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August 21, 1970

Golden Gate Bridge, Highway &
Transportation District
San Francisco, California 94129

Gentlemen:

In accordance with the Agreement of January 11, 1970, by and between the GOLDEN GATE BRIDGE, HIGHWAY & TRANSPORTATION DISTRICT and PHILIP F. SPAULDING & ASSOCIATES, INC., we are pleased to submit our design for a passenger ferry system and our recommendation for the optimum vessel design.

The ferry system is designed primarily for commute service; however, mid-day, evening and weekend service have been incorporated. Consideration was given to the fact that the ferry system is to be part of an integrated bus and ferry system, the one providing feeder service to the other. In an effort to provide highest feasibility for the proposed system, care was exercised to maximize the recreational use of the ferry system. The optimum vessel design incorporates all known features which will be as attractive an alternate as possible to the private automobile.

This report includes ship construction cost estimates, capital cost requirements, estimated crewing requirements, estimates for the cost of dredging and spoil disposal and that portion of the terminal design necessary for vessel servicing facilities. All regulatory agencies were consulted regarding the optimum vessel design to assure approval of the final design. To provide maximum flexibility in the implementation of the ferry system, it was designed so that service can be provided between San Francisco and any one of the Marin County terminals independently. Estimates of the minimum feasible level of service are included. Expected patronage growth for each route through 1980 is given.

We trust this report satisfactorily fulfills the Agreement and look forward to implementation of the Ferryboat System and final design of the optimum vessels.

Respectfully submitted,


Philip F. Spaulding
President


Charles F. Heye
Transportation Economist

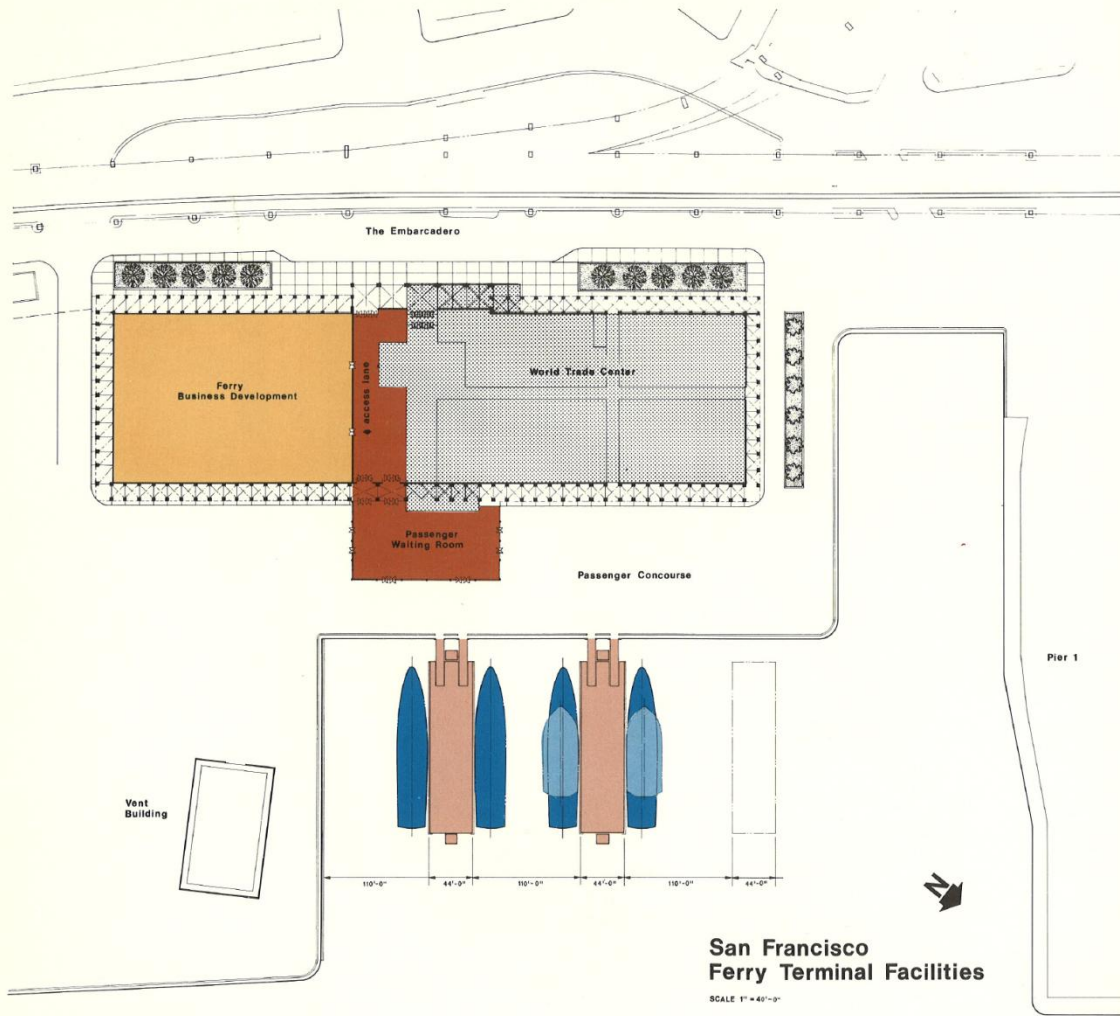
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San Francisco Ferry Building

Shown is the proposed layout of the docking facilities at the Ferry Building. The climatic conditions at this site are the most severe of any of the terminals. With winds from the southeast causing five foot waves and the possibility of a four knot current, it was found that the anchorage of the boarding floats would be quite difficult and costly. Therefore a breakwater is provided along the southeast side of the terminal area. This breakwater would also permit easier berthing of the vessels in stormy weather. Two boarding floats accommodate four vessels. A third float can be added later when the service demands. Available soundings indicate that a small amount of dredging will be required.

Terminal Facilities

Minimum loading and unloading time with rapid turn-around is the prime objective in our plan for developing terminals for the Golden Gate Commuter Ferryboat System. Passengers will walk on and off the vessels. Landing floats load on the upper and lower deck levels so that the interface between the vessel and landing float will always be the same without regard to tidal variations.

In anticipation of servicing the vessels, a service float will provide fueling facilities, fresh water facilities and sewage disposal for rapid servicing of the vessels. A vehicle ramp has been provided to permit delivery trucks, repair equipment, mobile cranes, etc., to drive directly to the ship's side. The service float will provide overnight berthing for two vessels. Swan & Wooster Engineering, Inc., has been retained as part of the study team to assist in the development of the terminal facilities and dredging problems.

Boarding Floats

The basic float is proposed to be 44' by 175' and manufactured of ferro cement. A typical cross section of ferro cement consists of a series of small diameter bars uniformly spaced. These are sandwiched between layers of wire mesh. From 4 to 16 layers have been used. These layers of mesh are tied tightly to the bars to form a compact layer of highly subdivided reinforcement. This is embedded in cement mortar with about a 1/8 inch cover over the outermost layer of mesh. Thus the total thickness will be at least 1½ inches. Mesh may be in the form of screen wire with square openings of various sizes; chicken wire with ½ inch, ¾ inch, or 1 inch openings, or expanded metal lath. Mortar is made with about a 1 to 2 mix and with a water-cement ratio of about 0.35. A good grade of sand with no material larger than about 1/8 inch is usually used.

Of particular interest is the fact that ferro cement hulls are virtually maintenance free. Marine borers have no effect. Hulls will not rot. They are fireproof. There are no seams to caulk or to leak. The surface will take a good paint coat but painting is for appearance only and is not needed for protection. The strength of the mortar actually increases with age. Resistance to shock and abrasion is excellent. Severe impact may cause local damage but seldom if ever has it penetrated a ferro cement hull. Local damage, usually in the form of fine cracking, has occurred in several boats involved in collisions or running aground. Leakage is easily controlled and readily repaired.

The hull would be divided into watertight compartments with precast waffle type bulkheads forming cubical cells of

equal dimensions, about 8 feet. Intermediate ribs and joists can be formed into the hull for additional support for the shell.

A minimum of five foot freeboard is desirable for wave action and to accommodate the rub strake on the vessel. To protect the float from the rub strake it is planned to install vertical timbers of greenheart or eucalyptus wood at about five foot centers from the water line to the deck on both sides of the float.

The berthing forces will be transferred from the float through A frames at either end of the floats into rigid type mooring dolphins. To absorb the energy of the berthing forces, rubber fenders similar to General Rubber Company's "Port Slides" will be used between the A frame and the dolphins. The dolphins are designed to resist all stresses imposed on the floats from wind, waves and berthing.

Inasmuch as it is planned to embark and disembark passengers from the upper deck of the vessel, it is necessary to add a second deck to the float to accommodate the ship's gangways. This second deck will be steel framed with a concrete deck. The sides and ends will be open with protective handrails. At the loading points a sliding section of handrail will be provided somewhat greater than the width of the gangways so that exact spotting of the ferry will not be required. This upper level will be roofed over with plastic skylights installed as required. Electric lighting will be provided for night operation. The loading ramps from the float to the bulkhead will be roofed and lighted like the upper deck.

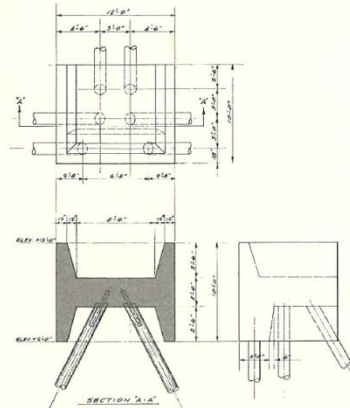
To facilitate rapid turn around of the ferry, it is planned to install hydraulic take-up cylinders on the float with quick release hooks to handle the spring lines. A permanent pendant line will be installed on the vessel. When berthing, the bight of the pendant line can be engaged in the hooks at both the forward and aft locations and the vessel quickly brought into position for lowering the gang planks. A similar system can also be used for the breasting lines.

Service Float

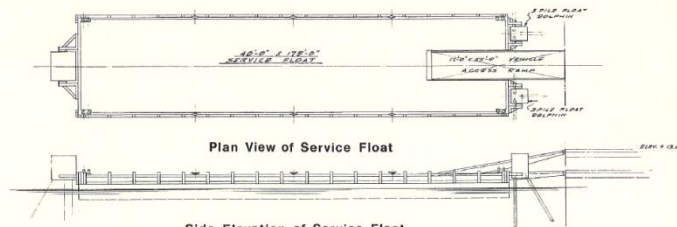
Also shown is the service float for use at Corte Madera. The basic construction of this unit would be ferro cement as above with proper anchorage. However, no superstructure is planned for this float. Its dimensions will be 40' by 175'.

Dredging

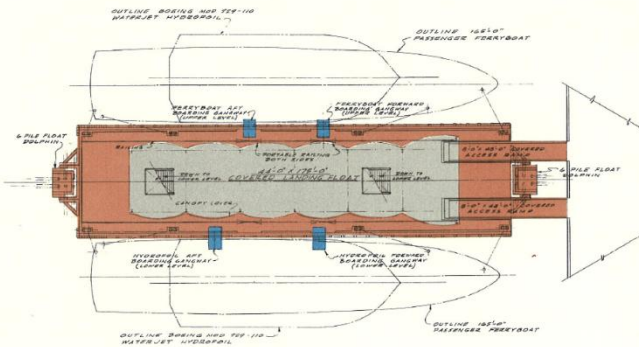
The extent of dredging is shown. Due to character of the bay mud at these sites, it is necessary to use very flat side slopes on the channel to maintain proper depth.



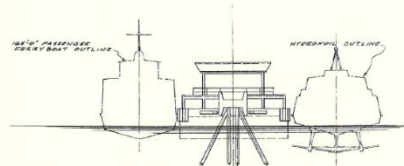
Typical Float Dolphin



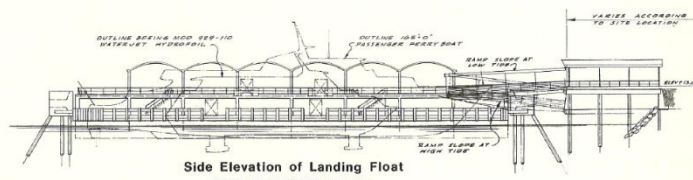
Side Elevation of Service Float



Plan View of Landing Float



Outboard End Elevation of Landing Float



Side Elevation of Landing Float

Typical Passenger Boarding Floats
SCALE 1/16" = 1'-0"

Philip F. Spaulding And Associates

Recommendations for Terminal Development

Design of terminal buildings and facilities beyond the water interface will be undertaken by architects selected by the Bridge District. In order to gain the greatest effectiveness, it is hoped that all possible factors affecting the total design of the ferryboat system relate and that each terminal design should consider the overall goal of functionalism and beauty. We recommend the following design criteria:

1. The style of architecture should achieve a composition of spacial variety with vertical and horizontal use of spaces clearly defined inside and out.
2. Covered and open outdoor spaces should be well related and suited to the region's topography and environment. The various structures should be sensitively developed and lend character and interest to the vessels, ramps, floats and docks. The architect should select a major building material to achieve unity throughout the design of each terminal facility.
3. Consideration should be taken to all overall sense of scale, recognizing the board expanses of the Bay, distant mountain views and climate.

Pedestrian Circulation

1. Pedestrian separation from vehicular movement.
2. Space used as an open, informal atmosphere utilizing careful comparison of alternative paths of movement to favor the largest number of people.
3. A consistency should be used in all communication and directional signs using expressive language, applying nondisruptive visual sign installation.

Parking Facilities

1. In parking and feeder service areas there should be stringent structural, traffic and land use controls to protect either the existing, or promoting a rural, harbor and waterfront resources with consideration given to saving any historic landmarks.
2. Parking distributed on the perimeter at points of easy direct pedestrian access without infringing on the terminal building. This facilitates pleasant pedestrian space and foreground for commuter circulation prior to entering or leaving terminals and allows for future growth. We recommend informal parking areas with benches, planters and use of graphic illumination along walkways, parkways, etc.
3. Grade separation and/or recessed parking surfaces, designed with either earth berms or surrounding walls and heavy landscape treatment.

Clearly each terminal is a part of the total water transportation system. The goal of community and regional planning will be accomplished as each terminal facility becomes a focal point of attention and a symbol of San Francisco Bay spirit and pride.

Estimated Costs/Dredging and Floats

Galinas Creek			Tiburon		
One large Boarding Float	\$ 250,000.		One Large Boarding Float	\$ 250,000.	
Dredging	1,540,000.	\$1,790,000.	Dredging	20,000.	\$ 270,000.
Corte Madera/Larkspur			Ferry Building		
Two Large Boarding Floats	\$ 500,000.		Two Large Boarding Floats	\$ 500,000.	
One Service Float	145,000.		Breakwater	76,000.	
Dredging	1,260,000.	\$1,905,000.	Dredging	10,000.	\$ 586,000.
Central Sausalito					
One Large Boarding Float	\$ 250,000.		Total		\$4,821,000.
Dredging	20,000.	\$ 270,000.			

Climatic Data at Terminals

Location	Wave Height-Ft.	Wave Length-Ft.	Period-Sec.	Current Knots	Wind* M.P.H.	Major Direction
Ferry Building	5.0	65.0	3.5	4.0	40	N.-S.E.
South Sausalito	4.2	57.0	3.3	1.5	40	S.E.
North Sausalito	3.0	53.0	3.0	1.0	40	E.
Tiburon Terminal	3.0	53.0	3.2	1.5	40	S.
Tiburon Outside	3.8	53.0	3.2	3.6	40	S.
Corte Madera		—Insignificant—				
Galinas Creek		—Insignificant—				

*Wind velocity is maximum sustained
Short term winds to 55 M.P.H.