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Traffic Impact Study

Mixed-Use Development Project

Torrance, California

January 31, 2018 (3rd Revision)

Prepared for

Ashai Design Consulting Corporation

Prepared by

KHR ASSOCIATES
Consulting Engineers - Surveyors - Planners

Revised
Feb. 2018

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ATTESTATION

This report has been prepared by, and under the direction of, the undersigned, a duly Registered Traffic Engineer and Registered Civil Engineer in the State of California. Except as noted, the undersigned attests to the technical information contained herein, and has judged to be acceptable the qualifications of any technical specialists providing engineering data for this report, upon which findings, conclusions, and recommendations are based.

_________________________________ Date: _January 31, 2018_____

James H. Kawamura, P.E.
Registered Traffic Engineer No. TR1110
Registered Civil Engineer No. C30560

TABLE OF CONTENTS

Mixed-Use Development Project
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I. EXECUTIVE SUMMARY

This report documents a Traffic Impact Study (TIS) completed for the proposed mixed-use development project (hereinafter referred to as the *Project*), to be located on the northwest corner of Hawthorne Boulevard and Via Valmonte, in the City of Torrance, California. The Second Revision was modified to respond to questions and comments provided by the City on August 30, 2017. This Third Revision includes analyses of four additional intersections analyses, as requested by the City that were beyond the original study scope.

Project Description

The *Project* site contains 23,657 square feet of vacant land area, of which 13,500 square feet are proposed for a multi-family residential building, and 4,500 square feet are proposed for commercial use – professional offices. The residential community will consist of 13 multi-family dwelling units and 26 parking spaces, and the commercial space will be served by 15 parking spaces. In addition, one guest parking space and 6,096 square feet of common open space will be provided for shared residential and commercial use. Common space amenities include pedestrian walkways, a pool and deck area, and landscaped areas. Access to the *Project* site is proposed via one entrance driveway and one exit driveway on Via Valmonte. The entrance driveway will be for right-in only movements, and the exit driveway will allow right and left turn movements.

Traffic Impact Study

The TIS was commissioned by **Ashai Design Consulting Corporation**, Beverly Hills, California, and performed by **KHR Associates**, Newport Beach, California. The scope of work for the study was provided by staff with the City of Torrance.

The original TIS focused on: 1) establishing a baseline for traffic conditions at potentially impacted intersections and roadways; 2) determining how much traffic could be generated by the proposed mixed-use development; 3) determining if the additional traffic would result in impacts at the study intersection and roadways under various future development scenarios; 4) determining appropriate mitigation measures should it be found that any or all of the study intersections and roadways are impacted; 5) performing two queue analyses of the eastbound left turn at the Via Valmonte/Hawthorne Boulevard intersection – one with a single left turn lane and another with dual left turn lanes, and 6) evaluating other traffic-related issues, including driveway locations and on-site circulation.

Per the request of the City of Torrance, this revised edition of the TIS includes four additional intersections analyzed for Levels of Service, beyond the original scope of only the Via Valmonte/Hawthorne Boulevard intersection. These additional intersections include Hawthorne Boulevard/Palos Verdes Drive North, Hawthorne Boulevard/Rolling Hills Road, Hawthorne Boulevard/Newton Street, and Hawthorne Boulevard/Pacific Coast Highway.

Study Findings

Based on the documentation and analyses presented herein, the following study findings were made:

1) Traffic counts taken in mid-April 2016 were used as a basis for this study and an annual one percent, per year growth factor was applied to estimate 2017 and 2019 conditions.

2) By the *Project* target year of 2019, the *Project* is estimated to generate a total of 15 A.M. and 16 P.M. peak hour trips ends, respectively.

3) The potential for “internal capture” of vehicle trips will be present, however, the percentage of such trip reduction is uncertain.

4) While the *Project* will generate some degree of regular transit use, thus potentially reducing private vehicle trips, the percentage of such trip reduction is uncertain.

5) Based on the current site plan for the *Project*, vehicular access will be provided via two future driveways on Via Valmonte - one entrance driveway and one exit driveway.

6) An additional left turn lane in the eastbound approach leg of the Via Valmonte/Hawthorne Boulevard intersection is slated for construction with the development of the proposed “Solana Torrance” development located directly across the street from this *Project*. This intersection was evaluated with and without the proposed second left turn lane (in case the Solana project is not constructed).

Study Conclusions

Based on the above study findings, the following study conclusions were reached:

1) Since the traffic counts take into consideration current vacant land uses, traffic generated by any previous developments cannot be deducted from the amount of traffic projected to be generated by the *Project* site.

2) The potential use of transit was not taken into consideration in reducing the amount of traffic projected to be generated by the *Project*.

3) The five studied intersections were analyzed for "Levels of Service" (LOS) using three scenarios: existing 2017 volumes, ambient growth plus *Project* 2019 volumes, and Project plus other cumulative development, 2019 volumes for both the A.M. and P.M. peak hours.

4) The intersections were analyzed using two methods – Intersection Capacity Utilization (ICU), and Highway Capacity Manual (HCM) (see Appendices).

5) Using existing counts and including the ambient growth factor, the 2017 ICU LOS at the study intersections, during both the A.M. and P.M. peak hours of weekday commute, fall within acceptable limits.

6) In the target year of 2019, with the addition of ambient growth, the ICU LOS at the study intersections during both the A.M. and P.M. peak hours of traffic increased slightly with no changes to the LOS designations.

7) In the target year 2019, with the addition of *Project* traffic and other cumulative development traffic, the ICU LOS at each of the study intersections during both the A.M. and P.M. peak hours of traffic are projected to stay within acceptable limits.

8) Using the HCM methodology to determine levels of service for the studied intersections revealed similar results in LOS (as the ICU method) with the exception of the Hawthorne Boulevard/Pacific Coast Highway intersection at LOS E in the P.M. and the Hawthorne Boulevard/Palos Verdes Drive North intersection in LOS E in the A.M. Intersection delays increased only slightly with each scenario with no deterioration in LOS during both peak hours of traffic.

9) The roadway connections and parking provisions depicted on the current site plan for the *Project*, appear to be well situated relative to the surrounding public streets and highways network.

10) A queuing analysis performed (including two separate field traffic surveys) for the eastbound approach to the Via Valmonte/Hawthorne Boulevard intersection revealed that the hour long average of vehicles waiting within the left-turn lane during the A.M. peak hour was 2.7 vehicles.

11) Per the City's request, estimating queueing using a higher volume of recorded traffic taken during peak hour counts in April 2016, plus adding right turning vehicles in the left turning queue, and applying a one percent annual growth factor results in an estimated existing average queue of 7.6 vehicles for 2017.

12) The distance between the proposed exit driveway and the Via Valmonte /Hawthorne Blvd. intersection is nearly 200 feet which could accommodate at least eight vehicles. The City's request to have at least a two vehicle clearance would indicate a maximum of six vehicles in the left turn queue.

13) Realigning the centerline striping (made possible with the additional roadway improvement along the *Project* frontage) could create a separate through/right turn lane. Removing the through and right turning vehicles from the left turn queue would result in an estimated 5.8 vehicles with *Project* buildout – less than the maximum six vehicles in the left turn queue noted above.

14) As part of the proposed *"Solana Torrance"* development, a second left turn lane was considered in an additional queuing analysis along with estimated additional trips from that development. Under these conditions, the average left turn queue would be 7.8 vehicles which can be accommodated with two left turn lanes in the eastbound approach – a capacity of 10 vehicles.

II. INTRODUCTION

Ashai Design Consulting Corporation, (Ashai), Beverly Hills, has proposed a 13-unit multi-family residential and commercial building development (i.e., *Project*) on a vacant site located on the northwest corner of Hawthorne Boulevard and Via Valmonte, in the *Hillside Residential Neighborhood District* of the City of Torrance, California. As part of its environmental review process, the City determined that a traffic impact study (TIS) was necessary, and that potential impacts associated with the proposed development must be analyzed, and mitigation measures must be identified.

Ashai was given permission by the City to commission **KHR Associates**, Newport Beach, California, to work with City staff and undertake the TIS. The City specified the requirements of the TIS, and identified intersection and roadway segments of concern. The City also indicated that queue analyses needed to be performed on Via Valmonte on the eastbound approach to its intersection with Hawthorne Boulevard. One analysis needed to include a single left turn lane and another with dual left turn lanes. Also, the study needed to include anticipated traffic generated by the proposed *Solana Torrance* project located directly across Via Valmonte from the Project site. This revised study addresses the comments/revisions provided by the City on August 30, 2017.

Information regarding the proposed *Mixed-Use Development* was provided by **Ashai**. The results of the TIS are presented herein, and the findings, conclusions, and recommendations are solely those of **KHR Associates**, and may not be reflect the opinions of **Ashai,** the City of Torrance, or any other interested parties.

Project Description

The *Project* site contains 23,657 square feet of vacant land area, of which 13,500 square feet are proposed for a multi-family residential building, and 4,500 square feet are proposed for professional office use. The residential community will consist of 13 multi-family dwelling units and 26 parking spaces, and the commercial space will be served by 15 parking spaces. In addition, one guest parking space and 6,096 square feet of common open space will be provided for shared residential and commercial use. Common space amenities include pedestrian walkways, a pool and deck area, and landscaped areas.

Access to the *Project* site is proposed via two driveways on Via Valmonte - one entrance driveway and one exit driveway. The entrance driveway will be for right-in only movements, and the exit driveway will allow left turn movements only. Right turns from the exit driveway will not be permitted. According to **Ashai**, the target year for completion and occupancy of the *Project* is 2019. Figure 1 depicts the most current conceptual plan for the *Project*.

Figure 1 – Mixed-Use Development Project

<u>Site Location and Existing Uses</u>

The *Project* site is located on the northwesterly corner of Hawthorne Boulevard and Via Valmonte, within the City of Torrance, California. The *Project* is within the Hillside Overlay Zone, with a General Plan Land Use Designation of General Commercial (C-GEN), and a Zoning designation of HBCSP (W) – Hawthorne Blvd. Corridor Specific Plan (Walteria Sub-District) for a portion of the site and A1-C2PP – Light Agricultural-General Commercial Precise Plan on File for the remainder of the site.

Adjacent land uses include residential uses to the north and west, residential and light commercial/office to the east and vacant/hillside land to the south. Hawthorne Boulevard, running along the east side of the *Project* site, is within the Hawthorne Boulevard Corridor Specific Plan. Figure 2 illustrates the location of the *Project* site within the City of Torrance along with the City's Residential Neighborhood Districts.

Current existing major land uses in close proximity to the *Project* site include the *Torrance Municipal Airport (also known as Zamperini Field),* a general aviation airport owned and operated by the City of Torrance, providing regional aviation access to recreational pilots, businesses, and emergency services flights; and *Del Amo Fashion Center*, a superregional shopping center with approximately three million square feet of retail space. The *Project* site is currently undeveloped land, vacant and unutilized. Figure 3 provides a recent aerial perspective of the configuration and limits of the *Project* site.

Located directly across Via Valmonte from the *Project* site is another proposed development – the "*Solana Torrance"* project. This development is now in the planning stages and currently includes 248 planned residential units. The City requested that this study take into account, the cumulative traffic impacts that may occur with this development added to the overall 2019 assessments.

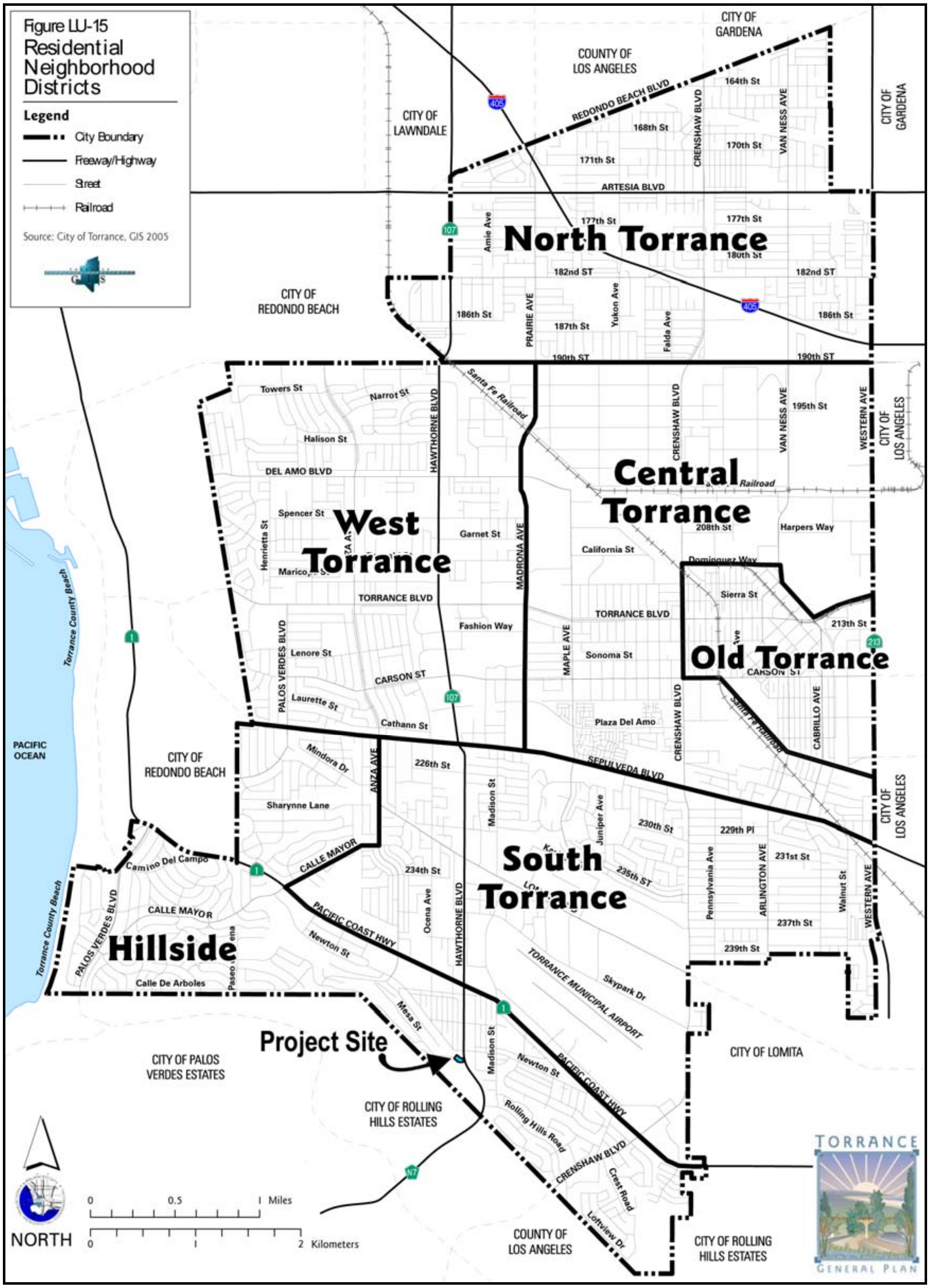

Figure 2 – Project Site Location within the City of Torrance[A]

[A] Land Use Element, City of Torrance General Plan, City of Torrance, April 2010.

Figure 3 – Aerial Perspective of Project Site

Traffic Impact Study Area

The TIS area generally consists of the *Project* site and surrounding residential communities and commercial properties. Three major transportation corridors exist within close proximity – Hawthorne Boulevard, Crenshaw Boulevard, and Pacific Coast Highway, which all provide regional access opportunities to either the San Diego Freeway (I-405) or the Harbor Freeway (I-110). The existing regional network of streets and highways servicing the development site include Via Valmonte, Hawthorne Boulevard, Pacific Coast Highway, Rolling Hills Road, and Newton Street.

Study intersections and arterial roadway segments for this study were identified by the Public Works Department. The following briefly describes each of these existing roadways and intersections, as designated within the City's General Plan – Circulation and Infrastructure Element.

Hawthorne Boulevard – Hawthorne Boulevard (SR-107) runs in a primarily north to south direction from Century Boulevard to Palos Verdes Drive, respectively. Hawthorne Boulevard is classified as a Principal Arterial, and is generally an eight-lane divided roadway with a raised median. Adjacent the project site, Hawthorne Boulevard is six lanes, divided, with an existing half right of way from the centerline to the westerly right of way line of 50 feet along the entire property frontage, and a centerline to westerly face-of-curb dimension of 40 feet. From Interstate 405, Hawthorne Boulevard provides access to the Del Amo Fashion Center as well as residential areas.

Via Valmonte – Via Valmonte is a Collector street providing access to the residential neighborhood adjacent to the development site. Trending in an east to west direction, terminating at Hawthorne Boulevard to the east and Paseo Del Campo to the west, Via Valmonte consists of two lanes, undivided.

Hawthorne Boulevard & Via Valmonte Intersection – The intersection of Hawthorne Boulevard and Via Valmonte is currently signalized for two phases of movement. The northbound approach leg features three through lanes, a right turn lane, a left turn pocket, and a raised median island. The southbound approach leg has three through lanes and a left turn pocket, and a raised median island. The eastbound leg has an optional through/right turn/left turn lane. The westbound leg has optional through/left and through/right turn lanes. Crosswalks are marked across the southbound, eastbound and westbound legs. U-turns in the northbound and southbound directions are currently prohibited at this intersection. Figure 4 is a close-up aerial photo of the intersection.

Hawthorne Boulevard & Rolling Hills Road – The intersection of Hawthorn Boulevard and Rolling Hills Road is signalized for four phases of traffic movement. The northbound approach leg features two through lanes and a left turn pocket. The southbound approach leg has two through lanes and dual left turn lanes. The eastbound approach leg serves as the driveway for the *Sunrise at Palos Verdes* development. The westbound approach leg has an optional through/right turn lane, a separate right turn lane, and a separate left turn lane. Crosswalks are marked across the northbound, southbound and westbound approach legs. U-turns in the northbound direction are not permitted. Figure 5 is a close-up aerial photo of the intersection.

Hawthorne Boulevard & Newton Street – The intersection of Hawthorne Boulevard and Newton Street is signalized for four phases of traffic movement. The northbound approach leg features three through lanes and a left turn pocket. The southbound approach leg has three through lanes and a left turn pocket. The eastbound approach leg has one through/right turn lane and a left turn pocket. The westbound approach leg has one through lane, a separate right turn lane, and a left turn pocket. Crosswalks are marked across all four legs of the intersection. Time period restrictions for this intersection include no northbound right turns between 6 and 9 A.M., Monday through Friday. Figure 6 is a close-up aerial photo of the intersection.

Hawthorne Boulevard & Pacific Coast Highway – This intersection is signalized for eight phases of traffic movement. The northbound approach leg features three through lanes and dual left turn lanes. The southbound approach leg has three through lanes, a separate right turn lane, and dual left turn lanes. The eastbound approach leg has three through lanes and a left turn pocket. The westbound approach leg has three through lanes and a left turn pocket. High-visibility crosswalks are marked across all four legs of the intersection. The City of Torrance has indicated that this intersection is slated for capital improvements in 2018 to include three through lanes and dual left turn lanes in all directions. The intersection will continue to operate with eight phases. Figure 7 is a close-up aerial photo of the intersection.

Hawthorne Boulevard & Palos Verdes Drive North – This intersection is signalized for eight phases of traffic movement. The northbound approach leg (Hawthorne Boulevard) features two through lanes, a separate right turn lane, and a left turn pocket. The southbound approach leg (Hawthorne Boulevard) has two through lanes, a separate right turn lane, and a left turn pocket. The eastbound approach leg (Palos Verdes Drive North) has two through lanes, a separate right turn lane, and a left turn pocket. The westbound approach leg (Palos Verdes Drive North) has two through lanes, a separate right turn lane, and dual left turn lanes. Crosswalks are marked across all four legs of the intersection. Also, eastbound and westbound U-turns are not permitted. Figure 8 is a close-up aerial photo of the intersection.

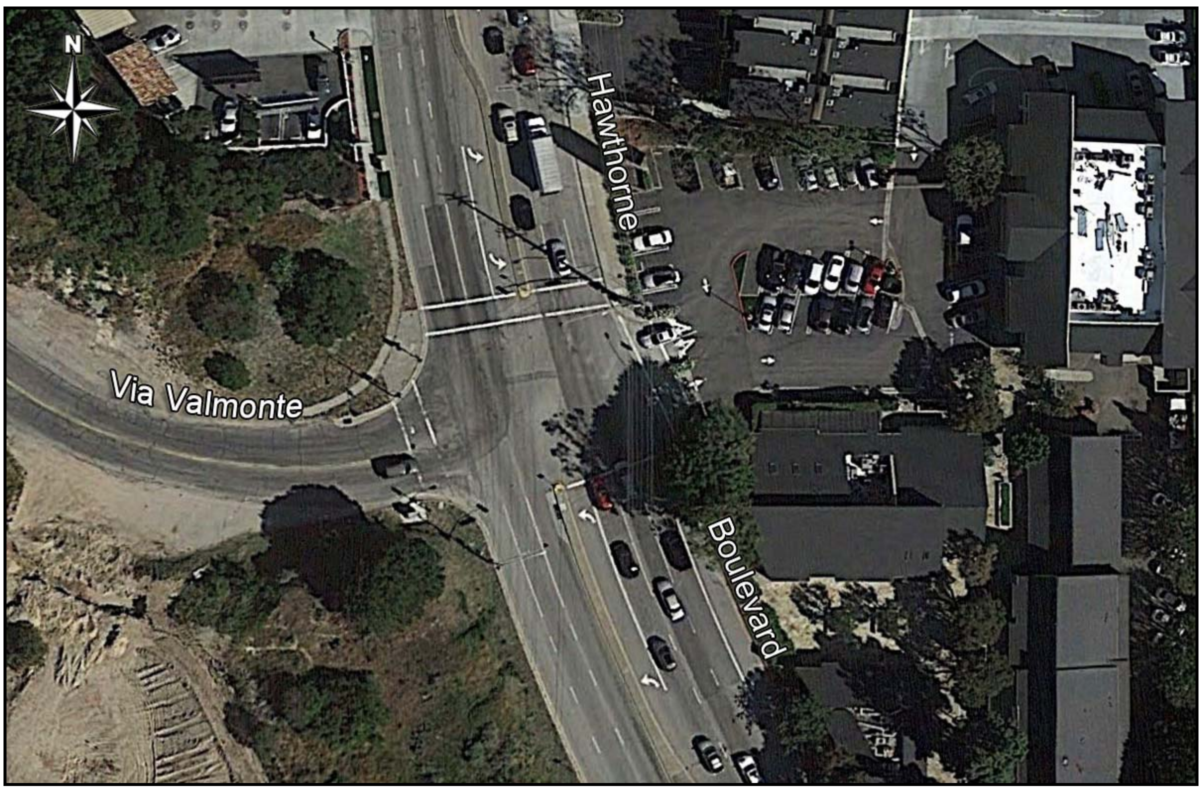

Figure 4 – Hawthorne Boulevard & Via Valmonte

Figure 9 illustrates the existing lane configurations for each study intersection.

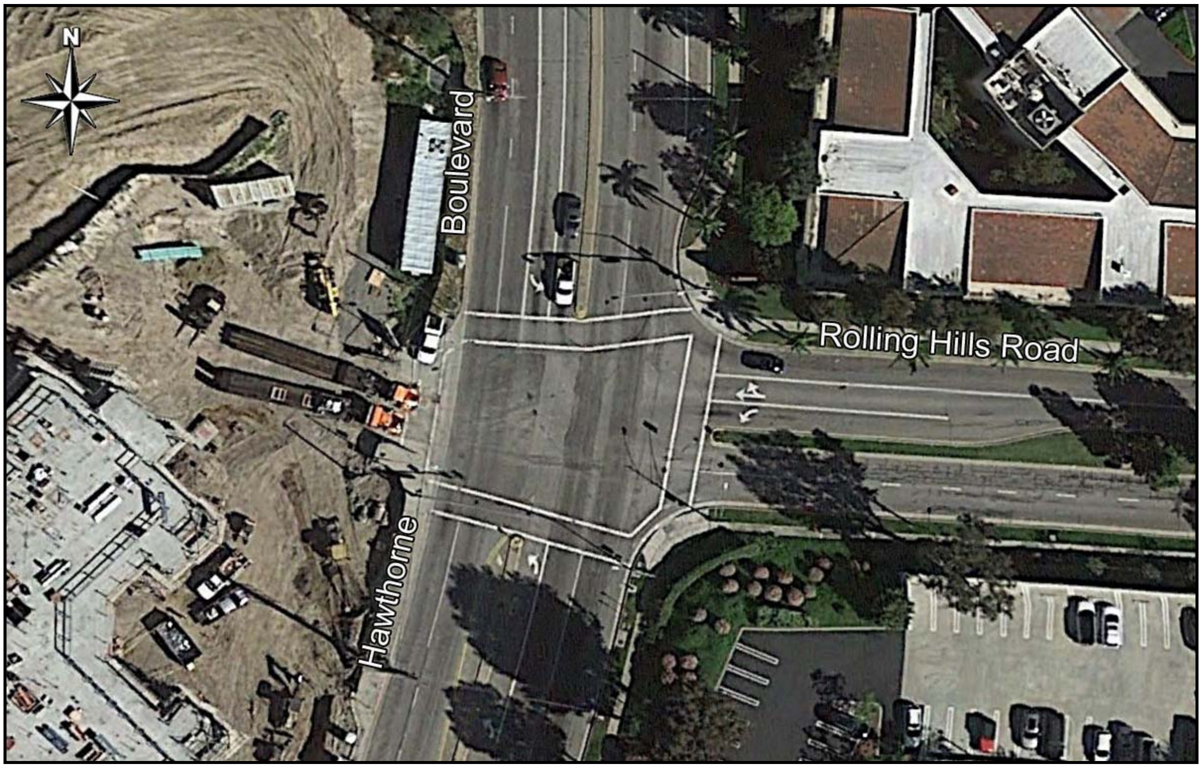

Figure 5 – Hawthorne Boulevard & Rolling Hills Road

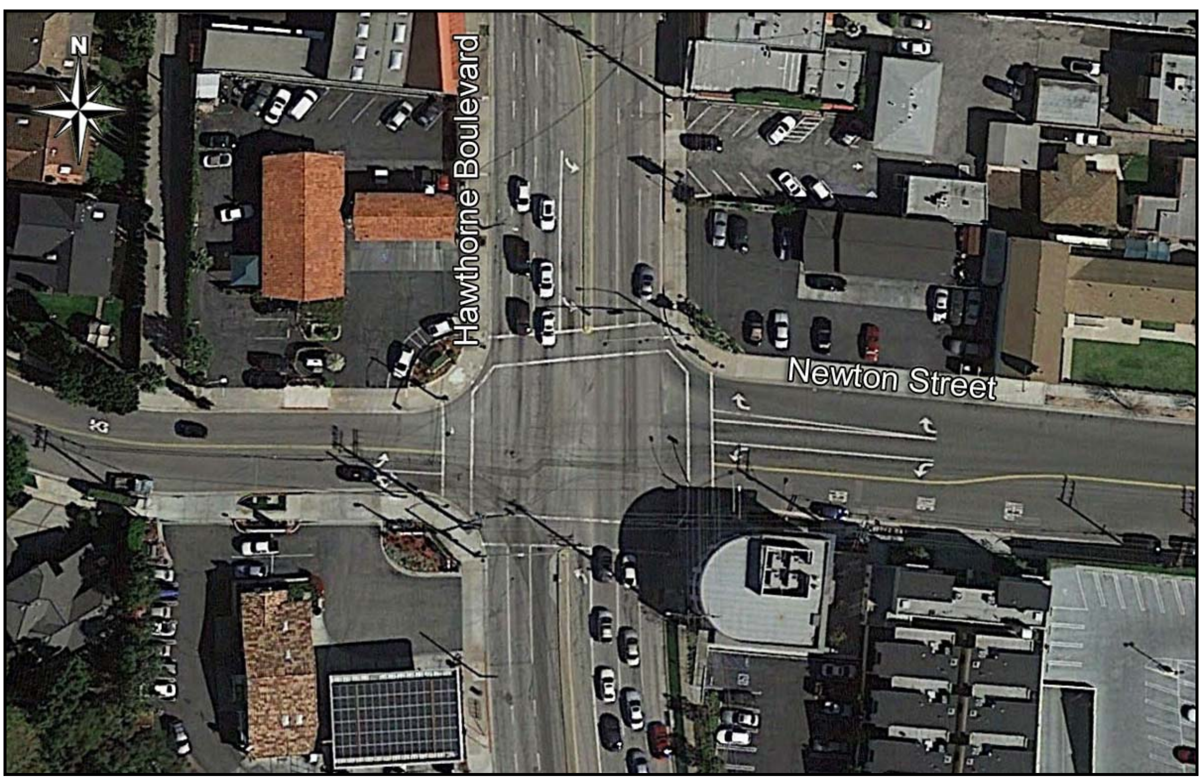

Figure 6 – Hawthorne Boulevard & Newton Street

Figure 7 – Hawthorne Boulevard & Pacific Coast Highway

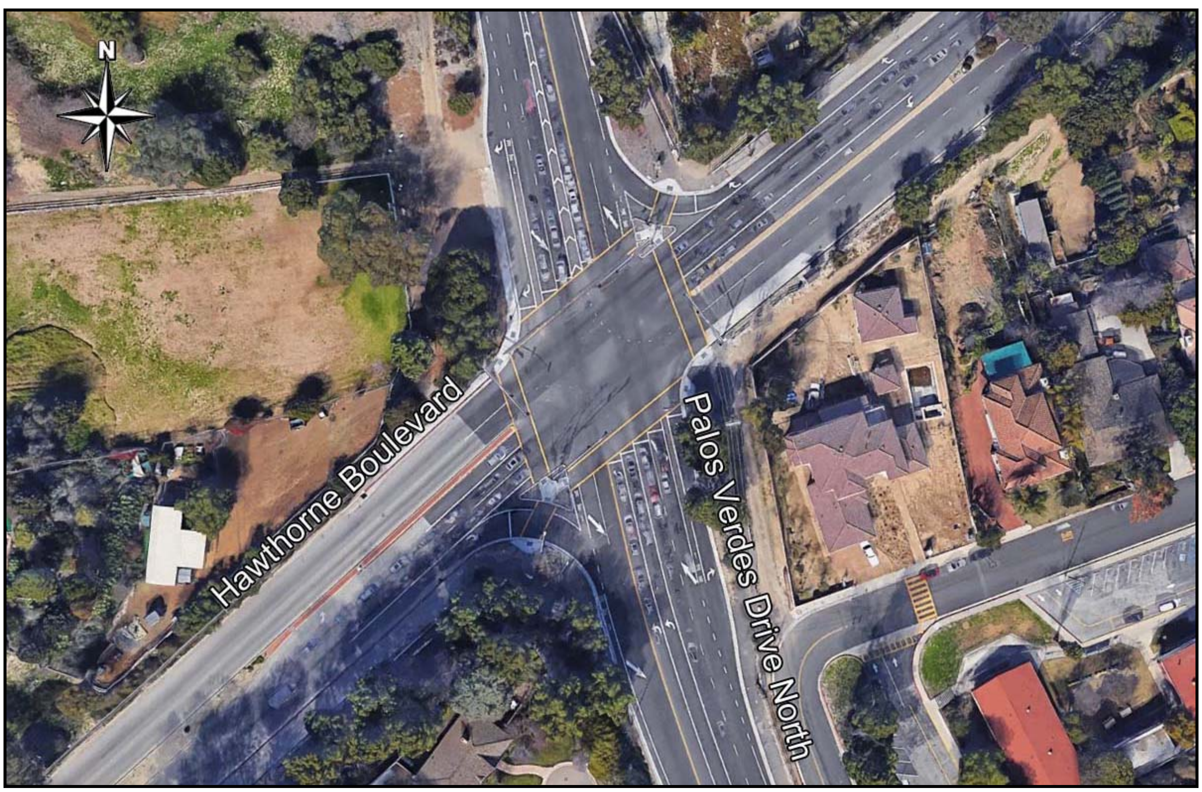

Figure 8 – Hawthorne Boulevard & Palos Verdes Drive North

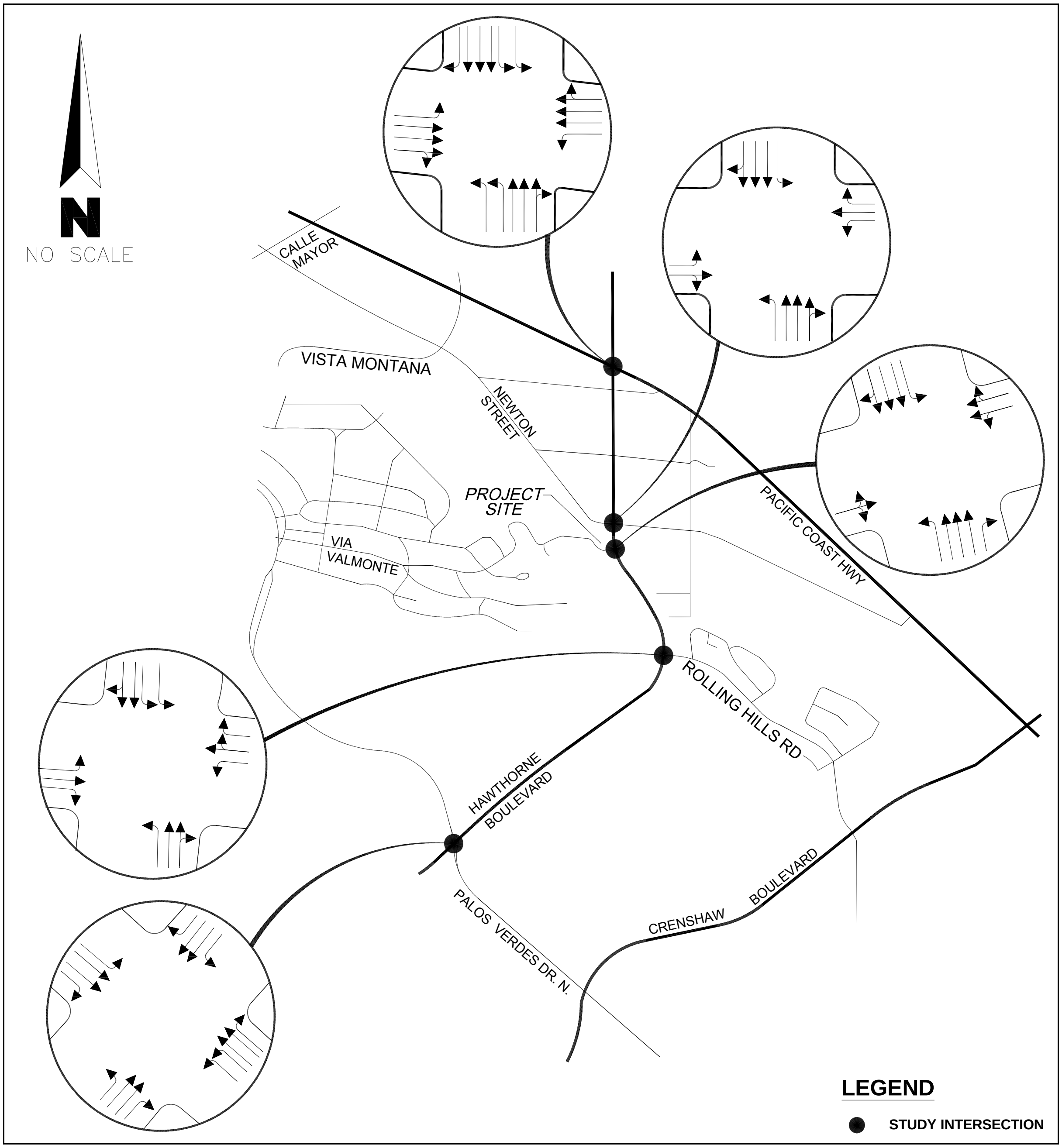

Figure 9 – Intersection Lane Configuration

III. STUDY TERMINOLOGY

The following are definitions of some of the terminology used throughout this report.

A.M. and P.M. Peak Hours

The *A.M and P.M. peak hours* refer to the morning and late afternoon times of the day during which the greatest number of motor vehicles are carried on a given roadway segment or intersection. Typically, the significant peak hours of traffic on an average weekday occur during the morning commute, between 7:00 and 9:00 A.M., and during the late afternoon commute, between 4:00 and 6:00 P.M. These hours do not necessarily correspond to the peak hour of trip generation, which, for commercial uses, can occur mid-day and on weekends. A.M. and P.M. peak hour turn movement traffic counts collected in the month of April 2016 for the proposed "*Solana Torrance"* project were used for this study. The recorded volumes were then increased by a growth factor of one percent to estimate current 2017 volumes. The intersection turn movement counts taken in 2016 were independently collected for **KHR Associates** by National Data & Surveying Services (NDS), Santa Ana, California. The summary intersection traffic count results can be found in the Appendix section of this report.

Average Daily Traffic

The *average daily traffic* (ADT) volume is an estimate of the number of motor vehicles carried on a given roadway segment over a 24-hour period of time. The estimate of ADT is often based on one or more days of actual traffic counts taken by a mechanical device designed specifically for counting traffic on streets. ADT volumes are typically expressed as the total number of vehicles for both directions of travel, but may be separated by direction when such information is useful, as was done for this traffic analysis. ADT volumes do not typically change in dramatic fashion from month to month or year to year, unless the area in question is undergoing rapid growth and development or seasonal variations are significant. Directional roadway segment traffic counts were continuously collected in the month of April 2016 over 24 consecutive hours – on a Wednesday. These daily traffic counts were also independently collected for **KHR Associates** by NDS. The summary ADT count results can be found in the Appendix section of this report.

Capacity

The *capacity* of a roadway segment or intersection is the maximum rate of vehicular traffic flow under prevailing traffic, physical design, and operational conditions. Factors affecting capacity include the type and frequency of traffic controls; the operational characteristics of traffic signals (if present); lane widths; horizontal and vertical grades; horizontal and vertical clearances from obstructions; the amount of truck and/or bus traffic; the availability of on-street parking and the rate of parking turnover; restrictions on mid-property access; and the volume of turn movements at adjacent intersections and driveways. Capacity is most commonly defined for hourly periods of time, and most analyses rely on peak 15-minute count increments to establish capacity values. It is useful to define capacity as the maximum volume of traffic that an intersection may be expected to carry, under the least desirable conditions (e.g., with heavy congestion during the peak hours).

For planning purposes, roadway segments are also assigned "capacities" based on the number of travel lanes; width of the roadway; access restrictions; medians; parkway and intersection design; and adjacent land uses. 24-hour roadway segment capacities are not indicative of the maximum number of vehicles that can be *physically* carried - rather, such capacities suggest the maximum number of vehicles that *should be allowed* under ideal conditions given the characteristics of the roadway and community preferences. The City of Torrance uses a per lane capacity of 1,600 vehicles.

Hourly capacities for roadways are typically stated in vehicles per hour per lane (VPHPL). On multi-lane arterials and freeways, unimpeded capacity is 2,000 VPHPL. On two-lane roadways, with directional traffic split 50%/50%, the total capacity for both directions combined is 2,800 vehicles per hour (VPH). Lane capacities on surface streets vary from 1,500 VPH to 1,900 VPH, depending on ambient and operational conditions, including the types of adjacent land uses, number and location of driveways, intersection signal operations, and other factors.

Level of Service

The *level of service* (LOS) of a roadway segment or an intersection is a qualitatively defined measure of prevailing traffic, design, and operational conditions. The LOS, denoted alphabetically from "A" to "F," best to worst, is an evaluation of the degree of congestion, roadway design constraints, delay, accident potential, and driver discomfort experienced during a given period of time - typically during the peak hour or on a daily basis. LOS “D” or better is considered to be a target for intersection operations within the City of Torrance to maintain stable traffic flow, realizing that peak hour congestion may occur at locations with unusual traffic characteristics due to regional traffic flow.[B]

The LOS may be quantitatively calculated by a number of methods that generally compare traffic volumes with the physical and operational capacity of a roadway section or intersection to carry traffic demands placed upon it. For roadway segments and intersections, the volume-to-capacity (V/C) ratio is indicative of LOS. Traffic volumes are measured by conducting actual counts over prescribed periods of time. Capacity figures are established by the governing jurisdiction, and often based on localized conditions. Intersection LOS can also be determined using computer software to account for various influencing factors such as lane configurations, traffic signal timing (for signalized intersections), and vehicle delays.

Table I lists the typical service volumes corresponding to the number of lanes and median type. It should be noted that the LOS for roadway segments are generally used for planning purposes only, and do not indicate true operational LOS.

Various methods of computing intersection LOS are used, including the Intersection Capacity Utilization (ICU) and HCS+ software, based on the 2010 Highway Capacity Manual (HCM).[C] Table II provides City of Torrance LOS definitions for signalized

[B] City of Torrance General Plan - Circulation and Infrastructure Element, Adopted April 6, 2010.
[C] HCS+, Release 6.50, McTrans Center, University of Florida, 2010.

intersections at corresponding volume-to-capacity (V/C) ratios. Table III provides criteria for signalized and unsignalized intersections, based on HCM methodologies for determining LOS. These LOS are used to approximate true operating conditions, and are calculated for intersections during morning and late afternoon peak hours.

TABLE I – LEVELS OF SERVICE FOR ROADWAY CLASSIFICATIONS

Traffic Lane Configuration	Levels of Service					
	A	B	C	D	E	F
8 (divided)	45,000	52,500	60,000	67,500	75,000	>75,000
6 (divided)	33,900	39,400	45,000	50,600	56,300	>56,300
4 (divided)	22,500	26,300	30,000	33,800	37,500	>37,500
4 (undivided)	15,000	17,500	20,000	22,500	25,000	>25,000
2 (undivided)	7,500	8,800	10,000	11,300	12,500	>12,500

TABLE II – SIGNALIZED INTERSECTION LOS & V/C RATIOS

LOS	V/C Ratio	Definitions
A	≤ 0.60	Excellent operation. All approaches to the intersection appear quite open, turning movements are easily made, and nearly all drivers find freedom of operation.
B	> 0.60 ≤ 0.70	Very good operation. Many drivers begin to feel somewhat restricted within platoons of vehicles. This represents stable flow. An approach to an intersection may occasionally be fully utilized and traffic queues start to form.
C	> 0.70 ≤ 0.80	Good operation. Occasionally backups may develop behind turning vehicles. Most drivers feel somewhat restricted.
D	> 0.80 ≤ 0.90	Fair operation. There are no long-standing traffic queues. This level is typically associated with design practice for peak periods.
E	> 0.90 ≤ 1.00	Poor operation. Some long-standing vehicular queues develop on critical approaches.
F	> 1.00	Forced flow. Represents jammed conditions. Backups from locations downstream or on the cross street may restrict or prevent movements of vehicles out of the intersection approach lanes. Potential for stop-and-go-type traffic flow.

Source: City of Torrance General Plan, Circulation and Infrastructure Element, April 2010

TABLE III – UNSIGNALIZED & SIGNALIZED INTERSECTION LOS CRITERIA

	Intersection Delay (in Seconds)	
Level of Service	Unsignalized Intersection	Signalized Intersection
A	≤ 10.0	≤ 10.0
B	> 10.0 and ≤ 15.0	> 10.0 and ≤ 20.0
C	> 15.0 and ≤ 25.0	> 20.0 and ≤ 35.0
D	> 25.0 and ≤ 35.0	> 35.0 and ≤ 55.0
E	> 35.0 and ≤ 50.0	> 55.0 and ≤ 80.0
F	> 50.0	> 80.0

Source: Highway Capacity Manual, HCM 2010 & Caltrans Guide for the Preparation of Traffic Impact Studies, 2010.

Significant Transportation Impact

Although the methodologies for calculating LOS are well-established and fairly consistent, determining whether or not a "significant transportation impact" or intersection traffic impact occurs is not as easy to quantify. Local jurisdictions have varying interpretations of what constitutes a significant impact. Some agencies base significant impacts on the number of seconds added to average intersection delay per vehicle or the number of additional vehicles added to a critical intersection turn movement. The City of Torrance defines a significant impact as when project traffic increases volume/capacity by .02 or more and the resulting LOS is E or worse.

Trip Ends

Traffic generated by different types of development and land use is typically expressed in terms of *trip ends*. A trip end (or trip) is the directional movement of a single motor vehicle either to or from a development site. When a vehicle enters a development site, one trip end is generated. When a vehicle exits a development site, one trip end is generated. Therefore, each vehicle entering and exiting a development site generates two trip ends. For analysis purposes, the number of trip ends generated over a given time period is the total of all vehicles entering plus all vehicles exiting the site during that time period. Trip ends generated to a development site are designated inbound trips and trip ends generated from a development site are designated outbound trips.

Trip Generation

Trip generation refers to the number of trip ends generated by a given development or land use over a specified period of time - usually per day and during morning and late afternoon peak hours of traffic demand. Attempts to quantify the trip making propensities of given land uses and types of development have led to the formulation of trip generation rates. In simplified travel demand forecasting, trip ends are often estimated by applying these empirically-determined trip generation rates. Rates for a variety of land uses, including residential developments, may be found in technical reference documents such as the Institute of Transportation Engineers' (ITE) *Trip Generation* manual.[D] The data found in these documents typically include average weekday and peak hour rates that correspond with the peak periods of commuter traffic. A wide assortment of land uses, including multi-family residential, commercial office, and lodging are covered.

For multi-family residential development, the independent variable is typically the number of dwelling units, and trip generation is stated in terms of trip ends per dwelling unit. For commercial-office uses, the variable is typically the gross floor area (in square feet), and trip generation is trip ends per 1,000 square feet of area.

[D] *Trip Generation*, 9th Edition, Volume 3 of 3, Institute of Transportation Engineers, latest edition available.

Trip Reduction

The convenient and price-sensitive availability of transit service to and from a given project site can also reduce private vehicle trips. The City provides a municipally operated transit system called the "Torrance Transit" serving the South Bay region of Los Angeles County. In addition, the proliferation of private taxi services such as Uber and Lyft are having an impact on how small groups of people routinely travel to certain destinations and venues. Due to the uncertain benefit of these services, trip reduction estimates were not used to estimate future traffic related impacts.

Trip Distribution/Trip Assignment

In addition to trip generation, travel demand forecasting also includes trip distribution and trip assignment. Trip distribution signifies by general direction (i.e., east, west, north, and south) the percentage of all traffic generated to and from a given project site. Trip assignment identifies the routes used by traffic generated to and from a given project site. These steps are often combined for small projects and/or areas of analysis. Trip distribution/trip assignment is used to predict the patterns of traffic generated by a project site, taking into consideration several factors, including: existing traffic patterns; existing land use and proposed land use; surrounding land uses; volumes of traffic on streets and highways; the traffic carrying capacity of these streets and highways; and site access (e.g., turn movement) restrictions.

Ambient Growth

In order to effectively estimate traffic conditions at the *Project* occupancy target year of 2019, an ambient growth factor was included in the evaluations. Volumes recorded in 2016 for study roadways and intersections were multiplied by one percent per year for each of the three years leading to 2019 conditions – the estimated date of occupancy for the *Project*.

Other Development

Additionally, assumed trips from the neighboring "*Solana Torrance*" development were also included in the analysis since their potential occupancy falls within the 2019 timeframe. The estimated trip generation from the "*Solana Torrance"* project (based upon the most current plan for 248 units) is as follows: 1,650 daily trips; 126 A.M. peak hour trips – 25 inbound, 101 outbound; 154 P.M. peak hour trips – 100 inbound, 54 outbound. The peak hour volumes were added to the movements through the Via Valmonte/Hawthorn Boulevard intersection to estimate the future intersection level of service conditions under the 2019 scenario.

IV. TRIP GENERATION

Trip generation for the proposed *Project* can be estimated by applying known trip generation rates for the various proposed uses. For urban settings, trip generation is calculated for an average weekday (24-hour period, and for the morning and afternoon peak hours of weekday commute (typically 7:00 to 9:00 A.M. and 4:00 to 6:00 P.M.) on streets serving a given project). For the proposed *Project* uses, the ITE *Trip Generation* manual provides the following definitions:

Land Use Code 220 – Apartments

Per ITE Land Use Code 220, "apartments" is defined as "rental dwelling units that are located within the same building with at least three other dwelling units." Additionally, with respect to analyzing potential traffic impacts associated with residential condominiums/townhouses, "the peak hour of the generator typically coincides with the peak hour of the adjacent street traffic."[E]

Land Use Code 715 – Single Tenant Office Building

Per ITE Land Use Code 715, "single tenant office building" consists of offices, meeting rooms and space for storage and data processing for a single business or company. Additionally, with respect to analyzing potential traffic impacts associated with residential condominiums/townhouses, "the peak hour of the generator typically coincides with the peak hour of the adjacent street traffic."[F]

As indicated in Table IV, the proposed *Project* is estimated to generate a total of 15 trip ends (9 inbound and 6 outbound) and 16 trip ends (6 inbound and 10 outbound), during the A.M. and P.M. peak hours, respectively.

TABLE IV - SUMMARY OF MULTI-USE DEVELOPMENT TRIP GENERATION

WEEKDAY A.M. PEAK HOUR OF ADJACENT STREET TRAFFIC

Land Use Category (Code)[1]	Size[2]	Trip Rate[3]	Inbound/ Outbound[3]	Inbound Trip Ends[4]	Outbound Trip Ends[4]	Total Trip Ends[4]
Mid Rise Apartment (220)	13 DU	.51/DU	20%80%	2	5	7
Single Tenant Office (715)	4,500 SF	1.80/KSF	89%/11%	7	1	8
Total A.M. Peak Hour Trips				9	6	15

WEEKDAY P.M. PEAK HOUR OF ADJACENT STREET TRAFFIC

Land Use Category (Code)[1]	Size[2]	Trip Rate[3]	Inbound/ Outbound[3]	Inbound Trip Ends[4]	Outbound Trip Ends[4]	Total Trip Ends[4]
Mid Rise Apartment (220)	13 DU	.62/DU	65%/35%	5	3	8
Single Tenant Office (715)	4,500 SF	1.74/SF	15%/85%	1	7	8
Total P.M. Peak Hour Trips				6	10	16

Notes:
1 - Land Use Code Per *Trip Generation Manual*, 9th Ed., Institute of Transportation Engineers.
2 - DU = Dwelling Units, SF = Square Feet, KSF = 1,000
3 - Trip Generation Rate & Percentage of Inbound/Outbound Trips Per *Trip Generation Manual*, 9th Ed., ITE
4 - All Trip Ends Rounded Up to Nearest Whole Unit

[E] *Trip Generation*, Volume 2 of 3, 9th Edition, Institute of Transportation Engineers, 2012
[F] *Trip Generation*, Volume 2 of 3, 9th Edition, Institute of Transportation Engineers, 2012

V. TRIP DISTRIBUTION/TRIP ASSIGNMENTS

Trip distribution and trip assignments for the proposed *Project* were formulated based upon observations of existing traffic, known regional travel patterns and turn movement restrictions.

Trip Distribution

Based on known trip making propensities and travel routes taken by those residing, working, and traveling within the regional proximity of the proposed *Project*, trip distribution assumptions were formulated. The distribution percentages of inbound and outbound trips generated by the proposed *Project* are depicted in Figure 10.

Trip Assignments

Based on the trip distribution assumptions, trip assignments were made. These trip assignments were based on constraints affecting roadways and intersections; direction (i.e., inbound or outbound) and time of day (i.e., A.M. or P.M. peak hour) of travel; and traffic control devices that regulate the flow of traffic on the streets and highways network. Inbound and outbound trips generated by the proposed *Project* during the A.M. and P.M. peak hours of weekday commute were assigned to available movements through the study intersection based on trip distribution percentages in each direction from the *Project* site. These inbound and outbound trip assignments during the A.M. and P.M. peak hours are depicted in Figure 11.

Existing Traffic – Year 2017 Conditions

Existing traffic at study roadway segments and intersections were documented by directional peak hour (i.e., A.M. and P.M. peak hours of weekday commute) turn movement counts – taken in April 2016. The turn movement counts were then increased by a growth factor of one percent to estimate 2017 volumes (Figure 12).

Existing + Ambient Growth + Project – Year 2019 Conditions

Adding additional ambient growth traffic (i.e., one percent per year for two years) to 2017 existing traffic, plus the anticipated *Project* trips at the study intersection during the A.M. and P.M peak hours of weekday commute are illustrated in Figure 13.

Project + Other Development Traffic – Year 2019 Conditions

Adding the estimated number of trips generated by the proposed "*Solana Torrance"* development to the 2019 *Project* traffic at the study intersection during the A.M. and P.M peak hours of weekday commute are illustrated in Figure 14. It is important to note that under this scenario, an additional separate left turn lane was included in the eastbound approach to the intersection due to off-site improvements slated for the "*Solana Torrance"* development.

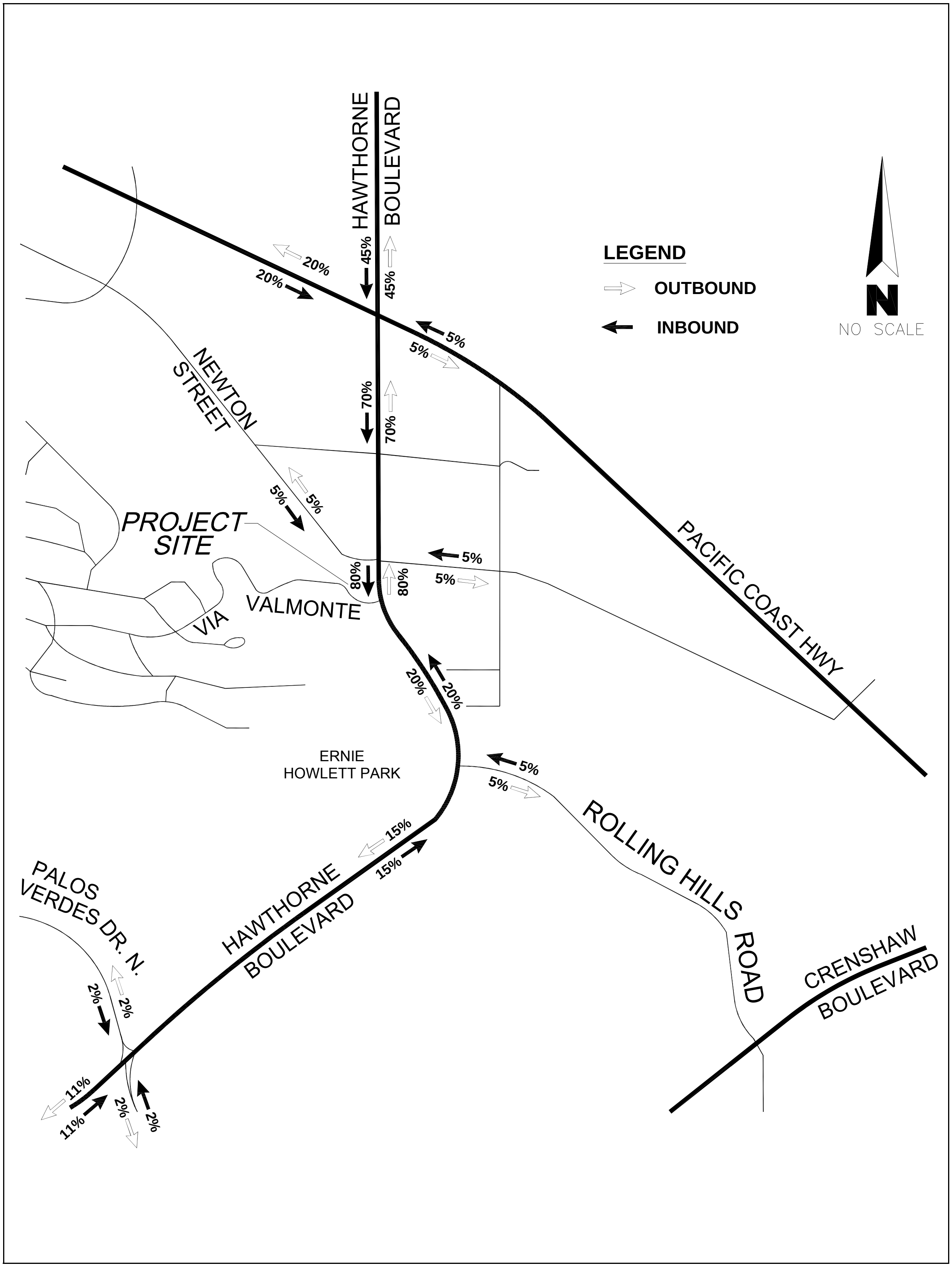

Figure 10 – Trip Distribution Assumptions

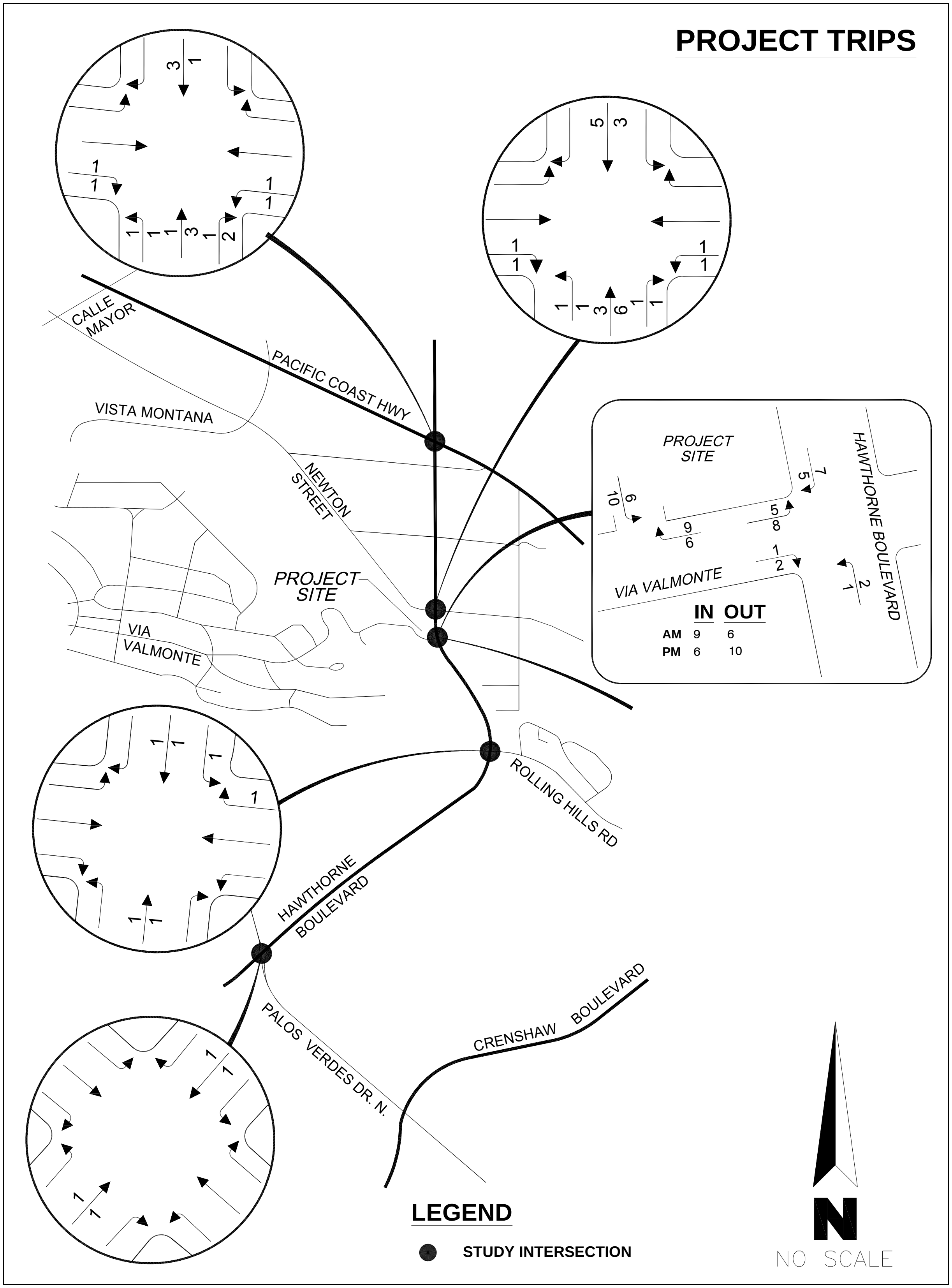

Figure 11 – Peak Hour "Project-Only" Trip Assignments

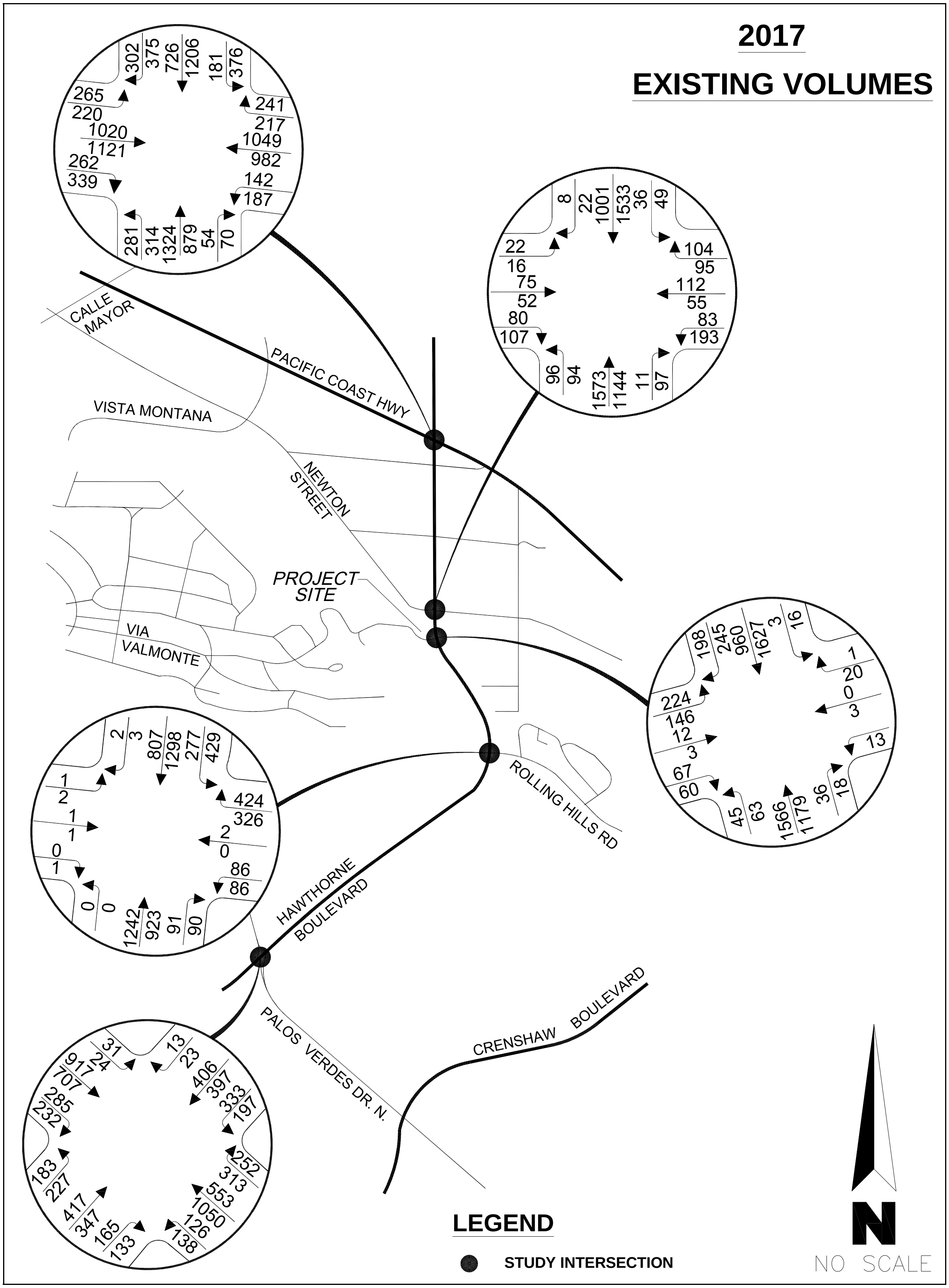

Figure 12 – 2017 Existing Peak Hour Intersection Traffic Volumes

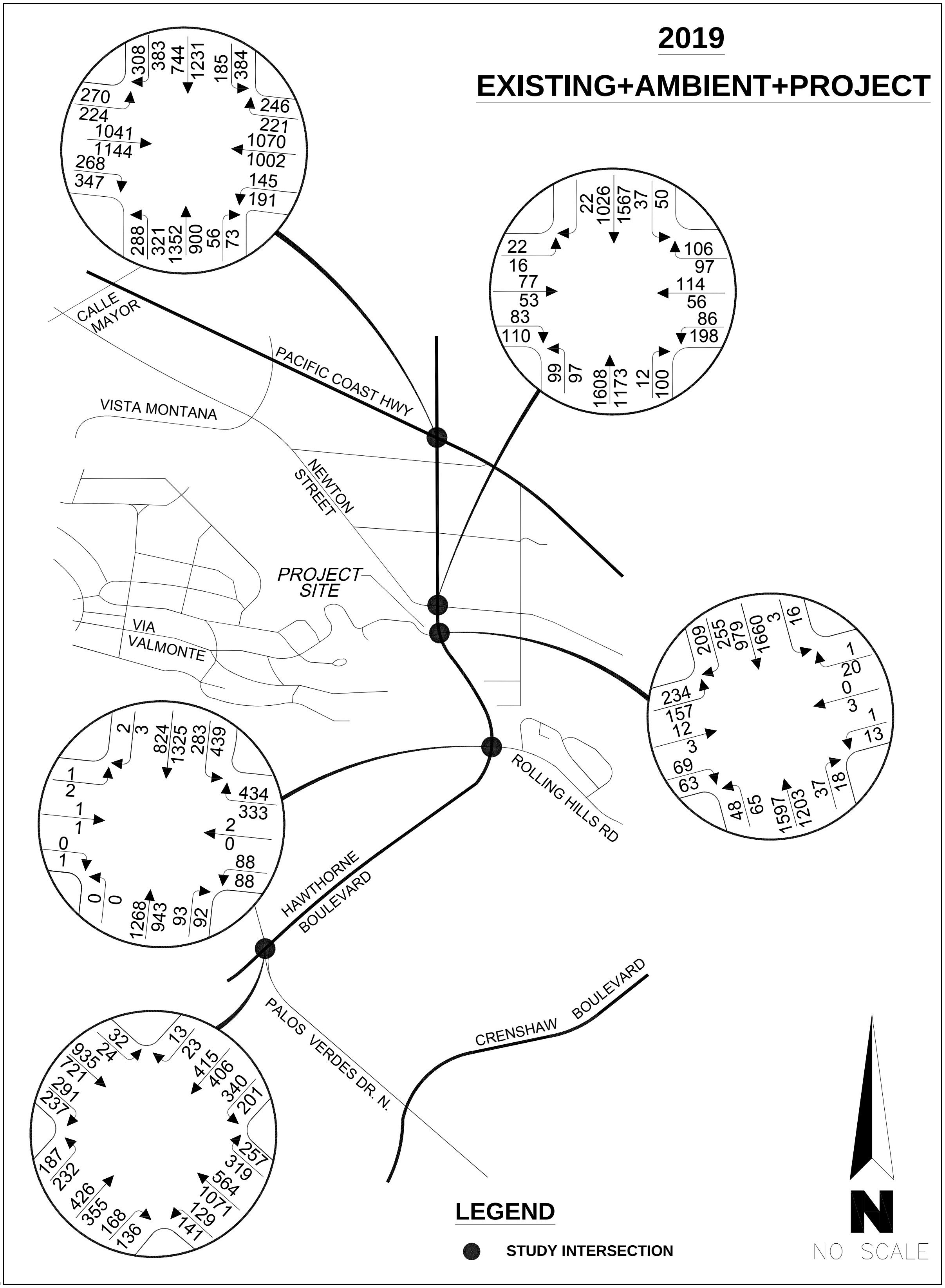

Figure 13 – 2019 Existing +Ambient + Project Peak Hour Intersection Traffic Volumes

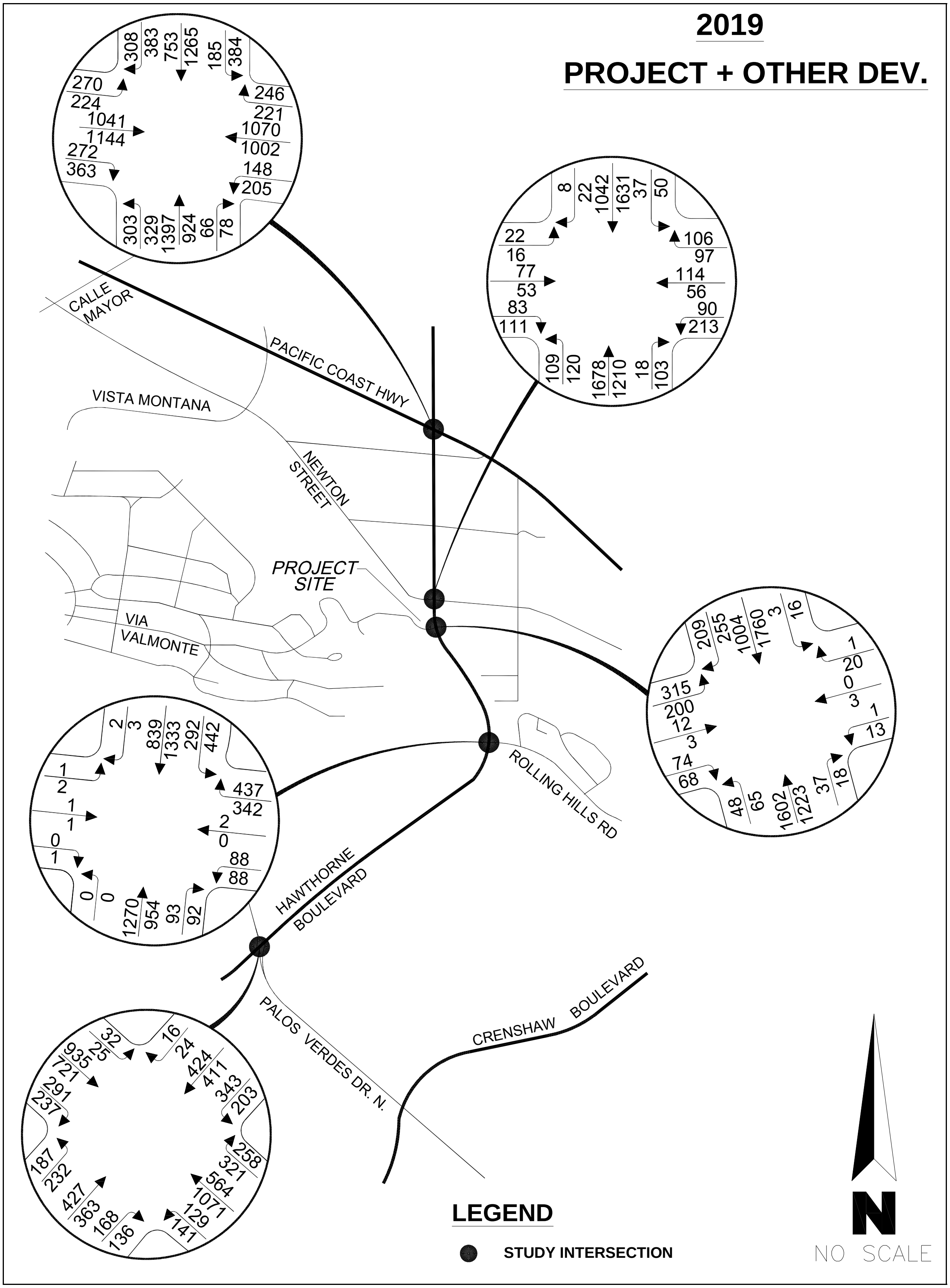

Figure 14 – Project + Other Development Peak Hour Intersection Traffic Volumes

VI. EXISTING & FUTURE LEVELS OF SERVICE

Future traffic conditions resulting from additional development may be predicted by performing a travel demand forecast. Such forecasts vary in magnitude and complexity, but at minimum include defining the streets and highways network of interest; estimating the amount of traffic generated by a given development or geographic area; determining the area-wide distribution of this traffic; and assigning it to specific portions of the streets and highways network. In order to determine the magnitude and impact of additional traffic generated onto streets surrounding the project site, a travel demand forecast of future traffic conditions was undertaken for the proposed *Project*. Using existing traffic counts, applying the annual growth factor, and employing trip generation, distribution and assignment of traffic, as described in Section V, existing and future intersection levels of service can be determined.

Both the ICU and the HCM methodologies were employed to determine intersection levels of service for the study intersections. For the 2019 Project and Other Development estimates, the estimated trip generation from the proposed "*Solana Torrance"* development was included in the analyses.

Existing (2017) & Ambient Growth (2019) Intersection LOS – ICU Method

Existing intersection LOS, as calculated using the ICU method, are summarized in Table V for the intersection studied. Turn movement counts for existing traffic were taken in April 2016. The ambient growth factor (i.e., one percent per year for one year) was then added to the existing volumes to estimate current 2017 conditions. Another two years of ambient growth was used to evaluate 2019 conditions. The ICU calculation forms may be found in the Appendix section of this report. As shown in the Table V, the study intersections operate within acceptable levels of service under both scenarios.

TABLE V – EXISTING (2017) & AMBIENT + PROJECT (2019)
ICU METHOD LOS

	2017 EXISTING[1,2]				2019 AMBIENT + PROJECT[2]			
	A.M. Peak Hour		P.M. Peak Hour		A.M. Peak Hour		P.M. Peak Hour	
Intersection	**ICU**	**LOS**	**ICU**	**LOS**	**ICU**	**LOS**	**ICU**	**LOS**
Hawthorne Blvd/Pacific Coast Hwy	0.878	D	0.870	D	0.894	D	0.886	D
Hawthorne Blvd/Newton St.	0.604	B	0.737	C	0.615	B	0.750	C
Hawthorne Blvd/Via Valmonte	0.576	A	0.633	B	0.586	A	0.643	B
Hawthorne Blvd/Rolling Hills Rd.	0.658	B	0.606	B	0.670	B	0.617	B
Hawthorne Blvd/Palos Verdes Dr.N	0.764	C	0.709	C	0.778	C	0.721	C

[1] Intersection Counts Taken by NDS, April 2016
[2] Annual Growth Rate of 1 Percent per Year

Project 2019 and Other Development Intersection LOS – ICU Method

Future *Project* 2019 *and Other Development"* LOS, as calculated using the ICU method, are summarized in Table VI for the intersections studied. These estimates included planned capital improvements at the Hawthorne Boulevard/Pacific Coast Highway intersection and an additional separate left turn lane in the eastbound approach to the Hawthorne Boulevard/Via Valmonte intersection due to off-site improvements slated for the "*Solana Torrance"* development. As shown in the table, the intersections are estimated to continue to operate within acceptable levels under both scenarios.

TABLE VI – 2019 PROJECT + OTHER DEVELOPMENT TRAFFIC
ICU METHOD LOS

	2019 + PROJECT				2019 + OTHER DEV.[2]			
	A.M. Peak Hour		P.M. Peak Hour		A.M. Peak Hour		P.M. Peak Hour	
Intersection	ICU	LOS	ICU	LOS	ICU	LOS	ICU	LOS
Hawthorne Blvd/Pacific Coast Hwy	0.747	C	0.755	C	0.756	C	0.769	C
Hawthorne Blvd/Newton St.	0.618	B	0.753	C	0.636	B	0.791	C
Hawthorne Blvd/Via Valmonte	0.512	A	0.598	A	0.538	A	0.632	B
Hawthorne Blvd/Rolling Hills Rd.	0.670	B	0.618	B	0.673	B	0.622	B
Hawthorne Blvd/Palos Verdes Dr.N	0.778	C	0.722	C	0.780	C	0.724	C

[2] Other Development Includes Estimated Trips from the Proposed "Solana Torrance" Project

Intersection LOS – HCM Method

"Existing 2017" and "2019 Ambient+Project" LOS, as calculated using the HCM method, are summarized in Table VII for the intersections studied. The "+Other Development" scenario is shown in Table VIII. The HCM calculation forms may be found in the Appendix section of this report. As indicated in Table VII, most of the intersections operate within acceptable LOS under existing conditions with the exception of Hawthorne Boulevard/Pacific Coast Highway at LOS E during the P.M. and Hawthorne Boulevard/Palos Verdes Drive North at LOS E during the A.M. Under the 2019 + Project scenario, the Hawthorne Boulevard/Pacific Coast Highway intersection improves with the planned capital improvements to that intersection. Table VIII shows the same results for the intersections with the additional traffic from the neighboring "*Solana Torrance*" project and the additional left turn lane in the eastbound approach.

VII. SITE CIRCULATION, PARKING, AND QUEUING ANALYSIS

Site access, internal circulation, and parking for the proposed *Project* were analyzed by reviewing the *Project* site plan and other constraints and opportunities. Additionally, the City of Torrance requested a queuing analysis be prepared for the eastbound approach leg of the Via Valmonte/Hawthorne Boulevard intersection to determine potential impacts from future left turn movements.

TABLE VII – EXISTING (2017) & AMBIENT + PROJECT (2019)
HCM METHOD LOS

	2017 EXISTING[1,2]				2019 AMBIENT + PROJECT[2]			
	A.M. Peak Hour		P.M. Peak Hour		A.M. Peak Hour		P.M. Peak Hour	
Intersection	**Delay[3]**	**LOS**	**Delay[3]**	**LOS**	**Delay[3]**	**LOS**	**Delay[3]**	**LOS**
Hawthorne Blvd/Pacific Coast Hwy	50.3	D	67.2	E	38.0	D	48.7	D
Hawthorne Blvd/Newton St.	10.4	B	11.9	B	10.7	B	12.1	B
Hawthorne Blvd/Via Valmonte	18.3	B	17.5	B	18.3	B	17.6	B
Hawthorne Blvd/Rolling Hills Rd.	17.5	B	13.7	B	18.6	B	13.6	B
Hawthorne Blvd/Palos Verdes Dr.N	55.3	E	31.2	C	56.8	E	31.8	C

[1] Intersection Counts Taken by NDS, April 2016
[2] Annual Growth Rate of 1 Percent per Year for 3 Years
[3] Worst Case Direction Average Intersection Delay Per Vehicle (In Seconds)

TABLE VIII – 2019 PROJECT + OTHER DEVELOPMENT TRAFFIC
HCM METHOD LOS

	PROJECT + OTHER[2]			
	A.M. Peak Hour		P.M. Peak Hour	
Intersection	**Delay[3]**	**LOS**	**Delay[3]**	**LOS**
Hawthorne Blvd/Pacific Coast Hwy	40.6	D	52.1	D
Hawthorne Blvd/Newton St.	11.0	B	13.0	B
Hawthorne Blvd/Via Valmonte	18.7	B	18.0	B
Hawthorne Blvd/Rolling Hills Rd.	18.7	B	13.6	B
Hawthorne Blvd/Palos Verdes Dr.N	57.6	E	32.2	C

[1] Project Related Trips Per Trip Distribution and Turn Movement Restrictions and Opportunities
[2] Cumulative Developments – Volumes Based Upon Various Trip Distribution Percentages for Each Region
[3] Worst Case Direction Average Intersection Delay Per Vehicle (In Seconds)
[4] Includes Planned Capital Improvements to that Intersection

Site Access, Circulation and Parking

A review of the site plan for the proposed *Project* reveals a simple, yet efficient, circulation system with convenient access to the *Project* via two driveways - one entrance driveway on Via Valmonte and one exit driveway further west (approximately 200 feet) on Via Valmonte. Within the property, driveways lead directly to surface lot parking as well as a multi-level subterranean parking garage. Within the parking structure, parking spaces and drive aisles are appropriately sized to accommodate resident and guest parking. Appropriately-sized fire lanes and maintenance roads are also provided on site. Off-site street improvements include road widening and construction of new sidewalks and curb/gutter along the frontage of the *Project* on both Via Valmonte and Hawthorne Boulevard. Additional on-site improvements include landscaping features throughout the property.

Intersection Queuing Analysis

The City of Torrance requested, as part of the TIS, that a queuing analysis be performed for the eastbound approach to the Via Valmonte/Hawthorne Boulevard intersection. The queuing analysis was intended to show the number of vehicles that typically wait for the left turn movement onto northbound Hawthorne Boulevard during the A.M. peak hour. Between 7:00 A.M. and 8:00 A.M, on May 24, 2016, a survey was taken to identify the number of vehicles waiting in the left turn lane at each traffic signal cycle. On March 9, 2017, an updated, follow-up survey was conducted at the same location. As a result of averages from both surveys, a total of 108 vehicles turned left at the eastbound approach and there were a total of 40 traffic signal cycles. This results in an hour long average of 2.7 vehicles turning left per cycle.

Subsequent to these field surveys, for this revised study, the City asked that the queueing analysis consider the same number of left turn vehicles as recorded during the traffic volume counts (conducted on April 13, 2016). The recorded number of left turning and through moving vehicles during the A.M. peak hour was 234. There were also 66 vehicles turning right onto southbound Hawthorne Boulevard. Additionally, the City asked that the right turning vehicles be included in the queueing analysis even though they clearly were observed (during the two survey days) as having enough room to turn right without waiting in the left turn lane. Adding the right turning vehicles brings the total to 300 vehicles. Applying a 1 percent growth factor for a 2017 estimate equates to 303 vehicles. Again assuming 40 traffic cycles at 90 seconds each, the average queue (inclusive of all left, through and right turning vehicles) is 7.6 vehicles.

In order to estimate the impact of additional *Project* related trips to the eastbound queue, the trip generation/distribution during the A.M. peak hour, as shown in Figure 7, was added to the vehicles. A total of five left turning and one right turning *Project* vehicle leaving the site from the Via Valmonte driveway during the peak hour, added to the recorded 303 vehicles brought the total of all eastbound traffic presumably waiting in the left turn queue to 309 vehicles during the A.M. hour with *Project* buildout. Assuming the same number of 40 traffic signal cycles, the average queue for this total is 7.7 vehicles during the A.M. peak hour. With a distance of nearly 200 feet between the proposed exit driveway and the Via Valmonte intersection, there should be adequate space for at least eight vehicles in the existing left turn queue.
The City is recommending that at least two vehicle lengths be available (open) between the proposed exit driveway and the back of the average queue. Assuming an excessive, worst case vehicle length of 25 feet, the average queue (in 150 feet) would be six vehicles. To reduce the estimated vehicle queueing in the eastbound approach with *Project* buildout (i.e., from 7.7 vehicles to six), it is recommended that the centerline striping be realigned to the north to create a separate right turn/through lane in the eastbound direction (i.e., in addition to the left turn lane).

This is made possible by the proposed road widening along the *Project* frontage creating enough room to realign the centerline striping. Removing the through and right turning vehicles from the queue analysis results in an estimated total of 229 left turning vehicles with *Project* buildout. Again, with a 90 second cycle length, the average queue for each cycle would drop to 5.8 vehicles – less than the maximum six vehicles in the left turn queue noted above..

The City also requested that we analyze left turn queuing with the buildout of the neighboring *"Solana Torrance"* development, utilizing the additional left turn lane slated as part of that project. Constructing a second left turn lane for the eastbound approach to the intersection could potentially equate to 250 feet of queuing distance (125 feet for each lane), which should accommodate approximately 10 vehicles (at 25 feet each). The *"Solana Torrance"* project is estimated to add another 81 left turning vehicles bringing the estimated total to 310 vehicles. Dividing that number by 40 cycles equates to an average of 7.8 vehicles per cycle. With a left turn queuing capacity of 10 vehicles (five vehicles in each lane), there should be adequate space within the eastbound lanes to accommodate future demands with both projects.

VIII. STUDY FINDINGS, CONCLUSIONS, & RECOMMENDATIONS

The *Project* site contains 23,657 square feet of vacant land area, of which 13,500 square feet are proposed for a multi-family residential building, and 4,500 square feet are proposed for professional office use. The residential community will consist of 13 multi-family dwelling units and 26 parking spaces, and the commercial space will be served by 15 parking spaces. The potential traffic impacts associated with the proposed *Project* were documented and analyzed in this Traffic Impact Study by focusing on the intersection of Via Valmonte and Hawthorne Boulevard. The City also required that traffic impacts associated with construction of the neighboring *"Solana Torrance"* project be analyzed. The findings and conclusions are as follows:

Study Findings

Based on the documentation and analyses presented herein, the following study findings were made:

1) Traffic counts taken in mid-April 2016 were used as a basis for this study and an annual one percent, per year growth factor was applied to estimate 2017 and 2019 conditions.

2) By the *Project* target year of 2019, the *Project* is estimated to generate a total of 15 A.M. and 16 P.M. peak hour trips ends, respectively.

3) The potential for "internal capture" of vehicle trips will be present, however, the percentage of such trip reduction is uncertain.

4) While the *Project* will generate some degree of regular transit use, thus potentially reducing private vehicle trips, the percentage of such trip reduction is uncertain.

5) Based on the current site plan for the *Project*, vehicular access will be provided via two future driveways on Via Valmonte - one entrance driveway and one exit driveway.

6) An additional left turn lane in the eastbound approach leg of the Via Valmonte/Hawthorne Boulevard intersection is slated for construction with the development of the proposed "Solana Torrance" development located directly across the street from this *Project*. This intersection was evaluated with and without the proposed second left turn lane (in case the Solana project is not constructed).

Study Conclusions

Based on the above study findings, the following study conclusions were reached:

1) Since the traffic counts take into consideration current vacant land uses, traffic generated by any previous developments cannot be deducted from the amount of traffic projected to be generated by the *Project* site.

2) The potential use of transit was not taken into consideration in reducing the amount of traffic projected to be generated by the *Project*.

3) The five studied intersections were analyzed for "Levels of Service" (LOS) using three scenarios: existing 2017 volumes, ambient growth plus *Project* 2019 volumes, and Project plus other cumulative development, 2019 volumes for both the A.M. and P.M. peak hours.

4) The intersections were analyzed using two methods – Intersection Capacity Utilization (ICU), and Highway Capacity Manual (HCM) (see Appendices).

5) Using existing counts and including the ambient growth factor, the 2017 ICU LOS at the study intersections, during both the A.M. and P.M. peak hours of weekday commute, fall within acceptable limits.

6) In the target year of 2019, with the addition of ambient growth, the ICU LOS at the study intersections during both the A.M. and P.M. peak hours of traffic increased slightly with no changes to the LOS designations.

7) In the target year 2019, with the addition of *Project* traffic and other cumulative development traffic, the ICU LOS at each of the study intersections during both the A.M. and P.M. peak hours of traffic are projected to stay within acceptable limits.

8) Using the HCM methodology to determine levels of service for the studied intersections revealed similar results in LOS (as the ICU method) with the exception of the Hawthorne Boulevard/Pacific Coast Highway intersection at LOS E in the P.M. and the Hawthorne Boulevard/Palos Verdes Drive

North intersection in LOS E in the A.M. Intersection delays increased only slightly with each scenario with no deterioration in LOS during both peak hours of traffic.

9) The roadway connections and parking provisions depicted on the current site plan for the *Project*, appear to be well situated relative to the surrounding public streets and highways network.

10) A queuing analysis performed (including two separate field traffic surveys) for the eastbound approach to the Via Valmonte/Hawthorne Boulevard intersection revealed that the hour long average of vehicles waiting within the left-turn lane during the A.M. peak hour was 2.7 vehicles.

11) Per the City's request, estimating queueing using a higher volume of recorded traffic taken during peak hour counts in April 2016, plus adding right turning vehicles in the left turning queue, and applying a one percent annual growth factor results in an estimated existing average queue of 7.6 vehicles for 2017.

12) The distance between the proposed exit driveway and the Via Valmonte /Hawthorne Blvd. intersection is nearly 200 feet which could accommodate at least eight vehicles. The City's request to have at least a two vehicle clearance would indic`ate a maximum of six vehicles in the left turn queue.

13) Realigning the centerline striping (made possible with the additional roadway improvement along the *Project* frontage) could create a separate through/right turn lane. Removing the through and right turning vehicles from the left turn queue would result in an estimated 5.8 vehicles with *Project* buildout – less than the maximum six vehicles in the left turn queue noted above.

14) As part of the proposed *"Solana Torrance"* development, a second left turn lane was considered in an additional queuing analysis along with estimated additional trips from that development. Under these conditions, the average left turn queue would be 7.8 vehicles which can be accommodated with two left turn lanes in the eastbound approach – a capacity of 10 vehicles.

IX. REFERENCES

1. City of Torrance General Plan, *Circulation and Infrastructure Element*, April 2010.
2. Institute of Transportation Engineers' (ITE) *Trip Generation* manual, 9TH Ed., 2012.
3. City of Torrance "Citywide Traffic Analysis," June 2008.
4. Caltrans' *Guide for the Preparation of Traffic Impact Studies*, December 2002.
5. Transportation Research Board, *Highway Capacity Manual*, HCM2010, 2010.

APPENDIX SECTION