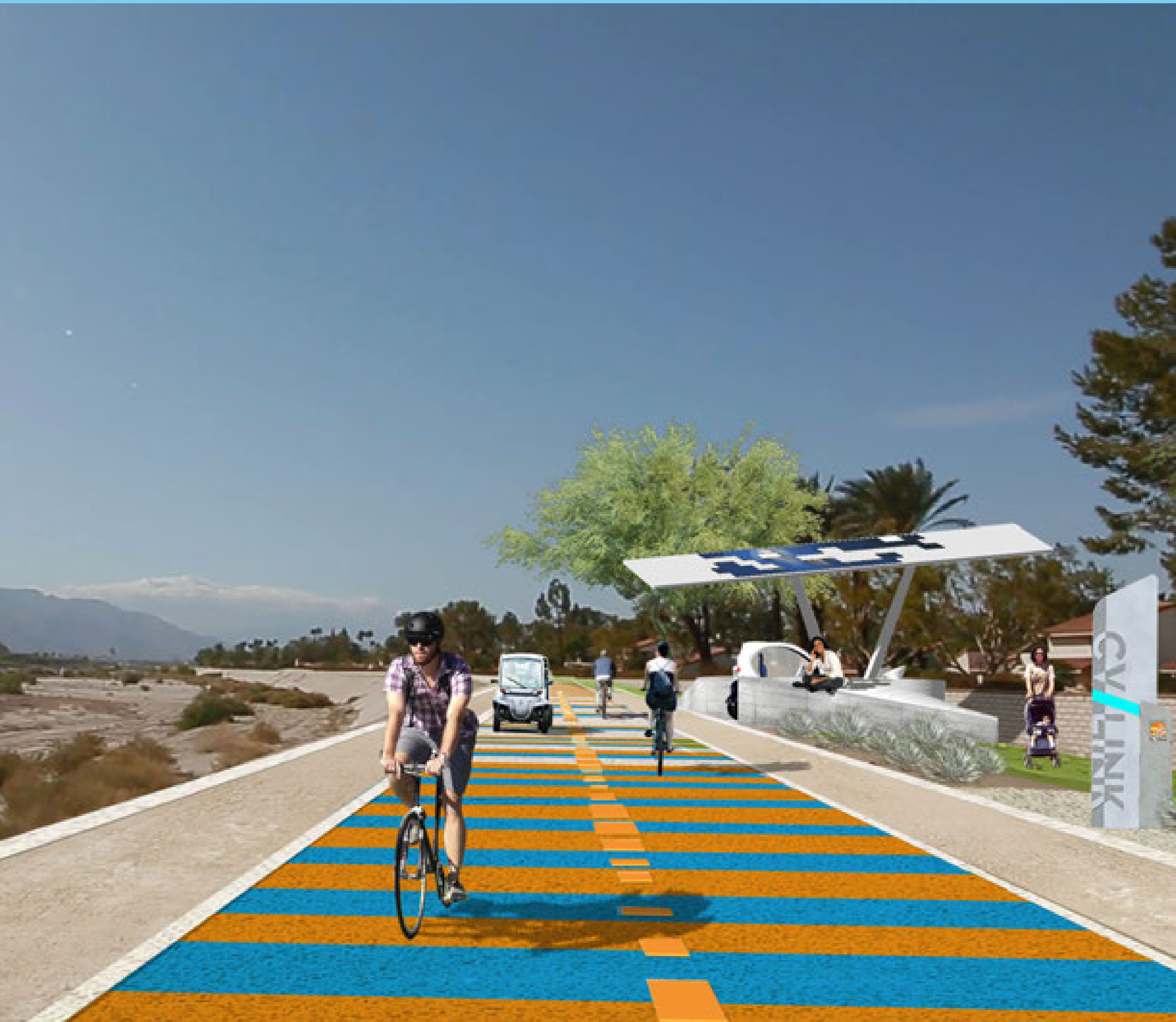
# CV LINK

CONNECTING THE COACHELLA VALLEY

# DRAFT PLAN: APPENDICES

## AUGUST 2014



THIS PAGE INTENTIONALLY LEFT BLANK

# Table of Contents

# PLANNING APPENDICES

THIS PAGE INTENTIONALLY LEFT BLANK

# APPENDIX 1. PLANNING AND DESIGN CONTEXT

## 1.1. Document Overview

The Master Plan development process has been informed by many planning and legislative documents. A selection of these documents is presented in Figure 1 (overleaf).

This memo reviews key planning documents and other resources that will inform the planning and design of the CV Link project over the next several years. An assessment of over 90 unique plans and documents identified the most relevant and important resources for this project and organized them into several different categories:

- Key resources that are intrinsically linked to the purpose of CV Link
- Policy resources that provide the context for issues such as regional transportation networks, land use, key destinations and activity areas.
- Design resources that will provide professional standards, example best practices, guidance and recommendations for specific elements such as geometric configurations and alignment decisions.
- Visioning resources that explain the importance of CV Link to the regional community and goals that construction of the facility is intended to accomplish.


FIGURE 1: PLANNING DOCUMENT CONTEXT

## 1.2. Key Resources

### 1.2.1. WHITEWATER RIVER / PARKWAY 1E11 PRELIMINARY STUDY REPORT

| Type | Corridor study | Geography | Coachella Valley |
|---|---|---|---|
| Author, Date | LSA Associates, Alta Planning + Design & RBF Consulting, 2012 | | |

**Document Significance**

Building on the prior Whitewater River, All American Canal, Dillon Road Regional Trails Study (2009), the Whitewater River / Parkway 1e11 NEV/Bike/Pedestrian Corridor Preliminary Study Report (typically referred to simply as the "PSR") added the concept of Low Speed Electric Vehicles (LSEVs – a vehicle category that includes Neighborhood Electric Vehicles or NEVs). It provided the starting point for this master plan process.

**Key Aspects**

- The PSR found that procuring right-of-way/easements, crossing arterials streets and topographical features, and passing through private developments like golf courses would be the greatest challenges to completing CV Link.
- Lesser, but notable challenges for the CV Link Master Plan identified in the PSR included maintenance and management agreements across multiple jurisdictions along the length of the corridor.
- Includes preliminary cross-sections and initial design guidelines.

### 1.2.2. PARKWAY 1E11 AIR QUALITY BENEFITS REPORT

| Type | Planning document | Geography | Coachella Valley |
|---|---|---|---|
| Author, Date | Alta Planning + Design, 2012 | | |

**Document Significance**

The Air Quality Benefits Report estimates are a useful resource for addressing environmental concerns.

**Key Aspects**

- The Seamless Travel Demand model estimates the mode shift from traditional motor vehicles to parkway users. By the planning horizon year 2035, it estimates that 43.5 million trips corresponding to 144.5 million miles will be eliminated in favor of the parkway. In the year 2035, this would be over 12 million less vehicle miles traveled (VMT).
- Using EPA and CARB emissions factors, the report estimates the air quality benefits (reductions in emissions) for hydrocarbons, particulate matter, nitrous oxides, carbon monoxide and carbon dioxide ($CO_2$). Table 4 presents annual benefits, while Table 5 presents cumulative benefits.

- By 2035, the total reduced emissions in pounds are estimated to be: hydrocarbons – 433,574; PM2.5 – 16,250; and CO2 – 117,572,330.
- These reductions could be monetized if the US adopts a carbon trading market as used in the European Union and other countries, or translated into health terms through a Health Impact Assessment (HIA).

### 1.2.3. WHITEWATER RIVER, ALL AMERICAN CANAL, DILLON ROAD REGIONAL TRAILS STUDY

| Type | Corridor study | Geography | Coachella Valley |
|---|---|---|---|
| Author, Date | Dangermond, 2009 | | |

**Document Significance**

This 2009 study is the predecessor to the 2012 Whitewater River/Parkway NEV/Bike/Pedestrian Corridor Preliminary Study Report. The study proposed an alignment for the pathway along the Whitewater River, All American Canal and Dillon Road. Regional destinations and areas of interest, such as parks, were considered in the development of the alignment, as well as initial feasibility, cost, safety and environmental considerations.

**Key Aspects**

- In several cases, the study recommends detours around rather than through golf courses
- The study identified arterial crossings as a major barrier to completion. Initial recommendations for how to facilitate these crossings are included in the report and will be considered through this master plan project.
- Discrepancies between County Assessor and CVWD ROW data were identified.

### 1.2.4. TAHQUITZ CREEK TRAIL MASTER PLAN (TCTMP)

| Type | Trails study | Geography | Palm Springs |
|---|---|---|---|
| Author, Date | Alta Planning + Design, 2010 | | |

**Document Significance**

The TCTMP proposes the improvements to the section of Tahquitz Creek Trail between Belardo Road and the bridge east of Desert Chapel Church and School (approximately 1.5 miles). The TCTMP reviews existing conditions, identifies opportunities and constraints, presents alignment options, proposes trail themes, addresses arterial crossing options, and estimates permitting and construction costs. It is a resource that can be applied to other sections of Tahquitz Creek Trail.

**Key Aspects**

- Planning and design for CV Link segment 2A through Palm Springs should reference the TCTMP and the City of Palm Springs Bicycle Infrastructure Improvements Project (Phase II Report)
- Recommendations in two phases (Phase 1 unless otherwise noted):
    a. Construct a soft-surface path on the south side of the Tahquitz Creek (Phase 2)
    b. Extend the western terminus of the existing trail across Palm Canyon to Belardo Road
    c. Install an equestrian trail at the bottom of the Creek (Phase 2)
    d. Realign the section between Sunrise and the small bridge east of Desert Chapel
    e. Build two trailheads (termed "access points" for CV Link)
    f. Add amenities such as landscaping, directional and interpretive signage, gateway monuments, and artistic elements.

### 1.2.5. CITY OF PALM SPRINGS BICYCLE INFRASTRUCTURE IMPROVEMENTS PROJECT

| Type | Plan and project review; field study | Geography | Palm Springs |
|---|---|---|---|
| Author, Date | LSA with assistance from CVCTA, 2012 | | |

**Document Significance**

This 2012 plan for the City of Palm Springs Sustainability Commission was Phase II of a two-part project. It reviewed existing city budgets and planned projects to identify opportunities for bikeway enhancements and included an extensive field study of the Tahquitz Creek Trail with photos. It is relevant to Segment 2A of the master plan.

**Key Aspects**

The report makes recommendations in the following areas:

- Identifying and directional signage, mileage markers
- Installation of a more direct crossing of Farrell Drive
- Re-paving and structures maintenance, including for the original route in Demuth Park.
- Rectifying the trail gap at the Tahquitz Creek Golf Course entrance (the head of the T intersection of 34th Avenue, Golf Club Drive, and Crossley Road).

### 1.2.6. INDIO TRAILS FEASIBILITY STUDY

| Type | Trails study | Geography | Indio |
|---|---|---|---|
| Author, Date | CVCTA, with LSA & PCA Engineering, 2009 | | |

**Document Significance**

This 2009 trails plan for the City of Indio proposed expanding the local trail network by nearly 100 miles, recommending improved facilities for use by pedestrians, bicyclists and equestrians. The plan also made some initial considerations of LSEV users. Much of the material presented in this plan was incorporated into recommendations of the CVAG Non-Motorized Plan update in 2010.

**Key Aspects**

- Planning and design considerations for sections of CV Link through the City of Indio will heavily reference the Indio Trails Feasibility Study for background information on the existing and planned local trail network.
- The Study also includes general recommendations about maintenance agreements, and trails partnerships between multiple entities, agencies and jurisdictions, that will be useful in several tasks of the master plan process.

### 1.2.7. COACHELLA VALLEY NON-MOTORIZED TRANSPORTATION PLAN (NMTP)

| Type | Transportation plan | Geography | Coachella Valley |
|---|---|---|---|
| Author, Date | Ryan Snyder Associates & Urban Crossroads, 2010 | | |

**Document Significance**

This comprehensive non-motorized plan for all cities in Coachella Valley summarized the existing conditions for bicycling and walking in the region in order to recommend future improvements. The proposed network of new facilities for bicycle and pedestrian users included design recommendations to accommodate shared use by equestrians and LSEVs. The NMTP was updated in 2011 and adopted by the City of Palm Springs as part of their General Plan.

**Key Aspects**

- The local bicycle network plans for each city that are included in the Non-motorized Transportation Plan will be referenced throughout the planning process. The master plan will consider how CV Link interfaces and connects with both existing and planned local bikeways.

### 1.2.8. CVWD JURISDICTIONAL DELINEATION (JD)

| Type | Corridor study | Geography | Coachella Valley |
|---|---|---|---|
| Author, Date | ICF International for CVWD, 2012 | | |

**Document Significance**

The Jurisdictional Delineation Report completed by ICF International (ICF) in 2012 identified water management issues along the Whitewater River and Coachella Valley Stormwater Channels and several tributaries for the Coachella Valley Water District (CVWD). The JD is required by the Army Corps of Engineers (ACOE).

**Key Aspects**

- The CVWD Jurisdictional Delineation Report omitted privately managed property and areas (such as golf courses) in Reach II because CVWD does not have responsibility for managing those areas. However, water and stormwater management may be an issue that arises later with private property owners through the course of CV Link planning and design.
- The report identified the extents of four different reaches (I, II, III and IV) throughout the study area, and identified agencies (such as the California Department of Fish and Game, and others) with jurisdiction over water and land management that could impact trail planning and design choices.
- Recent delineation of federal and State waters, riparian areas, and wetlands for much of the Whitewater channel.

### 1.2.9. CVWD DEVELOPMENT DESIGN MANUAL

| Type | Design guide | Geography | Coachella Valley |
|---|---|---|---|
| Author, Date | Coachella Valley Water District, 2010 | | |

**Document Significance**

Based on the applicable state, regional and local law, Section 8 Design Criteria Stormwater Facilities outlines the standards that pertain to the conveyance of floodwaters through the stormwater system and provide the maximum possible protection to properties. “Guidance is provided to developers and their engineers on submissions required for approval of the design and construction of projects that encroach on or are adjacent to stormwater facilities” (p.8-1).

**Key Aspects**

- Any manipulation of the levee structure will need to comply with the design criteria outlined in this manual, especially with respect to design flood capacity.
- Capacity issues are known to exist south of Indio to the Salton Sea and involve substantial planning uncertainties.

### 1.2.10. GOLF TRAILS BEST PRACTICES

| Type | Design guide | Geography | California, Oregon |
|---|---|---|---|
| Author, Date | Alta Planning + Design, 2005 | | |

**Document Significance**

The CV Link draft alignment interacts with seven golf courses along its length. This best practices document will inform specialty trail design in the vicinity of local golf courses in order to maximize shared benefits by local and regional trail users as well as golf course users and adjacent property owners.

**Key Aspects**

- Golf Trails Best Practices examines standards of liability of interactions between path users and golf course users and owners; this background information and understanding will provide a starting point for discussing CV Link segment alignments through local golf courses.
- Profiles of golf course-specific path treatments (such as high curved fences, cage fencing and netting) will be useful throughout the design stages of the project.
- Recommendations on maintenance, designs for shared use between passing trail users and golf course users, strategies for deterring trespassing and standards for hours of use will all be relevant to the development of maintenance agreements for CV Link between local jurisdictions and property owners.

### 1.2.11. PLUG IN ELECTRIC VEHICLE READINESS PLAN

| | | | |
|---|---|---|---|
| Type | Transportation plan | Geography | Coachella Valley |
| Author, Date | ICF International, 2014 | | |

**Document Significance**

With grant funding support from the California Energy Commission, CVAG convened the Coachella Valley PEV Coordinating Council to develop a plan to prepare for the influx of plug-in electric vehicles (PEVs). This document focuses on the near-term development of the infrastructure, market, and regulatory mechanisms necessary for regional deployment of electric vehicles. “Infrastructure” is limited to charging stations and EV Supply Equipment (EVSE), since the plan includes all EVs (not just NEVs).

### 1.2.12. REVEALING THE INVISIBLE COACHELLA VALLEY

| | | | |
|---|---|---|---|
| Type | Health & Environmental Planning Report | Geography | Eastern Coachella Valley |
| Author, Date | UC Davis for California Institute for Rural Studies, 2013 | | |

**Document Significance**

The authors developed a Cumulative Environmental Vulnerability Assessment (CEVA) that reveals “…residents in the Eastern Coachella Valley face significant and overlapping environmental hazards and social vulnerability that far exceed those in the Western Coachella Valley and the county as a whole. In particular, agricultural pesticide applications, drinking water quality, and housing quality are key challenges to community well-being.” The implication for CV Link is that environmental justice may be an important criterion in selection of early action segments.

**Key Aspects**

- A mismatch in affordable housing and job locations results in long trip distances; public advocates have prioritized equitable access to transportation due to gaps in public transportation
- The report recommends utilizing planning processes (including transportation) to improve environmental and social conditions, including in unincorporated areas

### 1.2.13. RECREATION AND PARKS MASTER PLAN

| Type | Parks Plan | Geography | Coachella Valley |
|---|---|---|---|
| Author, Date | Coachella Valley Recreation & Park District, 2006 | | |

**Document Significance**

This plan includes existing conditions (as of 2006), visioning, programs and policies, and funding sources. The CV Link master plan includes a Maintenance and Management Plan component that could build on the Recreation and Parks Master Plan.

## 1.3. Policy Resources

### 1.3.1. GENERAL PLANS

- Coachella General Plan Circulation Element Update 2012, City of Coachella, 2012
- La Quinta General Plan Circulation Element Update Traffic Impact Analysis, City of La Quinta.
- Rancho Mirage General Plan Circulation Element, City of Rancho Mirage, 2005
- Desert Hot Springs, 2000, City of Desert Hot Springs General Plan Circulation Element, City of Desert Hot Springs, 2000
- Palm Springs General Plan Circulation Element 4-1, City of Palm Springs, 2007.
- Cathedral City General Plan Circulation Element, City of Cathedral City, 2009.
- Cathedral City Neighborhood Traffic Control Program, City of Cathedral City.
- Desert Recreation District Strategic Plan, Desert Recreation District, 2012.

### 1.3.2. NEV PLANS AND STUDIES

- *NEV Transportation Plan*, City of Lincoln, 2006.
- Final Draft NEV Transportation Plan, Resolution No. 2008-39, City of Rocklin, 2008.
- Report to the California State Legislature, City of Lincoln Neighborhood Electric Vehicle Transportation Plan Evaluation, City of Lincoln, 2008.
- Woodland to Davis ATC Study, Fehr & Peers, 2009.
- NEV Operating Costs Study (Electricity), Paul Ternullo.
- The Mobility Needs of Older Americans: Implications for Transportation Reauthorization, Brookings Institute, 2003.
- Household Markets for Neighborhood Electric Vehicles, ITS Davis, 1995.
- Neighborhood Electric Vehicles, Office of Legislative Research (OLR) Report, Connecticut General Assembly, 2008.
- Prospects for Neighborhood Electric Vehicles, UCTC, 1994.

### 1.3.3. **LEGISLATION**

- 49 CFR Part 571 Federal Motor Vehicle Safety Standards; Low Speed Vehicles, NHTSA, 2005.
- SB 663 (2009), Neighborhood Electric Vehicle Plan for the City of Palm Desert.
- AB 110 (1995), Chapter 334, Golf Cart Lanes / Transportation Plan for the City of Palm Desert.
- AB 118 (2007), Alternative Fuels and Vehicle Technologies: Funding Programs,
- AB 29633 (2008), Chapter 199, Neighborhood Electric Vehicle Plan, City of Lincoln and Rocklin.
- AB 956 (2007), Chapter 442, Neighborhood Electric Vehicle Plan, Rancho Mission Viejo.
- AB No. 956 (2007), Neighborhood Electric Vehicle Plan, Rancho Mission Viejo.
- AB No. 2353 (2004), Chapter 422, Neighborhood Electric Vehicle Plan, City of Lincoln and Rocklin.
- *Vehicle Code*, California Department of Motor Vehicles (DMV), 2009.
- City of Palm Desert Municipal Code, Chapter 10.76 Golf Carts, City of Palm Desert.
- Resolution No. 99-010 Sun City Golf Cart Transportation Plan, County of Riverside, 1998.
- Riverside County Ordinance No. 782 An Ordinance of the County of Riverside establishing the Riverside County Golf Cart Transportation Plan, County of Riverside, 1998.
- SB 732 (2007), Strategic Growth Council.

## 1.4. Design Resources

Throughout the planning and preliminary design, established national and state design standards and guides have been consulted. However, in several respects CV Link is breaking new ground and setting new standards for quality, safety, comfort and efficiency. Accordingly, new ideas are proposed in the Design chapter and guidelines.

### 1.4.1. **GENERAL DESIGN GUIDANCE**

- *Development Design Manual,* CVWD, 2010. In particular, Chapter 8 Stormwater Facilities.
- A Policy on Geometric Design of Highways and Streets, 6th Edition, AASHTO, 2011.
- Highway Design Manual, Caltrans, 2012.
- Manual on Uniform Traffic Control Devices for Streets and Highways, CTCDC, 2012.
- Cathedral City Whitewater Bike Trail Phase 1, City of Cathedral City.
- Agua Caliente Complete Streets Planning Effort, Agua Caliente, 2013.

### 1.4.2. BICYCLE / PEDESTRIAN DESIGN GUIDANCE

- Guide for the Development of Bicycle Facilities 4th Ed, AASHTO, 2012.
- Urban Bikeway Design Guide, 2nd Ed, NACTO, 2012.
- Riverside County General Plan, Circulation Element – Non-motorized Transportation, County of Riverside, 2013.

### 1.4.3. NEV SPECIFIC DESIGN GUIDANCE

- Demonstration of Neighborhood Electric Vehicles (NEVs), CA Energy Commission, 2002.
- *Study of NEV User Behavior*, Green Car Institute, 2003.
- Thriving with Neighborhood Electric Vehicles, ASCE, 2007.
- Assessment of Low-Speed Electric Vehicles in Urban Communities, Transportation Development Centre (CAN), 2002.
- Policy and Design Considerations for Accommodating Low-Speed Vehicles and Golf Carts in Community Transportation Networks, AARP (Undated)
- Meeting Minutes on City of Lincoln NEV Signage, CTCDC, 2005.
- Roadway Infrastructure for Neighborhood Electric Vehicles, UC Berkeley, 1994.
- Studies of Road Infrastructure Requirements for Small Innovative Vehicles, ITS Berkeley, 1993.
- CTCDC Approved Experimental Standards, City of Lincoln.

## 1.5. Visioning Resources

These documents represent regional policy goals and a vision for a facility that will transform transportation and recreation within the Coachella Valley. Interim evaluation of the planning and design process with consideration of the vision established in these documents will help CV Link to achieve the level of impact desired by the regional community.

- Parkway 1e11 Economic Benefits Report, 2012.
- Building a Healthier Coachella Valley: A Toolkit for Change, CVAG.
- *Critical Evaluation of EV Benefits*, Transportation Development Centre (CAN), 1999.
- *Coachella Valley Blueprint for Action,* Clinton Foundation, undated.

# APPENDIX 2. OUTREACH

## 2.1. Citizens Advisory Group

A Citizens Advisory Group (CAG) was formed by the project consulting team to serve as a sounding board on key master plan elements, assist the consulting team with identification of the opportunities and constraints found along the study area, and advise the project team on public involvement plan implementation. The group was not officially appointed. The meetings and topics discussed are listed as follows:

- 3/4/13 Introduction
- 4/17/13 Opportunities and Constraints
- 6/12/13 Design concept
- 9/18/13 Design elements
- 12/10/13 Alignment
- 2/19/14 Alignment and NEV Plan
- 5/6/14 Alignment and Phasing

The CAG membership was based on geographic and community diversity factors. Membership changed over the course of the project however the list of members as of December 2013 is presented in Table 1.

TABLE 1: CITIZENS ADVISORY GROUP MEMBERSHIP AS AT DECEMBER 2013

| Name | Affiliation | Location |
|---|---|---|
| Richard Arghittu | Go Go Green Golf Carts | La Quinta |
| Lorraine Becker | Cabots Museum Board, DHS Parks Committee, PS Desert Resorts, CVA Board | DHS |
| Ezekiel Bonillas | Coachella Valley Economic Partnership (CVEP) | Indio |
| Vic Gainer | Coachella Valley HOA Presidents Council, Palm Springs Track Club | Palm Springs |
| Tricia Gehrlein | William J Clinton Foundation | Palm Desert |
| Paul Harris | Friends of CV Link | Cathedral City |
| Gary Lueders | CV Bicycle Club, CVCTA, CVAG Trails Committee | Rancho Mirage |
| Judy A. May | Incight – Move Beyond Your Boundaries | Palm Desert |
| Larry McLaughlin | College of the Desert | Palm Desert |
| Dr. Nicole Ortiz | Live Well Clinic | La Quinta |
| Paul Quill | Quill Enterprises, LQ Planning Commission | La Quinta |
| Jim Rothblatt | Community Trails Alliance, Incight | Palm Springs |
| Ed Schiller | Innovative Land Concepts, Inc. | Indio |

| Name | Affiliation | Location |
|---|---|---|
| Roger Snoble | LA Metropolitan Transit Authority (retired) | Rancho Mirage |
| Tim Sullivan | Renaissance Esmeralda Resort & Spa | Indian Wells |
| Russ Collins | Rancho Mirage | Rancho Mirage |

## 2.2. Events and Meetings

Aside from the aforementioned CAG meetings, a list of the events and meetings attended is presented in Table 2 below. Three media articles are presented following the table of events and meetings.

TABLE 2. EVENTS AND MEETINGS ATTENDED

| Date | Event or Meeting | Location |
|---|---|---|
| 1/24/13 | Palm Springs Bicycle Roundtable | Palm Springs |
| 2/10/13 | Unitarian Universalist Church of the Desert | Rancho Mirage |
| 3/16/13 | Rancho Las Palmas Community Meeting | Palm Desert |
| 3/19/13 | Desert Trails Coalition | Palm Desert |
| 3/26/13 | Associated Planners | Palm Springs |
| 3/26/13 | Caltrans – Jefferson Interchange | Indio |
| 3/27/13 | County Trails Committee | Other |
| 3/28/13 | Realtors Group Meeting | Palm Springs |
| 4/8/13 | Agua Caliente Planning Meeting | Palm Springs |
| 4/14/13 | International Trails Symposium | Other |
| 4/18/13 | Monterey Community | Monterey CC |
| 4/18/13 | Cathedral City HOA Presidents Council | Cathedral City |
| 5/9/13 | Palm Springs Bicycle Club | Palm Springs |
| 6/4/13 | Community Workshop # 1 | Palm Springs |
| 6/12/13 | City of Desert Hot Springs staff meeting | Desert Hot Springs |
| 6/27/13 | City of Palm Springs staff meeting | Palm Springs |
| 6/28/13 | City of Rancho Mirage staff meeting | Rancho Mirage |
| 7/1/13 | Escena Community | Palm Springs |
| 7/1/13 | College of the Desert Board of Directors | Palm Desert |
| 7/11/13 | Welk Resorts / Desert Oasis | Cathedral City |

| Date | Event or Meeting | Location |
|---|---|---|
| 7/17/13 | Palm Springs Board of Relators | Palm Springs |
| 7/25/13 | Community Workshop #2 | Indio |
| 7/25/13 | Frank Sinatra bridge planning meeting | Rancho Mirage |
| 7/25/13 | City of Palm Desert planning meeting | Palm Desert |
| 7/26/13 | Riverside County Parks and Open Space meeting | Palm Springs |
| 8/7/13 | Palm Springs Bicycle Roundtable | Palm Springs |
| 9/27/13 | Coachella Valley Water District | |
| 10/4/13 | Southern California Energy Summit | Palm Springs |
| 10/8/13 | Indian Wells Community | Indian Wells |
| 10/15/13 | Cathedral Canyon Country Club Representatives | Palm Springs |
| 10/15/13 | Tahquitz Golf Course Representatives | Palm Springs |
| 10/15/13 | Community Workshop #3 | Rancho Mirage |
| 10/16/13 | Desert Princess Community | Palm Springs |
| 10/18/13 | Leadership Coachella Valley | Palm Desert |
| 10/26/13 | Mesquite Country Club Community | Palm Springs |
| 11/20/13 | Desert Sands Unified School District | La Quinta |
| 11/21/13 | Palm Springs Village Fest | Palm Springs |
| 11/22/14 | Palm Springs Unified School District | Palm Springs |
| 11/22/14 | Coachella Valley Unified School District | Thermal |
| 12/3/13 | Notice of Preparation (NOP) Meeting | Palm Desert |
| 12/5/13 | Community Workshop #4 | Coachella |
| 12/7/13 | Tamale Festival | Indio |
| 12/10/13 | Indian Wells Country Club Representatives | Indian Wells |
| 1/2/14 | Rancho Las Palmas Country Club Representatives | Rancho Mirage |
| 1/11/14 | Humana Healthy Fun Fair | La Quinta |
| 1/11/14 | Palm Springs Mayor's Race & Wellness Festival | Palm Springs |
| 1/11/14 | CV Disability Sports Festival | Palm Desert |
| 1/21/14 | Four Seasons Community Meeting | Palm Springs |
| 1/22/14 | Rancho Mirage Mobile Home Park Community | Rancho Mirage |

| Date | Event or Meeting | Location |
|---|---|---|
| 1/22/14 | Mesquite Country Club Representatives | Palm Springs |
| 1/22/14 | Four Seasons residents | Palm Springs |
| 1/22/14 | Indio Middle School | Indio |
| 1/22/14 | La Quinta High School | La Quinta |
| 1/30/14 | Palm Desert Middle School / Lincoln Elementary | Palm Desert |
| 2/6/14 | Palm Desert International Sports Festival | Palm Desert |
| 2/7/14 | Tour de Palm Springs | Palm Springs |
| 2/11/14 | Indio Senior Health Fair | Indio |
| 2/15/14 | Palm Springs Modernism Week | Palm Springs |
| 2/15/14 | Color in Motion 5K run | Indio |
| 2/19/14 | Cathedral City Representatives | Palm Desert |
| 2/27/14 | City of Cathedral City staff | Cathedral City |
| 3/15/14 | Cathedral City Relay for Life | Cathedral City |
| 3/29/14 | 7th Annual Picnic Community Expo | Palm Springs |
| 3/30/14 | Race to be Ready | Rancho Mirage |
| 4/5/14 | Day of the Young Child | Coachella |
| 5/3/14 | Salsa & 5k Festival | Coachella |
| 5/5/14 | NEV Plan meeting with City of Indio staff | Indio |
| 5/5/14 | NEV Plan meeting with City of Coachella staff | Coachella |
| 5/6/14 | NEV Plan meeting with City of Palm Desert staff | Palm Desert |
| 5/6/14 | NEV Plan meeting with City of Cathedral City staff | Cathedral City |
| 5/12/14 | NEV Plan meeting with City of Rancho Mirage staff | Rancho Mirage |
| 5/13/14 | NEV Plan meeting with City of Palm Springs staff | Palm Springs |
| 5/15/14 | NEV Plan meeting with City of La Quinta staff | La Quinta |
| 5/9/14 | CSUSB PD Environmental & Sustainability Expo | Palm Desert |
| 5/10/14 | City of Palm Springs Bike Festival | Palm Springs |
| 6/10/14 | Palm Springs Police Department | Palm Springs |
| 6/12/14 | Cathedral City Police Department | Cathedral City |
| 6/16/14 | Riverside County Sheriffs | |

## 2.3. Selected Media Articles



### Valley Voice: Whitewater parkway will improve fitness

*Written by Dr. Nicole Ortiz Special to The Desert Sun*
*Feb 25*

mydesert.com

---

New Year's resolutions often target improvements in personal physical health and well-being. It is clear that these resolutions are often neglected as we all-too-passively observe the rise of obesity and diabetes in both adult and children of our community.

I would like our desert to commit to a resolution that is too important to fail yet another year to address: community well-being. I have been introduced to the valleywide proposal to create a parkway along the Whitewater River. This I believe is the greatest improvement to our community's health and well-being. Safe accessible recreational exercise areas are not abundant in the Coachella Valley. How can we expect our citizens to get out and get mobile when access is difficult to the existing recreation areas?

As a doctor who has dedicated her life to improving personal well-being, the health benefits alone of having a multi-use bike path that runs through the heart of the valley could be vast. When I was a medical student in Portland, Ore., I admired how the community placed an emphasis on access to safe outdoor recreation. Bike paths are available in every corner of the city. They allow for a range of citizens to use them, from a mode of transportation to school and work or a family outing. Portland is a model city that has taken advantage of seemingly every extra space to build bike paths, and it's a marvel at the resiliency of Portlanders who bike through the seemingly never-ending stream of rain.

For those who don't believe such a path would be used in the Coachella Valley, join me one morning on the Bear Creek Trail, which runs along the La Quinta Cove. Even on the hottest of summer days, before the sun rises, you will find many of us jogging, walking and enjoying a clean, paved path. I only wish more of my patients and the community as a whole would know about this great trail or at least have access to it. I believe a more accessible 46-mile parkway like the Bear Creek Trail would attract families, seniors and visitors alike. Trails like these do not exclude subsets of the population. This is an important limitation that a recreation facility such as a gym or a pool may have.

Concern about safety is one the factors that discourages outdoor activity. Today, many of my patients will not bike along our busy streets, such as Highway 111 because of traffic concerns. Few parents will let their children do so. Like the Bear Creek Trail that I use daily, the 46-mile-long parkway along the Whitewater would be separated from major streets and their fast-moving vehicles. The parkway is designed to dip under major bridges like Date Palm Canyon in Cathedral City and over major streets like Fred Waring Drive in Palm Desert.

It is a motivation to have the Clinton Foundation and the Humana Tournament focus on the well-being of the Coachella Valley each January. The first big push of the year reminds us of the fundamental importance of a community, its health and vitality. Wouldn't it be wonderful to channel this support and energy into building a safe "healthway" down the Whitewater River?

I can understand why the Desert Healthcare District is financially supporting the project. Obesity is not a quick-fix problem, and weeklong health initiatives and special events don't cure our community. It's time to look toward long-term investments into our health.

I see the Whitewater River Parkway as a financial investment that is wise and will truly pay it forward to the health of our community.

Dr. Nicole Ortiz is co-founder of Live Well Clinic, an integrative health center in La Quinta. To learn more about Live Well Clinic visit www.livewellclinic.org.

# The Desert Sun

WEDNESDAY, OCTOBER 16, 2013 WWW.MYDESERT.COM A GANNETT COMPANY

SERVING THE COACHELLA VALLEY SINCE 1927

ENVIRONMENT: GREEN PARKWAY PROJECT

## 'Game-changer' experience

Coachella Valley officials want to build a 52-mile green parkway along the Whitewater River wash. The paved plan, as envisioned here, would be open to pedestrians, bikes, golf carts and neighborhood electric vehicles. IMAGE COURTESY OF CVAG

# Future construction plans link Coachella Valley cities

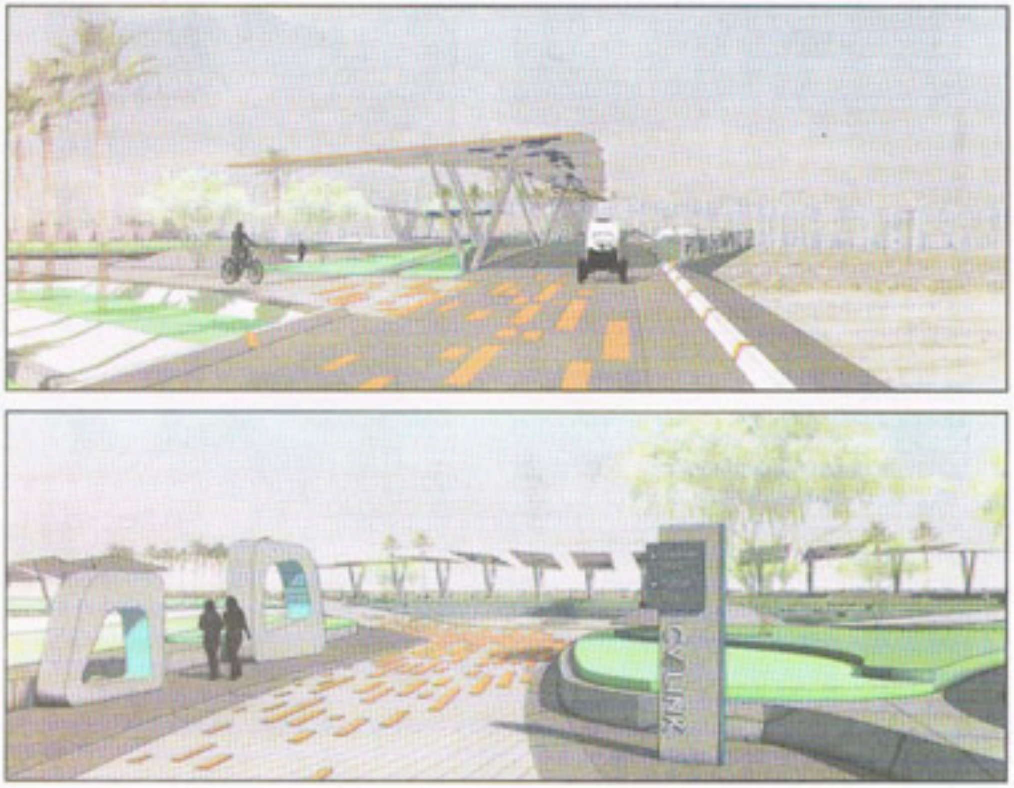


PHOTO COURTESY OF BURKE RIX COMMUNICATIONS

**The Coachella Valley Master Plan aims to ease travel and stimulate the economy.**

BY DAMARIS TREVIZO

IN THE CITIES EDITOR

Coachella Valley cities and tribal lands unite in the CV Link Master Plan that will allow citizens to travel on a safe, continuous pathway geared toward pedestrians, bicyclists, and low-speed electric vehicles. The trail will provide a passageway from Palm Springs to Coachella with ease of access from city to city.

Funded by California Strategic Growth Council, Caltrans, and Riverside County Regional Park and Open Space District, the CV Link is set to begin construction in 2015 and already has over 45 million dollars secured in funding for the project.

According to Michael Shoberg, Transportation Manager for the Coachella Valley Association of Governments, "The entire build out is expected by 2022 or 2023. The first phase is expected to start construction in about two years."

The CV Link will provide numerous benefits, such as improvements in air quality, over 650 jobs, and additional recreation and fitness opportunities. The plan claims it will relieve congestion on Highway 111 and be an amenity for the tourist industry.

Predicted to stimulate the economy with design, construction, and maintenance jobs, the 52 mile long site will provide approximately 1.47 billion dollars in economic benefits, according to the Burke Rix Communications project description. It will include NEV charging stations, public art, and environmental benefits.

Parts of the pathway will be built on existing streets of the cities it will go through, but will ensure that the trail meets the needs of each community.

There will be an upcoming environmental scoping meeting on the CV Link project on Thursday November 21 from 6 p.m. to 8 p.m. at the Coachella Valley Association of Governments in room 115. It will be located on 73710 Fred Waring Drive, Palm Desert, CA.

For more information and construction updates, visit www.cvag.org

THIS PAGE INTENTIONALLY LEFT BLANK

# APPENDIX 3. COLLISION DATA

Project alternatives that could address the identified safety hazards include a reduction in speed limits on arterial roadways and/or reallocation of road space to provide additional separation of users. However, these alternatives would be difficult to implement given the seasonal variability in traffic density resulting in congestion at peak periods and the existing geometric design of arterial roadways.

TABLE 3: COACHELLA VALLEY NON-MOTORIZED CRASH STATISTICS

| Year | Bikes | | Pedestrians | |
|---|---|---|---|---|
| | Injuries | Deaths | Injuries | Deaths |
| 2008 | 62 | 2 | 50 | 5 |
| 2009 | 63 | 2 | 71 | 6 |
| 2010 | 63 | 3 | 59 | 9 |
| 2011 | 62 | 2 | 55 | 9 |
| 2012 | 66 | 5 | 58 | 9 |
| Total | 316 | 14 | 293 | 34 |

The number of reported fatal and injury bicycle and pedestrian collisions by city and by year is given in Table 3. While Palm Springs appears to be over-represented in the data, this is likely to be due to a higher rate of walking and biking compared to other cities.

All casualty information was taken from the 2006 to 2013 Statewide Integrated Traffic Records System (SWITRS) maintained by the California Highway Patrol.

TABLE 4: PED / BIKE CASUALTIES 2008-2012

| Pedestrian Fatalities | 2008 | 2009 | 2010 | 2011 | 2012 | Total |
|---|---|---|---|---|---|---|
| CATHEDRAL CITY | | 1 | 1 | 3 | 1 | 6 |
| COACHELLA | 1 | 2 | 1 | 1 | 2 | 7 |
| INDIAN WELLS | | | | | | |
| INDIO | 1 | | 1 | | 2 | 4 |
| LA QUINTA | | | | 1 | | 1 |
| PALM DESERT | 1 | | 1 | | | 2 |
| PALM SPRINGS | 2 | 2 | 5 | | 4 | 13 |
| RANCHO MIRAGE | | 1 | | | | 1 |
| **Grand Total** | **5** | **6** | **9** | **5** | **9** | **34** |

| Pedestrian Injuries | 2008 | 2009 | 2010 | 2011 | 2012 | Total |
|---|---|---|---|---|---|---|
| CATHEDRAL CITY | 8 | 6 | 15 | 5 | 9 | 43 |
| COACHELLA | 5 | 11 | 3 | 7 | 3 | 29 |
| INDIAN WELLS | | | 1 | | | 1 |
| INDIO | 10 | 10 | 14 | 10 | 20 | 64 |
| LA QUINTA | 3 | 8 | 2 | 2 | 3 | 18 |
| PALM DESERT | 12 | 14 | 8 | 9 | 7 | 50 |
| PALM SPRINGS | 12 | 21 | 15 | 21 | 16 | 85 |
| RANCHO MIRAGE | | 1 | 1 | 1 | | 3 |
| **Grand Total** | **50** | **71** | **59** | **55** | **58** | **293** |

| Bicyclist Fatalities | 2008 | 2009 | 2010 | 2011 | 2012 | Total |
|---|---|---|---|---|---|---|
| CATHERAL CITY | | | | | | |
| COACHELLA | 2 | | | 1 | | 3 |
| INDIAN WELLS | | | | | 1 | 1 |
| INDIO | | 2 | | | 1 | 3 |
| LA QUINTA | | | 1 | | | 1 |
| PALM DESERT | | | | | | |
| PALM SPRINGS | | | 2 | | 1 | 3 |
| RANCHO MIRAGE | | | | 1 | 2 | 3 |
| **Grand Total** | **2** | **2** | **3** | **2** | **5** | **14** |

| Bicyclist Injuries | 2008 | 2009 | 2010 | 2011 | 2012 | Total |
|---|---|---|---|---|---|---|
| CATHEDRAL CITY | 4 | 6 | 9 | 10 | 6 | 35 |
| COACHELLA | 3 | 1 | 3 | 5 | | 12 |
| INDIAN WELLS | 1 | 1 | 1 | 1 | 1 | 5 |
| INDIO | 13 | 9 | 9 | 9 | 10 | 50 |
| LA QUINTA | 6 | 14 | 6 | 5 | 3 | 34 |
| PALM DESERT | 17 | 14 | 16 | 16 | 15 | 78 |
| PALM SPRINGS | 13 | 17 | 19 | 14 | 27 | 90 |
| RANCHO MIRAGE | 5 | 1 | | 2 | 4 | 12 |
| **Grand Total** | **62** | **63** | **63** | **62** | **66** | **316** |

# APPENDIX 4. RECREATIONAL DEMAND

Two-thirds of American adults own a smartphone[1], making crowd-sourced travel data sets more accessible for planning purposes. Cities such as San Francisco and Atlanta have launched smartphone applications such as CycleTracks to gather bicycle trip data. Although such applications have not yet been implemented in the Coachella Valley, the recreational running and cycling website Strava (www.strava.com) does have local data. With Strava, it is likely that the typical user is more technologically adept, younger, and athletic compared to the typical resident. Nevertheless, it is more data than previously available and helps confirm expert judgments on the routes that bicyclists are more or less likely to use given the current infrastructure. In Figure 2, the red lines indicate routes of high use, purple medium use, and blue light use.

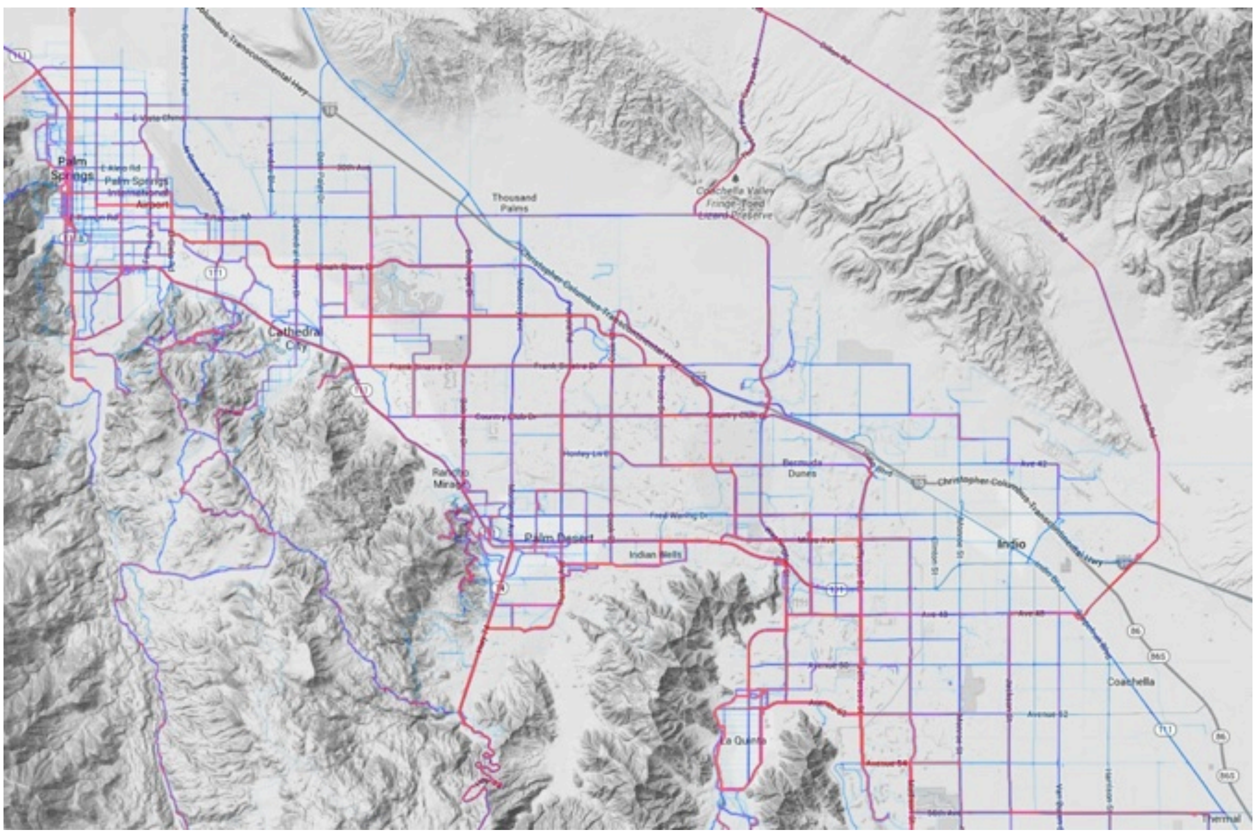



FIGURE 2: CROWD-SOURCED DATA ON RECREATIONAL WALKING AND CYCLING ROUTES

---

[1] http://www.nielsen.com/us/en/reports/2014/the-us-digital-consumer-report.html

THIS PAGE INTENTIONALLY LEFT BLANK

# APPENDIX 5. EQUESTRIAN TRAILS

All known equestrian facilities with the potential for CV Link interaction have been reviewed based on local knowledge and online resources such as the Rancho Mirage Trails map[2]. An extract from this map is presented in Figure 3.

1. Bud Fuhrer Trail – Palm Springs: This little-used urban equestrian trail begins at the Palm Canyon Wash where it intersects with the east terminus of Escoba Drive. There are stables on Escoba Drive and an equestrian trailhead at the east end of Sonora Road. The trail follows the south and east edges of Tahquitz Creek Golf Course to El Cielo Road. West of El Cielo Road the trail is primarily in the bed of Tahquitz Creek. The Rock Garden Restaurant, located SW of Palm Canyon and Tahquitz Creek, has a hitching post. The nexus with CV Link is in Tahquitz Creek between Sunrise and Belardo. *Since CV Link will be staying on the levee in this area, it should not have any impact on equestrian use on the trail.*
2. Whitewater Channel – Palm Springs: The entire Whitewater Channel in Palm Springs has been identified as an equestrian trail. This is not a formal trail, nor a high-use route, and CV Link should not have any impact on this little used equestrian route.
3. The Jenkins Trail – Palm Springs / Cathedral City: The Jenkins trail, which circumvents the Cathedral Canyon Golf Course, is signed as an equestrian trail. There is an asphalt path for bikes, and a dirt path for equestrians. *The trail does not appear to receive any equestrian use. The CV Link would either need to be narrower with a separating fence to preserve the unpaved equestrian facility or the equestrian aspect of the Jenkins Trail might be abandoned if no longer used or other equestrian connections could be found.*
4. Butler-Abrams Trail – Rancho Mirage: Beginning at Wolfson Park (Frank Sinatra) an asphalt trail parallels the Whitewater Wash dipping down into and out of the wash and becomes divided on the other side into separate asphalt and dirt (for equestrians) trails. As it continues between a residential area and Morningside Country Club, the trail ends at Country Club Drive, one block north of Highway 111. CV Link proposes to use the Butler-Abrams path as part of the core alignment. This path has a restricted right-of-way in some places. The amount of equestrian usage is unknown. *The CV Link may need to accommodate and preserve this equestrian trail.*
5. Clancy Lane Trail – Rancho Mirage: This trail begins on Clancy Lane between Rancho Manaña and the Monterey Gate as a developed trail, continues under

---

[2] http://www.ranchomirageca.gov/content_files/pdf/residents/things_to_do/CRM-parks-trails-map.pdf

Bob Hope Drive down into and crossing the Whitewater Wash to Whitewater Park, following the edge of the wash. The trail may extend into the Magnesia Falls Wash. East of Bob Hope the trail is on the left bank levee; west of Bob Hope it continues in the wash and on the right bank levee. There is equestrian parking at Whitewater Park, however the equestrian path is not clearly signed in the park. *Depending on the CV Link alignment in this area (to be determined), the project could adversely impact this equestrian trail. The trail east of Bob Hope on the left bank is a possible alternative for the CV Link. However, this equestrian resource will likely need to be preserved.*

6. East Valley Equestrian Trails: La Quinta, Indio, and the community of Vista Santa Rosa have a network of equestrian trails adjacent to major arterials. Lake Cahuilla Park has an equestrian campground. The resources are all located well south of the Whitewater River. *CV Link will have no impact on these trails.*

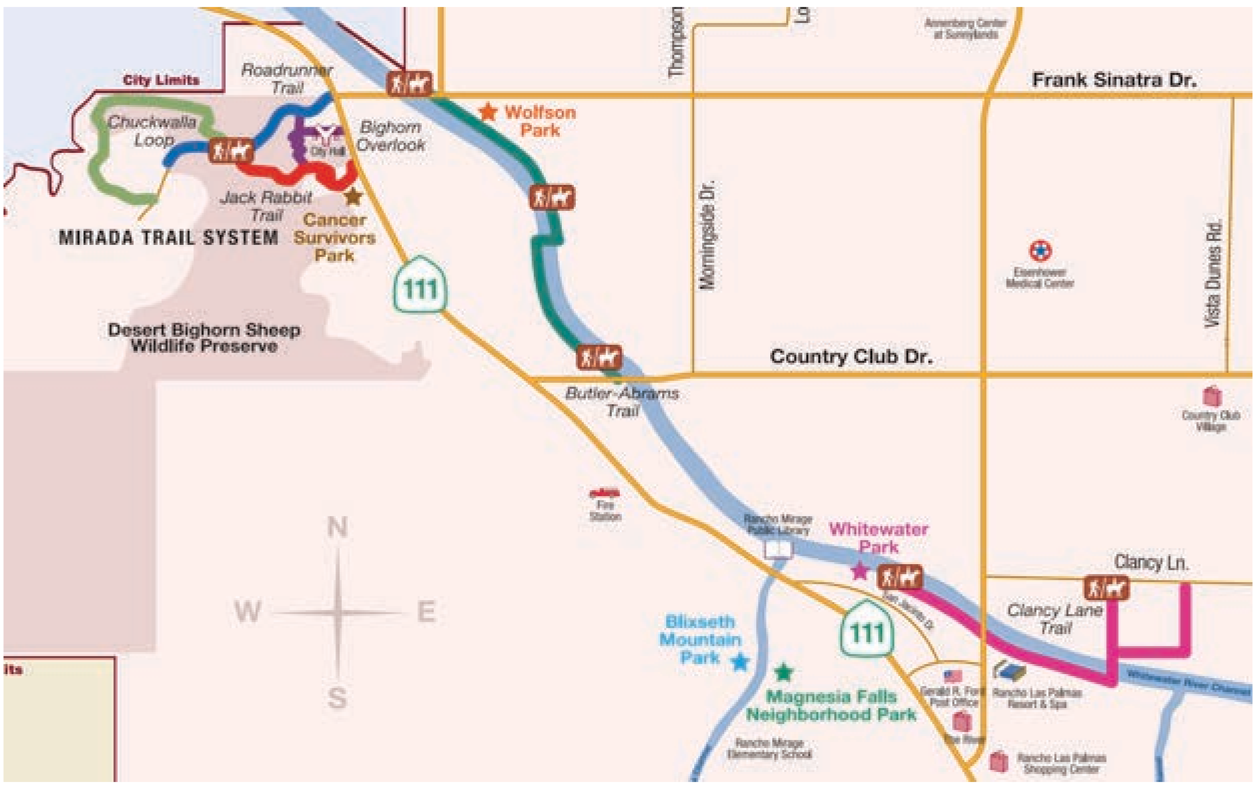



FIGURE 3: RANCHO MIRAGE EQUESTRIAN TRAILS MAP EXTRACT

In summary, the Butler-Abrams and the Clancy Lane trails (both in Rancho Mirage) could be adversely impacted by the project and will most likely need to be preserved. When the alignment has been refined in areas such as Rancho Las Palmas and Segment 2A through the Tahquitz Creek, equestrian groups should be consulted to help determine how existing trails can be accommodated for equestrian use.

# APPENDIX 6. OPINION OF PROBABLE COSTS

## 6.1. Development of the Alignment and Cost Estimate

**Step 1: Alignment Development in Google Earth**

The process began with an export of the Preliminary Study Report alignment from GIS to Google Earth. Over the next 18 months and countless public and stakeholder meetings, the team tightened this line work and adjusted, added or removed route variations. Note that in National Environmental Policy Act (NEPA) terms, an alternative is “end-to-end” meaning from one end of the project the other. Therefore the term “alignment variation” is used throughout the Master Plan.

**Step 2: Alignment Refinement in GIS**

Once the alignment variations were selected, Google Earth files were transferred to GIS for further refinement. The core route from Palm Springs to Coachella was divided into 10 segments and then further divided into links by property boundary intersections, crossings, and connections to intersecting roadways.

**Step 3: Data Tables Spreadsheet**

The GIS data was then exported to a spreadsheet with the following attributes:

- Sheet-link number identifier
- Length in feet (Excel “CONVERT” function was used to obtain miles)
- Segment number (there are ten main segments)
- ROW needed (obtained through manual inspection of the ROW maps by our sub)
- ROW committed
- Indian Land encroachment or adjacency
- Channel lining (slope protection) present, not present, or unknown (sometimes the slope is concrete lined but sand obscures this)

Categorization of the links resulted in the identification of links or link alternatives. A given link may be present in multiple alignment variations.

**Step 4: Guardrails and Screening Analysis**

Back in Google Earth, the alignment was inspected again. For each link or link alternative that is proposed to traverse a golf course, it was assumed that 20% of the link length would need screening fencing to protect CV Link users from errant golf balls. For each link or link alternative that is proposed to be adjacent to private homes, it was assumed that the proportion of that link adjacent to homes would require privacy screening.

In AutoCAD, the 2’ topographic contours were used to calculate height of the CV Link and adjacent slope gradients. AASHTO guardrail guidelines were reviewed and engineering judgment applied to establish a table specifying when guardrails are required. The resulting screening and guardrail requirements were entered in the main spreadsheet.

**Step 5: Cost Basis**

The engineering team calculated unit rates for each of 54 proposed sections, crossing types, or access point types in a two-step process.

1. Values derived from engineering experience, comparable projects, Caltrans guidelines, and the "Costs for Pedestrian and Bicyclist Infrastructure Improvements" synthesis (UNC Highway Safety Research Center, 2013) were entered in a vertical column in the "section costs" worksheet.
2. Section costs were then referenced in a horizontal array in a separate "sections" worksheet, permitting the use of the HLOOKUP formula in multiple columns in the main "segments" worksheet. Each section type was also assigned a customized contingency percentage from 10% to 25% depending on the level of confidence in the available data.

**Step 6: Integration**

In the segments worksheet, a section identifier was created to reference the section costs based on all previous steps (field studies, desktop reviews, AutoCAD analyses, etc.). Columns were developed for the following cost components:

- Path cost/LF – a lookup value referencing the sections worksheet
- Path cost total – calculated by multiplying the path cost by the linear feet
- Access point costs – a lookup value referencing a separate sheet on pathway support elements (landscaping, signage, shade structures, etc.)
- Grade separation costs – referencing undercrossing and overcrossing worksheets
- At-grade crossing costs – referencing costs for five types of at-grade crossings in the sections worksheet
- Screening / fencing costs
- Acquisition, contingency, art, and mobilization costs

**Step 7: Summary**

Pivot tables were then used to create the cost estimate. As numbers do not sort sequentially in a pivot table, letter identifiers (A to R) were assigned to alternative groups to enable sorting from east to west along the corridor. Alternatives and phasing identification columns enabled various cross tabulations to answer questions such as the length and value of various section types for the whole corridor, a breakdown of investment and mileage by city, the number and value of each crossing type, and lists of route variations.

## 6.2. Comparison to Previous Estimates

The anticipated CV Link budget has increased from the original PSR estimate. The project team performed extensive public outreach to gather input on the project and the budget increase directly responds to this feedback while also making significant enhancements to increase public safety. The budget increases were primarily in the following areas:

**It was necessary to re-route around some of the major country club golf courses** within the Whitewater River Channel in Rancho Mirage and Palm Desert. During public meetings it was clear that the residents of the gated golf course communities in Rancho Mirage and Palm Desert strongly preferred an alternative route that went around their developments. The Master Plan addresses these concerns by using existing on-street alignments for CV Link but this added length and street retrofits with increased cost.

**Concrete instead of asphalt is proposed for paving CV Link**. The cost of maintenance was consistently raised as a concern in all of our public outreach meetings. Concrete is more costly up front but cheaper to maintain over the long run. Colored stripes of recycled landscape glass will aid users in navigation as well as heighten awareness at high use areas.

**Additional shade structures were added to the project**. Community feedback indicated a need and desire to use CV Link year round. CV Link's regularly spaced shade structures include charging facilities and accommodate solar panels that will help offset lighting and other electricity costs. Other amenities will include drinking fountains and solar powered trash compactors to minimize litter and lower trash collection costs.

**Width of the CV Link was increased**. A consistent concern raised during public meetings was that there is sufficient room to safely accommodate all uses including pedestrian, bicycle and low speed electric vehicles. All parts of the CV Link have been slightly widened to alleviate those concerns.

**The number of bridges has been increased to improve public safety**. Getting users safely across major roads and stormwater channels is imperative in a project that is almost 50 miles in length. An additional bridge was added at Cook Street when it was determined there was not a safe way to have users cross without it. The community voiced concerns about older and physically impaired users being able to utilize CV Link. Five channel bridges were added to the original plan to eliminate some of the large inclines and declines resulting in a smoother and more even pathway making the project more accessible to a larger number of users. These bridges also reduce flooding incidents and thus long-term maintenance costs.

**Lighting was added to CV Link**. In all of the community meetings the public told us that they wanted to have access to the project at night particularly in the warmer months. Members of many communities also told us that they did not want lights shining into their windows. The proposed low maintenance and energy efficient lighting will provide for personal security and navigation while minimizing light spillover into homes and the night sky.

## 6.3. Cost Estimate Tables

The tables presented on the following pages summarize the preliminary (10%) level opinion of probable construction costs. As more data is collected (e.g. survey) and the design development advances through 30%, 60%, and 90% stages, the contingency percentage will decline and the estimates will be further refined. A Construction Manager process is planned to aid the engineering team with local constructability reviews and estimation.

Note: The design and engineering consultant team has no control over the cost of labor, materials, equipment, or over the contractor's methods of determining prices or over competitive bidding or market conditions. Opinions of probable costs provided herein are based on the information known to the team at this time and represent only the team’s judgment as professionals familiar with the construction industry. There is no guarantee that proposals, bids, or actual construction costs will not vary from its opinions of probable costs.

| CAPITAL COST ESTIMATE | REVISED: 6/25/14 |
|---|---|

**TABLE OF CONTENTS**

**INITIAL IMPLEMENTATION TABLES - FOR 100% DESIGN**



**OTHER SUMMARY TABLES - ONLY INITIAL AND PHASE 2 FOR 30% DESIGN**



## TABLE 1. DEFINITIONS AND ASSUMPTIONS

**Initial Implementation**

"Initial Implementation" is a proposed package of design and route variations up to $100M

This package is subject to change based on stakeholder feedback on the 10% plans and available funding

Currently, $65M is available for planning, design, acquisition and construction

**Phases**

Phase 1 (near term) will include:

- CEQA/NEPA approved preferred initial implementation routes and designs
- Phase 1 will be subdivided into sub phase bid packages such as Phase 1A, 1B, etc.

Phase 2 (medium term) may include:

- Preferred initial implementation routes and designs exceeding Phase 1 budget and/or timeframe
- Opposite bank facilities in La Quinta
- Selected additional grade separations defined in Table 9
- Selected access point enhancements and additional restrooms

Phase 3 (long term) may include:

- Selected additional bridges and grade separations defined in Table 9
- Desert Hot Springs and/or Salton Sea extensions

| Allowance Assumptions for Initial Implementation | Allowance |
|---|---|
| Acquisition based on $0.25/sf for channel links; Zillow for Rancho Mirage variation | $1,037,340 |
| Contingency is 10-25% (section dependent) of construction plus acquisition costs | $13,092,897 |
| Mobilization is 7.5% of construction cost excluding contingency and acquisition | $5,682,076 |
| Art budget is 1% of construction cost excluding contingency and acquisition | $757,610 |
| *All costs are expressed in 2014 dollars* | |

**Support Elements Included in Initial Implementation**

Glass seeded colored pavement up to 520,000 SF spaced in groups about two per mile

Landscaping is included at regional, local & commercial Access Points

Landscaping at other locations included in separate line item linked to Amenities table, locations TBD

Lighting: light tubes (20 groups), bollards (200), undercrossing & shade structure down lights

Lighted LED Mark center and edge lines

Fountains (44) Big Belly trash & recycling compactors (30)

Signage: wayfinding, regulatory (where required) & interpretive signs (8)

| | |
|---|---|
| Shade structures: provided at 44 pathway rest areas and up to 14 access points | |
| **Access Points Acronyms and Descriptions** | |
| AP-R and L are regional (arterial or major city park) and local (collector or minor city park) | |
| AP-C and N are commercial and neighborhood accesses | |
| RR: CV Link restroom | |
| Basic: at locations with existing infrastructure, provide only signage, shade & charging for initial project | |
| **Pedestrians** | |
| Use a 5' colored decomposed granite (DG) shoulder between 111 and Dinah Shore | |
| Use a 6' DG shoulder in Indio and Coachella | |
| Share the path at right of way constraints for short distances, channel bottom paths, and roadway connections | |
| Have a curb separated concrete path on bridges and most undercrossings | |
| Have a horizontally and vertically separated DG path in most other locations | |
| **LSEV/Bike path on Constrained Width Levees** | |
| Concrete path off-center on 20' levees to provide 5' DG pedestrian surface on one side | |
| Guardrail included on one side where shoulder <5' | |
| **Initial Implementation Route and Design Assumptions** | |
| Mesquite Ave will be restriped as Class II buffered bike/NEV lanes and signage only (no curb works) | |
| Demuth Park to Gene Autry to be 14'+6'; minor earthworks | |
| Gene Autry UC remains as existing, except lessening of the ramp grade east of Gene Autry | |
| Gene Autry to Crossley Rd alongside Knott's Water Park: signage and resurfacing/overlay | |
| 34th Ave will be a Class III route with signs only (short low volume on-street link) | |
| Frank Sinatra Dr to be resurfaced existing channel crossing to Da Vall signals & Wolfson Park | |
| Hwy 111 frontage in Rancho Mirage - widen existing path and improve side street crossings | |
| Magnesia Falls Dr in Palm Desert - no change to existing layout (signs only) | |
| Cook St and Fred Waring will be path overcrossings | |
| Fred Waring to Miles (IW Club) will be left bank lower slope full bench with gentle gradient below (D5 or D6) | |
| Portions of Miles to Tennis Garden will require widening of the top of slope (D10) | |
| Tennis Garden to Washington will be built at top of slope adjacent to parking area | |
| At Washington, cross to right bank using a channel bottom path | |
| Washington to Dune Palms left bank only; cross to right bank at Dune Palms at-grade with hybrid beacon | |
| Restripe existing Dune Palm channel grade crossing to switch banks | |
| Only right bank Dune Palms to Jefferson | |
| Mid slope benched paths will have a separate pedestrian path (not a shoulder) | |
| Steep 1:1 slope below bench will be retained by 15' paving | |
| **Fees Not Included** | |
| Preparation of Environmental Documents, Plans, Specifications and Estimates | |
| Bid Preparation, Construction Administration, Management Reserve and Public Outreach | |

**TABLE 2. BREAKDOWN BY CITY**

| City | Miles | Cost | Cost/mi |
|---|---|---|---|
| Cathedral City | 3.0 | $5,792,500 | $1,900,000 |
| Coachella | 5.5 | $8,536,400 | $1,560,000 |
| Indian Wells | 3.6 | $11,504,600 | $3,200,000 |
| Indio | 5.7 | $11,103,100 | $1,960,000 |
| La Quinta | 2.6 | $4,399,500 | $1,710,000 |
| Palm Desert | 5.3 | $9,585,600 | $1,820,000 |
| Palm Springs | 15.8 | $22,847,700 | $1,450,000 |
| Rancho Mirage | 4.7 | $10,578,300 | $2,240,000 |
| Unincorporated | 2.0 | $2,209,900 | $1,100,000 |
| Valley wide landscaping | | $7,578,000 | |
| Valley wide support elements | | $5,171,000 | |
| **Grand Total** | **48.1** | **$99,306,600** | **$2,060,000** |

**TABLE 3. ROUTE AND DESIGN VARIATIONS INCLUDED**

| | Miles | Cost |
|---|---|---|
| **A Palm Springs Gateway** | | |
| 1. Gateway signals | 0.6 | $758,700 |
| **B Four Seasons** | | |
| 1. CHANNEL side | 0.9 | $902,700 |
| **C Gene Autry Whitewater** | | |
| 1. Via Escuela signals | 0.2 | $205,100 |
| **D S. Palm Canyon Tahquitz UC** | | |
| 1. Connect existing 10' | 0.02 | $17,000 |
| **E Sunrise Way Crossing** | | |
| 1. Sunrise Way at-grade | 0.2 | $200,600 |
| **F Gene Autry UC at Tahquitz** | | |
| 1. Existing dual paths | 0.0 | $- |
| **G Gene Autry UC ramp** | | |
| 1. Reconfigure ramp to lessen grade | 0.1 | $110,100 |
| **H Tahquitz GC lake** | | |
| 1. Existing boardwalk | 0.2 | $- |
| **I 34th Ave** | | |
| 1. Signage only | 0.5 | $1,600 |
| **J Cathedral GC** | | |
| 1. Right bank | 0.7 | $941,800 |
| **K Frank Sinatra** | | |
| 1. Cross to L.Bank Abrams Trail | 0.7 | $835,000 |
| **L RM Paxton to Bob Hope** | | |
| 1. Right bank and Bob Hope UC | 0.8 | $1,682,600 |
| **M RM Bob Hope to Monterey** | | |

| | | |
|---|---|---|
| 1. Parkview - 111 at grade | 1.5 | $2,009,700 |
| **N Monterey Parkview** | | |
| 1. Enhance existing at-grade signals | 0.0 | $6,100 |
| **O Magnesia Falls or San Pasqual** | | |
| 1. Magnesia Falls alignment | 0.7 | $603,700 |
| **P Indian Wells** | | |
| 1. Left bank | 1.3 | $2,991,100 |
| **Q Miles to Washington** | | |
| 1. Left bank | 1.3 | $3,103,400 |
| **R Washington crossing** | | |
| 1. At-grade path on channel bottom | 0.1 | $72,000 |
| **Grand Total** | **9.7** | **$14,441,200** |

**TABLE 4. SECTION TYPE SUMMARY**

| Section Group | Miles | Cost | Type Group |
|---|---|---|---|
| Undercrossings and ramps | 2.0 | $9,782,900 | X-3 |
| Bridge crossings of channels and roadways | 0.3 | $9,038,500 | X-2 |
| Crossings of roadways at-grade | 0.5 | $1,255,100 | X-1 |
| Existing no change in Phase 1, or UC ramps incl. in UC costs | 2.7 | $7,800 | Existing * |
| Street segments to be upgraded | 7.4 | $8,257,600 | A |
| Off Street Pathway | 35.2 | $55,239,000 | B, C, D |
| Support Elements | | $5,171,000 | |
| Landscaping | | $7,578,000 | |
| Access Points | | $2,976,700 | |
| Total | 48.1 | $99,306,600 | |
| Class I Pathway on and off street | 40.5 | $61,905,900 | A1-A4, B, C, D |

| TABLE 5. SECTION TYPES DETAIL | | | |
|---|---|---|---|
| **Row Labels** | **Count** | **Miles** | **Cost** |
| A-1 | 12 | 1.4 | $2,043,200 |
| A-10 | 3 | 0.2 | $969,400 |
| A-2 | 7 | 1.4 | $1,959,700 |
| A-3 | 7 | 1.1 | $1,429,500 |
| A-4 | 6 | 0.9 | $1,234,500 |
| A-7B | 9 | 1.3 | $327,000 |
| A-9 | 3 | 1.0 | $294,300 |
| AP-C | 3 | | $180,000 |
| AP-L Basic | 4 | | $360,000 |
| AP-L RR | 1 | | $382,800 |
| AP-N | 10 | | $584,000 |
| AP-R | 1 | | $254,300 |
| AP-R Basic | 5 | | $450,000 |
| AP-R RR | 2 | | $765,600 |
| B-1 | 22 | 2.2 | $3,017,700 |
| B-2 | 6 | 1.5 | $1,917,700 |
| B-3 | 6 | 0.7 | $832,100 |
| B-4 | 52 | 4.9 | $4,489,200 |
| C-1 | 31 | 7.8 | $15,441,100 |
| C-5 | 35 | 9.2 | $10,803,600 |
| D-1 | 22 | 4.0 | $5,131,800 |
| D-12 | 4 | 0.5 | $952,700 |
| D-14 | 4 | 0.6 | $1,408,900 |
| D-2 | 12 | 2.0 | $3,978,300 |
| D-3 | 1 | 0.2 | $227,800 |
| D-4 | 6 | 0.8 | $5,253,900 |
| D-5 | 2 | 0.5 | $836,900 |
| D-6 | 2 | 0.4 | $947,300 |
| Existing Class I | 4 | 0.4 | $- |
| Existing Class II | 14 | 1.4 | $4,600 |
| Existing Class III | 2 | 0.9 | $3,200 |
| Landscaping | 1 | | $7,578,000 |
| Ramp | 23 | 1.5 | $18,900 |
| Support Elements | 1 | | $5,171,000 |
| X-1 | 9 | 0.1 | $39,600 |
| X-1 ES | 1 | 0.0 | $6,100 |
| X-1 NS | 5 | 0.1 | $919,000 |
| X-1 P | 7 | 0.2 | $67,200 |
| X-1 PHB | 3 | 0.1 | $223,200 |
| X-2 | 8 | 0.3 | $9,038,500 |
| X-3 | 18 | 0.5 | $9,764,000 |
| **Grand Total** | **374** | **48.1** | **$99,306,600** |

**TABLE 6. BRIDGES AND CROSSINGS SUMMARY**

| Row Labels | Count of Section | Sum of Total Cost | |
|---|---|---|---|
| X-1 | 9 | $39,600 | Stop controlled |
| X-1 ES | 1 | $6,100 | Upgrade signal |
| X-1 NS | 5 | $919,000 | New signal |
| X-1 P | 7 | $67,200 | New phase |
| X-1 PHB | 3 | $223,200 | Beacon |
| X-2 | 8 | $9,038,500 | O/C or bridge |
| X-3 | 18 | $9,764,000 | Undercrossing |
| **Grand Total** | **51** | **$20,057,600** | |

**TABLE 7. BRIDGES AND CROSSINGS DETAIL**

| Row Labels | Count | Cost | |
|---|---|---|---|
| **X-1** | **9** | **$39,600** | Crosswalk & curb ramps at stop |
| Cross Magnesia Falls | 1 | $4,400 | |
| Cross San Pablo (at Alumni Dr) | 1 | $4,400 | |
| Cross San Pablo (at Magnesia Falls) | 1 | $4,400 | |
| Paxton crossing | 1 | $4,400 | |
| Belardo Rd | 1 | $4,400 | |
| Sunrise Way at-grade | 1 | $4,400 | |
| Farrell Dr | 1 | $4,400 | |
| El Cielo Rd | 1 | $4,400 | |
| Golf Club Dr at 34th OR at Fairway Circle | 1.00 | $4,400 | |
| **X-1 ES** | **1** | **$6,100** | Crosswalk & curb ramps at existing |
| Monterey at Parkview at grade | 1 | $6,100 | |
| **X-1 NS** | **5** | **$919,000** | New or substantially upgraded signals |
| Country Club / 111 intersection | 1 | $183,800 | |
| Crossley Rd xing | 1 | $183,800 | |
| Dune Palms Rd at-grade crossing at Corporate Center Dr | 1 | $183,800 | |
| Indian Canyon Dr | 1 | $183,800 | |
| Portola Ave at Magnesia Falls Dr | 1 | $183,800 | |
| **X-1 P** | **7** | **$67,200** | Crosswalk, curb ramps and new phase |
| Cross Avenida Las Palmas east side of Bob Hope | 1 | $9,600 | |
| Cross Magnesia Falls Dr | 1 | $9,600 | |
| Existing Da Vall signals | 1 | $9,600 | |
| Gateway crossing at grade | 1 | $9,600 | |

| | | | |
|---|---|---|---|
| Thunderbird Rd signals upgrade | 1 | $9,600 | |
| Vista Chino/Clubhouse View signals upgrade | 1 | $9,600 | |
| Gene Autry Trail at E Via Escuela | 1 | $9,600 | |
| **X-1 PHB** | **3** | **$223,200** | Flashing beacon |
| 50th Ave short term at grade crossing | 1 | $74,400 | |
| Ave 44 at-grade (existing) | 1 | $74,400 | |
| Dillon Rd Short term at grade crossing and connection | 1 | $74,400 | |
| **X-2** | **8** | **$9,038,500** | Bridges |
| Cathedral Canyon Channel West bridge | 1 | $994,800 | |
| Cathedral Channel East bridge - perpendicular | 1 | $497,400 | |
| Cook St OC | 1 | $1,655,700 | |
| Cross La Quinta channel at promontory | 1 | $787,600 | |
| Magnesia Falls Channel bridge | 1 | $1,231,700 | |
| Thunderbird Channel - replace existing | 1 | $530,700 | |
| Four Seasons outflow | 1 | $400,500 | |
| Fred Waring Dr OC | 1 | $2,940,100 | |
| **X-3** | **18** | **$9,764,000** | Undercrossings |
| Adams St UC right bank - completed | 1 | $- | |
| Airport UC retrofit existing | 1 | $660,000 | |
| Ave 52 UC | 1 | $660,000 | |
| Bob Hope UC | 1 | $733,100 | |
| Cathedral Canyon UC | 1 | $402,900 | |
| Date Palm UC | 1 | $651,800 | |
| Dinah Shore UC | 1 | $406,700 | |
| Fred Waring Dr E UC | 1 | $416,100 | |
| Golf Center UC - retrofit existing | 1 | $772,700 | |
| Indio Blvd / RR / near I-10 UC | 1 | $845,800 | |
| Jackson UC | 1 | $642,100 | |
| Jefferson UC Right bank | 1 | $416,100 | |
| Miles East UC | 1 | $391,300 | |
| Monroe UC | 1 | $693,500 | |
| Ramon Rd UC | 1 | $270,200 | |
| El Dorado Dr UC right bank | 1 | $671,200 | |
| Miles Ave UC left bank | 1 | $734,200 | |
| Washington St UC left bank | 1 | $396,300 | |
| **Grand Total** | **51** | **$20,057,600** | |

| TABLE 8. ROUTE AND DESIGN VARIATIONS - ALL (FOR 30% DESIGN) | | | |
|---|---|---|---|
| **City** | **Miles** | **Cost** | |
| **A Palm Springs Gateway** | **1.8** | | |
| 1. Gateway signals | 0.6 | $758,700 | |
| 2. 111 overcrossing - signature | 0.6 | $14,439,200 | |
| 3. 111 overcrossing - base | 0.6 | $5,611,400 | |
| **B Four Seasons** | **2.8** | | |
| 1. CHANNEL side | 0.9 | $902,700 | |
| 2. GULLY residential side | 0.9 | $900,200 | |
| 3. LEVEE top | 0.9 | $1,457,100 | |
| **C Gene Autry Whitewater** | | | |
| 1. Via Escuela signals | 0.2 | $205,100 | |
| 2. Gene Autry Overcrossing | 0.1 | $2,010,000 | |
| **Connect** | **3.7** | **$4,176,300** | |
| 50th Ave | 0.0 | $25,200 | |
| Adams | 0.2 | $162,100 | |
| Ave 52 | 0.2 | $165,000 | |
| Connect to Desert Highland Park | 0.2 | $214,500 | |
| Cook St | 0.1 | $473,000 | |
| Date Palm | 0.1 | $92,200 | |
| Dinah Shore | 0.1 | $81,400 | |
| Dune Palms left bank | 0.0 | $74,400 | |
| El Dorado | 0.0 | $40,300 | |
| Frank Sinatra | 0.0 | $39,400 | |
| Fred Waring East | 0.2 | $192,200 | |
| Fred Waring West | 0.2 | $624,200 | |
| Golf Center Pkwy | 0.2 | $211,300 | |
| Indio Blvd | 0.1 | $60,500 | |
| Jackson St | 0.1 | $81,900 | |
| Jefferson | 0.0 | $40,300 | |
| Jefferson | 0.0 | $120,500 | |
| Miles E | 0.2 | $172,700 | |
| Miles L bank | 0.1 | $104,500 | |
| Miles R bank | 0.1 | $55,900 | |
| Monroe St | 0.1 | $144,000 | |
| Ramon Rd | 0.2 | $194,900 | |
| Switch banks at Esmeralda | 0.1 | $- | Use existing |
| Switch banks at Miles Bridge | 0.1 | $- | Assume existing path is not a future turn lane |
| Washington | 0.1 | $127,500 | |
| Dune Palms channel crossing | 0.1 | $23,400 | |
| Washington R bank | 0.1 | $74,500 | |
| Adams R bank | 0.1 | $114,200 | |

| | | |
|---|---|---|
| Dune Palms R bank | 0.2 | $307,300 |
| Switch banks at Adams Bridge | 0.1 | $200 |
| Jefferson L bank | 0.1 | $158,000 |
| Switch banks at Jefferson Bridge | 0.2 | $800 |
| **Core** | **35.4** | **$78,258,000** |
| COD LOOP | 1.7 | $1,046,100 |
| (blank) | 33.7 | $77,211,900 |
| **D S. Palm Canyon Tahquitz UC** | | |
| 1. Connect existing 10' | 0.0 | $17,000 |
| 2. Widen to 16' | 0.0 | $479,600 |
| **E Sunrise Way Crossing** | | |
| 1. Sunrise Way at-grade | 0.2 | $200,600 |
| 2. Sunrise Way UC and channel | 0.2 | $230,600 |
| 3. Sunrise Way UC and road frontage | 0.2 | $301,100 |
| **F Gene Autry UC at Tahquitz** | | |
| 1. Existing dual paths | 0.0 | $- |
| 2. Widen UC | 0.0 | $419,800 |
| **G Gene Autry UC ramp** | | |
| 1. Reconfigure ramp to lessen grade | 0.1 | $110,100 |
| 2. Existing steep ramp | 0.0 | $- |
| **H Tahquitz GC lake** | | |
| 1. Existing boardwalk | 0.2 | $- |
| 2. Add cvLink boardwalk | 0.1 | $1,898,800 |
| **I 34th Ave** | | |
| 1. Signage only | 0.5 | $1,600 |
| 2. Two-way path wider 34th | 0.5 | $484,100 |
| **J Cathedral GC** | | |
| 1. Right bank | 0.7 | $941,800 |
| 2. Left bank | 0.8 | $1,015,000 |
| 3. Jenkins widen and resurface | 1.2 | $969,600 |
| **K Frank Sinatra** | | |
| 1. Cross to L.Bank Abrams Trail | 0.7 | $835,000 |
| 2. Frank Sinatra OC and R.Bank | 0.8 | $3,283,500 |
| **L RM Paxton to Bob Hope** | | |
| 1. Right bank and Bob Hope UC | 0.8 | $1,682,600 |
| 2. San Jacinto | 0.8 | $990,100 |
| **M RM Bob Hope to Monterey** | | |
| 1. Parkview - 111 at grade | 1.5 | $2,009,700 |
| 2. Parkview - Viaduct parallel to 111 | 1.4 | $11,602,400 |
| 3. Parkview - Residential route | 1.5 | $10,181,200 |
| 4. Rancho Las Palmas CC | 1.1 | $29,609,300 |
| **N Monterey Parkview** | | |
| 1. Enhance existing at-grade signals | 0.0 | $6,100 |
| 2. Skewed OC away from int - basic | 0.1 | $7,412,500 |
| 3. Perpendicular OC at int - basic | 0.0 | $5,353,900 |

| | | | |
|---|---|---|---|
| **O Magnesia Falls or San Pasqual** | | | |
| 1. Magnesia Falls alignment | 0.7 | $603,700 | |
| 2. Channel alignment | 1.0 | $3,665,100 | |
| **P Indian Wells** | | | |
| 1. Left bank | 1.3 | $2,991,100 | |
| 2. Left to right bank | 1.5 | $4,859,800 | |
| 3. El Dorado and 111 | 1.7 | $2,620,100 | |
| **Q Miles to Washington** | | | |
| 1. Left bank | 1.3 | $3,103,400 | |
| 2. Right bank | 1.4 | $6,672,600 | |
| **R Washington crossing** | | | |
| 1. At-grade path on channel bottom | 0.1 | $72,000 | |
| 2. Reallocate space on existing bridge deck | 0.1 | $105,600 | |
| 3. Widen existing bridge | 0.1 | $2,937,300 | |
| **Phase 2** | | | |
| Ave 44 UC (ongoing bridge project) | 0.2 | $496,600 | |
| Dune Palms left bank | 0.5 | $1,244,600 | |
| Jefferson UC left bank | 0.0 | $416,100 | |
| Vista Chino UC | 0.4 | $597,800 | |
| Left bank La Quinta | 1.1 | $1,763,900 | |
| **Grand Total** | **68.5** | | Total dollar figure not applicable as only one variation will be constructed |

| TABLE 9. BRIDGES AND CROSSINGS - ALL | | | |
|---|---|---|---|
| | **Count** | **Cost** | |
| X-1 | 9.0 | $39,600 | Stop / yield |
| X-1 ES | 1.0 | $6,100 | Ramps, x-walk |
| X-1 NS | 5.0 | $919,000 | New signals |
| X-1 P | 7.0 | $67,200 | New phase |
| X-1 PHB | 3.0 | $223,200 | Hybrid beacon |
| X-2 | 8.0 | $9,038,500 | Bridge with ramps |
| X-3 | 18.0 | $9,764,000 | U/C with ramps |
| **Grand Total** | **51.0** | **$20,057,600** | |

| TABLE 10. ACCESS POINTS | | | |
|---|---|---|---|
| **Type** | **Future AP** | **Initial AP** | **Grand Total** |
| **Commercial** | **$120,000** | **$180,000** | **$300,000** |
| Corporate Center Dr | | $60,000 | $60,000 |
| Jefferson Retail Center | | $60,000 | $60,000 |
| La Quinta Retail Center | | $60,000 | $60,000 |
| Rancho Las Palmas Shopping Center | $60,000 | | $60,000 |
| Wild Bird Center | $60,000 | | $60,000 |
| **Local - Deluxe** | **$1,017,200** | | **$1,017,200** |
| Ave 52 | $254,300 | | $254,300 |
| Desert Highland | $254,300 | | $254,300 |
| Sunrise Way (north) | $254,300 | | $254,300 |
| Whitewater Park Drive | $254,300 | | $254,300 |
| **Local - Basic** | **$90,000** | **$360,000** | **$450,000** |
| Airport Blvd | $90,000 | | $90,000 |
| Belardo Road | | $90,000 | $90,000 |
| Shields Park | | $90,000 | $90,000 |
| Sierra Vista Park at Tyler St | | $90,000 | $90,000 |
| Wolfson Park / De Vall / Frank Sinatra | | $90,000 | $90,000 |
| **Local - Deluxe + Restroom** | **$765,600** | **$382,800** | **$1,148,400** |
| 34th Avenue | | $382,800 | $382,800 |
| Barbara Dr / 111 | $382,800 | | $382,800 |
| Indian Wells Tennis Garden | $382,800 | | $382,800 |
| **Neighborhood** | | **$584,000** | **$584,000** |
| Columbine Dr | | $58,400 | $58,400 |
| Desert Cove Dr | | $58,400 | $58,400 |
| Dream Homes at Chia Place | | $58,400 | $58,400 |
| Escena | | $58,400 | $58,400 |
| Fan Palm Way | | $58,400 | $58,400 |
| Kelsey Circle | | $58,400 | $58,400 |
| Lafayette Court | | $58,400 | $58,400 |
| Park Pl | | $58,400 | $58,400 |
| Rancho Mirage Racquet Club | | $58,400 | $58,400 |
| San Pasqual Ave | | $58,400 | $58,400 |
| **Regional - Deluxe** | **$1,271,500** | **$254,300** | **$1,525,800** |
| 111 / Indian Wells City Hall | $254,300 | | $254,300 |
| Adams St | $254,300 | | $254,300 |
| Cathedral Canyon Dr | $254,300 | | $254,300 |
| Palm Desert Civic Center | | $254,300 | $254,300 |
| Portola | $254,300 | | $254,300 |
| Ramon Road | $254,300 | | $254,300 |

| | | | |
|---|---|---|---|
| **Regional - Basic** | | **$450,000** | **$450,000** |
| 111 / Rancho Mirage Library | | $90,000 | $90,000 |
| 111/ Visitor Center | | $90,000 | $90,000 |
| Demuth | | $90,000 | $90,000 |
| Jackson Park | | $90,000 | $90,000 |
| Whitewater Annex | | $90,000 | $90,000 |
| **Regional - Deluxe + Restroom** | **$2,296,800** | **$765,600** | **$3,062,400** |
| 111 / Country Club Drive | $382,800 | | $382,800 |
| Amistad, Golf Center Parkway | $382,800 | | $382,800 |
| Date Palm Dr: Cathedral City Promontory 1 | $382,800 | | $382,800 |
| Fred Waring | $382,800 | | $382,800 |
| Gene Autry | $382,800 | | $382,800 |
| Indio Blvd | | $382,800 | $382,800 |
| Miles Ave (west) | | $382,800 | $382,800 |
| Vista Grande: La Quinta Promontory 2 | $382,800 | | $382,800 |
| **Grand Total** | **$5,561,100** | **$2,976,700** | **$8,537,800** |

TABLE 10B. ACCESS POINTS - COUNT

| Row Labels | Future AP | Initial AP | Grand Total |
|---|---|---|---|
| AP-C | 2 | 3 | 5 |
| AP-L | 4 | | 4 |
| AP-L Basic | 1 | 4 | 5 |
| AP-L RR | 2 | 1 | 3 |
| AP-N | | 10 | 10 |
| AP-R | 5 | 1 | 6 |
| AP-R Basic | | 5 | 5 |
| AP-R RR | 6 | 2 | 8 |
| **Grand Total** | **20** | **26** | **46** |

| TABLE 11. PHASING IN MILES BY SECTION TYPE | | | |
|---|---|---|---|
| **Row Labels** | **Phase 1** | **Phase 2** | **Phase 3** |
| A-1 | 1.4 | 0.4 | |
| A-10 | 0.2 | | |
| A-2 | 1.4 | 0.0 | |
| A-3 | 1.1 | 0.2 | |
| A-4 | 0.9 | 0.8 | |
| A-7B | 1.3 | 0.2 | |
| A-9 | 1.0 | | |
| B-1 | 2.2 | | |
| B-2 | 1.5 | | |
| B-3 | 0.7 | | |
| B-4 | 4.8 | 0.4 | |
| C-1 | 7.8 | | 0.1 |
| C-5 | 9.2 | | |
| D-1 | 4.0 | 2.0 | |
| D-12 | 0.5 | 0.1 | |
| D-14 | 0.6 | 0.9 | |
| D-2 | 2.0 | 0.2 | |
| D-3 | 0.2 | 0.6 | |
| D-4 | 0.8 | | |
| D-5 | 0.5 | 0.1 | |
| D-6 | 0.4 | | |
| Existing Class I | 0.4 | | |
| Existing Class II | 1.2 | 0.2 | |
| Existing Class III | 0.9 | | |
| Ramp | 1.5 | 0.7 | 0.5 |
| X-1 | 0.1 | | |
| X-1 ES | 0.0 | | |
| X-1 NS | 0.1 | | |
| X-1 P | 0.2 | 0.0 | |
| X-1 PHB | 0.1 | 0.0 | |
| X-2 | 0.3 | 0.7 | 0.1 |
| X-3 | 0.5 | 0.3 | 0.1 |
| TBD | | | 31.8 |
| **Grand Total** | **47.9** | **7.8** | **32.6** |

| TABLE 11B. CROSSINGS BY PHASE | | | |
|---|---|---|---|
| **Row Labels** | **Phase 1** | **Phase 2** | **Phase 3** |
| X-1 | 9 | | |
| X-1 ES | 1 | | |
| X-1 NS | 5 | | |
| X-1 P | 7 | 1 | |
| X-1 PHB | 3 | 1 | |
| X-2 | 8 | 9 | 2 |
| X-3 | 18 | 8 | 4 |
| **Grand Total** | **51** | **19** | **6** |

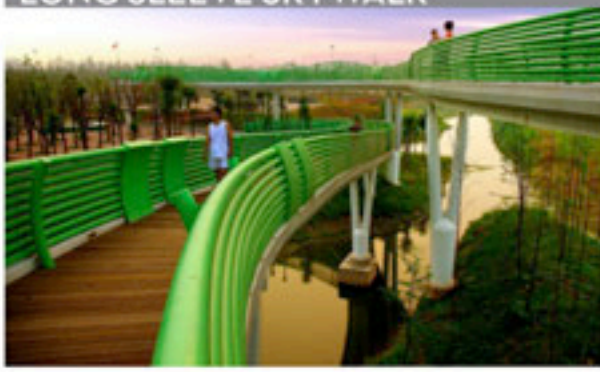
# DESIGN APPENDICES

THIS PAGE INTENTIONALLY LEFT BLANK

# APPENDIX 7. CASE STUDIES

## LONG SLEEVE SKYWALK

XUZHOU CITY, CHINA

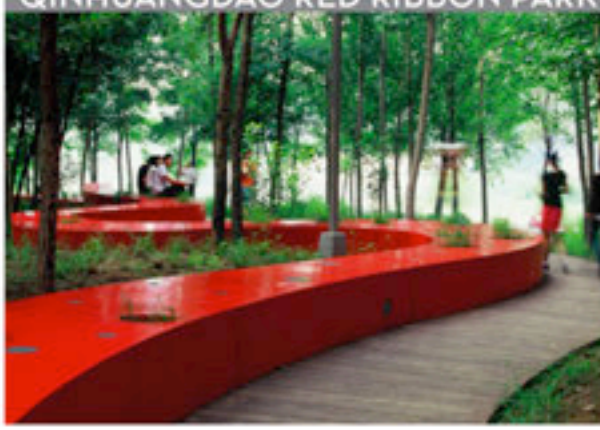


This pedestrian bridge, which crosses several riparian systems and connects Harmony Square to Forest Plaza, was designed to strengthen spatial connections while ensuring safe pedestrian crossing over or across the fast-paced expressway, Xuning Road, below.

FUN/WACKY/COLORFUL • ARTFUL INTEGRATION OF FUNCTION • FORM

## QINHUANGDAO RED RIBBON PARK

QINGHUANGDAO CITY, CHINA



Red Ribbon Park spans five hundred meters, and integrates the functions of lighting, seating, environmental interpretation, and orientation. While preserving as much of the natural river corridor as possible during the process of urbanization, this project demonstrates how a minimal design solution can achieve a dramatic improvement to the landscape.

FUN/WACKY/COLORFUL • ARTFUL INTEGRATION OF FUNCTION • FORM

## BEKO MASTERPLAN

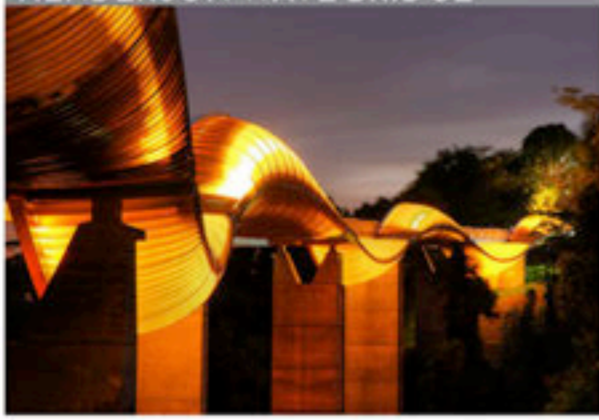
BELGRADE, SERBIA

An urban regeneration project that was architecturally designed as a series of lines that "carve the inhabited landscape and act as continuities where outdoor spaces, landscape undulations, balconies, roof edges, and bridges all flow into one another". The ground level of the building is open and exposed to the city, allowing the public and the flexible civic space to flow through the site in an uninterrupted and harmonious manner.

MOTION/ MODERN EDGE/ FLOW

## HENDERSON WAVE BRIDGE

SINGAPORE



The Henderson Wave Bridge spans 284 meters across Henderson Road with a flowing organic form of "wave" spans. The bridge's organic, undulating form is visually appealing while satisfying functional needs. While the pedestrian route is level, the waves deform as access ramps, balustrades, benches, and shelters for leisure walking and scenic viewing for the public.

MOTION/ MODERN EDGE/ FLOW

## SUPERKILEN

COPENHAGEN, DENMARK

The Superkilen is defined by three color-coded areas, each offering distinctive functions and atmospheres, and stands as a vehicle of integration for the cultures represented by the area. The kilometer-long "Super Park" consists of three themed parts-"Red Square", "Black Market", and "Green Park". The goal of the project was to create a unifying space for a very diverse neighborhood. Rather than try to make the space Danish or cater to satisfy the needs of specific groups, the design team decided to reference every group represented.

INTUITIVE CIRCULATION

## HIGH TRESTLE BIKE BRIDGE

IOWA

This trail runs for 25 miles through five towns (Ankeny Sheldahl, Slater, Madrid, and Woodward), and through Polk, Story, Boone, and Dallas counties. The trail includes a 13-story-high bridge across the Des Moines River valley, one of the largest trail bridges in the world. The bridge decking incorporates a decorative structure that represents the view through a mine shaft, and includes decorative lighting that remains on until midnight. At each end of the 1/2-mile-long bridge are four 42-foot-tall artistic towers. The dark bands represent geologic coal veins found in area limestone deposits.

SITE APPROPRIATE MATERIALS, DRAMATIC LIGHTING, FUNCTION + FORM

# APPENDIX 8. DESIGN GUIDELINES

The following provides recommended design guidelines for CV Link that are consistent with guidelines currently observed in California and in the United States. Ultimately, the path must be designed to meet the safety of path users. Considerations specific to the Coachella Valley Water District and Riverside County Flood Control District (RCFCD) are addressed at the end of this section. The challenge is to find ways of accommodating each of the anticipated uses with minimum compromises related to safety or function.

Planning, design, and implementation standards in this document are derived from the following sources:

- American Association of State Highway and Transportation Officials (AASHTO), *Guide for the Development of Bicycle Facilities, 4th Edition*, 2012
- AASHTO, *Roadside Design Guide*, 4th edition, 2011
- AASHTO LRFD Guide Specification for Design of Pedestrian Bridges, 2nd Edition, December 2009
- AASHTO LRFD Bridge Design Specifications, 4th Edition, 2010
- Caltrans, California Manual on Uniform Traffic Control Devices, 2012
- Caltrans, California Amendments to the AASHTO LRFD Bridge Design Specifications, November 2011
- Caltrans: Highway Design Manual,6th edition 2013
- Institute of Transportation Engineers (ITE), *Design and Safety of Pedestrian Facilities,* 1997
- Coachella Valley Area Government (CVAG), Whitewater River/Parkway 1e11 NEV/Bike/Pedestrian Corridor Preliminary Study Report, 2012
- CVAG, Coachella Valley Non-motorized Transportation Plan Update, 2010
- Coachella Valley Water District (CVWD), *Development Design Manual,* 2010
- Riverside County, General Plan Draft Circulation Element, Trails and Bikeway System, 2013
- City of Lincoln, NEV Transportation Plan, 2006
- City of Lincoln, CTCDC Approved Experimental Standards, 2005
- National Association of City Transportation Officials (NACTO), *Urban Bikeway Design Guide*, 2nd Ed, 2012.
- U.S. Department of Agriculture, Forest Service Trail Accessibility Guidelines, 2006
- USDOT, FHWA, Conflicts on Multiple-Use Trails: Synthesis of the Literature and State of the Practice, 1994
- U.S. Department of Transportation (USDOT), Federal Highway Administration (FHWA), 2009 *Manual on Uniform Traffic Control Devices* (MUTCD), with revisions 1 and 2, May 2012

The sources listed above provide details on many aspects of path design, but a) may contain recommendations that conflict with each other; b) are not, in most cases, officially recognized “requirements”; and c) do not cover all conditions on most paths. All design guidelines must be supplemented in the application to specific situations by the professional judgments of the path designers and engineers.

## 8.1. Off-Street Facilities

CV Link will accommodate a wide range of users including pedestrians, persons in wheelchairs, motorized mobility devices, bicyclists of varied abilities including family cycling, and Low Speed Electric Vehicles (LSEVs). Due to the speed differential between pathway users, CV Link will be a dual path system whenever possible incorporating a shared use path for faster modes of travel including bicycles and electric mobility devices and LSEVs (up to 25 mph) and a separate pedestrian path for slower modes.

### 8.1.1. **SHARED USE PATH DESIGN**

Shared use paths are completely separated from motorized vehicular traffic and are constructed in their own corridor, or within an open-space area. Path design recommendations are listed below:

- The typical cross section is 14’ wide minimum with 2’ wide compacted crushed stone shoulders.
- The preferred cross section for areas of heavy use is 16’ wide with 2’ wide compacted crushed stone shoulders.
- On the overcrossings (bridges), 14’ wide with 1’ shoulders to separate pedestrian traffic.
- Steep grades should be avoided on any shared use path, with less than 5% as the recommended maximum gradient. Steeper grades can be tolerated for short distances (up to 30 feet).
- A 2% cross slope will resolve most drainage issues on a shared use path, except along cut sections where uphill water must be collected in a ditch and directed to a catch basin, where the water can be directed under the path in a drainage pipe of suitable dimensions. No sharp curves are anticipated along the path.
- Dashed centerline striping shall be used along the path with constrained areas and sharp or blind curves having a solid line.
- The typical setback from edge of tread to obstructions shall be 3 feet, 2-foot minimum.
- The design speed for the shared use path should be 25 miles per hour. Speed bumps or other surface irregularities or obstacles should not be used to slow bicycles. Slower speeds may be posted for areas that have at least one of the following: higher typical user volumes, substandard pathway conditions, or equestrian usage.
- Stopping sight distance on horizontal curves and lateral clearance can be calculated using the equations in the American Association of State Highway and

Transportation Officials Guide for the Development of Bicycle Facilities, 4th Edition (AASHTO). Sight distance is generally not expected to pose a problem on CV Link.

- A twelve-foot desirable minimum vertical clearance should be maintained. Any exception shall be documented and will require CVAG approval. The vertical clearance area should be free from tree limbs and any other obstructions that may interfere with pathway use.
- The use of bollards for access control is discouraged to avoid creating obstacles for bicyclists. Bollards, particularly solid bollards, have caused serious injury to bicyclists. Instead, design the path entry and use signage to alert pathway users that combustion engines are prohibited. In cases where bollards must be used, they should be installed to be removed or be flexible to allow passage of maintenance or emergency vehicles. Solid bollards should not be used at all.
- Bollards may be used for pathway lighting if placed outside the traveled way.

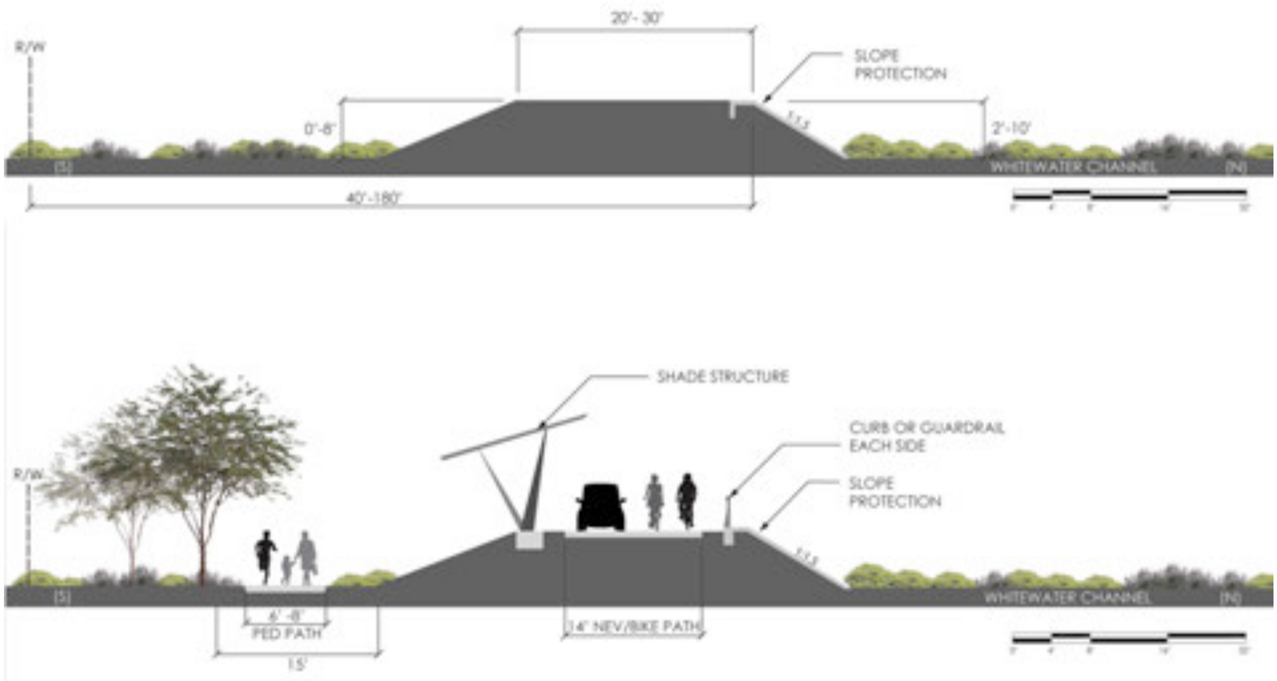
### 8.1.2. **PEDESTRIAN PATH DESIGN**

Pedestrian paths are also separated from motorized vehicular traffic but are usually narrower than shared use paths. Path design recommendations for segments that are not within the roadway right-of-way are listed below:

- Stabilized decomposed granite is the recommended surface treatment.
- The typical cross section is 4-8' wide.
- The running slope should be less than 5%.
- The cross slope should be 2% maximum and 0.5% minimum.

## 8.1.3. TYPICAL CROSS-SECTIONS

### Single Low Independent Levee



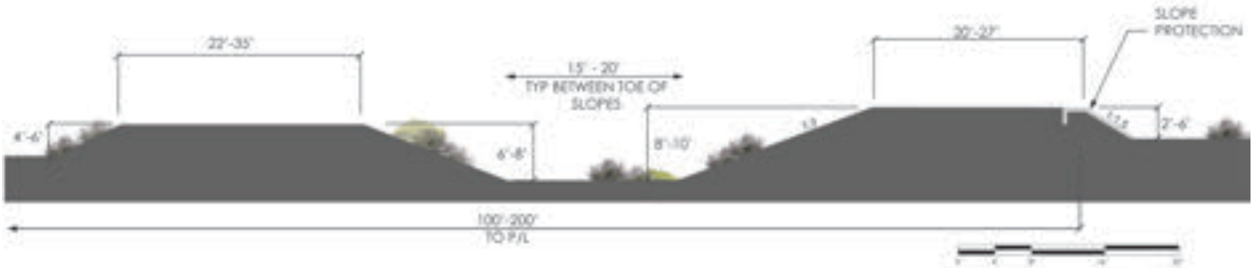

## Existing

- Single elevated levee 25’ – 30’ wide
- Slope reinforcement to top of levee on channel side
- Vacant lands south of levee to be developed

## Proposed

- LSEV/bicycle path on levee
- Guardrail each side of levee where slope and vertical drop warrants are met, and 5’ horizontal separation not feasible
- Shade structures on non-channel side of levee
- Separate pedestrian path on non-channel side of levee
- Trees to be 15’ minimum from toe of levee slope on non-channel side
- Grasses and shrubs under 3’ tall
  may be planted on levee structure

**Double Low Independent Levee**





## Existing

- Two elevated levees 20' - 35' wide
- Slope reinforcement to top of channel adjacent levee on channel side
- Residential properties adjacent to south side of right-of-way

## Proposed

- LSEV/bicycle path on channel adjacent levee, pedestrian path on secondary levee
- Guardrail each side of levee where slope and vertical drop warrants are met, and 5' horizontal separation not feasible
- Shade structures on non-channel sides of levees
- Trees to be 15' minimum from toe of levee slope on non-channel side
- Grasses and shrubs under 3' tall may be planted on levee structures

**ROW Adjacent Levee, Unconstrained**



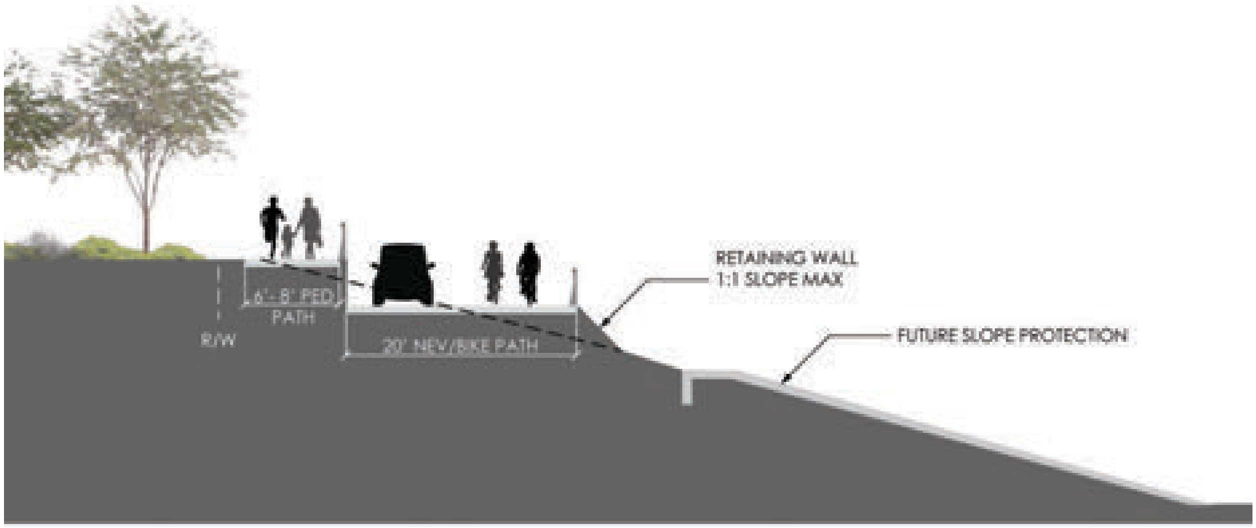
## Existing

- Right-of-way adjacent levee
- No existing slope protection, anticipated in future
- Sufficient width between area of future slope protection (High Surface Water elevation) and right-of-way line for pathway improvements

## Proposed

- LSEV/bicycle path adjacent to channel edge
- Separate pedestrian path adjacent to LSEV/bicycle path
- Guardrail to be used where slope and vertical drop warrants are met, and 5’ horizontal separation not feasible
- Trees to be 20’ minimum from top of slope protection
- Grasses and shrubs under 3’ tall may be planted on levee

**ROW Adjacent Levee, Constrained Bench**



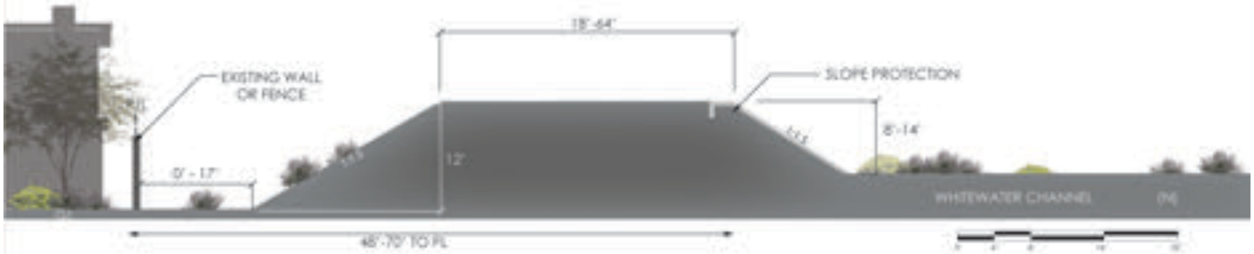

## Existing

- Right-of-way adjacent levee
- Constrained bench width between slope protection and right-of-way line for pathway improvement
- Slope protection may or may not be present, anticipated in future

## Proposed

- LSEV/bicycle path adjacent to channel edge
- Separate pedestrian path adjacent to LSEV/bicycle path
- Half bench (cut/fill) used to create area for CV Link paths
- LSEV/bicycle path may be a full bench into slope or half bench with retaining wall with 1:1 slope max
- Guardrail to be used where slope and vertical drop warrants are met, and 5' horizontal separation not feasible
- Curb and guardrail where slope is greater than 1:3 and sufficient horizontal separation is not achievable
- Trees to be 20' minimum from top of slope protection
- Grasses and shrubs under 3' tall may be planted on levee

**Raised Independent Levee**





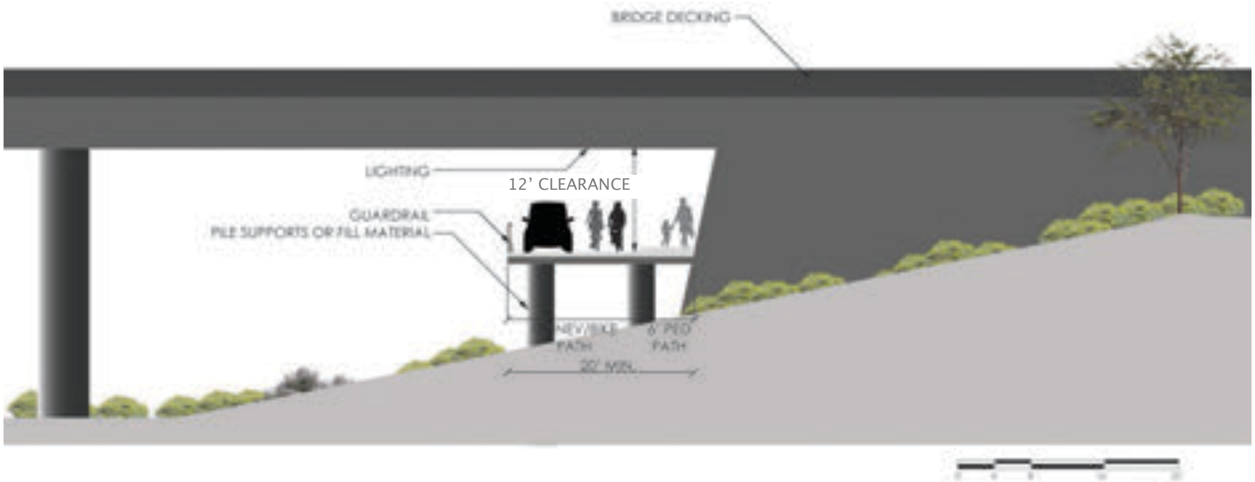
## Existing

- Single elevated levee 30' – 40' wide
- Slope reinforcement to top of levee on channel side
- Residential properties typically 12' below top of levee

## Proposed

- LSEV/bicycle and pedestrian paths on levee
- Guardrail each side of levee where slope and vertical drop warrants are met, and 5' horizontal separation not feasible
- Shade structures on non-channel side of levee
- Trees to be 15' from toe of levee slope on non-channel side
- Grasses and shrubs under 3' tall may be planted on levee structure
- Screening of adjacent residences to be provided via fencing, walls and/or vegetation

**Undercrossing**




## Existing

- Roadway or rail bridge undercrossing

## Proposed

- Pathway on pile supports or fill under road and rail bridges
- 12’ is the desirable minimum vertical clearance.  Any exceptions shall be documented and will require CVAG approval.
- Guardrail to be used where slope and vertical drop warrants are met, and 5’ horizontal separation not feasible
- Full pathway design width to be maintained

# 8.2. Bridge Design

### 8.2.1. **DESIGN CRITERIA**

The Bridge Structure Alternatives described in the following section have been selected considering the following design criteria. Detailed discussion of each of the parameters follows the list.

- Geometry
- Loads – Pedestrian, Bike, LSEV (NEV), Equestrian, pickup truck, Bridge Inspection Trucks/Units, and Environmental conditions
- Materials
- Approaches
- Construction Cost & Schedule
- Bridge Deck Drainage
- Bridge Lighting
- Barrier and Safety fence Options
- Aesthetics – Bridge superstructure, Barriers, fences, screenings etc.

### 8.2.2. **GEOMETRY**

Geometry includes width, span configuration, horizontal alignment/curvature, vertical clearance, cross slope and longitudinal profile, skew angle, pier and abutments, approach embankments/ramps.

Bridge width/cross section: The roadway width on the bridge is selected to match with the width of approach pathway/roadway.

The total out-to-out deck width of a typical bridge is set at a minimum of 23'-0" accommodating 1 – 6'-0" lane (pedestrian use), 1 – 14'-0" lane (NEV/Bike shared path), and 2 – 1'-6" wide barriers with safety fences on top.

Horizontal and Vertical Alignment: The bridge will be on a tangent alignment horizontally, with a maximum skew of 60 degrees at bridge begin and/or bridge end locations. The longitudinal slope will be limited to 8% in order to meet the ADA requirements. Maximum Cross slope of 2% will be used on the deck to facilitate drainage on the bridge and approach embankments.

Vertical Clearance: Only with regards to the overcrossing of Highway 111 where it is a state highway AND the overcrossing is classified as a pedestrian overcrossing rather than a roadway for LSEVs, per Caltrans sec. 309.2, minimum vertical clearance for is 2 ft. greater than the standard for major structures for the state facility in question. Accordingly, the following vertical clearance will be adopted for CV Link overcrossing structures.

- Over State Highway 111: 17'-6" if the design is not considered to have the redundancy needed for protection from oversize vehicles; otherwise 15'-6"
- Over Local Roads: 17'-0" if the design is not considered to have the redundancy needed for protection from oversize vehicles; otherwise 15'-0"
- Over Channel/Waterways: 1' min. free board will be provided over the Standard Project Flood (SPF) or 3' free board over the 100-year design flood.

Span Configuration: The total bridge length will be established based on the site conditions, and a maximum longitudinal/run slope of 8%. The number of spans and maximum span length will be derived based on the structure type, and hauling and erection limitations.

### 8.2.3. **LOADS**

The bridge and approach embankments/ramps will be designed for a 90 psf pedestrian load, and AASHTO H10 truck load. Expected loads due to pedestrian, small pickup or maintenance vehicles and equestrian loads all will be less than AASHTO H10 loads on most of the overcrossings on the path. In addition, wind and seismic loads will be considered in the design according to the Caltrans Bridge Design Specifications. The temperature range in the region is 20° F-120° F, and the overcrossings will be designed appropriately for "Hot Climate" category per AASHTO and Caltrans standards. Combined with the hot climate, possible wind blasting effect on the longevity of the paint will be considered in the final design and appropriate recommendations will be made as to the type of the paint and number of coatings for the painted steel girder option. In addition, the wind loads are specifically critical for the cable-stayed bridges, and special wind studies are warranted. The seismicity is expected to be very high in the region and all the structures both - traditional and signature types will be appropriately designed meeting Caltrans requirements.

### 8.2.4. **MATERIALS**

Steel and concrete options will be considered and selected appropriately based on the structural performance, and cost criterion. Weathering steel, painted and galvanized steel will be considered on a case-by-case basis, upon discussion with CVAG, to mitigate the corrosion, but also considering the aesthetics.

### 8.2.5. **APPROACHES**

Approaches to the overcrossing bridges consist of embankment fill supported by cantilever walls or MSE walls. MSE wall consist of precast concrete panels, metallic soil reinforcement, and granular backfill. MSE walls provide a composite retention system where strength and stability are derived from the frictional interaction between the granular backfill and the reinforcements. Both wall type offer flexibility to modify the exposed faces for architectural treatments.

These walls are generally more economical than the conventional cantilever walls for wall heights greater than 20 ft. The cost difference between the two types of walls is expected to be small for the overcrossing approaches on this project.

### 8.2.6. **CONSTRUCTION COST & SCHEDULE –**

In order to minimize the cost, schedule, and disruption to the traffic, Accelerated Bridge Techniques are considered in reviewing the structure alternatives. For example, the use of steel girders, prefabricated steel trusses for superstructures, precast abutment and precast wingwall elements for substructures is recommended for overcrossings of roadways.

### 8.2.7. **BRIDGE DECK DRAINAGE**

Deck cross slope and longitudinal profile will be designed to drain the runoff water on the deck without the need of any special drainage devices/systems. A design cross slope of 2% (max.) will be provided over the travel way on the overcrossings to facilitate the deck drainage. This combined with 8% longitudinal slope is sufficient to meet the expected runoff on the overcrossings. However, for the structures crossing local roads, use of scuppers, downspouts, and other drainage devices will be considered, as deemed necessary, to discharge the water at suitable outlet points.

### 8.2.8. BRIDGE LIGHTING

Lighting on the bridge will be provided consistent with the lighting along the pathway, with additional consideration given to the safety requirements as per the applicable standards. For example, lighting on the overcrossings above highways and local roads are required to meet additional safety and illumination requirements that may not be applicable to the pathway at-grade lighting.

### 8.2.9. BARRIER AND SAFETY FENCE OPTIONS:

Caltrans defines specific barrier and fence types such as Type 3 chain link, Type 26 and Type 732 barriers for overcrossing structures. For bridges over channels, tall tubular railing may be an option. The heights of the fence and railing will be designed to meet safety requirements maintaining a minimum combined height of 42”. Modifications to the Caltrans standards will be made to incorporate project specific aesthetic requirements in the final design.

### 8.2.10. AESTHETICS

Exposed faces of the bridge superstructure, embankment walls, barriers, and safety fences will be modified to enhance the structure aesthetics. Some of the measures that will be considered include: use of color concrete, impregnating city/neighborhood logos, and screenings.

In addition, other criteria such as Future Maintenance or reparability, and Construction Cost and schedule will be considered in reviewing various structure types, and recommendation will be made based on the context sensitive for a given location.

## 8.3. Bridge Types

### 8.3.1. CAST-IN-PLACE POST-TENSIONED BOX GIRDER

This alternative consists of a cast-in-place post-tensioned concrete box girder superstructure supported on concrete piers, and abutments. The superstructure is integrally built with the intermediate bent/pier caps offering additional structural redundancy.

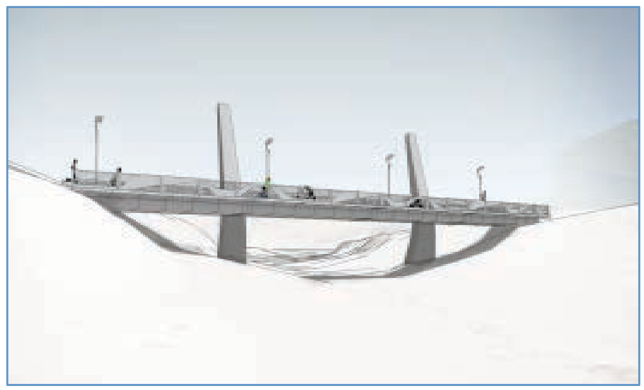
Advantages:

- Most common structure type in California
- Aesthetically Pleasing
- Low Maintenance
- Longer Spans

Disadvantages:

- Longer Construction Time.
- Falsework is required.
- Traffic disruption expected.

This would help to minimize the required structure depth, and the overall bridge and ramp lengths needed at a given location. Since this option requires falsework, this alternative is best suited for bridges over creeks/channels/canyons. No additional topping is required with this option. The superstructure depth with this option will be less than that of a steel truss option, and will be similar to that of a steel girder option (Inverset option).



This alternative is suitable for spans ranging from 100 ft. to 250 ft. The superstructure depth is about 4% of the span length.

The substructure units consist of single column concrete bents at the intermediate supports, and high cantilever concrete abutments at the bridge ends. The approaches will consist of embankment fills supported by MSE walls, with wall panels treated for aesthetics. Pile foundations consisting of CIDH piles are expected at both the pier supports and abutments.

To enhance the aesthetics, architectural treatment can be applied to the exposed faces of the superstructure and barriers with custom colors and captions.  Similarly, architectural features can be added to the safety fences with special screenings to further enhance the aesthetics.

The estimated cost of this alternative is $180/sf.

## 8.3.2. PRECAST, PRESTRESSED CONCRETE VOIDED SLABS

This alternative consists of a precast prestressed concrete superstructure voided slabs supported on concrete pier and abutment substructure. A 3” concrete or asphalt topping is applied as riding surface after installation of the precast slabs in place.

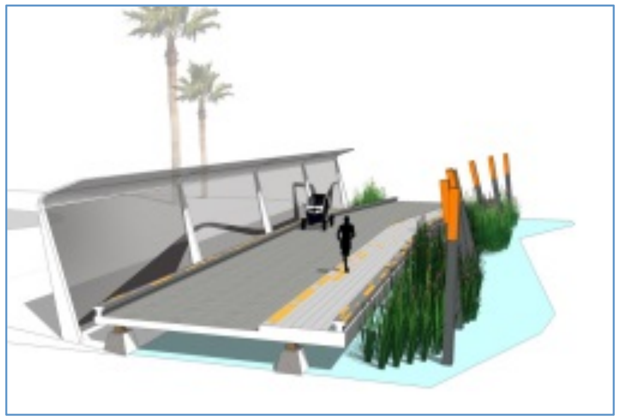
Advantages:

- Economical
- Easy erection/installation
- Minimal or No Traffic Disruption
- Shorter Construction Time
- Aesthetically Pleasing
- Low Maintenance

Disadvantages:

- Shorter spans.

This alternative offers benefits of the speed of construction and low maintenance. This alternative is suitable for shorter span situations with span lengths up to 85 ft. The superstructure depth is about 3% of the span length. The width of a typical precast slab unit is 4 ft., and depth varies from 12” to 30”. This alternative does not require falsework, and hence best suited for overcrossing applications with limited available vertical clearance.



The substructure units consist of single column concrete bents at the intermediate supports, and seat type concrete abutments at the bridge ends. No embankment fills are expected at the location where this option is proposed (Tahquitz GC Lake Boardwalk). Pile foundations consisting of CIDH piles are expected at both the pier supports and abutments.

To enhance the aesthetics, the exposed faces of the beams, and barriers can be treated with custom colors. Similarly, the safety fences with architectural finishes/ screening could be used to further enhance the aesthetics.

The estimated cost of this alternative is $260/sf

### 8.3.3. STRUCTURAL STEEL GIRDER/TRUSS SYSTEM

This alternative consists of a steel girders or prefabricated steel truss superstructure with cast-in-place concrete deck. The substructure units consist of concrete bent and abutments. The prefabricated truss superstructure is a proprietary system pre-engineered (designed) and prefabricated by the manufacturer/supplier. Steel truss modules of fixed lengths are delivered to the site where the contactor assembles and erects them onsite per manufacturer's recommendations.

Advantages:

- Economical
- Easy erection/installation
- Minimal or No Traffic Disruption
- Shorter Construction Time
- Aesthetically Pleasing
- Custom made/wide range of options
- Proven Technology

Disadvantages:

- Maintenance Cost

The bridge is designed to meet all the applicable national standards such as AISC, AASHTO, and AISI design criteria. It is also possible to use prefabricated substructure elements with this alternative.

This alternative is suitable for bridges with span lengths ranging from 100 ft. to 300 ft., deck width from 10 ft. to 30 ft. For longer span applications, a cable-stayed steel truss option is available up to a maximum span length of 300 ft. The superstructure depth ranges from 7% to 10% of the clear span.

The substructure units consit of steel column bents at the intermediate supports, and seat type concrete abutments at the bridge ends. No embankment fills are expected at the location where this option is proposed (Tahquitz GC Lake Boardwalk). Pile foundations consiting of CIDH piles are expected at both the pier supports and abutments.

Three finishing options are available for the steel girder/truss superstructure units and support columns – weathering steel, painted, and galvanized – to resist corrosion and enhance the longevity of the bridge.

Four material choices are available for the bridge deck – timber, concrete, asphalt, or steel grating to choose from – depending upon the bridge location. However, traditional concrete deck is recommended for the proposed overcrossings to maximize the structural efficiency and minimize the construction cost. Similary, a variety of rail options are also available which can be custom designed and/or treated.

While the prefabricated products are patented product, once purchased, the owner gets full rights of the product, and can use, inspect/maintain the bridge like any other traditional bridge structure. Different manufactured products are available on the market offering competitive price.

The estimated cost of this alternative varies from $250/sf to $400/sf depending upon the span length.

### 8.3.4. LONG SPAN - ARCH / CABLE-STAYED

This alternative is suitable for span lengths greater than 250 ft.

Within this alternative, multiple structure types are available - ranging from Concrete or Steel Arch to Cable-Stayed Bridge option. While the Arch Bridges are suitable for moderately longer spans (300 ft - 1,500 ft), cable-stayed bridges are best suited for spans raging from 300 ft - 3,500 ft).

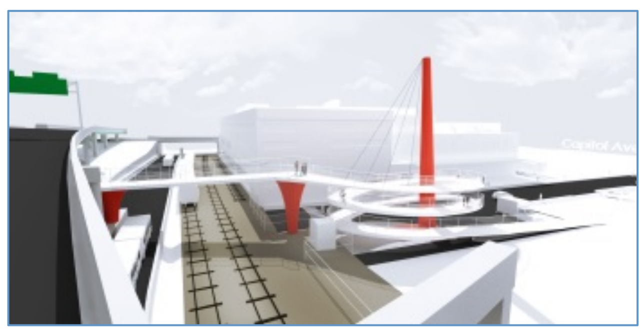
Advantages:

- Structural efficiency for longer span lengths.
- Aesthetically Pleasing
- Enhances/Uplifts the neighborhood profile and helps to boost the local economy

Disadvantages:

- Cost & Schedule
- Requires special design, and specialty contractors
- Maintenance

Arch Bridges are relatively difficult to build compared to the Cable-Stayed bridges, but the later is very sensitive to lateral wind loads. While both the Arch and Cable-Stayed bridges require longer construction time, it can be minimized by using prefabricated steel trusses or arches for superstructures.



The substructure will consist of pile supported concrete abutments and concrete towers/pylons (for cable stay option) and will be designed according to the final structure type selected.

The forces on the foundation of these structures, especially cable-stayed type require competent soil/geological conditions to support the structure foundation - specifically at the abutments. Hence, the suitability of the foundation soil will be evaluated before a final recommendation is made.

These structures are aesthetically elegant and pleasing. The cost of these bridges varies from $750/sf-$900/sf.

# 8.4. On Street Facilities

## 8.4.1. **LSEV/BICYCLE FACILITIES**

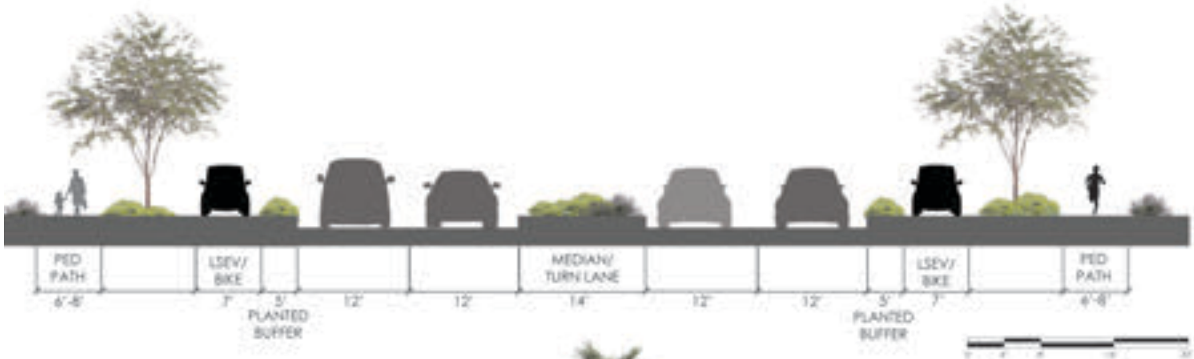
On street or within road right-of-way facilities should provide a safe and comfortable facility to maintain consistency in the experience of CV Link. Where traffic volumes and speeds are high and space is available, protected or buffered LSEV/bike facilities should be considered.

Depending on roadway width available, this could be as elaborate as a planted strip between concrete curbs, to something as simple as a two foot wide painted buffer area.

Each potential within road right-of-way alignment needs to be closely assessed for the optimum cross section configuration. On roadways with higher vehicle volumes and/or higher posted vehicle speeds, a greater level of protection should be pursued. On roadways with drainage issues or where numerous driveway or roadway intersections occur, separation techniques may be limited to the use of painted buffers.

Where physical space is constrained, LSEV/bicycle lanes or boulevard type treatments may be used to achieve the pathway system. LSEV/bike facilities are a portion of the right-of-way that have been designated by either vertically separated concrete path/cycletrack (preferred) or striping, signing, and pavement markings for the use of LSEVs and bicyclists. LSEV/Bicycle facilities should be located on both sides of the road, except on one-way streets, and carry users in the same direction as adjacent motor vehicle traffic.

**Typical On-Street Options**





Proposed

- 7’ wide LSEV/bicycle facilities
- 8’ wide pedestrian paths, 6’ minimum
- 8” wide white barrier line between LSEV/bike lane and traffic lane required, with LSEV and bicycle pavement markings
- Bike friendly catch basin grates shall be used for on street segments
- Painted lines appropriate for use on roadways with average daily traffic (ADT) counts of 3,000 or more. If the ADT is over 10,000, then a separated LSEV/cycle track should be considered.
- Not suitable where there are a high number of commercial driveways

- A separate lane is required for LSEVs on roadways with speed limits greater than 35 mph

Alignments occurring on low volume local streets may accommodate LSEVs and cyclists within the existing roadway. Similar to bicycle boulevards, streets with less than 3,000 ADT and under 35 mph do not warrant lane striping. Instead, a system of wayfinding signs and markings, supplemented by traffic calming measures, is considered acceptable practice.

### 8.4.2. **SIDEWALKS**

Sidewalks are separated from motorized vehicular traffic but typically within right-of-way. Design guidelines for new sidewalk construction related to the CV Link alignment are listed below:

- Permeable concrete is the recommended surface treatment.
- The preferred cross section width is 8' wide, 6' minimum.
- The running slope should be less than 5%.
- The cross slope should be 2% maximum and 0.5% minimum.
- Curb ramps with tactile warning devices to be used at all at-grade roadway crossings.

## 8.5. LSEV Design Requirements

### 8.5.1. Design Speed and Speed Limit

Based on the legislated maximum LSEV speed (25 mph) and HDM table 1003.1, the path design speed conventionally would be 30 mph. In an effort to maintain the desired maximum speed of the pathway, a design speed of 25 mph should be utilized. A posted speed limit of 20 mph should be considered. In comparison, the adult cyclist typically travels between 8 and 15 mph.

American roads are often over-engineered, or designed to accommodate higher speeds that are not only faster than the posted speed limit, but also faster than is appropriate for the area. Aligning the design speed (the speed that vehicles can navigate the facility without losing control) with the desired driving speed, results in a speed that makes sense for the context.

The maximum speed on the shared use path should be 20 mph due to the significant increase in injury at higher speeds. Research on highway capable motor vehicle collisions has shown that at 20 mph, a pedestrian or cyclist has a 95% chance of surviving a crash. As speed increases above 20 mph, the chance of survival decreases significantly. Lower speed limits have been effective at reducing the crash and fatality rate in cities across Europe.

Table 5 shows how, when a pedestrian is struck, the likelihood of death increases faster than the percentage increase in vehicle speed, in a nonlinear fashion. Table 6 shows the injury severity in single vehicle collisions based on Florida data 1993-1996[3].

TABLE 5. PROBABLILITY OF PEDESTRIAN DEATH IN COLLISION WITH VEHICLE

| Vehicle Speed | Probability[4] |
|---|---|
| 20 mph | 5% |
| 30 mph | 37-45% |
| 40 mph | 83-85% |

TABLE 6: VEHICLE TRAVEL SPEED AND PEDESTRIAN INJURY SEVERITY

| Injury Severity | Travel Speed (Officer Estimates) | | | | | | Total |
|---|---|---|---|---|---|---|---|
| | 1-20 mph | 21-25 mph | 26-30 mph | 31-35 mph | 36-45 mph | 46+ mph | |
| Fatal (K) injury | 1.1% | 3.7% | 6.1% | 12.5% | 22.4% | 36.1% | 6.5% |
| Incapacitating (A) | 19.4% | 32.0% | 35.9% | 39.3% | 40.2% | 33.7% | 27.0% |
| Nonincapacitating (B) | 43.8% | 41.2% | 36.8% | 31.6% | 24.7% | 20.5% | 38.8% |
| Possible inj (C) or none | 35.6% | 23.0% | 21.2% | 16.6% | 12.7% | 9.7% | 27.7% |
| Total frequency | 13,368 | 1,925 | 2,873 | 2,188 | 2,493 | 906 | 23,753 |

However, no research has been conducted on collisions between LSEVs and non-motorized users. The lower mass and improved visibility (and therefore reaction time) of a LSEV may provide comparable injury risk at 25 mph as a highway capable motor vehicle at 20 mph. If a speed limit of 20 mph were to be established, LSEV operators would have to maintain awareness of speed (rather than allowing the vehicle speed limiter to control maximum speed). This may absorb some of the operator's attention and therefore reduce the ability of the operator to observe and react to potential conflicts. Furthermore, a 20 mph speed limit for LSEVs would reduce the travel time competitiveness with using automobiles on the existing public streets and may therefore reduce the potential usage of CV Link. In the absence of data on the risk and severity of collisions between lighter LSEVs and non-motorized users, it cannot be concluded that a 20 mph speed limit is justified.

**Recommendations**

- Path speed limit to be 25 mph.
- Design speed to be 25 mph.

---

[3] NHTSA (1999) *Literature Review on Vehicle Travel Speeds and Pedestrian Injuries*

[4] UK DOT (1994) *Killing Speed and Saving Lives;* lower percentages are cited in Australian Federal Office of Road Safety (1994) *Vehicle Speeds and the Incidence of Fatal Pedestrian Collisions*

### 8.5.2. **SHARED USE PATH WIDTH**

A 4-seat LSEV is approximately 5.5' wide with a 7' minimum design envelope. The minimum paved width or travel area of a shared use path accommodating two-way LSEV travel should be paved 14' wide and 16' preferred. Wider widths are recommended when high user volumes or a mix of user types are anticipated. A reduced path width of 12' may be used over short distances due to physical constraints including: environmental features, bridge abutment, utility structure, or fence. A minimum path width of 12' is regarded as appropriate where maintenance vehicles are anticipated. Path less than 12' wide are subject to edge breakage from vehicle loads. Constrained pathway sections should be indicated with warning signs or markings.

### 8.5.3. **STOPPING SIGHT DISTANCE**

This refers to the distance the LSEV driver needs to be able to see in order have room to stop in advance of an obstacle on the path. The LSEV braking distance is 10' at 25 mph. AASHTO provides formulae for calculating stopping sight distance depending on the gradient and the typical design vehicle coefficient of friction (a lower coefficient applies to inline skaters and recumbent bicyclists). For shared use path design purposes, the stopping sight distance should be based on bicycles.

### 8.5.4. **HORIZONTAL CLEARANCE**

A shoulder or recovery area provides a driver or cyclist room to maneuver to avoid crashes, recover a vehicle that has left the travel way, as well as an area for temporarily disabled vehicles. While shoulder or recovery area guidelines do not exist for NEVs, the standards for low speed vehicle roadways and bicycle facilities have been reviewed.

Horizontal clearance also includes a clear zone or area where lateral objects shall not be placed. The width of a clear zone along the horizontal alignment is dependent on roadside geometry, design speed, radius of horizontal curve, and the number of Average Daily Trips (ADT). Higher speeds mean vehicles will travel farther before recovering. In general, hazards within the clear zone, which cannot be removed, relocated, or made breakaway, will warrant guardrail.

**Bicycle Guidance**

AASHTO's bicycle design guidelines require 5' of recovery area from the hazard (channel slope). When sufficient recovery area is not present, a safety rail should be used as follows:

- Slopes 1V:3H or steeper, with a drop of 6 ft. (1.8 m) or greater;
- Slopes 1V:3H or steeper, adjacent to a parallel body of water or other substantial obstacle;
- Slopes 1V:2H or steeper, with a drop of 4 ft. (1.2 m) or greater; and
- Slopes 1V:1H or steeper, with a drop of 1 ft. (0.3 m) or greater.

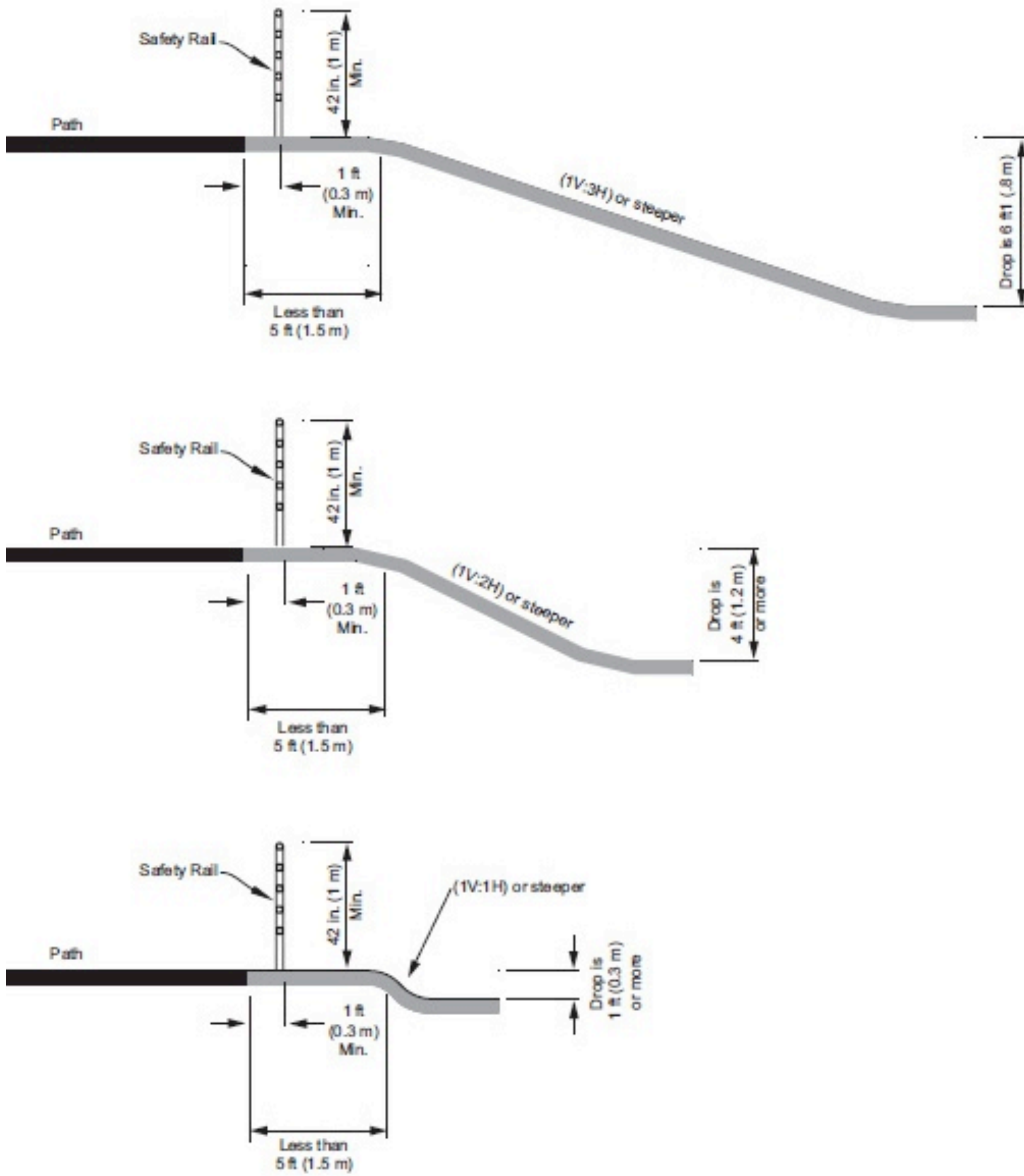



FIGURE 4. BICYCLE PATH SAFETY RAIL RECOMMENDATION BY CONDITION

Source: AASHTO Bicycle Guide, 2012

### Vehicle Guidance

The FHWA's 2005, *Barrier Guide for Low Volume and Low Speed Roads*, clarifies clear zone and barrier warrants for low volume roadways. Guardrail itself is considered a hazard. Every effort should be made to maintain a sufficient clear zone recovery area so that guardrail is not needed.

TABLE 7: CLEAR ZONE DISTANCES FROM EDGE OF THROUGH TRAVELED WAY

| DESIGN SPEED | DESIGN ADT | FORESLOPES | | | BACKSLOPES | | |
|---|---|---|---|---|---|---|---|
| | | 1V: 6H or flatter | 1V: 5H to 1V: 4H | 1V: 3H | 1V: 3H | 1V: 5H to 1V: 4H | 1V: 6H or flatter |
| 20 mph | Under 750 | 2 - 6 | 3 – 7 | | 2 - 6 | 2 - 6 | 3 - 7 |
| | 750 - 1500 | 3 - 7 | 5 - 8 | ** | 2 - 6 | 2 - 6 | 3 - 7 |
| | 1500 - 6000 | 5 - 8 | 6 - 10 | | 3 - 7 | 3 - 7 | 5 - 8 |
| | over 6000 | 7 - 10 | 7 - 10 | | 5 - 8 | 5 - 8 | 7 - 10 |
| 25 - 30 mph | Under 750 | 3 - 7 | 5 – 8 | | 2 - 6 | 2 - 6 | 3 - 7 |
| | 750 - 1500 | 5 - 8 | 6 - 10 | ** | 3 - 7 | 3 - 7 | 5 - 8 |
| | 1500 - 6000 | 7 - 10 | 7 - 10 | | 5 - 8 | 5 - 8 | 7 - 10 |
| | over 6000 | 7 - 10 | 10 - 12 | | 7 - 10 | 7 - 10 | 7 - 10 |
| 35 mph | Under 750 | 5 - 8 | 6 – 10 | | 3 - 7 | 3 - 7 | 5 - 8 |
| | 750 - 1500 | 7 - 10 | 7 - 12 | ** | 5 - 8 | 5 - 8 | 7 - 10 |
| | 1500 - 6000 | 10 - 12 | 12 - 14 | | 7 - 10 | 7 - 10 | 10 - 12 |
| | over 6000 | 12 - 14 | 14 - 16 | | 10 - 12 | 10 - 12 | 12 - 14 |
| 40 mph * | Under 750 | 7 - 10 | 7 – 10 | | 7 - 10 | 7 - 10 | 7 - 10 |
| | 750 - 1500 | 10 - 12 | 12 - 14 | ** | 10 - 12 | 10 - 12 | 10 - 12 |
| | 1500 - 6000 | 12 - 14 | 14 - 16 | | 12 - 14 | 12 - 14 | 12 - 14 |
| | over 6000 | 14 - 16 | 16 - 18 | | 14 - 16 | 14 - 16 | 14 - 16 |
| 45 - 50 mph * | Under 750 | 10 - 12 | 12 – 14 | | 8 - 10 | 8 - 10 | 10 - 12 |
| | 750 - 1500 | 14 - 16 | 16 - 20 | ** | 10 - 12 | 12 - 14 | 14 - 16 |
| | 1500 - 6000 | 16 - 18 | 20 - 26 | | 12 - 14 | 14 - 16 | 16 - 18 |
| | over 6000 | 20 - 22 | 24 - 28 | | 14 - 16 | 18 - 20 | 20 - 22 |

* Data in these rows come directly from the AASHTO *Roadside Design Guide*.

** Foreslopes between 1V: 4H and 1V: 3H are traversable but non-recoverable. Since vehicles will not reduce speed or change direction on these slopes the needed clear zone is determined by the slopes above and below the non-recoverable slope and extended by the width of the non-recoverable slope. See Chapter 3 of the *RDG* for more information on this procedure. Foreslopes steeper than 1V: 3H are considered hazards.

At 25 mph, and an estimated ADT of less than 750 (bicycle and NEV), 3-7' of near level shoulder or clear space between the edge of traveled way and the top of the hazardous condition is considered sufficient to not warrant a safety barrier.

As engineering judgment may be used, Table 8 categorizes the severity of different hazards to assist designers with design decisions. Slopes greater than 1:2 are deemed moderately severe when less than 13' tall and as having high severity when the vertical difference is more than 13'.

TABLE 8: INJURY SEVERITY BY SLOPE GRADIENT

| Potential Hazard | Group 1 (Low Severity) | Group 2 (Moderate Severity) | Group 3 (High Severity) |
|---|---|---|---|
| | | | |
| **Parallel Ditches:** | | | |
| Ditches outside the preferred cross section on Figures 3.6 and 3.7 of the *RDG* and with foreslope flatter than 1V: 3H | X | | |
| Ditches with foreslopes 1V: 3H or steeper (Deep ditches should also meet the foreslope criteria below) | | X | |
| | | | |
| **Slopes** | | | |
| 1V: 3H foreslope less than 2 m (7 ft) high* | X | | |
| 1V: 3H foreslope 2 m (7 ft) and higher* | | X | |
| 1V: 2H to 1V: 1.5H foreslope less than 4 m (13 ft) high* | | X | |
| 1V: 2H to 1V: 1.5H foreslope 4 m (13 ft) high and higher | | | X |
| Vertical foreslope or fill wall less than 2 m (7 ft) high | | X | |
| Vertical foreslope or fill wall 2 m (7 ft) and higher | | | X |
| Backslopes that are uneven, or with deep erosion ruts, large rocks, and trees | | X | |
| Vertical backslope with horizontal projections of 200 mm (4 in) or smaller | X | | |
| Vertical backslope with horizontal projections larger than 200 mm (4 in) | | X | |
| Downward intersecting slope (transverse to travel way, such as a river bank) 1V: 4H or steeper, between than 0.5 (2 ft) high to 2 m (6 ft) high | | X | |
| Downward intersecting slope (transverse to travel way, such as a river bank) 1V: 4H or steeper, 2 m (6 ft) or higher | | | X |
| Upward intersecting slope (transverse to travel way, such as an overpass fill) 1V: 4H to flatter than 1V: 1.5H, greater than 0.3 m (1 ft) high | | X | |
| Upward intersecting slope (transverse to travel way, such as an overpass fill) 1V: 1.5 H or steeper, greater than 0.3 m (1 ft) high | | | X |

* Slopes are assumed to be relatively smooth and free of obstacles. If slopes are uneven, have deep erosion ruts, large rocks and trees or other vegetation that may cause a vehicle to be unstable, then the classification should be increased one category. Conditions at the bottom of these slopes must also be evaluated.

**Corrective Actions**

CV Link often occurs next to an edge having a 1:1.5 slope. The above chart classifies this as a moderate severity condition when the vertical distance to the bottom of the channel is less than 13' and as having high severity when vertical distance is greater than 13'. FHWA recommends the following based on severity rating.

- Group 1: Low Severity – Accepting the risk and leaving the hazard is usually appropriate. Avoid placing these conditions in the clear zone or take simple, low-cost corrective actions if possible. Group 1 hazards commonly do not justify expenditure of substantial funds to correct.
- Group 2: Moderate Severity – Consider cost-effective strategies to reduce probability, eliminate the hazard or reduce the severity of the hazard. Because these hazards generally do not warrant shielding with a roadside barrier, the cost of a corrective action should be less than the expected cost of a barrier. If a new road, avoid placing Group 2 hazards in the clear zone.
- Group 3: High Severity – Evaluate for possible use of roadside barriers if it is too expensive or impractical to eliminate either the hazard or make it crashworthy. If a barrier is not warranted or if an alternate treatment is less expensive than a barrier, treat as a Group 2 hazard.

Additional barrier warrant considerations are described in Table 9.

TABLE 9: BARRIER WARRANT CONSIDERATIONS

| Consideration | Barrier is more warranted if: | Barrier is less warranted if: |
|---|---|---|
| | | |
| Speed | 70 km/h (45 mph) or higher | 40 km/h (25 mph) or lower |
| Hazard on outside of horizontal curve | 350 m (1,150 ft) or smaller radius | Radius larger than 400 m (1,430 ft) |
| Hazard does not fit the descriptions in Tables 2.3 through 2.6 | Hazard is more severe | Hazard is less severe |
| Size of hazard | Very large | Very small |
| Traffic volume | Above 1,000 vpd | Below 400 vpd |
| Hazard on inside of horizontal curve | 350 m (1,150 ft) or smaller radius | Radius larger than 400 m (1,430 ft) |
| Hazard on a downgrade | 5 percent or greater | Less than 3 percent |
| Crash history | Clear crash pattern | No crash pattern |
| Anticipated cost of barriers | Expected costs are low | Expected costs are high |
| Roadway cross section | Severe section elements | Good section elements |
| Multiple hazards exist at the site | Many additional hazards | |
| Aesthetic impacts | | Serious concerns |
| Environmental impacts | | Serious concerns |

**Recommendations**

Based on the severity of the channel slope hazard, an assumed design speed of 25 mph and a projected ADT of less than 750, a 5' wide minimum shoulder/recovery area should be provided on each side of the NEV/bike path where space allows. The recommendations for barrier use described by existing condition are given in Table 10.

TABLE 10. BARRIER RECOMMENDATIONS BY CONDITION

| | 5' Separation Not Possible | | 5' Separation Possible | |
|---|---|---|---|---|
| | Height > 6' | Height < 6' | Height > 6' | Height < 6' |
| Shallow Slope<br>> 1V:3H<br>< 1V:2H | Guardrail | Curb | Curb | NA |
| | Height > 4' | Height < 4' | Height > 4' | Height < 4' |
| Moderate Slope<br>> 1V:2H<br>< 1V:1H | Guardrail | Curb | Curb | NA |
| | Height > 1' | Height < 1' | Height > 1' | Height < 1' |
| Steep Slope<br>> 1V:1H | Guardrail | Curb | Curb | NA |

### 8.5.5. EDGE PROTECTION

A critical foreslope is one on which a vehicle is likely to overturn. Per AASHTO, slopes over 1:3 (vertical to horizontal) are considered non-recoverable and special design consideration is required. If sufficient recovery area is not achievable adjacent to a slope 1:3 or greater, a guardrail may be warranted. The design of the guardrail will depend on many factors. In any guardrail/fencing type condition, the structure will need to withstand a minimum of 5,000 pounds of lateral force (LSEV traveling at 25 MPH).

Barriers are not an ideal treatment for roadside hazards on low volume, low speed roads for a number of reasons, including the costs of installation, maintenance and repair as well as possible environmental and aesthetic impacts. The frequency of crashes into barriers will be larger than crashes into the hazard (simply because barriers are closer to the travel way and longer than the condition being shielded). Crashes into barriers can be serious events.

Curbs offer little or no redirection for vehicles departing the roadway. Per the FHWA, curbs are generally recognized as having no significant containment or redirection capability. Curbs greater than 4" in height may cause vaulting and instability of a vehicle.

Although generally a lower speed impact with a curb results in more redirection, crash tests and crash analyses find that curbs are frequently mounted by an impacting vehicle even at very low speeds. The decision to place curbs should be based on other factors including drainage, available right of way and land-use characteristics.

The AASHTO Roadside Design Guide recommends not placing barriers where curbs are present:

1. It is preferable to not use barriers with curbs at speeds 80 km/h (50 mph) and higher. If necessary, the best location for the barrier is in front of the curb. If the curb is sloped and no higher than 100 mm (4 in) the barrier may be placed flush with the face of the curb. Do not place a wall-type barrier on top of a curb. Remove the curb if necessary.
2. Avoid placing barriers with curb present at speeds 50 km/h (30 mph) to 70 km/h (45 mph). If necessary, the best location for the barrier is in front of the curb. If the curb is sloped and no higher than 150 mm (6 in) the barrier may be placed flush with the face of the curb. Do not place a wall-type (CSS, PCG, or SMG) barrier on top of a curb. Remove the curb if possible. A shoulder gutter design may be good option to a curb.
3. It is acceptable to place curbs in line with the face of a barrier at speeds 40 km/h (25 mph) and lower.

If a curb is used, 18" of clear zone behind the curb (channel side) should be provided in addition to the shoulder. Obstructions that may interfere with vehicle operation should not be placed within this area. If a "smooth" feature, such as a bicycle railing or fence is present, a lesser clearance of 18" may be used.

### 8.5.6. **TURNING RADIUS**

LSEVs come in various shapes and sizes, a typical 4-seat LSEV has an inside turn-radius of 12' and exterior turn radius of up to 18'. Based on the maximum design speed of 25 mph, the smallest radius along the shared use path should be 115'. Tight turns should be signed and/or striped well in advance of the turn, and sign location should be based on braking distance.

### 8.5.7. **RANGE**

Travel distance between charging is reported to be between 20 and 30 miles. This number is influenced by terrain with steeper routes resulting is faster battery drain. While the SBCCOG Local Use Vehicle (LUV) Demonstration project showed 99% of trips occurring within 3 radial miles of the residential origin, the Demonstration project is adapting local residential streets for LSEV/electric vehicle use without construction of a robust LSEV network or backbone network as proposed with CV Link.

### 8.5.8. PARKING DESIGN STANDARDS

Most LSEVs using CV Link will be parked at home origins and existing parking lots at destinations. LSEV parking along CV Link will be limited to one or two charging spaces in most locations. For any parking that is provided, the following guidance should be considered during detailed design.

**Signage**

The colors, shapes and wording of electric vehicle parking and charging station signs are still evolving nationwide, leading to confusion as to the proper formats and procedures that a government official or local business owner should adopt when installing EV supply equipment in a public location. These sources offer design guidance:

- Plug-In Electric Vehicles: Universal Charging Access Guidelines and Best Practices (California Office of Planning and Research, 2013)
- Draft Coachella Valley Plug-in Electric Vehicle Readiness Plan (CVAG, 2014)
- Electrical Vehicle (EV) Signs (National Committee on Uniform Traffic Control Devices, 2014)

The latter document notes that human factors studies indicate black background signs are more effective than blue. Blue is also considered inappropriate because it has been established through the MUTCD for guidance, not regulation of parking spaces.

**Parking Space Design**

LSEV parking spaces should take into account the size of LSEV, rather than a highway capable electric vehicle. A six seat LSEV manufactured by GEM is 162” long (13’6”). Although six seat LSEVs are likely to be a small proportion of LSEV traffic on CV Link, this should be the minimum dimension to avoid overhang into traveled ways. Therefore 7’ x 15’ is preferred. Locations for parking spaces will be adjacent to charging stations if available.

## 8.6. Path Related Facilities

### 8.6.1. STRIPING

The Manual of Uniform Traffic Control Devices (MUTCD) regulates the design and use of all traffic control devices including both signs and pavement markings. A summary of the MUTCD guidance for both bicycles and vehicles follows.

**Striping for Bicycle Paths**

A 4 to 6 inch wide solid line may be used when passing by path users should be discouraged. A dashed line may be used when adequate passing conditions are present. While the CA-MUTCD section 9C.03 provides optional guidance suggesting yellow striping, there is no requirement to use yellow. CV Link colors may be considered.

The use of striping is particularly beneficial at areas of restricted sight distance, high traffic areas, intersection approaches and/or where nighttime riding is expected with limited lighting. Some path design professionals believe that center and edge lines give paths the appearance of being a roadway and thus are oftentimes not recommended except in the special circumstances listed above. When pathway striping is judiciously used, its impact on safety is more effective.

On the striping of shared use paths, AASHTO states the following:

> On pathways with heavy peak hour and/or seasonal volumes, or other operational challenges such as sight distance constraints, the use of a centerline stripe on the path can help clarify the direction of travel and organize pathway traffic. A solid yellow centerline stripe may be used to separate two directions of travel where passing is not permitted, and a broken yellow line may be used where passing is permitted. The centerline can either be continuous along the entire length of the path, or may be used only in locations where operational challenges exist.

Per the MUTCD, all markings used on bikeways shall be retroreflective. Section 9C.03 of the CAMUTCD describes Marking Patterns and Colors on Shared-Use Paths as optional.

Option: Where shared-use paths are of sufficient width to designate two minimum width lanes, a solid yellow line may be used to separate the two directions of travel where passing is not permitted, and a broken yellow line may be used where passing is permitted (see Figure 9C-2).

Guidance: Broken lines used on shared-use paths should have the usual 1-to-3 segment-to-gap ratio. A nominal 3-foot segment with a 9-foot gap should be used. If conditions make it desirable to separate two directions of travel on shared-use paths at particular locations, a solid yellow line should be used to indicate no passing and no traveling to the left of the line.

Support: A centerline marking is particularly beneficial in the following circumstances:

A. Where there is heavy use

B. On curves with restricted sight distance

C. Where the path is unlighted and nighttime riding is expected

**Striping for Roadways**

The standards, guidance and warrants for centerline striping of vehicle travel ways are described in chapter 3B of the CAMUTCD.

Center line pavement markings, when used, shall be the pavement markings used to delineate the separation of traffic lanes that have opposite directions of travel on a roadway and shall be yellow.

Standard: Center line markings shall be placed on all paved urban arterials and collectors that have a traveled way of 20 feet or more in width and an ADT of 6,000 vehicles per day or greater.

Guidance: Engineering judgment should be used in determining whether to place center line markings on traveled ways that are less than 16 feet wide because of the potential for traffic encroaching on the pavement edges, traffic being affected by parked vehicles, and traffic encroaching into the opposing traffic lane.

Option: Centerline markings may be placed on other paved two-way traveled ways that are 16 feet or more in width.

The design section for the CV Link travel way is 16' wide at most.

**Recommendations**

Based on a review of the guidance available for bicycles and motor vehicles, centerline and edge striping of the pathway is not required unless substandard conditions are present (sharp curves, constricted lane widths). If center and edge line striping is desired due to the design concept, it may be used. Benefits include clear vehicle placement within the travel way. The cons include less effective warning at substandard conditions as well as regular maintenance to maintain effectiveness. LED pavement marker lights may be considered to augment the presence of a centerline. Cycle guide lights are flush mounted, solar powered LED lights to assist with travel delineation.

### 8.6.2. LANE MARKINGS

The California Traffic Control Devices Committee (CTCDC) Experimental Standard LSEV Pavement Marking is predominantly text. It is recommended that a graphic symbol pavement marking design be developed so that the markings are more legible to locals and tourists who may not fully understand the difference between an LSEV and a motor vehicle or golf cart. Additionally, a graphic symbol serves international needs and does not require comprehension of written English.

### 8.6.3. SIGN SIZE

The California Manual on Uniform Traffic Control Devices (CAMUTCD) lists sizes for shared use path regulatory signs in Part 9, Traffic Control for Bicycle Facilities. Proposed sign sizes should be based on the larger dimensions found in the Roadway column of table 9B-1(CA). California Bicycle Facility Sign and Plaque Minimum Sizes.

### 8.6.4. SIGNAGE AND WAYFINDING

A comprehensive system of signs ensures that information is provided regarding the safe and appropriate use of the path, both on-road and off-road.

Pathway systems typically include the three basic sign categories:

- Directional/wayfinding signs
- Regulatory and warning signs
- Educational/interpretive features

### 8.6.5. DIRECTIONAL/WAYFINDING SIGNS

Directional or wayfinding signs improve pathway experience and function for path users while increasing awareness by motorists. For path users, directional signs and street name references help orient users as well as clarify the route to destinations.

Directional signs should impart the overall design theme so path users know they are on CV Link and which direction they are going. The theme shall be conveyed in a variety of ways: imprinted concrete, color, gateway features, and mile markers. A central information installation at major access points also helps users find their way and acknowledge the rules of the path.

- Kiosks may provide directional signage as well as information on other path opportunities, regional destinations, or local/seasonal events occurring along the path.
- Path access signs with overall path maps shall be located at path access points to help users entering the path determine their next destination.
- Locate directional signs at key decision points along the path to help users identify their destination or orient their position.
- Locate mile markers no closer than 3’ from the edge of the path and at ¼ mile intervals and at path-roadway intersections to help users determine their location and the distance to their destination. Mile markers may be referenced in emergency situations.
- Conveying distance in terms of length as well as time required to walk, bike or drive an LSEV to one’s destination.

### Identity

The CV Link logo should be used to aid in reinforcing the path's identity. Identity signs with the logo should be placed at each major and secondary entry point to the path system. An identity sign is the first step in the path visitor's way-finding experience. Identity signs may be small-scale plaques or large-scale monuments depending on the site context. Images and text on the identity sign should be clear and legible from a roadway when oriented towards those arriving via motorized vehicle. Smaller scaled signs, legible from the pedestrian perspective, are recommended for neighborhood gateway points.

- Identity signs should be simple, direct, and consistent in design theme.
- Logo elements should be symbolic in nature with high levels of contrast to be legible to a broad spectrum of the population.
- Logo use should be consistent throughout the path by using it as a standalone element, on other signage, or incorporating it into path furnishings or surfaces.

## 8.6.6. REGULATORY AND WARNING SIGNS

### Layout

Shared use path, bike lane, and bike route signing and markings should generally follow the standards and guidelines in the California Manual on Uniform Traffic Control Devices (CA-MUTCD). This includes advisory, warning, directional, and informational signs for bicyclists, pedestrians, and motorists. All signs shall be retro-reflective on shared-use paths. Lateral sign clearance shall be a minimum of three feet and a maximum of six feet from the near edge of the sign to the near edge of the path. Mounting height shall be seven feet from the bottom edge of the sign to the path surface level. The final striping, marking, and signing plan for CV Link will be resolved in the full design phase of the path. This will be most important at locations where there are poor sight lines from the path to cross-traffic (either pedestrian or motor vehicle).

### Traffic Control

Crossing features for all roadways include warning signs for both vehicles and path users. The type, location, and other criteria are identified in the Manual for Uniform Traffic Control Devices (MUTCD). Adequate warning distance is based on vehicle speeds and line of sight. Signs should be highly visible; catching the attention of motorists accustomed to roadway signs may require additional alerting devices such as a flashing light, roadway striping, or changes in pavement texture. Signs oriented towards path users must include a standard stop sign and pavement marking, sometimes combined with other features such as a kink in the path to slow bicyclists. Care must be taken not to place too many signs at crossings lest they overwhelm the user and lose their impact.

**Etiquette Signs**

Potential conflicts between user types need to be considered on any shared use path system. Etiquette signs should be developed to orient users to the expected modes on the shared use path. Etiquette signs often convey who should yield way when more than one user type is present.

### 8.6.7. EDUCATIONAL/INTERPRETIVE FEATURES

Educational signs provide path users with information about the path, the local environment, history and culture, and significance of elements along the path. While signs are the most well known method of conveying interpretive information, other means such as art, three-dimensional models, auditory experiences and interactive features are also options. QR Codes (images smartphone-users can scan with free downloadable apps) can be added to any path sign or feature. QR codes typically send scanners to websites for more information including GPS coordinates, regional maps, agency websites, videos, additional interpretive information etc.

- Consider the character of the path and surrounding elements when designing informational signage.
- A skilled graphic designer should be used for any sign design.
- Locate interpretive signs a minimum of 3' from the edge of the path.

## 8.7. Path / Roadway Crossings

### 8.7.1. **CROSSINGS INTRODUCTION**

It is highly desirable to minimize the number of roadway crossings that occur on any pathway system. As a general rule, when crossings are required, they should occur at established pedestrian crossings, or at locations completely away from the influence of intersections.

LSEV/Bike/Pedestrian crossing stencils may be placed in advance of path crossings to alert motorists. Curb ramps should be designed to accommodate the range and number of users.

When considering a proposed off-street shared-use path and required at-grade crossings of roadways, it is important to remember two items: 1) path users will be enjoying an auto-free experience and may enter into an intersection unexpectedly; and 2) motorists may not anticipate LSEVs or bicyclists riding out from a perpendicular path into the roadway. However, in most cases, an at-grade path can be properly designed to a reasonable degree of safety and meet existing traffic engineering standards.

Evaluation of shared use path crossings should involve an analysis of vehicular traffic patterns, as well as the behavior of path users. This includes traffic speeds (85th percentile), street width, traffic volumes (average daily traffic and peak hour traffic), line of sight, and path user profile (age distribution, range of mobility, destinations). A traffic safety study should be conducted as part of the actual engineering design of the proposed crossings to determine the most appropriate design features. This study would identify the most appropriate crossing options given available information, which must be verified and/or refined through the actual engineering and construction document stage.

Like most paths in built urban areas, CV Link must cross roadways at certain points. These roadway crossings may be designed at-, below-, or above-grade. At-grade crossings create potential conflicts between path users and motorists. However, well-designed crossings have not historically posed a safety problem, as evidenced by the thousands of successful paths around the United States with at-grade crossings.

### 8.7.2. **BASIC CROSSING PROTOTYPES**

Intersection approaches are based on established standards, published technical reports, and experiences from existing facilities. The Preliminary Plan set includes additional information on bridge structures and a bridge report is in development. The following typology pictures are only for categorization purposes and do not reflect the CV Link aesthetic.

TABLE 11: CROSSING TYPES

| | |
|---|---|
| **Type 1: Unprotected/Marked**<br>Unprotected/marked crossings include path crossings of residential, collector, and sometimes major arterial streets or railroad tracks. |  |
| **Type 2: Route Users to Existing Intersection**<br>Paths that emerge near existing intersections may be routed to these locations, provided that sufficient protection is provided at the existing intersection. |  |
| **Type 3: Signalized/Controlled**<br>Path crossings that require signals or other control measures due to traffic volumes, speeds, and path usage. |  |
| **Type 4: Grade-Separated – Overcrossing**<br>Bridges or under-crossings provide the maximum level of safety but also generally are the most expensive and have right-of-way, maintenance, and other public safety considerations. |  |
| **Type 4: Grade-Separated – Undercrossing**<br>Roadway undercrossings (an "underpass" if below a railway) can have shorter ramps than overcrossings. CV Link desirable minimum overhead clearance is 12', although exceptions may be required. |  |
| **Type 4: Grade-Separated – Bridges**<br>CV Link has several tributary channels to cross. Existing bridges may be widened or replaced. |  |

### 8.7.3. TYPE 1: UNPROTECTED/MARKED CROSSINGS

An unprotected crossing (Type 1) consists of a crosswalk, signing, and often no other devices to slow or stop traffic. The approach to designing crossings at mid-block locations depends on an evaluation of vehicular traffic, line of sight, path traffic, use patterns, vehicle speed, road type and width, and other safety issues such as the proximity of schools. The following thresholds recommend where unprotected crossings may be acceptable:

- Install crosswalks at all path-roadway crossings
- Maximum traffic volumes:
  - Up to 15,000 ADT on two-lane roads, preferably with a median.
  - Up to 12,000 ADT on four-lane roads with median.
- Maximum travel speed
  - 35 mi/h
- Minimum line of sight:
  - 25 mi/h zone: 250 feet
  - 35 mi/h zone: 350 feet
  - 45 mi/h zone: 450 feet

On two lane residential and collector roads below 15,000 ADT with average vehicle speeds of 35 mph or less, crosswalks and warning signs ("LSEV/Bike/Pedestrian Xing") should be provided to warn motorists, and stop signs and slowing techniques should be used on the path approach. Care should be taken to keep vegetation and other obstacles out of the sight line for motorists and path users. Engineering studies should be done to determine the appropriate level of traffic control and design.

A flashing yellow beacon such as the Pedestrian Hybrid Beacon (PHB) or Rectangular Rapid Flashing Beacon (RRFB, formerly "HAWK") may be used with a marked crosswalk, activated by the path user rather than operating continuously. Some jurisdictions have successfully used flashing lights activated by motion detectors on the path, triggering the lights as path users approach the intersection. This equipment, while slightly more expensive, informs motorists about the presence of path users. This type of added warning would be especially important at locations with restricted sight distance.

### 8.7.4. TYPE 2: ROUTE USERS TO EXISTING INTERSECTION

Crossings within 250 feet of an existing signalized intersection with pedestrian crosswalks are often diverted to the signalized intersection for safety purposes. For this option to be effective, barriers and signs may be needed to direct path users to the signalized crossings. Ideally, signal modifications would be made to add pathway user detection and to comply with ADA recommendations.

### 8.7.5. TYPE 3: SIGNALIZED/CONTROLLED CROSSINGS

New signalized crossings are recommended for crossings more than 250 feet from an existing signalized intersection and where 85th percentile travel speeds are 40 mi/h and above and/or ADT exceeds 15,000 vehicles. Each crossing, regardless of traffic speed or volume, requires additional review by a registered engineer to identify sight lines, potential impacts on traffic progression, timing with adjacent signals, capacity and safety.

Path signals are normally activated by push buttons, but also may be triggered by motion detectors or weight sensors. The maximum delay for activation of the signal should be two minutes, with minimum crossing times determined by the width of the street. The signals may rest on flashing yellow or green for motorists when not activated, and should be supplemented by standard advanced warning signs.

### 8.7.6. **TYPE 4: GRADE-SEPARATED CROSSINGS**

Grade-separated crossings are needed where ADT exceeds 25,000 vehicles, and 85th percentile speeds exceed 45 mi/h. Safety is a major concern with both overcrossings and undercrossings. When designed properly, grade-separated crossings practically eliminate any safety concerns related to crossing a roadway.

Grade-separated crossing approaches should minimize the out-of-direction travel required by the path user, so that users don't alternatively attempt to dart across the roadway. Under-crossings, like parking garages, have the reputation of being places where crimes occur, but these safety concerns can be addressed through design.

An undercrossing can be designed to be spacious, well lit, equipped with emergency phones at each end, and completely visible for its entire length prior to entering. For LSEVs, cyclists and pedestrians, the desirable minimum vertical clearance is 12'.

New crossings of the Whitewater Channel may be considered with the preferred alignment. The width of the channel bottom ranges from approximately 565' in width and would not require extensive approach ramps since the channel is sunken below the grade of the path.

## 8.8. Accessible Path Design

The design guidelines listed above for pedestrian paths, adequately address the needs of people with disabilities. General guidelines include: running slopes not greater than 5% grade and cross slopes at less than 2%. Ramps at 8% may be used, however landings or resting areas must be provided every thirty feet at a minimum. Travel ways shall be a minimum of three feet in width.

Surfaces shall be firm and stable. The Forest Service Accessibility Guidelines defines a firm surface as a path surface that is not noticeably distorted or compressed by the passage of a device that simulates a person who uses a wheelchair.

Curb ramps with high visibility tactile warning strips shall be provided at roadway crossings. It is also a best management practice to provide auditory crossing signals help those with site impairments safely negotiate roadway crossings.

Providing a path that is accessible to everyone, regardless of age or ability, often improves the experience for all users; for instance curb ramps that were originally designed for people in wheelchairs provide easier access for bicyclists and people with strollers. Americans with Disabilities Act (ADA) guidelines currently include:

- Minimum clear width of four feet, and where less than five feet, a passing space should be provided at least every 100 feet.
- Signs shall be provided indicating the length of the accessible path segment.
- Curb ramps shall be provided at roadway crossings and curbs. Tactile warning strips and auditory crossing signals are recommended.
- The path surface shall be firm and stable.[5]

Slopes typically should not exceed 5 percent. However, certain conditions may require the use of a steeper slope. For conditions exceeding a 5 percent slope, the recommendations are as follows:

- 8.3 percent for a maximum of 200 feet
- 10 percent for a maximum of 30 feet
- 12.5 percent for a maximum of 10 feet[6]

---

[5] The *Forest Service Accessibility Guidelines* defines a firm surface as a path surface that is not noticeably distorted or compressed by the passage of a device that simulates a person who uses a wheelchair.

[6] FHWA. (2001*). Designing Sidewalks and Paths for Access*, Chapter 14: Shared Use Path Design, Section 14.5.1: Grade.. http://www.fhwa.dot.gov/environment/sidewalk2/sidewalks214.htm

Between each maximum gradient run length, a flat rest interval can be provided. To avoid path user conflicts, these rest intervals should ideally be positioned only on the pedestrian path, not on the LSEV / bicycle path.

CV Link will meet all applicable requirements of the Americans with Disabilities Act (ADA) and the Architectural and Transportation Barriers Compliance Board's Architectural Barriers Act Accessibility Guidelines; Outdoor Developed Areas.

- ADA was fully taken into consideration as a design driver with the development of the design guidelines for CV Link
- LSEVs inherently improve mobility options for people of all abilities
- Design elements will include high visual contrast for the visually impaired
- Drinking fountains will be accessible for wheeled pedestrians and people using recumbent bicycles
- The wayfinding concept makes the corridor readily legible to a wide spectrum of users including the cognitively impaired
- Smartphone technology will provide auditory information.
- The CV Link website will continue to meet ADA requirements
- During the design development and construction phases, public meeting invitations will include contact information should language translation or signing services be needed.

## 8.9. Path Surface Materials

### 8.9.1. **OVERVIEW**

When approaching a path or road project, designers and local agency representatives often assume asphalt or concrete. But this may not be what local residents had in mind or considered until a specific surface was proposed, and then suddenly everyone has an opinion. These conflicts lead designers into exploring possible surfacing options (of which there are more every year), including:

- Traditional asphalt and concrete, with or without recycled materials
- Permeable asphalt and concrete
- Decomposed Granite (DG)
- Rubberized running track materials

### 8.9.2. **SELECTION CONSIDERATIONS**

In arriving at a recommended surface, several key criteria have been considered including:

- **Initial Capital Cost** –. Construction costs include excavation, subbase preparation, aggregate base placement, and application of the selected path surface and can vary substantially.
- **Maintenance and Long Term Durability** – The anticipated life of a pavement surface can vary from a single year (e.g. bark surface in a moist climate) to 25+ years (e.g. concrete). In addition, each surface has varying maintenance needs that will require regular to sporadic inspections and follow-up depending on the material selected. Some surface repairs can be made with volunteer efforts such as on a crusher fines path, while other surfaces such as concrete will require skilled contractors to perform the repair.
- **Existing Soil and Environmental Conditions** – Soil conditions are predetermined and play a critical role in surface selection. In addition, when considering the use of a permeable concrete or asphalt surface, the success of these surfaces is directly correlated to the permeability of the soil and climatic conditions. The lower the permeability and moisture, the greater the risk of failure. For the Coachella Valley, impermeable soil is obviously not a problem – but sand clogging the pores of the pavement is.
- **Availability of Materials** – A successful path surface in one area of the country may prove cost-prohibitive in another area due to availability of materials. This may be a particular issue for recycled products like glass in asphalt (called “Glassphalt”).
- **Anticipated Use/Functionality** – Who are the anticipated users of the path? Will the path surface need to accommodate maintenance vehicles in addition to LSEVs and bicycles? Does the path provide critical access to a popular destination for many users or is it a local access route to a community park? Multi-use paths attempt to meet the needs of all anticipated path users. This may not be feasible with a single path surface. Considering the shoulder area as a usable surface, it may be possible to provide enough width to accommodate

use by those preferring a softer material. Each surface also has varying degrees of roughness and therefore accommodates different users. In-line skates, for example, cannot be used on most permeable concrete surfaces due to the coarseness of the finished surface.

- **Funding Source** – The funding source for the path may dictate the path surface characteristics. If the path has federal funds and is being administered through a state Department of Transportation (i.e. Caltrans), the DOT will need to review and approve the selected path surface.
- **Susceptibility to Vandalism** – Path surfaces are not usually thought of as being susceptible to vandalism, but the characteristics of the varying surfaces do lend themselves to a variety of vandalism including movement of materials such as crusher fines or graffiti on hard surfaces.
- **Aesthetics** – Each path surface has varying aesthetic characteristics that should fit with the overall design concept desired for the project and for the region in which the path is located.

### 8.9.3. SURFACING OPTIONS

There are many options related to path surfacing. This choice determines the types of users who can enjoy the path, as well as construction costs, maintenance costs, and other factors. The most common surfacing materials for a path are concrete, or asphalt; less common surfaces are permeable concrete, permeable asphalt, crusher fines, or Glassphalt. The following paragraphs show the path surfacing options reviewed for this project.

**Concrete**

Concrete was used to build much of the nation's highway system and with rising petroleum prices driving up the cost of asphalt, concrete is once again becoming cost effective. Using modern construction practices, concrete provides a smooth ride for bicycles with low maintenance costs. Runners may prefer to use the softer surface along the sides of the path. Concrete does not become brittle with age or deformed by roots and weeds as with asphalt.

FIGURE 5: CONCRETE PATH SURFACE

It has been speculated that the lighter color of concrete relative to asphalt reduces the heat island effect. There is ongoing research at Arizona State University and the University of California at Davis on this topic.  Concrete lasts 25-40 years, must be periodically inspected for uplift and settlement, and repaired as needed. Figure 6 shows a typical concrete path section.

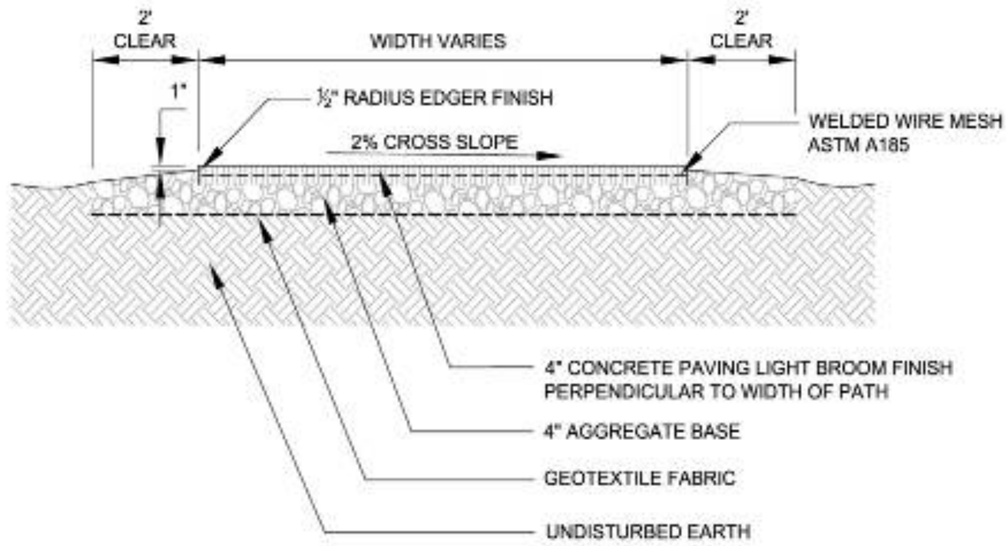



FIGURE 6. CONCRETE PATH CROSS-SECTION[7]

**Recycled Materials in Concrete[8]**

Concrete typically used for a paved path tread can be composed of recycled materials that otherwise would end up in a landfill instead of new base material. This reuse of materials reduces hauling-related energy consumption and construction waste management. These materials include:

- Recycled Concrete Aggregate (RCA): RCA is granular material manufactured by removing, crushing, and processing hydraulic-cement concrete pavement for reuse with a hydraulic cementing medium to produce fresh paving concrete. Except for removing steel, impurities, and contaminates, this process is identical to the process used to produce aggregate from virgin stone materials. Adding RCA to concrete pavement may reduce costs, depending on the availability of RCA vs. virgin stone materials.[9]
- Fly Ash: Fly ash is a fine, glass-like powder recovered from gases created by coal-fired electric power generation. U.S. power plants produce millions of tons of fly ash annually, which is usually dumped in landfills. Fly ash is an inexpensive replacement for Portland cement used in concrete, and it improves strength, segregation, and ease of pumping of the concrete. The techniques for

---

[7] Note: The "clear" shoulders shown on the cross-section should be kept empty of buildings or fences; however, low-lying vegetation or bioswale plantings are encouraged in these areas. Depth of subbase should be determined by a soil analysis.

[8] Bondurant , Julie and Thompson, Laura. (2009). *Path Planning in California Communities.*

[9] Additional information available at: http://www.fhwa.dot.gov/pavement/t504037.cfm

working with this type of concrete are standard for the industry and will not impact the budget of a job.

**Permeable Concrete**

Permeable concrete allows rain to seep through the surface and percolate into the soil, reducing run-off. The use of permeable pavement systems attenuates the peak discharge of storm water into drainage systems. Regions that receive a lot of rain and a small amount of snow and ice in the winter are good places for permeable-surface concrete. It is less successful in regions that receive a lot of snow and ice during the winter months as the concrete, tends to crack, similar to normal pavement.

FIGURE 7: PERMEABLE CONCRETE

Permeable concrete lasts for approximately 15 years and requires frequent sweeping, pressure washing or vacuuming to keep the pores open and maintain the performance characteristics.  Given the sandy desert environment, permeable concrete is not likely to be cost-effective except in very limited quantities and locations.

**Asphalt**

Asphalt is the most common surface treatment for roads and paths (Figure 8). The material composition and construction methods used can significantly affect the longevity of the surface. Thicker asphalt sections and a well-prepared subgrade will reduce deformation over time and reduce long-term maintenance costs. Asphalt is suitable for a wide variety of users and is less jarring on people's joints than concrete. Figure 9 shows a typical section of an asphalt path.

FIGURE 8: ASPHALT PATH SURFACE

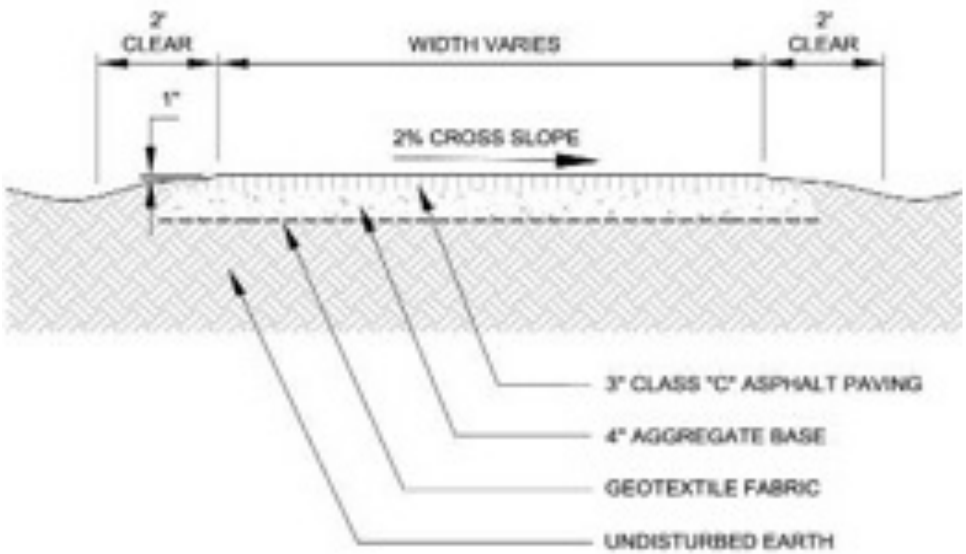



FIGURE 9: ASPHALT PATH CROSS SECTION

However, the different thermal expansion properties of asphalt and concrete means that where a joint is required (e.g. at a undercrossing ramp where concrete must be specified for structural reasons) a bump may form over time.  Careful design and ongoing maintenance would be required to maintain a smooth ride and avoid trip hazards.

The edges of asphalt often crumble over time, and the material is prone to cracking, doming, heaving, and settling. To improve the lifespan of the path, an adequate pavement structural section is required to support any maintenance vehicles that may be using the path and enough width is needed to avoid pavement edge break.

Based on observations and analysis of existing asphalt paths, the pavement surfacing will need an overlay or extensive replacement and renovation every 15 to 20 years. Deteriorated sections are easier to remove and replace than concrete. However, this extensive replacement could be mitigated and the expense reduced with preventative maintenance measures such as chip-sealing every five to eight years. Chip seal is not recommended for use near water resources due to the potential for excess oil to be washed off the surface.

### Recycled Materials in Asphalt[10]

Asphalt can be composed of recycled materials including:

- Glassphalt: A mixture of traditional asphalt and recycled glass.  The glass is used to replace some of the sand that would otherwise be found in asphalt. Glassphalt can be installed using the same equipment and procedures as conventional asphalt.

[10] Bondurant , Julie and Thompson, Laura. (2009). *Path Planning in California Communities.*

- Reclaimed Asphalt Pavement (RAP)[11]: RAP can be used as an aggregate in the hot recycling of asphalt paving mixtures. RAP is routinely accepted in asphalt paving mixtures as an aggregate substitute and as a portion of the binder in nearly all 50 states. Substitution rates of 10 to 50 percent or more, depending on state specifications, are normally introduced in pavements, and recently developed technology has even made it possible to recycle 90 to 100 percent RAP in hot mix.
- Rubberized Asphalt Concrete (RAC): Also known as asphalt rubber hot mix, this material uses crumb rubber from scrap tires. Below is a list of the benefits of rubberized asphalt according to the California Department of Resources Recycling and Recovery CAlRecycle,[12]:
    - RAC can be used at a reduced thickness compared to conventional asphalt overlays--in some cases at half the thickness of conventional material--which may results in significant material reduction and cost savings.
    - RAC is long lasting. It resists cracking, which can reduce maintenance costs.
    - RAC provides better skid resistance, which can provide better traction. Moreover, RAC retains its darker color longer so that road markings are more clearly visible and can reduce road noise.
    - A two-inch-thick RAC resurfacing project uses about 2,000 scrap tires per lane mile.

**Permeable Asphalt**

Permeable asphalt (Figure 10) is similar in appearance to traditional asphalt. Permeable asphalt is similar to permeable concrete in that it allows rain to seep through the surface, thereby reducing run-off. Paths that are along bodies of water or that may have flooding problems should consider using this surface.

FIGURE 10: PERMEABLE ASPHALT SURFACE

[11] Source: http://www.fhwa.dot.gov/pavement/recycling/rap/index.cfm

[12] Source: http://www.calrecycle.ca.gov/tires/RAC/

## Decomposed Granite (DG) Crusher Fines

As a natural path surface, decomposed granite crusher fines or simply DG (Figure 11) is a practical option for narrow facilities that will not see significant traffic. DG provides a stable surface while allowing rainwater to percolate down into the earth.

DG is made from angular crushed rock particles that interlock and bind to form a firm surface. The particle screenings should be graded from 3/8-inch particles to dust, and applied over landscape fabric to a depth of 4-6 inches minimum.

FIGURE 11: DG SURFACE

Costs for DG paths include grading, vegetation clearing, aggregate base, landscape fabric, and crusher fines. Maintenance of paths includes annual inspection and repair of low spots or ruts to avoid erosion and tripping hazards. DG paths should last 5-7 years. Figure 12 shows a standard cross-section of a DG path.

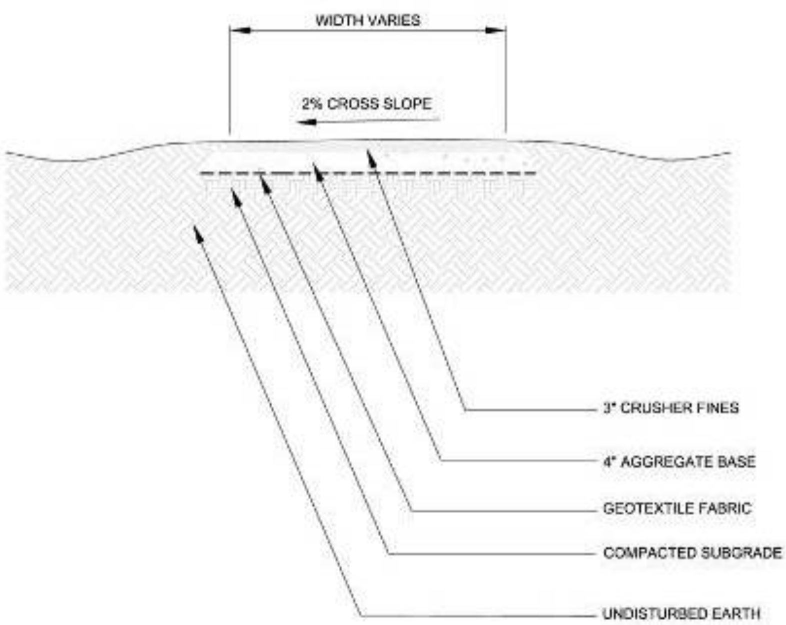



Figure 12: DG cross section

### 8.9.4. SURFACE MATERIALS SUMMARY

The materials discussed in this section are summarized in Table 12. Note that wheelchair users typically have the same requirements as high-pressure tire equipped road bicycles, although some power wheelchairs are now available with tires suitable for softer surfaces.

TABLE 12: SURFACE MATERIALS SUMMARY

| Product | Description / Installation Method | Life (years) | Maintenance Description | Permeable | Functionality<br>P=Pedestrian<br>S= Skates<br>B=Bike<br>N=NEV | Initial Cost $/SF |
|---|---|---|---|---|---|---|
| Nike Grind - Atlas Tracks | Prepare subbase, place geotextile, 6" aggregate base, apply Nike grind atlas track rubberized surface over base. | 8-10 | Reapply binding agent every 5-6 years. Keep surface clean, dirt and sand wear surface down, full replacement needed after 10 years | Yes | P | $12.50 |
| Nike Grind - Rebound Ace | Prepare subbase, place geotextile, 6" aggregate base, pour concrete or asphalt base, apply rebound Ace surface directly over hard surface. | 8-12 | Replace topcoat after 10 years | No | P, S, B | $10.50 |
| Permeable Concrete | Prepared subbase, place geotextile, 12" depth aggregate base, Portland cement, coarse aggregate, water, 5" depth section | 15 | Vacuum sweep and pressure wash 4 times a year | Yes | P, B, N | $6.00 |
| Concrete | Prepared subbase, place geotextile, 6" agg. base, Portland cement, aggregate, sand, water<br>4" depth section | 25+ | Periodic inspection for uplift and settlement, repair as needed | No | P, S, B, N | $4.75 |
| Permeable Asphalt | Prepared subbase, place geotextile, 12" depth aggregate base, emulsion and coarse aggregate 2" depth section | 8 | Vacuum sweep and pressure wash 4 times a year, patch any pot holes as needed | Yes | P, S, B, N | $3.50 |
| Glassphalt | Prepared subbase, place geotextile, 6" agg. base, asphalt with aggregate/glass, 2" depth section | 7-10 | Pothole patching | No | P, S, B, N | $2.75 |
| Reground Asphalt | Prepared subbase, place geotextile 6" aggregate base, emulsion recycled asphalt chips<br>2" depth section | 7-10 | Pothole patching | No | P, S, B, N | $2.75 |

| Product | Description / Installation Method | Life (years) | Maintenance Description | Permeable | Functionality<br>P=Pedestrian<br>S= Skates<br>B=Bike<br>N=NEV | Initial Cost $/SF |
|---|---|---|---|---|---|---|
| Asphalt | Prepared subbase, place geotextile, 6" aggregate base, emulsion, aggregate | 10 | Pothole patching | No | P, S, B, N | $2.75 |
| Poly Pave | Prepared subbase, place geotextile, 6" aggregate base, grade and shape, mix poly pave in top 2" of base, spray on two top coats of poly pave<br>2" depth section | 5-10 | Reapply Poly pave solidifier every 1-2 years depending on level of use. Make spot repairs as needed. | No | P, S, B, N | $2.50 |
| Chip Seal | Prepared subbase, place geotextile, 6" aggregate base, emulsion, ½" - ¼" aggregate, two coat process | 7-10 | Pothole patching | No | P, B, N | $2.00 |
| Decomposed Granite (DG) | 3/8-inch particles are ground up and applied over landscape fabric to a depth of 4-6 inches minimum. | 5-7 | Reapply additional material as needed | Yes | P, B, NEV | $2.00 |

## 8.9.5. LIFE CYCLE COST ANALYSIS OF CONCRETE VERSUS ASPHALT

A life-cycle cost analysis has been conducted using the information known at this time about pavement durability. Geotechnical testing of the soils condition and more detailed pavement design tailored to each of the many conditions throughout CV Link will enable a more refined estimate of life-cycle costs.

CV Link - Pavement Cost Comparison 2/19/14 By : KSR

| | | **Unit Price** | | **Quantity** | | | **SY/in** | **Ton/SF** | **Cost $/SF** |
|---|---|---|---|---|---|---|---|---|---|
| | | Caltrans 2012 Price Index | | L (ft) | W (ft) | T (in) | V (cf) | V (CY) | |
| A. | **Rigid Pavement** | | | | | | | | |
| | Concrete Pavement (401000) | $250.00 | $/CM | | | | | | |
| | | $191.11 | $/CY | 1.00 | 1.00 | 6.00 | 0.50 | 0.02 | $3.54 |
| | Class 2 Aggregate Base, 260200 | $26.00 | $/CY | 1.00 | 1.00 | 8.00 | 0.67 | 0.02 | $0.64 |
| | | | | | | | | **Total** | **$4.18** |
| B. | **Flexible Pavement (HMA)** | | | | | | | | |
| | Hot Mix Asphalt, Type A (390132) | $100.00 | $/ton | 1.00 | 1.00 | 4.00 | 0.44 | 0.03 | $2.56 |
| | Class 2 Aggregate Base, 260200 | $26.00 | $/CY | 1.00 | 1.00 | 8.00 | 0.67 | 0.02 | $0.64 |
| | Class 2 Aggregate Sub base, 250101 | $18.00 | $/CY | 1.00 | 1.00 | 0.00 | 0.00 | 0.00 | |
| | | | | | | | | **Total** | **$3.20** |

| | | | | |
|---|---|---|---|---|
| C. | **Total Cost (Initial + Maintenance)** | | | |
| | | **Concrete** | **Asphalt** | **Remarks** |
| | 1. Initial cost ($/SF) | **$4.18** | **$3.20** | Asphalt includes load conversion factor 0.0575 |
| | 2. Maintenance | | | |
| | Replace Asphalt Concrete Pavement | $1.06 | $1.42 | $230/CY, Item Code, 390095 |
| | Interval of Maintenance | 45 | 15 | |
| | Asset Life | 75 | 75 | |
| | | $0.67 | $4.00 | |
| | Total maintenance Cost over (years) | $0.71 | $5.68 | |
| | Total Cost (Initial + Maintenance) | **$4.89** | **$8.88** | Assuming 2" Asphalt is removed |
| | | | **$6.04** | Assuming 1" Asphalt is removed |

### 8.9.6. PAVEMENT RECOMMENDATIONS

The following recommendations may be revised when the geotechnical testing has been completed.

**Pedestrian Paths**

Based on community input and cost considerations, most pedestrian paths will be DG whether separated or adjacent shoulders to the LSEV/bicycle path. Exceptions to this will be where sand accumulation is known – mechanized sweeping will require a hard surface and in these locations asphalt or concrete will be used.

**NEV / Bike Paths**

Based on the life-cycle cost analysis, concrete with DG shoulders is recommended. The pavement will have recycled glass aggregate sub-base and crushed colored glass seeding in the concrete mix in mixing zones. The DG shoulder provides space for runners and pedestrians where no separate pedestrian path is provided. In areas of high sand accumulation, the shoulders may have a steeper cross fall (camber) and be composed of aggregate only.

**Road Connections**

Most of these pathways are anticipated to be a single 14' wide concrete path, with 3' DG shoulders where possible.

**Undercrossings and Channel Crossings at Grade**

A single 14-16' wide concrete path without shoulders will be provided, except where a low pile supported "all-season" path is constructed. In the latter case, a curb-separated concrete pedestrian path may be provided.

**Bridges and Overcrossings**

A 6' concrete sidewalk will be curb separated from a 14' wide concrete bicycle and LSEV roadway.

## 8.10. Operating Standards

The US Army Corp of Engineers, Coachella Valley Water District (CVWD) and Riverside County Flood Control and Water Conservation District (RCFCWCD) own much of the area within which the CV Link will occur. Accordingly, operational and maintenance requirements must be respected with the development of any related path facilities.

The main priority for the public agencies is to maintain the flood capacity of Whitewater Channel. Any changes or alterations to the river channel itself must assure that design improvements do not negatively impact flood capacity. Alterations that result in improvements to water quality should be considered.

A maintenance road is currently found along much of the embankment adjacent to the Whitewater Channel. A 20’ width is desired for accommodation of maintenance vehicles. Curbs and guardrails present challenges to maintenance vehicles and should be kept to a minimum or be designed to be removable. Straight roadways are preferred with minimum 50’ turning radii. CVWD maintenance procedures include:

- Spraying herbicides to control vegetation
- Sediment removal on an as-needed basis
- Debris removal on an as-needed basis

The following matrix represents design features that CVWD may find acceptable within their right-of-way.

| | CVWD Design Parameters | Acceptable | Conditionally Acceptable | Unacceptable | |
|---|---|---|---|---|---|
| | *Updated 24 July 2013* | | | | |
| | **NOTE: CVWD is not be responsible for any costs associated with the operation or maintenance of the facilities** | | | | |
| | Red comments: CVWD, Black comments: Alta | | | | |
| | Items initially marked unacceptable (X) by CVWD, moved to conditionally acceptable after additional discussion/explanation. Items are subject to further review and discussion. | | | | |
| | **Non-Site Specific Improvements (above slope protection)** | | | | **CVWD Comments (8 July 2013) & Discussion/Resolution (16 July 2013)** |
| 1 | 14-16' wide concrete path with 2' d.g. shoulders | | X | | Must support H-20+ loading |
| 2 | 6-8' wide d.g. or concrete path adjacent to (1) | | X | | |
| 3 | 12-24" wide 8" high curb for separation b/t (1) & (2) NEV/bike/maintenance route and pedestrian path | | X | | |
| 4 | 5-10' wide planted buffer b/t NEV/bike/maintenance route and pedestrian path | | X | X | Initial response no. Per discussion open to separation if space is available and not needed by CVWD. Location dependent, subject to further review. |
| 5 | Trees to be 15' away from toe of outside bank of slope protection | | X | | On non-channel side of bank |
| 5b | Trees to be 20' away from top of slope protection | | X | | On non independent levee |
| 6 | Shrubs >3' tall 15' away from toe of slope protection/HWS | | X | | On non-channel side of bank; HWS = High Water Surface |
| 7 | Grasses and shrubs <3' tall above slope protection | | X | | On non-channel side of bank. |
| 8 | Irrigation above slope protection line | | X | X | May be ok 20' away from top of slope protection, drip assumed |
| 9 | 12" wide x 8" high curb above slope protection | | X | X | More explanation required. They are ok with it as long as we acknowledge that it may be damanged and they will not replace. |
| 10 | Guardrail above slope protection line | | X | | Rail would need to be removable for access |
| 11 | Barrier or retaining wall above slope protection | | X | | Want to retain ability to drive down slope. |
| 12 | Cut and fill above slope protection | | X | | |
| 13 | Site furnishings above slope protection | | | | |
| 14 | Benches, picnic tables, signs, trash receptacles, bike racks | | X | | |
| 15 | Drinking fountains (w/ water line) | | X | | |
| 16 | Water features (splash pad or fountain feature) | | X | | |
| 17 | Light fixtures | | X | | |
| 18 | Shade structures (10' vertical clearance) | | X | | Structure would need to be removable for access. Clearance to be the same as a bridge minimum. |
| 19 | Structures | | | | |
| 20 | Restrooms | | X | X | Initally said no, ok if it were on surplus lands. |
| 21 | Trailhead vehicle parking and NEV charging stations | | X | | |
| 22 | Elevated pathway with structural support embedded in levee | | X | X | Initial "no" response." Maybe 30-40' from slope protection would be ok. Bring this idea back for additional discussion. |
| | **Non-Site Specific Improvements (below slope protection)** | | | | |
| 23 | 14-22' wide pile supported pathways at bridge underpasses | | X | | |
| 24 | Decorative treatments of concrete slope lining | | | | Overall concern for maintenance and impact to slope protection. Welcome to bring below ideas back with additional information. |
| 25 | ~~Paint or~~ colored stain | | X | | CVWD not responsible for maintenance as noted above |
| 26 | Sand blasted decorative patterns | | | X | Concern about integrity of concrete |
| 27 | Painted, tile or glass mural art | | | X | Concern about integrity of concrete |
| 28 | Decorative lighting mounted to concrete | | | X | More explanation required |

| | | | | | |
|---|---|---|---|---|---|
| 29 | Decorative metal art elements | | | X | More explanation required |
| 30 | Digital projection or laser lights (projector to be mounted above slope protection) | | X | X | Initially no, more explanation required. Ok after discussion/explanation (minimum to no impact). |
| | **Site Specific Improvements** | | | | |
| | A) West of Gene Autry | | | | |
| | Cut/fill on non-channel side of levee to create bench for separate d.g. or concrete pedestrian path | | X | | No impacts to slope stability/No trees on levee |
| | B) Double levee at Cathedral City | | | | |
| | Separate NEV/ bike and pedestrian pathways, one per levee | | X | | |
| | Park improvements neighborhood side of levee | | X | | |
| | Decorative treatments of levee slope protection as described above | | | X | See comments above. Welcome to bring idea back with further explanation. |
| | C) Whitewater Park - levee top route | | | | |
| | Retain and fill up to top of slope protection to expand width of bench for trail and maintenance route | | X | | |
| | D) Elevated levee near Coachella branch of American Canal in Indio | | | | |
| | Vegetative or structural screening on non-channel side of levee | | X | X | Initial no response, due to pending detailed study/levee certification. Clarification that issue is west of Monroe. Moved to conditionally acceptable. |
| | E) Golf courses | | | | |
| | Protective screening as warranted by orientation of greens | | X | | |
| | F) Constrained route (e.g. Point Happy) | | | | |
| | Cantilevered or pile supported pathway | | X | X | Initial no response. Discussion that structural support would need to be independent of levee/slope protection. Further study needed. |
| | Reviewed by___Dan Charlton_and Mark Johnson_____ | | | | |
| | for CVWD | | | | |
| | Date___8 July 2013_________________________ | | | | |

THIS PAGE INTENTIONALLY LEFT BLANK

# APPENDIX 9. PLANTING GUIDELINES

The purpose of these guidelines is to provide an organized approach to defining and recognizing the CV Link throughout the Coachella Valley. Creativity is encouraged, as all conditions have not been defined at this time.

## 9.1. Overview

The Coachella Valley is classified as a "tropical desert" where there can be frost in the winter and temperatures that reach 120 in the summer. The coldest month is typically December and the hottest is July. The average annual rainfall is less than 4" and it typically occurs in the fall and winter with occasional monsoon conditions that bring in higher levels of humidity and intermittent rainfall. Flash floods often occur during monsoon season, which is the time that the Whitewater wash will often be flowing with runoff. Evergreen plants grow nearly year round with a short dormancy. This results in an exceptional rate of growth for the arid climate if adequate watering is provided. Annual color is tricked into blooming in the late winter by the high UV light index and warm daytime temperatures. See Attachment A for evapotranspiration rates.

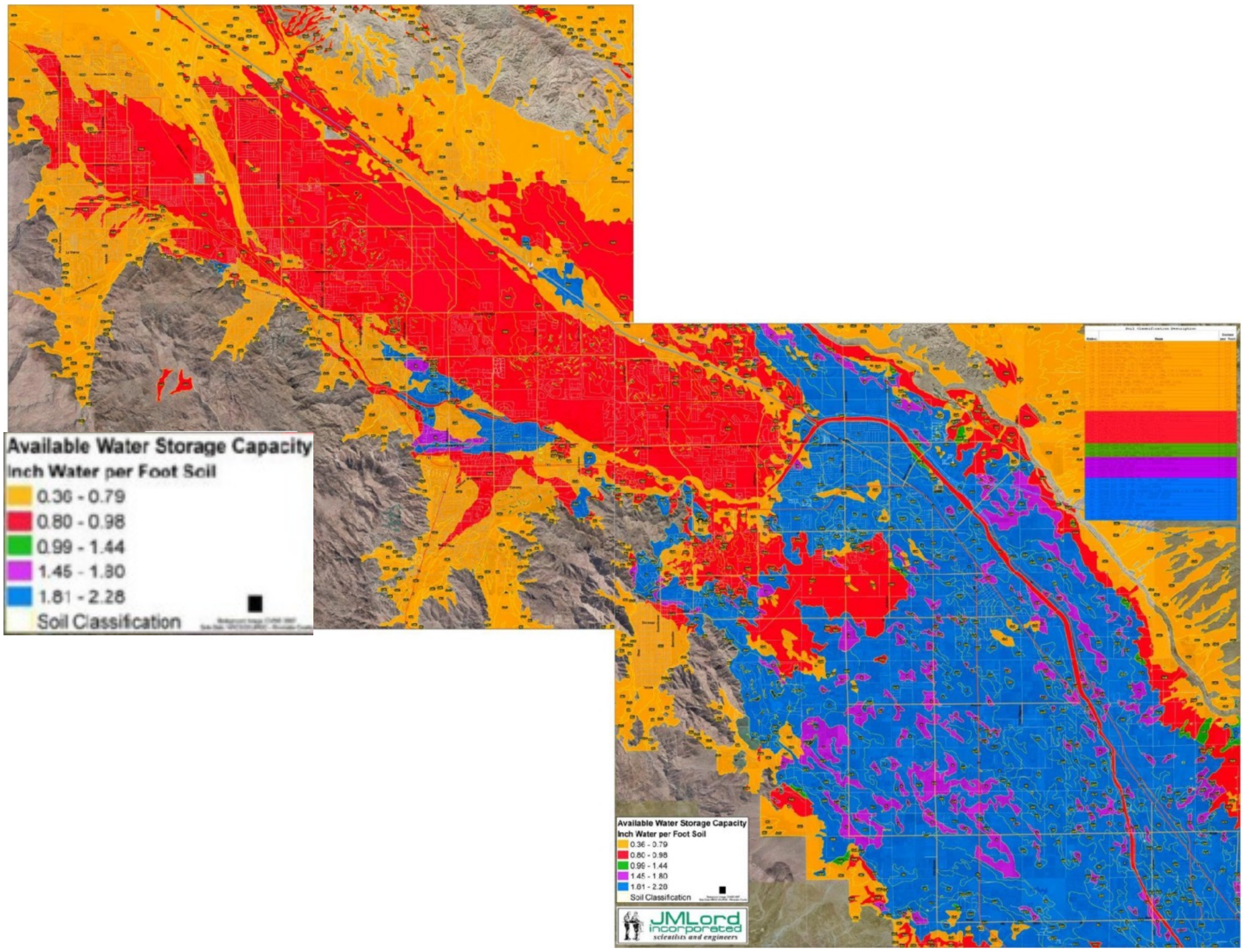
Water in the desert is held in an aquifer below the desert floor and is in good supply. Every effort needs to be made to minimize the use of water in the landscape. The Coachella Valley Water District (CVWD) has a very good book available to the public on this topic and is a wonderful resource on plant material selection. The State of California passed Model Efficient Landscape Ordinance AB 1881 in January 2010 in an effort to manage this precious resource through design.

## 9.2. Coachella Valley Soils

There are sandy soils in Desert Hot Springs, Palm Springs, Thousand Palms, Bermuda Dunes and the windy areas of Palm Desert. There is little for plant nutrition and with most non-native plants, soil amendments including fertilizer, mulch, and compost need to be added to the plant backfill. Watering in these fast draining soils needs to be sufficient to overcome the wind and heat.

The foothills edging the valley, including the coves of La Quinta, Palm Desert, Cathedral City and south Palm Springs, are either rocky or so dense that water needs to be applied slowly. This may mean changing irrigation control clocks to run for only a minute or two but have several start times per day. In order to improve the drainage of these soils, compost should be added to allow larger gaps in the soil to prevent water, fertilizer, and soil particles from packing in tightly.

The Whitewater Wash is composed primarily of fluvents within the Coachella Soils Series. The soil has been worked by water as well as wind and can usually be found near the old streambed of the Whitewater River flood course. It is probably the best soil in the Coachella Valley because it is an ideal mix of available water-holding capacity, permeability, and drainage. Stratifications are often present, but they are usually thin and deep, posing only a problem to deep-rooted trees. A deep planting hole will usually solve this problem because the backfill will have shattered and mixed up the restricting layer.



## 9.3. Planting Design Concept

### 9.3.1. CONCEPT INTRODUCTION

The landscape design for the CV Link has been conceived to reinforce the overall design concept of ***contrast*** by introducing color, vibrancies, and levity into the planting design. Interesting forms and textures will be derived from native species found in the Mojave and Sonoran desert environments. The use of grasses will soften the edges and provide kinetic motion. Low water demand materials will contrast the bold, contemporary forms of architectural elements such as shade, seating, walls, and planter areas. Plants with spines, thorns, and other potentially harmful characteristics must be carefully considered to not be a danger to users. Planting is not planned along the entire length of the path.

A plant palette and matrix (Attachment C), illustrates the following eight conditions along CV Link and the preferred plant material choices that help inform the design:

1. Slopes
2. Barriers
3. Windbreaks
4. Speed Zones
5. Social nodes
6. Connections
7. Charging Stations
8. Channel protection

### 9.3.2. COLOR THEME

The primary choices for flowering shrubs and ground cover will be orange with contrasting accents of purple, blue, and violet. Yellow and pink will be used to complement these colors where they can be viewed and appreciated. A seasonal color chart is provided as part of this technical resource document.

### 9.3.3. PLANTING GUIDELINES

**CVWD Standards** – Trees are to be 15' from levee toe of slope on the non-channel side of levees. In places where slope protection is adjacent to the property line without a freestanding levee configuration, trees are to be 20' from slope protection. Grasses and shrubs under 3' high may be planted on levees as well as adjacent to slope protection. Please refer to the typical cross-sections within the Design Guidelines for additional information on CVWD requirements.

**Slopes** – Plants under 3' in height will be used on slopes on the non-channel side and above slope protection where permitted. The best way to retain soil on slopes is with a variety of rooting depths. Native seeds are proposed above concrete slope protection that are hydroseeded and established with temporary water. Species such as

Eschscholzia californica (California poppy), Lupinus texenisis (Lupine), and Arbronia maritima (sand verbena) are suggested in the plant palette.

**Barriers** – Planting that will be used to define edges, separate users, and provide privacy to adjacent landowners. Typically, these areas are 5'-8' in width; however, there are locations where small trees may be used for barrier planting.

**Windbreaks** – A combination of heights and types of plants provide the best opportunity to break up the wind. This is especially important on the west end of the Valley.

**Speed zones** – Long stretches of the CV Link are considered speed zones and will emphasize speed and efficiency of travel. These areas will emphasize movement predominantly through the judicious use of low-maintenance, low water use grasses. Transitions to major access points and social nodes will be planted with Phoenix dactylifera (Date palm) or Washingtonia robusta (Mexican fan palm). Spacing will be used to provide a visual cue about speed with 50' spacing indicating the highest rate of speed. As pathway users approach caution areas such as pathway intersections or high use areas, spacing would be reduced to as little as 20'.

**Social Nodes** – These locations will have shade trees and interesting plantings for those seeking to rest, relax, be social or otherwise have a moment of pause.

**Connections** – Access to CV Link from adjoining properties may be as wide as 40' and as little 20'. Plant material selections will be sensitive to the ultimate growth characteristics of each plant and provide another thematic queue that is consistent throughout the entire length of CV Link.

**Charging stations** – These locations will have shade, interesting planting, and a thematic design that carries throughout the project.

**Slope protection areas** – At locations above the top of concrete slope protection there are numerous opportunities to introduce plantings of native seeds that will bloom and thrive on seasonal rainfall once established. Several seed choices are included, as well as the use of self-attaching vines at the top of the concrete slope protection to help soften the hard lines of the channel. Glare and heat will also be reduced through the strategic placement of these types of plants that are placed on drip irrigation.

**Root Barriers** – Where trees are planted within 5' of paved surfaces, in raised planters or above slope protection, root barriers will be used. BioBarrier or Deep Root Barriers will be acceptable.

**Maintenance** – Where date palms are selected consideration for long-term maintenance costs will be reduced if a local date company harvests dates. Often times the date company will maintain trees and pay a portion of water costs to have access to the fruit. If this option is not feasible, watering of dates can be drastically reduced and fruiting will not take place. Trimming of fronds will be the only required maintenance just like any other trees that are selected for CV Link. Pruning practices should be limited to keeping natural forms by selectively thinning branching.  Tree pruning will follow standard arboricultural practices in the desert where tree canopies are reduced in size once a year to provide deeper root growth and reduction of wind damage.

### 9.3.4. **IRRIGATION**

Irrigation design will meet CVWD design standards. Irrigation will be designed to accommodate grade differences by separating zones for top, center and bottom of slope. All spray and rotor irrigation must be installed to eliminate overspray into access, sidewalks, and hardscape. Flow sensors and master valves are required by CVWD downstream of the all points of connection.

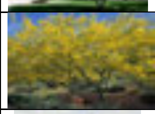
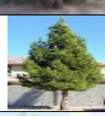
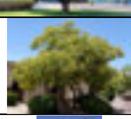
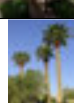
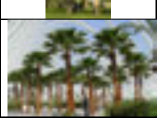
Drip irrigation will be provided for all planting and will be controlled by smart weather-based equipment with rain sensors. *At this time, solar-powered controllers do not support flow control valves and master valves required by CVWD.*

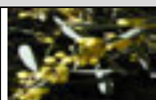
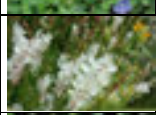
Where planting is permitted above concrete slope protection, aboveground systems such as Salco Irrigation will be considered using UV-resistant pipe. Typical details for CVWD approved installations are included as part of this technical guide.

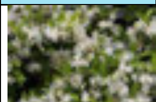
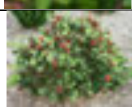
The plant palette is presented on the following pages.  These varieties should be considered a menu of possibilities; the final selection will depend on availability and budget.

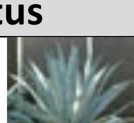
THIS PAGE INTENTIONALLY LEFT BLANK

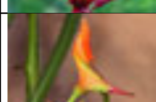
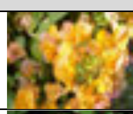
# 9.4. Plant Palette

| LATIN NAME | COMMON NAME | IMAGE | MAX SIZE | WATER | BLOOM | BLOOM SEASON | EXPOSURE | BARRIERS | SLOPES | WIND BREAKS | SPEED ZONES | SOCIAL NODES | CONNECTIONS | PATH SEPARATION | SHADE STRUCTURE | CHANNEL (OPTIONAL) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Trees** | | | | | | | | | | | | | | | | |
| Acacia aneura | Mulga |  | 20' h x 20' w | L | Yellow | Spring-Summer | Full sun | | | X | | | | X | | |
| Acacia farnesiana | Sweet Acacia |  | 15-25' h& w | L | Yellow | Winter-Spring | Full sun | X | | X | | X | X | | X | |
| Acacia Stenophlylla | Shoestring Acacia |  | | | Creamy White | Fall - Spring | Full sun | | | | | | | X | X | |
| Chilopsis linearis | Desert Willow |  | 30' h x 25' w | M | Pink-Purple | Spring - Summer | Full sun | | | | | X | X | | | X |
| Parkinsonia floridum | Blue Palo Verde |  | 35' h x 30'w | L | Yellow | Spring - Summer | Full sun | X | | X | | X | | | X | X |
| Parkinsonia x. 'Desert Museum' | Desert Museum |  | 25'h x 25'w | L | Yellow | Spring | Full sun | | | | | X | X | | X | X |
| Parkinsonia praecox | Palo brea |  | 20-30' h & w | L | Yellow | Spring - Summer | Full sun | X | | X | | X | X | X | X | X |
| Phoenix dactylifera | Date Palm |  | 60' h x 20' w | L | Creamy Yellow | Spring - Summer | Full sun | | | | X | X | | X | | |
| Phoenix roebellini | Pigmy Date Palm |  | 6-10' h & w | M | None | N/A | Full sun | | | | | X | X | | X | |
| Pinus eldarica | Afghan Pine |  | 30-40' h & w | M | None | N/A | Full sun | X | | X | | | | | | |
| Prosopsis chilensis 'thornless' | Thornless Chilean Mesquite |  | 25' h x 25' w | L | Yellow-Green | Late Spring | Full sun | X | | | | X | | | X | |
| Rhus lancea | African sumac |  | 20-25' h & w | M | Whitish-Green | Spring | Full sun | X | | X | | X | X | | X | |
| Tipuana tipu | Tipu |  | 25'-40' h x 30'-60'w | M | Yellow | Spring | Full sun | | | | | X | X | | X | |
| Washington ia filifera | California fan palm |  | 35'40' h | M | Creamy Yellow | Spring | Full sun | | | | X | X | X | | X | X |
| Washington ia robusta | Mexican fan palm |  | | | | | | | | | X | | | X | | |

| LATIN NAME | COMMON NAME | IMAGE | MAX SIZE | WATER | BLOOM | BLOOM SEASON | EXPOSURE | BARRIERS | SLOPES | WIND BREAKS | SPEED ZONES | SOCIAL NODES | CONNECTIONS | PATH SEPARATION | SHADE STRUCTURE | CHANNEL (OPTIONAL) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Citrus Trees** | | | | | | | | | | | | | | | | |
| Grapefruit | |  | 10' -12' h & w | M | White | Spring | Full sun | X | | X | | X | X | | X | |
| Orange | |  | 10' -12' h & w | M | White | Spring | Full sun | X | | X | | X | X | | X | |
| Lemon | |  | 10' -12' h & w | M | White | Spring | Full sun | X | | X | | X | X | | X | |
| Lime | |  | 10' -12' h & w | M | White | Spring | Full sun | X | | X | | X | X | | X | |
| **Groundcover** | | | | | | | | | | | | | | | | |
| Acacia redolens 'Prostrata' | Desert Carpet |  | 2' h x 8' w | L | Yellow | Spring | Full sun | | X | | | | | | | |
| Baccharis x centennial | Prostrate Desert Bloom |  | 2' h x 6' w | L | White | Spring | Full sun | | X | | | | | | | |
| Carissa "Green Carpet" | Prostrate Natal Plum |  | 2' h x 4' w | L | White | Spring-Summer | Part shade | | X | | | | | | | |
| Dalea capitata | Golden dalea |  | 1' h x 3' w | M | Yellow | Spring-Fall | Reflected | | X | | | | | | | |
| Dalea greggii | Trailing indigo bush |  | 1 1/2' h x 10' w | L | Light Purple | Spring | Full sun | | X | | | | | | | |
| Eschscholzia californica | California poppy |  | 2' h & w | L | Yellow-Orange | Spring-Summer | Full sun | | X | | | | | | | |
| Evolvulus glomeratus | Hawaiian Blue Eyes |  | 1' h x 3' w | M | Blue-Purple | Spring-Summer | Part shade | | X | | | | | | | |
| Guara lindheimeri | Gaura |  | 3' h x 3' w | M | Pink-White | Summer-Fall | Part Shade | | X | | | | | | | |
| Lantana 'Spreading Sunset" | Spreading lantana |  | 3' h x 8' w | M | Orange | All | Full sun | | X | | | | | | | |
| Myoporum parvifolium | Myoporum |  | 4" h x 6' w | H | White | Spring | Part Shade | | | | | | | | | |
| Ruellia brittoniana 'Katie' | Dwarf Ruellia |  | 1' h x 2' w | M | Blue-Purple | Summer-Fall | Full sun | | X | | | | | | | |

| LATIN NAME | COMMON NAME | IMAGE | MAX SIZE | WATER | BLOOM | BLOOM SEASON | EXPOSURE | BARRIERS | SLOPES | WIND BREAKS | SPEED ZONES | SOCIAL NODES | CONNECTIONS | PATH SEPARATION | SHADE STRUCTURE | CHANNEL (OPTIONAL) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Trachelospermum jasminoides | Star jasmine |  | 2' h x 6' w | H | White | Spring | Part shade | | X | | | | | | | |
| Verbena peruviana | Verbena |  | 1' h x 3' w | M | Purple,Pink | Spring-Fall | Full sun | | X | | | | | | | |
| **Shrubs** | | | | | | | | | | | | | | | | |
| Caesalpinia pulcherrima | Red Bird of Paradise |  | 10' h x 10' w | L | Orange-Yellow | Summer | Full sun | | | | | X | X | | X | X |
| Calliandra californica | Baja Fairy Duster |  | 6' h x 4' w | L | Red | Spring-Fall | Full sun | X | | | | X | | | | |
| Callistemon "Little John" | Dwarf Bottlebrush |  | 3' h x 3' w | M | Red | Fall-Spring | Full sun | | X | | X | X | X | X | X | |
| Carissa "Boxwood Beauty" | Dwarf Natal Plum |  | 2 ' h x 2' w | M | White | Spring-Fall | Part shade | | X | | | | | | | |
| Cassia nemophila | Green Cassia |  | 8' h x 8' w | L | Yellow | Winter-Spring | Reflected | X | | | | | | | | |
| Dodonea viscosa | Hopseed Bush |  | 15' h x 10' w | M | Inconspicuous | None | Full sun | X | | X | | | | | | |
| Encelia farinosa | Brittle Bush |  | 3' h x 4' w | L | Yellow | Spring | Full sun | | X | | | | | | X | X |
| Ficus nitida columnar | Indian Laurel Fig |  | 20' h x 5' w | L | Inconspicuous | | Full sun | | | X | | | X | | | |
| Hamelia patens | Firebush |  | 5' h x 5' w | M | Orange | Spring-Summer | Full sun | | | | | X | X | X | X | |
| Ixora coccinea | Jungle Flame |  | 4' h x 4' w | M | Orange | Winter-Spring | Part shade | | | | | X | X | | X | |
| Justicia spicigera | Mexican Honeysuckle |  | 4' h x 4' w | M | Orange | Spring-Fall | Part Sun | | | | | X | X | X | X | X |
| Larrea tridenta | Creosote Bush |  | 8' h x 8' w | L | Yellow | All | Reflected | X | | X | | X | X | | X | X |
| Leucophyllum "Green Cloud" | Green Cloud |  | 6-8' h x6-8' w | L | Purple | Summer-Fall | Reflected | X | | X | | X | X | X | X | |

| LATIN NAME | COMMON NAME | IMAGE | MAX SIZE | WATER | BLOOM | BLOOM SEASON | EXPOSURE | BARRIERS | SLOPES | WIND BREAKS | SPEED ZONES | SOCIAL NODES | CONNECTIONS | PATH SEPARATION | SHADE STRUCTURE | CHANNEL (OPTIONAL) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Leucophyllum pruinosum | Sierra Bouquet |  | 6-8' h x 6-8' w | L | Blue-Violet | Summer-Fall | Reflected | X | | X | | X | X | X | X | |
| Leucophyllum langmaniae | Lynn's Legacy |  | 5' h x 5' w | L | Lavender | Summer and Fall | Reflected | X | | X | | X | X | X | X | |
| Leucophyllum lanmaniae 'Rio Bravo' | Rio Bravo |  | 5' h x 5' w | L | Lavender | Summer | Reflected | X | | X | | X | X | X | X | |
| Russelia equisetiformis | Coral Fountain |  | 5' h x 5' w | M | Red-Orange | Spring - Summer | Part shade | | | | X | X | X | | X | |
| Simmondsia chinensis | Jojoba |  | 8' h x 8' w | L | Green | Spring | Full sun | X | | X | | X | X | | X | X |
| Tagetes lemmonii | Desert Marigold |  | 4' h x 4' w | M | Yellow | Fall | Part shade | | X | | | X | X | X | X | X |
| Tecoma x. 'Orange Jubilee" | Orange Bells |  | 12' h x 8' w | L - M | Orange | Spring-Fall | Full sun | | | X | | X | X | | X | |
| Thevitia peruviana | Lucky Nut |  | 25 h x 25' w | M | Yellow | Spring-Fall | Reflected | X | | X | | X | X | | X | |
| **Grasses** | | | | | | | | | | | | | | | | |
| Aristida purpurea | Purple Three Awn |  | 12"-20" h & w | M | Purple | Spring-Fall | Full sun | | X | | X | X | X | X | X | X |
| Muhlenbergia c. 'Regal Mist' | Pink Muhly |  | 4' h x 5' w | M | Purple-Pink | Summer-Fall | Reflected | | X | | X | X | X | X | X | X |
| Nassella tenuissima | Mexican Feather Grass |  | 2' h x 2' w | L | None | N/A | Full | | X | | X | X | X | X | X | X |
| **Succulents/Cactus** | | | | | | | | | | | | | | | | |
| Agave americana | Century plant |  | 10' h x 10' w | L | None | N/A | Reflected | X | | | | X | X | | X | |
| Agave parryii v parryii | Parry's agave |  | 2' h x 2' w | L | None | N/A | Full sun | | | | | X | X | | X | |
| Agave desmettiana | Smooth agave |  | 3' h x 3' w | L | None | N/A | Full sun | | | | | X | X | | X | |
| Agave vilmoriniana | Octopus agave |  | 6' h x 6' w | L | None | N/A | Full sun | | | | | X | X | | X | |

| LATIN NAME | COMMON NAME | IMAGE | MAX SIZE | WATER | BLOOM | BLOOM SEASON | EXPOSURE | BARRIERS | SLOPES | WIND BREAKS | SPEED ZONES | SOCIAL NODES | CONNECTIONS | PATH SEPARATION | SHADE STRUCTURE | CHANNEL (OPTIONAL) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Agave geminiflora | Twin flowered agave |  | 3' h x 3' w | L | None | N/A | Reflected | | | | | X | X | X | | |
| Asclepias subulata | Desert Milkweed |  | 4' h x 4' w | L | Yellow | Spring-Fall | Full sun | | | | | X | X | X | | |
| Aloe 'Blue Elf' | Blue Elf Aloe |  | 3' h x 3' w | L | Orange-Red | Winter-Spring | Part sun | | | | | X | X | X | | |
| Aloe Vera | Medicinal Aloe |  | | | | | | | | | | X | X | | X | |
| Dasylirion longissimum | Mexican Grass Tree |  | 10' h x 6' w | L | None | N/A | Full sun | | | | | X | X | | | |
| Dasylirion wheeleri | Desert Spoon |  | 5' h x 5' w | L | None | N/A | Full sun | X | | | | X | | | | X |
| Fouquieria splendens | Ocotillo |  | 15' h x 10' w | L | Orange-Red | Spring | Full sun | X | | | | | X | | X | |
| Hesperaloe 'Brakelights' | Red Yucca |  | 3' h x 3' w | L | Red | Spring-Summer | Full sun | | | | | X | X | X | X | |
| Pedilanthus macrocarpus | Lady Slipper |  | 3' h x 3' w | L | Orange-Red | Spring-Fall | Full sun | | | | | X | X | X | X | |
| Yucca rostrata | Beaked Yucca |  | 10' h x 5' w | L | White | Late Spring | Full sun | X | | | | X | X | | X | |
| **Vines** | | | | | | | | | | | | | | | | |
| Bougainvillea species | N/A |  | 20' h x 15' w | L | Orange,Red, Pink | Spring-Fall | Full sun | X | | | | | | | | |
| Calliandra haematocephala | Powder Puff Vine |  | 10' h x 10' w | L | Red | Fall-Spring | Part shade | | | | | X | X | | X | |
| Campsis radicans | Orange Trumpet vine |  | 20' h x 20'w | M | Orange | Summer-Fall | Part shade | | | | | X | X | | X | |
| Duranta repens | Skyflower |  | 20' h x 15' w | L | Purple | Summer-Fall | Full sun | | | | | X | X | | X | |
| Macfadyena-unguis-cati | Cat Claw |  | 40' h x 40' w | L | Yellow | Spring | Part sun | | X | | | X | X | | X | |

THIS PAGE INTENTIONALLY LEFT BLANK

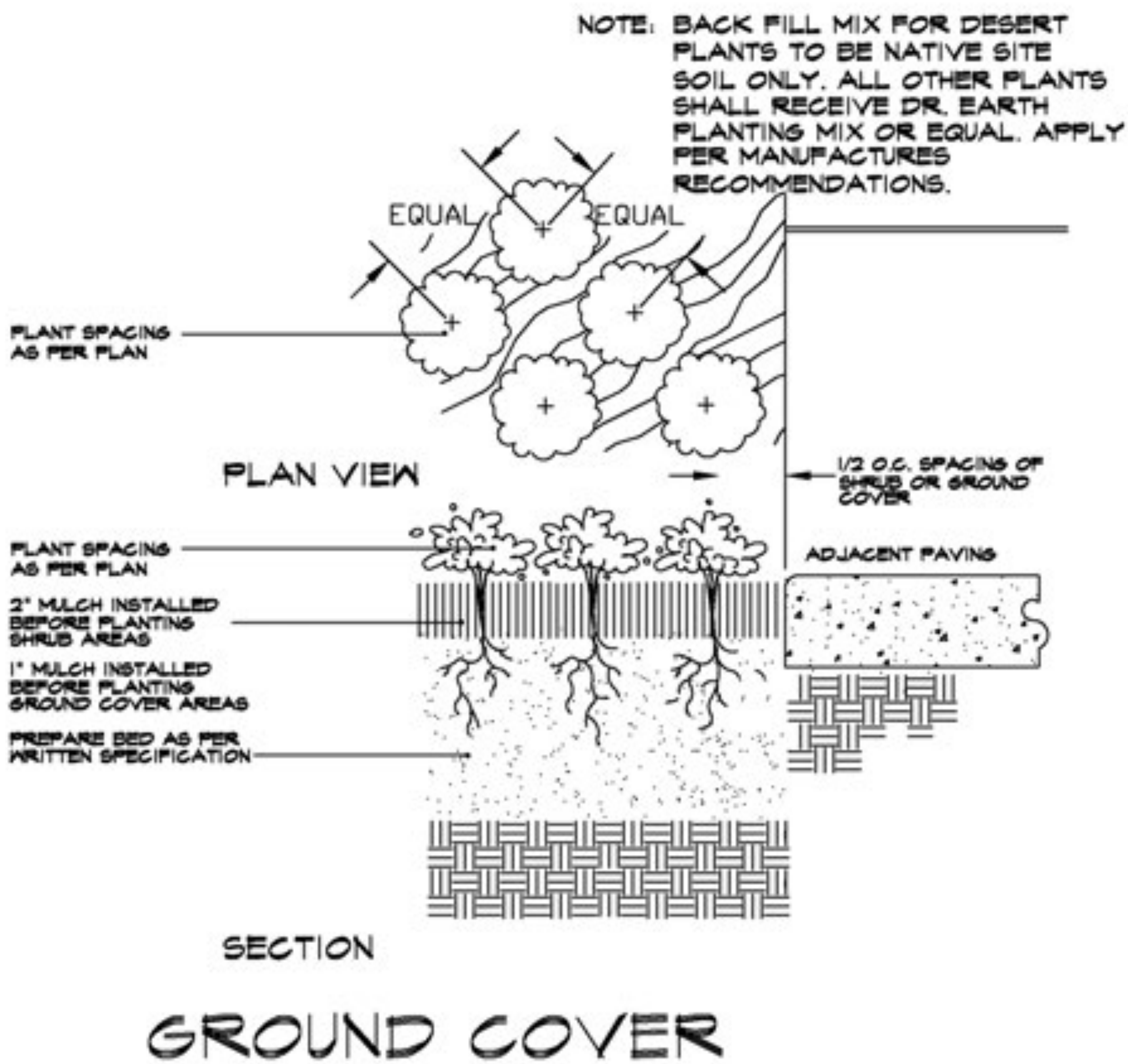
## 9.5. Landscaping Details

The following pages cover these topics:

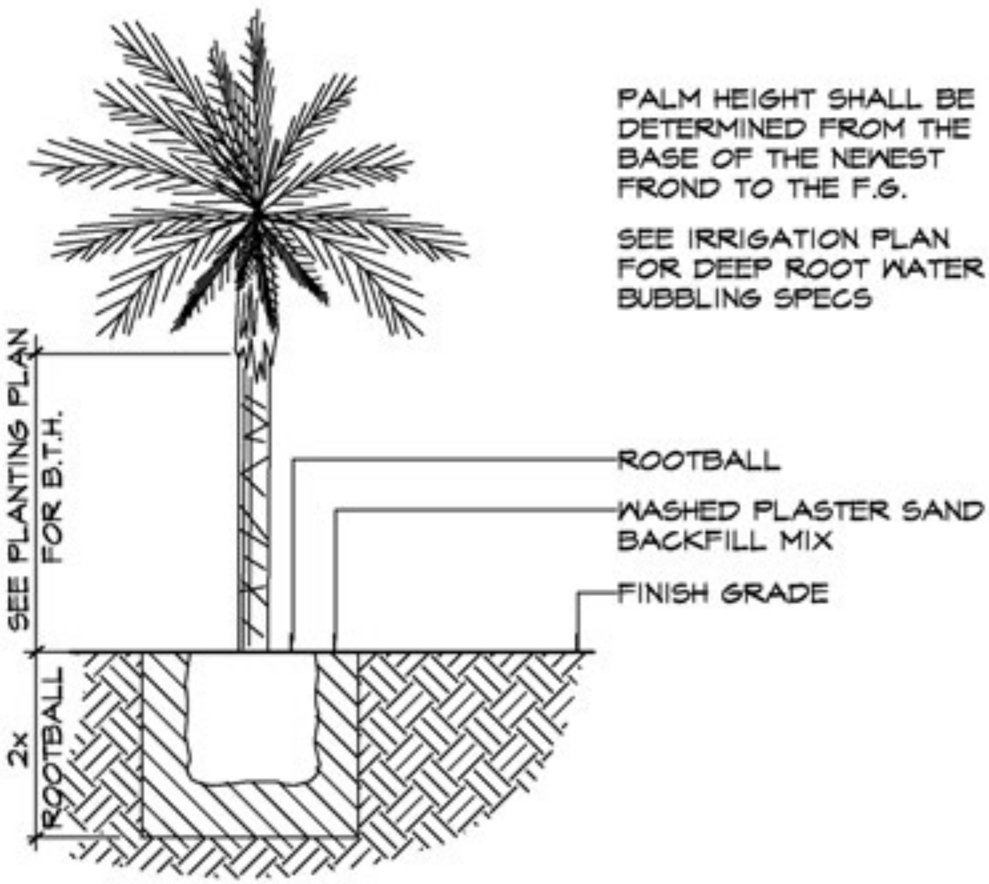
- GROUND COVER
- PALM PLANTING
- DEEP ROOT BARRIER
- SHRUB/VINE PLANTING
- TREE PLANTING
- VINE ON WALL
- DEEP ROOT WATERING SYSTEM
- MASTER VALVE
- QUICK COUPLER
- TRENCHING
- TREE/PALM BUBBLER
- SHRUB EMITTER
- BALL VALVE
- SLEEVING
- FLOW SENSOR
- REMOTE CONTROL VALVE
- DRIP REMOTE CONTROL VALVE
- CONTROLLER
- AUTOMATIC FLUSH VALVE
- EMITTER ASSEMBLY
- SHRUB EMITTER ASSEMBLY
- POINT-TO-POINT LATERAL LAYOUT

THIS PAGE INTENTIONALLY LEFT BLANK

9.5.1. **GROUND COVER**



9.5.2. **PALM PLANTING**




PALM PLANTING

## 9.5.3. DEEP ROOT BARRIER

# Linear Style Planting with DeepRoot Barriers

Determine the correct number of panels to be used. Depending upon the actual planting plan and the number of trees involved the length of linear barrier will vary, but as a general rule of thumb take the anticipated mature canopy diameter of the tree and add 2 feet (61cm). This will be the number of feet necessary for a Linear style planting application. (See chart below.)

A. Choose the barrier that best suits the application. Generally if a sidewalk, patio or driveway is to be protected, 18" (46cm) (LB 18-2) is sufficient depth with 12" (30cm) (LB 12-2) as an alternate choice for non-aggressive, deeper rooting trees. However for curb and gutter protection or more agressive roots 24" (61cm) (UB 24-2) is generally the better choice.

B. Dig the trench to the depth based upon the particular barrier chosen.

C. Install the barrier. When using DeepRoot Linear Barriers simply pull the appropriate number of panels out of the box (they come preassembled) and separate the joiner at the correct length. When installing DeepRoot Universal Barriers in a linear fashion you will need to join the appropriate number of panels together.

D. Next place the barrier in the trench with the vertical ribs facing toward the tree and align in a straight fashion. It is helpful to place the barrier against the hardscape. Use the hardscape as a guide and backfill against the barriers to promote a clean smooth fit to the hardscape. Be sure to keep the barrier's double top edge at least 1/2" (13mm) above grade to ensure roots do not grow over the top.

E. Plant the tree(s). The Linear style offers a more expansive rooting growth area, however adverse soil and drainage conditions may exist in the actual planting area. Take steps to ensure healthy growth of the tree at planting. Consult with a local Arborist for planting tips and recommendations.

F. If the tree(s) will be subject to maintenance work such as lawn mowing or weed trimming we strongly recommend the installation of ArborGard+ Tree Trunk Protectors which is placed around the base of young trees to protect them from damage by weed trimmers, lawn mowers and small rodents.

For additional information please consult the 16 page DeepRoot Product Selection and Installation Guidelines.

For information regarding distributors please call: 1 800 ILV ROOT (458.7668). For help with difficult drainage or other difficult installation questions please call DeepRoot Technical Support at: 1 800 ROOT TEK (766.8835).

For a simple formula to determine the quantity of panels required for a Linear application use:

Estimated Diameter of the Tree Canopy at Maturity + 2' (61cm) = Length of Barrier per Side.

As little as one side of the tree may need barrier for root direction as there may be no hardscape elsewhere requiring protection.

Note: Linear Barriers (LB 12-2 and LB 18-2) are packaged in 2' (61cm) long panels with pre-attached flexible joiners ready to pull out of the carton and install in one continuous line of up to:

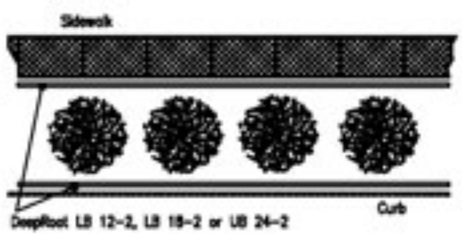
LB 12-2 80' (24 m) per Carton
LB 18-2 52' (16 m) per Carton

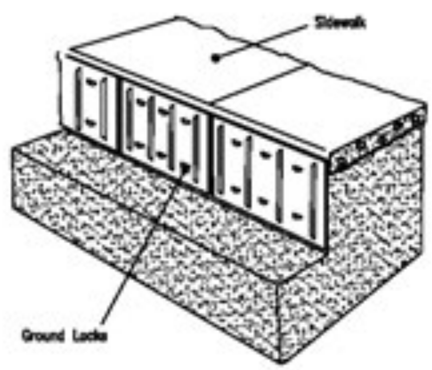
Line can be separated at any two foot interval.

For One Side of Tree

| Expected Tree Canopy at Maturity | | Number of Feet of Linear Barrier (LB 12 or LB 18) | Optional Universal Barrier (UB) in number of Panels |
|---|---|---|---|
| 12' (3.6m) Diameter | +2' (61cm) = | 14' (4.2m) | 7 Panels |
| 18' (5.5m) Diameter | +2' (61cm) = | 20' (6.1m) | 10 Panels |
| 24' (7.3m) Diameter | +2' (61cm) = | 26' (7.9m) | 13 Panels |

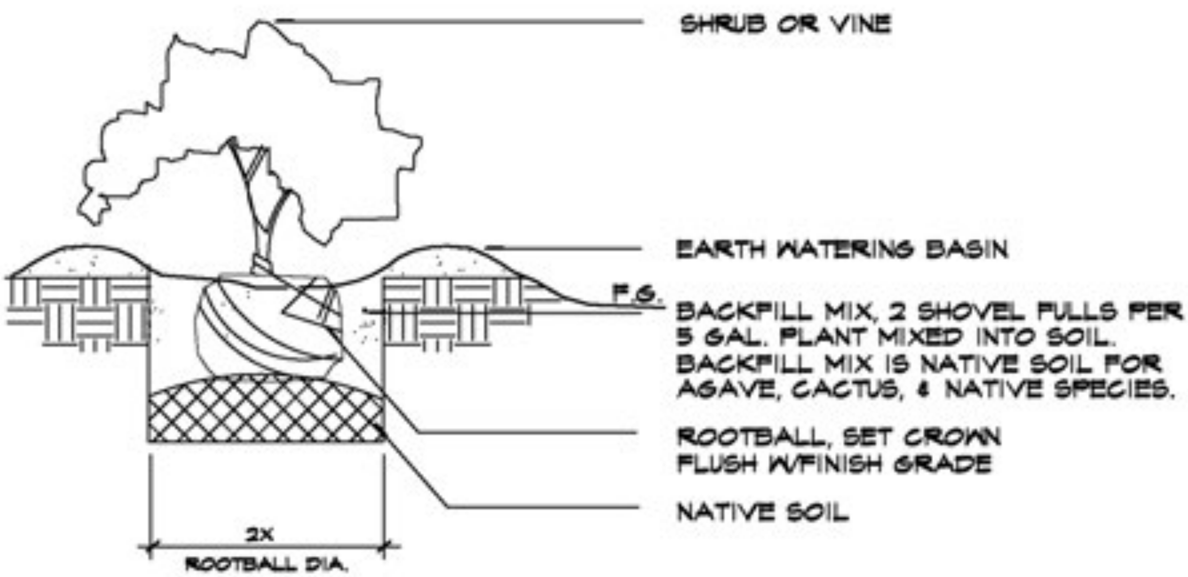
DeepRoot LB 12-2, LB 18-2 or UB 24-2



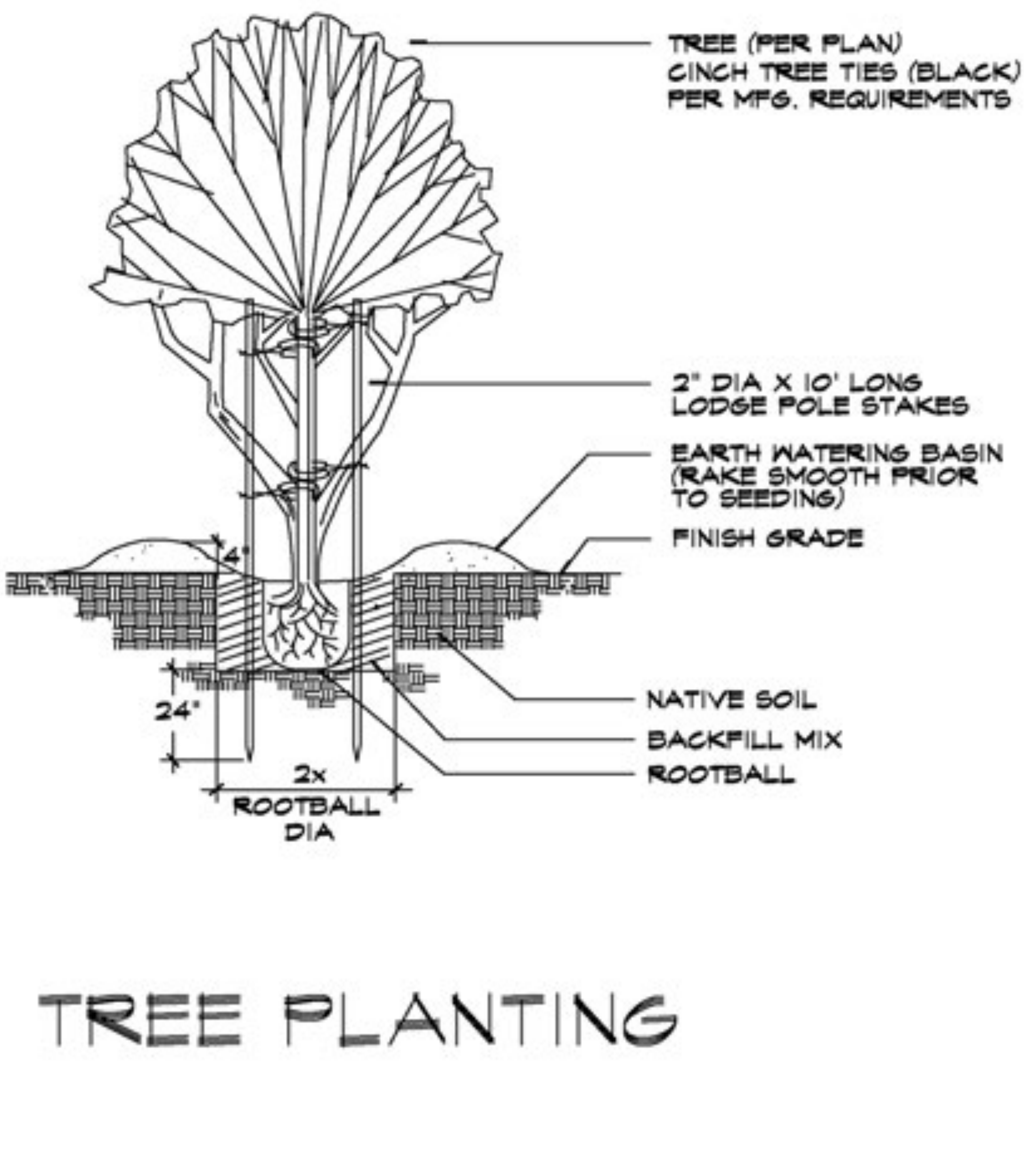

TO BE 24" DEEP ON ALL SIDES

9.5.4. **SHRUB/VINE PLANTING**

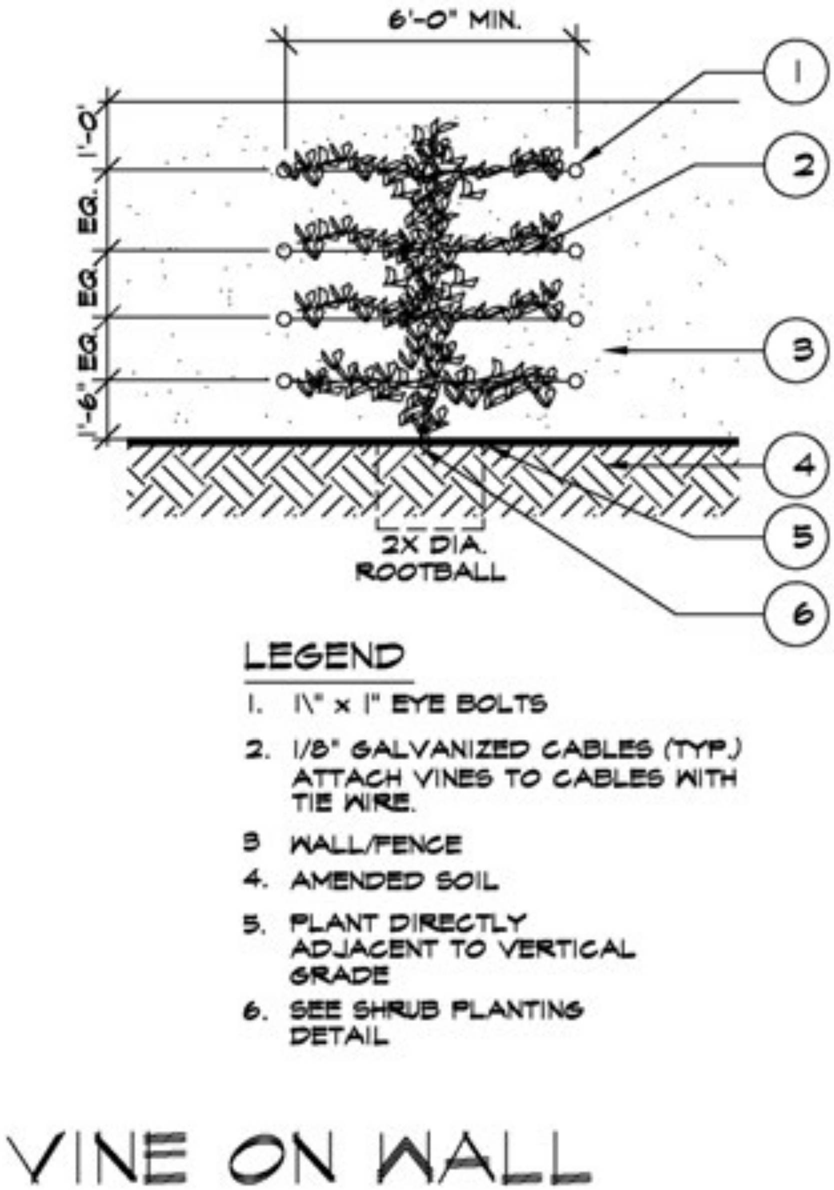



SHRUB/VINE PLANTING

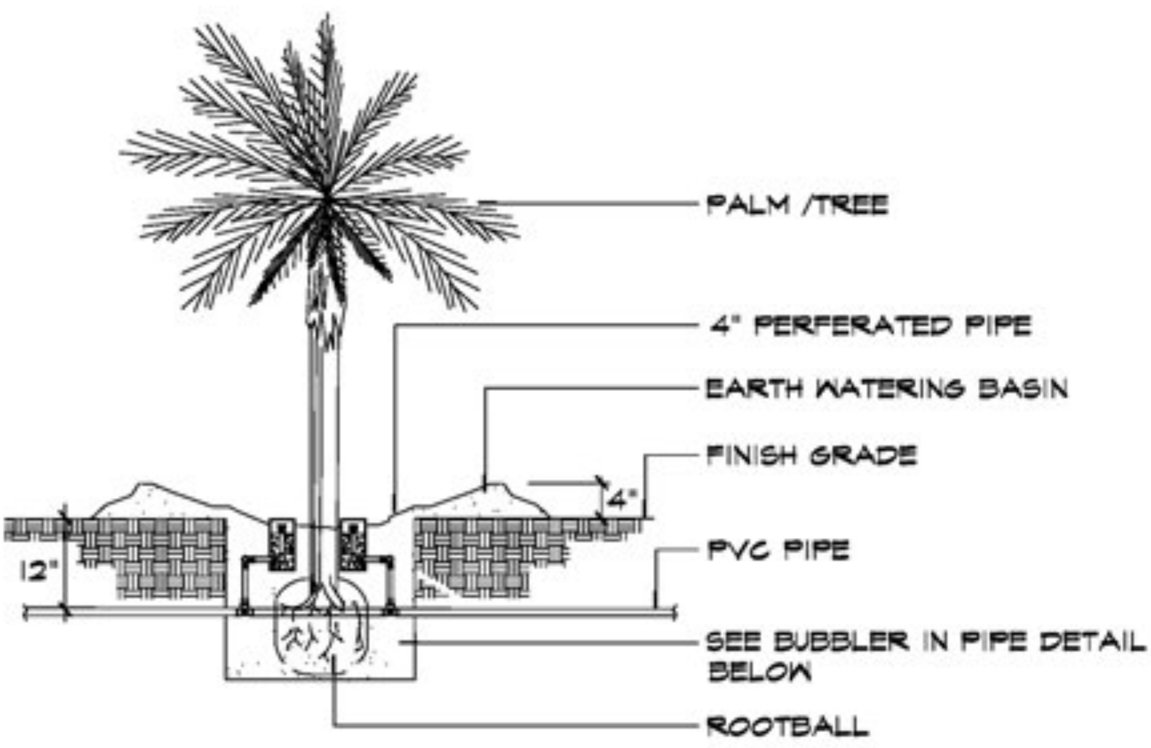
## 9.5.5. **TREE PLANTING**



## 9.5.6. **VINE ON WALL**

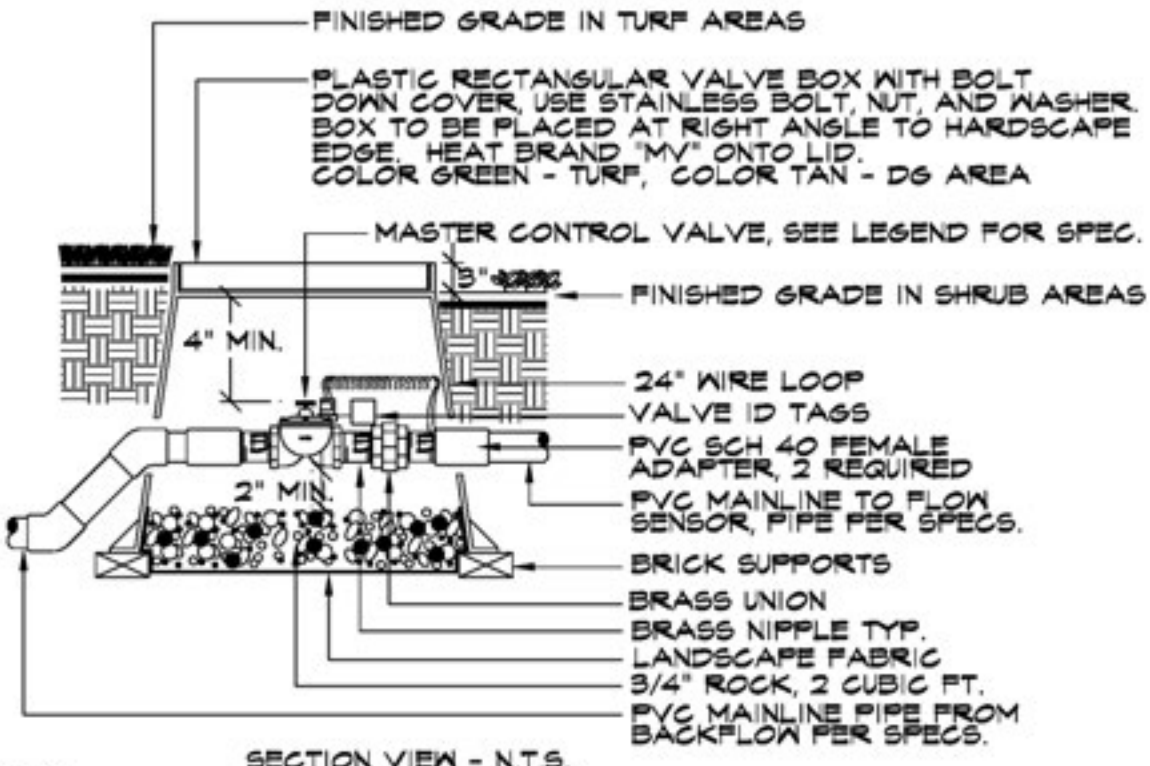


9.5.7. **DEEP ROOT WATERING SYSTEM**




DEEP ROOT WATERING SYSTEM

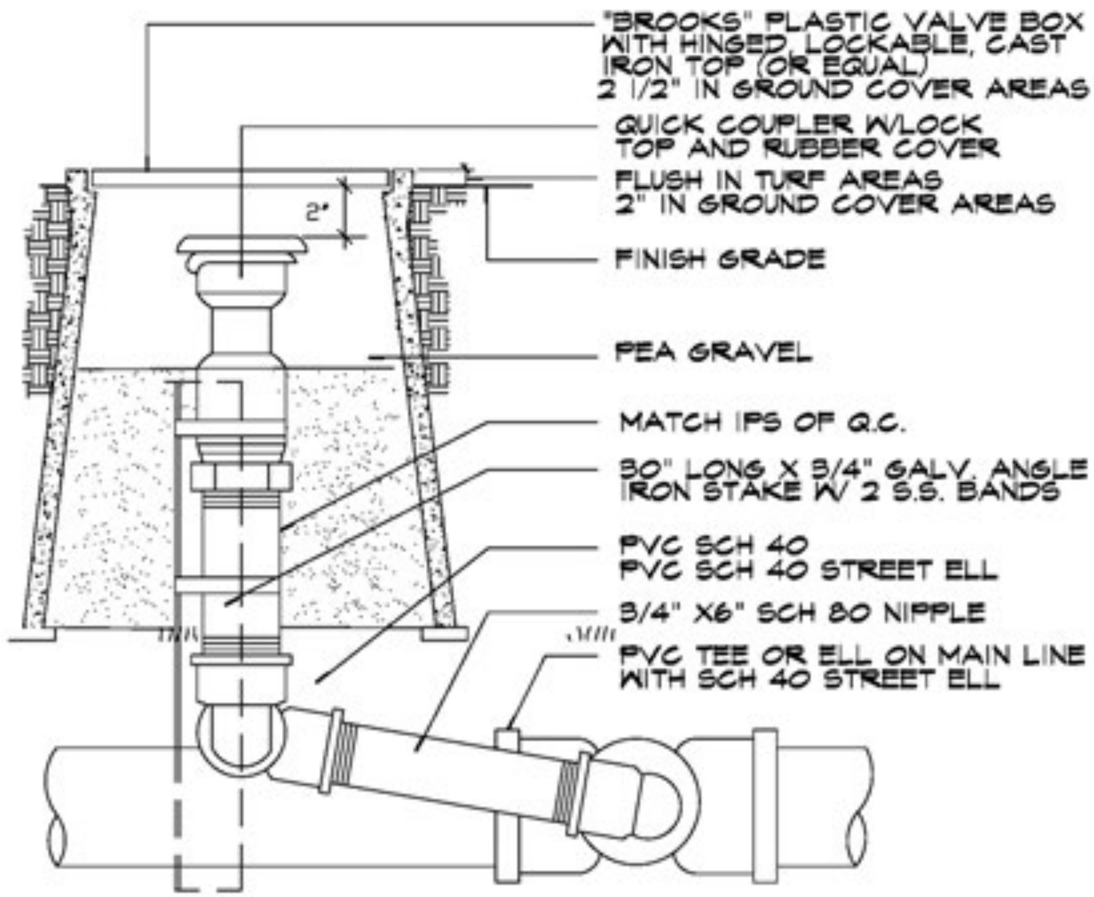
## 9.5.8. MASTER VALVE




NOTE:
USE 45 DEGREE ELLS TO ACHIEVE MAINLINE DEPTH FROM UP-STREAM SIDE OF THE MASTER VALVE ASSEMBLY.

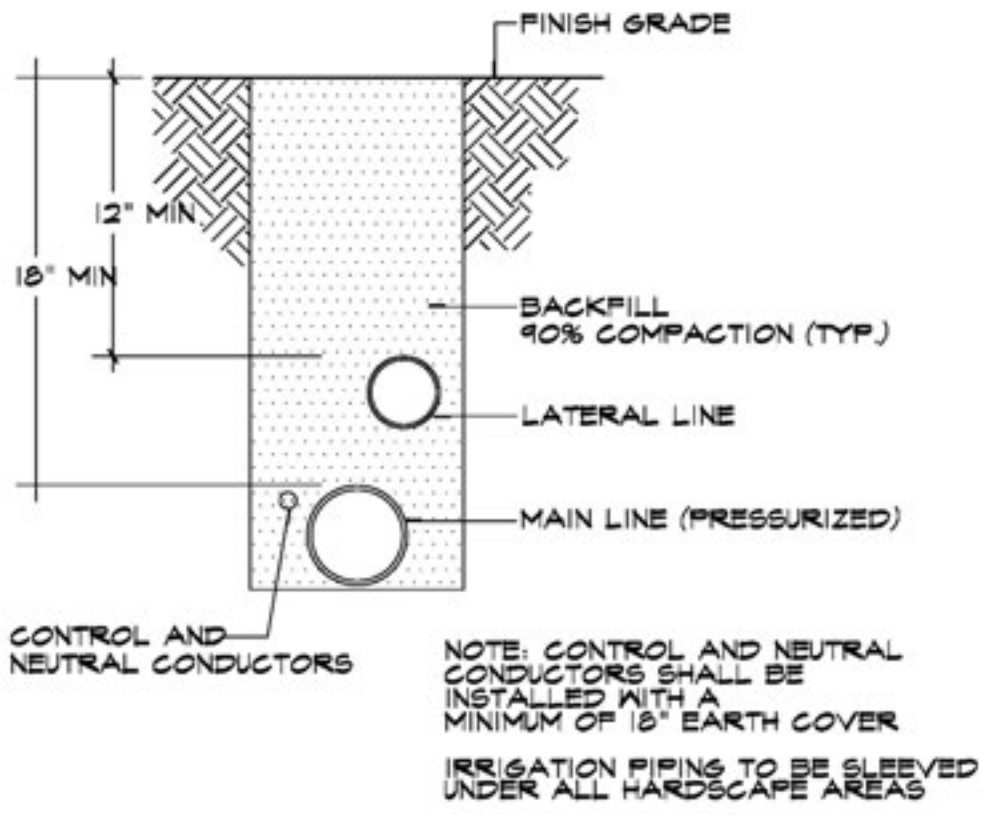
MASTER VALVE

9.5.9. **QUICK COUPLER**



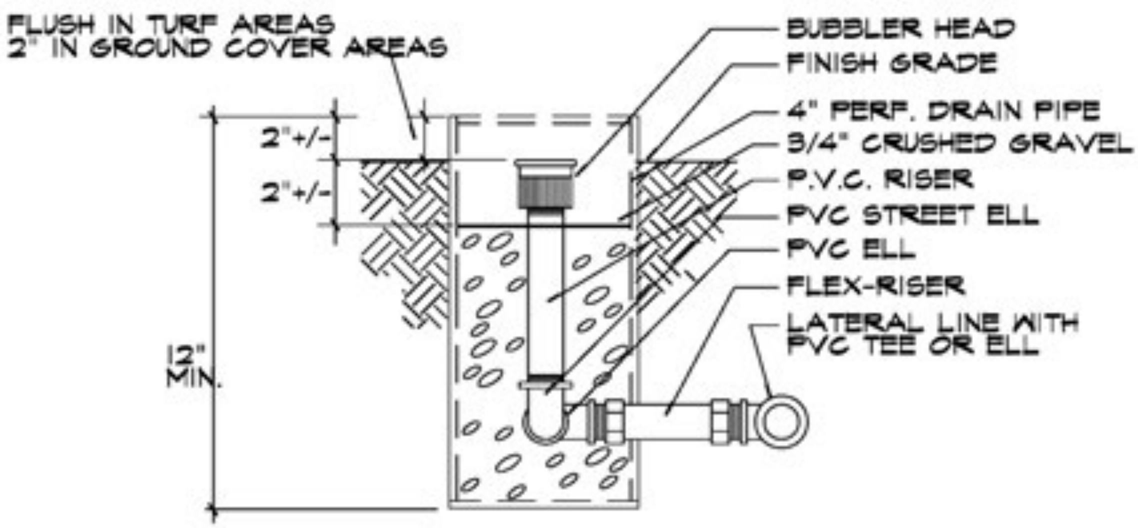

QUICK COUPLER

## 9.5.10. **TRENCHING**



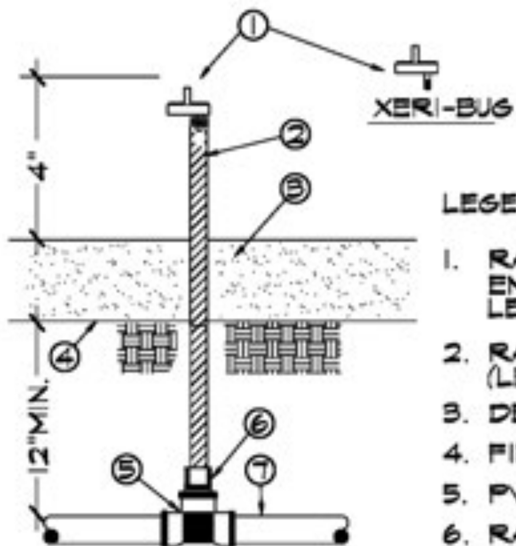

TRENCHING

9.5.11. **TREE/PALM BUBBLER**




TREE/PALM BUBBLER

## 9.5.12. **SHRUB EMITTER**

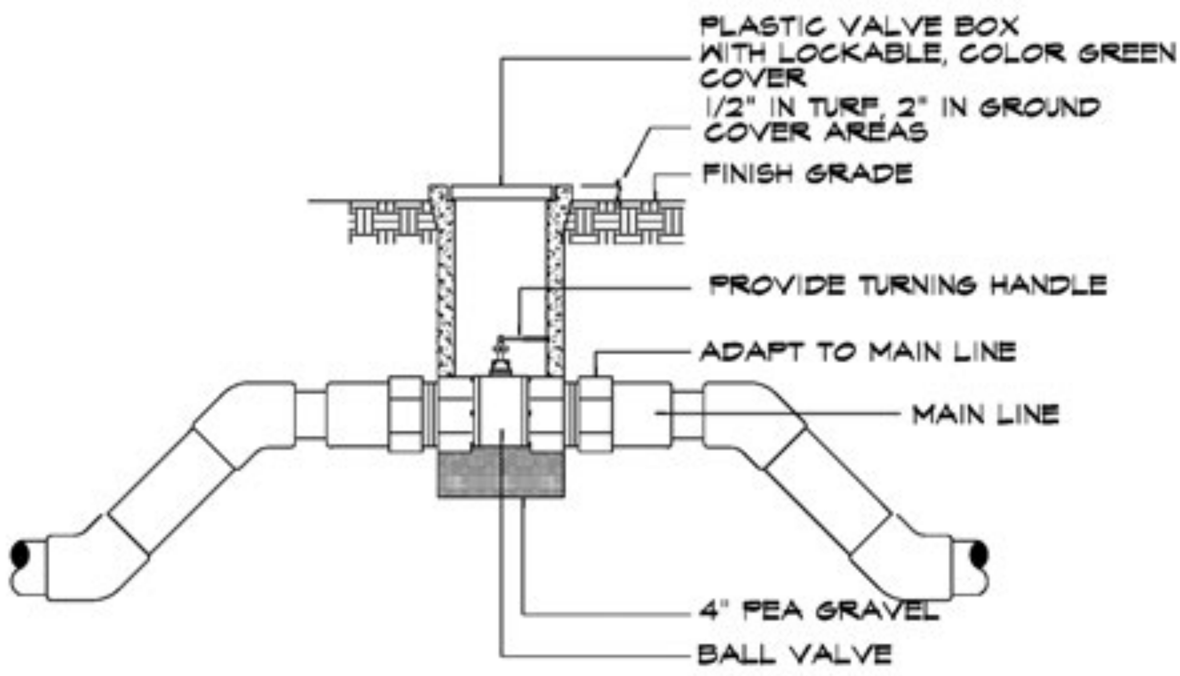



LEGEND

1. RAIN BIRD XERI-BUG - THREAD EMISSION DEVICE (SEE IRRIGATION EQUIPMENT LEGEND FOR MODEL #).
2. RAIN BIRD MODEL # PFR-12 POLY FLEX RISER (LENGTH AS REQUIRED).
3. DECOMPOSED GRANITE/ MULCH
4. FINISH GRADE.
5. PVC FITTING (S x S x 1/2" FIPT).
6. RAIN BIRD MODEL # FRA-050 POLY FLEX RISER ADAPTER.
7. PVC PIPE (12" COVER).

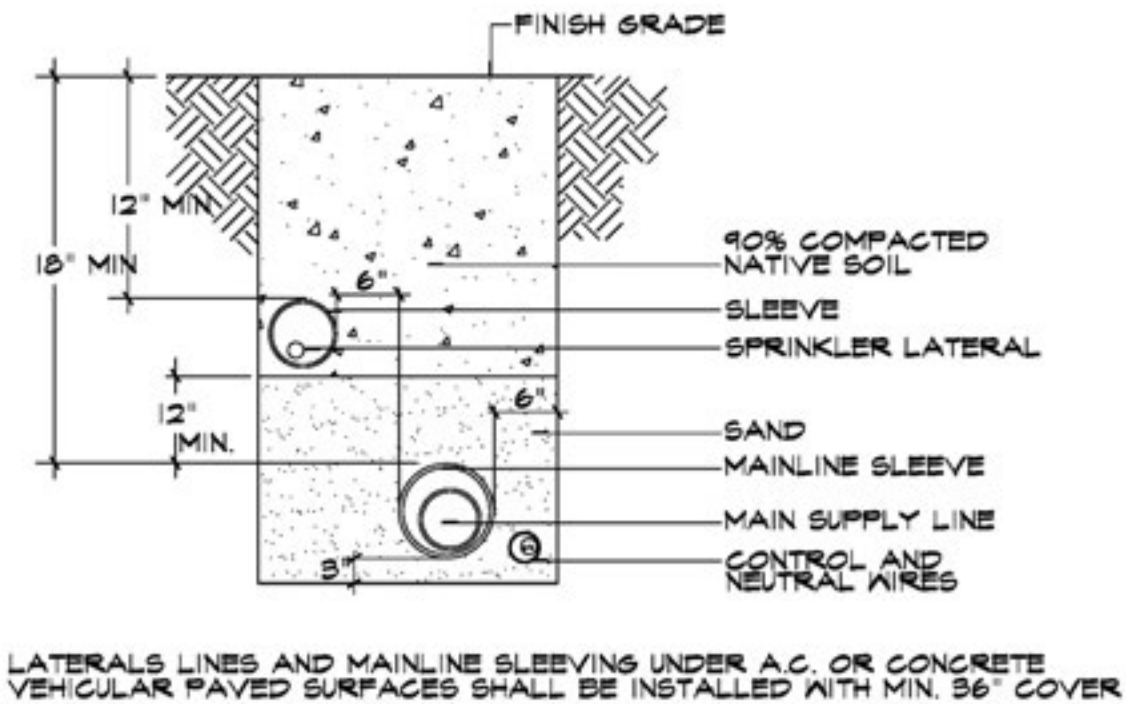
SHRUB EMITTER

9.5.13. **BALL VALVE**



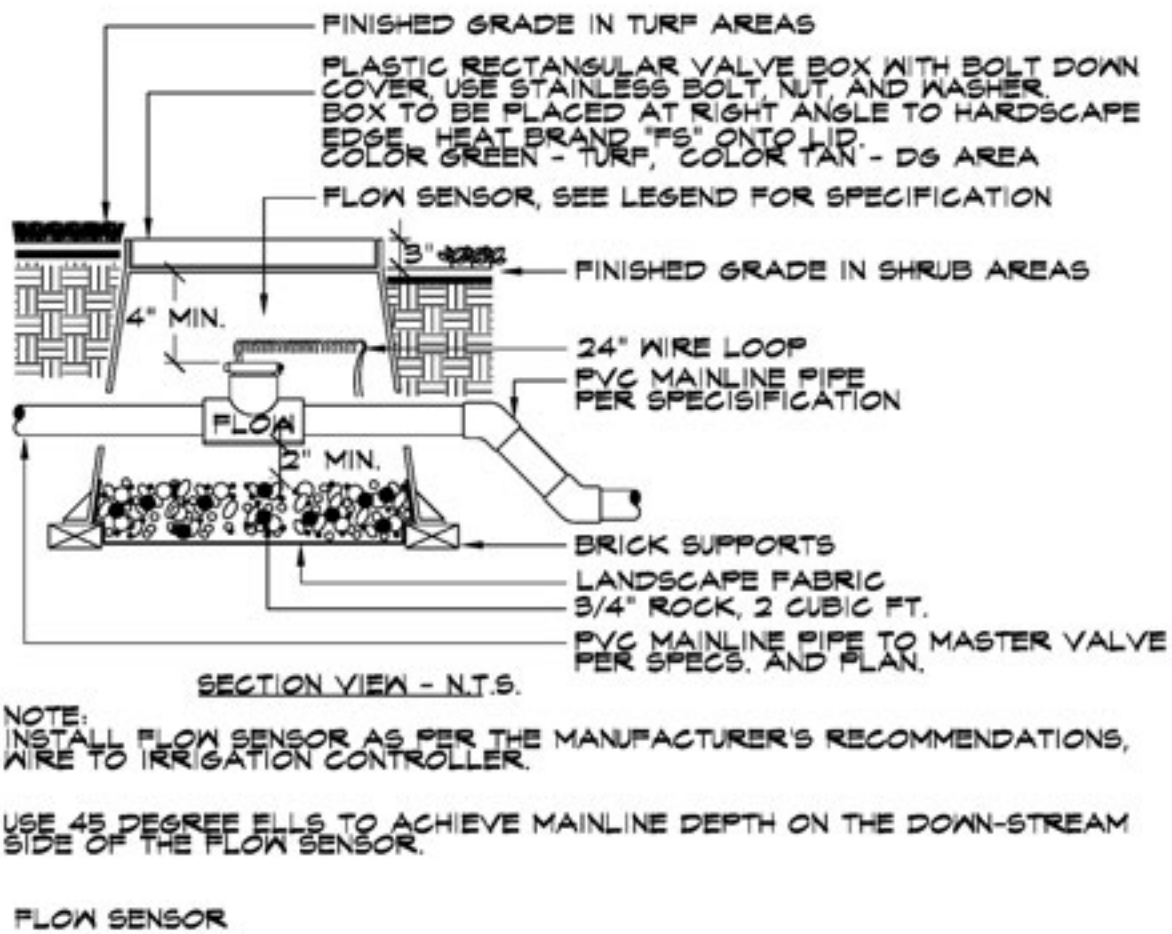

BALL VALVE

### 9.5.14. **SLEEVING**

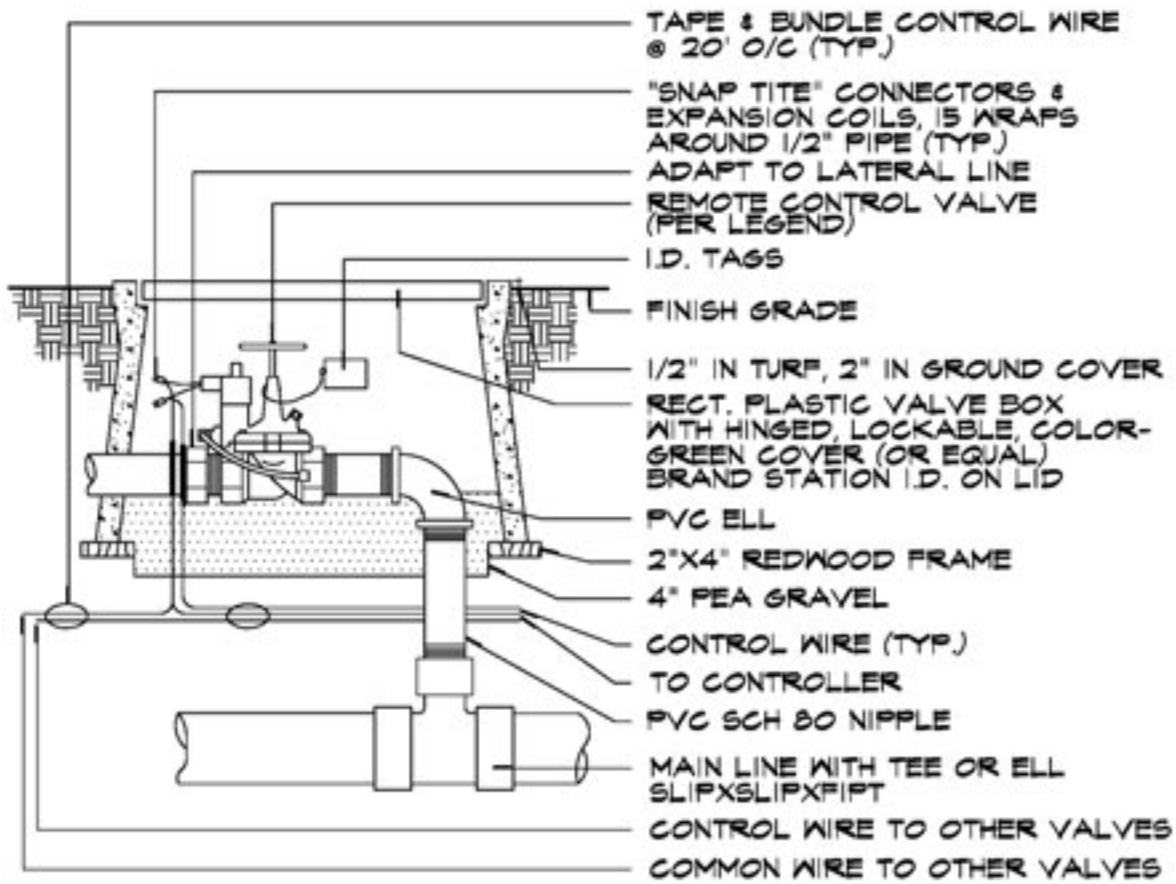



SLEEVING

## 9.5.15. **FLOW SENSOR**

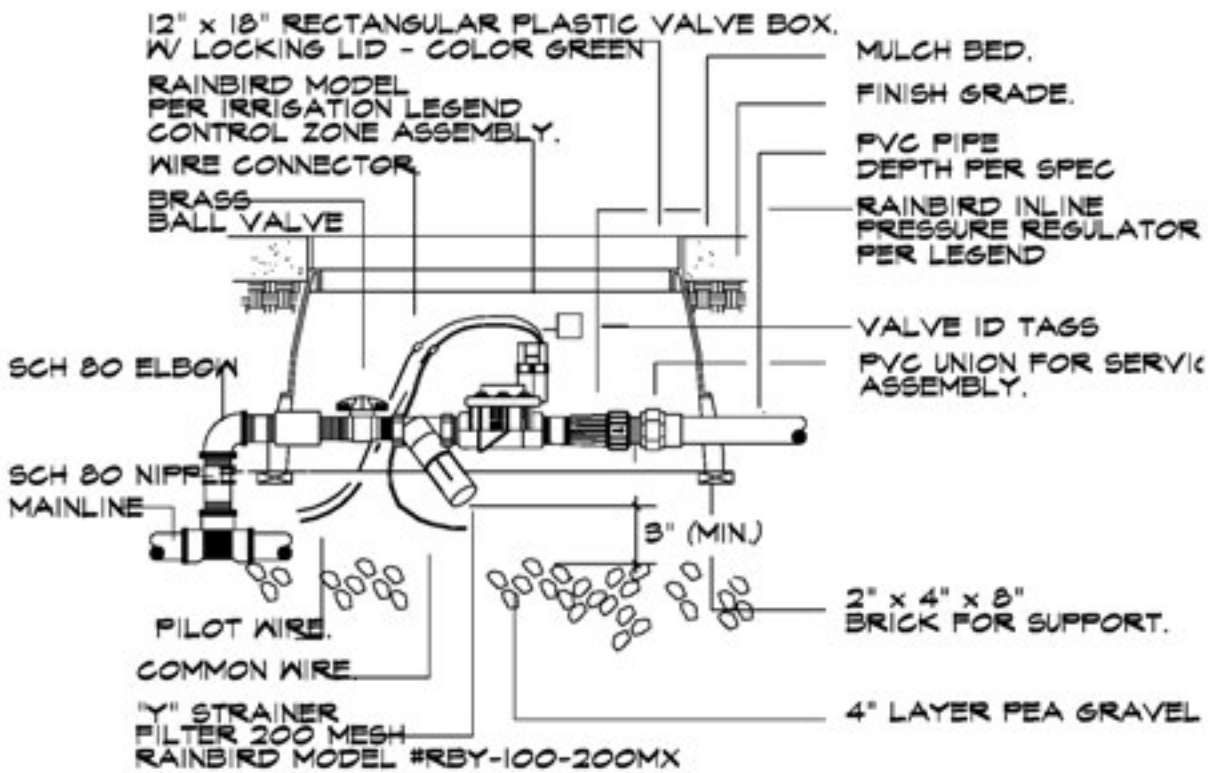


9.5.16. **REMOTE CONTROL VALVE**



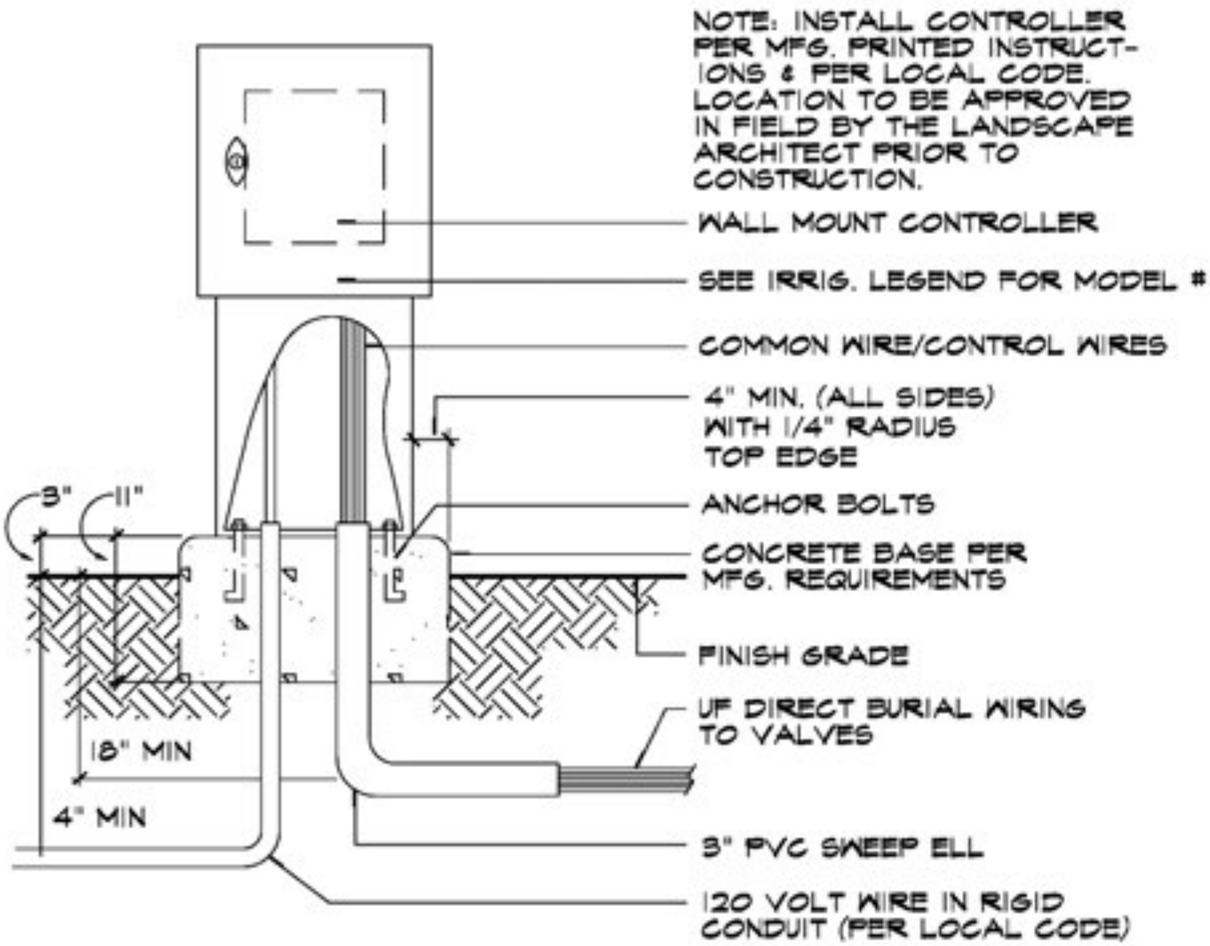

REMOTE CONTROL VALVE

9.5.17. **DRIP REMOTE CONTROL VALVE**



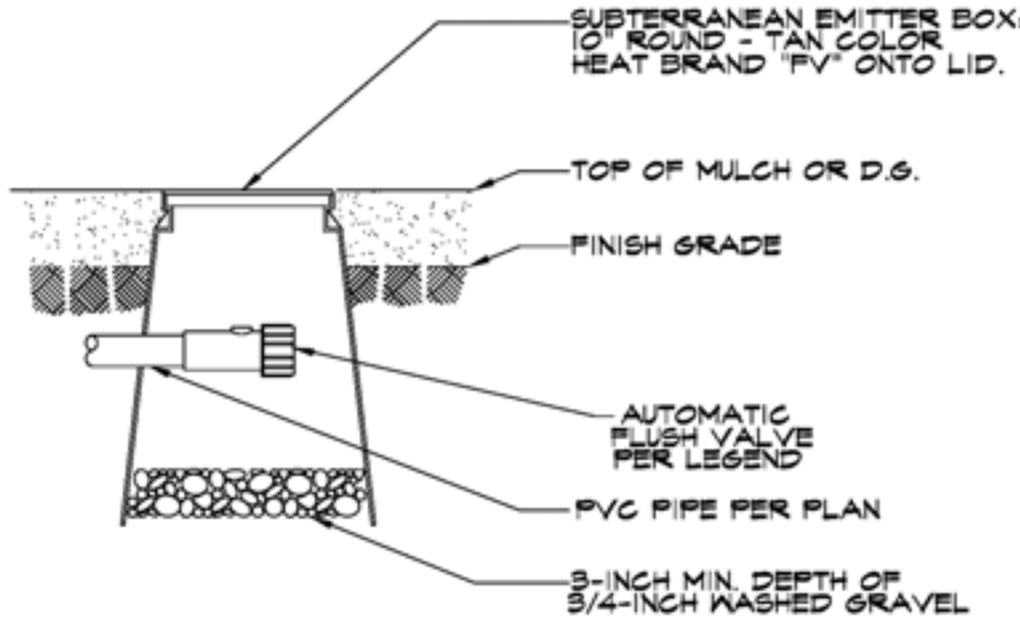

DRIP R.C. VALVE

9.5.18. **CONTROLLER**



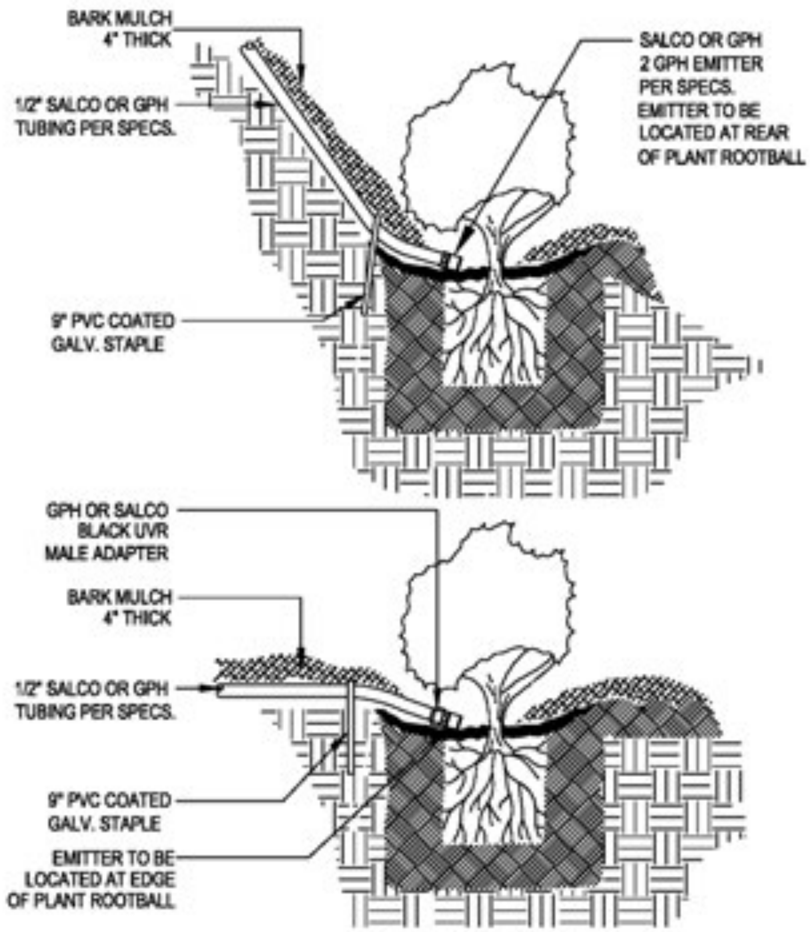

CONTROLLER

9.5.19. **AUTOMATIC FLUSH VALVE**



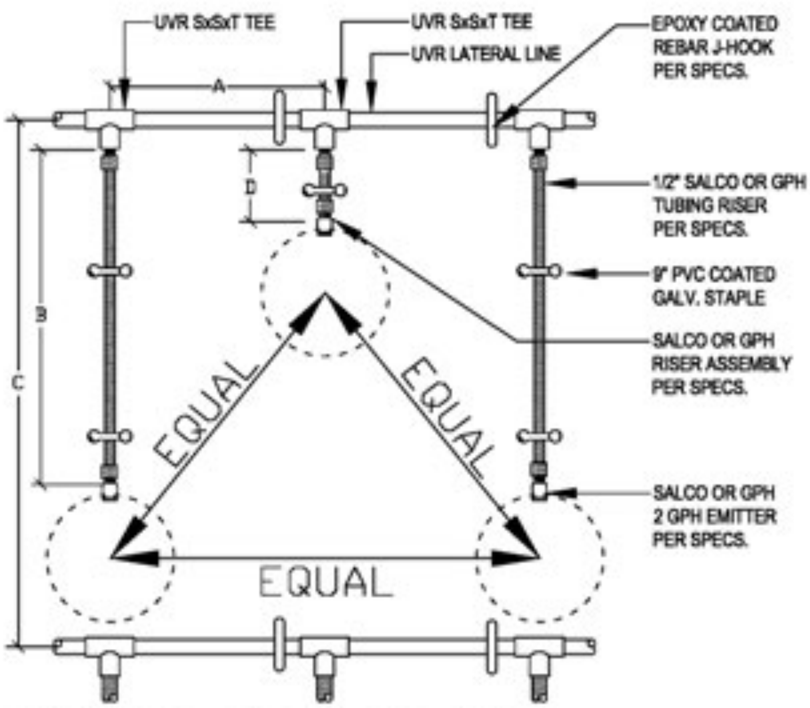

AUTOMATIC FLUSH VALVE

9.5.20. **EMITTER ASSEMBLY**




EMITTER ASSEMBLY SECTION VIEW

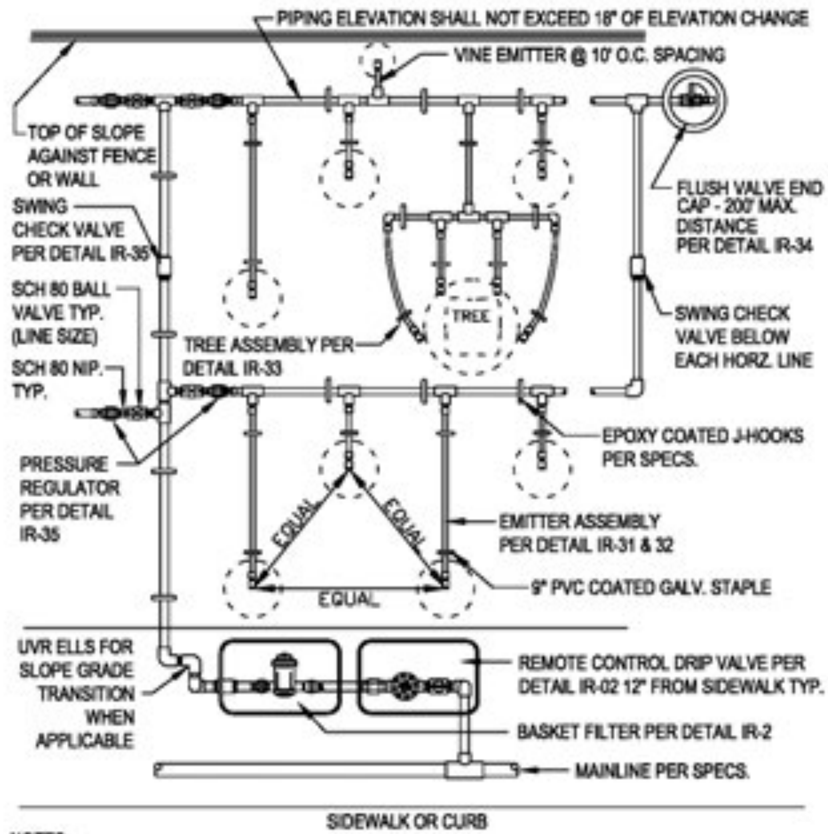
## 9.5.21. **SHRUB EMITTER ASSEMBLY**




| PLANT SPACING | A | B | C | D |
|---|---|---|---|---|
| 2' O.C. | 18" | 32" | 42" | 12" |
| 3' O.C. | 18" | 42" | 5'0" | 12" |
| 4' O.C. | 24" | 54" | 7'0" | 12" |
| 5' O.C. | 30" | 64" | 8'8" | 12" |

SHRUB EMITTER ASSEMBLY LAYOUT

## 9.5.22. **POINT-TO-POINT LATERAL LAYOUT**




NOTES:

1. ALL PIPING FOR POINT TO POINT LATERALS WITHIN 8 FEET OF ANY WALKING OR DRIVING SURFACE SHALL BE BURIED 4" DEEP. PIPING SHALL BE UVR PVC AND HAVE J-HOOKS PER DETAILS AND SPECS.
2. ALL UVR PIPE JOINTS AND FITTINGS BELOW AND ABOVE GRADE SHALL BE PRIMED.

POINT TO POINT LATERAL LAYOUT

# APPENDIX 10. GREEN DESIGN GUIDELINES

## 10.1. Pre-design

### 10.1.1. PRE-DESIGN SITE ASSESSMENT

A detailed assessment of existing site conditions was performed to explore opportunities for sustainable site design, construction, operations, and maintenance. The following areas were reviewed during site assessment:

- Review of the historical and environmental role of the corridor,
- Establish environmental limitations (natural and cultural constraints),
- Microclimate analysis,
- Hydrology (streams, floodplains, wetlands, vegetative buffers for water bodies, and drainage patterns)
- Soils (cursory analysis of site soils – quality and structure of existing),
- Vegetation (habitat analysis, natives vs. invasives)
- Materials Inventory (identification of existing site elements – structures, roadways, parking lots, existing pathways, etc.), and
- Human use of the facility (identification of anticipated users, existing shops, services and facilities that have access to the project, elements of significant local or historical value, and interesting or unique features that will enhance or encourage facility usage, e.g. key viewpoints, landmarks or water bodies)

### 10.1.2. ENGAGE USERS AND OTHER STAKEHOLDER IN SITE DESIGN

Site users and other stakeholders were engaged in meaningful participation during the site design process to identify needs and supplement professional expertise with local knowledge. The stakeholder engagement process included:

- Meetings with Citizen's Advisory Group throughout design process
- Public meetings held in each sub-region of the valley
- The creation of a project website where the public is welcome to review and comment on project progress

## 10.2. Design

### 10.2.1. PATHWAY LAYOUT AND GRADING

The project site was evaluated in detail for opportunities to incorporate sustainable practices while creating a circulation network that decreases costs for long-term maintenance and protects the site's natural environment. Sustainable road design techniques include:

- Maintain or improve existing community connectivity and circulation patterns for pedestrians, cyclists and LSEV drivers to reduce pollution and development impacts, support local economies and improve human health.
- Design pathway systems that are long lasting, low maintenance and, minimize erosion.
- Contour and bench pathway beds to align with the site's natural topography to avoid excessive cut and fill slopes.
- Route pathways to protect sensitive/significant natural/cultural resources and avoid segmenting of wildlife corridors.

### 10.2.2. DRAINAGE AND WATER MANAGEMENT

Water on a project site can take many forms and serve many functions. Water from the site will be managed in the most beneficial and efficient manner possible. Sustainable drainage and water management techniques include:

- Pathways shall be designed and constructed to maximize sheet (surface) drainage and drain such that natural hydraulic flow patterns of the site are maintained.
- Pathways will be designed for inclusion of a Storm Water Pollution Prevention Plan (SWPPP). When the project site and/or right-of-way allows, storm water may be captured and treated in a series of onsite water quality swales and basins prior to offsite release of the water. The design team will review the best management practices (BMP's) for the most current storm water pollution prevention techniques and how they may apply to the project.
- The team will route pathways to improve flood control and water quality, stabilize soils, control erosion and provide wildlife corridors and habitat. Pathways will be designed to not be damaged by flooding and to result in no negative impact to the existing floodplain storage or conveyance. The project recommends the use of efficient irrigation systems, plant materials appropriate for the site conditions and climate, and the use of captured rainwater and/or gray water to reduce waste and conserve resources.
- When feasible, the design team will integrate visually and physically accessible rainwater/storm water features into the site in an aesthetically pleasing way creating a unique landscape amenity. Collaborations with local artists/craftsman can yield rainwater systems that provide both function and amenity while also promoting a stronger connection to local climate and water systems.

### 10.2.3. SOILS AND VEGETATION MANAGEMENT

The preservation and enhancement of site soil and vegetation systems are integral to a project's sustainability. Existing site soils and vegetation shall be evaluated. Measures will be utilized to minimize disturbance and maximize sustainable practices, techniques include:

- Develop and communicate to construction contractors a soil management plan (SMP) prior to construction to: limit disturbance, assist soil restoration efforts, and define the location and boundaries of all vegetation and soil protection zones (VSPZ).
- Limit disturbance of healthy soil to protect soil horizons and maintain soil structure, existing hydrology, organic matter and nutrients stored in the soils.
- VSPZ shall be protected with a fence or other physical barrier (wildlife-permeable barrier, if appropriate) that protects the zone during construction from equipment parking and traffic, storage of materials, and other construction activities.
- Identify and preserve all vegetation designated as special status by local, state or federal entities.
- Plant appropriate vegetation that is native to the ecoregion of the site and preserve native plant material that contributes to regional diversity of flora and provides habitat for native wildlife.

### 10.2.4. PATHWAY DESIGN FOR HUMAN HEALTH AND WELL BEING

Alternative transportation facilities have numerous benefits to the communities in which they are constructed including being a healthy, nonpolluting choice. The positive impacts of community pathway networks are widespread and contribute significantly to the improvement of human health and well-being. The positive impacts of alternative transportation networks may be achieved by incorporating, the following techniques:

- Promote sustainability awareness and education.
- Interpret on-site features and processes to promote understanding of sustainability in ways that positively influence user behavior on site and beyond.
- Protect and maintain cultural and historical sites, attributes and artifacts to enhance a project's sense of place and meaning. Enhanced human experience and attachment to the land leads to a stronger sense of stewardship.
- Provide for optimum site accessibility, safety, and wayfinding. Safe, accessible and legible projects encourage both use and enjoyment.
- Promote site use by increasing user's ability to understand and safely access the system.
- Provide opportunities that encourage outdoor physical activity to improve human health.
- Provide view areas and quiet spaces for mental restoration.
- Provide outdoor gathering spaces of various sizes and orientations to accommodate groups, for the purpose if building community and improving social ties.
- Reduce light pollution by minimizing light trespass on site for the purpose of reducing sky-glow, increasing nighttime visibility and minimizing negative effects on nocturnal environments and human health and functioning.

# 10.3. Construction

### 10.3.1. **PROTECTION AND RESTORATION OF SOILS DURING CONSTRUCTION**

Construction is a critical phase in a project life cycle. During construction there is the most risk of contamination as well as opportunity for putting the site on the correct track to restoration. The protection and restoration of soils during construction shall be achieved through the following means:

- Control and retain construction pollutants. The design team shall create and implement an erosion, sedimentation, and pollutant control plan (SWPPP-Stormwater Pollution Prevention Plan).
- Restore soils disturbed during construction in all areas that will be re-vegetated. This includes restoring the soil's ability to support healthy plants, biological communities, water storage and infiltration. It does not apply to areas of the site that were not disturbed.

### 10.3.2. **DIVERT MATERIALS FROM DISPOSAL**

Non-hazardous materials will be diverted from landfills. Efforts will be made to recycle and/or reuse construction and demolition materials on site or redirect materials back to the manufacturing process, other construction sites, or building materials reuse markets.

### 10.3.3. **USE OF LOCAL, RECYCLED/SALVAGED MATERIALS**

Using local materials reduces the amount of fuel needed and pollution expended for construction. Recycled and/or salvaged materials should be evaluated for use in construction and pathway surfacing. Some examples of such materials include reclaimed asphalt and recycled plastic lumber. Recycled plastic lumber diverts plastics from the landfill while lowering maintenance costs on existing projects. Vegetation, rocks and soil generated during construction should also be reused thereby reducing the need to truck in new materials while simultaneously reducing the need to haul away material generated during construction.

### 10.3.4. **MINIMIZE CONSTRUCTION EMISSIONS**

Minimizing generation of greenhouse gas emissions and exposure to localized air pollutants during construction may be achieved by reducing diesel engine idling time to no more than five minutes per 60-minute period during construction. Other ways include implementing a preventative maintenance plan for all equipment and using ultra low sulfide diesel fuel. Sourcing materials locally thereby decreasing transportation requirements may also avoid the generation of greenhouse gases.

### 10.3.5. SUSTAINABLE PLANT PRODUCTION

Landscape plants should be purchased from providers who reduce resource consumption and waste. For example, plant providers that use peat-free potting soil mixes help to preserve the environment around them. Other sustainable practices in plant production include:

- Reduce, capture and reuse runoff from irrigation
- Use integrated pest management
- Reduce use of potable water and waste
- Recycle organic matter for use on site

### 10.3.6. PROMOTE EQUITABLE SITE DEVELOPMENT

During construction of the site, ensure that the pathway provides economic or social benefits to the local community.

## 10.4. Stewardship And Management

### 10.4.1. PLAN FOR SUSTAINABLE MAINTENANCE

Plant stewardship requires thought and an action plan for plant maintenance. The process of plant stewardship entails a list of aspects vital to thriving plant life. That list includes a plant maintenance process, good plant health through proper monitoring, and site safety by properly maintaining vegetation to meet the needs of the intended users of the site. A list of potentially appropriate replacement plants should be prepared for use if the need arrives. A Pest Management plan should also be crafted to control pests, diseases and any unwanted species of plants and animals.

### 10.4.2. INVASIVE SPECIES MANAGEMENT

Invasive species are defined as plant species in the area that are currently listed as invasive on regional, state, and federal laws or lists. An invasive species management plan must include integrated pest management strategies, a procedure for how to identify additional invasive species as well as follow-up treatment and long-term control.

- Organic materials management-A plan needs to be in place for disposal of excess healthy as well as diseased plant material or other vegetation that is not suitable for composting.
- Soil stewardship
- Irrigation and water use
- Stormwater management features and BMPs
- Materials management
- Recyclable materials
- Landscape Maintenance Equipment
- Provide for storage and collection of recyclables

- Recycle organic materials generated during site operations and maintenance
- Reduce outdoor energy consumption for all landscape and exterior operations
- Minimize generation of greenhouse gases and exposure to localized air pollutants during landscape maintenance activities

### 10.4.3. **MONITORING**

Monitor and document sustainable design practices to evaluate their performance over time and improve the body of knowledge on long-term sustainability.

# APPENDIX 11. CRIME PREVENTION THROUGH ENVIRONMENTAL DESIGN (CPTED)

## 11.1. CPTED Defined

CPTED is a proactive approach to deterring undesired behavior in neighborhoods and communities. CPTED is defined as "the proper design and effective use of the built environment that can lead to a reduction in the fear and incidence of crime and an improvement in the quality of life."[13] The basic premise of CPTED is that the arrangement and design of buildings and open spaces can *encourage* or *discourage* undesirable behavior and criminal activity. A report prepared for the National Institute of Justice noted that "physical features influence behavior" and the "[offenders] prefer to commit crimes that require the least effort, provide the highest benefits and pose the lowest risks"[14]. When all spaces have a defined use and the use should be clearly legible in the landscape, it makes it easier to identify undesired behavior. The following are the four key CPTED principles:

- Natural Access Control, including the placement of entrances, exits, fencing, landscaping, hours of operation and lighting. Natural access control helps to clearly differentiate public and private space.
- Natural Surveillance, including the placement of physical features, activities and people to maximize visibility. Natural surveillance increases the opportunity "to be seen" and therefore deters unwanted behavior.
- Territorial Reinforcement strategies put the spotlight on undesired behavior and activities, increasing the perception of being watched. Strategies include the use of physical attributes such as fences, paving materials, public art, signage and "security" landscaping materials to convey ownership of the space along the corridor and buffer private properties. Pedestrian scaled mile markers tagged with emergency ID or "address" codes; along with emergency phones (where cell service is not available) are key territorial reinforcement strategies.
- Maintenance is an expression of ownership of a property. Unmaintained facilities indicate that there is a greater tolerance of disorder and less control by the intended users.

A safety analysis of the project area highlighted a number of potential safety issues. The identified issues are listed in Table 13.

---

[13] "Designing Safer Communities" A Crime Prevention Through Environmental Design Handbook," National Crime Prevention Council, Washington D.C., pg.7.

[14] "Physical Environment and Crime: A Final Summary Report Presented to the National Institute of Justice", U.S. Department of Justice, National Institute of Justice, January 1996.

TABLE 13: IDENTIFIED CPTED ISSUES

| | |
|---|---|
| **Crime** | 1. Manage vegetation so that CV Link can be visually surveyed from adjacent streets and residences; select shrubs that grow below 2' in height and trees that branch out greater than 6' in height<br>2. Utilize thorny vegetation to eliminate entrapment areas and control off-path usage<br>3. Use uniform lighting to minimize shadowed areas and allow CV Link users to identify facial features from 20 yards away<br>4. Place benches and other CV Link amenities at locations with good visual surveillance and high activity<br>5. Create a "CV Link Watch Program" involving local residents<br>6. Proactive law enforcement of CV Link regulations |
| **Litter and dumping:** | 1. Place garbage receptacles at access points<br>2. Encourage local residents to report incidents promptly<br>3. Remove dumpsites as soon as possible |
| **CV Link user safety** | 1. Post regulatory signage<br>2. Provide mileage markers at quarter-mile increments and clear directional signage for orientation<br>3. Include signage encouraging users to bring water |
| **Unwanted vehicle access** | 1. Utilize landscaping to define the corridor edge, including earth berms, large boulders and fencing<br>2. Use bollards at intersections |
| **Vandalism** | 1. Select materials that are durable and vandal resistant<br>2. Use permeable fencing wherever possible<br>3. Respond through removal or replacement in rapid manner<br>4. Encourage local residents to report vandalism<br>5. Create a neighborhood watch program<br>6. Maintain good surveillance of the corridor<br>7. Involve neighbors in projects to build a sense of ownership |

## 11.2. Safety and Security Strategies

### 11.2.1. COMMUNITY ENGAGEMENT

Active and informed community members are a tremendous resource. Volunteer patrol groups have been used successfully to assist local government by reporting on conditions, picking-up litter, and filing safety reports. Ambassadors can provide guide and interpretative services, organize rides/walks, carry informational material, and generally promote CV Link. Community service organizations, school classes or clubs, church groups and businesses are often looking for outlets to support the community.

### 11.2.2. FENCING

Fencing can serve as a key design element define corridor edges and delineate between public and private property. Fencing installed along the corridor should be permeable, where feasible, to encourage natural surveillance opportunities. Where the corridor is fenced for long stretches, intermittent openings should be located to enable access at locations with good visibility from the surrounding neighbors.

### 11.2.3. GRAFFITI

Graffiti hurts communities in a number of ways and often encourages other undesired behaviors such as loitering, littering, crime and more graffiti. According to the Graffiti Hurts website[15] graffiti costs $1-$3 per year, per taxpayer, and accounts for lost revenue for transit systems, retail sales and declines in property values. The appearance of graffiti is perceived as an indicator that an area is in decline.

Rapid removal of graffiti is a key component to maintaining a safe corridor. Rapid removal signals to the taggers and the community that the path is cared for and being regularly observed. Data shows that graffiti removal within 24 to 48 hours results in a

[15] www.graffitihurts.org

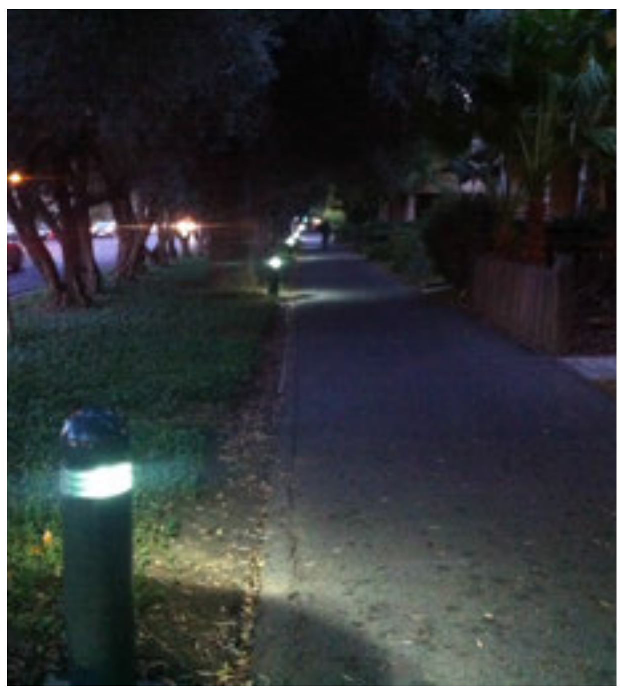
nearly zero rate of recurrence.[16] Signage should include the 911 contact number to report graffiti (e.g., immediately report any observed graffiti to 911).

### 11.2.4. LANDSCAPING

Landscaping that obstructs natural surveillance and allows entrapment areas or "hiding" places should be avoided.

- All groundcover and shrubs to be trimmed to a max. 24" above ground level height.
- Trees should be trimmed up to provide a minimum of 8' of vertical clearance within the corridor.
- Tree canopies should not obstruct pathway illumination.
- Hostile landscaping material (e.g. vegetation with thorns) can be used in strategic areas to discourage off-path use and eliminate entrapment areas.

### 11.2.5. LIGHTING



Adequate pedestrian-scaled lighting helps users observe their surrounding and respond to potential threats. Where lighting is installed on pathways, the illumination should:

- Be adequate to identify a face up to 20 yards away
- Have full cut-off fixtures to reduce light pollution
- Provide uniform coverage, eliminating dark pockets
- Provide good color rendition (the measure of light quality to replicate colors as viewed on a typical sunny day)
- Not be obstructed by tree canopies

The use of metal halide or light emitting diodes (LED) lamps is recommended, as they provide excellent color rendition. Color rendition is especially important when describing identifying features such as hair, clothing and vehicle color. Light quality is

[16] Jay Beswick and Ernie Garrett, Graffiti Prevention Systems, data from over 1,500 sites in Los Angeles County

as important as the quantity. Poor lighting, whether too bright or not bright enough can diminish safety.

Lighting should respond to the conditions of the site and meet the minimum standards set forth by the Illuminating Engineering Society of North America (IESNA) standards.

At high traffic (e.g. intersections) and more urban locations a higher degree of luminance may be required. Section 7.2.13 of the Guideline for Security Lighting for People, Property, and Public Spaces[17] notes that "Sidewalks, footpaths, and grounds supporting mass movement of persons should be illuminated to at least an average maintained luminance of 10 lux (1 fc), with an average-to-minimum uniformity ratio not greater than 4:1 during planned use periods."

### 11.2.6. LITTER AND ILLEGAL DUMPING

Staff or volunteers should remove litter as soon as possible. Litter receptacles should be placed at access points such as access points and intersections with other access points. CV Link should be patrolled for litter (not in receptacles) at least once a week and after any special events held on the pathway.

Vehicle barriers, regulatory signage and fines should control illegal dumping.

When it does occur, it must be removed as soon as possible in order to prevent further dumping. Neighborhood volunteers, friends groups, alternative community service crews and inmate labor should be used in addition to maintenance staff.

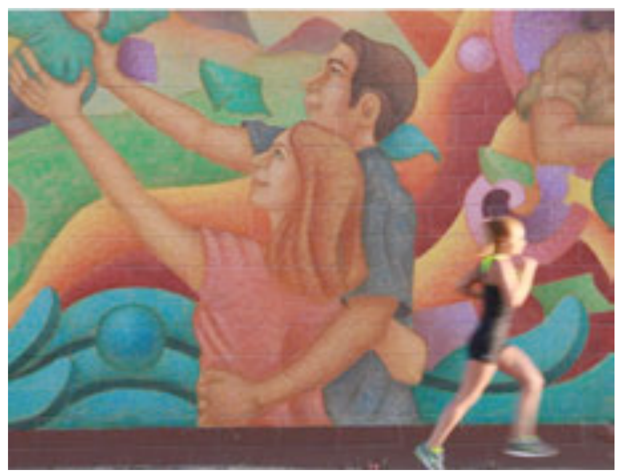
[17] IESNA Guideline for Security Lighting for People, Property, and Public Spaces" (G-1-03), section 7.2.13, Schools and Institutions (IESNA Security Lighting Committee 2003)

### 11.2.7. **PUBLIC ART**

Public art installations contribute and enhance a community’s identity and character, creating a strong “sense of place” branding. Public art incorporated into CV Link provides visual cues that it is “owned” and cared for by the community.

From a CPTED perspective, the use of public art in the landscape is an effective ‘target hardening” strategy. Public art can result in a large reduction of graffiti vandalism, can define trail edges, improve the appearance of the community, and discourage unwanted behaviors.

### 11.2.8. **MURALS**



CPTED practices encourage the installation of murals with faux windows and/or human features in areas where visibility is limited due to physical or other barriers. These types of murals have a psychological effect on people, conveying the perception of being watched.

The depiction of athletes in a mural promotes the perception of safety and the illusion of activity.

This perception can discourage undesired behaviors in an area. The National Crime Prevention Council reports “Community paintbrush murals are rarely defaced by graffiti and instill a sense of pride among those who live nearby.”[18]

[18] http://bit.ly/mOr7CY

### 11.2.9. **SEATING**

CV Link is designed for movement and users not moving can attract attention. However, periodic seating nodes on long stretches may be needed to accommodate senior citizens and families with small children. Care should be exercised in locating seating areas so that they have good visibility from the surrounding neighbors.

### 11.2.10. **WAY FINDING**


A comprehensive way finding system should be incorporated into the network. Way finding signage at major decision points should include the walking and bicycling times.

Pedestrian-scaled mile markers should be posted at one-quarter mile intervals. The mile markers should include either a GPS coordinate or an address identification number to assist emergency responders in locating users in need of assistance.