

3. STATE ROUTE 1 at Surfer's Beach

California Department of
Transportation (Caltrans)

VULNERABILITY SUMMARY

State Route 1 (SR1) at Surfer's Beach is **highly vulnerable** to sea level rise. The section of road offers access to residential communities and recreational areas, serving approximately 28,000 vehicles per day. It is currently exposed to erosive forces, such as waves and water levels, that will only grow more severe with sea level rise. The highway's level of service is very sensitive to erosion damage and any inundation caused by waves. The section of the highway has low adaptive capacity because of its exposure to the open coast and the lack of nearby alternatives for the level of traffic it supports. Consequences from temporary or permanent loss of the highway are high.

SENSITIVITY High	EXPOSURE High	ADAPTIVE CAPACITY Low	CONSEQUENCES High
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ASSET CHARACTERISTICS

Cabrillo Highway (SR1) | El Granada

Asset Description and Function:

In El Granada, SR1 passes Coronado Street and Pillar Point RV Park at Surfer's Beach, primarily serving automobile, truck, and bicycle travel. The road is on a small cliff above the beach. Surfer's Beach serves 20,000 people locally, and the road accommodates an average of 28,000 cars per day. SR1 provides regional and wider tourist access to many small businesses, residential communities, beaches, and coastal state parks. There is a stormwater line under SR1 which runs north of the highway.



Asset Type	Transportation Infrastructure
Asset Risk Class	4
Size	153,479 square feet
Year of Construction	1949
Elevation	15 feet, MSL
Level of Use	28,000 vehicles/day
Annual O&M Cost	\$145,445
Special Flood Hazard Area	N/A
Physical Condition	Fair
Landowner	State of California
Underground Facilities	

A stormwater force main associated with Sewer Authority Midcoastside Plant runs under the highway (see AVP #2).

Environmental Considerations

Special status plants, animals, and natural communities may be present in the project area; a more detailed analysis will be needed before implementing adaptation strategies.



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ASSET SENSITIVITY

SR1 is well maintained and in fair condition. Nevertheless, it remains extremely sensitive to both present day and future impacts of flooding, erosion, and sea level rise. When temporarily inundated or damaged by erosion, this section of the road would be closed due to public safety concerns. For example, when waves have washed away riprap in the past, Caltrans has shut down the section of the SR1 entirely. The section of SR1 is reopened once water has drained and any damaged sections have been rebuilt.

Temporary flooding or damage from erosion would require the use of side streets, but those roads were not designed to accommodate the traffic demand on SR1. This detour would result in a reduction in level of service. If this segment of SR1 were permanently lost due to erosion or inundation, use of these side streets would not be viable, and recovering the level of service would require significant traffic rerouting.

California Coastal Trail west of SR1 at Surfer's Beach.



SHORELINE VULNERABILITY

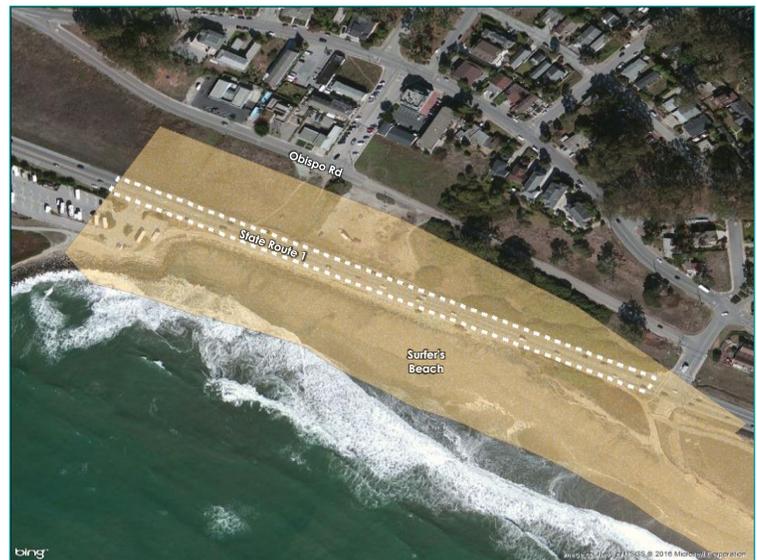
Erosion Extent

This segment of SR1 is within the area identified by the Pacific Institute study (2012) as susceptible to erosion by 2100 (the eastern extent of which is shown in yellow). The site was identified in the Santa Cruz Littoral Cell Sediment Management Plan as an Area of Concern due to its high usage and current bluff erosion during high tides and storm wave activity. See the "Exposure Discussion" section for more details.

Cross-Cutting Vulnerabilities

A force main for the storm sewer runs under SR1 to the SAM Plant in Half Moon Bay (see AVP #2). When the force main backs up from overloads at the treatment plant, there can be a sewage overflow at the open the grates north of SR1 at Surfer's Beach, which then drains through a culvert to Surfer's Beach, forcing the beach to close. Any disruption at Surfer's Beach affects recreation as the site is popular for beach access and offers connection to the California Coastal Trail.

Erosion Extent: Future erosion zone extends far east of SR1.



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SEA LEVEL RISE EXPOSURE ANALYSIS

Exposure Discussion

SR1 is highly exposed at Surfer's Beach. The beach itself is subject to daily high tides and wave action, which have caused significant beach erosion and created the need for repair and ongoing slope protection maintenance along this section of SR1. Since 1964, the beach has lost roughly 140 lateral feet due to erosive forces and a loss of neighboring sediment sources that could have supported beach replenishment. The presence of the jetty (US Army Corps of Engineers) north of Surfer's Beach that protects Pillar Point Harbor further exacerbates erosion because waves are redirected toward Surfer's Beach and are amplified as they approach the beach.

Long-term disruption of natural sediment processes in the Santa Cruz Littoral Cell contributes to the vulnerability at this spot because beach renourishment (an otherwise natural process) is insufficient to compensate for the sand loss.

This segment's exposure to high tides and wave action is likely to increase with sea level rise. Additionally, storm and sewer backup at the water treatment plant in Half Moon Bay has caused backup in stormwater lines, which then spill out of the grates north of the road, releasing water to cover the road and Surfer's Beach on its way to the Pacific Ocean.

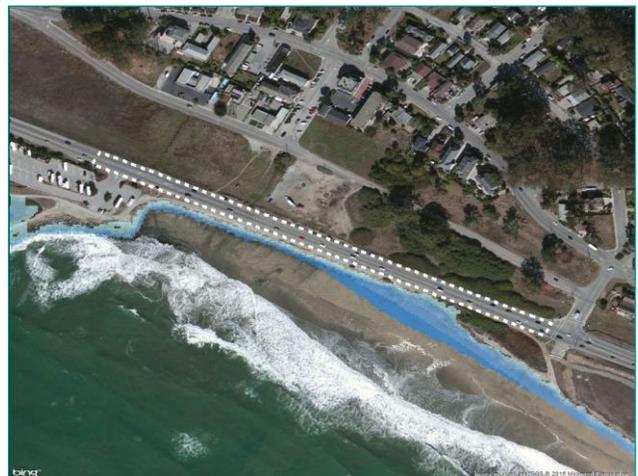
Exposure Analysis Results

Potential Inundation Depth (feet)		
Scenario	Minimum	Maximum
First Significant Impacts	Area Not Included in Overtopping Analysis	
Baseline 1% Flood	0	0
Mid-Level 1% + 3.3 feet	0	0
High-End 1% + 6.6 feet	0	0

Baseline Scenario: Asset not inundated.



Mid-Level Scenario: Asset not inundated.



High-End Scenario: Bike path inundated.



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ADAPTIVE CAPACITY, CONSEQUENCES, AND POTENTIAL ADAPTATION

Adaptive Capacity

The overall adaptive capacity of the asset is low. However, in the near-term, adaptive capacity is moderate as Caltrans is engaged in routine maintenance to maintain road access and repair the road expeditiously following a disruption. Future adaptive capacity to sea level rise is low because alternate routes, such as Avenue Alhambra and Obispo Road, are a slow and short-term alternative during temporary closures on this section of road. These routes are not considered suitable permanent alternatives for the volume of SR1 traffic, and they do not provide beach access.

Consequences

SR1 is an essential asset of local, county-wide, and regional importance. Direct damages to the road could require costly repairs (around \$2.7 million) and lead to considerable traffic delays due to detours. Traffic accidents may also occur on flooded or damaged roadways (prior to road closure). Delays could cause additional secondary economic impacts that are not yet quantified, including the value of time lost on a daily commute, or the loss of revenue for local businesses along the route. A permanent loss of this section of SR1 could potentially isolate the coastal communities that depend on it for daily transit to and from work, and elsewhere. If the rate of beach erosion continues, Surfer's Beach itself could be used less and less, until it is eventually forced to permanently close. Frequent traffic delays and beach closures would severely affect recreational activity in the area, and consequently reduce recreation- and tourism-related economic activity.

Additional Important Information

Emergency work has been underway to repair damage to the bike lane, and Caltrans is working on a long-term plan to address erosion to SR1 at this location. Erosion prevention and mitigation is challenging due to ongoing coastal processes (exacerbated by the jetty) and financial constraints. Currently, permit regulations restrict the size of the riprap that can be used to fortify the bank that supports the highway. This means a larger riprap could better protect the highway, but it is not presently allowed, presumably because it may increase erosion in adjacent areas; therefore, erosion continues at the site.

Asset-Specific Adaptation

Potential near-term adaptation measures include nourishing the beach or building a bridge over the erosion-sensitive areas. Long-term adaptation options are limited. It may be possible to implement a bypass for SR1, though the location options are limited. If the nearby jetty were to be removed, waves would be reduced, thus improving sediment transport, environmental conditions, and an overall decrease in erosion rates. Because erosion mitigation can have impacts "downstream", any armoring or other type of coastline solution will need to be coordinated.

Vulnerable Coastal Highways

There are Asset Vulnerability Profiles on the following vulnerable highways: Highway 101 (AVP #9) and SR 84 - HWY 101 Interchange (AVP #19). The vulnerability assessment analysis shows that there are 99.6 miles of vulnerable highways in the project area, including State Routes 54, 92, and 114.

California Coastal Trail west of SR1 at Surfer's Beach.



Construction and repair at Surfer's Beach.

