Appendix N

Technical Reports prepared

for the No Project/American Assets Trust Alternative

Drainage Report

Water Quality Technical Report

Traffic Impact Analysis

Sewer Study

Drainage Report

DRAINAGE REPORT

SOLANA 101

MIXED-USE PROJECT

Northwest Corner of Highway 101 and Dahlia Drive

Solana Beach, CA 92075

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October 8, 2015

FOR REVIEW ONLY

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A. 50- and 100-Year Rational Method Analyses and Supporting Data

INTRODUCTION

The Solana 101 – Mixed-Use Project is a proposed high-density residential, commercial, and retail project located immediately north of Dahlia Drive between Highway 101 and South Sierra Avenue in the city of Solana Beach (see the Preliminary Grading and Drainage Plan included after this report text). The site is rectangular and covers approximately 1.9 acres.

Under pre-project conditions, the northerly half of the site contains a mobile home park, while the easterly portion of the southerly half contains commercial uses and the westerly portion of the southerly half contains single-family residential homes. Figure 1 includes a Google Earth aerial photograph from 2008 showing the historic development at the site. Currently, the mobile home park and residential homes have been abandoned. Under post-project conditions, the easterly portion of the site will be developed with a market and offices/retail space, while the westerly portion will be developed with multi-family residential units. An underground parking garage will be constructed beneath the site.

Figure 1. Pre-Project Development within Project Site (North is up)

Under pre- and post-project conditions, storm runoff will be conveyed away from the site in three directions. The easterly third of the site flows onto Highway 101. Surface runoff enters an existing curb inlet on Highway 101 near the southeast corner of the site or is conveyed southerly

along Highway 101 to an existing curb inlet just south of Dahlia Drive. The curb inlets connect to a storm drain system that discharges to the railroad corridor just east of Highway 101. Storm runoff from the westerly two-thirds of the site will flow onto South Sierra Avenue. A high point exists in South Sierra Avenue approximately midway along the site. Storm runoff north of the high point will be conveyed northerly in South Sierra Avenue to a curb inlet near Fletcher Cove. The curb inlet connects to a storm drain system that discharges into the Pacific Ocean at Fletcher Cove. Storm runoff south of the high point will be conveyed southerly in South Sierra Avenue to a curb inlet approximately 640 feet south of the site. The curb inlet connects to a storm drain system that discharges directly west into the Pacific Ocean. Under the current proposal, the on-site runoff will be conveyed into the underground parking lot, treated (and detained as needed), then pumped up to the three respective flow directions.

This report contains hydrologic and hydraulic analyses for the preliminary engineering design and project entitlements. The analyses include pre- and post-project (existing and proposed condition) hydrologic analyses. More detailed analyses will be required during final engineering.

HYDROLOGIC ANALYSES

Hydrologic analyses were performed to determine the 50- and 100-year flow rates under pre- and post-project conditions. The County of San Diego's 2003 *Hydrology Manual* rational method procedure was used for the 50- and 100-year hydrologic analyses. The rational method input parameters are summarized below and the supporting data is included in Appendix A:

- Precipitation: The 50-year, 6- and 24-hour precipitation values are 2.2 and 3.7 inches, respectively. The 100-year, 6- and 24-hour precipitation values are 2.4 and 3.9 inches, respectively.

- Drainage areas: The drainage basins were delineated from the 1-foot contour base topography flown for the project and the preliminary grading and drainage plan. A site investigation was performed to verify the pre-project delineations. See the Rational Method Work Map exhibits in the map pocket for the drainage basin boundaries, rational method node numbers, and drainage basin areas. The overall existing condition drainage basin boundary was set equal to the overall proposed condition boundary to allow a comparison of results.

- Hydrologic soil groups: The hydrologic soil groups were determined from the Natural Resources Conservation Service's (NRCS) *Web Soil Survey*. The soil group in the study area is entirely type B.

- Runoff coefficients: Runoff coefficients for the pre- and post-project conditions were based on the percentage of impervious area within each drainage subbasin. For pre-project conditions, this was determined from the topographic mapping, review of historic aerial photographs, and a site visit. The Existing Condition Rational Method Work Map shows the historic impervious areas shaded in yellow. Table 1 summarizes the impervious area and percent impervious in each existing condition drainage subarea digitized from the work

map. The land use most closely representing the percent impervious was selected in the rational method program. For instance, from Nodes 10-12, a Neighborhood Commercial land use was selected because Table 3-1 from the *Hydrology Manual* indicates this represents 80 percent impervious, which is the closest value to 81 percent impervious.

Rational Method Nodes	Impervious Area, sf	Total Area, sf	Percent Impervious
10-12	22,512	27,835	81
20-22	13,551	33,871	40
30-32	6,588	6,993	94
32-34	5,084	17,691	29

Table 1. Existing Condition Impervious Areas

For post-project conditions, the site will be almost entirely impervious. The primary pervious areas are from a series of landscape areas (these will serve as treatment control BMPs) along the westerly property line. All of the pervious areas total over 2,545 square feet or about 3 percent of the overall study area. Based on this, the proposed condition site will be approximately 97 percent impervious. A General Industrial land use was assigned to the entire proposed condition site because Table 3-1 from the *Hydrology Manual* indicates this represents 95 percent impervious.

- Flow lengths and elevations: The flow lengths and elevations were obtained from the base topography and preliminary engineering plans. The flow lengths are shown on the work maps – the flow direction is from a lower node number to a higher node number.

The existing and proposed condition rational method results are included in Appendix A and summarized in Table 2. Table 2 provides the overall results for the three major existing condition drainage basins within the site.

	50-Year Flow Rate, cfs		100-Year Flow Rate, cfs	
Drainage Basin	**Existing Conditions**	**Proposed Conditons**	**Existing Conditions**	**Proposed Conditons**
Easterly	2.9	9.0	3.1	9.8
Northwesterly	1.6		1.8	
Southwesterly	1.8		1.9	
Total	6.3	9.0	6.8	9.8

Table 2. Summary of 50- and 100-Year Rational Method Results

Under proposed conditions, the storm runoff will be conveyed to a below grade collection reservoir at the westerly portion of the site. The proposed condition flow rates in Table 2 represent the overall flow to the storage reservoir. The water will be pumped from the storage reservoir to treatment planters at or above ground level. The treated water will then be collected and discharged (pumped) in appropriate percentages to each of the three flow directions from the site. The proposed condition drainage system consisting of gravity flow, pumping, treatment, and

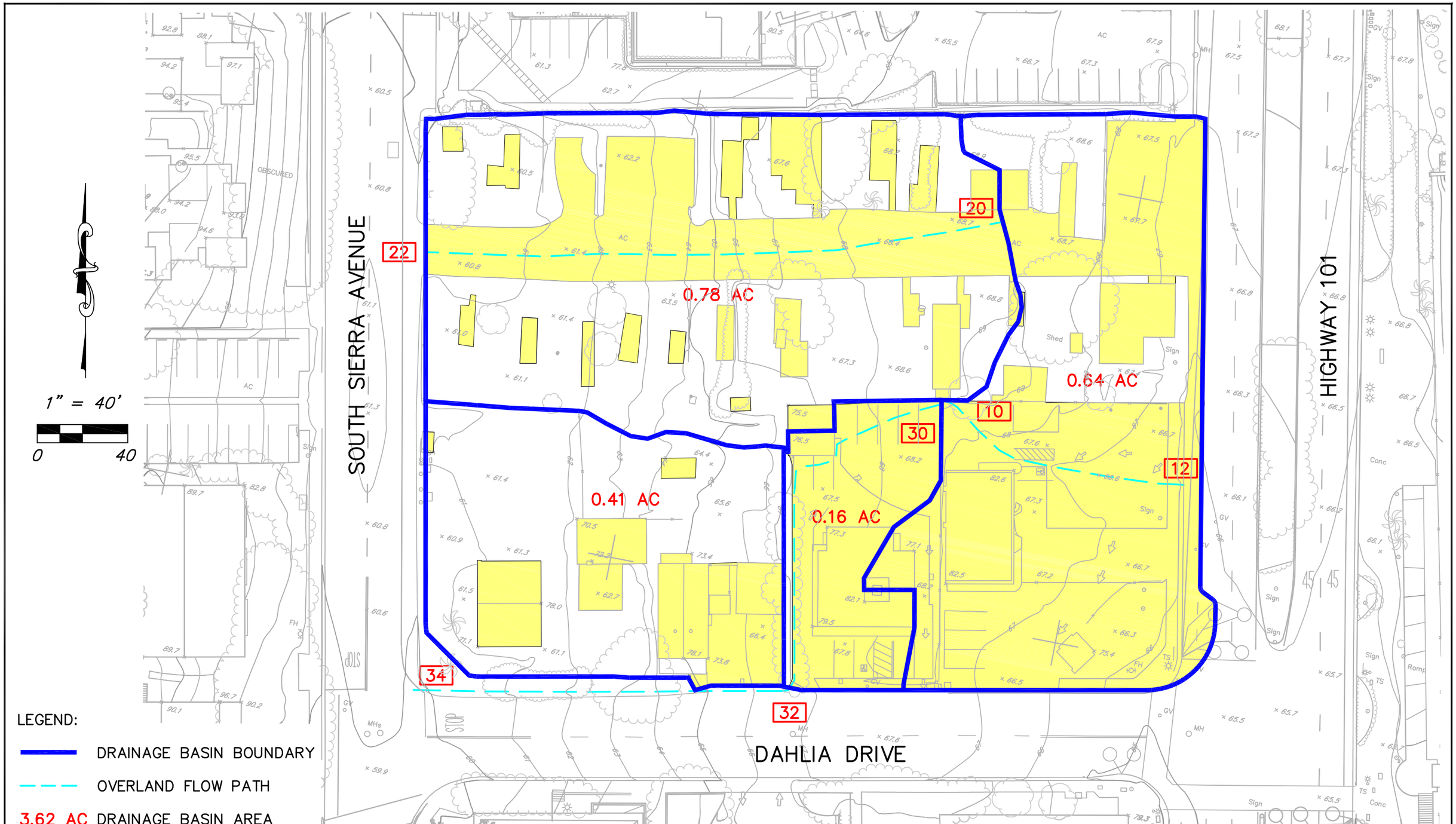
pumping will increase the time of concentration. As a result, the proposed condition flow onto the adjacent streets will occur much later than under existing conditions. The delayed time of concentration (along with storage reserviors) will assist in avoiding off-site flood inundation impacts.

CONCLUSION

Hydrologic analyses have been performed for preliminary engineering of the Solana 101 – Mixed-Use Project. The analyses show that the project will increase the overall 100-year flow rate from the on-site area. However, this will be mitigitated by the storage, pumping, and treatment control BMP system proposed for the project. More detailed analyses of the mitigation will be performed during final engineering. A small detention area within the underground parking garage can be incorporated into the final drainage system design, if needed..

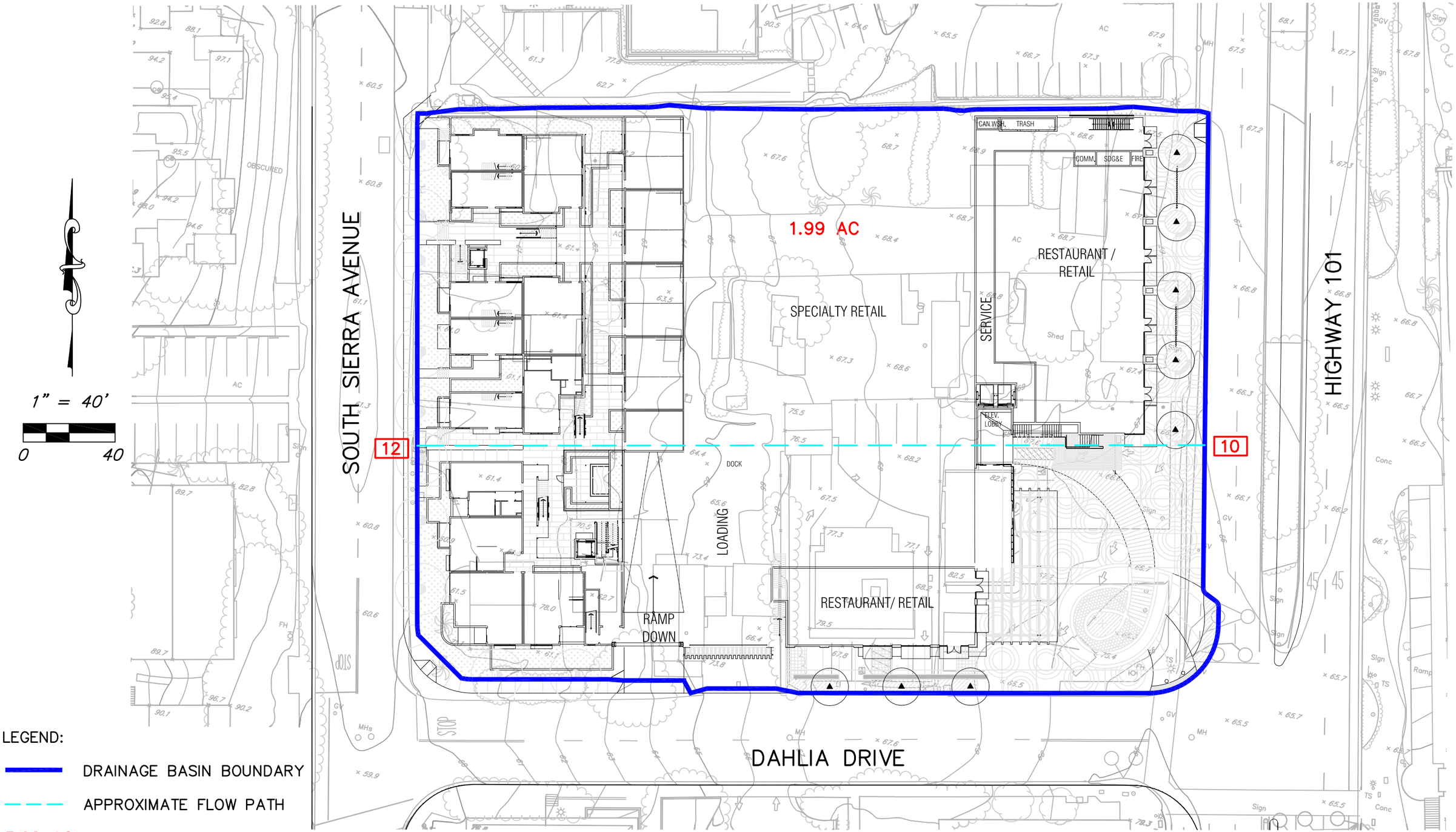
APPENDIX A

100-YEAR RATIONAL METHOD ANALYSES AND SUPPORTING DATA



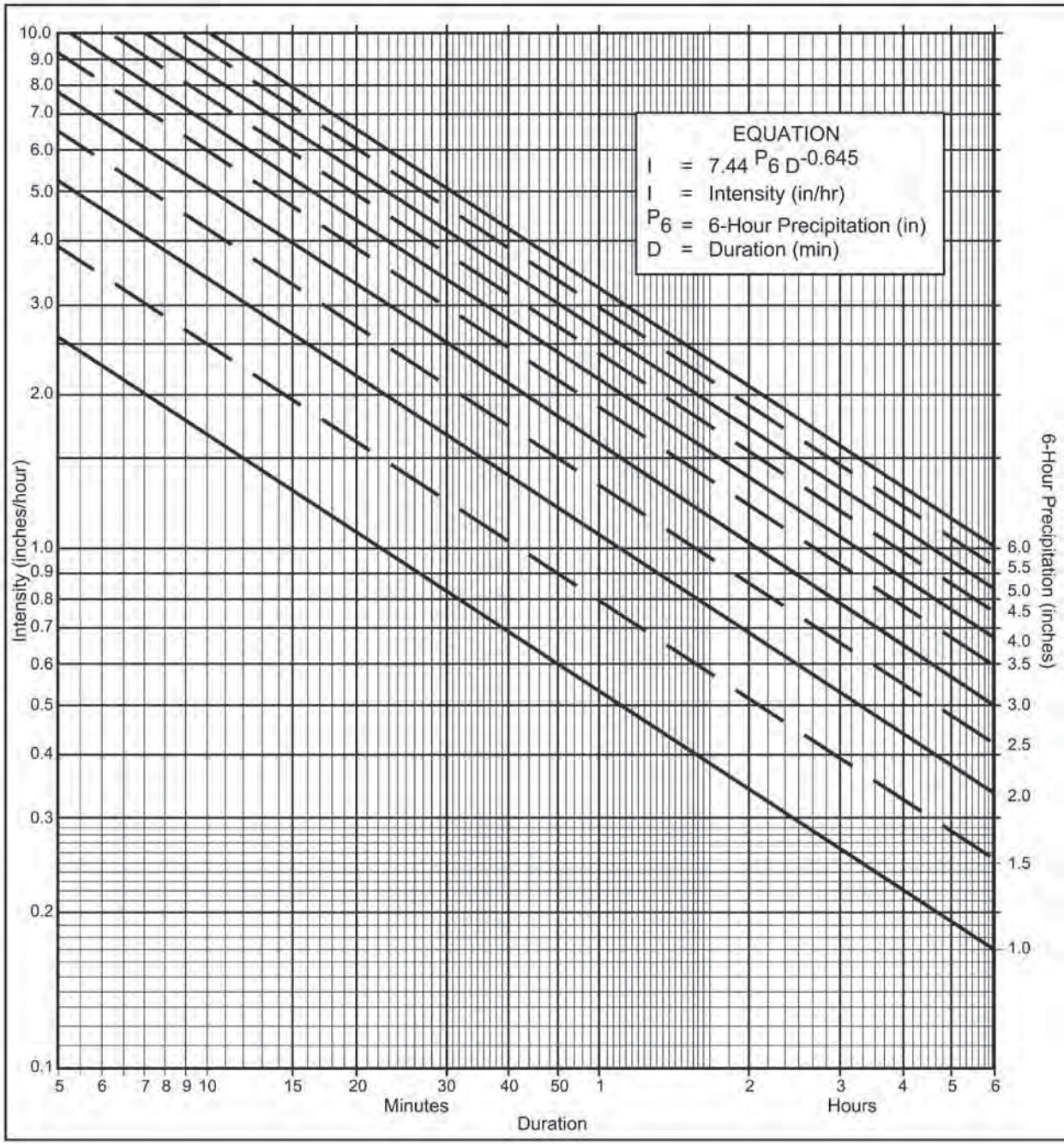
EXISTING CONDITION

RATIONAL METHOD WORK MAP



PROPOSED CONDITION

RATIONAL METHOD WORK MAP



Directions for Application:

(1) From precipitation maps determine 6 hr and 24 hr amounts for the selected frequency. These maps are included in the County Hydrology Manual (10, 50, and 100 yr maps included in the Design and Procedure Manual).

(2) Adjust 6 hr precipitation (if necessary) so that it is within the range of 45% to 65% of the 24 hr precipitation (not applicaple to Desert).

(3) Plot 6 hr precipitation on the right side of the chart.

(4) Draw a line through the point parallel to the plotted lines.

(5) This line is the intensity-duration curve for the location being analyzed.

Application Form:

(a) Selected frequency 50 year

(b) P_6 = 2.2 in., P_{24} = 3.7 , $\frac{P_6}{P_{24}}$ = 59 %(2)

(c) Adjusted P_6(2) = 2.2 in.

(d) t_x = _____ min.

(e) I = _____ in./hr.

See CivilD analyses.

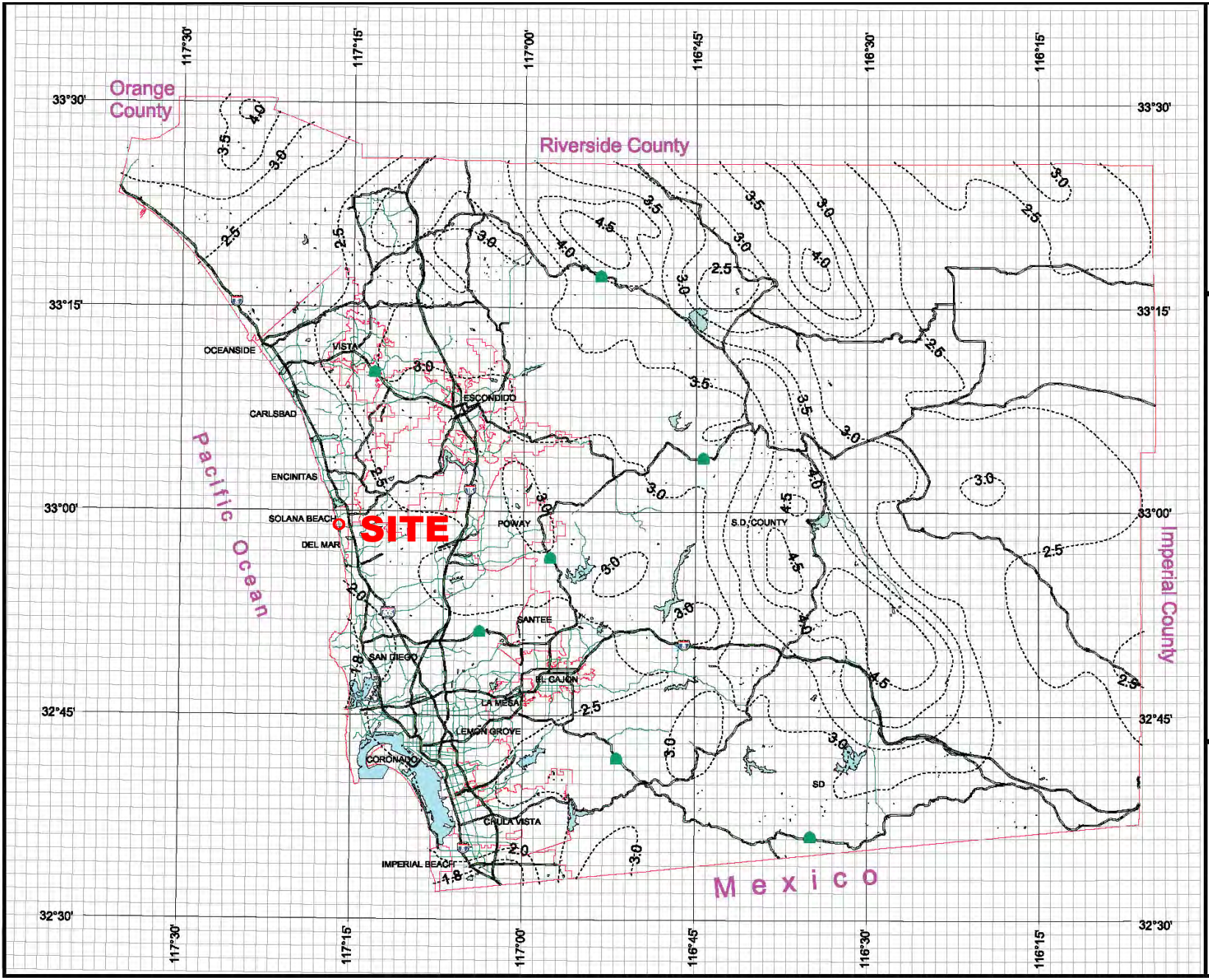
Note: This chart replaces the Intensity-Duration-Frequency curves used since 1965.

P6	1	1.5	2	2.5	3	3.5	4	4.5	5	5.5	6
Duration	I	I	I	I	I	I	I	I	I	I	I
5	2.63	3.95	5.27	6.59	7.90	9.22	10.54	11.86	13.17	14.49	15.81
7	2.12	3.18	4.24	5.30	6.36	7.42	8.48	9.54	10.60	11.66	12.72
10	1.68	2.53	3.37	4.21	5.05	5.90	6.74	7.58	8.42	9.27	10.11
15	1.30	1.95	2.59	3.24	3.89	4.54	5.19	5.84	6.49	7.13	7.78
20	1.08	1.62	2.15	2.69	3.23	3.77	4.31	4.85	5.39	5.93	6.46
25	0.93	1.40	1.87	2.33	2.80	3.27	3.73	4.20	4.67	5.13	5.60
30	0.83	1.24	1.66	2.07	2.49	2.90	3.32	3.73	4.15	4.56	4.98
40	0.69	1.03	1.38	1.72	2.07	2.41	2.76	3.10	3.45	3.79	4.13
50	0.60	0.90	1.19	1.49	1.79	2.09	2.39	2.69	2.98	3.28	3.58
60	0.53	0.80	1.06	1.33	1.59	1.86	2.12	2.39	2.65	2.92	3.18
90	0.41	0.61	0.82	1.02	1.23	1.43	1.63	1.84	2.04	2.25	2.45
120	0.34	0.51	0.68	0.85	1.02	1.19	1.36	1.53	1.70	1.87	2.04
150	0.29	0.44	0.59	0.73	0.88	1.03	1.18	1.32	1.47	1.62	1.76
180	0.26	0.39	0.52	0.65	0.78	0.91	1.04	1.18	1.31	1.44	1.57
240	0.22	0.33	0.43	0.54	0.65	0.76	0.87	0.98	1.08	1.19	1.30
300	0.19	0.28	0.38	0.47	0.56	0.66	0.75	0.85	0.94	1.03	1.13
360	0.17	0.25	0.33	0.42	0.50	0.58	0.67	0.75	0.84	0.92	1.00

Intensity-Duration Design Chart - Template

FIGURE

3-1



County of San Diego Hydrology Manual

Rainfall Isopluvials

50 Year Rainfall Event - 6 Hours

Isopluvial (inches)

P6=2.2"

DPW GIS
Department of Public Works Geographic Information Services

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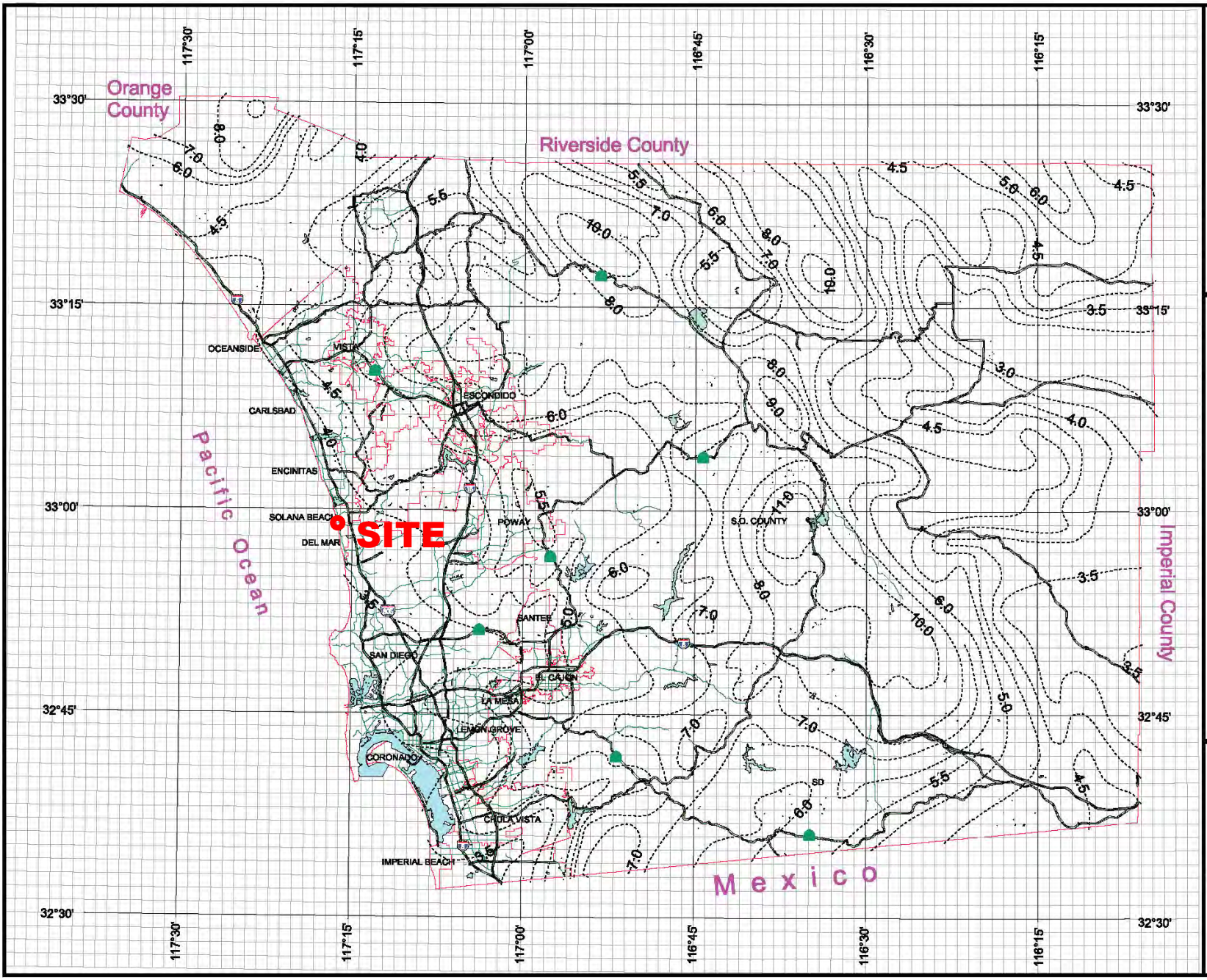

County of San Diego Hydrology Manual

Rainfall Isopluvials

50 Year Rainfall Event - 24 Hours

Isopluvial (inches)

P24=3.7"

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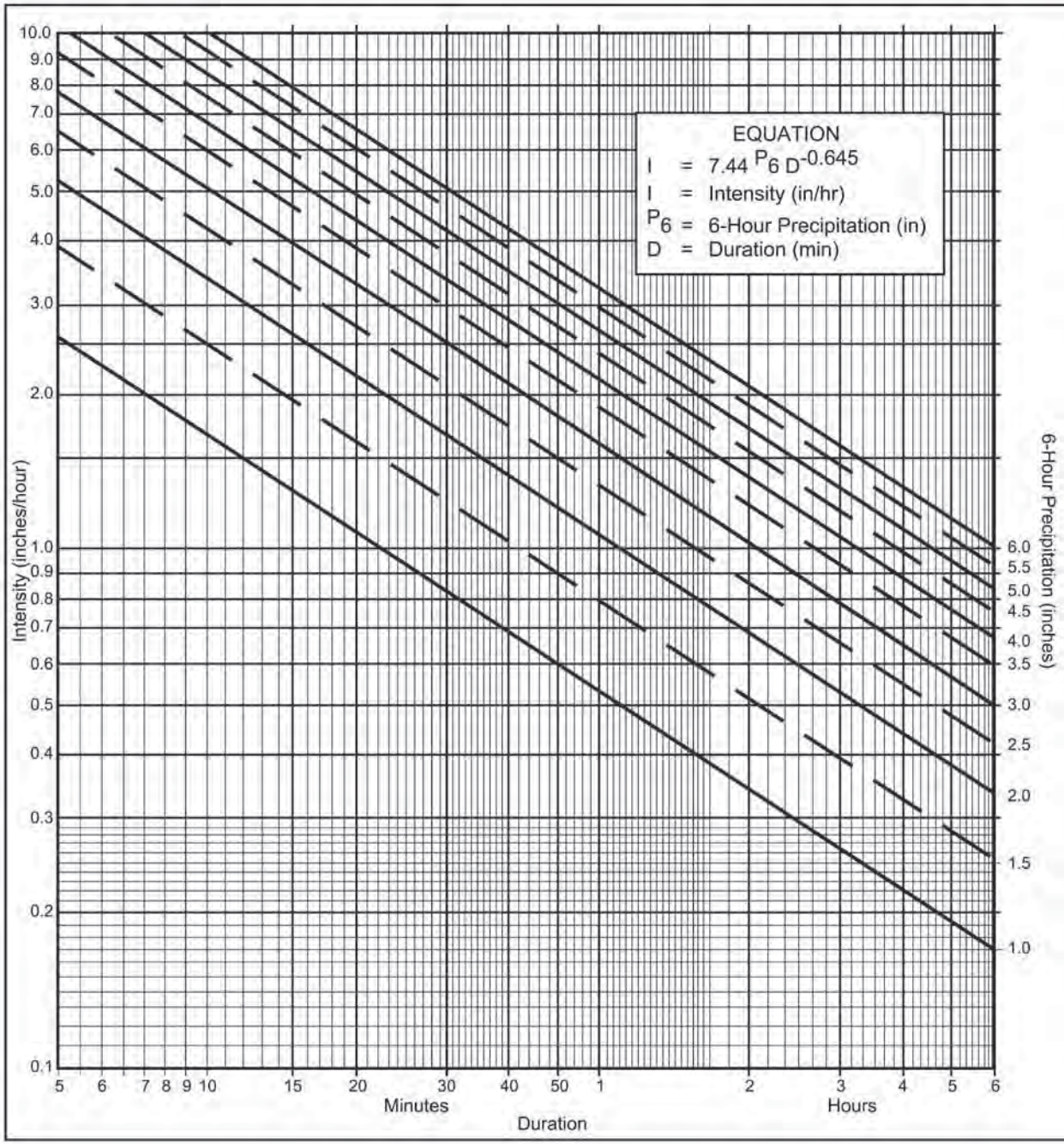

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(3) Plot 6 hr precipitation on the right side of the chart.

(4) Draw a line through the point parallel to the plotted lines.

(5) This line is the intensity-duration curve for the location being analyzed.

Application Form:

(a) Selected frequency 100 year

(b) P_6 = 2.4 in., P_{24} = 3.9 , $\frac{P_6}{P_{24}}$ = 62 %(2)

(c) Adjusted P_6(2) = 2.4 in.

(d) t_x = _____ min.

(e) I = _____ in./hr.

See CivilD analyses.

Note: This chart replaces the Intensity-Duration-Frequency curves used since 1965.

P6	1	1.5	2	2.5	3	3.5	4	4.5	5	5.5	6
Duration	I	I	I	I	I	I	I	I	I	I	I
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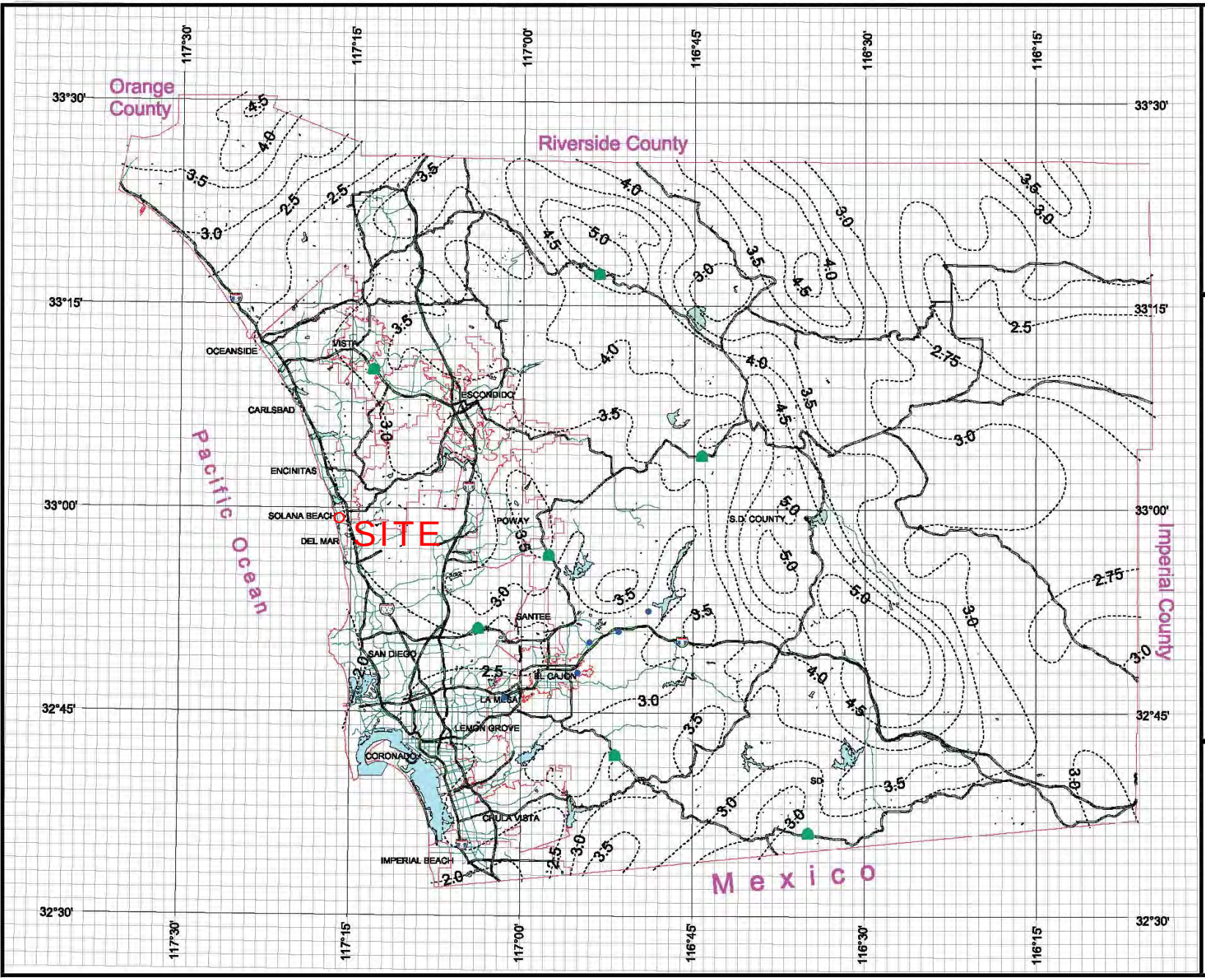
360	0.17	0.25	0.33	0.42	0.50	0.58	0.67	0.75	0.84	0.92	1.00

Intensity-Duration Design Chart - Template

FIGURE

3-1



County of San Diego Hydrology Manual

Rainfall Isopluvials

100 Year Rainfall Event - 6 Hours

Isopluvial (inches)

P6 = 2.4"

DPW GIS
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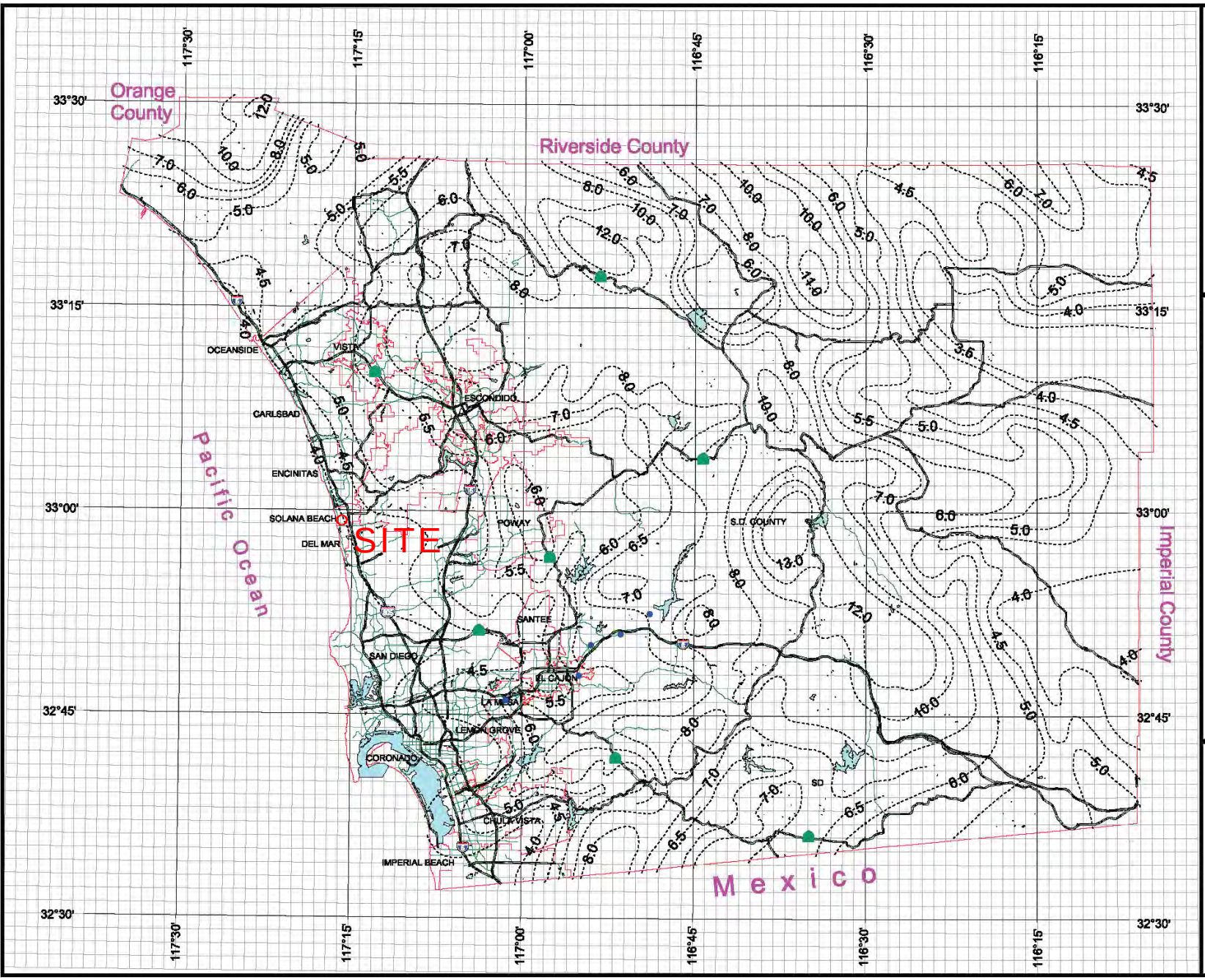

County of San Diego Hydrology Manual

Rainfall Isopluvials

100 Year Rainfall Event - 24 Hours

Isopluvial (inches)

P24 = 3.9"

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Table 3-1
RUNOFF COEFFICIENTS FOR URBAN AREAS

Land Use		Runoff Coefficient "C"				
			Soil Type			
NRCS Elements	County Elements	% IMPER.	A	B	C	D
Undisturbed Natural Terrain (Natural)	Permanent Open Space	0*	0.20	0.25	0.30	0.35
Low Density Residential (LDR)	Residential, 1.0 DU/A or less	10	0.27	0.32	0.36	0.41
Low Density Residential (LDR)	Residential, 2.0 DU/A or less	20	0.34	0.38	0.42	0.46
Low Density Residential (LDR)	Residential, 2.9 DU/A or less	25	0.38	0.41	0.45	0.49
Medium Density Residential (MDR)	Residential, 4.3 DU/A or less	30	0.41	0.45	0.48	0.52
Medium Density Residential (MDR)	Residential, 7.3 DU/A or less	40	0.48	0.51	0.54	0.57
Medium Density Residential (MDR)	Residential, 10.9 DU/A or less	45	0.52	0.54	0.57	0.60
Medium Density Residential (MDR)	Residential, 14.5 DU/A or less	50	0.55	0.58	0.60	0.63
High Density Residential (HDR)	Residential, 24.0 DU/A or less	65	0.66	0.67	0.69	0.71
High Density Residential (HDR)	Residential, 43.0 DU/A or less	80	0.76	0.77	0.78	0.79
Commercial/Industrial (N. Com)	Neighborhood Commercial	80	0.76	0.77	0.78	0.79
Commercial/Industrial (G. Com)	General Commercial	85	0.80	0.80	0.81	0.82
Commercial/Industrial (O.P. Com)	Office Professional/Commercial	90	0.83	0.84	0.84	0.85
Commercial/Industrial (Limited I.)	Limited Industrial	90	0.83	0.84	0.84	0.85
Commercial/Industrial (General I.)	General Industrial	95	0.87	0.87	0.87	0.87

*The values associated with 0% impervious may be used for direct calculation of the runoff coefficient as described in Section 3.1.2 (representing the pervious runoff coefficient, Cp, for the soil type), or for areas that will remain undisturbed in perpetuity. Justification must be given that the area will remain natural forever (e.g., the area is located in Cleveland National Forest).
DU/A = dwelling units per acre
NRCS = National Resources Conservation Service

Hydrologic Soil Group—San Diego County Area, California

Map Scale: 1:2,680 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 35 70 140 210

Feet: 0 100 200 400 600

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 11N WGS84

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Rating Polygons

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Lines

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Points

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Water Features

Streams and Canals

Transportation

- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background

Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: San Diego County Area, California
Survey Area Data: Version 8, Sep 17, 2014

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Nov 3, 2014—Nov 22, 2014

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Hydrologic Soil Group

Hydrologic Soil Group— Summary by Map Unit — San Diego County Area, California (CA638)				
Map unit symbol	**Map unit name**	**Rating**	**Acres in AOI**	**Percent of AOI**
MIC	Marina loamy coarse sand, 2 to 9 percent slopes	B	29.2	100.0%
Totals for Area of Interest			**29.2**	**100.0%**

Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: *None Specified*

San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2009 Version 7.8

Rational method hydrology program based on
San Diego County Flood Control Division 2003 hydrology manual
Rational Hydrology Study Date: 10/08/15

Solana 101 Mixed-Use Project
Existing Conditions
50-Year Flow Rate

********* Hydrology Study Control Information **********

Program License Serial Number 4028

Rational hydrology study storm event year is 50.0
English (in-lb) input data Units used

Map data precipitation entered:
6 hour, precipitation(inches) = 2.200
24 hour precipitation(inches) = 3.700
P6/P24 = 59.5%
San Diego hydrology manual 'C' values used

++
Process from Point/Station 10.000 to Point/Station 12.000
**** INITIAL AREA EVALUATION ****

Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
[COMMERCIAL area type]
(Neighborhod Commercial)
Impervious value, Ai = 0.800
Sub-Area C Value = 0.770
Initial subarea total flow distance = 118.000(Ft.)
Highest elevation = 69.000(Ft.)
Lowest elevation = 66.000(Ft.)
Elevation difference = 3.000(Ft.) Slope = 2.542 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 85.00 (Ft)
for the top area slope value of 2.54 %, in a development type of
Neighborhod Commercial
In Accordance With Figure 3-3

```
Initial Area Time of Concentration =   4.01 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.7700)*(  85.000^.5)/(   2.542^(1/3)]=   4.01
The initial area total distance of  118.00 (Ft.) entered leaves a
remaining distance of   33.00 (Ft.)
Using Figure 3-4, the travel time for this distance is   0.47 minutes
for a distance of  33.00 (Ft.) and a slope of  2.54 %
with an elevation difference of   0.84(Ft.) from the end of the top area
Tt = [11.9*length(Mi)^3)/(elevation change(Ft.))]^.385 *60(min/hr)
 =    0.474 Minutes
Tt=[(11.9*0.0063^3)/(  0.84)]^.385=  0.47
Total initial area Ti =   4.01 minutes from Figure 3-3 formula plus
  0.47 minutes from the Figure 3-4 formula =   4.49 minutes
Calculated TC of    4.487 minutes is less than 5 minutes,
 resetting TC to 5.0 minutes for rainfall intensity calculations
Rainfall intensity (I) =      5.796(In/Hr) for a    50.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.770
Subarea runoff =      2.856(CFS)
Total initial stream area =        0.640(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       10.000 to Point/Station       12.000
**** CONFLUENCE OF MAIN STREAMS ****
______________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =      0.640(Ac.)
Runoff from this stream =      2.856(CFS)
Time of concentration =    4.49 min.
Rainfall intensity =     5.796(In/Hr)
Program is now starting with Main Stream No. 2


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       20.000 to Point/Station       22.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
[MEDIUM DENSITY RESIDENTIAL                  ]
(7.3 DU/A or Less       )
Impervious value, Ai = 0.400
Sub-Area C Value = 0.510
Initial subarea total flow distance  =  256.000(Ft.)
Highest elevation =   68.800(Ft.)
Lowest elevation =   60.600(Ft.)
Elevation difference =    8.200(Ft.) Slope =  3.203 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 95.00 (Ft)
```

```
for the top area slope value of   3.20 %, in a development type of
 7.3 DU/A or Less
In Accordance With Figure 3-3
Initial Area Time of Concentration =   7.02 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.5100)*(  95.000^.5)/(   3.203^(1/3)]=   7.02
The initial area total distance of  256.00 (Ft.) entered leaves a
remaining distance of  161.00 (Ft.)
Using Figure 3-4, the travel time for this distance is   1.47 minutes
for a distance of 161.00 (Ft.) and a slope of  3.20 %
with an elevation difference of   5.16(Ft.) from the end of the top area
Tt = [11.9*length(Mi)^3)/(elevation change(Ft.))]^.385 *60(min/hr)
 =    1.470 Minutes
Tt=[(11.9*0.0305^3)/(  5.16)]^.385=  1.47
Total initial area Ti =   7.02 minutes from Figure 3-3 formula plus
  1.47 minutes from the Figure 3-4 formula =   8.49 minutes
Rainfall intensity (I) =      4.119(In/Hr) for a    50.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.510
Subarea runoff =      1.639(CFS)
Total initial stream area =        0.780(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       20.000 to Point/Station       22.000
**** CONFLUENCE OF MAIN STREAMS ****
______________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area =      0.780(Ac.)
Runoff from this stream =      1.639(CFS)
Time of concentration =    8.49 min.
Rainfall intensity =     4.119(In/Hr)
Program is now starting with Main Stream No. 3


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       30.000 to Point/Station       32.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
[INDUSTRIAL area type                       ]
(General Industrial       )
Impervious value, Ai = 0.950
Sub-Area C Value = 0.870
Initial subarea total flow distance  =  174.000(Ft.)
Highest elevation =   69.100(Ft.)
Lowest elevation =   66.800(Ft.)
Elevation difference =    2.300(Ft.) Slope =  1.322 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
```

```
The maximum overland flow distance is 60.00 (Ft)
for the top area slope value of   1.32 %, in a development type of
 General Industrial
In Accordance With Figure 3-3
Initial Area Time of Concentration =   2.92 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.8700)*(  60.000^.5)/(   1.320^(1/3)]=   2.92
The initial area total distance of  174.00 (Ft.) entered leaves a
remaining distance of  114.00 (Ft.)
Using Figure 3-4, the travel time for this distance is   1.58 minutes
for a distance of 114.00 (Ft.) and a slope of  1.32 %
with an elevation difference of   1.50(Ft.) from the end of the top area
Tt = [11.9*length(Mi)^3)/(elevation change(Ft.))]^.385 *60(min/hr)
 =    1.585 Minutes
Tt=[(11.9*0.0216^3)/(  1.50)]^.385=  1.58
Total initial area Ti =   2.92 minutes from Figure 3-3 formula plus
  1.58 minutes from the Figure 3-4 formula =   4.51 minutes
Calculated TC of    4.508 minutes is less than 5 minutes,
 resetting TC to 5.0 minutes for rainfall intensity calculations
Rainfall intensity (I) =      5.796(In/Hr) for a    50.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.870
Subarea runoff =      0.807(CFS)
Total initial stream area =        0.160(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       32.000 to Point/Station       34.000
**** IMPROVED CHANNEL TRAVEL TIME ****
______________________________________________________________________
Upstream point elevation =    66.800(Ft.)
Downstream point elevation =    59.800(Ft.)
Channel length thru subarea  =   164.000(Ft.)
Channel base width    =    1.000(Ft.)
Slope or 'Z' of left channel bank =  50.000
Slope or 'Z' of right channel bank =   2.000
Estimated mean flow rate at midpoint of channel =      1.324(CFS)
Manning's 'N'    = 0.018
Maximum depth of channel  =    0.500(Ft.)
Flow(q) thru subarea =      1.324(CFS)
Depth of flow =   0.117(Ft.), Average velocity =   2.799(Ft/s)
Channel flow top width =    7.084(Ft.)
Flow Velocity =    2.80(Ft/s)
Travel time  =    0.98 min.
Time of concentration =    5.48 min.
Critical depth =      0.156(Ft.)
 Adding area flow to channel
Rainfall intensity (I) =      5.461(In/Hr) for a    50.0 year storm
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
[MEDIUM DENSITY RESIDENTIAL                  ]
```

```
(4.3 DU/A or Less       )
Impervious value, Ai = 0.300
Sub-Area C Value = 0.450
Rainfall intensity =      5.461(In/Hr) for a    50.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.568  CA =      0.324
Subarea runoff =      0.961(CFS) for      0.410(Ac.)
Total runoff =      1.768(CFS)   Total area =       0.570(Ac.)
Depth of flow =   0.132(Ft.), Average velocity =   3.012(Ft/s)
Critical depth =      0.178(Ft.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       32.000 to Point/Station       34.000
**** CONFLUENCE OF MAIN STREAMS ****
______________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 3
Stream flow area =      0.570(Ac.)
Runoff from this stream =      1.768(CFS)
Time of concentration =    5.48 min.
Rainfall intensity =     5.461(In/Hr)
Summary of stream data:

Stream   Flow rate      TC            Rainfall Intensity
 No.       (CFS)       (min)                 (In/Hr)


1        2.856      4.49            5.796
2        1.639      8.49            4.119
3        1.768      5.48            5.461
Qmax(1) =
        1.000 *    1.000 *     2.856) +
        1.000 *    0.528 *     1.639) +
        1.000 *    0.818 *     1.768) + =       5.168
Qmax(2) =
        0.711 *    1.000 *     2.856) +
        1.000 *    1.000 *     1.639) +
        0.754 *    1.000 *     1.768) + =       5.002
Qmax(3) =
        0.942 *    1.000 *     2.856) +
        1.000 *    0.646 *     1.639) +
        1.000 *    1.000 *     1.768) + =       5.517

Total of 3 main streams to confluence:
Flow rates before confluence point:
       2.856       1.639       1.768
Maximum flow rates at confluence using above data:
        5.168        5.002        5.517
Area of streams before confluence:
        0.640        0.780        0.570
```

```
Results of confluence:
Total flow rate =      5.517(CFS)
Time of concentration =     5.485 min.
Effective stream area after confluence  =      1.990(Ac.)
End of computations, total study area =           1.990 (Ac.)
```

San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2009 Version 7.8

Rational method hydrology program based on
San Diego County Flood Control Division 2003 hydrology manual
Rational Hydrology Study Date: 10/08/15

Solana 101 Mixed-Use Project
Existing Conditions
100-Year Flow Rate

********* Hydrology Study Control Information **********

Program License Serial Number 4028

Rational hydrology study storm event year is 100.0
English (in-lb) input data Units used

Map data precipitation entered:
6 hour, precipitation(inches) = 2.400
24 hour precipitation(inches) = 3.900
P6/P24 = 61.5%
San Diego hydrology manual 'C' values used

++
Process from Point/Station 10.000 to Point/Station 12.000
**** INITIAL AREA EVALUATION ****

Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
[COMMERCIAL area type]
(Neighborhod Commercial)
Impervious value, Ai = 0.800
Sub-Area C Value = 0.770
Initial subarea total flow distance = 118.000(Ft.)
Highest elevation = 69.000(Ft.)
Lowest elevation = 66.000(Ft.)
Elevation difference = 3.000(Ft.) Slope = 2.542 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 85.00 (Ft)
for the top area slope value of 2.54 %, in a development type of
Neighborhod Commercial
In Accordance With Figure 3-3

```
Initial Area Time of Concentration =   4.01 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.7700)*(  85.000^.5)/(   2.542^(1/3)]=   4.01
The initial area total distance of  118.00 (Ft.) entered leaves a
remaining distance of   33.00 (Ft.)
Using Figure 3-4, the travel time for this distance is   0.47 minutes
for a distance of  33.00 (Ft.) and a slope of  2.54 %
with an elevation difference of   0.84(Ft.) from the end of the top area
Tt = [11.9*length(Mi)^3)/(elevation change(Ft.))]^.385 *60(min/hr)
 =    0.474 Minutes
Tt=[(11.9*0.0063^3)/(  0.84)]^.385=  0.47
Total initial area Ti =   4.01 minutes from Figure 3-3 formula plus
  0.47 minutes from the Figure 3-4 formula =   4.49 minutes
Calculated TC of    4.487 minutes is less than 5 minutes,
 resetting TC to 5.0 minutes for rainfall intensity calculations
Rainfall intensity (I) =      6.323(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.770
Subarea runoff =      3.116(CFS)
Total initial stream area =        0.640(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       10.000 to Point/Station       12.000
**** CONFLUENCE OF MAIN STREAMS ****
______________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 1
Stream flow area =      0.640(Ac.)
Runoff from this stream =      3.116(CFS)
Time of concentration =    4.49 min.
Rainfall intensity =     6.323(In/Hr)
Program is now starting with Main Stream No. 2


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       20.000 to Point/Station       22.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
[MEDIUM DENSITY RESIDENTIAL                  ]
(7.3 DU/A or Less       )
Impervious value, Ai = 0.400
Sub-Area C Value = 0.510
Initial subarea total flow distance  =  256.000(Ft.)
Highest elevation =   68.800(Ft.)
Lowest elevation =   60.600(Ft.)
Elevation difference =    8.200(Ft.) Slope =  3.203 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 95.00 (Ft)
```

```
for the top area slope value of   3.20 %, in a development type of
 7.3 DU/A or Less
In Accordance With Figure 3-3
Initial Area Time of Concentration =   7.02 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.5100)*(  95.000^.5)/(   3.203^(1/3)]=   7.02
The initial area total distance of  256.00 (Ft.) entered leaves a
remaining distance of  161.00 (Ft.)
Using Figure 3-4, the travel time for this distance is   1.47 minutes
for a distance of 161.00 (Ft.) and a slope of  3.20 %
with an elevation difference of   5.16(Ft.) from the end of the top area
Tt = [11.9*length(Mi)^3)/(elevation change(Ft.))]^.385 *60(min/hr)
 =    1.470 Minutes
Tt=[(11.9*0.0305^3)/(  5.16)]^.385=  1.47
Total initial area Ti =   7.02 minutes from Figure 3-3 formula plus
  1.47 minutes from the Figure 3-4 formula =   8.49 minutes
Rainfall intensity (I) =      4.493(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.510
Subarea runoff =      1.787(CFS)
Total initial stream area =        0.780(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       20.000 to Point/Station       22.000
**** CONFLUENCE OF MAIN STREAMS ****
______________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 2
Stream flow area =      0.780(Ac.)
Runoff from this stream =      1.787(CFS)
Time of concentration =    8.49 min.
Rainfall intensity =     4.493(In/Hr)
Program is now starting with Main Stream No. 3


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       30.000 to Point/Station       32.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
[INDUSTRIAL area type                       ]
(General Industrial       )
Impervious value, Ai = 0.950
Sub-Area C Value = 0.870
Initial subarea total flow distance  =  174.000(Ft.)
Highest elevation =   69.100(Ft.)
Lowest elevation =   66.800(Ft.)
Elevation difference =    2.300(Ft.) Slope =  1.322 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
```

```
The maximum overland flow distance is 60.00 (Ft)
for the top area slope value of   1.32 %, in a development type of
 General Industrial
In Accordance With Figure 3-3
Initial Area Time of Concentration =   2.92 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.8700)*(  60.000^.5)/(   1.320^(1/3)]=   2.92
The initial area total distance of  174.00 (Ft.) entered leaves a
remaining distance of  114.00 (Ft.)
Using Figure 3-4, the travel time for this distance is   1.58 minutes
for a distance of 114.00 (Ft.) and a slope of  1.32 %
with an elevation difference of   1.50(Ft.) from the end of the top area
Tt = [11.9*length(Mi)^3)/(elevation change(Ft.))]^.385 *60(min/hr)
 =    1.585 Minutes
Tt=[(11.9*0.0216^3)/(  1.50)]^.385=  1.58
Total initial area Ti =   2.92 minutes from Figure 3-3 formula plus
  1.58 minutes from the Figure 3-4 formula =   4.51 minutes
Calculated TC of    4.508 minutes is less than 5 minutes,
 resetting TC to 5.0 minutes for rainfall intensity calculations
Rainfall intensity (I) =      6.323(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.870
Subarea runoff =      0.880(CFS)
Total initial stream area =        0.160(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       32.000 to Point/Station       34.000
**** IMPROVED CHANNEL TRAVEL TIME ****
______________________________________________________________________
Upstream point elevation =    66.800(Ft.)
Downstream point elevation =    59.800(Ft.)
Channel length thru subarea  =   164.000(Ft.)
Channel base width    =    1.000(Ft.)
Slope or 'Z' of left channel bank =  50.000
Slope or 'Z' of right channel bank =   2.000
Estimated mean flow rate at midpoint of channel =      1.446(CFS)
Manning's 'N'    = 0.018
Maximum depth of channel  =    0.500(Ft.)
Flow(q) thru subarea =      1.446(CFS)
Depth of flow =   0.121(Ft.), Average velocity =   2.863(Ft/s)
Channel flow top width =    7.317(Ft.)
Flow Velocity =    2.86(Ft/s)
Travel time  =    0.95 min.
Time of concentration =    5.46 min.
Critical depth =      0.162(Ft.)
 Adding area flow to channel
Rainfall intensity (I) =      5.972(In/Hr) for a   100.0 year storm
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
[MEDIUM DENSITY RESIDENTIAL                  ]
```

```
(4.3 DU/A or Less       )
Impervious value, Ai = 0.300
Sub-Area C Value = 0.450
Rainfall intensity =      5.972(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.568  CA =      0.324
Subarea runoff =      1.053(CFS) for      0.410(Ac.)
Total runoff =      1.933(CFS)   Total area =       0.570(Ac.)
Depth of flow =   0.137(Ft.), Average velocity =   3.081(Ft/s)
Critical depth =      0.185(Ft.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       32.000 to Point/Station       34.000
**** CONFLUENCE OF MAIN STREAMS ****
______________________________________________________________________
The following data inside Main Stream is listed:
In Main Stream number: 3
Stream flow area =      0.570(Ac.)
Runoff from this stream =      1.933(CFS)
Time of concentration =    5.46 min.
Rainfall intensity =     5.972(In/Hr)
Summary of stream data:

Stream   Flow rate      TC            Rainfall Intensity
 No.       (CFS)       (min)                 (In/Hr)


1        3.116      4.49            6.323
2        1.787      8.49            4.493
3        1.933      5.46            5.972
Qmax(1) =
        1.000 *    1.000 *     3.116) +
        1.000 *    0.528 *     1.787) +
        1.000 *    0.821 *     1.933) + =       5.648
Qmax(2) =
        0.711 *    1.000 *     3.116) +
        1.000 *    1.000 *     1.787) +
        0.752 *    1.000 *     1.933) + =       5.456
Qmax(3) =
        0.944 *    1.000 *     3.116) +
        1.000 *    0.643 *     1.787) +
        1.000 *    1.000 *     1.933) + =       6.026

Total of 3 main streams to confluence:
Flow rates before confluence point:
       3.116       1.787       1.933
Maximum flow rates at confluence using above data:
        5.648        5.456        6.026
Area of streams before confluence:
        0.640        0.780        0.570
```

```
Results of confluence:
Total flow rate =      6.026(CFS)
Time of concentration =     5.463 min.
Effective stream area after confluence  =      1.990(Ac.)
End of computations, total study area =           1.990 (Ac.)
```

San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2009 Version 7.8

Rational method hydrology program based on
San Diego County Flood Control Division 2003 hydrology manual
Rational Hydrology Study Date: 10/08/15

Solana 101 Mixed-Use Project
Proposed Conditions
50-Year Flow Rate

********* Hydrology Study Control Information **********

Program License Serial Number 4028

Rational hydrology study storm event year is 50.0
English (in-lb) input data Units used

Map data precipitation entered:
6 hour, precipitation(inches) = 2.200
24 hour precipitation(inches) = 3.700
P6/P24 = 59.5%
San Diego hydrology manual 'C' values used

++
Process from Point/Station 10.000 to Point/Station 12.000
**** INITIAL AREA EVALUATION ****

Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
[INDUSTRIAL area type]
(General Industrial)
Impervious value, Ai = 0.950
Sub-Area C Value = 0.870
Initial subarea total flow distance = 343.000(Ft.)
Highest elevation = 66.000(Ft.)
Lowest elevation = 61.000(Ft.)
Elevation difference = 5.000(Ft.) Slope = 1.458 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 60.00 (Ft)
for the top area slope value of 1.46 %, in a development type of
General Industrial
In Accordance With Figure 3-3

```
Initial Area Time of Concentration =   2.83 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.8700)*(  60.000^.5)/(   1.458^(1/3)]=   2.83
The initial area total distance of  343.00 (Ft.) entered leaves a
remaining distance of  283.00 (Ft.)
Using Figure 3-4, the travel time for this distance is   3.07 minutes
for a distance of 283.00 (Ft.) and a slope of  1.46 %
with an elevation difference of   4.13(Ft.) from the end of the top area
Tt = [11.9*length(Mi)^3)/(elevation change(Ft.))]^.385 *60(min/hr)
 =    3.072 Minutes
Tt=[(11.9*0.0536^3)/(  4.13)]^.385=  3.07
Total initial area Ti =   2.83 minutes from Figure 3-3 formula plus
  3.07 minutes from the Figure 3-4 formula =   5.90 minutes
Rainfall intensity (I) =      5.209(In/Hr) for a    50.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.870
Subarea runoff =      9.019(CFS)
Total initial stream area =        1.990(Ac.)
End of computations, total study area =           1.990 (Ac.)
```

```
           San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2009 Version 7.8

Rational method hydrology  program based on
San Diego County Flood Control Division 2003 hydrology manual
     Rational Hydrology Study        Date: 10/08/15
----------------------------------------------------------------------
Solana 101 Mixed-Use Project
Proposed Conditions
100-Year Flow Rate

----------------------------------------------------------------------
 *********   Hydrology Study Control Information **********

----------------------------------------------------------------------


Program License Serial Number 4028

----------------------------------------------------------------------
Rational hydrology study storm event year is   100.0
English (in-lb) input data Units used

Map data precipitation entered:
6 hour,  precipitation(inches) =  2.400
24 hour precipitation(inches) =  3.900
P6/P24 =    61.5%
San Diego hydrology manual 'C' values used


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       10.000 to Point/Station       12.000
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
[INDUSTRIAL area type                       ]
(General Industrial       )
Impervious value, Ai = 0.950
Sub-Area C Value = 0.870
Initial subarea total flow distance  =  343.000(Ft.)
Highest elevation =   66.000(Ft.)
Lowest elevation =   61.000(Ft.)
Elevation difference =    5.000(Ft.) Slope =  1.458 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 60.00 (Ft)
for the top area slope value of   1.46 %, in a development type of
 General Industrial
In Accordance With Figure 3-3
```

```
Initial Area Time of Concentration =   2.83 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.8700)*(  60.000^.5)/(   1.458^(1/3)]=   2.83
The initial area total distance of  343.00 (Ft.) entered leaves a
remaining distance of  283.00 (Ft.)
Using Figure 3-4, the travel time for this distance is   3.07 minutes
for a distance of 283.00 (Ft.) and a slope of  1.46 %
with an elevation difference of   4.13(Ft.) from the end of the top area
Tt = [11.9*length(Mi)^3)/(elevation change(Ft.))]^.385 *60(min/hr)
 =    3.072 Minutes
Tt=[(11.9*0.0536^3)/(  4.13)]^.385=  3.07
Total initial area Ti =   2.83 minutes from Figure 3-3 formula plus
  3.07 minutes from the Figure 3-4 formula =   5.90 minutes
Rainfall intensity (I) =      5.683(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.870
Subarea runoff =      9.839(CFS)
Total initial stream area =        1.990(Ac.)
End of computations, total study area =           1.990 (Ac.)
```

Water Quality Technical Report

WATER QUALITY TECHNICAL REPORT

SOLANA 101

MIXED-USE PROJECT

Northwest Corner of Highway 101 and Dahlia Drive

Solana Beach, CA 92075

Prepared by:

Stuart Engineering
7525 Metropolitan Drive, Suite 308
San Diego, CA 92108
Job Number 153-10-26
Stuart Peace, RCE 27232

October 8, 2015

FOR REVIEW ONLY

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A. BMP Data

INTRODUCTION

The Solana 101 – Mixed-Use Project is a proposed high-density residential, commercial, and retail project located immediately north of Dahlia Drive between Highway 101 and South Sierra Avenue in the city of Solana Beach (see the Preliminary Grading and Drainage Plan included after the figures). The site is rectangular and covers approximately 1.9 acres. The City of Solana Beach classifies development projects as minor, standard, and priority for stormwater purposes (see the Project Classifications following the report figures). The proposed project meets the commercial-greater than one acre, restaurants, and development projects-greater than one acre criteria, so it is considered a priority project. The project will also create a parking lot of more than 5,000 square feet and 15 spaces. However, the parking lot will be underground and not exposed to precipitation. This report contains initial preliminary Water Quality Technical Report information for the project entitlement. A final WQTR will be prepared for final engineering.

Figure 1. Pre-Project Development within Project Site (North is up)

Under pre-project conditions, the northerly half of the site contains a mobile home park, while the easterly portion of the southerly half contains commercial uses and the westerly portion of the southerly half contains single-family residential homes. Figure 1 includes a Google Earth aerial photograph from 2008 showing the historic development at the site.

Currently, the mobile home park and residential homes have been abandoned. Under post-project conditions, the easterly portion of the site will be developed with a market and offices/retail space, while the westerly portion will be developed with multi-family residential units.

HYDROMODIFICATION

As of January 14, 2011, priority development projects are required to incorporate hydromodification best management practices unless they qualify for an exemption. The purpose of hydromodification is to ensure that post-development peak flows do not exceed pre-development peak flows (within defined tolerances) for events ranging from a portion of the 2-year storm to the 10-year storm. The County of San Diego's March 2011, *Final Hydromodification Management Plan* (HMP), outlines several hydromodification exemption criteria. The project does not meet criteria such as avoiding peak flow increases, etc. On the other hand, it does meet one of the criteria, which states "If the proposed project discharges runoff directly to an exempt receiving water such as the Pacific Ocean . . . ." The following describes the drainage patterns from the site and demonstrates that the project meets this exemption criteria.

Under pre- and post-project conditions, storm runoff will be conveyed away from the site in three directions. The easterly third of the site flows onto Highway 101. Surface runoff is conveyed southerly along the curb and gutter of Highway 101 to an existing curb inlet near the southeast corner of the site or to an existing curb inlet just south of Dahlia Drive. The curb inlets connect to a storm drain system that discharges to the railroad corridor just east of Highway 101. Storm flows are conveyed northerly along the railroad corridor in a concrete ditch and storm drain (see Figure 2) towards Lomas Santa Fe Drive. The flows are then collected by a storm drain system that is directed westerly through Fletcher Cove and outlets into the Pacific Ocean (see Figure 3). Since storm runoff from the easterly project area is conveyed downstream in hardened, non-erodible drainage facilities that discharge into an exempt receiving water, this portion of the site is exempt from hydromodification.

Storm runoff from the westerly two-thirds of the site will flow onto South Sierra Avenue. A high point exists in South Sierra Avenue approximately midway along the westerly site boundary. Storm runoff north of the high point will be conveyed northerly in South Sierra Avenue to a curb inlet near Fletcher Cove. The curb inlet connects to the aforementioned storm drain system that discharges into the Pacific Ocean. Therefore, storm runoff from this portion of the site is conveyed to the ocean in hardened, non-erodible drainage facilities and this portion of the site is exempt from hydromodification.

Storm runoff south of the South Sierra Avenue high point will be conveyed southerly in South Sierra Avenue to a curb inlet approximately 640 feet south of the site. The curb inlet connects to a storm drain system that discharges directly west into the Pacific Ocean (see Figure 4). Therefore, storm runoff from this portion of the site is conveyed to the ocean in hardened, non-erodible drainage facilities, and this remaining portion of the site is exempt from hydromodification.

Based on the findings in this section, storm runoff from the entire project site will be conveyed in hardened, non-erodible drainage facilities (street, curb and gutter, concrete ditch, or storm drain pipe) to the Pacific Ocean. Consequently, the proposed project is exempt from hydromodification.

LOW IMPACT DEVELOPMENT

Although the site is exempt from hydromodification, it must still meet low impact development (LID) treatment control requirements. Common LID treatment control best management practices include bioretention basins, flow-through planters, cisterns, etc. The project proposes a series of landscape planters along South Sierra Avenue (see the Sierra Avenue & Dahlia Drive Drainage Exhibit after the report figures). The landscape planters can function as flow-through planters (see the data sheets in Appendix A) for treating the project areas that flow towards South Sierra Avenue and Highway 101.

The current treatment control requirements are tentatively scheduled to be updated after December 24, 2015. Flow-through planters will still be an acceptable BMP, but will be renamed biofiltration basins. The sizing criteria for biofiltration basins will change and is outlined in the draft June 2015, *Model BMP Design Manual, San Diego Region.* The sizing will be based on the design capture volume established by the 85th percentile, 24-hour storm event.

The site is being designed to meet the upcoming criteria since entitlements will not be obtained until after 2015. The on-site runoff will be collected and conveyed to a collection reservoir within the westerly portion of the site. Storm water will be pumped from the reservoir to a series of flow-through planters/biofiltration basin along the westerly portion of the site. These biofiltration basins will be at or above grade, and have been preliminarily sized for the upcoming criteria (see Appendix A). Since the biofiltration basins are sized for the upcoming criteria, they will provide the necessary amount of treatment control in accordance with the upcoming post-construction water quality regulations. After treatment, the water will be collected and then discharged to the appropriate direction away from the site and at the appropriate flow rate (the discharge will be onto either Highway 101, south on South Sierra Avenue, or north on South Sierra Avenue).

CONCLUSION

This Water Quality Technical Report indicates that the proposed Solana 101 – Mixed-Use Project is a priority project, but not subject to hydromodification. The project merely needs to meet low impact development requirements. The current site plan proposes landscape planters (biofiltration basins) to treat the site's storm runoff. These BMPs have been sized for the upcoming water quality criteria. The analyses in Appendix A show that the total treatment area must be at least 2,271 square feet, while the preliminary site plan provides

2,545 square feet. A system of private drainage facilities, storage reservoirs, and pumps will need to be incorporated into the final engineering site design.

The City of Solana Beach's Stormwater Checklist is included after the report figures. The checklist identifies the construction, LID, and post-construction BMPs likely for the project. The exhibits contained in this WQTR show the proposed project components identified in the checklist.

Figure 2. Concrete Ditch and Pipe along Right (West) Side of Railroad Corridor

Figure 3. Storm Drain Discharge into Pacific Ocean near Fletcher Cover

Figure 4. Storm Drain Discharge into Pacific Ocean South of Project Site

Project Classifications and Stormwater Submittal Requirements

MINOR	STANDARD	PRIORITY
Minor development projects are those that do not increase, add or replace 1,000 square feet or more of impervious surface. This includes but is not limited to: -Decking: new, replacement, or addition of less than 1,000 square feet. -Addition and/or remodel that does not add or increase the impervious surface of a lot by 1,000 square feet. -Site walls -Roof deck -Landscaping -Awning -Entry-way structure -Trellis -Signage -Pool and/or spa -Trash enclosure -Fencing -Exterior stairway -A/C unit(s) -Materials/color/façade changes -Tree removal -Outdoor fireplace -Barbeque -Lightwells -Lighting -Parking bollards -Satellite dish -Window/doors changes and additions -Seawall cut Submit Stormwater Checklist for Minor Projects.	Standard development projects are those that exceed the 1,000 square foot "Minor" project threshold but do not meet the "Priority" requirements. Any of the projects to the left could be classified as "Standard", thus subject to additional conditions and requirements, by exceeding the 1,000 square foot threshold of new or additional impervious surfaces. Submit Stormwater Checklist for Standard Projects.	**Does the project meet any of these criteria?** -Housing subdivisions of 10 or more dwelling units -Commercial-greater than one acre Any development other than heavy industry or residential. -Heavy industry greater than one acre. -Automotive repair shops. . A facility categorized in any one of Standard Industrial Classification (SIC) codes 5013, 5014, 5541, 7532-7534, or 7536-7539 -Restaurants. Any facility where the land area for development is greater than 5,000 square feet. Restaurants where land development is less than 5,000 square feet shall meet all SUSMP requirements except for structural treatment BMP and numeric sizing criteria requirements and hydromodification requirements. -Hillside development greater than 5,000 square feet. Any development that creates 5,000 square feet of impervious surface and is located in, an area with known erosive soil conditions. -Environmentally Sensitive Areas (ESAs). All development which either creates 2,500 square feet of impervious surface on a proposed project site or increases the area of imperviousness of a proposed project site to 10% or more of its naturally occurring condition. -Parking lots 5,000 square feet or more. or with 15 or more parking spaces -Street, roads, highways, and freeways. Any paved surface that is 5,000 square feet or greater. -Retail Gasoline Outlets (RGOs) that are: (a) 5,000 square feet or more or (b) a projected Average Daily Traffic (ADT) of 100 or more vehicles per day. -Development Projects-greater than one acre. Any development projects that result in the disturbance of one acre or more of land. Submit WQTR for priority development project.

CITY OF SOLANA BEACH

Stormwater Checklist for Standard Projects

Based on Federal, State, and local regulations, all project applicants must submit stormwater documentation for all proposed development or redevelopment projects. The purpose of this checklist is to assist applicants in addressing potential water quality impacts from their proposed projects during planning stages of development. **NOTE: Completion of this form does not automatically exempt your project from additional documentation and/or design requirements related to stormwater management. Additional requirements may be necessary after staff review of the project, and a Water Quality Technical Report (WQTR) or other documentation may still be required.**

Project Information

Project Name: Solana 101 - Mixed-Use Project

Project Address:	Project APN:
NW corner of Highway 101 and Dahlia Drive	298-052-06, 07, 08, 13, and 14
Prepared by:	**Prepared for:**
Stuart Engineering	American Assets

Project Description: (Please provide a brief description of the work to be done.)

Development of a 2 and 3 story mixed-use project over underground parking. Project will include a 2-level below grade parking structure, commercial office space, commercial retail and restaurant space, and multi-family residential apartments.

Project Size

Total Site Area 83,025 ☒ ft^2 ☐ acres

Pre-Project:	Post-Project:
Total Disturbed Area 83,025 ☒ ft^2 ☐ acres	Total Disturbed Area 83,025 ☒ ft^2 ☐ acres
Total Impervious Area 47,735 ☒ ft^2 ☐ acres	Total Impervious Area 80,480 ☒ ft^2 ☐ acres

Project Location

☒ **Attachment 1**: **Site Plan** – attached site plan showing, at a minimum, the location of the proposed project and stormwater improvements.

Watershed (available upon request)	Supporting Documentation (attached)
☒ San Dieguito	☐ Soils Report
☐ San Elijo	☒ Drainage Study
	☐ Other_____

Construction Stormwater BMPs
All construction projects are required to reduce pollution to the maximum extent practicable by implementing best management practices (BMPs). The City's Jurisdictional Urban Runoff Management Program outlines the requirements for Construction Stormwater BMPs. There are five categories: 1. Erosion control practices 2. Velocity reduction 3. Sediment control practices 4. Offsite sediment tracking control 5. General site and materials management BMPs from each of the five categories must be used together as a system in order to prevent potential discharges.

	If you answer "Yes" to any of the questions below, your project is subject to the BMPs identified in Table I below (Minimum Required Standard Construction Stormwater BMPs). As noted in the table, please select at least the minimum number of required BMPs, or as many as are feasible for your project. If no BMP is selected, an explanation must be given in the box provided. The following questions are intended to aid in determining construction BMP requirements for your project	YES	NO
1	Will there be soil disturbing activities that will result in exposed soil areas? (This includes minor grading and trenching)[1] : *Table I items A, B, D and E*	x	
2	Will there be asphalt paving, including patching? : *Table I items D and F*	x	
3	Will there be mortar mixing, coring, or concrete saw cutting? : *Table I items D and F*	x	
4	Will there be concrete demolition and removal, wall construction, or concrete form work? : *Table I items D and F*	x	
5	Will there be stockpiling (soil, compost, asphalt, concrete, solid waste) for over 24 hours? : *Table I items D and F*		x
6	Will there be dewatering operations? : *Table I items C and D*		x
7	Will there be temporary on-site storage of construction materials, including but not limited to mortar mix, raw landscaping and soil stabilization materials, treated lumber, rebar, and plated metal fencing materials? : *Table I items C and D*	x	
8	Will trash or solid waste product be generated from this project? : *Table I items I and F*	x	
9	Will construction equipment be stored on site (e.g.: fuels, oils, trucks, etc.)? : *Table I items I and F*	x	
10	Will Portable Sanitary Services ("Port-a-potty") be used on the site? : *Table I items I and F*	x	

[1] Soil disturbances NOT considered significant include, but are not limited to, change in use, mechanical/electrical/plumbing activities, signs, temporary trailers, interior remodeling, and minor tenant improvement

Table I : Minimum Required Standard Construction BMPs

BMPs will be included on plan during final engineering.

Minimum Required Best Management Practices (BMPs)	CALTRANS Stormwater Handbook Detail	BMP Selected	Each selected BMP must be shown on the Plan. If No BMP is selected, an explanation must be provided.
A. Select Erosion Control method for Disturbed Slopes (Choose at least one for the appropriate season)			
Vegetation Stabilization Planting (Summer)	SS-2, SS-4	X	Existing vegetation shall remain until it needs to be disturbed. A fiber matrix shall be placed on loose soil, as needed.
Hydraulic Stabilization Hydroseeding (Summer)	SS-4	☐	
Bonded Fiber Matrix or Stabilized Fiber Matrix (Winter)	SS-3	X	
Physical Stabilization Erosion Control Blanket (Winter)	SS-7	☐	
B. Select Erosion Control method for Disturbed Flat Areas (slope < 5%) (Choose at least one)			
Standard Lot Perimeter Protection Detail	DPLU 659, SC-2	X	The downstream lot perimeters shall be bermed or protected with fiber rolls, gravel bags, or silt fencing.
Will use erosion control measures from Item A on flat areas also	SS-3, SS-4, SS-7	☐	
Standard Desilting Basin (must treat all site runoff)	DPLU 660, SC-2	☐	
Mulch, straw, wood chips, soil application	SS-6, SS-8	☐	
C. If Runoff or Dewatering Operation is concentrated, velocity must be controlled using an energy dissipater			
Energy Dissipater Outlet Protection	SS-10	☐	N/A
D. Select Sediment Control method for all disturbed areas (Choose at least one)			
Silt Fence	SC-1	X	Fiber rolls, gravel bags, or silt fencing shall be used to control sediment from disturbed areas.
Fiber Rolls (Straw Wattles)	SC-5	X	
Gravel Bags	SC-6, SC-8	X	
Dewatering Filtration	NS-2	☐	
Storm Drain Inlet Protection	SC-10	☐	
Engineered Desilting Basin (sized for 10-year flow)	SC-2	☐	
E. Select method for preventing offsite tracking of sediment (Choose at least one)			
Stabilized Construction Entrance	TC-1	X	A stabilized construction entrance shall be installed at the construction entrance/exit. Street sweeping shall be performed as needed.
Construction Road Stabilization	TC-2	☐	
Entrance/Exit Tire Wash	TC-3	☐	
Entrance/Exit Inspection & Cleaning Facility	-	☐	
Street Sweeping and Vacuuming	SC-7	X	
F. Select the General Site Management BMPs for each waste that will be on site			
Materials Management			
Material Delivery & Storage		X	Per WM-1
Spill Prevention and Control		X	Per WM-4
Waste Management			
Concrete Waste Management		X	Per WM-8
Solid Waste Management		X	Per WM-5
Sanitary Waste Management		X	Per WM-9
Hazardous Waste Management		X	Per WM-6

Low Impact Development (LID) BMPs
The City requires all development projects, regardless of priority, to implement Low Impact Development (LID) BMPs. The goal of the LID BMPs is to protect water quality by preserving and mimicking nature through the use of stormwater planning and management techniques such as small-scale detention and retention on development sites. Table II contains LID planning and management practices which are outlined in detail in the County of San Diego Low Impact Development Handbook. You are required to select a minimum of two LID Planning Practices and at least one LID Management Practice to reduce runoff from your site, and are encouraged to select additional BMPs as applicable. Additional information and details are available at http://www.sdcounty.ca.gov/dplu/docs/LIDHandbook.pdf

Table II : Minimum Required Low Impact Development (LID) BMPs

Minimum Required Low Impact Development (BMPs)	County LID Handbook Detail	BMP Selected	Each selected BMP must be shown on the Plan. If No BMP is selected, an explanation must be provided.
A. LID Planning Practices (Reference Section 2.2 of County LID Handbook)			
Conservation of Natural Drainages, Well Drained Soils and Significant Vegetation (e.g., minimize disturbance of natural areas; construct in least environmentally sensitive areas of the site)	2.2.1	☐	
Minimize Disturbances to Natural Drainages (e.g., avoid disturbing natural swales & topographic depressions; construction setback from creek)	2.2.2	☐	
Minimize Impervious Surfaces (e.g., preserve existing vegetation; permeable pavement for walkways, excess parking/driveway areas, exterior exposed slabs, etc.)	2.2.3	☒	Planters will be included at the site.
Disconnect Impervious Surfaces (e.g., disconnect continuously paved areas with landscaping; direct roof runoff to permeable areas)	2.2.3	☐	
Minimize Soil Compaction (e.g., protect native soil & vegetation from construction equipment; avoid compaction in planned landscaping areas)	2.2.4	☐	
Drain Runoff from Impervious Surfaces to Pervious Areas (e.g., direct runoff from rooftops, patio slabs, walkways, parking lots, etc. to landscaped areas)	2.2.5	☒	Impervious area runoff will be directed to pervious areas, where possible.
B. LID Management Practices (Reference Section 3 of the County LID Handbook)			
Hydrologic Design (e.g., infiltration trench or basin; depression area in a lawn for infiltration; bio-filters such as vegetated or rock swales)	3.1	☐	
Permeable Pavement Design (e.g., pervious concrete; permeable asphalt concrete/pavers; granular materials)	3.2	☐	
LID Road Design for Developments (e.g., reduce overall road coverage; direct surface flow to vegetated swales)	3.3	☐	
LID Parking Lot Design for Commercial Projects (e.g., use permeable materials for overflow parking; perimeter landscaping)	3.4	☒	Parking will be underground and not interact with rainfall.
LID Driveway, Sidewalk and Bike Path Design (e.g., single lane driveway flared at multi-car garage; slope driveways 2% to adjacent vegetated area)	3.5	☐	
LID Building Design (e.g., dry-well; roof downspout to landscaped area or swale; cisterns and rain barrels)	3.6	☒	A green roof will be installed on the market building.
LID Landscaping Design (e.g., concave area of lawn; save and reuse native topsoil for landscaped areas; protect areas of native vegetation; street trees adjacent to sidewalks and driveways)	3.7	☒	Street trees and landscape will be planted along some sidewalks and site areas.

Post-Construction (Permanent) BMPs

The City requires development projects with the potential to add pollutants to stormwater or to affect the flow rate or velocity of stormwater runoff after construction is completed to employ post-construction (permanent) BMPs, as feasible, to ensure that pollutants and runoff from the development are reduced to the maximum extent practicable. Using Table III below, select the post-construction BMPs that will be implemented on your project.

Table III : Post-Construction (Permanent) BMPs

Best Management Practices (BMPs)	CASQA Stormwater Handbook	BMP Selected	Each selected BMP must be shown on the Plan. If No BMP is selected, an explanation must be provided.
A. Source Control BMPs (Select all that apply)			
Implementation of Efficient Irrigation Systems	SD-12	☒	Efficient system to be designed.
Storm Drain Stenciling and Posting of Signage	SD-13	☐	
Proper Design of Trash Storage Areas	SD-32	☒	Trash storage areas to be covered.
Proper Design of Outdoor Material Storage Areas	SD-34	☐	
B. Buffer Zones			
Design project to include a buffer zone for natural water bodies. Where buffer zones are not feasible, other equally serving methods may be implemented such as trees or access restrictions.	N/A	☐	
C. Additional Permanent Stormwater BMPs			
Protection of Channel Banks/Manufactured Slopes	SD-10	☐	
Outlet Protection (Velocity Dissipation Devices)	EC-10	☐	
Flat Pad Area Coverage (Permanent Landscaping / Groundcover)	SD-10	☒	Landscape areas to contain permanent vegetation/cover.
Underground Infiltration Trench	TC-10	☐	

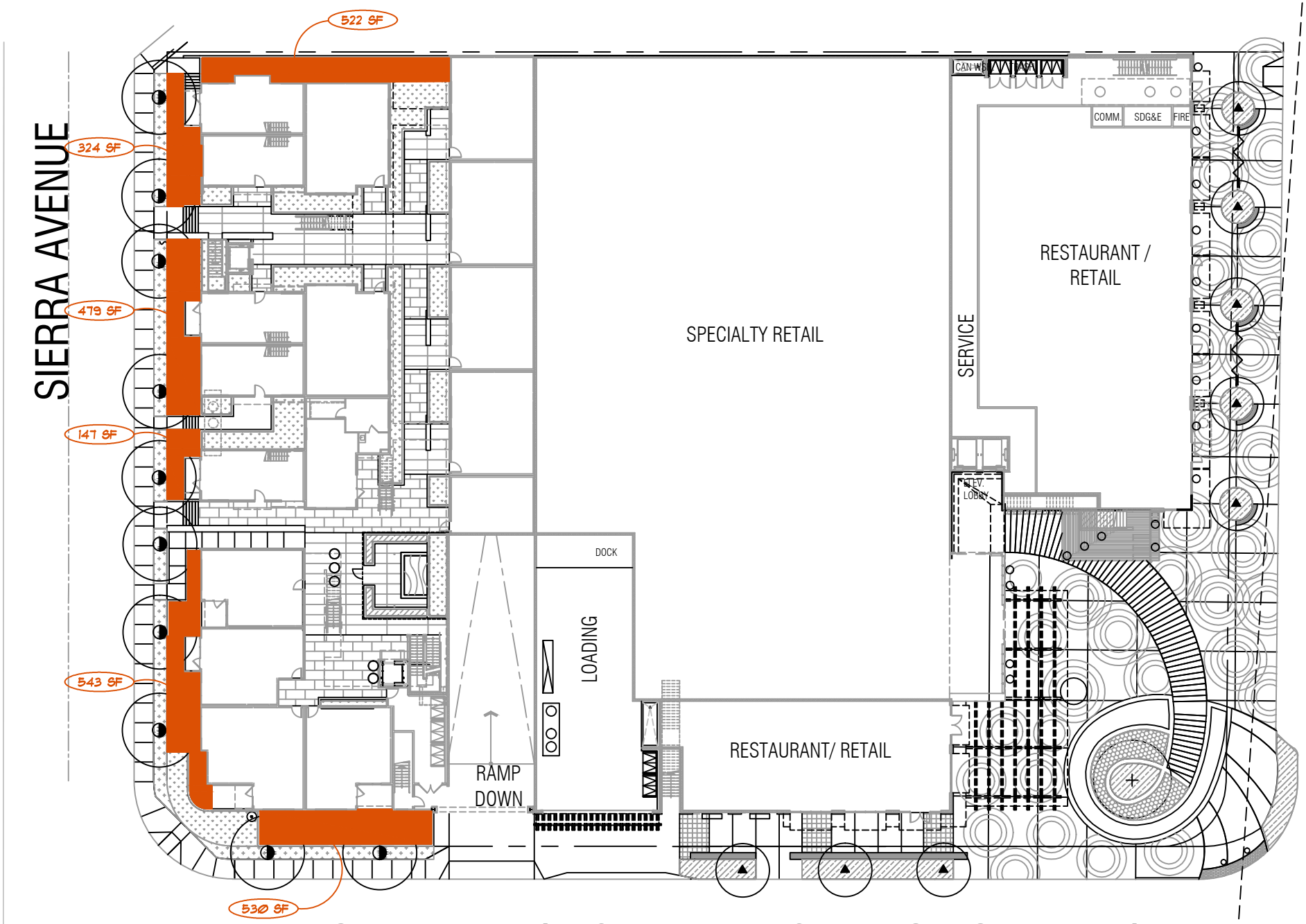
Certification

This Water Quality Technical Report (WQTR) has been prepared under the direction of the following Registered Civil Engineer. The Registered Civil Engineer (Engineer) attests to the technical information contained herein and the engineering data upon which the following design, recommendations, conclusions and decisions are based. The selection, sizing, and preliminary design of stormwater treatment and other control measures in this report meet the requirements of Regional Water Quality Control Board Order R9-2007-0001 and subsequent amendments.

_____ _____

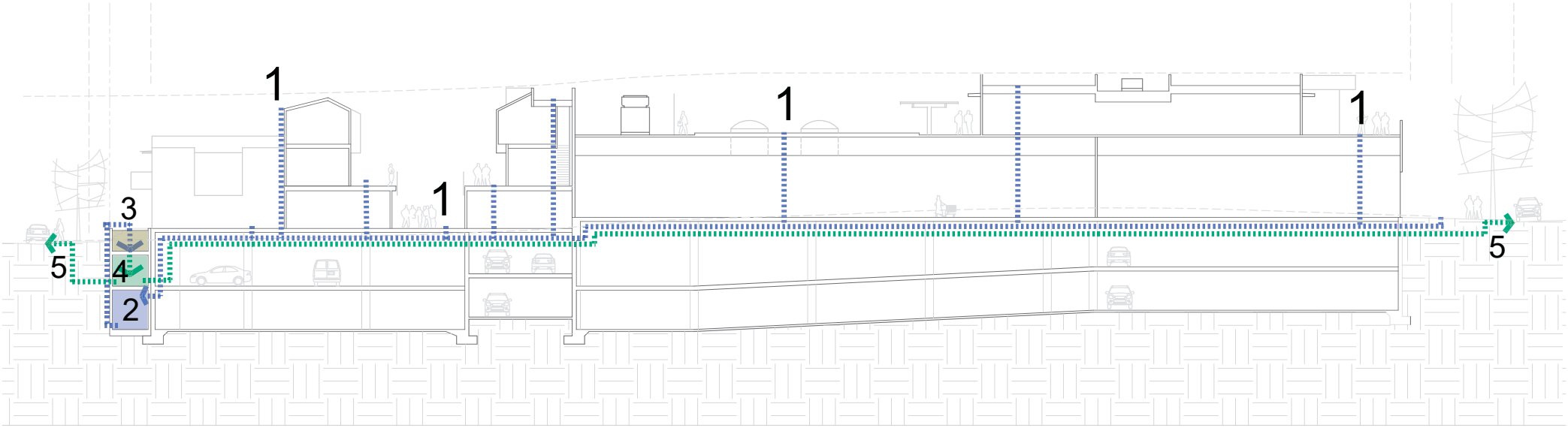
[Engineer's Name] [Date]
Registered Civil Engineer

Place Stamp Here



SITE PLAN (BIOFILTRATION BASINS IN RED)

1. collect 100% of storm water from impervious surfaces and consolidate into collection reservoir
2. pump water through distribution piping to various planters
3. flow water through treatment planters
4. collect treated water from all treatment planters
5. discharge water in appropriate percentages to each of the three street curb outlets.



DRAINAGE DESCRIPTION

APPENDIX A

BMP DATA

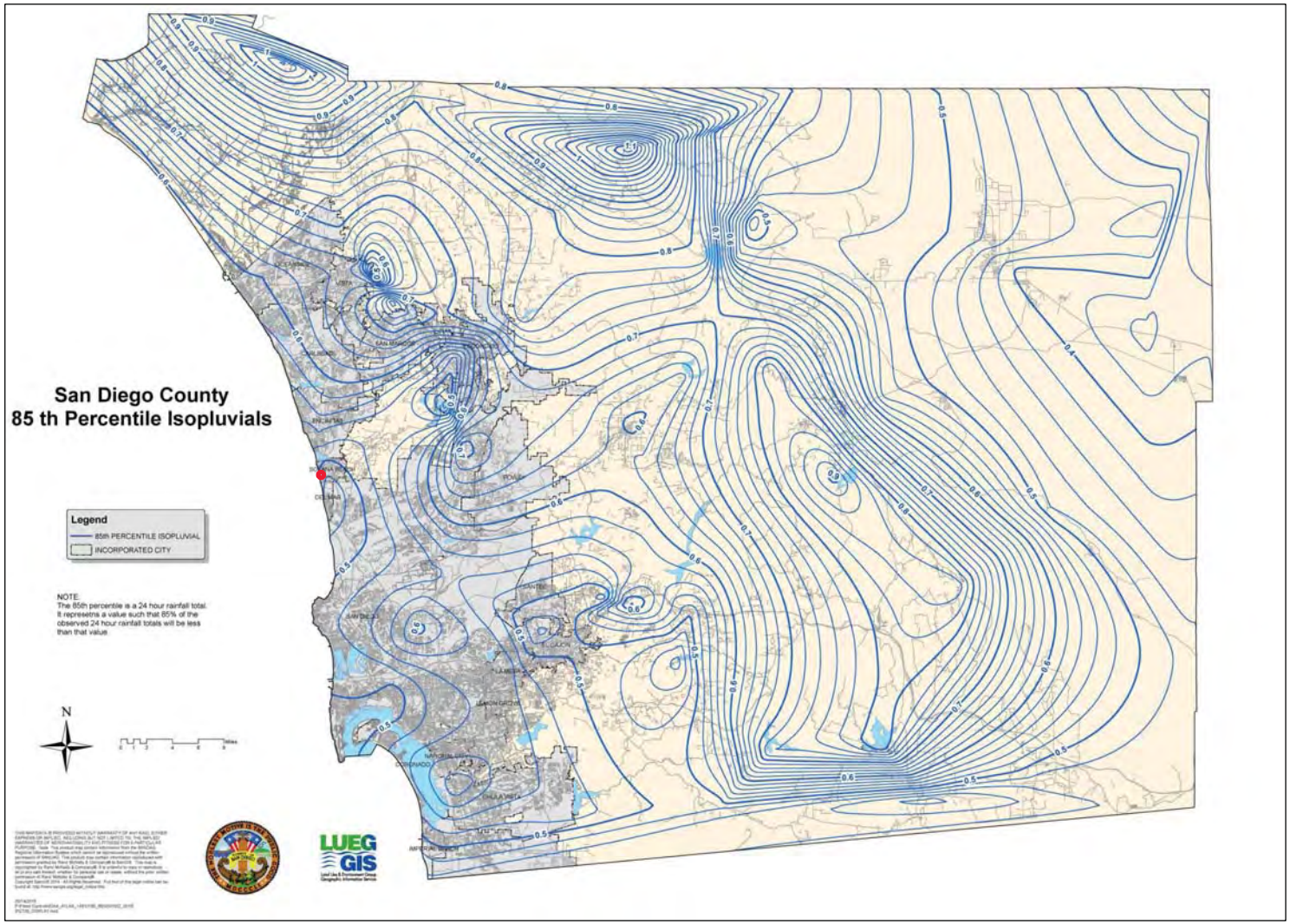


Figure B.1-1: 85th Percentile 24-hour Isopluvial Map

B.1 DCV

DCV is defined as the volume of storm water runoff resulting from the 85th percentile, 24-hr storm event. The following hydrologic method shall be used to calculate the DCV:

$$DCV = C \times d \times A \times 43{,}560\ sf/ac \times 1/12\ in/ft$$
$$DCV = 3{,}630 \times C \times d \times A$$

Where:

DCV = Design Capture Volume in cubic feet

C = Runoff factor (unitless); refer to section B.1.1

d = 85th percentile, 24-hr storm event rainfall depth (inches), refer to section B.1.3

A = Tributary area (acres) which includes the total area draining to the BMP, including any offsite or onsite areas that comingles with project runoff and drains to the BMP. Refer to Chapter 3, Section 3.3.3 for additional guidance. Street redevelopment projects consult section 1.4.3.

B.1.1 Runoff Factor

Estimate the area weighted runoff factor for the tributary area to the BMP using runoff factor (from Table B.1-1) and area of each surface type in the tributary area and the following equation:

$$C = \frac{\sum C_x A_x}{\sum A_x}$$

Where:

C_x = Runoff factor for area X

A_x = Tributary area X (acres)

These runoff factors apply to areas receiving direct rainfall only. For conditions in which runoff is routed onto a surface from an adjacent surface, see Section B.2 for determining composite runoff factors for these areas.

Table B.1-1: Runoff factors for surfaces draining to BMPs – Pollutant Control BMPs

Surface	Runoff Factor
Roofs[1]	0.90
Concrete or Asphalt[1]	0.90
Unit Pavers (grouted)[1]	0.90
Decomposed Granite	0.30
Cobbles or Crushed Aggregate	0.30
Amended, Mulched Soils or Landscape	0.10
Compacted Soil (e.g., unpaved parking)	0.30

1. Surface is considered impervious and could benefit from use of Site Design BMPs and adjustment of the runoff factor per Section B.2.1.

Worksheet B.5-1: Simple Sizing Method for Biofiltration BMPs

Simple Sizing Method for Biofiltration BMPs		Worksheet B.5-1	
1	Remaining DCV after implementing retention BMPs		cubic-feet
Partial Retention			
2	Infiltration rate from Worksheet D.5-1 if partial infiltration is feasible		in/hr.
3	Allowable drawdown time for aggregate storage below the underdrain	36	hours
4	Depth of runoff that can be infiltrated [Line 2 x Line 3]		inches
5	Aggregate pore space	0.40	in/in
6	Required depth of gravel below the underdrain [Line 4/ Line 5]		inches
7	Assumed surface area of the biofiltration BMP		sq-ft
8	Media retained pore space	0.1	in/in
9	Volume retained by BMP [[Line 4 + (Line 12 x Line 8)]/12] x Line 7		cubic-feet
10	DCV that requires biofiltration [Line 1 – Line 9]		cubic-feet
BMP Parameters			
11	Surface Ponding [6 inch minimum, 12 inch maximum]		inches
12	Media Thickness [18 inches minimum]		inches
13	Aggregate Storage above underdrain invert (12 inches typical) – use 0 inches for sizing if the aggregate is not over the entire bottom surface area		inches
14	Media available pore space	0.2	in/in
15	Media filtration rate to be used for sizing	5	in/hr.
Baseline Calculations			
16	Allowable Routing Time for sizing	6	hours
17	Depth filtered during storm [Line 15 x Line 16]	30	inches
18	Depth of Detention Storage [Line 11 + (Line 12 x Line 14) + (Line 13 x Line 5)]		inches
19	Total Depth Treated [Line 17 + Line 18]		inches
Option 1 – Biofilter 1.5 times the DCV			
20	Required biofiltered volume [1.5 x Line 10]		cubic-feet
21	Required Footprint [Line 20/ Line 19] x 12		sq-ft
Option 2 - Store 0.75 of remaining DCV in pores and ponding			
22	Required Storage (surface + pores) Volume [0.75 x Line 10]		cubic-feet
23	Required Footprint [Line 22/ Line 18] x 12		sq-ft
Footprint of the BMP			
24	Area draining to the BMP		sq-ft
25	Adjusted Runoff Factor for drainage area (Refer to Appendix B.1 and B.2)		
26	Minimum BMP Footprint [Line 24 x Line 25 x 0.03]		sq-ft
27	Footprint of the BMP = Maximum(Minimum(Line 21, Line 23), Line 26) sq-ft	**Note**: Line 7 is used to	

estimate the amount of volume retained by the BMP. Update assumed surface area in Line 7 until its equivalent to the required biofiltration footprint (either Line 21 or Line 23)

SEE CALCULATIONS ON ATTACHED SPREADSHEET

Design Capture Volume

85th %	0.49	in
Area	1.99	ac
C	0.88	
DCV	3,102	cf

Pervious, sf	2,545
Impervious, sf	83,845
Total, sf	86,390

Biofiltration (Worksheet B.5-1 from Draft Manual)

Analysis	
1	3,102
2	0
3	*36*
4	0
5	*0.40*
6	0
7	0
8	*0.1*
9	0
10	3,102
11	6
12	18
13	12
14	*0.2*
15	*5*
16	*6*
17	*30*
18	14.4
19	44.4
20	4,653
21	1,258
22	2,327
23	1,939
24	86,390
25	0.88
26	2,271
27	2,271

E.12 BF-1 Biofiltration

Location: 43rd Street and Logan Avenue, San Diego, California

MS4 Permit Category
Biofiltration
Manual Category
Biofiltration
Applicable Performance Standard
Pollutant Control Flow Control
Primary Benefits
Treatment Volume Reduction (Incidental) Peak Flow Attenuation (Optional)

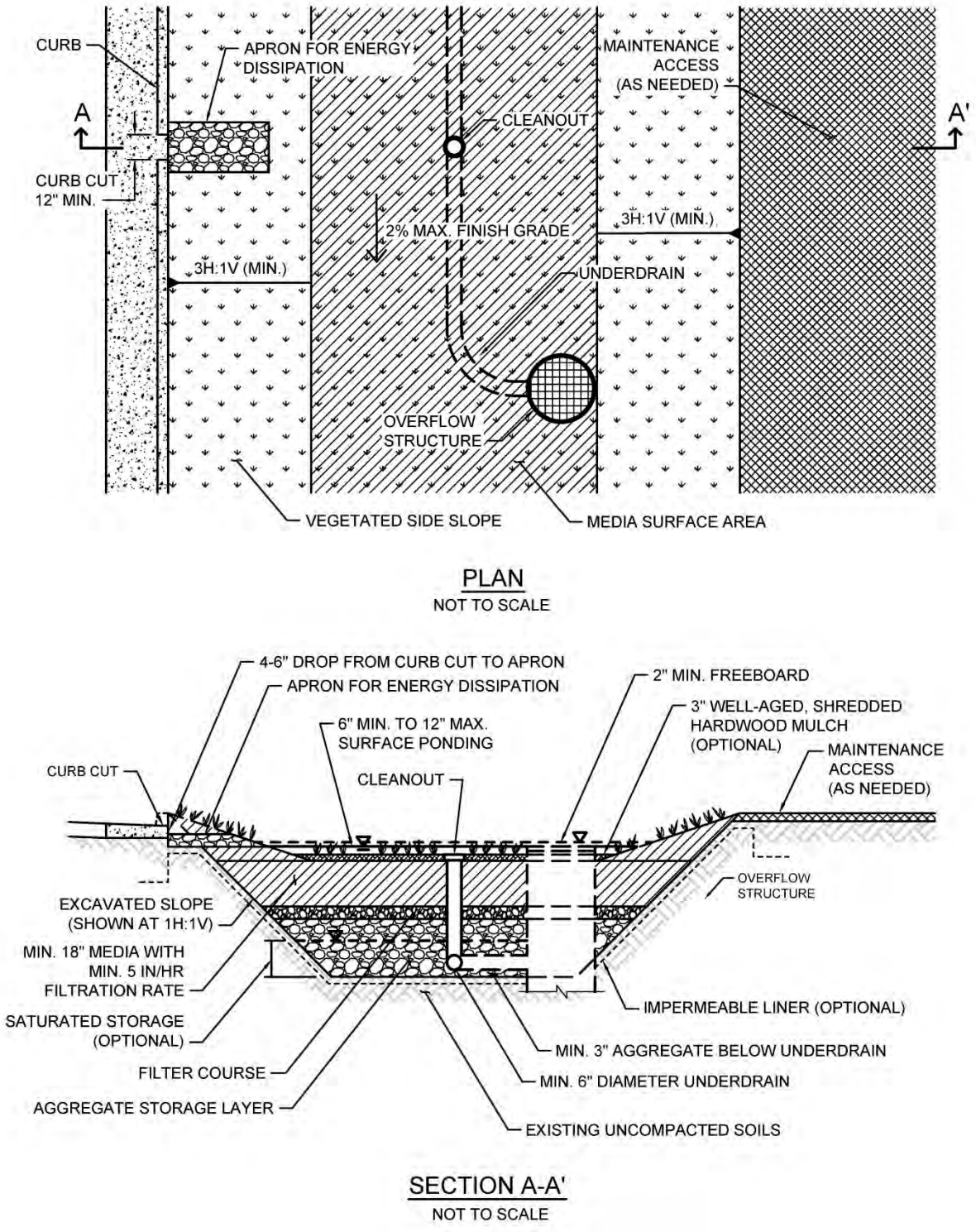
Description

Biofiltration (Bioretention with underdrain) facilities are vegetated surface water systems that filter water through vegetation, and soil or engineered media prior to discharge via underdrain or overflow to the downstream conveyance system. Bioretention with underdrain facilities are commonly incorporated into the site within parking lot landscaping, along roadsides, and in open spaces. Because these types of facilities have limited or no infiltration, they are typically designed to provide enough hydraulic head to move flows through the underdrain connection to the storm drain system. Treatment is achieved through filtration, sedimentation, sorption, biochemical processes and plant uptake.

Typical bioretention with underdrain components include:

- Inflow distribution mechanisms (e.g, perimeter flow spreader or filter strips)
- Energy dissipation mechanism for concentrated inflows (e.g., splash blocks or riprap)
- Shallow surface ponding for captured flows
- Side slope and basin bottom vegetation selected based on expected climate and ponding depth
- Non-floating mulch layer (Optional)
- Media layer (planting mix or engineered media) capable of supporting vegetation growth
- Filter course layer consisting of aggregate to prevent the migration of fines into uncompacted native soils or the aggregate storage layer
- Aggregate storage layer with underdrain(s)
- Impermeable liner or uncompacted native soils at the bottom of the facility

- Overflow structure



Typical plan and Section view of a Biofiltration BMP

Design Adaptations for Project Goals

Biofiltration Treatment BMP for storm water pollutant control. The system is lined or un-lined to provide incidental infiltration, and an underdrain is provided at the bottom to carry away filtered runoff. This configuration is considered to provide biofiltration treatment via flow through the media layer. Storage provided above the underdrain within surface ponding, media, and aggregate storage is considered included in the biofiltration treatment volume. Saturated storage within the aggregate storage layer can be added to this design by raising the underdrain above the bottom of the aggregate storage layer or via an internal weir structure designed to maintain a specific water level elevation.

Integrated storm water flow control and pollutant control configuration. The system can be designed to provide flow rate and duration control by primarily providing increased surface ponding and/or having a deeper aggregate storage layer above the underdrain. This will allow for significant detention storage, which can be controlled via inclusion of an outlet structure at the downstream end of the underdrain.

Design Criteria and Considerations

Bioretention with underdrain must meet the following design criteria. Deviations from the below criteria may be approved at the discretion of the [City Engineer] if it is determined to be appropriate:

	Siting and Design	*Intent/Rationale*
☐	Placement observes geotechnical recommendations regarding potential hazards (e.g., slope stability, landslides, liquefaction zones) and setbacks (e.g., slopes, foundations, utilities).	Must not negatively impact existing site geotechnical concerns.
☐	An impermeable liner or other hydraulic restriction layer is included if site constraints indicate that infiltration or lateral flows should not be allowed.	Lining prevents storm water from impacting groundwater and/or sensitive environmental or geotechnical features. Incidental infiltration, when allowable, can aid in pollutant removal and groundwater recharge.
☐	Contributing tributary area shall be ≤ 5 acres (≤ 1 acre preferred).	Bigger BMPs require additional design features for proper performance. Contributing tributary area greater than 5 acres may be allowed at the discretion of the [City Engineer} if the following conditions are met: 1) incorporate design features (e.g. flow spreaders) to

Siting and Design		*Intent/Rationale*
		minimizing short circuiting of flows in the BMP and 2) incorporate additional design features requested by the [City Engineer] for proper performance of the regional BMP.
☐	Finish grade of the facility is ≤ 2%.	Flatter surfaces reduce erosion and channelization within the facility.
Surface Ponding		
☐	Surface ponding is limited to a 24-hour drawdown time.	Surface ponding limited to 24 hour for plant health.
☐	Surface ponding depth is ≥ 6 and ≤ 12 inches.	Surface ponding capacity lowers subsurface storage requirements. Deep surface ponding raises safety concerns. Surface ponding depth greater than 12 inches (for additional pollutant control or surface outlet structures or flow-control orifices) may be allowed at the discretion of the [City Engineer] if the following conditions are met: 1) surface ponding depth drawdown time is less than 24 hours; and 2) safety issues and fencing requirements are considered (typically ponding greater than 18" will require a fence and/or flatter side slopes) and 3) potential for elevated clogging risk is considered.
☐	A minimum of 2 inches of freeboard is provided.	Freeboard provides room for head over overflow structures and minimizes risk of uncontrolled surface discharge.
☐	Side slopes are stabilized with vegetation and are = 3H:1V or shallower.	Gentler side slopes are safer, less prone to erosion, able to establish vegetation more quickly and easier to maintain.
Vegetation		
☐	Plantings are suitable for the climate and expected ponding depth. A plant list to aid in selection can be found in Appendix E.20.	Plants suited to the climate and ponding depth are more likely to survive.

Siting and Design		*Intent/Rationale*
☐	An irrigation system with a connection to water supply should be provided as needed.	Seasonal irrigation might be needed to keep plants healthy.
Mulch (Optional or Mandatory – Dependent on jurisdiction)		
☐	A minimum of 3 inches of well-aged, shredded hardwood mulch that has been stockpiled or stored for at least 12 months is provided.	Mulch will suppress weeds and maintain moisture for plant growth. Aging mulch kills pathogens and weed seeds and allows the beneficial microbes to multiply.
Media Layer		
☐	Media maintains a minimum filtration rate of 5 in/hr over lifetime of facility. An initial filtration rate of 8 to 12 in/hr is recommended to allow for clogging over time; the initial filtration rate should not exceed 12 inches per hour.	A filtration rate of at least 5 inches per hour allows soil to drain between events. The initial rate should be higher than long term target rate to account for clogging over time. However an excessively high initial rate can have a negative impact on treatment performance, therefore an upper limit is needed.
☐	Media is a minimum 18 inches deep, meeting either of these two media specifications: City of San Diego Low Impact Development Design Manual (page B-18) (July 2011, unless superseded by more recent edition) **or** County of San Diego Low Impact Development Handbook: Appendix G -Bioretention Soil Specification (June 2014, unless superseded by more recent edition). Alternatively, for proprietary designs and custom media mixes not meeting the media specifications contained in the City or County LID Manual, the media meets the pollutant treatment performance criteria in Section F.1.	A deep media layer provides additional filtration and supports plants with deeper roots. Standard specifications shall be followed. For non-standard or proprietary designs, compliance with F.1 ensures that adequate treatment performance will be provided.
☐	Media surface area is 3% of contributing area times adjusted runoff factor or greater.	Greater surface area to tributary area ratios: a) maximizes volume retention as required by the MS4 Permit and b) decrease loading rates per square foot and therefore increase longevity. Adjusted runoff factor is to account for site design BMPs implemented upstream of the BMP (such as rain barrels,

Siting and Design		*Intent/Rationale*
		impervious area dispersion, etc.). Refer to Appendix B.2 guidance. Use Worksheet B.5-1 Line 26 to estimate the minimum surface area required per this criteria.
☐	Where receiving waters are impaired or have a TMDL for nutrients, the system is designed with nutrient sensitive media design (see fact sheet BF-2).	Potential for pollutant export is partly a function of media composition; media design must minimize potential for export of nutrients, particularly where receiving waters are impaired for nutrients.
Filter Course Layer		
☐	A filter course is used to prevent migration of fines through layers of the facility. Filter fabric is not used.	Migration of media can cause clogging of the aggregate storage layer void spaces or subgrade. Filter fabric is more likely to clog.
☐	Filter course is washed and free of fines.	Washing aggregate will help eliminate fines that could clog the facility and impede infiltration.
☐	Filter course calculations assessing suitability for particle migration prevention have been completed.	Gradation relationship between layers can evaluate factors (e.g., bridging, permeability, and uniformity) to determine if particle sizing is appropriate or if an intermediate layer is needed.
Aggregate Storage Layer		
☐	Class 2 Permeable per Caltrans specification 68-1.025 is recommended for the storage layer. Washed, open-graded crushed rock may be used, however a 4-6 inch washed pea gravel filter course layer at the top of the crushed rock is required.	Washing aggregate will help eliminate fines that could clog the aggregate storage layer void spaces or subgrade.
☐	The depth of aggregate provided (12-inch typical) and storage layer configuration is adequate for providing conveyance for underdrain flows to the outlet structure.	Proper storage layer configuration and underdrain placement will minimize facility drawdown time.
Inflow, Underdrain, and Outflow Structures		
☐	Inflow, underdrains and outflow structures are accessible for inspection and maintenance.	Maintenance will prevent clogging and ensure proper operation of the flow

Siting and Design		*Intent/Rationale*
		control structures.
☐	Inflow velocities are limited to 3 ft/s or less or use energy dissipation methods. (e.g., riprap, level spreader) for concentrated inflows.	High inflow velocities can cause erosion, scour and/or channeling.
☐	Curb cut inlets are at least 12 inches wide, have a 4-6 inch reveal (drop) and an apron and energy dissipation as needed.	Inlets must not restrict flow and apron prevents blockage from vegetation as it grows in. Energy dissipation prevents erosion.
☐	Underdrain outlet elevation should be a minimum of 3 inches above the bottom elevation of the aggregate storage layer.	A minimal separation from subgrade or the liner lessens the risk of fines entering the underdrain and can improve hydraulic performance by allowing perforations to remain unblocked.
☐	Minimum underdrain diameter is 6 inches.	Smaller diameter underdrains are prone to clogging.
☐	Underdrains are made of slotted, PVC pipe conforming to ASTM D 3034 or equivalent or corrugated, HDPE pipe conforming to AASHTO 252M or equivalent.	Slotted underdrains provide greater intake capacity, clog resistant drainage, and reduced entrance velocity into the pipe, thereby reducing the chances of solids migration.
☐	An underdrain cleanout with a minimum 6-inch diameter and lockable cap is placed every 250 to 300 feet as required based on underdrain length.	Properly spaced cleanouts will facilitate underdrain maintenance.
☐	Overflow is safely conveyed to a downstream storm drain system or discharge point Size overflow structure to pass 100-year peak flow for on-line infiltration basins and water quality peak flow for off-line basins.	Planning for overflow lessens the risk of property damage due to flooding.

Conceptual Design and Sizing Approach for Storm Water Pollutant Control Only

To design bioretention with underdrain for storm water pollutant control only (no flow control required), the following steps should be taken:

1. Verify that siting and design criteria have been met, including placement requirements, contributing tributary area, maximum side and finish grade slopes, and the recommended media surface area tributary ratio.
2. Calculate the DCV per Appendix B based on expected site design runoff for tributary areas.

3. Use the sizing worksheet presented in Appendix B.5 to size biofiltration BMPs.

Conceptual Design and Sizing Approach when Storm Water Flow Control is Applicable

Control of flow rates and/or durations will typically require significant surface ponding and/or aggregate storage volumes, and therefore the following steps should be taken prior to determination of storm water pollutant control design. Pre-development and allowable post-project flow rates and durations should be determined as discussed in Chapter 6 of the manual.

1. Verify that siting and design criteria have been met, including placement requirements, contributing tributary area, maximum side and finish grade slopes, and the recommended media surface area tributary ratio.
2. Iteratively determine the facility footprint area, surface ponding and/or aggregate storage layer depth required to provide detention storage to reduce flow rates and durations to allowable limits. Flow rates and durations can be controlled from detention storage by altering outlet structure orifice size(s) and/or water control levels. Multi-level orifices can be used within an outlet structure to control the full range of flows.
3. If bioretention with underdrain cannot fully provide the flow rate and duration control required by this manual, an upstream or downstream structure with significant storage volume such as an underground vault can be used to provide remaining controls.
4. After bioretention with underdrain has been designed to meet flow control requirements, calculations must be completed to verify if storm water pollutant control requirements to treat the DCV have been met.

Traffic Impact Analysis

TRAFFIC IMPACT ANALYSIS

For

SOLANA 101

Prepared for the

CITY OF SOLANA BEACH

&

ZEPHYR PARTNERS

8th Submittal: October 9, 2017

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1.0 EXECUTIVE SUMMARY

Urban Systems Associates, Inc. (USAI) was retained by Zephyr Partners and American Assets Trust to determine potential transportation impacts and appropriate mitigation measures for the development of Solana 101. The proposed project is located on an approximately 1.91 acre parcel of land on the north side of Dahlia Drive bound by Highway 101 to the east and Sierra Avenue to the west in the City of Solana Beach.

The proposed project is a mixed-use development consisting of:

- 31 Apartments
- 24,284 square feet of Specialty Supermarket
- 14,137 square feet of Standard Commercial Office
- 5,125 square feet of High Turnover Restaurant
- 5,090 square feet of Quality Restaurant

The proposed project is expected to generate 4,438 average daily trips (ADT) with 204 (124 in / 81 out) trips in the AM peak hour and 404 (208 in / 196 out) trips in the PM peak hour before reductions using driveway rates. The existing uses on-site generate 31 ADT with 4 (4 in / 0 out) trips in the AM peak hour and 4 (1 in / 3 out) trips in the PM peak hour using driveway rates. Where appropriate, transit and mixed-use credits were taken. After transit, mixed-use, and existing use credits were applied, the Net New Trips for the proposed project is expected to generate 3,381 ADT with 172 (104 in / 68 out) trips in the AM peak hour and 345 (180 in / 165 out) trips in the PM peak hour. For a detailed summary of the trip generation and credits taken, refer to Section 3.0 of this report.

In order to determine a scope of work for the Transportation Impact Study, staff of Urban Systems Associates, Inc. (USAI) used the regional SANTEC / ITE guidelines in coordination with staff from the City of Solana Beach. This effort resulted in a study area consisting of five (5) roadway segments and five (5) intersections.

The traffic generation of the Project was estimated based on trip generation rates from the *(Not So) Brief Guide of Vehicular Traffic Generation Rates for the San Diego Region*, April 2002. The addition of project traffic was evaluated in Existing, Near Term, and Horizon Year 2035 scenarios, and an impact analysis was completed in which six scenarios were analyzed. The following scenarios were included in the report:

- Existing
- Existing With Project
- Near Term Without Project
- Near Term With Project
- Horizon Year 2035 Without Project
- Horizon Year 2035 With Project

The term "Near Term" is meant to discuss a condition occurring at the project's opening day where traffic from other known development projects in the area is added onto existing traffic levels. This reflects the best information available for determining what traffic would be in the next several years. The term "Horizon Year 2035" is meant to discuss traffic conditions in the Year 2035. The analysis year used for modeling purposes is the Year 2035.

Study Results:

Based upon this transportation impact analysis, it was determined that development of the proposed project would have the following impacts:

Impacts:

Street Segments – The proposed project is expected to have no direct project impacts to street segments in the Existing With Project scenario as shown in **Table 1-1**. The proposed project has no direct project impacts in the Near Term With Project scenario as shown in **Table 1-2**. The proposed project is expected to have no significant cumulative project impacts in the Year 2035 With Project scenario as shown in **Table 1-3**. For the segment of Via de la Valle east of Cedros Ave. the segment was analyzed in more detail using the peak hour arterial analysis (mirrors HCM 2000 arterial LOS methodology) the resulting LOS was D or better in all studied conditions. Peak hour arterial analysis can be found in **Appendix K**.

Intersections – As shown in **Table 1-4**, the project is expected to have no direct project impacts to intersections in the Existing With Project scenario. In **Table 1-5**, the project is expected to have no cumulative significant project impacts in the Near Term With Project scenario. The proposed project is expected to have no significant cumulative intersection impacts in the Year 2035 With Project scenario as shown in **Table 1-6**.

TABLE 1-1

Existing Without and Existing With Project Street Segment Comparison

Road	Segment	# of Lanes	LOS "E" Capacity	Class.	Existing			Existing + Project			ΔV/C	Is this impact Significant?
					LOS	Volume	V/C	LOS	Volume	V/C		
Highway 101	Lomas Santa Fe Drive to Dahlia Drive	4	40,000	4-M	B	18,127	0.45	B	19,157	0.48	0.026	***NO***
	Dahlia Drive to Via De La Valle	4	40,000	4-M	B	18,604	0.47	B	20,164	0.50	0.039	***NO***
Dahlia Drive	Sierra Avenue to Highway 101	2	8,000	2-Cc	A	2,405	0.30	A	2,406	0.30	0.000	***NO***

Legend:

Class. = Functional Class

LOS = Level of Service

V/C = Volume/Capacity

2-Cc = 2 Lane Collector (w/ commercial-industrial property)

4-M = 4 lane major arterial

Existing Without and Existing With Project Arterial Comparison

Road	Segment	Direction	Existing				Existing + Project				ΔSpeed (mph) AM	ΔSpeed (mph) PM	Is this impact Significant?
			AM		PM		AM		PM				
			Speed	LOS	Speed	LOS	Speed	LOS	Speed	LOS			
Via de la Valle	Highway 101 to Jimmy Durante Blvd.	Eastbound	18.8	C	16.7	D	18.7	C	16.7	D	0.1	0.0	***NO***
		Westbound	21.7	C	20.5	C	21.7	C	20.5	C	0.0	0.0	***NO***

Legend:

LOS= Level of Service

TABLE 1-2

Near Term Without and Near Term With Project Street Segment Comparison

Road	Segment	# of Lanes	LOS "E" Capacity	Class.	Near Term			Near Term + Project			ΔV/C	Is this impact Significant?
					LOS	Volume	V/C	LOS	Volume	V/C		
Highway 101	Lomas Santa Fe Drive to Dahlia Drive	4	40,000	4-M	B	18,127	0.45	B	19,157	0.48	0.026	***NO***
	Dahlia Drive to Via De La Valle	4	40,000	4-M	B	18,604	0.47	B	20,164	0.50	0.039	***NO***
Dahlia Drive	Sierra Avenue to Highway 101	2	8,000	2-Cc	A	2,405	0.30	A	2,406	0.30	0.000	***NO***

Legend:

Class. = Functional Class

LOS = Level of Service

V/C = Volume/Capacity

2-Cc = 2 Lane Collector (w/ commercial-industrial property)

4-M = 4 lane major arterial

Near Term Without and Near Term With Project Arterial Comparison

Road	Segment	Direction	Near Term				Near Term + Project				ΔSpeed (mph) AM	ΔSpeed (mph) PM	Is this impact Significant?
			AM		PM		AM		PM				
			Speed	LOS	Speed	LOS	Speed	LOS	Speed	LOS			
Via de la Valle	Highway 101 to Jimmy Durante Blvd.	Eastbound	18.4	C	16.4	D	18.3	C	16.4	D	0.1	0.0	***NO***
		Westbound	21.9	C	20.6	C	21.9	C	20.6	C	0.0	0.0	***NO***

Legend:

LOS= Level of Service

TABLE 1-3

Year 2035 Without and Year 2035 With Project Street Segment Comparison

Road	Segment	# of Lanes	LOS "E" Capacity	Class.	Year 2035			Year 2035 + Project			ΔV/C	Is this impact Significant?
					LOS	Volume	V/C	LOS	Volume	V/C		
Highway 101	Lomas Santa Fe Drive to Dahlia Drive	4	40,000	4-M	C	24,800	0.62	C	25,830	0.65	0.026	***NO***
	Dahlia Drive to Via De La Valle	4	40,000	4-M	C	25,800	0.65	C	27,360	0.68	0.039	***NO***
Dahlia Drive	Sierra Avenue to Highway 101	2	8,000	2-Cc	B	3,100	0.39	B	3,101	0.39	0.000	***NO***

Legend:

Class. = Functional Class

LOS = Level of Service

V/C = Volume/Capacity

2-Cc = 2 Lane Collector (w/ commercial-industrial property)

4-M = 4 lane major arterial

Year 2035 Without and Year 2035 With Project Arterial Comparison

Road	Segment	Direction	Year 2035				Year 2035 + Project				ΔSpeed (mph) AM	ΔSpeed (mph) PM	Is this impact Significant?
			AM		PM		AM		PM				
			Speed	LOS	Speed	LOS	Speed	LOS	Speed	LOS			
Via de la Valle	Highway 101 to Jimmy Durante Blvd.	Eastbound	16.8	D	15.4	D	16.8	D	15.4	D	0.0	0.0	***NO***
		Westbound	21.8	C	20.6	C	21.8	C	20.6	C	0.0	0.0	***NO***

Legend:

LOS= Level of Service

TABLE 1-4

Existing Without and Existing With Project Intersection Comparison

#	Intersection	Existing				Existing + Project							
		AM Peak Hour		PM Peak Hour		AM Peak Hour		Δ	S ?	PM Peak Hour		Δ	S ?
		D	LOS	D	LOS	D	LOS			D	LOS		
1	Highway 101 / Lomas Santa Fe Dr.	33.9	C	41.3	D	34.0	C	0.1	No	41.5	D	0.2	No
2	Cedros Ave. / Lomas Santa Fe Dr.	24.3	C	23.7	C	24.6	C	0.3	No	23.7	C	0.0	No
3	Sierra Ave. / Dahlia Dr.	8.0	A	8.3	A	8.0	A	0.0	No	8.5	A	0.2	No
4	Highway 101 / Dahlia Dr.	7.2	A	9.0	A	12.9	B	5.7	No	17.9	B	8.9	No
5	Highway 101 / Via de la Valle	31.0	C	35.9	D	31.3	C	0.3	No	42.2	D	6.3	No
A	Dahlia Dr. / Project Diveway A	(1)	(1)	(1)	(1)	2.5	A	N/A	No	4.1	A	N/A	No

Notes:

LOS = Level of Service
Δ = Change
S = Significant
D= Delay
(1) = Current access to be redesigned with proposed project

TABLE 1-5

Near Term Without and Near Term With Project Intersection Comparison

#	Intersection	Near Term				Near Term + Project							
		AM Peak Hour		PM Peak Hour		AM Peak Hour		Δ	S ?	PM Peak Hour		Δ	S ?
		D	LOS	D	LOS	D	LOS			D	LOS		
1	Highway 101 / Lomas Santa Fe Dr.	35.4	D	43.5	D	35.4	D	0.0	No	43.7	D	0.2	No
2	Cedros Ave. / Lomas Santa Fe Dr.	24.3	C	23.8	C	27.4	C	3.1	No	26.9	C	3.1	No
3	Sierra Ave. / Dahlia Dr.	8.1	A	8.5	A	8.1	A	0.0	No	8.7	A	0.2	No
4	Highway 101 / Dahlia Dr.	9.3	A	9.8	A	13.1	B	3.8	No	20.0	B	10.2	No
5	Highway 101 / Via de la Valle	38.6	D	44.7	D	40.7	D	2.1	No	47.0	D	2.3	No
A	Dahlia Dr. / Project Driveway A	(1)	(1)	(1)	(1)	2.4	A	N/A	No	4.0	A	N/A	No

Notes:

LOS = Level of Service
Δ = Change
S = Significant
D= Delay
(1) = Current access to be redesigned with proposed project

TABLE 1-6

Year 2035 Without and Year 2035 With Project Intersection Comparison

#	Intersection	Year 2035				Year 2035 + Project							
		AM Peak Hour		PM Peak Hour		AM Peak Hour		Δ	S ?	PM Peak Hour		Δ	S ?
		D	LOS	D	LOS	D	LOS			D	LOS		
1	Highway 101 / Lomas Santa Fe Dr.	47.6	D	69.9	E	52.0	D	4.4	No	71.5	E	1.6	No
2	Cedros Ave. / Lomas Santa Fe Dr.	24.6	C	25.5	C	39.3	D	14.7	No	35.4	D	9.9	No
3	Sierra Ave. / Dahlia Dr.	8.2	A	9.2	A	8.2	A	0.0	No	9.4	A	0.2	No
4	Highway 101 / Dahlia Dr.	12.5	B	10.0	B	20.5	C	8.0	No	21.1	C	11.1	No
5	Highway 101 / Via de la Valle	40.6	D	45.0	D	42.0	D	1.4	No	50.3	D	5.3	No
A	Dahlia Dr. / Project Driveway A	(1)	(1)	(1)	(1)	2.4	A	N/A	No	4.0	A	N/A	No

Notes:

LOS = Level of Service
Δ = Change
S = Significant
D= Delay in seconds
(1) = Current access to be redesigned with proposed project

2.0 INTRODUCTION

Urban Systems Associates, Inc. (USAI) was retained by ZEPHYR PARTNERS to determine potential transportation impacts and appropriate mitigation measures for the development of Solana 101. The proposed project is located on an approximately 1.91 acre parcel of land on the north side of Dahlia Drive bound by Highway 101 to the east and Sierra Avenue to the west in the City of Solana Beach. See **Figure 2-1**.

The proposed project is a mixed-use development consisting of:

- 31 Apartments
- 24,284 square feet of Specialty Supermarket
- 14,137 square feet of Standard Commercial Office
- 5,125 square feet of High Turnover Restaurant
- 5,090 square feet of Quality Restaurant

The proposed project, before reductions, is expected to generate 4,438 average daily trips (ADT) with 204 (124 in / 81 out) trips in the AM peak hour and 404 (208 in / 196 out) trips in the PM peak hour using driveway rates. The existing uses on-site generate 31 ADT with 4 (4 in / 0 out) trips in the AM peak hour and 4 (1 in / 3 out) trips in the PM peak hour using driveway rates. Where appropriate, transit and mixed-use credits were taken. After transit, mixed-use, and existing use credits were applied, the Net New Trips for the proposed project is expected to generate 3,381 ADT with 172 (104 in / 68 out) trips in the AM peak hour and 345 (180 in / 165 out) trips in the PM peak hour. For a detailed summary of the trip generation and credits taken, refer to Section 3.0 of this report.

Figure 2-2 shows the proposed project site plan.

For study area purposes, USAI used Regional guidelines that 50 trips in one direction during a peak hour be used as a threshold to determine study intersections and street segments. **Figure 2-3** shows the study area boundary and the intersection key selected for the study. USAI then obtained counts of the existing ADT and peak hour traffic flow data for the study intersections and street segments on August 3, 2016. **Table 2-1** lists the study area street segments and intersections.

FIGURE 2-1

Project Location Map

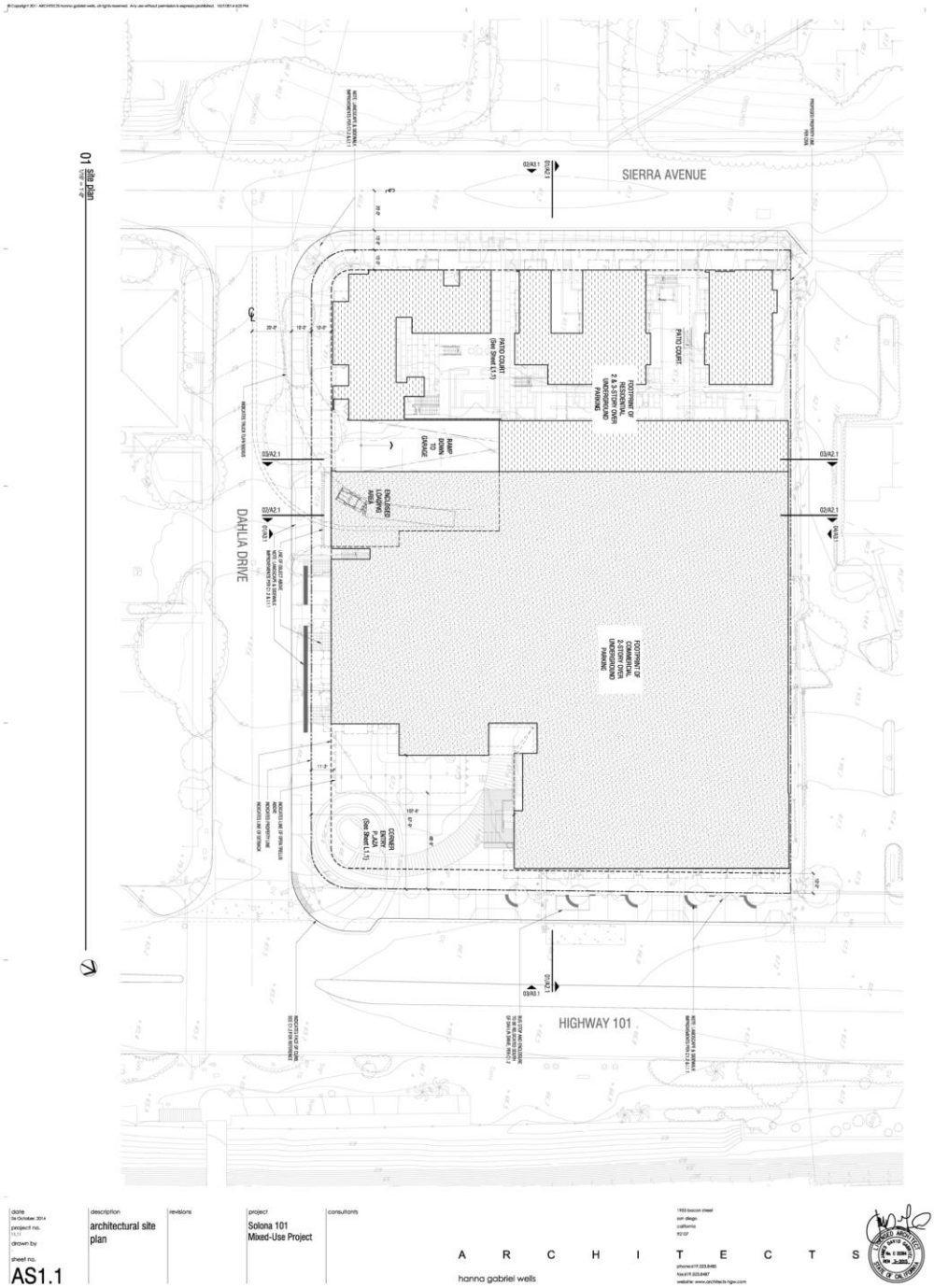

FIGURE 2-2

Project Site Plan

FIGURE 2-3

Study Area Boundary / Intersection Key

In order to summarize project impacts and required mitigation, this report is divided into the following text sections:

1.0 Executive Summary

2.0 Introduction

3.0 Proposed Project

4.0 Methodology

5.0 Existing Conditions

6.0 Existing With Project

7.0 Other Projects

8.0 Near Term Without Project

9.0 Near Term With Project

10.0 Horizon Year 2035 Without Project

11.0 Horizon Year 2035 With Project

12.0 Parking

13.0 Conclusions and Recommendations

14.0 References

15.0 Urban Systems Associates, Inc., Preparers

TABLE 2-1

Study Area Street Segments and Intersections

Street Segments	
Road	**Segment**
Highway 101	Lomas Santa Fe Drive to Dahlia Drive
	Dahlia Drive to Via De La Valle
Dahlia Drive	Sierra Avenue to Highway 101
Via de la Valle*	Highway 101 to Jimmy Durante Boulevard

*Analyzed with a Peak Hour Arterial Analysis (results can be found in **Appendix K**)

Intersections	
Number	**Intersection**
1	Highway 101 / Lomas Santa Fe Dr.
2	Cedros Ave. / Lomas Santa Fe Dr.
3	Sierra Ave. / Dahlia Dr.
4	Highway 101 / Dahlia Dr.
5	Highway 101 / Via de la Valle
A	Dahlia Dr./ Project Driveway A

3.0 PROPOSED PROJECT

The proposed project is a mixed-use development consisting of 31 Apartments; 24,284 square feet of Specialty Supermarket; 14,137 square feet of Standard Commercial Office; 5,125 square feet of High Turnover Restaurant; and 5,090 square feet of Quality Restaurant.

3.1 TRIP GENERATION

USAI prepared a trip generation table in accordance with the standards of practice used in the San Diego Association of Governments' (SANDAG) *(Not So) Brief Guide of Vehicle Traffic Generation Rates*, April 2002, included in **Appendix A**. As shown in **Table 3-1-A**, the trip generation assumes mixed-use and transit credits. For specialty supermarket and apartment rates, mixed-use reductions were already accounted for in the use *Mixed Use: Commercial (w/supermarket)/ Residential* rates according to the SANDAG trip generation rates. However, a transit reduction was applied to apartments only due to the proximity to the Solana Beach Train Station and commuter bus services provided by North County Transit District located on Highway 101, north of Dahlia Drive. For commercial office and restaurants, both a mixed-use reduction as well as transit reduction was applied according to the ITE *Trip Generation Handbook* 3rd Ed. methodology. See **Appendix A** for transit and mixed-use reduction information. As shown in **Table 3-1-A**, the driveway trips with transit and mixed-use reductions is calculated to be 3,412 average daily trips (ADT) with 176 (108 in / 68 out) AM peak hour trips and 349 (181 in / 168 out) PM peak hour trips.

Existing land uses and trip generation is provided in **Table 3-1-B** which includes two office tenants of 840 square feet and 710 square feet respectively (total of 1,550 square feet office space). Some of the

existing uses are no longer in operation. However, they present the "historical" use of the site and were not taken into account in the trip generation.

Table 3-1-C shows the driveway NET NEW TRIPS (Proposed – Existing) to be 3,381 ADT with 172 (104 in / 68 out) AM peak hour trips and 345 (180 in / 165 out) PM peak hour trips. Also included in this table are the primary and pass-by trips. Driveway trips are the total number of trips generated by the project. Primary trips are defined as the trips that go directly between the origin and the primary destination i.e. to and from the project. Pass-by trips are trips that are deviated from a roadway within the vicinity of the generator to access the project. These trips "pass-by" the project driveway while in route to a primary destination. These are existing trips in the community and are not new trips to the region. Driveway trips are the sum of primary trips and pass-by trips.

3.2 TRIP DISTRIBUTION AND ASSIGNMENT

Figure 3-1 shows the project only trip distribution percentages, which are based on a SANDAG Series 12 Select Zone Full Forecast Model dated August 2015. The distribution percentages at study intersections are included in **Figure 3-2**. The distribution of project traffic shows 35% travel north on Highway 101 while 53% travel south on Highway 101. Ten percent (10%) of project traffic is distributed west of the project site onto South Sierra Avenue (4% north and 6% south). According to the forecast, this ten percent is expected to be distributed into the adjacent side streets and neighborhoods. Two percent (2%) leaves the project site and enters the opposite shopping center across the street. **Figure 3-3** shows the project average daily traffic distributed to the street system. AM/PM peak hour project only traffic volumes are shown in **Figure 3-4**. **Appendix A** also shows the SANDAG Model.

TABLE 3-1-A

Solana 101 Project Trip Generation

Proposed Project (with Transit and Mixed-Use Reductions)

Use	Intensity	Rate(1)	ADT	AM*					PM*				
				Peak %	Vol.	In % : Out%	In	Out	Peak %	Vol.	In % : Out%	In	Out
Apartment	31 DU	5 /DU	**155**	9%	**14**	30% : 70%	**4**	**10**	13%	**20**	60% : 40%	**12**	**8**
Transit Reduction %(3)							3%	3%				3%	3%
Transit Reduction Subtotal			9		0		0	0		1		0	0
Driveway Trips			**146**		**14**		**4**	**9**		**20**		**12**	**8**
Primary Trips(97%)			**141**		**13**		**4**	**9**		**19**		**11**	**8**
Pass-By Trips(3%)			**4**		**0**		**0**	**0**		**1**		**0**	**0**
Specialty Supermarket	24,284 SF	110 /KSF	**2,671**	3%	**80**	60% : 40%	**48**	**32**	9%	**240**	50% : 50%	**120**	**120**
Driveway Trips (AM/PM)			**2,671**		**80**		**48**	**32**		**240**		**120**	**120**
Primary Trips(85/60)			**2,271**		**68**		**41**	**27**		**144**		**72**	**72**
Pass-By Trips(15/40)			**401**		**12**		**7**	**5**		**96**		**48**	**48**
Standard Commercial Office	14,137 SF	20 /KSF	**283**	14%	**40**	90% : 10%	**36**	**4**	13%	**37**	20% : 80%	**7**	**29**
Transit Reduction %(3)							8%	8%				8%	8%
Transit Reduction Subtotal(5%)			28		2		2	0		2		0	1
Mixed-Use Reduction %(2)							17%	75%				43%	24%
Mixed-Use Reduction Subtotal			143		9		6	3		10		3	7
Driveway Trips			**111**		**29**		**28**	**1**		**25**		**4**	**21**
Primary Trips(96%)			**107**		**27**		**27**	**1**		**24**		**4**	**20**
Pass-By Trips(4%)			**4**		**1**		**1**	**0**		**1**		**0**	**1**
Restaurant (High Turnover)	5,125 SF	160 /KSF	**820**	8%	**66**	50% : 50%	**33**	**33**	8%	**66**	60% : 40%	**39**	**26**
Mixed-Use Reduction %(2)							22%	26%				34%	50%
Mixed-Use Reduction Subtotal			528		16		7	9		27		13	13
Driveway Trips (AM/PM)			**292**		**50**		**26**	**24**		**39**		**26**	**13**
Primary Trips(88/80)			**257**		**44**		**23**	**21**		**34**		**23**	**12**
Pass-By Trips(12/20)			**35**		**6**		**3**	**3**		**8**		**5**	**3**
Restaurant (Quality)	5,090 SF	100 /KSF	**509**	1%	**5**	60% : 40%	**3**	**2**	8%	**41**	70% : 30%	**29**	**12**
Mixed-Use Reduction %(2)							22%	26%				34%	50%
Mixed-Use Reduction Subtotal			318		**1**		1	1		16		10	6
Driveway Trips (AM/PM)			**191**		**4**		**2**	**2**		**25**		**19**	**6**
Primary Trips(88/90)			**168**		**3**		**2**	**1**		**22**		**17**	**5**
Pass-By Trips(12/10)			**23**		**0**		**0**	**0**		**2**		**2**	**1**
Proposed Project Trips													
Total Proposed Driveway Trips			**3,412**		**176**		**108**	**68**		**349**		**181**	**168**
Total Proposed Primary Trips			**2,944**		**156**		**96**	**60**		**244**		**127**	**117**
Total Proposed Pass-By Trips			**468**		**20**		**12**	**8**		**108**		**56**	**52**

(1) - Rates are used from SANDAG, "Not so Brief Guide of Vehicular Traffic Generation Rates for San Diego Region", April 2002.

(2) - Mixed Use Reductions are calculated using ITE Trip Generation Handbook 3rd Edition Spreadsheet Tool

(3) - Transit Reductions are used from ITE Trip Generation Handbook 3rd Edition Appendix E (Tables E.1 & E.2)

TABLE 3-1-B

Solana 101 Project Trip Generation

Existing Land Uses

Use	Intensity	Rate*	ADT	AM						PM					
				Peak %	Vol.	In %	Out%	In	Out	Peak %	Vol.	In %	Out%	In	Out
Standard Commercial Office*	1,550 SF	20 /KSF	**31**	14%	**4**	90% :	10%	**4**	**0**	13%	**4**	20% :	80%	**1**	**3**
Primary Trips(96%)	SF		**30**		**4**			**4**	**0**		**4**			**1**	**3**
Pass-By Trips(4%)	SF		**1**		**0**			**0**	**0**		**0**			**0**	**0**

Source:

*Rates are used from SANDAG, "Not so Brief Guide of Vehicular Traffic Generation Rates for San Diego Region", April 2002.

Note:

ADT= Average Daily Trips

KSF = 1,000 Square Feet

VFS = Vehicle Fueling Station

DU = Dwelling Units

TABLE 3-1-C
Solana 101 Project Trip Generation

Proposed Trip Generation											
	ADT with Transit & Mixed-Use Reductions		Vol.		In	Out		Vol.		In	Out
Total Proposed Driveway Trips	3,412		176		108	68		349		181	168
Total Proposed Pass-By Trips	468		20		12	8		108		56	52
Total Proposed Primary Trips	2,944		156		96	60		244		127	117
Existing Trip Generation											
	ADT with Transit & Mixed-Use Reductions		Vol.		In	Out		Vol.		In	Out
Total Proposed Driveway Trips	31		4		4	0		4		1	3
Total Proposed Pass-By Trips	30		4		4	0		4		1	3
Total Proposed Primary Trips	1		0		0	0		0		0	0
NET NEW TRIPS (Proposed - Existing)											
	ADT with Transit & Mixed-Use Reductions		Vol.		In	Out		Vol.		In	Out
Total Net Driveway Trips	3,381		172		104	68		345		180	165
Total Net Pass-By Trips	438		16		8	8		104		55	49
Total Net Primary Trips	2,943		156		96	60		244		127	117

Source:

*Rates are used from SANDAG, "Not so Brief Guide of Vehicular Traffic Generation Rates for San Diego Region", April 2002.

Note:

ADT= Average Daily Trips

KSF = 1,000 Square Feet

DU = Dwelling Units

(AM/PM) = AM and PM percentages for primary and pass-by trips

Vol. = Volume

FIGURE 3-1

Project Distribution Percentages

FIGURE 3-2

Project Distribution Percentages At Study Intersections

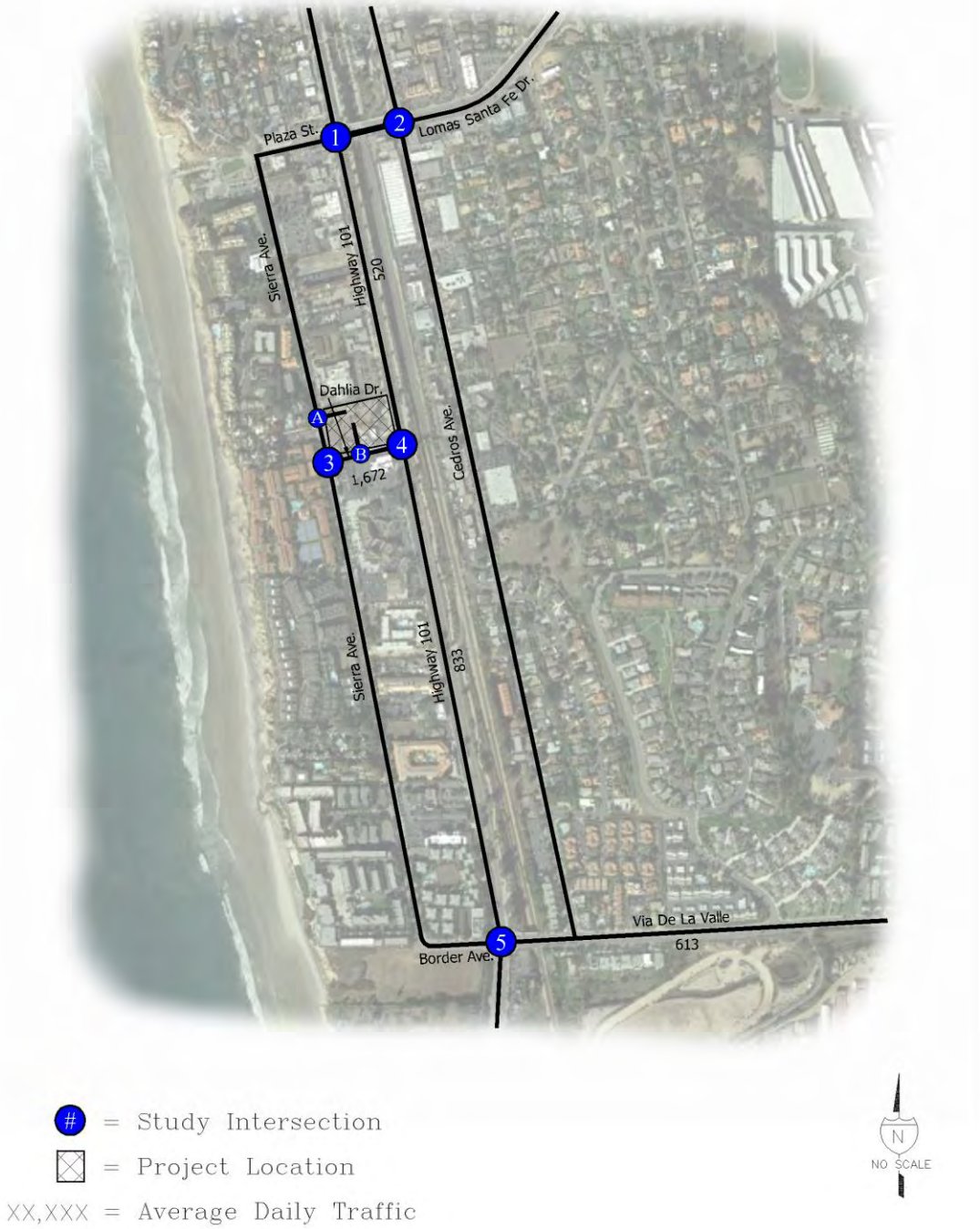

FIGURE 3-3

Project Only Average Daily Traffic

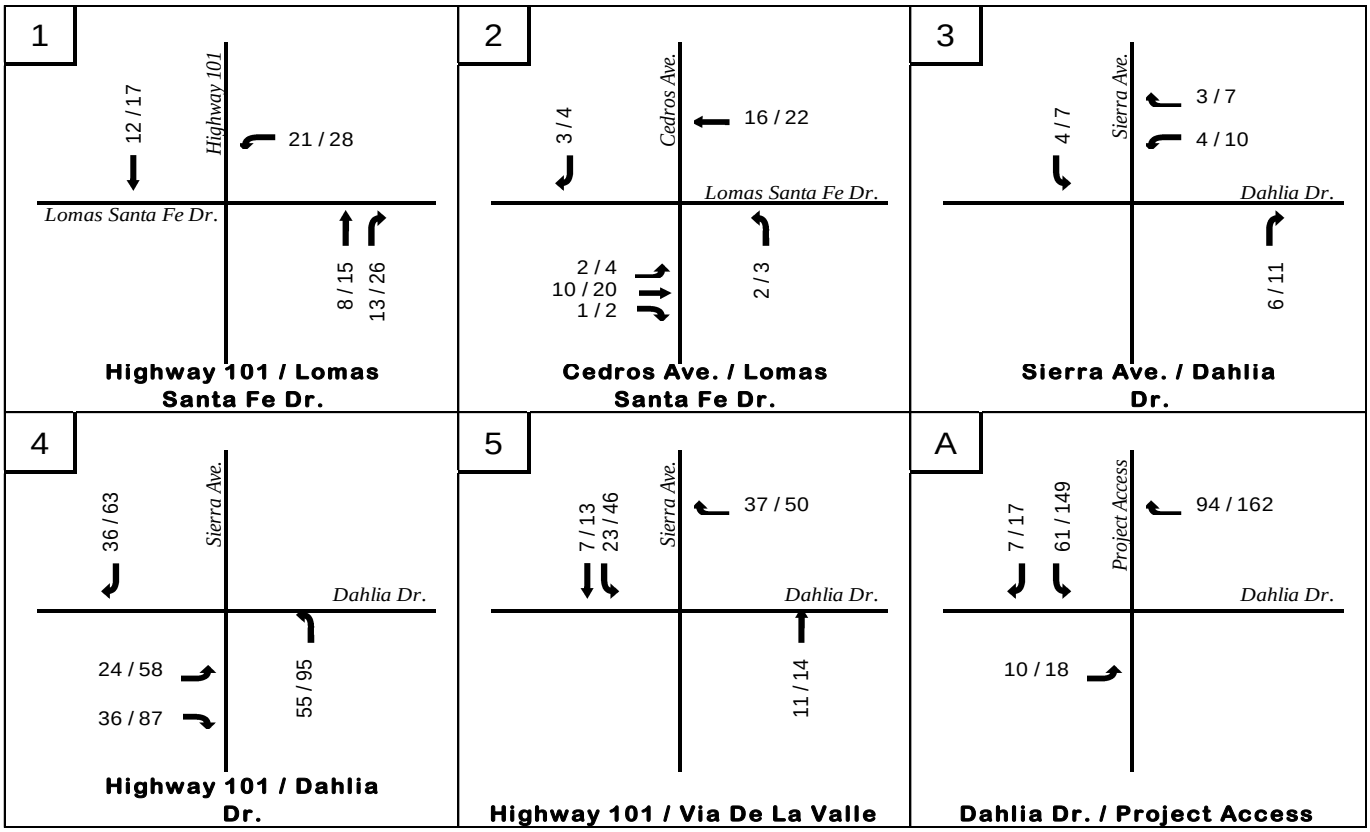

FIGURE 3-4

Project Only AM / PM Peak Hour Traffic

4.0 METHODOLOGY

This section of the report describes various analysis procedures and criteria that are used to determine if the proposed project has a significant impact and if mitigation is required. Mitigation may be either specific improvements by the project for a direct or cumulative impact or a financial contribution toward an improvement by others if a cumulative impact occurs. Two criteria must be met before project mitigation is required. First, the intersection or street segment must be projected to operate at an unacceptable LOS after project trips are added (i.e., "E" or "F" as discussed below). Second, the amount of project traffic must be significant based on the application of criteria also discussed below. For an intersection, if the change in delay anticipated due to the project is greater than 2 seconds and the LOS is "E" or "F" respectively, then the project's intersection impacts would be considered significant. For a street segment, if the change in volume to capacity ratio (V/C ratio) anticipated due to the project exceeds 0.02, and the LOS is "E" or "F," respectively, then the project's street segment impact would be considered significant. If project traffic causes an intersection, roadway segment, or freeway segment to degrade from LOS "D" to LOS "E" or LOS "F," the project impact would be significant and project mitigation is required. For freeway segment impacts to be considered significant, the segment would need to operate at an unacceptable LOS and exceed a change in V/C ratio of 0.01 for LOS "E" and "F," respectively. A project ramp meter impact would be significant if the ramp meter calculations show 15 minutes of delay or greater and the change in delay due to the project is greater than 2 minutes and the freeway mainline segments are expected to operate at LOS "E" and "F," respectively, using the most restrictive meter rate method. For this study, the freeway criteria was not applicable because the project would not be expected to contribute 50 directional peak hour trips to I-5.

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4.1 SANTEC/ITE GUIDELINES

The City of Solana Beach has adopted the SANTEC/ITE guidelines for traffic impact studies in the San Diego region. The SANTEC/ITE guidelines "attempt to consolidate regional efforts to identify when a TIS is needed, what professional procedures should be followed, and what constitutes a significant traffic impact".

The City's Significance Determination Thresholds (2011) establish criteria that identify the allowable change in delay or V/C ratio due to project impacts. This publication also establishes criteria for measuring project impacts at intersections. This method establishes an allowable increase in delay at intersections due to the addition of project trips. The SANTEC/ITE specifies use of the most current Highway Capacity Manual (HCM) operational method for studying intersections. For analyzing intersections, a software package called Synchro is used. This software package is a direct and faithful application of the HCM methodology.

4.2 TRIP DISTRIBUTION

Trip distribution is the process of determining traffic percentage splits on the regional and local roadway network. Trip distribution for the proposed project was based on a SANDAG Series 12 Select Zone Full Forecast Model dated August 2015.

4.3 STREET LOS THRESHOLD

When analyzing street segments, the LOS must be determined. LOS is a measure used to describe the conditions of traffic flow. LOS is expressed using letter designations from "A" to "F." LOS "A" represents the best case, and LOS "F" represents the worst case. Generally, LOS "A" through "C" represents free-flowing traffic conditions with little or no delay. LOS "D" represents limited congestion and some delay. However, the duration of periods of delay is acceptable to most people. LOS "E" and "F" represent significant delays on local streets, which are generally unacceptable for urban design purposes. The LOS descriptions are from Chapter 9 of the HCM (Transportation Research Board 2000).

The SANTEC/ITE guidelines have developed LOS threshold tables based on the different functional street classifications and their ability to carry traffic. For the City of Solana Beach, LOS "D" is the acceptable LOS standard for roadways and intersections.

4.4 INTERSECTION LOS PROCEDURES

The City and SANTEC/ITE guidelines, as adopted by SANDAG (2006), determine the procedures to be used for intersection peak hour analysis. To determine an intersection peak hour LOS, the SANTEC/ITE guidelines require use of the most recent procedure from Chapter 9 of the HCM (Transportation Research Board 2000). The procedure in Chapter 9, which is used to analyze signalized intersections, is the "operational method." This method determines LOS based on average control delay expressed in seconds. **Table 4-1** shows the LOS based upon the delay. A computer program is used to complete the analysis. As discussed above, the City and SANTEC/ITE guidelines have established LOS "D" or better as the objective for intersections and street segments.

4.5 CMP ENHANCED CEQA REVIEW GUIDELINES

Federal Highway Administration 23 CFR 450.320 requires that each transportation management area (TMA) address congestion management through a process involving an analysis of multimodal metropolitan wide strategies that are cooperatively developed to foster safety and integrated management of new and existing transportation facilities eligible for federal funding.

SANDAG has been designated as the TMA for the San Diego region. The 2050 Regional Transportation Plan meets the requirements of 23 CFR 450.320 by incorporating the following federal congestion management process: performance monitoring and measurement of the regional transportation system, multimodal alternatives and non-SOV analysis, land use impact analysis, the provision of congestion management tools, and integration with the regional transportation improvement program process.

California State Proposition 111, passed by voters in 1990, established a requirement that urbanized areas prepare and regularly update a Congestion Management Program (CMP). The requirements within the State CMP were developed to monitor the performance of the transportation system, develop programs to address near-term and long-term congestion, and better integrate transportation and land use planning. SANDAG provided regular updates for the State CMP, and since this decision, SANDAG has been abiding by 23 CFR 450.320 to ensure the region's continued compliance with the federal congestion management process. Therefore, the City of Solana Beach has been exempted from the requirements of the State CMP.

TABLE 4-1

Level of Service Criteria for Signalized Intersections

Level of Service	Control Delay Per Vehicle (sec)
A	≤10
B	>10 and ≤20
C	>20 and ≤35
D	>35 and ≤55
E	>55 and ≤80
F	>80

Source: Transportation Research Board 2000, Table 9-1

Level of Service Criteria for Un-Signalized Intersections

Level of Service	Control Delay Per Vehicle (sec)
A	≤10
B	>10 and ≤15
C	>15 and ≤25
D	>25 and ≤35
E	>35 and ≤50
F	>50

Source: Transportation Research Board 2000, Table 10-7

4.6 FREEWAY SEGMENT LOS PROCEDURES

To determine the LOS of main-lane freeway segments, a V/C analysis would be conducted consistent with California Department of Transportation (Caltrans) District 11 Procedures for Estimating Freeway Level of Service. This analysis study area does not include any freeway analysis so these procedures have not been utilized.

4.7 SIGNIFICANCE THRESHOLDS

As discussed above, two criteria must be met before project traffic mitigation is required. First, an unacceptable LOS (i.e., "E" or "F") must occur, and second, significance thresholds for only project traffic must be exceeded. Alternatively, if project traffic causes a facility to degrade from LOS "D" to "E," a significant impact would occur. The City's significance thresholds are summarized in **Table 4-2**. These thresholds are used in this analysis along with LOS to determine if project mitigation is required. **Table 4-3** shows the roadway classifications for the City of Solana Beach as defined in the SANTEC/ITE Guidelines, 2000.

TABLE 4-2

Significance Thresholds

Traffic Impact Significant Thresholds

Level of Service with Project[a]	Allowable Increase Due to Project Impacts[b]					
	Freeways		Roadway Segments		Intersections	Ramp Metering
	V/C	Speed (mph)	V/C	Speed (mph)	Delay (sec.)	Delay (min.)
D,E & F (or ramp meter delays above 15 minutes	0.01	1	0.02	1	2	2[c]

Footnotes:

a. All level of sevice measurements are based upon HCM procedures for peak-hour conditions. However, V/C ratios for Roadway Segments may be estimated on an ADT/24-hour traffic volume basis (using Table 2 or a similar LOS chart for each jurisdiction). The acceptable LOS for freeways, roadways, and intersections is generally "D" ("C" for undeveloped or not densely developed locations per jurisdiction definitions). For metered freeway ramps, LOS does not apply. However,ramp meter delays above 15 minutes are considered excessive.

b. If a proposed project's traffic causes the values shown in the table to be exceeded, the impacts are deemed to be significant. These impact changes may be measured from appropriate computer programs or expanded manual spreadsheets. The project applicant shall then identify feasible mitigations (within the Traffic Impact Study [TIS] report) that will maintain the traffic facility at an acceptable LOS. If the LOS with the proposed project becomes unacceptable (see note a above), or if the project adds a significant amount of peak hour trips to cause any traffic queues to exceed on- or off-ramp storage capacities, the project applicant shall be responsible for mitigating significant impact changes.

c. The impact is only considered significant if the total delay exceeds 15 minutes.

General Notes:

1. V/C =Volume to Capacity Ratio
2. Speed = Arterial speed measured in miles per hour
3. Delay = Average stopped delay per vehicle measured in seconds for intersections, or minutes for ramp meters
4. LOS = Level of Service

TABLE 4-3
Roadway Classifications

		Level of Service W/ ADT				
Street Classification	**Lanes**	**A**	**B**	**C**	**D**	**E**
Multi Modal Boulevard	4 Lanes	15,000	21,000	30,000	35,000	40,000
Commercial Bicycle Boulevard	2 Lanes	2,500	3,500	5,000	6,500	8,000
Local Street	2 Lanes	---	---	2,200	---	---

Notes:

1. Classifications were taken from the City of Solana Beach General Plan.
2. Capacities were derived from the SANTEC/ITE, *Guidelines for Traffic Impact Studies (TIS) In the San Diego Region*. The most comparable street classification category to the classifications in the City of Solana Beach General Plan were used.

5.0 EXISTING CONDITIONS

The proposed project is located on the north side of Dahlia Drive bound by Highway 101 to the east and Sierra Avenue to the west in the City of Solana Beach. See **Figure 2-1** for the project location.

5.1 EXISTING ROADWAY FACILITIES

Highway 101 – runs north/south and is constructed as a four lane divided roadway. It is classified as a Multi Modal Boulevard (comparable to a four lane Major Arterial as defined by SANTEC/ITE) within the project study area according to the City of Solana Beach General Plan Circulation Element. It has a raised median with select median breaks. Class II bike lanes are provided on both sides of the street. Parking is only allowed on the west side of the roadway. The posted speed limit is 45 MPH.

The Highway 101 Westside Improvement project has recently been completed between Dahlia Street and Cliff Street. This improvement project is assumed in the Existing and Near Term analysis. The project has shifted the center median along Highway 101 to the east to construct a wide sidewalk on the west side of Highway 101. A sharrow lane, shared by motorists and bicyclists, is now provided in the southbound direction. Due to the reduced vehicular capacity associated with sharrow lanes, Highway 101 between Dahlia Drive and Lomas Santa Fe Drive was analyzed as a Major Road with a reduced capacity of 35,000 ADT as opposed to 40,000 ADT. This capacity was derived based on the assumption that each Major Road lane has a capacity of 10,000 ADT. The two northbound lanes and the inside southbound lane retain their original Major Road capacity of 10,000 ADT. However, the outer southbound lane (now shared with bicyclists) is assumed to have half the capacity, or 5,000 ADT.

Lomas Santa Fe Drive – runs east/west and is constructed as a four lane undivided roadway connecting Highway 101 and Interstate 5. According to the City of Solana Beach General Plan Circulation Element, this roadway is classified as a Multi Modal Boulevard (comparable to a four lane Major Arterial as defined by SANTEC/ITE) within the project study area. Bike lanes are provided on both sides of the street with a posted speed limit of 35 MPH.

Dahlia Drive – runs east/west connecting Sierra Avenue and Highway 101. Dalia Drive is constructed as a two lane undivided roadway along the project frontage. According to the City of Solana Beach General Plan Circulation Element, Dahlia Drive is a considered a Local Street (comparable to a Sub-Collector as defined by SANTEC/ITE). No bike lanes are provided on either side of the street.

Via De La Valle – runs east/west located in the City of Del Mar. It is functionally classified as a Commercial Bicycle Boulevard (comparable to a two lane Collector with commercial-industrial fronting as defined by SANTEC/ITE) two lane Major roadway consistent with the EIR for the Del Mar Fairgrounds Master Plan (LSA Associates, Inc. October 2009), see **Appendix B**. This roadway also provides access to Interstate 5 to the east. Bike lanes are provided along both sides of the street with a posted speed limit of 45 MPH.

5.2 EXISTING TRAFFIC VOLUMES

Figure 5-1 shows the existing average weekday 24-hour traffic volumes for street segments in the project study area. Existing street segment functional classifications were used for purposes of this analysis.

Figure 5-2 shows the lane configurations for the existing roadway network at the project access and at intersections studied.

For conservative analysis, traffic counts were obtained and reviewed to account for the highest daily and peak hour traffic throughout the year. In this community, seasonal events such as the Del Mar Fair and Racetrack temporarily contribute the highest traffic volumes along Highway 101 and local streets. In order to ensure that existing volumes accounted for these seasonal events counts were taken in August of 2016. Traffic count worksheets are provided in **Appendix B**. Data was obtained from Caltrans Performance Measurement System (PeMS) and analyzed for a 3 month period from June to September of 2015. This data shows that August is the month with the highest traffic volumes along Highway 101. A graphical representation of this data is provided in **Appendix B**. The southbound graph data was obtained from Manchester Avenue, which is located north of the Del Mar Fairgrounds. The northbound graph data was obtained from Carmel Mountain Road, which is located south of the Del Mar Fairgrounds.

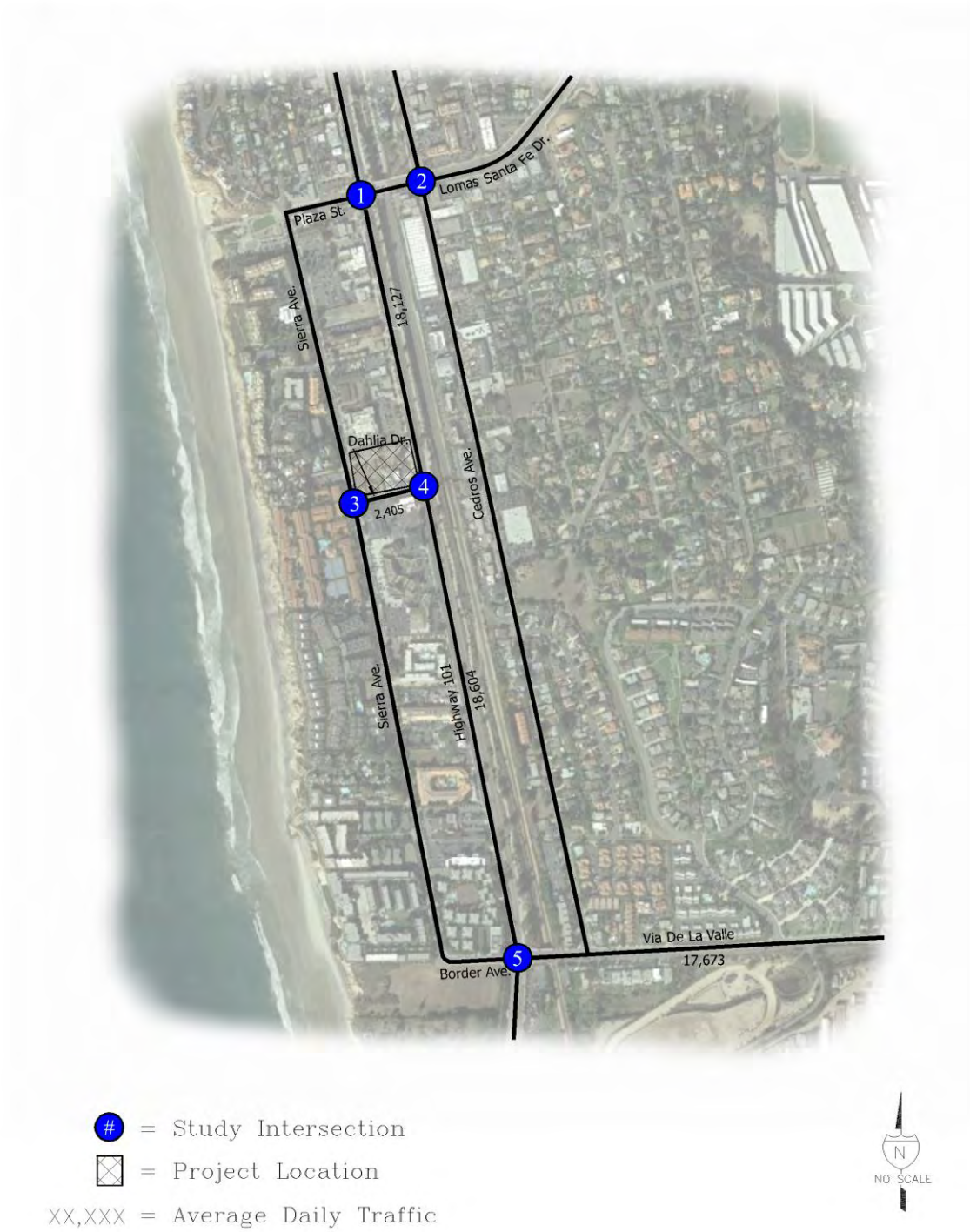


FIGURE 5-1

Existing Average Daily Traffic

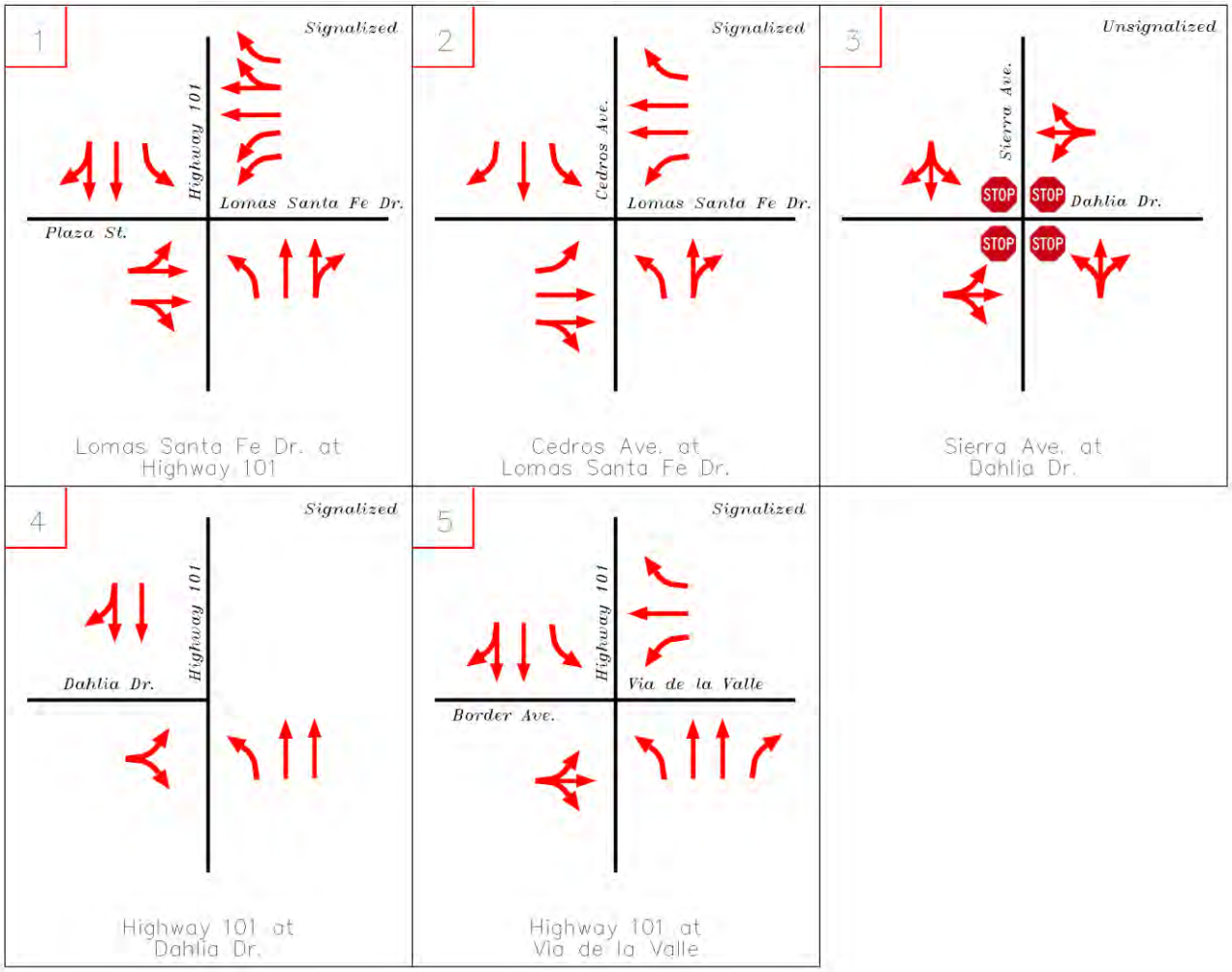


FIGURE 5-2

Existing Lane Configurations

5.3 STREET SEGMENT ANALYSIS

As shown on **Table 5-1**, all street segments are projected to operate at an acceptable LOS (D or Better) in the existing condition. Via de la Valle was analyzed using the peak hour analysis contained in Chapter 11 of the current HCM and the segment was found to operate at an acceptable LOS D or better.

5.4 EXISTING INTERSECTIONS

As previously discussed in Section 5.2, **Figure 5-2** shows the existing lane configurations for the intersections in the study area.

5.5 EXISTING INTERSECTION PEAK HOUR VOLUMES AND LOS

Figure 5-3 shows the existing AM and PM peak hour intersection traffic volumes. As required by the City of Solana Beach, the analysis of peak hour intersection performance was based on the 2000 HCM using operational analysis procedures. A computer program (Synchro), which is based on the HCM, was used to complete the analysis. As shown on **Table 5-2**, all intersections currently operate at a LOS "D" or better during the AM and PM peak hour periods. LOS calculation worksheets for existing conditions may be found in **Appendix C**.

TABLE 5-1

Existing Street Segment Levels of Service

Road	Segment	Standard	# of Ln.	Class.	Cap.	Volume	V/C	LOS
Highway 101	Lomas Santa Fe Drive to Dahlia Drive	SD	4	4-M	40,000	18,127	0.45	B
	Dahlia Drive to Via De La Valle	SD	4	4-M	40,000	18,604	0.47	B
Dahlia Drive	Sierra Avenue to Highway 101	SD	2	2-Cc	8,000	2,405	0.30	A

Legend:

Class. = Functional Class

LOS = Level of Service

Ln. = Lanes

Cap. = Capacity

V/C = Volume/Capacity

2-Cc = 2 Lane Collector (w/ commercial-industrial property)

4-M = 4 lane major arterial

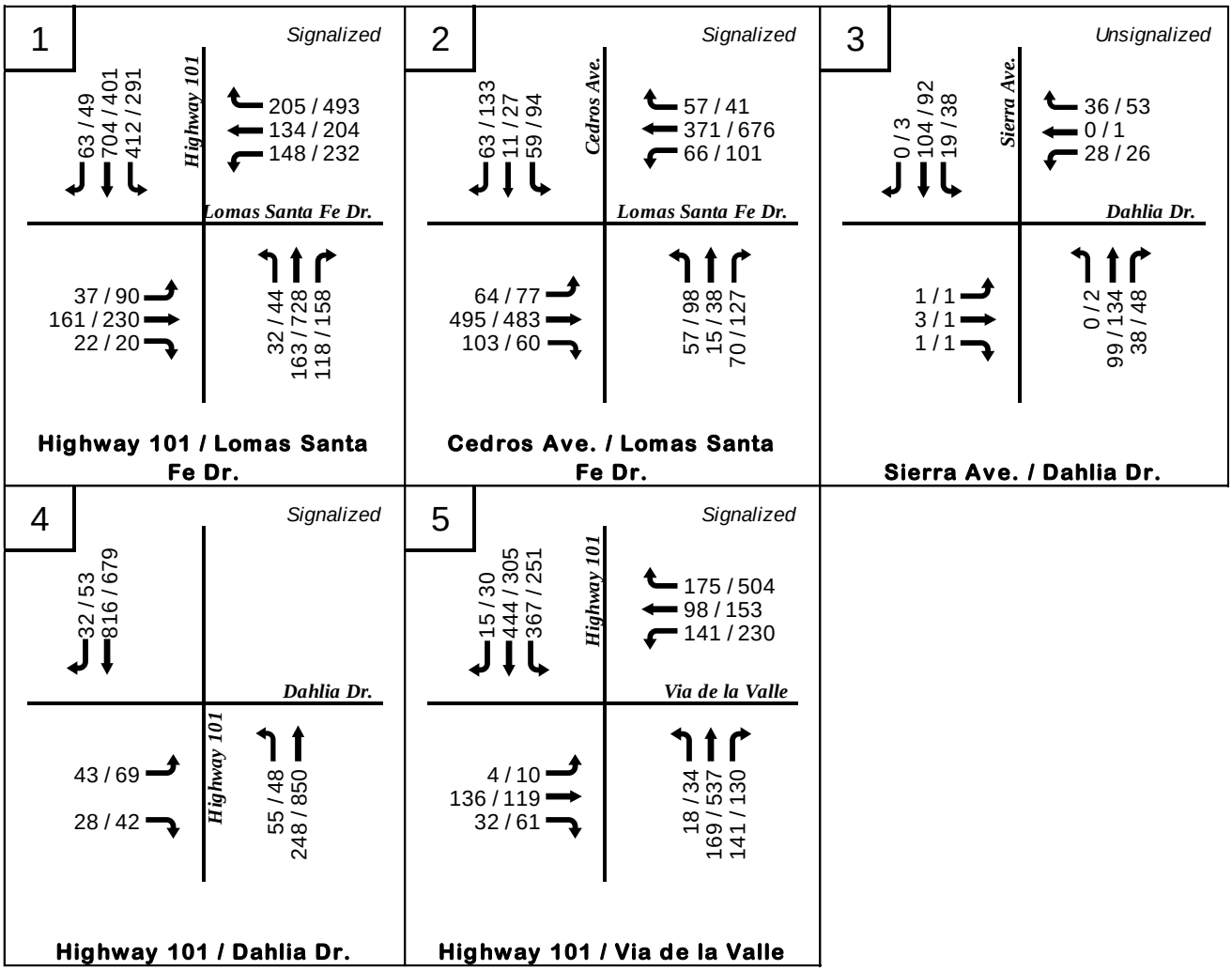


FIGURE 5-3

Existing AM/PM Peak Hour Traffic

TABLE 5-2

Existing Intersection Levels of Service

Number	Intersection	Control	AM Peak Hour		PM Peak Hour	
			Delay	LOS	Delay	LOS
1	Highway 101 / Lomas Santa Fe Dr.	Signalized	33.9	C	41.3	D
2	Cedros Ave. / Lomas Santa Fe Dr.	Signalized	24.3	C	23.7	C
3	Sierra Ave. / Dahlia Dr.	Unsignalized	8.0	A	8.3	A
4	Highway 101 / Dahlia Dr.	Signalized	7.2	A	9.0	A
5	Highway 101 / Via de la Valle	Signalized	31.0	C	35.9	D

Notes:

Delay = seconds per vehicle

LOS = Level of Service

6.0 EXISTING WITH PROJECT

The purpose of this chapter is to evaluate the impacts of the Existing with Project analysis. This analysis evaluates the project's "direct impacts" by comparing existing conditions without project to existing condition with the project. **Appendix D** includes the Existing with Project Synchro worksheets which is the basis for the following discussion.

6.1 STREET SEGMENTS

Street segments LOS with project traffic were determined by adding expected project only daily volumes to the existing daily volumes. **Figure 6-1** shows the Existing with Project average daily traffic volumes. **Table 6-1** shows street segment LOS with the addition of the Solana 101 project traffic. As shown, all study street segments are projected to operate at acceptable levels of service when project traffic is added to existing traffic. Via de la Valle was analyzed using the peak hour analysis contained in Chapter 11 of the current HCM and the segment was found to operate at an acceptable LOS D or better.

6.2 INTERSECTIONS

Project traffic for the AM and PM peaks were added to the existing traffic as shown in **Figure 6-2**. Intersection delays and LOS for the Existing with Project peak hour traffic is provided in **Table 6-2**. As shown, all intersections analyzed within the study area are projected to operate at acceptable LOS "D" or better.

FIGURE 6-1

Existing + Project Average Daily Traffic

TABLE 6-1

Existing + Project Street Segment Levels of Service

Road	Segment	Standard	# of Ln.	Class.	Cap.	Volume	V/C	LOS
Highway 101	Lomas Santa Fe Drive to Dahlia Drive	SD	4	4-M	40,000	19,157	0.48	B
	Dahlia Drive to Via De La Valle	SD	4	4-M	40,000	20,164	0.50	B
Dahlia Drive	Sierra Avenue to Highway 101	SD	2	2-Cc	8,000	2,406	0.30	A

Legend:

Class. = Functional Class

Cap. = Capacity

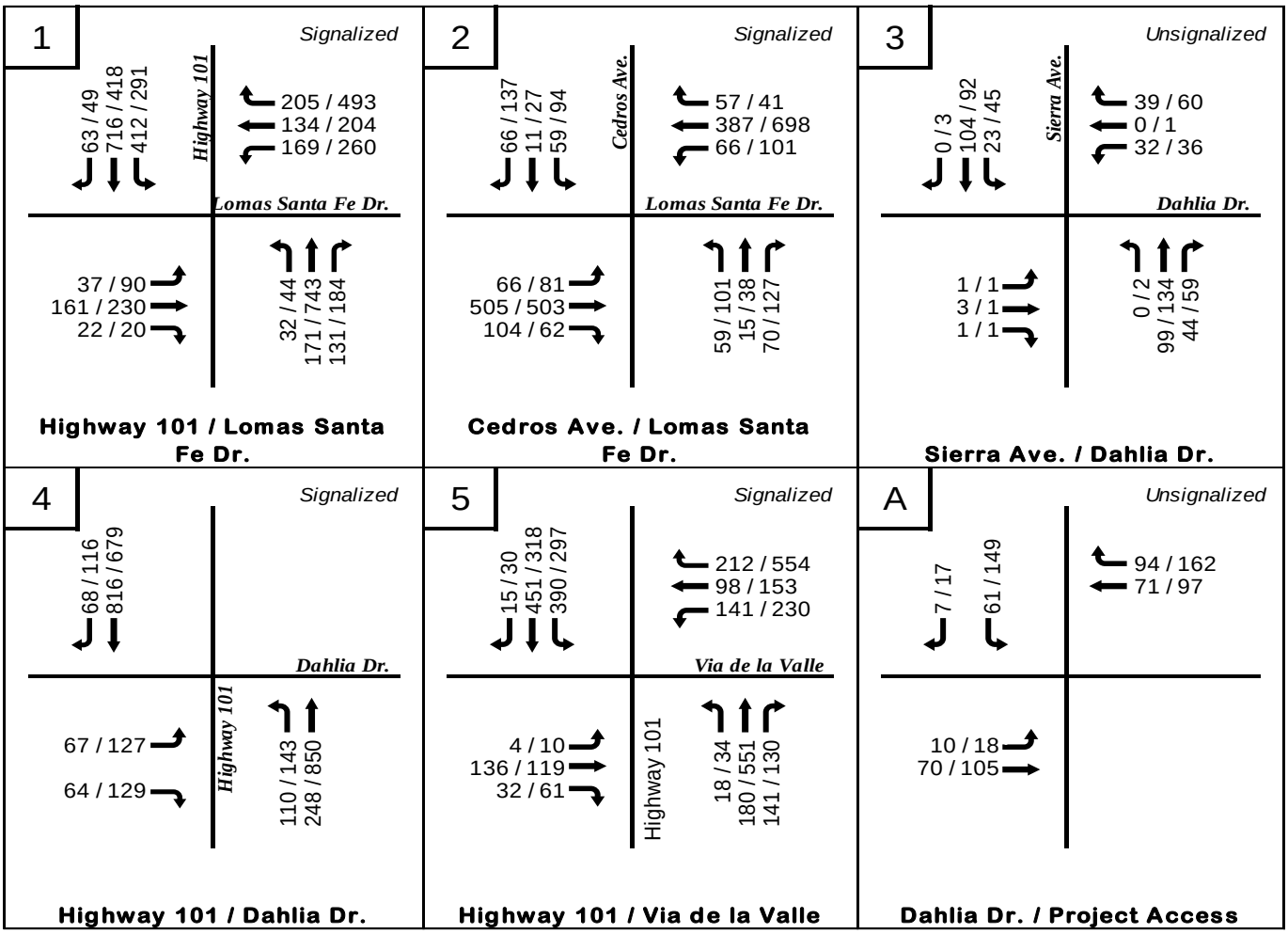
Ln. = Lanes

LOS = Level of Service

V/C = Volume/Capacity

2-Cc = 2 Lane Collector (w/ commercial-industrial property)

4-M = 4 lane major arterial



XX / XX = AM / PM Peak hour volumes

FIGURE 6-2

Existing + Project AM / PM Peak Hour Traffic

TABLE 6-2

Existing With Project Intersection Levels of Service

Number	Intersection	Control	AM Peak Hour		PM Peak Hour	
			Delay	LOS	Delay	LOS
1	Highway 101 / Lomas Santa Fe Dr.	Signalized	34	C	41.5	D
2	Cedros Ave. / Lomas Santa Fe Dr.	Signalized	24.6	C	23.7	C
3	Sierra Ave. / Dahlia Dr.	Unsignalized	8	A	8.5	A
4	Highway 101 / Dahlia Dr.	Signalized	12.9	B	17.9	B
5	Highway 101 / Via de la Valle	Signalized	31.3	C	42.2	D
A	Dahlia Dr. / Project Driveway A	Unsignalized	2.5	A	4.1	A

Notes:

Delay = seconds per vehicle

LOS = Level of Service

7.0 OTHER PROJECTS

To find the Near Term (Existing With Other Projects) traffic volumes, USAI consulted with City staff to determine other pending or recently approved projects that are expected to be completed and occupied, after the date of existing traffic counts but prior to the project's expected opening day that would contribute traffic within the project study area. The City found two (2) cumulative projects within Solana Beach that could contribute traffic to the project study area which are the Pearl project and the Cedros 330 project. Volumes from these projects were taken from their respective traffic studies. In addition to these projects, the analysis assumed a 5% growth (1% per year for 5 years) factor onto the existing traffic volumes to account for any unforeseen future "other" projects that may contribute traffic to the study area within the next five years.

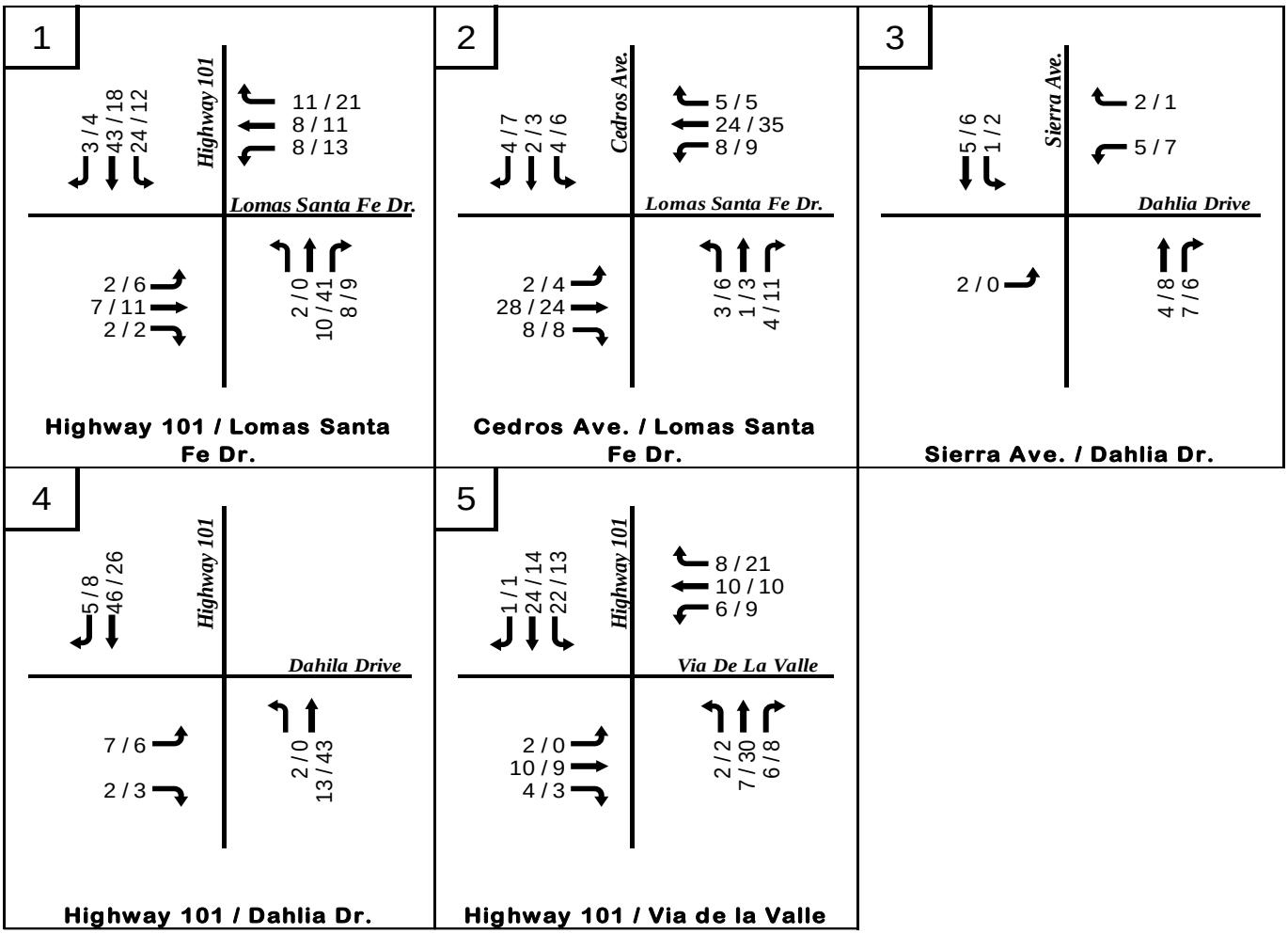
The "other projects" daily and peak hour traffic volumes assumed in this analysis include the Pearl project, Cedros 330 project, and 5% growth of the seasonal existing traffic volumes. These volumes were added to the seasonal existing traffic volumes to obtain Near Term traffic volumes.

Figure 7-1 shows the other projects average daily traffic volumes when added to existing traffic. **Figure 7-2** shows the other projects AM/PM peak hour traffic volumes.

The worksheets providing AM/PM peak hour traffic from other approved/pending projects in the area and the calculation for the 5% growth are provided in **Appendix E**.

FIGURE 7-1

Other Projects Average Daily Traffic



XX / XX = AM / PM Peak hour volumes

FIGURE 7-2

Other Projects AM/PM Peak Hour Traffic

8.0 NEAR TERM WITHOUT PROJECT

In order to determine Near Term traffic, USAI followed the methodology outlined in the SANTEC/ITE Guidelines for Traffic Impact Studies. An examination of the immediate area surrounding the project to include projects that were approved, pending approval, or planned in the area and assumed to be constructed and occupied at the project's opening day were evaluated, as discussed in the previous section of this report. Other project traffic volumes were added to the existing traffic to reflect an "existing plus other project" or Near Term scenario.

8.1 STREET SEGMENTS

Figure 8-1 shows average daily traffic volumes from the other projects added to existing average daily traffic volumes.

Table 8-1 shows street segment LOS without project traffic. As shown in the table, all street segments are projected to operate at acceptable levels of service. Via de la Valle was analyzed using the peak hour analysis contained in Chapter 11 of the current HCM and the segment was found to operate at an acceptable LOS D or better.

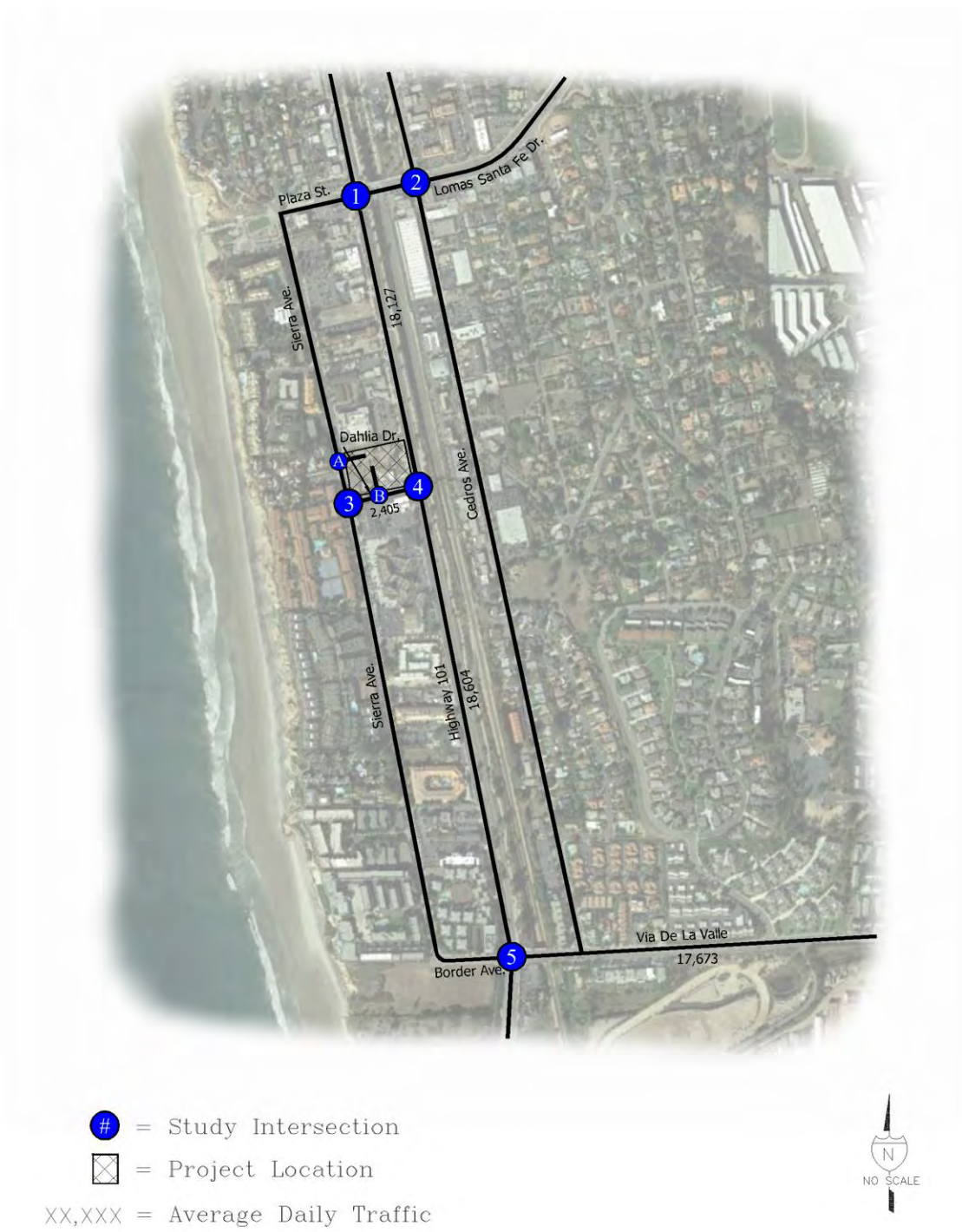


FIGURE 8-1

Near Term Without Project Average Daily Traffic

TABLE 8-1

Near Term Without Project Street Segment Levels of Service

Road	Segment	Standard	# of Ln.	Class.	Cap.	Volume	V/C	LOS
Highway 101	Lomas Santa Fe Drive to Dahlia Drive	SD	4	4-M	40,000	18,127	0.45	B
	Dahlia Drive to Via De La Valle	SD	4	4-M	40,000	18,604	0.47	B
Dahlia Drive	Sierra Avenue to Highway 101	SD	2	2-Cc	8,000	2,405	0.30	A

Legend:

Class. = Functional Class

Cap. = Capacity

Ln. = Lanes

LOS = Level of Service

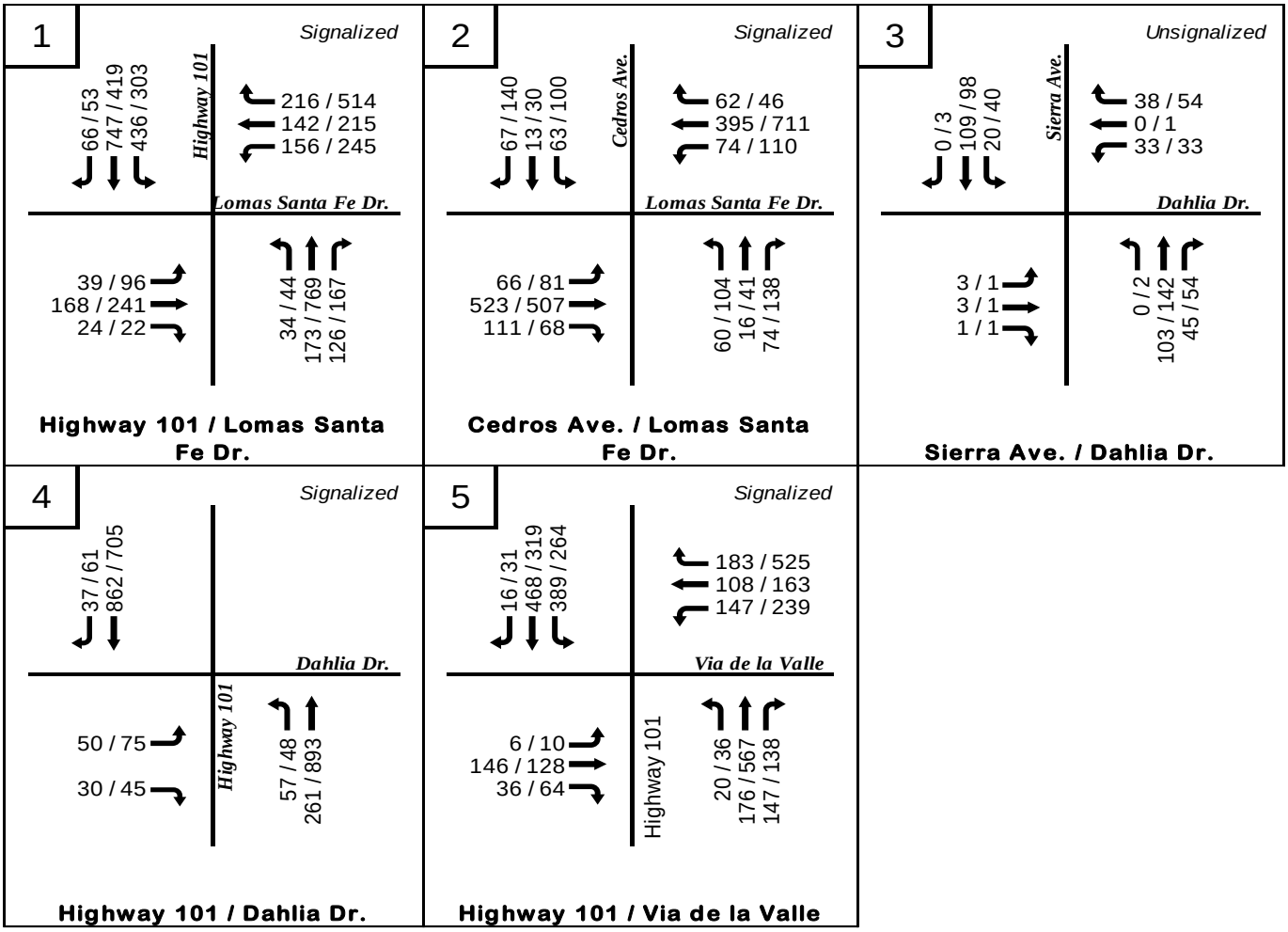
2-Cc = 2 Lane Collector (w/ commercial-industrial property)

4-M = 4 lane major arterial

8.2 INTERSECTIONS

Figure 8-2 shows the peak hour traffic volumes from the other projects when added to existing peak hour volumes at the study area intersections. **Table 8-2** shows the resulting AM and PM peak hour LOS. As shown in **Table 8-2**, all intersections are projected to operate at acceptable levels of service.

Appendix F includes the Near Term Without Project Synchro worksheets.



XX / XX = AM / PM Peak hour volumes

FIGURE 8-2

Near Term Without Project AM/PM Peak Hour Traffic

TABLE 8-2

Near Term Without Project Intersection Levels of Service

Number	Intersection	Control	AM Peak Hour		PM Peak Hour	
			Delay	LOS	Delay	LOS
1	Highway 101 / Lomas Santa Fe Dr.	Signalized	35.4	D	43.5	D
2	Cedros Ave. / Lomas Santa Fe Dr.	Signalized	24.3	C	23.8	C
3	Sierra Ave. / Dahlia Dr.	Unsignalized	8.1	A	8.5	A
4	Highway 101 / Dahlia Dr.	Signalized	9.3	A	9.8	A
5	Highway 101 / Via de la Valle	Signalized	38.6	D	44.7	D

Notes:

Delay = seconds per vehicle

LOS = Level of Service

9.0 NEAR TERM WITH PROJECT

This section of the report evaluates the Near Term With Project traffic conditions by adding the other projects plus the project traffic to existing volumes and evaluating project traffic impacts.

9.1 STREET SEGMENTS

Figure 9-1 shows average daily traffic volumes with project traffic added to existing plus other projects traffic volumes. Via de la Valle was analyzed using the peak hour analysis contained in Chapter 11 of the current HCM and the segment was found to operate at an acceptable LOS D or better.

Table 9-1 shows street segment levels of service with project traffic.

As shown in **Table 9-1**, all street segments analyzed in the study area are projected to operate at acceptable levels of service.

FIGURE 9-1

Near Term With Project Average Daily Traffic

TABLE 9-1

Near Term With Project Street Segment Levels of Service

Road	Segment	Standard	# of Ln.	Class.	Cap.	Volume	V/C	LOS
Highway 101	Lomas Santa Fe Drive to Dahlia Drive	SD	4	4-M	40,000	19,157	0.48	B
	Dahlia Drive to Via De La Valle	SD	4	4-M	40,000	20,164	0.50	B
Dahlia Drive	Sierra Avenue to Highway 101	SD	2	2-Cc	8,000	2,406	0.30	A

Legend:

Class. = Functional Class

Cap. = Capacity

Ln. = Lanes

LOS = Level of Service

2-Cc = 2 Lane Collector (w/ commercial-industrial property)

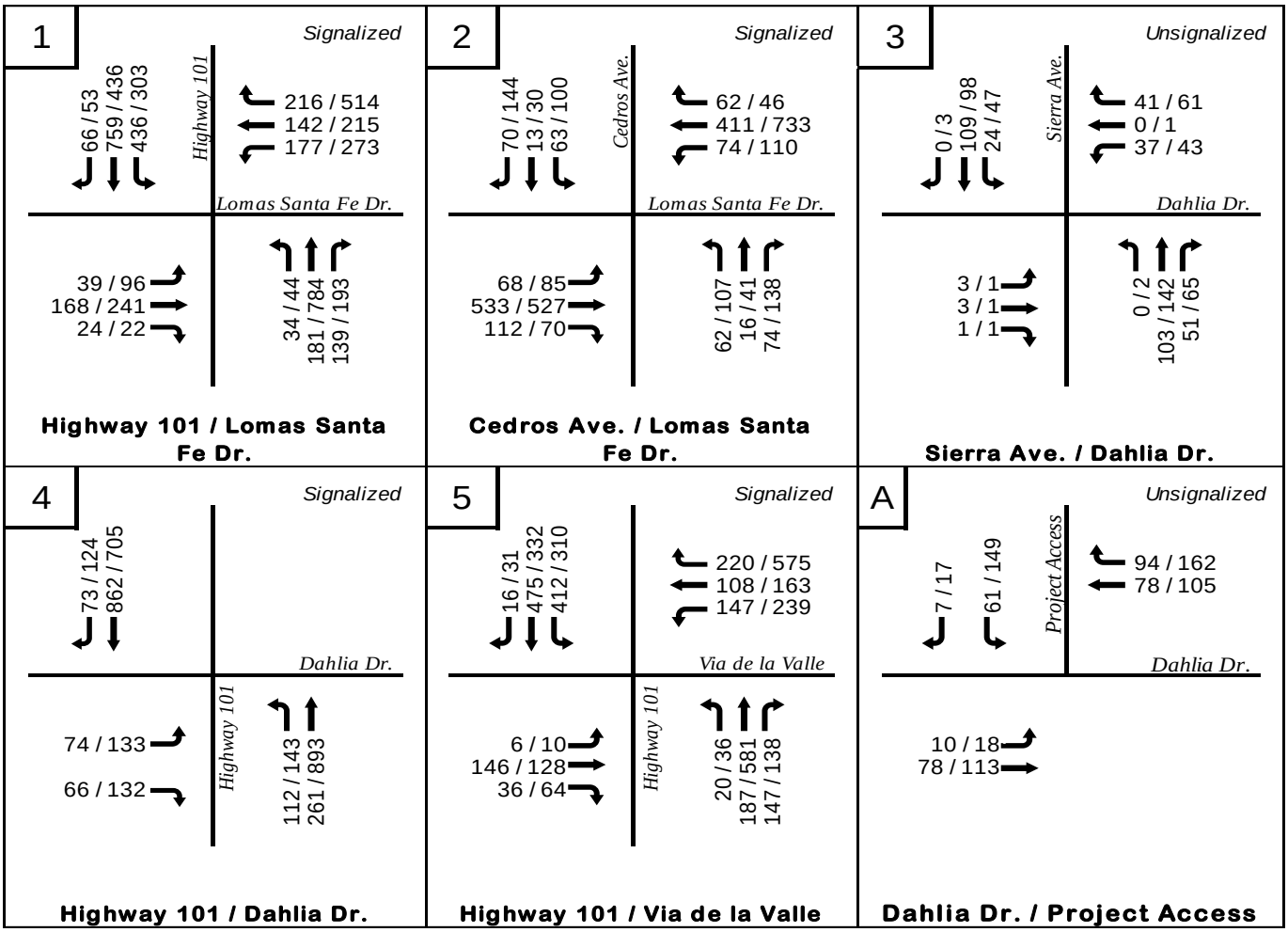
4-M = 4 lane major arterial

9.2 INTERSECTIONS

Figure 9-2 shows existing plus other projects plus project combined traffic volumes during AM/PM peak hours at study area intersections.

Table 9-2 includes study area intersection LOS with the project traffic added. As shown in **Table 9-2**, all intersections show acceptable levels of service.

Appendix G includes the Near Term With Project Synchro worksheets.



XX / XX = AM / PM Peak hour volumes

FIGURE 9-2

Near Term With Project AM/PM Peak Hour Traffic

TABLE 9-2
Near Term With Project Intersection Levels of Service

Number	Intersection	Control	AM Peak Hour		PM Peak Hour	
			Delay	LOS	Delay	LOS
1	Highway 101 / Lomas Santa Fe Dr.	Signalized	35.4	D	43.7	D
2	Cedros Ave. / Lomas Santa Fe Dr.	Signalized	27.4	C	26.9	C
3	Sierra Ave. / Dahlia Dr.	Unsignalized	8.1	A	8.7	A
4	Highway 101 / Dahlia Dr.	Signalized	13.1	B	20	B
5	Highway 101 / Via de la Valle	Signalized	40.7	D	47	D
A	Dahlia Dr./ Project Driveway A	Unsignalized	2.4	A	4	A

Notes:

Delay = seconds per vehicle

LOS = Level of Service

10.0 HORIZON YEAR 2035 WITHOUT PROJECT

This section of the report evaluates the Horizon Year 2035 Without Project condition. The Year 2035 traffic volumes are based on the SANDAG Series 12 model. Traffic volumes from the Year 2035 scenario were compared to near term traffic volumes to verify growth was assumed in the future. If near term traffic volumes exceeded Year 2035 volumes, future (Year 2035) traffic volumes were manually adjusted to reflect the near term volumes which include community growth. Project traffic volumes were then added to the base Year 2035 traffic volumes to obtain Year 2035 With Project traffic volumes.

10.1 STREET SEGMENTS

Street segment volumes for Horizon Year 2035 Without Project are shown in **Figure 10-1**. The street segments LOS for Horizon Year 2035 conditions without the project are shown in **Table 10-1**.

All street segments analyzed in the study area are projected to operate at acceptable levels of service.

FIGURE 10-1

Horizon Year 2035 Without Project Average Daily Traffic

TABLE 10-1

Horizon Year 2035 Without Project Street Segment Levels of Service

Road	Segment	Standard	# of Ln.	Class.	Cap.	Volume	V/C	LOS
Highway 101	Lomas Santa Fe Drive to Dahlia Drive	SD	4	4-M	40,000	24,800	0.62	C
	Dahlia Drive to Via De La Valle	SD	4	4-M	40,000	25,800	0.65	C
Dahlia Drive	Sierra Avenue to Highway 101	SD	2	2-Cc	8,000	3,100	0.39	B

Legend:

Class. = Functional Class

Cap. = Capacity

Ln. = Lanes

LOS = Level of Service

2-Cc = 2 Lane Collector (w/ commercial-industrial property)

4-M = 4 lane major arterial

Notes:

Taken from SANDAG Series 11 Year 2035 traffic model

10.2 INTERSECTIONS

Year 2035 AM/PM peak hour volume worksheets for all study intersections can be found in **Appendix H**.

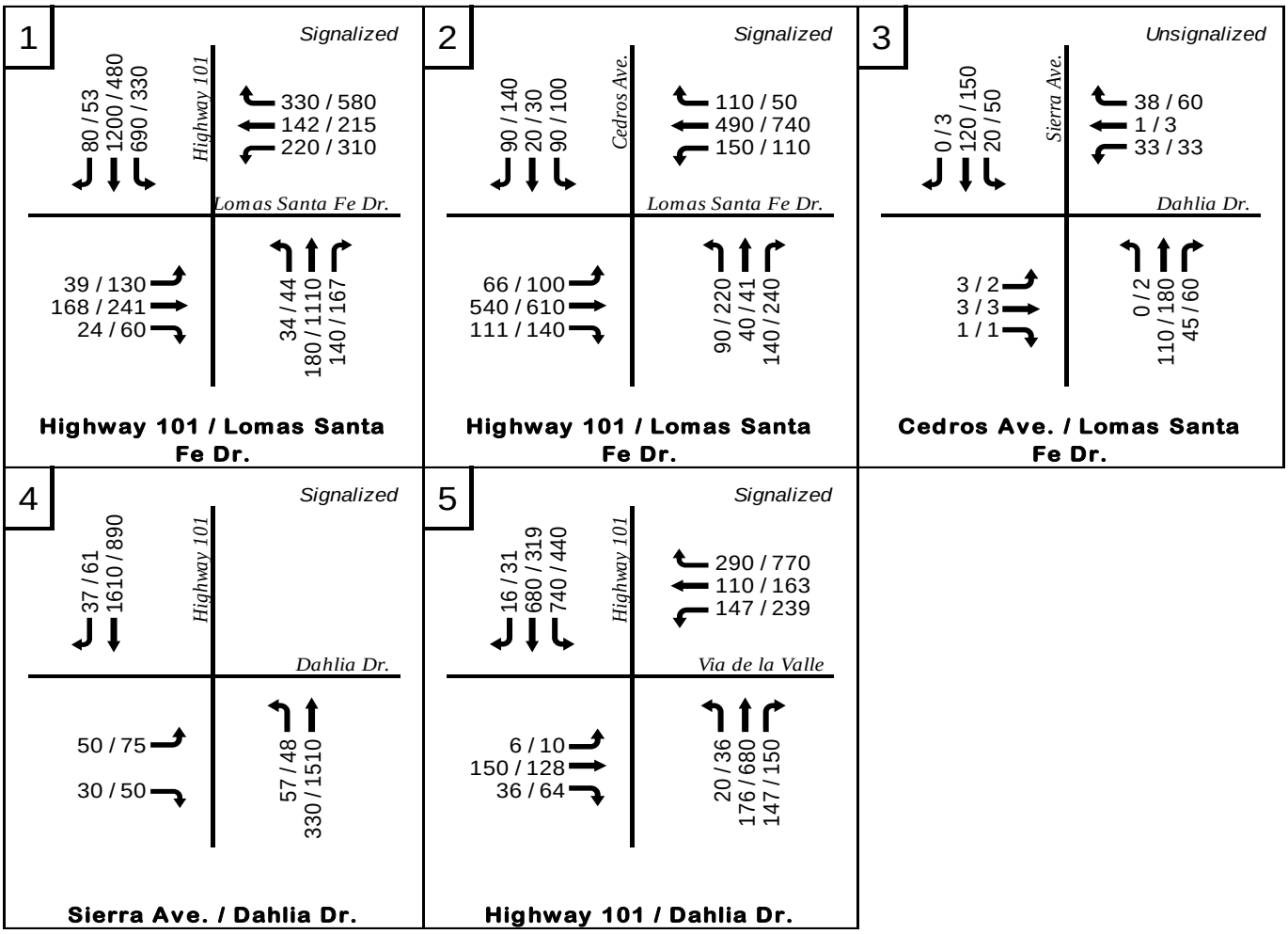
In the future (Year 2035) scenario with and without the project, network changes are assumed with the addition of the proposed Solana 101 project illustrated in **Figure 10-2**.

Figure 10-3 shows the expected Horizon Year 2035 Without Project peak hour volumes at the intersections analyzed.

Table 10-2 shows the AM/PM peak hour intersection levels of service in the Year 2035 scenario. As shown, all intersections are projected to operate at acceptable level of service except for:

- Highway 101 / Lomas Santa Fe Drive LOS E in the PM peak hour

The Synchro worksheets for the Horizon Year 2035 Without Project condition may be found in **Appendix I**.



XX / XX = AM / PM Peak hour volumes

FIGURE 10-2

Horizon Year 2035 Without Project AM/PM Peak Hour Traffic Volumes

TABLE 10-2

Horizon Year 2035 Without Project Intersection Levels of Service

Number	Intersection	Control	AM Peak Hour		PM Peak Hour	
			Delay	LOS	Delay	LOS
1	Highway 101 / Lomas Santa Fe Dr.	Signalized	47.6	D	69.9	E
2	Cedros Ave. / Lomas Santa Fe Dr.	Signalized	24.6	C	25.5	C
3	Sierra Ave. / Dahlia Dr.	Unsignalized	8.2	A	9.2	A
4	Highway 101 / Dahlia Dr.	Signalized	12.5	B	10	B
5	Highway 101 / Via de la Valle	Signalized	40.6	D	45	D

Notes:

LOS = Level of Service

Delay= (sec./veh.)

11.0 HORIZON YEAR 2035 WITH PROJECT

As previously discussed, Year 2035 With Project volumes are based on SANDAG's Series 12 travel forecast. Project traffic was added to the Horizon Year 2035 Without Project volumes to get the Horizon Year 2035 With Project traffic volumes.

11.1 STREET SEGMENTS

Figure 11-1 shows the Horizon Year 2035 With Project street segment traffic volumes.

An analysis was completed for street segments in the Horizon Year 2035 With Project condition based on the network assumptions discussed in the previous section of this report. As shown on **Table 11-1**, all street segments are expected to operate at an acceptable LOS.

FIGURE 11-1

Horizon Year 2035 With Project Average Daily Traffic

TABLE 11-1

Horizon Year 2035 With Project Street Segment Levels of Service

Road	Segment	Standard	# of Ln.	Class.	Cap.	Volume	V/C	LOS
Highway 101	Lomas Santa Fe Drive to Dahlia Drive	SD	4	4-M	40,000	25,830	0.65	C
	Dahlia Drive to Via De La Valle	SD	4	4-M	40,000	27,360	0.68	C
Dahlia Drive	Sierra Avenue to Highway 101	SD	2	2-Cc	8,000	3,101	0.39	B

Legend:

Class. = Functional Class

Cap. = Capacity

Ln. = Lanes

LOS = Level of Service

2-Cc = 2 Lane Collector (w/ commercial-industrial property)

4-M = 4 lane major arterial

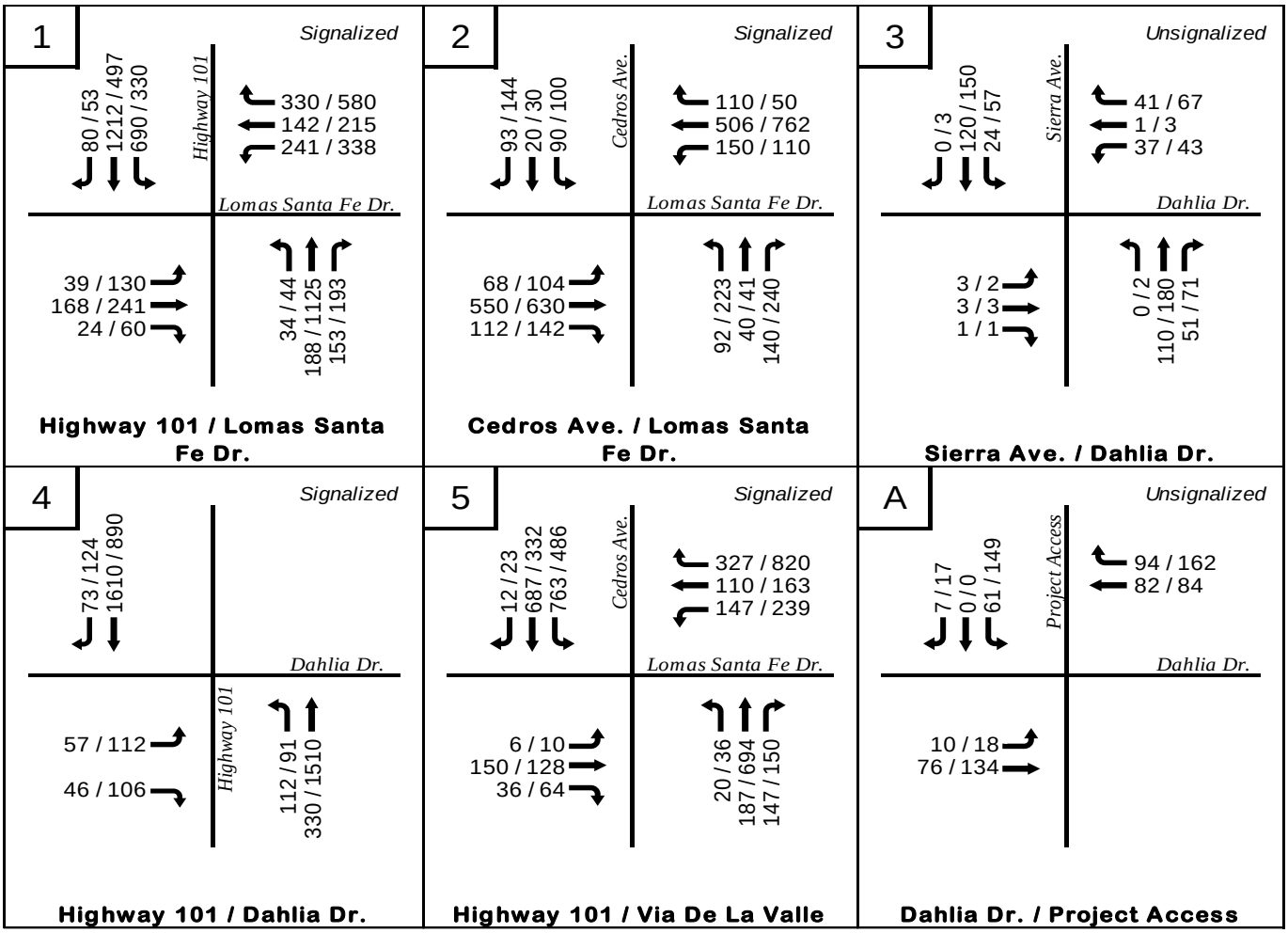
11.2 HORIZON YEAR 2035 WITH PROJECT INTERSECTIONS VOLUMES

Figure 11-2 shows the expected peak hour volumes at Horizon Year 2035 With Project for the intersections analyzed. **Table 11-2** shows the AM and PM peak hour LOS for the Horizon Year 2035 With Project condition.

As shown, all intersections are projected to operate at acceptable levels of service except for:

- Highway 101 / Lomas Santa Fe Drive LOS E in the PM peak

Appendix J includes Synchro worksheets for Horizon Year 2035 With Project condition.



XX / XX = AM / PM Peak hour volumes

FIGURE 11-2

Horizon Year 2035 With Project AM/PM Peak Hour Traffic

TABLE 11-2

Horizon Year 2035 With Project Intersection Levels of Service

Number	Intersection	Control	AM Peak Hour		PM Peak Hour	
			Delay	LOS	Delay	LOS
1	Highway 101 / Lomas Santa Fe Dr.	Signalized	52	D	71.5	E
2	Cedros Ave. / Lomas Santa Fe Dr.	Signalized	39.3	D	35.4	D
3	Sierra Ave. / Dahlia Dr.	Unsignalized	8.2	A	9.4	A
4	Highway 101 / Dahlia Dr.	Signalized	20.5	C	21.1	C
5	Highway 101 / Via de la Valle	Signalized	42	D	50.3	D
A	Dahlia Dr./ Project Driveway A	Unsignalized	2.4	A	4	A

Notes:

LOS = Level of Service

Delay= (sec./veh.)

12.0 PARKING

The project proposes a two-level subterranean parking garage. The two level parking garage serves both the residential and commercial land uses which include the office, retail, and restaurant uses. Parking ratios are based on the City of Solana Beach Municipal Code requirements. As shown in **Table 12-1**, a summary of the parking calculations for the commercial, residential, ADA, motorcycle, and bicycle spaces are provided. The parking required for the commercial uses include 279 parking spaces and residential (with guest spaces) include 62 spaces for a total of 341 parking spaces. The proposed project adequately addresses parking.

TABLE 12-1

Parking Summary Table

Use	Floor Area	Parking Ratio	Parking Required
COMMERCIAL OFFICE:	14,137 G.S.F.	250 s.f / space	57 SPACES
COMMERCIAL RETAIL:	24,284 G.S.F.	225 s.f / space	108 SPACES
COMMERCIAL RESTAURANT / RETAIL:	10,215 G.S.F.	100 s.f / space	102 SPACES
COMMERCIAL SERVICE AREA:	2,626 G.S.F.	225 s.f / space	12 SPACES
SUBTOTAL			279 SPACES
MULTI FAMILY RESIDENTIAL:			
1-BEDROOM	16 D.U.	1.5 spaces / D.U.	24 SPACES
2-BEDROOM	15 D.U.	2 spaces / D.U.	30 SPACES
GUEST PARKING		1 spaces / D.U.	8 SPACES
SUBTOTAL	31 D.U.		62 SPACES
TOTAL OF ALL PARKING REQUIRED			341 SPACES
TOTAL PARKING PROPOSED			341 SPACES

ACCESSIBLE PARKING INCLUDED WITHIN OVERALL PARKING TABULATIONS:

COMMERCIAL:	201-300 SPACES = 7 SPACES = 6 STANDARD SPACES +1 VAN SPACE
RESIDENTIAL:	2% OF 31 D.U. = .62 SPACES = 1 VAN SPACE
RESIDENTIAL GUEST:	5% OF 8 GUEST SPACES = .40 SPACES = 1 VAN SPACE

MOTORCYCLE SPACES:	1% OF 341 SPACES = 3 SPACES
BICYCLE SPACES:	10% OF 279 SPACES = 28 SPACES

13.0 ALTERNATIVE PROJECT ANALYSIS

In addition to the analysis in this report, an analysis was conducted analyzing an alternative project. This alternative project would be constructed on the same project site and would generate fewer trips. The alternative project would consist of 25 Apartments; 45,632 square feet of Standard Commercial Office; 3,000 square feet of High Turnover Restaurant; 9,204 square feet of Quality Restaurant; and 5,331 square feet of Retail. This alternative project would generate approximately 1,167 fewer primary trips. **Table 13-1** shows the trip generation table for this alternative project analysis and a comparison of the net primary trips generated by each project. **Figure 13-1** shows the proposed project site plan for these uses.

American Assets Main Project	Alternative Project
31 Apartments	25 Apartments
24,284 square feet of Specialty Supermarket	5,331 square feet of Retail
14,137 square feet of Standard Commercial Office	45,632 square feet of Standard Commercial Office
5,125 square feet of High Turnover Restaurant	3,000 square feet of High Turnover Restaurant
5,090 square feet of Quality Restaurant	9,204 square feet of Quality Restaurant

A full project analysis of this alternative project was completed and can be found in **Appendix L.**

TABLE 13-1

Alternative Project Trip Generation Table

Proposed Trip Generation											
	ADT with Transit & Mixed-Use Reductions		Vol.		In	Out		Vol.		In	Out
Total Proposed Driveway Trips	1,961		144		116	28		208		93	115
Total Proposed Pass-By Trips	184		8		6	2		23		14	9
Total Proposed Primary Trips	1,777		134		110	26		184		78	106
Existing Trip Generation											
	ADT with Transit & Mixed-Use Reductions		Vol.		In	Out		Vol.		In	Out
Total Existing Driveway Trips	31		4		4	0		4		1	3
Total Existing Pass-By Trips	30		4		4	0		4		1	3
Total Existing Primary Trips	1		0		0	0		0		0	0
NET NEW TRIPS (Proposed - Existing)											
	ADT with Transit & Mixed-Use Reductions		Vol.		In	Out		Vol.		In	Out
Total Net Driveway Trips	1,930		140		112	28		204		92	112
Total Net Pass-By Trips	154		4		2	2		20		14	6
Total Net Primary Trips	1,776		136		110	26		184		78	106

Source:

*Rates are used from SANDAG, "Not so Brief Guide of Vehicular Traffic Generation Rates for San Diego Region", April 2002.

Note:

ADT= Average Daily Trips

KSF = 1,000 Square Feet

DU = Dwelling Units

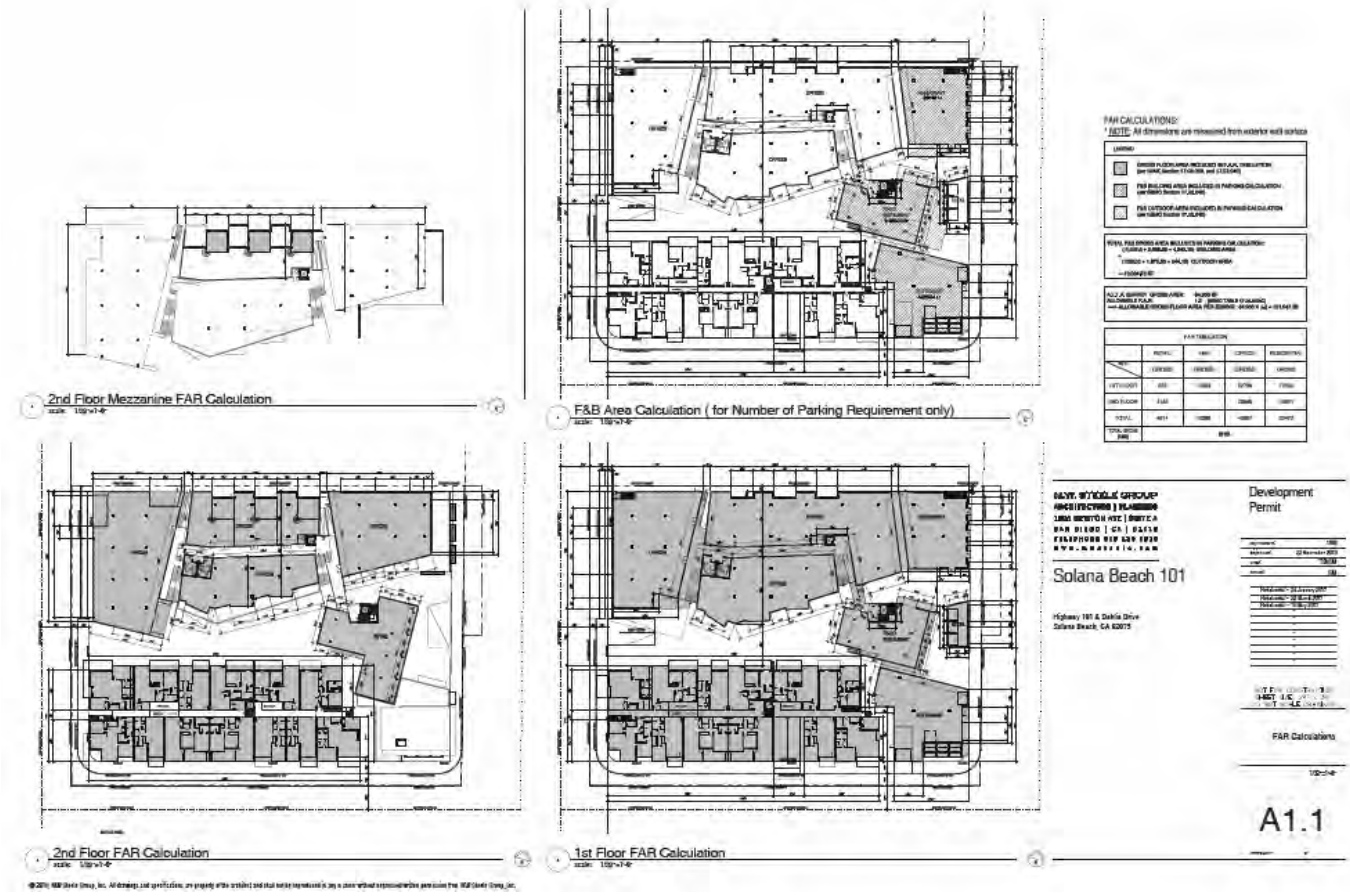
(AM/PM) = AM and PM percentages for primary and pass-by trips

Vol. = Volume

Project ADT Comparison											
	ADT with Transit & Mixed-Use Reductions		Vol.		In	Out		Vol.		In	Out
American Assets Main Project Net Primary Trips	2,943		156		96	60		244		127	117
Alternative Project Net Primary Trips	1,776		136		110	26		184		78	106
Difference (American Assets - Alternative)	1,167		20		-14	34		60		49	11

Figure 13-1

Alternative Project Site Plan



14.0 CONCLUSIONS AND RECOMMENDATIONS

14.1 PROJECT TRIP GENERATION

The proposed Solana 101 project is expected to generate approximately 3,381 average daily vehicle trips with 172 AM (104 in/68 out) peak hour trips and 345 PM (180 in/165 out) peak hour trips.

14.2 EXISTING CONDITIONS

Street Segments:

All street segments are anticipated to operate at LOS "D" or better in the Existing scenario. A more detailed arterial analysis, outlined in Chapter 11 of the HCM, was used for Via De La Valle and the segment was found to operate at an acceptable LOS D or better.

Intersections:

All intersections are expected to operate at LOS "D" or better in the Existing condition.

14.3 EXISTING WITH PROJECT

When project traffic is added to existing traffic, the following results occur.

Street Segments:

All street segments are anticipated to operate at LOS "D" or better in the Existing With Project scenario. A more detailed arterial analysis, outlined in Chapter 11 of the HCM, was used for Via De La Valle and the segment was found to operate at an acceptable LOS D or better.

Intersections:

All intersections are projected to operate at LOS "D" or better in the Existing With Project condition.

14.4 NEAR TERM WITHOUT PROJECT

Street Segments:

All street segments are anticipated to operate at LOS "D" or better in the Near Term Without Project scenario. A more detailed arterial analysis, outlined in Chapter 11 of the HCM, was used for Via De La Valle and the segment was found to operate at an acceptable LOS D or better.

Intersections:

All intersections are projected to operate at LOS "D" or better in Near Term Without Project scenario.

14.5 NEAR TERM WITH PROJECT

When the existing plus the other projects plus the proposed project is added, the following results occur.

Street Segments:

All street segments are projected to operate at LOS "D" or better in the Near Term With Project condition. A more detailed arterial analysis, outlined in Chapter 11 of the HCM, was used for Via De La Valle and the segment was found to operate at an acceptable LOS D or better.

Intersections:

All intersections are projected to operate at LOS "D" or better in this condition with the project.

14.6 DIRECT & CUMULATIVE IMPACTS:

Street Segments:

Table 13-1 shows the summary of the direct impacts in the Existing With Project scenario for street segments within the study area. As shown, there are no significant direct street segment impacts expected as a result of the project. A summary of cumulative impacts in the Near Term With Project scenario for street segments within the study area is shown in **Table 14-2**. As shown, there are no significant direct or short term cumulative street segment impacts expected as a result of the project. Therefore, no mitigation is proposed.

Intersections:

Table 14-3 shows the summary of the direct impacts in the Existing With Project scenario for intersections within the study area. As shown in the table, there are no significant impacts. A summary of cumulative impacts in the Near Term With Project scenario for intersections within the study area are shown in **Table 14-4**. As shown, there are no significant cumulative intersection impacts expected as a result of the project. Therefore, no mitigation is proposed.

TABLE 14-1

Existing With and Without Project Street Segment Significance

Road	Segment	# of Lanes	LOS "E" Capacity	Class.	Existing			Existing + Project			ΔV/C	Is this impact Significant?
					LOS	Volume	V/C	LOS	Volume	V/C		
Highway 101	Lomas Santa Fe Drive to Dahlia Drive	4	40,000	4-M	B	18,127	0.45	B	19,157	0.48	0.026	***NO***
	Dahlia Drive to Via De La Valle	4	40,000	4-M	B	18,604	0.47	B	20,164	0.50	0.039	***NO***
Dahlia Drive	Sierra Avenue to Highway 101	2	8,000	2-Cc	A	2,405	0.30	A	2,406	0.30	0.000	***NO***

Legend:

Class. = Functional Class

LOS = Level of Service

V/C = Volume/Capacity

2-Cc = 2 Lane Collector (w/ commercial-industrial property)

4-M = 4 lane major arterial

TABLE 14-2

Near Term Without and Near Term With Project Street Segment Comparison

Road	Segment	# of Lanes	LOS "E" Capacity	Class.	Near Term			Near Term + Project			ΔV/C	Is this impact Significant?
					LOS	Volume	V/C	LOS	Volume	V/C		
Highway 101	Lomas Santa Fe Drive to Dahlia Drive	4	40,000	4-M	B	18,127	0.45	B	19,157	0.48	0.026	***NO***
	Dahlia Drive to Via De La Valle	4	40,000	4-M	B	18,604	0.47	B	20,164	0.50	0.039	***NO***
Dahlia Drive	Sierra Avenue to Highway 101	2	8,000	2-Cc	A	2,405	0.30	A	2,406	0.30	0.000	***NO***

Legend:

Class. = Functional Class

LOS = Level of Service

V/C = Volume/Capacity

2-Cc = 2 Lane Collector (w/ commercial-industrial property)

4-M = 4 lane major arterial

Existing With and Without Project Arterial Levels of Service

Road	Segment	Direction	Existing				Existing + Project				ΔSpeed (mph) AM	ΔSpeed (mph) PM	Is this impact Significant?
			AM		PM		AM		PM				
			Speed	LOS	Speed	LOS	Speed	LOS	Speed	LOS			
Via de la Valle	Highway 101 to Jimmy Durante Blvd.	Eastbound	18.8	C	16.7	D	18.7	C	16.7	D	0.1	0.0	***NO***
		Westbound	21.7	C	20.5	C	21.7	C	20.5	C	0.0	0.0	***NO***

Legend:

LOS= Level of Service

TABLE 14-3

Existing Without and Existing With Project Intersection Comparison

#	Intersection	Existing				Existing + Project							
		AM Peak Hour		PM Peak Hour		AM Peak Hour		Δ	S ?	PM Peak Hour		Δ	S ?
		D	LOS	D	LOS	D	LOS			D	LOS		
1	Highway 101 / Lomas Santa Fe Dr.	33.9	C	41.3	D	34.0	C	0.1	No	41.5	D	0.2	No
2	Cedros Ave. / Lomas Santa Fe Dr.	24.3	C	23.7	C	24.6	C	0.3	No	23.7	C	0.0	No
3	Sierra Ave. / Dahlia Dr.	8.0	A	8.3	A	8.0	A	0.0	No	8.5	A	0.2	No
4	Highway 101 / Dahlia Dr.	7.2	A	9.0	A	12.9	B	5.7	No	17.9	B	8.9	No
5	Highway 101 / Via de la Valle	31.0	C	35.9	D	31.3	C	0.3	No	42.2	D	6.3	No
A	Dahlia Dr. / Project Diveway A	(1)	(1)	(1)	(1)	2.5	A	N/A	No	4.1	A	N/A	No

Notes:

LOS = Level of Service
Δ = Change
S = Significant
D= Delay
(1) = Current access to be redesigned with proposed project

TABLE 14-4

Near Term Without and Near Term With Project Intersection Comparison

#	Intersection	Near Term				Near Term + Project							
		AM Peak Hour		PM Peak Hour		AM Peak Hour		Δ	S ?	PM Peak Hour		Δ	S ?
		D	LOS	D	LOS	D	LOS			D	LOS		
1	Highway 101 / Lomas Santa Fe Dr.	35.4	D	43.5	D	35.4	D	0.0	No	43.7	D	0.2	No
2	Cedros Ave. / Lomas Santa Fe Dr.	24.3	C	23.8	C	27.4	C	3.1	No	26.9	C	3.1	No
3	Sierra Ave. / Dahlia Dr.	8.1	A	8.5	A	8.1	A	0.0	No	8.7	A	0.2	No
4	Highway 101 / Dahlia Dr.	9.3	A	9.8	A	13.1	B	3.8	No	20.0	B	10.2	No
5	Highway 101 / Via de la Valle	38.6	D	44.7	D	40.7	D	2.1	No	47.0	D	2.3	No
A	Dahlia Dr. / Project Driveway A	(1)	(1)	(1)	(1)	2.4	A	N/A	No	4.0	A	N/A	No

Notes:

LOS = Level of Service
Δ = Change
S = Significant
D= Delay
(1) = Current access to be redesigned with proposed project

Near Term Without and Near Term With Project Arterial Levels of Service

Road	Segment	Direction	Near Term				Near Term + Project				ΔSpeed (mph) AM	ΔSpeed (mph) PM	Is this impact Significant?
			AM		PM		AM		PM				
			Speed	LOS	Speed	LOS	Speed	LOS	Speed	LOS			
Via de la Valle	Highway 101 to Jimmy Durante Blvd.	Eastbound	18.4	C	16.4	D	18.3	C	16.4	D	0.1	0.0	***NO***
		Westbound	21.9	C	20.6	C	21.9	C	20.6	C	0.0	0.0	***NO***

Legend:

LOS= Level of Service

14.7 HORIZON YEAR 2035 WITHOUT PROJECT

When future (Year 2035) traffic volumes without project are evaluated, the following results occur.

Street Segments:

All street segments are projected to operate at LOS "D" or better in the Near Term With Project condition. A more detailed arterial analysis, outlined in Chapter 11 of the HCM, was used for Via De La Valle and the segment was found to operate at an acceptable LOS D or better.

Intersections:

All intersections are projected to operate at LOS "D" or better in this condition without the project except for the following intersections:

- Highway 101 / Lomas Santa Fe Drive LOS E in the PM peak

14.8 HORIZON YEAR 2035 WITH PROJECT

When future traffic volumes including project traffic are evaluated, the following results occur.

Street Segments:

All street segments are projected to operate at LOS "D" or better in the Near Term With Project condition. A more detailed arterial analysis, outlined in Chapter 11 of the HCM, was used for Via De La Valle and the segment was found to operate at an acceptable LOS D or better.

Intersections:

All intersections are projected to operate at LOS "D" or better in this condition with the project except for the following intersections:

- Highway 101 / Lomas Santa Fe Drive LOS E in the PM peak

14.9 CUMULATIVE LONG TERM (YEAR 2035) IMPACTS

Street Segments:

Table 14-5 shows the summary of the cumulative impacts in the Horizon Year 2035 Plus Project scenario for street segments within the study area. As shown, there are no significant street segment impacts as a result of the project, therefore no mitigation is proposed.

Intersections:

Table 14-6 shows the summary of the cumulative impacts in the Horizon Year 2035 plus project scenario for intersections within the study area. As shown, there are no significant impacts expected as the result of project implementation. Therefore, no mitigation is proposed.

TABLE 14-5

Horizon Year 2035 Without and With Project Street Segment Comparison

Road	Segment	# of Lanes	LOS "E" Capacity	Class.	Year 2035			Year 2035 + Project			ΔV/C	Is this impact Significant?
					LOS	Volume	V/C	LOS	Volume	V/C		
Highway 101	Lomas Santa Fe Drive to Dahlia Drive	4	40,000	4-M	C	24,800	0.62	C	25,830	0.65	0.026	***NO***
	Dahlia Drive to Via De La Valle	4	40,000	4-M	C	25,800	0.65	C	27,360	0.68	0.039	***NO***
Dahlia Drive	Sierra Avenue to Highway 101	2	8,000	2-Cc	B	3,100	0.39	B	3,101	0.39	0.000	***NO***

Legend:

Class. = Functional Class

LOS = Level of Service

V/C = Volume/Capacity

2-Cc = 2 Lane Collector (w/ commercial-industrial property)

4-M = 4 lane major arterial

Horizon Year 2035 Without and With Project Arterial Levels of Service

Road	Segment	Direction	Year 2035				Year 2035 + Project				ΔSpeed (mph) AM	ΔSpeed (mph) PM	Is this impact Significant?
			AM		PM		AM		PM				
			Speed	LOS	Speed	LOS	Speed	LOS	Speed	LOS			
Via de la Valle	Highway 101 to Jimmy Durante Blvd.	Eastbound	16.8	D	15.4	D	16.8	D	15.4	D	0.0	0.0	***NO***
		Westbound	21.8	C	20.6	C	21.8	C	20.6	C	0.0	0.0	***NO***

Legend:

LOS= Level of Service

TABLE 14-6

Horizon Year 2035 With and Without Project Intersection Summary

#	Intersection	Year 2035				Year 2035 + Project							
		AM Peak Hour		PM Peak Hour		AM Peak Hour		Δ	S ?	PM Peak Hour		Δ	S ?
		D	LOS	D	LOS	D	LOS			D	LOS		
1	Highway 101 / Lomas Santa Fe Dr.	47.6	D	69.9	E	52.0	D	4.4	No	71.5	E	1.6	No
2	Cedros Ave. / Lomas Santa Fe Dr.	24.6	C	25.5	C	39.3	D	14.7	No	35.4	D	9.9	No
3	Sierra Ave. / Dahlia Dr.	8.2	A	9.2	A	8.2	A	0.0	No	9.4	A	0.2	No
4	Highway 101 / Dahlia Dr.	12.5	B	10.0	B	20.5	C	8.0	No	21.1	C	11.1	No
5	Highway 101 / Via de la Valle	40.6	D	45.0	D	42.0	D	1.4	No	50.3	D	5.3	No
A	Dahlia Dr. / Project Driveway A	(1)	(1)	(1)	(1)	2.4	A	N/A	No	4.0	A	N/A	No

Notes:

LOS = Level of Service
Δ = Change
S = Significant
D= Delay in seconds
(1) = Current access to be redesigned with proposed project

15.0 REFERENCES

SANDAG (San Diego Association of Governments). (Not So) *Brief Guide of Vehicular Traffic Generation Rates for the San Diego Region, April 2002.*

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Transportation Research Board. 2000. *Highway Capacity Manual*. Washington, D.C.: Transportation Research Board.

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This report is site and time specific and is intended for a one-time use for this intended project under the conditions described as "Proposed Project." Any changes or delay in implementation may require re-analysis and re-consideration by the public agency granting approvals. California land development planning involves subjective political considerations as well as frequently re-interpreted principals of law as well as changes in regulations, policies, guidelines and procedures. Urban Systems and their professionals make no warrant, either express or implied, regarding our findings, recommendations, or professional advice as to the ability to successfully accomplish this land development project.

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APPENDIX A

SANDAG Trip generation table

SANDAG Select Zone Forecast Model

ITE Trip Reduction Table and Calculation

(NOTSO)

BRIEF GUIDE OF VEHICULAR TRAFFIC GENERATION RATES FOR THE SAN DIEGO REGION

SANDAG
401 B Street, Suite 800
San Diego, California 92101
(619)595-5300 · Fax (619)595-5305

APRIL 2002

NOTE: This listing only represents a *guide* of average, or estimated, traffic generation "driveway" rates and some very general trip data for land uses (emphasis on acreage and building square footage) in the San Diego region. These rates (both local and national) are subject to change as future documentation becomes available, or as regional sources are updated. For more specific information regarding traffic data and trip rates, please refer to the San Diego Traffic Generators manual. *Always check with local jurisdictions for their preferred or applicable rates.*

LAND USE	TRIP CATEGORIES (PRIMARY:DIVERTED:PASS-BY)[a]	ESTIMATED WEEKDAY VEHICLE TRIP GENERATION RATE (DRIVEWAY)	HIGHEST PEAK HOUR % (plus IN:OUT ratio) Between 6:00-6:30 A.M.		Between 3:00-6:30 P.M.		TRIP LENGTH (Miles)[b]
AGRICULTURE (Open Space)	[80:18:2]	2/acre**					10.8
AIRPORT	[78:20:2]						12.6
Commercial		60/acre, 100/flight, 70/1000 sq. ft.* **	5%	(6:4)	6%	(5:5)	
General Aviation		6/acre, 2/flight, 6/based aircraft* **	0%	(7:3)	15%	(5:5)	
Heliports		100/acre**					
AUTOMOBILE[d]							
Car Wash							
Automatic		800/site, 600/acre**	4%	(5:5)	9%	(5:5)	
Self-serve		100/wash stall**	4%	(6:5)	8%	(6:6)	
Gasoline	[21:51:20]						2.8
with/Food Mart		160/vehicle fueling space**	7%	(6:5)	8%	(5:5)	
with/Food Mart & Car Wash		156/vehicle fueling space**	6%	(5:5)	9%	(5:6)	
Older Service Station Design		160/vehicle fueling space, 800/station**	7%	(5:5)	9%	(5:5)	
Sales (Dealer & Repair)		50/1000 sq. ft., 300/acre, 80/service stall* **	5%	(7:3)	8%	(4:6)	
Auto Repair Center		20/1000 sq. ft., 400/acre, 20/service stall*	0%	(7:3)	11%	(4:6)	
Auto Parts Sales		60/1000 sq. ft.**	4%		10%		
Quick Lube		40/service stall**	7%	(6:4)	10%	(5:5)	
Tire Store		25/1000 sq. ft., 30/service stall**	7%	(6:4)	11%	(5:5)	
CEMETERY		5/acre*					
CHURCH (or Synagogue)	[64:25:11]	9/1000 sq. ft., 30/acre** (quadruple rates for Sunday, or days of assembly)	5%	(6:4)	8%	(5:5)	5.1
COMMERCIAL/RETAIL[e]							
Super Regional Shopping Center (More than 80 acres, more than 800,000 sq. ft., w/usually 3+ major stores)		35/1000 sq. ft.[c] 400/acre*	4%	(7:3)	10%	(5:5)	
Regional Shopping Center (40-80acres, 400,000-800,000 sq. ft., w/usually 2+ major stores)	[64:35:11]	60/1000 sq. ft.[c] 600/acre*	4%	(7:3)	9%	(5:5)	5.2
Community Shopping Center (15-40 acres, 125,000-400,000 sq. ft., w/usually 1 major store, detached restaurant(s), grocery and drugstore)	[47:31:22]	80/1000 sq. ft., 700/acre* **	4%	(6:4)	10%	(5:5)	3.5
Neighborhood Shopping Center (Less than 15 acres, less than 125,000 sq. ft., w/usually grocery & drugstore, cleaners, beauty & barber shop, & fast food services)		120/1000 sq. ft., 1200/acre* **	4%	(6:4)	10%	(5:5)	
Commercial Shops	[45:40:15]						4.3
Specialty Retail/Strip Commercial		40/1000 sq. ft., 400/acre*	3%	(6:4)	9%	(5:5)	
Electronics Superstore		50/1000 sq. ft.**			10%	(5:5)	
Factory Outlet		40/1000 sq. ft.**	3%	(7:3)	9%	(5:5)	
Supermarket		150/1000 sq. ft., 2000/acre* **	4%	(7:3)	10%	(5:5)	
Drugstore		90/1000 sq. ft.**	4%	(6:4)	10%	(5:5)	
Convenience Market (15-16 hours)		500/1000 sq. ft.**	8%	(5:5)	8%	(5:5)	
Convenience Market (24 hours)		700/1000 sq. ft.**	9%	(5:5)	7%	(5:5)	
Convenience Market (w/gasoline pumps)		850/1000 sq. ft., 550/vehicle fueling space**	0%	(5:5)	7%	(5:5)	
Discount Club		60/1000 sq. ft., 600/acre* **	1%	(7:3)	9%	(5:5)	
Discount Store		60/1000 sq. ft., 600/acre**	3%	(6:4)	8%	(5:5)	
Furniture Store		8/1000 sq. ft., 100/acre**	4%	(7:3)	9%	(5:5)	
Lumber Store		30/1000 sq. ft., 150/acre**	7%	(6:4)	9%	(5:5)	
Home Improvement Superstore		40/1000 sq. ft.**	5%	(6:4)	8%	(5:5)	
Hardware/Paint Store		60/1000 sq. ft., 600/acre**	2%	(6:4)	9%	(5:5)	
Garden Nursery		40/1000 sq. ft., 80/acre**	3%	(6:4)	10%	(5:5)	
Mixed Use: Commercial (w/supermarket)/Residential		110/1000 sq. ft., 2000/acre* (commercial only) 5/dwelling unit, 200/acre* (residential only)	3% 9%	(6:4) (3:7)	9% 13%	(5:5) (6:4)	
EDUCATION							
University (4 years)	[91:9:0]	2.4/student, 100 acre*	10%	(8:2)	9%	(3:7)	8.9
Junior College (2 years)	[92:7:1]	1.2/student, 24/1000 sq. ft., 120/acre* **	12%	(8:2)	9%	(6:4)	9.0
High School	[75:19:6]	1.3/student, 15/1000 sq. ft., 60/acre* **	20%	(7:3)	10%	(4:6)	4.8
Middle/Junior High	[63:25:12]	1.4/student, 12/1000 sq. ft. 60/acre**	30%	(6:4)	9%	(4:6)	5.0
Elementary	[67:25:10]	1.6/student, 14/1000 sq. ft., 90/acre* **	32%	(6:4)	9%	(4:6)	3.4
Day Care	[26:58:14]	5/child, 80/1000 sq. ft.**	17%	(5:5)	18%	(5:5)	3.7
FINANCIAL[e]	[35:42:23]						3.4
Bank (Walk in only)		150/1000 sq. ft., 1000/acre* **	4%	(7:3)	8%	(4:8)	
with Drive-Through		200/1000 sq. ft., 1500/acre*	5%	(6:4)	10%	(5:5)	
Drive-Through only		250 (125 one-way)/lane*	3%	(5:5)	13%	(5:5)	
Savings & Loan		60/1000 sq. ft., 800/acre**	2%		9%		
Drive-Through only		100 (50 one-way)/lane**	4%		15%		
HOSPITAL	[73:25:2]						6.3
General		20/bed, 25/1000 sq. ft. 250/acre*	8%	(7:3)	10%	(4:6)	
Convalescent/Nursing		3/bed**	7%	(6:4)	7%	(4:6)	
INDUSTRIAL							
Industrial/Business Park (commercial included)	[79:19:2]	18/1000 sq. ft., 200/acre* **	12%	(8:2)	12%	(2:8)	9.0
Industrial Park (no commercial)		8/1000 sq. ft., 90/acre**	11%	(9:1)	12%	(2:8)	
Industrial Plant (multiple shifts)	[92:5:3]	10/1000 sq. ft., 120/acre*	14%	(8:2)	15%	(3:7)	11.7
Manufacturing/Assembly		4/1000 sq. ft., 50/acre**	19%	(9:1)	20%	(2:8)	
Warehousing		5/1000 sq. ft., 60/acre**	13%	(7:3)	15%	(4:6)	
Storage		2/1000 sq. ft., 0.2/vault, 30/acre*	6%	(5:5)	9%	(5:5)	
Science Research & Development		8/1000 sq. ft., 80/acre*	16%	(9:1)	14%	(1:9)	
Landfill & Recycling Center		6/acre	11%	(5:5)	10%	(4:6)	

(OVER)

MEMBER AGENCIES: Cities of Carlsbad, Chula Vista, Coronado, Del Mar, El Cajon, Encinitas, Escondido, Imperial Beach, La Mesa, Lemon Grove, National City, Oceanside, Poway, San Diego, San Marcos, Santee, Solana Beach, Vista and County of San Diego.
ADVISORY/LIAISON MEMBERS: California Department of Transportation, County Water Authority, U.S. Department of Defense, S.D. Unified Port District and Tijuana/Baja California.

LAND USE	TRIP CATEGORIES (PRIMARY:DIVERTED:PASS-BY)*	ESTIMATED WEEKDAY VEHICLE TRIP GENERATION RATE (DRIVEWAY)	HIGHEST PEAK HOUR % (plus IN:OUT ratio) Between 6:00-9:30 A.M.		Between 3:00-6:30 P.M.		TRIP LENGTH (Miles)[f]
LIBRARY	[44:44:12]	50/1000 sq. ft., 400/acre**	2%	(7:3)	10%	(5:5)	3.0
LODGING	[58:38:4]						7.6
Hotel (w/convention facilities/restaurant)		10/occupied room, 300/acre	6%	(5:4)	8%	(6:4)	
Motel		9/occupied room, 200/acre*	6%	(4:6)	9%	(6:4)	
Resort Hotel		8/occupied room, 100/acre*	5%	(6:4)	7%	(4:6)	
Business Hotel		7/occupied room**	0%	(4:6)	9%	(6:4)	
MILITARY	[82:16:2]	2.5/military & civilian personnel*	9%	(9:1)	10%	(2:8)	11.2
OFFICE							
Standard Commercial Office (less than 100,000 sq. ft.)	[77:19:4]	20/1000 sq. ft.,[a] 300/acre*	14%	(9:1)	13%	(2:8)	8.0
Large (High-Rise) Commercial Office (more than 100,000 sq. ft., 6+ stories)	[82:15:3]	17/1000 sq. ft.,[a] 600/acre*	13%	(9:1)	14%	(2:8)	10.0
Office Park (400,000+ sq. ft.)		12/1000 sq. ft., 200/acre* **	13%	(9:1)	13%	(2:8)	
Single Tenant Office		14/1000 sq. ft., 100/acre*	15%	(9:1)	15%	(2:8)	8.0
Corporate Headquarters		7/1000 sq. ft., 110/acre*	17%	(9:1)	16%	(1:9)	
Government (Civic Center)	[50:34:16]	30/1000 sq. ft.**	9%	(9:1)	12%	(3:7)	6.0
Post Office		80/1000 sq. ft.**	5%		7%		
Central/Walk-In Only		200/1000 sq. ft., 1300/acre*	6%	(6:4)	9%	(5:5)	
Community (w/ mail drop lane)		300/1000 sq. ft., 2000/acre*	7%	(5:5)	10%	(5:5)	
Community (w/mail drop lane)		1500 (750 one-way)/lane*	7%	(5:5)	12%	(5:5)	
Mail Drop Lane only		100/1000 sq. ft., 900/acre**	6%	(6:4)	10%	(4:6)	
Department of Motor Vehicles		50/1000 sq. ft., 500/acre*	6%	(8:2)	11%	(3:7)	6.4
Medical-Dental	[80:30:10]		4%		8%		5.4
PARKS	[66:28:6]						
City (developed w/meeting rooms and sports facilities)		50/acre*	13%	(5:5)	8%	(6:5)	
Regional (developed)		20/acre*					
Neighborhood/County (undeveloped)		5/acre (add for specific sport uses), 8/picnic site* **					
State (average 1000 acres)		1/acre, 10/picnic site**					
Amusement (Theme)		80/acre, 130/acre (summer only)**			6%	(6:4)	
San Diego Zoo		115/acre*					
Sea World		80/acre*					
RECREATION							
Beach, Ocean or Bay	[52:39:9]	600/1000 ft. shoreline, 60/acre*					6.3
Beach, Lake (fresh water)		50/1000 ft. shoreline, 5/acre*					
Bowling Center		30/1000 sq. ft., 300/acre, 30/lane **	7%	(7:3)	11%	(4:6)	
Campground		4/campsite**	4%		8%		
Golf Course		7/acre, 40/hole, 700/course* **	7%	(8:2)	9%	(3:7)	
Driving Range only		70/acre, 14/tee box*	3%	(7:3)	9%	(5:5)	
Marinas		4/berth, 20/acre* **	3%	(3:7)	7%	(6:4)	
Multi-purpose (miniature golf, video arcade, batting cage, etc.)		80/acre	2%		6%		
Racquetball/Health Club		30/1000 sq. ft., 300/acre, 40/court*	4%	(6:4)	9%	(6:4)	
Tennis Courts		10/acre, 30/court**	6%		11%	(5:5)	
Sports Facilities							
Outdoor Stadium		50/acre, 0.2/seat*					
Indoor Arena		30/acre, 0.1/seat*					
Racetrack		40/acre, 0.6 seat*					
Theaters (multiplex w/matinee)	[56:17:17]	80/1000 sq. ft., 1.8/seat, 360/screen*	1/3%		8%	(6:4)	6.1
RESIDENTIAL	[66:11:3]						7.9
Estate, Urban or Rural (average 1-2 DU/acre)		12/dwelling unit*[b]	8%	(3:7)	10%	(7:3)	
Single Family Detached (average 3-6 DU/acre)		10/dwelling unit*[b]	8%	(3:7)	10%	(7:3)	
Condominium (or any multi-family 6-20 DU/acre)		8/dwelling unit*[b]	6%	(2:8)	10%	(7:3)	
Apartment (or any multi-family units more than 20 DU/acre)		8/dwelling unit*[b]	6%	(2:8)	9%	(7:3)	
Military Housing (off base, multi-family)							
(less than 6 DU/acre)		8/dwelling unit	7%	(3:7)	9%	(6:4)	
(6-20 DU/acre)		6/dwelling unit	7%	(3:7)	9%	(6:4)	
Mobile Home							
Family		5/dwelling unit, 40/acre*	8%	(3:7)	11%	(6:4)	
Adults Only		3/dwelling unit, 20/acre*	9%	(3:7)	10%	(6:4)	
Retirement Community		4/dwelling unit**	5%	(4:6)	7%	(6:4)	
Congregate Care Facility		2.5/dwelling unit**	4%	(6:4)	6%	(5:5)	
RESTAURANT[c]	[51:37:12]						4.7
Quality		100/1000 sq. ft., 3/seat, 600/acre* **	1%	(6:4)	8%	(7:3)	
Sit-down, high turnover		160/1000 sq. ft., 6/seat, 1000/acre* **	8%	(5:5)	8%	(6:4)	
Fast Food (w/drive-through)		650/1000 sq. ft., 20/seat, 3000/acre* **	7%	(5:5)	7%	(6:5)	
Fast Food (without drive-through)		700/1000 sq. ft.**	5%	(6:4)	7%	(5:5)	
Delicatessen (7am-4pm)		150/1000 sq. ft., 11/seat*	9%	(6:4)	3%	(3:7)	
TRANSPORTATION							
Bus Depot		25/1000 sq. ft.**					
Truck Terminal		10/1000 sq. ft., 7/bay, 80/acre**	9%	(4:6)	8%	(5:5)	
Waterport/Marine Terminal		170/berth, 12/acre**					
Transit Station (Light Rail w/parking)		300/acre, 2[1/3]/parking space (4/occupied]**	14%	(7:3)	15%	(3:7)	
Park & Ride Lots		400/acre (800/paved acre), 5/parking space (8/occupied)* **	14%	(7:3)	15%	(3:7)	

* Primary source: *San Diego Traffic Generators.*

** Other sources: *ITE Trip Generation Report (4th Edition)*, Trip Generation Rates (other agencies and publications), various SANDAG & CALTRANS studies, reports and estimates

[a] Trip category percentage ratios are daily from local household surveys, often cannot be applied to very specific land uses, and do not include non-resident drivers
(draft SANDAG *Analysis of Trip Diversion*, revised November, 1990):
PRIMARY - one trip directly between origin and primary destination.
DIVERTED - linked trip (having one or more stops along the way to a primary destination) where distance compared to direct distance ≥ 1 mile.
PASS-BY - undiverted or diverted < 1 mile.

[b] Trip lengths are average weighted for all trips to and from general land use site. (All trips system-wide average length = 6.9 miles)

[c] Fitted curve equation: $Ln(T) = 0.602\ Ln(x) + 6.845$ } T = total trips, x = 1,000 sq. ft.

[d] Fitted curve equation: $Ln(T) = 0.756\ Ln(x) + 3.950$ }

[e] Fitted curve equation: $t = -2.159\ Ln(d) + 12.05$ t = trips/DU, d = density (DU/acre), DU = dwelling unit

[f] Suggested PASS-BY (undiverted or diverted <1 mile) percentages for trip rate reductions only during P.M. peak period (based on combination of local data/review and Other sources**):

COMMERCIAL/RETAIL	
Regional Shopping Center	20%
Community " "	30%
Neighborhood " "	40%
Specialty Retail/Strip Commercial (other)	10%
Supermarket	40%
Convenience Market	50%
Discount Club/Store	30%
FINANCIAL	
Bank	25%
AUTOMOBILE	
Gasoline Station	60%
RESTAURANT	
Quality	10%
Sit-down high turnover	20%
Fast Food	40%

[g] Trip Reductions - In order to help promote regional "smart growth" policies, and acknowledge San Diego's expanding mass transit system, consider vehicle trip rate reductions (with proper documentation and necessary adjustments for peak periods). The following are some examples:

(1) A 5% daily trip reduction for land uses with transit access or near transit stations accessible within 1/4 mile.

(2) Up to 10% daily trip reduction for mixed-use developments where residential and commercial retail are combined (demonstrate mode split of walking trips to replace vehicular trips).

SANDAG
Series 12

Solana GP Updates
2035rc11b Follow Up

TAZ 4704

Select Zone Plot

Functional Classifications

- Freeway
- Prime
- Major
- Collector
- Light Collector
- Rural Collector
- Local
- Freeway Ramp
- Local Ramp
- Zone Connector

Traffic Analysis Zones

Select Volumes & Percentage

Unadjusted ADT(x1000)

N

0 0.05 0.1 0.15
Miles

SANDAG

servicebureau

NCHRP 684 Internal Trip Capture Estimation Tool			
Project Name:	Solana 101	**Organization:**	USAI
Project Location:	Dahlia Dr. / Highway 101	**Performed By:**	Henryk Pedersen
Scenario Description:		**Date:**	9/14/2015
Analysis Year:		**Checked By:**	
Analysis Period:	**AM Street Peak Hour**	**Date:**	

Table 1-A: Base Vehicle-Trip Generation Estimates (Single-Use Site Estimate)

Land Use	Development Data (*For Information Only*)			Estimated Vehicle-Trips[3]		
	ITE LUCs[1]	Quantity	Units	Total	Entering	Exiting
Office	701	14,137	SF	40	36	4
Retail	850	24,284	SF	80	48	32
Restaurant	931 / 932	10,215	SF	71	36	35
Cinema/Entertainment				0		
Residential	221	31	DU	14	4	10
Hotel				0		
All Other Land Uses[2]				0		
				205	124	81

Table 2-A: Mode Split and Vehicle Occupancy Estimates

Land Use	Entering Trips			Exiting Trips		
	Veh. Occ.[4]	% Transit	% Non-Motorized	Veh. Occ.[4]	% Transit	% Non-Motorized
Office	1.00	8%	4%	1.00	8%	4%
Retail						
Restaurant						
Cinema/Entertainment						
Residential	1.00	3%	16%	1.00	3%	16%
Hotel						
All Other Land Uses[2]						

Table 3-A: Average Land Use Interchange Distances (Feet Walking Distance)

Origin (From)	Destination (To)					
	Office	Retail	Restaurant	Cinema/Entertainment	Residential	Hotel
Office						
Retail						
Restaurant						
Cinema/Entertainment						
Residential						
Hotel						

Table 4-A: Internal Person-Trip Origin-Destination Matrix*

Origin (From)	Destination (To)					
	Office	Retail	Restaurant	Cinema/Entertainment	Residential	Hotel
Office		1	2	0	0	0
Retail	1		4	0	0	0
Restaurant	5	4		0	0	0
Cinema/Entertainment	0	0	0		0	0
Residential	0	0	2	0		0
Hotel	0	0	0	0	0	

Table 5-A: Computations Summary

	Total	Entering	Exiting
All Person-Trips	205	124	81
Internal Capture Percentage	19%	15%	23%
External Vehicle-Trips[5]	162	101	61
External Transit-Trips[6]	2	2	0
External Non-Motorized Trips[6]	3	2	1

Table 6-A: Internal Trip Capture Percentages by Land Use

Land Use	Entering Trips	Exiting Trips
Office	17%	75%
Retail	10%	16%
Restaurant	22%	26%
Cinema/Entertainment	N/A	N/A
Residential	0%	20%
Hotel	N/A	N/A

[1]Land Use Codes (LUCs) from *Trip Generation Manual*, published by the Institute of Transportation Engineers.

[2]Total estimate for all other land uses at mixed-use development site is not subject to internal trip capture computations in this estimator.

[3]Enter trips assuming no transit or non-motorized trips (as assumed in ITE *Trip Generation Manual*).

[4]Enter vehicle occupancy assumed in Table 1-A vehicle trips. If vehicle occupancy changes for proposed mixed-use project, manual adjustments must be made to Tables 5-A, 9-A (O and D). Enter transit, non-motorized percentages that will result with proposed mixed-use project complete.

[5]Vehicle-trips computed using the mode split and vehicle occupancy values provided in Table 2-A.

[6]Person-Trips

*Indicates computation that has been rounded to the nearest whole number.

Estimation Tool Developed by the Texas A&M Transportation Institute - Version 2013.1

Project Name:	Solana 101
Analysis Period:	**AM Street Peak Hour**

Table 7-A: Conversion of Vehicle-Trip Ends to Person-Trip Ends

Land Use	Table 7-A (D): Entering Trips			Table 7-A (O): Exiting Trips		
	Veh. Occ.	Vehicle-Trips	Person-Trips*	Veh. Occ.	Vehicle-Trips	Person-Trips*
Office	1.00	36	36	1.00	4	4
Retail	1.00	48	48	1.00	32	32
Restaurant	1.00	36	36	1.00	35	35
Cinema/Entertainment	1.00	0	0	1.00	0	0
Residential	1.00	4	4	1.00	10	10
Hotel	1.00	0	0	1.00	0	0

Table 8-A (O): Internal Person-Trip Origin-Destination Matrix (Computed at Origin)

Origin (From)	Destination (To)					
	Office	Retail	Restaurant	Cinema/Entertainment	Residential	Hotel
Office		1	3	0	0	0
Retail	9		4	0	4	0
Restaurant	11	5		0	1	1
Cinema/Entertainment	0	0	0		0	0
Residential	0	0	2	0		0
Hotel	0	0	0	0	0	

Table 8-A (D): Internal Person-Trip Origin-Destination Matrix (Computed at Destination)

Origin (From)	Destination (To)					
	Office	Retail	Restaurant	Cinema/Entertainment	Residential	Hotel
Office		15	8	0	0	0
Retail	1		18	0	0	0
Restaurant	5	4		0	0	0
Cinema/Entertainment	0	0	0		0	0
Residential	1	8	7	0		0
Hotel	1	2	2	0	0	

Table 9-A (D): Internal and External Trips Summary (Entering Trips)

Destination Land Use	Person-Trip Estimates			External Trips by Mode*		
	Internal	External	Total	Vehicles[1]	Transit[2]	Non-Motorized[2]
Office	6	30	36	27	2	1
Retail	5	43	48	43	0	0
Restaurant	8	28	36	28	0	0
Cinema/Entertainment	0	0	0	0	0	0
Residential	0	4	4	3	0	1
Hotel	0	0	0	0	0	0
All Other Land Uses[3]	0	0	0	0	0	0

Table 9-A (O): Internal and External Trips Summary (Exiting Trips)

Origin Land Use	Person-Trip Estimates			External Trips by Mode*		
	Internal	External	Total	Vehicles[1]	Transit[2]	Non-Motorized[2]
Office	3	1	4	1	0	0
Retail	5	27	32	27	0	0
Restaurant	9	26	35	26	0	0
Cinema/Entertainment	0	0	0	0	0	0
Residential	2	8	10	7	0	1
Hotel	0	0	0	0	0	0
All Other Land Uses[3]	0	0	0	0	0	0

[1]Vehicle-trips computed using the mode split and vehicle occupancy values provided in Table 2-A

[2]Person-Trips

[3]Total estimate for all other land uses at mixed-use development site is not subject to internal trip capture computations in this estimator

*Indicates computation that has been rounded to the nearest whole number.

NCHRP 684 Internal Trip Capture Estimation Tool			
Project Name:	Solana 101	**Organization:**	USAI
Project Location:	Dahlia Dr. / Highway 101	**Performed By:**	Henryk Pedersen
Scenario Description:		**Date:**	9/14/2015
Analysis Year:		**Checked By:**	
Analysis Period:	**PM Street Peak Hour**	**Date:**	

Table 1-P: Base Vehicle-Trip Generation Estimates (Single-Use Site Estimate)

Land Use	Development Data (*For Information Only*)			Estimated Vehicle-Trips[3]		
	ITE LUCs[1]	Quantity	Units	Total	Entering	Exiting
Office				36	7	29
Retail				240	120	120
Restaurant				106	68	38
Cinema/Entertainment				0		
Residential				20	12	8
Hotel				0		
All Other Land Uses[2]				0		
				402	207	195

Table 2-P: Mode Split and Vehicle Occupancy Estimates

Land Use	Entering Trips			Exiting Trips		
	Veh. Occ.[4]	% Transit	% Non-Motorized	Veh. Occ.[4]	% Transit	% Non-Motorized
Office	1.00	8%	4%	1.00	8%	4%
Retail						
Restaurant						
Cinema/Entertainment						
Residential	1.00	3%	16%	1.00	3%	16%
Hotel						
All Other Land Uses[2]						

Table 3-P: Average Land Use Interchange Distances (Feet Walking Distance)

Origin (From)	Destination (To)					
	Office	Retail	Restaurant	Cinema/Entertainment	Residential	Hotel
Office		260	260		260	
Retail					260	
Restaurant					260	
Cinema/Entertainment						
Residential		260	260			
Hotel						

Table 4-P: Internal Person-Trip Origin-Destination Matrix*

Origin (From)	Destination (To)					
	Office	Retail	Restaurant	Cinema/Entertainment	Residential	Hotel
Office		6	1	0	0	0
Retail	2		20	0	6	0
Restaurant	1	16		0	2	0
Cinema/Entertainment	0	0	0		0	0
Residential	0	3	2	0		0
Hotel	0	0	0	0	0	

Table 5-P: Computations Summary

	Total	Entering	Exiting
All Person-Trips	402	207	195
Internal Capture Percentage	29%	29%	30%
External Vehicle-Trips[5]	280	147	133
External Transit-Trips[6]	2	0	2
External Non-Motorized Trips[6]	2	1	1

Table 6-P: Internal Trip Capture Percentages by Land Use

Land Use	Entering Trips	Exiting Trips
Office	43%	24%
Retail	21%	23%
Restaurant	34%	50%
Cinema/Entertainment	N/A	N/A
Residential	67%	63%
Hotel	N/A	N/A

[1]Land Use Codes (LUCs) from *Trip Generation Manual*, published by the Institute of Transportation Engineers.

[2]Total estimate for all other land uses at mixed-use development site is not subject to internal trip capture computations in this estimator.

[3]Enter trips assuming no transit or non-motorized trips (as assumed in ITE *Trip Generation Manual*).

[4]Enter vehicle occupancy assumed in Table 1-P vehicle trips. If vehicle occupancy changes for proposed mixed-use project, manual adjustments must be

[5]Vehicle-trips computed using the mode split and vehicle occupancy values provided in Table 2-P.

[6]Person-Trips

*Indicates computation that has been rounded to the nearest whole number.

Estimation Tool Developed by the Texas A&M Transportation Institute - Version 2013.1

Project Name:	Solana 101
Analysis Period:	**PM Street Peak Hour**

Table 7-P: Conversion of Vehicle-Trip Ends to Person-Trip Ends

Land Use	Table 7-P (D): Entering Trips			Table 7-P (O): Exiting Trips		
	Veh. Occ.	Vehicle-Trips	Person-Trips*	Veh. Occ.	Vehicle-Trips	Person-Trips*
Office	1.00	7	7	1.00	29	29
Retail	1.00	120	120	1.00	120	120
Restaurant	1.00	68	68	1.00	38	38
Cinema/Entertainment	1.00	0	0	1.00	0	0
Residential	1.00	12	12	1.00	8	8
Hotel	1.00	0	0	1.00	0	0

Table 8-P (O): Internal Person-Trip Origin-Destination Matrix (Computed at Origin)

Origin (From)	Destination (To)					
	Office	Retail	Restaurant	Cinema/Entertainment	Residential	Hotel
Office		6	1	0	1	0
Retail	2		35	5	31	6
Restaurant	1	16		3	7	3
Cinema/Entertainment	0	0	0		0	0
Residential	0	3	2	0		0
Hotel	0	0	0	0	0	

Table 8-P (D): Internal Person-Trip Origin-Destination Matrix (Computed at Destination)

Origin (From)	Destination (To)					
	Office	Retail	Restaurant	Cinema/Entertainment	Residential	Hotel
Office		9	1	0	0	0
Retail	2		20	0	6	0
Restaurant	2	60		0	2	0
Cinema/Entertainment	0	5	2		0	0
Residential	4	12	9	0		0
Hotel	0	2	3	0	0	

Table 9-P (D): Internal and External Trips Summary (Entering Trips)

Destination Land Use	Person-Trip Estimates			External Trips by Mode*		
	Internal	External	Total	Vehicles[1]	Transit[2]	Non-Motorized[2]
Office	3	4	7	4	0	0
Retail	25	95	120	95	0	0
Restaurant	23	45	68	45	0	0
Cinema/Entertainment	0	0	0	0	0	0
Residential	8	4	12	3	0	1
Hotel	0	0	0	0	0	0
All Other Land Uses[3]	0	0	0	0	0	0

Table 9-P (O): Internal and External Trips Summary (Exiting Trips)

Origin Land Use	Person-Trip Estimates			External Trips by Mode*		
	Internal	External	Total	Vehicles[1]	Transit[2]	Non-Motorized[2]
Office	7	22	29	19	2	1
Retail	28	92	120	92	0	0
Restaurant	19	19	38	19	0	0
Cinema/Entertainment	0	0	0	0	0	0
Residential	5	3	8	3	0	0
Hotel	0	0	0	0	0	0
All Other Land Uses[3]	0	0	0	0	0	0

[1]Vehicle-trips computed using the mode split and vehicle occupancy values provided in Table 2-P

[2]Person-Trips

[3]Total estimate for all other land uses at mixed-use development site is not subject to internal trip capture computations in this estimator

*Indicates computation that has been rounded to the nearest whole number.

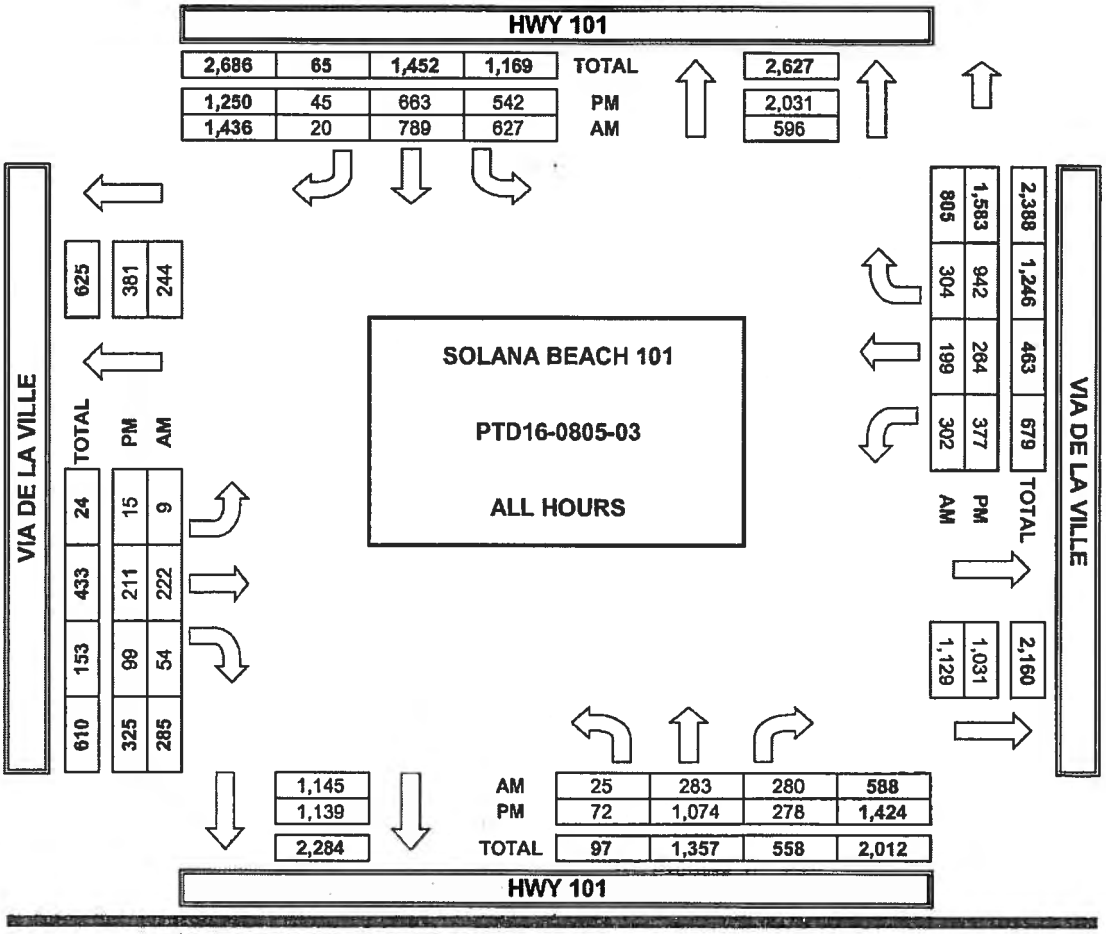
APPENDIX B

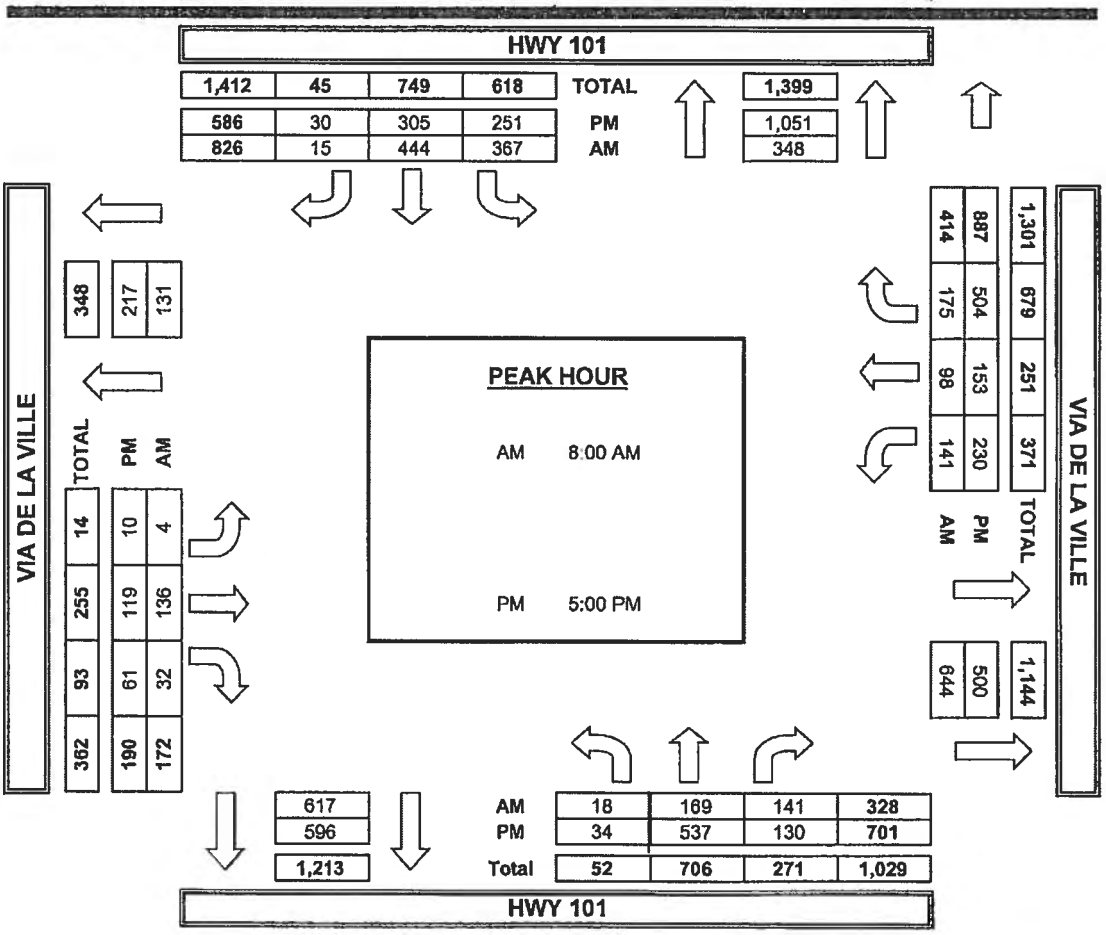
EXISTING TRAFFIC COUNTS

PEMS GRAPH + DATA

PACIFIC TECHNICAL DATA

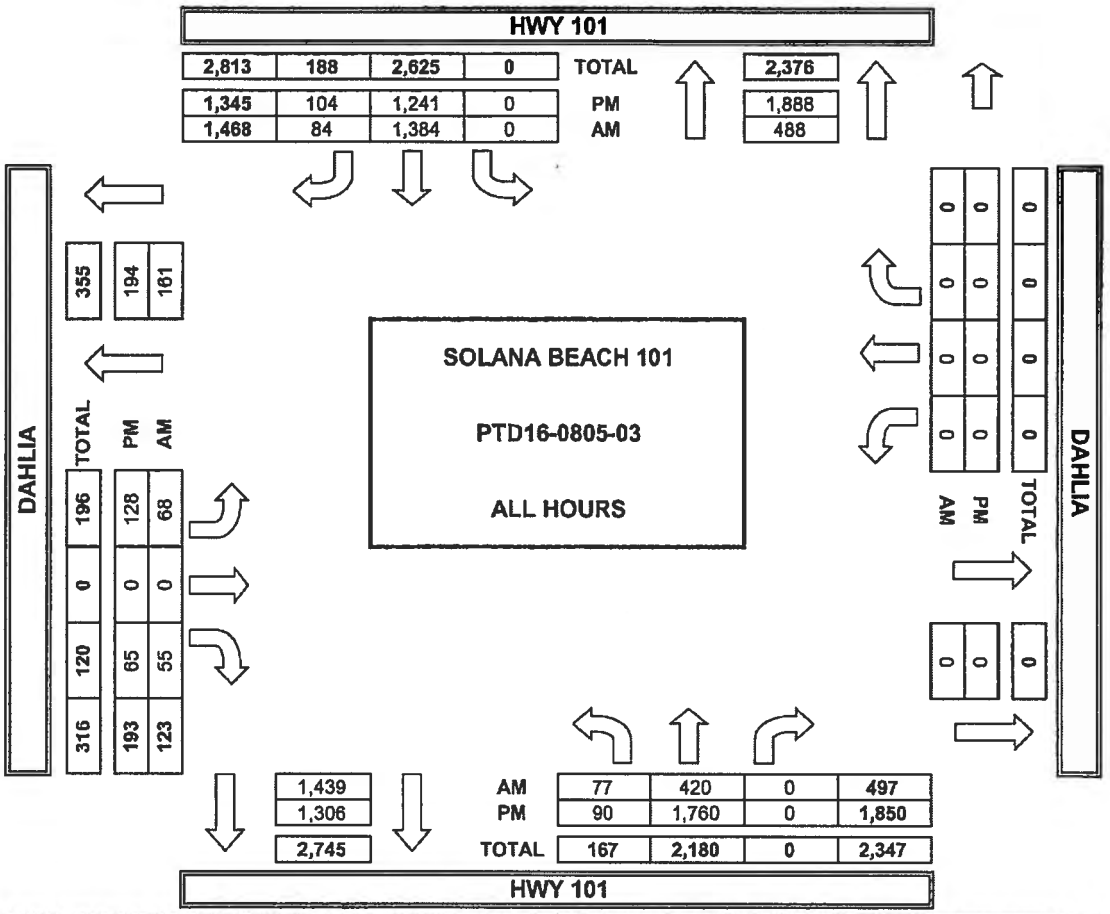
TURNING MOVEMENT COUNTS

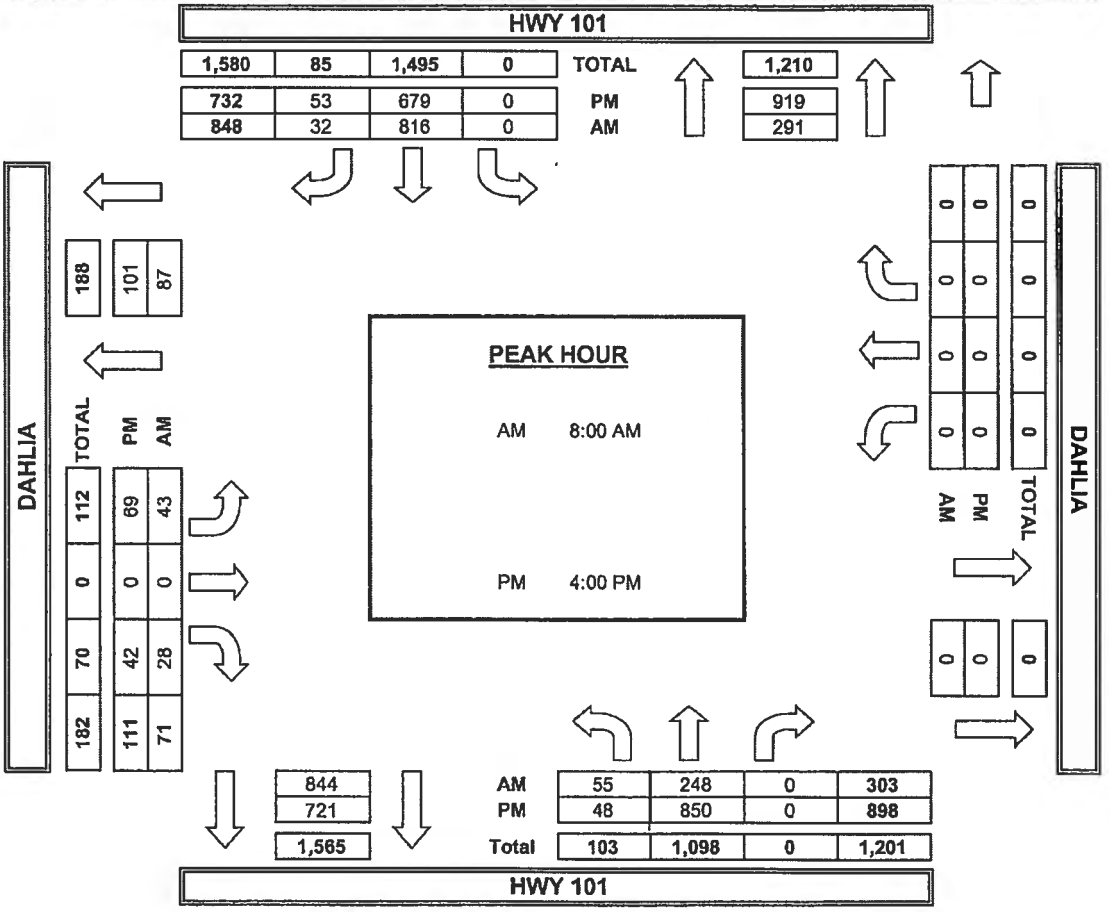




PACIFIC TECHNICAL DATA

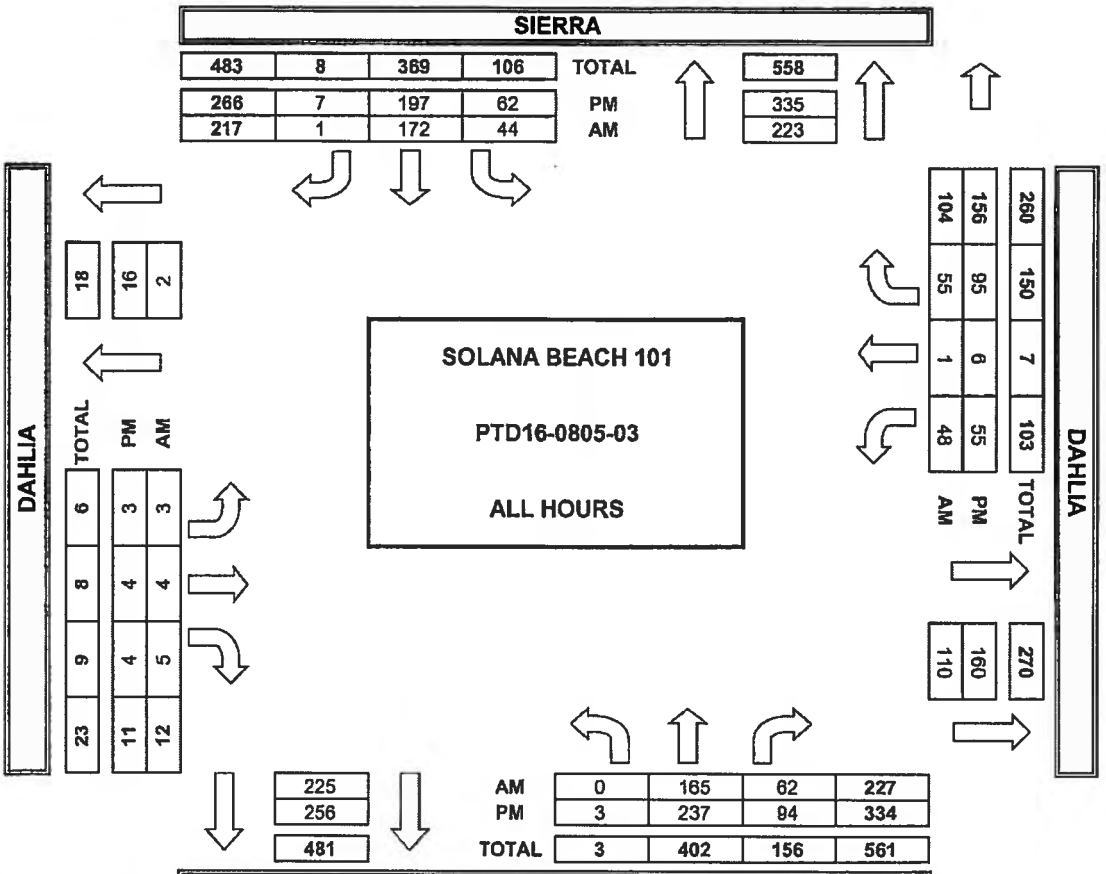
TURNING MOVEMENT COUNTS

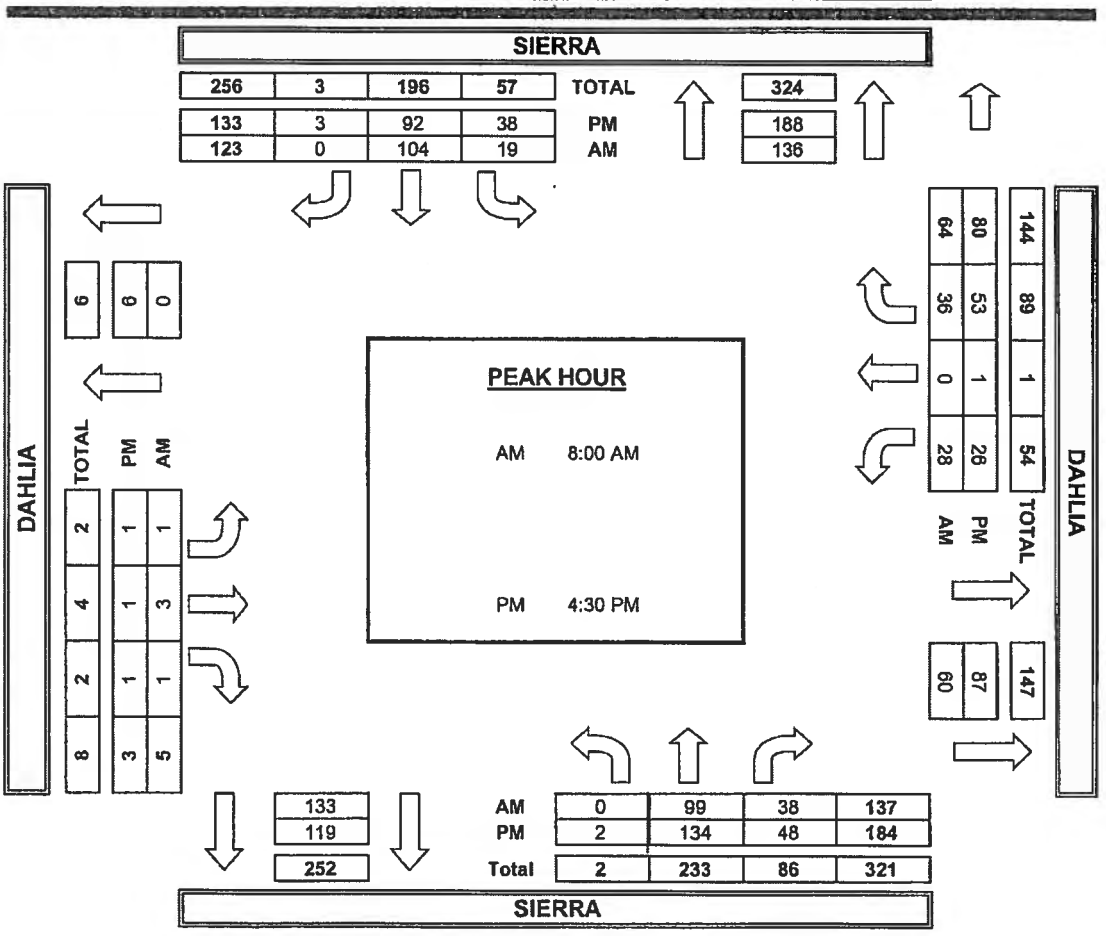




PACIFIC TECHNICAL DATA

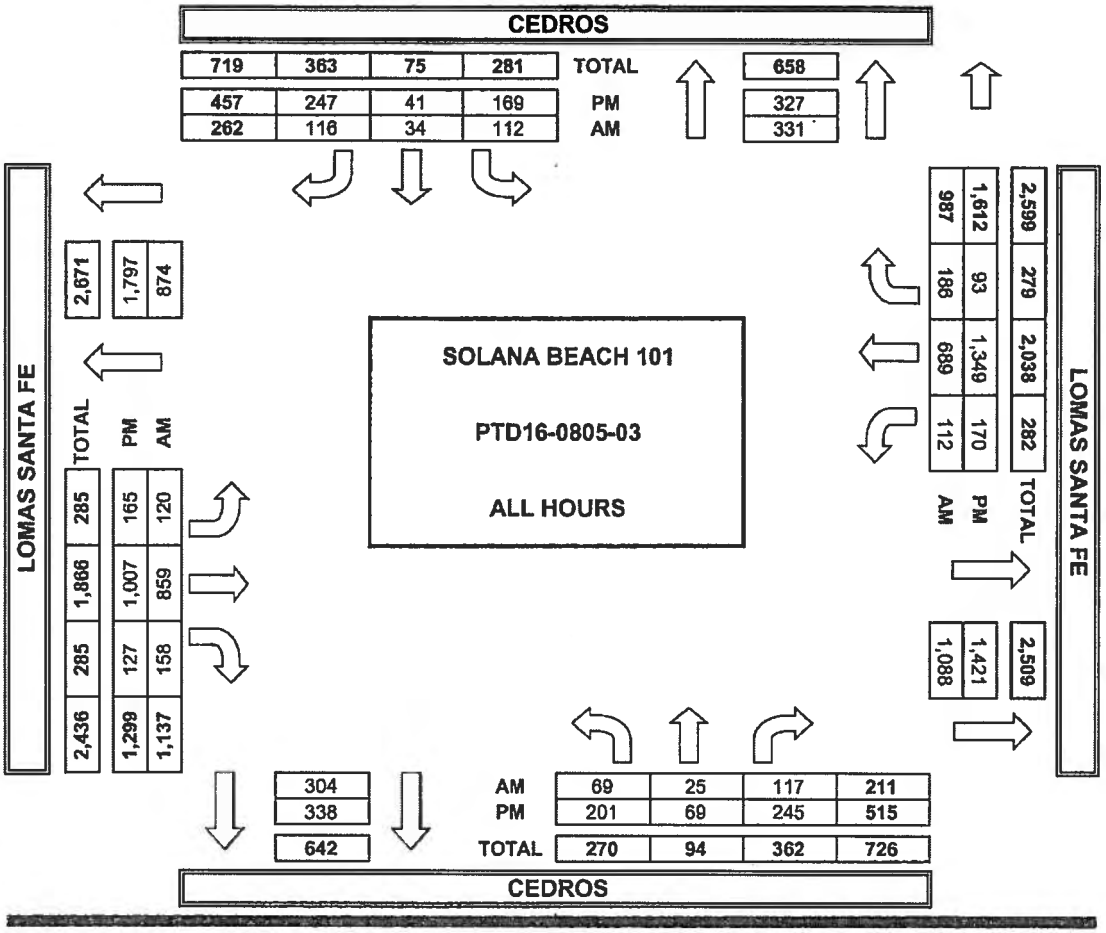
TURNING MOVEMENT COUNTS

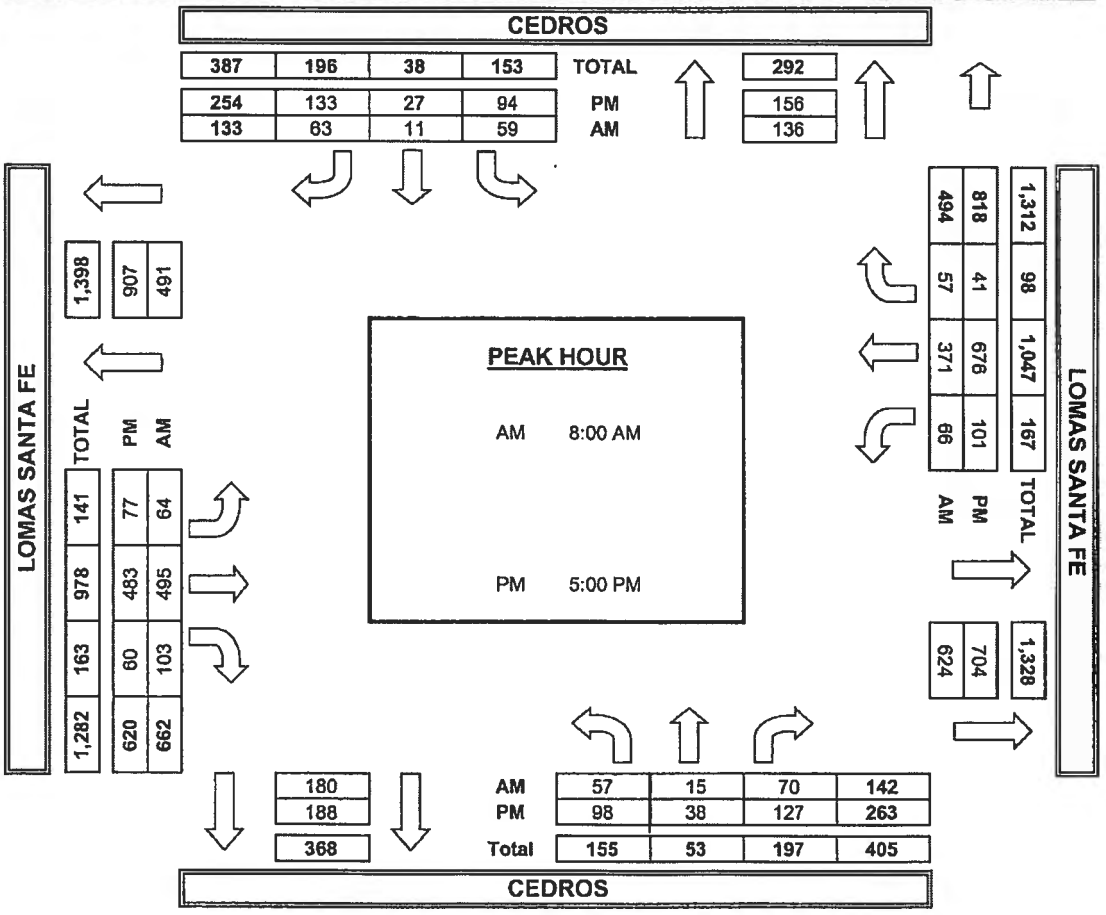




PACIFIC TECHNICAL DATA

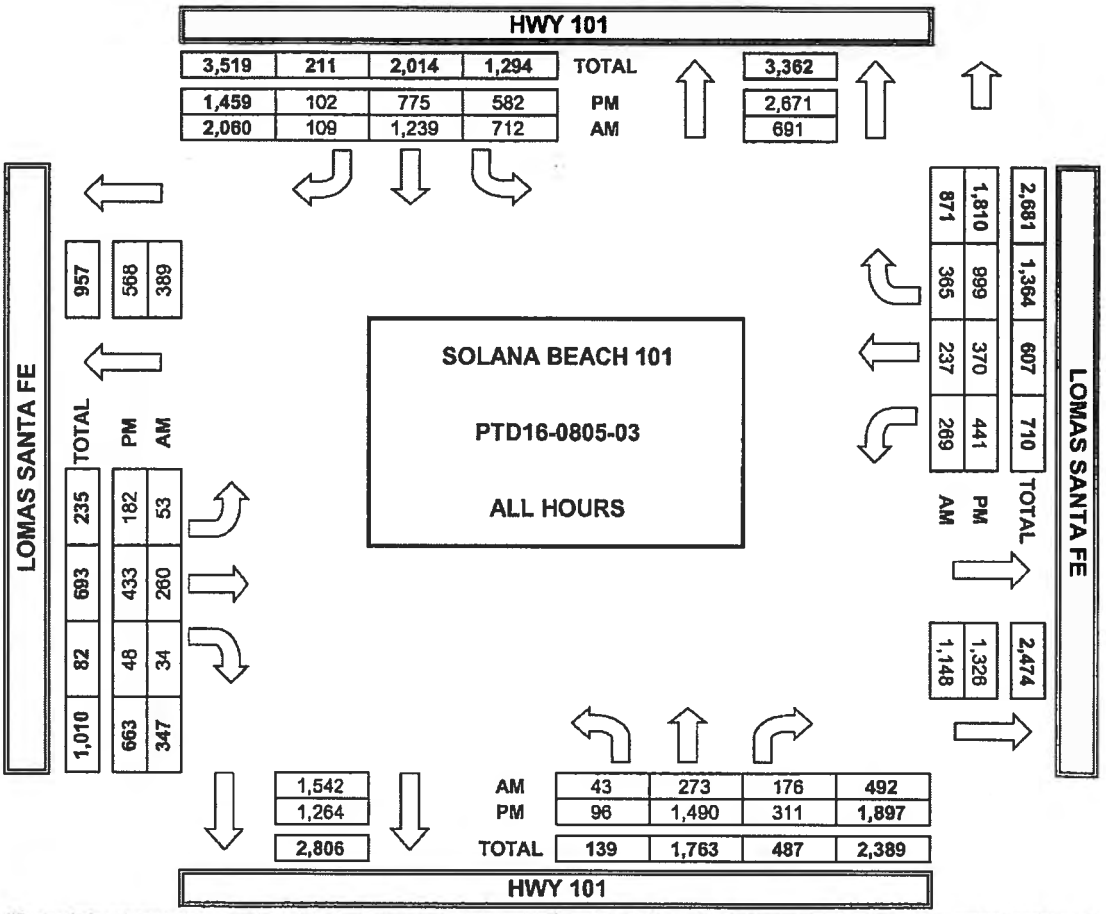
TURNING MOVEMENT COUNTS

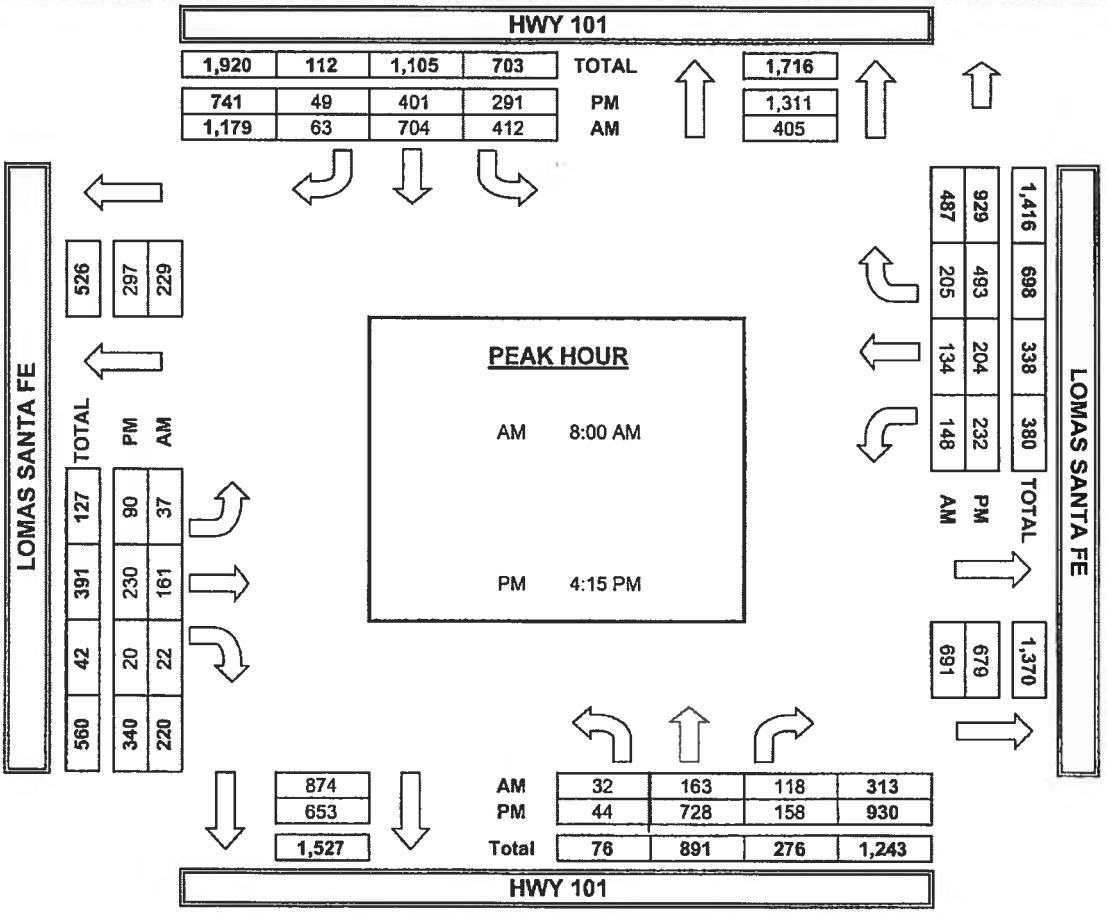




PACIFIC TECHNICAL DATA

TURNING MOVEMENT COUNTS





WEDNESDAY - AUGUST 3, 2016 CITY: SOLANA BEACH 101 PROJECT: PTD16-0805-03

HWY 101 - LOMAS SANTA FE TO DAHLIA

AM Period	NB		SB		EB	WB		PM Period	NB		SB		EB	WB	
00:00	9		10					12:00	125		189				
00:15	6		14					12:15	143		169				
00:30	4		6					12:30	141		200				
00:45	3	22	3	33			55	12:45	142	551	151	709			1260
01:00	4		6					13:00	164		124				
01:15	2		5					13:15	144		181				
01:30	4		2					13:30	133		196				
01:45	0	10	4	17			27	13:45	127	568	197	698			1266
02:00	1		3					14:00	136		197				
02:15	2		3					14:15	127		153				
02:30	2		0					14:30	142		175				
02:45	2	7	1	7			14	14:45	151	556	145	670			1226
03:00	1		1					15:00	154		149				
03:15	2		3					15:15	155		185				
03:30	0		1					15:30	189		177				
03:45	4	7	2	7			14	15:45	220	718	168	679			1397
04:00	3		3					16:00	215		185				
04:15	1		5					16:15	201		210				
04:30	3		5					16:30	250		188				
04:45	1	8	8	21			29	16:45	237	903	144	727			1630
05:00	6		6					17:00	243		161				
05:15	3		5					17:15	228		184				
05:30	9		17					17:30	249		141				
05:45	8	26	35	63			89	17:45	234	954	145	631			1585
06:00	18		31					18:00	250		150				
06:15	20		63					18:15	244		141				
06:30	27		53					18:30	213		148				
06:45	32	97	87	234			331	18:45	192	899	111	550			1449
07:00	43		104					19:00	146		127				
07:15	40		151					19:15	124		94				
07:30	54		169					19:30	97		109				
07:45	60	197	208	632			829	19:45	109	476	93	423			899
08:00	88		181					20:00	105		96				
08:15	71		210					20:15	106		83				
08:30	55		207					20:30	76		62				
08:45	78	292	254	852			1144	20:45	57	344	68	309			653
09:00	88		182					21:00	43		61				
09:15	102		181					21:15	48		59				
09:30	89		175					21:30	42		47				
09:45	77	356	188	726			1082	21:45	55	188	53	220			408
10:00	100		141					22:00	33		32				
10:15	108		190					22:15	32		36				
10:30	121		181					22:30	30		17				
10:45	115	444	188	700			1144	22:45	22	117	25	110			227
11:00	140		144					23:00	12		19				
11:15	152		187					23:15	14		8				
11:30	143		173					23:30	7		10				
11:45	150	585	197	701			1286	23:45	8	41	5	42			83
Total Vol.		2051		3993			**6044**			6315		5768			**12083**

Daily Totals

NB	SB	EB	WB	Combined
8366	9761			**18127**

	AM			PM		
Split %	33.9%	66.1%	**33.3%**	52.3%	47.7%	**66.7%**
Peak Hour	11:00	08:15	**11:15**	17:30	13:15	**15:45**
Volume	585	853	**1316**	977	771	**1637**
P.H.F.	0.96	0.84	**0.95**	0.98	0.98	**0.93**

PACIFIC TECHNICAL DATA

WEDNESDAY - AUGUST 3, 2016 CITY: SOLANA BEACH 101 PROJECT: PTD16-0805-03

HWY 101 - VIA DE LA VILLE TO DAHLIA

AM Period	NB		SB		EB	WB		PM Period	NB		SB		EB	WB	
00:00	9		8					12:00	123		180				
00:15	5		13					12:15	152		189				
00:30	6		6					12:30	143		207				
00:45	4	24	3	30			54	12:45	145	563	158	734			1297
01:00	1		4					13:00	162		122				
01:15	3		7					13:15	134		182				
01:30	5		2					13:30	144		200				
01:45	1	10	4	17			27	13:45	134	574	178	682			1256
02:00	2		2					14:00	123		165				
02:15	2		4					14:15	144		158				
02:30	3		0					14:30	140		195				
02:45	1	8	0	6			14	14:45	163	570	136	654			1224
03:00	3		1					15:00	165		155				
03:15	3		2					15:15	168		194				
03:30	1		1					15:30	182		166				
03:45	4	11	3	7			18	15:45	242	757	171	686			1443
04:00	3		3					16:00	234		188				
04:15	4		7					16:15	205		205				
04:30	4		5					16:30	254		177				
04:45	9	20	12	27			47	16:45	258	951	160	730			1681
05:00	10		5					17:00	246		144				
05:15	12		10					17:15	251		168				
05:30	9		17					17:30	251		127				
05:45	33	64	26	58			122	17:45	261	1009	158	597			1606
06:00	30		34					18:00	269		155				
06:15	30		50					18:15	252		126				
06:30	28		65					18:30	233		139				
06:45	52	140	84	233			373	18:45	209	963	143	563			1526
07:00	43		108					19:00	134		138				
07:15	45		148					19:15	131		122				
07:30	70		174					19:30	94		107				
07:45	95	253	170	600			853	19:45	101	460	105	472			932
08:00	86		193					20:00	87		98				
08:15	76		186					20:15	90		99				
08:30	78		204					20:30	70		75				
08:45	89	329	229	812			1141	20:45	48	295	86	358			653
09:00	100		177					21:00	37		62				
09:15	123		175					21:15	38		70				
09:30	95		197					21:30	37		56				
09:45	87	405	181	730			1135	21:45	52	164	59	247			411
10:00	101		147					22:00	28		42				
10:15	114		195					22:15	37		47				
10:30	130		196					22:30	26		18				
10:45	123	468	151	689			1157	22:45	19	110	33	140			250
11:00	149		153					23:00	14		22				
11:15	156		166					23:15	14		14				
11:30	146		194					23:30	5		11				
11:45	168	619	158	671			1290	23:45	7	40	7	54			94
Total Vol.		2351		3880			**6231**			6456		5917			**12373**

Daily Totals

NB	SB	EB	WB	Combined
8807	9797			**18604**

	AM			PM		
Split %	37.7%	62.3%	**33.5%**	52.2%	47.8%	**66.5%**
Peak Hour	11:00	08:00	**11:45**	17:30	15:45	**16:00**
Volume	619	812	**1320**	1033	741	**1681**
P.H.F.	0.92	0.89	**0.94**	0.98	0.90	**0.98**

PACIFIC TECHNICAL DATA

WEDNESDAY - AUGUST 3, 2016 CITY: SOLANA BEACH 101 PROJECT: PTD16-0805-03

DAHLIAH - SIERRA TO HWY 101

AM Period	NB	SB	EB		WB			PM Period	NB	SB	EB		WB		
00:00			0		4			12:00			28		26		
00:15			4		2			12:15			21		22		
00:30			1		0			12:30			28		20		
00:45			0	5	2	8	13	12:45			24	101	28	96	197
01:00			1		0			13:00			25		22		
01:15			1		0			13:15			21		17		
01:30			1		0			13:30			21		22		
01:45			0	3	0	0	3	13:45			13	80	17	78	158
02:00			0		1			14:00			19		32		
02:15			1		1			14:15			14		26		
02:30			0		0			14:30			20		13		
02:45			0	1	1	3	4	14:45			22	75	28	99	174
03:00			0		0			15:00			11		16		
03:15			0		1			15:15			9		21		
03:30			0		0			15:30			34		24		
03:45			0	0	1	2	2	15:45			18	72	28	89	161
04:00			1		0			16:00			28		25		
04:15			1		0			16:15			20		26		
04:30			4		2			16:30			33		28		
04:45			2	8	3	5	13	16:45			25	106	20	99	205
05:00			3		1			17:00			26		25		
05:15			0		2			17:15			20		28		
05:30			2		1			17:30			18		18		
05:45			3	8	4	8	16	17:45			15	79	21	92	171
06:00			5		4			18:00			31		25		
06:15			4		4			18:15			20		14		
06:30			6		5			18:30			11		18		
06:45			10	25	3	16	41	18:45			29	91	10	67	158
07:00			7		9			19:00			20		15		
07:15			12		9			19:15			13		17		
07:30			17		18			19:30			11		8		
07:45			12	48	27	63	111	19:45			12	56	13	53	109
08:00			24		16			20:00			10		7		
08:15			18		21			20:15			20		14		
08:30			8		22			20:30			13		6		
08:45			11	61	22	81	142	20:45			10	53	5	32	85
09:00			16		14			21:00			9		6		
09:15			13		12			21:15			11		5		
09:30			23		16			21:30			4		4		
09:45			21	73	27	69	142	21:45			8	32	5	20	52
10:00			27		15			22:00			11		3		
10:15			19		27			22:15			4		5		
10:30			17		14			22:30			6		5		
10:45			15	78	26	82	160	22:45			2	23	1	14	37
11:00			20		20			23:00			3		2		
11:15			35		30			23:15			2		1		
11:30			44		25			23:30			2		1		
11:45			34	133	27	102	235	23:45			3	10	2	6	16
Total Vol.				443		439	**882**					778		745	**1523**

	AM			PM		
				Daily Totals		
	NB	SB	EB	NB	SB	EB	WB	Combined
						1221	1184	**2405**
Split %	50.2%	49.8%	**36.7%**	51.1%	48.9%	**63.3%**
Peak Hour	11:15	11:15	**11:15**	16:00	15:45	**15:45**
Volume	141	108	**249**	106	107	**206**
P.H.F.	0.80	0.90	**0.90**	0.80	0.96	**0.84**

PACIFIC TECHNICAL DATA

WEDNESDAY - AUGUST 3, 2016 CITY: SOLANA BEACH 101 PROJECT: PTD16-0805-03

VIA DE LA VILLE - CEDROS TO SOLANA CIR.

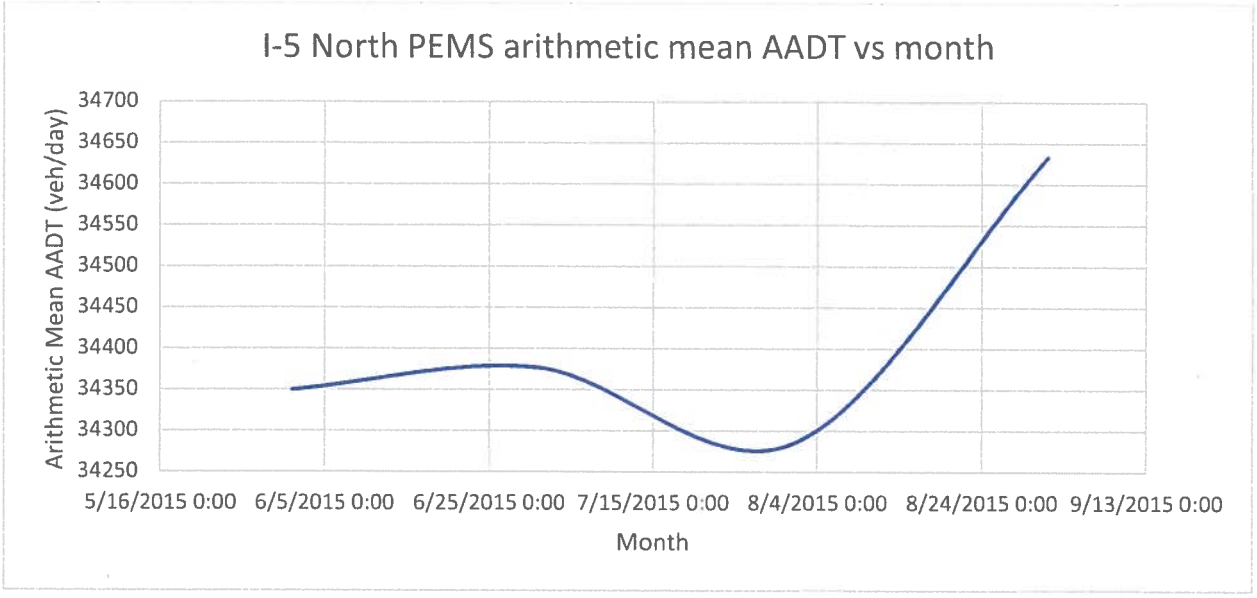
AM Period	NB	SB	EB		WB			PM Period	NB	SB	EB		WB		
00:00			10		10			12:00			166		181		
00:15			7		7			12:15			148		167		
00:30			7		9			12:30			164		168		
00:45			6	30	5	31	61	12:45			185	663	155	671	1334
01:00			4		5			13:00			153		139		
01:15			3		5			13:15			149		134		
01:30			5		8			13:30			179		146		
01:45			2	14	2	20	34	13:45			135	616	146	565	1181
02:00			1		3			14:00			169		124		
02:15			4		1			14:15			126		144		
02:30			2		4			14:30			156		125		
02:45			1	8	2	10	18	14:45			126	577	156	549	1126
03:00			1		3			15:00			144		159		
03:15			3		3			15:15			128		158		
03:30			6		2			15:30			157		159		
03:45			5	15	4	12	27	15:45			133	562	184	660	1222
04:00			4		4			16:00			134		186		
04:15			10		8			16:15			126		196		
04:30			7		7			16:30			136		191		
04:45			13	34	11	30	64	16:45			122	518	193	766	1284
05:00			6		9			17:00			130		200		
05:15			11		16			17:15			107		233		
05:30			14		16			17:30			107		244		
05:45			29	60	36	77	137	17:45			127	471	223	900	1371
06:00			38		43			18:00			132		273		
06:15			54		53			18:15			128		225		
06:30			64		69			18:30			120		204		
06:45			78	234	95	260	494	18:45			135	515	176	878	1393
07:00			71		68			19:00			127		130		
07:15			107		80			19:15			119		108		
07:30			152		129			19:30			101		94		
07:45			151	481	152	429	910	19:45			105	452	91	423	875
08:00			138		121			20:00			111		74		
08:15			154		116			20:15			110		82		
08:30			156		101			20:30			112		61		
08:45			170	618	131	469	1087	20:45			84	417	54	271	688
09:00			160		139			21:00			68		39		
09:15			139		149			21:15			72		53		
09:30			125		123			21:30			66		36		
09:45			169	593	130	541	1134	21:45			50	256	31	159	415
10:00			124		129			22:00			43		41		
10:15			134		142			22:15			45		34		
10:30			142		144			22:30			26		29		
10:45			124	524	166	581	1105	22:45			32	146	17	121	267
11:00			130		170			23:00			24		21		
11:15			170		190			23:15			25		12		
11:30			176		183			23:30			18		6		
11:45			130	606	172	715	1321	23:45			10	77	9	48	125
Total Vol.				3217		3175	**6392**					5270		6011	**11281**

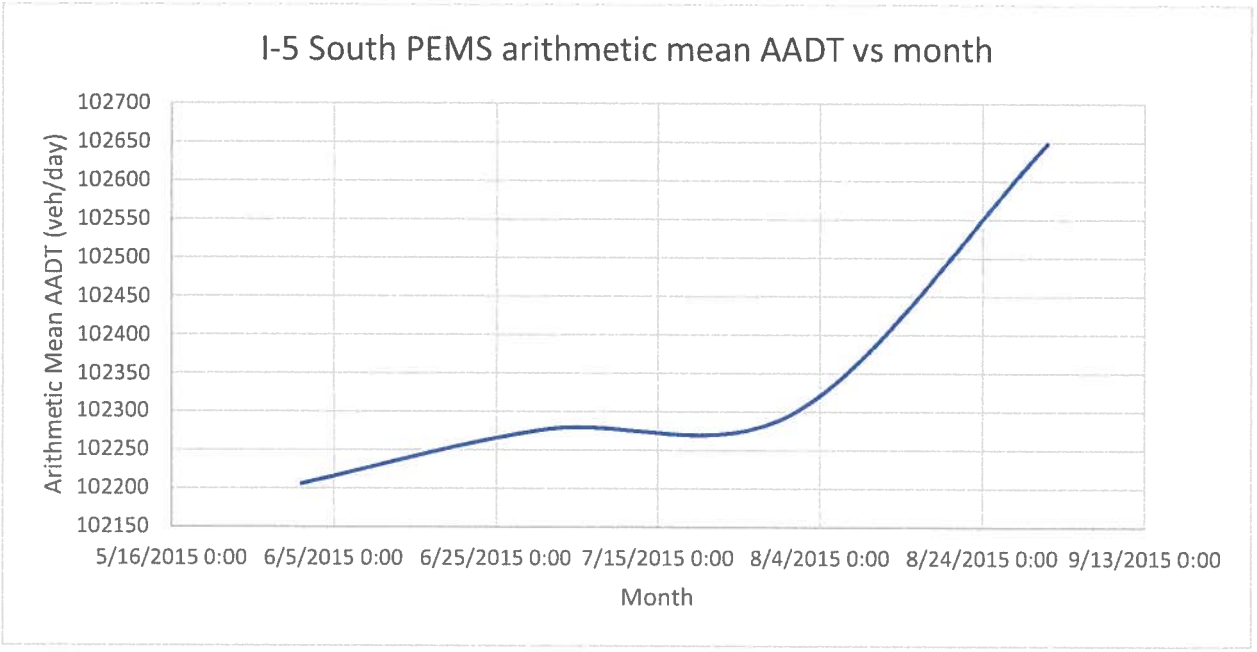
Daily Totals

NB	SB	EB	WB	Combined
		8487	9186	**17673**

	AM			PM		
Split %	50.3%	49.7%	**36.2%**	46.7%	53.3%	**63.8%**
Peak Hour	11:15	11:15	**11:15**	12:45	17:15	**17:30**
Volume	642	726	**1368**	666	973	**1459**
P.H.F.	0.91	0.96	**0.95**	0.90	0.89	**0.90**

PACIFIC TECHNICAL DATA

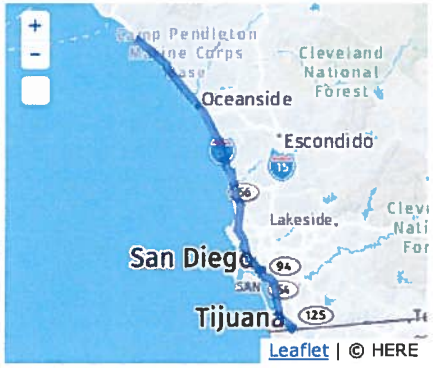

I-5 North PEMS arithmetic mean AADT vs month
Arithmetic Mean AADT (veh/day)
34700
34650
34600
34550
34500
34450
34400
34350
34300
34250
5/16/2015 0:00
6/5/2015 0:00
6/25/2015 0:00
7/15/2015 0:00
8/4/2015 0:00
8/24/2015 0:00
9/13/2015 0:00
Month


I-5 South PEMS arithmetic mean AADT vs month
Arithmetic Mean AADT (veh/day)
102700
102650
102600
102550
102500
102450
102400
102350
102300
102250
102200
102150
5/16/2015 0:00
6/5/2015 0:00
6/25/2015 0:00
7/15/2015 0:00
8/4/2015 0:00
8/24/2015 0:00
9/13/2015 0:00
Month

PeMS 17.0

Freeway I5-N in District 11

Current Location



Maps Real-Time | Performance | Inventory

California

Freeway Details

Directional Distance	72.3 mi
Controllers	112
Stations	168
Detectors	545
Traffic Census Stations	176

Quick Links

View this page for another part of I5-N...

View this page for another freeway...

View opposite direction of travel

Tools

Holidays
Data Clearinghouse
PeMS User Manual
Transit PeMS User Manual
Lane Closure Manual
District TCR Training Guide
PeMS Forum (External Site)

Facilities & Devices | Performance | Data Quality | Configuration | Events

Performance > Planning Analysis > AADT

ABOUT THIS REPORT

From 05/2015 To 09/2015

Max Range: 10 years

VIEW TABLE | EXPORT TEXT | EXPORT to XLS

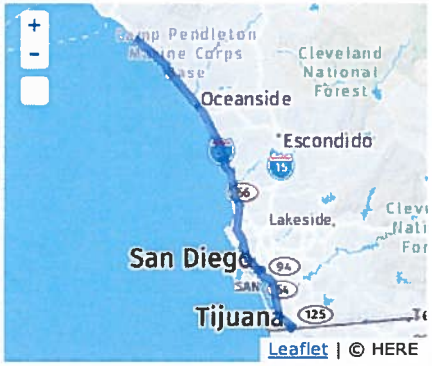
2822 488 0

Starting Month	Fwy	CA PM	Abs PM	VDS	Name	Type	Arithmetic Mean	ASTM Std 1442	Conv. AASHTO	Prov. AASHTO	Sum of 24 Annual Avg Hours	Mod. ASTM Std	Mod. Conv. AASHTO	Mod. Prov. AASHTO	% Data Used	K
05/01/2015 00:00:00	I5-N	R.147	0.06		N/O CMNO DE LA PLAZA	Mainline	40,601			39,574	41,337			39,574	44	2,411
06/01/2015 00:00:00	I5-N	R.147	0.06		N/O CMNO DE LA PLAZA	Mainline	40,557			39,416	41,152			39,416	50	2,404
07/01/2015 00:00:00	I5-N	R.147	0.06		N/O CMNO DE LA PLAZA	Mainline	40,582			40,179	41,046	41,105		40,179	56	2,401
08/01/2015 00:00:00	I5-N	R.147	0.06		N/O CMNO DE LA PLAZA	Mainline	40,527			40,223	40,871	40,844		40,223	60	2,388
09/01/2015 00:00:00	I5-N	R.147	0.06		N/O CMNO DE LA PLAZA	Mainline	40,305			39,922	40,526	40,399	40,241	39,922	65	2,383
05/01/2015 00:00:00	I5-N	1.233	1.14		5 NB @ S. Ysidro	Mainline	19,155	19,101			19,193	19,101			48	1,313
06/01/2015 00:00:00	I5-N	1.233	1.14		5 NB @ S. Ysidro	Mainline	19,126	19,057			19,171	19,057			45	1,312
07/01/2015 00:00:00	I5-N	1.233	1.14		5 NB @ S. Ysidro	Mainline	19,076	19,018			19,133	19,018			43	1,307
08/01/2015 00:00:00	I5-N	1.233	1.14		5 NB @ S. Ysidro	Mainline	18,969	18,951			19,035	18,951			39	1,296
09/01/2015 00:00:00	I5-N	1.233	1.14		5 NB @ S. Ysidro	Mainline	18,880	18,810			18,893	18,810			41	1,294
05/01/2015 00:00:00	I5-N	1.502	1.41		N/O VIA DE SAN YSIDR	Mainline	27,716	27,655			27,881	27,655			46	1,710
06/01/2015 00:00:00	I5-N	1.502	1.41		N/O VIA DE SAN YSIDR	Mainline	27,753	27,699			27,892	27,699			48	1,710
07/01/2015 00:00:00	I5-N	1.502	1.41		N/O VIA DE SAN YSIDR	Mainline	27,714	27,664			27,845	27,664			48	1,705
08/01/2015 00:00:00	I5-N	1.502	1.41		N/O VIA DE SAN YSIDR	Mainline	27,678	27,645			27,780	27,645			47	1,704
09/01/2015 00:00:00	I5-N	1.502	1.41		N/O VIA DE SAN YSIDR	Mainline	27,662	27,581			27,703	27,581			47	1,702
05/01/2015 00:00:00	I5-N	2.285	2.20		5 NB @ Dairy Mart	Mainline	23,422	23,413			23,486	23,413	23,439	23,433	73	1,495
06/01/2015 00:00:00	I5-N	2.285	2.20		5 NB @ Dairy Mart	Mainline	23,380	23,414			23,455	23,414	23,398	23,393	73	1,491
07/01/2015 00:00:00	I5-N	2.285	2.20		5 NB @ Dairy Mart	Mainline	23,354	23,359			23,424	23,359	23,344	23,340	72	1,488

Starting Month	Fwy	CA PM	Abs PM	VDS	Name	Type	Arithmetic Mean	ASTM Std 1442	Conv. AASHTO	Prov. AASHTO	Sum of 24 Annual Avg Hours	Mod. ASTM Std	Mod. Conv. AASHTO	Mod. Prov. AASHTO	% Data Used	K
05/01/2015 00:00:00	I5-N	R36.232	36.12		EB VIA DE LA VALLE	On Ramp	4,512	4,525	4,525	4,529	4,528	4,525	4,525	4,529	85	649
05/01/2015 00:00:00	I5-N	R36.232	36.12		EB VIA DE LA VALLE	Mainline	94,786	94,867	94,867	94,947	95,034	94,867	94,867	94,947	86	6,941
05/01/2015 00:00:00	I5-N	R36.232	36.12		VIA DE LA VALLE	HOV	11,513	11,516	11,516	11,483	11,494	11,516	11,516	11,483	86	1,465
05/01/2015 00:00:00	I5-N	R36.232	36.12		VIA DE LA VALLE	Off Ramp	15,926	15,963	15,963	15,971	15,974	15,963	15,963	15,971	86	1,717
06/01/2015 00:00:00	I5-N	R36.232	36.12		VIA DE LA VALLE	Off Ramp	15,882	15,935	15,935	15,943	15,941	15,935	15,935	15,943	86	1,717
06/01/2015 00:00:00	I5-N	R36.232	36.12		VIA DE LA VALLE	HOV	11,582	11,595	11,595	11,558	11,560	11,595	11,595	11,558	86	1,465
06/01/2015 00:00:00	I5-N	R36.232	36.12		EB VIA DE LA VALLE	Mainline	94,892	94,987	94,987	95,067	95,168	94,987	94,987	95,067	86	6,924
06/01/2015 00:00:00	I5-N	R36.232	36.12		EB VIA DE LA VALLE	On Ramp	4,528	4,545	4,545	4,551	4,547	4,545	4,545	4,551	86	649
07/01/2015 00:00:00	I5-N	R36.232	36.12		EB VIA DE LA VALLE	Mainline	95,036	95,110	95,110	95,179	95,262	95,110	95,110	95,179	87	6,908
07/01/2015 00:00:00	I5-N	R36.232	36.12		VIA DE LA VALLE	HOV	11,680	11,677	11,677	11,639	11,663	11,677	11,677	11,639	87	1,486
07/01/2015 00:00:00	I5-N	R36.232	36.12		EB VIA DE LA VALLE	On Ramp	4,534	4,541	4,541	4,548	4,550	4,541	4,541	4,548	86	657
07/01/2015 00:00:00	I5-N	R36.232	36.12		VIA DE LA VALLE	Off Ramp	15,842	15,872	15,872	15,877	15,901	15,872	15,872	15,877	87	1,662
08/01/2015 00:00:00	I5-N	R36.232	36.12		VIA DE LA VALLE	Off Ramp	15,785	15,825	15,825	15,833	15,855	15,825	15,825	15,833	87	1,662
08/01/2015 00:00:00	I5-N	R36.232	36.12		EB VIA DE LA VALLE	On Ramp	4,521	4,524	4,524	4,538	4,543	4,524	4,524	4,538	87	662
08/01/2015 00:00:00	I5-N	R36.232	36.12		VIA DE LA VALLE	HOV	11,787	11,789	11,789	11,756	11,792	11,789	11,789	11,756	87	1,487
08/01/2015 00:00:00	I5-N	R36.232	36.12		EB VIA DE LA VALLE	Mainline	95,047	95,164	95,164	95,278	95,302	95,164	95,164	95,278	87	6,907
09/01/2015 00:00:00	I5-N	R36.232	36.12		EB VIA DE LA VALLE	On Ramp	4,521	4,514	4,514	4,532	4,535	4,514	4,514	4,532	88	656
09/01/2015 00:00:00	I5-N	R36.232	36.12		VIA DE LA VALLE	Off Ramp	15,807	15,795	15,795	15,809	15,837	15,795	15,795	15,809	88	1,650
09/01/2015 00:00:00	I5-N	R36.232	36.12		EB VIA DE LA VALLE	Mainline	95,217	95,188	95,188	95,291	95,365	95,188	95,188	95,291	88	6,894
09/01/2015 00:00:00	I5-N	R36.232	36.12		VIA DE LA VALLE	HOV	11,911	11,889	11,889	11,878	11,911	11,889	11,889	11,878	88	1,487
05/01/2015 00:00:00	I5-N	R36.496	36.39		WB VIA DE LA VALLE	On Ramp	5,664	5,662	5,662	5,662	5,669	5,662	5,662	5,662	87	519
06/01/2015 00:00:00	I5-N	R36.496	36.39		WB VIA DE LA VALLE	On Ramp	5,650	5,648	5,648	5,650	5,657	5,648	5,648	5,650	87	514
07/01/2015 00:00:00	I5-N	R36.496	36.39		WB VIA DE LA VALLE	On Ramp	5,634	5,630	5,630	5,632	5,639	5,630	5,630	5,632	88	510
08/01/2015 00:00:00	I5-N	R36.496	36.39		WB VIA DE LA VALLE	On Ramp	5,628	5,626	5,626	5,628	5,634	5,626	5,626	5,628	87	514
09/01/2015 00:00:00	I5-N	R36.496	36.39		WB VIA DE LA VALLE	On Ramp	5,624	5,617	5,617	5,625	5,626	5,617	5,617	5,625	87	511
05/01/2015 00:00:00	I5-N	R37.37	37.26		LOMAS SANTA FE DR	On Ramp	4,705	4,729	4,729	4,740	4,745	4,729	4,729	4,740	86	614
05/01/2015 00:00:00	I5-N	R37.37	37.26		5N Lomas Santa Fe EB	Mainline	94,353	94,445	94,445	94,516	94,584	94,445	94,445	94,516	86	6,856
05/01/2015 00:00:00	I5-N	R37.37	37.26		LOMAS SANTA FE	Off Ramp	8,894	8,904	8,904	8,905	8,918	8,904	8,904	8,905	86	887

Freeway I5-N in District 11

Current Location



Maps Real-Time | Performance | Inventory

California

Freeway Details

Directional Distance	72.3 mi
Controllers	112
Stations	168
Detectors	545
Traffic Census Stations	176

Quick Links

View this page for another part of I5-N...

View this page for another freeway...

View opposite direction of travel

Tools

Holidays
Data Clearinghouse
PeMS User Manual
Transit PeMS User Manual
Lane Closure Manual
District TCR Training Guide
PeMS Forum (External Site)

Facilities & Devices | Performance | Data Quality | Configuration | Events

Performance > Planning Analysis > AADT

ABOUT THIS REPORT

From 05/2015 To 09/2015

Max Range: 10 years

VIEW TABLE | EXPORT TEXT | EXPORT to XLS

2822 488 0

Starting Month	Fwy	CA PM	Abs PM	VDS	Name	Type	Arithmetic Mean	ASTM Std 1442	Conv. AASHTO	Prov. AASHTO	Sum of 24 Annual Avg Hours	Mod. ASTM Std	Mod. Conv. AASHTO	Mod. Prov. AASHTO	% Data Used	K
05/01/2015 00:00:00	I5-N	R.147	0.06		N/O CMNO DE LA PLAZA	Mainline	40,601			39,574	41,337			39,574	44	2,411
06/01/2015 00:00:00	I5-N	R.147	0.06		N/O CMNO DE LA PLAZA	Mainline	40,557			39,416	41,152			39,416	50	2,404
07/01/2015 00:00:00	I5-N	R.147	0.06		N/O CMNO DE LA PLAZA	Mainline	40,582			40,179	41,046	41,105		40,179	56	2,401
08/01/2015 00:00:00	I5-N	R.147	0.06		N/O CMNO DE LA PLAZA	Mainline	40,527			40,223	40,871	40,844		40,223	60	2,388
09/01/2015 00:00:00	I5-N	R.147	0.06		N/O CMNO DE LA PLAZA	Mainline	40,305			39,922	40,526	40,399	40,241	39,922	65	2,383
05/01/2015 00:00:00	I5-N	1.233	1.14		5 NB @ S. Ysidro	Mainline	19,155	19,101			19,193	19,101			48	1,313
06/01/2015 00:00:00	I5-N	1.233	1.14		5 NB @ S. Ysidro	Mainline	19,126	19,057			19,171	19,057			45	1,312
07/01/2015 00:00:00	I5-N	1.233	1.14		5 NB @ S. Ysidro	Mainline	19,076	19,018			19,133	19,018			43	1,307
08/01/2015 00:00:00	I5-N	1.233	1.14		5 NB @ S. Ysidro	Mainline	18,969	18,951			19,035	18,951			39	1,296
09/01/2015 00:00:00	I5-N	1.233	1.14		5 NB @ S. Ysidro	Mainline	18,880	18,810			18,893	18,810			41	1,294
05/01/2015 00:00:00	I5-N	1.502	1.41		N/O VIA DE SAN YSIDR	Mainline	27,716	27,655			27,881	27,655			46	1,710
06/01/2015 00:00:00	I5-N	1.502	1.41		N/O VIA DE SAN YSIDR	Mainline	27,753	27,699			27,892	27,699			48	1,710
07/01/2015 00:00:00	I5-N	1.502	1.41		N/O VIA DE SAN YSIDR	Mainline	27,714	27,664			27,845	27,664			48	1,705
08/01/2015 00:00:00	I5-N	1.502	1.41		N/O VIA DE SAN YSIDR	Mainline	27,678	27,645			27,780	27,645			47	1,704
09/01/2015 00:00:00	I5-N	1.502	1.41		N/O VIA DE SAN YSIDR	Mainline	27,662	27,581			27,703	27,581			47	1,702
05/01/2015 00:00:00	I5-N	2.285	2.20		5 NB @ Dairy Mart	Mainline	23,422	23,413			23,486	23,413	23,439	23,433	73	1,495
06/01/2015 00:00:00	I5-N	2.285	2.20		5 NB @ Dairy Mart	Mainline	23,380	23,414			23,455	23,414	23,398	23,393	73	1,491
07/01/2015 00:00:00	I5-N	2.285	2.20		5 NB @ Dairy Mart	Mainline	23,354	23,359			23,424	23,359	23,344	23,340	72	1,488

Starting Month	Fwy	CA PM	Abs PM	VDS	Name	Type	Arithmetic Mean	ASTM Std 1442	Conv. AASHTO	Prov. AASHTO	Sum of 24 Annual Avg Hours	Mod. ASTM Std	Mod. Conv. AASHTO	Mod. Prov. AASHTO	% Data Used	K
05/01/2015 00:00:00	I5-N	R36.232	36.12		EB VIA DE LA VALLE	On Ramp	4,512	4,525	4,525	4,529	4,528	4,525	4,525	4,529	85	649
05/01/2015 00:00:00	I5-N	R36.232	36.12		EB VIA DE LA VALLE	Mainline	94,786	94,867	94,867	94,947	95,034	94,867	94,867	94,947	86	6,941
05/01/2015 00:00:00	I5-N	R36.232	36.12		VIA DE LA VALLE	HOV	11,513	11,516	11,516	11,483	11,494	11,516	11,516	11,483	86	1,465
05/01/2015 00:00:00	I5-N	R36.232	36.12		VIA DE LA VALLE	Off Ramp	15,926	15,963	15,963	15,971	15,974	15,963	15,963	15,971	86	1,717
06/01/2015 00:00:00	I5-N	R36.232	36.12		VIA DE LA VALLE	Off Ramp	15,882	15,935	15,935	15,943	15,941	15,935	15,935	15,943	86	1,717
06/01/2015 00:00:00	I5-N	R36.232	36.12		VIA DE LA VALLE	HOV	11,582	11,595	11,595	11,558	11,560	11,595	11,595	11,558	86	1,465
06/01/2015 00:00:00	I5-N	R36.232	36.12		EB VIA DE LA VALLE	Mainline	94,892	94,987	94,987	95,067	95,168	94,987	94,987	95,067	86	6,924
06/01/2015 00:00:00	I5-N	R36.232	36.12		EB VIA DE LA VALLE	On Ramp	4,528	4,545	4,545	4,551	4,547	4,545	4,545	4,551	86	649
07/01/2015 00:00:00	I5-N	R36.232	36.12		EB VIA DE LA VALLE	Mainline	95,036	95,110	95,110	95,179	95,262	95,110	95,110	95,179	87	6,908
07/01/2015 00:00:00	I5-N	R36.232	36.12		VIA DE LA VALLE	HOV	11,680	11,677	11,677	11,639	11,663	11,677	11,677	11,639	87	1,486
07/01/2015 00:00:00	I5-N	R36.232	36.12		EB VIA DE LA VALLE	On Ramp	4,534	4,541	4,541	4,548	4,550	4,541	4,541	4,548	86	657
07/01/2015 00:00:00	I5-N	R36.232	36.12		VIA DE LA VALLE	Off Ramp	15,842	15,872	15,872	15,877	15,901	15,872	15,872	15,877	87	1,662
08/01/2015 00:00:00	I5-N	R36.232	36.12		VIA DE LA VALLE	Off Ramp	15,785	15,825	15,825	15,833	15,855	15,825	15,825	15,833	87	1,662
08/01/2015 00:00:00	I5-N	R36.232	36.12		EB VIA DE LA VALLE	On Ramp	4,521	4,524	4,524	4,538	4,543	4,524	4,524	4,538	87	662
08/01/2015 00:00:00	I5-N	R36.232	36.12		VIA DE LA VALLE	HOV	11,787	11,789	11,789	11,756	11,792	11,789	11,789	11,756	87	1,487
08/01/2015 00:00:00	I5-N	R36.232	36.12		EB VIA DE LA VALLE	Mainline	95,047	95,164	95,164	95,278	95,302	95,164	95,164	95,278	87	6,907
09/01/2015 00:00:00	I5-N	R36.232	36.12		EB VIA DE LA VALLE	On Ramp	4,521	4,514	4,514	4,532	4,535	4,514	4,514	4,532	88	656
09/01/2015 00:00:00	I5-N	R36.232	36.12		VIA DE LA VALLE	Off Ramp	15,807	15,795	15,795	15,809	15,837	15,795	15,795	15,809	88	1,650
09/01/2015 00:00:00	I5-N	R36.232	36.12		EB VIA DE LA VALLE	Mainline	95,217	95,188	95,188	95,291	95,365	95,188	95,188	95,291	88	6,894
09/01/2015 00:00:00	I5-N	R36.232	36.12		VIA DE LA VALLE	HOV	11,911	11,889	11,889	11,878	11,911	11,889	11,889	11,878	88	1,487
05/01/2015 00:00:00	I5-N	R36.496	36.39		WB VIA DE LA VALLE	On Ramp	5,664	5,662	5,662	5,662	5,669	5,662	5,662	5,662	87	519
06/01/2015 00:00:00	I5-N	R36.496	36.39		WB VIA DE LA VALLE	On Ramp	5,650	5,648	5,648	5,650	5,657	5,648	5,648	5,650	87	514
07/01/2015 00:00:00	I5-N	R36.496	36.39		WB VIA DE LA VALLE	On Ramp	5,634	5,630	5,630	5,632	5,639	5,630	5,630	5,632	88	510
08/01/2015 00:00:00	I5-N	R36.496	36.39		WB VIA DE LA VALLE	On Ramp	5,628	5,626	5,626	5,628	5,634	5,626	5,626	5,628	87	514
09/01/2015 00:00:00	I5-N	R36.496	36.39		WB VIA DE LA VALLE	On Ramp	5,624	5,617	5,617	5,625	5,626	5,617	5,617	5,625	87	511
05/01/2015 00:00:00	I5-N	R37.37	37.26		LOMAS SANTA FE DR	On Ramp	4,705	4,729	4,729	4,740	4,745	4,729	4,729	4,740	86	614
05/01/2015 00:00:00	I5-N	R37.37	37.26		5N Lomas Santa Fe EB	Mainline	94,353	94,445	94,445	94,516	94,584	94,445	94,445	94,516	86	6,856
05/01/2015 00:00:00	I5-N	R37.37	37.26		LOMAS SANTA FE	Off Ramp	8,894	8,904	8,904	8,905	8,918	8,904	8,904	8,905	86	887

APPENDIX C

EXISTING SYNCHRO WORKSHEETS

HCM 6th Edition methodology does not support turning movements with shared & exclusive lanes.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	37	161	22	148	134	205	32	163	118	412	704	63
Future Volume (vph)	37	161	22	148	134	205	32	163	118	412	704	63
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Lane Util. Factor		0.95		0.97	0.91	0.91	1.00	0.95		1.00	0.95	
Frt		0.99		1.00	0.94	0.85	1.00	0.94		1.00	0.99	
Flt Protected		0.99		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)		3458		3433	3175	1441	1770	3316		1770	3496	
Flt Permitted		0.99		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)		3458		3433	3175	1441	1770	3316		1770	3496	
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	41	179	24	164	149	228	36	181	131	458	782	70
RTOR Reduction (vph)	0	7	0	0	97	106	0	89	0	0	4	0
Lane Group Flow (vph)	0	237	0	164	161	13	36	223	0	458	848	0
Turn Type	Split	NA		Split	NA	Perm	Prot	NA		Prot	NA	
Protected Phases	4	4		8	8		5	2		1	6	
Permitted Phases						8						
Actuated Green, G (s)		14.4		13.3	13.3	13.3	4.6	38.1		38.2	71.7	
Effective Green, g (s)		14.4		13.3	13.3	13.3	4.6	38.1		38.2	71.7	
Actuated g/C Ratio		0.12		0.11	0.11	0.11	0.04	0.32		0.32	0.60	
Clearance Time (s)		4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Vehicle Extension (s)		3.0		3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)		414		380	351	159	67	1052		563	2088	
v/s Ratio Prot		c0.07		0.05	c0.05		0.02	0.07		c0.26	c0.24	
v/s Ratio Perm						0.01						
v/c Ratio		0.57		0.43	0.46	0.08	0.54	0.21		0.81	0.41	
Uniform Delay, d1		49.9		49.8	50.0	47.9	56.7	30.0		37.6	12.8	
Progression Factor		1.00		1.00	1.00	1.00	0.97	0.84		1.00	1.00	
Incremental Delay, d2		1.9		0.8	1.0	0.2	8.0	0.5		8.8	0.6	
Delay (s)		51.8		50.6	50.9	48.1	63.2	25.7		46.4	13.4	
Level of Service		D		D	D	D	E	C		D	B	
Approach Delay (s)		51.8			50.2			29.5			25.0	
Approach LOS		D			D			C			C	

Intersection Summary			
HCM 2000 Control Delay	33.9	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.59		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	56.6%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	64	495	103	66	371	57	57	15	70	59	11	63
Future Volume (veh/h)	64	495	103	66	371	57	57	15	70	59	11	63
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	71	550	114	73	412	63	63	17	78	66	12	70
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	92	728	150	95	1276	396	801	157	721	759	1007	854
Arrive On Green	0.05	0.25	0.25	0.05	0.25	0.25	0.54	0.54	0.54	0.54	0.54	0.54
Sat Flow, veh/h	1781	2933	606	1781	5106	1585	1316	292	1338	1301	1870	1585
Grp Volume(v), veh/h	71	332	332	73	412	63	63	0	95	66	12	70
Grp Sat Flow(s),veh/h/ln	1781	1777	1761	1781	1702	1585	1316	0	1630	1301	1870	1585
Q Serve(g_s), s	3.0	13.0	13.1	3.0	4.9	2.3	1.8	0.0	2.1	2.0	0.2	1.6
Cycle Q Clear(g_c), s	3.0	13.0	13.1	3.0	4.9	2.3	2.0	0.0	2.1	4.1	0.2	1.6
Prop In Lane	1.00		0.34	1.00		1.00	1.00		0.82	1.00		1.00
Lane Grp Cap(c), veh/h	92	441	437	95	1276	396	801	0	878	759	1007	854
V/C Ratio(X)	0.77	0.75	0.76	0.77	0.32	0.16	0.08	0.00	0.11	0.09	0.01	0.08
Avail Cap(c_a), veh/h	238	687	681	261	2042	634	801	0	878	759	1007	854
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.61	0.61	0.61	1.00	1.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	35.1	26.1	26.1	35.1	22.9	22.0	8.5	0.0	8.5	9.5	8.0	8.4
Incr Delay (d2), s/veh	8.2	1.6	1.7	12.4	0.1	0.2	0.2	0.0	0.2	0.2	0.0	0.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.5	5.4	5.4	1.6	1.9	0.9	0.5	0.0	0.7	0.6	0.1	0.5
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	43.3	27.7	27.8	47.5	23.1	22.2	8.7	0.0	8.7	9.7	8.1	8.5
LnGrp LOS	D	C	C	D	C	C	A	A	A	A	A	A
Approach Vol, veh/h		735			548			158			148	
Approach Delay, s/veh		29.2			26.2			8.7			9.0	
Approach LOS		C			C			A			A	

Timer - Assigned Phs		2	3	4		6	7	8				
Phs Duration (G+Y+Rc), s		44.4	8.0	22.6		44.4	7.9	22.7				
Change Period (Y+Rc), s		4.0	4.0	4.0		4.0	4.0	4.0				
Max Green Setting (Gmax), s		23.0	11.0	29.0		23.0	10.0	30.0				
Max Q Clear Time (g_c+I1), s		4.1	5.0	15.1		6.1	5.0	6.9				
Green Ext Time (p_c), s		0.6	0.1	3.6		0.4	0.1	3.0				

Intersection Summary	
HCM 6th Ctrl Delay	24.3
HCM 6th LOS	C

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Traffic Volume (vph)	1	3	1	28	0	36	0	99	38	19	104	0
Future Volume (vph)	1	3	1	28	0	36	0	99	38	19	104	0
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	1	3	1	31	0	40	0	110	42	21	116	0

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total (vph)	5	71	152	137
Volume Left (vph)	1	31	0	21
Volume Right (vph)	1	40	42	0
Hadj (s)	-0.05	-0.22	-0.13	0.06
Departure Headway (s)	4.6	4.3	4.1	4.3
Degree Utilization, x	0.01	0.09	0.17	0.16
Capacity (veh/h)	723	772	854	818
Control Delay (s)	7.6	7.7	7.9	8.1
Approach Delay (s)	7.6	7.7	7.9	8.1
Approach LOS	A	A	A	A

Intersection Summary			
Delay	8.0		
Level of Service	A		
Intersection Capacity Utilization	31.4%	ICU Level of Service	A
Analysis Period (min)	15		

HCM 6th Edition methodology does not support turning movements with shared & exclusive lanes.

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	43	28	55	248	816	32
Future Volume (vph)	43	28	55	248	816	32
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0	4.5	4.5	
Lane Util. Factor	1.00		1.00	0.95	0.95	
Frt	0.95		1.00	1.00	0.99	
Flt Protected	0.97		0.95	1.00	1.00	
Satd. Flow (prot)	1712		1770	3539	3519	
Flt Permitted	0.97		0.95	1.00	1.00	
Satd. Flow (perm)	1712		1770	3539	3519	
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	48	31	61	276	907	36
RTOR Reduction (vph)	23	0	0	0	1	0
Lane Group Flow (vph)	56	0	61	276	942	0
Turn Type	Prot		Prot	NA	NA	
Protected Phases	4		5	2	6	
Permitted Phases						
Actuated Green, G (s)	9.5		8.3	102.0	89.7	
Effective Green, g (s)	9.5		8.3	102.0	89.7	
Actuated g/C Ratio	0.08		0.07	0.85	0.75	
Clearance Time (s)	4.0		4.0	4.5	4.5	
Vehicle Extension (s)	3.0		3.0	3.0	3.0	
Lane Grp Cap (vph)	135		122	3008	2630	
v/s Ratio Prot	c0.03		c0.03	0.08	c0.27	
v/s Ratio Perm						
v/c Ratio	0.41		0.50	0.09	0.36	
Uniform Delay, d1	52.6		53.8	1.5	5.2	
Progression Factor	1.00		0.86	0.99	0.35	
Incremental Delay, d2	2.1		3.2	0.1	0.4	
Delay (s)	54.7		49.5	1.5	2.2	
Level of Service	D		D	A	A	
Approach Delay (s)	54.7			10.2	2.2	
Approach LOS	D			B	A	

Intersection Summary			
HCM 2000 Control Delay	7.2	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.37		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	12.5
Intersection Capacity Utilization	41.4%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	4	136	32	141	98	175	18	169	141	367	444	15
Future Volume (veh/h)	4	136	32	141	98	175	18	169	141	367	444	15
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	4	151	36	157	109	194	20	188	157	408	493	17
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	33	295	69	249	381	323	29	1594	711	441	2384	82
Arrive On Green	0.20	0.20	0.20	0.20	0.20	0.20	0.02	0.45	0.45	0.33	0.90	0.90
Sat Flow, veh/h	11	1451	339	1196	1870	1585	1781	3554	1585	1781	3505	121
Grp Volume(v), veh/h	191	0	0	157	109	194	20	188	157	408	250	260
Grp Sat Flow(s),veh/h/ln	1801	0	0	1196	1870	1585	1781	1777	1585	1781	1777	1849
Q Serve(g_s), s	0.0	0.0	0.0	9.5	5.9	13.3	1.3	3.7	7.3	26.5	2.0	2.0
Cycle Q Clear(g_c), s	11.3	0.0	0.0	20.8	5.9	13.3	1.3	3.7	7.3	26.5	2.0	2.0
Prop In Lane	0.02		0.19	1.00		1.00	1.00		1.00	1.00		0.07
Lane Grp Cap(c), veh/h	397	0	0	249	381	323	29	1594	711	441	1208	1257
V/C Ratio(X)	0.48	0.00	0.00	0.63	0.29	0.60	0.69	0.12	0.22	0.92	0.21	0.21
Avail Cap(c_a), veh/h	599	0	0	384	592	502	74	1594	711	713	1208	1257
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.33	1.33	1.33
Upstream Filter(I)	1.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	0.95	0.95
Uniform Delay (d), s/veh	42.5	0.0	0.0	48.0	40.4	43.4	58.7	19.3	20.2	39.1	1.9	1.9
Incr Delay (d2), s/veh	0.9	0.0	0.0	2.6	0.4	1.8	25.6	0.2	0.7	11.7	0.4	0.4
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	5.2	0.0	0.0	4.7	2.8	5.4	0.8	1.6	2.8	12.3	0.7	0.8
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	43.4	0.0	0.0	50.6	40.8	45.2	84.3	19.4	21.0	50.8	2.3	2.3
LnGrp LOS	D	A	A	D	D	D	F	B	C	D	A	A
Approach Vol, veh/h		191			460			365			918	
Approach Delay, s/veh		43.4			46.0			23.6			23.9	
Approach LOS		D			D			C			C	

Timer - Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	33.7	57.8		28.4	5.9	85.6		28.4
Change Period (Y+Rc), s	4.0	4.0		4.0	4.0	4.0		4.0
Max Green Setting (Gmax), s	48.0	22.0		38.0	5.0	65.0		38.0
Max Q Clear Time (g_c+I1), s	28.5	9.3		13.3	3.3	4.0		22.8
Green Ext Time (p_c), s	1.2	1.3		1.1	0.0	3.4		1.6

Intersection Summary		
HCM 6th Ctrl Delay		31.0
HCM 6th LOS		C

HCM 6th Edition methodology does not support turning movements with shared & exclusive lanes.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	90	230	20	232	204	493	44	728	158	291	401	49
Future Volume (vph)	90	230	20	232	204	493	44	728	158	291	401	49
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Lane Util. Factor		0.95		0.97	0.91	0.91	1.00	0.95		1.00	0.95	
Frt		0.99		1.00	0.92	0.85	1.00	0.97		1.00	0.98	
Flt Protected		0.99		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)		3463		3433	3112	1441	1770	3444		1770	3482	
Flt Permitted		0.99		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)		3463		3433	3112	1441	1770	3444		1770	3482	
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	100	256	22	258	227	548	49	809	176	323	446	54
RTOR Reduction (vph)	0	4	0	0	188	230	0	14	0	0	7	0
Lane Group Flow (vph)	0	374	0	258	313	44	49	971	0	323	493	0
Turn Type	Split	NA		Split	NA	Perm	Prot	NA		Prot	NA	
Protected Phases	4	4		8	8		5	2		1	6	
Permitted Phases						8						
Actuated Green, G (s)		18.0		19.3	19.3	19.3	6.4	41.8		24.9	60.3	
Effective Green, g (s)		18.0		19.3	19.3	19.3	6.4	41.8		24.9	60.3	
Actuated g/C Ratio		0.15		0.16	0.16	0.16	0.05	0.35		0.21	0.50	
Clearance Time (s)		4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Vehicle Extension (s)		3.0		3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)		519		552	500	231	94	1199		367	1749	
v/s Ratio Prot		c0.11		0.08	c0.10		0.03	c0.28		c0.18	0.14	
v/s Ratio Perm						0.03						
v/c Ratio		0.72		0.47	0.63	0.19	0.52	0.81		0.88	0.28	
Uniform Delay, d1		48.6		45.7	47.0	43.6	55.3	35.5		46.1	17.3	
Progression Factor		1.00		1.00	1.00	1.00	0.99	0.77		1.00	1.00	
Incremental Delay, d2		4.9		0.6	2.4	0.4	5.0	5.8		21.0	0.4	
Delay (s)		53.5		46.3	49.4	44.0	59.7	33.1		67.1	17.7	
Level of Service		D		D	D	D	E	C		E	B	
Approach Delay (s)		53.5			47.2			34.4			37.1	
Approach LOS		D			D			C			D	

Intersection Summary			
HCM 2000 Control Delay	41.3	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.78		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	75.1%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	77	483	60	101	676	41	98	38	127	94	27	133
Future Volume (veh/h)	77	483	60	101	676	41	98	38	127	94	27	133
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	86	537	67	112	751	46	109	42	141	104	30	148
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	112	713	89	144	1239	385	732	202	677	668	1000	848
Arrive On Green	0.06	0.22	0.22	0.08	0.24	0.24	0.53	0.53	0.53	0.53	0.53	0.53
Sat Flow, veh/h	1781	3180	396	1781	5106	1585	1206	377	1266	1201	1870	1585
Grp Volume(v), veh/h	86	299	305	112	751	46	109	0	183	104	30	148
Grp Sat Flow(s),veh/h/ln	1781	1777	1799	1781	1702	1585	1206	0	1643	1201	1870	1585
Q Serve(g_s), s	3.6	11.8	11.9	4.6	9.8	1.7	3.5	0.0	4.4	3.7	0.6	3.6
Cycle Q Clear(g_c), s	3.6	11.8	11.9	4.6	9.8	1.7	4.1	0.0	4.4	8.1	0.6	3.6
Prop In Lane	1.00		0.22	1.00		1.00	1.00		0.77	1.00		1.00
Lane Grp Cap(c), veh/h	112	398	403	144	1239	385	732	0	878	668	1000	848
V/C Ratio(X)	0.77	0.75	0.76	0.78	0.61	0.12	0.15	0.00	0.21	0.16	0.03	0.17
Avail Cap(c_a), veh/h	261	616	624	285	1838	571	732	0	878	668	1000	848
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.51	0.51	0.51	1.00	1.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	34.6	27.1	27.2	33.8	25.2	22.2	9.2	0.0	9.1	11.3	8.3	9.0
Incr Delay (d2), s/veh	5.7	1.5	1.5	8.6	0.5	0.1	0.4	0.0	0.5	0.5	0.1	0.4
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.7	4.9	5.0	2.3	3.8	0.6	0.9	0.0	1.5	1.0	0.2	1.2
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	40.3	28.6	28.7	42.4	25.7	22.3	9.6	0.0	9.7	11.8	8.3	9.4
LnGrp LOS	D	C	C	D	C	C	A	A	A	B	A	A
Approach Vol, veh/h		690			909			292			282	
Approach Delay, s/veh		30.1			27.6			9.7			10.2	
Approach LOS		C			C			A			B	

Timer - Assigned Phs		2	3	4		6	7	8				
Phs Duration (G+Y+Rc), s		44.1	10.1	20.8		44.1	8.7	22.2				
Change Period (Y+Rc), s		4.0	4.0	4.0		4.0	4.0	4.0				
Max Green Setting (Gmax), s		25.0	12.0	26.0		25.0	11.0	27.0				
Max Q Clear Time (g_c+I1), s		6.4	6.6	13.9		10.1	5.6	11.8				
Green Ext Time (p_c), s		1.4	0.1	3.0		0.9	0.1	4.8				

Intersection Summary	
HCM 6th Ctrl Delay	23.7
HCM 6th LOS	C

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Traffic Volume (vph)	1	1	1	26	1	53	2	134	48	38	92	3
Future Volume (vph)	1	1	1	26	1	53	2	134	48	38	92	3
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	1	1	1	29	1	59	2	149	53	42	102	3

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total (vph)	3	89	204	147
Volume Left (vph)	1	29	2	42
Volume Right (vph)	1	59	53	3
Hadj (s)	-0.10	-0.30	-0.12	0.08
Departure Headway (s)	4.7	4.4	4.2	4.4
Degree Utilization, x	0.00	0.11	0.24	0.18
Capacity (veh/h)	696	756	839	785
Control Delay (s)	7.7	7.9	8.4	8.4
Approach Delay (s)	7.7	7.9	8.4	8.4
Approach LOS	A	A	A	A

Intersection Summary			
Delay	8.3		
Level of Service	A		
Intersection Capacity Utilization	33.4%	ICU Level of Service	A
Analysis Period (min)	15		

HCM 6th Edition methodology does not support turning movements with shared & exclusive lanes.

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	69	42	48	850	679	53
Future Volume (vph)	69	42	48	850	679	53
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0	4.5	4.5	
Lane Util. Factor	1.00		1.00	0.95	0.95	
Frt	0.95		1.00	1.00	0.99	
Flt Protected	0.97		0.95	1.00	1.00	
Satd. Flow (prot)	1714		1770	3539	3501	
Flt Permitted	0.97		0.95	1.00	1.00	
Satd. Flow (perm)	1714		1770	3539	3501	
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	77	47	53	944	754	59
RTOR Reduction (vph)	21	0	0	0	3	0
Lane Group Flow (vph)	103	0	53	944	810	0
Turn Type	Prot		Prot	NA	NA	
Protected Phases	4		5	2	6	
Permitted Phases						
Actuated Green, G (s)	12.9		7.9	98.6	86.7	
Effective Green, g (s)	12.9		7.9	98.6	86.7	
Actuated g/C Ratio	0.11		0.07	0.82	0.72	
Clearance Time (s)	4.0		4.0	4.5	4.5	
Vehicle Extension (s)	3.0		3.0	3.0	3.0	
Lane Grp Cap (vph)	184		116	2907	2529	
v/s Ratio Prot	c0.06		c0.03	c0.27	0.23	
v/s Ratio Perm						
v/c Ratio	0.56		0.46	0.32	0.32	
Uniform Delay, d1	50.8		54.0	2.6	6.0	
Progression Factor	1.00		0.77	2.16	0.50	
Incremental Delay, d2	3.6		2.5	0.3	0.3	
Delay (s)	54.5		44.2	5.9	3.3	
Level of Service	D		D	A	A	
Approach Delay (s)	54.5			7.9	3.3	
Approach LOS	D			A	A	

Intersection Summary			
HCM 2000 Control Delay	9.0	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.37		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	12.5
Intersection Capacity Utilization	40.6%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	10	119	61	230	153	504	34	537	130	251	305	30
Future Volume (veh/h)	10	119	61	230	153	504	34	537	130	251	305	30
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	11	132	68	256	170	560	38	597	144	279	339	33
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	45	419	206	460	698	592	49	1264	564	305	1635	158
Arrive On Green	0.37	0.37	0.37	0.37	0.37	0.37	0.03	0.36	0.36	0.34	1.00	1.00
Sat Flow, veh/h	37	1124	552	1182	1870	1585	1781	3554	1585	1781	3274	317
Grp Volume(v), veh/h	211	0	0	256	170	560	38	597	144	279	183	189
Grp Sat Flow(s),veh/h/ln	1713	0	0	1182	1870	1585	1781	1777	1585	1781	1777	1813
Q Serve(g_s), s	0.0	0.0	0.0	16.0	7.5	41.1	2.5	15.6	7.7	18.0	0.0	0.0
Cycle Q Clear(g_c), s	10.2	0.0	0.0	26.2	7.5	41.1	2.5	15.6	7.7	18.0	0.0	0.0
Prop In Lane	0.05		0.32	1.00		1.00	1.00		1.00	1.00		0.17
Lane Grp Cap(c), veh/h	671	0	0	460	698	592	49	1264	564	305	888	906
V/C Ratio(X)	0.31	0.00	0.00	0.56	0.24	0.95	0.78	0.47	0.26	0.91	0.21	0.21
Avail Cap(c_a), veh/h	701	0	0	482	733	621	89	1264	564	430	888	906
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	2.00	2.00	2.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	0.96	0.96	0.96
Uniform Delay (d), s/veh	26.8	0.0	0.0	33.1	25.9	36.5	58.0	30.0	27.4	38.6	0.0	0.0
Incr Delay (d2), s/veh	0.3	0.0	0.0	1.3	0.2	23.2	23.4	1.3	1.1	18.4	0.5	0.5
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	4.4	0.0	0.0	6.4	3.4	19.4	1.5	6.9	3.1	8.1	0.1	0.1
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	27.0	0.0	0.0	34.4	26.1	59.7	81.4	31.2	28.5	57.0	0.5	0.5
LnGrp LOS	C	A	A	C	C	E	F	C	C	E	A	A
Approach Vol, veh/h		211			986			779			651	
Approach Delay, s/veh		27.0			47.3			33.2			24.7	
Approach LOS		C			D			C			C	

Timer - Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	24.6	46.7		48.8	7.3	63.9		48.8
Change Period (Y+Rc), s	4.0	4.0		4.0	4.0	4.0		4.0
Max Green Setting (Gmax), s	29.0	32.0		47.0	6.0	55.0		47.0
Max Q Clear Time (g_c+I1), s	20.0	17.6		12.2	4.5	2.0		43.1
Green Ext Time (p_c), s	0.6	3.9		1.4	0.0	2.4		1.7

Intersection Summary		
HCM 6th Ctrl Delay		35.9
HCM 6th LOS		D

APPENDIX D

EXISTING WITH PROJECT SYNCHRO WORKSHEETS

HCM 6th Edition methodology does not support turning movements with shared & exclusive lanes.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	37	161	22	169	134	205	32	171	131	412	716	63
Future Volume (vph)	37	161	22	169	134	205	32	171	131	412	716	63
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Lane Util. Factor		0.95		0.97	0.91	0.91	1.00	0.95		1.00	0.95	
Frt		0.99		1.00	0.94	0.85	1.00	0.93		1.00	0.99	
Flt Protected		0.99		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)		3458		3433	3175	1441	1770	3309		1770	3496	
Flt Permitted		0.99		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)		3458		3433	3175	1441	1770	3309		1770	3496	
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	41	179	24	188	149	228	36	190	146	458	796	70
RTOR Reduction (vph)	0	7	0	0	96	105	0	96	0	0	4	0
Lane Group Flow (vph)	0	237	0	188	162	14	36	240	0	458	862	0
Turn Type	Split	NA		Split	NA	Perm	Prot	NA		Prot	NA	
Protected Phases	4	4		8	8		5	2		1	6	
Permitted Phases						8						
Actuated Green, G (s)		14.4		13.8	13.8	13.8	4.6	40.7		35.1	71.2	
Effective Green, g (s)		14.4		13.8	13.8	13.8	4.6	40.7		35.1	71.2	
Actuated g/C Ratio		0.12		0.12	0.12	0.12	0.04	0.34		0.29	0.59	
Clearance Time (s)		4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Vehicle Extension (s)		3.0		3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)		414		394	365	165	67	1122		517	2074	
v/s Ratio Prot		c0.07		c0.05	0.05		0.02	0.07		c0.26	c0.25	
v/s Ratio Perm						0.01						
v/c Ratio		0.57		0.48	0.44	0.08	0.54	0.21		0.89	0.42	
Uniform Delay, d1		49.9		49.7	49.5	47.4	56.7	28.2		40.5	13.2	
Progression Factor		1.00		1.00	1.00	1.00	1.24	0.35		1.00	1.00	
Incremental Delay, d2		1.9		0.9	0.9	0.2	8.0	0.4		16.5	0.6	
Delay (s)		51.8		50.6	50.4	47.7	78.4	10.5		57.1	13.8	
Level of Service		D		D	D	D	E	B		E	B	
Approach Delay (s)		51.8			49.9			17.0			28.8	
Approach LOS		D			D			B			C	

Intersection Summary			
HCM 2000 Control Delay	34.0	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.61		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	57.2%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	66	505	104	66	387	57	59	15	70	59	11	66
Future Volume (veh/h)	66	505	104	66	387	57	59	15	70	59	11	66
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	73	561	116	73	430	63	66	17	78	66	12	73
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	95	725	149	95	1262	392	800	157	722	761	1009	855
Arrive On Green	0.05	0.25	0.25	0.05	0.25	0.25	0.54	0.54	0.54	0.54	0.54	0.54
Sat Flow, veh/h	1781	2934	605	1781	5106	1585	1313	292	1338	1301	1870	1585
Grp Volume(v), veh/h	73	339	338	73	430	63	66	0	95	66	12	73
Grp Sat Flow(s),veh/h/ln	1781	1777	1762	1781	1702	1585	1313	0	1630	1301	1870	1585
Q Serve(g_s), s	3.0	13.3	13.4	3.0	5.2	2.3	1.8	0.0	2.1	2.0	0.2	1.7
Cycle Q Clear(g_c), s	3.0	13.3	13.4	3.0	5.2	2.3	2.1	0.0	2.1	4.1	0.2	1.7
Prop In Lane	1.00		0.34	1.00		1.00	1.00		0.82	1.00		1.00
Lane Grp Cap(c), veh/h	95	439	436	95	1262	392	800	0	879	761	1009	855
V/C Ratio(X)	0.77	0.77	0.78	0.77	0.34	0.16	0.08	0.00	0.11	0.09	0.01	0.09
Avail Cap(c_a), veh/h	333	616	611	333	1770	549	800	0	879	761	1009	855
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.54	0.54	0.54	1.00	1.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	35.0	26.3	26.3	35.0	23.2	22.1	8.5	0.0	8.4	9.4	8.0	8.3
Incr Delay (d2), s/veh	6.9	2.2	2.3	12.2	0.2	0.2	0.2	0.0	0.2	0.2	0.0	0.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.5	5.6	5.6	1.6	2.0	0.9	0.5	0.0	0.7	0.6	0.1	0.6
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	41.9	28.4	28.6	47.2	23.4	22.3	8.7	0.0	8.7	9.7	8.0	8.5
LnGrp LOS	D	C	C	D	C	C	A	A	A	A	A	A
Approach Vol, veh/h		750			566			161			151	
Approach Delay, s/veh		29.8			26.3			8.7			9.0	
Approach LOS		C			C			A			A	

Timer - Assigned Phs		2	3	4		6	7	8
Phs Duration (G+Y+Rc), s		44.5	8.0	22.5		44.5	8.0	22.5
Change Period (Y+Rc), s		4.0	4.0	4.0		4.0	4.0	4.0
Max Green Setting (Gmax), s		23.0	14.0	26.0		23.0	14.0	26.0
Max Q Clear Time (g_c+I1), s		4.1	5.0	15.4		6.1	5.0	7.2
Green Ext Time (p_c), s		0.6	0.1	3.1		0.4	0.1	3.0

Intersection Summary	
HCM 6th Ctrl Delay	24.6
HCM 6th LOS	C

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Traffic Volume (vph)	1	3	1	32	0	39	0	99	44	23	104	0
Future Volume (vph)	1	3	1	32	0	39	0	99	44	23	104	0
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	1	3	1	36	0	43	0	110	49	26	116	0

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total (vph)	5	79	159	142
Volume Left (vph)	1	36	0	26
Volume Right (vph)	1	43	49	0
Hadj (s)	-0.05	-0.20	-0.15	0.07
Departure Headway (s)	4.6	4.4	4.1	4.3
Degree Utilization, x	0.01	0.10	0.18	0.17
Capacity (veh/h)	715	764	851	811
Control Delay (s)	7.6	7.8	8.0	8.2
Approach Delay (s)	7.6	7.8	8.0	8.2
Approach LOS	A	A	A	A

Intersection Summary			
Delay	8.0		
Level of Service	A		
Intersection Capacity Utilization	33.0%	ICU Level of Service	A
Analysis Period (min)	15		

HCM 6th Edition methodology does not support turning movements with shared & exclusive lanes.

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	67	64	110	248	816	68
Future Volume (vph)	67	64	110	248	816	68
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0	4.5	4.5	
Lane Util. Factor	1.00		1.00	0.95	0.95	
Frt	0.93		1.00	1.00	0.99	
Flt Protected	0.98		0.95	1.00	1.00	
Satd. Flow (prot)	1696		1770	3539	3498	
Flt Permitted	0.98		0.95	1.00	1.00	
Satd. Flow (perm)	1696		1770	3539	3498	
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	74	71	122	276	907	76
RTOR Reduction (vph)	33	0	0	0	3	0
Lane Group Flow (vph)	112	0	122	276	980	0
Turn Type	Prot		Prot	NA	NA	
Protected Phases	4		5	2	6	
Permitted Phases						
Actuated Green, G (s)	13.3		13.6	98.2	80.6	
Effective Green, g (s)	13.3		13.6	98.2	80.6	
Actuated g/C Ratio	0.11		0.11	0.82	0.67	
Clearance Time (s)	4.0		4.0	4.5	4.5	
Vehicle Extension (s)	3.0		3.0	3.0	3.0	
Lane Grp Cap (vph)	187		200	2896	2349	
v/s Ratio Prot	c0.07		c0.07	0.08	c0.28	
v/s Ratio Perm						
v/c Ratio	0.60		0.61	0.10	0.42	
Uniform Delay, d1	50.8		50.7	2.1	9.0	
Progression Factor	1.00		0.85	2.03	0.45	
Incremental Delay, d2	5.1		5.1	0.1	0.5	
Delay (s)	55.9		48.4	4.4	4.6	
Level of Service	E		D	A	A	
Approach Delay (s)	55.9			17.9	4.6	
Approach LOS	E			B	A	

Intersection Summary			
HCM 2000 Control Delay	12.9	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.46		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	12.5
Intersection Capacity Utilization	48.9%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	4	136	32	141	98	212	18	180	141	390	451	15
Future Volume (veh/h)	4	136	32	141	98	212	18	180	141	390	451	15
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	4	151	36	157	109	236	20	200	157	433	501	17
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	33	296	69	250	382	324	29	1563	697	455	2383	81
Arrive On Green	0.20	0.20	0.20	0.20	0.20	0.20	0.02	0.44	0.44	0.51	1.00	1.00
Sat Flow, veh/h	11	1450	339	1196	1870	1585	1781	3554	1585	1781	3507	119
Grp Volume(v), veh/h	191	0	0	157	109	236	20	200	157	433	254	264
Grp Sat Flow(s),veh/h/ln	1800	0	0	1196	1870	1585	1781	1777	1585	1781	1777	1849
Q Serve(g_s), s	0.0	0.0	0.0	9.5	5.9	16.7	1.3	4.0	7.4	27.7	0.0	0.0
Cycle Q Clear(g_c), s	11.3	0.0	0.0	20.8	5.9	16.7	1.3	4.0	7.4	27.7	0.0	0.0
Prop In Lane	0.02		0.19	1.00		1.00	1.00		1.00	1.00		0.06
Lane Grp Cap(c), veh/h	399	0	0	250	382	324	29	1563	697	455	1207	1256
V/C Ratio(X)	0.48	0.00	0.00	0.63	0.29	0.73	0.69	0.13	0.23	0.95	0.21	0.21
Avail Cap(c_a), veh/h	584	0	0	374	577	489	74	1563	697	564	1207	1256
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	2.00	2.00	2.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	0.91	0.91	0.91
Uniform Delay (d), s/veh	42.5	0.0	0.0	47.9	40.3	44.6	58.7	19.9	20.9	28.6	0.0	0.0
Incr Delay (d2), s/veh	0.9	0.0	0.0	2.6	0.4	3.1	25.6	0.2	0.7	22.1	0.4	0.3
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	5.1	0.0	0.0	4.7	2.8	6.8	0.8	1.7	2.9	11.7	0.1	0.1
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	43.4	0.0	0.0	50.5	40.7	47.8	84.3	20.1	21.6	50.7	0.4	0.3
LnGrp LOS	D	A	A	D	D	D	F	C	C	D	A	A
Approach Vol, veh/h		191			502			377			951	
Approach Delay, s/veh		43.4			47.1			24.2			23.3	
Approach LOS		D			D			C			C	

Timer - Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	34.7	56.8		28.5	5.9	85.5		28.5
Change Period (Y+Rc), s	4.0	4.0		4.0	4.0	4.0		4.0
Max Green Setting (Gmax), s	38.0	33.0		37.0	5.0	66.0		37.0
Max Q Clear Time (g_c+I1), s	29.7	9.4		13.3	3.3	2.0		22.8
Green Ext Time (p_c), s	0.9	1.8		1.1	0.0	3.5		1.8

Intersection Summary			
HCM 6th Ctrl Delay			31.3
HCM 6th LOS			C

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	10	70	71	94	61	7
Future Volume (Veh/h)	10	70	71	94	61	7
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	11	76	77	102	66	8
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)			208			
pX, platoon unblocked						
vC, conflicting volume	179				226	128
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	179				226	128
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	99				91	99
cM capacity (veh/h)	1397				756	922

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	87	179	74
Volume Left	11	0	66
Volume Right	0	102	8
cSH	1397	1700	771
Volume to Capacity	0.01	0.11	0.10
Queue Length 95th (ft)	1	0	8
Control Delay (s)	1.0	0.0	10.2
Lane LOS	A		B
Approach Delay (s)	1.0	0.0	10.2
Approach LOS			B

Intersection Summary			
Average Delay	2.5		
Intersection Capacity Utilization	22.6%	ICU Level of Service	A
Analysis Period (min)	15		
Description: Driveway A			

HCM 6th Edition methodology does not support turning movements with shared & exclusive lanes.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	90	230	20	260	204	493	44	743	184	291	418	49
Future Volume (vph)	90	230	20	260	204	493	44	743	184	291	418	49
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Lane Util. Factor		0.95		0.97	0.91	0.91	1.00	0.95		1.00	0.95	
Frt		0.99		1.00	0.92	0.85	1.00	0.97		1.00	0.98	
Flt Protected		0.99		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)		3463		3433	3112	1441	1770	3434		1770	3484	
Flt Permitted		0.99		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)		3463		3433	3112	1441	1770	3434		1770	3484	
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	100	256	22	289	227	548	49	826	204	323	464	54
RTOR Reduction (vph)	0	4	0	0	187	229	0	17	0	0	7	0
Lane Group Flow (vph)	0	374	0	289	314	45	49	1013	0	323	512	0
Turn Type	Split	NA		Split	NA	Perm	Prot	NA		Prot	NA	
Protected Phases	4	4		8	8		5	2		1	6	
Permitted Phases						8						
Actuated Green, G (s)		18.0		19.6	19.6	19.6	6.4	41.6		24.8	60.0	
Effective Green, g (s)		18.0		19.6	19.6	19.6	6.4	41.6		24.8	60.0	
Actuated g/C Ratio		0.15		0.16	0.16	0.16	0.05	0.35		0.21	0.50	
Clearance Time (s)		4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Vehicle Extension (s)		3.0		3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)		519		560	508	235	94	1190		365	1742	
v/s Ratio Prot		c0.11		0.08	c0.10		0.03	c0.29		c0.18	0.15	
v/s Ratio Perm						0.03						
v/c Ratio		0.72		0.52	0.62	0.19	0.52	0.85		0.88	0.29	
Uniform Delay, d1		48.6		45.9	46.7	43.3	55.3	36.3		46.2	17.6	
Progression Factor		1.00		1.00	1.00	1.00	1.33	0.71		1.00	1.00	
Incremental Delay, d2		4.9		0.8	2.2	0.4	4.9	7.4		21.6	0.4	
Delay (s)		53.5		46.7	48.9	43.7	78.4	33.2		67.8	18.0	
Level of Service		D		D	D	D	E	C		E	B	
Approach Delay (s)		53.5			47.0			35.2			37.1	
Approach LOS		D			D			D			D	

Intersection Summary			
HCM 2000 Control Delay	41.5	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.79		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	76.4%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	81	503	62	101	698	41	101	38	127	94	27	137
Future Volume (veh/h)	81	503	62	101	698	41	101	38	127	94	27	137
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	90	559	69	112	776	46	112	42	141	104	30	152
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	117	736	91	145	1260	391	721	199	668	658	987	836
Arrive On Green	0.07	0.23	0.23	0.08	0.25	0.25	0.53	0.53	0.53	0.53	0.53	0.53
Sat Flow, veh/h	1781	3185	392	1781	5106	1585	1202	377	1266	1201	1870	1585
Grp Volume(v), veh/h	90	311	317	112	776	46	112	0	183	104	30	152
Grp Sat Flow(s),veh/h/ln	1781	1777	1800	1781	1702	1585	1202	0	1643	1201	1870	1585
Q Serve(g_s), s	3.7	12.2	12.3	4.6	10.1	1.7	3.7	0.0	4.4	3.8	0.6	3.8
Cycle Q Clear(g_c), s	3.7	12.2	12.3	4.6	10.1	1.7	4.3	0.0	4.4	8.2	0.6	3.8
Prop In Lane	1.00		0.22	1.00		1.00	1.00		0.77	1.00		1.00
Lane Grp Cap(c), veh/h	117	411	416	145	1260	391	721	0	867	658	987	836
V/C Ratio(X)	0.77	0.76	0.76	0.77	0.62	0.12	0.16	0.00	0.21	0.16	0.03	0.18
Avail Cap(c_a), veh/h	309	616	624	309	1770	549	721	0	867	658	987	836
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.50	0.50	0.50	1.00	1.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	34.5	26.9	26.9	33.8	25.1	21.9	9.5	0.0	9.4	11.6	8.5	9.3
Incr Delay (d2), s/veh	5.2	1.5	1.5	8.5	0.5	0.1	0.5	0.0	0.6	0.5	0.1	0.5
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.7	5.1	5.2	2.3	4.0	0.6	1.0	0.0	1.6	1.0	0.2	1.3
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	39.7	28.4	28.4	42.3	25.6	22.0	10.0	0.0	10.0	12.1	8.6	9.7
LnGrp LOS	D	C	C	D	C	C	A	A	A	B	A	A
Approach Vol, veh/h		718			934			295			286	
Approach Delay, s/veh		29.8			27.4			10.0			10.5	
Approach LOS		C			C			A			B	

Timer - Assigned Phs		2	3	4		6	7	8
Phs Duration (G+Y+Rc), s		43.6	10.1	21.3		43.6	8.9	22.5
Change Period (Y+Rc), s		4.0	4.0	4.0		4.0	4.0	4.0
Max Green Setting (Gmax), s		24.0	13.0	26.0		24.0	13.0	26.0
Max Q Clear Time (g_c+I1), s		6.4	6.6	14.3		10.2	5.7	12.1
Green Ext Time (p_c), s		1.4	0.1	3.0		0.8	0.1	4.7

Intersection Summary	
HCM 6th Ctrl Delay	23.7
HCM 6th LOS	C

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Traffic Volume (vph)	1	1	1	36	1	60	2	134	59	45	92	3
Future Volume (vph)	1	1	1	36	1	60	2	134	59	45	92	3
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	1	1	1	40	1	67	2	149	66	50	102	3

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total (vph)	3	108	217	155
Volume Left (vph)	1	40	2	50
Volume Right (vph)	1	67	66	3
Hadj (s)	-0.10	-0.26	-0.15	0.09
Departure Headway (s)	4.8	4.5	4.2	4.5
Degree Utilization, x	0.00	0.13	0.25	0.19
Capacity (veh/h)	680	740	829	769
Control Delay (s)	7.8	8.2	8.6	8.5
Approach Delay (s)	7.8	8.2	8.6	8.5
Approach LOS	A	A	A	A

Intersection Summary			
Delay	8.5		
Level of Service	A		
Intersection Capacity Utilization	36.1%	ICU Level of Service	A
Analysis Period (min)	15		

HCM 6th Edition methodology does not support turning movements with shared & exclusive lanes.

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	127	129	143	850	679	116
Future Volume (vph)	127	129	143	850	679	116
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0	4.5	4.5	
Lane Util. Factor	1.00		1.00	0.95	0.95	
Frpb, ped/bikes	1.00		1.00	1.00	1.00	
Flpb, ped/bikes	1.00		1.00	1.00	1.00	
Frt	0.93		1.00	1.00	0.98	
Flt Protected	0.98		0.95	1.00	1.00	
Satd. Flow (prot)	1694		1770	3539	3462	
Flt Permitted	0.98		0.95	1.00	1.00	
Satd. Flow (perm)	1694		1770	3539	3462	
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	141	143	159	944	754	129
RTOR Reduction (vph)	43	0	0	0	7	0
Lane Group Flow (vph)	241	0	159	944	876	0
Confl. Peds. (#/hr)	137					
Turn Type	Prot		Prot	NA	NA	
Protected Phases	4		5	2	6	
Permitted Phases						
Actuated Green, G (s)	22.7		15.9	88.8	68.9	
Effective Green, g (s)	22.7		15.9	88.8	68.9	
Actuated g/C Ratio	0.19		0.13	0.74	0.57	
Clearance Time (s)	4.0		4.0	4.5	4.5	
Vehicle Extension (s)	3.0		3.0	3.0	3.0	
Lane Grp Cap (vph)	320		234	2618	1987	
v/s Ratio Prot	c0.14		c0.09	0.27	c0.25	
v/s Ratio Perm						
v/c Ratio	0.75		0.68	0.36	0.44	
Uniform Delay, d1	46.0		49.6	5.5	14.6	
Progression Factor	1.00		0.74	1.94	0.54	
Incremental Delay, d2	9.6		6.4	0.3	0.7	
Delay (s)	55.6		43.3	11.1	8.5	
Level of Service	E		D	B	A	
Approach Delay (s)	55.6			15.7	8.5	
Approach LOS	E			B	A	

Intersection Summary			
HCM 2000 Control Delay	17.9	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.54		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	12.5
Intersection Capacity Utilization	55.8%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	10	119	61	230	153	554	34	551	130	297	318	30
Future Volume (veh/h)	10	119	61	230	153	554	34	551	130	297	318	30
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	11	132	68	256	170	616	38	612	144	330	353	33
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	46	429	211	473	717	608	49	1122	500	358	1609	150
Arrive On Green	0.38	0.38	0.38	0.38	0.38	0.38	0.03	0.32	0.32	0.34	0.82	0.82
Sat Flow, veh/h	37	1120	550	1182	1870	1585	1781	3554	1585	1781	3287	305
Grp Volume(v), veh/h	211	0	0	256	170	616	38	612	144	330	190	196
Grp Sat Flow(s),veh/h/ln	1707	0	0	1182	1870	1585	1781	1777	1585	1781	1777	1815
Q Serve(g_s), s	0.0	0.0	0.0	15.6	7.4	46.0	2.5	17.1	8.2	21.4	2.9	2.9
Cycle Q Clear(g_c), s	10.0	0.0	0.0	25.6	7.4	46.0	2.5	17.1	8.2	21.4	2.9	2.9
Prop In Lane	0.05		0.32	1.00		1.00	1.00		1.00	1.00		0.17
Lane Grp Cap(c), veh/h	686	0	0	473	717	608	49	1122	500	358	870	889
V/C Ratio(X)	0.31	0.00	0.00	0.54	0.24	1.01	0.78	0.55	0.29	0.92	0.22	0.22
Avail Cap(c_a), veh/h	686	0	0	473	717	608	89	1122	500	490	870	889
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.67	1.67	1.67
Upstream Filter(I)	1.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	0.90	0.90	0.90
Uniform Delay (d), s/veh	25.9	0.0	0.0	31.9	25.1	37.0	58.0	33.9	30.9	39.0	5.9	5.9
Incr Delay (d2), s/veh	0.3	0.0	0.0	1.2	0.2	40.0	23.4	1.9	1.4	17.5	0.5	0.5
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	4.3	0.0	0.0	6.3	3.3	24.2	1.5	7.7	3.4	10.0	1.1	1.2
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	26.2	0.0	0.0	33.2	25.3	77.0	81.4	35.8	32.3	56.4	6.4	6.4
LnGrp LOS	C	A	A	C	C	F	F	D	C	E	A	A
Approach Vol, veh/h		211			1042			794			716	
Approach Delay, s/veh		26.2			57.8			37.4			29.4	
Approach LOS		C			E			D			C	

Timer - Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	28.1	41.9		50.0	7.3	62.7		50.0
Change Period (Y+Rc), s	4.0	4.0		4.0	4.0	4.0		4.0
Max Green Setting (Gmax), s	33.0	29.0		46.0	6.0	56.0		46.0
Max Q Clear Time (g_c+I1), s	23.4	19.1		12.0	4.5	4.9		48.0
Green Ext Time (p_c), s	0.7	3.3		1.4	0.0	2.5		0.0

Intersection Summary			
HCM 6th Ctrl Delay			42.2
HCM 6th LOS			D

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	18	105	97	162	149	17
Future Volume (Veh/h)	18	105	97	162	149	17
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	20	114	105	176	162	18
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)			208			
pX, platoon unblocked						
vC, conflicting volume	281				347	193
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	281				347	193
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	98				75	98
cM capacity (veh/h)	1282				640	849

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	134	281	180
Volume Left	20	0	162
Volume Right	0	176	18
cSH	1282	1700	656
Volume to Capacity	0.02	0.17	0.27
Queue Length 95th (ft)	1	0	28
Control Delay (s)	1.3	0.0	12.6
Lane LOS	A		B
Approach Delay (s)	1.3	0.0	12.6
Approach LOS			B

Intersection Summary			
Average Delay	4.1		
Intersection Capacity Utilization	36.8%	ICU Level of Service	A
Analysis Period (min)	15		

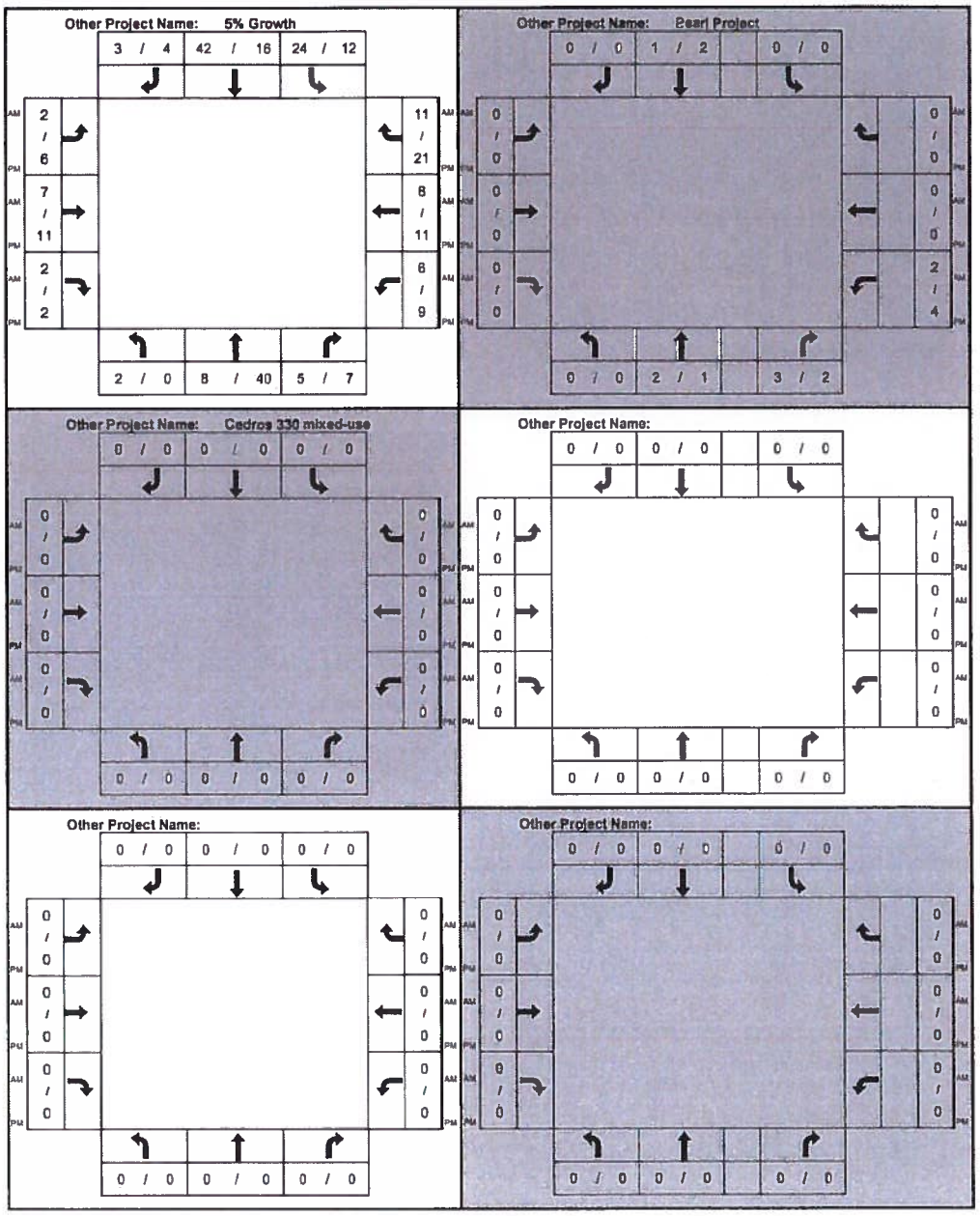
APPENDIX E

CUMULATIVE PROJECTS INFORMATION

Other Projects

Intersection 1

Analyst:	Henryk Pedersen	E/W Street Name:	Lomas Santa Fe Drive
Intersection:	Highway 101 / Lomas Santa Fe Dr.	N/S Street Name:	Highway 101
Future Condition:	Other Projects		
Date:	12/10/2014		
Company:	Urban Systems Associates, Inc.		
Project Number:	004113		

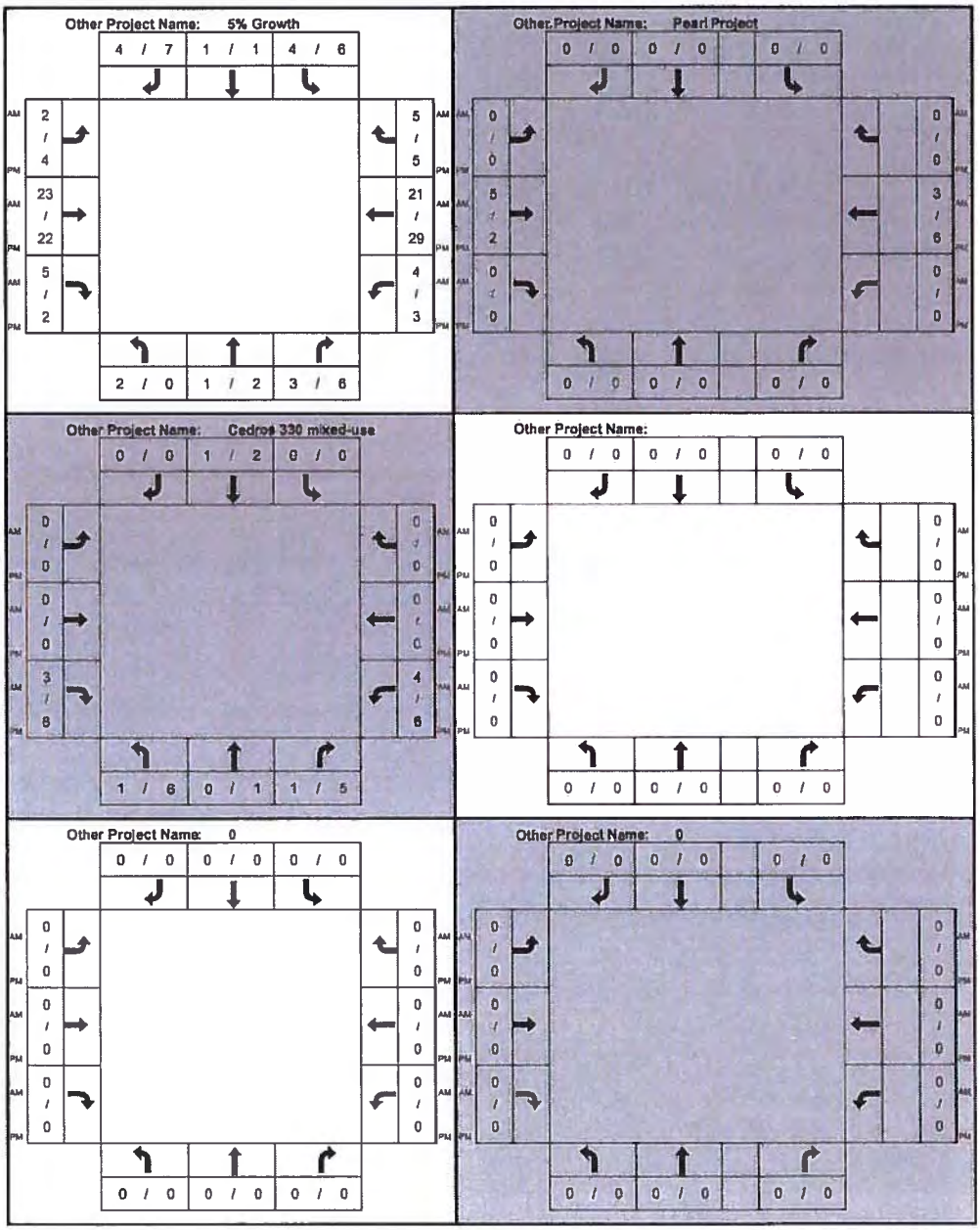


Turn movement	Project Only turn (v) AM	Project Only turn (v) PM
NLT	2	0
NTH	10	41
NRT	8	9
SLT	24	12
STH	43	18
SRT	3	4
ELT	2	6
ETH	7	11
ERT	2	2
WLT	8	13
WTH	8	11
WRT	11	21

5% Growth			
AM		PM	
Existing	5%	Existing	5%
32	1.6	37	1.8
157	7.9	803	40
96	4.8	136	6.8
472	24	233	12
840	42	321	16
58	2.9	77	3.9
48	2.4	122	6.1
140	7	229	11
43	2.2	34	1.7
120	6	173	8.6
169	8.4	226	11
213	11	426	21

Other Projects

Analyst:	Henryk Pedersen	Intersection 2	
Intersection:	Cedros Ave. / Lomas Santa Fe Dr.	E/W Street Name:	Lomas Santa Fe Dr.
Future Condition:	Other Projects	N/S Street Name:	Cedros Ave.
Date:	12/10/2014		
Company:	Urban Systems Associates, Inc.		
Project Number:	004113		



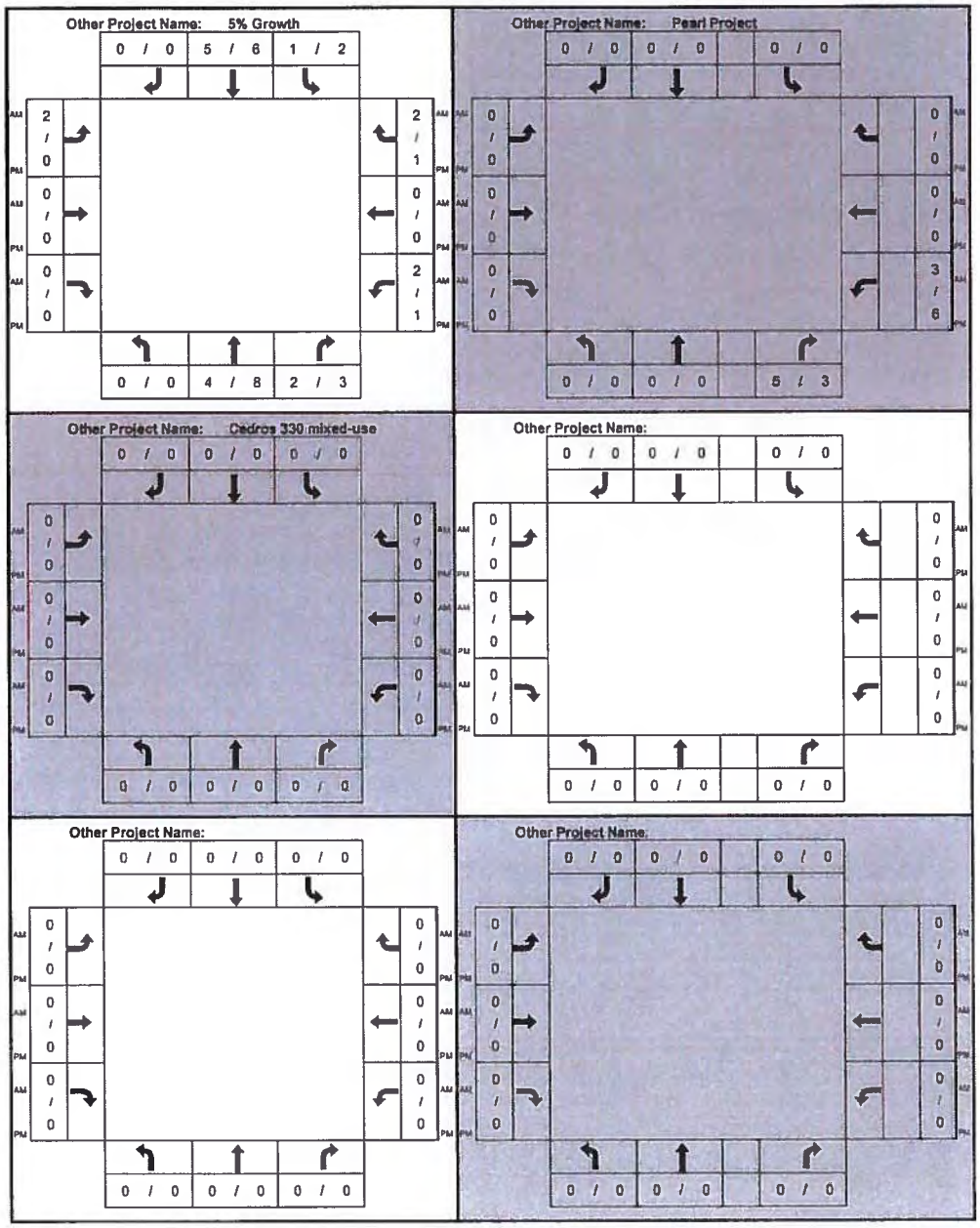
Turn movement	Project Only turn (v) AM	Project Only turn (v) PM
NLT	3	6
NTH	1	3
NRT	4	11
SLT	4	6
STH	2	3
SRT	4	7
ELT	2	4
ETH	28	24
ERT	8	8
WLT	8	9
WTH	24	35
WRT	5	5

5% Growth

AM Existing	5%	PM Existing	5%
39	2	122	6.1
22	1.1	42	2.1
66	3.3	116	5.8
75	3.8	117	5.8
25	1.2	18	0.9
85	4.2	149	7.4
48	2.4	89	4.4
462	23	446	22
103	5.2	41	2
71	3.6	57	2.8
425	21	586	29
103	5.2	96	4.8

Other Projects

Analyst:	Henryk Pedersen	Intersection 3	
Intersection:	Sierra Ave. / Dahlia Dr.	E/W Street Name:	Dahlia Drive
Future Condition:	Other Projects	N/S Street Name:	Sierra Ave.
Date:	12/10/2014		
Company:	Urban Systems Associates, Inc.		
Project Number:	004113		

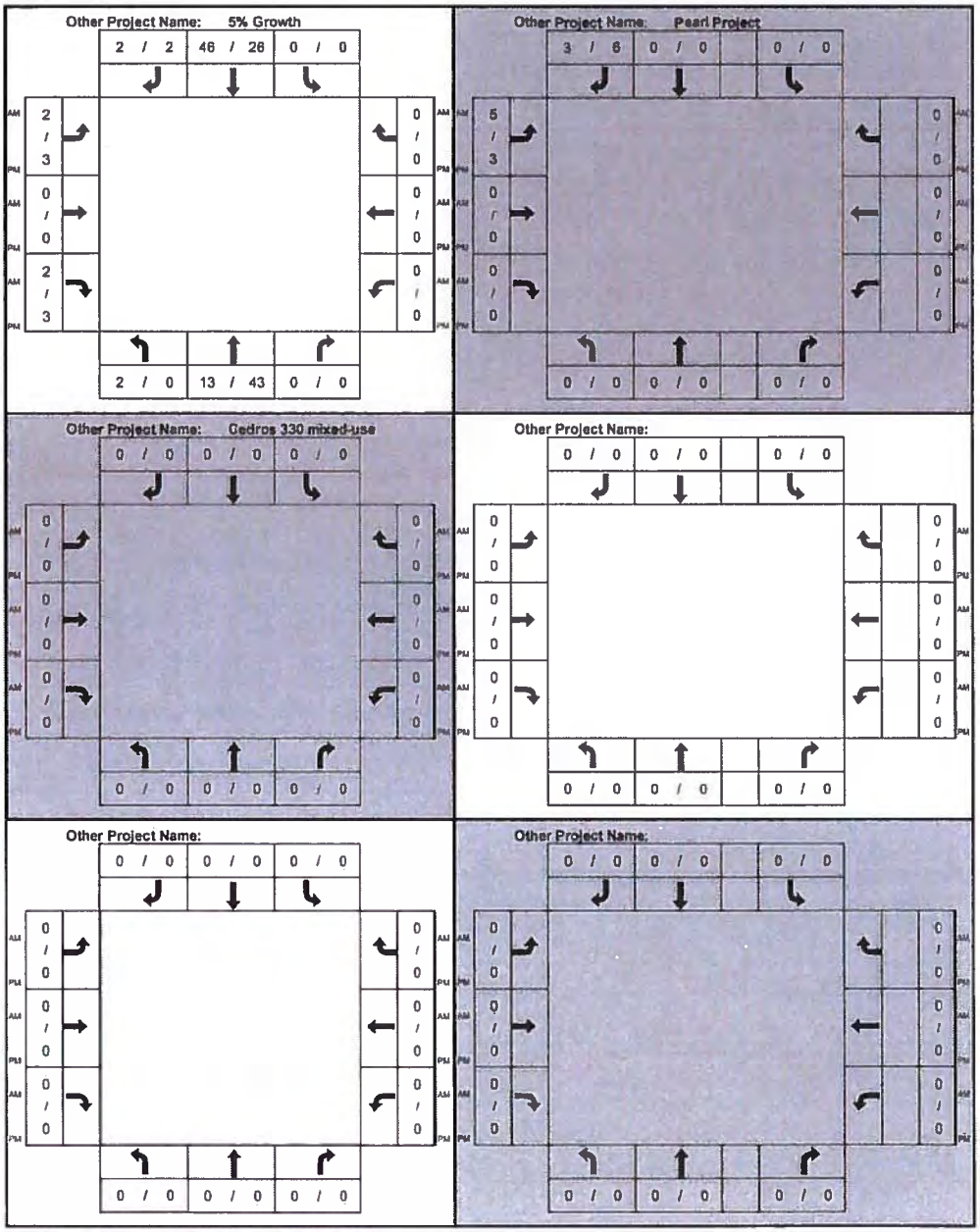


Turn movement	Project Only turn (v) AM	Project Only turn (v) PM
NLT	0	0
NTH	4	8
NRT	7	6
SLT	1	2
STH	5	6
SRT	0	0
ELT	2	0
ETH	0	0
ERT	0	0
WLT	5	7
WTH	0	0
WRT	2	1

5% Growth			
AM Existing	5%	PM Existing	5%
0	0	1.2	0.1
89	4.4	166	8.3
31	1.5	60	3
25	1.2	48	2.4
109	5.5	121	6
1.2	0.1	3.7	0.2
48	2.4	0	0
4.9	0.2	1.2	0.1
1.2	0.1	0	0
32	1.6	30	1.5
0	0	2.5	0.1
32	1.6	25	1.2

Other Projects

Analyst:	Henryk Pedersen	**Intersection 4**	
Intersection:	Highway 101 / Dahlia Dr.	E/W Street Name:	Dahlia Drive
Future Condition:	Other Projects	N/S Street Name:	Highway 101
Date:	12/10/2014		
Company:	Urban Systems Associates, Inc.		
Project Number:	004113		



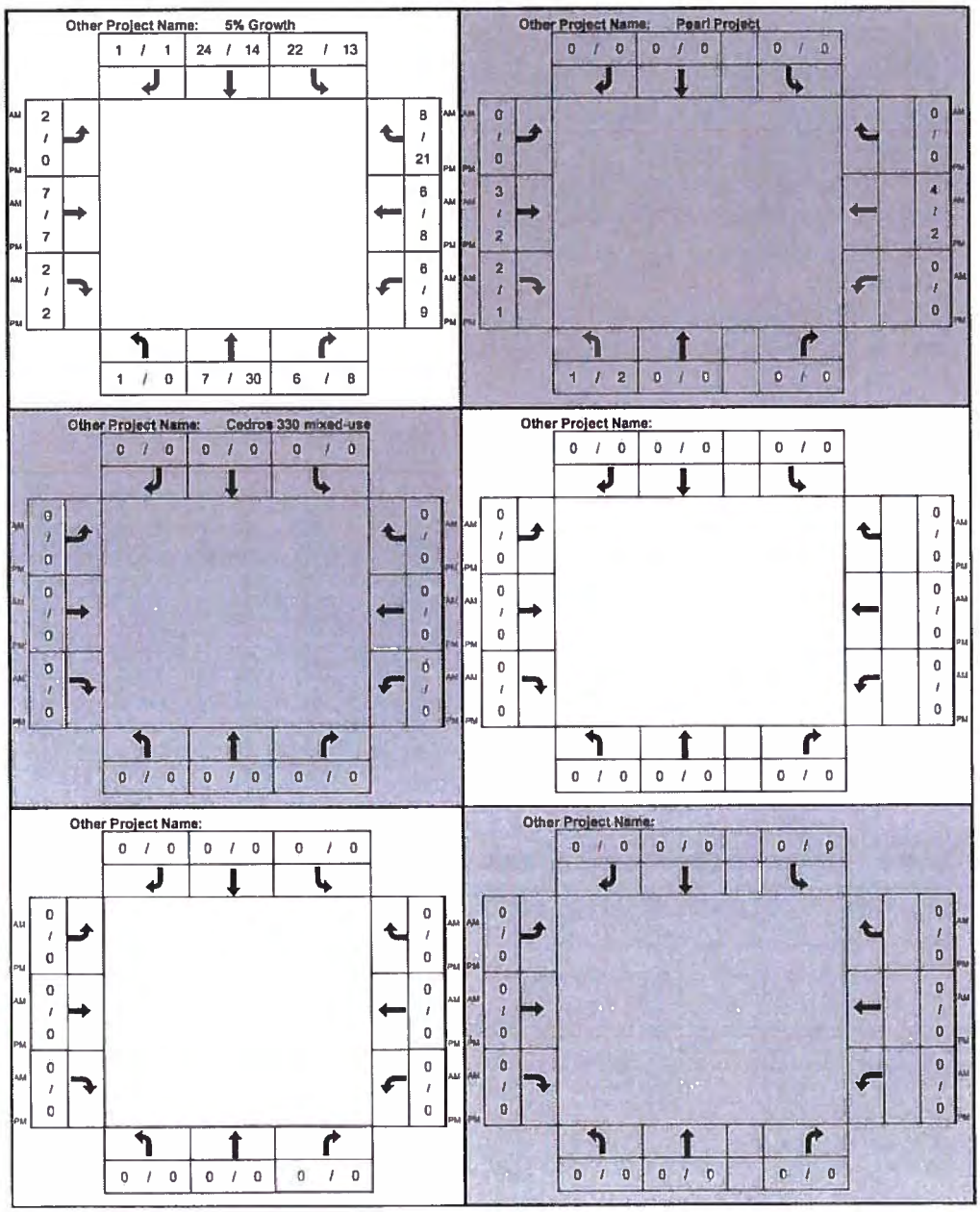
Turn movement	Project Only turn (v) AM	Project Only turn (v) PM
NLT	2	0
NTH	13	43
NRT	0	0
SLT	0	0
STH	46	26
SRT	5	8
ELT	7	6
ETH	0	0
ERT	2	3
WLT	0	0
WTH	0	0
WRT	0	0

5% Growth			
AM		PM	
Existing	5%	Existing	5%
36	1.8	41	2
260	13	868	43
0	0	0	0
0	0	0	0
922	46	516	26
44	2.2	38	1.9
48	2.4	68	3.4
0	0	0	0
36	1.8	50	2.5
0	0	0	0
0	0	0	0
0	0	0	0

Other Projects

Intersection 5

Analyst:	Henryk Pedersen	E/W Street Name:	Via De La Valle
Intersection:	Highway 101 / Via de la Valle	N/S Street Name:	Highway 101
Future Condition:	Other Projects		
Date:	12/10/2014		
Company:	Urban Systems Associates, Inc.		
Project Number:	004113		

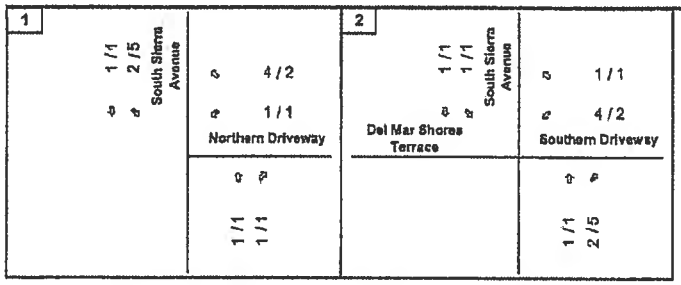


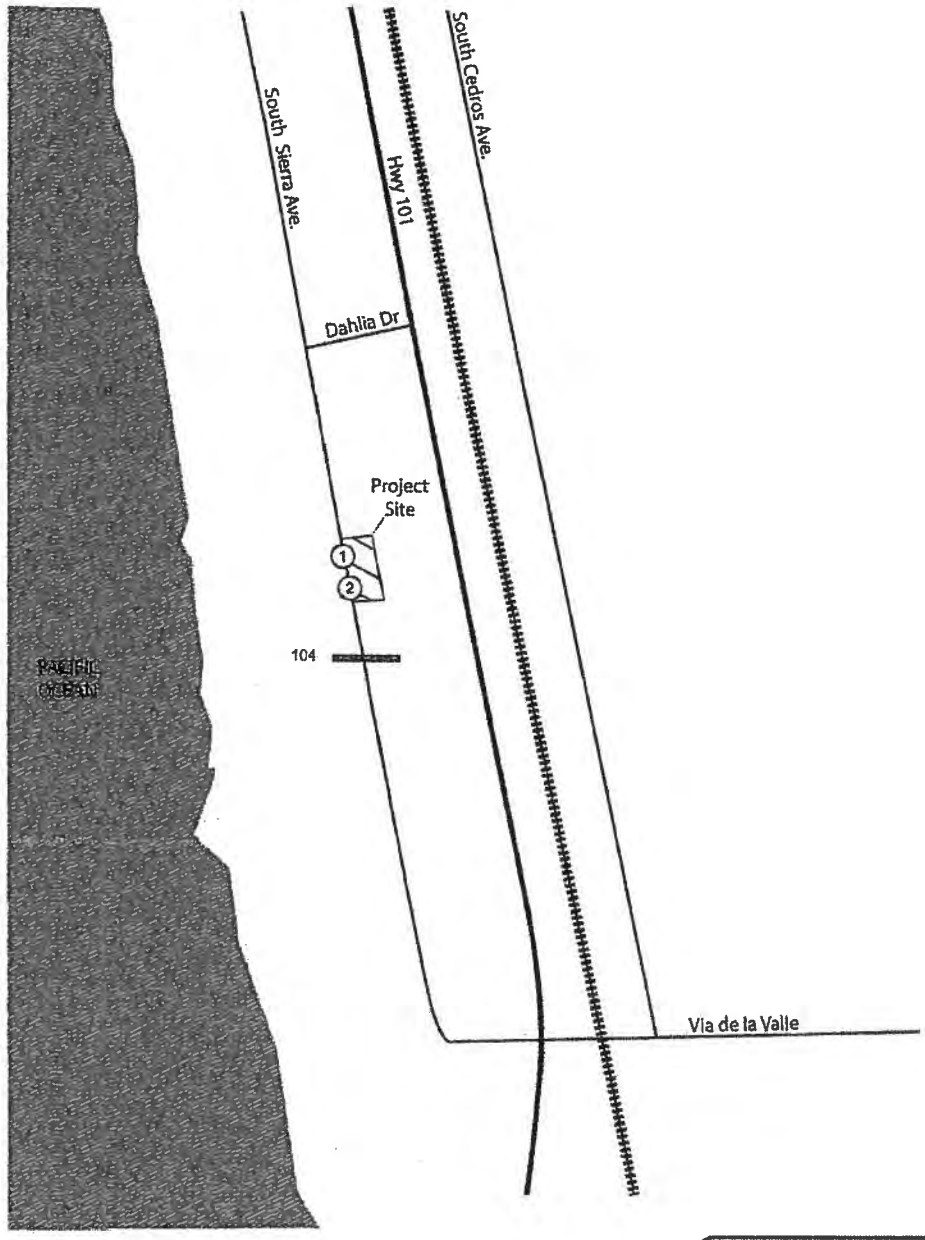
Turn movement	Project Only turn (v) AM	Project Only turn (v) PM
NLT	2	2
NTH	7	30
NRT	6	8
SLT	22	13
STH	24	14
SRT	1	1
ELT	2	0
ETH	10	9
ERT	4	3
WLT	6	9
WTH	10	10
WRT	8	21

5% Growth

AM Existing	AM 5%	PM Existing	PM 5%
22	1.1	38	1.9
145	7.2	592	30
127	6.3	154	7.7
445	22	265	13
488	24	282	14
11	0.6	22	1.1
48	2.4	1.2	0.1
138	6.9	137	6.8
32	1.6	32	1.6
112	5.6	177	8.8
112	5.6	159	7.9
154	7.7	415	21

The Peal Mixed Use





Legend

X / Y = AM / PM PEAK HOUR TURNING VOLUMES

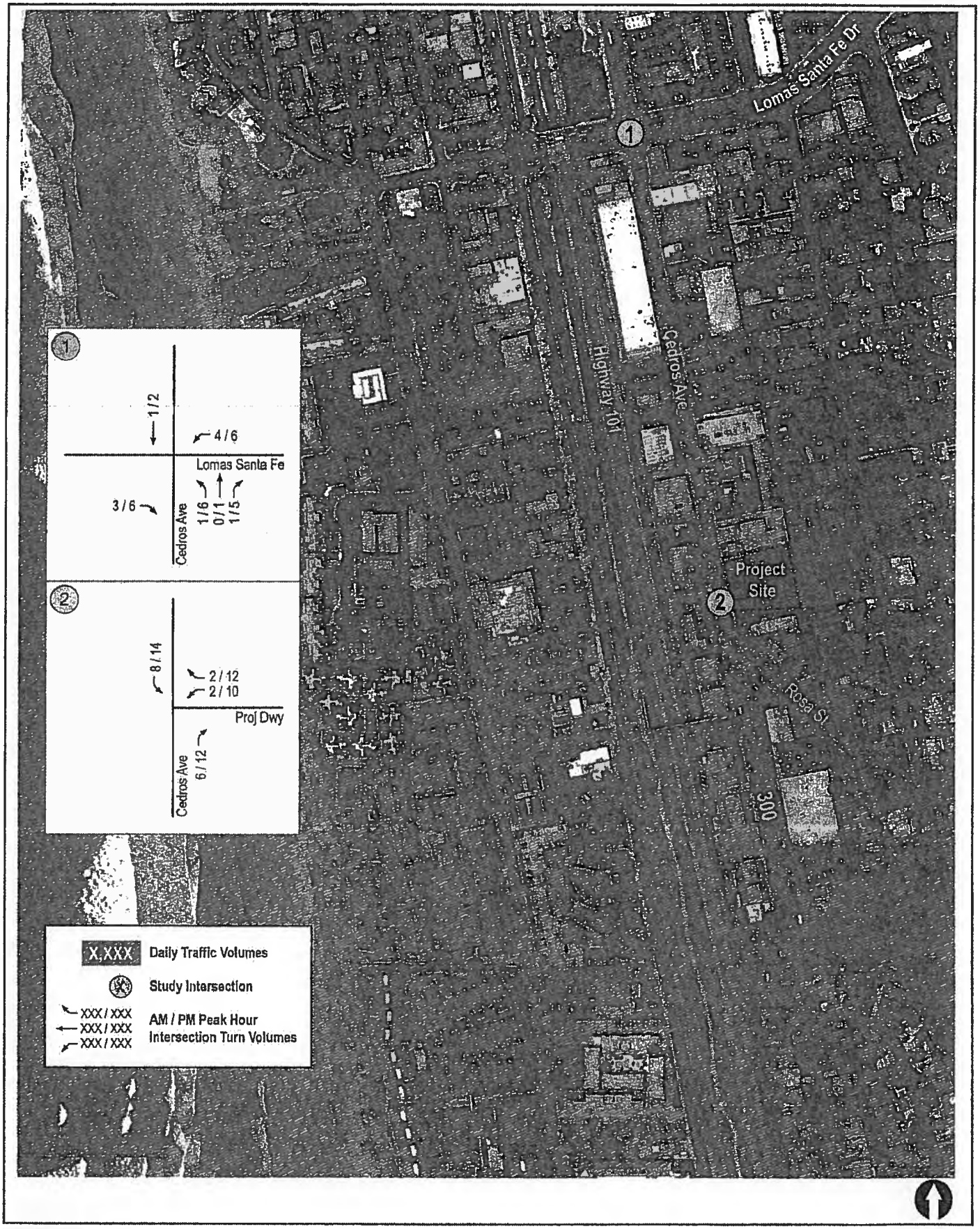
XXX =AVERAGE DAILY TRAFFIC VOLUMES

NOT TO SCALE

Kimley-Horn and Associates, Inc.

Figure 5

Project Trip Assignment



LINSCOTT LAW & GREENSPAN engineers

N:\2570\Figures
Date: 05/25/16

Figure 7-2

Project Traffic Volumes

CEDROS GARDENS MIXED-USE

APPENDIX F

NEAR TERM WITHOUT PROJECT SYNCHRO WORKSHEETS

HCM 6th Edition methodology does not support turning movements with shared & exclusive lanes.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	39	168	24	156	142	216	34	173	126	436	747	66
Future Volume (vph)	39	168	24	156	142	216	34	173	126	436	747	66
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Lane Util. Factor		0.95		0.97	0.91	0.91	1.00	0.95		1.00	0.95	
Frt		0.98		1.00	0.94	0.85	1.00	0.94		1.00	0.99	
Flt Protected		0.99		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)		3455		3433	3176	1441	1770	3315		1770	3496	
Flt Permitted		0.99		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)		3455		3433	3176	1441	1770	3315		1770	3496	
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	43	187	27	173	158	240	38	192	140	484	830	73
RTOR Reduction (vph)	0	8	0	0	102	111	0	97	0	0	4	0
Lane Group Flow (vph)	0	249	0	173	171	14	38	235	0	484	899	0
Turn Type	Split	NA		Split	NA	Perm	Prot	NA		Prot	NA	
Protected Phases	4	4		8	8		5	2		1	6	
Permitted Phases						8						
Actuated Green, G (s)		14.8		13.6	13.6	13.6	4.6	37.0		38.6	71.0	
Effective Green, g (s)		14.8		13.6	13.6	13.6	4.6	37.0		38.6	71.0	
Actuated g/C Ratio		0.12		0.11	0.11	0.11	0.04	0.31		0.32	0.59	
Clearance Time (s)		4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Vehicle Extension (s)		3.0		3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)		426		389	359	163	67	1022		569	2068	
v/s Ratio Prot		c0.07		0.05	c0.05		0.02	0.07		c0.27	c0.26	
v/s Ratio Perm						0.01						
v/c Ratio		0.58		0.44	0.48	0.09	0.57	0.23		0.85	0.43	
Uniform Delay, d1		49.7		49.7	49.9	47.6	56.7	30.9		38.0	13.5	
Progression Factor		1.00		1.00	1.00	1.00	1.16	0.95		1.00	1.00	
Incremental Delay, d2		2.0		0.8	1.0	0.2	10.5	0.5		11.7	0.7	
Delay (s)		51.7		50.5	50.9	47.9	76.5	30.0		49.7	14.1	
Level of Service		D		D	D	D	E	C		D	B	
Approach Delay (s)		51.7			50.1			34.7			26.5	
Approach LOS		D			D			C			C	

Intersection Summary			
HCM 2000 Control Delay	35.4	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.63		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	59.1%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	66	523	111	74	395	62	60	16	74	63	13	67
Future Volume (veh/h)	66	523	111	74	395	62	60	16	74	63	13	67
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	73	581	123	82	439	69	67	18	82	70	14	74
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	94	750	158	106	1346	418	777	154	700	734	979	830
Arrive On Green	0.05	0.26	0.26	0.06	0.26	0.26	0.52	0.52	0.52	0.52	0.52	0.52
Sat Flow, veh/h	1781	2920	616	1781	5106	1585	1309	293	1336	1295	1870	1585
Grp Volume(v), veh/h	73	353	351	82	439	69	67	0	100	70	14	74
Grp Sat Flow(s),veh/h/ln	1781	1777	1759	1781	1702	1585	1309	0	1630	1295	1870	1585
Q Serve(g_s), s	3.0	13.8	13.9	3.4	5.2	2.5	1.9	0.0	2.3	2.2	0.3	1.7
Cycle Q Clear(g_c), s	3.0	13.8	13.9	3.4	5.2	2.5	2.2	0.0	2.3	4.5	0.3	1.7
Prop In Lane	1.00		0.35	1.00		1.00	1.00		0.82	1.00		1.00
Lane Grp Cap(c), veh/h	94	456	452	106	1346	418	777	0	853	734	979	830
V/C Ratio(X)	0.78	0.77	0.78	0.77	0.33	0.17	0.09	0.00	0.12	0.10	0.01	0.09
Avail Cap(c_a), veh/h	190	640	633	214	1906	592	777	0	853	734	979	830
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.56	0.56	0.56	1.00	1.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	35.1	25.8	25.9	34.8	22.3	21.3	9.1	0.0	9.1	10.2	8.6	8.9
Incr Delay (d2), s/veh	7.5	2.2	2.3	11.3	0.1	0.2	0.2	0.0	0.3	0.3	0.0	0.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.5	5.8	5.8	1.8	2.0	0.9	0.5	0.0	0.8	0.6	0.1	0.6
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	42.6	28.0	28.2	46.1	22.4	21.4	9.3	0.0	9.3	10.5	8.6	9.1
LnGrp LOS	D	C	C	D	C	C	A	A	A	B	A	A
Approach Vol, veh/h		777			590			167			158	
Approach Delay, s/veh		29.5			25.6			9.3			9.7	
Approach LOS		C			C			A			A	

Timer - Assigned Phs		2	3	4		6	7	8
Phs Duration (G+Y+Rc), s		43.3	8.5	23.3		43.3	8.0	23.8
Change Period (Y+Rc), s		4.0	4.0	4.0		4.0	4.0	4.0
Max Green Setting (Gmax), s		27.0	9.0	27.0		27.0	8.0	28.0
Max Q Clear Time (g_c+I1), s		4.3	5.4	15.9		6.5	5.0	7.2
Green Ext Time (p_c), s		0.7	0.0	3.4		0.5	0.0	3.1

Intersection Summary	
HCM 6th Ctrl Delay	24.3
HCM 6th LOS	C

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Traffic Volume (vph)	3	3	1	33	0	38	0	103	45	20	109	0
Future Volume (vph)	3	3	1	33	0	38	0	103	45	20	109	0
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	3	3	1	37	0	42	0	114	50	22	121	0

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total (vph)	7	79	164	143
Volume Left (vph)	3	37	0	22
Volume Right (vph)	1	42	50	0
Hadj (s)	0.03	-0.19	-0.15	0.06
Departure Headway (s)	4.7	4.4	4.1	4.3
Degree Utilization, x	0.01	0.10	0.19	0.17
Capacity (veh/h)	700	758	849	799
Control Delay (s)	7.7	7.9	8.0	8.2
Approach Delay (s)	7.7	7.9	8.0	8.2
Approach LOS	A	A	A	A

Intersection Summary			
Delay	8.1		
Level of Service	A		
Intersection Capacity Utilization	30.5%	ICU Level of Service	A
Analysis Period (min)	15		

HCM 6th Edition methodology does not support turning movements with shared & exclusive lanes.

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	50	30	57	261	862	37
Future Volume (vph)	50	30	57	261	862	37
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0	4.5	4.5	
Lane Util. Factor	1.00		1.00	0.95	0.95	
Frt	0.95		1.00	1.00	0.99	
Flt Protected	0.97		0.95	1.00	1.00	
Satd. Flow (prot)	1716		1770	3539	3517	
Flt Permitted	0.97		0.95	1.00	1.00	
Satd. Flow (perm)	1716		1770	3539	3517	
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	56	33	63	290	958	41
RTOR Reduction (vph)	28	0	0	0	1	0
Lane Group Flow (vph)	61	0	63	290	998	0
Turn Type	Prot		Prot	NA	NA	
Protected Phases	4		5	2	6	
Permitted Phases						
Actuated Green, G (s)	10.8		8.4	100.7	88.3	
Effective Green, g (s)	10.8		8.4	100.7	88.3	
Actuated g/C Ratio	0.09		0.07	0.84	0.74	
Clearance Time (s)	4.0		4.0	4.5	4.5	
Vehicle Extension (s)	3.0		3.0	3.0	3.0	
Lane Grp Cap (vph)	154		123	2969	2587	
v/s Ratio Prot	c0.04		c0.04	0.08	c0.28	
v/s Ratio Perm						
v/c Ratio	0.39		0.51	0.10	0.39	
Uniform Delay, d1	51.5		53.8	1.7	5.8	
Progression Factor	1.00		0.76	2.37	0.73	
Incremental Delay, d2	1.7		3.5	0.1	0.4	
Delay (s)	53.2		44.4	4.1	4.7	
Level of Service	D		D	A	A	
Approach Delay (s)	53.2			11.3	4.7	
Approach LOS	D			B	A	

Intersection Summary			
HCM 2000 Control Delay	9.3	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.40		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	12.5
Intersection Capacity Utilization	43.4%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	6	146	36	147	108	183	20	176	147	389	468	16
Future Volume (veh/h)	6	146	36	147	108	183	20	176	147	389	468	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	7	162	40	163	120	203	22	196	163	432	520	18
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	36	309	74	253	405	343	31	1477	659	478	2335	81
Arrive On Green	0.22	0.22	0.22	0.22	0.22	0.22	0.02	0.42	0.42	0.09	0.22	0.22
Sat Flow, veh/h	22	1427	343	1180	1870	1585	1781	3554	1585	1781	3504	121
Grp Volume(v), veh/h	209	0	0	163	120	203	22	196	163	432	263	275
Grp Sat Flow(s),veh/h/ln	1792	0	0	1180	1870	1585	1781	1777	1585	1781	1777	1849
Q Serve(g_s), s	0.0	0.0	0.0	10.1	6.4	13.8	1.5	4.1	8.0	28.8	14.6	14.6
Cycle Q Clear(g_c), s	12.3	0.0	0.0	22.4	6.4	13.8	1.5	4.1	8.0	28.8	14.6	14.6
Prop In Lane	0.03		0.19	1.00		1.00	1.00		1.00	1.00		0.07
Lane Grp Cap(c), veh/h	419	0	0	253	405	343	31	1477	659	478	1184	1232
V/C Ratio(X)	0.50	0.00	0.00	0.64	0.30	0.59	0.71	0.13	0.25	0.90	0.22	0.22
Avail Cap(c_a), veh/h	552	0	0	342	546	462	89	1477	659	787	1184	1232
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.33	0.33	0.33
Upstream Filter(I)	1.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	0.93	0.93	0.93
Uniform Delay (d), s/veh	41.7	0.0	0.0	47.6	39.4	42.3	58.7	21.7	22.8	53.2	21.3	21.3
Incr Delay (d2), s/veh	0.9	0.0	0.0	2.7	0.4	1.6	26.0	0.2	0.9	8.2	0.4	0.4
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	5.6	0.0	0.0	4.9	3.0	5.6	0.9	1.8	3.2	14.9	7.1	7.4
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	42.6	0.0	0.0	50.3	39.8	43.9	84.7	21.9	23.7	61.3	21.7	21.7
LnGrp LOS	D	A	A	D	D	D	F	C	C	E	C	C
Approach Vol, veh/h		209			486			381			970	
Approach Delay, s/veh		42.6			45.0			26.3			39.3	
Approach LOS		D			D			C			D	

Timer - Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	36.2	53.9		30.0	6.1	84.0		30.0
Change Period (Y+Rc), s	4.0	4.0		4.0	4.0	4.0		4.0
Max Green Setting (Gmax), s	53.0	20.0		35.0	6.0	67.0		35.0
Max Q Clear Time (g_c+I1), s	30.8	10.0		14.3	3.5	16.6		24.4
Green Ext Time (p_c), s	1.3	1.2		1.1	0.0	3.6		1.5

Intersection Summary		
HCM 6th Ctrl Delay		38.6
HCM 6th LOS		D

HCM 6th Edition methodology does not support turning movements with shared & exclusive lanes.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	96	241	22	245	215	514	44	769	167	303	419	53
Future Volume (vph)	96	241	22	245	215	514	44	769	167	303	419	53
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Lane Util. Factor		0.95		0.97	0.91	0.91	1.00	0.95		1.00	0.95	
Frt		0.99		1.00	0.92	0.85	1.00	0.97		1.00	0.98	
Flt Protected		0.99		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)		3461		3433	3113	1441	1770	3444		1770	3480	
Flt Permitted		0.99		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)		3461		3433	3113	1441	1770	3444		1770	3480	
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	107	268	24	272	239	571	49	854	186	337	466	59
RTOR Reduction (vph)	0	4	0	0	187	238	0	15	0	0	8	0
Lane Group Flow (vph)	0	395	0	272	338	47	49	1025	0	337	517	0
Turn Type	Split	NA		Split	NA	Perm	Prot	NA		Prot	NA	
Protected Phases	4	4		8	8		5	2		1	6	
Permitted Phases						8						
Actuated Green, G (s)		18.5		19.8	19.8	19.8	6.0	39.5		26.2	59.7	
Effective Green, g (s)		18.5		19.8	19.8	19.8	6.0	39.5		26.2	59.7	
Actuated g/C Ratio		0.15		0.17	0.17	0.17	0.05	0.33		0.22	0.50	
Clearance Time (s)		4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Vehicle Extension (s)		3.0		3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)		533		566	513	237	88	1133		386	1731	
v/s Ratio Prot		c0.11		0.08	c0.11		0.03	c0.30		c0.19	0.15	
v/s Ratio Perm						0.03						
v/c Ratio		0.74		0.48	0.66	0.20	0.56	0.90		0.87	0.30	
Uniform Delay, d1		48.5		45.4	46.9	43.2	55.7	38.4		45.3	17.8	
Progression Factor		1.00		1.00	1.00	1.00	1.12	0.75		1.00	1.00	
Incremental Delay, d2		5.5		0.6	3.1	0.4	7.1	11.4		19.0	0.4	
Delay (s)		53.9		46.1	50.0	43.7	69.6	40.1		64.3	18.2	
Level of Service		D		D	D	D	E	D		E	B	
Approach Delay (s)		53.9			47.3			41.5			36.3	
Approach LOS		D			D			D			D	

Intersection Summary			
HCM 2000 Control Delay	43.5	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.82		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	78.3%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	81	507	68	110	711	46	104	41	138	100	30	140
Future Volume (veh/h)	81	507	68	110	711	46	104	41	138	100	30	140
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	90	563	76	122	790	51	116	46	153	111	33	156
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	116	739	99	155	1311	407	705	197	655	631	969	821
Arrive On Green	0.06	0.23	0.23	0.09	0.26	0.26	0.52	0.52	0.52	0.52	0.52	0.52
Sat Flow, veh/h	1781	3147	424	1781	5106	1585	1194	380	1263	1183	1870	1585
Grp Volume(v), veh/h	90	317	322	122	790	51	116	0	199	111	33	156
Grp Sat Flow(s),veh/h/ln	1781	1777	1794	1781	1702	1585	1194	0	1643	1183	1870	1585
Q Serve(g_s), s	3.7	12.5	12.5	5.0	10.2	1.9	4.0	0.0	5.0	4.3	0.6	3.9
Cycle Q Clear(g_c), s	3.7	12.5	12.5	5.0	10.2	1.9	4.6	0.0	5.0	9.2	0.6	3.9
Prop In Lane	1.00		0.24	1.00		1.00	1.00		0.77	1.00		1.00
Lane Grp Cap(c), veh/h	116	417	421	155	1311	407	705	0	851	631	969	821
V/C Ratio(X)	0.78	0.76	0.76	0.79	0.60	0.13	0.16	0.00	0.23	0.18	0.03	0.19
Avail Cap(c_a), veh/h	166	616	622	214	1906	592	705	0	851	631	969	821
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.49	0.49	0.49	1.00	1.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	34.5	26.7	26.8	33.6	24.5	21.4	10.0	0.0	9.9	12.4	8.9	9.7
Incr Delay (d2), s/veh	7.0	1.6	1.6	12.4	0.4	0.1	0.5	0.0	0.6	0.6	0.1	0.5
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.8	5.2	5.3	2.6	4.0	0.7	1.0	0.0	1.8	1.2	0.3	1.4
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	41.5	28.3	28.4	46.0	25.0	21.5	10.5	0.0	10.5	13.0	8.9	10.2
LnGrp LOS	D	C	C	D	C	C	B	A	B	B	A	B
Approach Vol, veh/h		729			963			315			300	
Approach Delay, s/veh		30.0			27.4			10.5			11.1	
Approach LOS		C			C			B			B	

Timer - Assigned Phs		2	3	4		6	7	8
Phs Duration (G+Y+Rc), s		42.9	10.5	21.6		42.9	8.9	23.3
Change Period (Y+Rc), s		4.0	4.0	4.0		4.0	4.0	4.0
Max Green Setting (Gmax), s		28.0	9.0	26.0		28.0	7.0	28.0
Max Q Clear Time (g_c+I1), s		7.0	7.0	14.5		11.2	5.7	12.2
Green Ext Time (p_c), s		1.6	0.1	3.1		1.0	0.0	5.1

Intersection Summary	
HCM 6th Ctrl Delay	23.8
HCM 6th LOS	C

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Traffic Volume (vph)	1	1	1	33	1	54	2	142	54	40	98	3
Future Volume (vph)	1	1	1	33	1	54	2	142	54	40	98	3
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	1	1	1	37	1	60	2	158	60	44	109	3

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total (vph)	3	98	220	156
Volume Left (vph)	1	37	2	44
Volume Right (vph)	1	60	60	3
Hadj (s)	-0.10	-0.26	-0.13	0.08
Departure Headway (s)	4.8	4.5	4.2	4.4
Degree Utilization, x	0.00	0.12	0.26	0.19
Capacity (veh/h)	681	737	832	776
Control Delay (s)	7.8	8.1	8.6	8.5
Approach Delay (s)	7.8	8.1	8.6	8.5
Approach LOS	A	A	A	A

Intersection Summary			
Delay	8.5		
Level of Service	A		
Intersection Capacity Utilization	35.6%	ICU Level of Service	A
Analysis Period (min)	15		

HCM 6th Edition methodology does not support turning movements with shared & exclusive lanes.

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	75	45	48	893	705	61
Future Volume (vph)	75	45	48	893	705	61
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0	4.5	4.5	
Lane Util. Factor	1.00		1.00	0.95	0.95	
Frt	0.95		1.00	1.00	0.99	
Flt Protected	0.97		0.95	1.00	1.00	
Satd. Flow (prot)	1715		1770	3539	3497	
Flt Permitted	0.97		0.95	1.00	1.00	
Satd. Flow (perm)	1715		1770	3539	3497	
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	83	50	53	992	783	68
RTOR Reduction (vph)	21	0	0	0	3	0
Lane Group Flow (vph)	112	0	53	992	848	0
Turn Type	Prot		Prot	NA	NA	
Protected Phases	4		5	2	6	
Permitted Phases						
Actuated Green, G (s)	13.3		7.9	98.2	86.3	
Effective Green, g (s)	13.3		7.9	98.2	86.3	
Actuated g/C Ratio	0.11		0.07	0.82	0.72	
Clearance Time (s)	4.0		4.0	4.5	4.5	
Vehicle Extension (s)	3.0		3.0	3.0	3.0	
Lane Grp Cap (vph)	190		116	2896	2514	
v/s Ratio Prot	c0.07		c0.03	c0.28	0.24	
v/s Ratio Perm						
v/c Ratio	0.59		0.46	0.34	0.34	
Uniform Delay, d1	50.7		54.0	2.8	6.2	
Progression Factor	1.00		0.77	2.62	0.45	
Incremental Delay, d2	4.6		2.4	0.3	0.4	
Delay (s)	55.3		44.1	7.5	3.2	
Level of Service	E		D	A	A	
Approach Delay (s)	55.3			9.3	3.2	
Approach LOS	E			A	A	

Intersection Summary			
HCM 2000 Control Delay	9.8	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.39		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	12.5
Intersection Capacity Utilization	42.1%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	10	128	64	239	163	525	36	567	138	264	319	31
Future Volume (veh/h)	10	128	64	239	163	525	36	567	138	264	319	31
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	11	142	71	266	181	583	40	630	153	293	354	34
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	43	389	186	407	639	542	51	1347	601	320	1736	166
Arrive On Green	0.34	0.34	0.34	0.34	0.34	0.34	0.03	0.38	0.38	0.36	1.00	1.00
Sat Flow, veh/h	34	1139	544	1168	1870	1585	1781	3554	1585	1781	3278	313
Grp Volume(v), veh/h	224	0	0	266	181	583	40	630	153	293	191	197
Grp Sat Flow(s),veh/h/ln	1717	0	0	1168	1870	1585	1781	1777	1585	1781	1777	1814
Q Serve(g_s), s	0.0	0.0	0.0	18.8	8.5	41.0	2.7	16.1	8.0	18.9	0.0	0.0
Cycle Q Clear(g_c), s	11.5	0.0	0.0	30.2	8.5	41.0	2.7	16.1	8.0	18.9	0.0	0.0
Prop In Lane	0.05		0.32	1.00		1.00	1.00		1.00	1.00		0.17
Lane Grp Cap(c), veh/h	618	0	0	407	639	542	51	1347	601	320	941	961
V/C Ratio(X)	0.36	0.00	0.00	0.65	0.28	1.08	0.78	0.47	0.25	0.92	0.20	0.21
Avail Cap(c_a), veh/h	618	0	0	407	639	542	119	1347	601	475	941	961
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	2.00	2.00	2.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	0.95	0.95
Uniform Delay (d), s/veh	29.8	0.0	0.0	37.8	28.8	39.5	57.9	28.1	25.6	37.6	0.0	0.0
Incr Delay (d2), s/veh	0.4	0.0	0.0	3.7	0.2	60.9	22.0	1.2	1.0	16.4	0.5	0.5
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	4.9	0.0	0.0	7.5	3.9	24.8	1.5	7.0	3.2	8.3	0.1	0.1
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	30.1	0.0	0.0	41.5	29.0	100.4	79.9	29.3	26.6	54.0	0.5	0.5
LnGrp LOS	C	A	A	D	C	F	E	C	C	D	A	A
Approach Vol, veh/h		224			1030			823			681	
Approach Delay, s/veh		30.1			72.6			31.3			23.5	
Approach LOS		C			E			C			C	

Timer - Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	25.5	49.5		45.0	7.5	67.5		45.0
Change Period (Y+Rc), s	4.0	4.0		4.0	4.0	4.0		4.0
Max Green Setting (Gmax), s	32.0	35.0		41.0	8.0	59.0		41.0
Max Q Clear Time (g_c+I1), s	20.9	18.1		13.5	4.7	2.0		43.0
Green Ext Time (p_c), s	0.7	4.5		1.4	0.0	2.5		0.0

Intersection Summary			
HCM 6th Ctrl Delay			44.7
HCM 6th LOS			D

APPENDIX G

NEAR TERM WITH PROJECT SYNCHRO WORKSHEETS

HCM 6th Edition methodology does not support turning movements with shared & exclusive lanes.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	39	168	24	177	142	216	34	181	139	436	759	66
Future Volume (vph)	39	168	24	177	142	216	34	181	139	436	759	66
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Lane Util. Factor		0.95		0.97	0.91	0.91	1.00	0.95		1.00	0.95	
Frt		0.98		1.00	0.94	0.85	1.00	0.93		1.00	0.99	
Flt Protected		0.99		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)		3455		3433	3176	1441	1770	3309		1770	3497	
Flt Permitted		0.99		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)		3455		3433	3176	1441	1770	3309		1770	3497	
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	43	187	27	197	158	240	38	201	154	484	843	73
RTOR Reduction (vph)	0	8	0	0	101	110	0	104	0	0	4	0
Lane Group Flow (vph)	0	249	0	197	172	15	38	251	0	484	912	0
Turn Type	Split	NA		Split	NA	Perm	Prot	NA		Prot	NA	
Protected Phases	4	4		8	8		5	2		1	6	
Permitted Phases						8						
Actuated Green, G (s)		14.8		14.2	14.2	14.2	4.6	39.0		36.0	70.4	
Effective Green, g (s)		14.8		14.2	14.2	14.2	4.6	39.0		36.0	70.4	
Actuated g/C Ratio		0.12		0.12	0.12	0.12	0.04	0.32		0.30	0.59	
Clearance Time (s)		4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Vehicle Extension (s)		3.0		3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)		426		406	375	170	67	1075		531	2051	
v/s Ratio Prot		c0.07		c0.06	0.05		0.02	0.08		c0.27	c0.26	
v/s Ratio Perm						0.01						
v/c Ratio		0.58		0.49	0.46	0.09	0.57	0.23		0.91	0.44	
Uniform Delay, d1		49.7		49.5	49.3	47.1	56.7	29.6		40.5	13.9	
Progression Factor		1.00		1.00	1.00	1.00	1.34	0.44		1.00	1.00	
Incremental Delay, d2		2.0		0.9	0.9	0.2	10.5	0.5		19.9	0.7	
Delay (s)		51.7		50.4	50.2	47.3	86.5	13.6		60.4	14.6	
Level of Service		D		D	D	D	F	B		E	B	
Approach Delay (s)		51.7			49.7			20.6			30.4	
Approach LOS		D			D			C			C	

Intersection Summary			
HCM 2000 Control Delay	35.4	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.64		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	59.7%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	68	533	112	74	411	62	62	16	74	63	13	70
Future Volume (veh/h)	68	533	112	74	411	62	62	16	74	63	13	70
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	76	592	124	82	457	69	69	18	82	70	14	78
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	95	702	147	108	1261	391	795	158	721	756	1009	855
Arrive On Green	0.05	0.24	0.24	0.06	0.25	0.25	0.54	0.54	0.54	0.54	0.54	0.54
Sat Flow, veh/h	1781	2926	611	1781	5106	1585	1304	293	1336	1295	1870	1585
Grp Volume(v), veh/h	76	359	357	82	457	69	69	0	100	70	14	78
Grp Sat Flow(s),veh/h/ln	1781	1777	1760	1781	1702	1585	1304	0	1630	1295	1870	1585
Q Serve(g_s), s	3.2	14.4	14.5	3.4	5.6	2.6	1.9	0.0	2.3	2.1	0.3	1.8
Cycle Q Clear(g_c), s	3.2	14.4	14.5	3.4	5.6	2.6	2.2	0.0	2.3	4.4	0.3	1.8
Prop In Lane	1.00		0.35	1.00		1.00	1.00		0.82	1.00		1.00
Lane Grp Cap(c), veh/h	95	426	422	108	1261	391	795	0	880	756	1009	855
V/C Ratio(X)	0.80	0.84	0.85	0.76	0.36	0.18	0.09	0.00	0.11	0.09	0.01	0.09
Avail Cap(c_a), veh/h	95	474	469	499	2519	782	795	0	880	756	1009	855
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.50	0.50	0.50	1.00	1.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	35.1	27.2	27.2	34.7	23.4	22.2	8.5	0.0	8.5	9.5	8.0	8.4
Incr Delay (d2), s/veh	21.1	6.4	6.7	10.4	0.2	0.2	0.2	0.0	0.3	0.2	0.0	0.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.9	6.6	6.6	1.7	2.2	0.9	0.5	0.0	0.8	0.6	0.1	0.6
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	56.2	33.6	33.9	45.1	23.5	22.4	8.7	0.0	8.7	9.8	8.0	8.6
LnGrp LOS	E	C	C	D	C	C	A	A	A	A	A	A
Approach Vol, veh/h		792			608			169			162	
Approach Delay, s/veh		35.9			26.3			8.7			9.0	
Approach LOS		D			C			A			A	

Timer - Assigned Phs		2	3	4		6	7	8				
Phs Duration (G+Y+Rc), s		44.5	8.5	22.0		44.5	8.0	22.5				
Change Period (Y+Rc), s		4.0	4.0	4.0		4.0	4.0	4.0				
Max Green Setting (Gmax), s		22.0	21.0	20.0		22.0	4.0	37.0				
Max Q Clear Time (g_c+I1), s		4.3	5.4	16.5		6.4	5.2	7.6				
Green Ext Time (p_c), s		0.7	0.1	1.5		0.4	0.0	3.6				

Intersection Summary	
HCM 6th Ctrl Delay	27.4
HCM 6th LOS	C

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Traffic Volume (vph)	3	3	1	37	0	41	0	103	51	24	109	0
Future Volume (vph)	3	3	1	37	0	41	0	103	51	24	109	0
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	3	3	1	41	0	46	0	114	57	27	121	0

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total (vph)	7	87	171	148
Volume Left (vph)	3	41	0	27
Volume Right (vph)	1	46	57	0
Hadj (s)	0.03	-0.19	-0.17	0.07
Departure Headway (s)	4.7	4.4	4.1	4.4
Degree Utilization, x	0.01	0.11	0.20	0.18
Capacity (veh/h)	693	752	845	791
Control Delay (s)	7.8	7.9	8.1	8.3
Approach Delay (s)	7.8	7.9	8.1	8.3
Approach LOS	A	A	A	A

Intersection Summary			
Delay	8.1		
Level of Service	A		
Intersection Capacity Utilization	31.7%	ICU Level of Service	A
Analysis Period (min)	15		

HCM 6th Edition methodology does not support turning movements with shared & exclusive lanes.

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	74	66	112	261	862	73
Future Volume (vph)	74	66	112	261	862	73
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0	4.5	4.5	
Lane Util. Factor	1.00		1.00	0.95	0.95	
Frt	0.94		1.00	1.00	0.99	
Flt Protected	0.97		0.95	1.00	1.00	
Satd. Flow (prot)	1699		1770	3539	3498	
Flt Permitted	0.97		0.95	1.00	1.00	
Satd. Flow (perm)	1699		1770	3539	3498	
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	82	73	124	290	958	81
RTOR Reduction (vph)	30	0	0	0	4	0
Lane Group Flow (vph)	125	0	124	290	1035	0
Turn Type	Prot		Prot	NA	NA	
Protected Phases	4		5	2	6	
Permitted Phases						
Actuated Green, G (s)	14.0		13.7	97.5	79.8	
Effective Green, g (s)	14.0		13.7	97.5	79.8	
Actuated g/C Ratio	0.12		0.11	0.81	0.66	
Clearance Time (s)	4.0		4.0	4.5	4.5	
Vehicle Extension (s)	3.0		3.0	3.0	3.0	
Lane Grp Cap (vph)	198		202	2875	2326	
v/s Ratio Prot	c0.07		c0.07	0.08	c0.30	
v/s Ratio Perm						
v/c Ratio	0.63		0.61	0.10	0.45	
Uniform Delay, d1	50.5		50.6	2.3	9.6	
Progression Factor	1.00		0.75	2.07	0.49	
Incremental Delay, d2	6.4		5.3	0.1	0.6	
Delay (s)	56.9		43.5	4.8	5.3	
Level of Service	E		D	A	A	
Approach Delay (s)	56.9			16.4	5.3	
Approach LOS	E			B	A	

Intersection Summary			
HCM 2000 Control Delay	13.1	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.49		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	12.5
Intersection Capacity Utilization	50.9%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	6	146	36	147	108	220	20	187	147	412	475	16
Future Volume (veh/h)	6	146	36	147	108	220	20	187	147	412	475	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	7	162	40	163	120	244	22	208	163	458	528	18
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	35	225	54	175	296	251	31	1674	747	482	2540	86
Arrive On Green	0.16	0.16	0.16	0.16	0.16	0.16	0.02	0.47	0.47	0.54	1.00	1.00
Sat Flow, veh/h	23	1423	342	1180	1870	1585	1781	3554	1585	1781	3506	119
Grp Volume(v), veh/h	209	0	0	163	120	244	22	208	163	458	267	279
Grp Sat Flow(s),veh/h/ln	1789	0	0	1180	1870	1585	1781	1777	1585	1781	1777	1849
Q Serve(g_s), s	1.8	0.0	0.0	5.7	6.9	18.4	1.5	3.9	7.3	29.1	0.0	0.0
Cycle Q Clear(g_c), s	13.3	0.0	0.0	19.0	6.9	18.4	1.5	3.9	7.3	29.1	0.0	0.0
Prop In Lane	0.03		0.19	1.00		1.00	1.00		1.00	1.00		0.06
Lane Grp Cap(c), veh/h	314	0	0	175	296	251	31	1674	747	482	1287	1339
V/C Ratio(X)	0.67	0.00	0.00	0.93	0.41	0.97	0.71	0.12	0.22	0.95	0.21	0.21
Avail Cap(c_a), veh/h	314	0	0	175	296	251	223	1674	747	683	1287	1339
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	2.00	2.00	2.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	0.90	0.90	0.90
Uniform Delay (d), s/veh	48.1	0.0	0.0	54.5	45.4	50.2	58.7	17.8	18.7	26.8	0.0	0.0
Incr Delay (d2), s/veh	5.2	0.0	0.0	48.2	0.9	48.9	26.0	0.2	0.7	17.5	0.3	0.3
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	6.4	0.0	0.0	7.3	3.3	10.7	0.9	1.7	2.8	11.3	0.1	0.1
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	53.3	0.0	0.0	102.7	46.3	99.1	84.7	18.0	19.4	44.2	0.3	0.3
LnGrp LOS	D	A	A	F	D	F	F	B	B	D	A	A
Approach Vol, veh/h		209			527			393			1004	
Approach Delay, s/veh		53.3			88.2			22.3			20.4	
Approach LOS		D			F			C			C	

Timer - Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	36.5	60.5		23.0	6.1	90.9		23.0
Change Period (Y+Rc), s	4.0	4.0		4.0	4.0	4.0		4.0
Max Green Setting (Gmax), s	46.0	43.0		19.0	15.0	74.0		19.0
Max Q Clear Time (g_c+I1), s	31.1	9.3		15.3	3.5	2.0		21.0
Green Ext Time (p_c), s	1.3	2.0		0.4	0.0	3.7		0.0

Intersection Summary		
HCM 6th Ctrl Delay		40.7
HCM 6th LOS		D

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	10	78	78	94	61	7
Future Volume (Veh/h)	10	78	78	94	61	7
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	11	85	85	102	66	8
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)			218			
pX, platoon unblocked						
vC, conflicting volume	187				243	136
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	187				243	136
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	99				91	99
cM capacity (veh/h)	1387				739	913

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	96	187	74
Volume Left	11	0	66
Volume Right	0	102	8
cSH	1387	1700	755
Volume to Capacity	0.01	0.11	0.10
Queue Length 95th (ft)	1	0	8
Control Delay (s)	0.9	0.0	10.3
Lane LOS	A		B
Approach Delay (s)	0.9	0.0	10.3
Approach LOS			B

Intersection Summary			
Average Delay	2.4		
Intersection Capacity Utilization	23.0%	ICU Level of Service	A
Analysis Period (min)	15		

HCM 6th Edition methodology does not support turning movements with shared & exclusive lanes.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	96	241	22	273	215	514	44	784	193	303	436	53
Future Volume (vph)	96	241	22	273	215	514	44	784	193	303	436	53
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Lane Util. Factor		0.95		0.97	0.91	0.91	1.00	0.95		1.00	0.95	
Frt		0.99		1.00	0.92	0.85	1.00	0.97		1.00	0.98	
Flt Protected		0.99		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)		3461		3433	3113	1441	1770	3435		1770	3482	
Flt Permitted		0.99		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)		3461		3433	3113	1441	1770	3435		1770	3482	
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	107	268	24	303	239	571	49	871	214	337	484	59
RTOR Reduction (vph)	0	4	0	0	186	237	0	17	0	0	7	0
Lane Group Flow (vph)	0	395	0	303	339	48	49	1068	0	337	536	0
Turn Type	Split	NA		Split	NA	Perm	Prot	NA		Prot	NA	
Protected Phases	4	4		8	8		5	2		1	6	
Permitted Phases						8						
Actuated Green, G (s)		18.5		20.1	20.1	20.1	6.4	39.4		26.0	59.0	
Effective Green, g (s)		18.5		20.1	20.1	20.1	6.4	39.4		26.0	59.0	
Actuated g/C Ratio		0.15		0.17	0.17	0.17	0.05	0.33		0.22	0.49	
Clearance Time (s)		4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Vehicle Extension (s)		3.0		3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)		533		575	521	241	94	1127		383	1711	
v/s Ratio Prot		c0.11		0.09	c0.11		0.03	c0.31		c0.19	0.15	
v/s Ratio Perm						0.03						
v/c Ratio		0.74		0.53	0.65	0.20	0.52	0.95		0.88	0.31	
Uniform Delay, d1		48.5		45.6	46.7	43.0	55.3	39.3		45.5	18.3	
Progression Factor		1.00		1.00	1.00	1.00	1.23	0.63		1.00	1.00	
Incremental Delay, d2		5.5		0.9	2.8	0.4	4.8	15.9		19.9	0.5	
Delay (s)		53.9		46.5	49.5	43.4	72.8	40.8		65.4	18.8	
Level of Service		D		D	D	D	E	D		E	B	
Approach Delay (s)		53.9			47.1			42.1			36.7	
Approach LOS		D			D			D			D	

Intersection Summary			
HCM 2000 Control Delay	43.7	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.84		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	79.5%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	85	527	70	110	733	46	107	41	138	100	30	144
Future Volume (veh/h)	85	527	70	110	733	46	107	41	138	100	30	144
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	94	586	78	122	814	51	119	46	153	111	33	160
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	95	715	95	155	1332	413	712	200	664	641	984	833
Arrive On Green	0.05	0.23	0.23	0.09	0.26	0.26	0.53	0.53	0.53	0.53	0.53	0.53
Sat Flow, veh/h	1781	3153	419	1781	5106	1585	1190	380	1263	1183	1870	1585
Grp Volume(v), veh/h	94	330	334	122	814	51	119	0	199	111	33	160
Grp Sat Flow(s),veh/h/ln	1781	1777	1795	1781	1702	1585	1190	0	1643	1183	1870	1585
Q Serve(g_s), s	4.0	13.2	13.3	5.0	10.5	1.8	4.0	0.0	4.9	4.2	0.6	4.0
Cycle Q Clear(g_c), s	4.0	13.2	13.3	5.0	10.5	1.8	4.7	0.0	4.9	9.1	0.6	4.0
Prop In Lane	1.00		0.23	1.00		1.00	1.00		0.77	1.00		1.00
Lane Grp Cap(c), veh/h	95	403	407	155	1332	413	712	0	864	641	984	833
V/C Ratio(X)	0.99	0.82	0.82	0.78	0.61	0.12	0.17	0.00	0.23	0.17	0.03	0.19
Avail Cap(c_a), veh/h	95	474	479	238	1770	549	712	0	864	641	984	833
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.49	0.49	0.49	1.00	1.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	35.5	27.5	27.5	33.5	24.4	21.2	9.7	0.0	9.6	12.0	8.6	9.4
Incr Delay (d2), s/veh	61.4	4.8	4.9	9.2	0.5	0.1	0.5	0.0	0.6	0.6	0.1	0.5
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	3.3	5.9	6.0	2.5	4.1	0.7	1.0	0.0	1.7	1.1	0.3	1.4
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	96.9	32.4	32.5	42.7	24.8	21.3	10.2	0.0	10.2	12.6	8.6	9.9
LnGrp LOS	F	C	C	D	C	C	B	A	B	B	A	A
Approach Vol, veh/h		758			987			318			304	
Approach Delay, s/veh		40.4			26.9			10.2			10.8	
Approach LOS		D			C			B			B	

Timer - Assigned Phs		2	3	4		6	7	8
Phs Duration (G+Y+Rc), s		43.4	10.5	21.0		43.4	8.0	23.6
Change Period (Y+Rc), s		4.0	4.0	4.0		4.0	4.0	4.0
Max Green Setting (Gmax), s		33.0	10.0	20.0		33.0	4.0	26.0
Max Q Clear Time (g_c+I1), s		6.9	7.0	15.3		11.1	6.0	12.5
Green Ext Time (p_c), s		1.7	0.1	1.7		1.1	0.0	4.9

Intersection Summary	
HCM 6th Ctrl Delay	26.9
HCM 6th LOS	C

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Traffic Volume (vph)	1	1	1	43	1	61	2	142	65	47	98	3
Future Volume (vph)	1	1	1	43	1	61	2	142	65	47	98	3
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	1	1	1	48	1	68	2	158	72	52	109	3

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total (vph)	3	117	232	164
Volume Left (vph)	1	48	2	52
Volume Right (vph)	1	68	72	3
Hadj (s)	-0.10	-0.23	-0.15	0.09
Departure Headway (s)	4.8	4.6	4.2	4.5
Degree Utilization, x	0.00	0.15	0.27	0.21
Capacity (veh/h)	664	725	822	760
Control Delay (s)	7.9	8.3	8.8	8.7
Approach Delay (s)	7.9	8.3	8.8	8.7
Approach LOS	A	A	A	A

Intersection Summary			
Delay	8.7		
Level of Service	A		
Intersection Capacity Utilization	38.3%	ICU Level of Service	A
Analysis Period (min)	15		

HCM 6th Edition methodology does not support turning movements with shared & exclusive lanes.

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	133	132	143	893	705	124
Future Volume (vph)	133	132	143	893	705	124
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0	4.5	4.5	
Lane Util. Factor	1.00		1.00	0.95	0.95	
Frt	0.93		1.00	1.00	0.98	
Flt Protected	0.98		0.95	1.00	1.00	
Satd. Flow (prot)	1695		1770	3539	3460	
Flt Permitted	0.98		0.95	1.00	1.00	
Satd. Flow (perm)	1695		1770	3539	3460	
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	148	147	159	992	783	138
RTOR Reduction (vph)	34	0	0	0	9	0
Lane Group Flow (vph)	261	0	159	992	912	0
Turn Type	Prot		Prot	NA	NA	
Protected Phases	4		5	2	6	
Permitted Phases						
Actuated Green, G (s)	23.6		16.0	87.9	67.9	
Effective Green, g (s)	23.6		16.0	87.9	67.9	
Actuated g/C Ratio	0.20		0.13	0.73	0.57	
Clearance Time (s)	4.0		4.0	4.5	4.5	
Vehicle Extension (s)	3.0		3.0	3.0	3.0	
Lane Grp Cap (vph)	333		236	2592	1957	
v/s Ratio Prot	c0.15		c0.09	0.28	c0.26	
v/s Ratio Perm						
v/c Ratio	0.78		0.67	0.38	0.47	
Uniform Delay, d1	45.8		49.5	6.0	15.4	
Progression Factor	1.00		0.78	2.36	0.59	
Incremental Delay, d2	11.5		6.0	0.3	0.8	
Delay (s)	57.3		44.4	14.4	9.8	
Level of Service	E		D	B	A	
Approach Delay (s)	57.3			18.6	9.8	
Approach LOS	E			B	A	

Intersection Summary			
HCM 2000 Control Delay	20.0	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.57		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	12.5
Intersection Capacity Utilization	57.2%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	10	128	64	239	163	575	36	581	138	310	332	31
Future Volume (veh/h)	10	128	64	239	163	575	36	581	138	310	332	31
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	11	142	71	266	181	639	40	646	153	344	369	34
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	44	426	204	451	701	594	51	1127	503	370	1633	150
Arrive On Green	0.38	0.38	0.38	0.38	0.38	0.38	0.03	0.32	0.32	0.35	0.83	0.83
Sat Flow, veh/h	33	1136	543	1168	1870	1585	1781	3554	1585	1781	3291	302
Grp Volume(v), veh/h	224	0	0	266	181	639	40	646	153	344	198	205
Grp Sat Flow(s),veh/h/ln	1712	0	0	1168	1870	1585	1781	1777	1585	1781	1777	1816
Q Serve(g_s), s	0.0	0.0	0.0	17.5	8.0	45.0	2.7	18.2	8.8	22.3	2.8	2.9
Cycle Q Clear(g_c), s	10.9	0.0	0.0	28.3	8.0	45.0	2.7	18.2	8.8	22.3	2.8	2.9
Prop In Lane	0.05		0.32	1.00		1.00	1.00		1.00	1.00		0.17
Lane Grp Cap(c), veh/h	674	0	0	451	701	594	51	1127	503	370	882	901
V/C Ratio(X)	0.33	0.00	0.00	0.59	0.26	1.08	0.78	0.57	0.30	0.93	0.22	0.23
Avail Cap(c_a), veh/h	674	0	0	451	701	594	104	1127	503	460	882	901
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.67	1.67	1.67
Upstream Filter(I)	1.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	0.88	0.88	0.88
Uniform Delay (d), s/veh	26.8	0.0	0.0	33.8	25.9	37.5	57.9	34.2	31.0	38.3	5.4	5.4
Incr Delay (d2), s/veh	0.3	0.0	0.0	2.0	0.2	58.7	22.1	2.1	1.6	20.6	0.5	0.5
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	4.7	0.0	0.0	6.9	3.6	26.8	1.5	8.2	3.6	10.7	1.1	1.1
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	27.1	0.0	0.0	35.8	26.1	96.2	80.0	36.3	32.5	58.9	5.9	5.9
LnGrp LOS	C	A	A	D	C	F	E	D	C	E	A	A
Approach Vol, veh/h		224			1086			839			747	
Approach Delay, s/veh		27.1			69.8			37.7			30.3	
Approach LOS		C			E			D			C	

Timer - Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	28.9	42.1		49.0	7.5	63.5		49.0
Change Period (Y+Rc), s	4.0	4.0		4.0	4.0	4.0		4.0
Max Green Setting (Gmax), s	31.0	32.0		45.0	7.0	56.0		45.0
Max Q Clear Time (g_c+I1), s	24.3	20.2		12.9	4.7	4.9		47.0
Green Ext Time (p_c), s	0.6	3.9		1.5	0.0	2.6		0.0

Intersection Summary			
HCM 6th Ctrl Delay			47.0
HCM 6th LOS			D

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	18	113	105	162	149	17
Future Volume (Veh/h)	18	113	105	162	149	17
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	20	123	114	176	162	18
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)			219			
pX, platoon unblocked						
vC, conflicting volume	290				365	202
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	290				365	202
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	98				74	98
cM capacity (veh/h)	1272				625	839

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	143	290	180
Volume Left	20	0	162
Volume Right	0	176	18
cSH	1272	1700	641
Volume to Capacity	0.02	0.17	0.28
Queue Length 95th (ft)	1	0	29
Control Delay (s)	1.2	0.0	12.8
Lane LOS	A		B
Approach Delay (s)	1.2	0.0	12.8
Approach LOS			B

Intersection Summary			
Average Delay	4.0		
Intersection Capacity Utilization	37.1%	ICU Level of Service	A
Analysis Period (min)	15		

APPENDIX H

HORIZON YEAR 2035 FACTORING WORKSHEETS

Year 2035 Without Project

Intersection 1

Analyst: Henryk Pedersen
Intersection: Highway 101 / Lomas Santa Fe Dr.
Future Condition: Year 2035 Without Project
Date: 12/2/2014
Company: Urban Systems Associates, Inc.
Project Number: 003314
Intersection Control: Signalized

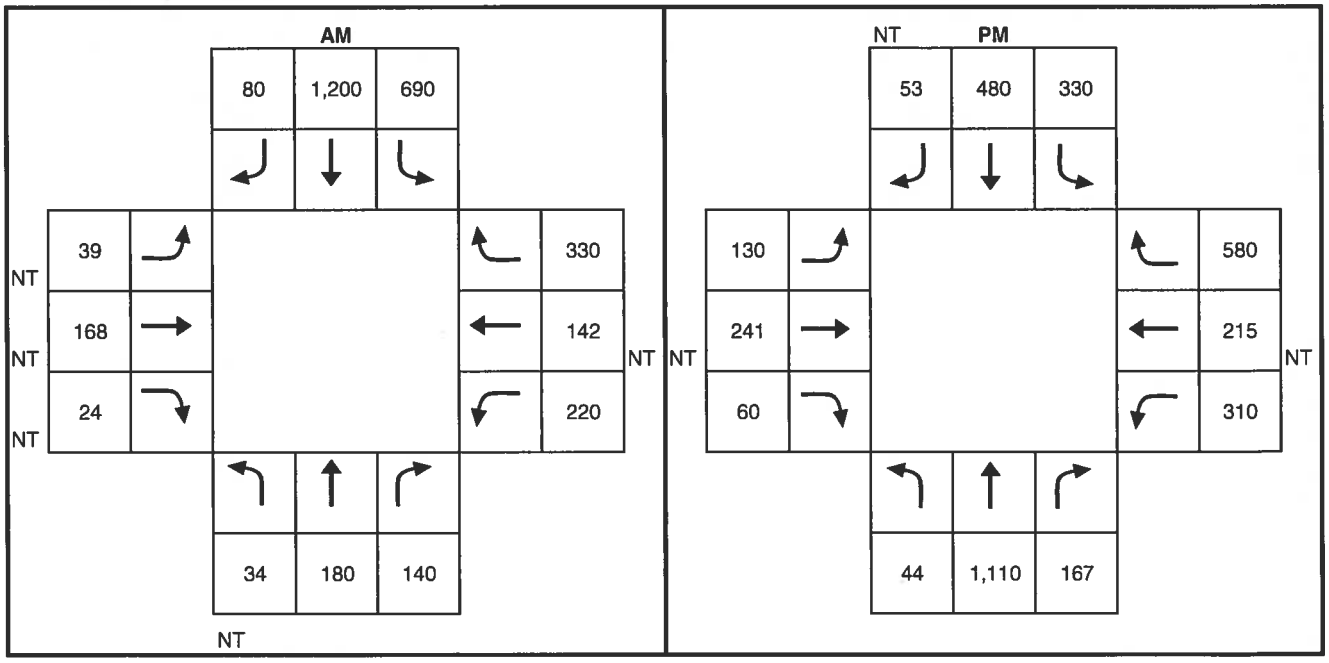
E/W Street Name: Lomas Santa Fe Dr.
N/S Street Name: Highway 101

Factored Turns

Note: Majority of volumes are from LLG 2035 volumes.
If NT was larger than LLG volume, NT was used.

LLG Volumes

Turn Movement	Near Term turn (v) AM	Near Term turn (v) PM	LLG AM	LLG PM	2035 AM turn (v) AM	2035 PM turn (v) PM
NLT	34	44	30	40	34	44
NTH	173	769	180	1,110	180	1110
NRT	126	167	140	160	140	167
SLT	436	303	690	330	690	330
STH	747	419	1,200	480	1200	480
SRT	66	53	80	40	80	53
ELT	39	96	30	130	39	130
ETH	168	241	140	180	168	241
ERT	24	22	20	60	24	60
WLT	156	245	220	310	220	310
WTH	142	215	140	150	142	215
WRT	216	514	330	580	330	580



Delay	LOS
47.6	D

Delay	LOS
69.9	E

Year 2035 Without Project

Intersection 2

Analyst: Henryk Pedersen
Intersection: Highway 101 / Lomas Santa Fe Dr.
Future Conditio Year 2035 Without Project
Date: 12/2/2014
Company: Urban Systems Associates, Inc.
Project Number 003314
Intersection Control: Signalized

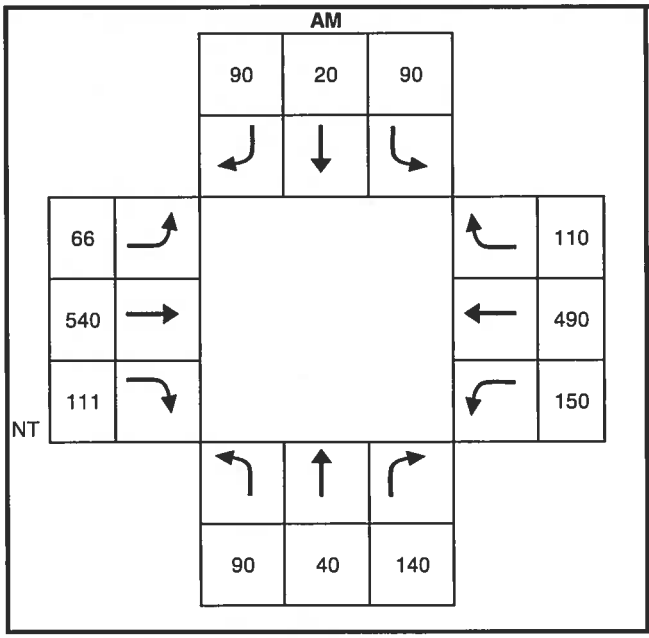
E/W Street Name: Lomas Santa Fe Dr.
N/S Street Name: Cedros Ave.

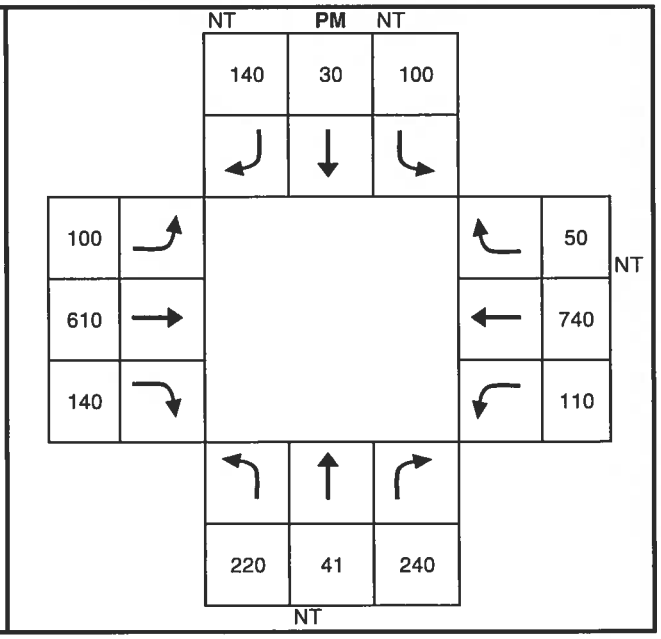
Factored Turns

Note: Majority of volumes are from LLG 2035 volumes.
If NT was larger than LLG volume, NT was used.

LLG Volumes

Turn Movement	Near Term turn (v) AM	Near Term turn (v) PM	LLG AM	LLG PM	2035 AM turn (v) AM	2035 PM turn (v) PM
NLT	60	104	90	220	90	220
NTH	16	41	40	30	40	41
NRT	74	138	140	240	140	240
SLT	63	100	90	100	90	100
STH	13	30	20	20	20	30
SRT	67	140	90	90	90	140
ELT	66	81	50	100	66	100
ETH	523	507	540	610	540	610
ERT	111	68	70	140	111	140
WLT	74	110	150	110	150	110
WTH	395	711	490	740	490	740
WRT	62	46	110	50	110	50





Delay	LOS
25.0	C

Delay	LOS
24.5	C

Year 2035 Without Project

Intersection 3

Analyst: Henryk Pedersen
Intersection: Cedros Ave. / Lomas Santa Fe Dr.
Future Conditio Year 2035 Without Project
Date: 12/2/2014
Company: Urban Systems Associates, Inc.
Project Number 003314
Intersection Control: Unsignalized

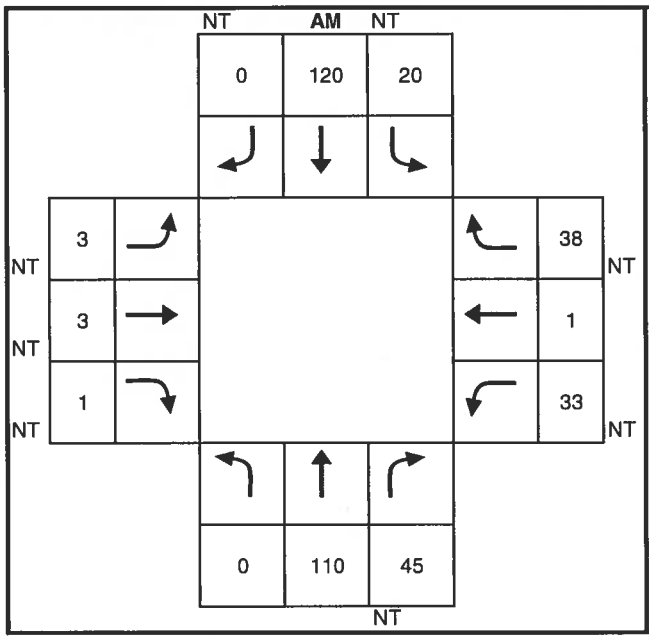
E/W Street Name: Dahlia Dr.
N/S Street Name: Sierra Ave.

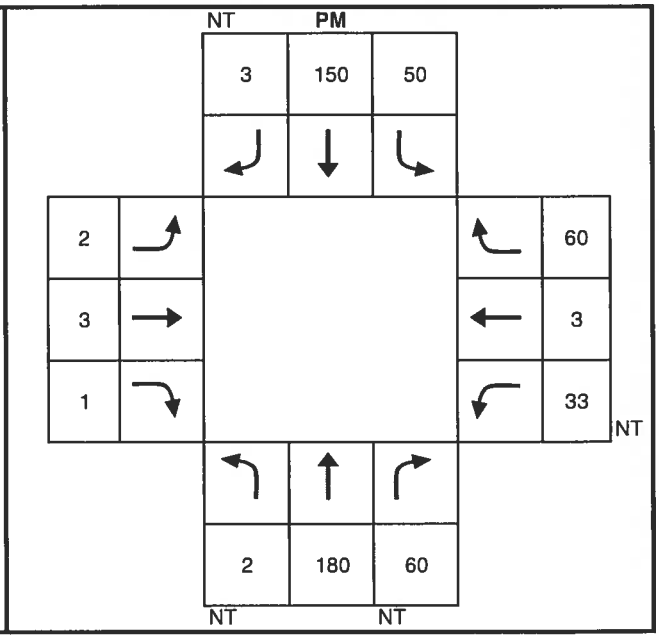
Factored Turns

Note: Majority of volumes are from LLG 2035 volumes.
If NT was larger than LLG volume, NT was used.

LLG Volumes

Turn Movement	Near Term turn (v) AM	Near Term turn (v) PM	LLG AM	LLG PM	2035 AM turn (v) AM	2035 PM turn (v) PM
NLT	0	2	0	0	0	2
NTH	103	142	110	180	110	180
NRT	45	54	30	60	45	60
SLT	20	40	20	50	20	50
STH	109	98	120	150	120	150
SRT	0	3	0	1	0	3
ELT	3	1	0	2	3	2
ETH	3	1	3	3	3	3
ERT	1	1	0	1	1	1
WLT	33	33	30	20	33	33
WTH	0	1	1	3	1	3
WRT	38	54	20	60	38	60





Delay	LOS
8.2	A

Delay	LOS
9.2	A

Note: segment volumes that are being compared to find the % increase are the segment opposing

Year 2035 Without Project

Intersection 4

Analyst: Henryk Pedersen
Intersection: Sierra Ave. / Dahlia Dr.
Future Conditio Year 2035 Without Project
Date: 12/2/2014
Company: Urban Systems Associates, Inc.
Project Number 003314
Intersection Control: Signalized

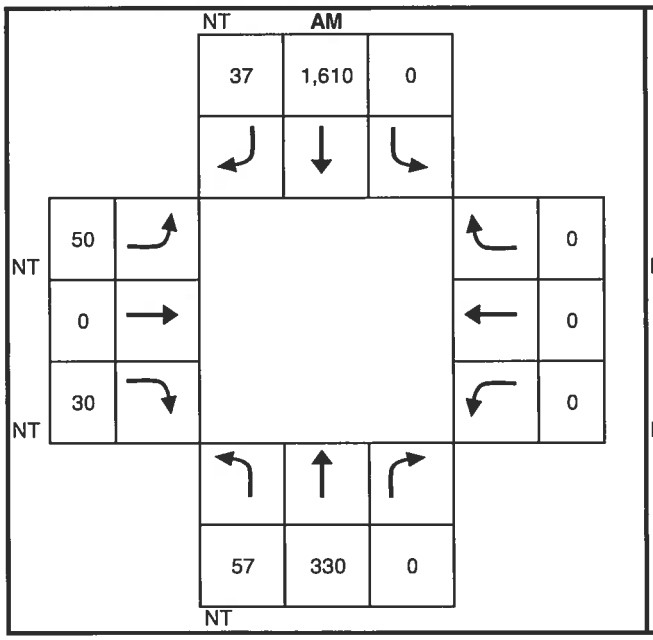
E/W Street Name: Dahlia Dr.
N/S Street Name: Highway 101

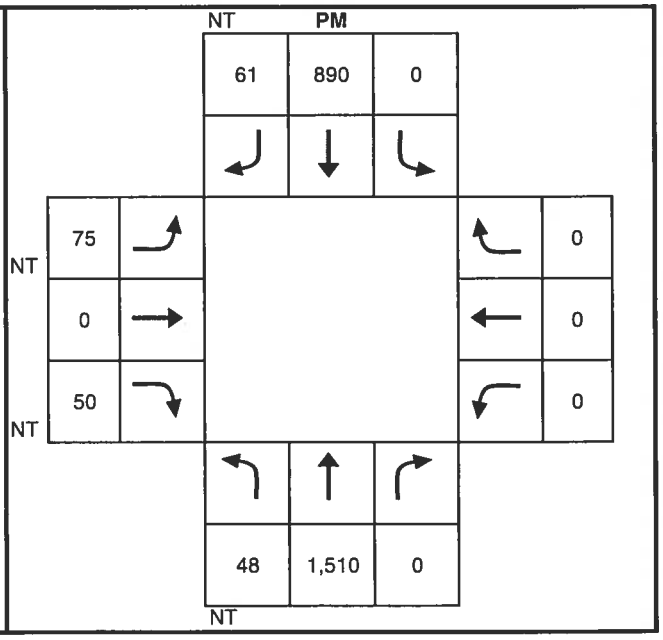
Factored Turns

Note: Majority of volumes are from LLG 2035 volumes.
If NT was larger than LLG volume, NT was used.

LLG Volumes

Turn Movement	Near Term turn (v) AM	Near Term turn (v) PM	LLG AM	LLG PM	2035 AM turn (v) AM	2035 PM turn (v) PM
NLT	57	48	30	40	57	48
NTH	261	893	330	1,510	330	1510
NRT	0	0	0	0	0	0
SLT	0	0	0	0	0	0
STH	862	705	1,610	890	1610	890
SRT	37	61	30	40	37	61
ELT	50	75	30	70	50	75
ETH	0	0	0	0	0	0
ERT	30	45	30	50	30	50
WLT	0	0	0	0	0	0
WTH	0	0	0	0	0	0
WRT	0	0	0	0	0	0





Delay	LOS
12.5	B

Delay	LOS
10.0	B

Year 2035 Without Project

Intersection 5

Analyst: Henryk Pedersen
Intersection: Highway 101 / Dahlia Dr.
Future Conditio Year 2035 Without Project
Date: 12/2/2014
Company: Urban Systems Associates, Inc.
Project Number 003314
Intersection Control: Signalized

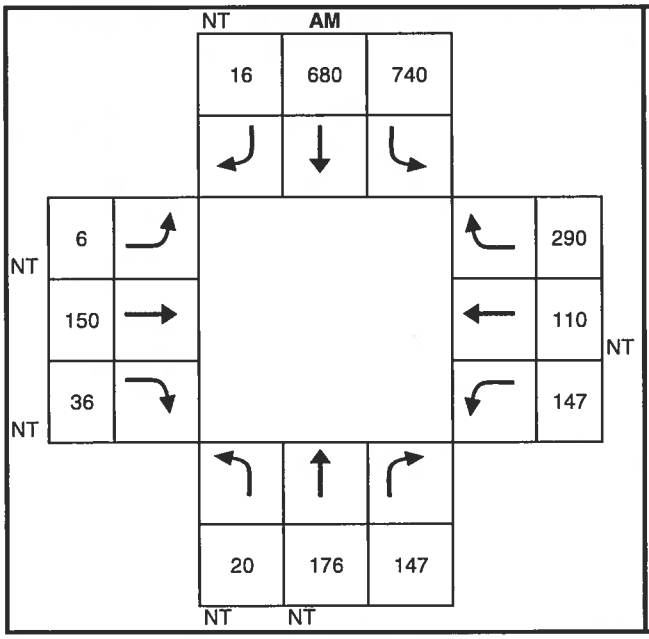
E/W Street Name: Via de la Valle
N/S Street Name: Highway 101

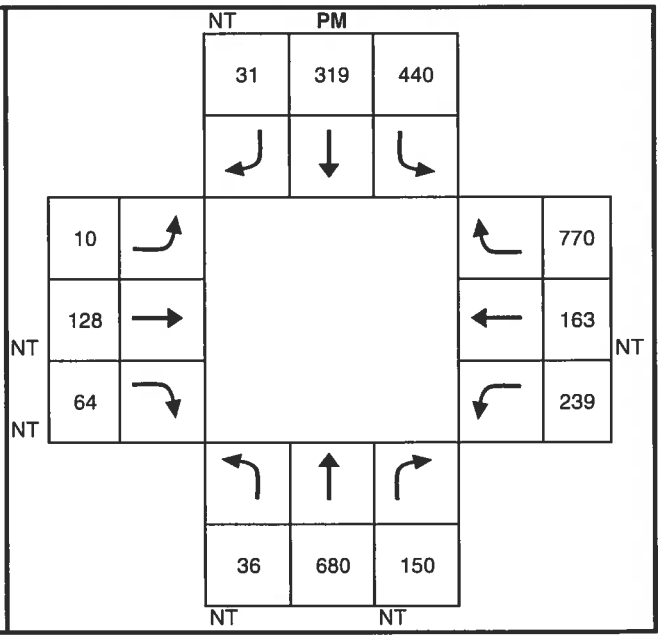
Factored Turns

Note: Majority of volumes are from LLG 2035 volumes.
If NT was larger than LLG volume, NT was used.

LLG Volumes

Turn Movement	Near Term turn (v) AM	Near Term turn (v) PM	LLG AM	LLG PM	2035 AM turn (v) AM	2035 PM turn (v) PM
NLT	20	36	10	30	20	36
NTH	176	567	150	680	176	680
NRT	147	138	130	150	147	150
SLT	389	264	740	440	740	440
STH	468	319	680	310	680	319
SRT	16	31	10	10	16	31
ELT	6	10	0	10	6	10
ETH	146	128	150	110	150	128
ERT	36	64	30	30	36	64
WLT	147	239	140	200	147	239
WTH	108	163	110	110	110	163
WRT	183	525	290	770	290	770





Delay	LOS
40.6	D

Delay	LOS
45.0	D

APPENDIX I

HORIZON YEAR 2035 WITHOUT PROJECT SYNCHRO WORKSHEETS

HCM 6th Edition methodology does not support turning movements with shared & exclusive lanes.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	39	168	24	220	142	330	34	180	140	690	1200	80
Future Volume (vph)	39	168	24	220	142	330	34	180	140	690	1200	80
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Lane Util. Factor		0.95		0.97	0.91	0.91	1.00	0.95		1.00	0.95	
Frt		0.98		1.00	0.92	0.85	1.00	0.93		1.00	0.99	
Flt Protected		0.99		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)		3455		3433	3117	1441	1770	3307		1770	3506	
Flt Permitted		0.99		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)		3455		3433	3117	1441	1770	3307		1770	3506	
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	43	187	27	244	158	367	38	200	156	767	1333	89
RTOR Reduction (vph)	0	7	0	0	160	159	0	108	0	0	3	0
Lane Group Flow (vph)	0	250	0	244	182	24	38	248	0	767	1419	0
Turn Type	Split	NA		Split	NA	Perm	Prot	NA		Prot	NA	
Protected Phases	4	4		8	8		5	2		1	6	
Permitted Phases						8						
Actuated Green, G (s)		15.3		16.7	16.7	16.7	6.1	30.1		51.9	75.9	
Effective Green, g (s)		15.3		16.7	16.7	16.7	6.1	30.1		51.9	75.9	
Actuated g/C Ratio		0.12		0.13	0.13	0.13	0.05	0.23		0.40	0.58	
Clearance Time (s)		4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Vehicle Extension (s)		3.0		3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)		406		441	400	185	83	765		706	2046	
v/s Ratio Prot		c0.07		c0.07	0.06		0.02	0.08		c0.43	c0.40	
v/s Ratio Perm						0.02						
v/c Ratio		0.62		0.55	0.45	0.13	0.46	0.32		1.09	0.69	
Uniform Delay, d1		54.6		53.2	52.4	50.2	60.3	41.5		39.1	18.9	
Progression Factor		1.00		1.00	1.00	1.00	1.16	0.51		1.00	1.00	
Incremental Delay, d2		2.8		1.5	0.8	0.3	3.9	1.1		59.7	2.0	
Delay (s)		57.3		54.7	53.3	50.5	73.9	22.2		98.8	20.9	
Level of Service		E		D	D	D	E	C		F	C	
Approach Delay (s)		57.3			53.0			27.2			48.2	
Approach LOS		E			D			C			D	

Intersection Summary			
HCM 2000 Control Delay	47.6	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.86		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	75.0%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	66	540	111	150	490	110	90	40	140	90	20	90
Future Volume (veh/h)	66	540	111	150	490	110	90	40	140	90	20	90
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	73	600	123	167	544	122	100	44	156	100	22	100
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	93	776	159	190	1624	504	684	169	600	564	878	744
Arrive On Green	0.05	0.26	0.26	0.11	0.32	0.32	0.47	0.47	0.47	0.47	0.47	0.47
Sat Flow, veh/h	1781	2938	601	1781	5106	1585	1269	361	1279	1182	1870	1585
Grp Volume(v), veh/h	73	362	361	167	544	122	100	0	200	100	22	100
Grp Sat Flow(s),veh/h/ln	1781	1777	1762	1781	1702	1585	1269	0	1640	1182	1870	1585
Q Serve(g_s), s	3.0	14.1	14.2	6.9	6.1	4.3	3.4	0.0	5.5	4.2	0.5	2.7
Cycle Q Clear(g_c), s	3.0	14.1	14.2	6.9	6.1	4.3	3.9	0.0	5.5	9.7	0.5	2.7
Prop In Lane	1.00		0.34	1.00		1.00	1.00		0.78	1.00		1.00
Lane Grp Cap(c), veh/h	93	469	465	190	1624	504	684	0	770	564	878	744
V/C Ratio(X)	0.78	0.77	0.78	0.88	0.33	0.24	0.15	0.00	0.26	0.18	0.03	0.13
Avail Cap(c_a), veh/h	95	663	658	190	2179	676	684	0	770	564	878	744
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.17	0.17	0.17	1.00	1.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	35.1	25.5	25.5	33.0	19.5	18.9	11.7	0.0	12.0	15.0	10.7	11.3
Incr Delay (d2), s/veh	6.9	0.6	0.7	34.2	0.1	0.2	0.5	0.0	0.8	0.7	0.1	0.4
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.5	5.8	5.7	4.7	2.3	1.5	1.0	0.0	2.0	1.2	0.2	0.9
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	42.0	26.2	26.2	67.2	19.6	19.1	12.2	0.0	12.8	15.6	10.7	11.6
LnGrp LOS	D	C	C	E	B	B	B	A	B	B	B	B
Approach Vol, veh/h		796			833			300			222	
Approach Delay, s/veh		27.6			29.1			12.6			13.4	
Approach LOS		C			C			B			B	

Timer - Assigned Phs		2	3	4		6	7	8
Phs Duration (G+Y+Rc), s		39.2	12.0	23.8		39.2	7.9	27.9
Change Period (Y+Rc), s		4.0	4.0	4.0		4.0	4.0	4.0
Max Green Setting (Gmax), s		27.0	8.0	28.0		27.0	4.0	32.0
Max Q Clear Time (g_c+I1), s		7.5	8.9	16.2		11.7	5.0	8.1
Green Ext Time (p_c), s		1.5	0.0	3.6		0.7	0.0	4.3

Intersection Summary	
HCM 6th Ctrl Delay	24.6
HCM 6th LOS	C

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Traffic Volume (vph)	3	3	1	33	1	38	0	110	45	20	120	0
Future Volume (vph)	3	3	1	33	1	38	0	110	45	20	120	0
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	3	3	1	37	1	42	0	122	50	22	133	0

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total (vph)	7	80	172	155
Volume Left (vph)	3	37	0	22
Volume Right (vph)	1	42	50	0
Hadj (s)	0.03	-0.19	-0.14	0.06
Departure Headway (s)	4.8	4.4	4.1	4.3
Degree Utilization, x	0.01	0.10	0.20	0.19
Capacity (veh/h)	691	748	843	797
Control Delay (s)	7.8	7.9	8.1	8.3
Approach Delay (s)	7.8	7.9	8.1	8.3
Approach LOS	A	A	A	A

Intersection Summary			
Delay	8.2		
Level of Service	A		
Intersection Capacity Utilization	31.5%	ICU Level of Service	A
Analysis Period (min)	15		

HCM 6th Edition methodology does not support turning movements with shared & exclusive lanes.

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	50	30	57	330	1610	37
Future Volume (vph)	50	30	57	330	1610	37
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0	4.5	4.5	
Lane Util. Factor	1.00		1.00	0.95	0.95	
Frt	0.95		1.00	1.00	1.00	
Flt Protected	0.97		0.95	1.00	1.00	
Satd. Flow (prot)	1716		1770	3539	3527	
Flt Permitted	0.97		0.95	1.00	1.00	
Satd. Flow (perm)	1716		1770	3539	3527	
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	56	33	63	367	1789	41
RTOR Reduction (vph)	17	0	0	0	1	0
Lane Group Flow (vph)	72	0	63	367	1829	0
Turn Type	Prot		Prot	NA	NA	
Protected Phases	4		5	2	6	
Permitted Phases						
Actuated Green, G (s)	11.6		7.6	109.9	98.3	
Effective Green, g (s)	11.6		7.6	109.9	98.3	
Actuated g/C Ratio	0.09		0.06	0.85	0.76	
Clearance Time (s)	4.0		4.0	4.5	4.5	
Vehicle Extension (s)	3.0		3.0	3.0	3.0	
Lane Grp Cap (vph)	153		103	2991	2666	
v/s Ratio Prot	c0.04		c0.04	0.10	c0.52	
v/s Ratio Perm						
v/c Ratio	0.47		0.61	0.12	0.69	
Uniform Delay, d1	56.3		59.8	1.7	8.0	
Progression Factor	1.00		0.77	1.38	1.19	
Incremental Delay, d2	2.3		9.5	0.1	1.2	
Delay (s)	58.5		55.3	2.5	10.8	
Level of Service	E		E	A	B	
Approach Delay (s)	58.5			10.2	10.8	
Approach LOS	E			B	B	

Intersection Summary			
HCM 2000 Control Delay	12.5	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.66		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	12.5
Intersection Capacity Utilization	59.1%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	6	150	36	147	110	290	20	176	147	740	680	16
Future Volume (veh/h)	6	150	36	147	110	290	20	176	147	740	680	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	7	167	40	163	122	322	22	196	163	822	756	18
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	33	320	75	249	417	354	30	732	326	853	2369	56
Arrive On Green	0.22	0.22	0.22	0.22	0.22	0.22	0.02	0.21	0.21	0.48	0.67	0.67
Sat Flow, veh/h	21	1433	334	1175	1870	1585	1781	3554	1585	1781	3548	84
Grp Volume(v), veh/h	214	0	0	163	122	322	22	196	163	822	379	395
Grp Sat Flow(s),veh/h/ln	1789	0	0	1175	1870	1585	1781	1777	1585	1781	1777	1855
Q Serve(g_s), s	0.0	0.0	0.0	11.5	7.0	25.7	1.6	6.0	11.8	58.1	11.7	11.7
Cycle Q Clear(g_c), s	13.5	0.0	0.0	25.0	7.0	25.7	1.6	6.0	11.8	58.1	11.7	11.7
Prop In Lane	0.03		0.19	1.00		1.00	1.00		1.00	1.00		0.05
Lane Grp Cap(c), veh/h	428	0	0	249	417	354	30	732	326	853	1186	1239
V/C Ratio(X)	0.50	0.00	0.00	0.65	0.29	0.91	0.73	0.27	0.50	0.96	0.32	0.32
Avail Cap(c_a), veh/h	482	0	0	285	475	402	82	732	326	932	1186	1239
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	0.68	0.68	0.68
Uniform Delay (d), s/veh	44.5	0.0	0.0	51.4	42.0	49.2	63.6	43.4	45.7	32.8	9.1	9.1
Incr Delay (d2), s/veh	0.9	0.0	0.0	4.3	0.4	22.7	28.6	0.9	5.4	15.8	0.5	0.5
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	6.2	0.0	0.0	5.5	3.3	12.4	1.0	2.8	5.2	28.1	4.5	4.7
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	45.4	0.0	0.0	55.7	42.4	72.0	92.2	44.3	51.1	48.6	9.6	9.6
LnGrp LOS	D	A	A	E	D	E	F	D	D	D	A	A
Approach Vol, veh/h		214			607			381			1596	
Approach Delay, s/veh		45.4			61.6			50.0			29.7	
Approach LOS		D			E			D			C	

Timer - Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	66.2	30.8		33.0	6.2	90.8		33.0
Change Period (Y+Rc), s	4.0	4.0		4.0	4.0	4.0		4.0
Max Green Setting (Gmax), s	68.0	17.0		33.0	6.0	79.0		33.0
Max Q Clear Time (g_c+I1), s	60.1	13.8		15.5	3.6	13.7		27.7
Green Ext Time (p_c), s	2.2	0.5		1.1	0.0	5.8		1.3

Intersection Summary			
HCM 6th Ctrl Delay			40.6
HCM 6th LOS			D

HCM 6th Edition methodology does not support turning movements with shared & exclusive lanes.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	130	241	60	310	215	580	44	1110	167	330	480	53
Future Volume (vph)	130	241	60	310	215	580	44	1110	167	330	480	53
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Lane Util. Factor		0.95		0.97	0.91	0.91	1.00	0.95		1.00	0.95	
Frt		0.98		1.00	0.91	0.85	1.00	0.98		1.00	0.99	
Flt Protected		0.99		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)		3414		3433	3098	1441	1770	3470		1770	3486	
Flt Permitted		0.99		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)		3414		3433	3098	1441	1770	3470		1770	3486	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	137	254	63	326	226	611	46	1168	176	347	505	56
RTOR Reduction (vph)	0	10	0	0	191	256	0	9	0	0	6	0
Lane Group Flow (vph)	0	444	0	326	341	49	46	1335	0	347	555	0
Turn Type	Split	NA		Split	NA	Perm	Prot	NA		Prot	NA	
Protected Phases	4	4		8	8		5	2		1	6	
Permitted Phases						8						
Actuated Green, G (s)		21.7		20.8	20.8	20.8	6.4	45.0		26.5	65.1	
Effective Green, g (s)		21.7		20.8	20.8	20.8	6.4	45.0		26.5	65.1	
Actuated g/C Ratio		0.17		0.16	0.16	0.16	0.05	0.35		0.20	0.50	
Clearance Time (s)		4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Vehicle Extension (s)		3.0		3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)		569		549	495	230	87	1201		360	1745	
v/s Ratio Prot		c0.13		0.09	c0.11		0.03	c0.38		c0.20	0.16	
v/s Ratio Perm						0.03						
v/c Ratio		0.78		0.59	0.69	0.21	0.53	1.11		0.96	0.32	
Uniform Delay, d1		51.9		50.7	51.6	47.5	60.3	42.5		51.3	19.3	
Progression Factor		1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2		6.9		1.7	4.0	0.5	5.7	62.2		37.7	0.5	
Delay (s)		58.7		52.4	55.5	47.9	66.0	104.7		88.9	19.7	
Level of Service		E		D	E	D	E	F		F	B	
Approach Delay (s)		58.7			52.7			103.4			46.2	
Approach LOS		E			D			F			D	

Intersection Summary			
HCM 2000 Control Delay	69.9	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	0.94		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	92.1%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	100	610	140	110	740	50	220	41	240	100	30	140
Future Volume (veh/h)	100	610	140	110	740	50	220	41	240	100	30	140
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	111	678	156	122	822	56	244	46	267	111	33	156
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	119	829	190	143	1543	479	647	112	652	464	881	747
Arrive On Green	0.07	0.29	0.29	0.08	0.30	0.30	0.47	0.47	0.47	0.47	0.47	0.47
Sat Flow, veh/h	1781	2869	660	1781	5106	1585	1194	238	1383	1067	1870	1585
Grp Volume(v), veh/h	111	420	414	122	822	56	244	0	313	111	33	156
Grp Sat Flow(s),veh/h/ln	1781	1777	1752	1781	1702	1585	1194	0	1621	1067	1870	1585
Q Serve(g_s), s	4.7	16.5	16.5	5.1	10.0	1.9	10.4	0.0	9.5	5.7	0.7	4.3
Cycle Q Clear(g_c), s	4.7	16.5	16.5	5.1	10.0	1.9	11.1	0.0	9.5	15.2	0.7	4.3
Prop In Lane	1.00		0.38	1.00		1.00	1.00		0.85	1.00		1.00
Lane Grp Cap(c), veh/h	119	513	506	143	1543	479	647	0	764	464	881	747
V/C Ratio(X)	0.93	0.82	0.82	0.86	0.53	0.12	0.38	0.00	0.41	0.24	0.04	0.21
Avail Cap(c_a), veh/h	119	616	607	143	1838	571	647	0	764	464	881	747
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.39	0.39	0.39	1.00	1.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	34.8	24.8	24.8	34.1	21.8	18.9	13.7	0.0	13.0	18.0	10.7	11.6
Incr Delay (d2), s/veh	34.8	3.0	3.0	37.0	0.3	0.1	1.7	0.0	1.6	1.2	0.1	0.6
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	3.1	7.0	6.9	3.6	3.8	0.7	2.9	0.0	3.5	1.5	0.3	1.5
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	69.6	27.8	27.9	71.1	22.1	19.0	15.3	0.0	14.6	19.2	10.8	12.3
LnGrp LOS	E	C	C	E	C	B	B	A	B	B	B	B
Approach Vol, veh/h		945			1000			557			300	
Approach Delay, s/veh		32.7			27.9			14.9			14.7	
Approach LOS		C			C			B			B	

Timer - Assigned Phs		2	3	4		6	7	8				
Phs Duration (G+Y+Rc), s		39.3	10.0	25.7		39.3	9.0	26.7				
Change Period (Y+Rc), s		4.0	4.0	4.0		4.0	4.0	4.0				
Max Green Setting (Gmax), s		31.0	6.0	26.0		31.0	5.0	27.0				
Max Q Clear Time (g_c+I1), s		13.1	7.1	18.5		17.2	6.7	12.0				
Green Ext Time (p_c), s		2.8	0.0	3.1		1.0	0.0	5.2				

Intersection Summary	
HCM 6th Ctrl Delay	25.5
HCM 6th LOS	C

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Traffic Volume (vph)	2	3	1	33	3	60	2	180	60	50	150	3
Future Volume (vph)	2	3	1	33	3	60	2	180	60	50	150	3
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	2	3	1	37	3	67	2	200	67	56	167	3

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total (vph)	6	107	269	226
Volume Left (vph)	2	37	2	56
Volume Right (vph)	1	67	67	3
Hadj (s)	0.00	-0.27	-0.11	0.08
Departure Headway (s)	5.2	4.7	4.3	4.5
Degree Utilization, x	0.01	0.14	0.32	0.29
Capacity (veh/h)	613	684	804	759
Control Delay (s)	8.2	8.5	9.4	9.4
Approach Delay (s)	8.2	8.5	9.4	9.4
Approach LOS	A	A	A	A

Intersection Summary			
Delay	9.2		
Level of Service	A		
Intersection Capacity Utilization	41.6%	ICU Level of Service	A
Analysis Period (min)	15		

HCM 6th Edition methodology does not support turning movements with shared & exclusive lanes.

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	75	50	48	1510	890	61
Future Volume (vph)	75	50	48	1510	890	61
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0	4.5	4.5	
Lane Util. Factor	1.00		1.00	0.95	0.95	
Frt	0.95		1.00	1.00	0.99	
Flt Protected	0.97		0.95	1.00	1.00	
Satd. Flow (prot)	1710		1770	3539	3505	
Flt Permitted	0.97		0.95	1.00	1.00	
Satd. Flow (perm)	1710		1770	3539	3505	
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	83	56	53	1678	989	68
RTOR Reduction (vph)	17	0	0	0	2	0
Lane Group Flow (vph)	122	0	53	1678	1055	0
Turn Type	Prot		Prot	NA	NA	
Protected Phases	4		5	2	6	
Permitted Phases						
Actuated Green, G (s)	16.2		8.7	125.3	112.6	
Effective Green, g (s)	16.2		8.7	125.3	112.6	
Actuated g/C Ratio	0.11		0.06	0.84	0.75	
Clearance Time (s)	4.0		4.0	4.5	4.5	
Vehicle Extension (s)	3.0		3.0	3.0	3.0	
Lane Grp Cap (vph)	184		102	2956	2631	
v/s Ratio Prot	c0.07		0.03	c0.47	0.30	
v/s Ratio Perm						
v/c Ratio	0.66		0.52	0.57	0.40	
Uniform Delay, d1	64.3		68.6	3.9	6.7	
Progression Factor	1.00		1.00	1.00	1.00	
Incremental Delay, d2	8.7		4.4	0.8	0.5	
Delay (s)	73.0		73.0	4.7	7.1	
Level of Service	E		E	A	A	
Approach Delay (s)	73.0			6.8	7.1	
Approach LOS	E			A	A	

Intersection Summary			
HCM 2000 Control Delay	10.0	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.60		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	12.5
Intersection Capacity Utilization	56.0%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	10	128	64	239	163	770	36	680	150	440	319	31
Future Volume (veh/h)	10	128	64	239	163	770	36	680	150	440	319	31
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	11	142	71	266	181	408	40	756	35	489	354	34
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	40	351	168	352	574	486	51	1107	494	516	1876	179
Arrive On Green	0.31	0.31	0.31	0.31	0.31	0.31	0.03	0.31	0.31	0.29	0.57	0.57
Sat Flow, veh/h	35	1144	547	1168	1870	1585	1781	3554	1585	1781	3278	313
Grp Volume(v), veh/h	224	0	0	266	181	408	40	756	35	489	191	197
Grp Sat Flow(s),veh/h/ln	1727	0	0	1168	1870	1585	1781	1777	1585	1781	1777	1814
Q Serve(g_s), s	0.0	0.0	0.0	22.5	9.7	31.2	2.9	24.2	2.0	34.9	6.7	6.8
Cycle Q Clear(g_c), s	13.1	0.0	0.0	35.5	9.7	31.2	2.9	24.2	2.0	34.9	6.7	6.8
Prop In Lane	0.05		0.32	1.00		1.00	1.00		1.00	1.00		0.17
Lane Grp Cap(c), veh/h	559	0	0	352	574	486	51	1107	494	516	1017	1038
V/C Ratio(X)	0.40	0.00	0.00	0.76	0.32	0.84	0.78	0.68	0.07	0.95	0.19	0.19
Avail Cap(c_a), veh/h	625	0	0	398	647	549	110	1107	494	562	1017	1038
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	0.92	0.92	0.92
Uniform Delay (d), s/veh	35.8	0.0	0.0	46.2	34.6	42.1	62.7	39.1	31.5	45.2	13.3	13.3
Incr Delay (d2), s/veh	0.5	0.0	0.0	7.2	0.3	10.2	21.7	3.4	0.3	23.4	0.4	0.4
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	5.8	0.0	0.0	9.0	4.5	13.5	1.6	11.1	0.8	18.7	2.8	2.9
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	36.2	0.0	0.0	53.4	34.9	52.2	84.4	42.6	31.8	68.6	13.7	13.7
LnGrp LOS	D	A	A	D	C	D	F	D	C	E	B	B
Approach Vol, veh/h		224			855			831			877	
Approach Delay, s/veh		36.2			48.9			44.1			44.3	
Approach LOS		D			D			D			D	

Timer - Assigned Phs	1	2		4	5	6		8				
Phs Duration (G+Y+Rc), s	41.6	44.5		43.9	7.8	78.4		43.9				
Change Period (Y+Rc), s	4.0	4.0		4.0	4.0	4.0		4.0				
Max Green Setting (Gmax), s	41.0	32.0		45.0	8.0	65.0		45.0				
Max Q Clear Time (g_c+I1), s	36.9	26.2		15.1	4.9	8.8		37.5				
Green Ext Time (p_c), s	0.7	2.6		1.4	0.0	2.5		2.3				

Intersection Summary			
HCM 6th Ctrl Delay			45.0
HCM 6th LOS			D

APPENDIX J

HORIZON YEAR 2035 WITH PROJECT SYNCHRO WORKSHEETS

HCM 6th Edition methodology does not support turning movements with shared & exclusive lanes.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	39	168	24	241	142	330	34	188	144	690	1212	80
Future Volume (vph)	39	168	24	241	142	330	34	188	144	690	1212	80
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Lane Util. Factor		0.95		0.97	0.91	0.91	1.00	0.95		1.00	0.95	
Frt		0.98		1.00	0.92	0.85	1.00	0.93		1.00	0.99	
Flt Protected		0.99		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)		3455		3433	3117	1441	1770	3309		1770	3506	
Flt Permitted		0.99		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)		3455		3433	3117	1441	1770	3309		1770	3506	
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	43	187	27	268	158	367	38	209	160	767	1347	89
RTOR Reduction (vph)	0	7	0	0	159	158	0	108	0	0	3	0
Lane Group Flow (vph)	0	250	0	268	183	25	38	261	0	767	1433	0
Turn Type	Split	NA		Split	NA	Perm	Prot	NA		Prot	NA	
Protected Phases	4	4		8	8		5	2		1	6	
Permitted Phases						8						
Actuated Green, G (s)		15.3		17.6	17.6	17.6	6.0	32.0		49.1	75.1	
Effective Green, g (s)		15.3		17.6	17.6	17.6	6.0	32.0		49.1	75.1	
Actuated g/C Ratio		0.12		0.14	0.14	0.14	0.05	0.25		0.38	0.58	
Clearance Time (s)		4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Vehicle Extension (s)		3.0		3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)		406		464	421	195	81	814		668	2025	
v/s Ratio Prot		c0.07		c0.08	0.06		0.02	0.08		c0.43	c0.41	
v/s Ratio Perm						0.02						
v/c Ratio		0.62		0.58	0.43	0.13	0.47	0.32		1.15	0.71	
Uniform Delay, d1		54.6		52.7	51.6	49.4	60.4	40.1		40.5	19.6	
Progression Factor		1.00		0.83	0.78	1.66	1.05	0.37		1.00	1.00	
Incremental Delay, d2		2.8		1.6	0.6	0.3	4.2	1.0		83.4	2.1	
Delay (s)		57.3		45.2	40.9	82.5	67.4	15.7		123.8	21.7	
Level of Service		E		D	D	F	E	B		F	C	
Approach Delay (s)		57.3			52.0			20.5			57.3	
Approach LOS		E			D			C			E	

Intersection Summary			
HCM 2000 Control Delay	52.0	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.88		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	75.4%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	68	550	109	150	506	110	92	40	140	90	20	93
Future Volume (veh/h)	68	550	109	150	506	110	92	40	140	90	20	93
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	76	611	121	167	562	122	102	44	156	100	22	103
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	97	762	151	137	1430	444	110	129	458	110	669	567
Arrive On Green	0.05	0.26	0.26	0.08	0.28	0.28	0.06	0.36	0.36	0.06	0.36	0.36
Sat Flow, veh/h	1781	2958	584	1781	5106	1585	1781	361	1279	1781	1870	1585
Grp Volume(v), veh/h	76	367	365	167	562	122	102	0	200	100	22	103
Grp Sat Flow(s),veh/h/ln	1781	1777	1765	1781	1702	1585	1781	0	1640	1781	1870	1585
Q Serve(g_s), s	2.7	12.5	12.6	5.0	5.8	3.9	3.7	0.0	5.8	3.6	0.5	2.9
Cycle Q Clear(g_c), s	2.7	12.5	12.6	5.0	5.8	3.9	3.7	0.0	5.8	3.6	0.5	2.9
Prop In Lane	1.00		0.33	1.00		1.00	1.00		0.78	1.00		1.00
Lane Grp Cap(c), veh/h	97	458	455	137	1430	444	110	0	587	110	669	567
V/C Ratio(X)	0.78	0.80	0.80	1.22	0.39	0.27	0.93	0.00	0.34	0.91	0.03	0.18
Avail Cap(c_a), veh/h	137	547	543	137	1571	488	110	0	587	110	669	567
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.09	0.09	0.09	1.00	1.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	30.4	22.6	22.6	30.0	18.9	18.2	30.4	0.0	15.3	30.3	13.6	14.3
Incr Delay (d2), s/veh	1.8	0.7	0.7	147.3	0.2	0.3	64.2	0.0	1.6	59.0	0.1	0.7
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	1.2	4.9	4.9	7.7	2.2	1.4	3.5	0.0	2.2	3.3	0.2	1.1
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	32.1	23.2	23.3	177.3	19.1	18.6	94.5	0.0	16.8	89.3	13.7	15.0
LnGrp LOS	C	C	C	F	B	B	F	A	B	F	B	B
Approach Vol, veh/h		808			851			302			225	
Approach Delay, s/veh		24.1			50.1			43.1			47.9	
Approach LOS		C			D			D			D	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	8.0	27.3	9.0	20.7	8.0	27.3	7.5	22.2
Change Period (Y+Rc), s	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Max Green Setting (Gmax), s	4.0	20.0	5.0	20.0	4.0	20.0	5.0	20.0
Max Q Clear Time (g_c+I1), s	5.6	7.8	7.0	14.6	5.7	4.9	4.7	7.8
Green Ext Time (p_c), s	0.0	0.9	0.0	2.2	0.0	0.3	0.0	3.4

Intersection Summary	
HCM 6th Ctrl Delay	39.3
HCM 6th LOS	D

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Traffic Volume (vph)	3	3	1	36	1	41	0	110	49	24	120	0
Future Volume (vph)	3	3	1	36	1	41	0	110	49	24	120	0
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	3	3	1	40	1	46	0	122	54	27	133	0

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total (vph)	7	87	176	160
Volume Left (vph)	3	40	0	27
Volume Right (vph)	1	46	54	0
Hadj (s)	0.03	-0.19	-0.15	0.07
Departure Headway (s)	4.8	4.5	4.1	4.4
Degree Utilization, x	0.01	0.11	0.20	0.19
Capacity (veh/h)	685	744	839	791
Control Delay (s)	7.8	8.0	8.2	8.4
Approach Delay (s)	7.8	8.0	8.2	8.4
Approach LOS	A	A	A	A

Intersection Summary			
Delay	8.2		
Level of Service	A		
Intersection Capacity Utilization	32.4%	ICU Level of Service	A
Analysis Period (min)	15		

HCM 6th Edition methodology does not support turning movements with shared & exclusive lanes.

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	72	66	112	330	1610	72
Future Volume (vph)	72	66	112	330	1610	72
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0	4.5	4.5	
Lane Util. Factor	1.00		1.00	0.95	0.95	
Frt	0.94		1.00	1.00	0.99	
Flt Protected	0.97		0.95	1.00	1.00	
Satd. Flow (prot)	1698		1770	3539	3516	
Flt Permitted	0.97		0.95	1.00	1.00	
Satd. Flow (perm)	1698		1770	3539	3516	
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	80	73	124	367	1789	80
RTOR Reduction (vph)	27	0	0	0	2	0
Lane Group Flow (vph)	126	0	124	367	1867	0
Turn Type	Prot		Prot	NA	NA	
Protected Phases	4		5	2	6	
Permitted Phases						
Actuated Green, G (s)	14.6		12.8	106.9	90.1	
Effective Green, g (s)	14.6		12.8	106.9	90.1	
Actuated g/C Ratio	0.11		0.10	0.82	0.69	
Clearance Time (s)	4.0		4.0	4.5	4.5	
Vehicle Extension (s)	3.0		3.0	3.0	3.0	
Lane Grp Cap (vph)	190		174	2910	2436	
v/s Ratio Prot	c0.07		c0.07	0.10	c0.53	
v/s Ratio Perm						
v/c Ratio	0.67		0.71	0.13	0.77	
Uniform Delay, d1	55.4		56.8	2.3	13.1	
Progression Factor	1.00		0.76	3.26	1.17	
Incremental Delay, d2	8.5		11.7	0.1	2.0	
Delay (s)	63.8		54.6	7.6	17.3	
Level of Service	E		D	A	B	
Approach Delay (s)	63.8			19.4	17.3	
Approach LOS	E			B	B	

Intersection Summary			
HCM 2000 Control Delay	20.5	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.75		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	12.5
Intersection Capacity Utilization	71.5%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	6	150	35	147	110	327	19	187	147	763	687	16
Future Volume (veh/h)	6	150	35	147	110	327	19	187	147	763	687	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	7	167	39	163	122	363	21	208	163	848	763	18
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	34	352	80	278	457	387	29	772	344	795	2296	54
Arrive On Green	0.24	0.24	0.24	0.24	0.24	0.24	0.02	0.22	0.22	0.75	1.00	1.00
Sat Flow, veh/h	21	1440	328	1176	1870	1585	1781	3554	1585	1781	3548	84
Grp Volume(v), veh/h	213	0	0	163	122	363	21	208	163	848	382	399
Grp Sat Flow(s),veh/h/ln	1789	0	0	1176	1870	1585	1781	1777	1585	1781	1777	1855
Q Serve(g_s), s	0.0	0.0	0.0	11.0	6.9	29.2	1.5	6.3	11.7	58.0	0.0	0.0
Cycle Q Clear(g_c), s	13.1	0.0	0.0	24.1	6.9	29.2	1.5	6.3	11.7	58.0	0.0	0.0
Prop In Lane	0.03		0.18	1.00		1.00	1.00		1.00	1.00		0.05
Lane Grp Cap(c), veh/h	466	0	0	278	457	387	29	772	344	795	1150	1201
V/C Ratio(X)	0.46	0.00	0.00	0.59	0.27	0.94	0.72	0.27	0.47	1.07	0.33	0.33
Avail Cap(c_a), veh/h	482	0	0	290	475	402	206	772	344	795	1150	1201
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.67	1.67	1.67
Upstream Filter(I)	1.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	0.56	0.56	0.56
Uniform Delay (d), s/veh	42.1	0.0	0.0	48.4	39.7	48.2	63.6	42.3	44.4	16.6	0.0	0.0
Incr Delay (d2), s/veh	0.7	0.0	0.0	2.8	0.3	29.1	28.2	0.9	4.6	44.0	0.4	0.4
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	6.0	0.0	0.0	5.2	3.2	14.6	0.9	2.9	5.0	23.4	0.1	0.1
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	42.8	0.0	0.0	51.2	40.0	77.2	91.8	43.2	49.0	60.6	0.4	0.4
LnGrp LOS	D	A	A	D	D	E	F	D	D	F	A	A
Approach Vol, veh/h		213			648			392			1629	
Approach Delay, s/veh		42.8			63.7			48.2			31.7	
Approach LOS		D			E			D			C	

Timer - Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	62.0	32.2		35.8	6.1	88.1		35.8
Change Period (Y+Rc), s	4.0	4.0		4.0	4.0	4.0		4.0
Max Green Setting (Gmax), s	58.0	27.0		33.0	15.0	70.0		33.0
Max Q Clear Time (g_c+I1), s	60.0	13.7		15.1	3.5	2.0		31.2
Green Ext Time (p_c), s	0.0	1.5		1.1	0.0	5.9		0.6

Intersection Summary		
HCM 6th Ctrl Delay		42.0
HCM 6th LOS		D

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	10	76	82	94	61	7
Future Volume (Veh/h)	10	76	82	94	61	7
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	11	83	89	102	66	8
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)			208			
pX, platoon unblocked						
vC, conflicting volume	191				245	140
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	191				245	140
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	99				91	99
cM capacity (veh/h)	1383				737	908

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	94	191	74
Volume Left	11	0	66
Volume Right	0	102	8
cSH	1383	1700	753
Volume to Capacity	0.01	0.11	0.10
Queue Length 95th (ft)	1	0	8
Control Delay (s)	0.9	0.0	10.3
Lane LOS	A		B
Approach Delay (s)	0.9	0.0	10.3
Approach LOS			B

Intersection Summary			
Average Delay	2.4		
Intersection Capacity Utilization	22.9%	ICU Level of Service	A
Analysis Period (min)	15		

HCM 6th Edition methodology does not support turning movements with shared & exclusive lanes.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	130	241	60	338	215	580	46	1125	193	330	497	53
Future Volume (vph)	130	241	60	338	215	580	46	1125	193	330	497	53
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Lane Util. Factor		0.95		0.97	0.91	0.91	1.00	0.95		1.00	0.95	
Frt		0.98		1.00	0.91	0.85	1.00	0.98		1.00	0.99	
Flt Protected		0.99		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)		3414		3433	3098	1441	1770	3462		1770	3488	
Flt Permitted		0.99		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)		3414		3433	3098	1441	1770	3462		1770	3488	
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	137	254	63	356	226	611	48	1184	203	347	523	56
RTOR Reduction (vph)	0	10	0	0	191	256	0	10	0	0	5	0
Lane Group Flow (vph)	0	444	0	356	341	49	48	1377	0	347	574	0
Turn Type	Split	NA		Split	NA	Perm	Prot	NA		Prot	NA	
Protected Phases	4	4		8	8		5	2		1	6	
Permitted Phases						8						
Actuated Green, G (s)		20.5		20.8	20.8	20.8	7.8	44.9		27.8	64.9	
Effective Green, g (s)		20.5		20.8	20.8	20.8	7.8	44.9		27.8	64.9	
Actuated g/C Ratio		0.16		0.16	0.16	0.16	0.06	0.35		0.21	0.50	
Clearance Time (s)		4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Vehicle Extension (s)		3.0		3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)		538		549	495	230	106	1195		378	1741	
v/s Ratio Prot		c0.13		0.10	c0.11		0.03	c0.40		c0.20	0.16	
v/s Ratio Perm						0.03						
v/c Ratio		0.83		0.65	0.69	0.21	0.45	1.15		0.92	0.33	
Uniform Delay, d1		53.0		51.2	51.6	47.5	59.0	42.5		50.0	19.5	
Progression Factor		1.00		1.00	1.00	1.00	1.19	0.81		1.00	1.00	
Incremental Delay, d2		10.0		2.6	4.0	0.5	2.3	76.2		26.5	0.5	
Delay (s)		63.0		53.8	55.5	47.9	72.4	110.5		76.5	20.0	
Level of Service		E		D	E	D	E	F		E	C	
Approach Delay (s)		63.0			53.1			109.2			41.2	
Approach LOS		E			D			F			D	

Intersection Summary			
HCM 2000 Control Delay	71.5	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	0.95		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	93.4%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	104	630	142	110	762	50	223	40	240	100	28	144
Future Volume (veh/h)	104	630	142	110	762	50	223	40	240	100	28	144
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	116	700	158	122	847	56	248	44	267	111	31	160
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	119	763	172	143	1421	441	285	83	502	143	527	446
Arrive On Green	0.07	0.27	0.27	0.08	0.28	0.28	0.16	0.36	0.36	0.08	0.28	0.28
Sat Flow, veh/h	1781	2880	650	1781	5106	1585	1781	229	1391	1781	1870	1585
Grp Volume(v), veh/h	116	432	426	122	847	56	248	0	311	111	31	160
Grp Sat Flow(s),veh/h/ln	1781	1777	1753	1781	1702	1585	1781	0	1620	1781	1870	1585
Q Serve(g_s), s	4.9	17.7	17.7	5.1	10.8	2.0	10.2	0.0	11.4	4.6	0.9	6.0
Cycle Q Clear(g_c), s	4.9	17.7	17.7	5.1	10.8	2.0	10.2	0.0	11.4	4.6	0.9	6.0
Prop In Lane	1.00		0.37	1.00		1.00	1.00		0.86	1.00		1.00
Lane Grp Cap(c), veh/h	119	471	465	143	1421	441	285	0	585	143	527	446
V/C Ratio(X)	0.98	0.92	0.92	0.86	0.60	0.13	0.87	0.00	0.53	0.78	0.06	0.36
Avail Cap(c_a), veh/h	119	474	468	143	1430	444	285	0	585	285	527	446
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.38	0.38	0.38	1.00	1.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	34.9	26.8	26.8	34.1	23.4	20.2	30.7	0.0	18.9	33.8	19.7	21.5
Incr Delay (d2), s/veh	44.5	10.7	10.9	37.0	0.7	0.1	23.9	0.0	3.4	8.6	0.2	2.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	3.5	8.5	8.4	3.6	4.2	0.7	6.1	0.0	4.6	2.3	0.4	2.4
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	79.4	37.5	37.7	71.1	24.1	20.4	54.7	0.0	22.4	42.5	19.9	23.8
LnGrp LOS	E	D	D	E	C	C	D	A	C	D	B	C
Approach Vol, veh/h		974			1025			559			302	
Approach Delay, s/veh		42.5			29.5			36.7			30.2	
Approach LOS		D			C			D			C	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	10.0	31.1	10.0	23.9	16.0	25.1	9.0	24.9
Change Period (Y+Rc), s	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Max Green Setting (Gmax), s	12.0	21.0	6.0	20.0	12.0	21.0	5.0	21.0
Max Q Clear Time (g_c+I1), s	6.6	13.4	7.1	19.7	12.2	8.0	6.9	12.8
Green Ext Time (p_c), s	0.1	1.2	0.0	0.2	0.0	0.5	0.0	3.7

Intersection Summary	
HCM 6th Ctrl Delay	35.4
HCM 6th LOS	D

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Traffic Volume (vph)	2	3	1	42	3	67	2	180	71	57	150	3
Future Volume (vph)	2	3	1	42	3	67	2	180	71	57	150	3
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Hourly flow rate (vph)	2	3	1	47	3	74	2	200	79	63	167	3

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total (vph)	6	124	281	233
Volume Left (vph)	2	47	2	63
Volume Right (vph)	1	74	79	3
Hadj (s)	0.00	-0.25	-0.13	0.08
Departure Headway (s)	5.3	4.8	4.4	4.6
Degree Utilization, x	0.01	0.17	0.34	0.30
Capacity (veh/h)	599	674	794	745
Control Delay (s)	8.3	8.8	9.6	9.6
Approach Delay (s)	8.3	8.8	9.6	9.6
Approach LOS	A	A	A	A

Intersection Summary			
Delay	9.4		
Level of Service	A		
Intersection Capacity Utilization	44.2%	ICU Level of Service	A
Analysis Period (min)	15		

HCM 6th Edition methodology does not support turning movements with shared & exclusive lanes.

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (vph)	132	137	145	1510	890	123
Future Volume (vph)	132	137	145	1510	890	123
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0	4.5	4.5	
Lane Util. Factor	1.00		1.00	0.95	0.95	
Frt	0.93		1.00	1.00	0.98	
Flt Protected	0.98		0.95	1.00	1.00	
Satd. Flow (prot)	1693		1770	3539	3475	
Flt Permitted	0.98		0.95	1.00	1.00	
Satd. Flow (perm)	1693		1770	3539	3475	
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	147	152	161	1678	989	137
RTOR Reduction (vph)	31	0	0	0	7	0
Lane Group Flow (vph)	268	0	161	1678	1119	0
Turn Type	Prot		Prot	NA	NA	
Protected Phases	4		5	2	6	
Permitted Phases						
Actuated Green, G (s)	25.4		15.7	96.1	76.4	
Effective Green, g (s)	25.4		15.7	96.1	76.4	
Actuated g/C Ratio	0.20		0.12	0.74	0.59	
Clearance Time (s)	4.0		4.0	4.5	4.5	
Vehicle Extension (s)	3.0		3.0	3.0	3.0	
Lane Grp Cap (vph)	330		213	2616	2042	
v/s Ratio Prot	c0.16		c0.09	c0.47	0.32	
v/s Ratio Perm						
v/c Ratio	0.81		0.76	0.64	0.55	
Uniform Delay, d1	50.0		55.3	8.4	16.3	
Progression Factor	1.00		0.83	2.02	0.56	
Incremental Delay, d2	14.2		7.6	0.6	1.0	
Delay (s)	64.2		53.6	17.6	10.2	
Level of Service	E		D	B	B	
Approach Delay (s)	64.2			20.8	10.2	
Approach LOS	E			C	B	

Intersection Summary			
HCM 2000 Control Delay	21.1	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.71		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	12.5
Intersection Capacity Utilization	64.5%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	10	126	64	239	162	820	37	694	150	486	332	31
Future Volume (veh/h)	10	126	64	239	162	820	37	694	150	486	332	31
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	11	140	71	266	180	483	41	771	29	540	369	34
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	41	371	180	380	611	518	53	971	433	548	1815	166
Arrive On Green	0.33	0.33	0.33	0.33	0.33	0.33	0.03	0.27	0.27	0.31	0.55	0.55
Sat Flow, veh/h	35	1135	550	1171	1870	1585	1781	3554	1585	1781	3291	302
Grp Volume(v), veh/h	222	0	0	266	180	483	41	771	29	540	198	205
Grp Sat Flow(s),veh/h/ln	1721	0	0	1171	1870	1585	1781	1777	1585	1781	1777	1816
Q Serve(g_s), s	0.0	0.0	0.0	21.5	9.3	38.4	3.0	26.2	1.8	39.2	7.3	7.4
Cycle Q Clear(g_c), s	12.6	0.0	0.0	34.1	9.3	38.4	3.0	26.2	1.8	39.2	7.3	7.4
Prop In Lane	0.05		0.32	1.00		1.00	1.00		1.00	1.00		0.17
Lane Grp Cap(c), veh/h	591	0	0	380	611	518	53	971	433	548	980	1001
V/C Ratio(X)	0.38	0.00	0.00	0.70	0.29	0.93	0.78	0.79	0.07	0.99	0.20	0.20
Avail Cap(c_a), veh/h	636	0	0	412	662	561	123	971	433	548	980	1001
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	0.82	0.82	0.82
Uniform Delay (d), s/veh	33.7	0.0	0.0	43.3	32.6	42.4	62.6	43.8	35.0	44.7	14.7	14.7
Incr Delay (d2), s/veh	0.4	0.0	0.0	4.8	0.3	21.9	21.1	6.7	0.3	31.0	0.4	0.4
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	5.5	0.0	0.0	8.5	4.3	18.0	1.7	12.4	0.7	21.8	3.1	3.2
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	34.1	0.0	0.0	48.1	32.9	64.3	83.8	50.5	35.3	75.7	15.1	15.1
LnGrp LOS	C	A	A	D	C	E	F	D	D	E	B	B
Approach Vol, veh/h		222			929			841			943	
Approach Delay, s/veh		34.1			53.5			51.6			49.8	
Approach LOS		C			D			D			D	

Timer - Assigned Phs	1	2		4	5	6		8
Phs Duration (G+Y+Rc), s	44.0	39.5		46.5	7.9	75.7		46.5
Change Period (Y+Rc), s	4.0	4.0		4.0	4.0	4.0		4.0
Max Green Setting (Gmax), s	40.0	32.0		46.0	9.0	63.0		46.0
Max Q Clear Time (g_c+I1), s	41.2	28.2		14.6	5.0	9.4		40.4
Green Ext Time (p_c), s	0.0	1.8		1.4	0.0	2.6		2.1

Intersection Summary	
HCM 6th Ctrl Delay	50.3
HCM 6th LOS	D

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	18	134	84	162	149	17
Future Volume (Veh/h)	18	134	84	162	149	17
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	20	146	91	176	162	18
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)			208			
pX, platoon unblocked						
vC, conflicting volume	267				365	179
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	267				365	179
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	98				74	98
cM capacity (veh/h)	1297				625	864

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	166	267	180
Volume Left	20	0	162
Volume Right	0	176	18
cSH	1297	1700	643
Volume to Capacity	0.02	0.16	0.28
Queue Length 95th (ft)	1	0	29
Control Delay (s)	1.1	0.0	12.8
Lane LOS	A		B
Approach Delay (s)	1.1	0.0	12.8
Approach LOS			B

Intersection Summary			
Average Delay	4.0		
Intersection Capacity Utilization	38.1%	ICU Level of Service	A
Analysis Period (min)	15		

APPENDIX K

PEAK HOUR ARTERIAL ANALYSIS

Arterial Level of Service: EB Via De La Valle

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Jimmy Durante Blvd.	III	30	72.8	43.1	115.9	0.61	18.8	C
Total	III		72.8	43.1	115.9	0.61	18.8	C

Arterial Level of Service: WB Via De La Valle

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Highway 101	III	30	72.8	27.8	100.6	0.61	21.7	C
Total	III		72.8	27.8	100.6	0.61	21.7	C

Arterial Level of Service: EB Via De La Valle

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
	III	30	72.8	57.7	130.5	0.61	16.7	D
Total	III		72.8	57.7	130.5	0.61	16.7	D

Arterial Level of Service: WB Via De La Valle

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Highway 101	III	30	72.8	33.6	106.4	0.61	20.5	C
Total	III		72.8	33.6	106.4	0.61	20.5	C

Arterial Level of Service: EB Via De La Valle

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Jimmy Durante Blvd.	III	30	72.8	44.4	117.2	0.61	18.6	C
Total	III		72.8	44.4	117.2	0.61	18.6	C

Arterial Level of Service: WB Via De La Valle

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Highway 101	III	30	72.8	27.7	100.5	0.61	21.7	C
Total	III		72.8	27.7	100.5	0.61	21.7	C

Arterial Level of Service: EB Via De La Valle

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
	III	30	72.8	57.7	130.5	0.61	16.7	D
Total	III		72.8	57.7	130.5	0.61	16.7	D

Arterial Level of Service: WB Via De La Valle

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Highway 101	III	30	72.8	30.8	103.6	0.61	21.1	C
Total	III		72.8	30.8	103.6	0.61	21.1	C

Arterial Level of Service: EB Via De La Valle

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Jimmy Durante Blvd.	III	30	72.8	46.1	118.9	0.61	18.4	C
Total	III		72.8	46.1	118.9	0.61	18.4	C

Arterial Level of Service: WB Via De La Valle

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Highway 101	III	30	72.8	26.9	99.7	0.61	21.9	C
Total	III		72.8	26.9	99.7	0.61	21.9	C

Arterial Level of Service: EB Via De La Valle

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
	III	30	72.8	59.9	132.7	0.61	16.4	D
Total	III		72.8	59.9	132.7	0.61	16.4	D

Arterial Level of Service: WB Via De La Valle

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Highway 101	III	30	72.8	33.4	106.2	0.61	20.6	C
Total	III		72.8	33.4	106.2	0.61	20.6	C

Arterial Level of Service: EB Via De La Valle

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Jimmy Durante Blvd.	III	30	72.8	25.5	98.3	0.61	22.2	C
Total	III		72.8	25.5	98.3	0.61	22.2	C

Arterial Level of Service: WB Via De La Valle

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Highway 101	III	30	72.8	51.3	124.1	0.61	17.6	D
Total	III		72.8	51.3	124.1	0.61	17.6	D

Arterial Level of Service: EB Via De La Valle

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
	III	30	72.8	59.9	132.7	0.61	16.4	D
Total	III		72.8	59.9	132.7	0.61	16.4	D

Arterial Level of Service: WB Via De La Valle

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Highway 101	III	30	72.8	30.6	103.4	0.61	21.1	C
Total	III		72.8	30.6	103.4	0.61	21.1	C

Arterial Level of Service: EB Via De La Valle

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Jimmy Durante Blvd.	III	30	72.8	56.9	129.7	0.61	16.8	D
Total	III		72.8	56.9	129.7	0.61	16.8	D

Arterial Level of Service: WB Via De La Valle

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Highway 101	III	30	72.8	27.5	100.3	0.61	21.8	C
Total	III		72.8	27.5	100.3	0.61	21.8	C

Arterial Level of Service: EB Via De La Valle

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
	III	30	72.8	68.9	141.7	0.61	15.4	D
Total	III		72.8	68.9	141.7	0.61	15.4	D

Arterial Level of Service: WB Via De La Valle

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Highway 101	III	30	72.8	33.3	106.1	0.61	20.6	C
Total	III		72.8	33.3	106.1	0.61	20.6	C

Arterial Level of Service: EB Via De La Valle

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Jimmy Durante Blvd.	III	30	72.8	35.5	108.3	0.61	20.2	C
Total	III		72.8	35.5	108.3	0.61	20.2	C

Arterial Level of Service: WB Via De La Valle

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Highway 101	III	30	72.8	61.0	133.8	0.61	16.3	D
Total	III		72.8	61.0	133.8	0.61	16.3	D

Arterial Level of Service: EB Via De La Valle

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
	III	30	72.8	68.9	141.7	0.61	15.4	D
Total	III		72.8	68.9	141.7	0.61	15.4	D

Arterial Level of Service: WB Via De La Valle

Cross Street	Arterial Class	Flow Speed	Running Time	Signal Delay	Travel Time (s)	Dist (mi)	Arterial Speed	Arterial LOS
Highway 101	III	30	72.8	30.7	103.5	0.61	21.1	C
Total	III		72.8	30.7	103.5	0.61	21.1	C

APPENDIX L

ALTERNATIVE PROJECT ANALYSIS

Sewer Study

Civil Engineering/Surveying/Planning
STUART ENGINEERING

November 2, 2015

Mr. Corey Andrews
City of Solana Beach
635 South Highway 101
Solana Beach, CA 92075

SUBJECT: COAST 101 MIXED USE PROJECT – SEWER STUDY

Mr. Andrews:

We are pleased to submit a Sewer Study for the Coast 101 Mixed Use Project (Project). This Sewer Study will document the change in usage type for the property and will analyze the proposed increase in sewer flows to the existing City of Solana Beach (City) system. Recommendations will be made for any improvements that may be necessary.

BACKGROUND

The Project is located in the City limits, north of Dahlia Drive between Sierra Avenue and Highway 101. See Figure 1 for Project Vicinity. The site encompasses 1.9 gross acres and previously consisted of a trailer park community, a single-family residential home, a gas station, and office space. The Project will consist of a mixed use development to include 2 and 3-story commercial office space, retail and restaurant space, and multi-family residential. Parking will be provided with a 2-story underground parking structure.

LAND USE

The proposed land uses for the Project are shown on Table 1. Each use is shown as a gross square footage (gsf) of the total project area, which includes multiple stories.

Table 1. Proposed Project Land Uses

Land Use	Units
Commercial Office	14,137 gsf
Commercial Retail	24,284 gsf
Commercial Restaurant/Retail	10,215 gsf
Commercial Service Area	2,626 gsf
Commercial Loading Area	2,824 gsf
Multi-Family Residential	34,150 gsf (31 DUs)
Total Floor Area	**88,236 gsf**

The underground parking structure will hold 279 commercial use parking spaces, and an additional 62 spaces for residential use, for a total of 341 parking spaces.

SEWER DESIGN CRITERIA

The City currently uses the Water Agency Standards (WAS) for standardized sewer design criteria (Section 4.2, Rev July 28, 2014). The criteria used in this study are shown in Table 2.

Table 2. Sewer Design Criteria

Parameter	Criteria
Unit Sewage Generation Rates:	
Commercial Office	1,500 gpd/g-ac[1]
Commercial Retail	1,500 gpd/g-ac[1]
Commercial Restaurant/Retail	1,500 gpd/g-ac[1]
Commercial Service Area	0 gpd/g-ac[1]
Commercial Loading Area	0 gpd/g-ac[1]
Multi-Family Residential	200 gpd/EDU[2]
Maximum Peak Flow Depth (d/D)	
Pipe Diameter ≤12"	0.50
Pipe Diameter >12"	0.75
Mannings 'n' factor (VCP)	0.013
Peaking Factor	(See Figure 2.)
Minimum Peak Velocity	2.0 fps
Maximum Peak Velocity	10 fps

Notes:
(1) Gross acres (g-ac)
(2) Equivalent Dwelling Unit (EDU) is generally assumed by the WAS as 220 gpd. Therefore, for purposes of this study, the EDU factor is 200 gpd/EDU ÷ 220 gpd = 0.91 EDU.

WASTEWATER PROJECTIONS

Table 3 summarizes the average daily sewage flows generated by the Project. Based on the criteria presented in the WAS, average annual wastewater projections are estimated at 7,311 gpd. The previous land use for the site was a trailer home community of 24 DUs, two single family residences, a real estate office building, and a gas station. Using the WAS unit generation rates would result in an existing average daily sewer flow of 5,329 gpd. Therefore, the total increase in wastewater created by the Project is 1,983 gpd.

Sewer systems are designed to convey peak wastewater flows. The WAS provides a ratio of average to peak daily flows in Figure 4-2-1, presented herein as Figure 2. The Project's average daily sewer flow increase is less than 0.1 MGD, which corresponds to a peak factor of 3.5. Therefore, total peak flow for the Project is 0.03 MGD, which is a total increase of 0.007 MGD over existing flows.

Table 3. Wastewater Projections

Land Use	Units (sf)	Quantity[1]	Unit Generation Rate	Avg Daily Sewer Flow (gpd)	EDU[2]
Proposed Project Uses					
Commercial Office	14,137	0.32 ac	1,500 gpd/ac	487	2
Commercial Retail	24,284	0.56 ac	1,500 gpd/ac	836	4
Commercial Restaurant/Retail	10,215	0.23 ac	1,500 gpd/ac	352	2
Commercial Service Area	2,626	0.06 ac	0 gpd/ac	0	0
Commercial Loading Area	2,824	0.06 ac	0 gpd/ac	0	0
Multi-Family Residential	34,150	31 DU	200 gpd/EDU	5,636	28
			TOTAL PROJECT	**7,311**	**36**
Existing Uses					
Trailer Park		24 DU	200 gpd/EDU	4,364	22
Single Family Residencial		2 DU	220 gpd/EDU	440	2
Commercial (Real Estate Office)	4,356	0.10 ac	1,500 gpd/ac	150	1
Commercial (Gas Station)	10,890	0.25 ac	1,500 gpd/ac	375	2
			TOTAL EXISTING	5,329	26
			TOTAL WASTEWATER INCREASE	**1,983**	**9**

Note:

(1) The total quantity for a given land use is assumed to be equal to the total gsf for that use, converted to acres.

(2) According to the WAS, one Equivalent Dwelling Unit (EDU) is equal to one Dwelling Unit (DU) using 220 gpd. Therefore, a unit using 200 gpd is approximately 0.91 EDU.

EXISTING SEWER SYSTEM

The existing system consists of a 6-inch vitrified clay pipe (VCP) in Highway 101, an 8-inch VCP in Dahlia Drive, and parallel 8-inch and 10-inch VCPs in Sierra Avenue. The Project is within the Solana Beach Drainage Basin, which conveys sewage flows to the Solana Beach Pump Station (PS). Ultimately, sewage from this basin it treated and disposed of at the San Elijo Joint Powers Authority Water Reclamation Facility.

Figure 3 shows the existing sewer system in the vicinity of the Project.

HYDRAULIC ANALYSIS

An analysis was performed to verify the size and available capacity of the existing gravity sewer system for the additional flows from the Project. Gravity mains are typically sized to convey ultimate flows and then reevaluated under buildout condition to maintain criteria for lower flows. Gravity sewer calculations are provided in Appendix A.

Based on the existing gravity sewer system conditions, slopes, and sizes, the additional flows from the Project will not cause any pipeline improvements based on WAS criteria.

If you have any questions or comments, please feel free to contact me at 619.334.4099.

Sincerely,

Jennifer R. Mael, P.E.
Principal

Attachments: Figure 1 – Project Vicinity
Figure 2 – WAS Sewer Peaking Factors
Figure 3 – Existing Sewer System
Appendix A – Hydraulic Analysis

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FIGURE 1

PROJECT VICINITY

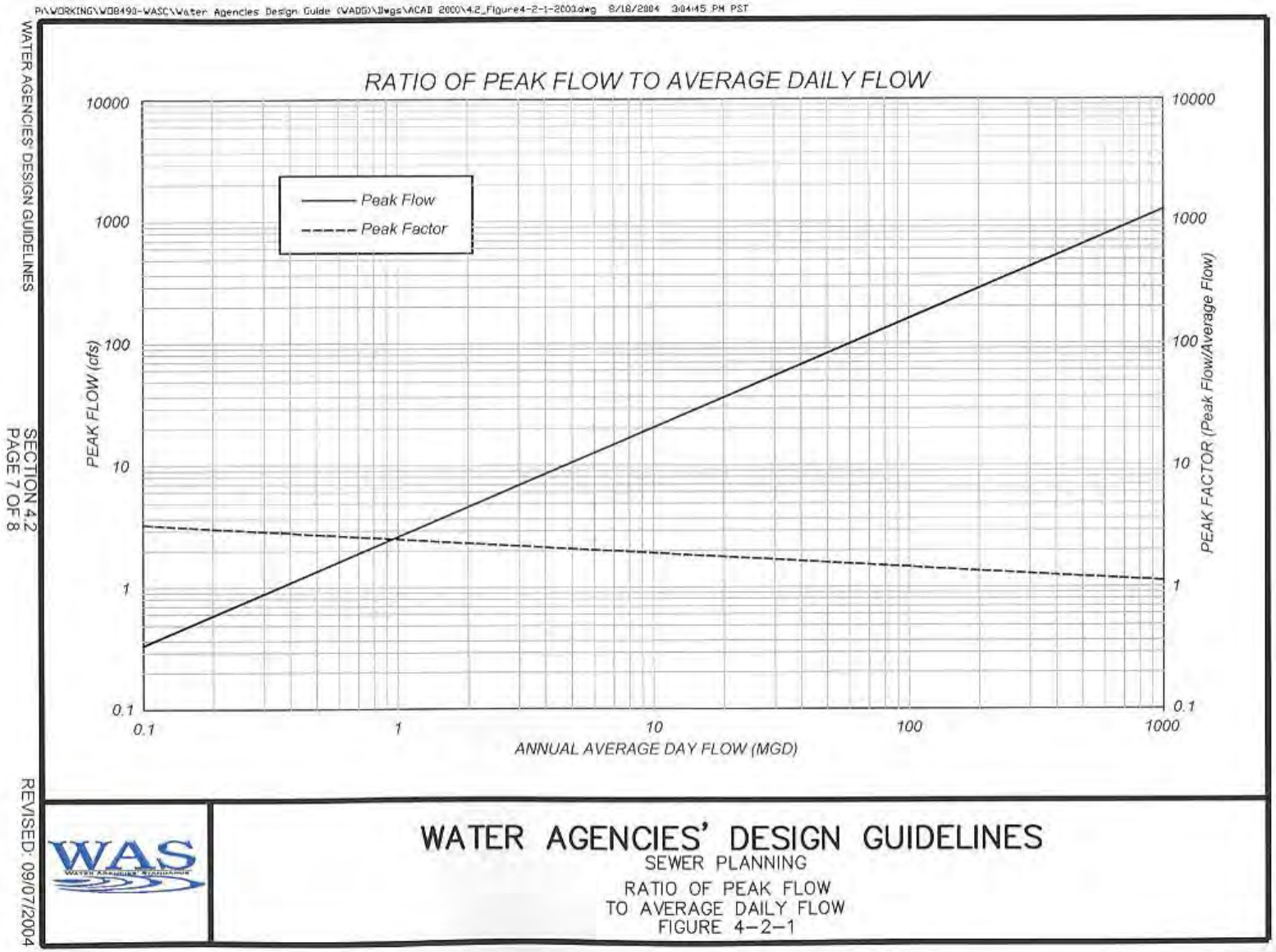

FIGURE 2

WAS SEWER PEAKING FACTORS

LEGEND

●	Sewer Manhole
—	Gravity Sewer Main
A	Trailer Park Community
B	Two Single-Family Residences
C	Real Estate Building
D	Gas Station

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FIGURE 3

EXISTING SEWER SYSTEM

APPENDIX A

LEGEND

- Sewer Manhole
- Gravity Sewer Main
- Gravity Sewer Main – Not Modeled

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NTS

PIPE AND NODE MAP

APPENDIX A - ANALYSIS RESULTS
TABLE A-1 EXISTING SEWER FLOWS

	Upstream MH			Downstream MH													
Pipe ID	ID	Rim	Inv	ID	Rim	Inv	Length	Diameter	Trib Avg Flow (gpd)[1]	Cumulative Average Flow (gpd)	Peaking Factor	Peak Dry Weather Flow (gpd)[2]	Peak Dry Weather Flow (cfs)	Slope (%)	Normal Depth (inches)	d/D	Velocity (fps)
1 [1]	DE9	68.00	60.84	MH46	66.20	58.60	320.0	6	375	375	3.50	1,312.5	0.00	0.70	0.25	0.04	2.2
2 [2]	MH46	66.20	58.60	MH44	65.00	53.11	300.0	6	2,250	2,625	3.50	9,187.5	0.01	1.83	0.57	0.10	3.2
3 [3]	DE10	65.10	55.83	MH45	64.30	54.51	330.0	8	3,750	3,750	3.50	13,125.0	0.02	0.40	0.90	0.11	2.1
4 [4]	MH45	64.30	54.51	MH44	65.00	53.11	350.0	8	750	4,500	3.50	15,750.0	0.02	0.40	0.98	0.12	2.7
5 [5]	MH44	65.00	53.11	MH43	61.00	52.39	171.0	8	375	7,500	3.50	26,250.0	0.04	0.42	1.24	0.16	2.0
6 [6]	MH43	61.00	52.39	MH42	58.00	51.63	189.0	8	150	7,650	3.50	26,775.0	0.04	0.40	1.26	0.16	1.8
7 [7]	MH42	58.00	51.63	MH41A	58.00	49.54	498.7	10	4,804	200,000	1.96	392,000.0	0.61	0.42	4.56	0.46	3.3
8	MH41A	58.00	49.54	MH40A	57.00	47.09	596.6	10	0	200,000	1.96	392,000.0	0.61	0.41	4.60	0.46	3.3

1. Flow at this location includes sewage generation for a 0.25-ac commercial development.
2. Flow at this location includes sewage generation for a 1.5-ac commercial development.
3. Flow at this location includes sewage generation for a 2.5-ac non-residential development.
4. Flow at this location includes sewage generation for a 0.5-ac commercial development.
5. Flow at this location includes sewage generation for a 0.25-ac commercial development (gas station).
6. Flow at this location includes sewage generation for a 0.1-ac commercial development (real estate building).
7. Flow at this location includes sewage generation for 2 existing single family homes and the 24-unit trailer park.

APPENDIX A - ANALYSIS RESULTS
TABLE A-2 EXISTING SEWER FLOWS PLUS ADDITIONAL FROM PROJECT

	Upstream MH			Downstream MH													
Pipe ID	ID	Rim	Inv	ID	Rim	Inv	Length	Diameter	Trib Avg Flow (gpd)	Cumulative Average Flow (gpd)	Peaking Factor	Peak Dry Weather Flow (gpd)	Peak Dry Weather Flow (cfs)	Slope (%)	Normal Depth (inches)	d/D	Velocity (fps)
1 [1]	DE9	68.00	60.84	MH46	66.20	58.60	320.0	6	375	375	3.50	1,312.5	0.00	0.70	0.25	0.04	2.2
2 [2]	MH46	66.20	58.60	MH44	65.00	53.11	300.0	6	2,250	2,625	3.50	9,187.5	0.01	1.83	0.57	0.10	3.2
3 [3]	DE10	65.10	55.83	MH45	64.30	54.51	330.0	8	3,750	3,750	3.50	13,125.0	0.02	0.40	0.90	0.11	2.1
4 [4]	MH45	64.30	54.51	MH44	65.00	53.11	350.0	8	750	4,500	3.50	15,750.0	0.02	0.40	0.98	0.12	2.7
5	MH44	65.00	53.11	MH43	61.00	52.39	171.0	8		7,125	3.50	24,937.5	0.04	0.42	1.21	0.15	2.0
6	MH43	61.00	52.39	MH42	58.00	51.63	189.0	8		7,125	3.50	24,937.5	0.04	0.40	1.22	0.15	1.8
7	MH42	58.00	51.63	**MH42A**	**60.90**	**50.90**	175.0	10		195,669	1.96	383,511.2	0.59	0.42	4.51	0.45	3.3
9 [5]	**MH42A**	**60.90**	**50.90**	MH41A	58.00	49.54	323.7	10	7,311	202,980	1.96	397,840.8	0.62	0.42	4.60	0.46	3.3
8	MH41A	58.00	49.54	MH40A	57.00	47.09	596.6	10		202,980	1.96	397,840.8	0.62	0.41	4.64	0.46	3.3

1. Flow at this location includes sewage generation for a 0.25-ac commercial development.
2. Flow at this location includes sewage generation for a 1.5-ac commercial development.
3. Flow at this location includes sewage generation for a 2.5-ac non-residential development.
4. Flow at this location includes sewage generation for a 0.5-ac commercial development.
5. Flow at this location includes sewage generation created by the Project.