City of Seal Beach

TRANSPORTATION ANALYSIS GUIDELINES

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Contents

TRANSPORTATION ANALYSIS OVERVIEW

Transportation Analysis of proposed projects in the City of Seal Beach includes A) operational analysis of the project impact of parking, site access, and intersection operations consistent with the City's General Plan; and B) environmental assessment consistent with the California Environmental Quality Act (CEQA). Not all projects are subject to these analyses and the requirement parameters are described in these guidelines. Questions regarding traffic impact studies or environmental transportation assessment should be directed to the City Engineer or designee at (562) 431-2527.

These guidelines are organized into two sections:

A. **Traffic Impact Study Guidelines** are conducted to ensure projects meet City requirements for parking, site access, and intersection operations.

B. **CEQA Transportation Assessment Guidelines** for projects required to perform environmental assessment for transportation impacts of vehicle miles traveled to promote state goals of the reduction of greenhouse gas emissions, the development of multimodal transportation networks, and a diversity of land uses.

A TRAFFIC IMPACT STUDY GUIDELINES

Traffic Impact Studies are conducted to ensure projects meet City requirements for parking, site access and intersection operations.

The following are minimum requirements for a Traffic Impact Study for submittal to the City of Seal Beach, California. In order to maintain consistency with the traffic reports submitted by various applicants, these requirements must be fulfilled in addition to any other special requirements, as will be discussed later in this document, before a Traffic Study Report can be reviewed and/or accepted by the City. While a considerable amount of details are presented below, the following will serve as a general overview of the City's current Traffic Study Report requirements. The City reserves the right to modify these guidelines as necessary.

The City Engineer or designee, in conjunction with these guidelines, will make a determination on the need for a Traffic Impact Study. Once this need is determined, the City will formally notify the applicant. At this point, the applicant is required to have a professional Traffic Engineer conduct the traffic study and prepare the report.

Once a Traffic Engineer has been selected, the selected Traffic Engineer shall contact the City Engineer or designee at (562) 431-2527 to define the scope and the parameters of the traffic study. Any special requirements and elements to be studied beyond the scope of the minimum requirements will be determined at this point. These minimum requirements must be met before the report is deemed complete.

WHEN IS A TRAFFIC IMPACT STUDY REQUIRED?

The determination of whether a Traffic Impact Study will be required is based on five basic factors. These factors are:

1) A Traffic Impact Study (TIS) is required for new developments or for the expansion of existing developments which are forecast to generate a minimum of 50 vehicles per hour (total two-way) during the greater of the A.M. or P.M. peak hours. In general, this lower limit includes:
   - Single family residential developments of 20 or more dwellings.
   - Multi-family residential developments of 30 or more dwellings.
   - Commercial developments of 5,000 square feet or more building area. All commercial developments, regardless of size, which include any type of restaurant, will require a TIS.
   - Office developments and industrial developments of 5,000 square feet or more.
   - All mixed use developments.
   - All car washes of any type.
   - Gas stations/convenience stores.

2) A TIS will also be required for all developments, regardless of size, located within

300 feet of the intersection of two arterial streets as defined in the General Plan or for any developments fronting on two different streets, regardless of classification.

3) The presence of an existing or future traffic safety problem will require a TIS.

4) The location of the developments in an environmentally or otherwise sensitive area, or in an area that generates controversy will require a TIS.

5) The presence of a near-by sub-standard intersection or street will require a TIS. The sub-standard condition is normally considered to be level of service “D” or worse.

Other developments at or below these thresholds may be required by the City Engineer or designee to submit a letter analysis.

TYPICAL TRAFFIC IMPACT STUDY OUTLINE

Each Traffic Impact Study submitted to the City of Seal Beach shall contain each of the following elements unless the topic is entirely not applicable:

1) Executive Summary
2) Introduction
3) Area Development
4) Existing Street Systems
5) Project Description and Location
6) Traffic Generation Forecast
7) Traffic Distribution and Assignment
8) Traffic Impact Study
9) On-Site Parking and Circulation
10) Truck Service Impacts
11) Active Transportation Impacts
12) Transit Impacts
13) Construction Period Impacts
14) Mitigation Measures

Detailed descriptions of the above elements are presented below.

Executive Summary

This portion of the report should present factual and concise information relative to the major issues. Pertinent information in this regard will include a brief overview of the project, a short discussion of the projects traffic generation potential, the expected impacts of the project and a summary of measures necessary to mitigate resultant project impacts.

Introduction

A detailed description of study procedures, plus a general overview of the proposed project site and study area boundaries, existing and proposed site uses, and existing

and proposed roadways and intersections within in the defined study area (defined study area to be determined by City Engineer or designee). Exhibits required for this section includes a regional map showing the project vicinity and a site layout map.

Area Development

A specific description of existing and proposed land uses surrounding the proposed project site need to be provided. If the land uses differ from the general plan designation for a particular parcel, it needs to be indicates in this section.

Existing Transportation System

This section will contain a definition of Regional and Local access including any CMP roadway which will serve the proposed project. This includes all major access routes to the site with descriptions of the most likely routes to be utilized.

Minimum information in this section shall include generalized geometric descriptions, i.e. the particular roadway as classified by the Seal Beach General Plan with the pavement and the right-of-way widths. A description is also required of existing traffic volumes that use the particular facility (include the source of your traffic count information). The adequacy of pedestrian facilities and the accessibility of bicycles and from adjacent transit stops shall also be described.

An exhibit showing the various roadways in the study area and presenting peak hour traffic count information, as well as a table showing daily (24-hour) volumes and Master Planned roadway configurations, is required. All traffic counts used need to have been surveyed within 12 months of the traffic study completion date unless otherwise approved by the City Engineer or designee.

Project Description and Location

This section shall expand on information presented in the introduction giving a detailed development scenario and specific project location. Exhibits in this section shall include, at a minimum, a clear illustration of the project in terms of a site plan, its density, adjacent roadways, on-site parking supply, proposed traffic circulation within the project, gross square footage, number of rooms/units, phasing, and other descriptions as appropriate. Any changes in these descriptors during the permitting and construction processes will require an amendment to the study report.

Traffic Generation Forecast

The traffic generation section of the report will include trip generation estimates for the project based on standard trip generation values established by the City Engineer or designee. Typically, these values will be derived from Trip Generation, latest Edition, published by the Institute of Transportation Engineers (ITE), but can be modified if the applicant proposes specific and permanent measures to reduce the traffic generation potential of the project.

However, to achieve reductions in estimated generation factors, the applicant must describe, accurately and completely, the proposed measure, the estimated reduction in

trip generation, and the basis for the estimate. It is not sufficient to state information is based on “past studies” without first presenting and reviewing these studies with the City Engineer or designee prior to preparing the report. The applicant’s Traffic Engineer should submit the proper documentation to prove the proposed reduction.

In all cases, the generation values must be displayed in terms of A.M., P.M., and afternoon peak hour volumes as well as daily (24-hour) volumes. Some uses may require traffic counts and studies during hours other than the peak hours, as determined by the City Engineer or designee. Documented reductions to generated values as discussed above or for “passer-by” and transit trips must be presented in the generation forecast as well.

Traffic Distribution and Assignment

Traffic distribution shall be consistent with the distribution patterns currently being used in the City. On that basis, the prospective applicant should consult with the City Engineer or designee for this information particularly in regard to the different distribution patterns for uses such as commercial, industrial, and residential. The City Engineer or designee prior to starting the study must approve any deviations from this concept.

The section is to include a description of the utilization of study area roadways by site-generated traffic. An exhibit must be supplied with this section which presents projected daily link volumes between intersections, as well as morning and afternoon peak house turning movement volumes at intersections. All of this information is usually presented on two exhibits: one presenting daily link volumes between intersections; and the second illustrating morning and afternoon peak hour turning movement volumes within the study area. However, with concurrence from the City, one exhibit could be acceptable depending on the size of the report.

Traffic Impact Study

The traffic study will be the key to the report. Unless directed otherwise by the City Engineer or designee, all reports will include a study of intersection operation as well as midblock operation. The intersection analysis will be performed via the Intersection Capacity Utilization (ICU) procedure as outlined in the appendix “B” to this document. The link analysis shall follow the highway capacity manual method.

In all cases, the analysis of intersection operation must be formulated for existing conditions and existing plus project conditions. Cumulative conditions need to be addressed and will be utilized to assess impacts relative to development of additional approved or in the process of being approved projects.

Three time frames will be addressed in the traffic impact study. These are:

1) Existing year.
2) Project completion year (One for each completed phase for multi-phase project).
3) General Plan target year (20 years in the future).

Additional time frames as designated by the City Engineer or designee may be required for large multi-phased developments.

Also, a table is to be included which identifies the forecast Level of Service (LOS) for each intersection within the defined study area. This summary table shall present LOS for both the background and background plus project conditions for all scenarios.

Regardless of the location (i.e. either at or removed from the project location), specific mitigation measures must be clearly identified in the text with supporting information presented in the above table as well as on exhibits. These exhibits will show proposed lane configurations, modified right-of-way requirements, signal modifications, and other measures as required.

If the applicant wishes to propose quantifiable improvements or changes to the circulation system, which may not appear to be strictly consistent with the Circulation Element, or special assumptions as a basis for the traffic study, they shall provide a description of such proposals in writing to the City, along with supporting data justifying their use.

Unless otherwise defined by the City Engineer or designee, the following intersections will be analyzed:

- All signalized intersections within 1/2 mile of the project.
- All intersections on arterial streets within 1 mile of the project where project traffic represents 1% or more of the peak hour critical volumes entering the intersection.
- All project site driveways.

The capacity of individual lane type to be used in the ICU calculations are as shown below.

Left Turn Lanes – 1,600 vehicles per hour
Through Lanes – 1,700 vehicles per hour
Right Turn Lanes – 1,700 vehicles per hour
Shared Lanes – 1,600 vehicles per hour

Yellow clearance/lost time should always be 0.100.

Link analysis shall be performed on all sections of arterial highways and collector streets within the project area where the daily project traffic after distribution to the street system represents 1% or more of the total directional volume. For the purposes of this report, links will be started and ended at each traffic signal and project entrance. High accident locations significantly impacted by the project are to be analyzed and mitigated. For the purpose of the high accident location, the level of significance is as defined for the links and intersections.

On-Site Parking and Circulation

This section will assess the on-site vehicle and bicycle parking supply versus the parking required per City codes. If the proposed development is of mixed-use type, a table shall be included presenting each land use, its size, and the code parking requirement.

This table should clearly indicate how the code parking was calculated and include the proposed on-site parking supply together with the resultant surplus or deficit from code requirements.

Should the on-site parking supply be less than required by the City code, a detailed explanation justifying a reduction to the code requirement must be included. This does not eliminate the need for any zoning code variance.

A discussion of on/off-site circulation shall be included in this section complete with descriptions of the proposed access points, turn prohibitions, number of lanes proposed, proposed bus stop locations, bicycle facilities, sidewalks and paths, deceleration or acceleration lanes provided, turn pocket requirements, vehicle storage length requirements, and any other applicable circulation issues.

Truck Service Impacts

A discussion of on/off-site delivery truck circulation shall be included in this section complete with descriptions of the proposed access points, turn prohibitions, number of lanes proposed, deceleration or acceleration lanes provided, turn pocket requirements, vehicle storage length, most probably routes to the site requirements, and any other applicable circulation issues.

This section will also address the on-site delivery docks versus the requirement based on City code. This discussion should clearly indicate how the code requirement was calculated.

Should the number of docks be less than required by the City code, a detailed explanation justifying a reduction to the code requirement must be included. This does not eliminate the need for any zoning code variance.

Active Transportation Impacts

A discussion of bicycle and pedestrian circulation shall include how the project will affect the use, safety of, or condition of existing or planned facilities.

Transit Impacts

All transit stops within one-half mile of the project shall be described through their scheduled service, condition, and access to and from the project site.

Construction Period Impacts

This section shall include a discussion of any unusual circumstances anticipated during construction. Proposed roadway lane closures, construction signage, safety features,

and detours shall be included. The City of Seal Beach, in general, requires all lanes on arterial roads shall be open to traffic during the periods from 6 to 9 AM and 4 to 7 PM.

At no time will any street capacity be reduced or closed without written permission of the City Engineer or designee.

Mitigation Measures

All measures required to mitigate intersection or roadway links with a significant impact on the Level-of-Service or high accident rate must be presented in this section. A table presenting resultant Level-of-Service for existing plus project conditions with and without mitigation shall be included. Appropriate text along with the sketches must be provided detailing each mitigation measure assumed in the study and method(s) of implementing those measures described. Unless otherwise prescribed by the City Engineer or designee, the following increases in Intersection Capacity Utilization (ICU) shall be deemed an impact and require mitigation.

Existing ICU	Project Related Increase in ICU
0.00 – 0.69	0.06
0.70 – 0.79	0.04
0.80 – 0.89	0.02
0.90+	0.01

Unless otherwise prescribed by the City Engineer or designee, intersections or roadway links having five or more reported accidents within the most recent 12 month period within significant influence of the project shall be analyzed and will require mitigation. The level of significance is as listed above. This figure of five accidents is a generalized figure used by the City as an indication of potential problems. The requirement for mitigation will depend on the location, i.e. intersection or midblock, and configuration, i.e. roadway width, number of lanes, sight distance, signalization, and the like.

Sketches illustrating proposed mitigation must be included, either in this section, the appendix, or accompanying the report. These sketches shall include, as a minimum, the existing intersection geometrics, striping, right-of-way, building locations (as applicable), and the proposed modifications.

Recommended signal phasing shall be provided for suggested mitigation measures, which will affect existing traffic signals as well as new traffic signal locations.

It should be noted improvements necessary as a result of project-related impacts could become conditions of approval for the subject development. Improvement of the roadways adjacent to the project, to at least half-width configuration, could also be a condition of approval. Additional off-site traffic related improvements may be required as determined by the City Engineer or designee on a project by project basis.

B CEQA TRANSPORTATION ASSESSMENT GUIDELINES

CEQA Transportation Assessments are required for environmental documentation in conformance with Resources Code section 21099 directing lead agencies to use criteria for determining the significance of transportation impacts that "promote the reduction of greenhouse gas emissions, the development of multimodal transportation networks, and a diversity of land uses.

Seal Beach, as a CEQA lead agency, developed the following analysis methodology, significance thresholds, and mitigation measures to address potential significant impacts in accordance with Title 14. Natural Resources, Division 6. California Natural Resources Agency, Chapter 3. Guidelines for the Implementation of the California Environmental Quality Act.

Beginning July 1, 2020 CEQA analysis for determining potential significant transportation impacts transitioned from an automobile delay or capacity measure to a vehicle miles traveled (VMT) metric in evaluating a project's environmental impacts under CEQA as required by Senate Bill (SB) 743. This necessitated a separation of transportation analysis into two types, with section A) Traffic Impact Study Guidelines no longer applicable for CEQA analysis.

CEQA Guidelines section 15064.3 establishes VMT as the most appropriate measure of transportation impacts, shifting away from the level of service analysis that evaluated a project's impacts on traffic conditions on nearby roadways and intersections.

Section XVII of Appendix G (Environmental Checklist) includes the following transportation items to be addressed in an initial study. Would the project:

a) Conflict with a program plan, ordinance or policy addressing the circulation system, including transit, roadway, bicycle and pedestrian facilities?

b) Would the project conflict or be inconsistent with CEQA Guidelines section 15064.3, subdivision (b)(1)?

c) Substantially increase hazards due to a geometric design feature (e.g., sharp curves or dangerous intersections) or incompatible uses (e.g., farm equipment)?

d) Result in inadequate emergency access?

WHEN IS A CEQA TRANSPORTATION ASSESSMENT REQUIRED?

A CEQA Transportation Assessment is required for any project undergoing review under CEQA. A project may be presumed to be less than significant if it meets one or more screening criteria, or would require further study to determine potential significant impacts.

The four outcomes of CEQA Transportation Assessment for a project are:

1) ***Screened from Further Analysis*:** Screened from analysis and presumed to be less than significant based on screening thresholds.

2) ***Less than Significant*:** Not screened from analysis and CEQA Transportation Assessment is conducted which found the project to be less than significant.

3) ***Less than Significant After Mitigation*:** Not screened from analysis and CEQA Transportation Assessment is conducted which found the project to be potentially significant, feasible mitigation measures are applied, and the project is less than significant transportation impacts after mitigation.

4) ***Statement of Overriding Considerations*:** Not screened from analysis and CEQA Transportation Assessment is conducted which found the project to be potentially significant, feasible mitigation measures are applied and a project cannot achieve less than significant transportation impacts after mitigation and a Statement of Overriding Considerations is approved.

CEQA ASSESSMENT FRAMEWORK

CEQA transportation analysis in the City is focused on the impact of automobile and light truck VMT from residents and employees. Project will be analyzed for the entire VMT of their trips, including outside of the City. A Project's change in VMT will be analyzed and assessed on a per capita and/or per employee in order to use an efficiency-based metric. These are compared to a baseline average City value to determine potential significant transportation impact. VMT from heavy trucks are not a component of the CEQA transportation analysis.

The tool used to calculate VMT and efficiency metrics of VMT will be the Orange County Transportation Analysis Model (OCTAM) which is a subarea model of the Southern California Association of Government's (SCAG) travel demand model. Most projects will be analyzed using the average VMT by trip type from the model traffic analysis zone (TAZ) the project is located. Since VMT is primarily a function of the location of a project, and the TAZ is the smallest geography in the Model, a project will be assumed to have the same average VMT characteristics as neighboring development within the TAZ. Contact the City Engineer or designee at (562) 431-2527 for VMT information.

For very large projects, as directed by the City Engineer, new model scenarios that include the proposed project may need to be produced, provided it is based on methods and assumptions approved by the City. The Project and citywide VMT outputs shall be from the same model and model version as to be internally consistent for the CEQA determination.

The SCAG travel demand model is updated every four years, with OCTAM updated subsequently. Baseline VMT values will be updated when a new model is released. The existing/baseline year of the model will be used for CEQA baseline conditions and the future year (approximately 20 year forecast) scenario will provide future year and

cumulative analysis VMT information.

The format of the CEQA Transportation Assessment would vary depending on the requirements of the environmental documentation, however it must conform to these guidelines.

Screening Criteria

Since the SB 743 law is intended to provide CEQA relief to projects that support the State's GHG emission goals the screening of projects as presumed as less than significant is an incentive for development in areas where vehicle trips are shorter or where other modes of transportation are supported. The screening therefore limits the technical analysis of CEQA transportation impacts to those projects which have the potential of significant impacts.

The following project conditions are reviewed at the CEQA Checklist stage to determine if a project can be presumed to have a less than significant CEQA transportation impact or if a specialized study in conformance with these guidelines is required for the determination. The City maintains discretion to approve a project applicant's conditions for a presumption of less than significant.

Small Projects: Projects that would generate less than 250 vehicles per day based on the latest Institute of Transportation Engineers (ITE) Trip Generation Manual may be presumed to be less than significant. As with other types of transportation analysis, the trip generation of the current uses could be removed from the proposed project so only net trips are assessed. A project demonstrating fewer and/or shorter trips leading to lower VMT than existing conditions could be presumed to be less than significance.

Transit Priority Areas: Transit Priority Areas (TPAs) are located within 1/2 mile of a major transit stop, and projects within them can be generally presumed to be less than significant. A "major transit stop" is a rail transit station, a ferry terminal served by either a bus or rail transit service, or the intersection of two or more major bus routes with a frequency of service interval of 15 minutes or less during the morning and afternoon peak commute periods. There are no current or planned TPAs in the City. The Electric-Main bus stop served by OCTA and Long Beach Transit does not have frequent enough service to be considered a "major transit stop".

Retail Projects: By adding retail opportunities into the urban fabric and thereby improving retail destination proximity, local-serving retail development tends to shorten trips and reduce VMT. Thus, the City generally presumes such development creates a less-than-significant transportation impact. Regional-serving retail development, on the other hand, which can lead to substitution of longer trips for shorter ones, may tend to have a significant impact." Locally serving retail less than 50,000 square feet can be presumed to be less than significant.

Affordable Housing: Adding affordable housing to infill locations generally improves jobs-housing match, in turn shortening commutes and reducing VMT. Further, "… low-wage workers in particular would be more likely to choose a residential location close to

their workplace, if one is available." Evidence supports a presumption of less than significant impact for a 100 percent affordable residential development (or the residential component of a mixed-use development) in infill locations.

Community-Serving Projects: Similar to the screening of retail projects, community-serving or municipal projects such as schools, parks, community centers, public buildings, day care and libraries intended for local use could be presumed to have a less-than-significant impact on transportation based on the discretion of the City.

Transportation Projects: Transportation projects not expected to increase VMT (such as intersection turn lanes, signalization, bicycle, pedestrian, or transit projects), as determined by the City's Public Works Department, would be presumed to have a Less Than Significant CEQA Transportation Impact.

Analysis Methodology

Projects not screened as Less Than Significant transportation impacts would be required to undergo a CEQA Transportation Assessment. The OCTAM, or other similar models as approved by the City Engineer, will be used to determine the project's VMT. Project VMT may be determined through new model runs or by using the VMT per capita or employee for the current land uses in the model TAZ that would contain the proposed project.

VMT is split into different land use and trip type components of home-based (residential) VMT and work-based (employment) VMT. These VMT will be indexed by the number of residents and the number of employees respectively. Therefore the two VMT metrics are in the two following categories:

- Residential VMT per capita: Home-Based Production VMT / Residential Population
- Employment VMT per employee: Home-Based Work Attraction VMT and Work-Based Production

In order to develop the VMT component of the metrics, travel demand model outputs by trip purpose and productions and attractions must be considered. The delineation of productions and attractions include both ends of an origin and destination trip. For example, production VMT for home-based work trips represents the total VMT of all commute trips VMT for people living in the City to and from wherever they work. The attraction VMT represents the VMT of all people commuting to and from the City for work no matter where they live.

Residential VMT includes the production of all home based VMT. Employment VMT includes home-based work attraction and work-based other production.

The estimated number of residents will be based on city average, or other estimates of the full occupancy of the residential units of a proposed project. Number of employees may be estimated using Typical Employment Conversion Factors from the Orange County Subarea Modeling Guidelines Manual or the ITE Trip Generation Manual.

The maximum internal capture of persons residing in and working in a mixed use development shall be three percent of the residents. The maximum average VMT reduction for residents of affordable housing units shall be four percent (e.g. a 100 percent affordable housing development could reduce average VMT per capita by a maximum of four percent whereas a 50 percent affordable housing development could reduce average VMT per capita by a maximum of two percent).

Thresholds of Significance

The City's thresholds of significance for development projects and land use plans is a project value residential VMT per capita and employment VMT per employee at or above the City's baseline average. A significant impact would occur if the VMT per capita or VMT per employee exceeds the citywide average VMT per population or per employee of the baseline.

For Transportation Projects, a significant impact would occur if the project would result in an increase to the total baseline VMT in the City (not indexed to population nor employment).

Mitigation Measures

CEQA requires an environmental impact report identify feasible alternatives and mitigation measures that could avoid or substantially reduce a project's significant environmental impacts (Pub. Resources Code, § 21002.1, subd. (a)).

If a significant transportation impact is identified for a project, it will be the Project applicant's responsibility to submit a mitigation measure plan to reduce impacts to Less Than Significant. Options include provision of on-site transportation infrastructure, on-site transportation demand management, off-site infrastructure improvements including roadway improvements for active transportation and multimodal infrastructure, or off-site multimodal improvements. The City Engineer or designee will review, make necessary changes and approve the TDM plan.

APPENDICES

Detailed appendix material is to be supplied as part of the report. If the main report is too large to include an appendix, such material shall be provided under a separate and identifiable cover. Typical material in this regard includes traffic counts, ICU calculation work sheets, HCM Link Analysis worksheets, fully completed signal warrants, accident diagrams at high accident locations, sketches of proposed mitigation measures, and other information necessary for the City's review of the report.

APPENDIX A

LEVEL OF SERVICE DEFINITIONS

For intersections, Level of Service is described in terms of Intersection Capacity Utilization (ICU). This ICU calculation, shown in Appendix B, quantifies the delay experienced by drivers at the intersection.

Table 1 – Intersection Level of Service Definitions

LEVEL OF SERVICE	OPERATING CONDITION	ICU VALUE
A	Free flowing, virtually no delay. Minimal traffic	<0.60
B	Free low and choice of lanes. Delays are minimal. All cars clear intersection easily.	0.60-0.69
C	State flow. Queue at signal starting to get relatively long. Delays starting to become a factor but still within "acceptable" limits.	0.70-0.79
D	Approaching unstable flow. Queues at intersection are quite long but most cars clear intersection on their green signal. Occasionally, several vehicles must wait for a second green signal. Congestion is moderate	0.80-0.89
E	Severe congestion and delay. Most of the available capacity is used. Many cars must wait through a complete signal cycle to clear the intersection.	0.90-0.99
F	Excessive delay and congestion. Most cars must wait through more than one on one signal cycle. Queues are very long and drivers are obviously irritated.	>1.00

For areas of roadways situated between intersections, LOS is described via a "mid-block roadway link" analysis. Highway capacity manual-Chapter 15 is used to find the Level-of-Service provided under section "Mitigation Measures' and duplicated here for quick reference.

APPENDIX B

SAMPLE ICU CALCULATIONS

INTERSECTION CAPACITY UTILIZATION WORKSHEET

PROJECT[A] Any Project

N-S STREET[B] Any Street E-W STREET[C] Any Avenue

TIME[D] ☐AM PEAK HOUR ☐PM PEAK HOUR ☐_____ ANALYST[E] Semore Green

DATE[F] February 28, 2021

TRAFFIC[G] ☐BACKGROUND ☐PROJECT ☐_____ TIME FRAME[H] ☐CURRENT ☐BUILDOUT ☐YEAR_____

APPROACH DIRECTION	MOVEMENT	VOLUME[I] (VPH)	LANES[J]	CAPACITY[K]	V/C RATIO[L]	CRITICAL VALUE[M]	
NB	LEFT	242	2	3200	0.076	***	N
	THRU	830	2	3400	0.258		
	RIGHT	47	0				
SB	LEFT	138	2	3200	0.043		
	THRU	871	2	3400	0.345	***	
	RIGHT	302	0				
EB	LEFT	280	1	1600	0.175	***	O
	THRU	286	2	3400	0.084		
	RIGHT	237	1	1700	0.139		
WB	LEFT	149	1	1600	0.093		
	THRU	548	2	3300	0.232	***	
	RIGHT	217	0				
SUM OF CRITICAL MOVEMENTS[P]						0.827	
YELLOW CLEARANCE[Q]						0.1	
ICU VALUE[R]						0.927	
LEVEL OF SERVICE						**E**	

A Enter the name of the development being studied at the location.

B Enter the name of the North-South street of the intersection being analyzed.

C Enter the name of the east-west street of the intersection being analyzed.

D Enter an "X" to indicate the time being analyzed. If the time is other than the AM or PM peak period, enter the time period being analyzed.

E Enter the name of the person doing the analysis at this intersection.

F Enter the date on which the traffic count was taken. Note that this is not the date the analysis was performed.

G Enter an "X" to indicate the type of traffic being used in the study. If the traffic type is not listed, indicate the type.

H Enter an "X" to indicate the time frame of the traffic listed. If the time is for some year other than the current year or build out year, indicate the year.

I Use this column to enter the traffic volume for each turning movement on each approach for the time period being analyzed.

J Enter the number of lanes for each movement on each approach. Do not use "1/2" lanes to indicate shared lanes. For example, the westbound approach in the example CU worksheet has three lanes. The left lane is an exclusive left-turn lane, the center lane is a through movement only lane, and the curb lane is a shared through/right turn lane. This column indicates 1 for the left turn lane, 2 as the number of through lanes and no right turn lanes. Traffic volumes for the right turns would be added to the through movement in the calculations.

K Enter the capacity for each movement as the sum of the lane capacity for that type of movement times the number of lanes. Use the following capacities:

Left turn lanes – 1600 vehicles per lane per hour through lanes – 1700 vehicles per lane per hour
Right turn lanes – 1700 vehicles per lane per hour shared lanes – 1600 vehicles per lane per hour

Referring to the westbound approach in the example, the capacity for the through movement is 3300 vehicles per hour, reflecting 1700 for the exclusive thorough lane, and 1600 for the shared through/right turn lane.

L Enter the Volume to Capacity ratio (V/C) for each movement in this column. In the sample problem, the V/C ratio of the northbound through movement is (830+47) divided by 3400, or 0.258. The V/C ratio of the westbound through movement is (548 + 217) divided by 3400, or 0.225.

M Indicate if the V/C ratio is the critical V/C ratio for this approach

N The critical V/C ratios for the north-south street are determined by comparing the sum of the northbound left turn V/C ratio plus the larger of the southbound through movement V/C ratio or the south bound right turn V/C ratio to the sum of the south bound left turn V/C ratio plus the larger of the northbound through movement V/C ratio or the northbound right turn V/C ratio and determining the greater. In this case, 0.076 + 0.345 = 0.424 which is greater than 0.043 + 0.258 = 0.301, meaning that the former V/C ratios are the critical movements. Since the through movements and the right turn movements can be made at the same time, only the larger of these two is critical.

O The critical V/C ratios for the east-west street are determined by comparing the sum of the eastbound left turn V/C ratio plus the larger of the westbound through movement V.C ratio or the westbound right turn V/C ratio to the sum of the westbound left turn V/C ratio plus the larger of the eastbound through movement V/C ratio or the eastbound right turn V/C ratio and determining the greater. In this case, 0.232 + 0.175 = 0.408 which is greater than 0.093 + 0.139 = 0.232, meaning the former V/C ratios are the critical movements. Note that since the through movements and the right turn movement can be made at the same time, only the larger of these two is critical.

P Sum the critical movement values determined above. In the sample, this would be 0.076+0.345+0.175+0.232=0.828.

Q Add in the time allowance for lost time/yellow clearance. This will always be 0.100.

R Sum the critical movement values and the yellow clearance and indicate the level of service. In the sample, 0.828 + 0.100 = 0.928. This would be a level of service “E”.

City of Seal Beach

INTERSECTION	CY W/OUT PROJECT				CY WITH PROJECT				CHANGE IN ICU		CY+ PROJECT+ACCUMALATIVE PROJECTS				CHANGE IN ICU		SIGNIFICANT IMAPCT?
	AM PEAK		PM PEAK		AM PEAK		PM PEAK				AM PEAK		PM PEAK				
	ICU	LOS	ICU	LOS	ICU	LOS	ICU	LOS	AM	PM	ICU	LOS	ICU	LOS	AM	PM	
ALTNTIC AT																	
HELLMAN																	
W/OUT IMPRMT																	
WITH IMPRMT																	
GARVEY																	
W/OUT IMPRMT																	
WITH IMPRMT																	

INTERSECTION	PCY W/OUT PROJECT				PCY WITH PROJECT				CHANGE IN ICU		PCY+ PROJECT+ACCUMALATIVE PROJECTS				CHANGE IN ICU		SIGNIFICANT IMAPCT?
	AM PEAK		PM PEAK		AM PEAK		PM PEAK				AM PEAK		PM PEAK				
	ICU	LOS	ICU	LOS	ICU	LOS	ICU	LOS	AM	PM	ICU	LOS	ICU	LOS	AM	PM	
ALTNTIC AT																	
HELLMAN																	
W/OUT IMPRMT																	
WITH IMPRMT																	
GARVEY																	
W/OUT IMPRMT																	
WITH IMPRMT																	

INTERSECTION	GPTY W/OUT PROJECT				GPTY WITH PROJECT				CHANGE IN ICU		GPTY+ PROJECT+ACCUMALATIVE PROJECTS				CHANGE IN ICU		SIGNIFICANT IMAPCT?
	AM PEAK		PM PEAK		AM PEAK		PM PEAK				AM PEAK		PM PEAK				
	ICU	LOS	ICU	LOS	ICU	LOS	ICU	LOS	AM	PM	ICU	LOS	ICU	LOS	AM	PM	
ALTNTIC AT																	
HELLMAN																	
W/OUT IMPRMT																	
WITH IMPRMT																	
GARVEY																	
W/OUT IMPRMT																	
WITH IMPRMT																	

CY CURRENT YEAR
PCY PROJECT COMLETION YEAR
GPTY GENERAL PLAN TARGET YEAR