

October 19, 2018

Mr. Rick Mummert
Benchmark Engineering, Inc.
915 17th Street
Modesto, CA 95354

**RE: TRAFFIC IMPACT ASSESSMENT FOR BELLEVUE RANCH NORTH
VILLAGE 23, MERCED, CA**

Dear Mr. Mummert:

Thank you for contacting KD Anderson & Associates (KDA) regarding the traffic study required by the City of Merced for **Bellevue Ranch North (BRN) Village 23**. As we understand BRN is an approved community with a system of arterial and collector streets that is consistent with the City of Merced's General Plan Circulation Element. Limited development has occurred in BRN since the area plan was approved, but the MUHSD's El Capitan High School was constructed and represents a significant new piece of the circulation puzzle.

Subsequently, appreciable wetlands have been delineated within BRN, making implementation of the original circulation plan problematic. You have suggested changes to the circulation plan to respond to both wetlands issues and the operational characteristics of the high school. While some proposed changes may affect the residential development adjoining and north of the high school (Village 23), the City Merced is interested in determining the feasibility of occupying Village 23 without immediate impacts in the area of El Capitan HS. Figure 1 is the site location and Figure 2 is the subdivision map.

Approach

Our work addressing the immediate impacts of developing BRN's Village 23 with access as proposed makes use of new traffic data collection and field observations to describe traffic operating conditions near El Capitan HS during the weekday a.m. peak hour for school traffic. The assessment deals specifically with site access on Farmland Avenue opposite the El Capitan HS driveway and the G Street / Farmland Avenue intersection. The amount of additional traffic added by Parcel 23 has been estimated and the feasibility of using project access to Farmland Avenue while school traffic occurs has been assessed.

Existing Conditions

Circulation System. The layout of the existing street system is described below.

The ***G Street / Farmland Avenue intersection*** is controlled by an actuated traffic signal. G Street has been widened along the school's frontage to its ultimate $\frac{1}{2}$ section (i.e., 3 southbound lanes), but northbound G Street remains a single through lane with an auxiliary right turn lane at Farmland Avenue. Separate left turn lanes are provided on G Street, with the southbound turn lane being about 60 feet long, but the northbound turn lane stretches for 850 feet as prescribed by the traffic study prepared for the High School in 2007¹. Eastbound Farmland Avenue has two lanes along the school frontage and at the G Street intersection is configured as a three-lane approach with separate left turn, through and right turn lanes.

The ***El Capitan HS access on Farmland Avenue*** is 450 feet from G Street (i.e., centerline to centerline) and today Farmland Avenue ends 60 feet beyond the driveway centerline. Eastbound Farmland Avenue has two lanes. Westbound Farmland Avenue is configured with a separate left turn lane into the high school and a through lane. The left turn lane begins immediate west of G Street and is 260 feet long preceded by a 40-foot bay taper. The El Capitan HS driveway has two inbound and two outbound lanes, and the exit lanes are marked "right turn only". The exit is stop sign controlled.

The quality of traffic operations near schools is often governed by a school's internal circulation system. In this case, the entry lanes off Farmland Avenue into El Capitan HS extend 500 feet before reaching the first on-site parking lot driveway, and the entrance to the school's eastern drop-off zone is another 130 feet further.

Traffic Data Collection. We conducted a site visit to acquaint ourselves with the study area circulation system and to observe the flow of traffic before school. While the quantitative analysis focusses on a.m. peak hour conditions, we collected intersection turning movement count data for the G Street / Farmland Avenue and at El Capitan HS access on Barclay Way during these time periods to confirm our study focus:

- Weekday a.m. peak hour (7:00 a.m. to 9:00 a.m.)
- Weekday afternoon when the regular school day ends (2:00 p.m. to 4:00 p.m.)
- Weekday p.m. peak hour (4:00 p.m. to 6:00 p.m.)

Figure 3 presents the results of these traffic counts for the a.m. and afternoon periods. A total of 1,228 entering and exiting vehicles were observed during the a.m. peak hour, while the volume dropped to 697 vehicles in the afternoon peak hour. As a comparison, the high school only generated 294 trips in the evening peak hour (i.e., 4:00 to 6:00 p.m.). Based on the results of this comparison quantitative analysis of the a.m. peak hour is appropriate.

The volume of traffic on G Street near the Village 23 access north of Farmland Avenue was also determined. The traffic volume north of Farmland Avenue is relatively low during all three periods, with 189 vph, 208 vph and 220 vph during the a.m., afternoon and p.m. peak hours, respectively.

¹ Traffic Impact Analysis for Merced Union High School District's Bellevue Road Campus, KDA, August 8, 2007

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As a point of interest, the traffic volumes observed at El Capitan HS are less than those anticipated in the school's 2007 traffic impact analysis. That analysis indicated that the school could generate 1,500 a.m. peak hour trips with 2,000 students and 1,800 trips with 2,400 students. The lower observed volumes are the result of fewer students (i.e., current enrollment at El Capitan is 1,600 students), and the actual a.m. peak hour trip generation rate is very similar to the assumption made in 2007 (i.e., 0.77 trips per student was observed versus 0.75 assumed in 2007).

The choice of Farmland Avenue and Barclay Way access by school drivers is slightly different than was anticipated in 2007. Today, roughly 45% of the school's a.m. peak hour traffic uses Farmland Avenue. The 2007 traffic study anticipated that 40% would use this access.

Existing Traffic Conditions – Level of Service. Current traffic operating conditions around El Capitan HS's Farmland Avenue access were described quantitatively based on intersection Level of Service, and confirmed from on-site observations. The methods in the *Highway Capacity Manual, 6th Edition (HCM, 6th)* applied using standard SYNCHRO software indicated that the G Street / Farmland Avenue intersection operated at LOS D during the school's peak 15-minute period. This satisfies the City's minimum LOS standard. However, SYNCHRO does not account well for the relatively close spacing between the school's access and G Street and for the effects of platooning on northbound G Street, and we also calculated peak hour intersection Level of Service using SimTraffic simulation. That work required us to create a "synthetic" intersection operation for the G Street / Bellevue Road intersection that reflected the long delays at that location and the release of northbound platoons of school traffic from that intersection. Simulation indicated that the Level of Service at the G Street / Farmland Avenue intersection was much better (i.e., LOS B), which is generally consistent with our observations, as noted below.

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TABLE 1
INTERSECTION LEVEL OF SERVICE

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Location	Control	AM Peak Hour							
		SYNCHRO ¹				SIMTRAFFIC ²			
		Existing		Existing Plus Village 23		Existing		Existing Plus Village 23	
		Average Delay (sec/veh)	Level of Service	Average Delay (sec/veh)	Level of Service	Average Delay (sec/veh)	Level of Service	Average Delay (sec/veh)	Level of Service
G Street / Farmland Avenue	Traffic Signal	38.4	D	48.0	D	11	B	13	B
Farmland Avenue / El Capitan HS	NB/SB Stop	8.5	A	8.5	A	3	A	3	A
Westbound left turn		11.5	B	11.7	B	6	A	6	A
Northbound approach		-	-	73.9	F	-	-	11	B
Southbound approach									
G Street / Village 23 access	EB Stop	-	-	9.3	A	-	-	3	A
Eastbound approach									
¹ Based on HCM 6 th edition using SYNCHRO software. Based on average of five SimTraffic simulation runs and assumed signal settings at Bellevue / G St									

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Observations. Morning peak traffic conditions at the school access were also observed. As with most schools El Capitan HS traffic is concentrated into a relatively short time period. During the peak 5-10 minute a large number of vehicles arrive from the south on G Street and make a left turn onto Farmland Avenue. These vehicles typically arrive in a long platoon, likely because the limited capacity of the Bellevue Road / G Street intersection is a major constraint to traffic flow. As a result, the actuated signal at Farmland Avenue may have no left turns during one signal cycle and have a large left turn volume during the next cycle. We observed that the signal will remain in green for left turns for a relatively long time (up to 45 seconds) and as a result the platoon of northbound traffic can often enter on a green indication and make the turn without delay. Conversely, we observed the waiting queue to nearly fill the 850-foot lane on one occasion when a pedestrian crossed G Street. That queue was however, nearly served in one cycle.

Most outbound school traffic turns right onto southbound G Street. Because these right turns have their own lane and can proceed after stopping when northbound traffic is turning left we saw no appreciable queueing on eastbound Farmland Avenue.

The design of the El Capitan HS access works well with the characteristics of traffic flow at the G Street signal. Most left turning vehicles turn into Farmland Avenue's westbound left turn lane and move continuously into the school. A few use the end of Farmland as a defacto drop-off zone, and these vehicles are shown in the traffic counts in Figure 1 as "through" vehicles. We never observed that left turning vehicles had to stop or wait as they arrived at the school. Alternatively, due to the limited arrivals from the north and east and due to the platooning effects of G Street traffic noted above, there were frequent periods when there was no westbound traffic on Farmland Avenue, even during the peak 15 minutes for school traffic. Traffic exiting the school and turning right did so with no delays.

Project Characteristics

Village 23 totals 59 single family lots located between Fahrens Creek and G Street in the area immediately north of El Capitan HS. As noted in Figure 2, access to this development would be limited to a new full access intersection on G Street through Village 24 ¼ mile north of Farmland Avenue and to a new connection to Farmland Avenue opposite the El Capitan HS access.

Trip Generation. The amount of vehicular traffic associated with Village 23 has been estimated based on trip generation rates included in the Institute of Transportation Engineers (ITE) publication *Trip Generation Manual, 10th Edition*. As noted in Table 2, these 59 homes could generate 11 inbound and 33 outbound trips in the a.m. peak traffic hour.

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TABLE 2 PROJECT TRIP GENERATION				
Description	Quantity	AM Peak Hour		
		In	Out	Total
Single Family Residence (ITE Code 210)	1 du	25%	75%	0.74
Village 23	59	11	33	44

Trip Distribution. Based on current travel patterns and on the project's location at the extreme north end of Merced, we expect nearly all trips to be oriented the south. However, some residences will likely include new El Capitan HS students and may create travel to and from the school. Assuming the typical "yield" for single family residences, we expect roughly 0.20 to 0.25 high school students per residence, or 12 to 15 students. It is reasonable to expect that many students will simply walk to the high school, particularly when weather is fair. Conversely, when the weather is poor many students would be dropped off by their parents, likely as a stop on a commute trip. We have assumed for this analysis that ¼ of the subdivision's 33 outbound trips in the morning would be made first to El Capitan HS before proceeding to another destination to the south (i.e., 8 diverted trips). While it is possible that some school trips will leave via Barclay Way we have conservatively assumed that all project trips stay on G Street.

Trip Assignment. Because the subdivision has two points of access it is likely that the choice of route will reflect the location of individual residences relative to the two driveways as well as residents' perceptions of the ease of access at either location and the travel time through the Farmland Avenue / G Street intersection. Because the current traffic volume on G Street north of Farmland Avenue is very low, leaving the subdivision directly onto that street would result in little delay. However, residents living closer to Farmland Avenue would be driving north out of their way to use the G Street access and would normally be inclined to use the shorter route via Farmland Avenue. For this analysis we assumed that ½ of the trips will use each access. This assignment is shown in Figure 4.

Project Traffic Impacts

Level of Service. Project trips were superimposed onto observed a.m. peak hour traffic volumes to create the "Existing Plus Project" condition, and the results are shown in Figure 4. These volumes were used to assess the change operating Level of Service resulting from the project at each location, was summarized in Table 1.

From the standpoint of Level of Service, the addition of project trips has a minor effect on the morning operation of the G Street / Farmland Avenue intersection. Standard SYNCHRO results indicate that the G Street / Farmland Avenue intersection would continue to operate at LOS D and meet City minimum standards, but long delays would occur at the new Farmland Avenue driveway. However, review of simulation results indicates that the length of the overall average delay will only increase slightly, that the Level of Service at the new access on G Street would

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be very good (i.e., LOS A) and that the length of delays at the new driveway connection on Farmland Avenue would be shorter (i.e., LOS B).

Feasibility of Access to Farmland Avenue. We considered the feasibility of the Farmland Avenue access to Village 23 by answering these questions:

Will there be opportunities for Village 23 traffic to enter Farmland Avenue when El Capitan traffic is arriving in the morning?

Yes, the traffic associated with Village 23 that uses the Farmland Avenue access can enter the intersection during the periods when the G Street / Farmland Avenue traffic signal is not delivering northbound traffic onto westbound Farmland Avenue and into the school. While there can be a few long periods when inbound school traffic in the westbound left turn lane is almost continuous for as long as 45 seconds, the traffic signal also causes periods when no traffic is traveling westbound on Farmland Avenue at all. This project traffic may occasionally have to wait but overall adequate gaps in traffic are available.

Is the sight distance at the new Village 23 access to Farmland Avenue adequate? Yes, the available sight distance looking left to G Street will satisfy the Highway Design Manual's corner sight distance requirement for the prevailing speed. Westbound traffic moves at 25 to 30 mph and HDM Table 405.1A suggests that 330 feet be provided if the available sight distance exceeds 330 feet.

Are there long term issues with the Farmland Avenue access? In the long term the feasibility of left turns from Village 23 could be constrained if the volume of through traffic on Farmland Avenue increases. This is likely to be the case if Farmland Avenue is extended to the west. While full access may be possible during non-school hours, the combination of additional through traffic and school related vehicles would make it difficult to turn. However, Village 23 will still have access via G Street and eventual limitations on Farmland Avenue access can be compensated for by this other option.

Thank you for your review of this information. Please feel free to call me if you have any questions.

Sincerely yours,

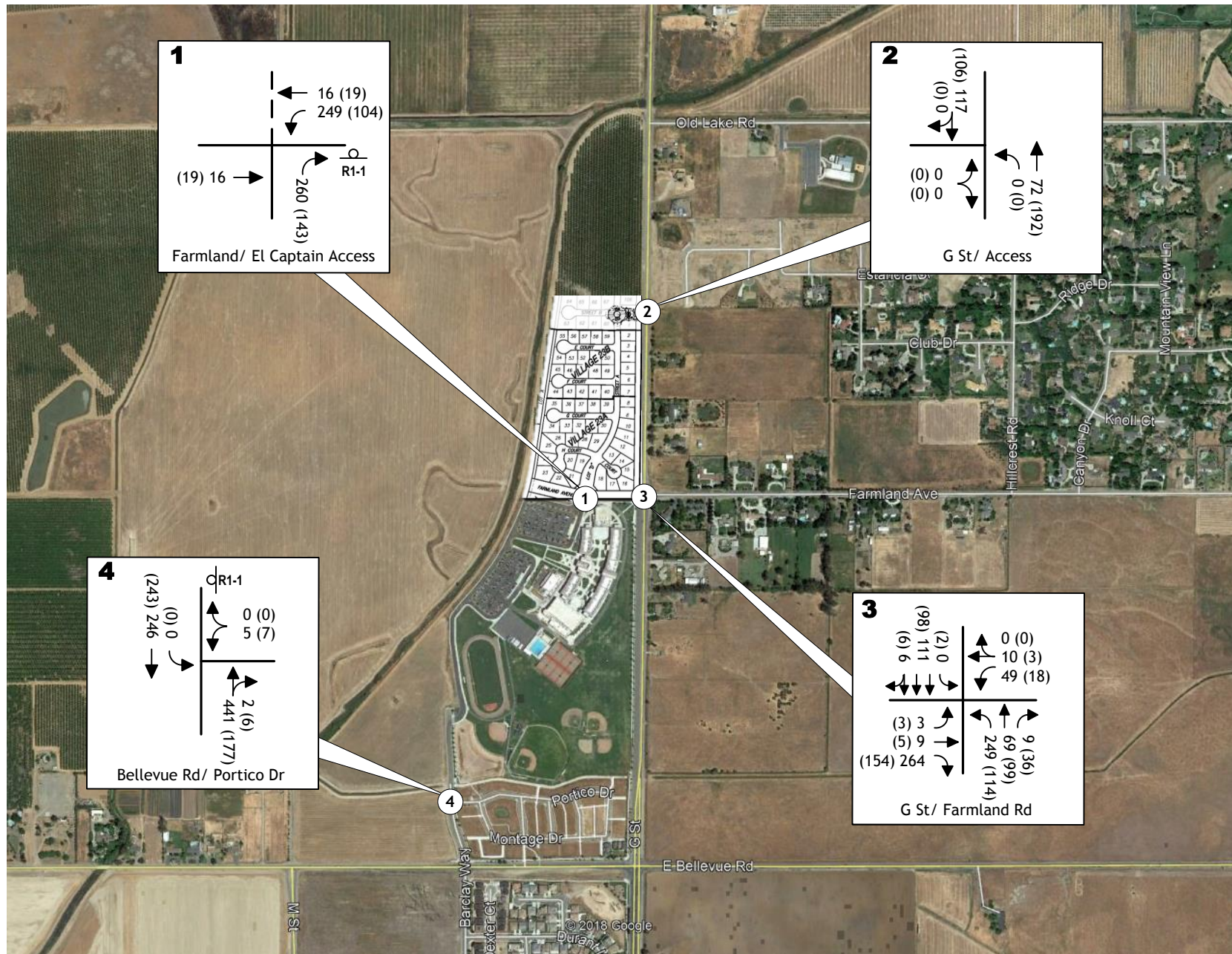
KD Anderson & Associates, Inc.



Kenneth D. Anderson, P.E.
President



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