RAJU Associates, Inc.

444 E. Huntington Dr,
Suite 305
Arcadia, CA 91006
Voice: (626) 792-2700
Fax: (626) 792-2772

TECHNICAL MEMORANDUM

TO: Ms. Alexis Oropeza, City of Hermosa Beach
CC: Mr. Amir Mikhail, Pacific Developments

FROM: Srinath Raju, P.E.
Christopher Muñoz

SUBJECT: Hermosa Beach Early Education Center Project - 210 Pacific Coast Highway Traffic Operations and Parking Study Evaluation

DATE: April 24, 2024 **REF:** RA 764

Raju Associates was retained to provide an assessment of the proposed Hermosa Beach Early Education Center Project (Project) to address the City's request for evaluation of the following site issues:

- The proposed loading and unloading layout and demand.
- Employee parking area, vehicle queueing, if any, and impact on abutting right-of -way.
- Assess the demand turnover rate for load/unload of children during drop-off and pick-up.
- Identify whether the parking lot can handle the peak demand or identify operational layout or parking changes are needed. Identify if an alternative parking location(s), configuration, or parking assignment is needed. In the event that there is a need for additional parking to support the current demand for 77 children or a future expansion, explore off-site parking arrangement on neighboring properties in accordance with Hermosa Beach municipal code.

This technical memorandum provides a summary of the description of existing conditions, Project description, summary of the Project's trip generation estimates, and an evaluation and assessment of the Project's parking and loading/unloading area(s), and drop-off and pick-up operations. Additionally, VMT screening analysis and updated traffic and queueing analysis using new traffic counts at the Pacific Coast Highway/2nd Street intersection have been provided in this memorandum.

Based on an assessment of the above, the Project will provide adequate drop-off/pick-up spaces to accommodate the demand of the students. No traffic issues were identified at the Pacific Coast Highway/2nd Street intersection.

EXISTING CONDITIONS

The Project site is located at 210 Pacific Coast Highway (PCH) in the City of Hermosa Beach, California. The Project site is generally bounded by commercial and several residential uses to the north, 2nd Street to the south, PCH to the west and residential use to the east. The Project site and general vicinity are shown in Figure 1.

The existing site currently contains a retail auto showroom-body shop building. Two existing surface parking lots would serve the Project. One parking lot is located north of the building and is accessed from the driveway along PCH, while the other parking lot is located south of the building and is accessed from a driveway located along 2nd Street. As proposed, this existing building will be converted to a day care (early education center) facility.

Existing Street System

A brief description of the roadways serving the Project Site including functional class, number of lanes, speed limits, and parking availability is presented in the following section.

- Pacific Coast Highway (PCH) – PCH (SR-1) is classified as a major arterial highway and runs in a north-south direction. It defines the western frontage of Project Site. This roadway generally provides five travel lanes, three lanes in the northbound direction and two lanes in the southbound direction, during the morning peak commute period; and two lanes in the northbound direction and three lanes in the southbound direction during the evening peak commute peak period. Two travel lanes in each direction are provided during the non-peak commute hours with restricted parking on both sides of the street. Within the study area, restricted (non-metered) on-street parking is generally allowed on both sides of the street. The posted speed limit along this facility is 30 miles per hour.

- 2nd Street – 2nd Street is a local roadway and defines the southern frontage of the Project Site. Adjacent to the Project Site, it provides two travel lanes, one lane in the eastbound and westbound directions. The roadway becomes one-way westbound approximately 150 feet east of PCH and provides neighborhood intrusion protection. The prima facie speed limit is 25 miles per hour. Due to the topography of 2nd Street, 15 miles per hour warning signs are posted along this roadway.

Image Source: Google Maps

N
Not to scale

FIGURE 1
LOCATION OF PROJECT SITE

RAJU Associates, Inc.

Existing Pedestrian Circulation System

The pedestrian circulation system includes crosswalks, intersection traffic control, and sidewalks available to serve pedestrians. PCH and 2nd Street offer pedestrian access and circulation possibilities to the Project Site. Sidewalks are available on both sides of PCH and 2nd Street near and adjacent to and in the vicinity of the Project site. The existing sidewalk/parkway along PCH adjacent to the Project Site is approximately 8 feet wide, while the existing sidewalk/parkway along 2nd Street is 5 to 8 feet wide. Pedestrian crosswalks adjacent to the Project Site are available at the nearby intersections of PCH/1st Street, PCH/2nd Street and PCH/3rd Street.

Existing Transit Serving the Study Area

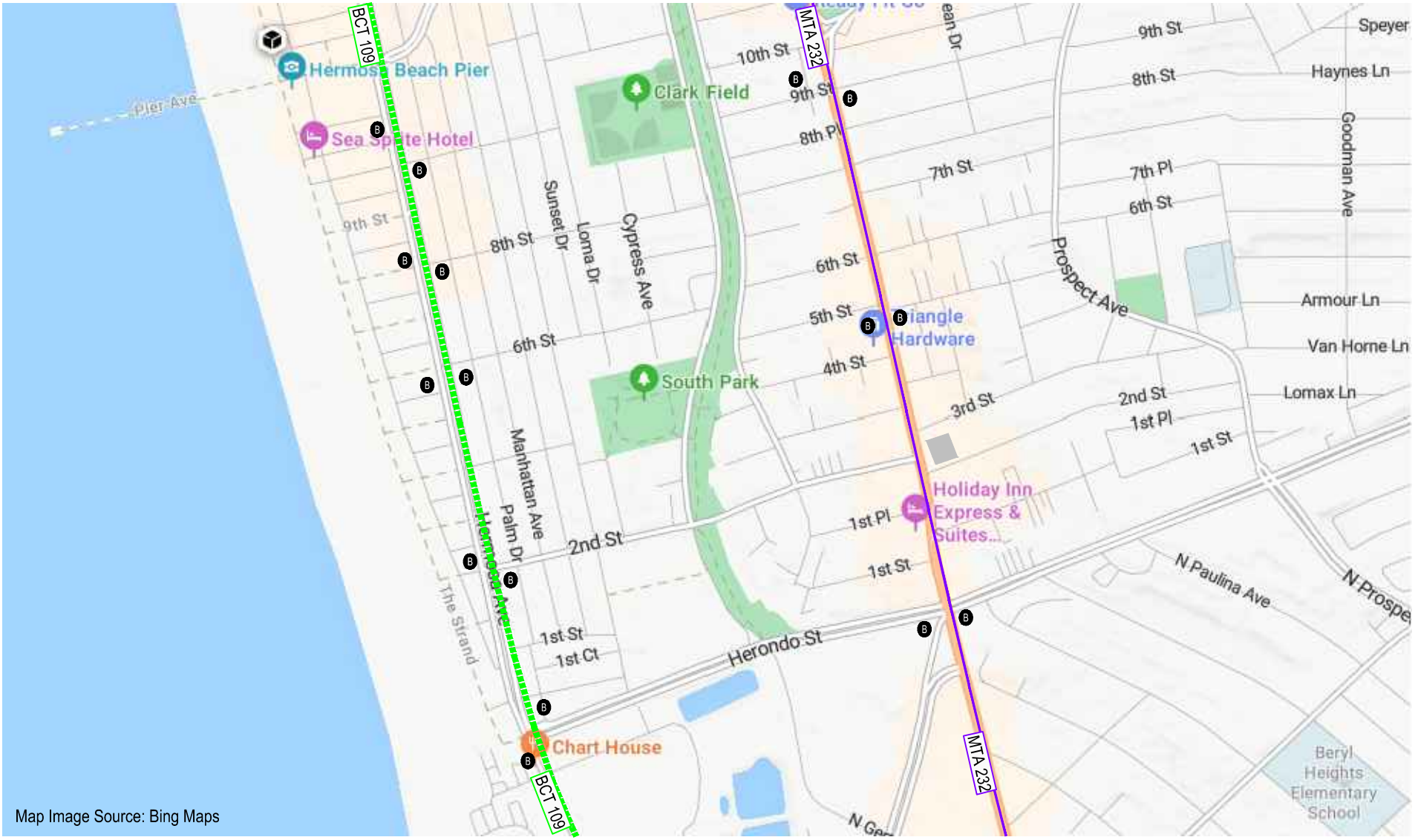
One bus line operated by the Los Angeles County Metropolitan Transportation Authority (MTA/Metro) and one bus line operated by Redondo Beach - Beach Cities Transit (BCT) currently serve the vicinity of the Project Site. A list of these transit lines is provided below and illustrated in Figure 2.

- Metro Line 232 – Metro Line 232 provides service from Long Beach to LAX and travels primarily along PCH within the study area.
- BCT Line 109 – BCT Line 109 provides service from Redondo Beach Riviera Village to the LAX City Bus Center and travels primarily along Hermosa Avenue with the study area.

Bus stops serving Metro Line 109 nearest to the Project Site are located at the corners of the intersection of PCH/5th Street and PCH/Herondo Street; as well as bus stops located at the corners of the intersection of Hermosa Avenue/2nd Street that serve BCT Line 109.

PROJECT DESCRIPTION

The Project is located on the north-east corner of the intersection of PCH and 2nd Street in the City of Hermosa Beach, California. The Project consists of an early education center (day care) with a maximum enrollment of 77 students. A total of 11 vehicle parking spaces will be available on site at the two existing surface parking lots. Five vehicle parking spaces would be provided in the PCH parking lot, while 6 vehicle parking spaces would be provided in the 2nd Street parking lot. The Project site plan is shown in Figure 3.



LEGEND:

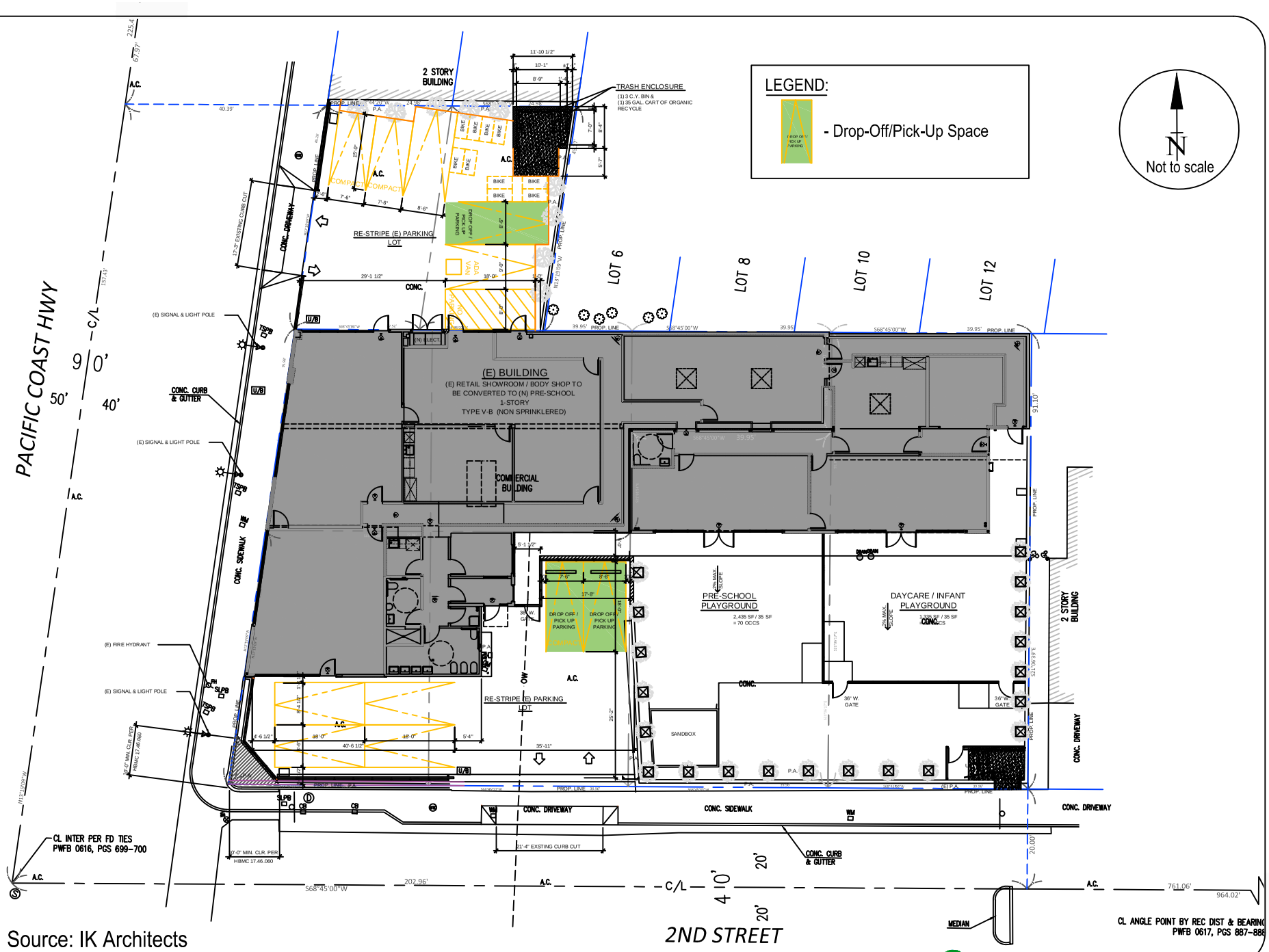
- Project Site
- B - Bus Stop
- Los Angeles County Metropolitan Transportation Authority (MTA)
- Redondo Beach - Beach Cities Transit (BCT)

N

Not to scale

FIGURE 2
EXISTING TRANSIT LINES

RAJU Associates, Inc.



Source: IK Architects

FIGURE 3
PROJECT SITE PLAN

RAJU Associates, Inc.

PROJECT PARKING REQUIREMENTS

Based on the City of Hermosa Beach Municipal Code Section 17.40.110 (A) – *Day Nursery, Preschools, and After School Child Care with Thirteen (13) or more Students*, the Project would need to provide 1 space for every seven (7) students. Therefore, the parking requirement for the Project is 11 spaces. The Project is providing a total of 11 parking spaces, satisfying the parking code requirement.

PROJECT PARKING LAYOUT

As shown in Figure 3, the Project is proposing to provide 5 parking spaces in the PCH parking lot located north of the Project building consisting of one standard parking space, two compact parking spaces, one designated drop-off/pick-up (standard) space and one ADA van accessible parking space. Additionally, this parking lot would provide 10 bicycle parking spaces. The existing approximately 17-foot driveway along PCH would continue to provide access to this parking lot.

The Project is proposing to provide 6 parking spaces in the 2nd Street parking lot located south of the Project building consisting of two standard tandem parking spaces (a total of 4 spaces), one compact drop-off/pick-up space and one standard drop-off/pick-up space. The existing approximately 21-foot driveway along 2nd Street would continue to provide access to this parking lot.

Overall, a total of 8 parking spaces (including one ADA parking space) would be provided for staff/employees and 3 parking spaces would be designated for student drop-off/pick-up (unloading/loading).

PROJECT TRIP GENERATION

The Project consists of a day care center with a maximum enrollment of 77 students. Utilizing the Institute of Transportation Engineer's (ITE) Trip Generation Manual, 11th Edition, the Project's trip generation was determined. Table 1 presents details of the Project's trip generation including type of use, size, applicable rate, and trip generation estimates. Other calculations within the table also provide for trip generation reductions from walk trips.

From Table 1, it can be observed that the Project's trip generation would result in a net total of approximately 289 daily trips of which approximately 53 trips (28 inbound and 25 outbound) would occur during the morning peak hour and 53 trips (25 inbound and 28 outbound) would occur during the evening peak hour.

The ITE Trip Generation Manual, 11th Edition, also provides hourly distribution of vehicles entering and exiting a typical day care facility (see Attachment A). Based on these percentages, an hourly distribution of vehicles entering and exiting the Project Site is provided in Table 2. As indicated in Table 2, the peak hour during the morning drop-off period occurred between 7:00 AM and 8:00 AM with a total of 28 inbound trips and 25 outbound trips. This is consistent with the morning peak hour trip generation shown in Table 1.

It was also assumed from the ITE hourly distribution that the pick-up period occurred over a four-hour period between the hours of 2:00 PM and 6:00 PM. From Table 2, the peak hour during the evening pick-up period occurred at 5:00 PM with a total of 25 inbound trips and 28 outbound trips. This is consistent with the evening peak hour trip generation shown in Table 1.

PROJECT DROP-OFF AND PICK-UP EVALUATION

This section provides an evaluation of the proposed drop-off and pick-up operations, an assessment of the demand turnover rate for unloading/loading students during drop-off and pick-up periods and identifies whether the parking lot can handle the estimated peak demand. This section also provides recommendations for the parking and operational layout to better serve the needs of the Project Site.

Proposed Drop-Off and Pick-Up Operations

As currently proposed, student drop-offs and pick-ups would occur in both parking lots. The PCH parking lot provides one parking space designated for drop-offs and pick-ups. Vehicles would enter from the driveway along PCH and park in the designated drop-off/pick-up space. The parent(s) would exit the vehicle and walk their child(ren) into the facility (drop-offs) or pick-up their child from the facility, return to their vehicle and exit right onto PCH.

TABLE 1
ESTIMATED PROJECT TRIP GENERATION

	Size	Daily Trips	AM Peak Hour			PM Peak Hour		
			IN	OUT	TOTAL	IN	OUT	TOTAL
Proposed Project								
Day Care Center	77 students	321	31	28	59	28	31	59
Walk Trips (10%)		(32)	(3)	(3)	(6)	(3)	(3)	(6)
Project Net Trip Generation Total		**289**	**28**	**25**	**53**	**25**	**28**	**53**
Trip Rates [1]								
Day Care Center (ITE Land Use 565)	Trips per student	[2]	53%	47%	[2]	47%	53%	[2]

[1] *Trip Generation Manual* , 11th Edition, ITE 2021.

[2] Trip generation estimates for Day Care Center (ITE Land Use 565) was calculated using the following equations:

Daily	T = 3.56 (X) + 47.23
AM Peak Hour:	T = 0.66 (X) + 8.42
PM Peak Hour:	Ln (T) = 0.87 Ln (X) + 0.29

Where:
Ln = Natural logarithm
T = Two-way volume of traffic (total trip-ends)
X = Number of students

TABLE 2
ESTIMATED HOURLY DISTRIBUTION

	Time Period	Vehicle Trips		
		Total	Entering	Exiting
Drop-Off Period [1]	7:00 - 8:00 AM	53	28	25
	8:00 - 9:00 AM	38	19	19
	9:00 - 10:00 AM	14	8	7
Pick-Up Period [1]	2:00 - 3:00 PM	21	10	10
	3:00 - 4:00 PM	21	11	10
	4:00 - 5:00 PM	40	20	19
	5:00 - 6:00 PM	53	25	28

* Based on ITE Trip Generation Manual, 11th Edition, Hourly Distribution of Entering and Exiting Vehicle Trips by Land Use Table, included in Attachment A.

[1] It was assumed from the ITE hourly distribution that the drop-off period occurred between the hours of 7:00 AM and 10:00 AM and the pick-up period occurred between the hours of 2:00 PM and 6:00 PM.

The 2nd Street parking lot provides two parking spaces designated for drop-offs and pick-ups. Due to the neighborhood traffic protection feature along 2nd Street, parents will be directed to enter 2nd Street from PCH to access the parking lot. Vehicles would enter from the driveway along 2nd Street and park in the designated drop-off space. The parent(s) would exit the vehicle and walk their child(ren) into the facility (drop-offs) or pick-up their child from the facility, return to their vehicle and exit right onto 2nd Street.

Drop-Off/Pick-Up Parking Space Turnover Rate

For the purposes of this evaluation, a drop-off demand turnover rate of 5 minutes per vehicle per space during the morning peak hour was assumed. This is based on observations at other day care facilities where the demand turnover rate was 3-5 minutes. A pick-up demand turnover rate of 3-4 minutes (or 4 minutes) per vehicle space during the evening peak hour was assumed. This pick-up demand turnover rate of 3-4 minutes was also based on observations at other day care facilities.

Drop-Off/Pick-Up Parking Space Capacity vs Demand

Table 3 provides a summary of the drop-off/pick-up space capacity by each schedule shift. As indicated in the table, based on a turnover rate of 5 minutes per vehicle per space and assuming a uniform arrival pattern, each space can accommodate up to 12 vehicles within each 60-minute drop-off morning period. The Project is providing a total of 3 drop-off/pick-up spaces and, therefore, would be able to accommodate a demand of approximately 36 vehicles during each 60-minute drop-off period. Similarly, the Project would be able to accommodate approximately 45 vehicles in the 60-minute pick-up evening time.

Based on the results of the trip generation evaluation, the Project is anticipated to generate approximately 25 drop-offs during the morning drop-off peak hour and approximately 25 pick-ups during the evening pick-up peak hour. Therefore, the proposed 3 drop-off/pick-up spaces would be adequate to serve the Project's projected demand.

City staff has requested that random arrivals be used and probabilities that the demand is three (3) or less and four (4) or more be determined. Random arrivals typically follow Poisson

TABLE 3
DROP-OFF/PICK-UP SPACES CAPACITY

Drop-Off Peak Hour	**Minutes**	**Number of Vehicles (Capacity)[1]**
7:00 - 8:00 AM	60	36 vehicles* (3 spaces x 60min/5 min)
PROJECT AM PEAK HOUR DEMAND		25 vehicles
Pick-Up Peak Hour	**Minutes**	**Number of Vehicles (Capacity)[2]**
5:00-6:00 PM	60	45 vehicles* (3 spaces x 60min/4 min)
PROJECT PM PEAK HOUR DEMAND		25 vehicles

* Based on the provision of 3 drop-off/pick-up spaces.
[1] A turnover rate of 5 minutes per vehicle per space was assumed during the morning peak hour drop-off time period.
[2] A turnover rate of 4 minutes per vehicle per space was assumed during the evening pick-up peak hour time period.

Distribution. The Poisson Probability Density Function gives the probability of an event happening a certain number of times (k) within a given interval of time or space. Table 4 provides the Poisson distribution for random arrivals. As indicated in Table 4, there is an approximately 91 percent probability that the demand will be three (3) or less (parents dropping-off/picking-up their child(ren) at one time). The probability that the demand is four (4) or more is approximately 9 percent. Therefore, since more than 90 percent of the time, the demand would be three (3) or less, there would be adequate drop-off/pick-up spaces provided on site.

Although there is a small percentage of the peak times that the demand would be greater than the three (3) available drop-off/pick-up spaces, this would not have any impact of emergency vehicles. There would be adequate space for these emergency vehicles to get past other vehicles on 2nd Street, similar to what currently occurs.

PROJECT VEHICLE MILES TRAVELED (VMT) AND OTHER ANALYSIS

The city staff requested that the Transportation Study also address VMT analysis and intersection level of service (LOS) and queueing analysis at PCH and 2nd Street. The city staff directed the applicant to conduct the VMT analysis using State guidelines. The following section addresses these elements.

VMT Analysis

The Governor's Office of Planning and Research (OPR) issued guidance on the technical aspects of SB 743 implementation. As part of the requirements, a new performance metric (VMT) was established for measurement of significant impacts under CEQA. The OPR's Technical Advisory, dated December 2019, stated that projects that generate less than 110 daily trips would be deemed to not cause significant transportation impacts.

Further, the advisory stated under *VMT Mitigation and Alternatives* section that potential measures to reduce vehicle miles traveled include the following:

- *Increase access to common goods and services, such as groceries, schools, and daycare.*

TABLE 4
POISSON DISTRIBUTION - RANDOM ARRIVALS FUNCTION

Probability(event)	k	P value	Cumulative P value
P(0)	0	0.186373976	0.186373976
P(1)	1	0.31310828	0.499482256
P(2)	2	0.263010955	0.762493211
P(3)	3	0.147286135	0.909779346
P(4)	4	0.061860177	
P(5)	5	0.020785019	
P(6)	6	0.005819805	
P(4) or more			*0.090220654*

Probability of Demand 3 or less = 0.91 OR 91%
Probability of Demand 4 ormore = 0.09 OR 9%

Poisson Probability Density Function is	P(k) = (X^k)*(e^-X)/ k!
Mean value X =	1.68

The proposed Day Care project includes 77 students replacing an existing use. The existing use could be retail or the last-known use (auto sales). Using the latest ITE 11th Edition Trip Generation Rates / Equations, the net trip generation estimates for the proposed Project with existing retail use credit and with existing auto sales credit were prepared. Tables 5 and 6 provide the net project trip generation for daily, AM and PM peak hours using existing retail credit and existing auto sales credit, respectively.

From Table 5, it can be observed that the project would generate fewer daily trips compared to the existing retail (65 less daily trips). Additionally, the project would generate less PM peak hour trips (3 trips less). During the AM peak hour, the project would generate approximately 19 trips inbound and outbound. Based on the project traffic assignment, it was estimated that the project would not cause any operational issues at the intersection of PCH and 2nd Street.

From Table 6, it can be observed that the project would generate a total of 94 daily trips. However, since the project would generate less than 110 daily trips, the project would be presumed to not cause any significant transportation impacts, according to the Governor's office of Planning and Research's Technical Advisory.

Finally, based on the net morning and evening peak hour trip generation and distribution, given the small amount of additional southbound left-turning movement traffic at the PCH/2nd Street intersection, it was estimated that there would be minimal operational effects associated with the Project and that the queue would not extend beyond the storage pocket. No further transportation analysis is necessary.

Intersection LOS and Queueing Analyses

Weekday morning (AM) and evening (PM) peak hour traffic counts were compiled from data collected at the study intersection in April 2024, included in Attachment B. These traffic volumes reflect typical weekday operations during current year 2024 conditions. The intersection lane configurations and Existing (2024) peak hour traffic volumes are shown in Figure 4. The existing signal timing information was obtained from a recently completed traffic study (*PCH and 2nd Street – Proposed Starbucks Transportation Analysis Memorandum*, General Technologies Solutions, December 29, 2021, revised January 12, 2022) in the City of Hermosa Beach and verified using field observations.

TABLE 5
ESTIMATED PROJECT TRIP GENERATION

	Size	Daily Trips	AM Peak Hour			PM Peak Hour		
			IN	OUT	TOTAL	IN	OUT	TOTAL
Proposed Project								
Day Care Center	77 students	321	31	28	59	28	31	59
	Walk Trips (10%)	(32)	(3)	(3)	(6)	(3)	(3)	(6)
Existing Use								
Retail	(7,214) s.f.	(393)	(10)	(7)	(17)	(31)	(31)	(62)
	Walk Trips (10%)	39	1	1	2	3	3	6
Project Net Trip Generation Total		**(65)**	**19**	**19**	**38**	**(3)**	**0**	**(3)**
Trip Rates [1]								
Day Care Center (ITE Land Use 565)	Trips per student	[2]	53%	47%	[2]	47%	53%	[2]
Retail < 40ksf (ITE Land Use 822)	Trips per 1,000 s.f.	54.45	60%	40%	2.36	50%	50%	[3]

[1] *Trip Generation Manual* , 11th Edition, ITE 2021.

[2] Trip generation estimates for Day Care Center (ITE Land Use 565) was calculated using the following equations:

Daily	T = 3.56 (X) + 47.23
AM Peak Hour:	T = 0.66 (X) + 8.42
PM Peak Hour:	Ln (T) = 0.87 Ln (X) + 0.29

Where:
Ln = Natural logarithm
T = Two-way volume of traffic (total trip-ends)
X = Number of students

[3] PM trip generation estimates for Retail (ITE Land Use 822) was calculated using the following equation:

PM Peak Hour:	Ln (T) = 0.71 Ln (X) + 2.72

Where:
Ln = Natural logarithm
T = Two-way volume of traffic (total trip-ends)
X = Number of students

TABLE 6
ESTIMATED PROJECT TRIP GENERATION

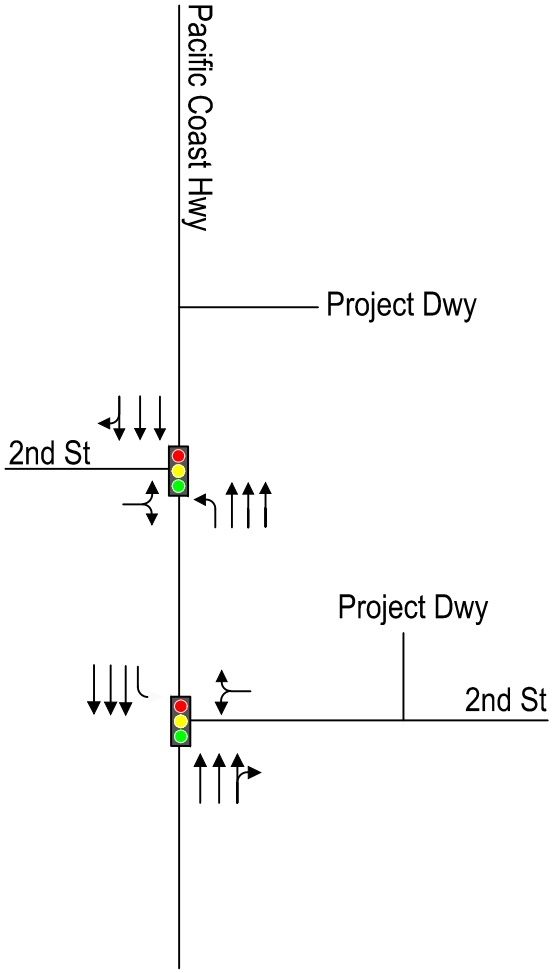
	Size	Daily Trips	AM Peak Hour			PM Peak Hour		
			IN	OUT	TOTAL	IN	OUT	TOTAL
Proposed Project								
Day Care Center	77 students	321	31	28	59	28	31	59
	Walk Trips (10%)	(32)	(3)	(3)	(6)	(3)	(3)	(6)
Existing Use								
Auto Sales - Used	(7,214) s.f.	(195)	(11)	(4)	(15)	(13)	(14)	(27)
Project Net Trip Generation Total		**94**	**17**	**21**	**38**	**12**	**14**	**26**
Trip Rates [1]								
Day Care Center (ITE Land Use 565)	Trips per student	[2]	53%	47%	[2]	47%	53%	[2]
Auto Sales - Used (ITE Land Use 841)	Trips per 1,000 s.f.	27.06	76%	24%	2.13	47%	53%	3.75

[1] *Trip Generation Manual* , 11th Edition, ITE 2021.

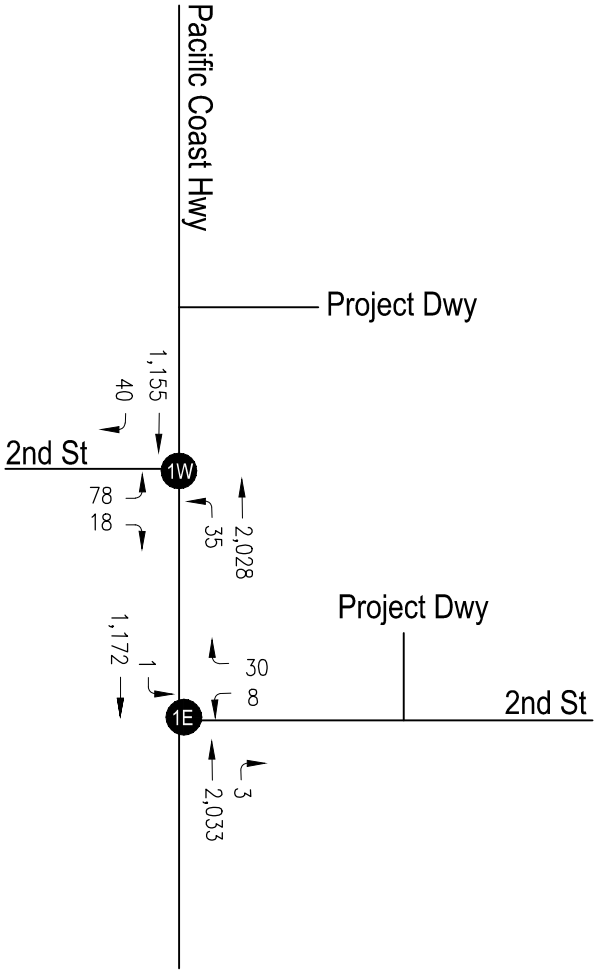
[2] Trip generation estimates for Day Care Center was calculated using the following equations:

Daily	T = 3.56 (X) + 47.23
AM Peak Hour:	T = 0.66 (X) + 8.42
PM Peak Hour:	Ln (T) = 0.87 Ln (X) + 0.29

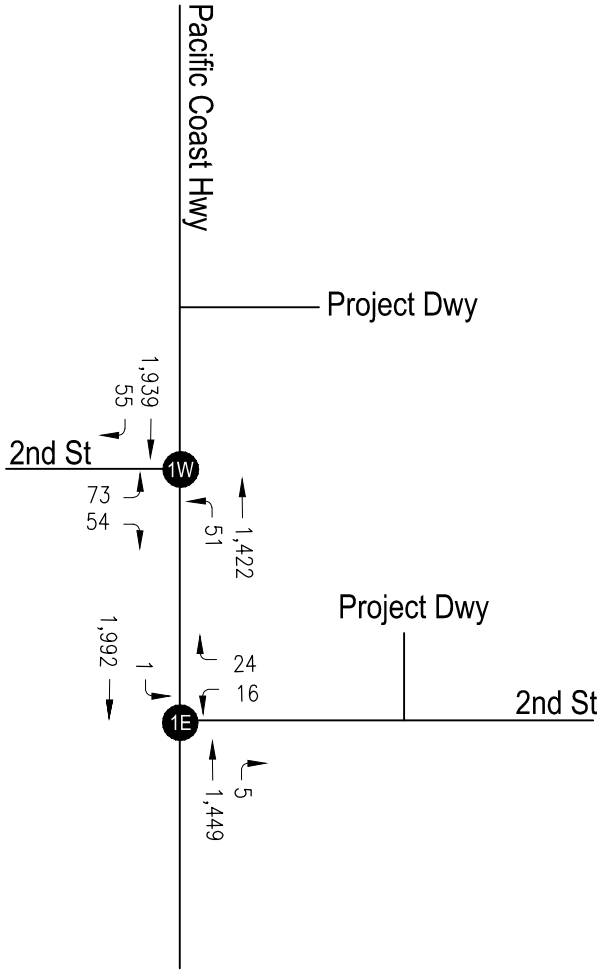
Where:
Ln = Natural logarithm
T = Two-way volume of traffic (total trip-ends)
X = Number of students



EXISTING (2024) CONDITIONS
LANE CONFIGURATIONS



EXISTING (2024) CONDITIONS
AM PEAK HOUR



EXISTING (2024) CONDITIONS
PM PEAK HOUR

LEGEND:

- Study Intersection

XX - Peak Hour Traffic Volume

Source: Existing (2024) peak hour traffic volumes were collected on Thursday, April 18, 2024.

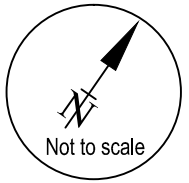


FIGURE 4
EXISTING (2024) CONDITIONS - LANE CONFIGURATION AND PEAK HOUR TRAFFIC VOLUMES

RAJU Associates, Inc.

The intersection capacity analysis and queue analysis were conducted based on the Highway Capacity Manual (HCM) signalized intersection methodology utilizing Synchro 11 software. The HCM signalized methodology calculates the average control delay, in seconds, for each vehicle passing through the intersection.

LOS is a qualitative measure used to describe the condition of traffic flow, ranging from excellent conditions at LOS A to overloaded conditions at LOS F. LOS D is typically recognized as the minimum acceptable level of service in urban areas. The LOS definitions for signalized intersections are provided in Table 7.

Existing (2024) LOS Analysis. The Existing (2024) traffic volumes presented in Figure 4 for AM and PM peak hours were used in conjunction with the level of service methodologies described above, and the current intersection lane configurations (also illustrated in Figure 4), to determine the existing operating conditions at the analyzed intersection. The study intersection, PCH at 2nd Street, consists of two closely spaced intersections that operate under one controller. For this unique condition, Synchro 11 software cluster editor was utilized to simulate this condition.

Table 7 summarizes the results of the intersection capacity analysis for existing conditions. The table indicates the existing average control delay for each intersection during the morning and evening peak hours and the corresponding LOS. As illustrated in the table, the study intersection is currently operating at LOS B during both the morning and evening peak hours. The operational calculation worksheets for Existing (2024) conditions are provided in Attachment C.

Project Trip Distribution and Assignment. The Project's trip distribution was based on various factors such as project site location, points of access of the project driveways, availability of major and secondary arterials connecting to the regional roadway system as well as professional judgment and local knowledge of travel patterns within the study area.

Based on these distribution assumptions, location and points of access, and Project trip generation estimates (AM: 28 inbound trips, 25 outbound trips and PM: 25 inbound trips, 28 outbound) traffic estimates of project-only trips were developed. Note that the Project traffic assignments include walk trip credit and do not include existing use credit. The resulting net Project-only trips are also shown in Figure 5.

TABLE 7
LEVEL OF SERVICE AND QUEUE ANALYSIS

Intersection	SBL Storage Length (feet)	NBL Storage Length (feet)	Peak Hour	Existing (2024) Conditions				Existing (2024) with Project Conditions			
				Delay [1]	LOS [2]	SBL Queue Length [3]	NBL Queue Length [3]	Delay [1]	LOS [2]	SBL Queue Length [3]	NBL Queue Length [3]
1W. PCH & 2nd Street (west leg)	-	-	AM	8.2	A	-	-	8.2	A	-	-
1E. PCH & 2nd Street (east leg)	25'	20'	AM	12.8	B	2'	41'	13.3	B	15'	41'
1W. PCH & 2nd Street (west leg)	-	-	PM	15.4	B	-	-	15.5	B	-	-
1E. PCH & 2nd Street (east leg)	25'	20'	PM	8.1	A	1'	80'	8.8	A	10'	83'

SBL = Southbound Left-Turn

NBL = Northbound Left-Turn

*These intersections are controlled by one traffic signal controller and have been evaluated as such utilizing Synchro 11 software intersection cluster editor.

[1] Delay based on HCM signalized intersection methodology reported in average seconds per vehicle.

[2] Level of Service definitions for signalized intersections (source: Highway Capacity Manual, Transportation Research Board, 2016):

LOS: Average Delay (seconds/vehicle)

LOS A: ≤ 10.0 seconds

LOS B: > 10.0 and ≤ 20.0 seconds

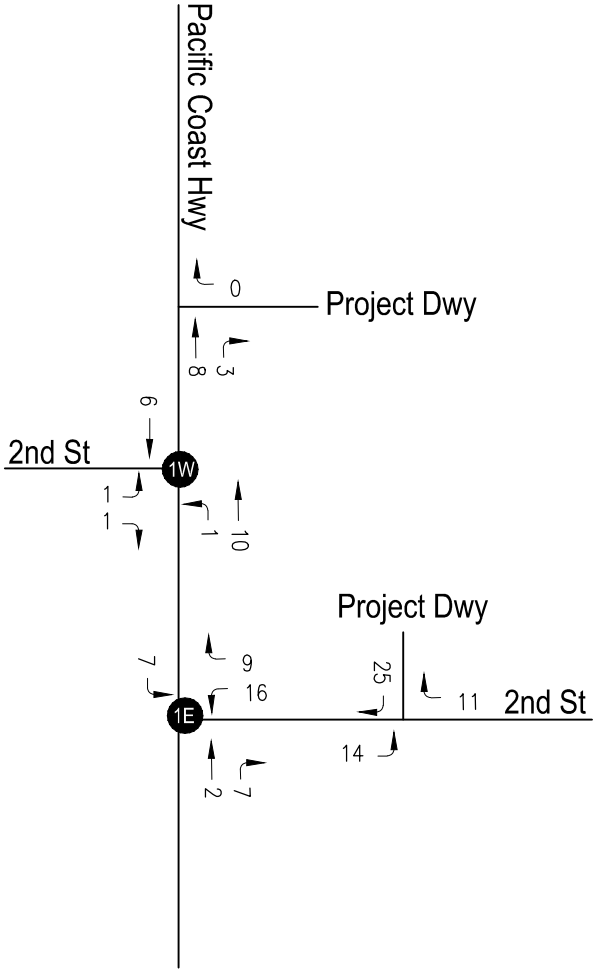
LOS C: > 20.0 and ≤ 35.0 seconds

LOS D: > 35.0 and ≤ 55.0 seconds

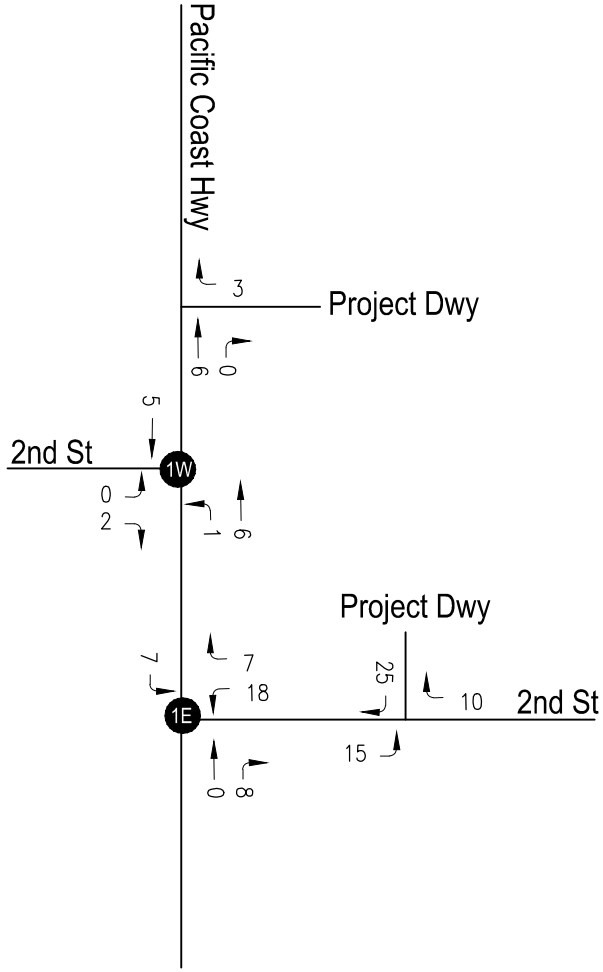
LOS E: > 55.0 and ≤ 80.0 seconds

LOS F: > 80.0 seconds

[3] 95th-Percentile queue length from Highway Capacity Manual (HCM) methodology using Synchro 11 software.



PROJECT ONLY NET TRIPS
AM PEAK HOUR



PROJECT ONLY NET TRIPS
PM PEAK HOUR

LEGEND:

1E - Study Intersection

XX - Peak Hour Traffic Volume

Not to scale

FIGURE 5
PROJECT ONLY - PEAK HOUR TRAFFIC VOLUMES

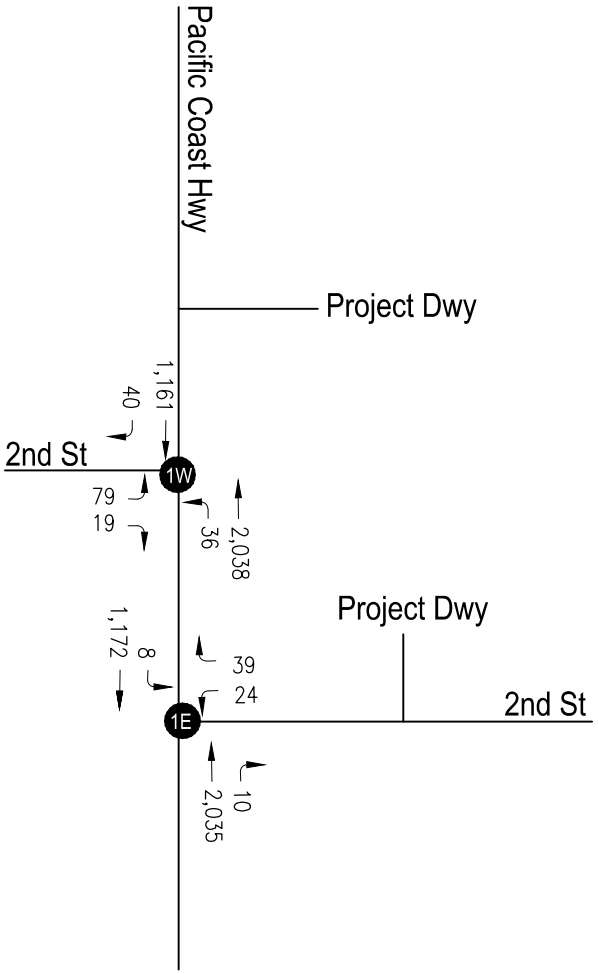
RAJU Associates, Inc.

Existing (2024) with Project Traffic Volumes. The Existing (2024) traffic volumes were combined with the Project-only (net) traffic volumes to obtain the Existing with Project traffic volume forecasts presented in Figure 6.

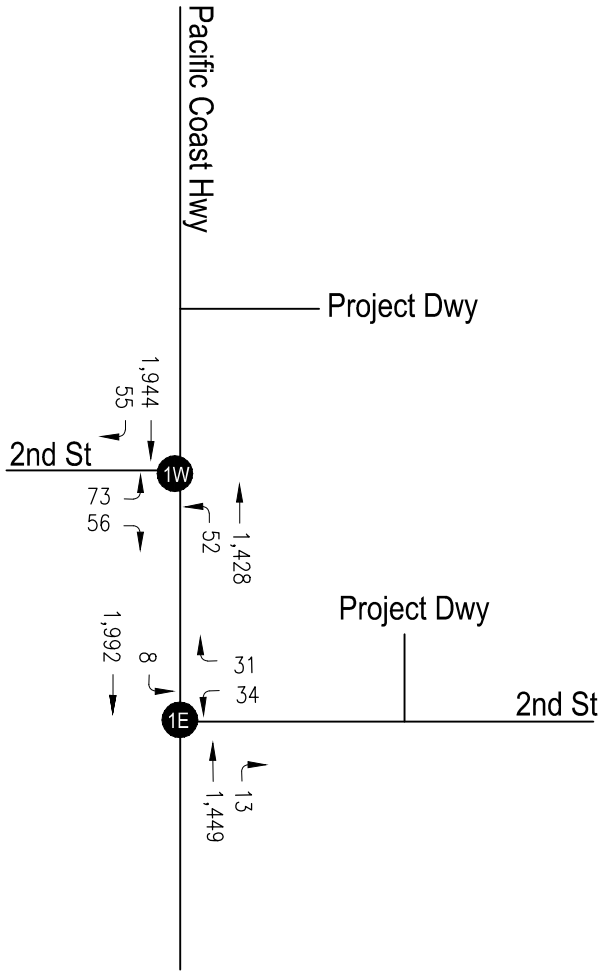
Existing (2024) with Project LOS Analysis. The Existing (2024) with Project traffic volumes, presented in Figure 6, were analyzed to determine the intersection LOS and delay. Table 7 presents the results of the LOS analysis at the study intersections for existing conditions without and with Project. As summarized in Table 7, Existing (2024) with Project conditions analysis indicates that the Project's traffic does not change the levels of service at the study location compared to Existing (2024) conditions (without Project) during both the morning and evening peak hours. The operational analysis calculation worksheets for Existing (2024) with Project conditions are provided in Attachment C.

Queue Analysis. The city staff requested that the Transportation Study also provide a southbound left-turn queueing analysis at PCH and 2nd Street intersection. The HCM methodology for signalized intersections (in Synchro software) was utilized to calculate vehicle queuing for the southbound left-turn. The operational analysis reports the 95th percentile queue length (in feet) for the signalized intersections. This is a conservative analysis and does not represent what the average driver would experience, but it is a standard commonly used in traffic engineering design to determine lengths of turn lane pockets.

Table 7 summarizes the study intersection's southbound left-turn queues for Existing (2024) conditions and Existing (2024) with Project conditions. The southbound left-turn pocket has a storage length of approximately 25 feet. As indicated in Table 7, the southbound left-turn has a queue length of 2 feet during the morning peak hour and 1 foot during the evening peak hour under Existing (2024) conditions. With the addition of Project traffic, the southbound left-turn is projected to have a queue length of approximately 15 feet during the morning peak hour and approximately 10 feet during the evening peak hour. Therefore, the southbound left-turn pocket can accommodate the addition of the Project's traffic. No spillover from the southbound left-turn pocket into the through lane is anticipated.



EXISTING (2024) WITH PROJECT CONDITIONS
AM PEAK HOUR



EXISTING (2024) WITH PROJECT CONDITIONS
PM PEAK HOUR

LEGEND:

- Study Intersection

XX - Peak Hour Traffic Volume

Not to scale

FIGURE 6
EXISTING (2024) WITH PROJECT CONDITIONS - PEAK HOUR TRAFFIC VOLUMES

RAJU Associates, Inc.

Additionally, the city has now requested the northbound left-turn queueing analysis. Table 7 also summarizes the study intersection's northbound left-turn queues for Existing (2024) conditions and Existing (2024) with Project conditions. The northbound left-turn pocket has a storage length of approximately 20 feet. As indicated in Table 7, the northbound left-turn queue length extends beyond the storage length under Existing (2024) conditions during both the morning (41 feet queue) and evening (80 feet queue) peak hours. The addition of Project traffic (one trip during both the morning and evening peak hours) would have no effect to minimal effect on the queue length during the morning peak hour (no change in queue length), and evening peak hour (3 feet increase in queue length), respectively.

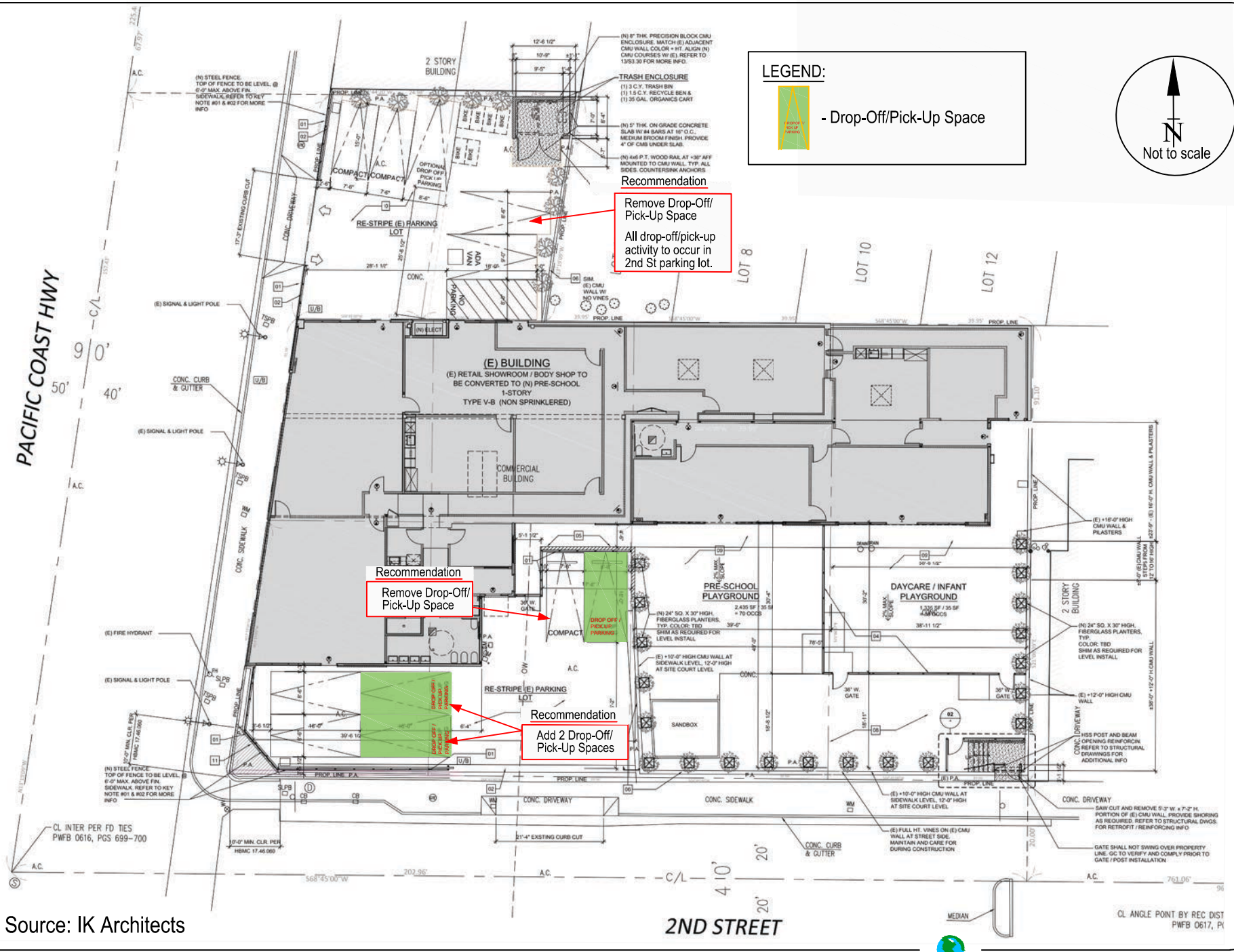
Recommendations

The following recommended changes to the parking layout and operations have been provided in order to accommodate the Project's estimated demand during the drop-off/pick-up periods and provide safer and organized drop-off/pick-up operations.

- The Project should provide one centralized drop-off/pick-up area. This can be accomplished by removing the drop-off/pick-up space from the PCH parking lot. This space would be designated as a standard parking space. All drop-off/pick-up activities should occur at the 2nd Street parking lot. This will organize vehicles dropping off or picking up students to/from one area, thereby improving operations and safety.

- The Project should designate one additional drop-off/pick-up space in the 2nd Street parking lot. This space can be provided behind the tandem spaces, as shown in Figure 7. A total of 3 spaces would be designated as drop-off/pick-up spaces. This would result in relocating one standard parking space to the Project's parking lot along PCH.

- Based on comments from the city, the compact space in the 2nd Street parking lot would no longer be designated as a drop-off/pick-up space. An additional drop-off/pick-up space would be provided behind the remaining tandem space, as shown Figure 7.



Source: IK Architects

FIGURE 7
RECOMMENDED PARKING LAYOUT CHANGES

RAJU Associates, Inc.

CONCLUSION

The Project would convert an existing retail vehicle showroom/body shop building into a day care center facility that would have a maximum enrollment of 77 students. The Project is anticipated to generate approximately 25 vehicle drop-offs during the morning drop-off peak hour and approximately 25 vehicle pick-ups during the evening pick-up peak hour. After implementation of the recommendations, the Project would provide a total of 3 drop-off/pick-up spaces at the Project's 2nd Street parking lot, which would be adequate for the proposed day care facility.

Based on Poisson distribution of random arrivals, there is an approximately 91 percent probability that the demand at the drop-off/pick-up spaces would be three (3) or less during peak times. The demand would have approximately 9 percent probability that it would be four (4) or more during peak times. Therefore, the recommended 3 drop-off/pick-up spaces would satisfy the Project's projected demand.

The proposed Project would be exempt from VMT analysis since the total net daily trips associated with the Project is less than 110 trips. The OPR guidelines also state that uses such as the proposed child day care project increases access to common goods and services, thereby reducing VMT and providing potential VMT mitigation. No further VMT analysis would be required for the Project.

Based on a level of service (LOS) evaluation at the PCH/2nd Street study intersection, the intersection is projected at LOS B during both the morning and evening peak hours under Existing (2024) with Project conditions, similar to Existing (2024) conditions. The queueing analysis at this location indicates that the southbound left-turn pocket can accommodate the addition of the Project's traffic and that no spillover from the southbound left-turn pocket into the through lane is anticipated. The effect of Project traffic on the PCH/2nd Street intersection operations would be minimal.

ATTACHMENT A

ATTACHMENT A

Hourly Distribution of Entering and Exiting Vehicle Trips by Land Use			
Source: ITE *Trip Generation Manual* , 11th Edition			
Land Use Code	565		
Land Use	Day Care Center		
Setting	General Urban/Suburban		
Time Period	Weekday		
# Data Sites	19		
	% of 24-Hour Vehicle Trips		
Time	Total	Entering	Exiting
7:00 - 8:00 AM	17.9%	19.5%	16.3%
8:00 - 9:00 AM	13.0%	13.2%	12.8%
9:00 - 10:00 AM	5.0%	5.4%	4.6%
10:00 - 11:00 AM	2.7%	2.6%	2.9%
11:00 - 12:00 PM	2.6%	2.6%	2.6%
12:00 - 1:00 PM	2.4%	2.1%	2.6%
1:00 - 2:00 PM	4.3%	4.1%	6.9%
2:00 - 3:00 PM	7.2%	6.7%	6.9%
3:00 - 4:00 PM	7.4%	7.5%	7.1%
4:00 - 5:00 PM	13.8%	13.6%	14.0%
5:00 - 6:00 PM	17.7%	16.7%	18.7%

ATTACHMENT B

INTERSECTION TURNING MOVEMENT COUNTS

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

DATE:	LOCATION:	Hermosa Beach	PROJECT #:	SC4591
Thu, Apr 18, 24	NORTH & SOUTH:	Pacific Coast Hwy	LOCATION #:	1
	EAST & WEST:	2nd St	CONTROL:	SIGNAL

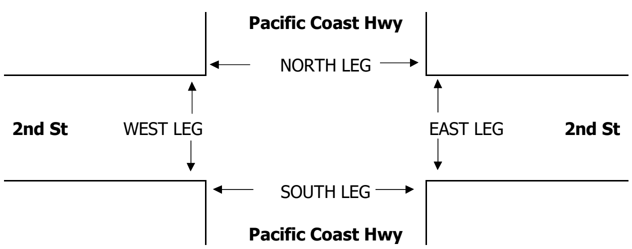
NOTES:

Queue NB AM; SB PM

AM / PM / MD / OTHER / OTHER

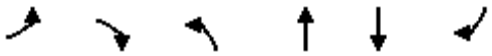
▲ N, ◄ W, E ►, S ▼

	NORTHBOUND Pacific Coast Hwy			SOUTHBOUND Pacific Coast Hwy			EASTBOUND 2nd St			WESTBOUND 2nd St				U-TURNS				
	NL	NT	NR	SL	ST	SR	EL	ET	ER	WL	WT	WR	TOTAL	NB	SB	EB	WB	TTL
LANES:	1	3	0	1	3	0	0	1	0	0	1	0		0	0	0	0	
AM 7:00 AM	3	460	0	0	220	10	16	0	1	1	3	0	714	0	0	0	0	0
7:15 AM	3	553	1	0	216	5	14	0	4	3	1	0	800	0	0	0	0	0
7:30 AM	5	564	0	0	260	8	17	0	3	3	0	5	865	0	0	0	0	0
7:45 AM	6	531	2	1	272	8	21	0	3	1	5	4	854	0	0	0	0	0
8:00 AM	4	479	1	0	284	12	20	0	6	2	6	7	821	0	0	0	0	0
8:15 AM	9	435	0	0	338	12	20	0	6	2	0	3	825	0	0	0	0	0
8:30 AM	8	454	0	0	303	18	16	0	3	6	1	3	812	0	0	0	0	0
8:45 AM	4	526	1	0	301	14	29	0	3	2	1	5	886	0	0	0	0	0
VOLUMES	42	4,002	5	1	2,194	87	153	0	29	20	17	27	6,577	0	0	0	0	0
APPROACH %	1%	99%	0%	0%	96%	4%	84%	0%	16%	31%	27%	42%						
APP/DEPART	4,049	/	4,182	2,282	/	2,243	182	/	6	64	/	146	0					
BEGIN PEAK HR		7:30 AM																
VOLUMES	24	2,009	3	1	1,154	40	78	0	18	8	11	19	3,365	0	0	0	0	
APPROACH %	1%	99%	0%	0%	97%	3%	81%	0%	19%	21%	29%	50%						
PEAK HR FACTOR		0.895			0.854			0.923			0.633		0.973					
APP/DEPART	2,036	/	2,106	1,195	/	1,180	96	/	4	38	/	75	0					
PM 4:00 PM	5	368	1	2	410	14	19	0	11	5	0	1	836	0	0	0	0	0
4:15 PM	11	367	1	0	475	9	18	0	12	6	1	3	903	1	0	0	0	1
4:30 PM	6	332	2	0	444	12	16	0	6	2	3	3	826	0	0	0	0	0
4:45 PM	5	386	2	0	516	11	21	0	12	5	2	3	963	0	0	0	0	0
5:00 PM	13	316	1	0	415	6	13	0	15	3	1	5	788	0	0	0	0	0
5:15 PM	11	376	1	0	517	20	22	0	21	3	3	4	978	0	0	0	0	0
5:30 PM	15	327	1	0	491	18	17	1	5	5	1	5	886	0	0	0	0	0
5:45 PM	4	351	1	0	471	10	18	0	18	3	0	6	882	0	0	0	0	0
VOLUMES	70	2,823	10	2	3,739	100	144	1	100	32	11	30	7,063	1	0	0	0	1
APPROACH %	2%	97%	0%	0%	97%	3%	59%	0%	41%	44%	15%	41%						
APP/DEPART	2,904	/	2,997	3,841	/	3,872	245	/	13	73	/	181	0					
BEGIN PEAK HR		4:45 PM																
VOLUMES	44	1,405	5	0	1,939	55	73	1	53	16	7	17	3,615	0	0	0	0	
APPROACH %	3%	97%	0%	0%	97%	3%	57%	1%	42%	40%	18%	43%						
PEAK HR FACTOR		0.925			0.928			0.738			0.909		0.924					
APP/DEPART	1,454	/	1,495	1,994	/	2,008	127	/	6	40	/	106	0					



	ALL PED + BIKE & SCOOTER					PEDESTRIAN CROSSINGS					BICYCLE & SCOOTER CROSSINGS				
	N LEG	S LEG	E LEG	W LEG	TOTAL	N LEG	S LEG	E LEG	W LEG	TOTAL	NL	SL	EL	WL	TOTAL
AM 7:00 AM	0	2	2	2	6	0	2	1	1	4	0	0	1	1	2
7:15 AM	0	4	2	1	7	0	4	2	1	7	0	0	0	0	0
7:30 AM	0	0	0	1	1	0	0	0	1	1	0	0	0	0	0
7:45 AM	0	8	0	0	8	0	4	0	0	4	0	4	0	0	4
8:00 AM	0	7	7	2	16	0	5	3	1	9	0	2	4	1	7
8:15 AM	0	7	6	8	21	0	6	5	5	16	0	1	1	3	5
8:30 AM	0	4	3	1	8	0	4	2	1	7	0	0	1	0	1
8:45 AM	0	6	5	1	12	0	5	4	1	10	0	1	1	0	2
TOTAL	0	38	25	16	79	0	30	17	11	58	0	8	8	5	21
BEGIN PEAK HR			7:30 AM			0	15	8	7	30					
PM 4:00 PM	0	5	2	2	9	0	4	1	1	6	0	1	1	1	3
4:15 PM	0	8	6	2	16	0	7	5	1	13	0	1	1	1	3
4:30 PM	0	7	3	3	13	0	6	3	1	10	0	1	0	2	3
4:45 PM	0	7	4	1	12	0	5	2	1	8	0	2	2	0	4
5:00 PM	0	17	6	2	25	0	16	5	1	22	0	1	1	1	3
5:15 PM	0	9	7	2	18	0	8	6	2	16	0	1	1	0	2
5:30 PM	0	9	9	2	20	0	9	8	1	18	0	0	1	1	2
5:45 PM	0	9	5	1	15	0	8	3	0	11	0	1	2	1	4
TOTAL	0	71	42	15	128	0	63	33	8	104	0	8	9	7	24
BEGIN PEAK HR			4:45 PM			0	38	21	5	64					

ATTACHMENT C



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	78	18	35	2028	1155	40
Future Volume (vph)	78	18	35	2028	1155	40
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5		4.5	4.5	4.5	
Lane Util. Factor	1.00		1.00	0.91	0.91	
Frt	0.97		1.00	1.00	1.00	
Flt Protected	0.96		0.95	1.00	1.00	
Satd. Flow (prot)	1744		1770	5085	5060	
Flt Permitted	0.96		0.95	1.00	1.00	
Satd. Flow (perm)	1744		1770	5085	5060	
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	80	19	36	2091	1191	41
RTOR Reduction (vph)	0	0	0	0	3	0
Lane Group Flow (vph)	99	0	36	2091	1229	0
Turn Type	Prot		Prot	NA	NA	
Protected Phases	3		4	2 4	6	
Permitted Phases						
Actuated Green, G (s)	21.5		19.5	109.5	85.5	
Effective Green, g (s)	21.5		19.5	109.5	85.5	
Actuated g/C Ratio	0.15		0.14	0.78	0.61	
Clearance Time (s)	4.5		4.5		4.5	
Lane Grp Cap (vph)	267		246	3977	3090	
v/s Ratio Prot	c0.06		0.02	c0.41	0.24	
v/s Ratio Perm						
v/c Ratio	0.37		0.15	0.53	0.40	
Uniform Delay, d1	53.2		52.9	5.6	14.0	
Progression Factor	1.00		1.51	0.10	1.00	
Incremental Delay, d2	3.9		0.9	0.4	0.4	
Delay (s)	57.1		80.7	0.9	14.4	
Level of Service	E		F	A	B	
Approach Delay (s)	57.1			2.3	14.4	
Approach LOS	E			A	B	

Intersection Summary			
HCM 2000 Control Delay	8.2	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.52		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	13.5
Intersection Capacity Utilization	52.1%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	8	30	2033	3	1	1172
Future Volume (vph)	8	30	2033	3	1	1172
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5		4.5		4.5	4.5
Lane Util. Factor	1.00		0.91		1.00	0.91
Frt	0.89		1.00		1.00	1.00
Flt Protected	0.99		1.00		0.95	1.00
Satd. Flow (prot)	1646		5084		1770	5085
Flt Permitted	0.99		1.00		0.95	1.00
Satd. Flow (perm)	1646		5084		1770	5085
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	8	31	2096	3	1	1208
RTOR Reduction (vph)	0	0	0	0	0	0
Lane Group Flow (vph)	39	0	2099	0	1	1208
Turn Type	Prot		NA		Prot	NA
Protected Phases	4		2		3	3 6
Permitted Phases						
Actuated Green, G (s)	19.5		85.5		21.5	111.5
Effective Green, g (s)	19.5		85.5		21.5	111.5
Actuated g/C Ratio	0.14		0.61		0.15	0.80
Clearance Time (s)	4.5		4.5		4.5	
Lane Grp Cap (vph)	229		3104		271	4049
v/s Ratio Prot	c0.02		c0.41		0.00	c0.24
v/s Ratio Perm						
v/c Ratio	0.17		0.68		0.00	0.30
Uniform Delay, d1	53.1		18.1		50.2	3.8
Progression Factor	1.00		1.00		1.32	0.01
Incremental Delay, d2	1.6		1.2		0.0	0.2
Delay (s)	54.7		19.3		66.3	0.2
Level of Service	D		B		E	A
Approach Delay (s)	54.7		19.3			0.3
Approach LOS	D		B			A

Intersection Summary			
HCM 2000 Control Delay	12.8	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.54		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	13.5
Intersection Capacity Utilization	51.0%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	NBL	NBT	SBT
Lane Group Flow (vph)	99	36	2091	1232
v/c Ratio	0.37	0.15	0.53	0.40
Control Delay	57.8	81.5	0.9	14.4
Queue Delay	0.0	127.9	0.2	0.0
Total Delay	57.8	209.5	1.2	14.4
Queue Length 50th (ft)	66	27	11	159
Queue Length 95th (ft)	113	m41	12	184
Internal Link Dist (ft)	149		37	168
Turn Bay Length (ft)		20		
Base Capacity (vph)	267	246	3977	3092
Starvation Cap Reductn	0	221	896	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.37	1.44	0.68	0.40

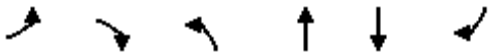
Intersection Summary

m Volume for 95th percentile queue is metered by upstream signal.

Lane Group	WBL	NBT	SBL	SBT
Lane Group Flow (vph)	39	2099	1	1208
v/c Ratio	0.17	0.68	0.00	0.30
Control Delay	55.4	19.5	66.0	0.2
Queue Delay	0.0	0.6	1.0	0.1
Total Delay	55.4	20.1	67.0	0.3
Queue Length 50th (ft)	25	353	0	0
Queue Length 95th (ft)	55	393	m2	0
Internal Link Dist (ft)	137	262		37
Turn Bay Length (ft)			25	
Base Capacity (vph)	229	3105	271	4049
Starvation Cap Reductn	0	0	246	1564
Spillback Cap Reductn	0	563	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.17	0.83	0.04	0.49

Intersection Summary

m Volume for 95th percentile queue is metered by upstream signal.



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	73	54	51	1422	1939	55
Future Volume (vph)	73	54	51	1422	1939	55
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5		4.5	4.5	4.5	
Lane Util. Factor	1.00		1.00	0.91	0.91	
Frt	0.94		1.00	1.00	1.00	
Flt Protected	0.97		0.95	1.00	1.00	
Satd. Flow (prot)	1706		1770	5085	5064	
Flt Permitted	0.97		0.95	1.00	1.00	
Satd. Flow (perm)	1706		1770	5085	5064	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	79	59	55	1546	2108	60
RTOR Reduction (vph)	0	0	0	0	2	0
Lane Group Flow (vph)	138	0	55	1546	2166	0
Turn Type	Prot		Prot	NA	NA	
Protected Phases	3		4	2 4	6	
Permitted Phases						
Actuated Green, G (s)	31.5		11.5	99.5	83.5	
Effective Green, g (s)	31.5		11.5	99.5	83.5	
Actuated g/C Ratio	0.22		0.08	0.71	0.60	
Clearance Time (s)	4.5		4.5		4.5	
Lane Grp Cap (vph)	383		145	3613	3020	
v/s Ratio Prot	c0.08		0.03	c0.30	c0.43	
v/s Ratio Perm						
v/c Ratio	0.36		0.38	0.43	0.72	
Uniform Delay, d1	45.8		60.9	8.4	19.9	
Progression Factor	1.00		1.51	0.09	1.00	
Incremental Delay, d2	2.6		6.4	0.3	1.5	
Delay (s)	48.4		98.6	1.1	21.4	
Level of Service	D		F	A	C	
Approach Delay (s)	48.4			4.4	21.4	
Approach LOS	D			A	C	

Intersection Summary			
HCM 2000 Control Delay	15.4	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.61		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	13.5
Intersection Capacity Utilization	57.2%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	16	24	1449	5	1	1992
Future Volume (vph)	16	24	1449	5	1	1992
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5		4.5		4.5	4.5
Lane Util. Factor	1.00		0.91		1.00	0.91
Frt	0.92		1.00		1.00	1.00
Flt Protected	0.98		1.00		0.95	1.00
Satd. Flow (prot)	1678		5083		1770	5085
Flt Permitted	0.98		1.00		0.95	1.00
Satd. Flow (perm)	1678		5083		1770	5085
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	17	26	1575	5	1	2165
RTOR Reduction (vph)	0	0	0	0	0	0
Lane Group Flow (vph)	43	0	1580	0	1	2165
Turn Type	Prot		NA		Prot	NA
Protected Phases	4		2		3	3 6
Permitted Phases						
Actuated Green, G (s)	11.5		83.5		31.5	119.5
Effective Green, g (s)	11.5		83.5		31.5	119.5
Actuated g/C Ratio	0.08		0.60		0.22	0.85
Clearance Time (s)	4.5		4.5		4.5	
Lane Grp Cap (vph)	137		3031		398	4340
v/s Ratio Prot	c0.03		c0.31		0.00	c0.43
v/s Ratio Perm						
v/c Ratio	0.31		0.52		0.00	0.50
Uniform Delay, d1	60.5		16.5		42.1	2.6
Progression Factor	1.00		1.00		1.27	0.01
Incremental Delay, d2	5.9		0.6		0.0	0.3
Delay (s)	66.4		17.2		53.5	0.3
Level of Service	E		B		D	A
Approach Delay (s)	66.4		17.2			0.3
Approach LOS	E		B			A

Intersection Summary			
HCM 2000 Control Delay	8.1	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.51		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	13.5
Intersection Capacity Utilization	50.2%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

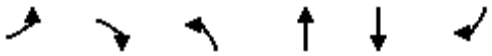
Lane Group	EBL	NBL	NBT	SBT
Lane Group Flow (vph)	138	55	1546	2168
v/c Ratio	0.36	0.38	0.43	0.72
Control Delay	49.0	99.6	1.1	21.6
Queue Delay	0.0	124.1	0.1	0.0
Total Delay	49.0	223.7	1.2	21.6
Queue Length 50th (ft)	86	42	8	388
Queue Length 95th (ft)	138	80	9	432
Internal Link Dist (ft)	149		37	168
Turn Bay Length (ft)		20		
Base Capacity (vph)	383	145	3613	3022
Starvation Cap Reductn	0	119	667	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.36	2.12	0.52	0.72

Intersection Summary

Lane Group	WBL	NBT	SBL	SBT
Lane Group Flow (vph)	43	1580	1	2165
v/c Ratio	0.31	0.52	0.00	0.50
Control Delay	67.2	17.3	54.0	0.3
Queue Delay	0.0	0.4	1.0	0.3
Total Delay	67.2	17.7	55.0	0.6
Queue Length 50th (ft)	30	235	1	0
Queue Length 95th (ft)	63	267	m1	0
Internal Link Dist (ft)	137	262		37
Turn Bay Length (ft)			25	
Base Capacity (vph)	137	3033	398	4340
Starvation Cap Reductn	0	0	372	1230
Spillback Cap Reductn	0	791	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.31	0.70	0.04	0.70

Intersection Summary

m Volume for 95th percentile queue is metered by upstream signal.



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	79	19	36	2038	1161	40
Future Volume (vph)	79	19	36	2038	1161	40
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5		4.5	4.5	4.5	
Lane Util. Factor	1.00		1.00	0.91	0.91	
Frt	0.97		1.00	1.00	1.00	
Flt Protected	0.96		0.95	1.00	1.00	
Satd. Flow (prot)	1743		1770	5085	5060	
Flt Permitted	0.96		0.95	1.00	1.00	
Satd. Flow (perm)	1743		1770	5085	5060	
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	81	20	37	2101	1197	41
RTOR Reduction (vph)	0	0	0	0	3	0
Lane Group Flow (vph)	101	0	37	2101	1235	0
Turn Type	Prot		Prot	NA	NA	
Protected Phases	3		4	2 4	6	
Permitted Phases						
Actuated Green, G (s)	21.5		19.5	109.5	85.5	
Effective Green, g (s)	21.5		19.5	109.5	85.5	
Actuated g/C Ratio	0.15		0.14	0.78	0.61	
Clearance Time (s)	4.5		4.5		4.5	
Lane Grp Cap (vph)	267		246	3977	3090	
v/s Ratio Prot	c0.06		0.02	c0.41	0.24	
v/s Ratio Perm						
v/c Ratio	0.38		0.15	0.53	0.40	
Uniform Delay, d1	53.2		53.0	5.7	14.0	
Progression Factor	1.00		1.49	0.10	1.00	
Incremental Delay, d2	4.0		0.9	0.4	0.4	
Delay (s)	57.3		79.8	0.9	14.4	
Level of Service	E		E	A	B	
Approach Delay (s)	57.3			2.3	14.4	
Approach LOS	E			A	B	

Intersection Summary			
HCM 2000 Control Delay	8.2	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.52		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	13.5
Intersection Capacity Utilization	52.4%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	24	39	2035	10	8	1172
Future Volume (vph)	24	39	2035	10	8	1172
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5		4.5		4.5	4.5
Lane Util. Factor	1.00		0.91		1.00	0.91
Frt	0.92		1.00		1.00	1.00
Flt Protected	0.98		1.00		0.95	1.00
Satd. Flow (prot)	1676		5082		1770	5085
Flt Permitted	0.98		1.00		0.95	1.00
Satd. Flow (perm)	1676		5082		1770	5085
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	25	40	2098	10	8	1208
RTOR Reduction (vph)	0	0	0	0	0	0
Lane Group Flow (vph)	65	0	2108	0	8	1208
Turn Type	Prot		NA		Prot	NA
Protected Phases	4		2		3	3 6
Permitted Phases						
Actuated Green, G (s)	19.5		85.5		21.5	111.5
Effective Green, g (s)	19.5		85.5		21.5	111.5
Actuated g/C Ratio	0.14		0.61		0.15	0.80
Clearance Time (s)	4.5		4.5		4.5	
Lane Grp Cap (vph)	233		3103		271	4049
v/s Ratio Prot	c0.04		c0.41		0.00	c0.24
v/s Ratio Perm						
v/c Ratio	0.28		0.68		0.03	0.30
Uniform Delay, d1	54.0		18.1		50.4	3.8
Progression Factor	1.00		1.00		1.15	0.01
Incremental Delay, d2	3.0		1.2		0.2	0.2
Delay (s)	56.9		19.3		58.0	0.2
Level of Service	E		B		E	A
Approach Delay (s)	56.9		19.3			0.6
Approach LOS	E		B			A

Intersection Summary			
HCM 2000 Control Delay	13.3	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.56		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	13.5
Intersection Capacity Utilization	51.2%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	NBL	NBT	SBT
Lane Group Flow (vph)	101	37	2101	1238
v/c Ratio	0.38	0.15	0.53	0.40
Control Delay	57.9	80.6	0.9	14.4
Queue Delay	0.0	126.0	0.2	0.0
Total Delay	57.9	206.6	1.2	14.4
Queue Length 50th (ft)	67	28	11	160
Queue Length 95th (ft)	115	m41	12	186
Internal Link Dist (ft)	149		37	168
Turn Bay Length (ft)		20		
Base Capacity (vph)	267	246	3977	3092
Starvation Cap Reductn	0	220	892	0
Spillback Cap Reductn	0	0	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.38	1.42	0.68	0.40

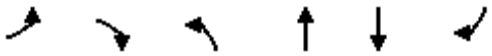
Intersection Summary

m Volume for 95th percentile queue is metered by upstream signal.

Lane Group	WBL	NBT	SBL	SBT
Lane Group Flow (vph)	65	2108	8	1208
v/c Ratio	0.28	0.68	0.03	0.30
Control Delay	57.6	19.5	58.4	0.2
Queue Delay	0.0	0.7	9.8	0.1
Total Delay	57.6	20.3	68.1	0.4
Queue Length 50th (ft)	43	355	6	0
Queue Length 95th (ft)	82	396	m15	0
Internal Link Dist (ft)	137	262		37
Turn Bay Length (ft)			25	
Base Capacity (vph)	233	3102	271	4049
Starvation Cap Reductn	0	0	246	1564
Spillback Cap Reductn	0	586	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.28	0.84	0.32	0.49

Intersection Summary

m Volume for 95th percentile queue is metered by upstream signal.



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	73	56	52	1428	1944	55
Future Volume (vph)	73	56	52	1428	1944	55
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5		4.5	4.5	4.5	
Lane Util. Factor	1.00		1.00	0.91	0.91	
Frt	0.94		1.00	1.00	1.00	
Flt Protected	0.97		0.95	1.00	1.00	
Satd. Flow (prot)	1705		1770	5085	5064	
Flt Permitted	0.97		0.95	1.00	1.00	
Satd. Flow (perm)	1705		1770	5085	5064	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	79	61	57	1552	2113	60
RTOR Reduction (vph)	0	0	0	0	2	0
Lane Group Flow (vph)	140	0	57	1552	2171	0
Turn Type	Prot		Prot	NA	NA	
Protected Phases	3		4	2 4	6	
Permitted Phases						
Actuated Green, G (s)	31.5		11.5	99.5	83.5	
Effective Green, g (s)	31.5		11.5	99.5	83.5	
Actuated g/C Ratio	0.22		0.08	0.71	0.60	
Clearance Time (s)	4.5		4.5		4.5	
Lane Grp Cap (vph)	383		145	3613	3020	
v/s Ratio Prot	c0.08		0.03	c0.31	c0.43	
v/s Ratio Perm						
v/c Ratio	0.37		0.39	0.43	0.72	
Uniform Delay, d1	45.8		60.9	8.4	20.0	
Progression Factor	1.00		1.50	0.09	1.00	
Incremental Delay, d2	2.7		6.8	0.3	1.5	
Delay (s)	48.5		98.2	1.1	21.5	
Level of Service	D		F	A	C	
Approach Delay (s)	48.5			4.5	21.5	
Approach LOS	D			A	C	

Intersection Summary			
HCM 2000 Control Delay	15.5	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.61		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	13.5
Intersection Capacity Utilization	58.2%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (vph)	34	31	1449	13	8	1992
Future Volume (vph)	34	31	1449	13	8	1992
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5		4.5		4.5	4.5
Lane Util. Factor	1.00		0.91		1.00	0.91
Frt	0.94		1.00		1.00	1.00
Flt Protected	0.97		1.00		0.95	1.00
Satd. Flow (prot)	1698		5079		1770	5085
Flt Permitted	0.97		1.00		0.95	1.00
Satd. Flow (perm)	1698		5079		1770	5085
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	37	34	1575	14	9	2165
RTOR Reduction (vph)	0	0	1	0	0	0
Lane Group Flow (vph)	71	0	1588	0	9	2165
Turn Type	Prot		NA		Prot	NA
Protected Phases	4		2		3	3 6
Permitted Phases						
Actuated Green, G (s)	11.5		83.5		31.5	119.5
Effective Green, g (s)	11.5		83.5		31.5	119.5
Actuated g/C Ratio	0.08		0.60		0.22	0.85
Clearance Time (s)	4.5		4.5		4.5	
Lane Grp Cap (vph)	139		3029		398	4340
v/s Ratio Prot	c0.04		c0.31		0.01	c0.43
v/s Ratio Perm						
v/c Ratio	0.51		0.52		0.02	0.50
Uniform Delay, d1	61.6		16.6		42.3	2.6
Progression Factor	1.00		1.00		1.23	0.01
Incremental Delay, d2	12.8		0.7		0.1	0.3
Delay (s)	74.3		17.2		52.1	0.3
Level of Service	E		B		D	A
Approach Delay (s)	74.3		17.2			0.5
Approach LOS	E		B			A

Intersection Summary			
HCM 2000 Control Delay	8.8	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.53		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	13.5
Intersection Capacity Utilization	50.2%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Lane Group	EBL	NBL	NBT	SBT
Lane Group Flow (vph)	140	57	1552	2173
v/c Ratio	0.37	0.39	0.43	0.72
Control Delay	49.1	99.3	1.1	21.6
Queue Delay	0.0	124.0	0.1	0.0
Total Delay	49.1	223.2	1.2	21.7
Queue Length 50th (ft)	87	44	8	390
Queue Length 95th (ft)	140	83	9	434
Internal Link Dist (ft)	149		37	168
Turn Bay Length (ft)		20		
Base Capacity (vph)	383	145	3613	3022
Starvation Cap Reductn	0	119	675	0
Spillback Cap Reductn	0	0	0	51
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.37	2.19	0.53	0.73

Intersection Summary

Lane Group	WBL	NBT	SBL	SBT
Lane Group Flow (vph)	71	1589	9	2165
v/c Ratio	0.51	0.52	0.02	0.50
Control Delay	75.1	17.3	52.4	0.3
Queue Delay	0.0	0.4	9.6	0.3
Total Delay	75.1	17.7	62.0	0.6
Queue Length 50th (ft)	50	237	7	0
Queue Length 95th (ft)	93	269	m10	0
Internal Link Dist (ft)	137	262		37
Turn Bay Length (ft)			25	
Base Capacity (vph)	139	3030	398	4340
Starvation Cap Reductn	0	0	371	1236
Spillback Cap Reductn	0	797	0	0
Storage Cap Reductn	0	0	0	0
Reduced v/c Ratio	0.51	0.71	0.33	0.70

Intersection Summary

m Volume for 95th percentile queue is metered by upstream signal.