Quay Crane Productivity

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Topics

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Quay crane demand Vessel turnaround time Look at cycle time segments Reducing cycle time Incremental: Up to 25% Quantum: Over 25%



See the printed paper for details.



The First Ship and Crane

1958 Matson Navigation A good start First new Panamax containership 24 foot box 12 to 15 lifts an hour 3 or 4 days in port

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Today's Ship

Post-Panamax 20/40/45 Box 25 to 35 lifts per hour 2 to 3 days in port





Tomorrow's Crane Today Plan Ahead

How many lifts per hour? 30, 40, 50, 60, 70 What will the vessel turnaround time be?

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Vessel Turnaround Time vs. Lifts per Hour

Vessel Size	6,000	8,000	10,000	12,000
TEU				
Cranes	Δ	5	6	6
Cranes		<u> </u>		
l ifts ner Hour	Vessel Turnaround Time Hours			
20	06	102	107	120
20	30	105	107	129
30	64	60	71	86
		03	/ 1	00
40	48	51	54	64
50	39	41	43	51
		••		
60	32	34	36	43
		•••		
Parameters: 1.75 TEU per lift. Turnover 75%.				

Two eight hour shifts/day.



CraneSim Calculates lifts per hour Actual 65% to 80% of calculated lifts per hour

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Think Seconds per Lift

8

Frequency vs. Period

Frequency: Lifts/hour 30 45 60 75 90 Period: Seconds/lift 120 80 60 48 40



Typical Time Segments: Half-Cycle



Cycle time from the wharf to the inside the ship's hold. Notice the hoist and trolley times are parallel and the Dwell times are in series. The longer parallel time governs. The travel times vary. Depending on the location of the container the hoist or trolley time will govern.



Incremental Improvements (< 25%) Curvilinear Cranes



Faster motions Automation Elevating girder Tandem forties



Elevating Girder Crane Virginia Port Authority





Tandem Forties Maersk Bromma





Quantum Improvements (> 25%)



Dual hoist BufferStation[©] Ship-in-a-Slip Shuttle type **Supertainer**[©] Conveyor type Carrier crane **Technotainer** SuperCrane



Dual Hoist

VPA 1980s

50% faster





Dual Hoist

HHLA

2000s



LIFTECH CONSULTANTS INC.



Paceco Bufferstation[©]



Like a second hoist but moveable



Paceco Bufferstation[©]



Ship-in-a-Slip Ceres, Amsterdam



80 - 100% faster









an







Paceco Supertainer[©]



CreaTech Technotainer[©]





Boom section



Delft University Carrier Crane



Liftech CONSULTANTS INC.

Liftech SuperCrane[©]



ftoo

Rotating Trolley





Light Weight Shuttle





Boom Section

Rotate trolley

Spreader

Container

Shuttle

Operator's cab





Revolutionary Systems—All Costly

New concepts for gates yards and cranes Octopus Automated warehouses Fully automated system



Port of Singapore, Fully Automated





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