SUSTAINABLE TRANSPORTATION PLANNING GRANTS

Caltrans Sustainable Transportation Planning Grants are available to communities for planning, study, and design work to identify and evaluate projects, including conducting outreach or implementing pilot projects. Communities are typically required to provide an 11.47 percent local match, but staff time or in-kind donations are eligible to be used for the match provided the required documentation is submitted.

Funds are programmed by Caltrans.

HIGHWAY SAFETY IMPROVEMENT PROGRAM

Caltrans offers Highway Safety Improvement Program (HSIP) grants every one to two years. Projects on any publicly owned road or active transportation facility are eligible, including bicycle and pedestrian improvements. HSIP focuses on projects that explicitly address documented safety challenges through proven countermeasures, are implementation-ready, and demonstrate cost-effectiveness.

Funds are programmed by Caltrans.

SOLUTIONS FOR CONGESTED CORRIDORS PROGRAM

Funded by SB1, the Congested Corridors Program strives to reduce congestion in highly-traveled and congested corridors through performance improvements that balance transportation improvements, community impacts, and environmental benefits. This program can fund a wide array of improvements, including bicycle and pedestrian facilities. Eligible projects must be detailed in an approved corridor-focused planning document. These projects must include aspects that benefit all modes of transportation using an array of strategies that can change travel behavior, dedicate ROW for bikes and transit, and reduce vehicle miles traveled.

Funds are programmed by Caltrans.

OFFICE OF TRAFFIC SAFETY

Under the Fixing America's Surface Transportation (FAST) Act, five percent of Section 405 funds are dedicated to addressing non-motorized safety. These funds may be used for law enforcement training related to pedestrian and bicycle safety, enforcement campaigns, equipment projects for non-federally funded roadways and public education and awareness campaigns.

Funds are programmed by the California Office of Traffic Safety.

AFFORDABLE HOUSING AND SUSTAINABLE COMMUNITIES PROGRAM (AHSC)

The AHSC program funds land-use, housing, transportation, and land preservation projects that support infill and compact development that reduces greenhouse gas emissions. Projects must fall within one of three project area types: transit-oriented development, integrated connectivity project, or rural innovation project areas. Fundable activities include affordable housing developments, sustainable transportation infrastructure, transportation-related amenities, and program costs.

Funds are programmed by the Strategic Growth Council and implemented by the Department of Housing and Community Development.

URBAN GREENING GRANTS

Urban Greening Grants support the development of green infrastructure projects that reduce Greenhouse Gas (GHG) emissions and provide multiple benefits. Projects must include one of three criteria, most relevant: reduce commute vehicle miles traveled by constructing bicycle paths, bicycle lanes, or pedestrian facilities that provide safe routes for travel between residences, workplaces, commercial centers, and schools. Eligible projects include green streets and alleyways and non-motorized urban trails that provide safe routes for travel between residences, workplaces, commercial centers, and schools.

Funds are programmed by the CA Natural Resource Agency.

TRANSFORMATIVE CLIMATE COMMUNITIES PROGRAM (TCC)

The TCC Program funds development and infrastructure projects that achieve major environmental, health, and economic benefits in California's most disadvantaged communities. TCC empowers the communities most impacted by pollution to choose their own goals, strategies, and projects to reduce greenhouse gas emissions and local air pollution – all with data-driven milestones and measurable outcomes.

Funds are programmed by California's Cap-and-Trade Program.

Other State Funds

SENATE BILL 1: LOCAL PARTNERSHIP PROGRAM

This program provides local and regional agencies that have passed sales tax measures, developer fees, or other transportation-imposed fees to fund road maintenance and rehabilitation, sound walls, and other transportation improvement projects. Jurisdictions with these taxes or fees are then eligible for a formulaic annual distribution of no less than $100,000. These jurisdictions are also eligible for a competitive grant program. Local Partnership Program funds can be used for a wide variety of transportation purposes, including roadway rehabilitation and construction, transit capital and infrastructure, bicycle and pedestrian improvements, and green infrastructure.

Funds are programmed by CTC.

SENATE BILL 1: ROAD MAINTENANCE AND REHABILITATION PROGRAM

Senate Bill 1 created the Road Maintenance and Rehabilitation Program (RMRP) to address deferred maintenance on state highways and local road systems. Program funds can be spent on both design and construction efforts. On-street active transportation-related maintenance projects are eligible if program maintenance and other thresholds are met.

Funds are allocated to eligible jurisdictions and programmed by CTC.

SAFE ROUTES TO SCHOOL

The goal of this program is to empower communities to make walking and bicycling to school a safe and routine activity once again. Funding is available for a wide variety of programs and projects, from building safer street crossings to establishing programs that encourage children and their parents to walk and bicycle safely to school. Infrastructure and non-infrastructure projects are eligible within 2 miles of a grade school or middle school.

Funds are programmed by the California Department of Transportation (Caltrans).

REGIONAL SURFACE TRANSPORTATION PROGRAM

This program was originally established by California State Statute to support ongoing construction and maintenance of highways and bridges in California. However, this program can also fund bicycle transportation and pedestrian walkways on any public road as long as the bicycle facilities are used primarily for transportation purposes as opposed to recreational use.

Funds are programmed by the California Department of Transportation (Caltrans).

TABLE 4-26 ACTIVE TRANSPORTATION FUNDING

FUNDING SOURCE	ON-STREET BIKEWAYS	PEDESTRIAN INFRASTRUCTURE	SAFE ROUTES TO SCHOOL	BICYCLE PROGRAMS	PEDESTRIAN PROGRAMS	STUDIES
LOCAL AND REGIONAL PROGRAMS						
BEYOND Framework Fund Program	x	x	x	x	x	x
Riverside County Community Improvement Designation (CID) Funds			x	x	x	x
Measure A	x	x	x			
Transportation Uniform Mitigation Fee Regional Arterial Roads (TUMF)	x	x				
TDA Article 3 Bicycle and Pedestrian Facilities Program	x	x				x
Sustainability Planning Grant Program	x	x	x			x
COMPETITIVE GRANT PROGRAMS						
California Active Transportation Program (ATP)	x	x	x	x	x	
Sustainable Transportation Planning Grants						x
Highway Safety Improvement Program	x	x	x			
Solutions for Congested Corridors Program	x	x				
Office of Traffic Safety (OTS)	x	x		x	x	
Affordable Housing and Sustainable Communities Program (AHSC)	x	x		x	x	
Transformative Climate Communities Program (TCC)	x	x				x
Urban Greening Grants	x	x	x			
OTHER STATE FUNDS						
Senate Bill 1: Local Partnership Program	x	x				
Senate Bill 1: Road Maintenance and Rehabilitation Program	x	x				
Safe Routes to School	x	x				x
Safe Routes to Parks	x	x	x			x
Regional Surface Transportation Program	x	x				

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Section 4.8:
Project Prioritization


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Project Prioritization

BECAUSE FUNDING IS LIMITED, THE CITY APPLIES A STRATEGIC APPROACH TO IMPLEMENTING PROJECTS IN A WAY THAT IS ALIGNED WITH COMMUNITY PRIORITIES. A PRIORITIZATION FRAMEWORK ALLOWS RIVERSIDE TO IDENTIFY PRIORITY PROJECTS AND PHASE IMPLEMENTATION OVER MANY YEARS. SOME PROJECTS CAN ALSO BE IMPLEMENTED AS PART OF ROUTINE ROADWAY MAINTENANCE PROGRAMS OR AS PART OF DEVELOPMENT CONDITIONS.

PROJECTS ARE PRIORITIZED WITH CONSIDERATION OF SEVERAL KEY FACTORS INCLUDING SAFETY, USE, PROGRAM AND PLAN GOALS, AS WELL AS COMMUNITY INPUT.

Table 4-27 outlines the prioritization methodology used to evaluate bicycle network projects and pedestrian projects, which is consistent with bicycle project prioritization, yet calibrated for the walking environment. These criteria derive from the plan's goals of supporting health and equity, making Riverside's streets safer for everyone, and connecting people to the places they want to go both locally and regionally. Furthermore, this prioritization plan is aligned with the State's Active Transportation Program grant criteria, which is the primary source of state funding the City pursues for pedestrian and bicycle infrastructure.

For each criterion, projects received an individual score as well as a composite score based on the sum of all five factors evaluated. Total scores falling within the top third are considered high priority projects; total scores falling in the middle third are considered medium priority; and scores falling in the lowest third tier are considered lower priority projects.

The prioritization list acts as a guide to implementation for the City. When funding sources become available, the City will take all available opportunities to propose the most competitive projects. Should opportunities arise to complete projects on lower tiers of the prioritization list prior to those on higher priority tiers, they may be taken. For example, if a new development is required to provide a public benefit along these corridors, proposed bikeways or sidewalks can be considered as an option. If the City plans to repave a corridor that has a recommended bikeway or pedestrian project in this Plan, the City will explore ways to install facilities as the street is repaved.

Projects were given one of three priorities:

- Tier 1: High Priority Projects. These are projects that the City will actively seek funding for and dedicate resources to planning and implementation in the immediate years. Timelines for outreach, and identification of funding sources will be a high priority and immediate next step. The Tier 1 projects that are lower-scale and cost should be considered for immediate implementation in the coming fiscal years.
- Tier 2: Priority Projects. These are projects that the City will maintain as potential projects, in the event that funding sources (such as developer impact fees or applicable grant funding opportunities arise) become available. The City's repaving plan will also take these projects into account as street repaving plans are implemented. These projects may be combined with Tier 1 projects to strengthen the network and gap closure portions of grant applications, and to complement other projects.
- Tier 3: Other Projects. These are projects that the City will pursue longer-term.

Figure 4-30 shows the recommended bicycle projects throughout the City based on prioritization results. The following tables list Tier 1, 2, and 3 projects among the recommended bikeways.

TABLE 4-27 PROJECT PRIORITIZATION CRITERIA

CRITERIA	MEASURE	POINTS
Connectivity	Project connects to major destinations, close gaps in the existing bicycle network/sidewalk network, and serves demand for active transportation trips based on proximity to where people live, work, play, shop, learn, and access transit.	0 – 10
Health + Equity	Project is located within a disadvantaged community, as defined by CalEnviroScreen 3.0, Riverside Unified School District Free and Reduced Meal Program, and/or household income thresholds (Department of Housing and Community Development ACS 5-year estimates).	0 – 6
Safety	Project is located in areas with high pedestrian and/or cyclist activity such as public schools, parks, libraries, community and senior centers increasing the potential for collisions or street with high levels of traffic stress, and thereby, addresses safety barriers.	0 – 6
Community-Identified Need	Project was identified as needing improvement by community members through one or more community engagement efforts.	0 – 6
Regional Goals	Project improves and builds upon the regional network identified in the Riverside County Bike Master Plan and/or WRCOG Active Transportation Plan.	0 – 2
	Maximum Possible Points	30

Prioritized Bicycle Projects

Figure 4-30 displays the recommended bicycle projects throughout Riverside based on prioritization score. The following tables summarized the recommended bikeway projects by Tier.

FIGURE 4-30 PRIORITIZED BICYCLE PROJECTS

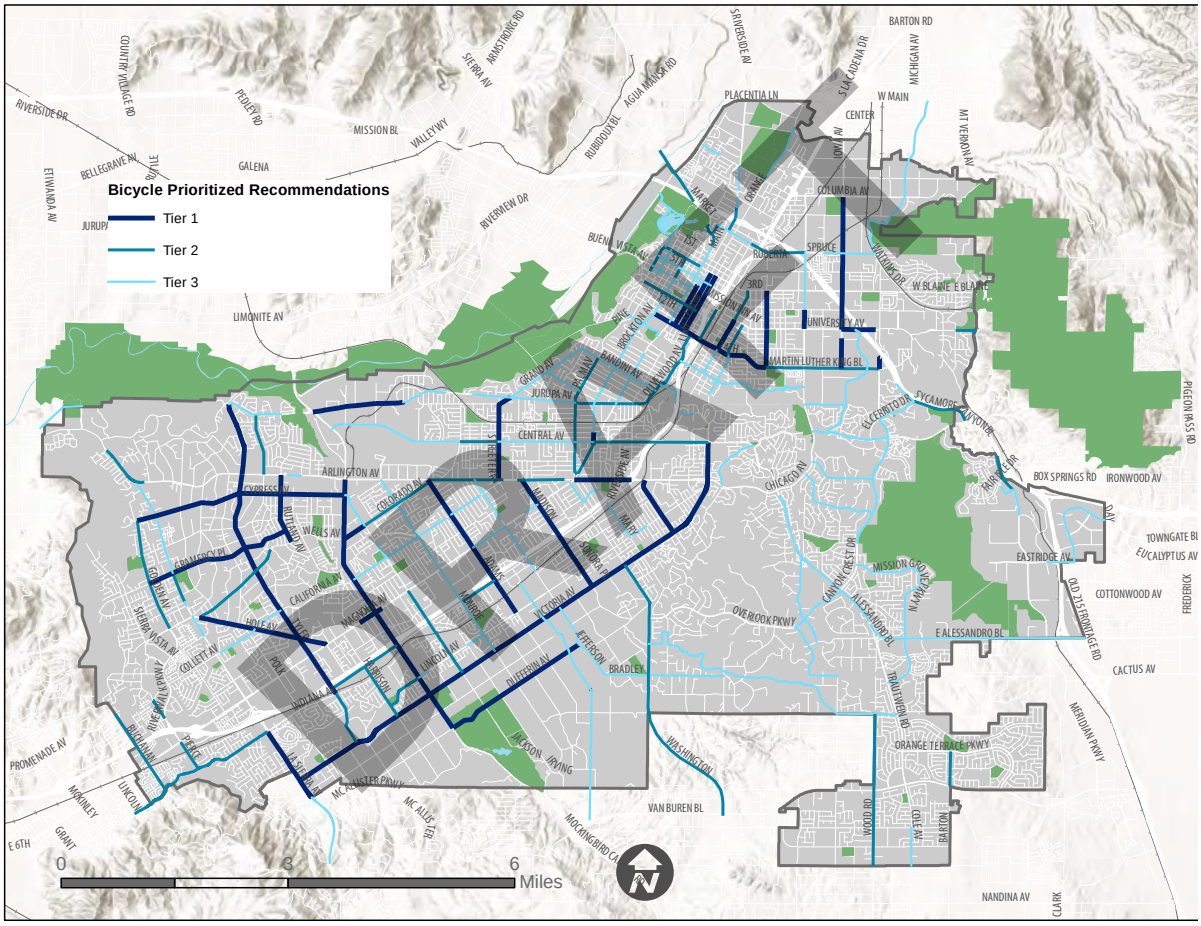


TABLE 4-28 RECOMMENDED BICYCLE PROJECTS: TIER 1

CORRIDOR	FROM	TO	FACILITY TYPE	LENGTH (MILES)	WARD
14th St	Kansas Ave	Brockton Ave	II	1.7	2
Adams St	Lincoln St	California St	II	1.6	5
Arlington Ave	Indiana Ave	Magnolia Ave	II	0.5	3
Brockton Ave	Magnolia Ave	Beatty Dr	II	0.2	3
Chicago Av	W Linden St	Spruce St	IIB	0.8	1,2
Colorado Ave	Van Buren Blvd	Monticello Ave	II	0.3	6
Cypress Ave	Golden Ave	Van Buren Blvd	II	2.8	6,7
Dufferin Ave	Van Buren Blvd	Jefferson St	IIIB	2.0	5
Gramercy Pl	Tyler St	Rutland Ave	IIIB	0.6	6,7
Gramercy Pl	Golden Ave	Tyler St	II	1.4	7
Hole Av	Wells Ave	Tyler St	IIB	1.4	6
Hole Ave	Tyler St	Magnolia Ave	II	0.4	6
Iowa Ave	University Ave	Columbia Ave	IIB	1.8	1,2
Jurupa Ave	Crest Ave	Columbus St	IIB	1.7	3
Kansas St	University Ave	3rd St	IIIB	1.0	2
La Sierra Ave	Indiana Ave	City Limits	IIB	1.1	5
Lemon St	14th St	3rd St	IV	0.8	1
Madison St	Arlington Ave	Victoria Ave	IIIB	1.7	3,4
Magnolia Ave	Meyers St	McKenzie St	II	0.42	5
Main St Pedestrian Mall	10th St	6th St	I	0.31	1
Main St	14th St	13th St	II	0.08	1
Main St	13th St	10th St	IIIB	0.23	1
Maude	Victoria Ave	Arlington Ave	IIIB	0.81	3
Orange St	14th St	3rd St	IV	0.83	1
Rutland Ave	Wells Ave	Arlington Ave	IIIB	0.92	6
Streeter	Arlington Ave	Jurupa Ave	IIB	1.17	3
Tyler St	Wells Ave	Arlington Ave	II	1.4	7
Tyler St	Indiana Ave	Wells Ave	II	1.9	5,6
Tyler St	Arlington Ave	Jurupa Ave	IIB	1.0	7
University Ave	Iowa Ave	W Campus Dr	IIB	0.5	2
Van Buren Blvd	Victoria Ave	Jurupa Ave	IIB	3.7	5,6,7
Victoria Ave	La Sierra Ave	Central Ave	IV	7.3	3,4,5

TABLE 4-29 RECOMMENDED BICYCLE PROJECTS: TIER 2

CORRIDOR	FROM	TO	FACILITY TYPE	LENGTH (MILES)	WARD
10th St	Lemon St	Redwood Dr	IIIB	0.8	1
3rd St	Market St	Redwood Ave	IIIB	0.6	1
Arlington Av	Adams St	Streeter Ave	II	1.0	3
Arlington Ave	Western Ave	Fairhaven Dr	IIB	0.7	7
Barton Rd	Van Buren Blvd	Orange Terrace Pkwy	III	0.5	4
Brockton Av	Mission Inn Ave	3rd St	IIIB	0.3	1
Buchannan Ave	SR-91	Indiana Ave	II	0.7	6, 7
Buchannan Ave	Collet Ave	SR-91 Overpass	III	0.5	7
Central Av	Hillside Ave	Streeter Ave	IIB	0.5	3
Central Ave	Victoria Ave	Brockton Ave	II	1.5	3
Colorado Ave	Jackson St	Adams Ave	IIIB	1.0	5, 6
Golden Ave	Pierce St	Cypress Ave	IIIB	1.5	7
Harrison St	Indiana Ave	Victoria Ave	IIIB	0.8	5
Indiana Av	Hillview Dr	La Sierra Ave	II	1.9	6
Indiana Av	Monroe St	Adams St	II	0.5	5
Indiana Ave	Tyler St	Van Buren Blvd	II	1.0	5
Jackson St	Diana Ave	Magnolia Ave	I	0.4	5
Jackson St	Victoria Ave	Diana Ave	II	0.9	5
Jurupa Ave	Riverside Ave	Palm Ave	II	0.8	1,3
La Sierra Ave	Hole Ave	Gramercy Pl	II	0.3	6,7
Lincoln Av	Harrison St	Van Buren Blvd	IIIB	0.6	5
Magnolia Ave	Brockton Ave	Central Ave	II	0.8	3
Main St	Oakley Ave	Spruce St	II	0.2	1
Main St	Strong St	Spruce St	IIB	0.3	1
Market St	Ridge Rd	Locust St	I	0.3	1
Market St	Rivera St	Santa Ana River Trail	II	0.6	1

TABLE 4-29 RECOMMENDED BICYCLE PROJECTS: TIER 2

CORRIDOR	FROM	TO	FACILITY TYPE	LENGTH (MILES)	WARD
Market St	SR-60	Rivera St	II	0.2	1
Martin Luther King Blvd	Canyon Crest Dr	Kansas Ave	IIB	1.0	2
Martin Luther King Blvd	Kansas Ave	Chicago Ave	IIB	0.5	2
Northbend St	Spruce St	Market St	IIIB	0.1	1
Olivewood Ave	14th St	Jurupa Ave	IIB	1.1	1
Palm Av	Tibbets St	Bandini Ave	IIIB	1.6	1,3
Park Ave	University Ave	3rd St	IIIB	0.4	2
Redwood Dr	University Ave	3rd St	II	0.4	1
Spruce St	Chicago Ave	Mulberry Ave	II	0.8	1
Sycamore Canyon Blvd	Lochmoor St	City Limits	II	0.5	2
Sycamore Canyon Blvd	Central Ave	El Cerrito Dr	IIB	0.8	2
Tyler St	Indiana Ave	Victoria Ave	IIIB	0.7	5
Victoria Ave	14th St	University Ave	III	0.5	2
Vine St	14th St	Mission Inn Ave	IV	0.5	2
Washington St	Victoria Ave	City Limits	II	2.6	4
Wells Av	Hole Ave	Tyler St	IIIB	1.0	6,7
Wood St	John F Kennedy Dr	Krameria St	IIB	2.0	4

TABLE 4-30 RECOMMENDED BICYCLE PROJECTS: TIER 3

CORRIDOR	FROM	TO	FACILITY TYPE	LENGTH (MILES)	WARD
5th St	Lemon St	Redwood Dr	IIIB	0.8	1
Alessandro Blvd	Chicago Ave	I-215	IIB	5.0	2,3,4
Bandini Ave	Olivewood Ave	Palm Ave	IIIB	0.9	1
Bradley St	Jefferson St	Harbart Dr	II	1.7	4
Cactus Ave	Crystal View Terrace	Dauchy Ave	II	0.3	4
Canyon Crest Dr	Via Vista Dr	El Cerrito Dr	IIB	1.8	2
Canyon Crest Dr	Martin Luther King Blvd	UC Riverside Parking Lot 30 Driveway	IV	0.2	2
Canyon Springs Pkwy/Valley Springs Pkwy	Eucalyptus Ave	Day St	IIB	1.3	2
Prince Albert Dr	Sedgwick Ave	Ottawa Ave	IIIB	0.5	2
Central Av	Van Buren Blvd	Hillside Ave	II	1.8	3
Central Ave	Canyon Crest Dr	Chicago Ave	IIB	1.0	2,3
Chicago Av	Spruce St	W Linden St	II	0.3	1,2
Cole Av	Lurin Ave	Krameria St	II	0.5	4
Columbia Av	American Dr	Salmon River Rd	II	0.3	1
Country Club Dr	Chicago Ave	Canyon Crest Dr	IIIB	0.9	2
Crystal View Terrace	Overlook Pkwy	Cactus Ave	IIIB	0.8	4
Dexter Dr	Redwood Dr	SART Trail Head	IIIB	0.1	1
Eastridge Ave/ Eucalyptus Ave	Sycamore Canyon Blvd	Valley Springs Pkwy	II	0.4	2
El Cerrito Dr	Sycamore Canyon Blvd	Canyon Crest Dr	II	0.5	2
Jefferson St	Victoria Ave	Gage Canal	II	1.0	4
Jurupa Ave	Crest Ave	Rutland Ave	II	0.3	7
Jurupa Ave	Crest Ave	Tyler St	IIB	0.4	7
La Sierra Ave	Schulyer Ave	Pierce St	IIB	0.3	6,7
Lincoln Av	Van Buren Blvd	Antares Dr	II	0.2	5
Main St	6th St	5th St	IIIB	0.2	1

TABLE 4-30 RECOMMENDED BICYCLE PROJECTS: TIER 3

CORRIDOR	FROM	TO	FACILITY TYPE	LENGTH (MILES)	WARD
Market St	1st St	Ridge Rd	II	0.2	1
Mary St	Lincoln Ave	Indiana Ave	II	0.5	3,4
Mission Grove Pkwy	Canyon Crest Dr	E Alessandro Blvd	IIIB	1.9	2,4
Mission Grove Pkwy S	Trautwein Rd	Alessandro Blvd	IIB	0.8	4
Monroe	California St	Diana Ave	II	1.0	5
Monroe St	California St	Arlington Ave	IIIB	0.9	5,6
N Orange St	Colombia Ave	Riverside Canal	IIB	0.8	1
Nixon Dr	Brockton Ave	Washington St	II	0.3	3
Overlook Pkwy	Easterly Terminus	Via Vista Dr	I	0.1	4
Overlook Pkwy	Dead end	Dead end w/ Sandtrack Rd	I	0.1	4
Overlook Pkwy	Crystal View Terrace	Alessandro Blvd	II	0.8	4
Park Ave	Cridge St	14th St	IIIB	0.4	2
Pine St	University Ave	3rd St	II	0.4	1
Ransom Rd	Chicago Ave	Canyon Crest Dr	IIIB	1.2	2
Redwood Dr	3rd St	Field Ln	IIIB	0.7	1
Spruce St	Mulberry Ave	Norhtbend St	IIIB	0.5	1
Sycamore Canyon Blvd	Box Springs Blvd	Lochmoor Dr	II	0.4	2
Sycamore Canyon Blvd	El Cerrito Dr	N University Dr	II	0.3	2
Via Vista Dr/ Corinthian Way	Alessandro Blvd	Berry Rd	IIIB	1.2	3,4
Washington St	Nixon Dr	Magnolia Ave	IIIB	0.3	3
S of Lot 4731 Chicago Ave	Chicago Ave	Ottawa Ave	I	0.3	2

Prioritized Pedestrian Projects

Figure 4-31 displays the recommended pedestrian projects throughout Riverside based on prioritization score. The following tables summarized the recommended pedestrian projects by Tier.

FIGURE 4-31 PRIORITIZED PEDESTRIAN PROJECTS

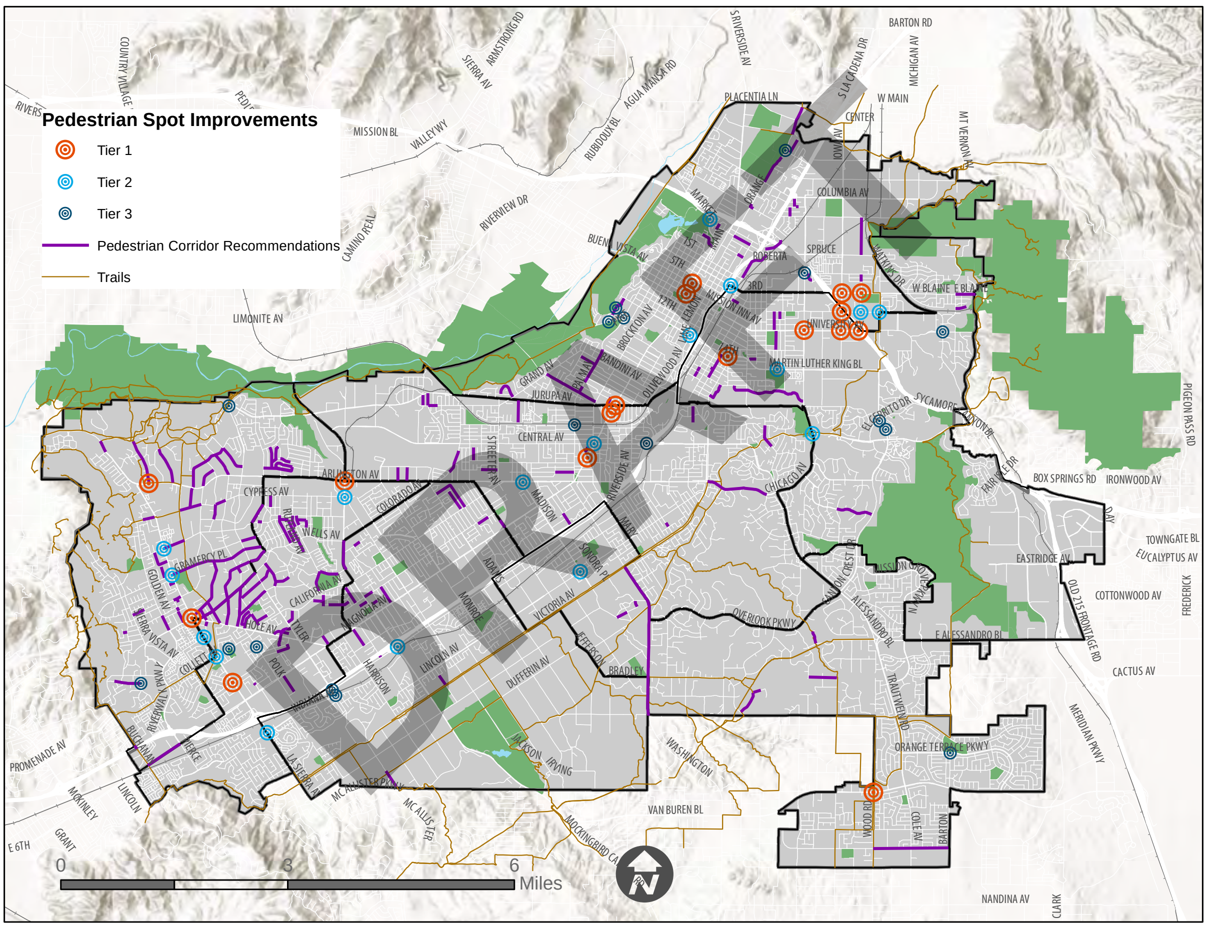


TABLE 4-31 PRIORITIZED PEDESTRIAN PROJECTS: TIER 1

CORRIDOR	CROSS STREET	IMPROVEMENT	WARD
Rustin Ave	Blaine St	Intersection Typology B	1
University Ave	Market St	Intersection Typology E	1
Blaine St	Iowa Ave	Intersection Typology A	1
Chicago Ave	University Ave	Intersection Typology A	2
Iowa Ave	W Linden St	Intersection Typology A	2
Magnolia Ave	Between Brockton Ave and Nelson St	Improve mid block crossing, Intersection Typology D	3
Western Ave	Arlington Ave	Intersection Typology C	7
University Ave	South entrance to University Village	Intersection Typology B, pedestrian scramble	2
14th St	Victoria Ave	Intersection Typology B	2
Jurupa Ave	Magnolia Ave	Intersection Typology A	3
University Ave	I-215 interchange	Intersection Typology F	2
Magnolia Ave	Elizabeth St	Intersection Typology B	3
La Sierra Ave	Pierce St and Hole St	Upgrade intersection. Bushnell pedestrian plaza with removable bollards and historic signage. Typology A	7
Wood Rd	Van Buren Blvd	Intersection Typology A	4
La Sierra Ave	Cochran Ave	Intersection Typology B. High visibility crosswalk	6
Van Buren Blvd	Arlington Ave	Intersection Typology A	3

TABLE 4-32 PRIORITIZED PEDESTRIAN PROJECTS: TIER 2

CORRIDOR	CROSS STREET	IMPROVEMENT	WARD
Rustin Ave	W Linden St	Intersection Typology B	2
Madison St	Arlington Ave	Intersection Typology A	3
14th St	Olivewood Ave	Intersection Typology B	1
W Linden St	Canyon Crest Dr	Intersection Typology C	2
MLK Blvd	Douglass Ave	Improve mid block crossing, Intersection Typology D	2
Third St	Vine St	Intersection Typology C	2
Central Ave	Magnolia Ave	Intersection Typology A	3
Van Buren Blvd	Jackson St	Intersection Typology B	6
Indiana Ave	La Sierra Ave	Intersection Typology A	5
Madison St	Lincoln Ave	Intersection Typology C	4
Chicago Ave	Central Ave	Intersection Typology A	3
Van Buren Blvd	Indiana Ave	Intersection Typology F	5
Gramercy Pl	La Sierra Ave	Intersection Typology B	7
Fairmount Blvd	Market St	Intersection Typology B add crosswalks	1
La Sierra Ave	Collett Ave	Intersection Typology B. High visibility crosswalk	6
La Sierra Ave	Minnier	Typology B. High visibility crosswalk	7
Campbell Ave	La Sierra Ave	Intersection Typology B. High visibility crosswalk	7

TABLE 4-33 PRIORITIZED PEDESTRIAN PROJECTS: TIER 3

CORRIDOR	CROSS STREET	IMPROVEMENT	WARD
Collett Ave	Newby Dr	Intersection Typology C. Upgrade intersection	6
Canyon Crest Dr	Via Pueblo	Install crossing, Intersection Typology B	2
Cass St	Polk St	Intersection Typology C	6
Tequesquite Ave	Glenwood Dr	Intersection Typology C	1
Watkins Dr	W Big Springs Rd	Intersection Typology C	2
El Cerrito Dr	Canyon Crest Dr	Intersection Typology B	2
Central Ave	SR-91 Interchange	Intersection Typology F	3
Mt Rubidoux Trail Head	Glenwood Dr	Intersection Typology D. Install mid block crossing on Glenwood Dr at trail head	1
Chicago Ave	Massachusetts Ave	Install Traffic Signal. Intersection Typology B	1
Tyler St	Jurupa Ave	Intersection Typology D. Upgrade crossing for SART Trail Head.	7
Reid Park Ruth H Lewis Center	Orange St	Intersection Typology D. Install mid block crossing on Orange St at park entrance	1
Knoefler Dr	Ambs Dr	Intersection Typology C and install sidewalks along Knoefler Dr	7
Tyler St	Indiana Ave N of Tracks	Intersection Typology F	5
Palm Ave	14th St	Intersection Typology C	1
Palm Ave	Dewey Ave	Intersection Typology C and improve railroad crossing	3
Tyler St	Indiana Ave S of Tracks	Intersection Typology F	5
Barton St	Orange Terrace Pkwy	Install mid block crossing across Orange Terrace Pkwy, Intersection Typology D	4

Section 4.9:
Implementation Plan

Implementation Plan

WITH LIMITED AND COMPETITIVE FUNDING OPTIONS, IMPLEMENTING OVER 110 MILES OF BIKEWAYS AND OVER 50 PEDESTRIAN SPOT IMPROVEMENT PROJECTS MUST BE PRIORITIZED IN A THOUGHTFUL AND FEASIBLE MANNER. THE FOLLOWING EVALUATION STRATEGY REFLECTS A SYSTEMATIC APPROACH TO DETERMINE EACH PROJECT'S COMMUNITY BENEFIT IN A MANNER THAT IS FEASIBLE, FUNDABLE, AND SUSTAINABLE. PROJECTS ARE SORTED INTO FOUR IMPLEMENTATION CATEGORIES BASED ON THE COMBINED RESULTS OF TWO EVALUATIONS: PROJECT PRIORITY AND PROJECT FEASIBILITY. EACH EVALUATION SCORES PROJECTS ON SPECIFIC CRITERIA.

PROJECT FEASIBILITY

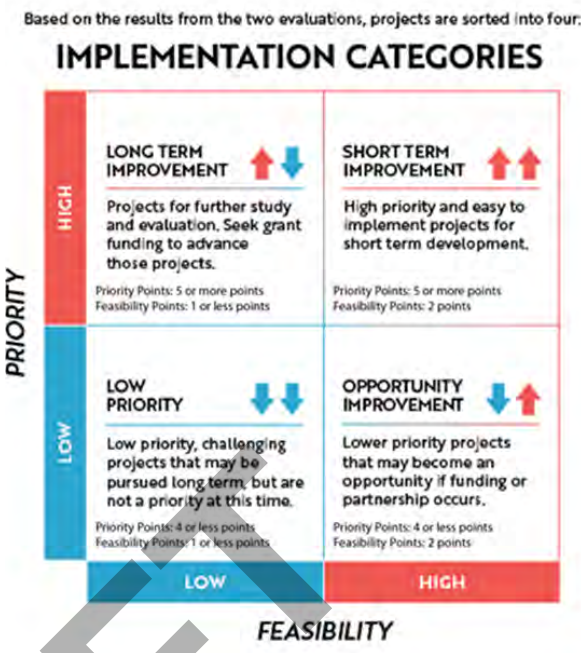
The project feasibility evaluation categorizes projects based on their complexity and high-level costs. In general, projects that only require signage and striping changes are considered highly feasible. Projects that require interagency coordination, hardscape changes, right-of-way acquisition or potential road diets (including parking removal) are considered low-feasibility projects. A feasibility breakdown is below:

- Cost - Projects that only require signage and striping (Class II, Class IIB, Class III, Class IIIB, and some pedestrian crossing improvements) score one point
- Complexity - Projects that will not require interagency coordination (i.e., Caltrans rights-of-way) or will not require a potential road diet score one point

Projects earning two points are considered highly feasible. Projects with zero or one point are considered low-feasibility projects.

IMPLEMENTATION CATEGORIES

Based on the aforementioned evaluations, projects are then placed into four categories: Long term improvements, short term improvements, low priority improvements, and opportunity improvements. Projects are listed by a combined point total within each category. See the graphic to the right:



Short term improvement projects are rated high priority and high feasibility, and represent projects that could be pursued for implementation within the first three to five years.

Long term improvement projects are rated high priority and low feasibility. They may require more study or analysis than short term projects, more significant interagency coordination, and/or additional funding for construction.

Opportunity improvements are those projects rated lower priority and high feasibility and may be pursued when nearby development or an overlapping project creates an opportunity to include these easy to implement projects or if appropriate for applicable grant funding opportunities.

Low priority improvements are those projects rated lower priority and low feasibility. They represent challenging projects that may not add significant value for a greater portion of the community walking or bicycling network on their own, but are part of a long-term vision for active transportation.

PROJECT CONSIDERATIONS

While some of the projects outlined within this Plan may be implemented more quickly, other projects require further community involvement, additional study of trade-offs, or multi-jurisdictional coordination. These pieces require additional time and resources that add complexity to the project.

PROJECT STUDIES AND PHASING

Some of the projects outlined in the Plan require additional study to evaluate trade-offs. For example, some of the proposed bikeways would require the removal of parking or of travel lanes. For many of these projects, the City will study how changing the roadway design impacts local residents and through traffic. Both Orange St and Lemon St have proposed Class IV facilities that would require the removal of existing travel lanes or parking. For other projects like Victoria Ave, project phasing (or sequencing) is also a consideration, due to the length of the project and connection to existing facilities.

INTERAGENCY COORDINATION

Specific proposed projects require the City of Riverside to coordinate with other agencies and stakeholders to coordinate design, implementation, and funding. For example, creating a Class I on the Pedestrian Mall will require coordination with Riverside Downtown Partnership. Likewise, the proposed additions to Victoria Ave will require coordination with community groups like Victoria Avenue Forever. Improvements at and along SR-91 highway crossings and interchanges will require coordination with Caltrans.

Bicycle Projects

Prioritized bicycle projects can be seen in Table 4-34.

TABLE 4-34 PRIORITIZED BICYCLE PROJECTS WITH PLANNING-LEVEL COSTS

CORRIDOR	FROM	TO	RECOMMENDED FACILITY	LENGTH (MILES)	IMPLEMENTATION CATEGORY	ESTIMATED TOTAL PROJECT COST	WARD
14th St	Chicago Ave	Brockton Ave	II	1.68	Short Term	$3,885,000	2
Adams St	Lincoln St	California St	II	1.56	Long Term	$602,837	5
Arlington Ave	Indiana Ave	Magnolia Ave	II	0.51	Short Term	$1,174,689	3
Brockton Ave	Magnolia Ave	Beatty Dr	II	0.16	Short Term	$62,605	3
Chicago Av	W Linden St	Spruce St	IIB	0.75	Opportunity	$290,250	1,2
Colorado Ave	Van Buren Blvd	Monticello Ave	II	0.33	Long Term	$759,999	6
Cypress Ave	Golden Ave	Van Buren Blvd	II	2.80	Long Term	$2,859,106	6,7
Dufferin Ave	Van Buren Blvd	Jefferson St	IIIB	2.02	Short Term	$4,672,260	5
Gramercy Pl	Tyler St	Rutland Ave	IIIB	0.61	Short Term	$1,399,719	6,7
Gramercy Pl	Golden Ave	Tyler St	II	1.37	Long Term	$1,394,676	7
Hole Av	Wells Ave	Tyler St	IIB	1.35	Short Term	$2,022,849	6
Hole Ave	Tyler St	Magnolia Ave	II	0.37	Short Term	$864,065	6
Iowa Ave	University Ave	Colombia Ave	IIB	1.76	Long Term	$2,634,476	1,2
Jurupa Ave	Van Buren Blvd	Columbus St	IIB	1.21	Long Term	$1,820,501	3
Kansas St	University Ave	3rd St	IIIB	1.01	Opportunity	$1,516,086	2
La Sierra Ave	Cleveland Ave	Indiana Ave	IIB	1.05	Short Term	$2,428,650	5

Planning level cost estimates using 2020 unit cost assumptions

TABLE 4-34 PRIORITIZED BICYCLE PROJECTS WITH PLANNING-LEVEL COSTS

CORRIDOR	FROM	TO	RECOMMENDED FACILITY	LENGTH (MILES)	IMPLEMENTATION CATEGORY	ESTIMATED TOTAL PROJECT COST	WARD
Lemon St	14th St	3rd St	IV	0.83	Long Term	$1,912,658	1
Madison St	Arlington Ave	Victoria Ave	IIIB	1.69	Opportunity	$2,532,356	3,4
Magnolia Ave	Meyers St	McKenzie St	II	0.42	Short Term	$14,747	5
Main St	10th St	6th St	I	0.31	Short Term	$120,93	1
Main St	14th St	13th St	II	0.08	Short Term	$30,555	1
Main St	13th St	10th St	IIIB	0.23	Short Term	$521,947	1
Maude	Victoria Ave	Arlington Ave	IIIB	0.81	Short Term	$1,215,000	3
Orange St	14th St	3rd St	IV	0.83	Long Term	$29,187	1
Rutland Ave	Wells Ave	Arlington Ave	IIIB	0.92	Opportunity	$121,680	6
Streeter	Arlington Ave	Jurupa Ave	IIB	1.17	Short Term	$1,752,162	3
Tyler St	Wells Ave	Arlington Ave	II	1.35	Long Term	$3,126,658	7
Tyler St	Indiana Ave	Wells Ave	II	1.94	Long Term	$1,979,468	5,6
Tyler St	Arlington Ave	Jurupa Ave	IIB	0.97	Opportunity	$2,242,315	7
University Ave	Iowa Ave	W Campus Dr	IIB	0.46	Opportunity	$682,713	2
Van Buren Blvd	Victoria Ave	Jurupa Ave	IIB	3.73	Opportunity	$8,631,186	5,6,7
Victoria Ave	La Sierra Ave	Central Ave	IV	7.31	Long Term	$16,897,911	3,4,5

Planning level cost estimates using 2020 unit cost assumptions

Pedestrian Projects

Prioritized pedestrian projects can be seen in Table 4-35

TABLE 4-35 PRIORITIZED PEDESTRIAN PROJECTS WITH PLANNING-LEVEL COSTS

LOCATION	CROSS STREET	IMPROVEMENT	IMPLEMENTATION CATEGORY	ESTIMATED TOTAL PROJECT COST	WARD
University Ave	Market St	Intersection Typology E	Long Term	$1,032,000	1
Iowa Ave	W Linden St	Intersection Typology A	Long Term	$760,000	2
Jurupa Ave	Magnolia Ave	Intersection Typology A	Opportunity	$435,000	3
Wood Rd	Van Buren Blvd	Intersection Typology A	Long Term	$447,000	4
Indiana Ave	La Sierra Ave	Intersection Typology A	Long Term	$947,000	5
La Sierra Ave	Pierce St and Hole St	Upgrade intersection. Bushnell pedestrian plaza with removable bollards and historic signage. Typology A	Long Term	$1,006,000	6
Western Ave	Arlington Ave	Intersection Typology C	Opportunity	$260,000	7

Section 6: Pedestrian Target Safeguarding

Section 6.1:
Executive Summary

Executive Summary

PRINCIPLES OF DESIGNING SAFER PUBLIC SPACES

The Pedestrian Target Safeguarding Plan (Plan) provides building perimeter and public space security design solutions intended to protect against threats resulting from unauthorized vehicles entering public spaces.

Based on stakeholder interviews the Plan identifies and provides design recommendations for six high priority areas within the City of Riverside including:

- Main Street Pedestrian Mall
- Ryan Bonaminio Park
- University Village
- Riverside Convention Center
- Martha McLean- anza Narrows Park
- Special Event Street Closure Program

OBJECTIVES

The overall objective of the Plan is to complete the following tasks:

- Identify six sites, which are representative of various locations throughout the City, for this Plan's assessment based on high levels of pedestrian activity and high risk for accidental/intentional vehicular collisions.
- Identify historic areas of concern.
- Identify what Pedestrian Safeguarding means to City staff and what is intended from the recommendations and this Plan.
- Identify prioritized locations where public safety should be addressed based on vulnerability and risk.

The approach of this Plan factors in the following considerations and safety methods typically employed:

- Where are special event sites and/or areas with frequent daily use by pedestrians?
- What is the frequency of use? How is a space being used?
- Where might accidental incidents occur related to public space?
- Where can intentional attacks occur as a result of barrier deficiencies?
- What is the density of the surrounding built environment?

GOALS

Based on a series of interviews with City staff and public safety officials in Riverside, the design team developed the following goals to guide the Plan development.

- Provide security in the context of streetscape enhancement and public realm beautification.
- Work within the framework of street furniture elements that currently exist in the City of Riverside.
- Produce a coherent strategy for deploying specific types of streetscape and security elements that also improve lighting, attractiveness of space, and function of public gathering when possible.
- Provide perimeter security in a manner that does not impede the City's commerce and vitality, excessively restrict or impede operational use of sidewalks or pedestrian and vehicular mobility, nor impact the health of existing trees.
- Identify an implementation strategy that can be efficiently coordinated in the most cost effective manner.

BEST PRACTICES

The Plan addresses the need to provide design solutions that will promote vibrant public spaces and support a variety of pedestrian experiences while seamlessly integrating security into existing and future development.

Crime Prevention Through Environmental Design CPTED strategies provided guidance when analyzing priority areas and developing recommendations. These strategies recommend using natural, visually pleasing passive surveillance elements to deter crime and the fear of crime.

Assessment of Soft Targets

Soft target areas are typically easily accessible and exposed, accommodate a high density of people, and frequently hold events. The Plan identifies vulnerable sites where protective measures should be strategically implemented and security should be increased.

Mitigation Plan

Hostile vehicle mitigation measures, such as vehicle barriers around a perimeter, can protect outdoor venues. The City should evaluate a site layout, and consider possible vehicle approach scenarios to determine mitigation measures that can reduce the vulnerability to both intentional and accidental vehicle ramming.

Vehicle Barrier Standards

Vehicle barrier standards must be understood to guide selection and procurement of an anti-ram vehicle barrier based on the specification of vehicle weight, impact speed and dynamic penetration distance.

Vehicle Barrier Design Elements

Vehicle barriers should be utilized in situations where site configuration is vulnerable and pedestrian activity is high. The placement of barriers should consider function, budget, design aesthetics, and proximity to other elements. Barrier systems can vary widely to provide a range of security from visual deterrents, engineered solutions that calculate weight and resistance, to the most robust and reliable anti-ram barriers.

Barriers can be permanent or temporary and passive or active. They should be strategically chosen to fit the needs of the location.

Accommodate Pedestrian and Vehicle Access

Circulation patterns of the site should be monitored under normal conditions and during large gathering events. Barrier placement should not impede desired travel patterns and should facilitate the funneling of pedestrians out of harm's way. Barrier selection and layout should allow for maintenance and emergency vehicle access.

PEDESTRIAN SAFEGUARDING DESIGN GUIDELINES

Street furnishings such as bollards, boulders, light poles, benches, and public art can act as pedestrian safeguarding elements. The Plan provides guidance on placement of safeguarding elements with respect to ADA compliance and best practices.

The guidelines provide installation and design parameters for pedestrian safeguarding standards in public spaces.

SECURITY ZONES

It is important to understand the best approach to support and facilitate movement of pedestrians and maintenance and emergency vehicles while maintaining a safe and secure public space. Security zone types and the functions and design elements associated within each should be identified. Examples of security zones include curb lanes (or furnishing zones) and sidewalks.

STREETSCAPE SECURITY ELEMENTS

The goal is to achieve a well-designed, secure and aesthetically pleasing street design by incorporating streetscape security elements into existing streetscape conditions. Appropriate elements should be selected based on recommended dimensions and placement with consideration given to existing underground systems, utilities and street trees. A variety of elements to select from and utilize allows for flexibility in creating a safe and comfortable pedestrian space, including the following:

- Street furniture (includes hardened benches, waste receptacles, etc)
- Benches
- Bollards
- Seat bollards
- Retractable bollard
- Gate arms
- Fences and walls
- Planters
- Precast concrete or stone seat planter
- Street trees
- Deciduous or evergreen plantings
- Street light standards
- Pedestrian light standards
- Heavy objects (boulders, art, etc.)

Section 6.2:
Principles of Designing Safer Public Space

Riverside-La Sierra Metrolink Station

Introduction

DESIGNING FOR PEDESTRIAN SAFEGUARDING

The Pedestrian Target Safeguarding Plan addresses increasingly varied strategies that potentially impact the character of the City of Riverside. The City of Riverside can have both good urban design and good security related to public spaces. As money is invested to make Riverside's streets and public spaces safer, it can also be invested in making them more beautiful. The City's goal is to seamlessly integrate building perimeter security into consistent, coherent, and welcoming streetscapes that are celebrated by the residents, businesses, and community of Riverside.

The Plan provides design solutions for public space security intended to protect against threats resulting from unauthorized vehicles entering public spaces. The Plan focuses exclusively on perimeters of public spaces designed to protect visitors, residents, and property from threats generated by unauthorized vehicles. It does not address other kinds of security measures, such as building hardening, operational procedures, or surveillance. To develop the appropriate security response the design team interviewed stakeholders from key agencies to determine the high priority areas and the magnitude of potential security threats. The responses guided the basis for further analysis and subsequent recommendations.

In conjunction with determining the most appropriate design interventions for each area, the required strength of the barrier system must also be determined. Some barriers must be designed to stop larger vehicles at high rates of speed, while others might be designed for smaller cars at lower speeds. Barriers of lesser strength may be used for protection at lower costs as more of a deterrent and vehicle approach angle. More robust protection will be required when an approach is unimpeded, allowing vehicles direct access at higher speeds.

The Plan includes six high priority areas within the City of Riverside including:

- Riverside Convention Center
- Main Street Pedestrian Mall
- Ryan Bonaminio Park
- University Village
- Martha McLean-anza Narrows Park
- Special Event Street Closure Program

Design recommendations for these areas include an array of streetscape elements that incorporate security components, such as walls and fences, planters, bollards, and hardened street furniture (e.g. light posts and seating).

Best Practices

"proper design and effective use of the built environment can lead to a reduction in the fear and incidence of crime and an improvement in the quality of life." [1]

The Plan recognizes that a vibrant downtown and public space must provide space for a variety of pedestrian experiences. Therefore, the Plan incorporated a thorough review of the Municipal Zoning Code, other specific plans adopted in the City of Riverside, as well as streetscape manuals of the City of Riverside, as a framework for identifying streetscape elements that seamlessly integrate security with existing and future development and potential City-led trails or park projects. Additionally, there are two unique areas in downtown Riverside, which warrant custom designed solutions due to their civic importance and special events status.

1 International CPTED Association."https://www.cpted.net/

Photo Caption: Festival of Lights photo from The Press Enterprise

CRIME PREVENTION THROUGH ENVIRONMENTAL DESIGN (CPTED)

Crime Prevention Through Environmental Design (CPTED) strategies are a guiding best practice related to public space design. CPTED strategies include the physical design, social management, and law enforcement directives that seek to positively influence human behavior as people interact with their environment. One of the key goals of CPTED is to reduce opportunities for crime that may be inherent to the design of an existing public space.

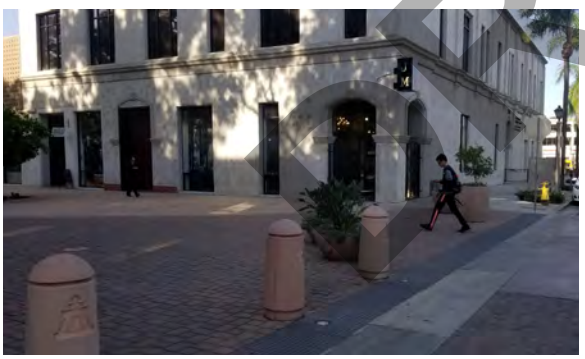
Four specific CPTED principles provided guidance during the design process for this Plan. Each of these strategies is important to consider when analyzing each priority area and when developing recommendations for protection, aesthetics, and accessibility of a space.

Natural Surveillance

The design and placement of physical features in a way that maximizes visibility, and creates unobstructed views of surrounding areas. Natural surveillance avoids the creation of building entrapment areas and prioritizes unobstructed doors and windows, transparent building materials, pedestrian-friendly sidewalks and streets, and good night time lighting.

Natural Access Control

Design concept that ensures entrances are clearly defined, visible, and well lit. People are physically guided through a space by the strategic design of streets, sidewalks, building entrances, landscaping, and neighborhood gateways. Design elements are very useful tools that clearly indicate public routes and discourage access to private areas and structural elements.



Territorial Reinforcement

Physical design can also create or extend a sphere of influence. Territorial reinforcement is the use of physical features that express ownership such as bollards, fencing, pavement treatments, signage, and landscaping.

Maintenance

Maintenance allows for the continued use of a space for its intended purpose. Deterioration and blight indicate less control by the intended users of a site and a level of disorder. Proper maintenance encourages visibility and limits inoperative lighting, and serves as an expression of ownership.

ASSESSMENT OF SOFT TARGETS

Soft Targets and Crowded Places (ST-CPs), such as entertainment venues, transportation hubs, outdoor parks and plazas, are destinations that are easily accessible to the public where they congregate in large crowds with limited security or protective measures in place making them vulnerable to attack. Limited security measures include a lack of recognizable security professionals controlling access to a venue as well as electronic means of monitoring and recording an area such as closed-circuit television cameras (CCTV). Protective measures would include the use of barriers that would prevent unauthorized access to an area and channel people and vehicles to designated access points with a security screening process.

Soft target areas are typically:

- Easily accessible and exposed
- Accommodate a high density of people
- Where frequent events are held

Photo Caption: Rhythm of Riverside Summer Nights Concert Series in Fairmount Park from Riversideca.gov

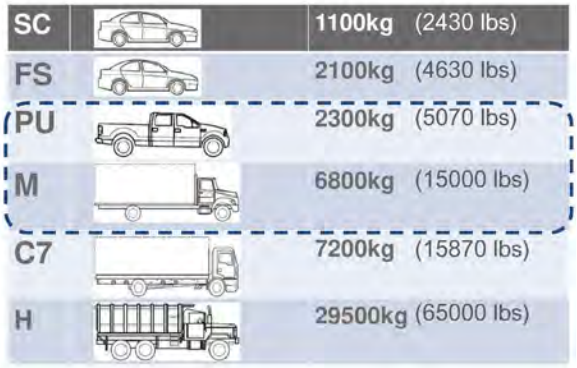
MITIGATION MEASURES

Attacks involving intentional vehicle ramming of soft-target, densely populated outdoor areas have become increasingly common (See Table 6-1). These events have predominately occurred at public parks and pathways, shopping districts and outdoor events where large crowds of people have congregated in an open, easily accessible setting. These events have propelled both public and private sector decision makers to implement hostile vehicle mitigation measures to protect these outdoor venues by means of installing vehicle barriers around the perimeter of a gathering space (i.e., plaza, outdoor theater, etc.), along the street side of heavily trafficked sidewalks and other vulnerable areas.

Implemention of a mitigation plan involves an initial assessment that evaluates the existing or proposed site layout considering possible vehicle approach scenarios, and determines mitigation measures to reduce the vulnerability to both intentional and accidental vehicle ramming. Vulnerabilities lie where vehicles can obtain high speeds through a direct (straight) path of travel to impact densely populated areas. Mitigation can be achieved by providing obstacles to limit a direct approach (curved roadways, lane dividers and/or curbs) and/or implementing rated or non-rated barriers to stop or deter vehicle access.

Year	Attacks	% Attacks	Fatalities	FPA
2014	11	8.8	62	5.6
2015	19	15.2	13	0.7
2016	11	8.8	102	9.3
2017	36	28.8	63	1.8
2018	35	28.0	61	1.7
2019	13	10.4	19	1.5
Total/Averages	**125**	**100**	**320**	**2.6**

Table 1. Vehicle Ramming Attacks/Incidents Fall in 2019, Mineta Transportation Institute - San Jose State University, Nov 26 2019)



ASTM-F2656 highlights the impact of different types of vehicles based on weight.

VEHICLE BARRIER STANDARDS

Risk associated with an intentional vehicle impact can be expressed in terms of barrier crash ratings, also termed anti-ram. There are a number of industry standards for determining the barrier capacity with respect to a vehicle impact, the most common of which is ASTM-F2656 ***Standard Test method for Vehicle Crash Testing of Perimeter Barriers*** (See Figure 6-1 at right). This standard is used for the selection and procurement of an anti-ram vehicle barrier based on the specification of vehicle weight, impact speed, and dynamic penetration distance (i.e., distance past the impact point that a vehicle is stopped). Other similar standards include ISO - IWA 14-1:2013 Vehicle security barriers - Part 1: Performance requirement, vehicle impact test method and performance rating, and BSI – PAS 68 impact test specifications for vehicle security barrier systems.

Crash-ratings are dependent on the vehicle type: Small Passenger Cars (2430-lb), Pickup Trucks (5070-lb), or Medium-duty Trucks (15,000 lb). Of these vehicle sizes, a pickup truck is the most commonly used for design of barriers domestically, including government, airports and other facilities, unless their target attractiveness and asset value warrants a larger vehicle. Once the vehicle size is determined the impact speed and dynamic penetration distance is specified for procurement of an anti-ram rated barrier.

There are also vehicle barrier standards and selection guides developed by the U.S. Department of Transportation and affiliated research groups that are used for accidental events, however, their objective is to redirect a vehicle with the aim of protecting the driver, rather than render the vehicle inoperable and stop them at a specific distance from an intended target. In the context of an intentional event, these guidelines generally do not provide a barrier design with the needed protection and should only be used

with the knowledge of their limitations.

VEHICLE BARRIER DESIGN ELEMENTS

The most effective approach for mitigating a hostile vehicle threat is to configure the site to prevent a direct path of travel to densely populated areas. Where the site design cannot accommodate redirecting roadways or relocating public access away from vulnerable areas, vehicle barriers may be considered. The placement of barriers should be coordinated with other physical security measures such as signage that makes it clear where vehicles and pedestrians should and should not be, as well as vehicle and pedestrian access points with active access controls. Barrier placement and design should also consider the aesthetics and function of an area, including pedestrian paths of travel. Most importantly, a clear zone along the line of barriers that provides significant distance between large crowds and vehicles should be implemented to protect bystanders from crash debris as well as facilitate detection, intervention, and response by the security force.

Barrier selection is highly dependent on the given site vulnerability, risk of an attack occurring, and existing conditions that would affect the installation and performance of the barrier. When considering barrier types, budget constraints may limit the best of

The comparison of images above highlights how the simple addition of bollards can act as a visual and effective physical barrier against vehicle penetration.

intentions. Anti-ram barriers are much more costly than non-rated elements (i.e., street furniture, bushes, boulders, etc.). Therefore, highly vulnerable areas with frequent, large-crowd events may warrant anti-ram barriers while less vulnerable areas with a lighter population density may warrant a more cost-effective approach of installing 'robust' non-rated barriers that would serve as an effective deterrent. As a part of this Plan process, recommendations for barrier design include both the visual aesthetic and effectiveness in stopping vehicle penetration. At right are some examples of design solutions for specific public space areas.

Barriers, whether they be anti-ram or a deterrent system, discussed in the next section, should always be spaced close

enough such that a vehicle cannot drive between them. The industry standard of practice is a 4-foot clear distance, however, the wheelbase distance of the design vehicle type (i.e., compact, sedan, light-duty truck, etc.), can range from 4 to 6 feet. Additionally, the bumper height should be considered to prevent a vehicle from vaulting over a barrier. Minimum barrier heights are typically 30 inches for a sedan and 36 inches for a truck.

Deterrent, Engineered & Anti-Ram

The appearance of a robust security presence, both operational and fixed, serves as a powerful visual deterrence to a potential attacker. This can be accomplished by means of stationing police vehicles at heavily populated perimeter zones as well as the placement of engineered barriers or other vehicle deterrents. Means to deter vehicles without using rated barriers include boulders, planters, benches, or non-rated bollards.

While these solutions are not technically rated, they do have capacity to stop or slow a vehicle. Additionally, engineered solutions that rely on the calculated barrier weight and frictional resistance, such as jersey barriers and water-filled barriers, have some capacity to stop a vehicle, but are more commonly used to defend against an accidental vehicle ramming.

The most robust and reliable barrier is an anti-ram barrier, such as bollards, heavily reinforced concrete knee-walls and planters, and cable and steel post systems with substantial foundations. These systems are specifically designed with the strength and stiffness to stop a vehicle traveling at speeds of up to 50 mph with validation by crash testing.

Permanent & Temporary

Barriers can be permanent or temporary. Permanent barriers are ideally designed and installed to fit within the context of

Wall Street, NY: An example of how bollards can serve as public art, lighting, and contribute to both security and streetscape character.

National Museum of American Indian, Washington DC: Grade and retaining walls can be used to create public seating and provide physical separation for vehicle travel lanes and pedestrian spaces.

the setting, not disrupt or conflict with the pedestrian and vehicle paths of travel, while remaining substantially anchored and robust to resist a vehicle impact. Temporary barriers typically serve a more transient purpose, with selection priorities based on ease of installation, weight, and factors other than aesthetic appeal. Additionally, crash resistance of temporary barriers is often much less than more permanent solutions, as demontrated by jersey and water-filled barriers.

Temporary barrier products that offer substantial resistance, include the Meridian Archer 1200 and Ameristar Surface Guard products. Both products were specifically designed as modular, unanchored, rapid deployment systems for roadway closure during mass gatherings. When selecting a temporary barrier product, there are many factors that should be considered, including the following:

- Crash Rating
- Weight
- Installation Time
- Storage Space
- Specialized Equipment for Transport & Installation
- Cost

Temporary barrier: Jersey barrier

Temporary barrier: Water filled barrier

Passive & Active

There are two types of barriers, passive and active. Passive barriers are always in a fixed state of deployment with non-moving parts. These include (see images at right):

- Bollards
- Kneewalls
- Planters
- Cables
- Jersey Barriers

Passive anti-ram rated barriers typically require substantial foundations that often times conflict with underground utilities, therefore, a civil survey should be performed

Temporary barrier: Meridian Archer 1200

Temporary barrier: Ameristar Surface Guard

Examples of passive barriers including kneewalls, planters, and public seating integrated into low retaining walls

prior to final design and placement. Alternatively, there are 'shallow mount' bollards and other rated barriers with foundations that extend no more than 12 inches into the subgrade and can be cast within an existing sidewalk.

Active barriers are those that retract or raise to allow the passage of a vehicle along a roadway, such as wedge and plate barriers that rotate up out of the ground and when retracted are flush with the roadway surface. Other types of active barriers include lift-out or retractable bollards, overhead drop arm with cable and dead man, and sliding or swing crash gates. There are several factors to be considered in the selection of active barriers, including:

- Crash Rating
- Control Mechanism (manual hydraulic, pneumatic or electro-mechanical)
- Failure Mode (aised or closed)
- Cycle Time (rate of operation)
- Safety & Security
- Durability, Maintenance and Environmental Resistance
- Maintenance
- Cost

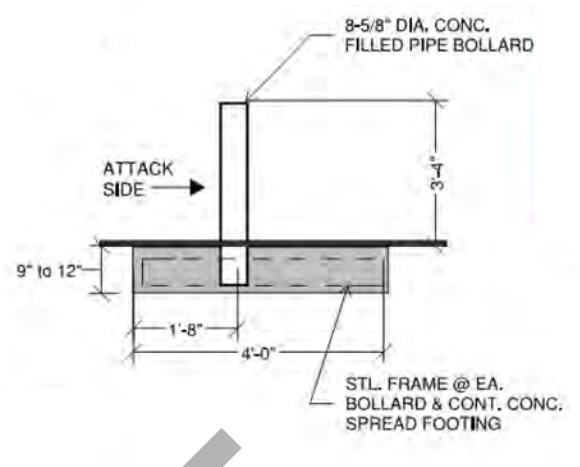


Image above shows a shallow mount foundation

Example of active barrier: "pop up" or retractable bollards shown above

Examples of active barrier: surface plate shown above

ACCOMMODATE PEDESTRIAN AND VEHICLE ACCESS

One of the most important considerations in the layout of permanent vehicle barriers is an understanding of how a specific area functions, both under normal (i.e. daily) conditions as well as during large gathering events. Barriers should be placed such that they do not impede paths of travel for pedestrians, bicyclists and permitted vehicles, and facilitate the funneling of pedestrians out of harm's way. For example, often barriers are positioned along roadways directly adjacent to curbs, which can impede the ability of a passenger to exit a parked vehicle.

Barrier selection and layout should consider allowance for maintenance and emergency vehicle access, as well as event set-up and break-down. In these instances, specific points of access should be coordinated with emergency responders with provisions for active barrier control by them. Manually removable barriers are also an option, however, they are heavy and would ideally be equipped with a tamper-proof locking device, use of which may impact emergency response time.

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Section 6.3:
Design Guidelines


Now Serving Breakfast
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