

**Memorandum – Coastal Engineering Review
GOGA Baker Beach Boardwalk and Stair Extension Review (Baker Beach,
California)
TAR 15460**

12 November 2020, Revised 02 December 2020

Review Request Summary

GOGA - Coastal Engineering Review of Proposed Design of Boardwalk and Stair Extensions to Baker Beach Accessible Ramp

Review

Introduction and Background

This memorandum presents comments regarding the evaluation of the proposed boardwalk and stair extension at the Baker Beach parking lot. Included in the proposed design is an extension of the stairs leading to the beach as well. The original structures were constructed from approximately March to June 2018 per review of Google Earth aerial imagery (refer to image below).



**Figure 1 - Google Earth Aerial Imagery from May 2018
Showing In-progress Construction of Accessible Ramp**

The accessible ramp is currently approximately 230 feet in overall length and at a slope up to but not exceeding 8 percent, in compliance with the Architectural Barriers Act Chapters 1-2 and 3-10 of the Americans with Disabilities Act and Architectural Barriers Act Accessibility Standards. When originally constructed, both the accessible ramp and stairs transitioned onto the beach smoothly. Since construction (per file *10-10-2020 SOW_R1 ramp & stairs.docx*) the sand has eroded, principally through daily wind action and storm events (per files *MChasse_email.pdf* and *waves_reaching_Baker_Beach_boardwalk_11-28-18.JPG*), leading to dangerous conditions for public beach access. According to park personnel sand is moved by maintenance staff to replenish these areas on a regular basis. However, once the sand erodes again, the conditions are severe enough that the beach is no longer in compliance with the ADA accessibility standards, and public complaints have been filed despite the ongoing maintenance efforts. The existing ramp transition and current conditions are shown in the figure below.



Figure 2 - Original 2018 (left) and Current 2020 (right) condition of the accessible ramp transition

NPS has requested that the proposed accessible ramp and stair extension designs be reviewed from a resiliency standpoint in order to assess the risk of similar erosion patterns rendering the proposed extension possibly dangerous to beach accessibility in the near future. For this review EA was not tasked with nor did the team review calculations or other background design information in detail but performed a cursory review to assess the resiliency and possible erosion risk for the accessible ramp and stair extensions.

Based upon this limited information review, EA is providing initial observations in section below as well as a summary based upon these.

Observations

1. As part of the review the EA team was provided the file *NY ERFO FIIS 2013-1(2)_ContractPlans.pdf* which shows the repair plans for the Fire Island, NY boardwalk that was destroyed during Hurricane Sandy in October 2012. It is understood the Baker Beach original boardwalk and stair design and the extension and stair design is based upon this design set. This set included significantly stronger connection elements to withstand submersion and the associated uplift forces, in addition to moving the board from the original alignment closer to the outer dunes inland, providing more natural protection than the previous alignment. Additional significant differences between the Fire Island and Baker Beach alignments include dense vegetation to disrupt both water and wave erosive forces, landing areas every 12 feet between

shallow slopes (5 percent), and both ends of the proposed boardwalk meet built constructed areas with set elevations.

Comment: The differences outlined above between the Fire Island site and Baker Beach site are sufficient to warrant an engineering review of the design elements for potential changes. Further, design standards for engineering differ significantly from New York to California in the structural practice of engineering.

2. The plans provided for construction bidding do not appear to be approved by a licensed professional engineer.

Comment: While sometimes a bid package is developed prior to design approval, the final construction drawings must be signed and sealed by a licensed professional engineer in the State of California. This is required by California State law and is paramount to protect public safety especially because this is a public facility. If not completed by NPS, this could be a stipulation to be completed and submitted for NPS review by the contractor who is selected to complete the construction prior to beginning construction.

3. The file *Plans for Ramp Extension.pdf* shows the construction plans for the ramp extension. The notes on Sheet 2 detail very specifically the construction materials. There are no specific details showing the embedment of the ramp extension.

Comment: Provide a construction detail showing the embedment of the ramp into the sand for contractor review and bidding.

4. The file *Stair Extension DWG at Boardwalk.pdf* shows the construction plans for the stair extension. Note 2 specifically calls out cutting the existing stairs and where to tie-in the new construction, with note 6 detailing the buried portion of the stairs. The shown elevation view details the splice to occur directly over the timber pile, with apparently a single bolt securing each timber stringer to the pile.

Comment: Review the tie-in detail proposed, as using half of a 3x12 timber stringer instead of a full timber element to bear on the timber posts should be verified for structural capacity, which is beyond the scope of this memorandum.

5. The notes on the plans and the bid solicitation documentation do not include any discussion of subsurface conditions or procedure should any resistance, such as a rock or other obstacle, be encountered during construction operations.

Comment: Provide a construction note on the plans or in the specifications to contact the engineer for direction should pile embedment not meet the required depth for analysis and direction.

6. Publicly available LIDAR information sourced from NOAA (link: <https://coast.noaa.gov/digitalcoast/data/coastallidar.html>) for the end of the existing ramp indicates an elevation of approximately +15.5 feet NAVD88. With the proposed extension length and slope, the future end of ramp elevation would be approximately +14.0 feet NAVD88. In reviewing the NOAA Station 9414290 – San Francisco tidal datums, the current MHHW tidal datum is +5.92 feet NAVD88. Estimates for SLR presented in the [State of California Sea-Level Rise Guidance](#) (2018) following the Medium-High projections with High Emissions indicate a +0.8 foot change by 2030, a +1.9 foot change by 2050, and a +6.9 foot change by 2100, leading to a new MHHW datum of approximately +6.72 feet by 2030, +7.82 feet by 2050, and +12.82 feet by 2100. This is a more conservative estimate than the estimated + 1.4 feet of sea level rise utilizing the RCP 6.0 projections from the Sea Level Rise and Storm Surge Projections for the National Park Service, dated 2018.

Reviewing the data from the National Data Buoy Center (NDBC) Station 46026 offshore of San Francisco provides a 100-yr offshore wave height of 33.5 feet, which would equate to a wave-induced setup of approximately +3 feet above still water level. Reviewing the various reported sea level rise values from the State of California Sea-Level Rise Guidance, the still water elevation plus wave-induced setup gives an inundation elevation of +12.5 feet in 2030, +13.6 feet in 2050, and +18.6 feet in 2100. Typical wave conditions lead to a wave-induced setup of approximately +1.8 feet in current conditions, leading to wave action occurring up to elevation +11.3 feet (+1.9 feet wave setup) in 2030, elevation +12.6 feet (+2.0 feet wave setup) in 2050, and elevation +15.9 feet (+2.3 feet wave setup) in 2100. All of the elevations in this section are in NAVD88 datum. Refer to the following Table that summarizes average conditions and storm conditions for the various timescales.

Table 1. Average Conditions and Storm Conditions for the Various Timescales

Year	MHHW Water Elevation	1% Annual Chance Storm Water Elevation	1% Annual Chance Storm Water Elevation Plus Average Wave Runup	1% Annual Chance Storm Water Elevation Plus 1% Annual Chance Wave Runup
Current	5.92 ft	8.7 ft	10.5 ft	11.7 ft
2030	6.72 ft	9.5 ft	11.3 ft	12.5 ft
2050	7.82 ft	10.6 ft	12.6 ft	13.6 ft
2100	12.82 ft	15.6 ft	17.9 ft	18.6 ft

It should be noted that the above information represents a statistical review of the site conditions. Winter conditions have been anecdotally observed to already impact the base of the existing ramp (refer to email *MChasse_email.pdf*). In addition, it is the responsibility of the designer to verify the information is appropriate for the proposed design.

Comment: Sea level rise, storm still water elevations and wave runup considerations, as noted above, indicate that the relative elevation of the extension of the board walk and stairs provides protection against most coastal wave action in the near future up to approximately 2050. Later in the century wave impact will be more likely. Because of this, changes to beach access should be considered in the future as these expected impacts increase the risk to the proposed configuration. The addition of additional hard infrastructure in this area will also become more of a maintenance concern in later stages of the current century as well. Besides the statistical information, the evidence presented that high water level events can currently impact the existing infrastructure should also be considered in planning for the project.

7. **Comment:** Based on our cursory review, these items are identified as possible modifications to the existing design which if utilized will require engineering design:
 - Possible utilization of sand stabilization mats to either stabilize the landing from the ramp end or possibly in place of the timber structure (example link: <https://shop.mobi-mat.com/>). This may also include geotechnical stabilization beneath the matting to prevent erosion.
 - Addition of transition plates, typically used in gangways or floating platforms (example link: <https://www.accudock.com/ada-compliant-docks-gallery-2/nggallery/page/2>), at the end of the timber walkway. This would allow for some erosion to occur prior to an unsafe beach access condition developing.

Summary

The design drawings for beach access improvements will likely address the immediate need to reduce access issues to Baker Beach at the end of the existing access ramp and stairs, however it is very likely that principally wind driven erosion in the area will jeopardize this situation in the near term as has been occurring since the construction of the current structure in 2018. Based upon this cursory design review, it is not known how the proposed depth of the end of the ramp and stairs of the new structure will change the regularity at which maintenance operations will need to replenish the sand in these two locations in the future. It is assumed that this will reduce the time frame between maintenance actions but will not eliminate it. It is possible that inclusion of additional infrastructure to either the end of the proposed or existing ramp, such as beach access matting or other technologies, could provide safe access to the beach as well, however it was beyond the scope of this review to specifically identify deployment of these. As noted above it is required by state law that the design drawings be reviewed and approved by an engineer through the design process or by the contractor prior to construction.

Sea level rise considerations, as noted above, indicate that the relative elevation of the extension of the board walk and stairs provides protection against most coastal wave action in the near future up to approximately 2050. Later in the century wave impact will be more likely. Because of this, changes to beach access should be considered in the future as these expected impacts increase the risk to the proposed configuration.

References

AccuDock®. ADA Compliant Docks Gallery. <https://www.accudock.com/ada-compliant-docks-gallery-2/nggallery/page/2>

California Natural Resources Agency and California Ocean protection Council. 2018. State of California Sea-Level Rise Guidance. http://www.opc.ca.gov/webmaster/ftp/pdf/agenda_items/20180314/Item3_Exhibit-A_OPC_SLR_Guidance-rd3.pdf

Mobi-mat® DESCHAMPS. Sand stabilization mats. <https://shop.mobi-mat.com/>

NOAA Office for Coastal Management. Coastal Topographic Lidar. <https://coast.noaa.gov/digitalcoast/data/coastallidar.html>