Contents

Appendix G. Reference Documents

G.1. 2004 Master Plan Recommendations

Conclusions from site visits, review of existing information, and evaluation of facilities are summarized below:

- **Market Analysis:** Since the tunnel conversion, tour companies, freight carriers, government agencies, and the military have expressed increased interest in the use of Whittier as a part of call, creating opportunities for development of infrastructure and services. The 2025 revenues for major revenue sources in Whittier were forecasted to increase from an estimated $6.5 million in 2004 to $17.6 million in 2025.
- **Phase I Environmental Site Assessment (ESA):** Because of historical contamination, there is a medium level of risk associated with development of new facilities.
- **Marginal Wharf:** This facility, damaged during the 1964 earthquake and suffering from age, is no longer in use. Its location at the end of the Whittier access road, near the ARRC tracks, and close to the town of Whittier is ideal for intermodal transfer of passengers between land, sea, and rail modes of transportation.
- **DeLong Dock:** At this dock, which primarily serves the fishing industry, improvements have enhanced safety and service. Additional improvements to protect the structure and enhance dock service are needed.
- **Transit Shed:** This structure was demolished because of structural deficiencies.
- **Barge Slip:** This facility is essential to barge traffic for Southcentral Alaska. Recent improvements include a side-loading facility to improve loading and unloading of barges.
- **Rail Yard Storm Drain System:** The existing storm drain system does not always effectively handle standing water and flooding that occurs during tides.
- **Rail Yard Track Layout and Alignment:** The Rail Yard currently operates at capacity for freight operations and provides no available unutilized track for maneuvering of passenger rail cars.
- **Security:** Concerns about security at marine and rail transportation facilities are resulting in new requirements for on-site security and control of access points. The Alaska Railroad Corporation (ARRC) has added year-round contract security personnel to augment its system-wide force.

The recommendations for future intermodal development by the ARRC are summarized below:

- **Market Analysis:**
  - Continue development of land lease relationships with port users that include private and government entities.
  - Consider strategies to increase rail ridership, such as the use of train sets that carry passengers to and from the Ted Stevens Anchorage International Airport or downtown to carry passengers south to Whittier, as a means of maximizing opportunities resulting from growth in Whittier cruise ship and other tourism traffic.

- Promote leasing of land or building space for retail shops adjacent or close to the cruise shipping docks.
- Increase capacity and frequency of train service to better meet the needs of day tour operations and create additional demand for retail and office space.

- **Phase 1 ESA:** Consult historical information in determining locations for development and conduct testing at those sites to identify whether remediation would be required.
- **Marginal Wharf:** Replace the existing facility with a modern dock facility that will accommodate tourism ventures, provide for additional freight operations, and service military deployment and response purposes.
- **DeLong Dock**: Provide upgrades consisting of water connection, safety ladders, and a cathodic protection system.
- **Barge Slip:** Provide repair and maintenance to extend the serviceability of the slip and improve efficiency of operations.
- **Rail Yard Storm Drain System:** develop a plan for addressing runoff control of storm water, including management of snow removal and reduction of sedimentation, and coordinate improvements with proposed track alignment upgrades.
- **Rail Yard Track Layout and Alignment:** Realign tracks in the Rail Yard to improve the offloading of barge freight and improve the ability of equipment to maneuver.
- **Security:** Prepare a detailed analysis to identify security needs and means to address them.
- **Potential Improvements:**

    - Advance passenger terminal concepts to provide a facility to handle loading and offloading of large cruise ships that would include space for passenger staging, baggage handling, office and counter space for cruise lines and airlines, accommodations for vehicle parking and bus staging, and an adjacent passenger loading facility.
    - Advanced proposed pedestrian enhancements consisting of a small visitor center that accommodates informational kiosks, outdoor viewing platforms, and restroom facilities for the U.S. Forest Service. ARRC must complete all mitigation activities specified in the Maritime Administration Record of Categorical Exclusion, issued on September 2, 2022, ensuring that the project complies with federal and state environmental regulations.

G.2. ARRC Whittier Terminal Reconstruction Barge Ramp – Draft Barge Ramp Alternatives Analysis – Contract No. 117853

On-Call Marine Structural Engineering Services
ARRC Whittier Terminal Reconstruction
Barge Ramp
DRAFT Barge Ramp Alternatives Analysis
Contract No. 117853

Prepared by KPFF Consulting Engineers

DRAFT Barge Ramp Alternatives Analysis

March 22, 2021

kpff 60 YEARS

TABLE OF CONTENTS

1.0 EXECUTIVE SUMMARY

The following alternatives analysis provides background on the existing Whittier Terminal Barge Rail Transfer Ramp and the overall alternatives analysis currently being undertaken by the Alaska Railroad Company (ARRC). It then focuses on six main alternatives for the rail transfer span, lift structures and foundations based on the number of rail tracks provided in each alternative, the type of deck system utilized, and whether the lift mechanics are elevated and mechanically coupled, or lower and electronically coupled. The alternatives are broken down into sub-alternatives based on the potential lift mechanisms, and discussion of reusing the existing ramp in a temporary location is also provided. The report closes with a discussion of lift span infrastructure costs.

As will be described in more detail below, it is anticipated that to replace the current rail barge transfer span with an updated two track system that provides sufficient overhead and width clearance for transfer of a 60-foot-wide container, the baseline cost for ramp, lift mechanism, and support foundation costs is approximately $8.2M. To further minimize in-water contact and mechanically couple the system utilizing an overhead bridge structure would increase this baseline cost to approximately $9.9M. Furthermore, it is anticipated that the cost will increase by $1M to $2.5M for each additional track added to the transfer span up to six tracks total depending on the lift system utilized.

2.0 PROJECT DESCRIPTION AND BACKGROUND

The Alaska Railroad Company's (ARRC) Whittier Terminal is almost 50 years old and reaching its service life expectancy. ARRC has invested over the last two years to extend the life of the Barge Slip including electrical, structural, and mechanical rehabilitations. The next phase is planning for reconstruction. This effort will likely include the barge slip, the old marginal wharf area, and potentially other areas to facilitate construction. R&M Engineering has recently begun pre-engineering efforts including survey and geotechnical support and PND Engineering will be assisting ARRC in marine engineering. KPFF has been contracted to provide engineering services for development of alternatives for the new transfer span ramp, specifically providing structural and mechanical engineering input and preliminary rough order of magnitude (ROM) cost estimates for ramp specific elements such as abutments, lift structures, mechanical systems, and the ramp itself.

This alternatives analysis describes the alternatives evaluated including variations of ramp width, deck system, mechanical lift system/coupling, and location. It then provides a discussion of the costs of these elements followed by a summary of our conclusions.

Alternatives Figures, Rough Order of Magnitude (ROM) Construction Cost Worksheets, and a Basis of Design (BOD), are included as appendixes to this report.

The BOD in Appendix 6.3 articulates the project requirements and desires related to location, safety, operational ease, durability, cost, and constructability as they pertain to the mechanical and structural systems for the ramp. This is a preliminary level BOD and intended to serve as a starting point for a design level BOD when appropriate. The information provided is intended to be the baseline assumptions that KPFF utilized in evaluation of the alternatives.

3.0 ALTERNATIVES EVALUATED

3.1 Introduction to Alternatives

KPFF evaluated three main track configuration alternatives for the lift span assuming that the spacing between the rails would be equivalent to the current rail spacing on the existing ramp but providing for the Whittier Tunnel clearance diagram along the outside rails with respect to height and width. Furthermore, KPFF evaluated width and height clearances associated with carrying a 60-foot wide container across the ramp utilizing a container handler and still providing adequate clearance to the lift towers on each side of the ramp. It should be noted, that in all cases this container width drives the overall width clearance on the ramp itself.

Alternatives 1 through 3 include these three main track configurations supported on a through girder deck system and hoisted by elevated towers with a mechanically coupled lift system running across an elevated spanning bridge. Given that elevated structures and machinery houses may pose ice management concerns, Alternatives 4 through 6 include the same three main track configurations but utilize a mechanically decoupled hoist mechanism employing multiple motors and electronic coupling.

In addition to the six main alternatives, KPFF also evaluated mechanical lift sub-alternatives. Two of these mechanisms stood out as being feasible and a net benefit in terms of operation, maintenance, and cost to ARRC. These were a counterweighted wire rope lift mechanism and an overhead hydraulic lift mechanism. These are referred to in our cost sheets as sub-alternatives A and B respectively. Other potential lift mechanisms are discussed below. These were not found to be of net benefit to ARRC but are discussed briefly below for completeness.

These alternatives and the associated costs discussed in 4.0 Rough Order of Magnitude Construction Costs, assume that the ramp will be constructed in a new location. The end of this section discusses the implications of temporarily relocating the existing ramp and constructing the new ramp in the existing ramp location.

1.1 Span Length Discussion

For each alternative, a 120’ bridge length was assumed based on the existing bathymetry of the slope, anticipated tidal range changes over the various design vessel freeboards, and track slope requirements. Based on the proposed geometry, there is little benefit to extending the length further – for each additional 5’ of span length added, approximately 16” of additional operational tidal range change can be accommodated. However, the proposed bridge length will accommodate all design vessels as articulated in the Basis of Design. The cost for increasing span length is discussed in 4.0 below.

3.2 Alternative 1: Two Track Through Girder with Elevated, Coupled Hoist System

Alternative 1 is a two-track configuration. The upland abutment consists of a cast-in-place (CIP) concrete abutment supported on steel pipe piles driven to approximate bedrock. Alternate foundation solutions such as concrete piles or shafts are possible, but for the purposes of this alternatives analysis and cost estimating, the specific foundation type would not significantly alter the solution within the fidelity of the level of design represented in a conceptual alternatives analysis. All alternatives utilize these same abutment configurations.

The span from the upland abutment to the rail barge consists of two deep built-up steel plate girders at the outer extents of the width with the bridge deck supported at the bottom of the girders. This will be referred to as a through-girder system. The span deck consists of floor beams supporting stringers which support deck beams, grating and the rail.

The bridge is hoisted utilizing an outboard built up plate girder lifting beam. The purpose of this system is to limit, as much is practically possible, the amount of structure that is subject to immersion and splash zone effects, while providing maximum overhead clearance and limiting the height that a container needs to be picked by a container handler when traversing the ramp.

The lifting beam would be hoisted by one of the mechanical lift mechanisms described below. The figures in Appendix 6.1 show the counterweight wire rope system described below. The other lift mechanisms are not shown in the figures for clarity, as the fundamental support system does not change from one sub-alternative to another. The lift mechanism is hung from two steel trussed lift towers which are supported on concrete dolphin structures. Though not shown as such, the trussed towers could be cladded to prevent ice buildup if desired by ARRC. Cost for cladding has been included in the estimate numbers provided. The dolphins are assumed to be supported on temporarily (either left in place or removed) cased cast-in-place concrete drilled shafts. As with the abutments, preliminary structural modeling was performed to estimate the foundation costs for these elements, but other foundation types are also possible within a similar cost range as that presented below. All alternatives utilize these same tower and concrete dolphin structure configurations.

The lift towers support the lift mechanism along with an equipment support bridge that runs between the towers. The equipment support bridge is supported on built up steel plate girders sized primarily for deflection control. The equipment support bridge provides access between the two towers in addition to supporting three steel framed machinery houses to house counterweight sheaves, drums, motors, or hydraulic equipment as required based on the lift mechanism. Though not shown in the figures, a stair system has been included in the cost estimates on the shoreside lift tower.

The distance between the lift towers (gauge) is shown on the figures and for Alternative 1 is based completely on providing sufficient width clearance between the towers and a 60-foot container width being carried down the center of the span by a container handler.

3.3 Alternative 2: Three Track Through Girder with Elevated, Coupled Hoist System

The only significant difference between the two-track and three-track configurations is the overall width of the bridge span itself. The gauge between the lift towers is equivalent between the two because it is driven by the lifted container width. This will be discussed further in Section 4.0 below.

3.4 Alternative 3: Four Track Through Girder with Elevated, Coupled Hoist System

Alternative 3 is a four-track alternative and represents a significant increase in footprint and, to a lesser degree, cost from the two and three-track alternatives. The biggest reason for this increase is the need to provide a third girder. The span between the exterior girders becomes too large to provide a reasonable deck system for a four-track alternative. To maintain the goal of having as much structure out of the water as possible, it is necessary to place the third through girder above the deck in the midspan of the deck.

With the central girder, the need to carry the 60-foot container down one side or the other of the central girder results in needing to significantly widen the gauge between the lift towers. There are two possible options for narrowing the gauge in the four-track through girder configuration.

- The first option would be to offset the central girder so there would be three tracks between one outside girder and the middle girder, and a single rail only line between the other outside girder and the middle girder. This would provide some cost savings from the four-track alternative shown in Appendix 6.1, but would limit container handler access to one side of the barge.
- The second option would be to utilize four girders with rail only tracks between the central girders and the outside girders and providing one central two-track zone where container handlers could operate. This provides less cost savings than the first option but would allow for more coverage on the barge by container handlers with slewing.

See Section 4.0 for the cost discussion associated with these intermediate options.

3.5 Alternative 4: Two Track Deck Girder with Lowered, De-coupled Hoist System

Alternative 4 is the first of three alternatives (4-6) that utilize a deck-girder system (see below) and a de-coupled hoist system thus eliminating the need for an overhead bridge structure to couple the mechanical systems. The downside to this type of system is that the mechanical system is not physically coupled, and thus failure of one side of the system may result in the structure needing to be hoisted or held in an elevated position via one side of the span or the other. This will result in an increase in span structure cost. However, the level of analysis to determine the exact increase is beyond the scope of this alternatives analysis study. The cost increase is not expected to be significant relative to the delta-costs discussed in this report.

The span from the upland abutment to the rail barge consists of steel plate deck girders beneath the deck. The deck consists of steel wide flange deck beams on top of the deck girders. These deck beams support the grating and rail. This will be referred to as a deck-girder system. To limit the amount of structure in the water, the lift beam runs through, or integrally with the deck girders. However, the net surface area of steel within the water on average is increased from the through-girder system.

Note that Figures for Alternatives 4 through 6 all show machinery houses at the top of the individual towers. These were included for conservativism in the costing. However, it may also be possible to locate these within the cladded truss towers as part of a final design.

3.6 Alternative 5: Three Track Deck Girder with Lowered, De-coupled Hoist System

Alternative 5 is identical to Alternative 4 with the exception that it includes three tracks versus two.

3.7 Alternative 6: Four Track Deck Girder with Lowered, De-coupled Hoist System

Alternative 6 is identical to Alternatives 4 and 5 with the exception that it includes four tracks. It should be noted that the gauge between towers in Alternatives 4 through 6 remains constant and is set by the clearance required for the 60' container width. Furthermore, it is less than it is for Alternative 3, because the container can still be driven down the center of the deck without the need for a deeper intermediate through-girder.

3.8 Lift Mechanism Alternatives

3.8.1 Sub-Alternative A: Counterweight Wire Rope System

The Counterweight Wire Rope System drives two wire rope subsystems off one or two motor and reducer combinations. In Alternatives 1 through 3, both subsystems are always in sync mechanically, because a single motor is utilized in the centrally located machinery house and mechanically coupled to the subsystems. In Alternatives 4 through 6 two motors would be utilized (one at each tower) and electronically coupled. Each subsystem includes a counterweight, drum, drive shaft, shaft support bearings, counterweight sheaves, hoist sheaves, sheave mounting brackets, counterweight wire rope, hoist wire rope, and associated components that connect the wire rope to the structure.

The benefits to this type of system are as follows:

- Reduction in power requirements
- Easier to operate manually if there is a loss of power

The downsides to this type of system are as follows:

- Added complexity due to the counterweight
- Significant total dead weight increase due to the counterweight

Maintenance is low to moderate with this type of system (see cost discussion below). The bearings, for both the shafts and sheaves, will need to be greased every month. An automatic grease system could be added to reduce maintenance but would increase the cost of the system. The wire rope will need to be inspected annually and replaced approximately every 20 years. The motor and reducer will typically need maintenance annually. This system has a life of approximately 50 years with the maintenance mentioned here.

3.8.2 Sub-Alternative A (Alternate): Non-Counterweight Wire Rope System

The Non-Counterweight Wire Rope System drives two wire rope subsystems off one or two motor and reducer combinations. In Alternatives 1 through 3, both subsystems are always in sync mechanically, because a single motor is utilized in the centrally located machinery house and mechanically coupled to the subsystems. In Alternatives 4 through 6 two motors would be utilized (one at each tower) and electronically coupled. Each subsystem includes a drum, drive shaft, shaft support bearings, hoist sheaves, sheave mounting brackets, hoist wire rope, and associated components that connect the wire rope to the structure.

The benefits to this type of system are as follows:

- Reduction in system complexity
- Reduction in maintenance
- Minimal increase to dead weight

The downsides to this type of system are as follows:

- Large power requirements
- Harder to operate manually if power failure occurs

There are a few options to keep the wire rope from going slack while connected to the vessel.

- The lift system could be separate from the lift beam so that the beam can move independently.
- A take up counterweight system could be implemented.
- A feedback control system could provide constant torque to the motors.

Maintenance is low with this type of system. The bearings, for both the shafts and sheaves, will need to be greased every month. An automatic grease system could be added to reduce maintenance but would increase the cost of the system. The wire rope will need to be inspected annually and replaced approximately every 20 years. The motor and reducer will typically need maintenance annually. This system has a life of approximately 50 years with the maintenance mentioned here.

A Non-Counterweight Wire Rope system would be a good option if not increasing the lift tower dead weight was a driving requirement. If increasing the lift tower dead weight is not a concern (which we currently do not believe it to be), then a Counterweight Wire Rope system would be beneficial because the power required to operate the lift system goes down significantly which decreases the cost and complexity of the drive system. As noted below, the non-counterweight lift system is approximately $100k more with respect to initial cost.

3.8.3 Sub-Alternative B: Hydraulic System

The Hydraulic system uses two cylinders to raise and lower the ramp. The system is composed of two hydraulic cylinders and one or two Hydraulic Power Unit(s) (HPU) with control valves. This system also requires a "float circuit" that allows the rod end and blind end of the cylinder to exchange fluid when the ramp is connected to the barge and moving with the tide.

The benefits to this type of system are as follows:

- Less annual and overall maintenance
- Easier solution for float system when supported by the vessel

The downsides to this type of system are as follows:

- It requires custom cylinders

- It adds the need for spare components
- There are environmental challenges with oil over water
- Technician availability for maintenance and repairs (see maintenance cost discussion below)

Maintenance is generally low for this type of system if the materials are selected carefully. The components would need to be inspected monthly. Monthly inspections would identify any components that need servicing or replacement. Typical components have a life of 10 years up to the life of the system, depending on the component. This system has a life of approximately 50 years.

3.8.4 Other Potential Lift Systems

A bascule system and a buoyant lift system were also considered. The bascule system would be beneficial because the counterweight and foundation would be entirely on land, so no piles or caissons would be required in the water. However, this system was not moved forward due to complexity of the supporting structure and the likely need for deep excavation on the land side if the counterweight is below ground or a high structure if the counterweight is above ground. The buoyant system was reviewed but not moved forward due to the high levels of maintenance required for corrosion control and the complexity of buoyancy control with the ballast system.

3.9 Ramp Physical Location Alternatives

Based on what is known now, the physical location of the final ramp has little effect on the cost or construction of the abutment, lift system, mechanical systems, or the ramp itself. However, ARRC's overall alternatives do include scenarios where the existing ramp is temporarily moved to a new location, and the new ramp is constructed within the footprint of the existing location. If this occurs there are additional elements of construction that will need to occur.

- Construction of a new abutment and caissons in the temporary location.
- Disconnecting, transferring, and reconnecting the existing rail span at the new temporary location.
- Installation of new mechanical lift mechanism (to match the existing) and electrical rerouting.
- Demolition of the existing ramp infrastructure at the existing location to allow for construction of the new ramp.

The most cost-effective method for lifting the ramp at the alternate location is to utilize the currently designed hydraulic system. Any other system would require a complete design effort which would not be beneficial from a cost perspective as the temporary ramp would be decommissioned after the new ramp is complete. The hydraulic system would be able to use all the existing components except for the hydraulic tubes from the hydraulic power unit to the connection point on the ramp. This option would cause a shutdown of approximately 2 weeks. If this is not acceptable, hydraulic tubing would have to be added between the two sites to operate both systems using the same hydraulic power unit or all new components could be procured. However, there will likely also be at least a two-week shutdown just to physically move the bridge. These two activities could occur concurrently.

The cost implications of these elements are discussed in the next section.

4.0 ROUGH ORDER OF MAGNITUDE CONSTRUCTION COSTS

4.1 Introduction to Cost Estimates

Cost estimate sheets are provided in Appendix 6.2 and provide a detailed line-item breakdown of assumptions that were made and what has been included in each of the alternative estimates. Given the preliminary nature of the design for this alternative's analysis, we have applied a design and construction aggregate contingency of 40% to reflect that the design is at an approximately 10% level.

Quantities were based on basic structural and mechanical analysis techniques including simplified finite element analysis models. However, very little geotechnical information was available for the site, so broad assumptions had to be made consistent with the level of design and contingency assigned.

The assigned unit costs have not been inflated by additional contingency but are values that would be utilized for developing cost for more advanced levels of design. The intent with this approach is to group the contingency associated the design and construction into one location for comparative analysis purposes.

The intent of this alternatives analysis was to focus on the ramp structural and mechanical costs. Per discussion with ARRC, other aspects of the overall alternatives are being calculated by others. Therefore, these estimates do not include the following elements:

- Upland infrastructure costs including regrading, rail connections, etc.
- Demolition costs of the existing lift span and foundations except for the discussion in Section 4.5 provided below.
- Furnishing and constructing other upland infrastructure such as bulkhead walls, piers, transverse barge ramps, or abutment.
- Furnishing and constructing mooring and berthing structures including upland structures or mooring/berthing dolphins utilized to moor and/or slew the barges.
- Berth deepening or dredging required for barge operations.

4.2 Alternatives Cost Discussion

Table 1: Summary of Alternative Costs below provides a summary of each alternative and sub alternative. Alternative 1A can be considered a baseline cost for the through girder with elevated, coupled hoist systems, and Alternative 4A can be considered a baseline cost for the deck girder with lowered, decoupled hoist systems. To increase from a two-track to a three-track span increases the overall ramp and lift structure cost by approximately $2M regardless of whether the system is coupled or de-coupled. The increase from a three-track to a four-track span is an additional approximately $2.5M for the elevated, coupled hoist system, but only about $1.1M for the lowered, decoupled system. However, with some of the other four track options discussed in Section 3.4, this number could likely be in the $2M increase range with slightly reduced functionality. Furthermore, it is also feasible that increasing to a six-track configuration could also be achieved within the lift span gauge of the four-track Alternative 3 with a similar $2M to $2.5M per track increase. Though the gauge of the towers would need to increase, going from the four track Alternative 6 structure to a six-track structure would likely have a similar order of magnitude cost increase of around $1M.

Table 1: Summary of Alternative Costs

	Sub-Alternative A (Counterweight Wire Rope Lift System)	Sub-Alternative B (Overhead Hydraulic Lift System)
Alternative 1: Two-Track Elevated, Coupled	$9.9M	$10.5M
Alternative 2: Three-Track Elevated, Coupled	$11.9M	$12.5M
Alternative 3: Four-Track Elevated, Coupled	$14.4M	$15.2M
Alternative 4: Two-Track Lowered, De-Coupled	$8.2M	$8.7M
Alternative 5: Three-Track Lowered, De-Coupled	$10.5M	$11.0M
Alternative 6: Four-Track Lowered, De-Coupled	$11.6M	$12.3M

Overall long term maintenance costs are very difficult to anticipate for the structural elements on the project, but it is anticipated that the elements depicted would be designed for a minimum of a 50 year design life with limited maintenance over that period of time, with the exception of potential recoating of select steel elements. However, it is anticipated that that maintenance cost would be approximately equivalent in Alternatives 1 through 3 but would be slightly higher for Alternatives 4 through 6 given that more of the structure would be subjected to tidal influences.

4.3 Through Girder vs. Deck Girder Cost Discussion

As seen in Table 1: Summary of Alternative Costs, the cost of the decoupled deck girder systems is less than the through girder overhead coupled systems. The largest portion of this decrease comes from eliminating the need for the overhead bridging structure, though it does slightly increase the cost of the mechanical system. A portion of this cost decrease is also accounted for in going from a through-girder to a deck-girder system which ranges from an approximately $500k to $1M depending on the number of tracks. However, it should be noted, that this savings comes at the cost of additional maintenance since more of the deck-girder system structural steel is in the water than the through-girder systems. Either deck system could be utilized with either tower or hoisting configuration.

It should also be noted that within the deck-girder alternatives, there is little cost variation between alternate solutions that use fewer deeper girders versus more shallow girders, at least that can be registered at the fidelity of this level of analysis. There is likely an optimal balance between number of girders and individual girder depths, but this optimization would be a task for final design of the span system when competing design requirements such as tortional span rigidity could be thoroughly evaluated. Finally, it appears that the cost to increase the span length, if desired for any reason, is approximately $100k/5 feet for a two-track configuration and up to $150k/5 feet for a four-track configuration. This would be expected to hold true for up to an approximately 10-foot increase.

4.4 Lift Mechanisms Cost Discussion

The order of the proposed systems in terms of least maintenance cost over time would be the Hydraulic System, Non-Counterweight Wire Rope System, and then the Counterweight Wire Rope System. Although the Non-

Counterweight system would have the least amount of maintenance cost for the wire rope systems, the delta between the maintenance costs for the wire rope systems is low, whereas the initial cost for the non-counterweight system is approximately $100K more than for a counterweight system. Table 2: Lift Mechanism Maintenance Costs, below provides an estimate of monthly, yearly, and 20-year maintenance costs for the various lift options. Much of the monthly cost is associated with inspections which we have assumed would need to be performed by non-local companies.

Table 2: Lift Mechanism Maintenance Costs

	Counterweight Wire Rope Lift System	Non-Counterweight Wire Rope Lift System	Hydraulic Lift System
Monthly	$10k	$10k	$10k
Yearly	$35k	$25k	N/A
20-Year	$135k	$100k	N/A

4.5 Physical Location Alternatives Cost Discussion

As described in Section 3.9, if the existing span needs to be relocated to a new location so that the new span can be installed in the existing footprint, it is anticipated that an additional cost of $1.6M in new construction, translation, and demolition costs would be required. This cost would apply to any of the alternatives and sub-alternatives listed above. A cost worksheet is included for this estimate as well in 6.2.

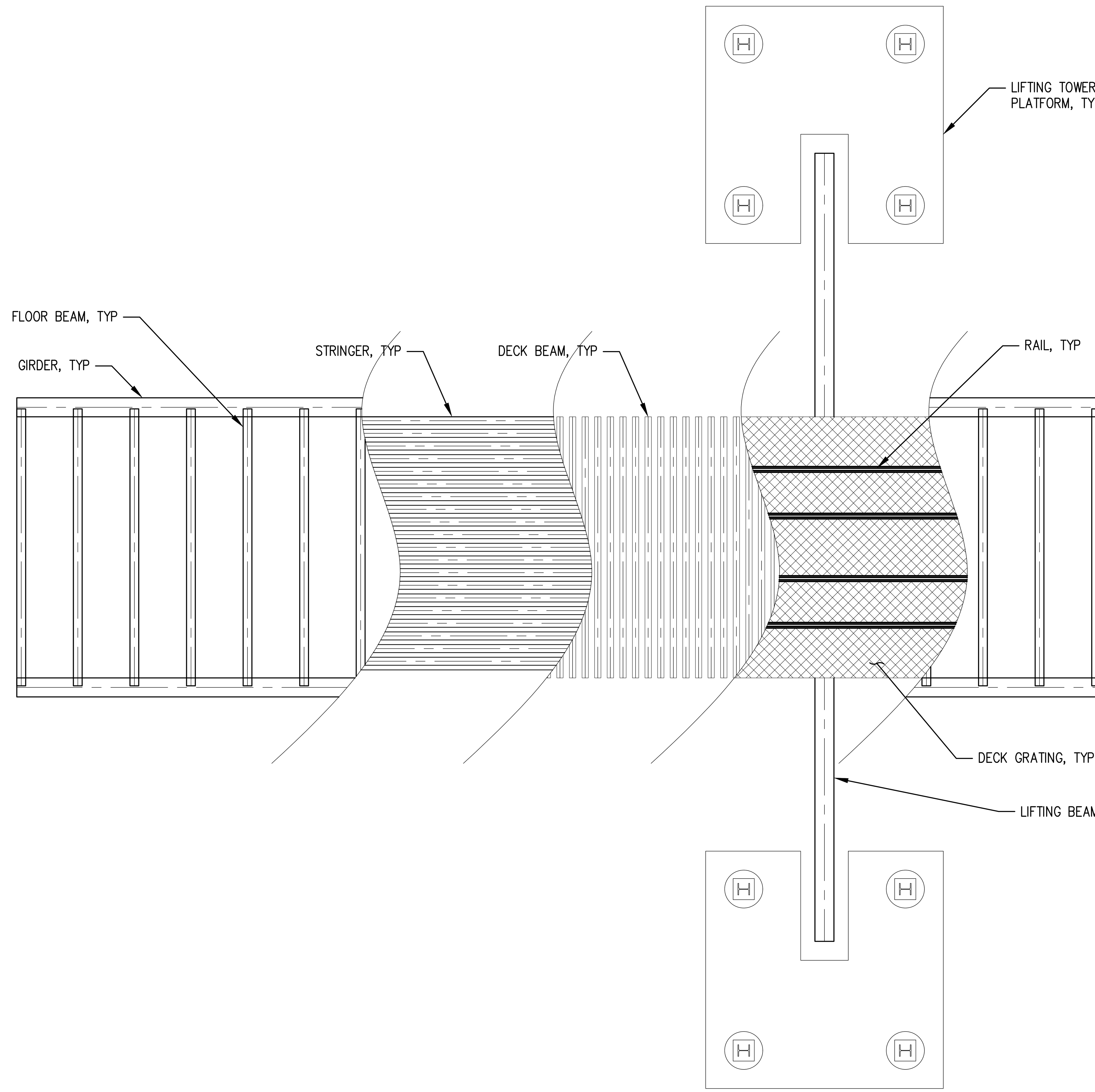
5.0 CONCLUSION

Based on this alternatives analysis study, it is anticipated that to replace the current rail barge transfer span with an updated two track system that provides sufficient overhead and width clearance for transfer of a 60-foot-wide container, the baseline cost for ramp, lift mechanism, and support foundation costs is approximately $8.2M. To further minimize in-water contact and mechanically couple the system utilizing an overhead bridge structure would increase this baseline cost to approximately $9.9M. Furthermore, it is anticipated that the cost will increase by $1M to $2.5M for each additional track added to the transfer span up to six tracks total depending on the lift system utilized.

The following three appendixes include figures, cost estimate work sheets and the basis of design which forms the assumptions utilized in the production of this alternative's analysis report.

6.0 APPENDIXES

6.1 Alternatives Figures



OPTION 1 - PLAN

SCALE: 1/8" = 1'-0"

Plotted: Mar 22, 2021 – 2:27pm sstory Layout: OPTION 1A
N:\2020\2000176 ARRC Whittier Terminal Reconstruction Transfer Span\Drawings\Current\ARRC Preferred Alternative 1-3.dwg

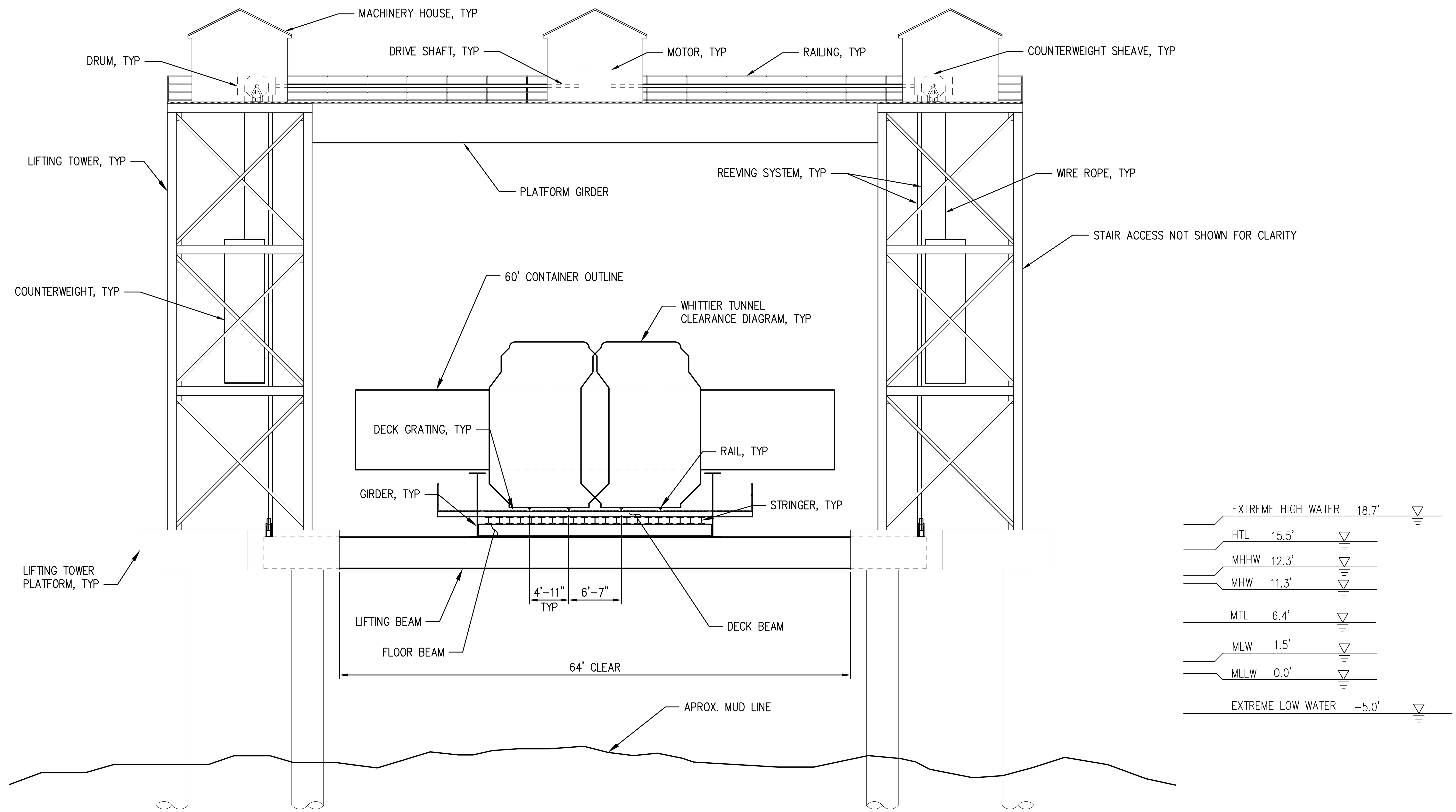
kpff
2407 North 31st Street, Suite 100
Tacoma, Washington 98407
(253) 396-0150 Fax (253) 396-0162

NO.	DATE	BY	REVISION

ARRC WHITTIER TERMINAL
RECONSTRUCTION BARGE RAMP

OPTION 1

DRAWN:	TRL	PROJECT NO.:
DESIGN:	SMS	SCALE: AS SHOWN
CHECKED:	AWB	DATE: 02/19/2021
DRAWING NO.		S1.1
SHEET NO.		01 OF 14



OPTION 1 - SECTION

SCALE: 1/8" = 1'-0"

Plotted: Mar 22, 2021 – 2:26pm sstory Layout: OPTION 1B
N:\2020\2000176 ARRC Whittier Terminal Reconstruction Transfer Span\Drawings\Current\ARRC Preferred Alternative 1-3.dwg

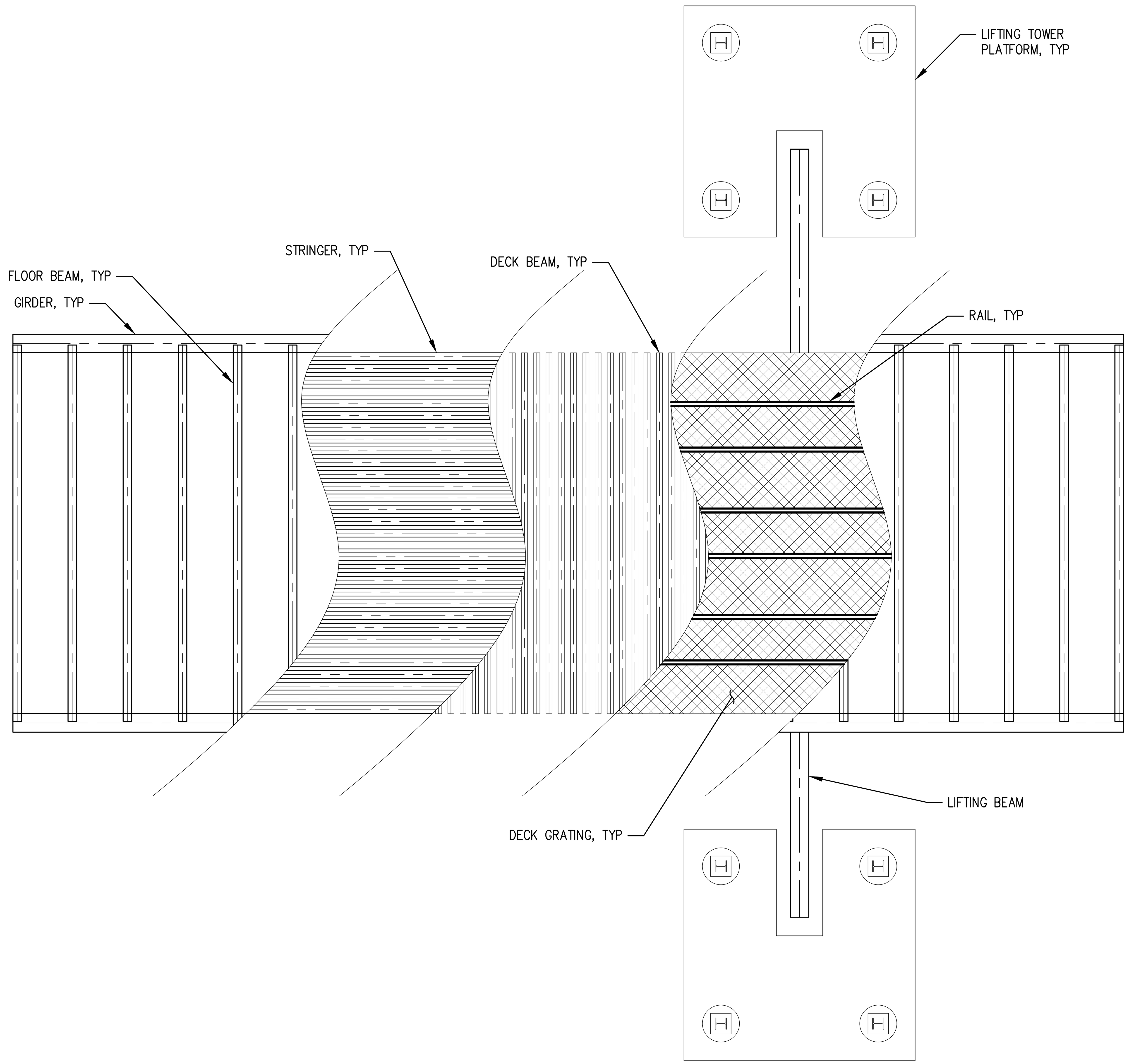
kpff
2407 North 31st Street, Suite 100
Tacoma, Washington 98407
(253) 396-0150 Fax (253) 396-0162

NO.	DATE	BY	REVISION

ARRC WHITTIER TERMINAL
RECONSTRUCTION BARGE RAMP

OPTION 1

DRAWN:	TRL	PROJECT NO.:	
DESIGN:	SMS	SCALE: AS SHOWN	
CHECKED:	AWB	DATE:	02/19/2021
DRAWING NO.		**S1.2**	
SHEET NO.		**02** OF 14	



OPTION 2 - PLAN

SCALE: 1/8" = 1'-0"

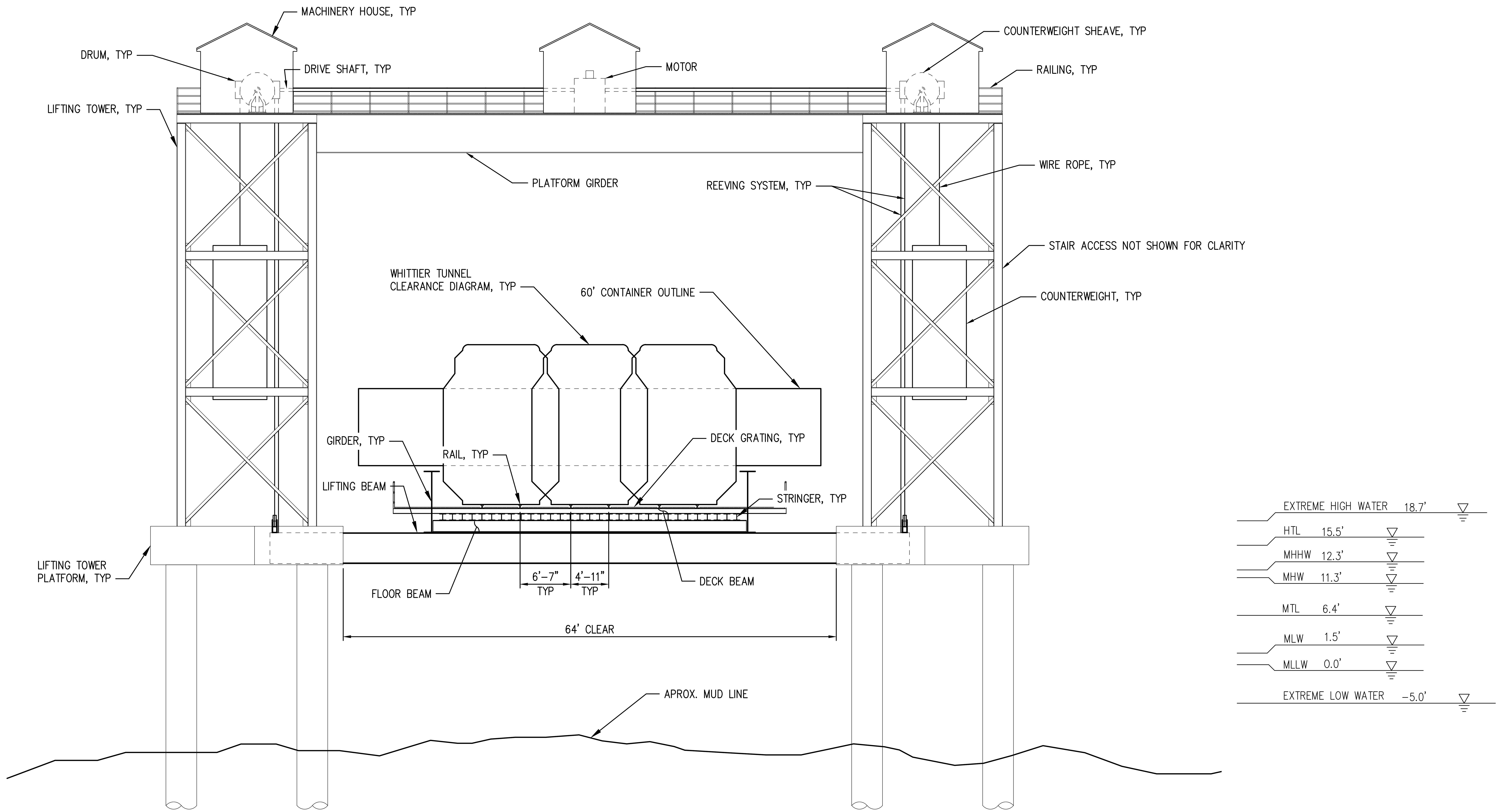
kpff
2407 North 31st Street, Suite 100
Tacoma, Washington 98407
(253) 396-0150 Fax (253) 396-0162

NO.	DATE	BY	REVISION

ARRC WHITTIER TERMINAL
RECONSTRUCTION BARGE RAMP

OPTION 2

DRAWN: TRL	PROJECT NO.:
DESIGN: SMS	SCALE: AS SHOWN
CHECKED: AWB	DATE: 02/19/2021
DRAWING NO.	**S2.1**
SHEET NO.	**03** OF 14



OPTION 2 - SECTION

SCALE: 1/8" = 1'-0"

Plotted: Mar 22, 2021 – 2:28pm sstory Layout: OPTION 2B
N:\2020\2000176 ARRC Whittier Terminal Reconstruction Transfer Span\Drawings\Current\ARRC Preferred Alternative 1-3.dwg

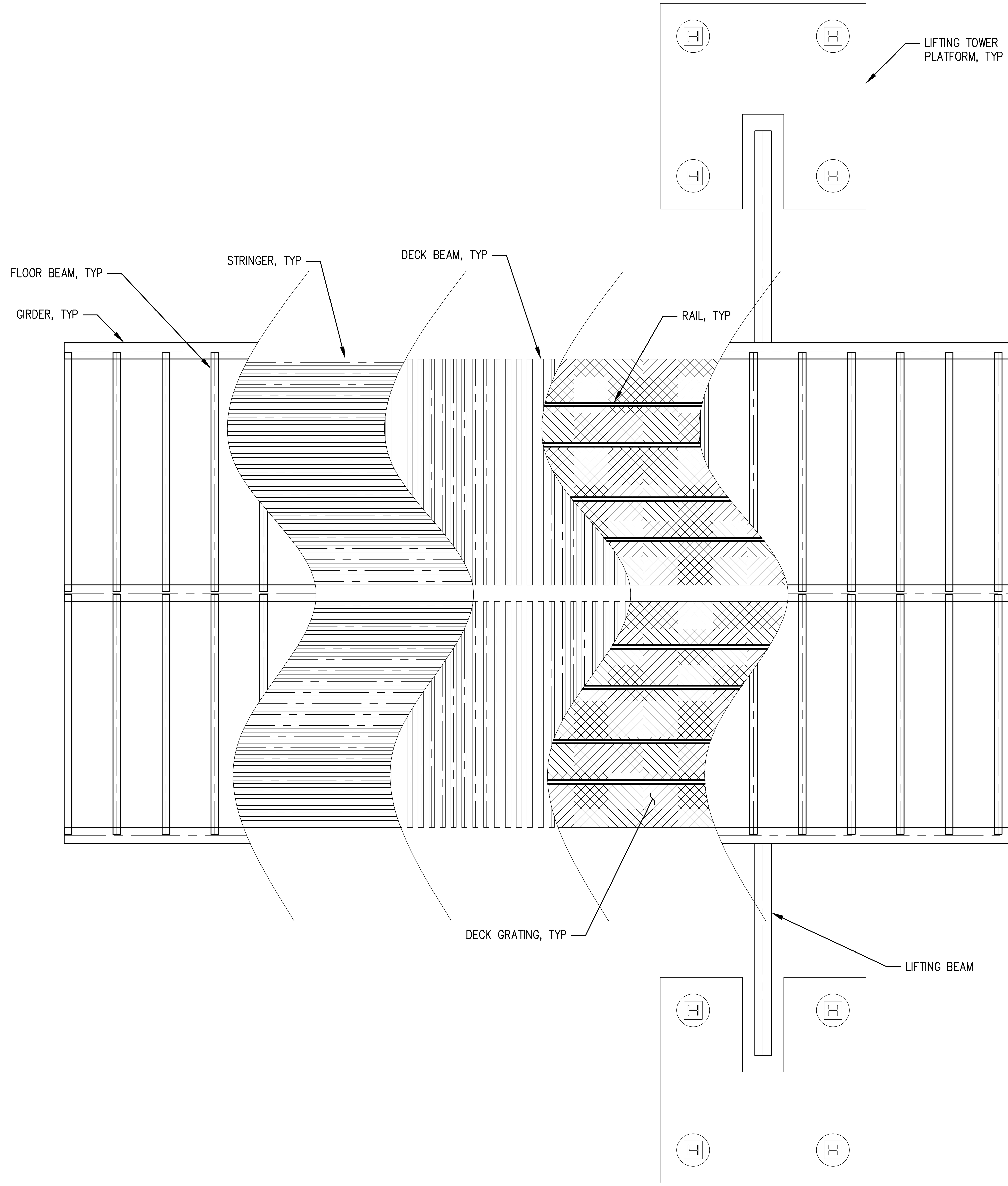
kpff
2407 North 31st Street, Suite 100
Tacoma, Washington 98407
(253) 396-0150 Fax (253) 396-0162

NO.	DATE	BY	REVISION

ARRC WHITTIER TERMINAL RECONSTRUCTION BARGE RAMP

OPTION 2

DRAWN: TRL	PROJECT NO.:
DESIGN: SMS	SCALE: AS SHOWN
CHECKED: xxxAWB	DATE: 02/19/2021
DRAWING NO.	**S2.2**
SHEET NO.	**04** OF 14



OPTION 3 - PLAN
SCALE: 1/8" = 1'-0"

Plotted: Mar 22, 2021 – 2:29pm sstory Layout: OPTION 3A
N:\2020\2000176 ARRC Whittier Terminal Reconstruction Transfer Span\Drawings\Current\ARRC Preferred Alternative 1-3.dwg

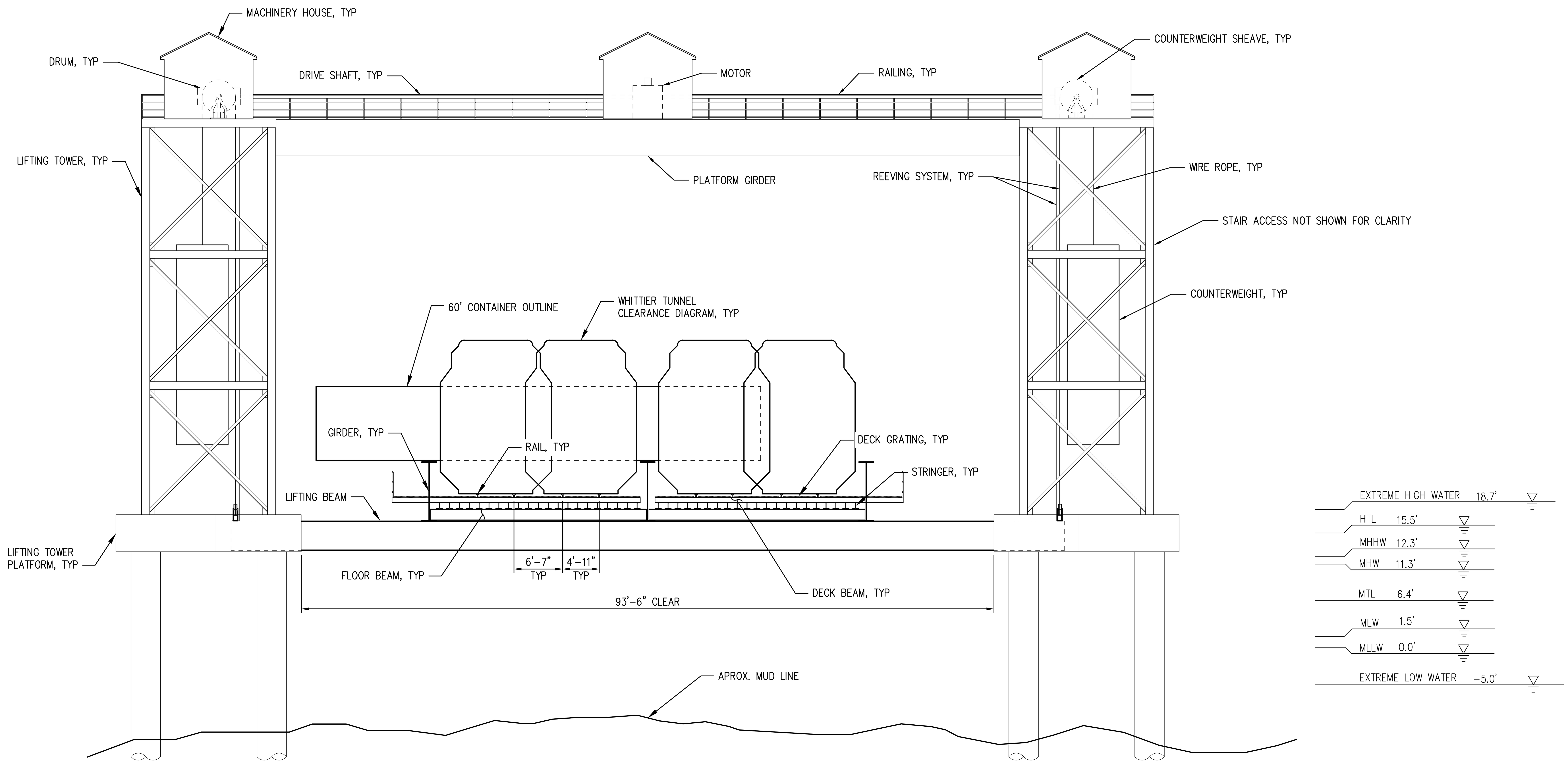
kpff
2407 North 31st Street, Suite 100
Tacoma, Washington 98407
(253) 396-0150 Fax (253) 396-0162

NO.	DATE	BY	REVISION

ARRC WHITTIER TERMINAL
RECONSTRUCTION BARGE RAMP

OPTION 3

DRAWN:	TRL	PROJECT NO.:
DESIGN:	SMS	SCALE: AS SHOWN
CHECKED:	AWB	DATE: 02/19/2021
DRAWING NO.		**S3.1**
SHEET NO.		**05** OF 14



OPTION 3 - SECTION

SCALE: 1/8" = 1'-0"

Plotted: Mar 22, 2021 – 2:29pm sstory Layout: OPTION 3B
N:\2020\2000176 ARRC Whittier Terminal Reconstruction Transfer Span\Drawings\Current\ARRC Preferred Alternative 1-3.dwg

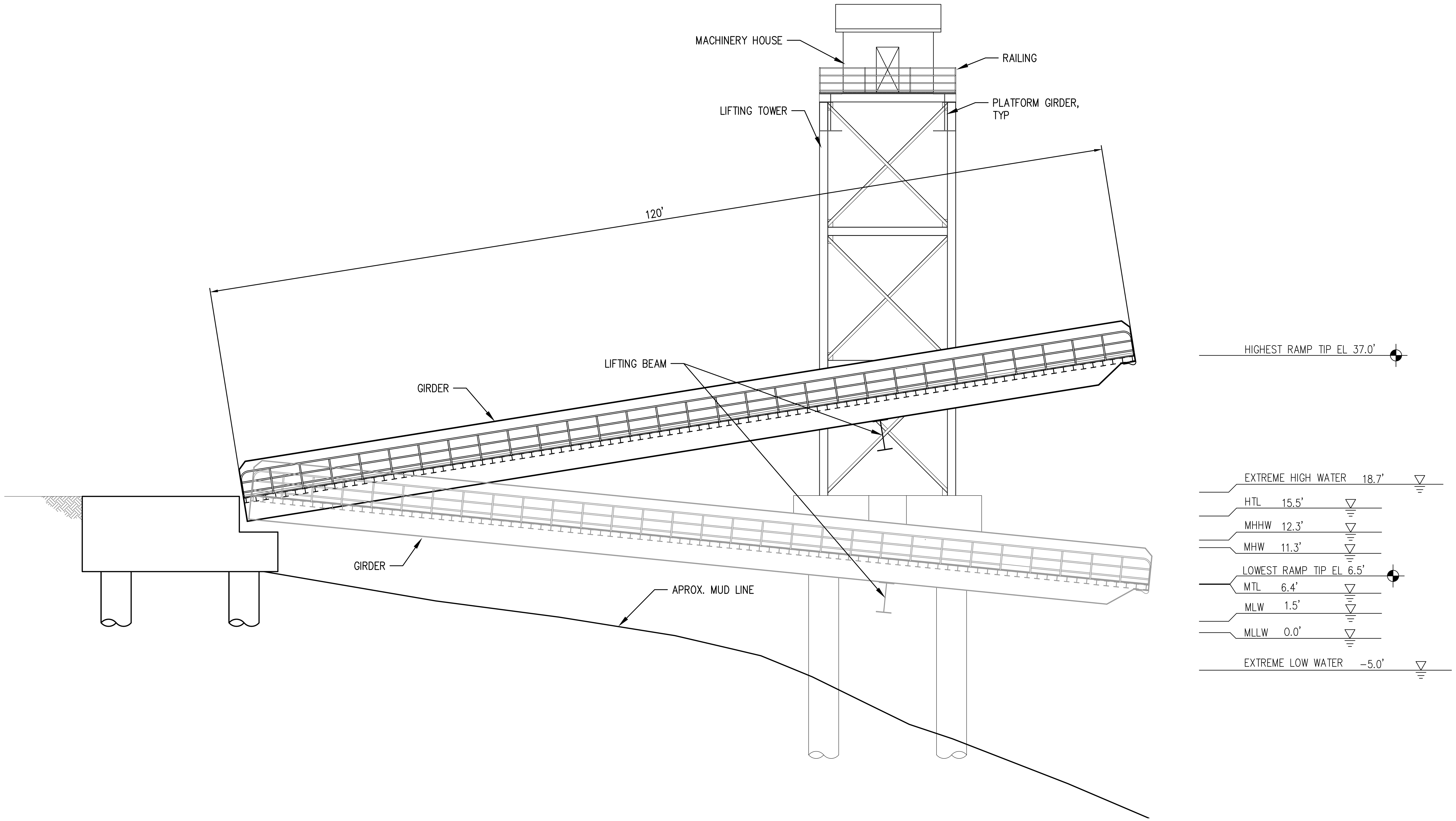
kpff
2407 North 31st Street, Suite 100
Tacoma, Washington 98407
(253) 396-0150 Fax (253) 396-0162

NO.	DATE	BY	REVISION

ARRC WHITTIER TERMINAL RECONSTRUCTION BARGE RAMP

OPTION 3

DRAWN: TRL	PROJECT NO.:
DESIGN: SMS	SCALE: AS SHOWN
CHECKED: AWB	DATE: 02/19/2021
DRAWING NO.	S3.2
SHEET NO.	06 OF 14



TYPICAL - ELEVATION

SCALE: 1/8" = 1'-0"

Plotted: Mar 22, 2021 - 2:33pm sstory Layout: ELEVATION 1-3
N:\2020\2000176 ARRC Whittier Terminal Reconstruction Transfer Span\Drawings\Current\ARRC Preferred Alternative 1-3.dwg

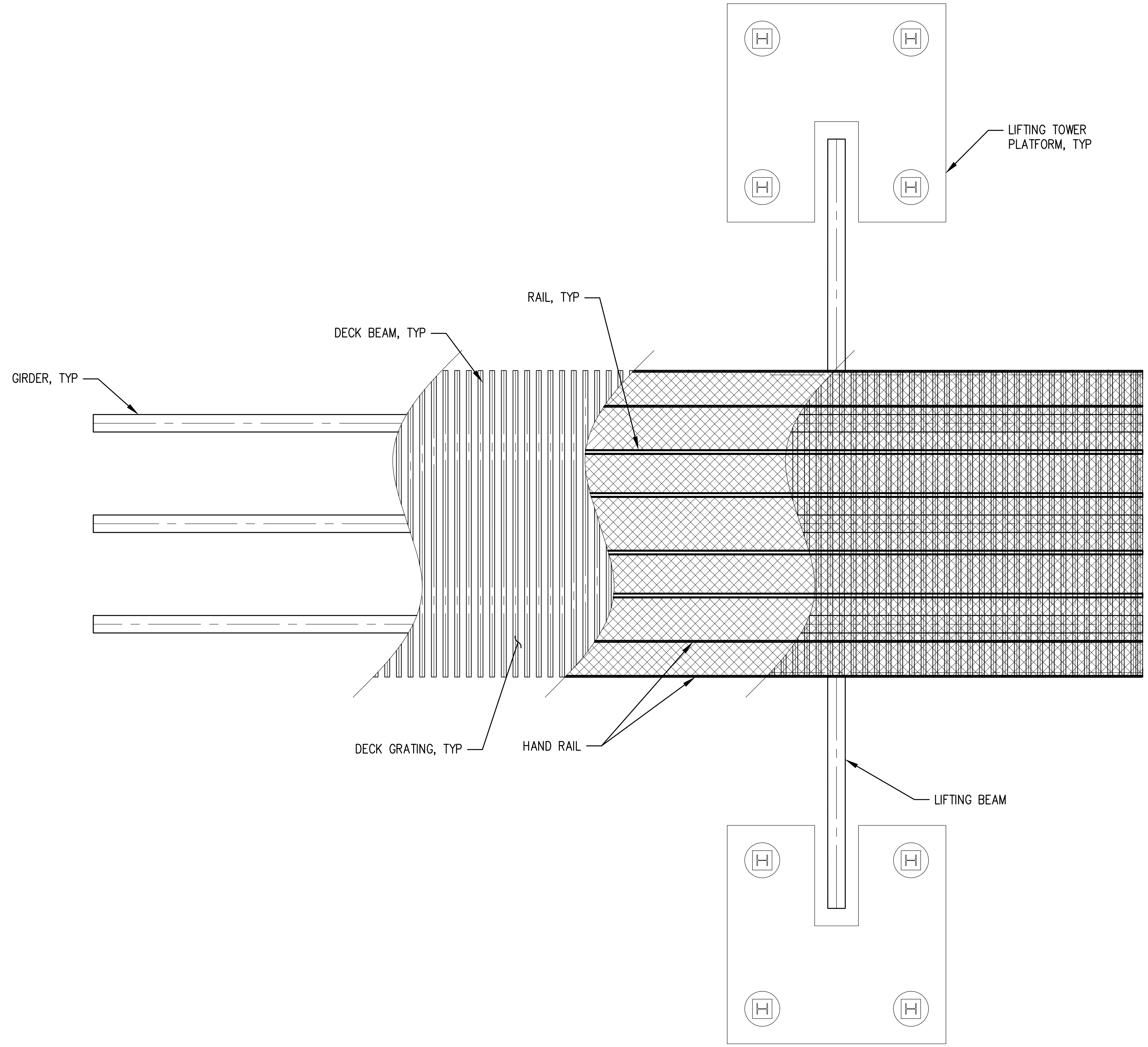
kpff
2407 North 31st Street, Suite 100
Tacoma, Washington 98407
(253) 396-0150 Fax (253) 396-0162

NO.	DATE	BY	REVISION

ARRC WHITTIER TERMINAL
RECONSTRUCTION BARGE RAMP

OPTIONS 1-3
ELEVATION

DRAWN: TRL	PROJECT NO.:	
DESIGN: SMS	SCALE: AS SHOWN	
CHECKED: AWB	DATE: 02/19/2021	
DRAWING NO.	S4.1	
SHEET NO.	07 OF 14	



OPTION 4 - PLAN
SCALE: 1/8" = 1'-0"

kpff
2407 North 31st Street, Suite 100
Tacoma, Washington 98407
(253) 396-0150 Fax (253) 396-0162

NO.	DATE	BY	REVISION

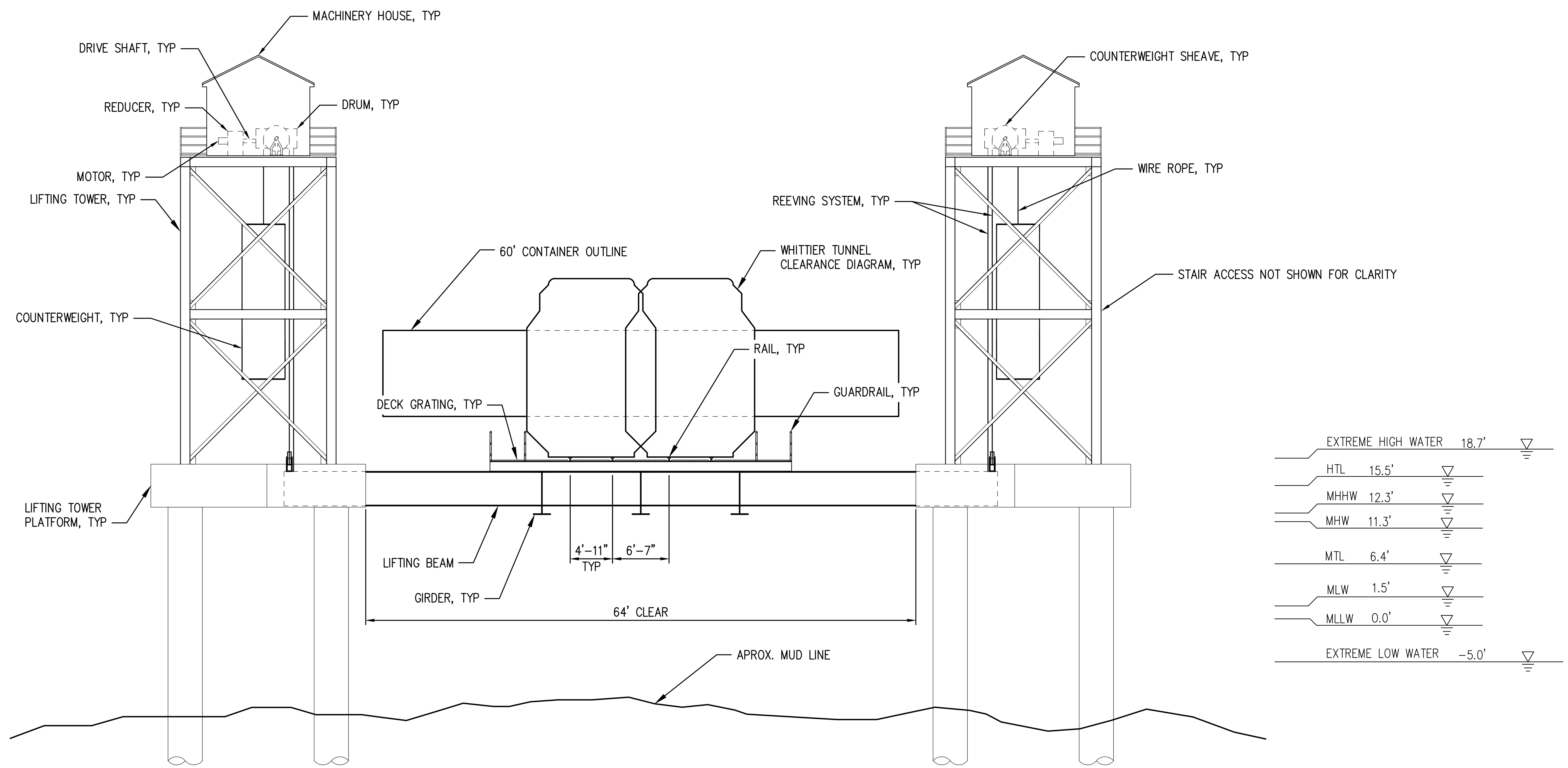
ARRC WHITTIER TERMINAL
RECONSTRUCTION BARGE RAMP

OPTION 4

DRAWN:	TRL	PROJECT NO.:
DESIGN:	SMS	SCALE: AS SHOWN
CHECKED:	AWB	DATE: 02/19/2021

DRAWING NO. **S5.1**

SHEET NO. **08** OF 14



OPTION 4 - SECTION

SCALE: 1/8" = 1'-0"

Plotted: Mar 22, 2021 – 12:35pm sstory Layout: OPTION 4B
C:\Users\sstory\Desktop\Drawings\Current\ARRC Preferred Alternative 4-6.dwg

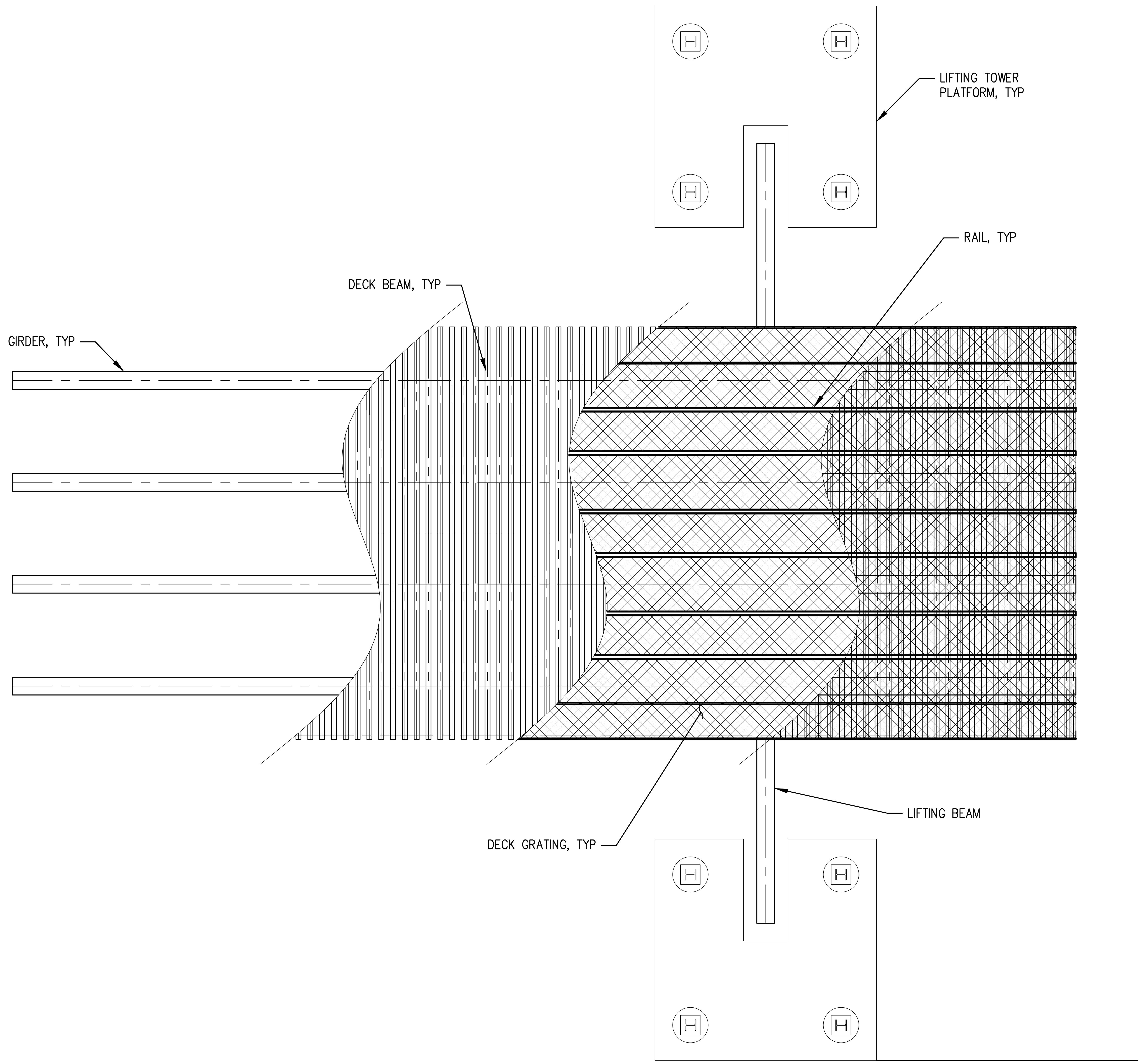
kpff
2407 North 31st Street, Suite 100
Tacoma, Washington 98407
(253) 396-0150 Fax (253) 396-0162

NO.	DATE	BY	REVISION

ARRC WHITTIER TERMINAL
RECONSTRUCTION BARGE RAMP

OPTION 4

DRAWN: TRL	PROJECT NO.:	
DESIGN: SMS	SCALE: AS SHOWN	
CHECKED: AWB	DATE: 02/19/2021	
DRAWING NO.	**S5.2**	
SHEET NO.	**09** OF **14**	



OPTION 5 - PLAN

SCALE: 1/8" = 1'-0"

Plotted: Mar 22, 2021 – 12:36pm sstory Layout: OPTION 5A
C:\Users\sstory\Desktop\Drawings\Current\ARRC Preferred Alternative 4-6.dwg

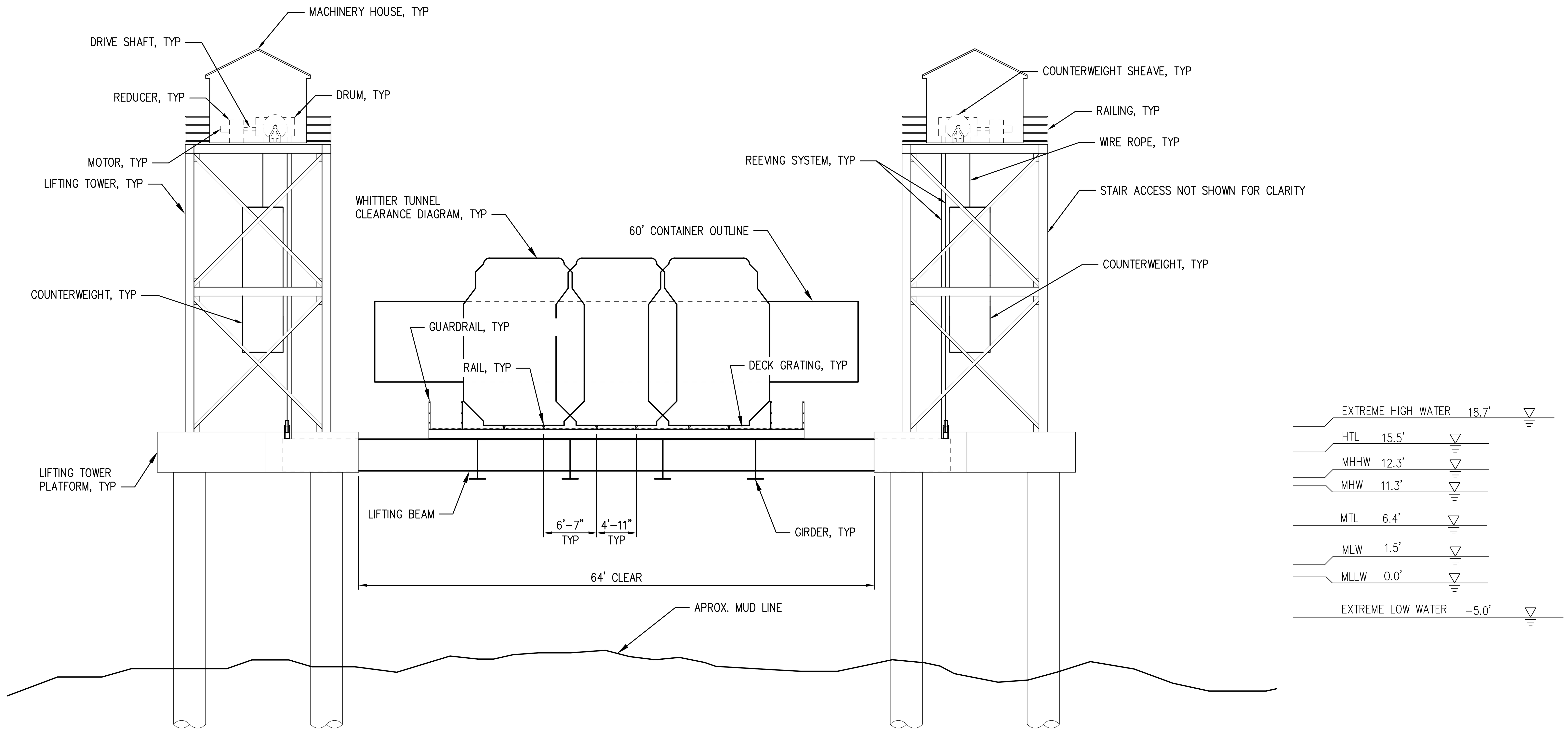
kpff
2407 North 31st Street, Suite 100
Tacoma, Washington 98407
(253) 396-0150 Fax (253) 396-0162

NO.	DATE	BY	REVISION

ARRC WHITTIER TERMINAL
RECONSTRUCTION BARGE RAMP

OPTION 5

DRAWN:	TRL	PROJECT NO.:	
DESIGN:	SMS	SCALE: AS SHOWN	
CHECKED:	AWB	DATE:	02/19/2021
DRAWING NO.		**S6.1**	
SHEET NO.		10 OF 14	



OPTION 5 - SECTION

SCALE: 1/8" = 1'-0"

Plotted: Mar 22, 2021 – 12:36pm sstory Layout: OPTION 5B
C:\Users\sstory\Desktop\Drawings\Current\ARRC Preferred Alternative 4-6.dwg

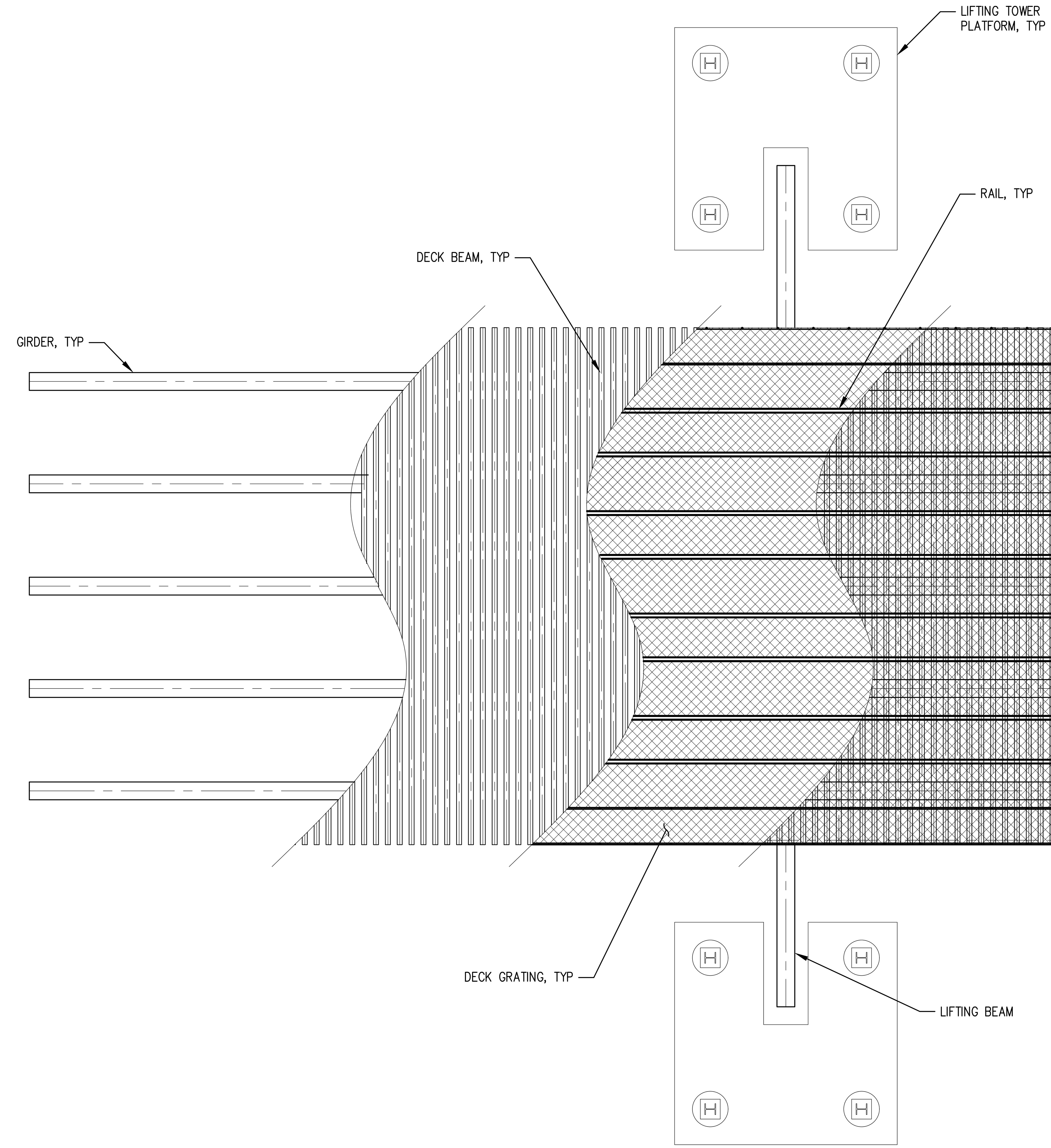
kpff
2407 North 31st Street, Suite 100
Tacoma, Washington 98407
(253) 396-0150 Fax (253) 396-0162

NO.	DATE	BY	REVISION

ARRC WHITTIER TERMINAL
RECONSTRUCTION BARGE RAMP

OPTION 5

DRAWN: TRL	PROJECT NO.:
DESIGN: SMS	SCALE: AS SHOWN
CHECKED: xxxAWB	DATE: 02/19/2021
DRAWING NO.	S6.2
SHEET NO.	11 OF 14



OPTION 6 - PLAN

SCALE: 1/8" = 1'-0"

kpff

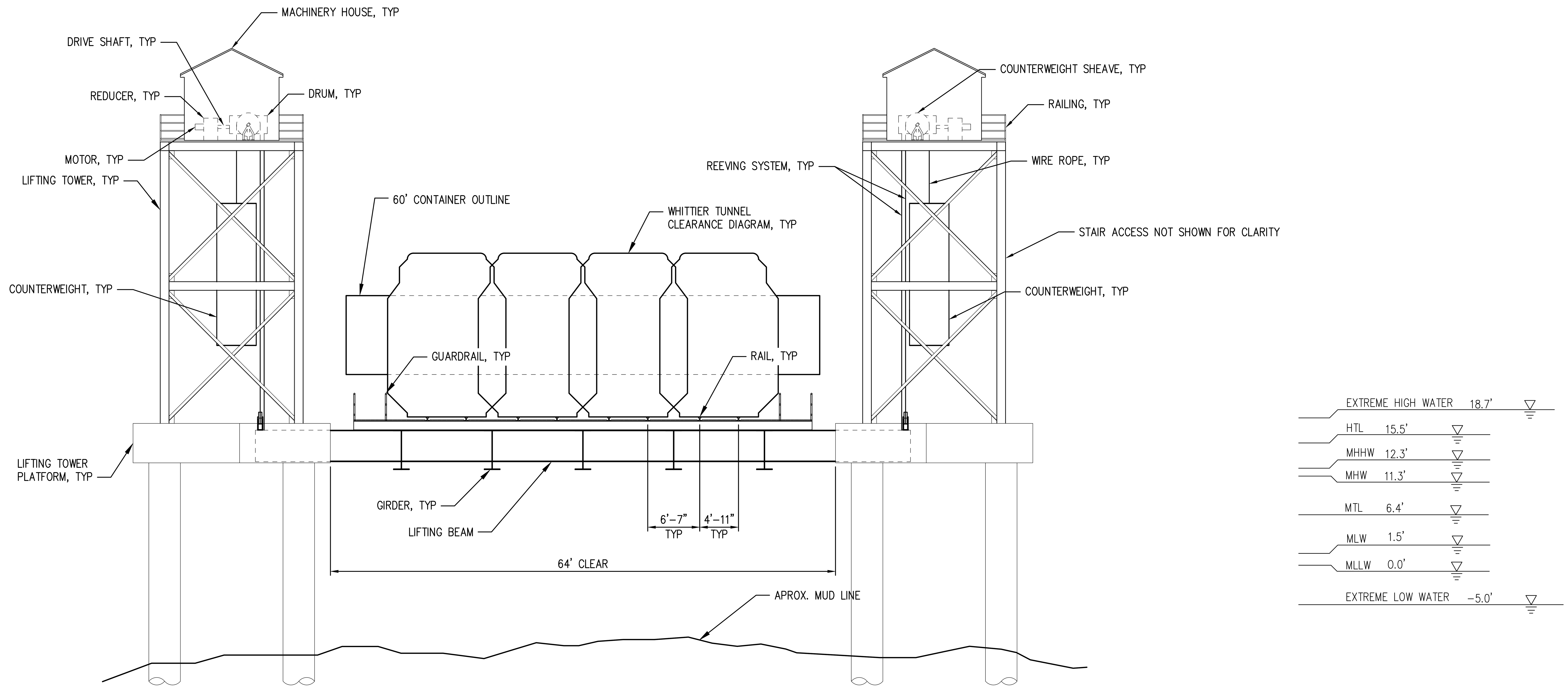
2407 North 31st Street, Suite 100
Tacoma, Washington 98407
(253) 396-0150 Fax (253) 396-0162

NO.	DATE	BY	REVISION

ARRC WHITTIER TERMINAL
RECONSTRUCTION BARGE RAMP

OPTION 6

DRAWN: TRL	PROJECT NO.:
DESIGN: SMS	SCALE: AS SHOWN
CHECKED: AWB	DATE: 02/19/2021
DRAWING NO.	**S7.1**
SHEET NO.	12 OF 14



OPTION 6 - SECTION
SCALE: 1/8" = 1'-0"

Plotted: Mar 22, 2021 – 12:37pm sstory Layout: OPTION 6B
C:\Users\sstory\Desktop\Drawings\Current\ARRC Preferred Alternative 4-6.dwg

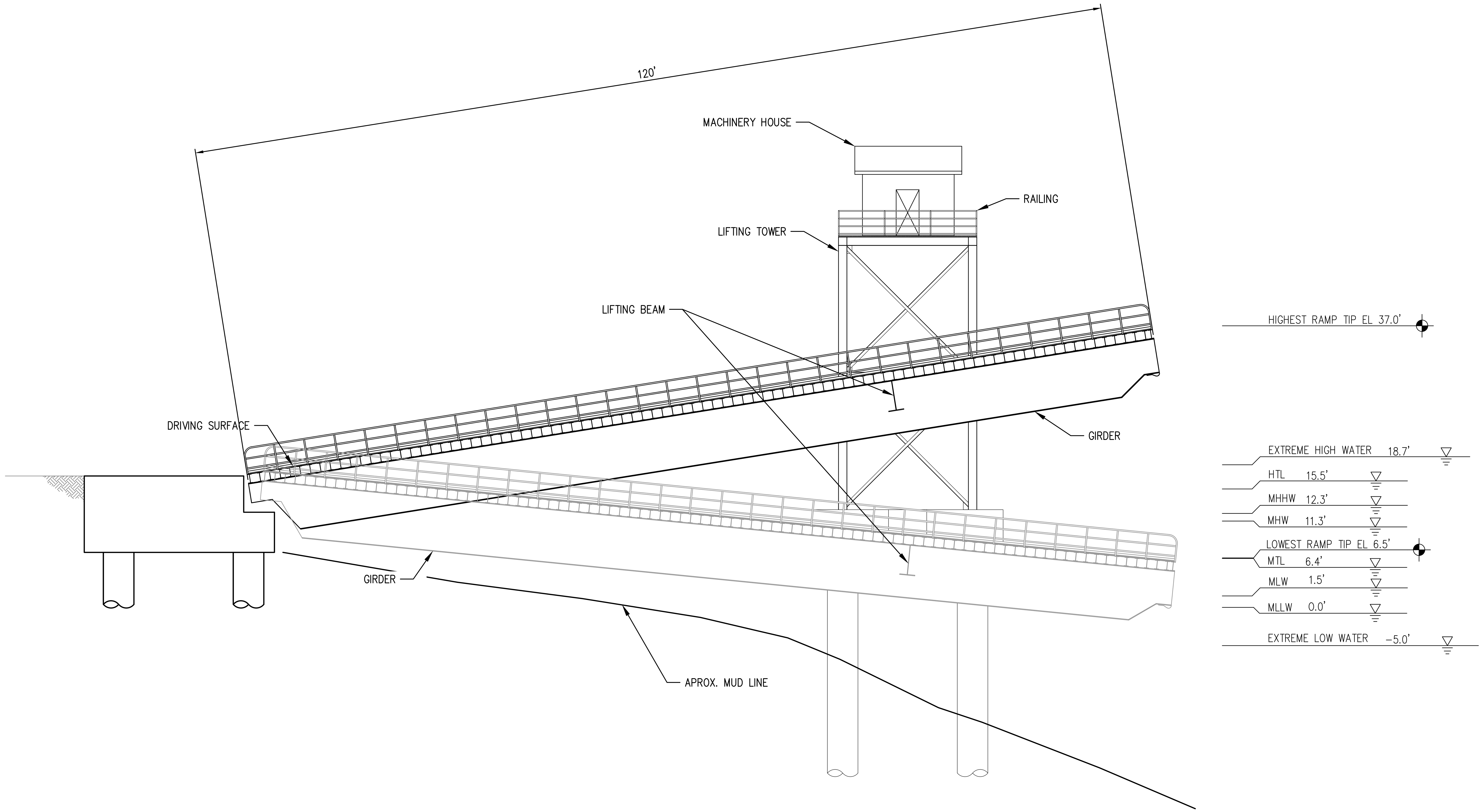
kpff
2407 North 31st Street, Suite 100
Tacoma, Washington 98407
(253) 396-0150 Fax (253) 396-0162

NO.	DATE	BY	REVISION

ARRC WHITTIER TERMINAL
RECONSTRUCTION BARGE RAMP

OPTION 6

DRAWN:	TRL	PROJECT NO.:	
DESIGN:	SMS	SCALE: AS SHOWN	
CHECKED:	AWB	DATE:	02/19/2021
DRAWING NO.		S7.2	
SHEET NO.		13 OF 14	



TYPICAL - ELEVATION

SCALE: 1/8" = 1'-0"

Plotted: Mar 22, 2021 – 2:25pm sstory Layout: ELEVATION 4-6
C:\Users\sstory\Desktop\Drawings\Current\ARRC Preferred Alternative 4-6.dwg

kpff
2407 North 31st Street, Suite 100
Tacoma, Washington 98407
(253) 396-0150 Fax (253) 396-0162

NO.	DATE	BY	REVISION

ARRC WHITTIER TERMINAL
RECONSTRUCTION BARGE RAMP

OPTIONS 4-6
ELEVATION

DRAWN:	TRL	PROJECT NO.:	
DESIGN:	SMS	SCALE: AS SHOWN	
CHECKED:	AWB	DATE:	02/19/2021
DRAWING NO.		**S8.1**	
SHEET NO.		14 OF 14	

6.2 Alternatives Rough Order of Magnitude (ROM) Construction Cost Worksheets

ARRC Whittier Terminal Reconstruction Transfer Span
Alternative Analysis
Order of Magnitude Estimate of Probable Construction Cost
Alternative 1A: (2) Track Through Girder with Elevated, Coupled Hoist System
Counterweight Wire Rope Lift Mechanism with One Motor Driving Two Drums

kpff 60 YEARS

March 22, 2021

Item		Quantity	Unit	Unit Cost	Total Cost	% of Total
Mobilization & Site Preparation						
1	Mobilization	1	LS	$167,750.00	$167,800	
2	De-Mobilization & Contractor Closeout	1	LS	$329,425.00	$329,400	
				Subtotal - Mobilization & Site Preparation	**$497,200**	7.0%
Bridge Seat						
3	Furnish and Install (8) 24" Steel Pipe Piles	800	LF	$340.00	$272,000	
4	CIP Concrete for Abutment and Wingwalls	285	CY	$900.00	$256,700	
				Subtotal - Bridge Seat	**$528,700**	7.5%
Ramp						
5	Built Up Plate Girders, Including Stiffeners and Appurtenances	65	TON	$11,000.00	$711,700	
6	Wide Flange Floor Beam	58	TON	$9,000.00	$521,300	
7	Wide Flange Stringer	86	TON	$9,000.00	$771,100	
8	Wide Flange Deck Beam	48	TON	$9,000.00	$427,900	
9	Deck Grating	3300	SF	$60.00	$198,000	
10	Rail & Accessories	480	LF	$40.00	$19,200	
11	Built Up Lift Beam	13	TON	$11,000.00	$142,100	
12	Bridge Seat Transition Plate Fabrication	1	EA	$10,000.00	$10,000	
13	Bridge Seat Pin Fabrication	2	EA	$10,000.00	$20,000	
14	Ramp to Barge Connection Assembly	1	EA	$5,000.00	$5,000	
				Subtotal - Ramp	**$2,826,300**	39.9%
Lifting Tower						
15	(8) Concrete Drilled Shafts	760	VLF	$1,275.00	$969,000	
16	CIP Concrete for Dolphin Pile Cap	210	CY	$2,500.00	$525,900	
17	Machinery Housing - (3) Houses	432	SF	$150.00	$64,800	
18	Wide Flange Columns	14	TON	$9,000.00	$122,400	
19	Wide Flange Beams	13	TON	$9,000.00	$117,500	
20	Angle Braces	8	TON	$9,000.00	$70,000	
21	Built Up Tower Cross Beams	30	TON	$9,000.00	$269,400	
22	Wide Flange Deck Support Stringers	6	TON	$9,000.00	$56,900	
23	Tower Deck Grating	2220	SF	$35.00	$77,700	
24	Tower Wall Cladding	7040	SF	$30.00	$211,200	
25	Stairs	100	VLF	$2,500.00	$250,000	
26	Handrail	2940	LB	$4.50	$13,200	
				Subtotal - Lifting Tower	**$2,748,000**	38.8%
Mechanical Components						
27	Motor	1	EA	$10,000.00	$10,000	
28	Reducer	1	EA	$50,000.00	$50,000	
29	Drum	2300	LB	$9.00	$20,700	
30	Drive Shaft	10000	LB	$9.00	$90,000	
31	Bearing	10	EA	$3,000.00	$30,000	
32	CW Sheave	4	EA	$5,500.00	$22,000	
33	Hoist Sheave	10	EA	$1,050.00	$10,500	
34	CW Sheave Bracket	4000	LB	$5.00	$20,000	
35	Hoist Sheave Bracket	5000	LB	$5.00	$25,000	
36	CW Wire Rope	330	FT	$22.00	$7,300	
37	Hoist Wire Rope	605	FT	$13.00	$7,900	
38	Counterweight	130500	LB	$0.20	$26,100	
39	Beam Connection	6	EA	$500.00	$3,000	
40	CW Connection	4	EA	$750.00	$3,000	
41	Electrical	1	EA	$100,000.00	$100,000	
				Subtotal - Mechanical Components	**$425,500**	6.0%
Mechanical Components Installation						
42	Labor	480	HR	$100.00	$48,000	
43	Equipment	24	HR	$500.00	$12,000	
				Subtotal - Mechanical Components Installation	**$60,000**	0.8%
				Total Construction Cost	**$7,085,700**	100.0%
				Alaska State Sales Tax 0.0%	**$0**	
				Total Estimate of Probable Construction Cost	**$7,085,700**	
				Design/Construction Contingency 40%	**$2,834,280**	
				Total Cost	**$9,919,980**	

Notes

1	Assumes 5% of Subtotal Consruction Cost for mobilization. This item only reflects mobilization for the barge ramp and associated structures.
2	Assumes 5% of Subtotal Consruction Cost for demobilization. This item only reflects demobilization for the barge ramp and associated structures.
3,15	Site specific geotechnical information has not been provided for this Alternatives Analysis. It has been assumed that ground improvement is not required and loading due to kinematic effects can be neglected.
G1	Mooring and slewing dolphin structures and hardware are not included in this estimate.

ARRC Whittier Terminal Reconstruction Transfer Span
Alternative Analysis
Order of Magnitude Estimate of Probable Construction Cost
Alternative 1B: (2) Track Through Girder with Elevated, Coupled Hoist System
Hydraulic Lift System

March 22, 2021

Item		Quantity	Unit	Unit Cost	Total Cost	% of Total
Mobilization & Site Preparation						
1	Mobilization	1	LS	$167,750.00	$167,800	
2	De-Mobilization & Contractor Closeout	1	LS	$347,450.00	$347,500	
	Subtotal - Mobilization & Site Preparation				**$515,300**	6.9%
Bridge Seat						
3	Furnish and Install (8) 24" Steel Pipe Piles	800	LF	$340.00	$272,000	
4	CIP Concrete for Abutment and Wingwalls	285	CY	$900.00	$256,700	
	Subtotal - Bridge Seat				**$528,700**	7.1%
Ramp						
5	Built Up Plate Girders, Including Stiffeners and Appurtenances	65	TON	$11,000.00	$711,700	
6	Wide Flange Floor Beam	58	TON	$9,000.00	$521,300	
7	Wide Flange Stringer	86	TON	$9,000.00	$771,100	
8	Wide Flange Deck Beam	48	TON	$9,000.00	$427,900	
9	Deck Grating	3300	SF	$60.00	$198,000	
10	Rail & Accessories	480	LF	$40.00	$19,200	
11	Built Up Lift Beam	13	TON	$11,000.00	$142,100	
12	Bridge Seat Transition Plate Fabrication	1	EA	$10,000.00	$10,000	
13	Bridge Seat Pin Fabrication	2	EA	$10,000.00	$20,000	
14	Ramp to Barge Connection Assembly	1	EA	$5,000.00	$5,000	
	Subtotal - Ramp				**$2,826,300**	37.9%
Lifting Tower						
15	(8) Concrete Drilled Shafts	760	VLF	$1,275.00	$969,000	
16	CIP Concrete for Dolphin Pile Cap	210	CY	$2,500.00	$525,900	
17	Machinery Housing - (3) Houses	432	SF	$150.00	$64,800	
18	Wide Flange Columns	14	TON	$9,000.00	$122,400	
19	Wide Flange Beams	13	TON	$9,000.00	$117,500	
20	Angle Braces	8	TON	$9,000.00	$70,000	
21	Built Up Tower Cross Beams	30	TON	$9,000.00	$269,400	
22	Wide Flange Deck Support Stringers	6	TON	$9,000.00	$56,900	
23	Tower Deck Grating	2220	SF	$35.00	$77,700	
24	Tower Wall Cladding	7040	SF	$30.00	$211,200	
25	Stairs	100	VLF	$2,500.00	$250,000	
26	Handrail	2940	LB	$4.50	$13,200	
	Subtotal - Lifting Tower				**$2,748,000**	36.8%
Mechanical Components						
1	Hydraulic Cylinder	5000	LB	$60.00	$300,000	
2	Hydraulic Power Unit with Control Valves	1	EA	$250,000.00	$250,000	
3	Electrical	1	EA	$100,000.00	$100,000	
	Subtotal - Mechanical Components				**$650,000**	8.7%
Mechanical Components Installation						
4	Labor	960	HR	$200.00	$192,000	
5	Equipment	8	HR	$500.00	$4,000	
	Subtotal - Mechanical Components Installation				**$196,000**	2.6%
	Total Construction Cost				**$7,464,300**	100.0%
	Alaska State Sales Tax 0.0%				**$0**	
	Total Estimate of Probable Construction Cost				**$7,464,300**	
	Design/Construction Contingency 40%				**$2,985,720**	
	Total Cost				**$10,450,020**	

Notes

1 Assumes 5% of Subtotal Consruction Cost for mobilization. This item only reflects mobilization for the barge ramp and associated structures.

2 Assumes 5% of Subtotal Consruction Cost for demobilization. This item only reflects demobilization for the barge ramp and associated structures.

3,15 Site specific geotechnical information has not been provided for this Alternatives Analysis. It has been assumed that ground improvement is not required and loading due to kinematic effects can be neglected.

G1 Mooring and slewing dolphin structures and hardware are not included in this estimate.

ARRC Whittier Terminal Reconstruction Transfer Span
Alternative Analysis
Order of Magnitude Estimate of Probable Construction Cost
Alternative 2A: (3) Track Through Girder with Elevated, Coupled Hoist System
Counterweight Wire Rope Lift Mechanism with One Motor Driving Two Drums

kpff 60 YEARS

March 22, 2021

Item		Quantity	Unit	Unit Cost	Total Cost	% of Total
Mobilization & Site Preparation						
1	Mobilization	1	LS	$227,905.00	$227,900	
2	De-Mobilization & Contractor Closeout	1	LS	$394,735.00	$394,700	
				Subtotal - Mobilization & Site Preparation	**$622,600**	7.3%
Bridge Seat						
3	Furnish and Install (8) 24" Steel Pipe Piles	800	LF	$340.00	$272,000	
4	CIP Concrete for Abutment and Wingwalls	381	CY	$900.00	$342,900	
				Subtotal - Bridge Seat	**$614,900**	7.2%
Ramp						
5	Built Up Plate Girders, Including Stiffeners and Appurtenances	65	TON	$11,000.00	$711,700	
6	Wide Flange Floor Beam	111	TON	$9,000.00	$999,600	
7	Wide Flange Stringer	126	TON	$9,000.00	$1,138,300	
8	Wide Flange Deck Beam	67	TON	$9,000.00	$606,900	
9	Deck Grating	4680	SF	$60.00	$280,800	
10	Rail & Accessories	720	LB	$40.00	$28,800	
11	Built Up Lift Beam	13	TON	$11,000.00	$142,100	
12	Bridge Seat Transition Plate Fabrication	1	EA	$10,000.00	$10,000	
13	Bridge Seat Pin Fabrication	2	EA	$10,000.00	$20,000	
14	Ramp to Barge Connection Assembly	1	EA	$5,000.00	$5,000	
				Subtotal - Ramp	**$3,943,200**	46.3%
Lifting Tower						
15	(8) Concrete Drilled Shafts	760	EA	$1,275.00	$969,000	
16	CIP Concrete for Dolphin Pile Cap	210	CY	$2,500.00	$525,900	
17	Machinery Housing - (3) Houses	432	SF	$150.00	$64,800	
18	Wide Flange Columns	14	TON	$9,000.00	$122,400	
19	Wide Flange Beams	13	TON	$9,000.00	$117,500	
20	Angle Braces	8	TON	$9,000.00	$70,000	
21	Built Up Tower Cross Beams	30	TON	$9,000.00	$269,400	
22	Wide Flange Deck Support Stringers	8	TON	$9,000.00	$72,800	
23	Tower Deck Grating	2220	SF	$35.00	$77,700	
24	Tower Wall Cladding	7040	SF	$30.00	$211,200	
25	Stairs	100	VLF	$2,500.00	$250,000	
26	Handrail	2940	LB	$4.50	$13,200	
				Subtotal - Lifting Tower	**$2,763,900**	32.5%
Mechanical Components						
27	Motor	1	EA	$10,000.00	$10,000	
28	Reducer	1	EA	$50,000.00	$50,000	
29	Drum	2300	LB	$9.00	$20,700	
30	Drive Shaft	10000	LB	$9.00	$90,000	
31	Bearing	10	EA	$3,000.00	$30,000	
32	CW Sheave	8	EA	$5,500.00	$44,000	
33	Hoist Sheave	10	EA	$1,050.00	$10,500	
34	CW Sheave Bracket	8000	LB	$5.00	$40,000	
35	Hoist Sheave Bracket	5000	LB	$5.00	$25,000	
36	CW Wire Rope	660	FT	$22.00	$14,500	
37	Hoist Wire Rope	605	FT	$13.00	$7,900	
38	Counterweight	295500	LB	$0.20	$59,100	
39	Beam Connection	10	EA	$500.00	$5,000	
40	CW Connection	8	EA	$750.00	$6,000	
41	Electrical	1	EA	$100,000.00	$100,000	
				Subtotal - Mechanical Components	**$512,700**	6.0%
Mechanical Components Installation						
42	Labor	480	HR	$100.00	$48,000	
43	Equipment	24	HR	$500.00	$12,000	
				Subtotal - Mechanical Components Installation	**$60,000**	0.7%
				Total Construction Cost	**$8,517,300**	100.0%
				Alaska State Sales Tax 0.0%	**$0**	
				Total Estimate of Probable Construction Cost	**$8,517,300**	
				Design/Construction Contingency 40%	**$3,406,920**	
				Total Cost	**$11,924,220**	

Notes

1 Assumes 5% of Subtotal Consruction Cost for mobilization. This item only reflects mobilization for the barge ramp and associated structures.

2 Assumes 5% of Subtotal Consruction Cost for demobilization. This item only reflects demobilization for the barge ramp and associated structures.

3,15 Site specific geotechnical information has not been provided for this Alternatives Analysis. It has been assumed that ground improvement is not required and loading due to kinematic effects can be neglected.

G1 Mooring and slewing dolphin structures and hardware are not included in this estimate.

ARRC Whittier Terminal Reconstruction Transfer Span
Alternative Analysis
Order of Magnitude Estimate of Probable Construction Cost
Alternative 2B: (3) Track Through Girder with Elevated, Coupled Hoist System
Hydraulic Lift System

March 22, 2021

Item		Quantity	Unit	Unit Cost	Total Cost	% of Total
Mobilization & Site Preparation						
1	Mobilization	1	LS	$227,905.00	$227,900	
2	De-Mobilization & Contractor Closeout	1	LS	$415,900.00	$415,900	
	Subtotal - Mobilization & Site Preparation				**$643,800**	7.2%
Bridge Seat						
3	Furnish and Install (8) 24" Steel Pipe Piles	800	LF	$340.00	$272,000	
4	CIP Concrete for Abutment and Wingwalls	381	CY	$900.00	$342,900	
	Subtotal - Bridge Seat				**$614,900**	6.9%
Ramp						
5	Built Up Plate Girders, Including Stiffeners and Appurtenances	65	TON	$11,000.00	$711,700	
6	Wide Flange Floor Beam	111	TON	$9,000.00	$999,600	
7	Wide Flange Stringer	126	TON	$9,000.00	$1,138,300	
8	Wide Flange Deck Beam	67	TON	$9,000.00	$606,900	
9	Deck Grating	4680	SF	$60.00	$280,800	
10	Rail & Accessories	720	LB	$40.00	$28,800	
11	Built Up Lift Beam	13	EA	$11,000.00	$142,100	
12	Bridge Seat Transition Plate Fabrication	1	EA	$10,000.00	$10,000	
13	Bridge Seat Pin Fabrication	2	EA	$10,000.00	$20,000	
14	Ramp to Barge Connection Assembly	1	EA	$5,000.00	$5,000	
	Subtotal - Ramp				**$3,943,200**	44.0%
Lifting Tower						
15	(8) Concrete Drilled Shafts	760	EA	$1,275.00	$969,000	
16	CIP Concrete for Dolphin Pile Cap	210	CY	$2,500.00	$525,900	
17	Machinery Housing - (3) Houses	432	SF	$150.00	$64,800	
18	Wide Flange Columns	14	TON	$9,000.00	$122,400	
19	Wide Flange Beams	13	TON	$9,000.00	$117,500	
20	Angle Braces	8	TON	$9,000.00	$70,000	
21	Built Up Tower Cross Beams	30	TON	$9,000.00	$269,400	
22	Wide Flange Deck Support Stringers	8	TON	$9,000.00	$72,800	
23	Tower Deck Grating	2220	SF	$35.00	$77,700	
24	Tower Wall Cladding	7040	SF	$30.00	$211,200	
25	Stairs	100	VLF	$2,500.00	$250,000	
26	Handrail	2940	LB	$4.50	$13,200	
	Subtotal - Lifting Tower				**$2,763,900**	30.8%
Mechanical Components						
27	Hydraulic Cylinder	7500	LB	$60.00	$450,000	
28	Hydraulic Power Unit with Control Valves	1	EA	$250,000.00	$250,000	
29	Electrical	1	EA	$100,000.00	$100,000	
	Subtotal - Mechanical Components				**$800,000**	8.9%
Mechanical Components Installation						
30	Labor	960	HR	$200.00	$192,000	
31	Equipment	8	HR	$500.00	$4,000	
	Subtotal - Mechanical Components Installation				**$196,000**	2.2%
	Total Construction Cost				**$8,961,800**	100.0%

Alaska State Sales Tax 0.0%	**$0**
Total Estimate of Probable Construction Cost	**$8,961,800**
Design/Construction Contingency 40%	**$3,584,720**
Total Cost	**$12,546,520**

Notes

1 Assumes 5% of Subtotal Consruction Cost for mobilization. This item only reflects mobilization for the barge ramp and associated structures.
2 Assumes 5% of Subtotal Consruction Cost for demobilization. This item only reflects demobilization for the barge ramp and associated structures.
3,15 Site specific geotechnical information has not been provided for this Alternatives Analysis. It has been assumed that ground improvement is not required and loading due to kinematic effects can be neglected.
G1 Mooring and slewing dolphin structures and hardware are not included in this estimate.

ARRC Whittier Terminal Reconstruction Transfer Span
Alternative Analysis
Order of Magnitude Estimate of Probable Construction Cost
Alternative 3A: (4) Track Through Girder with Elevated, Coupled Hoist System
Counterweight Wire Rope Lift Mechanism with One Motor Driving Two Drums

kpff 60 YEARS

March 22, 2021

Item		Quantity	Unit	Unit Cost	Total Cost	% of Total
Mobilization & Site Preparation						
1	Mobilization	1	LS	$299,915.00	$299,900	
2	De-Mobilization & Contractor Closeout	1	LS	$474,600.00	$474,600	
				Subtotal - Mobilization & Site Preparation	**$774,500**	7.5%
Bridge Seat						
3	Furnish and Install (10) 24" Steel Pipe Piles	1000	LF	$340.00	$340,000	
4	CIP Concrete for Abutment and Wingwalls	531	CY	$900.00	$477,900	
				Subtotal - Bridge Seat	**$817,900**	8.0%
Ramp						
5	Built Up Plate Girders, Including Stiffeners and Appurtenances	97	TON	$11,000.00	$1,067,600	
6	Wide Flange Floor Beam	116	TON	$9,000.00	$1,042,600	
7	Wide Flange Stringer	171	TON	$9,000.00	$1,542,200	
8	Wide Flange Deck Beam	95	TON	$9,000.00	$855,900	
9	Deck Grating	6600	SF	$60.00	$396,000	
10	Rail & Accessories	960	LF	$40.00	$38,400	
11	Built Up Lift Beam	18	TON	$11,000.00	$192,700	
12	Bridge Seat Transition Plate Fabrication	1	EA	$10,000.00	$10,000	
13	Bridge Seat Pin Fabrication	3	EA	$10,000.00	$30,000	
14	Ramp to Barge Connection Assembly	1	EA	$5,000.00	$5,000	
				Subtotal - Ramp	**$5,180,400**	50.5%
Lifting Tower						
15	(8) Concrete Drilled Shafts	760	VLF	$1,275.00	$969,000	
16	CIP Concrete for Dolphin Pile Cap	210	CY	$2,500.00	$525,900	
17	Machinery Housing - (3) Houses	432	SF	$150.00	$64,800	
18	Wide Flange Columns	14	TON	$9,000.00	$122,400	
19	Wide Flange Beams	13	TON	$9,000.00	$117,500	
20	Angle Braces	8	TON	$9,000.00	$70,000	
21	Built Up Tower Cross Beams	41	TON	$9,000.00	$365,200	
22	Wide Flange Deck Support Stringers	10	TON	$9,000.00	$89,100	
23	Tower Deck Grating	2800	SF	$35.00	$98,000	
24	Tower Wall Cladding	7040	SF	$30.00	$211,200	
25	Stairs	100	VLF	$2,500.00	$250,000	
26	Handrail	3695	LB	$4.50	$16,600	
				Subtotal - Lifting Tower	**$2,899,700**	28.2%
Mechanical Components						
27	Motor	1	EA	$10,000.00	$10,000	
28	Reducer	1	EA	$50,000.00	$50,000	
29	Drum	2300	LB	$9.00	$20,700	
30	Drive Shaft	10000	LB	$9.00	$90,000	
31	Bearing	10	EA	$3,000.00	$30,000	
32	CW Sheave	12	EA	$5,500.00	$66,000	
33	Hoist Sheave	10	EA	$1,050.00	$10,500	
34	CW Sheave Bracket	12000	LB	$5.00	$60,000	
35	Hoist Sheave Bracket	5000	LB	$5.00	$25,000	
36	CW Wire Rope	990	FT	$22.00	$21,800	
37	Hoist Wire Rope	605	FT	$13.00	$7,900	
38	Counterweight	130500	LB	$0.20	$26,100	
39	Beam Connection	14	EA	$500.00	$7,000	
40	CW Connection	12	EA	$750.00	$9,000	
41	Electrical	1	EA	$100,000.00	$100,000	
				Subtotal - Mechanical Components	**$534,000**	5.2%
Mechanical Components Installation						
42	Labor	480	HR	$100.00	$48,000	
43	Equipment	24	HR	$500.00	$12,000	
				Subtotal - Mechanical Components Installation	**$60,000**	0.6%
				Total Construction Cost	**$10,266,500**	100.0%
				Alaska State Sales Tax 0.0%	**$0**	
				Total Estimate of Probable Construction Cost	**$10,266,500**	
				Design/Construction Contingency 40%	**$4,106,600**	
				Total Cost	**$14,373,100**	

Notes

1 Assumes 5% of Subtotal Consruction Cost for mobilization. This item only reflects mobilization for the barge ramp and associated structures.

2 Assumes 5% of Subtotal Consruction Cost for demobilization. This item only reflects demobilization for the barge ramp and associated structures.

3,15 Site specific geotechnical information has not been provided for this Alternatives Analysis. It has been assumed that ground improvement is not required and loading due to kinematic effects can be neglected.

G1 Mooring and slewing dolphin structures and hardware are not included in this estimate.

ARRC Whittier Terminal Reconstruction Transfer Span
Alternative Analysis
Order of Magnitude Estimate of Probable Construction Cost
Alternative 3B: (4) Track Through Girder with Elevated, Coupled Hoist System
Hydraulic Lift System

March 22, 2021

Item		Quantity	Unit	Unit Cost	Total Cost	% of Total
Mobilization & Site Preparation						
1	Mobilization	1	LS	$299,915.00	$299,900	
2	De-Mobilization & Contractor Closeout	1	LS	$503,700.00	$503,700	
				Subtotal - Mobilization & Site Preparation	**$803,600**	7.4%
Bridge Seat						
3	Furnish and Install (10) 24" Steel Pipe Piles	1000	LF	$340.00	$340,000	
4	CIP Concrete for Abutment and Wingwalls	531	CY	$900.00	$477,900	
				Subtotal - Bridge Seat	**$817,900**	7.5%
Ramp						
5	Built Up Plate Girders, Including Stiffeners and Appurtenances	97	TON	$11,000.00	$1,067,600	
6	Wide Flange Floor Beam	116	TON	$9,000.00	$1,042,600	
7	Wide Flange Stringer	171	TON	$9,000.00	$1,542,200	
8	Wide Flange Deck Beam	95	TON	$9,000.00	$855,900	
9	Deck Grating	6600	SF	$60.00	$396,000	
10	Rail & Accessories	960	LF	$40.00	$38,400	
11	Built Up Lift Beam	18	TON	$11,000.00	$192,700	
12	Bridge Seat Transition Plate Fabrication	1	EA	$10,000.00	$10,000	
13	Bridge Seat Pin Fabrication	3	EA	$10,000.00	$30,000	
14	Ramp to Barge Connection Assembly	1	EA	$5,000.00	$5,000	
				Subtotal - Ramp	**$5,180,400**	47.6%
Lifting Tower						
15	(8) Concrete Drilled Shafts	760	EA	$1,275.00	$969,000	
16	CIP Concrete for Dolphin Pile Cap	210	CY	$2,500.00	$525,900	
17	Machinery Housing - (3) Houses	432	SF	$150.00	$64,800	
18	Wide Flange Columns	14	TON	$9,000.00	$122,400	
19	Wide Flange Beams	13	TON	$9,000.00	$117,500	
20	Angle Braces	8	TON	$9,000.00	$70,000	
21	Built Up Tower Cross Beams	41	TON	$9,000.00	$365,200	
22	Wide Flange Deck Support Stringers	10	TON	$9,000.00	$89,100	
23	Tower Deck Grating	2800	SF	$35.00	$98,000	
24	Tower Wall Cladding	7040	SF	$30.00	$211,200	
25	Stairs	100	VLF	$2,500.00	$250,000	
26	Handrail	3695	LB	$4.50	$16,600	
				Subtotal - Lifting Tower	**$2,899,700**	26.7%
Mechanical Components						
27	Hydraulic Cylinder	10500	LB	$60.00	$630,000	
28	Hydraulic Power Unit with Control Valves	1	EA	$250,000.00	$250,000	
29	Electrical	1	EA	$100,000.00	$100,000	
				Subtotal - Mechanical Components	**$980,000**	9.0%
Mechanical Components Installation						
30	Labor	960	HR	$200.00	$192,000	
31	Equipment	8	HR	$500.00	$4,000	
				Subtotal - Mechanical Components Installation	**$196,000**	1.8%
				Total Construction Cost	**$10,877,600**	100.0%
				Alaska State Sales Tax 0.0%	**$0**	
				Total Estimate of Probable Construction Cost	**$10,877,600**	
				Design/Construction Contingency 40%	**$4,351,040**	
				Total Cost	**$15,228,640**	

Notes

1 Assumes 5% of Subtotal Consruction Cost for mobilization. This item only reflects mobilization for the barge ramp and associated structures.

2 Assumes 5% of Subtotal Consruction Cost for demobilization. This item only reflects demobilization for the barge ramp and associated structures.

3,15 Site specific geotechnical information has not been provided for this Alternatives Analysis. It has been assumed that ground improvement is not required and loading due to kinematic effects can be neglected.

G1 Mooring and slewing dolphin structures and hardware are not included in this estimate.

ARRC Whittier Terminal Reconstruction Transfer Span
Alternative Analysis
Order of Magnitude Estimate of Probable Construction Cost
Alternative 4A: (2) Track Deck Girder with Lowered, De-coupled Hoist System
Counterweight Wire Rope Lift Mechanism with Two Motors Driving Two Drums

March 22, 2021

Item		Quantity	Unit	Unit Cost	Total Cost	% of Total
Mobilization & Site Preparation						
1	Mobilization	1	LS	$142,235.00	$142,200	
2	De-Mobilization & Contractor Closeout	1	LS	$272,680.00	$272,700	
				Subtotal - Mobilization & Site Preparation	**$414,900**	7.1%
Bridge Seat						
3	Furnish and Install (8) 24" Steel Pipe Piles	800	LF	$340.00	$272,000	
4	CIP Concrete for Abutment and Wingwalls	285	CY	$900.00	$256,700	
				Subtotal - Bridge Seat	**$528,700**	9.0%
Ramp						
5	Built Up Plate Girders, Including Stiffeners and Appurtenances	75	TON	$11,000.00	$825,600	
6	Wide Flange Floor Beam	116	TON	$9,000.00	$1,042,600	
7	Deck Grating	4191	SF	$60.00	$251,500	
8	Rail & Accessories	480	LF	$40.00	$19,200	
9	Built Up Lift Beam	13	TON	$11,000.00	$142,100	
10	Bridge Seat Transition Plate Fabrication	1	EA	$10,000.00	$10,000	
11	Bridge Seat Pin Fabrication	2	EA	$10,000.00	$20,000	
12	Ramp to Barge Connection Assembly	1	EA	$5,000.00	$5,000	
				Subtotal - Ramp	**$2,316,000**	39.5%
Lifting Tower						
13	(8) Concrete Drilled Shafts	760	VLF	$1,275.00	$969,000	
14	CIP Concrete for Dolphin Pile Cap	210	CY	$2,500.00	$525,900	
15	Machinery Housing - (2) Houses	288	SF	$150.00	$43,200	
16	Wide Flange Columns	9	TON	$9,000.00	$81,600	
17	Wide Flange Beams	9	TON	$9,000.00	$78,300	
18	Angle Braces	5	TON	$9,000.00	$46,700	
19	Tower Deck Grating	256	SF	$35.00	$9,000	
20	Tower Wall Cladding	4608	SF	$30.00	$138,200	
21	Stairs	67	VLF	$2,500.00	$166,700	
22	Handrail	1636	LB	$4.50	$7,400	
				Subtotal - Lifting Tower	**$2,066,000**	35.2%
Mechanical Components						
23	Motor	2	EA	$10,000.00	$20,000	
24	Reducer	2	EA	$50,000.00	$100,000	
25	Drum	2300	LB	$9.00	$20,700	
26	Drive Shaft	600	LB	$9.00	$5,400	
27	Bearing	4	EA	$3,000.00	$12,000	
28	CW Sheave	4	EA	$5,500.00	$22,000	
29	Hoist Sheave	10	EA	$1,050.00	$10,500	
30	CW Sheave Bracket	4000	LB	$5.00	$20,000	
31	Hoist Sheave Bracket	5000	LB	$5.00	$25,000	
32	CW Wire Rope	330	FT	$22.00	$7,300	
33	Hoist Wire Rope	605	FT	$13.00	$7,900	
34	Counterweight	130500	LB	$0.20	$26,100	
35	Beam Connection	6	EA	$500.00	$3,000	
36	CW Connection	4	EA	$750.00	$3,000	
37	Electrical	1	EA	$200,000.00	$200,000	
				Subtotal - Mechanical Components	**$482,900**	8.2%
Mechanical Components Installation						
38	Labor	480	HR	$100.00	$48,000	
39	Equipment	24	HR	$500.00	$12,000	
				Subtotal - Mechanical Components Installation	**$60,000**	1.0%
				Total Construction Cost	**$5,868,500**	100.0%
				Alaska State Sales Tax 0.0%	**$0**	
				Total Estimate of Probable Construction Cost	**$5,868,500**	
				Design/Construction Contingency 40%	**$2,347,400**	
				Total Cost	**$8,215,900**	

Notes

1 Assumes 5% of Subtotal Consruction Cost for mobilization. This item only reflects mobilization for the barge ramp and associated structures.

2 Assumes 5% of Subtotal Consruction Cost for demobilization. This item only reflects demobilization for the barge ramp and associated structures.

3,15 Site specific geotechnical information has not been provided for this Alternatives Analysis. It has been assumed that ground improvement is not required and loading due to kinematic effects can be neglected.

G1 Mooring and slewing dolphin structures and hardware are not included in this estimate.

ARRC Whittier Terminal Reconstruction Transfer Span
Alternative Analysis
Order of Magnitude Estimate of Probable Construction Cost
Alternative 4B: (2) Track Deck Girder with Lowered, De-coupled Hoist System
Hydraulic Lift System

kpff 60 YEARS

March 22, 2021

Item		Quantity	Unit	Unit Cost	Total Cost	% of Total
Mobilization & Site Preparation						
1	Mobilization	1	LS	$142,235.00	$142,200	
2	De-Mobilization & Contractor Closeout	1	LS	$287,835.00	$287,800	
				Subtotal - Mobilization & Site Preparation	**$430,000**	7.0%
Bridge Seat						
3	Furnish and Install (8) 24" Steel Pipe Piles	800	LF	$340.00	$272,000	
4	CIP Concrete for Abutment and Wingwalls	285	CY	$900.00	$256,700	
				Subtotal - Bridge Seat	**$528,700**	8.5%
Ramp						
5	Built Up Plate Girders, Including Stiffeners and Appurtenances	75	TON	$11,000.00	$825,600	
6	Wide Flange Floor Beam	116	TON	$9,000.00	$1,042,600	
7	Deck Grating	4191	SF	$60.00	$251,500	
8	Rail & Accessories	480	LF	$40.00	$19,200	
9	Built Up Lift Beam	13	TON	$11,000.00	$142,100	
10	Bridge Seat Transition Plate Fabrication	1	EA	$10,000.00	$10,000	
11	Bridge Seat Pin Fabrication	2	EA	$10,000.00	$20,000	
12	Ramp to Barge Connection Assembly	1	EA	$5,000.00	$5,000	
				Subtotal - Ramp	**$2,316,000**	37.4%
Lifting Tower						
13	(8) Concrete Drilled Shafts	760	VLF	$1,275.00	$969,000	
14	CIP Concrete for Dolphin Pile Cap	210	CY	$2,500.00	$525,900	
15	Machinery Housing - (2) Houses	288	SF	$150.00	$43,200	
16	Wide Flange Columns	9	TON	$9,000.00	$81,600	
17	Wide Flange Beams	9	TON	$9,000.00	$78,300	
18	Angle Braces	5	TON	$9,000.00	$46,700	
19	Tower Deck Grating	256	SF	$35.00	$9,000	
20	Tower Wall Cladding	4608	SF	$30.00	$138,200	
21	Stairs	67	VLF	$2,500.00	$166,700	
22	Handrail	1636	LB	$4.50	$7,400	
				Subtotal - Lifting Tower	**$2,066,000**	33.4%
Mechanical Components						
1	Hydraulic Cylinder	5000	LB	$60.00	$300,000	
2	Hydraulic Power Unit with Control Valves	1	EA	$250,000.00	$250,000	
3	Electrical	1	EA	$100,000.00	$100,000	
				Subtotal - Mechanical Components	**$650,000**	10.5%
Mechanical Components Installation						
4	Labor	960	HR	$200.00	$192,000	
5	Equipment	8	HR	$500.00	$4,000	
				Subtotal - Mechanical Components Installation	**$196,000**	3.2%
				Total Construction Cost	**$6,186,700**	100.0%
				Alaska State Sales Tax 0.0%	**$0**	
				Total Estimate of Probable Construction Cost	**$6,186,700**	
				Design/Construction Contingency 40%	**$2,474,680**	
				Total Cost	**$8,661,380**	

Notes

1	Assumes 5% of Subtotal Consruction Cost for mobilization. This item only reflects mobilization for the barge ramp and associated structures.
2	Assumes 5% of Subtotal Consruction Cost for demobilization. This item only reflects demobilization for the barge ramp and associated structures.
3,15	Site specific geotechnical information has not been provided for this Alternatives Analysis. It has been assumed that ground improvement is not required and loading due to kinematic effects can be neglected.
G1	Mooring and slewing dolphin structures and hardware are not included in this estimate.

ARRC Whittier Terminal Reconstruction Transfer Span
Alternative Analysis
Order of Magnitude Estimate of Probable Construction Cost
Alternative 5A: (3) Track Deck Girder with Lowered, De-coupled Hoist System
Counterweight Wire Rope Lift Mechanism with Two Motors Driving Two Drums

March 22, 2021

Item		Quantity	Unit	Unit Cost	Total Cost	% of Total
Mobilization & Site Preparation						
1	Mobilization	1	LS	$212,510.00	$212,500	
2	De-Mobilization & Contractor Closeout	1	LS	$347,315.00	$347,300	
				Subtotal - Mobilization & Site Preparation	**$559,800**	7.5%
Bridge Seat						
3	Furnish and Install (8) 24" Steel Pipe Piles	800	LF	$340.00	$272,000	
4	CIP Concrete for Abutment and Wingwalls	381	CY	$900.00	$342,900	
				Subtotal - Bridge Seat	**$614,900**	8.2%
Ramp						
5	Built Up Plate Girders, Including Stiffeners and Appurtenances	100	TON	$11,000.00	$1,096,000	
6	Wide Flange Floor Beam	222	TON	$9,000.00	$1,999,200	
7	Deck Grating	5569.2	SF	$60.00	$334,200	
8	Rail & Accessories	720	LB	$40.00	$28,800	
9	Built Up Lift Beam	13	TON	$11,000.00	$142,100	
10	Bridge Seat Transition Plate Fabrication	1	EA	$10,000.00	$10,000	
11	Bridge Seat Pin Fabrication	2	EA	$10,000.00	$20,000	
12	Ramp to Barge Connection Assembly	1	EA	$5,000.00	$5,000	
				Subtotal - Ramp	**$3,635,300**	48.4%
Lifting Tower						
13	(8) Concrete Drilled Shafts	760	EA	$1,275.00	$969,000	
14	CIP Concrete for Dolphin Pile Cap	210	CY	$2,500.00	$525,900	
15	Machinery Housing - (2) Houses	288	SF	$150.00	$43,200	
16	Wide Flange Columns	9	TON	$9,000.00	$81,600	
17	Wide Flange Beams	9	TON	$9,000.00	$78,300	
18	Angle Braces	5	TON	$9,000.00	$46,700	
19	Tower Deck Grating	256	SF	$35.00	$9,000	
20	Tower Wall Cladding	4608	SF	$30.00	$138,200	
21	Stairs	67	VLF	$2,500.00	$166,700	
22	Handrail	1636	LB	$4.50	$7,400	
				Subtotal - Lifting Tower	**$2,066,000**	27.5%
Mechanical Components						
23	Motor	2	EA	$10,000.00	$20,000	
24	Reducer	2	EA	$50,000.00	$100,000	
25	Drum	2300	LB	$9.00	$20,700	
26	Drive Shaft	600	LB	$9.00	$5,400	
27	Bearing	4	EA	$3,000.00	$12,000	
28	CW Sheave	8	EA	$5,500.00	$44,000	
29	Hoist Sheave	10	EA	$1,050.00	$10,500	
30	CW Sheave Bracket	8000	LB	$5.00	$40,000	
31	Hoist Sheave Bracket	5000	LB	$5.00	$25,000	
32	CW Wire Rope	660	FT	$22.00	$14,500	
33	Hoist Wire Rope	605	FT	$13.00	$7,900	
34	Counterweight	295500	LB	$0.20	$59,100	
35	Beam Connection	10	EA	$500.00	$5,000	
36	CW Connection	8	EA	$750.00	$6,000	
37	Electrical	1	EA	$200,000.00	$200,000	
				Subtotal - Mechanical Components	**$570,100**	7.6%
Mechanical Components Installation						
38	Labor	480	HR	$100.00	$48,000	
39	Equipment	24	HR	$500.00	$12,000	
				Subtotal - Mechanical Components Installation	**$60,000**	0.8%
				Total Construction Cost	**$7,506,100**	100.0%

Alaska State Sales Tax 0.0%	**$0**
Total Estimate of Probable Construction Cost	**$7,506,100**
Design/Construction Contingency 40%	**$3,002,440**
Total Cost	**$10,508,540**

Notes

1	Assumes 5% of Subtotal Consruction Cost for mobilization. This item only reflects mobilization for the barge ramp and associated structures.
2	Assumes 5% of Subtotal Consruction Cost for demobilization. This item only reflects demobilization for the barge ramp and associated structures.
3,15	Site specific geotechnical information has not been provided for this Alternatives Analysis. It has been assumed that ground improvement is not required and loading due to kinematic effects can be neglected.
G1	Mooring and slewing dolphin structures and hardware are not included in this estimate.

ARRC Whittier Terminal Reconstruction Transfer Span
Alternative Analysis
Order of Magnitude Estimate of Probable Construction Cost
Alternative 5B: (3) Track Deck Girder with Lowered, De-coupled Hoist System
Hydraulic Lift System

March 22, 2021

Item		Quantity	Unit	Unit Cost	Total Cost	% of Total
Mobilization & Site Preparation						
1	Mobilization	1	LS	$212,510.00	$212,500	
2	De-Mobilization & Contractor Closeout	1	LS	$365,610.00	$365,600	
				Subtotal - Mobilization & Site Preparation	**$578,100**	7.3%
Bridge Seat						
3	Furnish and Install (8) 24" Steel Pipe Piles	800	LF	$340.00	$272,000	
4	CIP Concrete for Abutment and Wingwalls	381	CY	$900.00	$342,900	
				Subtotal - Bridge Seat	**$614,900**	7.8%
Ramp						
5	Built Up Plate Girders, Including Stiffeners and Appurtenances	100	TON	$11,000.00	$1,096,000	
6	Wide Flange Floor Beam	222	TON	$9,000.00	$1,999,200	
7	Deck Grating	5569.2	SF	$60.00	$334,200	
8	Rail & Accessories	720	LB	$40.00	$28,800	
9	Built Up Lift Beam	13	EA	$11,000.00	$142,100	
10	Bridge Seat Transition Plate Fabrication	1	EA	$10,000.00	$10,000	
11	Bridge Seat Pin Fabrication	2	EA	$10,000.00	$20,000	
12	Ramp to Barge Connection Assembly	1	EA	$5,000.00	$5,000	
				Subtotal - Ramp	**$3,635,300**	46.1%
Lifting Tower						
13	(8) Concrete Drilled Shafts	760	EA	$1,275.00	$969,000	
14	CIP Concrete for Dolphin Pile Cap	210	CY	$2,500.00	$525,900	
15	Machinery Housing - (2) Houses	288	SF	$150.00	$43,200	
16	Wide Flange Columns	9	TON	$9,000.00	$81,600	
17	Wide Flange Beams	9	TON	$9,000.00	$78,300	
18	Angle Braces	5	TON	$9,000.00	$46,700	
19	Tower Deck Grating	256	SF	$35.00	$9,000	
20	Tower Wall Cladding	4608	SF	$30.00	$138,200	
21	Stairs	67	VLF	$2,500.00	$166,700	
22	Handrail	1636	LB	$4.50	$7,400	
				Subtotal - Lifting Tower	**$2,066,000**	26.2%
Mechanical Components						
23	Hydraulic Cylinder	7500	LB	$60.00	$450,000	
24	Hydraulic Power Unit with Control Valves	1	EA	$250,000.00	$250,000	
25	Electrical	1	EA	$100,000.00	$100,000	
				Subtotal - Mechanical Components	**$800,000**	10.1%
Mechanical Components Installation						
26	Labor	960	HR	$200.00	$192,000	
27	Equipment	8	HR	$500.00	$4,000	
				Subtotal - Mechanical Components Installation	**$196,000**	2.5%
				Total Construction Cost	**$7,890,300**	100.0%
				Alaska State Sales Tax 0.0%	**$0**	
				Total Estimate of Probable Construction Cost	**$7,890,300**	
				Design/Construction Contingency 40%	**$3,156,120**	
				Total Cost	**$11,046,420**	

Notes

1 Assumes 5% of Subtotal Consruction Cost for mobilization. This item only reflects mobilization for the barge ramp and associated structures.

2 Assumes 5% of Subtotal Consruction Cost for demobilization. This item only reflects demobilization for the barge ramp and associated structures.

3,15 Site specific geotechnical information has not been provided for this Alternatives Analysis. It has been assumed that ground improvement is not required and loading due to kinematic effects can be neglected.

G1 Mooring and slewing dolphin structures and hardware are not included in this estimate.

ARRC Whittier Terminal Reconstruction Transfer Span
Alternative Analysis
Order of Magnitude Estimate of Probable Construction Cost
Alternative 6A: (4) Track Deck Girder with Lowered, De-coupled Hoist System
Counterweight Wire Rope Lift Mechanism with Two Motors Driving Two Drums

March 22, 2021

Item		Quantity	Unit	Unit Cost	Total Cost	% of Total
Mobilization & Site Preparation						
1	Mobilization	1	LS	$245,480.00	$245,500	
2	De-Mobilization & Contractor Closeout	1	LS	$381,350.00	$381,400	
	Subtotal - Mobilization & Site Preparation				**$626,900**	7.6%
Bridge Seat						
3	Furnish and Install (10) 24" Steel Pipe Piles	1000	LF	$340.00	$340,000	
4	CIP Concrete for Abutment and Wingwalls	531	CY	$900.00	$477,900	
	Subtotal - Bridge Seat				**$817,900**	9.9%
Ramp						
5	Built Up Plate Girders, Including Stiffeners and Appurtenances	125	TON	$11,000.00	$1,377,100	
6	Wide Flange Floor Beam	232	TON	$9,000.00	$2,085,200	
7	Deck Grating	6732	SF	$60.00	$403,900	
8	Rail & Accessories	960	LF	$40.00	$38,400	
9	Built Up Lift Beam	13	TON	$11,000.00	$142,100	
10	Bridge Seat Transition Plate Fabrication	1	EA	$10,000.00	$10,000	
11	Bridge Seat Pin Fabrication	3	EA	$10,000.00	$30,000	
12	Ramp to Barge Connection Assembly	1	EA	$5,000.00	$5,000	
	Subtotal - Ramp				**$4,091,700**	49.6%
Lifting Tower						
13	(8) Concrete Drilled Shafts	760	VLF	$1,275.00	$969,000	
14	CIP Concrete for Dolphin Pile Cap	210	CY	$2,500.00	$525,900	
15	Machinery Housing - (2) Houses	288	SF	$150.00	$43,200	
16	Wide Flange Columns	9	TON	$9,000.00	$81,600	
17	Wide Flange Beams	9	TON	$9,000.00	$78,300	
18	Angle Braces	5	TON	$9,000.00	$46,700	
19	Tower Deck Grating	256	SF	$35.00	$9,000	
20	Tower Wall Cladding	4608	SF	$30.00	$138,200	
21	Stairs	67	VLF	$2,500.00	$166,700	
22	Handrail	1636	LB	$4.50	$7,400	
	Subtotal - Lifting Tower				**$2,066,000**	25.0%
Mechanical Components						
23	Motor	2	EA	$10,000.00	$20,000	
24	Reducer	2	EA	$50,000.00	$100,000	
25	Drum	2300	LB	$9.00	$20,700	
26	Drive Shaft	600	LB	$9.00	$5,400	
27	Bearing	4	EA	$3,000.00	$12,000	
28	CW Sheave	12	EA	$5,500.00	$66,000	
29	Hoist Sheave	10	EA	$1,050.00	$10,500	
30	CW Sheave Bracket	12000	LB	$5.00	$60,000	
31	Hoist Sheave Bracket	5000	LB	$5.00	$25,000	
32	CW Wire Rope	990	FT	$22.00	$21,800	
33	Hoist Wire Rope	605	FT	$13.00	$7,900	
34	Counterweight	130500	LB	$0.20	$26,100	
35	Beam Connection	14	EA	$500.00	$7,000	
36	CW Connection	12	EA	$750.00	$9,000	
37	Electrical	1	EA	$200,000.00	$200,000	
	Subtotal - Mechanical Components				**$591,400**	7.2%
Mechanical Components Installation						
38	Labor	480	HR	$100.00	$48,000	
39	Equipment	24	HR	$500.00	$12,000	
	Subtotal - Mechanical Components Installation				**$60,000**	0.7%
	Total Construction Cost				**$8,253,900**	100.0%
	Alaska State Sales Tax 0.0%				**$0**	
	Total Estimate of Probable Construction Cost				**$8,253,900**	
	Design/Construction Contingency 40%				**$3,301,560**	
	Total Cost				**$11,555,460**	

Notes

1 Assumes 5% of Subtotal Consruction Cost for mobilization. This item only reflects mobilization for the barge ramp and associated structures.

2 Assumes 5% of Subtotal Consruction Cost for demobilization. This item only reflects demobilization for the barge ramp and associated structures.

3,15 Site specific geotechnical information has not been provided for this Alternatives Analysis. It has been assumed that ground improvement is not required and loading due to kinematic effects can be neglected.

G1 Mooring and slewing dolphin structures and hardware are not included in this estimate.

ARRC Whittier Terminal Reconstruction Transfer Span
Alternative Analysis
Order of Magnitude Estimate of Probable Construction Cost
Alternative 6B: (4) Track Deck Girder with Lowered, De-coupled Hoist System
Hydraulic Lift System

March 22, 2021

Item		Quantity	Unit	Unit Cost	Total Cost	% of Total
Mobilization & Site Preparation						
1	Mobilization	1	LS	$245,480.00	$245,500	
2	De-Mobilization & Contractor Closeout	1	LS	$407,580.00	$407,600	
				Subtotal - Mobilization & Site Preparation	**$653,100**	7.4%
Bridge Seat						
3	Furnish and Install (10) 24" Steel Pipe Piles	1000	LF	$340.00	$340,000	
4	CIP Concrete for Abutment and Wingwalls	531	CY	$900.00	$477,900	
				Subtotal - Bridge Seat	**$817,900**	9.3%
Ramp						
5	Built Up Plate Girders, Including Stiffeners and Appurtenances	125	TON	$11,000.00	$1,377,100	
6	Wide Flange Floor Beam	232	TON	$9,000.00	$2,085,200	
7	Deck Grating	6732	SF	$60.00	$403,900	
8	Rail & Accessories	960	LF	$40.00	$38,400	
9	Built Up Lift Beam	13	TON	$11,000.00	$142,100	
10	Bridge Seat Transition Plate Fabrication	1	EA	$10,000.00	$10,000	
11	Bridge Seat Pin Fabrication	3	EA	$10,000.00	$30,000	
12	Ramp to Barge Connection Assembly	1	EA	$5,000.00	$5,000	
				Subtotal - Ramp	**$4,091,700**	46.5%
Lifting Tower						
13	(8) Concrete Drilled Shafts	760	EA	$1,275.00	$969,000	
14	CIP Concrete for Dolphin Pile Cap	210	CY	$2,500.00	$525,900	
15	Machinery Housing - (2) Houses	288	SF	$150.00	$43,200	
16	Wide Flange Columns	9	TON	$9,000.00	$81,600	
17	Wide Flange Beams	9	TON	$9,000.00	$78,300	
18	Angle Braces	5	TON	$9,000.00	$46,700	
19	Tower Deck Grating	256	SF	$35.00	$9,000	
20	Tower Wall Cladding	4608	SF	$30.00	$138,200	
21	Stairs	67	VLF	$2,500.00	$166,700	
22	Handrail	1636	LB	$4.50	$7,400	
				Subtotal - Lifting Tower	**$2,066,000**	23.5%
Mechanical Components						
23	Hydraulic Cylinder	10500	LB	$60.00	$630,000	
24	Hydraulic Power Unit with Control Valves	1	EA	$250,000.00	$250,000	
25	Electrical	1	EA	$100,000.00	$100,000	
				Subtotal - Mechanical Components	**$980,000**	11.1%
Mechanical Components Installation						
26	Labor	960	HR	$200.00	$192,000	
27	Equipment	8	HR	$500.00	$4,000	
				Subtotal - Mechanical Components Installation	**$196,000**	2.2%
				Total Construction Cost	**$8,804,700**	100.0%
				Alaska State Sales Tax 0.0%	**$0**	
				Total Estimate of Probable Construction Cost	**$8,804,700**	
				Design/Construction Contingency 40%	**$3,521,880**	
				Total Cost	**$12,326,580**	

Notes

1	Assumes 5% of Subtotal Consruction Cost for mobilization. This item only reflects mobilization for the barge ramp and associated structures.
2	Assumes 5% of Subtotal Consruction Cost for demobilization. This item only reflects demobilization for the barge ramp and associated structures.
3,15	Site specific geotechnical information has not been provided for this Alternatives Analysis. It has been assumed that ground improvement is not required and loading due to kinematic effects can be neglected.
G1	Mooring and slewing dolphin structures and hardware are not included in this estimate.

ARRC Whittier Terminal Reconstruction Transfer Span
Alternative Analysis
Order of Magnitude Estimate of Probable Construction Cost
Relocation of Existing Ramp & Lift System

March 22, 2021

Item		Quantity	Unit	Unit Cost	Total Cost	% of Total
Mobilization & Site Preparation						
1	Mobilization	1	LS	$51,890.00	$51,900	
2	De-Mobilization & Contractor Closeout	1	LS	$51,890.00	$51,900	
	Subtotal - Mobilization & Site Preparation				**$103,800**	9.1%
Bridge Seat						
3	Furnish and Install (8) 24" Steel Pipe Piles	800	LF	$340.00	$272,000	
4	CIP Concrete for Abutment and Wingwalls	208	CY	$900.00	$187,500	
	Subtotal - Bridge Seat				**$459,500**	40.3%
Ramp Relocation						
5	Partial Dissasembly of Ramp	7	DAYS	$7,000.00	$49,000	
6	Derrick Barge Ramp Transport & Crew	3	DAYS	$20,000.00	$60,000	
7	Partial Ramp Reassembly	7	DAYS	$7,000.00	$49,000	
8	Relocation of Reusable Mechanical Equipment	1	EA	$45,000.00	$45,000	
	Subtotal - Ramp Relocation				**$203,000**	17.8%
Ramp Lift System						
9	Furnish and Install (2) 36" x 3/4" Lift Piles	160	LF	$360.00	$57,600	
10	Furnish and Install Caisson Wall Plating	22	LF	$7,500.00	$165,000	
11	Caisson Concrete	3	CY	$900.00	$2,700	
12	New Non-Salvagable Mechanical and Connection Hardware	1	EA	$150,000.00	$150,000	
	Subtotal - Ramp Lift System				**$375,300**	32.9%
	Total Construction Cost				**$1,141,600**	100.0%
	Alaska State Sales Tax 0.0%				**$0**	
	Total Estimate of Probable Construction Cost				**$1,141,600**	
	Design/Construction Contingency 40%				**$456,640**	
	Total Cost				**$1,598,240**	

Notes

1 Assumes 5% of Subtotal Consruction Cost for mobilization. This item only reflects mobilization for the barge ramp and associated structures.

2 Assumes 5% of Subtotal Consruction Cost for demobilization. This item only reflects demobilization for the barge ramp and associated structures.

3,15 Site specific geotechnical information has not been provided for this Alternatives Analysis. It has been assumed that ground improvement is not required and loading due to kinematic effects can be neglected.

6.3 Basis of Design

On-Call Marine Structural Engineering Services
ARRC Whittier Terminal Reconstruction
Barge Ramp
Draft Mechanical/Structural Basis of Design
Contract No. 117853

Prepared by KPFF Consulting Engineers

Draft Basis of Design

March 3, 2021

TABLE OF CONTENTS

1.0 PROJECT DESCRIPTION

The Alaska Railroad Company's (ARRC) Whittier Terminal is almost 50 years old and reaching its service life expectancy. ARRC has invested over the last two years to extend the life of the Barge Slip including electrical, structural, and mechanical rehabilitations. The next phase is planning for reconstruction. This effort will likely include the barge slip, the old marginal wharf area, and potentially other areas to facilitate construction. R&M Engineering has recently begun pre-engineering efforts including survey and geotechnical support and PND Engineering will be assisting ARRC in marine engineering. KPFF has been contracted to provide engineering services for development of alternatives for the new transfer span ramp, specifically providing structural and mechanical engineering input and preliminary rough order of magnitude (ROM) cost estimates.

This basis of design document (BOD) articulates the project requirements and desires related to location, safety, operational ease, durability, cost, and constructability as they pertain to the mechanical and structural systems for the ramp. This is a preliminary level BOD and intended to serve as a starting point for a design level BOD when appropriate. The information provided here is intended to be the baseline assumptions that KPFF will be utilizing as we evaluate various alternatives. Upon receiving consensus from AARC on this BOD, KPFF will progress with the development of conceptual alternatives and cost estimates. A final version of this preliminary BOD will be included as an appendix to the final alternative analysis report provided by KPFF to AARC.

2.0 PROJECT GOALS AND LESSONS LEARNED FROM CURRENT FACILITIES

2.1 Corrosion Prevention

Waterfront and overwater structures are inherently subject to section loss and degradation due to corrosion from the marine environment, particularly in the splash zone where areas are exposed to an abundance of sea water and oxygen. The alternatives described in Section 12 below will seek to mitigate the effects of corrosion by minimizing the amount of structure directly in-contact with seawater by elevating as much structure as practical above the extreme water level. Sacrificial thickness to in-water steel piling and ramp elements subject to tide cycles may also be assumed to extend the service life of the structure, as well as implementing corrosion inhibiting coatings such as galvanizing, epoxy paint, passive galvanic anodes, or a combination thereof. Crack control provisions for concrete elements exposed to aggressive environmental conditions will also be assumed to mitigate corrosion of reinforcing steel exposed to chlorides.

2.2 Mechanical Systems

Bridge operating machinery must be robust, reliable, easy to maintain and hardened to withstand both the marine environment and the extreme winter conditions experienced at the site. Typical types of operating machinery for large transfer bridges are built around wire rope or hydraulic cylinder primary hoists.

Each type of primary hoist has inherent features that are not ideal for either the marine environment or for operating in extreme cold weather.

Both hoist types are degraded by exposure to the marine corrosion environment. On cylinders this can be mitigated by using corrosion resistant materials for the cylinder rods, and the careful selection of rod wipers and seals. Similarly, the impact on wire rope systems can be mitigated through the selection of special corrosion resistant materials or through protective coatings. Both measures substantially increase the capital cost of the operating machinery.

The site's extreme winter environment has a more wide-spread impact on the machinery and can be only partially mitigated through design measures. Critical routine maintenance of the hoist machinery becomes more difficult and, in some cases, impossible to complete.

For this study, we propose looking at both hydraulic and wire rope-based hoist systems. Rather than focusing on traditional hoist configurations with exposed hoist machinery, our alternatives will prioritize configurations that that keep critical mechanical components separated from the marine water and splash zone, and that can be hardened against cold weather via climate controlled machinery houses or enclosures. While these hardening provisions add a capital construction cost item to the project, we believe that this cost increase will be more than offset by reduced initial machinery costs and by reduced ongoing operations and maintenance (O&M) costs over the life of the project.

Additional systems such as bascule or swing systems will be considered as part of the alternatives analysis, but it is unlikely that such systems will prove to be advantageous from a cost or maintenance perspective. However, these alternate systems will be discussed.

3.0 DESIGN CRITERIA DOCUMENTS AND REFERENCES

3.1 Applicable Codes and Standards

- International Building Code (IBC), 2018 Edition
- American Society of Civil Engineers (ASCE), 2016, Minimum Design Loads for Buildings and Other Structures, ASCE Standard No. 7-16
- ASCE, 2014, Seismic Design of Pile-Supported Piers and Wharves, ASCE Standard No. 61-14.
- American Concrete Institute (ACI) Building Code Requirements for Structural Concrete, ACI 318-14
- American Institute of Steel Construction (AISC) Steel Construction Manual, 14th Edition
- American Association of State Highway & Transportation Officials (AASHTO) – Standard Specifications for Highway Bridges 2015
- American Society for Testing and Materials (ASTM) – Standards in Building Codes current editions
- American Welding Society – Structural Welding Code (AWS D1.1)
- American Railway Engineering and Maintenance-Of-Way Association (AREMA)
- AASHTO Movable Bridge Code (AASHTO MBC)

3.2 Reference Documents

- Drawings "AARC Whittier Barge Slip Dual Use Conversion", Dated March 26, 2010
- Drawings "AML Barge Loading Facility Whittier", Dated September 30, 2009
- ARRC e-mail input regarding various design parameters and operational desires

4.0 DESIGN LOADS

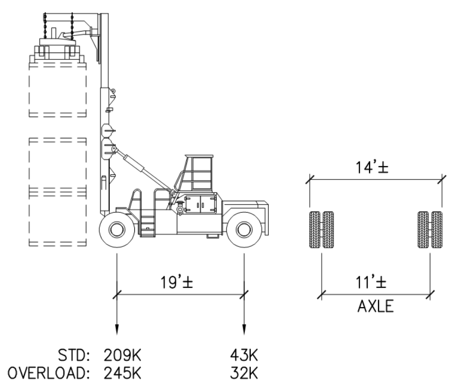
4.1 Dead Loads

Permanent loads will include the cumulative weight of all structures, including the weight of all structural components, utilities, and other permanent attachments. The following unit weights are assumed for design:

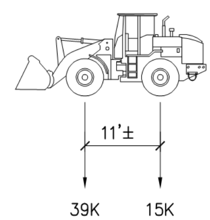
- Steel: 490 pounds-per-cubic-foot (pcf)
- Concrete: 150 pcf

4.2 Live Loads

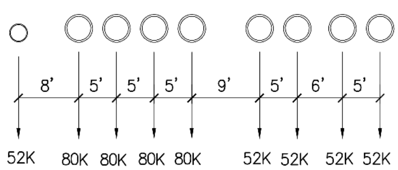
Per communications with AARC, the following design vehicles and their corresponding loading diagrams are considered for the preliminary design of the barge ramp. The COOPER E70 Single Locomotive Vehicle has been increased to a COOPER E80 based on email correspondence. Dynamic amplification effects due to impact are included where noted in the axle loads shown and appropriate live load reductions based on speed and the number of loaded tracks will be considered:



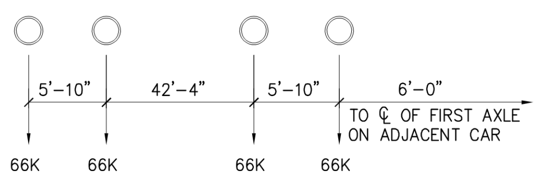
CONTAINER HANDLER
STD GVW= 252K IMPACT=20%
OVERLOAD GVW= 277K IMPACT=10%



CAT 966 LOADER
GVW= 54K IMPACT=33%

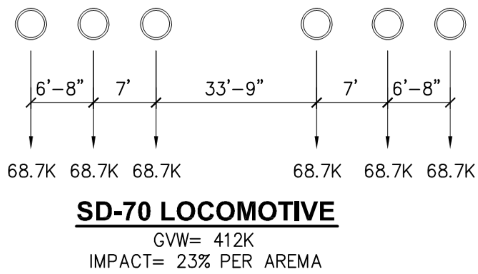


COOPER E80 SINGLE LOCOMOTIVE
GVW= 568 K NO IMPACT PER ORIGINAL DESIGN CRITERIA



CEMENT SHORT CAR
GVW= 264K PER CAR
IMPACT= 23% PER AREMA

kpff 60 YEARS



4.3 Earth Loads

Final design will require a geotechnical report for the site, which will characterize the subsurface profile for the site for the design of both on grade and in-water structures subject to earth loading. Soil loading and stability for shallow foundations and walls will be based on the respective active/passive pressures acting on the structural member, as well as friction between the structure and soil. Lower-bound soil resistances and allowable bearing pressures may be assumed for the alternative analysis based on recommendations in the IBC. Deep foundations, including caissons/piling, will eventually need to be analyzed for their subjected demands based on the respective resistance provided from each soil layer they penetrate to account for soil-structure interaction (SSI) effects. These analyses are typically performed in structural analysis software such as LPILE or SAP2000 through the form of lateral (PY) and axial (TZ/Q) soil springs applied to a representative model of the structure. The final lengths required for deep foundations will typically be based on the geotechnical vertical capacities provided from the geotechnical study for the site.

For the alternatives analysis, in the absence of geotechnical information, KPFF will utilize broad assumptions based on experience to approximate required pile size, quantity and depth for preliminary cost estimating purposes. KPFF can also incorporate preliminary input from R&M regarding site geotechnical assumptions if they become available during this study. For gravity load capacity of shafts and foundations, KPFF will assume that these elements reach bedrock for costing purposes. Furthermore, we will assume that fixity on pile or shaft elements can be reached at approximately 10 times the diameter of the foundation element. It will be assumed that there is no additional lateral kinematic earth pressure on foundation elements due to lateral spreading and that there is not significant down-drag due to liquefaction. Lateral earth pressure value minimums per ASCE 7 will be utilized where needed.

4.4 Seismic Loads

Seismic loading on the ramp and its supporting structures will be preliminarily based on an assumed ASCE 7, Site Class D classification and its respective response spectra for the project site. Site Class D does not require an analysis to be performed to consider the effects of soil-liquefaction and slope failure due to ground shaking. As mentioned previously, for final design a geotechnical study will be required to verify this assumption. The assumed response spectra will be based on AASHTO provisions utilizing a response modification factor (R-Factor) of (1) one for the barge framing. Provisions from ASCE-61 will be adopted when there is a lack of applicable provisions from the AASHTO specifications or ASCE 7. The seismic performance criteria will be defined as life-safety under a design level event for each alternative.

The analysis will assume that lateral spreading producing kinematic loading on the piling will not occur at the site, or that suitable ground improvements will be incorporated to prevent such loading. Costs for ground improvement will not be included in the alternatives analysis study and will need to be evaluated by others responsible for the overall site design and evaluation. This cost should be relatively consistent for all structural/mechanical alternatives, and thus should not inhibit ARRC from deciding regarding the optimal alternative. However, it will eventually affect the overall project cost if it is required. If ARRC desires the structure to be able to withstand lateral spreading forces without ground improvement, geotechnical input will need to be provided as this is highly site specific and not a structural demand that can be easily assumed based on past experience or anecdotal information.

4.5 Wind Loads

Wind loading will be in accordance with ASCE 7-16 for a Risk Category II structure, corresponding to a 160mph basic wind speed for the project site. This loading will be considered for all exposed elements in both their nominal condition and conditions that reflect potential ice-buildup and increased sail areas.

4.6 Snow and Ice Loads (Arctic Conditions)

Snow and ice buildup loading will be considered as additional vertical loading on exposed structures in accordance with ASCE 7-16 and accepted practice. Ice flow acting on piling due to the ice crushing force will also be assumed.

4.7 Ocean/Coastal Loads

Climatological and/or coastal reports near the project site are not available or pending from AARC, though it is not anticipated these loads will govern the design of any alternative given that the intent of the alternatives will be to limit the amount of structure that is in the water.

4.8 Machinery Design Loads

The Transfer Bridge Hoist Machinery and other mechanical elements shall be designed to carry both the anticipated ***Bridge Operational Loads*** and the ***Bridge Holding Loads***.

Bridge Operational Loads govern the size, speed, and power requirements of the hoist system. Operational Loads include bridge and machinery Dead Load, Snow and Ice Loads, Wind Loads, and any other primary load that the bridge would experience while it is being moved.

Bridge Holding Loads include all loads that the mechanical system would encounter while the bridge is stationary and supporting vessel loading and unloading.

All bridge machinery shall be designed to meet the Service, Fatigue and Fracture, and Overload limit states established by ASHTO Movable Bridge Code.

Where mechanical components serve as critical structural elements of the Bridge, these components will also be designed to carry Seismic and other Extreme Loads.

It should also be noted that there are many nuances to the mechanical design of this type of ramp including how the bearing assemblies at both the abutment and the barge respond to vessel motion. While developing details for these elements is not in the scope of the alternatives analysis, they are elements that will need to be considered in final design.

It is understood that the existing transfer span is used to slew the barges using two upland winches with fairleads at each of the two corners at the face of the span. The alternatives analysis will assume that this function will be served by onshore and offshore structures specifically designed to this purpose and will not be integrated into the ramp system.

5.0 TIDAL DATUMS AND RANGES

5.1 Current Tidal Information

For the purposes of this alternative analysis, the vertical elevation datum is 0.0 Mean Lower Low Water. It will be assumed that mudline elevations will be set based on dredging activity as needed to accommodate the ramp operations. Dredge quantities and costs will not be included in the alternatives analysis as they will be the same for all alternatives and are assumed to be part of the overall site project costs being developed by others.

It will also be assumed that the top of rail elevation at the bulkhead will be raised from the +18-foot MLLW elevation where the existing rail sits. The new elevation will be based on the current extreme high-water elevation identified below and projected sea level rise for the site. It is assumed that the upland implications associated with this assumption will be addressed by others on the project team.

Assumed water levels are in accordance with the General Notes on Sheet 18 of 21 of the AARC Whittier Barge Slip Dual Use Conversion Drawings:

Tidal Data	Mean Lower Low Water Datum
Extreme High Water	+18.7 ft
High Tide Line (HTL)	+15.5 ft
Mean Higher High Water (MHHW)	+12.3 ft
Mean High Water (MHW)	+11.3 ft
Mean Tide Line (MTL)	+06.4 ft
Mean Low Water (MLW)	+01.5 ft
Mean Lower Low Water (MLLW)	+00.0 ft
Extreme Low Water	-05.0 ft

5.2 Projected Tidal Information

Potential sea-level rise will be in accordance with a 50-year projection for the project location. The amount of rise will be extrapolated from historically recorded sea-level change data for the site if the information is not provided in a coastal report within the vicinity of the project. At a minimum two (2) feet of sea-level rise will be considered for each of the alternatives.

6.0 VESSEL CRITERIA

6.1 Current or Future Vessels

Based on correspondence with AARC, the following barge/vessel characteristics will be considered for the different alternatives:

- Barge: Dimensions up to 460’x125’
- CN 400’x76’x20’ DP
- AML 420’x100’x24’ DP
- Existing Dock Design Vessel: LOA 656’, Beam 106’, Displacement 44,000 tons

7.0 SERVICE LIFE CRITERIA

7.1 Structural Systems Service Life and Maintenance

A predicted minimum service life of 50 years may be assumed by implementing corrosion-inhibiting measures as discussed in Section 2.1, including sacrificial thickness, epoxy coatings to steel members, passive cathodic protection, as well as crack-control criteria for the design of concrete elements.

A monitoring program will be assumed to periodically assess the structural integrity of any coatings or the development of concrete cracks so that any minor issues can be addressed before causing accelerated corrosion. The alternatives analysis will consider options for removable decking and other elements that will make periodic inspection and routine maintenance easier than it is with the current facility.

7.2 Mechanical Systems Service Life and Maintenance

Bridge Mechanical systems shall be designed in accordance with AASHTO Movable Bridge Code to provide reliable bridge operation for the design life of the facility.

Design Life for the Machinery is assumed to be 50 years and could be extended to 75 years with minimal refurbishment after 50 years of operation.

Design life assumes that routine maintenance is completed for all mechanical systems for the life of the project.

8.0 OPERATIONAL CRITERIA

8.1 Ramp Design Range of Motion and Operational Slopes

The alternatives analysis will assume that rail cars will be up to 89-foot in length and that ramp angles will be as follows to match closely to current operations. The ramp upward angle will be assumed to be such that it can be stowed in a condition such that most of the structure will remain out of the water during stowage.

- Train Loading Condition
  - Max upward angle of +5.0 degrees
  - Max downward angle of -4.5 degrees

- Barge Engaged Maximums
    - Max upward angle of +6.5 degrees
    - Max downward angle of -4.5 degrees
- Ramp Angle Maximums (Not Operating or Stowed)
    - Max upward angle as required to keep ramp out of water as much as practical during stowage
    - Max downward angles of approximately -7.0 degrees

8.2 Lift/Hoist Mechanisms

Both Hydraulic Cylinder and Wire Rope type hoist systems could provide excellent service for this new Transfer Bridge.

Cylinder based systems have the load capacity to manage the transfer bridge without the need for a counter-weight system. This minimizes the machinery dead weight that the marine structures carry and eliminates an entire mechanical system that must be maintained. The trade-off is that the un-counterweighted system requires more power to operate at the same speed as a system with counterweights. Another major advantage to cylinder systems is that, if properly designed and fabricated they can operate for the full design life of the facility without refurbishment or replacement.

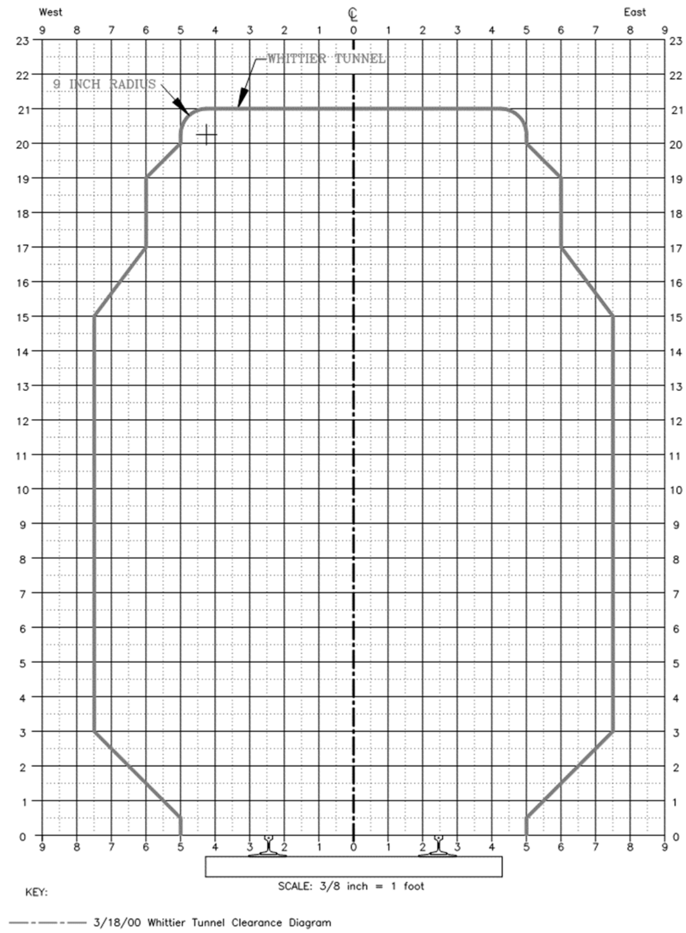
Wire rope hoist systems generally need to be combined with a counterweight system to operate large transfer bridges. These systems can operate the bridge using minimal power. The systems are relatively simple and robust, require less technical expertise to maintain and eliminate the need to manage hydraulic fluid over environmentally sensitive marine waters. On the negative side, these systems nearly double the system dead weight that the marine structures have to carry and require replacement of both the hoist and counterweight wire ropes approximately every 20 years.

As mentioned above, both types of systems can be packed and hardened for this study in a way that mitigates the impact of both the marine corrosion environment and extreme winter environment at the site.

As both types of hoist arrangements have merit for this application, and both types can be readily hardened to withstand the unique site conditions, we will be looking at both approaches as part of this alternatives study.

8.3 Lane Configuration and Throughput

The alternatives to be investigated in the analysis consist of two-track, three-track, and four-track configurations. Some discussion will also be provided for larger numbers of tracks, but these will not be included as full alternatives for evaluation. Based on information provided by ARRC to KPFF, we understand that the maximum container width dimension that is desired for transfer over the barge and/or side ramp correspond to a 60-foot Conex container. This width will be assumed along with the current spacing between tracks. Outside tracks will accommodate the Whittier Tunnel clearance diagram shown below. Structural and mechanical members will be analyzed for the operational configuration that produces the maximum load demands to a given element under consideration.



9.0 ELECTRICAL DEMAND

It is assumed that electrical load demand may moderately increase in some scenarios. Cost estimates will not include costs for additional sub stations or transformers that may be required for new equipment. Such issues would need to be evaluated by an electrical engineer. However, the alternatives analysis will investigate the power requirements for the equipment needed in each alternative.

10.0 PHASING AND CONSTRUCTION SCHEDULE

10.1 Possible Ramp Locations and Phasing Considerations

The alternatives analysis will discuss two potential sub-alternatives related to each of the main alternatives discussed in Section 12 below.

One sub-alternative will be to construct the new ramp in a completely new location to the south of the existing ramp location. This sub-alternative would leave the existing ramp in place during construction. The existing ramp could then be removed/decommissioned after the new ramp comes online. The exact location of the new ramp will need to be coordinated with the overall design team, as its positioning is mostly related to upland considerations.

The second sub-alternative will be to construct foundations and a modified hoist mechanism in a location to the south of the existing ramp, and then move the existing ramp structure to that location. This modified ramp would then be utilized as a temporary ramp while the new ramp is constructed in the footprint of the existing structure. The modified ramp could then be decommissioned or rehabilitated as a secondary ramp for ARRC's purposes in the future. There will be some down time associated with the movement of the ramp, such that the Whittier Terminal would be without a barge ramp for a period. The alternatives analysis will investigate the potential duration of this shut down.

10.2 Construction Seasons Assumptions and Maintaining Operations

It will be assumed that substantial concrete work cannot be easily achieved in the winter months. However, many construction activities are possible in the winter, which will be considered when evaluating timelines for the various alternatives. KPFF will provide some discussion of these timelines in the alternatives analysis document.

10.3 Typical Vessel Schedules

KPFF currently has no hard data on typical vessel schedules. However, this information will be something to consider when evaluating the second sub alternative described above. For now, based on discussions with ARRC, it is assumed that there are typically 2 to 3 regular vessel calls weekly, but these calls can be impacted by weather.

11.0 ANALYSIS APPROACH AND ASSUMPTIONS

A brief description of the limits of the alternatives analysis that will be performed and things to consider in final design are described below.

11.1 Assumed Material Properties

Concrete:

The following concrete strengths will be used unless otherwise noted:
Class A: f'_c = 5,000 psi; miscellaneous cast-in-place concrete (mostly for abutments).

Reinforcement:

All reinforcement shall conform to ASTM A615 or A706 Grade 60, fy = 60 ksi except where noted otherwise.

Structural Steel and Anchor Bolts:

- Rolled Shapes: ASTM A992, f_y = 50 ksi unless otherwise noted
- Plate: ATSM A36, f_y = 36 ksi
- Square and Rectangular Tube: ASTM A500 Grade B, f_y = 46ksi
- Anchor Bolts: ASTM A307, f_u = 60 ksi unless otherwise noted
- High Strength Bolts: ASTM A325, f_u = 105/120 ksi

11.2 Preliminary Structural Analysis Assumptions and Procedures

Preliminary structural analysis for each alternative will include preliminary simplified analytical models generated in SAP2000 to determine basic load demands to the primary members. Gross member dimensions will be determined from the governing demands of all load combinations and loading configurations in order to determine a feasible framing concept for each alternative to allow for comparative cost estimates to be produced. Foundation elements will be sized utilizing assumed geotechnical capacities and/or geotechnical information from adjacent projects as available. Based on input from AARC, it is assumed bolted connections will be utilized as much as possible for ease of future maintenance – detailing of miscellaneous connections will be performed during final design, but KPFF will consider conceptually where bolted connections are feasible.

11.3 Preliminary Mechanical Analysis Assumptions and Procedures

Transfer Bridge Hoist Machinery will be sized for each alternative based on a combination of simplified 3D Kinematic Models and Hand Calculations based on Engineering First Principles. Analysis will focus on establishing overall component sizes and power requirements for each alternative to a level of detail appropriate to estimate the ROM relative cost.

12.0 ALTERNATIVES TO BE EVALUATED

Three main alternatives have been identified for investigation in the alternatives analysis. The alternatives have been selected to reflect a range in both capacity and overall estimated construction costs. In each alternative the barge ramp structure will consist of built-up steel plate girders and miscellaneous rolled steel member bracing and decking with bolted connections where possible. Any dredging required to accommodate future vessels at low tide will be coordinated with other members of the project team. These alternatives have been selected as they will effectively bound the relative cost. The following alternatives will be evaluated:

- Two-track through girder
- Three-track through girder
- Four-track through girder

Sub alternatives to each of these main alternatives will be evaluated based on the selected lift system, either a cable lift system or a hydraulic lift system.

A discussion will be included related to utilizing the existing span as a temporary span, other potential lift systems, and the potential cost implications of providing additional tracks to the alternatives.

G.3. Alaska Railroad Whittier Terminal Waterfront Reconstruction – Alternatives Study

WORKING DRAFT

ALASKA RAILROAD
WHITTIER TERMINAL WATERFRONT RECONSTRUCTION

Alternatives Study

May 13, 2021

Prepared with support from

PND Engineers

R&M

KPFF

Updated xxxx

Table of Contents

List of Tables and Figures

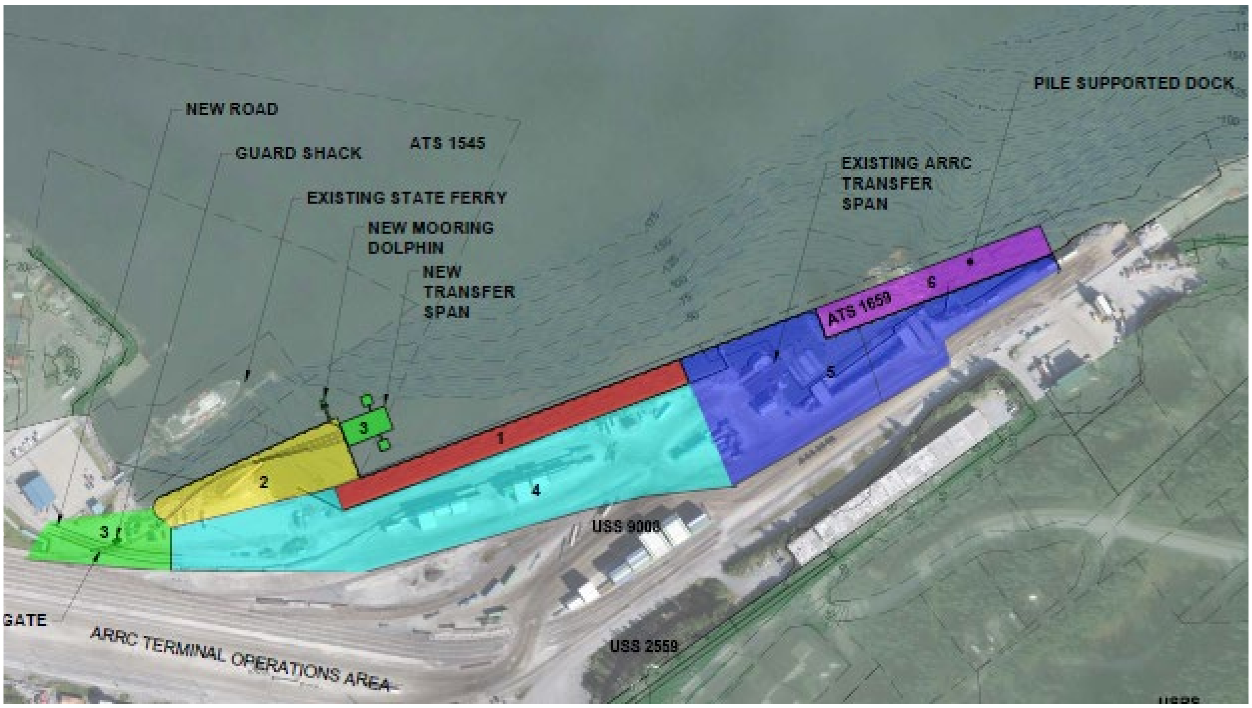
Appendices

Appendix A Alternatives Plans
Appendix B Cost Estimates
Appendix C Transfer Span Type Selection Report
Appendix D Geotechnial Report
Appendix E Inspection Report (Photos)
Lettters of Support (Draft go by letter)

1 Executive Summary

The Study examined alternatives for the reconstruction of the Alaska Railroad Corporation's "ARRC" Whittier Terminal marine facilities. Alternatives were developed with considerations for current needs, future expansion, and the potential for financing.

The recommended Alternative 7 will allow for a phased development………



2 Project Overview

2.1 Purpose of the Study

The purpose of the Alaska Railroad Whittier Terminal Waterfront Reconstruction Alternatives Study is to explore options to replace the marine terminal's deteriorating docks and barge slip with new berthing infrastructure. The Study addresses continuing the functionality of the aging facilities, improving operations, reducing maintenance requirements, providing for future development, and optimizing the cost/benefit of the restoration project.

2.2 Project Location

The Alaska Railroad's Whittier Terminal is located in an ice-free fjord at the head of Passage Canal, at east end of developed Whittier waterfront. The railroad terminal and marine facilities were originally constructed by the U.S. Army during World War II. Since then, the waterfront has developed servicing rail, freight, commercial/fisheries, marine passengers and public boating needs.

Figure 1- ARRC Whittier Terminal

3 Existing Conditions

3.1 Waterfront Facilities

The Railroad Terminal's Waterfront includes: the sheet-pile wall "bulkhead" retaining the primary roadway; the "Barge Slip" consisting of the rail-ferry unloading dock "transfer span", two "pass-pass" docks, a loading ramp and associated mooring and berthing facilities; the barge "ITB" ramp; the DeLong Dock which was transferred to the City of Whittier; and the Smitty's Cove ramp which is leased by the City of Whittier. In addition to the functional waterfront structures, remains of the old Marginal Wharf exist on the west end of the waterfront

Figure 2 - Waterfront Structures

The Marginal Wharf berth was originally constructed by the U.S. Army Corps of Engineers in 1958, and restored after the 1964 earthquake. The concrete marginal wharf, transfer span, and associated facilities were demolished in 2005. The berth consisted of a concrete wharf 60’x1100’ deck on a steel piling, and a transfer span operated from tower supported on breasting dolphins. Piling was removed to mudline.

The remaining structures include the bulkhead seawall, and portions of the transfer span docks, and west abutment. The bulkhead is failing and requires replacement in the near future.

Figure 3 - Marginal Wharf Bulkhead Wall

The Barge Slip was constructed in 1970 with a 120 ft 3-track transfer span and circular cell berthing dolphins. The transfer span was originally was elevated from towers structures. In 2003, a side-loading facility was constructed, additional fill placed, two 34-foot wide dock “pass-pass” structures installed long the side of the barge slip, and the lifting system converted to hydraulics. A side ramp was later added for more efficient side loading.

Most of the original elements of the barge slip berth are past their service life and require significant rehabilitation or replacement in the next few years. Extensive deterioration has been documented on the steel sheet piling and timber elements.

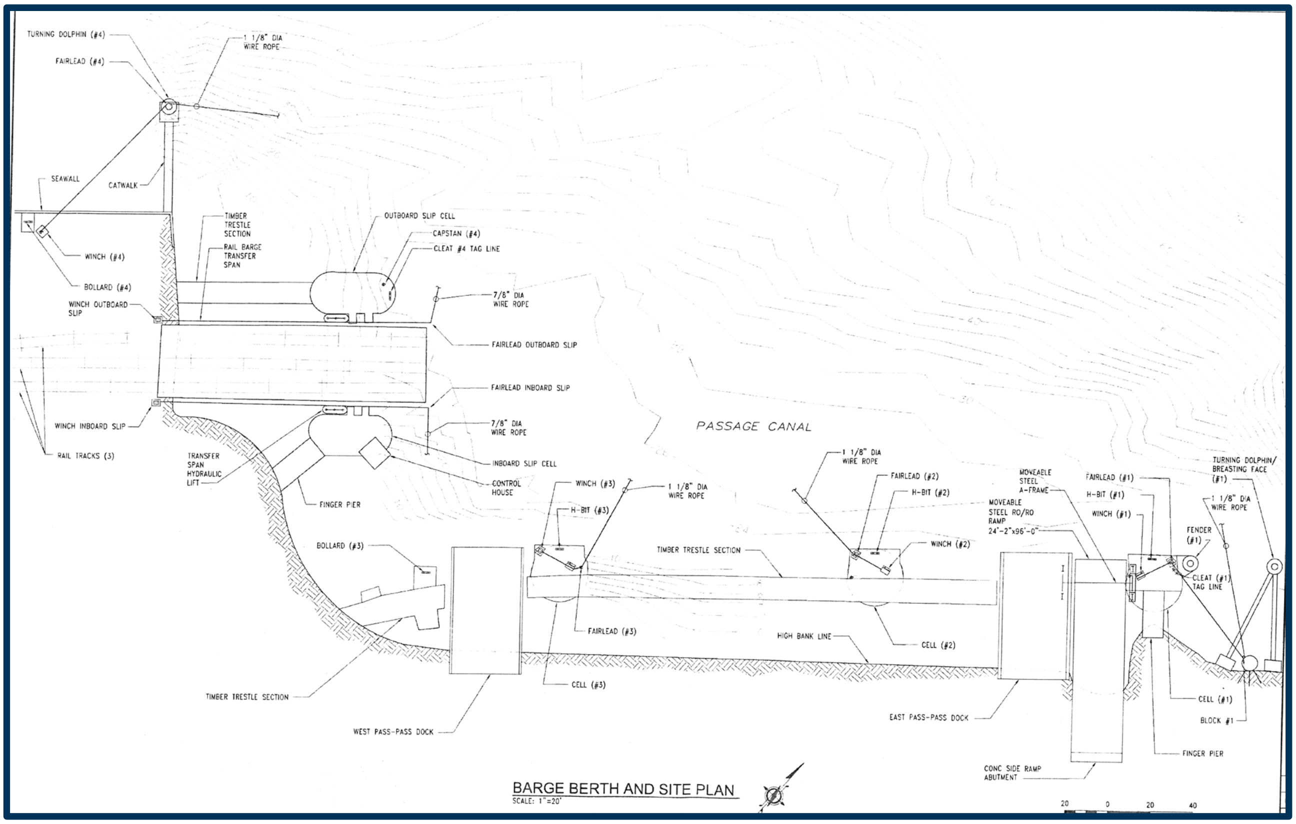


Figure 4 - Barge Berth Site Plan

In 2019-2020, electrical, structural, and mechanical repairs were completed on the barge transfer span and mooring facilities to extend the life of the facility 5-10 years. Additional repairs are anticipated on the side docks and facilities to maintain safe operations.

At the far eastern end of the Terminal waterfront is the integrated tug-barge “ITB” ramp. Barge cargo is rolled on/off the ITB into the terminal.

Figure 5 - Sheet piling highly corroded and damaged

The DeLong Dock consists of two steel barges supported by steel caissons. It was constructed in 1953 by the US Army Corps of Engineers and is beyond the typical service life of this type of facility. The dock was originally part of the Railroad Terminal, but the dock and associated property rights were sold to the City of Whittier in 2018.

Adjacent to the DeLong dock is Smitty's Cove which is leased to the City. The City maintains and operates the uplands and a deteriorating launch ramp into Smitty's Cove.

3.2 Terminal Operations

Alaska Marine Lines “”AML” (Lynden) is the primary operator of Whittier marine Terminal, with ARRC operating the rail car operations. Marine vessels which call on the terminal are almost exclusively AML operated or in partnership with AML. The Canadian National ferried trains from Prince Rupert until spring 2021.

Currently AML's rail-ferry barges sail from Seattle WA. These bare are 420'x100'x24' (draft) with eight tracks and 48-car capacity. They are equipped with cargo racks which are loaded over the train tracks. The barges need to be slewed to three locations at the Whittier barge slip to unload the eight tracks.

AML typically load cargo off the side of the barges via a ramp. Occasionally the docks are also used for load transfers. The integrated tug-barge “ITB” ramp is operated exclusively and maintained by AML.

3.3 Uplands Track and Cargo

The Whittier Railroad Terminal has a single main track, a series of yard tracks, and associates yard service tracks.

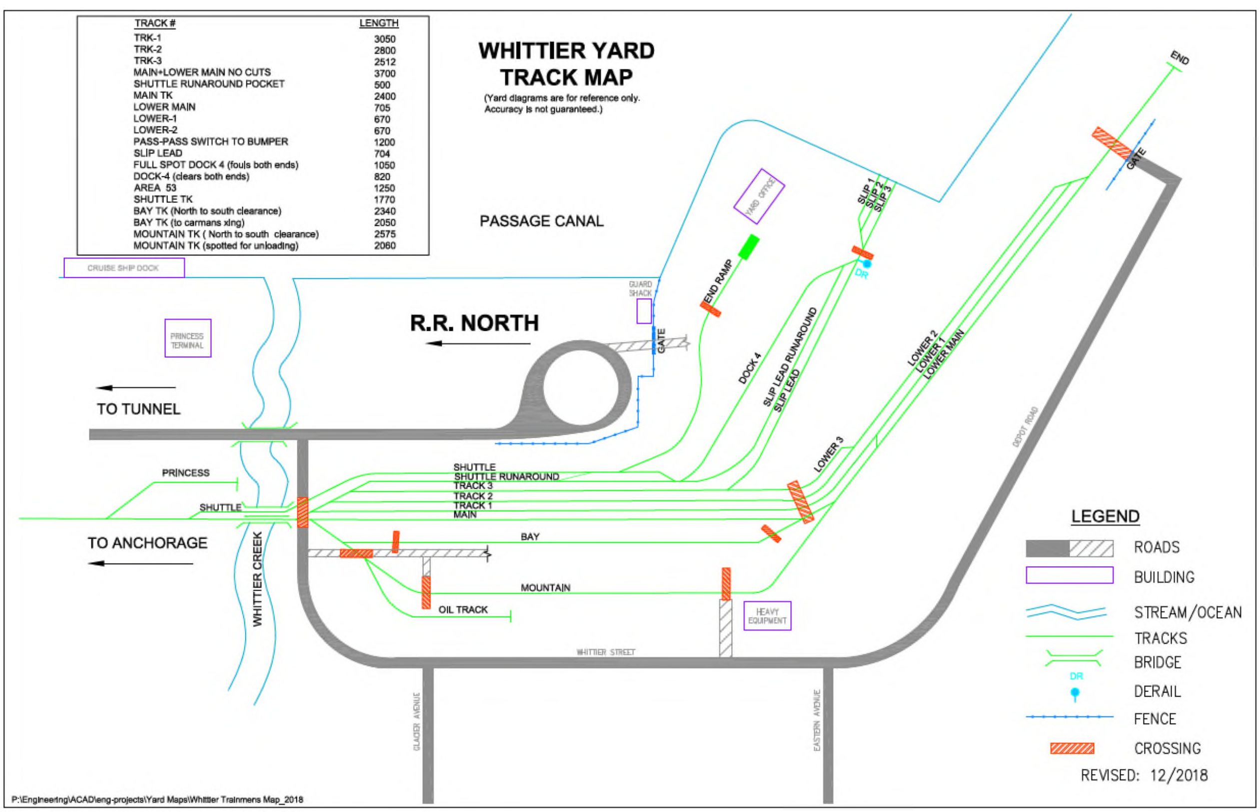


Figure 6 – Whittier Terminal Track Map

The track lengths and layouts limit arrangement and movements, and segment the uplands for freight storage and operations. Ideally, the tracks would be extended and realigned to created longer trains and more efficient switching, and additional uplands would be developed for cargo.

3.4 Climate

Whittier is located at the northern end of the world's northernmost temperate rainforest, the Tongass, and is one of the wettest cities in the United States, receiving an annual precipitation of approximately 200 inches, and is often in a form other than rain. Temperatures generally range from 23 to 31 degrees Fahrenheit in the winter and 51 to 61 in the summer months. Whittier often experiences high winds with speeds of 50+ miles per hour. The terminal is somewhat shielded from long fetch waves with maximum waves approximately 2.5m.

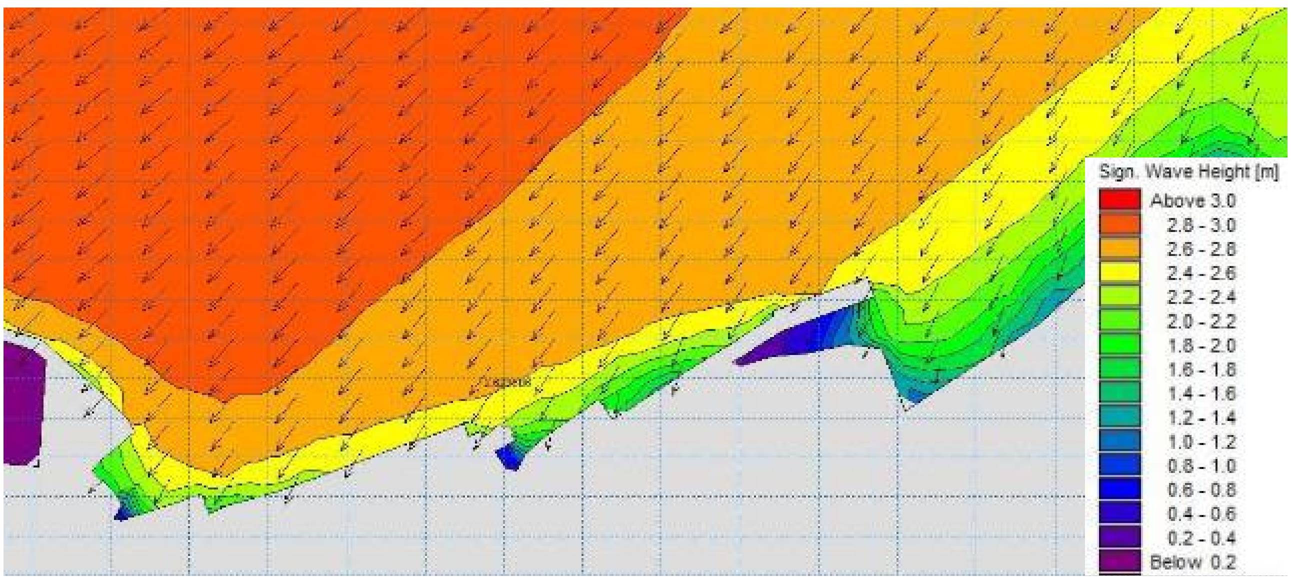


Figure 7 – Potential Significant Wave Heights

3.5 Geology and Geotechnical Considerations

ARRC contracted with R&M Consultants to preform geotechnical investigation to support the planning and design of future improvements at Whittier Terminal Waterfront. The following excerpt summaries the general findings:

The landside of the project site is interpreted to consist of relatively thick, coarse-grained fill embankments placed over tideland and seabed. The fill material primarily consists of sand and gravel with silt containing occasional to frequent cobbles and occasional boulders. Various debris was observed or interpreted sporadically occurring within the fill across the site, including concrete, wood, and iron materials. Marine deposits, primarily consisting of fine-grained soils, were interpreted both underlying the fill and interbedded within alluvial deposits within the central western portion of the site. Alluvial deposits, primarily consisting of sand and gravel and containing occasional *cobbles and possible boulders, were interpreted underlying the fill across the western portion of the project site. This unit extended from the base of the fill to depths of over 100 feet at the far western portion of the project, thinning and becoming more intermixed with marine deposits to the east.*

Bedrock is deep (>100 feet) under the western portion of the site, and may occur at shallow depths (<20 to 50 feet) on the eastern portion of the site. The depth of bedrock underlying the eastern portion of the site appears to be highly erratic. Observed bedrock consisted of high quality graywacke. Thin to thick (0 to 20+ feet) deposits of very coarse-grained soils including frequent cobbles and boulders were observed overlying the bedrock.

Geologic hazards at this site include earthquake induced ground shaking, liquefaction, dynamic settlement of fill materials and soils, lateral spreading, and tsunamis; and erosive wave and tidal action, landslide induced tsunamis, seawater inundation, and mass slope wasting. The existing fill material embankment and underlying soil deposits along the majority of the ARRC Whittier Yard waterfront landside are both of good quality and favorable for installation of piles and embankment stability, if properly retained. However, pile installation may be challenging within the eastern portion of the project site due to shallow bedrock and frequent boulders. (Ref 2)

4 Environmental Screening

4.1 Location Considerations

The environmental setting of Whittier has been summarized in several documents including the Whittier Comprehensive Plan (2020), Whittier Coastal Management Plan (2007 Plan Amendment), and the Prince William Sound Area Plan (as amended in 2007). The 2020 Whittier Comprehensive Plan describes the environmental setting as follows:

The City of Whittier is located near the head of Passage Canal, a fjord in western Prince William Sound. Of the 17 square miles within Whittier city limits, 20% is covered by glacier and much of the remaining land has grades in excess of 33%, making developable land relatively scarce. Due to its location at the junction between the Chugach and Kenai Ranges, Whittier is subject to high winds and frequent cloud cover. Temperatures are moderated by coastal processes, but winter snowfall is significant.

Forests in the area are typically dominated by Sitka spruce with western hemlock and are populated by bald eagles, black bears, occasional wolves, coyotes, ptarmigan, and small mammals typical to most similar settings in Alaska. Mountain goats are common above forested elevations. In 2012, European black slugs, which have been invasive in other parts of Prince William Sound, were reported by the U.S. Forest Service (USFS) in Whittier.

Prince William Sound is home to important fisheries for rockfish, flounder, halibut, and all five Pacific salmon species, as well as crab, shrimp, and clams. These fisheries are important to local residents as well as the tourist industry. The Sound is also home to whales, porpoises, sea lions, and sea otters at various seasons. Passage Canal and Portage Pass are also important corridors for bird migration, and some waterfowl remain in Whittier year-round. A large sea bird rookery on the north side of Passage canal is a popular destination for tour boats and recreational boaters.

4.2 Whittier Comprehensive Plan

Proposed alternatives for this project are consistent with goals in the 2020 Comprehensive Plan's Focus Area 3: Harbor District, Focus Area 4: Head of the Bay, and Focus Area 5: Business Development. The project will improve access and quality of existing amenities, expand waterfront services, and improve safety features. Maintenance or expansion of the rail yard facilities supports other industry and future business development in the community. According to the 2020 Plan, the Railroad owns 70% of Whittier's total waterfront area, making it a significant driver in meeting these goals.

4.3 Prince William Sound Area Plan

The proposed reconstruction alternatives are consistent with the 2007 Prince William Sound Area Plan, which predicts expansion of the developed portion of the City along the southern coast of Passage Canal. Improvement and maintenance of railroad facilities is consistent with the designated "shoreline development" use of tidelands in the "Head of Passage Canal" unit. Area Plan guidelines for shoreline development include:

- Siting of nearshore infrastructure will be planned to the extent feasible to "minimize impacts on longshore transport, circulation, and mixing" and to "optimize flushing to avoid concentration of pollutants".
- Siting of nearshore infrastructure will account for "upland demands, such as parking, support facilities, and increased traffic flow".
- To the extent feasible and prudent, pilings preferred over fill. Bulkheads will be utilized to prevent erosion or to reduce fill footprints and will be designed so as to minimize erosion and protect water quality.
- Development will "maintain tideland and streambank access and protect adjacent fish habitat, public water supplies, and public recreation".
- Bonding may be required for tideland facilities in the event of abandonment or improper clean-up.

4.4 Whittier Coastal Management Plan

Although Alaska no longer participates in the National Coastal Management Program, Whittier has a Coastal Management Plan (CMP) that was updated in 2007. The plan emphasizes the need to prioritize water-dependent activities in the coastal areas due to limited developable waterfront. Plan goals emphasize balanced development of industrial, commercial, and recreational infrastructure in the waterfront district while maintaining environmental quality and coastal habitat. Objectives include:

- Efficient utilization of waterfront areas and cooperative usage;
- Protection of natural circulation patterns, water quality, and natural resources;
- Maintenance of safe navigation;
- Support of public access; and
- Innovative development.

The plan also recommends limiting fill placement to projects with no practicable alternatives to fill placement and to the minimum amount of material feasible.

The City of Whittier coastal district and Passage Canal are identified as at risk from earthquakes, high winds, avalanches, and landslides. The port was extensively damaged during the 1964 earthquake and the City experiences occasional avalanches during typical winters. In order to minimize risks to the project from natural hazards, the plan recommends:

- Development designed and constructed to minimize seismic, flood, snow, and wind damage and
- Response planning for seismic and tsunami events.

5 Approvals and Permits

5.1 Federal Approvals

5.1.1 NEPA

Assessment of project potential impacts and possible mitigation for the environmental consequences identified in the studies is mandated under the National Environmental Policy Act (NEPA) of 1970 for all Federal actions, including funding or permitting of the actions of other non-Federal agencies.

Based on past consultation and experience, the Railroad anticipates the lead agency of the NEPA process to be the United States Maritime Administration (MARAD). With MARAD's assistance, the project team will consult with the U.S. Army Corps of Engineers (USACE), U.S. Fish & Wildlife Service (USFWS), National Marine Fisheries

Service (NMFS), U.S. Coast Guard (USCG), and Federal Emergency Management Agency (FEMA).

The Railroad anticipates that an Environmental Assessment (EA) will determine the proper level of environmental documentation and has conservatively allocated 24 months for the entire NEPA and permitting processes, consistent with other projects the Railroad has completed in recent years. The Railroad has completed environmental assessments for projects in Nenana, Port MacKenzie, North Pole, and South Wasilla, among others, which were all completed within 17 to 24 months.

5.1.2 Protected Species Requirements

Endangered Species Act (ESA) Section 7 and Marine Mammal Protection Act (MMPA) consultation with USFWS and NMFS may require an Incidental Harassment Authorization (IHA) for incidental take of protected species resulting from permitted project activities. IHA processing may take 9 to 18 months, on average, and will likely require the implementation of a comprehensive protected species observer program during construction. Should the project be developed without the need for an IHA, informal Section 7 consultation can be anticipated to require 3 to 9 months, on an average. Preparation of request for consultation in either permitting process will require the preparation of a Biological Assessment (BA).

Potential impacts of the project to fisheries or Essential Fish Habitat (EFH) protected by a Fisheries Management Plan (FMP) under the Magnuson–Stevens Fishery Conservation and Management Act (MSA) will need to be assessed by the lead agency or its designee. EFH assessments may be incorporated into the project’s BA.

5.1.3 USACE Requirements

U.S. Army Corps of Engineers (USACE), Alaska District Regulatory Division approval will be required for issuance of a Department of the Army Permit (DAP). Regulatory jurisdiction for this permit is established under Section 10 of the Rivers and Harbors Act (RHA) of 1899 for the project’s structural improvements that impact a navigable waterway and under Section 404 of the Federal Water Pollution Control Act (CWA) as amended (1972) for dredge and fill in waters of the United States.

USACE review of a DAP application will require coordination with other Federal permitting timelines and issuance of the permit may not occur until the completion of any USFWS and NMFS protected species consultations and permitting.

5.1.4 USCG Requirements

Approval may be required from the USCG for the addition navigational devices to review compliance and facilitate the appropriate charting of nautical features.

5.2 State and Local Approvals

The relevant state agency is the Alaska Department of Natural Resources (ADNR) and the 2017 Master Plan indicates that no permits will be required. The Railroad will consult with this agency as part of the NEPA process.

5.2.1 ADEC Requirements

Issuance of a Section 404 CWA permit by USACE would necessitate the completion of a Section 401 review and certification. Additional water quality information may be requested by the State of Alaska Department of Environmental Conservation (ADEC) Division of Water to complete the Antidegradation review, but processing will typically mirror the USACE process and be completed slightly in advance of the DAP issuance.

In addition to the ADEC Antidegradation review, construction of water or wastewater facilities, fuel storage, or other potential environmental or health hazardous activities may require coordination with the appropriate divisions of the ADEC.

5.2.2 ADNR Requirements

Generally speaking, tidelands within State waters are owned by the State (unless otherwise assigned or leased) and require permission from the Alaska Department of Natural Resources (ADNR) for all but exempted types of development. If a project alternative is selected that requires expansion or relocation beyond existing tideland leases, additional coordination with the ADNR Division of Mining, Land, and Water would be required.

5.2.3 Local requirements

The project will fall within the City of Whittier and building or zoning permits may be required, as well as coordination with the City's Port & Harbor Commission.

6 Planning Considerations

6.1 Marine Terminal Requirements

The planning criteria was separated into three categories: elements which must, should and could be integrated into the design, should be considered, and could be incorporated if the cost-benefit analysis justifies the component.

"Must" – Elements which need to be part of the design and are not subject to scrutiny

- Provide for existing barges and barge traffic
- No interruption in barge or cargo transport
- Address the failing marginal wharf bulkhead.
- Be "permitable" in regards to land use rights and environmental considerations

“Should” be incorporated as best possible be considered and integrated

- Maintain or improve the current operational efficiency
- Provide for future expansion of cargo
- Provide for larger and varied vessels
- Avoid impacts to the City’s DeLong dock
- Provide for a fair return on investment over the life of the facility.
- Be phased to allow for anticipated funding

“Could” be incorporated if the cost-benefit analysis justifies.

- Improve cargo and rail operations
- Improvements to the yard/
- More uplands,
- track reconfiguration,
- Include provisions for future development of future alternative shipping such as cruise ships or material handling.
- Include property “swaps”
- Utilize property and material outside of the Terminal

6.2 Considerations - Merit Criteria

- Operations
- Constructability
- Staging
- Business/ Financial justification
- Cost
- Maintenance

6.3 Cost-effectiveness analysis

Cost-effectiveness analysis (CEA) is used rather than cost benefit analysis as the availability of funds and provisions for future development are difficult to assign monetary value.

The elements being considered are broken down into four primary categories:

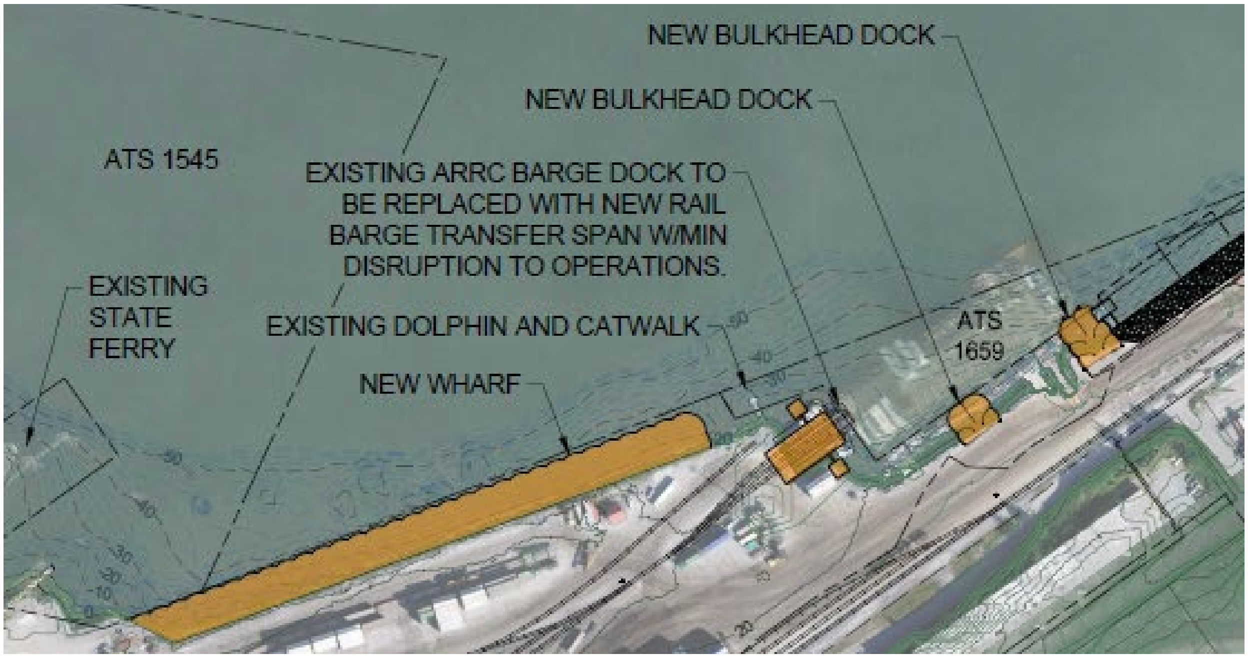
- Cost vs Finance-ability
- Operational Effectiveness and Future Business/Development Opportunities

7 Alternatives Considered

7.0 Alternative 0 – No Build

The original elements of the transfer span will require significant investment to maintain including potential reconstruction of some of the cell structures. No build on the Bulkhead Sea-wall could result in failure and loss of uplands facilities included the access road.

7.1 Alternative 1 – Reconstruct in existing location – during operations.



The final configuration has the new marginal wharf and barge rail slip constructed in the same location as the prior/existing facilities.

A new 60' marginal wharf will replace the demolished wharf in the same footprint. A new barge slip breasting dock would be constructed in alignment of the existing breasting face Lay-out-Line. A new transfer span would be construction in a close location to the existing transfer span. The existing transfer span will be kept operational while the towers for the transfer span are constructed inboard of the existing cells. Unless temporary relocation of service is provided elsewhere, a temporary loss of service will be required while the transfer span is installed and new side docks and ramps are put into service.

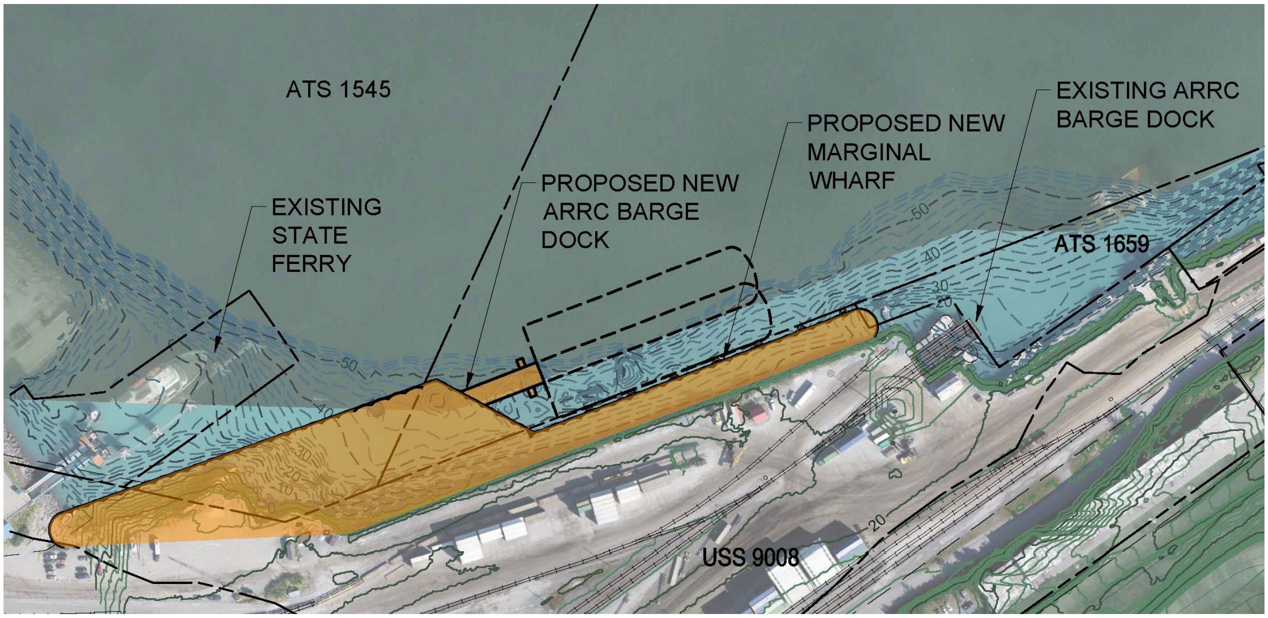
The track will be reconfigured to unload the slip tracks onto the Dock track. The marginal wharf and slip replacement can be constructed in two phases.

Construction is:

1. Marginal Wharf
2. Side Dock structures around the existing
3. Transfer Span towers and utilities
4. Install Transfer Span, Side Dock mooring/berthing devices, and track during temporary outage.

Estimated Cost: $XXM

7.2 Alternative 2 – Relocate transfer span to West end of terminal



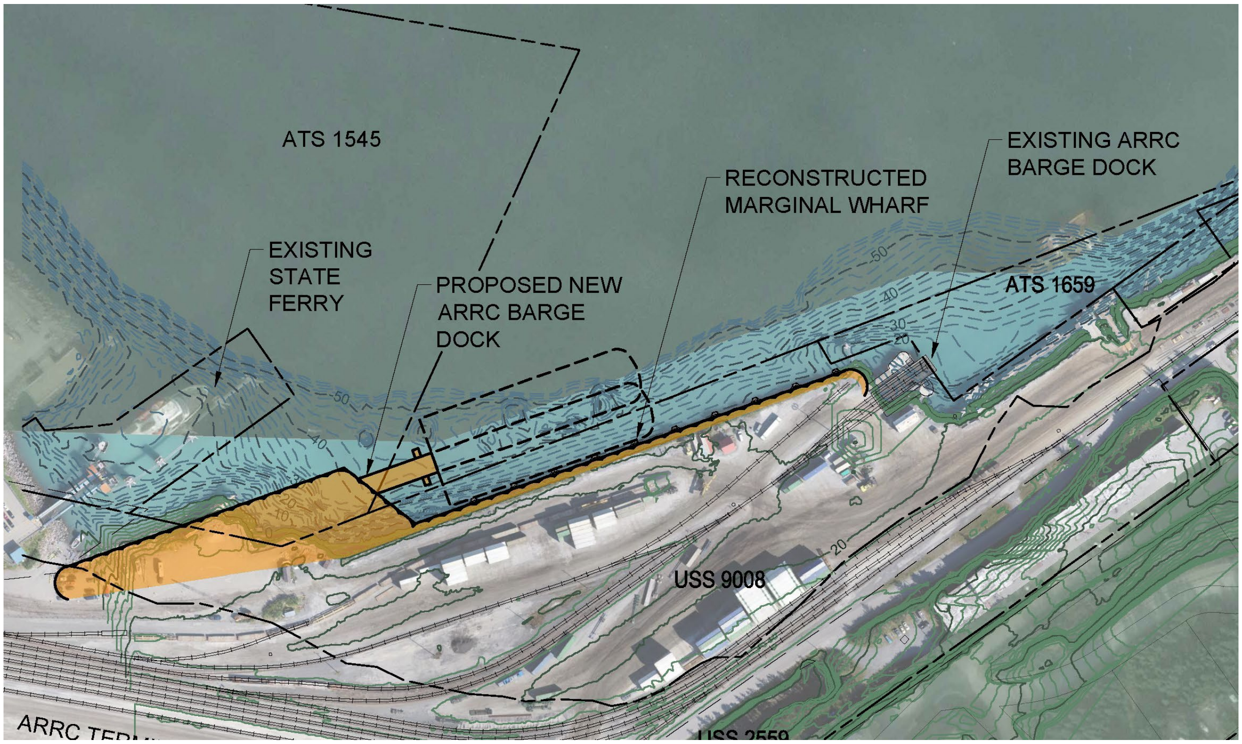
This alternative is similar to the Alternative in the 2020 Port of Whittier Freight Study (PND). A new approach fill will take advantage of more working yard and moderate track configuration. It will allow for future development on the east end of the waterfront. Additional Tidelands lease would be needed

Construction is:

1. New Abutment and transfer span facilities outside of tidelands lease
2. New wall and fill similar footprint to the old marginal wharf
3. New Transfer span
4. Permanent track
5. Uplands

Estimated Cost: $95M

7.3 Alternative 3 – Relocate existing transfer span bridge



The relocated and refurbished existing bridge would be used for operations until funding is available to replace the bridge or reconstruct a new transfer span east of this location. Construction will include a new abutment, approach fill, relocation of the hydraulic rams, a new bulkhead in front of existing wall, and dredging.

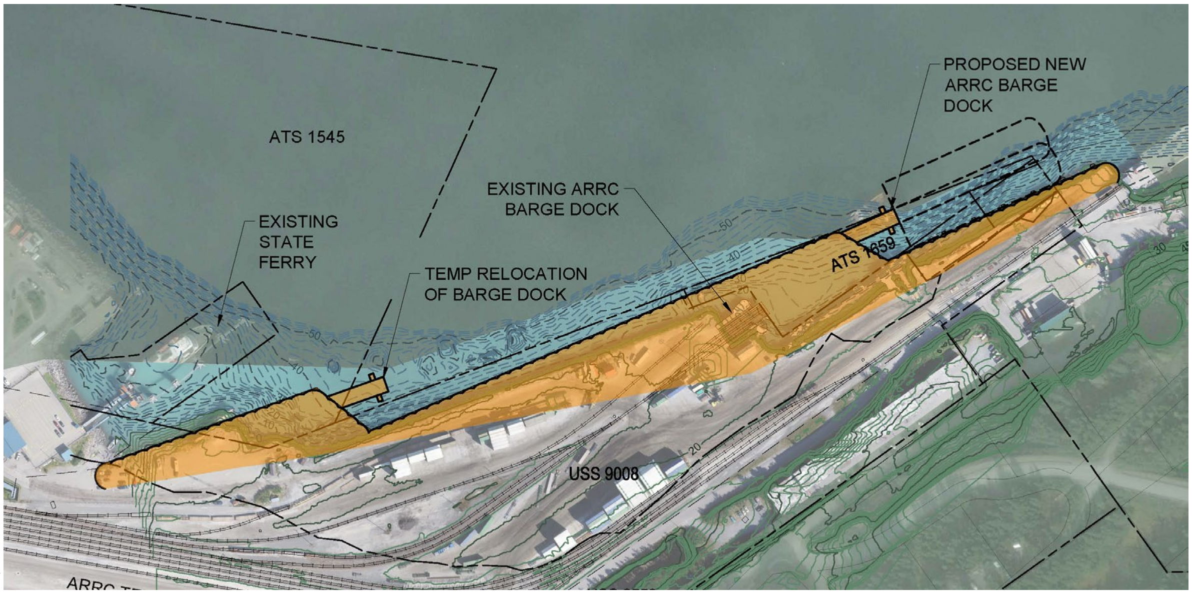
Inside tidelands

Construction is:

1. Abutment inside of tidelands lease
2. Transfer span support outside of tidelands lease
3. New wall off in front of existing sea wall
4. Permanent track
5. Uplands

Estimated Cost: $66M

7.4 Alternative 4 – Relocate transfer span to East end of waterfront



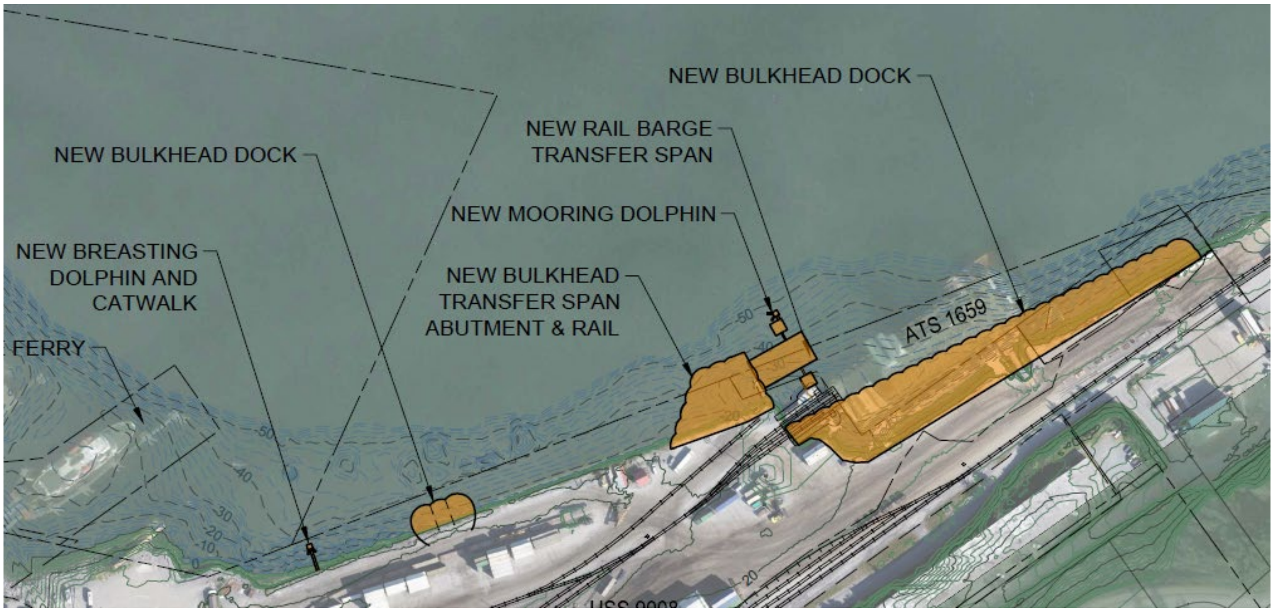
A temporary relocation of the transfer span, similar to Alternative 3, but the alignment of the new seawall is constructed for permanent facilities at the far-east end of the waterfront. The ITD ramp would be eliminated.

Construction is:

1. New wall aligned to maximize uplands in front of existing bulkhead
2. West Abutment inside of tidelands lease
3. Old transfer span support outside of tidelands lease
4. Temporary track
5. Extend wall
6. New Barge Slip on the east end of the yard

Estimated Cost: $106M

7.5 Alternative 5 – New Transfer Span Constructed North of existing



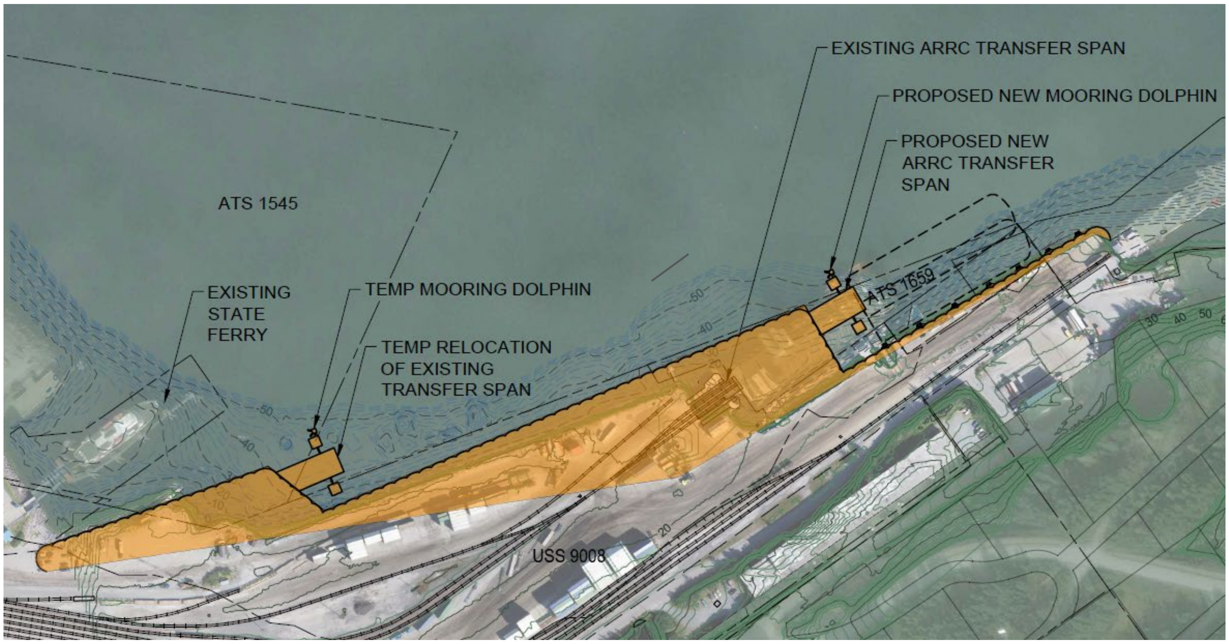
A New Barge Slip north of the existing transfer span, with a side dock and additional uplands. A new side unloading facility would be built for unloading during construction, but can be used after construction as an auxiliary dock. Some construction will be outside of the Tidelands Lease.

Construction is:

1. Side unloading dock and breasting dolphin on the west end of the former marginal wharf area.
2. New abutment north of the existing bridge abutment
3. New transfer span bridge support towers north of existing Barge Slip, and Install Bridge.
4. New track
5. Temporary stern unloading at new transfer span, side unload on west berth.
6. Demolish old barge slip and construct new fill and side dock

Estimated Cost: $59M

7.6 Alternative 6 – Extended Marginal Wharf



A temporary relocation of the transfer span, similar to Alternative 3, but the alignment and details of the new 20' fill dock and seawall is constructed for a future 40' marginal wharf structure in the same footprint as the old wharf. A future project will construct a new barge slip and transfer span generally in the same location as the existing barge slip

Construction is:

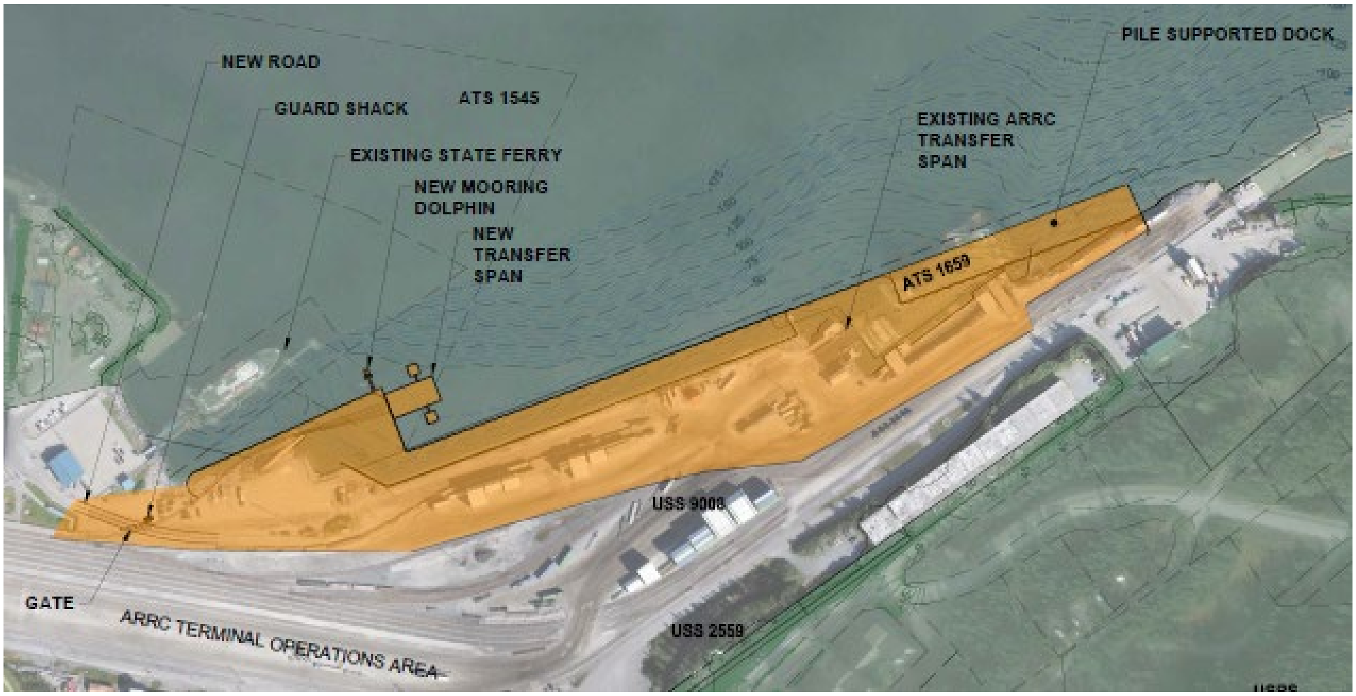
1. Construct new wall and fill (20'?) proud of existing bulkhead in the alignment of old dock.
2. Dredging
3. Construct New Abutment and fill in tidelands lease
4. Relocate existing transfer span
5. Construct temporary track
6. New Transfer span Barge Slip in existing location

   Future

7. New Barge Slip in approximate location as the existing
8. New marginal Wharf structure (40 ft. wide) in footprint of the old marginal wharf

Cost = $xxM

7.7 Alternative 7 – New Barge Slip on west end of waterfront



Similar to Alternative 3, with a new barge slip constructed on the west end of the waterfront. All fill in this alternative is inside tidelands lease. Full project development will include a marginal wharf along the extent of the waterfront. Work can be phased for partial construction is elements which provide benefit to the operations of the Terminal.

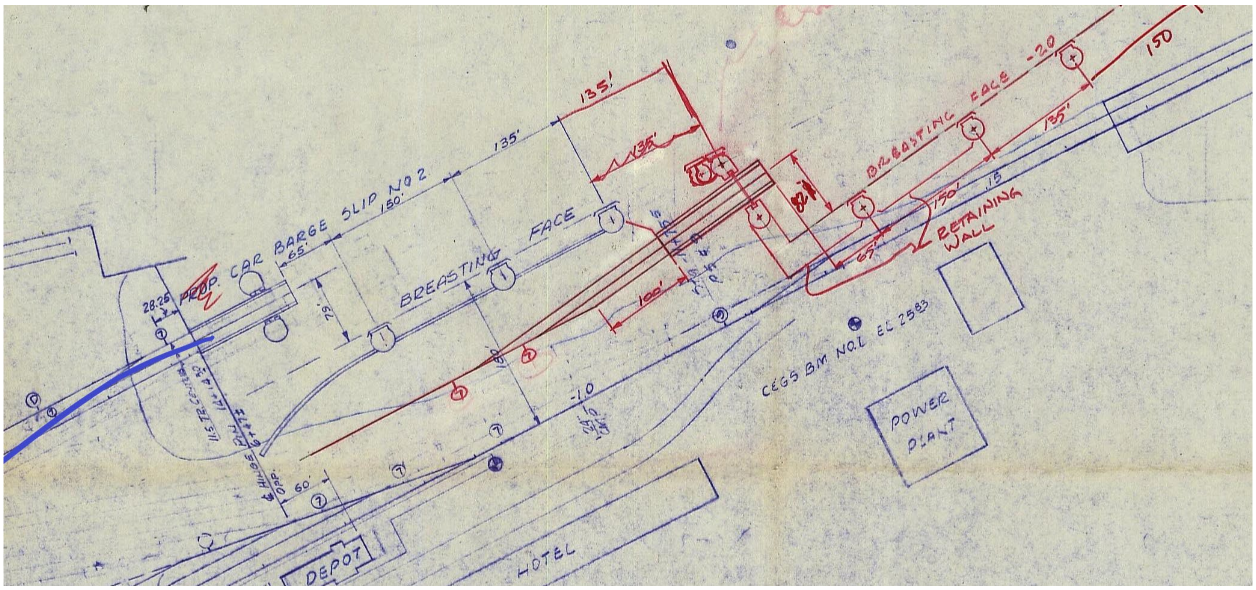
1. New 60 ft. side unloading marginal wharf
2. New Abutment and approach uplands
3. New Transfer span and facilities
4. Uplands and track
5. Construct remainder of the 60 ft. marginal wharf in foot print of the old wharf
6. Demolish old barge slip and extend marginal wharf

Conceptually this alternative could be incorporated into the City's reconstruction of Delong Dock, or into a land swap with Smitty's Cove development.

Estimate = $68M

7.8 Alternative 8 – New Barge Slip on east end of waterfront

NOTE: THIS ALTERNATIVE WAS NOT DEVELOPED AND MAY BE REMOVED



A new barge slip constructed on the east end of the waterfront.. Full project development will include a marginal wharf along the extent of the waterfront. Work can be phased for partial construction is elements which provide benefit to the operations of the Terminal. This would require a lease from the City and removal of the ITB Dock.

1. New 60 ft. side unloading marginal wharf
2. New Abutment and approach uplands
3. Remove some fill and realign unloading face
4. New Transfer span and facilities
5. Uplands and track

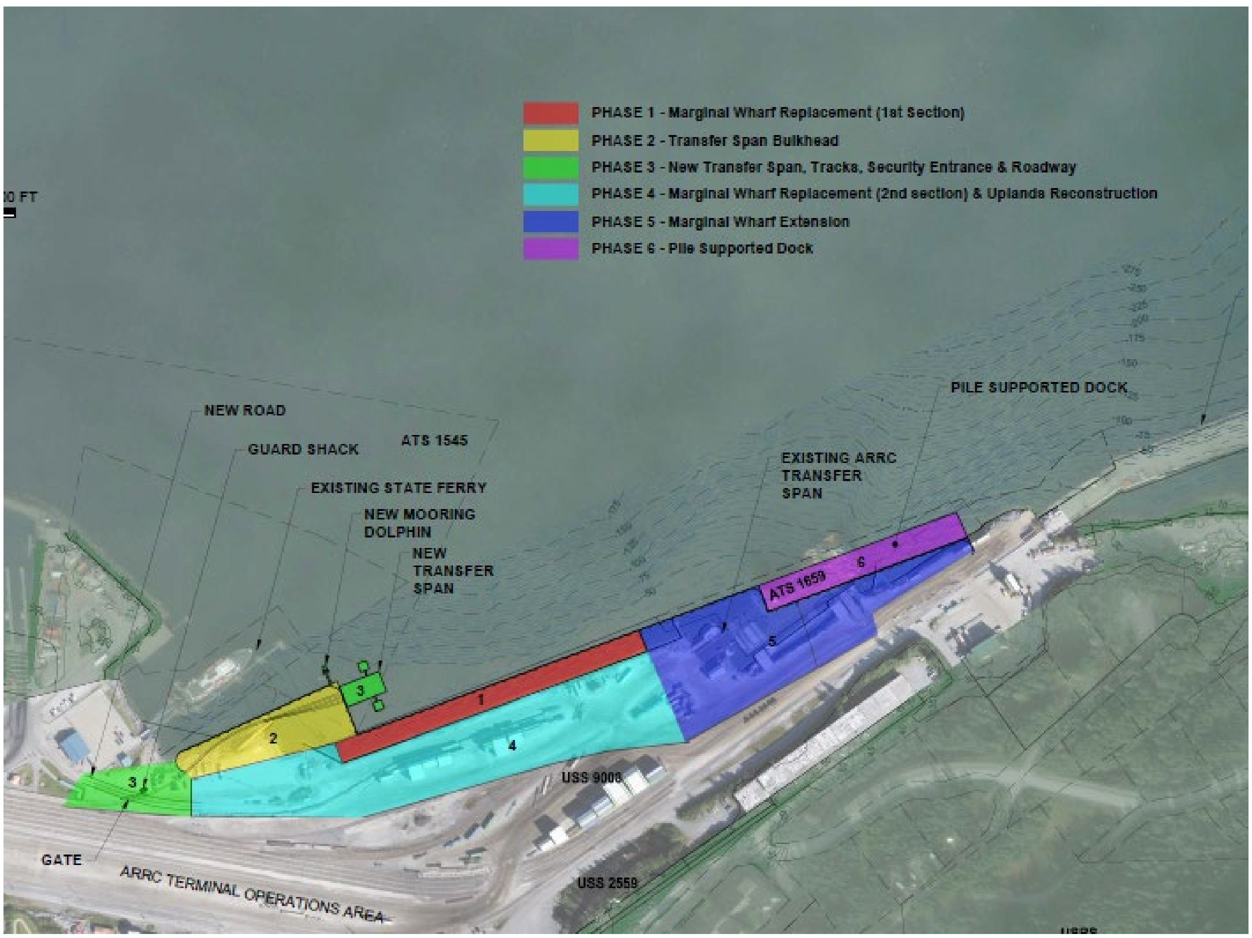
8 Recommended Alternative

8.1 Selected Alternative

Alternative 7, divided up into phases, is the preferred alternative. This Alternative provides minimal impact to existing operations, and the best opportunities for future cargo, vessels changes and new transportation commerce such as passengers. The full build out also provides additional uplands for increased operational efficiency.

Some less desirable elements of this alternative include:

- In the ultimate build out the, marginal wharf bulkhead is replaced; however, an interim risk of wall failure will need to be mitigated. Alternative might include a new waler beam along the face, or rock protection.
- In water dolphins and one tower support will require permits/tidelands leases.
- The Port entry approach road is substantially shorter.



Stages of Alternative 7

Initial Construction

1. New side unloading dock on west end of the Terminal. This can be a marginal wharf or partial facilities for loading and berthing.
2. New Abutment and approach uplands

3. New Transfer span and facilities
4. Uplands and track

Estimate = $xxM

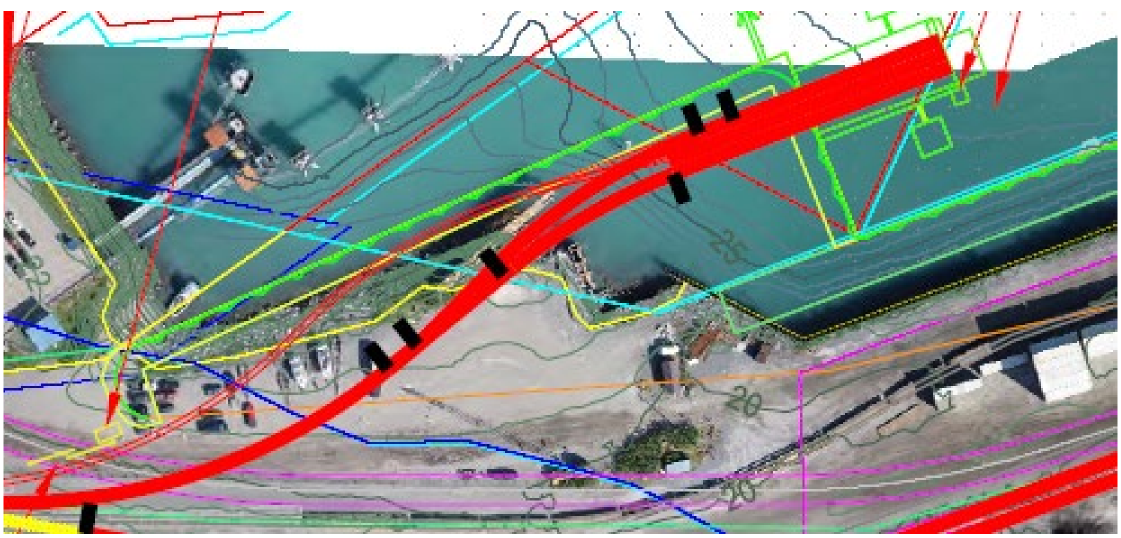
Future Construction

5. Construct remainder of the 60 ft. marginal wharf in foot print of the old wharf
6. Demolish old barge slip
7. Fill old barge slip and extend marginal wharf fill
8. Construct marginal wharf structure on the east end of the waterfront.
9. Relocate operations & Demo existing slip

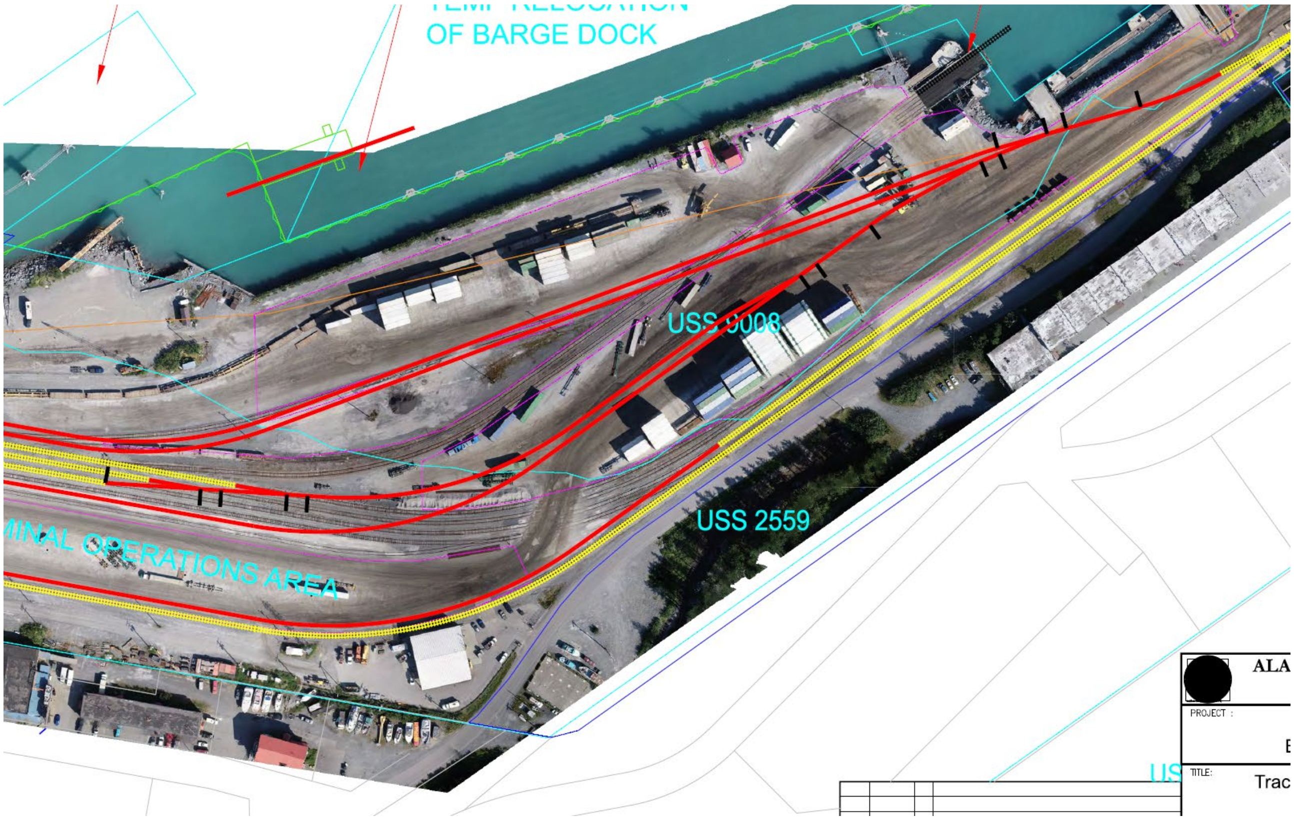
Estimate = $xxM

8.2 Track reconfiguration

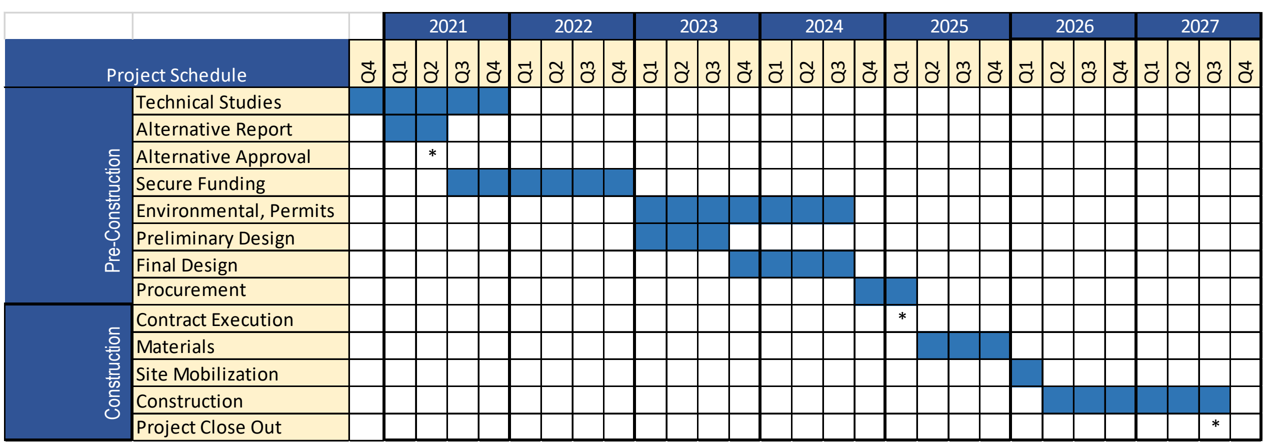
A minor track reconfiguration can be constructed to accommodate the slip tracks and avoid interferenace with the Whittier Pedestrian tunnel. The trackwork for Phase 1 would include termination of the north Shuttle Track, adding a turnout for the new lead slip track, and reconfigurations of the ramp track connection.



Track reailgnments to improve overal Port operations can be made in the ultimate layout…….



8.3 Project Schedule



9 Reference Documents

1. “The Port of Whittier Freight Study”, PND Engineers Inc. / DOWL. 2020
2. “Geotechnical Data Report Whittier Waterfront Improvements Landside (Onshore) Investigation Whittier, Alaska” (Draft). R&M Consultants, Inc. February 2021
3. “ARRC Whittier Terminal Reconstruction DRAFT Barge Ramp Alternatives Analysis”. KPFF Consulting Engineers. April 2021
4. City of Whittier “Whitter Comprehensive Plan 2020”, Catalyst Consulting. 2020.
5. “ARRC Whittier Master Plan”, ARRC. 2006
6. “Whittier Alaska Barge Ramp Mooring Capacity Report & Recommendations”, Harbor Consulting Engineers, Inc. 2015
7. AML Barge Loading Facility. PND Engineers Inc. 2005
8. https://www.usclimatedata.com/
9. also eco study

Appendix A

Appendix B

G.4. Draft Submittal – Whittier Intermodal Development Concept and Design

NEEDS AND PURPOSE REPORT

Draft Submittal

Whitter Intermodal Development Concept and Design

Alaska Railroad Corporation

September, 2004

Copy 2 of 3 Rcv'd 5/16/05

PND Incorporated
CONSULTING ENGINEERS

TABLE OF CONTENTS

LIST OF APPENDICES

LIST OF FIGURES

LIST OF TABLES

LIST OF PHOTOGRAPHS

ABBREVIATIONS

ARRC	Alaska Railroad Corporation
CP	cathodic protection
DCED	Department of Community and Economic Development
ESA	environmental site assessment
MLLW	mean lower low water
PCB	polychlorinated biphenyl
PND	Peratrovich, Nottingham & Drage, Inc.
psf	pounds per square foot

EXECUTIVE SUMMARY

The Alaska Railroad Corporation (ARRC) contracted with Peratrovich, Nottingham & Drage, Inc., to participate in a study of intermodal transportation development needs and possibilities in Whittier, Alaska. The study was requested to provide updated analysis of business opportunities in Whittier, the condition of ARRC current facilities, and the best use of ARRC Whittier assets in meeting the corporation's long-term strategic objectives. The community of Whittier has been significantly changed by the 2000 opening of the tunnel to vehicle access. Railroad operations and demand for service also have been affected. The ARRC Whittier assets include a rail yard, other rail facilities, and real estate.

The ARRC desires to develop its Whittier facilities in a manner that promotes passenger safety, achieves operational goals and objectives, and provides economic benefits to the corporation. This Needs and Purpose Report discusses results of a market analysis, Phase I Environmental Site Assessment (ESA), and evaluation of several facilities.

Conclusions from the site visits, review of existing information, and evaluation of facilities are summarized below:

- Market analysis: Since the tunnel conversion, tour companies, freight carriers, government agencies, and the military have expressed increased interest in the use of Whittier as a port of call, creating opportunities for development of infrastructure and services. The 2025 revenues for major revenue sources in Whittier are forecast to increase from an estimated $6.5 million in 2004 to $17.6 million in 2025.

- Phase I Environmental Site Assessment: Because of historical contamination, there is a medium level of risk associated with development of new facilities.

- Marginal Wharf: This facility, damaged during the 1964 earthquake and suffering from age, is no longer in use. Its location, at the end of the Whittier access road, near the ARRC tracks, and close to the town of Whittier, is ideal for intermodal transfer of passengers between land, sea, and rail modes of transportation.

- DeLong Dock: At this dock, which primarily serves the fishing industry, improvements have enhanced safety and service. Additional improvements to protect the structure and further improve service are needed.
- Transit Shed: This structure has been demolished because of structural deficiencies.
- Barge Slip: This facility is essential to barge traffic for South-central Alaska. Recent improvements include a side-loading facility to improve loading and unloading of barges.
- Rail Yard — storm drain system: The existing storm drain system does not always effectively handle standing water and flooding that occurs during tides.
- Rail Yard — track layout and alignment: The rail yard currently operates at capacity for freight operations and provides no available unutilized track for maneuvering of passenger rail cars.
- Security: Concerns about security at marine and rail transportation facilities are resulting in new requirements for onsite security and control of access points. The ARRC has added year-round contract security personnel to augment its system-wide force.

The recommendations for future intermodal development by the ARRC are summarized below:

- Market analysis
  - Continue development of land lease relationships with port users that include private and government entities.
  - Consider strategies to increase rail ridership, such as the use of train sets that carry passengers to and from the Anchorage International Airport or downtown to carry passengers south to Whittier, as a means of maximizing opportunities resulting from the growth in Whittier cruise ship and other tourism traffic.
  - Promote leasing of land or building space for retail shops adjacent or close to the cruise ship docks.

  - Increase capacity and frequency of train service to take advantage of and foster day tour operations and fuel demand for retail and office space.

- Phase I ESA: Consult historical information in determining locations for development and conduct testing at those sites to identify whether remediation would be required.

- Marginal Wharf: Replace the existing facility with a modern dock facility that will accommodate tourism ventures, provide for additional freight operations, and serve military deployment and response purposes.

- DeLong Dock: Provide upgrades consisting of water connection, safety ladders, and a cathodic protection system.

- Barge Slip: Provide repair and maintenance to extend the serviceability of the slip and improve efficiency of operations.

- Rail Yard — storm drain system: Develop a plan for addressing runoff control of storm water, including management of snow removal and reduction of sedimentation, and coordinate improvements with proposed track alignment upgrades.

- Rail Yard — track layout and alignment: Realign tracks in the rail yard to improve the offloading of barge freight and improve the ability of equipment to maneuver.

- Security: Prepare a detailed analysis to identify security needs and means to address them.

- Potential improvements

  - Advance passenger terminal concepts to provide a facility to handle loading and offloading of large cruise ships that would include space for passenger staging, baggage handling, office and counter space for cruise lines and airlines, accommodations for vehicle parking and bus staging, and an adjacent passenger loading facility.

- Advance proposed pedestrian enhancements consisting of a small visitor center that accommodates informational kiosks, outdoor viewing platforms, and restroom facilities for the U.S. Forest Service.

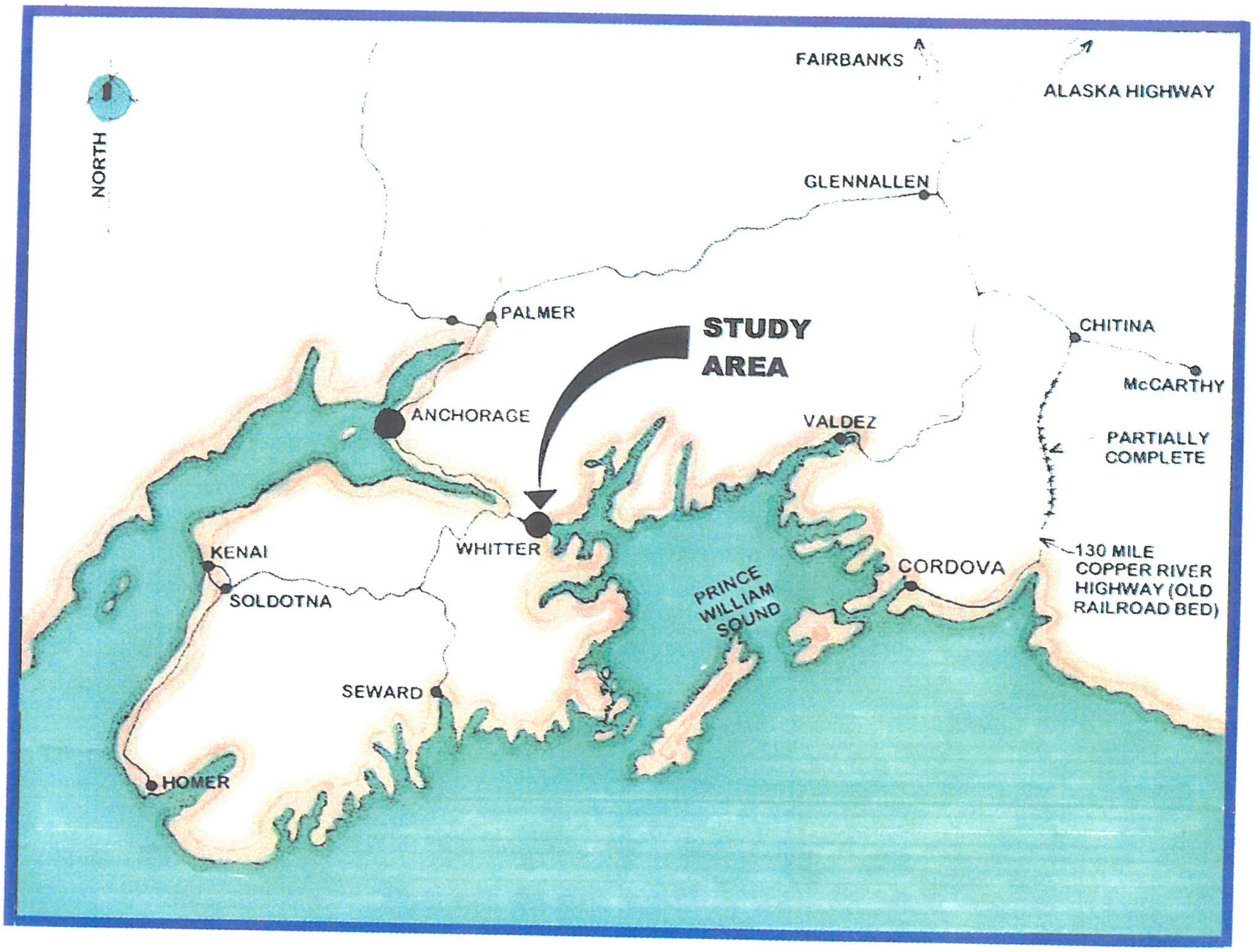
1. INTRODUCTION

1.1 STUDY BACKGROUND

The Alaska Railroad Corporation (ARRC) contracted with Peratrovich, Nottingham & Drage, Inc. (PND), to participate in a study of intermodal transportation development needs and possibilities in Whittier, Alaska, approximately 65 miles southeast of Anchorage (Figure 1). The introduction of road access to Whittier in 2000 has brought change to the South-central Alaska community and has affected rail and other transportation operations. To address the current conditions and plan future capital investment, the ARRC needs an updated analysis of business opportunities in Whittier, the condition of its current facilities, and the best use of its assets there in meeting the corporation's long-term strategic objectives. The ARRC Whittier assets include a rail yard, other rail facilities, and real estate.

The ARRC desires that development of its Whittier facilities and properties meet the primary goals of providing passenger safety, operating efficiency, and economic benefits to the corporation. In support of these goals, the ARRC has identified the following objectives for Whittier developments:

- Increasing rail passenger and pedestrian safety
- Increasing passenger service to and from Whittier
- Providing docking facilities for day cruise boats and cruise ships to stimulate rail passenger travel to and from Whittier
- Providing a suitable passenger terminal to accommodate future growth
- Enhancing snow removal operations
- Enhancing drainage within the rail yard.
- Providing for development of businesses that promote rail passenger travel
- Providing safe and efficient setting for freight operations



SOUTH-CENTRAL ALASKA

ALASKA RAILROAD CORPORATION
OFFICE OF THE CHIEF ENGINEER
P.O.BOX 107500, ANCHORAGE, ALASKA 99510-7500 (907) 265-2456

PROJECT :

WHITTIER INTERMODAL DEVELOPMENT

TITLE:

FIGURE 1
STUDY AREA LOCATION MAP

- Promoting connections of transportation modes to create and improve intermodal opportunities
- Increasing freight handling capacity
- Providing facilities that enable Whittier to serve as a back-up port for Anchorage in case of a catastrophe

The ARRC also identified the following four types of development as those that are most complementary to its rail operations in Whittier:

1. Passenger-related amenities to facilitate growth in tourism
2. Freight-handling facilities to expedite movements of cargo by rail and improve delivery time
3. Waterfront development on ARRC properties, either through construction of ARRC-owned facilities or through land lease options private or public entities, to participate in expanded or new Whittier business opportunities
4. Dock-front facilities on ARRC property to facilitate loading and unloading of container freight shipped on barges or container ships

1.2 Study Activities

The scope of work developed for the study specified completion of the following tasks:

1. Review of potential market forces such as day boat use, freight operations, rail passenger traffic, and cruise ship passenger traffic that could influence development decisions by the ARRC
2. Review of the structural integrity and suitability for potential improvements of existing ARRC facilities at the Marginal Wharf, DeLong Dock, and Transit Shed
3. Evaluation of the rail yard and Barge Slip for potential improvements

4. Performance of and reporting on the results of a Phase I Environmental Site Assessment (ESA) of the study area

5. Presentation of conclusions and recommendations for modification of existing facilities or construction of new facilities to best meet the needs of the ARRC, local residents, and visitors to Whittier

To complete the study of potential development options, PND and its subcontractors gathered information, assessed existing facilities, and identified economic opportunities. Conclusions from the study findings were used to prepare conclusions and recommendations for the future development of ARRC assets in Whittier that meet the needs and purposes of the facilities and are consistent with ARRC goals and objectives.

The study began in 1999 when three activities were conducted simultaneously: (1) a market analysis, (2) a Phase I ESA, and (3) a structural investigation of existing facilities. Subsequent activities included an independent review of track layout and alignment in 2000; a site visit to the rail yard in 2001; and an update of the market analysis in December 2003. These activities are briefly described below.

1.2.1 Market Analysis

The market analysis, completed by Northern Economics Inc., consisted of identifying market forces that could affect future economic conditions in the Whittier area and be indicative of community and business opportunities. The 1999 analysis also provided estimates of potential revenues from development of ARRC properties targeted to meet the projected market demands. The update for this analysis, completed in 2003, described recent changes in the Whittier market and infrastructure that are relevant to potential development opportunities.

1.2.2 Phase I Environmental Site Assessment

The Phase I ESA of the study area, conducted by subconsultant Larsen Consulting Group, was intended to identify the level of risk for potential contamination. The work consisted primarily of a review of historical documents, interviews with persons having knowledge of the site, and general observations of the site and surrounding parcels. No environmental testing or sampling was performed in conjunction with the ESA.

1.2.3 Facility Evaluation

Selected team members from PND visited the project site in October 1999 to perform structural and architectural inspections. Existing ARRC facilities consisting of the Marginal Wharf, DeLong Dock, and Transit Shed were inspected to provide information useful in assessing condition of the facilities and the potential for improvements.

In 2001, PND visited the rail yard and observed the storm drain system.

An international rail design firm, Hatch Mott MacDonald, was subcontracted by the ARRC to review the track layout at the Whittier rail yard. Representatives of the firm met with the ARRC to discuss proposed improvements for freight handling and rail car maneuvering.

Additional facility information was provided by the ARRC, which inspected the Barge Slip and provided information about security operations in Whittier.

1.3 Report Organization

The information gathered through research and inspection, as well as the conclusions and recommendations prepared from the findings, are documented in this Needs and Purpose report. The report is organized as follows:

- Executive Summary
- Introduction
- Study Area Background
- Market Analysis Findings
- Phase I Environmental Site Assessment Findings
- Facility Evaluation Findings

- Conclusions

- Recommendations

The following documents are provided as appendices:

- Appendix A, market analysis

- Appendix B, Phase I ESA (The main body of the report is provided; the report appendices are not included.)

2. STUDY AREA BACKGROUND

2.1 COMMUNITY DESCRIPTION

The City of Whittier lies in a fjord at the head of Passage Canal in Prince William Sound. The port remains free of ice year-round. It serves a variety of marine activity and provides access for freight and visitors traveling to and from South-central Alaska.

According to the State of Alaska, Department of Community and Economic Development (DCED), the second-class city area encompasses 12.5 square miles of land and 7.2 square miles of water. Winter temperatures range from 17°F (Fahrenheit) to 28°F; summer temperatures average 49°F to 63°F. Average annual precipitation includes 66 inches of rain and 80 inches of snowfall. The DCED reports that the resident population was estimated at 178 people in 2003.

Whittier was established as a strategic military facility during World War II. A port and railroad terminus were constructed by the U.S. Army for transport of fuel and other supplies. The railroad spur and two tunnels were completed in 1943, and the Whittier Port became the entrance for troops and dependents of the Alaska Command.

Formerly rail cars provided the sole means of transporting passengers, vehicles, and freight by land in and out of Whittier. The railroad track extends 12 miles to and from the Portage Station, east of Girdwood. As part of a $70 million road connection completed in the summer of 2000, the Anton Anderson Memorial Tunnel was reconstructed. Today road vehicles can reach Whittier by using the same tunnel traveled by the railroad. In particular, increased access to Whittier has boosted marine passenger traffic, which consists of (1) travelers arriving and departing by cruise ship and (2) customers of day boat operators who provide fishing, sightseeing, marine taxi, kayaking, and other scheduled and charter activities.

Currently operated Whittier marine facilities include the following:

- Barge Slip, owned and operated by the ARRC, which serves barge traffic
- DeLong Dock, an ARRC general service facility that primarily serves the fishing industry

- Prince William Sound Cruises dock, operated on waterfront property leased from the ARRC
- Whittier Ferry Terminal serving the Alaska Marine Highway System ferries, located on ARRC land
- Small-boat harbor with 360 slips, owned and operated by the City of Whittier
- 600-foot floating dock, owned by Whittier Dock Enterprises (whose partners include Princess Cruise Lines) and serving cruise ship traffic

A privately owned condominium-type marina with 150 slips is in the planning stage.

2.2 Characteristics of the Study Area

The study area, shown in Photographs 1 and 2, consists of approximately 50 acres of ARRC-owned property. Passage Canal borders the area on the north, and properties owned by the ARRC, private entities, the City of Whittier, and the federal government abut the south, east, and west sides of the study area.

The majority of the study area was developed by the U.S. Army Corps of Engineers in the mid-1940s. Site infrastructure elements include buried and above-grade utilities consisting of electrical, sewer, water, storm sewer, natural gas, telephone, and cable, as well as fuel lines.

The study area slopes south to north, which the exception of the rail yard, which is generally flat. Recent site investigations have shown that groundwater depth is approximately 12 feet below grade.

The 1964 earthquake in South-central Alaska caused significant damage to the ARRC facilities in Whittier. One harmful impact of the earthquake was widespread land mass subsidence, including local settlement of approximately 5.5 feet.

LEGEND

▪▪▪▪▪▪▪▪▪ STUDY AREA BOUNDARY

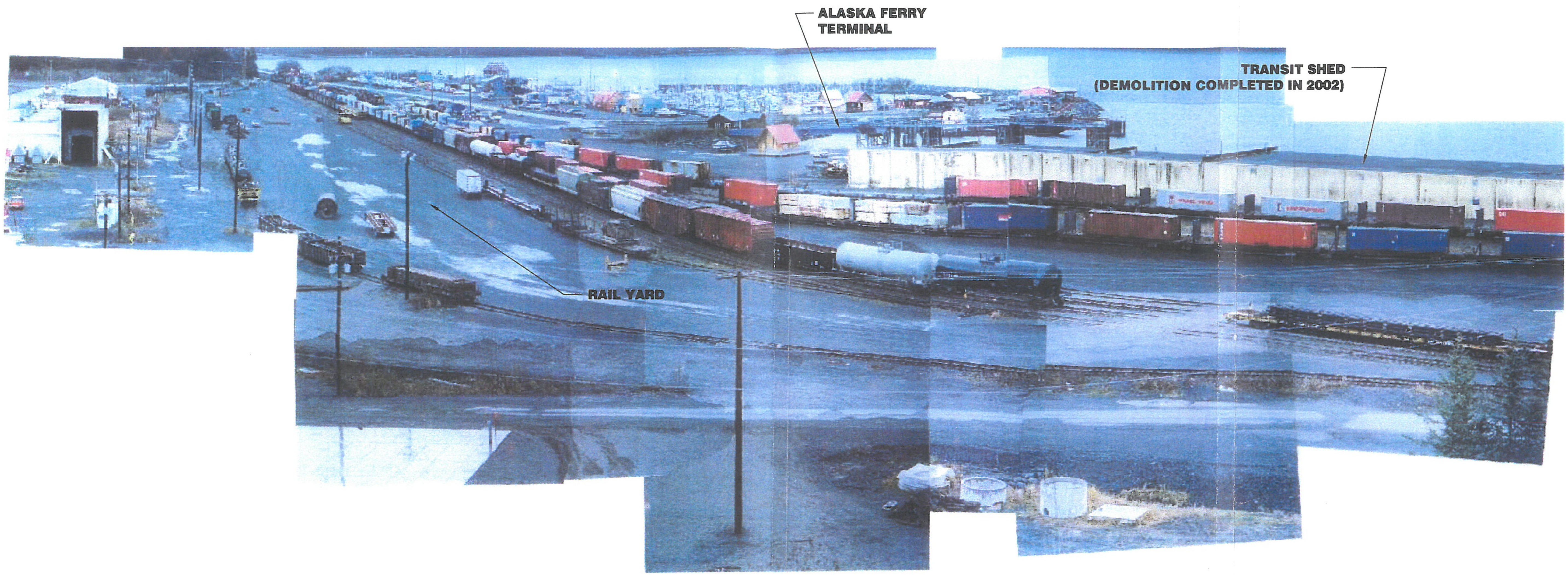
ALASKA RAILROAD CORPORATION
OFFICE OF THE CHIEF ENGINEER
P.O.BOX 107500, ANCHORAGE, ALASKA 99510-7500 (907) 265-2456

PROJECT:

WHITTIER INTERMODAL DEVELOPMENT

TITLE:

PHOTO ONE
WHITTIER STUDY AREA BOUNDARY



ALASKA RAILROAD CORPORATION
OFFICE OF THE CHIEF ENGINEER
P.O.BOX 107500, ANCHORAGE, ALASKA 99510-7500 (907) 265-2456

PROJECT:
WHITTIER INTERMODAL DEVELOPMENT

TITLE:
PHOTO TWO
STUDY AREA - COMPOSITE PHOTOGRAPH

3. MARKET ANALYSIS

The market analysis conducted by Northern Economics identified potential market forces relevant to the development of the ARRC properties in Whittier and estimated revenues that could be derived by tapping the resulting economic opportunities. The goal was to help planners better understand the various market forces, as well as the complementary nature or points of conflict between those forces. The complete report is provided in Appendix A. This section summarizes the findings about market forces and potential revenues. (Note that since preparation of the report in December 2003, some potential developments in Whittier have occurred, notably completion of a private-sector cruise ship dock and the Inn at Whittier.)

Total ARRC annual revenues from various activities in the Whittier area are significant and have the potential to increase substantially in future years. Estimates of potential annual freight transport, passenger rail, dockage and boat fees, parking lot, and land lease revenues for the ARRC in Whittier for 2004 through 2025 are shown in Table 1.

Table 1. Summary of Annual Gross Revenues for Major Revenue Items

Year	Freight Transport Revenue ($)	Passenger Rail Revenue ($)	Dockage and Boat Fee Revenue ($)	Parking Lot Revenue ($)	Land Lease Revenue ($)	Total Annual Revenue ($)
2004	4,807,000	1,473,000	17,000	6,000	218,000	6,521,000
2005	4,860,000	2,602,000	17,000	14,000	1,249,000	8,742,000
2006	4,914,000	2,777,000	58,000	17,000	1,311,000	9,077,000
2008	5,022,000	3,046,000	69,000	25,000	1,446,000	9,608,000
2010	5,134,000	3,530,000	69,000	56,000	1,594,000	10,383,000
2015	5,590,000	4,443,000	117,000	91,000	2,034,000	12,275,000
2020	6,088,000	5,637,000	151,000	195,000	2,596,000	14,667,000
2025	6,630,000	7,247,000	164,000	261,000	3,314,000	17,616,000

The revenue estimates in Table 1 are based on illustrative scenarios that take into account the considerable uncertainty associated with looking 25 years into the future. They are designed to show potential impacts of various markets on ARRC revenues. Because of uncertainties surrounding the type of equipment that might be used and other factors, no attempt is made to estimate costs or net revenues the ARRC might earn in the different markets.

Freight revenues are generated by barge traffic in and out Whittier. Barge traffic consists of a weekly ARRC/Alaska Railroad Marine Services rail barge and a Canadian National barge that calls in Whittier every 11 or 13 days.

Passenger rail revenue is attributable to both cruise ship and day tour customers who may choose to use the train for transportation into or out of Whittier.

Dockage and boat fee revenues are from day passenger boats that land and sail from DeLong Dock. Currently the DeLong Dock is the only dock owned and operated by the ARRC. (The City of Whittier also owns a portion of DeLong Dock.)

Parking lot revenues come from the new parking lot being developed by Alaska Recreation Inc. on ARRC-owned land. Land lease revenues come from 25 acres of ARRC land managed by the City of Whittier and leased to private entities. The ARRC also leases 5 acres directly to the City. The majority of residents in Whittier live in a large condominium complex that sits on these 5 acres.

The new market forces in play in Whittier are the result of infrastructure development, Whittier's proximity to Anchorage, policy decisions by the City of Whittier, entrepreneurship, and continued growth in the cruise industry.

4. PHASE I ENVIRONMENTAL SITE ASSESSMENT FINDINGS

During the 1999 Phase I ESA of the study area and surrounding properties, historical records were reviewed and interviews were conducted with persons who had knowledge of the study area. Findings show that the study area has experienced significant environmental degradation over the years, particularly as a result of the 1964 earthquake.

Many past uses that could have contributed potential contamination are related to operations during ownership of the study area by the federal government, before the state assumed ownership of the railroad in 1985. Historical cleanup operations to address the presence of hazardous wastes and contamination have included removal of (1) transformers containing polychlorinated biphenyls (PCBs) from a site adjacent to the Transit Shed in the late 1980s and (2) solvents and other hazardous substances from the Transit Shed. In addition, soils contaminated with fuel, PCBs, or debris have been found during excavation activities. A spill of about 10 million gallons occurred as a result of the 1964 earthquake in an area referred to as the Harbor Expansion Area, an ARRC property adjoining the north side of the study area.

Considerable groundwater flow was reported to occur throughout the study area. Because of the groundwater flow, the potential exists for migration of contamination onto study area properties from upgradient properties.

During the site visit, the study area was observed to be relatively clean and free of solid waste and to have minimal signs of contamination. In addition, sources of contamination were not observed.

Interviews with ARRC officials identified the existence of established policies for hazardous and solid waste prevention and cleanup.

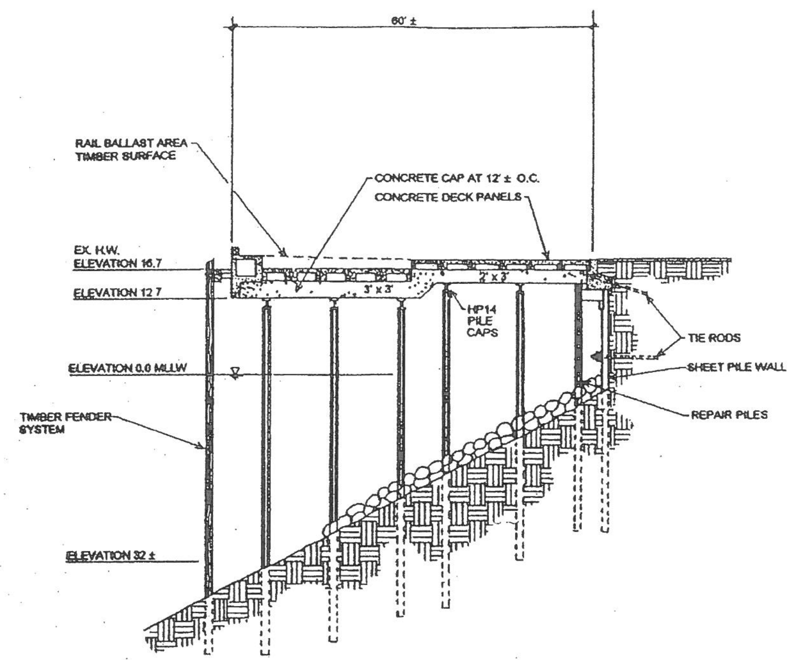
5. FACILITY EVALUATION FINDINGS

In October 1999, a team consisting of an architect, a structural engineer, and two environmental engineers visited Whittier to inspect these ARRC properties: Marginal Wharf, DeLong Dock, and Transit Shed. The inspection of each structure primarily assessed structural integrity. Staff from PND also visited the rail yard in 2001. In 2000, the track layout was assessed by Hatch Mott MacDonald. Information for the Barge Slip and security operations evaluations was provided by the ARRC.

This section presents the results of the facility reviews. For the sites inspected in 1999, relevant historical information and the investigation findings are described. For all facilities evaluated, the recent improvements and current status are discussed.

5.1 MARGINAL WHARF

The ARRC closed the Marginal Wharf in 2002. The facility had been constructed by the U.S. Army Corps of Engineers in the 1940s and was condemned in 2002. The Marginal Wharf consisted of a dock on a steel pile foundation and a concrete deck approximately 60 feet wide and 1,000 feet long. The steel piles and concrete pile caps of the wharf had been periodically submerged in seawater because of land subsidence from the 1964 earthquake. Figure 2 shows the Marginal Wharf.



EXISTING DOCK SECTION

Figure 2. Cross Section View of the Marginal Wharf

5.1.1 Evaluation of Structure

Past Investigations. The ARRC contracted with several engineering firms to perform condition surveys of the dock structure in the past 10 years and in previous decades. Studies revealed a gradual deterioration of both the steel piles and the concrete pile caps. As long ago as the late 1950s, a cathodic protection (CP) system was recommended because of rapid corrosion observed in the steel members, but was not installed.

One effect of the 1964 earthquake, which caused significant damage to the Marginal Wharf, was a permanent lateral displacement that is most prominent on the east end of the dock. After the earthquake, batter piles were added to strengthen the east end of the dock.

The earthquake also caused widespread land mass subsidence, including local settlement of approximately 5.5 feet. The subsidence from the earthquake resulted in immersion of the concrete caps during high tides. In 1975, a structural inspection indicated that extensive corrosion had occurred in support piles and various other structural members. In 1978, the results of another structural inspection indicated that the strength of the dock had been compromised. Demolition of the structure was recommended.

In 1980, supplemental piling and subcaps were installed to bolster the dock and an active CP system was installed to protect the new piling. The rail spur and ballast were also removed to decrease the load on the outer piles. In 1991, the firm completing an inspection and assessment suggested limiting live loads to 100 pounds per square foot (psf) over the old rail bed and 250 psf between the building and the rail bed.

In 1993, PND inspected the dock and verified the 1991 report findings and recommendations. The 1993 report indicated an almost total loss of capacity for the original steel H piles. Furthermore, the CP system was determined to be inoperative. It was recommended that the eastern 200 feet of the dock be removed.

Findings of the Current Study. The 1999 inspection focused on degradation and corrosion of concrete and piles. The steel thicknesses of existing elements were measured at accessible locations, typically where absent or broken fender piles allowed access under the dock. Inspection of the east end of the dock was limited to visual inspection.

Measurements and visual inspection of members indicated an advanced state of corrosion on virtually all steel members (Photograph 3). The large web sections of many H piles were completely missing or pitted. Only flanges remained on most of the channel bracing. The concrete caps had many areas of exposed and corroding reinforcement steel and a number of large cracks (larger than 1/8 inch) (Photograph 4). Areas of concrete slabs, particularly near the dock face, were observed to be pitted down to the steel reinforcing bars (Photographs 5 and 6). In addition, the CP system did not appear to be functional. Several fender piles were missing or broken along the face of the dock, particularly at the east end of the wharf.

Considering the level of corrosion, the concrete cap capacity was determined to be controlling the vertical capacity of the dock. The estimated dock capacity was found to be on the order of 100 psf over the rail bed and 250 psf between the rail bed and the location of the former Transit

Photo 3: Marginal Wharf: corroded piles and damaged cap

Photo 4: Marginal Wharf: crack in sheet pile cap

Photo 5: Marginal Wharf: exposed reinforcement in pile cap

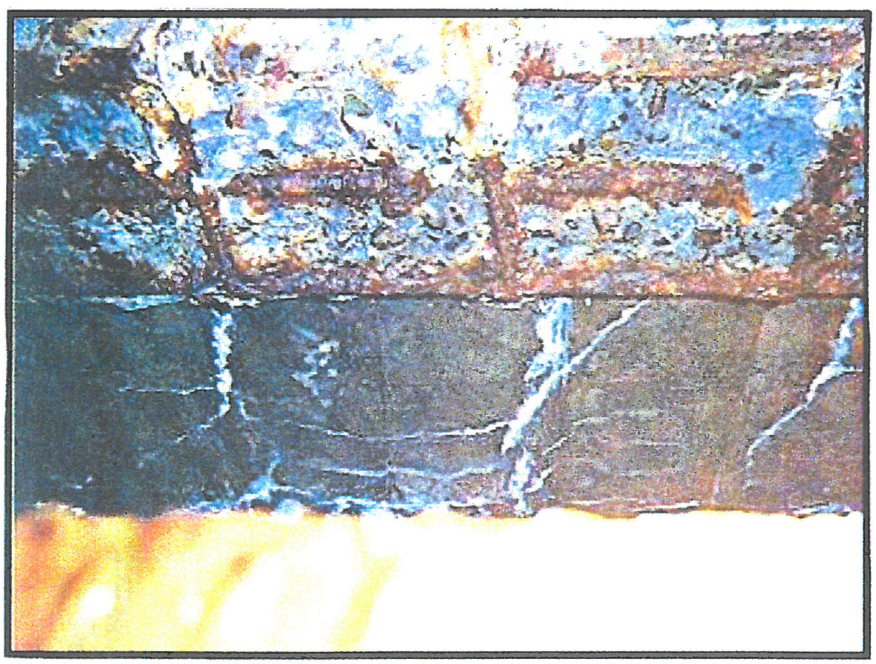


Photo 6: Marginal Wharf: corroded reinforcement in pile

Shed. It was noted that future expectancy was that cracks in the caps would enlarge and the reinforcing would deteriorate, causing the cap shear capacity to diminish and creating the potential for nonductile and sudden failure.

The seismic capacity of the wharf also was determined to be inadequate. At least one crack in a pile cap exposed No. 3 reinforcing steel, placed at 12 inches on center. This structural configuration was considered to be insufficient at that particular location.

5.1.2 Current Status

The ARRC stopped use of the Marginal Wharf in 2002. The existing facility is expected to be replaced.

5.2 DeLong Dock

The DeLong Dock, which primarily serves the fishing industry, consists of two steel barges that bear on a number of 6-foot-diameter steel piles. The barges measure 60 feet by 250 feet and 90 feet by 427 feet and are equipped with active CP systems. The original timber cap planks were replaced with concrete more than a decade ago. Four fuel lines that are 14 inches in diameter extend from the dock to a tank farm near the west end of Passage Canal. These fuel lines are no longer used.

5.2.1 Evaluation of the Structure

In 1999, both barges supporting the dock were observed to have a number of leaks in the bottom of the hulls. The leaks were undoubtedly causing internal corrosion damage to the barges. Furthermore, the barges were slowly filling with seawater, which caused significant loading of the piles during low tide.

At the time of the 1999 inspection, the CP system appeared to be operational. Even in areas where external coatings had failed, corrosion was found to be relatively light. There were some areas of moderate pitting on the bottoms of the barges. The barge fendering appeared to be fairly intact with some maintenance required at the rub railing. The cap slab appeared to be in excellent condition.

5.2.2 Recent Improvements

To address the seawater entrapment in the barges observed in 1999, the ARRC cut larger holes in the bottom of the barges. The holes allow trapped water to escape from the barges at low tides.

Minor repairs and improvements also have been made to the DeLong Dock recently to accommodate users. In early 2003, a local construction company installed a fender system along the dock face to accommodate vessel moorage. In conjunction with the fendering project, the contractor also demolished and removed an abandoned fuel piping manifold and a hydraulic boom crane.

To serve the fish processing companies displaced from Marginal Wharf, the existing water and electrical systems were enhanced. Use of DeLong Dock has increased since the Marginal Wharf was closed.

5.3 Transit Shed

The U.S. Army Corps of Engineers built this 100-foot-wide by 830-foot-long building in 1958. The building, which was demolished in 2002 and 2003, was located immediately south of Marginal Wharf and lay in an east-west direction.

The building consisted of perimeter precast concrete panels placed between cast-in-place piers with rolled steel beams and girders ledgered off the walls. Interior framing consisted of steel columns and bearing walls constructed similarly to the perimeter walls. A flat roof was formed of metal decking spanning between steel beams or precast wall panels. The north foundation wall of the Transit Shed rested directly atop the retaining wall that provided lateral support to the Marginal Wharf.

In 1999, the Transit Shed was used for maintenance and storage. A rail track inside the building permitted repair of equipment. A wood-framed pedestrian access was used to transfer passengers from the wharf to the passenger train.

5.3.1 Evaluation of the Structure

The 1999 inspection revealed several structural deficiencies, including lateral shifting of several pilasters at the stem wall construction joint, lack of footing attachments for exterior precast panels, shrinking and shear cracks in the panels, cracked interior walls of concrete masonry, 50 feet of settlement affecting the loading dock, inadequate roof support for snow loads, sagging metal decking in the roof, and damage to concrete pilasters beside several door openings that exposed steel reinforcing bar.

Other deficiencies noted included architectural faults, "unattractive" aesthetic appearance, and mechanical and electrical systems requiring significant maintenance and enhancement to meet codes.

5.3.2 Current Status

The ARRC decided to demolish the Transit Shed because it no longer met ARRC needs, had significant code deficiencies, and occupied strategically located waterfront property that could have a higher economic benefit to the ARRC. The demolition occurred in 2002 and 2003. The demolition budget was approximately $975,000 with roughly 80% of the funding provided by the Federal Transit Administration and the remaining 20% by the ARRC.

5.4 Rail Yard

The rail yard is an unpaved area containing railroad tracks used for freight operations that consist of loading and unloading barges. These barges move rail cars and other freight to and from Seattle, Washington, and Prince Rupert, British Columbia. Freight rail cars used to move the barge freight often are stored temporarily in the yard. The rail yard also contains a small rail spur that is used for winter freight operations.

Containers are loaded and unloaded onto flat cars with the use of a forklifts. The rail yard generally operates at capacity for freight operations.

5.4.1 Evaluation of Infrastructure

Storm Water Drainage System. Whittier is subject to heavy precipitation, which occurs in the form of rain and snow. The combination of inadequate grading, seasonal freezing, and heavy precipitation creates conditions in which maintenance of the rail yard is nearly a day-to-day operation. The yard is generally graded flat with a series of catch basins.

Operators at the rail yard historically have experienced significant difficulty in dealing with snow removal and drainage. Rail cars have derailed as a result of ice buildup in the yard.

Extreme snowfall often results in standing snow depths of 10 feet or more adjacent to the rail yard. The snow in storage areas adjacent to the tracks can reach 15 feet in depth. In the spring, as the snow in these storage areas melts and also during the summer months when heavy rainfall occurs, there is a significant problem with standing water in the rail yard area. Although many storm drain catch basins and large-diameter storm drain lines traverse certain portions of the rail yard, drainage remains poor in several large areas.

The existing storm drainage system can become flooded during high tides. When flooded, the storm drain pipes have reduced rate of flow and capacity and undergo increased sedimentation. Also contributing sediments to the catch basins and storm drain piping is the ongoing grading of the unpaved yard.

Track Layout. Hatch Mott MacDonald evaluated the capabilities of the current track to identify ways to enhance freight handling and rail car maneuvering. The placement of tracks was evaluated to determine ways to improve efficiency of freight transfers, facilitate maneuvering of large equipment, and move rail cars more effectively.

5.4.2 Recent Improvements

Pedestrian Underpass. The pedestrian underpass, completed in June 2002, is a 300-foot-long pedestrian underpass crossing beneath the rail yard, from the waterfront area to the Whittier town site. A 10-foot-diameter corrugated pipe provides the underpass frame, enclosing a concrete pathway. Covered portal ramps at each end provide for ingress and egress, and covered pathways lead to the tunnel openings. The tunnel has significantly improved pedestrian safety in the rail yard area.

The project budget was $2.285 million for design, construction, and construction management. Funding was 80% by the Federal Transit Administration and 20% by the ARRC.

Maintenance Facility. The maintenance facility, completed in March 2003, provides a building with space for storage and maintenance of equipment. The facility can house as many as four pieces of heavy equipment. Previously the ARRC had no indoor facility for equipment repair and maintenance in Whittier; work was performed outdoors or in Anchorage. The new building permits year-round repair and maintenance of large equipment in Whittier.

The project budget of approximately $2.3 million was funded 80% by the Federal Transit Administration and 20% by the ARRC.

5.5 Barge Slip

The Barge Slip functions primarily as the rail link with the Lower 48 and Canada. The slip works as a bridge from land to a barge. It rests on the barge during loading and unloading operations so that tracks on the slip align with those on the barge deck. Anchored on the land end, the Barge Slip is able to move to accommodate tides and the changing freeboard of the barge.

5.5.1 Evaluation of Infrastructure

Evaluation of this structure was completed by the ARRC.

5.5.2 Recent Improvements

Side Unloading Facility. A side-loading facility was created in 2001 and 2002. These improvements were needed to facilitate pass-pass unloading, in which a forklift on a barge passes containers to a forklift on the dock or conversely from a forklift on the dock to a forklift on the barge. Containers that are not mounted on rail cars are moved onto and off the barge, which is equipped with racks that accommodate the containers.

Fill was placed and two 34-foot dock structures were installed along the side of the existing Barge Slip. A CP system and structural reinforcement were added to the slip in 2001, and the pass-pass structures were completed in 2002. The cost of approximately $2.26 million was funded entirely by the ARRC.

Additional safety improvements in 2003 included installing a fendering system on the pass-pass platforms, ramps to allow safer access to trestles, and handrails on trestles. The improvements, budgeted at $182,000, were funded by the ARRC.

5.6 SECURITY

The ARRC-owned properties where rail and barge activities are conducted are routinely patrolled by officers of the Whittier Police Department. An established Area Maritime Security Committee actively oversees security issues in Whittier. In addition, the Alaska State Defense Force of the Alaska Office of Homeland Security, in the Division of Homeland Security and Emergency Management, has assigned a unit to Whittier. Members of the force conduct monthly drills to promote both land and waterside security.

The system-wide Alaska Railroad Security Program is organized as a standard railroad police force. The program is conducted by a senior agent who oversees railroad security agents. Railroad agents are responsible for all aspects of rail security for the ARRC system, including emergency response management.

5.6.1 Evaluation of Existing Organization

Railroad agents have ultimate security responsibility at the Whittier ARRC facilities. At the Barge Slip, the facility manager, who is the employee in charge, oversees day-to-day operations and security.

5.6.2 Recent Improvements

A recent addition is the year-round use of contract security officers. Their functions are to control entry control functions to the rail yard and perform extra security functions during barge operations.

6. CONCLUSIONS

Conclusions drawn from the market analysis, Phase I ESA, and facility evaluations are discussed below.

6.1 MARKET ANALYSIS CONCLUSIONS

- Since 2000, when the tunnel opened to vehicle use and vehicles gained access to Whittier, tour companies, freight carriers, government agencies, and the military have expressed increased interest in the use of Whittier as a port of call.
- New market opportunities are being created by infrastructure development in Whittier, the attractiveness of Whittier as a port of call because of its proximity to Anchorage, and the growth of the cruise industry.
- The 2025 revenues for major revenue sources in Whittier are forecast to increase from an estimated $6.5 million in 2004 to $17.6 million in 2025. (See Table 1 in Section 3.)
- A projected passenger rail revenue increase of from about $1.5 million in 2004 to about $7.2 million in 2025 accounts for roughly 40% of total annual revenues for the ARRC in 2025.

6.2 PHASE I ENVIRONMENTAL SITE ASSESSMENT

- Because historical contamination near the study area was identified, there is a medium level of risk associated with development of new facilities.
- The ARRC has worked to minimize the contamination present in the study area from previous activities and has developed procedures for management and control of hazardous substance storage and use.
- Although contamination identified has been remediated, it is possible that hydrocarbon and other contamination is present in almost any location because of historical uses of the study area.

6.3 EVALUATIONS OF FACILITIES

Marginal Wharf

- The ARRC-owned Marginal Wharf was found to be unserviceable and a safety hazard because of heavy damage sustained during the 1964 earthquake, age, and deterioration. The ARRC is no longer using the facility.

- The location of the Marginal Wharf, at the end of the Whittier access road, near the ARRC tracks, and close to the town of Whittier, is ideal for intermodal transfer of passengers between land, sea, and rail modes of transportation. A replacement wharf facility is anticipated to be attractive to passenger cruise ships, freight barges, the U.S. Coast Guard, National Oceanic and Atmospheric Administration, and U.S. Navy.

DeLong Dock

- Seawater infiltration resulting from leaks in the floating barges was observed to be a cause of internal corrosion, and the infiltrating seawater was resulting in significant loading of the piles during low tide. Larger holes in the barge bottoms, cut by the ARRC, have allowed water to escape from the barges during low tides.

- Improvements in 2003 have helped to make the dock safer for users and enhance dock service. These improvements included the installation of a fender system along the dock face to accommodate vessel moorage and the demolition and removal of an abandoned fuel piping manifold and a hydraulic boom crane.

Transit Shed

- The 1999 inspection revealed several structural deficiencies resulting from age and deterioration. Subsequently, the ARRC demolished the Transit Shed.

Barge Slip

- This facility plays a key role in facilitating shipment of goods to South-central Alaska by barge.

- Recent improvements to the Barge Slip, particularly those benefiting side loading and unloading of barges, have enhanced freight handling from the slip and improved safety of personnel.

Rail Yard

- Drainage in certain portions of the rail yard does not adequately handle standing water throughout the yard. The existing storm drainage system can become flooded during high tides. Flooding of the storm pipes and ongoing yard grading of the unpaved surface contribute to sedimentation in catch basins and the storm drain piping.

- Track layout and alignment require modifications to permit expanded operations. The rail yard currently operates at capacity for freight operations and provides no available unutilized track for maneuvering of passenger rail cars.

Security

- The importance of security at marine and railroad facilities has escalated since the events of September 11, 2001. As additional security requirements are established by the Alaska Office of Homeland Security, the U.S. Department of Homeland Security, and other government departments, the number of security officers and the related equipment are expected to increase at all railroad and marine facilities.

- The ARRC has added year-round contract security personnel in Whittier to augment its system-wide force.

7. RECOMMENDATIONS

This section presents recommendations for future intermodal development by the ARRC. Recommendations were developed from review of information gathered during the market analysis, Phase I ESA, and facility evaluations and are discussed below. A final subsection describes potential new improvements to serve the needs of passenger and freight customers of the ARRC.

7.1 MARKET ANALYSIS

The market analysis identified revenue opportunities in freight and passenger services. It is recommended that the ARRC continue to develop land lease relationships with port users that include private and government entities. An example of a recent use of ARRC-owned land is the development of a new parking lot.

Potential sources of revenues related to the re-emergence of cruise ships in the Whittier area include docking, passenger transport, retail sales, and land leases. One opportunity to investigate is the use of train sets that carry passengers to and from the Anchorage International Airport or downtown to carry passengers south to Whittier. Increased train ridership, expanded services to cruise ship customers, and add-on tours to other rail destinations are strategies that can maximize the growth in Whittier cruise ship traffic, meeting the needs of visitors.

As economic activity in Whittier is bolstered by additional cruise ship traffic, retail activity should continue to grow. The ARRC should consider leasing land or building space for retail shops adjacent or close to the cruise ship docks. This approach would help meet the needs of visitors and residents.

The growth in day tours could enable the ARRC to boost ridership. To meet the needs of the day tour operators and consequently facilitate growth of that market segment, additional train capacity is recommended. The capacity enhancement would require larger trains and more frequent service. Contributing to the growth in day tour operations would also result in additional demand for retail and office space.

7.2 Phase I ESA

The recommendations resulting from the Phase I ESA are general in nature and apply broadly to future development. They are listed below:

- Historical information should be used to determine the best locations for any new development within the study area.
- Locations where contamination is known to exist should be avoided.
- During development activities, additional environmental testing should be conducted at the sites of proposed construction projects to fully assess environmental remediation needs.

7.3 Facility Evaluations

Recommendations are presented for each facility.

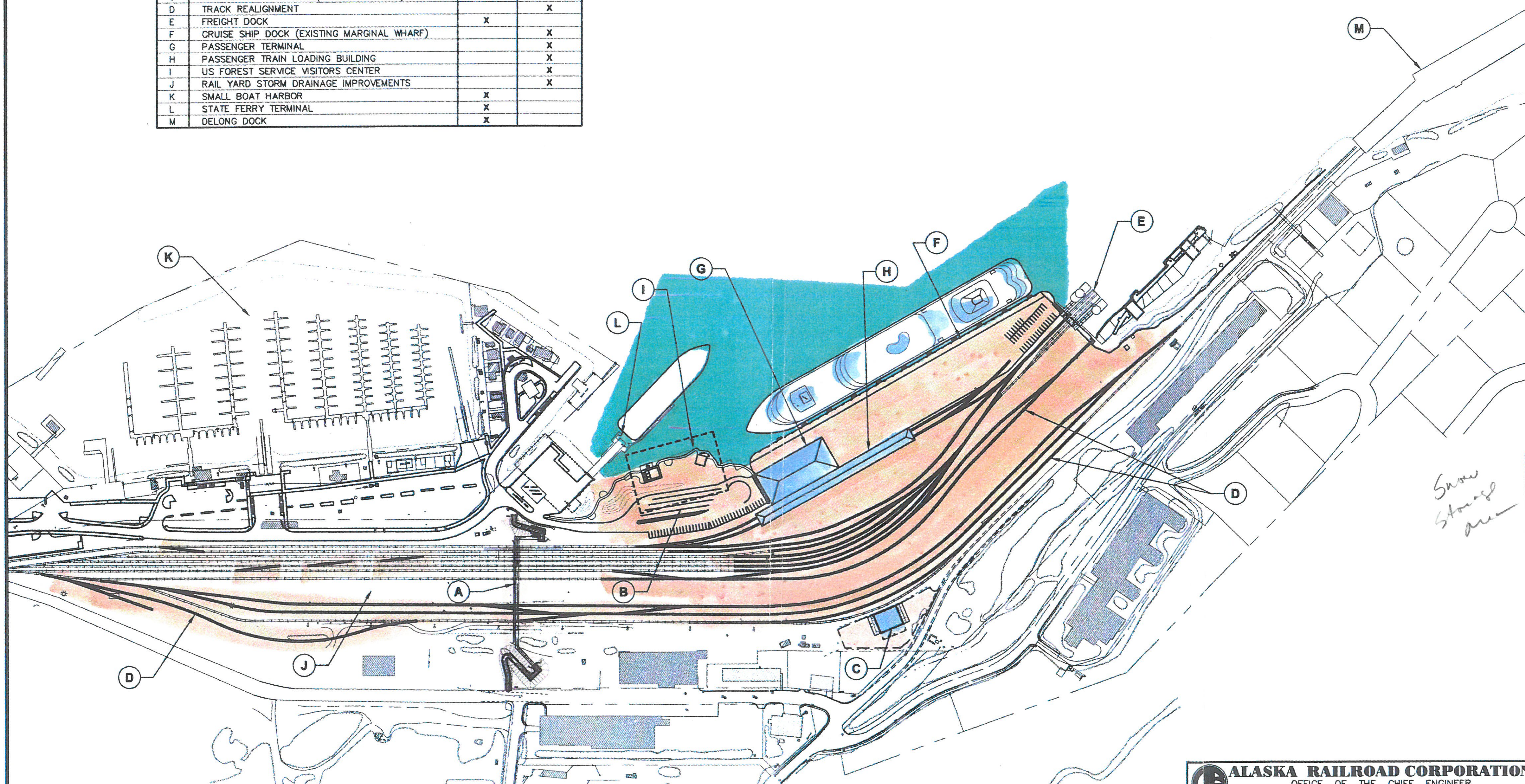
Marginal Wharf. The existing pile-supported portion of the dock should be demolished and replaced with a more modern dock facility that will accommodate the projected increase in cruise ship traffic at Whittier. The ARRC has investigated the potential of constructing a sheet pile bulkhead dock that would accommodate cruise ships up to 1,100 feet in length, as shown on Figure 3. The proposed dock would be constructed in approximately the same location as the existing Marginal Wharf and could also be used to supplement freight operations when needed. Associated costs for the proposed dock structure are provided in Table 2, which is provided at the end of this section.

The new facility at the Marginal Wharf site would meet the following current and future needs:

- Fishing and tour industries—An improved facility would provide room for expansion of day cruise and charter fishing businesses in Whittier.
- Freight — A new wharf at the Marginal Wharf site would provide more flexibility in freight operations and allow for increased freight shipments through Whittier to take advantage of the city's location close to the major population center of Anchorage.

CURRENT AND PROPOSED PROJECTS

ID	DESCRIPTION	EXISTING	PROPOSED
A	PEDESTRIAN UNDERPASS (COMPLETED 2002)	X	
B	BUS STAGING AND PARKING		X
C	MAINTENANCE BUILDING (COMPLETED 2003)	X	
D	TRACK REALIGNMENT		X
E	FREIGHT DOCK	X	
F	CRUISE SHIP DOCK (EXISTING MARGINAL WHARF)		X
G	PASSENGER TERMINAL		X
H	PASSENGER TRAIN LOADING BUILDING		X
I	US FOREST SERVICE VISITORS CENTER		X
J	RAIL YARD STORM DRAINAGE IMPROVEMENTS		X
K	SMALL BOAT HARBOR	X	
L	STATE FERRY TERMINAL	X	
M	DELONG DOCK	X	



ALASKA RAILROAD CORPORATION
OFFICE OF THE CHIEF ENGINEER
P.O.BOX 107500, ANCHORAGE, ALASKA 99510-7500 (907) 265-2456

PROJECT:
WHITTIER INTERMODAL DEVELOPMENT

TITLE:
FIGURE 3 MASTER PLAN PROPOSED WHITTIER RAIL STATION DEVELOPMENT LAYOUT

- Passenger cruise ships — Additional docking for cruise ships would permit more cruise companies to dock vessels on or near weekend days, a stated preference of the industry. The expanded capacity may attract additional cruise ship traffic.

- U.S. government vessels — Potential users of additional docking facilities include the U.S. Coast Guard, the National Oceanic and Atmospheric Administration, and the U.S. Navy. Whittier could serve as an alternative port site for deployment of the Stryker Brigade that is being deployed in Alaska. The location near the rail line further enhances the ability of the site to efficiently serve military deployment.

DeLong Dock. Upgrades that have been identified for DeLong Dock include water connection and safety ladders. These improvements are recommended to help meet the needs of current and future users and enhance the safety of dock operations. The addition of a CP system also is recommended to maintain structural integrity and extend the useful life of the dock. The CP system will help reduce corrosion and rust where the barges meet.

The long-term arrangement for this dock is to have the ARRC operate the facility and share net revenues with the City of Whittier. It is anticipated that any future needs and improvements at the DeLong dock will be paid for out of ARRC maintenance funds.

Barge Slip. The ARRC has identified the following necessary repair and maintenance items to protect the existing facilities and improve operations:

- Filling the void under the tracks at the base of the slip

- Installation of a bracing system to tie the end of the slip to dolphins to provide lateral support during barge slewing operations as a means of preventing hinge pin damage

- Installation of CP:

  - On the tower support piles inside the sheet pile cells

  - On the sheet pile wall

- Repair of holes in the cell sheet pile walls that support the tower

- Upgrade of the tower winch motors and brakes
- Replacement of the slip support cables and sheaves
- Installation of lights and support trusses between towers to illuminate the center of barges at the slip
- Increased size of track adjustment ratchets at the end of the slip
- Installation of brackets to hold down the track at the end of the slip
- Installation of new dolphin and catwalk for the Winch No. 4 block on Marginal Wharf
- Replacement of fendering on the mooring dolphin
- Evaluation of support towers and cables to determine if the ramp is too heavy
- Reduction of ramp weight and removal of extra weights from counterweights if required
- Installation of new waler, coating, and tiebacks:
  - On tower cells
  - On bulging sheet pile wall north and south of the slip
- Electrical repairs
- Repair of the slip abutment pile cap
- Removal and replacement of all ties
- Removal and replacement of the transfer span deck
- Cleaning and coating of the transfer span steel while the deck is removed
- Addition of pressure rollers and a better tensioning system to improve the winch line performance
- Dredging of the shore end of the Barge Slip basin

- Replacement of wire ropes
- Replacement and servicing for winches
- Replacement of winch controls and feeder panels
- Replacement of Winch No. 3 underground feed
- Replacement of deteriorated conduits and wiring
- Other miscellaneous maintenance and repair

Rail Yard. The rail yard improvements discussed below are needed to improve efficiency of operations.

Storm Drainage System. Improvements are needed to accommodate storm water runoff control and snow removal within the rail yard. A conceptual study was performed in 2002 to determine general grading and possible improvements. A more detailed plan should be prepared with particular attention paid to the proposed track realignment effort and how it relates to storm water infrastructure design. Current Alaska Department of Environmental Conservation requirements must be followed in the preparation of drainage improvements.

Paving of the rail yard offers the potential of reducing sedimentation problems; however, some type of treatment would be required to deal with increased runoff before the storm water could be discharged to a water body. Other means of reducing sedimentation in the storm drain system might include (1) the use of a more durable aggregate in the surfacing material or (2) providing a concrete apron around catch basins. Either option would help reduce the amount of sediments pushed into the catch basins during grading operations. Any upgrades or changes to the existing storm drainage system within the rail yard must be thoroughly coordinated with proposed track alignment upgrades.

Track Layout and Realignment. Realignment of several tracks in the rail yard is needed to improve the offloading of barge freight and improve the ability of equipment to maneuver. The recommended track realignment is shown in Figure 3.

Security. A detailed analysis is needed to create a comprehensive program that can address security needs at the Whittier facilities of the ARRC.

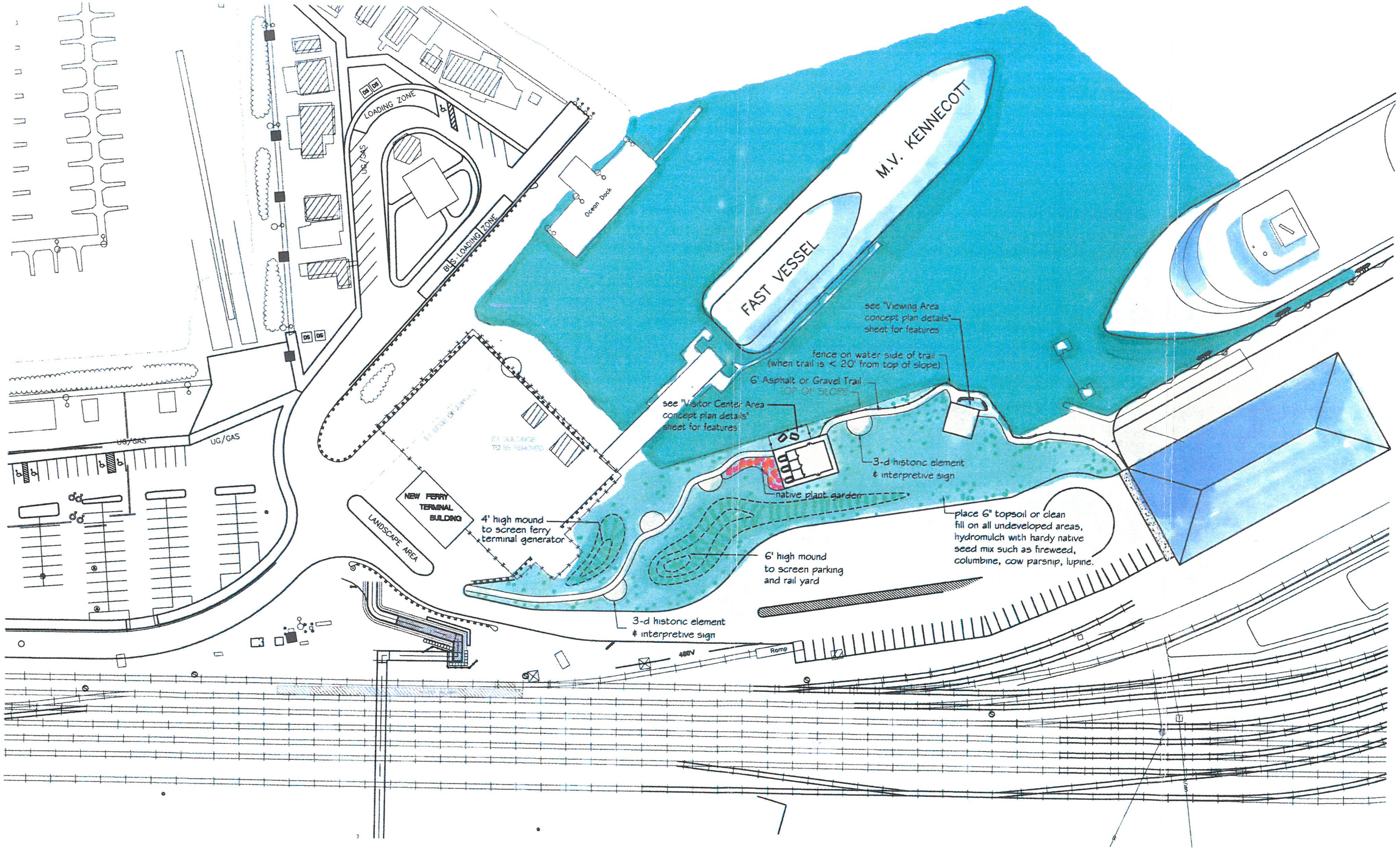
7.4 POTENTIAL IMPROVEMENTS

The following major enhancements are recommended to position the ARRC to meet the needs that resulting from future growth in cruise ship traffic, associated rail passenger volumes, and freight. Associated costs are provided in Table 2.

Passenger Terminal. A passenger terminal and train loading shelter, as shown in Figure 3, would support anticipated growth in cruise ship traffic and supplement the proposed dock development. The passenger terminal would be constructed to handle loading and offloading of large cruise ships and would include space for passenger staging, baggage handling, office and counter space for cruise lines and airlines, and accommodations for vehicle parking and bus staging. The proposed development would also include a 500-foot long passenger train loading facility adjacent to the terminal. This covered loading area would provide two tracks to accommodate immediate loading of two passenger trains.

Pedestrian Enhancements. The U.S. Forest Service has approached the ARRC about the potential of enhancing the waterfront area, adjacent to the proposed passenger terminal, with a small visitor center. The visitor center would accommodate small groups and would include informational kiosks, outdoor viewing platforms, and restroom facilities. The proposed layout of the visitor center is shown in Figure 3. Figures 4 and 5 present examples of potential developments.

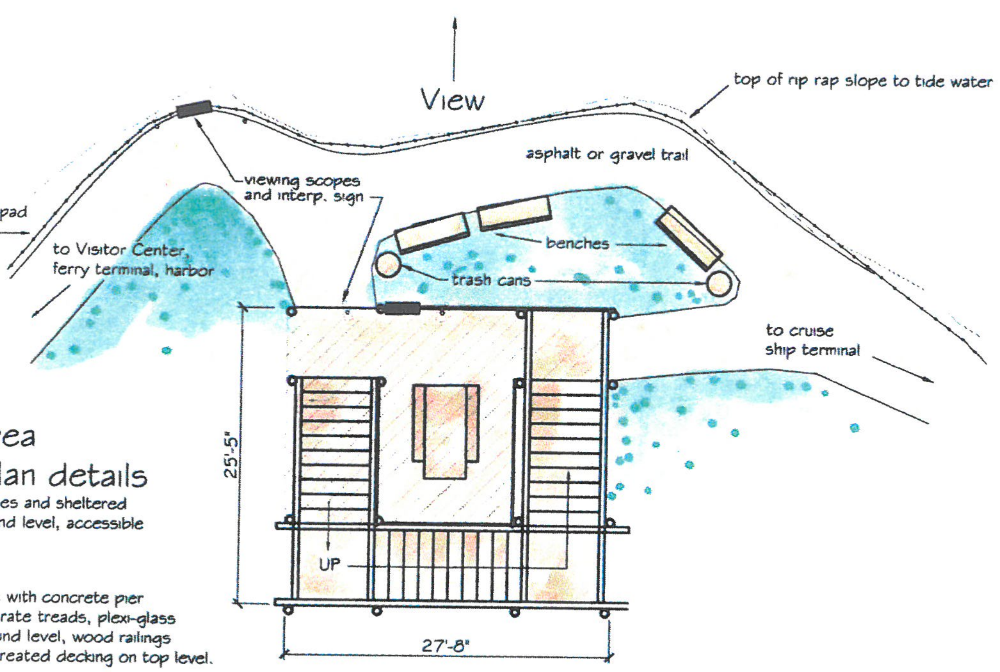
The ARRC should work with the Forest Service to explore participation in these pedestrian amenities.



ALASKA RAILROAD CORPORATION
OFFICE OF THE CHIEF ENGINEER
P.O.BOX 107500, ANCHORAGE, ALASKA 99510-7500 (907) 265-2456

PROJECT:
WHITTIER INTERMODAL DEVELOPMENT

TITLE:
FIGURE 4
POTENTIAL US FOREST SERVICE ENHANCEMENT



Viewing Area concept plan details

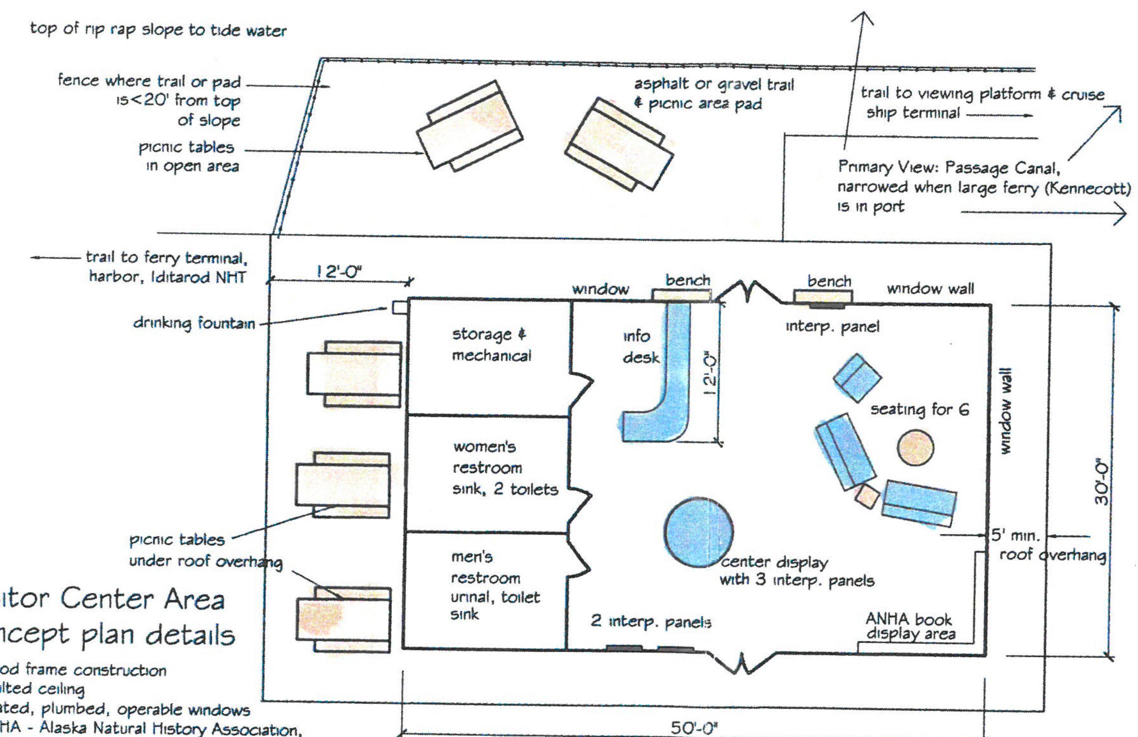
View scopes, benches and sheltered picnic table on ground level, accessible along trail.

Viewing Platform:
wood pole structure with concrete pier foundations, metal grate treads, plexi-glass wind screen for ground level, wood railings all levels, pressure treated decking on top level.

Ground Level:
shelter central area from wind & rains while allowing as much light/views as possible.

Stairs:
3 sets of risers, 6' wide
with 4' - 5' height between landings

Top Deck:
hatched area on plan
12' - 15' above grade
view scopes, interpretive sign
benches



Visitor Center Area concept plan details

wood frame construction
vaulted ceiling
heated, plumbed, operable windows
ANHA - Alaska Natural History Association,
(sells books and related items)
seating area for people to browse books and enjoy view
Interpretive Topics: natural history, area info/orientation,
Iditarod National Historic Trail, local history.
Site could be Whittier terminus of Iditarod
National Historic Trail (INHT)

ALASKA RAILROAD CORPORATION
OFFICE OF THE CHIEF ENGINEER
P.O.BOX 107500, ANCHORAGE, ALASKA 99510-7500 (907) 265-2456

PROJECT:
WHITTIER INTERMODAL DEVELOPMENT

TITLE:
FIGURE 5
POTENTIAL US FOREST SERVICE VISITOR CENTER