CITY OF OAKLAND LOCAL ROADWAY SAFETY PLAN

SAFE OAKLAND **STREETS**

U.S. Department of Transportation
Federal Highway Administration

Caltrans

City of Oakland | Department of Transportation

About this Plan

This Local Roadway Safety Plan, developed with the guidance from the Federal Highway Adminnistration, represents the City of Oakland Department of Transportation's (OakDOT's) coordinated safety plan that provides a comprehensive framework for reducing severe and fatal crashes on Oakland's streets by articulating OakDOT's safety goals, objectives, and key emphasis areas.

The purpose of the LRSP is to identify key safety needs and guide Oakland's investment decisions to prevent severe and fatal traffic crashes, eliminate existing injury and fatality inequities, and to take a data-driven and systematic approach to the implementation of safety projects to prevent or mitigate any new adverse equity impacts from arising as a result of the City's efforts.

Cover Photo: Rapid Response Project at Foothill Blvd & 22nd Avenue

Problem

Severe and fatal crashes in Oakland are unacceptably high – with an increase in deaths in 2020. Crashes disproportionately impact Oakland's priority equity neighborhoods1. However, life-changing and life-ending collisions on roadways can be prevented.

There were 29 fatalities in Oakland in 2021, down from a surge in traffic-related fatalities in 2020 with 36 people killed on Oakland's roadways, compared to 26 in year 2019. Twenty-five to forty percent of people are killed while walking on Oakland's streets. In 2018, the Oakland Equity Indicators Report found troubling disparities in pedestrian deaths in Oakland . The City of Oakland experiences approximately two severe or fatal traffic crashes each week, which disproportionately impact Black, Indigenous and people of color (BIPOC), seniors, and people that live in the City's higher priority equity neighborhoods. The majority (60%) of these collisions are highly concentrated on just 6% of the 800 miles of Oakland's city-maintained streets, as identified as Oakland's **High Injury Network** ***(Appendix A)***. The most common causes of collisions are speeding, failure to yield, unsafe turning, red light running, and driving under the influence of drugs and/or alcohol.

Solution

The City of Oakland has an established history of setting policy goals regarding traffic and public safety and advancing more equitable outcomes through the City's services. In 2013, the City of Oakland adopted a "Complete Streets Policy" (Resolution No. 84204 C.M.S.), committing to supporting roadways designed and operated to enable safe, attractive, and comfortable access and travel for all users. In 2016, the City's Department of Transportation (OakDOT) was established and in that same year, OakDOT adopted a **Strategic Plan** committed to building better and safer streets, including reviewing speed limits to support safe travel on our roadways and providing safe access to all Oakland schools, with the goal of eliminating traffic deaths and serious injuries.

In 2021, OakDOT led the development of **Safe Oakland Streets**, a citywide initiative in partnership with the City Administrator's Office, Police Department, Department of Race and Equity, and most recently the Fire Department to prevent severe and fatal traffic crashes, eliminate existing injury and fatality inequities, and to take a data-driven and systematic approach to the implementation of safety projects to prevent or mitigate any new adverse equity impacts from arising as a result of the City's efforts.

Focus Areas of Safe Oakland Streets

In the Safe Oakland Streets initiative, Oakland is focusing on six areas of strategy implementation that will save lives and prevent severe injuries: engineering; policy; planning and evaluation; engagement, education, and programs; and enforcement. Together, these strategies will be coordinated and collaborated on by the Safe Oakland Streets interdepartmental team.

Engineering

- Focus project investment in higher priority equity neighborhoods and on the High Injury Network that represents just 6% of Oakland streets that make up 60% of severe and fatal crashes.
- Work in partnership with communities to implement responsive, proactive, and near-term improvements.
- Apply existing tools to increase safety in the highest priority equity neighborhoods through engagement and partnerships.
- Increase the delivery of traffic safety treatments through routine paving projects.

Policy

- Reduce school zone speed limits to 15 mph as allowed by state law.
- Explore re-establishing automated red-light running enforcement with guidance on equity mitigations.
- Advocate for State policy to authorize guidelines for the use of automated speed enforcement and for local speed limit reductions to improve safety.
- Identify and advance policies to expedite the delivery of traffic safety improvements, reflecting the urgency to prevent severe and fatal traffic injuries.

Planning & Evaluation

- Explore data partnerships to supplement police-reported crash data for more comprehensive collision data.
- Provide public-facing tracking of traffic deaths in Oakland for transparent monitoring and accountability.
- Provide public access to stop data via City Open Data platform.

Engagement, Education, & Programs

- Explore how to best engage community members on the comprehensive traffic safety strategies advanced by Oakland, and how to increase resident participation and communications to be more representative and transparent.
- Develop protocols to provide a holistic approach to community safety.
- Partner with community-based organizations to provide traffic safety programs per the Bike & Pedestrian plans.

Enforcment

- Consider complementary strategies to traffic enforcement to achieve traffic safety goals and a culture of safety.
- Collaborate on data sharing across departments to guide traffic enforcement to be more operationally focused and data driven.
- Pilot high visibility enforcement focused on dangerous driving behaviors within the high injury corridors, as feasible.
- Develop guidance for reducing the racial disparity between non-dispatch traffic stops2 and crashes.
- Add focused traffic violations as a special section within the annual OPD Stop Data report.

Current Efforts

Safe street design plays a critical role in encouraging safe traffic behaviors and preventing severe and fatal crashes from happening in the first place. OakDOT prioritizes safety investments on the High Injury Network, areas where severe and fatal crashes are concentrated and in priority equity neighborhoods where communities of color, low-income residents, and other priority populations are concentrated across virtually all our street redesign efforts, including:

1. Capital Improvement Program (CIP): The City's CIP outlines our major capital investments. From a transportation perspective, projects within the CIP are our most transformative projects that can help turn a high injury corridor into a thriving, vibrant place. Projects are ranked based on several factors that the community identified as important, such as equity and safety. The department's **Geographic Equity Toolbox** can be used to cross-reference the priority equity neighborhoods, neighborhoods that experience patterns of displacement and gentrification, neighborhoods that are disproportionately burdened by or vulnerable to multiple sources of pollution, and neighborhoods on or near the High Injury Network.

2. Implementation of the Bicycle and Pedestrian Plans: OakDOT implements the City's **Bicycle** **and** **Pedestrian** **Plans**, using data driven decisions and quality street design to enhance safety. Both plans include specific location and non-specific location guidance for the implementation of proven traffic safety countermeasures ***(Appendix B)***. These countermeasures can also be found in the department's **Crash Prevention Street Design Toolkit** ***(Appendix C)*** and can also be focused on addressing disparities found in the **Citywide Crash Analysis** ***(Appendix D)***.

3. Prioritizing the High Injury Network and High Priority Equity Neighborhoods in the Paving Plan: The **Paving Plan (3 YR; 5 YR)** touches the largest number of High Injury Network miles across the City of Oakland. The Paving Plan prioritizes strategies to reduce racial inequities and streets on the High Injury Network, creating a cost-effective strategy to implement striping improvements that can effectively reduce crashes.

4. School Traffic Safety: OakDOT partners with the Alameda County Transportation Commission (ACTC) to hold around five walk audits per year at schools with the support of a professional engineering team. The recommendations from these walk audits help to build a pipeline of school transportation capital projects. OakDOT also responds to requests from schools on an ongoing basis to encourage safer walking and bicycling to school while accommodating drop-off and pick-up vehicle traffic and minimizing neighborhood impacts. Generally, our toolkit of short-turnaround measures includes signage, pavement markings including crosswalk markings and curb paint, and speedbumps on local, residential streets. In addition, OakDOT manages the School Crossing Guard program, which deploys crossing guards at City elementary schools.

5. 311 Service Requests for Traffic Safety: OakDOT receives over 1,000 traffic safety requests from community members through our **311 system** each year. Requests are evaluated and prioritized based on crash history, equity, and proximity to schools. The service request program implements efficient, effective solutions — typically using traffic signs, pavement markings, and common traffic calming devices like speed bumps — to support safer traffic speeds and lower traffic volumes on specific intersections and street segments.

6. Rapid Response Projects: A Rapid Response is a coordinated OakDOT effort in the days and weeks following a traffic fatality that may include investigations, targeted maintenance, innovative near-term improvements, and the identification and prioritization of longer-term capital needs.

Year 1 of Success

OakDOT continues to focus on project investments, transparency and reporting on engineering solutions in high priority equity neighborhoods, on the high injury network, in school zones, and solutions consistent with the Bike and Pedestrian Plans.

2021 Highlights

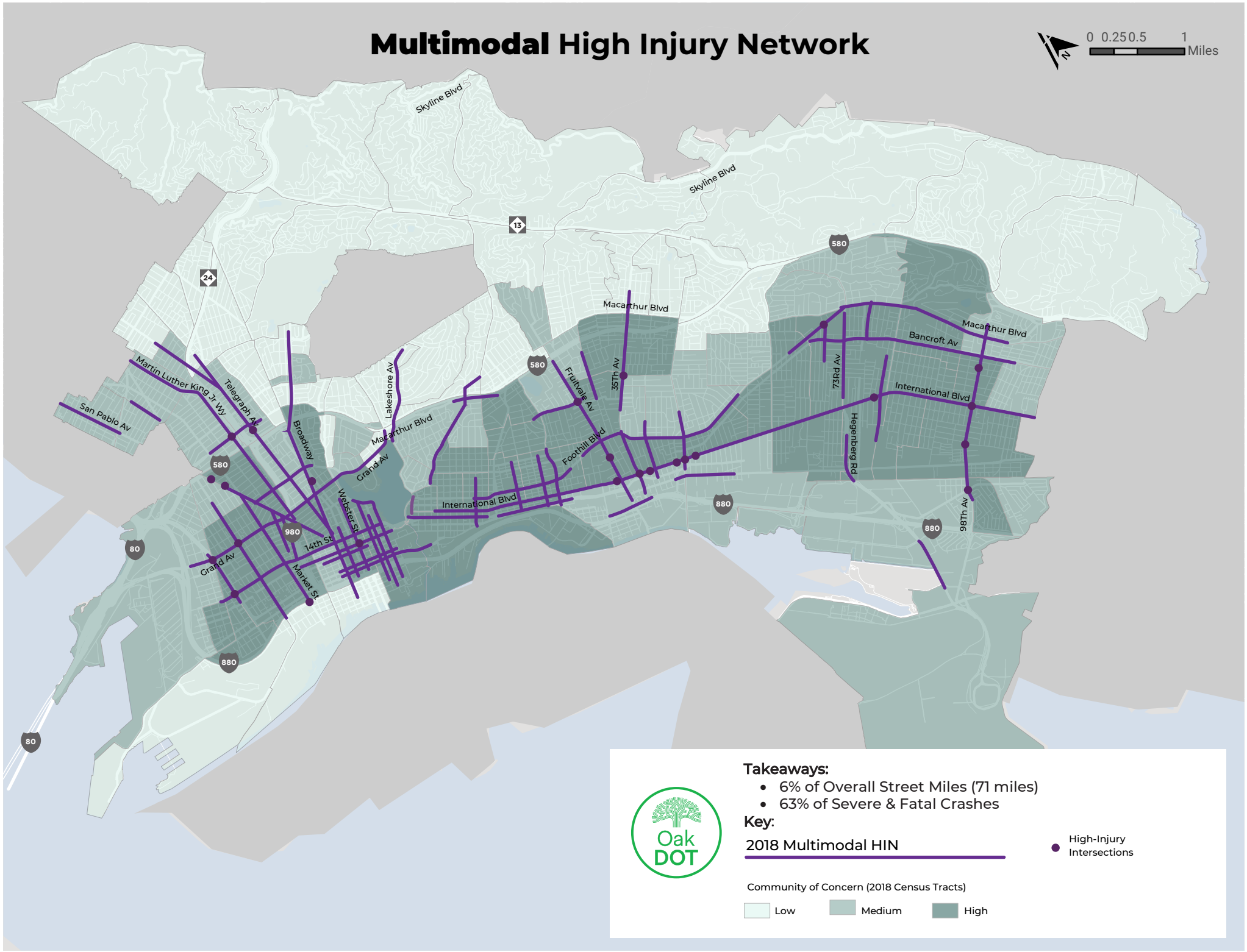
- Approximately **70 traffic safety projects *(Appendix E)*** are currently in the pipeline of OakDOT projects that prioritize addressing traffic safety issues on the High Injury Network, in School Zones, in High Priority Equity Neighborhoods, and/or implement safety strategies in the City's Bike and Pedestrian Plans.
- Delivery of traffic safety treatments increased by leveraging ongoing work to pave and restripe streets via the **3-Year Paving Plan**.
- OakDOT worked to respond to residents' needs during the pandemic by maintaining **Slow Streets-Essential Places** throughout Oakland, transitioning some Essential Places safety improvements from temporary to more durable installations.
- In coordination with state-wide partners, OakDOT aggressively advocated to advance AB 550 (automated speed cameras, did not pass) and **AB 43** (lower speed limits, passed in September 2021).

2021 Highlights (cont.)

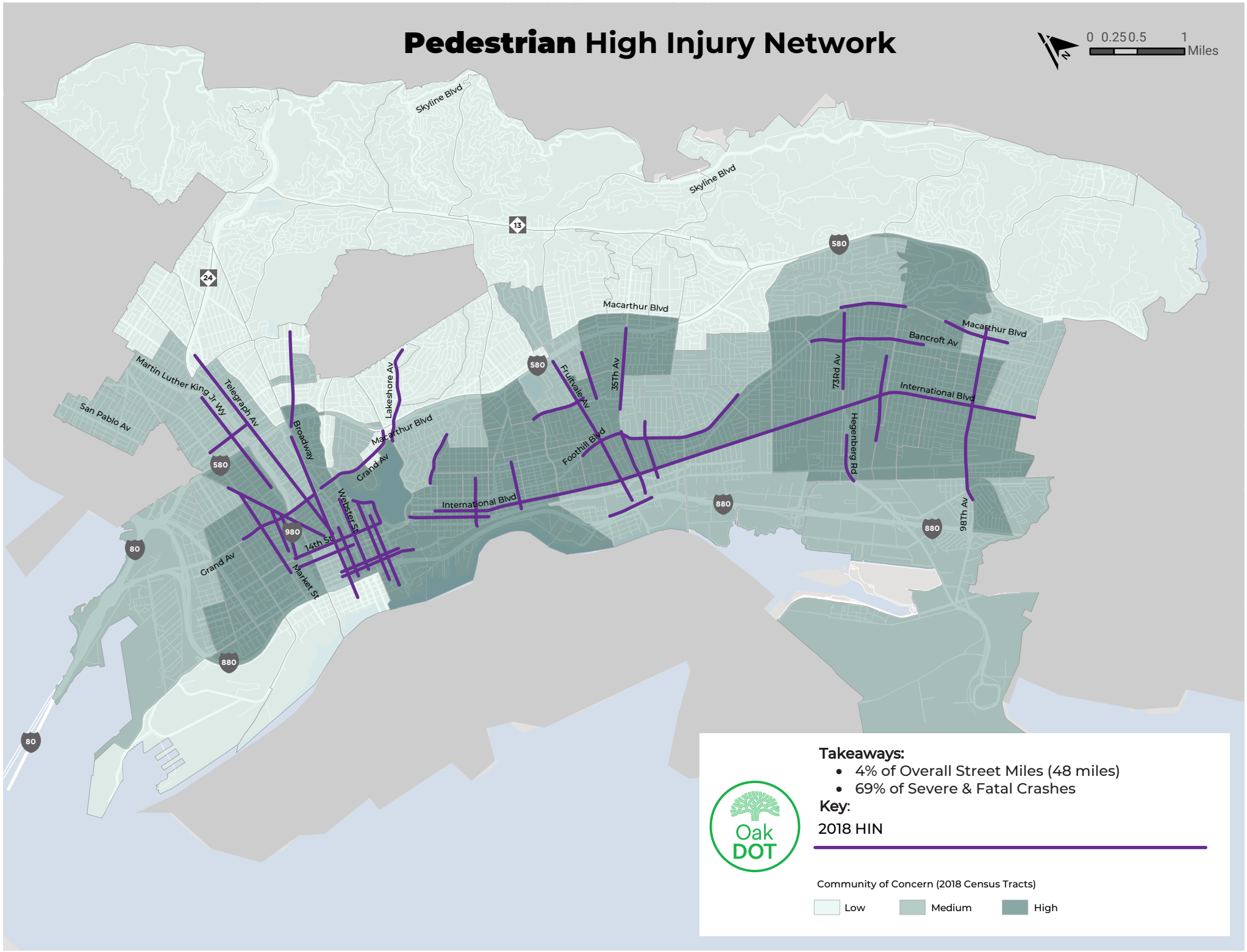
- A **Major Projects Map** was published to the OakDOT website to increase community engagement and support partnerships with developers, other agencies, and advocacy organizations.
- Updated the **traffic safety service request prioritization** approach with more current crash and equity data, expanded data on essential places where more vulnerable populations travel (schools plus senior centers, libraries, transit stops, etc.), and published a **Traffic Safety Requests webpage** to increase transparency.
- Ten **(10) Rapid Response investigations** to severe and fatal crashes – focused on vulnerable road users - were initiated in 2021. To date three locations have resulted in quick build improvements or expedited construction, two designs for improvements are being advanced for installation in 2022, two improvements are being incorporated into forthcoming major capital projects, and one major improvement is recommended to be advanced in the next CIP. OakDOT also upgraded previous work by the Rapid Response Programs with more durable materials.
- OakDOT began **retiming 85 signals** primarily in Oakland's Downtown with **leading pedestrian intervals** – a relatively low-cost treatment that enhances pedestrian visibility, gives people walking priority over turning vehicles, and reduces pedestrian vs. permissive turning vehicle collisions.
- Safe Oakland Streets **– Institute of Transportation Engineers Speed Management Workshop:** Oakland was **one of three cities in California selected** for a two-part Speed Management Workshop led by the Institute of Transportation Engineers and the Vision Zero Network. The workshop was attended by close to 30 participants including City Council staff, staff from OakDOT, the CAO, OPD, DRE, Alameda County Transportation Commission, and the Alameda County Public Health Department, with a welcome by Council President Bas and closing remarks by OakDOT Director Ryan Russo. Participants received an overview of speed management, safe systems, potential impacts of AB 43, engineering solutions, automated enforcement, interactive exercises and worked to conceptualize next steps. This peer learning experience helped advance knowledge and partnerships to implement **Safe Oakland Streets** strategies addressing slower speeds to save lives and address injury inequities.

APPENDIX A: High Injury Network

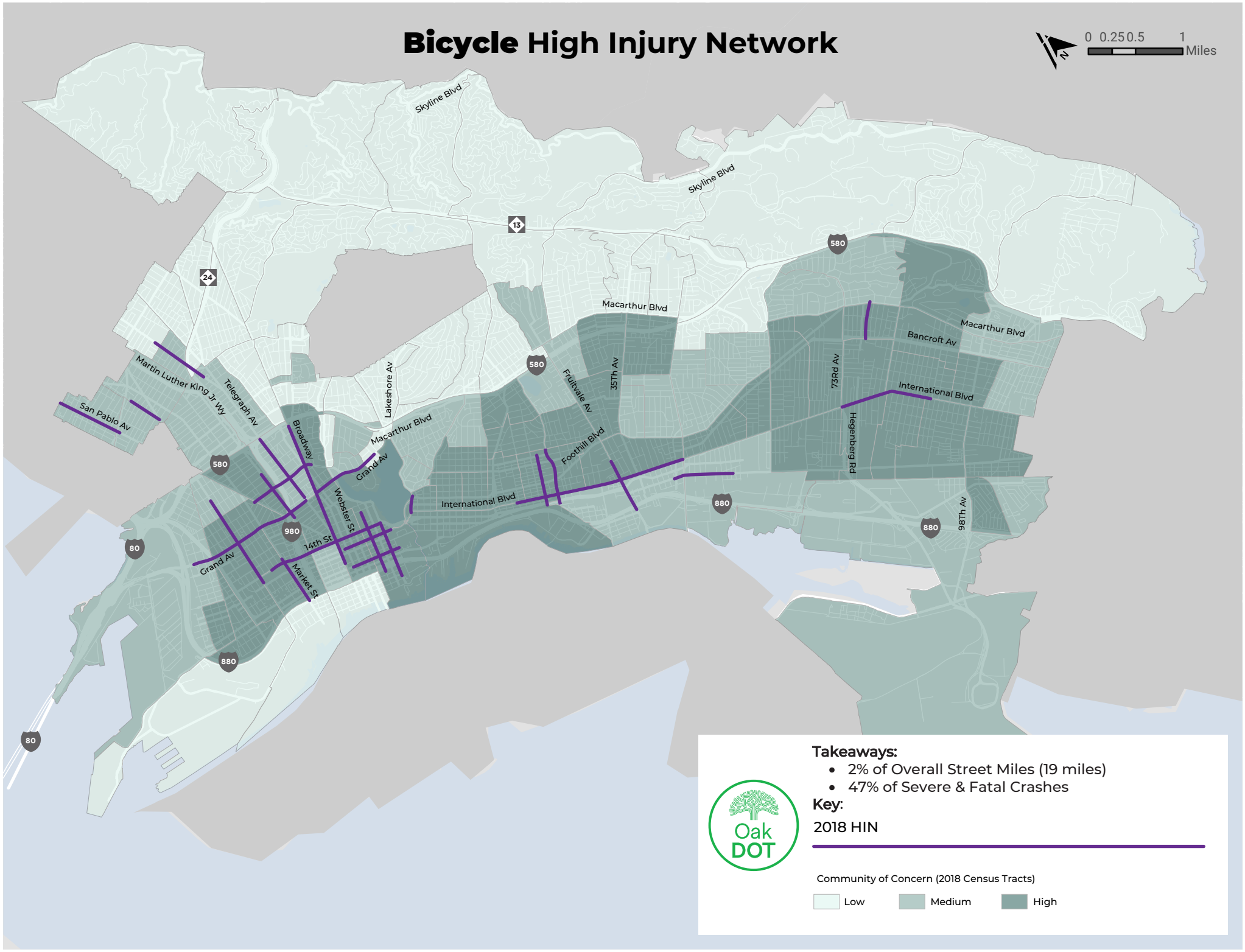
Multimodal High Injury Network



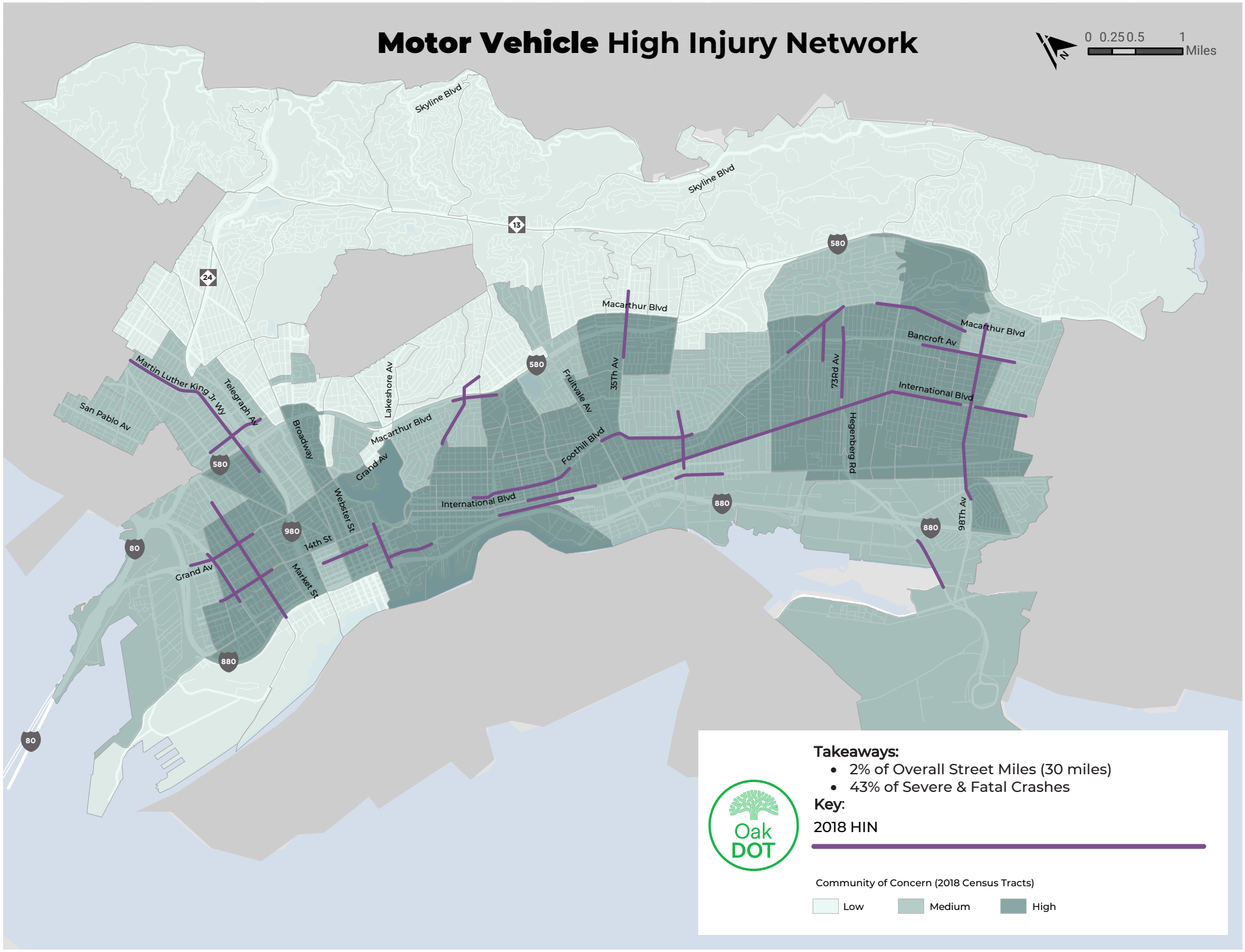
Pedestrian High Injury Network



Bicycle High Injury Network



Motor Vehicle High Injury Network



APPENDIX C: Bike & Pedestrian Plan Countermeasures

Safety Strategy: Improvements and Countermeasures

The high injury corridors and intersections, known as the High Injury Network, were identified using a safety analysis as described in Chapter 6 (Prioritizing Pedestrian Improvements).

The safety strategy identified improvements or countermeasures to increase pedestrian safety at a select number of high injury intersections and high injury corridors. Many of the high injury corridors and intersections were not studied here because they have already received funding for pedestrian improvements - most notably the Bus Rapid Transit project on International Boulevard - while others are part of ongoing planning efforts, such as the Downtown Specific Plan, that will require further coordination or study. City staff will continue to monitor and coordinate pedestrian safety improvements for intersections and corridors that were not included in this safety strategy while those on the list below are implemented. The tables below are divided into three categories:

- Projects included in the safety strategy (B1-B2)
- Projects with associated funding (B3-B4)
- Projects with no associated funding and need for additional analysis and design (B5-B6)

The safety strategy countermeasures that are included in Table B-1 and Table B-2 have associated sheets that describe the locations in more detail. Note that these countermeasures are suggestions for City staff and will be considered according to current and future City policy and practices as well as future projects.

Table B1: Corridors Studied in the Safety Strategy

Street Name	Start	End	Short Term Countermeasures	Long Term Countermeasures	Other Improvements
14TH ST	MYRTLE ST	OAK ST	• At signalized intersections, set pedestrian countdown timers within the CA MUTCD recommended time of 3.5 feet per second • At the 14th Street and Market Street intersection, which is adjacent to the West Oakland Middle School, re-stripe marked crosswalks with high visibility markings • At the 14th Street and Jackson Street and 14th Street and Madison Street intersections, which are adjacent to Little Star Preschool, restripe marked crosswalks with high visibility markings • At the 14th Street and Broadway intersection, shorten signal cycle length • At each intersection, restrict on-street parking within 20-feet of the intersection and marked crosswalks • Implement near-term road diet with signing and pavement markings only to reduce 14th Street from a four-lane street to a two-lane street	• Convert near-term road diet to permanent installation with hardscape sidewalk improvements • At the 14th Street and Market Street, 14th Street and West Street, and 14th Street and Brush Street intersections, extend medians to provide pedestrian refuge islands at marked crosswalks	Awarded Active Transportation Program (ATP) grant in 2016, between Brush Street and Oak Street, resulting in a reduction of travel lanes from four to two lanes, addition of Class IV protected bicycles lanes, improved pedestrian facilities including refuge, market crossings, retimed signals, storm drain gardens, and transit boarding islands

Table B1: Corridors Studied in the Safety Strategy (cont.)

Street Name	Start	End	Short Term Countermeasures	Long Term Countermeasures	Other Improvements
8TH ST	FRANKLIN ST	HARRISON ST	• At the 8th Street and Fallon Street intersection, add a high visibility crosswalk on the north leg and re-stripe marked crosswalk with high visibility markings • At the 8th Street and Fallon Street intersection, install advanced yield signage at each crossing • At signalized intersections, set pedestrian countdown timers within the CA MUTCD recommended time of 3.5 feet per second • At signalized intersections, implement Leading Pedestrian Interval (LPI) • At the 8th Street and Harrison Street and 8th Street and Franklin Street intersections, convert permissive phase to protected phase • At each intersection, restrict on-street parking within 20-feet of the intersection and marked crosswalks • Implement pedestrian safety zones extending from the curb at the 8th Street and Harrison Street and 8th Street and Fallon Street intersections	• At the 8th Street and Harrison Street and 8th Street and Fallon Street intersections, install curb extensions on each corner • Implement road diet to manage vehicle speeds and shorten crossing distance	Highway Safety Improvement Program 2016-Upgraded traffic signals on 8th Street and Madison Street, 8th Street and Oak Street. New bikeway striping, repaved, and new ADA curb ramps along the corridor. Identified in Lake Merritt Station Area Plan as a community priority for two way conversion, or sidewalk extensions. Downtown Plan calls for 2-waying the street with a potential parking protected Class IV bike lane
8TH ST	OAK ST	FALLON ST	• At the 8th Street and Fallon Street intersection, add a high visibility crosswalk on the north leg and re-stripe marked crosswalk with high visibility markings • At the 8th Street and Fallon Street intersection, install advanced yield signage at each crossing • At signalized intersections, set pedestrian countdown timers within the CA MUTCD recommended time of 3.5 feet per second • At signalized intersections, implement Leading Pedestrian Interval (LPI) • At the 8th Street and Harrison Street and 8th Street and Franklin Street intersections, convert permissive phase to protected phase • At each intersection, restrict on-street parking within 20-feet of the intersection and marked crosswalks ($600 per approach) • Implement pedestrian safety zones extending from the curb at the 8th Street and Harrison Street and 8th Street and Fallon Street intersections	• At the 8th Street and Harrison Street and 8th Street and Fallon Street intersections, install curb extensions on each corner • Implement road diet to manage vehicle speeds and shorten crossing distance	Highway Safety Improvement Program 2016-Upgraded traffic signals on 8th Street and Madison Street, 8th Street and Oak Street. New bikeway striping, repaved, and new ADA curb ramps along the corridor. Identified in LMSA Plan as a community priority for two way conversion, or sidewalk extensions. Downtown Plan calls for 2-waying the street with a potential parking protected Class IV bike lane

Table B1: Corridors Studied in the Safety Strategy (cont.)

Street Name	Start	End	Short Term Countermeasures	Long Term Countermeasures	Other Improvements
94TH AVE	CHERRY ST	BURR ST	• At the 94th Avenue and MacArthur Boulevard and 94th Avenue and Thermal Street intersections, install advanced yield signage at marked crosswalks • At the 94th Avenue and Peach Street intersection, add crosswalks across 94th Avenue with in-street "Pedestrian Crossing" signage and advanced yield signage • At the 94th Avenue and MacArthur Boulevard intersection, implement crosswalks and crossing treatments to provide access to transit stops • At the 94th Avenue and Thermal Street intersection, re-stripe marked crosswalks with high visibility markings • At each intersection, restrict on-street parking within 20-feet of the intersection and marked crosswalks • Implement pedestrian safety zones extending from the curb at the 94th Avenue and MacArthur Boulevard intersection	• Extend median to provide refuge island on the north side of the 94th Street and MacArthur Boulevard intersection • Provide raised median/refuge island at the marked crosswalk on the south side of the 94th Avenue and MacArthur Boulevard intersection • Install raised crosswalks at marked crosswalk locations to help improve visibility of marked crosswalks and slow vehicle speeds • At the 94th Avenue and MacArthur Boulevard intersection, install curb extensions on each corner	Proposed Bike Route, and intersection improvements for 94thAvenue and MacArthur Boulevard

Table B1: Corridors Studied in the Safety Strategy (cont.)

Street Name	Start	End	Short Term Countermeasures	Long Term Countermeasures	Other Improvements
9TH ST	FRANKLIN ST	FALLON ST	• At the 9th Street and Alice Street and 9th Street and Fallon Street intersections, install advanced yield signage at marked crosswalks • At the 9th Street and Fallon Street intersection, which is adjacent to Laney College, add a high visibility crosswalk across the north leg of Fallon Street • At the 9th Street and Fallon Street intersection, re-stripe the marked crosswalk on the south leg with high visibility markings • At signalized intersections, set pedestrian countdown timers within the CA MUTCD recommended time of 3.5 feet per second • At the 9th Street and Franklin Street, 9th Street and Webster Street, and 9th Street and Harrison Street intersections, shorten signal cycle length • At each intersection, restrict on-street parking within 20-feet of the intersection and marked crosswalks • Implement near-term road diet with signing and pavement markings only; consider moving on-street parking away from curb to create separated bike facility	•At the 9th Street and Alice Street and 9th Street and Fallon Street intersections, install rectangular rapid flashing beacons (RRFBs) on each crossing • Convert near-term road diet to more permanent installation by providing hardscape sidewalk improvements	New bike lane added between Harrison Street and Fallon Street and stop control added at 9th Street and Alice Street. Downtown is funded for 13 intersections, including signal mast arms, vehicle/ bicycle detection, accessible pedestrian signal upgrade, and other improvements. Identified in Downtown Plan to be a two-way with back in parking
BANCROFT AVE	84TH AVE	98TH AVE	• At the Bancroft Avenue and 86th Avenue, Bancroft Avenue and 87th Avenue, Bancroft Avenue and 88th Avenue, and Bancroft Avenue and 89th Avenue intersections, install in-street “Pedestrian Crossing” signage at marked crosswalks • At the Bancroft Avenue and 86th Avenue, Bancroft Avenue and 87th Avenue, Bancroft Avenue and 88th Avenue, and Bancroft Avenue and 89th Avenue intersections, install advanced yield signage at marked crosswalks • At signalized intersections, implement Leading Pedestrian Interval (LPIs) • At the Bancroft Avenue and 85th Avenue, Bancroft Avenue and 87th Avenue, Bancroft Avenue and 90th Avenue, Bancroft Avenue and 94th Avenue, Bancroft Avenue and 96th Avenue intersections, implement crosswalks and crossing treatments to provide access to transit stops • At the Bancroft Avenue and 98th Avenue intersection, which is adjacent to the E Morris Cox Elementary School, re-stripe marked crosswalks with high visibility markings	• At the Bancroft Avenue and 84th Avenue, Bancroft Avenue and 85th Avenue, Bancroft Avenue and 86th Avenue, Bancroft Avenue and 88th Avenue, Bancroft Avenue and 94th Avenue, and Bancroft Avenue and 96th Avenue intersections, install crosswalks with RRFBs	Highway Safety Improvement Program 2016-Install High Intensity Activated Crosswalks (HAWKs) and RRFBs at eleven locations along the corridor; install signal mast arms at three locations; and install a landscape at the northeast corner of Bancroft Avenue and 67th Street. Corridor improvements from Havenscourt Boulevard to 98th Avenue

Table B1: Corridors Studied in the Safety Strategy (cont.)

Street Name	Start	End	Short Term Countermeasures	Long Term Countermeasures	Other Improvements
BANCROFT AVE	CHURCH ST	80TH AVE	• At the Bancroft Avenue and 78th Avenue and Bancroft Avenue and Ritchie Street intersections, install advanced yield signage at marked crosswalks • At signalized intersections, implement Leading Pedestrian Interval (LPI) • At the Bancroft Avenue and Ritchie Street intersection, implement a crosswalk on the south leg and crossing treatments to provide access to transit stops • At the Bancroft Avenue and 73rd Avenue intersection which is adjacent to Markham Elementary School, re-stripe marked crosswalks with high visibility markings • At the Bancroft Avenue and Ritchie Street and Bancroft Avenue and 78th Avenue intersections, re-stripe high visibility crosswalks • Prohibit right-turn on red at signalized intersections when pedestrian pushbuttons have been pushed	• At uncontrolled marked crosswalks, install RRFBs	Highway Safety Improvement Program 2016-Install HAWKs and RRFBs at eleven locations along the corridor; install signal mast arms at three locations; and install a landscape at the northeast corner of Bancroft and 67th Street. Corridor improvements from Havenscourt to 98th Ave
BROADWAY	9TH ST	11TH	• Convert each intersection to fixed pedestrian recall • At each intersection, set pedestrian countdown timers within the CA MUTCD recommended time of 3.5 feet per second • At each intersection, shorten signal cycle length • At each intersection, implement Leading Pedestrian Interval (LPI) • Implement pedestrian safety zones extending from the curb at each intersection	• At signalized intersections adjust signal timing to separate turning movements from pedestrian crossing phase • Extend median to provide refuge island on the south side of the Broadway and 11th Street intersection • Implement road diet on low volume cross streets1 to shorten pedestrian crossing distances	Pedestrian Improvements funded through the Bus Rapid Transit (BRT). Includes new ADA curb ramps as well as pedestrian access to new stations. Included in downtown Oakland specific plan (Broadway from Embarcadero to 27th Street)
BROADWAY	16TH ST	19TH ST	• Convert each intersection to fixed pedestrian recall • At each intersection, set pedestrian countdown timers within the CA MUTCD recommended time of 3.5 feet per second • At each intersection, shorten signal cycle length • At each intersection, implement Leading Pedestrian Interval (LPI) • Implement pedestrian safety zones extending from the curb at each intersection	• At signalized intersections adjust signal timing to separate turning movements from pedestrian crossing phase • Extend median to provide refuge island on the south side of the Broadway and 11th Street intersection • Implement road diet on low volume cross streets1 to shorten pedestrian crossing distances	Pedestrian Improvements funded through the BRT. Includes new ADA curb ramps as well as pedestrian access to new stations. Included in downtown Oakland specific plan (Broadway from Embarcadero to 27th Street)

Table B1: Corridors Studied in the Safety Strategy (cont.)

Street Name	Start	End	Short Term Countermeasures	Long Term Countermeasures	Other Improvements
E 15TH ST	21ST AVE	26TH AVE	• At the 15th Street and 26th Avenue intersection, add stop sign on southbound approach • At the 15th Street and 23rd Avenue and 15th Street and Miller Avenue intersections, install advanced yield markings to each minor approach • At the 15th Street and 22nd Avenue intersection, which is adjacent to Garfield Elementary School, add high visibility crosswalks with signage and advanced yield markings • Add edgeline markings for street narrowing and parking definition • At each intersection, restrict on-street parking within 20-feet of intersection and marked crosswalks • Implement pedestrian safety zones extending from the curb at the 15th Street and 22nd Avenue intersection	• Implement crossing improvements such as RRFBs, pedestrian refuge island, or high visibility crosswalk at the High Street and 22nd Avenue intersection • At the 15th Street and 22nd Avenue intersection, install curb extensions on each corner	-
FOOTHILL BLVD	45TH AVE	TRASK ST	• Add crossing sign and include directional arrow indicating crossing • At the Foothill Boulevard and 45th Street intersection, upgrade school crossing sign to current standard and include directional arrow indicating crossing • At signalized intersections, set pedestrian countdown timers within the CA MUTCD recommended time of 3.5 feet per second • At the Foothill Boulevard and 45th Avenue, Foothill Boulevard and 46th Avenue, Foothill Boulevard and 50th Avenue, Foothill Boulevard and 51st Avenue, Foothill Boulevard and Congress Avenue, Foothill Boulevard and Belvedere Street, and Foothill Boulevard and Cole Street intersections, install advanced yield markings and advanced pedestrian crosswalk ahead signs across Foothill Boulevard • At the Foothill Boulevard and Vicksburg intersection, re-stripe marked crosswalk on north leg • At the Foothill Boulevard and 47th Street intersection, convert signal from pedestrian actuated to fixed recall for the pedestrian walk phase	• At the Foothill Boulevard and Trask Street intersection, install curb extensions on the northeast, northwest, and southwest corners • At the Foothill Boulevard and 45th Avenue and Foothill Boulevard and 50th Street intersections, install a rectangular rapid flashing beacon and associated school crossing signs	Former Redevelopment Streetscape

Table B1: Corridors Studied in the Safety Strategy (cont.)

Street Name	Start	End	Short Term Countermeasures	Long Term Countermeasures	Other Improvements
GRAND AVE	LAKE PARK AVE	WILDWOOD AVE	• Convert each signalized intersection to fixed pedestrian recall • At signalized intersections, set pedestrian countdown timers within the CA MUTCD recommended time of 3.5 feet per second • At the 2 mid-block crossings located between Grand Avenue and Sunnyslope Avenue and Grand Avenue and Weldon Avenue, add in street "Pedestrian Crossing signage" • At the Grand Avenue and Park View Terrace, Grand Avenue and Elwood Avenue, Grand Avenue and Mandana Boulevard, and Grand Avenue and Boulevard Way intersections, implement crosswalks and crossing treatments to provide access to transit stops • At signalized intersections, implement Leading Pedestrian Interval (LPI) • Implement near-term road diet with signing and pavement markings only from east of the I-580 intersection to Elwood Avenue	• At the mid-block, marked crossing at Grand Avenue and Sunnyslope Avenue, install a rectangular rapid flashing beacon and associated crossing signs • Remove channelized right turn lanes at the Grand Avenue and Santa Clara and the Grand Avenue and Bay Place intersections • Convert near-term road diet to permanent installation by providing hardscape sidewalk improvements • At signalized intersections, adjust signal timing to separate turning movements from pedestrian crossing phase	Grand Avenue Road Diet
GRAND AVE	VALLEY ST	PARK VIEW TERRACE	• Convert each signalized intersection to fixed pedestrian recall • At signalized intersections, set pedestrian countdown timers within the CA MUTCD recommended time of 3.5 feet per second • At the 2 mid-block crossings located between Grand Avenue and Sunnyslope Avenue and Grand Avenue and Weldon Avenue, add in street "Pedestrian Crossing signage" • At the Grand Avenue and Park View Terrace, Grand Avenue and Elwood Avenue, Grand Avenue and Mandana Boulevard, and Grand Avenue and Boulevard Way intersections, implement crosswalks and crossing treatments to provide access to transit stops • At signalized intersections, implement Leading Pedestrian Interval (LPI) • Implement near-term road diet with signing and pavement markings only from east of the I-580 intersection to Elwood Avenue	• At the mid-block, marked crossing at Grand Avenue and Sunnyslope Avenue, install a rectangular rapid flashing beacon and associated crossing signs • Remove channelized right turn lanes at the Grand Avenue and Santa Clara and the Grand Avenue and Bay Place intersections • Convert near-term road diet to permanent installation by providing hardscape sidewalk improvements • At signalized intersections, adjust signal timing to separate turning movements from pedestrian crossing phase	-

Table B1: Corridors Studied in the Safety Strategy (cont.)

Street Name	Start	End	Short Term Countermeasures	Long Term Countermeasures	Other Improvements
HIGH ST	LYON ST	KANSAS ST	• At the High Street and Fleming Avenue, High Street and Penniman Avenue, High Street and Culver Street, and High Street and Kansas Street intersections, install advanced yield signage at marked crosswalks • At the High Street and Culver Street, High Street and Fleming Avenue, and High Street and Kansas Street intersections, implement crosswalks and crossing treatments to provide access to transit stops • At the High Street and Fleming Avenue, High Street and Penniman Avenue, High Street and Culver Street, and High Street and Kansas Street intersections, re-stripe marked uncontrolled crosswalks with high visibility markings • At each intersection, restrict on-street parking within 20-feet	• At each intersection east of the High Street and Masterson Street intersection, install crosswalks with curb ramps in medians • At the High Street and Porter Street intersection, which is adjacent to the Boys and Girls Club, install raised pedestrian crossings • At the High Street and Masterson Street and High Street and Kansas Street intersections, which are adjacent to the St. Lawrence O'Toole Catholic School, install raised pedestrian crossings	Highway Safety Improvement Program 2016-Construct crossing enhancements, signal placement improvements, and new pedestrian signal countdown heads

Table B1: Corridors Studied in the Safety Strategy (cont.)

Street Name	Start	End	Short Term Countermeasures	Long Term Countermeasures	Other Improvements
MACARTHUR BLVD	77TH AVE	83RD AVE	• At the mid-block crossing south of the MacArthur Boulevard and Ritchie Street intersection, add advanced yield markings • At the MacArthur Boulevard and Parker Avenue intersection, consider implementing a crosswalk on the north leg with crossing treatments to provide access to transit stop • At unsignalized intersections, re-stripe marked crosswalks to high visibility crosswalks • Add high visibility crosswalks with signage and advanced yield markings at the MacArthur Boulevard and 83rd Avenue intersection • At signalized intersections, convert permissive phase to protected phase • At each intersection, restrict on-street parking within 20-feet of intersections and mid-block crossings • Implement near-term road diet with signing and pavement markings only north of MacArthur Boulevard and 83rd Street	• Install continuous median with pedestrian refuge islands • Convert near-term road diet to more permanent installation by providing hardscape sidewalk improvements	Former Redevelopment Streetscape
BRUSH ST	12TH ST	14TH ST	• At the Brush Street and 12th Street intersection, add "Pedestrian Crossing Prohibited" signage at the north side of Brush Street • At the Brush Street and 14th Street intersection, replace pedestrian countdown timer on northwest corner • At signalized intersections, re-stripe marked crosswalks for general maintenance • At the Brush Street and 12th Street intersection, implement Leading Pedestrian Interval (LPI) • At each intersection, restrict on-street parking within 20-feet of intersection and marked crosswalks • Implement pedestrian safety zones extending from the curb at the Brush Street and 12th Street and Brush Street and 14th Street intersections	• Implement road diet along Brush Street; would need to extend beyond the limits of 12th and 14th Streets • At the Brush Street and 12th Street and Brush Street and 14th Street intersections, install curb extensions on each corner • At the Brush Street and 14th Street intersection, adjust signal timing to separate turning movements from pedestrian phase crossing	Combined intersections to make a corridor

Table B1: Corridors Studied in the Safety Strategy (cont.)

Street Name	Start	End	Short Term Countermeasures	Long Term Countermeasures	Other Improvements
73RD AVE	BANCROFT AVE	HILLSIDE ST	• At signalized intersections, set pedestrian countdown timers within the CA MUTCD recommended time of 3.5 feet per second ($8,000 per intersection) • Implement crosswalks and crossing treatments to provide access to transit stops at the 73rd Avenue and Bancroft Avenue, 73rd Avenue and Garfield Avenue and 73rd Avenue and Hillside Street intersections ($2,500 per crosswalk) • At each signalized intersections, implement Leading Pedestrian Interval (LPI) ($2,000 per intersection) • Implement near-term road diet, with signing and pavement markings only to reduce 73rd Avenue from a six-lane street to a four-lane or three-lane street ($30,000 per mile)	• Install high visibility crosswalk across 73rd Avenue and Hillside Street including crossing treatments such as advanced yield markings, advanced warning signs, and rectangular rapid flashing beacon ($34,300 per crossing) • Extend medians at marked crosswalks to provide refuge island ($25,000 per island) • Re-design the right-turn movement at 73rd Avenue and MacArthur Boulevard to remove the lane add so the right-turn movement is not a free movement • Convert near-term road diet to permanent installation with hardscape sidewalk improvements ($150,000 per mile) • At signalized intersections, adjust signal timing to separate turning movements from pedestrian crossing phase ($30,000 per intersection)	Combined intersections to make a corridor

Table B2: Intersections Studied in the Safety Strategy

Street 1	Street 2	Short Term Countermeasures	Long Term Countermeasures	Other Improvements
7TH ST	HARRISON ST	• Install pedestrian countdown timers at each crossing • Install pedestrian activation buttons at each crossing • Implement Leading Pedestrian Interval (LPI) at each crossing • Integrate protected northbound right turn phase		High Safety Improvement Program -2016-Construct safety improvements at 13 intersections, including signal mast arms, vehicle/bicycle detection, accessible pedestrian signal upgrade, and other improvements
8TH ST	MARKET ST	• Restripe each crosswalk • Install pedestrian countdown timers at each crossing • Install pedestrian activation buttons at each corner • Convert each device to fixed pedestrian recall • Implement pedestrian safety zones extending from the curb at the intersection	• Add lighting for crosswalks across Market St • Convert eastbound and westbound left-turn phase to protected left-turn phase • Extend medians to create pedestrian refuge islands on north and south legs • Install curb extensions on each corner	
GRAND AVE	STATEN AVE	• Re-stripe each marked crosswalk • Install pedestrian countdown timers at each crossing • Implement Leading Pedestrian Interval (LPI) at each crossing • Prohibit right turn on red on each approach	• Convert eastbound and westbound permissive left turn phase to protected left turn phase • Integrate eastbound and westbound protected right turn phase	
HIGH ST	SAN LEANDRO ST	• Remove “Sidewalk Closed” sign on northeast approach • Prohibit right turn on red on each approach • Install pedestrian activation buttons on each corner except southwest ($8,000 per intersection) • Implement Leading Pedestrian Interval (LPI) at each crossing	• Resurface intersection pavement • Construct sidewalk on north-westbound approach • Reconstruct intersection to accommodate heavy vehicles while providing pedestrian crossing treatments	

Table B3: High Injury Corridors with Associated Funding

Street Name	Start	End	Funding Source/Plan	Treatment
12TH ST	JEFFERSON ST	OAK ST	AC Transit Bus Rapid Transit	Pedestrian Improvements included as part of East Bay Bus Rapid Transit
14TH ST	MYRTLE ST	OAK ST	Funded by Active Transportation Program (ATP) 2016	Awarded ATP grant in 2016, between Brush Street and Oak Street, resulting in a reduction of travel lanes from four to two lanes, additional of Class IV protected bicycles lanes, improved pedestrian facilities including refuges, market crossings, and retimed signals, storm drain gardens, and transit boarding islands
8TH ST	FRANKLIN ST	FALLON ST	High Safety Improvement Program (2013)	Upgraded traffic signals on 8th Street and Madison Street, 8th Street and Oak Street. New bikeway striping, repaved, and new ADA curb ramps along the corridor. Identified in LMSA Plan as a community priority for two way conversion, or sidewalk extensions. Downtown Plan calls for 2-wayng the street with a potential parking protected Class IV bike lane
98TH AVE	A ST	MACARTHUR BLVD	High Safety Improvement Program (2012)	98th Avenue Corridor (including intersections with MacArthur Boulevard, Bancroft Avenue, Sunnyside Street, Holly Street, International Boulevard, D Street, E Street, Medford Avenue, San Leandro Street, Pippin Street, Walter Avenue. and Edes Avenue, Install advanced "dilemma zone" detection, crosswalks, speed feedback signs; construct bulb-outs
BANCROFT AVE	CHURCH ST	HAVENSCOURT BLVD	High Safety Improvement Program (2016)	Install HAWKs and RRFBs at eleven locations along the corridor; install signal mast arms at three locations; and install a landscape at the northeast corner of Bancroft and 67th Street. Corridor improvements from Havenscourt to 98th Ave
BROADWAY	9TH ST	19TH ST	AC Transit's East Bay Bus Rapid Transit (BRT)	Pedestrian Improvements funded through the BRT. Includes new ADA curb ramps as well as pedestrian access to new stations. Included in downtown Oakland specific plan (Broadway from Embarcadero to 27th Street). Specific sections included in safety strategy
FOOTHILL BLVD	RUTHERFORD ST	40TH AVE	Former Redevelopment Streetscape	Partially funded. Streetscape improvements funded through Redevelopment, from Mitchell Street to Rutherford Street
FOOTHILL BLVD	51ST AVE	SEMINARY AVE	Former Redevelopment Streetscape	Partially included in the safety strategy, unfunded from Trask St to Seminary Ave

Table B3: High Injury Corridors with Associated Funding (cont.)

Street Name	Start	End	Funding Source/Plan	Treatment
FRUITVALE AVE	ALAMEDA AVE	E 16TH ST	High Safety Improvement Program (2016), Safe Routes to School, Measure B	Fruitvale Alive Project, widened sidewalks, high visibility crosswalks, bulbouts, improved pavement, lighting, and pedestrian signal upgrades
GRAND AVE	LAKE PARK AVE	OAKLAND AVE	High Safety Improvement Program (2013)	Grand Avenue Road Diet, (Grand Avenue from Jean Street to Oakland Avenue is in Piedmont)
INTERNATIONAL BLVD	HIGH ST	56TH AVE	East Bay Bus Rapid Transit	Pedestrian Improvements included as part of East Bay Bus Rapid Transit
INTERNATIONAL BLVD	16TH AVE	28TH AVE	East Bay Bus Rapid Transit	Pedestrian Improvements included as part of East Bay Bus Rapid Transit
INTERNATIONAL BLVD	73RD AVE	91ST AVE	East Bay Bus Rapid Transit	Pedestrian Improvements included as part of East Bay Bus Rapid Transit
INTERNATIONAL BLVD	1ST AVE	12TH AVE	East Bay Bus Rapid Transit	Pedestrian Improvements included as part of East Bay Bus Rapid Transit
INTERNATIONAL BLVD	95TH AVE	DURANT AVE	East Bay Bus Rapid Transit	Pedestrian Improvements included as part of East Bay Bus Rapid Transit
INTERNATIONAL BLVD	HIGH ST	FRUITVALE AVE	East Bay Bus Rapid Transit	Pedestrian Improvements included as part of East Bay Bus Rapid Transit
MACARTHUR BLVD	FOOTHILL BLVD	82ND AVE	Former Redevelopment Streetscape	Streetscape which included bulbouts, ADA curbramps, and high visibility crosswalks from Foothill Boulevard to 77th Avenue. Included in pedestrian safety strategy from 77th Avenue to 83rd Avenue
MARTIN LUTHER KING JR WAY	29TH ST	40TH ST	-	Road Diet, on Martin Luther King Jr Way from West Grand Avenue to 40th Street

Table B3: High Injury Corridors with Associated Funding (cont.)

Street Name	Start	End	Funding Source/Plan	Treatment
SHATTUCK AVE	45TH ST	55TH ST	High Safety Improvement Program (2015)	Bike lanes, potential plaza on 45th and Shattuck
TELEGRAPH AVE	WILLIAM ST	27TH ST	Active Transportation Program, High Safety Improvement Program (2015)	ATP: This project is located along Telegraph Avenue, between 20th Street and 38th Street. Project will construct pedestrian and bicycle safety enhancements, including Class II bicycle lanes, median refuge islands, pedestrian crossing beacons, traffic signal upgrades, and transit boarding islands
TELEGRAPH AVE	30TH ST	51ST ST	Active Transportation Program, Highway Safety Improvement Program (2015)	ATP: This project is located along Telegraph Avenue, between 20th Street and 38th Street. Project will construct pedestrian and bicycle safety enhancements, including Class II bicycle lanes, median refuge islands, pedestrian crossing beacons, traffic signal upgrades, and transit boarding islands. HSIP: Stripe and sign road diet with buffered bike lanes between 29th and 41st Sts; install signal modifications at 29th and 45th Sts; install uncontrolled crosswalk enhancements, painted bulb-outs, and painted median refuges
TELEGRAPH AVE	WILLIAM ST	BROADWAY	Some Measure B funding, Alameda County Transportation Commission (ACTC) and Housing and Community Development (HCD) funds, Transportation Services Division (TSD) and paving program funds	Completed as part of Latham and complete streets work, Intersection of Telegraph and 17th is not funded

Table B4: High Injury Intersections with Associated Funding

Street 1	Street 2	Funding Source	Treatment
14TH ST	MARKET ST	High Safety Improvement Program (2015)	Install uncontrolled crosswalk enhancements, such as RRFBs, ladder striping, raised bulb-outs, and raised median refuges at multiple locations
21ST AVE	INTERNATIONAL BLVD	East Bay Bus Rapid Transit	Pedestrian Improvements included as part of East Bay Bus Rapid Transit
24TH ST	BROADWAY	Improvement by private developer	RRFP installed
29TH ST	TELEGRAPH AVE	Active Transportation Program, High Safety Improvement Program (2015)	This project is located along Telegraph Avenue, between 20th Street and 38th Street. Project will construct pedestrian and bicycle safety enhancements, including Class II bicycle lanes, median refuge islands, pedestrian crossing beacons, traffic signal upgrades, and transit boarding islands
33RD AVE	FOOTHILL BLVD	Redevelopment/One Bay Area Grant (OBAG)	Streetscape project
34TH ST	MARTIN LUTHER KING JR WAY	Redevelopment/OBAG	Martin Luther King Jr. Way streetscape project & road diet
34TH ST	SAN PABLO AVE	High Safety Improvement Program (2011)	RRFB's and other crossing improvements at 32nd Street/Brockhurst Sreet/34th Street at San Pablo
35TH AVE	INTERNATIONAL BLVD	East Bay Bus Rapid Transit	Pedestrian Improvements included as part of East Bay Bus Rapid Transit

Table B4: High Injury Intersections with Associated Funding (cont.)

Street 1	Street 2	Funding Source	Treatment
37TH ST	TELEGRAPH AVE	Active Transportation Program, High Safety Improvement Program (2015)	ATP: This project is located along Telegraph Avenue, between 20th Street and 38th Street. Project will construct pedestrian and bicycle safety enhancements, including Class II bicycle lanes, median refuge islands, pedestrian crossing beacons, traffic signal upgrades, and transit boarding islands
52ND AVE	INTERNATIONAL BLVD	East Bay Bus Rapid Transit	Pedestrian improvements included as part of East Bay Bus Rapid Transit
5TH AVE	INTERNATIONAL BLVD	East Bay Bus Rapid Transit	Pedestrian Improvements included as part of East Bay Bus Rapid Transit
76TH AVE	MACARTHUR BLVD	Redevelopment/OBAG	Recent streetscape work on MacArthur Blvd as part of streetscape
80TH AVE	INTERNATIONAL BLVD	East Bay Bus Rapid Transit	Pedestrian Improvements included as part of East Bay Bus Rapid Transit
83RD AVE	INTERNATIONAL BLVD	East Bay Bus Rapid Transit	Pedestrian Improvements included as part of East Bay Bus Rapid Transit
84TH AVE	INTERNATIONAL BLVD	East Bay Bus Rapid Transit	Pedestrian Improvements included as part of East Bay Bus Rapid Transit

Table B4: High Injury Intersections with Associated Funding (cont.)

Street 1	Street 2	Funding Source	Treatment
90TH AVE	INTERNATIONAL BLVD	East Bay Bus Rapid Transit	Pedestrian Improvements included as part of East Bay Bus Rapid Transit
98TH AVE	CHERRY ST	-	Paving/complete streets project in process, plus RRFB installed as SRTS in 2015
98TH AVE	INTERNATIONAL BLVD	East Bay Bus Rapid Transit	Pedestrian Improvements included as part of East Bay Bus Rapid Transit
9TH ST	MADISON ST	-	Lake Merritt BART Bikeways; road diet on Madison Street, also included in corridor study
E 16TH ST	FRUITVALE AVE	High Safety Improvement Program (2016)	RRFB installed as SRTS project 2015 install new Class II bicycle lanes, enhanced safety features at pedestrian crossings, and a new protected left turn phase at Foothill Boulevard
E 19TH ST	FRUITVALE AVE	High Safety Improvement Program (2016)	RRFB installed as SRTS project 2015 install new Class II bicycle lanes, enhanced safety features at pedestrian crossings, and a new protected left turn phase at Foothill Boulevard
GRAND AVE	HARRISON ST	Measure DD	Lakeside Green Streets project

Table B4: High Injury Intersections with Associated Funding (cont.)

Street 1	Street 2	Funding Source	Treatment
MACARTHUR BLVD	MARTIN LUTHER KING JR WAY	-	Streetscape project as part of MacArthur Transit Hub
SAN PABLO AVE	W GRAND AVE	High Safety Improvement Program (2011)	Install protected left-turn phasing; modify intersection

Table B5: High Injury Corridors with No Associated Funding

Street Name	Start	End	Comments
7TH ST	WASHINGTON ST	7TH ST BRIDGE	Currently studied as part of the Lake Merritt Station Area Plan, Downtown Specific Plan, and Freeway Circulation Plan. Improvements from E7th Street East of Fallon to Bridge includes reducing three right turn lanes to two right-turn lanes, an expanded median island for a pedestrian refuge, enhanced pedestrian crosswalks, and signalized midblock crosswalks. Class II bike lane added. As part of the Downtown Specific Plan, 7th Street between Fallon and Castro is identified as a street for improvements, including conversion to a two-way. The Alameda Access Project Study, currently in environmental phase, is also looking at 7th Street from Adeline Street to Fallon Street
8TH ST	FRANKLIN ST	FALLON ST	Upgraded traffic signals on 8th Street and Madison Street, 8th Street and Oak Street. New bikeway striping, repaved, and new ADA curb ramps along the corridor. Identified in LMSA Plan as a community priority for two way conversion, or sidewalk extensions. Downtown Plan calls for 2-waying the street with a potential parking protected Class IV bike lane
FOOTHILL BLVD	RUTHERFORD ST	MITCHELL ST	Partially funded. Streetscape improvements funded through Redevelopment, from Rutherford to High St
FOOTHILL BLVD	TRASK ST	SEMINARY AVE	Partially included in the safety strategy. Unfunded from Trask St to Seminary Ave
HEGENBERGER RD	HEGENBER PL	HEGENBERGER LP	Identified in 2016 using 2014 data
MARTIN LUTHER KING JR WAY	40TH ST	44TH ST	Identified in 2016 using 2014 data
PIEDMONT AVE	WARREN AVE	ENTRADA AVE	Identified in 2016 using 2014 data
TELEGRAPH AVE	51ST ST	SR 24	To be studied as part of Phase II of Telegraph Avenue Complete Streets Plan
14TH ST	MYRTLE ST	BRUSH ST	-

Table B6: High Injury Intersections with No Associated Funding

STREET 1	STREET 2	Comments
27TH ST	BROADWAY	Developer proposing a bulbout on the SE side of Broadway and 27th. Rest of intersection remains unfunded
48TH ST	TELEGRAPH AVE	Phase II of Telegraph Avenue Complete Streets Plan
51ST ST	TELEGRAPH AVE	Phase II of Telegraph Avenue Complete Streets Plan
17TH ST	TELEGRAPH AVE	-
BRUSH ST	W GRAND AVE	-
COOLIDGE AVE	SCHOOL ST	-
E 27TH ST	FRUITVALE AVE	-

Pedestrian Safety Solutions Toolbox

Signalized Intersections

PROTECTED RIGHT TURN PHASE

Magnitude Cost: $3,000 – 5,000[3]

Protected right turn phases may be used where vehicle and pedestrian volumes are high to separate the two conflicting movements.

Portland, OR

Benefits

- Reduces conflicts and collisions between right-turning motorists and pedestrians.

Constraints

- Increases pedestrian wait time at crossings
- Requires right-turn only lane.

Typical Applications

- Signalized intersections where high right-turning vehicle movements and high volumes of crossing pedestrians.
- Locations with a documented history of right-turning vehicle and pedestrian conflicts or collisions.

Design Considerations

- Protected right turn phases could be considered where:
  - There is inadequate sight distance for pedestrians and vehicles to see each other - inadequate sight distance means insufficient stopping sight distance for motorists and/or pedestrians do not have sufficient line of sight to judge a safe gap to cross based on prevailing vehicle speeds;
  - Geometric or operational characteristics may result in unexpected conflicts;
  - There are an unacceptable number of pedestrian conflicts with right-turn movements;
  - Heavy pedestrian volumes; and
  - Heavy right-turning vehicle volumes.

Additional Guidance

- *California Manual on Uniform Traffic Control Devices*

Pedestrian Safety Solutions Toolbox

Signalized Intersections

MODIFY SIGNAL TIMING

Magnitude Cost: $1,000 – $3,500 (per intersection)[4]

OC&E Trail, *Klamath Falls, OR*

Adjusting existing signal timings to better accommodate pedestrians. This could include reducing the amount of vehicular green time to decrease pedestrian wait time at signals.

Benefits

- Provides additional crossing times and reducing wait times.
- Can be used to manage vehicle speeds along a corridor.

Constraints

- Improving conditions for one mode is often done at the expense of others (e.g. increased delay).

Typical Applications

- Signalized intersections where pedestrian cross times are inadequate for pedestrian volumes.
- Locations with a documented crash history of pedestrians frequently crossing against the signal.
- Along a corridor signal timing could be modified to help manage vehicle speeds – e.g., establishing progression for a vehicle speed of 13 mph.

Design Considerations

- Allow pedestrians sufficient time to cross the street, including seniors, children, and people with disabilities.
- A walking speed of 3.5 feet per second should be used to calculate the minimum pedestrian clearance interval (flashing red hand plus yellow and any all-red phases).
- Where pedestrians walk slower than 3.5 feet per second, or pedestrians who use wheelchairs routinely use the crosswalk, consider a walking speed of less than 3.5 feet per second.
- Provide a walk interval at least 7 seconds long to allow time for a pedestrian to leave the curb or shoulder before the clearance time begins.

Additional Guidance

- *California Manual on Uniform Traffic Control Devices*
- NACTO *Urban Street Design Guide*

Pedestrian Safety Solutions Toolbox
Signalized Intersections

CONVERT PERMISSIVE PHASE TO PROTECTED OR PROTECTED/PERMISSIVE PHASING

Magnitude Cost: $3,000 - $5,000[5]

Adjust signal phasing to allow left-turning vehicles a protected or protected/permissive left-turn phase instead of a permissive phase.

Benefits

- Reduce left-turning conflicts with pedestrians and vehicles
- Improve vehicle turning-related safety for pedestrians and improve safety for left-turning motorists.
- Improve left-turning operations

Constraints

- Less green time for through and right turn movements
- Less green time for pedestrian crossings

Typical Applications

- Signalized intersections where left-turning vehicle-pedestrian crashes are frequent.
- Signalized intersections where left-turning vehicles and pedestrians have frequent conflicts.

Design Considerations

- Consider protected or protected/permissive phasing at intersections with a history of left-turning collisions, where pedestrian-vehicle turning conflicts are high, and intersections with large skews.

Additional Guidance

- *California Manual on Uniform Traffic Control Devices*
- *NCHRP Report 617: Accident Modification Factors for Traffic Engineering and ITS Improvements*
- FHWA *Toolbox of Countermeasures and Their Potential Effectiveness for Pedestrian Crashes*
- NACTO *Urban Street Design Guide*

Pedestrian Safety Solutions Toolbox

Signalized Intersections

INSTALL PEDESTRIAN COUNTDOWN TIMERS

Magnitude Cost: $300 - $1,000 (per device)[6]

Static Walk/Don't Walk pedestrian signals with countdown signal informing pedestrians of the time remaining to cross the street.

Orlando, FL

Benefits

- Fewer pedestrians cross the street late in the countdown as compared to signal heads with only the Flashing Don't Walk light

Constraints

- Typically a network-wide or subarea wide treatment to create consistency for road-users, but it expensive to implement throughout an area

Typical Applications

- Signalized intersections
- Particularly useful to pedestrians for longer distance crossings so pedestrians know how much time remains before signal changes
- May be useful where crash or conflict patterns indicate pedestrians cross frequently against the signal

Design Considerations

- Countdown pedestrian signals are particularly suitable for crosswalks where the pedestrian change interval is more than 7 seconds to inform pedestrians of the number of seconds remaining in interval.
- Where they are installed, push buttons to activate the pedestrian signal should be easily accessible by pedestrians, wheelchair users, and bicyclists for each crossing.

Additional Guidance

- *California Manual on Uniform Traffic Control Devices*
- NACTO *Urban Street Design Guide*

Pedestrian Safety Solutions Toolbox

Signalized Intersections

IMPLEMENT LEADING PEDESTRIAN INTERVAL (LPI)

Magnitude Cost: $1,000 - $2,000[7]


Orlando, FL


Sacramento, CA

A leading pedestrian interval gives pedestrians a 2-5 second head start before the concurrent vehicle phase turns green to allow pedestrians to enter and occupy the crosswalk before turning vehicles get there.

Benefits

- Pedestrians are more visible in the crosswalk before vehicles start moving.
- Helps reduce conflicts with pedestrians and turning vehicles.
- Relatively low cost to implement

Constraints

- Reduces green time for vehicle movements.
- May add to delays at intersections operating near capacity.

Typical Applications

- Intersections where frequent turning vehicle movements make pedestrian crossing movements uncomfortable.
- Intersections with a documented history of turning movement-related vehicle-pedestrian crashes.

Design Considerations

- The leading pedestrian interval should give a minimum head start of 3-7 seconds depending on crossing distance.
- May be combined with a curb extension to improve visibility at high-conflict intersections.

Additional Guidance

- *California Manual on Uniform Traffic Control Devices*
- ITE *Traffic Engineering Handbook*
- ITE/FHWA *Traffic Calming: State of the Practice*
- NACTO *Urban Street Design Guide*

Pedestrian Safety Solutions Toolbox

Signalized Intersections

IMPLEMENT FLASHING YELLOW ARROW (FYA)

Magnitude Cost: $7,500[8]

A flashing yellow arrow with a leading pedestrian interval gives pedestrians a 2-5 second period when vehicles may turn if no conflicts are present but must yield to crossing pedestrians.

Portland, OR

Benefits

- Intended to communicate to motorists that caution should be used in making maneuver and motorists must yield to oncoming vehicles and crossing pedestrians
- Relatively low cost to implement

Constraints

- Reduces green time for vehicle movements.
- May add to delays at intersections operating near capacity.
- Does not provide a protected head start for pedestrians

Typical Applications

- Intersections where frequent turning vehicle movements make pedestrian crossing movements uncomfortable.
- Intersections with a documented history of turning movement-related vehicle-pedestrian crashes.

Design Considerations

- The FYA leading pedestrian interval should give a minimum head start of 3-7 seconds depending on crossing distance.
- May be combined with a curb extension to improve visibility of and for pedestrians.

Additional Guidance

- *California Manual on Uniform Traffic Control Devices*
- *Improved Pedestrian Safety at Signalized Intersections Operating the Flashing Yellow Arrow*

Pedestrian Safety Solutions Toolbox

Marked Uncontrolled Crosswalks at Two-Way Stop-Controlled Locations

INSTALL RAISED INTERSECTION/PEDESTRIAN CROSSING ★

Magnitude Cost: $10,000 – $50,000 (per crossing/intersection)[9]

A pedestrian crossing or intersection area raised vertically to give motorists and pedestrians a better view of the crossing area. A raised crosswalk is essentially a speed table marked and signed for pedestrian crossing.

Benefits

- Increases visibility of pedestrians by motorists
- Slows motorists' travel speeds

Constraints

- Can be difficult to navigate for large trucks and buses.
- May present drainage challenges
- Emergency response times may be increased

Typical Applications

- Two-lane roadways where pedestrians volumes are high (greater than 50 pedestrians per hour) and vehicle speed control is needed.
- Locations where low-volume streets intersect with high-volume streets or where a street changes its street type or functions.
- Locations where conflict and/or crash patterns reflect vehicle-pedestrian crashes due to unsafe speeds and failure to yield to pedestrians.

Design Considerations

- Locate raised intersection/crossings where vehicles have adequate stopping sight distance to see and slow. Consider nighttime visibility.
- Challenging locations for raised crosswalks include designated transit routes or at locations with steep grades or sharp curves.
- Raised crosswalks should be long enough to allow a passenger vehicle's front and rear wheels to be on top of the table at the same time. Average wheelbase for passenger vehicles is about 9 feet.[10]
- Consider drainage patterns resulting from installation and consider impacts on emergency response times.

Additional Guidance

- ITE/FHWA *Traffic Calming: State of the Practice*
- *California Manual on Uniform Traffic Control Devices*
- NACTO *Urban Street Design Guide*

Pedestrian Safety Solutions Toolbox

Marked Uncontrolled Crosswalks at Two-Way Stop-Controlled Locations

INSTALL RAISED MEDIAN/REFUGE ISLANDS

Magnitude Cost: $15,000 – 25,000 (per island)[11]

Provides a raised refuge area in the median for pedestrians to stop while crossing the street. Can also help narrow roadway cross-section to slow vehicle speeds.

Benefits

- Creates possibility of two-stage crossings for pedestrians
- Can be used as a gateway to high pedestrian activity
- Can be used to help slow vehicle speeds

Constraints

- Must have at least 6 feet of space to accommodate wheelchairs; not all streets will have adequate space
- Physical barrier in the street

Typical Applications

- Intersections where:
  - pedestrians volumes are greater than 20 pedestrians per hour;
  - vehicle ADT volumes are greater than 12,000; and,
  - sufficient width to provide a refuge (minimum of 6 feet).
- Locations with a high frequency of pedestrian crashes.
- Locations with long blocks and vehicle speeds are higher than desired or posted.
- Multilane roadways with pedestrian crossing needs

Design Considerations

- Raised median/refuge island should be located in places where pedestrians commonly cross (e.g., transit stops, schools, etc.)
- Can be located at intersection crossings as well as midblock crossings

Additional Guidance

- *California Manual on Uniform Traffic Control Devices*

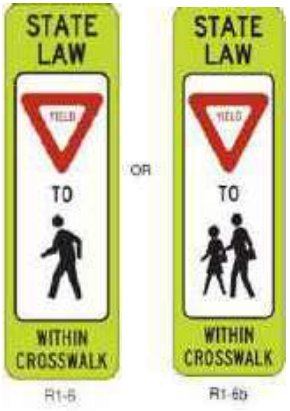
Pedestrian Safety Solutions Toolbox

Marked Uncontrolled Crosswalks at Two-Way Stop-Controlled Locations

INSTALL IN-STREET "YIELD FOR PEDESTRIANS" SIGNS ★

Magnitude Cost: $800 (per crossing)[12]

Signs placed in the middle of opposing travel lanes to increase driver awareness of pedestrians and the legal responsibility to yield right-of-way to pedestrians in the crosswalk.



Benefits

- Increases the number of motorists that yield to pedestrians in the crosswalk
- Reinforces the right of pedestrians in the travel-way

Constraints

- If used too often, motorists may ignore the signs
- Less effective on higher volume streets
- May require more maintenance than roadside signs.

Typical Applications

- Undivided two-lane road locations near schools and other pedestrian generators.
- In-street "Yield for Pedestrians" signs are commonly used in areas with lower vehicle volumes, low speeds (less than 35 mph), and poor yielding rates by motorists.
- Crash or conflict patterns resulting in vehicle-pedestrian crashes related to failure to yield by vehicles or unsafe speeds.

Design Considerations

- Per the *California MUTCD* (Section 2B.12), the in-street sign(s) should be placed in the roadway at the crosswalk location on the center line, lane line, or on a median island.
- Consider vehicle clearance widths for roadway design vehicles to avoid signs being hit.
- Use in-streets signs strategically, overuse will lead to lower compliance.

Additional Guidance

- *California Manual on Uniform Traffic Control Devices*

Pedestrian Safety Solutions Toolbox

Marked Uncontrolled Crosswalks at Two-Way Stop-Controlled Locations

STRIPE ADVANCE STOP AND YIELD LINES

Magnitude Cost: $1,000 (per crossing)[13]

Advance stop and yield lines reduce vehicle encroachment into the crosswalk, improve drivers' view of pedestrians, and reduce multiple threat situations for pedestrians.

R1-5

Benefits

- Increase pedestrian-motorist visibility at the crosswalk.
- Reduce multiple threat situations for pedestrians

Constraints

- May interfere with vehicle operations and contribute to queuing at congested locations.
- Potential sign clutter

Typical Applications

- At multilane locations where marked crosswalks are present and vehicular ADT is greater than 12,000 per day.
- At intersections where pedestrian volumes are greater than 20 per day and vehicular ADT is greater than 8,000 per day.
- At locations where vehicle encroachment into the crosswalk is common.
- In advance of Rectangular Rapid Flashing Beacons and Pedestrian Hybrid Beacons

Design Considerations

- Yield lines should be placed 4 to 50 feet in advance of controlled marked crosswalks based; distance is based on vehicle speeds, street width, on-street parking, nearby land uses, and demand for queuing space.
- Yield lines should be placed a minimum of 4 feet in advance of uncontrolled marked crosswalk locations.

Additional Guidance

- *California Manual on Uniform Traffic Control Devices*

Pedestrian Safety Solutions Toolbox

Marked Uncontrolled Crosswalks at Two-Way Stop-Controlled Locations

RESTRICT PARKING AT INTERSECTION APPROACHES

Magnitude Cost: $600 (per approach)[14]

Red parking zones on the approaches to an intersection or crosswalk allow for improved sight distance between pedestrians waiting to cross or entering the crosswalk and approaching motorists.

Benefits

- Increase pedestrian-motorist visibility at the crosswalk.

Constraints

- Reduces available parking supply in area of restriction.

Typical Applications

- Locations where sight distance is currently limited and could be improved by removing parked vehicles.
- Locations with a history of frequent collisions or other documented safety concerns.

Design Considerations

- Each location should be evaluated to determine whether parking removal is appropriate.
- A minimum 10 foot red zone should be painted on all crosswalk approach legs.
- Longer red zones should be used at locations with a greater need for improved visibility due to unique sight distances, higher vehicle speeds, road geometry, or other conditions.

Additional Guidance

- *California Manual on Uniform Traffic Control Devices*

Pedestrian Safety Solutions Toolbox

Marked Uncontrolled Crosswalks at Two-Way Stop-Controlled Locations

INSTALL PEDESTRIAN LIGHTING

Magnitude Cost: $6,000 (per light)[15]

Pedestrian lighting may increase nighttime street visibility for pedestrians where existing illumination does not readily address crossing locations.

Denmark, Credit: Dan Burden

Benefits

- Increases visibility of pedestrians waiting to cross and in the crossing.

Constraints

- Potential to restrict and/or clutter sidewalk environment near the crosswalk.

Typical Applications

- Crossings or areas with high levels of nighttime pedestrian activity (e.g., greater than 20 pedestrians per hour).
- Locations with a high frequency of nighttime pedestrian crashes.
- Could also be considered for crossings with lower pedestrian volume activity if crossing conflict is severe or unexpected (e.g., pedestrian crossing location across a higher speed roadway).

Design Considerations

- Illumination could be used to contribute to the identity of a district or neighborhood and serve as a unifying element in the streetscape.
- Lighting should be scaled to the street and land use contexts to avoid light pollution/trespass and ensure a comfortable illumination quality for users.

Additional Guidance

- *California Manual on Uniform Traffic Control Devices*

Pedestrian Safety Solutions Toolbox

Marked Uncontrolled Crosswalks at Two-Way Stop-Controlled Locations

REDUCE CORNER RADII

Magnitude Cost: $15,000 - $60,000 (per corner)[16]

Reduces right-turning vehicle speeds at an intersection by forcing sharper turns. Reduced corner radii also shorten crossing distances for pedestrians.

Benefits

- Reduces right-turning vehicle speeds at the intersection.
- Reduces pedestrian exposure by reducing crossing distance.

Constraints

- Potential drainage changes needed in some retrofits.
- Less effective at reducing speeds before and after turns.

Typical Applications

- Intersections with average right-turn speeds above 15 miles per hour and where pedestrian volumes are greater than 20 pedestrians per hour.
- Intersections with a documented crash history of right-turning vehicle and pedestrian conflicts.

Design Considerations

- Corner curb radii should accommodate the roadway type's design vehicle turning movements.
- A smaller curb radius expands the pedestrian area and allows for better pedestrian ramp/crosswalk alignment.
- Minimize effective turning radius where possible.
- Consider existing drainage infrastructure needs for modifications.

Additional Guidance

- *California Manual for Uniform Traffic Control Devices*
- NACTO *Urban Street Design Guide*

Pedestrian Safety Solutions Toolbox

Marked Uncontrolled Crosswalks at Midblock Locations

INSTALL PEDESTRIAN SIGNAL

Magnitude Cost: $225,000 (per installation)

Provides pedestrians with a signal-controlled crossing at a mid-block location or at a previously stop-controlled intersection where pedestrian volumes warrant full signalization. The signal remains green for the mainline traffic movement until actuated by a push button to call a red signal for traffic.

Beaverton, OR

Tucson, AZ

Benefits

- Has nearly 100 percent rate of motorist yielding behavior at crossing locations.
- Same appearance as standard traffic signal, so motorist understanding is high.

Constraints

- Must be activated by pedestrians.
- More costly than other crossing treatments.

Typical Applications

- Locations meeting traffic signal warrants for pedestrians as defined in the California MUTCD (Part 4).
- Locations where there are conflict or crash patterns between vehicle-pedestrians.
- Typical applications include:
  - Locations with four or more lanes and vehicle volumes greater than 15,000 per day
  - Locations with pedestrian volumes greater than 20 per hour and speed limits greater than 35 mph
  - At locations where multi-use paths intersect with roadways.

Design Considerations

- The push button to activate the pedestrian signal should be easily accessible by pedestrians, wheelchair users, and bicyclists (if applicable).

Additional Guidance

- *California Manual on Traffic Control Devices*
- NACTO *Urban Street Design Guide*
- *NCHRP Report 562 Improving Pedestrian Safety at Unsignalized Crossings*

Pedestrian Safety Solutions Toolbox

Marked Uncontrolled Crosswalks at Midblock Locations

INSTALL PEDESTRIAN HYBRID BEACON (PHB)

Magnitude Cost: $150,000 (per installation)[17]

Boise, ID

A pedestrian hybrid beacon is a pedestrian activated display that is unlit when not in use. It begins with a yellow light alerting drivers to slow, and then displays a solid red light requiring drivers to remain stopped while pedestrians cross the street. Finally, the beacon shifts to flashing red lights to indicate motorists may proceed after pedestrians have completed their crossing.

Benefits

- Higher rates of motorists yielding than crosswalks without PHB.
- Reduces pedestrian-involved crashes.
- Less delay to motor vehicle drivers than a signal.

Constraints

- Must be activated by pedestrians.
- More costly than other crossing treatments.
- Initially, may be unfamiliar to motorists.

Typical Applications

- Conditions consistent with the California MUTCD guidance.
- Typical locations include:
  - Locations with four or more lanes and vehicle volumes greater than 15,000 per day
  - Locations with pedestrian volumes greater than 20 per hour and speed limits greater than 35 mph
  - At locations where multi-use paths intersect with roadways.

Design Considerations

- The push button to activate the pedestrian hybrid beacon should be easily accessible by all users.

Additional Guidance

- *California Manual on Uniform Traffic Control Devices*
- NACTO *Urban Street Design Guide*
- *NCHRP Report 562 Improving Pedestrian Safety at Unsignalized Crossings*

[17] Cost includes design, materials, and installation.

Pedestrian Safety Solutions Toolbox

Marked Uncontrolled Crosswalks at Midblock Locations

INSTALL RECTANGULAR RAPID FLASHING BEACON (RRFB)

Magnitude Cost: $30,000 (per installation)


Portland, OR


Beaverton, OR

These crossing treatments include signs that have a pedestrian-activated "strobe-light" flashing pattern to attract motorists' attention and provide awareness of pedestrians and/or bicyclists that are intending to cross the roadway.

Benefits

- Provides a visible warning to motorists at eye level.
- Increases motorists yielding behavior at crossing locations over round yellow flashing beacons (80 to 100 percent compliance).
- Allows motorists to proceed after yielding to pedestrians.

Constraints

- Flashing beacons must be activated by pedestrians.
- Motorists may not understand the flashing lights of the RRFB, so compliance may be lower than with a traffic signal.

Typical Applications

- Midblock crossings with pedestrian volumes of 20 or more pedestrians per hour and documented midblock crossing pedestrian collisions.
- Locations with:
  - three or more lanes and posted speeds of 30 mph or higher without a raised median.
  - three or more lanes and posted speeds of 40 mph with or without a raised median
- Locations where multi-use paths intersect with roadways.

Design Considerations

- The push button should be easily accessible by pedestrians, wheelchair users, and bicyclists (if applicable).
- Consider adding a push button in the median island for crossings of multi-lane facilities.
- Automated pedestrian detection may also be installed; it would increase cost of installation.

Additional Guidance

- *California Manual on Uniform Traffic Control Devices*
- NCHRP *Report 562 Improving Pedestrian Safety at Unsignalized Crossings*

Pedestrian Safety Solutions Toolbox

Marked Uncontrolled Crosswalks at Midblock Locations

INSTALL CROSSING ISLAND (PEDESTRIAN REFUGE)

Magnitude Cost: $15,000 – $25,000 (per crossing island)[18]

Portland, OR

Portland, OR

Provides a raised refuge area in between opposing travel streams for pedestrians to stop while crossing the street. They can be used at intersections or mid-block crossings.

Benefits

- Reduces pedestrian exposure at marked and unmarked crosswalks.
- Requires shorter gaps in traffic to cross the street by allowing pedestrians to cross in two phases.
- Can help reduce vehicle speeds.

Constraints

- Streets with constrained right-of-way may not have sufficient width to allow for a crossing island.

Typical Applications

- Four or more lane roadways without a raised median where:
  - Posted speeds are 30 mph or less and vehicular ADT is between 9,000 and 12,000 per day.
  - Posted speeds are 35 mph and vehicular ADT is 9,000 per day or less.
- Often used in areas with high levels of vulnerable pedestrian users, such as near schools or senior centers/housing, or a demonstrated pedestrian crash history.

Design Considerations

- Must have at least 6 feet of clear width to accommodate people using wheelchairs.
- At crossing locations where bicyclists are anticipated, a width of 10 feet or greater is desirable to accommodate bicycles with trailers or groups of bicyclists.
- Can be applied in conjunction with other treatments.

Additional Guidance

- *California Manual for Uniform Traffic Control Devices*
- NACTO *Urban Streets Design Guide*
- *NCHRP Report 562 Improving Pedestrian Safety at Unsignalized Crossings*

[18] Cost range varies from installation alone at the low end to design and installation at the high end.

Pedestrian Safety Solutions Toolbox

Marked Uncontrolled Crosswalks at Midblock Locations

INSTALL CURB EXTENSIONS ★

Magnitude Cost: $15,000 (per extension)[19]

An extension of the curb or the sidewalk into the street, usually at an intersection, that narrows the vehicle path, inhibits fast turns, and shortens the crossing distance for pedestrians.


Boston, MA


Bend, OR

Benefits

- Shortens crossing distances for pedestrians.
- Reduces motorist turning speeds.
- Increases visibility between motorists and pedestrians.
- Enables permanent parking
- Enables tree and landscape planting and water runoff treatment.

Constraints

- More easily implemented on streets with on-street parking.
- Physical barrier can be exposed to traffic.
- Greater cost and time to install than standard crosswalks.
- Can present turning radius problems to large vehicles.

Typical Applications

- Mid-block or intersection pedestrian crossings on streets with unrestricted on-street parking.
- Crossing locations with pedestrian collision history.
- Streets with on-street parking where:
  - pedestrian volumes ≥ 20 pedestrians per hour;
  - ADT ≥ 1,500 vehicles per day; and,
  - average right-turn speeds ≥ 15 mph.

Design Considerations

- Include a passage for bicycles to prevent conflicts with vehicles.
- Provide accessible curb ramps and detectible warnings.
- Include landscaping on the curb extension to differentiate the pedestrian travel path.

Additional Guidance

- *California Manual for Uniform Traffic Control Devices*
- ITE/FHWA *Traffic Calming: State of the Practice*
- FHWA *Designing Sidewalks and Trails for Access Part II*

[19] Costs will vary based on the length and drainage requirements.

APPENDIX C: Crash Prevention Street Design Toolkit

Pedestrian Safety Toolkit

Pedestrian Refuge Islands

Pedestrian refuge islands and medians create a safe space for pedestrians crossing the street, especially on high-speed roads and streets with multiple travel lanes in one direction. Can be painted or concrete.

Crashes reduced by 56% [1]

Pedestrian Scramble

Gives pedestrians exclusive access to an intersection by stopping vehicular traffic on all approaches, allowing pedestrians to cross diagonally or conventionally.

Crashes reduced by 35%[2]

Rapid Flashing Beacons

Pedestrian-activated flashing LEDs accompanied by warning signs at crosswalks. Increase driver awareness of crossing pedestrians at uncontrolled crossings.

50% improvement in driver yielding[3]

Traffic Circles

Neighborhood traffic circles lower traffic speeds at minor, uncontrolled intersections and can help beautify the street.

Crashes reduced by up to 90%, driver speeds reduced by 11%[4,5]

Painted Bulb-Outs

Effectively widens the sidewalk to shorten pedestrian crossings, increase visibility, and slow turning vehicles.

Turning speeds decreased by 55%[6]

Left Turn Traffic Calming

Reducing the speed of drivers' left turns lessens the risk of pedestrian collision.

Decreases left turn speeds by 20%[7]

High Visibility Crosswalk

High-visibility crosswalk styles have been shown to improve yielding behavior.

Crashes reduced by 48%[1]

Pedestrian Countdown Signals

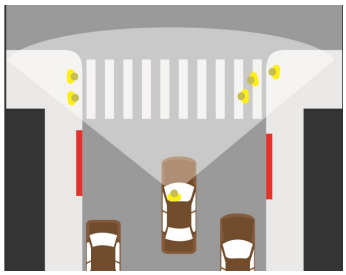
Discourages pedestrians from crossing late by showing how much time they have until the light turns.

Crashes reduced by 25%[1]

Increased Crossing Time

Children and seniors may need more than the minimum required time (7 seconds) to cross the street safely.

Crashes reduced by 51%[1]



Daylighting

Removing visual barriers by converting parking spaces to red curbs so that vehicles and pedestrians have a clear view of the intersection. Can be combined with bulb-outs to reinforce daylighting.

Crashes reduced by 30%[1]

Road Diet

Decreasing the number of through-traffic lanes reduces vehicle conflict and speeds, making pedestrian crossing safer.

Crashes reduced by 50%[4]

Raised Crosswalk

A combination of speed tables and high-visibility crosswalks; can be used at midblock or intersections and in controlled or uncontrolled locations.

69-91% improvement in driver yielding*

Reduces vehicle speeds to 20-30 mph[8]

Pedestrian Safety Toolkit

Leading Pedestrian Interval

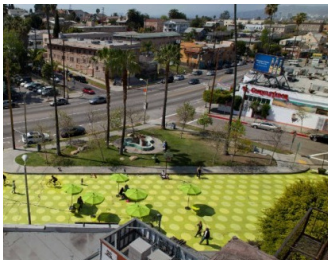
Gives pedestrians a head start when entering an intersection, enhancing visibility and reinforcing their right-of-way over turning vehicles.

Crashes reduced by up to 60%[9]

Flashing Arrow Turn Signals

Increases driver awareness of and yielding to pedestrians and bikes when making left turns.

Yield rate of 70%
Crashes reduced by 10%[10]



Reconfiguring Complex Intersections

Simplifying intersection design can result in more clarity for drivers and more pedestrian space, reducing conflicts.

Traffic Diverters

Reduces cut-through traffic on neighborhood streets reduces total vehicle traffic, slows speeds, and eliminates points of conflict.

Shared Streets

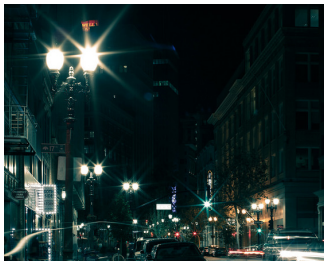
Eliminate distinctions between vehicle, pedestrian, and bike rights-of-way to make roads more comfortable for pedestrian street activity and keep drivers alert, slowing traffic.

Slows vehicle traffic to under 10mph[11]

Protected Left

Intorudcing protected left turn signal phasing allows better coordination with pedestrian signals and increase driver awareness.

Reduce total crashes by 99%[12]



Intersection Lighting

Installing lighting at intersections allows cars better visibility of pedestrians and bikers at night.

Nighttime vehicle/ pedestrian crashes reduced by 42%[13]

Bike Safety Toolkit

Bike Boulevard

Streets with low car traffic volumes and speeds, designated and designed to give bicycle travel priority through use of signs, pavement markings, and speed and volume management.

Crashes reduced by 63%[14]

Buffered Bike Lanes

Conventional bicycle lanes paired with a designated buffer space separating the bicycle lane from the adjacent motor vehicle travel lane and/or parking lane.

Injury crashes reduced by 40%*[15]

Cycle Track

An exclusive bike facility that feels like a separate path but uses on-street infrastructure of a conventional bike lane.

89% reduction in injury risk[15]

Advanced Stop Line (Bike Box)

Pavement marking designed to give priority to bicyclists over vehicles at signalized intersections, while also increasing visibility between motorists and bicyclists.

70% improvement in driver yielding[16]

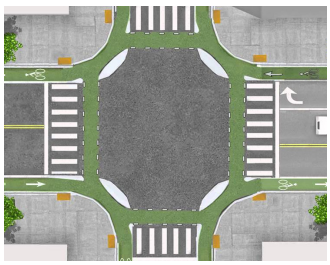
Two-Stage Turn Queue Box

Offers a safe way make left turns at multi-lane signalized intersections from a right side bike lane, or right turns from a left side bike lane.

Bike Lanes

A portion of the roadway that has been designated by striping, signage, and pavement markings for the preferential or exclusive use of bicyclists.

Improves perception of safety, but actual effectiveness varies.[15]



Protected Intersection (Dutch Junction)

Maintains the separation of protected bike lanes through intersections to improve motorist-bicyclist sight lines, slow the speeds of turning vehicles, and to give bicyclists a head-start

Crashes reduced by 63%[15]

Contra-flow Bike Lanes

Bike lanes in the opposite direction of vehicle traffic can reduce wrong-way and sidewalk riding on one-way streets and help connect parts of the bike network.

Can reduce sidewalk riding by 20%[17]

Back-in Angled Parking

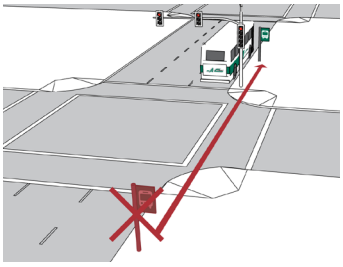
This style of parking is more space-efficient and allows greater visibility of oncoming bike and vehicle traffic.

Shown to reduce vehicle/ bicycle crashes.[18]

Bicycle Signals

Used in conjunction with bike lanes or other facilities, bike-specific signals can give bicyclists their own signal phase to avoid conflict with cars and increase cyclists' signal compliance. [19]

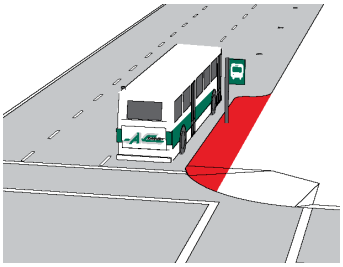
Transit Safety Toolkit



Far-side Bus Stops

Encourage pedestrians to cross behind the bus at stops rather than in front.

Improves visibility between buses and pedestrians[20]



Bus Bulbs

Allow buses to stop without having to merge back into traffic, decreasing risk of conflict with cars and bikes while making the bus route more efficient. Doubles as pedestrian bulb-out.

Improves bus efficiency while providing safe space for pedestrians.[20]

Transit-only Lanes

Red-painted transit-only lanes can reduce speeding and lower collision rates.

Injury collisions reduced by 24%[21]

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APPENDIX D: Citywide Crash Analysis

Citywide Crash Analysis

City of Oakland

Crash Landscape in Oakland

Crashes are an all-too regular occurrence on Oakland's streets. Fatalities and injuries from crashes impact many lives and collectively cost Oaklanders hundreds of millions of dollars per year. The City of Oakland analyzed nearly 2,000 injury crashes from 2012-2016 to understand how they affect Oaklanders and how to effectively focus safety efforts.

2

weekly severe or fatal injuries

$900 Million

yearly cost of traffic crashes in Oakland, or 6% of the total annual income of all City residents. This includes lost quality of life, property damage, lost work time, medical care, and other costs. [1]

76%

severe or fatal injuries increase between 2012 and 2016

What Kinds of Crashes are Happening on Our Streets?

HIGH SPEEDS ARE MORE DEADLY

9 out of 10 pedestrians survive

5 out of 10 pedestrians survive

1 out of 10 pedestrians survive

AND SPEED MATTERS IN OAKLAND

Just over **1 in 4** Oaklanders killed are involved in a crash where **speed** is a primary factor

SYSTEM CHANGE, NOT JUST BEHAVIOR CHANGE, IS CRITICAL

3 in 4 bicyclists killed are hit by a sober driver. While the influence of alcohol and drugs can be deadly, it's not the full story.

INJURIES ARE CONCENTRATED AT INTERSECTIONS

75% of Oaklanders' severe or fatal injuries occur at **intersections**

Driver failure to yield to a pedestrian at a crosswalk accounts for over **1/3** of pedestrian fatalities or severe injuries

Oaklanders are killed or severly injured by **left-turning** vehicles at over **4 times** the rate of right-turning vehicles

ESPECIALLY AT SIGNALIZED INTERSECTIONS

Under **10%** of intersections in Oakland are **signalized intersections**

but nearly **50%** of fatalities occur at **signalized intersections**

Broadside crashes at **signalized intersections** account for nearly **20%** of all fatal or severe injury motor vehicle crashes

[1] Total crash cost from "Crash Cost Analysis for the City of Oakland," May 2018; total annual income from American Community Survey (ACS), 2012-2016. Direct costs to City of Oakland through litigation payout associated with traffic safety totaled $250,000 between 2011 and 2016.

Sources: SWITRS, 2012-2016; Alameda County Sheriff's Office Coroner's report, 2015-2016; American Community Survey (ACS), 2012-2016. Excludes crashes on freeway mainlines and freeway ramps outside of local intersections. Characteristics of individuals involved in crashes are based on police observations recorded in crash reports.

Note: Crashes include all modes unless otherwise specified.

Oak DOT

Citywide Crash Analysis

City of Oakland

Who is Most Impacted by Crashes?

Reported crash data reveal that certain demographic groups and geographic areas experience a disproportionate share of crashes in Oakland. However, the data may not tell the full story. Research shows that police reports can miss 20% or more of crashes due to underreporting, especially from black injury victims. It has also been shown that driver biases can contribute to crash racial inequities, as people in vehicles do not yield as often to people of color on foot. [2]

VULNERABLE ROAD USERS

People walking, biking, and taking public transit make up under **30%** of commute trips

but experience nearly **50%** of **severe or fatal injuries**

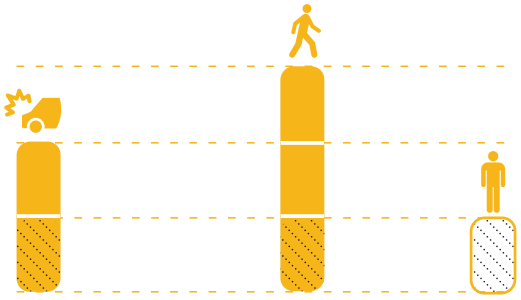
AGE INEQUITIES IN OAKLAND CRASHES

67% of **Older Oaklanders' (65+)** fatalities occur while **walking**

compared to only **26%** for Oaklanders of all other ages

Older Oaklanders (65+) are more than **2 times** as likely to be killed in a crash compared to all other Oaklanders

RACIAL INEQUITIES IN OAKLAND CRASHES



30% of streets in majority **Asian census tracts** fall on the City of Oakland Pedestrian High Injury Network - the highest percentage of any ethnicity [3]

Black Oaklanders are **2 times** as likely to be killed or severely injured in a crash (all modes) and **3 times** as likely to be killed or severely injured while **walking** compared to all other Oaklanders

[2] Underreporting from Sciortino, S., Vassar, M., Radetsky, M., & Knudson, M. M. (2005). San Francisco pedestrian injury surveillance: mapping, under-reporting, and injury severity in police and hospital records. Accident Analysis & Prevention, 37(6), 1102-1113; driver yielding disparity from Goddard, T., Kahn, K. B., & Adkins, A. (2015). Racial bias in driver yielding behavior at crosswalks. Transportation research part F: traffic psychology and behaviour, 33, 1-6.

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Note: Crashes include all modes unless otherwise specified.

Oak DOT

APPENDIX E: 2021 Traffic Safety Project Pipeline

2021 OakDOT Traffic Safety Project Pipeline

The Q4 2021 safety project pipeline represents a majority of OakDOT's capital projects and serves as a barometer of the delivery to be expected over the next decade or sooner. These projects can be found on OakDOT's Major Project Map. The list is only a partial list and does not include all projects such as Paving Plan projects, Rapid Response projects or projects resulting from Oak 311 requests. Click on links for more information where available.

Project by Phase	**Priority Areas of Investment**			
	High Injury Network	**School Zone** (fronting a school)	**High Priority Equity Neighborhood**	**Bike & Pedestrian Plan Consistency**
Planning				
1. Pedestrian Crossing Improvements	X		X	X
2. 66th Avenue/Zhone Way widened sidewalk			X	X
3. Bancroft Greenway	X	X	X	X
4. Safer 8th Street			X	X
5. 14th Avenue Streetscape Project			X	X
6. Macarthur: Lakeshore to East Oakland Connection	X		X	X
7. West Oakland Transit Access Improvements			X	
8. East Oakland Neighborhood Initiative (EONI) Transportation Improvements			X	X
9. East Oakland Neighborhood Bike Routes	X	X	X	X
10. SR2S Improvements - Yu Ming Charter School		X		X
11. SR2S Improvements - Lincoln Elementary School		X		X
12. SR2S Improvements - Westlake Middle School		X		X

Project by Phase	Priority Areas of Investment			
	High Injury Network	School Zone (fronting a school)	High Priority Equity Neighborhood	Bike & Pedestrian Plan Consistency
13. SR2S Improvements – Martin Luther King Jr. Elementary School	X	X	X	X
14. SR2S Improvements - Oakland International/Emerson		X		X
15. SR2S Improvements - Encompass Academy	X	X	X	X
16. SR2S Improvements - East Oakland Pride Elementary	X	X	X	X
17. Grand Avenue Mobility Action Plan	X	X	X	X
18. Chinatown Complete Streets Plan	X	X	X	X
19. East Oakland Mobility Action Plan	X	X	X	X
20. Power the People: MLK Jr Shoreline Access Study	X	X	X	X
Design				
21. Foothill Blvd Pedestrian Safety Improvements	X	X	X	X
22. 98th Avenue Crossing Improvements	X	X	X	X
23. 14th Street Pedestrian Crossing Improvements	X		X	X
24. I-880/42nd/High Freeway Access Project			X	
25. MacArthur Boulevard Pedestrian Improvements	X	X	X	X
26. West Oakland Industrial Streets	X		X	X
27. Macarthur Blvd Smart City Corridor Project (Phase 1 & 2)	X		X	X
28. 7th Street Wood to Bay Gap Closure				X

Project by Phase	**Priority Areas of Investment**			
	High Injury Network	**School Zone** (fronting a school)	**High Priority Equity Neighborhood**	**Bike & Pedestrian Plan Consistency**
29. Coliseum Connections (Bike Lanes Along San Leandro Street)			X	X
30. East Bay Greenway - Segment II			X	X
31. 10th Street Pedestrian Improvement		X	X	X
32. 73rd Avenue Active Connections to Transit	X	X	X	X
33. Intermodal Terminal Coliseum Bart Improvements			X	X
34. Downtown Pedestrian Crossing Improvements (Various Locations)	X		X	X
35. 105th Ave Railroad Crossing Improvements	X		X	X
36. 85th Ave Railroad Crossing Improvements	X		X	X
37. Crossing to Safety - Park Blvd at East 38th St and Excelsior Ave	X			X
38. International Blvd Pedestrian Lighting (36th-45th Ave)	X		X	X
39. 27th St Complete Streets				X
40. E 12th St Bikeway	X		X	X
41. Rockridge Bart Safe Routes To Transit				
42. 29th Ave Railroad Crossing Improvements	X	X	X	X
43. Foothill Blvd (three separate projects including two intersection projects described here and here, and one corridor project)	X	X	X	X
44. Lakeside Family Streets			X	X

Project by Phase	Priority Areas of Investment			
	High Injury Network	School Zone (fronting a school)	High Priority Equity Neighborhood	Bike & Pedestrian Plan Consistency
45. 18th St Bikeways & Railroad Removal		X	X	X
46. Martin Luther King, Jr. Way Safety Improvements			X	X
47. Lake Merritt Bikeway Improvement Project				X
48. Coliseum Connections Bike Improvements (Flora Street)			X	X
49. 7th Street Connection Project			X	X
Construction				
50. Telegraph Avenue Corridor Improvements (20th Street to 29th Street)	X		X	X
51. Oakland Hills Guardrails				
52. Fruitvale Alive Gap Closure	X		X	X
53. Telegraph Avenue Corridor Improvements (29th Street to 45th Street)	X		X	X
54. Market St and San Pablo Ave (Various Locations)	X		X	X
55. Claremont Ave And Shattuck Ave	X	X		X
56. Bancroft Ave Bike & Pedestrian Safety Project	X	X	X	X
57. Fruitvale Ave Bike and Pedestrian Safety Project	X		X	X
58. High St Traffic Calming and Pedestrian Safety Improvements	X		X	X
59. Thornhill/Montclair Elementary Safe Routes to School		X		X
60. 69th Ave Traffic Calming & Pedestrian Lighting Project			X	X

Project by Phase	Priority Areas of Investment			
	High Injury Network	School Zone (fronting a school)	High Priority Equity Neighborhood	Bike & Pedestrian Plan Consistency
61. Lower Park Blvd Complete Streets Project	X			X
62. 20th St Streetscape Project: 19th St BART to Lake Merritt Urban Greenway			X	X
63. 7th Street Phase 2				X
64. Caldecott Tunnel Mitigations				X
65. West Street Road Diet Project	X			X
66. Camino 23 International Blvd Pedestrian Improvements	X		X	X
67. 35th Ave Safety Improvements	X	X	X	
68. MacArthur Blvd Safety Improvements	X		X	X
69. 11th Ave Bikeway Traffic Calming Implementation	X			X
70. D Street Bikeway Traffic Calming Implementation			X	X
71. 4th Ave Bikeway Traffic Calming Implementation			X	X

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