

San Francisco Bay Conservation and Development Commission

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TO: All Engineering Criteria Review Board Members

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SUBJECT: WETA San Francisco Ferry Terminal Project, 30% Design; Engineering Criteria Review Board Meeting
(For Board consideration on October 22, 2015)

Project Summary

Project Name. Water Emergency Transportation Authority San Francisco Ferry Terminal Expansion

Applicant. Water Emergency Transportation Authority (WETA)

Project Representatives. Michael Gougherty (WETA), Jamie Hurley, Steven Reel and Uday Prasad (Port of San Francisco), Ingrid Maloney, Azadeh Bozogzadeh, Dilip Trivedi, and Jim Brady (Moffatt & Nichol), John Gouchon (Langan Treadwell Rollo), Boris Dramov and Ivana Micic (ROMA Design Group).

Presenters: Mike Gougherty (WETA), Ingrid Maloney and Dilip Trivedi, P.E. (Moffatt & Nichol) and John Gouchon, G.E. (Langan).

Project Background. WETA currently provides ferry service to and from Alameda and Harbor Bay, Oakland, Vallejo and South San Francisco at the Downtown San Francisco Ferry Terminal. The agency is planning to expand ferry routes throughout the region to ease congestion on Bay Area roads and to improve the agency's mandated responsibility to provide emergency transportation services in the event of a disaster. Key to the WETA's expansion strategy is the San Francisco Downtown Ferry Terminal Expansion Project.

The project includes the expansion of the South Basin ferry terminal that includes changes to Gate E as well as the construction of two new gates – Gates F and G. The project would demolish Pier 2's existing approximately 21,023 square-foot deck and piles and dredging approximately 25,000 cubic yards for the new berths.

The project also includes construction of a new 37,000-square-foot Bayside Promenade to align with the existing promenade on the east side of the Ferry Building. The new promenade would also connect to the south apron of the Agriculture (Ag) Building to provide interim access until the renovation of the Ag Building is undertaken by the Port of San Francisco. In addition, the existing lagoon west of Pier 2 would be covered to create a new public plaza and a staging area for first responders and evacuation in the event of a major catastrophe. A portion of the promenade would include canopies for queuing and waiting.

An interim 105-foot long gangway would be installed from the ferry promenade to the Embarcadero promenade for a second means of egress and public access to the south (south of Ag Building).

Sea Level Rise. The project's Design Water Level (DWL) is 14.5 feet NAVD88. This elevation takes into account FEMA base flood elevation (BFE) of 11.4 feet NAVD88 and three (3) feet of SLR projections to the year 2068, the life of project. The existing landside Embarcadero Promenade and adjacent Ferry Plaza are at elevation 11.5 feet NAVD88.

According to WETA, the design reflects sea level rise projections for the 50-year life of the facilities as well as the ability to adaptively extend them beyond to year 2100 SRL projections. As part of the adaptation measures, a one-foot curb would be installed at the outer edge of the new ferry terminal promenade along the bay perimeter of the new promenade. The curb will not only raise the flood protection afforded to inland areas to 15.5 feet NAVD88, or the 2100 SLR projection, but will also prevent windblown trash from entering the Bay. In the future, in order to meet 2100 projections, the 42-foot access deck that extends from the ferry promenade to the portal gates would be sloped from 14.5 feet NAVD88 to 15.5 at the portal and gangway entrance. Proper drainage inlets at the deck ends toward the curb will be installed now as part of the project.

Note: NAVD88 and MLLW datums have been used interchangeably since both elevations are similar at this location.

Geotechnical Conditions and Seismic Design Criteria. *This criteria represents a thirty-percent (30%) design.* The South Basin improvements will be designed as an essential facility, with site-specific response spectra developed using the Next Generation Attenuation (NGA) relationships for the Western United States, the NGA-West 2 project.

The seismic design of the pier elements will follow the performance-based approach outlined in ASCE 61-14 (Seismic Design of Piers and Wharves). The design approach will be based on two seismic hazard levels consistent with the requirements in the 2012 Port of San Francisco Seismic Engineering Standard, CBC 2013 and ASCE 7-10:

- Basic Safety Earthquake or BSE (BSE-2N): the risk targeted is Maximum Considered Earthquake (MCER) per ASCE 7-10 defined as the lesser of the probabilistic spectrum having 2 percent probability of exceedance in 50 years in the direction of maximum response or the 84th percentile event on the governing fault in the direction of maximum response. The performance requirement criterion is Life Safety (1,000-year return).
- BSE-1N: the Design Earthquake (DE) defined as 2/3 of the MCER. The performance requirement criterion is Immediate Occupancy (475-year return).

The project material includes a memorandum by Langan Treadwell Rollo, dated 7 October 2015, and with subject "Development of the Site Specific Response Spectra and SSI Seawall Stability/San Francisco Ferry Terminal-Phase 2," presenting the development of site-specific spectra and the FLAC model that will be used to evaluate the stability of the seawall for the Downtown Ferry Terminal expansion. The memo is supplemental to the draft geotechnical

report dated 22 September 2015 included in the materials. The seawall/FLAC analysis is ongoing, and the rock time series presented in the draft geotechnical report above will be used as the input motions.

The information provided in the referenced memo and the results of the seawall stability analysis will be included in the final geotechnical report.

Current Conditions: The site is within San Francisco Port Authority property. It is currently occupied by two buildings (a two-story building known as the Agriculture Building and a one-story building, Sinbad's restaurant), a concrete and wooden deck around the east side of the Ag Building and west side of Sinbad's restaurant, and open water.

A concrete seawall was constructed in 1898 along the front side of the site and borders the eastern side of The Embarcadero. Drawings indicate that the seawall is supported on approximately 80-foot long timber piles that derive support from soft to medium stiff, compressible clay (Bay Mud).

The deck and buildings are supported on concrete piles with tip elevations ranging from approximately Elevation -38 to 70 feet with the west side of the Ag Building constructed directly over the seawall. Pier surface elevations around the Ag Building range from Elevation 8.84 to 10.50 feet NAVD. According to as-built drawings, the Ag Building is supported on pile foundations and partially supported by the seawall.

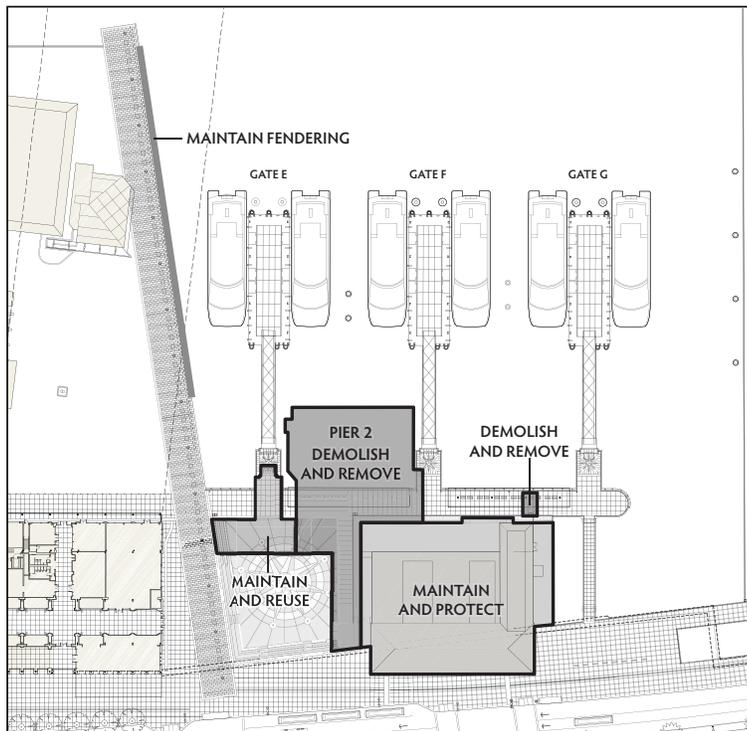


FIGURE 2.2-1: AREAS PROPOSED FOR DEMOLITION AND REPAIR

Law and Policy Considerations. The *McAteer-Petris Act* allows the Commission to approve fill¹ only when public benefits from fill clearly exceed public detriment from the loss of the water areas and should be limited to water-oriented uses (Section 66605).

Further, fill shall meet certain specific criteria, including that the fill be constructed "in accordance with sound safety standards which will afford reasonable protection to persons and property against the hazards of unstable geologic or soil conditions or of flood or storm waters" (Section 66605(e)) and that that the fill should be the "minimum necessary to achieve the purpose of the fill" (Section 66605(c)).

Within the Commission's 100-foot shoreline band, the Commission can only deny a project if it fails to provide the "maximum feasible public access consistent with the project" (Section 66632.4).

Additionally, in order to carry out its responsibility, the San Francisco Bay Plan includes policies regarding the safety of fills and climate change.

San Francisco Bay Plan Policies Regarding the Safety of Fills

1. Policy No. 1 states, in part, that the Commission has appointed and empowered the ECRB to:
 - “(a) establish and revise safety criteria for Bay fills and structures thereon; and
 - (b) review all except minor projects for the adequacy of their specific safety provisions, and make recommendations concerning these provisions...”
2. Policy No. 2 states, in part, that “even if the Bay Plan indicates that a fill may be permissible, no fill or building should be constructed if hazards cannot be overcome adequately for the intended use in accordance with the criteria prescribed by the ECRB.”
3. Policy No. 3 states, in part, that “to provide vitally-needed information on the effects of earthquakes on all kinds of soils, installation of strong-motion seismographs should be required on all future major land fills. In addition, the Commission encourages installation of strong-motion seismographs in other developments on problem soils, and in other areas recommended by the U. S. Geological Survey, for purposes of data comparison and evaluation.”
4. Policy No. 4 states, in part, that “[a]dequate measures should be provided to prevent damage from sea level rise and storm activity that may occur on fill or near the shoreline over the expected life of a project. The Commission may approve fill that is needed to provide flood protection for existing projects and uses. New projects on fill or near the shoreline should either be:

¹ Fill is defined in the *McAteer-Petris Act* as "earth or any other substance or material, including pilings or structures placed on pilings, and structures floating at some or all times and moored for extended periods, such as houseboats and floating docks" (Section 66632(a)).

- [a] set back from the edge of the shore so that the project will not be subject to dynamic wave energy,
- [b] be built so the bottom floor level of structures will be above a 100-year flood elevation that takes future sea level rise into account for the expected life of the project,
- [c] be specifically designed to tolerate periodic flooding, or
- [d] employ other effective means of addressing the impacts of future SLR and storm activity.”

San Francisco Bay Plan on Climate Change

1. Policy No. 2 states, in part, that “When planning shoreline areas or designing larger shoreline projects, a risk assessment should be prepared by a qualified engineer and should be based on the estimated 100-year flood elevation that takes into account the best estimates of future sea level rise and current flood protection and planned flood protection that will be funded and constructed when needed to provide protection for the proposed project or shoreline area. A range of sea level rise projections for mid-century and end of century based on the best scientific data available should be used in the risk assessment. Inundation maps used for the risk assessment should be prepared under the direction of a qualified engineer. The risk assessment should identify all types of potential flooding, degrees of uncertainty, consequences of defense failure, and risks to existing habitat from proposed flood protection devices.”
2. Policy No. 3 states, in part, that “to protect public safety and ecosystem services, within areas that a risk assessment determines are vulnerable to future shoreline flooding that threatens public safety, all projects should be designed to be resilient to a mid-century sea level rise projection. If it is likely the project will remain in place longer than mid-century, an adaptive management plan should be developed to address the long-term impacts that will arise based on a risk assessment using the best available science-based projection for sea level rise at the end of the century.”

BCDC Request for the ECRB’s Technical Advice. The Downtown Ferry Terminal is a major infrastructure project that would expand ferry routes throughout the Bay region and improve WETA’s ability to respond in the event of a catastrophe. Due to its location and anticipated high ridership, the ferry terminal and associated plaza, unlike similar structures around the Bay, will be designed as an essential facility requiring higher level design earthquake criteria. Therefore, BCDC seeks the expert advice of the Board regarding the adequacy of the project’s proposed overall safety standards as described in the materials. Among some of the issues of concern regarding the project are:

1. **Seismic, Structural and Geotechnical**
 - a. **The proposed promenade and other public access structures in the proximity of the Agriculture Building, the historic seawall and BART.** The project’s engineering performance-based approach is designed for life safety and immediate occupancy during and after a major earthquake. The new structures are designed to higher safety standards than existing surrounding historic facilities. The geotechnical

report indicates that the most significant geological hazards in the project are the potential for strong ground shaking and soil liquefaction, and that the soil behind the seawall is considered liquefiable. The report recommends that the potential for soil liquefaction and its effects on the performance of the seawall should be considered. Although there were no reports of landsliding into the Bay along the waterfront in the project area, the area behind the seawall liquefied during the 1906 and 1989 earthquakes. Similarly, there were no reports of landshifting along the waterfront such as at the adjacent Ferry Building, which is pile-supported. However, soil liquefaction behind the seawall during the 1989 Loma Prieta Earthquake resulted in up to four inches of ground settlement adjacent to the seawall and the Ferry Building, but without any noticeable lateral movement of the structures.

Given the geotechnical information, the Board's advice is sought on whether the proposed engineering strategy for the public plaza encompassed by historic structures would be sufficient to ensure the long-term safety and durability of the plaza and promenade

- b. **Potential Impact to New Deep foundation.** The new deep foundations of the public plaza would consist of 36-inch-diameter steel piles 12 feet away from existing seawall and penetrating the historic rock dike. The 24-inch-diameter steel piles of the new terminal promenade would be 37 feet and a similar distance away from the east side of the Ag Building, 17 feet away from the north side of the Ag Building and 8 feet – 10 inches from the concrete piles of the Ferry Plaza.

Based on the information and similar to the concerns in item 1a, the Board's advice is sought on whether the design criteria would mitigate most, if not all, of the possible risks to protect the stability of the project and its intended use?

2. Sea Level Rise and Flooding

- a. The design life of the project is 50 years. The applicant's team used the FEMA BFE plus sea level rise projections (County and City of San Francisco 2014) to estimate a top-of-deck design elevation of 14.5 feet NAVD88, an elevation three (3) feet higher than the current facilities. In addition, one of the adaptation measures proposed for end-of-century SLR projections include the installation of a one-foot curb along the bayside perimeter of the new deck and promenade and the future raising of the decks connecting the promenade and the access gates to the berths to an elevation of 15.5 NAVD88. The curb is meant to protect the promenade from flooding at projected year 2100 sea level rise. When adaptation measures become necessary, the entry portals, the gangways and the 42- by 27- foot deck areas in front of the entry portals would be elevated to 15.5 NAVD to meet the 2100 SLR projections.

An interim 105-foot long gangway would be installed for a second means of egress and public access at the south end of the Ag Building until the latter is structurally upgraded and a permanent promenade around the Ag Building is constructed.

Based on the information provided, the Board's advice is sought regarding the following:

- (1) Are there any engineering concerns about potential impacts to the overall proposed facilities from such curb side strategy?*
- (2) Is the proposed perimeter curb practical and realistic to prevent future flooding?*

Enclosed Material

1. "Basis of Design/Downtown Ferry Terminal Expansion South Basin," prepared by Moffatt & Nichol for Roma Design Group and Water Emergency Transportation Authority, September 17, 2015.
2. Plan drawings entitled "South Basin Downtown Ferry Terminal Expansion San Francisco CA," prepared by Moffatt & Nichol for Roma Design Group and Water Emergency Transportation Authority, October 1, 2015.
3. Draft "Geotechnical Investigation San Francisco Ferry Terminal-Phase 2/San Francisco, California," prepared for ROMA Design Group, San Francisco, California by Langan Treadwell Rollo, dated 22 September 2015.
4. Langan Treadwell Rollo 7 October 2015 Memorandum to Mr. Michael Gougherty-WETA on "Development of the Site Specific Response Spectra and SSI Seawall Stability/San Francisco Ferry Terminal-Phase 2."