BLUE FOLDER ITEM

Blue folder items are additional back up material to administrative reports and/or public comments received after the printing and distribution of the agenda packet for receive and file.

PLANNING COMMISSION MEETING
September 15, 2022

J.1. A PUBLIC HEARING FOR CONSIDERATION OF AN ENVIRONMENTAL ASSESSMENT (ENVIRONMENTAL IMPACT REPORT - STATEMENT OF OVERRIDING CONSIDERATIONS AND MITIGATION MONITORING AND REPORTING PROGRAM), VARIANCE, COASTAL DEVELOPMENT PERMIT, CONDITIONAL USE PERMIT (DENSITY BONUS), PLANNING COMMISSION DESIGN REVIEW, AND VESTING TENTATIVE MAP NO. 82561 TO PERMIT CONSTRUCTION OF A PROPOSED 30-UNIT RESIDENTIAL PROJECT WITH ADAPTIVE REUSE OF EXISTING NON-RESIDENTIAL BUILDINGS FOR COMMERCIAL PURPOSES ON PROPERTY LOCATED WITHIN A LOW DENSITY, MULTIPLE-FAMILY RESIDENTIAL (R-3A) ZONE, IN THE COASTAL ZONE, AT 100-132 N. CATALINA AVENUE. (CASE NOS. IES-EIR-2021-01; CUP-2022-01; VAR-2022-02; CDP-2022-03; PCDR-2022-01; VTPM 82561)

CONTACT: ANTONIO GARDEA, SENIOR PLANNER

- Draft Local Transportation Assessment

Draft Local Transportation Assessment for the

Catalina Village Project

Prepared for:
Rincon Consultants

August 2021

LB20-0012

FEHR PEERS

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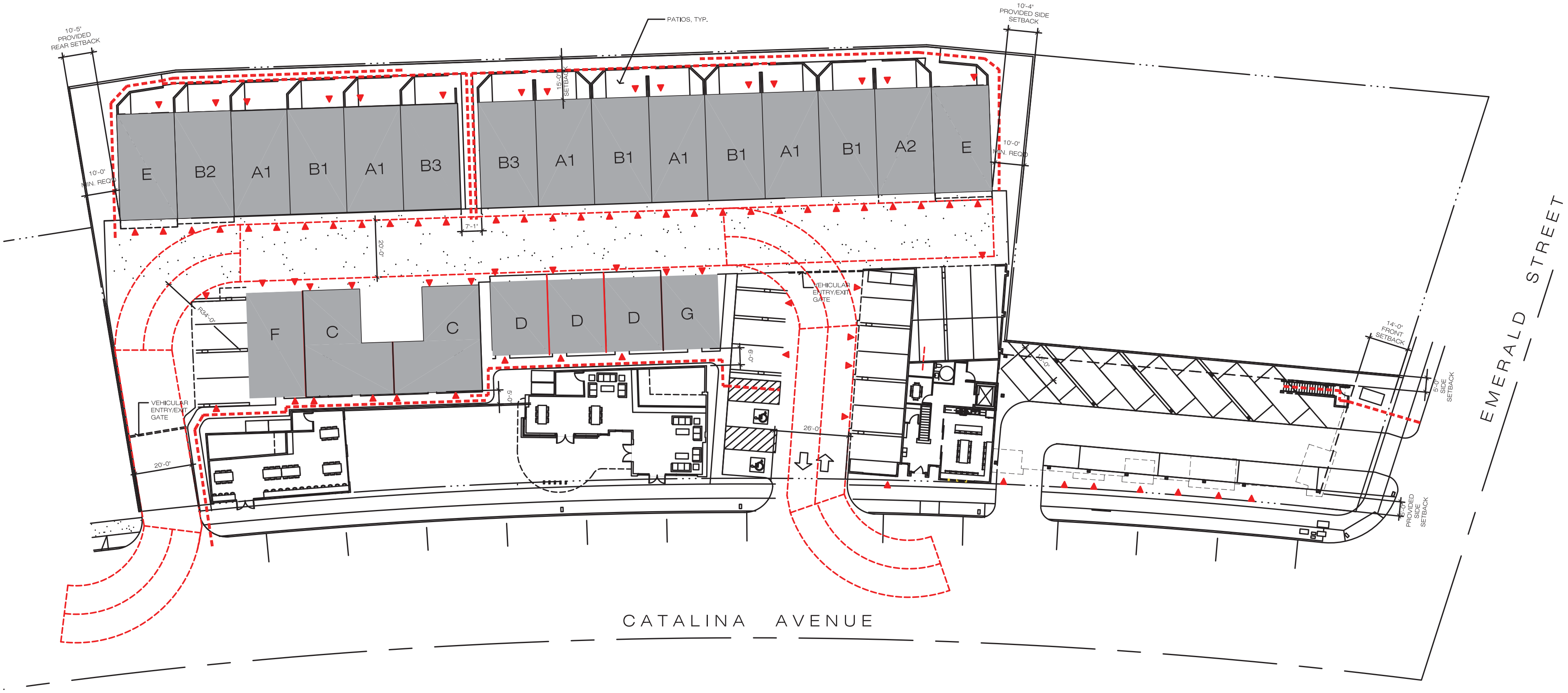
1. Introduction

This report analyzes the operational effects associated with the proposed Catalina Village Project ("Project"), in the City of Redondo Beach, California. The report documents the methodologies and criteria used to evaluate the Project and summarizes the analysis and operational effects of Existing and future Cumulative conditions.

1.1 Project Description

The proposed project (the Project) spans fourteen adjacent parcels across six addresses, including 100, 112, 116, 124, 126, and 132 N Catalina Avenue, and occupies almost the entire southwest quadrant of the block bounded by Diamond Street to the North, Emerald Street to the South, Catalina Avenue to the West, and North Broadway to the East. All of the Project parcels are currently zoned for Low-Density Multifamily Residential (R3-A).

Existing uses on the site include an office, a frame store, a cabinet shop, a tile and granite sales store, and a clothing store, as well as a vacant dry cleaner and coffee shop and a former Masonic Temple and United States Post Office. The Project involves the construction of 30 three-story mixed income apartment units and would preserve and retrofit approximately 3,000 square feet of commercial retail buildings, replacing the existing commercial uses with a 1,784 square foot coffee shop and a 1,279 square foot beer tasting room. Site access would be provided via two driveways on Catalina Avenue, and the Project would provide 72 parking stalls, with an additional 7 parking spaces available on-street in front of the commercial retail uses. **Figure 1** illustrates the ground level site plan for the Project.



▲ Access to Bedroom*

---- 150’ Fire Hose

*All Bedrooms are located at 1st and 2nd Levels

N

scale: 1/16" = 1'-0"

0 16 32 48 64

Figure 1

Site Plan

1.2 Localized Analysis Study Scope

This section details the analysis scenarios, methodologies, and operational criteria used to assess the Project's potential to trigger transportation operational effects. This scope was prepared in accordance with the requirements of the City of Redondo Beach.

1.2.1 Study Area

In consultation with City of Redondo Beach staff, the study area for the localized analysis was selected to include the intersections most likely to be affected by traffic generated by the Project. A total of 11 intersections were identified for analysis in the scenarios detailed below. These study intersections are shown in **Figure 2**. Each of the 11 study intersections, listed in **Table 1**, operates under signal control. AM and PM peak hour turning movement volumes were analyzed at these study intersections.

Due to the COVID-19 pandemic, the Existing Conditions analysis for most intersections relies on traffic counts that were collected in Spring 2017, while the traffic counts for the remaining intersections were collected in Spring 2014. An annual growth rate, described in greater detail below, was applied to estimate Year 2020 conditions. Because of the disruption to businesses and schools caused by COVID-19 and the resulting shelter-in-place orders throughout the region, new traffic counts would show lower traffic volumes than what would typically be observed under normal conditions. Therefore, using historical traffic counts and applying a growth rate results in a more conservative analysis.

Table 1 – Study Area Intersections

ID	North-South Street Name	East-West Street Name	Count Date
1	South Catalina Avenue	Torrance Boulevard	Spring 2014
2	South Catalina Avenue	Garnet Street	No Counts Available
3	North Catalina Avenue	Emerald Street	Spring 2014
4	North Catalina Avenue	Diamond Street	Spring 2014
5	North Catalina Avenue	Beryl Street	Summer 2017
6	Pacific Coast Highway	Herondo Street / Anita Street	Spring 2017
7	Pacific Coast Highway	North Catalina Avenue	Spring 2017
8	Pacific Coast Highway	Beryl Street	Spring 2017
9	Pacific Coast Highway	Diamond Street	Spring 2017
10	Pacific Coast Highway	Emerald Street	Spring 2017
11	Pacific Coast Highway	Torrance Boulevard	Spring 2017

Notes: Intersection 2 was analyzed qualitatively because existing traffic counts were not available at the time of the study.

🟧 Project Site

● Study Intersections

Figure 2

Study Intersections

1.2.2 Localized Analysis Scenarios

The scenarios described below were analyzed for this study.

1.2.2.1 Baseline Conditions

- Existing (Year 2020) Conditions – The analysis of Existing traffic conditions using existing counts and geometric lane configurations provides a basis for the remainder of the study and includes an assessment of the street system, traffic volumes, and operating conditions. The peak hour count for each intersection was selected for analysis, and an annual growth rate was applied to estimate Year 2020 conditions. The annual growth rate applied to the 2014 and 2017 traffic volumes was obtained from the Southern California Association of Government's (SCAG) population growth forecast for the City of Redondo Beach, an average annual growth rate of 0.38%.[1] Population growth rates, rather than traffic growth rates, were used to estimate existing Year 2020 conditions because SCAG forecasts a slight decline in average traffic volumes Citywide.
- Cumulative without Project Conditions (Year 2023) – Future traffic conditions are provided in this scenario without the proposed Project. The annual growth rate from the SCAG population growth forecast that was applied to estimate Existing Year 2020 traffic volumes was also applied to estimate future Year 2023 traffic volumes.

Fehr & Peers ran the 2016 SCAG RTP travel demand model and compared the model-assigned traffic on roadways in the City of Redondo Beach citywide between the base year and the forecast year. Because the net change in volumes shows a decline due to transportation infrastructure improvements, land use changes, and policy strategies associated with the RTP and the Sustainable Communities Strategy (SCS), the use of the population growth rate is considered a conservative worst-case analysis.[2] Detail about what the SCAG model is and how it was applied in this analysis is provided below.

While public agencies may rely exclusively upon growth projections for cumulative analyses, the City also incorporated a specific development project near the study area (the Foundry) to produce a highly conservative analysis.

1.2.2.2 Project Conditions

- Existing plus Project Conditions – This scenario provides the basis for the analysis of the effects of the Project's trips on Existing operating conditions. Project trips were assigned to the roadway network based on the trip generation and trip distribution analyses described in this report. This scenario was developed by adding Project trips to the Existing Conditions (2020) without Project scenario detailed above.
- Cumulative plus Project Conditions (Year 2023) – This scenario provides the basis for the analysis of future conditions with traffic generated by the Project. Project trips were assigned to the

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[1] SCAG Integrated Growth Forecast available online at:
http://www.scag.ca.gov/Documents/2016DraftGrowthForecastByJurisdiction.pdf

[2] SCAG 2016 RTP/SCS is available online at: http://scagrtpscs.net/Pages/FINAL2016RTPSCS.aspx

roadway network based on the trip generation and trip distribution analyses described in this report. This scenario was developed by adding Project trips to the Cumulative Conditions (2023) without Project scenario detailed above.

1.2.3 Localized Analysis Methodologies & Operational Effect Criteria

The following section documents the transportation analysis methodologies and thresholds used to evaluate the Project's potential for transportation operational effects.

1.2.4 Trip Generation

Standard trip generation methodologies typically use the Institute of Transportation (ITE) Engineers Trip Generation Manual (10th Edition) to establish trip rates for each individual land use in isolation. However, most of the empirical data used to develop ITE trip generation rates were collected in isolated, suburban settings, and do not accurately predict trip generation for mixed use and urban infill sites with transit proximity and a density, scale, and design that can facilitate walking and biking. Research indicates that the ITE manuals overestimate peak traffic generation for mixed-use development (MXD) by an average of 35%.[3] To overcome this shortcoming of the conventional ITE trip generation procedure, researchers have developed a mixed-use trip generation model. **Appendix A** includes *Getting Trip Generation Right - Eliminating the Bias Against Mixed Use Development* (Walters, Bochner, Ewiing 2013), a summary of the MXD model development, calibration and validation process published by the American Planning Association for their Planning Advisory Service. It includes references to several additional research papers documenting the MXD model development and process.

Reflecting the mixed-use nature of the Project, Fehr & Peers used the mixed-use trip generation model (MXD+). MXD+ represents a substantial improvement over conventional traffic estimation methods. It improves accuracy, virtually eliminates overestimation, and is supported by substantial evidence. The established MXD method developed by Fehr & Peers for the US EPA, and continuously refined through consulting for other state, regional and local clients, is based on:

- Pooled household survey data for 239 MXDs in six diverse US regions.
- Equations on internal trip capture and mode share that were developed using regression statistical analysis of MXD variables that affect trip generation, such as population and employment density, number of bus stops, and other factors to determine a statistically significant model. Additional detail on the variables included in the MXD+ model are summarized in Getting Trip Generation Right.

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[3] Ewing, Reid, Michael Greenwald, Ming Zhang, Jerry Walters, Robert Cervero, Lawrence Frank, and John Thomas. 2011. "Traffic Generated by Mixed-Use Developments — Six-Region Study Using Consistent Built Environmental Measures." ASCE Journal of Urban Planning and Development 137(3): 248–61. https://ascelibrary.org/doi/10.1061/%28ASCE%29UP.1943-5444.0000068

- Validation at 27 existing MXD sites across the US, including mixed-use developments in California, Georgia, Florida, Texas, and Georgia. The mixed-use sites ranged from transit-oriented developments, to suburban mixed-use retail centers.
- Peer reviews.

MXD+ 2.0 accounts for 97% of the statistical variation in trip generation among the 27 validation sites, compared to 65% for the ITE Handbook. It also all but eliminates the Handbook's systematic overestimation of traffic, found to be 35% for the validation sites. MXD+ 2.0 reduces the overestimation to 4%., meaning that the MXD model still slightly overestimates trip generation relative to the actual counted trip generation of the validation sites.

The model starts with ITE trip generation rates for each individual land use, but through the statistical processes of the model, calibrates the ITE rates to reflect the site specific and area contexts of the Project, including its mixture of uses, site and area demographics, accessibility to other land uses, such as adjacent residential development, availability of transit service, pedestrian connectivity, and other factors. The model calibrates ITE rates based on these factors to provide a much more accurate estimate of external project trip generation than the application of ITE trip rates alone. Project trip generation estimates are included in **Table 5** in Chapter 4.

1.2.5 Trip Distribution

A travel demand model is a tool that uses population, employment, and other demographic data to mathematically forecast transportation demand (usually in the form of traffic volumes on roadway links). Travel models typically have three or four steps: trip generation, trip distribution, mode-choice (if the model is a four-step model), and trip assignment. Using various mathematical equations the model will take input data from a set of transportation analysis zones (TAZs) that divide geographies (such as the City of Redondo Beach) into subareas, calculate trip generation for the TAZs based on different trip rates associated with different land uses, and distribute and assign those trips to different TAZs based on a series of equations that calculate the relative attractiveness of a particular zone (for example a zone with a lot of employment), and the shortest travel path to get to that TAZ. More complex models will include the mode-choice step, which uses probabilities to estimate how many trips could be vehicle trips versus transit trips. Ultimately, the primary use of the model is to estimate aggregate demand for travel on the street network.

To develop a trip distribution pattern for the Project, the Southern California Association of Governments (SCAG) 2016 Regional Transportation Plan (RTP) Travel Demand Model, which is the most recent available regionally valid travel demand model, was used.[4] The SCAG model is a trip-based four-step model used to forecast travel demand for the RTP and can be used for the analysis of localized projects. The model development and validation process is described by SCAG in SCAG Regional Travel Demand Model and

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[4] The SCAG 2020 RTP Travel Demand Model is in development but has not yet been made widely available for use at the time of this study.

2012 Model Validation (SCAG 2016).[5] The model uses TAZ data as described above to estimate future transportation demand.

The SCAG model was used to run a select zone analysis for the TAZ that contains the Project site. A select zone analysis tracks trips generated by, or attracted to, the Project TAZ through the street network, and quantifies the percentage of Project TAZ trips assigned to particular roadways. The SCAG model assignment accounts for congested travel time on roadways and iteratively assigns trips until equilibrium is reached (e.g. no trips can be assigned to a quicker route than the route they are assigned).

Based on the evaluation of the select zone assignment analysis, Fehr & Peers developed a trip distribution pattern for the Project. **Figure 5** in Chapter 4 shows the trip distribution for the Project.

1.2.6 Signalized Intersection Operational Effect Analysis

1.2.6.1 Analysis Methodology

Consistent with past City practice, all study intersections were analyzed using the Intersection Capacity Utilization (ICU) methodology because each study intersection is signalized. The ICU methodology is used to determine the intersection V/C ratio and corresponding level of service (LOS) for the turning movements and intersection characteristics at the signalized intersections. The ICU value is calculated by summing the V/C ratio sum of the critical movements, plus a factor for yellow signal time. AM and PM peak hour ICU ratios and levels of service (LOS) were calculated using the Fehr & Peers' ICU spreadsheet tool. Lane capacity assumptions do not exceed 1,600 vehicles per lane per hour. This methodology addresses operational effects on all motor vehicles utilizing City of Redondo Beach roadways, including transit vehicles.

1.2.6.2 Thresholds of Evaluation

The following thresholds of evaluation for the incremental increase in ICU ratio were used to assess transportation operational effects at the study intersections. The level of effect of the Project's incremental increase in the ICU ratio is dependent upon the underlying LOS value for that specific peak hour based on the following operational thresholds:

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[5] SCAG Regional Travel Demand Model and 2012 Model Validation: http://www.scag.ca.gov/Documents/SCAG_RTDM_2012ModelValidation.pdf

Intersection LOS Under Without Project Conditions	Change in Volume to Capacity (Future w/Project less Future w/o Project)
A	----
B	----
C	0.040
D	0.020
E	0.010
F	0.010

1.3 Organization of the Report

This report is divided into five chapters, including this introduction. Chapter 2 introduces the localized analysis and documents Existing Conditions in the study area. Chapter 3 describes the methodologies used to develop traffic forecasts for the Cumulative (2023) Without Project scenario and assesses Cumulative operating conditions. Chapter 4 summarizes the methodologies to forecast Project conditions and includes an assessment of the Project’s potential transportation operational effects compared with the Existing and Cumulative baseline scenarios. Chapter 5 summarizes the results of the study.

2. Existing (2020) Conditions

This chapter details the comprehensive data collection and analysis effort undertaken to assess Existing Conditions in the study area.

2.1 Existing Roadway Facilities

The street network in the City of Redondo Beach is primarily gridded with good connectivity. A few large land uses, including the AES Power Plant, Sea Hawk Stadium, and Redondo Union High School contribute to a "super-block" roadway network. Arterial streets in the study area generally provide two to three vehicle travel lanes in each direction, with left-turn pockets at most intersections and right-turn pockets at some intersections. Posted travel speeds in the study area range from 35 to 50 miles per hour (mph), with the majority of streets allowing travel up to 35 mph. As described in detail below, regional access to the Project site is provided by PCH and a network of arterial and collector streets. The arterial street network that serves the proposed project area includes Anita Street, Beryl Street, Catalina Avenue, Herondo Street, and Torrance Boulevard. The local streets include Diamond Street, Emerald Street, and Garnet Street. The following describes the key roadway facilities that serve the project site:

The following details the key roadway facilities that serve the Project site:

- Pacific Coast Highway (State Route 1) - PCH is a 4-lane north/south major arterial. Left-turn lanes are provided at major intersections. A raised median is provided south of Avenue H. On-street parking is prohibited along sections of PCH at Torrance Boulevard, Catalina Avenue and Diamond Street, and generally permitted elsewhere. As a state route, PCH is under the jurisdiction of Caltrans.
- Anita Street - Anita Street is an east/west major arterial that runs east of Pacific Coast Highway (PCH) with two lanes in each direction. Between Maria and Prospect Avenue, it has a center turning lane. East of Prospect, there are left-turn pockets at most intersections, with a raised median. On-street parking is generally permitted on both sides of Anita Street.
- Beryl Street - Beryl Street is an east-west secondary arterial that runs from Harbor Drive to 190th Street. Between Prospect Street and Catalina Avenue, Beryl Street has one lane in each direction with a center turning lane. Beryl Street narrows to two lanes east of Flagler Lane. On- street parking is permitted between Catalina Avenue and Flagler Lane.
- Catalina Avenue - Catalina Avenue is a 4-lane north/south secondary arterial that runs from PCH near the northern City boundary to Palos Verdes Boulevard at the southern City boundary. On-street parking is metered on the west side from Carnelian Street to Torrance Boulevard and on the east side from Emerald Street to Pearl Street. On-street parking is metered on both the west and east side from Avenue I to Palos Verdes Boulevard. It has a raised median between Beryl Street and Torrance Boulevard.

- Herondo Street - Herondo Street is an east/west secondary arterial that runs from PCH to Harbor Drive with one lane in each direction. It has a raised median, and left-turn pockets are provided at most intersections. Diagonal on-street parking is generally provided on both sides of Herondo Street. On-street striped bike lanes are also provided.

- Torrance Boulevard - Torrance Boulevard is a 4-lane east/west major arterial that ends in a cul- de-sac west of Catalina Avenue. On-street parking is permitted along most of its length in the study area.

- Diamond Street – Diamond Street is a 2-lane east/west collector with a shared left-turn lane that runs from Catalina Avenue to Prospect Avenue. On-street parking is provided on both sides of the street.

- Emerald Street – Emerald Street is a 2-lane east/west local street that runs from Catalina Avenue to Edgemere Drive. East of Edgemere Drive, it continues on as Wayne Avenue. On-street parking is provided on both sides of the street.

- Garnet Street – Garnet Street is a 4-lane east/west collector between Catalina Avenue and PCH. East of PCH, it continues as local street with one lane in each direction, ending at Prospect Avenue. On-street parking is provided on both sides of the street in the study area.

2.2 Existing Pedestrian and Bicycle Facilities

Sidewalks are generally present throughout the study area and Project site, and marked crosswalks are provided at all major arterial intersections. Most signalized intersections of major arterials and collector streets in the study area provide marked crossings on all four legs of the intersection, while some do not provide crossing facilities on all four legs of the intersection. Pedestrian access to the Project site is provided via a sidewalk on Catalina Avenue, with marked crosswalks provided at the intersection of Catalina Avenue and Emerald Street and Catalina Avenue and Diamond Street.

Class I bicycle facilities in the study area include the bicycle path/cycle track connecting the Hermosa Beach Strand to the Redondo Beach Pier. Class II bicycle lanes are located on Herondo Street west of the PCH, Catalina Avenue north of Torrance Boulevard and south of Pacific Avenue, and Diamond Street. A Class III bicycle route is located on Catalina Avenue south of Torrance Boulevard. The South Bay Bicycle Master Plan indicates that additional Class I, II, and III facilities are planned throughout the study area. Existing and planned bicycle facilities are presented in **Figure 3**. Bicycle access to the Project site is provided via a Class II bicycle lane on the east side of Catalina Avenue.

2.3 Existing Public Transit Facilities

The study area is served by several bus routes operated by four transit operators, including the Los Angeles County Metropolitan Transportation Authority (Metro), Los Angeles Department of Transportation Commuter Express (CE), Beach Cities Transit (BCT), and Torrance Transit (TT). **Figure 4** illustrates transit routes in the study area. The following details each individual line that serves the study area. Importantly, the information presented regarding weekday peak period headways is reflective of COVID-19 conditions.

- Metro Line 130 - Metro Line 130 provides local service between the Los Cerritos Center in Cerritos and Redondo Beach. In the study area, Line 130 travels north and south along Harbor Boulevard and Catalina Avenue. Service is provided seven days per week, with weekday peak period headways of approximately 20 to 30 minutes.

- Metro Line 232 - Metro Line 232 provides local service between the LAX bus center and Downtown Long Beach. In the study area, Line 232 travels north and south along PCH. Service is provided seven days per week with weekday peak period headways of approximately 10 to 20 minutes.

- CE Line 438 - Commuter Express (CE) Line 438 (operated by LADOT) provides express service between Downtown Los Angeles and the City of Redondo Beach. In the study area, Line 438 travels north and south along Harbor Drive and Catalina Avenue. Service is provided Monday through Friday, with peak period headways of approximately 15 minutes.

- BCT Line 102 - Beach Cities Transit (BCT) Line 102 provides local service between the Metro Green Line, the South Bay Galleria, and the Redondo Beach Pier. In the study area, Line 102 travels north and south along Catalina Avenue and northeast and southwest along Diamond Street. Service is provided seven days per week, with weekday peak period headways of approximately 30 to 45 minutes.

- BCT Line 109 - BCT Line 109 provides local service between the LAX Bus Center, Redondo Beach Pier, and Riviera Village. In the study area, Line 109 travels north and south along Catalina Avenue. Service is provided seven days per week, with weekday peak period headways of approximately 40 to 50 minutes.

- TT Line 3 - Torrance Transit (TT) Line 3 provides local service between Downtown Long Beach and the Redondo Beach Pier. In the study area, Line 3 travels east and west along Torrance Boulevard. Service is provided seven days per week, with weekday peak period headways of approximately 10 to 15 minutes.

- TT Line 7 - Line 7 provides local service between Carson and the Redondo Beach Pier. In the study area, Line 7 travels east and west along Torrance Boulevard. Service is provided Monday through Saturday, with weekday peak period headways of approximately 15 minutes.

N:\Projects\Active\2020\0012_100-132 N Catalina Ave\Graphics\GIS\MXD\CatalinaRedondo_Bikeways.mxd

	Existing	Proposed
Bike Route	━	┅
Bike Lane	━	┅
Bike Path	━	
Cycle Track	━	

Figure 3

Existing and Proposed Bikeways

Figure 4

Transit Routes

2.4 Existing Intersection Operating Conditions

This section details Existing intersection operating conditions, including the peak hour turning movement traffic volumes developed for the intersections analyzed in the study, as well as the resulting operating conditions at each intersection, analyzed by the calculation of volume-to-capacity (V/C) ratios, and the corresponding LOS.

2.4.1 Intersection Lane Geometries

A detailed field review of each study intersection was conducted to document the Existing geometric lane configurations to be used as input to the LOS analysis.

2.4.2 Intersection Traffic Volumes

To analyze Existing Conditions, weekday morning and afternoon peak period intersection turning movement counts were conducted at the study intersections in the spring/summer of 2017 and spring of 2014. The maximum peak hour traffic volumes for each intersection from the combined data sets were selected to reflect peak volumes at each intersection, regardless of the season. As described above, these counts were grown using the SCAG population growth forecast for Redondo Beach to reflect Year 2020 conditions.

Peak hour turning movement volumes, as well as intersection lane configurations are included in **Appendix B**. Traffic count data sheets are provided in **Appendix C**.

2.4.3 Level of Service Methodology

LOS is a qualitative measure used to describe the condition of traffic flow on the street system, ranging from excellent conditions at LOS A to overloaded conditions at LOS F. All 11 study intersections are signalized. As described in Chapter 1, the Intersection Capacity Utilization (ICU) methodology was used to analyze these intersections. LOS definitions for the ICU methodology are provided in **Table 2**.

The ICU method of intersection analysis was used to determine the intersection V/C ratio and corresponding LOS for the turning movements and intersection characteristics. The ICU value is determined by summing the V/C ratio sum of the critical movements, plus a factor for yellow signal time.

Table 2 – Level of Service Definitions for Signalized Intersections – ICU Methodology

Level of Service	Intersection Capacity Utilization (ICU)	Definition
A	0.000-0.600	**EXCELLENT.** No vehicle waits longer than one red light and no approach phase is fully used.
B	0.601-0.700	**VERY GOOD.** An occasional approach phase is fully utilized; many drivers begin to feel somewhat restricted within groups of vehicles.
C	0.701-0.800	**GOOD.** Occasionally drivers may have to wait through more than one red light; backups may develop behind turning vehicles.
D	0.801-0.900	**FAIR.** Delays may be substantial during portions of the rush hours, but enough lower volume periods occur to permit clearing of developing lines, preventing excessive backups.
E	0.901-1.000	**POOR.** Represents the most vehicles intersection approaches can accommodate; may be long lines of waiting vehicles through several signal cycles.
F	>1.000	**FAILURE.** Backups from nearby locations or on cross streets may restrict or prevent movement of vehicles out of the intersection approaches. Tremendous delays with continuously increasing queue lengths.

Source: Adapted from Transportation Research Board

2.4.4 Level of Service Results

The Existing peak hour traffic volumes shown in **Appendix B** were analyzed using the ICU methodology described above to determine the Existing operating conditions at the 11 study intersections selected for analysis under Existing Conditions. LOS calculation worksheets are included in **Appendix D**.

Table 3 summarizes the results of the AM and PM peak hour intersection analysis. As shown in **Table 3**, the following intersection operates at LOS E during the AM and PM peak hour under Existing Conditions. All other intersections currently operate at LOS D or better during both peak hours.

6) Pacific Coast Highway & Herondo Street/Anita Street (AM & PM peak hour)[6]

Intersection 2 (Catalina Avenue & Garnet Street) is located directly north of Intersection 1 (Catalina Avenue & Torrance Boulevard) and directly south of Intersection 3 (Catalina Avenue & Emerald Street) and likely has peak hour traffic volumes that are comparable to the peak hour traffic volumes at those intersections, particularly in the north-south directions of travel. Given that Intersections 1 and 3 operate at LOS A during

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[6] The lane configuration shown in Appendix B differs from what is shown in Appendix D. Additional right turn lanes are shown for the eastbound and southbound approaches to distinguish between vehicles turning onto the Pacific Coast Highway and vehicles turning onto Catalina Avenue.

both peak hours under Existing conditions, it is estimated that Intersection 2 also operates at LOS A under this scenario.

TABLE 3
EXISTING CONDITIONS INTERSECTION LEVEL OF SERVICE

Int	N/S Street Name	E/W Street Name	Peak Hour	LOS	V/C
1	South Catalina Avenue	Torrance Boulevard	AM	A	0.448
			PM	A	0.503
2	South Catalina Avenue [a]	Garnet Street [a]	AM	-	-
			PM	-	-
3	South Catalina Avenue	Emerald Street	AM	A	0.459
			PM	A	0.449
4	South Catalina Avenue	Diamond Street	AM	A	0.439
			PM	A	0.458
5	South Catalina Avenue	Beryl Street	AM	A	0.444
			PM	B	0.666
6	Pacific Coast Highway	Herondo/Anita Street	AM	**E**	**0.972**
			PM	**E**	**0.948**
7	Pacific Coast Highway	North Catalina Avenue	AM	D	0.840
			PM	D	0.817
8	Pacific Coast Highway	Beryl Street	AM	C	0.734
			PM	D	0.884
9	Pacific Coast Highway	Diamond Street	AM	C	0.793
			PM	C	0.733
10	Pacific Coast Highway	Emerald Street	AM	C	0.747
			PM	B	0.676
11	Pacific Coast Highway	Torrance Boulevard	AM	D	0.844
			PM	D	0.818

Note: Intersections operating at LOS E or F are noted in **Bold**.

[a] Intersection 2 was not analyzed using the ICU methodology because existing counts were not available to inform the analysis, requiring a qualitative analysis to be performed for this intersection instead.

3. Cumulative (2023) Conditions

This chapter details the traffic volume forecasts prepared to evaluate Cumulative conditions, and the resulting forecasted Cumulative operating conditions.

3.1 Cumulative Without Project (2023) Operating Conditions

3.1.1 Intersection Lane Geometries

Study intersections are expected to remain consistent with their Existing lane geometries under the Cumulative without Project scenario.

3.1.2 Intersection Traffic Volumes

To estimate Cumulative (2023) Without Project traffic volumes, the Existing (2020) traffic volumes were increased by 0.38% per year, (1.14% total growth over three years), using the SCAG population growth rate. CEQA typically allows a public agency to rely upon (1) growth projections, and/or (2) a list of projects for assessing cumulative impacts. As described in Chapter 1, in addition to forecasted growth projections, the City also incorporated a specific development project near the study area (the Foundry) to produce a highly conservative cumulative analysis. Cumulative without Project AM and PM peak hour traffic volumes are illustrated in **Appendix B**.

3.1.3 Level of Service Methodology

The AM and PM peak hour Cumulative (2019) without Project traffic volumes and intersection lane geometries were analyzed using the ICU methodology documented above.

3.1.4 Level of Service Results

As shown in **Table 4**, of the 11 study area intersections, one intersection is projected to operate at LOS E during both peak hours:

6) PCH/Catalina Avenue & Herondo Street/Anita Street (AM & PM peak hour)[7]

All other intersections are estimated to operate at LOS D or better during both peak hours. Given that Intersections 1 and 3 operate at LOS A during both peak hours under Cumulative without Project conditions, it is estimated that Intersection 2 also operates at LOS A under this scenario. Detailed LOS worksheets are provided in **Appendix D**.

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[7] The lane configuration shown in Appendix B differs from what is shown in Appendix D. Additional right turn lanes are shown for the eastbound and southbound approaches to distinguish between vehicles turning onto the Pacific Coast Highway and vehicles turning onto Catalina Avenue.

TABLE 4
CUMULATIVE WITHOUT PROJECT CONDITIONS INTERSECTION LEVEL OF SERVICE

Int	N/S Street Name	E/W Street Name	Peak Hour	LOS	V/C
1	South Catalina Avenue	Torrance Boulevard	AM	A	0.451
			PM	A	0.509
2	South Catalina Avenue [a]	Garnet Street [a]	AM	-	-
			PM	-	-
3	South Catalina Avenue	Emerald Street	AM	A	0.462
			PM	A	0.451
4	South Catalina Avenue	Diamond Street	AM	A	0.441
			PM	A	0.461
5	South Catalina Avenue	Beryl Street	AM	A	0.449
			PM	B	0.671
6	Pacific Coast Highway	Herondo/Anita Street	AM	**E**	**0.982**
			PM	**E**	**0.956**
7	Pacific Coast Highway	North Catalina Avenue	AM	D	0.846
			PM	D	0.824
8	Pacific Coast Highway	Beryl Street	AM	C	0.740
			PM	D	0.892
9	Pacific Coast Highway	Diamond Street	AM	D	0.801
			PM	C	0.739
10	Pacific Coast Highway	Emerald Street	AM	C	0.754
			PM	B	0.682
11	Pacific Coast Highway	Torrance Boulevard	AM	D	0.852
			PM	D	0.828

Note: Intersections operating at LOS E or F are noted in **Bold**.

[a] Intersection 2 was not analyzed using the ICU methodology because existing counts were not available to inform the analysis, requiring a qualitative analysis to be performed for this intersection instead.

3.1.5 Cumulative without Project Pedestrian and Bicycle Conditions

No substantial changes to the pedestrian and bicycle system are expected under Cumulative without Project conditions by 2023, although the South Bay Bicycle Master Plan indicates that additional Class I, II, and III facilities are planned in the study area.

3.1.6 Cumulative without Project Transit Conditions

No substantial changes to the transit system are expected under Cumulative without Project conditions, though the SCAG RTP anticipates increases in transit ridership in the future. The Metro C Line (Green) Extension to Torrance is a planned regional transit project on the east side of the City of Redondo Beach, but is not expected to be implemented by the 2023 Project opening year.

4. Project Conditions & Operational Effects Analysis

This chapter details the assessment of traffic conditions with the completion of the Project.

4.1 Project Trip Generation

The MXD+ model was used in combination with trip rates from ITE's *Trip Generation 10th Edition* to estimate Project trip generation. A summary of the input data the model is sensitive to, and the accuracy benefits of the MXD+ model over traditional ITE trip generation methods, are described above in Chapter 1. Based on the outputs from the MXD+ model, internal capture and walk/bike credits were applied to the trip generation estimates derived from the ITE rates. Accounting for these credits, and an additional credit for the existing land uses on the Project site, the Project is estimated to generate a net increase of 525 daily trips, 108 AM peak hour trips (51 inbound, 57 outbound), and 47 PM peak hour trips (27 inbound, 20 outbound). **Table 5** presents the Project trip generation estimates.

Importantly, the operational effects analysis presented in this report is based on a previous version of the Project trip generation estimates that does not account for the existing land uses on the Project site or the distinct trip generation rates that were applied to the affordable housing units in **Table 5**. As such, the operational effects analysis is more conservative than what would result from applying the Project trip generation estimates shown in **Table 5**. Because no operational effects were found under existing or cumulative conditions using the more conservative trip generation estimates, it is expected that operations may improve somewhat at the study intersections if the trip generation estimates shown in **Table 5** were applied, but the conclusions of the study would not be altered. For the operational effects analysis, it is assumed that the Project is estimated to generate a net increase of 745 daily trips, 115 AM peak hour trips (55 inbound, 60 outbound), and 69 PM peak hour trips (38 inbound, 31 outbound).

4.2 Project Trip Distribution

As described in Chapter 1, the SCAG travel demand model was used to run a select zone analysis for the TAZ that contains the Project. Fehr & Peers developed a trip distribution pattern from the model, taking into account the hierarchy of streets in the study area and areas of known congestion. The trip generation estimates were then assigned to the roadway network based on this distribution pattern. Project-Only traffic volumes reflecting this trip distribution/assignment pattern are provided in **Appendix B**, and trip distribution percentages are shown in **Figure 5**.

TABLE 5
CATALINA VILLAGE PROJECT
VEHICLE TRIP GENERATION ESTIMATES

			Trip Generation Rates [a]							Estimated Trip Generation						
				AM Peak Hour			PM Peak Hour				AM Peak Hour Trips			PM Peak Hour Trips		
Land Use	ITE Land Use Code	Size	Daily	Rate	In%	Out%	Rate	In%	Out%	Daily	In	Out	Total	In	Out	Total
PROPOSED PROJECT																
Multifamily Residential (Low-Rise)	220	26 DU	7.32	0.46	23%	77%	0.56	63%	37%	190	3	9	12	9	6	15
Multifamfily Residential (Affordable)	[b]	4 DU	4.16	0.52	38%	62%	0.38	55%	45%	17	1	1	2	1	1	2
Coffee Shop [c]	936	1.784 ksf	364.35	101.14	51%	49%	36.31	50%	50%	650	92	88	180	33	32	65
Internal Capture [d]			*1%*		*3%*	*3%*		*6%*	*6%*	(6)	(3)	(3)	(6)	(2)	(2)	(4)
Walk/Bike [e]			*37%*		*40%*	*40%*		*29%*	*29%*	(242)	(37)	(36)	(73)	(10)	(9)	(19)
Net External Coffee Shop										402	52	49	101	21	21	42
Tasting Room [f]	925	1.279 ksf	155.30	-	-	-	11.36	66%	34%	199	0	0	0	10	5	15
Internal Capture [d]			*1%*					*6%*	*6%*	(2)	0	0	0	(1)	0	(1)
Walk/Bike [d]			*37%*					*29%*	*29%*	(74)	0	0	0	(3)	(1)	(4)
Net External Tasting Room										123	0	0	0	6	4	10
Total External Vehicle Trips										*732*	*56*	*59*	*115*	*38*	*32*	*69*
EXISTING USE CREDIT																
General Office	710	1.3 ksf	9.74	1.16	86%	14%	1.15	16%	84%	(13)	(2)	0	(2)	0	(1)	(1)
Commercial Retail	820	8.3 ksf	37.75	0.94	62%	38%	3.81	48%	52%	(313)	(5)	(3)	(8)	(15)	(17)	(32)
Internal Capture [d]			*1%*		*3%*	*3%*		*6%*	*6%*	3	0	0	0	1	1	2
Walk/Bike [e]			*37%*		*40%*	*40%*		*29%*	*29%*	116	2	1	3	4	5	9
Net Commercial Retail										(194)	(3)	(2)	(5)	(10)	(11)	(21)
Total Existing Use Credit										*(207)*	*(5)*	*(2)*	*(7)*	*(10)*	*(12)*	*(22)*
NET EXTERNAL VEHICLE TRIPS										525	51	57	108	27	20	47

Notes:

[a] Source: Institute of Transportation Engineers (ITE), *Trip Generation, 10th Edition* , 2017. Unless otherwise notes, all rates are Peak Hour of Adjacent Street Traffic.

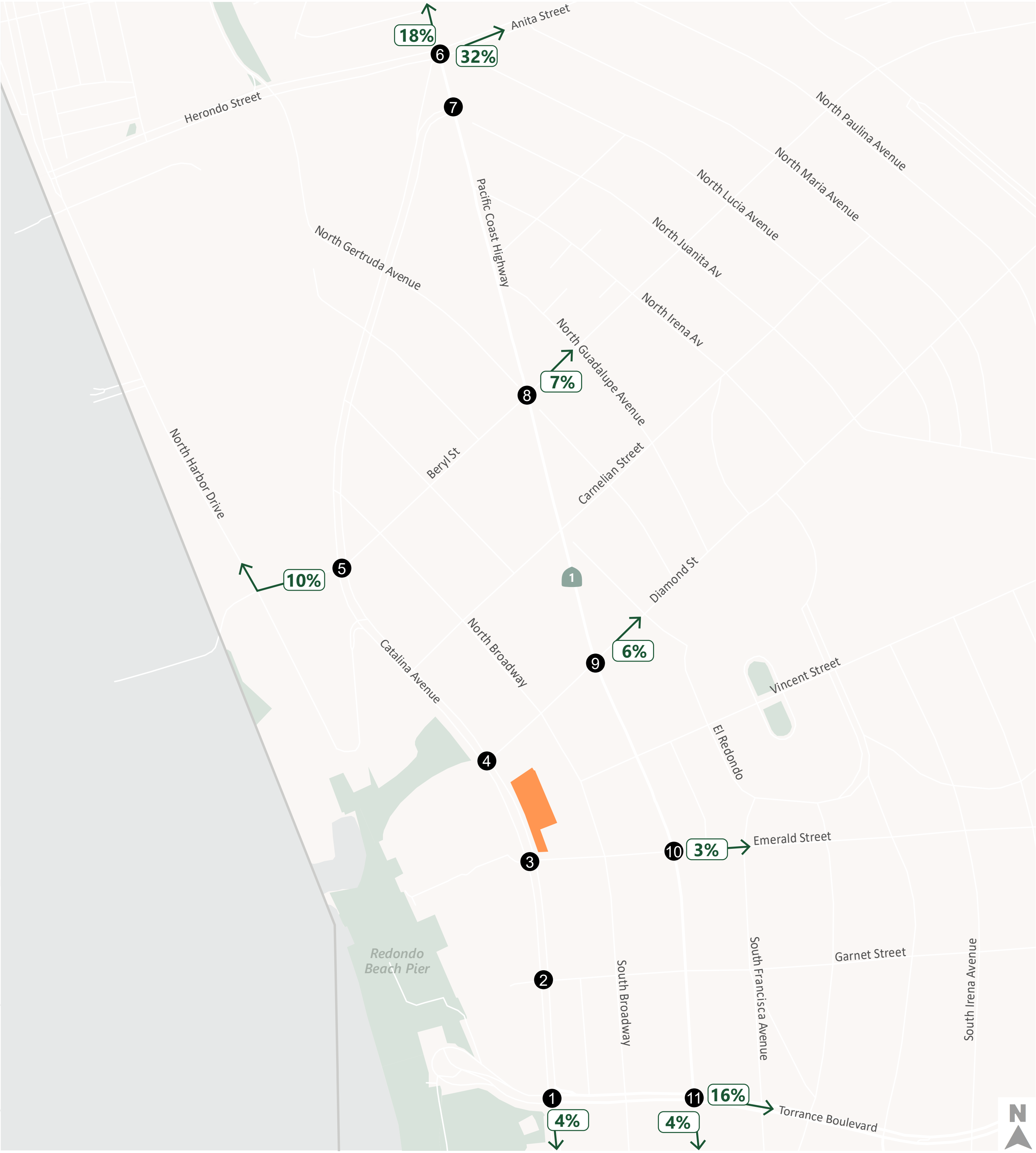
[b] Source: City of Los Angeles' Local Affordable Housing Trip Generation Study (see Appendix B).

[c] The number of daily trips was estimated to be 10 times greater than the total PM peak hour trips.

[d] Internal capture represents the percentage of trips between land uses that occur within the site. This percentage is informed by the Fehr & Peers Mainstreet/MXD+ tool, which uses census data to account for demographic characteristics of the area surrounding the project site, including residential density and local employment.

[e] The Walk/Bike credit includes non-auto trips from the surrounding neighborhood. This percentage is informed by the Fehr & Peers Mainstreet/MXD+ tool, which uses census data to account for demographic characteristics of the area surrounding the project site, including residential density and local employment.

[f] The number of daily trips was estimated to be 10 times greater than the total PM Peak Hour trips based on the PM Peak Hour of the Generator rate (15.53 trips/ksf).



W:\Long Beach N Drive\Projects\Active\2020\0012_100-132 N Catalina Ave\Graphics\GIS\MXD\CatalinaRedeondo_Basemap.mxd

🟧 Project Site
● Study Intersections
→ Trip Distribution

Figure 5

Trip Distribution

4.3 Existing Plus Project Conditions

4.3.1 Intersection Traffic Volumes

The Project-only AM and PM peak hour traffic volumes described above were added to the Existing traffic volumes to develop Existing plus Project traffic volumes.

4.3.2 Level of Service Methodology

The AM and PM peak hour Existing plus Project traffic volumes and intersection lane geometries were analyzed using the ICU methodology documented above.

4.3.3 Level of Service Results

Table 6 summarizes the results of the AM and PM peak hour intersection LOS analysis for Existing plus Project conditions. The following intersection is projected to operate at LOS E during both peak hours under this scenario:

6) PCH & Herondo Street/Anita Street (AM & PM peak hours)[8]

To determine the Project's operational effects under existing conditions, the City compared (1) the Existing (2020) plus Project Conditions scenario, against (2) the Existing (2020) Conditions scenario. As shown in **Table 6**, after applying the City of Redondo Beach operational effect criteria detailed in Chapter 1, the Project is not expected to result in a substantial traffic operational effect at any study intersection during either peak hour under Existing plus Project conditions. Given that Intersections 1 and 3 operate at LOS A during both peak hours under Existing plus Project conditions, it is estimated that Intersection 2 also operates at LOS A under this scenario.

---

[8] The lane configuration shown in Appendix B differs from what is shown in Appendix D. Additional right turn lanes are shown for the eastbound and southbound approaches to distinguish between vehicles turning onto the Pacific Coast Highway and vehicles turning onto Catalina Avenue.

TABLE 6
EXISTING PLUS PROJECT LEVEL OF SERVICE

Int	N/S Street Name	E/W Street Name	Peak Hour	EX		EP		Change in V/C	Operational Effect?
				LOS	V/C	LOS	V/C		
1	South Catalina Avenue	Torrance Boulevard	AM	A	0.448	A	0.454	0.006	NO
			PM	A	0.503	A	0.509	0.006	NO
2	South Catalina Avenue [a]	Garnet Street [a]	AM	-	-	-	-	-	-
			PM	-	-	-	-	-	-
3	South Catalina Avenue	Emerald Street	AM	A	0.459	A	0.491	0.032	NO
			PM	A	0.449	A	0.469	0.020	NO
4	South Catalina Avenue	Diamond Street	AM	A	0.439	A	0.459	0.020	NO
			PM	A	0.458	A	0.459	0.001	NO
5	South Catalina Avenue	Beryl Street	AM	A	0.444	A	0.451	0.007	NO
			PM	B	0.666	B	0.672	0.006	NO
6	Pacific Coast Highway	Herondo/Anita Street	AM	**E**	**0.972**	**E**	**0.974**	**0.002**	**NO**
			PM	**E**	**0.948**	**E**	**0.953**	**0.005**	**NO**
7	Pacific Coast Highway	North Catalina Avenue	AM	D	0.84	D	0.852	0.012	NO
			PM	D	0.817	D	0.826	0.009	NO
8	Pacific Coast Highway	Beryl Street	AM	C	0.734	C	0.739	0.005	NO
			PM	D	0.884	D	0.889	0.005	NO
9	Pacific Coast Highway	Diamond Street	AM	C	0.793	C	0.798	0.005	NO
			PM	C	0.733	C	0.739	0.006	NO
10	Pacific Coast Highway	Emerald Street	AM	C	0.747	C	0.750	0.003	NO
			PM	B	0.676	B	0.682	0.006	NO
11	Pacific Coast Highway	Torrance Boulevard	AM	D	0.844	D	0.850	0.006	NO
			PM	D	0.818	D	0.821	0.003	NO

Note: Intersections operating at LOS E or F are noted in **Bold**.

[a] Intersection 2 was not analyzed using the ICU methodology because existing counts were not available to inform the analysis, requiring a qualitative analysis to be performed for this intersection instead.

4.4 Cumulative Plus Project Conditions

4.4.1 Intersection Traffic Volumes

The Project-only AM and PM peak hour traffic volumes described above were added to the Cumulative without Project traffic volumes to develop Cumulative plus Project traffic volumes.

4.4.2 Level of Service Methodology

The AM and PM peak hour Cumulative plus Project traffic volumes and intersection lane geometries were analyzed using the ICU methodology documented above.

4.4.3 Level of Service Results

Table 7 summarizes the results of the AM and PM peak hour intersection LOS analysis for Cumulative plus Project conditions. Based on the analysis, the following intersection is projected to operate at LOS E during both peak hours under this scenario:

6) PCH & Herondo Street/Anita Street (AM & PM peak hours)[9]

To determine the Project's operational effects under Cumulative conditions, the City compared: (1) the Cumulative plus Project Conditions (2023) scenario, against (2) the Cumulative Conditions (2023) Without Project scenario. As shown in **Table 7**, after applying the City of Redondo Beach operational effect criteria detailed in Chapter 1, the Project is not expected to result in substantial traffic operational effects at any study intersection during either peak hour under Cumulative plus Project conditions. Given that Intersections 1 and 3 operate at LOS A during both peak hours under Cumulative plus Project conditions, it is estimated that Intersection 2 also operates at LOS A under this scenario.

4.5 City of Redondo Beach General Plan LOS Consistency Check

The City of Redondo Beach's General Plan Circulation Element includes a policy to maintain LOS D at City intersections, where feasible. The addition of Project trips to the street network does not degrade operations below LOS D at any study intersections. While one study intersection, Pacific Coast Highway & Herondo Street/Anita Street, operates at LOS E under Existing conditions and Cumulative without Project conditions, the addition of Project trips does not degrade operations beyond the existing level of service.

---

[9] The lane configuration shown in Appendix B differs from what is shown in Appendix D. Additional right turn lanes are shown for the eastbound and southbound approaches to distinguish between vehicles turning onto the Pacific Coast Highway and vehicles turning onto Catalina Avenue.

TABLE 7
CUMULATIVE PLUS PROJECT CONDITIONS LEVEL OF SERVICE

Int	N/S Street Name	E/W Street Name	Peak Hour	CB		CP		Change in V/C	Operational Effect?
				LOS	V/C	LOS	V/C		
1	South Catalina Avenue	Torrance Boulevard	AM	A	0.452	A	0.458	0.006	NO
			PM	A	0.508	A	0.514	0.006	NO
2	South Catalina Avenue [a]	Garnet Street [a]	AM	-	-	-	-	-	-
			PM	-	-	-	-	-	-
3	South Catalina Avenue	Emerald Street	AM	A	0.463	A	0.494	0.031	NO
			PM	A	0.452	A	0.471	0.019	NO
4	South Catalina Avenue	Diamond Street	AM	A	0.442	A	0.461	0.019	NO
			PM	A	0.462	A	0.463	0.001	NO
5	South Catalina Avenue	Beryl Street	AM	A	0.448	A	0.455	0.007	NO
			PM	B	0.672	B	0.677	0.005	NO
6	Pacific Coast Highway	Herondo/Anita Street	AM	**E**	**0.981**	**E**	**0.984**	**0.003**	**NO**
			PM	**E**	**0.957**	**E**	**0.961**	**0.004**	**NO**
7	Pacific Coast Highway	North Catalina Avenue	AM	D	0.849	D	0.858	0.009	NO
			PM	D	0.825	D	0.834	0.009	NO
8	Pacific Coast Highway	Beryl Street	AM	C	0.741	C	0.744	0.003	NO
			PM	D	0.893	D	0.898	0.005	NO
9	Pacific Coast Highway	Diamond Street	AM	D	0.802	D	0.804	0.002	NO
			PM	C	0.740	C	0.745	0.005	NO
10	Pacific Coast Highway	Emerald Street	AM	C	0.754	C	0.756	0.002	NO
			PM	B	0.683	B	0.688	0.005	NO
11	Pacific Coast Highway	Torrance Boulevard	AM	D	0.853	D	0.858	0.005	NO
			PM	D	0.826	D	0.831	0.005	NO

Note: Intersections operating at LOS E or F are noted in **Bold**.

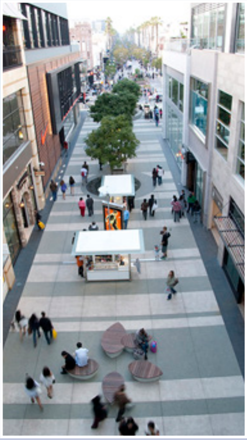
[a] Intersection 2 was not analyzed using the ICU methodology because existing counts were not available to inform the analysis, requiring a qualitative analysis to be performed for this intersection instead.

5. Summary

This study was prepared to analyze the potential operational effects associated with the Catalina Village Project. The following summarizes the results of the study:

- The Project involves the construction of 30 three-story mixed income apartment units and would preserve and retrofit approximately 3,000 square feet of commercial retail buildings, replacing the existing commercial uses on the site with a 1,784 square foot coffee shop and a 1,279 square foot beer tasting room. Site access would be provided via two driveways on Catalina Avenue, and the Project would provide 77 parking stalls, with an additional 7 parking spaces available on-street in front of the commercial retail uses.
- In consultation with City of Redondo Beach staff, the study area was selected to include the intersections most likely to be affected by traffic generated by the Project. A total of 11 intersections where identified for analysis, all of them operating under signal control. All intersections were analyzed using the ICU methodology per the City's requirements, with the exception of Intersection 2 (Catalina Avenue & Garnet Street), which was analyzed qualitatively due to a lack of existing traffic counts. New traffic counts could not be obtained because of the COVID-19 pandemic.
- The Project's potential for substantial traffic operational effects was assessed against an Existing baseline (2020), as well as a Cumulative Baseline (2023).
- The Project is not expected to have any operational effects compared to both the Existing baseline and the Cumulative baseline. Under baseline and plus project conditions, all intersections operate at LOS D or better, with the exception of Intersection 6 (Pacific Coast Highway & Herondo Street/Anita Street), which operates at LOS E under all scenarios.
- The Project is not expected to significantly degrade transit operations and facilities or pedestrian and bicycle modes.

Appendix A:
MXD Model
Documentation



GETTING TRIP GENERATION RIGHT

Eliminating the Bias Against Mixed Use Development

By Jerry Walters, Brian Bochner, and Reid Ewing

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Making Great Communities Happen

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Photos in document courtesy of Fehr & Peers.

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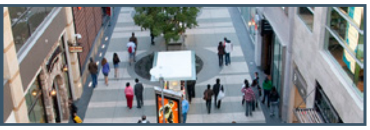
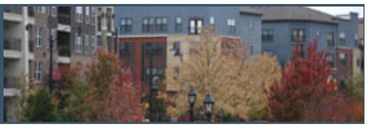




When planners, developers, or traffic engineers conduct traffic impact analyses for proposed developments, they typically use the trip-generation data and analysis methods published by the Institute of Transportation Engineers (ITE) in its *Trip Generation* report and *Trip Generation Handbook*. However, standard traffic engineering practice does not account for project characteristics such as the mix and balance of land uses, compactness of design, neighborhood connectivity and walkability, infill versus remote location, and the variety of transportation choices offered. This can have significant implications when the project in question is a mixed use development.

The conventional methods used by traffic engineers throughout the U.S. to evaluate traffic impacts fail to account for the benefits of mixed use and other forms of lower-impact development. They exaggerate estimates of impacts and result in excessive development costs, skewed public perceptions, and decision maker resistance. These techniques overlook the full potential for internalizing trips through interaction among on-site activities and the extent to which development with a variety of nearby complementary destinations and high-quality transit access will produce less traffic. These effects can reduce the number of vehicle trips generated to a far greater degree than recognized in standard traffic engineering practice.

The ITE trip-generation data and analysis methods apply primarily to single-use and freestanding sites, which limits their applicability to compact, mixed-use, transit oriented developments (ITE 2004, 2012). The *Handbook* does include an approach based on limited data on mixed use developments, but only from six sites in Florida, not nearly enough to cover today's diverse mixed use developments across the United States.

It is important that planners and developers recognize the implications of using standard ITE trip generation data and methodologies for mixed use developments and use methods that more accurately estimate traffic generated by these projects. Commonly used methods unjustifiably favor types of development that consume greater resources and generate greater impacts, shifting our attention away from development forms and locations that stimulate higher levels of social interaction and benefit to established communities.

Researchers have attempted to analyze how a mix of uses in a compact, walkable project design affects trip generation and on-the-ground traffic impacts. In 2011, two major studies introduced methodologies for predicting traffic generation from mixed use development. The researchers on those studies have now collaborated to combine the advantages of both and provide, in this *PAS Memo*, an even more complete and reliable approach to measuring the benefits of such forms of development. Using this new approach, planners conducting trip-generation analysis for mixed use development projects will produce more accurate forecasts of traffic generation, which will allow more appropriate on-site design features and off-site mitigation measures.

The Problem with Conventional Traffic Impact Analysis

Traffic analysis is intended to inform planners, community members, and public officials of the most suitable planning features and infrastructure elements needed to support new development. However, the conventional methods were developed during an era when most new development was single use, stand alone, highway oriented, and suburban. Standard practices ascribe similar levels of impact to mixed-use, integrated, transit-oriented, and infill development, and consequently overlook the benefits of — and impose unreasonable obstacles to — appropriate planning and approval of such "smart growth" forms.

The standard analytic process used for planning, design, and impact analysis does not account for the degree to which well-designed mixed use development places shops, restaurants, offices, and residences in close proximity to one another, shortening internal trips between them and making more trips conducive to walking, biking, or riding transit. Such reductions in traffic and vehicle miles traveled reduce fuel consumption, greenhouse-gas and other emissions, and exposure of residents to passing traffic and the related threats to comfort, health, and safety. Reduced vehicular travel can also lessen the need to construct new or wider streets and highways, allowing communities to economize on infrastructure. Mixed use developments (MXD) also create opportunities for shared parking, which can reduce the number of spaces needed in parking lot and garage construction.

Traffic-Reducing Attributes of Mixed Use Development

Many of the attributes of lower-impact development can reduce traffic generation compared with conventional single-use suburban development forms:

Diverse land uses and activities can fill basic needs nearby, thereby reducing automobile travel. They allow for linkage of trips in multipurpose trip chains, with a single auto trip to an activity center followed by several short trips on foot. Mixed use sites also create the opportunity for shared parking, which in turn encourages multipurpose trips and reduces the tendency to make separate automobile trips from one destination to the next.

Higher densities and intensities of development provide opportunities for residents, employees, and visitors to circulate among larger numbers of businesses and activities by walking, bicycling, or making short trips by automobile. Higher concentrations of land use also support higher quality and higher-frequency transit service, offering tenants and visitors a viable alternative to driving. High land values and cost to provide parking also leads to higher parking prices, a disincentive to driving versus other available modes of travel.

Walkable urban design and interconnected streets generally reduce the perceived and real separation among destinations, encourage walking and cycling, and reduce the circuitousness and length of each trip.

Short distances to transit help make transit a viable alternative to the automobile and can create activity centers with sufficient street life, amenities, and walking connections where needs and entertainment can be accomplished without independent car trips.

Accessibility to complementary destinations outside the development reduces distances between jobs and housing, services and entertainment, and recreation, often making automobile travel unnecessary. Placed at infill locations, complementary new development that satisfies local needs can also reduce trip making by residents, employees, and shoppers in the surrounding community.

Socio-demographic compatibility can further reduce auto traffic to the extent that developments are designed to attract and accommodate residents with low auto ownership (through, for example, parking supply limits), low travel needs (based on, for example, family size,

fewer employed residents, lower income, or age range), or close affiliation with other project elements or surrounding land uses (linked, or simply compatible, jobs and residents).

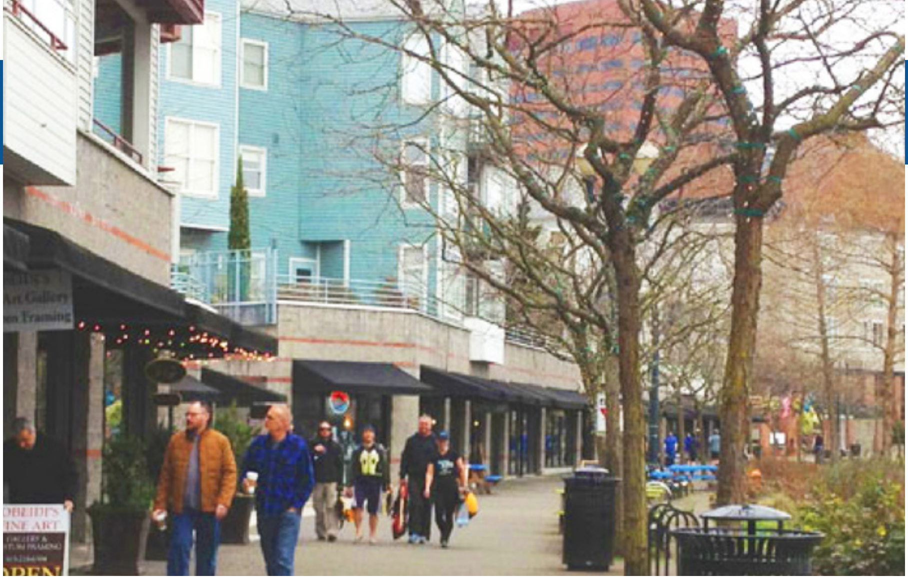
Scale of development affects feasibility for communities and employers to provide travel demand options and management services that can shift traveler modes from the auto to alternative modes of travel. Residents and businesses that self-select into such sites and settings are also often more amenable to travelling less or using alternatives to the automobile. Transportation demand management (TDM) programs are both more likely to be available and more likely to be successful in compact, central, transit-supported settings.

The danger of using traditional traffic-generation data based on single-use facilities is that it misrepresents the true traffic generation impacts of mixed use development. The consequences of miscalculating the benefits of mixed-use development may include unreasonable development cost, exaggerated impacts and mitigation responsibilities, skewed public perceptions, and decision maker resistance. This penalizes mixed use development proposals, often tipping the balance in favor of projects that offer fewer benefits and ultimately generate higher impacts. Denying "smart" forms of development does not reduce the overall market demand for housing and business, so the building disallowed ends up in other locations within the region, often in less accessible locations, at lower densities, and in less-mixed use configurations. The end result can be more traffic and higher regional vehicle-miles traveled than had the smart-growth development been approved.

Understandably, communities and public reviewers want to minimize the risk of unmitigated impacts. However, doing so through the application of overly conservative project evaluation criteria undermines the pursuit of other community values, such as vibrant neighborhoods with integrated development and activities that minimize the need to travel and the impacts produced by excessive unnecessary use of the automobile.

Conservative traffic-generation estimates have supply-side impacts, affecting design and cost of streets and parking. Within constrained sites, over design of traffic elements can limit the space available for revenue-producing land uses and increase other development costs. Development fee programs also rely heavily on traffic-generation estimates from the ITE *Trip Generation Manual*; this can lead to setting excessively high fee rates on mixed use development. Unquestioning use of the ITE data can unreasonably jeopardize a MXD project's approval, financial feasibility, and design quality.

Mixed use sites can take many forms, but all offer a diversity of uses in walkable settings. Oakland City Center BART (left); RiverPlace, Portland, Oregon (opposite page).



New Research Evidence for Mixed Use Development Trip Generation

Several hundred studies over the past 20 years have confirmed that the built environment affects travel generation (Ewing and Cervero 2010). Development features associated with reduced trip rates include a series of "D" variables: density, diversity of uses, design of urban environment, distance from transit, destination accessibility, development scale, demographics of inhabitants, and demand management. In the past three years, research has examined more directly the relative influence of each factor and their interactions and has sought to corroborate the research results through field verification. Organizations such as the U.S. Environmental Protection Agency and the National Academy of Sciences Transportation Research Board have sponsored several of the more reputable studies on the subject.

The Eight "D" Variables

The most advanced research has confirmed that trip rate reductions are quantifiably associated with the attributes of mixed use development, defined in terms of these characteristics of urban development patterns:

Density: dwellings, jobs per acre. Higher densities shorten trip lengths, allow for more walking and biking, and support quality transit.

Diversity: mix of housing, jobs, retail. A diverse neighborhood allows for easier trip linking and shortens distances between trips. It also promotes higher levels of walking and biking and allows for shared parking.

Design: connectivity, walkability. Good design improves connectivity, encourages walking and biking, and reduces travel distance.

Destinations: regional accessibility. Destination accessibility links travel purposes, shortens trips, and offers transportation options.

Distance to Transit: rail proximity. Close proximity to transit encourages its use, along with trip-linking and walking, and often creates accessible walking environments.

Development Scale: residents, jobs. Appropriate development scale provides critical mass, increases local opportunities, and supports transit investment.

Demographics: household size, income. Mixed use development allows self-selection by households into settings with their preferred activities and travel modes, allows businesses to locate convenient to clients, and supports a socioeconomic "fit" among residents, businesses, and activities.

Demand Management: pricing, incentives. Demand management ties incentives to the urban environment and allows alignment of auto disincentives with available alternate modes. It takes advantage of critical mass of travel resulting from density, diversity, and design.

A growing body of evidence indicates that these factors, individually or together, quantifiably explain the number of vehicle trips and vehicle-miles traveled for a development project and for a region as a whole. Each of the D factors influences traffic generation through a variety of mechanisms. There are also important interactions, both synergistic and mutually dampening, among the D factors that call for sophisticated techniques when quantifying the travel generation effects of different combinations proposed in any project or plan.

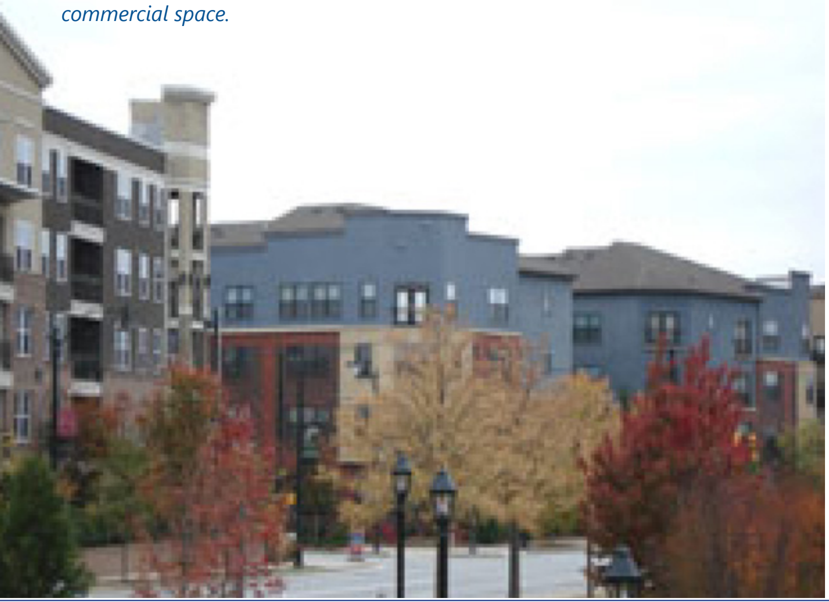
The Evidence that Conventional Methods Overstate MXD Impacts

Empirical evidence and research provides evidence that mixed-use, infill, and transit-oriented developments generate fewer external vehicle trips than equivalent stand-alone uses. A nationwide study sponsored by the U.S. EPA (Ewing et al. 2011) found statistical correlation between the D factors and increased trip internalization and increased walking and transit use. It further demonstrated, for 27 mixed-use development sites across the U.S., that:

1. On average, the sites' land uses would generate 49 percent more traffic if they were distributed among single-use sites in suburban settings, the situations to which the ITE *Trip Generation Manual* would apply.

2. The ITE *Handbook*, the current state-of-practice resource for estimating mixed use trip generation, would overestimate peak hour traffic by an average of 35 percent.

Atlantic Station offers residential units alongside walkable office and commercial space.



The following examples from recent studies demonstrate the degree by which such developments reduce traffic generation relative to what would be presumed under conventional traffic analysis methods.

Atlantic Station in Atlanta is a major mixed-use infill development located on a 138-acre former brownfield site in midtown Atlanta, connected by nonstop shuttle service to a MARTA metro rail station about a half-mile away. At the time it was studied, the development included 798 mid- and high-rise residential units, 550,600 square feet of office space, 434,500 square feet of retail space, a 101-room hotel, a restaurant, and a cinema.

For Atlantic Station, the "internal capture rate" (proportion of generated trips that remain internal to the site) is 15 percent in the morning peak hour and about 40 percent of evening peak-hour. Of the trips entering and leaving the site, between 5 and 7 percent use transit and another 5 to 7 percent walk or bicycle.

According to standard ITE trip-generation rates, were the Atlantic Station development elements located at single-use suburban sites, they would generate 37 percent more weekday traffic and 69 percent more PM peak traffic than actually counted at the centrally located, mixed use site.

RiverPlace in Portland is an award-winning mixed use waterfront development on a former brownfield within easy walking distance of downtown Portland, Oregon. Adjacent to the Tom McCall Waterfront Park, the site contains 700 residential units (condominiums and apartments), 40,000 square feet of office space, 26,500 square feet of small retail shops and restaurants, a 300-room hotel, and a marina, cinema, and athletic club. The waterfront walking environment conveniently links all of the activities within the development site and connects the site to the Portland central business district. Transit is also available at the site; the Portland Streetcar connects RiverPlace to downtown Portland and the greater Portland area.

RiverPlace (left) offers a mix of residential, office, and commercial uses on Portland's waterfront. Photo courtesy Fehr & Peers. Bay Street's walkable urban village (below) is designed on a Main Street theme.

RiverPlace's internal capture rate is 36 percent. For internal and external trips combined, 40 percent are by walking and 5 percent by transit. These statistics are significantly higher than the regional averages of 15 percent of trips taken by walking and 2 percent by transit.

Bay Street in Emeryville is a vibrant, thriving recent redevelopment project in Emeryville, California, just outside San Francisco. The previously heavy-industrial area within and around Bay Street has undergone dramatic revitalization in the past two decades, and it now includes the headquarters of Pixar Studios and other businesses. Bay Street itself is a one-million-square-foot walkable urban village designed on a Main Street theme. It contains a major theater complex, hotel, and 382,000 square feet of fashionable retail shops (including an Apple Store) with 381 apartment units and offices above. The site is within walking distance of a Capitol Corridor commuter rail station and within a shuttle bus ride of BART metro rail.

Bay Street's daily traffic generation is about 41 percent less than the combined total that would be generated by similarly sized suburban shopping centers, theater complexes, residential uses, and office developments based on standard ITE trip rates for stand-alone land uses. It also generates 36 percent less daily traffic than would be estimated by traffic engineers applying the ITE *Handbook* and conventional analysis methods. In the PM peak hour, Bay Street traffic generation is 46 percent lower than would be generated by the same land uses scattered on individual suburban sites, and 41 percent lower than would be estimated by standard ITE traffic analysis.

New Models for Mixed Use Development Traffic Analysis

To address the shortcomings in conventional analysis methods, the National Cooperative Highway Research Program (NCHRP) and the U.S. EPA recently conducted significant research studies to improve quantification of the trip-reducing effects of mixed use development. Each study took a different approach: NCHRP undertook extensive visitor surveys and traffic counts at Atlantic Station and two mixed-use developments in Texas (Bochner et al. 2011), while EPA sponsored a nationwide study of more than 260 mixed use developments across the U.S. using regional travel survey data and verification traffic counts at a subset of the sites (Ewing et al. 2011). Using different analysis methods, each study developed a recommended approach to discounting traffic generation estimates to account for the mix of uses and other development characteristics. Each study represents a major advancement over conventional analysis methods.

NCHRP Report 684

National Cooperative Highway Research Program (NCHRP) Report 684, "Enhancing Internal Trip Capture Estimation for Mixed-Use Developments," analyzed internal-capture relationships of MXD sites and examined the travel interactions among six individual types of land uses: office, retail, restaurant, residential, cinema, and hotel. The study looked at three master-planned developments: Mockingbird Station, a single-block TOD in Dallas; Legacy Town C enter, a multiblock district in suburban Plano, Texas, containing fully integrated and adjacent complementary uses; and Atlantic Station (see above). It compared the survey results to those found in prior ITE studies at three Florida sites, Boca del Mar, Country Isles, and Village Commons, all containing a variety of land uses, though in single-use pods.

Based on traveler and vehicle counts and interviews, the study ascertained interactions among the six land-use types of interest and compared them with site characteristics. It then examined the percentage of visitors to each land-use type who also visited each of the other uses during the same trip. The study considered site context factors and described percentage reductions in sitewide traffic generation that might result from the availability of transit service and other factors.

Researchers then performed verification tests by comparing the analysis results to those available from ITE for three earlier studies at Florida mixed use sites. The validation confirmed that the estimated values were a reasonable match for actual counted traffic. The product of the study is a series of tables and spreadsheets that balance and apply the discovered use-to-use visitation percentages to the land uses within the project site under study. The interaction percentages are then used to discount ITE trip-generation rates and to reduce what would otherwise represent the number of trips entering and leaving the entire site.

EPA MXD

The U.S. EPA–sponsored 2011 report, "Traffic Generated by Mixed-Use Developments — A Six-Region Study Using Consistent Built Environmental Measures," investigated trip generation, mode choice, and trip length for trips produced and attracted by mixed use developments. Researchers selected six regions — Atlanta, Boston, Houston, Portland, Sacramento, and Seattle — to represent a wide range of urban scale, form, and climatic conditions. Regional travel survey data with geographic coordinates and parcel-level detail available for these areas allowed researchers to isolate trips to, from, and within MXDs and relate travel choices to fine-grained characteristics of these developments.

In each region, researchers worked with local planners and traffic engineers to identify a total of 239 MXDs that met the ITE definition of multi-use development. The MXDs ranged from compact infill sites near regional cores to low-rise freeway-oriented developments. They varied in size, population and employment densities, mixes of jobs and housing, presence or absence of transit, and locations within their regions. In total, the MXD sample for the six regions provided survey data on almost 36,000 trips.

The analysis found that one or more variables in each of seven D categories (see above) were statistically significant predictors of internal capture, external walking, external transit use, and external private vehicle trip length. Specifically, an MXD's external traffic generation was related to population and employment within the site (density); the relative balance of jobs and housing within the site and the amount of employment within 1 mile of the site (diversity); the density of intersections within the site as a measure of street connectivity (design); the presence of bus stops within a quarter mile or the presence of a rail station (distance from transit); employment within a mile of site boundaries and percentage of regional employment within 20 minutes by car, 30 minutes by car, and 30 minutes by transit (destination accessibility); the gross acreage of the development (development scale); and the average number of household members as well as household vehicle ownership per capita(demographics). The accuracy of the EPA MXD method was verified through traffic generation comparisons at 27 mixed-use sites across the U.S.

The EPA MXD product is a series of equations and instructions captured in a spreadsheet workbook. The methodology calculates the percentage reductions in ITE trip generation resulting from the national statistical analysis of seven D effects on internal trip capture, walking, and transit use. The spreadsheets produce reduced estimates of traffic generation on a daily basis and for peak traffic hours.

Combining the Approaches

The NCHRP 684 method and EPA MXD method each derive from different research approaches and produce different methods of analyzing trip generation at mixed use developments. They focus on overlapping but not identical aspects of mixed-use development sites and their contexts and offer respective strengths and weaknesses in terms of factors considered and ease of application. Selecting which method to employ under different circumstances requires both a comparison of their capabilities as well as professional judgment of their respective strengths and weaknesses.

Report 684 includes a refined assessment of on-site land-use categories, specifically recognizing the roles of restaurants, theaters, and hotels within the site land-use mix, along with an adjustment to account for the spatial separations among individual land uses within the development site. It is directly useful for the evaluation of proposed development sites that are similar to the one or more of the three surveyed in Atlanta and Texas for the report. However, it is not responsive to factors such as regional location, transit availability, density of development, walkability factors, and the socio-demographic profile of site residents and businesses.

In contrast, the EPA MXD method accounts directly and quantitatively for these factors. However, while it accounts for the balances of retail, office, and residential development, it does not explicitly differentiate subcategories such as restaurants, theaters, and hotels. Furthermore, it requires the analyst to account for off-site development, including employment within a one-mile radius of the MXD and the number of jobs available within 30 minutes of the site.

To develop a method that captures the best of both sets of research findings, the authors of the two original studies decided to collaborate on an integrated method that recognizes the full array of on-site and context characteristics that contribute to traffic reduction and, through a focus on empirical verification, achieves greater accuracy than either method individually.

In developing the integrated approach, we compared the performances of the methods to actual traffic counts at a diverse group of mixed use developments in a variety of settings. The 27 verification sites were successful mixed-use development, exhibiting moderate to high levels of activity in terms of business sales, occupied residential units, property value, and household income, with average or above-average person trips, at the time of the survey. They included those studied for NCHRP 684, the sites used as the basis for the ITE *Trip Generation Handbook*, and others surveyed by Fehr & Peers, transportation consultants. Six of the 27 sites were located in Florida, and three were located in Atlanta and Texas. Three of these nine were nationally known examples of smart growth or transit-oriented development: Atlantic Station, Mockingbird Station, and Celebration, Florida. Six sites were located in San Diego County and were designated by local planners and traffic engineers in 2009 as representing a wide range of examples of smart growth trip generators in that region. The 12 remaining sites were MXD developments located elsewhere in California and in Utah, ranging from TOD sites (commuter rail and ferry) to conventional suburban freeway-oriented mixed use sites.

A New Approach: The MXD+ Method

The new analytical approach, the MXD+ method, combines the strengths of NCHRP 684 and EPA MXD. The authors sought to (1) address the fact that each method has strengths relative to the other, (2) create a method that is more accurate than either of the individual methods alone, and (3) reduce confusion among practitioners on which is the most appropriate method.

The proposed MXD+ method incorporates the underlying data sources and logic that the two methods share. It offers the ability to assess the effects of spatial separation of uses and recognition of more specific land-use categories and to consider the dynamic influences of local development context, regional accessibility, transit availability, development density and walkability factors, and the characteristics of residents.

To develop the preferred method, the authors experimented with different methods of integrating the two methods and arrived at a direct calibration approach. The appropriate combination of the results of the two individual methods was determined through regression analysis to identify the proportions that provided the best correlation with the traffic counted at the 27 validation sites. Table 1 presents results from the regression analysis, listing the proportions of the two methods found most effective at matching the traffic generation at the diverse set of mixed use validation sites. Weighting the results of the two individual analyses by the percentages in Table 1 and combining the results produces more accurate estimates of traffic generation and captures the effects of all of the site description variables included in the NCHRP and EPA methods.

TABLE 1 **OPTIMAL BLEND OF NCHRP 684 AND EPA MXD METHODS**

	AM PEAK TRAFFIC	PM PEAK TRAFFIC	AVERAGE DAILY TRAFFIC
NCHRP 684	10.1%	36.5%	n/a
EPA MXD	89.9%	63.5%	100%

The step-by-step method is as follows:

1. Apply the full EPA MXD methodology to predict external traffic generation as influenced by site development scale, density, accessibility, walkability and transit availability, resident demographics, and general mix of uses.

2. Apply the full NCHRP 684 method to capture the effects of detailed land-use categories, including hotel, theater, and restaurant, and the spatial separation of uses within small and medium sites.

3. Combine the results of the two methods in terms of percentages of trips remaining internal to the development site, using proportioning factors presented in the table above.

4. Apply adjustments to account for off-site walking and transit travel using the EPA MXD method.

5. Discount standard ITE traffic-generation rates by the percentages of internalization produced in step 3 and the percentage of walk and transit travel in step 4 to obtain the estimate of site- generated traffic.

TABLE 2 **COMPARISON OF THREE PRINCIPAL METHODS IN TERMS OF PROJECT CHARACTERISTICS CONSIDERED**

	EPA MXD METHOD	NCHRP 684 METHOD	MXD+ METHOD
Project Characteristics Considered			
Density of Development	◆		◆
Diversity of Uses: Jobs/Housing	◆	◆	◆
Diversity of Uses: Housing/Retail		◆	◆
Diversity of Uses: Jobs/Services		◆	◆
Diversity of Uses: Entertainment, Hotel		◆	◆
Design: Connectivity, Walkability	◆	◆	◆
Design: Separation Among Uses		◆	◆
Destination Accessibility by Transit	◆		◆
Destination Accessibility by Walk/Bike	◆		◆
Distance from Transit Stop	◆		◆
Development Scale	◆		◆
Distance from Transit Stop	◆		◆
Development Scale	◆		◆
Demographic Profile	◆		◆
Data Needs (beyond Project Site Plan)			
Average Residents per Dwelling Unit	◆		◆
Average Autos Owned per Dwelling Unit	◆		◆
Nearby (1/4 mi) Bus Stops and Rail Stations	◆		◆
Jobs Within 1 Mile of Site	◆		◆
Jobs Within 30-Minute Transit Trip	◆		◆
Regional Employment	◆		◆
Located in CBD or TOD?	◆		◆
Site Development by Classification		◆	◆
Vehicle Occupancy Estimate		◆	
Mode Split Estimate		◆	

As Table 2 indicates, the MXD+ method improves traffic generation estimates by considering the full array of 12 site development and context characteristics shown to influence internal capture and mode share, while the individual methods consider only 5 to 8 factors each. Effects considered in MXD+ that are not included in the NCHRP 684 method include household size and auto ownership, site proximity to bus and rail stops, and accessibility to local and regional jobs. Effects considered in the NCHRP 684 method that do not appear in the EPA MXD method include specific land uses and proximity of interacting land uses to each other.

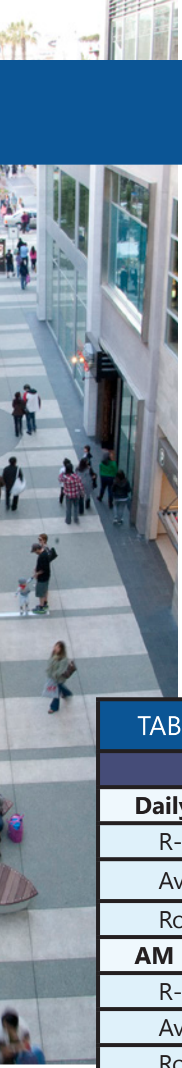


Table 3 presents the statistical performance of the MXD+ integrated method with the individual performance of the individual NCHRP 684 and EPA MXD methods. We compared the ability of each of the available methods to replicate the amount of traffic generated at the 27 validation sites in terms of statistical measures including percent root mean squared error, a metric used in the transportation field to evaluate model accuracy, and the coefficient of determination (or "R-squared"), which measures the ability of the analysis method to account for the variations in traffic generation among the 27 survey sites. For daily traffic generation, MXD+ is equivalent to the EPA MXD method, as the NCHRP 684 method does not address daily analysis. For peak hour traffic generation, MXD+ performs notably better than either of the individual methods.

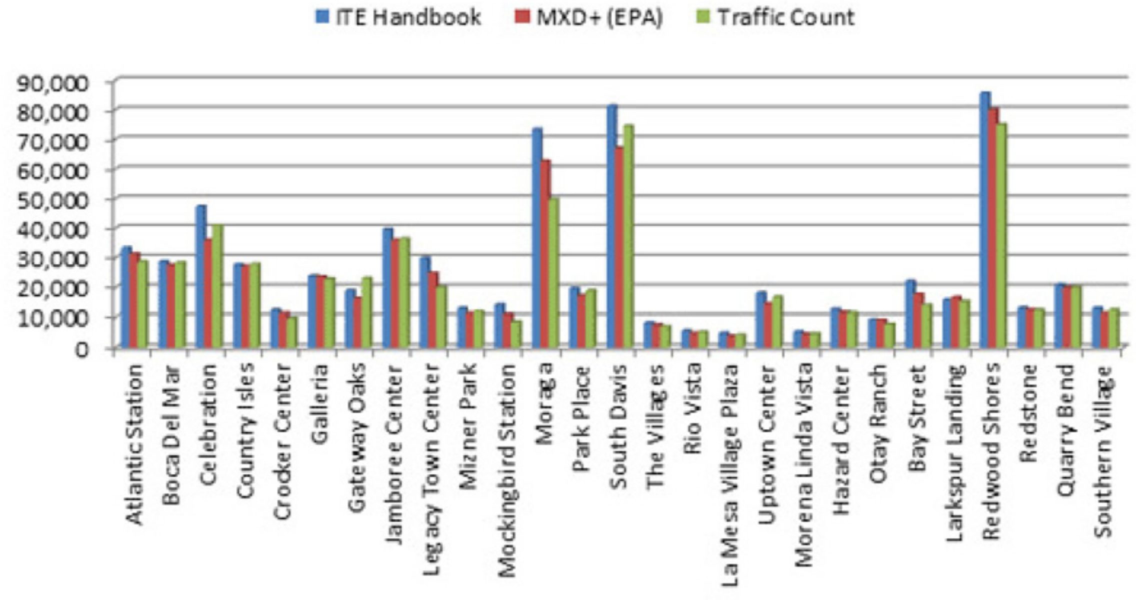
TABLE 3 **COMPARISON OF THREE PRINCIPAL METHODS IN TERMS OF PERFORMANCE AT VALIDATION SITES**

	EPA MXD METHOD	NCHRP 684 METHOD	MXD+ METHOD
Daily Traffic Generation			
R-squared	96%	89%*	**96%**
Average Error	2%	16%*	**2%**
Root Mean Square Error	17%	27%	**17%**
AM Peak Traffic Generation			
R-squared	97%	93%*	**97%**
Average Error	12%	30%	**12%**
Root Mean Square Error	21%	33%	**21%**
PM Peak Traffic Generation			
R-squared	95%	81%	**97%**
Average Error	8%	18%	**4%**
Root Mean Square Error	18%	36%	**15%**

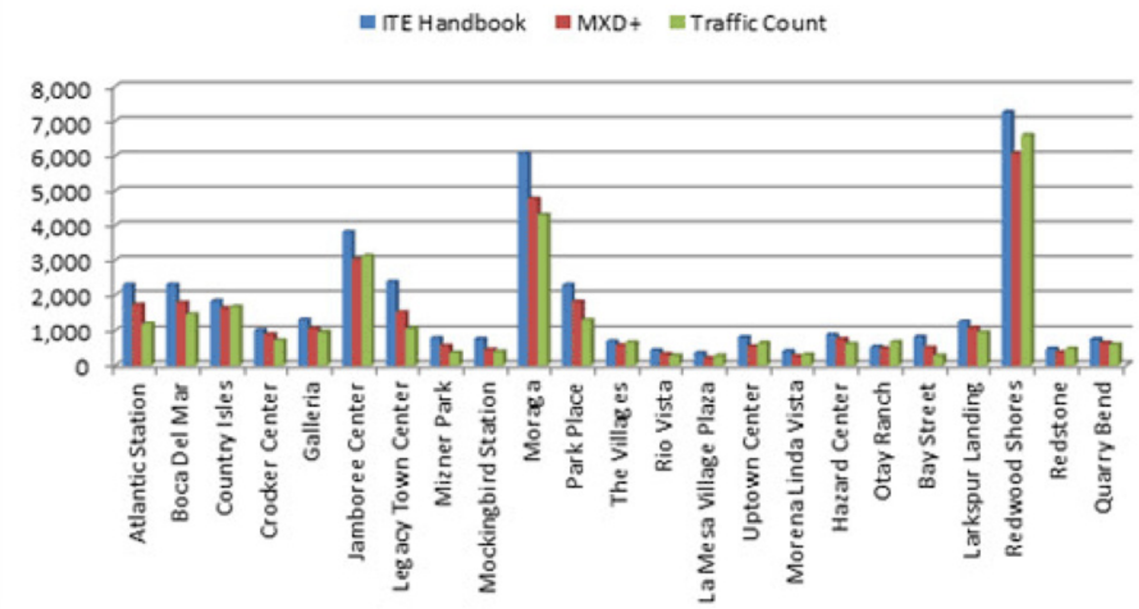
** ITE Handbook internalization statistics (NCHRP 684 method does not address daily trip generation)*

The graphs on the following page compare the performance of the MXD+ method to the ITE *Handbook* method at replicating traffic generation at the diverse group of mixed-use validation sites. Compared with the ITE *Handbook*, MXD+ method more accurately matches the amount of daily traffic actually counted at 20 of the 27 survey sites. In the AM peak hour, it is more accurate than the ITE Handbook at 21 of the 24 sites for which counts were available, and in the PM peak hour, MXD+ is more accurate than the ITE *Handbook* method at 23 of 25 sites.

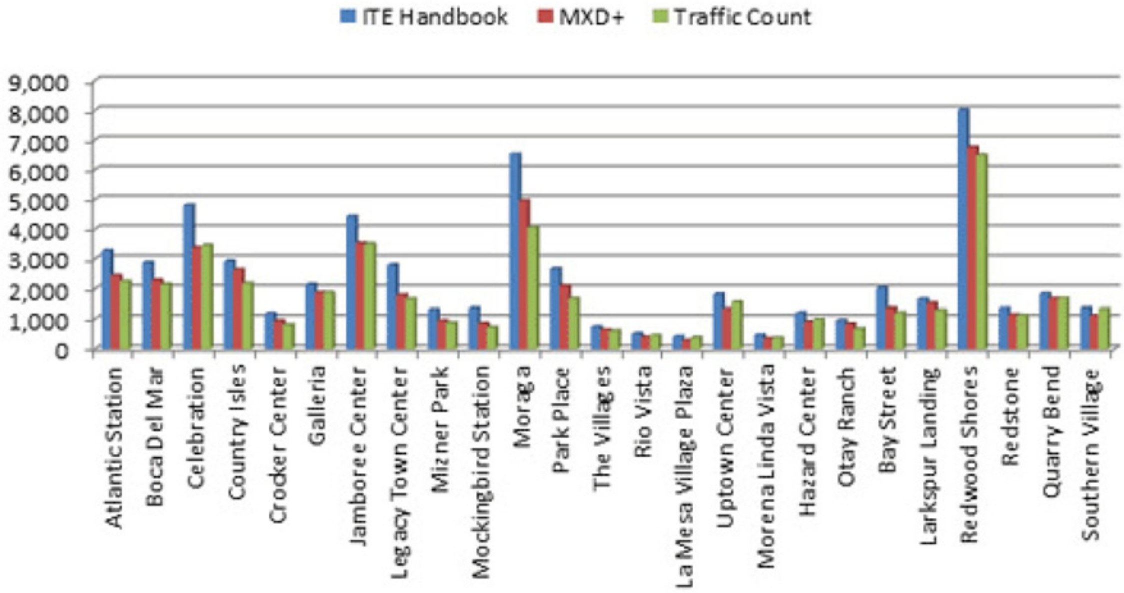
DAILY TRAFFIC GENERATION COMPARISON OF ITE HANDBOOK & MXD+ METHODS



AM PEAK HOUR TRAFFIC GENERATION COMPARISON OF ITE HANDBOOK & MXD+ METHODS



PM PEAK HOUR TRAFFIC GENERATION COMPARISON OF ITE HANDBOOK & MXD+ METHODS



The MXD+ method explains 97 percent of the variation in trip generation among mixed-use developments, compared with 65 percent for the ITE *Handbook* method. On average, the *Handbook* overestimates AM peak traffic generation by 49 percent, compared with 12 percent for MXD+. For the PM peak hour, the ITE *Handbook* overestimates actual traffic by 35 percent. The MXD+ method reduces this to 4 percent, remaining slightly conservative and unlikely to understate impacts.

By combining and refining the two most advanced methodologies for estimating traffic generation for mixed-use development, the MXD+ method provides transportation planners and engineers a more accurate single approach that accounts for the most important factors that distinguish lower impact development from other forms. Doing so advances development planning and impact assessment beyond the practices that have, to date, unreasonably discouraged mixed-use development.

Recommendations for Planners

We recommend that planners adopt the latest methods for evaluating traffic generation of mixed use and other forms of smart growth, including infill and transit-oriented development. The MXD methods developed under the U.S. EPA multiregional study and the NCHRP 684 study on enhancing trip-capture estimation each represent substantial advances to the conventional practices previously available through ITE. Combining the two new methods, as described above, improves upon both individual methods. Tools for all three approaches are available for use through the references and resources listed below.

Traffic engineers are beginning to take notice of the new methods, but we expect that natural sluggishness in adopting new practices will continue to impose unfair penalties on mixed use and other forms of lower-impact development. We recommend activism on the part of all planners, development reviewers, and impact analysts on behalf of the more accurate MXD methods.

Immediate adoption of the improved methods will allow planners to account for a project's regional location, transit availability, density of development, walkability factors, and the characteristics of residents and businesses and on-site adjacencies of land uses including residential, office, retail, restaurants, theaters, and hotels. Accounting for these factors through the MXD+ method will achieve the highest levels of accuracy possible in estimating traffic impacts of mixed use development.

We recommend applying and promoting the MXD+ method for day-to-day project planning and performance-based site-plan refinement, impact analysis, and discretionary review. Doing so will eliminate what is presently a systematic bias in traffic analysis that favors single-use, isolated, suburban-style development.

Conclusion

Standard traffic engineering practices are blind to the primary benefits of smart growth. A plan's development density, scale, design, accessibility, transit proximity, demographics, and mix of uses all affect traffic generation in ways unseen to prescribed methods. The Institute of Transportation Engineers (ITE) *Trip Generation Manual* and *Handbook* overestimate peak traffic generation for mixed-use development by an average of 35 percent. For conventional suburban stand-alone development, ITE rates portray the average for such sites; so hedging mixed-use analysis toward more conservative assumptions creates a systematic bias in favor of single-use suburban development.

ITE overestimation of traffic impacts reduces the likelihood of approval of mixed use and related forms of smart growth such as infill, compact, and transit-oriented development. Such overestimation escalates development costs, skews public perception, heightens community resistance, and favors isolated single-use development.

The methods of evaluating mixed use development described in this report represent a substantial improvement over conventional traffic-estimation methods. They improve accuracy and virtually eliminate overestimation bias, and they are supported by the substantial evidence of surveys and traffic counts at 266 mixed use sites across the U.S. The MXD+ analysis method explains 97 percent of the variation in trip generation among mixed use sites and all but eliminates the ITE systematic overestimation of traffic. We hope planners and other professionals will take advantage of the available spreadsheet tools listed below to help even the playing field between conventional development patterns and more sustainable, walkable, livable places.

About the Authors

Jerry Walters is a principal and sustainability practice leader with Fehr & Peers, transportation consultants. He has more than 30 years of experience in transportation planning, engineering, and travel forecasting and is a registered traffic engineer. Jerry developed project evaluation methods for the U.S. EPA study "Mixed-use Development and Vehicle Trips: Improving the Standard Estimation Methodology." He is a co-author of the book Growing Cooler – the Evidence on Urban Development and Climate Change (Urban Land Institute, 2008).

Brian S. Bochner is a senior research engineer at Texas Transportation Institute with over 40 years of experience in traffic engineering and planning. He is a certified professional traffic engineer, a professional traffic operations engineer and transportation planner, an affiliate with the Transportation Research Board, and past president and member of the International Board of Direction of the Institute of Transportation Engineers (ITE). His awards include Transportation Innovator, Texas Department of Transportation Research Program, and Transportation Engineer of the Year for the Texas Section of ITE.

Reid Ewing is a professor of city and metropolitan planning at the University of Utah, associate editor of the *Journal of the American Planning Association*, columnist for *Planning* magazine, and Fellow of the Urban Land Institute. His 2010 article, "Travel and the Built Environment: A Meta-Analysis," won the Best Article of the Year award from the American Planning Association, and his book, Best Development Practices (APA Planners Press, 1996), is listed by APA as one of the 100 essential planning books of the past 100 years.

References

Bochner, Brian, Kevin Hooper, Benjamin Sperry, and Robert Dunphy. 2011. *NCHRP Report 684: Enhancing Internal Trip Capture Estimation for Mixed-Use Developments*. Washington, D.C.: National Cooperative Highway Research Program, Transportation Research Board. http://onlinepubs.trb.org/onlinepubs/nchrp/nchrp_rpt_684.pdf

Ewing, Reid, and Robert Cervero. 2010. "Travel and the Built Environment: A Meta-Analysis." *Journal of the American Planning Association* 76(3): 265–94. www.tandfonline.com/doi/abs/10.1080/01944361003766766

Ewing, Reid, Michael Greenwald, Ming Zhang, Jerry Walters, Robert Cervero, Lawrence Frank, and John Thomas. 2011. "Traffic Generated by Mixed-Use Developments — Six-Region Study Using Consistent Built Environmental Measures." *ASCE Journal of Urban Planning and Development* 137(3): 248–61. http://ascelibrary.org/action/showAbstract?page=248&volume=137&issue=3&journalCode=jupddm&isAuthorized=no

Institute of Transportation Engineers. 2012. *Trip Generation Manual*, Ninth Edition. www.ite.org/emodules/scriptcontent/orders/ProductDetail.cfm?pc=IR-016G

Institute of Transportation Engineers. 2004. *Trip Generation Handbook*, Second Edition. www.ite.org/emodules scriptcontent/orders/ProductDetail.cfm?pc=RP-028B

San Diego Association of Governments. 2010. *Trip Generation for Smart Growth: Planning Tools for the San Diego Region*. San Diego, Calif.: SANDAG. www.sandag.org/uploads/publicationid/publicationid_1500_11604.pdf

Walters, Jerry, Reid Ewing, and John Thomas Eary. 2013. "Getting Trip Generation Right -- How to Accurately Account for Impact Reduction Attributable to Mixed-Use and Related Forms of Sustainable Development." *National Association of Environmental Professionals Conference Proceedings*, April.

Additional Resources

Description, documentation, and spreadsheet tools for the NCHRP 684 method, Enhancing Internal Trip Capture Estimation for Mixed-Use Developments may be found at www.trb.org/Main/Blurbs/165014.aspx.

Description, documentation, and spreadsheet tools for the EPA MXD Trip Generation Tool for Mixed-Use Developments may be found at www.epa.gov/smartgrowth/mxd_tripgeneration.html.

Quick-response analysis tools for applying the EPA MXD method, the combined EPA /NCHRP method MXD+, and MXD in conjunction with analysis of vehicle-miles traveled, GHG emissions, and shared parking, Plan+, may be found at http://asap.fehrandpeers.com/tools/.

Appendix B:

Peak Period

Turning Movements & Lane Geometries

Appendix B

Traffic Volumes, Lane Configurations, and Level of Service Existing (2020) Conditions

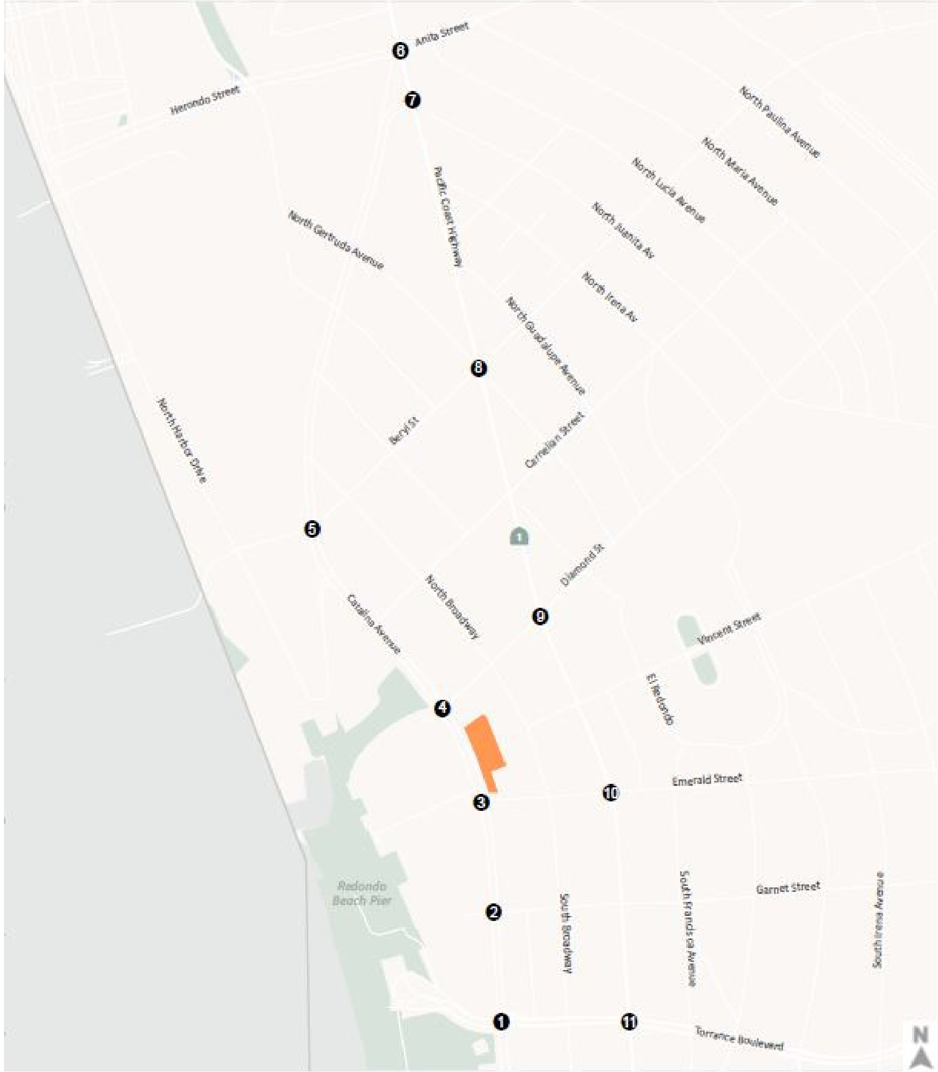
Appendix B

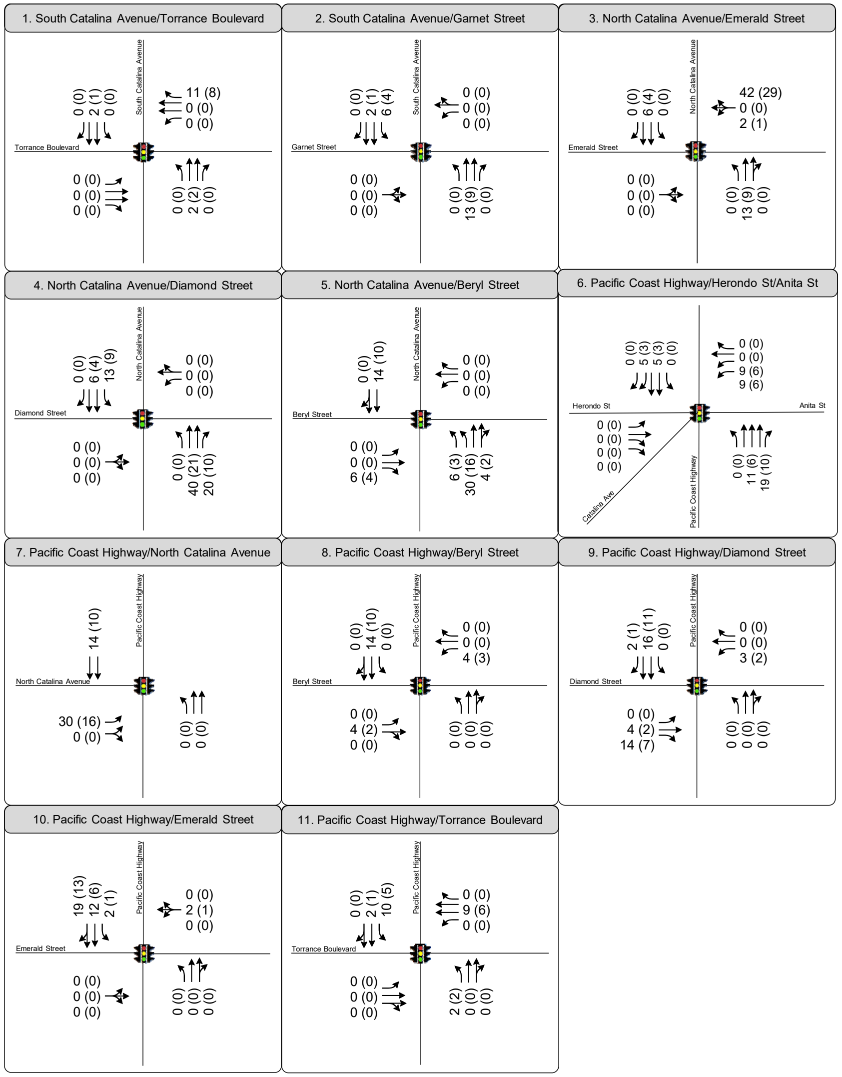
Traffic Volumes, Lane Configurations, and Level of Service
Cumulative Without Project (2023) Conditions

Appendix B
Traffic Volumes, Lane Configurations, and Level of Service Existing Plus Project (2020) Conditions

Appendix B

Traffic Volumes, Lane Configurations, and Level of Service Cumulative Plus Project (2023) Conditions





#	Study Intersection
AM (PM)	Peak Hour Traffic Volume

Appendix B

Traffic Volumes and Lane Configurations
Project Only Volumes

Appendix C:
Traffic Count Sheets

ITM Peak Hour Summary

Prepared by:

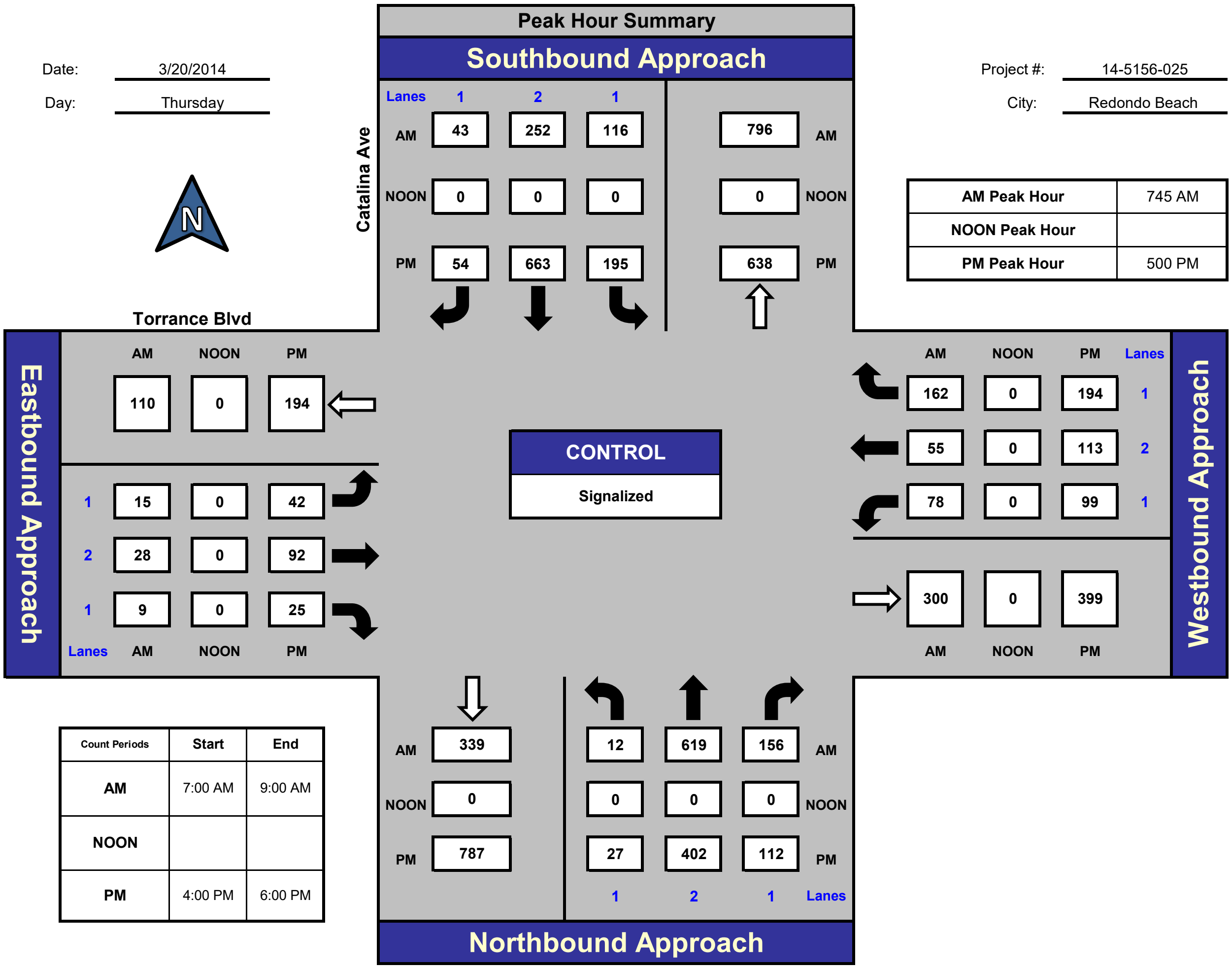
National Data & Surveying Services

Catalina Ave and Torrance Blvd , Redondo Beach

Date: 3/20/2014
Day: Thursday

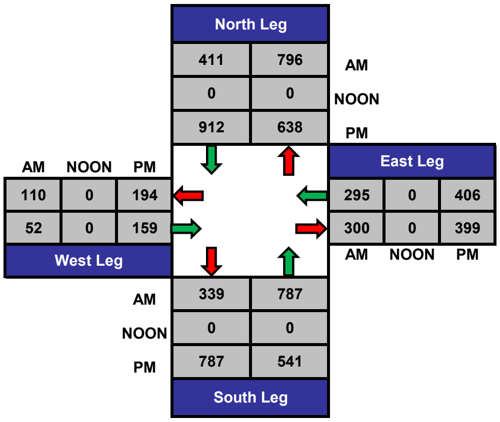
Project #: 14-5156-025
City: Redondo Beach

AM Peak Hour	745 AM
NOON Peak Hour	
PM Peak Hour	500 PM

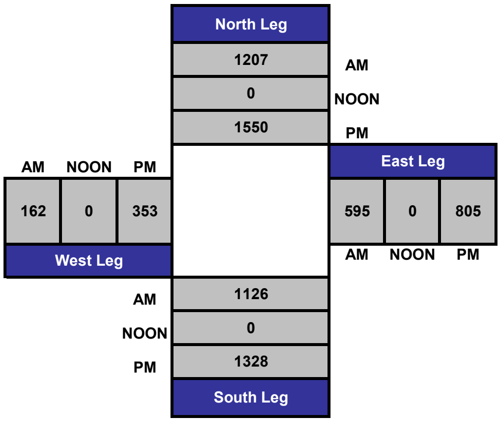


Count Periods	Start	End
AM	7:00 AM	9:00 AM
NOON		
PM	4:00 PM	6:00 PM

Total Ins & Outs



Total Volume Per Leg



ITM Peak Hour Summary

Prepared by:

NDS

National Data & Surveying Services

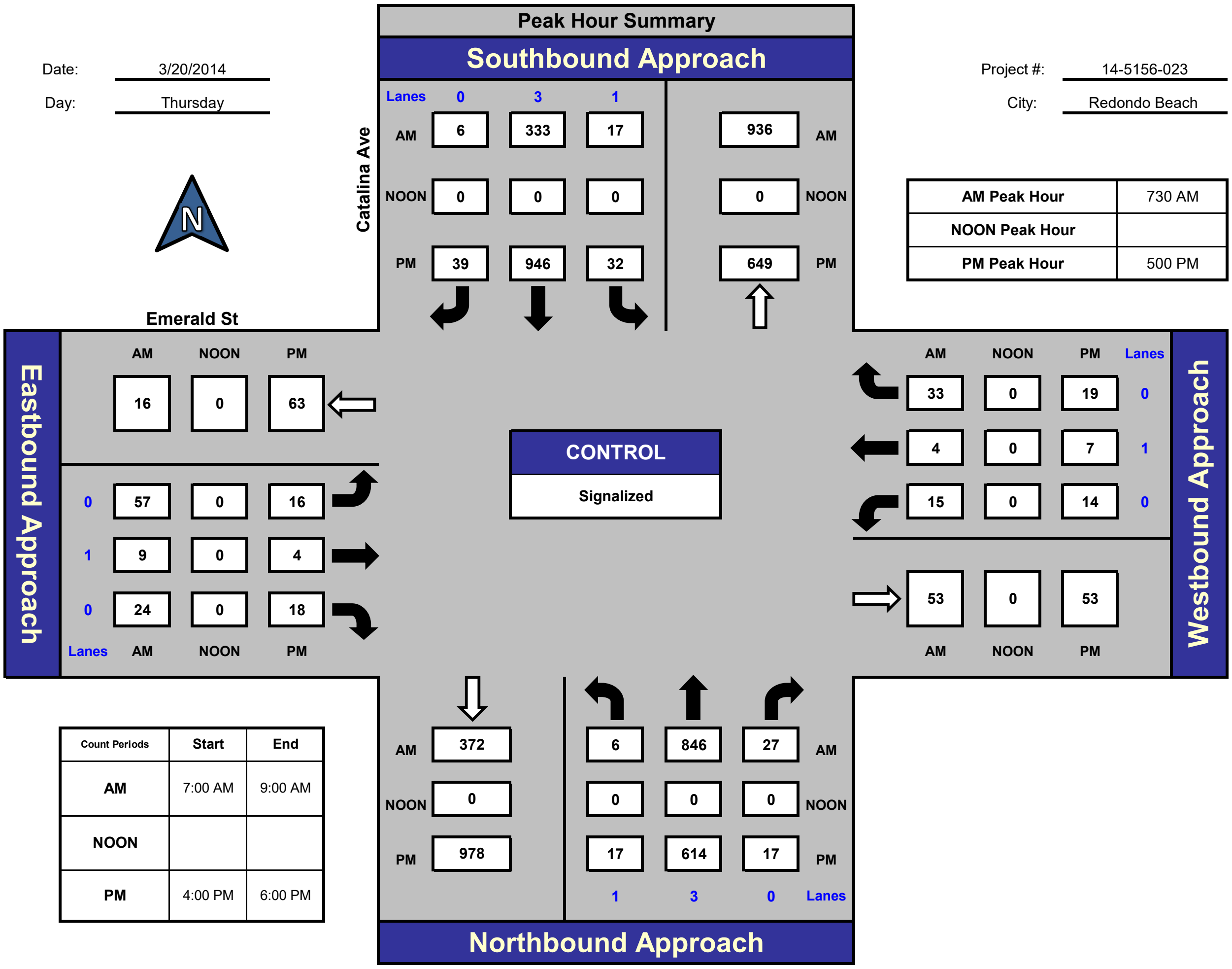
Catalina Ave and Emerald St , Redondo Beach

Date: 3/20/2014

Day: Thursday

Project #: 14-5156-023

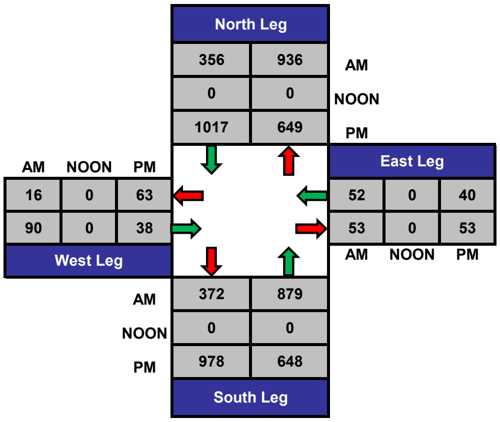
City: Redondo Beach



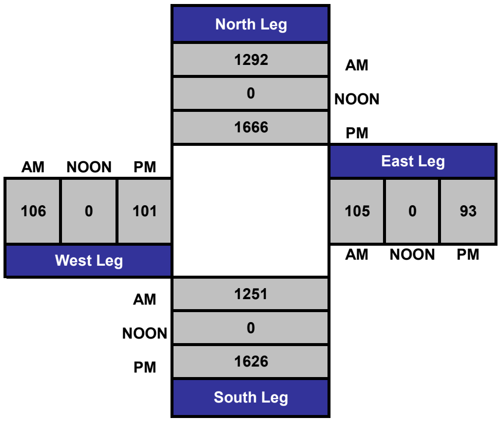
AM Peak Hour	730 AM
NOON Peak Hour	
PM Peak Hour	500 PM

Count Periods	Start	End
AM	7:00 AM	9:00 AM
NOON		
PM	4:00 PM	6:00 PM

Total Ins & Outs



Total Volume Per Leg



ITM Peak Hour Summary

Prepared by:

NDS

National Data & Surveying Services

Catalina Ave and Diamond St , Redondo Beach

Date: 3/20/2014

Day: Thursday

Project #: 14-5156-022

City: Redondo Beach

N

AM Peak Hour	730 AM
NOON Peak Hour	
PM Peak Hour	445 PM

Peak Hour Summary

Catalina Ave

Diamond St

Southbound Approach

	↲	↓	↳		⇧
Lanes	0	3	1		
AM	4	327	26	AM	934
NOON	0	0	0	NOON	0
PM	7	982	68	PM	624

Eastbound Approach

	AM	NOON	PM
⇦	7	0	25

Lanes		AM	NOON	PM
0	↱	17	0	7
1	→	9	0	4
0	↴	6	0	3

CONTROL

Signalized

Westbound Approach

	AM	NOON	PM	Lanes
↰	52	0	46	0
←	1	0	8	1
↙	29	0	41	0

	AM	NOON	PM
⇨	98	0	118

Count Periods	Start	End
AM	7:00 AM	9:00 AM
NOON		
PM	4:00 PM	6:00 PM

Northbound Approach

	⇩		↰	↑	↱	
AM	362		2	865	63	AM
NOON	0		0	0	0	NOON
PM	1026		10	571	46	PM
			1	3	0	Lanes

Total Ins & Outs

North Leg

AM	357	934	
NOON	0	0	
PM	1057	624	

West Leg

AM	NOON	PM
7	0	25
32	0	14

East Leg

AM	NOON	PM
82	0	95
98	0	118

South Leg

AM	362	930
NOON	0	0
PM	1026	627

Total Volume Per Leg

North Leg

AM	1291
NOON	0
PM	1681

West Leg

AM	NOON	PM
39	0	39

East Leg

AM	NOON	PM
180	0	213

South Leg

AM	1292
NOON	0
PM	1653

ITM Peak Hour Summary

Prepared by:

National Data & Surveying Services

Catalina Ave and Beryl St , Redondo Beach

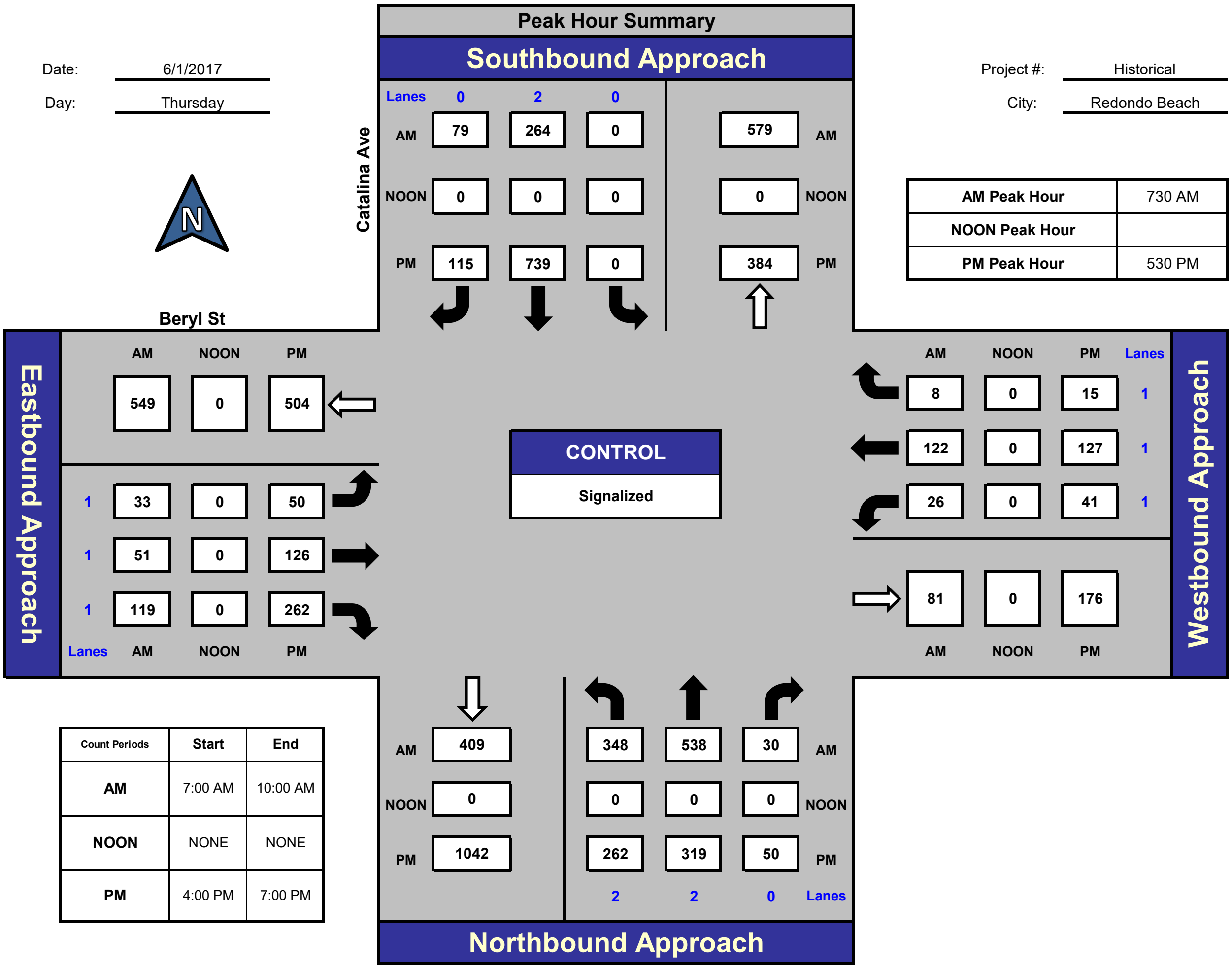
Date: 6/1/2017

Day: Thursday

Project #: Historical

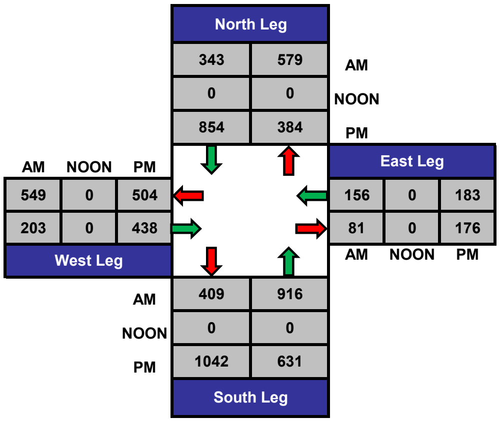
City: Redondo Beach

AM Peak Hour	730 AM
NOON Peak Hour	
PM Peak Hour	530 PM

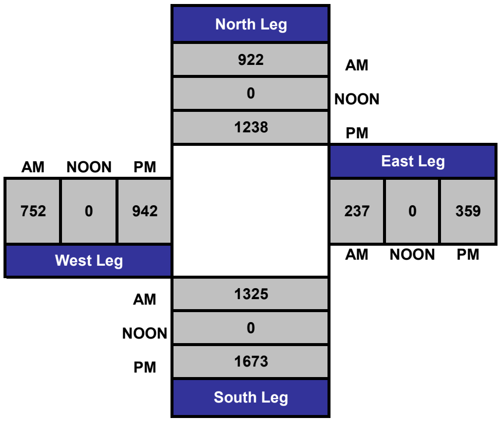


Count Periods	Start	End
AM	7:00 AM	10:00 AM
NOON	NONE	NONE
PM	4:00 PM	7:00 PM

Total Ins & Outs



Total Volume Per Leg



ITM Peak Hour Summary

Prepared by:

National Data & Surveying Services

Pacific Coast Hwy and Anita St/Herondo St , Redondo Beach

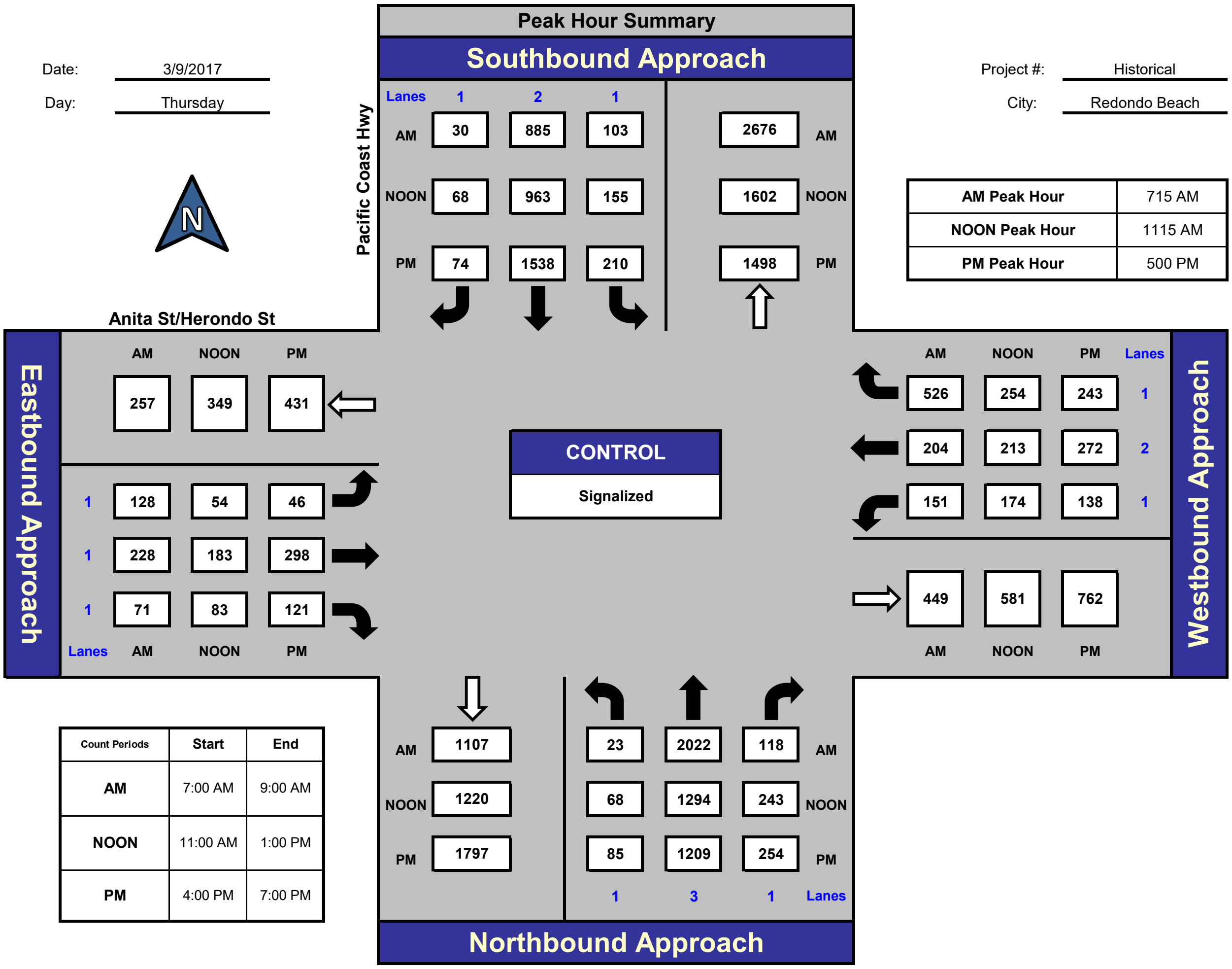
Date: 3/9/2017

Day: Thursday

Project #: Historical

City: Redondo Beach

AM Peak Hour	715 AM
NOON Peak Hour	1115 AM
PM Peak Hour	500 PM



Peak Hour Summary

Southbound Approach

Pacific Coast Hwy

Lanes	1	2	1		
AM	30	885	103	2676	AM
NOON	68	963	155	1602	NOON
PM	74	1538	210	1498	PM

Anita St/Herondo St

Eastbound Approach

	AM	NOON	PM
	257	349	431
1	128	54	46
1	228	183	298
1	71	83	121
Lanes	AM	NOON	PM

CONTROL

Signalized

Westbound Approach

AM	NOON	PM	Lanes
526	254	243	1
204	213	272	2
151	174	138	1
449	581	762	
AM	NOON	PM	

Northbound Approach

AM	1107	23	2022	118	AM
NOON	1220	68	1294	243	NOON
PM	1797	85	1209	254	PM
		1	3	1	Lanes

Count Periods	Start	End
AM	7:00 AM	9:00 AM
NOON	11:00 AM	1:00 PM
PM	4:00 PM	7:00 PM

Total Ins & Outs

North Leg

1018	2676	AM
1186	1602	NOON
1822	1498	PM

West Leg

AM	NOON	PM
257	349	431
427	320	465

East Leg

881	641	653
449	581	762
AM	NOON	PM

South Leg

AM	1107	2163
NOON	1220	1605
PM	1797	1548

Total Volume Per Leg

North Leg

3694	AM
2788	NOON
3320	PM

West Leg

AM	NOON	PM
684	669	896

East Leg

1330	1222	1415
AM	NOON	PM

South Leg

AM	3270
NOON	2825
PM	3345

ITM Peak Hour Summary

Prepared by:

National Data & Surveying Services

Pacific Coast Hwy and Anita St/Herondo St , Redondo Beach

Date: 3/9/2017

Day: Thursday

Project #: Historical

City: Redondo Beach

Peak Hour Summary

AM Peak Hour	745 AM
NOON Peak Hour	1115 AM
PM Peak Hour	515 PM

Southbound Approach

Pacific Coast Hwy

Lanes	1	2	1		
AM	0	130	0	0	AM
NOON	0	189	0	0	NOON
PM	0	377	0	0	PM

Anita St/Herondo St

Eastbound Approach

	AM	NOON	PM
	0	0	0

1	0	0	0
1	0	0	0
1	4	13	6
Lanes	AM	NOON	PM

CONTROL

Signalized

Westbound Approach

AM	NOON	PM	Lanes
0	0	0	1
0	0	0	2
170	157	171	1

0	0	0
AM	NOON	PM

AM	304	0	0	0	AM
NOON	359	0	0	0	NOON
PM	554	0	0	0	PM
		0	0	0	Lanes

Northbound Approach

Count Periods	Start	End
AM	7:00 AM	9:00 AM
NOON	11:00 AM	1:00 PM
PM	4:00 PM	7:00 PM

Total Ins & Outs

North Leg

130	0	AM
189	0	NOON
377	0	PM

West Leg

AM	NOON	PM
0	0	0
4	13	6

East Leg

170	157	171
0	0	0
AM	NOON	PM

South Leg

AM	304	0
NOON	359	0
PM	554	0

Total Volume Per Leg

North Leg

130	AM
189	NOON
377	PM

West Leg

AM	NOON	PM
4	13	6

East Leg

170	157	171
AM	NOON	PM

South Leg

AM	304
NOON	359
PM	554

ITM Peak Hour Summary

Prepared by:

National Data & Surveying Services

Pacific Coast Hwy and Catalina Ave , Redondo Beach

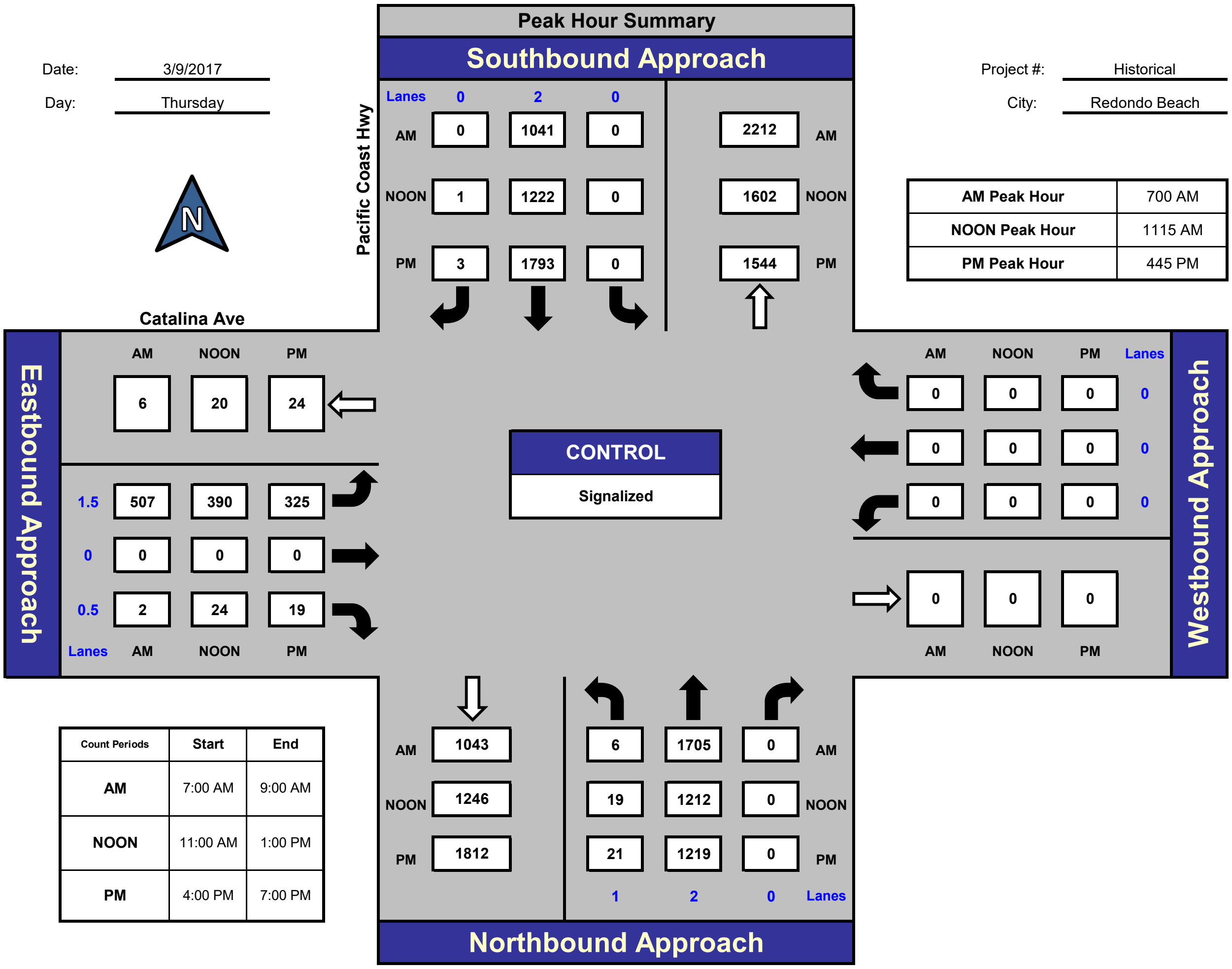
Date: 3/9/2017

Day: Thursday

Project #: Historical

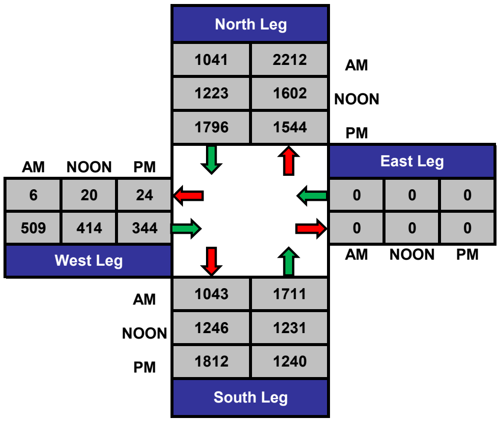
City: Redondo Beach

AM Peak Hour	700 AM
NOON Peak Hour	1115 AM
PM Peak Hour	445 PM

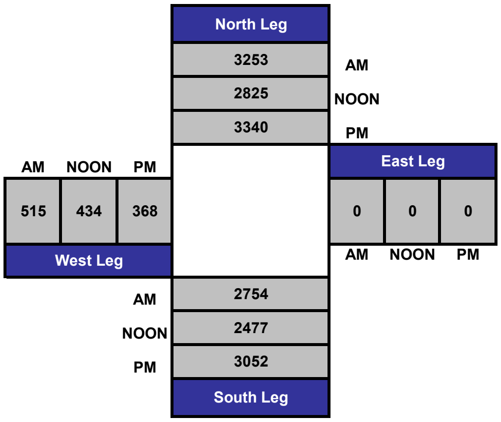


Count Periods	Start	End
AM	7:00 AM	9:00 AM
NOON	11:00 AM	1:00 PM
PM	4:00 PM	7:00 PM

Total Ins & Outs



Total Volume Per Leg



ITM Peak Hour Summary

Prepared by:

National Data & Surveying Services

Pacific Coast Hwy and Beryl St , Redondo Beach

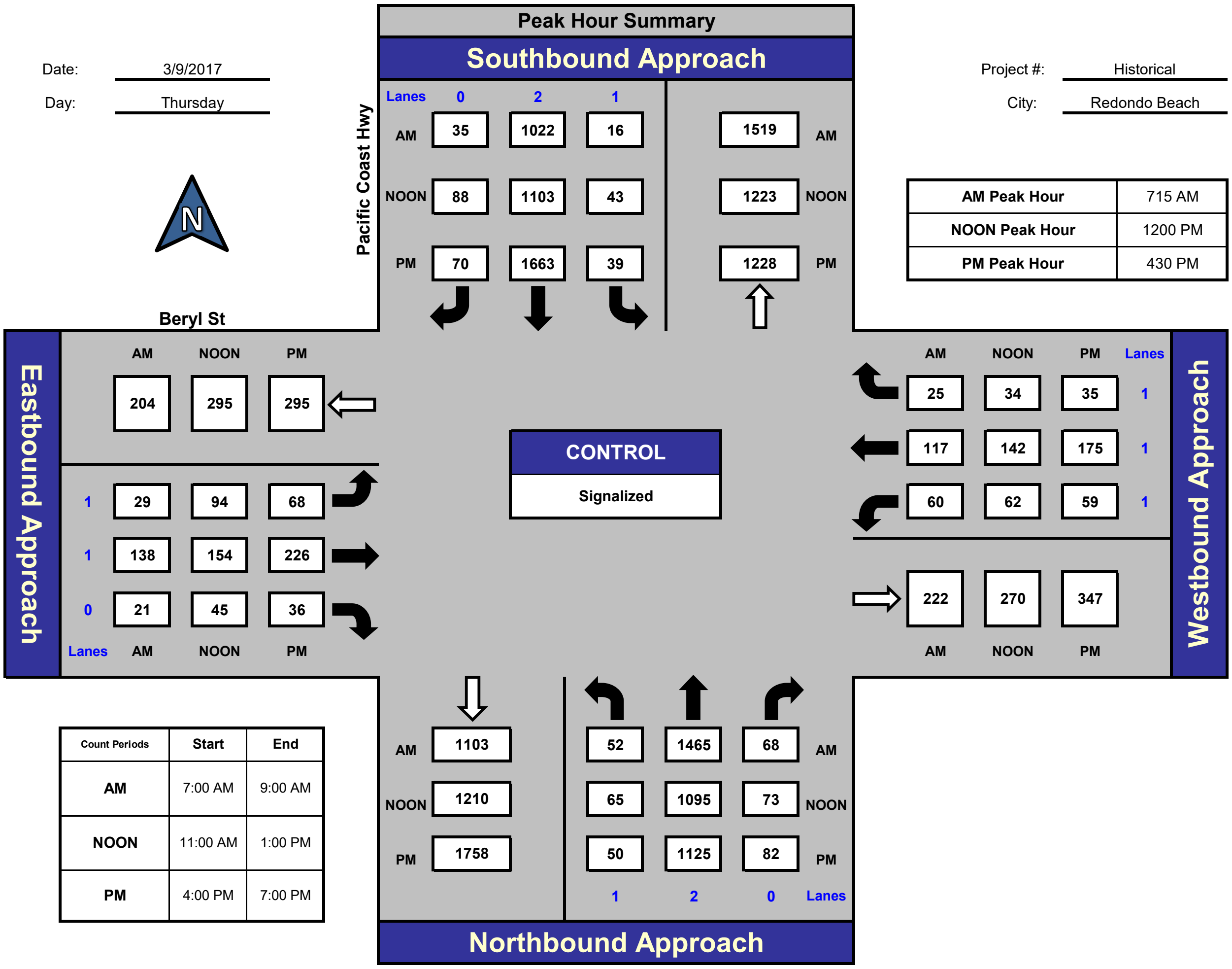
Date: 3/9/2017

Day: Thursday

Project #: Historical

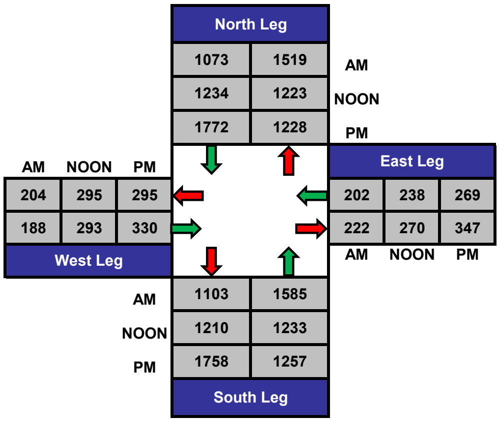
City: Redondo Beach

AM Peak Hour	715 AM
NOON Peak Hour	1200 PM
PM Peak Hour	430 PM

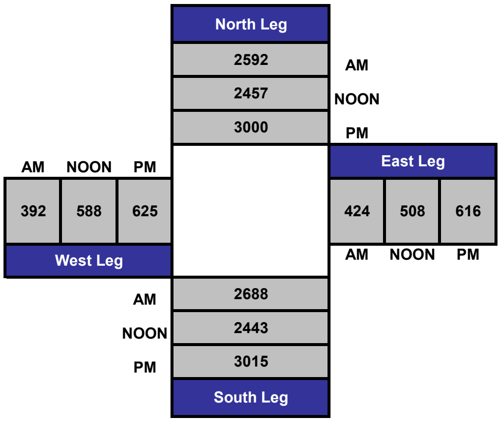


Count Periods	Start	End
AM	7:00 AM	9:00 AM
NOON	11:00 AM	1:00 PM
PM	4:00 PM	7:00 PM

Total Ins & Outs



Total Volume Per Leg



ITM Peak Hour Summary

Prepared by:

National Data & Surveying Services

Pacific Coast Hwy and Diamond St , Redondo Beach

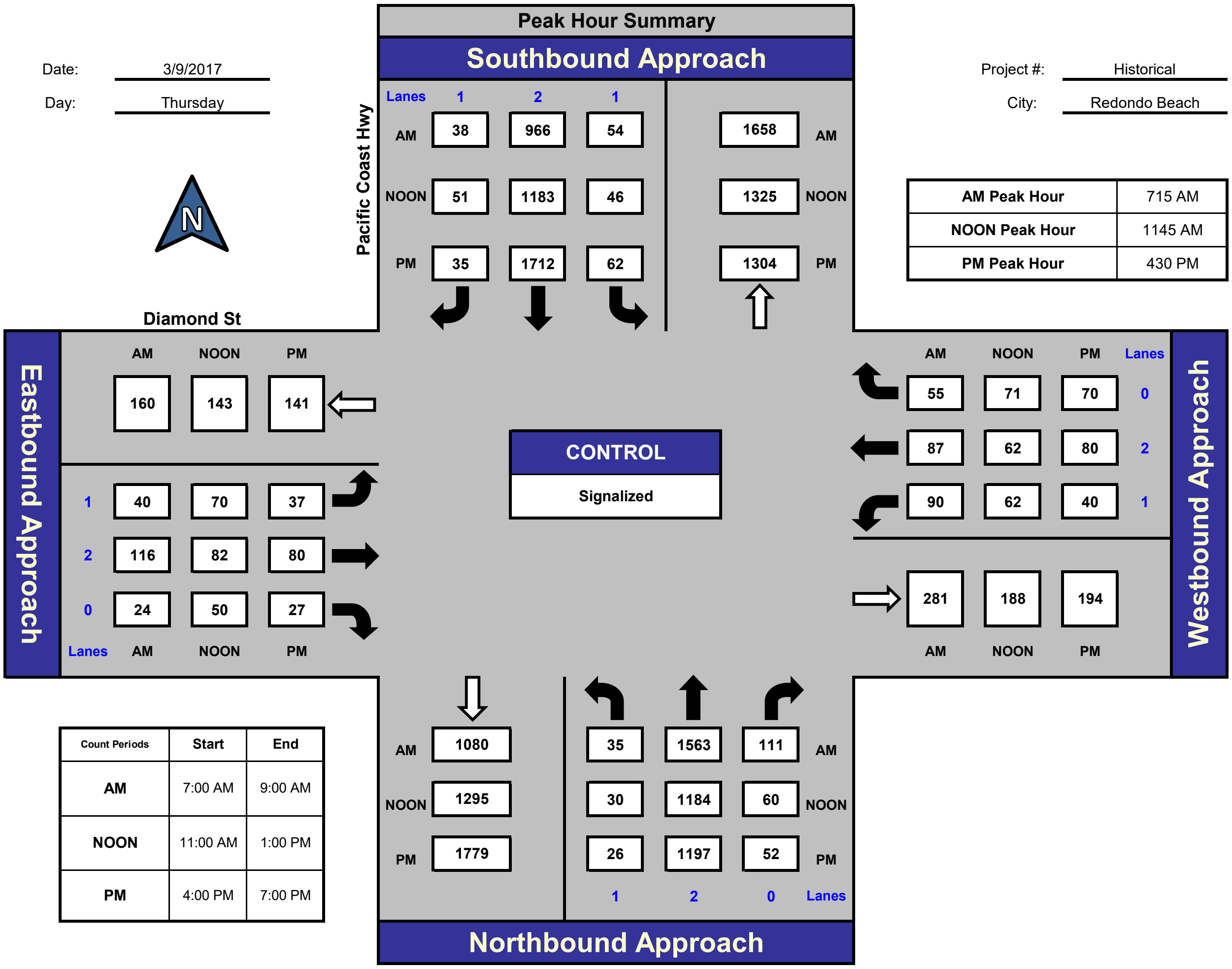
Date: 3/9/2017

Day: Thursday

Project #: Historical

City: Redondo Beach

AM Peak Hour	715 AM
NOON Peak Hour	1145 AM
PM Peak Hour	430 PM



Peak Hour Summary

Southbound Approach

Pacific Coast Hwy

Lanes	1	2	1		
AM	38	966	54	1658	AM
NOON	51	1183	46	1325	NOON
PM	35	1712	62	1304	PM

Diamond St

Eastbound Approach

	AM	NOON	PM
	160	143	141

1	40	70	37
2	116	82	80
0	24	50	27
Lanes	AM	NOON	PM

Westbound Approach

AM	NOON	PM	Lanes
55	71	70	0
87	62	80	2
90	62	40	1

281	188	194
AM	NOON	PM

CONTROL

Signalized

Northbound Approach

AM	1080	35	1563	111	AM
NOON	1295	30	1184	60	NOON
PM	1779	26	1197	52	PM
		1	2	0	Lanes

Count Periods	Start	End
AM	7:00 AM	9:00 AM
NOON	11:00 AM	1:00 PM
PM	4:00 PM	7:00 PM

Total Ins & Outs

North Leg

1058	1658	AM
1280	1325	NOON
1809	1304	PM

West Leg

AM	NOON	PM
160	143	141
180	202	144

East Leg

232	195	190
281	188	194
AM	NOON	PM

South Leg

AM	1080	1709
NOON	1295	1274
PM	1779	1275

Total Volume Per Leg

North Leg

2716	AM
2605	NOON
3113	PM

West Leg

AM	NOON	PM
340	345	285

East Leg

513	383	384
AM	NOON	PM

South Leg

AM	2789
NOON	2569
PM	3054

ITM Peak Hour Summary

Prepared by:

NDS

National Data & Surveying Services

Pacific Coast Hwy and Emerald St , Redondo Beach

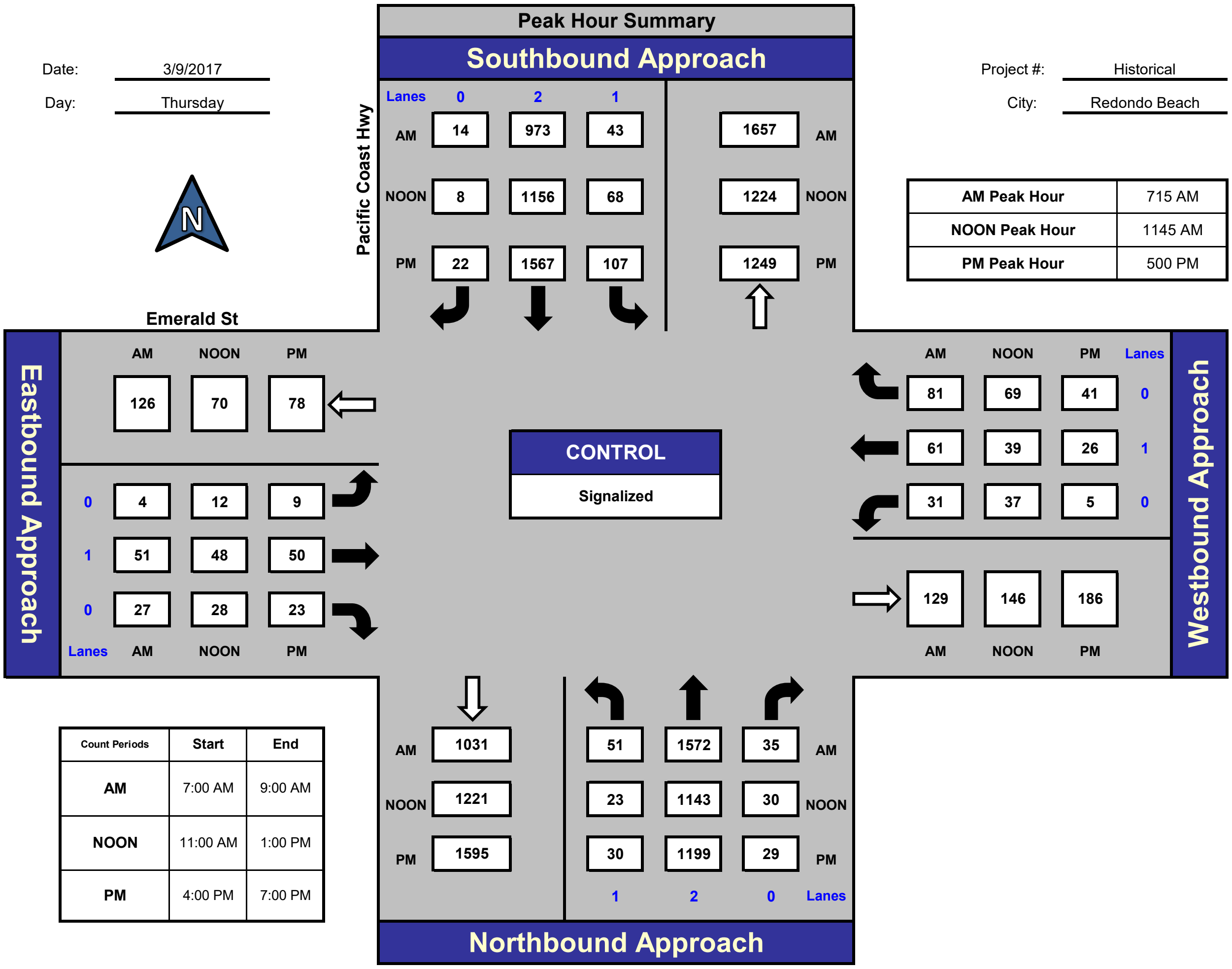
Date: 3/9/2017

Day: Thursday

Project #: Historical

City: Redondo Beach

AM Peak Hour	715 AM
NOON Peak Hour	1145 AM
PM Peak Hour	500 PM



Peak Hour Summary

Southbound Approach

Lanes	0	2	1	
AM	14	973	43	1657
NOON	8	1156	68	1224
PM	22	1567	107	1249

Eastbound Approach

	AM	NOON	PM
	126	70	78

Lanes	AM	NOON	PM
0	4	12	9
1	51	48	50
0	27	28	23

Westbound Approach

AM	NOON	PM	Lanes
81	69	41	0
61	39	26	1
31	37	5	0
129	146	186	

CONTROL

Signalized

Northbound Approach

AM	1031	51	1572	35
NOON	1221	23	1143	30
PM	1595	30	1199	29
Lanes		1	2	0

Count Periods	Start	End
AM	7:00 AM	9:00 AM
NOON	11:00 AM	1:00 PM
PM	4:00 PM	7:00 PM

Total Ins & Outs

North Leg

AM	1030	1657
NOON	1232	1224
PM	1696	1249

West Leg

AM	NOON	PM
126	70	78
82	88	82

East Leg

AM	NOON	PM
173	145	72
129	146	186

South Leg

AM	1031	1658
NOON	1221	1196
PM	1595	1258

Total Volume Per Leg

North Leg

AM	2687
NOON	2456
PM	2945

West Leg

AM	NOON	PM
208	158	160

East Leg

AM	NOON	PM
302	291	258

South Leg

AM	2689
NOON	2417
PM	2853

ITM Peak Hour Summary

Prepared by:

National Data & Surveying Services

Pacific Coast Hwy and Torrance Blvd , Redondo Beach

Date: 3/9/2017

Day: Thursday

Project #: Historical

City: Redondo Beach

AM Peak Hour	730 AM
NOON Peak Hour	1145 AM
PM Peak Hour	500 PM

N

Peak Hour Summary

Southbound Approach

Pacific Coast Hwy

Lanes	0	2	1	
	↲	↓	↳	⇧
AM	27	823	207	1594
NOON	45	916	227	1192
PM	34	1283	264	1241

Torrance Blvd

Eastbound Approach

	Lanes	AM	NOON	PM
⇦		429	501	592
↱	1	46	76	57
→	2	315	310	406
↴	0	28	46	72

CONTROL

Signalized

Westbound Approach

	AM	NOON	PM	Lanes
↰	269	229	278	1
←	357	402	499	2
↙	122	125	138	1
⇨	598	635	751	

Northbound Approach

	⇩	↰	↑	↱
AM	973	45	1279	76
NOON	1087	54	887	98
PM	1493	59	906	81
Lanes		1	2	0

Count Periods	Start	End
AM	7:00 AM	9:00 AM
NOON	11:00 AM	1:00 PM
PM	4:00 PM	7:00 PM

Total Ins & Outs

North Leg

	⇩	⇧
AM	1057	1594
NOON	1188	1192
PM	1581	1241

East Leg

	AM	NOON	PM
←	748	756	915
→	598	635	751

West Leg

	AM	NOON	PM
←	429	501	592
→	389	432	535

South Leg

	↓	↑
AM	973	1400
NOON	1087	1039
PM	1493	1046

Total Volume Per Leg

North Leg

AM	2651
NOON	2380
PM	2822

East Leg

AM	NOON	PM
1346	1391	1666

West Leg

AM	NOON	PM
818	933	1127

South Leg

AM	2373
NOON	2126
PM	2539

Appendix D:
Level of Service Worksheets

EXISTING CONDITIONS

Project Title: **Catalina Village**
Intersection: **1 - South Catalina Avenue & Torrance Boulevard**
Description: **Existing**

Thru Lane:	1600 vph	N-S Split Phase :	N
Left Lane:	1600 vph	E-W Split Phase :	N
Double Lt Penalty:	20 %	Lost Time (% of cycle) :	10
ITS:	0 %	V/C Round Off (decs.) :	3
OLA Movements :			
FF Movements:			

Date/Time: **AM PEAK HOUR**

APPROACH	MVMT	LANES	VOLUME	CAPACITY	V/C	ICU ANALYSIS	
Southbound	RT	1.00	44	1,600	0.023	N-S(1):	0.272 *
	TH	2.00	258	3,200	0.081	N-S(2):	0.089
	LT	1.00	119	1,600	0.074 *	E-W(1):	0.059
Westbound	RT	1.00	166	1,600	0.067 *	E-W(2):	0.076 *
	TH	2.00	56	3,200	0.018		
	LT	1.00	80	1,600	0.050	V/C:	0.348
Northbound	RT	1.00	160	1,600	0.075	Lost Time:	0.100
	TH	2.00	633	3,200	0.198 *	ITS:	0.000
	LT	1.00	12	1,600	0.008		
Eastbound	RT	1.00	9	1,600	0.002	ICU:	0.448
	TH	2.00	29	3,200	0.009		
	LT	1.00	15	1,600	0.009 *	LOS:	A

Date/Time: **PM PEAK HOUR**

APPROACH	MVMT	LANES	VOLUME	CAPACITY	V/C	ICU ANALYSIS	
Southbound	RT	1.00	55	1,600	0.034	N-S(1):	0.252 *
	TH	2.00	678	3,200	0.212	N-S(2):	0.230
	LT	1.00	199	1,600	0.124 *	E-W(1):	0.092
Westbound	RT	1.00	198	1,600	0.124 *	E-W(2):	0.151 *
	TH	2.00	116	3,200	0.036		
	LT	1.00	101	1,600	0.063	V/C:	0.403
Northbound	RT	1.00	115	1,600	0.072	Lost Time:	0.100
	TH	2.00	411	3,200	0.128 *	ITS:	0.000
	LT	1.00	28	1,600	0.018		
Eastbound	RT	1.00	26	1,600	0.016	ICU:	0.503
	TH	2.00	94	3,200	0.029		
	LT	1.00	43	1,600	0.027 *	LOS:	A

* - Denotes critical movement

Project Title: **Catalina Village**
Intersection: **3 - North Catalina Avenue & Emerald Street**
Description: **Existing**

Thru Lane:	1600 vph	N-S Split Phase :	N
Left Lane:	1600 vph	E-W Split Phase :	N
Double Lt Penalty:	20 %	Lost Time (% of cycle) :	10
ITS:	0 %	V/C Round Off (decs.) :	3
OLA Movements :			
FF Movements:			

Date/Time: **AM PEAK HOUR**

APPROACH	MVMT	LANES	VOLUME	CAPACITY	V/C	ICU ANALYSIS	
Southbound	RT	1.00	6	1,600	0.000	N-S(1):	0.290 *
	TH	2.00	341	3,200	0.107	N-S(2):	0.111
	LT	1.00	17	1,600	0.011 *	E-W(1):	0.067
Westbound	RT	0.00	34	0	0.000	E-W(2):	0.069 *
	TH	1.00	4	1,600	0.033 *		
	LT	0.00	15	1,600	0.009	V/C:	0.359
Northbound	RT	0.00	28	0	0.000	Lost Time:	0.100
	TH	2.00	865	3,200	0.279 *	ITS:	0.000
	LT	1.00	6	1,600	0.004		
Eastbound	RT	0.00	25	0	0.000	ICU:	0.459
	TH	1.00	9	1,600	0.058		
	LT	0.00	58	1,600	0.036 *	LOS:	A

Date/Time: **PM PEAK HOUR**

APPROACH	MVMT	LANES	VOLUME	CAPACITY	V/C	ICU ANALYSIS	
Southbound	RT	1.00	40	1,600	0.025	N-S(1):	0.223
	TH	2.00	968	3,200	0.303 *	N-S(2):	0.314 *
	LT	1.00	33	1,600	0.021	E-W(1):	0.033
Westbound	RT	0.00	19	0	0.000	E-W(2):	0.035 *
	TH	1.00	7	1,600	0.025 *		
	LT	0.00	14	1,600	0.009	V/C:	0.349
Northbound	RT	0.00	17	0	0.000	Lost Time:	0.100
	TH	2.00	628	3,200	0.202	ITS:	0.000
	LT	1.00	17	1,600	0.011 *		
Eastbound	RT	0.00	18	0	0.000	ICU:	0.449
	TH	1.00	4	1,600	0.024		
	LT	0.00	16	1,600	0.010 *	LOS:	A

* - Denotes critical movement

Project Title: Catalina Village
Intersection: 4 - North Catalina Avenue & Diamond Street
Description: Existing

Thru Lane: 1600 vph
Left Lane: 1600 vph
Double Lt Penalty: 20 %
ITS: 0 %
OLA Movements :
FF Movements:

N-S Split Phase : N
E-W Split Phase : N
Lost Time (% of cycle) : 10
V/C Round Off (decs.) : 3

Date/Time: **AM PEAK HOUR**

APPROACH	MVMT	LANES	VOLUME	CAPACITY	V/C	ICU ANALYSIS	
Southbound	RT	1.00	4	1,600	0.000	N-S(1):	0.294 *
	TH	2.00	334	3,200	0.104	N-S(2):	0.105
	LT	1.00	27	1,600	0.017 *	E-W(1):	0.039
Westbound	RT	0.98	53	1,570	0.025	E-W(2):	0.045 *
	TH	0.02	1	30	0.034 *		
	LT	1.00	30	1,600	0.019	V/C:	0.339
Northbound	RT	1.00	64	1,600	0.031	Lost Time:	0.100
	TH	2.00	885	3,200	0.277 *	ITS:	0.000
	LT	1.00	2	1,600	0.001		
Eastbound	RT	0.00	6	0	0.000	ICU:	0.439
	TH	1.00	9	1,600	0.020		
	LT	0.00	17	1,600	0.011 *	LOS:	A

Date/Time: **PM PEAK HOUR**

APPROACH	MVMT	LANES	VOLUME	CAPACITY	V/C	ICU ANALYSIS	
Southbound	RT	1.00	7	1,600	0.004	N-S(1):	0.227
	TH	2.00	1,004	3,200	0.314 *	N-S(2):	0.320 *
	LT	1.00	70	1,600	0.044	E-W(1):	0.035
Westbound	RT	0.85	47	1,367	0.034	E-W(2):	0.038 *
	TH	0.15	8	233	0.034 *		
	LT	1.00	42	1,600	0.026	V/C:	0.358
Northbound	RT	1.00	47	1,600	0.029	Lost Time:	0.100
	TH	2.00	584	3,200	0.183	ITS:	0.000
	LT	1.00	10	1,600	0.006 *		
Eastbound	RT	0.00	3	0	0.000	ICU:	0.458
	TH	1.00	4	1,600	0.009		
	LT	0.00	7	1,600	0.004 *	LOS:	A

* - Denotes critical movement

Project Title: **Catalina Village**
Intersection: **5 - North Catalina Avenue & Beryl Street**
Description: **Existing**

Thru Lane:	1600 vph	N-S Split Phase :	N
Left Lane:	1600 vph	E-W Split Phase :	N
Double Lt Penalty:	20 %	Lost Time (% of cycle) :	10
ITS:	0 %	V/C Round Off (decs.) :	3
OLA Movements :			
FF Movements:			

Date/Time: **AM PEAK HOUR**

APPROACH	MVMT	LANES	VOLUME	CAPACITY	V/C	ICU ANALYSIS	
Southbound	RT	0.00	80	0	0.000	N-S(1):	0.179
	TH	2.00	267	3,200	0.108 *	N-S(2):	0.246 *
	LT	0.00	0	0	0.000	E-W(1):	0.049
Westbound	RT	1.00	8	1,600	0.005	E-W(2):	0.098 *
	TH	1.00	123	1,600	0.077 *		
	LT	1.00	26	1,600	0.016	V/C:	0.344
Northbound	RT	0.00	30	0	0.000	Lost Time:	0.100
	TH	2.00	544	3,200	0.179	ITS:	0.000
	LT	2.00	352	2,560	0.138 *		
Eastbound	RT	1.00	120	1,600	0.006	ICU:	0.444
	TH	1.00	52	1,600	0.033		
	LT	1.00	33	1,600	0.021 *	LOS:	A

Date/Time: **PM PEAK HOUR**

APPROACH	MVMT	LANES	VOLUME	CAPACITY	V/C	ICU ANALYSIS	
Southbound	RT	0.00	116	0	0.000	N-S(1):	0.117
	TH	2.00	747	3,200	0.270 *	N-S(2):	0.374 *
	LT	0.00	0	0	0.000	E-W(1):	0.192 *
Westbound	RT	1.00	15	1,600	0.009	E-W(2):	0.112
	TH	1.00	128	1,600	0.080		
	LT	1.00	41	1,600	0.026 *	V/C:	0.566
Northbound	RT	0.00	51	0	0.000	Lost Time:	0.100
	TH	2.00	323	3,200	0.117	ITS:	0.000
	LT	2.00	265	2,560	0.104 *		
Eastbound	RT	1.00	265	1,600	0.166 *	ICU:	0.666
	TH	1.00	127	1,600	0.079		
	LT	1.00	51	1,600	0.032	LOS:	B

* - Denotes critical movement

Project Title: Catalina Village
Intersection: 6 - Pacific Coast Highway & Herondo Street
Description: Existing

Thru Lane:	1600 vph	N-S Split Phase :	N
Left Lane:	1600 vph	E-W Split Phase :	N
Double Lt Penalty:	20 %	Lost Time (% of cycle) :	10
ITS:	0 %	V/C Round Off (decs.) :	3
OLA Movements :			
FF Movements:			

Date/Time: **AM PEAK HOUR**

APPROACH	MVMT	LANES	VOLUME	CAPACITY	V/C	ICU ANALYSIS	
Southbound	RT	1.00	153	1,600	0.055	N-S(1):	0.491 *
	TH	2.00	895	3,200	0.280	N-S(2):	0.294
	LT	1.00	104	1,600	0.065 *	E-W(1):	0.260
Westbound	RT	1.00	532	1,600	0.300 *	E-W(2):	0.381 *
	TH	1.00	206	1,600	0.129		
	LT	2.00	296	2,560	0.116	V/C:	0.872
Northbound	RT	1.00	119	1,600	0.017	Lost Time:	0.100
	TH	3.00	2,045	4,800	0.426 *	ITS:	0.000
	LT	1.00	23	1,600	0.014		
Eastbound	RT	1.00	75	1,600	0.040	ICU:	0.972
	TH	1.00	231	1,600	0.144		
	LT	1.00	129	1,600	0.081 *	LOS:	E

Date/Time: **PM PEAK HOUR**

APPROACH	MVMT	LANES	VOLUME	CAPACITY	V/C	ICU ANALYSIS	
Southbound	RT	1.00	450	1,600	0.281	N-S(1):	0.388
	TH	2.00	1,556	3,200	0.486 *	N-S(2):	0.540 *
	LT	1.00	212	1,600	0.133	E-W(1):	0.308 *
Westbound	RT	1.00	246	1,600	0.154	E-W(2):	0.201
	TH	1.00	275	1,600	0.172		
	LT	2.00	306	2,560	0.120 *	V/C:	0.848
Northbound	RT	1.00	257	1,600	0.161	Lost Time:	0.100
	TH	3.00	1,223	4,800	0.255	ITS:	0.000
	LT	1.00	86	1,600	0.054 *		
Eastbound	RT	1.00	128	1,600	0.080	ICU:	0.948
	TH	1.00	301	1,600	0.188 *		
	LT	1.00	47	1,600	0.029	LOS:	E

* - Denotes critical movement

Project Title: **Catalina Village**
Intersection: **7 - Pacific Coast Highway & North Catalina Avenue**
Description: **Existing**

Thru Lane: 1600 vph
Left Lane: 1600 vph
Double Lt Penalty: 20 %
ITS: 0 %
OLA Movements :
FF Movements:

N-S Split Phase : N
E-W Split Phase : N
Lost Time (% of cycle) : 10
V/C Round Off (decs.) : 3

Date/Time: **AM PEAK HOUR**

APPROACH	MVMT	LANES	VOLUME	CAPACITY	V/C	ICU ANALYSIS	
Southbound	RT	0.00	0	0	0.000	N-S(1):	0.539 *
	TH	2.00	1,053	3,200	0.329	N-S(2):	0.333
	LT	0.00	0	0	0.000 *	E-W(1):	0.159
Westbound	RT	0.00	0	0	0.000	E-W(2):	0.201 *
	TH	0.00	0	0	0.000 *		
	LT	0.00	0	0	0.000	V/C:	0.740
Northbound	RT	0.00	0	0	0.000	Lost Time:	0.100
	TH	2.00	1,724	3,200	0.539 *	ITS:	0.000
	LT	1.00	6	1,600	0.004		
Eastbound	RT	0.01	2	12	0.159	ICU:	0.840
	TH	0.00	0	0	0.000		
	LT	1.99	513	2,550	0.201 *	LOS:	D

Date/Time: **PM PEAK HOUR**

APPROACH	MVMT	LANES	VOLUME	CAPACITY	V/C	ICU ANALYSIS	
Southbound	RT	0.00	3	0	0.000	N-S(1):	0.385
	TH	2.00	1,813	3,200	0.568 *	N-S(2):	0.581 *
	LT	0.00	0	0	0.000	E-W(1):	0.109
Westbound	RT	0.00	0	0	0.000	E-W(2):	0.136 *
	TH	0.00	0	0	0.000 *		
	LT	0.00	0	0	0.000	V/C:	0.717
Northbound	RT	0.00	0	0	0.000	Lost Time:	0.100
	TH	2.00	1,233	3,200	0.385	ITS:	0.000
	LT	1.00	21	1,600	0.013 *		
Eastbound	RT	0.11	19	175	0.109	ICU:	0.817
	TH	0.00	0	0	0.000		
	LT	1.89	329	2,420	0.136 *	LOS:	D

* - Denotes critical movement

Project Title: Catalina Village
Intersection: 8 - Pacific Coast Highway & Beryl Street
Description: Existing

Thru Lane: 1600 vph
Left Lane: 1600 vph
Double Lt Penalty: 20 %
ITS: 0 %
OLA Movements :
FF Movements:

N-S Split Phase : N
E-W Split Phase : N
Lost Time (% of cycle) : 10
V/C Round Off (decs.) : 3

Date/Time: **AM PEAK HOUR**

APPROACH	MVMT	LANES	VOLUME	CAPACITY	V/C	ICU ANALYSIS	
Southbound	RT	0.00	35	0	0.000	N-S(1):	0.495 *
	TH	2.00	1,034	3,200	0.334	N-S(2):	0.367
	LT	1.00	16	1,600	0.010 *	E-W(1):	0.139 *
Westbound	RT	1.00	25	1,600	0.011	E-W(2):	0.092
	TH	1.00	118	1,600	0.074		
	LT	1.00	61	1,600	0.038 *	V/C:	0.634
Northbound	RT	0.00	69	0	0.000	Lost Time:	0.100
	TH	2.00	1,482	3,200	0.485 *	ITS:	0.000
	LT	1.00	53	1,600	0.033		
Eastbound	RT	0.13	21	209	0.084	ICU:	0.734
	TH	0.87	140	1,391	0.101 *		
	LT	1.00	29	1,600	0.018	LOS:	C

Date/Time: **PM PEAK HOUR**

APPROACH	MVMT	LANES	VOLUME	CAPACITY	V/C	ICU ANALYSIS	
Southbound	RT	0.00	71	0	0.000	N-S(1):	0.406
	TH	2.00	1,682	3,200	0.548 *	N-S(2):	0.580 *
	LT	1.00	39	1,600	0.024	E-W(1):	0.204 *
Westbound	RT	1.00	35	1,600	0.022	E-W(2):	0.154
	TH	1.00	177	1,600	0.111		
	LT	1.00	60	1,600	0.038 *	V/C:	0.784
Northbound	RT	0.00	83	0	0.000	Lost Time:	0.100
	TH	2.00	1,138	3,200	0.382	ITS:	0.000
	LT	1.00	51	1,600	0.032 *		
Eastbound	RT	0.14	36	217	0.166	ICU:	0.884
	TH	0.86	229	1,383	0.166 *		
	LT	1.00	69	1,600	0.043	LOS:	D

* - Denotes critical movement

Project Title: **Catalina Village**
Intersection: **9 - Pacific Coast Highway & Diamond Street**
Description: **Existing**

Thru Lane:	1600 vph	N-S Split Phase :	N
Left Lane:	1600 vph	E-W Split Phase :	N
Double Lt Penalty:	20 %	Lost Time (% of cycle) :	10
ITS:	0 %	V/C Round Off (decs.) :	3
OLA Movements :			
FF Movements:			

Date/Time: **AM PEAK HOUR**

APPROACH	MVMT	LANES	VOLUME	CAPACITY	V/C		ICU ANALYSIS		
Southbound	RT	1.00	38	1,600	0.011		N-S(1):	0.563	*
	TH	2.00	977	3,200	0.305		N-S(2):	0.327	
	LT	1.00	55	1,600	0.034	*	E-W(1):	0.130	*
Westbound	RT	1.00	56	1,600	0.018		E-W(2):	0.080	
	TH	1.00	88	1,600	0.055				
	LT	1.00	91	1,600	0.057	*	V/C:	0.693	
Northbound	RT	0.00	112	0	0.000		Lost Time:	0.100	
	TH	2.00	1,581	3,200	0.529	*	ITS:	0.000	
	LT	1.00	35	1,600	0.022				
Eastbound	RT	1.00	24	1,600	0.004		ICU:	0.793	
	TH	1.00	117	1,600	0.073	*			
	LT	1.00	40	1,600	0.025		LOS:	C	

Date/Time: **PM PEAK HOUR**

APPROACH	MVMT	LANES	VOLUME	CAPACITY	V/C		ICU ANALYSIS		
Southbound	RT	1.00	35	1,600	0.022		N-S(1):	0.434	
	TH	2.00	1,732	3,200	0.541	*	N-S(2):	0.557	*
	LT	1.00	63	1,600	0.039		E-W(1):	0.076	*
Westbound	RT	1.00	71	1,600	0.044		E-W(2):	0.074	
	TH	1.00	81	1,600	0.051				
	LT	1.00	40	1,600	0.025	*	V/C:	0.633	
Northbound	RT	0.00	53	0	0.000		Lost Time:	0.100	
	TH	2.00	1,211	3,200	0.395		ITS:	0.000	
	LT	1.00	26	1,600	0.016	*			
Eastbound	RT	1.00	27	1,600	0.017		ICU:	0.733	
	TH	1.00	81	1,600	0.051	*			
	LT	1.00	37	1,600	0.023		LOS:	C	

* - Denotes critical movement

Project Title: **Catalina Village**
Intersection: **10 - Pacific Coast Highway & Emerald Street**
Description: **Existing**

Thru Lane:	1600	vph
Left Lane:	1600	vph
Double Lt Penalty:	20	%
ITS:	0	%
OLA Movements :		
FF Movements:		

N-S Split Phase :	N
E-W Split Phase :	N
Lost Time (% of cycle) :	10
V/C Round Off (decs.) :	3

Date/Time: **AM PEAK HOUR**

APPROACH	MVMT	LANES	VOLUME	CAPACITY	V/C		ICU ANALYSIS		
Southbound	RT	0.00	14	0	0.000		N-S(1):	0.535	*
	TH	2.00	984	3,200	0.312		N-S(2):	0.345	
	LT	1.00	43	1,600	0.027	*	E-W(1):	0.071	
Westbound	RT	0.00	82	0	0.000		E-W(2):	0.112	*
	TH	1.00	62	1,600	0.109	*			
	LT	0.00	31	1,600	0.019		V/C:	0.647	
Northbound	RT	0.00	35	0	0.000		Lost Time:	0.100	
	TH	2.00	1,590	3,200	0.508	*	ITS:	0.000	
	LT	1.00	52	1,600	0.033				
Eastbound	RT	0.00	27	0	0.000		ICU:	0.747	
	TH	1.00	52	1,600	0.052				
	LT	0.00	4	1,600	0.003	*	LOS:	C	

Date/Time: **PM PEAK HOUR**

APPROACH	MVMT	LANES	VOLUME	CAPACITY	V/C		ICU ANALYSIS		
Southbound	RT	0.00	22	0	0.000		N-S(1):	0.456	
	TH	2.00	1,585	3,200	0.502	*	N-S(2):	0.521	*
	LT	1.00	108	1,600	0.068		E-W(1):	0.055	*
Westbound	RT	0.00	41	0	0.000		E-W(2):	0.051	
	TH	1.00	26	1,600	0.045				
	LT	0.00	5	1,600	0.003	*	V/C:	0.576	
Northbound	RT	0.00	29	0	0.000		Lost Time:	0.100	
	TH	2.00	1,213	3,200	0.388		ITS:	0.000	
	LT	1.00	30	1,600	0.019	*			
Eastbound	RT	0.00	23	0	0.000		ICU:	0.676	
	TH	1.00	51	1,600	0.052	*			
	LT	0.00	9	1,600	0.006		LOS:	B	

* - Denotes critical movement

Project Title: **Catalina Village**
Intersection: **11 - Pacific Coast Highway & Torrance Boulevard**
Description: **Existing**

Thru Lane:	1600 vph	N-S Split Phase :	N
Left Lane:	1600 vph	E-W Split Phase :	N
Double Lt Penalty:	20 %	Lost Time (% of cycle) :	10
ITS:	0 %	V/C Round Off (decs.) :	3
OLA Movements :			
FF Movements:			

Date/Time: **AM PEAK HOUR**

APPROACH	MVMT	LANES	VOLUME	CAPACITY	V/C	ICU ANALYSIS	
Southbound	RT	0.00	27	0	0.000	N-S(1):	0.559 *
	TH	2.00	832	3,200	0.268	N-S(2):	0.297
	LT	1.00	209	1,600	0.131 *	E-W(1):	0.185 *
Westbound	RT	1.00	272	1,600	0.105	E-W(2):	0.142
	TH	2.00	361	3,200	0.113		
	LT	1.00	123	1,600	0.077 *	V/C:	0.744
Northbound	RT	0.00	77	0	0.000	Lost Time:	0.100
	TH	2.00	1,294	3,200	0.428 *	ITS:	0.000
	LT	1.00	46	1,600	0.029		
Eastbound	RT	0.00	28	0	0.000	ICU:	0.844
	TH	2.00	319	3,200	0.108 *		
	LT	1.00	47	1,600	0.029	LOS:	D

Date/Time: **PM PEAK HOUR**

APPROACH	MVMT	LANES	VOLUME	CAPACITY	V/C	ICU ANALYSIS	
Southbound	RT	0.00	34	0	0.000	N-S(1):	0.479 *
	TH	2.00	1,298	3,200	0.416	N-S(2):	0.454
	LT	1.00	267	1,600	0.167 *	E-W(1):	0.239 *
Westbound	RT	1.00	281	1,600	0.176	E-W(2):	0.212
	TH	2.00	505	3,200	0.158		
	LT	1.00	140	1,600	0.088 *	V/C:	0.718
Northbound	RT	0.00	82	0	0.000	Lost Time:	0.100
	TH	2.00	916	3,200	0.312 *	ITS:	0.000
	LT	1.00	60	1,600	0.038		
Eastbound	RT	0.00	73	0	0.000	ICU:	0.818
	TH	2.00	411	3,200	0.151 *		
	LT	1.00	58	1,600	0.036	LOS:	D

* - Denotes critical movement

EXISTING PLUS PROJECT

Project Title: **Catalina Village**
Intersection: **1 - South Catalina Avenue & Torrance Boulevard**
Description: **Existing + Project**

Thru Lane:	1600 vph	N-S Split Phase :	N
Left Lane:	1600 vph	E-W Split Phase :	N
Double Lt Penalty:	20 %	Lost Time (% of cycle) :	10
ITS:	0 %	V/C Round Off (decs.) :	3
OLA Movements :			
FF Movements:			

Date/Time: **AM PEAK HOUR**

APPROACH	MVMT	LANES	VOLUME	CAPACITY	V/C	ICU ANALYSIS	
Southbound	RT	1.00	44	1,600	0.023	N-S(1):	0.272 *
	TH	2.00	260	3,200	0.081	N-S(2):	0.089
	LT	1.00	119	1,600	0.074 *	E-W(1):	0.059
Westbound	RT	1.00	177	1,600	0.073 *	E-W(2):	0.082 *
	TH	2.00	56	3,200	0.018		
	LT	1.00	80	1,600	0.050	V/C:	0.354
Northbound	RT	1.00	160	1,600	0.075	Lost Time:	0.100
	TH	2.00	635	3,200	0.198 *	ITS:	0.000
	LT	1.00	12	1,600	0.008		
Eastbound	RT	1.00	9	1,600	0.002	ICU:	0.454
	TH	2.00	29	3,200	0.009		
	LT	1.00	15	1,600	0.009 *	LOS:	A

Date/Time: **PM PEAK HOUR**

APPROACH	MVMT	LANES	VOLUME	CAPACITY	V/C	ICU ANALYSIS	
Southbound	RT	1.00	55	1,600	0.034	N-S(1):	0.253 *
	TH	2.00	679	3,200	0.212	N-S(2):	0.230
	LT	1.00	199	1,600	0.124 *	E-W(1):	0.092
Westbound	RT	1.00	206	1,600	0.129 *	E-W(2):	0.156 *
	TH	2.00	116	3,200	0.036		
	LT	1.00	101	1,600	0.063	V/C:	0.409
Northbound	RT	1.00	115	1,600	0.072	Lost Time:	0.100
	TH	2.00	413	3,200	0.129 *	ITS:	0.000
	LT	1.00	28	1,600	0.018		
Eastbound	RT	1.00	26	1,600	0.016	ICU:	0.509
	TH	2.00	94	3,200	0.029		
	LT	1.00	43	1,600	0.027 *	LOS:	A

* - Denotes critical movement

Project Title: **Catalina Village**
Intersection: **3 - North Catalina Avenue & Emerald Street**
Description: **Existing + Project**

Thru Lane:	1600 vph	N-S Split Phase :	N
Left Lane:	1600 vph	E-W Split Phase :	N
Double Lt Penalty:	20 %	Lost Time (% of cycle) :	10
ITS:	0 %	V/C Round Off (decs.) :	3
OLA Movements :			
FF Movements:			

Date/Time: **AM PEAK HOUR**

APPROACH	MVMT	LANES	VOLUME	CAPACITY	V/C	ICU ANALYSIS	
Southbound	RT	1.00	6	1,600	0.000	N-S(1):	0.294 *
	TH	2.00	347	3,200	0.108	N-S(2):	0.112
	LT	1.00	17	1,600	0.011 *	E-W(1):	0.069
Westbound	RT	0.00	76	0	0.000	E-W(2):	0.097 *
	TH	1.00	4	1,600	0.061 *		
	LT	0.00	17	1,600	0.011	V/C:	0.391
Northbound	RT	0.00	28	0	0.000	Lost Time:	0.100
	TH	2.00	878	3,200	0.283 *	ITS:	0.000
	LT	1.00	6	1,600	0.004		
Eastbound	RT	0.00	25	0	0.000	ICU:	0.491
	TH	1.00	9	1,600	0.058		
	LT	0.00	58	1,600	0.036 *	LOS:	A

Date/Time: **PM PEAK HOUR**

APPROACH	MVMT	LANES	VOLUME	CAPACITY	V/C	ICU ANALYSIS	
Southbound	RT	1.00	40	1,600	0.025	N-S(1):	0.225
	TH	2.00	972	3,200	0.304 *	N-S(2):	0.315 *
	LT	1.00	33	1,600	0.021	E-W(1):	0.033
Westbound	RT	0.00	48	0	0.000	E-W(2):	0.054 *
	TH	1.00	7	1,600	0.044 *		
	LT	0.00	15	1,600	0.009	V/C:	0.369
Northbound	RT	0.00	17	0	0.000	Lost Time:	0.100
	TH	2.00	637	3,200	0.204	ITS:	0.000
	LT	1.00	17	1,600	0.011 *		
Eastbound	RT	0.00	18	0	0.000	ICU:	0.469
	TH	1.00	4	1,600	0.024		
	LT	0.00	16	1,600	0.010 *	LOS:	A

* - Denotes critical movement

Project Title: **Catalina Village**
Intersection: **4 - North Catalina Avenue & Diamond Street**
Description: **Existing + Project**

Thru Lane: 1600 vph
Left Lane: 1600 vph
Double Lt Penalty: 20 %
ITS: 0 %
OLA Movements :
FF Movements:

N-S Split Phase : N
E-W Split Phase : N
Lost Time (% of cycle) : 10
V/C Round Off (decs.) : 3

Date/Time: **AM PEAK HOUR**

APPROACH	MVMT	LANES	VOLUME	CAPACITY	V/C	ICU ANALYSIS	
Southbound	RT	1.00	4	1,600	0.000	N-S(1):	0.314 *
	TH	2.00	340	3,200	0.106	N-S(2):	0.107
	LT	1.00	40	1,600	0.025 *	E-W(1):	0.039
Westbound	RT	0.98	53	1,570	0.021	E-W(2):	0.045 *
	TH	0.02	1	30	0.034 *		
	LT	1.00	30	1,600	0.019	V/C:	0.359
Northbound	RT	1.00	84	1,600	0.043	Lost Time:	0.100
	TH	2.00	925	3,200	0.289 *	ITS:	0.000
	LT	1.00	2	1,600	0.001		
Eastbound	RT	0.00	6	0	0.000	ICU:	0.459
	TH	1.00	9	1,600	0.020		
	LT	0.00	17	1,600	0.011 *	LOS:	A

Date/Time: **PM PEAK HOUR**

APPROACH	MVMT	LANES	VOLUME	CAPACITY	V/C	ICU ANALYSIS	
Southbound	RT	1.00	7	1,600	0.004	N-S(1):	0.238
	TH	2.00	1,008	3,200	0.315 *	N-S(2):	0.321 *
	LT	1.00	79	1,600	0.049	E-W(1):	0.035
Westbound	RT	0.85	47	1,367	0.034	E-W(2):	0.038 *
	TH	0.15	8	233	0.034 *		
	LT	1.00	42	1,600	0.026	V/C:	0.359
Northbound	RT	1.00	57	1,600	0.036	Lost Time:	0.100
	TH	2.00	605	3,200	0.189	ITS:	0.000
	LT	1.00	10	1,600	0.006 *		
Eastbound	RT	0.00	3	0	0.000	ICU:	0.459
	TH	1.00	4	1,600	0.009		
	LT	0.00	7	1,600	0.004 *	LOS:	A

* - Denotes critical movement

Project Title: Catalina Village
Intersection: 5 - North Catalina Avenue & Beryl Street
Description: Existing + Project

Thru Lane:	1600 vph	N-S Split Phase :	N
Left Lane:	1600 vph	E-W Split Phase :	N
Double Lt Penalty:	20 %	Lost Time (% of cycle) :	10
ITS:	0 %	V/C Round Off (decs.) :	3
OLA Movements :			
FF Movements:			

Date/Time: **AM PEAK HOUR**

APPROACH	MVMT	LANES	VOLUME	CAPACITY	V/C	ICU ANALYSIS	
Southbound	RT	0.00	80	0	0.000	N-S(1):	0.190
	TH	2.00	281	3,200	0.113 *	N-S(2):	0.253 *
	LT	0.00	0	0	0.000	E-W(1):	0.049
Westbound	RT	1.00	8	1,600	0.005	E-W(2):	0.098 *
	TH	1.00	123	1,600	0.077 *		
	LT	1.00	26	1,600	0.016	V/C:	0.351
Northbound	RT	0.00	34	0	0.000	Lost Time:	0.100
	TH	2.00	574	3,200	0.190	ITS:	0.000
	LT	2.00	358	2,560	0.140 *		
Eastbound	RT	1.00	126	1,600	0.009	ICU:	0.451
	TH	1.00	52	1,600	0.033		
	LT	1.00	33	1,600	0.021 *	LOS:	A

Date/Time: **PM PEAK HOUR**

APPROACH	MVMT	LANES	VOLUME	CAPACITY	V/C	ICU ANALYSIS	
Southbound	RT	0.00	116	0	0.000	N-S(1):	0.123
	TH	2.00	757	3,200	0.273 *	N-S(2):	0.378 *
	LT	0.00	0	0	0.000	E-W(1):	0.194 *
Westbound	RT	1.00	15	1,600	0.009	E-W(2):	0.112
	TH	1.00	128	1,600	0.080		
	LT	1.00	41	1,600	0.026 *	V/C:	0.572
Northbound	RT	0.00	53	0	0.000	Lost Time:	0.100
	TH	2.00	339	3,200	0.123	ITS:	0.000
	LT	2.00	268	2,560	0.105 *		
Eastbound	RT	1.00	269	1,600	0.168 *	ICU:	0.672
	TH	1.00	127	1,600	0.079		
	LT	1.00	51	1,600	0.032	LOS:	B

* - Denotes critical movement

Project Title: **Catalina Village**
Intersection: **6 - Pacific Coast Highway & Herondo Street**
Description: **Existing + Project**

Thru Lane:	1600 vph	N-S Split Phase :	N
Left Lane:	1600 vph	E-W Split Phase :	N
Double Lt Penalty:	20 %	Lost Time (% of cycle) :	10
ITS:	0 %	V/C Round Off (decs.) :	3
OLA Movements :			
FF Movements:			

Date/Time: **AM PEAK HOUR**

APPROACH	MVMT	LANES	VOLUME	CAPACITY	V/C	ICU ANALYSIS	
Southbound	RT	1.00	158	1,600	0.058	N-S(1):	0.493 *
	TH	2.00	900	3,200	0.281	N-S(2):	0.295
	LT	1.00	104	1,600	0.065 *	E-W(1):	0.267
Westbound	RT	1.00	532	1,600	0.300 *	E-W(2):	0.381 *
	TH	1.00	206	1,600	0.129		
	LT	2.00	314	2,560	0.123	V/C:	0.874
Northbound	RT	1.00	138	1,600	0.025	Lost Time:	0.100
	TH	3.00	2,056	4,800	0.428 *	ITS:	0.000
	LT	1.00	23	1,600	0.014		
Eastbound	RT	1.00	75	1,600	0.040	ICU:	0.974
	TH	1.00	231	1,600	0.144		
	LT	1.00	129	1,600	0.081 *	LOS:	E

Date/Time: **PM PEAK HOUR**

APPROACH	MVMT	LANES	VOLUME	CAPACITY	V/C	ICU ANALYSIS	
Southbound	RT	1.00	453	1,600	0.283	N-S(1):	0.389
	TH	2.00	1,559	3,200	0.487 *	N-S(2):	0.541 *
	LT	1.00	212	1,600	0.133	E-W(1):	0.312 *
Westbound	RT	1.00	246	1,600	0.154	E-W(2):	0.201
	TH	1.00	275	1,600	0.172		
	LT	2.00	318	2,560	0.124 *	V/C:	0.853
Northbound	RT	1.00	267	1,600	0.167	Lost Time:	0.100
	TH	3.00	1,229	4,800	0.256	ITS:	0.000
	LT	1.00	86	1,600	0.054 *		
Eastbound	RT	1.00	128	1,600	0.080	ICU:	0.953
	TH	1.00	301	1,600	0.188 *		
	LT	1.00	47	1,600	0.029	LOS:	E

* - Denotes critical movement

Project Title: **Catalina Village**
Intersection: **7 - Pacific Coast Highway & North Catalina Avenue**
Description: **Existing + Project**

Thru Lane: 1600 vph
Left Lane: 1600 vph
Double Lt Penalty: 20 %
ITS: 0 %
OLA Movements :
FF Movements:

N-S Split Phase : N
E-W Split Phase : N
Lost Time (% of cycle) : 10
V/C Round Off (decs.) : 3

Date/Time: **AM PEAK HOUR**

APPROACH	MVMT	LANES	VOLUME	CAPACITY	V/C	ICU ANALYSIS	
Southbound	RT	0.00	0	0	0.000	N-S(1):	0.539 *
	TH	2.00	1,067	3,200	0.333	N-S(2):	0.337
	LT	0.00	0	0	0.000 *	E-W(1):	0.168
Westbound	RT	0.00	0	0	0.000	E-W(2):	0.213 *
	TH	0.00	0	0	0.000 *		
	LT	0.00	0	0	0.000	V/C:	0.752
Northbound	RT	0.00	0	0	0.000	Lost Time:	0.100
	TH	2.00	1,724	3,200	0.539 *	ITS:	0.000
	LT	1.00	6	1,600	0.004		
Eastbound	RT	0.01	2	12	0.168	ICU:	0.852
	TH	0.00	0	0	0.000		
	LT	1.99	543	2,551	0.213 *	LOS:	D

Date/Time: **PM PEAK HOUR**

APPROACH	MVMT	LANES	VOLUME	CAPACITY	V/C	ICU ANALYSIS	
Southbound	RT	0.00	3	0	0.000	N-S(1):	0.385
	TH	2.00	1,823	3,200	0.571 *	N-S(2):	0.584 *
	LT	0.00	0	0	0.000	E-W(1):	0.114
Westbound	RT	0.00	0	0	0.000	E-W(2):	0.142 *
	TH	0.00	0	0	0.000 *		
	LT	0.00	0	0	0.000	V/C:	0.726
Northbound	RT	0.00	0	0	0.000	Lost Time:	0.100
	TH	2.00	1,233	3,200	0.385	ITS:	0.000
	LT	1.00	21	1,600	0.013 *		
Eastbound	RT	0.10	19	167	0.114	ICU:	0.826
	TH	0.00	0	0	0.000		
	LT	1.90	345	2,426	0.142 *	LOS:	D

* - Denotes critical movement

Project Title: **Catalina Village**
Intersection: **8 - Pacific Coast Highway & Beryl Street**
Description: **Existing + Project**

Thru Lane: 1600 vph
Left Lane: 1600 vph
Double Lt Penalty: 20 %
ITS: 0 %
OLA Movements :
FF Movements:

N-S Split Phase : N
E-W Split Phase : N
Lost Time (% of cycle) : 10
V/C Round Off (decs.) : 3

Date/Time: **AM PEAK HOUR**

APPROACH	MVMT	LANES	VOLUME	CAPACITY	V/C	ICU ANALYSIS	
Southbound	RT	0.00	35	0	0.000	N-S(1):	0.495 *
	TH	2.00	1,048	3,200	0.338	N-S(2):	0.371
	LT	1.00	16	1,600	0.010 *	E-W(1):	0.144 *
Westbound	RT	1.00	25	1,600	0.011	E-W(2):	0.092
	TH	1.00	118	1,600	0.074		
	LT	1.00	65	1,600	0.041 *	V/C:	0.639
Northbound	RT	0.00	69	0	0.000	Lost Time:	0.100
	TH	2.00	1,482	3,200	0.485 *	ITS:	0.000
	LT	1.00	53	1,600	0.033		
Eastbound	RT	0.13	21	204	0.087	ICU:	0.739
	TH	0.87	144	1,396	0.103 *		
	LT	1.00	29	1,600	0.018	LOS:	C

Date/Time: **PM PEAK HOUR**

APPROACH	MVMT	LANES	VOLUME	CAPACITY	V/C	ICU ANALYSIS	
Southbound	RT	0.00	71	0	0.000	N-S(1):	0.406
	TH	2.00	1,692	3,200	0.551 *	N-S(2):	0.583 *
	LT	1.00	39	1,600	0.024	E-W(1):	0.206 *
Westbound	RT	1.00	35	1,600	0.022	E-W(2):	0.154
	TH	1.00	177	1,600	0.111		
	LT	1.00	63	1,600	0.039 *	V/C:	0.789
Northbound	RT	0.00	83	0	0.000	Lost Time:	0.100
	TH	2.00	1,138	3,200	0.382	ITS:	0.000
	LT	1.00	51	1,600	0.032 *		
Eastbound	RT	0.13	36	216	0.167	ICU:	0.889
	TH	0.87	231	1,384	0.167 *		
	LT	1.00	69	1,600	0.043	LOS:	D

* - Denotes critical movement

Project Title: **Catalina Village**
Intersection: **9 - Pacific Coast Highway & Diamond Street**
Description: **Existing + Project**

Thru Lane:	1600 vph	N-S Split Phase :	N
Left Lane:	1600 vph	E-W Split Phase :	N
Double Lt Penalty:	20 %	Lost Time (% of cycle) :	10
ITS:	0 %	V/C Round Off (decs.) :	3
OLA Movements :			
FF Movements:			

Date/Time: **AM PEAK HOUR**

APPROACH	MVMT	LANES	VOLUME	CAPACITY	V/C	ICU ANALYSIS	
Southbound	RT	1.00	40	1,600	0.013	N-S(1):	0.563 *
	TH	2.00	993	3,200	0.310	N-S(2):	0.332
	LT	1.00	55	1,600	0.034 *	E-W(1):	0.135 *
Westbound	RT	1.00	56	1,600	0.018	E-W(2):	0.080
	TH	1.00	88	1,600	0.055		
	LT	1.00	94	1,600	0.059 *	V/C:	0.698
Northbound	RT	0.00	112	0	0.000	Lost Time:	0.100
	TH	2.00	1,581	3,200	0.529 *	ITS:	0.000
	LT	1.00	35	1,600	0.022		
Eastbound	RT	1.00	38	1,600	0.013	ICU:	0.798
	TH	1.00	121	1,600	0.076 *		
	LT	1.00	40	1,600	0.025	LOS:	C

Date/Time: **PM PEAK HOUR**

APPROACH	MVMT	LANES	VOLUME	CAPACITY	V/C	ICU ANALYSIS	
Southbound	RT	1.00	36	1,600	0.023	N-S(1):	0.434
	TH	2.00	1,743	3,200	0.545 *	N-S(2):	0.561 *
	LT	1.00	63	1,600	0.039	E-W(1):	0.078 *
Westbound	RT	1.00	71	1,600	0.044	E-W(2):	0.074
	TH	1.00	81	1,600	0.051		
	LT	1.00	42	1,600	0.026 *	V/C:	0.639
Northbound	RT	0.00	53	0	0.000	Lost Time:	0.100
	TH	2.00	1,211	3,200	0.395	ITS:	0.000
	LT	1.00	26	1,600	0.016 *		
Eastbound	RT	1.00	34	1,600	0.021	ICU:	0.739
	TH	1.00	83	1,600	0.052 *		
	LT	1.00	37	1,600	0.023	LOS:	C

* - Denotes critical movement

Project Title: **Catalina Village**
Intersection: **10 - Pacific Coast Highway & Emerald Street**
Description: **Existing + Project**

Thru Lane:	1600 vph	N-S Split Phase :	N
Left Lane:	1600 vph	E-W Split Phase :	N
Double Lt Penalty:	20 %	Lost Time (% of cycle) :	10
ITS:	0 %	V/C Round Off (decs.) :	3
OLA Movements :			
FF Movements:			

Date/Time: **AM PEAK HOUR**

APPROACH	MVMT	LANES	VOLUME	CAPACITY	V/C	ICU ANALYSIS	
Southbound	RT	0.00	33	0	0.000	N-S(1):	0.536 *
	TH	2.00	996	3,200	0.322	N-S(2):	0.355
	LT	1.00	45	1,600	0.028 *	E-W(1):	0.071
Westbound	RT	0.00	82	0	0.000	E-W(2):	0.114 *
	TH	1.00	64	1,600	0.111 *		
	LT	0.00	31	1,600	0.019	V/C:	0.650
Northbound	RT	0.00	35	0	0.000	Lost Time:	0.100
	TH	2.00	1,590	3,200	0.508 *	ITS:	0.000
	LT	1.00	52	1,600	0.033		
Eastbound	RT	0.00	27	0	0.000	ICU:	0.750
	TH	1.00	52	1,600	0.052		
	LT	0.00	4	1,600	0.003 *	LOS:	C

Date/Time: **PM PEAK HOUR**

APPROACH	MVMT	LANES	VOLUME	CAPACITY	V/C	ICU ANALYSIS	
Southbound	RT	0.00	35	0	0.000	N-S(1):	0.456
	TH	2.00	1,591	3,200	0.508 *	N-S(2):	0.527 *
	LT	1.00	109	1,600	0.068	E-W(1):	0.055 *
Westbound	RT	0.00	41	0	0.000	E-W(2):	0.052
	TH	1.00	27	1,600	0.046		
	LT	0.00	5	1,600	0.003 *	V/C:	0.582
Northbound	RT	0.00	29	0	0.000	Lost Time:	0.100
	TH	2.00	1,213	3,200	0.388	ITS:	0.000
	LT	1.00	30	1,600	0.019 *		
Eastbound	RT	0.00	23	0	0.000	ICU:	0.682
	TH	1.00	51	1,600	0.052 *		
	LT	0.00	9	1,600	0.006	LOS:	B

* - Denotes critical movement

Project Title: **Catalina Village**
Intersection: **11 - Pacific Coast Highway & Torrance Boulevard**
Description: **Existing + Project**

Thru Lane:	1600 vph	N-S Split Phase :	N
Left Lane:	1600 vph	E-W Split Phase :	N
Double Lt Penalty:	20 %	Lost Time (% of cycle) :	10
ITS:	0 %	V/C Round Off (decs.) :	3
OLA Movements :			
FF Movements:			

Date/Time: **AM PEAK HOUR**

APPROACH	MVMT	LANES	VOLUME	CAPACITY	V/C	ICU ANALYSIS	
Southbound	RT	0.00	27	0	0.000	N-S(1):	0.565 *
	TH	2.00	834	3,200	0.269	N-S(2):	0.299
	LT	1.00	219	1,600	0.137 *	E-W(1):	0.185 *
Westbound	RT	1.00	272	1,600	0.102	E-W(2):	0.145
	TH	2.00	370	3,200	0.116		
	LT	1.00	123	1,600	0.077 *	V/C:	0.750
Northbound	RT	0.00	77	0	0.000	Lost Time:	0.100
	TH	2.00	1,294	3,200	0.428 *	ITS:	0.000
	LT	1.00	48	1,600	0.030		
Eastbound	RT	0.00	28	0	0.000	ICU:	0.850
	TH	2.00	319	3,200	0.108 *		
	LT	1.00	47	1,600	0.029	LOS:	D

Date/Time: **PM PEAK HOUR**

APPROACH	MVMT	LANES	VOLUME	CAPACITY	V/C	ICU ANALYSIS	
Southbound	RT	0.00	34	0	0.000	N-S(1):	0.482 *
	TH	2.00	1,299	3,200	0.417	N-S(2):	0.456
	LT	1.00	272	1,600	0.170 *	E-W(1):	0.239 *
Westbound	RT	1.00	281	1,600	0.176	E-W(2):	0.212
	TH	2.00	511	3,200	0.160		
	LT	1.00	140	1,600	0.088 *	V/C:	0.721
Northbound	RT	0.00	82	0	0.000	Lost Time:	0.100
	TH	2.00	916	3,200	0.312 *	ITS:	0.000
	LT	1.00	62	1,600	0.039		
Eastbound	RT	0.00	73	0	0.000	ICU:	0.821
	TH	2.00	411	3,200	0.151 *		
	LT	1.00	58	1,600	0.036	LOS:	D

* - Denotes critical movement

CUMULATIVE BASE

Project Title: **Catalina Village**
Intersection: **1 - South Catalina Avenue & Torrance Boulevard**
Description: **Cumulative Base**

Thru Lane: 1600 vph
Left Lane: 1600 vph
Double Lt Penalty: 20 %
ITS: 0 %
OLA Movements :
FF Movements:

N-S Split Phase : N
E-W Split Phase : N
Lost Time (% of cycle) : 10
V/C Round Off (decs.) : 3

Date/Time: **AM PEAK HOUR**

APPROACH	MVMT	LANES	VOLUME	CAPACITY	V/C	ICU ANALYSIS	
Southbound	RT	1.00	45	1,600	0.023	N-S(1):	0.274 *
	TH	2.00	264	3,200	0.083	N-S(2):	0.091
	LT	1.00	120	1,600	0.075 *	E-W(1):	0.061
Westbound	RT	1.00	168	1,600	0.068 *	E-W(2):	0.077 *
	TH	2.00	57	3,200	0.018		
	LT	1.00	83	1,600	0.052	V/C:	0.351
Northbound	RT	1.00	159	1,600	0.073	Lost Time:	0.100
	TH	2.00	637	3,200	0.199 *	ITS:	0.000
	LT	1.00	12	1,600	0.008		
Eastbound	RT	1.00	9	1,600	0.002	ICU:	0.451
	TH	2.00	29	3,200	0.009		
	LT	1.00	15	1,600	0.009 *	LOS:	A

Date/Time: **PM PEAK HOUR**

APPROACH	MVMT	LANES	VOLUME	CAPACITY	V/C	ICU ANALYSIS	
Southbound	RT	1.00	56	1,600	0.035	N-S(1):	0.257 *
	TH	2.00	683	3,200	0.213	N-S(2):	0.231
	LT	1.00	201	1,600	0.126 *	E-W(1):	0.093
Westbound	RT	1.00	200	1,600	0.125 *	E-W(2):	0.152 *
	TH	2.00	117	3,200	0.037		
	LT	1.00	100	1,600	0.063	V/C:	0.409
Northbound	RT	1.00	118	1,600	0.074	Lost Time:	0.100
	TH	2.00	418	3,200	0.131 *	ITS:	0.000
	LT	1.00	28	1,600	0.018		
Eastbound	RT	1.00	26	1,600	0.016	ICU:	0.509
	TH	2.00	95	3,200	0.030		
	LT	1.00	43	1,600	0.027 *	LOS:	A

* - Denotes critical movement

Project Title: **Catalina Village**
Intersection: **3 - North Catalina Avenue & Emerald Street**
Description: **Cumulative Base**

Thru Lane: 1600 vph
Left Lane: 1600 vph
Double Lt Penalty: 20 %
ITS: 0 %
OLA Movements :
FF Movements:

N-S Split Phase : N
E-W Split Phase : N
Lost Time (% of cycle) : 10
V/C Round Off (decs.) : 3

Date/Time: **AM PEAK HOUR**

APPROACH	MVMT	LANES	VOLUME	CAPACITY	V/C	ICU ANALYSIS	
Southbound	RT	1.00	6	1,600	0.000	N-S(1):	0.292 *
	TH	2.00	348	3,200	0.109	N-S(2):	0.113
	LT	1.00	17	1,600	0.011 *	E-W(1):	0.067
Westbound	RT	0.00	34	0	0.000	E-W(2):	0.070 *
	TH	1.00	4	1,600	0.033 *		
	LT	0.00	15	1,600	0.009	V/C:	0.362
Northbound	RT	0.00	28	0	0.000	Lost Time:	0.100
	TH	2.00	872	3,200	0.281 *	ITS:	0.000
	LT	1.00	6	1,600	0.004		
Eastbound	RT	0.00	25	0	0.000	ICU:	0.462
	TH	1.00	9	1,600	0.058		
	LT	0.00	59	1,600	0.037 *	LOS:	A

Date/Time: **PM PEAK HOUR**

APPROACH	MVMT	LANES	VOLUME	CAPACITY	V/C	ICU ANALYSIS	
Southbound	RT	1.00	40	1,600	0.025	N-S(1):	0.225
	TH	2.00	976	3,200	0.305 *	N-S(2):	0.316 *
	LT	1.00	33	1,600	0.021	E-W(1):	0.033
Westbound	RT	0.00	19	0	0.000	E-W(2):	0.035 *
	TH	1.00	7	1,600	0.025 *		
	LT	0.00	14	1,600	0.009	V/C:	0.351
Northbound	RT	0.00	17	0	0.000	Lost Time:	0.100
	TH	2.00	637	3,200	0.204	ITS:	0.000
	LT	1.00	17	1,600	0.011 *		
Eastbound	RT	0.00	18	0	0.000	ICU:	0.451
	TH	1.00	4	1,600	0.024		
	LT	0.00	16	1,600	0.010 *	LOS:	A

* - Denotes critical movement

Project Title: **Catalina Village**
Intersection: **4 - North Catalina Avenue & Diamond Street**
Description: **Cumulative Base**

Thru Lane:	1600 vph	N-S Split Phase :	N
Left Lane:	1600 vph	E-W Split Phase :	N
Double Lt Penalty:	20 %	Lost Time (% of cycle) :	10
ITS:	0 %	V/C Round Off (decs.) :	3
OLA Movements :			
FF Movements:			

Date/Time: **AM PEAK HOUR**

APPROACH	MVMT	LANES	VOLUME	CAPACITY	V/C	ICU ANALYSIS	
Southbound	RT	1.00	4	1,600	0.000	N-S(1):	0.296 *
	TH	2.00	341	3,200	0.107	N-S(2):	0.108
	LT	1.00	27	1,600	0.017 *	E-W(1):	0.039
Westbound	RT	0.98	54	1,571	0.026	E-W(2):	0.045 *
	TH	0.02	1	29	0.034 *		
	LT	1.00	30	1,600	0.019	V/C:	0.341
Northbound	RT	1.00	65	1,600	0.031	Lost Time:	0.100
	TH	2.00	892	3,200	0.279 *	ITS:	0.000
	LT	1.00	2	1,600	0.001		
Eastbound	RT	0.00	6	0	0.000	ICU:	0.441
	TH	1.00	9	1,600	0.020		
	LT	0.00	17	1,600	0.011 *	LOS:	A

Date/Time: **PM PEAK HOUR**

APPROACH	MVMT	LANES	VOLUME	CAPACITY	V/C	ICU ANALYSIS	
Southbound	RT	1.00	7	1,600	0.004	N-S(1):	0.229
	TH	2.00	1,012	3,200	0.316 *	N-S(2):	0.322 *
	LT	1.00	71	1,600	0.044	E-W(1):	0.035
Westbound	RT	0.86	48	1,371	0.035	E-W(2):	0.039 *
	TH	0.14	8	229	0.035 *		
	LT	1.00	42	1,600	0.026	V/C:	0.361
Northbound	RT	1.00	48	1,600	0.030	Lost Time:	0.100
	TH	2.00	593	3,200	0.185	ITS:	0.000
	LT	1.00	10	1,600	0.006 *		
Eastbound	RT	0.00	3	0	0.000	ICU:	0.461
	TH	1.00	4	1,600	0.009		
	LT	0.00	7	1,600	0.004 *	LOS:	A

* - Denotes critical movement

Project Title: **Catalina Village**
Intersection: **5 - North Catalina Avenue & Beryl Street**
Description: **Cumulative Base**

Thru Lane:	1600 vph	N-S Split Phase :	N
Left Lane:	1600 vph	E-W Split Phase :	N
Double Lt Penalty:	20 %	Lost Time (% of cycle) :	10
ITS:	0 %	V/C Round Off (decs.) :	3
OLA Movements :			
FF Movements:			

Date/Time: **AM PEAK HOUR**

APPROACH	MVMT	LANES	VOLUME	CAPACITY	V/C	ICU ANALYSIS	
Southbound	RT	0.00	81	0	0.000	N-S(1):	0.180
	TH	2.00	273	3,200	0.111 *	N-S(2):	0.250 *
	LT	0.00	0	0	0.000	E-W(1):	0.049
Westbound	RT	1.00	8	1,600	0.005	E-W(2):	0.099 *
	TH	1.00	124	1,600	0.078 *		
	LT	1.00	26	1,600	0.016	V/C:	0.349
Northbound	RT	0.00	30	0	0.000	Lost Time:	0.100
	TH	2.00	547	3,200	0.180	ITS:	0.000
	LT	2.00	356	2,560	0.139 *		
Eastbound	RT	1.00	121	1,600	0.006	ICU:	0.449
	TH	1.00	53	1,600	0.033		
	LT	1.00	33	1,600	0.021 *	LOS:	A

Date/Time: **PM PEAK HOUR**

APPROACH	MVMT	LANES	VOLUME	CAPACITY	V/C	ICU ANALYSIS	
Southbound	RT	0.00	117	0	0.000	N-S(1):	0.119
	TH	2.00	753	3,200	0.272 *	N-S(2):	0.377 *
	LT	0.00	0	0	0.000	E-W(1):	0.194 *
Westbound	RT	1.00	15	1,600	0.009	E-W(2):	0.114
	TH	1.00	129	1,600	0.081		
	LT	1.00	41	1,600	0.026 *	V/C:	0.571
Northbound	RT	0.00	52	0	0.000	Lost Time:	0.100
	TH	2.00	329	3,200	0.119	ITS:	0.000
	LT	2.00	268	2,560	0.105 *		
Eastbound	RT	1.00	268	1,600	0.168 *	ICU:	0.671
	TH	1.00	128	1,600	0.080		
	LT	1.00	52	1,600	0.033	LOS:	B

* - Denotes critical movement

Project Title: **Catalina Village**
Intersection: **6 - Pacific Coast Highway & Herondo Street**
Description: **Cumulative Base**

Thru Lane: 1600 vph
Left Lane: 1600 vph
Double Lt Penalty: 20 %
ITS: 0 %
OLA Movements :
FF Movements:

N-S Split Phase : N
E-W Split Phase : N
Lost Time (% of cycle) : 10
V/C Round Off (decs.) : 3

Date/Time: **AM PEAK HOUR**

APPROACH	MVMT	LANES	VOLUME	CAPACITY	V/C	ICU ANALYSIS	
Southbound	RT	1.00	155	1,600	0.056	N-S(1):	0.495 *
	TH	2.00	905	3,200	0.283	N-S(2):	0.297
	LT	1.00	102	1,600	0.064 *	E-W(1):	0.263
Westbound	RT	1.00	541	1,600	0.306 *	E-W(2):	0.387 *
	TH	1.00	210	1,600	0.131		
	LT	2.00	305	2,560	0.119	V/C:	0.882
Northbound	RT	1.00	114	1,600	0.012	Lost Time:	0.100
	TH	3.00	2,068	4,800	0.431 *	ITS:	0.000
	LT	1.00	23	1,600	0.014		
Eastbound	RT	1.00	76	1,600	0.040	ICU:	0.982
	TH	1.00	231	1,600	0.144		
	LT	1.00	130	1,600	0.081 *	LOS:	E

Date/Time: **PM PEAK HOUR**

APPROACH	MVMT	LANES	VOLUME	CAPACITY	V/C	ICU ANALYSIS	
Southbound	RT	1.00	455	1,600	0.284	N-S(1):	0.393
	TH	2.00	1,574	3,200	0.492 *	N-S(2):	0.546 *
	LT	1.00	216	1,600	0.135	E-W(1):	0.310 *
Westbound	RT	1.00	246	1,600	0.154	E-W(2):	0.203
	TH	1.00	276	1,600	0.173		
	LT	2.00	304	2,560	0.119 *	V/C:	0.856
Northbound	RT	1.00	264	1,600	0.165	Lost Time:	0.100
	TH	3.00	1,237	4,800	0.258	ITS:	0.000
	LT	1.00	87	1,600	0.054 *		
Eastbound	RT	1.00	129	1,600	0.081	ICU:	0.956
	TH	1.00	306	1,600	0.191 *		
	LT	1.00	48	1,600	0.030	LOS:	E

* - Denotes critical movement

Project Title: **Catalina Village**
Intersection: **7 - Pacific Coast Highway & North Catalina Avenue**
Description: **Cumulative Base**

Thru Lane: 1600 vph
Left Lane: 1600 vph
Double Lt Penalty: 20 %
ITS: 0 %
OLA Movements :
FF Movements:

N-S Split Phase : N
E-W Split Phase : N
Lost Time (% of cycle) : 10
V/C Round Off (decs.) : 3

Date/Time: **AM PEAK HOUR**

APPROACH	MVMT	LANES	VOLUME	CAPACITY	V/C	ICU ANALYSIS	
Southbound	RT	0.00	0	0	0.000	N-S(1):	0.544 *
	TH	2.00	1,068	3,200	0.334	N-S(2):	0.338
	LT	0.00	0	0	0.000 *	E-W(1):	0.160
Westbound	RT	0.00	0	0	0.000	E-W(2):	0.202 *
	TH	0.00	0	0	0.000 *		
	LT	0.00	0	0	0.000	V/C:	0.746
Northbound	RT	0.00	0	0	0.000	Lost Time:	0.100
	TH	2.00	1,741	3,200	0.544 *	ITS:	0.000
	LT	1.00	6	1,600	0.004		
Eastbound	RT	0.01	2	12	0.160	ICU:	0.846
	TH	0.00	0	0	0.000		
	LT	1.99	516	2,550	0.202 *	LOS:	D

Date/Time: **PM PEAK HOUR**

APPROACH	MVMT	LANES	VOLUME	CAPACITY	V/C	ICU ANALYSIS	
Southbound	RT	0.00	3	0	0.000	N-S(1):	0.390
	TH	2.00	1,831	3,200	0.573 *	N-S(2):	0.586 *
	LT	0.00	0	0	0.000	E-W(1):	0.111
Westbound	RT	0.00	0	0	0.000	E-W(2):	0.138 *
	TH	0.00	0	0	0.000 *		
	LT	0.00	0	0	0.000	V/C:	0.724
Northbound	RT	0.00	0	0	0.000	Lost Time:	0.100
	TH	2.00	1,249	3,200	0.390	ITS:	0.000
	LT	1.00	21	1,600	0.013 *		
Eastbound	RT	0.11	19	172	0.111	ICU:	0.824
	TH	0.00	0	0	0.000		
	LT	1.89	335	2,423	0.138 *	LOS:	D

* - Denotes critical movement

Project Title: **Catalina Village**
Intersection: **8 - Pacific Coast Highway & Beryl Street**
Description: **Cumulative Base**

Thru Lane:	1600 vph	N-S Split Phase :	N
Left Lane:	1600 vph	E-W Split Phase :	N
Double Lt Penalty:	20 %	Lost Time (% of cycle) :	10
ITS:	0 %	V/C Round Off (decs.) :	3
OLA Movements :			
FF Movements:			

Date/Time: **AM PEAK HOUR**

APPROACH	MVMT	LANES	VOLUME	CAPACITY	V/C		ICU ANALYSIS		
Southbound	RT	0.00	35	0	0.000		N-S(1):	0.499	*
	TH	2.00	1,049	3,200	0.339		N-S(2):	0.373	
	LT	1.00	16	1,600	0.010	*	E-W(1):	0.141	*
Westbound	RT	1.00	25	1,600	0.011		E-W(2):	0.092	
	TH	1.00	119	1,600	0.074				
	LT	1.00	62	1,600	0.039	*	V/C:	0.640	
Northbound	RT	0.00	70	0	0.000		Lost Time:	0.100	
	TH	2.00	1,496	3,200	0.489	*	ITS:	0.000	
	LT	1.00	54	1,600	0.034				
Eastbound	RT	0.13	21	206	0.085		ICU:	0.740	
	TH	0.87	142	1,394	0.102	*			
	LT	1.00	29	1,600	0.018		LOS:	C	

Date/Time: **PM PEAK HOUR**

APPROACH	MVMT	LANES	VOLUME	CAPACITY	V/C		ICU ANALYSIS		
Southbound	RT	0.00	72	0	0.000		N-S(1):	0.411	
	TH	2.00	1,698	3,200	0.553	*	N-S(2):	0.586	*
	LT	1.00	39	1,600	0.024		E-W(1):	0.206	*
Westbound	RT	1.00	35	1,600	0.022		E-W(2):	0.156	
	TH	1.00	179	1,600	0.112				
	LT	1.00	61	1,600	0.038	*	V/C:	0.792	
Northbound	RT	0.00	84	0	0.000		Lost Time:	0.100	
	TH	2.00	1,153	3,200	0.387		ITS:	0.000	
	LT	1.00	52	1,600	0.033	*			
Eastbound	RT	0.13	36	215	0.168		ICU:	0.892	
	TH	0.87	232	1,385	0.168	*			
	LT	1.00	70	1,600	0.044		LOS:	D	

* - Denotes critical movement

Project Title: **Catalina Village**
Intersection: **9 - Pacific Coast Highway & Diamond Street**
Description: **Cumulative Base**

Thru Lane: 1600 vph
Left Lane: 1600 vph
Double Lt Penalty: 20 %
ITS: 0 %
OLA Movements :
FF Movements:

N-S Split Phase : N
E-W Split Phase : N
Lost Time (% of cycle) : 10
V/C Round Off (decs.) : 3

Date/Time: **AM PEAK HOUR**

APPROACH	MVMT	LANES	VOLUME	CAPACITY	V/C	ICU ANALYSIS	
Southbound	RT	1.00	38	1,600	0.011	N-S(1):	0.569 *
	TH	2.00	991	3,200	0.310	N-S(2):	0.332
	LT	1.00	56	1,600	0.035 *	E-W(1):	0.132 *
Westbound	RT	1.00	57	1,600	0.018	E-W(2):	0.081
	TH	1.00	89	1,600	0.056		
	LT	1.00	92	1,600	0.058 *	V/C:	0.701
Northbound	RT	0.00	113	0	0.000	Lost Time:	0.100
	TH	2.00	1,596	3,200	0.534 *	ITS:	0.000
	LT	1.00	35	1,600	0.022		
Eastbound	RT	1.00	24	1,600	0.004	ICU:	0.801
	TH	1.00	118	1,600	0.074 *		
	LT	1.00	40	1,600	0.025	LOS:	D

Date/Time: **PM PEAK HOUR**

APPROACH	MVMT	LANES	VOLUME	CAPACITY	V/C	ICU ANALYSIS	
Southbound	RT	1.00	35	1,600	0.022	N-S(1):	0.440
	TH	2.00	1,749	3,200	0.547 *	N-S(2):	0.563 *
	LT	1.00	64	1,600	0.040	E-W(1):	0.076 *
Westbound	RT	1.00	72	1,600	0.045	E-W(2):	0.074
	TH	1.00	82	1,600	0.051		
	LT	1.00	40	1,600	0.025 *	V/C:	0.639
Northbound	RT	0.00	54	0	0.000	Lost Time:	0.100
	TH	2.00	1,227	3,200	0.400	ITS:	0.000
	LT	1.00	26	1,600	0.016 *		
Eastbound	RT	1.00	27	1,600	0.017	ICU:	0.739
	TH	1.00	82	1,600	0.051 *		
	LT	1.00	37	1,600	0.023	LOS:	C

* - Denotes critical movement

Project Title: **Catalina Village**
Intersection: **10 - Pacific Coast Highway & Emerald Street**
Description: **Cumulative Base**

Thru Lane:	1600 vph	N-S Split Phase :	N
Left Lane:	1600 vph	E-W Split Phase :	N
Double Lt Penalty:	20 %	Lost Time (% of cycle) :	10
ITS:	0 %	V/C Round Off (decs.) :	3
OLA Movements :			
FF Movements:			

Date/Time: **AM PEAK HOUR**

APPROACH	MVMT	LANES	VOLUME	CAPACITY	V/C	ICU ANALYSIS	
Southbound	RT	0.00	14	0	0.000	N-S(1):	0.540 *
	TH	2.00	998	3,200	0.316	N-S(2):	0.349
	LT	1.00	43	1,600	0.027 *	E-W(1):	0.072
Westbound	RT	0.00	83	0	0.000	E-W(2):	0.114 *
	TH	1.00	63	1,600	0.111 *		
	LT	0.00	31	1,600	0.019	V/C:	0.654
Northbound	RT	0.00	35	0	0.000	Lost Time:	0.100
	TH	2.00	1,605	3,200	0.513 *	ITS:	0.000
	LT	1.00	53	1,600	0.033		
Eastbound	RT	0.00	27	0	0.000	ICU:	0.754
	TH	1.00	53	1,600	0.053		
	LT	0.00	4	1,600	0.003 *	LOS:	C

Date/Time: **PM PEAK HOUR**

APPROACH	MVMT	LANES	VOLUME	CAPACITY	V/C	ICU ANALYSIS	
Southbound	RT	0.00	22	0	0.000	N-S(1):	0.461
	TH	2.00	1,600	3,200	0.507 *	N-S(2):	0.526 *
	LT	1.00	109	1,600	0.068	E-W(1):	0.056 *
Westbound	RT	0.00	41	0	0.000	E-W(2):	0.051
	TH	1.00	26	1,600	0.045		
	LT	0.00	5	1,600	0.003 *	V/C:	0.582
Northbound	RT	0.00	29	0	0.000	Lost Time:	0.100
	TH	2.00	1,229	3,200	0.393	ITS:	0.000
	LT	1.00	30	1,600	0.019 *		
Eastbound	RT	0.00	23	0	0.000	ICU:	0.682
	TH	1.00	52	1,600	0.053 *		
	LT	0.00	9	1,600	0.006	LOS:	B

* - Denotes critical movement

Project Title: Catalina Village
Intersection: 11 - Pacific Coast Highway & Torrance Boulevard
Description: Cumulative Base

Thru Lane: 1600 vph
Left Lane: 1600 vph
Double Lt Penalty: 20 %
ITS: 0 %
OLA Movements :
FF Movements:

N-S Split Phase : N
E-W Split Phase : N
Lost Time (% of cycle) : 10
V/C Round Off (decs.) : 3

Date/Time: **AM PEAK HOUR**

APPROACH	MVMT	LANES	VOLUME	CAPACITY	V/C	ICU ANALYSIS	
Southbound	RT	0.00	27	0	0.000	N-S(1):	0.564 *
	TH	2.00	845	3,200	0.273	N-S(2):	0.302
	LT	1.00	211	1,600	0.132 *	E-W(1):	0.188 *
Westbound	RT	1.00	275	1,600	0.106	E-W(2):	0.145
	TH	2.00	367	3,200	0.115		
	LT	1.00	127	1,600	0.079 *	V/C:	0.752
Northbound	RT	0.00	75	0	0.000	Lost Time:	0.100
	TH	2.00	1,306	3,200	0.432 *	ITS:	0.000
	LT	1.00	47	1,600	0.029		
Eastbound	RT	0.00	28	0	0.000	ICU:	0.852
	TH	2.00	320	3,200	0.109 *		
	LT	1.00	48	1,600	0.030	LOS:	D

Date/Time: **PM PEAK HOUR**

APPROACH	MVMT	LANES	VOLUME	CAPACITY	V/C	ICU ANALYSIS	
Southbound	RT	0.00	34	0	0.000	N-S(1):	0.486 *
	TH	2.00	1,310	3,200	0.420	N-S(2):	0.458
	LT	1.00	270	1,600	0.169 *	E-W(1):	0.242 *
Westbound	RT	1.00	284	1,600	0.178	E-W(2):	0.215
	TH	2.00	509	3,200	0.159		
	LT	1.00	140	1,600	0.088 *	V/C:	0.728
Northbound	RT	0.00	85	0	0.000	Lost Time:	0.100
	TH	2.00	928	3,200	0.317 *	ITS:	0.000
	LT	1.00	61	1,600	0.038		
Eastbound	RT	0.00	74	0	0.000	ICU:	0.828
	TH	2.00	418	3,200	0.154 *		
	LT	1.00	59	1,600	0.037	LOS:	D

* - Denotes critical movement

CUMULATIVE PLUS PROJECT

Project Title: **Catalina Village**
Intersection: **1 - South Catalina Avenue & Torrance Boulevard**
Description: **Cumulative + Project**

Thru Lane:	1600 vph	N-S Split Phase :	N
Left Lane:	1600 vph	E-W Split Phase :	N
Double Lt Penalty:	20 %	Lost Time (% of cycle) :	10
ITS:	0 %	V/C Round Off (decs.) :	3
OLA Movements :			
FF Movements:			

Date/Time: **AM PEAK HOUR**

APPROACH	MVMT	LANES	VOLUME	CAPACITY	V/C		ICU ANALYSIS		
Southbound	RT	1.00	45	1,600	0.023		N-S(1):	0.275	*
	TH	2.00	266	3,200	0.083		N-S(2):	0.091	
	LT	1.00	120	1,600	0.075	*	E-W(1):	0.061	
Westbound	RT	1.00	179	1,600	0.074	*	E-W(2):	0.083	*
	TH	2.00	57	3,200	0.018				
	LT	1.00	83	1,600	0.052		V/C:	0.358	
Northbound	RT	1.00	159	1,600	0.073		Lost Time:	0.100	
	TH	2.00	639	3,200	0.200	*	ITS:	0.000	
	LT	1.00	12	1,600	0.008				
Eastbound	RT	1.00	9	1,600	0.002		ICU:	0.458	
	TH	2.00	29	3,200	0.009				
	LT	1.00	15	1,600	0.009	*	LOS:	A	

Date/Time: **PM PEAK HOUR**

APPROACH	MVMT	LANES	VOLUME	CAPACITY	V/C		ICU ANALYSIS		
Southbound	RT	1.00	56	1,600	0.035		N-S(1):	0.257	*
	TH	2.00	684	3,200	0.214		N-S(2):	0.232	
	LT	1.00	201	1,600	0.126	*	E-W(1):	0.093	
Westbound	RT	1.00	208	1,600	0.130	*	E-W(2):	0.157	*
	TH	2.00	117	3,200	0.037				
	LT	1.00	100	1,600	0.063		V/C:	0.414	
Northbound	RT	1.00	118	1,600	0.074		Lost Time:	0.100	
	TH	2.00	420	3,200	0.131	*	ITS:	0.000	
	LT	1.00	28	1,600	0.018				
Eastbound	RT	1.00	26	1,600	0.016		ICU:	0.514	
	TH	2.00	95	3,200	0.030				
	LT	1.00	43	1,600	0.027	*	LOS:	A	

* - Denotes critical movement

Project Title: **Catalina Village**
Intersection: **3 - North Catalina Avenue & Emerald Street**
Description: **Cumulative + Project**

Thru Lane: 1600 vph
Left Lane: 1600 vph
Double Lt Penalty: 20 %
ITS: 0 %
OLA Movements :
FF Movements:

N-S Split Phase : N
E-W Split Phase : N
Lost Time (% of cycle) : 10
V/C Round Off (decs.) : 3

Date/Time: **AM PEAK HOUR**

APPROACH	MVMT	LANES	VOLUME	CAPACITY	V/C	ICU ANALYSIS	
Southbound	RT	1.00	6	1,600	0.000	N-S(1):	0.296 *
	TH	2.00	354	3,200	0.111	N-S(2):	0.115
	LT	1.00	17	1,600	0.011 *	E-W(1):	0.069
Westbound	RT	0.00	76	0	0.000	E-W(2):	0.098 *
	TH	1.00	4	1,600	0.061 *		
	LT	0.00	17	1,600	0.011	V/C:	0.394
Northbound	RT	0.00	28	0	0.000	Lost Time:	0.100
	TH	2.00	885	3,200	0.285 *	ITS:	0.000
	LT	1.00	6	1,600	0.004		
Eastbound	RT	0.00	25	0	0.000	ICU:	0.494
	TH	1.00	9	1,600	0.058		
	LT	0.00	59	1,600	0.037 *	LOS:	A

Date/Time: **PM PEAK HOUR**

APPROACH	MVMT	LANES	VOLUME	CAPACITY	V/C	ICU ANALYSIS	
Southbound	RT	1.00	40	1,600	0.025	N-S(1):	0.228
	TH	2.00	980	3,200	0.306 *	N-S(2):	0.317 *
	LT	1.00	33	1,600	0.021	E-W(1):	0.033
Westbound	RT	0.00	48	0	0.000	E-W(2):	0.054 *
	TH	1.00	7	1,600	0.044 *		
	LT	0.00	15	1,600	0.009	V/C:	0.371
Northbound	RT	0.00	17	0	0.000	Lost Time:	0.100
	TH	2.00	646	3,200	0.207	ITS:	0.000
	LT	1.00	17	1,600	0.011 *		
Eastbound	RT	0.00	18	0	0.000	ICU:	0.471
	TH	1.00	4	1,600	0.024		
	LT	0.00	16	1,600	0.010 *	LOS:	A

* - Denotes critical movement

Project Title: **Catalina Village**
Intersection: **4 - North Catalina Avenue & Diamond Street**
Description: **Cumulative + Project**

Thru Lane: 1600 vph
Left Lane: 1600 vph
Double Lt Penalty: 20 %
ITS: 0 %
OLA Movements :
FF Movements:

N-S Split Phase : N
E-W Split Phase : N
Lost Time (% of cycle) : 10
V/C Round Off (decs.) : 3

Date/Time: **AM PEAK HOUR**

APPROACH	MVMT	LANES	VOLUME	CAPACITY	V/C	ICU ANALYSIS	
Southbound	RT	1.00	4	1,600	0.000	N-S(1):	0.316 *
	TH	2.00	347	3,200	0.108	N-S(2):	0.109
	LT	1.00	40	1,600	0.025 *	E-W(1):	0.039
Westbound	RT	0.98	54	1,571	0.022	E-W(2):	0.045 *
	TH	0.02	1	29	0.034 *		
	LT	1.00	30	1,600	0.019	V/C:	0.361
Northbound	RT	1.00	85	1,600	0.044	Lost Time:	0.100
	TH	2.00	932	3,200	0.291 *	ITS:	0.000
	LT	1.00	2	1,600	0.001		
Eastbound	RT	0.00	6	0	0.000	ICU:	0.461
	TH	1.00	9	1,600	0.020		
	LT	0.00	17	1,600	0.011 *	LOS:	A

Date/Time: **PM PEAK HOUR**

APPROACH	MVMT	LANES	VOLUME	CAPACITY	V/C	ICU ANALYSIS	
Southbound	RT	1.00	7	1,600	0.004	N-S(1):	0.242
	TH	2.00	1,016	3,200	0.318 *	N-S(2):	0.324 *
	LT	1.00	80	1,600	0.050	E-W(1):	0.035
Westbound	RT	0.86	48	1,371	0.035	E-W(2):	0.039 *
	TH	0.14	8	229	0.035 *		
	LT	1.00	42	1,600	0.026	V/C:	0.363
Northbound	RT	1.00	58	1,600	0.036	Lost Time:	0.100
	TH	2.00	614	3,200	0.192	ITS:	0.000
	LT	1.00	10	1,600	0.006 *		
Eastbound	RT	0.00	3	0	0.000	ICU:	0.463
	TH	1.00	4	1,600	0.009		
	LT	0.00	7	1,600	0.004 *	LOS:	A

* - Denotes critical movement

Project Title: **Catalina Village**
Intersection: **5 - North Catalina Avenue & Beryl Street**
Description: **Cumulative + Project**

Thru Lane: 1600 vph
Left Lane: 1600 vph
Double Lt Penalty: 20 %
ITS: 0 %
OLA Movements :
FF Movements:

N-S Split Phase : N
E-W Split Phase : N
Lost Time (% of cycle) : 10
V/C Round Off (decs.) : 3

Date/Time: **AM PEAK HOUR**

APPROACH	MVMT	LANES	VOLUME	CAPACITY	V/C	ICU ANALYSIS	
Southbound	RT	0.00	81	0	0.000	N-S(1):	0.191
	TH	2.00	287	3,200	0.115 *	N-S(2):	0.256 *
	LT	0.00	0	0	0.000	E-W(1):	0.049
Westbound	RT	1.00	8	1,600	0.005	E-W(2):	0.099 *
	TH	1.00	124	1,600	0.078 *		
	LT	1.00	26	1,600	0.016	V/C:	0.355
Northbound	RT	0.00	34	0	0.000	Lost Time:	0.100
	TH	2.00	577	3,200	0.191	ITS:	0.000
	LT	2.00	362	2,560	0.141 *		
Eastbound	RT	1.00	127	1,600	0.009	ICU:	0.455
	TH	1.00	53	1,600	0.033		
	LT	1.00	33	1,600	0.021 *	LOS:	A

Date/Time: **PM PEAK HOUR**

APPROACH	MVMT	LANES	VOLUME	CAPACITY	V/C	ICU ANALYSIS	
Southbound	RT	0.00	117	0	0.000	N-S(1):	0.125
	TH	2.00	763	3,200	0.275 *	N-S(2):	0.381 *
	LT	0.00	0	0	0.000	E-W(1):	0.196 *
Westbound	RT	1.00	15	1,600	0.009	E-W(2):	0.114
	TH	1.00	129	1,600	0.081		
	LT	1.00	41	1,600	0.026 *	V/C:	0.577
Northbound	RT	0.00	54	0	0.000	Lost Time:	0.100
	TH	2.00	345	3,200	0.125	ITS:	0.000
	LT	2.00	271	2,560	0.106 *		
Eastbound	RT	1.00	272	1,600	0.170 *	ICU:	0.677
	TH	1.00	128	1,600	0.080		
	LT	1.00	52	1,600	0.033	LOS:	B

* - Denotes critical movement

Project Title: **Catalina Village**
Intersection: **6 - Pacific Coast Highway & Herondo Street**
Description: **Cumulative + Project**

Thru Lane: 1600 vph
Left Lane: 1600 vph
Double Lt Penalty: 20 %
ITS: 0 %
OLA Movements :
FF Movements:

N-S Split Phase : N
E-W Split Phase : N
Lost Time (% of cycle) : 10
V/C Round Off (decs.) : 3

Date/Time: **AM PEAK HOUR**

APPROACH	MVMT	LANES	VOLUME	CAPACITY	V/C	ICU ANALYSIS	
Southbound	RT	1.00	160	1,600	0.059	N-S(1):	0.497 *
	TH	2.00	910	3,200	0.284	N-S(2):	0.298
	LT	1.00	102	1,600	0.064 *	E-W(1):	0.270
Westbound	RT	1.00	541	1,600	0.306 *	E-W(2):	0.387 *
	TH	1.00	210	1,600	0.131		
	LT	2.00	323	2,560	0.126	V/C:	0.884
Northbound	RT	1.00	133	1,600	0.020	Lost Time:	0.100
	TH	3.00	2,079	4,800	0.433 *	ITS:	0.000
	LT	1.00	23	1,600	0.014		
Eastbound	RT	1.00	76	1,600	0.040	ICU:	0.984
	TH	1.00	231	1,600	0.144		
	LT	1.00	130	1,600	0.081 *	LOS:	E

Date/Time: **PM PEAK HOUR**

APPROACH	MVMT	LANES	VOLUME	CAPACITY	V/C	ICU ANALYSIS	
Southbound	RT	1.00	458	1,600	0.286	N-S(1):	0.394
	TH	2.00	1,577	3,200	0.493 *	N-S(2):	0.547 *
	LT	1.00	216	1,600	0.135	E-W(1):	0.314 *
Westbound	RT	1.00	246	1,600	0.154	E-W(2):	0.203
	TH	1.00	276	1,600	0.173		
	LT	2.00	316	2,560	0.123 *	V/C:	0.861
Northbound	RT	1.00	274	1,600	0.171	Lost Time:	0.100
	TH	3.00	1,243	4,800	0.259	ITS:	0.000
	LT	1.00	87	1,600	0.054 *		
Eastbound	RT	1.00	129	1,600	0.081	ICU:	0.961
	TH	1.00	306	1,600	0.191 *		
	LT	1.00	48	1,600	0.030	LOS:	E

* - Denotes critical movement

Project Title: Catalina Village
Intersection: 7 - Pacific Coast Highway & North Catalina Avenue
Description: Cumulative + Project

Thru Lane:	1600 vph	N-S Split Phase :	N
Left Lane:	1600 vph	E-W Split Phase :	N
Double Lt Penalty:	20 %	Lost Time (% of cycle) :	10
ITS:	0 %	V/C Round Off (decs.) :	3
OLA Movements :			
FF Movements:			

Date/Time: **AM PEAK HOUR**

APPROACH	MVMT	LANES	VOLUME	CAPACITY	V/C	ICU ANALYSIS	
Southbound	RT	0.00	0	0	0.000	N-S(1):	0.544 *
	TH	2.00	1,082	3,200	0.338	N-S(2):	0.342
	LT	0.00	0	0	0.000 *	E-W(1):	0.169
Westbound	RT	0.00	0	0	0.000	E-W(2):	0.214 *
	TH	0.00	0	0	0.000 *		
	LT	0.00	0	0	0.000	V/C:	0.758
Northbound	RT	0.00	0	0	0.000	Lost Time:	0.100
	TH	2.00	1,741	3,200	0.544 *	ITS:	0.000
	LT	1.00	6	1,600	0.004		
Eastbound	RT	0.01	2	12	0.169	ICU:	0.858
	TH	0.00	0	0	0.000		
	LT	1.99	546	2,551	0.214 *	LOS:	D

Date/Time: **PM PEAK HOUR**

APPROACH	MVMT	LANES	VOLUME	CAPACITY	V/C	ICU ANALYSIS	
Southbound	RT	0.00	3	0	0.000	N-S(1):	0.390
	TH	2.00	1,841	3,200	0.576 *	N-S(2):	0.589 *
	LT	0.00	0	0	0.000	E-W(1):	0.116
Westbound	RT	0.00	0	0	0.000	E-W(2):	0.145 *
	TH	0.00	0	0	0.000 *		
	LT	0.00	0	0	0.000	V/C:	0.734
Northbound	RT	0.00	0	0	0.000	Lost Time:	0.100
	TH	2.00	1,249	3,200	0.390	ITS:	0.000
	LT	1.00	21	1,600	0.013 *		
Eastbound	RT	0.10	19	164	0.116	ICU:	0.834
	TH	0.00	0	0	0.000		
	LT	1.90	351	2,429	0.145 *	LOS:	D

* - Denotes critical movement

Project Title: **Catalina Village**
Intersection: **8 - Pacific Coast Highway & Beryl Street**
Description: **Cumulative + Project**

Thru Lane:	1600 vph	N-S Split Phase :	N
Left Lane:	1600 vph	E-W Split Phase :	N
Double Lt Penalty:	20 %	Lost Time (% of cycle) :	10
ITS:	0 %	V/C Round Off (decs.) :	3
OLA Movements :			
FF Movements:			

Date/Time: **AM PEAK HOUR**

APPROACH	MVMT	LANES	VOLUME	CAPACITY	V/C	ICU ANALYSIS	
Southbound	RT	0.00	35	0	0.000	N-S(1):	0.499 *
	TH	2.00	1,063	3,200	0.343	N-S(2):	0.377
	LT	1.00	16	1,600	0.010 *	E-W(1):	0.145 *
Westbound	RT	1.00	25	1,600	0.011	E-W(2):	0.092
	TH	1.00	119	1,600	0.074		
	LT	1.00	66	1,600	0.041 *	V/C:	0.644
Northbound	RT	0.00	70	0	0.000	Lost Time:	0.100
	TH	2.00	1,496	3,200	0.489 *	ITS:	0.000
	LT	1.00	54	1,600	0.034		
Eastbound	RT	0.13	21	201	0.088	ICU:	0.744
	TH	0.87	146	1,399	0.104 *		
	LT	1.00	29	1,600	0.018	LOS:	C

Date/Time: **PM PEAK HOUR**

APPROACH	MVMT	LANES	VOLUME	CAPACITY	V/C	ICU ANALYSIS	
Southbound	RT	0.00	72	0	0.000	N-S(1):	0.411
	TH	2.00	1,708	3,200	0.556 *	N-S(2):	0.589 *
	LT	1.00	39	1,600	0.024	E-W(1):	0.209 *
Westbound	RT	1.00	35	1,600	0.022	E-W(2):	0.156
	TH	1.00	179	1,600	0.112		
	LT	1.00	64	1,600	0.040 *	V/C:	0.798
Northbound	RT	0.00	84	0	0.000	Lost Time:	0.100
	TH	2.00	1,153	3,200	0.387	ITS:	0.000
	LT	1.00	52	1,600	0.033 *		
Eastbound	RT	0.13	36	213	0.169	ICU:	0.898
	TH	0.87	234	1,387	0.169 *		
	LT	1.00	70	1,600	0.044	LOS:	D

* - Denotes critical movement

Project Title: **Catalina Village**
Intersection: **9 - Pacific Coast Highway & Diamond Street**
Description: **Cumulative + Project**

Thru Lane:	1600 vph	N-S Split Phase :	N
Left Lane:	1600 vph	E-W Split Phase :	N
Double Lt Penalty:	20 %	Lost Time (% of cycle) :	10
ITS:	0 %	V/C Round Off (decs.) :	3
OLA Movements :			
FF Movements:			

Date/Time: **AM PEAK HOUR**

APPROACH	MVMT	LANES	VOLUME	CAPACITY	V/C		ICU ANALYSIS		
Southbound	RT	1.00	40	1,600	0.013		N-S(1):	0.569	*
	TH	2.00	1,007	3,200	0.315		N-S(2):	0.337	
	LT	1.00	56	1,600	0.035	*	E-W(1):	0.135	*
Westbound	RT	1.00	57	1,600	0.018		E-W(2):	0.081	
	TH	1.00	89	1,600	0.056				
	LT	1.00	95	1,600	0.059	*	V/C:	0.704	
Northbound	RT	0.00	113	0	0.000		Lost Time:	0.100	
	TH	2.00	1,596	3,200	0.534	*	ITS:	0.000	
	LT	1.00	35	1,600	0.022				
Eastbound	RT	1.00	38	1,600	0.013		ICU:	0.804	
	TH	1.00	122	1,600	0.076	*			
	LT	1.00	40	1,600	0.025		LOS:	D	

Date/Time: **PM PEAK HOUR**

APPROACH	MVMT	LANES	VOLUME	CAPACITY	V/C		ICU ANALYSIS		
Southbound	RT	1.00	36	1,600	0.023		N-S(1):	0.440	
	TH	2.00	1,760	3,200	0.550	*	N-S(2):	0.566	*
	LT	1.00	64	1,600	0.040		E-W(1):	0.079	*
Westbound	RT	1.00	72	1,600	0.045		E-W(2):	0.074	
	TH	1.00	82	1,600	0.051				
	LT	1.00	42	1,600	0.026	*	V/C:	0.645	
Northbound	RT	0.00	54	0	0.000		Lost Time:	0.100	
	TH	2.00	1,227	3,200	0.400		ITS:	0.000	
	LT	1.00	26	1,600	0.016	*			
Eastbound	RT	1.00	34	1,600	0.021		ICU:	0.745	
	TH	1.00	84	1,600	0.053	*			
	LT	1.00	37	1,600	0.023		LOS:	C	

* - Denotes critical movement

Project Title: **Catalina Village**
Intersection: **10 - Pacific Coast Highway & Emerald Street**
Description: **Cumulative + Project**

Thru Lane: 1600 vph
Left Lane: 1600 vph
Double Lt Penalty: 20 %
ITS: 0 %
OLA Movements :
FF Movements:

N-S Split Phase : N
E-W Split Phase : N
Lost Time (% of cycle) : 10
V/C Round Off (decs.) : 3

Date/Time: **AM PEAK HOUR**

APPROACH	MVMT	LANES	VOLUME	CAPACITY	V/C	ICU ANALYSIS	
Southbound	RT	0.00	33	0	0.000	N-S(1):	0.541 *
	TH	2.00	1,010	3,200	0.326	N-S(2):	0.359
	LT	1.00	45	1,600	0.028 *	E-W(1):	0.072
Westbound	RT	0.00	83	0	0.000	E-W(2):	0.115 *
	TH	1.00	65	1,600	0.112 *		
	LT	0.00	31	1,600	0.019	V/C:	0.656
Northbound	RT	0.00	35	0	0.000	Lost Time:	0.100
	TH	2.00	1,605	3,200	0.513 *	ITS:	0.000
	LT	1.00	53	1,600	0.033		
Eastbound	RT	0.00	27	0	0.000	ICU:	0.756
	TH	1.00	53	1,600	0.053		
	LT	0.00	4	1,600	0.003 *	LOS:	C

Date/Time: **PM PEAK HOUR**

APPROACH	MVMT	LANES	VOLUME	CAPACITY	V/C	ICU ANALYSIS	
Southbound	RT	0.00	35	0	0.000	N-S(1):	0.462
	TH	2.00	1,606	3,200	0.513 *	N-S(2):	0.532 *
	LT	1.00	110	1,600	0.069	E-W(1):	0.056 *
Westbound	RT	0.00	41	0	0.000	E-W(2):	0.052
	TH	1.00	27	1,600	0.046		
	LT	0.00	5	1,600	0.003 *	V/C:	0.588
Northbound	RT	0.00	29	0	0.000	Lost Time:	0.100
	TH	2.00	1,229	3,200	0.393	ITS:	0.000
	LT	1.00	30	1,600	0.019 *		
Eastbound	RT	0.00	23	0	0.000	ICU:	0.688
	TH	1.00	52	1,600	0.053 *		
	LT	0.00	9	1,600	0.006	LOS:	B

* - Denotes critical movement

Project Title: **Catalina Village**
Intersection: **11 - Pacific Coast Highway & Torrance Boulevard**
Description: **Cumulative + Project**

Thru Lane:	1600 vph	N-S Split Phase :	N
Left Lane:	1600 vph	E-W Split Phase :	N
Double Lt Penalty:	20 %	Lost Time (% of cycle) :	10
ITS:	0 %	V/C Round Off (decs.) :	3
OLA Movements :			
FF Movements:			

Date/Time: **AM PEAK HOUR**

APPROACH	MVMT	LANES	VOLUME	CAPACITY	V/C		ICU ANALYSIS		
Southbound	RT	0.00	27	0	0.000		N-S(1):	0.570	*
	TH	2.00	847	3,200	0.273		N-S(2):	0.304	
	LT	1.00	221	1,600	0.138	*	E-W(1):	0.188	*
Westbound	RT	1.00	275	1,600	0.103		E-W(2):	0.148	
	TH	2.00	376	3,200	0.118				
	LT	1.00	127	1,600	0.079	*	V/C:	0.758	
Northbound	RT	0.00	75	0	0.000		Lost Time:	0.100	
	TH	2.00	1,306	3,200	0.432	*	ITS:	0.000	
	LT	1.00	49	1,600	0.031				
Eastbound	RT	0.00	28	0	0.000		ICU:	0.858	
	TH	2.00	320	3,200	0.109	*			
	LT	1.00	48	1,600	0.030		LOS:	D	

Date/Time: **PM PEAK HOUR**

APPROACH	MVMT	LANES	VOLUME	CAPACITY	V/C		ICU ANALYSIS		
Southbound	RT	0.00	34	0	0.000		N-S(1):	0.489	*
	TH	2.00	1,311	3,200	0.420		N-S(2):	0.459	
	LT	1.00	275	1,600	0.172	*	E-W(1):	0.242	*
Westbound	RT	1.00	284	1,600	0.178		E-W(2):	0.215	
	TH	2.00	515	3,200	0.161				
	LT	1.00	140	1,600	0.088	*	V/C:	0.731	
Northbound	RT	0.00	85	0	0.000		Lost Time:	0.100	
	TH	2.00	928	3,200	0.317	*	ITS:	0.000	
	LT	1.00	63	1,600	0.039				
Eastbound	RT	0.00	74	0	0.000		ICU:	0.831	
	TH	2.00	418	3,200	0.154	*			
	LT	1.00	59	1,600	0.037		LOS:	D	

* - Denotes critical movement