CITY OF MANHATTAN BEACH

DEPARTMENT OF COMMUNITY DEVELOPMENT

TO: Parking and Public Improvements Commission

FROM: Erik Zandvliet, Traffic Engineer

DATE: March 26, 2015

SUBJECT: **Highland Avenue at 38th Street**
Pedestrian Crossing Treatment Evaluation

BACKGROUND:

The City's Draft Mobility Plan encourages a balanced, multi-modal transportation system serving all users, including motorists, pedestrians, bicyclists, persons with disabilities and transit users. The Mobility Plan is an update to the City's General Plan Circulation Element. The Plan includes a Draft Pedestrian Crossing Enhancements Policy which identifies a consistent method to apply potential signing, striping, geometric, signal or other crossing treatments to intersections throughout the City.

During the 2013-14 Capital Improvement Project Budget hearings, the City Council directed the Traffic Engineer to conduct a study to determine the feasibility of a traffic signal or other crossing treatments at the intersection of Highland Avenue and 38th Street. This memo presents the findings and recommendations of the City Traffic Engineer's evaluation of potential crossing treatments. The Traffic Engineer has prepared a number of concept sketches for consideration (Exhibits A to G).

In 2003, the Traffic Engineer conducted a study to evaluate pedestrian crossing alternatives at this intersection. The Parking and Public Improvements Commission supported the Traffic Engineer's recommendation to make no changes to the intersection at that time.

Existing crosswalks on the north and south approaches of Highland Avenue at 38th Street were removed in 1995 to discourage pedestrians from crossing at that location after a series of four vehicle-pedestrian collisions in 3 years, including one fatal collision. In 1998, the City Council approved the posting of "Use Crosswalk" signs with arrows pointing towards the traffic signal to the south. Pedestrian crossings are legal at this intersection, based on the California Vehicle Code Section 275 that defines a crosswalk as:

1. That portion of a roadway included within the prolongation or connection of the boundary lines of sidewalks at (an) intersection where the intersecting roadways meet at approximately right angles, except the prolongation of such lines from an alley across a street.
2. Any portion of a roadway distinctly indicated for pedestrian crossing by lines or other markings on the surface.

   Notwithstanding the foregoing provisions of this section, there shall not be a crosswalk where local authorities have placed signs indicating no crossing.

DISCUSSION:

The intersection of Highland Avenue and 38th Street is located in the North Manhattan Beach Business District, approximately 200 feet north of the traffic signal at Highland Avenue and Rosecrans Avenue. Highland Avenue is a three-to-four-lane 50-feet wide collector street that carries approximately 22,700 vehicles per day and has a speed limit of 30 mph. 38th Street is 24-feet wide local residential street that carries approximately 4,300 vehicles per day and has a speed limit of 25 mph. 38th Street is stopped at Highland Avenue in the eastbound and westbound directions. 38th Street ends at Crest Drive to the east and Ocean Drive to the west.

Highland Avenue is improved with curbs, gutters and sidewalks on both sides. 38th Street is improved with curbs, gutters and narrow sidewalks on both sides. Curb parking is allowed on the west side of Highland Avenue south of 38th Street and on both sides north of 38th Street. Parking is prohibited on the east side between 6:30am and 9am weekdays to provide a second northbound lane. Curb parking demand is generally heavy throughout the day and during evening business hours. There is a public parking structure on the northeast corner of Rosecrans Avenue and Highland Avenue. Access to the parking structure is via Highland Avenue (lower level), and 38th Street (upper level). There are several pedestrian access points to the parking structure, including the northeast corner of Rosecrans Avenue and Highland Drive, and stairs on the Rosecrans Avenue frontage, as well as via the driveways.

Highland Avenue is relatively flat and straight in this street segment, and the sidewalks are generally ADA compliant along Highland Avenue. However, 38th Street is not ADA compliant due to the significant vertical slope. The lower level of the parking structure is ADA compliant, but not the upper level.

TRAFFIC DATA:

24-hour traffic volumes were conducted on Highland Avenue at 38th Street on typical weekdays in 2009. A summary of the peak hour and daily traffic volume is provided below:

Traffic Volume Counts
Highland Avenue at 38th Street

DIRECTION	A.M. PEAK HOUR 8:00 am	P.M. PEAK HOUR 5:00 pm	TOTAL DAILY VOLUME (Veh/Day)
Northbound (Highland Avenue)	1,397	689	11,725
Southbound (Highland Avenue)	447	1,349	11,054
Subtotal	**1,844**	**2,038**	**22,779**

DIRECTION (Observed Volumes Provided for these Approaches)	A.M. PEAK HOUR 8:00 am	P.M. PEAK HOUR 5:00 pm	TOTAL DAILY VOLUME (Veh/Day)
Eastbound (38th Street) (Observed)	40	50	400
Westbound (38th Street)	30	60	500
Subtotal	**70**	**110**	**900**

Pedestrian counts were conducted on a typical weekday during the mid-day lunch peak period. The peak pedestrian volume is approximately 24 pedestrian crossings per hour, including mid-block crossings between Rosecrans Avenue and 38th Street.

The traffic collision history between January 1, 2006 and December 31, 2013 was analyzed for this segment of Highland Avenue between Rosecrans Avenue and 38th Street. (Exhibit I) According to City records, there have been no pedestrian collisions reported during this five (5) year period. During this same time period, there were six reported collisions of various kinds between vehicles. No collision patterns were identified.

FIELD OBSERVATIONS:

Highland Drive carries a high percentage of commuter through traffic in the AM and PM peak hours. Traffic volume on Highland Avenue is highly directional, with heavy northbound AM and southbound PM volumes. A large percentage of traffic makes turns at Rosecrans Avenue. Highland Avenue is relatively straight in this segment with somewhat restricted sight distance for drivers stopped on the eastbound approaches due to the downslope of the cross-streets. Pedestrian volumes crossing Highland Avenue at 38th Street are higher than other cross streets to the north and are primarily generated by adjacent commercial businesses. Driver sight distance of pedestrian at the intersection is adequate for southbound drivers, but is somewhat unexpected for northbound drivers due to the proximity to the signalized intersection at Rosecrans Avenue, especially for drivers making the westbound Rosecrans Avenue to northbound Highland Avenue right turn.

Cross-street traffic volume on 38th Street is low, but somewhat higher than similar parallel streets that intersect with Highland Avenue due to adjacent commercial businesses and access to the upper level of the public parking structure. 38th Street provides access to Verandas Restaurant, the parking structure, an office building at 3770 Highland Avenue and residences along Crest Drive north of 38th Street.

While Highland Avenue has numerous uncontrolled crosswalks, there is only one uncontrolled crosswalk at 41st Street in which pedestrians must cross four traffic lanes. All other four-lane crosswalks on Highland Avenue are signalized: 45th Street, 40th Street and Rosecrans Avenue.

During field observations, pedestrians were seen crossing both at 38th Street and mid-block in approximately equal numbers. (Exhibit J) Midblock crossings were primarily oriented between the public parking lot on the east side and the businesses on the west side of Highland Avenue. All pedestrians crossed after checking for a gap in traffic in both directions, but many ran or stopped in the middle of the street to avoid cars. Midblock crossings were not as prevalent north of 38th Street, probably due to fewer retail businesses. Pedestrian crossing volumes are higher at mid-day and in the early evening hours. As noted above, these crossings at and between intersections that are not controlled by traffic signals are legal. One concern is that pedestrians would continue to cross mid-block even with a marked crossing, unless physically prevented from doing so.

PEDESTRIAN CROSSING ENHANCEMENT POLICY:

Pursuant to the Draft Pedestrian Crossing Enhancements Policy in the Draft Mobility Plan, there are many potential crossing treatments that could be considered, known as the Pedestrian Crossing Toolbox. (Exhibit H) The Toolbox is based on the most current state of the practice. It includes

measures that enhance driver visibility of the crossing, physical enhancements, and traffic controls. The recommended treatment(s) are selected through an evaluation of physical attributes, traffic data and collective research on appropriate crossing measures.

For an uncontrolled intersection crossing, the possible treatments are:

- High-Visibility Marked Crosswalk
- Advance Yield Limit Line
- Advance Pedestrian Warning Signs
- Curb Extensions
- Pedestrian Refuge Island
- Raised Crosswalk

Signalized enhancements include:

- Overhead Flashing Beacon
- Rectangular Rapid Flashing Beacon (RRFB)
- Pedestrian Activated Traffic Signal

PEDESTRIAN CROSSING OPTIONS:

For the purposes of applying the suggested Pedestrian Crossing Toolbox guidelines, the location is considered an uncontrolled crossing with four lanes, an average daily traffic in excess of 22,000 vehicles per day and a speed limit of 30 miles per hour. An evaluation for each possible crossing treatment made by the Traffic Engineer is summarized below:

High-Visibility Marked Crosswalk – Exhibit A

A high-visibility marked crosswalk could be painted on the north and/or south leg of Highland Avenue and supplemented with pedestrian warning signs. However, this crossing location would be unexpected to many drivers due to its proximity to Rosecrans Avenue and turning movements. These multiple driving tasks increase reaction times, and drivers may not perceive a pedestrian in an uncontrolled crosswalk until too late. Further, pedestrians would be required to cross four lanes of traffic in one movement, which results in greater exposure to traffic and fewer gaps in traffic flow. Most importantly, it was shown that a high pedestrian collision rate occurred when painted crosswalks existed prior to 1995. Also, crosswalk markings at 38th Street would not be expected to significantly reduce the number of mid-block crossings. Based on the above evaluation, crosswalk markings alone or with standard crosswalk signs are not advised.

Advance Yield Limit Line – Exhibit A

This measure could be used to supplement a marked crosswalk, and would enhance driver awareness of the crossing. It also reduces the occurrence of second lane pedestrian collisions, in which a car stopped in one lane blocks the view of the crossing pedestrian from the second lane. This measure is recommended if marked crosswalks are painted.

Advance Pedestrian Warning Signs – Exhibit A

This measure could be used in addition to a marked crosswalk, and would enhance the driver awareness of the crossing. This measure is recommended if marked crosswalks are painted.

Curb Extensions – Exhibit B

This measure could be used in conjunction with a marked crosswalk, and would enhance the driver awareness of the crossing and the pedestrian's view of approaching vehicles. It reduces the crossing distance which then reduces the pedestrian's exposure to cross-traffic. It also has a traffic calming effect. One disadvantage is that curb extensions at this location would eliminate one or more curb parking spaces. Also, they would not be expected to significantly reduce the number of mid-block crossings.

Pedestrian Refuge Island – Exhibit C

This measure could be used in conjunction with a marked crosswalk, and would enhance the driver awareness of the crossing and the pedestrian's view of approaching vehicles. It reduces the crossing distance by giving the pedestrian a waiting area between opposing lanes in which to cross shorter distances in separate movements. It also has a traffic calming effect, reducing prevailing speeds through the crossing. A refuge island should be part of a landscaped center median between Rosecrans Avenue and 38th Street to eliminate midblock crossings and redirect pedestrians to the crossings at either end. It would not require removal of any parking.

One disadvantage is that pedestrian refuge island would require the elimination of the part-time second northbound lane in the morning peak, which then merges north of 38th Street at other times when curb parking is allowed. However, a single northbound lane has sufficient capacity to handle peak traffic in this segment and would reduce the potential for merging sideswipe type collisions. It would also eliminate left turns in and out of the lower parking structure driveway. Access would be right turn in/out only.

This measure would provide the opportunity for street beautification in the business district as well. The median would also provide a location for a pedestrian activated beacon mounted in the center of the street, further improving driver awareness of pedestrian crossings.

Raised Crosswalk – Exhibit D

A raised crosswalk could be constructed on the north and/or south leg of Highland Avenue with pedestrian warning signs. While this measure would offer greater driver awareness of pedestrians than a marked crosswalk only, it would have similar disadvantages to a marked crosswalk identified above. In addition, a raised crosswalk may alter surface drainage and accessibility. Based on the above evaluation, a raised crosswalk is not recommended.

Overhead Flashing Beacon – Exhibit E

This measure could be used in addition to a marked crosswalk, and would enhance the driver awareness of the crossing. Overhead flashing beacons would be preferred over side mounted beacons due to the proximity to a traffic signal with overhead indications. However, overhead flashing beacons would not be expected to significantly reduce the number of mid-block crossings.

Rectangular Rapid Flashing Beacon (RRFB) - Exhibit F

This measure could be used in conjunction with a marked crosswalk, and would enhance the driver awareness of the crossing. The rapid flash pattern has been shown to achieve greater driver compliance over standard round beacons. The beacons are highly directional, so they are not as visible from the roadside or adjadjacent properties. However, they would not be expected to significantly reduce the number of mid-block crossings.

Pedestrian Actuated Traffic Signal – Exhibit G

A pedestrian actuated traffic signal could be constructed to provide a fully controlled crossing. Since this crossing is located at an intersection, a traffic signal would include both vehicle and pedestrian traffic. Pursuant to the Draft guidelines, this measure is recommended at locations with a speed limit of 30 miles per hour, four or more lanes, and greater than 15,000 vehicles per day. It should be noted that a traffic signal at 38th Street would need to be fully coordinated with the traffic signal at Rosecrans Avenue because of its proximity. A traffic signal would attract more pedestrians that would otherwise cross midblock, and any midblock crossings would be illegal pursuant to the California Vehicle Code. It is also the only Toolbox measure that provides a fully protected crossing for pedestrians.

Several disadvantages would be anticipated if a traffic signal is constructed, including the following:

- Potential traffic diversion onto 38th Street due to improved access to/from Highland Avenue
- Increased traffic volume on Crest Drive and Ocean Drive due to cut-through traffic
- Vehicle queuing and intersection blockage through both intersections at Rosecrans Avenue and 38th Streets caused by red lights.
- Left turn traffic blocking through traffic due to absence of a left turn pocket.
- Potential increase in rear-end collisions by drivers navigating closely spaced traffic signals
- Conflicts between ingress/egress traffic at parking structure driveway and intersection movements.
- Reduced sidewalk width and accessibility due to traffic signal poles.

Some of these disadvantages could be addressed by turn restrictions or signal timing, but such measures would decrease intersection capacity and restrict resident access to the adjacent neighborhood.

ESTIMATED COSTS:

The estimated design and construction costs for the potential crossing treatments are summarized in the following table:

Exhibit	Description	Estimated Cost
A	High-Visibility Marked Crosswalk, Signs and Markings	$ 3,000
B	Curb Extension and Flashing Beacons	$100,000
C	Pedestrian Refuge Island and Flashing Beacons	$ 175,000
D	Raised Crosswalk	$ 60,000
E	Overhead Flashing Beacons	$ 90,000
F	Rectangular Rapid Flashing Beacons (RRFB)	$ 50,000
G	Pedestrian Traffic Signal	$ 250,000

CONCLUSION:

Crosswalk markings are primarily used to indicate the preferred pedestrian crossing location when it may not be obvious or at locations where there is a high volume of pedestrian traffic. It is also used at signalized intersections to channelize pedestrians within the intersection. The Traffic Engineer has determined that there is a need to indicate the proper place to cross Highland Avenue due to prevalent mid-block crossings. While the preferred crossing location is the signalized intersection at Rosecrans Avenue, observations have shown that pedestrians are not willing to walk significantly farther in order to cross the street. In addition, the high percentage of midblock crossings is a significant concern, especially in a high volume corridor with four traffic lanes.

For this location, the draft Pedestrian Crossing Toolbox recommends a combination of enhanced crossing treatments in addition to crosswalk signs and markings. Curb extensions, refuge islands and raised crosswalks are appropriate measures on streets with 3 or more lanes, a speed limit of 30 MPH and greater than 12,000 vehicles per day. Overhead beacons or rectangular rapid flashing beacons would also be appropriate. A pedestrian traffic signal is appropriate on streets with four or more lanes, a speed limit of 30 MPH and greater than 15,000 vehicles per day. Stop signs are not appropriate at this location because it would violate driver's expectations on street segments with signalized controls, as well as the likelihood of significant traffic delays and queuing due to a significant reduction in street capacity.

The combination of high visibility crosswalk markings, signs, center median refuge and center landscaped median (Exhibit C) is the preferred crossing treatment at this location because it is the only one that offers all of the following benefits:

- Shorter crossing distances
- Greater driver awareness of pedestrians
- Prevention of midblock pedestrian crossings
- Fewer conflicting turning movements
- High visibility beacon location in center of street
- Traffic calming to reduce prevailing speed on Highland Avenue
- Street beautification in the commercial area

The preferred treatment would not divert or increase traffic on residential streets, unlike a traffic signal, as noted above. It would not require the removal of curb parking.

It should be noted that there is significant pedestrian activity at night, therefore, street lighting should also be considered at the crossing to improve pedestrian conspicuity after dark. If any crossing treatment is selected, crosswalk markings should be painted across the stopped east and west legs of 38th Street at the intersection as well.

RECOMMENDATION:

Based on the evaluation of the Draft Pedestrian Crossing Enhancement Policy for the intersection at Highland Avenue and 38th Street and the Traffic Engineer's analysis, the installation of high visibility crosswalk markings, pedestrian crossing signs, center median refuge and center landscaped median is recommended.

Exhibits

A	High-Visibility Marked Crosswalk, Signs and Markings Sketch
B	Curb Extension and Flashing Beacons Sketch
C	Pedestrian Refuge Island and Flashing Beacons Sketch
D	Raised Crosswalk and Flashing Beacons Sketch
E	Overhead Flashing Beacons Sketch
F	Rectangular Rapid Flashing Beacons (RRFB) Sketch
G	Pedestrian Traffic Signal Sketch
H	Draft Pedestrian Crossing Enhancements Policy
I	Collision Summary
J	Pedestrian Crossing Photographs

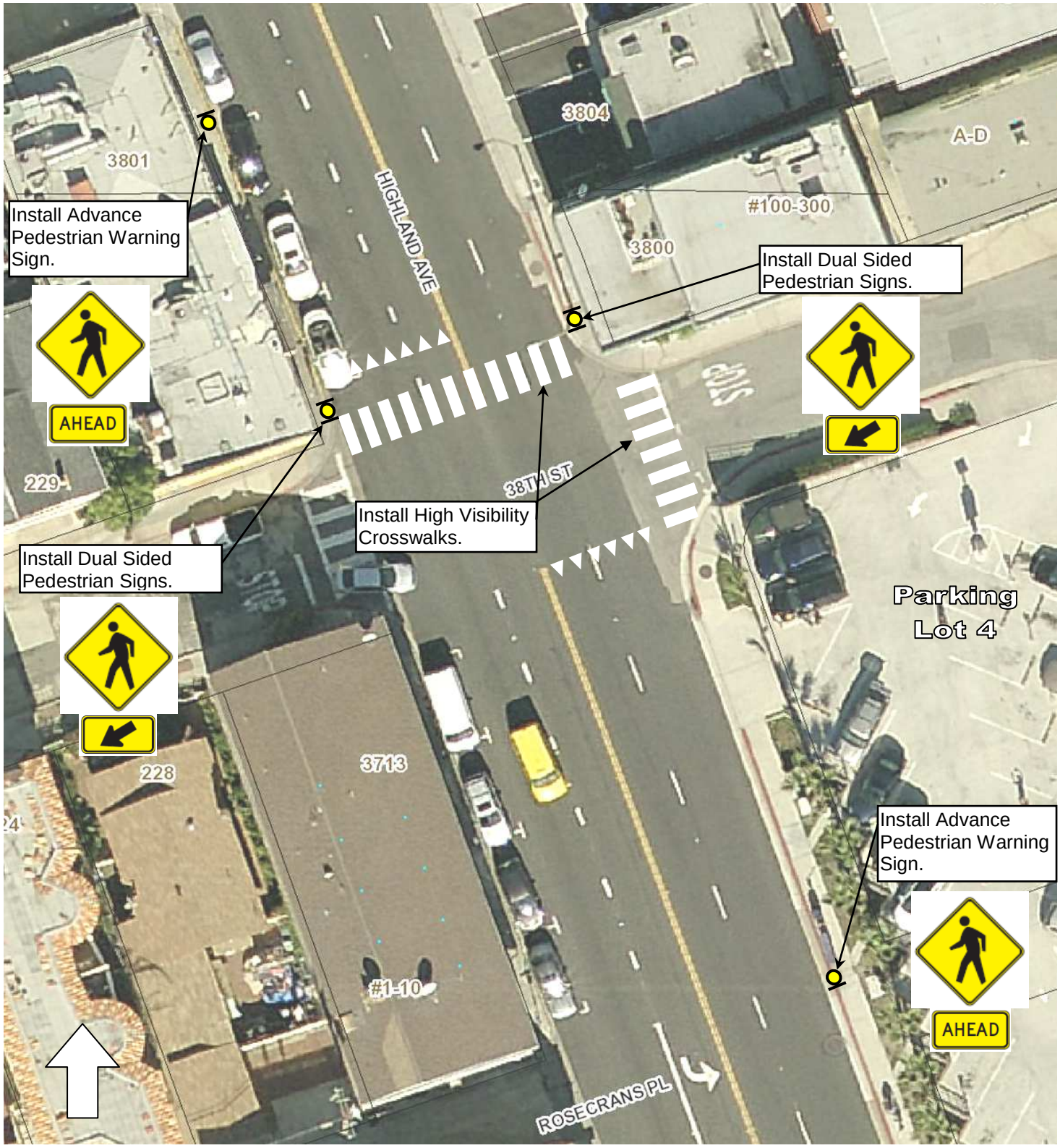

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Exhibit A
Highland Avenue at 38th Street
Crosswalk Signs and Markings Concept

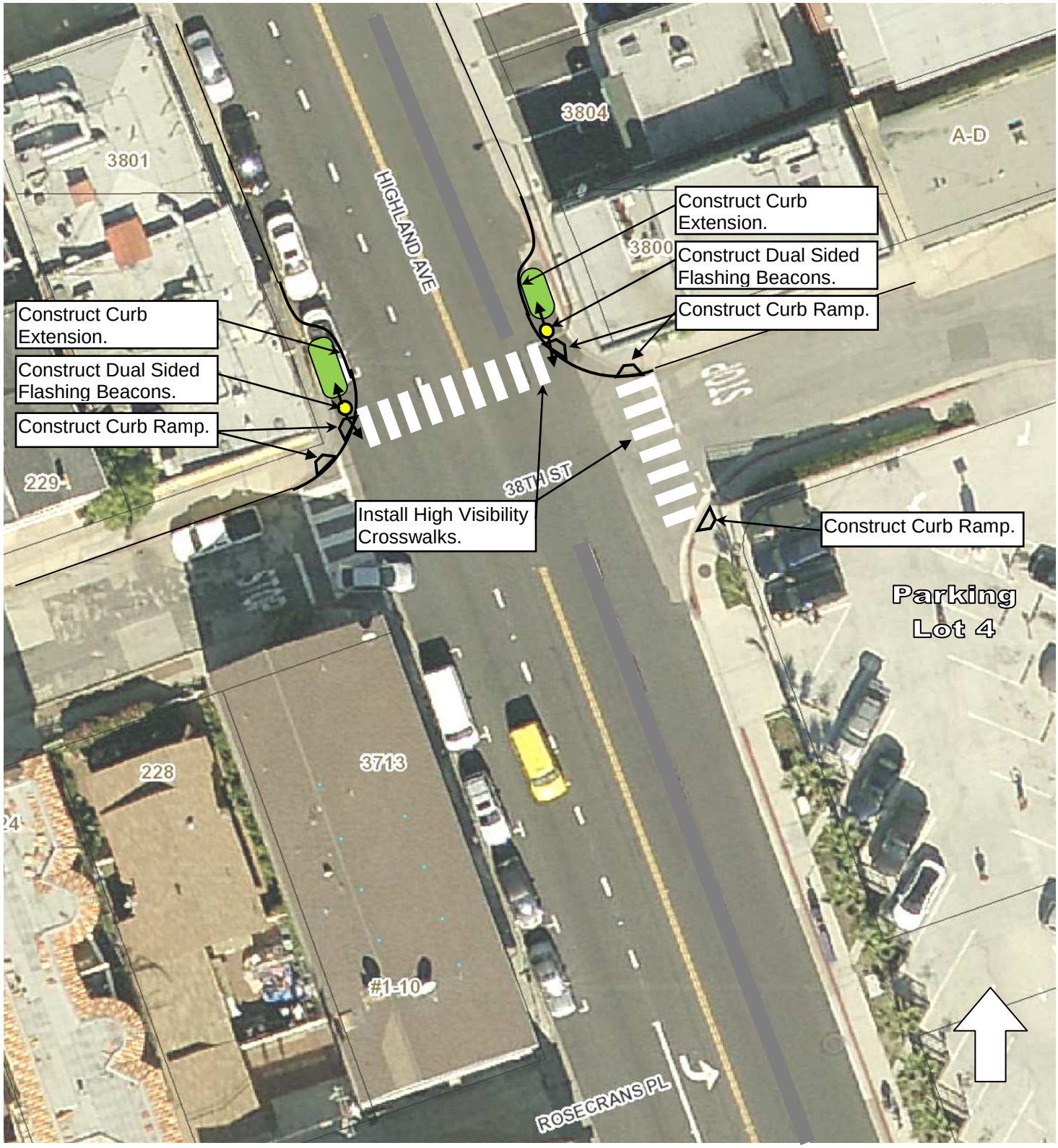

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Exhibit B
Highland Avenue at 38th Street
Curb Extension and Flashing Beacons Concept

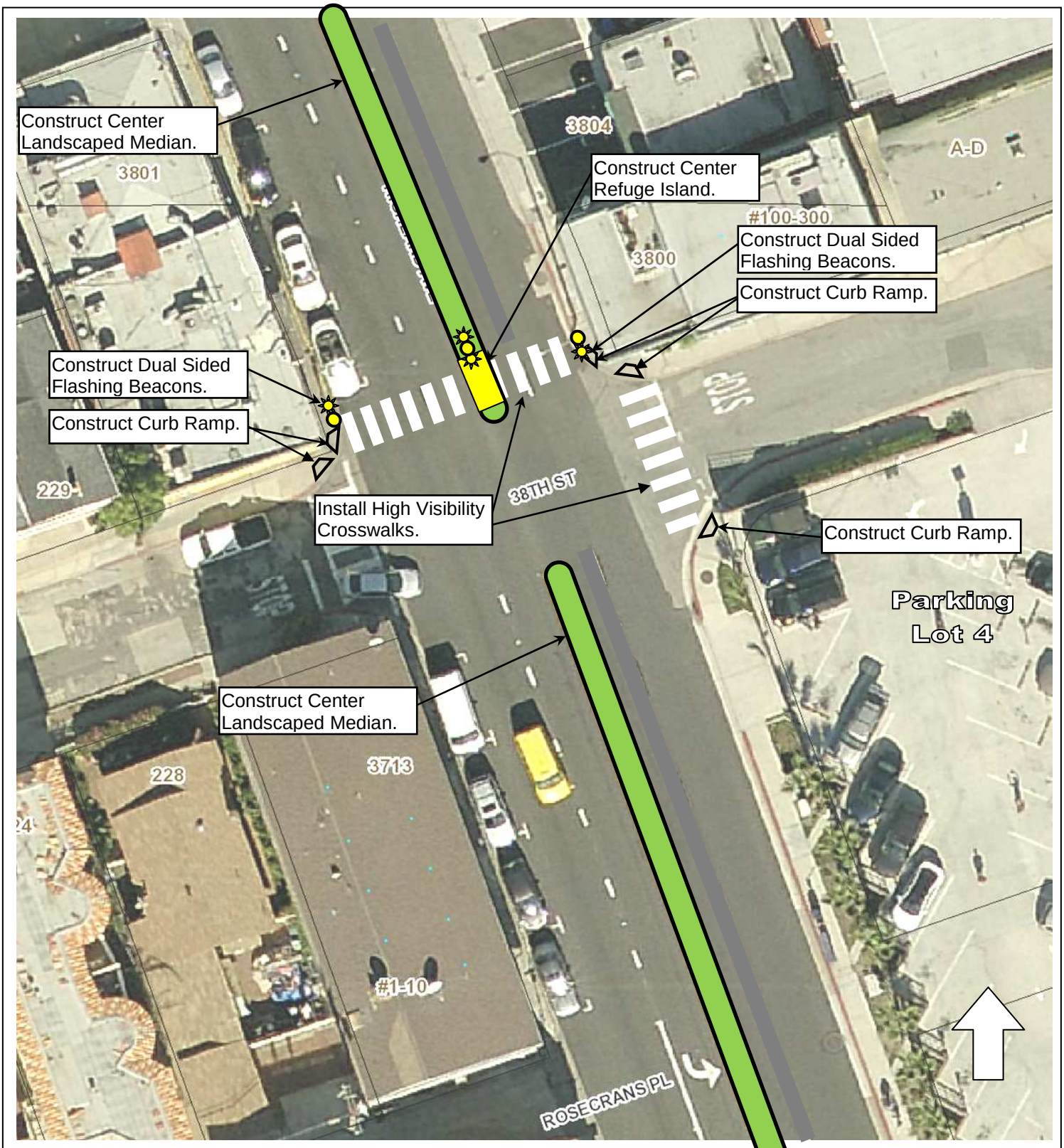

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Exhibit C
Highland Avenue at 38th Street
Flashing Beacon and Center Median Concept

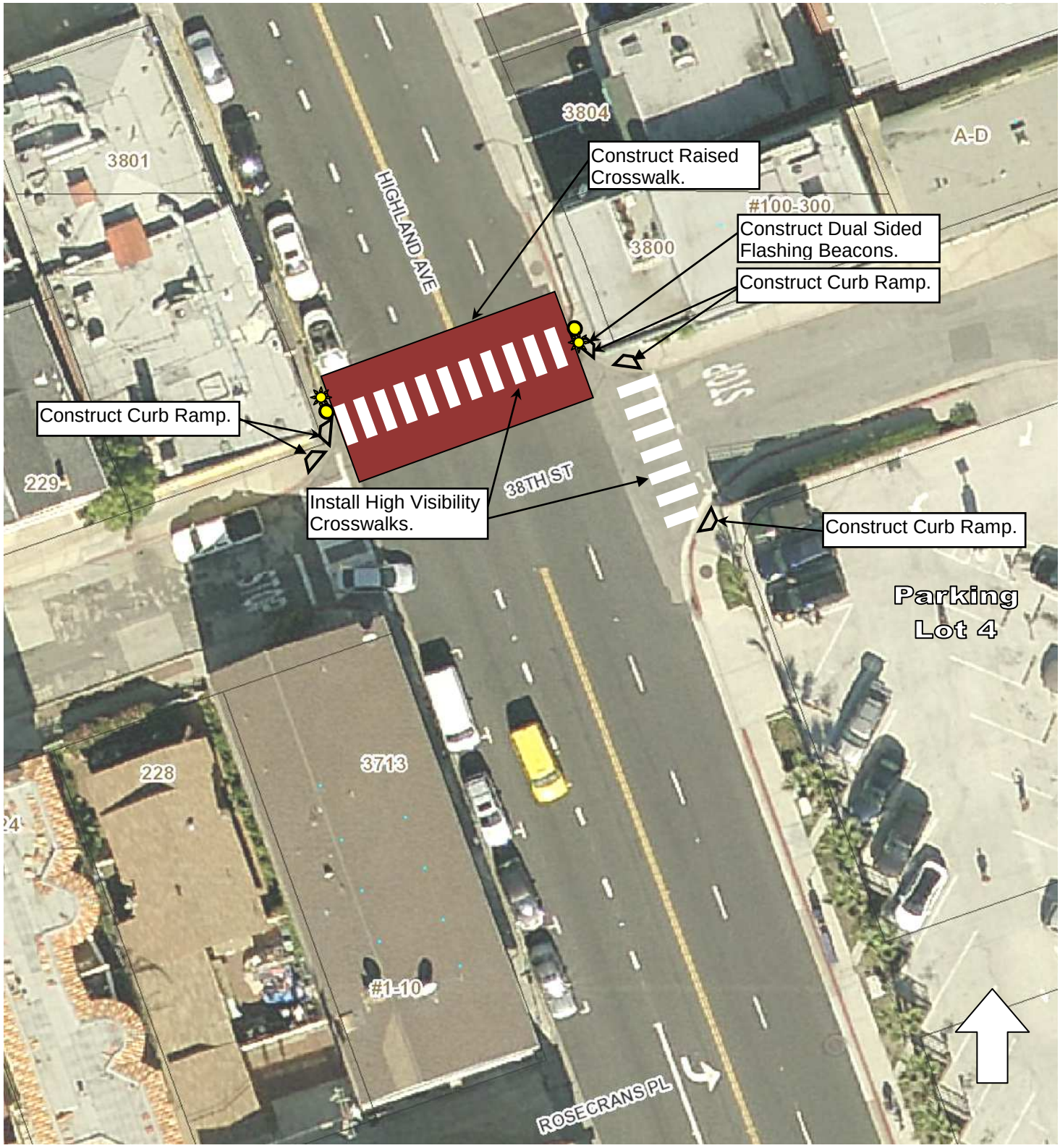

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Exhibit D
Highland Avenue at 38th Street
Curb Extension and Flashing Beacons Concept

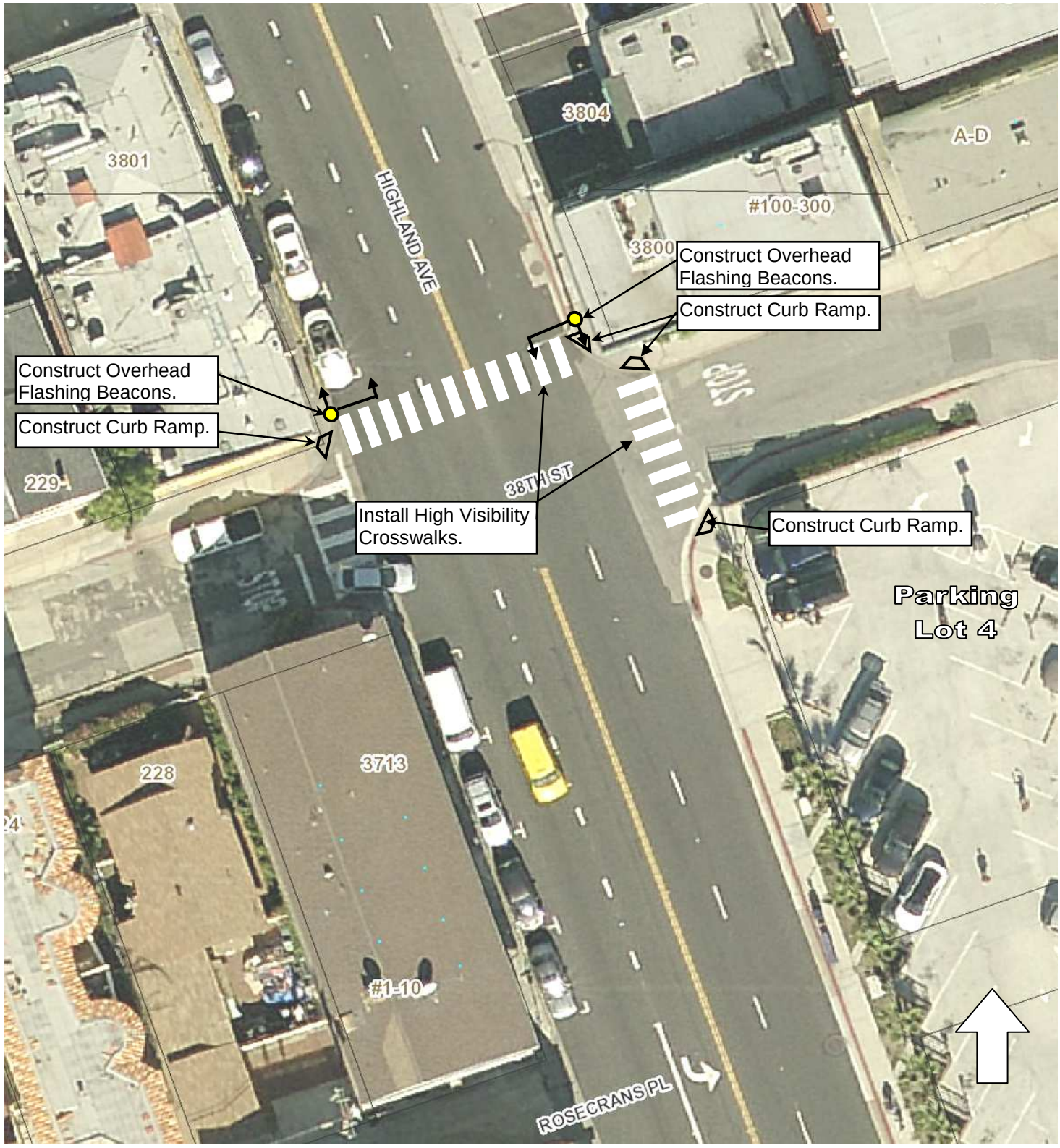

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Exhibit E
Highland Avenue at 38th Street
Overhead Flashing Beacons Concept

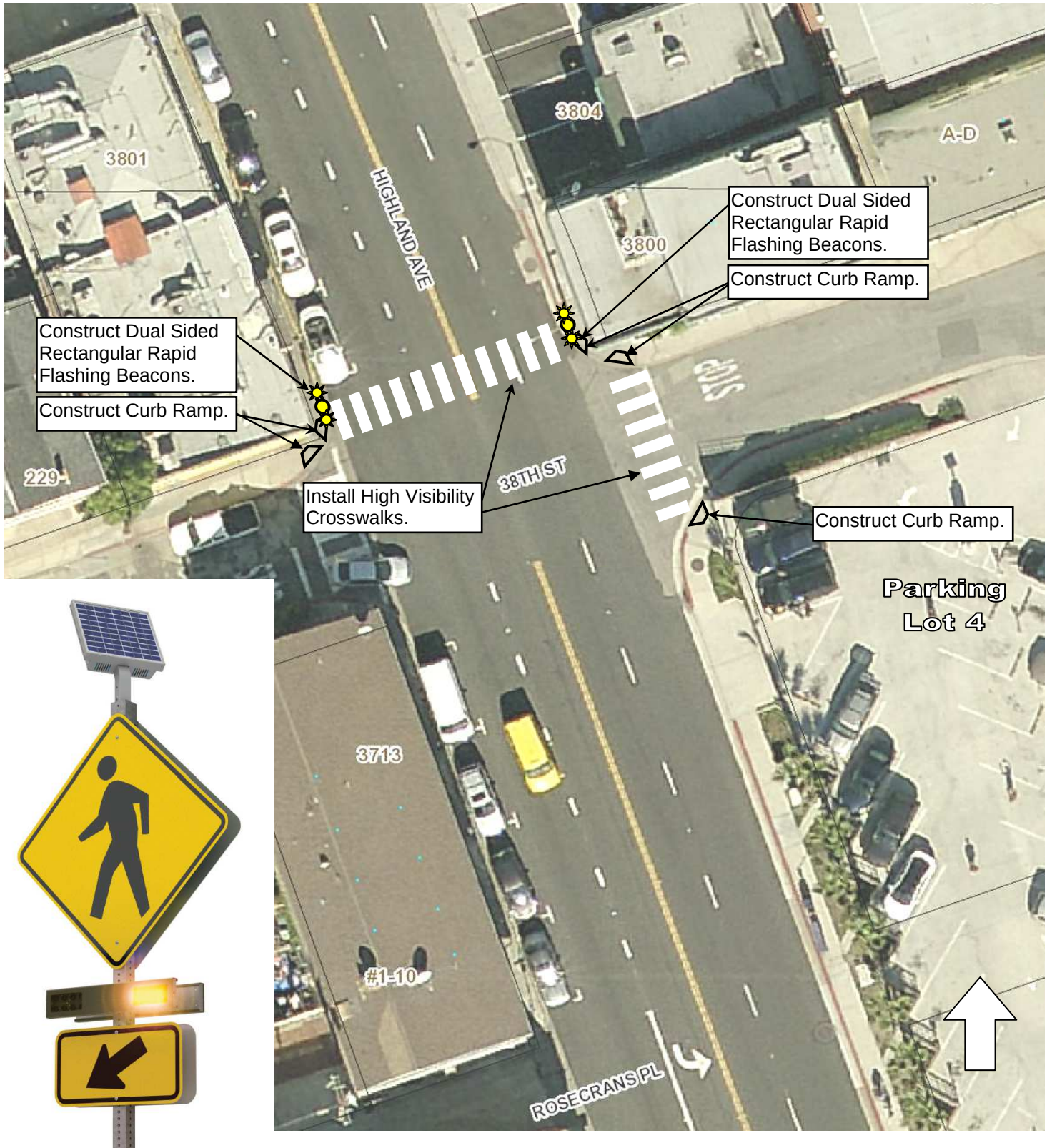

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Exhibit F
Highland Avenue at 38th Street
Rectangular Rapid Flashing Beacons Concept

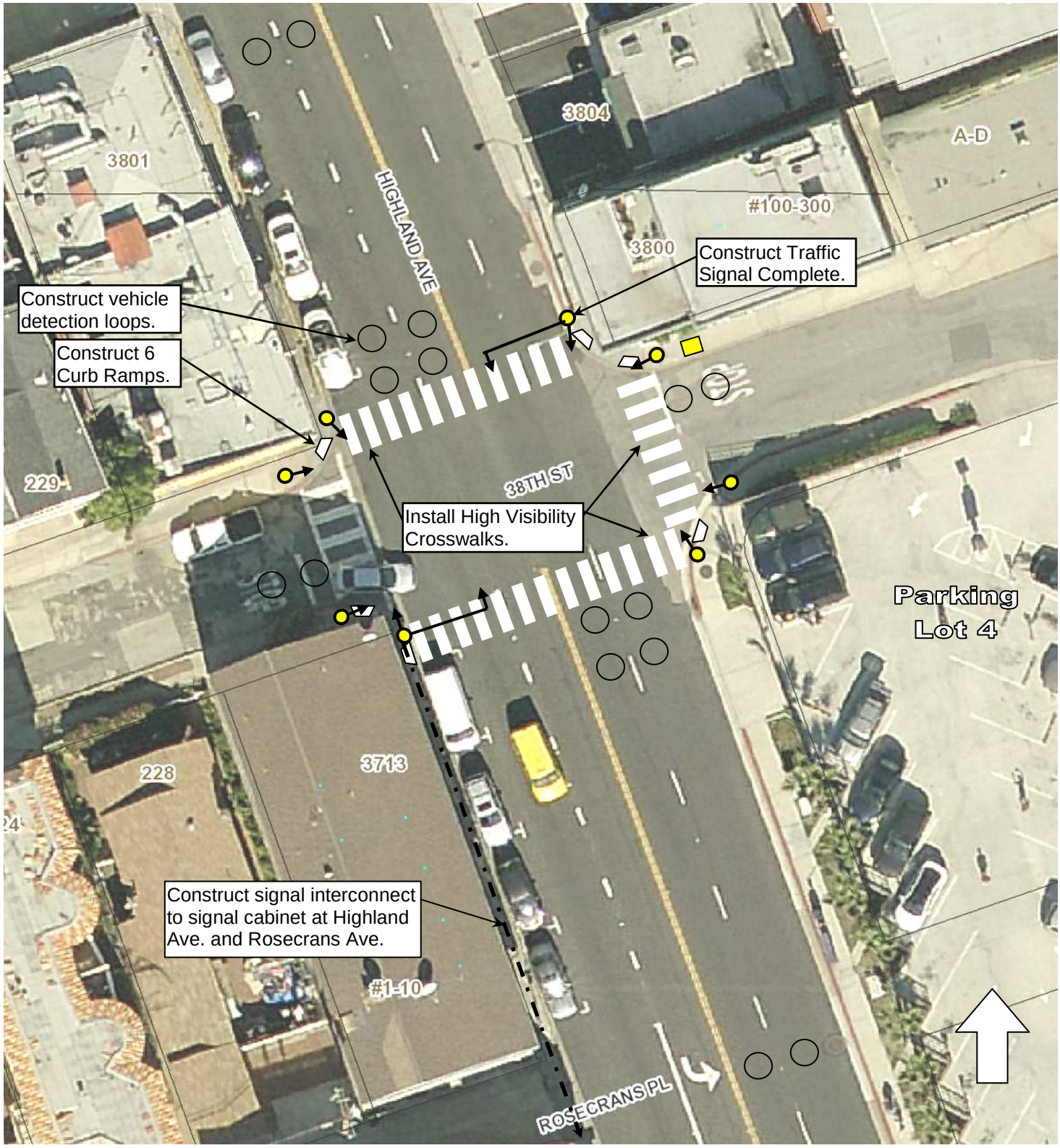

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Exhibit G
Highland Avenue at 38th Street
Pedestrian Traffic Signal Concept

EXHIBIT H

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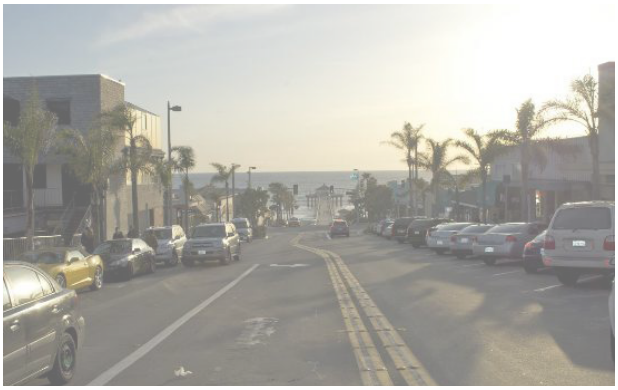
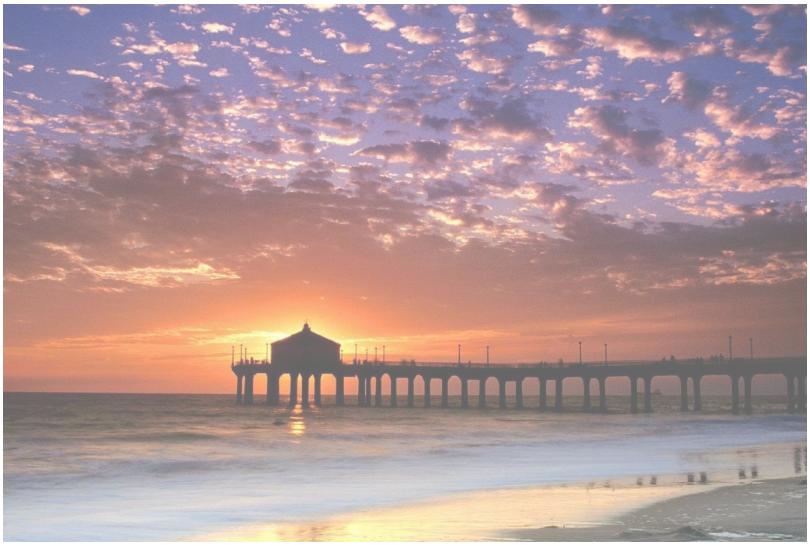
Manhattan Beach Mobility Plan
Pedestrian Crossing Enhancements Policy





Prepared by:

ITERIS Innovation for better mobility

FEHR PEERS

March 2014

TABLE A \\ UNCONTROLLED CROSSING TREATMENT TOOLBOX

POTENTIAL STRIPING ENHANCEMENTS

TREATMENT	IMPLEMENTATION GUIDANCE
HIGH-VISIBILITY MARKED CROSSWALK/TEXTURED CROSSWALK **[Striping]** High-visibility markings include a family of crosswalk striping styles such as the "ladder" and the "triple-four," as well as decorative or textured crosswalk markings. These marking provide greater crosswalk visibility to motorists.  	Implemented together as package of improvements at all locations that meet the flow chart test justifying a marked crossing. Additional enhancements to this package may be needed depending upon width of street, posted speed limit, sight distance and average daily traffic volumes. See guidance under which conditions additional enhancements are needed.
ADVANCE YIELD LIMIT LINE (MULTI-LANE ROADWAYS) **[Striping]** Yield limit lines (also referred to as "sharks' teeth") are placed in advance of marked, uncontrolled crosswalks to indicate to motorists where they should stop when a pedestrian is in a crosswalk.  *City of Pasadena*	
ADVANCE WARNING SIGNS/CROSSWALK SIGN ASSEMBLY **[Signage]** High-visibility fluorescent yellow green signs posted in advance of and at crossings increase the visibility of a pedestrian crossing. Requirements for the design and placement of these signs may be found in the California Manual on Uniform Traffic Control Devices (MUTCD). Additionally, in street pedestrian signs may be added.  *pedbikeimages.org* 	

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TABLE A \\ UNCONTROLLED CROSSING TREATMENT TOOLBOX, CONT'D

POTENTIAL GEOMETRIC ENHANCEMENTS

TREATMENT	IMPLEMENTATION GUIDANCE		
	SPEED LIMIT		
	30MPH OR LOWER	35 MPH	40 MPH+
CURB EXTENSIONS **[Geometrics]** Also known as a pedestrian bulb-out, this traffic-calming measure is meant to slow traffic and increase driver awareness of pedestrians. It consists of an extension of the curb into the street, making the pedestrian space (sidewalk) wider and the crosswalk narrower. It improves driver visibility of pedestrians waiting to enter the crosswalk 	One geometric enhancement is recommended under the following conditions: • 3 lane street with ADT of 12,000+ • 4+ lane street (no raised median) with ADT of 9,000+ • 4+ lane street (with raised median) with ADT of 12,000+ Locations where pedestrian actuated signals are installed may not require these enhancements	One geometric enhancement is recommended under the following conditions: • 2 lane street with ADT of 15,000+ • 3 lane street with ADT of 9,000 • 4+ lane street (no raised median) with ADT of 9,000 or less • 4+ lane street (with raised median) with ADT of 12,000+ Locations where pedestrian actuated signals are installed may not require these enhancements	One geometric enhancement is recommended at all crossings with a speed limit of 40 mph or greater regardless of lane width and ADT. Locations where pedestrian actuated signals are installed may not require these additional enhancements
REFUGE ISLANDS **[Geometrics]** Raised islands are placed in the center of the roadway, separating opposing lanes of traffic with cutouts or ramps for accessibility along the pedestrian path. Median refuge islands are recommended where right-of-way allows and conditions warrant. Refuge medians can also be designed as a split pedestrian crossover where crosswalks in the roadway are staggered such that a pedestrian crosses half the street and then walks toward traffic to reach the second half of the crosswalk. This measure must be designed for accessibility to direct sight-impaired pedestrians along the path of travel.  tfhrc.gov			
RAISED CROSSWALK **[Geometrics]** This traffic calming measure provides a crosswalk with a surface elevated above the travel lanes (typically at curb height), attracting drivers' attention, encouraging lower speeds at the pedestrian crossing point, and improving the visibility of pedestrians in the crosswalk.  saferoutesinfo.org			

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TABLE A \\ UNCONTROLLED CROSSING TREATMENT TOOLBOX, CONT'D

POTENTIAL SIGNAL ENHANCEMENTS

TREATMENT	IMPLEMENTATION GUIDANCE		
	SPEED LIMIT		
	30MPH OR LOWER	35 MPH	40 MPH+
OVERHEAD FLASHING BEACON **[Signal Treatment]** Flashing amber lights are installed on overhead signal arms in advance of the crosswalk or at the entrance to the crosswalk. Typically overhead beacons are pedestrian push button actuated and are most appropriate on multi-lane, signalized streets.  *tti.tamu.edu*	Instead of, or in addition to a geometric enhancement, install an overhead beacon or RRFB under the following conditions: • 3+ lane street with ADT of 12,000+	Instead of, or in addition to a geometric enhancement, install an overhead beacon or RRFB under the following conditions: • 2 lane street with ADT of 15,000+ • 3+ lane street with ADT of 9,000+	A geometric and/or an overhead beacon or RRFB is recommended at all crossings with a speed limit of 40 mph or greater regardless of lane width and ADT.
RECTANGULAR RAPID FLASHING BEACON (RRFB) **[Signal Treatment]** RRFB is a flashing beacon that is enhanced by replacing the traditional slow flashing incandescent lamps with rapid flashing LED lamps. The beacons may be push-button activated or activated with pedestrian detection. Research indicated the greatest response from RRFBs.  *mutcd.fhwa.dot.gov*	Beacons should not be installed at locations of pedestrian actuated signals.	Beacons should not be installed at locations of pedestrian actuated signals.	Beacons should not be installed at locations of pedestrian actuated signals.
PEDESTRIAN ACTUATED SIGNAL **[Signal Treatment]** This is a conventional traffic control device with warrants for use based on the MUTCD. Signal remains on green until a pedestrian push button activation. Signal operates with a flashing red until completion of pedestrian phase.  *City of Pasadena*	Recommended on 4+ lane streets with ADT of15,000+. If pedestrian actuated signal is installed, geometric enhancements may not be necessary.	Recommended on 3+ lane street with ADT of 15,000+ If pedestrian actuated signal is installed, geometric enhancements may not be necessary.	Recommend on 2 lane street with ADT of 15,000 + or 3+ lane street with ADT of 9,000+ If pedestrian actuated signal is installed, geometric enhancements may not be necessary.

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The following is a list of potential enhancements options for intersections in pedestrian priority areas (such as around schools, parks, Downtown, etc.):

TABLE B \\ STOP-CONTROLLED LOCATION TOOLBOX

City of Pasadena

REFUGE ISLAND

[Geometrics]

Raised islands are placed in the center of the roadway, separating opposing lanes of traffic with cutouts or ramps for accessibility along the pedestrian path.

CURB EXTENSION/BUS BULBS/SHORT RIGHT-TURN LANE ELIMINATION

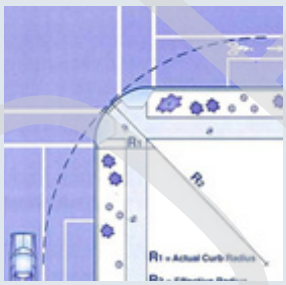
[Geometrics]

Also known as a pedestrian bulb-out, this traffic-calming measure is meant to slow traffic and increase driver awareness of pedestrians. It consists of an extension of the curb into the street, making the pedestrian space (sidewalk) wider.

IMPROVED RIGHT-TURN SLIP-LANE DESIGN/PORK CHOP REDESIGN

[Geometrics]

Right-turn slip lanes (aka channelized right-turn lanes) are separated from the rest of the travel lanes by a pork chop-shaped striped or raised median area. This measure separates right-turning traffic and streamlines right turning movements. Improved right-turn slip lanes provide pedestrian crossing islands within the intersection and are designed to optimize the right-turning motorist's view of the pedestrian and of vehicles to his or her left.



saferoutesinfo.org

REDUCED TURNING RADIUS AS DETERMINED BY DESIGN VEHICLE

[Geometrics]

The size of the curb radius determines the speed at which approaching vehicles can navigate a turn. Reduced turn radii force approaching vehicles to slow down when turning, while still efficiently accommodating the largest vehicle commonly expected at the intersection.

www.ci.mil.wi.us

PEDESTRIAN-SCALE LIGHTING

[Streetscape]

Pedestrian-scale lighting improves motorist sight of pedestrians.

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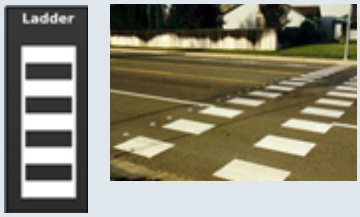


walkinginfo.org/pedsafe/

STANDARD CROSSWALK FOR STOP-CONTROLLED APPROACHES, LADDER OR TRIPLE FOUR AT UNCONTROLLED APPROACHES

[Striping]

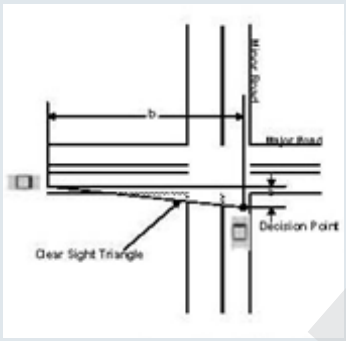
High-visibility markings include a family of crosswalk striping styles such as the "ladder" and the "triple-four." Stop bars should be striped in advance of the crosswalk on approaches controlled by a stop sign.

City of Pasadena

DIRECTIONAL CURB RAMP WITH TRUNCATED DOMES

[Geometrics/ADA Treatments]

Where right-of-way is available, directional curb ramps are installed at two per corner and guide pedestrians in to the crosswalk they would utilize to cross the street. Truncated domes provide a tactile signal to the visually impaired that they are leaving the sidewalk area. Exceptions for directional curb ramps may be allowed when physical considerations such as existing drainage or required turn radius deem infeasible. Selecting directional curb ramps as a preferred treatment does not call for retrofit of existing curb ramps, rather installation will be done oppurtunistically in scenarios such as grant funding, development review, new construction, and



Nazir Lalani

REMOVAL OF SIGHT DISTANCE OBSTRUCTIONS

[Geometrics]

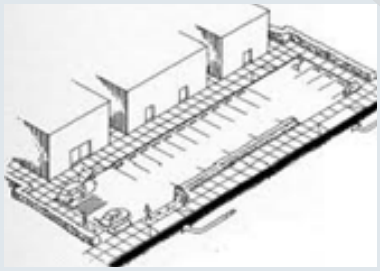
If objects impede sight distance, it may result in an unsafe condition when motorists and pedestrians are unable to see each other. Items such as parked cars, signage, landscaping, fencing, and street furniture should be placed in a location that will not obstruct sight distance.

danpink.com

LIMITED SIGNAGE/SIGN CLUTTER EVALUATION

[Signage]

Road signs and street signs at intersections may distract motorists from the road. Unnecessary signage should be removed and relocated to present motorists only with signage relevant to the operation of the intersection.



mrsc.org

DRIVEWAY ACCESS MANAGEMENT

[Geometrics]

Access management strategies can reduce the number of driveway crossings pedestrians encounter and result in a wider sidewalk through more efficient allocation of space.

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The following is a list of potential enhancements options for intersections in pedestrian priority areas (such as around schools, parks, Downtown, etc.):

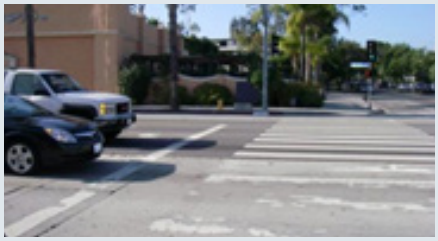
TABLE C \\ SIGNAL-CONTROLLED LOCATION TOOLBOX

walkinginfo.org/pedsafe/

MARKED CROSSWALK

[Striping]

Marked crosswalks should be installed to provide designated pedestrian crossings at signalized locations, on all feasible approaches. Exceptions for striping crosswalks on all four legs of a signalized intersection may be allowed due to operational and physical considerations



ADVANCE LIMIT LINE

[Striping]

Standard advance limit (white stop) lines are placed four feet in advance of marked crosswalks

www.saferoutesinfo.org

COUNTDOWN SIGNAL

[Signal Treatment]

Displays a "countdown" of the number of seconds remaining for the pedestrian crossing interval.

www.livablestreets.com

SLOWER WALKING SPEED

[Signal Treatment]

The California MUTCD requires that signal timings be changed to reflect 3.5 feet per second walk times rather than 4.0 feet per second. In locations adjacent to schools, senior centers, etc., a slower walk speed should be considered in signal timings.

www.saferoutesinfo.org

PEDESTRIAN RECALL IN HIGH ACTIVITY PEDESTRIAN AREAS

[Signal Treatment]

Pedestrian Recall provides a guaranteed walk phase for each crossing at the signal during periods of peak pedestrian activity regardless of whether the pedestrian push button has been activated. This ensures ample time is provided for pedestrian crossings when pedestrians are typically present (even if a pedestrian fails to push the button).

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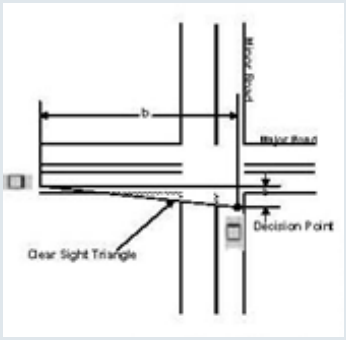
City of Pasadena

DIRECTIONAL CURB RAMP WITH TRUNCATED DOMES & SEPARATED PEDESTRIAN PUSH BUTTONS (PPB)

[Geometrics/ADA Treatments]

When right-of-way is available, directional curb ramps are installed two per corner and guide pedestrians into the crosswalk. Truncated domes provide a tactile signal to the visually impaired that they are leaving the sidewalk area. Separated push buttons are placed within five feet of each curb ramp, one per crosswalk. Exceptions for directional curb ramps may be allowed when physical considerations such as existing drainage or required turn radius deem infeasible.



Nazir Lalani

REMOVAL OF SIGHT DISTANCE OBSTRUCTIONS

[Geometrics]

If objects impede sight distance, this may result in an unsafe condition where motorists and pedestrians are unable to see each other. Items such as parked cars, signage, landscaping, fencing, and street furniture should be placed in a location that will not obstruct sight distance.

www.ci.mil.wi.us

PEDESTRIAN-SCALE LIGHTING

[Streetscape]

Pedestrian-scale lighting improves motorists' visibility of pedestrians.

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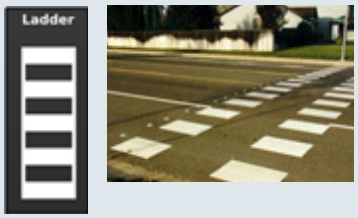


walkinginfo.org/pedsafe/

HIGH-VISIBILITY CROSSWALK

[Striping]

High-visibility markings include a family of crosswalk striping styles such as the "ladder" and the "continental." High-visibility striping should be provided for crosswalks with heavy pedestrian volumes, with frequent pedestrian-vehicle conflicts (such as with permissive left turns), or at skewed intersections. One style of high-visibility striping should be selected as the City's preferred style.

polara.com

ACCESSIBLE PEDESTRIAN SIGNALS

[ADA Treatments]

Accessible pedestrian signals communicate information about pedestrian crossings in non-visual format such as audible tones, verbal messages, and/or vibrating surfaces, providing access to the pedestrian signals for the visually impaired. Locations for accessible pedestrian signals are coordinated with the Accessibility Disability Commission.

freefoto.com

ALL RED CLEARANCE

[Signal Treatment]

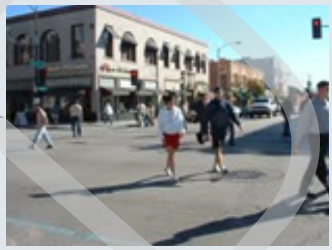
Provides a phase (1-2 seconds) where all vehicle indicators hold the red at an intersection.

walkinginfo.org

LEADING PEDESTRIAN INTERVAL (LPI)

[Signal Treatment]

Provides pedestrians with a walk indicator while all vehicle indicators hold the red ball. This allows pedestrians to get a head start crossing the street before vehicles get the green indication.



streetswiki.wikispaces.com

SCRAMBLE PHASE

[Signal Treatment]

Provides an all-red phase for vehicles while providing pedestrians with a walk indication. Pedestrians may cross the street orthogonally or diagonally.

safety.fhwa.dot.gov

PROTECTED LEFTS

[Signal Treatment]

Protected left turns give vehicles that are turning left an exclusive phase that does not coincide with the pedestrian walk phase. This eliminates the pedestrian-vehicle conflict between permissive lefts and pedestrians in a crosswalk.

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lincoln.ne.gob

FULL-TIME RECALL/FIXED TIME PEDESTRIAN INTERVALS

[Signal Treatment]

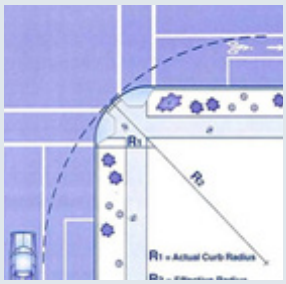
Pre-timed signals give pedestrians the walk signal without requiring push button actuation.

luni.net

PROHIBITED RIGHT TURN ON RED

[Signal Treatment]

Prohibits vehicles from turning right when the signal has a red indication.

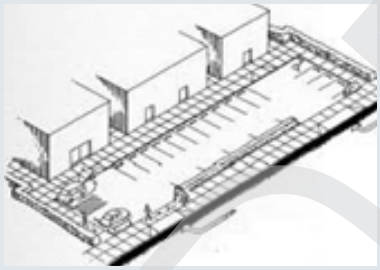


saferoutesinfo.org

REDUCED TURNING RADIUS AS DETERMINED BY DESIGN VEHICLE

[Geometries]

The size of the curb radius determines the speed at which approaching vehicles can navigate a turn. Reduced turn radii force approaching vehicles to slow down when turning, while still accommodating emergency vehicles and the largest vehicle expected to typically navigate the intersection (i.e., the design vehicle).



DRIVEWAY ACCESS MANAGEMENT

[Geometries]

Access management strategies can reduce the number of driveway crossings pedestrians encounter and result in a wider sidewalk through more efficient allocation of space.

City of Pasadena

REFUGE ISLAND

[Geometries]

Raised islands are placed in the center of the roadway, separating opposing lanes of traffic with cutouts or ramps for accessibility along the pedestrian path.

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TABLE C \\ SIGNAL-CONTROLLED LOCATION TOOLBOX, CONT'D

CURB EXTENSION/BUS BULBS/SHORT RIGHT-TURN LANE ELIMINATION

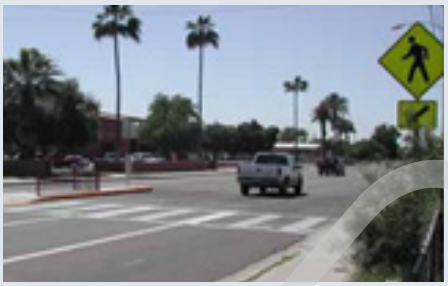
[Geometrics]

Also known as a pedestrian bulb-out, this traffic-calming measure is meant to slow traffic and increase driver awareness of pedestrians. It consists of an extension of the curb into the street, making the pedestrian space (sidewalk) wider.

IMPROVED RIGHT-TURN SLIP-LANE DESIGN/PORK CHOP REDESIGN

[Geometrics]

Right-turn slip lanes (aka channelized right-turn lanes) are separated from the rest of the travel lanes by a pork chop-shaped striped or raised median area. This measure separates right-turning traffic and streamlines right turning movements. Improved right-turn slip lanes provide pedestrian crossing islands within the intersection and are designed to optimize the right-turning motorist's view of the pedestrian and of vehicles to his or her left.



tfhrc.gov

TWO-STAGE CROSSING

[Geometrics]

This measure is similar to traditional median refuge islands except that the crosswalk is staggered such that a pedestrian crosses half the street and then must walk towards traffic to reach the second half of the crosswalk. This measure must be designed for accessibility by including rails and truncated domes to direct sight-impaired pedestrians along the path of travel.

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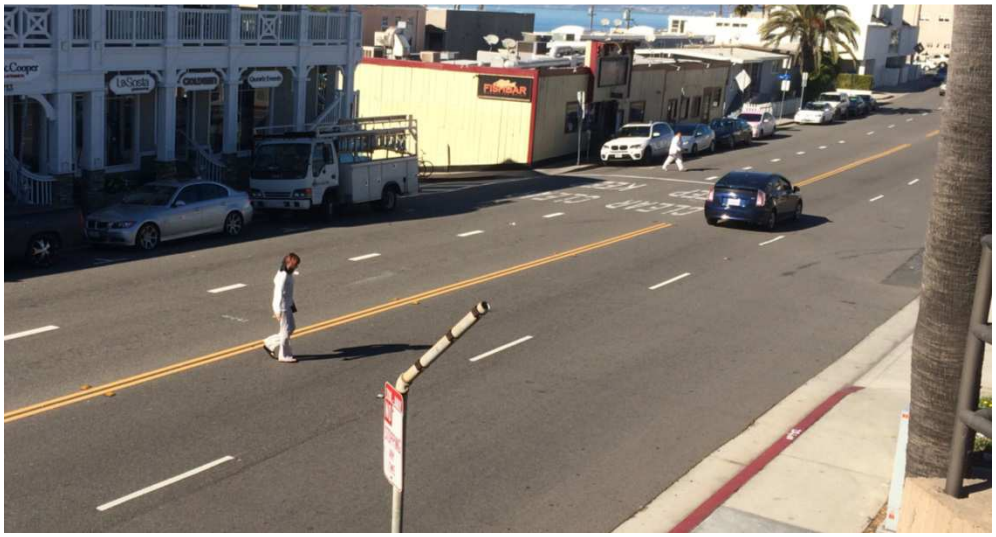
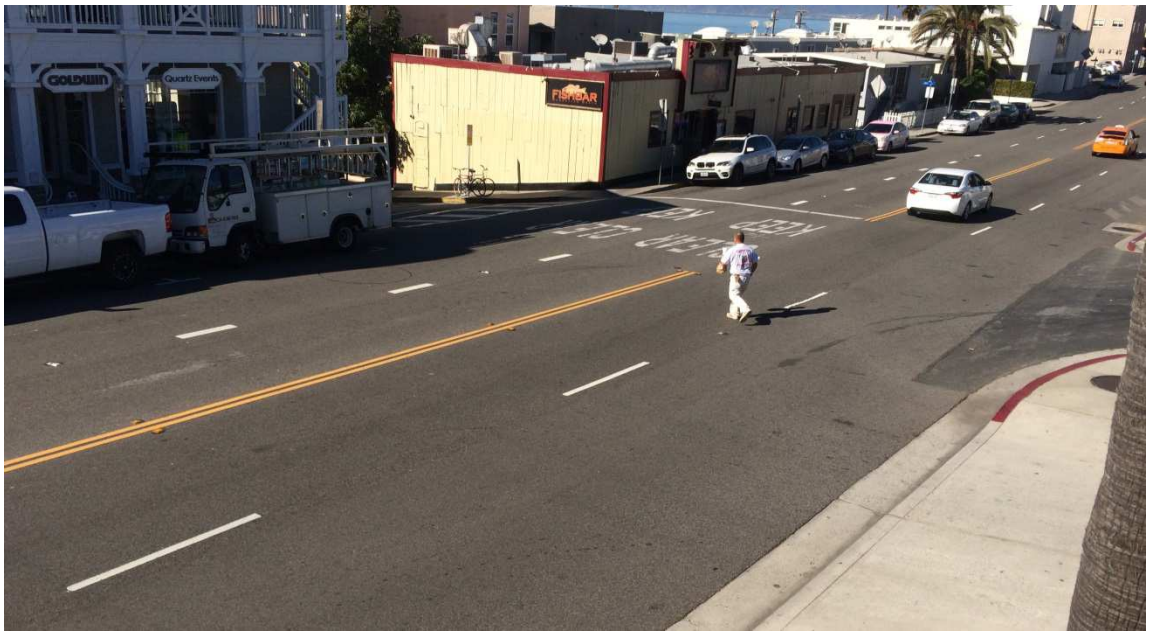
EXHIBIT I
COLLISION SUMMARY

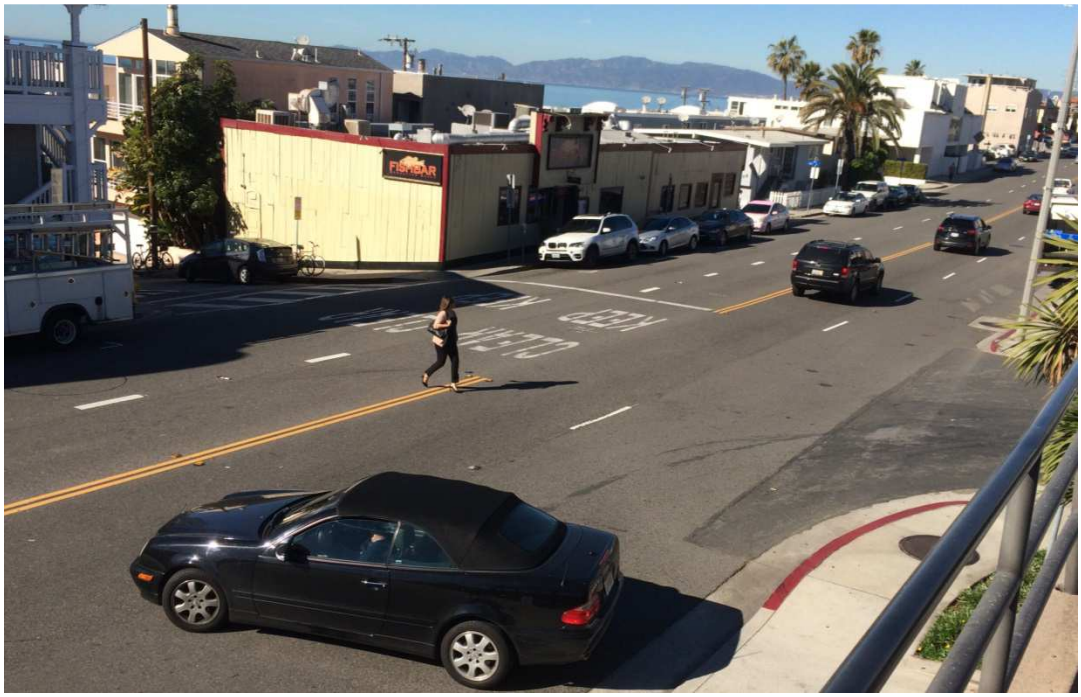
Highland Avenue between Rosecrans Avenue and 38th Street
January 1, 2006 to December 31, 2013

DATE	TIME	STREET	LOCATION	DIRECTION	TYPE	REASON
09/13/2013	20:21	HIGHLAND AVE	45' N/O ROSECRANS AVE	SB THRU VS. SB STOP	REAREND	FAILURE TO STOP
04/01/2012	20:19	HIGHLAND AVE	68' S/O 38TH STREET	SB THRU VS. SB STOP	REAREND	FAILURE TO STOP
07/29//2011	08:12	HIGHLAND AVE	AT 38TH STREET	EB THRU VS. NB THRU	BROADSIDE	ROW VIOLATION
12/04/2011	11:53	HIGHLAND AVE	21' NO 38TH STREET	NB THRU VS. NB STOP	REAREND	FAILURE TO STOP
2010			NONE			
02/05/2009	16:29	HIGHLAND AVE	16' S/O 38TH STREET	NB RT VS. SB THRU VS. SB PARKED	BROADSIDE	UNSAFE SPEED
07/08/2008	21:05	HIGHLAND AVE	AT ROSECRANS	SB THRU VS SB THRU	SIDESWIPE	UNSAFE LANE CHANGE
2007			NONE			
08/03/2006	18:05	HIGHLAND AVE	AT ROSECRANS	SB THRU VS SB THRU	SIDESWIPE	UNSAFE LANE CHANGE

EXHIBIT J
PEDESTRIAN CROSSING PHOTOGRAPHS




GOLDWIN
Quartz Events
FISHBAR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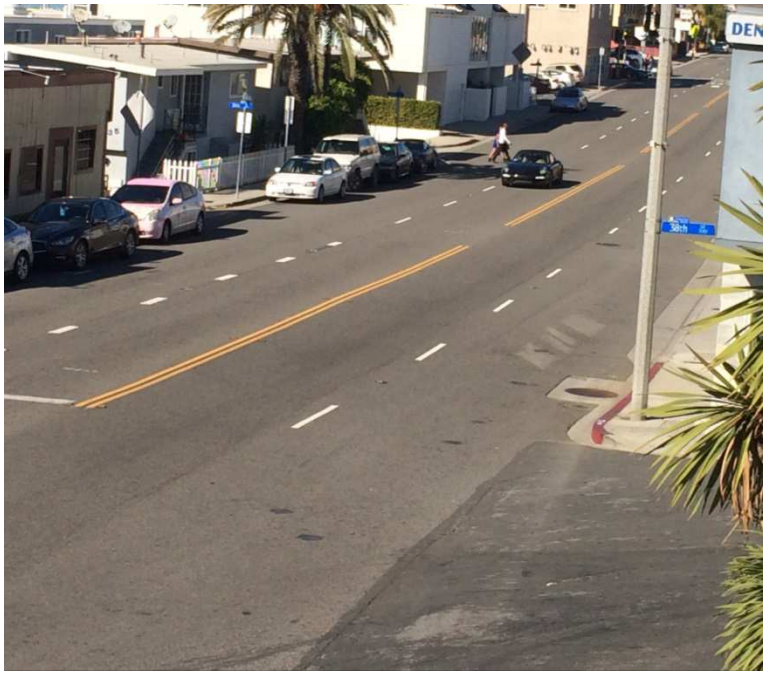
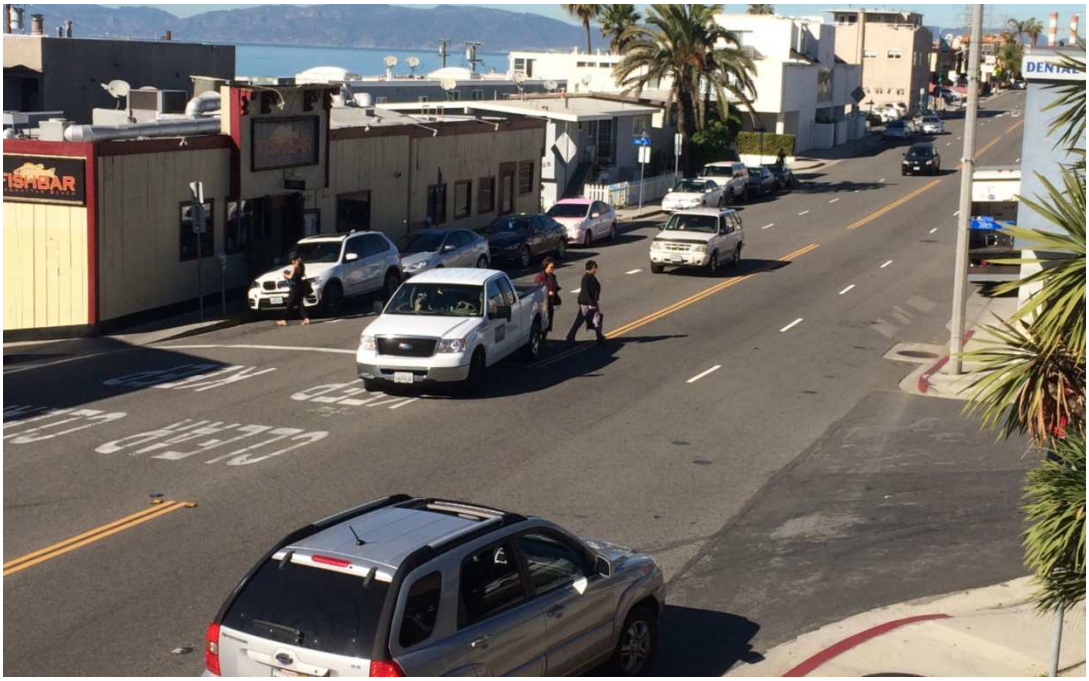



LaSosta
GOLDWIN
Quartz Events
FISHBAR


Sugaring LA
LaSosta
BRONZED


FISHBAR


DENTAL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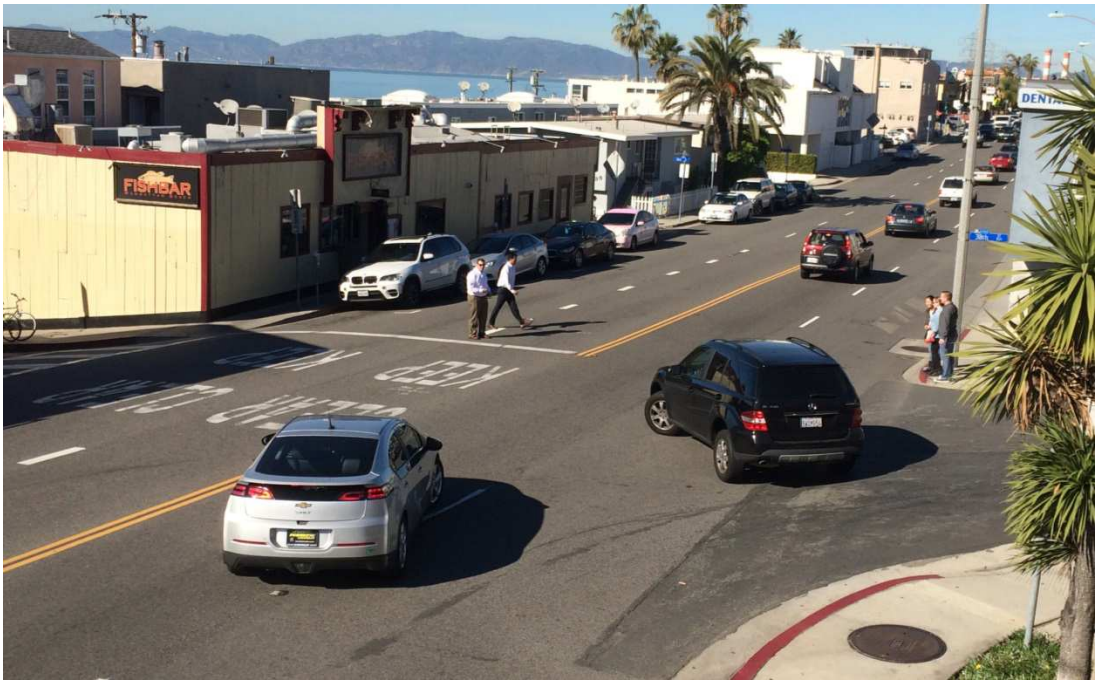
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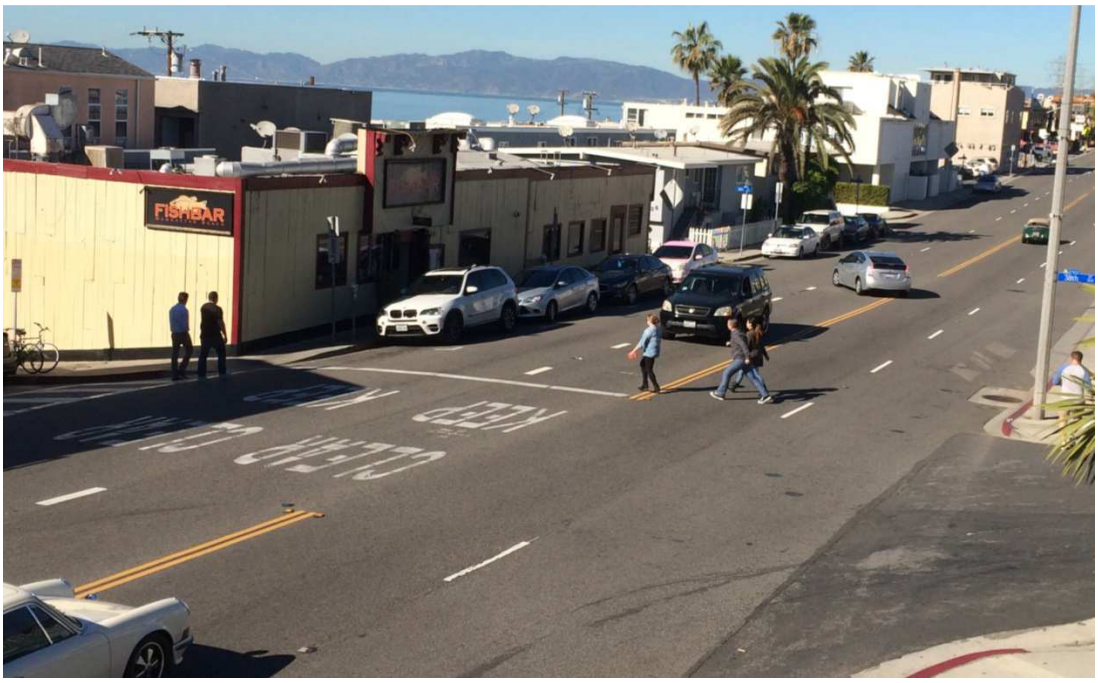
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