CSW | ST2

MEMORANDUM

To: Eric Chen, San Mateo County
From: Robert Stevens, CSW Stuber Stroeh Engineering Group
Date: October 2, 2019 (Original August 30, 2019)
Subject: Mirada Road Project Benefits and Alternatives Analysis (4122700)

The Coastal Trail along the Pacific Ocean in the communities of unincorporated San Mateo County and the City of Half Moon Bay is an incredibly popular destination for residents and tourists. The segment between Magellan Avenue and Mirada Road can exceed 1,000 walkers and bikers on a Saturday or Sunday. The trail includes a pedestrian bridge that crosses the Arroyo de en Medio, located just south of Medio Avenue.

Although the pedestrian bridge is only 15 years old, it has severe corrosion given it is constructed of weathering steel, which is not appropriate for a marine environment. San Mateo County has concluded that the bridge must be replaced to ensure safe access for pedestrians and bicyclists along this segment of the San Mateo coastline. This memorandum evaluates the benefits of the pedestrian bridge and potential alternatives to replacing the bridge.

BENEFITS OF THE PEDESTRIAN BRIDGE

The Mirada Road pedestrian bridge is an important link for residents, commuters, and tourists visiting the San Mateo coastline as it is the only nonmotorized crossing of the Arroyo de en Medio creek. Without the pedestrian bridge along Mirada Road, pedestrians and bicyclists would have to use Highway 1 to cross the creek. At this location, Highway 1 has a high volume of fast-moving vehicles, which is not safe for use by pedestrians and bicyclists as the street lacks sidewalks and bicycle lanes. A count of bicycle and pedestrian traffic on Saturday June 30, 2018 found over 700 pedestrians and 400 bicyclists using the bridge in one direction.

In addition to non-motorized access, the bridge provides a crossing of the Arroyo de en Medio, for electrical and sanitary sewer systems that serve the Miramar neighborhood. The electrical infrastructure is owned by Pacific Gas and Electric and includes both primary and secondary electrical circuits. Disruption of the connection across the Arroyo de en Medio with a collapse of the bridge would limit the reliability of the electrical system. The sanitary sewer infrastructure is owned by the Granada Community Services District (GCSD), which includes a 2-inch sanitary sewer force main connected to the pedestrian bridge and a 10-inch gravity sanitary sewer connected on the old concrete vehicle bridge. The 2-inch pipeline serves about 25 homes located south of the pedestrian bridge discharging wastewater to the District's collection system located to the north. The 10-inch pipeline was the former main collection system. However, it now serves as a by-pass to convey wastewater flows from the Miramar neighborhood should the existing pump system fail.

The following illustrates the financial impact to the community should the pedestrian bridge become damaged and require removal.

- Pacific Gas and Electric could theoretically replace the infrastructure using an overhead system along Mirada Road. The total cost to design, permit, and construct the facilities would be about $300,000. Note that the overhead lines were undergrounded in 2015 as part of a Rule 20A program. Placing an overhead system in this location is not consistent with local regulations.

- Based upon discussions with the GCSD, the County understands there is an option to re-route the sewer system to cross the Arroyo de en Medio at Alameda Avenue. GCSD notes that this requires about 150 feet of pipeline to be installed by trenchless methods and another 250 by open trenching. The total cost to design, permit and construct these improvements is about $400,000. Permitting to complete these improvements would require approvals from State and Federal regulatory agencies as well as the City of Half Moon bay.

- If the bluff eroded and destabilized the pedestrian bridge, the County would need to remove it as it would be a hazard. The estimated cost to mobilize to remove and dispose of the bridge and concrete abutments is about $300,000.

Therefore, the cost to re-route utilities, remove the pedestrian bridge, and install barriers on either side of the Arroyo de en Medio would be about $1 million.

A project benefit that is difficult to quantify, but important to note, is the Mirada Road bridge serves the Coastal Trail and is a critical component of the local transportation network. For pedestrians and bicyclists traveling north and south, the only connections across the Arroyo de Medio is along Highway 1 or the Mirada Road bridge. Highway 1 is not friendly for pedestrians and bicyclists, as only a narrow shoulder exists along the roadway with a large vehicle volume travelling at high speeds. Thus, the Mirada Road bridge is the primary means for non-motorized users traveling along the coast side. As previously noted, nearly 1,100 people use the bridge on a Saturday. The users of the trail and bridge are exercising, commuting by bicycle to work, visiting restaurants and beaches, as well as exploring the coast. Based upon local observation, nearly 50% of the trips are visitors to the community who spend funds in the restaurants and hotels within the community. It is important to note that many of the restaurant and hotel workers use the bridge to commute to their jobs by bicycle, reducing vehicle congestion. Finally, if the bridge did not exist, we could expect more patrons using vehicles to visit the amenities north of the bridge creating additional traffic and parking congestion.

If we assume that 100 of the 1,100 people currently using the trail stopped visiting the San Mateo coastline and each spent about $30 per trip, the economic loss would be about $3,000 on a Saturday. Should this occur 35 times per year, the overall loss would be about $100,000. Thus, the total potential cost for not repairing the bluff would be nearly $1 million the first year and, not including inflation, about $100,000 every year thereafter.

ALTERNATIVES

San Mateo County evaluated several alternatives for maintaining pedestrian and bicycle access along the coastline near the crossing of the Arroyo de en Medio. The alternatives investigated included:

1. No project;
2. Managed retreat, which relocates the pedestrian trail and bridge east – see **Figures 1** and **2**;
3. Removing the bridge and providing seasonal access to cross the Arroyo de en Medio – see **Figure 3**; and
4. Replace the bridge in its current location – see F**igures 4 and 5**.

Alternative 1: No Project

As discussed in the project benefits section, not protecting the crossing of the Arroyo de en Medio and the Coastal Trail from damage creates the following hardships for the community:

- Eliminates a safe pathway for pedestrians and bicyclists travelling along the San Mateo Coast. This places a specific hardship on low income commuters who use the bridge to travel to their places of employment;
- Sanitary sewer and electrical utilities would be damaged, potentially causing untreated sewage to flow into the ocean; and
- Creates a significant economic loss due to a reduction in tourism.

The cost to the County of San Mateo and local community for not completing the project could theoretically exceed $1 million the first year and about $100,000 every year thereafter. This assumes the County does complete removal of the bridge and re-routing of the utilities as previously described. If this is not completed, the costs could be much higher due to fines paid for wastewater released to the ocean, damage due to debris, emergency mobilization to restore service, and loss of access to properties related to no electrical/ sewer service.

Alternative 2: Managed Retreat

This alternative relocates the pedestrian bridge and the Coastal Trail inland as future sea level rise scenarios have the potential for increased bluff erosion, which could compromise the coastal trail as well as the Mirada Road pedestrian bridge. The retreat option investigated relocating the crossing to Alameda Avenue about 500 feet east of its current location.

The Coastal Trail is generally a Class 1 facility, meaning that it has at least a 10 feet wide all-weather surface with two 2-foot-wide shoulders. In the current configuration, south of the creek crossing, the trail meets this configuration except for a short segment when it enters the Mirada Road turnaround. To the north, trail users share the roadway with vehicles. In considering relocating the crossing, a linkage will need to be provided along Mirada Road, Alameda Avenue, and Medio Avenue. One alternative is the most basic trail accommodation as shown in **Figure 1**, which would be a Class III facility including the application of shared use markings along the roadways. The northern segment of Alameda Avenue from the crossing to Medio Avenue would require the application of asphalt as the street's surfacing is aggregate base; this would ensure

an all-weather accessible surface that requires minimal maintenance. The approximate construction cost to implement this option is $2.7 million, which includes $250,000 for surface (asphalt and striping); $950,000 for the bridge and foundation; $500,000 for design, permitting, mitigation, and inspection costs; and, as previously stated, $1 million to re-route utilities, remove the pedestrian bridge, and install barriers on either side of the Arroyo de en Medio.

A second alternative to the relocation of the overcrossing to Alameda Avenue as shown in **Figure 2** includes developing a Class 1 facility constructed along Mirada Road as well as both Alameda and Medio Avenues. This would likely require the removal of improvements private parties have installed in the public right of way as well as the need to acquire temporary construction easements to conform to existing conditions. The approximate construction cost to implement this option is $3.65 million, which includes $900,000 for surface (asphalt, sidewalk, and curbs); $950,000 for the bridge, foundation and foundation; $800,000 for design, permitting, mitigation, and inspection costs; and, as previously stated, $1 million to re-route utilities, remove the pedestrian bridge, and install barriers on either side of the Arroyo de en Medio.

The critical challenge with implementing this alternative is the time required to develop the project. The County expects significant negative feedback from community members related to relocating the trail, which could require a significant expenditure of funds related to environmental review and litigation. Thus, the County does not believe this is the preferred option.

Alternative 3: Seasonal Access

This option would remove the pedestrian bridge, abutment, and the old concrete bridge. The project would install stairs as shown in **Figure 3** from each of the trail approaches down to the Arroyo de en Medio. As the elevation difference is about 27 feet, this would require almost 50 stairs, which would require large structures on each side of the creek. The County would only allow access during periods where the creek does not flow, which is generally between June and November. In addition, during years where the sand is highly eroded and the tide washes up into the creek, the County may close the crossing for safety. As this option is not accessible to those with physical disabilities and not passible for bicyclists, the County does not consider the alternative as feasible.

Alternative 4: Bridge Replacement

Based upon investigation, the County found an aluminum pedestrian bridge vendor that can manufacture the bridge to fit the existing foundation. As it is lighter than the existing bridge, the project can re-use the existing abutment and foundation. Thus, the project can simply remove and replace the pedestrian bridge with a unit more suitable for a marine environment as shown in **Figures 4** and **5**.

As the cost to replace the pedestrian bridge is about $900,000 including design, permitting, and construction, the County seeks to ensure the bridge's foundation is protected from future bluff erosion. To stabilize the bluff, the County is seeking a 40-year design life. The purpose of the 40-year design life is to establish the highest benefit at the lowest cost to protect the pedestrian bridge, trail, and utility infrastructure for the foreseeable future. The anticipated sea level rise is a factor in selecting the option. For instance, 40 years from now, we can expect that as seas rise,

waves will begin overtopping Mirada Road requiring the construction of a taller wall to protect these facilities. A summary of bluff repair options includes the following:

1. Full height rock revetment. This option would install rock rip rap along the face of bluff. To create a stable configuration, the slope of the bluff will need to be flattened by expanding the base of the rip-rap reducing the beach area. In this option, the rock would extend about 40 feet into the beach. This is a lowest cost option ($3,000 per wall foot) but creates a large loss of beach area.

2. Full height shotcrete seawall with tie-backs. This option installs a series of anchors into the bluff that are grouted in place; concrete is sprayed onto the surface of the bluff preventing erosion. Note that this is not a simple soil nail wall, the anchors could extend 20+ feet landward, likely requiring easements from property owners. The wall covers the face of the bluff and extends below the current beach's sand layer either to a depth near that of the marine sedimentary rock or it could stop higher if the project installs rock at the toe to prevent scour. The cost of this wall is about $8,000 per wall foot.

3. Full height in-ground wall (secant pile or similar). This option installs a series of intersecting concrete piles to form a concrete wall that stabilizes the slope and creates a barrier to the flow of groundwater. This option could be designed to be raised in the future to accommodate sea level rise in conjunction with a wall that serves the remainder of Mirada Road. Typically, the wall is installed several feet back from the face of the bluff as the drilled holes serve as the form for the concrete. The cost of this wall is in excess of $15,000 per wall foot.

4. Hybrid system including a shotcrete/ revetment wall. This option installs rock revetment at the base of the wall to an approximate elevation of 5 feet with the remaining height completed as a shotcrete wall. The proper selection of rock is key to stabilizing the slope and preventing the migration of soil from the bluff. To prevent the migration of soil, the contractor places a backing layer of small rock (#2 or 3), a geosynthetic reinforcement fabric and finally the armor rock (1/4 to 1/2 ton) facing the ocean. The cost of this wall is about $6,000 per wall foot.

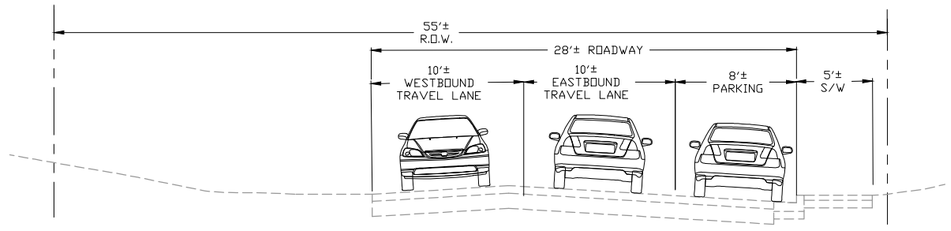
Each of the above options can be designed to serve a design life of 40+ years without structural failure. However, about 40 years from now, the frequency of overtopping will increase due to sea level rise. Since the full height rock wall likely removes beach area and the shotcrete wall has potential complications due to private property issues, the County evaluated the following two options:

- The full height in-ground wall offers the opportunity to be designed to meet today's wave heights but could be raised in the future to accommodate sea level rise. The approximate cost of this feature is $5.4 million. The estimate assumes the bluff is removed and shotcrete facing is applied during the wall's construction.
- The hybrid system provides protection to the bluff and improvements until waves begin to overtop due to sea level rise. The approximate cost for this feature is $2 million.

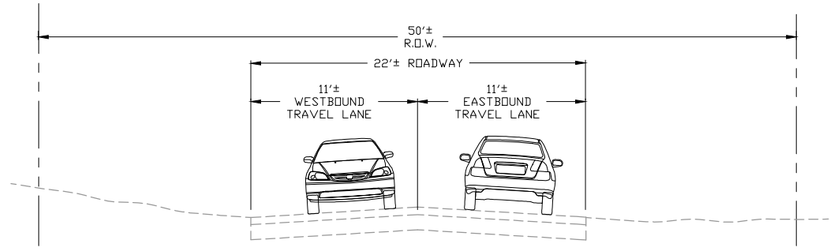
While the full height wall offers a long-term solution, the high cost to protect a small area of the coast exceeds the benefit. The hybrid system will serve the site for a reasonable time period until such a time that a regional solution to sea level rise can be implemented.

Preferred Alternative

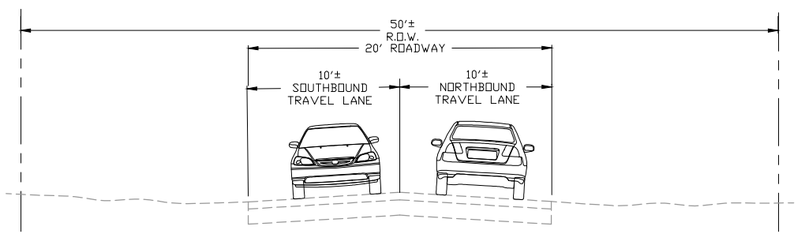
As there is no safe alternative for pedestrian and bicycle access along the Coastal Trail between Mirada Road and Medio Avenue, maintaining a pedestrian bridge crossing the Arroyo de en Medio is critically important for residents, tourists, and commuters traveling to their workplaces. Alternative 4, which replaces the pedestrian bridge with a prefabricated aluminum unit, is the preferred alternative. This alternative maintains the existing foundation offering the lowest cost and quickest installation. In conjunction, installing bluff protection adjacent to the bridge will protect it as well as the coastal trail for the foreseeable future.



1 CLASS III PATHWAY
SCALE: 1" = 10'–0"



2 CLASS III PATHWAY
SCALE: 1" = 10'–0"

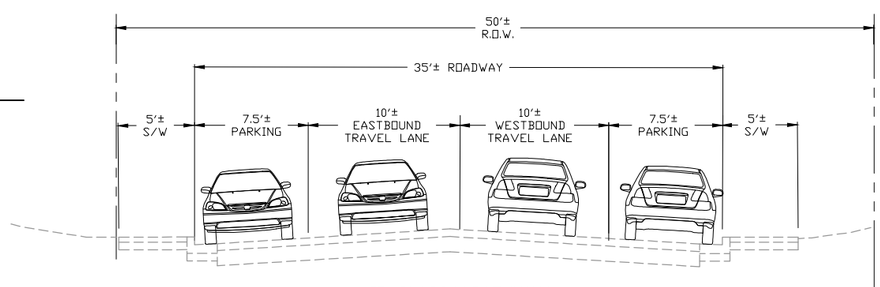


3 CLASS III PATHWAY
SCALE: 1" = 10'–0"

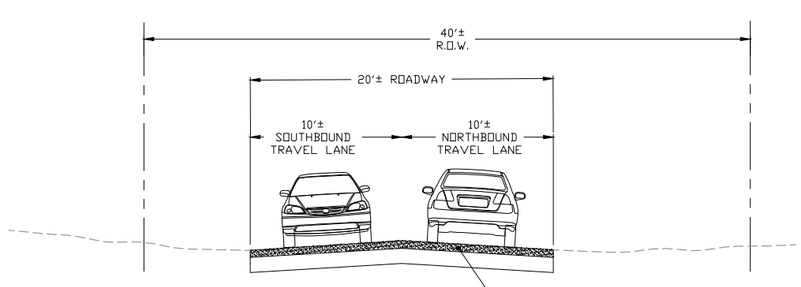
LEGEND

NEW A.C. PAVEMENT

SHARROW



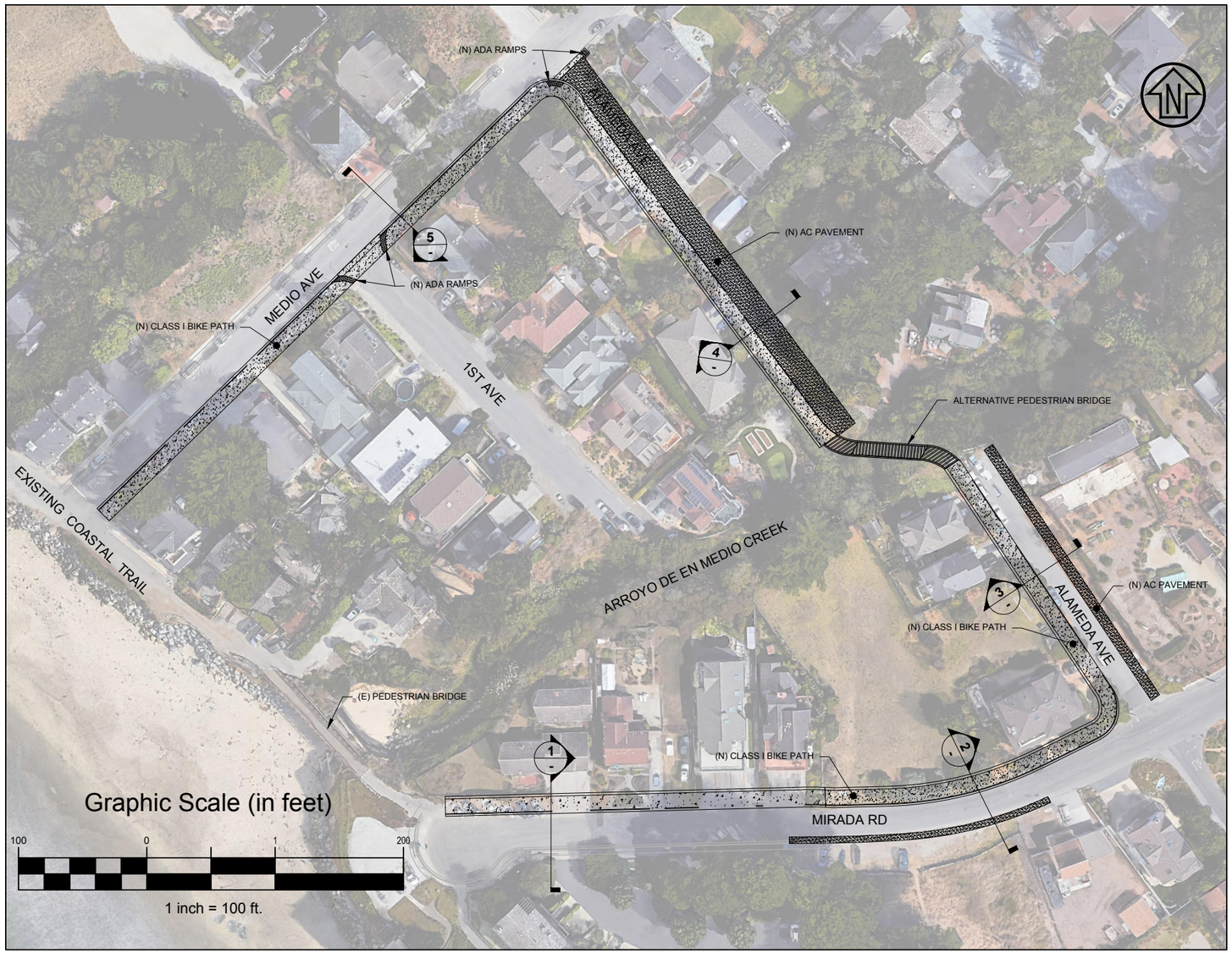
5 CLASS III PATHWAY
SCALE: 1" = 10'–0"

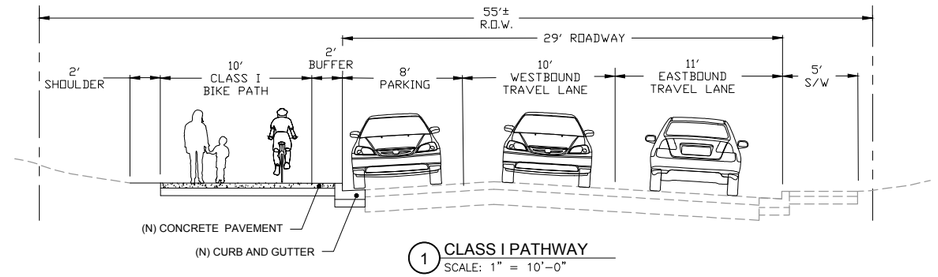


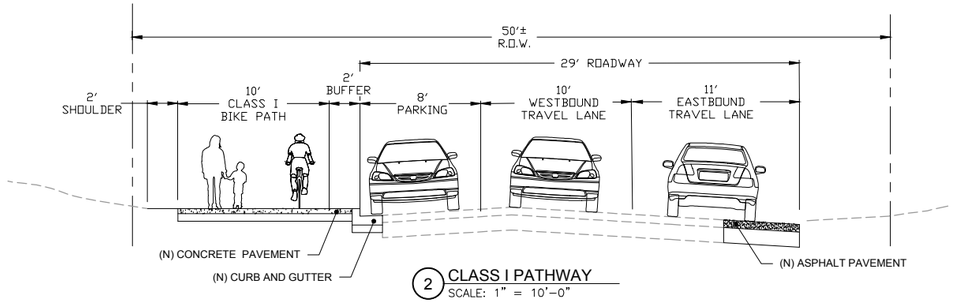
4 CLASS III PATHWAY
SCALE: 1" = 10'–0"

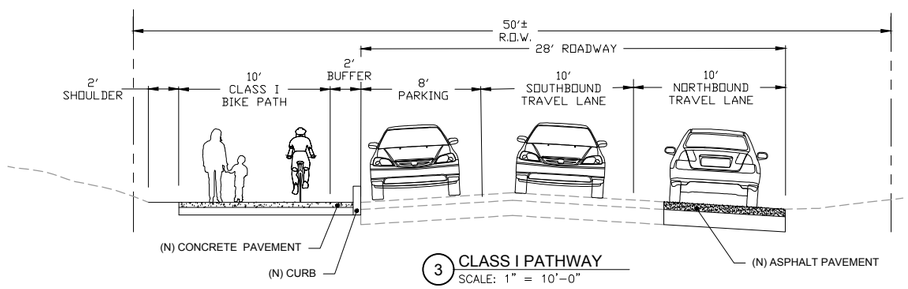
COASTAL TRAIL – MEDIO AVENUE TO MIRADA ROAD
ALTERNATIVE ARROYO DE EN MEDIO CROSSING LOCATION
OPTION 1

FIGURE 1





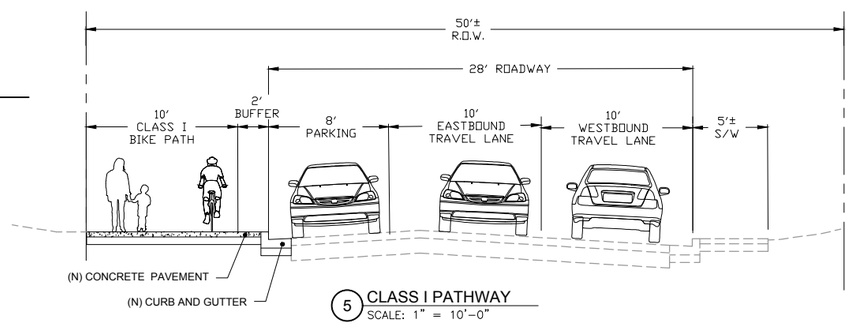


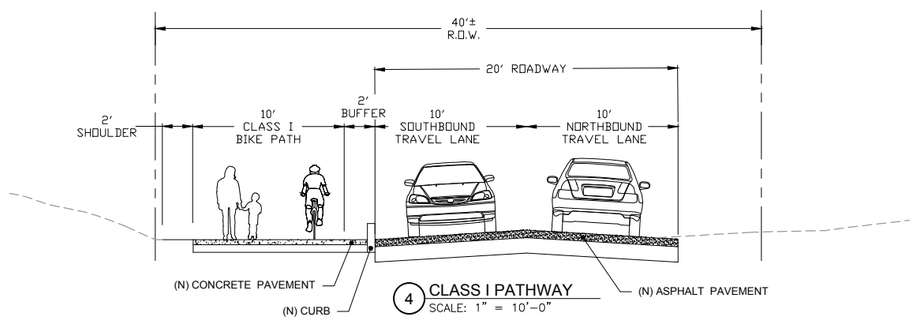


LEGEND

NEW A.C. PAVEMENT

NEW CONCRETE PAVEMENT





COASTAL TRAIL – MEDIO AVENUE TO MIRADA ROAD
ALTERNATIVE ARROYO DE EN MEDIO CROSSING LOCATION
OPTION 2

FIGURE 2

REGISTERED PROFESSIONAL ENGINEER
JAMES C. PORTER
C 48056
EXPIRES 12/31/19
CIVIL
STATE OF CALIFORNIA

APPROVED: _____

DATE: _____

JAMES C. PORTER, DIRECTOR OF PUBLIC WORKS
R. C. E. # 48056 / EXPIRES 12-31-2019

LEGEND

- BOUNDARY OFFSITE
- 100 CONTOUR MAJOR (5' INTERVAL)
- 99 CONTOUR MINOR (1' INTERVAL)
- FENCE
- GRADE BREAK LINE
- MONUMENT LINE
- RIGHT OF WAY
- SS SEWER
- STORM DRAIN
- TOE OF BANK
- TOP OF BANK

ABBREVIATIONS

AC	ASPHALTIC CONCRETE	IRR	IRRIGATION
BFP	BACK FLOW PREVENTER	L	LIGHTING CONDUIT
CL	CENTER LINE	RW	RIGHT OF WAY
CP	CONTROL POINT	SD	STORM DRAIN
CONC	CONCRETE	SL	STREET LIGHT
DEP	DEPRESSED	SS	SANITARY SEWER
E	ELECTRIC	SUAS	SMALL UNMANNED AERIAL SYSTEM
ELEC	ELECTRICAL	TBW	TOP BACK OF WALL
FDC	FIRE DEPARTMENT CONNECTION	TC	TOP OF CURB
FH	FIRE HYDRANT	TELE	TELEPHONE
FL	FLOW LINE	TYP	TYPICAL
G	GAS	TFW	TOP FACE OF WALL
GV	GAS VALVE	TW	TOP OF WALL
HV	HIGH VOLTAGE	W	WATER
HYD	HYDRANT	WV	WATER VALVE

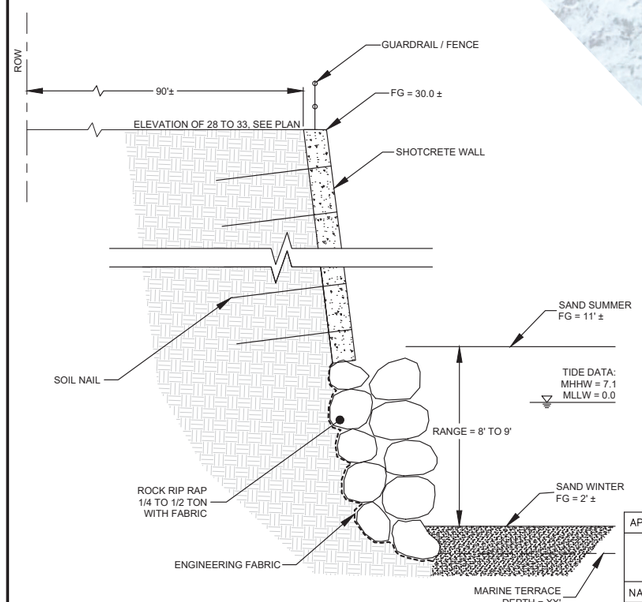
FIGURE 3

APPROVED DATE:	
NAME NAME, CITY ENGINEER	
HALF MOON BAY	
R.C.E. # 00000 / EXPIRES 00-00-0000	

APPROVED DATE:	
ROBERT C. STEVENS, P.E.	
CSW|ST2 ENGINEERING GROUP, INC.	
R.C.E. # 058660 / EXPIRES 12-31-2020	

COUNTY OF SAN MATEO PUBLIC WORKS

REVISION	DATE	DESIGNED BY: RCS	IMPROVEMENT PLAN	SCALE: AS SHOWN
		CHECKED BY: RCS	MIRADA ROAD	DATE: 06/21/2019
		DRAWN BY: MJV		FILE NO.: 4122700
		JAMES C. PORTER, DIRECTOR OF PUBLIC WORKS SAN MATEO COUNTY	555 COUNTY CENTER, 5th FLOOR REDWOOD CITY, CALIFORNIA 94063	
		FOR REDUCED PLANS ORIGINAL SCALE IS IN INCHES 0 1 2 3 4		5 SHEET 5 OF 7



SECTION 5A: SHOTCRETE / REVETMENT WALL

LEGEND

- BOUNDARY OFFSITE
- 100 CONTOUR MAJOR (5' INTERVAL)
- 99 CONTOUR MINOR (1' INTERVAL)
- FENCE
- GRADE BREAK LINE
- MONUMENT LINE
- RIGHT OF WAY
- SS SEWER
- STORM DRAIN
- TOE OF BANK
- TOP OF BANK

HATCH LEGEND

- NEW ASPHALT PAVING
- SHOTCRETE / REVETMENT WALL, SEE SECTION THIS SHEET, SEE NOTE 3

NOTES

1. TO ACCESS THE SITE WITH CONSTRUCTION EQUIPMENT SEE SHEET C-50.
2. ROUTE PG&E ELECTRICAL CONDUITS ALONG EACH SIDE OF THE NEW BRIDGE.
3. THE EXISTING ROCK RIP RAP AT THE LOCATION WHERE THE SHOTCRETE / REVETMENT WALL CONFORMS INTO THE EXISTING ROCK RIP RAP SHALL BE REMOVED AND REPLACED IN A MANNER TO ENSURE IT IS STABILIZED.

ABBREVIATIONS

AC	ASPHALTIC CONCRETE	IRR	IRRIGATION
BFP	BACK FLOW PREVENTER	L	LIGHTING CONDUIT
CL	CENTER LINE	RW	RIGHT OF WAY
CP	CONTROL POINT	SD	STORM DRAIN
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G	GAS	TFW	TOP FACE OF WALL
GV	GAS VALVE	TW	TOP OF WALL
HV	HIGH VOLTAGE	W	WATER
HYD	HYDRANT	WV	WATER VALVE

FIGURE 4

APPROVED DATE:	
NAME NAME, CITY ENGINEER	
HALF MOON BAY	
R.C.E. # 00000 / EXPIRES 00-00-0000	

APPROVED DATE:	
ROBERT C. STEVENS, P.E.	
CSW|ST2 ENGINEERING GROUP, INC.	
R.C.E. # 058660 / EXPIRES 12-31-2020	

REGISTERED PROFESSIONAL ENGINEER
JAMES C. PORTER
C 48056
EXPIRES 12/31/19
CIVIL
STATE OF CALIFORNIA

APPROVED:

DATE:

JAMES C. PORTER, DIRECTOR OF PUBLIC WORKS
R. C. E. # 48056 / EXPIRES 12-31-2019

COUNTY OF SAN MATEO PUBLIC WORKS

REVISION	DATE		
		DESIGNED BY: RCS	IMPROVEMENT PLAN MIRADA ROAD
		CHECKED BY: RCS	
		DRAWN BY: MJV	
		JAMES C. PORTER, DIRECTOR OF PUBLIC WORKS SAN MATEO COUNTY	555 COUNTY CENTER, 5th FLOOR REDWOOD CITY, CALIFORNIA 94063

SCALE: AS SHOWN
DATE: 06/21/2019
FILE NO.: 4122700

FOR REDUCED PLANS ORIGINAL SCALE IS IN INCHES 0 1 2 3 4

5
SHEET 5 OF 7

REGISTERED PROFESSIONAL ENGINEER
JAMES C. PORTER
C 48056
EXPIRES 12/31/19
CIVIL
STATE OF CALIFORNIA

APPROVED: _____

DATE: _____

JAMES C. PORTER, DIRECTOR OF PUBLIC WORKS
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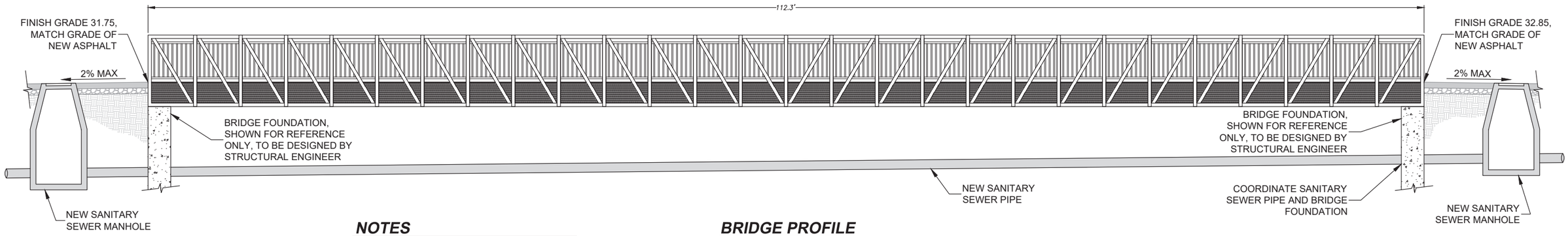


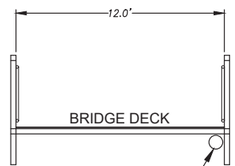
NOTES

1. BRIDGE SHALL BE A WELDED ALUMINUM BRIDGE WITH NON-SLIP DECKING.
2. BRIDGE DESIGN, PROFILE AND SECTION ARE PRELIMINARY AND SHOWN FOR REFERENCE ONLY.

BRIDGE PROFILE

Graphic Scale (in feet)

Scale: 1"=4'



BRIDGE SECTION

APPROVED DATE:	
NAME NAME, CITY ENGINEER	
HALF MOON BAY	
R.C.E. # 00000 / EXPIRES 00-00-0000	

APPROVED DATE:	
ROBERT C. STEVENS, P.E.	
CSW|ST2 ENGINEERING GROUP, INC.	
R.C.E. # 058660 / EXPIRES 12-31-2020	

FIGURE 5

COUNTY OF SAN MATEO PUBLIC WORKS

REVISION	DATE	DESIGNED BY: RCS	BRIDGE PROFILE AND SECTION PLAN	SCALE: AS SHOWN
		CHECKED BY: RCS	MIRADA ROAD	DATE: 06/21/2019
		DRAWN BY: MJV		FILE NO.: 4122700
		JAMES C. PORTER, DIRECTOR OF PUBLIC WORKS, SAN MATEO COUNTY	555 COUNTY CENTER, 5th FLOOR, REDWOOD CITY, CALIFORNIA 94063	
		FOR REDUCED PLANS ORIGINAL SCALE IS IN INCHES 0 1 2 3 4		7 SHEET 7 OF 7

C:\Users\michael\OneDrive\Documents\Projects\Mirada\Bridge\DWG\Sheet_Drawings\07_Bridge_24x36.dwg 07/01/2019 - 11:11 AM michael