REQUEST FOR INFORMATION – AUTOMATIC SHORE CONNECTION SYSTEM

GUEMES ISLAND FERRY REPLACEMENT

000 GENERAL REQUIREMENTS

000.1 Objective

This Request for Information describes the requirements for an automatic shore connection system (ASCS) to charge the batteries aboard the Guemes Island Ferry Replacement (GIFR) vessel, a 160-ft. battery electric passenger and vehicle ferry, at the ferry terminal in Anacortes, Washington. Skagit County owns and operates the Guemes Island ferry and ferry terminal. Glosten has been selected by Skagit County to design the replacement vessel and the associated charging system. We are requesting detailed technical information including a description of the shore connection system, equipment drawings, specifications, and rough order of magnitude (ROM) pricing for this equipment to progress the design of the vessel and ferry terminal.

The GIFR vessel is expected to be the first purpose-built electric vehicle ferry in the United States and implementation of the automated shore connection system for the vessel is expected to be the first of its kind in the United States. The automated shore connection system selected for this project could serve as a model for future ferry projects in Washington State and the surrounding region.

The information provided in response to this RFI will not be used as a basis for selection of vendor or equipment.

Responses are requested by 30 June. Please note all information does not need to be provided at one time and early information submittal is encouraged.

000.2 Reference Documents

The following are documents referenced within this RFI:

1. *GIFR Vessel Layout (2D CAD)*, Glosten, Inc. (17097.02_GIFR Vessel Layout_ASCS RFI_2019-07-21.dwg).

2. *Anacortes Terminal As-Builts (2D CAD)*, PND Engineers, Inc. (174082-01.dwg).

3. *GIFR Transportation System Assessment (PDF)*. Glosten, Inc., Document No. 17097-000-02, Rev. -, 14 December 2018.

The above documents are for informational purposes only and should not be used for design and engineering beyond the purposes of this inquiry.

To request these documents, please email Jeff Rider at jmrider@glosten.com.

000.3 Acronyms

Acronyms used throughout this document are as follows:

ASCS	Automatic Shore Connection System
CFR	Code of Federal Regulations
FMLB	First Make/Last Break
GIFR	Guemes Island Ferry Replacement

LMFB	Last Make/First Break
NEC	National Electrical Code, NFPA 70
RFI	Request for Information
ROM	Rough Order of Magnitude
SES	Shoreside Electrical System
VES	Vessel Electrical System
WAC	Washington Administrative Code

000.4 Requested Data

The following drawings and data are requested:

- Dimensional drawings of all components.
  - Vessel and shoreside charging apparatus.
  - Control cabinets, panels, misc. equipment.
  - Proposed arrangement(s) of the charging apparatus interface between vessel and shoreside components.
- Weight estimate of all components.
- Electrical equipment description and ratings.
- One-line electrical diagram indicating scope of supply and significant features.
- Auxiliary system requirements (electrical, hydraulics, etc.).
- Description and/or schematics of interlocks and safety functions.
- Technical description of equipment and its operation. The description should list all components that are in the scope of supply and proposed step by step instructions for system operation. If drawings of minor components cannot be provided at this time, a clear description with overall dimensions and weights should be provided.
- Overall electrical efficiency of components.
- ROM cost estimate for equipment packages, with itemized commissioning services. Cost estimates should not include costs for shipping equipment.
- Information outlining vendor support and warrantee of equipment throughout vessel's operational life.

All documents do not need to be delivered at one time.

000.5 Project Information

The GIFR project electrical system (see Figure 1 for overview) has been divided into three portions: the Shoreside Electrical System (SES), the Automatic Shore Connection System (ASCS), and Vessel Electrical System (VES). Figure 1 is an outline of how the systems are expected to interface with each other; details of system architecture within each system may vary by vendor and technical solution.

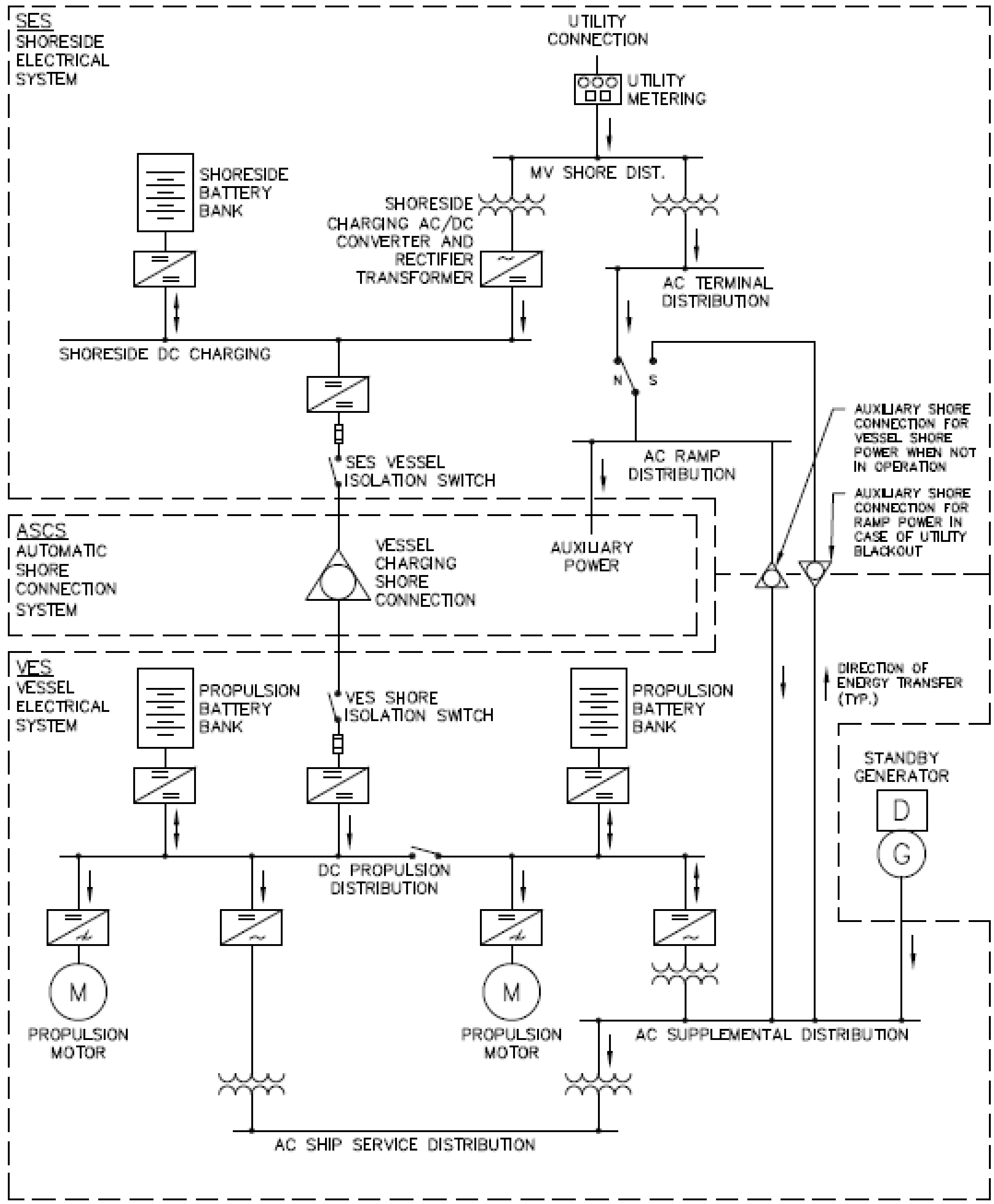

Figure 1 GIFR project electrical overview

000.5.1 Procurement and Support

Table 1 Estimated project timeline

Preliminary design complete	September 2020
Contract design complete	March 2021
Shipyard period	November 2021 to July 2023
Terminal modification period	November 2022 to April 2023
Vessel in service	September 2023

Table 1 provides an estimated timeline for major milestones for the GIFR project. Preliminary ASCS information from vendors is expected ahead of the completion of the preliminary design.

000.5.2 Multiple GIFR RFIs

Glosten will issue separate RFIs for the vessel electrical system (VES), shoreside electrical system (SES), and propulsor units. Vendors may elect to respond to any of the RFIs on an individual basis. In cases where a cost savings may be obtained by selection of a single vendor for multiple scope items, this should be explicitly stated and costs savings broken out.

000.5.3 Vessel

Table 2 Vessel particulars

Length, Overall	160'-0"
Beam	53'-0"
Draft	7'-6"
Car Capacity	28
Full Load Displacement	530 LT
Propulsors	(2) 700 kW L-Drive Azimuthing Propulsors
Speed, Cruise at Full Load	11.5 kts

It is estimated that the vessel will operate 365 days per year, with an average of 24 round-trip crossings per operating day. Figure 2 depicts the timeline of a typical roundtrip crossing, which takes 30 minutes.

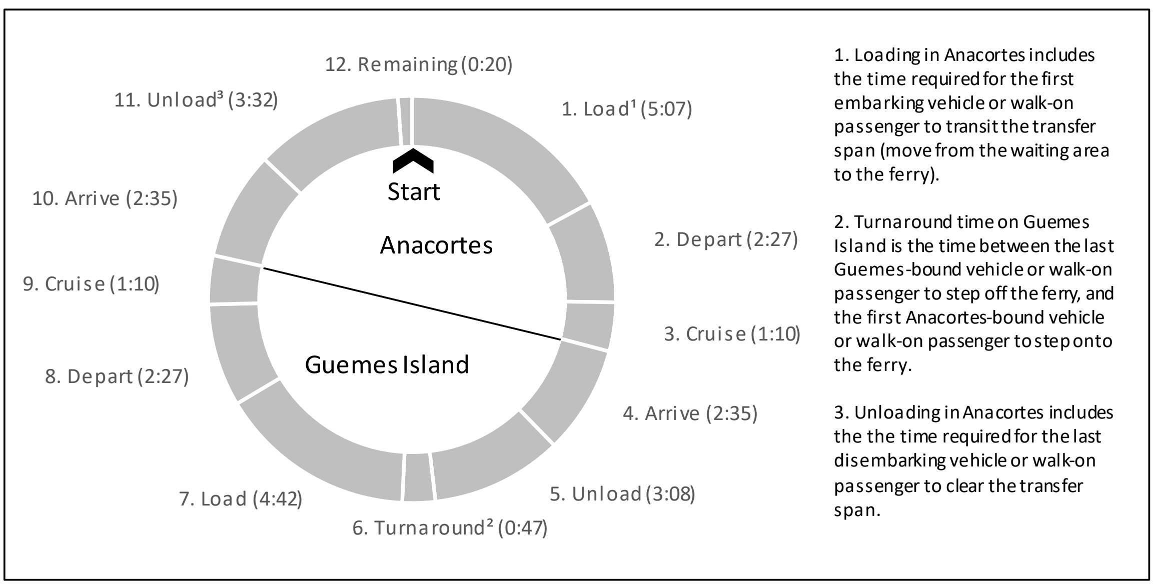

Figure 2 Typical round-trip transit

The vessel electrical system (VES) will consist of a common DC bus with two independent propulsion battery banks, which serve as the primary sources of power. Power for the propulsion motors will be taken directly from the DC bus and converted to 600-690VAC, 3-phase. Other consumers can be powered by 480VAC or 208Y-120VAC, 3-phase, 60 Hz. A 550 ekW onboard standby diesel generator will provide supplementary power for propulsion, ship loads, and battery charging during abnormal operations (e.g. bad weather, transit offsite).

The VES outlined above is outside the scope of this RFI, see Section 000.5.2.

000.5.4 Terminal

The ASCS will be installed at the Anacortes terminal (see Figure 3) to serve the GIFR vessel. No shore charging connection is possible on the Guemes Island side.

SES

The shoreside terminal facilities on the Anacortes side will be modified to provide electrical power to the new vessel. The following will be included in the scope of the shoreside electrical system (SES) modifications:

- Electrical house for SES equipment.
- New primary distribution voltage point of delivery from utility with associated metering equipment.
- New 690V step-down transformer from utility primary distribution voltage (12.5kV).
- Shore batteries with sufficient capacity to eliminate spikes in utility power demand while charging.
- Battery management and control system.
- Shore connection circuit protection and disconnects.

The SES outlined above is outside the scope of this RFI, see Section 000.5.2.

The voltage of the shoreside batteries and shore connection supply are planned for 1000VDC.

Existing Terminal

480VAC, 3-phase, 60 Hz power is currently supplied to machinery at the ramp apron and lifting tower. This is the preferred power source for auxiliary equipment required for the ASCS. One other voltage can be provided at the terminal, if necessary, for the ASCS. The additional voltage must be either 120V 1-phase, 240V 1-phase, 120V 3-phase, or 208V 3-phase.

The shoreside vehicle loading infrastructure is depicted in Figure 3, and consists of a fixed approach span, movable transfer span and apron ramp, and the lifting tower and headframe. The transfer span is hinged at the approach span and the other end is supported at the lifting tower with a cable system that allows the height of vessel end of the span to be adjusted to match the tides. The apron ramp is supported by the transfer span and is raised and lowered by a hydraulic system. When the ferry arrives at the terminal, a deckhand on the vessel lowers the apron ramp to the ferry car deck using a control pendant attached to the end of the apron ramp, as seen in Figure 4. The apron ramp will extend full width between the wingwalls, the full width is required to allow simultaneous vehicle and passenger loading/unloading.

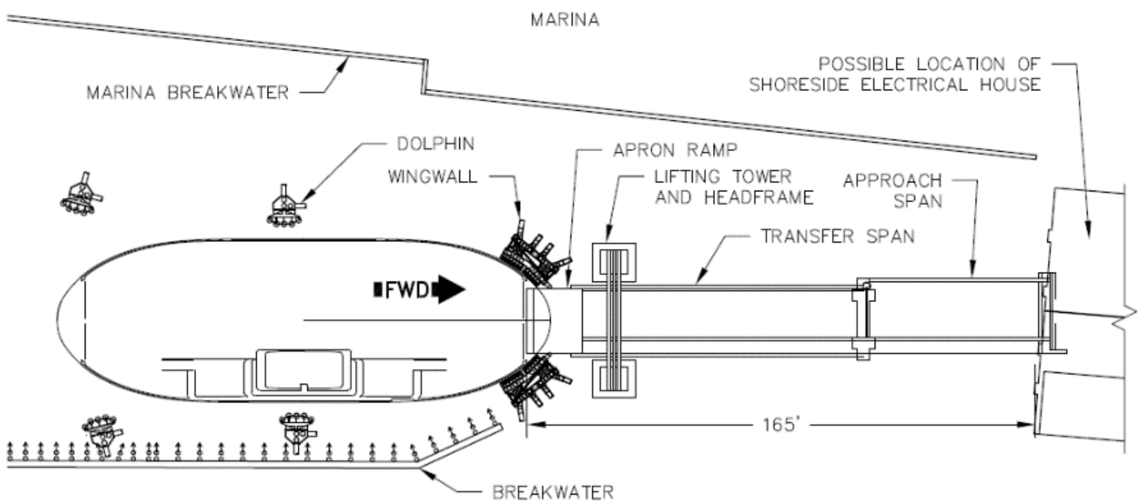

Figure 3 Anacortes terminal

Figure 4 Apron ramp operation on existing vessel

000.5.5 Regulatory

The modifications to the existing ferry terminal in Anacortes will be required to satisfy the requirements of WAC-246B Electrical Safety Standards, Administration and Installation, and the NEC. The scope of these rules will apply to all installations not on the vessel.

The vessel will be required to satisfy the rules for a USCG Inspected Small Passenger Vessel under US CFR Title 46, Subchapter T. This includes all aspects of the automatic shore connection system which are installed on the vessel, and may also include review of the shoreside system for information.

The integration of an ASCS of this nature on the vessel is unique in the United States and we expect both the USCG and the Washington State electrical inspectors to review this aspect of the project. Glosten is working with the regulatory bodies to define particular requirements and will provide details to vendors when available.

001 AUTOMATIC SHORE CONNECTION SYSTEM

001.1 Power Transfer and Connection Requirements

Table 3 Connection requirements

Energy Transfer	280 kWh (1008 MJ)
Power Transfer*	2.0 MW
Ramp up/down duration*	30 seconds (each)
Connect/disconnect duration*	30 seconds (each)
Available duration for connection	10 minutes

*Estimated values, may be adjusted by vendor based on proposed ASCS capabilities

Table 3 lists the required energy transfer through the ASCS and the available connection duration. In Table 3, power transfer is estimated from assumed ramp rates and connection speed. Total time available for connection, ramp-up, charging, ramp-down, and disconnection is 10 minutes. Estimated power transfer rate may be adjusted by the vendor based on ASCS connection speed.

The ASCS must be capable of completing a full connection, charge, disconnect cycle with minimal supervision from the crew. Operation of the ASCS will be primarily monitored from the pilothouse. The pilothouse should be equipped with controls for one-touch commands for connection and disconnection, emergency stop/disconnect, and other manual operations. In addition to these controls, it would be preferable to have a fully automated system which allows for fully automated connection and disconnection. All other aspects of the charging cycle should be automated through interfaces between the SES, ASCS, and VES.

001.2 Range of Motion Requirements

The expected range of motions for the vessel while the ASCS is active are listed in Table 4. This information is preliminary and will be confirmed or revised by Glosten during contract design.

The ASCS must be able to follow the vessel through all combinations of dynamic ranges without interrupting power transfer to the vessel or damage to equipment. No margin factor has been applied to the dynamic ranges listed in Table 4, systems with capability to exceed the listed ranges will be considered beneficial.

In general, the motions listed in Table 4 can be assumed to be from a point at the center of buoyancy of the ferry which is on centerline, amidships, and approximately 5' above baseline. Due to the interaction of the bow of the vessel with the wing walls, both yaw and sway are referenced from a point 20' aft of the bow (60' forward of amidships). The bow refers to the Anacortes end of the vessel, as shown in Figure 3. Given that the connection point location has not been established, linear movements at a particular location will need to be estimated based on the reference points.

The range of motion listed in Table 4 does not account for the range required for the ASCS to deploy from a standby position out of the way of the ferry. See Section 001.3 regarding positions and clearances around the vessel while docking.

Table 4 Preliminary range of vessel motion

	Dynamic Range of Motion (minimum)	Reference Location	Additional Details	Notes
Pitch	± 1.5°	Center of buoyancy		
Roll	± 4°	Center of buoyancy		
Yaw	± 1°	20' aft of bow	See Allowable Yaw, Section 001.2.2	Rotation about bow (Anacortes) end
Heave	± 12"	Center of buoyancy	See Tidal Compensation, Section 001.2.1	Does not include tidal range
Surge	± 4"	Center of buoyancy		
Sway	± 4"	20' aft of bow	See Allowable Yaw, Section 001.2.2	The apparent sway near amidships is larger due to yaw

001.2.1 Tidal Compensation

The shoreside portion of the ASCS will be installed on a fixed foundation supported by steel piles. The ASCS should be able to connect with the vessel over the 15.5' tidal range at the terminal while allowing for the dynamic motion in Table 4. Proposed ASCS which provide for a slightly smaller tidal range may be put forward, but the limitation to vessel operations will be taken into consideration when the ASCS information is assessed.

Other options for foundations which do not require tidal compensation integral to the ASCS, such as floating platforms or installations fixed to the apron ramp, may be considered, but are not preferred. Where the cost, weight, or complexity of an ASCS is significantly increased by following the tidal range, vendors may provide additional information for an ASCS without tidal compensation for installation on an alternate foundation.

001.2.2 Allowable Yaw

The range of allowable yaw depends on how the vessel operates. A full range of yaw between the two midships dolphins (see Figure 5) is desired because it will allow the operator full flexibility to rest against either dolphin (dictated by tidal current or wind direction), allow the vessel to be centered between dolphins (preferred for loading long or oversized vehicles), and allow the vessel to be bow moored during breaks between ferry transits. Proposed ASCS with smaller yaw ranges than that shown in Figure 5 may be put forward, but the limitation to vessel operations should be clearly provided. Figure 6 illustrates the minimum range of yaw that an ASCS must allow due to deflection of the dolphin fender panels.

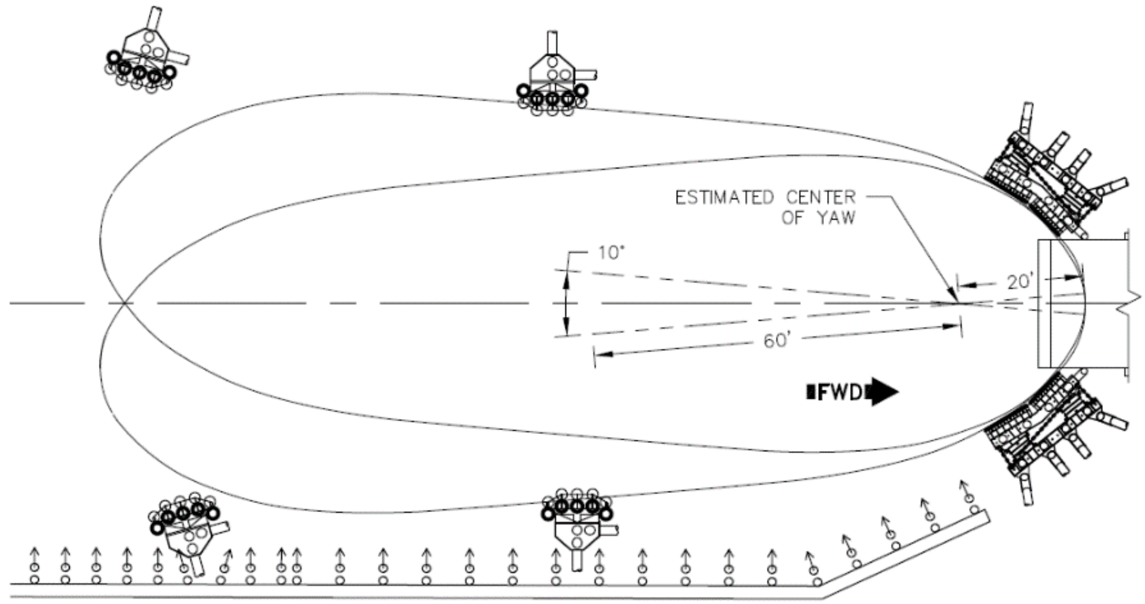

Figure 5 Desired yaw range

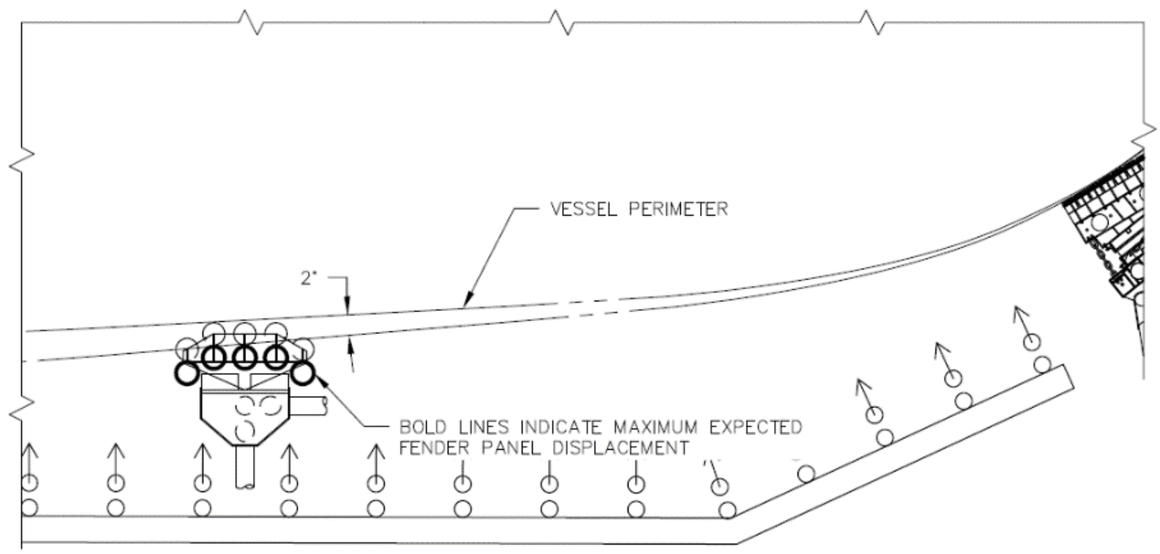

Figure 6 Minimum required yaw range

001.3 Equipment Location and Configuration

Glosten will determine the best location and configuration for each ASCS based on the discussions with vendors and the information provided. Vendors are encouraged to work closely with Glosten to help determine the optimum location and configuration for their system.

The following factors should be considered when contemplating locations and configurations:

- Visibility from the pilothouse.
- Effect on passenger walkways and seating, and vehicle loading/unloading.
- Risk of vessel collisions with shoreside shore connection equipment and foundation.

Effect of connection apparatus on vessel appearance; notably, connection apparatus which have minimal impact of the profile outline of the vessel is preferred.

Based on initial review of ASCS options available and the vessel layout, Glosten has developed several possible locations which would be suitable for the shore charging system; these hatched locations are shown in Figure 7.

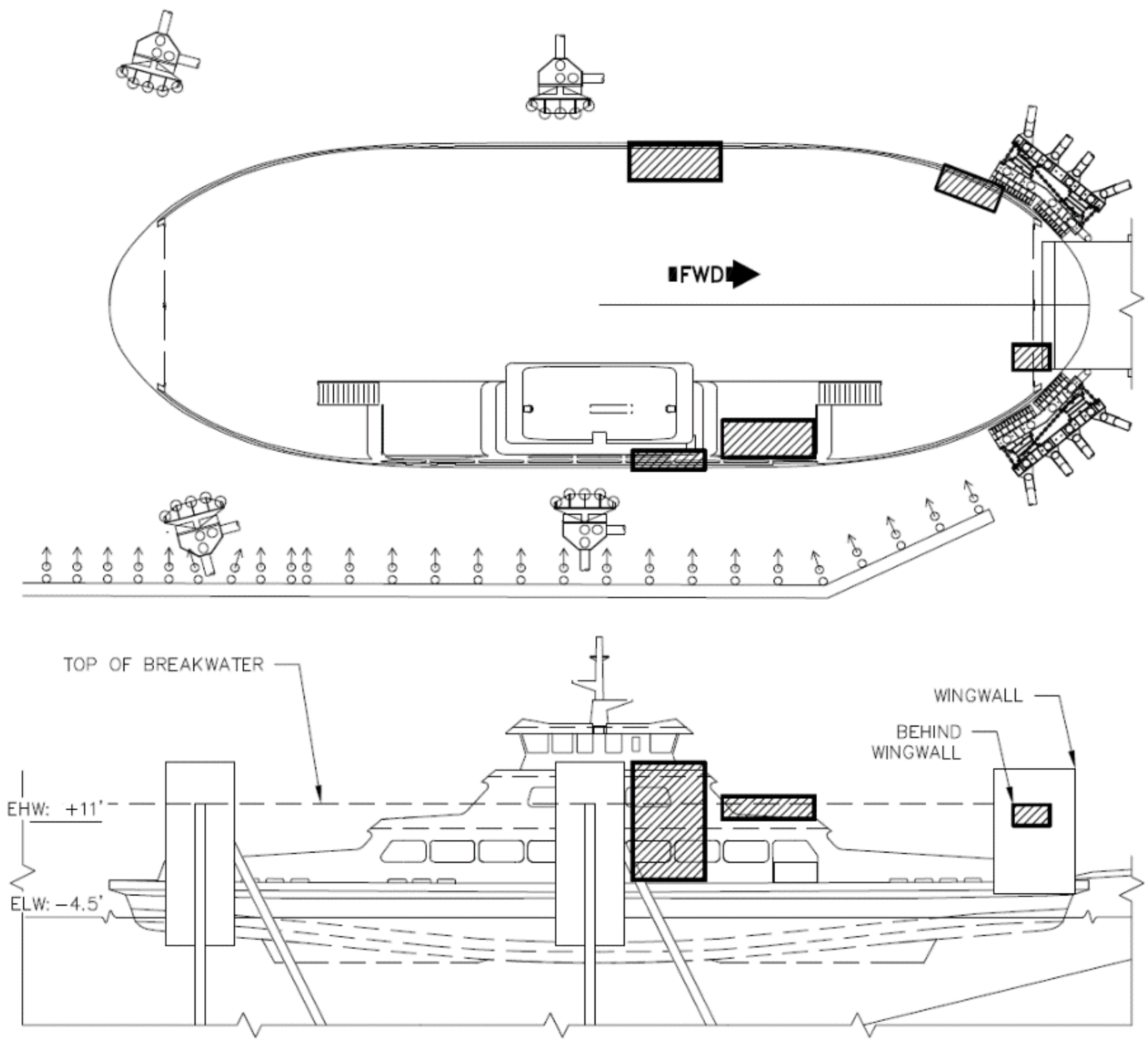

Figure 7 Vessel layout and possible locations for vessel portion of ASCS indicated by hatching

001.4 Safety Provisions

The size and arrangement of the GIFR vessel requires the charging connection on the vessel to be located adjacent to crew, passenger, and/or vehicle areas. Any shore connection system must be able to provide a very high level of protection for passengers and crew and minimize the risk of physical damage to the vessel and shore connection equipment.

Vendors should include details of the safety provisions and protections that are either integral to the system or should be provided by others as part of the overall vessel and terminal installations. This should include prevention or mitigation of risks associated with planned and unplanned events, including:

- Unplanned or unexpected actuation of automatically controlled ASCS equipment.
- Electrical faults.
- Failure of electrical disconnects, ground connections, or safety controls and monitoring.
- Interference of passengers, water spray, or other foreign objects into normal deployment and charging.
- Vessel motions outside the allowable range that could cause physical damage to the charging connection.
- Unplanned disconnection due to extreme vessel motion or vessel departure.

001.5 System Integration

The ASCS will be integrated with the VES and SES to provide the required power for charging the vessel batteries and shore connection circuit protection. Control of the power transmission rate will be through the VES and SES and should be considered outside the scope of the ASCS, unless necessary for operation of the ASCS.

The ASCS should provide for transmission between the SES and VES of electrical power at a nominal 1000VDC, vital safety and control functions over hard-wired 24VDC control circuits, and data communication over wired industrial ethernet. Alternative types of transmission methods may be considered and should be discussed with Glosten.

Vendors should provide emergency pushbuttons to open the circuit at the pilothouse control stations and adjacent to the ASCS socket. The installation of this equipment on the vessel will be performed by others.

Vendors should include information related to the integration of electrical, control, and safety features of the ASCS with the vessel and shoreside electrical systems. The following is a basic outline of the minimum level of interfaces expected for a typical galvanically connected ASCS. Vendors should provide a details list of interfaces specific for their system:

- FMLB ground conductor(s) and ground continuity check safety system for tripping vessel and shoreside disconnect switches.
- LMFB permissive circuit conductors for vessel and shoreside disconnect switches.
- Emergency stop and disconnect operable by crew at the pilothouse, connection point, and shoreside.
- Hardwired and/or serial/ethernet connections to both the VES and SES for control and monitoring.
- Wireless communication connection for remote monitoring and fault indication of the ASCS on the vessel while in transit.