

TRAFFIC IMPACT STUDY – FINAL REPORT

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# AVIANO RESIDENTIAL ANTIOCH, CA

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Prepared for:

City of Antioch, CA

Prepared by:

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## INTRODUCTION

Kimley-Horn and Associates, Inc. was retained by the City of Antioch to prepare a traffic study for the proposed Aviano Residential in Antioch, CA. The proposed project was originally analyzed in 2008 as a 533-unit senior residential development. It is now proposed to be a 533-unit single-family residential development. The development is proposed to be constructed on the property to the southwest of the intersection of Prewett Ranch Drive and Hillcrest Avenue. The property is bordered by the Dozier Libbey Medical High School to the west, Sand Creek Road (future roadway extension) to the south, and Hillcrest Avenue (future roadway extension) to the east.

**Figure 1** illustrates the location of the project site in relation to the City of Antioch.

This traffic study was prepared based on discussions with, and criteria set forth by, the City of Antioch and Contra Costa Transportation Authority (CCTA). This study addresses the traffic and transportation effects of the proposed development to assist the project applicant and the City in project planning and determining conditions of approval for the project.

## Study Methodology

### Development Conditions

The Aviano Residential traffic study was based on the following development conditions:

- Existing (2014) conditions – Based on current traffic counts in 2013 and existing roadway geometry and traffic control.
- Existing (2014) Plus Project conditions – Based on current traffic counts and existing roadway geometry and traffic control, plus the traffic generated by the Aviano residential development.
- Near-term (2015) conditions – Based on traffic volumes and traffic added by pending and approved (but not yet completed) developments anticipated to occur at the time the project is constructed. Also includes programmed roadway projects which are scheduled to be in place at the same time the project is anticipated to be completed in 2015.
- Near-term (2015) Plus Project conditions – Based on existing traffic volumes, traffic added by approved and pending (but not yet completed developments), and traffic generated by the Aviano residential development, as well as programmed roadway projects anticipated to be in place at the same time the project is to be completed.
- Long-term (2030) conditions – Based on future year traffic forecasts from the Contra Costa Transportation Authority (CCTA) 2030 model. Future year

corresponds with the approximate buildout of the City’s General Plan. Includes road projects anticipated to be in place under the long-term condition.

- Long-term (2030) Plus Project conditions – Based on CCTA traffic forecasts and traffic generated by the Aviano residential development. Future year corresponds with the approximate buildout of the city’s General Plan. Includes road projects anticipated to be in place under the long-term condition.

**Operating Conditions and Criteria**

Analysis of project effects at intersections is based on the concept of Level of Service (LOS). The LOS of an intersection is a qualitative measure used to describe operational conditions. LOS ranges from A (best), which represents minimal delay, to F (worst), which represents heavy delay and a facility that is operating at or near its functional capacity. Levels of Service for this study were determined using methods defined in the *Highway Capacity Manual, 2010* (HCM) and appropriate traffic analysis software.

The HCM included procedures for analyzing side-street stop-controlled (SSSC), all-way stop-controlled (AWSC), and signalized intersections. The SSSC procedure defines LOS as a function of average control delay for each minor street approach movement. Conversely, the AWSC and signalized intersection procedures define LOS as a function of average control delay for the intersection as a whole. **Table 1** relates the operational characteristics associated with each LOS category for signalized and unsignalized intersections.

**Table 1 – Intersection Level of Service Definitions**

Level of Service	Description	Signalized (Avg. control delay per vehicle sec/veh.)	Unsignalized (Avg. control delay per vehicle sec/veh.)
A	Free flow with no delays. Users are virtually unaffected by others in the traffic stream	≤ 10	≤ 10
B	Stable traffic. Traffic flows smoothly with few delays.	> 10 – 20	> 10 – 15
C	Stable flow but the operation of individual users becomes affected by other vehicles. Modest delays.	> 20 – 35	> 15 – 25
D	Approaching unstable flow. Operation of individual users becomes significantly affected by other vehicles. Delays may be more than one cycle during peak hours.	> 35 – 55	> 25 – 35
E	Unstable flow with operating conditions at or near the capacity level. Long delays and vehicle queuing.	> 55 – 80	> 35 – 50
F	Forced or breakdown flow that causes reduced capacity. Stop and go traffic conditions. Excessive long delays and vehicle queuing.	> 80	> 50

Sources: Highway Capacity Manual 2010, National Research Council, 2010

According to the CCTA requirements, there are multiple routes of regional significance within the project study area. These include Lone Tree Way, Hillcrest Avenue (north of Lone Tree Way), and Deer Valley Road. Sand Creek Road is a future route of regional significance when it extends from State Route 4 to Dallas Ranch Road. Routes of regional significance are governed by the CCTA Technical Procedures, which has a level of service requirement of LOS D or better. These requirements would apply to all study intersections on routes of regional significance.

For study intersections in the City of Antioch and not associated with routes of regional significance, the City has a level of service requirement of LOS “High D” or better.

Project impacts are determined by comparing conditions with the proposed project to those without the proposed project. The following criteria were used for determining impacts:

- A study intersection **not** identified as a route of regional significance would worsen from operating at an acceptable LOS “High D” or better to an unacceptable LOS E or worse with the addition of proposed project traffic.
- A study intersection identified as a route of regional significance would worsen from operating at an acceptable LOS “Mid D” or better to an unacceptable LOS “High D” or worse with the addition of proposed project traffic.
- A study intersection operating unacceptably without the proposed project traffic added would experience an increase in delay due to the proposed project.
- A study intersection experiences an increase in queue of one or more vehicles that exceeds the turn pocket length.

It should be noted that CCTA does not have a threshold criteria for delay index and therefore the delay index is used for comparison purposes only.

Mitigation may be required when traffic from the project causes the intersection to operate below acceptable levels of traffic operation.

The effects of vehicle queuing were also analyzed and the 95th percentile queue is reported for all study intersections. The 95th percentile queue length represents a condition where 95 percent of the time during the peak period, traffic volumes and related queuing will be at, or less, than the queue length determined by the analysis. This is referred to as the “95th percentile queue.” Average queuing is generally less. Queuing is considered a potentially significant impact since queues that exceed the turn pocket length can create potentially hazardous conditions by blocking or disrupting through traffic in adjacent travel lanes. However, these potentially hazardous queues are generally associated with left-turn movements. Locations where the right turn pocket storage is exceeded are not considered potentially hazardous because the right turn movement may go at the same time as the through movement and the additional vehicles that spill out over the turn pocket will not be hindering or disrupting the adjacent



through traffic as would be the case in most left turn pockets. Thus, for purposes of this analysis, a queuing impact was considered to occur under conditions where project traffic causes the queue in a left turn pocket to extend beyond the turn pocket by 25 feet or more (i.e., the length of one vehicle) into adjacent traffic lanes that operate (i.e., move) separately from the left turn lane. Where the vehicle queue already exceeds that turn pocket length under pre-project conditions, a project impact would occur if project traffic lengthens the queue by 25 feet or more.

## Study Intersections Included in Analysis

The proposed project will generate new vehicular trips that will increase traffic volumes on the nearby street network. To assess changes in traffic conditions associated with the project, the following intersections, illustrated in **Figure 1**, were selected for evaluation in this traffic study:

1. Lone Tree Way/Dallas Ranch Road
2. Lone Tree Way/Black Diamond Drive
3. Lone Tree Way/Country Hills Drive
4. Country Hills Drive/Deer Valley Road
5. Lone Tree Way/Deer Valley Road
6. Lone Tree Way/Prewett Park
7. Prewett Ranch Drive/Deer Valley Road
8. Sand Creek Road/Deer Valley Road
9. Sand Creek Road/Kaiser Way
10. Sand Creek Road/High School Driveway (future)
11. Sand Creek Road/South Project Driveway (future)
12. Sand Creek Road/Hillcrest Avenue (future)
13. Sand Creek Road/Heidorn Ranch Road (future)
14. Sand Creek Road/SB SR-4 Ramps (future)
15. Sand Creek Road/NB SR-4 Ramps (future)
16. East Project Driveway/Hillcrest Avenue (future)
17. Prewett Ranch Drive/Heidorn Ranch Road (future)
18. Prewett Ranch Drive/Hillcrest Avenue
19. Lone Tree Way/Hillcrest Avenue
20. Country Hills Drive/Hillcrest Avenue
21. Laurel Road/Hillcrest Avenue
22. Lone Tree Way/Vista Grande Drive
23. Lone Tree Way/Heidorn Ranch Road
24. Lone Tree Way/Canada Valley Road
25. Lone Tree Way/SR-4
26. Lone Tree Way/Jeffrey Way

## EXISTING (2014) CONDITIONS

### Existing Site Uses

The Aviano residential development is proposed to be built on the property to the southwest of the intersection of Prewett Ranch Drive and Hillcrest Avenue.

### Existing Uses in Vicinity of Site

The proposed project site is surrounded by residential homes to the north, vacant lots to the east and south, and the Dozier Libbey Medical High School on the west.

### Existing Roadway Network

Below is a description of the principal roadways included in this study.

#### State Route 4 (SR-4) Bypass

State Route 4 Bypass is a highway between Vasco Road in Brentwood and the existing State Route 4 in Antioch. The highway is still undergoing construction, but is currently a two-lane highway between Lone Tree Way and Balfour Road. North of Lone Tree Way, SR-4 is divided and has four to six lanes. Currently, a freeway interchange is being built at Sand Creek Road. SR-4 provides access to West Contra Costa County, Interstate 680, and Interstate 80 to the west. SR-4 also provides access to Brentwood and Interstate 580 to the south. The speed limit on SR-4 is 65 mph.

#### Black Diamond Drive

Black Diamond Drive is a two-lane, undivided local street with turn lanes and bike lanes serving residential areas south of Lone Tree Way. There is no on-street parking along Black Diamond Drive. The posted speed limit is 30 mph.

#### Canada Valley Road

Canada Valley Road is a two-lane, undivided collector roadway with no turn lanes serving residential areas north of Country Hills Drive. Canada Valley Road is a four lane, divided roadway between Lone Tree Way and Country Hills Drive with a raised median, bike lanes, and no on-street parking. The posted speed limit is 40 mph. South of Lone Tree Way the roadway is four lanes, undivided, with turn lanes serving the Lone Tree Plaza which includes the Home Depot store.

#### Country Hills Drive

Country Hills Drive is a two-lane roadway serving residential areas, commercial areas, Carmen Dragon Elementary School, and Jack London Elementary School north of Lone Tree Way. Country Hills Drive is divided with a raised median and has turn lanes east of Hillcrest Avenue. There are also bike lanes on either side, but no on-street parking. Country Hills Drive is undivided with no turn lanes to the west of Hillcrest Avenue.

There are no bike lanes west of Hillcrest Avenue, but there is on-street parking. The posted speed limit is 25 and 30 mph along Country Hills Drive.

### **Dallas Ranch Road**

Dallas Ranch Road is a four-lane, divided roadway with a raised median and turn lanes serving residential areas, commercial areas, and Dallas Ranch Middle School south of Lone Tree Way. There is no on-street parking, but bike lanes exist along Dallas Ranch Road. The posted speed limit is 45 mph outside the school zone of 25 mph.

### **Deer Valley Road**

Deer Valley Road is currently a four-lane, divided arterial roadway with a raised median and turn lanes serving mostly residential areas. There are bike lanes on either side, but no on-street parking. South of Sand Creek Road, the street becomes a two lane, undivided roadway and provides access to rural areas. The posted speed limit is 45 mph. Deer Valley Road is designated as a Route of Regional Significance.

### **Heidorn Ranch Road**

Heidorn Ranch Road is a four-lane, divided arterial with a raised median and turn lanes. There are bike lanes on either side, but no on-street parking. The posted speed limit on Heidorn Ranch Road is 45 mph. The roadway serves residential and commercial uses and is planned to be extended to the south to connect with Sand Creek Road. North of Lone Tree Way, the street is named Fairside Way. Fairside Way is a two-lane roadway with on-street parking, but no bike lanes and serves residential areas.

### **High School Access Road (HSAR)**

The High School Access Road (HSAR) will be built by Aviano and will extend along the western edge of the Dozier Libby Medical High School and extend from Sand Creek Road to the temporary road that has been constructed to serve the school. The road will serve the Dozier Libby Medical High School. A temporary road has been constructed from the eastern terminus of Sand Creek Road east to intersect the HSAR and will temporarily provide access to the school until the HSAR is constructed by the Aviano developer.

### **Hillcrest Avenue**

Hillcrest Avenue is a four-lane, divided roadway with a landscaped median and left turn bays. There are bike lanes on either side, but no on-street parking. The roadway serves mostly residential uses and SR-4 to the north. The speed limit on Hillcrest Avenue is posted at 45 mph in the study area. As part of the Aviano project, Hillcrest Avenue will be extended to the south to connect with Sand Creek Road and will be extended farther to the south in the future. Hillcrest Avenue is designated as a Route of Regional Significance.

### **Jeffery Way**

Jeffery Way is a two-lane, divided roadway with a raised median and left turn bays. There is no marked bike lane, but there is a wide shoulder where on-street parking is

prohibited. The posted speed limit is 25 mph. Jeffrey Way is connected to the northbound ramps for the SR-4 Bypass that was completed in 2007. Existing conditions were analyzed in 2006 before the bypass was completed.

### **Laurel Road**

Laurel Road is a four lane, divided roadway with a raised median and turn lanes serving residential areas. There are bike lanes on either side of Laurel Road, but no on-street parking. Laurel Road currently ends at Canada Valley Road, but is still under construction and may be extended for future residential development. Laurel Road has a posted speed limit of 45 mph. West of Hillcrest Avenue, Laurel Road is named Sterling Hill Drive. Sterling Hill Drive is a two-lane, undivided local street serving residential areas and Black Diamond Middle School west of Hillcrest Avenue. There are no bike lanes, but on-street parking on Sterling Hill Drive. The posted speed limit is 25 mph.

### **Lone Tree Way**

Lone Tree Way is an arterial roadway that that connects Antioch with the City of Brentwood. Through the project study area, Lone Tree Way is a four- to six-lane, divided roadway with a landscaped median, left turn bays, no bike lanes, and no on-street parking. The speed limit on Lone Tree Way is posted at 45 mph in the study area. Lone Tree Way is designated as a Route of Regional Significance. Deer Valley High School is located on Lone Tree Way east of Deer Valley Road. Traffic from the high school represents a large portion of traffic during the AM peak period.

### **Mokelumne Drive**

Mokelumne Drive is a two-lane, undivided local street with no left turn bays serving residential areas, commercial areas, and Lone Tree Elementary School south of Lone Tree Way. There are bike lanes on either side of Mokelumne Drive, but no on-street parking between Lone Tree Way and Prewett Ranch Drive. There is on-street parking, but no bike lanes along Mokelumne Drive between Prewett Ranch Drive and Southwood Way. The posted speed limit is 30 mph.

### **Prewett Ranch Drive**

Prewett Ranch Drive is a two-lane collector street with turn lanes at major intersections. Portions of Prewett Ranch Drive are divided with a landscaped median and turn lanes. There are bike lanes and on-street parking along portions of Prewett Ranch Drive. The posted speed limit on Prewett Ranch Drive is 35 mph near Deer Valley Road and 25 mph near Hillcrest Avenue. Diablo Vista Elementary School is located on Prewett Ranch Drive east of Deer Valley Road. Traffic from the elementary school represents a large portion of traffic during the AM peak period.

### **Sand Creek Road**

Sand Creek Road is a planned four-lane arterial with turn lanes at major intersections. The roadway is designated as a Route of Regional Significance. In the near-term, Sand

Creek Road will be extended from the SR-4 Bypass to Heidorn Ranch Road as well as from Hillcrest Avenue west to the western edge of the Dozier Libby Medical High School. In the long-term, Sand Creel Creek road will connect from Dallas Ranch Road in Antioch to Sand Creek Road in Brentwood. The posted speed limit on Sand Creek Road will be 45 mph. Sand Creek Road is designated as a future Route of Regional Significance.

### **Vista Grande Drive**

Vista Grande Drive is a two-lane street with turn lanes at major intersections. There is a landscaped median along portions of Vista Grande Drive. There are bike lanes on either side of Vista Grande Drive, but no on-street parking south of Country Hills Drive. North of Country Hills Drive, there are no bike lanes, but there is on-street parking. The speed limit on Vista Grande is 25 mph.

## **Existing Site Access**

There are currently no driveways for access to the site as shown in **Figure 2**. Hillcrest Avenue and Sand Creek Road will be extended along the proposed project frontages and access to the residential development will be constructed on both streets.

## **Existing (2014) Lane Configurations and Traffic Control**

Existing intersection lane configurations and traffic controls are illustrated in **Figure 3**. The two proposed project accesses will need to be controlled by traffic signals and will be full access intersections. It should be noted that the two proposed project access streets do not exist as current intersections and were therefore not analyzed in the without project condition.

## **Existing (2014) Peak Hour Turning Movement Volumes**

Weekday intersection turning movement volumes were collected at project study area intersections in January 2014. Volumes were collected during the AM (7:00 AM to 9:00 AM) and PM (4:00 PM to 6:00 PM) peak periods of a typical weekday. These volumes were collected during a typical weekday when school was in session and not near any major holidays.

AM and PM peak one-hour volumes are shown in **Figure 4**. Traffic volume data sheets are shown in the **Appendix**.

## **Existing Transit Facilities**

Tri-Delta Transit provides bus service in Antioch. Routes 379, 380, 383, 385, 388, 392, and 395 operate within the study area. Currently there are no bus routes that pass directly adjacent to the proposed project site because there is no roadway access to the vacant lot for the project site. However, routes 379, 388, and 392 operate on Sand Creek Road to the Kaiser Permanente, which is west of the proposed project site. Tri-

Delta Transit connects passengers to the Antioch Park and Ride (Hillcrest), Kaiser Medical Center, Pittsburg/Bay Point BART Station, Tri Delta Transit Station, various local schools, Brentwood Park and Ride, the Streets of Brentwood and convenient connections to many locations in the City and connections to other local and regional transit routes.

Route 379 operates between the Antioch Park and Ride (Hillcrest) to the Kaiser Medical Center. This route runs along Hillcrest Avenue, Deer Valley Road, and Sand Creek Road within the study area. This route operates only on Antioch Unified School District days only from 7:28 AM to 7:40 AM and 3:05 PM to 3:23 PM.

Route 380 operates between the Pittsburg/Bay Point BART Station to the Tri Delta Transit station. This route runs along Lone Tree Way, Canada Valley Road, Laurel Road, and Hillcrest Avenue within the study area. This route operates on weekdays from 3:04 AM to 11:33 PM on a frequency of 10-minute to 120-minute headways.

Route 383 operates between the Antioch Park and Ride (Hillcrest) to Freedom High School. This route runs along Deer Valley Road and Lone Tree Way within the study area. This route operates on weekdays from 7:12 AM to 5:23 PM on a frequency of 60-minute to 125-minute headways.

Route 385 operates between the Antioch Park and Ride (Hillcrest) to the Brentwood Park and Ride. This route runs along Hillcrest Avenue, Lone Tree Way, Sand Creek Road, and the SR-4 bypass within the study area. This route operates on weekdays from 6:39 AM to 7:17 PM on a frequency of 25-minute to 145-minute headways.

Route 388 operates between the Pittsburg/Bay Point BART Station to Kaiser Medical Center. This route runs along Lone Tree Way, Dallas Ranch Road, Prewett Ranch Road, Deer Valley Road, and Sand Creek Road within the study area. This route operates on weekdays from 5:29 AM to 11:28 PM on a frequency of 30-minute to 74-minute headways.

Route 392 operates between the Pittsburg/Bay Point BART Station to the Antioch Park and Ride (Hillcrest). This route runs along Lone Tree Way, Hillcrest Avenue, Deer Valley Road, and Sand Creek Road within the study area. This route operates on weekends from 5:23 AM to 1:28 AM on a frequency of 49-minute to 120-minute headways.

Route 395 operates between the Antioch Park and Ride (Hillcrest) to the Streets of Brentwood. This route runs along the SR-4 bypass and Sand Creek Road within the study area. This route operates on weekends from 9:40 AM to 8:03 PM on a frequency of 60-minute headways.

## Existing Bicycle and Pedestrian Facilities

There are multiple existing and proposed bikeway facilities in Antioch. Class I bicycle facilities are bike paths or trails, class II bicycle facilities are defined as bike lanes, and class III bicycle facilities are bike routes.

Class I bike paths located within the project study area include the Mokelumne Trail, the Canada Valley Trail, the Mesa Ridge Trail, and the Deerfield Corridor Trail. The Mokelumne Trail runs parallel to Lone Tree Way on the north side, starting at the western edge of the study area and terminates at Hillcrest Avenue. The Canada Valley Trail runs parallel to Country Hills Drive on the south side, starting at Hillcrest Avenue and terminates near SR-4. The Mesa Ridge Trail runs east-west starting at Mesa Ridge Drive and terminates at Pawnee Drive. The Deerfield Corridor Trail runs north-south starting at the Delta De Anza and terminates at Prewett Ranch Drive. It is proposed that the Mokelumne Trail be extended from Hillcrest Avenue to Brentwood.

Class II bike lanes are located within the project study area on Canada Valley Road from Vista Grande Drive to Lone Tree Way, Country Hills Road from Hillcrest Avenue to near the SR-4 bypass and from Lone Tree Way to Deer Valley Road, Dallas Ranch Road from Lone Tree Way to Mokelumne Drive, Deer Valley Road from Hillcrest Avenue to just south of Wellness Way, Hillcrest Avenue from E. 18<sup>th</sup> Street to Prewett Ranch Drive, Laurel Road from Hillcrest Avenue to Canada Valley Road, and Prewett Ranch Drive from Dallas Ranch Road to Cedar Point Way. Class II bike lanes are proposed on Dallas Ranch Road from Mokelumne Drive to the southern terminus of the roadway, Canada Valley Road from Vista Grande Drive to Lone Tree Way, Hillcrest Avenue from Deer Valley Road to SR-4, Laurel Road from Canada Valley Road to Laurel Road in Oakley.

There are no Class III bike routes located within the project study area.

Sidewalks and crosswalks are mostly provided throughout the study area in Antioch to allow for pedestrians to access nearby transit stops, residential uses, and commercial uses. Sidewalks are absent near the southern portion of the City of Antioch near where the roadways are not built out yet or where they are adjacent to rural lands. There are no sidewalks along Deer Valley Road south of Sand Creek Road, along Sand Creek Road east of the Kaiser entrance, Hillcrest Avenue south of Prewett Ranch Drive, Heidorn Ranch Road south of Lone Tree Plaza Drive, and Sand Creek Road west of the SR-4 bypass ramps.

## Existing (2014) Levels of Service at Study Intersections

Traffic operations were evaluated at the study intersections under existing traffic conditions.

Results of the analysis are presented in **Table 2**, along with the minimum jurisdictional standard for acceptable levels of service (as previously described in Operating Conditions and Criteria). Additional detail of the analysis is provided in the **Appendix**.

As shown in **Table 2**, all of the study intersections function within acceptable standards under this analysis scenario.

**Table 2 – Existing (2014) Level of Service Summary**

	Intersection	LOS Criteria	Jurisdiction	Control	Existing			
					AM Peak		PM Peak	
					LOS	Delay	LOS	Delay
1	Lone Tree Way and Dallas Ranch Road	D	City	Signal	C	25.2	C	20.7
2	Lone Tree Way and Black Diamond Drive	D	City	Signal	A	5.1	A	3.7
3	Lone Tree Way and Country Hills Drive	D	City	Signal	C	25.3	B	18.2
4	Country Hills Drive and Deer Valley Road	D	City	Signal	B	15.4	B	11.1
5	Lone Tree Way and Deer Valley Road	D	City	Signal	D	44.0	C	25.1
6	Lone Tree Way and Prewett Park	D	City	Signal	C	29.5	B	13.2
7	Prewett Ranch Drive and Deer Valley Road	D	City	Signal	B	19.6	B	15.3
8	Sand Creek Road and Deer Valley Road	D	City	Signal	C	24.8	A	6.7
9	Sand Creek Road and Kaiser Way	D	City	SSSC	B	13.1	A	1.6
	<i>Worst Approach</i>				D	31.0	A	9.2
10	Sand Creek Road and High School Driveway	D	City	SSSC	Future Intersection			
	<i>Worst Approach</i>							
11	Sand Creek Road and South Project Driveway	D	City	Signal	Future Intersection			
12	Sand Creek Road and Hillcrest Avenue	D	City	Signal	Future Intersection			
13	Sand Creek Road and Heidorn Ranch Road	D	City	Signal	Future Intersection			
14	Sand Creek Road and SB SR-4 Ramp	D	City	Signal	A	1.2	A	0.7
15	Sand Creek Road and NB SR-4 Ramp	D	City	Signal	A	8.4	A	9.7
16	East Project Driveway and Hillcrest Avenue	D	City	Signal	Future Intersection			
17	Prewett Ranch Drive and Heidorn Ranch Road	D	City	Signal	Future Intersection			
18	Prewett Ranch Drive and Hillcrest Avenue	D	City	Signal (AWSC)*	A	9.8	A	9.8
19	Lone Tree Way and Hillcrest Avenue	D	City	Signal	C	22.1	B	18.0
20	Country Hills Drive and Hillcrest Avenue	D	City	Signal	C	28.7	C	20.4
21	Laurel Road and Hillcrest Avenue	D	City	Signal	B	14.4	B	13.8
22	Lone Tree Way and Vista Grande Drive	D	City	Signal	A	8.7	A	8.3
23	Lone Tree Way and Heidorn Ranch Road	D	City	Signal	A	3.0	A	3.6
24	Lone Tree Way and Canada Valley Road	D	City	Signal	B	13.6	B	14.4
25	Lone Tree Way and SB SR-4	D	City	Signal	B	13.3	A	8.8
26	Lone Tree Way and Jeffrey Way	D	City	Signal	B	11.2	A	7.9

Note: \*Prewett Ranch Drive and Hillcrest Avenue is a signalized intersection, however it operates as an All Way Stop Control

## AVIANO RESIDENTIAL DEVELOPMENT PROJECT

### Proposed Site Uses

As noted previously, the proposed Aviano residential development will be on the property to the southwest of the intersection of Prewett Ranch Drive and Hillcrest Avenue. The proposed development will consist of 533 single family residential homes.



## Project Trip Generation

Trip generation for residential development projects is typically calculated based on rates contained in the Institute of Transportation Engineer's publication, *Trip Generation 9th Edition*<sup>1</sup>. *Trip Generation* is a standard reference used by jurisdictions throughout the country for the estimation of trip generation potential of proposed developments.

A trip is defined in *Trip Generation* as a single or one-directional vehicle movement with either the origin or destination at the project site. In other words, a trip can be either "to" or "from" the site. In addition, a single customer visit to a site is counted as two trips (i.e., one to and one from the site).

For purposes of determining the worst-case impacts of traffic on the surrounding street network, the trips generated by a proposed development are typically estimated between the hours of 7:00-9:00 AM and 4:00-6:00 PM. This methodology is in harmony with the City's standard for the preparation of traffic impact studies.

The proposed single family residential development is most appropriately classified as Single-Family Detached Housing (ITE Land Use 210).

## Internal Capture

Internal capture reductions were considered, but since the project site will only be used for the residential homes and no other land uses, no internal capture reductions were taken.

## Project Trip Pass-By

The Aviano residential development is unlikely to create any pass-by trips. Pass-by trips are typically calculated based on data published in ITE's *Trip Generation Handbook, 2nd Edition*<sup>2</sup> which includes weekday AM and PM information. This reference assumes no pass-by trips for this specific land use.

Trip generation was calculated based on the previous discussions and is reported in **Table 3**. Additional trip generation calculations are contained in the **Appendix**.

As noted in **Table 3**, the project will generate approximately 400 new peak AM trips and approximately 533 new peak PM trips.

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<sup>1</sup> *Trip Generation, 9th Edition*, Institute of Transportation Engineers, 2012.

<sup>2</sup> *Trip Generation Handbook, 2nd Edition*, Institute of Transportation Engineers, June 2004.

**Table 3 – Aviano Residential Trip Generation**

TIME PERIOD	LAND USE	Trip Rate			Trips		
		In	Out	Total	In	Out	Total
AM Peak	Single-Family Detached Housing (533 DU)	0.1875	0.5625	0.75	100	300	400
PM Peak	Single-Family Detached Housing (533 DU)	0.63	0.37	1.00	336	197	533

### Project Trip Distribution and Assignment

The Aviano residential development project trip distribution is based on the City’s traffic model provided by the City from the previous traffic study published in 2008 and as well as existing traffic patterns and field observations. **Figure 5** shows the traffic distribution assumed in this traffic report for the Existing and Near-term plus Project scenarios. Based on the assumed trip distribution, new vehicle trips generated by the Aviano residential development were assigned to the street network as shown in **Figure 6**.

It was also assumed that in the Existing and Near-term plus Project scenarios, the trip distribution for the Dozier Libbey Medical High School would redistribute to utilize the Hillcrest Road extension and Sand Creek Road extension to get to school. It was assumed that trips coming from the east would utilize the Hillcrest Road and Sand Creek Road extension instead of traveling along Lone Tree Way and Deer Valley Road (which is to the west of the school). The distribution of trips coming from the east and the west was based off of the future travel demand model’s distribution in the Long-Term scenario.

Due to the future roadways being completed only in the Long-term scenario, the trip distribution is different in the Near-term than the Long-term. When compared, the Long-term trip distribution is higher in the southern portions of the City along Sand Creek Road, Deer Valley Road, Hillcrest Avenue, and the SR-4 bypass. **Figure 7** shows the traffic distribution assumed in this traffic report for the Long-term plus Project scenario. Based on the assumed trip distribution, new vehicle trips generated by the Aviano residential development were assigned to the street network as shown in **Figure 8**.

### Project Roadway Improvements

As part of the proposed project, Hillcrest Avenue will be extended from Prewett Ranch Drive to the future extension of Sand Creek Road. Sand Creek Road will also be extended from the Dozier Libbey Medical High School to the Hillcrest Avenue extension. The project also proposes to add sidewalk along the frontage of the project. Bicycle

lanes will be added along Hillcrest Avenue and Sand Creek Road. The project also proposes to add an access intersection on the Hillcrest Avenue extension, which is planned to be signalized. An access intersection on the Sand Creek Road extension is also planned, which is signalized. It is important to note that the project intersections are only analyzed under the plus Proposed Project conditions, as they will not exist without the construction of the project.

## EXISTING (2014) PLUS PROJECT TRAFFIC CONDITIONS

Project traffic was added to the existing volumes at the study intersections and the volumes are shown in **Figure 9**. Traffic operations were evaluated under the Existing (2014) Plus Project Traffic Conditions. Results of the analysis are presented in **Table 4**. Additional detail is provided in the **Appendix**.

As shown in **Table 4**, all the study intersections function within acceptable standards under this analysis scenario.

**Table 4 – Existing (2014) Plus Project Level of Service Summary**

	Intersection	LOS Criteria	Jurisdiction	Control	Existing				Existing + Project					
					AM Peak		PM Peak		AM Peak			PM Peak		
					LOS	Delay	LOS	Delay	LOS	Delay	Var	LOS	Delay	Var
1	Lone Tree Way and Dallas Ranch Road	D	City	Signal	C	25.2	C	20.7	C	25.0	-0.2	C	20.7	0.0
2	Lone Tree Way and Black Diamond Drive	D	City	Signal	A	5.1	A	3.7	A	5.0	-0.1	A	3.6	-0.1
3	Lone Tree Way and Country Hills Drive	D	City	Signal	C	25.3	B	18.2	C	25.1	-0.2	B	18.2	0.0
4	Country Hills Drive and Deer Valley Road	D	City	Signal	B	15.4	B	11.1	B	15.5	0.1	B	11.2	0.1
5	Lone Tree Way and Deer Valley Road	D	City	Signal	D	44.0	C	25.1	D	42.6	-1.4	C	25.1	0.0
6	Lone Tree Way and Prewett Park	D	City	Signal	C	29.5	B	13.2	C	29.9	0.4	B	13.8	0.6
7	Prewett Ranch Drive and Deer Valley Road	D	City	Signal	B	19.6	B	15.3	B	19.8	0.2	B	16.1	0.8
8	Sand Creek Road and Deer Valley Road	D	City	Signal	C	24.8	A	6.7	C	23.5	-1.3	A	7.7	1.0
9	Sand Creek Road and Kaiser Way	D	City	SSSC	B	13.1	A	1.6	B	12.9	-0.2	A	2.5	0.9
	<i>Worst Approach</i>				D	31.0	A	9.2	D	29.3	-1.7	A	9.6	0.4
10	Sand Creek Road and High School Driveway	D	City	SSSC	Future Intersection				A	8.9	-	A	2.2	-
	<i>Worst Approach</i>				Future Intersection				B	12.6	-	A	8.6	-
11	Sand Creek Road and South Project Driveway	D	City	Signal	Future Intersection				A	7.6	-	A	7.8	-
12	Sand Creek Road and Hillcrest Avenue	D	City	Signal	Future Intersection				B	19.1	-	C	21.7	-
13	Sand Creek Road and Heidorn Ranch Road	D	City	Signal	Future Intersection				Future Intersection					
14	Sand Creek Road and SB SR-4 Ramp	D	City	Signal	A	1.2	A	0.7	A	1.2	0	A	0.7	0.0
15	Sand Creek Road and NB SR-4 Ramp	D	City	Signal	A	8.4	A	9.7	A	8.4	0	A	9.8	0.1
16	East Project Driveway and Hillcrest Avenue	D	City	Signal	Future Intersection				A	8.9	-	C	20.2	-
17	Prewett Ranch Drive and Heidorn Ranch Road	D	City	Signal	Future Intersection				Future Intersection					
18	Prewett Ranch Drive and Hillcrest Avenue	D	City	Signal (AWSC)*	A	9.8	A	9.8	B	11.3	1.5	B	13.2	3.4
19	Lone Tree Way and Hillcrest Avenue	D	City	Signal	C	22.1	B	18.0	C	23.7	1.6	C	25.2	7.2
20	Country Hills Drive and Hillcrest Avenue	D	City	Signal	C	28.7	C	20.4	C	28.3	-0.4	B	19.8	-0.6
21	Laurel Road and Hillcrest Avenue	D	City	Signal	B	14.4	B	13.8	B	14.2	-0.2	B	13.6	-0.2
22	Lone Tree Way and Vista Grande Drive	D	City	Signal	A	8.7	A	8.3	A	7.9	-0.8	A	7.5	-0.8
23	Lone Tree Way and Heidorn Ranch Road	D	City	Signal	A	3.0	A	3.6	A	2.7	-0.3	A	3.4	-0.2
24	Lone Tree Way and Canada Valley Road	D	City	Signal	B	13.6	B	14.4	B	12.9	-0.7	B	13.8	-0.6
25	Lone Tree Way and SB SR-4	D	City	Signal	B	13.3	A	8.8	B	13.4	0.1	A	9.2	0.4
26	Lone Tree Way and Jeffrey Way	D	City	Signal	B	11.2	A	7.9	A	9.2	-2	A	8.1	0.2

Note: \*Prewett Ranch Drive and Hillcrest Avenue is a signalized intersection, however it operates as an All Way Stop Control (AWSC) with flashing red lights.

## NEARBY ROADWAY AND DEVELOPMENT PROJECTS

### Planned Roadway Projects in Vicinity of Site

There are roadway improvements planned in the study area for the Near-term (2015) as identified by the City. The following summarizes the future intersection improvements and roadway improvements that will affect the study area:

- Intersection 5 – The intersection of Deer Valley Road and Lone Tree Way is anticipated to add a second southbound left turn lane.
- Intersection 14 – The west leg of Sand Creek Road and SB SR-4 Ramps will be striped to have a westbound left turn lane and two westbound through lanes. A southbound right turn lane will be added as well.
- Intersection 18 – The intersection of Hillcrest Avenue and Prewett Ranch Drive currently has new traffic signal equipment constructed, but is set on flashing all red. However, when the project is constructed and the south leg is built with the project, it is anticipated that the traffic signal will be fully operational. In addition to the traffic signal being fully operational, a southbound through lane will be added, and the southbound right turn will be converted to a shared through-right turn lane.
- Intersection 19 – The intersection of Lone Tree Way and Hillcrest Avenue is anticipated to add a second southbound left turn lane.
- Intersection 24 – The intersection of Lone Tree Way and Canada Valley Road will be restriped on the eastbound and southbound approaches. The eastbound approach will be restriped to have dual left turns. The southbound approach will be restriped to be dual left turn lanes and a through-right lane.

The extension of Hillcrest Avenue and Sand Creek Road will be completed as part of the proposed project and therefore will not be assumed in the Near-term (2015) without project scenario.

**Figure 10** illustrates the intersection geometry and traffic control assumed in the Near-term (2015) analysis.

### Approved & Pending Development Projects in Vicinity of Site

Kimley-Horn coordinated with the City of Antioch, City of Brentwood, and City of Oakley to determine if there were any development projects in the vicinity of the project site that are in various stages of planning, approval, or development. These projects were identified and included in the Near-term (2015) conditions. Available trip generation and trip distribution was used to assign vehicle trips to the study area. Since there are a significant number of large residential developments, the number of residential units assumed to generate traffic was limited to 263 units per year. This number was determined based on data provided by the cities showing the number of building permits

pulled annually in previous years. This average number of permits pulled annually was used for the future years.

**Figure 11** shows the pending and approved projects considered in this study for the Near-term scenario. The pending and approved project trips were assigned to the study area and are shown in **Figure 12**.

## NEAR-TERM (2015) TRAFFIC CONDITIONS

Traffic operations were evaluated under the following development conditions:

- Near-Term (2015) Conditions
- Near-Term (2015) plus Project Conditions

Near-term (2015) volumes were calculated by using the list of pending and approved development projects and determining trip generation, trip distribution, and trip assignment for each project. Vehicle trips were then assigned to the project study area. **Figure 13** illustrates the Near-term (2015) volumes.

### Near-Term Intersection Level of Service

Near-term (2015) volumes were evaluated at the study intersections. Results are presented in **Table 5**. Analysis sheets are provided in the **Appendix**. As shown in **Table 5**, all study intersections function within acceptable standards under this analysis scenario, except the intersection of Sand Creek Road and Kaiser Way. This intersection operates at LOS F in the AM peak during the Near-term without Project scenario.

The intersection mentioned above would operate below acceptable thresholds regardless of the proposed project. Analysis sheets are provided in the **Appendix**.

**Table 5 – Near-Term (2015) Intersection Level of Service Summary**

	Intersection	LOS Criteria	Jurisdiction	Control	Near-Term			
					AM Peak		PM Peak	
					LOS	Delay	LOS	Delay
1	Lone Tree Way and Dallas Ranch Road	D	City	Signal	C	25.0	C	20.5
2	Lone Tree Way and Black Diamond Drive	D	City	Signal	A	4.8	A	3.3
3	Lone Tree Way and Country Hills Drive	D	City	Signal	C	24.1	C	21.8
4	Country Hills Drive and Deer Valley Road	D	City	Signal	B	17.5	B	13.0
5	Lone Tree Way and Deer Valley Road	D	City	Signal	D	48.4	D	43.4
6	Lone Tree Way and Prewett Park	D	City	Signal	C	31.8	B	15.0
7	Prewett Ranch Drive and Deer Valley Road	D	City	Signal	C	23.0	B	17.3
8	Sand Creek Road and Deer Valley Road	D	City	Signal	D	44.5	A	10.0
9	Sand Creek Road and Kaiser Way	D	City	SSSC	<b>F</b>	<b>65.4</b>	A	0.9
	<i>Worst Approach</i>				<b>F</b>	<b>193.1</b>	B	10.0
10	Sand Creek Road and High School Driveway	D	City	SSSC	Future Intersection			
	<i>Worst Approach</i>				Future Intersection			
11	Sand Creek Road and South Project Driveway	D	City	Signal	Future Intersection			
12	Sand Creek Road and Hillcrest Avenue	D	City	Signal	Future Intersection			
13	Sand Creek Road and Heidorn Ranch Road	D	City	Signal	Future Intersection			
14	Sand Creek Road and SB SR-4 Ramp	D	City	Signal	B	19.5	C	31.8
15	Sand Creek Road and NB SR-4 Ramp	D	City	Signal	B	12.1	B	15.2
16	East Project Driveway and Hillcrest Avenue	D	City	Signal	Future Intersection			
17	Prewett Ranch Drive and Heidorn Ranch Road	D	City	Signal	Future Intersection			
18	Prewett Ranch Drive and Hillcrest Avenue	D	City	Signal	B	15.4	B	14.8
19	Lone Tree Way and Hillcrest Avenue	D	City	Signal	C	30.0	C	26.2
20	Country Hills Drive and Hillcrest Avenue	D	City	Signal	C	29.3	C	22.6
21	Laurel Road and Hillcrest Avenue	D	City	Signal	B	15.2	B	15.4
22	Lone Tree Way and Vista Grande Drive	D	City	Signal	A	7.6	A	7.7
23	Lone Tree Way and Heidorn Ranch Road	D	City	Signal	A	2.5	A	3.1
24	Lone Tree Way and Canada Valley Road	D	City	Signal	A	9.5	B	12.6
25	Lone Tree Way and SB SR-4	D	City	Signal	B	13.2	B	12.5
26	Lone Tree Way and Jeffrey Way	D	City	Signal	B	10.7	A	8.9

Note: Intersections that are operating below acceptable levels are shown in **BOLD**.

It should be noted that calculations of delay at saturated conditions (i.e., LOS F) are less reliable than at LOS E or better. Therefore, delay in excess of 80 seconds is reported in the table to allow a relative comparison of without and with project conditions and should not be interpreted as an exact representation of actual delay.

## Near-Term Plus Project Intersection Level of Service

Near-Term plus project traffic conditions were evaluated at the study intersections and are shown in **Figure 14**. As noted earlier, locations operating unacceptably that have an increase in delay are considered to be subject to a significant impact.

As shown in **Table 6**, all study intersections function within acceptable standards under this analysis scenario, except the intersection of Sand Creek Road and Kaiser Way. This intersection operates at LOS F in the AM peak during the Near-term plus Project scenario. Although the intersection operated at LOS F without the project, the delay decreased with the addition of project trips and redistribution of school trips and therefore is not a significant impact.

**Table 6 – Near-Term (2015) Plus Project Intersection Level of Service Summary**

	Intersection	LOS Criteria	Jurisdiction	Control	Near-Term				Near-Term + Project					
					AM Peak		PM Peak		AM Peak			PM Peak		
					LOS	Delay	LOS	Delay	LOS	Delay	Var	LOS	Delay	Var
1	Lone Tree Way and Dallas Ranch Road	D	City	Signal	C	25.0	C	20.5	C	24.9	-0.1	C	20.7	0.2
2	Lone Tree Way and Black Diamond Drive	D	City	Signal	A	4.8	A	3.3	A	4.7	-0.1	A	3.2	-0.1
3	Lone Tree Way and Country Hills Drive	D	City	Signal	C	24.1	C	21.8	C	23.9	-0.2	C	21.9	0.1
4	Country Hills Drive and Deer Valley Road	D	City	Signal	B	17.5	B	13.0	B	17.6	0.1	B	13.1	0.1
5	Lone Tree Way and Deer Valley Road	D	City	Signal	D	48.4	D	43.4	D	47.7	-0.7	D	45.7	2.3
6	Lone Tree Way and Prewett Park	D	City	Signal	C	31.8	B	15.0	D	34.4	2.6	B	15.7	0.7
7	Prewett Ranch Drive and Deer Valley Road	D	City	Signal	C	23.0	B	17.3	C	23.4	0.4	B	18.3	1.0
8	Sand Creek Road and Deer Valley Road	D	City	Signal	D	44.5	A	10.0	D	39.2	-5.3	B	11.2	1.2
9	Sand Creek Road and Kaiser Way	D	City	SSSC	<b>F</b>	<b>65.4</b>	A	0.9	<b>F</b>	<b>64.3</b>	<b>-1.1</b>	A	1.5	0.6
	<i>Worst Approach</i>				<b>F</b>	<b>193.1</b>	B	10.0	<b>F</b>	<b>183.1</b>	<b>-10.0</b>	B	10.5	0.5
10	Sand Creek Road and High School Driveway	D	City	SSSC	Future Intersection				A	8.9	-	A	2.2	-
	<i>Worst Approach</i>				Future Intersection				B	12.6	-	A	8.6	-
11	Sand Creek Road and South Project Driveway	D	City	Signal	Future Intersection				B	13.0	-	B	18.7	-
12	Sand Creek Road and Hillcrest Avenue	D	City	Signal	Future Intersection				B	15.9	-	B	18.3	-
13	Sand Creek Road and Heidorn Ranch Road	D	City	Signal	Future Intersection				Future Intersection					
14	Sand Creek Road and SB SR-4 Ramp	D	City	Signal	B	19.5	C	31.8	B	19.6	0.1	C	32.1	0.3
15	Sand Creek Road and NB SR-4 Ramp	D	City	Signal	B	12.1	B	15.2	B	12.0	-0.1	B	15.8	0.6
16	East Project Driveway and Hillcrest Avenue	D	City	Signal	Future Intersection				A	8.8	-	C	20.2	-
17	Prewett Ranch Drive and Heidorn Ranch Road	D	City	Signal	Future Intersection				Future Intersection					
18	Prewett Ranch Drive and Hillcrest Avenue	D	City	Signal	B	15.4	B	14.8	B	19.0	3.6	C	20.5	5.7
19	Lone Tree Way and Hillcrest Avenue	D	City	Signal	C	30.0	C	26.2	C	28.2	-1.8	C	27.8	1.6
20	Country Hills Drive and Hillcrest Avenue	D	City	Signal	C	29.3	C	22.6	C	28.9	-0.4	C	22.3	-0.3
21	Laurel Road and Hillcrest Avenue	D	City	Signal	B	15.2	B	15.4	B	15.1	-0.1	B	15.2	-0.2
22	Lone Tree Way and Vista Grande Drive	D	City	Signal	A	7.6	A	7.7	A	7.1	-0.5	A	7.4	-0.3
23	Lone Tree Way and Heidorn Ranch Road	D	City	Signal	A	2.5	A	3.1	A	2.4	-0.1	A	3.1	0.0
24	Lone Tree Way and Canada Valley Road	D	City	Signal	A	9.5	B	12.6	A	9.1	-0.4	B	12.7	0.1
25	Lone Tree Way and SB SR-4	D	City	Signal	B	13.2	B	12.5	B	14.3	1.1	B	19.8	7.3
26	Lone Tree Way and Jeffrey Way	D	City	Signal	B	10.7	A	8.9	B	10.8	0.1	A	9.2	0.3

Note: Intersections that are operating below acceptable levels are shown in **BOLD**.

It should be noted that calculations of delay at saturated conditions (i.e., LOS F) are less reliable than at LOS E or better. Therefore, delay in excess of 80 seconds is reported in the table to allow a relative comparison of without and with project conditions and should not be interpreted as an exact representation of actual delay.



## LONG-TERM (2030) CONDITIONS

### Long-Term Lane Configurations and Traffic Control

There are roadway improvements planned in the study area for the Long-term (2030) as identified by the City. In the Long-term (2030) scenario, Lone Tree Way, west of Hillcrest Road, will be restriped to have three through lanes in each direction. Sand Creek Road is planned to be extended from the Dozier Libbey Medical High School to the SR-4 bypass, regardless of whether the proposed Aviano residential development occurs or not. It is assumed that there will be other development that occurs to warrant the construction of the Sand Creek Road extension. Sand Creek Road is also anticipated to be extended from Deer Valley Road to the Dozier Libbey Medical High School. The extension of Hillcrest Avenue is also planned regardless of the proposed Aviano residential development, and will extend to Balfour Road.

The following summarizes the future intersection improvements and roadway improvements that will affect the study area:

- Intersection 5 – The intersection of Lone Tree Way/Deer Valley Road will be updated. The eastbound right turn lane will be restriped as an eastbound shared through-right turn lane. The westbound approach will be restriped to include two left turn lanes, a through lane, and a shared through-right turn lane.
- Intersection 8 – The intersection of Sand Creek Road/Deer Valley Road will be updated. An additional through lane will be added to the southbound, eastbound, and westbound approaches. The southbound approach will also include dual left turns.
- Intersection 9 – The intersection configuration for the intersection of Sand Creek Road/Kaiser Way will be altered due to the realignment of Sand Creek Road. Sand Creek Road will be two lanes in each direction. The eastbound approach will be a left turn lane and two through lanes. The westbound approach will be two through lanes, and a right turn lane. The southbound approach will be a left turn lane and two right turn lanes.
- Intersection 10 – The intersection configuration for the intersection of Sand Creek Road/Dozier Libby Medical High School will be altered due to the realignment of Sand Creek Road. Sand Creek Road will now run east-west and be two lanes in each direction. The eastbound approach will be a left turn lane and two through lanes. The westbound approach will be one through lane and a shared through-right turn lane. The southbound approach will be a left turn lane and a right turn lane.
- Intersection 13 – The intersection of Sand Creek Road/Heidorn Ranch Road will be a newly constructed intersection. The eastbound approach will be a left turn lane and two through lanes. The westbound approach will be one through lane and a shared through-right turn lane. The southbound approach will be a left turn lane and a right turn lane.

- Intersection 15 – The intersection of Sand Creek Road/NB SR-4 Ramps will be slightly altered. The eastbound approach will be a left turn lane and two through lanes. The westbound approach will be two through lanes, and a right turn lane. The southbound approach will be a shared left-through lane and a right turn lane.
- Intersection 17 – The intersection of Prewett Ranch Drive/Heidorn Ranch Road will be a newly constructed intersection. The eastbound approach will be a left turn lane and a right turn lane. The northbound approach will be a left turn lane and two through lanes. The southbound approach will be a future left turn lane, a through lane, and a shared through-right turn lane.
- Intersection 19 – The intersection of Lone Tree Way and Hillcrest Avenue will be updated. The eastbound right turn lane will be restriped as an eastbound shared through-right turn lane. The westbound approach will be restriped to include two left turn lanes, two through lanes, and a right turn lane.
- Intersection 24 – The intersection of Lone Tree Way and Canada Valley Road will be restriped on the eastbound and southbound approaches. The eastbound approach will be restriped to have dual left turns. The southbound approach will be restriped to be dual left turn lanes and a shared through-right lane.

**Figure 15** illustrates the intersection geometry and traffic control assumed in the Long-term (2030) analysis.

## Year 2030 Forecast Model Volumes

Year 2030 roadway link volumes from the CCTA Travel Demand Forecast model were obtained from the County. The model was used to plot bi-directional AM and PM peak-hour traffic volumes on each segment along roadways within the study area. Model output was used to compare 2010 base year volumes and year 2040 future model forecasts to determine the annual incremental growth in traffic volumes at study intersections. Year 2030 turning movement volumes were calculated by adding the growth increment to the current year (2014) traffic count to calculate the final adjusted roadway link forecast volume. Final adjusted forecast volumes were then converted to Long-term (2030) intersection turning movement volumes using a traffic modeling standard process commonly referred to as the Furness method. The Furness method uses an iterative process to derive future turning movement volumes based on future year roadway link volumes and an initial estimate of turning percentages (obtained from the 2014 intersection turning movement counts).

## LONG-TERM TRAFFIC CONDITIONS

Traffic operations were evaluated under the following long-term conditions:

- Long-Term (2030) Conditions
- Long-Term (2030) plus Project Conditions

## Long-Term Intersection Level of Service

Long-term (2030) traffic volumes were evaluated at study intersections and are presented in **Figure 16**. As shown in **Table 7**, all the intersections function within acceptable standards under this analysis scenario. Analysis sheets are provided in the **Appendix**.

**Table 7 – Long-Term (2030) Intersection Level of Service Summary**

	Intersection	LOS Criteria	Jurisdiction	Control	Long-Term (2030)			
					AM Peak		PM Peak	
					LOS	Delay	LOS	Delay
1	Lone Tree Way and Dallas Ranch Road	D	City	Signal	D	36.7	D	52.2
2	Lone Tree Way and Black Diamond Drive	D	City	Signal	A	4.6	A	3.2
3	Lone Tree Way and Country Hills Drive	D	City	Signal	C	30.3	C	26.8
4	Country Hills Drive and Deer Valley Road	D	City	Signal	C	21.4	B	15.1
5	Lone Tree Way and Deer Valley Road	D	City	Signal	D	48.4	D	48.0
6	Lone Tree Way and Prewett Park	D	City	Signal	C	29.1	B	14.6
7	Prewett Ranch Drive and Deer Valley Road	D	City	Signal	C	24.8	B	18.0
8	Sand Creek Road and Deer Valley Road	D	City	Signal	D	39.3	B	12.2
9	Sand Creek Road and Kaiser Way	D	City	Signal	B	10.0	B	10.3
10	Sand Creek Road and High School Driveway	D	City	SSSC	A	6.8	A	1.4
	<i>Worst Approach</i>				B	11.2	B	10.1
11	Sand Creek Road and South Project Driveway	D	City	Signal	Future Intersection			
12	Sand Creek Road and Hillcrest Avenue	D	City	Signal	C	28.2	C	27.5
13	Sand Creek Road and Heidorn Ranch Road	D	City	Signal	B	19.5	B	15.6
14	Sand Creek Road and SB SR-4 Ramp	D	City	Signal	B	14.6	C	28.7
15	Sand Creek Road and NB SR-4 Ramp	D	City	Signal	B	17.9	B	17.9
16	East Project Driveway and Hillcrest Avenue	D	City	Signal	Future Intersection			
17	Prewett Ranch Drive and Heidorn Ranch Road	D	City	Signal	B	10.5	A	8.1
18	Prewett Ranch Drive and Hillcrest Avenue	D	City	Signal	B	18.0	B	17.4
19	Lone Tree Way and Hillcrest Avenue	D	City	Signal	C	33.1	C	25.5
20	Country Hills Drive and Hillcrest Avenue	D	City	Signal	C	28.7	C	22.9
21	Laurel Road and Hillcrest Avenue	D	City	Signal	B	16.0	B	15.5
22	Lone Tree Way and Vista Grande Drive	D	City	Signal	A	8.1	A	8.1
23	Lone Tree Way and Heidorn Ranch Road	D	City	Signal	A	2.7	A	3.9
24	Lone Tree Way and Canada Valley Road	D	City	Signal	A	9.8	B	12.6
25	Lone Tree Way and SB SR-4	D	City	Signal	B	13.6	B	17.7
26	Lone Tree Way and Jeffrey Way	D	City	Signal	B	12.9	A	8.9

Note: Intersections that are operating below acceptable levels are shown in **BOLD**.

## Long-Term (2030) Plus Project Intersection Level of Service

Long-Term (2030) plus project traffic conditions were evaluated at the study intersections and are shown in **Figure 17**. As shown in **Table 8**, all the intersections function within acceptable standards under this analysis scenario.

**Table 8 – Long-Term (2030) Plus Project Intersection Level of Service Summary**

	Intersection	LOS Criteria	Jurisdiction	Control	Long-Term (2030)				Long-Term (2030) + Project					
					AM Peak		PM Peak		AM Peak			PM Peak		
					LOS	Delay	LOS	Delay	LOS	Delay	Var	LOS	Delay	Var
1	Lone Tree Way and Dallas Ranch Road	D	City	Signal	D	36.7	D	52.2	D	36.6	-0.1	D	53.5	1.3
2	Lone Tree Way and Black Diamond Drive	D	City	Signal	A	4.6	A	3.2	A	4.5	-0.1	A	3.1	-0.1
3	Lone Tree Way and Country Hills Drive	D	City	Signal	C	30.3	C	26.8	C	30.1	-0.2	C	26.8	0.0
4	Country Hills Drive and Deer Valley Road	D	City	Signal	C	21.4	B	15.1	C	21.5	0.1	B	15.2	0.1
5	Lone Tree Way and Deer Valley Road	D	City	Signal	D	48.4	D	48.0	D	50.5	2.1	D	49.8	1.8
6	Lone Tree Way and Prewett Park	D	City	Signal	C	29.1	B	14.6	C	29.9	0.8	B	14.5	-0.1
7	Prewett Ranch Drive and Deer Valley Road	D	City	Signal	C	24.8	B	18.0	C	25.2	0.4	B	17.5	-0.5
8	Sand Creek Road and Deer Valley Road	D	City	Signal	D	39.3	B	12.2	D	41.1	1.8	B	13.7	1.5
9	Sand Creek Road and Kaiser Way	D	City	Signal	B	10.0	B	10.3	B	10.1	0.1	B	10.3	0.0
10	Sand Creek Road and High School Driveway	D	City	SSSC	A	6.8	A	1.4	A	6.6	-0.2	A	1.2	-0.2
	<i>Worst Approach</i>				B	11.2	B	10.1	B	11.5	0.3	B	10.5	0.4
11	Sand Creek Road and South Project Driveway	D	City	Signal	Future Intersection				A	8.4	-	B	11.4	-
12	Sand Creek Road and Hillcrest Avenue	D	City	Signal	C	28.2	C	27.5	C	30.4	2.2	C	30.3	2.8
13	Sand Creek Road and Heidorn Ranch Road	D	City	Signal	B	19.5	B	15.6	B	18.6	-0.9	B	15.8	0.2
14	Sand Creek Road and SB SR-4 Ramp	D	City	Signal	B	14.6	C	28.7	B	15.9	1.3	C	27.9	-0.8
15	Sand Creek Road and NB SR-4 Ramp	D	City	Signal	B	17.9	B	17.9	B	17.8	-0.1	B	18.2	0.3
16	East Project Driveway and Hillcrest Avenue	D	City	Signal	Future Intersection				A	7.6	-	B	14.1	-
17	Prewett Ranch Drive and Heidorn Ranch Road	D	City	Signal	B	10.5	A	8.1	B	10.5	0.0	A	8.1	0.0
18	Prewett Ranch Drive and Hillcrest Avenue	D	City	Signal	B	18.0	B	17.4	B	19.0	1.0	B	17.2	-0.2
19	Lone Tree Way and Hillcrest Avenue	D	City	Signal	C	33.1	C	25.5	C	33.8	0.7	C	27.1	1.6
20	Country Hills Drive and Hillcrest Avenue	D	City	Signal	C	28.7	C	22.9	C	28.5	-0.2	C	22.7	-0.2
21	Laurel Road and Hillcrest Avenue	D	City	Signal	B	16.0	B	15.5	B	16.0	0.0	B	15.4	-0.1
22	Lone Tree Way and Vista Grande Drive	D	City	Signal	A	8.1	A	8.1	A	7.9	-0.2	A	7.9	-0.2
23	Lone Tree Way and Heidorn Ranch Road	D	City	Signal	A	2.7	A	3.9	A	2.7	0.0	A	3.9	0.0
24	Lone Tree Way and Canada Valley Road	D	City	Signal	A	9.8	B	12.6	A	9.5	-0.3	B	12.6	0.0
25	Lone Tree Way and SB SR-4	D	City	Signal	B	13.6	B	17.7	B	14.6	1.0	C	23.2	5.5
26	Lone Tree Way and Jeffrey Way	D	City	Signal	B	12.9	A	8.9	B	13.1	0.2	A	8.7	-0.2

Note: Intersections that are operating below acceptable levels are shown in **BOLD** and significant impacts are highlighted.

## VEHICLE QUEUING FOR ALL SCENARIOS

As congestion increases it is common for traffic at signals and stop signs to form lines of stopped (or queued) vehicles. Queue lengths were determined for each lane and measure the distance that vehicles back up for each lane. Synchro software calculates the queues based on HCM 2000 methodology. The 95th percentile queue represents a condition where 95 percent of the time during the peak period, traffic volumes and related queuing will be less than or equal to the queue length reported by the analysis. It is used as the benchmark for impacts as a standard transportation engineering practice. Average queuing is generally less. The 95th percentile queue was estimated under the various development conditions and in consideration of the planned intersection and signal timing improvements.<sup>3</sup> A typical vehicle length of 25 feet is used in the queuing analysis. As stated in the Operating Conditions and Criteria, a significant impact was assumed to occur if the queue increases by one or more vehicles and the vehicle queue exceeds the turn pocket length. A summary of the queuing results is included in the **Appendix**.

The analysis showed that several existing turn bays lengths are exceeded under future traffic volumes. In most cases the inadequate queue lengths are not associated with the project, but are a result of pre-existing deficiencies. For example, the eastbound right turn queue at the intersection of Lone Tree Way and Dallas Ranch Road is 133 feet during the AM peak during Existing conditions and the queue length is also 133 feet during the PM peak in the Existing Plus Project conditions. Although the turn pocket length is 75 feet long and the queue spills out of the turn pocket, the result is a pre-existing deficiency not associated with the project and is therefore not an impact since the project did not increase the queue by at least one vehicle length.

In addition, queues that extend out of their turn pockets for turning movements that go with the through movement are not considered significant impacts. This applies to all right turn movements, as well as left turn movements that have split phasing.

At locations affected by project traffic, the increase in vehicle queuing is typically less than one vehicle, except at the following intersections:

- Intersection 19 (Existing Plus Project) – Hillcrest Avenue / Lone Tree Way (WBL: Total queue length is 455 feet, 195 feet longer than the 260 foot turn pocket length during the PM peak hour in Existing Plus Project conditions. The Existing (Without Project) queue length is 92 feet. The project creates less than fifteen (15) vehicles or 363 feet of the total queue.)

Although the queue increase is more than one vehicle at this location due to the project, there is a planned improvement by the City at the intersection. The City will restripe one

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<sup>3</sup> Existing queuing was calibrated in the Synchro model based on existing signal timing parameters and field observations.

of the westbound through lanes to be a left turn lane. This will result in two westbound left turn lanes at this intersection. The improvement is expected to be completed by 2017, before the project is built. The improvement will reduce the queue to be contained in the left turn storage and therefore, there is no significant impact.

## DELAY INDEX FOR ALL SCENARIOS

The delay index (DI) is defined as the ratio between the peak congested travel time and the uncongested travel time along a roadway segment. A Synchro model was used for the traffic study to determine the delay index during all scenarios. Travel times were determined under peak congestion and also under uncongested conditions. Based on CCTA established criteria, Lone Tree Way, Hillcrest Avenue (north of Lone Tree Way), and Deer Valley Road are considered routes of regional significance within the study area and would be subject to this delay index analysis. In the Long-term scenario, Sand Creek Road be extended from SR-4 to Deer Valley Road and will become a route of regional significance. CCTA criteria do not have a threshold for DI and therefore the DI is used for comparison purposes only.

**Table 9** summarizes the delay index for the routes of regional significance in the study area. Based on the analysis, all routes of regional significance will operate at a delay index of 2.3 or better.

**Table 9 – Delay Index Summary**

Scenario	Time Period	Lone Tree Way		Hillcrest Avenue		Deer Valley Road		Sand Creek Road		
		EB	WB	NB	SB	NB	SB	EB	WB	
Uncongested Travel Time (sec)	AM Peak	325.3	325.3	191.6	60.2	191.6	181.5			
	PM Peak	325.1	325.3	191.6	60.2	191.6	181.5			
Existing	AM Peak	CTT (sec)	524.6	550.9	327.6	130.6	327.6	290.6		
		DI	1.6	1.7	1.7	2.2	1.7	1.6		
	PM Peak	CTT (sec)	502.3	517.2	331.9	119.8	331.9	273.4		
		DI	1.5	1.6	1.7	2.0	1.7	1.5		
Existing + Project	AM Peak	CTT (sec)	538.4	557.6	330.3	131.9	330.3	288.4		
		DI	1.7	1.7	1.6	2.2	1.7	1.6		
	PM Peak	CTT (sec)	521.8	529.1	83.3	120.8	324.0	267.9		
		DI	1.6	1.6	1.4	2.0	1.7	1.5		
Near-Term	AM Peak	CTT (sec)	583.4	596.6	98.2	132.4	336.9	331.6		
		DI	1.8	1.8	1.6	2.2	1.8	1.8		
	PM Peak	CTT (sec)	555.3	623.8	91.3	120.0	354.2	276.5		
		DI	1.7	1.9	1.5	2.0	1.8	1.5		
Near-Term + Project	AM Peak	CTT (sec)	575.5	601.1	98.9	132.8	334.8	314.5		
		DI	1.8	1.8	1.6	2.2	1.7	1.7		
	PM Peak	CTT (sec)	566.1	582.1	91.7	127.4	352.1	270.3		
		DI	1.7	1.8	1.5	2.1	1.8	1.5		
Long-Term	AM Peak	CTT (sec)	529.1	614.9	103.5	135.7	401.5	353.4	323.7	371.9
		DI	1.6	1.9	1.7	2.3	2.1	1.9	1.1	1.3
	PM Peak	CTT (sec)	561.1	658.1	92.6	120.8	350.5	273.2	337.6	369.9
		DI	1.7	2.0	1.5	2.0	1.8	1.5	1.1	1.3
Long-Term + Project	AM Peak	CTT (sec)	534.8	623.1	104.0	136.0	396.6	362.4	329.9	384.5
		DI	1.6	1.9	1.7	2.3	2.1	2.0	1.1	1.3
	PM Peak	CTT (sec)	568.7	668.1	92.8	121.6	345.5	276.3	339.4	378.0
		DI	1.7	2.1	1.5	2.0	1.8	1.5	1.2	1.3

CTT = Congested Travel Time

## POTENTIAL EFFECTS ON TRANSIT, BICYCLE, AND PEDESTRIAN MOBILITY

The project was evaluated to determine if it would likely conflict with adopted policies, plans, or programs supporting alternative transportation (e.g., bus turnouts, bicycle racks) or generate pedestrian, bicycle, or transit travel demand that would not be accommodated by transit, bicycle, or pedestrian facilities and plans.

Residents to the Aviano residential development have the option of driving, taking transit, walking or bicycling. For those taking transit, they can reach the site via future bus routes of the Tri-Delta Transit system.

According to the 2008-2012 U.S. Census<sup>4</sup>, five percent of Antioch residents use transit to travel to work. This typically represents the highest level of transit ridership during the day. If it is conservatively assumed that five percent of the residents associated with the Aviano residential development will use transit during the peak hours of the day, it represents approximately 20 passengers in the weekday AM and 27 passengers in the weekday PM peak periods.

Data was not readily available for peak hour ridership levels on the Tri-Delta Transit system but during the weekday periods, the routes operate as often as every 10 minutes and observations indicate that sufficient capacity exists on the buses to accommodate the potential additional transit demand. Furthermore, dispersion of the project-generated riders to the bus routes would result in a minimal effect on transit capacity. Thus the project impact on transit service is determined to be less than significant.

There are adequate pedestrian walkways from the project site to the existing sidewalks on Hillcrest Avenue. The project proposes to extend Hillcrest Avenue from Prewett Ranch Road to Sand Creek Road, adjacent to the proposed project, and construct sidewalks along either side. Although, the project proposes to construct sidewalk along Sand Creek Road fronting the southern edge of the project, there is still no sidewalk along Sand Creek Road between the Dozier Libbey Medical High School and the Kaiser Permanente access intersection. Pedestrians can walk along Hillcrest Avenue to Prewett Ranch Drive and walk west to access Deer Valley Road.

Cyclists will be able to access the residential development using the bike lane along Deer Valley Road to just south of Wellness Way. There is a gap between the bike lane and the proposed project. There are no bicycle facilities along Sand Creek Road between Deer Valley Road and the proposed project. Cyclists will also be able to access the project site via the bike lanes along Hillcrest Avenue to Prewett Ranch Drive.

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<sup>4</sup> *American Factfinder*, U.S. Census Bureau, 2013.

There is a gap between the bike lane and the proposed project. There are no bicycle facilities planned along Hillcrest Avenue south of Prewett Ranch Drive. There are also no bicycle facilities along Sand Creek Road east to the SR-4 bypass. This extensive bicycle network allows residents and visitors living within biking distance to travel to and from the project.

There are adequate transit facilities adjacent to the project site with continuous sidewalks and ramps to the transit stop locations. Therefore the Aviano residential development's impact on transit, pedestrian, or bicycle facilities is determined to be less than significant.

## SITE ACCESS AND CIRCULATION

On-site circulation was evaluated at the project's two access streets and within the project site. **Figure 2** shows the project site plan.

The two access points to the project are along the Hillcrest Avenue extension and the Sand Creek Road extension. Each of these intersections will be signalized intersections with full access.

The proposed project access street depths are as follows:

- Sand Creek Road/South entrance – 400 feet
- Hillcrest Avenue/East entrance – 400 feet

Blocked parking aisles can generate on-site congestion and inhibit efficient parking lot circulation. An analysis of on-site queuing with the Aviano residential development indicates that vehicles are not expected to queue up beyond the depth of the access streets.

## SUPPLEMENTAL ANALYSIS

A supplemental evaluation was completed to determine if Sand Creek Road will need to be four lanes or six lanes in the Long-term (2030) scenario. In addition, a supplemental evaluation was completed to determine the level of traffic that can be accommodated at the intersection of Lone Tree Way and Hillcrest Avenue if Sand Creek Road is not constructed between Deer Valley Road and Hillcrest Avenue as part of the Aviano project. The results are discussed below.



## Sand Creek Road Lane Geometry

It was determined that Sand Creek Road can operate with only four lanes in the Long-term scenario. The intersections along Sand Creek Road between SR-4 and Deer Valley Road all operate acceptably, with the exception of the intersection of Sand Creek Road and Deer Valley Road. However, this intersection operates poorly in the AM peak because of the insufficient number of turn lanes at the intersection. Sand Creek Road operates at a delay index of 1.3 or better in both direction and the AM and PM peaks, as shown in **Table 9**. This delay index is well below the County's threshold of 2.0. Therefore, Sand Creek Road can operate as a four lane roadway, and does not need six lanes.

## Intersection Operations of Lone Tree Way and Hillcrest Avenue if Sand Creek Road Is Not Constructed

It was determined that the intersection of Lone Tree Way and Hillcrest Avenue will operate acceptably if the Sand Creek Road extension was not constructed.

The project trips were rerouted to use only Hillcrest Avenue and not Sand Creek Road. A majority of the project trips would go through the intersection of Lone Tree Way and Hillcrest Avenue to reach their final destinations. A portion of the project trips turned off Hillcrest Avenue at the intersection Hillcrest Avenue and Prewett Ranch Drive. After rerouting the project trips, the project trips were added to the Long-term without project volumes in the AM and PM peaks to determine the worst case scenario for the intersection.

The intersection of Hillcrest Avenue and Prewett Ranch Drive operates at LOS C in the AM and PM peaks with a delay of 30.1 seconds and 30.9 seconds, respectively. Since the intersection operates at LOS C in the Long-term plus Project scenario, which is better than the LOS D threshold, the full project can be accommodated even if Sand Creek Road between Deer Valley Road and Hillcrest Avenue is not built with the project.

## SUMMARY OF IMPACTS AND RECOMMENDED MITIGATION

Based on the results of the traffic analysis and evaluation of the proposed site plan, there are no significant impacts.