

Peer Review of Proposed Float Size for Sausalito Ferry Terminal Improvement Project – Summary Report

COWI was retained by the City of Sausalito in May 2016 to perform a Peer Review of the Golden Gate Bridge Highway and Transportation District's (District) proposed float for the Sausalito Ferry Terminal Improvement (Project). The Peer review consisted of two phases.

Phase 1 (May 2016 – July 2016) – Review of Proposed Float Size based on District Assumptions

- COWI reviewed documents provided by the District related to the design of the terminal, see Section 1 below.
- COWI identified the key design criteria used by the District for the design of the terminal, see Section 2 below.
- COWI performed a Peer review of the terminal to verify if the float has been size appropriately using the District's design criteria. The Peer review and COWI's conclusions are based on accepting the District's criteria and the underlining assumptions related to passenger count and loading time. COWI made no assessment of the validity of the District's assumptions. See Section 3 for Peer review conclusions.

Phase 2 (Aug. 2016 – Sept. 2016) – Review of District's Passenger Loading Calculations

- COWI reviewed additional information provided by the District related to the assumptions/calculations used to size the width of the gangway and central walkway based on passenger boarding times. The width of the central walkway directly affects the overall width of the float (i.e. a one foot reduction to the central walkway would allow for a one foot reduction in the overall float width). See Section 4 for our review of the District's passenger loading calculations.

Section 1 – Summary of Information reviewed by COWI

The following is a summary of the communications and the documents reviewed by COWI (**key documents reviewed are listed in bold text**):

- a. May 11, 2016 – Lily Whalen of the City of Sausalito (City) sent Carolina Wallin of the District an email titled "*List of information from COWI*". The email contained a list of information needed by COWI to perform the review.
- b. May 16, 2016 – Carolina Wallin (District) sent Lily Whalen (City) a document titled "**Proposed Float Size Discussion – For City of Sausalito Peer Review**" (45-pages). Lily forwarded the document to COWI on May 23, 2016. The document was prepared by the District and their consultant Moffatt & Nichol (M&N). The document provides a discussion of the proposed float size, shows selected drawings and renderings of the proposed float, provides vessel data for the applicable ferries and provides schedules for the Sausalito ferry.
- c. June 1, 2016 – Lily Whalen (City) sent Carolina Wallin (District) an email titled "*List of information from COWI*". The email contained a list of additional items COWI required to complete the review.

- d. June 08, 2016 - Carolina Wallin (District) sent Lily Whalen (City) an email titled "**List of information from COWI**" (1-page). Lily forwarded the email to COWI on June 08, 2016. The email provided a response to the June 1, 2016 email. The District provided notes on where the missing information needed to complete the review could be found in the "*Proposed Float Size Discussion – For City of Sausalito Peer Review*" document along with some additional explanation of the design.
- e. June 09, 2016 - Adam Politzer (City) sent Denis Mulligan (District) an email titled "Sausalito Ferry Landing - Peer Review". The email contained five (5) questions from COWI related to the design.
- f. June 16, 2016 – Carolina Wallin (District) sent Adam Politzer (City) a document titled "**Responses to Questions from the City of Sausalito Received June 9, 2016**" (4-pages). Adam forwarded the document to COWI on June 16, 2016. The document responded to the five (5) COWI questions sent to the District on June 9, 2016.
- g. June 17, 2016 – Carolina Wallin and Denis Mulligan (District), Bo Jensen (M&N), Adam Politzer and Jonathon Goldman (City), and James Connolly (COWI) attended a Float Peer Review Meeting at Golden Gate Bridge Toll Plaza Building. COWI's June 09, 2016 questions and the District's responses were discussed. The District and M&N agreed to provide additional information to clarify some of the float design requirements.
- h. June 30, 2016 - Carolina Wallin (District) sent Adam Politzer (City) a document titled "**Additional Proposed Float Information for City of Sausalito Peer Reviewer**" (29-pages). COWI was cc'd on the email from Carolina. The document addresses issues raised by the City and COWI during their meeting with the District on June 17, 2016. Calculations were provided relating the width of the walkways, number of passengers, and ferry schedule. Information was also provided explaining how various dimensions were calculated.
- i. July 12, 2016 - Carolina Wallin (District), Bo Jensen and Azadeh Bozorgzadeh (M&N), and James Connolly and Casey Bowden (COWI) held a telephone conference call to clarify information provide in the June 30, 2016 document.
- j. July 13, 2016 – James Connolly (COWI) sent Carolina Wallin (District) an email titled "*Follow-Up Question requested by COWI about GG ferry Terminal*". The email summarized the four (4) outstanding questions discussed during the July 12, 2016 conference call.
- k. July 14, 2016 - Carolina Wallin (District) sent Adam Politzer (City) an email titled "**Follow-Up Question requested by COWI about GG ferry Terminal**". (2-pages). COWI was cc'd on the email from Carolina. The document provides responses to the four (4) questions sent by COWI on July 13, 2016.
- l. July 21, 2016 – Adam Politzer (City) sent Denis Mulligan (District) an email titled "**July 21st District/City Meeting - Request for Additional Information**" The email contained a list of four items the City needed from the District.
- m. August 11, 2016 - Carolina Wallin (District) sent Adam Politzer (City) a letter titled "**Additional Information per City of Sausalito 7-22-16 Request**". (385-pages). The document provides responses to the four (4) questions sent by the City on July 21, 2016.

Section 2 – Summary of Key Design Criteria for Float

The float size included in the District's proposed Project is governed by the following assumptions, requirements, and operational considerations.

Vessel Size – The District is retrofitting all of its ferry vessels, Spaulding class and Catamaran class, to enable two-door boarding and disembarking through two 8-foot doors from the main deck of the vessels. The centerline to centerline spacing of each door is 48 feet. See Exhibit 1 for additional information.

Number Passengers – The design of the proposed Project is based on the District's projected year 2029 maximum volume of passengers per trip using the 85-percentile volume. Note that the 85-percentile means that from 100% of the trips sorted in order from highest to lowest volume, the passenger volume representing the 85% spot on the list is used for the design. The estimate assumes 4% ferry passenger growth per year but notes that average growth in recent years was 7%. Based on these District assumptions the ferry passenger count used for design of the proposed facility is as follows. See Exhibit 2 for additional information.

408 total passengers (no bicycles) disembark from the ferry vessel onto the facility

512 total passengers (200 with bicycles) board from the facility onto the ferry vessel

Schedule – The existing Sausalito ferry schedule, from GoldenGate.org, shows the following turnaround times in minutes, where the turnaround times are the departure time minus the arrival time.

weekdays: 10*, 25, 10*, 30, 20, 25, 20, 20, 20, 15

weekends: 10*, 15, 15, 30, 20, 25, 20, 15

The proposed boarding facility has been designed by the District to allow the assumed number of passengers to disembark and board the ferry without delaying the District's preferred schedule. The District notes that, with the existing boarding facilities, in order to maintain the schedule, boarding must cease at a specified time which often leaves passengers behind while a less-than-full vessel departs. Based on the proposed boarding facility, the District has calculated a turnaround time ranging from 12.6 to 14.6 minutes. The District notes that this estimated turnabout time is based on ideal operational conditions and doesn't account for delays due to: poor weather, passengers not queued and ready to disembark upon ferry landing, security sweeps which encounter hazards that require immediate attention, passengers not familiar with the boarding procedure, and passengers with limited mobility. See Exhibit 3 for additional information.

* COWI assumes that the 10-minute turnaround times occur when ferries enter Sausalito empty and therefore the 3 to 5 minute security sweep is not required so the estimated turnaround time is 9.6 minutes. The District should confirm this assumption.

ADA Requirements – All sloped areas are limited to a maximum slope of 1 vertical to 12 horizontal per ADA guidelines. This requirement controls approximately 2/3 of the float width due to the gangway slopes as shown in Exhibit 4 (Ref. b, Figure 4). With respect to the length of the float, the ADA slope requirement controls the length of the Boarding Apron as shown in Exhibit 5.

Operational Considerations– In addition to the District's desire to design the Project to conform to the assumed passenger growth and schedule described above, the following operation considerations were applied by the District. At both the near and far ends of the float the District has determined minimum clearances for workers to access, maintain and repair the various features of the boarding facility. At the near end of the float the District has determined that a minimum of 5.5' in front of the gangway support is required along the float length to allow for at least two employees with their equipment to service the gangway support and stay a safe distance away from the float edge. See Exhibit 6 for additional information. At the far end of the float the District has determined that a 6' wide clear walking path is the minimum width required for worker safety. See Exhibit 7 for additional information.

Section 3 - Conclusions on if the float dimensions are optimized

Our conclusions regarding whether or not the float and walkway dimensions are optimized are summarized in the following section. The float width (53'-0") and length (145'-6") were reviewed. The dimensions of each key component were reviewed individually. See Figures 1 and 2 for the layout of the float and location of the key dimension reviewed.

Note that COWI's engineering review is based on the information provided by the District and their consultant M&N as listed in Section 1, the operational requirements established as the basis of design in the documents provided (size of vessels, number of passengers, ferry schedule, ADA requirements, tidal range, etc.), and COWI's independent calculation of key dimensions. The review is based on accepting the District's criteria and the underlining assumptions related to passenger count and loading time.

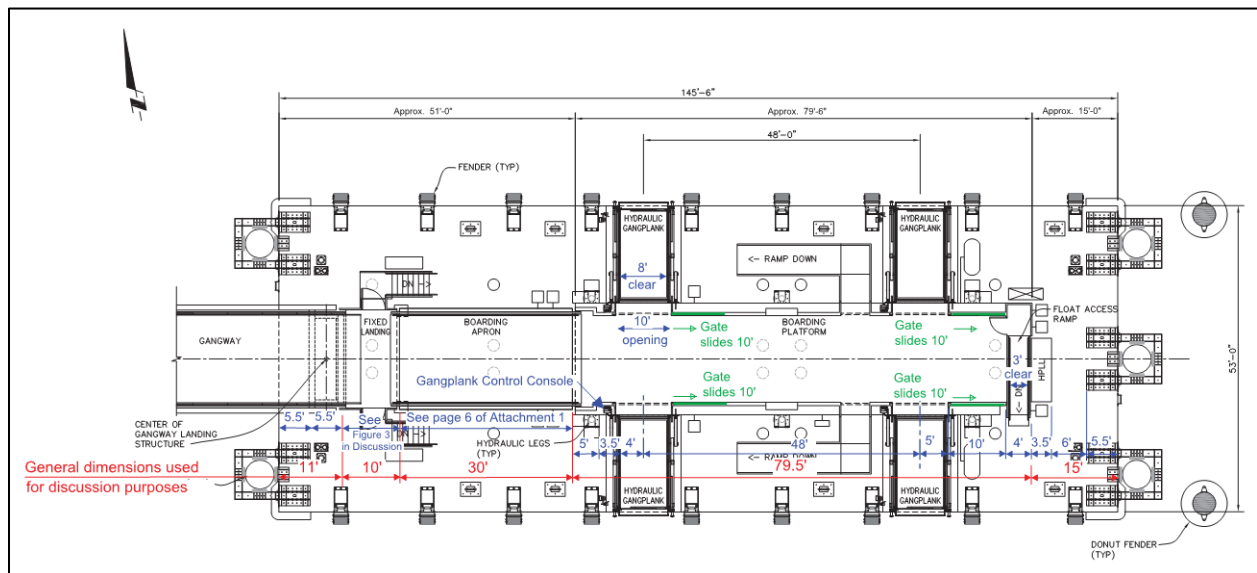


Figure 1 – Plan View of Float and Walkways

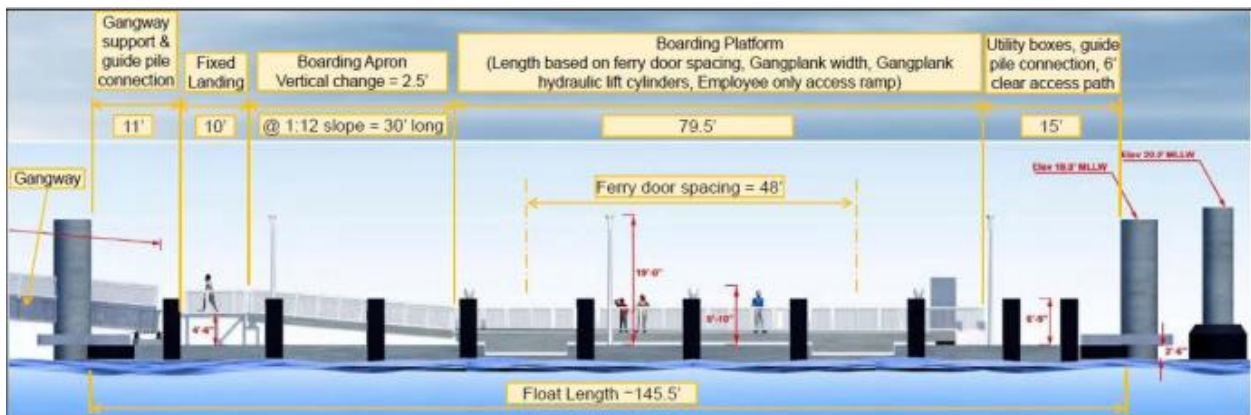


Figure 2 – Elevation View of Float and Walkways

Float Length (145'-6")

The proposed float length of 145.5' is composed of the various sections along the length of the float.

a. Near End - Gangway Support & Guide Pile Connection (11'-0")

The proposed 11'-0" Near End of the float consists of 5.5' of space for workmen to access the gangway rollers/pins for maintenance/repair and 5.5' for the gangway support structure. The details and assumptions of the District with respect to the 5.5' gangway support structure appear reasonable.

It appears that the 5.5' worker access space could be optimized based our review of the available information. This distance could be reduced by approximately 1ft.

In the response provided on July 14, 2016 the District indicates that "*the 5.5' worker access space is necessary for access and safety purposes.*" COWI has not been able to independently verify the need for 5.5' width for safety reasons. Typically safety requirements are established by the owner/end users in addition to governing regulatory agencies (California Building Code, OSHA, etc.). In this situation, the "safety reasons" appear to be an owner/end users requirement and COWI cannot offer a definitive conclusion on the provided width.

b. Fixed Landing (10'-0")

The proposed 10.0' Fixed Landing provides a flat transition between the Gangway and Boarding Apron. Although only 5.0' is required per ADA requirements, the 10.0' must include transition plates between the flat Fixed Landing and varying slopes of the Gangways and Boarding Aprons. The details and assumptions of the District with respect to these plates and other design constraints such as gaps at hinges appear reasonable. It is our conclusion that the Fixed Landing length is optimized.

c. Boarding Apron (30'-0")

The proposed 30.0' Boarding Apron length must accommodate 2.5' of vertical movement and is controlled by ADA requirements that slopes must not exceed 1:12. Our independent calculation confirms the 30.0' length. It is our conclusion that the Boarding Apron length is optimized.

d. Boarding Platform (79'-6")

The proposed 79.5' Boarding Platform length chiefly accommodates the spacing of the existing ferry doors (56.0' from the outside of the near door to the outside of the far door), 10.0' to store the rolling gates when passengers are disembarking and/or boarding the ferries, and 4.0' for an employee ramp (note that stairs cannot be used since the Boarding Platform moves up and down). The remaining 9.5' of length is occupied by hinge connections, hydraulic connections, gangplank consoles, etc. The details and assumptions of the District, along with our independent calculations support the 56.0' dimension. The 4.0' and 9.5' lengths appear to be reasonable. The 10.0' space provided to store the rolling gate could be optimized if the solid rolling gate was changed to a fabric mesh gate similar to the system used at the San Francisco Downtown Ferry Terminal Gate E, see Figure 3. The fabric mesh does not require significant space for storage, and the 10.0' space currently proposed could be reduced by 2 to 6 feet.



Figure 3 – San Francisco Downtown Ferry Terminal Gate E – Fabric Mesh Gate

COWI performed an independent check of the width of the two Hydraulic gangplanks. Our calculations confirm that the 8.0' width is controlled by the time it takes to unload and load the passengers from the vessel within the prescribed schedule. In addition, the District state that all of their vessels have been set up for 8 foot wide gangplanks. It is our conclusion that the length of the Boarding Platform could be optimized if the type of gates are changed from solid rolling to fabric mesh.

e. Far End - Utility Boxes, guide pile connection, 6' clear access path (15'-0")

The proposed 15.0' Far End of the float consists of 3.5' for hydraulic power units (HPU's), a 6.0' worker walkway and 5.5' for the guide pile collar connection to the float. The details and assumptions of the District with respect to the 3.5' width for the HPU's and 5.5' guide pile collar connection appear reasonable.

It appears that the 6.0' worker walkway space could be optimized based our review of the available information. Doors can be specified for the HPU's that open a full 180 degrees rather than 90 degrees and therefore do not obstruct the walkway. By eliminating the obstruction caused by the HPU doors would allow for the 6.0' worker walkway to be reduced by approximately 1 to 2 feet.

In the response provided on July 14, 2016 the District indicates that *"the 6.0' of clear worker access width is the minimum necessary for operational and safety purposes."* COWI has not been able to independently verify the need for 6.0' width for safety reasons. Typically safety requirements are established by the owner/end users in addition to governing regulatory agencies (California Building Code, OSHA, etc.). In this situation, the "safety reasons" appear to be an owner/end users requirement and COWI cannot offer a definitive conclusion on the provided width.

Float Width (53'-0")

The proposed float width of 53.0' is composed of the central walkway and gangplanks on either side of the walkway.

a. Central Walkway (16'-0")

The central walkway (Boarding Platform, Boarding Apron, Landing Platform and Gangway) provides access to and from the vessel to shore. COWI reviewed the District's rational for having a 16.0' walkway. The width is based on having two eight foot paths of travel feeding each of the 8.0' doors (8.0' door/path + 8.0' door/path = 16.0' walkway). The District maintains that the consistent 16' walkway is needed to maintain the District's preferred schedule. COWI has reviewed the District's calculations used to determine the 16' width and have provided comment in Section 4. The calculations indicate that the width of the central walkway may be able to be optimized by 2 feet while maintaining the District's preferred schedule.

b. Gangplanks (18'-6" x 2 Sides)

The gangplanks are located on each side of the central Boarding Platform. The 18.5' gangplanks are designed to be raised to meet high-freeboard catamarans or lowered to meet low-freeboard Spaulding class vessels. The slopes of the gangplanks must not exceed 1:12 per ADA for either vessel. Our independent calculation confirms the 18.5' length. It is our conclusion that the Gangplank length is optimized.

Summary

Table 1 summarizes COWI's conclusions on if the float dimensions are optimized using the criteria and assumptions provided by the District. Overall it is COWI's conclusion that the float length could be reduced by 4 to 9 feet and the float width by 2 feet.

Table 1 – Float Dimensions Summary

Feature	Length	Optimized	Potential Savings	Comments
Float Length	145.5'	Inconclusive	4.0' to 9.0'	Optimization may be possible.
a. Near End	11.0'	Inconclusive	1.0'	Current width controlled by safety requirements per District.
b. Fixed Landing	10.0'	Yes		
c. Boarding Apron	30.0'	Yes		
d. Boarding Platform	79.5'	Inconclusive	2.0' to 6.0'	If the solid rolling gate is changed to a mesh gate the space to store the gate can be decreased, reducing the overall length of the boarding platform.
e. Far End	15.0'	Inconclusive	1.0 to 2.0'	Current width controlled by safety requirements per District.
Float Width	53.0'	Inconclusive	2.0'	Optimization may be possible.
a. Central Walkway	16.0'	Inconclusive	2.0'	Conclusion is based on review of the District's passenger count and boarding time calculations presented in Section 4 of this report.
b. Gangplanks	18.5'x2	Yes		

Section 4 – Review of Passenger Loading Calculations

The District prepared a letter dated August 11, 2016 that provided responses to questions submitted by the City on July 22, 2016 (Exhibit 8). The response included calculations by the District summarizing the Off-Loading and Boarding times for the terminal when the gangway and center walkway width is reduced from 16-foot to 14-foot and 12-foot (Exhibit 9). The letter also included passenger data for the years 2014, 2015, and 2016 through July 9, 2016.

COWI performed a review of the passenger data provided by the District. COWI was not able to validate the District's assumption of 4% growth between years, and the statement that the average growth in recent years is 7%, based on the information provided by the District. The following table summarizes the total passenger count for the years 2014-2016 and the calculated % growth.

Table 2 – Annual Passenger Count

Year (Period of Data)	Total Annual Patrons	% Growth from prior year	Notes
2016 (1/2/16 to 7/9/16)	382,186	-4.6% decrease	Growth based on the same year to date period for 2015 (2015 total on 7/9/15 =400,851)
2015 (1/2/15 to 12/31/15)	813,047	1.8% Increase	
2014 (1/2/14 to 12/31/14)	798,234	-	

COWI reviewed the calculations provided by the District and also checked the boarding times if the width is further reduced to 10-foot. Our primary comment is that the off-loading and boarding time calculations are not consistent with the previous calculations from Carolina Wallin's memo dated June 30, 2016. To summarize:

- In the June 30, 2016 memo the off-loading and boarding times are calculated as the time it takes for passengers to pass through the ferry doors plus the time it takes for the passengers to walk to/from the ferry doors to the landside security gate. The time calculation to pass through the ferry doors explicitly includes the 8-foot width of the ferry doors while the time calculation to walk to/from the ferry doors from the landside security gate does not explicitly include the width of the walkways.
- In the August 11, 2016 memo the off-loading and boarding times are calculated for 14-foot and 12-foot walkways and compared to the time for the 16-foot walkway. The August calculations assume that the width of the 8ft ferry doors and hydraulic gangplanks have been reduced when only the width of the gangway, fixed landing, boarding apron and boarding platform should be reduced. The District ratioed the ferry doors and hydraulic gangplank widths using the same ratioed reduction applied to the central walkway width. This ratioing is incorrect as the ferry doors and hydraulic gangplank have not changed in each of the scenarios.
- If these discrepancies are corrected it appears that the extra turnaround time for a terminal with 14-foot and 12-foot walkways (and two 8-foot ferry doors and two 8-foot hydraulic gangplanks) is 0.4 minutes and 0.9 minutes respectively.

To clarify these points see Tables 3 and 4 below. Table 3 shows the off-loading and boarding calculations from both the June and August memos by the District for the 16, 14 and 12-foot walkways. Table 4 shows a corrected version of Table 3, where changes are shown in *red italics*. The 10-foot walkway width calculations have also been calculated by COWI following the methodology used by the District and included in each table.

Table 3: Off-Loading and Boarding Calculations by the District

Case	16' Walkway (from 30 Jun. 2016 Memo.)	14' Walkway (from 11 Aug. 2016 Memo.)	12' Walkway (from 11 Aug. 2016 Memo.)	10' Walkway
1a: Off-Loading - time to pass through ferry doors	408 pax without bikes / (20 pfm x 8' door x 2 drs.) = 1.3 min = 77 sec	77 sec x 16'/14' 88 sec = 1.5 min INCORRECT, SEE TABLE 4	77 sec x 16'/12' = 103 sec = 1.7 min INCORRECT, SEE TABLE 4	77 sec x 16'/10' = 123 sec = 2.1 min INCORRECT, SEE TABLE 4
1b: Off-Loading - time to walk to gate	233' / 3 fps = 78 sec, use 0 sec, see *	(233' / 3 fps) x 16'/14' = 89 sec, use 0 sec, see *	(233' / 3 fps) x 16'/12' = 104 sec, use 0 sec, see *	(233' / 3 fps) x 16'/10' = 124 sec, use 0 sec, see *
Off-Loading Sum (1a + 1b)	77 sec = 1.3 min	88 sec = 1.5 min	103 sec = 1.7 min	123 sec = 2.1 min
2a: Boarding - time to walk to ferry doors	403' / 2.5 fps = 161 sec	(403' / 2.5 fps) x 16'/14' = 184 sec	(403' / 2.5 fps) x 16'/12' = 215 sec	(403' / 2.5 fps) x 16'/10' = 258 sec
2b: Boarding - time to pass through ferry doors	200 pax with bikes / (12 pfm x 8' door x 1 door) = 2.1 min = 125 sec	125 sec x 16'/14' = 143 sec INCORRECT, SEE TABLE 4	125 sec x 16'/12' = 167 sec INCORRECT, SEE TABLE 4	125 sec x 16'/10' = 200 sec INCORRECT, SEE TABLE 4
Boarding Sum (2a + 2b)	286 sec = 4.8 min	327 sec = 5.5 min	382 sec = 6.4 min	458 sec = 7.6 min
1a + 1b + 2a + 2b	363 sec = 6.1 min	415 sec = 6.9 min	485 sec = 8.1 min	581 sec = 9.7 min
Sum of Other Tasks **	8.5 min	8.5 min	8.5 min	8.5 min
TOTAL TURNAROUND TIME	873 sec = 14.6 min	925 sec = 15.4 min	995 sec = 16.6 min	1091 sec = 18.2 min
EXTRA TIME	0 sec = 0 min	52 sec = 0.9 min	122 sec = 2.0 min	218 sec = 3.6 min

* The 3 to 5 minute security sweep takes place while off-loading passengers walk to the gate therefore that time is ignored when calculating the off-loading times.

** Other Tasks include: ferry landing (1.0 min), extending ferry gangplanks (1.0 min), security sweep (5.0 min), lifting gangplanks (0.5 min) and closing ferry doors/departing (1.0 min).

Table 4: Off-Loading and Boarding Calcs by the District *Modified by COWI (changes from Table 3 shown in red italics)*

Case	16' Walkway (from 30 Jun. 2016 Memo.)	14' Walkway (from 11 Aug. 2016 Memo.)	12' Walkway (from 11 Aug. 2016 Memo.)	10' Walkway
1a: Off-Loading - time to pass through ferry doors	408 pax without bikes / (20 pfm x 8' door x 2 drs.) = 1.3 min = 77 sec	<i>408 pax without bikes/ (20 pfm x 8' door x 2 doors) = 1.3 min = 77 sec</i>	<i>408 pax without bikes/ (20 pfm x 8' door x 2 doors) = 1.3 min = 77 sec</i>	408 pax without bikes/ (20 pfm x 8' door x 2 doors) = 1.3 min = 77 sec
1b: Off-Loading - time to walk to gate	233' / 3 fps = 78 sec, use 0 sec, see *	(233' / 3 fps) x 16'/14' = 89 sec, use 0 sec, see *	(233' / 3 fps) x 16'/12' = 104 sec, use 0 sec, see *	(233' / 3 fps) x 16'/10' = 124 sec, use 0 sec, see *
Off-Loading Sum (1a + 1b)	77 sec = 1.3 min	<i>77 sec = 1.3 min</i>	<i>= 77 sec = 1.3 min</i>	=77 sec = 1.3 min
2a: Boarding - time to walk to ferry doors	403' / 2.5 fps = 161 sec	(403' / 2.5 fps) x 16'/14' = 184 sec	(403' / 2.5 fps) x 16'/12' = 215 sec	(403' / 2.5 fps) x 16'/10' = 258 sec
2b: Boarding - time to pass through ferry doors	200 pax with bikes / (12 pfm x 8' door x 1 door) = 2.1 min = 125 sec	<i>200 pax with bikes / (12 pfm x 8' door x 1 door) = 2.1 min = 125 sec</i>	<i>200 pax with bikes/ (12 pfm x 8' door x 1 door) = 2.1 min = 125 sec</i>	200 pax with bikes/ (12 pfm x 8' door x 1 door) = 2.1 min = 125 sec
Boarding Sum (2a + 2b)	286 sec = 4.8 min	<i>309 sec = 5.2 min</i>	<i>340 sec = 5.7 min</i>	383 sec = 6.4 min
1a + 1b + 2a + 2b	363 sec = 6.1 min	<i>386 sec = 6.4 min</i>	<i>417 sec = 7.0 min</i>	460 sec = 7.7 min
Sum of Other Tasks **	8.5 min	8.5 min	8.5 min	8.5 min
TOTAL TURNAROUND TIME	873 sec = 14.6 min	<i>896 sec = 14.9 min</i>	<i>927 sec = 15.5 min</i>	970 sec = 16.2 min
EXTRA TIME	0 min = 0 sec	<i>23 sec = 0.4 min</i>	<i>54 sec = 0.9 min</i>	97 sec = 1.6 min

* The 3 to 5 minute security sweep takes place while off-loading passengers walk to the gate therefore that time is ignored when calculating the off-loading times.

** Other Tasks include: ferry landing (1.0 min), extending ferry gangplanks (1.0 min), security sweep (5.0 min), lifting gangplanks (0.5 min) and closing ferry doors/departing (1.0 min).

Exhibits 1 - 9

Exhibit 1 - Vessel Size (1/2) - [from Ref. b]

The District is retrofitting all of its ferry vessels to enable two door boarding and disembarking from the main deck. The width of these doors is eight feet. The proposed new boarding facilities will enable boarding and disembarking of all vessels from the same one level through two eight-foot wide doors, spaced 48 feet apart. M/S San Francisco, a Spaulding class, was the first ferry vessel retrofitted and resumed service in Sausalito in early 2016.

Spaulding Class

Example: M/S San Francisco

Catamaran Class

Example: M/V Napa

Example: M/V Mendocino

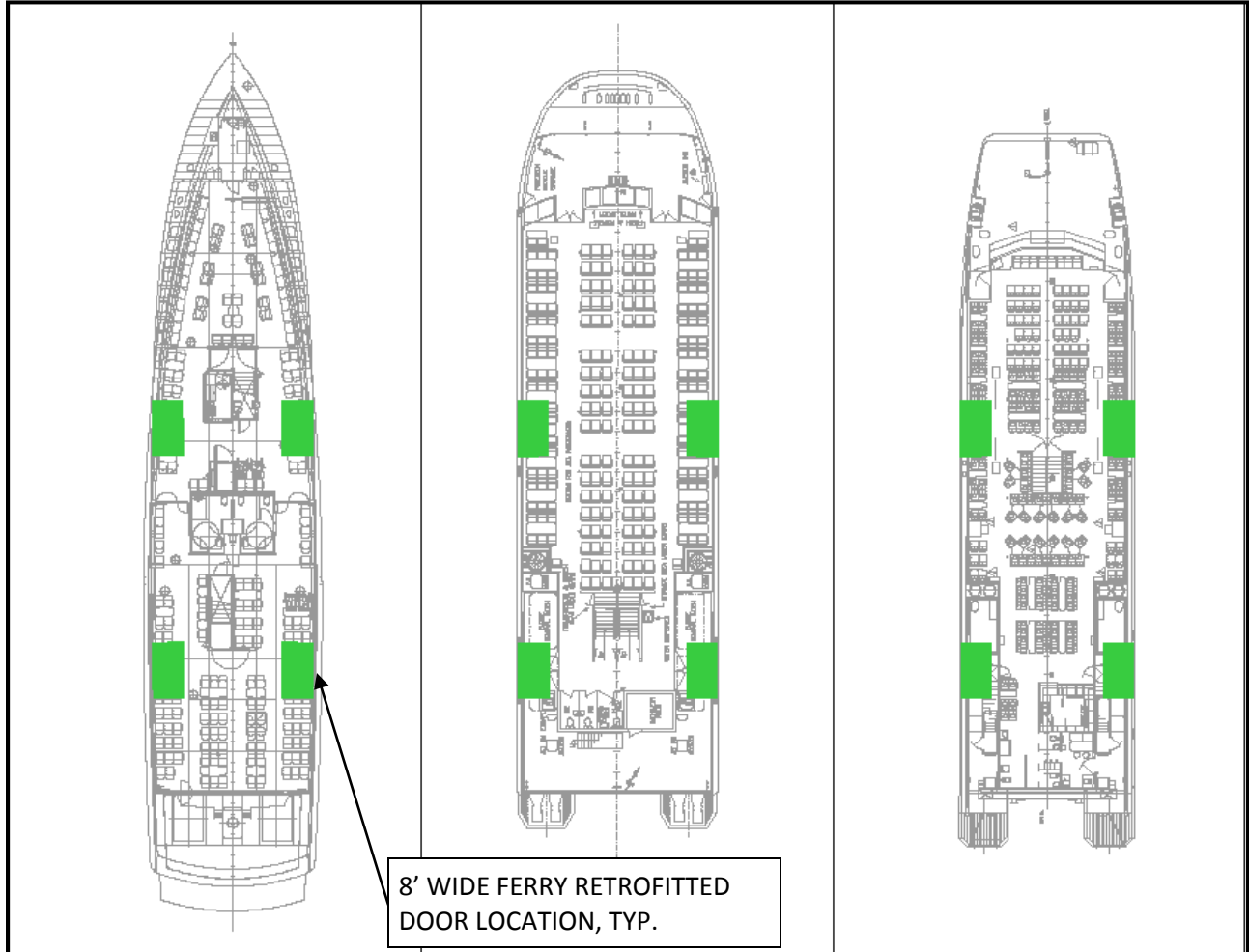
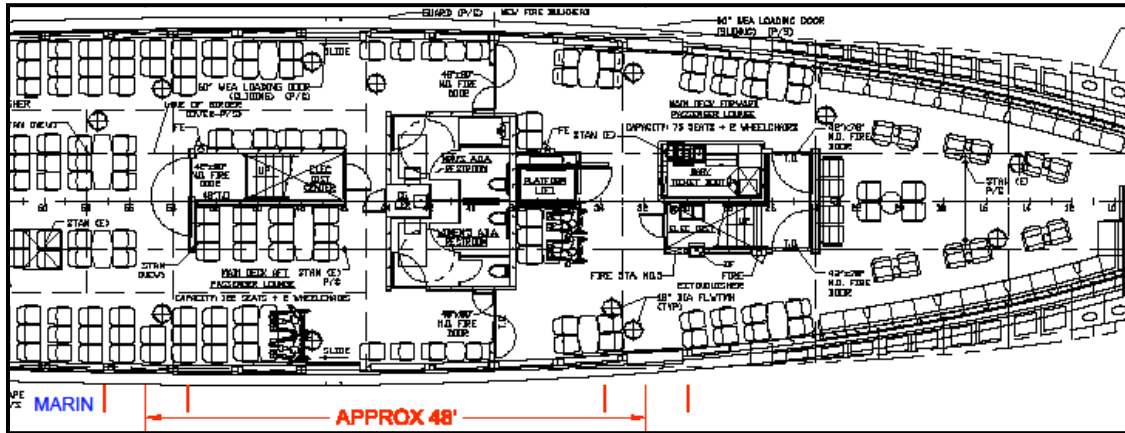
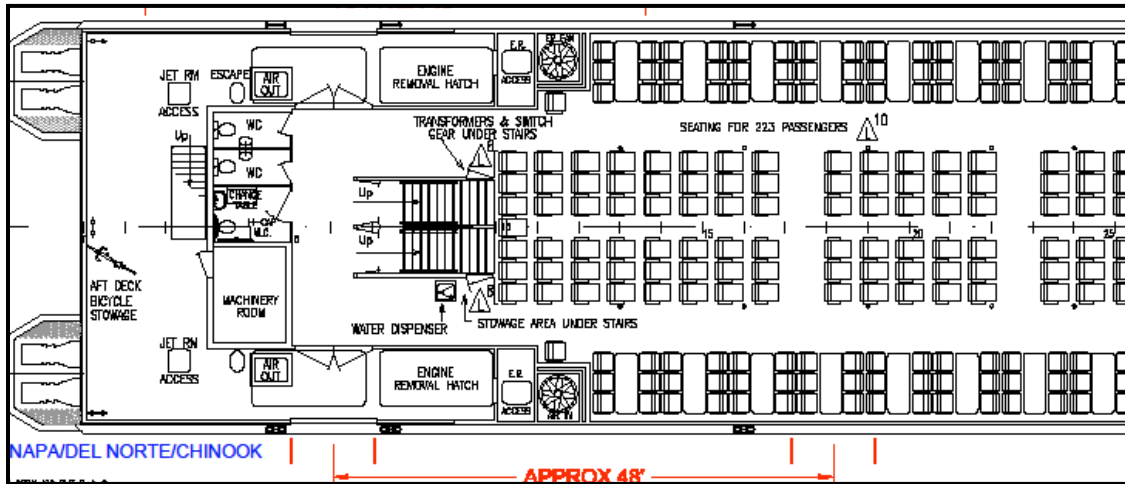


Exhibit 1 - Vessel Size (2/2) - [from Ref. b]

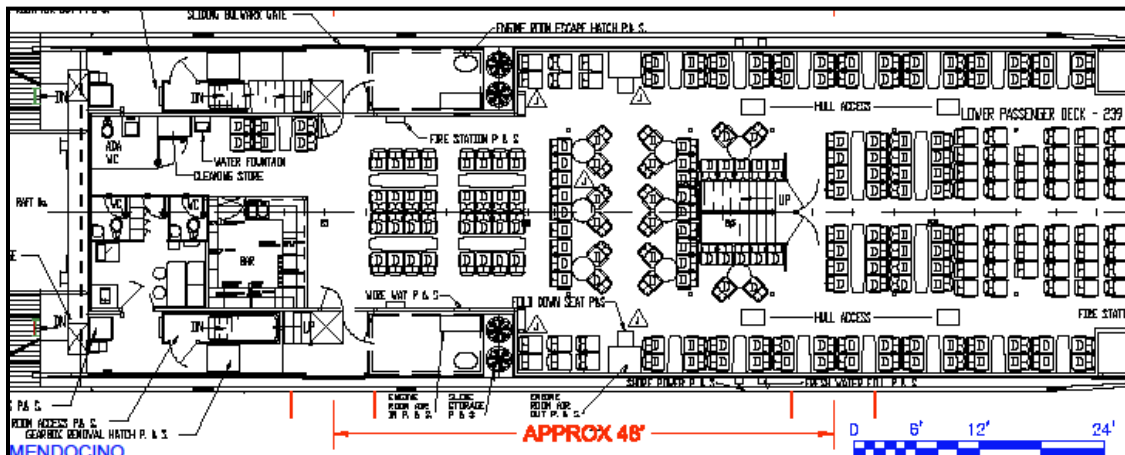
Spaulding Class – Retrofitted Door Locations – M/S Marin



Catamaran Class – Retrofitted Door Locations – M/V Napa and M/V Del Norte



Catamaran Class – Retrofitted Door Locations – M/V Mendocino



Responses to Questions from the City of Sausalito Received June 9, 2016

This serves to respond to the questions sent June 9, 2016 by the City of Sausalito to the District. The questions and answers are intended to facilitate in City of Sausalito's Peer Review of the proposed float dimensions.

1. *Q: The 16.0' clear width of the gangway, fixed landing, boarding apron and boarding platform is based on the ferries having two 8.0' wide doors being used simultaneously (Ref. A: page 3 of 7 second paragraph, Float-Dimension Discussion-Width). Also the 16' central walkway was sized "to accommodate passenger flow from each of the two ferry doors (coming out of the ferry, going into the ferry) being used simultaneously (operational consideration)" (Ref. C: page 5 of 14 first paragraph, Float Width). Please provide quantitative information to support the conclusion that the 16.0' width is needed to accommodate the desired boarding operations. For reference, minimum clear widths for some of the subject elements are: 36" gangway (Ref. B chapter V410.5), 36" fixed landing (Ref. B chapter V410.7.2) and 36" Boarding Apron (Ref. B chapter V405.5).*

A: The proposed width of the gangway is not driven by ADA access concerns, but by operational needs. Currently, disembarking and boarding at the existing facility is slow, due to a narrow passage way and single door access to the vessel. In order to stay on schedule, boarding must cease at a specified time, often leaving passengers behind while a less-than-full vessel departs. The new facility is designed to increase speed of disembarking and boarding to achieve full utilization of the vessel capacity.

To determine the appropriate width of the gangway and boarding ramps, the District estimated the volume of passenger growth through year 2029. Using a moderate 4% escalation factor of ferry passenger growth per year (note that in the recent years the growth was 7% on average), the maximum demand in the peak summer season in year 2029 is projected to exceed 700 passengers per trip. However, the design of the replacement boarding facilities is on the projected year 2029 maximum volume of passengers per trip using the 85-percentile volume (the 85-percentile means that from 100% of trips sorted in the order from the highest to the lowest volume, the passenger volume representing the 85% spot on the list is used for the design). Based on this, the ferry passenger count used for the design of the proposed facility is:

- 408 total passengers disembark from ferry vessel onto facility
- 512 total passengers board from facility onto ferry vessel (200 out of the 512 total passengers board with bicycles)

Based on these estimates, designers used "Pedestrian Planning and Design", revised edition, by John J. Fruin, to verify that the proposed facility is able to meet the projected passenger counts, within the current ferry schedule and without leaving queued passengers behind. This document is considered to be standard for ferry facility design. This document presents different level-of-service (LOS) descriptions for walkways and queuing areas. The LOS ranges from A (pedestrians freely chose their own walking speed and have no space restrictions) to F (close and unavoidable contact with others causing physical and psychological discomfort). The information provided for each LOS does not account for passengers with bicycles, so assumptions were made based on observations to determine the applicable LOS criteria for passengers with bicycles. The following LOS requirements for the proposed design were chosen to be consistent with the currently observed conditions at the existing facility:

- Passengers walking while disembarking: LOS D/E = 10 sf/pax , 20 pfm
 - Passengers walking while boarding: LOS E = 8 sf/pax , 23 pfm
 - Passengers walking with bicycles while boarding: LOS E = 36 sf / pax (4' x 9') , 12 pfm
 - Passengers while queuing (waiting in line): LOS C/D = 7 sf/pax
 - Passengers with bicycle while queuing (waiting in line): LOS C/D = 32 sf/pax (4' x 8')
- Note: sf = square feet; pax = passenger; pfm = passengers per foot width per minute

Applying the LOS requirements, it was determined that a 16' wide clear path for passengers is the minimum width required to keep the current ferry schedule with the projected passenger counts. This also helps with passenger flow from the two 8' wide ferry doors by not introducing intentional choke points on the float design.

Additional Proposed Float Information for City of Sausalito Peer Reviewer

On May 16, 2016, in response to a request from the City, the District submitted information regarding the District’s proposed float size, including a discussion on the float dimensions, construction drawings, renderings, and ferry vessel information and schedules. The City has hired a consultant, COWI, to peer review the District’s float design. The City’s peer reviewer had additional questions and the District responded on June 16, 2016 with a document titled “Responses to Questions from the City of Sausalito Received June 9, 2016”. On June 17, 2016, the District and their consultant, Moffatt & Nichol, met with the City of Sausalito and their peer reviewer to discuss the items that have been submitted to the City by the District regarding the proposed float size. During the June 17, 2016 meeting, the peer reviewer requested additional information from the District. The additional information requested is provided in this document.

- 1. *Provide more information and calculations for the 16’ clear width provided on the float. Relevant information was received on June 16, 2016 but more clarity is requested. Show that this dimension is necessary for the ferries to stay on schedule.*

A: Based on the criteria described in our previous response to comments (specifically see “Responses to Questions from the City of Sausalito Received June 9, 2016” dated June 16, 2016), the calculated turnaround time for a Spaulding Class ferry in Sausalito is shown below. The turnaround time shown is based on ideal operational conditions. Situations not accounted for in the ideal turnaround time that will increase turnaround time include: ferry docking delays due to poor weather conditions, passengers not queued and ready to disembark upon ferry landing, security sweep encounters a safety hazard that requires immediate attention, boarding passengers are not familiar with the boarding procedure, and passengers with limited mobility. Summary calculations as requested are provided in Attachment 2. Other tasks must be done within the ferry turnaround time (listed below) regardless of the clear width distance provided on the float for passengers.

• Ferry landing	1.0 min	1.0 min
• Extend and place gangplanks on ferry	1.0 min	1.0 min
• Disembark passengers	1.3 min	1.3 min
• Security sweep ¹	3.0 min	5.0 min
• Board passengers	4.8 min	4.8 min
• Lift Gangplanks	0.5 min	0.5 min
• Close doors and depart	<u>1.0 min</u>	<u>1.0 min</u>
 Total estimate turnaround time	 12.6 min	 14.6 min

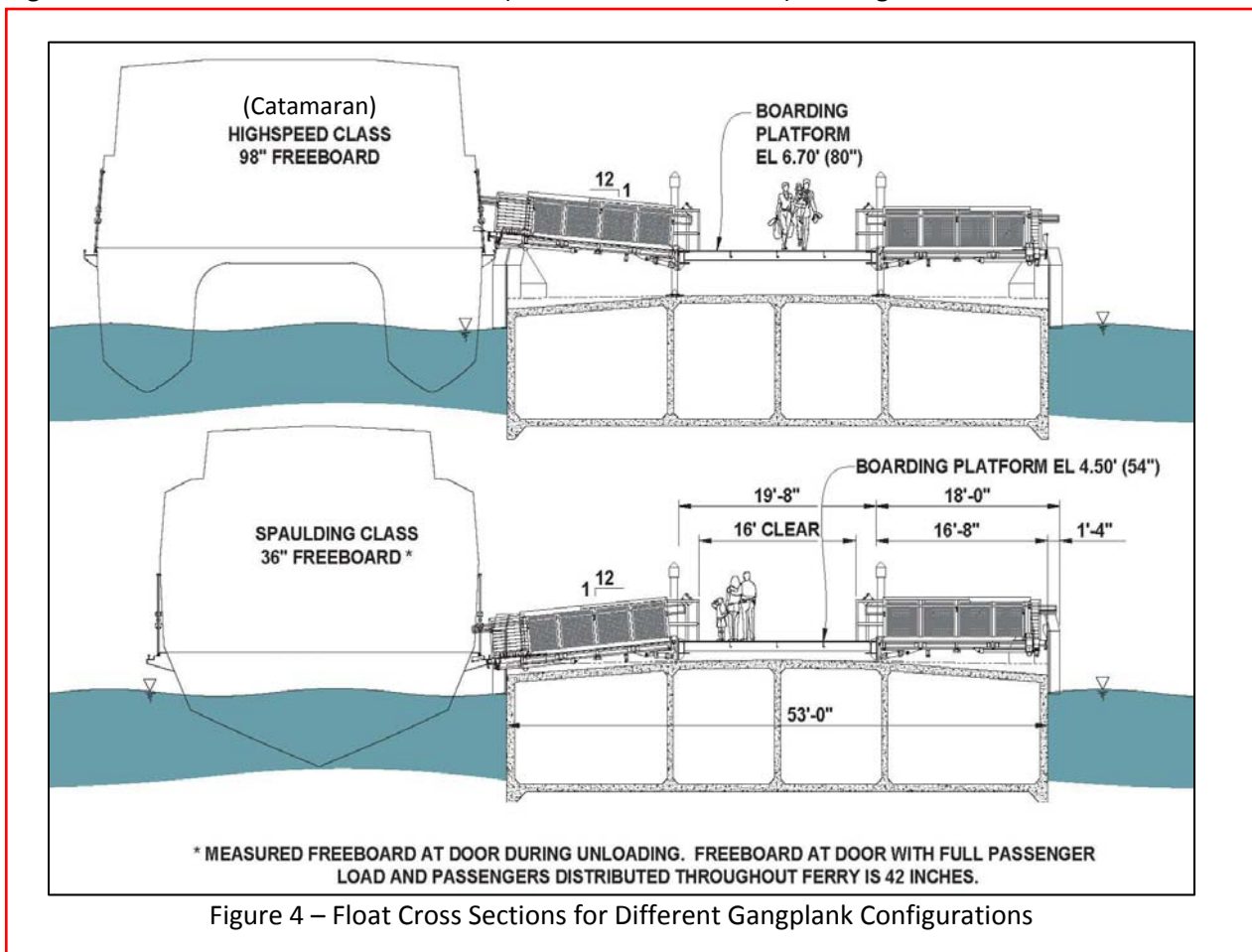
Note 1: The average security sweep time is estimated by ferry operations staff to take between 3 and 5 minutes. The average security sweep time assumes nothing out of the ordinary was found during the security sweep.

As explained in previous responses to comments, the disembarking and boarding at the existing facility is slow, due to a narrow passage way and single door access to the vessel. In order to stay on schedule, boarding must cease at a specified time, often leaving passengers behind while a less-than-full vessel departs. In order to provide reliable transportation services to commuters between Sausalito and San Francisco, the ability to stay on schedule is important. Based on existing facility observations, current ferry schedules and the assumed passenger level of service described in the “Responses to Questions from the City of Sausalito Received June 9, 2016” dated June 16,

Exhibit 4 - ADA Requirements (1/1) - [from Ref. b]

vertical distance between the ferry freeboard of 36 inches and the boarding platform of 54 inches (4.5 feet) is 18 inches. Using a maximum slope of 1:12 results in a gangplank length of 18 feet (see Figure 2). The ferry will lay up against the float fender which will be 1'- 4" beyond the float face. This results in a distance on the float of 16'-8" (18'-0" – 1'-4"). Higher ferry door freeboards do not affect the float width or gangway length.

The ferries have 8-foot wide doors and passengers will be using both doors simultaneously. The boarding platform has a 16-foot clear width to accommodate the passenger flow from both doors being used simultaneously. To provide a maximum 16 feet of clear walking space on the boarding platform and all associated framing (guardrails, gates to the gangplanks fixed boarding platform, controls, and cabinets) required an overall boarding platform width of 19 feet 8 inches. Adding these distances together results in a float beam of 53 feet (16'-8" + 19'-8" + 16'-8"). See Figure 4.



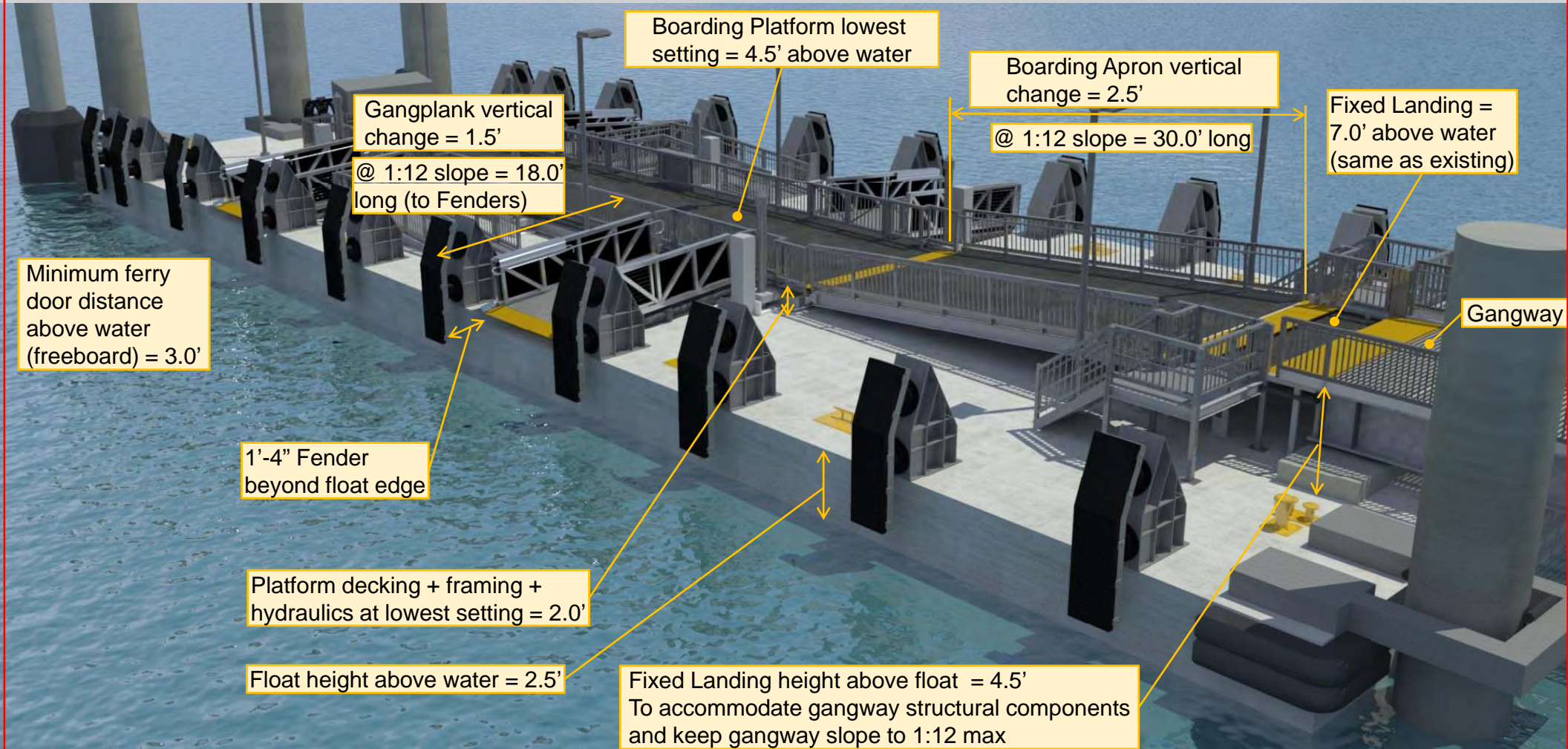
FLOAT LENGTH:

The gangway is supported on the float by a support frame. This frame is 5.5 feet from the float edge for repair and maintenance access. The support frame itself occupies 5.5 feet of space. Therefore, the distance from the float edge to the end of the support frame is 11.0 feet (5.5'+5.5'). The fixed landing is approximately 10 feet long to provide a minimum of 5 feet of level surface per ADA requirements and space for the transition plates between the fixed landing and the gangway and between the fixed landing and the boarding apron. This gives a distance of 21 feet (5.5'+5.5'+10') from the forward edge of the float to the beginning of the boarding apron (see Figure 5).

Exhibit 4
Sheet 1/1

[from Ref. b]

FLOAT – DIMENSIONS DISCUSSION



2016, the target ferry turnaround time for the replacement facility was chosen to be an ideal 10 minutes to a maximum of 15 minutes.

- 2. 11.0' feet is provided under the float end of the gangway for: the gangway support frame, maintenance access and the guide pile collars. Please clarify if this distance can be optimized. Information was received on May 16, 2016 and June 16, 2016 but more clarity and detail is requested.

A: The gangway support frame design has not been finalized but the general expected design is shown in Figure 1. The gangway is fixed on the access pier and is supported by rollers on the float. Due to the variability of the tides and waves, the design must have moving parts, as it will be necessary for the gangway landing to move with the float longitudinally and transversely. Based on preliminary engineering judgment, the preliminary gangway support frame design allows the gangway rollers/wheels approximately 3'-3" of movement to accommodate tide changes, extreme storm conditions, and unexpected high waves. The gangway rollers/wheels in the longitudinal direction must remain between the two pins as shown in Figure 1. Therefore, in order to accommodate for this movement and to provide the structural framing, the gangway support distance has been set at 5.5'. The District will need to access the gangway support for inspection and maintenance of the rollers and pins. For employee safety, the District has determined that a minimum of 5.5' in front of the gangway support is required along the float length to allow for at least 2 employees with their equipment to service the gangway support and to stay a safe distance away from the float edge. See Figure 2 for the 5.5'+5.5'=11.0' referenced. Also, see page 1 on Attachment 1 for the referenced dimensions along the overall float length.

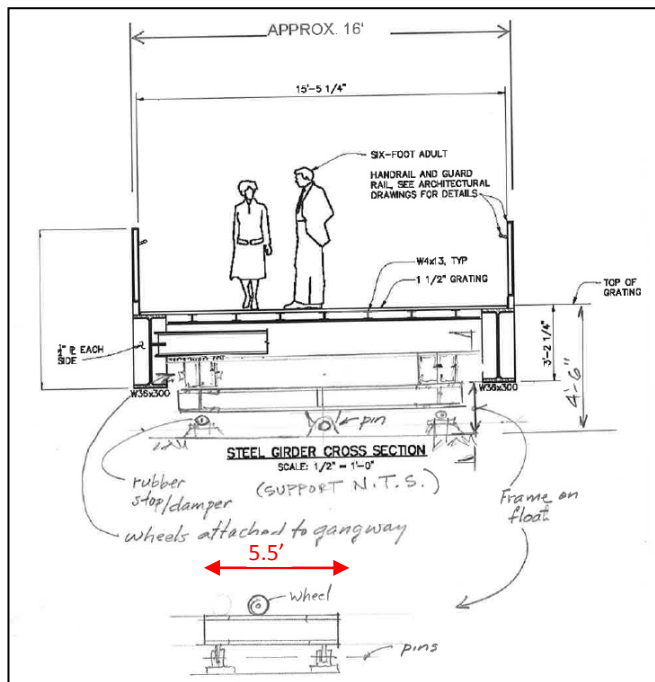


Figure 1

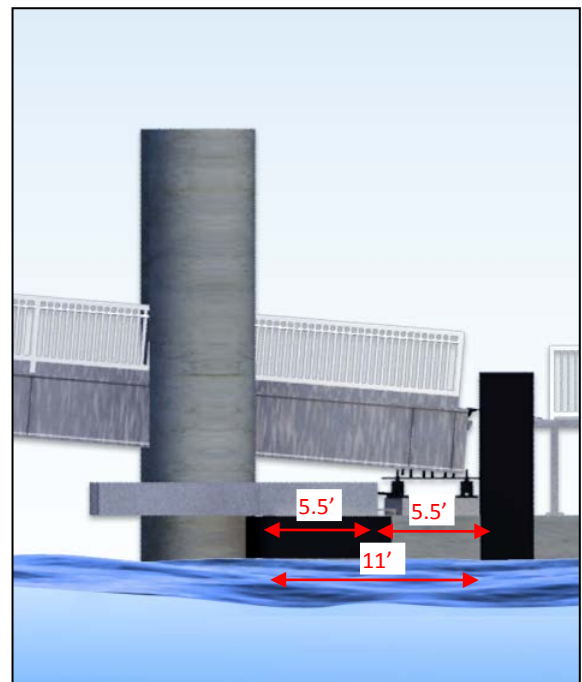


Figure 2

- 3. The fixed landing is 10.0' long whereas the minimum length is 5.0'. Please provide sketches and/or calculations showing that the combination of the tides and transition plates require the fixed landing to be 10' long. Information was received on May 16, 2016 and June 16, 2016 but more clarity and detail is requested.

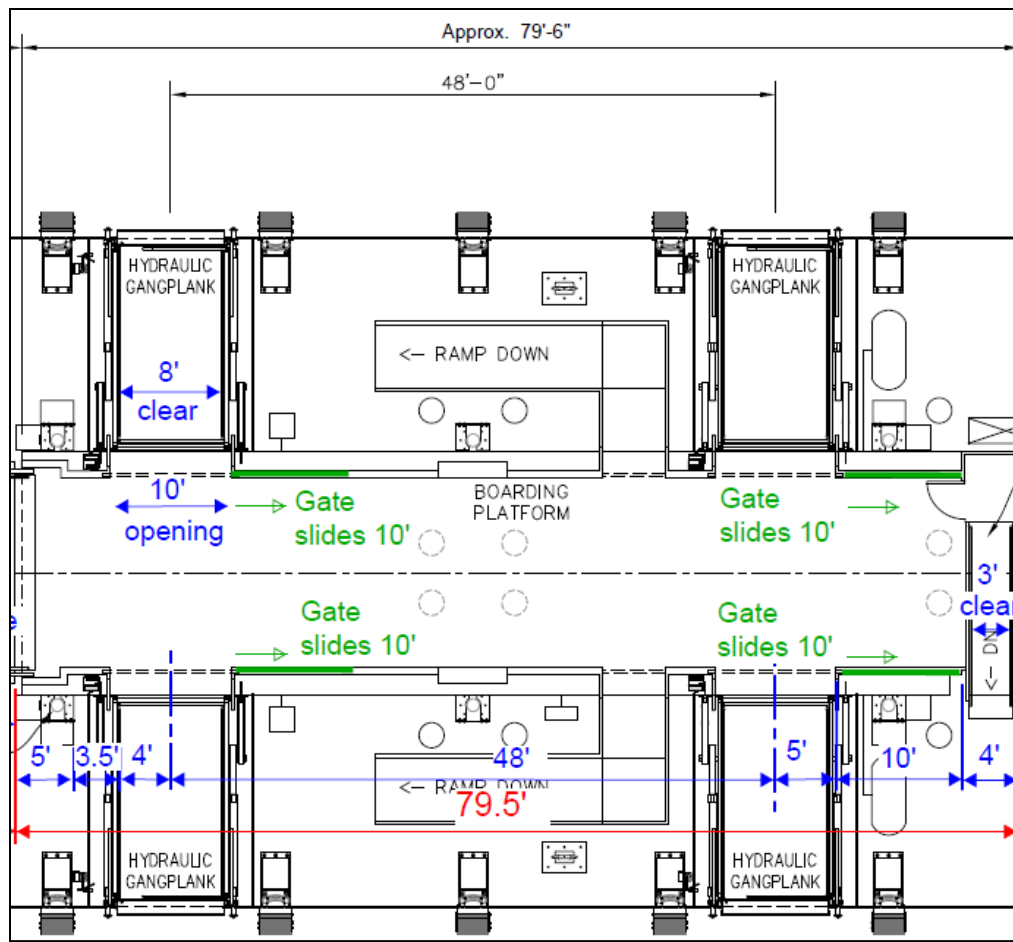
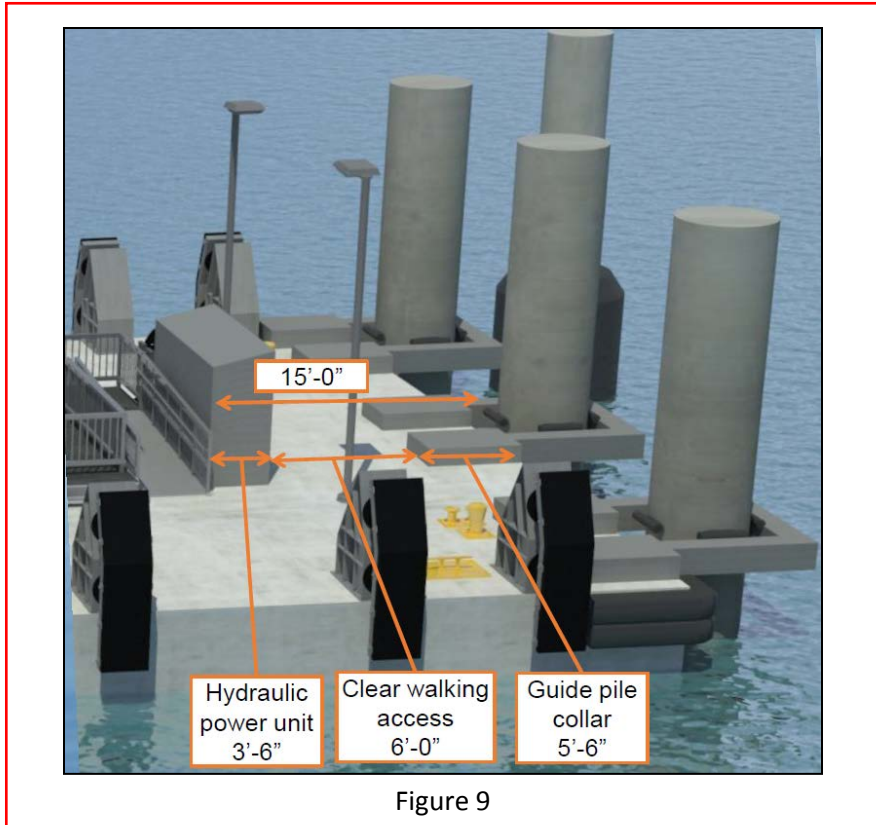


Figure 8

5. 15.0' is provided at the end of the float for the guide pile collars, utility boxes and a 6.0' access path (Ref. A: page 5 of 7 first paragraph, Figure 7, Drawing S1.2). Information was received on May 16, 2016 and June 16, 2016 but more clarity and detail is requested.

A: This distance has been re-evaluated and optimized to the extent possible. The hydraulic power unit required to operate the boarding apron and gangplanks is 3.5' wide. A 6' wide clear walking path is considered minimum for worker safety. This assumption is based on 2 maintenance workers with their equipment (such as a small cart) servicing the hydraulic power unit (there are 3 doors on the hydraulic power unit, each swing 3'). Adjacent to the 6' clear walking path is the 5.5' long guide pile collar necessary to connect the float to the guide piles to hold the float in place. The guide pile collar is a tripping hazard for employees and a safe walking area needs to be provided away from the guide pile collars. $3.5' + 6' + 5.5' = 15'$ shown in Figure 9 is the necessary distance along the float length for the hydraulic power unit, safe walking/working path, and the guide pile collar. See page 1 on Attachment 1 for the description of these items along the entire length of the float.



James Connolly

From: Carolina Wallin <CWallin@goldengate.org>
Sent: Friday, July 15, 2016 9:39 AM
To: Adam Politzer
Cc: 'Lilly Whalen'; Mary Wagner; Denis Mulligan; James Connolly; 'Jensen, Bo'; 'Bozorgzadeh, Azadeh'
Subject: RE: Follow-Up Question requested by COWI about GG ferry Terminal

Hi Adam,

We received an email from James Connolly on 7/13/16 with a few comments/questions regarding their peer review of the proposed float. Our responses are shown in blue below. Please let me know if you have questions.

Comment related to Response #1)

1.1) *The turnaround time calculations, based on the ferry schedule and passenger usage, support the sizing of the two 8ft doors. The width of the 16ft walkway is not directly included in the calculation. We infer from your response that the 16ft walkway is based on having two eight foot paths of travel feeding each of the 8ft doors (8ft door/path + 8ft door/path = 16ft walkway). The turnaround time calculations require the two 8ft doors and having the 16ft walkway prevents the possibility of a bottleneck. Can you please confirm our understanding of how the 16ft width was determined?*

Yes, we confirm that the width of the boarding platform was based on having two 8' wide doors on the vessels. The calculations show the time it takes passengers to pass through two 8' wide doors (totaling 16' in width) assuming the passengers are consistently walking through the same width from the landside pier to the ferry doors. Based on our observations in all three existing ferry terminals, a change in width along the passenger walkway creates a bottleneck which causes congested areas and delays the boarding and disembarking.

Comments related to Response #2)

2.1) *Please clarify how the 3'-3" of gangway movement on the fixed landing is calculated. Specifically, if the 90-foot gangway is flat (at high tide) its horizontal length component will be 90.0'. If the gangway is at the maximum 1:12 slope (low tide) the horizontal length component will be $90' \times \cos(\tan^{-1}(1/12)) = 89.69'$. The difference between these values, 0.3' or 3.7", is less than 3'-3". If our understanding of the gangway movement is accurate, the 5.5' of space for the gangway fixed landing support frame could be optimized.*

In addition to accommodating the gangway movement due to tides, the gangway support frame must accommodate the movement of the float and must account for extreme loading conditions. The float analysis shows that the float moves $\pm 7''$ along the longitudinal direction during a 100 year storm. The same analysis shows that the gangway will move an additional $\pm 1.5''$ along the support frame in the longitudinal direction due to the float's $\pm 50''$ of vertical movement during a 100-yr storm. These values do not include a safety factor. Also, there is a maximum 2" gap between the guide pile collars and the guide piles. Adding these possible movements of the float and change in tides results in approximately 30" ($7'' + 1.5'' + 2'' + 3.7'' = 14.2'' \times 2 \approx 30''$) of wheel movement longitudinally on the gangway support. Considering uncertainties associated with a storm condition, the gangway support frame was designed to allow the gangway wheels approximately 3'-3" of movement.

2.2) *The Near End of the float consists of 5.5' of space for workmen to access the gangway rollers/pins for maintenance/repair. It is our opinion that the 5.5' of worker access space could be optimized. This distance could be reduced by approximately 1ft.*

The District maintains that the 5.5' worker access space is necessary for access and safety purposes. As shown in Figures 1 and 2 of the June 30, 2016 "Additional Proposed Float Information for City of Sausalito Peer Reviewer", a worker would need to crawl under the 3-foot deep steel girders to access the gangway support frame for inspection,

Exhibit 7 - Safety/Operational Requirements (2/2) - [from Ref. k]

maintenance and repairs. Once under the gangway, there would be insufficient head room for a worker to stand up. For worker safety, we believe 5.5' is the minimum distance for two workers with their equipment to work around each other in the limited space provided under the gangway.

Comment related to Response #5)

5.1) The proposed 15.0' Far End of the float consists of 3.5' for hydraulic power units (HPU's), a 6.0' worker walkway and 5.5' for the guide pile collar connection to the float. It is our opinion that the 6.0' worker walkway space could be optimized. Doors can be specified for the HPU's that open a full 180 degrees rather than 90 degrees and therefore do not obstruct the walkway. By eliminating the obstruction caused by the HPU doors would allow for the 6.0' worker walkway to be reduced by approximately 1 to 2 feet.

The District maintains that the 6.0' of clear worker access width is the minimum necessary for operational and safety purposes. This end of the float is heavily used on the existing float and multiple workers are simultaneously working in this area. The existing float allows for a minimum of 17' clear width at this end of the float. Hoses, ropes, etc. are currently used at this end of the existing float and are expected to also be used in the same location on the proposed float. When servicing the HPU, a person will still be occupying a space at least 3 feet wide in front of the unit. Reducing the clear width as suggested will not allow other staff to safely pass behind the person working on the unit. The District will not compromise worker safety by reducing the 6 foot clear width at this location.

Thank you,
Carolina

Carolina A. Wallin, PE, SE
Senior Civil Engineer
Golden Gate Bridge, Highway and Transportation District

Mailing Address: Box 9000, Presidio Station, San Francisco, CA 94129
Direct: (415) 923-2359
Cell: (415) 793-3203
cwallin@goldengate.org

From: James Connolly [mailto:jmc@cowi.com]
Sent: Wednesday, July 13, 2016 11:27 AM
To: Bozorgzadeh, Azadeh; Carolina Wallin; Jensen, Bo
Cc: Mary Wagner; 'Arthur Friedman'; Casey Bowden
Subject: RE: Follow-Up Question requested by COWI about GG ferry Terminal

All,

As discussed during yesterday's call COWI has the following comments/questions on the information provided on 6/30/16 (Clarification for Float Peer Review_final.pdf)

Comment related to Response #1)

1.1) The turnaround time calculations, based on the ferry schedule and passenger usage, support the sizing of the two 8ft doors. The width of the 16ft walkway is not directly included in the calculation. We infer from your response that the 16ft walkway is based on having two eight foot paths of travel feeding each of the 8ft doors (8ft door/path + 8ft door/path = 16ft walkway). The turnaround time calculations require the two 8ft doors and having the 16ft walkway prevents the possibility of a bottleneck. Can you please confirm our understanding of how the 16ft width was determined?

James Connolly

From: Adam Politzer <apolitzer@ci.sausalito.ca.us>
Sent: Friday, July 22, 2016 12:00 PM
To: DMulligan@goldengate.org
Cc: Carolina Wallin; James Connolly; Danny Castro
Subject: July 21st District/City Meeting - Request For Additional Information

Dear Denis,

Thank you very much for taking the time to meet with Jill, Tom and I yesterday. I felt the meeting was very productive. As we discussed at the meeting there are four items we need from the District.

- 1) Please provide to COWI and the City the calculated delay impacts from a more narrow pathway if the gangway and/or boarding platform was reduced from 16' to 14' and from 16' to 12'.
- 2) In order to complete our due diligence on this project the City needs to get the District's passenger counts from 2014, 2015 and 2016 (year to date). Please include the breakdown for bikes and pedestrians per trip for both inbound and outbound passengers.
- 3) As we discussed yesterday, please provide the rationale behind the need to install two Donut Fenders at the end of the float.
- 4) Please provide the City with the revised photo renderings from View #3 for display here at City Hall. The view from the Yacht Club to the ferry landing at high tide and low tide.

Please note that James Connolly, will be on vacation for two weeks, Monday, July 25 – August 5th.

Thanks again for your timely responses to our request for additional information.

My very best,

Adam

Additional Information per City of Sausalito 7-22-16 Request

On July 22, 2016, the City of Sausalito, via email from Adam Politzer, requested the District provide information on four additional items related to the District’s design. The requested information and the District’s response to each is as follows:

1. *Please provide to COWI and the City the calculated delay impacts from a more narrow pathway if the gangway and/or boarding platform was reduced from 16' to 14' and from 16' to 12'.*

A: The District has previously provided information substantiating the 16 foot clear width for the gangway and boarding platform. Refer to the following information that the District submitted to the City for the City’s peer reviewer:

- May 16, 2016 float discussion submittal
- June 8, 2016 email answering peer reviewer’s questions
- June 16, 2016 submittal answering reviewer’s questions
- June 30, 2016 submittal answering peer reviewer’s questions
- July 15, 2016 email answering peer reviewer’s questions

The District has consistently stated that a 16 foot clear width is the minimum width required for the District to address its operational needs. The District’s ferry vessels are being modified to accommodate boarding and unloading from two 8 foot doors. Two 8 foot wide gangplanks will span between the vessels and the boarding platform, necessitating the boarding platform to be 16 feet wide. Reducing the boarding platform and gangway widths to less than 16 feet will cause passenger flow congestion which in turn will increase the ferry turnaround time and result in passengers being left behind as they are today in order to maintain the ferry schedule. The existing facility has varying passenger walkway widths which cause congestion and slowdowns as passengers navigate through the facility. The District’s design is intended to eliminate these operational inefficiencies.

The District notes that compared to other recently completed and proposed ferry terminals on the San Francisco Bay which use vessels with smaller passenger capacities, the 16 foot gangway width for the Sausalito Ferry Terminal Improvements project is reasonable.

Ferry Terminal Location	Lead Agency	Status	Gangway Width	Maximum Ferry Capacity
Sausalito	GGBHTD	CEQA complete – Filed NOD in 2012	16 feet	750 passengers
San Francisco - Ferry Building	WETA	CEQA complete – Filed NOD in 2014	10 feet 1 inch	395 passengers ¹
South San Francisco	WETA	Construction complete in 2012	10 feet 1 inch	199 passengers ²

¹ 395 passengers is the largest passenger capacity ferry vessel in the San Francisco Bay Ferry fleet (operated by WETA). Two ferry vessels with an expected 400 passenger capacity are under construction now and are projected to be completed by late 2016.

² The maximum ferry vessel capacity currently operating out of South San Francisco ferry terminal

The District has performed an analysis as requested by the City, and the calculated delays associated with increased ferry turnaround times due to reducing the gangway and boarding platform clear width are listed in the table below. As shown, reducing the width results in an increased turnaround time of up to nearly 5 minutes.

Minimum Passenger Clear Width	Project Goal Turnaround Times		Calculated Typical Turnaround Times		Difference Between Project Goals and Calculated Turnaround Times ¹	
	Target	Max	Typ. Min	Typ. Max	Typ. Min ²	Typ. Max ³
16 feet	10 min	15 min	12.6 min	14.6 min	+ 2.6 min	- 0.4 min
14 feet	10 min	15 min	13.5 min	15.5 min	+ 3.5 min	+ 0.5 min
12 feet	10 min	15 min	14.6 min	16.6 min	+ 4.6 min	+ 1.6 min

¹ A positive value indicates there will be a delay in turnaround times due to calculated time greater than project goals

² Calculated typical minimum turnaround time – Project target goal turnaround time

³ Calculated typical maximum turnaround time – Project maximum goal turnaround time

Note that these times assume ideal ferry operational conditions and do not account for slowdowns caused by intentional varying walkway widths (i.e. bottlenecks/choke points). The calculations and assumptions are provided in Attachment A. Recall that the District’s previous information to the City’s peer reviewer stated that the turnaround time calculations were based on aggressive, ideal situations that do not account for ferry docking delays due to poor weather conditions, passengers not queued and ready to disembark upon ferry landing, safety hazards encountered during the security sweep that require immediate attention, boarding passengers that are not familiar with the boarding procedure, and passengers with limited mobility.

Also, recall that the design of the replacement boarding facilities is based on the projected year 2029 maximum volume of passengers per trip using the 85-percentile volume (the 85-percentile means that from 100% of trips sorted in the order from the highest to the lowest volume, the passenger volume representing the 85% spot on the list is used for the design). This means that 15% of the time, the number of passengers will be greater than those used in the calculations.

As previously stated, the District will not build a defective ferry terminal that does not address the District’s operational needs. The District’s mission is to encourage ferry ridership to reduce traffic along the 101 corridor. To encourage the use of public transportation, the ferries must provide a reliable, safe, and cost effective alternative to driving.

- In order to complete our due diligence on this project the City needs to get the District's passenger counts from 2014, 2015 and 2016 (year to date). Please include the breakdown for bikes and pedestrians per trip for both inbound and outbound passengers.*

A: The District previously submitted March 2014 – March 2015 data to the City in April 2015 in response to requests made during the joint Planning Commission and Historic Landmarks Board April 1, 2015 meeting. For completeness, the passenger counts from January 1, 2014 to July 9, 2016 per ferry trip are attached in Attachment B.

Please note that the District provided additional ferry trips that were not scheduled in order to alleviate some of the crowds at the Sausalito Ferry Landing. These extra trips (denoted with an “E” under the “Source” data column in Attachment B) are significant additional operational costs for the District and cannot be sustained. As stated in previous submittals to the City, the District does not profit from ferry services as they are subsidized with bridge tolls and other revenue means to reduce traffic congestion on the Golden Gate Bridge and reduce vehicle use. Currently, disembarking and boarding at the existing facility is slow, due to a narrow passage way and single door access to the vessel. In order to stay on schedule, boarding must cease at a specified time, often leaving passengers behind while a less-than-full vessel departs. The proposed ferry terminal replacement will allow for full utilization of the ferry vessel capacity due to faster disembarking and boarding of passengers, therefore generally eliminating the need for extra ferry trips.

Attachment A

Disembark and Board Time Delay Calculations due to Reducing Gangway and Boarding Platform Width

SAUSALITO FERRY TERMINAL OFF-LOADING AND BOARDING TIMES DUE TO A REDUCED WIDTH GANGWAY AND BOARDING PLATFORM

The following description presents the effects on passenger off-loading and boarding times resulting from changing the gangway and boarding platform width from 16 feet to 14 feet and to 12 feet. Calculations are included following the text. These calculations are based and extend the calculations provided in the June 9, 2016 responses.

OFF-LOADING

To maintain the design Level of Service, more time will be required to off-loading passengers when the width of the walking space is reduced. The increase in time is determined by assuming the time is proportional to the walking width available. For example, changing from a 16-foot width to a 12-foot width would increase the time by a factor of 1.33 (16 divided by 12). The increase in time for the reduced walking width during off-loading is 0.2 minutes and 0.4 minutes for a 14-foot wide and a 12-foot wide width respectively. These times are included in the summary table below.

BOARDING

Similar to off-loading, more time will be required to board the ferry when the width of the walking space is reduced. The increase in time is determined by assuming the time is proportional to the walking width available. The increase in time for the reduced walking width during boarding is 0.7 minutes and 2.0 minutes for a 14-foot wide and a 12-foot wide width respectively. These times are included in the summary table below.

SUMMARY –FERRY TURNAROUND INCREASE IN TIME (MINUTES)

TASK	14-FOOT WIDTH	12-FOOT WIDTH
Off-Loading	0.2	0.4
Boarding	0.7	1.6
Total	0.9	2.0

SUMMARY –FERRY TURNAROUND TIME (MINUTES)

TASK	16-FOOT WIDTH	14-FOOT WIDTH	12-FOOT WIDTH
Ferry Landing	1.0	1.0	1.0
Gangplanks on Ferry	1.0	1.0	1.0
Disembark passengers	1.3	1.5	1.7
Security Sweep ¹	5.0	5.0	5.0
Boarding Passengers	4.8	5.5	6.4
Lift Gangplanks	0.5	0.5	0.5
Close doors & Depart	1.0	1.0	1.0
Total	14.6	15.5	16.6

Note 1: The average security sweep time is estimated by ferry operations staff to take between 3 and 5 minutes. The times shown above use the 5.0 minute time. The average security sweep assumes nothing out of the ordinary was found during the security sweep.

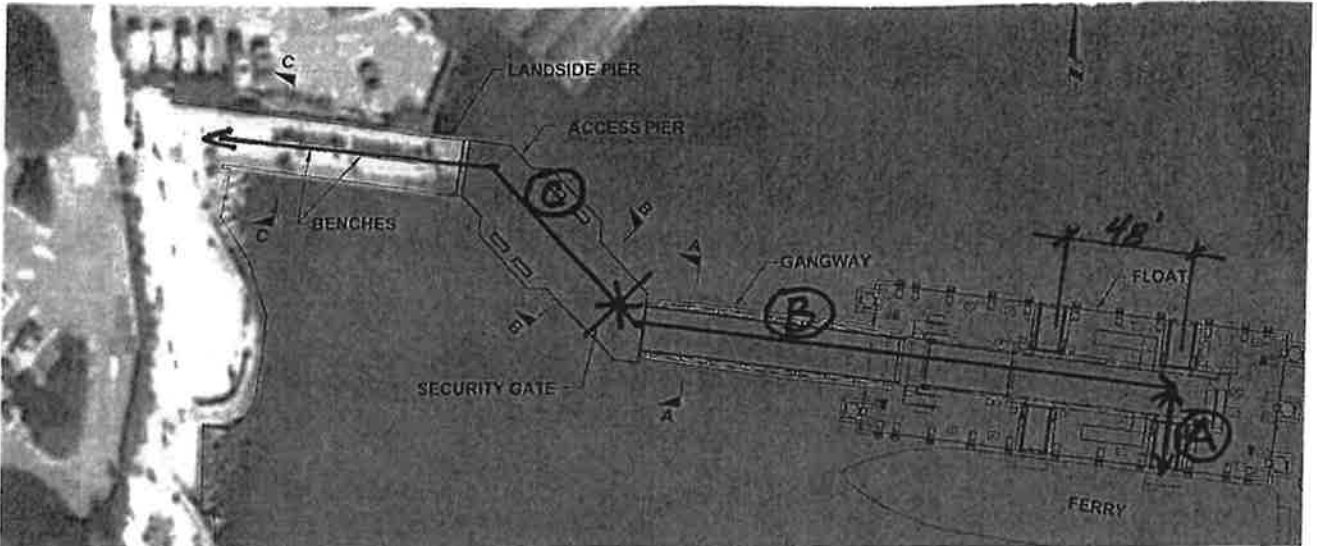
ATTACHMENT 2



CLIENT	GG BHTD	JOB NO	7038
PROJECT	FERRY TERM. IMPROVEMENT	SHEET	1 OF 4
DESIGN FOR	SFT - SCHEDULE	DESIGNER	Bmy
		CHECKER	
		DATE	6/23/16
		DATE	7/26/16

OFF-LOADING - 16' GANGWAY & BOARDING PLATFORM WIDTH

\downarrow Pax = PASSENGERS
 408 Pax, LOS D/E: 20 PFM (Pax PER FOOT PER MINUTE)
 WALKING SPEED USE 3 FPS (FEET PER SECOND)




WALKWAY WIDTH
 16-FOOT: $\frac{408 \text{ PAX}}{20 \text{ PFM} \times 16} = 1.3 \text{ MIN}$
 14-FOOT: $\frac{16}{14} \times 1.3 = 1.5 \text{ MIN}$
 12-FOOT: $\frac{16}{12} \times 1.3 = 1.7 \text{ MIN}$
 $A = 18' + 9' = 27'$
 $B = 60' + 30' + 8' + 4' + 92' + 12' = 206'$
 $C = 95' + 75' = 170'$
 } 233'

TIME PAX TO REACH GATE = $\frac{233'}{3 \text{ FPS}} = 78 \text{ sec}$

TIME FOR SECURITY SWEEP = 3 TO 5 min.
 (SWEEP WILL OCCUR WHEN PAX HAVE LEFT VESSEL, THEREFORE 78 SEC. IS IGNORED)

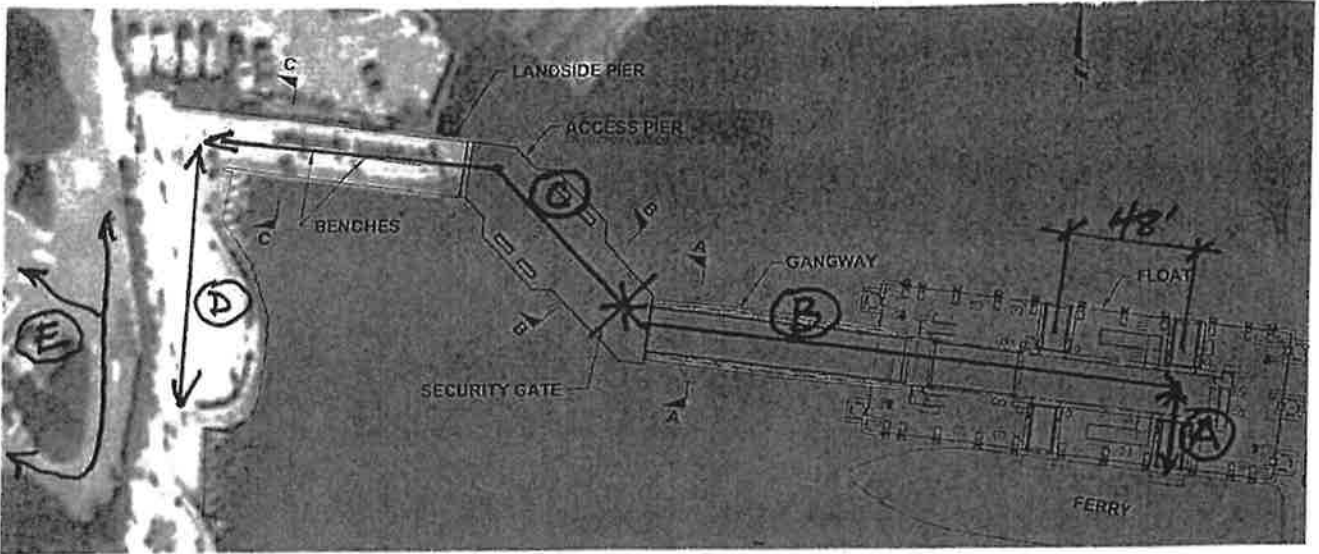
UNLOADING TIME:
 16-FOOT WALKWAY = 4.3 min TO 6.3 min
 14-FOOT " = 4.5 " TO 6.5 min
 12-FOOT " = 4.7 " TO 6.7 min

ATTACHMENT 2

 moffatt & nichol	CLIENT	GGBH+TD	JOB NO	7038
	PROJECT	FERRY TERM. IMPROVEMENT	SHEET	2 OF 4
	DESIGN FOR	SPT - SCHEDULE	DESIGNER	Vomy
			DATE	6/23/16
			CHECKER	
			DATE	7/26/16

BOARDING - 16-FOOT GANGWAY & BOARDING PLATFORM WIDTH

512 Pax : 312 Pax + 200 Pax with Bicycles
 LOS D/E : 23 PFM (Pax)
 12 " (Pax w/ Bicycles)



233 { A = 27'
 B = 206'
 C = 170' } 403'
 D = 140' (Pax in line)
 E = 200' (Pax w/ bicycles in line) } 543'

LOAD 312 Pax:


$$\text{TIME TO REACH DOOR} = \frac{233' - 48'}{3 \text{ FPS}} = 62 \text{ sec}$$

$$\text{BOARDING: } \frac{312}{8 \times 23} = 1.70 \text{ min} = \frac{102 \text{ min}}{164 \text{ sec}} \checkmark$$

LOAD 200 Bicycles:

$$\text{TIME TO REACH DOOR} = \frac{403'}{2.5 \text{ FPS}} = 161 \text{ sec}$$

$$\text{BOARDING: } \frac{200}{8 \times 12} = 2.08 \text{ min} = \frac{125 \text{ min}}{286 \text{ sec}} = 4.8 \text{ min} \checkmark$$

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			CHECKER	DATE

BOARDING - cont'd 14' & 12' WIDTH

Ratio times for 16' wide walkway to adjust for 14' and 12' widths.

14' WIDTH

Passengers:

$$\text{Time to reach door} = \frac{16}{14} \times 62 \text{ sec} = 71 \text{ sec}$$

$$\text{Time thru gate} = \frac{16}{14} \times 102 \text{ sec} = \frac{117 \text{ sec}}{188 \text{ sec}}$$

Bicycles:

$$\text{Time to reach door} = \frac{16}{14} \times 161 \text{ sec} = 184 \text{ sec}$$

$$\text{Time through gate} = \frac{16}{14} \times 125 \text{ sec} = \frac{143 \text{ sec}}{\boxed{327 \text{ sec}}}$$

↑ Governs

12' WIDTH

Passengers:

$$\text{Time to reach door} = \frac{16}{12} \times 62 \text{ sec} = 83 \text{ sec}$$


$$\text{Time thru gate} = \frac{16}{12} \times 102 \text{ sec} = \frac{136 \text{ sec}}{219 \text{ sec}}$$

Bicycles:

$$\text{Time to reach door} = \frac{16}{12} \times 161 \text{ sec} = 215 \text{ sec}$$

$$\text{Time thru gate} = \frac{16}{12} \times 125 \text{ sec} = \frac{167 \text{ sec}}{\boxed{382 \text{ sec}}}$$

↑ Governs

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BOARDING - cont'd

TIME COMPARISON

16' WIDTH	286 sec	
14' "	327 "	INCR = 41 sec (0.7 min)
12' "	382 "	INCR = 96 sec (1.6 min)

THEREFORE, BOARDING TIMES FOR THE REDUCED WIDTHS WILL BE:

16' WIDTH	=	4.8 min	
14' "	=	4.8 "	+ 0.7 min = 5.5 min
12' "	=	4.8 "	+ 1.6 " = 6.4 min