KUNZMAN ASSOCIATES, INC.

VARITY STORE PROJECT - MORONGO VALLEY

FOCUSED TRAFFIC ANALYSIS

July 26, 2016

Traffic Engineering | Transportation Planning | Parking | Noise/Vibration | Expert Witness
Air Quality | Global Climate Change | Health Risk Assessment

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Prepared by:

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JN 6575

July 26, 2016

Mr. David Friedberg, Project Manager
SIMONCRE ASHFORD, LLC
6900 East 2nd Street
Scottsdale, AZ 85251

Dear Mr. Friedberg:

INTRODUCTION

The firm of Kunzman Associates, Inc. is pleased to provide this focused traffic analysis for the Variety Store Project, Morongo Valley. The proposed development consists of a 9,100 square foot variety store and is located adjacent to the northern side of Twentynine Palms Highway (SR-62) just northeast of Vale Drive in the Morongo Valley area of the County of San Bernardino (see Figure 1). Figure 2 illustrates the project site plan.

Although this is a technical report, every effort has been made to write the report clearly and concisely. To assist the reader with those terms unique to transportation engineering, a glossary of terms is provided within Appendix A.

TRAFFIC IMPACT ANALYSIS CRITERIA

The County of San Bernardino Transportation Department staff has requested that California Department of Transportation guidelines be utilized for this project. As stated in the Guide for the Preparation of Traffic Impact Studies, California Department of Transportation, December 2002, a traffic impact study may be needed when a project:

1. Generates over 100 peak hour trips assigned to a State highway facility.

2. Generates 50 to 100 peak hour trips assigned to a State highway facility - and, affected State highway facilities are experiencing noticeable delay; approaching unstable traffic flow conditions (Level of Service "C" or "D").

3. Generates 1 to 49 peak hour trips assigned to a State highway facility - the following are examples that may require a full traffic impact study or some lesser analysis:

    a. Affected State highway facilities experiencing significant delay; unstable or forced traffic flow conditions (Level of Service "E" or "F").

    b. The potential risk for a traffic accident is significantly increased (i.e., congestion related collisions, non-standard sight distance considerations, increase in traffic conflict points, etc.).

c. Change in local circulation networks that impact a State highway facility (i.e., direct access to State highway facility, a non-standard highway geometric design, etc.).

EXISTING TRAFFIC CONDITIONS

Figure 3 identifies the existing conditions for study area roadways. The number of through lanes for existing roadways and the existing intersection controls are identified.

Existing intersection traffic conditions were established through morning and evening peak hour traffic counts obtained by Kunzman Associates, Inc. from July 2016 (see Appendix B). Explicit peak hour factors have been calculated using the data collected for this effort as well. The morning and evening peak hour traffic volumes were identified by counting the two-hour periods from 7:00 AM – 9:00 AM and 4:00 PM – 6:00 PM. In addition, truck classification counts were conducted at the study area intersections. The existing volumes and types (number of axles) of trucks was used in the conversion of trucks to Passenger Car Equivalents.

The morning peak hour and evening peak hour traffic counts have been converted to Passenger Car Equivalents. The following passenger car equivalents have been utilized throughout this report based on the San Bernardino Association of Governments, Congestion Management Program, Appendix C: Guidelines for CMP Traffic Impact Analysis Reports in San Bernardino County, 2005:

- 2 axle = 1.5
- 3 axle = 2.0
- 4+ axle = 3.0

The technique used to assess the capacity needs of an intersection is known as the Intersection Delay Method (see Appendix C) based on the 2010 Highway Capacity Manual – Transportation Research Board. To calculate delay, the volume of traffic using the intersection is compared with the capacity of the intersection.

For existing/existing plus project/and existing plus ambient growth plus project traffic conditions, saturation flow rates of 1,800 vehicles per hour of green for through and right turn lanes and 1,700 vehicles per lane for single left turn lanes, 1,600 vehicles per lane for dual left turn lanes and 1,500 vehicles per lane for triple left turn lanes have been assumed for the capacity analysis.

The definition of an intersection deficiency has been obtained from the County of San Bernardino General Plan. The General Plan states that peak hour intersection operations of Level of Service D or better for all County maintained roads. For Desert Regions, the County shall ensure that all new development proposals do not degrade Levels of Service on Major arterials below Level of Service C. Therefore, any intersection operating at Level of Service D to F will be considered deficient.

The Existing delay and Level of Service for the study area intersections are shown in Table 1. The study area intersections currently operate within acceptable Levels of Service during the peak hours for Existing traffic conditions. The Existing delay worksheets are provided in Appendix C. Existing morning

and evening peak hour intersection turning movement volumes are shown on Figures 4 and 5, respectively.

Existing pedestrian facilities adjacent to the project site are shown on Figure 6.

PROJECT TRIP GENERATION

Trip generation rates were determined for daily traffic, morning peak hour inbound and outbound traffic, and evening peak hour inbound and outbound traffic for the proposed land use. By multiplying the trip generation rates by the land use quantity, the project generated traffic volumes are determined.

Table 2 exhibits the trip generation rates, project peak hour volumes, and project daily traffic volumes. The trip generation rates are derived from the Institute of Transportation Engineers, Trip Generation Manual, 9th Edition, 2012. In the absence of data from the Institute of Transportation Engineers, the morning and evening peak hour inbound/outbound ratio splits for specialty retail/strip commercial were obtained from the San Diego Association of Governments, Traffic Generators, May 2003.

The proposed project has been identified as a Variety Store (Land Use Code 814) in the Institute of Transportation Engineers, Trip Generation Manual, 9th Edition, 2012. A Variety Store (15 study locations) is described as follows:

> *A variety store is a retail store that sells a broad range of inexpensive items often at a single price. These stores are typically referred to as "dollar stores". Items sold at these stores typically include kitchen supplies, cleaning products, home office supplies, food products, household goods, decorations and toys. These stores are sometimes stand-alone sites, but they may also be located in small strip shopping centers. Free-standing discount store (Land Use 815) is a related use.*

The proposed development is projected to generate approximately 583 daily vehicle trips, 35 of which occur during the morning peak hour and 62 of which occur during the evening peak hour.

It should be noted that for variety store land uses, a portion of the trips would come from pass-by trips from adjacent roadways, trips that are currently on the roadway system. In order to analyze a "conservative" scenario, the traffic volumes from the project have not been reduced as a result of pass-by trips.

PROJECT TRIP DISTRIBUTION

Figure 7 contains the directional distribution of the project trips for the proposed land use. To determine the trip distribution for the proposed project, peak hour traffic counts of the existing directional distribution of traffic for existing areas in the vicinity of the site and other additional information on future development and traffic impacts in the area were reviewed.

STUDY AREA TRAFFIC CONDITIONS

The study area intersections were analyzed for Existing Plus Project[1] and Existing Plus Ambient Growth Plus Project traffic conditions (see Appendix C).

The technique used to assess the capacity needs of an intersection is known as the Intersection Delay Method (see Appendix C) based on the 2010 Highway Capacity Manual – Transportation Research Board. To calculate delay, the volume of traffic using the intersection is compared with the capacity of the intersection. The signalized intersections are considered deficient (Level of Service F) if the overall intersection critical volume to capacity ratio equals or exceeds 1.0, even if the Level of Service defined by the delay value is below the defined Level of Service standard. The volume to capacity ratio is defined as the critical volumes divided by the intersection capacity. A volume to capacity ratio greater than 1.0 implies an infinite queue.

To assess Existing Plus Ambient Growth Plus Project traffic conditions, project traffic is combined with existing traffic and areawide growth. The Opening Year for analysis purposes in this report is 2017.

For future traffic conditions, an annual growth rate of 0.81% was used. This growth rate was based on average daily traffic volumes obtained from the 2014 Traffic Volumes on California State Highways by the California Department of Transportation along SR-62 adjacent to the project site over a three year period.

According to the County of San Bernardino Transportation Department staff, there are not currently any approved projects within the vicinity of the project site that would generate significant trips to the study area intersections. Therefore, the Existing Plus Ambient Growth Plus Project traffic conditions are representative of Existing Plus Ambient Growth Plus Project Plus Cumulative traffic conditions.

For Existing Plus Project traffic conditions, the study area intersections are projected to operate at acceptable Levels of Service during the peak hours (see Table 3).

For Existing Plus Ambient Growth Plus Project traffic conditions, the study area intersections are projected to operate at acceptable Levels of Service during the peak hours (see Table 4).

Morning and evening peak hour intersection turning movement volumes for the Project, Existing Plus Project, and Existing Plus Ambient Growth Plus Project traffic conditions are shown on Figures 8 to 13.

EMERGENCY ACCESS

Figure 14 shows distances from SR-62 to the entrance of the building and property boundary for an emergency vehicle parked along SR-62. Since these distances are less than 1,000 feet, adequate

[1] The existing plus project conditions has been analyzed to comply with the Sunnyvale West Neighborhood Association v. City of Sunnyvale CEQA court case. This scenario assumes the full development of the proposed project and full absorption of the proposed project trips on the circulation system at the present time.

emergency access is provided because emergency personnel can park along SR-62 and provide emergency services in the event that the project access is blocked and inaccessible.

CONCLUSIONS

The proposed development is projected to generate approximately 583 daily vehicle trips, 35 of which occur during the morning peak hour and 62 of which occur during the evening peak hour.

For Existing Plus Project traffic conditions, the study area intersections are projected to operate at acceptable Levels of Service during the peak hours.

For Existing Plus Ambient Growth Plus Project traffic conditions, the study area intersections are projected to operate at acceptable Levels of Service during the peak hours.

For Existing Plus Ambient Growth Plus Project Plus Cumulative traffic conditions, the study area intersections are projected to operate at acceptable Levels of Service during the peak hours.

RECOMMENDATIONS

The following improvements are recommended in conjunction with the proposed development to ensure adequate circulation within the project itself (see Figure 15).

Construct SR-62 from the west project boundary to the east project boundary at its ultimate half-section width including landscaping and parkway improvements in conjunction with development adhering to sight distance requirements, as necessary.

Sight distance at the project access shall comply with standard California Department of Transportation and County of San Bernardino sight distance standards. The final grading, landscaping, and street improvement plans shall demonstrate that sight distance standards are met. Such plans must be reviewed by the County and approved as consistent with this measure prior to issue of grading permits.

The site should provide sufficient parking spaces to meet County of San Bernardino parking code requirements in order to service on-site parking demand.

On-site traffic signing/striping should be implemented in conjunction with detailed construction plans for the project site.

As is the case for any roadway design, the County of San Bernardino should periodically review traffic operations in the vicinity of the project once the project is constructed to assure that the traffic operations are satisfactory.

Mr. David Friedberg, Project Manager
SIMONCRE ASHFORD, LLC
July 26, 2016

It has been a pleasure to service your needs on this project. Should you have any questions or if we can be of further assistance, please do not hesitate to call at (714) 973-8383.

Sincerely,

KUNZMAN ASSOCIATES , INC.

Bryan Crawford
Senior Associate

JN 6575

KUNZMAN ASSOCIATES, INC.

William Kunzman, P.E.
Principal

Table 1

Existing Intersection Delay and Level of Service

Intersection	Jurisdiction	Traffic Control[3]	Intersection Approach Lanes[1]												Peak Hour Delay-LOS[2]	
			Northbound			Southbound			Eastbound			Westbound				
			L	T	R	L	T	R	L	T	R	L	T	R	Morning	Evening
West Drive / Mountain View Drive (NS) at: SR-62 (EW) - #1	Caltrans	CSS	0	1	0	0	1	0	1	1.5	0.5	1	1.5	0.5	19.3-C	24.1-C
East Drive (NS) at: SR-62 (EW) - #3	Caltrans	CSS	0	1	0	0	1	0	1	1.5	0.5	1	1.5	0.5	19.5-C	15.9-C

[1] When a right turn lane is designated, the lane can either be striped or unstriped. To function as a right turn lane there must be sufficient width for right turning vehicles to travel outside the through lanes.
L = Left; T = Through; R = Right

[2] Delay and level of service has been calculated using the following analysis software: HCS+ Version 5.6. Per the 2010 Highway Capacity Manual, overall average for intersection delay and level of service are shown for intersections with traffic signal or all way stop control, the delay and level of service for the worst individual movement (or movements sharing a single lane) are shown.

[3] CSS = Cross Street Stop

Table 2

Project Trip Generation[1]

Land Use	Quantity	Units[2]	Peak Hour						Daily
			Morning			Evening			
			Inbound	Outbound	Total	Inbound	Outbound	Total	
Trip Generation Rates									
Variety Store		TSF	2.29	1.52	3.81	3.41	3.41	6.82	64.03
Trips Generated									
Variety Store	9.100	TSF	21	14	35	31	31	62	583

[1] Source: Institute of Transportation Engineers, Trip Generation Manual, 9th Edition, 2012, Land Use Code 814. Since morning and evening peak hour inbound/outbound ratios are not available, the morning and evening peak hour inbound/outbound ratio splits for specialty retail/strip commercial has been obtained from the San Diego Association of Governments, Traffic Generators, May 2003.

[2] TSF = Thousand Square Feet

Table 3

Existing Plus Project Intersection Delay and Level of Service

Intersection	Jurisdiction	Traffic Control[3]	Intersection Approach Lanes[1]												Peak Hour Delay-LOS[2]	
			Northbound			Southbound			Eastbound			Westbound				
			L	T	R	L	T	R	L	T	R	L	T	R	Morning	Evening
West Drive / Mountain View Drive (NS) at: SR-62 (EW) - #1	Caltrans	CSS	0	1	0	0	1	0	1	1.5	0.5	1	1.5	0.5	20.7-C	19.1-C
Project Access (NS) at: SR-62 (EW) - #2	Caltrans	**CSS**	0	0	0	**0.5**	0	**0.5**	1	2	0	0	1.5	0.5	13.9-B	12.7-B
East Drive (NS) at: SR-62 (EW) - #3	Caltrans	CSS	0	1	0	0	1	0	1	1.5	0.5	1	1.5	0.5	19.6-C	16.1-C

[1] When a right turn lane is designated, the lane can either be striped or unstriped. To function as a right turn lane there must be sufficient width for right turning vehicles to travel outside the through lanes.

L = Left; T = Through; R = Right; **BOLD** = Improvement

[2] Delay and level of service has been calculated using the following analysis software: HCS+ Version 5.6. Per the 2010 Highway Capacity Manual, overall average for intersection delay and level of service are shown for intersections with traffic signal or all way stop control, the delay and level of service for the worst individual movement (or movements sharing a single lane) are shown.

[3] CSS = Cross Street Stop

Table 4

Existing Plus Ambient Growth Plus Project Intersection Delay and Level of Service

Intersection	Jurisdiction	Traffic Control[3]	Intersection Approach Lanes[1]												Peak Hour Delay-LOS[2]	
			Northbound			Southbound			Eastbound			Westbound				
			L	T	R	L	T	R	L	T	R	L	T	R	Morning	Evening
West Drive / Mountain View Drive (NS) at: SR-62 (EW) - #1	Caltrans	CSS	0	1	0	0	1	0	1	1.5	0.5	1	1.5	0.5	20.9-C	19.1-C
Project Access (NS) at: SR-62 (EW) - #2	Caltrans	**CSS**	0	0	0	**0.5**	0	**0.5**	1	2	0	0	1.5	0.5	14.0-B	12.7-B
East Drive (NS) at: SR-62 (EW) - #3	Caltrans	CSS	0	1	0	0	1	0	1	1.5	0.5	1	1.5	0.5	19.8-C	16.2-C

[1] When a right turn lane is designated, the lane can either be striped or unstriped. To function as a right turn lane there must be sufficient width for right turning vehicles to travel outside the through lanes.

L = Left; T = Through; R = Right; **BOLD** = Improvement

[2] Delay and level of service has been calculated using the following analysis software: HCS+ Version 5.6. Per the 2010 Highway Capacity Manual, overall average for intersection delay and level of service are shown for intersections with traffic signal or all way stop control, the delay and level of service for the worst individual movement (or movements sharing a single lane) are shown.

[3] CSS = Cross Street Stop

Figure 1
Project Location Map

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OVER 40 YEARS OF EXCELLENT SERVICE

Figure 2
Site Plan

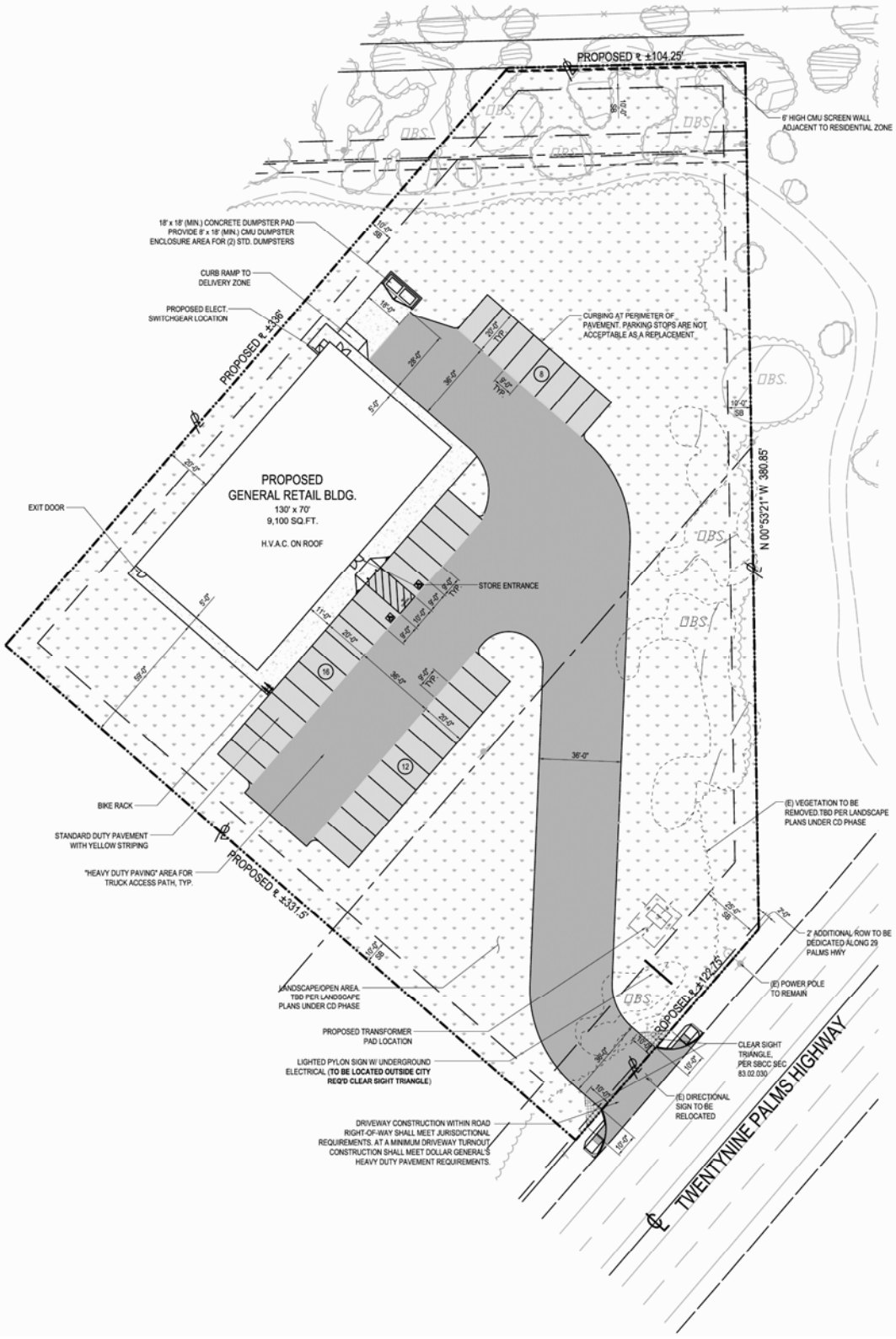


Figure 3
Existing Through Travel Lanes and Intersection Controls

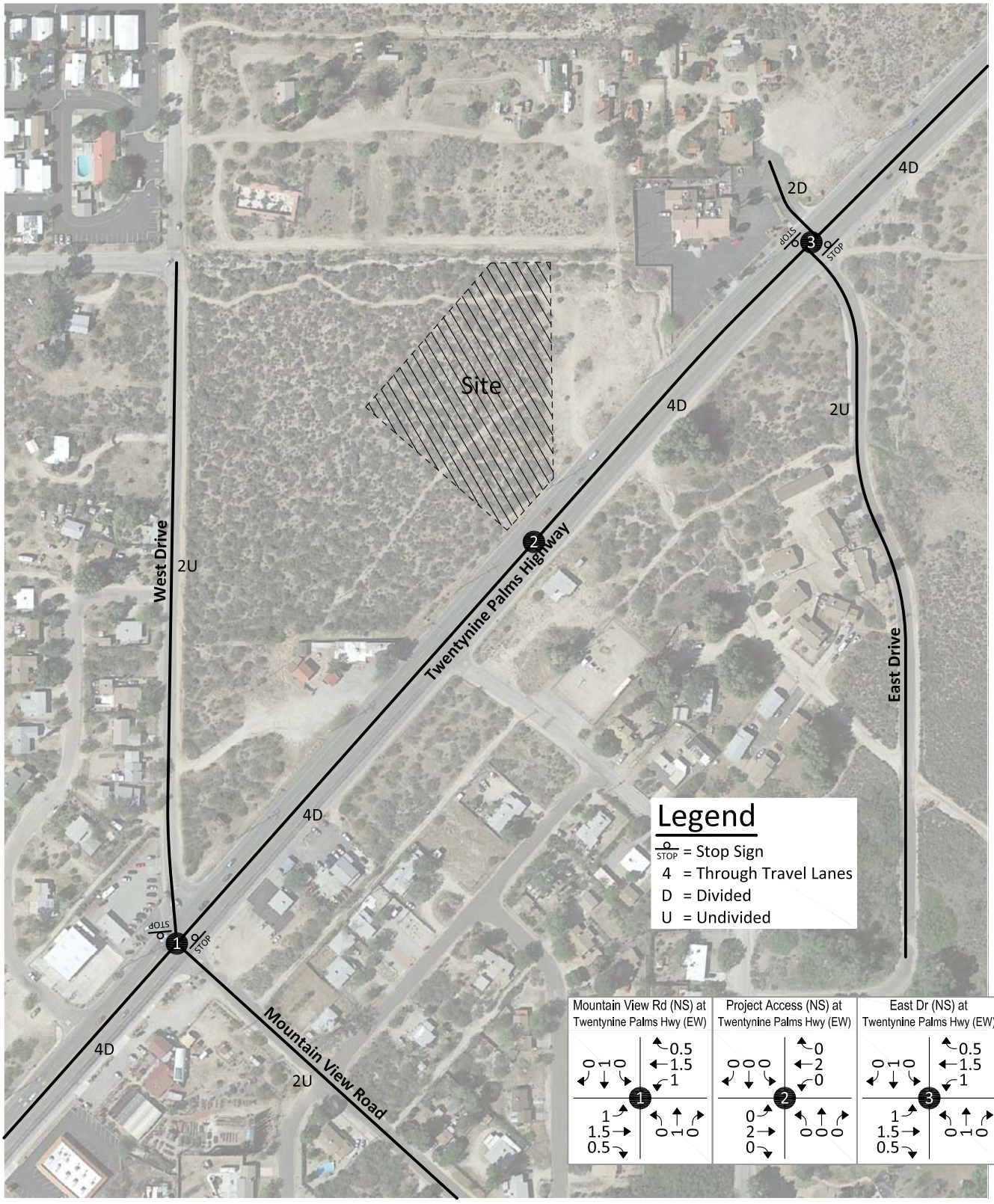
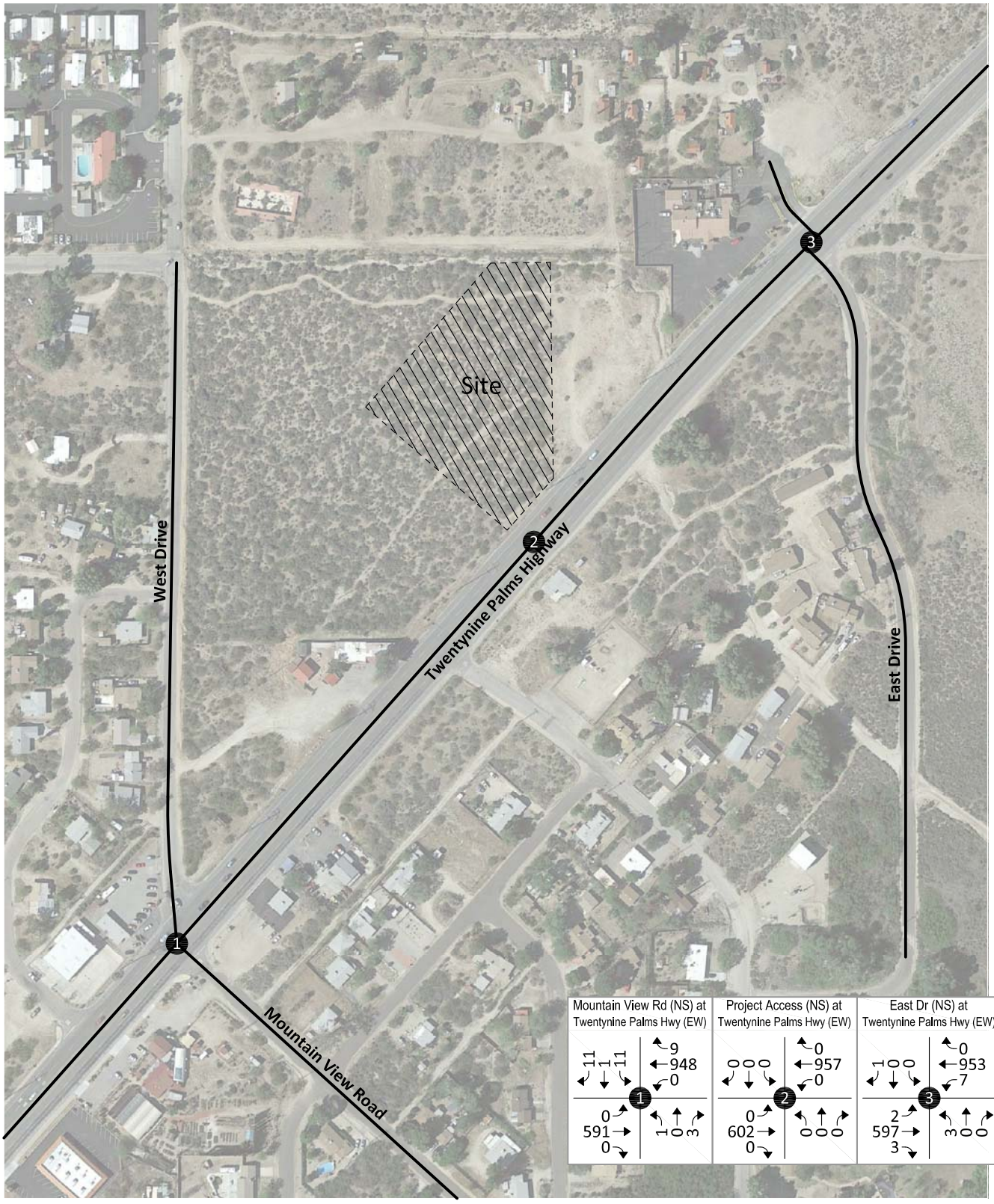


Figure 4
Existing Morning Peak Hour Intersection Turning Movement Volumes



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OVER 40 YEARS OF EXCELLENT SERVICE

Figure 5
Existing Evening Peak Hour Intersection Turning Movement Volumes

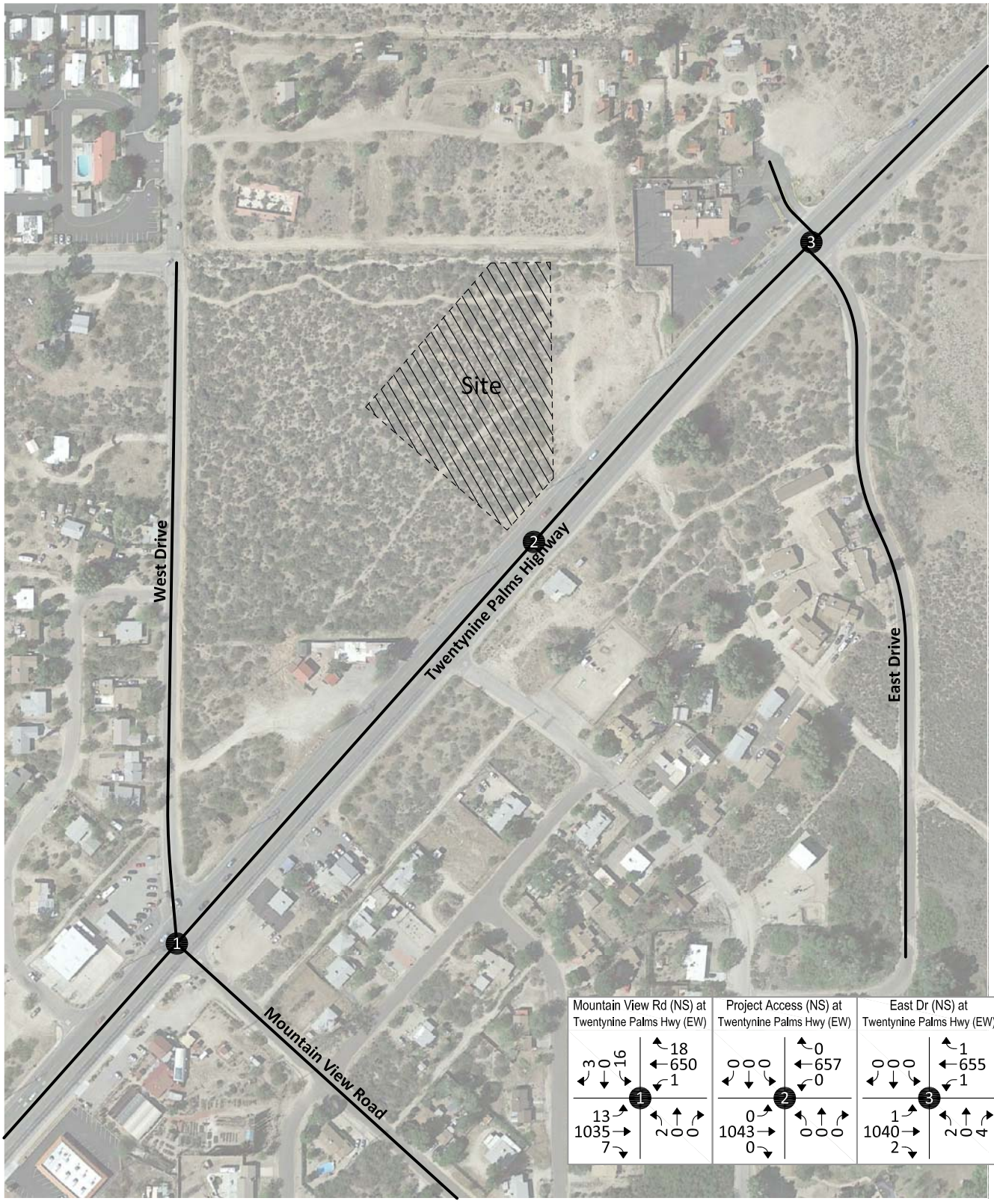

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Figure 6
Existing Pedestrian Facilities

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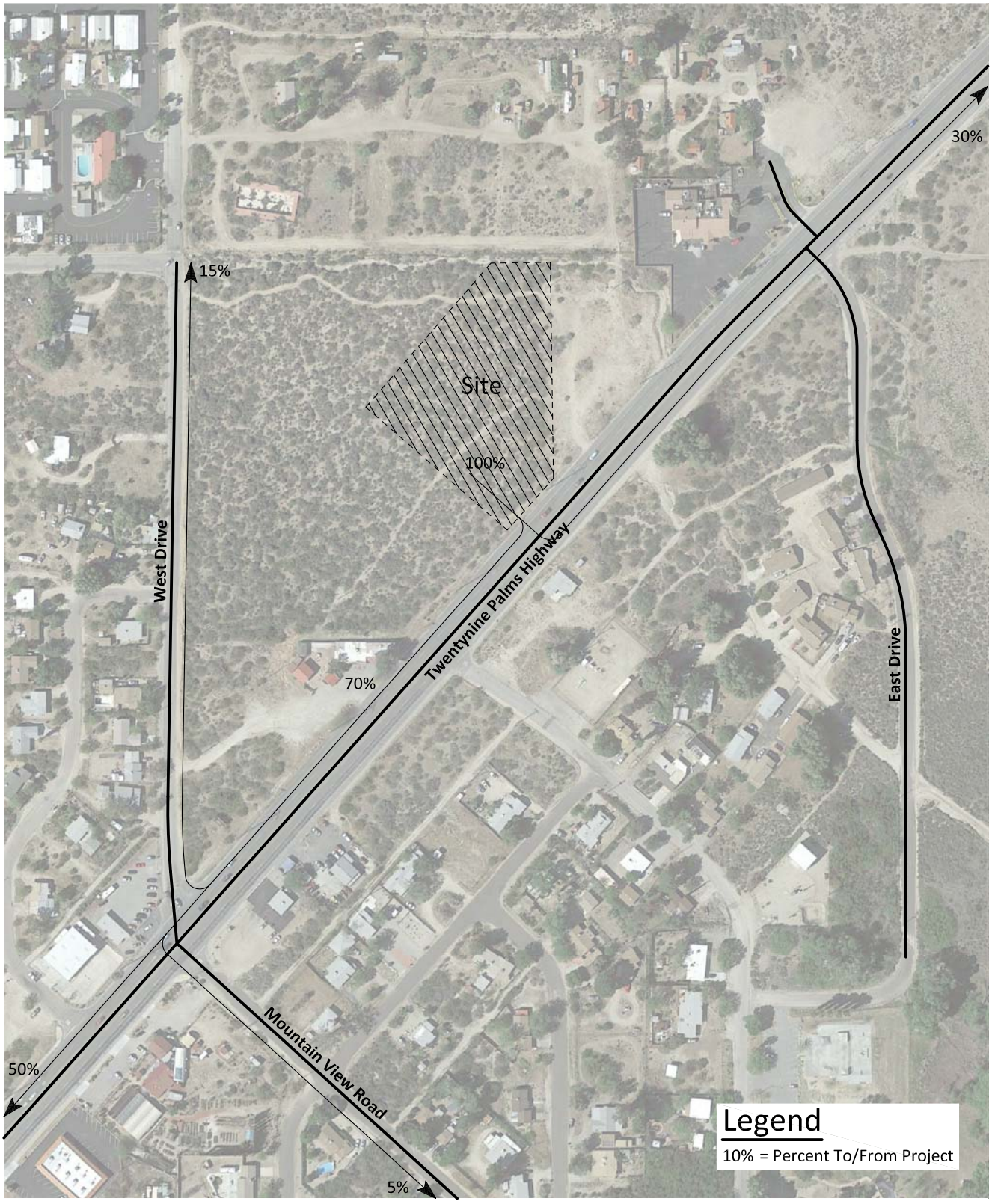
Figure 7
Project Trip Distribution



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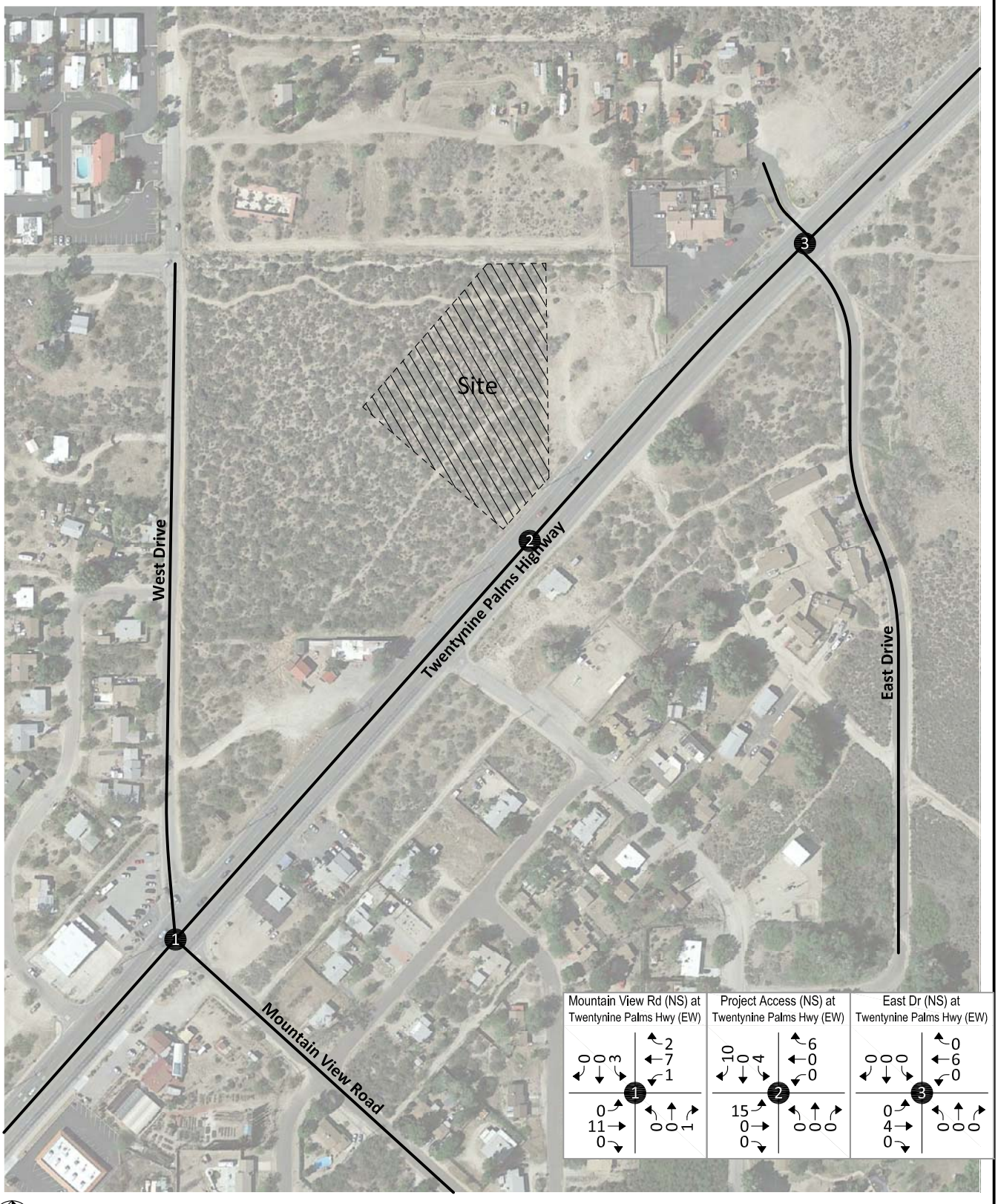
OVER 40 YEARS OF EXCELLENT SERVICE

Figure 8
Project Morning Peak Hour Intersection Turning Movement Volumes



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OVER 40 YEARS OF EXCELLENT SERVICE

Figure 9
Project Evening Peak Hour Intersection Turning Movement Volumes

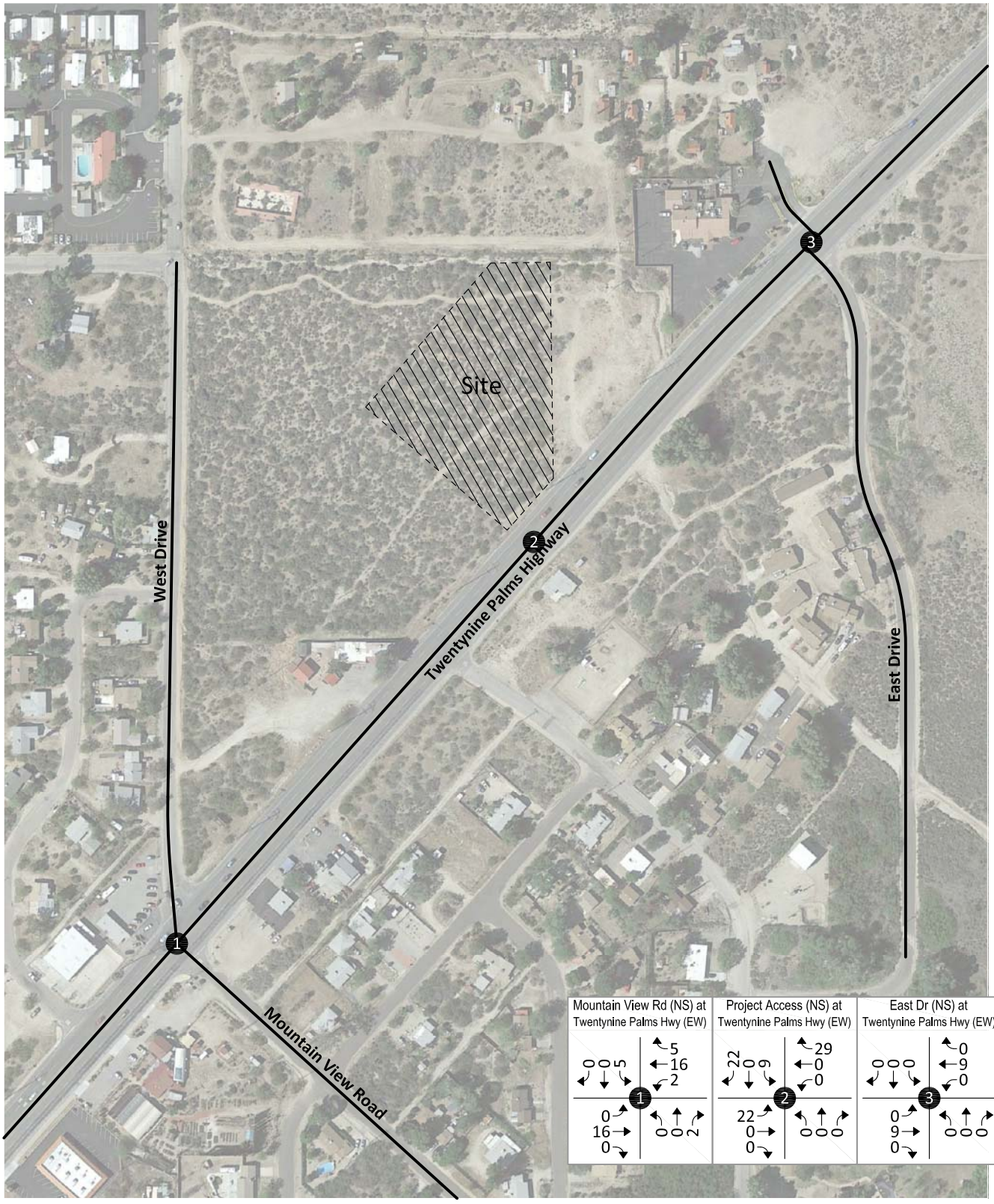


Figure 10
Existing Plus Project
Morning Peak Hour Intersection Turning Movement Volumes

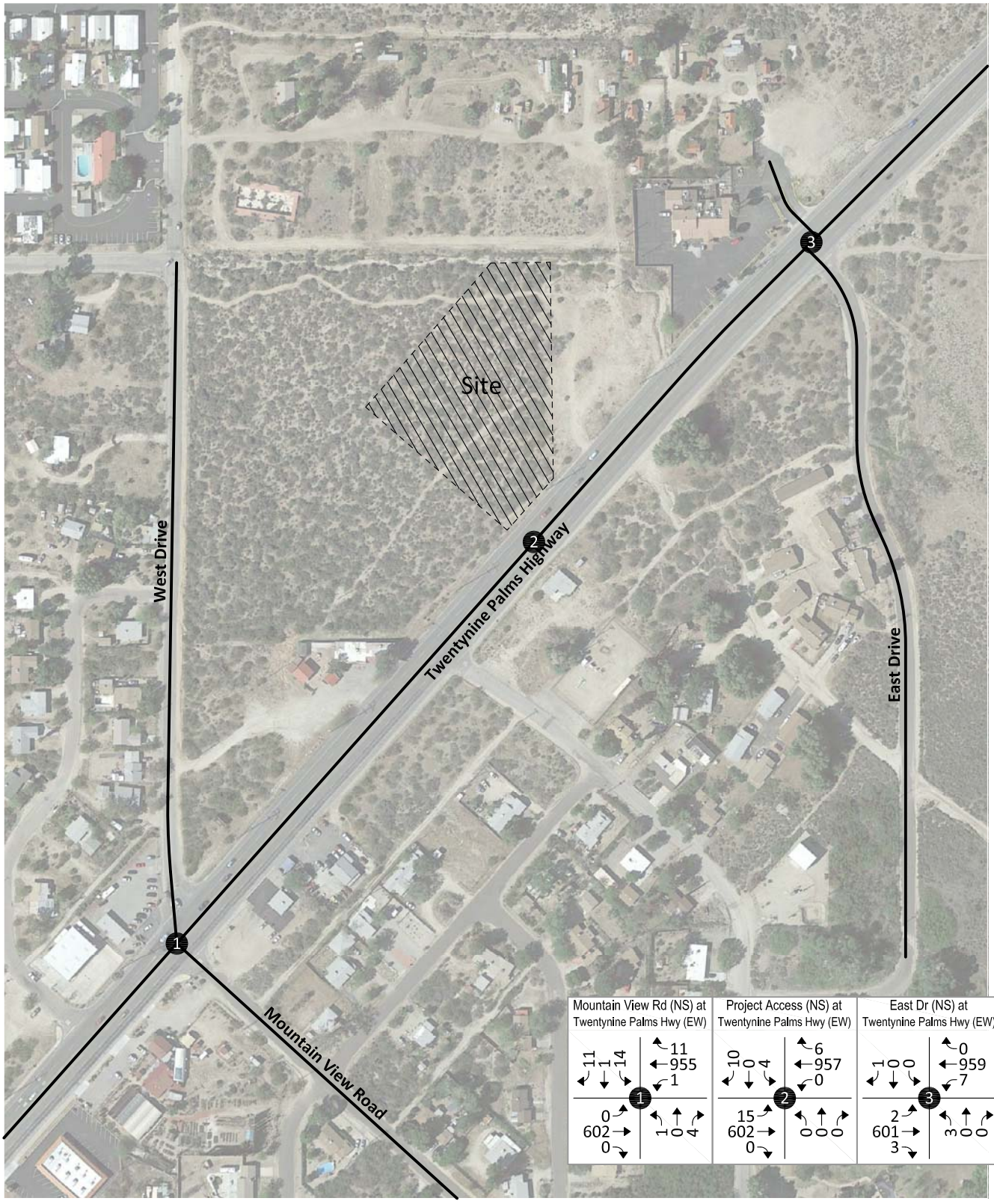


Figure 11
Existing Plus Project
Evening Peak Hour Intersection Turning Movement Volumes

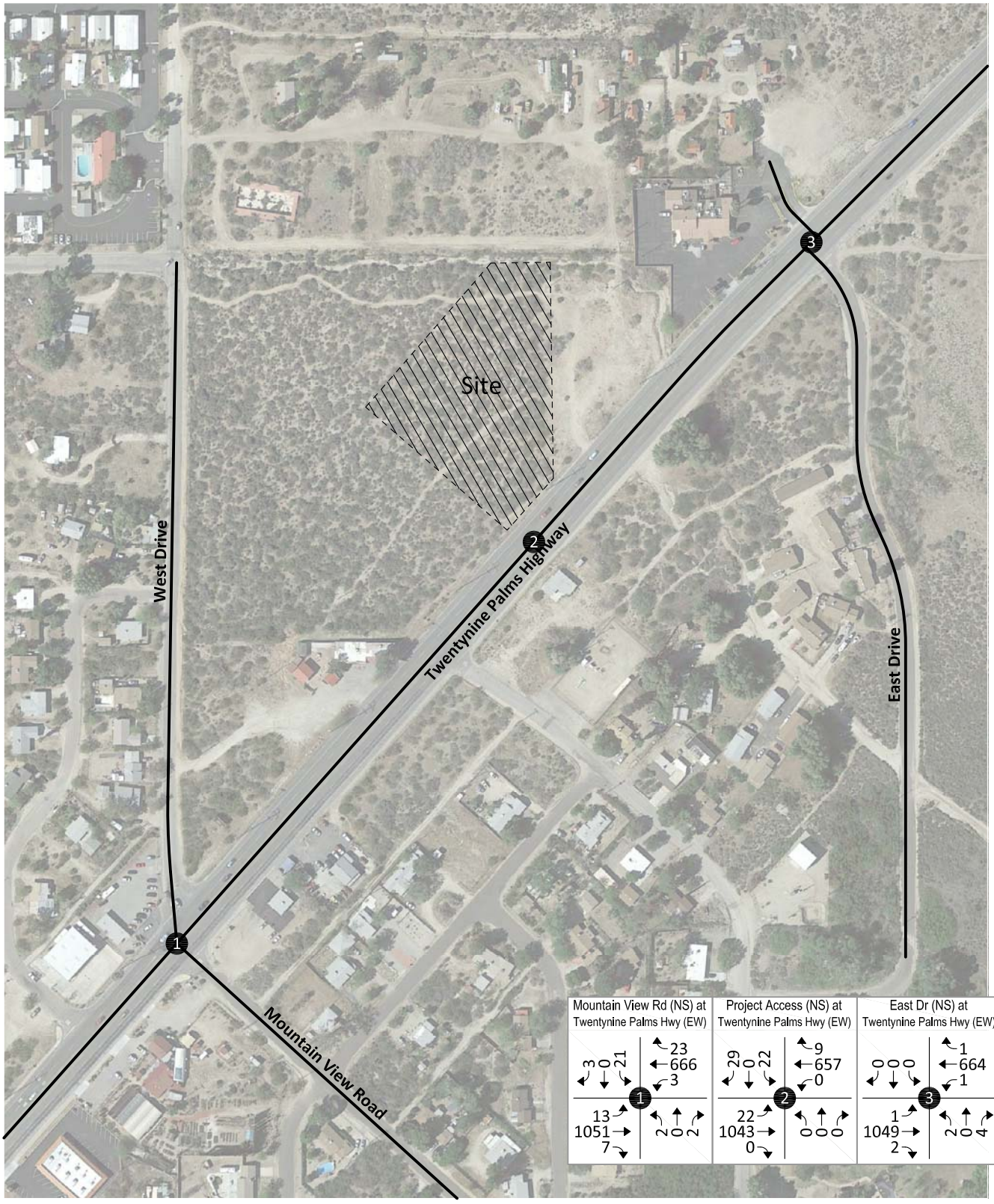


Figure 12
Existing Plus Ambient Growth Plus Project
Morning Peak Hour Intersection Turning Movement Volumes

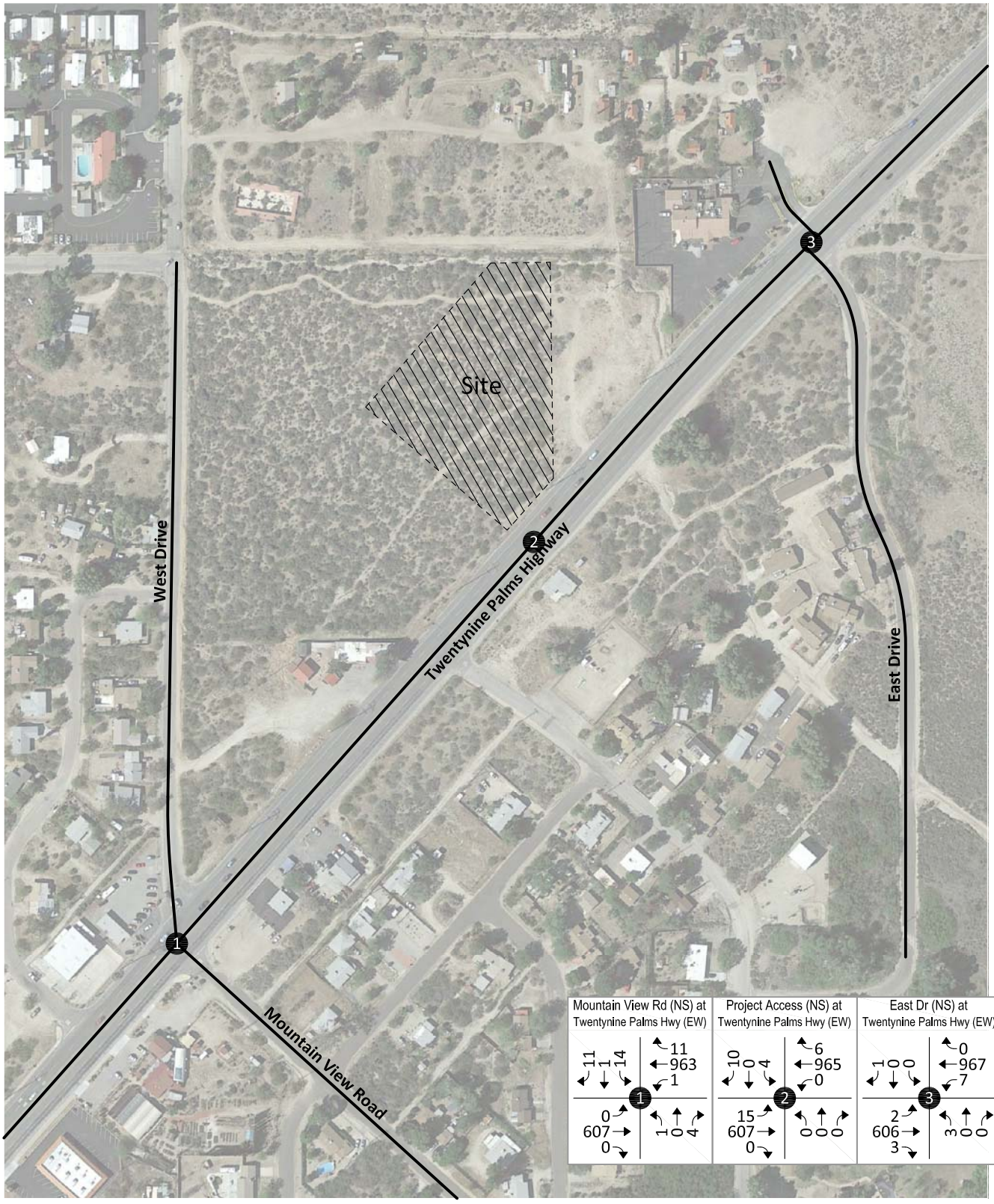


Figure 13
Existing Plus Ambient Growth Plus Project
Evening Peak Hour Intersection Turning Movement Volumes

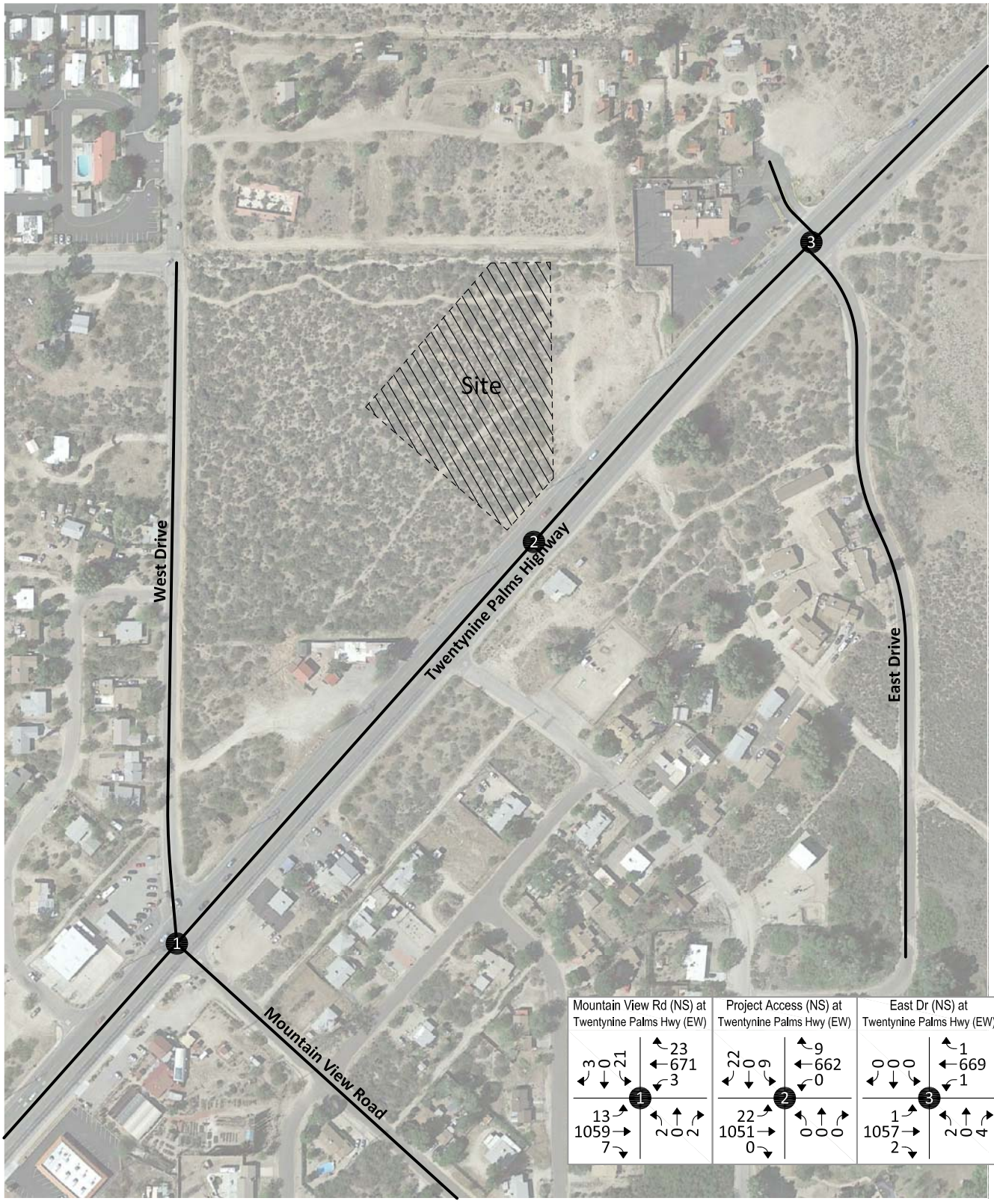


Figure 14
Emergency Access

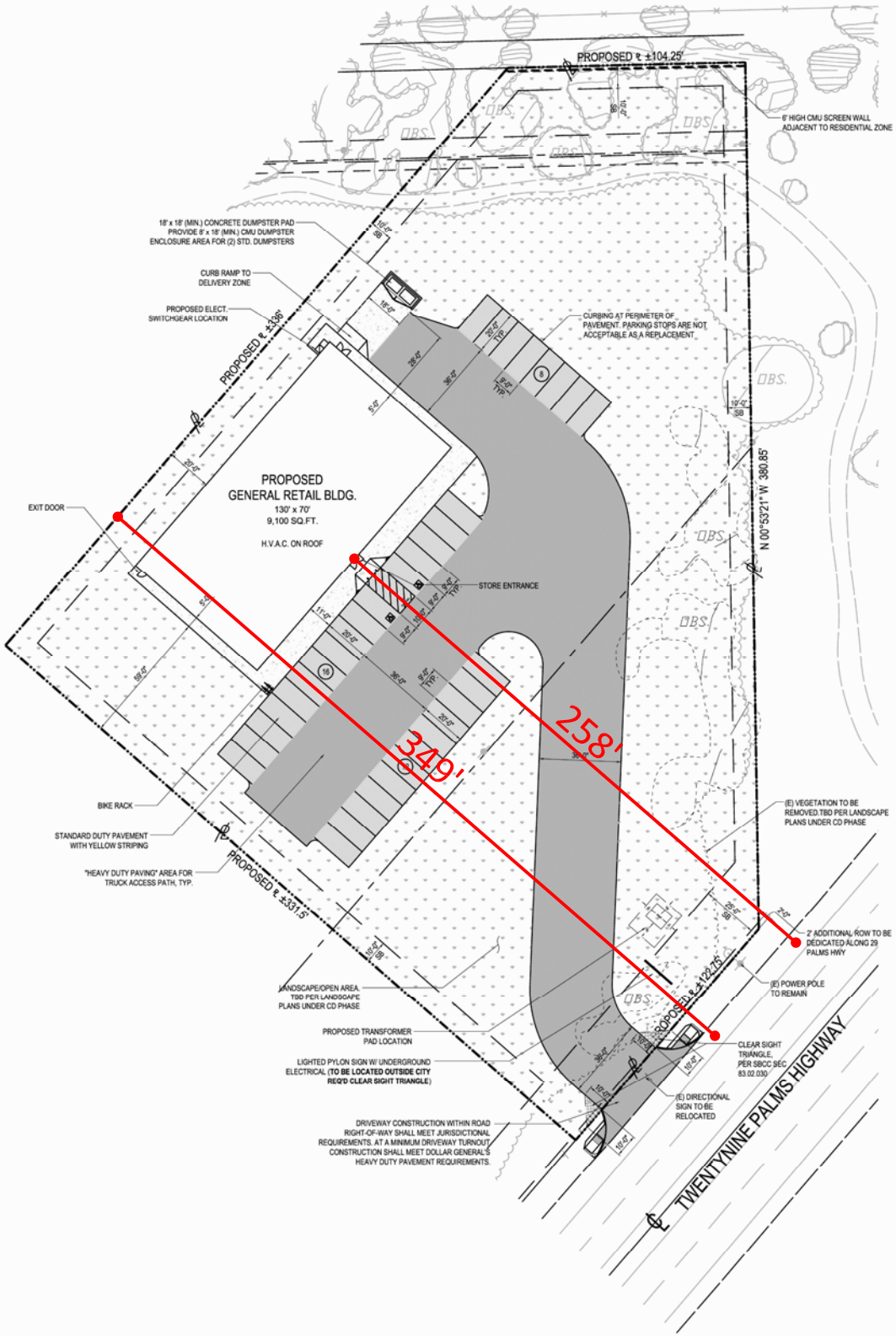
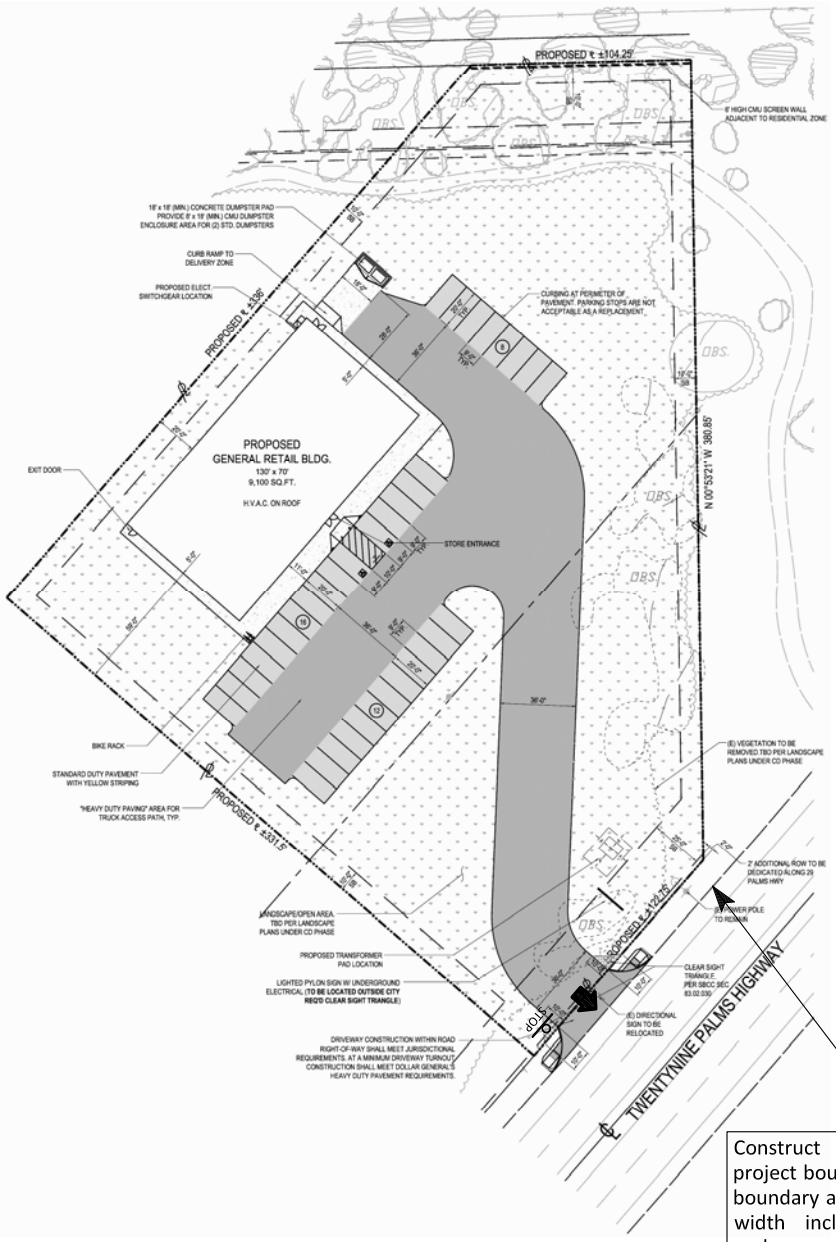


Figure 15
Circulation Recommendations



Construct SR-62 from the west project boundary to the east project boundary at its ultimate half-section width including landscaping and parkway improvements in conjunction with development adhering to sight distance requirements, as necessary.

Sight distance at the project access shall comply with standard California Department of Transportation and County of San Bernardino sight distance standards. The final grading, landscaping, and street improvement plans shall demonstrate that sight distance standards are met. Such plans must be reviewed by the County and approved as consistent with this measure prior to issue of grading permits.

The site should provide sufficient parking spaces to meet County of San Bernardino parking code requirements in order to service on-site parking demand.

On-site traffic signing/striping should be implemented in conjunction with detailed construction plans for the project site.

As is the case for any roadway design, the County of San Bernardino should periodically review traffic operations in the vicinity of the project once the project is constructed to assure that the traffic operations are satisfactory.

Legend

STOP = Stop Sign

= Full Access Driveway

APPENDIX A

Glossary of Transportation Terms

GLOSSARY OF TRANSPORTATION TERMS

COMMON ABBREVIATIONS

AC:	Acres
ADT:	Average Daily Traffic
Caltrans:	California Department of Transportation
DU:	Dwelling Unit
ICU:	Intersection Capacity Utilization
LOS:	Level of Service
TSF:	Thousand Square Feet
V/C:	Volume/Capacity
VMT:	Vehicle Miles Traveled

TERMS

AVERAGE DAILY TRAFFIC: The total volume during a year divided by the number of days in a year. Usually only weekdays are included.

BANDWIDTH: The number of seconds of green time available for through traffic in a signal progression.

BOTTLENECK: A constriction along a travelway that limits the amount of traffic that can proceed downstream from its location.

CAPACITY: The maximum number of vehicles that can be reasonably expected to pass over a given section of a lane or a roadway in a given time period.

CHANNELIZATION: The separation or regulation of conflicting traffic movements into definite paths of travel by the use of pavement markings, raised islands, or other suitable means to facilitate the safe and orderly movements of both vehicles and pedestrians.

CLEARANCE INTERVAL: Nearly same as yellow time. If there is an all red interval after the end of a yellow, then that is also added into the clearance interval.

CORDON: An imaginary line around an area across which vehicles, persons, or other items are counted (in and out).

CYCLE LENGTH: The time period in seconds required for one complete signal cycle.

CUL-DE-SAC STREET: A local street open at one end only, and with special provisions for turning around.

DAILY CAPACITY: The daily volume of traffic that will result in a volume during the peak hour equal to the capacity of the roadway.

DELAY: The time consumed while traffic is impeded in its movement by some element over which it has no control, usually expressed in seconds per vehicle.

DEMAND RESPONSIVE SIGNAL: Same as traffic-actuated signal.

DENSITY: The number of vehicles occupying in a unit length of the through traffic lanes of a roadway at any given instant. Usually expressed in vehicles per mile.

DETECTOR: A device that responds to a physical stimulus and transmits a resulting impulse to the signal controller.

DESIGN SPEED: A speed selected for purposes of design. Features of a highway, such as curvature, superelevation, and sight distance (upon which the safe operation of vehicles is dependent) are correlated to design speed.

DIRECTIONAL SPLIT: The percent of traffic in the peak direction at any point in time.

DIVERSION: The rerouting of peak hour traffic to avoid congestion.

FORCED FLOW: Opposite of free flow.

FREE FLOW: Volumes are well below capacity. Vehicles can maneuver freely and travel is unimpeded by other traffic.

GAP: Time or distance between successive vehicles in a traffic stream, rear bumper to front bumper.

HEADWAY: Time or distance spacing between successive vehicles in a traffic stream, front bumper to front bumper.

INTERCONNECTED SIGNAL SYSTEM: A number of intersections that are connected to achieve signal progression.

LEVEL OF SERVICE: A qualitative measure of a number of factors, which include speed and travel time, traffic interruptions, freedom to maneuver, safety, driving comfort and convenience, and operating costs.

LOOP DETECTOR: A vehicle detector consisting of a loop of wire embedded in the roadway, energized by alternating current and producing an output circuit closure when passed over by a vehicle.

MINIMUM ACCEPTABLE GAP: Smallest time headway between successive vehicles in a traffic stream into which another vehicle is willing and able to cross or merge.

MULTI-MODAL: More than one mode; such as automobile, bus transit, rail rapid transit, and bicycle transportation modes.

OFFSET: The time interval in seconds between the beginning of green at one intersection and the beginning of green at an adjacent intersection.

PLATOON: A closely grouped component of traffic that is composed of several vehicles moving, or standing ready to move, with clear spaces ahead and behind.

ORIGIN-DESTINATION SURVEY: A survey to determine the point of origin and the point of destination for a given vehicle trip.

PASSENGER CAR EQUIVALENTS: One car is one Passenger Car Equivalent. A truck is equal to 2 or 3 Passenger Car Equivalents in that a truck requires longer to start, goes slower, and accelerates slower. Loaded trucks have a higher Passenger Car Equivalent than empty trucks.

PEAK HOUR: The 60 consecutive minutes with the highest number of vehicles.

PRETIMED SIGNAL: A type of traffic signal that directs traffic to stop and go on a predetermined time schedule without regard to traffic conditions. Also, fixed time signal.

PROGRESSION: A term used to describe the progressive movement of traffic through several signalized intersections.

SCREEN-LINE: An imaginary line or physical feature across which all trips are counted, normally to verify the validity of mathematical traffic models.

SIGNAL CYCLE: The time period in seconds required for one complete sequence of signal indications.

SIGNAL PHASE: The part of the signal cycle allocated to one or more traffic movements.

STARTING DELAY: The delay experienced in initiating the movement of queued traffic from a stop to an average running speed through a signalized intersection.

TRAFFIC-ACTUATED SIGNAL: A type of traffic signal that directs traffic to stop and go in accordance with the demands of traffic, as registered by the actuation of detectors.

TRIP: The movement of a person or vehicle from one location (origin) to another (destination). For example, from home to store to home is two trips, not one.

TRIP-END: One end of a trip at either the origin or destination; i.e. each trip has two trip-ends. A trip-end occurs when a person, object, or message is transferred to or from a vehicle.

TRIP GENERATION RATE: The quantity of trips produced and/or attracted by a specific land use stated in terms of units such as per dwelling, per acre, and per 1,000 square feet of floor space.

TRUCK: A vehicle having dual tires on one or more axles, or having more than two axles.

UNBALANCED FLOW: Heavier traffic flow in one direction than the other. On a daily basis, most facilities have balanced flow. During the peak hours, flow is seldom balanced in an urban area.

VEHICLE MILES OF TRAVEL: A measure of the amount of usage of a section of highway, obtained by multiplying the average daily traffic by length of facility in miles.

APPENDIX B

Traffic Count Worksheets

APPENDIX C

Explanation and Calculation of Intersection Delay

EXPLANATION AND CALCULATION OF INTERSECTION LEVEL OF SERVICE USING DELAY METHODOLOGY

The levels of service at the unsignalized and signalized intersections are calculated using the delay methodology in the Highway Capacity Manual. This methodology views an intersection as consisting of several lane groups. A lane group is a set of lanes serving a movement. If there are two northbound left turn lanes, then the lane group serving the northbound left turn movement has two lanes. Similarly, there may be three lanes in the lane group serving the northbound through movement, one lane in the lane group serving the northbound right turn movement, and so forth. It is also possible for one lane to serve two lane groups. A shared lane might result in there being 1.5 lanes in the northbound left turn lane group and 2.5 lanes in the northbound through lane group.

For each lane group, there is a capacity. That capacity is calculated by multiplying the number of lanes in the lane group times a theoretical maximum lane capacity per lane time's 12 adjustment factors.

Each of the 12 adjustment factors has a value of approximately 1.00. A value less than 1.00 is generally assigned when a less than desirable condition occurs.

The 12 adjustment factors are as follows:

1. Peak hour factor (to account for peaking within the peak hour)
2. Lane utilization factor (to account for not all lanes loading equally)
3. Lane width
4. Percent of heavy trucks
5. Approach grade
6. Parking
7. Bus stops at intersections
8. Area type (CBD or other)
9. Right turns
10. Left turns

11. Pedestrian activity

12. Signal progression

The maximum theoretical lane capacity and the 12 adjustment factors for it are all unknowns for which approximate estimates have been recommended in the Highway Capacity Manual. For the most part, the recommended values are not based on statistical analysis but rather on educated estimates. However, it is possible to use the delay method and get reasonable results as will be discussed below.

Once the lane group volume is known and the lane group capacity is known, a volume to capacity ratio can be calculated for the lane group.

With a volume to capacity ratio calculated, average delay per vehicle in a lane group can be estimated. The average delay per vehicle in a lane group is calculated using a complex formula provided by the Highway Capacity Manual, which can be simplified and described as follows:

Delay per vehicle in a lane group is a function of the following:

1. Cycle length

2. Amount of red time faced by a lane group

3. Amount of yellow time for that lane group

4. The volume to capacity ratio of the lane group

The average delay per vehicle for each lane group is calculated, and eventually an overall average delay for all vehicles entering the intersection is calculated. This average delay per vehicle is then used to judge Level of Service. The Level of Services are defined in the table that follows this discussion.

Experience has shown that when a maximum lane capacity of 1,900 vehicles per hour is used (as recommended in the Highway Capacity Manual), little or no yellow time penalty is used, and none of the 12 penalty factors are applied, calculated delay is realistic. The delay calculation for instance assumes that yellow time is totally unused. Yet experience shows that most of the yellow time is used.

An idiosyncrasy of the delay methodology is that it is possible to add traffic to an intersection and reduce the average total delay per vehicle. If the average total delay is 30 seconds per vehicle for all vehicles traveling through an intersection, and traffic is

added to a movement that has an average total delay of 15 seconds per vehicle, then the overall average total delay is reduced.

The delay calculation for a lane group is based on a concept that the delay is a function of the amount of unused capacity available. As the volume approaches capacity and there is no more unused capacity available, then the delay rapidly increases. Delay is not proportional to volume, but rather increases rapidly as the unused capacity approaches zero.

Because delay is not linearly related to volumes, the delay does not reflect how close an intersection is to overloading. If an intersection is operating at Level of Service C and has an average total delay of 18 seconds per vehicle, you know very little as to what percent the traffic can increase before Level of Service E is reached.

LEVEL OF SERVICE DESCRIPTION[1]

Level Of Service	Description	Average Total Delay Per Vehicle (Seconds)	
		Signalized	Unsignalized
A	Level of Service A occurs when progression is extremely favorable and most vehicles arrive during the green phase. Most vehicles do not stop at all. Short cycle lengths may also contribute to low delay.	0 to 10.00	0 to 10.00
B	Level of Service B generally occurs with good progression and/or short cycle lengths. More vehicles stop than for Level of Service A, causing higher levels of average total delay.	10.01 to 20.00	10.01 to 15.00
C	Level of Service C generally results when there is fair progression and/or longer cycle lengths. Individual cycle failures may begin to appear in this level. The number of vehicles stopping is significant at this level, although many still pass through the intersection without stopping.	20.01 to 35.00	15.01 to 25.00
D	Level of Service D generally results in noticeable congestion. Longer delays may result from some combination of unfavorable progression, long cycle lengths, or high volume to capacity ratios. Many vehicles stop, and the proportion of vehicles not stopping declines. Individual cycle failures are noticeable.	35.01 to 55.00	25.01 to 35.00
E	Level of Service E is considered to be the limit of acceptable delay. These high delay values generally indicate poor progression, long cycle lengths, and high volume to capacity ratios. Individual cycle failures are frequent occurrences.	55.01 to 80.00	35.01 to 50.00
F	Level of Service F is considered to be unacceptable to most drivers. This condition often occurs with oversaturation, i.e., when arrival flow rates exceed the capacity of the intersection. It may also occur at high volume to capacity ratios below 1.00 with many individual cycle failures. Poor progression and long cycle lengths may also be major contributing causes to such delay levels.	80.01 and up	50.01 and up

[1] Source: Highway Capacity Manual Special Report 209, Transportation Research Board, National Research Council, Washington, D.C., 2000.

Existing

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	BC	Intersection	West Drive/SR-62
Agency/Co.	Kunzman Associates, Inc.	Jurisdiction	CALTRANS
Date Performed	7/25/16	Analysis Year	Existing
Analysis Time Period	Morning Peak Hour		

Project Description: Variety Store - Morongo Valley

East/West Street: SR-62 Highway | North/South Street: West Drive/Mountain View Drive

Intersection Orientation: East-West | Study Period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	0	591	0	0	948	9
Peak-Hour Factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Hourly Flow Rate, HFR (veh/h)	0	642	0	0	1030	9
Percent Heavy Vehicles	0	--	--	0	--	--
Median Type	Two Way Left Turn Lane					
RT Channelized			0			0
Lanes	1	2	0	1	2	0
Configuration	L	T	TR	L	T	TR
Upstream Signal		0			0	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	1	0	3	11	1	11
Peak-Hour Factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Hourly Flow Rate, HFR (veh/h)	1	0	3	11	1	11
Percent Heavy Vehicles	0	0	0	0	0	0
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration		LTR			LTR	

Delay, Queue Length, and Level of Service

Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	L	L		LTR			LTR	
v (veh/h)	0	0		4			23	
C (m) (veh/h)	677	952		519			274	
v/c	0.00	0.00		0.01			0.08	
95% queue length	0.00	0.00		0.02			0.27	
Control Delay (s/veh)	10.3	8.8		12.0			19.3	
LOS	B	A		B			C	
Approach Delay (s/veh)	--	--	12.0			19.3		
Approach LOS	--	--	B			C		

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TWO-WAY STOP CONTROL SUMMARY

General Information

Analyst	BC
Agency/Co.	Kunzman Associates, Inc.
Date Performed	7/25/16
Analysis Time Period	Evening Peak Hour

Site Information

Intersection	West Drive/SR-62
Jurisdiction	CALTRANS
Analysis Year	Existing

Project Description: Variety Store - Morongo Valley

East/West Street: SR-62 Highway | North/South Street: West Drive/Mountain View Drive

Intersection Orientation: East-West | Study Period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	13	1035	7	1	650	18
Peak-Hour Factor, PHF	0.99	0.99	0.99	0.99	0.99	0.99
Hourly Flow Rate, HFR (veh/h)	13	1045	7	1	656	18
Percent Heavy Vehicles	0	--	--	0	--	--
Median Type	Two Way Left Turn Lane					
RT Channelized			0			0
Lanes	1	2	0	1	2	0
Configuration	L	T	TR	L	T	TR
Upstream Signal		0			0	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	2	0	0	16	0	3
Peak-Hour Factor, PHF	0.99	0.99	0.99	0.99	0.99	0.99
Hourly Flow Rate, HFR (veh/h)	2	0	0	16	0	3
Percent Heavy Vehicles	0	0	0	0	0	0
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration		LTR			LTR	

Delay, Queue Length, and Level of Service

Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	L	L		LTR			LTR	
v (veh/h)	13	1		2			19	
C (m) (veh/h)	927	669		190			296	
v/c	0.01	0.00		0.01			0.06	
95% queue length	0.04	0.00		0.03			0.20	
Control Delay (s/veh)	8.9	10.4		24.1			18.0	
LOS	A	B		C			C	
Approach Delay (s/veh)	--	--	24.1			18.0		
Approach LOS	--	--	C			C		

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TWO-WAY STOP CONTROL SUMMARY

General Information

Analyst	BC
Agency/Co.	Kunzman Associates, Inc.
Date Performed	7/25/16
Analysis Time Period	Morning Peak Hour

Site Information

Intersection	East Drive/SR-62
Jurisdiction	CALTRANS
Analysis Year	Existing

Project Description: Variety Store - Morongo Valley

East/West Street: SR-62 Highway | North/South Street: East Drive

Intersection Orientation: East-West | Study Period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	2	597	3	7	953	0
Peak-Hour Factor, PHF	0.85	0.85	0.85	0.85	0.85	0.85
Hourly Flow Rate, HFR (veh/h)	2	702	3	8	1121	0
Percent Heavy Vehicles	0	--	--	0	--	--
Median Type	Two Way Left Turn Lane					
RT Channelized			0			0
Lanes	1	2	0	1	2	0
Configuration	L	T	TR	L	T	TR
Upstream Signal		0			0	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	3	0	0	0	0	1
Peak-Hour Factor, PHF	0.85	0.85	0.85	0.85	0.85	0.85
Hourly Flow Rate, HFR (veh/h)	3	0	0	0	0	1
Percent Heavy Vehicles	0	0	0	0	0	0
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration		LTR			LTR	

Delay, Queue Length, and Level of Service

Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	L	L		LTR			LTR	
v (veh/h)	2	8		3			1	
C (m) (veh/h)	631	902		251			532	
v/c	0.00	0.01		0.01			0.00	
95% queue length	0.01	0.03		0.04			0.01	
Control Delay (s/veh)	10.7	9.0		19.5			11.8	
LOS	B	A		C			B	
Approach Delay (s/veh)	--	--	19.5			11.8		
Approach LOS	--	--	C			B		

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TWO-WAY STOP CONTROL SUMMARY

General Information

Analyst	BC
Agency/Co.	Kunzman Associates, Inc.
Date Performed	7/25/16
Analysis Time Period	Evening Peak Hour

Site Information

Intersection	East Drive/SR-62
Jurisdiction	CALTRANS
Analysis Year	Existing

Project Description: Variety Store - Morongo Valley

East/West Street: SR-62 Highway | North/South Street: East Drive

Intersection Orientation: East-West | Study Period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	1	1040	2	1	655	1
Peak-Hour Factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96
Hourly Flow Rate, HFR (veh/h)	1	1083	2	1	682	1
Percent Heavy Vehicles	0	--	--	0	--	--
Median Type	Two Way Left Turn Lane					
RT Channelized			0			0
Lanes	1	2	0	1	2	0
Configuration	L	T	TR	L	T	TR
Upstream Signal		0			0	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	2	0	4	0	0	0
Peak-Hour Factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96
Hourly Flow Rate, HFR (veh/h)	2	0	4	0	0	0
Percent Heavy Vehicles	0	0	0	0	0	0
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration		LTR			LTR	

Delay, Queue Length, and Level of Service

Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	L	L		LTR			LTR	
v (veh/h)	1	1		6			0	
C (m) (veh/h)	919	651		335				
v/c	0.00	0.00		0.02				
95% queue length	0.00	0.00		0.05				
Control Delay (s/veh)	8.9	10.5		15.9				
LOS	A	B		C				
Approach Delay (s/veh)	--	--	15.9					
Approach LOS	--	--	C					

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Existing Plus Project

TWO-WAY STOP CONTROL SUMMARY

General Information

Analyst	BC
Agency/Co.	Kunzman Associates, Inc.
Date Performed	7/25/16
Analysis Time Period	Morning Peak Hour

Site Information

Intersection	West Drive/SR-62
Jurisdiction	CALTRANS
Analysis Year	Existing Plus Project

Project Description: Variety Store - Morongo Valley

East/West Street: SR-62 Highway | North/South Street: West Drive/Mountain View Drive

Intersection Orientation: East-West | Study Period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	0	602	0	1	955	11
Peak-Hour Factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Hourly Flow Rate, HFR (veh/h)	0	654	0	1	1038	11
Percent Heavy Vehicles	0	--	--	0	--	--
Median Type	Two Way Left Turn Lane					
RT Channelized			0			0
Lanes	1	2	0	1	2	0
Configuration	L	T	TR	L	T	TR
Upstream Signal		0			0	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	1	0	4	14	1	11
Peak-Hour Factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Hourly Flow Rate, HFR (veh/h)	1	0	4	15	1	11
Percent Heavy Vehicles	0	0	0	0	0	0
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration		LTR			LTR	

Delay, Queue Length, and Level of Service

Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	L	L		LTR			LTR	
v (veh/h)	0	1		5			27	
C (m) (veh/h)	671	943		544			256	
v/c	0.00	0.00		0.01			0.11	
95% queue length	0.00	0.00		0.03			0.35	
Control Delay (s/veh)	10.4	8.8		11.7			20.7	
LOS	B	A		B			C	
Approach Delay (s/veh)	--	--	11.7			20.7		
Approach LOS	--	--	B			C		

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TWO-WAY STOP CONTROL SUMMARY

General Information

Analyst	BC
Agency/Co.	Kunzman Associates, Inc.
Date Performed	7/25/16
Analysis Time Period	Evening Peak Hour

Site Information

Intersection	West Drive/SR-62
Jurisdiction	CALTRANS
Analysis Year	Existing Plus Project

Project Description: Variety Store - Morongo Valley

East/West Street: SR-62 Highway

North/South Street: West Drive/Mountain View Drive

Intersection Orientation: East-West

Study Period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	13	1051	7	3	666	23
Peak-Hour Factor, PHF	0.99	0.99	0.99	0.99	0.99	0.99
Hourly Flow Rate, HFR (veh/h)	13	1061	7	3	672	23
Percent Heavy Vehicles	0	--	--	0	--	--
Median Type	Two Way Left Turn Lane					
RT Channelized			0			0
Lanes	1	2	0	1	2	0
Configuration	L	T	TR	L	T	TR
Upstream Signal		0			0	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	2	0	2	21	0	3
Peak-Hour Factor, PHF	0.99	0.99	0.99	0.99	0.99	0.99
Hourly Flow Rate, HFR (veh/h)	2	0	2	21	0	3
Percent Heavy Vehicles	0	0	0	0	0	0
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration		LTR			LTR	

Delay, Queue Length, and Level of Service

Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	L	L		LTR			LTR	
v (veh/h)	13	3		4			24	
C (m) (veh/h)	910	660		277			280	
v/c	0.01	0.00		0.01			0.09	
95% queue length	0.04	0.01		0.04			0.28	
Control Delay (s/veh)	9.0	10.5		18.2			19.1	
LOS	A	B		C			C	
Approach Delay (s/veh)	--	--	18.2			19.1		
Approach LOS	--	--	C			C		

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TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	BC	Intersection	Project Access/SR-62
Agency/Co.	Kunzman Associates, Inc.	Jurisdiction	CALTRANS
Date Performed	7/25/16	Analysis Year	Existing Plus Project
Analysis Time Period	Morning Peak Hour		

Project Description: Variety Store - Morongo Valley

East/West Street: SR-62 Highway | North/South Street: Project Access

Intersection Orientation: East-West | Study Period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	15	602			957	6
Peak-Hour Factor, PHF	0.95	0.95	1.00	1.00	0.95	0.95
Hourly Flow Rate, HFR (veh/h)	15	633	0	0	1007	6
Percent Heavy Vehicles	0	--	--	0	--	--
Median Type	Two Way Left Turn Lane					
RT Channelized			0			0
Lanes	1	2	0	0	2	0
Configuration	L	T			T	TR
Upstream Signal		0			0	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)				4	0	10
Peak-Hour Factor, PHF	1.00	1.00	1.00	0.95	1.00	0.95
Hourly Flow Rate, HFR (veh/h)	0	0	0	4	0	10
Percent Heavy Vehicles	0	0	0	0	0	0
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	0	0	0	1	0
Configuration					LTR	

Delay, Queue Length, and Level of Service

Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	L						LTR	
v (veh/h)	15						14	
C (m) (veh/h)	692						417	
v/c	0.02						0.03	
95% queue length	0.07						0.10	
Control Delay (s/veh)	10.3						13.9	
LOS	B						B	
Approach Delay (s/veh)	--	--					13.9	
Approach LOS	--	--					B	

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TWO-WAY STOP CONTROL SUMMARY

General Information

Analyst	*BC*
Agency/Co.	*Kunzman Associates, Inc.*
Date Performed	*7/25/16*
Analysis Time Period	*Evening Peak Hour*

Site Information

Intersection	*Project Access/SR-62*
Jurisdiction	*CALTRANS*
Analysis Year	*Existing Plus Project*

Project Description *Variety Store - Morongo Valley*

East/West Street: *SR-62 Highway* | North/South Street: *Project Access*

Intersection Orientation: *East-West* | Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*22*	*1043*			*657*	*9*
Peak-Hour Factor, PHF	*0.95*	*0.95*	*1.00*	*1.00*	*0.95*	*0.95*
Hourly Flow Rate, HFR (veh/h)	*23*	*1097*	*0*	*0*	*691*	*9*
Percent Heavy Vehicles	*0*	--	--	*0*	--	--
Median Type	*Two Way Left Turn Lane*					
RT Channelized			*0*			*0*
Lanes	*1*	*2*	*0*	*0*	*2*	*0*
Configuration	*L*	*T*			*T*	*TR*
Upstream Signal		*0*			*0*	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)				*9*	*0*	*22*
Peak-Hour Factor, PHF	*1.00*	*1.00*	*1.00*	*0.95*	*1.00*	*0.95*
Hourly Flow Rate, HFR (veh/h)	*0*	*0*	*0*	*9*	*0*	*23*
Percent Heavy Vehicles	*0*	*0*	*0*	*0*	*0*	*0*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*0*	*0*	*0*	*1*	*0*
Configuration					*LTR*	

Delay, Queue Length, and Level of Service

Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*L*						*LTR*	
v (veh/h)	*23*						*32*	
C (m) (veh/h)	*906*						*500*	
v/c	*0.03*						*0.06*	
95% queue length	*0.08*						*0.20*	
Control Delay (s/veh)	*9.1*						*12.7*	
LOS	*A*						*B*	
Approach Delay (s/veh)	--	--					*12.7*	
Approach LOS	--	--					*B*	

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TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	BC	Intersection	East Drive/SR-62
Agency/Co.	Kunzman Associates, Inc.	Jurisdiction	CALTRANS
Date Performed	7/25/16	Analysis Year	Existing Plus Project
Analysis Time Period	Morning Peak Hour		

Project Description: Variety Store - Morongo Valley

East/West Street: SR-62 Highway | North/South Street: East Drive

Intersection Orientation: East-West | Study Period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	2	601	3	7	959	0
Peak-Hour Factor, PHF	0.85	0.85	0.85	0.85	0.85	0.85
Hourly Flow Rate, HFR (veh/h)	2	707	3	8	1128	0
Percent Heavy Vehicles	0	--	--	0	--	--
Median Type	Two Way Left Turn Lane					
RT Channelized			0			0
Lanes	1	2	0	1	2	0
Configuration	L	T	TR	L	T	TR
Upstream Signal		0			0	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	3	0	0	0	0	1
Peak-Hour Factor, PHF	0.85	0.85	0.85	0.85	0.85	0.85
Hourly Flow Rate, HFR (veh/h)	3	0	0	0	0	1
Percent Heavy Vehicles	0	0	0	0	0	0
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration		LTR			LTR	

Delay, Queue Length, and Level of Service

Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	L	L		LTR			LTR	
v (veh/h)	2	8		3			1	
C (m) (veh/h)	627	899		249			529	
v/c	0.00	0.01		0.01			0.00	
95% queue length	0.01	0.03		0.04			0.01	
Control Delay (s/veh)	10.8	9.0		19.6			11.8	
LOS	B	A		C			B	
Approach Delay (s/veh)	--	--	19.6			11.8		
Approach LOS	--	--	C			B		

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TWO-WAY STOP CONTROL SUMMARY

General Information

Analyst	BC
Agency/Co.	Kunzman Associates, Inc.
Date Performed	7/25/16
Analysis Time Period	Evening Peak Hour

Site Information

Intersection	East Drive/SR-62
Jurisdiction	CALTRANS
Analysis Year	Existing Plus Project

Project Description: Variety Store - Morongo Valley

East/West Street: SR-62 Highway | North/South Street: East Drive

Intersection Orientation: East-West | Study Period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	1	1049	2	1	664	1
Peak-Hour Factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96
Hourly Flow Rate, HFR (veh/h)	1	1092	2	1	691	1
Percent Heavy Vehicles	0	--	--	0	--	--
Median Type	Two Way Left Turn Lane					
RT Channelized			0			0
Lanes	1	2	0	1	2	0
Configuration	L	T	TR	L	T	TR
Upstream Signal		0			0	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	2	0	4	0	0	0
Peak-Hour Factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96
Hourly Flow Rate, HFR (veh/h)	2	0	4	0	0	0
Percent Heavy Vehicles	0	0	0	0	0	0
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration		LTR			LTR	

Delay, Queue Length, and Level of Service

Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	L	L		LTR			LTR	
v (veh/h)	1	1		6			0	
C (m) (veh/h)	912	645		331				
v/c	0.00	0.00		0.02				
95% queue length	0.00	0.00		0.06				
Control Delay (s/veh)	9.0	10.6		16.1				
LOS	A	B		C				
Approach Delay (s/veh)	--	--	16.1					
Approach LOS	--	--	C					

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Existing Plus Ambient Growth Plus Project

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	BC	Intersection	West Drive/SR-62
Agency/Co.	Kunzman Associates, Inc.	Jurisdiction	CALTRANS
Date Performed	7/25/16	Analysis Year	Existing + AG + P
Analysis Time Period	Morning Peak Hour		

Project Description: Variety Store - Morongo Valley

East/West Street: SR-62 Highway | North/South Street: West Drive/Mountain View Drive

Intersection Orientation: East-West | Study Period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	0	607	0	1	963	11
Peak-Hour Factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Hourly Flow Rate, HFR (veh/h)	0	659	0	1	1046	11
Percent Heavy Vehicles	0	--	--	0	--	--
Median Type	Two Way Left Turn Lane					
RT Channelized			0			0
Lanes	1	2	0	1	2	0
Configuration	L	T	TR	L	T	TR
Upstream Signal		0			0	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	1	0	4	14	1	11
Peak-Hour Factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Hourly Flow Rate, HFR (veh/h)	1	0	4	15	1	11
Percent Heavy Vehicles	0	0	0	0	0	0
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration		LTR			LTR	

Delay, Queue Length, and Level of Service

Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	L	L		LTR			LTR	
v (veh/h)	0	1		5			27	
C (m) (veh/h)	667	939		541			253	
v/c	0.00	0.00		0.01			0.11	
95% queue length	0.00	0.00		0.03			0.35	
Control Delay (s/veh)	10.4	8.8		11.7			20.9	
LOS	B	A		B			C	
Approach Delay (s/veh)	--	--	11.7			20.9		
Approach LOS	--	--	B			C		

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Generated: 7/25/2016 4:50 PM

TWO-WAY STOP CONTROL SUMMARY

General Information

Analyst	BC
Agency/Co.	Kunzman Associates, Inc.
Date Performed	7/25/16
Analysis Time Period	Evening Peak Hour

Site Information

Intersection	West Drive/SR-62
Jurisdiction	CALTRANS
Analysis Year	Existing + AG + P

Project Description: Variety Store - Morongo Valley

East/West Street: SR-62 Highway | North/South Street: West Drive/Mountain View Drive

Intersection Orientation: East-West | Study Period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	13	1059	7	3	671	23
Peak-Hour Factor, PHF	0.99	0.99	0.99	0.99	0.99	0.99
Hourly Flow Rate, HFR (veh/h)	13	1069	7	3	677	23
Percent Heavy Vehicles	0	--	--	0	--	--
Median Type	Two Way Left Turn Lane					
RT Channelized			0			0
Lanes	1	2	0	1	2	0
Configuration	L	T	TR	L	T	TR
Upstream Signal		0			0	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	2	0	2	21	0	3
Peak-Hour Factor, PHF	0.99	0.99	0.99	0.99	0.99	0.99
Hourly Flow Rate, HFR (veh/h)	2	0	2	21	0	3
Percent Heavy Vehicles	0	0	0	0	0	0
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration		LTR			LTR	

Delay, Queue Length, and Level of Service

Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	L	L		LTR			LTR	
v (veh/h)	13	3		4			24	
C (m) (veh/h)	906	656		274			279	
v/c	0.01	0.00		0.01			0.09	
95% queue length	0.04	0.01		0.04			0.28	
Control Delay (s/veh)	9.0	10.5		18.3			19.1	
LOS	A	B		C			C	
Approach Delay (s/veh)	--	--	18.3			19.1		
Approach LOS	--	--	C			C		

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TWO-WAY STOP CONTROL SUMMARY

General Information

Analyst	BC
Agency/Co.	Kunzman Associates, Inc.
Date Performed	7/25/16
Analysis Time Period	Morning Peak Hour

Site Information

Intersection	Project Access/SR-62
Jurisdiction	CALTRANS
Analysis Year	Existing + AG + P

Project Description: Variety Store - Morongo Valley

East/West Street: SR-62 Highway | North/South Street: Project Access

Intersection Orientation: East-West | Study Period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	15	607			965	6
Peak-Hour Factor, PHF	0.95	0.95	1.00	1.00	0.95	0.95
Hourly Flow Rate, HFR (veh/h)	15	638	0	0	1015	6
Percent Heavy Vehicles	0	--	--	0	--	--
Median Type	Two Way Left Turn Lane					
RT Channelized			0			0
Lanes	1	2	0	0	2	0
Configuration	L	T			T	TR
Upstream Signal		0			0	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)				4	0	10
Peak-Hour Factor, PHF	1.00	1.00	1.00	0.95	1.00	0.95
Hourly Flow Rate, HFR (veh/h)	0	0	0	4	0	10
Percent Heavy Vehicles	0	0	0	0	0	0
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	0	0	0	1	0
Configuration					LTR	

Delay, Queue Length, and Level of Service

Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	L						LTR	
v (veh/h)	15						14	
C (m) (veh/h)	688						414	
v/c	0.02						0.03	
95% queue length	0.07						0.10	
Control Delay (s/veh)	10.3						14.0	
LOS	B						B	
Approach Delay (s/veh)	--	--					14.0	
Approach LOS	--	--					B	

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Generated: 7/25/2016 4:53 PM

TWO-WAY STOP CONTROL SUMMARY

General Information

Analyst	BC
Agency/Co.	Kunzman Associates, Inc.
Date Performed	7/25/16
Analysis Time Period	Evening Peak Hour

Site Information

Intersection	Project Access/SR-62
Jurisdiction	CALTRANS
Analysis Year	Existing + AG + P

Project Description: Variety Store - Morongo Valley

East/West Street: SR-62 Highway | North/South Street: Project Access

Intersection Orientation: East-West | Study Period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	22	1051			662	9
Peak-Hour Factor, PHF	0.95	0.95	1.00	1.00	0.95	0.95
Hourly Flow Rate, HFR (veh/h)	23	1106	0	0	696	9
Percent Heavy Vehicles	0	--	--	0	--	--
Median Type	Two Way Left Turn Lane					
RT Channelized			0			0
Lanes	1	2	0	0	2	0
Configuration	L	T			T	TR
Upstream Signal		0			0	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)				9	0	22
Peak-Hour Factor, PHF	1.00	1.00	1.00	0.95	1.00	0.95
Hourly Flow Rate, HFR (veh/h)	0	0	0	9	0	23
Percent Heavy Vehicles	0	0	0	0	0	0
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	0	0	0	1	0
Configuration					LTR	

Delay, Queue Length, and Level of Service

Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	L						LTR	
v (veh/h)	23						32	
C (m) (veh/h)	902						498	
v/c	0.03						0.06	
95% queue length	0.08						0.21	
Control Delay (s/veh)	9.1						12.7	
LOS	A						B	
Approach Delay (s/veh)	--	--					12.7	
Approach LOS	--	--					B	

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TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	BC	Intersection	East Drive/SR-62
Agency/Co.	Kunzman Associates, Inc.	Jurisdiction	CALTRANS
Date Performed	7/25/16	Analysis Year	Existing + AG + P
Analysis Time Period	Morning Peak Hour		

Project Description: Variety Store - Morongo Valley

East/West Street: SR-62 Highway | North/South Street: East Drive

Intersection Orientation: East-West | Study Period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	2	606	3	7	967	0
Peak-Hour Factor, PHF	0.85	0.85	0.85	0.85	0.85	0.85
Hourly Flow Rate, HFR (veh/h)	2	712	3	8	1137	0
Percent Heavy Vehicles	0	--	--	0	--	--
Median Type	Two Way Left Turn Lane					
RT Channelized			0			0
Lanes	1	2	0	1	2	0
Configuration	L	T	TR	L	T	TR
Upstream Signal		0			0	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	3	0	0	0	0	1
Peak-Hour Factor, PHF	0.85	0.85	0.85	0.85	0.85	0.85
Hourly Flow Rate, HFR (veh/h)	3	0	0	0	0	1
Percent Heavy Vehicles	0	0	0	0	0	0
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration		LTR			LTR	

Delay, Queue Length, and Level of Service

Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	L	L		LTR			LTR	
v (veh/h)	2	8		3			1	
C (m) (veh/h)	622	895		247			526	
v/c	0.00	0.01		0.01			0.00	
95% queue length	0.01	0.03		0.04			0.01	
Control Delay (s/veh)	10.8	9.1		19.8			11.9	
LOS	B	A		C			B	
Approach Delay (s/veh)	--	--	19.8			11.9		
Approach LOS	--	--	C			B		

TWO-WAY STOP CONTROL SUMMARY

General Information		Site Information	
Analyst	BC	Intersection	East Drive/SR-62
Agency/Co.	Kunzman Associates, Inc.	Jurisdiction	CALTRANS
Date Performed	7/25/16	Analysis Year	Existing + AG + P
Analysis Time Period	Evening Peak Hour		

Project Description: Variety Store - Morongo Valley

East/West Street: SR-62 Highway | North/South Street: East Drive

Intersection Orientation: East-West | Study Period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	1	1057	2	1	669	1
Peak-Hour Factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96
Hourly Flow Rate, HFR (veh/h)	1	1101	2	1	696	1
Percent Heavy Vehicles	0	--	--	0	--	--
Median Type	Two Way Left Turn Lane					
RT Channelized			0			0
Lanes	1	2	0	1	2	0
Configuration	L	T	TR	L	T	TR
Upstream Signal		0			0	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)	2	0	4	0	0	0
Peak-Hour Factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96
Hourly Flow Rate, HFR (veh/h)	2	0	4	0	0	0
Percent Heavy Vehicles	0	0	0	0	0	0
Percent Grade (%)		0			0	
Flared Approach		N			N	
Storage		0			0	
RT Channelized			0			0
Lanes	0	1	0	0	1	0
Configuration		LTR			LTR	

Delay, Queue Length, and Level of Service

Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	L	L		LTR			LTR	
v (veh/h)	1	1		6			0	
C (m) (veh/h)	909	640		328				
v/c	0.00	0.00		0.02				
95% queue length	0.00	0.00		0.06				
Control Delay (s/veh)	9.0	10.6		16.2				
LOS	A	B		C				
Approach Delay (s/veh)	--	--	16.2					
Approach LOS	--	--	C					

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Kunzman Associates, Inc.

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