At Berth Regulation Port & Terminal Plans

Oxnard Harbor District

Emissions Capture Assessment
Project No. 134687

Revision 4
11/24/2021

At Berth Regulation Port & Terminal Plans

prepared for

Oxnard Harbor District
Emissions Capture Assessment
Oxnard, CA

Project No. 134687

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prepared by

Burns & McDonnell Engineering Company, Inc.
Enter City, State of Office Location

INDEX AND CERTIFICATION

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Report Index

Signature of Responsible Port Official

Kristin Decas Digitally signed by Kristin Decas Date: 2021.12.01 13:14:48 -08'00'

Kristin Decas, CEO and Port Director

Date: December 1, 2021

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LIST OF ABBREVIATIONS

Abbreviation	Term/Phrase/Name
AECS	Approved Emission Control Strategy
AERAS	AERAS Technologies
CAEM	Clean Air Engineering Maritime
CARB	California Air Resources Board
ECCS	Emissions Capture and Control System
GHG	Greenhouse gas
HVSC	High Voltage Shore Connection
Port	Port of Hueneme
Reefer	Refrigerated cargo
Ro-ro	Roll-on roll-off
STAX	STAX Engineering

1.0 INTRODUCTION

The California Air Resources Board (CARB) issued a Final Regulation Order under Section 93130, which extends the Control Measure for Ocean-Going Vessels At Berth to all ocean-going vessels effective January 1, 2021. The 2020 Regulation requires emissions controls to be initiated for vessel types according to the following schedule (Table 1).

Table 1-1: 2020 Regulation emissions controls compliance start dates by vessel type

Compliance Start Date	Vessel Type
January 1, 2023	Container and refrigerated cargo vessels
January 1, 2023	Cruise (passenger) vessels
January 1, 2025	Roll-on roll-off vessels
January 1, 2025	Tanker vessels that visit the Ports of Los Angeles and Long Beach
January 1, 2027	All remaining tanker vessels

The purpose of the control measure is to reduce emissions of select criteria pollutants and greenhouse gases (GHGs) from vessels while at berth by requiring terminal operators to use shore power or a CARB Approved Emission Control Strategy (AECS), such as an emission capture and control system (ECCS). In addition, the updated order requires that ports and terminal operators develop and submit port and terminal plans by December 1, 2021 that describe the port and/or terminal's proposed approach for complying with the order.

Section 93130.14(a) of the California Code of Regulations requires that terminal operators (or as an alternative port authorities) submit terminal plans that describe the 'necessary infrastructure modifications needed to reduce emissions from ocean-going vessels at a terminal.' The terminal plan is to include the following information for each strategy to be implemented at a terminal:

(A) Identification and description of all necessary equipment, including whether it will be located on the vessel, wharf, shore, or elsewhere;

(B) Number of vessels expected to visit the terminal using the strategy;

(C) List of each berth with geographic boundary coordinates;

(D) Identify berth(s) where equipment will be used;

(E) Terminal/port specific berthing restrictions;

(F) Schedule for installing equipment;

(G) Division of responsibilities between the terminal operator and the port, including contractual limitations applicable to the terminal, relevant to enacting the infrastructure required by each terminal's plan; and

(H) A terminal operator claiming that a physical and/or operational constraint will delay its ability to implement its preferred CARB approved control strategy to achieve emission reductions from vessels at berth according to the requirements of section 93130 et seq, must also include with its terminal plan a technical feasibility study evaluating if there are any other emission control options that could be implemented more quickly at the terminal.

Section 93130.14(b) also calls for the development of a port plan that describes the 'necessary infrastructure modifications needed to reduce emissions from ocean-going vessels at a terminal, such that each terminal at the port is capable of meeting compliance requirements by the implementation dates.' The port plan is to include the following information:

(A) Identification and description of which strategy each applicable terminal will use for compliance;

(B) Identify any equipment purchases and/or construction that are in progress or must still be completed to reduce emissions;

(C) Provide schedule for installing equipment and/or any necessary construction projects;

(D) Identify terminals where equipment will be used;

(E) Specify any port specific berthing restrictions; and

(F) List the division of responsibilities between the terminal and the ports for enacting the infrastructure required by each terminal's plan.

Vessels subject to the 2020 Regulation calling at the Port of Hueneme (Port) include refrigerated cargo (reefer), roll-on roll-off (ro-ro) vessels, and tanker vessels. Reefer operations at the Port typically occur at the Wharf 1 or South Terminal (includes Berths 1, and 2), ro-ro operations occur at two terminals, consisting of Wharf 2 or North Terminal (includes Berths 4 and 5) and infrequently at the Navy Terminal, and tanker vessels call on the Wharf 1 (Figure 1-1). In 2020, there were 153 reefer vessels calls at the port, with 145 occurring at Wharf 1 (96%), 8 at Wharf 2 (4%), and none at the Navy Terminal. In 2020, there were 186 ro-ro vessel calls at the Port with 182 occurring at Wharf 2 (95%) and 4 at the Navy Terminal (5%). Lastly, there were 12 tanker vessel calls at Wharf 1 in 2020.

The Navy Terminal has had fewer than 20 calls from regulated vessels in the past calendar year and therefore is considered to be a low-use terminal. Low-use terminals do not have emissions control requirements; however, opacity and visit reporting requirements still apply. It is important to note that Navy Terminal is located on Navy Base Ventura County and is therefore neither on Port property nor under Port jurisdiction. The Port must request approval from Navy Port Operations to allow any vessel to be berthed at the Navy Terminal.

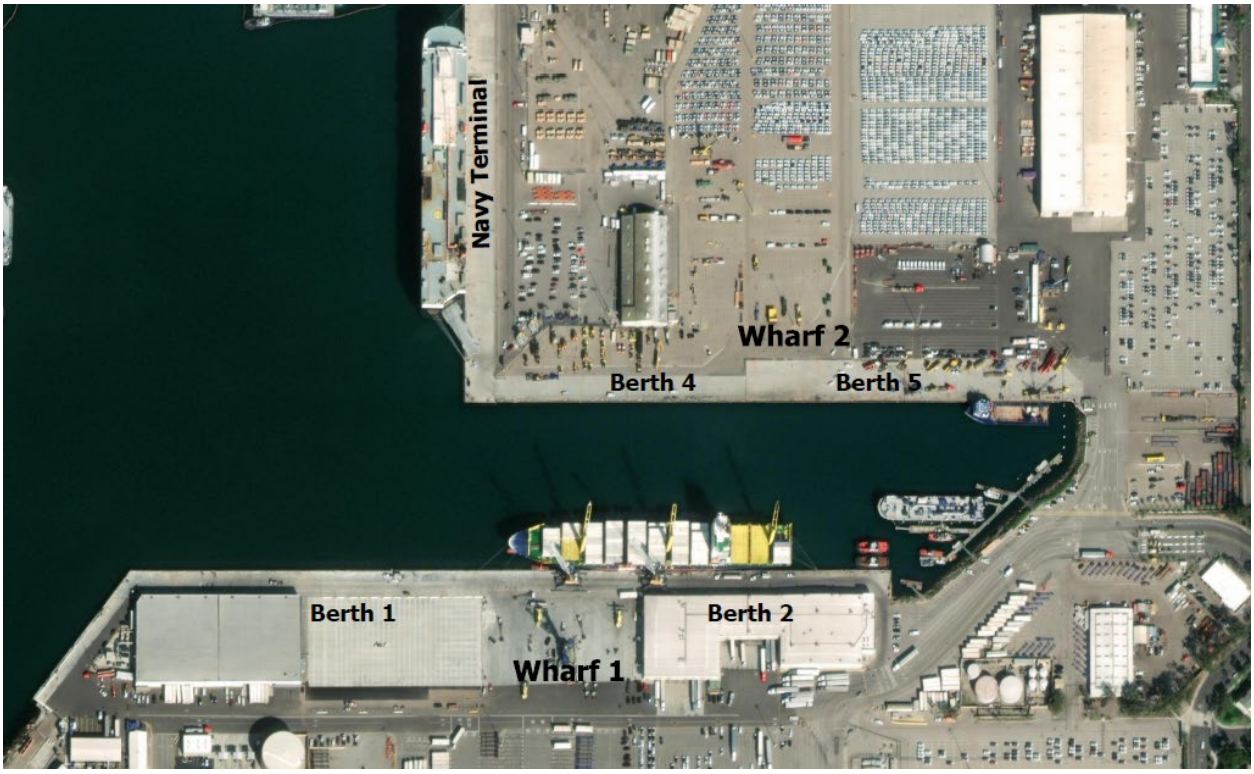

Figure 1-1: Port of Hueneme terminals

The Port plans to implement two strategies to comply with the At-Berth Regulation – shore power and an ECCS. There is currently a shore power system on the Wharf 1 South Terminal that serves reefer vessels. Shore power will be installed at the North Terminal at Berths 4 and 5. Upon project completion (estimated in 2024-5), the North Terminal's shore power system will be able to also serve reefer and ro-ro vessels. One barge-based ECCS will be deployed by January 1, 2025 to serve ro-ro vessels at the North Terminal that are not shore power compatible, as well as reefer vessels as a back-up option and potentially tanker vessels.

The Port is an operating port, directly involved in terminal operations at Wharf 1, Wharf 2, and Navy terminals, and as such serves in the role of both port authority and terminal operator. The Port will be

responsible for implementing emissions control strategies at the South and North Terminals for both reefer and ro-ro vessels. The following sections detail the Port's planned emissions control strategies for the Wharf 1 or South Terminal (Section 2) and North Terminal (Section 3) in compliance with the Control Measure for Ocean-Going Vessels at Berth, per Sections 93130.14(a) and (b) of the California Code of Regulations.

2.0 STATE OF THE TECHNOLOGY

2.0

The Port intends to continue to research the feasibility of different technology options to reduce emissions from vessel calls. The current strategies of enabling emissions control, and proposed within, include the primary control technology of shore power infrastructure with an ECCS as the alternate, however the Port must ensure that it maintains the flexibility to pursue the most effective and feasible technologies for future use. Other than existing shore power, this plan does not tie the Port to one technology if others prove to be a better fit for use within the Port of Hueneme. This recognizes the rapid pace of development of other potential control technologies and the constraints on implementation posed by the global pandemic and nascent state of the technology's manufacturing abilities.

2.1 Shore Power

While shore power is a proven strategy for reducing emissions from at-berth vessels, there is uncertainty as to whether the IEC/ISO/IEEE High Voltage Shore Connection (HVSC) Standard 80005-01 for ro-ro vessels will be 6.6 kilovolts (kV) or 11 kV. This uncertainty is delaying the initiation of shore power retrofits of ro-ro vessels by vessel owners. Any delay in initiating retrofits can have significant ramifications to the Port's planned compliance strategies because vessel owners anticipate that retrofits of their fleets will take approximately three years due to the need to drydock vessels when performing retrofits.

2.2 Emissions Capture and Control Systems

There are three companies that offer or plan to offer ECCS for at-berth ro-ro vessels, including AERAS Technologies (AERAS), Clean Air Engineering-Maritime (CAEM), and STAX Engineering (STAX). Of which, CAEM is the only company that has an operating ECCS. CAEM offers a barge-based system that has a CARB Executive Order (EO) for container vessels. They also have developed a shore-based ECCS for break bulk vessels for which they are currently seeking an EO. Both AERAS and STAX are in the process of developing their first ECCS for container vessels so neither has CARB-approved systems. All three companies reported that they plan to develop barge-based ECCS for ro-ro and reefer vessels that would meet the At-Berth Emissions reduction requirements as well as have grid-neutral power sources. Since the CARB At-Berth Regulations for ro-ro vessels are scheduled to go into effect in January 2025, there are currently no ECCS that have been designed specifically for ro-ro vessels. The absence of a CARB-approved ECCS for ro-ro vessels and the lack of diversity in ECCS providers with CARB-approved systems raises questions regarding the technical and economic feasibility and availability of ECCS units to serve the Port. The Port has been in close communication with the known ECCS

companies for the last three years to stay apprised of the development of the technology and potential plans and timelines for deployment of control technology including the potential for the Port of Hueneme serving as a testing location.

The Port will continue to evaluate the feasibility of different AECS options as they become available and will submit revised Port and Terminal Plans for ro-ro vessels by February 1, 2024 and tanker vessels by February 1, 2026, per Section 9.3130.14 of the 2020 At-Berth Regulation.

3.0 IMPLEMENTATION CHALLENGES

3.1 Shore Power

One of the key challenges for expanding the shore power system at the Port is the anticipated need to upgrade the utility feeds from Southern California Edison (SCE). Without adequate transmission and distribution system capacity, the terminal shore power system will have limited functionality and may be subject to utility-initiated outages. The Port is asking questions of the utility company provider to make sure we have adequate power provided to the Port when we needed it for shore side power. In addition, the Port is evaluating on-site distributed energy resource options, including on-site generation and energy storage to help offset peak demands and reduce utility upgrades.

As previously noted, the uncertainty as to whether the IEC/ISO/IEEE HVSC Standard 80005-01 for ro-ro vessels will be 6.6 kilovolts (kV) or 11 kV is delaying the initiation of shore power retrofits of ro-ro vessels by vessel owners. Delays in retrofits will limit the number of ro-ro vessels that will be able to connect to shore power, creating more demand for the ECCS. The Port will continue to work with shipping lines to stay apprised of their shore power retrofit schedules for vessel fleets calling on the Port.

3.2 Emissions Capture and Control Systems

The complete lack of CARB-approved ECCS for ro-ro and tanker vessels increases the uncertainty of the ability to implement the strategies described in the Port and Terminal Plan. While there are three companies (AERES, CAEM, and STAX) that report that they are developing ECCS to serve these vessels, only CAEM has a CARB-approved system that is in service. In addition the small size of these companies may present supply challenges as multiple ports and terminals procure systems to meet the treatment deadlines. The Port will continue to evaluate the operational viability of ECCS as systems are developed for ro-ro and tanker vessels by different ECCS providers.

4.0 SOUTH TERMINAL

The Port plans to implement two strategies to comply with the 2020 At Berth Regulation at the South Terminal, including shore power to serve reefer vessels and deployment of one barge-based ECCS to serve ro-ro and reefer vessels throughout the Port. Shore power will serve as the primary emissions control strategy for reefer vessels at the South Terminal (Wharf 1) and the ECCS will serve as a back-up control strategy.

4.1 Shore Power

Shore power is installed and available at the South Terminal (Wharf 1) to serve reefer vessels. The system allows three ships to be shore-power connected simultaneously while at berth. A shore power system has been in place at Wharf 1 since 2014 to serve reefer vessels.

4.1.1 Necessary Equipment

Shore power equipment is installed and in service at the terminal. No additional equipment is required.

4.1.2 Number of Vessels Expected to Use Strategy

In 2020, 145 reefer vessels visited Wharf 1, and there are anticipated to be over 160 reefer vessel calls in 2021. Going forward, the Port plans to use shore power as its primary emissions control strategy at the South Terminal to serve all shore-power-capable reefer vessels.

4.1.3 Berths Where Equipment will be Used

Shore power is installed at Berths 1 and 2 on the South Terminal (Wharf 1).

4.1.4 Berthing Restrictions

Reefer vessels generally dock at Wharf 1 due to the proximity of the associated container handling equipment and facilities. There are no berthing restrictions for reefer vessels at Wharf 1 (South Terminal). The shore power system on the South Terminal is a 6.6-kV system, which may not be compatible with the international electrical standard for ro-ro vessels, which may be 11 kV.

4.1.5 Division of Responsibilities

The Port will be responsible for the on-berth shore power infrastructure. Vessel operators are responsible for on-board shore power systems.

4.1.6 Physical and/or Operational Constraints

There are no physical or operational constraints for using shore power for those vessels that will be shore power compatible and meeting IEC/ISO/IEEE High Voltage Shore Connection (HVSC) Standard 80005-01. All other vessels will require the use of an ECCS to comply with the At-Berth Regulation.

4.2 Emissions Capture and Control System

The Port plans to provide the option for utilizing the services of one barge-based ECCS to serve ro-ro and reefer vessels that are not shore power compatible. As noted, reefer vessels primarily call on the South Terminal while ro-ro vessels primarily call on the North Terminal. It is anticipated that the ECCS will be primarily deployed at the North Terminal to serve ro-ro vessels because most reefer vessels calling on the Port are shore power compatible, while ro-ro vessels currently are not.

4.2.1 Necessary Equipment

One barge-based ECCS will be required to serve the Port full time. The ECCS that will be chosen will have a CARB Executive Order, with the capability to capture and treat emissions from two auxiliary engine stacks simultaneously. The reach of the emissions capture boom will be sufficient to reach stacks when the barge is positioned to the stern of the vessel (i.e., 200 ft or more). Barge-based ECCS will be either self-propelled or will require a tug.

4.2.2 Number of Vessels Expected to Use Strategy

Nearly all vessels visiting the South Terminal will use shore power. Less than 10 vessels would be expected to use the ECCS at the South Terminal.

4.2.3 Berths Where Equipment will be Used

The ECCS will be used at Berths 1, and 2 for vessels that cannot connect to shore power.

4.2.4 Berthing Restrictions

Due to the channel width between the Port's North and South Wharfs (395 ft), when vessels are at berth at both the North and South Terminals, the channel width is reduced to 155 ft. The use of a barge-based ECCS along the starboard side (in the channel) limits the ability of other vessels to navigate the channel (Figure 4-1).

Figure 4-1: Channel width constraint when vessels are simultaneously berthed at Wharfs 1 and 2

4.2.5 Division of Responsibilities

The Port will be responsible providing the option for utilizing an ECCS or entering into a contract with an ECCS provider for emissions control services.

5.0 NORTH TERMINAL

The Port plans to implement two strategies to comply with the At Berth Regulation at the North Terminal, including shore power at Wharf 2 and deployment of a barge-based ECCS for vessels that are not shore power compatible. The North Terminal (Wharf 2), consisting of Berths 4 and 5, is shown in Figure 5-1. Spatial and operational constraints at Wharf 2 allow only one ro-ro vessel to be berthed at the terminal at one time.

Figure 5-1: Port of Hueneme North Terminal (Wharf 2)

5.1 Shore Power

Shore power will be deployed at the North Terminal (Wharf 2) to serve ro-ro and reefer vessels (Figure 5-2). The shore power system will include two (2) outlet vaults for ro-ro vessels and two (2) outlet vaults for reefer vessels to provide flexibility in connecting to the greatest number of shore power compatible vessels.

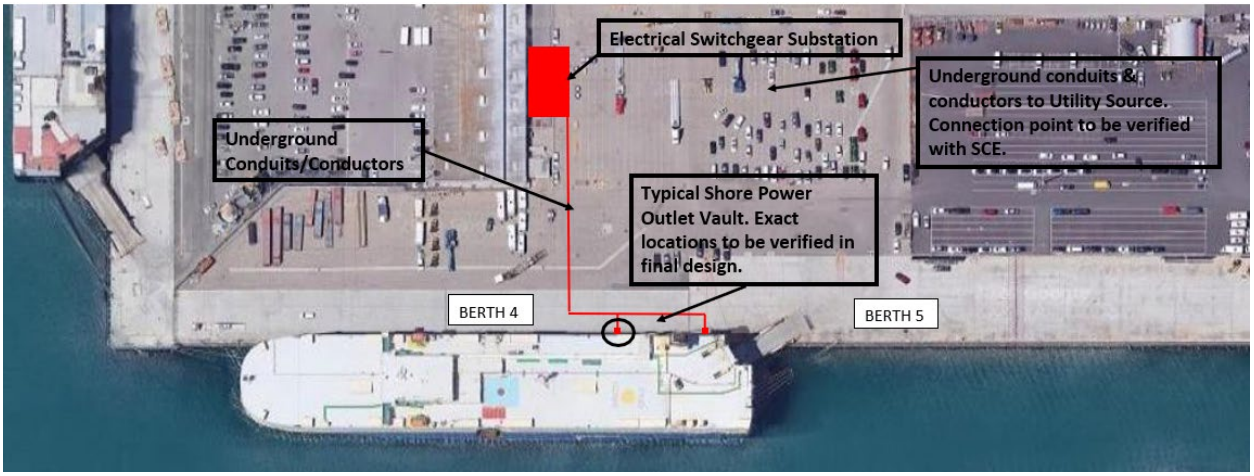

Figure 5-2: Planned shore power infrastructure at Wharf 2 to serve ro-ro vessels

5.1.1 Necessary Equipment

The shore power system will be compliant to IEC/ISO/IEEE High Voltage Shore Connection (HVSC) Standard 80005-01. Equipment to be installed include an electrical switchgear substation, associated underground conduits/conductors, two (2) typical shore power outlet vaults, and all utility company required infrastructure backbone.

5.1.2 Number of Vessels Expected to Use Strategy

In 2020, there were 182 ro-ro vessels that berthed at the North Terminal, and there are anticipated to be over 190 reefer vessel calls in 2021. Based on discussions with the shipping lines calling at the Port, plans for incorporating shore power into existing and new vessels vary by shipping line. It is anticipated that approximately 40-60 vessels will be shore power compatible by 2025.

5.1.3 Berths Where Equipment will be Used

Shore power will be used at Berths 4 and 5 at Wharf 2 for primarily ro-ro vessels and reefer vessels occasionally.

5.1.4 Berthing Restrictions

There are no berthing restrictions. The locations of the two shore power outlet vaults will accommodate a range of vessel sizes, provided that the vessels are shore power enabled.

5.1.5 Schedule for Installing Equipment

The estimated timeline for engineering is calendar year (CY) 2022 quarter 1 (Q1) to CY 2022 Q3, pending funding availability. Construction is scheduled to go out to bid in CY 2022 Q4, with building and commissioning running from CY 2022 Q4 to CY2023 Q4.

5.1.6 Division of Responsibilities

The Port will be responsible for the installation of the on-berth shore power infrastructure. Vessel operators will be responsible for retrofitting vessels for shore power. Plans for retrofitting and constructing new vessels with shore power vary among shipping lines. All retrofits will be voluntary and at the discretion of the shipping lines and/or vessel owners.

5.1.7 Physical and/or Operational Constraints

There are no physical or operational constraints for using shore power for those vessels that will be shore power compatible and meeting IEC/ISO/IEEE High Voltage Shore Connection (HVSC) Standard 80005-01. All other vessels will require the use of an ECCS to comply with the At-Berth Regulation.

5.2 Emissions Capture and Control System

The Port plans to procure the services of one barge-based ECCS to primarily serve ro-ro vessels at the North Terminal, and it will also be used at the South Terminal if needed and not in use on North Terminal.

5.2.1 Necessary Equipment

One barge-based ECCS will be required to serve the Port full time. The ECCS that will be chosen will have a CARB Executive Order, with the capability to capture and treat emissions from two auxiliary engine stacks simultaneously. The reach of the emissions capture boom will be sufficient to reach stacks when the barge is positioned to the stern of the vessel (i.e., 200 ft or more). Barge-based ECCS will be either self-propelled or will require a tug.

5.2.2 Number of Vessels Expected to Use Strategy

In 2025, it is anticipated that over 200 vessels will require the use of an ECCS while at berth. As additional ro-ro vessels are retrofitted or constructed with shore power, the use of the ECCS will gradually decline.

5.2.3 Berths Where Equipment will be Used

The ECCS will be used at Berths 4 and 5 at the North Terminal (Wharf 2). The ECCS will be used opportunistically at Wharf 1 and Navy Terminals when an ECCS is not required to serve ro-ro vessels at Wharf 2.

5.2.4 Berthing Restrictions

Most ro-ro vessels have a stern ramp positioned on the starboard side of the vessel. ECCS will need to have the capacity to treat emissions from at least two auxiliary engine stacks potentially located at beam's

width or more from the barge. Due to the channel width between the Port's North and South Wharfs (395 ft), the ideal position for the ECCS will be on the portside of the stern of the vessel to accommodate a vessel transiting the channel when there are ships at berth along the North and South Terminals (Figure 5-3).

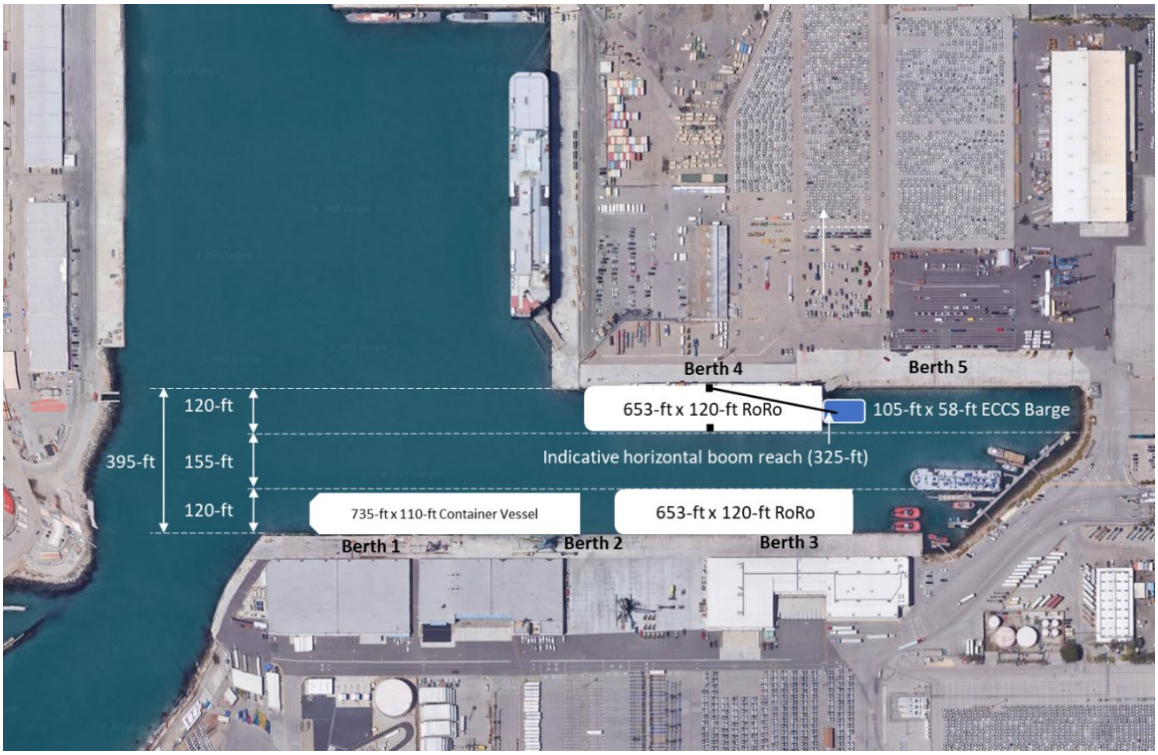

Figure 5-3: Ideal positioning of barge-based ECCS to maintain channel navigability

5.2.5 Schedule for Installing Equipment

ECCS services will be procured in advance of January 1, 2025 emissions control compliance date for ro-ro vessels. ECCS providers indicated that they will be developing systems to begin the CARB approval process no later than 2023.

5.2.6 Division of Responsibilities

The Port will be responsible providing the option for utilizing an ECCS or entering into a contract with an ECCS provider for emissions control services.

5.2.7 Physical and/or Operational Constraints

The principal constraint for deploying a barge-based ECCS is the channel width between the north and south wharfs. Initial analyses have shown that planned ECCS can be positioned at the stern of the vessel to the portside of the stern ramp. The ECCS will have the ability to reach vessel auxiliary engine stacks

located near the stern of the vessel. ECCS providers report that they are developing capture booms that will have adequate reach, the ability to connect to and treat two stacks simultaneously, and the flexibility to be compatible with different stack configurations; however, it is important to note that there are no ECCS that have been developed for ro-ro vessels and consequently none are CARB approved.

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