



# REVISITING TERMINAL CAPACITY: THE IMPACT BERTH EXPANSION/LOSS

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# Presentation Agenda

- Revisiting the Concept of Terminal Capacity
- Berth Operation Simulation
- Quantifying Impact of Berth Expansion / Loss for Concession Agreements
- San Antonio Added Capacity
- St. Vicente Loss of Capacity

# Capacity Calculation Methodologies

- Berth Indicators
  - Actual Data (typical)
  - $f$  (Ship Size, Number of Berths)
  - TOC 2009
- UNCTAD's Queuing
  - Berth Productivity  $\times$  Workable Time  $\times$  Utilization
  - What is a berth?
- Operation Simulation
  - Utilization =  $f$  (Allowed Ship Waiting)

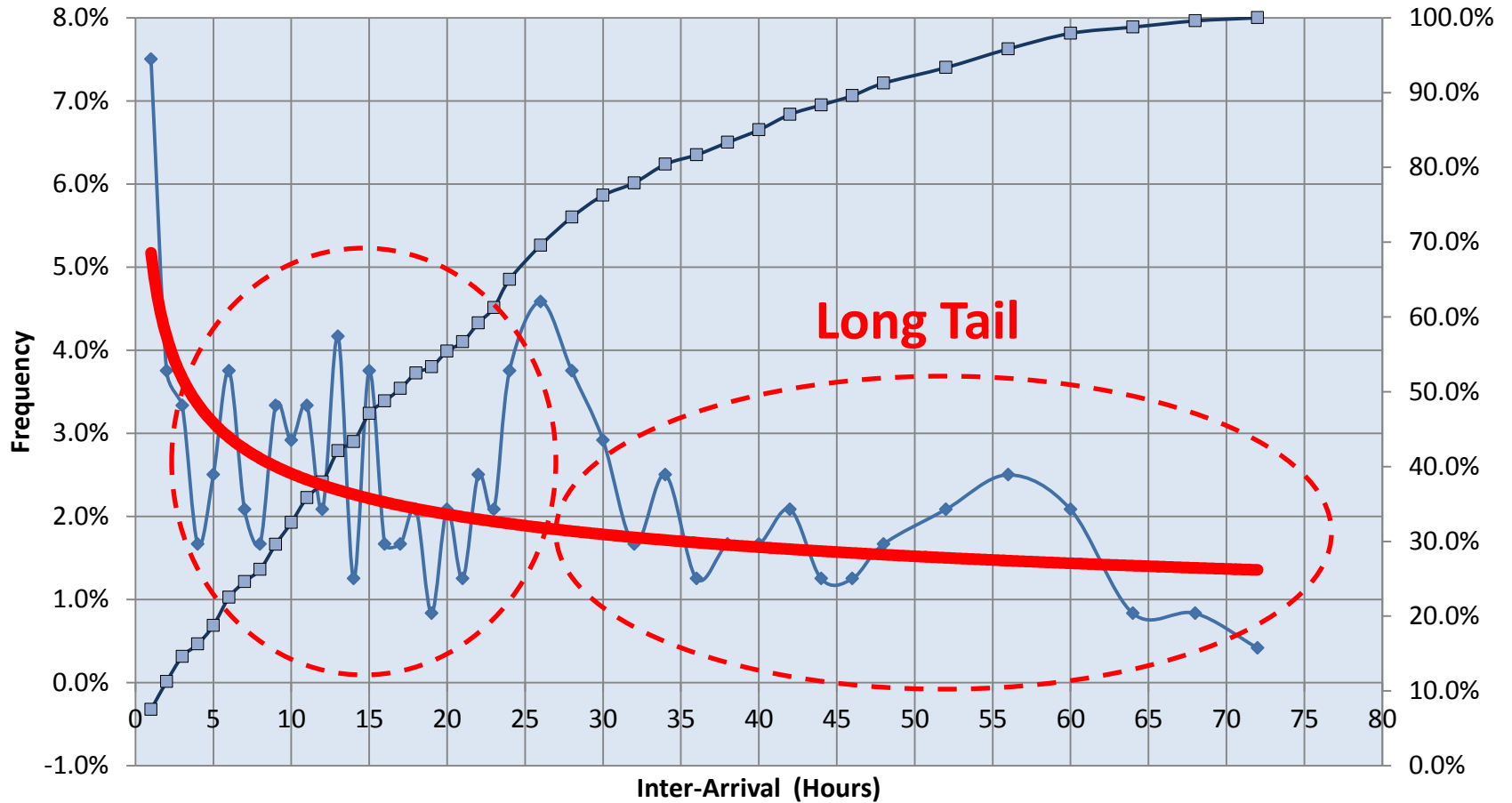


Complexity

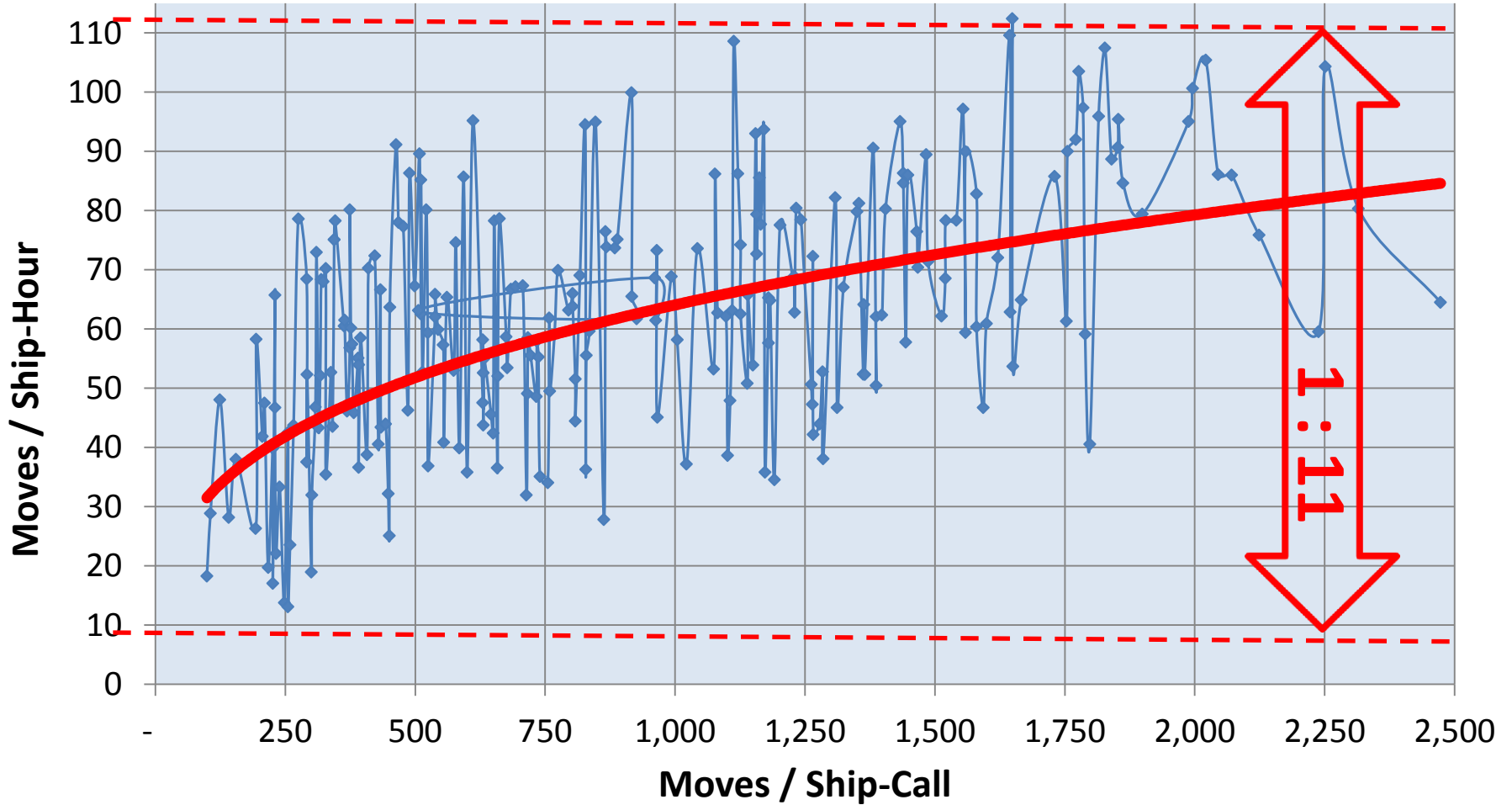
# Capacity in Concession Agreements

- San Antonio need for ***Additional*** Capacity
  - Adding to Berth Length
  - Arrival Pattern
  - Moves / Ship-Call and Productivity
- St. Vicente ***Loss*** of Capacity
  - Reducing Berth Length
  - Ship Population (LOA)
  - Comparison of Methodologies

# San Antonio Ships' Inter-Arrival Time



# San Antonio Berth Productivity



# San Antonio Capacity

Description	Actual 2008	Capacity 2008	Capacity 2008	Capacity Future	Capacity Future Windows
Berth Occupancy		28.3%	48.5%	44.2%	49.3%
Moves / Ship-Call	984	904	922	1,788	1,764
Moves / Berth-Hour		65.3	79.5	121.7	120.2
Average Wait		0.1	0.3	0.4	0.3
% Ships Waiting		3.5%	13.7%	11.8%	13.2%
% Ships Waiting > 4 hrs		2.4%	9.0%	8.3%	8.8%
Throughput	550,802	553,948	1,106,371	1,637,291	1,805,772
<b>Ratio</b>	<b>1.00</b>	<b>1.01</b>	<b>2.01</b>	<b>2.97</b>	<b>3.28</b>

# Maersk seeks to improve terminal efficiency

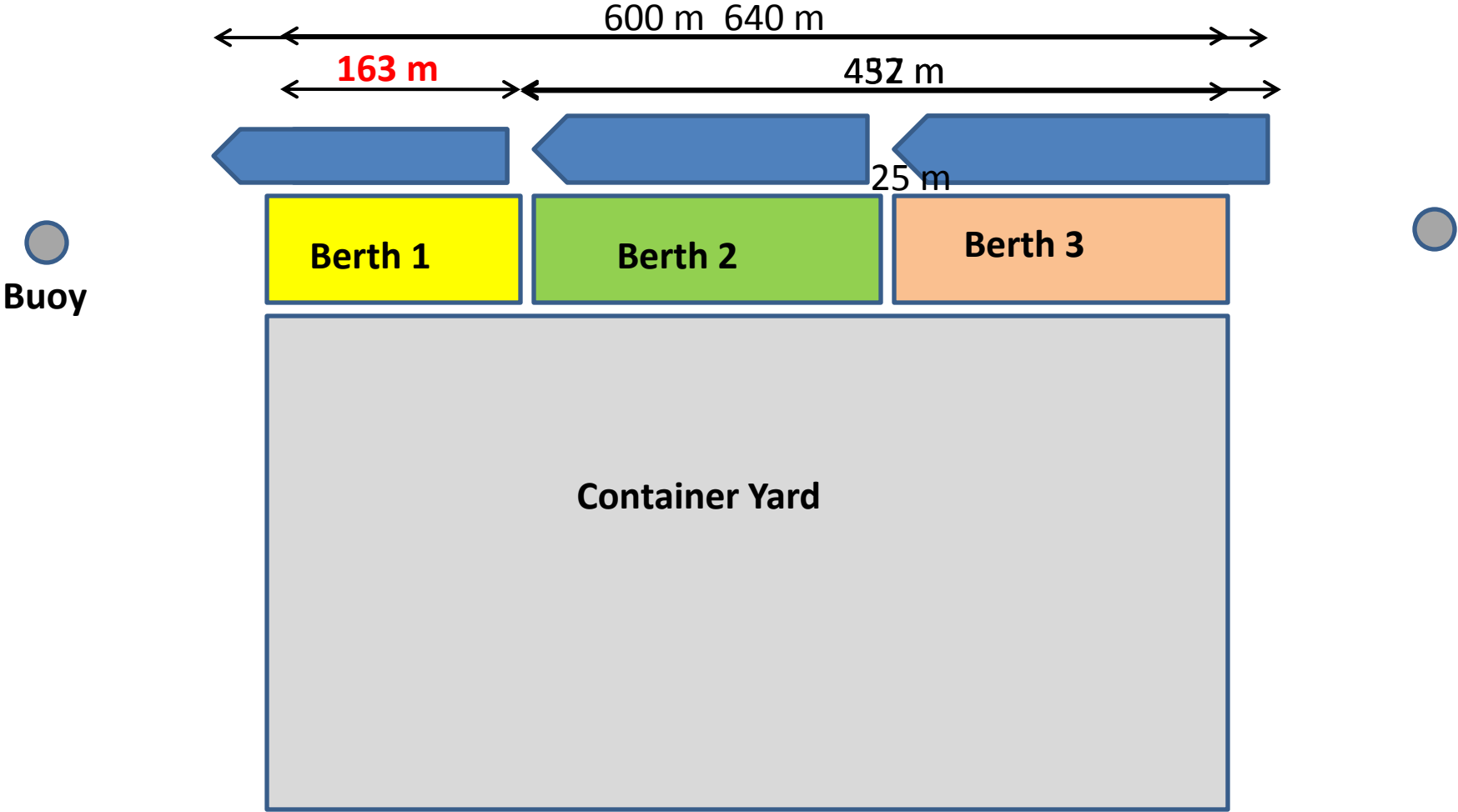
Maersk Line said that by collaborating closely with terminals... The pilot project was implemented with terminals on the AE7 string between Asia and Europe (E-Class).

In many ports, the project has so far reduced total port time required by up to 15%, but is to reach **30%**.

“By getting vessels out of the port earlier, we’ll be able to **reduce bunker consumption**,” Knudsen said. “We can also create opportunities to **add extra port calls** to — or **even take a vessel out of — a rotation.**”



# St. Vicente Berth Situations



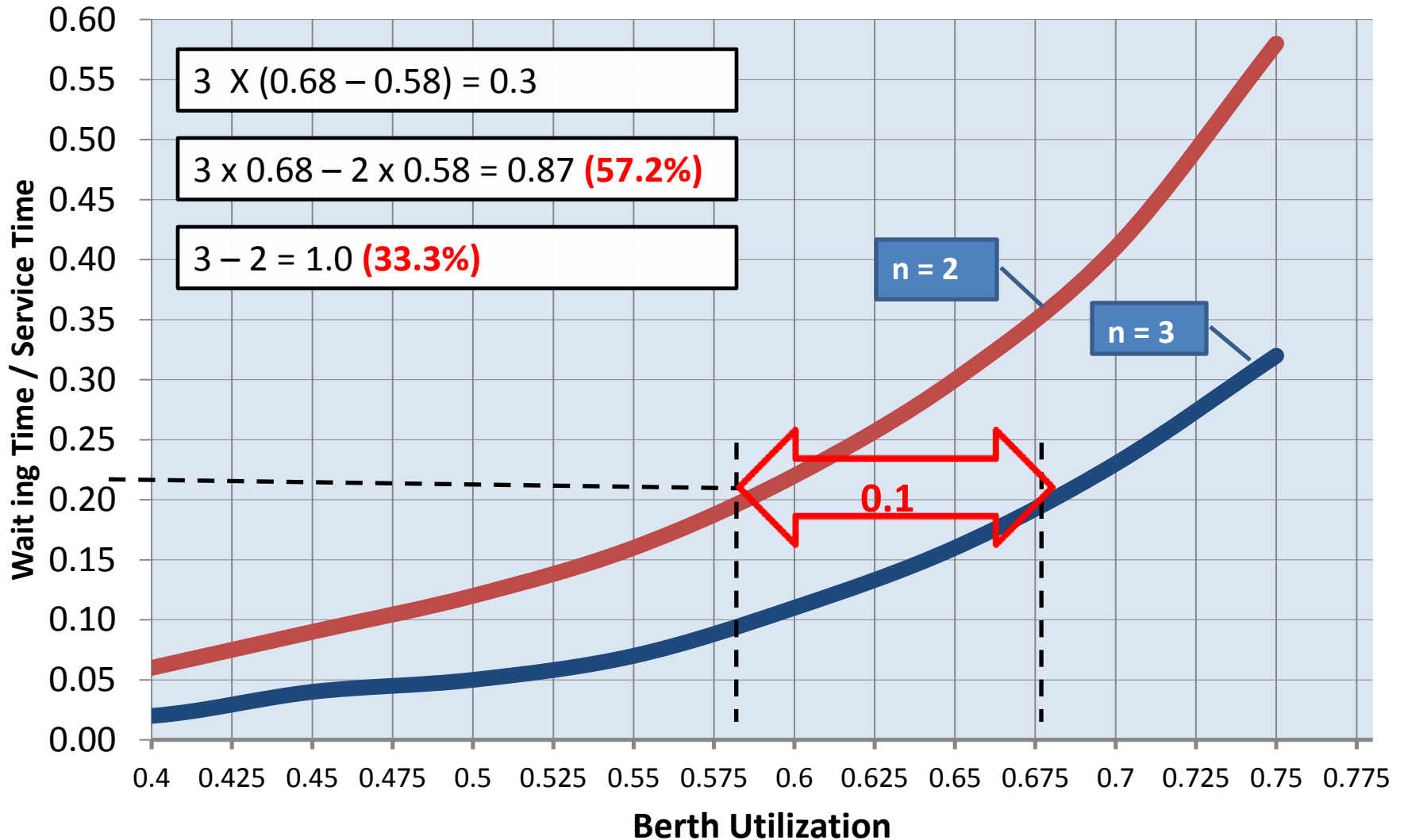
# St. Vicente Assumptions

- Damage only to Berthage (not Yard)
- Berth Productivity Unchanged
- Berthage Dictates Capacity
- Only Containers, Preferable Cargo
- Capacity = **Potential** (Maximum) Throughput
- Level of Service Dictated by Market Conditions
- Compare Pre to Post Earthquake Capacities
- Difference (%) =  $1 - \text{Post} / \text{Pre}$

# Berth-Length Comparison

Description	Dock Structure	Dock Structure + Extension Buoys	Dock Structure + Extension Buoys - Spacing
Pre	600	640	615
Post	437	477	452
Post / Pre	72.8%	74.5%	73.5%
1 - Post / Pre	27.2%	25.5%	26.5%

# UNCTAD E2 / E2 / n

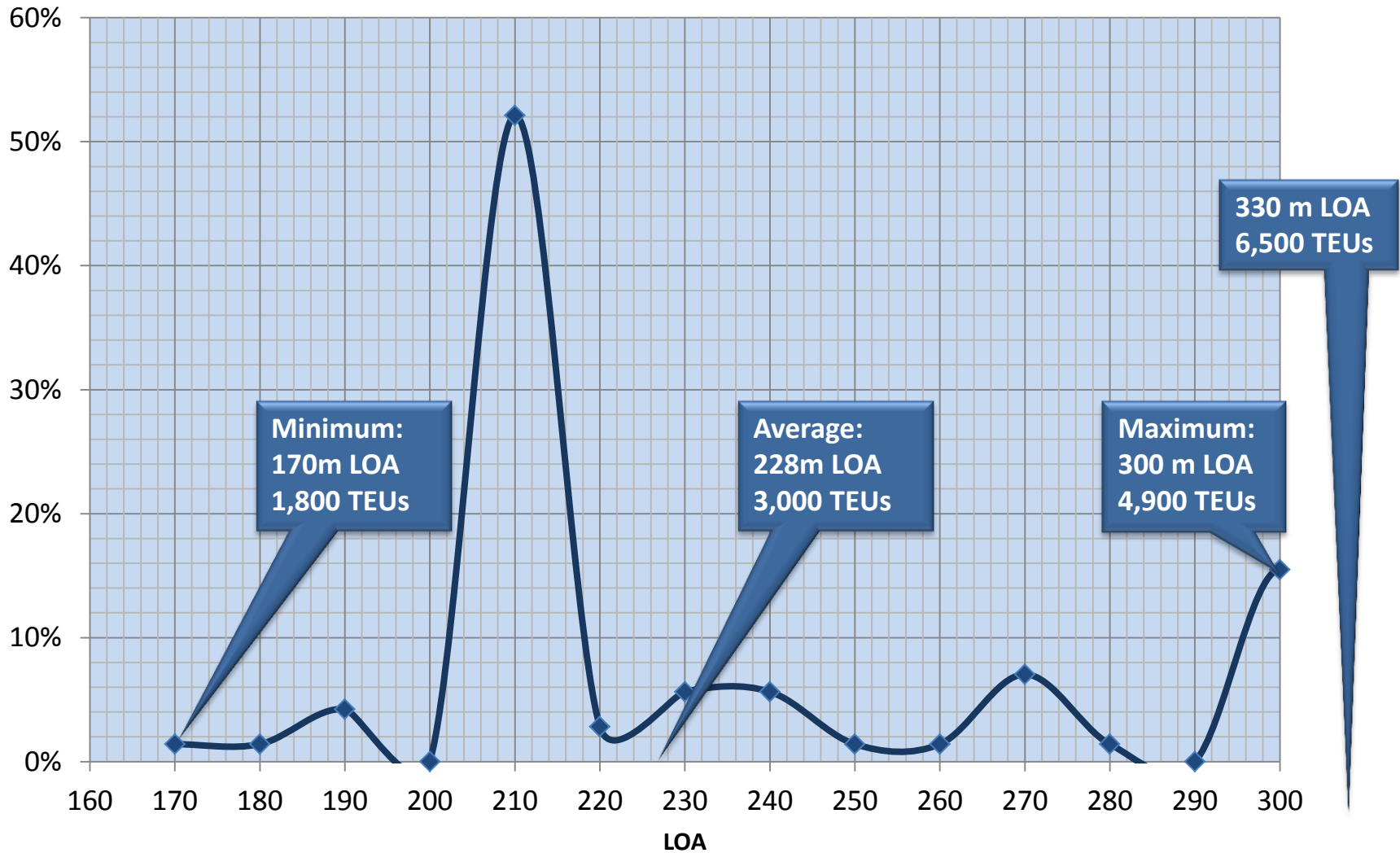


# UNCTAD Queuing Model

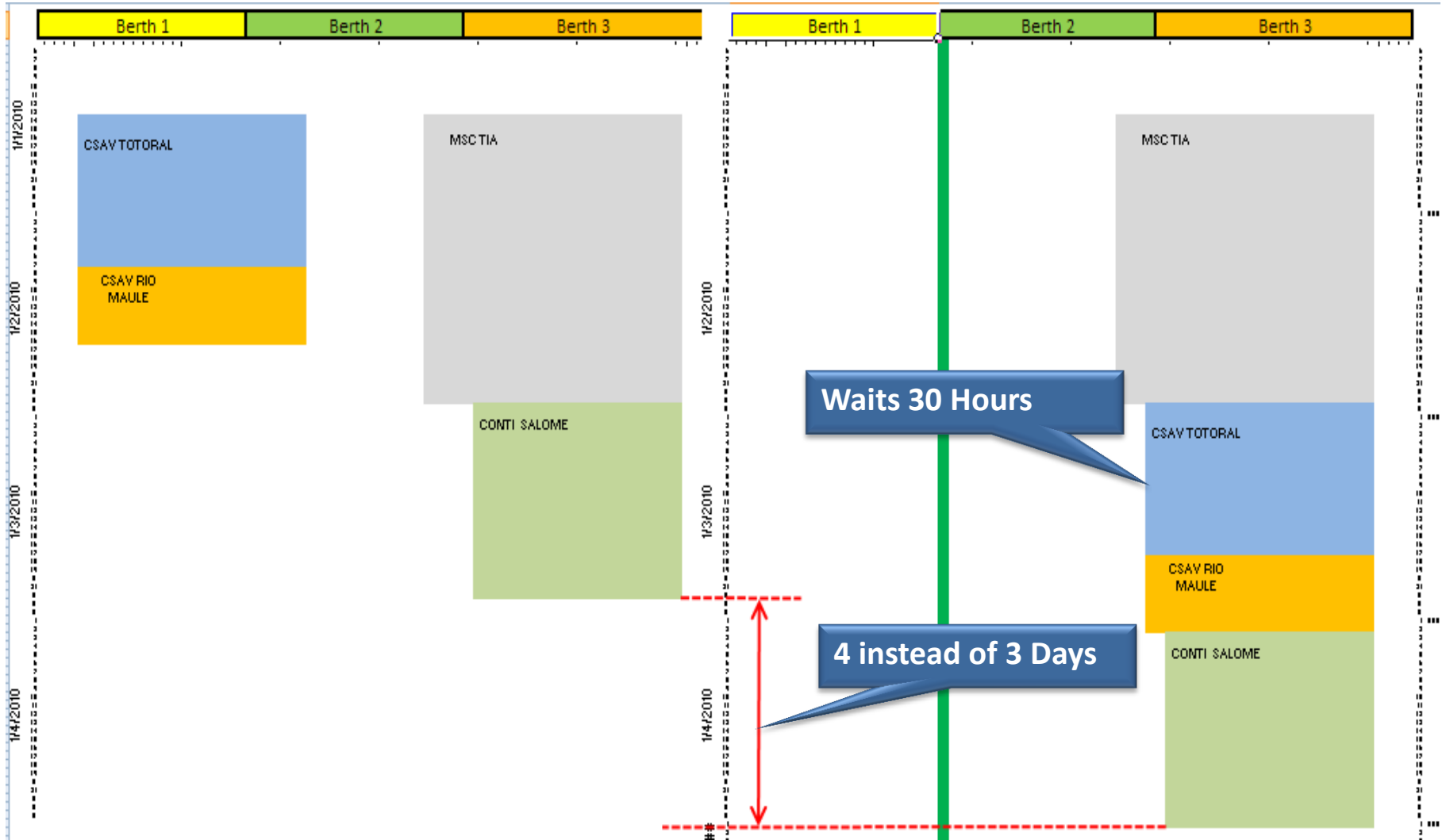
Description	Num. of Berths	M / E2 / n	E2 / E2 / n
Allowed Utilization	2	0.45	0.58
	3	0.58	0.68
Num. of Berth Pre	3	1.74	2.04
Num. of Berth Post	2	0.90	1.17
Post / Pre		51.8%	57.2%
1 – Post / Pre		48.2%	42.8%

E = Earlang Distribution  
M = Markovian Distribution  
n = Number of Berths

# St. Vicente Fleet Distribution



# Berth Assignment Pre and Post

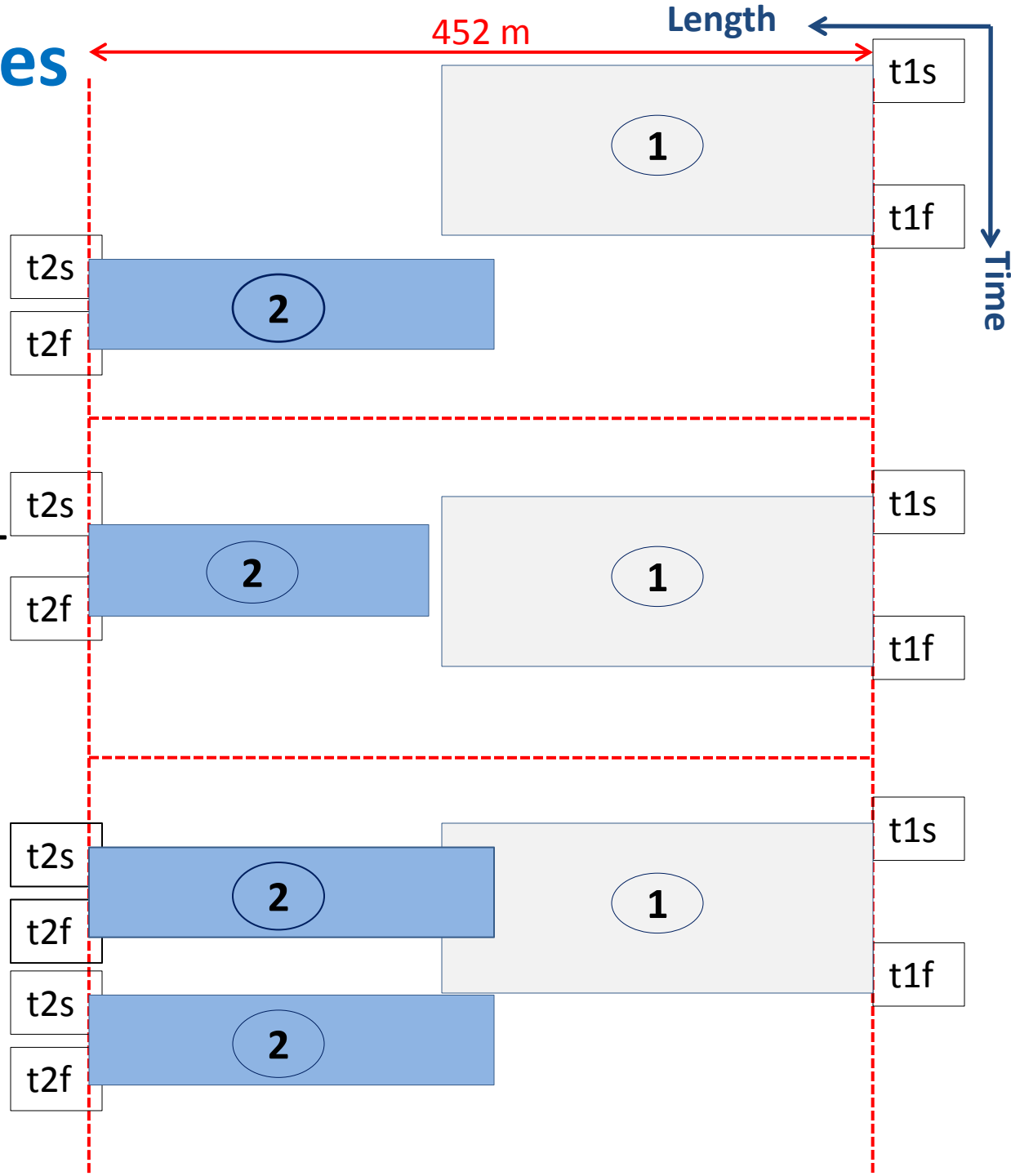


# Assignment Rules

If  $t_{2a} > t_{1f}$   
Then  $t_{2s} = t_{2a}$

If  $t_{2a} < t_{1f}$   
And  $L_2 < 452 - L_1$   
Then  $t_{2s} = t_{2a}$

If  $t_{2a} < t_{1f}$   
And  $L_2 > 452 - L_1$   
Then  $t_{2s} = t_{1f}$





# Capacity Reduction by Methodology

Methodology	Reduction in Berth Capacity
Berth Length	26.5%
UNCTAD E2 / E2 / n	42.8%
UNCTAD M / E2 / n	48.2%
Simulation with Present Fleet	55.3%
Simulation with Future Fleet	64.5%

