DESIGN VESSEL RECOMMENDATION AND CHANNEL WIDENING ANALYSIS

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GUIDANCE - DESIGN VESSEL

EM 1110-2-1613 Hydraulic Design of Deep Draft Navigation Projects

Section 2-4 Design Considerations: "…design ship, which is usually the largest ship of the major commodity movers expected to use the project improvements on a *frequent and continuing basis*…"

Section 3-11 Design Ship: "The design ship or ships are selected on the basis of economic studies of the types and sizes of the ship fleet expected to use the proposed navigation channel over the project life. For project improvement studies, a thorough review and analysis of ships presently using the project should be included as a part of the study. Projections of ship *fleet data, usually needed, account for expected ship construction trends*…"

"The design ship is chosen as the maximum or near-maximum-size ship in the range of ship sizes from the vessel fleet. The design dimensions of the channel will be determined to accommodate the design ship(s) representative of the project forecasted user fleet…"

ADDITIONAL GUIDANCE – DESIGN VESSEL

ER 1110-2-1404 Hydraulic Design of Deep-Draft Navigation Projects
6.c: Design Vessel. “The study plan proceeds on the basis of alternative design fleets represented by a design vessel. Determination of the design fleet is the responsibility of the planning discipline. Selecting the design vessel representative of a design fleet is the joint responsibility of engineering and planning disciplines…”

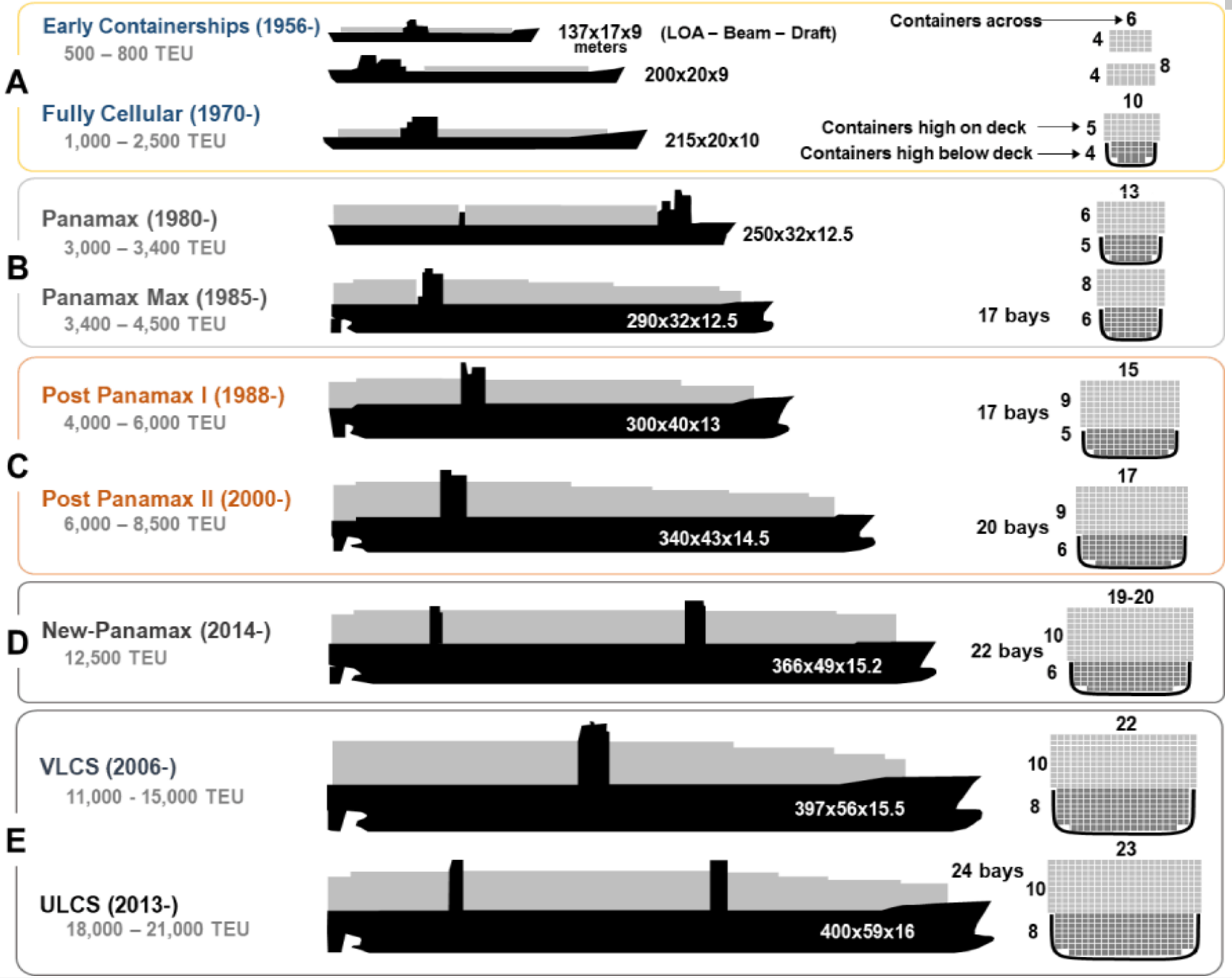
ER 1105-2-100 Planning Guidance Notebook
Appendix E, paragraph E-10. “Vessel Fleet Composition. Key components in the study of deep-draft harbor improvements are the size and characteristics of the vessels expected to use the project. Present data on past trends in vessel size and fleet composition, and on anticipated changes in fleet composition over the project life. Use estimates of future fleet consistent with domestic and world fleet trends. Undertake studies to the extent necessary to determine the appropriate vessel fleet. The assessment of available secondary data forms the basis of the independent studies.”

METHODOLOGY

Existing Fleet Distribution

Cascading Vessel Size

Regional Comparisons


A
Early Containerships (1956-)
500 – 800 TEU
137x17x9
meters
(LOA – Beam – Draft)
200x20x9
Fully Cellular (1970-)
1,000 – 2,500 TEU
215x20x10
Containers across
6
4
4
8
10
Containers high on deck
5
Containers high below deck
4
B
Panamax (1980-)
3,000 – 3,400 TEU
250x32x12.5
Panamax Max (1985-)
3,400 – 4,500 TEU
290x32x12.5
13
6
5
8
6
17 bays
C
Post Panamax I (1988-)
4,000 – 6,000 TEU
300x40x13
Post Panamax II (2000-)
6,000 – 8,500 TEU
340x43x14.5
15
9
5
17 bays
17
9
6
20 bays
D
New-Panamax (2014-)
12,500 TEU
366x49x15.2
19-20
10
6
22 bays
E
VLCS (2006-)
11,000 - 15,000 TEU
397x56x15.5
ULCS (2013-)
18,000 – 21,000 TEU
400x59x16
22
10
8
23
10
8
24 bays

Representative Containership Size by Generation

Vessel Class	Capacity (TEU)	Containers Across	Draft (feet)	Beam (feet)	Length Overall (feet)	Air Draft (feet)
Panamax	4,000	15	40	106	965	117
Post-Panamax	7,000	17	49	144	1,100	138
Super Post-Panamax	9,000	19	50	158	1,200	159
Neo Panamax	13,000	20	50	160	1,200	164
Megaship	18,000	23	52	193	1,300	187

KEY: TEU =Twenty-foot equivalent unit

SOURCE: USDOT, BTS research based upon industry publication.

TANKERS

Class	Handysize	MR1	MR2	Aframax	Suezmax	Ultra Large Crude Carrier
DWT	20,000	60,000	80,000	120,000	200,000	325,000
Length (ft)	498	685	745	838	973	1,121
Beam (ft)	79	113	124	141	167	195
Draft (ft)	30	42	46	52	60	70
Immersion Rate (tpi)	79	159	191	247	343	468

DATA SOURCES

MARAD

Lloyds

Clarksons

IHS Global Insight

MSI

Marine Traffic/Ship Spotting/Vessel Finder

Previous Studies

EFFICIENCY CALCULATION EXAMPLE

Class	Max Draft	UKC + Sinkage	Adjusted Max Draft (Depth Constraint)	Vessel Specs			Weight per loaded TEU					Volume Capacity Limits				Max Volume Restricted Tonnage				Capacity Allocations				Shares of Vessel Capacity		
				TPI	DWT Rating	TEU Rating	% Empty	% Vacant	Average Weight per Loaded	Average Container Weight	Total weight per loaded	Number of vacant slots	Max Occupied Slots	Max Laden TEUs	Max Empty TEUs	Max weight for cargo	Max weight for laden boxes	Max weight for empties	Total Volume Restricted Tonnage	DWT Available for Vessel Draft	Variable Ballast	Allowance for Ops	Available for Cargo	Space Available for Cargo	Space Available for Laden TEUs (Box)	Space Available for Empty TEUs
Largest Existing Call	47.57	2.2	44.30	264	84,688	6,696	6%	8%	8.72	2	10.8	516	6,180	5,805	375	50,623	11,611	750	62,984	74,325	8,176	5,646	60,504	48,630	11,154	721
Largest Ever Call	49.21	2.2	44.30	315	114,108	8,401	6%	8%	8.72	2	10.8	647	7,754	7,284	471	63,513	14,567	941	79,021	95,534	10,509	7,607	77,418	62,224	14,272	922
FWOP	50.85	2.3	44.20	315	118,908	#####	6%	8%	8.72	2	10.8	778	9,322	8,757	566	76,358	17,513	1,131	95,002	93,753	10,313	7,927	75,513	60,693	13,920	899
USACE	49.00	2.2	44.30	315	119,042	#####	6%	8%	8.72	2	10.8	776	9,305	8,740	565	76,214	17,480	1,129	94,824	101,271	11,140	7,936	82,195	66,064	15,152	979
NFS Recommendation	51.00	2.5	44.00	423	153,507	#####	6%	8%	8.72	2	10.8	1,082	12,968	12,181	787	106,220	24,362	1,574	132,157	117,947	12,974	10,234	94,739	76,146	17,465	1,128
	sea-web			VOC I	Sea-Web	Sea-We	AOM As:	AOM As:	AOM As:	AOM Assumption																	

Number of TEUs				Cargo Share Import	Cargo Share Export	Houston Laden Import TEUs	Houston Laden Export TEU	Average Route Distance	Average Economic Speed	Hours at Sea	Economic Speed Cost/hour	At-Sea Cost	Hours in Port of Houston	In-Port VOC	Total Cost In-Port	Average Cost per TEU	Average Allocated Cost
Number Laden TEUs	Number Empty TEUs	Occupied TEU Slots on Vessel	Vacant Slots														
5,577	360	5,937	759	61.0%	61.0%	3,402	3,402	23,366	21	1,094	$ 5,794	$ 6,339,283	23.5	$ 984	$ 23,116	$ 935	$ 572
7,136	461	7,597	804	61.0%	61.0%	4,353	4,353	23,366	21	1,122	$ 6,396	$ 7,178,143	23.5	$ 1,225	$ 28,788	$ 828	$ 506
6,960	450	7,410	2,690	61.0%	61.0%	4,246	4,246	23,366	21	1,122	$ 6,396	$ 7,178,143	23.5	$ 1,225	$ 28,788	$ 849	$ 519
7,576	489	8,066	2,015	61.0%	61.0%	4,621	4,621	23,366	21	1,122	$ 6,396	$ 7,178,143	23.5	$ 1,225	$ 28,788	$ 780	$ 477
8,732	564	9,296	4,754	61.0%	61.0%	5,327	5,327	23,366	21	1,118	$ 7,934	$ 8,868,433	23.5	$ 1,516	$ 35,619	$ 836	$ 511
				AOM Assu	AOM Assumption			AOM Assu	VOC Interpolation		VOC Library interpolatic	Rough Aver		VOC Library interpolation			

OTHER CONSIDERATIONS

Port Facilities (berth space, cranes, container capacity, bridges, tunnels, etc.)

Harbor Pilots

Port Users

CHANNEL WIDENING

WIDENING ANALYSIS

Simulation of movements within a harbor subject to transiting rules and tide

Benefits are associated with reductions in transiting costs or reduced congestion in the harbor

Safety risks are taken into account with Pilot transiting rules – limitations on movements

Is it necessary for the design vessel to call the harbor (achieve NED benefits) or to reduce delays/congestion in harbor – incremental analysis?

TYPES OF CHANNEL WIDENING

Passing Lanes

Meeting Areas

Bend Easing

Anchorage

Two Way Traffic

OTHER CONSIDERATIONS

Widening Costs

Delays to carriers vs. cost of construction and continued maintenance of project feature

One size does not fit all

Additional environmental impacts

QUESTIONS?