APPENDIX G

Transportation Study

Transportation Impact Report

Santa Monica Housing Element Update – 6th Cycle

Prepared for:
City of Santa Monica

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FEHR PEERS

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1. Introduction

This study is completed in support of the 2021 Housing Element Update of the City of Santa Monica. This transportation analysis provides the background and analysis to inform the State-required Environmental Impact Report for consideration of the Housing Element Update. This transportation impact report is not a general analysis of transportation in Santa Monica. It is a project-specific impact analysis performed in compliance with the rules and regulations of CEQA and using CEQA criteria. In some cases, CEQA criteria do not reflect more general community transportation concerns. This study seeks to support a specific process and is focused and structured for that process.

The California Department of Housing and Community Development (HCD) has established that the 6th Cycle of the Housing Element for jurisdictions in the Southern California (SCAG) region will plan for the period of October 15, 2021 – October 15, 2029. SCAG has completed a Regional Housing Needs Assessment (RHNA) which allocates 8,895 housing units to the City of Santa Monica, approximately 69% of which must be affordable to very low- and low-income households. The City must demonstrate that it has the policies and strategies as well as the land capacity necessary to meet the City's housing needs. The proposed update to the Santa Monica Housing Element (Project) has been prepared in response to State requirements. The City is proposing changes in development standards and regulations to promote the production of additional housing. This includes amendments to the City's *Land Use and Circulation Element* (LUCE), *Downtown Community Plan*, *Bergamot Area Plan*, *Zoning Ordinance*, and other City plans/programs. As part of the 6th Cycle Housing Element, the City has also prepared a Suitable Sites Inventory (SSI) which identifies potential sites that could be redeveloped with housing. A detailed land use analysis based on existing land use throughout the City, current development activity, adopted plans and the SSI was conducted by City staff. Land use data for the Adjusted Baseline, 2030 No Project, and 2030 With Project scenarios was provided by the City for use in this study.

This report describes the City's existing transportation and circulation system and mobility options, describes where housing can potentially be accommodated in the City per the Housing Element Update SSI, the assumptions and methodologies for the analysis, and the results of the transportation impact analysis.

1.1 Study Scope

In accordance with the California Environmental Quality Act (CEQA) and City transportation study requirements, this study analyzes the Project's effect on vehicle miles traveled (VMT) as the primary metric of assessing the potential for the Project to result in significant transportation impacts. Section 15064.3 of the CEQA Guidelines was added by the Office of Planning and Research on December 28, 2018, and states that vehicle miles traveled (VMT) is the appropriate measure of transportation impacts for projects subject to CEQA. Section 15064.3(c) also states that the provisions of this section shall apply prospectively (i.e., only applicable to new projects after date of adoption) and must be implemented statewide by July 1,

2020. On June 9, 2020, the Santa Monica City Council adopted a new process for analyzing the transportation impacts of land use and transportation projects to be consistent with State law. For land use projects in Santa Monica, the analysis consists of a two-step process which includes VMT screening and, if necessary, VMT analysis. Analysis was conducted for the Project using the City's VMT analysis procedures.

As required by State CEQA guidance, a programmatic and qualitative analysis of the potential for the Project to increase hazards due to a geometric design feature or to result in inadequate emergency access is also included. An assessment of the proposed Project was made to assess consistency with the City's No Not Increase in PM Peak Hour Trips policy. This study also analyzes the transportation impacts of alternatives to the proposed Project.

1.2 Organization of Report

This report is divided into four chapters, including this introduction. **Transportation Environmental Setting** describes the existing transportation system and mobility options in Santa Monica (including the roadway network, public transit, bicycle/pedestrian facilities). **Future Analysis Scenarios** describes the scenarios analyzed for this Project. **Transportation Impact Analysis** provides the vehicle miles traveled (VMT) impact analysis, identifies potential mitigation measures and presents other transportation analyses conducted for the Project. Appendices contain supporting technical documentation and data.

2. Transportation Environmental Setting

This section describes the existing and future (2030) transportation environmental setting for the City of Santa Monica. The transportation environmental setting includes the existing transportation network, including automobile, transit, bicycle, and pedestrian facilities (including facilities that also serve newer Shared Mobility devices such as shared e-scooters and bikes), and planned and funded transportation improvements.

2.1 Existing Street and Highway System

The roadway network serving the City consists of the roadway classifications listed below. The functional classification of streets, as defined in the LUCE, is illustrated in **Figure 1**.

- **Highways (Interstate 10):** Highways are major regional connectors designed to accommodate longer, regional trips with limited local access. The highway system in the City of Santa Monica is owned and operated by Caltrans and is limited to the Santa Monica Freeway (I-10) and Palisades Beach Road (SR-1, Pacific Coast Highway, PCH).
- **Avenues:** Avenues are streets serving regional auto trips while accommodated all other modes. The City of Santa Monica has four different "Avenue" typologies – Major, Secondary, Minor, and Industrial. Major Avenues are designed to minimize auto traffic on secondary and minor avenues. Secondary and Minor Avenues are designed primarily as connectors to neighborhood streets. Secondary Avenues are also designed to serve regional bike trips by signalizing major crossings. Industrial Avenues are local streets on which truck movement is prioritized to ensure adequate access to individual parcels.
- **Boulevards:** Boulevards are regional transportation corridors with continuous adjacent mixed-use and commercial land uses. Regional auto traffic is accommodated, but transit and pedestrian uses are emphasized.
- **Commercial Streets:** Commercial Streets serve commercial zones throughout the City of Santa Monica. The City has two different "Commercial Street" typologies – Downtown and Neighborhood. Downtown Commercial Streets include all streets in the Downtown District and prioritize pedestrian uses but experience a high level of competition among all modes. Neighborhood Commercial Streets are Commercial Streets outside the Downtown District.
- **Neighborhood Streets:** Neighborhood Streets primarily provide access to residential land uses throughout the City.
- **Shared Streets:** Shared Streets are streets with low enough auto speeds that autos, bikes, and pedestrians can mix comfortably and safely.

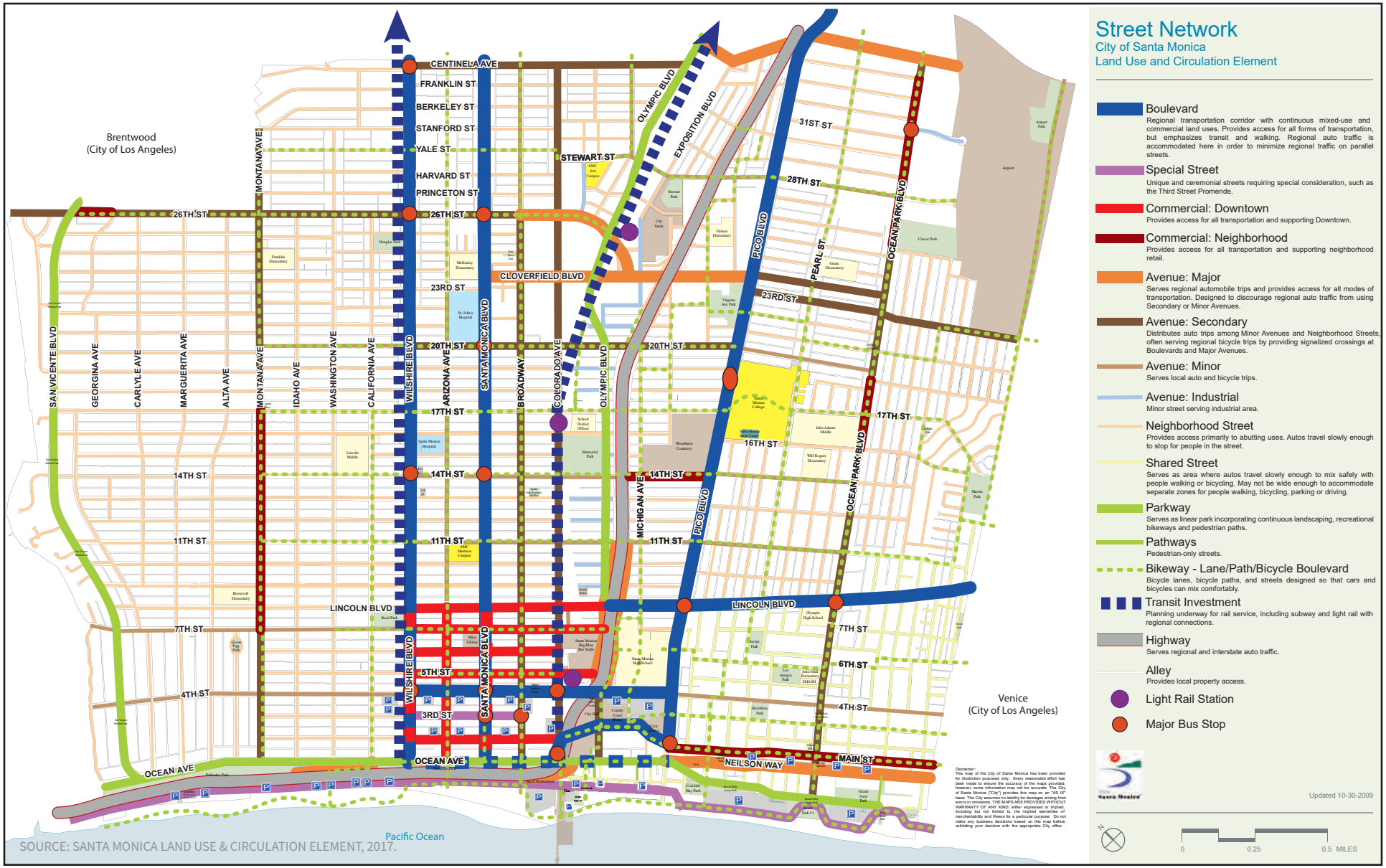


Figure 1

Santa Monica Land Use & Circulation Element
Street Network

- Alleys: The City of Santa Monica has a significant alley network that provides local property access in throughout most residential neighborhoods

2.2 Existing Transit System

Big Blue Bus and LA Mero provide transit service throughout the City of Santa Monica:

- **Big Blue Bus:** Big Blue Bus is the municipal bus service run by the City of Santa Monica. It operates 16 fixed-route lines that primarily serve the entire City of Santa Monica and provide connections to the surrounding areas of Los Angeles, with some lines also providing access to major destinations/employment hubs outside of the City including Downtown Los Angeles, UCLA, and Los Angeles International Airport.
- **LA Metro:** LA Metro operates the Metro E Line (formerly Expo Line), a light rail line providing connections between the City of Santa Monica and Downtown Los Angeles. The Metro E Line has three stops in Santa Monica: Bergamot Station at 26th/Olympic; Santa Monica College at 17th Street/Colorado Avenue, and the Downtown Station at 4th/Colorado Avenue. The Metro E runs every 12 minutes during most daytime hours on weekdays and weekend days, and every 15 to 20 minutes during other periods.
  LA Metro also provides regional bus connections to the City of Santa Monica, including local and rapid lines on Santa Monica Boulevard (4/704), Wilshire Boulevard (20/720), and Venice Boulevard (33/733).
- **Dial-a-Ride Senior Services:** Residents of Santa Monica 65 years or older or people with disabilities who are 18 years or older also have access to low-cost, shared-ride, curb-to-curb service offered in partnership between Big Blue Bus, WISE & Health Aging, and Lyft. This service is available to destinations within the City of Santa Monica, as well as major medical centers on the Westside and select shopping destinations in Venice.

2.3 Existing Bicycle and Pedestrian Facilities

The City's commitment to providing safe and comfortable bicycle and pedestrian infrastructure is laid out in the *Santa Monica Bike Action Plan* (City of Santa Monica, 2011, as amended through 2020) and *City of Santa Monica Pedestrian Action Plan* (City of Santa Monica, 2016), respectively.

Bicycle infrastructure includes a connected network of on-street bicycle lanes and routes, as well as off-street paths, intended to increase access to citywide destinations, cyclist safety and citywide ridership. The bicycle network throughout the City is made up of a grid of the following facility types:

- **Class I Bike Paths:** Class I bike paths provide a completely separated right-of-way for the exclusive use by bicycles and pedestrians. Class I bike paths in the City of Santa Monica include bike paths, side paths, and multi-use trails.
- **Class II Bike Lanes:** Class II bike lanes are striped lanes that provide dedicated space for bicyclists on the roadway adjacent to auto and bus traffic. Class II bike lanes in the City of Santa Monica include climbing bike lanes, where a bike lane is provided in the uphill direction, and buffered

bike lanes, where an additional striped buffer between parked cars or traffic is provided, and green bike lanes that increase facility visibility and legibility for people riding and driving.

- **Class III Bike Routes:** Class III bike routes are shared-use roadways where autos and bikes mix in the travel lane. The City of Santa Monica's Class III bike routes include neighborhood greenways and Shared Streets.
- **Class IV Bikeways:** Class IV bikeways are on-street bike lanes that are physically separated from the adjacent travel lane. Class IV bikeways in the City of Santa Monica include parking-protected bike lanes, where the bike lane is positioned between the parking lane and the curb, cycletracks where two-way bike facilities are located on one side of the street, and contraflow bike lanes, where a dedicated lane is provided in the opposite direction of traffic.

The City's bicycle network is mainly comprised of Class II and Class III facilities, with the City starting to implement some Class IV bikeways, including the Colorado Esplanade from 4th Street to Ocean Avenue, and Ocean Avenue from California to Colorado Avenues. The primary Class I facilities in the City of Santa Monica are the Colorado Esplanade, the Marvin Braude Beach Bike Path and the Expo Bike Path. The network of existing and planned bicycle facilities in the City, as well as recently adopted vision for additional protected bicycle facilities, is shown in **Figure 2**.

Pedestrian infrastructure includes a nearly citywide network of sidewalks and marked crosswalks that improve the safety, comfort and visibility of pedestrians. Pedestrian facilities in the City of Santa Monica include sidewalks, crosswalks, and multi-use paths. Other infrastructure treatments such as mid-block crossings and scramble crossings provide some efficiency to trips on foot and reduce conflicts between vehicles and pedestrians. These infrastructure treatments are built in many locations throughout the City. Recently, lead-pedestrian walk signals have been added to the signal timing at many signalized intersections to allow pedestrians a "head-start" across intersections which increases pedestrian visibility and safety.

2.4 Other Transportation Services

- **Shared Micromobility:** Several private micromobility providers operate within the City of Santa Monica through the City's Shared Mobility Pilot Program, providing residents and guests with shared bikes, e-bikes, and scooters to utilize throughout the City. LA Metro also operates Metro Bike Share in the City, with bike stations located along the Expo Line.
- **Ride-Hailing Services:** Ride-hailing services are a newer model, and allow riders to hail a ride (similar to a taxi ride) through a mobile app. Several ride-hailing operators operate within the City of Santa Monica, providing users with curb-to-curb service. The City currently partners with Lyft for their Dial-A-Ride Service, offering older residents and residents with disabilities discounted rides.
- **Car Share Services:** Carshare systems have existed for several decades, and rely on a membership model to gain access to hourly car rentals. Currently, Zipcar has the widest coverage in the Los Angeles region, with carshare vehicles in Santa Monica, Marina del Rey, Playa del Rey, near Culver City, near the Sunset Strip in West Hollywood, and throughout the west side of Los Angeles.

- **Circuit:** In partnership with local hotels and the City, Circuit is a microtransit service operating free electric shuttles in areas generally west of Lincoln Boulevard between Downtown Santa Monica, Main Street, and the Montana Avenue corridor.

2.5 Future Transportation Improvements

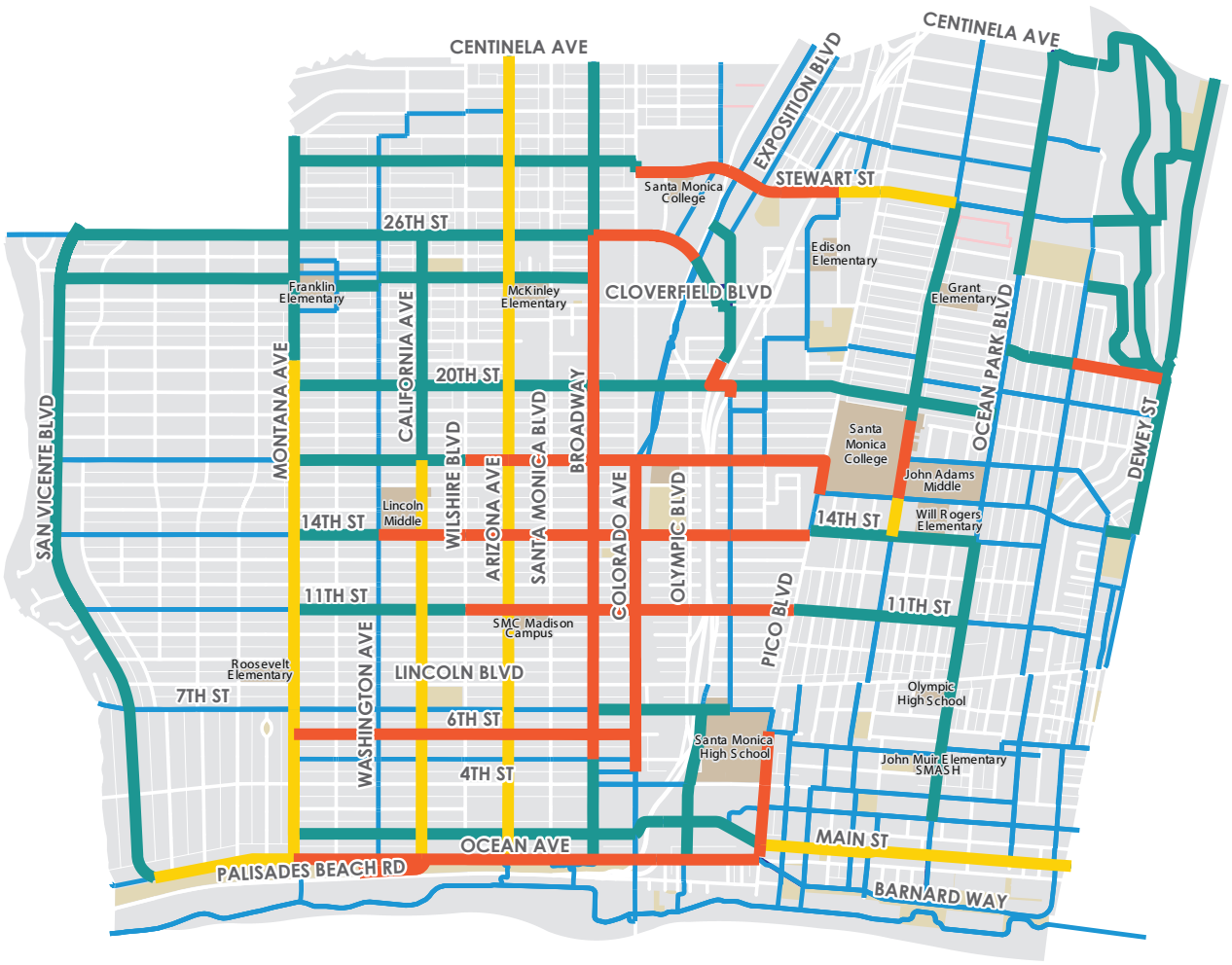
The City's goal to create a complete and connected mobility network requires a combination of street improvements, and programs to encourage walking, biking, use of transit, and other sustainable modes of mobility. Santa Monica has made great strides in more inclusive street design, but continued investments in future mobility projects and services are needed to create safer roadways and increase the use of more sustainable mobility options. There are many anticipated infrastructure and service changes described in adopted plans such as the Bike Action Plan, Pedestrian Action Plan, Downtown and Bergamot Plans. While too numerous to repeat all off them, the most notable improvements to the local and regional transportation system by 2030 for the purposes of the Housing Element project transportation analysis are described below.

- **Projects included in the *Santa Monica Bike Action Plan*:**
  - **Pico Boulevard between 6th Street and Ocean Avenue:** Remove one auto travel lane in each direction to facilitate implementation of protected bicycle lanes
  - **Cloverfield Boulevard between Colorado Avenue and Olympic Boulevard:** Remove one southbound travel lane to facilitate implementation of protected bicycle lanes
  - **Ocean Avenue between California Avenue and Moomat Ahiko Way:** Add protected bicycle lanes on the west side of Ocean Avenue. Two northbound auto lanes will be maintained while a single southbound through lane for autos will be provided between California Avenue and Broadway. This improvement was implemented in late 2020 and is considered to be a future improvement for the purposes of this analysis.
- **Street network changes included in the *Downtown Community Plan*:**
  - **Wilshire Boulevard Road Diet:** Widen sidewalk on south side of Wilshire Boulevard and remove one eastbound auto travel lane between Ocean Avenue and Fourth Street
  - **East/West Local Street between 4th and 5th Street:** Provide a new east/west local access street through the Downtown Station site from 4th Street to 5th Street allowing for taxi and kiss-and-ride drop-off zones, access to bus stops and layover space, and access to potential public parking on this site. Additionally, the access way would include a new traffic signal to enable all turns at 4th Street.
  - **East/West Access Street Extension and Sears Access:** Provide a new east/west connection westward through the Sears site and across the I-10 freeway to Main Street (breaking down the superblock and providing additional walking paths between the Downtown Station and Civic Center/Tongva Park).
  - **Transit Mall:** Removal of the existing transit mall on Santa Monica Boulevard east of 4th Street to create additional traffic capacity.

- **Additional Capacity:** Selected removal of on-street parking to create additional capacity at selected locations., including an additional westbound through lane on Santa Monica Boulevard from 5th Street to Ocean Avenue and additional eastbound and westbound through lanes on Olympic Drive between Main Street and 4th Street.

- **Street network changes included in the *Bergamot Area Plan*:**
  - **Berkeley Street Extension:** Extend Berkeley Street (H Street) between Nebraska and Olympic (1 lane each way) with new traffic signal (full access) at Olympic & Berkeley
  - **Stanford Street Extension:** Extend Stanford Street (I Street) between Nebraska and Olympic (1 lane each way) (right-turn in, right-turn out at Olympic & Stanford
  - **Pennsylvania Avenue Two-Way Conversion:** Convert Pennsylvania Avenue to two-way operation
  - **Pennsylvania Avenue Extension:** Extend Pennsylvania Avenue between Stewart Street and Stanford Street
  - **Minor Network Changes:** Other minor street network changes planned in this area per the Bergamot Area Plan

- **Metro Purple Line:** Complete extension of Metro Purple Line (D Line) Westside Subway Extension to West Los Angeles Veterans Affairs Campus.
- **I-405 Express Lanes Project:** Construct one more high-occupancy vehicle (HOV) lane in each direction and convert all HOV lanes to Express Lane operations on I-405 between US 101 and I-10.



Santa Monica Protected Bikeway Vision

Protected Bikeways

- Five-Year Vision
- Longer-Term Vision

Priority Connections

- Future Priority Connection

Existing & Planned Bike Network

- Existing or Planned Bike Facility

Notes: The Colorado Avenue protected bikeway is westbound only.

0 0.25 0.5 Miles

Data obtained from the City of Santa Monica
Map created June, 2020

SOURCE: SANTA MONICA BIKE ACTION PLAN AMENDMENT, 2020.

Figure 2

Santa Monica Protected Bikeway Vision

3. Future Analysis Scenarios

3.1 Housing Element Update Project

The proposed Housing Element lays out the strategic plan for the development of housing to meet the City's state-mandated Regional Housing Needs Allocation (RHNA). SCAG has determined that Santa Monica's RHNA for the 6th Cycle Housing Element is 8,895 housing units for the 2021-2029 planning period. To ensure that sufficient capacity exists in the housing element to accommodate the RHNA throughout the planning period, HCD recommends that a jurisdiction create a buffer in the housing element inventory of at least 15 to 30 percent more capacity than required, especially for capacity to accommodate the lower income RHNA. Therefore, the transportation study analyzes approximately 11,000 units, which includes the City's RHNA allocation of 8,895 units plus a buffer of 24 percent within the current RHNA cycle.

3.2 Base Year Model Development Background

The LUCE provides a framework for integrating land use and transportation to reduce vehicle trips; encourage walking, bicycling and transit use; and create active, pedestrian-oriented neighborhoods. The LUCE establishes the goal of achieving no net new PM peak hour vehicle trips generated within the City by 2030. There are three ways that this goal is achieved in future conditions: the D's (i.e., development density, diversity, destination), the Metro E Line (Expo Light Rail) and other transportation improvements, and LUCE and DCP Transportation Demand Management (TDM) strategies.

As part of the LUCE, the City developed its first comprehensive Citywide Travel Demand Forecasting Model (TDFM). The City's TDFM was calibrated to a base year of 2008, based on 2008 land use data and 2008 traffic counts. Since that time, the City's TDFM has been updated and recalibrated to reflect 2019 land uses, traffic volumes, and trip lengths. Documentation of the recent update to the City's model is provided in **Appendix A**. The City's extensive land use data was supplemented by Southern California Association of Governments (SCAG) traffic analysis zone (TAZ)-based data for areas in the City of Los Angeles surrounding the City of Santa Monica. The City's TDFM forecasts future conditions across the City's transportation network in the form of traffic volumes for weekday daily and peak hours. The model also produces estimates of trip generation, trip lengths, and VMT by trip type. The model contains all major roadways in the City and considers the trip reduction effects of walking, bicycling, and transit, including the Metro E Line (Expo) Light Rail. The City's TDFM contains several enhancements that allow it to capture the effects of land use and circulation element policy initiatives on traffic congestion. These enhancements include the effects of sustainable development patterns (e.g., mixed-use and transit-oriented development), urban streetscape design factors, active transportation networks, parking pricing and management, and TDM programs. The model also enables the City to analyze the transportation effects of development projects and transportation network changes. Additional details are provided in

Appendix A. For this study, the City's TDFM was used to estimate VMT on a citywide basis and the results were then used to assess the VMT impacts of the proposed Housing Element Update.

3.3 Adjusted Baseline Scenario

For this study, an Adjusted Baseline scenario was created and modeled with the TDFM. Based on information from the California Department of Finance, the land use and socio-economic data in the 2019 base year model was updated to represent 2020 pre-pandemic conditions for the City as following:

- Total population: 92,357 persons
- Total employment: 90,992 employees
- Total number of dwelling units: 52,589 units
- Total commercial development: 31,457,321 square feet.

The above information provides a better approximation of conditions at the time that this environmental study was undertaken. A list of development projects under construction and included in this scenario is presented in **Appendix B**. The transportation network under the 2020 Adjusted Baseline scenario is consistent with 2019 base year.

3.4 Future No Project (2030) and With Project (2030) Scenario

Table 1 presents the land use and socio-economic assumptions for the Future No Project and Future With Project scenarios that were provided for use in this study. Because a portion of the City's RHNA allocation can be accommodated within existing zoning across the city, a portion of the allocation is included in the Future No Project scenario. **Figure 3** and **Figure 4** show the projected changes in dwelling units and commercial space across the City under the Future No Project scenario relative to the Adjusted Baseline scenario. **Figure 5** and **Figure 6** show the projected changes in dwelling units and commercial space across the City under the Future With Project scenario relative to the Adjusted Baseline scenario.

Table 1: Future (2030) Land Use and Population Assumptions

Category	Adjusted Baseline	Future No Project[2]	Future With Project	Percent Change from Adj. Baseline	Percent Change from Future No Project
Population	92,357	101,583	116,245	26%	14%
Employment	90,992	95,409	92,760	2%	-3%
Total Dwelling units	52,589	57,552	64,883	23%	13%
Total Commercial Space[1] (sf)	31,457,321	32,880,837	31,874,889	1%	-3%

Notes: Source: Fehr & Peers, 2021.
1. Commercial space includes office, retail, restaurant, hotel, hospital, etc.
2. No Project accounts for projects that are under construction and assumes the following: 90% of approved and pending units will be constructed by the future year; projected growth per the adopted DCP, and anticipated ADU production of 700 units consistent with past trends.

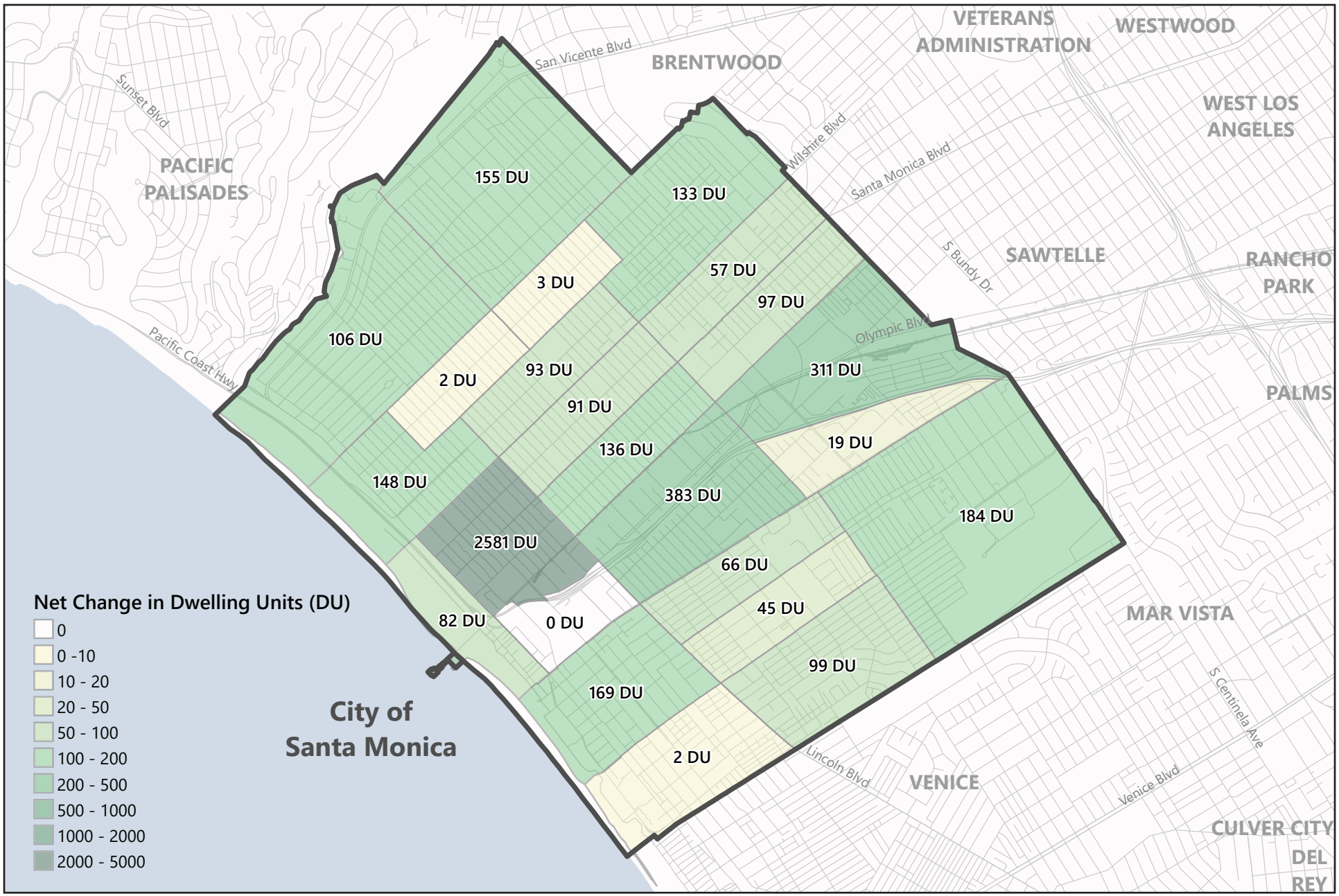


Figure 3

ADJUSTED BASELINE TO 2030 FUTURE

No Project Change in Residential Dwelling Units (DU)

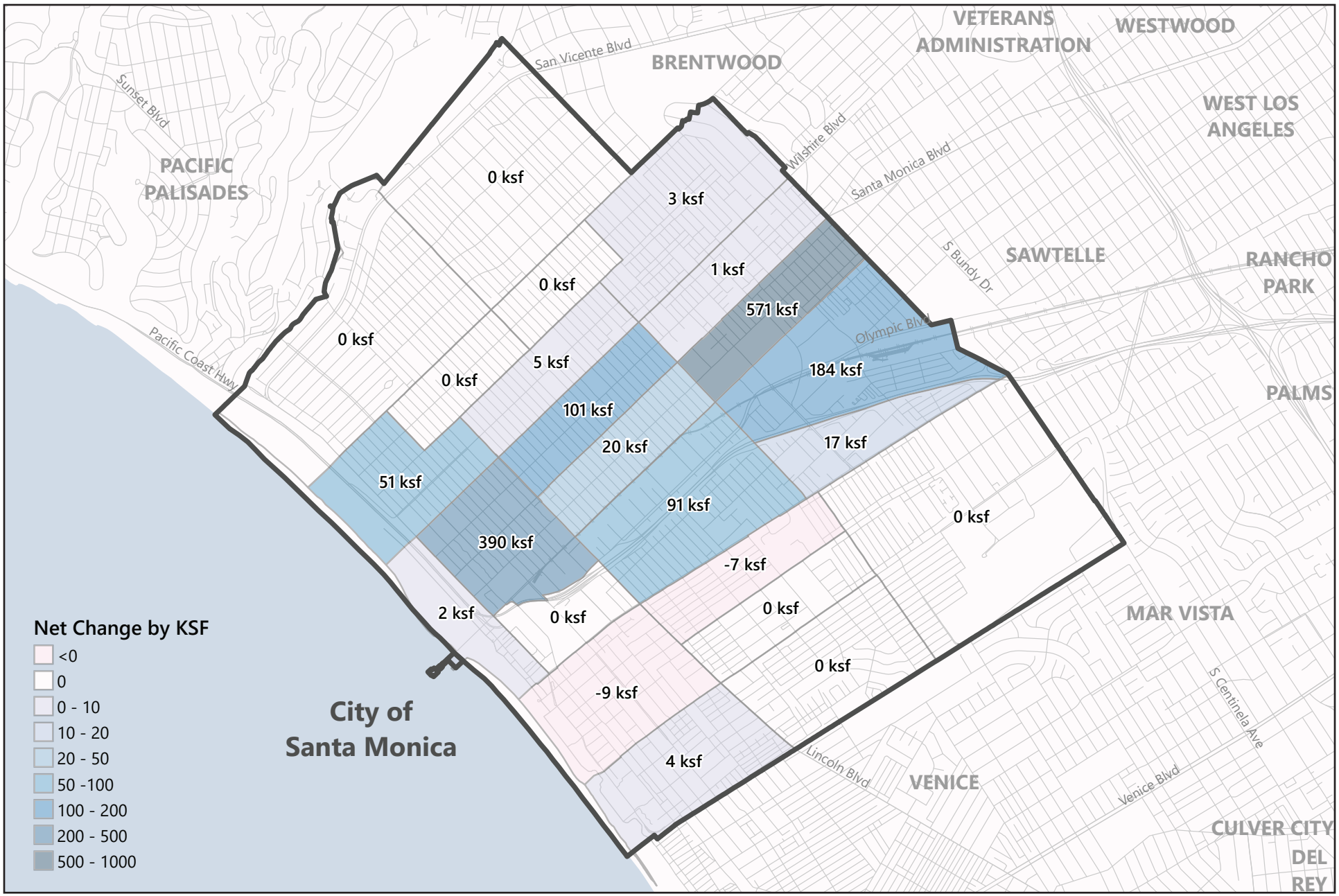


Figure 4

Adjusted Baseline to 2030 Future

No Project Non-Residential Change in Commercial Space (Thousands of Square Feet (KSF))

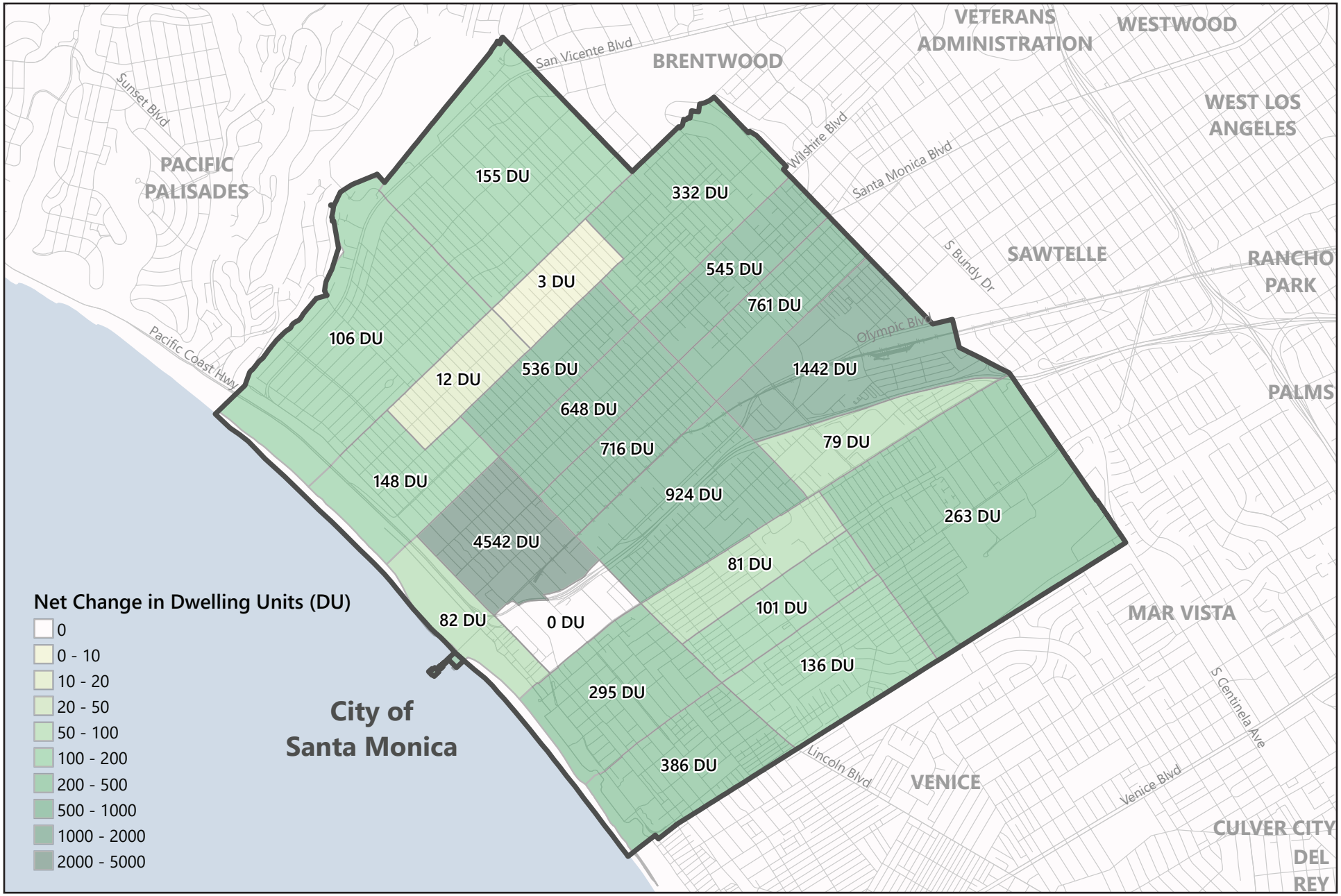


Figure 5

ADJUSTED BASELINE TO 2030 FUTURE

With Project Change in Residential Dwelling Units (DU)

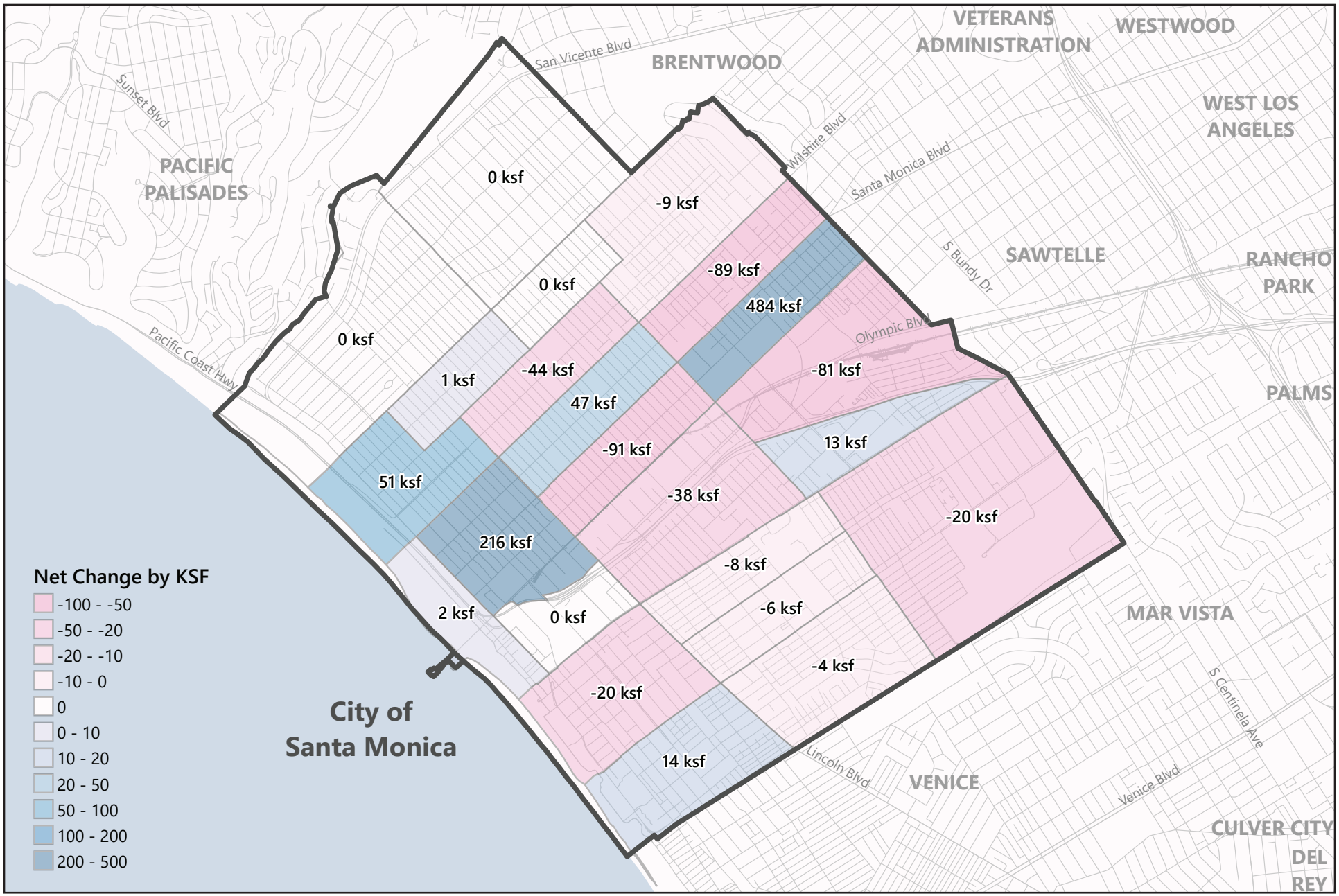


Figure 6

ADJUSTED BASELINE TO 2030 FUTURE

No Project Non-Residential Change in Commercial Space (Thousands of Square Feet (KSF))

4. Transportation Impact Analysis

This chapter documents the transportation impact analysis conducted to determine the potential for the proposed Project, implementation of the Housing Element Update, to result in significant transportation impacts under CEQA. The City's adopted methodologies and threshold criteria were used.

Section 15064.3 of the CEQA Guidelines was added by the Office of Planning and Research (OPR) on December 28, 2018, and states that vehicles miles traveled (VMT) is the appropriate measure of transportation impacts for projects subject to CEQA. Section 15064.3(c) also states that the provisions of the section shall apply prospectively (i.e., only applicable to new projects after date of adoption) and must be implemented statewide by July 1, 2020. On June 9, 2020, the Santa Monica City Council adopted a new process for analyzing the transportation impacts of land use and transportation projects consistent with State law. For land use projects in Santa Monica, the analysis consists of a two-step process which includes VMT screening and, if necessary, VMT analysis. The adopted screening criteria, analytical methods and significance thresholds, which are outlined as follows, are applied to the proposed Project. As required by CEQA the potential for the Project to result in significant transportation impacts related to geometric design features or inadequate emergency access was also assessed. The consistency of the Project with the City's "No Net New PM Peak Hour Trips" policy was also assessed.

4.1 Background on VMT

VMT measures the cumulative distance of automobile travel, taking into account the origin and destination of a particular trip. Typically, development located at a greater distance from other land uses and in areas without transit and active transportation options generates more VMT than development near other land uses with more robust transportation options. As noted by OPR, mitigation to reduce VMT can include designing projects with a mix of uses, building transportation demand management (TDM) features into the project, locating the project in neighborhoods that have transit or active transportation opportunities, or contributing to the creation of such opportunities. Since VMT is sensitive to regional location, it can also be mitigated by choosing a more central location for the project. Used as a transportation metric under CEQA, VMT could encourage reduction of motor vehicle travel, increase transit and active transportation, and increase infill development.

For many years, VMT information has been used to help measure other CEQA impacts, including air quality and greenhouse gas emissions at a project level and, has been used in the analysis of the City's *Land Use and Circulation Element* and other long-range plans, to identify long-range transportation impacts. This is the first long-range plan analyzed by the City since the adoption of new VMT-based CEQA transportation impact methods and metrics in 2020.

4.2 City of Santa Monica VMT Guidance

4.2.1 Screening Criteria for VMT Analysis

As a first step in the transportation review of projects, the City has adopted screening criteria that can be used to "screen" out projects from VMT analysis. Projects meeting the VMT screening criteria are deemed to have a less than significant impact and no further VMT analysis is necessary. The tiered screening criteria for land use projects are described below.

Tier 1: Does the project include the development of the following land uses, which are screened out from further analysis?

Land Uses Screened from VMT Analysis

- 200 residential dwelling units or less
- 100% affordable housing
- 50,000 sf or less of commercial floor area by land use type[1]
- New construction of educational facilities/institutions (such as increased classrooms, gym/recreational space, and other supportive areas) provided that there would be no student enrollment increase or if student enrollment is increased, 75% of the student body comes from within 2.0 miles of the school
- Expansions of civic/government use (such as fire and police stations) and utility facilities less than 50,000 sf or replacement of such uses/facilities (in same or another location) to serve the community, or if larger than 50,000 sf, the project would not result in more than 50 net new additional full time equivalent employees
- Local serving Parks and Recreational facilities, as determined by City Staff

[1] Commercial uses covered under this screening criteria include retail, restaurant, movie theater, gym/fitness, grocery store/market, hotel, medical office, office, and hospital uses less than 50,000 sf. Excludes museums, amusement parks, and other large regional trip attractors as may be determined by City Staff.

If yes, no further analysis is required. If no, move to Tier 2.

For a mixed-use project, the individual components of the project should be evaluated to determine if each can be screened out. For example, a mixed-use project with 150 units and 75,000 sf of office area cannot be screened out at the Tier 1 level and would be required to move to Tier 2.

Tier 2: Is the project located within 0.5-mile walking distance of an Expo LRT station or 0.25 walking distance of Rapid BRT stop?

If no, conduct VMT analysis. If yes, move to Tier 3.

Tier 3: Would the project provide more parking than required by Code (or if located in the Downtown, exceed parking maximums)?

If no, no further analysis is required. If yes, conduct VMT analysis.

Additionally, a land use project would be screened from VMT analysis and concluded to have a less than significant impact if:

- A project decreases [total] vehicle miles traveled in the project area compared to existing conditions or
- A redevelopment project replaces existing VMT generating land uses with new uses that result in a net overall decrease in VMT.

Screening Evaluation

Projects that are screened out based on the criteria above are presumed to have a less than significant impact on transportation and as such, no VMT analysis is required. This Project, the proposed Housing Element Update is a citywide housing plan and does not meet the screening criteria and is therefore not screened out from VMT analysis under this screening criteria.

Achieving the RHNA allocation of 8,895 units throughout the City within the next 8 years would result in housing projects that would fall within and outside of the pre-screened thresholds. Specific development projects that occur following adoption of the proposed Housing Element Update will be subject to subsequent individual review to determine compliance with CEQA and analysis of VMT as necessary. These aspects of individual projects cannot be known at this time.

4.3 VMT Significance Thresholds

The proposed Housing Element Update is a citywide plan and as such cannot be screened out, as described above, and a VMT analysis is required. The VMT estimates of the proposed Housing Element Update were compared against the City's adopted VMT significance thresholds. The City on June 9, 2020 adopted two sets of VMT significance thresholds, both of which are applied to land use projects.[1] For the proposed Housing Element update, which is a land use plan, the City has elected to apply the same thresholds that are used for land use projects.

4.3.1 Threshold 1: VMT per capita

A project's VMT per capita must not exceed the existing Citywide average VMT per capita for that particular land use. Metrics are citywide average daily residential VMT/capita for residential land uses and citywide average daily work VMT/employee for commercial land uses.

[1] City of Santa Monica, Staff Report 3988 Adoption of New CEQA Transportation Guidelines and Thresholds, June 9, 2020; online at http://santamonicacityca.iqm2.com/Citizens/Detail_LegiFile.aspx?Frame=&MeetingID=1229&MediaPosition=&ID=3988&CssClass=

Table 2: City of Santa Monica VMT Threshold: Significance Criteria 1 (VMT per Capita)

Land Use	Proposed Threshold
Residential	No greater than existing Citywide average daily residential VMT/capita
Commercial Employee	No greater than existing Citywide average daily work VMT/employee
Retail	Any net increase in total City VMT

Source: Fehr & Peers, 2021.

4.3.2 Threshold 2: Total VMT

The Project's combined total VMT for residents and commercial employees must be at least 16.8% below existing Citywide "business as usual" VMT per capita. Business as Usual VMT is defined as what the calculated VMT for the Project would be if the Project were generating VMT per capita at the existing citywide average.

Projects exceeding either or both of these thresholds are considered to have a significant transportation impact on the environment. These City-specific thresholds reflect a local consideration to the City's existing transportation conditions as well as State and local land use and sustainability goals. This strategic approach would also ensure that new development will not hinder the City's progress towards reducing GHG emissions, improving mobility options, and implementation of the LUCE.

4.4 VMT Calculation Methodology and Estimation Process

Various VMT metrics described in the City's guidelines are estimated using the City's TDFM. This model is calibrated to represent trip generation by various land use types, traffic volumes on local roadway, trip lengths, and the overall distribution and origin-destination patterns for the various trip purposes. The TDFM is the best available tool to estimate the VMT for the current study. The model represents the following trip purposes:

- Residential trips generated at residential units (Home-based trips)
- Residential trips generated at residential units (Home-based trips)
- Non-residential trips generated at other places beside home and work (Non-home-based trips)

Each of the above trip purposes have specific trip lengths, trip distribution and time-of-day patterns. For example, based on the 2018 census commute to work survey, only about 9.4 % of job opportunities in the City are filled by workers who also reside in the City. Approximately 81.7% of the City's working population is employed outside of the City. A large sample of cell phone data was used to estimate the trip lengths and trip distribution patterns for various trip purposes of trips originating or arriving in the City. This information is essential for accurate VMT estimation. The model VMT calibration and validation is further described in **Appendix A**.

Given the significant increase in housing supply in the City under both the Future No Project and Future With Project scenarios, the parameters of the model such as internalization of trips within the City were updated to reflect the increase in percent of jobs that will be fulfilled by local residents.

Since the LUCE was adopted in 2010, the City has made significant investments into infrastructure projects, programs, services and policy to expand mobility opportunities and reduce VMT. This work has been continually evolving in response to the changing environment. As explained in **Future Analysis Scenarios**, the City's implementation of the TDM ordinance, mobility programs, and capital investments reduce the number of vehicle trips and encourage active transportation and transit trips. These measures will also tend to lessen increases in VMT per capita and VMT per employee under both 2030 No Project and 2030 Future With Project that would otherwise occur.

4.5 Project VMT Impact Analysis

4.5.1 Project Comparison to Significance Threshold 1

Based on the most recent data available from the City's TDFM, the Adjusted Baseline citywide average daily residential VMT per capita is 11.1 and the existing Adjusted Baseline citywide average daily work VMT per employee is 15.3. Therefore, these are the current thresholds applied to the Project.

Table 3 presents results from the City's TDFM runs for this Project for the Adjusted Baseline (2020), Future No Project (2030) and Future With Project (2030) scenarios. Under Future With Project conditions the future population of 116,245 is estimated to produce a total of 198,651 daily trips and 1,162,450 daily residential VMT, with an average of 10.0 miles per capita. The 92,760 employees are estimated to generate a total of 117,070 commute trips and 1,233,708 commute VMT, with an average of 13.3 miles per employee. Thus, the Project's daily VMT per capita and VMT per employee would not exceed the City's VMT Significance Threshold 1.

Table 3: Santa Monica Housing Element Update Summary of Vehicle Miles Traveled

	VMT Metrics	2020 Adjusted Baseline	2030 No Project	2030 With Project
Socio-Economic Data (SED)	Population	92,357	101,583	116,245
	Employment	90,992	95,409	92,760
Vehicle Trips (VT)	Total Vehicle Trips	954,436	989,249	995,832
	Home Based Vehicle Trips (Production)	164,861	181,047	198,651
	Home Based Work Vehicle Trips (Attraction)	118,939	121,163	117,070
	Total Vehicle Trips per Service Population	5.2	5.0	4.8
	Home Based Vehicle Trips per Capita	1.8	1.8	1.7
	Home Based Work Vehicle Trips per Employee	1.3	1.3	1.3
Average Trip Length (VMT/VT)	Average Trip Length (Total Trip)	6.9	7.1	6.7
	Average Trip Length (Home-Based Trip Production)	6.2	6.2	5.9
	Average Trip Length (Home-Based Work Trip Attraction)	11.7	11.4	10.5
Vehicle Miles Traveled (VMT)	Total VMT	6,617,899	6,975,327	6,664,276
	Home-Based VMT (Production)	1,025,163	1,127,571	1,162,450
	Home-Based Work VMT (Attraction)	1,392,162	1,383,431	1,233,708
	Home-Based VMT per Capita	**11.1**	**11.1**	**10.0**
	Home-Based Work VMT per Employee	**15.3**	**14.5**	**13.3**

Source: Fehr & Peers, 2021.

4.5.2 Project Comparison to Significance Threshold 2

The Future With Project (2030) scenario would have an estimated 116,245 residents and 92,760 employees. In terms of the City's VMT Significance Threshold 2, the sum of residential and employee VMT are estimated at 2,814,168 miles calculated with the baseline (Business as Usual) residential VMT per capita and VMT per employee. Under Future With Project conditions, the residential VMT per capita would be reduced by 9.9% (from 11.1 to 10.0) and the work VMT per employee would be reduced by 13.1% (from 15.3 to 13.3). Applying the future VMT values to the projected number of future residents and employees yields a calculated total of 2,396,158 total residential and employee VMT, which is 11.6% lower than the "business as usual" residential and employment VMT. The City's threshold for significance is a minimum reduction of 16.8% VMT. The Future with Project scenario shows a reduction in VMT, but a lesser reduction than the 16.8% threshold of significance. With the Proposed Project, the decreases in citywide average VMT metrics are greater for employee trips than for residential trips, which may reflect the improved jobs-housing balance and the fact that existing TDM activities are more effective in reducing commute trips than home-based trips. The proposed Project's total residential and employee VMT would exceed the City's VMT Significance Threshold 2. **Table 3** provides the details of this analysis and provides a summary of the analysis. Since the VMT per capita and VMT per employee would not exceed VMT Significance Threshold 1 but would exceed Significance Threshold 2, the proposed Project would have a significant impact on VMT.

It should be noted that the 16.8% lower than BAU VMT target was based in part on achieving the City's Climate Action and Adaption Plan (CAAP) greenhouse gas reduction goals and was established by the California Air Resources Board (CARB) to help the State achieve its GHG emission goals. While the proposed Housing Element Update would create significant housing opportunities for many of the workers in the City and would decrease VMT per capita, meeting the 16.8% lower than BAU VMT target would require complementary investments in the City's transportation network and mobility programs. Merely providing housing closer to jobs would not be sufficient to reduce total citywide VMT to below the targeted goal. A more aggressive transportation approach that is integrated with implementation of the proposed Housing Element Update would be required.

Table 4: City of Santa Monica VMT Threshold: Significance Criteria 2 (Total VMT)

	Project VMT	City Average VMT/capita	Project Population	Business as Usual (BAU) VMT
Residential	A (Baseline)	11.1	116,245	1,290,320
Commercial Employee	B (Baseline)	15.3	92,760	1,419,228
Total Resident + Employee (Baseline) BAU VMT				***2,709,548***
Residential	A (Future)	10.0	116,245	1,162,450
Commercial Employee	B (Future)	13.3	92,760	1,233,708
Total Resident + Employee Future VMT				***2,396,158***
Is Total Resident + Employee Future VMT at least 16.8% lower than Total BAU VMT? No, the estimated reduction of 313,390 VMT is 11.6% less than Total BAU VMT.				

Source: Fehr & Peers, 2021.

4.6 Mitigation Measures

As detailed above, the proposed Project would result in an exceedance of the adopted threshold for Total Resident + Employee Future VMT because, while this measure would be 11.6% below the estimated Total Resident + Employee BAU VMT, it would not be 16.8% or more below that threshold. In order to reduce the Total Resident + Employee Future VMT to a less than significant level, a further reduction of 5.2%, or 141,184 VMT, would be needed. In order to achieve this reduction, a range of potential policy actions, infrastructure and transportation service improvements were considered for the City to undertake. These included the following:

- **Residential TDM Program** - Conduct a future study of programmatic transportation demand management (TDM) activities to reduce residential automobile trips, such as promoting (1) resident travel support and incentives to reduce vehicle-based trips, (2) the expansion of car-sharing businesses/activities in the city, (3) the expansion of micro-mobility services in city, (4) autonomous and/or low-emission goods delivery (such as e-bikes and other land-based delivery modes) and other programs and services. Collaborate with private sector partners and the Transportation Management Organization to improve and expand use of these services.
- **Update the Transportation Impact Fee** - Conduct an update to the Transportation Impact Fee (TIF) to change the basic metric from trips to VMT. The nexus study conducted when the City's TIF was adopted in 2013 reflects the costs associated with specified transportation improvements and the amount of new auto trips that can be attributed to projected land use changes. Using VMT as the metric to relate the trip fee to land uses would better align with the City's current

analytical framework for analyzing transportation impacts. Transportation Impact Fee revenues are used to construct infrastructure that support transit, bicycle, pedestrian and active transportation trips for all purposes.

- **Connections to Purple Line** - Investigate the potential for improving bus transit connections through higher frequency service and route adjustments between Santa Monica and the planned stations on the Metro Purple Line (D Line) at the West Los Angeles Veterans Affairs Campus station or from the Westwood station. Construction on this section of the subway extension began in 2019 and operation is planned to begin in 2027. Investigate the potential for creating a protected bicycle facility to complement high frequency transit service to the Metro Purple Line (D Line).

Because empirical data is difficult to collect for these programmatic interventions, it is not possible to quantify the VMT reduction from these efforts in the context of a CEQA-required analysis. The evidence criteria are higher for a CEQA-required analysis than are needed to guide policy and infrastructure decisions. Research organizations like the Transportation Research Board, UCLA and UCB transportation institutes regularly study interventions like the ones described with positive results in terms of vehicle trip and VMT reductions. As a result, these interventions continue to be recommended for Santa Monica to facilitate access and to manage vehicle congestion. However, because it cannot be assured that these measures would be fully effective in reducing total VMT to below adopted VMT Significance Threshold 2, the impact would be considered to remain significant and unavoidable.

4.7 "No Net New PM Peak Hour Trips" Policy Consistency Analysis

Background

The LUCE establishes a bold goal of No Net New Evening Peak Period Vehicle Trips from 2009 levels. The intent of the LUCE is that this goal be achieved by changing travel behavior associated with both existing and future development in the City through a variety of proactive programs, including transportation impact fees and associated infrastructure improvements, TDM strategies, incentives for active transportation modes, congestion management and parking management strategies. The City's trip reduction goals are citywide, understanding that individual new development will inevitably generate vehicle trips. However, the majority of trips in the city are generated by existing land uses, and small percentage reductions in trips and VMT from existing land uses can effectively offset new trips and VMT from new land uses. The LUCE provides a framework for integrating land use and transportation to reduce vehicle trips; encouraging walking, bicycling, and transit use; and creating active, pedestrian-oriented neighborhoods. The LUCE has supported the further development of a complete multi-modal transportation system which builds on the City's historic and ongoing investments in transit and the opportunity created by the extension of the Expo Line (E Line) into the City. The LUCE focuses future development into transit-oriented areas and along transit corridors. The LUCE establishes the goal of achieving the generation of no net new PM peak hour vehicle trips citywide by 2030, and has guided the City's investments in the transportation system to substantially reduce vehicle trips generated by new development and to offset new vehicle trips with reductions elsewhere in the circulation system, such as

from existing development. The LUCE goal of generating no net new PM peak hour trips is not a requirement to be applied on a project-by-project basis. Rather, the intent of this goal is to reduce vehicle trips for existing and future uses on a citywide basis through land use and transportation policy-driven decisions and implementation of programs set forth in the LUCE. The LUCE was adopted in 2010 and set a policy-driven cap of 60,100 PM peak hour trips, based on the anticipated growth in the City through 2030. This specific numeric threshold was obtained from the TDFM modeling conducted at that time and included all trips with one or both trip ends in Santa Monica. Through trips were excluded on the basis that the City's policies could not materially affect the behavior of travelers whose trips did not begin or end in the City. The TDFM used in the LUCE analysis was calibrated to a base year of 2008 through use of extensive baseline traffic count data collected in 2007, 2008, and 2009. Substantial additional traffic data was collected in 2013 when the TDFM was updated. The policy-driven cap of 60,100 PM peak hour trips is directly related to the volume of traffic on City streets in those years.

Analysis of No Net New PM Peak Hour Trips

The Future With Project (2030) scenario is estimated using the current version of the TDFM. The current version of the travel model reflects on-going updates that have been made to incorporate current data and improved transportation modeling practices. This is done to increase the accuracy and level of detail of the model, so that as it is used it provides the most current and best information possible to inform decision-making.

The current Santa Monica Model is updated based on the previous City model, which was calibrated and validated for year 2013, and which itself was an update to the 2008 model. Major updates in the new model include the ones listed below.

- The TransCAD 5.0 software was updated to the more recent version TransCAD 7.0;
- Model structure: the old City model was a peak hour and daily model, and the new model is updated to a peak period and daily model to provide improved accuracy in forecasts of daily trips and VMT;
- Expanded study area to include a larger area of the Westside surrounding the city, and increased network detail was added to the street network to better represent the local traffic;
- The Metro E (Expo) Line is now a mature transit line and its effect was incorporated into the updated model.
- Land use data within the City was updated based on 2019 City Parcel land use inventory, land use data outside of the City was updated based on 2020 SCAG RTP 2019 planning scenario land use for the region.

The current TDFM estimates that there were 56,400 PM peak hour trips under baseline (2020) conditions. However because of changes in the structure of the TDFM and the model enhancements described above made as it was updated and recalibrated to 2019 conditions, the current estimate cannot be directly compared to the policy-driven threshold of 60,100 PM peak hour trips that was produced by the earlier version of the TDFM. It is possible, however, to make direct comparisons of actual traffic counts on the

City streets over the past decade. These comparisons uniformly show that, on a citywide level, traffic volumes have decreased. Detailed traffic volume data is provided in **Appendix C** to support the summary statistics given below.

- The total weighted average traffic volume in the four-hour PM peak period from 3:00 PM to 7:00 PM on 169 street segments located throughout Santa Monica declined by approximately one percent between 2013 and 2019.
- The total weighted average daily traffic volume on 169 street segments located throughout Santa Monica declined by approximately one percent between 2013 and 2019.
- The total weighted average traffic volume in the four-hour PM peak period from 3:00 PM to 7:00 PM on 28 street segments located around the perimeter of Santa Monica declined by approximately eight percent between 2007 and 2019.
- The total weighted average daily traffic volume on 28 street segments located around the perimeter of Santa Monica declined by approximately four percent between 2007 and 2019.
- The City has regularly collected intersection turning movement counts at locations citywide. Comparing the total weighted average of PM peak hour volume data collected throughout the City at 157 locations since 2007 shows that observed volumes have been declining. From 2007 to 2011 the weighted average volume at these intersections declined by approximately 19%, from 2007 to 2013 volume declined by approximately 20% and from 2007 to 2019 volume declined 27%.

The data on daily, PM peak period and PM peak hour traffic volumes collected across the city shows that, in aggregate, volume has declined between 2008 and 2019 despite growth in population and employment in the city during this period.

The TDFM estimates 56,400 PM peak hour trips in the Adjusted Baseline (2020) and approximately 52,900 PM peak hour trips in 2030 with the proposed Housing Element update. Therefore, the proposed Housing Element Update is consistent with the citywide No Net New PM Peak Hour Trips policy articulated in the LUCE.

Current and forecasted continued achievement of the City's No Net New PM Peak Hour Trips can be attributed to the effectiveness of the City's past investments in mobility improvements and ongoing efforts to promote sustainable transportation and to reduce vehicle trips. The City's progress reports for its Sustainable City Plan provides measured data showing positive trends in mobility on a local level.[2] While the indicators do not show a uniform pattern, several of these show trends of increasing use of non-automotive travel modes and an increasing number of persons per vehicle for commute trips.

- Average Vehicle Ridership (AVR) has consistently been increasing for the most part since 1993, when it was 1.64, and reached 1.85 in 2019. AVR is the ratio of people (employees) to vehicles arriving at the worksite. The indicator measures the AVR of employers with more than 50 employees.

[2] *https://data.sustainablesm.org/stat/goals/yr85-esc6*, accessed April 2021.

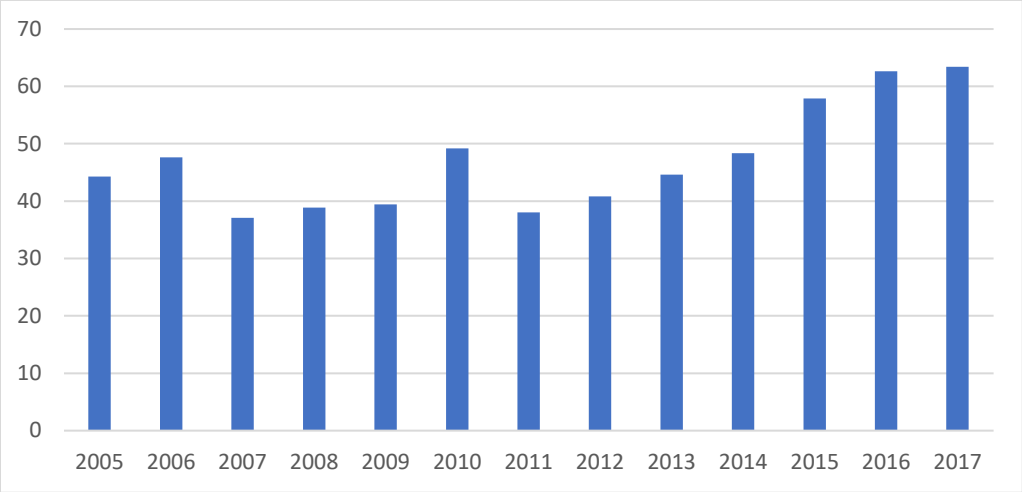
- Use of sustainable transportation modes among employees is improving at a modest rate. In 2007, only 32% of Santa Monica employees used sustainable travel options. By 2019, this amount rose to 45% chose to travel via bike, foot, bus, or carpool. This indicator measures the percent of employees of large employers (50 employees or more) who have chosen to take sustainable transportation modes (bike, bus, foot, carpool) in lieu of driving alone.
- A comparison of 2013 and 2019 count data shows an increase of bicycling on City streets. During the PM peak hour commute, there was a 5% increase in bicycles counted, rising from 6,417 to 6,741 bicycles counted at intersections across the city.
- As of 2020, the bike network was 73% complete; 136 miles out of the Bike Action Plan's 187 miles of bike lanes and paths had been built. This is an increase from 20% complete in 2011. This indicator measures the percent of completion of the bike network proposed in the 2011 Bike Action Plan.

Many people experience traffic congestion as a worsening phenomenon and have daily lives that include more time traveling. This lived experience is informed by many factors, including regional roadway performance such as congestion on I-10, I-405, and major regional corridors like Wilshire and Sunset Boulevards. The data shown for Santa Monica is for streets and roadways within the geographic boundaries of the City of Santa Monica. And while traffic congestion may be worsening on regional corridors, it does not necessarily mean that Santa Monica streets have the same trend. In fact, the data collected suggests that the trend in Santa Monica is different than highway and regional/county data. As noted earlier, Santa Monica can influence travel behavior to/from Santa Monica destinations through services, programs and infrastructure within the city. Santa Monica continues to advocate on the regional/county levels to encourage similar regional investments at that scale to influence trip and VMT reduction. However, for the purposes of this analysis and for transportation planning Santa Monica focuses on local data and trends to inform local decision-making.

Despite local successes in reducing traffic volumes and expanding mobility options within city borders, congestion continues to be a regional and county problem. SCAG's Connect SoCal Congestion Management Technical Report indicates that congestion has increased substantially in all counties since the 2016 RTP/SCS.[3] For example, the top three bottlenecks in the region have nearly doubled in the amount of congestion over the last four years, and virtually all bottlenecks are active all day. **Figure 7** shows the increases in congestion measured by vehicle hours of delay within Caltrans District 7 where the City is located within. Los Angeles County contained the large majority of the region's congestion. The jobs/housing ratio has been cited as a factor contributing to congestion since many residents have been compelled to move farther and farther away from their workplaces for cheaper housing, thereby adding to VMT and congestion in the region.

[3] SCAG Connect SoCal Congestion Management Technical Report, September 2020.

Figure 7: District 7 Annual Vehicle Hours of Delay (million) at 35 mph



4.8 Transportation Hazards

4.8.1 Threshold

Would the Project substantially increase hazards due to a geometric design feature (e.g., share curves or dangerous intersections) or incompatible uses (e.g., farm equipment)?

4.8.2 Impact Statement

While this Housing Element Update provides a framework to expand development opportunities for increased housing development in the City, it does not include any site-specific project plans that can be evaluated for transportation hazards. Individual projects proposed for development subsequent to approval of the proposed Housing Element Update would be subject to, and designed in accordance with, City of Santa Monica standards and specifications. Therefore, the Project would result in a less-than-significant impact.

4.9 Emergency Access

4.9.1 Threshold

Would the project result in inadequate emergency access?

4.9.2 Impact Statement

While this Housing Element Update provides a framework to expand housing development opportunities, it does not include any site-specific project plans that can be evaluated for adequate emergency access. Individual projects proposed for development under the Housing Element Update, including specific site development projects, would be subject to review by the City of Santa Monica and responsible emergency service agencies, ensuring that projects would be designed to meet all emergency access and design standards. Therefore, adequate emergency access would be provided and there is no significant effect. This Project would result in a less-than-significant impact to emergency access.

5. Project Alternatives

Traffic conditions and impacts for the Proposed Project and for the Future No Project alternative were fully evaluated as part of the study. As permitted under CEQA, other project alternatives were evaluated to a lesser level of detail than the proposed project. A qualitative assessment of two additional alternatives to the Project was made to determine their potential impacts on VMT as compared to the proposed Project. Compliance with the City's policy on No Net New PM Peak Hour Trips was also evaluated qualitatively and compared with that of the proposed Project. The alternatives to the proposed Project are described below:

- Alternative 1 - No Project. The No Project Alternative assumes that the Housing Element Update is not implemented. Growth would continue to occur in accordance with adopted plans and regulations. By 2030, it is estimated that a total of approximately 5,000 new dwelling units would be added to the Adjusted Baseline supply. This is less than half as many as are anticipated under the Project.
- Alternative 2 - Transit-Oriented Housing Development on Fewer Sites. Alternative 2 would carry forward the policies of the LUCE but would concentrate new housing within a 0.5-mile radius of the Metro E Light Rail stations. With Alternative 2, the amount of housing planned for would be the same as with the proposed Housing Element Update. However, housing would be intensified on fewer sites and focused in the areas of the Downtown/Civic Center, Bergamot Area, and Memorial Park to meet the RHNA.
- Alternative 3 - Quantified Objective. Given the limitations in available resources, particularly financing for affordable housing as well as infrastructure considerations, the City is seeking a quantified objective that is lower than the RHNA. The quantified objective does not represent a ceiling on development, but rather sets a target goal for the jurisdiction to achieve, based on needs, resources, and constraints. Alternative 3 represents the City's requested quantified objective of 5,363 new units for the 6th Cycle Housing Element. This accounts for 90% buildout of approved/pending projects, development of the sites with high potential for housing development in the DCP, use of City-owned sites (Parking Structure #3, 4th/Arizona, and Bergamot Arts Center) for affordable housing, and development of prior 5th Cycle SSI sites that have high potential for housing. Including the projects that are under construction and in the plan check process and expected to receive building permits by June 30, the total citywide increase in housing by 2030 under this alternative would be 6,744 units. This is slightly more than half as many that are anticipated under the Project.

5.1 Impact Analysis of Project Alternatives

The alternatives were reviewed against the City's VMT screening criteria to determine if a VMT analysis would be required. Each of the alternatives includes development across the entire city whose size, location and specific characteristics cannot be know at this time. While it can be anticipated that under each alternative some individual housing projects would fall within the pre-screened thresholds, it can also be anticipated that some would not. Each development project would be subject to subsequent individual review to determine CEQA compliance and analysis of VMT as necessary. Because the

alternatives cannot be screened out, a qualitative VMT analysis was conducted relative to the City's two significance thresholds related to VMT and the potential impact of each alternative was the compared to that of the proposed Project.

The first threshold test relates to VMT per capita. A project's VMT per capita must not exceed the existing Citywide average VMT per capita for that particular land use. Metrics are citywide average daily residential VMT per capita for residential land uses and citywide average daily work VMT per employee for commercial land uses. As summarized above in Table 3, under the proposed Project, home-based VMT per capita would decline from 11.1 to 10.0 and home-based work VMT per employee would decline from 15.3 to 13.3, a less than significant impact under this impact criteria.

The second threshold test specifies that a project's combined total VMT for residents and commercial employees must be at least 16.8% below existing Citywide "business as usual" (BAU) VMT per capita. Business as Usual VMT is defined as what the calculated VMT for the project would be if it were to generate VMT per capita at the existing citywide average. The proposed Project was found to result in a reduction of 11.6% from the BAU VMT. Because that is less than the 16.8% threshold, the Project was found to result in a significant impact under this impact criteria. Feasible mitigation measures were identified but it was found that this impact could not be reduced to a less than significant level.

Alternative 1 was fully analyzed as part of this study and the results are presented above in Table 3. As shown, under Alternative 1 home-based VMT per capita would remain unchanged at 11.1 and home-based work VMT per employee would decline from 15.3 to 14.5. Thus, it would have a less than significant impact for VMT per capita. This data can be used to calculate that Alternative 1 would generate at total of 2,511,002 combined total Future VMT for residents and commercial employees, which is a reduction of 3% from the 2,587,329 BAU VMT under this alternative.[4] Therefore, like the Project, Alternative 1 would generate less than BAU VMT but not 16.8% or more less than BAU VMT, which would therefore be considered a significant total VMT impact. Because the reduction would be less than what is forecast with the Project, it would be a greater impact than the Project.

Alternative 2 assumes development of the same amount of new housing as the proposed Project but it would be concentrated in closer proximity to rail transit stations. The increased development density around rail transit stations would increase the convenience of non-auto travel modes and reduce vehicle trips and therefore would be expected to result in fewer vehicle trips than what is forecast under the proposed Project. Thus, it would generate less VMT per capita than the proposed Project and would have a less than significant impact for VMT per capita. With fewer vehicle trips and the same number of future residents and commercial employees that are anticipated under the proposed Project, Alternative 2 would generate a lower combined total VMT for residents and commercial employees than what would occur under BAU VMT and lower than what is projected for the proposed Project. Without conducting a

[4] (101,583 x 11.1) + (95,409 x 14.5) = 2,511,001 Future VMT with Alternative 1; and (101,583 x 11.1) + (95,409 x 15.3) = 2,587,329 BAU VMT with Alternative 1

comprehensive quantitative analysis, however, it cannot be known if the reduction in total VMT would be 16.8% or more from Alternative 2 BAU VMT and this impact would be considered significant.

Alternative 3 assumes development of slightly over half the number of new dwelling units that are analyzed under the proposed Project, and more than are assumed under Alternative 1. This would further expand the supply of housing in Santa Monica and improve the local jobs-housing balance. Based on these considerations it is estimated that Alternative 3 would result in average trip lengths for home-based work trip productions and home-based work trip attractions that are between what is shown in Table 3 for the No Project scenario (Alternative 1) and for the proposed Project and would result in VMT per capita values that lie between what is shown in Table 3 for the Alternative 1 and for the proposed Project. Thus, it is estimated that Alternative 3 would have a less than significant VMT per capita impact but that it would not perform as well as the proposed Project. With longer average trip lengths than are anticipated under the proposed Project, Alternative 3 would generate a higher combined total VMT for residents and commercial employees than what would occur under the proposed Project. Because the proposed Project was found to have a significant total VMT impact, it is concluded that Alternative 3 would also have a significant total VMT impact.

The proposed project was found to be consistent with the City's No Net New Evening Peak Period Vehicle Trips policy, as discussed in Section 4.7 above. The City's travel demand forecasting model estimates 56,400 PM peak hour trips in the Adjusted Baseline (2020) and approximately 52,900 PM peak hour trips in 2030 with the proposed Project. Because the level of overall development in the City that is analyzed under Alternatives 1, 2 and 3 is more than the Adjusted Baseline and less than or equal to what is analyzed under the proposed Project, it can be concluded that PM peak hour trips generated by each of the alternatives would be similar to or less than that of the proposed Project and would also be in compliance with the City's No Net New Evening Peak Period Vehicle Trips policy.

The results of the impact analysis of project alternatives is presented in Table 5.

Table 5: Summary of Impacts for Project Alternatives

Scenario	Threshold Criteria 1 (VMT per Capita)	Threshold Criteria 2 (Total VMT)	Compliance with No Net New PM Peak Hour Trips Policy
Proposed Project	LTS	SUI	Compliant
Alternative 1: No Project	LTS / Worse than Project	SUI / Worse than Project	Compliant
Alternative 2: Transit-Oriented Housing Development on Fewer Sites	LTS / Better than Project	SUI / Better than Project	Compliant
Alternative 3: Quantified Objective	LTS / Worse than Project	SUI / Worse than Project	Compliant

Notes: LTS = Less Than Significant Impact SUI = Significant and Unavoidable Impact

References

- *2010 Santa Monica Land Use and Circulation Element* (revised July 25, 2017)
- *Downtown Community Plan* (City of Santa Monica, 2017)
- *Bergamot Area Plan* (City of Santa Monica, 2013)
- *City of Santa Monica Municipal Code Zoning Ordinance and Land Use and Zoning Related Provisions* (City of Santa Monica, 2017)
- *Countywide ExpressLanes Strategic Plan Final Report (LA Metro, March 1, 2017)*
- *Santa Monica Bike Action Plan* (City of Santa Monica, 2011, as amended through 2020)
- *City of Santa Monica Pedestrian Action Plan* (City of Santa Monica, 2016)
- *SCAG Connect SoCal Congestion Management Technical Report* (September 2020)

Appendix A: Santa Monica Citywide Travel Demand Forecasting Model Documentation

FEHR PEERS

Santa Monica Travel Demand Forecasting Model Development Report

Prepared for:
City of Santa Monica

Ref. LA17-3018

June 2021

FEHR & PEERS

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Introduction

This report introduces and describes updates to the Travel Demand Forecasting (TDF) model built for the City of Santa Monica. The report describes the model development process in general (including detail on the base year model development), the sources of data used to develop key model inputs, and calibration/validation.

General Discussion of the TDF Model

This section summarizes the answers to commonly asked questions related to TDF models and how the City of Santa Monica can use a TDF model.

What Is a TDF Model?

A TDF model is a computer program that simulates traffic levels and travel patterns for a specific geographic area. The program consists of input files that summarize the area's land uses, street network, travel characteristics, and other key factors. Using this data, the model performs a series of calculations to determine the number of trips generated, the beginning and ending location of each trip, and the route taken by the trip. The model's output includes projections of traffic volumes on major roads and peak hour turning movements at certain key intersections.

How Is a TDF Model Useful?

The TDF model serves as a valuable tool for preparing long-range transportation planning studies, such as the City's General Plan update, Housing Element, and Circulation Plan update. The travel model can be used to estimate the average daily and peak hour traffic volumes on the major roads in response to future land use, transportation infrastructure, and policy assumptions, and to form a consistent basis by which to analyze the different potential land use scenarios. Additionally, using these traffic projections, transportation improvements can be identified to accommodate the changing traffic patterns associated with the City's future land use. Furthermore, the travel model provides the trip distribution between each origin and destination zone pair in the model, which can be used to calculate a vehicle miles traveled (VMT) metric in accordance with Senate Bill 743.

How Do We Know if the TDF Model is Accurate?

To be deemed accurate for projecting traffic volumes in the future, a model must first be calibrated to a year in which actual land use data and traffic volumes are available and well documented. A model is

accurately calibrated when it replicates the actual traffic counts on the major roads within certain ranges of error as established in the *2017 Regional Transportation Plan for Metropolitan Planning Organizations* (California Transportation Commission, 2017) and the *Travel Model Validation and Reasonability Checking Manual* (Federal Highway Administration 2010), and when it demonstrates stable responses to varying levels of inputs. The Santa Monica model has been calibrated to 2019 base year conditions using observed traffic counts, census data, land use data compiled by City staff, from the Southern California Association of Governments (SCAG), and from the Employment Development Department (EDD). The Santa Monica model also used data from California Household Travel Survey Data, the Southern California Association of Governments (SCAG) Regional Travel Model, and Streetlight data, which consists of GPS data collected from cell phones and in-vehicle navigation devices to better understand travel patterns, trip length, and trip distribution within the City.

Is the City of Santa Monica TDF Model Consistent with Standard Practices?

The City of Santa Monica model is consistent in form and function with standard travel forecasting models used in transportation planning. The model includes a trip generation model based on land use input, has a gravity-based trip distribution model, and uses a capacity-restrained equilibrium traffic assignment process. This Citywide model is a four-step process that ultimately produces vehicle trips and vehicle miles traveled. The travel model uses TransCAD Version 7.0 build 12410 (64-bit), which is a transportation GIS software program consistent with many of the models used by local jurisdictions in California and throughout the nation. The Southern California Association of Governments (SCAG), the Metropolitan Planning Organization (MPO) for Southern California, maintains its current regional travel demand model in TransCAD. The Santa Monica Model uses information from the regionally validated SCAG 2016 RTP model to obtain travel information outside of the City of Santa Monica boundaries.

How Can the TDF Model Be Used?

The TDF model may be used for many purposes related to the planning and design of the City of Santa Monica's transportation system. The following is a partial listing of potential TDF model uses:

- To update the land use and circulation elements of the General Plan
- To conduct a City-wide traffic impact fee program
- To evaluate the anticipated VMT reduction as a result of the newly adopted TDM Ordinance
- To evaluate the traffic impacts of area-wide land use plan alternatives

- To evaluate the shift in traffic resulting from any future roadway improvements
- To evaluate the traffic impacts of land development proposals
- To determine trip distribution patterns of large land development proposals
- To support the development of transportation sections of Environmental Impact Reports (EIRs)
- To support the preparation of project development reports for Caltrans
- To evaluate City-wide and project-level VMT accordance with SB743

Current Model Major Updates

The current Santa Monica model is updated based on the previous City model, which was calibrated and validated for year 2013. Some major updates were incorporated in this new model and the details are provided in each section of the remaining report. A summary of the updates is provided below.

- **Software:** TransCAD 5.0 was updated to TransCAD 7.0.
- **Model Structure:** The old City model was a peak hour and daily model, while the new model is updated to a peak period and daily model.
- **Study Area and Street Network:** An expanded study area includes more buffer zones around the City and a detailed, reviewed street network to better represent the local traffic.
- **Land Use:** Land use within the City is updated based on 2019 City of Santa Monica parcel land use inventory; land use outside of the City is updated based on 2020 SCAG RTP 2019 planning scenario land use.
- **Trip Rates:** Metro Expo line ridership was reviewed and vehicle trip rates in the model are calibrated to match with existing traffic counts. The previous transit reduction estimation process was eliminated since the new rates already consider Expo.

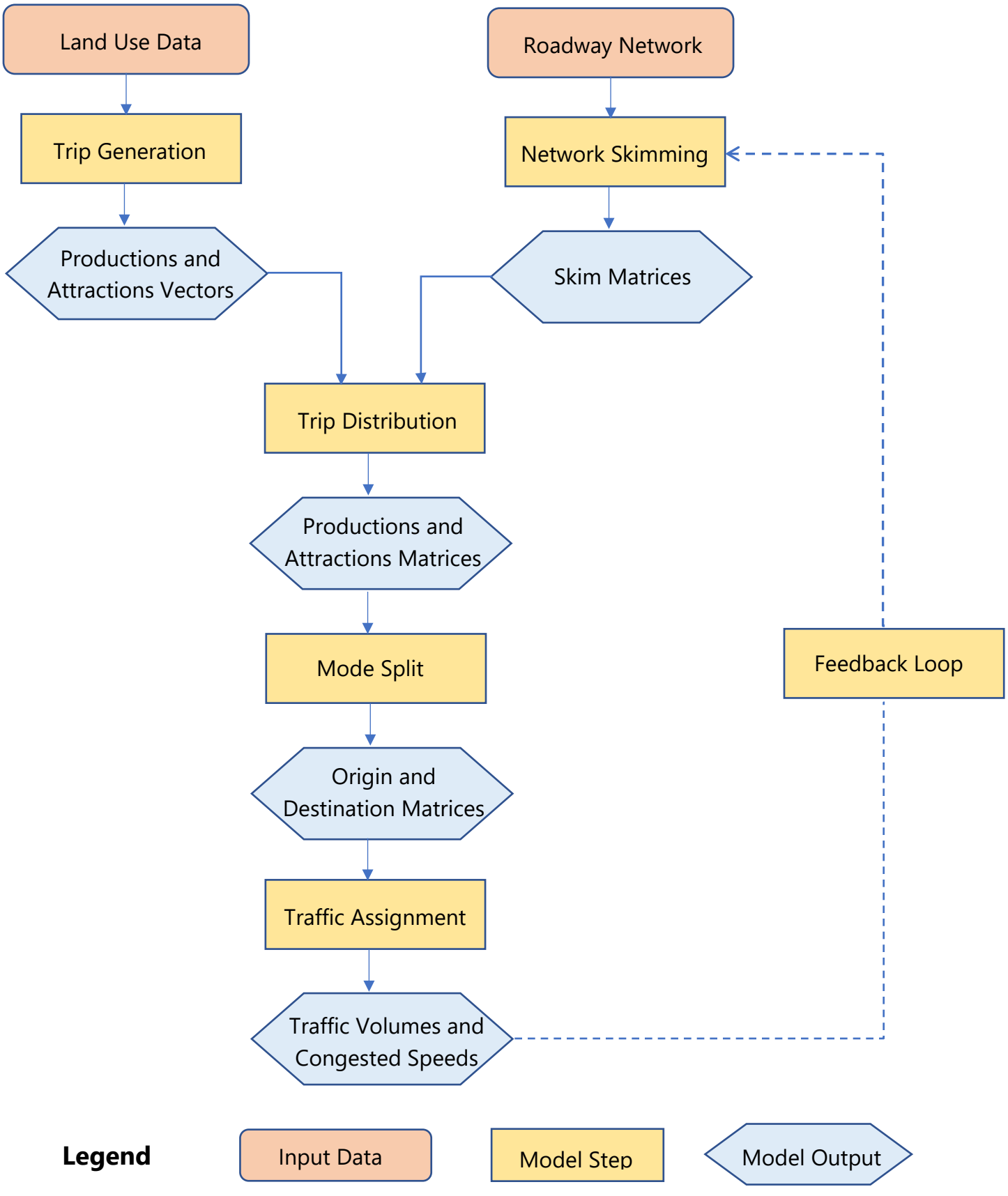


Figure 1

Santa Monica Travel Demand Model (2019)
Santa Monica Model Structure

Input Data Summary

Data Collection

A data collection effort was undertaken at the outset of the model update process. Data sources included the SCAG 2016 RTP for street network and regional travel characteristics, the SCAG 2020 RTP for socioeconomic data outside the City, the 2010-2012 California Household Travel Survey, the 2010 Census, Caltrans Performance Measurement System (PeMS) traffic count data, independently collected 2019 traffic counts within Santa Monica, and GPS data for travel flow information. The City of Santa Monica provided land use data within the City and additional street network data.

Land Use Data

Land use data is one of the primary inputs to the Santa Monica model, and this data is instrumental in estimating trip generation. The model's primary source of land use data is the City of Santa Monica's parcel-level land use database, compiled by City staff for this model in 2020. This database provides information on how much development currently exists on every parcel within the City, which is aggregated into model land use categories within each traffic analysis zone (TAZ). A detailed explanation of the TAZ system is provided below. The land use data in the model is divided into a variety of residential and non-residential categories. Table 1 shows the variety of land uses as aggregated into each of the model land use categories. The City's land use data is supplemented by SCAG socioeconomic data for areas bordering the City of Santa Monica.

The 2019 land use estimate for the City of Santa Monica includes more than 50,000 residential dwelling units and nearly 30,000 square feet in commercial and industrial. In the SCAG areas outside of the City's boundaries, the model includes more than 100,000 residential dwelling units and over 100,000 employees. **Table 2** summarizes the quantity of land use by model land use category for the City of Santa Monica and the model area surrounding the City, as well as comparison with the previous 2013 model land use.

Table 1: Land Use Categories

Land Use Type	Model Code	Units
Residential		
Single-Family	SF_DU	Dwelling Units
Multi-Family Zero Cars	MF_DU_0	Dwelling Units
Multi-Family One Car	MF_DU_1	Dwelling Units
Multi-Family Two or More Cars	MF_DU_2P	Dwelling Units
Convalescent Care	CARE_DU	Dwelling Units
Non-Residential		
Personal Services	PSRV_KSF	Thousand Square-feet
Airport	AIR_BSA	Based Aircraft
Entertainment	ENT_KSF	Thousand Square-feet
Office	OFF_KSF	Thousand Square-feet
Creative Office	COFF_KSF	Thousand Square-feet
Government Office	GOFF_KSF	Thousand Square-feet
Medical Office	MOFF_KSF	Thousand Square-feet
Hospital	HOSP_KSF	Thousand Square-feet
Automotive Related	GSWSH_KSF	Thousand Square-feet
Lodging	LODG_KSF	Thousand Square-feet
Cultural	CULTL_KSF	Thousand Square-feet
Nightlife	NIGHT_KSF	Thousand Square-feet
Restaurant	RSTNT_KSF	Thousand Square-feet
Retail	RET_KSF	Thousand Square-feet
Light Industrial	LTIND_KSF	Thousand Square-feet
Heavy Industrial	HVIND_KSF	Thousand Square-feet
Police and Fire Services	SAFE_KSF	Thousand Square-feet
Elementary and Middle School	ELEM_STU	Students
High Schools	HS_STU	Students
College	COLL_STU	Students
Religious Facilities	RELIG_KSF	Thousand Square-feet
Recreation (Parks and Beaches)	PARK_AC	Acres
Adjacent Neighborhoods - SCAG		
Retail	SCAG_RET	Employees
Office	SCAG_OFF	Employees
Industrial	SCAG_IND	Employees
Educational	SCAG_ED	Employees

Table 2: Land Use Quantities

Land Use Category	Units	2008	2013	2019	Delta
Single-family	Dwelling Units	7,584	7,565	7,806	241
Multi-family	Dwelling Units	41,086	41,625	44,355	2,730
Convalescent Care	Dwelling Units	366	366		-366
Residential Subtotal	Dwelling Units	49,036	49,556	52,161	2,605
Office	Thousand Square Feet	10,271	10,281	10,607	326
Creative Office	Thousand Square Feet	3,483	3,877	5,121	1,244
Government Office	Thousand Square Feet	416	389	465	76
Medical Office	Thousand Square Feet	2,058	2,052	1,939	-113
Hospital	Thousand Square Feet	958	1,185	639	-546
Retail	Thousand Square Feet	3,485	3,715	3,511	-204
Personal Services	Thousand Square Feet	2,110	1,939	1,861	-78
Cultural	Thousand Square Feet	494	541	606	65
Entertainment	Thousand Square Feet	765	780	631	-149
Nightlife	Thousand Square Feet	72	53	56	3
Restaurant	Thousand Square Feet	1,177	1,240	1,347	107
Automotive	Thousand Square Feet	57	55	53	-2
Lodging	Thousand Square Feet	1,157	1,196	2,533	1,337
Religious	Thousand Square Feet	219	220	706	486
Police and Fire	Thousand Square Feet	226	226	211	-15
Light Industrial	Thousand Square Feet	1,553	1,547	1,785	238
Heavy Industrial	Thousand Square Feet	142	127	139	12
Employment Subtotal	Thousand Square Feet	28,643	29,423	32,212	2,789
K-8 School	Students	8,391	8,391	8,391	0
High School	Students	4,148	4,148	4,148	0
College	Students	30,000	30,000	30,000	0
Airport	Based Aircraft	500	500	120	-380
Recreation	Acres	328	321	331	10
Adjacent Neighborhoods					
Residential	Dwelling Units	40,738	40,669	104,131	63,462
Office	Employees	32,733	30,440	33,355	2,915
Retail	Employees	3,993	3,917	10,258	6,341
Industrial	Employees	4,585	3,814	3,232	-582
Education	Employees	5,854	5,458	91,641	86,183
Employment Subtotal	Employees	47,165	43,629	138,486	94,857

Traffic Analysis Zone System

Travel demand models use traffic analysis zones (TAZs) to subdivide the model area for the purpose of connecting land uses to the street network. TAZs represent physical areas containing land uses that produce or attract vehicle trip ends. The TAZ system for this model was developed based on the system from the previous City of Santa Monica TDF model. The TAZs within the City remain almost the same as the previous model, with 613 TAZs. TAZs within the City were originally developed based on SCAG TAZ structure and further updated based on the roadway network, focus areas, and major development projects.

The updated Santa Monica model underwent a major update to expand the current study area of the model. TAZs outside of the City changed from 225 zones to 310 zones. The study area in the new model was expanded to include I-405 on the east and Ballona Creek on the south. No changes were made for the north and west boundaries because of geographical barriers. The TAZ system for the model areas outside the City of Santa Monica was based on the SCAG 2016 RTP model, with TAZs subdivided to match the level of detail within Santa Monica's TAZ system to better represent the detailed socioeconomic (SED) information. **Figure 2** illustrates the TAZ boundaries within the model area. **Table 3** shows the TAZ numbering system in the model. After reviewing the TAZ layer used in both the previous Santa Monica model and SCAG regional model, along with the street network and recent aerial photographs, a set of TAZ boundaries was created to achieve the following local area enhancements:

- Modifying TAZ boundaries to coincide with large developments or geographic features
- Subdividing large TAZs to provide for a more detailed traffic assignment
- Merging TAZs with similar development and traffic circulation behavior

The enhancements result in a system of 1,029 TAZs, with 613 TAZs within the City of Santa Monica and 310 TAZs covering the surrounding areas of the City of Los Angeles. The model also includes 67 spare (empty) TAZs that can be used to add TAZ detail in the future, if necessary.

The external stations or gateways at points where major roadways provide access into the model area are also included in the TAZ structure. The external gateways represent all major routes by which traffic can enter or exit the study area and capture the traffic entering, existing, or passing through the model area. **Table 4** contains a list of the 29 external gateways, numbered from 1001 to 1029, that were established for this model. **Figure 3** illustrates the locations of the external stations.

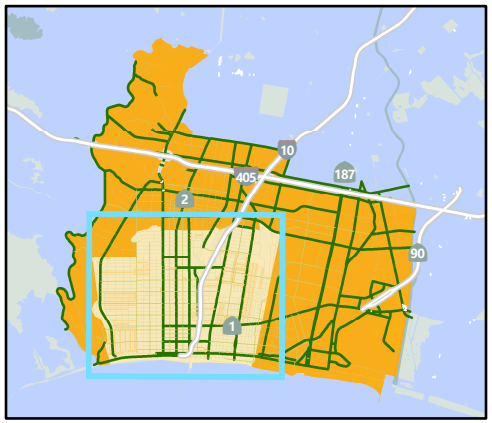
Table 3: TAZ Numbering System

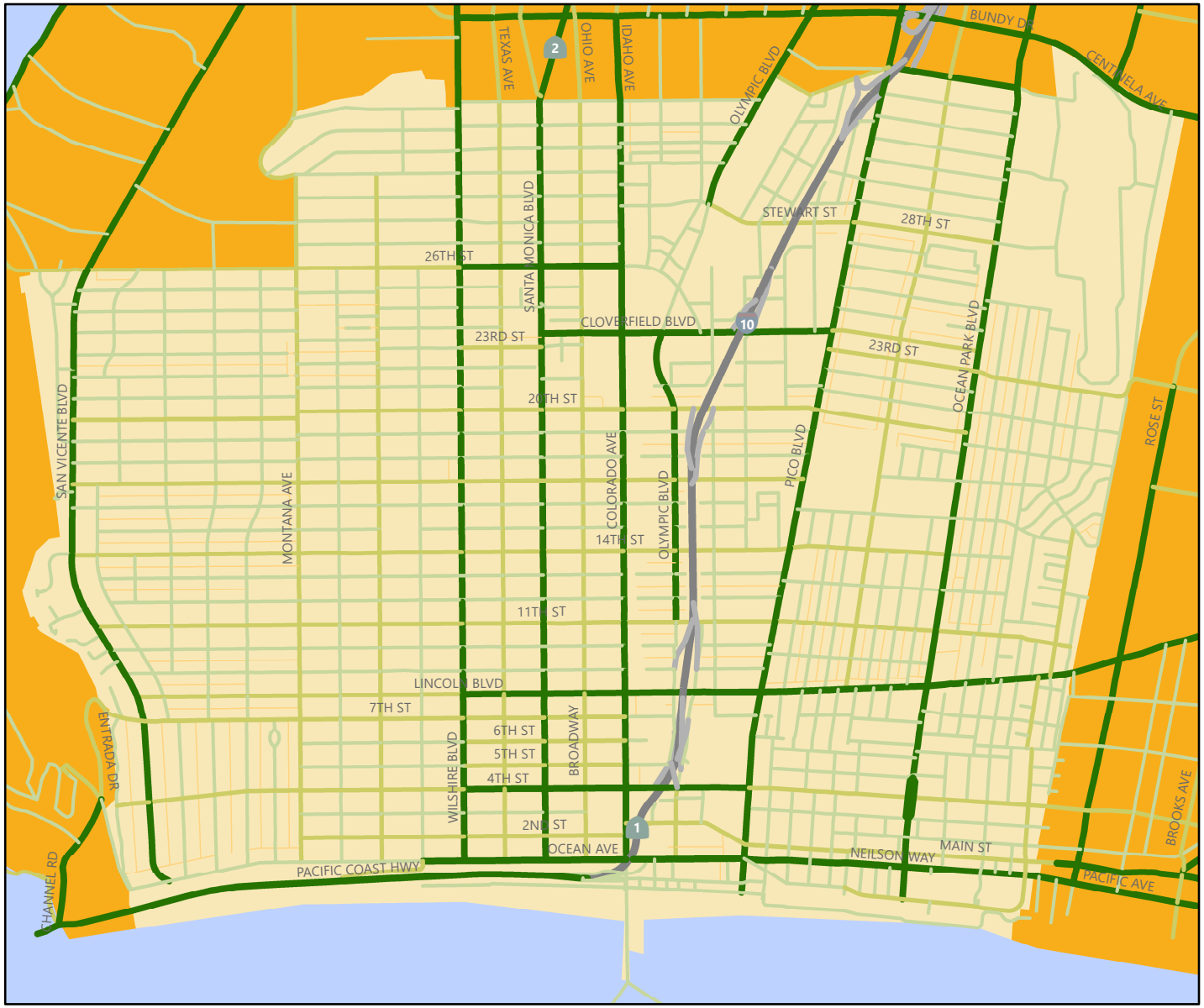
TAZ	Description
1-600,602-614	Santa Monica
601,615-664	Unassigned
665-974	SCAG
975-1000	Unassigned
1001-1029	External gateways

Source: Fehr & Peers, 2020

Table 4: External Gateways

ID	Description
1001	PCH north of Chautauqua Blvd
1002	Sunset Bl south of Hartzell St (north of Chautauqua Blvd)
1003	Kenter Ave north of Sunset Blvd
1004	Bundy Dr north of Sunset Blvd
1005	Barrington Ave north of Sunset Blvd
1006	Sunset Blvd east of Beverly Glen Blvd
1007	Wilshire Blvd east of Selby Ave
1008	Ohio Ave east of Westwood Blvd
1009	Santa Monica Blvd east of Westwood Blvd
1010	Olympic Blvd east of Westwood Blvd
1011	Pico Blvd east of Westwood Blvd
1012	Westwood Blvd south of National Blvd
1013	National Blvd east of Veteran Ave
1014	Palms Blvd east of Sepulveda Blvd
1015	Venice Blvd (WB) east of Sepulveda Blvd
1016	Venice Blvd (EB) east of Sepulveda Blvd
1017	Washington Blvd/Washington Pl east of Tilden Ave
1018	Culver Blvd east of Sepulveda Blvd
1019	Braddock Dr east of Sepulveda Blvd
1020	Sepulveda Blvd south of Ballona Creek
1021	Sawtelle Blvd south of Ballona Creek
1022	Inglewood Blvd south of Ballona Creek
1023	Centinela Ave south of Ballona Creek
1024	SR-90 south of Ballona Creek
1025	Lincoln Blvd south of Ballona Creek
1026	Culver Blvd south of Ballona Creek
1027	I-405 south of Ballona Creek
1028	I-405 north of Church Ln/Ovada Pl
1029	I-10 east of Westwood Blvd





City of Santa Monica
Buffer
Freeway
Ramp
Arterial
Collector
Local
Alley

Figure 2

Santa Monica Travel Demand Model (2019)
Santa Monica Model Area and Street Network

Figure 3

Santa Monica Travel Demand Model (2019)
Santa Monica External Station Locations

Street Network

The original street network for the 2008 base year conditions is derived from the City of Santa Monica's GIS roadway centerline file. The model street network includes all freeways, state highways, arterials, collectors, and local roads within the study area. These classifications are based on the City's 2010 Land Use and Circulation Element (LUCE) and reflect existing conditions. Later in the 2013 base year model, modifications to the street network were made to incorporate changes that occurred between 2008 and 2013. This updated 2019 base year model is updated on top of the previous changes by using aerial photography and gathering input from the City regarding roadway network assumptions. As is typical for urban area models, the model network focuses on the most-used facility types. Some residential streets are included as well, not to replicate individual travel patterns, but to distribute traffic volumes more realistically along major arterials. As a major update in the new model network, most of the alleys and courts in the downtown area and other dense areas in the City previously coded in the model are now replaced with centroid connectors. The access points for each TAZ are reviewed to make sure all the centroid connectors can appropriately represent the real network. This improves the model assignment performance. The street categories included in the model are described below.

Freeways

Freeways are high-capacity facilities that primarily serve longer-distance travel. Access is limited to interchanges, typically spaced at least one mile apart. Interstate 10 is the freeway that runs directly through the Santa Monica model area. As part of expanding the model study area, I-405 was added into the 2019 base year model to capture trips coming to and from the City through I-405 to West Los Angeles.

Highways

Roadways designated as highways are typically state highways that are not limited-access freeways. In Santa Monica, these facilities serve travel between the City and its neighboring jurisdictions. The primary highway in Santa Monica is SR 1 (Pacific Coast Highway or PCH). Portions of Lincoln Boulevard and Santa Monica Boulevard are also designated as State Routes in Santa Monica. However, these facilities function more like arterials and are coded as such in the model.

Arterials

Roadway segments classified as arterials are major roads that provide connections within the City, between the City and neighboring areas, and through the City. Minor arterials in Santa Monica typically have two lanes in each direction, with travel speeds of 30-35 miles per hour (mph). Examples of these arterials include Wilshire Boulevard, Santa Monica Boulevard, Ocean Avenue or Lincoln Boulevard.

Collectors

Collectors are facilities that connect local streets to the arterial and highway system and may also provide direct access to local land uses. Collectors typically have one lane in each direction, with speeds of 25-30 mph. In Santa Monica, streets that fulfill this purpose and are primarily located in residential areas are called feeders.

Local Streets

Some local streets have been added to the model; these streets primarily feed collector roads and are typically one lane in each direction, with speeds of 20-25 mph. These streets were added mainly to provide more realistic loadings to larger roadways and have not been calibrated with observed vehicle volumes.

For each of its records, the street network database includes a street name, distance, functional class, speed, capacity, and number of lanes. These attributes were checked using maps, aerial photographs, and other data provided by the City of Santa Monica. The number of lanes and free-flow speeds were verified for the entire network. The capacities of roadway links and travel time factors were adjusted during the calibration process for each time period to reflect actual conditions at specific locations. **Table 5** shows the initial roadway speeds, lanes, and capacities used for each roadway class in the model. Where necessary, these values were adjusted to reflect current conditions at specific locations.

Alleys

The original 2013 model included all alleys and courts within the City of Santa Monica. During the update of 2019 Santa Monica model, the majority of alleys and courts in the downtown and other dense areas were removed and replaced with centroid connectors. However, there are still some alleys in the model to provide the network density in less dense areas. These streets are typically one lane in each direction, with speeds of 10 mph. Examples of these alleys include Euclid Court. and 12th Court. between Georgina Avenue and Montana Avenue.

Table 4: Typical Roadway Speeds and Capacities

Roadway Classification	Speed (MPH)	Total Through Lanes	Lane Capacity (Vehicles per hour per lane)	Total Facility Capacity (Vehicles per hour)
Freeway	65	4-10	2,000	8,000-20,000
Highway	50	4-6	1,200	4,800-7,200
Arterial	30-35	4	900	3,600
Collector/Feeder	25-30	2	600	1,200
Local	25	2	600	1,200
Alley	10	2	250	500
Ramp	30	1	1,800	1,500
Centroid Connector	30	2	10,000	20,000

* Functional Class definitions are in concurrence with the City of Santa Monica Land Use and Circulation Element, 2010.

** Centroid connectors are abstract representations of the starting and ending point of each trip, and thus should have no capacity constraints.

Description of the Model Calibration Process

Model calibration is the process by which parameters for the model are determined. These parameters are based on comparing travel estimates computed by the model with actual data from the area being modeled. This section provides a general description of the calibration steps and the adjustments made during the process to achieve accuracy levels within Caltrans guidelines.

Trip Generation

Trip Generation Rates

Trip generation rates relate the number of vehicle trips going to and from a site to the type of land use intensity and diversity of that particular site. Each trip has two ends, a "production" and an "attraction." By convention, trips with one end at a residence are defined as being "produced" by the residence and "attracted" to the other use (workplace, school, retail store, etc.) and are called "Home-Based" trips. Trips that do not have one end at a residence are called "Non-Home-Based" trips.

Six trip purposes are used in the Santa Monica model:

1. Home-Based Work (HBW): Trips between a residence and a workplace
2. Home-Based Other (HBO): Trips between a residence and any other destination
3. Non-Home-Based (NHB): Trips that do not begin or end at a residence, such as traveling from a workplace to a restaurant or from a retail store to a bank
4. School (SCHOOL): Trips between a residence and a K-12 school
5. College (COLLEGE): Trips between a residence and a college or university
6. Recreational (REC): Trips between a residence and the beaches and parks

Trip generation rates are initially defined for total trips and later split by trip purpose for both productions and attractions.

The most widely used source for individual project vehicle trip generation rates in the transportation planning field is the *Trip Generation Manual, 10th Edition*. This book contains national averages of trip generation rates for a variety of land uses in what are generally suburban locations. The ITE land use categories tend to be very specific, while model land use categories (accounting for all land use in the City)

tend to be more general. ITE rates are appropriate for smaller site-specific uses, such as traffic studies for development review, and they provide a starting point for travel models by capturing the interaction between all land uses in the City. However, the unique local characteristics of Santa Monica require the development of specific trip generation rates for the model.

A traffic impact study uses ITE trip generation rates because, in most cases, the project being examined shares characteristics with the information contained in the *Trip Generation Manual, 10th Edition*. In other words, both the traffic impact study and the ITE rates rely on single-use, isolated projects that have plenty of free parking and little or no interaction with other nearby uses. When assessing the impact of an individual project, the ITE rates are typically appropriate since they can correctly mimic the site being analyzed in the traffic impact study.

The Santa Monica model, on the other hand, generates trips by purpose, and balances productions to attractions. The model also has trip rates calibrated to local conditions and other advanced trip generation features, such as the cross classification of dwelling units by vehicle availability. Traffic impact studies rely on ITE trip rates that only vary based on land use type or size. While these trip rates are a valid starting point for model calibration and validation, they have a different purpose and are not necessarily suitable for demand forecasting without customization.

Certain ITE rates are more applicable to Santa Monica model rates because of their comparable level of detail. For example, both ITE and the Santa Monica model have a generic office category. Some ITE rates, however, cannot be used directly because the land use category is not the same as the City of Santa Monica's land use classifications. For example, ITE's restaurant categories include high-turnover restaurant, fast food restaurant, fast food restaurant with drive-through with seating, fast food restaurant with drive-through and no seating, and other types. By necessity, Santa Monica restaurant rates represent a compilation and average of rates from other Southern California locations and have been customized to the City. It is important to recognize that ITE rates are also averages, based on driveway counts at multiple locations, so the use of average rates within the Santa Monica model is entirely appropriate.

The original model trip generation rates were initially based on the Land Use and Circulation Element (LUCE) of the Santa Monica General Plan. During the model calibration and validation process, the SCAG regional model, ITE's *Trip Generation 10th Edition*, and the trip generation rates used for the Glendale, West Hollywood, and Pasadena City-wide models were all reviewed to better adjust the initial trip generation rate. These City models were reviewed because they share some socioeconomic and land use characteristics with the City of Santa Monica. The rates were then modified to account for local conditions based on traffic counts, production-to-attraction balancing (discussed below), and the difference between ITE and model land use definitions. The final Santa Monica trip generation rates are unique to the Santa Monica model, and they are ultimately based upon the results of successful model calibration and validation.

Production and Attraction Balancing

Local trips (internal-to-internal or I-I) are trips that both start and end in the study area. One of the basic assumptions of any travel model is that the total number of local trips produced is equal to the total number of local trips attracted. It is logically assumed that if a journey is started somewhere, it must have an ending somewhere else. If the total productions and attractions are not equal, the model will typically adjust the attractions to match the productions, thus ensuring that each departing traveler finds a destination. While it is never possible to achieve a perfect match between productions and attractions prior to the automatic balancing procedure, the existence of a substantial mismatch in one or more trip purposes indicates that either land use inputs or trip generation factors may be in error. Therefore, in developing the trip productions and attractions for the Santa Monica model, a careful pre-balancing was conducted outside the model stream to eliminate possible disparity errors.

Estimating the proportion of local trips is the first step in this process. **Table 6** shows the distribution of work locations for Santa Monica residents and the distribution of residential locations for Santa Monica employees, based on 2018 U.S. Census OnTheMap data. The proportion of local HBW trips, which start and end within the model area, was estimated to be between 9% and 20%.

Table 5: City of Santa Monica Commuting Patterns

Location	Inside Santa Monica	Outside Santa Monica
Santa Monica Residents -Employment Location	19.5%	81.7%
Santa Monica Employees - Residential Location	9.4%	91.0%

Source: U.S. Census Bureau OnTheMap, 2018 https://onthemap.ces.census.gov/

For non-work trip purposes, information from the SCAG Reginal Model and the California Household Travel Survey was used to develop estimates of the percentage of HBO and NHB trips that are local to the model area. **Table 7** shows the number of internal (I-I) and external (I-X and X-I) trips broken down by purpose, as well as the target percentages of internal trips compared to the total internal and external trips by trip purposes from the regional data sources.

Table 6: Internal and External Trips by Trip Purpose

Trip Purpose	Internal Trips	External Trips	Percent of Total Daily Vehicle Trips	
			Santa Monica Model	Regional Targets*
Home-Based Work (HBW)	47,832	363,728	12%	12%
Home-Based Other (HBO)**	256,033	261,409	49%	50%
Non-Home-Based (NHB)	196,778	354,332	36%	35%
Total	500,644	979,469	34%	35%

* 2012 California Statewide Household Travel Survey

** School, college, and recreation trips are subsets of the HBO trip purpose

The second step in the pre-balancing is to compare the number of productions with the number of attractions by purpose for local trips within the model area. In this step, it is important to understand the production and attraction trip purpose distribution by land use type, which determines the number of trips produced or attracted by different trip purposes for a certain land use type. To minimize the number of variables in this step, model land use types are grouped into eight sub land use groups. The production and attraction trip purpose distributions are identified by these sub land use groups. **Table 11** lists the sub land use groups for trip purpose distribution. **Table 8** summarizes the trip purpose distribution assumptions. **Table 9** summarizes the local trip productions and attractions from the Santa Monica model for each trip purpose, prior to the application of the automatic balancing procedure. Guidelines published by the Federal Highway Administration's Transportation Model Improvement Program (TMIP) and the National Highway Cooperative Research Program (NCHRP) suggest that, prior to balancing, the number of productions and attractions should match to within plus or minus 10%. The results indicate that the 2019 model meets the published guidelines for all trip purposes.

Table 7: Internal and External Trips by Trip Purpose

Sub Land Use Group	Production						Attraction						Total
	HBW	HBO	NHB	SCH	COL	REC	HBW	HBO	NHB	SCH	COL	REC	
Residential	20%	32%	17%	4%	3%	2%		5%	17%				100%
Office			17%				36%	30%	17%				100%
Retail			25%				15%	35%	25%				100%
Industrial			30%				30%	10%	30%				100%
School			15%				5%		15%	65%			100%
College			15%				5%		15%		65%		100%
Recreation			5%				5%		5%			85%	100%
Hotel			30%				40%		30%				100%

Source: Fehr & Peers, 2021

Table 8: Trip Productions and Attractions by Purpose

Trip Purpose	Productions (Trips)	Attractions (Trips)	% Difference
Home-Based Work (HBW)	47,862	48,507	1%
Home-Based Other (HBO)	200,075	200,733	0%
Non-Home-Based (NHB)	196,778	196,778	0%
School (SCH)	28,730	27,873	3%
College (COL)	19,475	18,854	3%
Recreation (REC)	9,800	9,232	6%

Source: Fehr & Peers, 2021

In addition to production and attraction balancing, the percentages of total trips for each purpose were checked for reasonableness. **Table 9** shows the trip purpose as a share to total trips in the Santa Monica model and based on the subset of the California Household Travel Survey (CHTS) that represents Santa Monica. This information indicates that the trip generation component of the Santa Monica model is performing reasonably.

Table 9: Trips Purpose Percentages

Trip Purpose	Number of Trips	Percent of Total Daily Person Trips	
		Santa Monica Model	Regional Targets*
Home-Based Work (HBW)	411,560	28%	28%
Home-Based Other (HBO)**	517,442	35%	39%
Non-Home-Based (NHB)	551,111	37%	33%
Total	1,480,112	100%	100%

* 2012 California Statewide Household Travel Survey

** School, college, and recreational trips are subsets of the HBO trip purpose

Further Refinement

In addition to the standard trip generation procedures, certain enhancements were added to the Santa Monica model to better capture local trip-making characteristics and provide the ability to test certain policy options for future development scenarios. These enhancements included dividing the model area into four area types and cross-classifying multifamily households by auto ownership.

Area Types

The model area contains a variety of development patterns, each with different land use characteristics and associated trip-making patterns. To account for these differences, the model area was divided into four area types. The four area types, shown in **Figure 4**, have their own associated trip generation rates and internal/external trip-making characteristics. Trip generation rates for each land use in each area type are shown in **Table 11**.

Area type 1 represents Downtown Santa Monica and the Special Office District. This area contains the greatest concentration of commercial and retail land uses within the boundaries of the model. These land uses are grouped together because of their similar density and propensity to attract trips from outside the model area. These two locations differ from the rest of the model area by exhibiting high levels of walkability, a lower propensity for driving, and denser transit service. The boundary drawn between area type 1 locations and the rest of the model was based on the likelihood of pedestrian travel between complementary land uses.

Mode choice is strongly determined by auto availability, and since most people arrive in Downtown Santa Monica and the Special Office District by car, the locations covered by area type 1 were defined by two

factors that counteracted what otherwise would have been a predisposition towards driving. Distance between origin and destination was the first factor. People are more likely to walk than drive when the distance they need to travel is a quarter mile or less. The second factor was a high density of complementary land uses. Driving trips are eliminated when people can park once and walk to multiple destinations. Complementary land uses also allow people who do not arrive by car (by way of public transit, biking, walking) to carry out multiple trips within their walking radius.

Area type 2 represents the remaining residential and commercial portions of Santa Monica. This area has development patterns generally consisting of connecting streets and a mixture of residential and non-residential land uses.

Area type 3 represents the coastal areas in the model area. These areas contain a large portion of the recreational land use. Most of the commercial land uses in the area support the recreational land uses. There is limited residential development in area type 3.

Area type 4 represents the buffer areas of the City of Los Angeles surrounding the City of Santa Monica.

Table 10: Daily Vehicle Trip Generation Rate by Area Type

Land Use	Units	Distribution	Area 1	Area 2	Area 3	Area 4
Ajacent Neighborhoods - SCAG						
Single-family	Dwelling Units	Residential	9.36	9.42	10.00	9.42
Multi-family, zero car	Dwelling Units	Residential	1.50	2.05	2.21	
Multi-family, one car	Dwelling Units	Residential	3.01	3.59	3.85	3.59
Multi-family, two or more cars	Dwelling Units	Residential	5.16	6.07	6.49	
Personal Services	Thousand Square-feet	Retail	19.66	43.61	44.32	
Airport	Based Aircraft	Retail	35.41	39.39	40.00	
Entertainment	Thousand Square-feet	Retail	35.41	39.39	40.00	
Office	Thousand Square-feet	Office	9.52	9.97	10.52	
Creative Office	Thousand Square-feet	Office	8.57	8.77	9.00	
Government Office	Thousand Square-feet	Retail	34.29	35.00	35.00	
Medical Office	Thousand Square-feet	Retail	28.58	29.32	30.00	
Hospital	Thousand Square-feet	Office	15.85	16.13	16.50	
Automotive Related	Thousand Square-feet	Retail	151.55	151.74	152.84	
Lodging	Thousand Square-feet	Hotel	1.84	1.83	1.93	
Cultural	Thousand Square-feet	Retail	29.20	29.22	29.75	

Land Use	Units	Distribution	Area 1	Area 2	Area 3	Area 4
Nightlife	Thousand Square-feet	Retail	21.55	21.61	21.77	
Restaurant	Thousand Square-feet	Retail	79.01	81.06	80.00	
Retail	Thousand Square-feet	Retail	29.41	40.56	38.76	
Light Industrial	Thousand Square-feet	Industrial	1.47	1.50	1.50	
Heavy Industrial	Thousand Square-feet	Industrial	1.48	1.51	1.50	
Police and Fire Services	Thousand Square-feet	Industrial	6.31	6.31	6.31	
Elementary and Middle School	Students	School	1.20	1.20	1.20	1.20
High Schools	Students	School	1.71	1.71	1.71	1.70
College	Students	College	1.15	1.15	1.15	1.10
Religious Facilities	Thousand Square-feet	Office	9.11	9.11	9.11	
Recreation (Parks and Beaches)	Acres	Recreation	27.50	28.00	52.50	
Ajacent Neighborhoods - SCAG						
Retail	Employees	Retail				16.47
Office	Employees	Office				2.89
Industrial	Employees	Industrial				6.80
Educational	Employees	Office				1.50

Multifamily Unit Vehicle Availability

To provide the ability to test certain potential policy alternatives, multifamily dwelling units were divided into three types representing varying levels of vehicle ownership. Vehicle ownership data for each census tract in Santa Monica was obtained from the 2018 Census data using 2014-2018 American Community Survey 5-Year estimates. The total number of multifamily units in each census tract was apportioned to the relevant multifamily category by the level of vehicle ownership. The daily vehicle trip generation rate is different depending on the vehicle ownership of each multifamily dwelling unit, as in **Table 12**.

Table 12: Multifamily Trip Generation Rate within the City of Santa Monica

Land Use Type	Land Use Code	2019	Trip Rate
Multi-family with 0 vehicle	MF_DU_0	4,998	1.9
Multi-family with 1 vehicle	MF_DU_1	23,859	3.6
Multi-family with 2+ vehicle	MF_DU_2P	15,498	6.0

Source: Fehr & Peers, 2021

Trip Generation by Time Period

The model trip generation step starts with daily trip generation assumptions. On top of the daily trip generation assumptions, there is a model input file that determines the trip distribution by time period, called the hourly input file. The following peak periods are defined in the model:

- AM Peak period : 6:00 am – 9:00 am
- Midday Periods: 9:00 am – 3:00 pm
- PM Peak Periods: 3:00 pm- 7:00 pm
- Off-Peak Periods: 7:00 pm – 6:00 am

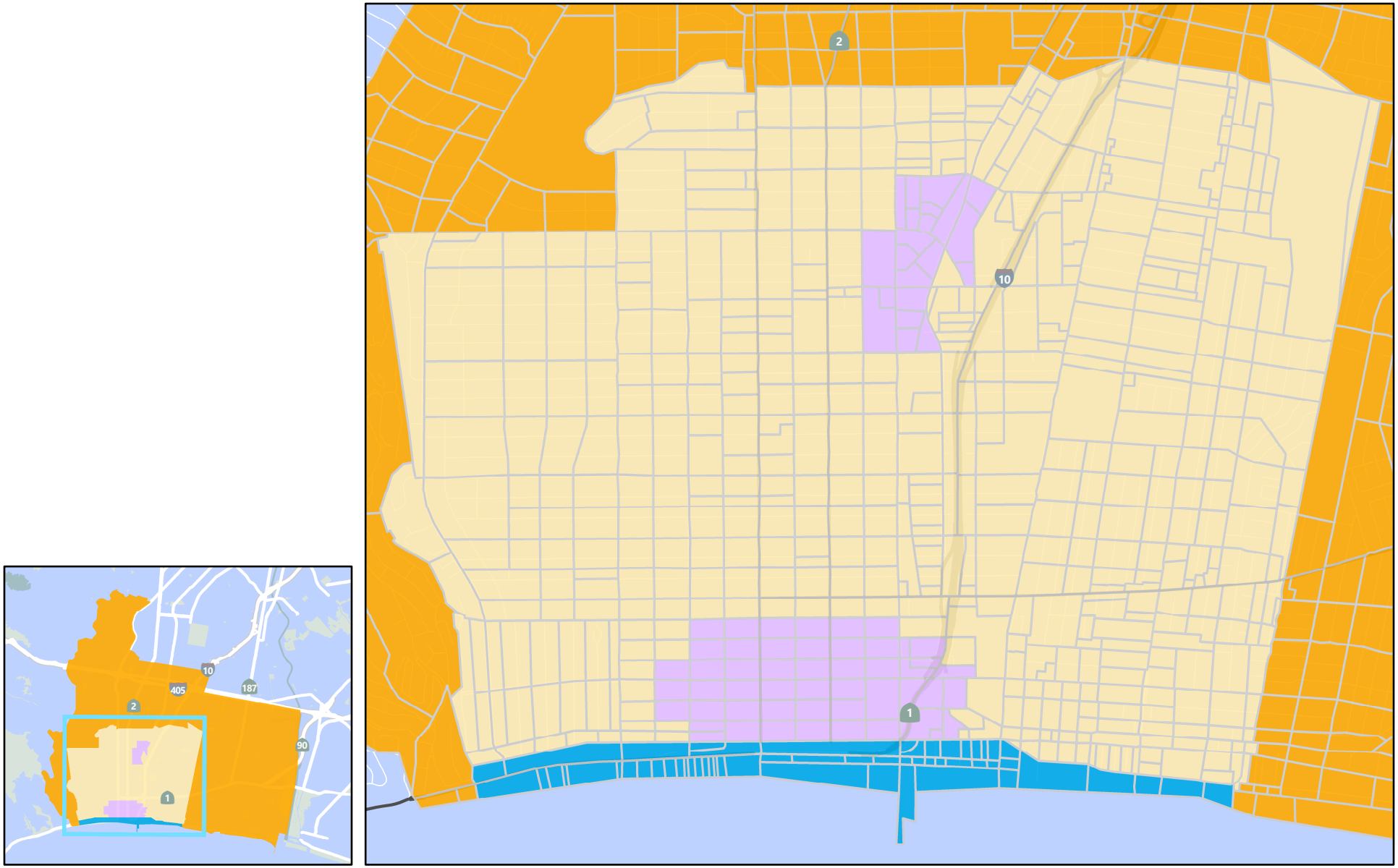
There are also two peak hour periods in the model:

- AM Peak Hour: 8:00 am – 9:00 am
- PM Peak Hour: 5:00 pm- 6:00 pm

Using peak period and peak hour counts, the hourly input is calibrated until the model outputs by time period are consistent with the City of Santa Monica by time period counts. **Table 13** summarizes the total number of trips generated by TAZs within the by trip purposes and by time periods.

Table 13: City of Santa Monica Trips Generation by Time Period

PURPOSE	HBW	HBO	NHB	SCH	COL	REC	TOTAL
Daily Trips	167,293	303,555	392,182	21,314	31,039	17,743	933,126
AM Peak Period Trips	50,188	33,391	31,375	7,460	6,518	1,419	130,351
PM Peak Period Trips	40,150	54,640	149,029	3,623	6,518	4,436	258,397
PM Peak Hour Trips	8,365	18,213	23,531	1,066	2,483	1,065	54,722



Area Type 1: Downtown and Special Office District

Area Type 2: Remaining City of Santa Monica

Area Type 3: Coastal Area within City of Santa Monica

Area Type 4: Buffer Zone outside of City of Santa Monica

Figure 4

Santa Monica Travel Demand Model (2019)
TAZ System and Area Type

Trip Distribution (Gravity Model)

Once the trip generation step has determined the number of trips that begin and end in each zone, the trip distribution process determines the specific destination of each originating trip. The destination may be within the zone itself, resulting in an intra-zonal trip. If the destination is outside of the zone of origin, it is an inter-zonal trip. Internal-internal (I-I) trips originate and terminate within the model area. Trips that originate within but terminate outside of the model area are internal-external (I-X), and trips that originate outside and terminate inside of the model area are external-internal (X-I). Trips passing completely through the model area are external-external (X-X).

The trip distribution model uses a gravity model equation to distribute trips to all zones. This equation estimates an accessibility index for each zone based on the number of attractions in each zone and a friction factor, which is a function of travel time between zones. Each attraction zone is given its share of productions based on its share of the accessibility index. This process applies to the I-I, I-X, and X-I trips. The X-X trips are added to the trip matrix prior to final assignment.

This stage of the model was calibrated and validated for trip length and trip distribution using data from the California Household Travel Survey and Streetlight. These comparisons are described in more detail in the Model Validation section below.

Friction Factors

Friction factors, also known as travel time factors, determine the relative attractiveness of each destination zone based on the travel time between TAZs and the number of potential origins and destinations in each TAZ. These factors are used in the trip distribution stage of the model. The 2019 Santa Monica model friction factors were initially developed based on the 2016 SCAG RTP. Different factors are used for each of the six purposes in the model. The trip distribution model calculates the travel between zones using the congested travel times from either the AM period or the mid-day period, depending on when the majority of trips occur by purpose. The HBW and school trip distributions use the AM congested travel times, while the HBO, NHB, college, and recreational trip distributions use the mid-day congested travel times.

Through Trips

Through trips (also called external-external or XX trips) are trips that pass through the study area without stopping inside the study area. The major flows of through traffic in the Santa Monica area travel through Santa Monica Boulevard, Wilshire Boulevard, Lincoln Boulevard, Pacific Coast Highway, and I-405, with lower

volumes of through traffic using other arterials. The size of these flows was estimated based on Caltrans traffic counts (PeMS) and the SCAG Regional Model. A sub-area extraction was performed in the SCAG Regional Model to obtain the traffic flow patterns coming in and out of the external stations, and then the flows were adjusted using the Fratar algorithm to properly estimate the volumes as observed by the counts. In other words, the through trips were modified in conjunction with the external station weights so that results at the model gateways accurately represent observed data.

Trip Length Comparison

Trip length distribution and average trip length for various trip purposes is another factor representing the model performance and determining if the model distributes different trip purposes correctly. Overall, the trip distribution model for the City of Santa Monica model produces short trips, because the trip length outside of the model area is not captured by the model. Streetlight data is used to calculate the extra trip length for external and through trips. Adding the additional trip length from Streetlight data on top of the original trip length generated from the model, the trip length for different trip purposes is compared with the CHTS data.

Figure 6 Trip length is another factor that can represent the model performance and if the model distributes different trips correctly. Overall, the trip distribution model for the City of Santa Monica model produces truncated trips because the trip length outside of the model area is not captured by the model. Streetlight data is used to calculate the extra trip length for external and through trips. The adjusted trip length is integrated into the model gateway connectors and are used in the model skimming process to distribute trips.

compares the IXXI average trip length from the model, with CHTS and Streetlight data by different planning areas within the City. As shown in the table below, the model trip lengths are longer than CHTS and shorter than Streetlight for most planning areas, and for the City. There are limited samples from CHTS data for the Downtown Community Plan area, and Ocean Park and Pier, therefore it is not statistically possible to estimate the average trip length for these areas. The limitation in number of samples in the CHTS data might cause an underestimation of average trip length, especially downtown and costal area generally attract longer trips comparing to other part of the City. For Streetlight data, there are 6% of the samples with extremely long trip length (longer than 40 miles) and long duration (longer than 2 hours), which is mainly because of the data collection method, that the trip stop might not be captured for the data. Since the model represents normal weekday condition, these long trips were excluded when the average trip length was calculated.

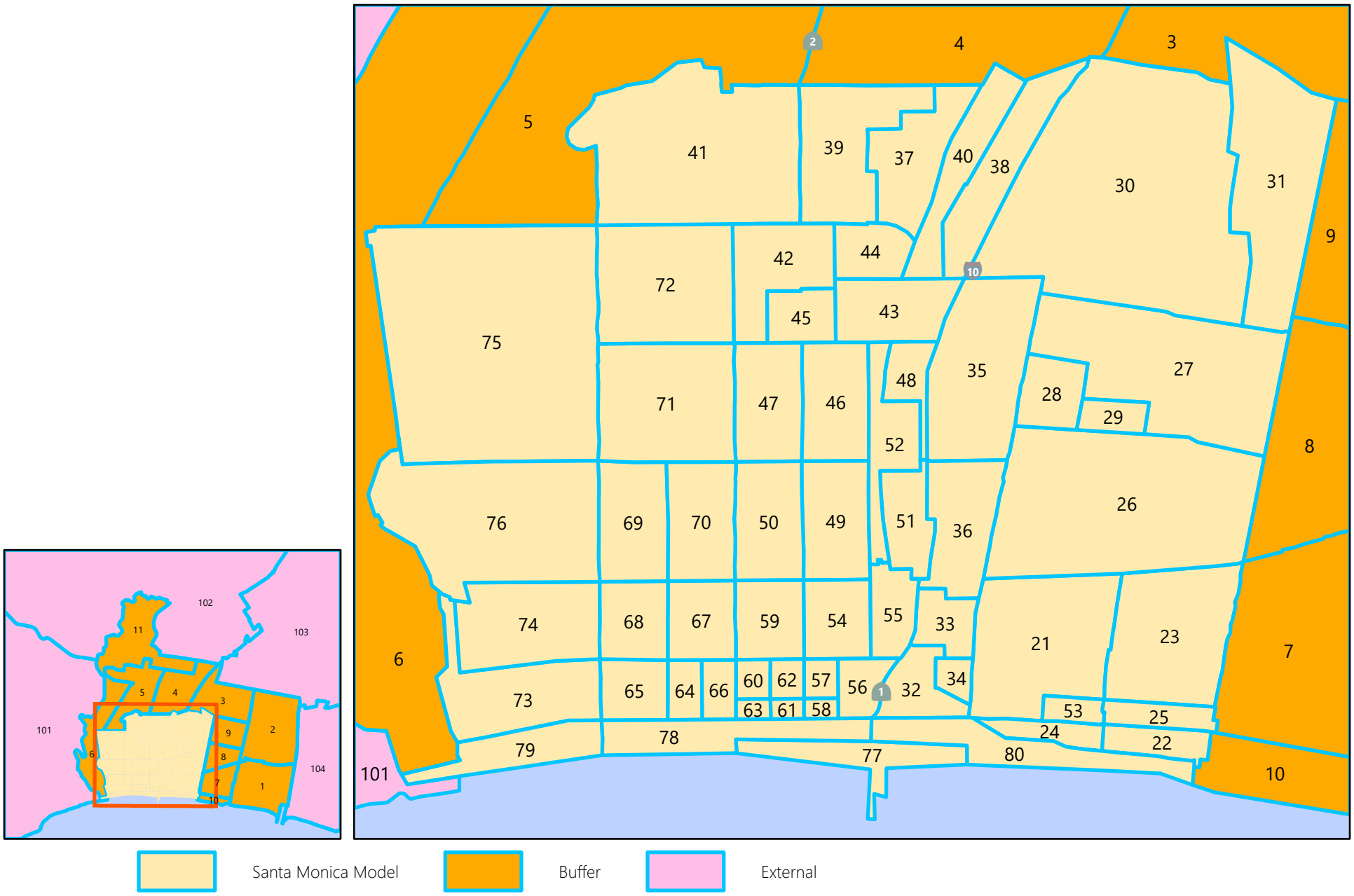
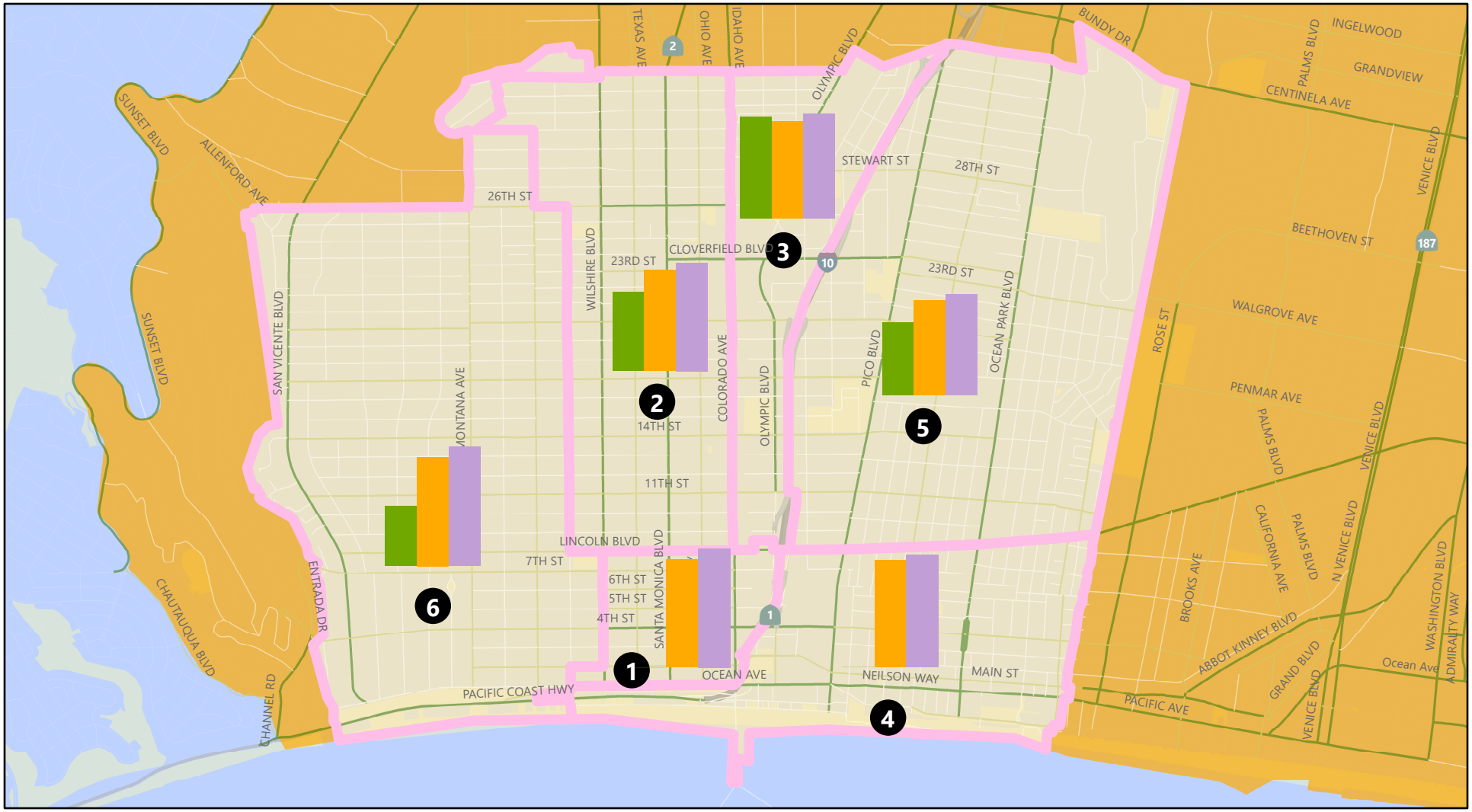


Figure 5

Santa Monica Travel Demand Model (2019)
Streetlight Zones



ID	Planning Area	CHTS	Model	Streetlight
1	Downtown Community Plan	-	14.2	15.6
2	North of Colorado Ave and South of California Ave	10.4	13.4	14.3
3	North of Pico Neighborhood Plan	13.5	12.9	13.9
4	Ocean Park and Pier	-	14.1	14.9
5	South of Santa Monica Fwy	9.6	12.5	13.3
6	Rest of the City	7.9	14.4	15.8
	Buffer	11.9	12.8	11.9
	City of Santa Monica	**10.8**	**13.5**	**14.7**
	Santa Monica Model	**11.3**	**13.1**	**12.9**

Figure 6

Santa Monica Travel Demand Model (2019)
IXXI Trip Length Comparison

Trip Assignment

The trip assignment process determines the route that each vehicle trip takes from a particular origin to particular destination. The model selects these routes in a manner that is sensitive to congestion and the desire of drivers to minimize overall travel time. It uses an iterative, capacity-restrained assignment, and volume adjustments are made that progress towards equilibrium. This technique finds a travel path for each trip that minimizes travel time, while taking into account congestion delays caused by the other simulated trips in the model.

The general assignment process includes the following steps.

- Assign all trips to the links along their selected paths.
- After all assignments, examine the volume on each link and adjust its impedance based on the volume-to-capacity ratio.
- Repeat the assignment process for a set number of iterations or until specified criteria related to minimizing travel delays are satisfied.
- Calibration of the street network included modification of the centroid connectors to represent more accurately the location at which traffic accesses local roads, adjustment of speeds from posted speed limits to reflect the attractiveness of the route and the prevailing speed of traffic, refinements to the turn penalties files, and application of an additional travel time factor.

Turn Penalties

Turn penalties are used to prohibit or add delay to certain turning movements. The Santa Monica model prohibits traffic from making turns across impassable medians. In addition, the model is adjusted to reflect current traffic condition, such as the one-way streets in Downtown Santa Monica, and the turn prohibition to Olympic Boulevard, and Colorado Avenue. In addition, the model does not allow U-turns in order to avoid counter-intuitive traffic routing. Information on prohibited turns was provided by the City and supplemented with field surveys. Turn penalties may be in effect during the entire day, during one or all peak periods.

Feedback Loops

The City of Santa Monica model includes a feedback loop which returns to the trip distribution step after the traffic assignment is complete. During the feedback process only the AM and MD vehicle trips are generated and assigned to the network. Once the feedback loop is complete, the demand from the other time periods is calculated and assigned to the network. The required number of feedback loops is determined by looking at the change between the congested travel times from subsequent loops. Once the

congested travel times stabilize the outputs of the trip distribution step, mode split step, and assignment step will be consistent and running additional feedback loops will not produce substantially different results.

During the model calibration process, the City of Santa Monica model was run with eight feedback loops and the comparison between subsequent runs of the AM and MD travel time skim matrices is shown in Table 11. Root mean square error (RMSE) is an estimate of the average error, similar to a standard deviation calculate. The percent RMSE normalizes the error based on the average values that being compared. As shown in the table, there is little benefit to running the model with more than three feedback loops, since the average changes between subsequent loops are less than one percent. The City of Santa Monica model uses three feedback loops as standard.

Table 11 - Feedback Loop Convergence

Iteration	AM RMSE	AM % RMSE	MD RMSE	MD % RMSE
Loop 1 to 2	199.55	30.6%	3.48	0.5%
Loop 2 to 3	11.64	0.6%	1.94	0.3%
Loop 3 to 4	6.79	0.4%	0.25	0.0%
Loop 4 to 5	2.87	0.2%	0.11	0.0%
Loop 5 to 6	0.92	0.1%	0.04	0.0%
Loop 6 to 7	0.33	0.0%	0.01	0.0%
Loop 7 to 8	0.06	0.0%	0.01	0.0%

Source: Fehr & Peers, 2019

Model Validation

Model validation is the term used to describe model performance in terms of how closely the model's output matches existing travel data in the base year. During the model development process, these outputs are used to further calibrate model inputs. The extent to which model outputs match existing travel data validates the assumptions of the inputs.

Traditionally, most model validation guidelines have focused on the performance of the trip assignment function in accurately assigning trips to the street network. This metric is called static validation, and it remains the most common means of measuring model accuracy.

Models are seldom used for static applications; however, by far the most common use of models is to forecast how a change in inputs would result in a change in traffic conditions. Therefore, another test of a model's accuracy focuses on the model's ability to predict realistic differences in outputs as inputs are changed. This method is referred to as dynamic validation.

This section describes the highest-level validation checks that have been performed for the Santa Monica model. The guidelines for the validation tests are taken from the 2010 California Regional Transportation Plan Guidelines (California Transportation Commission, 2010) which incorporated relevant guidance from Travel Forecasting Guidelines (Caltrans, 1992), and Model Validation and Reasonableness Checking Manual (Travel Model Improvement Program, FHWA, 1997)

Static Validation

The most critical static measurement of the accuracy of any travel model is the degree to which it can approximate actual traffic counts in the base year. The validity of the Santa Monica model was tested under daily, AM peak period, PM peak period, midday peak period, off-peak period, AM peak hour, and PM peak hour. Link volume results from model runs were examined and checked for reasonableness. Links where model results varied substantially from the observed counts were identified, and the characteristics of these links were reviewed to ensure that the link attributes reflected local operating conditions. In some cases, link characteristics such as speeds were modified to better reflect conditions on the ground.

Validation Guidelines

For a model to be considered accurate and appropriate for use in travel forecasting, it must replicate actual conditions within a certain level of accuracy. Since it would be impossible for any model to replicate all counts precisely, validation guidelines have been established by Caltrans and other agencies. Key validation standards for daily travel models based on the Caltrans guidelines are summarized below:

- At least 75 percent of the roadway links for which counts are available should be within the maximum desirable deviation, which ranges from approximately 15 to 60 percent depending on total volume (the larger the volume, the less deviation is permitted).
- All of the roadway screenlines should be within the maximum desirable deviation, which ranges from approximately 15 to 64 percent depending on total volume.
- The two-way sum of the volumes on all roadway links for which counts are available should be within 10 percent of the counts.
- The correlation coefficient between the actual ground counts and the estimated traffic volumes should be greater than 88 percent.
- The percent root mean square error (RMSE) should be less than 40 percent.

Validation Results

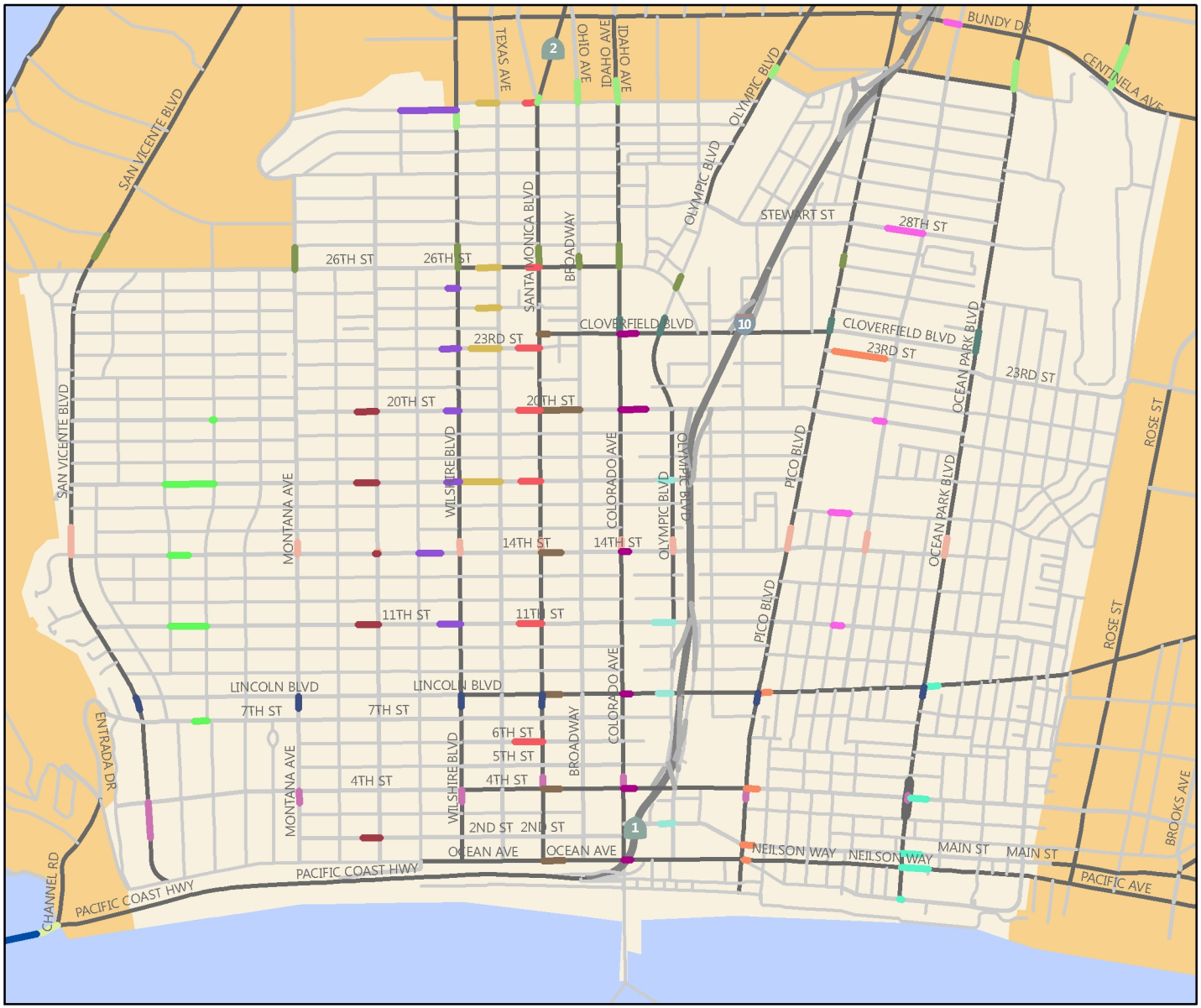
Model volumes were compared to existing traffic counts at 222 individual count sites for daily, peak period, and peak hour validation. Of these count locations, 181 locations are within boundary of the City and 41 locations are in the buffer area surrounding the City. Additionally, 16 screenlines were drawn using the arterial segment counts. Screenlines are imaginary boundaries drawn across a street network to determine the total volume crossing the boundary. Screenline accuracy determines whether the volume moving across the model area is consistent with he observed volumes. The screenlines and count locations used to validate the City of Santa Monica model are shown in Figure 6. List of screenlines presented in **Table 12**.

The correlation efficient estimates the overall level of accuracy between observed traffic counts and the estimated traffic volumes from the model. These coefficient ranges from 0 to 1, where 1 indicates that the model perfectly fits the data. The percent root mean square error (RMSE) is the average of all the link-by-link percent differences, and it is an indicator on how far the model volumes are away from counts expressed as a percent. It is a measure similar to standard deviation in that it assesses the accuracy of the entire model.

Static validation statistics was computed for all four assignment periods plus a daily volume estimate. The results are shown in **Table 13**, **Table 14**, and **Table 15**. Based on the results shown in the tables, the model is considered to be statically validated for all time periods.

Table 12 – List of Screen Lines

Iteration	ID	Np. Of counts along the line
Washington Ave	2	5
Wilshire Blvd	3	7
Arizona Ave	4	5
Santa Monica Blvd (North)	5	7
Olympic Blvd	7	4
Pico Blvd	8	5
Pearl St	9	5
Ocean Park Blvd	10	5
4th St	11	7
Lincoln Blvd	12	6
14th St	13	10
Cloverfield Blvd.	14	4
26th St	15	8
Bundy/ Centinela Ave	16	8
Santa Monica Blvd (south)	17	6
New External	80	29



City of Santa Monica

Buffer

Figure 7

Santa Monica Travel Demand Model (2019)
Screen Lines Location

Table 13 - Results of Daily Model Validation

Validation Item	Criterion for Acceptance	Model Results
Count Locations	N/A	222
% of Links within Caltrans Standard Deviations	At least 75%	80.0%
% of Screenlines with Caltrans Standard Deviations	100%	100.0%
2-way Sum of All Links Counted	Within +/- 10%	-4.0%
Correlation Coefficient	Greater than 88%	0.97
RMSE	40% or less	25.0%

Source: Fehr & Peers, 2019

Table 14 - Results of Peak Period Model Validation

Validation Item	Criterion for Acceptance	AM Period	MD Period	PM Period	OP Period
Count Locations	N/A	222	222	222	222
% of Links within Caltrans Standard Deviations	At least 75%	85.0%	76.0%	79.0%	75.0%
% of Screenlines with Caltrans Standard Deviations	1.00	1	1	1	1
2-way Sum of All Links Counted	Within +/- 10%	-3.0%	-4.0%	-3.0%	-3.0%
Correlation Coefficient	Greater than 88%	0.95	0.95	0.97	0.94
RMSE	40% or less	21.0%	31.0%	25.0%	33.0%

Source: Fehr & Peers, 2019

Table 15 - Results of Peak Hour Model Validation

Validation Item	Criterion for Acceptance	AM Peak Hour	PM Peak Hour
Count Locations	N/A	222	222
% of Links within Caltrans Standard Deviations	At least 75%	75.0%	78.0%
% of Screenlines with Caltrans Standard Deviations	1.00	0.79	0.83
2-way Sum of All Links Counted	Within +/- 10%	-7.0%	-1.0%
Correlation Coefficient	Greater than 88%	0.94	0.95
RMSE	40% or less	37.0%	35.0%

Dynamic Validation

Dynamic validation determines a model's sensitivity to changes in land use and/or the transportation system. These tests are recommended in the 2010 California Regional Transportation Guidelines. The results of dynamic validation tests are inspected for reasonableness in the direction and magnitude of changes. The City of Santa Monica Model was developed to be used as a tool in evaluation for land use scenarios and transportation system alternative. Several Dynamic Validation tests were performed to validate that the model responds appropriately to changes on the land use and network. A summary of those changes and their effect on the model outputs are listed and shown in tables and figures below. For each run the model responds to the changes appropriately. The standard tests described below were performed, and the results are shown in **Table 16, 17, Figure 8 and 9**.

- Add or remove certain amount of residential land uses
- Add or remove certain amount of non-residential land uses
- Change roadway capacities

Land Use Tests

To determine if the model would respond reasonably to changes in land use, a series of tests were conducted that involved modifying the base year land use and calculating the change in daily vehicle trip generation. The marginal trip rate (change in trips / change in land use) should be constant for any amount of change within the same land use category. The following land uses were added or subtracted from area type 2 in the model with 100 Multi-family households with single car, and 10 ksf retail. For each of these categories, based on the results in Table 15 and 16, the marginal trip rates were constant, and the model is appropriately increasing or decreasing the number of daily vehicle trips based on changes in land use.

Table 16 - Dynamic Validation Result when Changing Residential Land Use Input

Scenario	Trip Generation	Difference	Trip Rate
Initial	72,166	-	-
Add 100 HH	72,546	380	3.8
Remove 100 HH	71,786	380	3.8

Source: Fehr & Peers, 2021

Table 17 - Dynamic Validation Result when Changing Commercial Land Use Input

Scenario	Trip Generation	Difference	Trip Rate
Initial	91,201	-	-
Add 10ksf retail	91,631	430	43
Remove 10ksf retail	90,771	430	43

Source: Fehr & Peers, 2021

Network Tests

To determine if the model would respond reasonably to changes in the roadway network, the following modifications were made to the base year network:

- Add capacity on California Avenue between Ocean Avenue and 7th Street, from 1 lane to 2 lanes each direction.
- Remove capacity on 4th Street between Colorado Avenue and Santa Monica Boulevard, from 2 lanes each direction to 1 lane.

The PM peak hour demand was then reassigned to each of these networks and the differences in vehicles flows were calculated from the validated base year model. The model should be sensitive to changes in capacities. Vehicles should shift to links with higher capacities away from congested roadways. The opposite effect should be seen when capacities are reduced.

The difference plots included in **Figure 8** and **Figure 9** verify that the direction of change in each test is consistent with expectations. In each of the tests, immediately adjacent parallel facilities are affected by the network changes, but traffic volumes on roadways away from the network change are constant. These controlled tests demonstrate that the model will respond reasonably to changes in the roadway network.

Running the Model

The Graphical User Interface (GUI) developed for the City of Santa Monica Travel Demand Model was built to conveniently allow the user to run the model with the click of a button, without going into the technicalities of the programs beneath the model. The GUI closely follows the stages in the model and gives the user the ability to run one stage of the model at a time or running the entire model system by the click of a button.

The default options are shown in **Figure 9** and these will be automatically loaded each time the model is opened. The setup button opens an interactive menu which shows information on the input files, output files, and other parameters for all scenarios. Additional scenarios can also be added through this menu.

The model can be run for the selected scenario by clicking the "Prepare Network" button. Other steps can be run individually by clicking the appropriate button and setting the necessary options in the GUI. The individual routine that will be run under each step can be seen by clicking on the images next to each of the steps. Table 17 summarizes all of the sub-routines in the model and when each will be run if the default options are selected for a full model run.

The input and output files associated with each scenario are described in Table 18 and 19. These files are required for each separate scenario and must be saved in a separate directory for each scenario. Files are organized to be consistent with the steps in the model.

Figure 10 - Graphical User Interface (GUI)

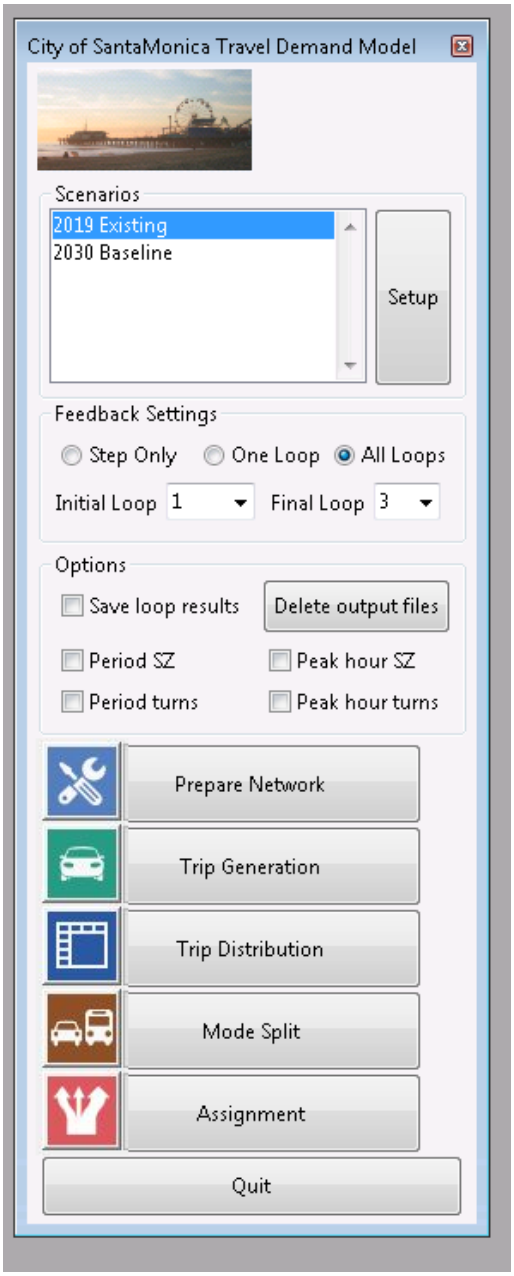


Table 18 Model Steps and Sub-Routines

Step	Sub-step	Loop 1	Loop 2	Loop 3	Final Loop
Prepare Network	Create Master Network	X	-	-	-
	Create Scenario Networks	X	X	X	-
Trip Generation	Daily Trip Generation	X	-	-	-
Trip Distribution	Network Skimming	X	X	X	-
	Daily Trip Distribution	X	X	X	-
Mode Split	Mode Split	X	X	X	-
	Daily PA 2 OD	X	X	X	-
	AM PA 2 OD	X	X	X	-
	MD PA 2 OD	X	X	X	-
	PM PA 2 OD	-	-	-	X
	OP PA 2 OD	-	-	-	X
	AM Peak Hour PA 2 OD	-	-	-	X
	PM Peak Hour PA 2 OD	-	-	-	X
Assignment	AM Assignment	X	X	X	-
	MD Assignment	X	X	X	-
	PM Assignment	-	-	-	X
	OP Assignment	-	-	-	X
	AM Peak Hour Assignment	-	-	-	X
	PM Peak Hour Assignment	-	-	-	X

Source: Fehr & Peers, 2021

Table 19 Input File Descriptions

File	Description
\1_Network\	
Glendale_Network.dbd	Roadway network file
Turn_Penalties_<PER>.bin	Turn penalties for AM, MD, PM, and OP periods
\2_Trip_Generation\	
Elasticities.bin	Not used in the base year model
Land_Use.bin	Land use database, households and employment
TAZ_Data.bin	TAZ input data
Trip_Rates.bin	Trip rates by land use
\3_Trip_Distribution\	
Friction_Factors.bin	Trip length distribution for gravity model
K_Factors.mtx	Trip distribution adjustment matrix
Through_Trips.mtx	Through trips (X-X) matrix
\4_Mode_Split\	
Hourly.bin	Diurnal factors to generate period and peak hour matrices
Mode_Split_Factors.mtx	SOV and HOV mode split factors
\5_Assignment\	
Query.qry	Select zone and select link query file

Source: Fehr & Peers, 2021

Table 20 Input Parameters

Parameter	Default Value	Description
Prepare Network		
Scenario Year	2015 or 2040	
Trip Generation		
Trip Generation Balance Method	1, 1, 1, 2, 2, 2	
Trip Distribution		
Trip Distribution Method	AM, MD, MD, AM, AM, MD	
Gravity Model Iterations	999	
Gravity Model Convergence	0.0001	
Through Trips Factor	1.00	
Assignment		
Assignment Method	OUE	
Assignment Iterations	999	
Assignment Convergence	10^{-6}	

Source: Fehr & Peers, 2021

Table 21 Output File Descriptions

File	Description
\1_Network\	
Loaded_Network.dbd	Roadway network loaded with final assignment results
Network_<PER>.net	Network settings for AM, MD, PM, OP, AM peak hour, and PM peak hour
\2_Trip_Generation\	
Land_Use.bin	Copy of land use file
TAZ_Data.bin	Copy of TAZ data file
PA_Balanced.bin	Balanced PA vectors, by purpose
PA_Unbalanced.bin	Unbalanced PA vectors, by purpose
\3_Trip_Distribution\	
Terminal_Times.mtx	Origin and destination terminal travel times
Skim_<PER>.mtx	Congested travel time skim matrices for AM and MD periods
PA_Total.mtx	Daily production-attraction matrix before mode split adjustments
\4_Mode_Split\	
PA_Final.mtx	Daily production-attraction matrix after mode split adjustments
OD_<PER>.mtx	OD matrices for daily, AM, MD, PM, OP, AM peak hour, and PM peak hour
\5_Assignment\	
Flows_<PER>.csv	Final volumes for daily, AM, MD, PM, OP, AM peak hour, and PM peak hour
Paths_<PER>.obt	Assignment path files for AM, MD, PM, OP, AM peak hour, and PM peak hour
Turns_<PER>.csv	Intersection volumes for AM, MD, PM, OP, AM peak hour, and PM peak hour
Iterations_<PER>.bin	Assignment iterations for AM, MD, PM, OP, AM peak hour, and PM peak hour
\6_Reports\	

<DATE>_Report.xml	Report file
<DATE>_Log.xml	Log file

Appendix B: Baseline Scenario Development Project List

APPENDIX B
LIST OF RELATED PROJECTS FOR ADJUSTED BASELINE YEAR (2020)

PROJECT	ADDRESS	USE	NET NEW SIZE	UNITS	STATUS
Residential	1012 2nd St	residential	4	DU	Final
100% affordable housing for Miramar	1127-1129 2nd St	affordable housing	42	DU	Approved
Mixed Use DA	1318-1324 2nd St	residential	45	DU	Final
		affordable housing	8	DU	Final
		restaurant	6.5	KSF	Final
		office	-11.672	KSF	Final
Addition to Rapp Saloon Hostel	1436 2nd St	hostel	37	rooms	Approved
TI conversion of retail to 14 room micro hotel with restaurant	1530 2nd St	restaurant	1.5	KSF	Pending
3-Unit Condos adjacent to Landmark	2501 2nd St	residential	3	DU	Approved
Commercial addition	1201 3rd St	retail	3.154	KSF	Final
Commercial addition	1360 3rd St	restaurant	3.6	KSF	Pending
New commercial building	1404-1408 3rd St	retail	2.7	KSF	Approved
Conversion of restaurant to retail	1410 3rd St	restaurant	-6.225	KSF	Final
		retail	6.225	KSF	Final
Commercial addition	1437 3rd St	retail	6	KSF	Approved
conversion of restaurant to retail	1444 3rd St	restaurant	-2.996	KSF	Final
		retail	2.996	KSF	Final
3-Unit Condos	2316 3rd St	residential	2	DU	Final
5-Unit Condos	947 4th St	residential	5	DU	Final
Retail remodel (new west elm)	1427 4th St	retail	7.5	KSF	Final
conversion of break room into studios	1455 4th St	residential	2	DU	Final
3-Unit Condos	1919 4th St	residential	1	DU	Final
Residential	908 5th St	residential	-5	DU	Final
5-Unit Condos	914 5th St	residential	4	DU	Final
3-Unit Condos	918 5th St	residential	3	DU	Approved
Addition of 3 condos above Landmark	954 5th St	residential	1	DU	Final
Mixed Use	1235 5th St	residential	18	DU	Under construction
		affordable housing	5	DU	Under construction
		retail	1.873	KSF	Under construction
SM Post Office Adaptive Reuse	1248 5th St	creative office	46.82	KSF	Approved
SRO Mixed Use Project with Commercial	1323 5th St	residential	8	DU	Approved
		SRO	35	DU	Approved
		affordable housing	9	DU	Approved
		retail	1.87	KSF	Approved
SRO Mixed Use Project with Commercial	1338-1342 5th St	residential	20	DU	Approved
		SRO	80	DU	Approved
		affordable housing	20	DU	Approved
		retail	2.703	KSF	Approved
Addition of 4 units	1410 5th St	residential	4	DU	Approved
SRO Mixed Use Project	1415-1423 5th St	residential	32	DU	Approved
		SRO	79	DU	Approved
		affordable housing	23	DU	Approved
		retail	-8.567	KSF	Approved
Mixed Use	1425-1427 5th St	residential	92	DU	Approved
		affordable housing	0	DU	Approved
		retail	-1.188	KSF	Approved
SRO Mixed Use Project	1437 5th St	residential	14	DU	Approved
		SRO	38	DU	Approved
		affordable housing	11	DU	Approved
		retail/restaurant	-5.995	KSF	Approved
New Courtyard by Marriot DA	1554 5th St	hotel	74.25	KSF	Final
		restaurant	-17.6	KSF	Final
New Hampton Inn and Suites DA	501 Colorado Ave	hotel	76.25	KSF	Final
		retail/restaurant	-19.578	KSF	Final
3-Unit Condos	2102 5th St	residential	1	DU	Under construction
2-Unit Condos	2215 5th St	residential	1	DU	Final
SRO Mixed Use Project with commercial	1437 6th St	residential	35	DU	Approved
		SRO	7	DU	Approved
		affordable housing	9	DU	Approved
		retail/restaurant	1.658	KSF	Approved
Addition of Units DA	1548 6th St	residential	4	DU	Final
100% Affordable Housing	1238 7th St	affordable housing	37	DU	Approved
		retail	1.543	KSF	Approved
		office	-1.976	KSF	Approved
Mixed Use DA	1317 7th St	residential	51	DU	Final
		affordable housing	6	DU	Final
		retail	2.676	KSF	Final
Fire Station #1	1337 7th St	fire station	26.72	KSF	Final
Mixed Use	1427 7th St	residential	48	DU	Final
		retail/restaurant	2.599	KSF	Final
Mixed Use	1437 7th St	residential	52	DU	Pending
		affordable housing	13	DU	Pending
		retail	-14.86	KSF	Pending

APPENDIX B
LIST OF RELATED PROJECTS FOR ADJUSTED BASELINE YEAR (2020)

PROJECT	ADDRESS	USE	NET NEW SIZE	UNITS	STATUS
Mixed Use	1448 7th St	residential	-2	DU	Approved
		affordable housing	2	DU	Approved
		retail	2.175	KSF	Approved
100% Affordable Housing	1514 7th St	affordable housing	50	DU	Approved
		retail	1	KSF	Approved
SRO Project with Commercial	701 Colorado Ave	residential	14	DU	Approved
		SRO	35	DU	Approved
		affordable housing	10	DU	Approved
		retail	2.9	KSF	Approved
5-Unit Condos	1211 9th St	residential	4	DU	Final
		affordable housing	1	DU	Final
Dog Kennel	1639 9th St	animal kennel	17.76	KSF	Approved
Residential	1827 9th St	residential	2	DU	Final
3-Unit Condos	949 10th St	residential	2	DU	Approved
Mixed Office/SFR	1348 10th St	office	1.432	KSF	Approved
		residential	0	DU	Approved
100% Affordable senior housing	1445-1453 10th St	affordable housing	37	DU	Under construction
Residential	1750 10th St	residential	6	DU	Final
		affordable housing	1	DU	Final
Apartments	1754 10th St	residential	2	DU	Approved
Condos	2913 10th St	residential	1	DU	Final
8-Unit Condominium	1444 11th St	residential	2	DU	Final
5-Unit Condos	1518 11th St	residential	5	DU	Under construction
5-Unit Condos	1533 11th St	residential	2	DU	Under construction
3-Unit Condos	734 12th St	residential	2	DU	Pending
15-Unit Condominium (Turtle Villas)	1211 12th St	residential	9	DU	Approved
		affordable housing	4	DU	Approved
remodel to 5 of 6 live/work condo	1643 12th St	residential	0	DU	Approved
3-Unit Condos	1824 12th St	residential	1	DU	Approved
8-unit Condominium	1837 12th St	residential	4	DU	Final
5-Unit Condos	1244 14th St	residential	4	DU	Under construction
Residential	1433-1437 14th St	residential	19	DU	Final
6-Unit Condos	1434 14th St	residential	5	DU	Approved
Media Production	1523 14th St	creative office	7.414	KSF	Final
Two-story commercial office	1640-1644 14th St	creative office	16.25	KSF	Pending
		retail	3.6	KSF	Pending
100% Affordable Housing	1820-1826 14th St	affordable housing	39	DU	Under construction
		office	-5.3	KSF	Under construction
5-Unit Condos	943 16th St	residential	3	DU	Final
		affordable housing	3	DU	Final
11-Unit Condominium	1803-1807 16th St	residential	9	DU	Final
		affordable housing	1	DU	Final
Condos	1432 17th St	residential	5	DU	Approved
3-Unit Condos on Landmark property	1527 17th St	residential	2	DU	Approved
Residential (5 condos/1 low income)	1807 17th St	residential	3	DU	Under construction
		affordable housing	1	DU	Under construction
5-Unit Condos	1840 17th St	residential	3	DU	Approved
		affordable housing	1	DU	Approved
5-Unit Condos	1949 17th St	residential	4	DU	Approved
		affordable housing	1	DU	Approved
3-Unit Condos	1136 18th St	residential	1	DU	Final
Residential	1433 18th St	residential	4	DU	Final
		affordable housing	1	DU	Final
Condos	1443 18th St	residential	9	DU	Approved
Senior Housing (affordable) FAME	1753 18th St	affordable housing	15	DU	Final
3-Unit Condos	1927 18th St	residential	2	DU	Final
Medical Office addition	1419 19th St	medical office	5.3	KSF	Under construction
Artist studio and Office	1347 19th St	residential	3	DU	Final
		creative office	1.8	KSF	Final
3-Unit Condos	1927 19th St	residential	0	DU	Under construction
1242 20th St Wellness Center	1242 20th St	R&D	65	KSF	Pending
	1925 Arizona Ave	medical office	16.5	KSF	Pending
		ancillary meeting	14	KSF	Pending
3-Unit Condos	1420 20th St	residential	-2	DU	Approved
3-Unit Condos	1422 20th St	residential	-2	DU	Approved
Auto Shop addition	1718 20th St	autobody shop	0.443	KSF	Final
New Science Building Crossroads	1731-1733 20th St	school	20.45	KSF	Final
3-Unit Condos	1900 20th St	residential	2	DU	Approved
New addition of 2 units	1958 20th St	residential	2	DU	Pending
3-Unit Condos	2425 20th St	residential	2	DU	Approved
3-Unit Condos	1035 21st St	residential	2	DU	Under construction
Storage	1645 21st St	warehouse	1	KSF	Final

APPENDIX B
LIST OF RELATED PROJECTS FOR ADJUSTED BASELINE YEAR (2020)

PROJECT	ADDRESS	USE	NET NEW SIZE	UNITS	STATUS
21-Unit Condominium/2020 Virginia	2002-2008 21st St	residential	2	DU	Approved
		affordable housing	2	DU	Approved
Residential	1236 25th St	residential	1	DU	Final
Creative Office (conversion of vacant light ind. to office)	1681 26th St	creative office	7.5	KSF	Final
New Office Project	1633 26th St	creative office	129.376	KSF	Pending
8-Unit Condominium	2323 28th St	residential	6	DU	Final
New Duplex	2409 28th St	residential	2	DU	Approved
3-Unit Condos	1665 Appian Way	residential	-1	DU	Pending
Condos	713 Ashland	residential	1	DU	Final
Mixed Use	603 Arizona Ave	residential	39	DU	Pending
		affordable housing	0	DU	Pending
		retail	21.4	KSF	Pending
		restaurant	1.128	KSF	Pending
702 Arizona Mixed Use	702 Arizona Ave	residential	45	DU	Final
		affordable housing	4	DU	Final
		retail	-8.845	KSF	Final
2-Unit Condos	1216 Arizona Ave	residential	2	DU	Under construction
3-Unit Condos	212 Bay St	residential	2	DU	Under construction
3-Unit Condos	1014 Bay St	residential	2	DU	Under construction
2-Unit Condos	1038 Bay St	residential	1	DU	Final
401 Broadway	401 Broadway	bank	7.5	KSF	Final
Mixed Use (Performance Bicycles)	501 Broadway	residential	75	DU	Approved
		affordable housing	19	DU	Approved
		retail	-1.034	KSF	Approved
Mixed Use (Sway Building)	525 Broadway	residential	125	DU	Final
		restaurant	-26.29	KSF	Final
Mixed Use (Von's)	710 Broadway	residential	206	DU	Pending
		affordable housing	90	DU	Pending
		retail	63.38	KSF	Pending
Conversion of commercial to residential	829 Broadway	residential	19	DU	Final
		retail	-4.3	KSF	Final
Office/Retail Addition	1501 Broadway	creative office	1.172	KSF	Under construction
Mixed Use Creative Office expansion	1820 Broadway	creative office	9.675	KSF	Approved
Mixed Use	2225 Broadway	residential	11	DU	Under construction
		affordable housing	2	DU	Under construction
4-Unit residential	3004 Broadway	residential	4	DU	Under construction
St. Monica School Expansion (also 1030 Lincoln)	725 California Ave	church/school	11.887	KSF	Final
3-Unit Condos	1329 California Ave	residential	3	DU	Under construction
3-Unit Condos	610 California Ave	residential	3	DU	Approved
6 unit condos	1319 Centinela Ave	residential	6	DU	Approved
3-Unit Condos	1649 Centinela Ave	residential	2	DU	Approved
Adaptive Reuse of Sears	302 Colorado Ave	retail	7.365	KSF	Under construction
SM Place Movie Theater (conversion of retail to movie)	315 Colorado Ave	movie	0	KSF	Final
100% Affordable Housing	*520 Colorado Ave*	*affordable housing*	34	*DU*	*Final*
Mixed Use	*525 Colorado Ave*	*residential*	32	*DU*	*Pending*
		affordable housing	8	*DU*	*Pending*
		retail	1.919	*KSF*	*Pending*
Mixed Use (Fritto misto)	*601-609 Colorado Ave*	*residential*	105	*DU*	*Approved*
		affordable housing	35	DU	Approved
		retail	1.219	KSF	Approved
Mixed Use	1431 Colorado Ave	residential	42	DU	Pending
		affordable housing	8	DU	Pending
		retail	-6.556	KSF	Pending
Creative office remodel/addition	2041-2043 Colorado Ave	creative office	15	KSF	Final
Creative Office/Post Production DA	2834 Colorado Ave	creative office	133	KSF	Final
		retail	9	KSF	Final
Village Trailer Park (Millenium Project) DA	2930 Colorado Ave	residential	324	DU	Final
		affordable housing	-70	DU	Final
		retail	24.94	KSF	Final
		creative office	4.2	KSF	Final
Mixed Use	1450 Cloverfield	residential	28	DU	Under construction
		affordable housing	4	DU	Under construction
		retail	5.584	KSF	Under construction
Mixed Use	1707 Cloverfield	residential	58	DU	Approved
		affordable housing	5	DU	Approved
		retail	74.665	KSF	Approved
Conversion of office to grocery store/restaurant	2121 Cloverfield	office	-26.668	KSF	Final
		retail	7.5	KSF	Final
3-Unit Condos	1802 Delaware Ave	residential	-2	DU	Approved
Apartments	1025 Euclid St	residential	1	DU	Under construction
Mixed use	1512 Euclid St	office	1.6	KSF	Approved
		residential	7	DU	Approved

APPENDIX B
LIST OF RELATED PROJECTS FOR ADJUSTED BASELINE YEAR (2020)

PROJECT	ADDRESS	USE	NET NEW SIZE	UNITS	STATUS
Commercial retail/office	1550 Euclid St	office	33.946	KSF	Under construction
		restaurant	4.13	KSF	Under construction
Creative office	1643-1651 Euclid St	creative office	23	KSF	Pending
Creative office	1650 Euclid St	creative office	37.58	KSF	Pending
Duplex addition to SFR	1834 Euclid St	residential	2	DU	Final
Triplex addition to SFR	1902 Euclid St	residential	2	DU	Approved
Apartments	1423 Franklin St	residential	2	DU	Final
Condos	1510 Franklin St	residential	0	DU	Approved
Apartments	1541 Franklin St	residential	4	DU	Under construction
		affordable housing	1	DU	Under construction
3-Unit Condos	1621 Franklin St	residential	0	DU	Under construction
6-Unit Condos	1171 Franklin St	residential	5	DU	Final
		affordable housing	1	DU	Final
2 Unit Multifamily	1021 Grant Street	residential	1	DU	Approved
45-Unit 100% Affordable Condominium	1943-59 High Place	affordable housing	38	DU	Final
duplex	2714 Highland	residential	1	DU	Approved
6-Unit Condos	3214 Highland	residential	-2	DU	Final
		affordable housing	1	DU	Final
Residential/retail building	207 Hollister	residential	1	DU	Final
Edison Elementary School	2425 Kansas	school	65	KSF	Final
4-Unit Townhomes	612 Lincoln Blvd	residential	0	DU	Final
Mixed Use	1427-31 Lincoln Blvd	residential	30	DU	Approved
		affordable housing	2	DU	Approved
		retail	-1.146	KSF	Approved
Commercial Building addition	1447 Lincoln Blvd	retail	4	KSF	Under construction
		residential	1	DU	Under construction
Mixed Use DA (Denny's site)	1560 Lincoln Blvd	residential	80	DU	Under construction
		affordable housing	20	DU	Under construction
		retail/restaurant	9.402	KSF	Under construction
Mixed Use DA (Norm's site)	1601 Lincoln Blvd	residential	71	DU	Final
		affordable housing	19	DU	Final
		retail/restaurant	6.448	KSF	Final
100% Affordable Housing	1626 Lincoln Blvd	affordable housing	64	DU	Final
		autobody shop	-8.9	KSF	Final
Mixed Use DRP (Aarons brothers)	1641-1645 Lincoln Blvd	residential	61	DU	Final
		affordable housing	5	DU	Final
		retail	-0.11	KSF	Final
Conversion of medical office to restaurant	1670 Lincoln Blvd	medical office	-5.352	KSF	Final
		restaurant	5.352	KSF	Final
Walgreens (conversion of existing retail)	1907 Lincoln Blvd	retail	0	KSF	Final
Conversion of commercial to residential	2640 Lincoln Blvd	retail	0	KSF	Final
		residential	2	DU	Final
2903-2931 Lincoln Boulevard Mixed Use	2903-2931 Lincoln Blvd	residential	43	DU	Under construction
		affordable housing	4	DU	Under construction
		retail	14.284	KSF	Under construction
2919 Lincoln/802 Ashland	2919 Lincoln Blvd	residential	10	DU	Under construction
		affordable housing	1	DU	Under construction
Commercial building	3280 Lincoln Blvd	retail	4	KSF	Approved
		residential	1	DU	Approved
Retail/Office	2321 Main St	retail	0.9	KSF	Final
		office	2	KSF	Final
New 2 story retail building	2740-2750 Main St	retail	4.833	KSF	Under construction
City Services Building	1685 Main St	government office	45	KSF	Final
Civic Center Early Childhoood Center	1855 Main St	child & family development center	12.5	KSF	Under construction
100% Affordable Housing	1413 Michigan Ave	affordable housing	57	DU	Approved
Parking Structure	2341 Michigan Ave	parking	93	KSF	Approved
		creative office	-21.6	KSF	Approved
City Yards Master Plan	2500 Michigan	industrial	79	KSF	Under construction
Learning Garden	401 Montana	learning garden/school use	2.39	KSF	Under construction
Mixed Use	3030 Nebraska Ave	residential	174	DU	Approved
		affordable housing	9	DU	Approved
		creative office	8.374	KSF	Approved
Adaptive Reuse of Residential	423 Ocean Ave	residential	6	DU	Under construction
Miramar Hotel Project DA	1133 Ocean Ave	residential	60	DU	Approved
		hotel	35.056	KSF	Approved
		retail/spa	16.69	KSF	Approved
		restaurant	8.704	KSF	Approved
		meeting space	-7.125	KSF	Approved
conversion of office to restaurant	1401 Ocean Ave	office	-1.98	KSF	Final
		restaurant	1.98	KSF	Final
Shore Hotel additional rooms	1515 Ocean Ave	hotel	14	rooms	Pending
Condos	2438 Ocean Park	residential	1	DU	Final

APPENDIX B
LIST OF RELATED PROJECTS FOR ADJUSTED BASELINE YEAR (2020)

PROJECT	ADDRESS	USE	NET NEW SIZE	UNITS	STATUS
Big Deans Café	1615 Ocean Front Walk	retail	-2.342	KSF	Final
		restaurant	2.342	KSF	Final
3-Unit Condos	436 Pier Ave	residential	2	DU	Under construction
3-Unit Condos	723 Pier Ave	residential	1	DU	Final
Mixed Use (bowling alley)	216-248 Pico Blvd	residential	97	DU	Approved
		affordable housing	8	DU	Approved
		retail	-13.408	KSF	Approved
Santa Monica High School (Sci and Tech Bldg)	601 Pico Blvd	school	97	KSF	Final
Residential	1112-1122 Pico Blvd	residential	28	DU	Final
		affordable housing	4	DU	Final
100% Affordable Housing	1819 Pico Blvd	affordable housing	48	DU	Approved
		retail	-2.326	KSF	Approved
conversion of bar to restaurant	2827 Pico Blvd	bar	-2.3	KSF	Final
		restaurant	2.3	KSF	Final
Office	2929 Pico Blvd	office	12.066	KSF	Approved
		retail	6.284	KSF	Approved
		auto service	-1.224	KSF	Approved
Office	3205 Pico Blvd	office	4.81	KSF	Under construction
3-Unit Condos	1127 Princeton	residential	2	DU	Final
2-Unit Condos	1514 Princeton	residential	1	DU	Approved
Mayfair Theater	214 Santa Monica Blvd	residential	38	DU	Final
Hotel/Mixed Use DA (Ocean Avenue Project)	101-129 Santa Monica Blvd	residential	61	DU	Pending
		affordable housing	20	DU	Pending
		hotel	165	KSF	Pending
		museum	40.722	KSF	Pending
		retail	21.75	KSF	Pending
Mixed Use Building	825 Santa Monica Blvd	residential	41	DU	Pending
		affordable housing	7	DU	Pending
		retail	4.044	KSF	Pending
Auto Dealership DA (Mini)	1402 Santa Monica Blvd	auto dealership	33.75	KSF	Final
Auto Dealership	1802 Santa Monica Blvd	residential	-18	DU	Approved
		retail	1.39	KSF	Approved
		auto dealership	15.1	KSF	Approved
conversion of office to medical office/café	1919 Santa Monica Blvd	office	-25.2	KSF	Final
		medical office	24.2	KSF	Final
		restaurant	1	KSF	Final
Providence Saint Johns Campus Master Plan Phase II	2121 Santa Monica Blvd	hospital and health care	339	KSF	Pending
		medical research	59	KSF	Pending
		health wellness center	41	KSF	Pending
		education/conf center	55	KSF	Pending
		child & family dev center	25.5	KSF	Pending
		health related services	17	KSF	Pending
		day care	9	KSF	Pending
		restaurant	10	KSF	Pending
		neighborhood commercial	5	KSF	Pending
		visitor housing	40	DU	Pending
		multifamily hsg	10	DU	Pending
Mixed Use	2822 Santa Monica Blvd	residential	46	DU	Under construction
		affordable housing	4	DU	Under construction
		retail	-3.506	KSF	Under construction
Mixed Use	2906-2918 Santa Monica Blvd	residential	42	DU	Approved
		affordable housing	4	DU	Approved
		restaurant	10.039	KSF	Approved
Mixed Use	3008 Santa Monica Blvd	residential	22	DU	Final
		affordable housing	4	DU	Final
		retail	-0.504	KSF	Final
3-Unit Condos	122 Strand St	residential	-1	DU	Approved
Santa Monica College AET Campus Expansion	1660 Stewart St	School	20	KSF	Final
		creative office	28	KSF	Final
conversion of retail to restaurant	214 Wilshire Blvd	retail	-7.986	KSF	Final
		restaurant	7.986	KSF	Final
conversion of retail to restaurant	331 Wilshire Blvd	retail	-2.453	KSF	Final
		restaurant	2.453	KSF	Final
conversion of office to fitness	401 Wilshire Blvd	retail		KSF	Final
New restaurant building	501 Wilshire Blvd	restaurant	-0.4	KSF	Under construction

APPENDIX B
LIST OF RELATED PROJECTS FOR ADJUSTED BASELINE YEAR (2020)

PROJECT	ADDRESS	USE	NET NEW SIZE	UNITS	STATUS
Hotel (adaptive reuse of historic building)	702-710 Wilshire Blvd	hotel	150.148	KSF	Final
		office	-31.138	KSF	Final
		retail	-11.793	KSF	Final
		restaurant	9.11	KSF	Final
Mixed-Use	1101 Wilshire Blvd	residential	82	DU	Pending
		affordable housing	11	DU	Pending
		retail	4.6	KSF	Pending
Mixed-Use Condos/Commercial	2300 Wilshire Blvd	residential	30	DU	Final
		retail	22.3	KSF	Final
		restaurant	2.7	KSF	Final
Mixed use Project with Commercial	2729 Wilshire Blvd	residential	8	DU	Under construction
		affordable housing	1	DU	Under construction
		retail	0.022	KSF	Under construction
Daycare	2919 Wilshire Blvd	daycare	9.799	KSF	Approved
convert comm. space to conv. store in ex. bldg.	3032 Wilshire Blvd	retail	0	KSF	Approved
Pico Branch Library	2200 Virginia Ave	library	7.5	KSF	Final
6-Unit Townhomes	1319 Yale St	residential	0	DU	Final
		affordable housing	1	DU	Final
Airport Park Expansion	3201 Airport Avenue	park	12	acre	Approved
The Village at Civic Center	1725-1755 Ocean Ave	residential	158	DU	Final
		affordable housing	160	DU	Final
		retail/restaurant	25	KSF	Final
Tongva Park		park	12.8	acre	Final

Appendix C: Data on Traffic Volume Changes in Santa Monica

Comparison of Total Daily and PM Peak Period (3 PM - 7 PM) Two-Way Roadway Segment Volumes in 2013 and 2019

Location	ADT			4-7PM Peak		
	2013	2019	*Diff vs 2013*	2013	2019	*Diff vs 2013*
Ocean Ave N/o San Vicente Blvd	7,381	7,673	4%	2,417	2,541	5%
Montana Ave W/o 4th St	6,043	6,707	11%	1,707	1,865	9%
Wilshire Blvd W/o 4th St	21,629	14,314	-34%	5,496	3,440	-37%
Santa Monica Blvd W/o 4th St	11,320	16,557	46%	3,155	4,622	46%
Colorado Ave W/o 4th St	12,061	4,450	-63%	3,588	1,271	-65%
Pico Blvd W/o 4th St	24,594	25,242	3%	6,688	6,920	3%
Ocean Park Blvd W/o 4th St	10,752	11,083	3%	3,262	3,386	4%
San Vicente Blvd W/o Lincoln Blvd	19,678	20,363	3%	5,574	5,795	4%
Montana Ave W/o Lincoln Blvd	14,815	15,311	3%	4,323	4,508	4%
WILSHIRE BLVD W/O LINCOLN BLVD	28,708	26,042	-9%	7,803	7,164	-8%
SANTA MONICA BLVD W/O LINCOLN BLVD	18,644	14,384	-23%	5,389	4,021	-25%
Pico Blvd W/o Lincoln Blvd	19,808	15,075	-24%	5,717	4,334	-24%
Ocean Park Blvd W/o Lincoln Blvd	17,308	17,889	3%	5,096	5,166	1%
San Vicente Blvd E/o 14th St	23,066	23,900	4%	6,569	6,836	4%
Montana Ave E/o 14th St	15,905	16,458	3%	4,778	4,989	4%
Wilshire Blvd E/o 14th St	31,088	32,104	3%	8,599	8,965	4%
Santa Monica Blvd E/o 14th St	24,275	25,041	3%	6,854	7,144	4%
Colorado Ave E/o 14th St	6,657	6,862	3%	2,108	2,174	3%
Olympic Blvd E/o 14th St	16,274	16,815	3%	4,939	5,136	4%
Pico Blvd E/o 14th St	21,821	22,547	3%	6,679	6,961	4%
Ocean Park Blvd E/o 14th St	18,245	18,874	3%	5,310	5,536	4%
San Vicente Blvd E/o 26th St	28,378	29,391	4%	7,709	8,052	4%
Montana Ave E/o 26th St	14,308	14,798	3%	4,510	4,699	4%
WILSHIRE BLVD E/O 26TH ST	35,758	45,357	27%	9,773	12,600	29%
Santa Monica Blvd E/o 26th St	30,654	29,747	-3%	8,177	8,190	0%
Colorado Ave E/o 26th St	15,896	15,023	-5%	4,977	4,461	-10%
Olympic Blvd E/o 26th St	28,210	18,982	-33%	9,181	6,592	-28%
Pico Blvd E/o 26th St	27,906	28,909	4%	8,117	8,549	5%
Ocean Park Blvd E/o 25th St	27,909	28,844	3%	7,875	8,212	4%
Ocean Ave S/o Santa Monica Blvd	23,562	22,038	-6%	6,522	5,853	-10%
4th St S/o Santa Monica Blvd	16,059	11,731	-27%	4,018	3,025	-25%
Lincoln Blvd S/o Santa Monica Blvd	32,457	33,142	2%	7,671	7,608	-1%
14th St S/o Santa Monica Blvd	13,608	14,068	3%	4,276	4,455	4%
20th St S/o Santa Monica Blvd	20,522	18,790	-8%	5,840	5,332	-9%
Cloverfield Blvd S/o Santa Monica Blvd	17,639	18,345	4%	4,284	4,522	6%
Ocean Ave S/o Colorado Ave	23,591	21,216	-10%	6,752	5,914	-12%
Main St S/o Colorado Ave	11,814	12,173	3%	3,426	3,553	4%
4TH ST S/O COLORADO AVE	26,048	27,650	6%	6,609	6,815	3%
LINCOLN BLVD S/O COLORADO AVE	45,483	43,767	-4%	10,719	10,099	-6%
14th St S/o Colorado Ave	15,091	15,598	3%	4,682	4,859	4%
20th St S/o Colorado Ave	23,629	18,169	-23%	6,655	5,172	-22%
Cloverfield Blvd S/o Colorado Ave	32,797	33,959	4%	7,586	7,888	4%
Nielson Way S/o Pico Blvd	28,501	29,467	3%	8,362	8,631	3%
Main St S/o Pico Blvd	16,574	17,145	3%	4,559	4,728	4%
4th St S/o Pico Blvd	14,676	15,148	3%	4,330	4,449	3%
Lincoln Blvd S/o Pico Blvd	44,361	37,009	-17%	10,880	8,730	-20%
Barnard Way S/o Ocean Park Blvd	4,043	2,523	-38%	1,342	846	-37%
Neilson Way S/o Ocean Park Blvd	29,328	27,863	-5%	8,456	7,372	-13%
Main St S/o Ocean Park Blvd	20,357	16,483	-19%	5,401	4,175	-23%
4th St S/o Ocean Park Blvd	10,938	9,617	-12%	3,252	3,112	-4%
Lincoln Blvd S/o Ocean Park Blvd	40,528	38,505	-5%	10,098	9,480	-6%
26th St N/o San Vicente Blvd	15,564	13,565	-13%	5,037	4,385	-13%
23rd St N/o Dewey St	22,585	19,257	-15%	7,133	5,661	-21%
2nd St N/o Idaho Ave	2,179	2,252	3%	630	664	5%
2nd St N/o Washington Ave	2,414	2,490	3%	693	730	5%
4TH ST S/O SAN VICENTE BLVD	4,358	3,823	-12%	1,341	1,211	-10%
4th St N/o Bicknell Ave	12,518	12,956	3%	3,381	3,490	3%

Comparison of Total Daily and PM Peak Period (3 PM - 7 PM) Two-Way Roadway Segment Volumes in 2013 and 2019

4th St N/o Pier Ave	6,751	6,976	3%	2,176	2,300	6%
4th St S/o Marine St	6,773	6,996	3%	2,326	2,448	5%
6th St N/o Santa Monica Blvd	5,624	4,451	-21%	1,719	1,175	-32%
7th St N/o Marguerita Ave	8,125	8,423	4%	2,494	2,614	5%
11th St N/o Marguerita Ave	2,528	2,623	4%	789	821	4%
11th St N/o Montana Ave	3,887	4,006	3%	1,238	1,288	4%
11th St N/o Washington	6,200	6,420	4%	1,834	1,907	4%
11th St N/o Wilshire Blvd	8,704	8,999	3%	2,673	2,797	5%
11th St N/o Santa Monica Blvd	12,635	13,071	3%	3,846	4,019	4%
11th St N/o Broadway	13,476	13,914	3%	4,241	4,406	4%
11th St N/o Colorado Ave	14,911	15,424	3%	4,467	4,647	4%
11th St N/o Olympic Blvd	15,521	16,058	3%	4,811	4,999	4%
11th St N/o Michigan Ave	14,550	15,024	3%	4,815	4,963	3%
11th St N/o Pico Blvd	12,662	13,108	4%	4,129	4,268	3%
11th St N/o Pearl St	9,543	9,909	4%	3,150	3,252	3%
11th St N/o Maple St	9,447	9,775	3%	3,263	3,358	3%
11th St N/o Hill St	7,043	7,286	3%	2,656	2,737	3%
14th St S/o San Vicente Blvd	3,537	3,659	3%	1,046	1,091	4%
14th St N/o Marguerite	3,647	3,764	3%	1,052	1,098	4%
14th St N/o Washington Ave	6,548	6,766	3%	1,958	2,046	5%
14th St N/o California Ave	7,784	8,053	3%	2,421	2,543	5%
14th St N/o Wilshire Blvd	10,633	10,973	3%	3,262	3,408	4%
14th St N/o Maple St	6,421	6,641	3%	2,295	2,362	3%
16th St N/o Pearl St	6,084	6,350	4%	1,924	2,003	4%
17th St S/o San Vicente Blvd	1,788	1,850	3%	524	548	4%
17th St N/o Marguerita Ave	1,738	1,805	4%	575	598	4%
17th St N/o Washington Ave	5,764	5,959	3%	1,707	1,788	5%
17th St N/o Wilshire Blvd	7,151	7,407	4%	2,079	2,177	5%
17th St N/o Arizona Ave	9,190	9,523	4%	2,724	2,854	5%
17th St N/o Santa Monica Blvd	11,160	11,536	3%	3,447	3,592	4%
17th St N/o Colorado Ave	10,465	10,814	3%	3,253	3,379	4%
17th St N/o Olympic Blvd	9,785	10,105	3%	3,168	3,281	4%
17th St N/o Michigan Ave	7,595	7,867	4%	2,520	2,612	4%
20th St N/o Marguerita Ave	1,113	1,158	4%	331	345	4%
20th St N/o Idaho Ave	6,198	6,425	4%	1,824	1,920	5%
20th St N/o Washington Ave	8,014	8,283	3%	2,284	2,387	5%
20th St N/o Wilshire Blvd	10,791	9,626	-11%	3,267	2,953	-10%
20th St N/o Santa Monica Blvd	19,757	19,161	-3%	5,415	5,272	-3%
20th St N/o Pico Blvd	17,624	18,194	3%	6,157	6,343	3%
20th St N/o Pearl St	10,686	8,521	-20%	3,242	2,744	-15%
21st St N/o Pier Ave	2,424	2,469	2%	1,456	1,464	1%
23rd St N/o Wilshire Blvd	3,094	5,006	62%	882	1,539	74%
23rd St N/o Arizona Ave	5,248	5,427	3%	1,376	1,449	5%
23rd St N/o Santa Monica Blvd	7,244	7,433	3%	1,824	1,894	4%
23rd St S/o Pico Blvd	7,883	8,194	4%	2,447	2,555	4%
23rd St N/o Ocean Park Blvd	10,211	10,576	4%	3,379	3,499	4%
23rd St N/o Ashland Ave	18,346	19,130	4%	5,016	5,225	4%
25th St N/o Wilshire Blvd	1,123	1,168	4%	348	365	5%
25th St N/o Hill St	2,220	2,299	4%	710	732	3%
26th St N/o California Ave	15,277	15,793	3%	4,356	4,543	4%
26th St N/o Arizona Ave	15,706	15,582	-1%	4,274	4,296	1%
26th St N/o Santa Monica Blvd	17,401	15,365	-12%	4,816	4,658	-3%
28th St N/o Pearl St	5,053	5,237	4%	1,795	1,888	5%
Airport Ave E/o Walgrove Ave	5,963	6,154	3%	2,296	2,405	5%
Arizona Ave E/o 2nd St	6,637	6,927	4%	1,929	1,868	-3%
Arizona Ave E/o Lincoln Blvd	5,558	5,753	4%	1,797	1,888	5%
Arizona Ave E/o 12th St	5,054	5,224	3%	1,700	1,775	4%
Arizona Ave E/o 16th St	7,072	7,321	4%	2,213	2,326	5%
Arizona Ave E/o 22nd St	7,657	7,908	3%	1,792	1,870	4%
Arizona Ave E/o 24th St	5,663	5,857	3%	1,740	1,818	4%

Comparison of Total Daily and PM Peak Period (3 PM - 7 PM) Two-Way Roadway Segment Volumes in 2013 and 2019

Broadway E/o 2nd St	9,381	10,322	10%	2,318	2,538	9%
Broadway E/o 12th St	13,031	13,476	3%	3,814	3,979	4%
BROADWAY E/O 18TH ST	14,763	10,929	-26%	4,259	3,460	-19%
Broadway E/o 26th St	9,388	8,687	-7%	2,930	2,915	-1%
Broadway (Ohio Ave) E/o Centinela Ave	6,361	6,623	4%	2,259	2,396	6%
California Ave E/o Ocean Ave	4,937	5,251	6%	1,513	1,494	-1%
California Ave E/o 11th St	3,468	3,574	3%	1,228	1,276	4%
California Ave E/o 23rd St	1,992	2,041	2%	645	666	3%
Chelsea Ave N/o Arizona Ave	1,695	1,754	3%	513	535	4%
Cloverfield Blvd N/o Michigan Ave	41,585	42,910	3%	9,671	10,026	4%
Cloverfield Blvd N/o Delaware Ave	50,881	59,361	17%	11,785	13,987	19%
Cloverfield Blvd N/o Virginia Ave	26,231	23,347	-11%	7,317	6,434	-12%
Colorado Ave E/o 2nd St	18,576	8,874	-52%	5,322	2,482	-53%
Colorado Ave E/o Cloverfield Blvd	14,819	15,325	3%	4,709	4,922	5%
Colorado Ave E/o Berkeley St	10,963	11,328	3%	4,014	4,124	3%
Colorado Ave (Idaho Ave) E/o Centinela Ave	7,116	7,382	4%	2,618	2,773	6%
Idaho Ave E/o 11th St	1,342	1,388	3%	431	450	5%
Lincoln Blvd n/o Montana Ave	3,218	3,355	4%	1,008	1,063	5%
Lincoln Blvd N/o California Ave	9,794	8,635	-12%	2,512	2,196	-13%
Lincoln Blvd N/o WB Olympic	44,581	46,037	3%	10,724	11,184	4%
Lincoln Blvd S/o EB Olympic	43,259	44,601	3%	10,123	10,488	4%
Lincoln Blvd S/o Rose Ave	46,326	47,893	3%	11,439	11,907	4%
Main St N/o Olympic Dr	12,053	12,405	3%	3,499	3,620	3%
Main St S/o Olympic Dr	13,192	13,718	4%	3,508	3,667	5%
Main St N/o Pacific St	15,941	16,507	4%	4,164	4,317	4%
Main St N/o Marine St	16,102	16,653	3%	4,505	4,671	4%
Marine St E/o 2nd St	3,012	3,121	4%	761	804	6%
Marine St E/o Highland Ave	821	847	3%	214	224	4%
Marine St E/o 7th St	1,023	1,051	3%	228	236	4%
Marine St E/o 16th St	5,006	5,131	3%	1,685	1,739	3%
Montana Ave E/o 5th St	9,813	10,173	4%	2,903	3,036	5%
Montana Ave E/o 9th St	15,692	16,236	3%	4,676	4,885	4%
Neilson Way N/o Ashland Ave	26,529	25,542	-4%	8,368	7,701	-8%
Neilson Way N/o Marine St	26,322	27,179	3%	7,903	8,166	3%
Ocean Park Blvd E/o 18th St	20,473	21,133	3%	5,733	5,959	4%
Ocean Park Blvd E/o Cloverfield Blvd	23,331	24,135	3%	6,597	6,882	4%
Olympic Blvd E/o Cloverfield Blvd	29,950	30,925	3%	8,879	9,217	4%
Olympic Blvd E/o Stewart St	30,701	31,713	3%	9,420	9,830	4%
Pearl St E/o 14th St	4,800	4,981	4%	1,727	1,799	4%
Pearl St E/o 16th St	5,743	5,964	4%	1,370	1,455	6%
Pearl St E/o 20th St	5,818	5,371	-8%	2,078	2,054	-1%
Pearl St E/o 25th St	4,879	5,081	4%	1,979	2,090	6%
Pico Blvd E/o 10th St	19,715	20,373	3%	5,783	6,020	4%
Pico Blvd E/o Euclid St	22,356	23,081	3%	6,857	7,136	4%
Pico Blvd E/o Cloverfield Blvd	25,471	23,923	-6%	7,782	6,897	-11%
Pico Blvd E/o 31st St	29,478	30,372	3%	8,537	8,804	3%
SAN VICENTE BLVD W/O 4TH ST	6,695	11,421	71%	1,935	3,768	95%
Santa Monica Blvd E/o 15th St	25,184	25,985	3%	6,983	7,287	4%
Santa Monica Blvd W/o 23rd St	31,613	32,576	3%	8,325	8,689	4%
Stewart St N/o Exposition Blvd	11,220	11,605	3%	3,907	4,016	3%
Stewart St S/o Pennsylvania Blvd	11,248	11,673	4%	3,530	3,656	4%
Wilshire Blvd W/o 23rd St	34,554	29,768	-14%	9,105	7,852	-14%
Total	2,519,444	2,494,951	-1%	717,646	712,060	-1%

Comparison of Daily and PM Peak Period Traffic Counts (2007, 2013, 2019)

Location	ADT					4-7PM Peak				
	2007	**2013**	*Diff vs 2007*	**2019**	*Diff vs 2007*	**2007**	**2013**	*Diff vs 2007*	**2019**	*Diff vs 2007*
Sunset Blvd S/o Hartzell St	25,915	30,323	17%	31,473	21%	7,706	8,706	13%	9,434	22%
Kenter Ave N/o Sunset Blvd	8,297	8,994	8%	9,121	10%	2,196	2,223	1%	2,309	5%
Barrington Ave N/o Sunset Blvd	4,534	4,933	9%	6,141	35%	1,427	1,476	3%	1,766	24%
Sunset Blvd E/o Barrington Ave	51,475	51,294	0%	48,486	-6%	12,470	11,669	-6%	9,003	-28%
Wilshire Blvd E/o Federal Ave	77,859	72,749	-7%	78,582	1%	17,985	18,325	2%	19,568	9%
Ohio Ave E/o Federal Ave	13,701	13,797	1%	8,953	-35%	4,080	4,138	1%	2,418	-41%
Santa Monica Blvd E/o Federal Ave	41,818	43,925	5%	29,732	-29%	10,342	8,630	-17%	6,569	-36%
Olympic Blvd E/o Federal Ave	41,482	44,716	8%	26,498	-36%	12,413	11,807	-5%	6,109	-51%
Pico Blvd E/o Barrington Ave	27,218	26,562	-2%	22,290	-18%	7,631	7,050	-8%	5,976	-22%
Gateway Blvd E/o Barrington Ave	17,477	14,181	-19%	20,842	19%	5,753	4,652	-19%	6,479	13%
National Blvd E/o Barrington Ave	18,046	23,380	30%	21,803	21%	5,888	6,592	12%	6,563	11%
Palms Blvd E/o McLaughlin Ave	18,750	19,492	4%	18,701	0%	6,518	6,750	4%	5,570	-15%
Venice Blvd E/o McLaughlin Ave	42,904	41,390	-4%	30,776	-28%	11,971	11,554	-3%	8,916	-26%
McLaughlin Ave S/o Venice Blvd	9,423	9,619	2%	9,803	4%	3,263	3,467	6%	3,518	8%
Inglewood Blvd S/o Venice Blvd	10,360	9,971	-4%	10,035	-3%	3,493	3,461	-1%	3,143	-10%
Centinela Ave S/o Venice Blvd	35,382	34,488	-3%	30,191	-15%	10,962	10,258	-6%	9,253	-16%
Walgrove Ave S/o Venice Blvd	11,572	13,474	16%	11,258	-3%	4,056	4,343	7%	3,396	-16%
Lincoln Blvd S/o Venice Blvd	59,412	49,795	-16%	37,751	-36%	15,318	12,626	-18%	8,844	-42%
Abbot Kinney Blvd N/o Victoria Ave *(btwn Washington Wy & Victoria Ave)*	16,940	16,847	-1%	20,511	21%	5,283	5,610	6%	6,103	16%
Ocean Ave S/o Venice Blvd	9,917	11,728	18%	11,067	12%	3,404	4,101	20%	3,470	2%
Pacific Ave S/o Venice Blvd	15,984	16,251	2%	12,683	-21%	4,882	4,451	-9%	3,299	-32%
Colorado Ave (Idaho Ave) E/o Centinela Ave	7,856	7,116	-9%	7,382	-6%	2,746	2,618	-5%	2,773	1%
Ocean Park Blvd E/o Centinela Ave	32,332	31,891	-1%	24,896	-23%	9,774	9,840	1%	7,774	-20%
Olympic Blvd E/o Centinela Ave	34,295	34,217	0%	59,472	73%	10,367	10,349	0%	17,525	69%
Palms Blvd E/o Centinela Ave	11,471	12,610	10%	13,090	14%	3,847	4,258	11%	4,473	16%
Santa Monica Blvd E/o Centinela Ave	27,835	28,118	1%	34,775	25%	7,582	7,532	-1%	9,139	21%
Santa Monica Blvd E/o Bundy Dr	30,768	31,767	3%	32,728	6%	8,042	8,177	2%	8,555	6%
Venice Blvd E/o Centinela Ave	42,221	42,017	0%	43,350	3%	11,952	11,833	-1%	12,321	3%
Total	745,244	745,645	0%	712,389	-4%	211,351	206,496	-2%	194,266	-8%

PM Peak Hour Intersection Turning Movement Counts and Change Relative to 2007

Intersection Name	2007 Count Data			2011 Count Data			2013 Count Data			2019 Count Data		
	Peak Hour		Volume	Peak Hr	Vol	% Diff	Peak Hr	Vol	% Diff	Peak Hr	Vol	% Diff
Palisades Beach Rd (PCH) and California Ave	545 PM		7,138	5:15 PM	5,724	-19.8%	5:15 PM	5,606	-21.5%	5:00 PM	5,708	-20.0%
Ocean Ave and California Ave	515 PM		2,781	5:15 PM	1,694	-39.1%	5:00 PM	1,948	-30.0%	5:15 PM	1,648	-40.7%
Ocean Ave and Wilshire Blvd	500 PM		2,534	5:45 PM	1,999	-21.1%	5:45 PM	1,957	-22.8%	5:30 PM	1,577	-37.8%
Ocean Ave and Arizona Ave	600 PM		2,153	5:15 PM	1,935	-10.1%	5:30 PM	1,636	-24.0%	5:30 PM	1,559	-27.6%
Ocean Ave and Santa Monica Blvd	445 PM		2,285	6:00 PM	1,848	-19.1%	5:30 PM	1,782	-22.0%	5:30 PM	1,775	-22.3%
Ocean Ave and Colorado Ave	545 PM		2,835	5:00 PM	2,175	-23.3%	5:15 PM	2,108	-25.6%	5:45 PM	1,791	-36.8%
Neilson Way and Ocean Park Blvd	515 PM		3,195	5:30 PM	2,630	-17.7%	5:30 PM	2,608	-18.4%	5:45 PM	2,452	-23.3%
Neilson Way and Barnard Way (Marine)	515 PM		2,772	5:30 PM	2,450	-11.6%	5:15 PM	2,329	-16.0%	5:15 PM	2,329	-16.0%
2nd St and Wilshire Blvd	500 PM		2,026	5:30 PM	1,788	-11.7%	6:00 PM	1,743	-14.0%	5:15 PM	1,420	-29.9%
2nd St and Arizona Ave	415 PM		1,553	6:00 PM	1,199	-22.8%	5:30 PM	1,132	-27.1%	5:00 PM	1,011	-34.9%
2nd St and Santa Monica Blvd	600 PM		1,815	5:45 PM	1,453	-19.9%	5:00 PM	1,474	-18.8%	5:30 PM	1,320	-27.3%
2nd St and Broadway	530 PM		1,606	5:00 PM	1,491	-7.2%	5:15 PM	1,377	-14.3%	5:30 PM	1,310	-18.4%
2nd St and Colorado Ave	500 PM		1,683	5:00 PM	1,579	-6.2%	5:15 PM	1,565	-7.0%	6:00 PM	931	-44.7%
Main St and Pico Blvd	500 PM		2,709	5:00 PM	2,476	-8.6%	5:00 PM	2,238	-17.4%	5:00 PM	2,019	-25.5%
Main St and Bicknell St	445 PM		1,530	5:00 PM	1,404	-8.2%	5:00 PM	1,247	-18.5%	5:00 PM	1,171	-23.5%
Main St and Ocean Park Blvd	600 PM		2,394	6:00 PM	1,981	-17.3%	5:00 PM	1,848	-22.8%	5:00 PM	1,849	-22.8%
Main St and Hill St	530 PM		2,041	5:15 PM	1,432	-29.8%	5:00 PM	1,349	-33.9%	5:00 PM	1,237	-39.4%
Main St and Ashland Ave	600 PM		1,862	5:45 PM	1,379	-25.9%	5:00 PM	1,244	-33.2%	5:15 PM	1,144	-38.6%
Main St and Marine St	545 PM		2,142	5:45 PM	1,732	-19.1%	5:00 PM	1,495	-30.2%	5:00 PM	1,303	-39.2%
3rd St and Wilshire Blvd	500 PM		1,986	5:30 PM	1,610	-18.9%	6:00 PM	1,425	-28.2%	5:45 PM	1,425	-28.2%
3rd St and Arizona Ave	500 PM		612	5:00 PM	499	-18.5%	5:30 PM	463	-24.3%	5:15 PM	465	-24.0%
3rd St and Santa Monica Blvd	500 PM		1,148	6:00 PM	710	-38.2%	6:00 PM	775	-32.5%	5:30 PM	724	-36.9%
3rd St and Broadway	500 PM		763	5:00 PM	651	-14.7%	5:45 PM	640	-16.1%	5:00 PM	587	-23.1%
6th St and Ocean Park	530 PM		1,561	5:15 PM	1,283	-17.8%	6:00 PM	1,347	-13.7%	5:00 PM	1,445	-7.4%
4th St and Montana Ave	400 PM		1,748	5:45 PM	1,115	-36.2%	5:00 PM	1,136	-35.0%	5:30 PM	988	-43.5%
4th St and California	530 PM		1,333	5:15 PM	1,039	-22.1%	5:30 PM	1,031	-22.7%	5:30 PM	991	-25.7%
4th St and Wilshire	530 PM		3,081	5:30 PM	2,562	-16.8%	5:30 PM	2,423	-21.4%	5:00 PM	1,497	-51.4%
4th St and Arizona Ave	515 PM		1,874	5:00 PM	1,661	-11.4%	5:30 PM	1,575	-16.0%	5:00 PM	1,159	-38.2%
4th St and Santa Monica Blvd	530 PM		2,641	6:00 PM	1,877	-28.9%	6:00 PM	1,972	-25.3%	5:15 PM	1,855	-29.8%
4th St and Broadway	600 PM		2,600	5:00 PM	2,217	-14.7%	5:45 PM	2,249	-13.5%	6:00 PM	2,028	-22.0%
4th St and Colorado	415 PM		3,083	5:30 PM	2,977	-3.4%	5:00 PM	2,132	-30.8%	5:30 PM	1,573	-49.0%
4th St and I-10 WB Off-Ramp	400 PM		3,235	5:15 PM	2,776	-14.2%	5:30 PM	2,427	-25.0%	6:00 PM	2,428	-24.9%
4th St and I-10 EB On-Ramp (Olympic Drive)	400 PM		3,133	5:00 PM	3,217	2.7%	5:00 PM	2,690	-14.1%	5:00 PM	2,672	-14.7%
4th St and Pico Blvd	545 PM		3,803	5:30 PM	3,188	-16.2%	5:15 PM	2,959	-22.2%	5:15 PM	2,818	-25.9%
5th St and Wilshire Blvd	400 PM		2,820	5:15 PM	2,653	-5.9%	6:00 PM	2,462	-12.7%	5:30 PM	1,803	-36.1%
5th St and Arizona Ave	500 PM		1,729	5:15 PM	1,263	-27.0%	6:00 PM	1,360	-21.3%	5:00 PM	1,083	-37.4%
5th St and Santa Monica Blvd	445 PM		2,062	6:00 PM	1,685	-18.3%	6:00 PM	1,762	-14.5%	6:00 PM	1,840	-10.8%
5th St and Broadway	500 PM		2,042	5:30 PM	1,634	-20.0%	5:30 PM	1,696	-16.9%	5:00 PM	1,625	-20.4%
5th St and Colorado Ave	500 PM		2,145	5:00 PM	1,985	-7.5%	5:30 PM	1,103	-48.6%	5:15 PM	1,168	-45.5%
6th St and Wilshire Blvd	400 PM		2,914	5:15 PM	2,208	-24.2%	6:00 PM	2,324	-20.2%	5:15 PM	1,866	-36.0%
6th St and Arizona Ave	500 PM		1,515	5:00 PM	1,089	-28.1%	5:15 PM	1,080	-28.7%	5:00 PM	1,011	-33.3%
6th St and Santa Monica Blvd	445 PM		1,812	5:30 PM	1,406	-22.4%	5:45 PM	1,468	-19.0%	5:45 PM	1,276	-29.6%
6th St and Broadway	500 PM		1,391	6:00 PM	1,292	-7.1%	5:30 PM	1,243	-10.6%	5:45 PM	1,108	-20.3%
6th St and Colorado Ave	445 PM		1,643	5:00 PM	1,405	-14.5%	5:15 PM	670	-59.2%	5:00 PM	589	-64.2%
7th St and San Vicente Blvd	515 PM		2,274	5:30 PM	2,083	-8.4%	5:00 PM	2,051	-9.8%	5:00 PM	1,902	-16.4%
7th St and Montana Ave	500 PM		1,795	5:00 PM	1,659	-7.6%	5:00 PM	1,531	-14.7%	5:00 PM	1,398	-22.1%
7th St and Wilshire Blvd	530 PM		2,644	5:15 PM	2,535	-4.1%	5:15 PM	2,464	-6.8%	5:15 PM	1,972	-25.4%
7th St and Arizona Ave	415 PM		1,390	5:00 PM	1,212	-12.8%	5:00 PM	1,164	-16.3%	5:30 PM	1,280	-7.9%
7th St and San Monica Blvd	515 PM		1,789	5:15 PM	1,591	-11.1%	6:00 PM	1,666	-6.9%	5:30 PM	1,659	-7.3%
7th St and Broadway	445 PM		1,545	5:30 PM	1,324	-14.3%	5:00 PM	1,395	-9.7%	5:00 PM	1,254	-18.8%
7th St and Colorado Ave.	515 PM		1,841	5:00 PM	1,547	-16.0%	5:00 PM	944	-48.7%	5:15 PM	806	-56.2%
Lincoln Blvd and Montana Ave	415 PM		1,645	5:00 PM	1,609	-2.2%	5:15 PM	1,423	-13.5%	5:00 PM	1,273	-22.6%
Lincoln Blvd and Wilshire Blvd	530 PM		4,664	5:30 PM	3,154	-32.4%	5:15 PM	3,151	-32.4%	5:30 PM	2,666	-42.8%
Lincoln Blvd and Arizona Ave	545 PM		2,740	5:00 PM	2,209	-19.4%	5:30 PM	2,102	-23.3%	6:00 PM	2,129	-22.3%
Lincoln Blvd and Santa Monica Blvd	545 PM		3,766	5:00 PM	3,041	-19.3%	6:00 PM	3,168	-15.9%	5:45 PM	3,039	-19.3%
Lincoln Blvd and Broadway	600 PM		3,902	5:30 PM	3,051	-21.8%	6:00 PM	3,173	-18.7%	5:15 PM	2,654	-32.0%
Lincoln Blvd and Colorado Ave	530 PM		4,450	5:30 PM	3,728	-16.2%	5:15 PM	3,274	-26.4%	5:45 PM	2,952	-33.7%
Lincoln Blvd and I-10 WB Off-Ramp	545 PM		4,528	6:00 PM	4,277	-5.5%	5:15 PM	4,133	-8.7%	5:00 PM	3,363	-25.7%
Lincoln Blvd and I-10 EB On-Ramp	600 PM		4,435	5:15 PM	3,692	-16.8%	5:00 PM	3,926	-11.5%	5:00 PM	3,926	-11.5%
Lincoln Blvd and Pico Blvd	600 PM		4,844	5:00 PM	3,847	-20.6%	5:15 PM	4,161	-14.1%	5:45 PM	3,266	-32.6%
Lincoln Blvd and Pearl St	515 PM		3,116	6:00 PM	2,751	-11.7%	5:00 PM	2,682	-13.9%	5:00 PM	2,682	-13.9%
Lincoln Blvd and Ocean Park Blvd	500 PM		4,583	6:00 PM	4,091	-10.7%	5:30 PM	3,803	-17.0%	5:45 PM	3,590	-21.7%
Lincoln Blvd and Ashland Ave	545 PM		3,865	5:15 PM	2,944	-23.8%	5:00 PM	2,741	-29.1%	5:00 PM	2,682	-30.6%
Lincoln Blvd and Marine St	545 PM		4,126	5:15 PM	2,963	-28.2%	6:00 PM	3,400	-17.6%	6:00 PM	2,703	-34.5%
17th St and Ocean Park Blvd	515 PM		2,440	5:45 PM	1,962	-19.6%	5:00 PM	1,696	-30.5%	5:00 PM	1,581	-35.2%
18th Crt and Pico Blvd (Alley btwn 18th & 19th)	600 PM		2,791	5:45 PM	2,011	-27.9%	6:00 PM	2,116	-24.2%	5:00 PM	1,847	-33.8%
20th St (East) and Montana Ave	530 PM		2,075	5:00 PM	1,523	-26.6%	5:15 PM	1,465	-29.4%	5:15 PM	1,235	-40.5%
20th St and Wilshire Blvd	515 PM		4,731	5:45 PM	3,470	-26.7%	5:15 PM	3,358	-29.0%	5:00 PM	2,933	-38.0%

PM Peak Hour Intersection Turning Movement Counts

Intersection Name	2007 Count Data			2011 Count Data			2013 Count Data			2019 Count Data		
	Peak Hour		Volume	Peak Hr	Vol	% Diff	Peak Hr	Vol	% Diff	Peak Hr	Vol	% Diff
20th St and Arizona Ave	515	PM	2,039	5:00 PM	1,867	-8.4%	5:15 PM	1,776	-12.9%	5:00 PM	1,595	-21.8%
20th St and Santa Monica Blvd	600	PM	4,006	5:00 PM	3,360	-16.1%	5:00 PM	3,461	-13.6%	5:00 PM	3,357	-16.2%
20th St and Broadway	530	PM	3,018	5:00 PM	2,721	-9.8%	5:00 PM	2,705	-10.4%	5:00 PM	2,428	-19.5%
20th St and Colorado Ave	500	PM	3,759	5:00 PM	3,307	-12.0%	5:00 PM	2,910	-22.6%	5:00 PM	2,187	-41.8%
20th St and Olympic Blvd	500	PM	7,082	5:00 PM	4,201	-40.7%	5:00 PM	4,015	-43.3%	5:15 PM	3,607	-49.1%
20th St and I-10 EB Off-Ramp	530	PM	2,678	5:00 PM	2,123	-20.7%	5:15 PM	1,599	-40.3%	5:00 PM	2,326	-13.1%
20th St and Delaware Ave	530	PM	2,406	5:00 PM	2,062	-14.3%	5:15 PM	2,079	-13.6%	5:00 PM	1,897	-21.2%
20th St and Pico Blvd	530	PM	4,414	5:00 PM	3,541	-19.8%	5:00 PM	3,591	-18.6%	5:00 PM	2,891	-34.5%
20th St and Ocean Park Blvd	530	PM	2,512	6:00 PM	1,690	-32.7%	6:00 PM	1,814	-27.8%	6:00 PM	1,774	-29.4%
21st St and Ocean Park Blvd	530	PM	2,604	5:00 PM	2,047	-21.4%	5:00 PM	2,038	-21.7%	5:30 PM	1,863	-28.5%
26th St and Pico Blvd	500	PM	3,001	6:00 PM	2,142	-28.6%	5:15 PM	2,314	-22.9%	5:15 PM	2,260	-24.7%
23rd St and Wilshire Blvd	515	PM	3,758	5:15 PM	2,808	-25.3%	5:00 PM	2,907	-22.6%	5:00 PM	2,431	-35.3%
23rd St and Santa Monica Blvd	600	PM	3,026	5:00 PM	2,300	-24.0%	5:00 PM	2,471	-18.3%	5:00 PM	2,485	-17.9%
23rd St and Pico Blvd	530	PM	3,404	5:45 PM	2,860	-16.0%	5:00 PM	2,842	-16.5%	5:15 PM	3,050	-10.4%
23rd St and Ocean Park Blvd	530	PM	3,269	6:00 PM	2,603	-20.4%	6:00 PM	2,390	-26.9%	5:15 PM	2,156	-34.0%
24th St and Montana Ave	545	PM	1,657	5:00 PM	1,237	-25.3%	5:00 PM	1,203	-27.4%	5:15 PM	1,070	-35.4%
Cloverfield Blvd and Santa Monica Blvd	515	PM	3,414	5:00 PM	2,435	-28.7%	5:00 AM	2,806	-17.8%	5:30 PM	2,887	-15.4%
Cloverfield Blvd and Broadway	515	PM	2,505	5:00 PM	2,179	-13.0%	6:00 PM	2,292	-8.5%	6:00 PM	2,292	-8.5%
Cloverfield Blvd and Colorado Ave	600	PM	4,192	5:00 PM	3,438	-18.0%	6:00 PM	3,283	-21.7%	5:30 PM	3,265	-22.1%
Cloverfield Blvd and Olympic Blvd	515	PM	5,500	5:00 PM	4,177	-24.1%	5:30 PM	4,545	-17.4%	5:00 PM	3,714	-32.5%
Cloverfield Blvd and Michigan Ave	530	PM	3,862	5:00 PM	3,469	-10.2%	5:30 PM	3,388	-12.3%	6:00 PM	3,293	-14.7%
Cloverfield Blvd and I-10 WB Off-Ramp	515	PM	4,066	5:15 PM	3,740	-8.0%	5:45 PM	3,885	-4.5%	5:30 PM	3,326	-18.2%
Cloverfield Blvd and I-10 EB On-Ramp	545	PM	3,758	5:00 PM	3,110	-17.2%	5:30 PM	2,950	-21.5%	5:30 PM	2,415	-35.7%
Cloverfield Blvd and Virginia Ave	500	PM	2,510	5:00 PM	1,801	-28.2%	5:15 PM	2,141	-14.7%	5:30 PM	2,013	-19.8%
Cloverfield Blvd and Pico Blvd	500	PM	3,177	5:00 PM	3,286	3.4%	5:15 PM	3,562	12.1%	5:00 PM	2,938	-7.5%
Cloverfield Blvd and Ocean Park Blvd	500	PM	2,679	6:00 PM	2,130	-20.5%	6:00 PM	1,702	-36.5%	5:00 PM	1,665	-37.8%
25th St and Ocean Park Blvd	500	PM	2,424	6:00 PM	2,049	-15.5%	6:00 PM	1,674	-30.9%	6:00 PM	1,591	-34.4%
26th St and San Vicente Blvd	500	PM	3,541	5:00 PM	3,118	-11.9%	5:00 PM	3,146	-11.2%	5:00 PM	3,089	-12.8%
26th St and Montana Ave	500	PM	3,585	5:00 PM	2,342	-34.7%	5:00 PM	2,279	-36.4%	5:30 PM	2,110	-41.1%
26th and Wilshire	545	PM	4,841	5:15 PM	3,643	-24.7%	5:00 PM	3,719	-23.2%	5:00 PM	3,120	-35.6%
26th St and Arizona Ave	515	PM	2,351	5:00 PM	1,777	-24.4%	5:30 PM	1,667	-29.1%	5:00 PM	1,618	-31.2%
26th St and Santa Monica Blvd	530	PM	4,224	5:30 PM	3,106	-26.5%	5:00 PM	3,236	-23.4%	5:00 PM	3,115	-26.3%
26th St and Broadway	530	PM	2,749	5:00 PM	2,126	-22.7%	5:00 PM	2,171	-21.0%	5:15 PM	2,231	-18.8%
26th St and Colorado Ave	545	PM	3,512	5:00 PM	2,899	-17.5%	5:00 PM	2,583	-26.5%	5:30 PM	2,378	-32.3%
26th St and Olympic Blvd	515	PM	3,891	5:15 PM	2,695	-30.7%	5:00 PM	3,180	-18.3%	5:30 PM	2,308	-40.7%
Yale St and Wilshire Blvd	545	PM	3,995	5:45 PM	2,890	-27.7%	5:30 PM	2,910	-27.2%	5:15 PM	2,756	-31.0%
Yale St and Santa Monica Blvd	500	PM	3,024	5:30 PM	2,275	-24.8%	5:15 PM	2,437	-19.4%	5:00 PM	2,673	-11.6%
Yale St and Broadway	530	PM	1,395	5:00 PM	1,061	-23.9%	5:00 PM	1,032	-26.0%	5:15 PM	983	-29.5%
Stewart St and Colorado Ave	545	PM	2,838	5:30 PM	1,890	-33.4%	5:15 PM	1,931	-32.0%	5:00 PM	1,522	-46.4%
Stewart St and Olympic Blvd	500	PM	4,403	5:15 PM	2,896	-34.2%	5:30 PM	3,889	-11.7%	5:30 PM	3,889	-11.7%
Stewart St / 28th St and Pico Blvd	500	PM	3,691	5:15 PM	2,685	-27.3%	5:00 PM	2,956	-19.9%	5:45 PM	2,735	-25.9%
28th St and Ocean Park Blvd	500	PM	2,781	5:00 PM	2,749	-1.2%	5:00 PM	2,523	-9.3%	5:15 PM	2,507	-9.9%
Berkeley St and Wilshire Blvd	515	PM	3,540	5:00 PM	2,826	-20.2%	5:15 PM	3,104	-12.3%	5:30 PM	2,815	-20.5%
31st St and Ocean Park Blvd	500	PM	3,228	5:00 PM	2,687	-16.8%	5:15 PM	2,779	-13.9%	5:15 PM	2,578	-20.1%
33rd St and Pico Blvd	500	PM	2,594	5:00 PM	2,012	-22.4%	5:15 PM	2,301	-11.3%	5:15 PM	2,202	-15.1%
34th St and Pico Blvd	545	PM	3,147	6:00 PM	2,490	-20.9%	5:45 PM	2,504	-20.4%	5:00 PM	2,636	-16.2%
Centinela Ave (East) and Wilshire Blvd	545	PM	2,162	6:00 PM	3,030	40.1%	5:00 PM	3,236	49.7%	5:30 PM	2,535	17.3%
Centinela Ave and Santa Monica Blvd	530	PM	3,958	5:30 PM	2,887	-27.1%	5:30 PM	3,039	-23.2%	5:15 PM	3,082	-22.1%
Centinela Ave and Broadway	515	PM	2,450	5:30 PM	1,695	-30.8%	5:15 PM	1,658	-32.3%	5:15 PM	1,623	-33.8%
Centinela Ave and Colorado Ave	530	PM	3,158	5:30 PM	2,215	-29.9%	5:00 PM	2,104	-33.4%	6:00 PM	1,873	-40.7%
Centinela Ave (East) and Olympic Blvd	600	PM	4,647	5:45 PM	4,044	-13.0%	5:30 PM	4,286	-7.8%	6:00 PM	2,997	-35.5%
Centinela Ave and Pico Blvd	600	PM	4,626	6:00 PM	3,993	-13.7%	6:00 PM	3,993	-13.7%	5:00 PM	3,644	-21.2%
Centinela Ave and Pearl St	545	PM	1,868	5:15 PM	1,963	5.1%	5:30 PM	2,002	7.2%	5:00 PM	1,632	-12.6%
Centinela Ave and Ocean Park Blvd	530	PM	3,700	5:00 PM	3,343	-9.6%	5:30 PM	3,600	-2.7%	5:45 PM	2,661	-28.1%
Appian Way and Seaside Terrace	515	PM	430	5:00 PM	118	-72.6%	5:00 PM	215	-50.0%	5:00 PM	211	-50.9%
Appian Way and Pico Blvd	600	PM	507	6:00 PM	375	-26.0%	5:00 PM	456	-10.1%	5:15 PM	556	9.7%
20th St and Pearl St	500	PM	1,654	5:00 PM	1,281	-22.6%	5:00 PM	1,298	-21.5%	5:00 PM	1,186	-28.3%
4th St and WB Ocean Park Blvd	545	PM	1,041	5:00 PM	1,069	2.7%	5:45 PM	948	-8.9%	5:30 PM	935	-10.2%
4th St and Marine St	545	PM	969	5:15 PM	836	-13.7%	5:15 PM	812	-16.2%	5:45 PM	682	-29.6%
11th St and Marine St	515	PM	893	5:00 PM	930	4.1%	5:15 PM	909	1.8%	5:30 PM	1,021	14.3%
11th St and Pearl St	500	PM	1,102	5:00 PM	1,006	-8.7%	5:00 PM	974	-11.6%	5:45 PM	1,056	-4.2%
23rd St and Pearl St	500	PM	1,429	5:00 PM	1,344	-5.9%	5:00 PM	1,227	-14.1%	5:15 PM	1,108	-22.5%
28th St and Pearl St	515	PM	1,037	5:15 PM	1,214	17.1%	5:30 PM	1,210	16.7%	5:30 PM	1,076	3.8%
Cloverfield Blvd and Pearl St	500	PM	1,399	5:00 PM	1,223	-12.6%	5:00 PM	1,168	-16.5%	5:00 PM	925	-33.9%
23rd St and Arizona Ave	515	PM	1,205	5:00 PM	1,086	-9.9%	5:00 PM	1,074	-10.9%	5:00 PM	1,076	-10.7%
4th St and EB Ocean Park Blvd	545	PM	1,210	5:00 PM	888	-26.6%	5:45 PM	921	-23.9%	5:15 PM	897	-25.9%

PM Peak Hour Intersection Turning Movement Counts

Intersection Name	2007 Count Data			2011 Count Data			2013 Count Data			2019 Count Data		
	Peak Hour		Volume	Peak Hr	Vol	% Diff	Peak Hr	Vol	% Diff	Peak Hr	Vol	% Diff
Ocean Ave and Broadway	415	PM	2,304	5:15 PM	2,041	-11.4%	5:30 PM	1,939	-15.8%	5:30 PM	1,746	-24.2%
20th St (West) and Montana Ave	515	PM	1,835	5:00 PM	1,426	-22.3%	5:15 PM	1,330	-27.5%	5:15 PM	1,091	-40.5%
Centinela Ave (West) and Olympic Blvd	600	PM	4,756	5:30 PM	3,735	-21.5%	5:30 PM	4,237	-10.9%	6:00 PM	2,881	-39.4%
25th (east) and Ocean Park	515	PM	2,424	5:00 PM	2,345	-3.3%	5:00 PM	2,021	-16.6%	5:30 PM	1,790	-26.2%
4th St and Civic Center Dr.	600	PM	2,552	5:00 PM	2,083	-18.4%	5:00 PM	2,004	-21.5%	5:30 PM	1,871	-26.7%
Ocean Ave and Seaside Terrace	515	PM	3,222	5:00 PM	2,577	-20.0%	5:15 PM	2,564	-20.4%	5:15 PM	2,104	-34.7%
Nielson Way/ Bicknell	530	PM	2,919	5:15 PM	2,458	-15.8%	5:00 PM	2,368	-18.9%	5:45 PM	2,264	-22.4%
Nielson Way/ Ashland	500	PM	2,600	5:30 PM	2,276	-12.5%	5:30 PM	2,157	-17.0%	5:30 PM	2,049	-21.2%
20th St and I-10 WB ON-Ramp	500	PM	1,878	5:00 PM	1,898	1.1%	5:00 PM	2,133	13.6%	5:00 PM	2,206	17.5%
Ocean Avenue/Montana Avenue	500	PM	1,264	5:15 PM	1,071	-15.3%	5:00 PM	1,067	-15.6%	5:00 PM	1,028	-18.7%
Nielson Way/ Pacific	530	PM	2,798	5:00 PM	2,321	-17.0%	5:45 PM	2,174	-22.3%	5:00 PM	2,081	-25.6%
Nielson Way/ Strand	530	PM	2,864	5:30 PM	2,201	-23.1%	5:00 PM	2,107	-26.4%	6:00 PM	1,948	-32.0%
Nielson Way/ Hollister	530	PM	2,712	5:15 PM	2,269	-16.3%	5:00 PM	2,323	-14.3%	5:00 PM	1,962	-27.7%
Nielson Way/ Hill	500	PM	2,655	5:30 PM	2,343	-11.8%	5:30 PM	2,265	-14.7%	5:30 PM	2,189	-17.6%
6th/ Pico	600	PM	1,365	6:00 PM	1,430	4.8%	5:15 PM	1,619	18.6%	5:15 PM	1,492	9.3%
16th and Pico Blvd	500	PM	2,163	5:00 PM	1,836	-15.1%	5:00 PM	2,046	-5.4%	5:45 PM	1,940	-10.3%
Nielson Way/ Bay	530	PM	2,954	5:00 PM	2,464	-16.6%	5:30 PM	2,358	-20.2%	5:30 PM	2,057	-30.4%
Lincoln/ Michigan	600	PM	3,491	6:00 PM	2,495	-28.5%	5:15 PM	2,925	-16.2%	5:45 PM	2,148	-38.5%
Santa Monica/ Berkeley	515	PM	2,905	6:00 PM	2,185	-24.8%	5:45 PM	2,460	-15.3%	5:00 PM	2,599	-10.5%
Neilson Way/ 120 feet North of Hill	530	PM	2,752	5:30 PM	2,290	-16.8%	5:15 PM	2,317	-15.8%	5:15 PM	1,917	-30.3%
Centinela North/ I-10 Westbound ramps	530	PM	3,137	5:30 PM	2,125	-32.3%	5:30 PM	1,972	-37.1%	5:15 PM	1,863	-40.6%
Centinela South/ I-10 East bound on ramp	600	PM	2,162	5:00 PM	1,951	-9.8%	5:00 PM	1,880	-13.0%	5:45 PM	1,353	-37.4%
Centinela at Airport Avenue	600	PM	4,839	5:00 PM	3,662	-24.3%	5:30 PM	3,554	-26.6%	5:45 PM	3,513	-27.4%
Weighted Average						**-17.5%**			**-18.4%**			**-27.0%**