APPENDIX H

TRAFFIC IMPACT ANALYSIS

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TRANSPORTATION ASSESSMENT

PORTUGUESE BEND LANDSLIDE REMEDIATION PROJECT

City of Rancho Palos Verdes, California
January 19, 2023

Prepared for:

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LLG Ref. 1-20-4386-1

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TRANSPORTATION ASSESSMENT

PORTUGUESE BEND LANDSLIDE REMEDIATION PROJECT

City of Rancho Palos Verdes, California
January 19, 2023

1.0 INTRODUCTION

This transportation assessment has been conducted to identify and evaluate the potential transportation impacts associated with the implementation of the proposed Portuguese Bend Landslide Remediation Project (i.e., referred to herein as the "Project") on the surrounding street system. The site location and general vicinity are shown in ***Figure 1–1***.

The transportation assessment follows City of Rancho Palos Verdes' transportation impact study requirements. This transportation assessment evaluates potential construction-related transportation impacts at four (4) key intersections in the vicinity of the project site. The Highway Capacity Manual (HCM) methodology was used to determine the delay and corresponding Levels of Service for the study intersections.

This study (i) presents existing traffic volumes, (ii) forecasts existing-plus-construction (project) traffic volumes, (iii) determines proposed construction (project)-related impacts, and (iv) identifies mitigation measures, where necessary.

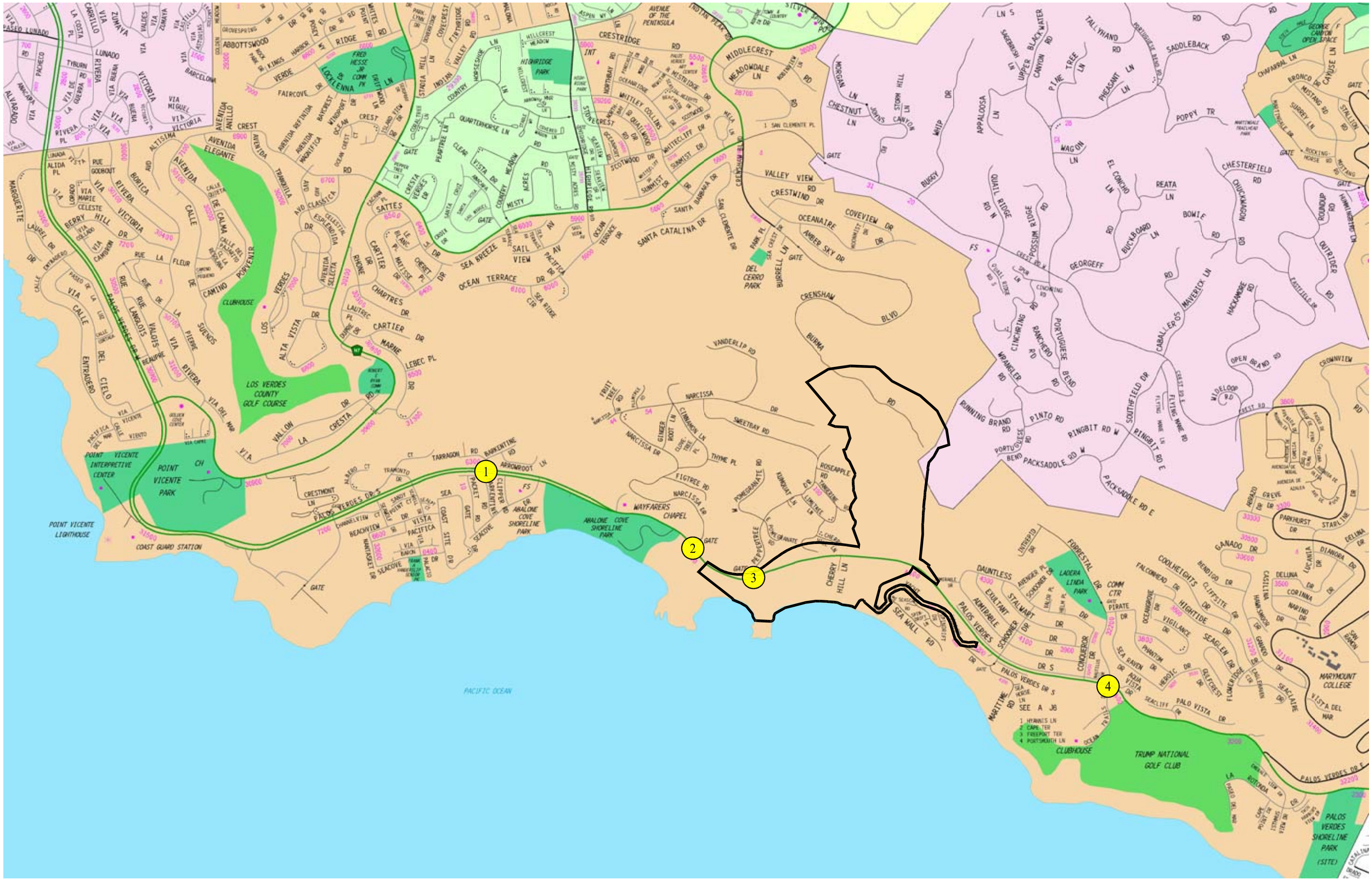
1.1 Study Area

The general location of the project in relation to the study locations and surrounding street system is presented in *Figure 1–1*. The transportation assessment study area is comprised of those locations which have the greatest potential to experience significant traffic impacts due to the proposed construction activities associated with the project. In the traffic engineering practice, the study area generally includes those intersections that are:

a. Immediately adjacent or in close proximity to the project site;

b. In the vicinity of the project site that are documented to have current or projected future adverse operational issues; and

c. In the vicinity of the project site that are forecast to experience a relatively greater percentage of project-related vehicular turning movements.



MAP SOURCE: RAND MCNALLY & COMPANY

N

= STUDY INTERSECTION

= PROJECT AREA

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FIGURE 1-1
VICINITY MAP

PORTUGUESE BEND LANDSLIDE REMEDIATION PROJECT

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The locations selected for analysis were based on the above criteria, forecast peak hour construction trip generation, anticipated distribution of vehicle trips, and existing intersection/corridor operations. Four (4) intersections were selected for analysis as they provide local access to the area, meet the above criteria, and define the extent of the boundaries for this transportation impact investigation. Further discussion of the existing street system and study area is provided in Section 4.0 herein.

1.2 Overview of Senate Bill 743

On September 27, 2013, Governor Brown signed Senate Bill (SB) 743. Under SB 743, the focus of transportation analysis pursuant to CEQA shifts from driver delay, or level of service (LOS), to reduction of vehicle miles traveled (VMT), reduction in greenhouse gas emissions, and creation of multimodal networks and promotion of mixed-use developments. In December 2018, the California Natural Resources Agency certified and adopted amendments to the CEQA Guidelines implementing SB743 with an implementation date of July 1, 2020. The City of Rancho Palos Verdes has not yet adopted guidelines or significance thresholds for VMT analyses associated with projects. As such, this assessment utilizes existing, long-established protocols in accordance with current City guidelines, which are intended for application to an individual development project's operational traffic as well as traffic associated with long-range planning projects. Application of these guidelines to this short-term construction project is therefore conservative. Having stated the above, a qualitative VMT analysis may be appropriate for purposes of assessing potential construction-related transportation impacts (i.e., refer to the Section 15064.3(b)(3) of the latest CEQA Guidelines). Therefore, it is assumed that the construction-related traffic associated with the Portuguese Bend Landslide Remediation Project could potentially result in a temporary increase in regional VMT. However, since the traffic anticipated to be generated by this construction project is expected to be temporary and intermittent, any increase in regional VMT resulting from this construction activity is also assumed to be temporary and intermittent.

1.3 Congestion Management Program Status

The Los Angeles County Congestion Management Program (CMP) was previously a state-mandated program that was enacted by the California State Legislature with the passage of Proposition 111 in 1990 that primarily utilized a LOS performance metric. SB 743 contains amendments to current congestion management law that allows counties to opt out of the LOS standards that would otherwise apply in areas where CMPs are utilized. Pursuant to California Government Code §65088.3, local jurisdictions may opt out of the CMP requirement without penalty if a majority of the local jurisdictions representing a majority of the County's population formally adopt resolutions requesting to opt out of the program. As of November 2019, the majority of local agencies representing the majority of the County's population have adopted resolutions to opt out of the program. Therefore, the CMP is no longer applicable in Los Angeles County.

2.0 PROJECT DESCRIPTION

2.1 Existing Site

The Portuguese Bend Landslide (PBL), a component of the City's ancient Landslide Complex, is located along the southern section of the Palos Verdes Peninsula within the City of Rancho Palos Verdes, California (Project Site). The PBL area is approximately 206 acres, however the overall area of land that contributes to the landslide instability is much larger, consisting of approximately 750 acres. The Project Site also includes approximately 104 acres of land located within the City-owned Preserve, specifically within the Portuguese Bend and Abalone Cove Reserves. The Preserve is managed by the Palos Verdes Peninsula Land Conservancy (PVPLC) pursuant to the City Council-adopted Natural Communities Conservation Plan/Habitat Conservation Plan (NCCP/HCP). Public trails within the Preserve are located on the eastern side of the project site and on the seaward side of Palos Verdes Drive South. One park, the Abalone Cove Reserve, is within the project site boundaries and is also designated as a State Ecological Preserve. The PBL is highlighted in an aerial photograph presented in ***Figure 2-1***.

2.2 Proposed Project Description

The geology of the PBL has been studied since the first reported landslide movement in 1956. The PBL has moved at various rates. Horizontal displacement of over 8.5 feet per year has been measured within the eastern and seaward subslides. The continued land movement has resulted in significant infrastructure damage to homes, moving some of them by hundreds of feet onto other properties. It has also resulted in damage to utilities and roadways, including Palos Verdes Drive South, a major transportation route, and to a sanitary sewer trunk line serving tens of thousands of residents of the Palos Verdes Peninsula.. The City of Rancho Palos Verdes and its citizens are seeking to minimize landslide movement to preserve infrastructures, open lands, natural vegetation and recreational features of the Palos Verdes Nature Preserve, reduce soil erosion losses, and reduce health and safety concerns related to the integrity of the surrounding road system, sewer system and other infrastructure. The proposed project involves a series of recommended geotechnical engineering solutions that will include relief of artesian pressure below the landslide basal surface and minimize storm water infiltration into the subsurface. The proposed improvements would include infilling surface fractures to reduce the infiltration of surface water into the ground, constructing surface swales and retention areas to collect, slow, and convey surface water to the ocean, and installing a subsurface water extraction system (hydraugers) by means of directional drilling to alleviate artesian pressure and also to lower groundwater levels within the landslide mass. Each component could be constructed in any order and the timing of each would depend on a number of factors such as funding, permitting, etc. The three (3) construction components are as follows:

- Construction Component I: Surface fracture infilling
- Construction Component II: Surface water improvements
- Construction Component III: Hydraugers

MAP SOURCE: GOOGLE EARTH

= PROJECT AREA

FIGURE 2-1
AERIAL PHOTOGRAPH OF EXISTING PROJECT SITE

PORTUGUESE BEND LANDSLIDE REMEDIATION PROJECT

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The overall staging, access and hydrauger locations are illustrated in ***Figure 2-2***. Descriptions of each construction component are provided in the following subsections.

2.2.1 *Construction Component I: Surface Fracture Infilling*

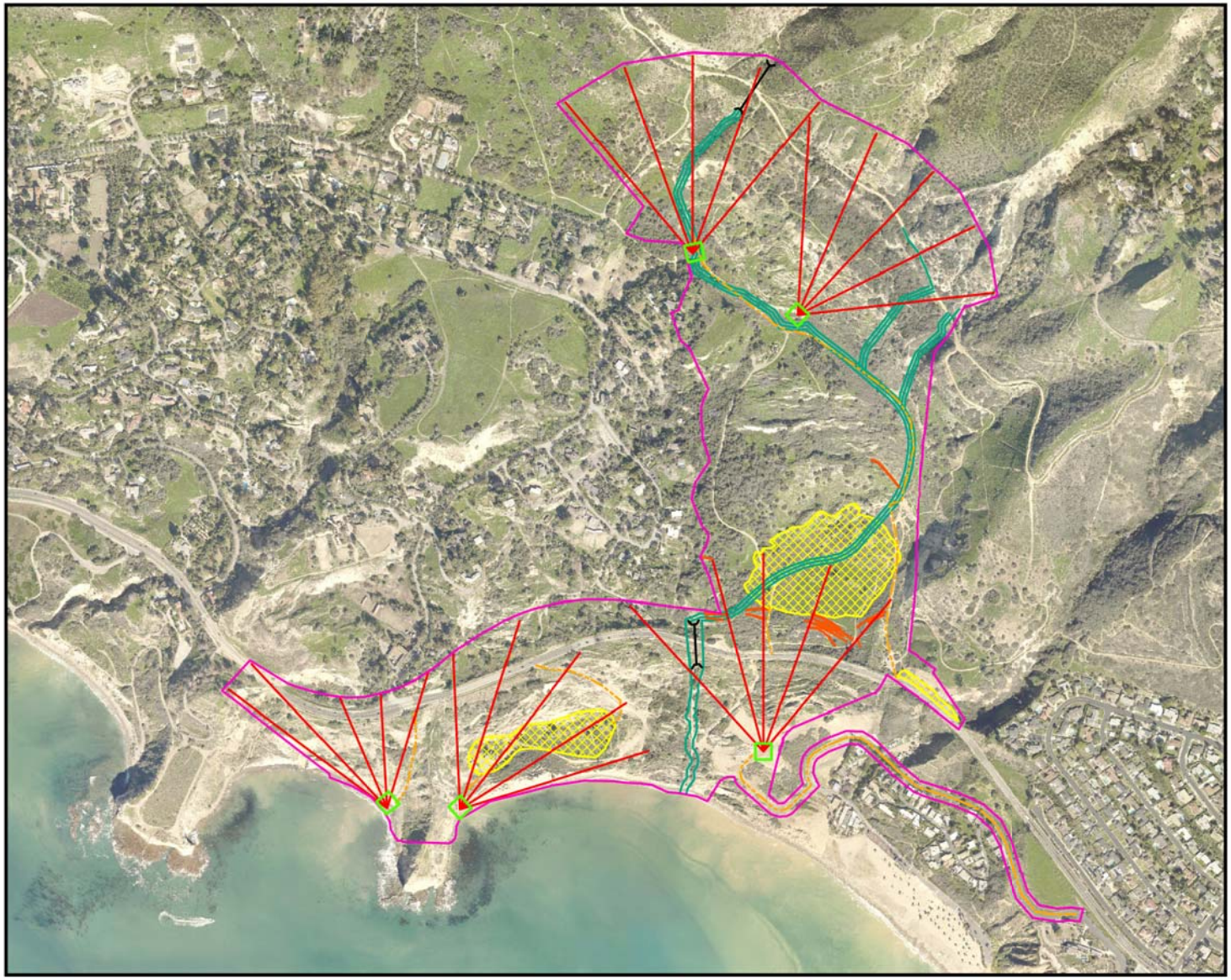
Multiple surface fractures are present throughout the Project Site. A surface fracture can be defined as a long, narrow crack opening observable at the ground surface. Surface fractures are induced by landslide movement and once formed can be extended and eroded by stormwater runoff. They can be hazardous to people living on or near the affected surfaces and damaging to property and infrastructure, as well as to the general public visiting the area and utilizing the trails in the Preserve. The existing surface fractures within the Project Site are a few feet wide and some are as deep as 15 or more feet. These fractures collect stormwater runoff that discharges into the ground. The stormwater runoff enters the fractures where it percolates into the ground and becomes a part of the groundwater which exacerbates landslide movement. The surface fracture infilling will control stormwater runoff infiltrating the ground and will help solving one aspect of the landslide movement.

2.2.2 *Construction Component II: Surface Water Improvements*

The Proposed Project considers installing new surface water improvements and refurbishing existing pipes to minimize soil erosion loss and stormwater ponding and infiltration that contributes to landslide movement. These improvements are described below:

- Engineered Swales: Swales are designed to manage surface stormwater runoff and can be described as shallow channels with gently sloping sides. The Proposed Project would install a network of engineered swales that extend south from Burma Road and traverse through the Project Site. The engineered swales would convey surface runoff from the northern limits of the Project Site, connecting to a new flow reduction area, and travel south underneath Palos Verdes Drive South to the Pacific Ocean. The surface swales would be designed to be visually complimentary to the surrounding setting of the Preserve and lined with context-sensitive vegetation instead of concrete. Erosion control measures, such as geocells and/or riprap will be implemented within swales The designs will be consistent with restoration requirements outlined in the City's Natural Community Conservation Plan and Habitat Conservation Plan (NCCP/HCP) and other resource/regulatory review requirements.

- Flow Reduction Area: A flow reduction area is a detention basin that helps manage the flow of excess stormwater runoff. These areas allow large flows of water to enter but limit the outflow through a small opening. The Proposed Project would install one permanent bentonite-lined flow detention basin that would be approximately 10 acres in size. It would be located approximately 250 feet north of Palos Verdes Drive South within the project limits and connect to the engineered surface swales. The flow reduction area would primarily prevent percolation but will release stormwater at a gradual rate slowing the flow and allowing fine particles of soil to settle within the flow reduction area resulting in sediment-free water to exit the flow reduction area, routing the water through an existing 60-inch pipe



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MAP SOURCE: CHAMBERS GROUP

FIGURE 2-2
ACCESS, STAGING AND HYDRAUGER LOCATIONS

PORTUGUESE BEND LANDSLIDE REMEDIATION PROJECT

that runs under Palos Verdes Drive South, before conveying the water into the Pacific Ocean. It will be designed to use gravity flow only, and no pumps are planned. It is anticipated that stormwater would accumulate in the detention basin only for a period of several hours or less than one day once rain stops. Due to its short duration, the additional weight would not have a substantial effect on landslide stability, however regular maintenance would be needed to remove fine soil particles.

- Underground Pipes: Installation, replacement, and refurbishment of underground piping to properly convey stormwater runoff will be required throughout the Project Site. This includes installing a new durable 36-inch-diameter pipe located below Burma Road; replacing an existing and deteriorating 36-inch-diameter plastic pipe located south of Palos Verdes Drive South; and refurbishing an existing 60-inch-diameter pipe below Palos Verdes Drive South. The intent of this environmentally sensitive solution is to utilize the footprint of the existing pipes and adding pipes with the least impact on the affected areas.

2.2.3 *Construction Component III: Hydraugers*

A groundwater extraction system of pipes, or "hydraugers", would be installed to alleviate artesian water pressure underground in the PBL, which is believed to the main contributor to landslide movement. Where possible, hydraugers would be installed below the side plane to avoid shearing off by landslide movement. Water will exit by controlled pressure flow and/or gravity flow. It will be routed through a storm drain system into the Pacific Ocean. The two hydraugers located within the northern portion of the Project Site will be installed horizontally, beneath the active movement zone of the landslide. The horizontal hydraugers are advanced on a slightly upward slope to promote gravity flow to alleviate artesian water pressure underground. The other three hydraugers in the southern portion of the Project Site will be installed directionally (following the contour of the basal sliding plane). Within the PBL, the hydraugers will be installed sequentially, in fan-shaped patterns. They will extend within City-owned right-of-way or property. The ultimate size of the hydraugers would depend on field conditions (groundwater yield). Depending on site conditions, hydrauger length might reach up to 1,200 feet with a diameter of up to 6 inches. The hydrauger depth will vary, with deepest points reaching up to 400 feet below ground surface.

2.3 Construction Staging Areas and Access Routes

The proposed construction staging areas and access routes for the Portuguese Bend Landslide Remediation project are displayed in *Figure 2-2*. Three staging areas will be utilized during construction to store construction-related equipment and materials (such as construction equipment, construction worker vehicles, construction materials, and stockpiles). Descriptions of the proposed construction staging areas and access routes are provided below.

- *Construction Staging Area 1:*

  The larger staging area is located on the north side of Palos Verdes Drive South. Access to this staging area will be provided via the two existing trail access points located on the north

side of Palos Verdes Drive South (i.e., for the Ishibashi Farm Trail and Klondike Canyon Trail).

- *Construction Staging Area 2:*

  The proposed second staging area is located on the south side of Palos Verdes Drive South. Access to this staging area will be provided via the existing Bow and Arrow/Archery Road access point located on the south side of Palos Verdes Drive South. The use of this area is dependent on property owner approval.

- *Construction Staging Area 3:*

  The third, smaller staging area is the existing dirt/gravel lot located on the north side of Palos Verdes Drive South, west of Schooner Drive-Yacht Harbor Drive. Access to this staging area will either occur via Yacht Harbor Drive/Seawall Road, a private road within the Portuguese Bend Beach Club community, or internally within the project site. An easement or access agreement will be necessary if the Yacht Harbor access is to be used..

2.4 Construction Workers

Construction workers are assumed to travel to the construction site on a daily basis. Based on information provided by City of Rancho Palos Verdes staff, the number of daily construction workers by construction component are provided below:

- Construction Component I (Infilling): 8 workers
- Construction Component II (Swales): 12 workers
- Construction Component III (Hydraugers): 12 workers

Construction worker parking is planned to be provided at construction staging area 3. As noted previously, the proposed staging area 3 is an existing dirt/gravel area located on the north side of Palos Verdes Drive South and can be accessed at the east end of the site.

3.0 EXISTING STREET SYSTEM

3.1 Local Street System

Immediate access to the construction site is provided via Palos Verdes Drive South. The following four (4) study intersections were selected for analysis in order to determine potential traffic impacts related to the proposed construction project:

1. Barkentine Road/Palos Verdes Drive South
2. Narcissa Drive/Palos Verdes Drive South
3. Peppertree Drive/Palos Verdes Drive South
4. Forrestal Drive-Trump National Drive/Palos Verdes Drive South

All of the study intersections selected for analysis are controlled by stop signs with the stop signs facing the minor street approaches. The existing roadway configurations and intersection controls at the study intersections are displayed in ***Figure 3-1***.

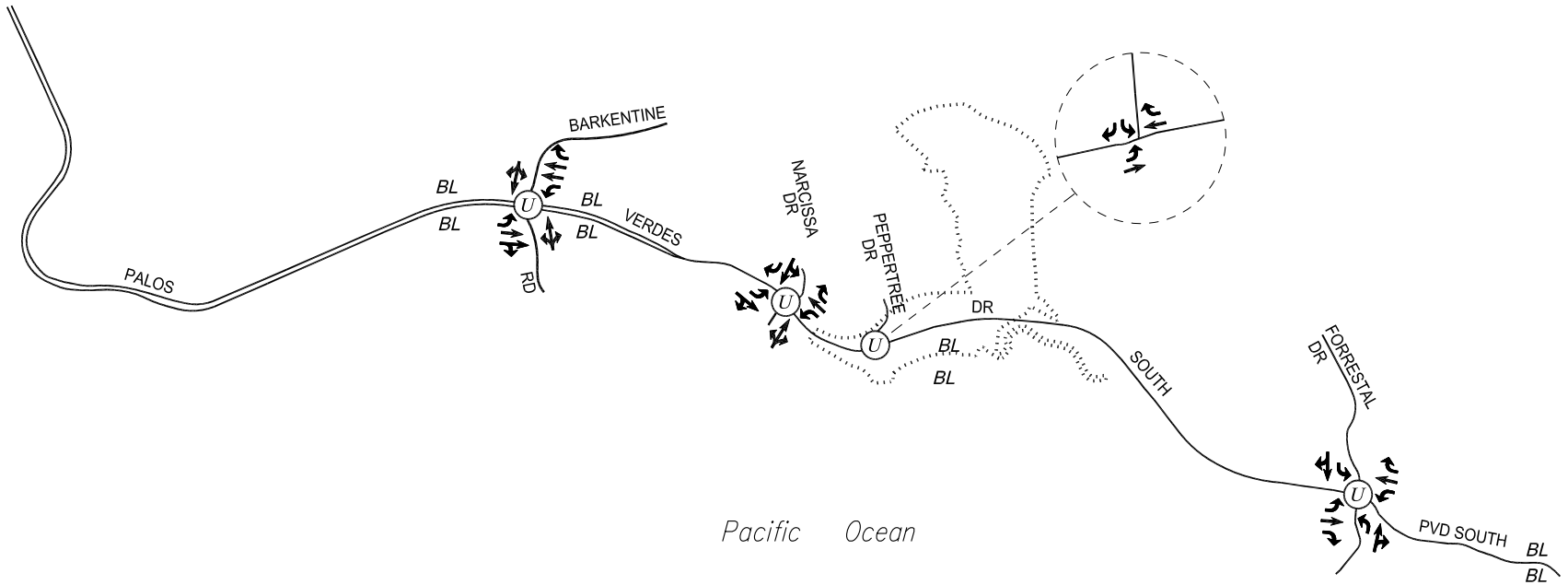
3.2 Roadway Classifications

The City of Rancho Palos Verdes utilizes similar roadway categories recognized by regional, state and federal transportation agencies. There are four general categories in the roadway hierarchy, ranging from freeways with the highest capacity to two-lane undivided roadways with the lowest capacity. The roadway categories are summarized as follows:

- *Freeways* are limited-access and high-speed travel ways included in the state and federal highway systems. Their purpose is to carry regional through-traffic. Access is provided by interchanges with typical spacing of one mile or greater. No local access is provided to adjacent land uses.

- *Arterial* roadways are major streets that primarily serve through-traffic and provide access to abutting properties as a secondary function. Arterials are generally designed with two to six travel lanes and their major intersections are signalized. This roadway type is divided into two categories: major and minor arterials. Major arterials are typically four-or-more lane roadways and serve both local and regional through-traffic. Minor arterials are typically two-to-four lane streets that service local and commuter traffic.

- *Collector* roadways are streets that provide access and traffic circulation within residential and non-residential (e.g., commercial and industrial) areas. Collector roadways connect local streets to arterials and are typically designed with two through travel lanes (i.e., one through travel lane in each direction) that may accommodate on-street parking. They may also provide access to abutting properties.



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NOTES: (U) UNSIGNALIZED INTERSECTION

BL BIKE LANE

FIGURE 3-1
EXISTING LANE CONFIGURATIONS

PORTUGUESE BEND LANDSLIDE REMEDIATION PROJECT

- *Local* roadways distribute traffic within a neighborhood, or similar adjacent neighborhoods, and are not intended for use as a through-street or a link between higher capacity facilities such as collector or arterial roadways. Local streets are fronted by residential uses and do not typically serve commercial uses.

3.3 Roadway Descriptions

A review of the important roadways in the construction site vicinity and study area is summarized in ***Table 3-1***. As indicated in *Table 3-1*, the important roadways within the study area were reviewed in terms of the number of lanes provided, parking restrictions, posted speed limits, etc. Additionally, the roadway classifications of key roads in the study area also are presented in *Table 3-1*.

3.4 Existing Public Bus Transit Service

Public bus transit service to the study area is currently provided by the Los Angeles County Metropolitan Transportation Authority and the Palos Verdes Peninsula Transit Authority. A summary of the existing transit service, including the transit route, destinations and peak hour headways is presented in ***Table 3-2***. The existing public transit routes in the site vicinity are illustrated in ***Figure 3-2***.

3.5 Bicycle Facilities

Bicycle access to the site is facilitated by the City's bicycle roadway network. Existing Class II bicycle facilities are provided along Palos Verdes Drive South in the immediate vicinity of the construction site. As this project is a construction project, the use of bicycles by construction workers for commute purposes is not envisioned to occur to any substantive degree.

Table 3-1
EXISTING ROADWAY DESCRIPTIONS

Roadway	Classification [1]	Travel Lanes			Median	Speed
		Direction [2]	No. Lanes [3]		Types [4]	Limit
Barkentine Road	Local Street	NB-SB	2		N/A	25
Narcissa Drive	Private Road	EB-WB	2		N/A	25
Peppertree Drive	Private Road	NB-SB	2		N/A	25
Forrestal Drive	Local Street	NB-SB	2		N/A	25
Trump National Drive	Local Street	NB-SB	2		N/A	25
Palos Verdes Drive South						
- Palos Verdes Drive West to Narcissa Drive	Arterial	EB-WB	4	[5]	RMI	45
- Narcissa Drive to 25th Street	Arterial	NB-SB	2	[5]	RMI/N/A	35

Notes:

[1] Roadway classifications obtained from the *City of Rancho Palos Verdes (Circulation Element)* , adopted September 2018.

[2] Direction of roadways in the project area: NB-SB = northbound and southbound; and EB-WB = eastbound and westbound.

[3] Number of lanes in both directions on the roadway.

[4] Median type of the road: RMI = Raised Median Island; 2WLT = 2-Way Left-Turn Lane; and N/A = Not Applicable.

[5] Class II (Bike Lane)

Table 3-2
EXISTING TRANSIT ROUTES [1]

ROUTE	DESTINATIONS	ROADWAY(S) NEAR SITE	NO. OF BUSES DURING PEAK HOUR		
			DIR	AM	PM
Metro 344	Ranchos Palos Verdes to Harbor Gateway via Torrance	Via Rivera, Tramonto Drive, Seahill Drive, Barkentine Road, Hawthorne Boulevard, Palos Verdes Drive South	NB SB	2 2	2 2
PVPTA 226	Palos Verdes Estates	Palos Verdes Drive West, Hawthorne Boulevard	NB SB	0 2	1 0
PVPTA Blue Line	Palos Verdes Estates to Rancho Palos Verdes (School Days)	Palos Verdes Drive West, Hawthorne Boulevard	Inbound Outbound	1 2	1 2
PVPTA Gold Line	Rancho Palos Verdes to Rolling Hills (School Days)	Tramonto Drive, Seahill Drive, Narcissa Drive, Pepper Tree Drive, Trump National Drive, Palos Verdes Drive South	Inbound Outbound	1 1	1 1
PVPTA Orange Line	Palos Verdes Estates to Rolling Hills via Rancho Palos Verdes (School Days)	Tramonto Drive, Seahill Drive, Narcissa Drive, Pepper Tree Drive, Trump National Drive, Palos Verdes Drive South	Inbound Outbound	0 2	1 0
			Total	**13**	**11**

[1] Sources: Los Angeles County Metropolitan Transportation Authority (Metro) and Palos Verdes Peninsula Transit Authority (PVPTA) websites, 2022.

MAP SOURCE: METROPOLITAN TRANSPORTATION AUTHORITY WEBSITE (SOUTH BAY/GATEWAY CITIES) 2022

MAP SOURCE: PALOS VERDES PENINSULA TRANSIT AUTHORITY WEBSITE 2022

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= PROJECT AREA

FIGURE 3-2
EXISTING TRANSIT ROUTES

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4.0 TRAFFIC COUNTS

Weekday AM and PM traffic count data for the four (4) study intersections were obtained from the Zone 2 – Portuguese Bend Landslide Moratorium Project Transportation Impact Study[1] and City of Rancho Palos Verdes Department of Public Works staff. All of the manual counts were conducted by independent traffic count subconsultants from 7:00 to 9:00 AM to determine the AM peak commute hour and from 4:00 to 6:00 PM to determine the PM peak commute hour. Three (3) of the manual counts utilized in the transportation assessment were conducted in November 2018. The available manual traffic count data for the three intersections were adjusted by an ambient growth rate to reflect Year 2022 existing conditions. Based on review of the general traffic growth factors provided in the Los Angeles County 2010 Congestion Management Program[2] (CMP) for the project study area (i.e., RSA 19, Palos Verdes), it is anticipated that existing traffic volumes in the vicinity are expected to increase at an annual rate of 0.52% per year between the years 2015 and 2020 and 0.2% per year between the years 2020 and 2025. In order to provide a conservative analysis, the higher ambient growth rate of 0.52% was utilized for the analysis.

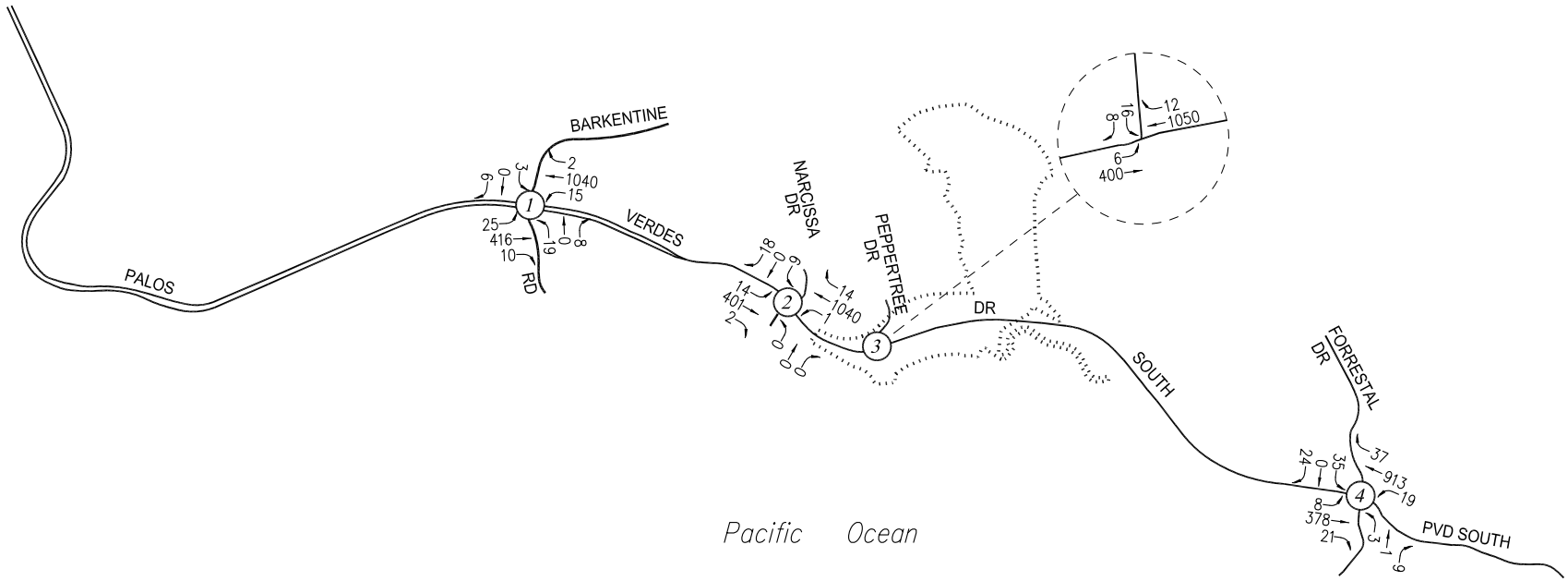
The existing weekday AM and PM peak hour manual counts of turning vehicles at the four (4) study intersections are summarized in ***Table 4-1***. The existing traffic volumes at the study intersections during the weekday AM and PM peak hours are shown in ***Figures 4-1*** and ***4-2***, respectively. Summary data worksheets of the manual traffic counts of the study intersections are contained in ***Appendix A***.

[1] *Zone 2 – Portuguese Bend Landslide Moratorium Project Transportation Impact Study*, Linscott, Law & Greenspan Engineers, Inc., January 18, 2019.
[2] Los Angeles County Metropolitan Transportation Authority (Metro) 2010 Congestion Management Program.

Table 4-1
EXISTING TRAFFIC VOLUMES [1], [2]
WEEKDAY AM AND PM PEAK HOURS

NO.	INTERSECTION	DATE	DIR	AM PEAK HOUR		PM PEAK HOUR	
				BEGAN	VOLUME	BEGAN	VOLUME
1	Barkentine Road/ Palos Verdes Drive South	11/14/2018	NB SB EB WB	8:00 AM	27 9 451 1,057	4:30 PM	14 7 872 525
2	Narcissa Drive/ Palos Verdes Drive South	11/14/2018	NB SB EB WB	8:00 AM	0 27 417 1,055	4:30 PM	0 44 862 503
3	Peppertree Drive/ Palos Verdes Drive South	11/14/2018	NB SB EB WB	8:00 AM	0 24 406 1,062	4:30 PM	0 17 854 511
4	Forrestal Drive/ Palos Verdes Drive South	04/26/2022	NB SB EB WB	7:30 AM	13 59 407 969	4:30 PM	51 42 679 477

[1] Counts conducted by Counts Unlimited, National Data & Surveying Services and AimTD LLC.
[2] The existing traffic count data for Intersection Nos. 1, 2 and 3 were adjusted by 0.52% per year to reflect Year 2022 conditions.



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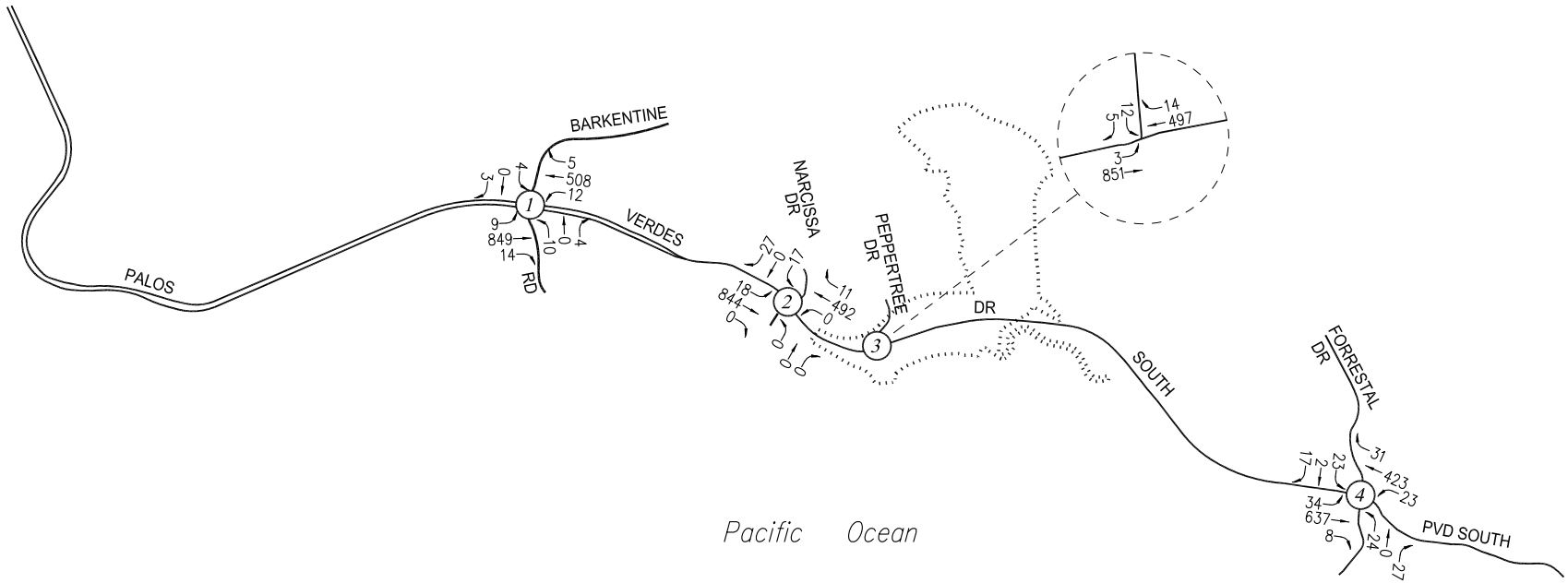
(X) = INTERSECTION NUMBER

= PROJECT AREA

FIGURE 4-1
EXISTING TRAFFIC VOLUMES
WEEKDAY AM PEAK HOUR
PORTUGUESE BEND LANDSLIDE REMEDIATION PROJECT



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(X) = INTERSECTION NUMBER

= PROJECT AREA

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FIGURE 4-2
EXISTING TRAFFIC VOLUMES
WEEKDAY PM PEAK HOUR
PORTUGUESE BEND LANDSLIDE REMEDIATION PROJECT

5.0 PROJECT CONSTRUCTION

Project construction would generate traffic from construction worker travel, the arrival and departure of trucks delivering construction materials to the site, and the removal of debris generated by on-site demolition and excavation/site grading activities. Both the number of construction workers and trucks would vary throughout the construction process.

As previously described in Section 2.2, the three (3) construction components are as follows :

- Construction Component I: Surface fracture infilling
- Construction Component II: Surface water improvements
- Construction Component III: Hydraugers

Each component could be conducted in any order and the timing of each would depend on a number of factors such as funding, permitting, etc. Construction activities would be expected to include site preparation, fencing, clearing/grubbing, grading, trenching, drilling, etc. Site preparation would involve access paths, working platforms, staging areas, and other temporary site features as needed to perform the construction. These items would be established in the field during the construction mobilization or areas that do not affect habitat sensitive vegetation. Site preparation and construction of the Project would be in accordance with all Federal, State, and City zoning codes and requirements.

Based on information provided by City of Rancho Palos Verdes staff and the environmental consultant team, it has been determined that the most intensive period of overall construction activity and construction traffic generation is expected to occur during the construction of Component II (i.e., surface water improvements). Other activities are expected to be less intensive in terms of overall construction traffic generation. Temporary lane closures are not anticipated to occur throughout the course of the project construction. If necessary, any such lane closures are expected to occur outside of the weekday AM and PM peak hours, however, so as to maintain roadway capacity when the street system is typically most heavily constrained.

5.1 Construction Assumptions

As discussed previously, the staging area and construction worker parking would be provided at the construction site. It is anticipated that construction equipment would be brought onto and stored within the construction site boundary, thus, no staging is expected to occur on the perimeter public streets. Flagmen, however, would be used to control traffic movement during the ingress or egress of trucks and heavy equipment to/from the construction site.

The City of Rancho Palos Verdes' Municipal Code[3] currently limits construction hours Monday through Friday to no earlier than 7:00 AM and no later than 6:00 PM (7:00 AM to 7:00 PM during Daylight Saving Time), with the exception of Saturdays, Sundays, and federal holidays, and in accordance with City noise standards. However, some construction may occur on Saturdays if work activities are behind schedule or if there are activities that have potential to impact traffic.

5.2 Construction Traffic Trip Generation

5.2.1 *Peak Construction Worker Demand*

During the peak period of construction activities (Component II), a work force of 12 construction workers would be required. As prevalent in the construction industry, the construction workday would commence at 7:00 AM and typically end at 3:00 PM. Therefore, these particular construction workers would arrive during off-peak commuter hours. It is anticipated that construction workers would remain on-site throughout their shift.

The number of construction worker vehicles is estimated using an average vehicle ridership (AVR) of 1.135 persons per vehicle (as provided in the South Coast Air Quality Management District in its CEQA Air Quality Handbook). Therefore, it is estimated that up to 22 vehicles (11 inbound trips and 11 outbound trips) on a daily basis would be generated by the construction workers during the peak construction phase. As noted above per typical construction industry practices, construction workers are expected to arrive to the project site before 7:00 AM. Assuming the typical work day ends at 3:00 PM, twenty-five percent (25%) of the workers are assumed to leave the site between 3:30 PM and 4:00 PM, twenty-five percent (25%) between 4:00 PM and 4:30 PM, twenty-five percent (25%) between 4:30 PM and 5:00 PM and the remaining twenty-five percent (25%) after 5:00 PM (including supervisors). Thus, while the majority of these construction worker trips would generally occur outside of the commute peak hours of adjacent street traffic, fifty percent (50%) of the work force (i.e., roughly 6 workers) have been assumed to overlap with the weekday commute PM peak hour (i.e., between 4:30 PM and 5:30 PM) in order to provide a conservative forecast of construction traffic generation.

5.2.2 *Peak Construction Truck Demand*

In addition to construction worker vehicles, truck trips would be generated so as to remove material from the site as well as to deliver material to the site. These trucks may consist of larger vehicles delivering equipment and/or construction materials to the project area, or smaller pick-up trucks or four-wheel drive vehicles used by construction supervisors and/or City inspectors. Heavy construction equipment would be located on-site during the construction activities and would not travel to and from the project site on a daily basis.

[3] City of Rancho Palos Verdes Municipal Code, 17.56.020.

Based on information provided by the City of Rancho Palos Verdes staff and the environmental team, during the peak construction activity, a maximum of 30 trucks per day (i.e., vendor and haul trucks) are anticipated to be generated to/from the site. Therefore, the anticipated peak truck trip generation would total 60 truck trips per day (30 inbound trucks and 30 outbound trucks). Assuming a construction period of 8 hours per day, this corresponds to a total of roughly 4 trucks per hour. When a passenger car equivalency (PCE) factor of 2.5 is applied to the trucks, a total of 20 PCE-adjusted truck trips per hour is forecast (i.e., 10 PCE-adjusted inbound trips and 10 PCE-adjusted outbound trips).

It is anticipated that delivery trucks/construction equipment would be brought onto the site and be stored within the construction site boundary, thus, no staging is expected to occur on the perimeter public streets. Therefore, detours around the construction sites would not be required. Flagmen, however, would be used to control traffic movement during the ingress or egress of trucks and heavy equipment from each construction site. As noted below in Section 8.0, a Construction Traffic Control Plan may be required by the City to be developed to minimize potential conflicts between construction activity and through traffic.

5.2.3 *Peak Construction Traffic Generation Summary*

During peak construction activities at the site, construction trucks are forecast to generate 60 truck trips per day (30 inbound trucks and 30 outbound trucks). Assuming a construction period of roughly 8 hours per day (beginning no earlier than 7:00 AM with the last truck exiting the site prior to 7:00 PM) and a PCE factor of 2.5, this corresponds to a total of roughly 20 PCE-adjusted truck trips per hour is forecast (i.e., 10 PCE-adjusted inbound trips and 10 PCE-adjusted outbound trips). It is anticipated that the construction workers would work in one shift, with the shift beginning at 7:00 AM and ending at 3:00 PM. The number of construction workers during this period totals 12 workers, which is forecast to result in an increase of six outbound worker vehicle trips during the weekday PM peak hour. The workers are expected to arrive to the site prior to the AM peak hour.

A full summary of the traffic generation associated with peak construction activities for the two (2) traffic analysis time periods is provided below:

- AM Peak Hour - The highest level of overall construction traffic impact during the AM peak hour is expected to occur when haul/vendor truck trips are forecast to result in 10 PCE-adjusted inbound truck trips and 10 PCE-adjusted outbound truck trips. Construction workers arrive at the site prior to 7:00 AM and thus do not impact the AM peak hour. Thus, the total AM peak hour peak traffic generation during construction is forecast to total 20 PCE-adjusted vehicle trips (i.e., 10 PCE-adjusted inbound trips and 10 PCE-adjusted outbound trips).

- PM Peak Hour - The highest level of overall construction traffic impact during the commuter PM peak hour is expected to occur when the peak construction workforce is forecast to result in 6 outbound vehicle trips. It is also estimated that 20 PCE-adjusted vendor truck trips (10 PCE-adjusted inbound trips and 10 PCE-adjusted outbound trips). Thus, the total

commuter PM peak hour traffic generation during construction is forecast to total 26 vehicle trips (10 inbound trips and 16 outbound trips).

Over a 24-hour period, the construction of the proposed project is expected to generate 172 daily trip ends (PCE-adjusted) during the peak construction activities. A summary of the traffic generation associated with peak construction activities is provided in ***Table 5-1***. The project traffic volume distribution percentages during weekday AM and PM peak hours at the study intersections are illustrated in ***Figure 5-1***.

Table 5-1
CONSTRUCTION PEAK HOUR TRIP GENERATION [1]

GENERATOR TYPE	DAILY	AM PEAK HOUR VOLUMES [2]			PM PEAK HOUR VOLUMES [2]		
		IN	OUT	TOTAL	IN	OUT	TOTAL
Workers [3]	22	--	--	--	0	6	6
Truck Trips [4]	60	4	4	8	4	4	8
PCE-Adjusted Truck Trips [5]	150	10	10	20	10	10	20
TOTAL PCE ADJUSTED TRIPS	**172**	**10**	**10**	**20**	**10**	**16**	**26**

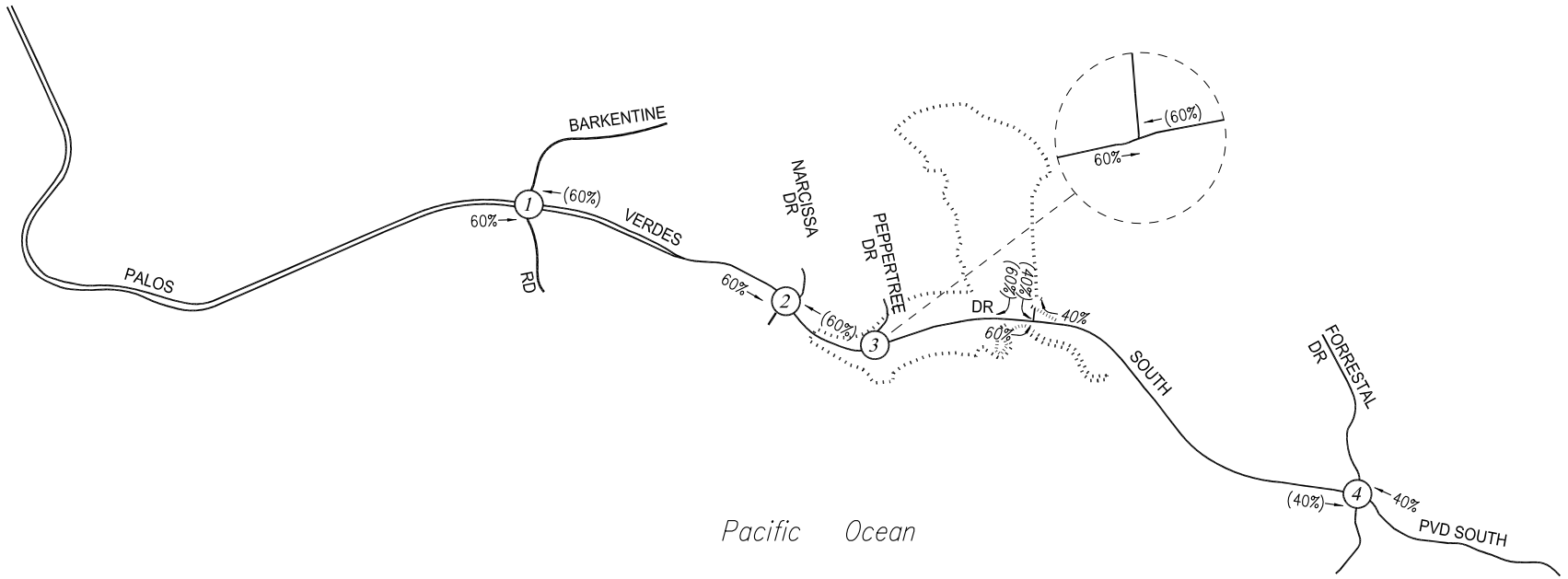
[1] Project construction information provided by City of Rancho Palos Verdes Department of Public Works and Chambers Group, Inc

[2] Trips are one-way traffic movements, entering or leaving.

[3] A total of 12 workers is anticipated at the project site during construction of Component II. Based on an average vehicle ridership (AVR) of 1.135 persons per vehicle, 22 vehicles would be generated by the construction workers. Workers are expected to arrive before the 7:00 AM shift start time (outside of the AM peak hour). During the PM peak hour, it is assumed that fifty percent (50%) of the workers will depart the site, therefore a total of 6 outbound trips are anticipated to occur (12 workers x 50% = 6 outbound trips).

[4] Truck trips were derived based on the following:
Daily Truck Trips = 30 trucks * 2 trips/day = 60 round-trip truck trips per day
Peak hour truck trips = 60 trips per day/8 hours = 8 truck trips per hour (4 inbound trips, 4 outbound trips)

[5] A passenger car equivalency (PCE) factor of 2.5 was employed for analysis purposes. This accounts for the assumption that a truck has the same overall effect on intersection traffic operations as 2.5 passenger cars.



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(X) = INTERSECTION NUMBER

= PROJECT AREA

XX = INBOUND PERCENTAGE

(XX) = OUTBOUND PERCENTAGE

FIGURE 5-1
CONSTRUCTION TRAFFIC TRIP DISTRIBUTION

PORTUGUESE BEND LANDSLIDE REMEDIATION PROJECT

6.0 TRANSPORTATION IMPACT ANALYSIS METHODOLOGY

Existing AM and PM peak hour operating conditions for the study intersections were evaluated using the methodology outlined in Chapter 20 of the *Highway Capacity Manual*[4] (HCM) for unsignalized intersections. The HCM method determines the average control delay experienced at the intersections. The TWSC methodology estimates the average control delay for each minor-street movement (or shared movement) as well as major-street left-turns and determines the LOS for each constrained movement. Average control delay for any particular movement is a function of the capacity of the approach and the degree of saturation. The average control delay is measured in seconds per vehicle, and includes delay due to deceleration to a stop at the back of the queue from free-flow speed, move-up time within the queue, stopped delay at the front of the queue, and delay due to acceleration back to free-flow speed. The six (6) qualitative categories of Level of Service have been defined along with the corresponding HCM control delay value range, as shown in ***Table 6-1***.

TABLE 6-1

LEVEL OF SERVICE CRITERIA FOR UNSIGNALIZED INTERSECTIONS

Level of Service (LOS)	Highway Capacity Manual Delay Value (sec/veh)	Level of Service Description
A	≤ 10.0	Little or no delay
B	> 10.0 and ≤ 15.0	Short traffic delays
C	> 15.0 and ≤ 25.0	Average traffic delays
D	> 25.0 and ≤ 35.0	Long traffic delays
E	> 35.0 and ≤ 50.0	Very long traffic delays
F	> 50.0	Severe congestion

6.1 Impact Criteria and Thresholds

The relative impact of the added traffic volumes expected to be generated during construction of the landslide remediation measures during the weekday AM and PM peak hours was evaluated based on analysis of existing operating conditions at the study intersections, without and with the peak construction traffic. The previously discussed capacity analysis procedures were utilized to investigate the future delay values and service level characteristics at each study intersection. The significance of the potential transportation impacts at each key intersection was then evaluated using the transportation impact criteria employed for projects in the City of Rancho Palos Verdes. Per the City's General Plan, the City of Rancho Palos Verdes' minimum level of service standard for roadway segment and intersection operations is LOS D.

[4] Source: *Highway Capacity Manual 6th Edition*, Transportation Research Board, 2016.

The City of Rancho Palos Verdes has established the following thresholds of significance for unsignalized intersections:

- A significant impact would occur at an unsignalized intersection when the addition of project-generated trips causes the peak hour level of service of the intersection to change from acceptable operation (LOS D or better) to deficient operation (LOS E or F); or

- A significant impact would occur at an unsignalized intersection if the peak hour level of service of the intersection is LOS E or F and the addition of project-generated trips changes the delay by 2.0 seconds or more.

6.2 Transportation Impact Analysis Scenarios

Transportation impacts at the study intersections were analyzed for the following conditions:

(a) Existing Conditions.

(b) Existing With Construction Traffic ("Project") Conditions.

(c) Existing With Construction Traffic ("Project") and Remediation Conditions, if necessary.

The traffic volumes for each condition were added to the volumes in the prior condition to determine the change in capacity utilization at the study intersections.

7.0 TRANSPORTATION ANALYSIS

Summaries of the delay and LOS values for the study intersections evaluated during the AM and PM peak hours are shown in ***Table 7–1***. The HCM data worksheets for the analyzed intersections are contained in *Appendix B*.

7.1 Existing Conditions

As shown in column [1] of *Table 7-1*, one of the four study intersections is currently operating at acceptable Levels of Service (i.e., LOS D or better) during the weekday AM and PM peak hours. The following study intersections currently operate at LOS E or F during the peak hours shown below under existing conditions based on the calculated intersection delay (in seconds):

- Int. No. 2: Narcissa Drive/Palos Verdes Dr. South. AM Peak Hour: *Delay* = 48.6, LOS E
  PM Peak Hour: *Delay* = 44.4, LOS E
- Int. No. 3. Peppertree Dr./Palos Verdes Dr. South AM Peak Hour: *Delay* = 37.3, LOS E
- Int. No. 4. Forrestal Dr./Palos Verdes Dr. South AM Peak Hour: *Delay* = 54.7, LOS F
  PM Peak Hour: *Delay* = 37.4, LOS E

As previously mentioned, the existing traffic volumes at the study intersections during the weekday AM and PM peak hours are displayed in *Figures 4-1* and *4-2*, respectively.

7.2 Existing With Construction Traffic Conditions

In order to determine the operating conditions of the street system under existing with project construction activities, traffic expected to be generated during peak construction activities was added to the existing traffic volumes at each of the study intersections. As shown in column [2] of *Table 7-1*, application of the City's significance criteria to the existing plus construction activity scenario indicates that none of the study intersections are expected to be significantly impacted by the peak construction activities of the proposed project during any of the analyzed time periods. Therefore, no formal, permanent transportation mitigation measures are required or recommended.

The existing with construction traffic volumes (existing traffic volumes plus construction traffic volumes) at the study intersections during the weekday AM and PM peak hours are shown in ***Figures 7-1*** and ***7-2,*** respectively.

Table 7-1
SUMMARY OF DELAYS AND LEVELS OF SERVICE
WEEKDAY AM, AND PM PEAK HOURS

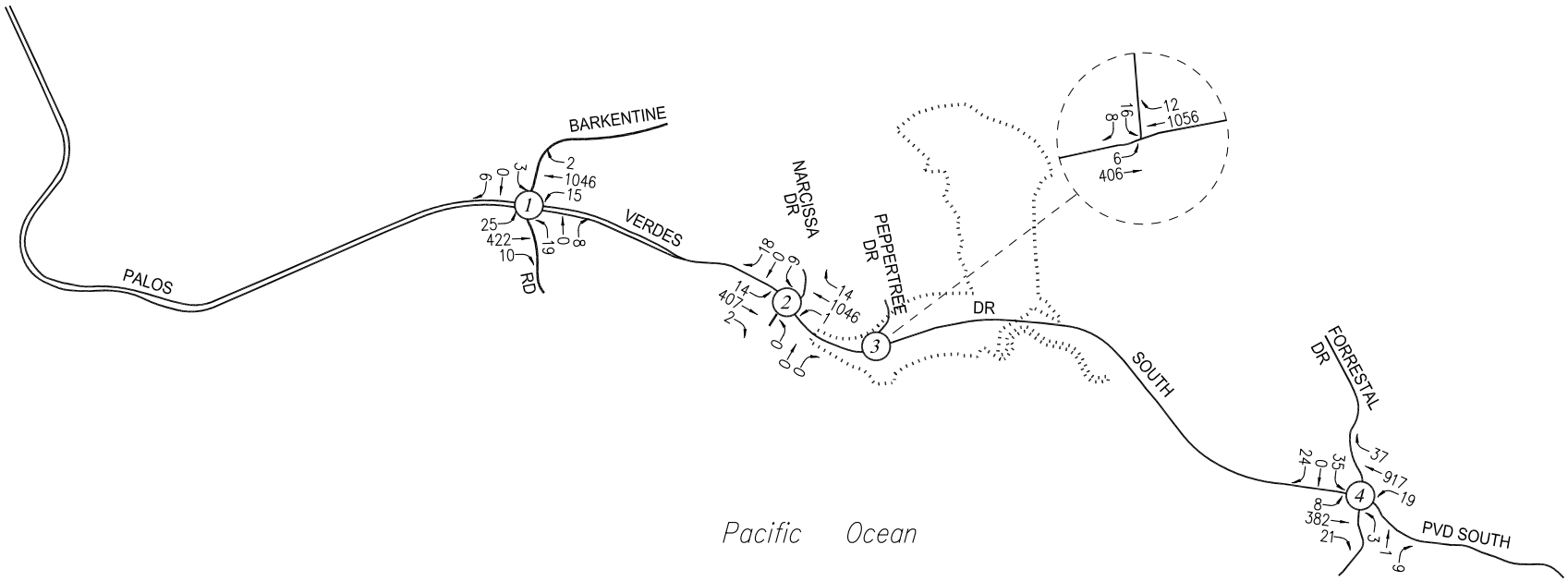
NO.	INTERSECTION	TRAFFIC CONTROL	PEAK HOUR	[1] EXISTING DELAY [a]	[1] EXISTING LOS [b]	[2] EXISTING W/ CONSTRUCTION DELAY [a]	[2] EXISTING W/ CONSTRUCTION LOS [b]	[2] CHANGE IN DELAY [(2)-(1)]	[2] IMPACT [c]
1	Barkentine Road/	Two-Way	AM	24.1	C	24.3	C	0.2	No
	Palos Verdes Drive South	Stop	PM	27.5	D	28.0	D	0.5	No
2	Narcissa Drive/	Two-Way	AM	48.6	E	49.7	E	1.1	No
	Palos Verdes Drive South	Stop	PM	44.4	E	45.7	E	1.3	No
3	Peppertree Drive/	Two-Way	AM	37.3	E	38.2	E	0.9	No
	Palos Verdes Drive South	Stop	PM	31.0	D	31.8	D	0.8	No
4	Forrestal Drive/	Two-Way	AM	54.7	F	55.4	F	0.7	No
	Palos Verdes Drive South	Stop	PM	37.4	E	38.0	E	0.6	No

[a] Reported control delay values in seconds per vehicle. For two-way stop controlled intersections, reported control delay values represent the delays associated with the most constrained approach of the intersection.

[b] Unsignalized Intersection Levels of Service are based on the following criteria:

Control Delay (s/veh)	LOS
<= 10	A
> 10-15	B
> 15-25	C
> 25-35	D
> 35-50	E
> 50	F

[c] For unsignalized intersections, the City of Rancho Palos Verdes has established the following thresholds of significance:
- A significant impact would occur at an unsignalized intersection when the addition of project-generated trips causes the peak hour level of service of the intersection to change from acceptable operation (LOS D or better) to deficient operation (LOS E or F); or
- A significant impact would occur at an unsignalized intersection if the peak hour level of service of the intersection is LOS E or F and the addition of project-generated trips changes the delay by 2.0 seconds or more.



(X) = INTERSECTION NUMBER

= PROJECT AREA

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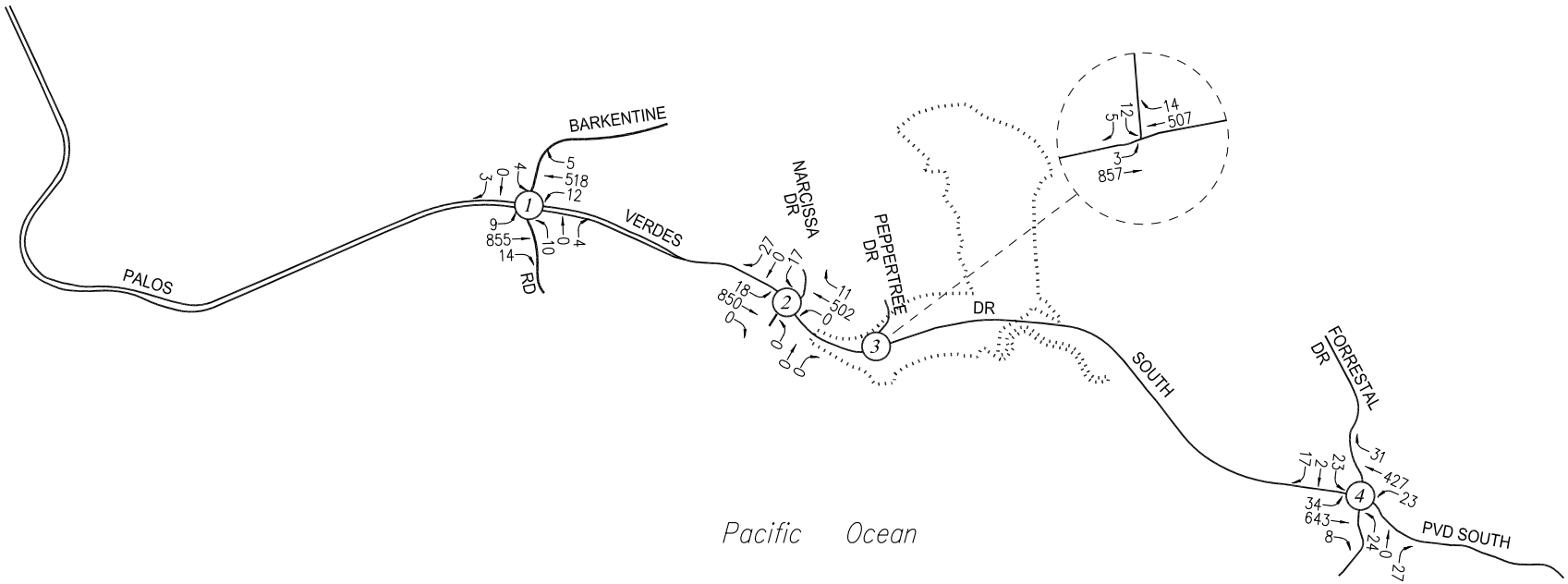
FIGURE 7-1

EXISTING WITH CONSTRUCTION TRAFFIC VOLUMES

WEEKDAY AM PEAK HOUR

PORTUGUESE BEND LANDSLIDE REMEDIATION PROJECT



N

X = INTERSECTION NUMBER

= PROJECT AREA

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FIGURE 7-2
EXISTING WITH CONSTRUCTION TRAFFIC VOLUMES
WEEKDAY PM PEAK HOUR
PORTUGUESE BEND LANDSLIDE REMEDIATION PROJECT

8.0 CONSTRUCTION TRAFFIC CONTROL PLAN

With the required haul route approval, the off-peak arrival and departure of construction workers and the other construction management practices described above, impacts from construction activity are concluded to be less than significant. Impacts would be further reduced with the implementation of the following design features:

- Maintain existing access for land uses in proximity of the project site;
- Limit any potential lane closures to off-peak travel periods;
- Schedule receipt of construction materials during non-peak travel periods, to the extent possible;
- Coordinate deliveries to reduce the potential of trucks waiting to unload for extended periods of time; and
- Prohibit parking by construction workers on adjacent streets and direct construction workers to available parking as determined in conjunction with City staff.

In order to minimize potential conflicts between construction activity and through traffic, a Construction Traffic Control Plan will be required by the City for use during construction. The Construction Traffic Control Plan would identify all traffic control measures, signs, and delineators to be implemented through the duration of construction activity. In addition, the City of Rancho Palos Verdes would develop the Truck Haul Route program for the landslide remediation/improvement program. Because of these requirements, and, moreover, construction-related trips would be nominal and well dispersed throughout the day, construction-related transportation impacts are expected to be less than significant.

9.0 CONCLUSIONS

- ***Project Description –*** The proposed Portuguese Bend Landslide Remediation improvements are anticipated to have three (3) construction components as follows:
  - Construction Component I: Surface fracture infilling
  - Construction Component II: Surface water improvements
  - Construction Component III: Hydraugers
- ***Study Scope*** – Four (4) intersections were selected for analysis in order to determine potential transportation impacts related to the project construction activities.
- ***Construction Trip Generation*** – During peak construction activities, the construction of the improvements is expected to generate 20 PCE-adjusted vehicle trips (10 PCE-adjusted inbound trips and 10 PCE-adjusted outbound trips) during the AM peak hour and 26 PCE-adjusted vehicle trips (10 PCE-adjusted inbound trips and 16 PCE-adjusted outbound trips) during the PM peak hour. Over a 24-hour period, the construction of the proposed project is expected to generate 172 daily trip ends (PCE-adjusted) during the peak construction activities.
- ***Transportation Impact Assessment*** – It is concluded that the construction of the Portuguese Bend Landslide Remediation Project is not expected to result in significant transportation impacts at any of the study intersections. Incremental, but less than significant impacts are noted at the study intersections. Therefore, no formal, permanent transportation mitigation measures are required, however, it is recommended that the City require the preparation of a Construction Traffic Control Plan for use during construction. The Construction Traffic Control Plan would identify all traffic control measures, signs, and delineators to be implemented through the duration of construction activity. In addition, the City of Rancho Palos Verdes would develop the Truck Haul Route program for the Portuguese Bend Landslide Remediation Project.
- ***Vehicle Miles Traveled (VMT) Assessment*** – A qualitative VMT analysis may be appropriate for purposes of assessing potential construction-related transportation impacts (i.e., refer to the Section 15064.3(b)(3) of the latest CEQA Guidelines). Therefore, it is assumed that the construction-related traffic associated with the Portuguese Bend Landslide Remediation Project could potentially result in a temporary increase in regional VMT. However, since the traffic anticipated to be generated by this construction project is expected to be temporary and intermittent, any increase in regional VMT resulting from this construction activity is also assumed to be temporary and intermittent.

APPENDIX A

TRAFFIC COUNT DATA

Counts Unlimited
PO Box 1178
Corona, CA 92878
(951) 268-6268

City of Rancho Palos Verdes
N/S: Barkentine Road
E/W: Palos Verdes Drive South
Weather: Clear

File Name : 01_RPV_Barkentine_Palos Verdes Dr S AM
Site Code : 05718832
Start Date : 11/14/2018

Groups Printed- Total Volume

	Barkentine Road Southbound				Palos Verdes Drive South Westbound				Barkentine Road Northbound				Palos Verdes Drive South Eastbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
07:00 AM	1	0	1	2	2	113	1	116	3	0	2	5	2	53	1	56	179
07:15 AM	0	0	3	3	2	181	0	183	8	0	1	9	0	56	1	57	252
07:30 AM	2	0	6	8	1	185	1	187	3	0	2	5	1	73	2	76	276
07:45 AM	0	1	1	2	0	238	1	239	8	0	1	9	0	90	2	92	342
Total	3	1	11	15	5	717	3	725	22	0	6	28	3	272	6	281	1049
08:00 AM	0	0	1	1	2	244	0	246	5	0	2	7	1	75	1	77	331
08:15 AM	0	0	2	2	4	271	0	275	5	0	1	6	5	78	0	83	366
08:30 AM	0	0	2	2	5	238	1	244	5	0	4	9	12	122	5	139	394
08:45 AM	3	0	1	4	4	222	1	227	4	0	1	5	6	115	4	125	361
Total	3	0	6	9	15	975	2	992	19	0	8	27	24	390	10	424	1452
Grand Total	6	1	17	24	20	1692	5	1717	41	0	14	55	27	662	16	705	2501
Apprch %	25	4.2	70.8		1.2	98.5	0.3		74.5	0	25.5		3.8	93.9	2.3		
Total %	0.2	0	0.7	1	0.8	67.7	0.2	68.7	1.6	0	0.6	2.2	1.1	26.5	0.6	28.2	

	Barkentine Road Southbound				Palos Verdes Drive South Westbound				Barkentine Road Northbound				Palos Verdes Drive South Eastbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 08:00 AM																	
08:00 AM	0	0	1	1	2	244	0	246	**5**	0	2	7	1	75	1	77	331
08:15 AM	0	0	**2**	2	4	**271**	0	**275**	5	0	1	6	5	78	0	83	366
08:30 AM	0	0	2	2	**5**	238	**1**	244	5	0	**4**	**9**	**12**	**122**	**5**	**139**	**394**
08:45 AM	**3**	0	1	**4**	4	222	1	227	4	0	1	5	6	115	4	125	361
Total Volume	3	0	6	9	15	975	2	992	19	0	8	27	24	390	10	424	1452
% App. Total	33.3	0	66.7		1.5	98.3	0.2		70.4	0	29.6		5.7	92	2.4		
PHF	.250	.000	.750	.563	.750	.899	.500	.902	.950	.000	.500	.750	.500	.799	.500	.763	.921

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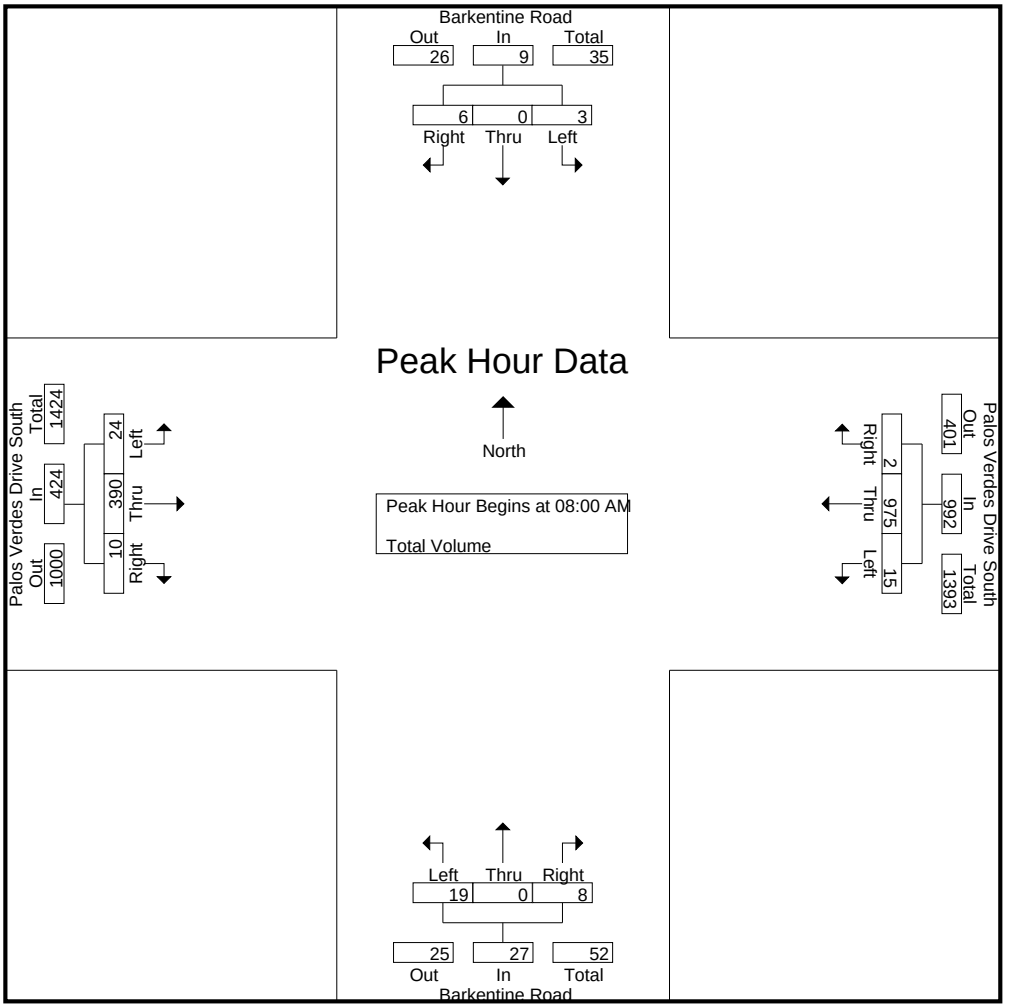
City of Rancho Palos Verdes
N/S: Barkentine Road
E/W: Palos Verdes Drive South
Weather: Clear

File Name : 01_RPV_Barkentine_Palos Verdes Dr S AM
Site Code : 05718832
Start Date : 11/14/2018
Page No : 2



Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	07:00 AM				07:45 AM				07:45 AM				08:00 AM			
+0 mins.	1	0	1	2	0	238	**1**	239	**8**	0	1	**9**	1	75	1	77
+15 mins.	0	0	3	3	2	244	0	246	5	0	2	7	5	78	0	83
+30 mins.	**2**	0	**6**	**8**	4	**271**	0	**275**	5	0	1	6	**12**	**122**	**5**	**139**
+45 mins.	0	**1**	1	2	**5**	238	1	244	5	0	**4**	9	6	115	4	125
Total Volume	3	1	11	15	11	991	2	1004	23	0	8	31	24	390	10	424
% App. Total	20	6.7	73.3		1.1	98.7	0.2		74.2	0	25.8		5.7	92	2.4	
PHF	.375	.250	.458	.469	.550	.914	.500	.913	.719	.000	.500	.861	.500	.799	.500	.763

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City of Rancho Palos Verdes
N/S: Barkentine Road
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Weather: Clear

File Name : 01_RPV_Barkentine_Palos Verdes Dr S PM 2
Site Code : 05718832
Start Date : 11/14/2018
Page No : 1

Groups Printed- Total Volume

	Barkentine Road Southbound				Palos Verdes Drive South Westbound				Barkentine Road Northbound				Palos Verdes Drive South Eastbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
04:00 PM	0	0	0	0	2	131	1	134	2	0	1	3	2	200	2	204	341
04:15 PM	1	0	3	4	1	121	0	122	1	0	0	1	4	182	4	190	317
04:30 PM	1	0	1	2	3	101	0	104	1	0	1	2	0	188	3	191	299
04:45 PM	0	0	0	0	3	130	3	136	3	0	0	3	1	207	2	210	349
Total	2	0	4	6	9	483	4	496	7	0	2	9	7	777	11	795	1306
05:00 PM	0	0	0	0	3	113	0	116	3	0	2	5	5	190	3	198	319
05:15 PM	3	0	2	5	3	138	2	143	3	0	1	4	3	220	6	229	381
05:30 PM	0	0	0	0	1	99	0	100	1	0	1	2	3	180	3	186	288
05:45 PM	3	0	2	5	0	81	0	81	1	0	5	6	2	156	2	160	252
Total	6	0	4	10	7	431	2	440	8	0	9	17	13	746	14	773	1240
Grand Total	8	0	8	16	16	914	6	936	15	0	11	26	20	1523	25	1568	2546
Apprch %	50	0	50		1.7	97.6	0.6		57.7	0	42.3		1.3	97.1	1.6		
Total %	0.3	0	0.3	0.6	0.6	35.9	0.2	36.8	0.6	0	0.4	1	0.8	59.8	1	61.6	

	Barkentine Road Southbound				Palos Verdes Drive South Westbound				Barkentine Road Northbound				Palos Verdes Drive South Eastbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 04:30 PM																	
04:30 PM	1	0	1	2	**3**	101	0	104	1	0	1	2	0	188	3	191	299
04:45 PM	0	0	0	0	3	130	**3**	136	**3**	0	0	3	1	207	2	210	349
05:00 PM	0	0	0	0	3	113	0	116	3	0	**2**	**5**	**5**	190	3	198	319
05:15 PM	**3**	0	**2**	**5**	3	**138**	2	**143**	3	0	1	4	3	**220**	**6**	**229**	**381**
Total Volume	4	0	3	7	12	482	5	499	10	0	4	14	9	805	14	828	1348
% App. Total	57.1	0	42.9		2.4	96.6	1		71.4	0	28.6		1.1	97.2	1.7		
PHF	.333	.000	.375	.350	1.00	.873	.417	.872	.833	.000	.500	.700	.450	.915	.583	.904	.885

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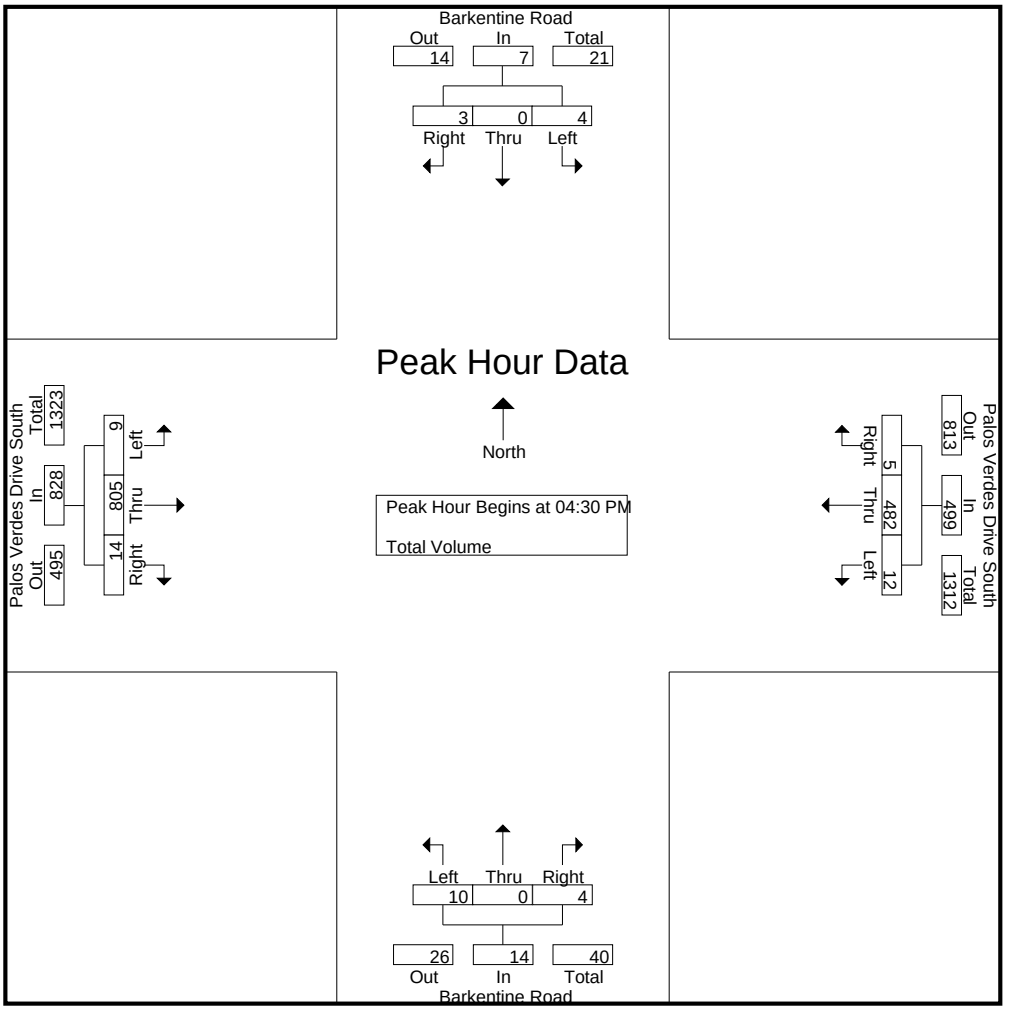
City of Rancho Palos Verdes
N/S: Barkentine Road
E/W: Palos Verdes Drive South
Weather: Clear

File Name : 01_RPV_Barkentine_Palos Verdes Dr S PM 2
Site Code : 05718832
Start Date : 11/14/2018
Page No : 2



Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	05:00 PM				04:30 PM				05:00 PM				04:30 PM			
+0 mins.	0	0	0	0	**3**	101	0	104	**3**	0	2	5	0	188	3	191
+15 mins.	**3**	0	**2**	**5**	3	130	**3**	136	3	0	1	4	1	207	2	210
+30 mins.	0	0	0	0	3	113	0	116	1	0	1	2	**5**	190	3	198
+45 mins.	3	0	2	5	3	**138**	2	**143**	1	0	**5**	**6**	3	**220**	**6**	**229**
Total Volume	6	0	4	10	12	482	5	499	8	0	9	17	9	805	14	828
% App. Total	60	0	40		2.4	96.6	1		47.1	0	52.9		1.1	97.2	1.7	
PHF	.500	.000	.500	.500	1.000	.873	.417	.872	.667	.000	.450	.708	.450	.915	.583	.904

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City of Rancho Palos Verdes
N/S: Narcissa Drive
E/W: Palos Verdes Drive South
Weather: Clear

File Name : 02_RPV_Narcissa_Palos Verdes Dr S AM
Site Code : 05718832
Start Date : 11/14/2018
Page No : 1

Groups Printed- Total Volume

	Narcissa Drive Southbound				Palos Verdes Drive South Westbound				PV Heritage Castle Museum Driveway Northbound				Palos Verdes Drive South Eastbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
07:00 AM	1	0	4	5	0	115	2	117	0	0	0	0	1	57	2	60	182
07:15 AM	4	0	5	9	2	170	5	177	0	0	0	0	0	56	0	56	242
07:30 AM	3	0	3	6	0	196	6	202	0	0	0	0	1	73	0	74	282
07:45 AM	4	0	5	9	0	237	4	241	2	0	0	2	4	88	0	92	344
Total	12	0	17	29	2	718	17	737	2	0	0	2	6	274	2	282	1050
08:00 AM	3	0	6	9	0	243	5	248	0	0	0	0	5	68	0	73	330
08:15 AM	3	0	3	6	0	264	5	269	0	0	0	0	2	79	0	81	356
08:30 AM	2	0	5	7	0	251	1	252	0	0	0	0	6	104	1	111	370
08:45 AM	1	0	4	5	1	217	3	221	0	0	0	0	1	125	1	127	353
Total	9	0	18	27	1	975	14	990	0	0	0	0	14	376	2	392	1409
Grand Total	21	0	35	56	3	1693	31	1727	2	0	0	2	20	650	4	674	2459
Apprch %	37.5	0	62.5		0.2	98	1.8		100	0	0		3	96.4	0.6		
Total %	0.9	0	1.4	2.3	0.1	68.8	1.3	70.2	0.1	0	0	0.1	0.8	26.4	0.2	27.4	

	Narcissa Drive Southbound				Palos Verdes Drive South Westbound				PV Heritage Castle Museum Driveway Northbound				Palos Verdes Drive South Eastbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 08:00 AM																	
08:00 AM	**3**	0	**6**	**9**	0	243	**5**	248	0	0	0	0	5	68	0	73	330
08:15 AM	3	0	3	6	0	**264**	5	**269**	0	0	0	0	2	79	0	81	356
08:30 AM	2	0	5	7	0	251	1	252	0	0	0	0	**6**	104	**1**	111	**370**
08:45 AM	1	0	4	5	**1**	217	3	221	0	0	0	0	1	**125**	1	**127**	353
Total Volume	9	0	18	27	1	975	14	990	0	0	0	0	14	376	2	392	1409
% App. Total	33.3	0	66.7		0.1	98.5	1.4		0	0	0		3.6	95.9	0.5		
PHF	.750	.000	.750	.750	.250	.923	.700	.920	.000	.000	.000	.000	.583	.752	.500	.772	.952

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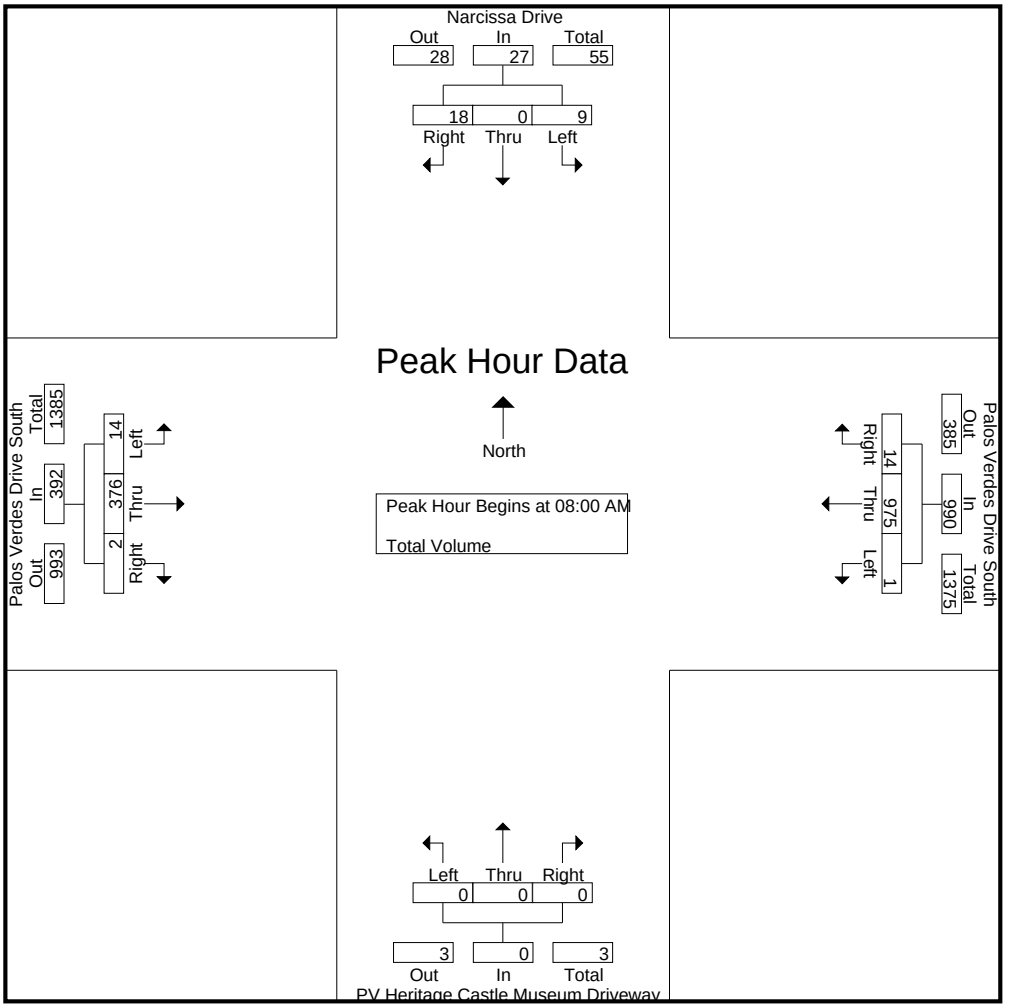
City of Rancho Palos Verdes
N/S: Narcissa Drive
E/W: Palos Verdes Drive South
Weather: Clear

File Name : 02_RPV_Narcissa_Palos Verdes Dr S AM
Site Code : 05718832
Start Date : 11/14/2018
Page No : 2



Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	07:15 AM				07:45 AM				07:00 AM				08:00 AM			
+0 mins.	**4**	0	5	**9**	0	237	4	241	0	0	0	0	5	68	0	73
+15 mins.	3	0	3	6	0	243	**5**	248	0	0	0	0	2	79	0	81
+30 mins.	4	0	5	9	0	**264**	5	**269**	0	0	0	0	**6**	104	**1**	111
+45 mins.	3	0	**6**	9	0	251	1	252	**2**	0	0	**2**	1	**125**	1	**127**
Total Volume	14	0	19	33	0	995	15	1010	2	0	0	2	14	376	2	392
% App. Total	42.4	0	57.6		0	98.5	1.5		100	0	0		3.6	95.9	0.5	
PHF	.875	.000	.792	.917	.000	.942	.750	.939	.250	.000	.000	.250	.583	.752	.500	.772

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City of Rancho Palos Verdes
N/S: Narcissa Drive
E/W: Palos Verdes Drive South
Weather: Clear

File Name : 02_RPV_Narcissa_Palos Verdes Dr S PM 2
Site Code : 05718832
Start Date : 11/14/2018
Page No : 1

Groups Printed- Total Volume

	Narcissa Drive Southbound				Palos Verdes Drive South Westbound				PV Heritage Castle Museum Driveway Northbound				Palos Verdes Drive South Eastbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
04:00 PM	3	0	6	9	1	123	2	126	0	0	0	0	7	192	0	199	334
04:15 PM	5	0	5	10	0	119	2	121	0	0	0	0	10	184	0	194	325
04:30 PM	7	0	7	14	0	102	2	104	0	0	0	0	5	191	0	196	314
04:45 PM	4	0	4	8	0	118	2	120	0	0	0	0	5	195	0	200	328
Total	19	0	22	41	1	462	8	471	0	0	0	0	27	762	0	789	1301
05:00 PM	3	0	6	9	0	119	5	124	0	0	0	0	1	197	0	198	331
05:15 PM	3	0	9	12	0	128	2	130	0	0	0	0	7	218	0	225	367
05:30 PM	4	0	7	11	0	97	5	102	0	0	0	0	9	171	0	180	293
05:45 PM	0	0	3	3	0	65	1	66	0	0	0	0	5	174	0	179	248
Total	10	0	25	35	0	409	13	422	0	0	0	0	22	760	0	782	1239
Grand Total	29	0	47	76	1	871	21	893	0	0	0	0	49	1522	0	1571	2540
Apprch %	38.2	0	61.8		0.1	97.5	2.4		0	0	0		3.1	96.9	0		
Total %	1.1	0	1.9	3	0	34.3	0.8	35.2	0	0	0	0	1.9	59.9	0	61.9	

	Narcissa Drive Southbound				Palos Verdes Drive South Westbound				PV Heritage Castle Museum Driveway Northbound				Palos Verdes Drive South Eastbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 04:30 PM																	
04:30 PM	**7**	0	7	**14**	0	102	2	104	0	0	0	0	5	191	0	196	314
04:45 PM	4	0	4	8	0	118	2	120	0	0	0	0	5	195	0	200	328
05:00 PM	3	0	6	9	0	119	**5**	124	0	0	0	0	1	197	0	198	331
05:15 PM	3	0	**9**	12	0	**128**	2	**130**	0	0	0	0	**7**	**218**	0	**225**	**367**
Total Volume	17	0	26	43	0	467	11	478	0	0	0	0	18	801	0	819	1340
% App. Total	39.5	0	60.5		0	97.7	2.3		0	0	0		2.2	97.8	0		
PHF	.607	.000	.722	.768	.000	.912	.550	.919	.000	.000	.000	.000	.643	.919	.000	.910	.913

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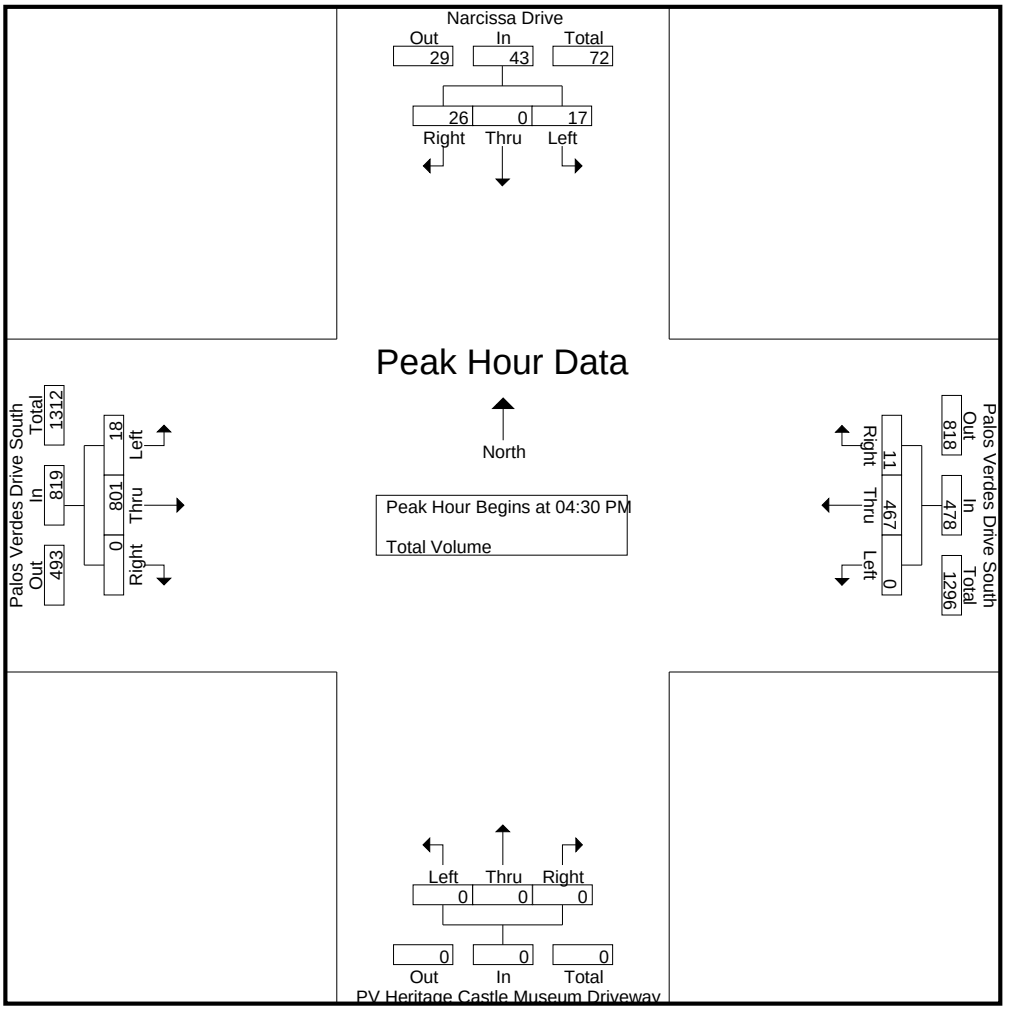
City of Rancho Palos Verdes
N/S: Narcissa Drive
E/W: Palos Verdes Drive South
Weather: Clear

File Name : 02_RPV_Narcissa_Palos Verdes Dr S PM 2
Site Code : 05718832
Start Date : 11/14/2018
Page No : 2



Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	04:30 PM				04:30 PM				04:00 PM				04:30 PM			
+0 mins.	**7**	0	7	**14**	0	102	2	104	0	0	0	0	5	191	0	196
+15 mins.	4	0	4	8	0	118	2	120	0	0	0	0	5	195	0	200
+30 mins.	3	0	6	9	0	119	**5**	124	0	0	0	0	1	197	0	198
+45 mins.	3	0	**9**	12	0	**128**	2	**130**	0	0	0	0	**7**	**218**	0	**225**
Total Volume	17	0	26	43	0	467	11	478	0	0	0	0	18	801	0	819
% App. Total	39.5	0	60.5		0	97.7	2.3		0	0	0		2.2	97.8	0	
PHF	.607	.000	.722	.768	.000	.912	.550	.919	.000	.000	.000	.000	.643	.919	.000	.910

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City of Rancho Palos Verdes
N/S: Peppertree Drive
E/W: Palos Verdes Drive South
Weather: Clear

File Name : 03_RPV_Peppertree_Palos Verdes Dr S AM
Site Code : 05718832
Start Date : 11/14/2018
Page No : 1

Groups Printed- Total Volume

	Peppertree Drive Southbound			Palos Verdes Drive South Westbound			Palos Verdes Drive South Eastbound			
Start Time	Left	Right	App. Total	Thru	Right	App. Total	Left	Thru	App. Total	Int. Total
07:00 AM	1	0	1	115	1	116	0	55	55	172
07:15 AM	2	0	2	181	3	184	0	62	62	248
07:30 AM	1	2	3	204	4	208	1	73	74	285
07:45 AM	1	0	1	237	7	244	1	89	90	335
Total	5	2	7	737	15	752	2	279	281	1040
08:00 AM	4	2	6	260	2	262	1	74	75	343
08:15 AM	4	2	6	257	3	260	2	77	79	345
08:30 AM	4	1	5	251	5	256	1	103	104	365
08:45 AM	4	3	7	216	2	218	2	121	123	348
Total	16	8	24	984	12	996	6	375	381	1401
Grand Total	21	10	31	1721	27	1748	8	654	662	2441
Apprch %	67.7	32.3		98.5	1.5		1.2	98.8		
Total %	0.9	0.4	1.3	70.5	1.1	71.6	0.3	26.8	27.1	

	Peppertree Drive Southbound			Palos Verdes Drive South Westbound			Palos Verdes Drive South Eastbound			
Start Time	Left	Right	App. Total	Thru	Right	App. Total	Left	Thru	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1										
Peak Hour for Entire Intersection Begins at 08:00 AM										
08:00 AM	**4**	2	6	**260**	2	**262**	1	74	75	343
08:15 AM	4	2	6	257	3	260	**2**	77	79	345
08:30 AM	4	1	5	251	**5**	256	1	103	104	**365**
08:45 AM	4	**3**	**7**	216	2	218	2	**121**	**123**	348
Total Volume	16	8	24	984	12	996	6	375	381	1401
% App. Total	66.7	33.3		98.8	1.2		1.6	98.4		
PHF	1.00	.667	.857	.946	.600	.950	.750	.775	.774	.960

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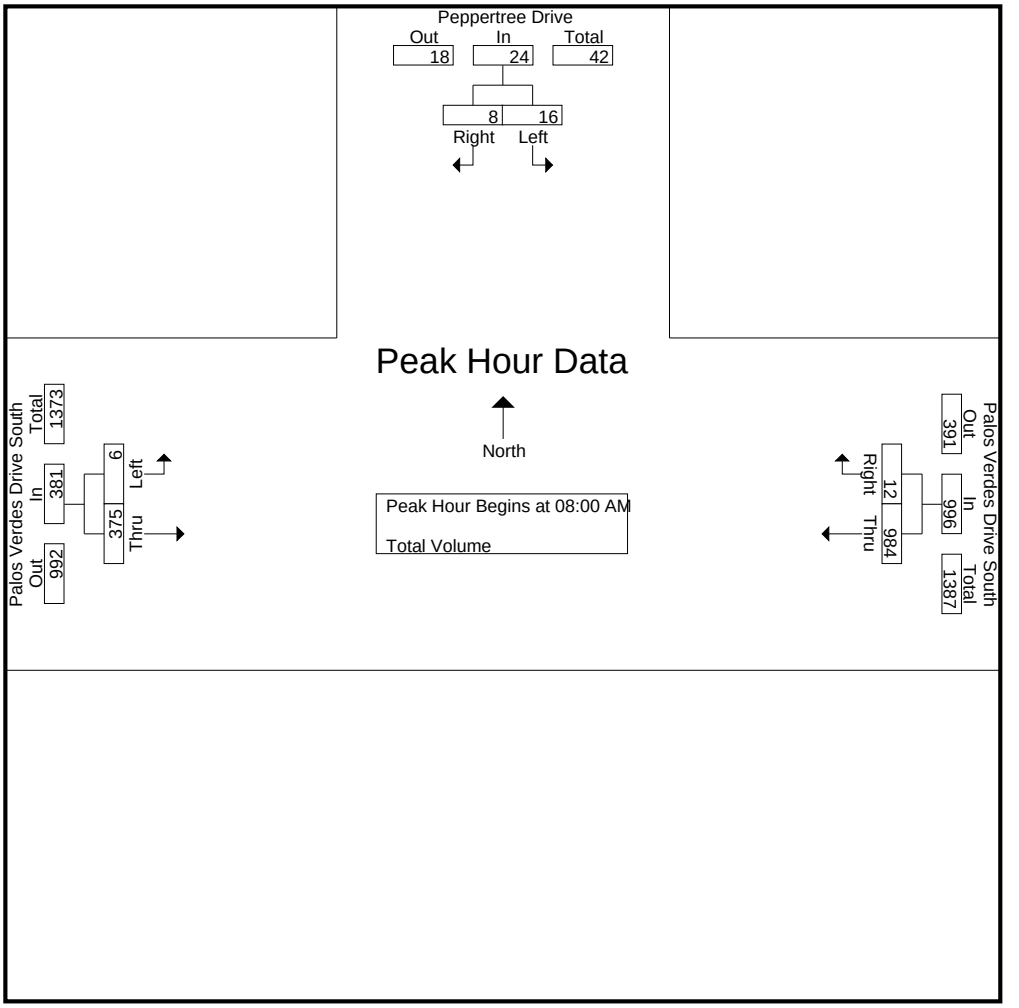
City of Rancho Palos Verdes
N/S: Peppertree Drive
E/W: Palos Verdes Drive South
Weather: Clear

File Name : 03_RPV_Peppertree_Palos Verdes Dr S AM
Site Code : 05718832
Start Date : 11/14/2018
Page No : 2



Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	08:00 AM			07:45 AM			08:00 AM		
+0 mins.	**4**	2	6	237	**7**	244	1	74	75
+15 mins.	4	2	6	**260**	2	**262**	**2**	77	79
+30 mins.	4	1	5	257	3	260	1	103	104
+45 mins.	4	**3**	**7**	251	5	256	2	**121**	**123**
Total Volume	16	8	24	1005	17	1022	6	375	381
% App. Total	66.7	33.3		98.3	1.7		1.6	98.4	
PHF	1.000	.667	.857	.966	.607	.975	.750	.775	.774

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City of Rancho Palos Verdes
N/S: Peppertree Drive
E/W: Palos Verdes Drive South
Weather: Clear

File Name : 03_RPV_Peppertree_Palos Verdes Dr S PM 2
Site Code : 05718832
Start Date : 11/14/2018
Page No : 1

Groups Printed- Total Volume

	Peppertree Drive Southbound				Palos Verdes Drive South Westbound				Dead End Northbound				Palos Verdes Drive South Eastbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
04:00 PM	4	0	2	6	0	133	4	137	0	0	0	0	1	203	0	204	347
04:15 PM	2	0	1	3	0	119	2	121	0	0	0	0	2	188	0	190	314
04:30 PM	7	0	2	9	0	101	5	106	0	0	0	0	0	194	0	194	309
04:45 PM	1	0	1	2	0	119	5	124	0	0	0	0	1	199	0	200	326
Total	14	0	6	20	0	472	16	488	0	0	0	0	4	784	0	788	1296
05:00 PM	2	0	0	2	0	123	2	125	0	0	0	0	1	196	0	197	324
05:15 PM	2	0	2	4	0	128	2	130	0	0	0	0	1	218	0	219	353
05:30 PM	3	0	1	4	0	97	2	99	0	0	0	0	3	182	0	185	288
05:45 PM	1	0	1	2	0	71	2	73	0	0	0	0	2	171	0	173	248
Total	8	0	4	12	0	419	8	427	0	0	0	0	7	767	0	774	1213
Grand Total	22	0	10	32	0	891	24	915	0	0	0	0	11	1551	0	1562	2509
Apprch %	68.8	0	31.2		0	97.4	2.6		0	0	0		0.7	99.3	0		
Total %	0.9	0	0.4	1.3	0	35.5	1	36.5	0	0	0	0	0.4	61.8	0	62.3	

	Peppertree Drive Southbound				Palos Verdes Drive South Westbound				Dead End Northbound				Palos Verdes Drive South Eastbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1																	
Peak Hour for Entire Intersection Begins at 04:30 PM																	
04:30 PM	**7**	0	**2**	**9**	0	101	**5**	106	0	0	0	0	0	194	0	194	309
04:45 PM	1	0	1	2	0	119	5	124	0	0	0	0	**1**	199	0	200	326
05:00 PM	2	0	0	2	0	123	2	125	0	0	0	0	1	196	0	197	324
05:15 PM	2	0	2	4	0	**128**	2	**130**	0	0	0	0	1	**218**	0	**219**	**353**
Total Volume	12	0	5	17	0	471	14	485	0	0	0	0	3	807	0	810	1312
% App. Total	70.6	0	29.4		0	97.1	2.9		0	0	0		0.4	99.6	0		
PHF	.429	.000	.625	.472	.000	.920	.700	.933	.000	.000	.000	.000	.750	.925	.000	.925	.929

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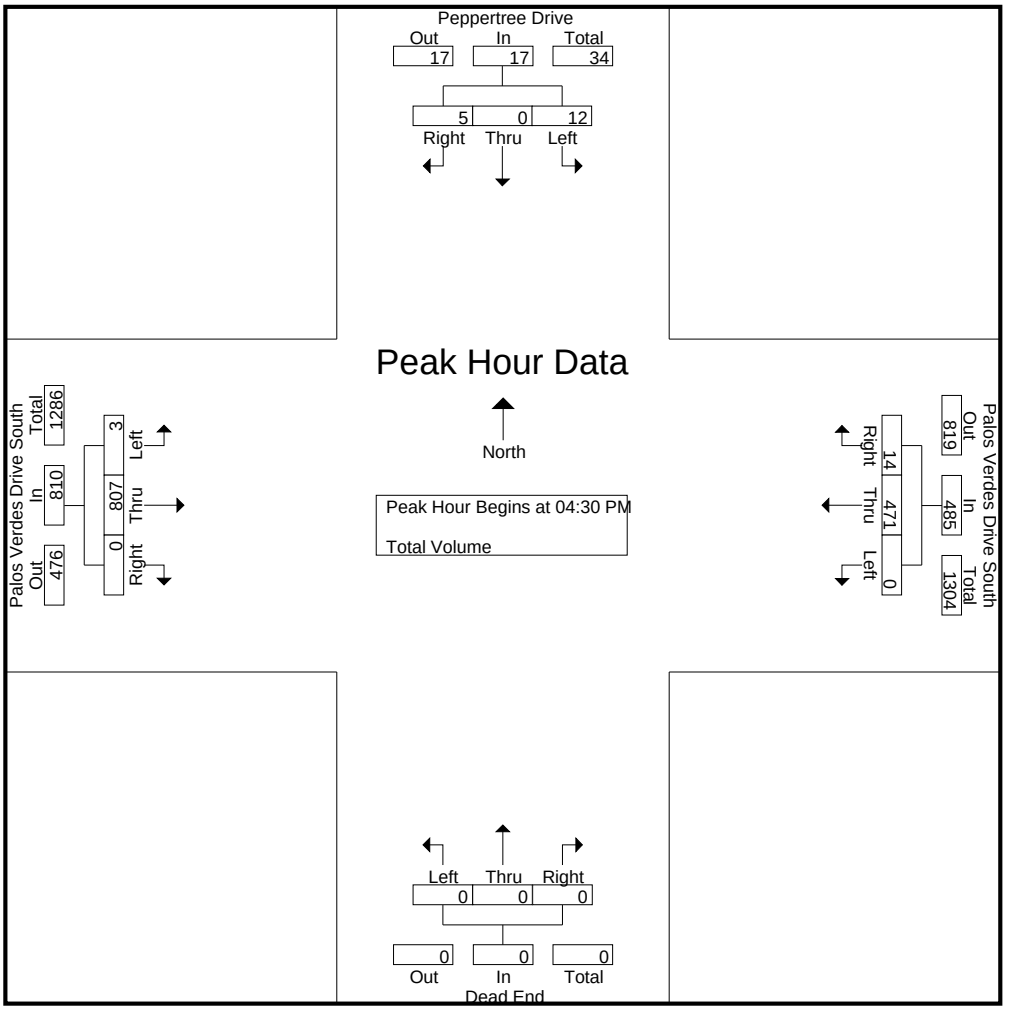
City of Rancho Palos Verdes
N/S: Peppertree Drive
E/W: Palos Verdes Drive South
Weather: Clear

File Name : 03_RPV_Peppertree_Palos Verdes Dr S PM 2
Site Code : 05718832
Start Date : 11/14/2018
Page No : 2



Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	04:00 PM				04:00 PM				04:00 PM				04:30 PM			
+0 mins.	4	0	**2**	6	0	**133**	4	**137**	0	0	0	0	0	194	0	194
+15 mins.	2	0	1	3	0	119	2	121	0	0	0	0	**1**	199	0	200
+30 mins.	**7**	0	2	**9**	0	101	**5**	106	0	0	0	0	1	196	0	197
+45 mins.	1	0	1	2	0	119	5	124	0	0	0	0	1	**218**	0	**219**
Total Volume	14	0	6	20	0	472	16	488	0	0	0	0	3	807	0	810
% App. Total	70	0	30		0	96.7	3.3		0	0	0		0.4	99.6	0	
PHF	.500	.000	.750	.556	.000	.887	.800	.891	.000	.000	.000	.000	.750	.925	.000	.925

INTERSECTION TURNING MOVEMENT COUNTS

PREPARED BY: AimTD LLC. tel: 714 253 7888 cs@aimtd.com

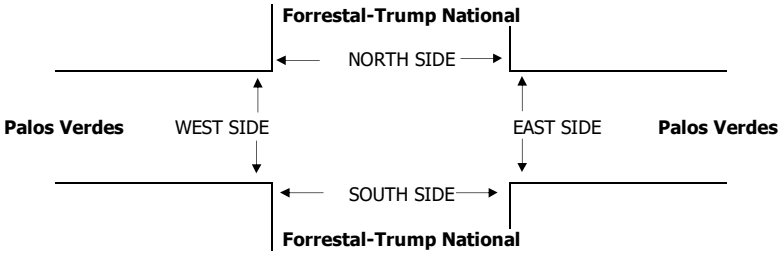
DATE:					
Tue, Apr 26, 22	LOCATION:	Rancho Palos Verdes	PROJECT #:	SC3388
	NORTH & SOUTH:	Forrestal	LOCATION #:	1
	EAST & WEST:	Palos Verdes	CONTROL:	STOP N/S

NOTES:

AM / PM / MD / OTHER / OTHER — ▲ N, ◄ W, E ►, S ▼

☑ Add U-Turns to Left Turns

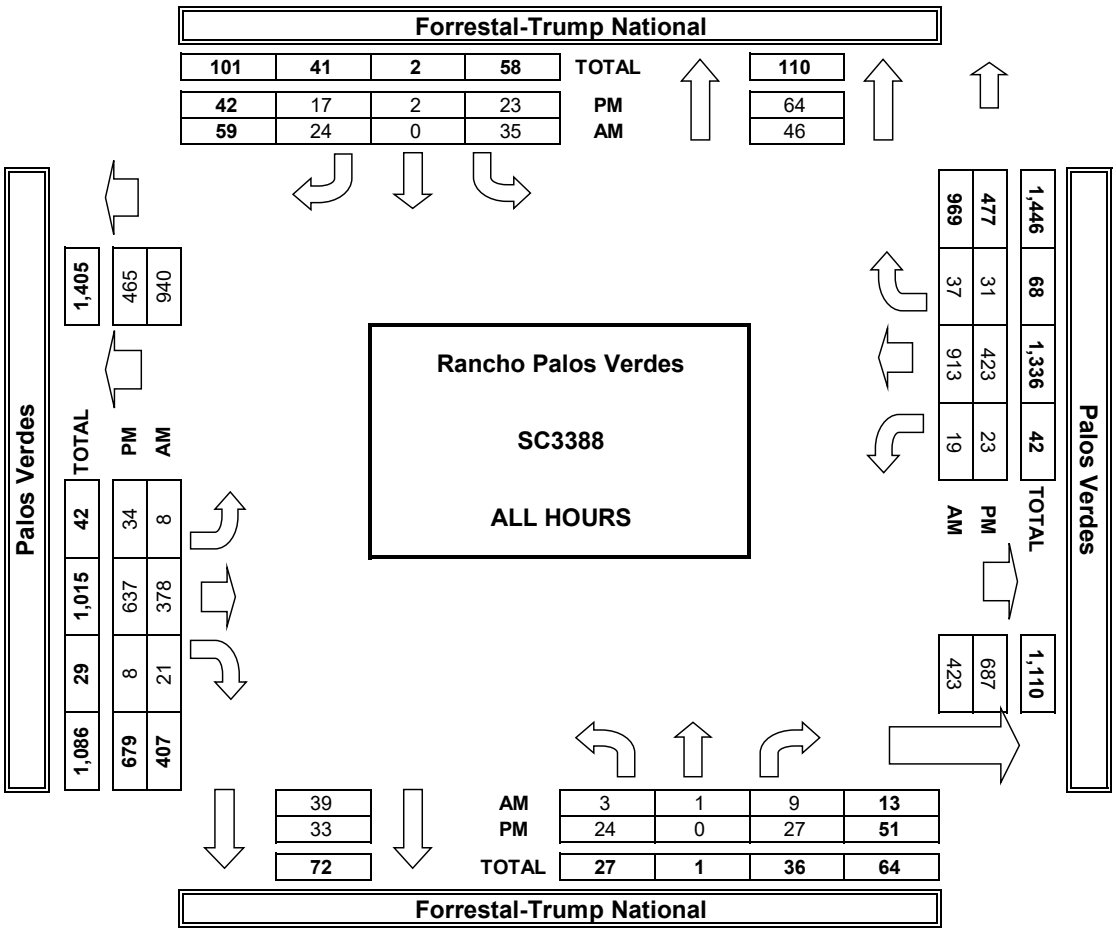
		NORTHBOUND Forrestal-Trump National			SOUTHBOUND Forrestal-Trump National			EASTBOUND Palos Verdes			WESTBOUND Palos Verdes				U-TURNS				
	LANES:	NL 1	NT 1	NR 0	SL 1	ST 0.5	SR 0.5	EL 1	ET 1	ER 1	WL 1	WT 1	WR 1	TOTAL	NB 0	SB 0	EB 0	WB 0	TTL
AM	7:30 AM	2	0	4	8	0	6	0	63	4	1	257	5	350	0	0	0	0	0
	7:45 AM	0	0	2	10	0	8	5	88	2	5	242	6	368	0	0	0	1	1
	8:00 AM	0	1	1	7	0	6	1	102	4	5	235	14	376	0	0	0	0	0
	8:15 AM	1	0	2	10	0	4	2	125	11	8	179	12	354	0	0	0	0	0
	VOLUMES	3	1	9	35	0	24	8	378	21	19	913	37	1,448	0	0	0	1	1
	APPROACH %	23%	8%	69%	59%	0%	41%	2%	93%	5%	2%	94%	4%						
	APP/DEPART	13	/	46	59	/	39	407	/	423	969	/	940	0					
	BEGIN PEAK HR		7:30 AM																
	VOLUMES	3	1	9	35	0	24	8	378	21	19	913	37	1,448					
	APPROACH %	23%	8%	69%	59%	0%	41%	2%	93%	5%	2%	94%	4%						
	PEAK HR FACTOR		0.542			0.819			0.737			0.921		0.963					
	APP/DEPART	13	/	46	59	/	39	407	/	423	969	/	940	0					
PM	4:30 PM	4	0	3	6	0	2	10	160	3	7	112	4	311	0	0	1	0	1
	4:45 PM	9	0	7	8	1	4	13	151	0	5	111	5	314	0	0	0	0	0
	5:00 PM	7	0	11	6	1	8	5	159	3	9	108	9	326	0	0	0	0	0
	5:15 PM	4	0	6	3	0	3	6	167	2	2	92	13	298	0	0	0	0	0
	VOLUMES	24	0	27	23	2	17	34	637	8	23	423	31	1,249	0	0	1	0	1
	APPROACH %	47%	0%	53%	55%	5%	40%	5%	94%	1%	5%	89%	6%						
	APP/DEPART	51	/	64	42	/	33	679	/	687	477	/	465	0					
	BEGIN PEAK HR		4:30 PM																
	VOLUMES	24	0	27	23	2	17	34	637	8	23	423	31	1,249					
	APPROACH %	47%	0%	53%	55%	5%	40%	5%	94%	1%	5%	89%	6%						
	PEAK HR FACTOR		0.708			0.700			0.970			0.946		0.958					
	APP/DEPART	51	/	64	42	/	33	679	/	687	477	/	465	0					

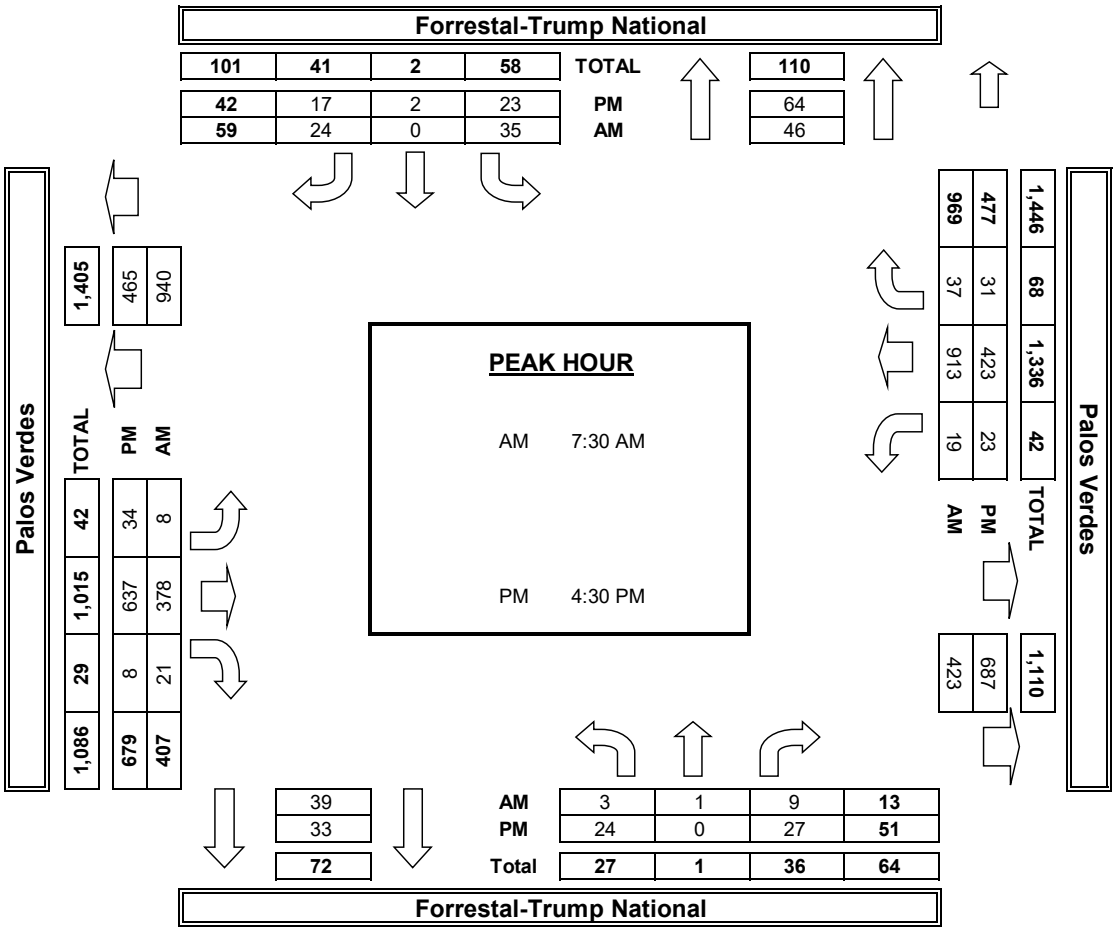


		PEDESTRIAN + BIKE CROSSINGS					PEDESTRIAN CROSSINGS					BICYCLE CROSSINGS				
		N SIDE	S SIDE	E SIDE	W SIDE	TOTAL	N SIDE	S SIDE	E SIDE	W SIDE	TOTAL	NS	SS	ES	WS	TOTAL
AM	7:30 AM	0	1	0	0	1	0	0	0	0	0	0	1	0	0	1
	7:45 AM	2	3	0	0	5	0	0	0	0	0	2	3	0	0	5
	8:00 AM	4	6	2	0	12	0	2	0	0	2	4	4	2	0	10
	8:15 AM	0	2	0	0	2	0	2	0	0	2	0	0	0	0	0
	TOTAL	6	12	2	0	20	0	4	0	0	4	6	8	2	0	16
	AM BEGIN PEAK HR			7:30 AM			0	4	0	0	4					
PM	4:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	4:45 PM	1	4	0	0	5	0	2	0	0	2	1	2	0	0	3
	5:00 PM	0	1	0	0	1	0	0	0	0	0	0	1	0	0	1
	5:15 PM	0	5	0	0	5	0	4	0	0	4	0	1	0	0	1
	TOTAL	1	10	0	0	11	0	6	0	0	6	1	4	0	0	5
	PM BEGIN PEAK HR			4:30 PM			0	6	0	0	6					

AimTD LLC

TURNING MOVEMENT COUNTS





APPENDIX B

HCM AND LEVELS OF SERVICE EXPLANATION

HCM DATA WORKSHEETS
WEEKDAY AM AND PM PEAK HOURS

LEVEL OF SERVICE FOR UNSIGNALIZED INTERSECTIONS

In the *Highway Capacity Manual (HCM)*, published by the Transportation Research Board, 2000, level of service for unsignalized intersections is defined in terms of delay, which is a measure of driver discomfort, frustration, fuel consumption, and lost travel time. The delay experienced by a motorist is made up of a number of factors that relate to control, geometrics, traffic, and incidents. Total delay is the difference between the travel time actually experienced and the reference travel time that would result during base conditions, in the absence of incidents, control, traffic, or geometric delay. Only the portion of total delay attributed to the traffic control measures, either traffic signals or stop signs, is quantified. This delay is called *control delay*. Control delay includes initial deceleration delay, queue move-up time, stopped delay, and final acceleration delay.

Level of Service criteria for unsignalized intersections are stated in terms of the average control delay per vehicle. The level of service is determined by the computed or measured control delay and is defined for each minor movement. Average control delay for any particular minor movement is a function of the service time for the approach and the degree of utilization. (Level of service is not defined for the intersection as a whole for two-way stop controlled intersections.)

Level of Service Criteria for TWSC/AWSC Intersections

Level of Service	Average Control Delay (Sec/Veh)
A	≤ 10
B	> 10 and ≤ 15
C	> 15 and ≤ 25
D	> 25 and ≤ 35
E	> 35 and ≤ 50
F	> 50

Level of Service (LOS) values are used to describe intersection operations with service levels varying from LOS A (free flow) to LOS F (jammed condition). The following descriptions summarize *HCM* criteria for each level of service:

LOS A describes operations with very low control delay, up to 10 seconds per vehicle.

LOS B describes operations with control delay greater than 10 and up to 15 seconds per vehicle.

LOS C describes operations with control delay greater than 15 and up to 25 seconds per vehicle.

LOS D describes operations with control delay greater than 25 and up to 35 seconds per vehicle.

LOS E describes operations with control delay greater than 35 and up to 50 seconds per vehicle.

LOS F describes operations with control delay in excess of 50 seconds per vehicle. For two-way stop controlled intersections, LOS F exists when there are insufficient gaps of suitable size to allow side-street demand to safely cross through a major-street traffic stream. This level of service is generally evident from extremely long control delays experienced by side-street traffic and by queuing on the minor-street approaches.

Intersection	
Int Delay, s/veh	0.8

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	25	416	10	15	1040	2	19	0	8	3	0	6
Future Vol, veh/h	25	416	10	15	1040	2	19	0	8	3	0	6
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	105	-	-	199	-	215	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	95	95	95	95	95	95	95	95	95	95	95	95
Heavy Vehicles, %	0	0	0	0	0	0	0	0	0	0	0	0
Mvmt Flow	26	438	11	16	1095	2	20	0	8	3	0	6

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	1097	0	0	449	0	0	1076	1625	225	1398	1628	548
Stage 1	-	-	-	-	-	-	496	496	-	1127	1127	-
Stage 2	-	-	-	-	-	-	580	1129	-	271	501	-
Critical Hdwy	4.1	-	-	4.1	-	-	7.5	6.5	6.9	7.5	6.5	6.9
Critical Hdwy Stg 1	-	-	-	-	-	-	6.5	5.5	-	6.5	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.5	5.5	-	6.5	5.5	-
Follow-up Hdwy	2.2	-	-	2.2	-	-	3.5	4	3.3	3.5	4	3.3
Pot Cap-1 Maneuver	644	-	-	1122	-	-	176	103	784	102	103	485
Stage 1	-	-	-	-	-	-	529	549	-	221	282	-
Stage 2	-	-	-	-	-	-	472	281	-	717	546	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	644	-	-	1122	-	-	166	98	784	97	98	485
Mov Cap-2 Maneuver	-	-	-	-	-	-	166	98	-	97	98	-
Stage 1	-	-	-	-	-	-	508	527	-	212	278	-
Stage 2	-	-	-	-	-	-	459	277	-	681	524	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.6	0.1	24.1	23.1
HCM LOS			C	C

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	217	644	-	-	1122	-	-	208
HCM Lane V/C Ratio	0.131	0.041	-	-	0.014	-	-	0.046
HCM Control Delay (s)	24.1	10.8	-	-	8.3	-	-	23.1
HCM Lane LOS	C	B	-	-	A	-	-	C
HCM 95th %tile Q(veh)	0.4	0.1	-	-	0	-	-	0.1

Intersection	
Int Delay, s/veh	0.5

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	9	849	14	12	508	5	10	0	4	4	0	3
Future Vol, veh/h	9	849	14	12	508	5	10	0	4	4	0	3
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	105	-	-	199	-	215	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	95	95	95	95	95	95	95	95	95	95	95	95
Heavy Vehicles, %	0	0	0	0	0	0	0	0	0	0	0	0
Mvmt Flow	9	894	15	13	535	5	11	0	4	4	0	3

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	540	0	0	909	0	0	1214	1486	455	1026	1488	268
Stage 1	-	-	-	-	-	-	920	920	-	561	561	-
Stage 2	-	-	-	-	-	-	294	566	-	465	927	-
Critical Hdwy	4.1	-	-	4.1	-	-	7.5	6.5	6.9	7.5	6.5	6.9
Critical Hdwy Stg 1	-	-	-	-	-	-	6.5	5.5	-	6.5	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.5	5.5	-	6.5	5.5	-
Follow-up Hdwy	2.2	-	-	2.2	-	-	3.5	4	3.3	3.5	4	3.3
Pot Cap-1 Maneuver	1039	-	-	757	-	-	140	126	558	192	125	736
Stage 1	-	-	-	-	-	-	296	352	-	485	513	-
Stage 2	-	-	-	-	-	-	695	511	-	552	350	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1039	-	-	757	-	-	137	123	558	187	122	736
Mov Cap-2 Maneuver	-	-	-	-	-	-	137	123	-	187	122	-
Stage 1	-	-	-	-	-	-	293	349	-	481	504	-
Stage 2	-	-	-	-	-	-	680	502	-	543	347	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.1	0.2	27.5	18.5
HCM LOS			D	C

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	175	1039	-	-	757	-	-	275
HCM Lane V/C Ratio	0.084	0.009	-	-	0.017	-	-	0.027
HCM Control Delay (s)	27.5	8.5	-	-	9.8	-	-	18.5
HCM Lane LOS	D	A	-	-	A	-	-	C
HCM 95th %tile Q(veh)	0.3	0	-	-	0.1	-	-	0.1

Intersection	
Int Delay, s/veh	0.8

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	25	422	10	15	1046	2	19	0	8	3	0	6
Future Vol, veh/h	25	422	10	15	1046	2	19	0	8	3	0	6
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	105	-	-	199	-	215	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	95	95	95	95	95	95	95	95	95	95	95	95
Heavy Vehicles, %	0	0	0	0	0	0	0	0	0	0	0	0
Mvmt Flow	26	444	11	16	1101	2	20	0	8	3	0	6

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	1103	0	0	455	0	0	1085	1637	228	1407	1640	551
Stage 1	-	-	-	-	-	-	502	502	-	1133	1133	-
Stage 2	-	-	-	-	-	-	583	1135	-	274	507	-
Critical Hdwy	4.1	-	-	4.1	-	-	7.5	6.5	6.9	7.5	6.5	6.9
Critical Hdwy Stg 1	-	-	-	-	-	-	6.5	5.5	-	6.5	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.5	5.5	-	6.5	5.5	-
Follow-up Hdwy	2.2	-	-	2.2	-	-	3.5	4	3.3	3.5	4	3.3
Pot Cap-1 Maneuver	640	-	-	1116	-	-	174	102	781	101	101	483
Stage 1	-	-	-	-	-	-	525	545	-	219	280	-
Stage 2	-	-	-	-	-	-	470	280	-	714	543	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	640	-	-	1116	-	-	165	96	781	96	96	483
Mov Cap-2 Maneuver	-	-	-	-	-	-	165	96	-	96	96	-
Stage 1	-	-	-	-	-	-	503	523	-	210	276	-
Stage 2	-	-	-	-	-	-	457	276	-	678	521	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.6	0.1	24.3	23.3
HCM LOS			C	C

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	215	640	-	-	1116	-	-	206
HCM Lane V/C Ratio	0.132	0.041	-	-	0.014	-	-	0.046
HCM Control Delay (s)	24.3	10.9	-	-	8.3	-	-	23.3
HCM Lane LOS	C	B	-	-	A	-	-	C
HCM 95th %tile Q(veh)	0.4	0.1	-	-	0	-	-	0.1

Intersection	
Int Delay, s/veh	0.5

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	9	855	14	12	518	5	10	0	4	4	0	3
Future Vol, veh/h	9	855	14	12	518	5	10	0	4	4	0	3
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	105	-	-	199	-	215	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	95	95	95	95	95	95	95	95	95	95	95	95
Heavy Vehicles, %	0	0	0	0	0	0	0	0	0	0	0	0
Mvmt Flow	9	900	15	13	545	5	11	0	4	4	0	3

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	550	0	0	915	0	0	1225	1502	458	1039	1504	273
Stage 1	-	-	-	-	-	-	926	926	-	571	571	-
Stage 2	-	-	-	-	-	-	299	576	-	468	933	-
Critical Hdwy	4.1	-	-	4.1	-	-	7.5	6.5	6.9	7.5	6.5	6.9
Critical Hdwy Stg 1	-	-	-	-	-	-	6.5	5.5	-	6.5	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.5	5.5	-	6.5	5.5	-
Follow-up Hdwy	2.2	-	-	2.2	-	-	3.5	4	3.3	3.5	4	3.3
Pot Cap-1 Maneuver	1030	-	-	754	-	-	137	123	555	188	123	731
Stage 1	-	-	-	-	-	-	293	350	-	478	508	-
Stage 2	-	-	-	-	-	-	691	505	-	550	348	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1030	-	-	754	-	-	134	120	555	183	120	731
Mov Cap-2 Maneuver	-	-	-	-	-	-	134	120	-	183	120	-
Stage 1	-	-	-	-	-	-	290	347	-	474	499	-
Stage 2	-	-	-	-	-	-	676	496	-	541	345	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.1	0.2	28	18.7
HCM LOS			D	C

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	171	1030	-	-	754	-	-	270
HCM Lane V/C Ratio	0.086	0.009	-	-	0.017	-	-	0.027
HCM Control Delay (s)	28	8.5	-	-	9.9	-	-	18.7
HCM Lane LOS	D	A	-	-	A	-	-	C
HCM 95th %tile Q(veh)	0.3	0	-	-	0.1	-	-	0.1

Intersection	
Int Delay, s/veh	0.4

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	14	401	2	1	1040	14	0	0	0	9	0	18
Future Vol, veh/h	14	401	2	1	1040	14	0	0	0	9	0	18
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	Free	-	-	None	-	-	Free
Storage Length	60	-	-	64	-	98	-	-	-	-	-	25
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	95	95	95	95	95	95	95	95	95	95	95	95
Heavy Vehicles, %	0	0	0	0	0	0	0	0	0	0	0	0
Mvmt Flow	15	422	2	1	1095	15	0	0	0	9	0	19

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	1095	0	0	424	0	0	1550	1550	423	1550	1551	-
Stage 1	-	-	-	-	-	-	453	453	-	1097	1097	-
Stage 2	-	-	-	-	-	-	1097	1097	-	453	454	-
Critical Hdwy	4.1	-	-	4.1	-	-	7.1	6.5	6.2	7.1	6.5	-
Critical Hdwy Stg 1	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Follow-up Hdwy	2.2	-	-	2.2	-	-	3.5	4	3.3	3.5	4	-
Pot Cap-1 Maneuver	645	-	-	1146	-	0	94	115	635	94	115	0
Stage 1	-	-	-	-	-	0	590	573	-	261	291	0
Stage 2	-	-	-	-	-	0	261	291	-	590	573	0
Platoon blocked, %		-	-		-							
Mov Cap-1 Maneuver	645	-	-	1146	-	-	92	112	635	92	112	-
Mov Cap-2 Maneuver	-	-	-	-	-	-	92	112	-	92	112	-
Stage 1	-	-	-	-	-	-	576	560	-	255	291	-
Stage 2	-	-	-	-	-	-	261	291	-	576	560	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.4	0	0	48.6
HCM LOS			A	E

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	SBLn1	SBLn2
Capacity (veh/h)	-	645	-	-	1146	-	92	-
HCM Lane V/C Ratio	-	0.023	-	-	0.001	-	0.103	-
HCM Control Delay (s)	0	10.7	-	-	8.1	-	48.6	0
HCM Lane LOS	A	B	-	-	A	-	E	A
HCM 95th %tile Q(veh)	-	0.1	-	-	0	-	0.3	-

Intersection	
Int Delay, s/veh	0.7

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	18	844	0	0	492	11	0	0	0	17	0	27
Future Vol, veh/h	18	844	0	0	492	11	0	0	0	17	0	27
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	Free	-	-	None	-	-	Free
Storage Length	60	-	-	64	-	98	-	-	-	-	-	25
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	95	95	95	95	95	95	95	95	95	95	95	95
Heavy Vehicles, %	0	0	0	0	0	0	0	0	0	0	0	0
Mvmt Flow	19	888	0	0	518	12	0	0	0	18	0	28

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	518	0	0	888	0	0	1444	1444	888	1444	1444	-
Stage 1	-	-	-	-	-	-	926	926	-	518	518	-
Stage 2	-	-	-	-	-	-	518	518	-	926	926	-
Critical Hdwy	4.1	-	-	4.1	-	-	7.1	6.5	6.2	7.1	6.5	-
Critical Hdwy Stg 1	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Follow-up Hdwy	2.2	-	-	2.2	-	-	3.5	4	3.3	3.5	4	-
Pot Cap-1 Maneuver	1058	-	-	771	-	0	111	133	345	111	133	0
Stage 1	-	-	-	-	-	0	325	350	-	544	536	0
Stage 2	-	-	-	-	-	0	544	536	-	325	350	0
Platoon blocked, %		-	-		-							
Mov Cap-1 Maneuver	1058	-	-	771	-	-	109	131	345	109	131	-
Mov Cap-2 Maneuver	-	-	-	-	-	-	109	131	-	109	131	-
Stage 1	-	-	-	-	-	-	319	344	-	534	536	-
Stage 2	-	-	-	-	-	-	544	536	-	319	344	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.2	0	0	44.4
HCM LOS			A	E

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	SBLn1	SBLn2
Capacity (veh/h)	-	1058	-	-	771	-	109	-
HCM Lane V/C Ratio	-	0.018	-	-	-	-	0.164	-
HCM Control Delay (s)	0	8.5	-	-	0	-	44.4	0
HCM Lane LOS	A	A	-	-	A	-	E	A
HCM 95th %tile Q(veh)	-	0.1	-	-	0	-	0.6	-

Intersection	
Int Delay, s/veh	0.4

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	14	407	2	1	1046	14	0	0	0	9	0	18
Future Vol, veh/h	14	407	2	1	1046	14	0	0	0	9	0	18
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	Free	-	-	None	-	-	Free
Storage Length	60	-	-	64	-	98	-	-	-	-	-	25
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	95	95	95	95	95	95	95	95	95	95	95	95
Heavy Vehicles, %	0	0	0	0	0	0	0	0	0	0	0	0
Mvmt Flow	15	428	2	1	1101	15	0	0	0	9	0	19

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	1101	0	0	430	0	0	1562	1562	429	1562	1563	-
Stage 1	-	-	-	-	-	-	459	459	-	1103	1103	-
Stage 2	-	-	-	-	-	-	1103	1103	-	459	460	-
Critical Hdwy	4.1	-	-	4.1	-	-	7.1	6.5	6.2	7.1	6.5	-
Critical Hdwy Stg 1	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Follow-up Hdwy	2.2	-	-	2.2	-	-	3.5	4	3.3	3.5	4	-
Pot Cap-1 Maneuver	642	-	-	1140	-	0	92	113	630	92	113	0
Stage 1	-	-	-	-	-	0	586	570	-	259	290	0
Stage 2	-	-	-	-	-	0	259	290	-	586	569	0
Platoon blocked, %		-	-		-							
Mov Cap-1 Maneuver	642	-	-	1140	-	-	90	110	630	90	110	-
Mov Cap-2 Maneuver	-	-	-	-	-	-	90	110	-	90	110	-
Stage 1	-	-	-	-	-	-	573	557	-	253	290	-
Stage 2	-	-	-	-	-	-	259	290	-	572	556	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.4	0	0	49.7
HCM LOS			A	E

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	SBLn1	SBLn2
Capacity (veh/h)	-	642	-	-	1140	-	90	-
HCM Lane V/C Ratio	-	0.023	-	-	0.001	-	0.105	-
HCM Control Delay (s)	0	10.7	-	-	8.2	-	49.7	0
HCM Lane LOS	A	B	-	-	A	-	E	A
HCM 95th %tile Q(veh)	-	0.1	-	-	0	-	0.3	-

Intersection	
Int Delay, s/veh	0.7

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	18	850	0	0	502	11	0	0	0	17	0	27
Future Vol, veh/h	18	850	0	0	502	11	0	0	0	17	0	27
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	Free	-	-	None	-	-	Free
Storage Length	60	-	-	64	-	98	-	-	-	-	-	25
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	95	95	95	95	95	95	95	95	95	95	95	95
Heavy Vehicles, %	0	0	0	0	0	0	0	0	0	0	0	0
Mvmt Flow	19	895	0	0	528	12	0	0	0	18	0	28

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	528	0	0	895	0	0	1461	1461	895	1461	1461	-
Stage 1	-	-	-	-	-	-	933	933	-	528	528	-
Stage 2	-	-	-	-	-	-	528	528	-	933	933	-
Critical Hdwy	4.1	-	-	4.1	-	-	7.1	6.5	6.2	7.1	6.5	-
Critical Hdwy Stg 1	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Follow-up Hdwy	2.2	-	-	2.2	-	-	3.5	4	3.3	3.5	4	-
Pot Cap-1 Maneuver	1049	-	-	767	-	0	108	130	342	108	130	0
Stage 1	-	-	-	-	-	0	322	348	-	538	531	0
Stage 2	-	-	-	-	-	0	538	531	-	322	348	0
Platoon blocked, %		-	-		-							
Mov Cap-1 Maneuver	1049	-	-	767	-	-	106	128	342	106	128	-
Mov Cap-2 Maneuver	-	-	-	-	-	-	106	128	-	106	128	-
Stage 1	-	-	-	-	-	-	316	342	-	528	531	-
Stage 2	-	-	-	-	-	-	538	531	-	316	342	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.2	0	0	45.7
HCM LOS			A	E

Minor Lane/Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	SBLn1	SBLn2
Capacity (veh/h)	-	1049	-	-	767	-	106	-
HCM Lane V/C Ratio	-	0.018	-	-	-	-	0.169	-
HCM Control Delay (s)	0	8.5	-	-	0	-	45.7	0
HCM Lane LOS	A	A	-	-	A	-	E	A
HCM 95th %tile Q(veh)	-	0.1	-	-	0	-	0.6	-

Intersection	
Int Delay, s/veh	0.6

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	6	400	1050	12	16	8
Future Vol, veh/h	6	400	1050	12	16	8
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	Stop
Storage Length	45	-	-	58	0	38
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	95	95	95	95	95	95
Heavy Vehicles, %	0	0	0	0	0	0
Mvmt Flow	6	421	1105	13	17	8

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	1118	0	-	0	1538	1105
Stage 1	-	-	-	-	1105	-
Stage 2	-	-	-	-	433	-
Critical Hdwy	4.1	-	-	-	6.4	6.2
Critical Hdwy Stg 1	-	-	-	-	5.4	-
Critical Hdwy Stg 2	-	-	-	-	5.4	-
Follow-up Hdwy	2.2	-	-	-	3.5	3.3
Pot Cap-1 Maneuver	632	-	-	-	129	259
Stage 1	-	-	-	-	320	-
Stage 2	-	-	-	-	658	-
Platoon blocked, %			-	-	-	
Mov Cap-1 Maneuver	632	-	-	-	128	259
Mov Cap-2 Maneuver	-	-	-	-	128	-
Stage 1	-	-	-	-	317	-
Stage 2	-	-	-	-	658	-

Approach	EB	WB	SB
HCM Control Delay, s	0.2	0	31.3
HCM LOS			D

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	632	-	-	-	128	259
HCM Lane V/C Ratio	0.01	-	-	-	0.132	0.033
HCM Control Delay (s)	10.8	-	-	-	37.3	19.4
HCM Lane LOS	B	-	-	-	E	C
HCM 95th %tile Q(veh)	0	-	-	-	0.4	0.1

Intersection	
Int Delay, s/veh	0.3

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	3	851	497	14	12	5
Future Vol, veh/h	3	851	497	14	12	5
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	Stop
Storage Length	45	-	-	58	0	38
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	95	95	95	95	95	95
Heavy Vehicles, %	0	0	0	0	0	0
Mvmt Flow	3	896	523	15	13	5

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	538	0	-	0	1425	523
Stage 1	-	-	-	-	523	-
Stage 2	-	-	-	-	902	-
Critical Hdwy	4.1	-	-	-	6.4	6.2
Critical Hdwy Stg 1	-	-	-	-	5.4	-
Critical Hdwy Stg 2	-	-	-	-	5.4	-
Follow-up Hdwy	2.2	-	-	-	3.5	3.3
Pot Cap-1 Maneuver	1040	-	-	-	151	558
Stage 1	-	-	-	-	599	-
Stage 2	-	-	-	-	399	-
Platoon blocked, %			-	-	-	
Mov Cap-1 Maneuver	1040	-	-	-	151	558
Mov Cap-2 Maneuver	-	-	-	-	151	-
Stage 1	-	-	-	-	597	-
Stage 2	-	-	-	-	399	-

Approach	EB	WB	SB
HCM Control Delay, s	0	0	25.3
HCM LOS			D

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	1040	-	-	-	151	558
HCM Lane V/C Ratio	0.003	-	-	-	0.084	0.009
HCM Control Delay (s)	8.5	-	-	-	31	11.5
HCM Lane LOS	A	-	-	-	D	B
HCM 95th %tile Q(veh)	0	-	-	-	0.3	0

Intersection	
Int Delay, s/veh	0.6

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	6	406	1056	12	16	8
Future Vol, veh/h	6	406	1056	12	16	8
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	Stop
Storage Length	45	-	-	58	0	38
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	95	95	95	95	95	95
Heavy Vehicles, %	0	0	0	0	0	0
Mvmt Flow	6	427	1112	13	17	8

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	1125	0	-	0	1551	1112
Stage 1	-	-	-	-	1112	-
Stage 2	-	-	-	-	439	-
Critical Hdwy	4.1	-	-	-	6.4	6.2
Critical Hdwy Stg 1	-	-	-	-	5.4	-
Critical Hdwy Stg 2	-	-	-	-	5.4	-
Follow-up Hdwy	2.2	-	-	-	3.5	3.3
Pot Cap-1 Maneuver	628	-	-	-	126	256
Stage 1	-	-	-	-	317	-
Stage 2	-	-	-	-	654	-
Platoon blocked, %			-	-		
Mov Cap-1 Maneuver	628	-	-	-	125	256
Mov Cap-2 Maneuver	-	-	-	-	125	-
Stage 1	-	-	-	-	314	-
Stage 2	-	-	-	-	654	-

Approach	EB	WB	SB
HCM Control Delay, s	0.2	0	32
HCM LOS			D

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	628	-	-	-	125	256
HCM Lane V/C Ratio	0.01	-	-	-	0.135	0.033
HCM Control Delay (s)	10.8	-	-	-	38.2	19.5
HCM Lane LOS	B	-	-	-	E	C
HCM 95th %tile Q(veh)	0	-	-	-	0.5	0.1

Intersection	
Int Delay, s/veh	0.3

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Vol, veh/h	3	857	507	14	12	5
Future Vol, veh/h	3	857	507	14	12	5
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	Stop
Storage Length	45	-	-	58	0	38
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	95	95	95	95	95	95
Heavy Vehicles, %	0	0	0	0	0	0
Mvmt Flow	3	902	534	15	13	5

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	549	0	-	0	1442	534
Stage 1	-	-	-	-	534	-
Stage 2	-	-	-	-	908	-
Critical Hdwy	4.1	-	-	-	6.4	6.2
Critical Hdwy Stg 1	-	-	-	-	5.4	-
Critical Hdwy Stg 2	-	-	-	-	5.4	-
Follow-up Hdwy	2.2	-	-	-	3.5	3.3
Pot Cap-1 Maneuver	1031	-	-	-	147	550
Stage 1	-	-	-	-	592	-
Stage 2	-	-	-	-	397	-
Platoon blocked, %			-	-		
Mov Cap-1 Maneuver	1031	-	-	-	147	550
Mov Cap-2 Maneuver	-	-	-	-	147	-
Stage 1	-	-	-	-	590	-
Stage 2	-	-	-	-	397	-

Approach	EB	WB	SB
HCM Control Delay, s	0	0	25.9
HCM LOS			D

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	1031	-	-	-	147	550
HCM Lane V/C Ratio	0.003	-	-	-	0.086	0.01
HCM Control Delay (s)	8.5	-	-	-	31.8	11.6
HCM Lane LOS	A	-	-	-	D	B
HCM 95th %tile Q(veh)	0	-	-	-	0.3	0

Intersection	
Int Delay, s/veh	2

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	8	378	21	19	913	37	3	1	9	35	0	24
Future Vol, veh/h	8	378	21	19	913	37	3	1	9	35	0	24
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	145	-	145	215	-	225	58	-	-	95	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	95	95	95	95	95	95	95	95	95	95	95	95
Heavy Vehicles, %	0	0	0	0	0	0	0	0	0	0	0	0
Mvmt Flow	8	398	22	20	961	39	3	1	9	37	0	25

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	1000	0	0	420	0	0	1447	1454	398	1431	1437	961
Stage 1	-	-	-	-	-	-	414	414	-	1001	1001	-
Stage 2	-	-	-	-	-	-	1033	1040	-	430	436	-
Critical Hdwy	4.1	-	-	4.1	-	-	7.1	6.5	6.2	7.1	6.5	6.2
Critical Hdwy Stg 1	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Follow-up Hdwy	2.2	-	-	2.2	-	-	3.5	4	3.3	3.5	4	3.3
Pot Cap-1 Maneuver	700	-	-	1150	-	-	110	131	656	113	135	314
Stage 1	-	-	-	-	-	-	620	597	-	295	323	-
Stage 2	-	-	-	-	-	-	283	310	-	607	583	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	700	-	-	1150	-	-	99	127	656	108	131	314
Mov Cap-2 Maneuver	-	-	-	-	-	-	99	127	-	108	131	-
Stage 1	-	-	-	-	-	-	613	590	-	292	318	-
Stage 2	-	-	-	-	-	-	256	305	-	590	577	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.2	0.2	19.8	39.6
HCM LOS			C	E

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	99	463	700	-	-	1150	-	-	108	314
HCM Lane V/C Ratio	0.032	0.023	0.012	-	-	0.017	-	-	0.341	0.08
HCM Control Delay (s)	42.6	13	10.2	-	-	8.2	-	-	54.7	17.5
HCM Lane LOS	E	B	B	-	-	A	-	-	F	C
HCM 95th %tile Q(veh)	0.1	0.1	0	-	-	0.1	-	-	1.3	0.3

Intersection	
Int Delay, s/veh	2.3

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	34	637	8	23	423	31	24	0	27	23	2	17
Future Vol, veh/h	34	637	8	23	423	31	24	0	27	23	2	17
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	145	-	145	215	-	225	58	-	-	95	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	95	95	95	95	95	95	95	95	95	95	95	95
Heavy Vehicles, %	0	0	0	0	0	0	0	0	0	0	0	0
Mvmt Flow	36	671	8	24	445	33	25	0	28	24	2	18

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	478	0	0	679	0	0	1263	1269	671	1254	1244	445
Stage 1	-	-	-	-	-	-	743	743	-	493	493	-
Stage 2	-	-	-	-	-	-	520	526	-	761	751	-
Critical Hdwy	4.1	-	-	4.1	-	-	7.1	6.5	6.2	7.1	6.5	6.2
Critical Hdwy Stg 1	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Follow-up Hdwy	2.2	-	-	2.2	-	-	3.5	4	3.3	3.5	4	3.3
Pot Cap-1 Maneuver	1095	-	-	923	-	-	148	170	460	150	176	617
Stage 1	-	-	-	-	-	-	410	425	-	562	550	-
Stage 2	-	-	-	-	-	-	543	532	-	401	421	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1095	-	-	923	-	-	136	160	460	135	166	617
Mov Cap-2 Maneuver	-	-	-	-	-	-	136	160	-	135	166	-
Stage 1	-	-	-	-	-	-	396	411	-	543	536	-
Stage 2	-	-	-	-	-	-	512	518	-	364	407	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.4	0.4	24.6	26.3
HCM LOS			C	D

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	136	460	1095	-	-	923	-	-	135	480
HCM Lane V/C Ratio	0.186	0.062	0.033	-	-	0.026	-	-	0.179	0.042
HCM Control Delay (s)	37.4	13.3	8.4	-	-	9	-	-	37.4	12.8
HCM Lane LOS	E	B	A	-	-	A	-	-	E	B
HCM 95th %tile Q(veh)	0.7	0.2	0.1	-	-	0.1	-	-	0.6	0.1

Intersection	
Int Delay, s/veh	2

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	8	382	21	19	917	37	3	1	9	35	0	24
Future Vol, veh/h	8	382	21	19	917	37	3	1	9	35	0	24
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	145	-	145	215	-	225	58	-	-	95	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	95	95	95	95	95	95	95	95	95	95	95	95
Heavy Vehicles, %	0	0	0	0	0	0	0	0	0	0	0	0
Mvmt Flow	8	402	22	20	965	39	3	1	9	37	0	25

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	1004	0	0	424	0	0	1455	1462	402	1439	1445	965
Stage 1	-	-	-	-	-	-	418	418	-	1005	1005	-
Stage 2	-	-	-	-	-	-	1037	1044	-	434	440	-
Critical Hdwy	4.1	-	-	4.1	-	-	7.1	6.5	6.2	7.1	6.5	6.2
Critical Hdwy Stg 1	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Follow-up Hdwy	2.2	-	-	2.2	-	-	3.5	4	3.3	3.5	4	3.3
Pot Cap-1 Maneuver	698	-	-	1146	-	-	109	130	653	112	133	312
Stage 1	-	-	-	-	-	-	616	594	-	294	322	-
Stage 2	-	-	-	-	-	-	282	309	-	604	581	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	698	-	-	1146	-	-	98	126	653	107	129	312
Mov Cap-2 Maneuver	-	-	-	-	-	-	98	126	-	107	129	-
Stage 1	-	-	-	-	-	-	609	587	-	291	317	-
Stage 2	-	-	-	-	-	-	255	304	-	587	575	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.2	0.2	19.9	40
HCM LOS			C	E

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	98	460	698	-	-	1146	-	-	107	312
HCM Lane V/C Ratio	0.032	0.023	0.012	-	-	0.017	-	-	0.344	0.081
HCM Control Delay (s)	43	13	10.2	-	-	8.2	-	-	55.4	17.6
HCM Lane LOS	E	B	B	-	-	A	-	-	F	C
HCM 95th %tile Q(veh)	0.1	0.1	0	-	-	0.1	-	-	1.4	0.3

Intersection	
Int Delay, s/veh	2.3

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	34	643	8	23	427	31	24	0	27	23	2	17
Future Vol, veh/h	34	643	8	23	427	31	24	0	27	23	2	17
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	145	-	145	215	-	225	58	-	-	95	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	95	95	95	95	95	95	95	95	95	95	95	95
Heavy Vehicles, %	0	0	0	0	0	0	0	0	0	0	0	0
Mvmt Flow	36	677	8	24	449	33	25	0	28	24	2	18

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	482	0	0	685	0	0	1273	1279	677	1264	1254	449
Stage 1	-	-	-	-	-	-	749	749	-	497	497	-
Stage 2	-	-	-	-	-	-	524	530	-	767	757	-
Critical Hdwy	4.1	-	-	4.1	-	-	7.1	6.5	6.2	7.1	6.5	6.2
Critical Hdwy Stg 1	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.1	5.5	-	6.1	5.5	-
Follow-up Hdwy	2.2	-	-	2.2	-	-	3.5	4	3.3	3.5	4	3.3
Pot Cap-1 Maneuver	1091	-	-	918	-	-	146	167	456	148	173	614
Stage 1	-	-	-	-	-	-	407	422	-	559	548	-
Stage 2	-	-	-	-	-	-	540	530	-	398	419	-
Platoon blocked, %		-	-		-	-						
Mov Cap-1 Maneuver	1091	-	-	918	-	-	134	157	456	133	163	614
Mov Cap-2 Maneuver	-	-	-	-	-	-	134	157	-	133	163	-
Stage 1	-	-	-	-	-	-	394	408	-	541	534	-
Stage 2	-	-	-	-	-	-	509	516	-	361	405	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.4	0.4	25	26.6
HCM LOS			D	D

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1	SBLn2
Capacity (veh/h)	134	456	1091	-	-	918	-	-	133	476
HCM Lane V/C Ratio	0.189	0.062	0.033	-	-	0.026	-	-	0.182	0.042
HCM Control Delay (s)	38	13.4	8.4	-	-	9	-	-	38	12.9
HCM Lane LOS	E	B	A	-	-	A	-	-	E	B
HCM 95th %tile Q(veh)	0.7	0.2	0.1	-	-	0.1	-	-	0.6	0.1

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