CMHC

Canada Mortgage and Housing Corporation

PERFORMANCE SPECIFICATION FOR DESIGN, MANUFACTURE, DELIVERY AND INSTALLATION OF NEW FALSE CREEK FERRY LANDING FLOAT GRANVILLE ISLAND, VANCOUVER, BC

BB3502

PARSONS

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1.0 INTRODUCTION

Canada Mortgage and Housing (CMHC) seeks Tenders from qualified marina float designers, manufacturers, and installers, to replace the existing timber landing float at Granville Island with a new buoyancy foam filled concrete float. A summary of the scope of work required by the Contractor is summarized below:

- Design and manufacture of a new landing float comprised of buoyancy foam filled reinforced concrete;
- Design of new float mooring system comprised of steel pipe piles and float mooring brackets;
- Design to include lights, power junction boxes, and water supply;
- Design to include in-deck utility conduit transfer on east side of dock for future transferring of lights, power, water to a new dock to the east.
- Delivery of the new float system to the Work site;
- Temporary disconnection and temporary support of existing gangway;
- Removal, refurbishment, and temporary storage of existing deck mounted information kiosk and information signage;
- Disconnection of moorings, removal and disposal of existing timber landing float and associated mooring piles;
- Installation of new float complete with new steel pile mooring system and transition connections to existing concrete and timber floats;
- Restoration of existing gangway onto new float;
- Reinstallation of information kiosk and information signage onto new float deck;
- Commissioning of new float system.
- Optional scope to include a new dock that would be east of the False Creek Ferry float and would connect into the existing dock system.

2.0 BACKGROUND

The False Creek ferry floats at Granville Island support pedestrian traffic and provide safe docking and moorage for small motor powered passenger ferries. Each ferry has the following approximate physical characteristics:

- Displacement: < 5 Tonnes;
- Length: 5.79 m;
- Breadth: 2.50 m;
- Depth: 0.73 m;
- Freeboard: 0.3 m to 0.46 m;
- Draft: 1.0 m.

Ferry service operates on a continuous basis with sailings every 5 minutes to the Aquatic Center (Route 1) and every 15 minutes to David Lam Park (Route 5).

The existing landing float is constructed of timber and measures approximately 7.43 m wide x 11.1 m long and is moored in position with timber piles. Flotation is achieved with rubber tires below deck level which are stacked four (4) high. The float supports the seaward end of a pedestrian gangway constructed of steel which measures approximately 1.68 m wide x 18.13 m long. It also supports a ferry schedule and route sign, and an information kiosk, which are mounted to the float deck. The long axis of the float is generally aligned in an east-west direction.

The east end of the landing float ties into a linear arrangement of existing concrete floats which each measure approximately 3.2 m wide x 42.8 m long. At the west end of the landing float there is a 3.05 m wide gap between the landing float and a privately owned timber finger float. The south end of the landing float ties into another timber float.

The nominal measured freeboard of the timber landing float under Dead Load only is approximately 0.66 m, and the nominal measured freeboard of the adjacent concrete float under Dead Load is approximately 0.38 m. A metal or plywood transition plate is used to eliminate the step between floats.

The timber landing float has sustained significant deterioration due to fungal decay and mechanical damage, and requires replacement with a new buoyancy foam filled concrete float. Installation of the new landing float must maintain existing connections to adjacent floats and maintain the 3.05 m gap to the finger float at the west end.

3.0 GENERAL DESIGN REQUIREMENTS

3.1 ENGINEERING DESIGN

The Contractor shall be responsible for all aspects of the project and for the satisfactory performance of the overall system.

Design of the new float system shall be performed by a registered Professional Engineer licensed in the Province of British Columbia with experience in concrete float design. The Engineer shall be the “Engineer of Record” for the new float system.

3.2 REFERENCE STANDARDS

3.2.1 American Society for Testing and Materials International, (ASTM):

- ASTM A-153, Standard Specification for Zinc Coating (hot dip) on Iron and Steel Hardware;

- ASTM A-307, Standard Specification for Carbon Steel Bolts and Studs, 413 MPa Ultimate Tensile Strength;
- ASTM A-325, Standard Specification for Structural Bolts, Steel, Heat Treated 830 MPa Ultimate Tensile Strength;
- ASTM A775, Epoxy Coated Reinforcing Bars;
- ASTM C203, Standard Test Method of Breaking Load and Flexural Properties of Concrete;
- ASTM C260, Standard Specification for Air-Entraining Admixtures for Concrete;
- ASTM C272, Test Method of Water Absorption of Core Materials for Structural Sandwich Construction;
- ASTM C492, Standard Specification for Chemical Admixtures in Concrete;
- ASTM D256, Izod Impact Testing;
- ASTM D638, Standard Test Method for Tensile Properties of Plastics;
- ASTM D792, Standard Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement;
- ASTM D1621, Test Method for Compression Properties of Rigid Cellular Plastics;
- ASTM D1894, Test Method for Static and Kinetic Co-efficient of Friction of Plastic Film and Sheeting;
- ASTM D2240, Standard Test Method for Rubber Property—Durometer Hardness.

3.2.2 Canadian Standards Association (CSA International):

- CAN/CSA-A23.1-09 (R2014), Concrete Materials and Methods of Concrete Construction;
- CAN/CSA-A23.2-09 (R2014), Methods of Test for Concrete;
- CAN/CSA-A23.3-04 (R2010), Design of Concrete Structures for Buildings;
- CAN/CSA-A23.4-09 (R2014), Pre-cast Concrete – Materials and Construction;
- CAN/CSA G40.21-13, General Requirements for Rolled or Welded Structural Quality Steel/ Structural Quality Steel;
- CAN/CSA G164-M92 (R2003) – Hot Dip Galvanizing of Irregularly Shaped Articles;
- CAN/CSA S16.1-01 (R2007), Steel Structures for Buildings – Limit States Design;
- CSA A23.4-00/A251-00 (R2005), Qualifications Code for Manufacturers of Architectural and Structural Precast Concrete;
- CAN/CSA 086-01 (R2006), Engineering Design in Wood;
- CAN/CSA G30.18-09, Carbon Steel Bars for Concrete Reinforcement;
- CSA G30.5-M1983 (R1998) - Welded Steel Wire Fabric for Concrete Reinforcement.

3.3 DESIGN LIFE

The design life of all components incorporated into the float shall be a minimum of 25 years.

3.4 WARRANTY

The Contractor shall provide a two (2) year warranty against defects in design and manufacture of the new float system. The warranty shall commence upon full and complete installation of the new float system and following issuance of the Certificate of Substantial Completion by CMHC.

3.5 SHOP DRAWINGS

The Contractor shall provide shop drawings for all float components and submit same to CMHC for review prior to proceeding with manufacture. The shop drawing submittal shall include as a minimum:

- Statement of design and performance criteria;
- Overall dimensions and cross sectional dimensions of float;
- Member sizes and details;
- Mooring pile dimensions, design penetration into sea bed, cut-off elevation, and capping;
- Mooring attachment details;
- Details of all embedded plates and anchor bolts;
- Material grades and specifications;
- Concrete mix designs;
- Ferry moorage cleat and fastening details;
- Details of transition plates between new float and existing floats;
- Details of gangway roller guides and their attachment to the float;
- Details of attaching salvaged information kiosk and ferry schedule/route signage to float deck;
- Post-tension and other construction details as applicable;
- Details of lighting;
- Details of power supply junction boxes;
- Details of water supply;
- Details of future utility transfer conduit on east side of dock;
- Methods of handling and installation;
- Schedules of reinforcing steel;
- Technical data sheets;

- Profile diagram showing float and gangway operation at extreme tides.
- Ensure Shop Drawings showing designed assemblies, components and connections are stamped and signed by the Engineer of Record.
- Submit float design calculations upon request by CMHC. Calculations shall be stamped and signed by the Engineer of Record.
- At completion of construction, the Contractor shall provide detailed as-constructed drawings, certified by the Engineer of Record.

4.0 DESIGN CRITERIA

4.1 PROJECT DATUM

Hydrographic Chart Datum which is 3.1m below Geodetic Datum.

4.2 ENVIRONMENTAL

4.2.1 Temperatures

From the climatic information provided in the British Columbia Building Code for Vancouver:

- Maximum temperature: 26oC;
- Minimum temperature: -9 oC.

4.2.2 Snow and Rain

From climatic information provided in the British Columbia Building Code for Vancouver:

- Annual Rain: 1,325 mm;
- 15 min Rain: 10 mm;
- 1-in-50 year ground snow load: Ss = 1.8 kPa;
- 1-in-50 year associated Rain Load: Sr = 0.2 kPa.

4.2.3 Wind

Fifty (50) year return and 200 year return wind velocity and pressures have been predicted for the False Creek ferry dock site based on data available from Vancouver International Airport and Point Atkinson, and are provided below in Table 1.

Table 1: Design wind speeds and wind pressures from various directions for 50 year and 200 year return period storms.

	Wind Speed (m/s)		*Wind Pressure (N/m^2)	
Direction	**50 Year**	**200 Year**	**50 Year**	**200 Year**
Northeast	15	17	220	280
East	15	17	220	280
Southeast	18	20	310	390
West	28	27	650	710
Northwest	19	22	350	470
*Based on an air density of 1.29 kg/m^3				

4.2.4 Waves

Wave conditions have been predicted for the False Creek Ferry dock site; Conditions associated with a 50 year return period storm and for a 200 year return period storm are provided below in Table 2.

Table 2: Design wave parameters for 50 year and 200 year return period storms.

Parameter	50 Year Return	200 Year Return
Significant Wave Height	0.5 m	0.6 m
Peak Wave Period	2 to 3 s	2 to 3 s
Primary Wave Direction	325°	325°

4.2.5 Currents

Currents at the False Creek Ferry dock site are estimated to be 0.7 m/s or less. For design purposes a current of 0.7 m/s shall be used.

4.2.6 Water Levels

The design water levels are provided below in Table 3.

Table 3: Design water levels at the False Creek Ferry Float (m).

Level	Elevation (CD)	Elevation (GSC)
HHWLT	5.1	2
HHWMT	4.4	1.3
MWL	3.1	0
LLWMT	1.2	-1.9
LLWLT	0	-3.1
Record Extreme High Water	5.6	2.5
Est. 50 Year High Water	5.7	2.6
Est. 200 Year High Water	5.9	2.8
Geodetic Datum	3.1	0
Sea Level Rise (Year 2100)	+1	+1

4.2.7 Water Depths (Re: Chart Datum)

Recently measured water depths around the perimeter of the existing landing float are provided below in Table 4.

Table 4: Surveyed water depths around existing float.

Description	Northing	Easting	Elevation (CD)	Elevation (GSC)
NW Corner	5457841	490100	-2.79	-5.89
N Edge Middle	5457841	490103	-2.72	-5.82
SE Corner	5457837	490111	-2.16	-5.26
NE Corner	5457841	490109	-2.63	-5.73
SW Corner	5457833	490099	-1.79	-4.89

4.2.8 Ice

False Creek is not subject to ice development.

4.3 DESIGN LOADING CRITERIA

4.3.1 Dead Loads

Dead load of the new float, the existing gangway, and, the existing information kiosk and information signage, shall be determined by the Contractor.

4.3.2 Live Loads

- Uniformly Distributed Live Load: 2.4 kPa;
- Concentrated Live Load: 2.2 kN at any location.

4.3.3 Wind Loads

Wind loads shall be determined based on the provided wind speeds and direction, and shall be applied to the full projected surfaces above water of two (2) docked ferries and the float freeboard.

The fifty (50) year severity storm shall be used to assess the operational performance of the float and its moorings. The two-hundred (200) year severity storm shall be utilized for all structural design.

4.3.4 Snow Loads

Snow loads shall be determined in accordance with the methods described in the British Columbia Building Code.

4.3.5 Wave Loads

Float, connections and moorings shall be designed to resist wave loads associated with the 200 year severity incident wave conditions. Wave loads shall be determined and applied both orthogonally and parallel to the float as well as at an angle of 45° in separate load cases.

4.3.6 Current Loads

Float system, connections and moorings shall be designed to resist current induced drag load associated with a nominal current speed. Current drag shall be applied to the combined hull area of moored vessels plus floats.

4.3.7 Wind, Wave, and Current loads

Shall be assumed to act concurrently for the design of the float system, connections and moorings.

4.3.8 Ferry Docking Loads

The float system, its connections and moorings shall be designed to resist impact force of the ferry traveling from any direction at a speed of 0.3 m/sec.

4.4 PHYSICAL CRITERIA

The float shall be designed to meet the following minimum physical criteria:

- Nominal Length: 11.2 m;
- Nominal Width: 7.5 m.

Position and Alignment: The position and alignment of the new float shall match the existing float. Clearance of 3.05 m shall be maintained between the new landing float and the timber finger float to the west

4.4.1 Free Board and Stability

Optimal freeboard while in operation: 400 mm;

Freeboard under Dead Load (DL) only: Minimum = 400 mm; Maximum = 500 mm;

Freeboard under DL and Uniform Live Load (ULL): Minimum 300 mm;

Freeboard under DL and Live Point Load (LPL): Minimum 300 mm.

4.4.2 Maximum Slopes

- 4.4.2.1 Under DL only and DL + ULL
  - Maximum Cross Slope = 0.75 %, not to exceed 56 mm;
  - Maximum Longitudinal Slope = 0.75 %, not to exceed 23 mm in 3 m.
- 4.4.4.2 Under DL + LPL
  - Max Cross Slope= 0.75 %, not to exceed 56 mm;
  - Maximum Longitudinal Slope = 0.75 %, not to exceed 23 mm in 3 m.

4.4.3 Mooring Attachments

The float shall be moored with steel pipe piles, driven into the sea bed. The Contractor shall ensure adequate load sharing between mooring points.

Pile mooring attachments shall be sized to accommodate a maximum space of 100 mm, in any direction, between the design location and installed location of the mooring pile.

Mooring attachments shall transfer working horizontal loads, acting in any direction, between the float and the mooring, with due consideration to the dynamic nature of the load and the resulting fatigue and wear on connecting surfaces.

Avoid direct contact of the mooring piles with the outer structural surfaces of the float and mooring attachments. Instead utilize engineered rubber fenders, UHMW PE wear strips, or other equivalent system.

4.4.4 Float Connections

The float shall have connections that are low maintenance and noiseless and be suitable to transfer float loads to the mooring system.

4.4.5 Tie-up Cleats

The float shall include four (4) aluminium or galvanized steel tie-up cleats along its outboard (north) edge. Alternate mooring systems may be proposed by bidders which will be evaluated for equivalent performance by CMHC. Alternate systems will only be accepted if approved by CMHC.

4.4.6 Rub Rails

The perimeter of the float shall be fitted with protective rub rails. Rub rail system details, inclusive of materials, attachment details and other pertinent features shall be submitted at the time of tender submission. The rub rail systems shall be evaluated by CMHC and shall be subject to CMHC's approval prior to acceptance.

4.4.7 Utilities

All conductor is to be copper, and all 600V circuit breakers to be rated 42kA RMS interrupting. All 120/208V circuit breakers to be rated 22kA RMS interrupting.

A power supply junction box pedestal and water hookups is to be located out of the way of pedestrians, but near enough to the water to be utilised by water craft.

Overhead lighting to be included on the ferry float to illuminate the dock at night time.

A maintenance hose bib is to be installed at the foot of the pedestrian ramp as well as an electrical box for the breakers and main disconnects for lighting and power for pedestals and receptacles, current and future.

4.4.8 Future utility transfer

Power, lighting, and water is to be transferred under the deck, through secured conduit, to a sealed hatch on the east side of the ferry float, with the potential of future hookup to a new dock that is to be built east of the ferry float.

4.4.9 East connecting dock (Optional Scope)

CMHC wishes for contractors to supply a price to also replace the dock that connects into the False Creek Ferry Float to the east. Reference Section 2.0 “Background” for more information on the existing concrete dock.

The new dock is to be the same width and length as the existing dock, with the addition of foot lighting every 6.0m, two electrical junction boxes, and water supply at the midway point along the dock.

Pile spacing to be 5.5m, to match existing pile spacing east of dock.

The current transition from the east connecting dock to the rest of the dock system has a metal railing/ramp that was placed due to a gap in the docks. The new dock is to butt-up flush and have the railing/ramp removed.

5.0 MATERIALS

The float shall be constructed of reinforced concrete with internal compartments filled with polystyrene foam.

5.1 BUOYANCY BILLETS

Buoyancy billets shall be formed from marine class closed cell expanded polystyrene foam. At minimum, billets shall have the following properties:

- Minimum compressive strength at 1% deformation: 76 kPa;
- Minimum Flexural Strength: 240 kPa;
- Max. Water Absorption by Volume: 2% (ASTM C272);
- Max Density: 16 kg/m3 (ASTM D1621);
- Min. Limiting Oxygen Index: 24 % (ASTM 8263).

The expanded polystyrene shall be a uniform structure free of voids resulting from unexpanded components or other causes.

Undertake construction so that buoyancy billet is protected from damage due to impact, ultra-violet degradation, marine borers, gasoline, diesel fuel, oil or any other substance likely to be encountered in the marine and marina environment.

Foam billet surfaces exposed to the air and water shall be coated for protection against fuel spill attack. Foam surfaces in contact with concrete shall be bonded to the concrete by casting the concrete directly onto the bare foam billet to promote bonding and therefore composite behaviour for structural purposes.

Where billets are assembled from multiple pieces, all segments shall be bonded with a hand trowelled adhesive in a manner recommended by the manufacturer of the adhesive along the bottom 300 mm of the vertical joints, while the upper joint may be

filled with an injected polyurethane expanding adhesive at 150 mm center to center along the bonding face to seal the rough surface of buoyancy billets.

5.2 CONCRETE

The Contractor shall be responsible for design, supply, and placement of the concrete mix in accordance with the latest editions of CSA-A23.1 and CSA A23.2; "Concrete Materials and Methods of Concrete Construction/Methods of Test for Concrete", to meet the following minimum requirements:

General:

- Cement: Type 10 or Type 20;
- Maximum Aggregate Size: 16 mm (5/8");
- Calcium chloride or products containing calcium chloride shall not be used;
- Cement, Aggregates and Admixtures in accordance with CAN/CSA-A23.1, CAN/CSA-A23.2, and CAN/CSA-A23.4;
- Air entrainment admixtures: in accordance with CAN/CSA-A23.1 and ASTM C260;
- Chemical admixtures: in accordance with CAN/CSA-A23.1 and ASTM C492 as approved by CMHC;
- Water, fine aggregates, and normal density coarse aggregates shall conform to CAN/CSA A23.1;
- Mineral admixtures: Type N (Natural Pozzolan) to CAN/CSA-A23.1 and CSA A23.5;
- Silica Fume: in accordance with CAN/CSA-A23.4.

Plastic State Requirements:

- Uniformity: in accordance with ASTM 1451;
- Minimum Air content: 6.5% +/- 1% by volume;
- Workability: free of surface blemishes, colour variations, and segregation;
- Finish-ability: minimize bleeding.

Hard State Requirements:

- Durability and Class of Exposure: C-1 (Structurally reinforced Concrete exposed to chlorides with freezing and thawing conditions);
- Minimum Compressive strength at 28days: 35 MPa;
- Volume Stability: The concrete mix shall be designed to prevent cracking of the finished concrete due to shrinkage, creep, and cyclic freezing and thawing;
- The Contractor shall submit his concrete mix design to CMHC for review prior to mixing.

5.3 CONCRETE QUALITY MANAGEMENT

The Contractor shall provide their quality management plan to CMHC for review to ensure procedures for verification of concrete quality to the specified performance requirements are in place.

The Contractor's method of mixing, placing and curing concrete shall be reviewed by CMHC and will be approved subject to provision of satisfactory evidence of quality control, quality assurance and successful use of these methods in producing a uniform durable concrete.

Concrete supplier's certification: Both the batch plant and materials shall meet CSA A23.1 requirements.

Contractor shall maintain accurate records of concrete placement. Records to include date, batch time, placement time, pour locations, plastic density, air temperature, slump, air content and test samples taken.

Unless specifically modified by CMHC, all concrete testing shall comply to CAN/CSA -A23.2.

Concrete shall be well compacted using internal and external vibrators.

Protection of concrete cast during hot or cold weather shall conform to CAN/CSA-A23.3 and to Clause 21 of CAN/CSA-A232.1.

All concrete to be membrane cured or moist cured for a minimum of 7 days.

Repair of structural defects or damage shall be subject to prior approval by CMHC. Structural defects shall be as defined in CAN/CSA-A23.4.

5.4 CONCRETE FINISHING

Concrete to receive a float finish in accordance with CAN/CAS-A23.1. Float finish to have sufficient roughness to provide a non-slip surface for pedestrians. No depressions or 'bird baths' permitted.

Repair all rock pockets and fill tie-holes. Remove fins and ridges from concrete surfaces.

Apply silane sealer following cure no earlier than 14 days after the curing period.

5.5 STEEL REINFORCEMENT

Reinforcing steel shall be deformed bars conforming to CSA G30.18 Grade 400. Ties and stirrups shall be to CSA G30.18 Grade 300.

Welding of reinforcement is not permitted.

Recommended cover of steel reinforcement for deck, side and bottom surface reinforcement are as follows:

- Surfaces exposed to air or water: 60 mm;
- Surface against foam billets: 50 mm.

Welded Wire Fabric; in accordance with CSA G30.5. All welded wire fabric shall be galvanized in accordance with CSA G164.

Spacers: plastic or concrete.

5.6 TIMBER

Sawn timbers shall be coast Douglas Fir, or other species that is demonstrated, to the satisfaction of CMHC, to provide equivalent or superior performance. All timber shall be Select Structural Grade, free of hard centre and loose knots, cut and with all holes predrilled before treatment.

All timber shall be given a salt preservative treatment (ACA or ACZA) in accordance with current CSA 080. Net retention shall be 6 kg per cubic metre (0.6 lbs per cubic foot) ACA or ACZA.

5.7 ULTRA-HIGH MOLECULAR WEIGHT POLYETHYLENE (UHMW PE)

UHMW PE (ultra-high molecular weight polyethylene) for wear strips shall be 100% cross linked and UV stabilized with the following properties:

- Co-efficient of Friction (ASTM D1894): not greater than 0.15;
- Density (ASTM D792): 0.92 to 0.98 g/cm2;
- Elongation at Break (ASTM D638): Minimum 350%;
- Abrasion resistant measure by volume of material lost during a sand slurry test using 50% sand and 50% water at 1.750 rpm for seven hours with a mild steel standard assigned 100 on the abrasion index:Maximum 12;
- Hardness (ASTM D2240): Minimum 65 durometer;
- Izod impact, double notch at 23 C (ASTM D256A):1.495 j/m.

5.8 STRUCTURAL STEEL

To CAN/CSA G40.21 Grade 300W, designed in accordance with CSA S16.1 and shall be hot dipped galvanized.

Galvanizing: hot dip galvanizing with minimum zinc coating of 600 g/m^2 in accordance with CSA G164.

All hardware embedded in concrete shall conform to ASTM A325, and shall be galvanized in accordance with ASTM A-153.