Terminal Master Planning:
A Key Planning Process Before Design Begins

Present At

AAPA Marine Terminal Management Training Program

September 15, 2015

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Shaping the Future

70 YEARS of shaping the future
1945-2015

- Founded in 1945
- A strong reputation throughout our domestic and international operations
- *Engineering News Records* Top Firms Lists
  - #23 Top 500 Design Firms
  - #32 Top 200 Environmental Firms
- A Dedicated staff that specializes in port/terminal planning and design:
  - Port and Terminal Master Plans
  - Bulk Terminal Planning and Material Handling Studies and Design
  - Container Terminal Designs
  - Equipment Studies and Specifications
  - Cost Estimating
  - Vessel Maneuvering and Hydrodynamic Modeling
  - Dredged Material Management and Navigational Studies
  - Sustainability and Energy Planning

ENR #23
2015 TOP 500
DESIGN FIRMS

ENGINEERING NEWS RECORD
#14
2015 TOP 20
INDUSTRIAL PROCESS/ PETROLEUM FIRMS

ENGINEERING NEWS RECORD
2015 TOP 200
ENVIRONMENTAL FIRMS
32

Terminal Master Planning Is An Important Step in The Design Process

- Terminal Master Planning or “Program Planning” is **Not** the same as preliminary design;
- Master Planning is more the “programmatic” phase of a project
- Master Planning a terminal before design starts will allow the Owner to:
  - Identifying problems and solutions early in the process
  - Determine project requirements
  - Finalize the design program and schedule;

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An Example Of Program Planning - Port of Houston Barbours Cut Terminal (BCT) Improvements

Project Team:

DANNENBAUM

- Prime Program Management Consultant

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- Lead Terminal Planners

Halcrow

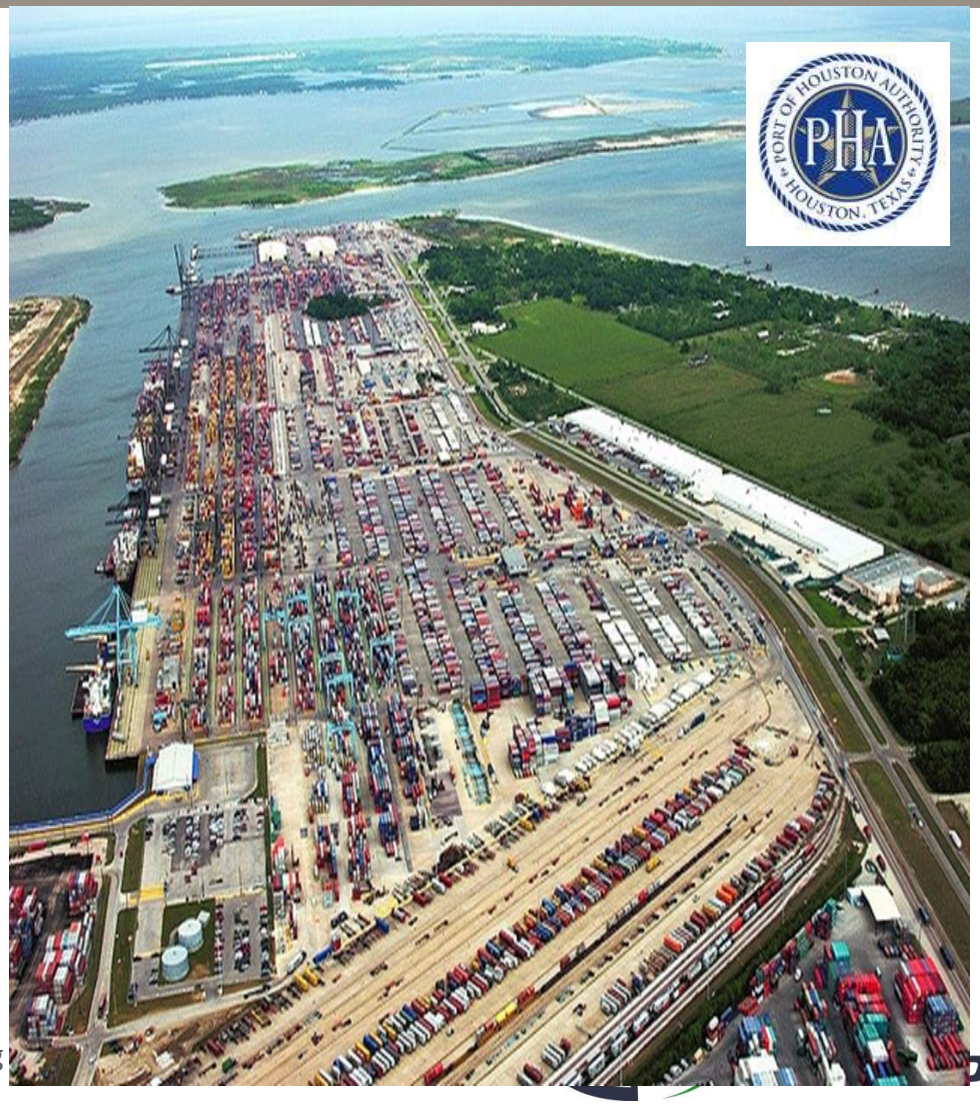
- (now CH2MHIll)- Wharf Concepts

CargoVelocity

- Automation Concepts

Project Owner:

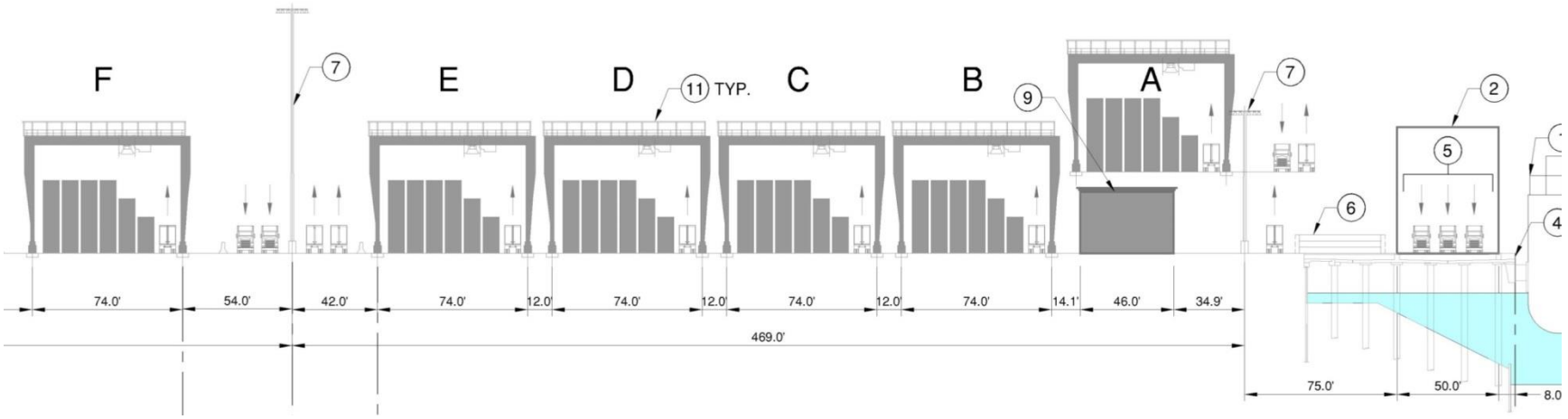
Port of Houston Authority



Existing Barbours Cut Terminal (BCT) Attributes

- 175 Acre Terminal
- 5,000 LF Wharf / 5 Berths (PHA only)
  - (A 6th Berth was operated by APMT, but now back to POHA)
- Existing STS Cranes – 50' Gage
- CY a combination of RTGs and wheeled storage
- Empties stored offsite

Landside Interface - Existing Condition - 50 Gage



> Amenities Building mixed in A-Row

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Port of Houston Authority (PHA)
Stated Operational Goals For The Program

- Retrofit wharf for 100-gage Quay Cranes (22-Wide) – Can not change existing berth-line!
- Construct minimum 1,000 FT of new wharf by 2014
- Densify yard to handle + 2.0 million TEU/yr
  - RTGs
  - RMGs
  - Automated system
- Return empty depot operations to on-site within BCT

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Wharf Operations Studies Early In the Program

- Berthing Concept Study
- Berth Capacity Model Results
- Wharf Face Operation Study
- Crane Rail Position Study
- Impact of 100 Gage Crane on Yard
- Amenities Building Location Study

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Berth Capacity

- Berth capacity model set up to assess multiple berth segments and number of cranes per berth
- Some enhancements were considered to improve productivity in the future
- Evaluate unit berth capacity under various crane options and apply to the number of berths available

Berth Capacity Based on Crane and Berth Count

BCT Berth Capacity (future crane count)	2.0	2.5	3.0	3.5	4.0
Berth Capacity - 4 Berths (Lifts/year)	**993,651**	**1,213,242**	**1,422,874**	**1,623,208**	**1,814,850**
Per Berth Capacity - 4 Berths (TEUs/year)	**1,649,460**	**2,013,982**	**2,361,970**	**2,694,525**	**3,012,651**
Total Cranes - 4 Berths	**8**	**10**	**12**	**14**	**16**
Berth Capacity - 5 Berths (Lifts/year)	**1,242,064**	**1,516,553**	1,778,592	**2,029,010**	**2,268,562**
Per Berth Capacity - 5 Berths (TEUs/year)	**2,061,825**	**2,517,477**	2,952,463	**3,368,156**	**3,765,813**
Total Cranes - 5 Berths	**10**	**13**	**15**	**18**	**20**
Berth Capacity - 6 Berths (Lifts/year)	**1,490,476**	**1,819,863**	**2,134,310**	**2,434,812**	**2,722,275**
Per Berth Capacity - 6 Berths (TEUs/year)	**2,474,191**	**3,020,973**	**3,542,955**	**4,041,788**	**4,518,976**
Total Cranes - 6 Berths	**12**	**15**	**18**	**21**	**24**

- 4 Berths adequate for 2 million TEU range
- 5 Berth scenario for 3 million TEU range
- Some flexibility in crane count / berth
- Yard capacity will drive berth demand

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Berth Face Operations Study – Key to setting W/S Rail Location

- Existing berth-line/wharf face location needed to be maintained
- Need to determine future wharf face activities
  - Crane power system
  - Accommodation ladders
  - Bollards
  - Future cold iron vaults
  - Service truck access

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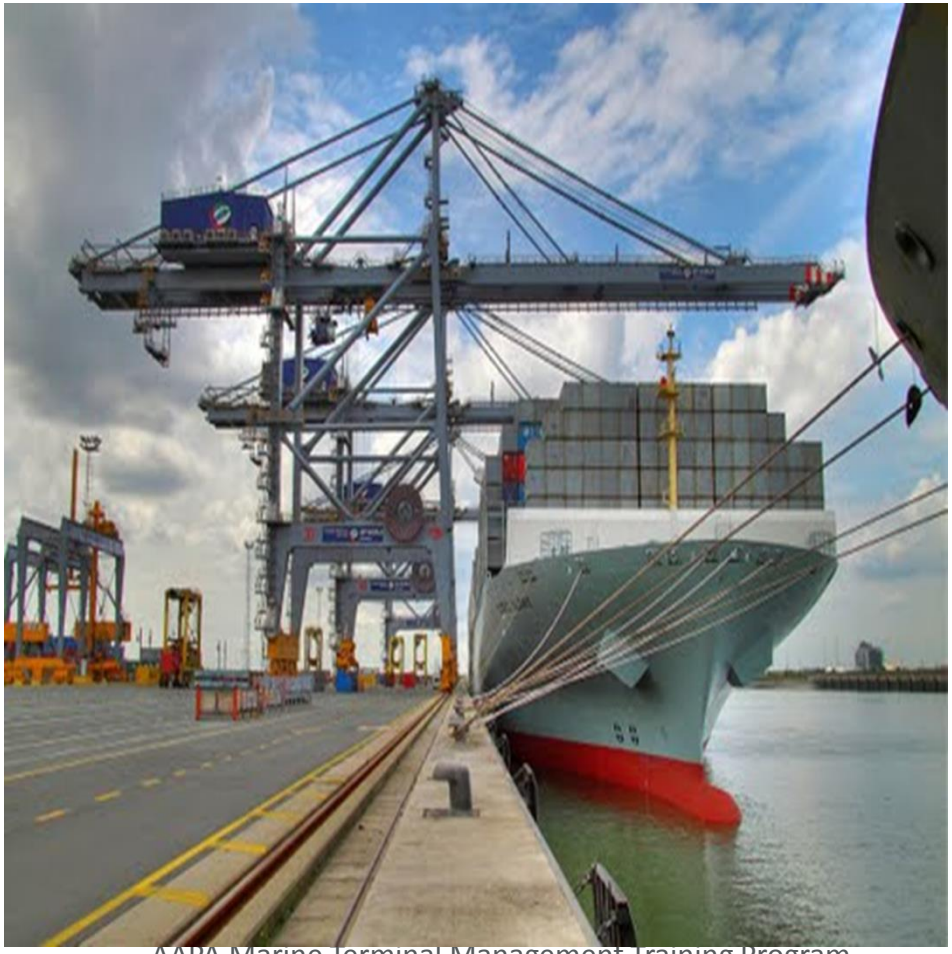
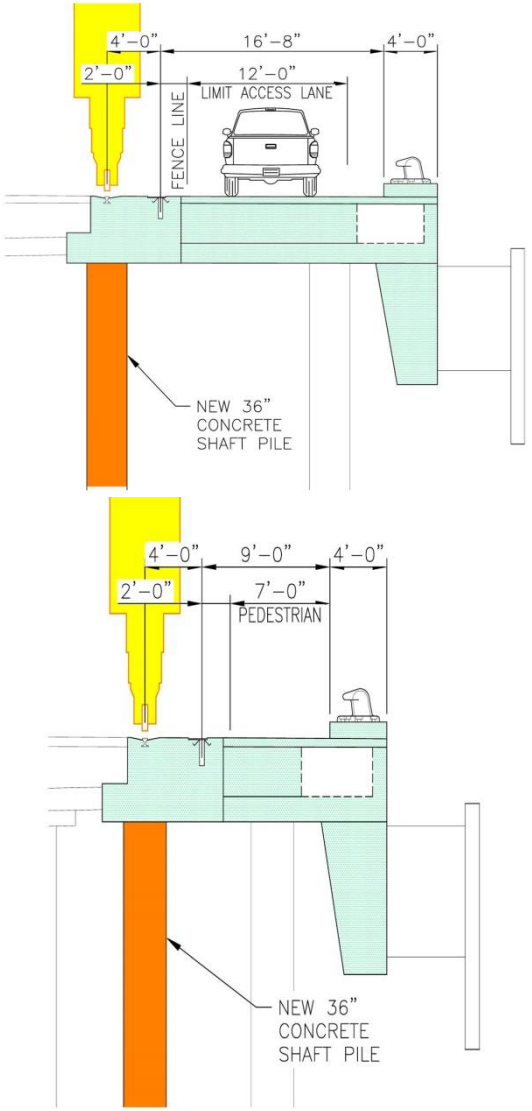
Berth Face Operations Study –Studied Various Options





Fill vs No-Fill Alternatives
Adds a 6th Berth

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Fill vs. No-Fill Capacity Analysis (TEUs)

RTG Layout	Yard Capacity	Berth Capacity	Limiting Factor
No Fill	3,293,202	2,619,696	Berth
Fill	3,445,387	3,274,620	Berth

- "No Fill" option 4 berths
- "Fill" option 5 berths
- Assumes 4 cranes/berth
- Some additional capacity by adding cranes
- Roughly +150,000 TEU/yr gained by adding fill and 5th berth

- It was determined that the Project Goals could be met with the No-Fill Option and the area behind the "fill section" could be better used for storage of break-bulk/project cargo.

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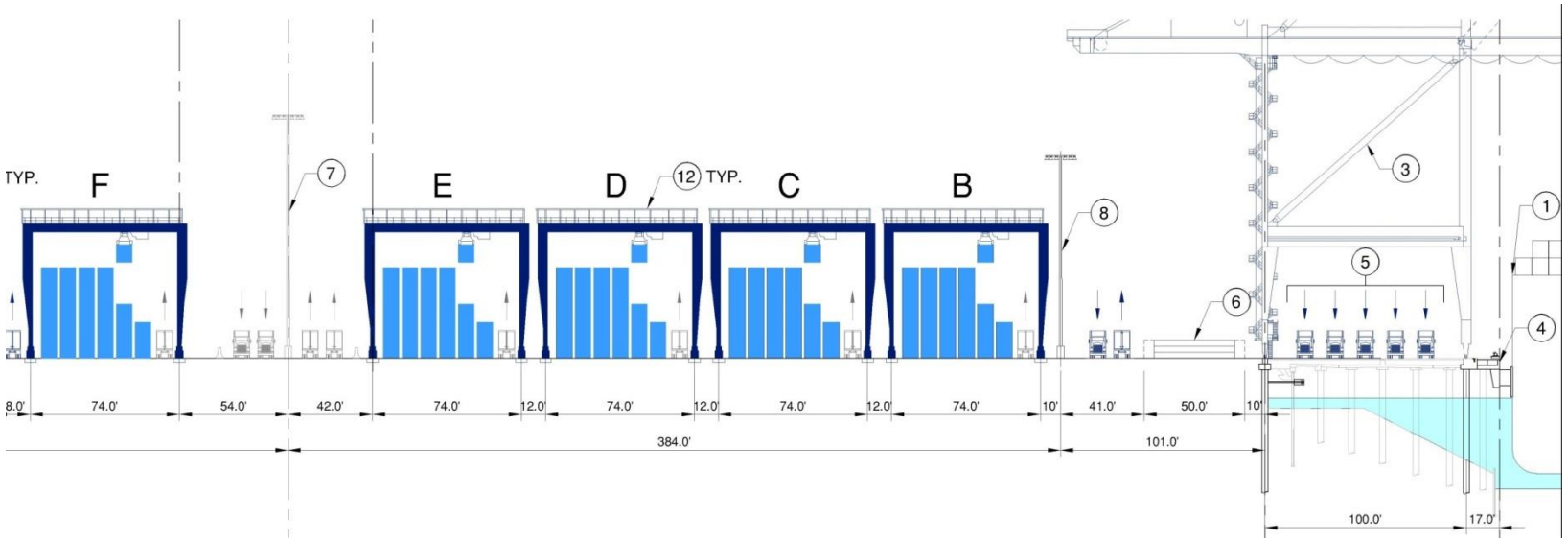
Landside Interface : Existing Layout - 100 Gage



- Retain existing RTG pad layout
- Impacts A-Row & Amenities Building
- 101’ from LS crane rail to B-Row

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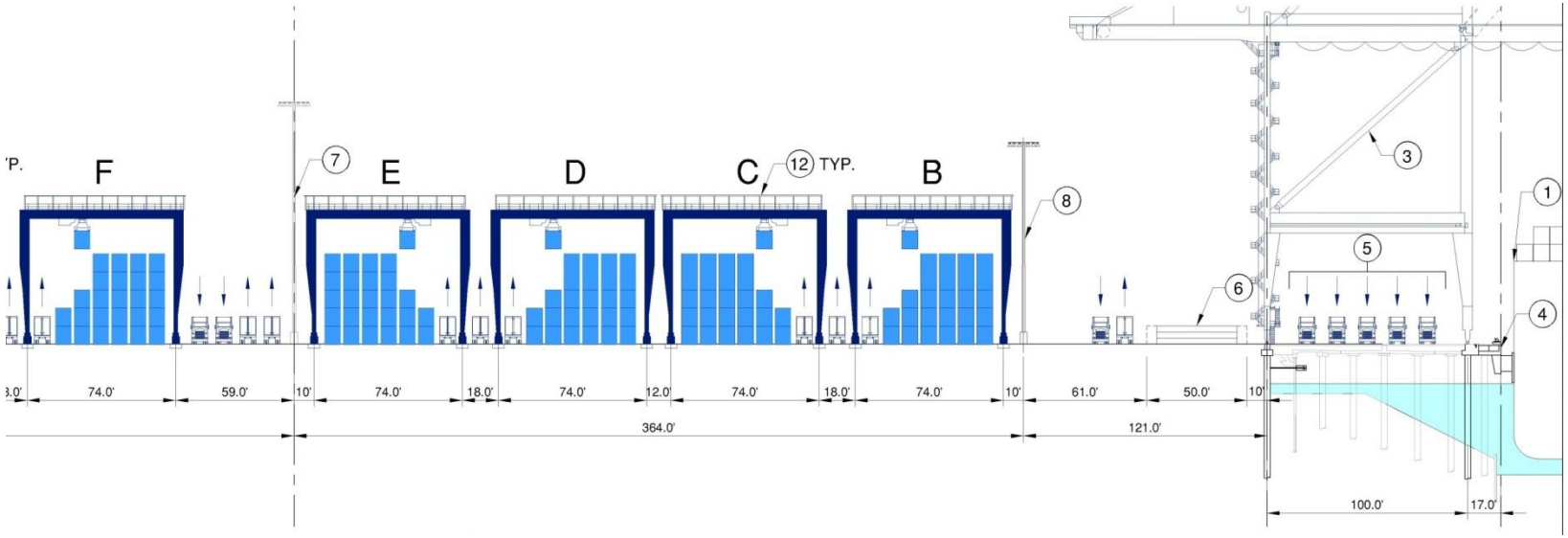
Landside Interface – Options
RTGs Back to Back - 100 Gage



- Back to Back layout
- 121 ‘ from LS crane rail to B-Row

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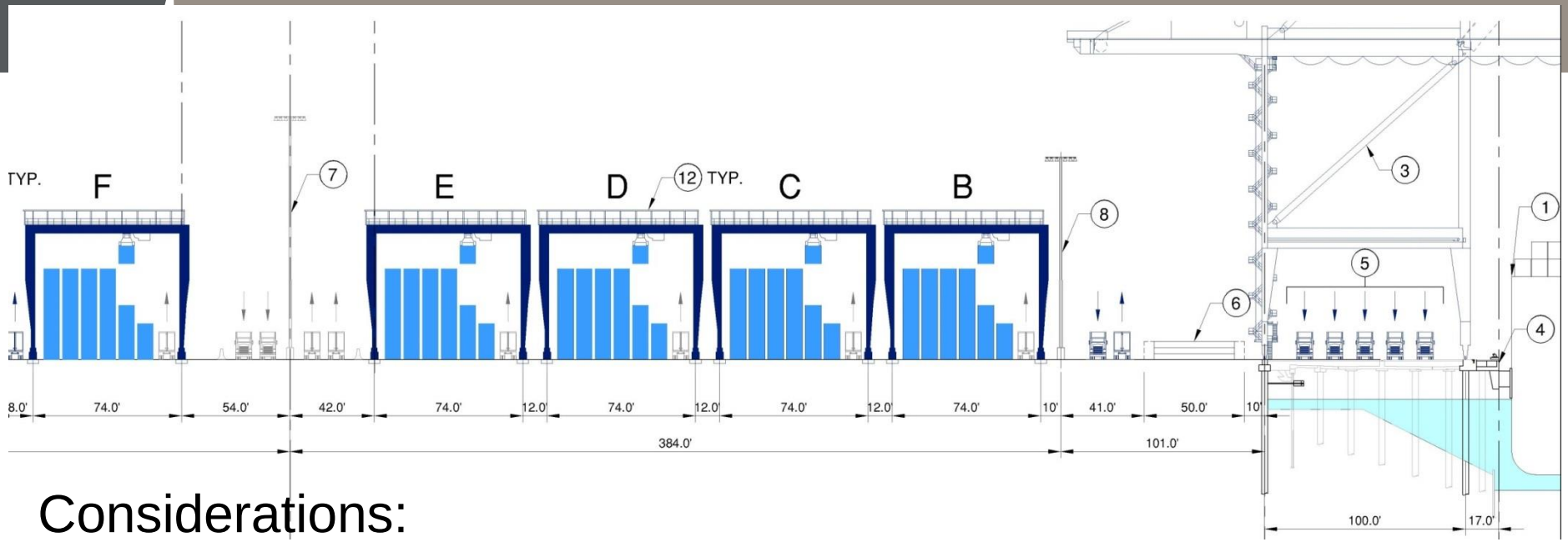
Landside Interface - Final



Considerations:

- Width/Requirements of Amenity Strip
- RTG Pad location and operation (One Way or Back-to-Back)
- RTG Pad distance from L/S Rail
- Width of Passing Lanes
- Light Pole and Camera Locations

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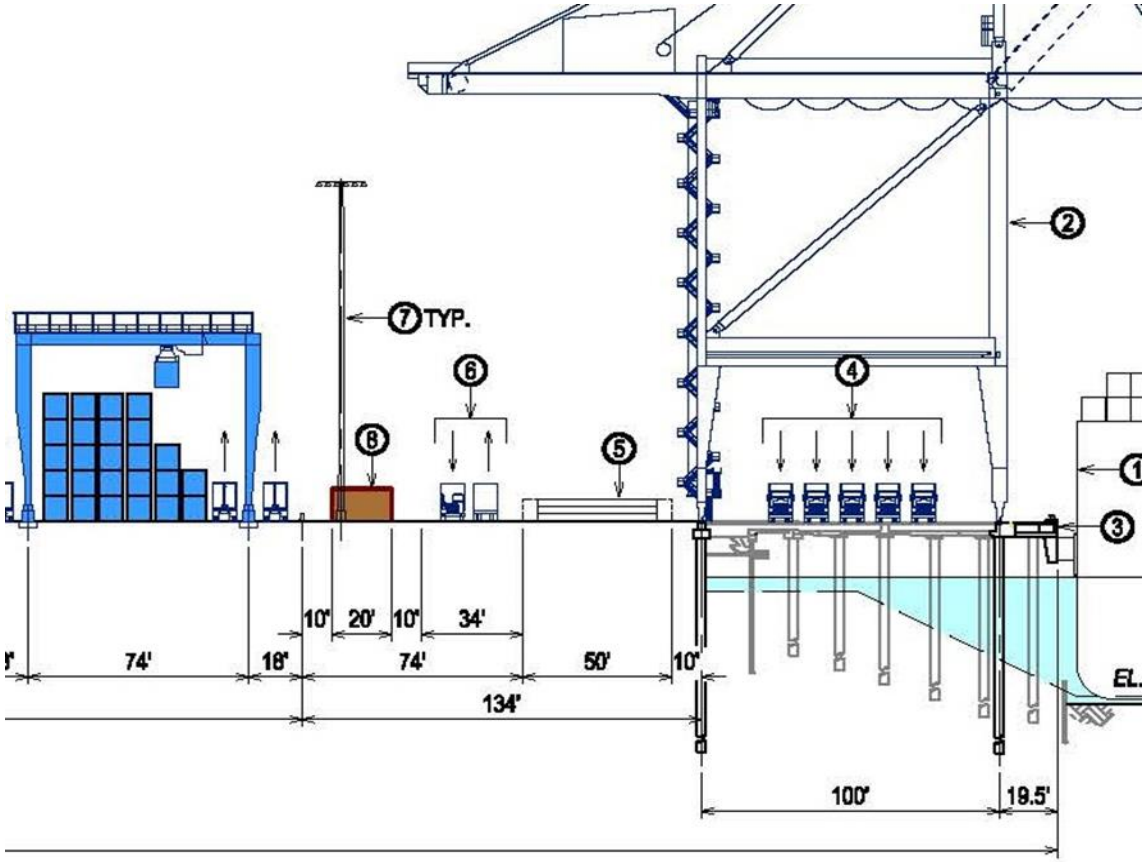
Narrow Amenities Strip



- Separate buildings from RTG pad
- 134 FT wharf apron
- 40 FT amenities strip
- Allows area for:
  - Substations
  - Electrical Equip
  - Misc Truck/equip. parking
  - Boneyard

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Yard Layout Alternatives

- Three alternatives considered:
  - RTG Dense operations
  - ASC Perpendicular to the wharf
  - ASC Parallel to the wharf
- General layouts provided for discussion
- Blocks provided for major terminal elements
- Further detailed layouts required

Camera Pole Study Goals

- Place camera pole at each RTG pad to view operations
- Avoid conflicts with yard circulation and RTGs
- Minimize impacts on terminal footprint
- Investigate using 80 FT high pole at each bypass lane for cameras
- Investigate placing wireless cameras on RTG's

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E-RTG Concept Study Evaluated Cost and Capacity of E-RTGs vs. Diesel RTGs

- Benefits:
  - 30% lower maintenance costs
  - 80% lower fuel costs
  - 60 – 80 % emissions reduction
- Constraints:
  - Fixed runway positions
  - Increased civil costs for power delivery and substations

E-RTG Concepts, cont.

- Power Delivery Methods
  - Motorized cable reel
  - Conductor bar

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Projected Return on Investment

- Estimated Capital Costs $ 33,503,433
- Operating Cost Savings $ 2,923,000/yr

- Projected Capital Cost Recovery +11 years

- POHA decided to stay with Diesel RTGs because of similarities with other PHA Terminals (Bayport)

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PHA Yard Layout Wish List

- Maximize RTG storage area
- Approx 50 acres for empty containers
- Approx 50 Ag Ramp slots
- 100 to 300 wheeled slots
- Wheeled reefer slots initially
- Dedicated area for VACIS inspections

Further Plan Refinement, cont.

- Modify CY terminal aisles to increase velocity
  - 20 FT truck bypass lanes
  - Dedicated RTG shuttle lane on entry gate aisle (114 FT)
  - N-S Aisles at 80 FT
  - Intra-terminal 4-lane road at 60 FT

Final Terminal Layout

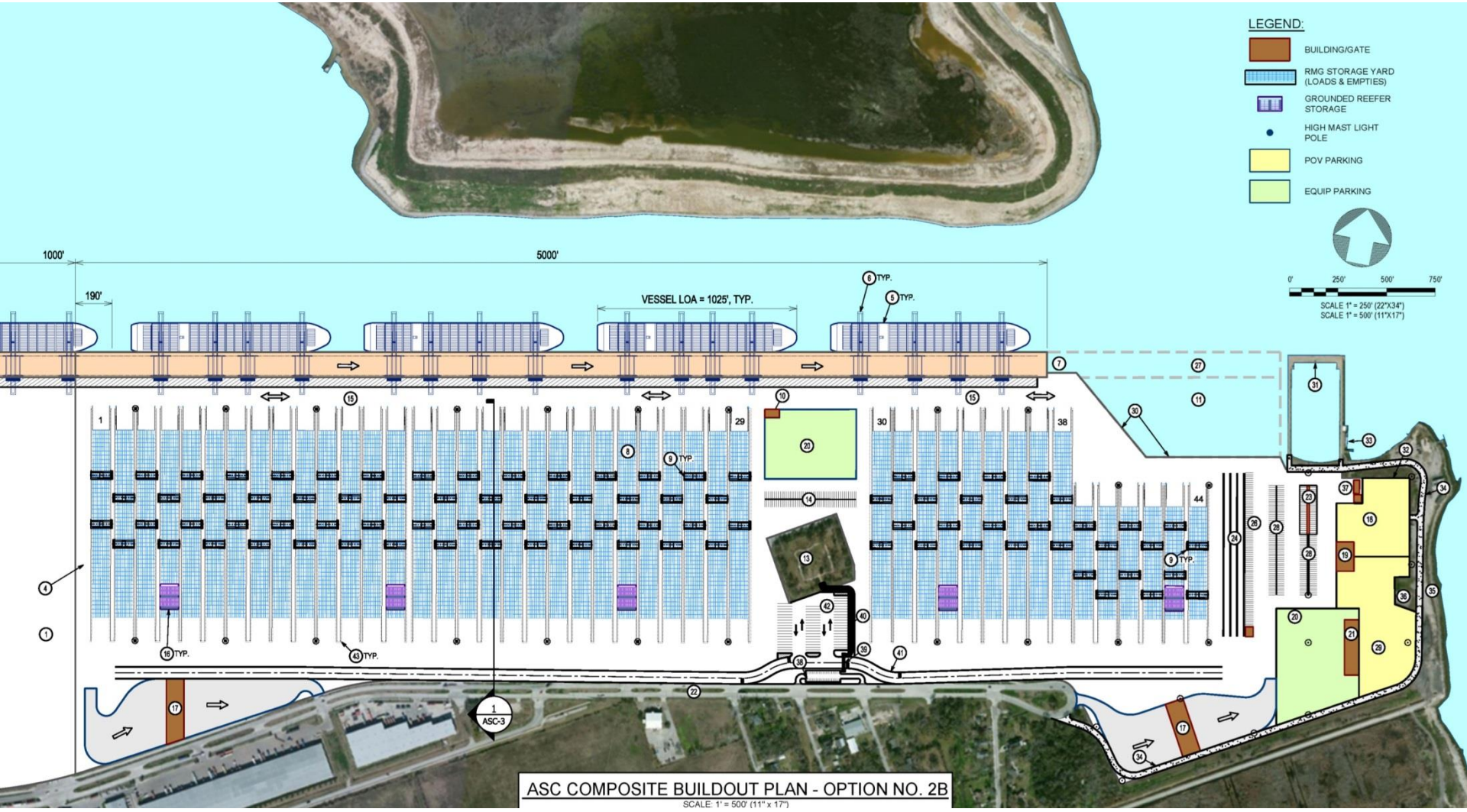
Summary of Final RTG Composite Plan

- TGS Count
  - RTG Loads 11,664
  - Reefer Racks 108
  - Empties 7,346
  - Wheeled Reefers 118
  - Misc Wheeled 249
- Empty container storage +32 acres
- Ag Ramp slots 50 slots

Automated Staking Crane (ASC) Alternative

- An Option For Future ASC Operation Was Studied;
- Would allow for the future conversion of the CY to ASC
- Buildings and other facilities were located so as to not be impacted by a future conversion
- A Phasing Plan was developed so the terminal could be converted to ASC by phases

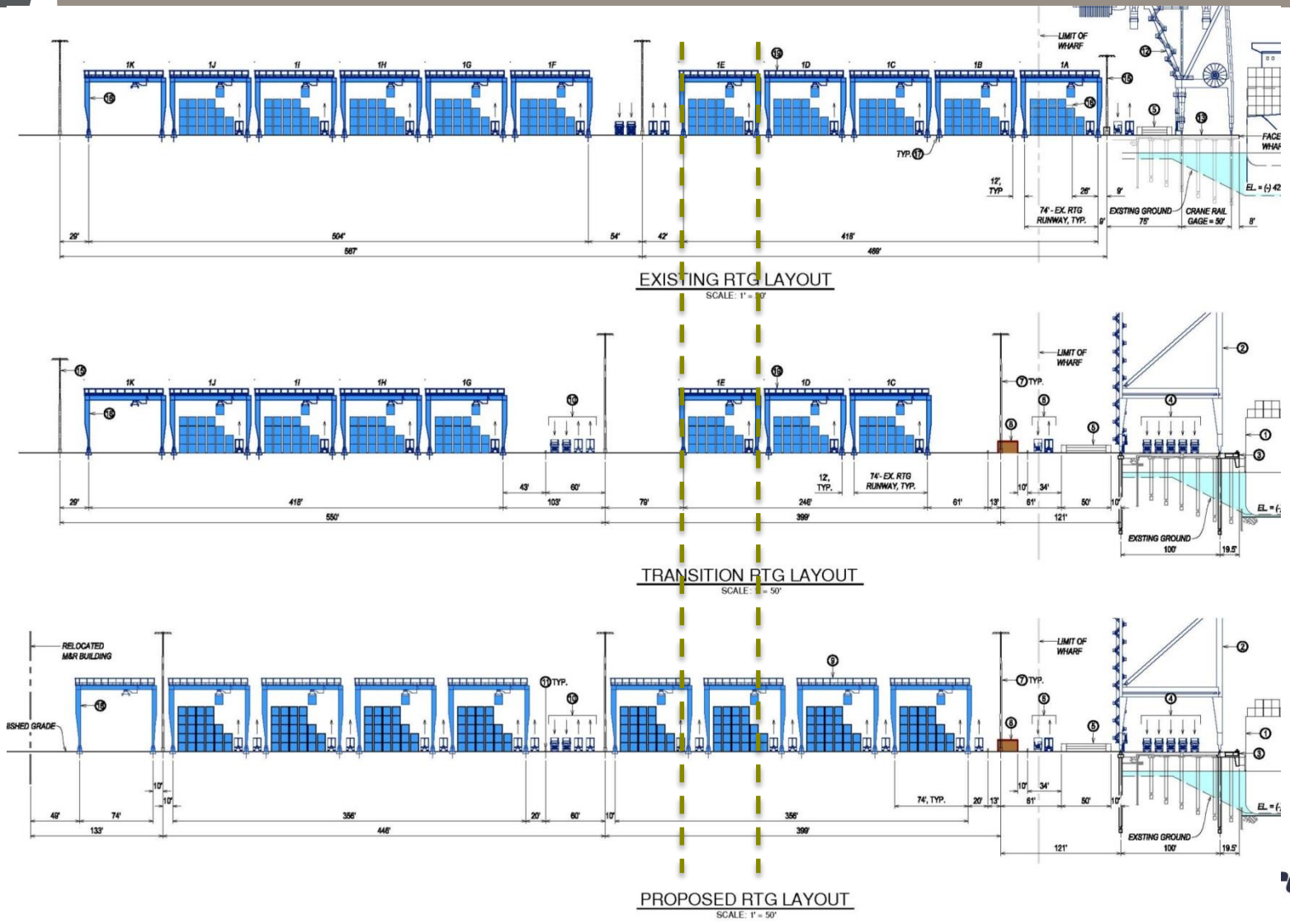
ASC Composite Plan



PHA Phasing Plan Preferences

- Focus redevelopment on wheeled areas first
- Maximize development of break bulk terminal
- Accelerate relocation of empty handling op's to BCT
- Redevelop waterfront RTG pads last
- Prefer working minimum three pads adjacent with same aisle alignment

RTG Phasing Plan

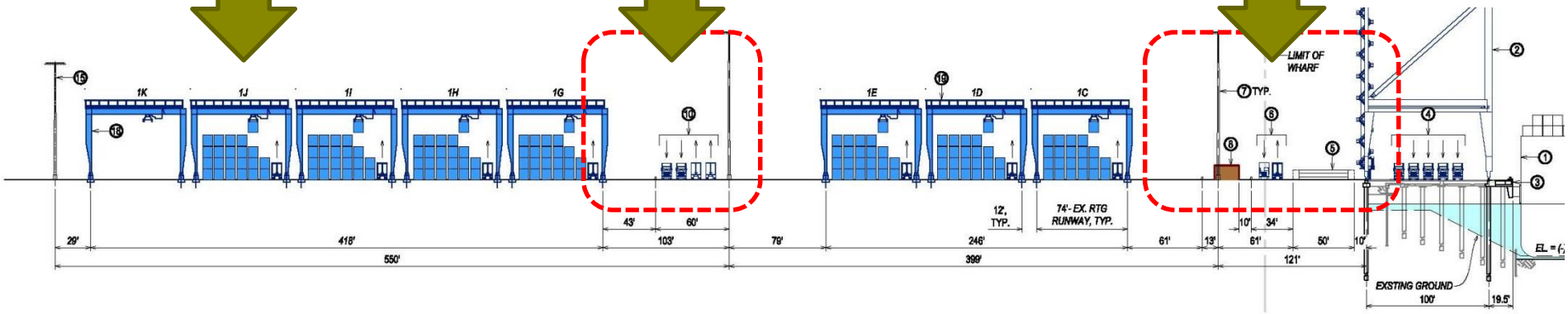


RTG Phasing Plan

Use Overflow Pads & Break Bulk Area for Replacement Capacity

2. Relocate Road (Entire Terminal)

1. Area Impacted by Wharf Project



TRANSITION RTG LAYOUT
SCALE: 1" = 50'

2. Lose one RTG Pad

1. Lose two RTG Pads

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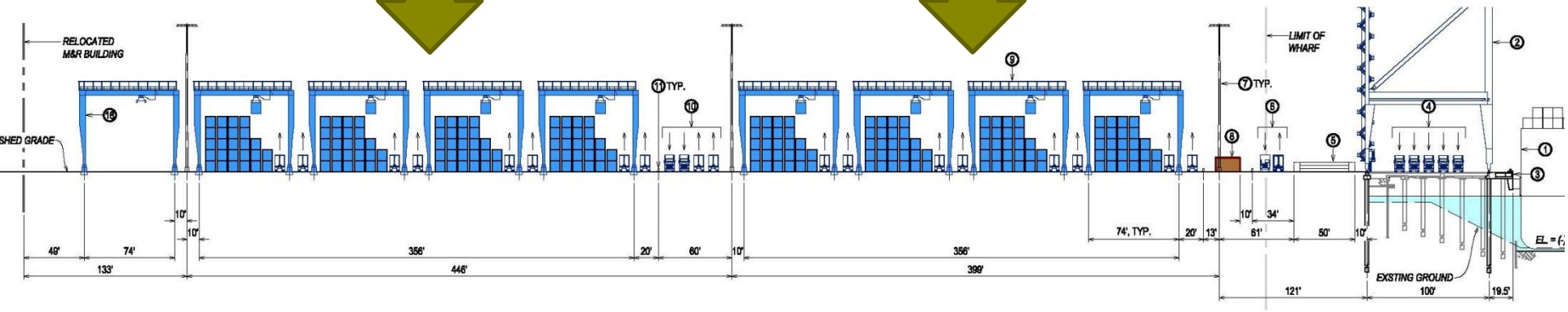
RTG Phasing Plan

4. Redevelop Landside RTG Pads

3. Redevelop Waterside RTG Pads



PROPOSED RTG LAYOUT
SCALE: 1" = 50'

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Near Term Construction Phasing
Project 1 - Phase 1 (June 2013)

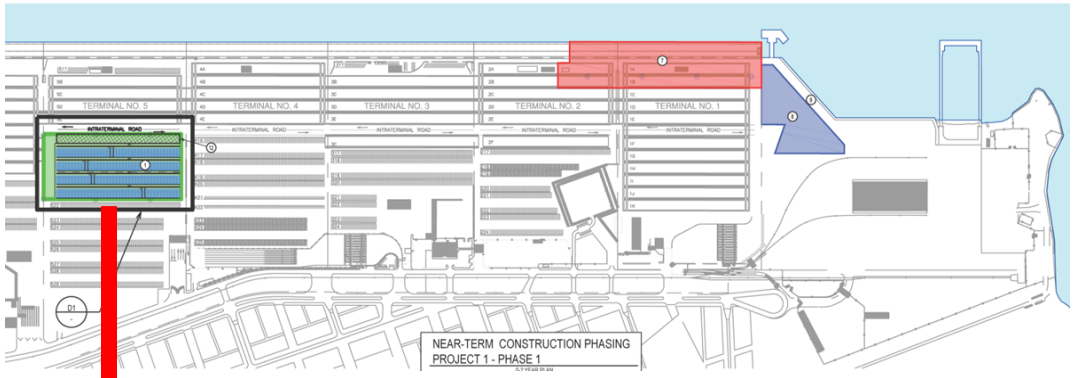
Terminal C5 yard construction (11.7 AC)

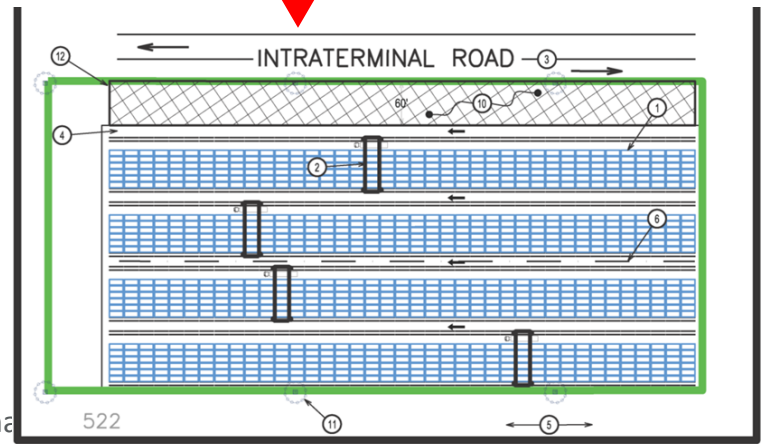
Phase addition: + 936 TGS

Phase removal: -720 TGS

Phase Net: + 216 TGS

Cumulative through project: +216 TGS

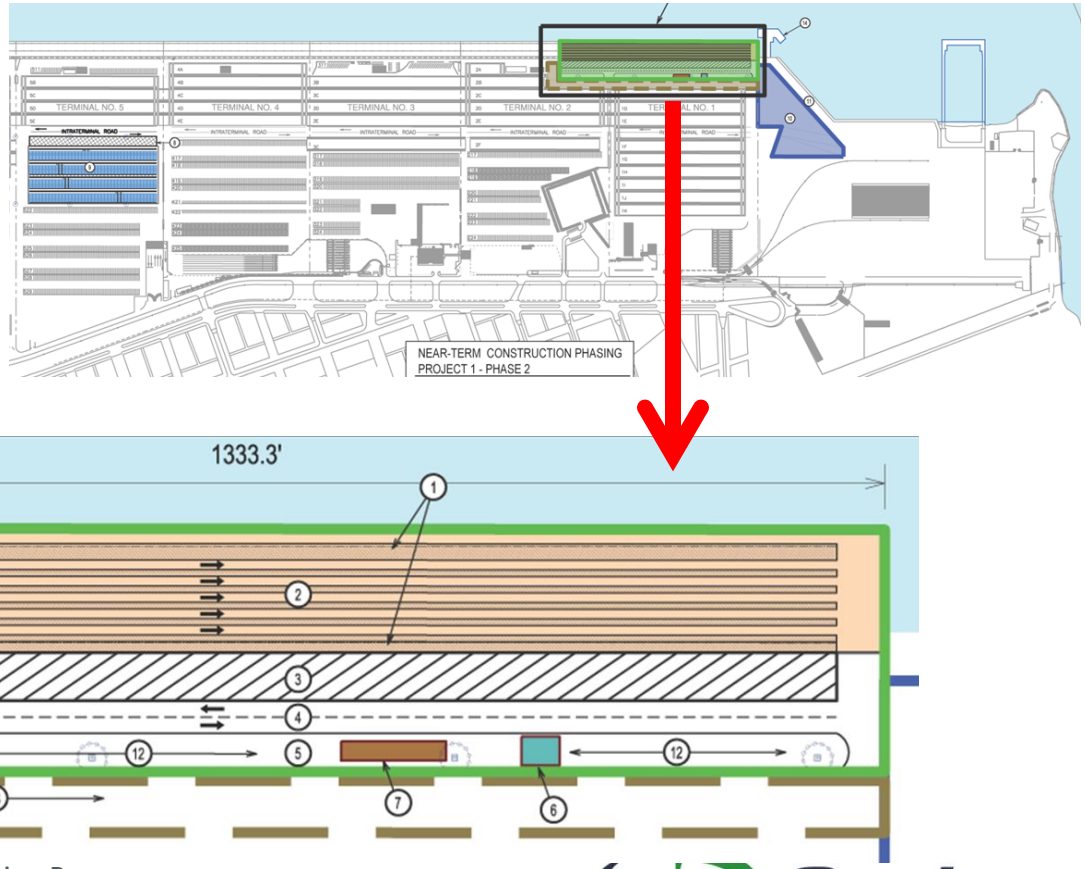




Near Term Construction Phasing Project 1 - Phase 2 (April 2014)

Terminal C5 operational during Rehab Wharf 1

No change in TGS count (Still +216 TGS)



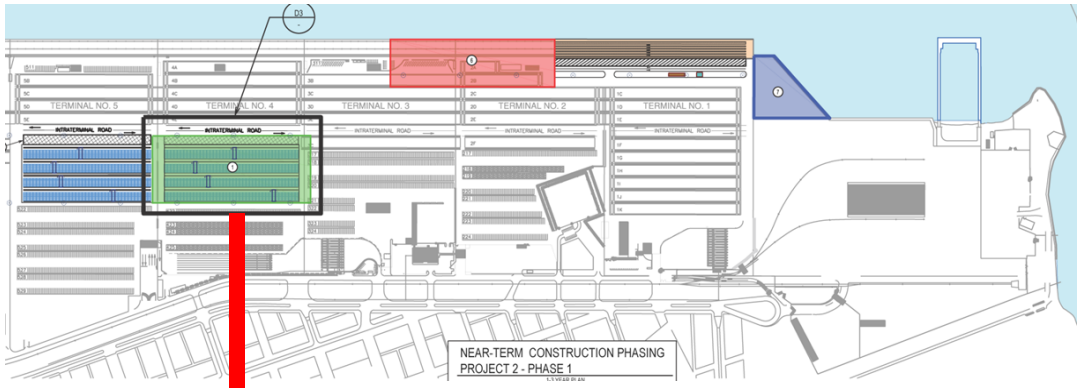
Near Term Construction Phasing Project 2 - Phase 1 (June 2014)

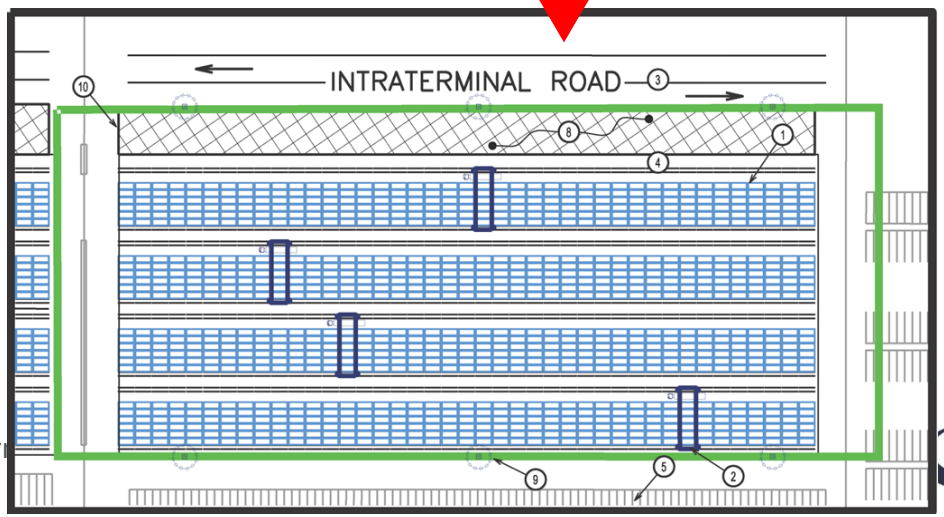
Phase addition: + 984 TGS

Phase removal: -102 TGS

Phase net: + 882 TGS

Cumulative: +1098 TGS





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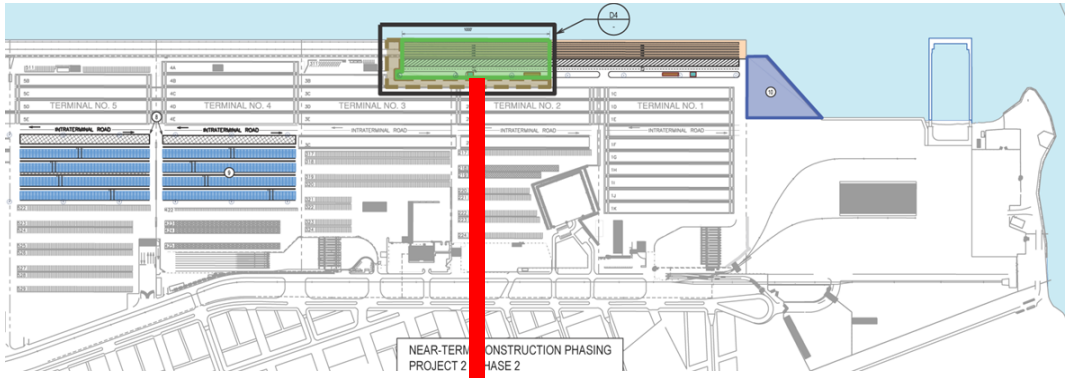
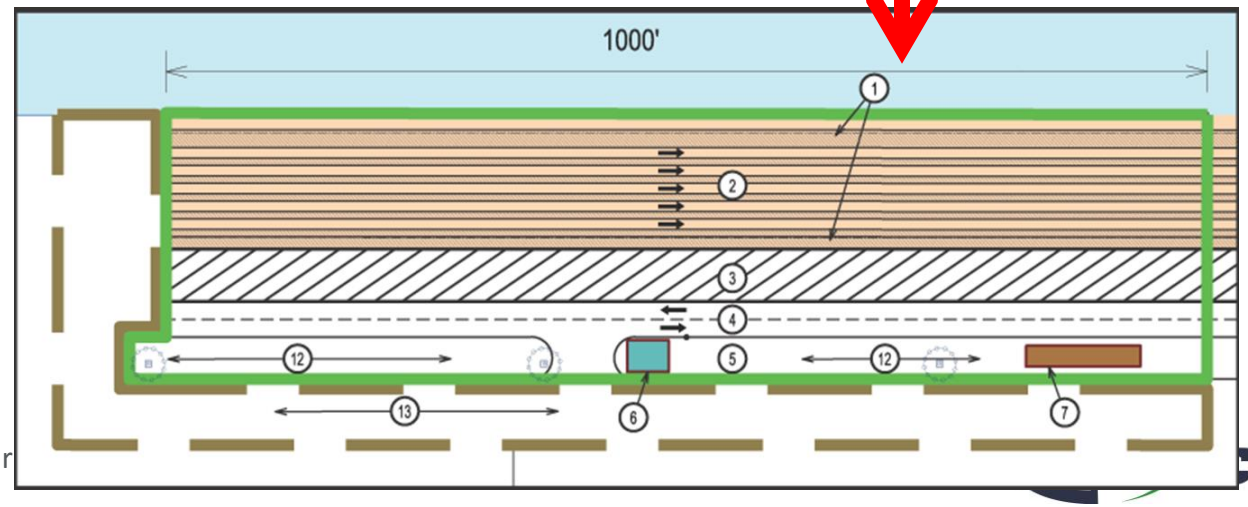
Near Term Construction Phasing Project 2 - Phase 2 (October 2015)

No change in TGS count





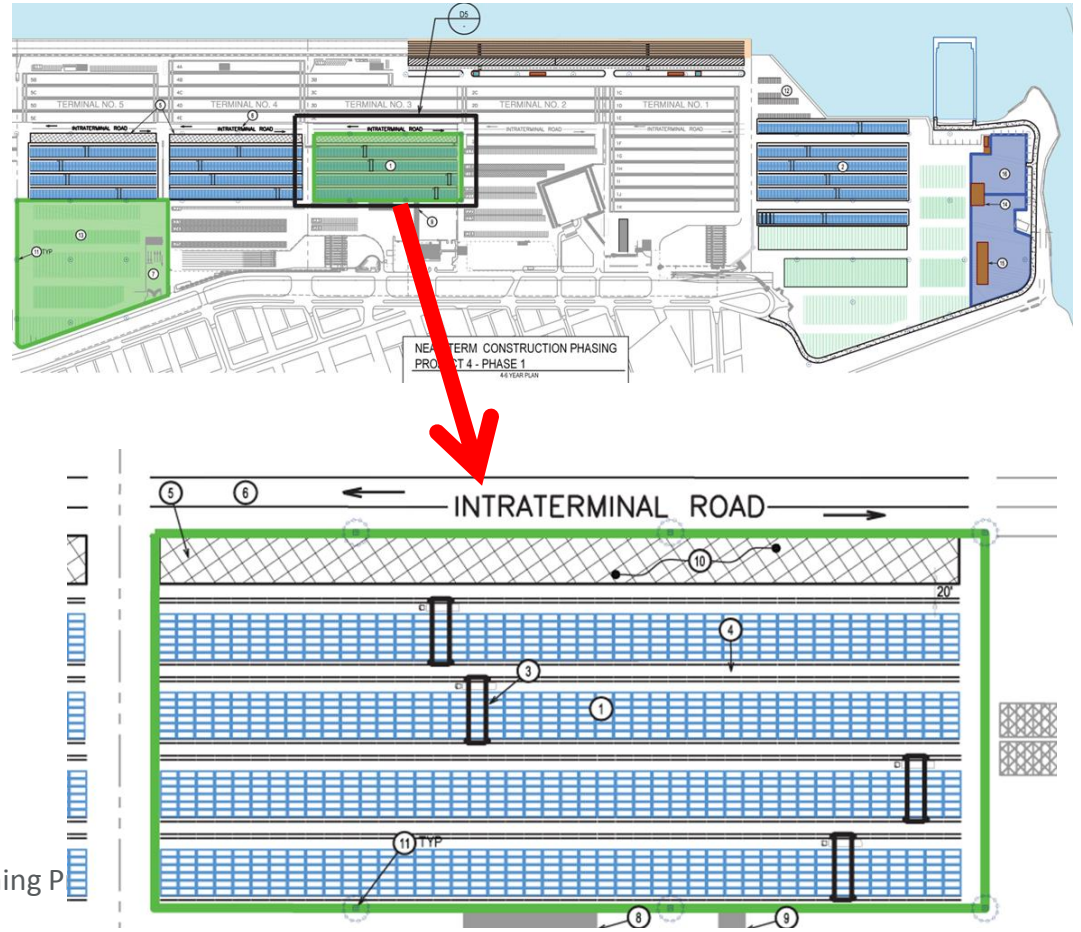
Near Term Construction Phasing
Project 4 - Phase 1 (5-7 Year Plan)

Project addition: + 1056 TGS

Project removal: -264 TGS

Net: + 792 TGS

Cumulative through project: + 3546 TGS



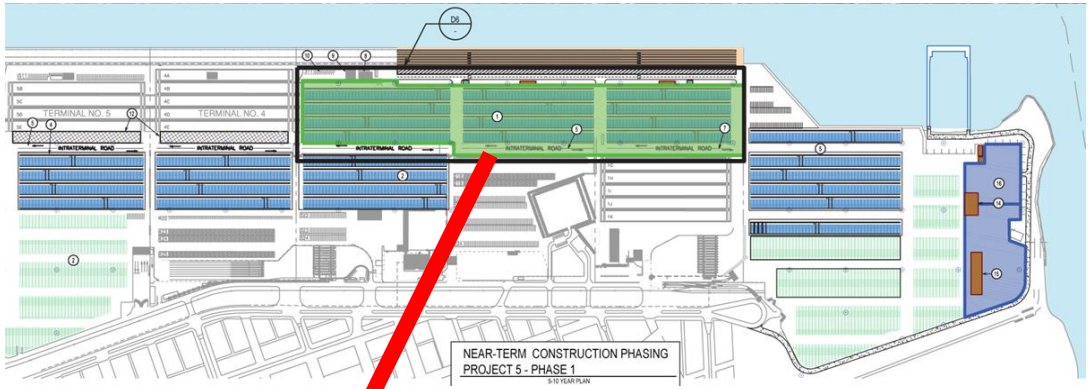
Near Term Construction Phasing
Project 5 - Phase 1 (6-10 Year Plan)

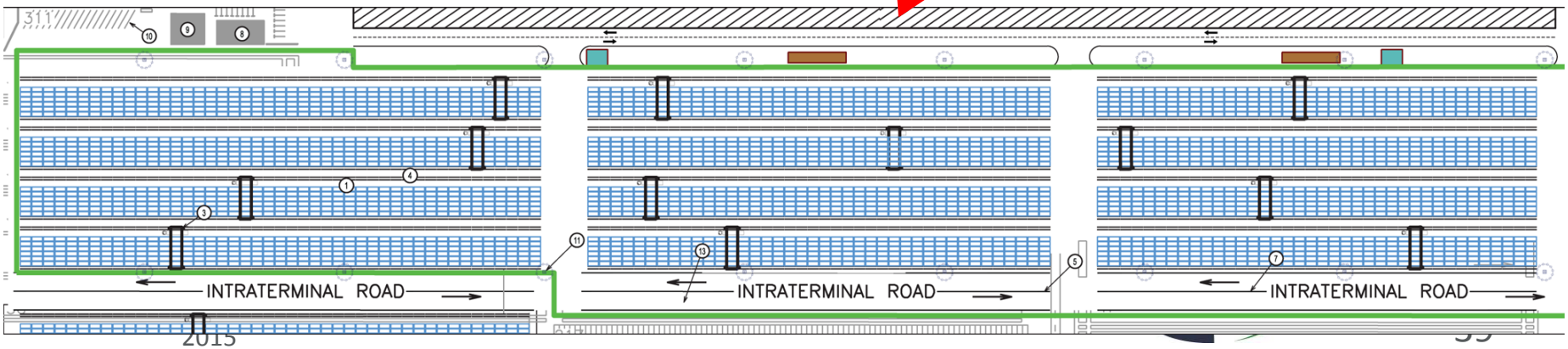
Phase addition: + 2952 TGS

Phase removal: - 2454 TGS

Phase net: + 498 TGS

Cumulative through project: + 4044 TGS





Near-Term Phasing
Project Timeline

Near-Term Construction Phasing

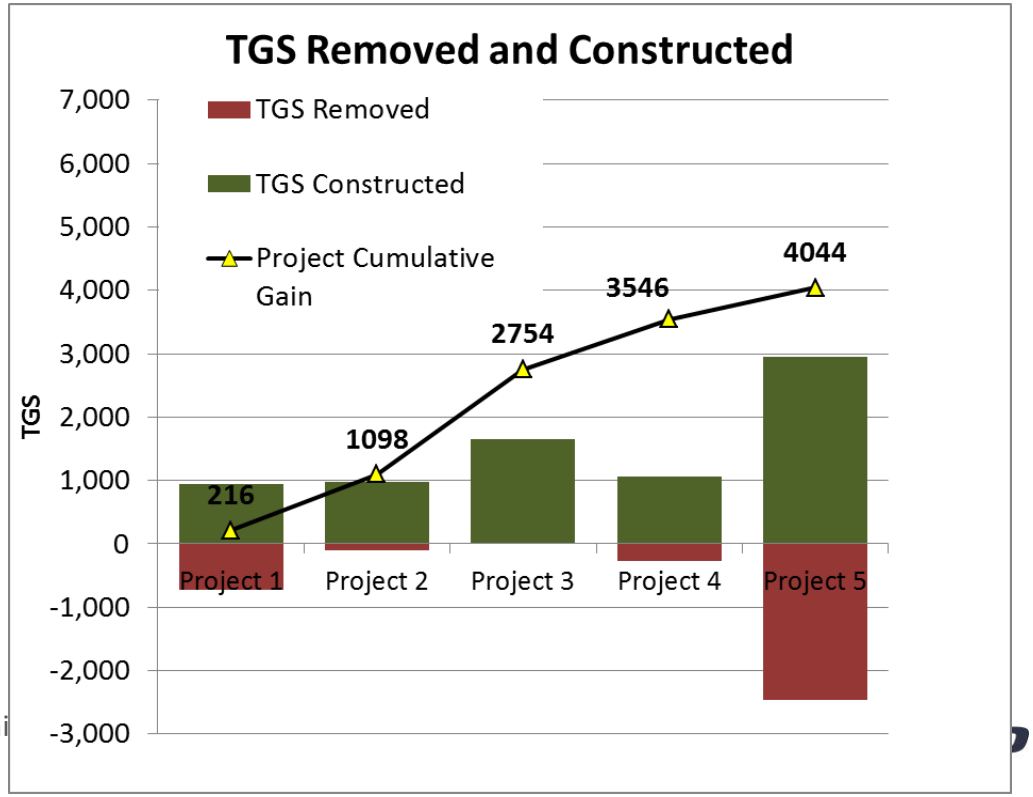
- Project 1 – Rehab Wharf 1 and C-5 Yard (0-3 Year Plan)
- Project 2 – Rehab Wharf 2 and C-4 Yard (0-4 Year Plan)
- Project 3 – Break Bulk Area (3-6 Year Plan)
- Project 4 – C-3 Yard (5-7 Year Plan)
- Project 5 – C-1/C-3 Waterfront (6-10 Year Plan)

			Year									
Project	Phase	Description	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
1	1	C-5 South Yard											
1	2	Rehab Wharf 1											
2	1	C-4 South Yard											
2	2	Rehab Wharf 2											
2	3	Substation & 12 kV Distribution											
3	1	Breakbulk Area											
4	1	C-3 South Yard & C-5 Backland											
5	1	C-1 to C-3 Waterfront											

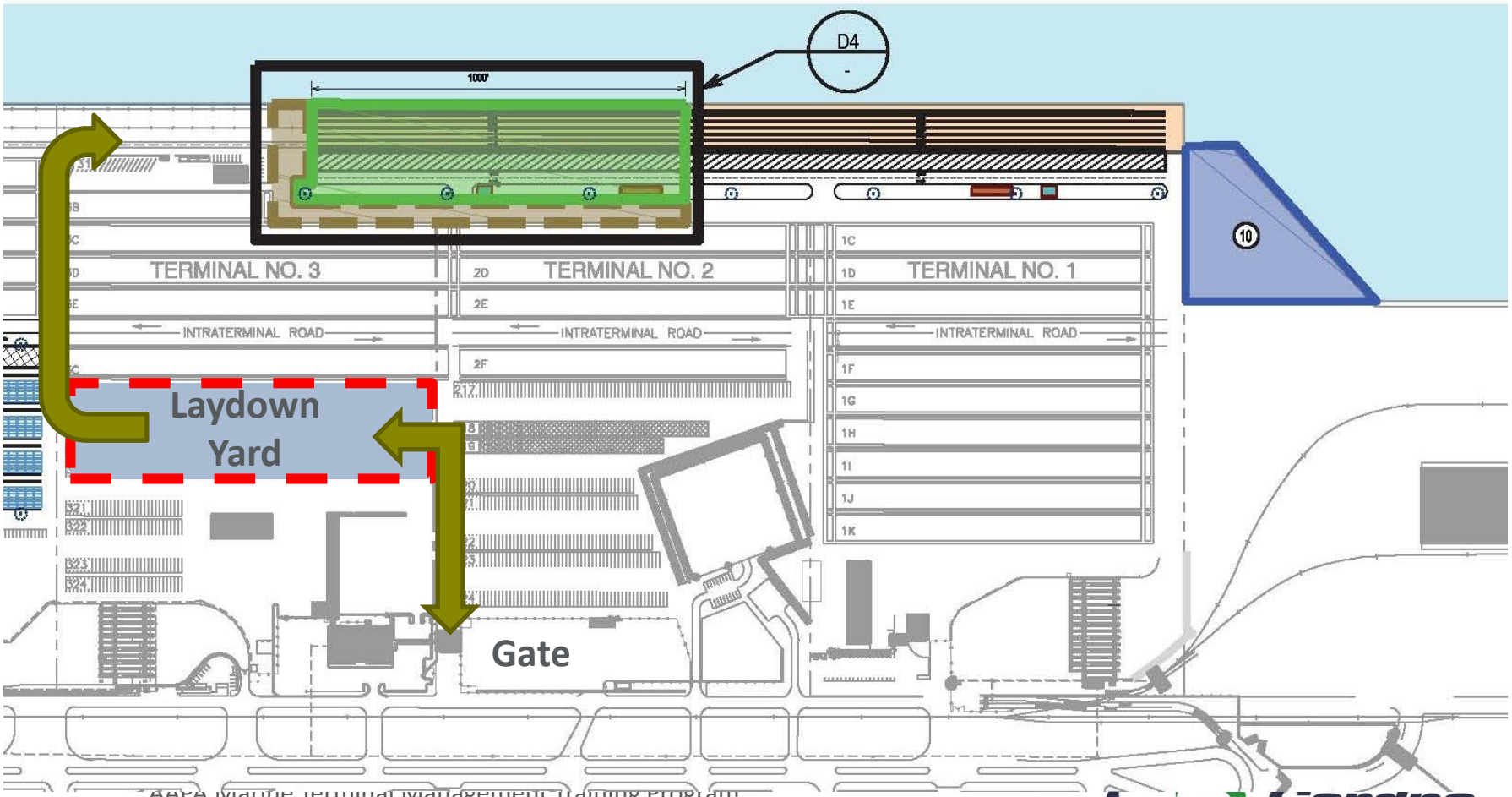
Near Term Construction Phasing
TGS Count by Project

Projects	Project 1	Project 2	Project 3	Project 4	Project 5	**Cumulative**
TGS Constructed	936	984	1656	1056	2952	**7584**
TGS Removed	-720	-102	0	-264	-2454	**-3540**
Project Net	216	882	1656	792	498	**4044**
Project Cumulative Gain	**216**	**1098**	**2754**	**3546**	**4044**	

- Each project adds more TGS than it removes
- After project is completed, the CY will have 4,044 more TGS than when construction began



Another Critical Item Is Laydown Areas and Haul Routes During Construction



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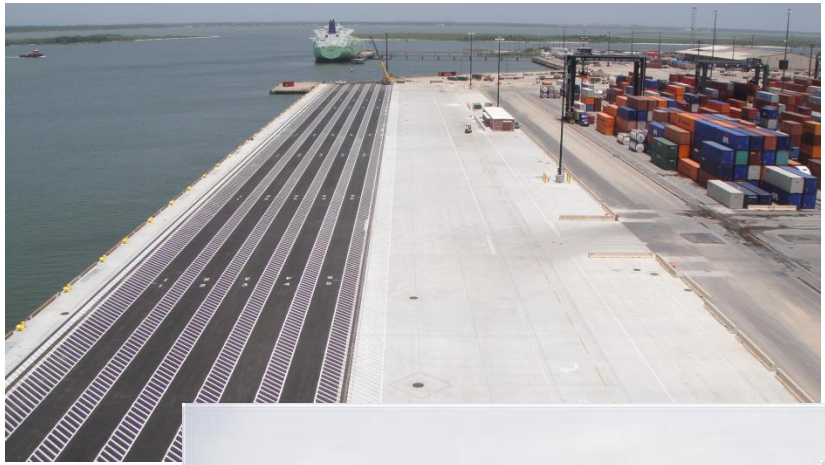
Wharf 1 Project Completed Fall 2014
Wharf 2 Advertised For Bid Fall 2015



- Berth 1 Completed;
- 4 New Post-Panama Cranes Delivered;
- Terminal areas 4 & 5 improvements completed
- Berth 2 project currently out for bid

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Conclusion

- Program Planning (Master Planning) is a critical element to any terminal development project;
- There are many “small” items that have to be considered during this planning process;
- Successful Program Master Planning ensures successful design and construction programs.

- For More Information:

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