

Traffic Impact Study for the 2151 Appian Way Multi-Family Housing Project



Prepared for the City of Pinole

Submitted by **W-Trans**

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Executive Summary

The proposed project includes the construction of 154 multi-family housing units to be located at 2151 Appian Way in the City of Pinole. The project is expected to generate an average of 838 trips per day, including 55 trips during the a.m. peak hour and 68 trips during the p.m. peak hour. The project site is currently occupied by a vacant medical center and is located within the Appian Way Project Area as part of the City's Three Corridors Specific Plan.

Analysis indicates that the study intersections of Appian Way/Mann Drive-Project Access and Appian Way/Tara Hills Drive-Canyon Drive both operate acceptably per the applicable City standards under Existing Conditions and would continue to do so with the addition of project-generated traffic.

The proposed project was determined to comply with land uses and bicycle plans set forth in the Three Corridors Specific Plan. However, it is suggested that the project applicant make a fair share contribution towards multimodal improvements identified in the Three Corridors Specific Plan.

The project is presumed to have a less-than-significant transportation impact on vehicle miles traveled based on OPR guidelines. However, to further reduce the project's potential impact, transportation demand management measures are recommended such as providing access to transit, provision of bicycle and pedestrian infrastructure improvements, and installation of electric vehicle charging stations.

There are adequate sidewalks and crosswalks for the pedestrians to access the project site. Upon the completion of the project, the proposed driveway with pedestrian crossing would be added as an east leg to the intersection of Appian Way/Mann Drive-Project Access, which may cause conflicts between pedestrian and vehicular traffic. To prevent potential conflicts, split phasing is recommended for the eastbound and westbound approaches of the intersection.

The existing bicycle facilities would be adequate to connect the project site with nearby destinations, upon completion of the bicycle projects in the project area. Additionally, as the project residents would be able to store their bicycles in the assigned private garages, the bicycle parking spaces would be considered adequate. The existing transit facilities serving the project are also adequate, with a WestCAT Route 17 bus stop located on Appian Way.

The project would be accessed via proposed driveways on Appian Way and Canyon Drive. It is noted that the driveway on Appian Way would become an east leg of the Appian Way/Mann Drive intersection. As the existing driveways would no longer be used upon the construction of the project, it is recommended to remove the southbound left-turn pocket serving the existing driveway on Appian Way approximately 350 feet south of the intersection with Mann Drive.

Adequate sight distance is available at each project driveway, on Appian Way and on Canyon Drive, with the exception of the sight lines to the east from the driveway on Canyon Drive due to the presence of the horizontal curve, steep hill, and on-street parking. To improve the sight lines, prohibition of on-street parking and maintenance or trimming vegetation is suggested. Additionally, the on-site circulation and access would have to satisfy City Design Standards and therefore would be expected to function acceptably for emergency response vehicles. The left-turn warrant analysis indicated that the left-turn lane on Canyon Drive at the proposed driveway is not warranted based on Existing plus Project p.m. peak hour volumes.

The proposed parking supply of 354 spaces would be equivalent to the City Code requirement.



Introduction

This report presents an analysis of the potential traffic impacts that would be associated with development of a proposed 154-unit multi-family housing project to be located at 2151 Appian Way in the City of Pinole. The traffic study was completed in accordance with the criteria established by the City and is consistent with standard traffic engineering techniques.

Prelude

The purpose of a traffic impact study is to provide City staff and policy makers with data that they can use to make an informed decision regarding the potential transportation impacts of a proposed project, and any associated improvements that would be required in order to mitigate these impacts to an acceptable level under CEQA, the City's General Plan, or other policies. Impacts relative to access for pedestrians, bicyclists, and to transit are addressed in the context of the CEQA criteria. Consistent with SB 743, the project's transportation impacts were analyzed using VMT. While no longer a part of the CEQA review process, vehicular traffic service levels at key intersections were evaluated for consistency with General Plan policies by determining the number of new trips that the proposed use would be expected to generate, distributing these trips to the surrounding street system based on anticipated travel patterns specific to the proposed project, then analyzing the effect the new traffic would be expected to have on the study intersections.

Project Profile

The proposed project includes 154 multi-family residential units on a site occupied by the vacant Doctor's Medical Center Pinole Campus. The project site would be accessed via driveways on Appian Way and Canyon Drive. It is noted that while the site is zoned with a residential mixed-use (RMU) land use in the northern half and commercial mixed-use (CMU) land use in the southern half, as contained in the *Three Corridors Specific Plan*, the project consists of only residential units. This is allowed with certain concessions, such as the affordable housing that is proposed as 15 percent of the units. The project site is located at 2151 Appian Way in the City of Pinole, as shown in Figure 1.





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Transportation Setting

Operational Analysis

Study Area and Periods

The study area consists of the following intersections:

- 1. Appian Way/Mann Drive-Project Access
- 2. Appian Way/Tara Hills Drive-Canyon Drive

Operating conditions during the a.m. and p.m. peak periods were evaluated to capture the highest potential impacts for the proposed project as well as the highest volumes on the local transportation network. The morning peak hour occurs between 7:00 and 9:00 a.m. and reflects conditions during the home to work or school commute, while the p.m. peak hour occurs between 4:00 and 6:00 p.m. and typically reflects the highest level of congestion during the homeward bound commute.

Study Intersections

Appian Way/Mann Drive-Project Access is a three-legged, signalized intersection with protected left-turn phasing on the northbound Appian Way approach. There are marked crosswalks on the west and south legs. It is noted that, upon completion of the project, the project driveway would be added as an east leg of the intersection.

Appian Way/Tara Hills Drive-Canyon Drive is a four-legged, signalized intersection with protected left-turn phasing on the northbound and southbound Appian Way approaches. The eastbound and westbound approaches both have split phasing and the eastbound approach also includes right-turn overlap phasing. There are marked crosswalks on north, west, and east legs.

The locations of the study intersections and the existing lane configurations and controls are shown in Figure 1.

Collision History

The collision history for the study area was reviewed to determine any trends or patterns that may indicate a safety issue. Collision rates were calculated based on records available from the California Highway Patrol as published in their Statewide Integrated Traffic Records System (SWITRS) reports. The most current five-year period available is April 1, 2015, through March 31, 2020.

As presented in Table 1, the calculated collision rates for the study intersections were compared to average collision rates for similar facilities statewide, as indicated in 2016 Collision Data on California State Highways, California Department of Transportation (Caltrans). These average rates statewide are for the signalized intersections in the urban environment with the four approaches. The collision rate for Appian Way/Mann Drive-Project access was below the statewide average while the Appian Way/Tara Hills Drive-Canyon Drive had a collision rate slightly above the statewide average. Therefore, the collision records for Appian Way/ Tara Hills Drive-Canyon Drive were further reviewed. The collision rate calculations are provided in Appendix A.



Table 1 – Collision Rates for the Study Intersections							
Study Intersection	Number of Collisions (2015-2020)	Calculated Collision Rate (c/mve)	Statewide Average Collision Rate (c/mve)				
1. Appian Wy/Mann Dr-Project Access	2	0.06	0.24				
2. Appian Wy/Tara Hills Dr-Canyon Dr	13	0.28	0.24				

Note: c/mve = collisions per million vehicles entering; **bold** text = higher crash rate than Statewide Average

The 13 recorded collisions that occurred at Appian Way/Tara Hills Drive-Canyon Drive included six rear-end, four sideswipe, one hit-object, one broadside, and one vehicle-pedestrian collision. Five out of six rear-end collisions involved northbound motorists and had a primary collision factor of unsafe speed. Upon reviewing the field conditions, this collision trend is likely due to the topography near the intersection. The incline in the northbound direction, as well as the curvature of the road with a hillside on the inside of the curve, may obstruct the line of sight for drivers who are traveling at speeds above the posted speed limit. As such, it recommended that the City consider installing an advance warning sign stating "Prepare to Stop" that lights up when northbound drivers should prepare to stop. Alternatively, or in addition, it is suggested that the City consider the need for increased enforcement on Appian Way near Tara Hills Drive-Canyon Drive to help reduce the potential for collisions due to unsafe speeds.

Alternative Modes

Pedestrian Facilities

Pedestrian facilities include sidewalks, crosswalks, pedestrian signal phases, curb ramps, curb extensions, and various streetscape amenities such as lighting, benches, etc. Within the project vicinity, sidewalks are present along both sides of Appian Way and Canyon Drive as well as on surrounding streets including Mann Drive and Tara Hills Drive. Further, pedestrian crossings are available at the intersections of Appian Way/ Mann Drive and Appian Way/Tara Hills Drive-Canyon Drive, which are signalized intersections with pedestrian phasing, marked crosswalks, and curb ramps.

Bicycle Facilities

The Highway Design Manual, Caltrans, 2017, classifies bikeways into the following four categories.

- **Class I Multi-Use Path** a completely separated right-of-way for the exclusive use of bicycles and pedestrians with cross flows of motorized traffic minimized.
- Class II Bike Lane a striped and signed lane for one-way bike travel on a street or highway.
- **Class III Bike Route** signing only for shared use with motor vehicles within the same travel lane on a street or highway.
- Class IV Bikeway also known as a separated bikeway, a Class IV Bikeway is for the exclusive use of bicycles and includes a separation between the bikeway and the motor vehicle traffic lane. The separation may include, but is not limited to, grade separation, flexible posts, inflexible physical barriers, or on-street parking.

There are currently Class III bicycle routes on Appian Way near the project site, which is planned to be converted into Class II bicycle lanes between Dalessi Lane and San Pablo Avenue according to the City's *General Plan*, 2010 and *Three Corridors Specific Plan*, City of Pinole, 2010. Class II bicycle lanes are also planned on San Pablo Avenue between Dursey Drive and the East City Limits. Along all the other streets in the project area, bicyclists would ride in the roadway and/or on sidewalks.



Table 2 summarizes the existing and planned bicycle facilities in the project vicinity, as contained in the *City of Pinole General Plan*.

Table 2 – Bicycle Facility Summary							
Status Facility	Class	Length (miles)	Begin Point	End Point			
Existing							
Appian Wy	III	0.70	I-80	San Pablo Ave			
Planned							
Appian Wy	II	1.30	Dalessi Ln	San Pablo Ave			
San Pablo Ave	II	1.90	Dursey Dr	East City Limits			

Sources: City of Pinole General Plan Update, City of Pinole, 2010.

Transit Facilities

Transit services in the City of Pinole and throughout Contra Costa County are provided by Western Contra Costa County Transit (WestCAT). WestCAT Route 16 provides fixed-route bus services in the cities of Hercules and Pinole and serves stops on both sides of Canyon Drive to the east of Appian Way, along the project frontage. The buses for Route 16 operate only on weekdays from 5:30 a.m. to 8:15 p.m. with nearly 30-minute headways.

WestCAT Route 17 also serves the project vicinity but at the time of the analysis, the Route is temporarily out of service due to the COVID-19 pandemic. Prior to the suspension, the Route provided services throughout the City and stopped on Appian Way along the project frontage.

Two bicycles can be carried on all WestCAT buses. Bike rack space is on a first-come, first-served basis.

Dial-a-ride, also known as paratransit, or door-to-door service, is available for those who are unable to independently use the transit system due to a physical or mental disability. WestCAT ADA Paratransit is designed to serve the needs of individuals with disabilities within the communities of Pinole and Hercules and the unincorporated communities of Montalvin Manor, Tara Hills, Bayview, Rodeo, Crockett, and Port Costa.



Capacity Analysis

Intersection Level of Service Methodologies

Level of Service (LOS) is used to rank traffic operation on various types of facilities based on traffic volumes and roadway capacity using a series of letter designations ranging from A to F. Generally, Level of Service A represents free flow conditions and Level of Service F represents forced flow or breakdown conditions. A unit of measure that indicates a level of delay generally accompanies the LOS designation.

The study intersections were analyzed using the "Signalized" methodology published in the *Highway Capacity Manual* (HCM), Transportation Research Board, 6th Edition, 2018. This methodology is based on factors including traffic volumes, green time for each movement, phasing, whether the signals are coordinated or not, truck traffic, and pedestrian activity. Average stopped delay per vehicle in seconds is used as the basis for evaluation in this LOS methodology. For purposes of this study, delays were calculated using signal timing obtained from the City of Pinole.

Tab	Table 3 – Signalized Intersection Level of Service Criteria							
LOS	A Delay of 0 to 10 seconds. Most vehicles arrive during the green phase, so do not stop at all.							
LOS	B Delay of 10 to 20 seconds. More vehicles stop than with LOS A, but many drivers still do not have to stop.							
LOS	C Delay of 20 to 35 seconds. The number of vehicles stopping is significant, although many still pass through without stopping.							
LOS	Delay of 35 to 55 seconds. The influence of congestion is noticeable, and most vehicles have to stop.							
LOS	E Delay of 55 to 80 seconds. Most, if not all, vehicles must stop and drivers consider the delay excessive.							
LOS	F Delay of more than 80 seconds. Vehicles may wait through more than one cycle to clear the intersection.							

Reference: Highway Capacity Manual, Transportation Research Board, 6th Edition, 2018

Traffic Operation Standards

Per the City of Pinole's Level of Service standards, the minimum desired service level for Appian Way/Mann Drive-Project Access is low LOS D and it is high LOS E for Appian Way/Tara Hills Drive-Canyon Drive. For the purposes of the analysis, a low LOS D was assumed to be an average intersection delay between 35 and 45 seconds. An intersection delay between 55 and 65 seconds was assumed to be a high LOS E. These Level of Service standards were applied to the overall intersection average delay.

Existing Conditions

The Existing Conditions scenario provides an evaluation of current operation based on existing traffic volumes during the a.m. and p.m. peak periods. This condition does not include project-generated traffic volumes. Volume data was collected on July 8, 2021. As the collected counts are unreliable due to the ongoing effects of the Covid-19 outbreak as well as the lack of school volumes, the traffic volume data was adjusted to reflect non-pandemic "existing" conditions. Using the collected counts as well as historical counts supplied by the City from September 2016, growth factors of 36 and 25 percent were applied to the morning and evening peaks, respectively.



Intersection Levels of Service

Under existing conditions, the study intersections operate acceptably at LOS C or better. The existing traffic volumes are shown in Figure 2. A summary of the intersection Level of Service calculations is contained in Table 4, and copies are provided in Appendix B.

Table 4 – Existing Peak Hour Intersection Levels of Service							
Study Intersection Approach		AM I	Peak	PM Peak			
		Delay	LOS	Delay	LOS		
1.	Appian Wy/Mann Dr-Project Access	10.4	В	7.9	Α		
2.	Appian Wy/Tara Hills Dr-Canyon Dr	34.5	С	30.1	С		

Delay is measured in average seconds per vehicle; LOS = Level of Service Notes:

The perception a motorist has of intersection operation as represented by the Level of Service can sometimes be at odds with the calculated values. At signalized intersections drivers on a minor street may encounter longer delays than motorists traveling through on the main street. Based on their experience, these drivers are likely to perceive that the intersection operates poorly. However, because the majority of drivers traveling through the intersection encounter little or no delay, the average for all drivers may fall within an acceptable range despite some approaches or movements having fairly high delays. It is noted that for the intersection of Appian Way/Tara Hills Drive-Canyon Drive, a majority of the trips are through movements north-south together with the eastbound right-turn movement, which is programmed with the right-turn overlap for additional green time during a cycle. As these three movements carry the greatest traffic volumes but have the lowest delays, the overall average delay is substantially lower than is experienced on the minor street approaches.

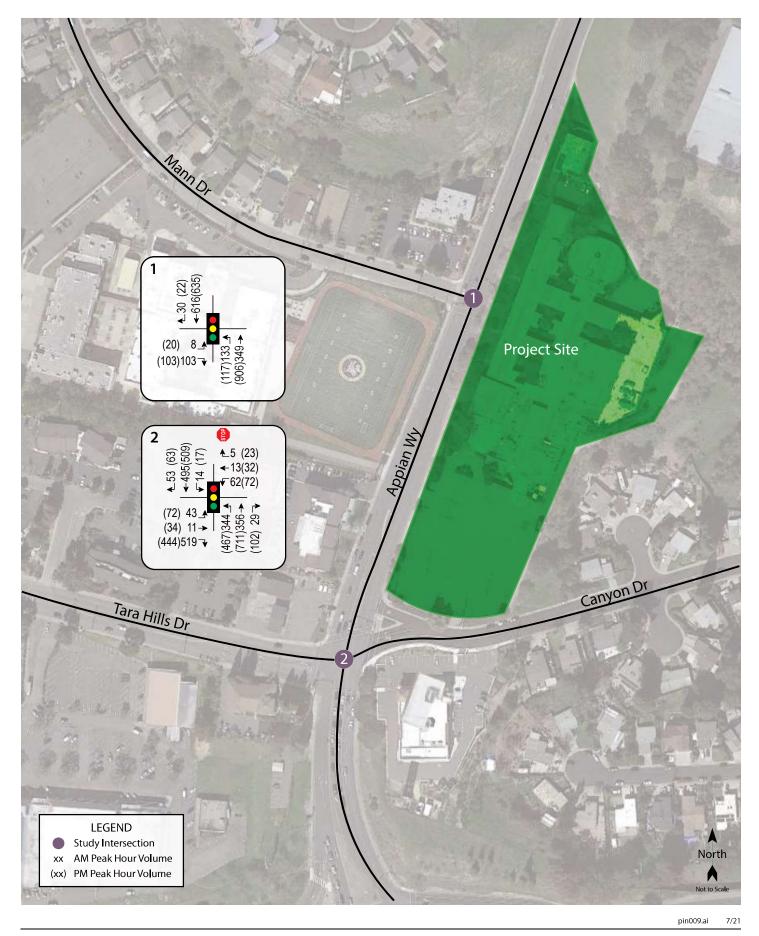
Project Description

The proposed project includes 154 multi-family residential units with access points on Canyon Drive and Appian Way on a site occupied by the vacant Doctor's Medical Center Pinole Campus. The project site is located within the Appian Way Project Area as part of the City of Pinole's Three Corridors Specific Plan and has a designated residential mixed-use (RMU) land use in the northern half and commercial mixed-use (CMU) land use in the southern half of the site. It is noted that the entire site would be developed only with the proposed multi-family attached units as allowed by the Specific Plan. The proposed project site plan is shown in Figure 3.

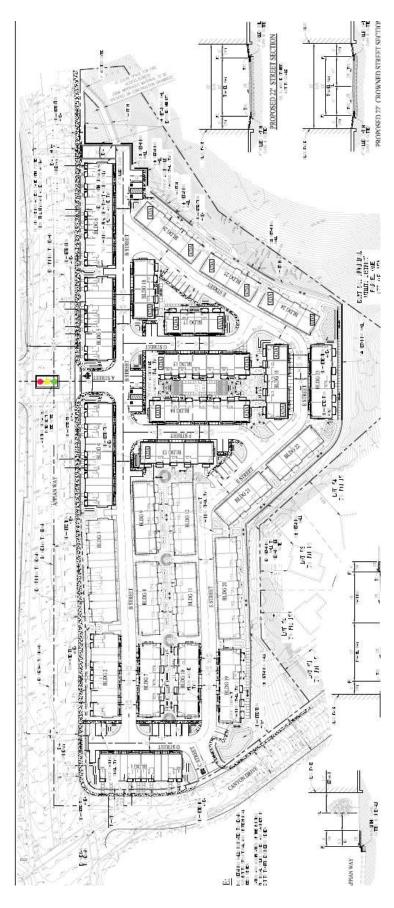
Trip Generation

The anticipated trip generation for the project was estimated using standard rates published in the 10th Edition of the Trip Generation Manual, 2017 for "Multifamily Housing (Mid-Rise)" (LU #221). Since the medical offices have not been in use since 2006, no trip reduction credit was applied to the previous use. As shown in Table 5, the proposed project would be expected to generate an average of 838 trips per day, including 55 trips during the a.m. peak hour and 68 trips during the p.m. peak hour.





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Source: cbg Civil engineers 8/9 pin009.ai 7/21



Table 5 – Trip Generation Summary											
Land Use	Units	Da	ily	ly AM Peak Hour			PM Peak Hour				
		Rate	Trips	Rate	Trips	ln	Out	Rate	Trips	In	Out
Proposed											
Multifamily Housing	154 du	5.44	838	0.36	55	14	41	0.44	68	41	27

Note: du = dwelling unit

Trip Distribution

The pattern used to allocate new project trips to the street network was based on census data from 2000 as well as knowledge of the area and the surrounding region. The distribution applied includes 85 percent of trips assigned to/from the south on Appian Way where there are access points to I-80. The remaining 15 percent were assigned to/from the north on Appian Way.

Intersection Operation

Existing plus Project Conditions

Upon the addition of project-related traffic to the existing volumes, the study intersections are expected to operate acceptably at LOS C or better. It is noted that Appian Way/Mann Drive-Project Access was evaluated as a four-legged intersection as the project driveway is planned to become an east leg. With the addition of the east leg, it was assumed that both eastbound and westbound would have split phasing while the southbound approach would be modified to include protected left-turn phasing. No changes to the phasing or lane geometry for the northbound approach were assumed. These results are summarized in Table 6. Project traffic volumes are shown in Figure 4. Existing plus Project traffic volumes are shown in Figure 5.

Tal	Table 6 – Existing and Existing plus Project Peak Hour Intersection Levels of Service								
Study Intersection Approach		Existing Conditions				Existing plus Project			
		AM Peak PM		PM P	PM Peak		AM Peak		PM Peak
		Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS
1.	Appian Wy/Mann Dr-Project Access	10.4	В	7.9	Α	14.8	В	11.2	В
2.	Appian Wy/Tara Hills Dr-Canyon Dr	34.5	С	30.1	С	34.6	С	30.2	С

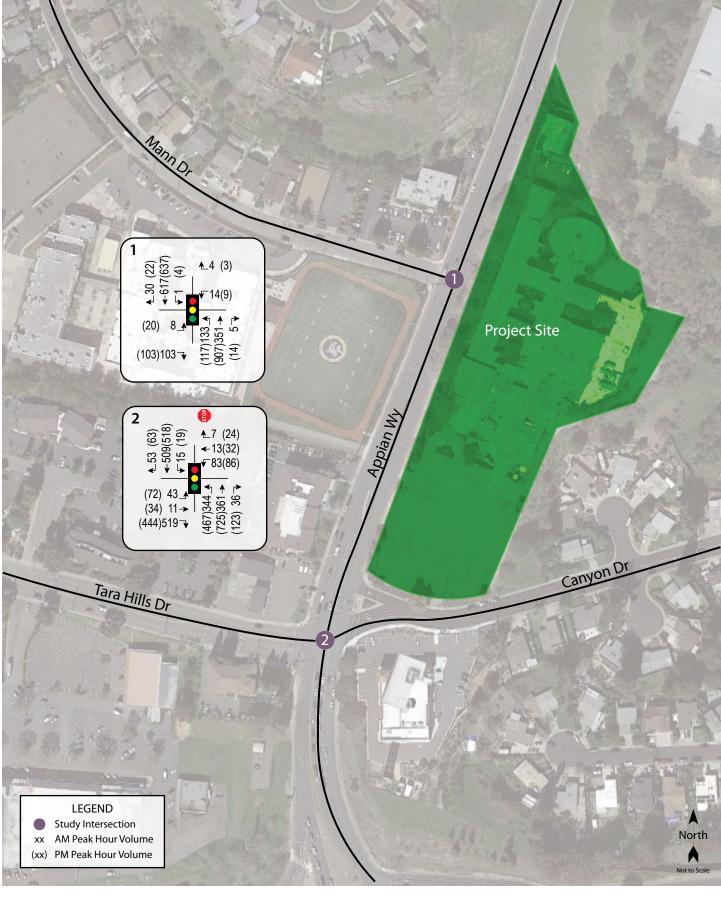
Notes: Delay is measured in average seconds per vehicle; LOS = Level of Service





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Consistency with Three Corridors Specific Plan

The proposed project was evaluated for consistency with the *Three Corridors Specific Plan*, City of Pinole, 2010. As noted in the Project Description, the project site is designated with a commercial mixed use (CMU) land use in the northern half and residential mixed use (RMU) land use in the southern half. While the RMU land use allows solely residential development, the CMU land use allows up to 100 percent residential development with an affordable housing agreement. Accordingly, 15 percent of the proposed apartment units are planned to be affordable housing units per agreement with the City. The proposed project is therefore permitted for both CMU and RMU land uses.

Additionally, the Specific Plan identifies the following improvements on Appian Way in the project vicinity.

- Between Marlesta Road and Mann Drive: Improve the roadway to include a five-foot bicycle lane and two 11-foot travel lanes in each direction with a median/turn lane.
- Between Mann Drive and Dalessi Lane: Improve the roadway to include a five- to six-foot bicycle lane and two 11-foot travel lanes in each direction with a median/turn lane.

Under Existing plus Project Conditions, it was assumed that the southbound approach at Appian Way/Mann Drive would be modified include a southbound left-turn lane. It is noted that there are currently two travel lanes in each direction with a median on the north leg of the intersection. Per the Specific Plan, Appian Way along the project would have 11-foot travel lanes, bike lanes, and a median. It is understood that from curb to curb, Appian Way is 65 feet wide north of the Appian Way/Mann Drive intersection. With five-foot bike lanes, the remaining width would be adequate for 11-foot travel lanes, including the proposed southbound left-turn lane. Since the proposed project complies with the zoning in the Specific Plan and the project does not conflict with the plans for bicycle lanes on Appian Way, it is reasonable to conclude that the project is consistent with the Three Corridors Specific Plan.

For the project to pay its proportional contribution towards the improvements listed in the Specific Plan, the project may be subject to the City's development impact fees as well as the development fee for the West County Subregional Transportation Mitigation Program (STMP). It is recommended that the project applicant make a fair share contribution towards multi-modal improvements identified by the Three Corridors Specific Plan based on the funding mechanism established by the City.

Finding – The project description as well as the operational analysis assumptions are consistent with the *Three* Corridors Specific Plan.

Recommendation – It is recommended that the project applicant make a fair share contribution towards the implementation of the multi-modal improvements identified in the Three Corridors Specific Plan as established by the City.



Vehicle Miles Traveled (VMT)

Senate Bill (SB) 743 established a change in the metric to be applied for determining traffic impacts associated with development projects. Rather than the delay-based criteria associated with a Level of Service analysis, the increase in Vehicle Miles Traveled (VMT) as a result of a project is now the basis for determining impacts. As of the date of this analysis, the City of Pinole has not yet established thresholds of significance related to VMT. As a result, the project-related VMT impacts were assessed based on guidance provided by the California Governor's Office of Planning and Research (OPR) in the publication *Transportation Impacts (SB 743) CEQA Guidelines Update and Technical Advisory*, 2018. The document indicates that a residential project generating vehicle travel that is 15 or more percent below the existing countywide residential VMT per capita may indicate a less than significant VMT impact.

Based on data from Contra Costa Transportation Authority (CCTA) 2020 travel demand model, the County of Contra Costa has a baseline average residential VMT of 17.3 miles per capita. Applying OPR's guidance, a residential project generating a VMT that is 15 percent or more below this value, or 14.7 miles per capita, would have a less-than-significant VMT impact. The CCTA model includes traffic analysis zones (TAZ) covering geographic areas throughout Contra Costa County. The project site is located within TAZ 10234, which has a baseline VMT per capita of 13.6 miles, which is less than the VMT screening threshold of 14.7. Therefore, the proposed project would be expected to result in a less-than-significant VMT impact.

Finding – The project would be expected to have a less-than-significant transportation impact on vehicle miles traveled.



Alternative Modes

Pedestrian Facilities

Given the proximity to surrounding commercial uses as well as Pinole Middle School, it is reasonable to assume that residents will want to walk and/or use transit to and from the project site. There are connected sidewalks along the project frontages on Appian Way and Canyon Drive as well as on cross streets including Mann Drive and Tara Hills Drive. Further, marked crosswalks with pedestrian signal facilities are available on Appian Way/Mann Drive-Project Access and Appian Way/Tara Hills Drive-Canyon Drive. As a result, the existing network of sidewalks and crosswalks provides adequate access for pedestrians.

Consideration was also given to pedestrians crossing on Appian Way at Mann Drive-Project Access as the project driveway would become an east leg. As the intersection crosswalks would be expected to be used by project residents as well as students attending Pinole Middle School, split phasing is recommended in the east-west direction. With split phasing, the left-turning movements would be separated from the pedestrian phase and oncoming through traffic. While permitted left-turn phasing east-west was considered and would result in lower average vehicular delay, it is not recommended given the conflict between east-west left-turning drivers and the pedestrians in the crosswalks, especially given that drivers on Mann Drive do not currently have any conflicting traffic to deal with, so would be surprised if they had to yield to oncoming traffic from the new leg.

Finding – Existing pedestrian facilities serving the project site are adequate but with the addition of the east leg for the project drive, there is a potential for pedestrian and vehicular conflicts.

Recommendation - Upon construction of the project driveway on Appian Way, it is recommended that split phasing in the eastbound and westbound directions of Mann Drive-Project Access be implemented to prevent conflicts between left-turning drivers and both oncoming through vehicles and pedestrians crossing the intersection.

Bicycle Facilities

There is a Class III bicycle route on Appian Way along project frontage, which is planned to be converted to Class Il bicycle lanes. Upon construction of the planned bicycle lanes on Appian Way, as well as on San Pablo Avenue, and with shared use of minor streets in the project vicinity, there would be adequate access for bicyclists to and from the project site.

Bicycle Storage

The required bicycle parking supply was calculated to ensure adequacy under City requirements. Section 17.48.120 of City of Pinole Code requires multi-family residential uses to provide bicycle parking at a rate of one space for every four units. Based on this ratio, 39 bicycle parking spaces are required. Bicycle parking is available within the garages of each dwelling unit. At least one bicycle may be stored within each garage providing for a minimum of 154 bicycle parking spaces which would exceed the City Code requirement.

Finding – The number of bicycle parking spaces provided by the project is adequate.



Transit

WestCAT Route 16 is adequate to accommodate project-generated transit trips and nearby stops are within an acceptable walking distance of the project site. It is noted that the transit service would improve upon the end of the temporary suspension of Route 17.

Finding – Transit facilities serving the project site are adequate and would improve once WestCAT Route 17 starts operating again.



Access and Circulation

Site Access

The project would be accessed via driveways on Appian Way and Canyon Drive. The proposed Appian Way driveway would be the east leg of the Appian Way/Mann Drive intersection, resulting in a four-legged signalized intersection. Additionally, while there is an existing driveway on Canyon Drive, the proposed project driveway would be relocated several feet to the east. Along the project frontage, Appian Way has a posted speed limit of 35 miles per hour (mph), which is reduced to the speed limit of 25 mph while the nearby Pinole Middle School is in session. Canyon Road has a posted speed limit of 25 mph and has one lane in each direction.

Since the proposed project would occupy a previously developed site, consideration was also given to the existing driveways that would no longer be in use with the project. On Appian Way along the project frontage there is a southbound left-turn pocket nearly 350 feet south of Appian Way/Mann Drive-Project Access that was previously used for the medical facilities. Since the driveway would be removed with the project, it is recommended that the applicant work with the City to remove this southbound left-turn lane by either restriping this section or through the installation of a median.

Finding – With the proposed project, one of the existing driveways and access turn lanes to access the site would no longer be needed.

Recommendation – It is recommended that the applicant work with the City to restripe Appian Way along the project frontage to eliminate the left-turn pocket located approximately 350 feet south of Appian Way/Mann Drive-Project Access as the receiving driveway would be removed with the project.

Sight Distance

Sight distances along Appian Way as well as Canyon Drive at project driveways were evaluated based on sight distance criteria contained in the Highway Design Manual published by Caltrans. The recommended sight distance at intersections of public streets is based on corner sight distances, while recommended sight distances for minor street approaches that are either a private road or a driveway are based on stopping sight distance. Both use the approach travel speeds as the basis for determining the recommended sight distance. Additionally, the stopping sight distance needed for the following driver to stop if there is a vehicle waiting to turn into a side street or driveway is evaluated based on the stopping sight distance criterion and the approach speed on the major street.

For the posted speed limit of 35 mph for Appian Way, the minimum stopping sight distance needed is 250 feet and the corner sight distance is 385 feet. Based on the review of field condition, sight lines to and from the project driveway on Appian Way extend more than 400 feet in each direction, which is more than adequate for the posted speed limit, especially given that the driveway would be part of a signalized intersection.

For the speed limit of 25 mph on Canyon Drive, 150 feet of stopping sight distance is needed. The sight lines to the west of the project driveway on Canyon Drive are more than 150 feet; however, the sight line to the east was measured to be only 45 feet due to location of the driveway at the crest of a steep hill, its location on the inside of a horizontal curve, and on-street parking on the north side of Canyon Drive. The recommended 150-foot line of sight to the east can be achieved if on-street parking is prohibited between the project driveway and approximately 150 feet to the east, provided that vegetation is also maintained. Given the location of the driveway near the crest of the steep incline and on the inside of a horizontal curve, vegetation east of the driveway has the potential to obstruct sight lines. It is noted that the existing vegetation was observed to be about one foot in height and does not obstruct the line of sight; however, vegetation only slightly taller would partially or fully restrict the line of sight. It is therefore recommended that the vegetation east of the driveway be trimmed and



maintained to be no more than about one foot tall, or no higher than the existing landscaping, to maintain adequate sight lines.

Additionally, due to the straight and flat roadway geometry of Appian Way, adequate stopping sight distance is available for a following driver to notice and react to a preceding motorist slowing to either enter the project site via northbound right turn or the southbound left-turn lane at the signalized intersection. Similarly, there is adequate stopping distance on Canyon Drive for a following driver to notice and react to the preceding driver slowing to turn right or left into the project driveway.

Finding – Adequate sight distances are available on Appian Way at the project driveway. While there are adequate sight lines to the west on Canyon Drive at the project driveway, the sight lines to the east were measured to be less than the minimum stopping sight distance due to on-street parking and horizontal and vertical curves.

Recommendation – On-street parking on Canyon Drive should be prohibited from the project driveway to nearly 150 feet east. Further, vegetation on the east side of the driveway on Canyon Drive should also be trimmed or maintained as very low-lying vegetation of about one foot in height.

Emergency Access

Given that the proposed parking lot design would meet the City design criteria, including the width of the drive aisle and turning radii, as well as receive feedback from the Fire District, the proposed project is not expected to impede emergency vehicle access.

Finding – Site access and on-site circulation would be expected to function acceptably for emergency response vehicles.

Turn Lane Warrant

The need for a left-turn lane on Canyon Drive at the proposed project driveway was evaluated based on criteria contained in the *Intersection Channelization Design Guide*, National Cooperative Highway Research Program (NCHRP) Report No. 279, Transportation Research Board, 1985, as well as an update of the methodology developed by the Washington State Department of Transportation and published in the *Method For Prioritizing Intersection Improvements*, January 1997. The NCHRP report references a methodology developed by M. D. Harmelink that includes equations that can be applied to expected or actual traffic volumes to determine the need for a left-turn pocket based on safety issues.

Based on Existing plus Project p.m. peak hour volumes, a left-turn lane is not warranted on Canyon Drive at the project driveway during the critical peak period evaluated. Copies of the warrant spreadsheets are provided in Appendix C.

Finding – A left-turn lane is not warranted on Canyon Drive at proposed project driveway based on volumes during the critical peak period evaluated.



Transportation Demand Management (TDM)

The following section describes a few examples of available Transportation Demand Management (TDM) features available to residents and guests traveling to the proposed project. While the project's potential impact is expected to be less than significant, these TDM measures would encourage use of non-vehicular travel and reduced use of private automobiles for basic transportation.

Transit

Convenient access to transit encourages reduced travel by private automobiles. Bus stops accessing the WestCAT bus service are located within 100 feet of the project site along Canyon Drive. Upon the return of service for WestCAT Route 17, additional bus stops will be available along Appian Way with the nearest stop location less than 100 feet from the project site.

Bicycle and Pedestrian Improvements

Bicycle and Pedestrian infrastructure that promotes a safe walking or riding environment can help reduce vehicle travel. The project will include paved walking paths between each building and the existing sidewalks on Canyon Drive and Appian Way. According to the City's *General Plan* and the *Three Corridors Specific Plan*, Class II bike lanes are planned along the segments of Appian Way and San Pablo Avenue within the immediate vicinity of the project site. Furthermore, several amenities (including the Pinole Middle School, CVS Pharmacy, and the Appian 80 Shopping Center) are located within 1,000 feet of the project and can be accessed via the existing sidewalk network.

Electric Vehicle Charging Stations

While the provision of dedicated parking for Electric Vehicles (EVs) and charging stations does not result in trip or VMT reductions, they do encourage and incentivize the use of electric vehicles which in turn reduces the total greenhouse gas (GHG) emissions of a project.



Parking

The project was analyzed to determine whether the proposed parking supply would be sufficient to satisfy the City Code requirements. The project site as proposed would provide a total of 354 parking spaces comprised of two covered spaces at each dwelling unit, as well as 46 guest spaces located throughout the development.

The City of Pinole parking supply requirements stipulate that 354 spaces are required for this project. This requirement is based on the *City of Pinole Municipal Code, Chapter 17.48.050; Number of Parking Spaces Required* which states that 2 assigned spaces and 0.3 visitor parking spaces are required for each dwelling unit for multifamily developments consisting of two or more bedrooms per unit.

The proposed parking supply of 354 spaces is equal to the number of required spaces as described in the City Code.

Finding – The number of parking spaces provided by the project is adequate.



Conclusions and Recommendations

Conclusions

- The project would be expected to generate an average of 838 daily trips including 55 trips during the a.m. peak hour and 68 p.m. peak hour trips.
- With the addition of the project trips, the study intersections are expected to operate acceptably at LOS C or
- The project description and the assumptions for the operational analysis are consistent with the *Three* Corridors Specific Plan.
- The project would be expected to have a less-than-significant impact on VMT per OPR guidelines.
- Existing pedestrian facilities would provide adequate access for project residents. However, there may be conflicts between pedestrian and vehicular traffic upon the addition of the project driveway as a new east leg to the intersection of Appian Way/Mann Drive-Project Access.
- The existing transit facilities are adequate to serve the project site and service would improve once service on WestCAT Route 17 resumes.
- Bicycle facilities would be adequate upon completion of the planned bicycle projects in the project vicinity. The number of bicycle parking spots provided is sufficient to satisfy City code requirements.
- The existing left-turn lane pocket and a driveway on Appian Way would no longer be needed with the proposed project.
- Although adequate sight lines are available on Appian Way at the project driveway, sight lines to the east on Canyon Drive at the project driveway are shorter than the minimum stopping sight distance due to location of the driveway on the inside of a horizontal and near the crest of a very steep incline, as well as the presence of on-street parking. Adequate sight lines are available to the west on Canyon Drive from the project driveway.
- The proposed parking lot and on-site circulation would be expected to function acceptably for emergency response vehicles.
- A left-turn lane is not warranted on Canyon Drive at the project driveway based on volumes during the critical peak period evaluated.
- The project would be located within an area with access to transit and an existing sidewalk network which potentially reduces travel by private automobile.
- The number of parking spaces provided by the project would satisfy City requirements.

Recommendations

It is recommended that the project applicant make a fair share contribution towards the multi-modal improvements identified in the Three Corridors Specific Plan if required by the City.



- To prevent conflicts between the left-turning motorists and either pedestrians or opposing through traffic, it is recommended that split phasing be implemented on the westbound and eastbound approaches to the Appian Way/Mann Drive-Project Access intersection as part of the project.
- It is suggested that the City restripe Appian Way along the project frontage to remove the left-turn pocket located about 350 feet south of Appian Way/Mann Drive-Project Access as the receiving driveway would be eliminated as part of the proposed project.
- On-street parking on the north side of Canyon Drive should be restricted from the project driveway to 150
 feet east to provide adequate sight lines for motorists exiting the driveway. The vegetation surrounding the
 driveway should also be trimmed to be no more than one foot tall to ensure that adequate sight lines are
 retained.

Study Participants and References

Study Participants

Principal in ChargeMark E. Spencer, TEAssociate EngineerBriana Byrne, TEAssistant PlannerJade KimGraphicsCameron WongEditing/FormattingHannah Yung-BoxdellQuality ControlDalene J. Whitlock, PE, PTOE

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PIN009





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Appendices

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- B. Intersection Level of Service Calculations
- C. Turn Lane Warrant





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Appendix A

Collision Rate Calculations





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raffic Study for the 2151 Appian Way Multi-Family Housing Project

Intersection # 1: Appian Way & Mann Drive Date of Count: Saturday, January 0, 1900

Number of Collisions: 2 Number of Injuries: 0 Number of Fatalities: 0 Average Daily Traffic (ADT): 18000 Start Date: April 1, 2015 End Date: March 31, 2020 Number of Years: 5

> Intersection Type: Four-Legged Control Type: Signals Area: Urban

> > Number of Collisions x 1 Million Collision Rate = ----ADT x Days per Year x Number of Years

> > Collision Rate = $\frac{2}{18,000}$ x 365

 Study Intersection Statewide Average*
 Collision Rate / C/mve
 Fatality Rate / 0.0%
 Injury Rate / 0.0%

 0.05 c/mve
 0.0%
 0.0%

 0.24 c/mve
 0.5%
 44.6%

ADT = average daily total vehicles entering intersection c/mve = collisions per million vehicles entering intersection
* 2016 Collision Data on California State Highways, Caltrans

Intersection # 2: Appian Way & Tara Hills Drive-Canyon Dr

Date of Count: Saturday, January 0, 1900

Number of Collisions: 13 Number of Injuries: 4 Number of Fatalities: 0 Average Daily Traffic (ADT): 25500 Start Date: April 1, 2015 End Date: March 31, 2020

Number of Years: 5

Intersection Type: Four-Legged Control Type: Signals Area: Urban

Number of Collisions x 1 Million Collision Rate = -ADT x Days per Year x Number of Years

Collision Rate = 25,500

Study Intersection tatewide Average*

Collision Rate Fatality Rate

0.28 c/mve 0.0%

0.24 c/mve 0.5% **Injury Rate** Statewide Average*

raffic Study for the 2151 Appian Way Multi-Family Housing Project

Intersection # 3: &

Date of Count: Saturday, January 0, 1900

Number of Collisions: 0 Number of Injuries: 0 Number of Fatalities: 0 Average Daily Traffic (ADT): 0

Start Date: January 0, 1900 End Date: January 0, 1900

Number of Years: 0

Intersection Type: 0 **Control Type:** Area: 0

> Number of Collisions x 1 Million ADT x Days per Year x Number of Years Collision Rate = -

Collision Rate = -

	Collisi	ion Rate	Fatality Rate	Injury Rate	
Study Intersection	0.00	c/mve	0.0%	0.0%	
Statewide Average*	0.22	c/mve	1.0%	34.6%	

ADT = average daily total vehicles entering intersection c/mve = collisions per million vehicles entering intersection * 2016 Collision Data on California State Highways, Caltrans

Intersection # 4: &

Date of Count: Saturday, January 0, 1900

Number of Collisions: 0 Number of Injuries: 0 Number of Fatalities: 0 Average Daily Traffic (ADT): 0

Start Date: January 0, 1900

End Date: January 0, 1900

Number of Years: 0

Intersection Type: 0

Control Type: No Controls
Area: 0

Number of Collisions x 1 Million Collision Rate = ADT x Days per Year x Number of Years

Collision Rate = -365

Injury Rate Statewide Average*

raffic Study for the 2151 Appian Way Multi-Family Housing Project

Intersection # 5: &

Date of Count: Saturday, January 0, 1900

Number of Collisions: 0 Number of Injuries: 0 Number of Fatalities: 0 Average Daily Traffic (ADT): 0

Start Date: January 0, 1900 End Date: January 0, 1900

Number of Years: 0

Intersection Type: 0
Control Type: No Controls Area:

Collision Rate = Number of Collisions x 1 Million
ADT x Days per Year x Number of Years

Collision Rate = $\frac{0}{0}$ $\frac{x}{x}$ 365

	Collision Rate		Fatality Rate	Injury Rate
Study Intersection	0.00	c/mve	0.0%	0.0%
Statewide Average*	0.22	c/mve	1.0%	34.6%

ADT = average daily total vehicles entering intersection c/mve = collisions per million vehicles entering intersection * 2016 Collision Data on California State Highways, Caltrans

Intersection # 6: &

Date of Count: Saturday, January 0, 1900

Number of Collisions: 0 Number of Injuries: 0 Number of Fatalities: 0 Average Daily Traffic (ADT): 0

Start Date: January 0, 1900

End Date: January 0, 1900 Number of Years: 0

Intersection Type: 0 Control Type: Area: 0 0

Number of Collisions x 1 Million Collision Rate = ADT x Days per Year x Number of Years

Collision Rate = -365

Study Intersection Statewide Average*

Collision Rate Fatality Rate

0.00 c/mve 0.0%

1.0% Injury Rate Statewide Average*

raffic Study for the 2151 Appian Way Multi-Family Housing Project

Intersection # 7: &

Date of Count: Saturday, January 0, 1900

Number of Collisions: 0 Number of Injuries: 0 Number of Fatalities: 0 Average Daily Traffic (ADT): 0

Start Date: January 0, 1900 End Date: January 0, 1900

Number of Years: 0

Intersection Type: 0 Control Type:

Number of Collisions x 1 Million ADT x Days per Year x Number of Years Collision Rate = -

x 365

	Collision Rate			Injury Rate
Study Intersection	0.00	c/mve	0.0%	0.0%
Statewide Average*	0.22	c/mve	1.0%	34.6%

Notes

ADT = average daily total vehicles entering intersection c/mve = collisions per million vehicles entering intersection * 2016 Collision Data on California State Highways, Caltrans

Intersection # 8: &

Date of Count: Saturday, January 0, 1900

Number of Collisions: 0 Number of Injuries: 0 Number of Fatalities: 0 Average Daily Traffic (ADT): 0

Start Date: January 0, 1900 End Date: January 0, 1900

Number of Years: 0

Intersection Type: 0 Control Type: 0 Area: 0

> Number of Collisions x 1 Million ADT x Days per Year x Number of Years Collision Rate = -

Collision Rate = -

Collision Rate Fatality Rate **Injury Rate** Study Intersection 0.00 c/mve 0.0% 0.0% Statewide Average* 0.22 c/mve

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raffic Study for the 2151 Appian Way Multi-Family Housing Project

Intersection # 9: &

Date of Count: Saturday, January 0, 1900

Number of Collisions: 0 Number of Injuries: 0 Number of Fatalities: 0 Average Daily Traffic (ADT): 0

Start Date: January 0, 1900 End Date: January 0, 1900

Number of Years: 0

Intersection Type: 0

Control Type:

Collision Rate = Number of Collisions x 1 Million
ADT x Days per Year x Number of Years

0 x 0 x 365 Collision Rate = -

	Collision Rate	Fatality Rate	Injury Rate
Study Intersection	0.00 c/mve	0.0%	0.0%
Statewide Average*	0.22 c/mve	1.0%	34.6%

Notes

ADT = average daily total vehicles entering intersection c/mve = collisions per million vehicles entering intersection * 2016 Collision Data on California State Highways, Caltrans

Intersection # 10: &

Date of Count: Saturday, January 0, 1900

Number of Collisions: 0 Number of Injuries: 0 Number of Fatalities: 0 Average Daily Traffic (ADT): 0

Start Date: January 0, 1900 End Date: January 0, 1900

Number of Years: 0

Intersection Type: 0 Control Type: 0 Area: 0

> Number of Collisions x 1 Million ADT x Days per Year x Number of Years Collision Rate = -

Collision Rate = -

Collision Rate | Fatality Rate **Injury Rate** Study Intersection 0.00 c/mve statewide Average* 0.22 c/mve 0.0% 0.0% Statewide Average*

raffic Study for the 2151 Appian Way Multi-Family Housing Project

Intersection # 11: &

Date of Count: Saturday, January 0, 1900

Number of Collisions: 0 Number of Injuries: 0 Number of Fatalities: 0 Average Daily Traffic (ADT): 0

Start Date: January 0, 1900 End Date: January 0, 1900

Number of Years: 0

Intersection Type: 0

Control Type:

Collision Rate = Number of Collisions x 1 Million
ADT x Days per Year x Number of Years

0 x 0 x 365

	Collision Rate	Fatality Rate	Injury Rate
Study Intersection	0.00 c/mve	0.0%	0.0%
Statewide Average*	0.22 c/mve	1.0%	34.6%

Notes

ADT = average daily total vehicles entering intersection c/mve = collisions per million vehicles entering intersection * 2016 Collision Data on California State Highways, Caltrans

Intersection # 12: &

Date of Count: Saturday, January 0, 1900

Number of Collisions: 0 Number of Injuries: 0 Number of Fatalities: 0 Average Daily Traffic (ADT): 0

Start Date: January 0, 1900 End Date: January 0, 1900

Number of Years: 0

Intersection Type: 0 Control Type: 0 Area: 0

> Number of Collisions x 1 Million ADT x Days per Year x Number of Years Collision Rate = -

Collision Rate = -

Collision Rate | Fatality Rate **Injury Rate** Study Intersection 0.00 c/mve statewide Average* 0.22 c/mve 0.0% 0.0% Statewide Average*

raffic Study for the 2151 Appian Way Multi-Family Housing Project

Intersection # 13: &

Date of Count: Saturday, January 0, 1900

Number of Collisions: 0 Number of Injuries: 0 Number of Fatalities: 0 Average Daily Traffic (ADT): 0

Start Date: January 0, 1900 End Date: January 0, 1900

Number of Years: 0

Intersection Type: 0

Control Type:

Collision Rate = Number of Collisions x 1 Million
ADT x Days per Year x Number of Years

0 x 0 x 365 Collision Rate = -

	Collisi	ion Rate	Fatality Rate	Injury Rate
Study Intersection	0.00	c/mve	0.0%	0.0%
Statewide Average*	0.22	c/mve	1.0%	34.6%

Notes

ADT = average daily total vehicles entering intersection $c/mve = collisions \ per \ million \ vehicles \ entering \ intersection$ * 2016 Collision Data on California State Highways, Caltrans

Intersection # 14: &

Date of Count: Saturday, January 0, 1900

Number of Collisions: 0 Number of Injuries: 0 Number of Fatalities: 0 Average Daily Traffic (ADT): 0

Start Date: January 0, 1900 End Date: January 0, 1900

Number of Years: 0

Intersection Type: 0 Control Type: 0 Area: 0

> Number of Collisions x 1 Million ADT x Days per Year x Number of Years Collision Rate = -

Collision Rate = -

Collision Rate Fatality Rate **Injury Rate** Study Intersection 0.00 c/mve statewide Average* 0.22 c/mve 0.0% 0.0% Statewide Average*

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raffic Study for the 2151 Appian Way Multi-Family Housing Project

Intersection # 15: &

Date of Count: Saturday, January 0, 1900

Number of Collisions: 0 Number of Injuries: 0 Number of Fatalities: 0 Average Daily Traffic (ADT): 0

Start Date: January 0, 1900 End Date: January 0, 1900

Number of Years: 0

Intersection Type: 0

Control Type:

Collision Rate = Number of Collisions x 1 Million
ADT x Days per Year x Number of Years

0 x 0 x 365

	Collision Rate	Fatality Rate	Injury Rate
Study Intersection	0.00 c/mve	0.0%	0.0%
Statewide Average*	0.22 c/mve	1.0%	34.6%

Notes

ADT = average daily total vehicles entering intersection c/mve = collisions per million vehicles entering intersection * 2016 Collision Data on California State Highways, Caltrans

Intersection # 16: &

Date of Count: Saturday, January 0, 1900

Number of Collisions: 0 Number of Injuries: 0 Number of Fatalities: 0 Average Daily Traffic (ADT): 0

Start Date: January 0, 1900 End Date: January 0, 1900

Number of Years: 0

Intersection Type: 0 Control Type: 0 Area: 0

> Number of Collisions x 1 Million ADT x Days per Year x Number of Years Collision Rate = -

Collision Rate = -

Collision Rate | Fatality Rate **Injury Rate** Study Intersection 0.00 c/mve statewide Average* 0.22 c/mve 0.0% 0.0% Statewide Average*

raffic Study for the 2151 Appian Way Multi-Family Housing Project

Intersection # 17: &

Date of Count: Saturday, January 0, 1900

Number of Collisions: 0 Number of Injuries: 0 Number of Fatalities: 0 Average Daily Traffic (ADT): 0

Start Date: January 0, 1900 End Date: January 0, 1900

Number of Years: 0

Intersection Type: 0

Control Type:

Collision Rate = Number of Collisions x 1 Million
ADT x Days per Year x Number of Years

0 x 0 x 365

	Collision Rate	Fatality Rate	Injury Rate
Study Intersection	0.00 c/mve	0.0%	0.0%
Statewide Average*	0.22 c/mve	1.0%	34.6%

Notes

ADT = average daily total vehicles entering intersection c/mve = collisions per million vehicles entering intersection * 2016 Collision Data on California State Highways, Caltrans

Intersection # 18: &

Date of Count: Saturday, January 0, 1900

Number of Collisions: 0 Number of Injuries: 0 Number of Fatalities: 0 Average Daily Traffic (ADT): 0

Start Date: January 0, 1900 End Date: January 0, 1900

Number of Years: 0

Intersection Type: 0 Control Type: 0 Area: 0

> Number of Collisions x 1 Million ADT x Days per Year x Number of Years Collision Rate = -

Collision Rate = -

Collision Rate | Fatality Rate **Injury Rate** Study Intersection 0.00 c/mve statewide Average* 0.22 c/mve 0.0% 0.0% Statewide Average*

raffic Study for the 2151 Appian Way Multi-Family Housing Project

Intersection # 19: &

Date of Count: Saturday, January 0, 1900

Number of Collisions: 0 Number of Injuries: 0 Number of Fatalities: 0 Average Daily Traffic (ADT): 0

Start Date: January 0, 1900 End Date: January 0, 1900

Number of Years: 0

Intersection Type: 0

Control Type:

Collision Rate = Number of Collisions x 1 Million
ADT x Days per Year x Number of Years

0 x 0 x 365

	Collis	ion Rate	Fatality Rate	Injury Rate
Study Intersection	0.00	c/mve	0.0%	0.0%
Statewide Average*	0.22	c/mve	1.0%	34.6%

Notes

ADT = average daily total vehicles entering intersection c/mve = collisions per million vehicles entering intersection * 2016 Collision Data on California State Highways, Caltrans

Intersection # 20: &

Date of Count: Saturday, January 0, 1900

Number of Collisions: 0 Number of Injuries: 0 Number of Fatalities: 0 Average Daily Traffic (ADT): 0

Start Date: January 0, 1900 End Date: January 0, 1900

Number of Years: 0

Intersection Type: 0 Control Type: 0 Area: 0

> Number of Collisions x 1 Million ADT x Days per Year x Number of Years Collision Rate = -

Collision Rate = -

Collision Rate Fatality Rate **Injury Rate** Study Intersection 0.00 c/mve statewide Average* 0.22 c/mve 0.0% 0.0% Statewide Average*

Appendix B

Intersection Level of Service Calculations





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HCM 6th Signalized Intersection Summary 1: Appian Wy & Mann Dr

	4	~	•	+	→	*	
Movement	표	E CH	N N	NRT	ZRT	SBS	
ii o c		į	1				
Lane Configurations	} -	000	-	‡	€	8	
I raffic Volume (ven/h)	∞ α	103	35	349	010	S 6	
Future Volume (Venim)	0 0	3 0	2	0 0 0 0	0 0	00	
Ped-Bike Adi(A obT)	00.	00	1.00	>	>	1.00	
Parking Bus, Adj	0.1	1.00	1.00	1.00	1.00	1.00	
Work Zone On Approach	2			2	2		
Adj Sat Flow, veh/h/In	1870	1870	1870	1870	1870	1870	
Adj Flow Rate, veh/h	6	112	145	379	029	33	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	
Percent Heavy Veh, %	2	2	2	2	2	2	
Cap, veh/h	12	4	196	2387	1622	80	
Arrive On Green	0.10	0.10	0.11	29.0	0.47	0.47	
Sat Flow, veh/h	118	1469	1781	3647	3541	170	
Grp Volume(v), veh/h	122	0	145	379	345	358	
Grp Sat Flow(s),veh/h/ln	1600	0	1781	1777	1777	1840	
Q Serve(g_s), s	3.3	0.0	3.5	1.7	5.6	5.6	
Cycle Q Clear(g_c), s	3.3	0:0	3.5	1.7	9.5	5.6	
Prop In Lane	0.07	0.92	1.00			60:0	
Lane Grp Cap(c), veh/h	157	0	196	2387	836	998	
V/C Ratio(X)	0.78	0.00	0.74	0.16	0.41	0.41	
Avail Cap(c_a), veh/h	874	0	1216	3721	1860	1926	
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	
Upstream Filter(I)	1.00	0.00	1.00	1.00	1.00	1.00	
Uniform Delay (d), s/veh	19.3	0.0	18.9	5.6	9.7	7.6	
Incr Delay (d2), s/veh	7.9	0.0	5.3	0.1	1.2	1.1	
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	
%ile BackOfQ(50%),veh/ln	1.4	0.0	1.5	0.3	2 8.	1.9	
Unsig. Movement Delay, s/veh							
LnGrp Delay(d),s/veh	27.2	0.0	24.3	2.8	8.8	8.8	
LnGrp LOS	ပ	A	ပ	A	A	A	
Approach Vol, veh/h	122			524	703		
Approach Delay, s/veh	27.2			8.7	89. 80.		
Approach LOS	ပ			∢	∢		
Timer - Assigned Phs	-	2		4		9	
Phs Duration (G+Y+Rc), s	8.8	25.8		9.3		34.6	
Change Period (Y+Rc), s	4.0	5.1		2.0		5.1	
Max Green Setting (Gmax), s	30.0	46.0		24.0		46.0	
Max Q Clear Time (g_c+l1), s	5.5	9.7		5.3		3.7	
Green Ext Time (p_c), s	0.4	13.1		0.3		6.9	
Intersection Summary							
HCM 6th Ctrl Delav			10.4				
HCM 6th LOS			മ				
Notes							
User approved pedestrian interval to be less than phase max green.	al to be	less than	phase m	ax green.			
User approved volume balancing among the lanes for turning movement	g among	the lane	s for turni	ng mover	nent		
User approved ignoring U-Tuming movement.	ng move	ment.					

HCM 6th Signalized Intersection Summary 2: Appian Wy & Tara Hills Dr/Canyon Dr

08/05/2021

08/05/2021

Lanconfound		4	†	>	-	ļ	4	•	-	•	۶	→	•
43 11 519 62 13 5 344 366 29 14 495 495 41 1519 62 13 5 344 366 29 14 495 495 41 1519 62 13 5 344 366 29 14 495 495 41 100 100 100 100 100 100 100 100 100	Movement	EB	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
43 11 519 62 13 5 344 356 29 14 495 6 10 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Lane Configurations		4	R.R.		₩.₽	¥C.	K.	₩		r	*	¥C.
1870 1870 1870 1870 1870 1870 1870 1870	Traffic Volume (veh/h)	43	Ξ	519	62	13	2	344	356	53	14	495	53
100 100 100 100 100 100 100 100 100 100	Future Volume (veh/h)	43	Ξ	519	62	13	2	344	326	59	14	495	23
1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00	Initial Q (Qb), veh	0 9	0	0	0 0	0	0 0	0 0	0	0 0	0 8	0	0 0
No	Ped-Bike Adj(A_pb1)	9.1	100	8.6	8.6	100	0.1	9.1	100	0.1	8.5	8	8.6
1870 1870 1870 1870 1870 1870 1870 1870	Work Zone On Approach	3	<u>8</u> 8	2	2	8 8	3	2	8 8	2	2	8 2	3
17 12 564 67 14 0 374 387 32 15 588 17 2 2 2 2 2 2 2 2 2	Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
17.5 17.5	Adj Flow Rate, veh/h	47	12	564	29	14	0	374	387	32	15	538	28
2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
171 44 687 194 193 449 1959 165 53 1747 143 386 2012 0.12 0.11 0.11 0.19 0.13 529 165 53 1747 143 386 2012 0.12 0.11 0.11 0.10 0.13 5224 274 1781 3854 177 1895 3495 362 0.59 0.03 0.49 1739 386 2.781 1777 1895 3495 3724 2.74 1781 1777 1895 3495 0.59 0.59 0.03 0.49 1777 1895 3495 3724 2.74 1781 1777 1895 3495 0.59 0.59 0.59 0.59 0.59 0.59 0.59 0.	Percent Heavy Veh, %	5	5	5	5	5	2	5	5	5	5	5	2
1433 366 2790 1781 1777 1885 3456 3324 274 1781 3554 1739 366 2790 1781 1777 1885 3456 3324 274 1781 3554 374 1781 1783 366 2790 1781 1777 1885 1778 1777 1871 1777 1871 1777 1871 1777 1871 1777 17	Cap, veh/h	171	44	289	194	193		439	1959	161	23	1747	779
1433	Arrive On Green	0.12	0.12	0.12	0.11	0.11	0.00	0.13	0.59	0.59	0.03	0.49	0.49
1789 0 0 004 1077 1885 1728 1777 1871 1771 1771 1771 1771 1771	Sat Flow, ven/n	1433	300	06/7	1/81	///	282	3450	3324	417	18/1	4000	1282
3.6 0.0 14.3 4.2 0.8 0.0 12.7 6.5 6.5 1.0 10.9 0.8 0.0 12.7 6.5 6.5 1.0 10.9 0.8 0.0 12.7 6.5 6.5 1.0 10.9 0.8 0.0 12.7 6.5 6.5 1.0 10.9 0.8 0.0 12.7 6.5 6.5 1.0 10.9 0.8 0.0 14.3 4.2 0.8 0.0 12.7 6.5 6.5 1.0 10.9 0.8 0.0 14.3 4.2 0.8 0.0 12.7 6.5 6.5 1.0 10.9 0.8 0.0 10.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.	Grp Volume(v), ven/n Grp Sat Flow(s) veh/h/lp	700	> c	1305	1787	1777	1585	4728	4777	1821	1787	228	22 23
3.6 0.0 14.3 4.2 0.8 0.0 12.7 6.5 6.5 1.0 10.9 0.80 0.10.1 0.0 0.15 1.00 0.80 0.10.1 0.0 0.0 0.15 1.00 0.80 0.10.1 0.0 0.0 0.1 0.0 0.0 0.1 0.0 0.2 0.2 0.2 0.2 0.2 0.2 0.2 0.2 0.2	Q Serve(a.s). s	3.6	0.0	14.3	4.2	0.8	0.0	12.7	6.5	6.5	1.0	10.9	2.3
10 10 10 10 10 10 10 10	Cycle Q Clear(g_c), s	3.6	0.0	14.3	4.2	0.8	0.0	12.7	6.5	6.5	1:0	10.9	2.3
app Cap(c), veh/h 214 0 687 194 193 439 1047 1073 53 1747 and (2), veh/h 214 0 687 496 495 691 1047 1073 134 1747 and (2), veh/h 214 0 687 496 495 691 1047 1073 134 1747 and (2), veh/h 214 0 688 7 496 691 1047 1073 134 1747 and (2), veh/h 214 0 688 7 496 691 1047 1073 134 1747 and (2), veh/h 214 0 0 600 100 100 0.03 0.93 0.93 and (2), siveh 314 0 0 42.7 49.5 49.0 0.0 0 100 100 0.33 0.93 0.93 and (2), siveh 314 0 0 42.7 49.5 49.0 0.0 0 100 0.0 0.0 0 0.0 0 0.0 0 0.0 0 0.0 0 0.0 0 0.0 0 0.0 0 0.0 0 0.0 0 0.0 0	Prop In Lane	0.80		1.00	1.00		1.00	1.00		0.15	1.00		1.00
ablacon Ratio Tools T	Lane Grp Cap(c), veh/h	214	0	289	194	193		439	1047	1073	23	1747	779
Bable on Ration (a), weithh 214 0 687 496 495 691 1047 1073 134 1747 Plaboon Ratio 1.00 1	V/C Ratio(X)	0.28	0.00	0.82	0.35	0.07		0.85	0.20	0.20	0.29	0.31	0.07
Palabon Ratio 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.0	Avail Cap(c_a), veh/h	214	0	289	496	495		691	1047	1073	134	1747	779
language (GF+RG), siveh (1.00 0.00 1.00 1.00 1.00 1.00 1.00 1.0	HCM Platoon Kato	1.00	1.00	1.00	1.00	00.1	1.00	00.1	00.1	00.1	00.1	00.1	0.0
m Delay(d3), siven 40.1	Upstream Filter(I)	0.0	0.00	1.00	1.00	1.00	0.00	1.00	1.00	1.00	0.93	0.93	0.93
Action Summary Delay(d)s, veh (10,000,000,000,000,000,000,000,000,000,	Uniform Delay (d), siven	- 0 - u	0.0	7.7	0.04	0.04	0.0	0.0 7.0	0.0	0.0	0.70	0.0	0.0
According (50%), well and the control of the contro	Incl Delay (vz.), siveri	0.0	0.0		† C	- c	0.0	0.0	† C	† C	0.0	† C	2.0
Movement Delay, siveh 486 0.504 49.9 48.1 0.0 54.8 11.9 18.0 18.7 LOS vision below, siveh ach Delay, siveh LOS 62.3 81 A 793 611 19.4 19.4 ach Delay, siveh ach Delay, siveh LOS 50.2 49.6 32.1 19.4	Wile BackOfO(50%) veh/ln	5. 6	0.0	0.8	0.0	0.0	0.0	5.7	2.6	2.7	0.5	4.6	6.0
Delay(j),siveh 486 0.0 504 49.9 48.1 0.0 54.8 11.9 11.9 58.0 18.7 LOS D D D D D D D B E B ach Vol, vehh 623 81 A 793 611 611 611 ach Delay, sveh 50.2 49 B C B 611 B 611 B 611 B A 611 B C B A 611 B C B B A 611 B B B G B B A A A B	Unsia. Movement Delay. s/veh		3	2	2	-	2	;	i	i	2	2	5
LOS D A D D D B B E B E B	LnGrp Delay(d),s/veh		0.0	50.4	49.9	48.1	0.0	54.8	11.9	11.9	58.0	18.7	16.3
ach Vol., veh/h ach Delay, skeh b. 20.2 49.6 32.1 ach LOS ac	LnGrp LOS	O	A	О	О	O		D	В	В	ш	В	В
ach Delay, skeh 50.2 49.6 32.1 ach LOS ach LOS ach LOS ach LOS b	Approach Vol, veh/h		623			81	A		793			611	
Assigned Phs 1 2 4 5 6 8 8 Assigned Phs 1 2 4 5 6 8 8 Assigned Phs 2 7.5 75.8 19.0 19.3 64.1 17.7 Assigned Phs 2 7.5 75.8 19.0 19.3 64.1 17.7 Assigned Phs 2 7.5 75.8 19.0 19.3 64.1 17.7 Assigned Phs 2 7.5 75.8 19.0 19.3 64.1 17.7 Assigned Phs 3 7.5 75.8 19.0 19.3 64.1 17.7 Assigned Phs 3 7.5 75.8 19.0 19.3 64.1 17.7 Assigned Phs 3 7.5 75.8 19.0 19.3 64.1 17.7 Assigned Phs 3 7.5 75.8 19.0 19.3 19.1 17.7 Assigned Phs 3 7.5 75.8 19.0 19.3 19.1 17.7 Assigned Phs 3 7.5 75.8 19.0 19.3 19.1 17.7 Assigned Phs 3 7.5 75.8 19.0 19.3 19.1 17.7 Assigned Phs 3 7.5 75.8 19.0 19.3 19.1 17.7 Assigned Phs 3 7.5 75.8 19.0 19.3 19.1 17.7 Assigned Phs 3 7.5 75.8 19.0 19.3 19.1 17.7 Assigned Phs 3 7.5 75.8 19.0 19.3 19.1 17.7 Assigned Phs 3 7.5 75.8 19.0 17.7 Assigned Phs 3 7.5 75.8 19.0 19.1 17.7 Assigned Phs 3 7.5 75.8 19.0 17.7 Assigned Phs 3 7.5 75.8 19.0 19.1 17.7 Assigned Phs 3 7.5 75.8 19.1 17.7 Assigned Phs 3 7.5 75.8 19.1 17.7 Assigned Phs 3 7.5 75.8 19.1 17.7 Assigned Phs 3 7.5 7	Approach Delay, s/veh		50.2			49.6			32.1			19.4	
Imer-Assigned Phs 1 2 4 5 6 8 Phs Duration (G+Y-Ro, s 7.5 75.8 19.0 19.3 64.1 17.7 Change Period (Y-Ro, s 7.5 75.8 19.0 19.3 64.1 17.7 Max Green Setting (Gnax), s 9.0 4.9 *14 24.0 29.9 33.4 Max Green Exit Time (g C+II), s 3.0 8.5 16.3 14.7 12.9 6.2 Green Ext Time (g C+II), s 3.0 8.5 16.3 14.7 12.9 6.2 Green Ext Time (g C+II), s 3.0 8.5 16.3 14.7 12.9 6.2 HOM 6th Crt Delay 34.5 HOM 6th LOS Notes User approved pedestrian interval to be less than phase max green. FLOM 6th LOS Notes User approved pedestrian interval to be less than phase max green. How fine the control of the phase crossing the barrier. How fine the control of the phase crossing the barrier.	Approach LOS								ပ			മ	
Phs Duration (G+Y+Ro), s 7.5 75.8 19.0 19.3 64.1 17.7 Change Period (Y+Ro), s 4.0 5.1 *4.7 4.0 5.1 4.6 Max Green Setting (Glass), s 9.0 44.9 *14.7 4.0 29.9 33.4 Max Green Striff (Glass), s 0.0 4.6 0.0 0.5 3.5 0.2 Green Ext Time (p_c), s 0.0 4.6 0.0 0.5 3.5 0.2 Intersection Summary HCM 6th Crt Delay C Notes Notes User approved pedestrian interval to be less than phase max green. *HCM 6th LOS Notes User approved pedestrian interval to be less than phase max green. *HCM 6th Dolay & C Notes User approved pedestrian interval to be less than phase max green. *HCM 6th Dolay & C Notes Notes User approved pedestrian interval to be less than phase max green. *HCM 6th Dolay & C Notes Notes User approved pedestrian interval to be less than phase max green. *HCM 6th Dolay & C Notes Notes Notes Notes **Note	Timer - Assigned Phs	_	2		4	2	9		8				
Change Period (Y+Rc), s 4.0 5.1 *4.7 4.0 5.1 4.6 Max Genes Setting (Gmax), s 9.0 44.9 **14 24.0 29.9 33.4 Max O Clear Time (g_C+If), s 3.0 4.5 16.2 Green Ext Time (g_C, s 0.0 4.6 0.0 6.5 3.5 0.2 Intersection Summary HCM 6th CLO Blay HCM 6th LCS Notes User approved pedestrian interval to be less than phase max green. **The Max O Clear Time (g_C, s 0.2 0.2 0.2 0.2 Notes User approved pedestrian interval to be less than phase max green. **The Max O C 0.2 0.2 Notes User approved pedestrian interval to be less than phase max green. **The Max O C 0.2 0.2 Notes User approved pedestrian interval to be less than phase max green. **The Max O C 0.2 0.2 Notes User approved pedestrian interval to be less than phase max green. **The Max O C 0.2 0.2 Notes Notes	Phs Duration (G+Y+Rc), s	7.5	75.8		19.0	19.3	64.1		17.7				
Max Green Setting (Ginax), s 9.0 44.9 114.0 28.9 33.4 Max Q Clear Time (gc+ft), s 3.0 8.5 16.3 14.7 12.9 6.2 Green Ext Time (gc+ft), s 3.0 4.6 0.0 0.5 3.5 0.2 Intersection Summary HOM 6th Crit Delay C Notes User approved pedestrian interval to be less than phase max green. I her medical engine equal because times for the phases crossing the barrier. I her mains to have a require equal because the solicitions of the phase crossing the barrier.	Change Period (Y+Rc), s	4.0	5.1		*4.7	4.0	5.1		4.6				
Max U clear Time (g_c+1), s 3.0 c.5 10.3 (4.7 12.9 0.2 Green Ext Time (g_c), s 0.0 4.6 0.0 0.5 3.5 0.2 Intersection Summary HCM 6th Crit belay C Notes User approved pedestrian interval to be less than phase max green. H CM 6th Crit belay belass than phase max green. H CM 6th Crit belay from relative equal belasmore times from the phases crossing the barrier.	Max Green Setting (Gmax), s	0.6	44.9		* 14	24.0	29.9		33.4				
Intersection Summary HCM 6th Chri Delay HCM 6th LOS HCM 6th LOS Notes User approved pedestrian interval to be less than phase max green. H HCM 6th no myndividual engine equal becaracts fine phases crossing the barrier. H HCM 8th on myndividual engine equal becaracts fine some some since the solitor of the phases crossing the barrier.	Max Q Clear Time (g_c+l1), s Green Ext Time (p c), s	0.0	6.5		0.0	0.5	3.5		0.2				
HEAM 6th CM Delay CA.5 HCM 6th LOS Notes User approved pedestrian interval to be less than phase max green. Historial and note approved pedestrian interval for the phase of the phase crossing the barrier. HCM 6th computational engine and e	Intercoction Cummany												
HCM 6th LOS Notes User approved pedestrian interval to be less than phase max green. FLMS filt organization and engine equal begins the phases crossing the barrier. In service the now to the provided from relativistic organization felax and intersection delay.	HCM 6th Ctrl Delay			34.5									
Notes User approved pedestrian interval to be less than phase max green. * HCM 6th computational engine requires equal clearance times for the phases crossing the barrier. In example a place for the phase of the pancoach place and intersection delay.	HCM 6th LOS			O									
Notes User approved pedestrian interval to be less than phase max green. *HCM 6th computational engine requires equal clearance times for the phases crossing the barrier. It here mains to have for IVMRN is explicited from calculations of the annormal relation and intersection delay.	00101												
Oser approved peositral rittle val to be tess than plase max gleen. * HOM for computational engine requires equal fedamore times for the phases crossing the barrier. I he mainset have trivially its explicitle from calculations of the amorteen helaw and intersection delay.	Salon	4	le contraction	a da									
Insimalized Delay for NVRR) is excluded from calculations of the anomach play and intersection play	* HCM 6th computational engin	val to be	es edilal	Pilase II	times for	the phase	es crossi	ng the ba	rrier				
	Unsignalized Delay for IWBR1 is	proxes	ed from c	alculation	s of the a	noroach	de lav and	intersect	ion delay				

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HCM 6th Signalized Intersection Summary 1: Appian Wy & Mann Dr

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	4	~	•	-	→	<i>*</i>	
Movement	a	GGG	ä	TAN	CBT	CBD	
MOVERIERIE	I I	LDN	NDL	IQN :	Igo	NGC	
Lane Configurations	3 -8	0	-	‡	4		
I raffic Volume (veh/h)	25	103	11/	906	635	7.7	
Future Volume (veh/h)	50	103	117	906	635	22	
Initial Q (Qb), veh	0 9	0 6	0 5	0	0	0 ,	
Ped-Bike Adj(A_pb1)	3.5	8.5	3.5			1.00	
Parking Bus, Adj	0.1	1.00	1.00	00.1	0.1	1.00	
Work Zone On Approach	No.	40.70	4040	NO 220	N 25	C 100	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	
Adj Flow Kate, ven/h	27 25	112	12/	989	069	24	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	
Percent Heavy Veh, %	7	7 :	7 :	7	7	7.	
Cap, veh/h	78	142	161	2665	2110	73	
Arrive On Green	0.11	0.11	0.18	0.0	0.60	0.60	
Sat Flow, veh/h	263	1341	1781	3647	3597	122	
Grp Volume(v), veh/h	135	0	127	982	350	364	
Grp Sat Flow(s),veh/h/ln	1616	0	1781	1777	1777	1848	
Q Serve(g_s), s	5.7	0.0	4.8	0.0	8.9	6.8	
Cycle Q Clear(g_c), s	2.7	0.0	4.8	0.0	8.9	6.8	
Prop In Lane	0.16	0.83	1.00			0.07	
Lane Grp Cap(c), veh/h	171	0	161	2665	1070	1113	
V/C Ratio(X)	0.79	0.00	0.79	0.37	0.33	0.33	
Avail Cap(c_a), veh/h	462	0	331	2665	1070	1113	
HCM Platoon Ratio	1.00	1.00	2.00	2.00	1.00	1.00	
Upstream Filter(I)	1.00	0.00	0.91	0.91	1.00	1.00	
Uniform Delay (d), s/veh	30.5	0.0	28.0	0.0	6.9	6.9	
Incr Delay (d2), s/veh	7.9	0.0	9.7	4.0	8:0	0.8	
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	
%ile BackOfQ(50%),veh/ln	2.5	0.0	2.1	0.1	2.4	2.4	
Unsig. Movement Delay, s/veh							
LnGrp Delay(d),s/veh	38.4	0.0	35.6	0.4	7.7	7.7	
LnGrp LOS	Ω	٧	۵	4	A	A	
Approach Vol, veh/h	135			1112	714		
Approach Delay, s/veh	38.4			4.4	7.7		
Approach LOS	Ω			∢	∢		
Timer - Assigned Phs	-	2		4		9	
Phs Duration (G+Y+Rc), s	10.3	47.3		12.4		57.6	
Change Period (Y+Rc), s	4.0	5.1		5.0		5.1	
Max Green Setting (Gmax), s	13.0	22.9		20.0		39.9	
Max Q Clear Time (g_c+I1), s	8.9	8.8		7.7		2.0	
Green Ext Time (p_c), s	0.1	2.2		0.3		20.4	
Intersection Summary							
HCM 6th Ctrl Delav			7.9				
HCM 6th LOS			⋖				
3							
Notes			-				
User approved pedestrian interval to be less than phase max green.	al to be	ess than	phase m	ax green.	4000		
Oser approved volune balancing among the lanes for mining movement.	שוויוווש אַ	nent		ig illover	1		
> 6:	5	2					

HCM 6th Signalized Intersection Summary 2: Appian Wy & Tara Hills Dr/Canyon Dr

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88088 0.92 203 1.00 No 1870 553 0.92 5.3 5.3 2 1635 0.92 3554 553 1777 2.5 2.5 1635 0.34 1635 2.00 0.95 3.1 0.5 0.0 00.1 1870 18 0.92 2 58 0.06 1781 1.4 1.00 58 0.31 115 2.00 0.95 64.0 0.0 0.0 65.1 1781 102 0 0 0 0 0 0 0 0 0 0 16.7 ш Jser approved pedestrian interval to be less than phase max green.

HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.

Linsignalized Delay for [WBR] is excluded from calculations of the approach delay and intersection delay. **↑** 117 0 1.00 No 773 773 0.92 2 2 2 2 1848 0.59 3119 440 1777 18.8 18.8 1053 0.42 1053 1.00 1.00 15.5 0.0 7.9 16.7 B 1392 33.1 18.4 4.6 33.4 7.8 0.4 NBL 467 467 0 0 1.00 1.00 23 23 0.0 0.92 5.1 30.9 4.5 4.2 0.00 0.0 1.00 No 1870 35 3.5 0.92 2 175 0.10 0 32 32 58.2 E 1113 59.5 E 27.1 4.0 37.0 22.2 0.9 35 777 2.5 2.5 175 0.20 0.20 1.00 1.00 58.0 0.2 0.0 1870 78 0.92 2 176 0.10 78 5.8 5.8 1.00 176 0.44 425 1.00 1.00 0.7 0.0 27 00. 60.1 *4.7 *20 22.2 0.0 483 0.92 30.1 0.0 9. 8 37 0.92 2 84 0.14 582 0.0 0.0 00.0 0.00 A 598 43.8 D 5.1 58.9 20.8 11.9 Ť 8.5 4.0 9.0 3.4 0.0 78 0.92 2 178 0.14 2200. 115 809 8.1 8.1 8.1 0.68 262 262 1.00 1.00 54.6 0.0 Max Green Setting (Gmax), s
Max Q Clear Time (g_c+I1), s
Green Ext Time (p_c), s Unsig. Movement Delay, s/veh LnGrp Delay(d),s/veh Incr Delay (d2), s/veh Initial Q Delay(d3),s/veh %ile BackOfQ(50%),veh/ln Initial Q (Qb), we have a good and a good a Q Serveig, s), s Cycle Q Clearig, c), s Prop In Lane Lane Grp Capic), verl/h V/C Ratic(X) Avail Capic, s), verl/h HCM Platoon Ratio hs Duration (G+Y+Rc), s Approach Vol, veh/h Approach Delay, s/veh Approach LOS Change Period (Y+Rc), s Grp Volume(v), veh/h Grp Sat Flow(s),veh/h/ln Upstream Filter(I) Uniform Delay (d), s/veh Lane Configurations Traffic Volume (veh/h) Future Volume (veh/h) imer - Assigned Phs HCM 6th Ctrl Delay HCM 6th LOS nGrp LOS

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HCM 6th Signalized Intersection Summary 1: Appian Wy & Mann Dr/Project Access

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Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		4			4		F	41		F	41	
Traffic Volume (veh/h)	00	0	103	14	0	4	133	321	2	-	617	30
Future Volume (veh/h)	∞	0	103	4	0	4	133	321	2	-	617	30
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1:00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		8			2			2			2	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	о	0	112	15	0	4	145	382	2	-	671	33
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	5	7	2	2	2	2	2	2	2
Cap, veh/h	12	0	148	35	0	∞	193	1856	24	က	1445	71
Arrive On Green	0.10	0.00	0.10	0.02	0.00	0.02	0.11	0.52	0.52	0.00	0.42	0.42
Sat Flow, veh/h	119	0	1479	1371	0	365	1781	3592	47	1781	3447	169
Grp Volume(v), veh/h	121	0	0	19	0	0	145	189	198	-	346	358
Grp Sat Flow(s),veh/h/ln	1598	0	0	1736	0	0	1781	1777	1862	1781	1777	1840
Q Serve(q s), s	3.9	0.0	0.0	9.0	0.0	0.0	4.2	3.1	3.1	0.0	7.5	7.5
Cycle Q Clear(g c), s	3.9	0.0	0.0	9.0	0.0	0.0	4.2	3.1	3.1	0.0	7.5	7.5
Prop In Lane	0.07		0.93	0.79		0.21	1.00		0.03	1.00		0.09
Lane Grp Cap(c), veh/h	160	0	0	40	0	0	193	918	962	က	745	771
V/C Ratio(X)	92.0	0.00	0.00	0.48	0.00	0.00	0.75	0.21	0.21	0.30	0.46	0.46
Avail Cap(c_a), veh/h	220	0	0	245	0	0	170	2070	2169	218	1535	1590
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	23.3	0:0	0.0	25.7	0.0	0.0	23.0	7.0	7.0	26.5	11.2	11.2
Incr Delay (d2), s/veh	7.1	0.0	0.0	8.5	0.0	0.0	2.8	0.4	0.4	43.5	1.6	1.6
Initial Q Delay(d3),s/veh	0.0	0:0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.7	0:0	0.0	0.3	0.0	0.0	1.9	1.0	1.0	0.1	2.8	2.9
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	30.4	0.0	0.0	34.2	0.0	0.0	28.8	7.4	7.3	70.1	12.8	12.7
LnGrp LOS	ပ	⋖	∢	ပ	⋖	⋖	S	∢	⋖	ш	ш	m
Approach Vol, veh/h		121			19			532			202	
Approach Delay, s/veh		30.4			34.2			13.2			12.8	
Approach LOS		O			ပ			ш			ш	
Timer - Assigned Phs	-	2		4	2	9		∞				
Phs Duration (G+Y+Rc), s	9.8	27.4		10.3	4.6	32.6		5.7				
Change Period (Y+Rc), s	4.0	5.1		2.0	4.5	5.1		4.5				
Max Green Setting (Gmax), s	23.0	46.0		19.0	6.5	62.0		7.5				
Max Q Clear Time (g_c+I1), s	6.2	9.5		5.9	2.0	5.1		5.6				
Green Ext Time (p_c), s	0.3	12.8		0.5	0.0	6.9		0.0				
Intersection Summary												
HCM 6th Ctrl Delay			14.8									
HCM 6th LOS			2									
)))			1									
Notes												

Notes
User approved pedestrian interval to be less than phase max green.
User approved ignoring U-Tuming movement.

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HCM 6th Signalized Intersection Summary 2: Appian Wy & Tara Hills Dr/Canyon Dr

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			۰				-	-	-			
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		4	KK		₩₽*	×	K	*		K	*	×
Traffic Volume (veh/h)	43	Ξ	519	83	13	7	344	361	36	15	209	23
Future Volume (veh/h)	43	#	519	83	13	7	344	361	36	15	209	23
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1:00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		%			%			%			9	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	47	12	264	06	14	0	374	392	39	16	553	28
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	2	2	2	5	5	2	2	2	2	2	2	2
Sap, veh/h	171	44	289	201	201		439	1906	189	22	1732	773
Arrive On Green	0.12	0.12	0.12	0.11	0.11	0.00	0.13	0.58	0.58	0.03	0.49	0.49
Sat Flow, veryin	5	200	2730	0/1	111	000	3430	3200	323	101	4000 211	2000
orp volume(v), venin	9 0	0	1204	1701	4777	700	1700	212	4012	1701	222	200
Sprie(as), verimin	3.6		14.3	1/01	80	000	127	2 0	2101		113	2000
Sych O Clear(n c) s	9 6	0.0	2.4	. 2	000	0.0	127	0 00	0.0	= =	5 5	2.3
Prop In Lane	0.80	5	1.00	1.00	9	1.00	1.00	3	0.18	1.00	2	1.00
ane Grp Cap(c), veh/h	214	0	289	201	201		439	1037	1057	22	1732	773
//C Ratio(X)	0.28	0.00	0.82	0.45	0.07		0.85	0.20	0.21	0.29	0.32	0.08
Avail Cap(c_a), veh/h	214	0	289	496	495		691	1037	1057	134	1732	773
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Jpstream Filter(I)	1.00	0.00	1.00	1.00	1.00	0.00	1.00	1.00	1.00	0.92	0.92	0.92
Jniform Delay (d), s/veh	48.1	0.0	42.7	49.7	47.6	0.0	51.3	11.8	11.8	26.8	18.7	16.4
ncr Delay (d2), s/veh	0.5	0.0	7.7	9.0	0.1	0.0	3.5	0.4	0.4	1.0	0.4	0.2
nitial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOrQ(50%),ven/in	0.	0.0	8.6	7.6	4.0	0.0	2.7	7.8	5.9	0.5	8.4	0.9
nisig. Movernent Delay, s/ven nGrn Delay/d) c/voh	3 01	c	E0.4	202	47 G	c	0 7 9	10.2	400	0 2 2	101	12
nGrn LOS	5 -	5. A	t. C	3.0	? ⊂	0.0	5	2 <u>.</u> a	2 E	ў Э. Ш	<u>-</u> <u>-</u>	2 00
Approach Vol. veh/h	ı	623	ı	1	104	V	ı	802	ı	ı	627	
Approach Delay, s/veh		50.2			49.9			32.0			19.9	
Approach LOS		۵			Ω			O			В	
Fimer - Assigned Phs	_	2		4	2	9		∞				
hs Duration (G+Y+Rc), s	7.7	75.1		19.0	19.3	63.6		18.2				
Change Period (Y+Rc), s	4.0	5.1		* 4.7	4.0	5.1		4.6				
Max Green Setting (Gmax), s	0.6	44.9		* 14	24.0	29.9		33.4				
Max Q Clear Time (g_c+I1), s	3.1	6.0		16.3	14.7	13.3		7.7				
ereen Ext IIme (p_c), s	0:0	¥.8		0.0	0.5	3.6		0.3				
ntersection Summary												
HCM 6th Ctrl Delay			34.6									
HCM 6th LOS			ပ									

* HOM 6th computational engine requires equal clearance times for the phases crossing the barrier. Unsignalized Delay for [WBR] is excluded from calculations of the approach delay and intersection delay.

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HCM 6th Signalized Intersection Summary 1: Appian Wy & Mann Dr/Project Access

Movement		1	†	<i>></i>	>	ţ	4	•	←	•	۶	→	*
10	Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
20	Lane Configurations		4			÷		F	₽		F	₩	
100 20	Traffic Volume (veh/h)	20	0	103	6	0	က	117	200	14	4	637	22
1.00	Future Volume (veh/h)	20	0	103	တ	0	က	117	206	4	4	637	22
1.00	Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
100 100	Ped-Bike Adj(A_pbT)	0.0		00.1	1:00		1:00	1.00		1.00	1.00		1.00
by siveh 1870 1870 1870 1870 1870 1870 1870 1870	Parking Bus, Adj	1.00	1.00	1.00	1:00	1:00	1:00	1.00	1.00	1.00	1.00	1.00	1.00
1870 1870 1870 1870 1870 1870 1870 1870	Work Zone On Approach		2			2			2			2	
22 0 112 10 0 3 127 986 15 4 692 6 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	Adj Sat Flow, veh/h/In	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
6.92 0.92 0.92 0.92 0.92 0.92 0.92 0.92 0	Adj Flow Rate, veh/h	52	0	112	9	0	က	127	986	15	4	692	24
6 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
27 0 135 21 0 6 160 2171 33 10 1852 28.0 0.00 0.02 0.18 1.00 1.00 1.00 1.00 1.00 1.00 1.00	Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
0.10 0.00 0.10 0.02 0.00 0.02 0.18 1.00 1.00 0.01 0.53 265 0 1349 132 0 4.00 1781 3383 55 1781 3504 134 0 0 173 0 0 0 1771 1861 1777 1861 1777 5.7 0.0 0.0 0.5 0.0 0.0 4.8 0.0 0.0 0.2 8.1 6.16 0 0.8 0.0 0.0 0.2 0.0 4.8 0.0 0.0 0.2 8.1 6.17 0 0.0 0.0 0.5 0.0 0.0 4.8 0.0 0.0 0.2 8.1 6.18 0 0.0 0.0 0.47 0.00 0.0 0.79 0.45 0.45 0.45 0.37 6.19 0 0.0 0.0 0.47 0.00 0.0 0.79 0.45 0.45 0.45 0.37 6.10 0 0.0 0.0 0.0 1.00 1.00 1.00 1.00 1	Cap, veh/h	27	0	135	51	0	9	160	2171	33	10	1852	64
265 0 1349 1332 0 400 1781 3583 55 1781 3504 134 0 0 13 0 0 127 489 512 4 351 144 0 0 0 1732 0 0 127 489 512 4 351 157 00 00 0.5 0.0 0.0 48 0.0 0.0 0.2 8.1 57 0.0 0.0 0.5 0.0 0.0 48 0.0 0.0 0.2 8.1 0.16 0 0.8 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	Arrive On Green	0.10	0.00	0.10	0.02	0.00	0.02	0.18	1.00	1.00	0.01	0.53	0.53
134	Sat Flow, veh/h	265	0	1349	1332	0	400	1781	3583	22	1781	3504	121
Mar. 1614 0 0 1732 0 0 1781 1777 1861 1781 1777 1861 1781 1777 1861 1781 1777 1861 1781 1777 1861 1781 1777 1861 1781 1777 1861 1781 1777 1861 1781 1777 1861 1781 1777 1861 1781 1781 1781 1781 1871 18	Grp Volume(v), veh/h	138	0	0	13	0	0	127	489	512	4	351	365
C) S 7 0.0 0.0 0.5 0.0 0.4 8 0.0 0.0 0.2 8.1 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1	Grp Sat Flow(s),veh/h/ln	1614	0	0	1732	0	0	1781	1777	1861	1781	1777	1848
0.16	Q Serve(q s), s	5.7	0.0	0.0	0.5	0.0	0.0	4.8	0.0	0.0	0.2	8.1	8.
0.16	Cycle Q Clear(a c).s	2.7	0.0	0.0	0.5	0.0	0.0	4.8	0.0	0.0	0.2	8.1	8.1
161 0 0 28 0 0 160 1776 1127 10 839 0.83 0.00 0.00 0.47 0.00 0.079 0.45 0.45 0.42 0.37 161 0 0 130 1.00 1.00 1.00 0.79 0.45 0.45 0.42 0.37 1.00 1.00 1.00 1.00 1.00 1.00 2.00 2.00	Prop In Lane	0.16		0.84	0.77		0.23	1.00		0.03	1.00		0.07
0.83 0.00 0.00 0.47 0.00 0.079 0.45 0.45 0.45 0.47 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.0	Lane Grp Cap(c), veh/h	161	0	0	78	0	0	160	1076	1127	10	939	977
161 0 0 136 0 254 1076 1127 140 339 1.00	V/C Ratio(X)	0.83	0.00	0.00	0.47	0.00	0.00	0.79	0.45	0.45	0.42	0.37	0.37
1.00 1.00 1.00 1.00 1.00 1.00 2.00 2.00	Avail Cap(c_a), veh/h	161	0	0	136	0	0	254	1076	1127	140	939	977
1.00 0.00 0.00 1.00 0.00 0.89 0.89 0.89 1.00 1.00 0.00 0.00 0.84 0.89 0.89 0.89 1.00 1.00 0.00 0.00 0.00 0.00 0.00 0.0	HCM Platoon Ratio	1.00	1.00	1.00	1:00	1.00	1:00	2.00	2.00	2.00	1.00	1.00	1.00
30.9 0.0 0.0 34.1 0.0 0.0 28.1 0.0 0.0 34.7 9.7 29.0 0.0 0.0 0.119 0.0 0.0 0.7 7 1.2 1.2 28.8 1.1 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0	Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	0.00	0.89	0.89	0.89	1.00	1.00	1.00
290 0.0 0.0 11.9 0.0 0.0 7.7 1.2 1.2 26.8 1.1 1.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0	Uniform Delay (d), s/veh	30.9	0.0	0.0	¥.	0.0	0.0	28.1	0.0	0.0	34.7	9.7	9.7
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0	Incr Delay (d2), s/veh	29.0	0.0	0.0	11.9	0.0	0.0	7.7	1.2	1.2	26.8	- -	1.1
3.4 0.0 0.0 0.3 0.0 0.0 2.2 0.4 0.4 0.1 3.0 18.9 0.0 0.0 46.1 0.0 0.0 35.8 1.2 1.2 61.5 10.8 13.4 A D A A D A B T A E B 13.4 13 12.0 4.9 47.5 5.6 10.0 28.9 7.0 5.5 32.9 5.5 6.8 10.1 7.7 2.2 2.0 2.5 11.2 B 11.2 A B B B B B B B B B B B B B B B B B B	Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
134	%ile BackOfQ(50%),veh/ln	3.4	0.0	0.0	0.3	0.0	0.0	2.2	0.4	0.4	0.1	3.0	3.1
599 0.0 0.0 461 0.0 0.0 35.8 1.2 61.5 10.8 E A A A A A E E B 134 13 1128 720 </td <td>Unsig. Movement Delay, s/veh</td> <td>_</td> <td></td>	Unsig. Movement Delay, s/veh	_											
E A A D A A D A A E B B 134	LnGrp Delay(d),s/veh	59.9	0.0	0.0	46.1	0.0	0.0	35.8	1.2	1.2	61.5	10.8	10.8
134 13 1128 59.9 46.1 5.1 1 2 4 5 6 8 10.3 42.1 120 4.9 47.5 5.6 4.0 5.1 5.0 4.5 5.1 4.5 6.8 10.1 7.7 2.2 2.0 2.5 0.1 9.2 0.0 0.0 17.7 0.0	LnGrp LOS	ш	V	A	Ω	A	٧	Ω	A	A	ш	В	В
599 46.1 5.1 E D A A B 6 8 103 42.1 12.0 4.9 47.5 5.6 4.0 5.1 5.0 4.5 5.1 4.5 6.8 10.1 77 2.2 2.0 2.5 0.1 9.2 0.0 0.0 17.7 0.0 B B	Approach Vol, veh/h		134			13			1128			720	
1 2 4 5 6 8 8 10.3 42.1 12.0 4.9 47.5 5.6 5.6 10.0 28.9 7.0 5.5 32.9 5.5 6.0 10.1 9.2 0.0 0.0 17.7 0.0	Approach Delay, s/veh		59.9			46.1			5.1			11.1	
10.3 42.1 12.0 4.9 47.5 4.0 5.1 5.0 45 5.1 10.0 28.9 7.0 5.5 32.9 0.1 9.2 0.0 0.0 17.7 11.2	Approach LOS		ш			Ω			∢			В	
10.3 42.1 12.0 4.9 47.5 4.0 5.1 5.0 4.5 5.1 10.0 28.9 7.0 5.5 32.9 0.1 9.2 0.0 0.0 17.7 11.2 B	Timer - Assigned Phs	_	2		4	2	9		∞				
4.0 5.1 5.0 4.5 5.1 10.0 28.9 7.0 5.5 32.9 6.8 10.1 7.7 2.2 2.0 0.1 9.2 0.0 0.0 17.7 11.2 B	Phs Duration (G+Y+Rc), s	10.3	42.1		12.0	4.9	47.5		5.6				
10.0 28.9 7.0 6.5 32.9 6.8 10.1 77 2.2 2.0 0.1 9.2 0.0 0.0 17.7 11.2 B	Change Period (Y+Rc), s	4.0	5.1		2.0	4.5	5.1		4.5				
6.8 10.1 7.7 2.2 2.0 0.1 9.2 0.0 0.0 17.7 11.2 B	Max Green Setting (Gmax), s		28.9		7.0	5.5	32.9		5.5				
0.1 9.2 0.0 0.0 17.7 11.2 B	Max Q Clear Time (g. c+11), s		10.1		7.7	2.2	2.0		2.5				
	Green Ext Time (p_c), s		9.5		0.0	0.0	17.7		0.0				
	Intersection Summary												
Jelay	I OM 6th Otal Dalan			0.44									
	HCM 6th Ctff Delay			7									
	HCM btn LOS			מ									

Notes
User approved pedestrian interval to be less than phase max green.
User approved volume balancing among the lanes for turning movement.

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HCM 6th Signalized Intersection Summary 2: Appian Wy & Tara Hills Dr/Canyon Dr

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Movement EBL EBT EBR WBL WBT WBT NBT	FBL FBT FBR WBL WBT WBR NBL NBT NBR SBL	FBL FBT FBR WBL WBT WBR NBL NBT NBR NBT NBT	EBL EBT
100 100	12	The color of the	72 34 72 34 72 34 72 34 70 0 100 100 100 100 100 100 1014 0.14 1027 88 103 0.0 100 0.0 100 0.0 100 0.0 100 0.0 100 0.0
72 34 444 86 32 24 467 725 123 19 18 19 10 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	The control of the	72 34 444 86 32 24 467 725 123 10 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	72 34 72 34 72 34 72 34 73 37 78 37 78 37 78 84 0.14 0.14 115 00 1809 0 115 00 1809 0 110 0.00 100 0.00 546 0.00 6.90 6.92 78 84 115 00 100 0.00 100 0.00
72 34 444 86 32 24 467 725 123 19 16 100 100 100 100 100 100 100 100 100	72 34 444 86 32 24 467 725 123 19 518 100 100 100 100 100 100 100 100 100 10	72 34 444 86 32 24 467 725 123 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	72 34 0 0 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.01 1.01 1.02 1.00 1.00 1.00
100 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	100 100 100 100 100 100 100 100 100 100	100 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00
1,00 1,00 1,00 1,00 1,00 1,00 1,00 1,00	100 100 100 100 100 100 100 100 100 100	100 1.00 1.00 1.00 1.00 1.00 1.00 1.00	1,00 1,00 1,00 1,00 1,00 1,00 1,00 1,00
100 100 100 100 100 100 100 100 100 100	100	100 100 100 100 100 100 100 100 100 100	1.00 1.00 1.00 1.00 1.00 1.00 1.00 1.00
1870 1870	No	No N	1870 1870 1870 1870 1870 1870 1870 1870
1870 1870	1870	1870 1870	1870 1870 1870 1870 1870 1870 1870 1870
78 37 483 93 35 0 508 788 134 21 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	78 37 483 93 35 0 508 788 134 21 563 1092 0.92 0.92 0.92 0.92 0.92 0.92 0.92 0	78 37 483 93 35 0 508 788 789 792 0.92 0.92 0.92 0.92 0.92 0.92 0.92 0.	78 37 79 27 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
0.92 0.92 0.92 0.92 0.92 0.92 0.92 0.92	0.92 0.92 0.92 0.92 0.92 0.92 0.92 0.92	0.92 0.92 0.92 0.92 0.92 0.92 0.92 0.92	0.92 0.92 0.92 0.92 0.92 0.92 0.92 0.92
2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	12	172	2 2 8 4 0.14 0.14 0.14 0.14 0.14 0.14 0.14 0.
178 84 864 177 176 569 1787 304 64 18 1127 1822 2790 1781 1777 1585 3456 3038 517 1781 37 1585 3456 3038 517 1781 37 1809 0 1395 1781 1777 1585 1722 202	178 84 864 177 176 569 1787 304 64 1633 10.14 0.14 0.14 0.10 0.10 0.16 0.59 0.59 0.07 0.59 0.11 115 0 483 93 35 0 50 0.50 0.07 0.05 0.16 0.10 0.10 0.10 0.10 0.10 0.10 0.10	178 84 864 177 176 569 1787 178	178 84 1227 562 115 60 11809 0 11809 0 11809 0 11809 0 11809 0 11809 0 1180 0 1190 0
1014 014 014 014 010 010 016 059 057 0 1027 582 2790 1781 1777 1585 346 508 517 1781 13 1809 0 1395 1781 1777 1585 1728 1777 1781 13 1809 0 1395 1781 1777 1585 1728 1777 1781 11 181 0.0 20.2 6.9 2.5 0.0 20.2 20.2 20.2 16 0.8 4 177 176 569 2.5 0.0 20.2 20.2 16 0.8 4 177 176 569 0.4 20.2 20.2 16 0.8 64 177 176 569 1045 1046 64 14 0.4 0.0 0.5 6.5 0.5 3 0.2 0.0 100 0.2 0.0 29 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0	1227 582 2790 1781 3554 465 3038 517 1781 3554 115 0 483 93 35 10 508 3614 115 0 483 93 35 10 508 461 461 1777 1865 3456 3038 517 1781 3554 116 0 683 617 1781 3554 1177 180 618 1177 1781 1777 1781 1777 1781 1777 1781 1777 1781 1777 1781 1777 1781 1777 1777 1781 1777 1777 1781 1777 1777 1781 1777 1777 1781 1777 1777 1782 1777 1777	1227 682 2790 1777 1865 3456 3038 1809 0 14 0.14 0.14 0.14 0.10 0.00 0.16 0.59 1809 0 1395 1781 1777 1865 3456 3038 365 0.2790 1781 1777 1865 3456 3038 1781 1777 1865 3456 3038 1781 1777 1865 1728 1777 1865 1728 1777 1865 1728 1777 1865 1728 1777 1865 1728 1777 1865 1728 1777 1865 1728 1777 1865 1728 1777 1865 1728 1777 1865 1728 1777 1865 1728 1777 178 178 178 178 178 178 178 178 1	0.14 0.14 115 00 1809 0 1809 0 181 0.0 0.68 0 0.44 0.00 1.00 0.00 1.00 0.00 546 0.0
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HCM 6th computational engine requires equal clearance times for the phases crossing the barrier.	TOW OIL OUR DATE OF THE TOTAL O	pedestrian interval to be less than phase max green. purlational engine requires equal clearance times for the phases crossing the barrier.	pedestrian interval to be less than pha putationa engine requires equa cleara
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2151 Appian Way Multi-Family Housing Traffic Study Existing plus Project Conditions PM

Appendix C

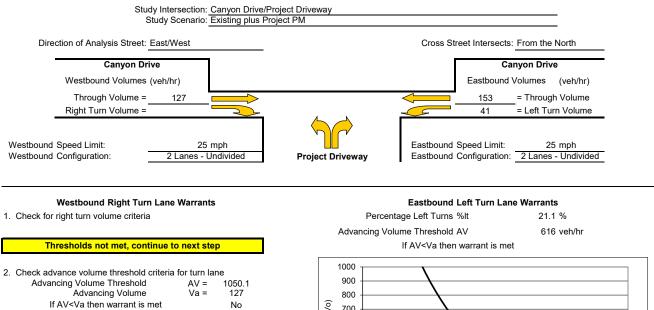
Turn Lane Warrant





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Turn Lane Warrant Analysis - Tee Intersections



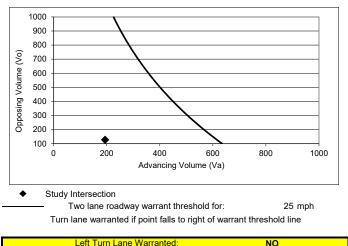
Westbound Right Turn Taper Warrants (evaluate if right turn lane is unwarranted)

1. Check taper volume criteria

NOT WARRANTED - Less than 20 vehicles

Check advance volume threshold criteria for taper
 Advancing Volume Threshold AV = Advancing Volume Va = 127
 If AV<Va then warrant is met -

Right Turn Taper Warranted: NO



Methodology based on Washington State Transportation Center Research Report Method For Prioritizing Intersection Improvements, January 1997. The right turn lane and taper analysis is based on work conducted by Cottrell in 1981.

The left turn lane analysis is based on work conducted by M.D. Harmelink in 1967, and modified by Kikuchi and Chakroborty in 1991.

W-Trans 8/9/2021