City of San Marino
Citywide Traffic Circulation Study
DRAFT Report

April 25, 2023

Submitted to:

City of San Marino California

J# 10466| Prepared by **Iteris, Inc.**

Innovating Through Informatics™

TABLE OF CONTENTS

TABLES

FIGURES

1.0 INTRODUCTION

The purpose of the San Marino Citywide Circulation Study is to utilize traffic data and community feedback to develop implementable safety and/or traffic calming improvements within the City. The City of San Marino is located approximately eight miles northeast of Downtown Los Angeles. The City is approximately 3.75 square miles in area and is bordered by the Cities of Pasadena, South Pasadena, Alhambra, and San Gabriel, as well as unincorporated Los Angeles County neighborhoods.

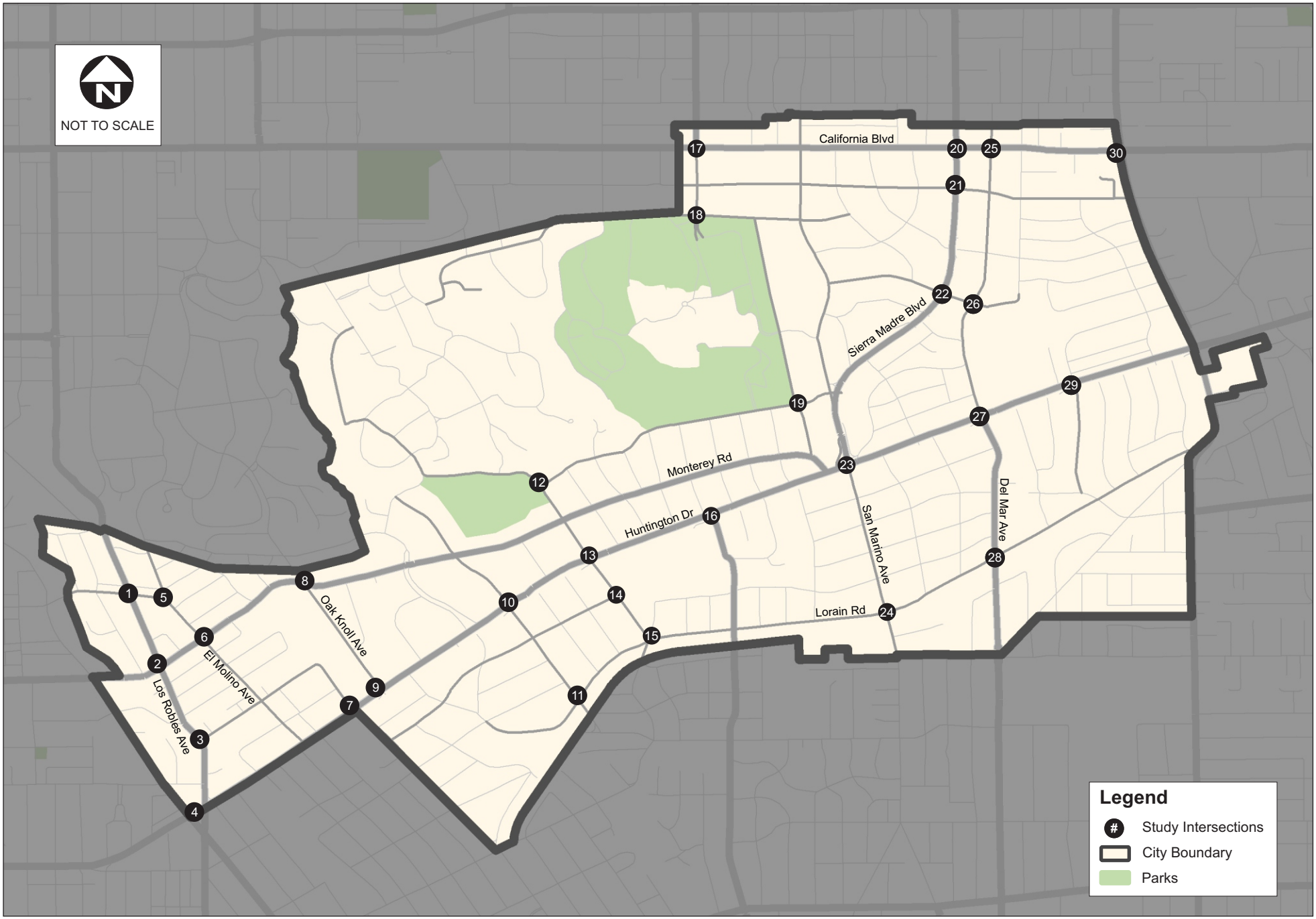
This report provides a summary of existing transportation conditions within the City, a discussion of previous planning efforts, recommendations for circulation improvements, and a toolbox for traffic calming measures. The report includes key information regarding traffic volumes, roadway and traffic signal characteristics, a review of other relevant plans/studies, historical collision data, and analysis of current and future traffic operations during peak conditions.

1.1 Study Area

Based on discussions with City of San Marino staff, the study area for analysis includes a combination of signalized and stop-controlled intersections. The study intersections are illustrated in **Figure 1** and are described in **Table 1**. The intersections generally represent locations where traffic congestion or safety may be a concern. Also indicated in **Table 1** are the traffic signal controller types at the 15 signalized intersections within the study area. All signals feature 170-type controllers, which is considered the most common traffic signal controller type in Los Angeles County.

Table 1: Study Intersections

Intersection		Traffic Control
1	Los Robles Ave/Mission St	Signalized (Controller Type 170)
2	Los Robles Ave/Monterey Rd	Signalized (Controller Type 170)
3	Los Robles Ave/Wilson Ave	Signalized (Controller Type 170)
4	Los Robles Ave-Atlantic Blvd/Huntington Dr	Signalized (Controller Type 170)
5	El Molino Ave/Mission St	All-way stop
6	El Molino Ave/Monterey Rd	All-way stop
7	Granada Ave/Huntington Dr	Signalized (Controller Type 170)
8	Oak Knoll Ave/Monterey Rd	All-way stop
9	Oak Knoll Ave/Huntington Dr	Signalized (Controller Type 170)
10	Saint Albans Rd/Huntington Dr	Signalized (Controller Type 170)
11	St Albans Rd/Lorain Rd	All-way stop
12	Virginia Rd/Euston Rd	All-way stop
13	Virginia Rd/Huntington Dr	Signalized (Controller Type 170)
14	Virginia Rd/Roanoke Rd	All-way stop
15	Virginia Rd/Lorain Rd	All-way stop
16	West Dr/Huntington Dr	Signalized (Controller Type 170)
17	Allen Ave/California Blvd	Signalized (Controller Type 170)
18	Allen Ave/Orlando Rd	All-way stop
19	Oxford Rd/Euston Rd	All-way stop
20	Sierra Madre Blvd/California Blvd	Signalized (Controller Type 170)
21	Sierra Madre Blvd/Lombardy Rd	Two-way stop
22	Sierra Madre Blvd/Robles Ave	Two-way stop
23	Sierra Madre Blvd/Huntington Dr	Signalized (Controller Type 170)
24	San Marino Ave/Lorain Rd	All-way stop
25	Winston Ave/California Blvd	Two-way stop
26	Winston Ave/Robles Ave	All-way stop
27	Del Mar Ave-Winston Ave/Huntington Dr	Signalized (Controller Type 170)
28	Del Mar Ave/Lorain Rd	All-way stop
29	Bradbury Rd/Huntington Dr	Signalized (Controller Type 170)
30	San Gabriel Blvd/California Blvd	Signalized (Controller Type 170)

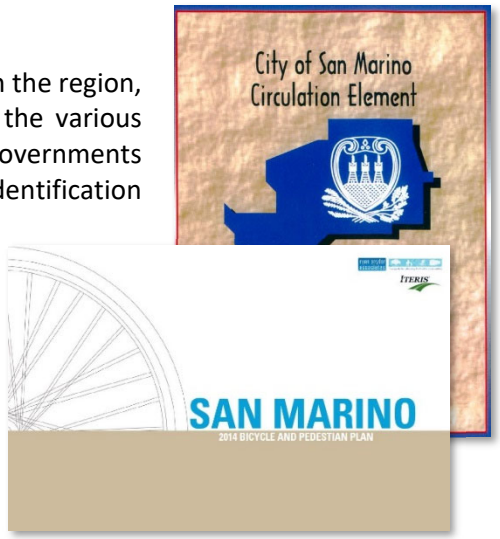


iteris

City of San Marino
Citywide Traffic Circulation Study

Figure 1
Study Intersections

2.0 LITERATURE REVIEW



In order to understand the recent history of planning efforts in the region, Iteris obtained and reviewed several studies completed by the various jurisdictions within the Southern California Association of Governments (SCAG) region. With the primary goal of this study being the identification of effective methods for the City to calm traffic at the neighborhood level, the review included traffic calming documentation, guidelines, and literature in order to set a baseline of available solutions and processes to discourage the intrusion and high speed of regional traffic onto local streets and encourage better and more efficient use of the transportation network for all users. The Literature Review memorandum is provided in **Appendix A**.

3.0 ENVIRONMENTAL SETTING

This section presents an overview of the existing roadways within the study area, and the methodology used to determine existing traffic volumes.

3.1 Roadway Configurations

The existing configuration of the key roadways within the study area are described below:

Huntington Drive, oriented in a northeast-southwest direction, is a six-lane divided roadway, representing the major east-west corridor through the City. Huntington Drive is designated as a Parkway in the current Circulation Element. The northeast-southwest travel lanes are separated by a 60 to 65-foot median parkway. The posted speed limit is 40 miles per hour. Within the study area, Huntington Drive directly serves mostly commercial and institutional uses, though there are some residences with frontage (driveway access) on the roadway.

Sierra Madre Boulevard, oriented in a north-south direction, consists of two lanes in each direction north of Huntington Drive, and is designated as a Parkway in the current Circulation Element. The posted speed limit on Sierra Madre Boulevard is 35 miles per hour. South of Huntington Drive, the roadway is named San Marino Avenue, and is designated as a Collector in the current Circulation Element. San Marino Avenue is a two-lane undivided roadway with a posted speed limit of 25 miles per hour.

San Gabriel Boulevard, oriented in a north-south direction, is a four-lane undivided roadway north of Huntington Drive and a four-lane divided roadway (painted median) south of Huntington Drive. Running along the eastern border of the City, San Gabriel Boulevard serves residential uses and is designated as a Major Arterial in the current Circulation Element. The posted speed limit is 40 miles per hour.

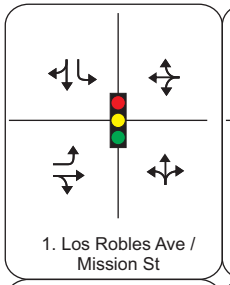
California Boulevard, oriented in an east-west direction, is a two-lane undivided roadway west of Sierra Madre Boulevard and is a two-lane divided roadway (two-way left-turn lane) east of Sierra Madre Boulevard. California Boulevard is designated as a Collector in the current Circulation Element, with a posted speed limit of 35 miles per hour.

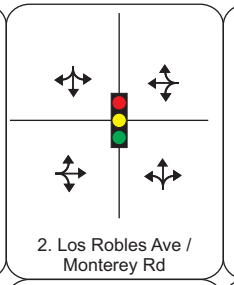
Virginia Road, oriented in a north-south direction, is a two-lane undivided roadway serving residential uses as well as Lacy Park. The roadway is designated as a Collector between Lacy Park and Huntington Drive, and as a Local Street everywhere else, in the current Circulation Element. The posted speed limit is 25 miles per hour. South of City limits, Virginia Road transitions to Alhambra Road which shifts to an east-west orientation.

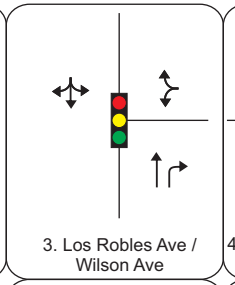
Los Robles Avenue, oriented in a north-south direction, is a two-lane undivided roadway within the City. Los Robles Avenue is designated as a Collector in the current Circulation Element, and serves residential uses. The posted speed limit is 30 miles per hour. South of City limits, Los Robles Avenue transitions to Atlantic Boulevard through the City of Alhambra and beyond.

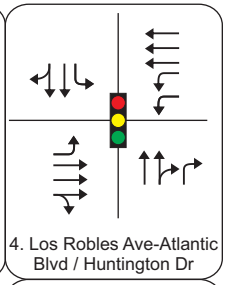
Lorain Road, oriented in an east-west direction, is a two-lane undivided roadway running generally parallel to Huntington Drive. Lorain Road serves residential uses, with on-street parking permitted, and is designated as a Local Street in the current Circulation Element, with a posted speed limit of 30 miles per hour.

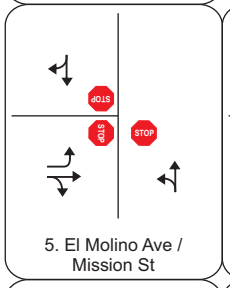
Figure 2 shows the existing intersection lane configurations.

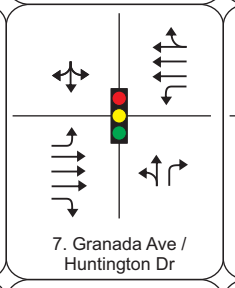


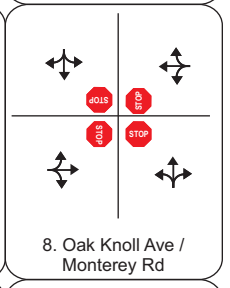


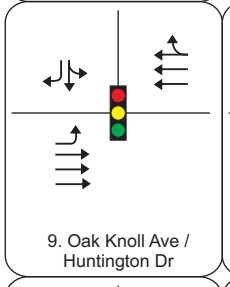


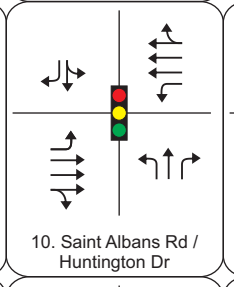


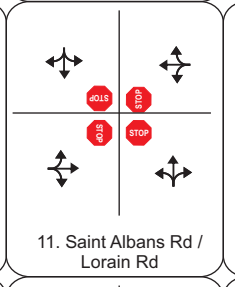


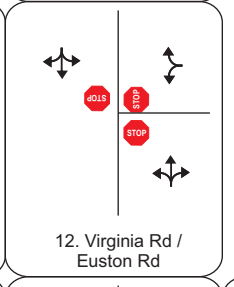


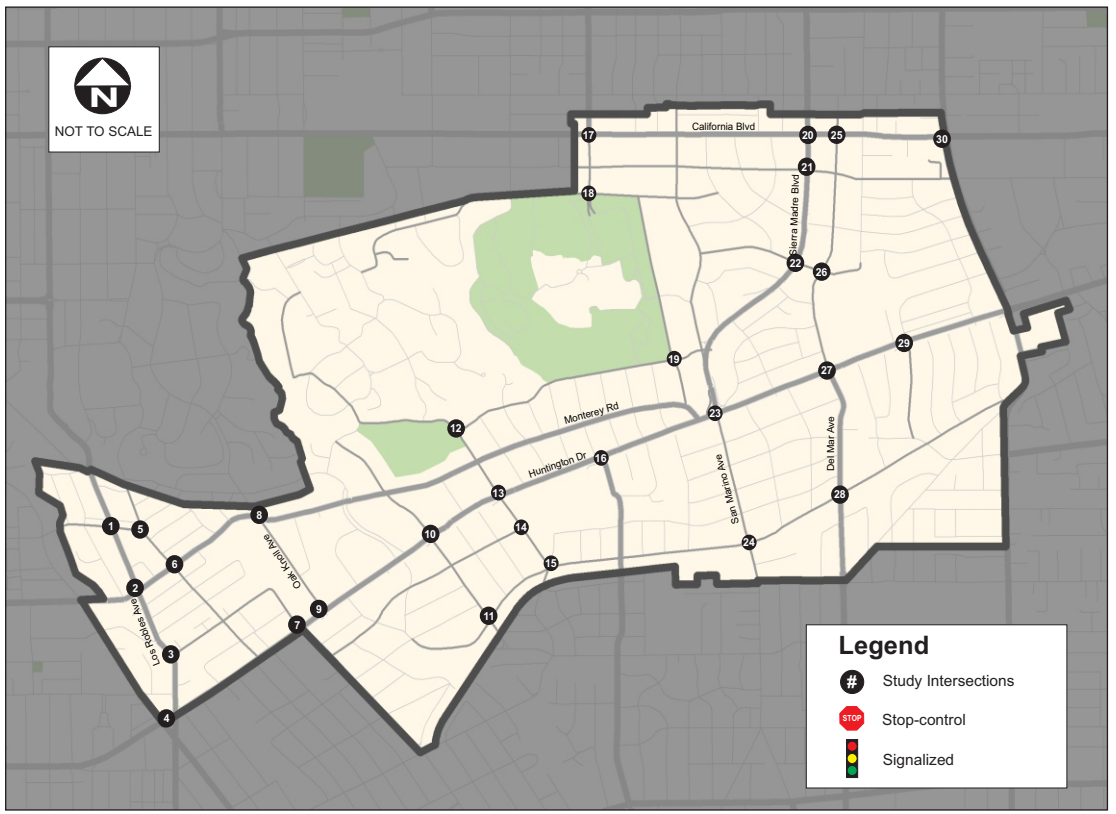


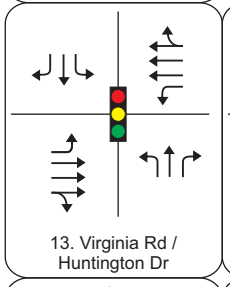


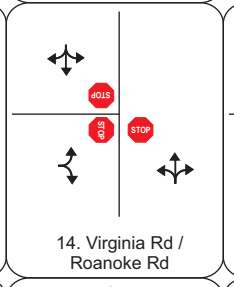


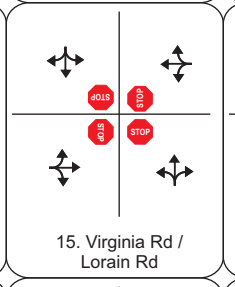


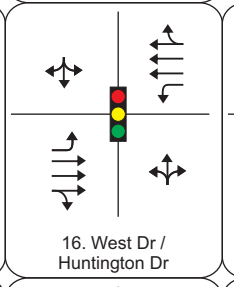


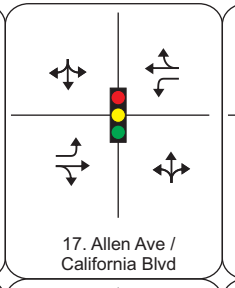


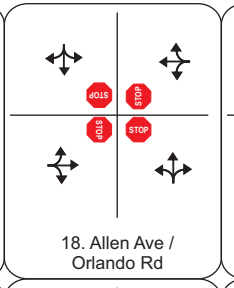


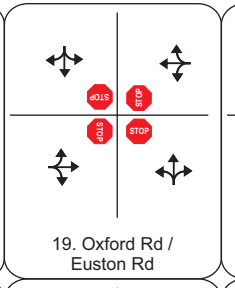


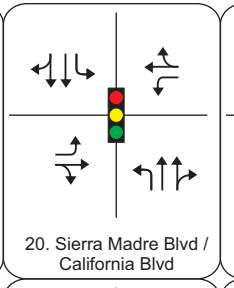


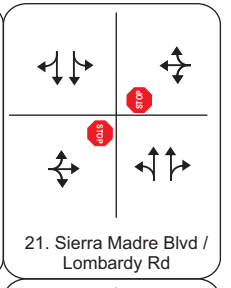


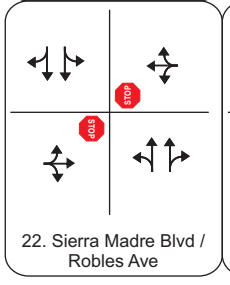


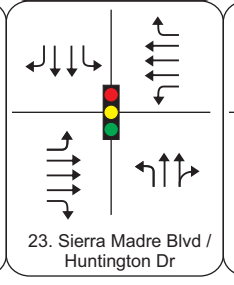


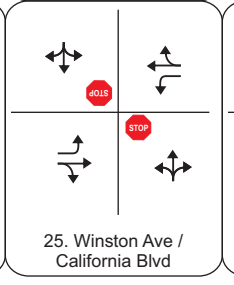


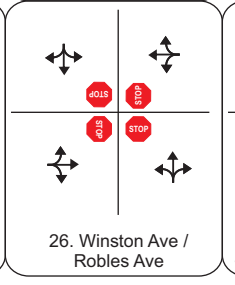


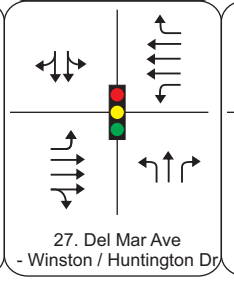


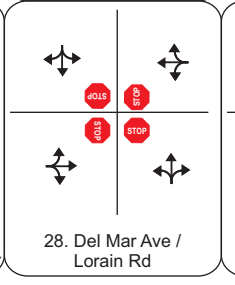


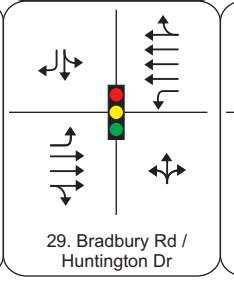


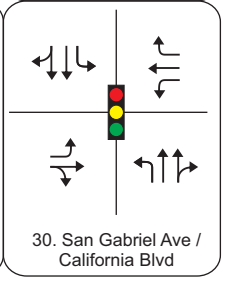












iteris®

City of San Marino
Citywide Traffic Circulation Study

Figure 2
Existing Lane Configurations

3.2 Existing Traffic Volumes

As part of the City's *2020 Engineering and Traffic Survey* report (February 2020), average daily traffic (ADT) on City roadways was collected and compared to volumes from 2010. Based on the results of the data collection, the most utilized roadways in the City are:

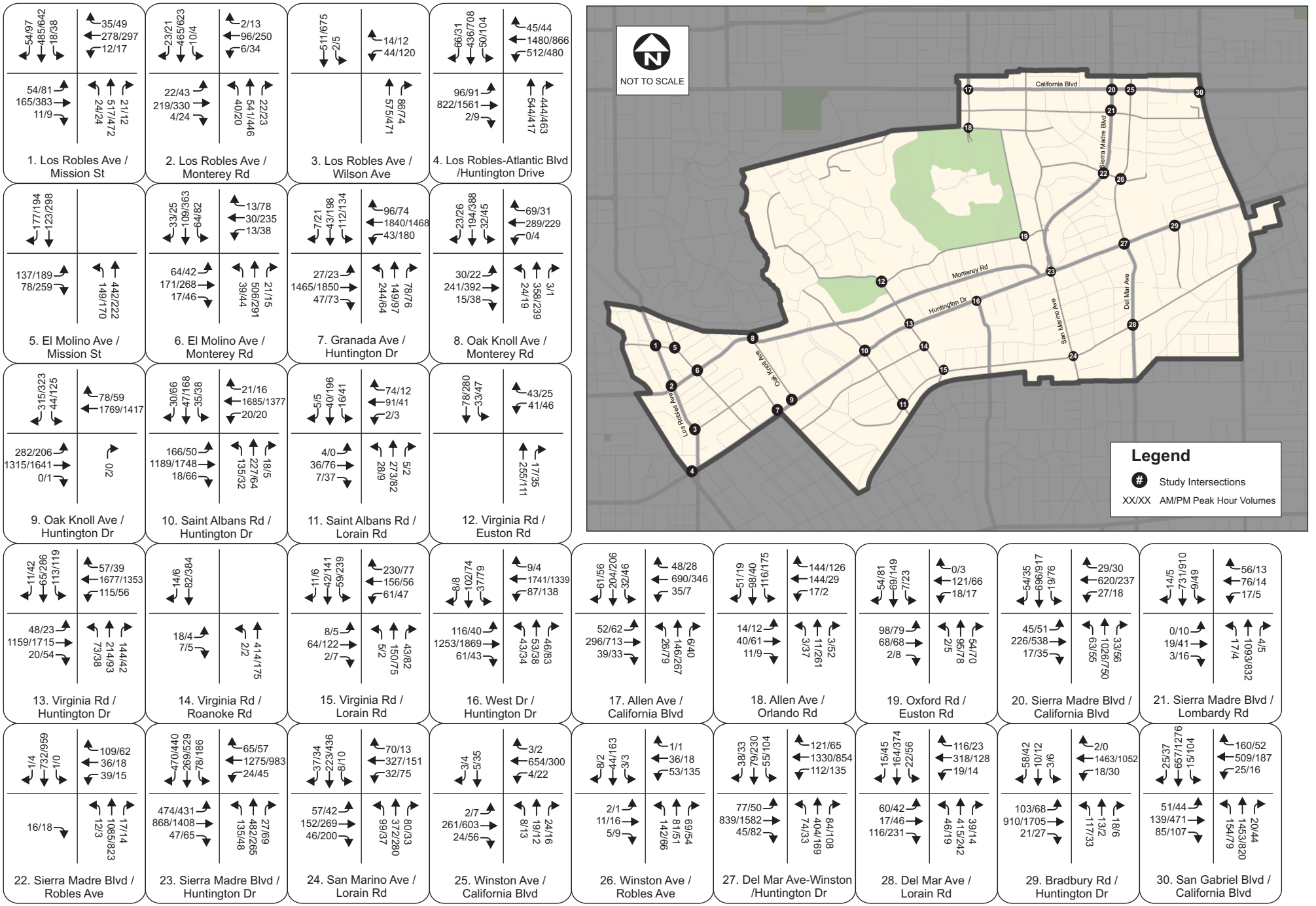
- Huntington Drive: 40,000 vehicles per day (an increase of roughly 25% from 2010)
- Sierra Madre Boulevard: 20,000 vehicles per day (an increase of roughly 27% from 2010)
- Los Robles Avenue: 17,000 vehicles per day (an increase of roughly 23% from 2010)
- California Boulevard: 13,700 vehicles per day (an increase of roughly 11% from 2010)
- Garfield Avenue: 12,800 vehicles per day (an increase of roughly 14% from 2010)
- San Marino Avenue 11,700 vehicles per day (an increase of roughly 31% from 2010)
- Oak Knoll Avenue: 8,300 vehicles per day (an increase of roughly 8% from 2010)

The full Citywide ADT map is provided in **Appendix B**, which includes both 2020 and 2010 ADT volumes.

Existing peak hour traffic volumes at the 30 intersections are based on vehicle turning movement counts conducted during a typical weekday in November 2019 during the a.m. (7:00 – 9:00) and p.m. (4:00 – 6:00) peak periods. The counts were collected prior to the Covid-19 pandemic, thus are still considered to be valid for this analysis. The peak hour volume used in the analysis was the highest single hour of traffic during each of the peak periods. Detailed traffic count data are included in **Appendix B**. **Figure 3** shows the existing peak hour volumes at the study intersections. Some key takeaways from the traffic count data are summarized as follows:

- Peak hour traffic volumes along Huntington Drive are directional. During the a.m. peak hour, the westbound direction carries the higher volume, approximately 1,800 to 1,900 vehicles (compared to 1,200 to 1,400 vehicles in the eastbound direction). During the p.m. peak hour, the flow is reversed, as the eastbound direction carries the higher volume, approximately 1,800 to 1,900 vehicles (compared to 1,400 to 1,500 vehicles in the westbound direction).

- As expected, signalized intersections carry higher volumes than two-way or all-way stop-controlled intersections.
    - The Los Robles Avenue-Atlantic Boulevard/Huntington Drive intersection carries the highest volume of traffic in both the a.m. and p.m. peak hour.
    - The Sierra Madre Boulevard/Huntington Drive intersection carries the second highest volume of traffic in both the a.m. and p.m. peak hour.
- Of the 12 all-way stop-controlled intersections in the study area, the San Marino Avenue/Lorain Road intersection carries the highest volumes during both the a.m. and p.m. peak hour.
- In addition to vehicle counts, pedestrian counts were collected. Peak hour pedestrian volumes are generally minimal throughout the study area (defined as a pedestrian hourly volume count of 10 pedestrians or less at a given crosswalk), with the exception of:
    - Virginia Road/Euston Road intersection (adjacent to Lacy Park) - A count of 109 pedestrians crossing Virginia Road was recorded during the p.m. peak hour (4:30 to 5:30 p.m.).
    - Virginia Road/Huntington Drive intersection - A count of 48 pedestrians crossing Virginia Road was recorded during the a.m. peak hour (7:30 to 8:30 a.m.), likely attributed to the proximity to Valentine Elementary School and Huntington Middle School.
    - Del Mar Avenue/Huntington Drive intersection - A count of 37 pedestrians crossing Huntington Drive was recorded during the a.m. peak hour (7:30 to 8:30 a.m.), likely attributed to the proximity to San Marino High School.



iteris®

City of San Marino
Citywide Traffic Circulation Study

Figure 3
Existing Volumes

4.0 TRAFFIC OPERATIONS ANALYSIS METHODOLOGY

The quality of traffic operations is characterized using the concept of level of service (LOS). Level of service is defined by a range of grades from A (best) to F (worst). At intersections, LOS "A" represents relatively free operating conditions with little or no delay. LOS "F" is characterized by extremely unstable flow conditions and severe congestion with volumes at or near the intersection's design capacity. This results in long queues backing up from all approaches to intersections.

Analysis of traffic operations were conducted using the Synchro software, utilizing the Highway Capacity Manual (HCM) delay methodology, which is described in the Highway Capacity Manual, Special Report 209 (Transportation Research Board, Washington, D.C., 2000). Under the HCM methodology, LOS at intersections is based on the average delay experienced by vehicles traveling through an intersection. **Table 1** presents a brief description of each level of service letter grade, as well as the range of delays associated with each grade for signalized and unsignalized intersections.

Table 2: Intersection Level of Service Definitions

Level Of Service	Description	Signalized Intersection Delay (seconds per vehicle)	Unsignalized Intersection Delay (seconds per vehicle)
A	Excellent operation. All approaches to the intersection appear quite open, turning movements are easily made, and nearly all drivers find freedom of operation.	≤ 10	≤ 10
B	Very good operation. Many drivers begin to feel somewhat restricted within platoons of vehicles. This represents stable flow. An approach to an intersection may occasionally be fully utilized and traffic queues start to form.	>10 and ≤ 20	>10 and ≤ 15
C	Good operation. Occasionally drivers may have to wait more than 60 seconds, and back-ups may develop behind turning vehicles. Most drivers feel somewhat restricted.	>20 and ≤ 35	>15 and ≤ 25
D	Fair operation. Cars are sometimes required to wait more than 60 seconds during short peaks. There are no long-standing traffic queues.	>35 and ≤ 55	>25 and ≤ 35
E	Poor operation. Some long-standing vehicular queues develop on critical approaches to intersections. Delays may be up to several minutes.	>55 and ≤ 80	>35 and ≤ 50
F	Forced flow. Represents jammed conditions. Backups from locations downstream or on the cross street may restrict or prevent movement of vehicles out of the intersection approach lanes; therefore, volumes carried are not predictable. Potential for stop and go type traffic flow.	> 80	> 50

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

5.0 TRAFFIC ANALYSIS

This section presents an evaluation of current and future citywide traffic conditions. A level of service analysis was conducted to evaluate intersection operations during the a.m. and p.m. peak hours at the study intersections. The intersection analysis includes current signal timing parameters provided by the City. These parameters include cycle length, minimum green time, yellow and all-red times, and pedestrian walk and flashing don't walk times (where available). Phase timing splits are optimized in the Synchro software based on the traffic volume demand. **Table 3** and **Figure 4** summarize the existing LOS at the study intersections. LOS calculation sheets are provided in **Appendix C**.

Table 3: Existing Intersection Peak Hour Level of Service

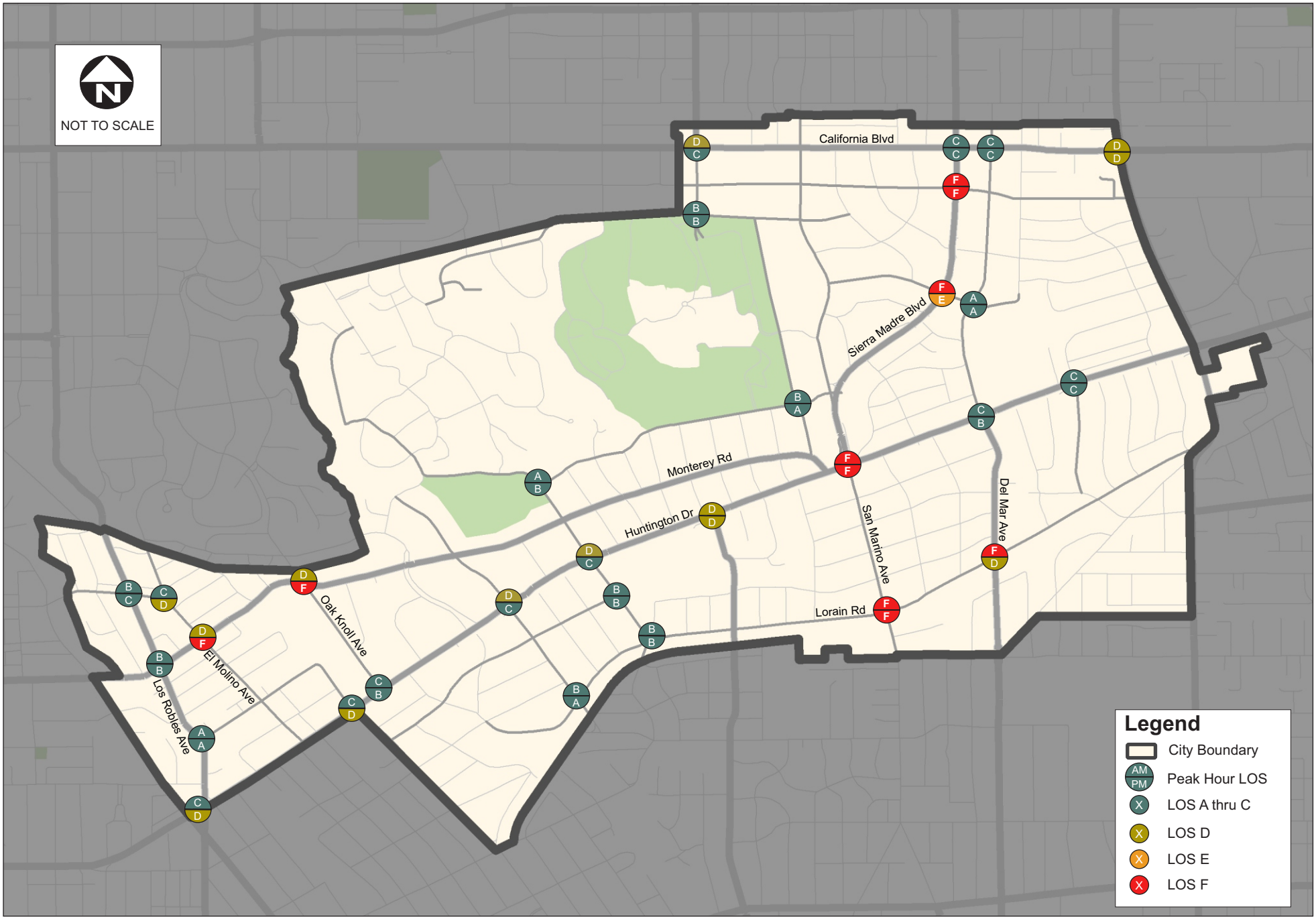
Intersection		Traffic Control	AM Peak Hour		PM Peak Hour	
			Delay (s)	LOS	Delay (s)	LOS
1	Los Robles Ave/Mission St	Signalized	15.6	B	22.8	C
2	Los Robles Ave/Monterey Rd	Signalized	12.6	B	17.3	B
3	Los Robles Ave/Wilson Ave	Signalized	4.5	A	7.8	A
4	Los Robles Ave-Atlantic Blvd/Huntington Dr	Signalized	31.9	C	43.7	D
5	El Molino Ave/Mission St	All-way stop	24.1	C	25.6	D
6	El Molino Ave/Monterey Rd	All-way stop	30.6	D	**97.6**	**F**
7	Granada Ave/Huntington Dr	Signalized	31.1	C	35.5	D
8	Oak Knoll Ave/Monterey Rd	All-way stop	28.8	D	**68.4**	**F**
9	Oak Knoll Ave/Huntington Dr	Signalized	23.2	C	18.6	B
10	Saint Albans Rd/Huntington Dr	Signalized	39.0	D	30.1	C
11	St Albans Rd/Lorain Rd	All-way stop	10.2	B	9.5	A
12	Virginia Rd/Euston Rd	All-way stop	9.1	A	10.5	B
13	Virginia Rd/Huntington Dr	Signalized	37.4	D	32.0	C
14	Virginia Rd/Roanoke Rd	All-way stop	11.4	B	11.3	B
15	Virginia Rd/Lorain Rd	All-way stop	14.7	B	14.0	B
16	West Dr/Huntington Dr	Signalized	50.0	D	51.0	D
17	Allen Ave/California Blvd	Signalized	38.2	D	34.5	C
18	Allen Ave/Orlando Rd	All-way stop	10.7	B	12.3	B
19	Oxford Rd/Euston Rd	All-way stop	10.1	B	9.8	A
20	Sierra Madre Blvd/California Blvd	Signalized	34.0	C	33.7	C
21	Sierra Madre Blvd/Lombardy Rd	Two-way stop	**>300***	**F**	**265.2***	**F**
22	Sierra Madre Blvd/Robles Ave	Two-way stop	**89.8***	**F**	**36.2***	**E**
23	Sierra Madre Blvd/Huntington Dr	Signalized	**226.2**	**F**	**201.5**	**F**
24	San Marino Ave/Lorain Rd	All-way stop	**141.3**	**F**	**101.6**	**F**

Intersection		Traffic Control	AM Peak Hour		PM Peak Hour	
			Delay (s)	LOS	Delay (s)	LOS
25	Winston Ave/California Blvd	Two-way stop	18.7*	C	23.6*	C
26	Winston Ave/Robles Ave	All-way stop	9.9	A	9.5	A
27	Del Mar Ave-Winston Ave/Huntington Dr	Signalized	22.1	C	18.6	B
28	Del Mar Ave/Lorain Rd	All-way stop	**69.6**	**F**	28.5	D
29	Bradbury Rd/Huntington Dr	Signalized	31.3	C	30.8	C
30	San Gabriel Blvd/California Blvd	Signalized	41.0	D	37.6	D

* Reporting the worst stop-controlled approach delay
Notes:
LOS = Level of Service, s = seconds.

As shown in **Table 3**, the majority of intersections within the study area operate at generally acceptable conditions (LOS D or better). Of the locations that operate at LOS E or F, most of these are two-way or all-way stop-controlled intersections. At two-way stop-controlled locations, the delay/LOS at the worst-case stop-controlled movement is presented, as opposed to an average of all vehicles approaching the intersection. This method is applied since the use of an average would skew the results since the majority of traffic through the intersection experience no delay (free-flow conditions).

The signalized Sierra Madre Boulevard/Huntington Drive intersection is currently operating at LOS F during the peak hours for vehicle operations. This is primarily due to the long pedestrian crossing times that are required in order to allow for pedestrian movements across Huntington Drive. For example, the distance to cross Huntington Drive is 185 feet, which requires a pedestrian crossing time of approximately 58 to 64 seconds (total of Walk phase and Flashing Don't Walk phase). As a result, the concurrent northbound (San Marino Avenue) and southbound (Sierra Madre Boulevard) vehicle phases run longer than the vehicle demand necessitates when a pedestrian phase is triggered. This results in delays to the heavier eastbound and westbound Huntington Drive movements. It should be noted, though, that the volume of pedestrians at this location is fairly minimal at this intersection (5 to 6 pedestrians along each north-south crosswalk in both a.m. and p.m. peak hours).



iteris

City of San Marino
Citywide Traffic Circulation Study

Figure 4
Existing Peak Hour Intersection LOS

5.1 Future Near-term Year Analysis

This section consists of a future year analysis of the study area. The analysis is representative of a near-term condition, which is typically considered to be three to five years from an existing/base year condition. In order to prepare the future near-term year analysis, traffic volume growth in the area was reviewed using the Southern California Association of Governments (SCAG) travel-demand model. Based on the review of roadway links in the City, comparing base year and future year model scenarios, the total average growth was derived to be approximately one to three percent. **Table 4** and **Figure 5** summarize the future near-term year conditions LOS at the study intersections. LOS calculation sheets are provided in **Appendix C**.

Table 4: Future Near-term Year Intersection Peak Hour Level of Service

Intersection		Traffic Control	AM Peak Hour		PM Peak Hour	
			Delay (s)	LOS	Delay (s)	LOS
1	Los Robles Ave/Mission St	Signalized	15.8	B	23.9	C
2	Los Robles Ave/Monterey Rd	Signalized	12.9	B	17.7	B
3	Los Robles Ave/Wilson Ave	Signalized	4.6	A	8.0	A
4	Los Robles Ave-Atlantic Blvd/Huntington Dr	Signalized	32.8	C	46.7	D
5	El Molino Ave/Mission St	All-way stop	25.2	D	26.7	D
6	El Molino Ave/Monterey Rd	All-way stop	**35.4**	**E**	**108.3**	**F**
7	Granada Ave/Huntington Dr	Signalized	32.7	C	38.0	D
8	Oak Knoll Ave/Monterey Rd	All-way stop	32.8	D	**76.7**	**F**
9	Oak Knoll Ave/Huntington Dr	Signalized	23.7	C	18.9	B
10	Saint Albans Rd/Huntington Dr	Signalized	39.9	D	30.5	C
11	St Albans Rd/Lorain Rd	All-way stop	10.3	B	9.6	A
12	Virginia Rd/Euston Rd	All-way stop	9.1	A	10.6	B
13	Virginia Rd/Huntington Dr	Signalized	38.2	D	32.4	C
14	Virginia Rd/Roanoke Rd	All-way stop	11.6	B	11.4	B
15	Virginia Rd/Lorain Rd	All-way stop	15.2	C	14.4	B
16	West Dr/Huntington Dr	Signalized	51.6	D	52.7	D
17	Allen Ave/California Blvd	Signalized	39.5	D	35.6	D
18	Allen Ave/Orlando Rd	All-way stop	10.9	B	12.5	B
19	Oxford Rd/Euston Rd	All-way stop	10.2	B	9.9	A
20	Sierra Madre Blvd/California Blvd	Signalized	35.4	D	35.0	D
21	Sierra Madre Blvd/Lombardy Rd	Two-way stop	**>300**	**F**	**>300**	**F**
22	Sierra Madre Blvd/Robles Ave	Two-way stop	**118.4**	**F**	**41.5**	**E**
23	Sierra Madre Blvd/Huntington Dr	Signalized	**238.2**	**F**	**215.2**	**F**

Intersection		Traffic Control	AM Peak Hour		PM Peak Hour	
			Delay (s)	LOS	Delay (s)	LOS
24	San Marino Ave/Lorain Rd	All-way stop	**155.3**	**F**	**110.7**	**F**
25	Winston Ave/California Blvd	Two-way stop	19.1	C	24.0	C
26	Winston Ave/Robles Ave	All-way stop	9.9	A	9.6	A
27	Del Mar Ave-Winston Ave/Huntington Dr	Signalized	22.5	C	18.9	B
28	Del Mar Ave/Lorain Rd	All-way stop	**74.3**	**F**	30.3	D
29	Bradbury Rd/Huntington Dr	Signalized	31.5	C	31.0	C
30	San Gabriel Blvd/California Blvd	Signalized	42.7	D	38.4	D

* Reporting the worst stop-controlled approach delay
Notes:
LOS = Level of Service, s = seconds.

As shown in **Table 4**, the majority of intersections within the study area are forecast to continue to operate at generally acceptable conditions (LOS D or better) in future near-term year conditions, despite average vehicle delays increasing due to the minimal growth in volume.

iteris

City of San Marino
Citywide Traffic Circulation Study

Figure 5
Future Near-term Year Peak Hour Intersection LOS

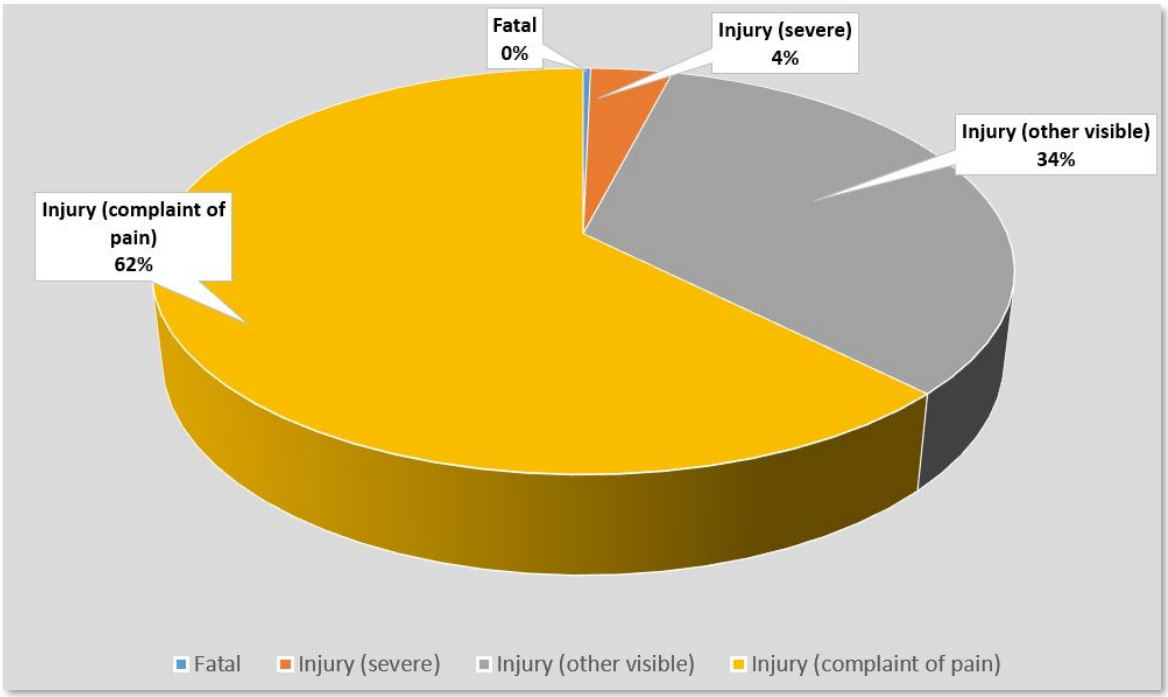
6.0 COLLISION EVALUATION

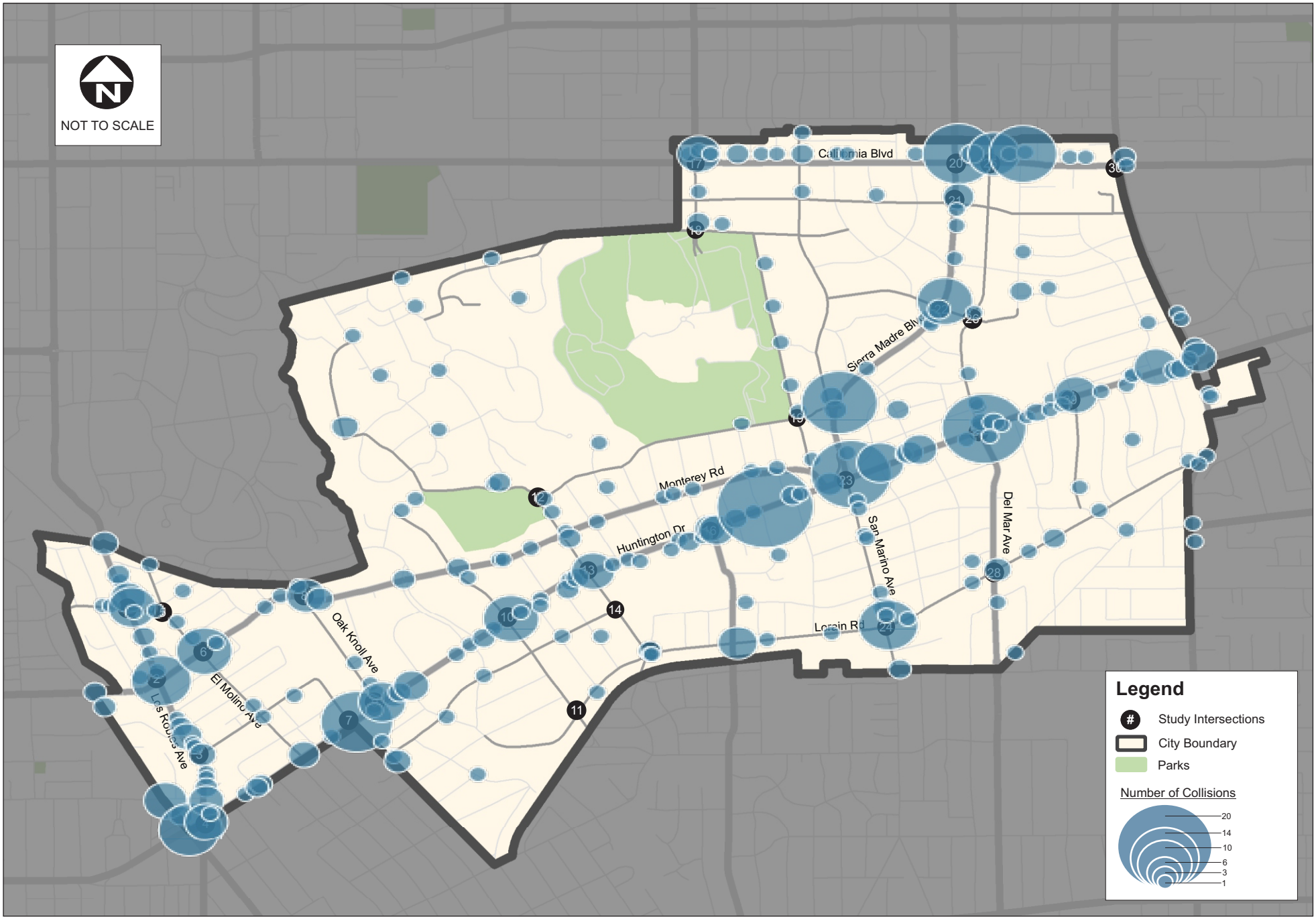
This section presents a discussion of overall safety conditions using traffic collision data within the City of San Marino. Data was extracted from the California Highway Patrol Statewide Integrated Traffic Records System (CHP SWITRS) from January 1, 2012 to December 31, 2021. The locations and frequency of collisions are shown in **Figure 6**. As shown on the figure, while the data shows collisions have occurred throughout the City, the largest, most concentrated clusters of collisions have historically occurred along Huntington Drive in the vicinity of Sierra Madre Boulevard/San Marino Avenue. During the 10-year period, a total of 599 collisions were recorded.

Further, the collision data was sorted in the following ways in order to adequately describe the safety conditions:

- Collisions by Severity (fatal, severe injury, etc.);
- Collisions by Type of Collision (rear-end, broadside, head-on, etc.); and
- Collisions involving non-motorized parties (pedestrians, bicycles).

In terms of collision severity, the breakdown of the categories is shown in the pie chart below. Two collisions of the 599 resulted in a fatality during the period. The majority of collisions (62%) resulted in minor injuries or complaint of pain. Only 4% of the total collisions resulted in severe injuries. A total of 805 injuries resulted from the 599 collisions.



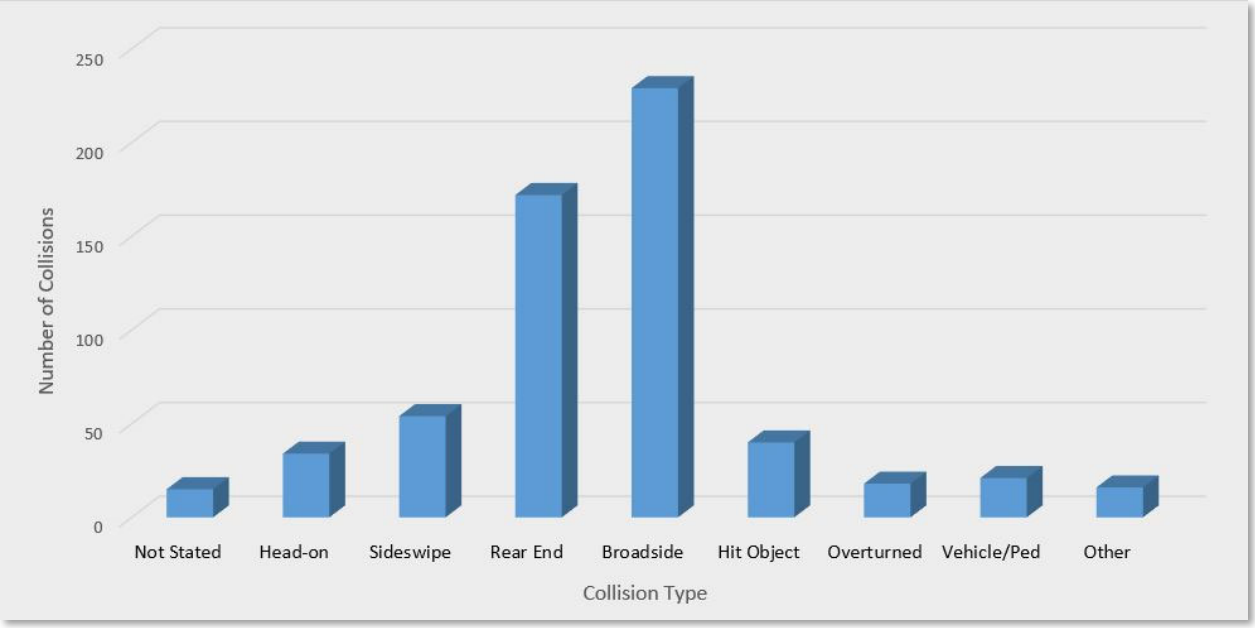


iteris

City of San Marino
Citywide Traffic Circulation Study

Figure 6
Collisions Hotspots

The two most frequent types of collisions were Broadside and Rear End collisions. Other less frequent types of collisions were Sideswipe and Hit Object. The data for all collision type categories is displayed in the following bar chart.



Lastly, the majority of collisions occurred between passenger vehicles and other passenger vehicles. Approximately 14% of collisions involved cyclists, 4% involved motorcycles, and 3% involved pedestrians. Of the incidents that involved pedestrians, the most frequent violations recorded were where drivers failed to yield to a pedestrian within a crosswalk's right-of-way. Detailed collision data from SWITRS is provided in **Appendix D**.

7.0 PUBLIC OUTREACH

In Spring 2022, the City of San Marino engaged the local community through a survey questionnaire focused on where residents feel traffic safety issues are present. The survey was responded to by approximately 100 residents. The comments received ranged from requests for additional stop signs to traffic calming suggestions to reduce vehicle speeds and cut-through traffic.

The most common locations cited in the survey were:

- San Marino Avenue/Lorain Road
- Belhaven Road/Huntington Drive
- San Gabriel Boulevard/Huntington Drive
- Virginia Road/Huntington Drive
- Los Robles Avenue/Mission Street
- Euclid Avenue/Mission Street
- West Drive/Sherwood Road

Respondents were asked to identify their most favored interventions to address the issues they experienced, with signage and vertical defection being the most favored and roadway narrowing and horizontal cross section being the least favored. In **Table 5**, the percentages are the percent marked under each type of intervention, therefore add up horizontally to 100 percent.

Table 5: Favorability of Intervention Type

Type of Intervention	Yes	No	Not Sure
Signage	40%	35%	25%
Vertical Deflection	29%	44%	27%
Narrowing	18%	52%	30%
Horizontal Cross-Sections	16%	56%	28%

The most favored specific interventions were:

- Warning Signs
- Speed Limit Signs and Striping
- High Visibility Crosswalks
- Speed Bumps/Tables

The least favored interventions were:

- Traffic Circles
- On-Street Parking
- Diverters
- Curb Reduction Radius
- Curb Extensions
- Lane Narrowing

Lastly, an initial draft of this report was presented to the Public Safety Commission on January 16, 2023. During that meeting, feedback from the community was received. In particular, the community voiced opposition to a previous recommendation for installation of a traffic signal at the San Marino Avenue/Lorain Road intersection. Thus, based on concurrence with the City, that recommendation has been removed from this version of the report. While a new traffic signal would reduce vehicle delay at the intersection, it could have the secondary impact of attracting more neighborhood cut-through traffic.

8.0 IMPROVEMENT RECOMMENDATIONS

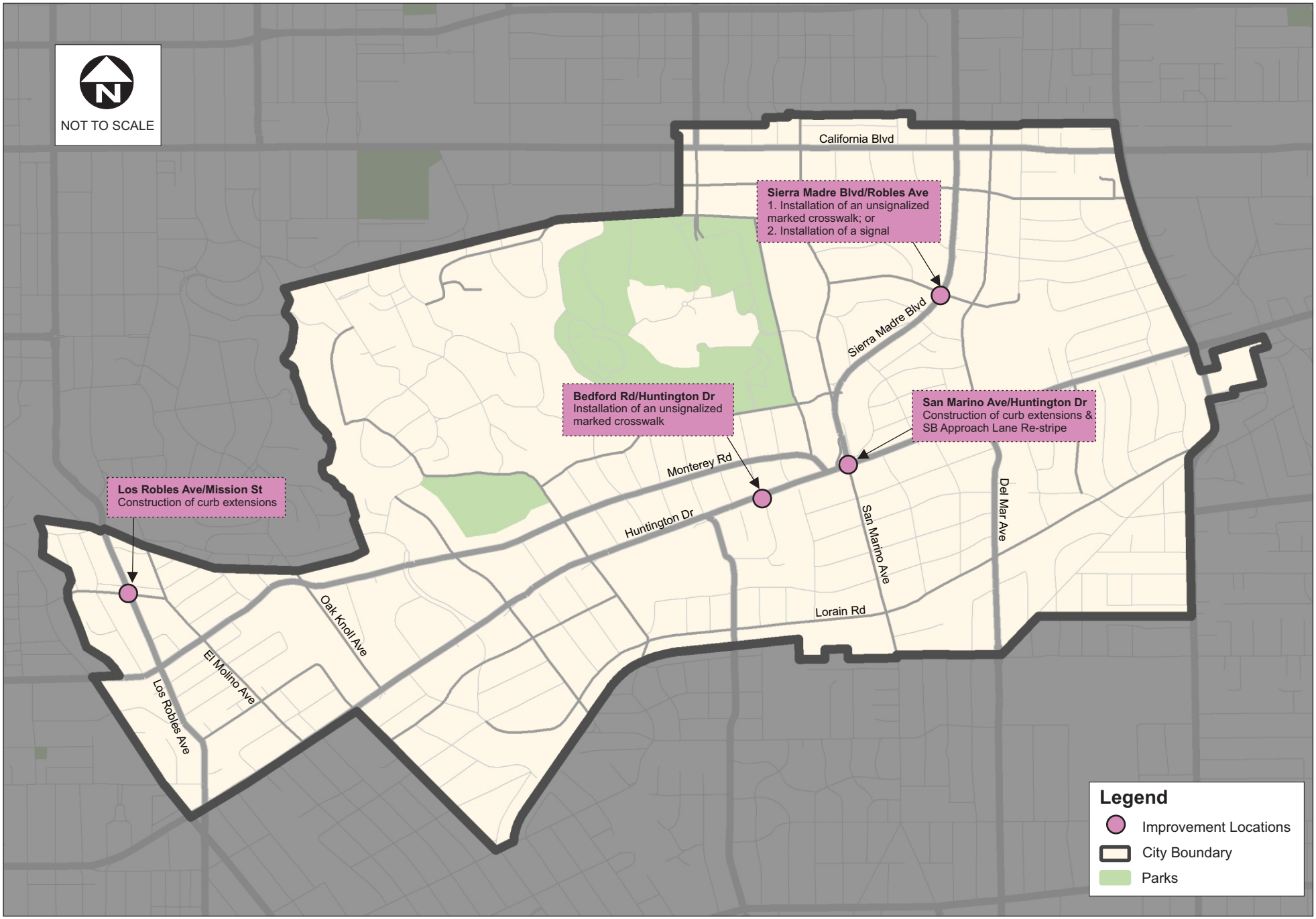
This section presents an analysis of improvements to inform decision makers on opportunities for improved safety and mobility within the City. Utilizing the results of the traffic analysis and feedback from the community, context sensitive circulation improvements were developed. The following improvements are recommended for consideration, with the locations shown in **Figure 7**:

- At the Bedford Road/Huntington Drive intersection, consider the installation of an unsignalized marked crosswalk across Huntington Drive, along the east leg of the intersection. The location of the marked crosswalk would be approximately 1,200 feet from the nearest marked crosswalk to the east, at San Marino Avenue, and approximately 700 feet from the nearest marked crosswalk to the west, at West Drive. This measure would provide enhanced pedestrian safety for pedestrians accessing commercial uses on the south side of Huntington Drive from residential areas north of Huntington Drive. As part of the improvement, it is recommended that a Rectangular Rapid Flashing Beacon (RRFB) control with a pedestrian push-button be installed along with a curb extension or bulb-out on the south side. RRFB's are user-actuated amber LED's that can be manually activated by pedestrians using a push button.

  A conceptual design plan of the marked crosswalk is shown in **Figure 8**. On the south side of the street, it is anticipated that up to two angled on-street parking spaces would need to be removed to accommodate the new crosswalk. A similar traffic control configuration can be found along Huntington Drive, east of San Marino Avenue at the Ridgeway Road and Kenilworth Avenue intersections.

- At the San Marino Avenue/Huntington Drive intersection, consider the construction of curb extensions to reduce pedestrian crossing distances across Huntington Drive. This measure would allow for reallocation of the intersection's signal timing by reducing the Flashing Don't Walk phase required. As mentioned, a pedestrian crossing time of approximately 58 to 64 seconds is currently required to cross Huntington Drive. This measure would also enhance intersection safety by improving a driver's awareness of a pedestrian that is waiting to cross or beginning to cross.

  As an additional measure, re-striping of the southbound approach to one right-turn lane, one through lane, and one left-turn lane (a reduction of one through lane) could accommodate additional southbound left-turn storage while reducing to one through lane in advance of Huntington Drive—rather than a lane reduction, leading to merging of vehicles, south of Huntington Drive. The re-stripe could potentially result in the "metering" of southbound approach traffic at the San Marino Avenue/Lorain Road intersection, as fewer southbound vehicles would make it through the intersection per cycle. A conceptual design plan is shown in **Figure 9**.



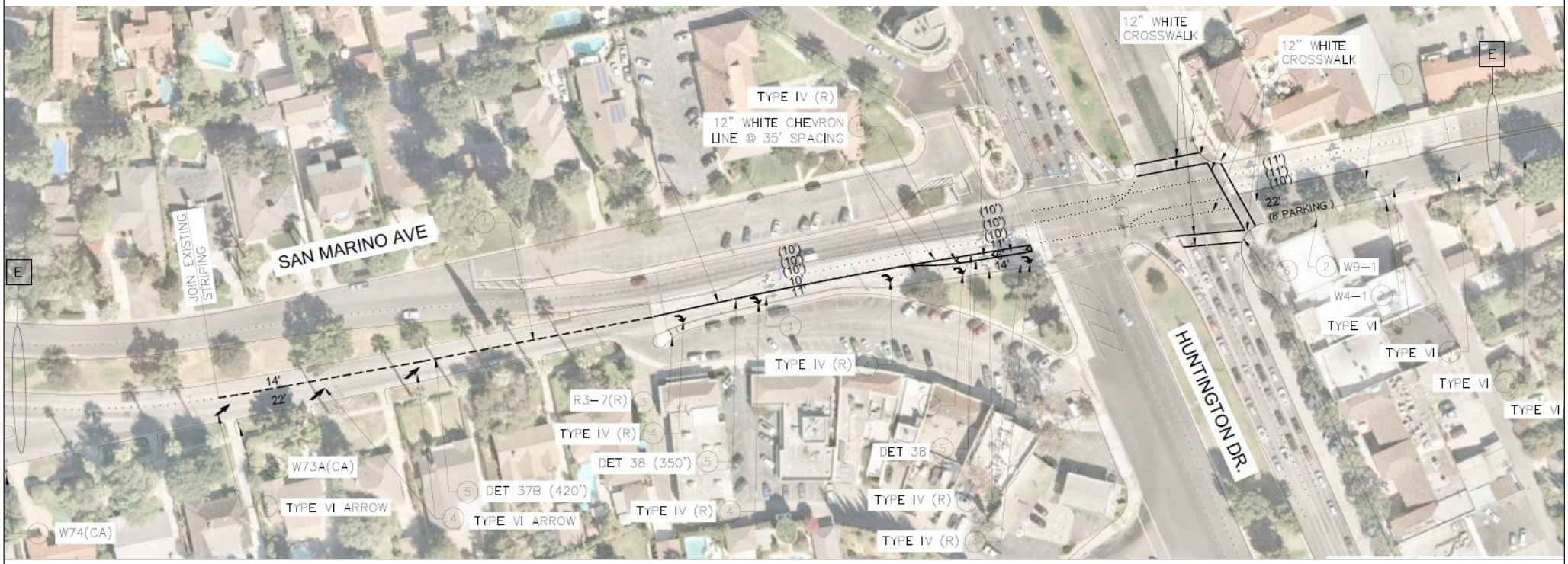
iteris

City of San Marino
Citywide Traffic Circulation Study

Figure 7
Improvement Measure Locations

Source: David Evans and Associates

Figure 8
Conceptual Design Plan at Bedford Rd/Huntington Dr



IMPROVEMENT NOTES

1. REMOVE EXISTING CONFLICTING TRAFFIC STRIPING OR PAVEMENT MARKINGS
2. REMOVE EXISTING SIGN(S) AND POST IF REQUIRED AS NOTED
3. INSTALL SIGN(S) AND POST IF REQUIRED AS NOTED
4. INSTALL PAVEMENT MARKINGS OR ARROWS PER DETAILS IN THE CALTRANS STD PLANS A24A TO A24F
5. INSTALL STRIPING PER DETAILS IN THE CALTRANS STD PLANS A20A TO A20E
6. CONSTRUCT CURB EXTENSION

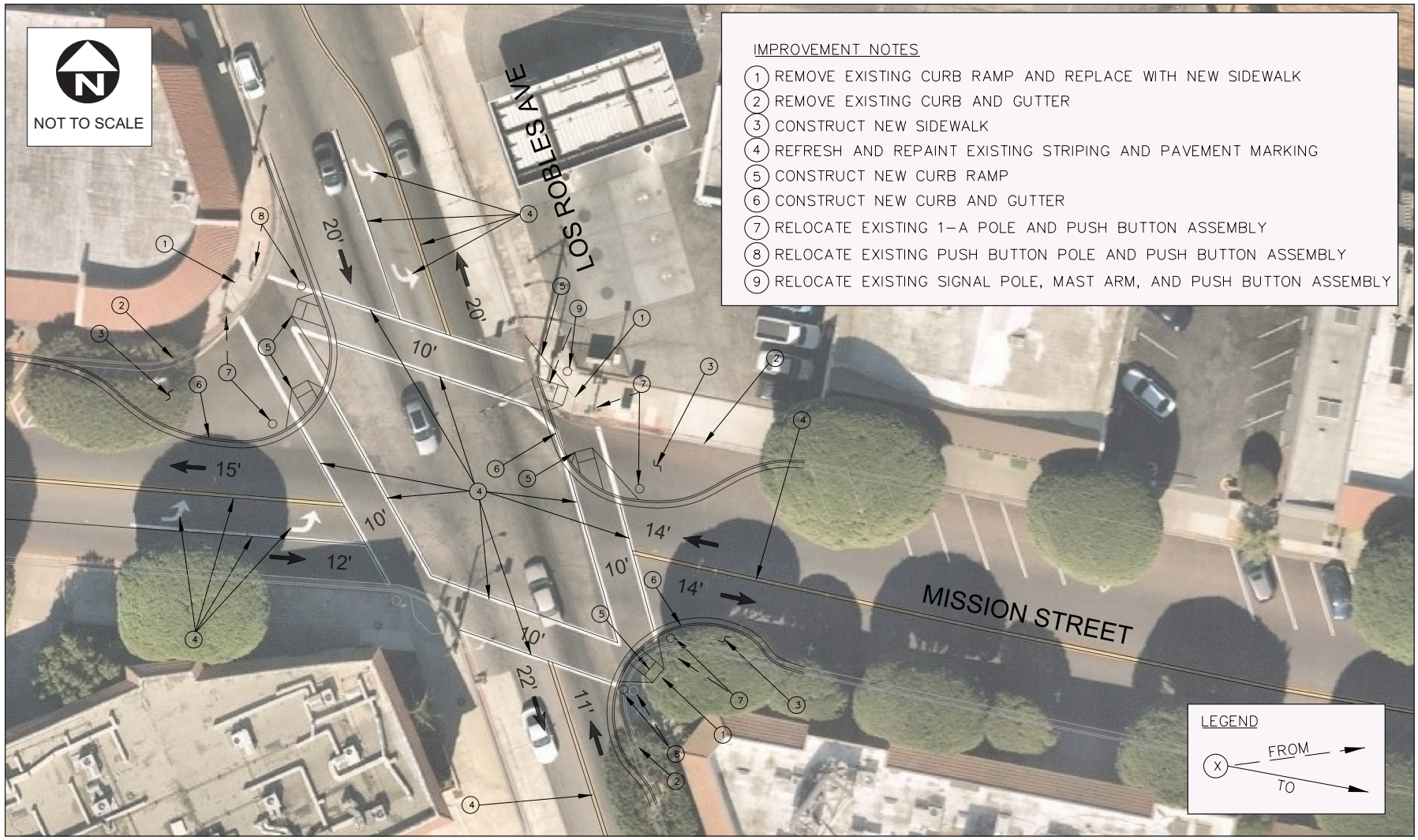
LEGEND

- (S) SIGNALIZED INTERSECTION
- [E] PROTECT EXISTING STRIPING & PAVEMENT MARKINGS
- ——— PROPOSED SOLID LANE STRIPING
- – – – PROPOSED DASHED LANE STRIPING
- (XX') EXISTING WIDTH
- XX' PROPOSED WIDTH

Source: David Evans and Associates

Figure 9
Conceptual Design Plan at Sierra Madre Blvd-San Marino Ave/Huntington Dr

- At the Los Robles Avenue/Mission Street intersection, consider the construction of curb extensions at the northwest corner, and potentially northeast and southeast corners, of the intersection to reduce pedestrian crossing distances across both Los Robles Avenue and Mission Street. The intersection is skewed, resulting in longer crosswalks than if the streets intersected at a 90-degree angle. The north leg crosswalk is approximately 80 feet long and the west leg crosswalk is approximately 88 feet long. The tight angle formed by the two crosswalks is shown in the adjacent photo (taken from the northwest corner of the intersection). A conceptual design plan of the curb extensions is shown in **Figure 10**.



Source: David Evans and Associates

- At the Sierra Madre Boulevard/Robles Avenue intersection, consider two potential options:

  Option 1 is the installation of an unsignalized marked crosswalk across Sierra Madre Boulevard, along the north side of the intersection. As part of the improvement, it is recommended that an RRFB control with a pedestrian push-button be installed along with curb extensions for enhanced visibility of pedestrians.

  Option 2 is the installation of a traffic signal to replace the current two-way stop control. The intersection is currently operating at LOS E and F during peak hours, due to the delay at the westbound Robles Avenue stop-controlled approach. The configuration/phasing of the signal would be similar to the Sierra Madre Boulevard/California Boulevard intersection to the north.

- The Huntington Drive/Los Robles Avenue /Garfield Avenue intersection cluster is being reviewed as part of the LA Metro SR-710 Mobility Improvement Project. Any modifications to that intersection cluster that would provide long-term north/south mobility solutions would need to include a comprehensive and inclusive review of the roadways from Fair Oaks Avenue to Oak Knoll Avenue. Los Robles Avenue provides one of the few north/south connections in the area due to Fair Oaks Avenue terminating at Huntington Drive and Garfield Avenue not crossing SR-110. Therefore, while the slowing of traffic can be achieved through traffic calming interventions, it is unlikely that vehicle travel patterns would be altered unless a parallel route was operationally improved.

- The Los Robles Avenue corridor was previously reviewed for neighborhood traffic calming as part of the City's Circulation Element. The *Phase 1 Neighborhood Traffic Management Plans* included recommendations for signal phasing modifications, new signage, and turning restrictions along Los Robles Avenue from the Pasadena border to Huntington Drive.

8.1 Operational Effects

Each of the improvement measures would have potential effects on traffic operations, driver's travel time, and/or the community. In some cases, the effects can be described quantitatively using standard analysis tools. In other cases, a qualitative assessment of potential effects in terms of safety and quality of life is more appropriate.

For example, the installation of marked crosswalks with an RRFB would provide traffic calming benefits along Huntington Drive and Sierra Madre Boulevard. Depending on the level of pedestrian activity at the new crosswalks, average speeds would decrease and travel times would increase along these corridors resulting in safety benefits. Though, quantifying these decreases and increases is difficult using traditional analysis tools.

With the addition of curb extensions, pedestrian crossing times would be reduced, which would lead to reduced vehicle delays at a traffic signal. At the San Marino Avenue/Huntington Drive intersection, reducing the north-south pedestrian crossing time across Huntington Drive would allow for signal timing adjustments that increase green time for the higher volume Huntington Drive movements (eastbound and westbound). Conversely, an extension of curb typically results in the removal of dedicated right-turns. This modification can result in increased vehicle delays, especially if right-turn volumes are heavy. Another consideration is the Metro bus stop at the southeast corner of the intersection, and the removal or relocation of this bus stop.

In terms of travel-time, given that the improvements would provide more benefits to safety and pedestrian flow, the effects on vehicle traffic time would be minimal.

8.2 Cost Estimates

This section presents planning-level cost estimate ranges for each of the described circulation improvements. The estimates are presented from lowest cost to highest cost measures. The cost estimate calculations are provided in **Appendix E**.

- Sierra Madre Boulevard/Robles Avenue intersection
  - Option 1: Marked crosswalk: – $15,000 to $25,000
  - Option 2: Traffic signal: $350,000 to $400,000
- Curb extensions at up to three corners of Los Robles Avenue/Mission Street intersection – $55,000 to $65,000
- Curb extensions at southwest and southeast corners of San Marino Avenue/Huntington Drive intersection and re-striping of southbound approach – $45,000 to $55,000
- Marked crosswalk, with curb extensions, at Bedford Road/Huntington Drive intersection – $40,000 to $55,000

It is not anticipated that the recommended improvements would require acquisition of right-of-way (ROW). However, further studies are required in order to provide more detailed engineering-level cost estimates.

8.3 Prioritization

The five improvement measures were prioritized/ranked based on their ability to meet the following set of goals, in order of highest "weight" to lowest:

- Provide safety benefits
- Address the desires of the community
- Minimize construction costs
- Improve vehicular circulation

The purpose of the scoring process is to provide the City with a high-level ranking of the improvements, in order to move forward with implementation when funding is available. Each of the goals were "weighted" on a scale of 1 to 5, and then each improvement was given a score within each goal on a scale of 1 to 10, based on their ability to achieve that goal. **Table 6** shows the scoring of the five measures.

Table 6: Prioritization of Improvements

Goal	Weight	Bedford/ Huntington marked crosswalk		San Marino/ Huntington curb extension & re-stripe		Los Robles/ Mission curb extensions		Sierra Madre/ Robles marked crosswalk (Option 1)		Sierra Madre/ Robles marked crosswalk (Option 2)	
		Score	Rating	Score	Rating	Score	Rating	Score	Rating	Score	Rating
Safety Benefits	*5*	5	**25**	7	**35**	7	**35**	5	**25**	**7**	**35**
Public Support	*5*	6	**30**	8	**40**	6	**30**	6	**30**	**6**	**30**
Construction Cost	*4*	5	**20**	4	**16**	3	**12**	7	**28**	**1**	**4**
Vehicle Circulation	*3*	2	**6**	2	**6**	2	**6**	2	**6**	**7**	**21**
Total Value		**81**		**97**		**83**		**89**		**90**	

Notes:
Weight ranges from 1 (least important) to 5 (most important)
Scores for each goal range from 1 (lowest in meeting goal) to 10 (highest in meeting goal)
Rating = Score x Weight

As shown, the San Marino Avenue/Huntington Drive improvement measures score highest in terms of meeting the goals, followed by the Sierra Madre Boulevard/Robles Avenue option 2 (traffic signal) improvement measure.

8.4 Quick-fix Considerations

In addition to the specific improvements described, the City should consider implementing "quick-fix" improvements to address safety citywide. These improvements should be considered:

- Include all-red phase at all signalized intersections. This consideration allows for improved vehicle clearance times at the end of a signal phase before the next phase starts.
- Install new Caltrans standard reflective back plates to all signal heads. These yellow reflective strips help to increase the visibility of a traffic signal head during morning or night, and particularly during a loss of power.
- Adopt a retroreflective program for all regulatory signs, consistent with the Manual of Uniform Traffic Control Devices (MUTCD), to ensure that all signs meet minimum standards, with a priority on areas where collisions have occurred at night or early morning.
- Adopt a program that annually addresses the education component of traffic safety
- Update school safety Changeable Message Signs (CMS's) that are currently in place
- Adopt a program for regular Tree Maintenance, addressing clearances for traffic signage of trees within the public right-of-way
- Adopt City-specific Stop Sign Warrant criteria consistent with the MUTCD. This criteria would consider the type of intersecting roadways, volume of traffic, and current delays experienced by vehicles along the stop-controlled approaches.

9.0 TRAFFIC CALMING TOOLBOX

Traffic calming toolboxes are developed by communities that want to develop a process for identifying, addressing and monitoring excessive traffic speed or volume on streets not intended for non-local traffic. Generally, traffic calming is accomplished by encouraging slower speeds or diversion to higher-capacity streets. This can be done through programs of education, citizen action and police intervention or infrastructure measures, collectively known as the "Three E's":

- **Education** – The process by which residents are informed of the appropriate tools to become active participants in addressing traffic issues affecting their neighborhood.
- **Enforcement** – The action by local police to provide enforcement that supports the traffic calming recommendations developed by the community.
- **Engineering** – The use of engineering methods/best practices to develop traffic calming strategies that address the issues brought forth by the community.

This section provides a discussion of the purpose of the program, basic terms/background, specific measures for use in San Marino, a proposed process by which citizens could request a measure for implementation, and a process for how City staff can evaluate a request.

9.1 Traffic Calming Basics

This section defines traffic calming and offers some considerations when weighing options.

9.1.1 Definition/Purpose

The Institute of Transportation Engineers (ITE) definition of traffic calming is: 'Traffic calming is the combination of mainly physical measures that reduce the negative effects of motor vehicle use, alter driver behavior, and improve conditions for non-motorized street users." The purpose of traffic calming is to improve safety, especially for pedestrians and bicyclists, and to improve the environment or 'livability" of streets for residents and visitors.

Non-infrastructure treatments include education and enforcement actions—generally through the police department. Infrastructure interventions include street design treatments that notify drivers to reduce speed or deflect vehicle flow either vertically or horizontally to induce a reduction in speed. Some treatments are intended to improve driver behavior on the street or to discourage "cut-through" drivers by increasing drive time along the street. By design, traffic calming treatments are self-enforcing traffic management approaches that force motorists to alter their speed or direction of travel.

There is no standard formula for applying traffic calming. Measures employed in a given neighborhood depend entirely on staff expertise, the available budget, local conditions, and the mobility trade-offs residents decide to make. But when applied correctly, traffic calming measures can have dramatic results.

9.1.2 Systemic Considerations

Too much traffic within a neighborhood typically is a problem of regional transportation connections and lack of alternative routes and modes of travel which causes a residential street to act as a neighborhood collector or a collector street to be used as a regional arterial. Cut-through traffic can grow over time and need not be fundamentally a problem of the roadway network design, but generally is a result of congested through streets. While solutions addressing regional street congestion through signal coordination or major roadway improvement projects are options, they do not directly address localized traffic conditions.

Traffic calming treatments generally involve making the neighborhood streets less attractive to through traffic. The downside is that they also disproportionately affect the most common users of the roadway—its residents. The cut-through traffic problem needs to be weighed against the impacts on the neighbors. Furthermore, diverting cut-through traffic from one neighborhood street to another only transplants the issues. Speed lowering techniques tend to only work near the calming element, so they need to be repeated at regular intervals to calm traffic throughout the neighborhood.

Specific to the City of San Marino, wide streets can also lead to higher vehicle speeds, which lead to more cut-through, as a result of drivers feeling more comfortable, as compared to narrower roads. Examples of this include streets such as Virginia Road, Monterey Road, and Shenandoah Road, where curb-to-curb widths are approximately 50 feet. In comparison, typical two-lane local roadways with residential frontage

consist of curb-to-curb widths of approximately 40 feet.

The most effective traffic calming measures are implemented to enhance safety rather than simply divert traffic. Safety enhancements often have the additional benefit of raising driver awareness and slowing traffic. Effective traffic calming should be designed with a systematic approach with appropriate and frequent enough spacing of measures and consideration for secondary effects of the installations. A specific measure that the City implemented over the past few years was the addition of "Caution" signs along certain neighborhood streets, shown in the attached photo. The City could consider replacing these existing signs with a new standard signage (adopted by City Council), specific to neighborhood streets.

9.2 Process for Implementation

Traffic calming on San Marino streets is intended to engineer physical design elements to support enforcement and education efforts in reducing roadway speeds. A clear and consistent process for implementing traffic calming measures involves seven general steps, described as follows and depicted in the flow chart shown on **Figure 11**.

Step 1: A Request to Review/Identification of a Location for Traffic Calming is Submitted to Public Works
A citizen-elected official or staff member submits a request to review a location for potential traffic calming to Public Works Staff.

Step 2: Staff Evaluation
The Public Works Director/City Engineer and City Traffic Engineer reviews the request, and available volume, speed, and collision data for the roadway in question to determine the nature of the issue. Based on the results of the evaluation, the City Staff can make three decisions:

- No issue exists –no further action
- The issue poses an immediate safety risk – immediate implementation of safety countermeasure
- The issue is appropriate for traffic calming – move to full evaluation

Step 3: Evaluation and Data Collection
If the issue is appropriate for traffic calming, City staff may collect additional data to understand the details of the issue and to determine the nature of the problem. This data may include: traffic volume counts, speed survey data, accident history. An example of how staff could initially evaluate a traffic calming request is shown in **Table 7**, where a score is calculated for an individual request based on point values

related to key criteria. Four data-driven criteria are used along with one qualitative criteria that applies engineering judgement (Public Works staff discretion).

Table 7: Traffic Calming Request Scoring Evaluation

Criteria	Measurement / Source	Max Score	Scoring Method
Speed of traffic	85th Percentile Speed	2	85th speed 5 mph+ above speed limit = 2 points
			85th speed 1-5 mph above speed limit = 1 point
			85th speed at or below speed limit = 0 points
Volume of traffic	Average Daily Traffic	2	ADT above 5,000 = 2 points
			ADT between 2,000-5,000 = 1 point
			ADT under 2,000 = 0 points
Accident history	Police Department data	2	3 or more collisions per year over 3 years = 2 points
			2 or less total collisions over 3 years = 1 point
Traffic Violation history	Police Department data	2	Any traffic violations over 3 years = 2 points
			No traffic violations over 3 years = 0 points
Public Works discretion	-	4	Scored based on City staff discretion to allow for consideration of other issues that are not directly addressed by the previous data-driven criteria.
Total		12	

This scoring method can be used for two purposes:

1. To determine whether a traffic calming request meets the minimum threshold for evaluation. For the purposes of this study, a minimum score of 4 points would qualify a request for further evaluation.
2. As a prioritization tool to determine where to focus first, if multiple traffic calming requests are submitted within a given timeframe.

Step 4: Develop Goals and Objectives
City staff will arrange a meeting with interested stakeholders to:

- Inform the neighborhood residents and businesses to ensure that all stakeholders have their interests represented. The police department, Public Safety Commission and City Council will be informed of the meeting.
- Share the results of the data collection
- Familiarize the stakeholders with the City's traffic calming toolbox and review potential solutions
- To generate specific goals (overall vision for implementation) and objectives (measurable performance), and rank each in the order of importance

Step 5: Action Plan
City staff shall select traffic calming measures from the traffic calming toolbox to target the traffic issue and account for the neighborhood input, land use context, traffic volumes, geometrics, and adjacent land uses of the traffic issue. Options include the previously mentioned 3 E's: education, enforcement, and/or engineering measures.

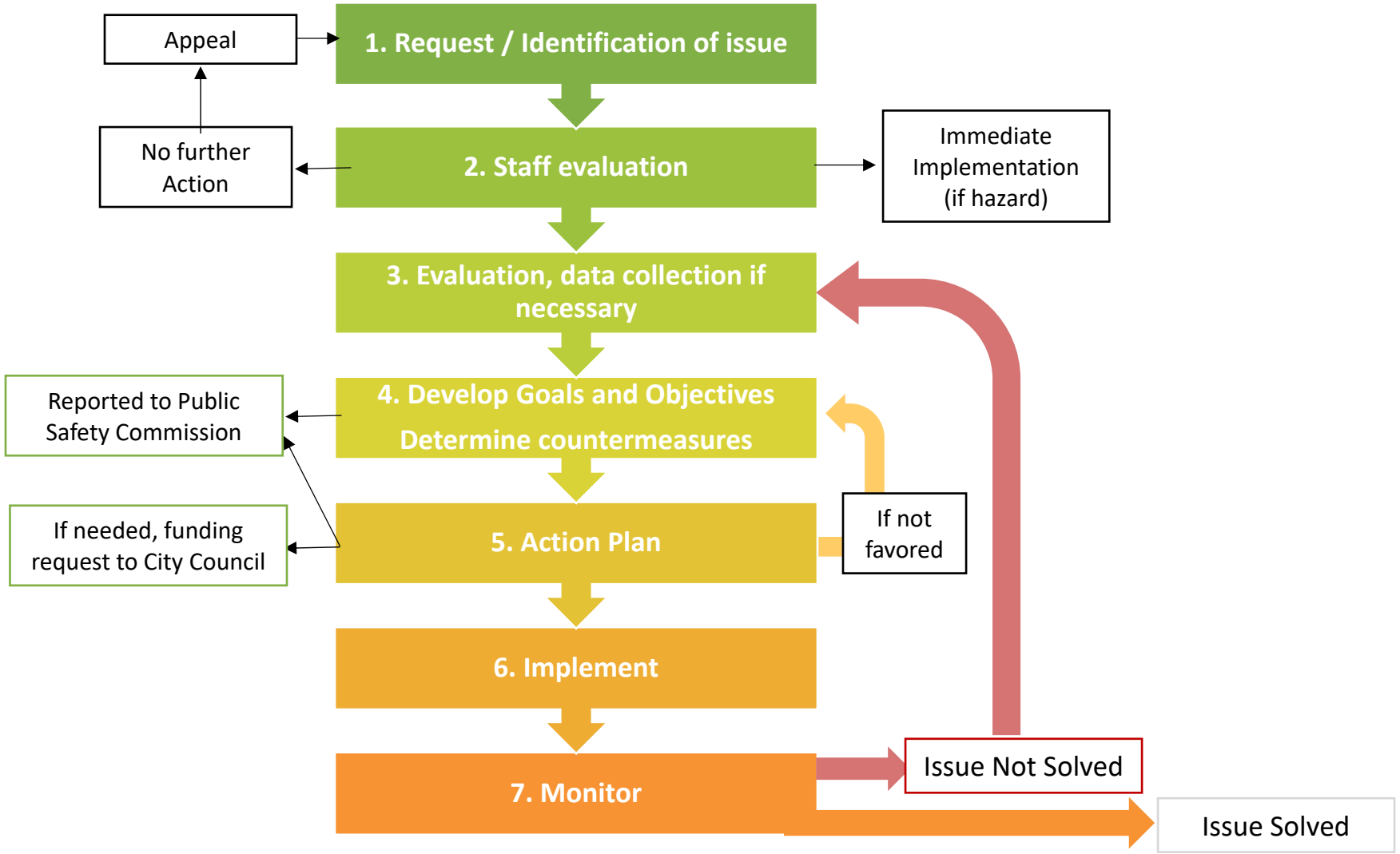
City staff will notify the Public Safety Commission, and forward to City Council if additional funding appropriation is necessary, and present the action plan at a public meeting. If the majority of responses from affected neighbors are in favor of the plan, the plan will move to implementation. If the plan is not favored, the City Staff will revisit the goals and objectives and countermeasure development.

If the selected countermeasure is beyond the ability of the Public Works Department to fund under its annual budget, it will be placed in the annual Department budget request for the next fiscal year, and City staff will explore the application for competitive State or County grant programs.

Step 6: Implementation
The project is implemented either as a short-term or permanent measure. Short-term measures will be used if the efficacy of the traffic calming measure must be demonstrated or if limited funding requires interim improvements in advance of future funding to address immediate traffic calming needs.

Step 7: Monitoring
The project is monitored using the objectives developed in Step 4 to evaluate effectiveness. If the implemented countermeasure project does not alleviate the identified issue or does not meet the project goals and objectives, the location will be reevaluated (Step 3) for additional safety countermeasures.

Figure 11 – Process for Implementation of Traffic Calming Measures



9.3 Toolbox Measures

The Toolbox Measures describe traffic calming treatments as a resource guide. There is no single tool to solve traffic issues and a treatment effective in one area may not be effective in another location under different conditions. This toolbox provides a listing of potential treatments to be considered when an issue is identified, which can be further refined under an engineering review. Traffic calming measures are organized as:

- **Signage** notifies drivers of changed conditions or are reminders to reduce speed or increase attentiveness;
- **Road Narrowing Measures** elicit a psychological sense of enclosure to discourage speed;
- **Vertical Measures** use forces of acceleration to discourage speeding; and
- **Horizontal cross-section Measures** force drivers to reduce speeds by impeding straight through movements.

For each measure, a high-level implementation cost range is provided as such:

- One dollar sign ***$*** = Under $1,000
- Two dollar signs ***$$*** = $1,000 to $5,000
- Three dollar signs ***$$$*** = Over $5,000

9.3.1 Signage

Signage notifies drivers of changed conditions or are reminders to reduce speed or increase attentiveness. Some examples of these measures are as follows:

Warning Signs *$* 	Traffic signs can be used to alert or inform motorists of a condition or a potential situation. Signs need to be selected and placed in accordance with the Manual of Uniform Traffic Control Devices (MUTCD). Pedestrian/ bicycles/school crossing signs and in-street pedestrian crossing signs have been used by municipalities to warn motorists of high pedestrian activity, and help to reduce speeds. Signs are also used in conjunction with other measures such as pavement markings. Pros: Low cost and increases awareness Cons: Can be considered to clutter the roadway especially on residential streets. Overall effectiveness can vary.

Turn Restrictions *$* 	Turn restrictions are a form of diverter where turns are necessary for the cut-through route. Signs and pavement markings are typically ineffective without constant enforcement unless there is some kind of physical change to the intersection making the turn difficult. A typical radius for a local street may be 20 feet, but if the turn is prohibited the radius can be reduced to practically zero. Pro: Low cost, reduces cut-through traffic Cons: Inconveniences residents on streets, can create more difficult traffic patterns, can be hard to enforce, may cause cut through traffic in other parts of neighborhood.

Speed Limit Signs and Striping *$* 	Speed limit signs improve awareness of the appropriate maximum speed on a roadway. Speed legends are pavement markings used to inform drivers of the current speed limit. Pros: With proper warning, vehicles are less likely to exceed maximum speeds. Cons: The pavement striping requires ongoing maintenance.

Speed Feedback Signs *$* 	A Speed Feedback Sign combines the regulatory speed limit sign with a radar speed feedback sign that displays the real-time speed of an approaching vehicle which tends to make motorists reduce their speed. Pros: Radar signs have proven to slow down traffic, even years after their initial installation. They are particularly effective on high volume arterials and highways, where physical measures would restrict traffic flow. Cons: Installing these signs may be impacted by the availability of a power source. They do not slow traffic as much as physical measures. Motorists' compliance is voluntary. Signs require long sight lines to be effective.

High-Visibility Crosswalks *$$* 	Ladder markings and defined crosswalk widths heighten awareness of pedestrian crossings. Pros: Communicates to the pedestrian where the preferred crossing is. Makes drivers aware of pedestrian presence. Cons: Does not accomplish traffic calming. May give pedestrians false sense of safety. ADA ramps must be present before a marked crosswalk can be installed which can significantly increase costs.

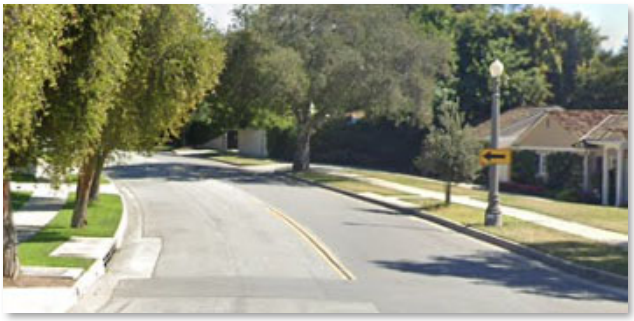
Gateway Signage Treatments *$$* 	A signing and/or landscaping treatment to alert motorists they are entering a special area can be used at entrances to neighborhoods, commercial areas, town centers, or busy places of activity. Gateways are typically supplemented with other traffic calming measures. Pros: Can be visually/aesthetically pleasing and heighten awareness. Cons: Generally expensive and can require routine maintenance. Can be potentially distracting to drivers and create potential traffic problems.

Flashing Beacons *$$* 	Flashing beacons can be installed to warn drivers of pedestrians at an uncontrolled crossing. A push-button would be included in order to activate the flashing. Pros: Driver awareness of pedestrians crossing is increased, resulting in reduced vehicle speeds. Cons: Additional pedestrian crossings could result in increased vehicle delay and travel time.

Pavement Markings/Stencils *$* 	Pavement markings are another means to alert or inform a motorist of a condition or a potential situation. Painted lines and symbols need to be selected and placed according to MUTCD. Crosswalks can be used to alert motorists of pedestrian activity. Pavement markings are used in conjunction with signage which increases the cost. Pros: Low cost and easy to install. Can increase awareness. Cons: Low initial cost but requires regular maintenance and may not be considered aesthetically pleasing. They can be ignored by motorists.

9.3.2 Narrowing

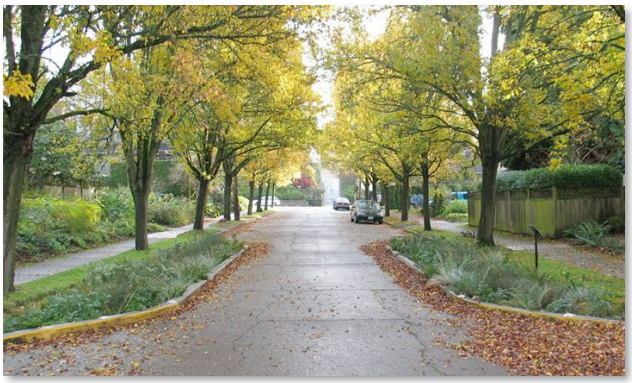
Road Narrowing elicits a psychological sense of enclosure to discourage speed. As mentioned, some residential streets in San Marino are wider than typical residential streets, thus these types of treatments may be applicable. Some examples of these measures are as follows:

Striping Centerlines or Lanes ***$$$*** 	Many local residential streets do not have striped centerlines or delineation of lanes. This lack of striping has the optical effect of widening the roadway for drivers and facilitate faster speeds. The delineation of these roadway elements help to direct drivers to the true operations width available.

Lane Narrowing ***$$$*** 	Narrow lanes reduce speeds and minimize crashes on city streets by way of reducing the right-of-way and making drivers wary of traffic and adjacent users. The additional space can be used for pedestrian space, cycle facilities, or green infrastructure. Narrowing traffic lanes differs from other road treatments by making slower speeds seem more natural to drivers and less of an artificial imposition, as opposed to other physical treatments that compel lower speeds or restrict route choice. Pros: Excess right-of-way can be shifted to providing wider sidewalks, bicycle lanes, or on-street parking. Narrowing also facilitates additional calming methods such as neck downs and mid-block bulb outs. Cons: Narrowing without providing a shoulder space can create conflicts for vehicles, bicycles or parked vehicles.

Road Diet *$$$* 	Reduces the number of travel lanes to accommodate other modes and slow vehicle speeds. This treatment is typically applied at locations with four-lanes of travel which have relatively low daily traffic. Pros: Repurposing travel lanes allows for Improved pedestrian and bicycle safety (via separated/striped bicycle lanes). Cons: Reducing travel lanes results in increased vehicle delay and travel time.

On-street Parking *$$* 	On-street Parking, both parallel and angled, helps to narrow roadways and calm traffic. The proximity of parked vehicles and necessity to watch for exiting vehicles and opening doors slows traffic. Solid striping of the outside lane helps to provide the continuous road narrowing. Pros: On-street parking creates a buffer between pedestrians and motorists, improving the walking environment. On-street parking in front of businesses help support access. Cons: On-street parking impedes traffic flow. Parallel and angled parking creates more right-of-way impacts. Drivers have reduced visibility backing out of parking spots, posing a greater risk to bicyclists.

Curb Extension – Pinch Point or Choker *$$$* 	Pinchpoints or chokers are mid-block curb extensions that restrict motorists from operating at high speeds on local streets and significantly expand the sidewalk realm for pedestrians. Chokers can have the same narrowing effect as parked vehicles on streets where there is little or no on-street parking. Chokers can facilitate mid-block pedestrian crossings of low-volume streets. Pros: Can potentially slow traffic, reduce turning speeds, and can enhance pedestrian safety by reducing crossing distance. Cons: Relatively high initial costs, loss of on-street parking, increased maintenance costs, complicates street sweeping operations, requires new and additional catch basins to mitigate drainage.

Curb Extension – Bulb-out/Gateway *$$$* 	Bulb-outs or gateways can be applied to the mouth of an intersection. When installed at the entrance to a residential or low speed street, a curb extension is referred to as a "gateway" treatment and is intended to mark the transition to a slower speed street. Curb extensions increase the overall visibility of pedestrians by aligning them with the parking lane and reducing the crossing distance for pedestrians. Pros: Can potentially slow traffic, reduce turning speeds, and can enhance pedestrian safety by reducing crossing distance. Cons: Relatively high initial costs, loss of on-street parking, increased maintenance costs, complicates street sweeping operations, requires new and additional catch basins to mitigate drainage.

9.3.3 Vertical Deflection

Vertical deflection creates a change in the height of the roadway which forces a motorist to slow down to maintain an acceptable level of comfort. Some examples of these measures are as follows:

Pavement Materials *$$$* 	Pavement appearance can be altered by unique treatments that add visual interest, such as colored or pattern-stamped asphalt, concrete, or concrete pavers. It makes other traffic calming techniques more noticeable to drivers. Pedestrian crossings and intersections can be painted to highlight crossing areas. Pros: Colored pavements attract the driver's attention visually and physically. They are permanent and effective and can add to the aesthetic identity of a neighborhood. Cons: Colored or stamped concrete is an expensive option and can create some long-term problems as the pavement and concrete settle differently and become a maintenance issue.

Speed Bump / Hump *$$$* 	Speed humps are areas of pavement raised three inches in height over a minimum of 12 feet in length. Speed humps have pavement markings, advisory signs and advanced warning signs. They can be used on residential 2-lane local or minor neighborhood collector roadways, with a maximum posted speed limit of 30 mph. It may also be used to deter cut-through traffic. Pros: Reduces vehicle speed, can reduce traffic volumes, does not require parking removal. Cons: May re-direct traffic to other streets, requires additional signage and striping, increases noise, may delay emergency vehicles, may cause street sweeping issues.

Speed Cushions *$$* 	Speed cushions are similar to speed humps, but have wheel cut-out openings to allow large vehicles like buses to pass unaffected while reducing car speeds. Pros: Reduces vehicle speeds, can reduce traffic volumes, preferred by larger vehicles, easy to install, may be removed and reinstalled, emergency vehicles can go by without delay. Cons: May re-direct traffic to other streets, requires additional signage and striping, increases noise, may result in street sweeping issues.

Speed Tables *$$$* 	Speed tables are similar to speed humps, but have a flat top, typically 15 to 20 feet long. When speed tables are combined with pedestrian crossings, at the intersection or mid-block, they are called raised crossings. Pros: Reduces speed, can reduce traffic volumes, preferred by larger vehicles. Cons: May re-direct traffic to other streets, requires additional signage and striping, increases noise, may lose street parking, may cause street sweeping and drainage issues.

Raised Median *$$$* 	Medians are raised islands in the center of the roadway that separate traffic directions. Medians are used on wide streets to narrow the travel lanes and ease pedestrian crossings. Pros: Landscaped or concrete islands and medians can potentially reduce speeds by narrowing drivable travel lane widths. They can improve pedestrian accommodation by providing a mid-block pedestrian refuge at crossings. They complement improved crosswalks and reduce pedestrian crossing width. They can be used to provide a visual enhancement or gateway to promote neighborhood identity. Cons: May reduce parking and driveway access, and also narrower road may increase motor vehicle/bicycle conflicts, impedes left turns.

Raised Intersection / Crosswalk Refuge *$$$* 	Raised intersections create a safe, slow-speed crossing and public space at minor intersections. Similar to speed humps and other vertical speed control elements, they reinforce slow speeds and encourage motorists to yield to pedestrians at the crosswalk. Pros: Can dramatically improve pedestrian safety. Cues drivers to expect crossing pedestrians. Cons: Without horizontal/vertical deflection or signage, may have limited effectiveness.

9.3.4 Horizontal Cross-section

Horizontal cross-section measures can have the effect of forcing drivers to reduce speeds by impeding straight through movements. Some examples of these measures are as follows:

Diverter *$$$* 	Diverters are raised areas placed across a four-way intersection that prohibit through movements and force turns for approaches. Diverters can be considered on local streets where cut-through traffic is a major problem. It breaks up the street grid while maintaining permeability for pedestrians and bicyclists. Pros: Diverters limit access and reduce through traffic without preventing pedestrian access. They can also be designed to favor bicycle travel, creating bicycle boulevards through neighborhoods. Cons: Diverters may create frustration for motorists confused by the irregular traffic pattern. They may impede transit and emergency vehicle operations. The shift in traffic patterns can have unintended consequences, sending more traffic to other nearby residential streets. Some diverters may affect existing in-street utilities, which may increase costs.
Chicane *$$$* 	Chicanes create a curved street alignment that can be designed into new developments or retrofitted in existing right-of-way. The curvilinear alignment requires additional maneuvering and shortens drivers' sightlines, resulting in lower overall speeds. Pros: Reduced speeds increase safety, result in lower severity collisions. Cons: May reduce on-street parking. Maintenance would be required if landscaping is added, thus increasing ongoing costs.

Traffic Circles *$$$* 	Traffic circles are used to slow driving speeds approaching intersections. Motorists must reduce speed to maneuver around the circle which can help reduce the frequency and severity of crashes as well as discourage neighborhood cut through traffic. Pros: Permanent installation forces reduced speeds at subject intersection. Can provide gateway or identity to a neighborhood. Cons: A single traffic circle used in isolation will not significantly calm traffic and can in fact create another traffic problem on adjacent intersections. A coordinated system of multiple traffic circles or other calming measures is required. Motorists may ignore painted traffic circles, and drive over them. Raised traffic circles need to be designed for emergency vehicle access.
Curb Radius Reduction *$$$* 	Corner radii of intersection curbs are reduced, forcing turning vehicles to slow down. Efforts to accommodate trucks and other large vehicles have historically led to increased corner radii at intersections. Pro: Can result in increased safety for pedestrians by reducing crossing distances and slowing the speed of turning vehicles. Con: May result in wide swings in turning movements of large vehicles.

10.0 CONCLUSIONS

This report provides a summary of existing and near-term future transportation conditions within the City, a discussion of previous planning efforts, recommendations for circulation/safety improvements, and a toolbox for traffic calming measures. The circulation network for analysis includes a combination of signalized and stop-controlled intersections.

New traffic counts were collected at 30 intersections during a typical weekday in November 2019, prior to the Covid-19 pandemic. Huntington Drive is the City's major thoroughfare, and peak hour traffic volumes along Huntington Drive are directional. During the a.m. peak hour, the westbound direction carries the higher volume, approximately 1,800 to 1,900 vehicles (compared to 1,200 to 1,400 vehicles in the eastbound direction). During the p.m. peak hour, the flow is reversed, as the eastbound direction carries the higher volume, approximately 1,800 to 1,900 vehicles (compared to 1,400 to 1,500 vehicles in the westbound direction).

The following improvements are recommended for consideration:

- At the Bedford Road/Huntington Drive intersection, consider the installation of an unsignalized marked crosswalk across Huntington Drive, along the east leg of the intersection.
- At the San Marino Avenue/Huntington Drive intersection, consider the construction of curb extensions to reduce pedestrian crossing distances across Huntington Drive, as well as a re-stripe of southbound approach lanes.
- At the Los Robles Avenue/Mission Street intersection, consider the construction of curb extensions at the northwest corner, and potentially northeast and southeast corners, of the intersection to reduce pedestrian crossing distances across both Los Robles Avenue and Mission Street.
- At the Sierra Madre Boulevard/Robles Avenue intersection, two potential options are recommended, 1) consider the installation of an unsignalized marked crosswalk across Sierra Madre Boulevard, along the north side of the intersection, 2) consider the installation of a traffic signal.

In addition to the specific improvements described, potential "quick-fix" improvements to address safety citywide are recommended, which include all-red phasing at all signalized intersections, installing Caltrans standard reflective back plates to all signal heads, and adopting a Stop Sign Warrant, among other measures.

Lastly, a Traffic Calming Toolbox is presented, which included a discussion of the purpose of the program, basic terms/background, specific measures for use in San Marino, a proposed process by which citizens could request a measure for implementation, and a process for how City staff can evaluate a request.