determined that McDowell Engineering performed a local Trip Generation study at the KOA Campground in Silt, Colorado, located south and west of I-70 exit 97. The trip generation count was completed in July 2016 and consisted of counting RV's, passenger vehicles and trucks / trailers, the generation rates are provided in Passenger Car Equivalents (PCEs). It is noted that there is no pedestrian connection between the KOA Campground and the Town of Silt, which is located to the north of the I-70 interchange. The

diamond interchange has (2) 12-ft lanes and 1 ft paved shoulders. The raw data for this KOA study is provided as an attachment.

The traffic type and use are similar, consisting of passenger vehicles and recreational vehicles, with trailers for boats, four-wheelers or campers. A vehicle and a trailer combination have a passenger car equivalent (PCE) of 2. The resulting trip generation is shown in the Table below.

TRIP GENERATION TABLE																
Base Camp Eagle																
Base Camp	Number of Sites	ITE Code	Average	Design Hour Rates						Average	Design Hour Traffic					
			Saturday Rate	AM Entering	AM Exiting	PM Entering	PM Exiting	SAT Entering	SAT Exiting	Saturday Traffic	AM IN	AM OUT	PM IN	PM OUT	SAT IN	SAT OUT
Camp / RV	57	*	2.36	0.14	0.12	0.16	0.09	0.30	0.33	135	8	7	9	5	17	19
TOTAL TRIPS:										135	8	7	9	5	17	19
<i>Directional Distribution</i>				55%	45%	64%	36%	48%	52%							
<i>Average Rate (in PCE's)</i>				0.26	0.26	0.25	0.25	0.63	0.63							
<i>*KOA Camground count 7/20/16 (Silt, CO)</i>																
SHAC - Vehicles or combination > 20 ft = 2 PCE's																

Trip Distribution and Assignment

The distribution and assignment of site generated trips are based upon the primary access and activities oriented toward Eagle, with the understanding users will maintain significant traffic toward Sylvan Lake and the National Forest for recreation. Existing Saturday directional distribution is approximately 55% (N) / 45% (S) at Brush Creek Road and Sylvan Lake Road near the Town of Eagle, and 40% (N) / 60% (S) at Brush Creek Road and Frost Creek Road. The existing distributions are calculated from the existing traffic volume figure provided as an attachment.

For this analysis, the trip distribution was conservatively split 60% (N) toward Eagle and 40% (S) toward Sylvan Lake. The following Table shows the assignment of traffic PCE's generated during the Design hour.

TRIP DISTRIBUTION TABLE							
Base Camp Eagle							
<i>Trip Distribution</i>		AM	PM	SAT			
To/From Eagle (N)		60%	60%	60%			
To/From Sylvan (S)		40%	40%	40%			
Based primary access and activities toward Eagle							
Design Hour Traffic PCE's							
		AM		PM		SAT	
<i>Turning</i>	<i>Movement</i>	IN	OUT	IN	OUT	IN	OUT
SB	Left IN	5		5		10	
WB	Right OUT		4		3		11
WB	Left OUT		3		2		8
NB	Right IN	3		4		7	
TOTAL PCE MOVEMENTS:		8	7	9	5	17	19

Internal Circulation

Based upon the Trip Generation volumes, the proposed access can safely operate as a two-way, two-lane access. The development is proposed to provide two-way internal traffic circulation to the restroom and dump station sites. Beyond that, generally to the north, the circulation is defined by one-way loops. Clear signage showing “Do Not Enter”, One-Way”, Two-Way” will be provided to maintain safety within the sight.

Future Traffic Volumes

Peak hour traffic volumes (2035) from the Frost Creek TIS were reviewed and estimated near the site access along Brush Creek Road. The peak hour two-way volumes are approximately 450 vph AM, 415 vph PM, and 500 vph Saturday. Those values were obtained by interpolating between the Sylvan Lake Rd and Frost Creek Road intersections with Brush Creek Road, the volumes and the interpolation are provided as an attachment.

Anticipated non-vehicular traffic routes & connections to the Town of Eagle

While separate non-vehicular connections to the property do not currently exist, the applicant and Town of Eagle have discussed proximity to both the existing Haymeadow and Wall trail systems.

As discussed with the Planning Commission and Board of Trustees in pre-application meetings held in July 2019, it is the goal of the applicant to promote a “Park Once” guest preference to accessing amenities in Town via alternative means (hiking, biking, etc.) due to the planned connectivity to the campground and minor RV park. To that end, management will actively discourage the use of Brush Creek Road for walking and biking.

Further, the applicant has support for the project by the Haymeadow project team, where a number of future trails are planned and will also serve visitors at Base Camp Eagle.

The applicant will continue working with Town and Haymeadow officials on timing of these connections to coincide with the opening of Base Camp Eagle. The proximity to downtown and Eagle Ranch (< 1mile) will further reduce vehicle trips to and from Eagle. The planned trail connections will provide trip reductions as traffic on Brush Creek Road continues to increase. Because many users are drawn to the Eagle area for mountain and road biking, the opportunity for trip reductions will be in the 5-10% range in the future. Those trip reductions are not considered in this analysis.

Auxiliary Lane Requirements

Auxiliary turn lane requirements for County Road accesses are typically analyzed using the CDOT State Highway Access Code based on the anticipated peak hour volumes, the speed limit and geometry of the highway adjacent to the access, and the classification of the highway. For analysis purposes, the Brush Creek Road speed limit adjacent to the site is 40 mph along an R-B highway. Based on the *State Highway Access Code (SHAC)*,

Auxiliary Lane Requirements

(8) Auxiliary turn lanes shall be installed according to the criteria below.

- a) A left turn deceleration lane with taper and additional storage length is required for any access with a projected peak hour left ingress turning volume greater than 10 vph.*
- b) A right turn deceleration lane with taper is required for any access with a projected peak hour right ingress turning volume greater than 25 vph.*
- c) A right turn acceleration lane with taper is required for any access with a projected peak hour right turning volume greater than 50 vph when the posted speed on the highway is*

45 mph or greater and the highway has only one lane for through traffic in the direction of the right turn. A right turn acceleration lane is not required on multi-lane highways of this category.

- d) *A left turn acceleration lane with taper may be required if it would be a benefit to the safety and operation of the roadway or as determined by subsection 3.5. A left turn acceleration lane is generally not required where: the posted speed is less than 45 mph, or the intersection is signalized, or the acceleration lane would interfere with the left turn ingress movements to any other access.*

Based upon the SHAC and the trip distribution table provided above, auxiliary turn lanes are not required. The proposed intersection can safely operate as a two-way, two-lane access.

Summary of Findings

Brush Creek Road has a capacity at Level of Service C reportedly up to 7500 vpd without additional improvements. Base Camp Eagle is estimated to generate approximately 72 weekday and 113 Saturday vpd (in PCE's), about 2% of the total roadway capacity.

As a primary access to Brush Creek, Sylvan Lake, and the National Forest; Brush Creek Road experiences its heaviest volumes on summer weekends. Peak hour Saturday two-way volumes as interpolated from the Frost Creek Study are anticipated to increase from 80 vph in 2015 to 450 vph near Base Camp Eagle. Saturday peak hour site-generated volume is estimated at 31 vph.

The proposed access driveway has adequate sight distance for entering the roadway and does not require turn lanes based upon the auxiliary lane requirements per the SHAC. The sight distance triangle discussed in this TIS should be implemented as part of the site access design.

Attachments:

- 2015 Traffic Volumes, reference Frost Creek TIS
- 2035 Traffic Volumes, reference Frost Creek TIS
- Comparable Campground Trip Generation Calculations, KOA Silt CO by McDowell Engineering
- Base Camp Eagle – Project Location and Trail Access
- Frost Creek TIS, 1/24/17 by McDowell Engineering

Figure 5: Year 2015 Existing Traffic **INTERPOLATED VALUES AT 3220 BRUSH CREEK ROAD***

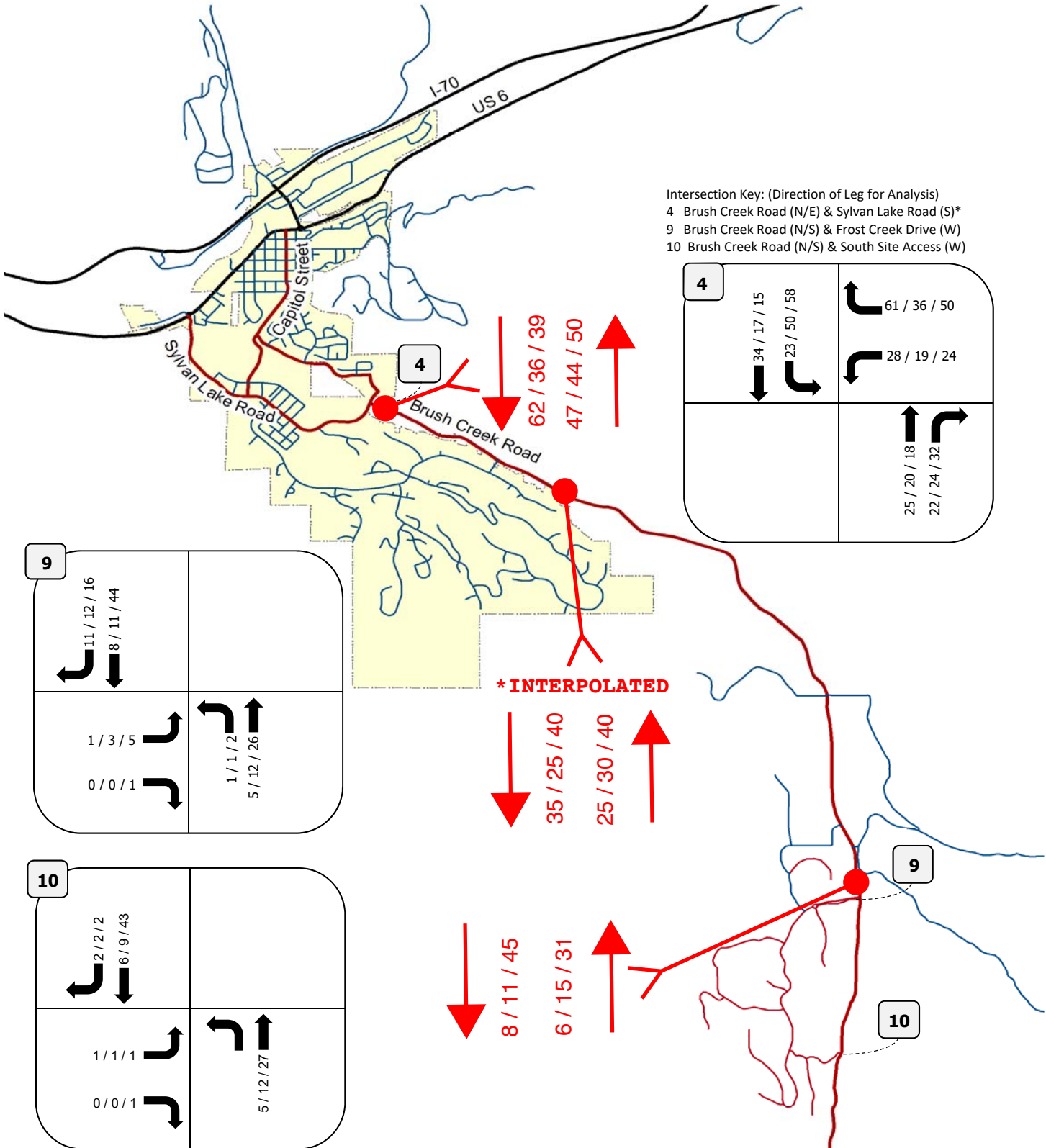
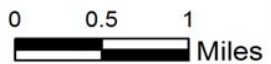
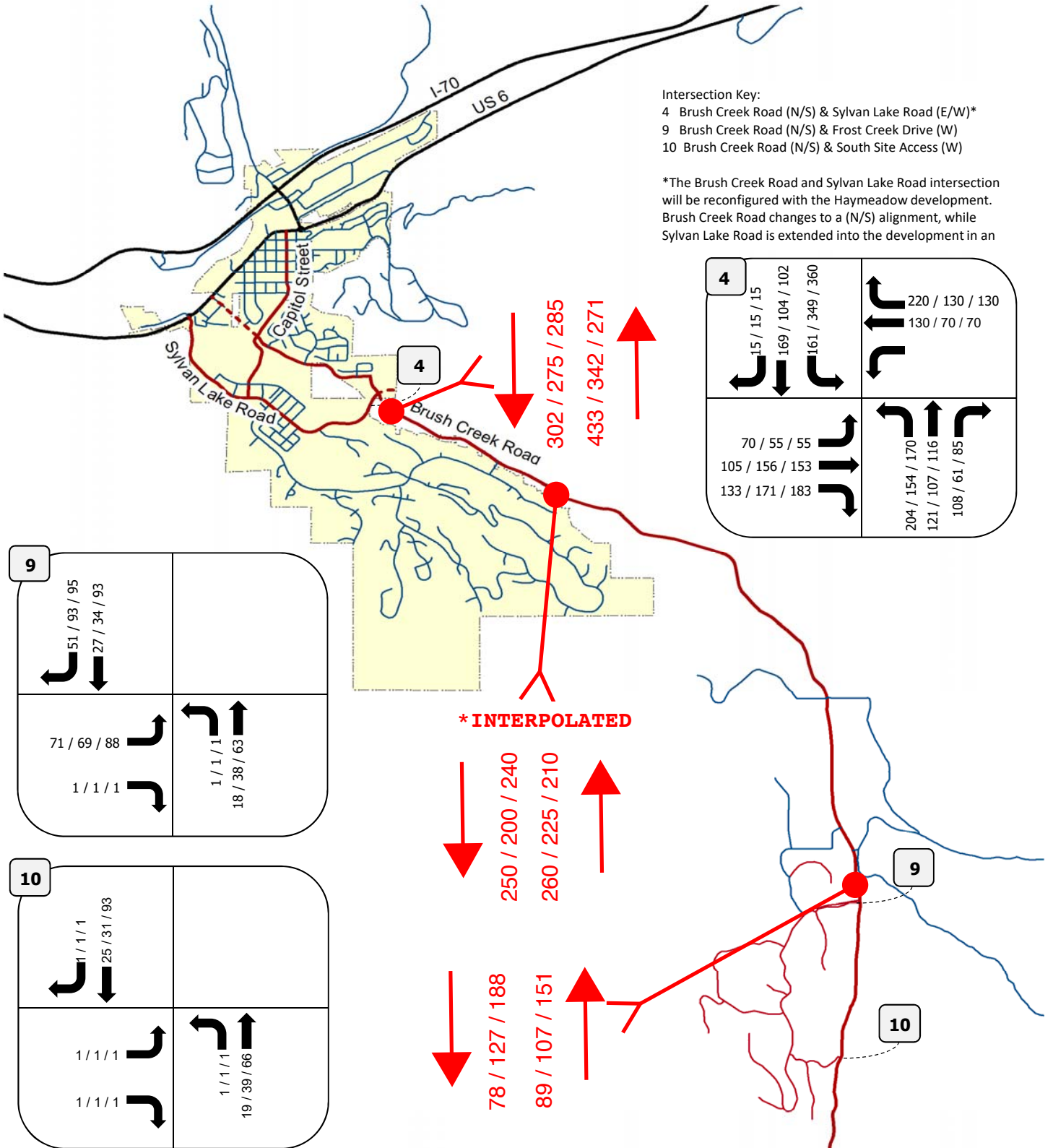


Figure 7: Year 2035 Background Traffic

***INTERPOLATED VALUES AT 3220 BRUSH CREEK ROAD**



LEGEND :
 AM/PM/SAT Volumes = XX / XX / XX vph
 Turning Movements

Project Number: M1158
 Prepared By: KJS
 Frost Creek, Eagle, Colorado

January 11, 2017



Project Number: M1231
 Prepared By: KJS
 Date: 7/20/2016
 Revised:

Table 1 - Comparable Campground Trip Generation Calculations
 KOA Campground
 Silt, Colorado

Observed Site-Generated Traffic¹

ITE Code	Units	Trip Generation Rates			Average Weekday		Average Saturday		Morning Peak Hour		Evening Peak Hour		Saturday Peak Hour						
		AM Peak Hour	PM Peak Hour	SAT Peak Hour	Average Weekday	Average Saturday	Trips (vpd)	Trips (vpd)	Inbound	Outbound	% Trips	Trips	Inbound	Outbound	% Trips	Trips	Inbound	Outbound	
Existing Land Use																			
Campground ²	73 Units	0.15	0.15	0.37	1.51	2.36	110	172	55%	6	45%	5	64%	7	36%	4	48%	13	14
# Cars/Pickups										2	1	1	4	4	0	0	6	6	2
# Large Vehicles (Campers or RVs)										4	4	4	3	3	4	4	7	7	12
Trucks in PCEs ²										8	8	8	6	6	8	8	14	14	24
Total PCEs ² at driveway		0.26	0.25	0.63						10	9	9	10	10	8	8	20	20	26

¹ Values obtained from KOA Campground in Silt, CO.

² Passenger Car Equivalents are based upon Section 2.3(4)(e) of the State of Colorado's State Highway Access Code.

Base Camp Eagle: Project Location and Trail Access

