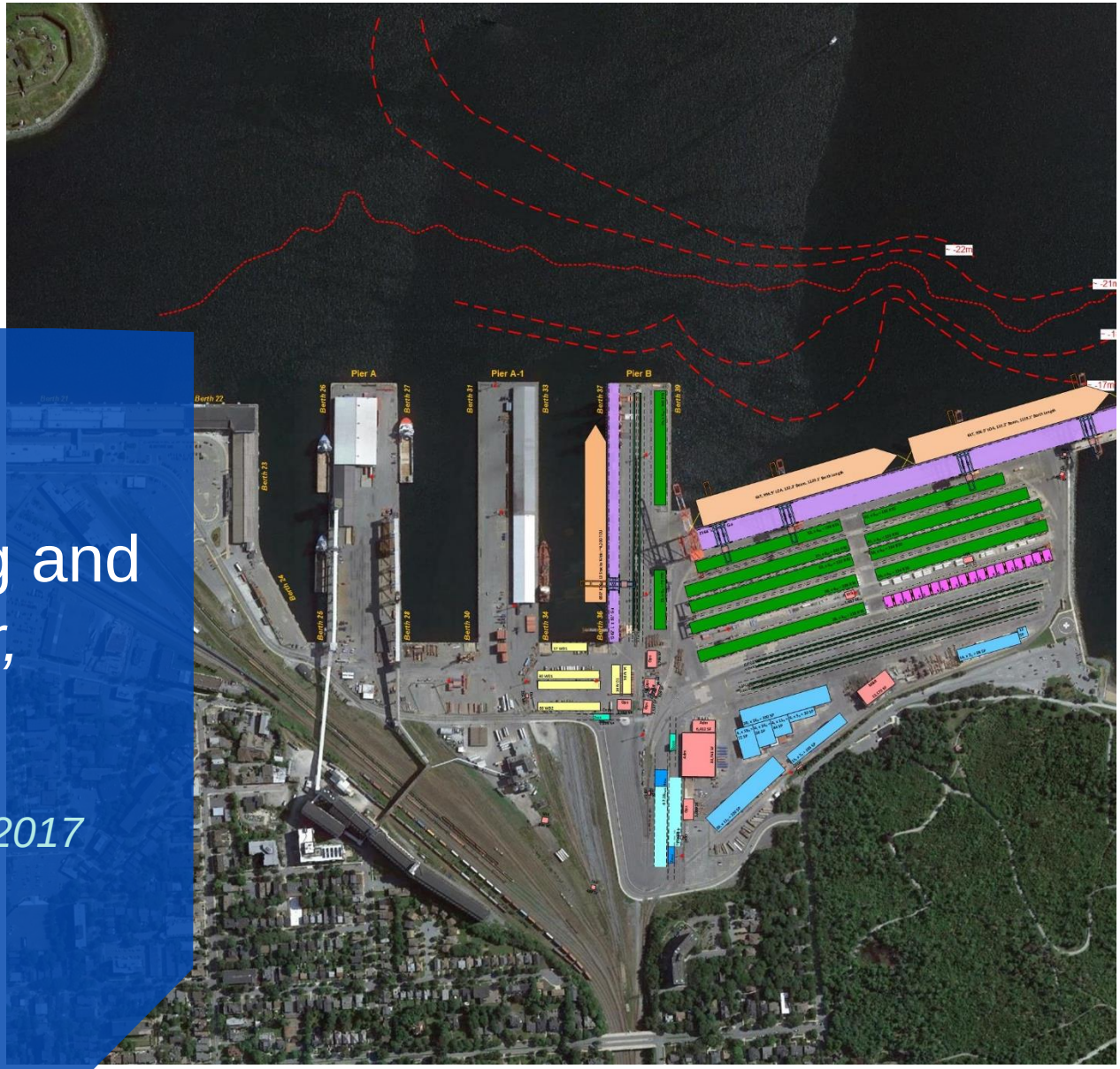
Port Master Planning and Land Use – *Cheaper, Faster, and Better!*

Ports and Terminal Technology 2017
Norfolk, Virginia



Hardik Gajjar, ENV SP
Senior Maritime Planner

April 12, 2017

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OVERVIEW

- → **Maritime Planning**
- → **What do Clients want?**
- → **Challenges**
- → **Planning Response**
- → **Summary**

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MARITIME PLANNING

- **Maritime planning is a process which requires laying out a facility such that it can handle anticipated cargo volume with safety and efficiency, within the available land mass, and in a stipulated budget.**
- **It's an iterative process of:**
  - Developing layouts
  - Calculating capacity
  - Comparing capacity to demand
  - Analyzing operational efficiency
  - Refining layout
  - Capital Expenditure (CapEx) and Operational Expenditure (OpEx) calculation

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TERMINAL PLANNING

- **Terminal level**
- **One entity: Terminal Operator**
- **Operational aspects**
  - Equipment requirement
  - Labor requirement
  - Operational flows
- **Financial aspects**
  - Capital expense
    - Site development
    - Equipment
    - Facility maintenance
  - Operational Expense
    - Labor
    - Maintenance
    - Consumables

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MASTER PLANNING

- **Port level**
- **Multiple entities/stakeholders**
- **Various aspects**
  - Operational
  - Financial
  - Economical
  - Public involvement
  - Stakeholder outreach

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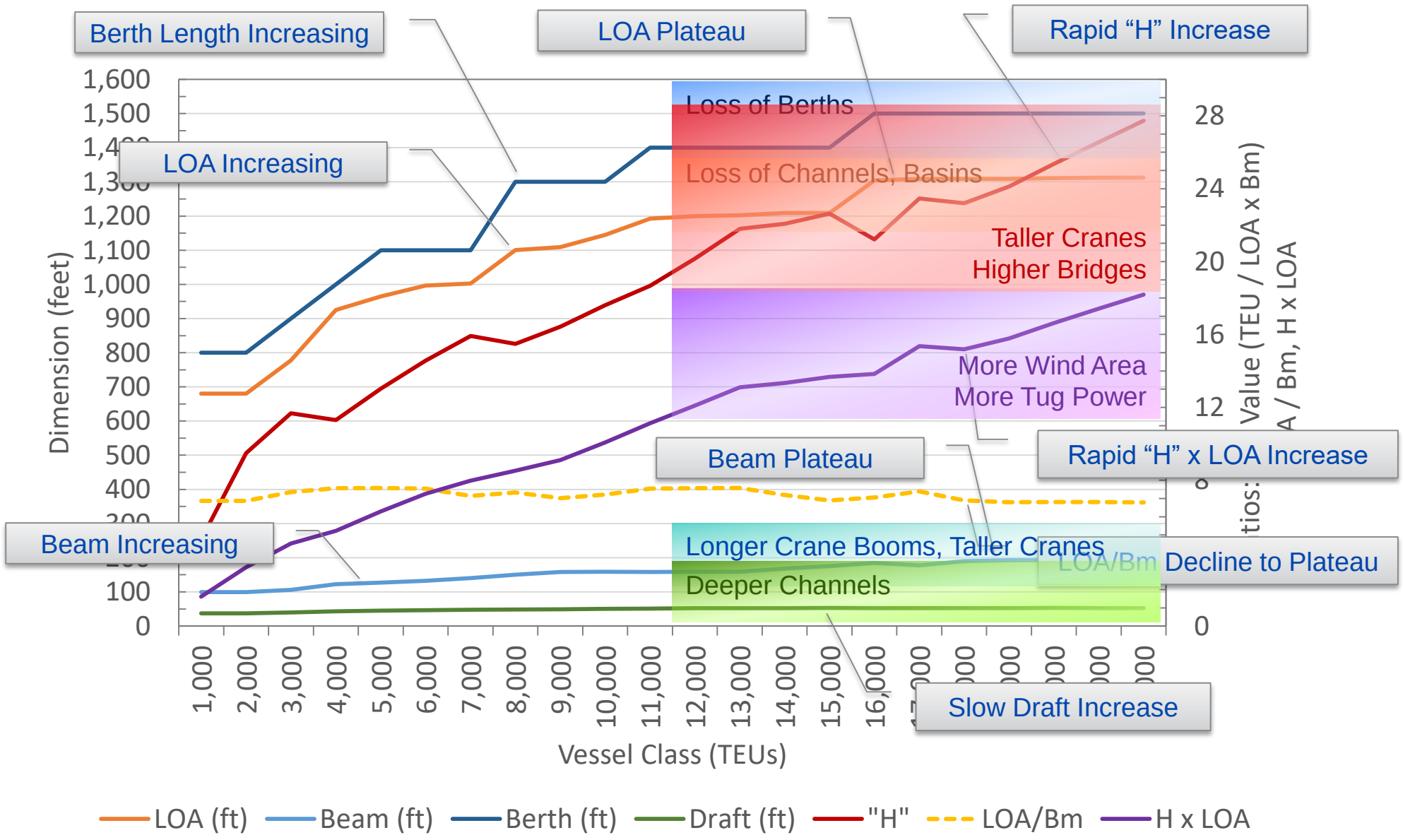
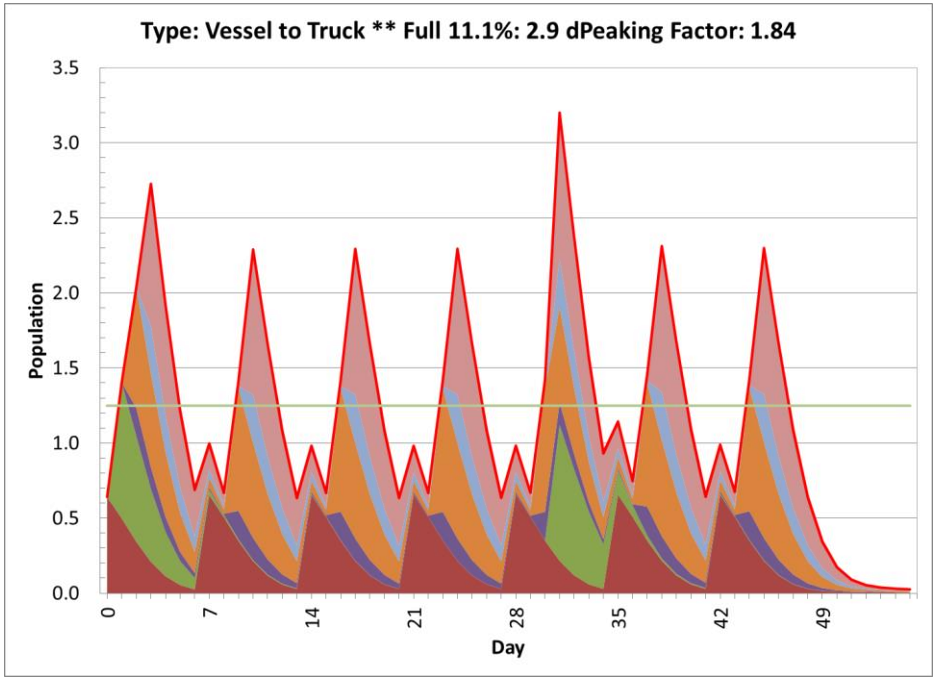
A BIG CHALLENGE: BIG SHIPS



TACTICAL PEAK

- Peak inventory vs. mean inventory over a short time frame
- Dock cranes create rapid changes in inventory – gains for imports, debits for exports
- For short-dwell containers, this can cause rapid swings of inventory: high TPF
- Bigger ships at longer intervals concentrate the movements: high TPF



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WHAT DO CLIENTS WANT?

- → **Realistic plans**
- → **Quick turnaround**
- → **At low cost**
- → **We need to stay ahead:**
  - Fulfill client needs
  - Win more work!
- → **Terminal Storage Demand Model (TSDM)**
- → **Port Rail Intermodal Modeling Environment (PRIME)**

Schedule

Cost

Scope

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TERMINAL STORAGE DEMAND MODEL

- **WSP | PB has created its proprietary TSDM tool to simulate the storage demand and flow volumes**
- **TSDM takes as input:**
  - Terminal operating schedule – vessel, gate (truck), rail
  - Container type definition – storage mode, transport mode
  - Container dwell time – mean and random distribution
  - Vessel service profile – container type mix and move count
  - Vessel schedule
- **TSDM reports as output, over the course of the year:**
  - Container inventory by hour
  - Container flow across each interface (gate, vessel, rail)
  - Required container storage area
- **We have used TSDM successfully in many terminals over the last ten years**

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TERMINAL STORAGE DEMAND MODEL

→ Three Cases:

- Three ships per week, 1,000 lifts per call, Days 2, 4 and 6
- Two bigger ships per week, 1,500 lifts per call, Days 2 and 5
- One big ship per week, 3,000 lifts per call, Day 2

→ Common elements

- Same annual volume: 156,000 lifts per year
- Maximum call duration is two working days
- 7-day gate operations
- US West Coast values
  - Empty/Full, Import/Export, Gate/Rail
  - Storage modes and densities
  - Dwell times and distributions

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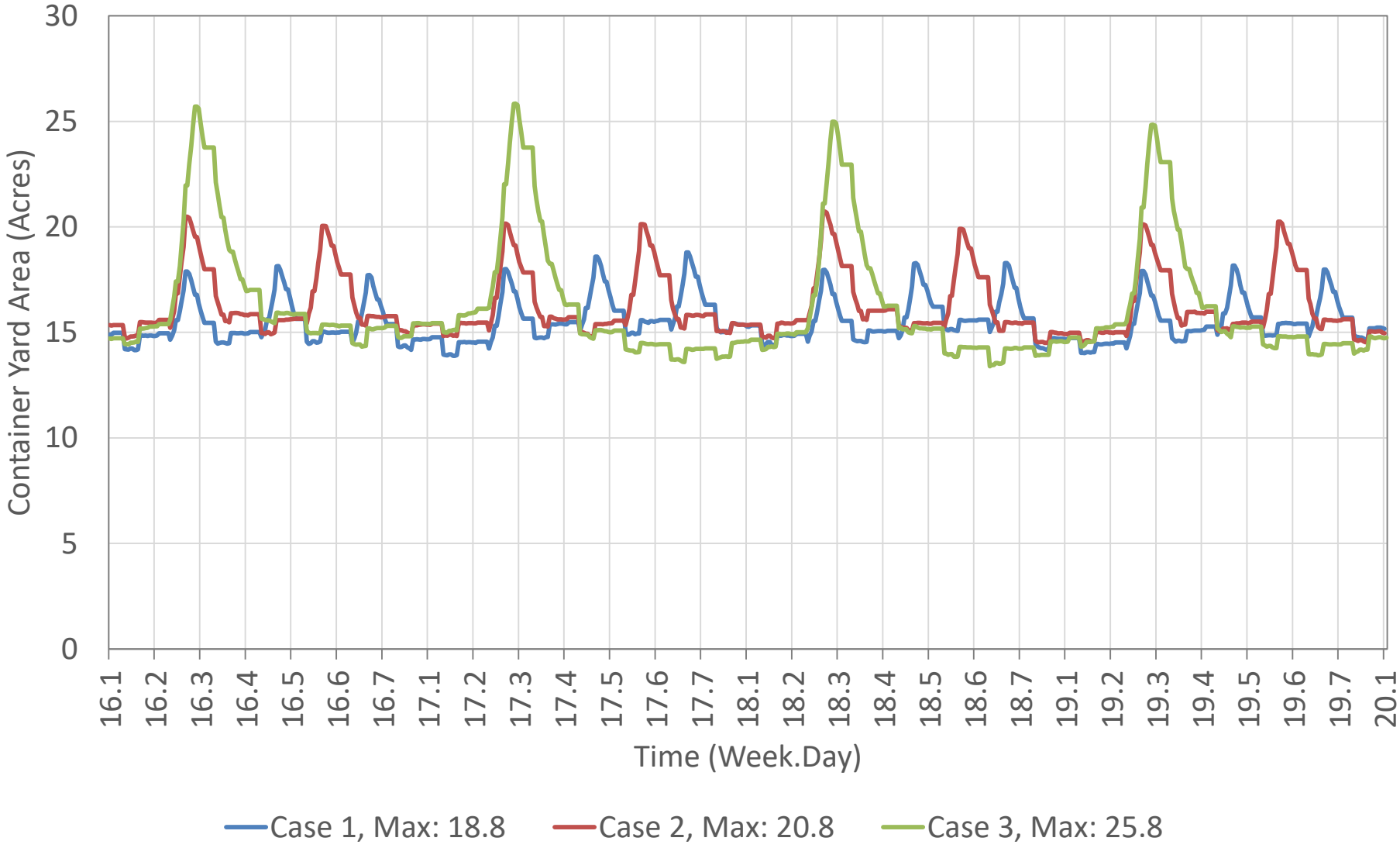
TSDM ANALYSIS: YARD AREA



Increased storage area for same volume:
Case 2: +11%, Case 3: +37%

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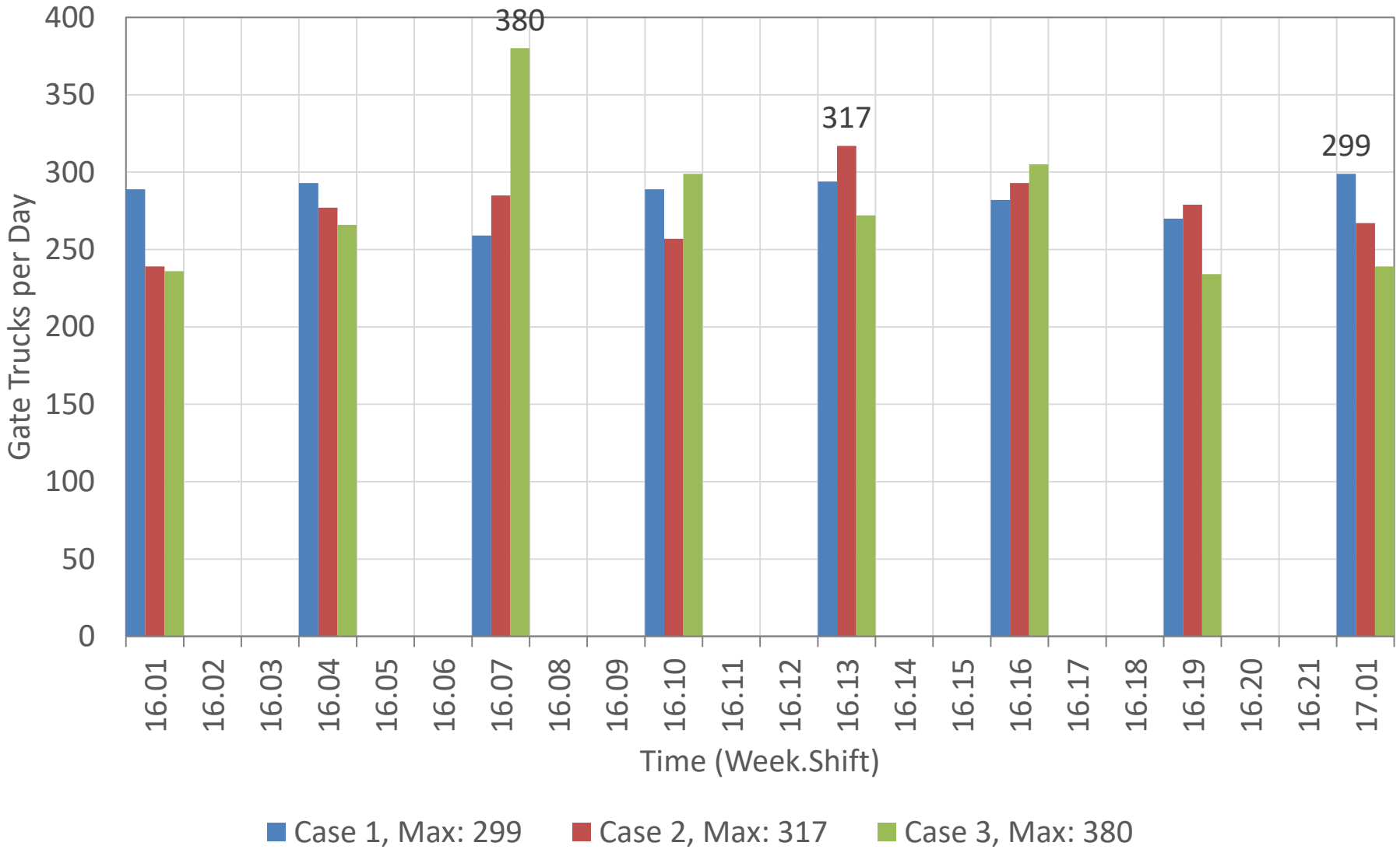
TSDM ANALYSIS: GATE FLOW



Increased boundary flow for same volume:
Case 2: +6%, Case 3: +27%

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PRIME

- **Integrated platform that allows rapid, robust planning and operational analysis of goods movement terminals**
- **Suitable for**
  - Conceptual planning
  - Master planning
  - Phased development analysis
  - Due diligence
- **Physical plans laid out in Microsoft Visio**
- **Operational models in Microsoft Excel**
- **Tight, direct integration between layouts and models using custom program codes**

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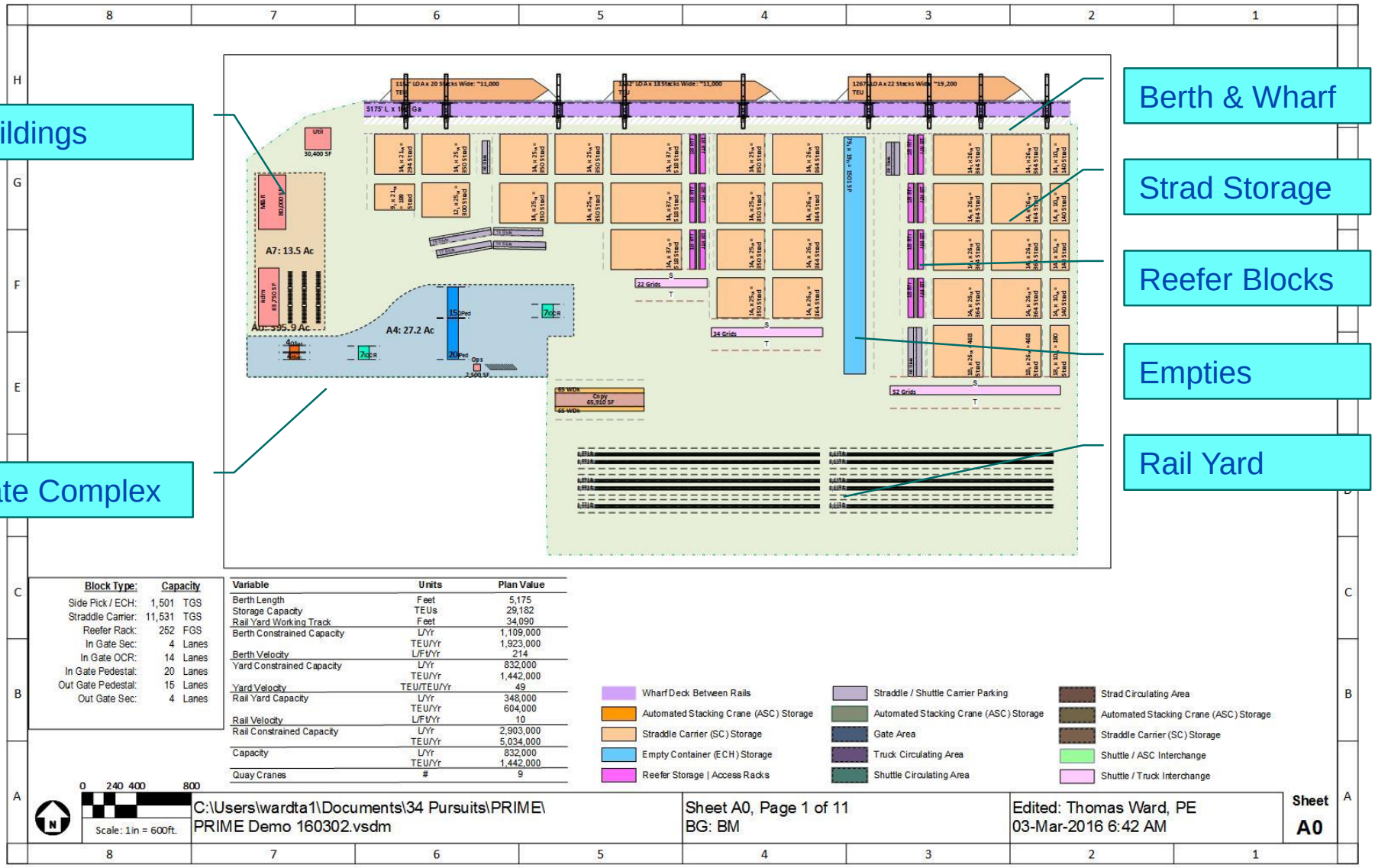
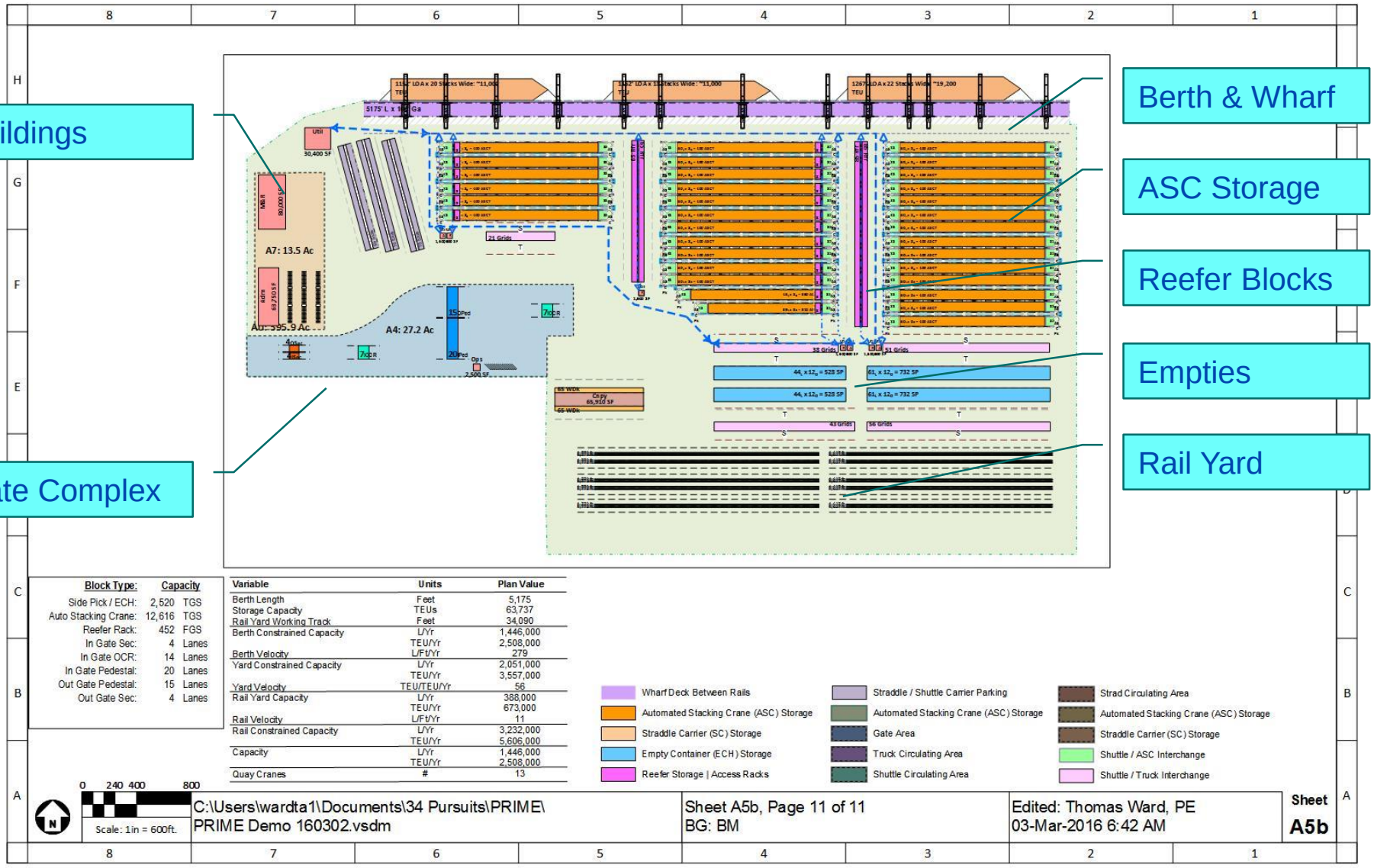
INITIAL LAYOUT

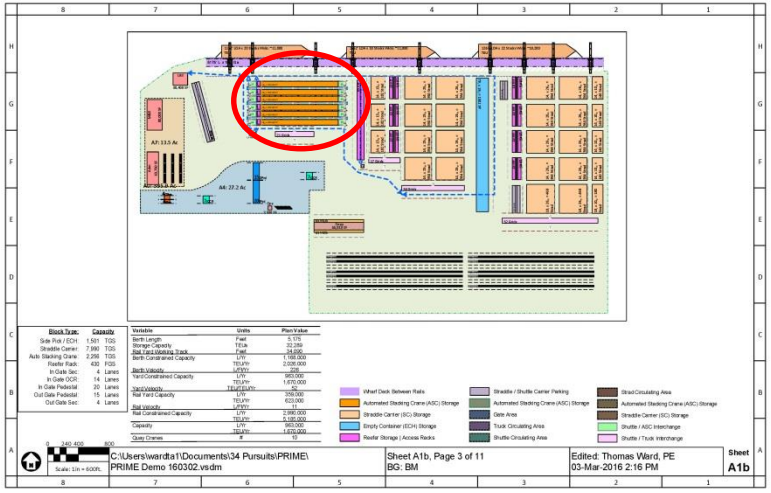


FINAL LAYOUT



PHASED DEVELOPMENT

1



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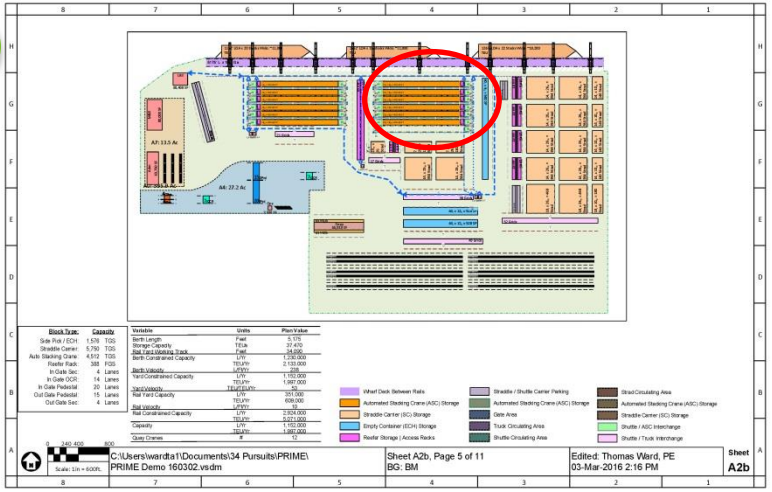

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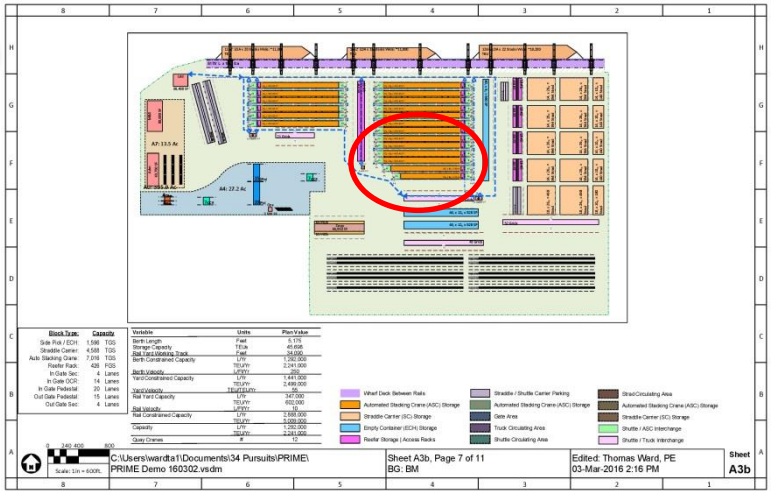

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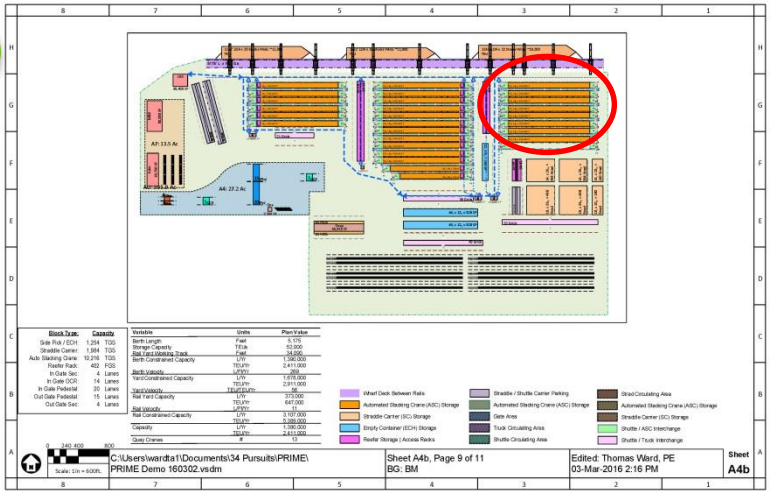

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STATISTICS TRANSFERRED TO PRIME MODEL

	Ground Slots in Visio Layout: PRIME Demo 160302.vsdm on 3/2/2016 at 17:02:21										
Block Name	**A0**	**A1a**	**A1b**	**A2a**	**A2b**	**A3a**	**A3b**	**A4a**	**A4b**	**A5a**	**A5b**
RfRk ASC	0	0	96	96	192	192	304	304	304	304	304
RfRk Strad	504	504	764	584	584	548	548	332	500	428	600
SP	1,501	1,501	1,501	1,576	1,576	1,576	1,596	1,146	1,254	1,056	2,520
SP Taper	0	0	0	0	0	0	0	0	0	0	0
Strad	11,531	7,990	7,990	5,750	5,750	4,588	4,588	1,984	1,984	806	0
Strad Taper	0	0	0	0	0	0	0	0	0	0	0
RMG	0	0	0	0	0	0	0	0	0	0	0
ASC/MS	0	0	2,400	2,400	4,800	4,800	7,472	7,472	10,672	10,672	13,072
ASCS	0	0	-144	-144	-288	-288	-456	-456	-456	-456	-456

- **Storage capacities as 20-foot ground slots**
- **Construction phasing pushes capacity down before it can go back up**
- **Phasing impacts on revenue potential must be considered**

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ANALYSIS MODEL COMPONENTS

- → **Berth-constrained capacity**
- → **Yard-constrained capacity**
- → **Rail yard capacity**
- → **Gate requirements**
- → **Equipment requirements and utilization**
- → **Demand timing**
- → **Capital expense estimation**
- → **Operating expense estimation**
- → **Cash flow estimation**

- → **All integrated and cross-referencing**

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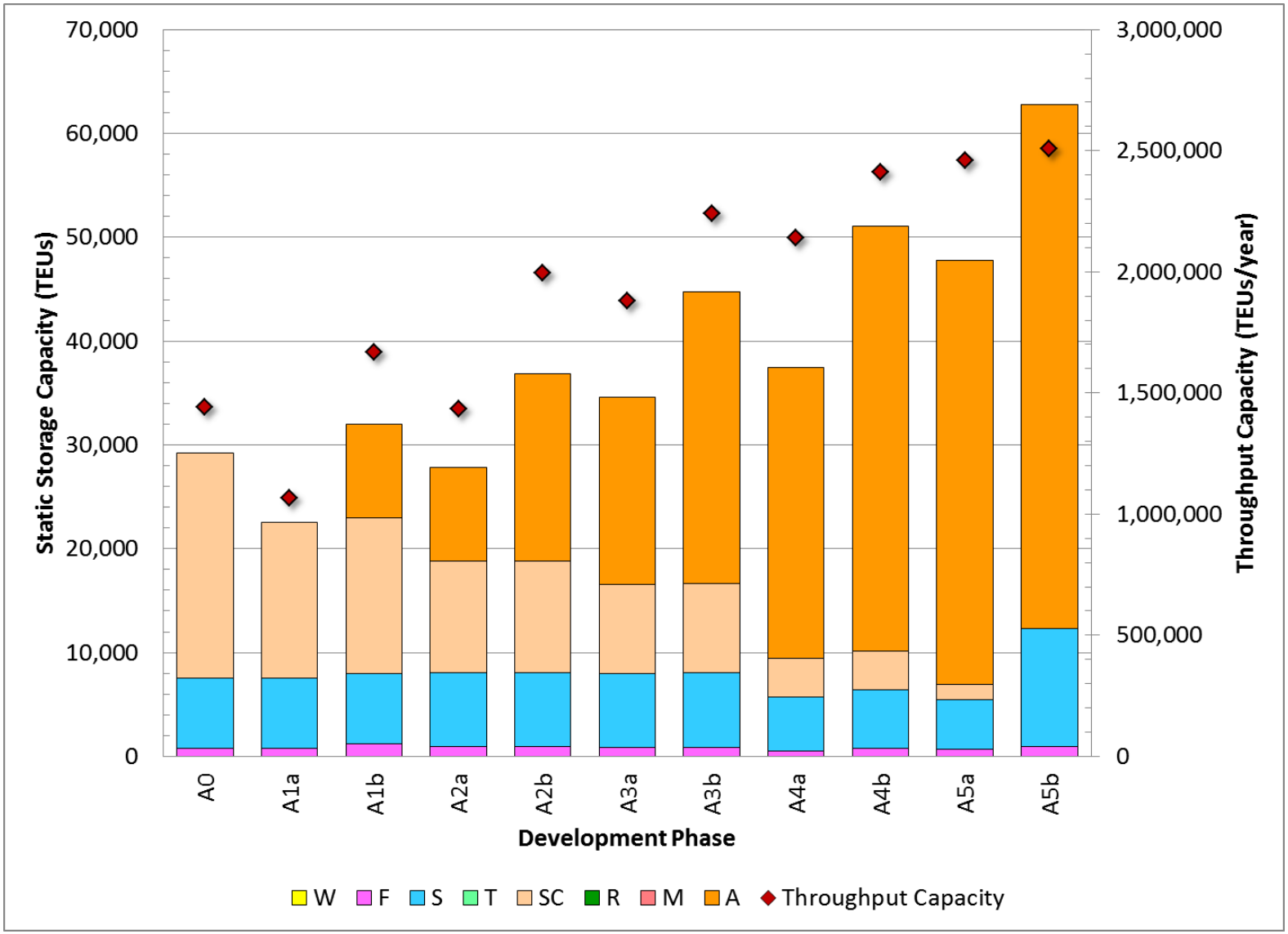
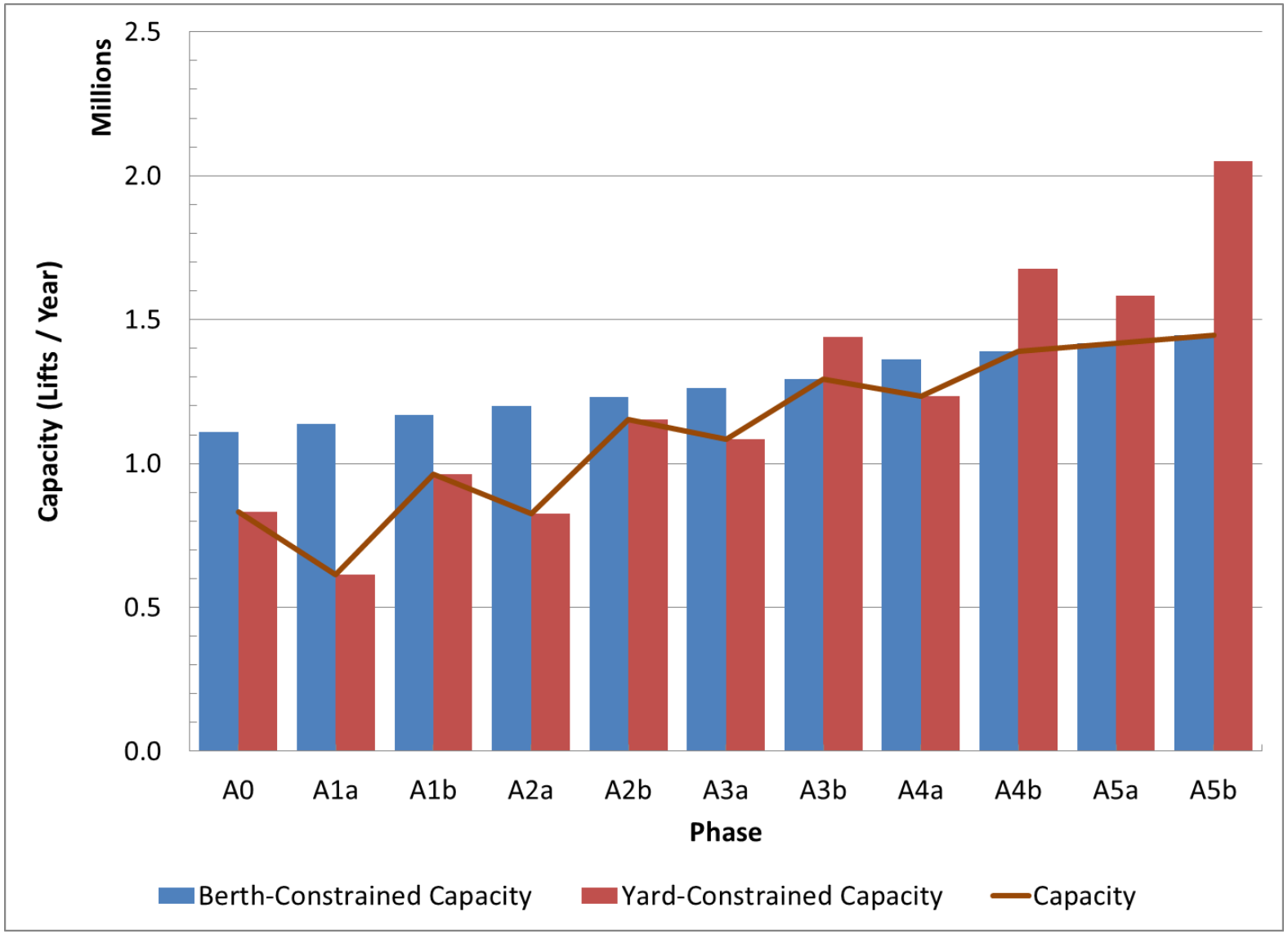
STATIC STORAGE & THROUGHPUT CAPACITY



BERTH- AND YARD-CONSTRAINED CAPACITY



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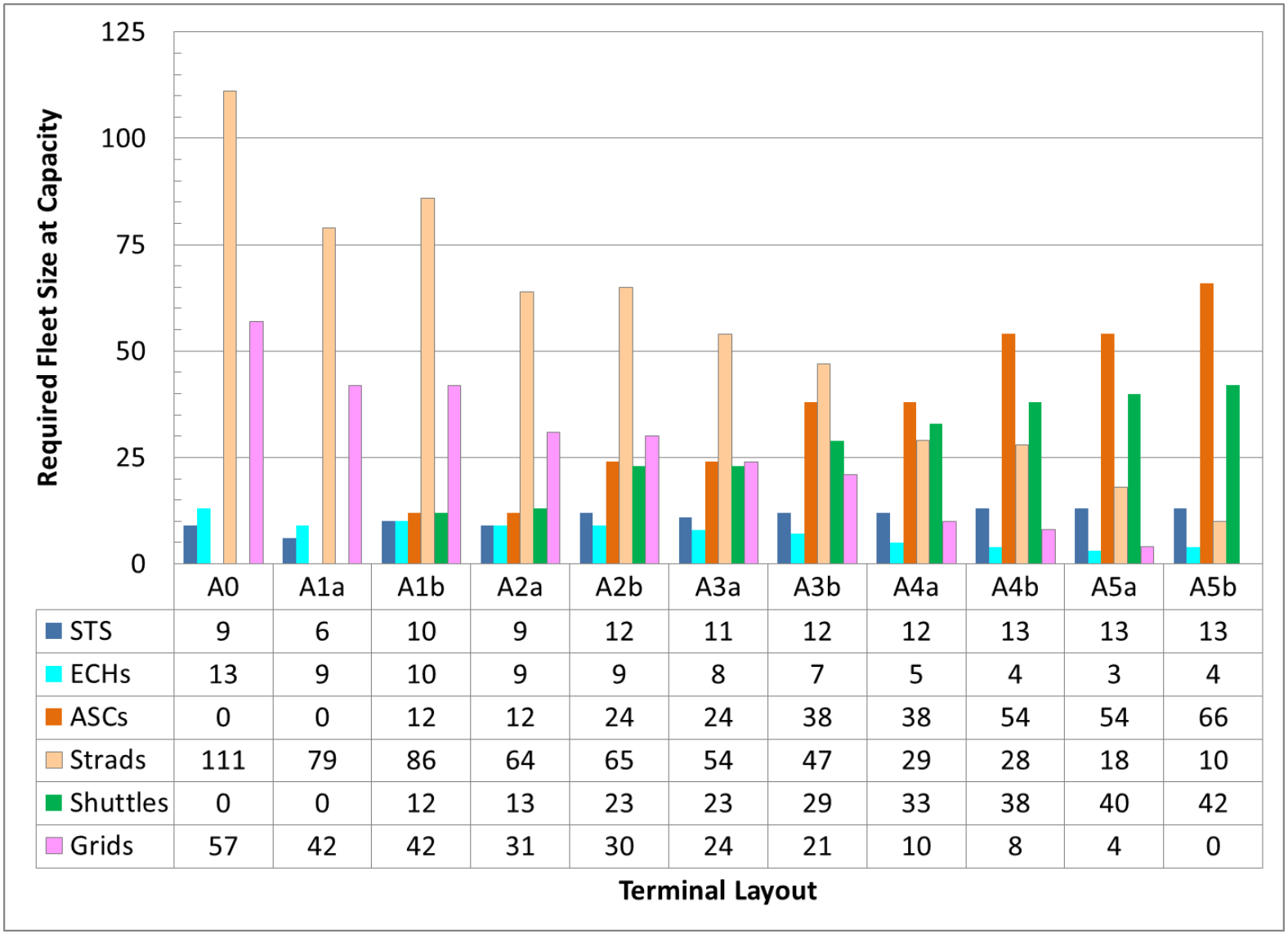
EQUIPMENT FLEET SIZING



	A0	A1a	A1b	A2a	A2b	A3a	A3b	A4a	A4b	A5a	A5b
STS	9	6	10	9	12	11	12	12	13	13	13
ECHs	13	9	10	9	9	8	7	5	4	3	4
ASCs	0	0	12	12	24	24	38	38	54	54	66
Strads	111	79	86	64	65	54	47	29	28	18	10
Shuttles	0	0	12	13	23	23	29	33	38	40	42
Grids	57	42	42	31	30	24	21	10	8	4	0

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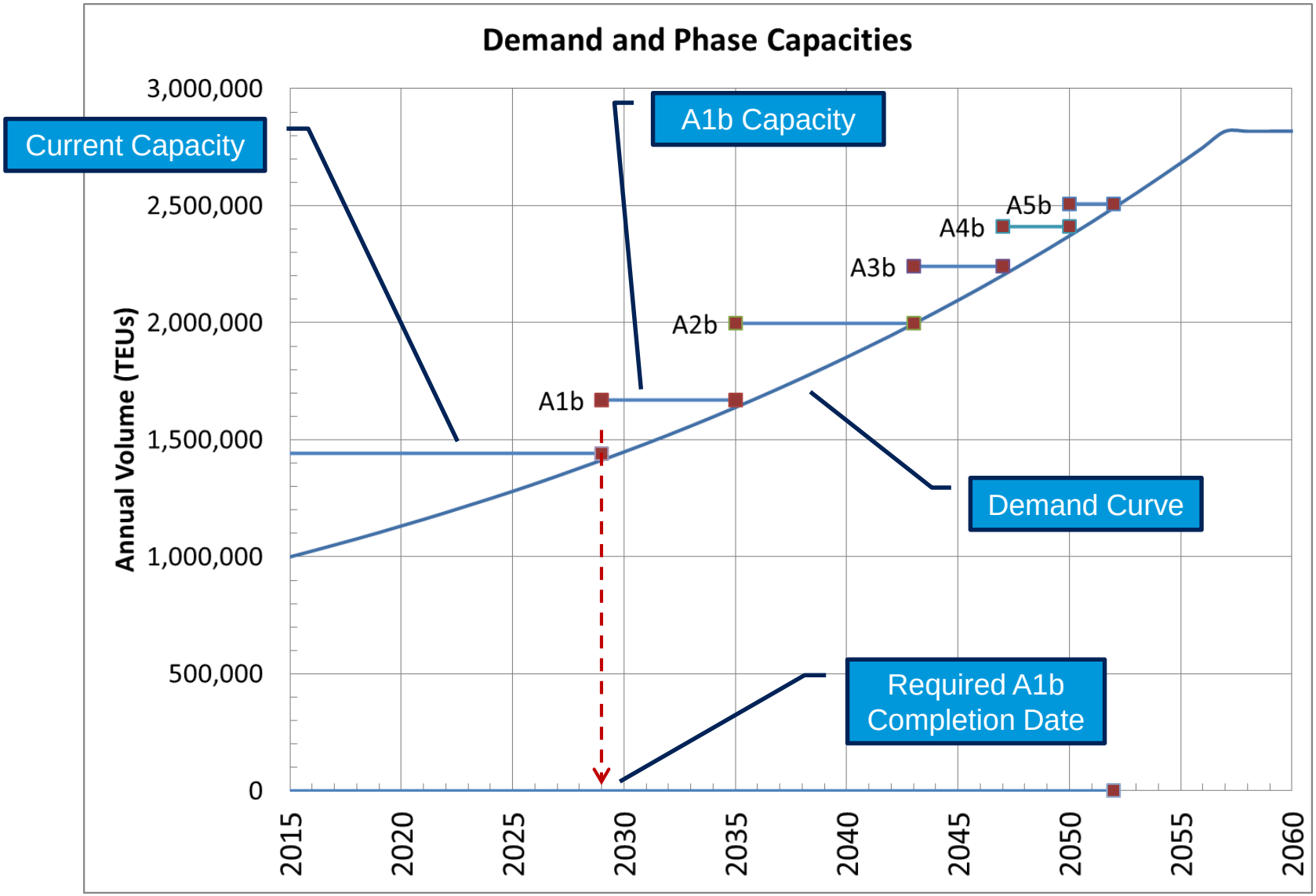
PHASE TIMING VS. DEMAND



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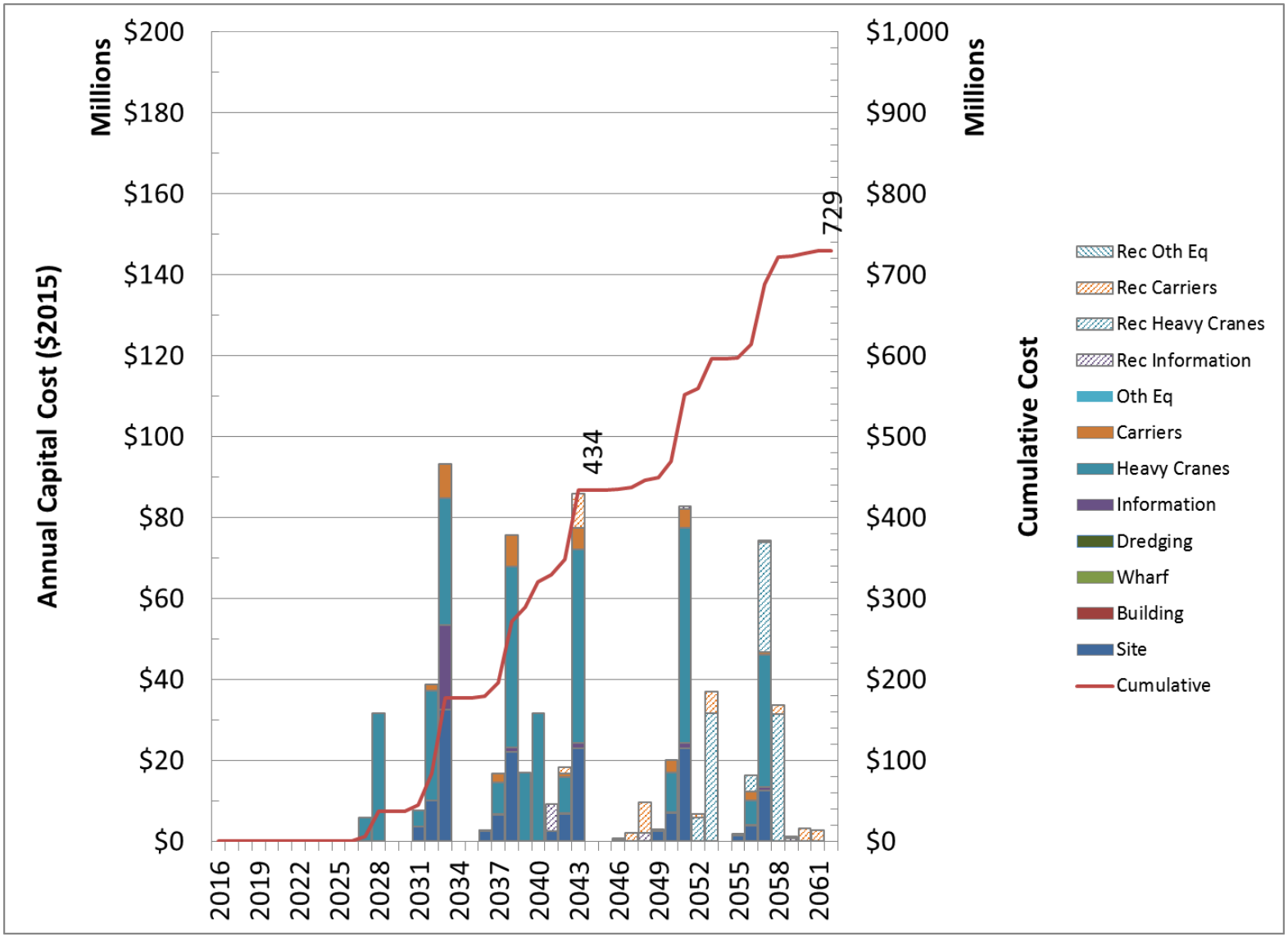
CAPEX CASH FLOW



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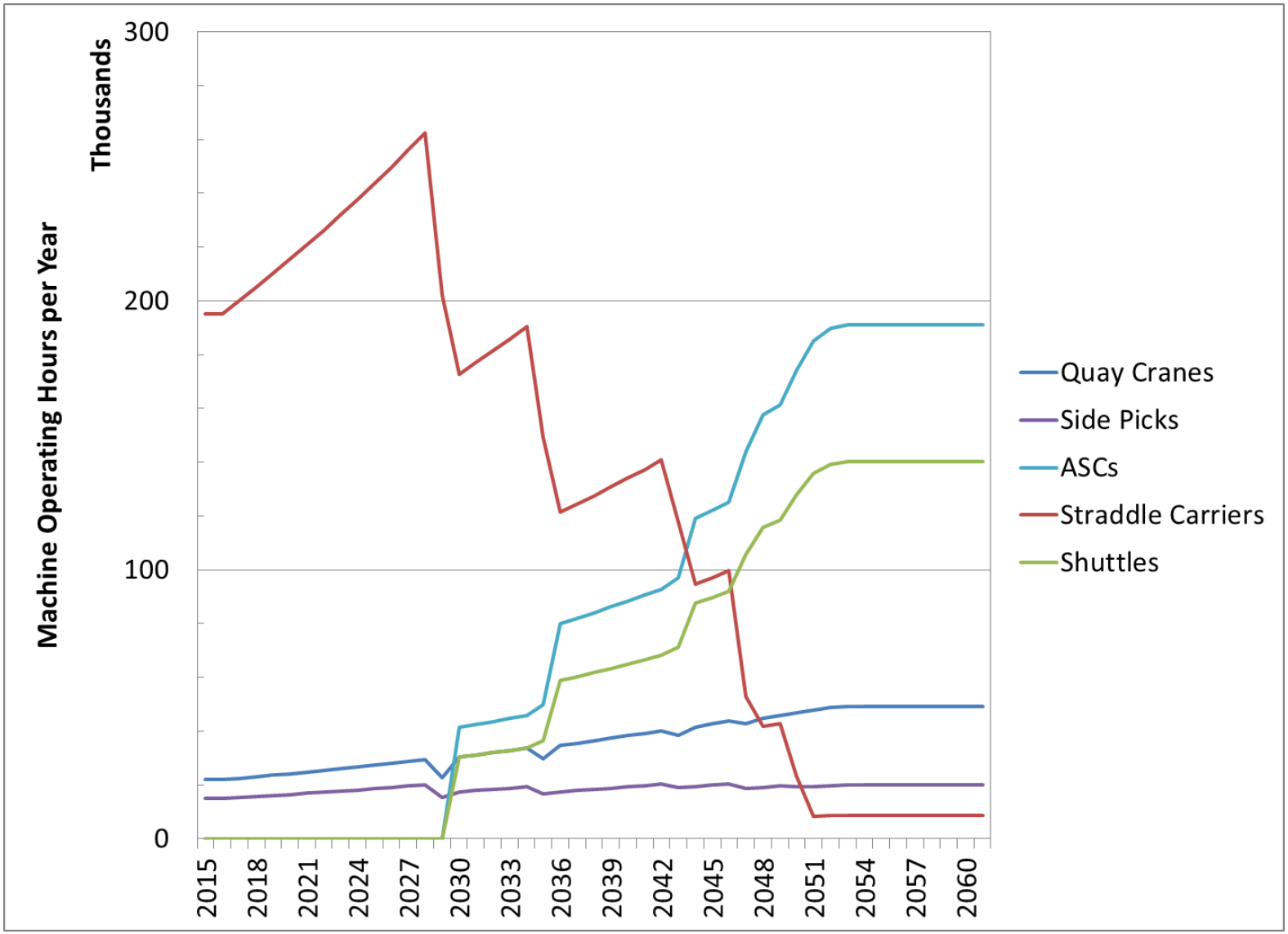
MACHINE OPERATING HOURS PER YEAR



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PRIME | PORT


Port of Long Beach
Land Use Study
LEGEND
Scale: 1in = 600ft.
Concept: LUS s0 a00
Layout: 1
Drawing Name:
A1

PRIME | PORT

- **Analyze multiple port layouts**
- **All commodities**
  - Container/Dry Bulk/Break Bulk/RORO/Liquid Bulk
- **Various KPIs**
  - Berth/Yard/Rail Capacity
  - Demand vs. Capacity
  - Vessel/Rail/Truck Volume
  - Truck traffic counts and rails per day
  - Emissions – PM10, NOx, CO_2e
  - Revenue and Capital Expense
  - Labor
- **GIS integration**

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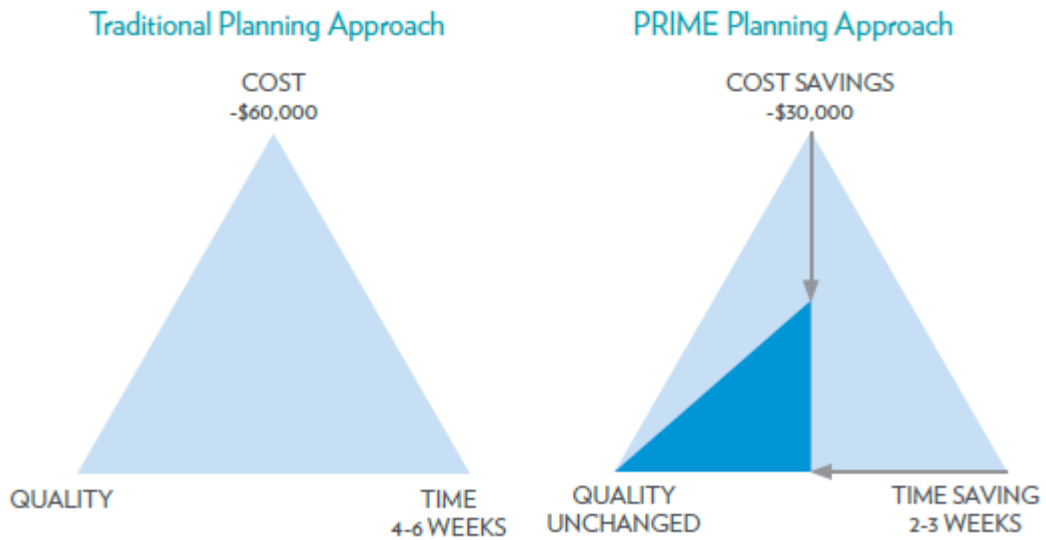
SUMMARY

→ Tackle the challenges and fulfill client expectations

- Requires a robust, reliable and sophisticated tool

→ PRIME Benefits

- Tight integration between layouts and capacity models
- Can explore more alternatives and analyze at greater depth without costing a lot.
- Not just containers – all cargo types
- Cheaper, Faster, and Better!



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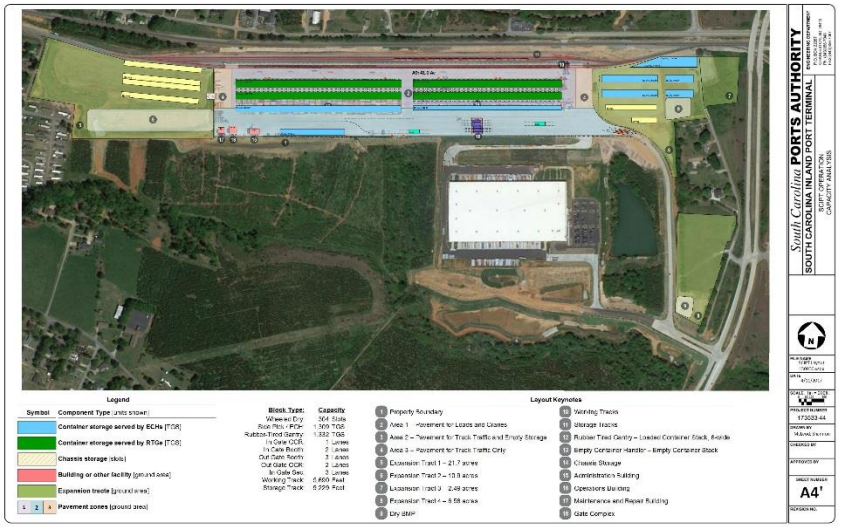
PRIME PROJECTS



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THANK YOU!

Hardik Gajjar

Senior Maritime Planner

GajjarHM@pbworld.com

Phone: 757-459-4727

Thomas Ward

Senior Maritime Planner

WardTA1@pbworld.com

Phone: 510-285-3372