Port of LONG BEACH
The Green Port

AECOM

Port Capacity Analysis in Long Beach

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About the Port of Long Beach

- Second busiest container port in N. America
- 7 container terminals covering 1,350 acres
- 2009 throughput of 5 million TEU
- 2007 peak throughput of 7.4 million TEU

Why does POLB Care about Terminal Capacity?

- Build efficient terminals
- Plan for projected cargo growth and inform terminal development decisions
- Build efficient support infrastructure: road+rail
- Understand environmental impacts and need for mitigation

Recent History of Capacity Analysis at POLB

- Early 2000s and before: projects analyzed on a case by case basis with little comparison or detailed explanation of assumptions
- Pier J South EIR scuttled in fall of 2004
- Environmental QA/QC process involving third-party review of methodologies
- Develop a general methodology for terminal capacity estimation which provides:
  - Consistent analysis for all Port terminals and proposed projects
  - Reasonable but conservative estimate of overall terminal capacity
  - Terminal specific throughput estimates over time
  - Terminal specific vessel activity

Related Studies

- SPB Long Term Cargo Forecasts (1998, 2007, 2009)
  - Expected cargo volumes
  - Expected mode splits (i.e., local vs. intermodal)
- Mercator Vessel Forecast (2006)
  - Number of weekly services calling at SPB
  - Expected range of vessel sizes
  - Number of box-moves for each vessel category
  - Air emissions factors for each vessel category

Overall POLB Capacity Analysis Procedure

- Identify future terminal layout
- Calculate container yard (CY) capacity with spreadsheets
- Develop an example vessel schedule based on Mercator distribution with volume similar to CY capacity
- Analyze vessel schedule with Bertha statistical model
  - If less than 5% queuing, terminal will be limited by CY capacity
  - If more than 5% queuing, remove one vessel and re-analyze, repeat until vessel queuing is under 5% threshold – terminal will be berth constrained
- Report overall capacity as lesser of CY or berth capacity

Long Term Trends in POLB Operations

- Larger ships with more cranes assigned
- Longer working hours when terminals are busy (21 vs. 16 hr)
- Shorter container dwell times
- Fewer containers stored on wheels (prior to recent downturn)
- Use of taller equipment to enable higher mean stack heights

Container Yard Capacity : Spreadsheet Analysis

- Area available for CY operations
- Cargo handling equipment (e.g., RTG vs. RMG)
- Mix of container types and dwell times
- Base operating assumptions reflect modest change from current operations.
  - Continue RTG operations at most terminals
  - Reduced wheeled storage
  - Higher density from higher stacking (e.g.,1/5 RTG)
  - Modest decrease in expected dwell times (vs. 2005)
- Resulting density reaches 10,000+ TEU per gross terminal acre per year at capacity.

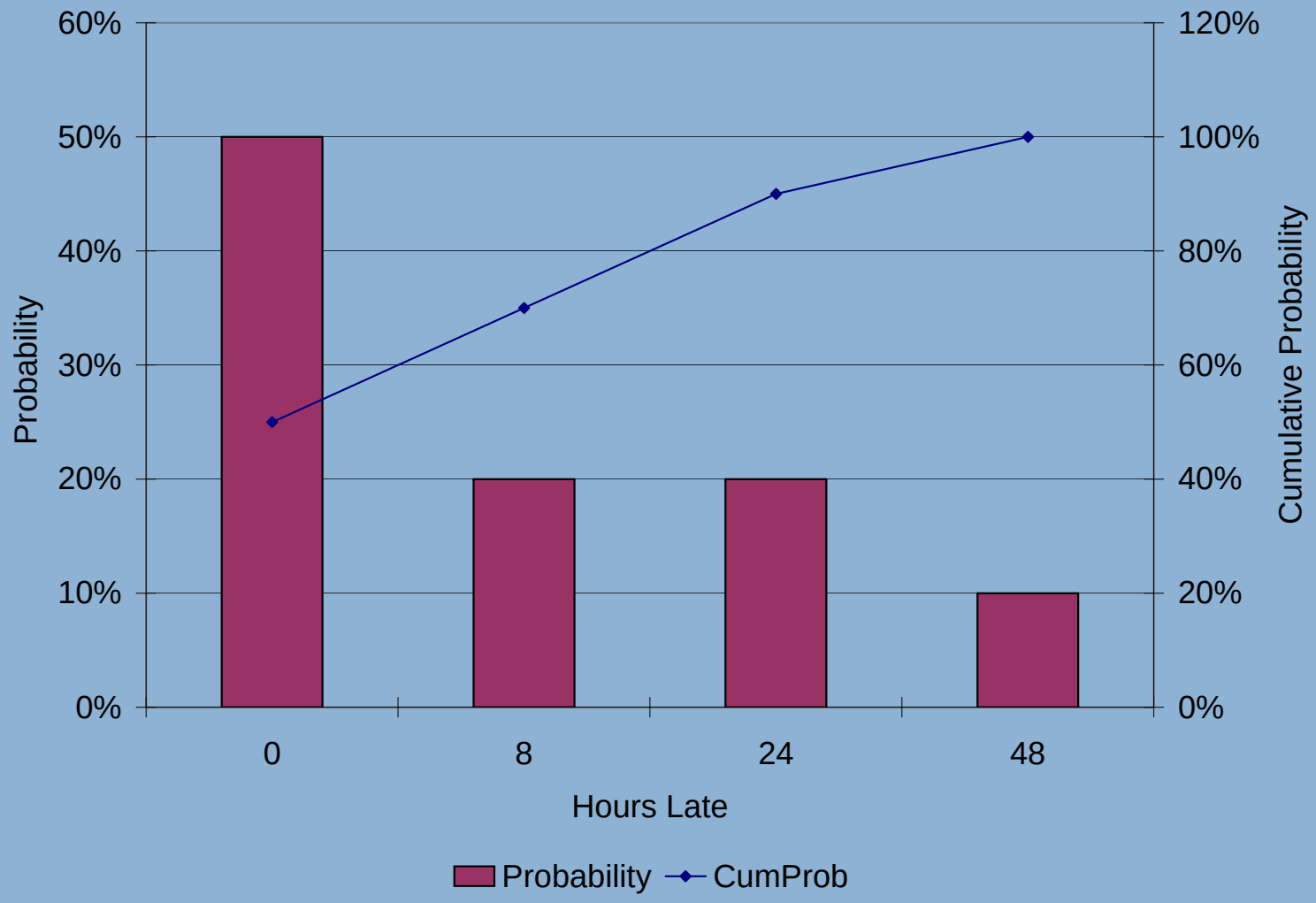
Berth Capacity Assumptions

- Terminal specific vessel allocations
- Vessel discharge rates (moves per vessel call)
- Increase crane productivity, up to 33 moves per hour
- Use up to 7 cranes on largest vessels
- Vessel activity more evenly distributed through the week
- Capacity determined by expected delay/vessel queuing (simulation of vessel arrivals and dwell times)

Why can’t berths run at 100% Occupancy

- Tradeoff with service – vessels get off schedule primarily due to weather
- Big ships that call POLB are very expensive to delay
- Berths must run relatively light to ensure no delay
- 5% max queuing during peak season set as POLB target
- Different at Transshipment hubs like Singapore where small barges will queue for any open space

Historical Arrival Reliability at San Pedro Terminals



BERTHA - Statistical Model of Berth Utilization

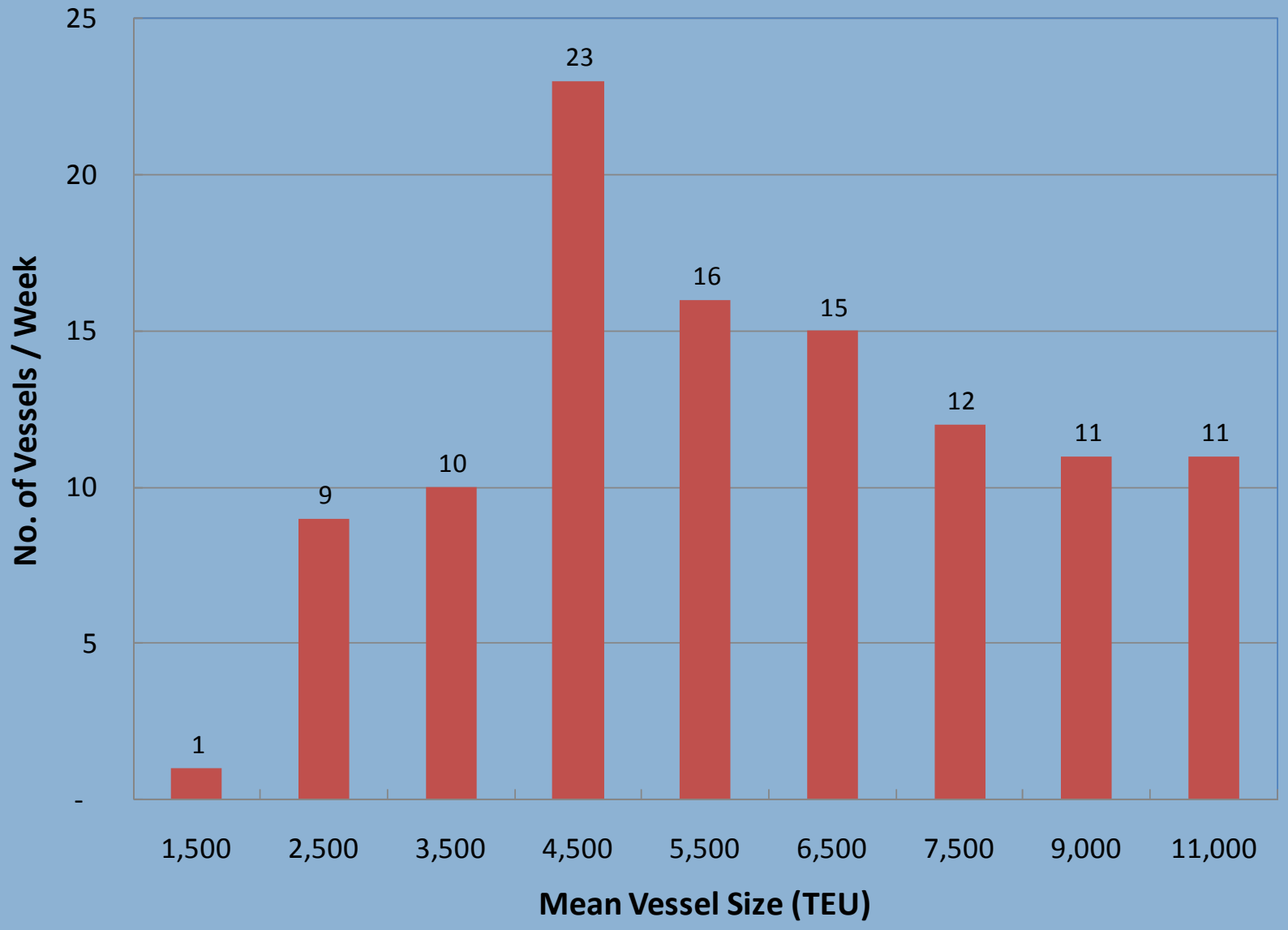
- INPUT:
  - Vessel call schedule
  - Vessel arrival variability
  - Vessel length
  - Dock crane assignment
- OUTPUT
  - Probabilistic data on Wharf and dock crane demand over time
  - Likelihood that a certain value will be exceeded

Vessel Inputs / Mercator Results

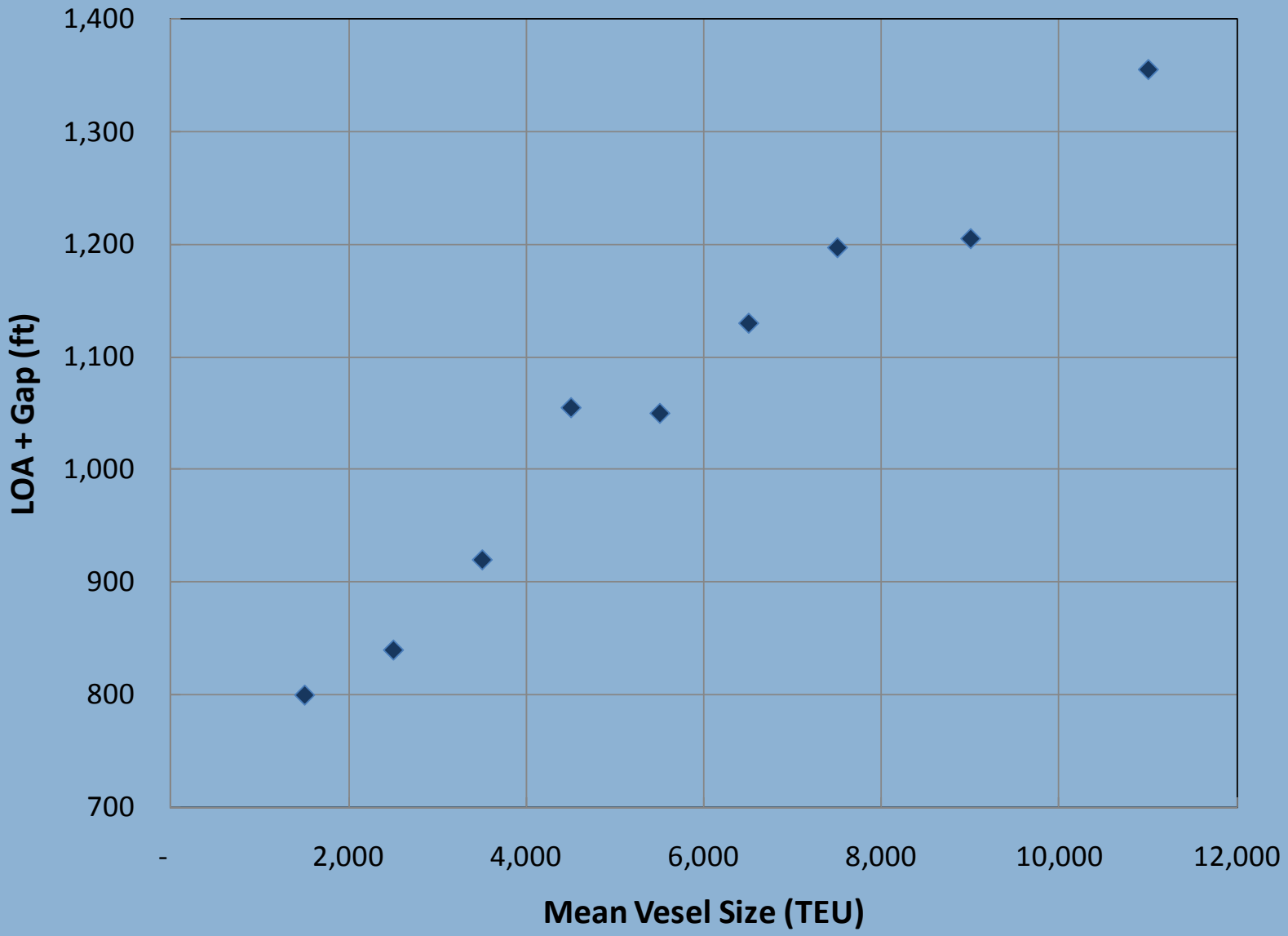
Schedules for specific terminals were selected from port-wide Mercator distribution

Vessel Category	Mercator Weekly SPB Services	Total Lifts per Call	Terminal Projected Weekly Services	Annual Throughput at Capacity (TEU)
1000-1999	1	600	-	-
2000-2999	9	1,450	-	-
3000-3999	10	2,200	-	-
4000-4999	23	1,800	2	346,320
5000-5999	16	4,000	1	384,800
6000-6999	15	5,300	1	509,860
7000-7999	12	6,200	1	596,440
8000-9999	11	6,820	1	656,084
10000-11999	11	8,550	1	822,510
Total	108		7	3,316,014

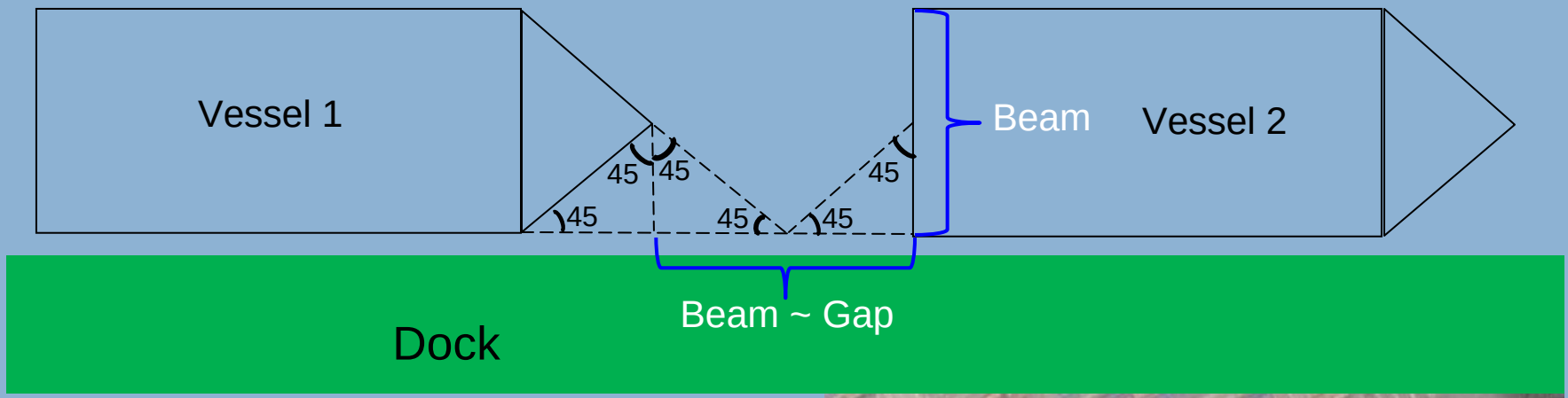
Mercator Estimate of Vessel Calls at POLB



Total Length vs. Mean Vessel Size

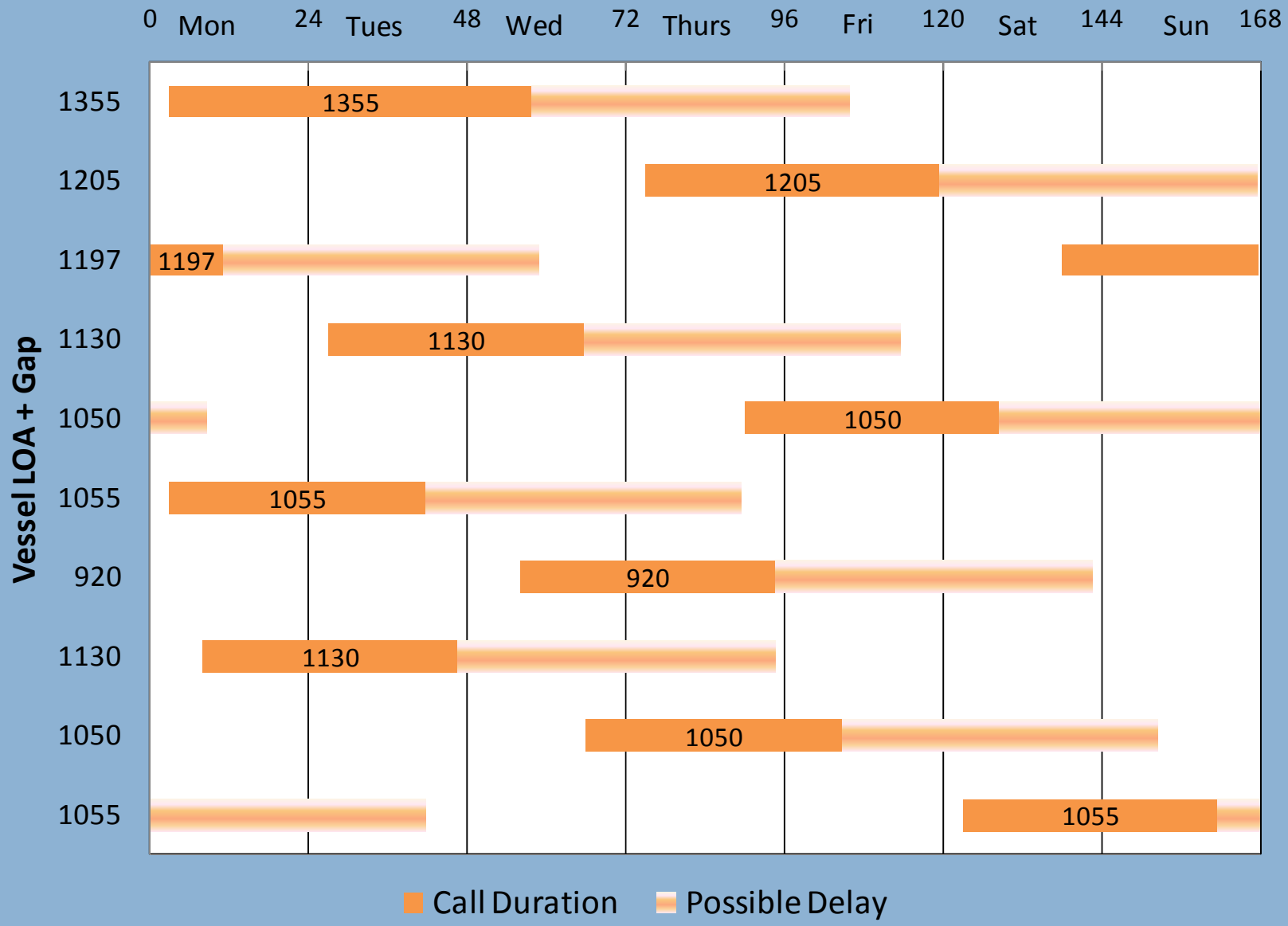


Vessels Occupy Berth Space for Mooring Lines

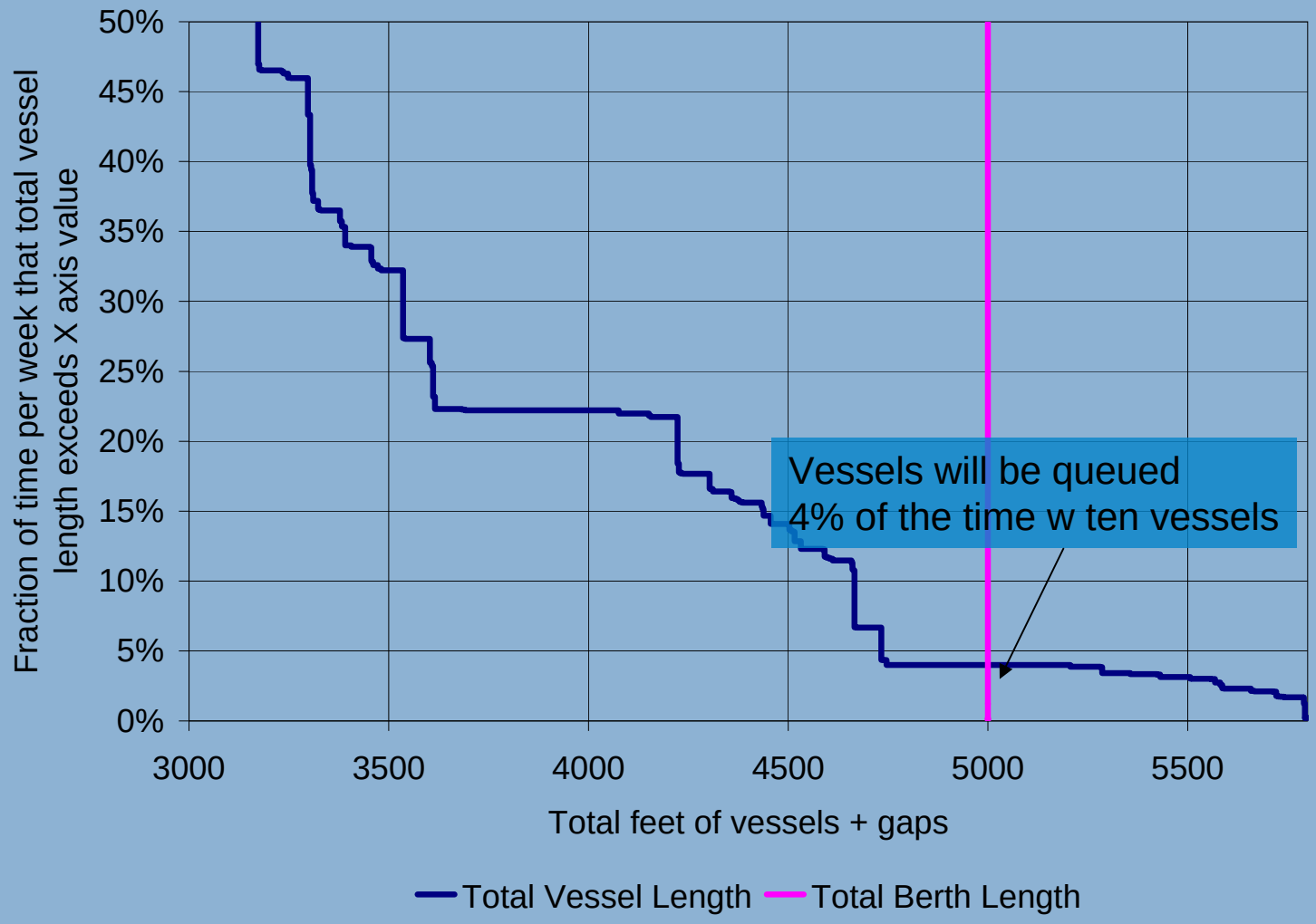


A vessel with length overall (LOA) of 1000’ and Beam of 100’ will occupy 1100’ of berth

Example Terminal Weekly Schedule - Ten Vessels



Berth Length vs. % of Time w Vessels Queued w Ten Vessels



Conclusions

- Robust, easily explainable capacity analyses are a big advantage in EIRs and in other planning efforts
- Analysis is an iterative process
- Revisions need to keep up with new technology and new projects
  - Revised vessel forecasts
  - Revised dwell time data
  - On-terminal rail
  - Automated RMG systems
  - Dedicated zero-emission transport systems between POLB and nearby railyards


Thank You

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