February 26, 2019

Executive Committee

Program Design Requirements

Presentation Overview

- Codes and Standards
- Port of Alaska Requirements
- Tenant Requirements
- Questions

What is a requirement?

- The current directives and criteria the program is following to implement the improvements on behalf of the MOA, POA, and the tenants.

February 26, 2019

Codes and Standards

Role of the Geotechnical Advisory Commission

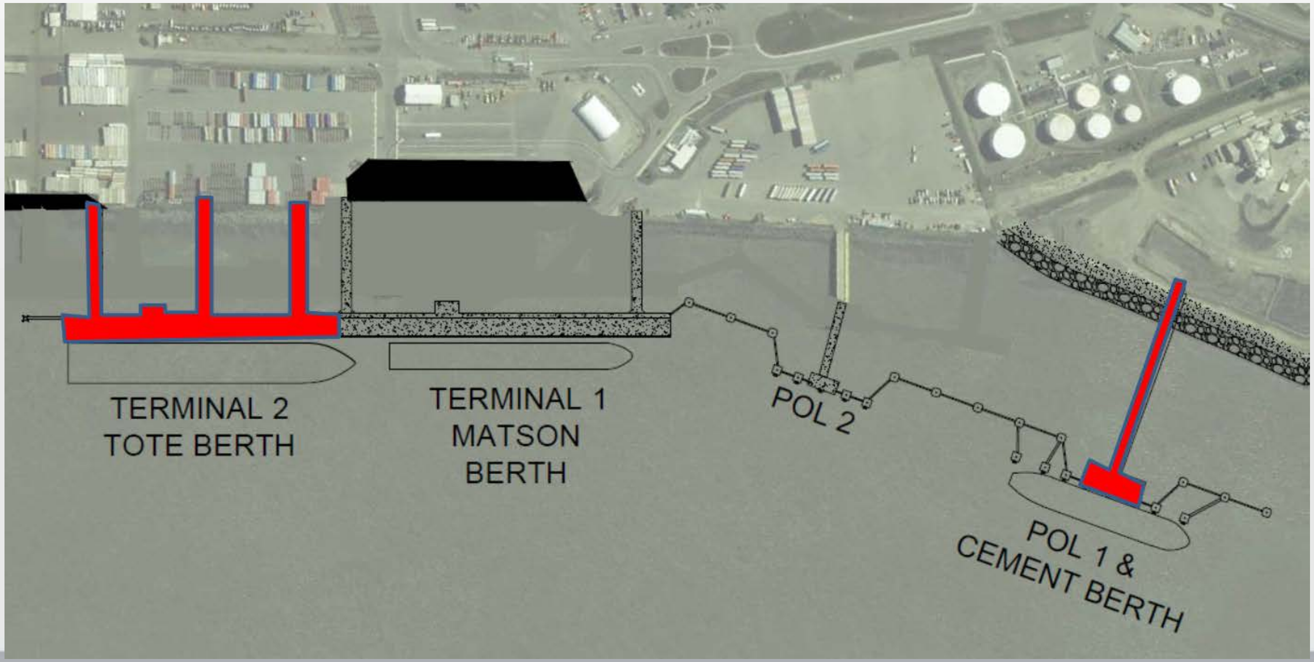
- The Geotechnical Advisory Commission (GAC) acts in an advisory capacity to the Assembly, Mayor, municipal departments, Planning and Zoning Commission, Platting Board, Building Board, Building Safety, and the professional design community by providing professional advice on issues relating to natural hazards risk mitigation.
- The GAC recognized the importance of the POA to the Alaskan economy and recommended more stringent design requirements were needed
- They were concerned that the state is so reliant on the POA that at least two berths should be designed for an uninterruptable supply chain.

GAC Letter 9-23-14

- At a minimum, one container dock and one petroleum, oil and lubricants (POL) dock should be designed for "minimal damage" at the Contingency Level (CLE) ground motions, and "controlled and repairable damage" at the Design Earthquake (DE) ground motions. These structures are referred to as the "seismic berths".

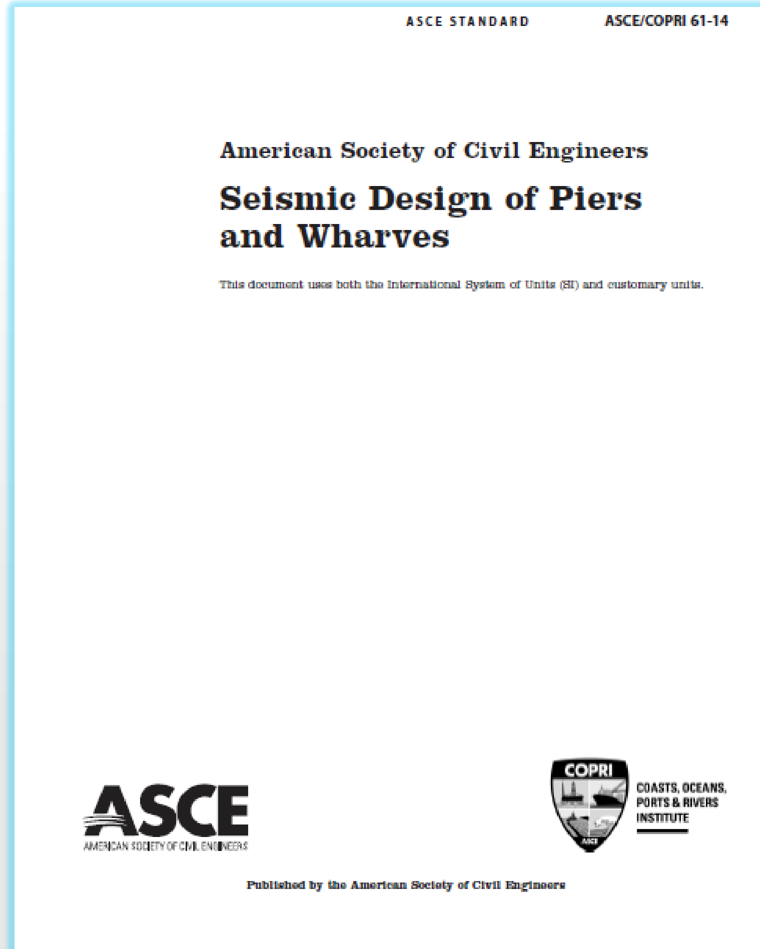
Seismic Program for POA

- Terminal 2 and PCT designed as “Seismic Berths” to provide container, fuel and petroleum service within 7-10 days of major earthquake.
- Terminal 1 and PT designed to provide life safety during the major earthquake



Seismic Requirement Source – ASCE 61-14

- State of the Practice Earthquake Design Code for Ports
- Provides three levels of EQ performance criteria (OLE, CLE, DE)
- All three EQ levels are considered in design.



ASCE STANDARD ASCE/COPRI 61-14

American Society of Civil Engineers

Seismic Design of Piers and Wharves

This document uses both the International System of Units (SI) and customary units.

ASCE AMERICAN SOCIETY OF CIVIL ENGINEERS

COPRI COASTS, OCEANS, PORTS & RIVERS INSTITUTE

Published by the American Society of Civil Engineers

PGA compared to 1964 Earthquake

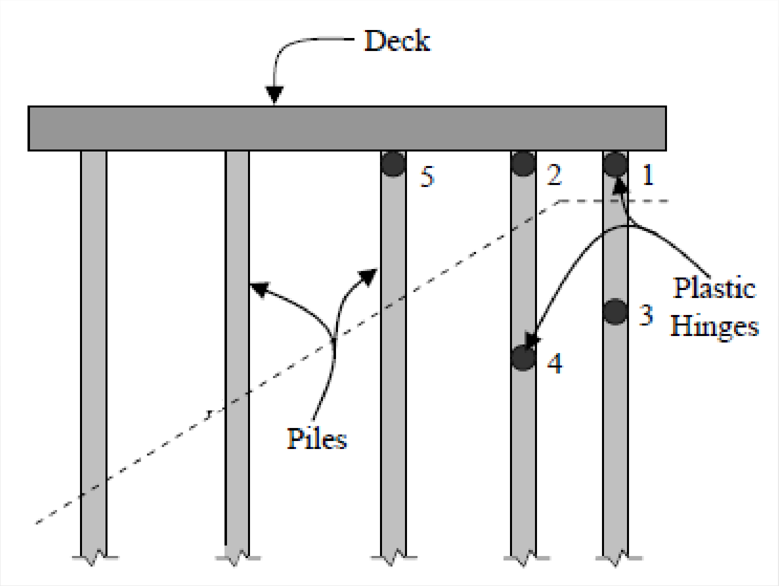
Table 1-1. Peak Ground Acceleration – APMP

Location	Seismic Hazard Level	Return Period	Peak Ground Acceleration (g)
Trestles	OLE	72 year	0.14
	CLE	475 year	0.31 (+29%)
	DE	1,000 year	0.39 (+63%)
Wharves	OLE	72 year	0.23 (approx. equal)
	CLE	475 year	0.38 (+58%)
	DE	1,000 year	0.45 (+88%)
1964 Alaska Earthquake (areas around Anchorage)			0.18-0.24[a]

[a] Estimated ground acceleration around Anchorage area. (USGS, 2008)

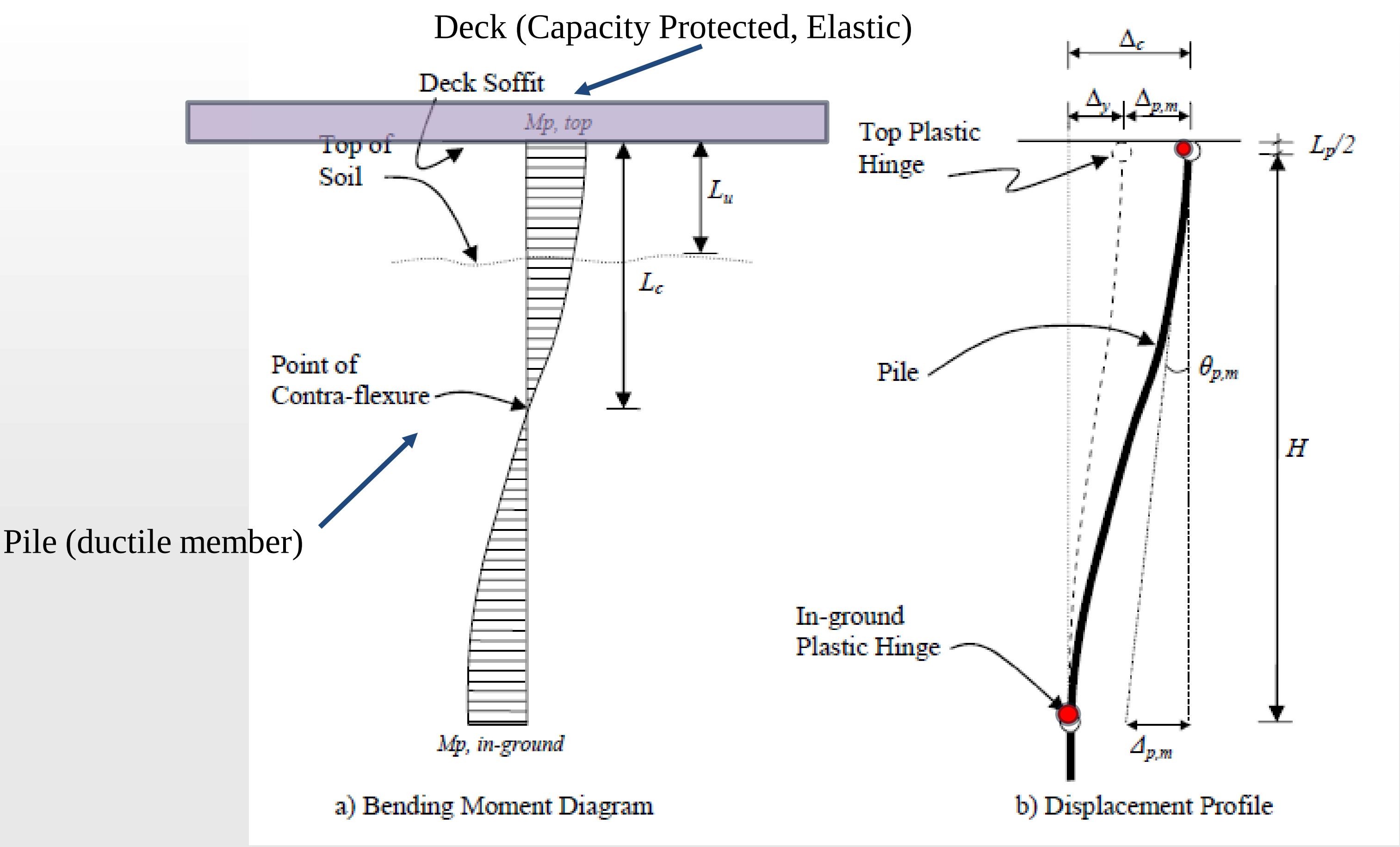
Earthquake Resistance

Deck Designed to Remain Elastic



Piles design absorb energy by forming plastic hinges

Earthquake resistance for pile supported docks

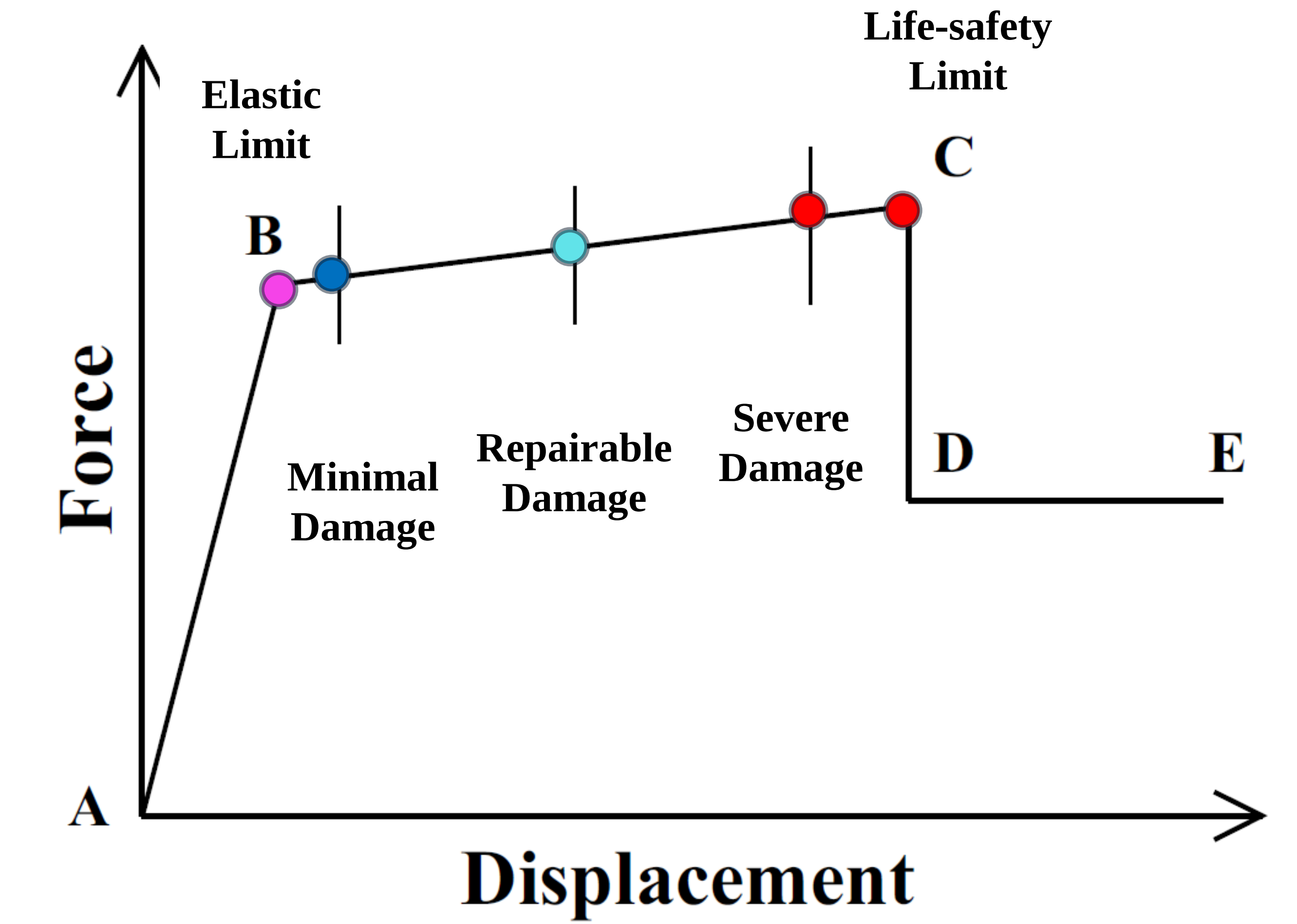


Damage States and Performance Levels

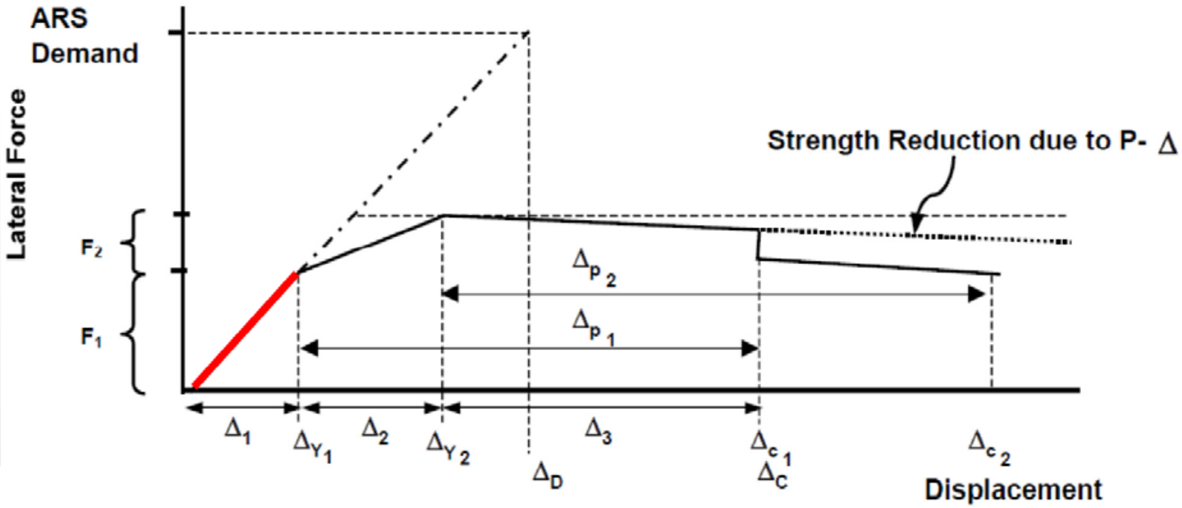
Minimal Damage OLE	Controlled and Repairable Damage CLE	Life Safety Protection DE
		
Initial cracking and spalling of the pile and/or deck	Substantial spalling of the pile and the deck in the vicinity of the pile thereby exposing reinforcement in the pile and the deck	Broken connection from either spalling into the core, fractured dowel bars or buckled strand.

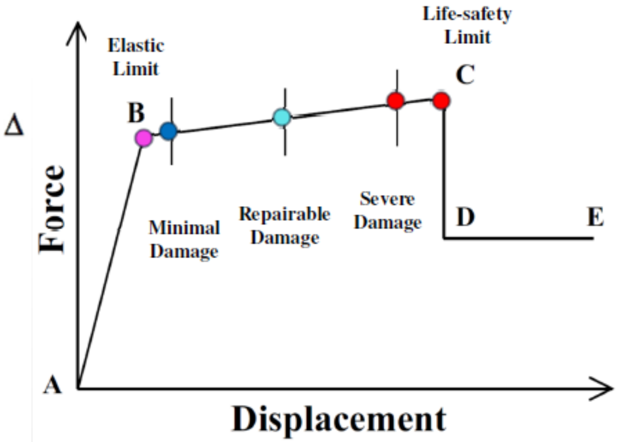
Ref: ASCE COPRI 61-14 (2014)

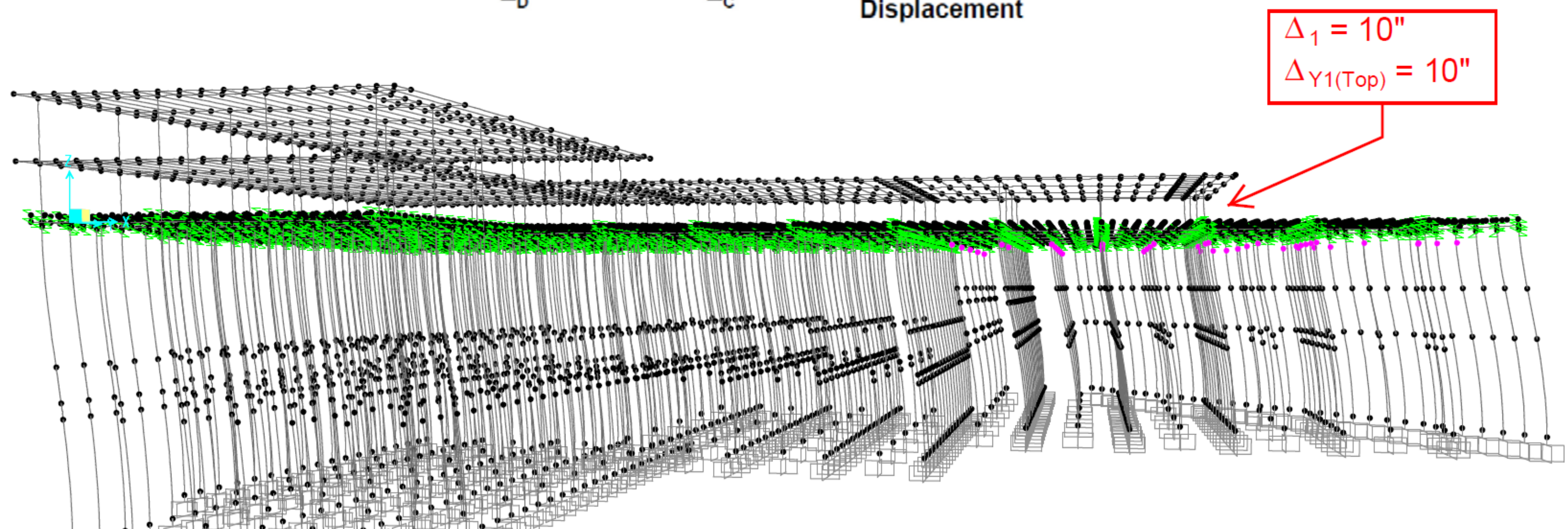
Performance Levels



Example: Minimal Damage

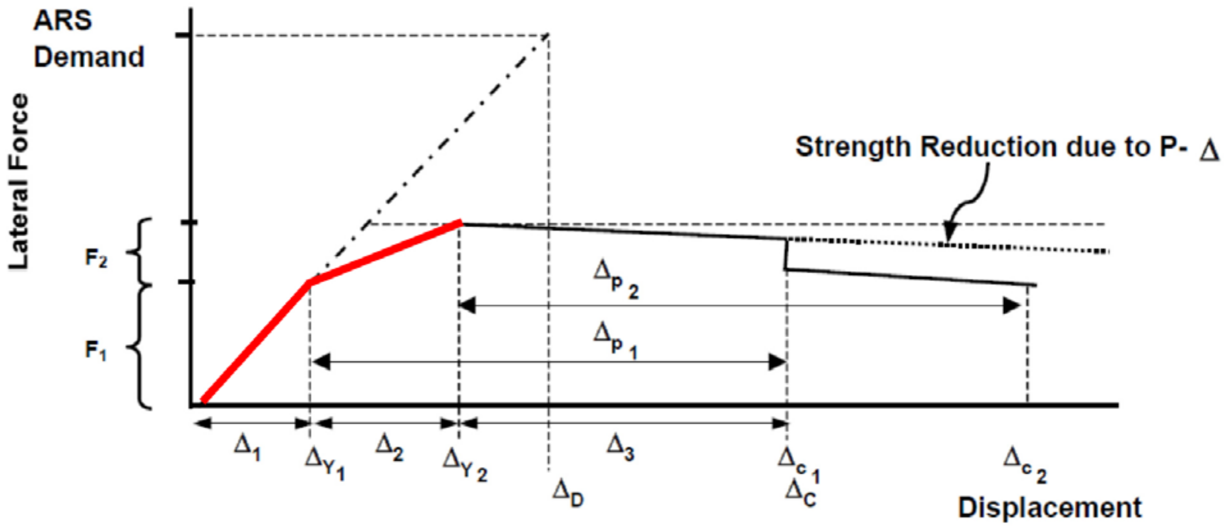


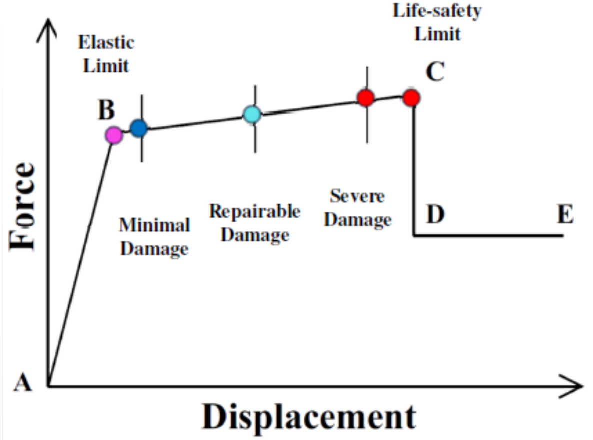


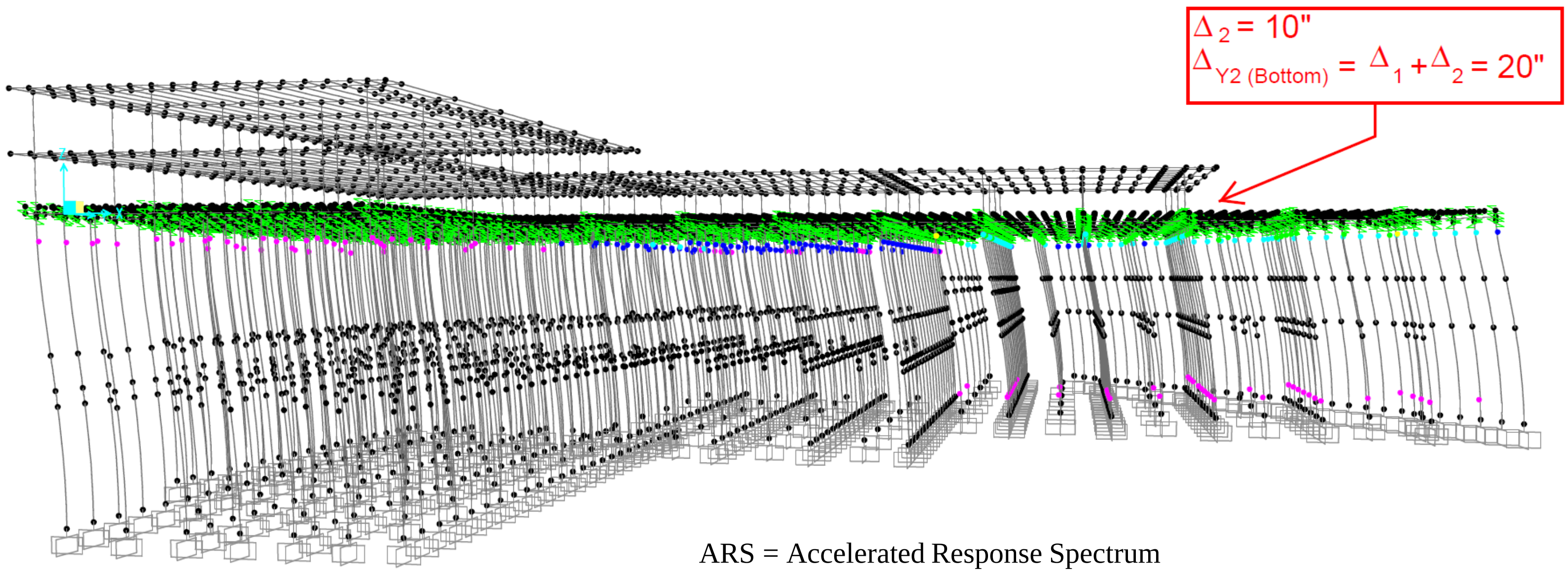


ARS = Accelerated Response Spectrum

Example: Controlled and Repairable

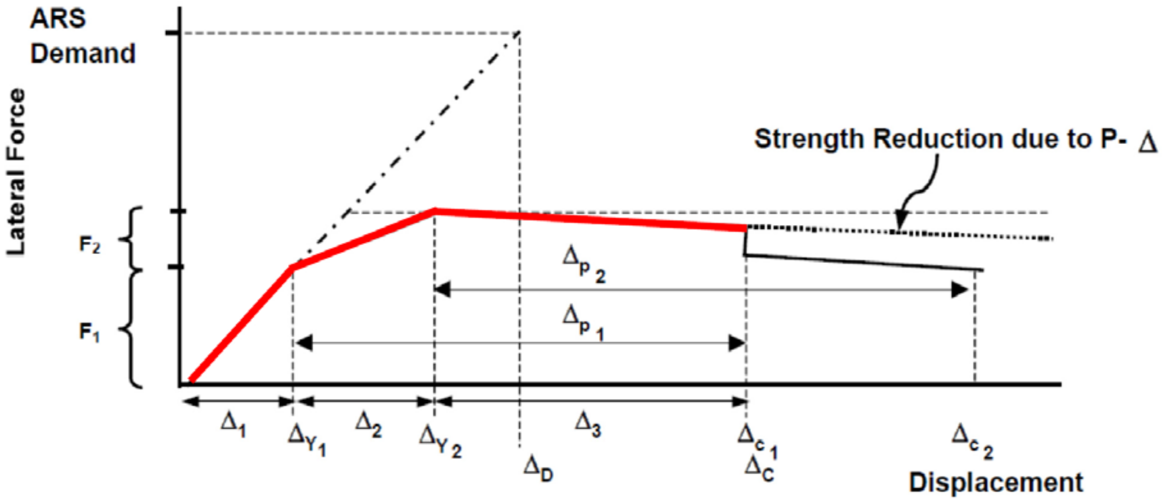


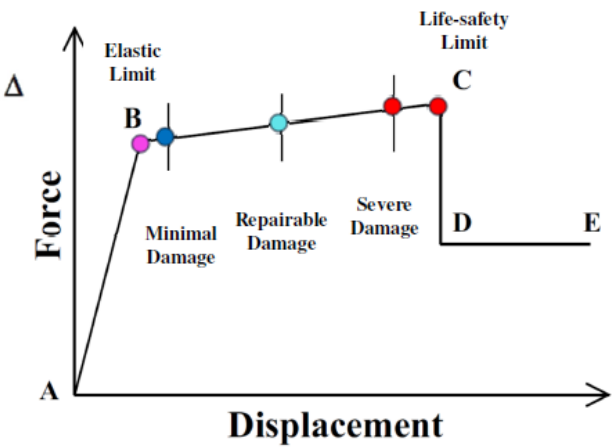




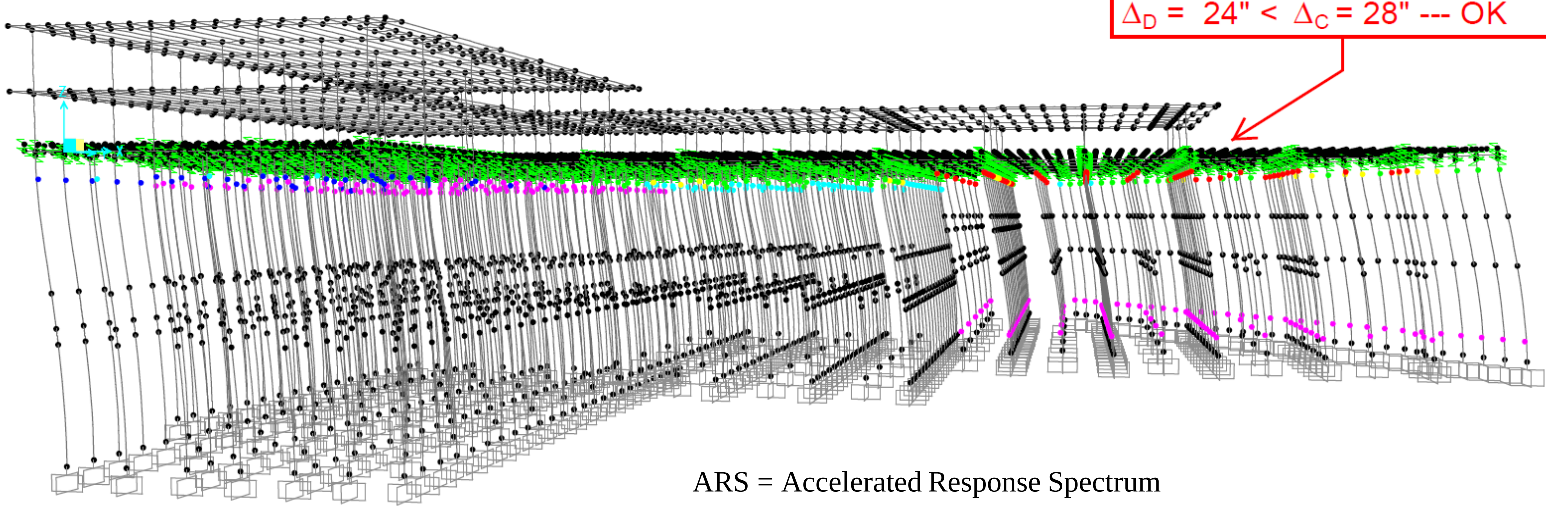
ARS = Accelerated Response Spectrum

Example: Severe Damage (life safety)





Δ_3 = 8"
$\Delta_{P1\ (Top)}$ = … = 18"
Δ_C = Δ_1 + … 28"
Δ_D=23”
Δ_D = 24" < Δ_C = 28" --- OK



ARS = Accelerated Response Spectrum

GAC Letter 9-23-14

- The GAC advises that the definition of "controlled and repairable damage" should be adjusted to mean damage which is feasibly repairable within several days to one week of the seismic event, and contingencies, plans and materials for the repair are to be included in the design to reduce response time. The GAC also recommends that the performance of the new port elements should consider the effects on repair and/or reconstruction schedules if a major earthquake occurs during the winter.

The GAC requirements effectively convert "life safety" requirement to "minimal damage"

Post Design Earthquake Structural Condition

- PCT and T2 are designed to “minimal damage” and will be functional within 7-10 days with minimal repair
- T1 and PT are designed to “life safety” will be severely damaged and unable to be put back in service for extended period of time.

Code Requirement 1- PCT and T2 Seismic

	Current Requirement	Current Requirement Source	Minimum Requirement	Minimum Requirement Source
OLE	Minimum Damage - 7-10 day repairable	COPRI 61-14 & ASCE 7-10 & GAC	Minimum Damage - 7-10 day repairable	COPRI 61-14 & ASCE 7-05
CLE	Minimum Damage - 7-10 day repairable	COPRI 61-14 & ASCE 7-10 & GAC	Controlled and Repairable Damage – Several months to repair	COPRI 61-14 & ASCE 7-05
DE	Minimum Damage - 7-10 day repairable	COPRI 61-14 & ASCE 7-10 & GAC	Life Safety – Year or more to repair	COPRI 61-14 & ASCE 7-05

Minimal Damage OLE	Controlled and Repairable Damage CLE	Life Safety Protection DE
		
Initial cracking and spalling of the pile and/or deck	Substantial spalling of the pile and the deck in the vicinity of the pile thereby exposing reinforcement in the pile and the deck	Broken connection from either spalling into the core, fractured dowel bars or buckled strand.

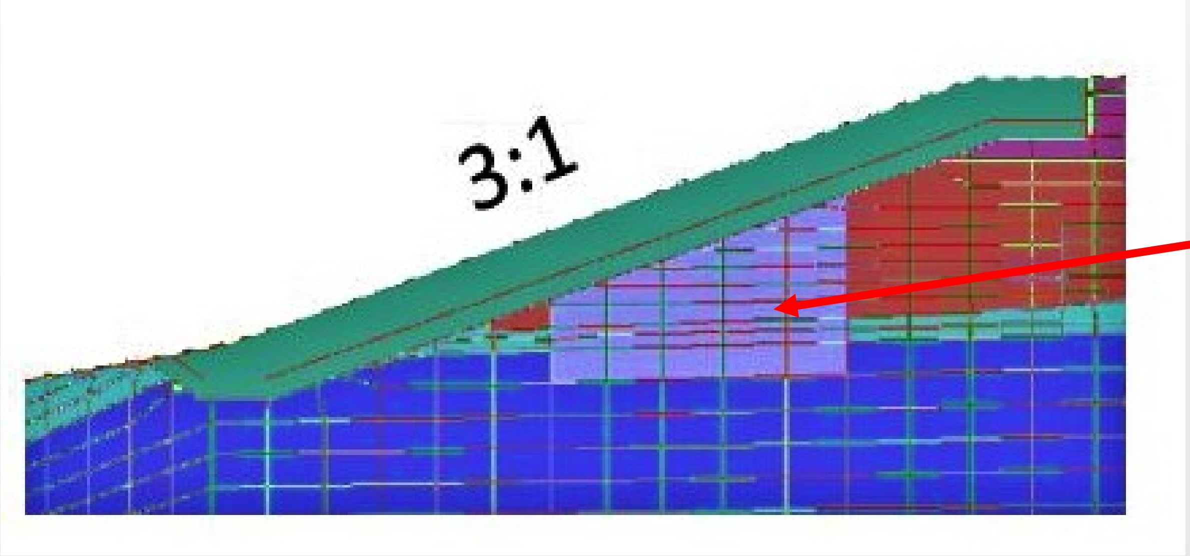
Code Requirement 1 – Design to minimum

	Operational Considerations	Life-cycle Considerations	Potential Cost Reduction
PCT	Not operable within 7-10 days, repairable in years	Requires extensive repairs after DE – prolonged outage	10%-20% material reduction in piles and deck cost

Minimal Damage OLE	Controlled and Repairable Damage CLE	Life Safety Protection DE
		
Initial cracking and spalling of the pile and/or deck	Substantial spalling of the pile and the deck in the vicinity of the pile thereby exposing reinforcement in the pile and the deck	Broken connection from either spalling into the core, fractured dowel bars or buckled strand.

Code Requirement 2- NES Seismic

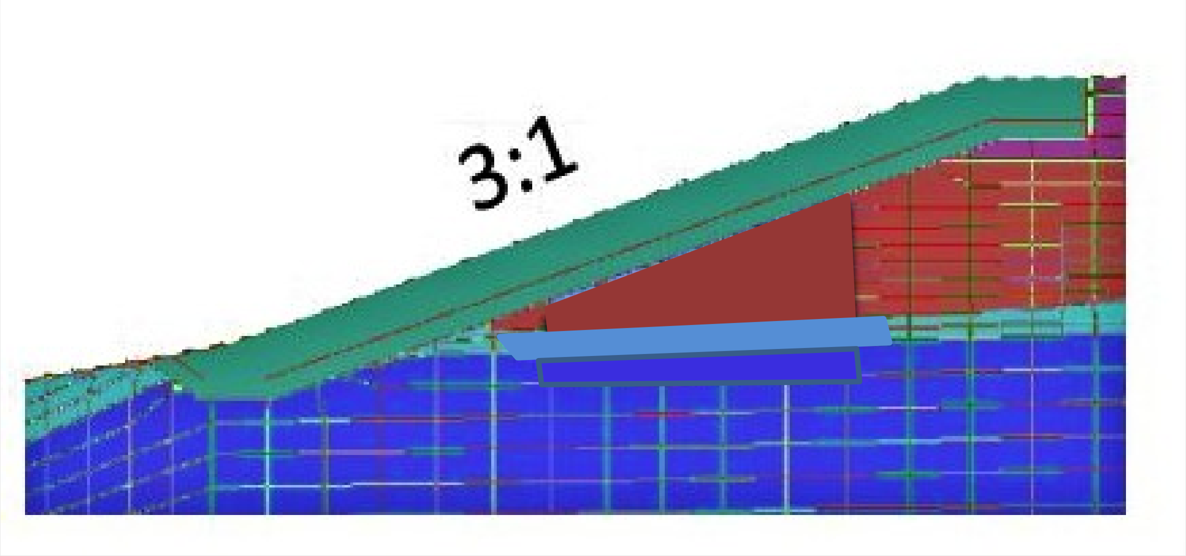
	Current Requirement	Current Requirement Source	Minimum Requirement	Minimum Requirement Source
NES	NES seismic requirements - < = 18-inch deformation for 50ft from crest, FS: Design > = 1.5, Operational > = 1.3, EQ > = 1.1	POA	Allow embankment slope failure	None



Ground Improvements and armoring to protect slope from seismic failure

Code Requirement 2 – Design to minimum

	Operational Considerations	Life-cycle Considerations	Potential Cost Reduction
NES	Do not store valuable assets within 100' of embankment crest	Would require extensive repairs after DE EQ if lost land deemed important. Ground improvements could be postponed and accomplished in future	Cost for ground improvements is \$11.6M for NES1 and \$10.6M for NES2.



Do not install ground improvements and accept slope failure

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Port of Alaska Requirements

POA Requirement 1: Design life

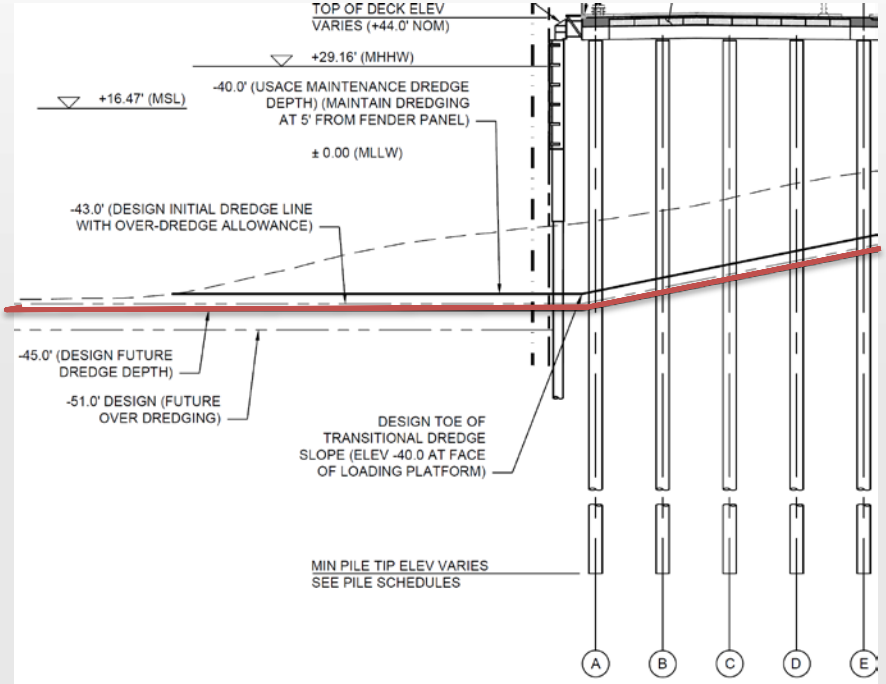
Current Requirement	Current Requirement Source	Minimum Requirement	Minimum Requirement Source
75 years	Program Charter – POA, based on current bridge design codes (AASHTO)	None- 50 years is common	Accepted practice in major west coast ports

POA Requirement 1: Design Life Reduction

Operational Considerations	Investment Costs	Life-cycle Considerations	Potential Cost Reduction
May require additional maintenance at end of project life due to component limitations	Lower investment costs on pile material thickness and superstructure thickness.	Need to program for replacement 25-years earlier	Would require modelling to determine but likely material costs savings

POA Requirement 2: Dredge depth

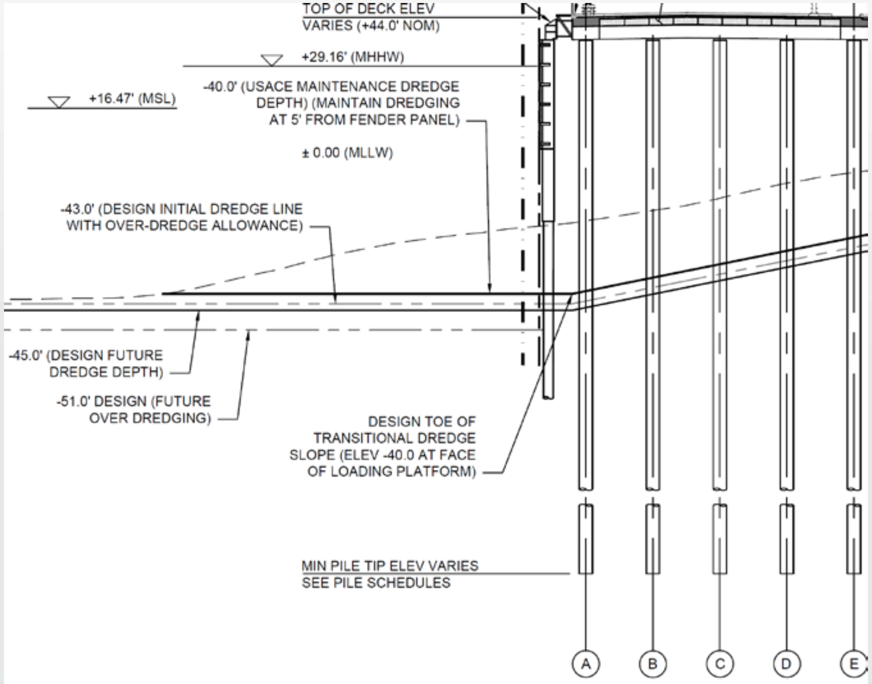
	Current Requirement	Current Requirement Source	Minimum Requirement	Minimum Requirement Source
Dredge depth	-45 MLLW	POA	Current dredge depth is -35 MLLW	USACE Anchorage Harbor Dredging Project



Largest impact on PCT, less impactful on berths to the north as existing depth is -42' MLLW

POA Requirement 2: Reduce dredge depth

Operational Considerations	Investment Costs	Life-cycle Considerations	Potential Cost Reduction
Status Quo - Draft restrictions on some tide regimes	Lower investment costs on pile material thickness, pile height, superstructure thickness, reinforcing steel	Potential future for cutoff if harbor is deepened.	Savings would be negligible on remaining structures.



POA Requirement 3: Ice Loading

Current Requirement	Current Requirement Source	Minimum Requirement	Minimum Requirement Source
Structural modeling includes the weight of the ice that is frozen to the piling. The added mass is assumed to be 3 feet thick all around the piling . Using a 4' piling for example the ice diameter is a total of 10 feet.	POA/PMC	Need POA and GAC on concurrence on reduced standard	None

The size of the adhered ice is important as it adds significantly to the mass of the piling which then add to the forces imparted by the EQ.

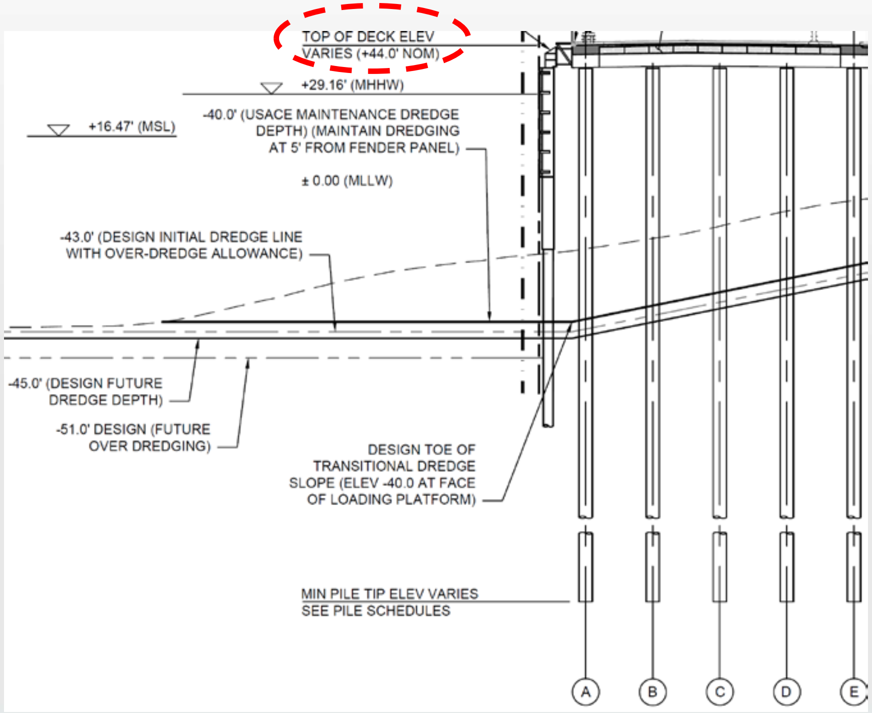
POA Requirement 3: Reduce ice loading

Operational Considerations	Investment Costs	Life-cycle Considerations	Potential Cost Reduction
None	Lowering the ice loading would lower the cost of the structure by reducing the load from the EQ	If the EQ occurs in a severe winter the ice may be greater than that used in the structural modeling	Lower ice loading would decrease seismic mass and potentially decrease piling and deck thickness by a few percent

Additional study would need to be performed and accepted by the POA and potentially GAC to confirm that reducing the ice loading is prudent.

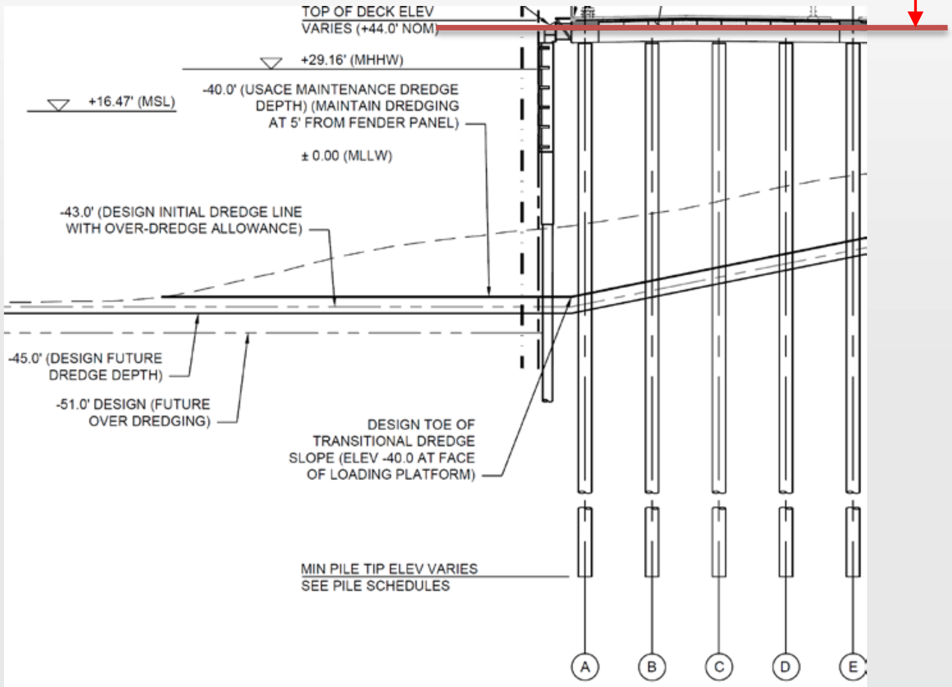
POA Requirement 4: Predicted Sea Level Rise

Current Requirement	Current Requirement Source	Minimum Requirement	Minimum Requirement Source
Deck heigh at +44 MLLW to meet 500 yr storm surge and Federal modeled sea level rise.	POA/FEMA	Maintain current terminal elevations of +40 or design for 500 year storm surge of +39.	UFC Criteria #2 for 500 year storm surge



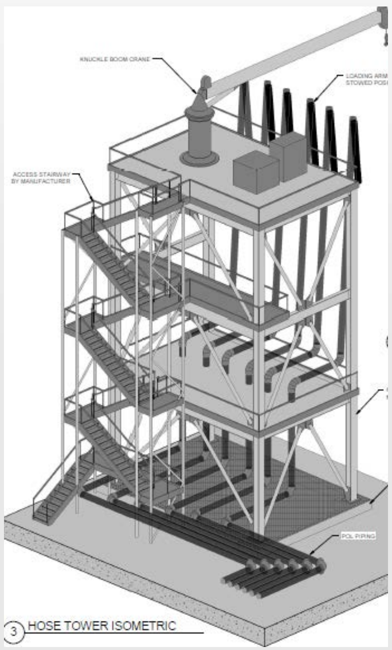
POA Requirement 4: Reduce sea level predictions

Operational Considerations	Investment Costs	Life-cycle Considerations	Potential Cost Reduction
Same as current operations	May lose FEMA grant	May experience overtopping of structure near end of design life	Lowering platform elevation saves piling material costs

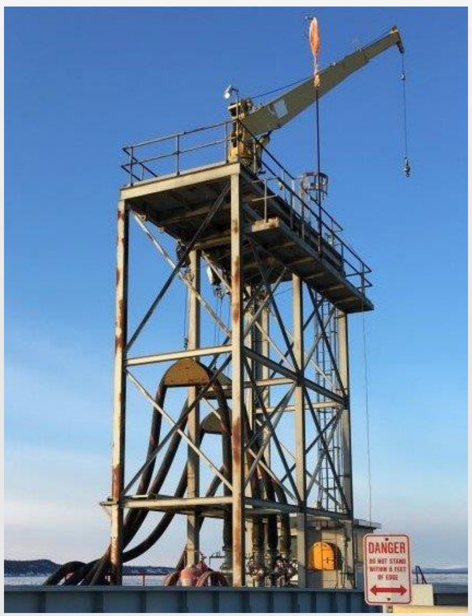


POA Requirement 5: Hose Tower

Current Requirement	Current Requirement Source	Minimum Requirement	Minimum Requirement Source
Design and construct new hose tower on PCT and PT	POA	Reuse existing tower	Current conditions at POA

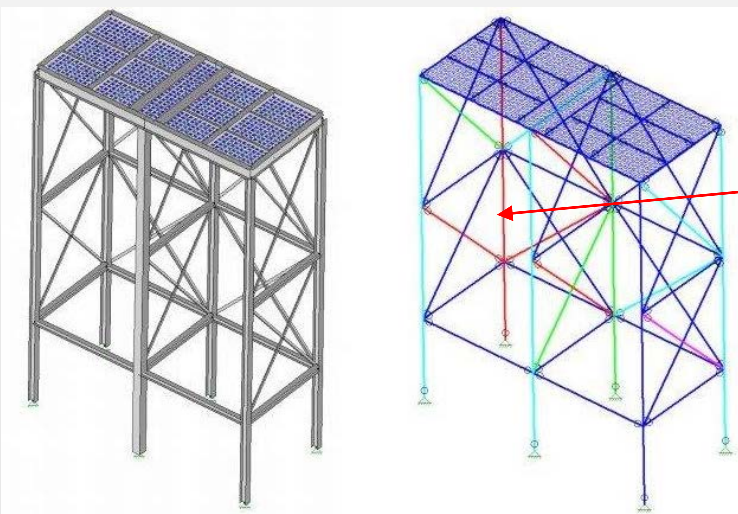


A new modern hose tower is proposed to replace the existing tower shown at right.

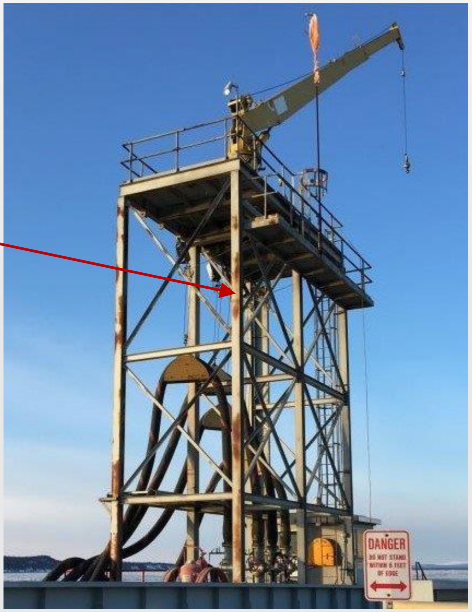


POA Requirement 5: Relocate Existing Hose tower

Operational Considerations	Investment Costs	Life-cycle Considerations	Potential Cost Reduction
New hose tower has quick disconnect feature. Existing hose tower is seismically vulnerable	Relocating would cost less however the risk of failure is greater	Existing hose tower will need additional maintenance	Saves cost of new hose tower, approximately $6.2M for each hose tower

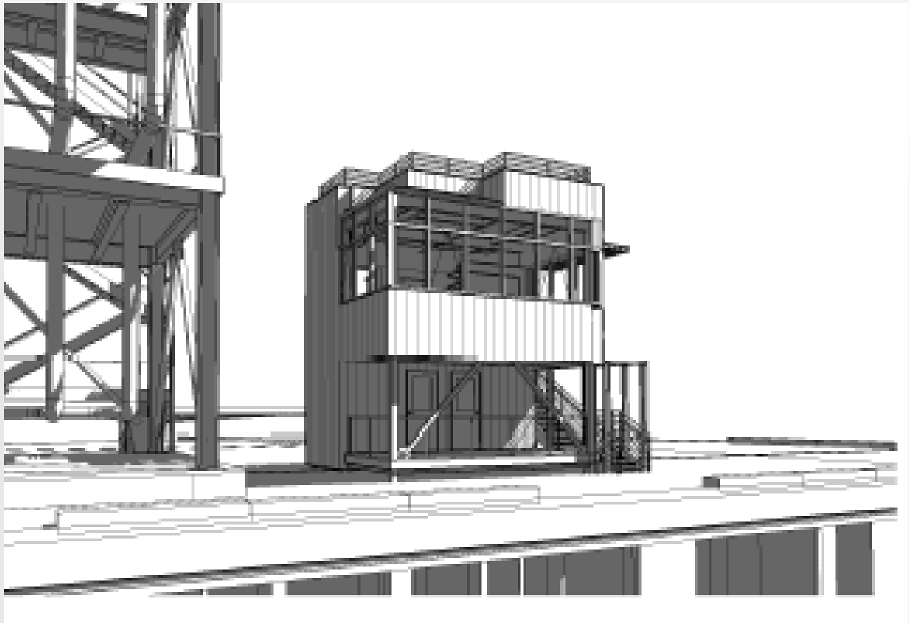


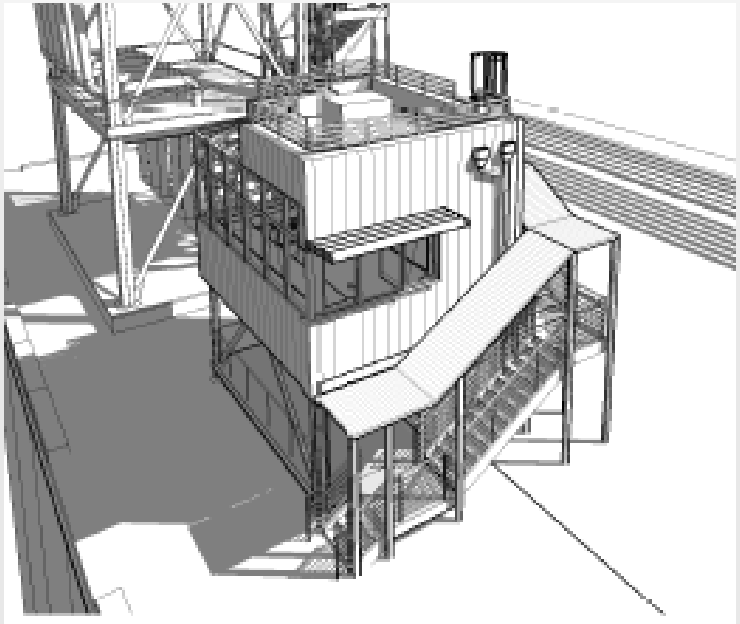
Modeling shows some members are seismically vulnerable.



POA Requirement 6: Operations Cabin

	Current Requirement	Current Requirement Source	Minimum Requirement	Minimum Requirement Source
Operations Cabin	Design and construct new operations cabin on PCT	POA	Reuse existing station	Current conditions at POA





POA Requirement 6: Relocate Existing Cabin

Operational Considerations	Investment Costs	Life-cycle Considerations	Potential Cost Reduction
Existing cabin’s users say it is undersized to support the extended periods required for year round petroleum transfer operations	Would need to update for Division 1 Electrical Code	Existing cabin will need additional maintenance	Saves cost of new cabin, approximately $3.5M each cabin

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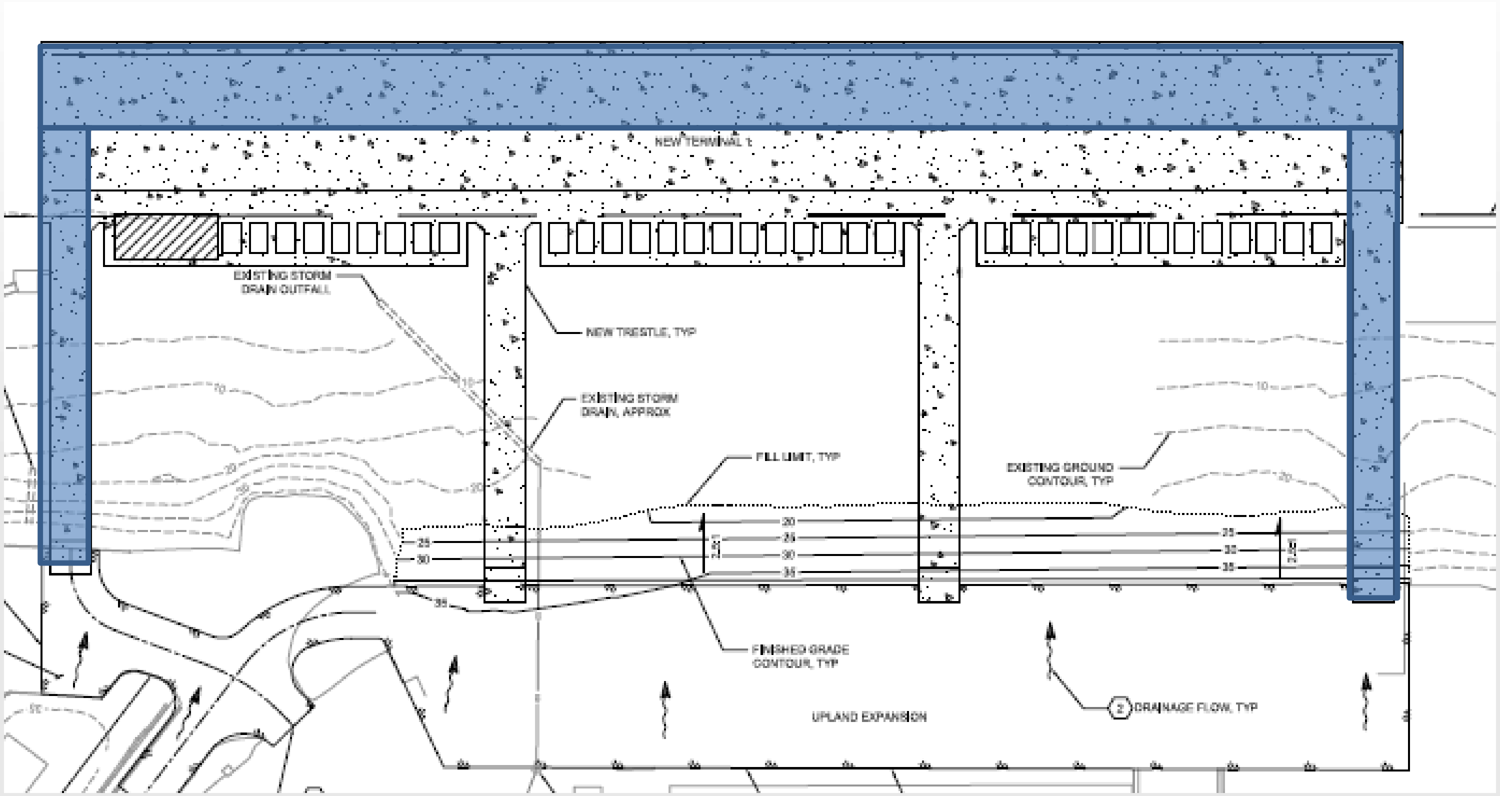
Tenant Requirements

Overview of T1

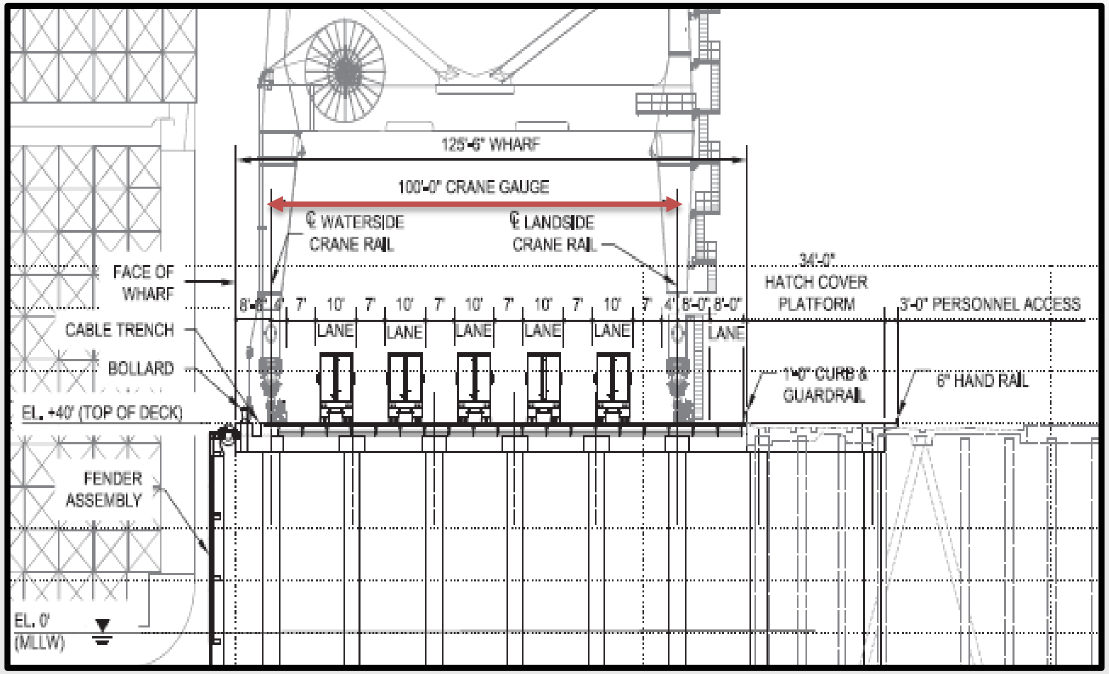
T1 shaded blue area as originally programmed at 75 feet wide for three 50 gage cranes with two trestles.



Tenant Requirement 1A: 100-gage cranes

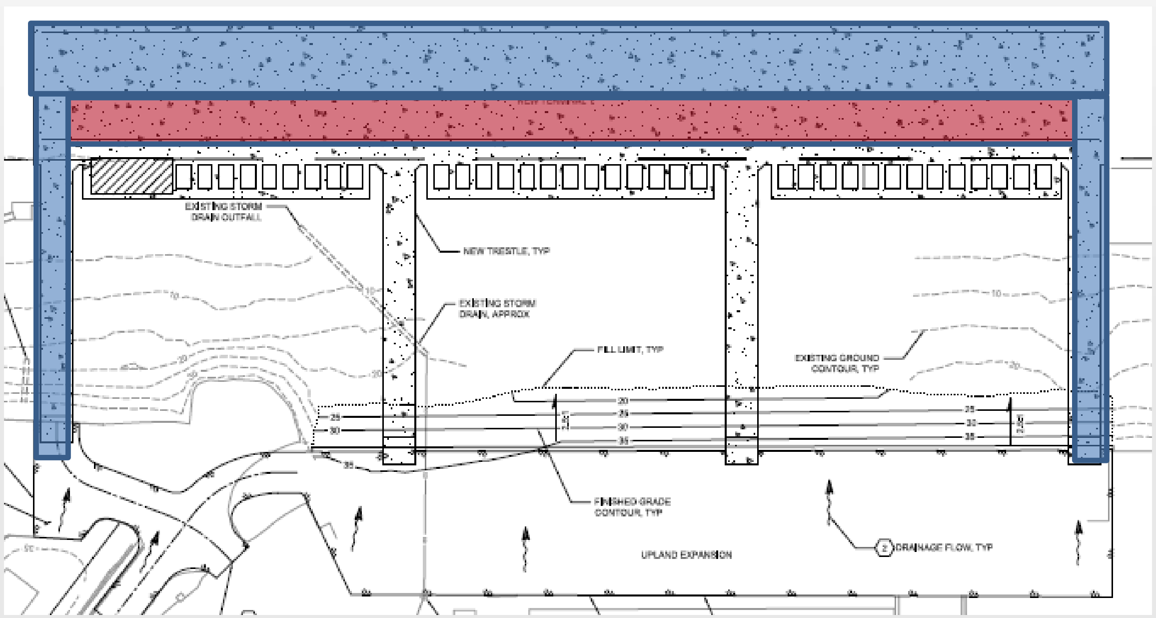
	Current Requirement	Current Requirement Source	Minimum Requirement	Minimum Requirement Source
Cranes size	100-gage cranes on T1	Program Change 7 - Input from Matson	50-gage cranes	Minimum could use existing cranes, however we are recommending minimum of 50 gage cranes to allow some growth in ship size

Rail gage is the distance between the two legs of the crane



Tenant Requirement 1B: Widen T1 to accommodate 100 gage cranes

Current Requirement	Current Requirement Source	Minimum Requirement	Minimum Requirement Source
Widened Wharf 950-ft x 50 ft or 47,500 sq ft with addition of 150 structural piles to support the widened wharf structure	Program Change 7 - Input from Matson	1000-ft x 75-ft or 75,000-sqft	Review required container throughput

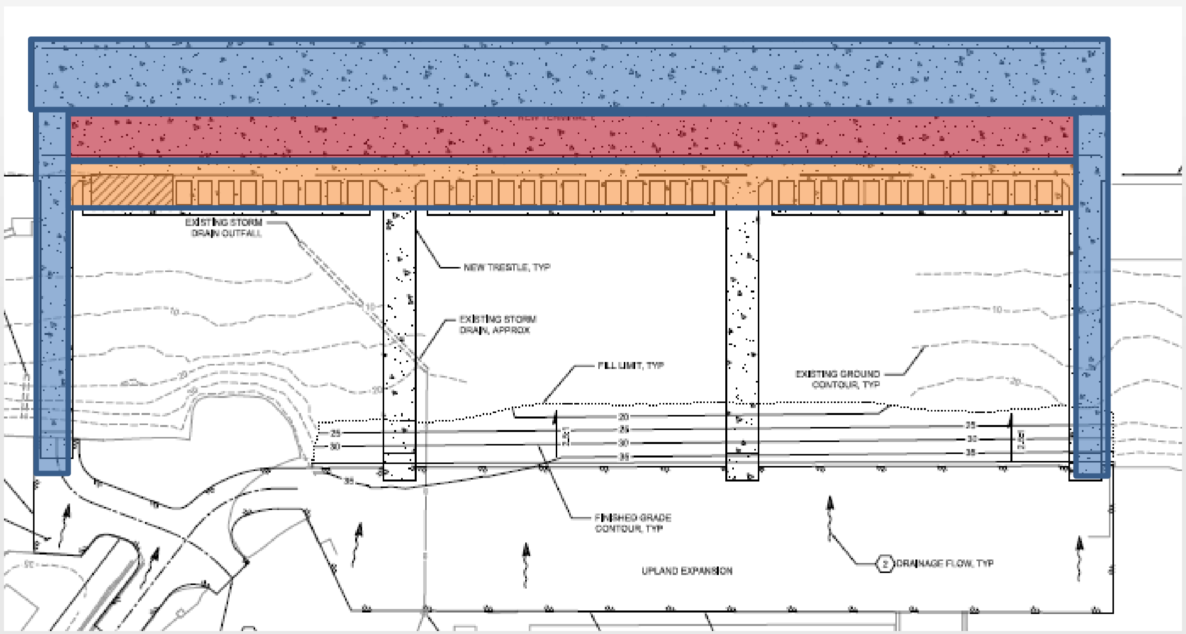


T1 shaded red width to accommodate 100 gage cranes

Increase wharf deck width with additional pile quantity: ECC: $129.4M, TIC: $135.8M

Tenant Requirement 2: Widen wharf to accommodate hatch cover laydown

Current Requirement	Current Requirement Source	Minimum Requirement	Minimum Requirement Source
37-ft x 750-ft (27,750-sqft) open grid hatch cover platform on T1	Program Change 7 - Input from Matson	None	Current Operations

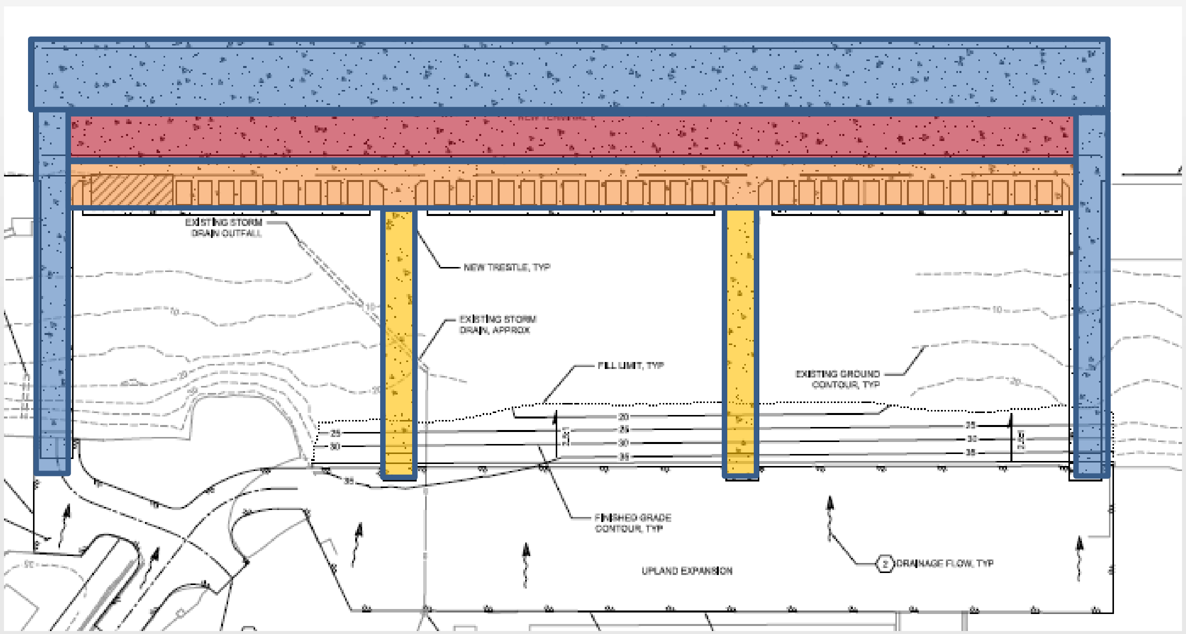


T1 shaded orange width to accommodate hatch cover laydown area

Hatch cover platform superstructure with additional pile quantity: ECC: $29.6M, TIC: $31.1M

Tenant Requirement 3: Provide 4 trestles for T1 container traffic

Current Requirement	Current Requirement Source	Minimum Requirement	Minimum Requirement Source
4 Trestles for T1 to support container traffic	Program Change 7 - Input from Matson	2 Trestles on T1 for container traffic	Minimal operational requirements



T1 shaded yellow shows additional trestles

Two additional container truck trestles superstructure with additional pile quantity: ECC: $23.8M, TIC: $25M

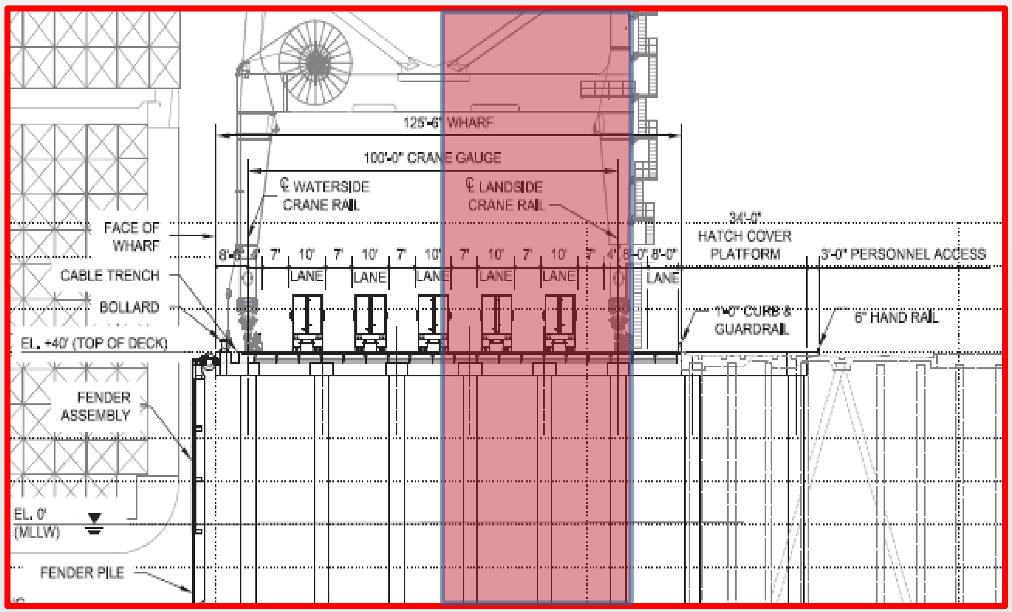
Tenant Requirement 4: Provide 4 Cranes on T1

	Current Requirement	Current Requirement Source	Minimum Requirement	Minimum Requirement Source
Crane #	4 STS cranes on T1	Program Change 7 - Input from Matson	3 STS cranes	Current operations only use 3 cranes.

Tenant Requirement 1: Reduce T1 crane size

Req.	Operational Considerations	Investment Costs	Life-cycle Considerations	Potential Cost Reduction
1A	Lost opportunity for more efficient operations and commonality between other terminals	Less investment cost.	Same between 50 gage and 100 gage cranes	Approximately $4 Million per crane
1B	Lost opportunity for expansion	Less investment cost.	Less wharf and piles to maintain of design life	ECC: $129.4M, TIC: $135.8M

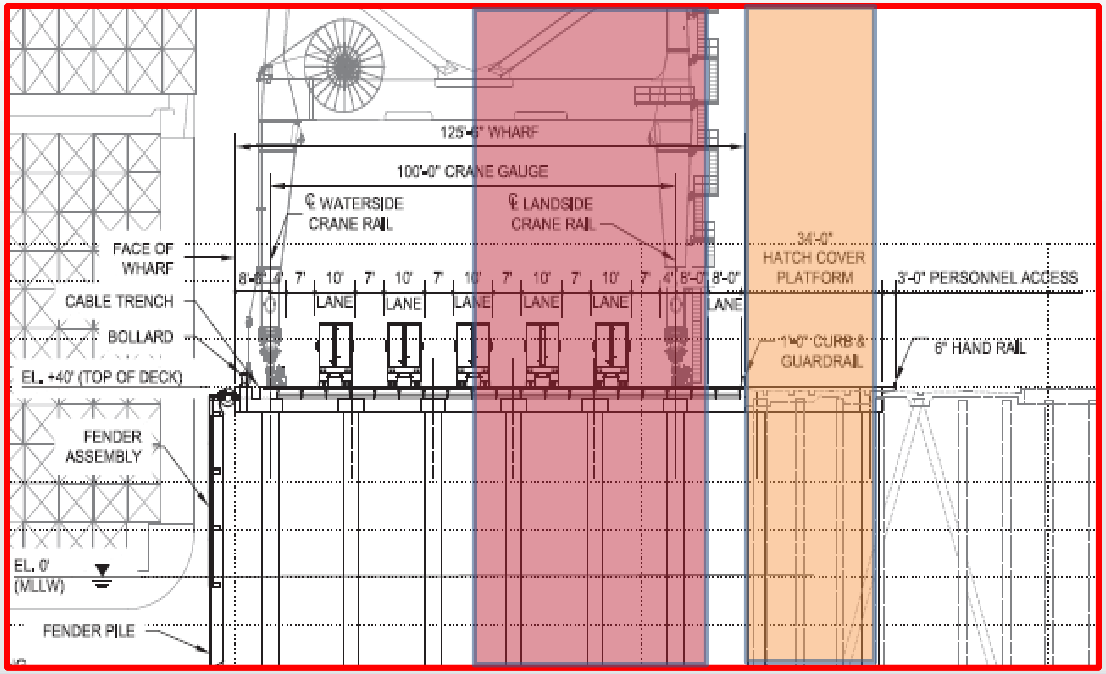
Decreasing rail gage from 100 gage to 50 gage, decreases required width of wharf by 50 feet



Tenant Requirement 2: Remove T1 Hatch Lay Down Area

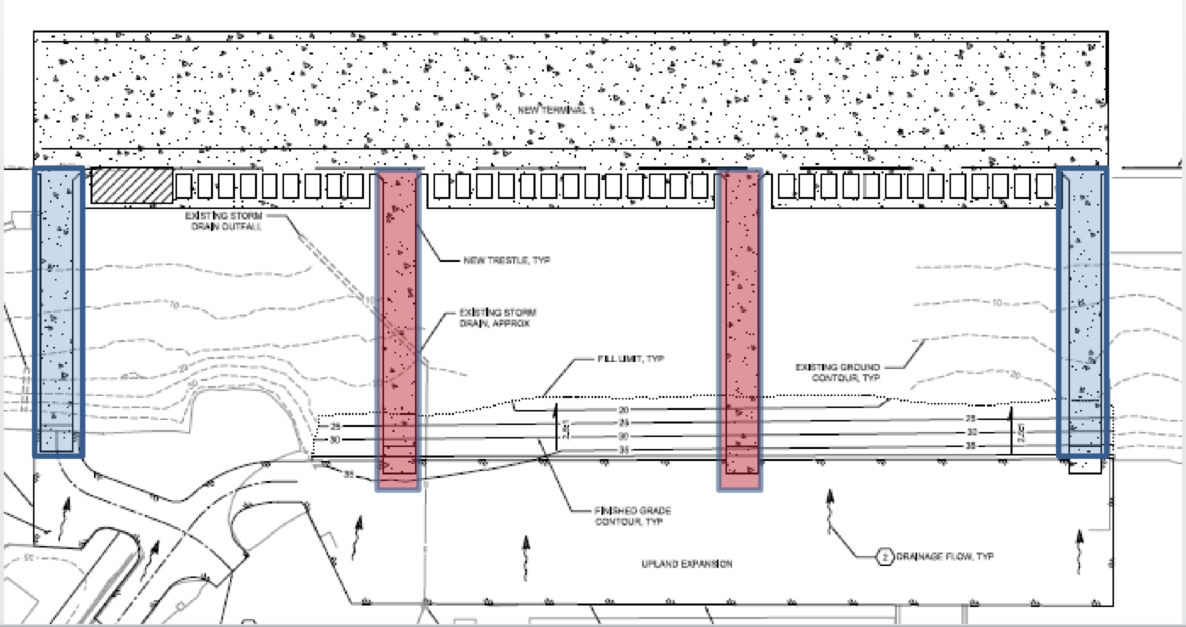
Operational Considerations	Investment Costs	Life-cycle Considerations	Potential Cost Reduction
Hatches would need to be stored on vessel or crane, same as existing conditions	none	Reduction in maintenance of structure	ECC: $29.6M, TIC: $31.1M

Removing hatch cover area decreases width by 37 feet



Tenant Requirement 3: Reduce T1 access to 2 trestles

Operational Considerations	Investment Costs	Life-cycle Considerations	Potential Cost Reduction
Less flexibility operational flexibility	Less investment cost	Less structure to maintain	ECC: $23.8M, TIC: $25M

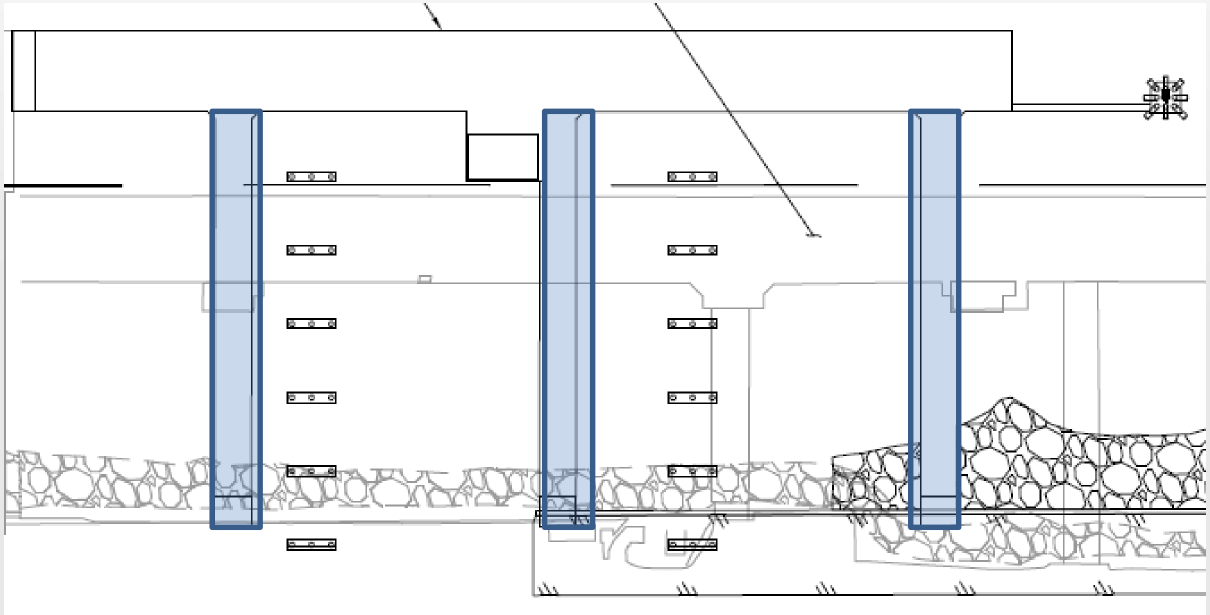


Tenant Requirement 4: Reduce T1 Cranes

Operational Considerations	Investment Costs	Life-cycle Considerations	Potential Cost Reduction
Operations would be similar to current operations with 3 cranes	Reduction of electrical of system support requirements.	Less cranes to maintain	Eliminates purchase of 1 crane at $12M

Tenant Requirement 5: Provide 3 trestles for T2 container traffic

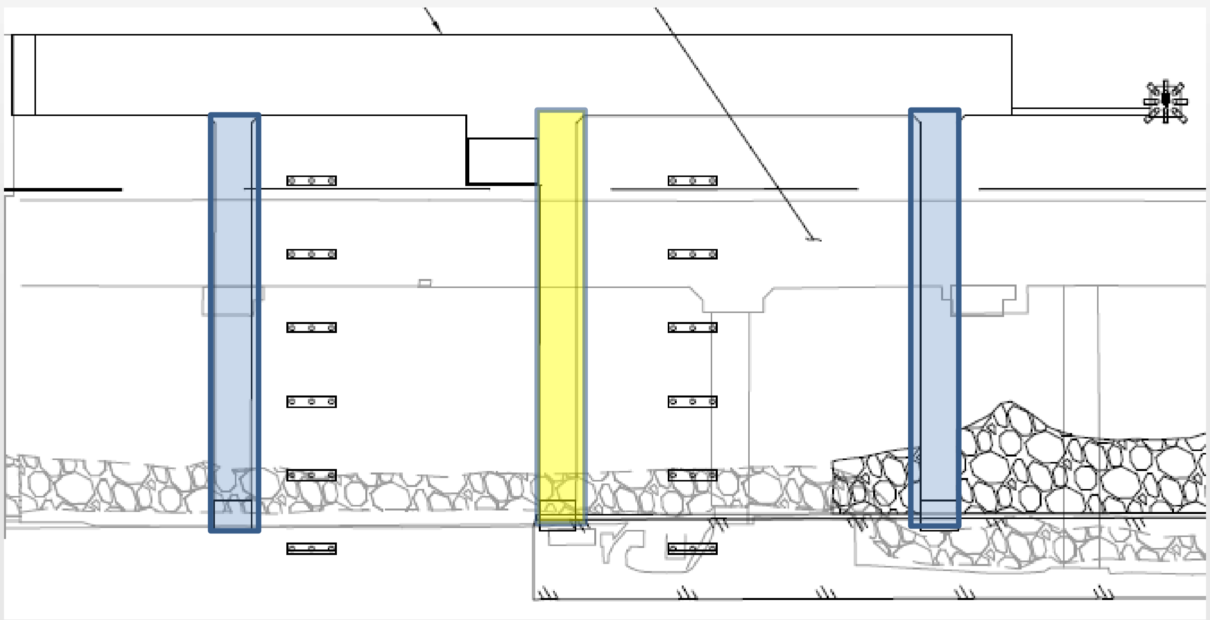
Current Requirement	Current Requirement Source	Minimum Requirement	Minimum Requirement Source
3 Trestles for T2 to support TOTE RO/RO	Program Change 15	2 Trestles for RO/RO operations	Standard Industry



T2 shaded blue shows planned trestles

Tenant Requirement 5: Reduce T2 access to 2 trestles

Operational Considerations	Investment Costs	Life-cycle Considerations	Potential Cost Reduction
Loading and unloading of the Tote ship would be slower	$18M	Large initial investment, proportionally higher maintenance/operational costs	Eliminates cost of 1 trestle



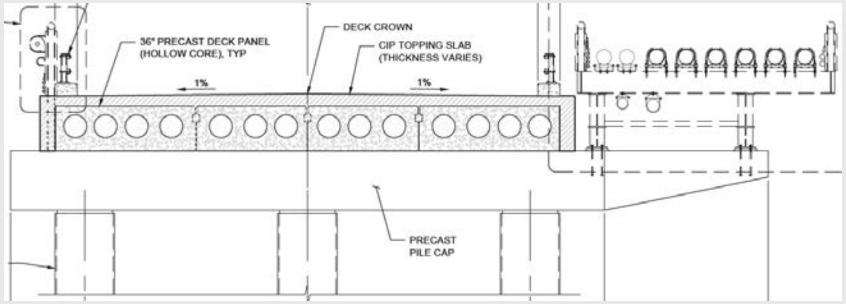
T2 shaded yellow shows extra trestle

One additional container truck trestle with additional pile quantity: ECC: $17M, TIC: $18M

Tenant Requirement 6: ABI trestle width

	Current Requirement	Current Requirement Source	Minimum Requirement	Minimum Requirement Source
Trestle Width	32’ wide trestle with 30’ travel width Requirement	ABI Programming Charrette Input	Provide platform area for stationary uploader and 15-ft trestle with 12-ft trestle travel way to support all other access requirements	15-ft trestle with 12-ft travel way to support all other vehicle access requirements

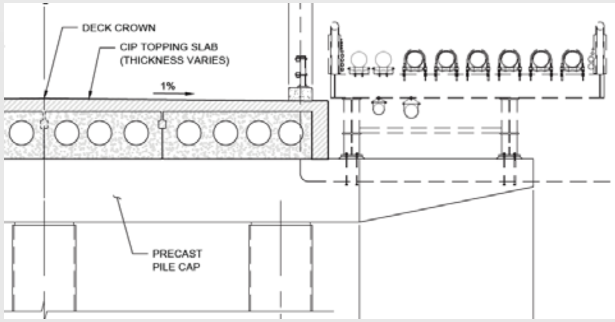
30’ traveled way needed for new ABI unloader to traverse between land and platform



Tenant Requirement 6: Reduce trestle width

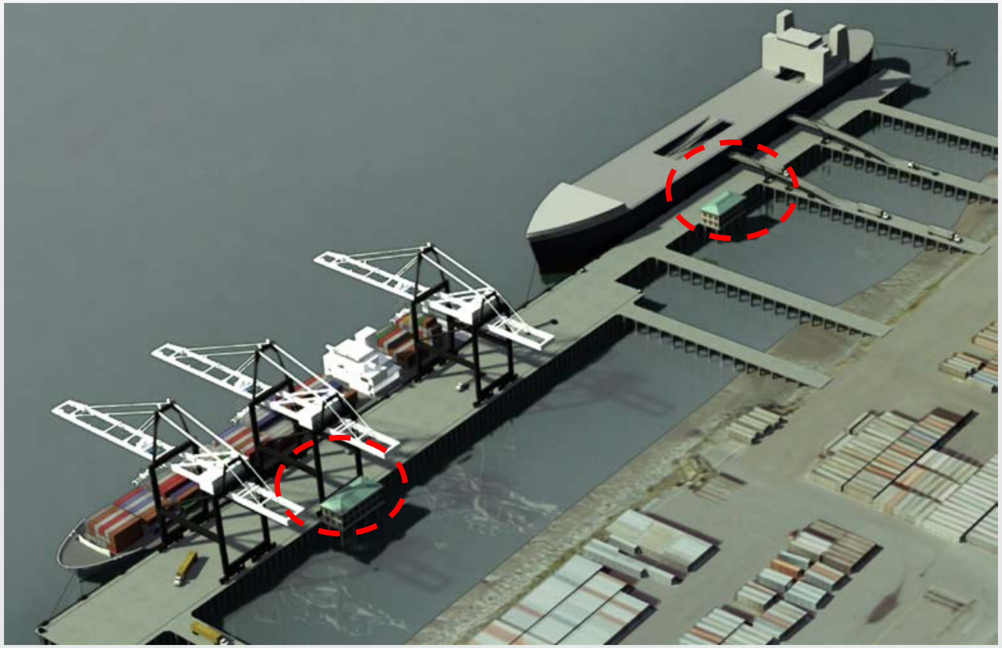
Operational Considerations	Investment Costs	Life-cycle Considerations	Potential Cost Reduction
Cement unloader has to winter in place on platform or be pulled off by floating gear if required	None, there is a cost savings.	Less trestle and piling to maintain	Saves cost of partial trestle at $7.3M

15’ traveled way needed if loader stays on platform



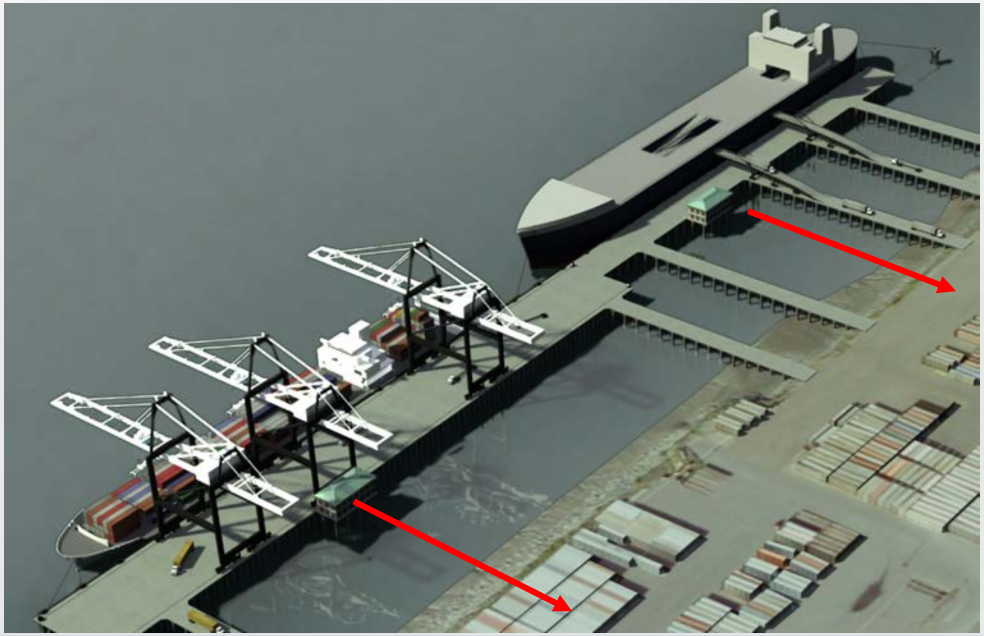
Tenant Requirement 7: On dock Stevedore buildings

	Current Requirement	Current Requirement Source	Minimum Requirement	Minimum Requirement Source
Stevedore Buildings	Stevedore Buildings on Terminals T1 and T2	Matson/ TOTE Programming Charrette Input	Stevedore Buildings on Port backlands	POA



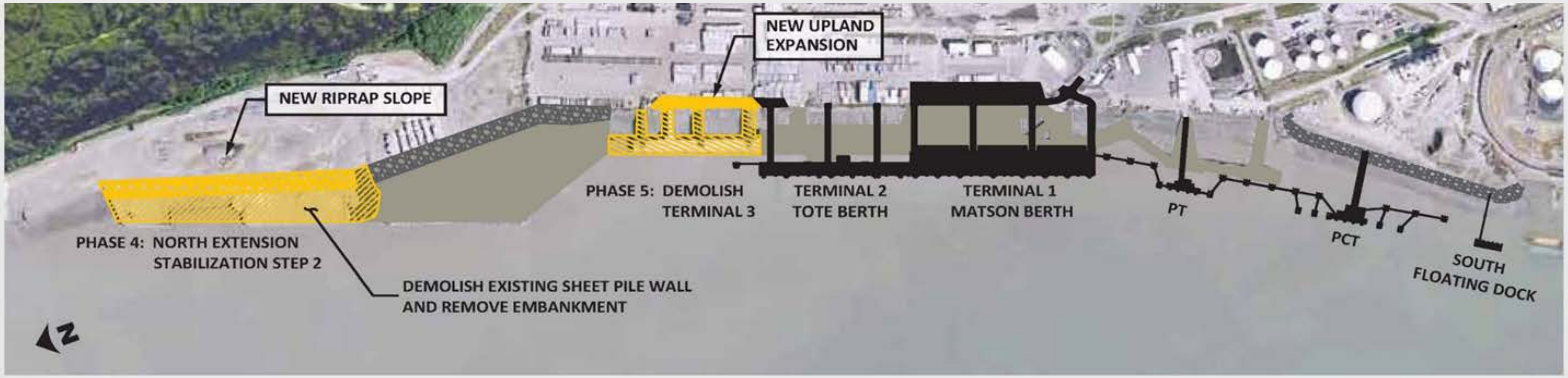
Tenant Requirement 7: Relocate Stevedore buildings to land

Operational Considerations	Investment Costs	Life-cycle Considerations	Potential Cost Reduction
Personal are farther from the ships	Cost would be less constructing the foundations on shore than on piling over the water	Maintenance costs would be less on shore	Cost reduction of approximately $1.4M per building foundation



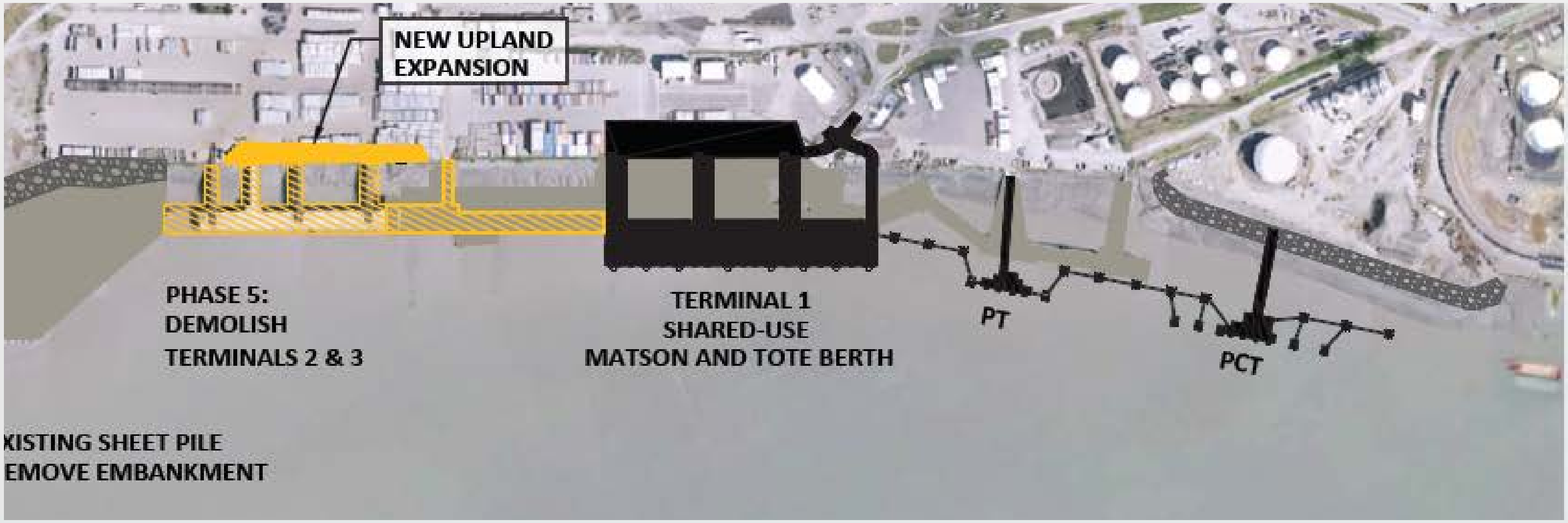
Tenant Requirement 8: Provide two separate container berths

Current Requirement	Current Requirement Source	Minimum Requirement	Minimum Requirement Source
Provide 2 separate container terminals	Matson/ TOTE Programming Charrette Input	Provide 1 shared container terminal TOTE currently stores their ramps on the access trestles. This requires doubling Trestles 1-B, 1-C, and 1-D width to allow storage of ramps during Matson operations. This added 84 pile to the design as well as doubled the pile cap width and decking	Minimum physical berth to maintain operations



Tenant Requirement 8: Reduce to single combined container berth

Operational Considerations	Investment Costs	Life-cycle Considerations	Potential Cost Reduction
Both shippers could not arrive on the same day, so supply chains would need to be adjusted accordingly	Costs would be significantly less	Overall there would be less structure to maintain Construction of a joint use terminal is expected to save 1 year in the PAMP Phase 2 schedule but add one year to PAMP Phase 5 for the demolition of the existing T2.	The estimated cost savings associated with a joint use terminal is estimated to be up to $285M which includes three years savings on dredging and tug assist during construction.



Tenant Requirement 9: Install T1 Panzer belt for power and data

Current Requirement	Current Requirement Source	Minimum Requirement	Minimum Requirement Source
T1 Crane Power Panzer Belt	Program Change 7 - Input from Matson	Overhead Buss System	Current Condition w/ existing 38-gage cranes

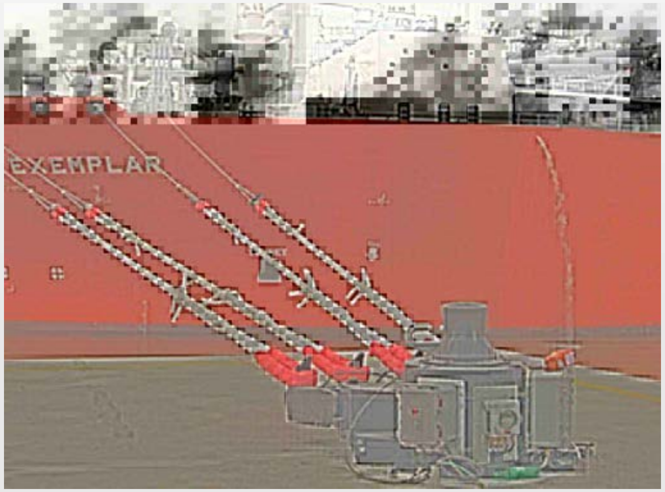
Tenant Requirement 9: Remove panzer belt requirement

Operational Considerations	Investment Costs	Life-cycle Considerations	Potential Cost Reduction
The Panzer belt system provides high speed data transfer that can improve the efficiency of the cranes	Costs would be less	POA does not have experience with the Panzer belt system and there is some concerns about ice build up	Approximately $8.1M

Existing buss bar system at POA

Tenant Requirement 10: Install Quick Release Mooring Hooks with integrated Capstans

Current Requirement	Current Requirement Source	Minimum Requirement	Minimum Requirement Source
Quick release hooks for mooring lines	POA – SWAPA – Program Change 6	Standard bollards	POA

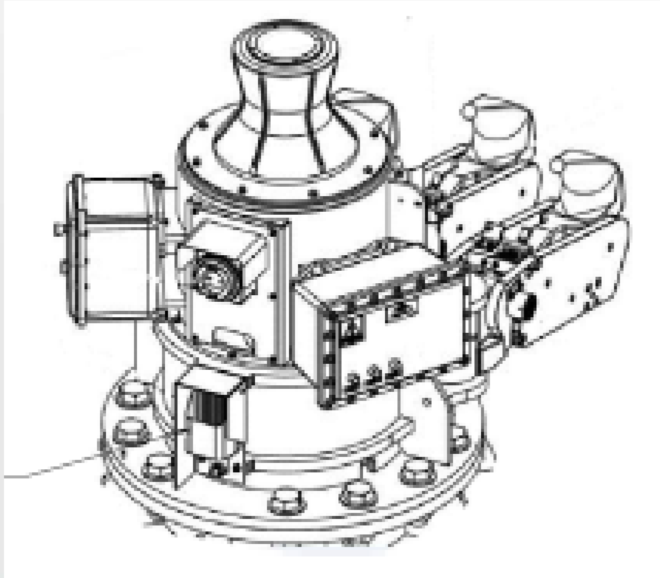


Quick Release Mooring Hooks with integrated Capstan

Standard Bollard

Tenant Requirement 10: Remove quick release hook requirement

Operational Considerations	Investment Costs	Life-cycle Considerations	Potential Cost Reduction
The quick release hooks are much safer. They have load monitoring capability and power captains that facilitate line handling	Quick release hooks are much more expensive	They will require more maintenance over their life; however, could reduce accidents such as dangerous line parting or accidental demerge of tankers during transfer operations	Approximately $90 thousand per bollard or $1.8M for PAMP requirements at PCT, PT and T2



February 26, 2019

Questions ?