Competitiveness of Routes for Asia-origin Intermodal Import Containers through Alternative US Gateway Ports

for: The Pacific Maritime Association

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Q3 2020

Introduction

US West Coast (USWC) port authorities have experienced declines in their shares of North American container imports from Asia over the last several years. As a result, the Pacific Maritime Association (PMA) wanted to obtain an independent analysis of the factors – labor arrangements, infrastructure investments, etc. – that might provide competitive advantages for container ports on the US East and Gulf Coast vis-à-vis USWC ports.

Import shipments that are moved through USWC ports by rail to US interior markets in the marine containers in which they arrived into the US - generally referred to "Intact Intermodal" movements - comprise a market segment which can be considered discretionary and for which non-USWC ports compete aggressively. It is this segment that is the focus of Mercator's study

Executive Summary

The relative competitiveness of the USWC ports for Asian imports into the interior of the USA, versus other US ports, depends on from which Asian country/port the cargo originates and to which inland market it is destined.

- The two main Northeast container ports – New York/New Jersey and Norfolk/Portsmouth – have route cost advantages of several hundred dollars per import FEU over the two main USWC gateways (Los Angeles/Long Beach and Seattle/Tacoma) for Intact Intermodal Asian imports to the Ohio Valley and Chicago

- The major Southeast gateway port – Savannah – has route cost advantages of several hundred dollars per FEU for Asian imports to Southeast markets (such as Atlanta), Memphis, main Ohio Valley markets, and Chicago, versus the two main USWC intermodal gateways

- The major Gulf Coast gateway ports – Houston and Mobile – have significant route cost advantages to Dallas and Memphis versus both the Los Angeles/Long Beach (San Pedro Bay) and Seattle/Tacoma (Puget Sound) gateways – but presently lack sufficient marine terminal and/or rail terminal capacity to capitalize on those advantages.

Higher terminal-to-rail costs and higher land transport costs for the San Pedro Bay and Puget Sounds ports are the key factors underpinning the route cost advantages that these other ports have vis-à-vis the USWC gateways for multiple inland destination markets.

The major route cost disadvantages of the USWC gateways could lead to further losses of Intact Intermodal Asian import traffic to other US port gateways, especially as planned terminal expansions/developments in those other ports are completed. In particular, recent and/or pending infrastructure improvements in the ports of Savannah, Charleston, Norfolk/Portsmouth, Baltimore, and New York/New Jersey will provide the capacity for those ports to handle approximately 500,000 TEUs/year of incremental volumes of Asia Intact Intermodal imports.

Initiatives of the California or Washington State governments that increase costs for the USWC gateways and/or that fail to address cost advantages of the key USEC and USGC ports will further compound the losses.

Competition Framework – Overview of USWC Container Port Traffic Base

In 2019, the three port gateways of the US West Coast (USWC) - San Pedro Bay (SPB), San Francisco Bay, and the Puget Sound - received a total of 10.81M TEUs of loaded international imports, 92% of which originated in Northeast or Southeast Asia.

Loaded international exports from these three port gateways to all offshore regions tallied only 47% of the loaded import volume, so clearly the international container traffic base of the USWC ports is driven by imports from Asia.

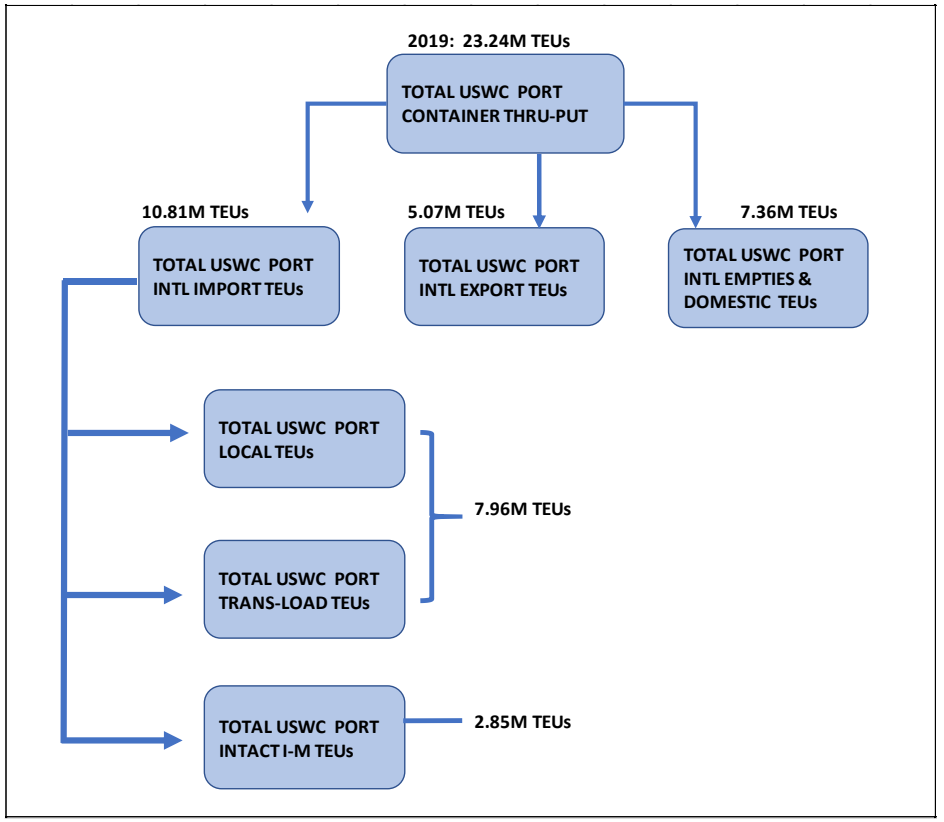
There are three segments of the Asian import container market thru the USWC ports:

- "Local" – containers being trucked to consignees' facilities located in the three West Coast states, as well as in adjacent states (Idaho, Nevada, Arizona) or in Baja California Norte
- "Transload" – containers being trucked to facilities in the three West Coast states, at which the import cargoes are unloaded and immediately transloaded into domestic containers and trailers for eastward movement by truck or rail
- "Intact Intermodal" – containers moving directly by rail from the USWC ports to inland import receiving facilities in the Central and Eastern US

The USWC ports have minimal competition from USEC or USGC gateway ports for the Local segment, given the much shorter distances from San Pedro Bay or the Puget Sound to consignees in California, Oregon, Washington and adjacent states.

However, the USWC ports confront intense competition from the USEC and USWC ports for the highly-discretionary Intact Intermodal segment, which comprises 26% of loaded USWC import TEUs, according to US Census data --- five years earlier, the Intact Intermodal segment accounted for over 32%% of USWC import TEUs from Asia.

Segmentation of container volumes through US West Coast ports



Sources: USWC Port Authorities, Datamyne and US Census: Intact intermodal imports based on the declared destination for each container load recorded in the Datamyne data base for 2019; US Census import manifest data used as a cross-check.

Note -- although the Transload segment is significant in volume and generates tens of thousands of logistics-related jobs in the USWC gateways, the balance of this report focuses exclusively on the Intact Intermodal segment

Competition Framework – Geographic Distribution of Intact Intermodal Imports

The Intact Intermodal segment of the USWC import container traffic base has a wide geographic distribution in terms of the destinations for those containers.

About 9% of the 2.85M TEUs of Intact Intermodal loaded imports through the USWC ports in 2019 were destined to cities in the **Mountain States** (Denver, Salt Lake City, El Paso, etc.). For these traffic flows, the USWC ports face minimal competition from USEC/USGC ports.

The balance of the Intact Intermodal containers terminated in seven regions east of the Rockies, demarcated in the map to the right.

The highest-volume flow was to the **"core" Midwest** zone of Illinois and Missouri (primarily Greater Chicago, Kansas City, and St. Louis), according to US Census data, with **about 30%** of total USWC Intact Intermodal volume destined to Chicago (and another 10% to KC/St. Louis)

The next largest was to the **South Central** zone, with **about 20%.**

The **Ohio Valley** zone accounted for **about 15%** and the **Lower Mississippi Valley** zone (including western Tennessee) received **about 8%** of Intact Intermodal containers moving through USWC ports.

The **Upper Midwest** zone was the destination for about **5%** of the USWC intermodal imports.

The **Northeast** and **Southeast** zones collectively accounted for only **3%,** because nearly all Asia imports to those zones are already moving via all-water services.

The competitive position of the USWC ports varies significantly across these seven destination zones, as will be discussed further on the next few pages.

Regions receiving Intact Intermodal imports

Competition Framework – Domestic Ports Competing for Asia Imports to Core Midwest Zone

The Core Midwest zone, as the largest market for Intact Intermodal imports, attracts the most competing gateways and rail routes, seeking to divert containers away from USWC ports. Illinois and Missouri are the states comprising this zone, with three metro markets therein – Chicago, Kansas City, and St. Louis.

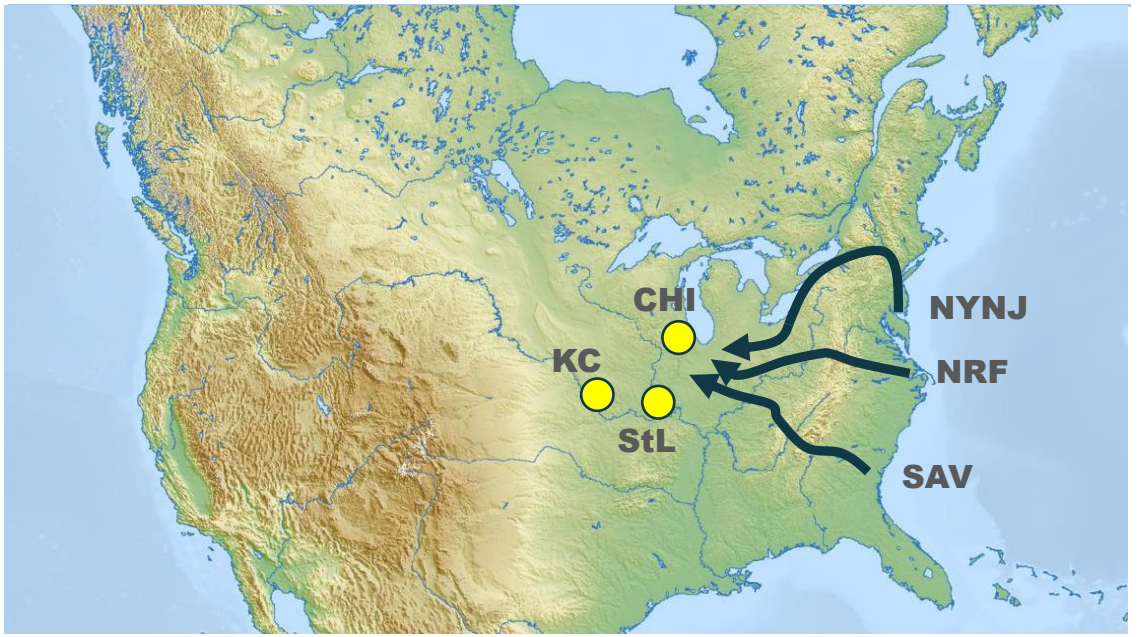
The primary domestic port competitors to Los Angeles/Long Beach and Seattle/Tacoma for the **Chicago** market are the two main Northeast ports – ***New York/New Jersey and Norfolk/Portsmouth***

- CSXT and NS each has a main line with high-frequency intermodal train operations between each of these two ports and Chicago
- Inefficient infrastructure and/or rail connectivity issues presently impede the competitiveness of the other Northeast container ports (Boston, Philadelphia, Baltimore, Montreal, Halifax) as gateways to the entire Core Midwest zone.
- However, when a tunnel renovation project in Baltimore is completed within the next four years, that port will start competing with the USWC ports for Asian imports to Chicago

The Port of Savannah is aiming to become a more-utilized gateway for Asian containers to Chicago following the completion of its new on-dock intermodal terminal, although its CSXT and NS routes are somewhat longer and slower than those railroads' respective lines from the main Northeast ports.

Suboptimal channel/terminal infrastructure and limited on-dock or near-dock rail transfer facilities presently impede the competitiveness of the Gulf Coast ports as gateways to Chicago.

Key non-USWC gateway ports and rail service corridors for Core Midwest Zone



The competitive landscape is different than Chicago's for the two secondary markets of the Core Midwest zone – Kansas City and St. Louis.

- Although CSXT has main-line access with St. Louis, its network does not reach Kansas City.
- NS has main-line access to both St. Louis and Kansas City from both main Northeast ports, but the 1300-mile distance from NY/NJ (or the 1400-mile distance from Norfolk) to KC is only modestly shorter than the 1,600-mile distance from SPB.

Hence, the USWC ports have minimal competition for the Kansas City market and compete only with NY/NJ and Hampton Roads for the smaller St. Louis market.

Competition Framework – Domestic Ports Competing for Asia Imports to South Central Zone

The South Central zone, comprised of Texas, Oklahoma and central Kansas, is the second largest market for Intact Intermodal imports from Asia thru USWC ports, accounting for 20% of those imports.

Almost 80% of the Asia-origin/Intact Intermodal volume destined to this zone is destined to the Dallas /Forth Worth area while most of the balance flows to Houston.

The vast majority of the Intact Intermodal imports to this South Central zone via USWC ports move thru San Pedro Bay – neither BNSF nor UP have competitive routes and intermodal services for containers that might be routed from the Puget Sound to either Dallas or Houston

The rail distances from either Savannah, Charleston, or Jacksonville to Dallas are not much shorter than from San Pedro Bay to Dallas, and the routes entail time-consuming interchanges and revenue splits between the Eastern and Western Class I railroads, so *the South Atlantic ports are not viable competitors with Los Angeles/Long Beach for this South Central Zone*

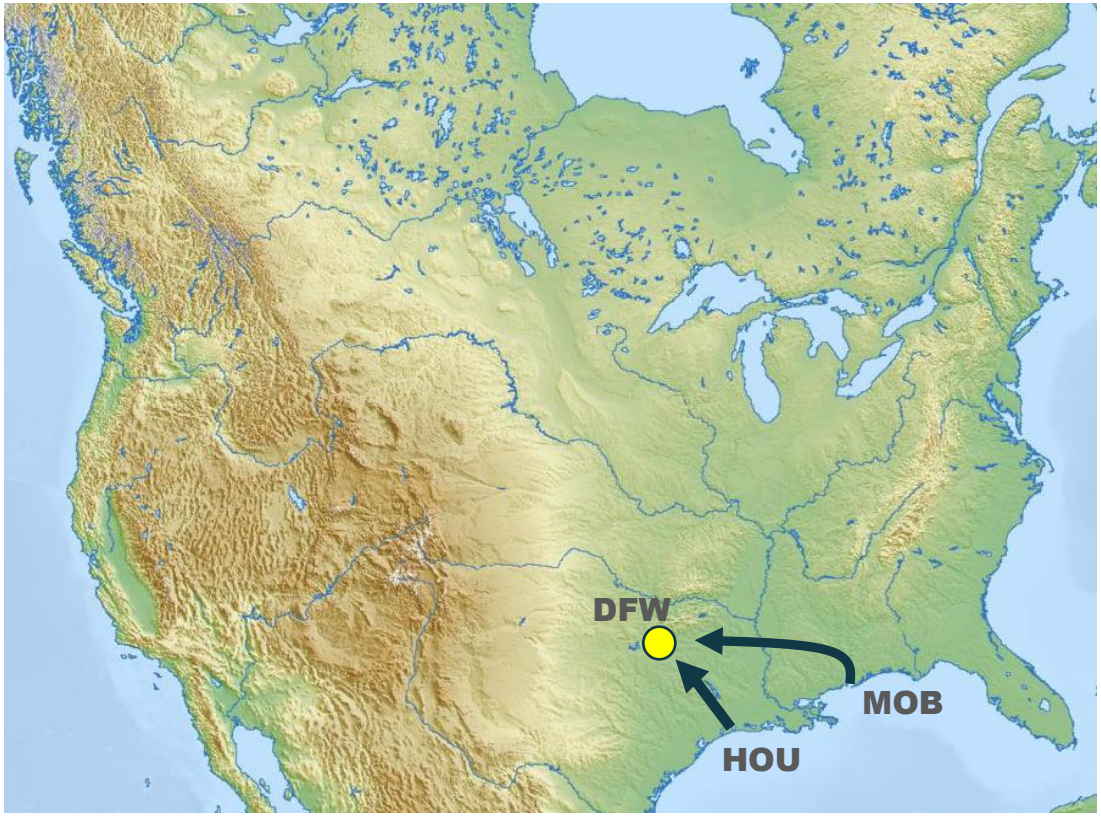
Thus, the main competitors for Los Angeles/Long Beach for this market segment are **Houston** and **Mobile.**

- New Orleans also handles small volumes of containers that are trucked to Dallas

At the present time, neither Houston nor Mobile have sufficient excess marine terminal capacity to be able to handle significant volumes of Intact Intermodal Asia imports diverted from the San Pedro Bay ports

Moreover, limitations on maximum ship sizes for both ports mitigate their advantages on lower inland transportation costs

Key non-USWC ports and inland transport corridors for South Central zone



Competition Framework – Domestic Ports Competing for Asia Imports to Ohio Valley Zone

The Ohio Valley zone consists of Ohio, Indiana, Kentucky, eastern Tennessee, West Virginia, and Michigan. It receives about 15% of Intact Intermodal imports moving thru the USWC ports.

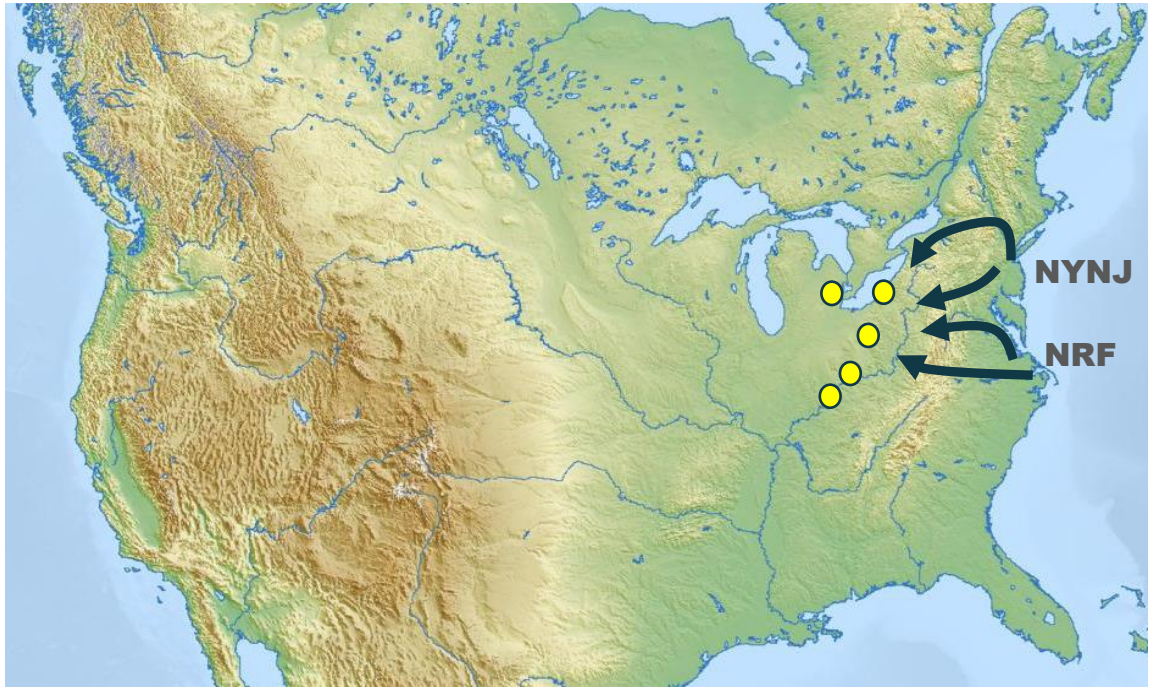
60% of the containers destined to this region move to Columbus, Cleveland and Cincinnati. Detroit and Louisville account for another 25%.

The main domestic competitors to the USWC ports for Asia imports to the Ohio Valley zone are the major Northeast ports of NY/NJ and Hampton Roads

- Both NS and CSXT each has competitive routes and intermodal train services from each of those two ports to all five of the main metro markets of this zone
- Some volumes of containers are trucked from Baltimore to Cleveland/Columbus, and
- Baltimore will become a more competitive gateway to this zone following the completion of the previously-mentioned tunnel project, which will allow more economic stack train services to and from the port

Savannah, which is linked by CSXT and NS, is seeking to capture a greater market share of Asia imports to this zone, but presently has limited volumes, so Savannah – Ohio Valley stack cars have to be switched in Atlanta into Atlanta – Ohio Valley trains moving domestic intermodal traffic, thereby making this gateway less transit-competitive

Key non-USWC ports and rail service corridors for Ohio Valley zone



New Orleans and Mobile are linked to Louisville/Cincinnati and other Ohio Valley metro markets by main lines of the NS and CSXT thru Birmingham

However, both of these ports presently receive a limited number of Asia all-water services and consequently do not generate enough volumes to the Ohio Valley markets to support frequent intermodal train services to the zone

Hence, the Gulf Coast ports are not currently competing effectively for Intact Intermodal traffic to the Ohio Valley

Competition Framework – Domestic Ports Competing for Asia Imports to Lower Mississippi Valley Zone

The Lower Mississippi Valley zone comprises western Tennessee, Arkansas, Louisiana, Mississippi, and Alabama.

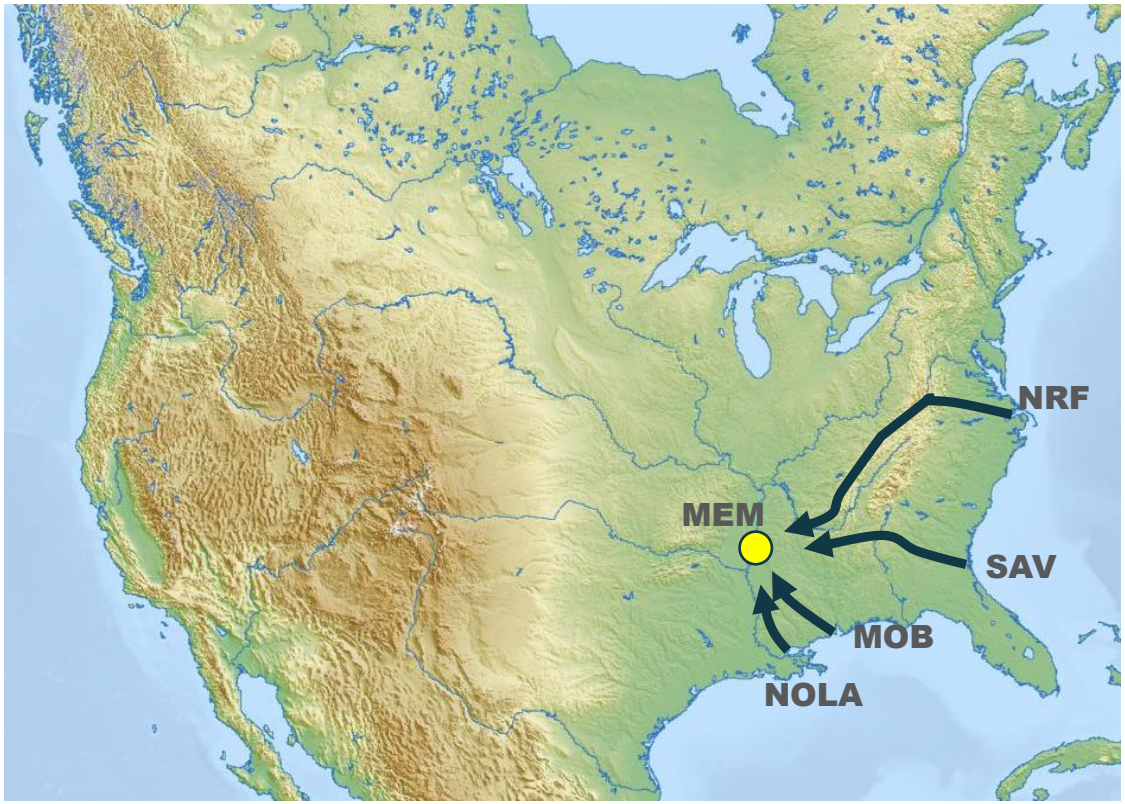
This zone receives about 8% of the Intact Intermodal containers imported via USWC ports from Asia. Over 90% of these containers coming to the zone are destined to Memphis.

The vast majority of the USWC land-bridge import traffic to this zone moves thru the SPB gateway, as both UP and BNSF have less efficient routes and fewer train frequencies between the Puget Sound and Memphis

The main domestic gateways competing with SPB for Asia containers to this zone are instead Savannah and Norfolk/Portsmouth.

- Both NS and CSXT have efficient routes and competitive service from Savannah to Memphis. For example, Savannah is only 720 miles to Memphis on NS via Atlanta, as compared to about 2000-2100 miles on BNSF/UP.
- NS also has an efficient route and competitive service from Norfolk to Memphis
- Both ports also receive multiple liner services each week from Asia, which enables the two railroads to obtain some scale economies in those lanes

Key non-USWC ports and rail service corridors for Lower Mississippi Valley zone



The ports of Mobile and New Orleans have the most direct and shortest rail links to Memphis, with both links being part of CN's main-line network

- However, because of the limited number of all-water liner services into the Gulf Coast, neither port is presently generating more than modest volumes to Memphis – and consequently, intermodal train services on those rail links are limited
- Moreover, current marine terminal capacity and rail transfer capacity in both ports constrain their abilities to capture Intact Intermodal volume away from the SPB ports

Competition Framework – Domestic Ports Competing for Asia Imports to Upper Midwest Zone

The Upper Midwest zone is comprised of Minnesota, Wisconsin, Iowa, Nebraska, and the Dakotas.

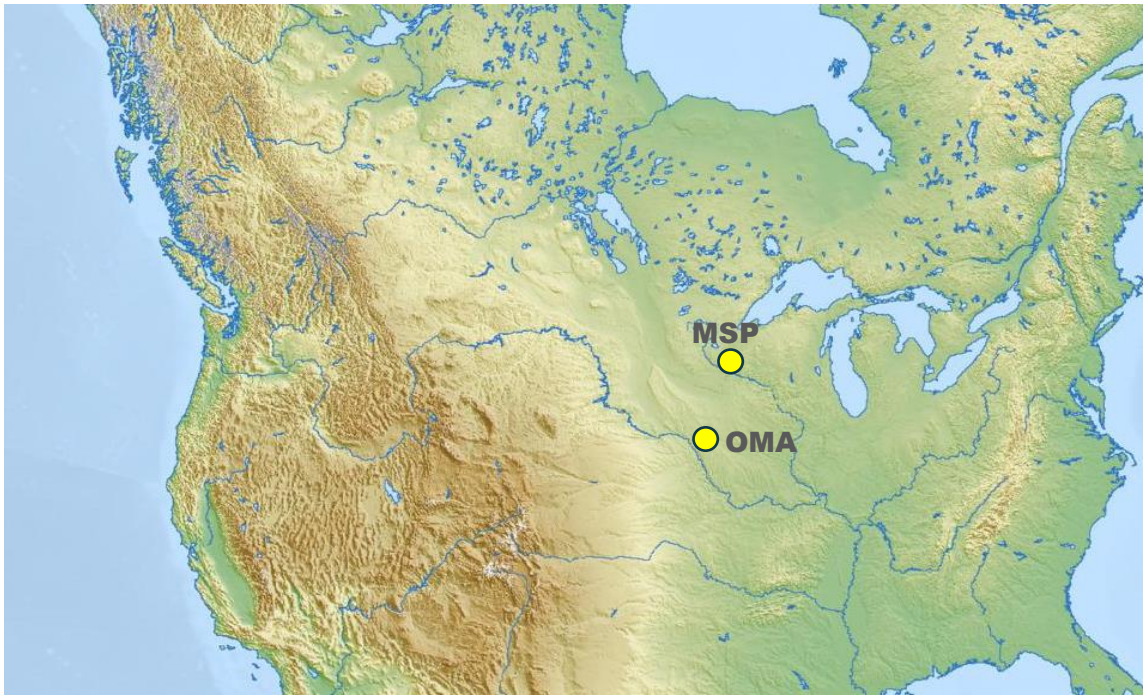
About 5% of USWC intact intermodal imports from Asia are destined to this zone, with 90% of the flow terminating in Minneapolis or Omaha.

Competition from other major domestic port gateways vis-à-vis the USWC ports (and in particular, versus the Puget Sound ports) is limited for several reasons:

- Neither NS or CSXT can offer single-line service to either Minneapolis or Omaha, from any East Coast or Gulf Coast port – thus requiring cost-adding interchanges with UP or BNSF in Chicago
- Moreover, this zone is too far west for the Northeast ports or Southeast ports to be cost-competitive with USWC ports (especially with the Puget Sound gateway)
- Neither UP or BNSF has an efficient, high-speed main-line route between New Orleans or Houston to either Minneapolis or Omaha
- In addition, present marine terminal capacity levels and rail transfer infrastructure limit the ability of the Gulf Coast ports to absorb significant volumes of Asia imports diverted from USWC ports
- The Upper Midwest zone is also too far north for the Gulf ports to be cost-competitive with Seattle/Tacoma

Thus, in the near term, ***Mercator expects minimal diversions of Asia – USWC – Upper Midwest import flows through other US coasts***

Key metro markets in Upper Midwest Zone



Competition Framework – Domestic Ports Competing for Asia Imports to Eastern Zones

The Northeast zone consists of the Mid-Atlantic states of Virginia, Maryland, Delaware, Pennsylvania, New Jersey, and New York, together with the New England states.

The Southeast zone consists of the Carolinas, Georgia, Florida, and eastern Tennessee

All-water liner services have continuously diminished the volume of Asia imports routed thru USWC ports to both zones over the past 15 years, such that collectively, only about 3% of USWC intact intermodal import volume moves to these two Eastern zones

- Over 60% of that 3% is destined to the Atlanta market

Clearly, the primary competitors to the SPB and Puget Sound gateways for Asian imports into the Atlanta market, as well as into other Southeast metro markets (such as Charlotte and Birmingham) are the South Atlantic ports of Savannah and Charleston primarily, but also the secondary ports of Jacksonville and Wilmington (NC)

- The Gulf Coast ports are not very competitive with Savannah and Charleston for most of the Southeast metro markets, given far fewer all-water services

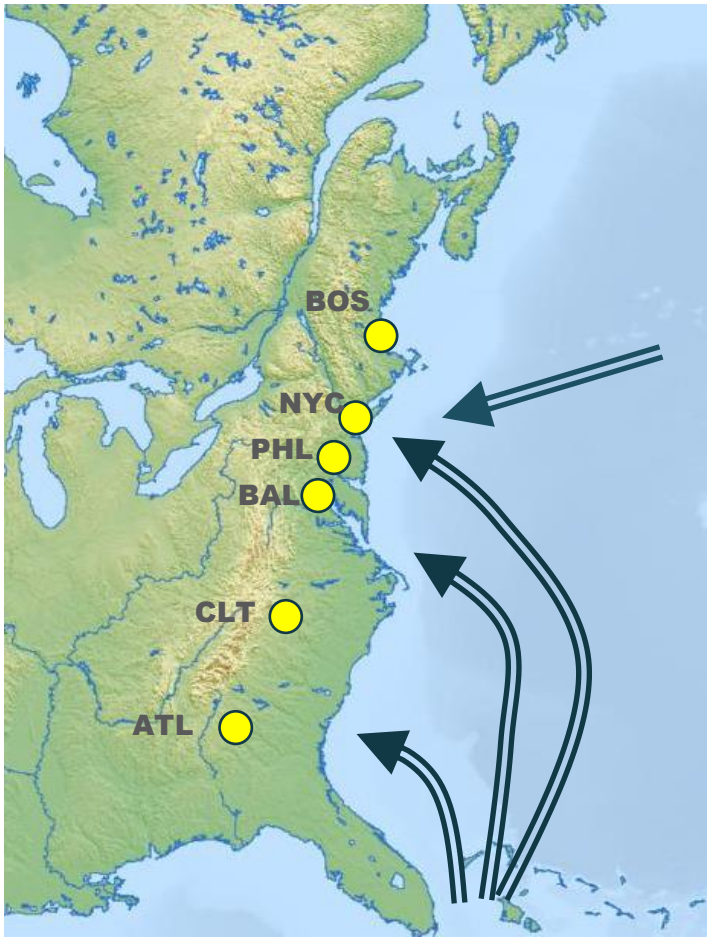
The Southeast ports are not very competitive with the Northeast ports for most of the Northeast metro markets, and vice versa

Eastbound land-bridge volumes to the Northeast metro markets comprise less than 1% of USWC intermodal import volumes

Clearly, the USWC ports are no longer competitive with the Northeast ports for the vast majority of imports into that zone from Northeast and Southeast Asia

Similarly, the USWC ports are no longer competitive with the Southeast ports for the vast majority of Asian imports into that zone

Key metro markets in Eastern zones



The cost competitiveness of a gateway port is determined by not just the costs incurred within the port complex, but rather by the sum of all the costs incurred along the container shipping routes which pass through the gateway.

The respective cost competitiveness of the two USWC port complexes handling significant Asia import volumes (i.e., San Pedro Bay and Puget Sound) was therefore assessed by comparing the "**intermodal route cost chains"** from three representative origin ports in Asia through those two gateways with costs along each of the principal alternate gateway ports and corollary routes that ocean carriers use to serve inland markets.

The intermodal route cost chains for ocean carriers to deliver intact intermodal Asia-origin containers to inland markets were divided into three categories for analysis:

A. **Ocean shipping costs** from the three origin ports to the North American gateway port, with the inbound load being charged for the return voyage of the vessel service back to Asia

B. Costs at the gateway port ("**gateway ship/rail transfer costs**") which include discharging the ship, transferring the container to an intermodal rail facility (normally, but not always, an "on dock" rail terminal at the port) and loading the container onto a railcar (unless the container is typically trucked to the inland market).

   i. Note that the capital spending that North American port authorities and terminal operators have incurred to date to comply with local, state/provincial, and/or federal environmental regulations are assumed by Mercator to be incorporated into the rates that ocean carriers are paying to their terminal operators/port authorities

   ii. Key surcharges paid by beneficial cargo owners are included in the derivation of gateway transfer costs

C. **Cost for inland transportation** from the gateway port to the inland market --- normally effected by double-stack train, but via truck for certain markets located close to the gateway port (such as the Dallas/Forth Worth market via the Port of Houston).

The derivation of each of these three cost components is described on the next pages, commencing with the ocean shipping costs.

Ocean Shipping Costs (Cost Per FEU-Slot) – Analytical Approach

Mercator's ocean shipping service cost model was used to calculate the underlying unit costs for carriers to operate services that connect the selected offshore origin points with each of the selected North American gateway ports.

The service cost model is built upon pro forma voyage plans for each fixed-day-weekly service, which are used to calculate days at port and at sea, speed, and fuel consumption.

- The analysis considers two ship sizes: 8000 TEU ships, which are the "workhorse" mid-sized ships presently operating in the transpacific trade, and ships of 14000 TEU size, which are the largest ships that can operate through the Panama Canal and are therefore the largest ships routinely calling the Pacific and Atlantic coasts of North America.
  - Cost per day for these ships was based on our estimated cost to carriers of owning and operating or long-term chartering the ships.
  - To reduce the impact on the results of variations in costs among carriers and among similar ships within a carrier's fleet, we applied the same daily costs for the standard ships used for each route.
  - Voyage itineraries were based on actual services operating in each trade to ensure the service models reflect current practice for port calls made, number of ships deployed on a route, and corresponding speed.
  - Fuel costs were computed for two categories of ships:
    a) ***Ships with exhaust gas scrubbers,*** *which allow the continued use at sea of high sulfur fuel oil (HSFO). For these ships that are able to consume lower priced, higher-sulfur fuel, a daily cost increment was added to account for the cost of installing the scrubber systems.*
    b) ***Ships without scrubbers,*** *which must now consume very low sulfur fuel oil (VLSFO) as per the IMO 2020 guidelines for ship fuels.*
  - Fuel costs also accounted for the impact of consuming ultra low sulfur fuel when operating within Emissions Control Areas.
  - Costs per port call were estimated based upon size of ship and historical cost data for each port.
  - These costs are summarized for the two different ship sizes and two categories of ships (with and without scrubbers) for each relevant route for each of the three representative origin ports in the table on the following page.

Ocean Transportation Cost Comparison – From Northeast Asia

Mercator used its ocean shipping operating cost model to assess the cost to operate a service in each of the key shipping corridors from Northeast Asia to North America.

We chose representative actual services wherever possible to ensure that the analysis reflected current service design practices, and selected Ningbo as the representative loading port for the Northeast Asia region

Slot Costs For Selected Routes and Common Ship Sizes

	Carrier Cost per Round-Trip FEU		Diff. vs PSW Route (Same size each route)		Diff. vs PSW Route (ECNA w. Larger Ships)
Ship Size	14000	8000	14000	8000	ECNA 14000, SPB 8000
Fuel Type	HSFO	HSFO	HSFO	HSFO	HSFO
Origin-Coast/Route	w. scrub.	w. scrub.	w. scrub.	w. scrub.	w. scrub.
Ningbo-PNW	670	800	-	-	
Ningbo-PSW (SPB)	670	800	-	-	
Ningbo-USGC		1,600		800	
Ningbo-ECNA-Pan	1,430	1,670	760	870	630
Ningbo-ECNA-Suez	2,000	2,300	1,330	1,500	1,200

- Vessel operating cost analysis shows that providing service from Ningbo to East Coast ports with 14000 TEU ships costs about $780 more per R-T FEU via the Panama Canal than serving West Coast ports
  - *The difference is greater – about $890 -- if using smaller 8000 TEU ships for both routes*
- East Coast routes are often served with larger ships than West Coast routes. If we compare the cost for a Ningbo - East Coast service with 14000 TEU ships with a Ningbo - West Coast service using 8000 TEU ships, the extra ocean transportation cost for the East Coast service is reduced to about $650/FEU.

Ocean Transportation Cost Comparison – from Southeast Asia

Mercator again used its ocean shipping operating cost model, this time to assess the cost to operate a service in each of the key shipping corridors from Southeast Asia to North America. We chose representative actual services wherever possible to ensure that the analysis reflected current service design practices, and selected Kalang (also known as Port Kelang, in Malaysia) as the representative loading port for this region.

Slot costs for selected routes and common ship sizes

	Carrier Cost per Round-Trip FEU		Diff. vs PSW Route (Same size each route)		Diff. vs PSW Route (ECNA w. Larger Ships)
Ship Size	14000	8000	14000	8000	ECNA 14000, SPB 8000
Fuel Type	HSFO	HSFO	HSFO	HSFO	HSFO
Origin-Coast/Route	w. scrub.	w. scrub.	w. scrub.	w. scrub.	w. scrub.
Kalang-PNW	810	980	(70)	(70)	
Kalang-PSW (SPB)	880	1,050	-	-	
Kalang-USGC		1,770		720	
Kalang-ECNA-Pan	1,490	1,770	610	720	510
Kalang-ECNA-Suez	1,390	1,680	510	630	410

- From Southeast Asia, the vessel operating cost to East Coast and Gulf Coast ports (via Panama) with 14,000 TEU ships costs about $610 more per R-T FEU than a West Coast vessel service. The difference increases to about $720/FEU if using smaller 8,000 TEU ships for both routes.
  - *If the East Coast is served via the Suez Canal, the extra cost to serve the East Coast ports is about $510 per R-T FEU using 14,000 TEU ships, and about $630 with 8,000 TEU ships.*
- East Coast routes are often served with larger ships than West Coast routes. If we compare the cost for a Southeast Asia-East Coast service with 14,000 TEU ships with Southeast Asia-West Coast service with 8,000 TEU ships, the extra cost for East Coast service is reduced to about $410/FEU if going via Suez.

Ocean Transportation Cost Comparison – from the Indian Subcontinent

Mercator used its ocean shipping operating cost model to assess the cost to operate a service in each of the key trade lanes from the Indian Subcontinent to North America. We chose representative actual services wherever possible to ensure that the analysis reflected current service design practices, and selected Chennai as the representative loading port for this region

Slot costs for selected routes and common ship sizes

	Carrier Cost per Round-Trip FEU		Diff. vs PSW Route (Same size each route)		Diff. vs PSW Route (ECNA w. Larger Ships)
Ship Size	14000	8000	14000	8000	ECNA 14000, SPB 8000
Fuel Type	HSFO	HSFO	HSFO	HSFO	HSFO
Origin-Coast/Route	w. scrub.	w. scrub.	w. scrub.	w. scrub.	w. scrub.
Chennai-PNW	1,460	1,620	(60)	(80)	
Chennai-PSW (SPB)	1,520	1,700	-	-	
Chennai-USGC		2,410		710	
Chennai-ECNA-Pan	2,130	2,410	610	710	510
Chennai-ECNA-Suez	1,840	2,130	320	430	220

- From Indian Subcontinent ports served via feeders, the vessel operating cost to East Coast ports (via Panama) with 14,000 TEU mainline ships costs about $610 more per R-T FEU than serving SPB ports. The difference increases to about $710/FEU if using smaller 8,000 TEU ships for both routes.
  - *If the East Coast is served via Suez, the extra cost to serve the East Coast ports is only a little more $300 using 14,000 TEU ships, and a little more than $400 with 8,000 TEU ships.*
- Panama and Suez routes are often served with larger ships than West Coast routes. If we compare the cost for an Indian Subcontinent-East Coast service with 14,000 TEU ships versus Indian Subcontinent-West Coast service with 8,000 TEU ships, the extra cost for the East Coast service is reduced to about $510/FEU if going via Panama, or about $220 if via Suez.

Ocean Transportation Cost Comparison – Sensitivity to Fuel Type / Scrubber Installation

Here we examine the impact of IMO 2020 VLSFO fuel use requirements for ships with no scrubbers on the differential in ocean costs for routes to SPB versus other gateways. As shown, the alternative (longer) ocean routes (via the Panama or Suez Canal) are less competitive (the extra cost for the all-water route is greater) if higher cost VLSFO is used.

Slot costs for selected routes and common ship sizes

	Carrier Cost per Round-Trip FEU				Difference vs PSW Route Same size ship each route.				Change in the Cost Differential vs PSW Route if Using VLSFO	
Ship Size	14000	14000	8000	8000	14000	14000	8000	8000	14000	8000
Fuel Type	HSFO	VLSFO	HSFO	VLSFO	HSFO	VLSFO	HSFO	VLSFO		
Origin-Coast/Route	w. scrub.	no scrub.	w. scrub.	no scrub.	w. scrub.	no scrub.	w. scrub.	no scrub.		
Ningbo-PNW	670	710	800	850	-	-	-	-	-	-
Ningbo-PSW (SPB)	670	710	800	850	-	-	-	-	-	-
Ningbo-USGC			1,600	1,690			800	840	-	40
Ningbo-ECNA-Pan	1,430	1,510	1,670	1,770	760	800	870	920	40	50
Ningbo-ECNA-Suez	2,000	2,110	2,300	2,430	1,330	1,400	1,500	1,580	70	80
Fuel Type	HSFO	VLSFO	HSFO	VLSFO	HSFO	VLSFO	HSFO	VLSFO		
Origin-Coast/Route	w. scrub.	no scrub.	w. scrub.	no scrub.	w. scrub.	no scrub.	w. scrub.	no scrub.		
Kalang-PNW	810	890	980	1,070	(70)	(60)	(70)	(70)	10	-
Kalang-PSW (SPB)	880	950	1,050	1,140	-	-	-	-	-	-
Kalang-USGC			1,770	1,880			720	740	-	20
Kalang-ECNA-Pan	1,490	1,580	1,770	1,880	610	630	720	740	20	20
Kalang-ECNA-Suez	1,390	1,470	1,680	1,770	510	520	630	630	10	-
Fuel Type	HSFO	VLSFO	HSFO	VLSFO	HSFO	VLSFO	HSFO	VLSFO		
Origin-Coast/Route	w. scrub.	no scrub.	w. scrub.	no scrub.	w. scrub.	no scrub.	w. scrub.	no scrub.		
Chennai-PNW	1,460	1,570	1,620	1,750	(60)	(60)	(80)	(70)	-	10
Chennai-PSW (SPB)	1,520	1,630	1,700	1,820	-	-	-	-	-	-
Chennai-USGC			2,410	2,560			710	740	-	30
Chennai-ECNA-Pan	2,130	2,260	2,410	2,560	610	630	710	740	20	30
Chennai-ECNA-Suez	1,840	1,910	2,130	2,210	320	280	430	390	(40)	(40)

- Note – the costs shown here for the ships with scrubbers are the same as shown on pages 16-18, and are included as a reference, to compare with the cost for using ships with no scrubbers and burning VLSFO

Terminal Costs at North American Gateway Ports

Mercator collected and analyzed inputs from a variety of industry sources to estimate the approximate charges paid by ocean carriers to discharge an inbound container and have it loaded aboard an intermodal train at gateway ports in each region of North America.

Cost to move an inbound 40' container from aboard ship to departing on a train

Average Charges by Region	Ship-Train Handling	Surcharges	Total Cost Ship-to-Train
San Pedro Bay	$520	$140	$660
Other USWC	$510	$90	$600
US Northeast	$430	$90	$520
US Southeast	$360	$90	$450
US Gulf - rail	$455	$90	$545
US Gulf - truck	$280	$90	$370

- Actual terminal charges are governed by confidential agreements between carriers and terminal operators. Figures above reflect our best estimates based on our participation in the sector and inputs from other participants.
  - *Ship-to-train handling includes discharge from the ship, handling in the terminal, and delivery to the rail terminal and loading aboard a train --- and assumes the rail terminal is an on-dock facility*
  - *In addition to the charges paid to terminal operators, the ship-train handling costs include assessments paid by ocean carriers to port worker pension and benefit funds and employer associations.*
  - *Wharfage charges are normally included within the handling rates paid to the terminal operator but, in any case, are included in the ship-to-train costs.*
- It is evident from this analysis that without including surcharges, ***USWC ports have substantially higher costs for ship-to-train handling. SPB costs are about $90 higher than in the Northeast, $160 higher than in the Southeast, and $65-240 higher than in the Gulf.***
- The Harbor Maintenance Fee (0.125% of cargo value, which we estimate to average about $90/container) applies to all US ports, but the Alameda Corridor Fee in San Pedro Bay ($26.33 per TEU, adds nearly $50 per 40' container for movements through Southern California.
  - *Other local West Coast fees (like the Pier Pass traffic mitigation or clean truck fees) do not generally apply to Intact Intermodal traffic, which is primarily loaded to trains at on-dock terminals.*

North American Inland Transport Costs

Mercator collected and analyzed inputs from shippers / carriers / industry participants to estimate the approximate inland transportation costs paid by ocean carriers for intermodal train service to key inland markets across North America. The results are summarized in the table below.

Cost per inbound container for movement from main gateway ports to key inland markets

Gateway	Inland Costs For relevant Gateway/Inland Combinations						
	Chicago	Kansas City	Dallas	Memphis	Atlanta	Columbus	Detroit
San Pedro Bay	1710	1630	1580	1630	1850	2170	1900
Sea/Tac	1700	1970		1800		2160	1890
Northeast US	635	830		730		525	525
Southeast US	860		930	700	410		
US Gulf	660	520	540	515	740		

- Actual rail transportation charges are governed by confidential agreements between ocean carriers and railroads. Figures above reflect our best estimates based on our participation in the sector and inputs from other participants.
- It is difficult to conclude very much about gateway competitiveness from the inland costs by themselves, without considering the ocean and port costs.
- It nonetheless appears, however, that NS and CSXT are pricing their respective intermodal train services at lower per-mileage rates than the UP and CSXT to the same metro markets
  - *For example, the rail mileage from the Port of NYNJ to Chicago is about 900 (NS) to 950 (CSXT) miles, so the representative rate per mile appears to be approximately 67-70 cents. Conversely, the rail mileage from San Pedro Bay is about 2,210 miles, which equates to about 77 cents per mile*

Combining the ocean transportation costs, gateway port handling costs and surcharges, and inland transportation costs, we computed the carrier's total route cost from origin (Ningbo, in this example) to key inland markets across North America. The results are summarized in the table below.

Cost per inbound container, origin to inland destination by gateway (upper); difference in cost versus SPB gateway (lower)

Gateway	Coast/Rte	Ocean-Gateway-Inland: Route Costs (8000 HSFO)						
		Chicago	Kansas City	Dallas	Memphis	Atlanta	Columbus	Detroit
San Pedro Bay	PSW	3170	3090	3040	3090	3310	3630	3360
Sea/Tac	PNW	3060	3330		3160		3520	3250
Northeast US	ECNA-Pan	2835	3030		2930		2725	2725
Southeast US	ECNA-Pan	2975		3045	2815	2525		
US Gulf	ECNA-Pan	2820	2680	2550	2675	2900		
	Coast/Rte	Diff in Ocean-Gateway-Inland Route Costs Vs SPB Route						
		Chicago	Kansas City	Dallas	Memphis	Atlanta	Columbus	Detroit
San Pedro Bay	PSW	-	-	-	-	-	-	-
Sea/Tac	PNW	(110)	240		70		(110)	(110)
Northeast US	ECNA-Pan	(335)	(60)		(160)		(905)	(635)
Southeast US	ECNA-Pan	(195)		5	(275)	(785)		
US Gulf	ECNA-Pan	(350)	(410)	(490)	(415)	(410)		

- Routes through the SPB and PNW gateways are shown to have higher costs than any of the alternative routes in use for each inland point.
  - *For northern US inland points, PNW ports are slightly better than SPB, but for southern destinations, PNW costs are higher than for SPB, as expected.*
- Moreover, for certain critical markets, the cost differences with key competitors is substantial, such that further share erosion is likely
- Tables to the left reflect costs using 8,000 TEU ships for all routes. If 14,000 TEU ships are used, the cost advantage for Northeast and Southeast gateways (that can accommodate those ships) is increased, as shown on the next page.

North American Route Costs – Using 14,000 TEU Ships

This table is also based on Ningbo as the origin point and repeats the figures from the prior table, except it is based on slot costs using 14,000 TEU ships in each lane other than to the US Gulf (which does not yet fully accommodate the larger ship size).

Cost per inbound container, origin to inland destination by gateway (upper); difference in cost versus SPB gateway (lower)

Gateway	Coast/Rte	Ocean-Gateway-Inland: Route Costs (14000 TEU, HSFO)						
		Chicago	Kansas City	Dallas	Memphis	Atlanta	Columbus	Detroit
San Pedro Bay	California	3040	2960	2910	2960	3180	3500	3230
Seattle/Tacoma	PNW	2930	3200		3030		3390	3120
Northeast US	ECNA-Pan	2595	2790		2690		2485	2485
Southeast US	ECNA-Pan	2735		2805	2575	2285		
US Gulf (8000 TEU)	ECNA-Pan	2820	2680	2550	2675	2900		

Gateway	Coast/Rte	Diff in Ocean-Gateway-Inland Route Costs Vs SPB Route						
		Chicago	Kansas City	Dallas	Memphis	Atlanta	Columbus	Detroit
San Pedro Bay	California	-	-	-	-	-	-	-
Seattle/Tacoma	PNW	(110)	240		70		(110)	(110)
Northeast US	ECNA-Pan	(445)	(170)		(270)		(1,015)	(745)
Southeast US	ECNA-Pan	(305)		(105)	(385)	(895)		
US Gulf (8000 TEU)	ECNA-Pan	(220)	(280)	(360)	(285)	(280)		

- The route cost advantage for Northeast and Southeast Gateways when using 14,000 TEU ships is about $110/container greater than when 8000 TEU ships are deployed on each route.
- The US Gulf market does not presently support the deployment of 14,000 TEU ships.
- As a consequence, the SPB versus Gulf Coast cost gap is narrowed when 14,000 TEU ships are assumed for the SPB gateway.

Additional Competitive Challenge: Compliance with California Clean Air Regulations

- California is well known for being in the vanguard of environmental protection regulations generally, and specifically with respect to regulations that affect ports and shipping.
- Laws and regulations already in place have had a significant impact on the cost of shipping cargo to/from/through California ports. Starcrest Consulting LLC, working on behalf of the pacific Merchant Shipping Association (PMSA) has undertaken analysis of transport operations, has estimated that compliance costs **already incurred** by the shipping sector in California **have amounted to nearly $6.5 billion dollars.** We assume that these costs are already contributing to the differentials enumerated in this report.
- Going forward, additional regulation of California shipping, port and trucking operations is planned and will add to the existing cost differentials. Analyzing the results produced by Starcrest, Mercator estimates that the additional costs for compliance with proposed clean air regulations will cost the **SPB container sector about $9.5 billion over the next 10 years.**

Cost of Compliying with Proposed Requirements	Total $ Est Cost	Container Sector % of Tot	Container Sector $ millions
Heavy Duty Trucks: Advanced Clean Truck Regulation	7,259	95%	6,896
Other (non-truck) Regulations			
Ocean going Vessels CARB At-Berth Amendments	178	100%	178
Ocean going Vessels VSR -thru 2030	50	53%	27
Ocean going Vessels Fuel Switch - thru 2030	220	44%	97
Cargo Handling Equipment CARB CHE Amendments	2,229	100%	2,229
Commercial Harbor Craft CARB HC Amendments	179	53%	95
Proposed Requirements (other than local trucks)			2,625
Proposed Requirements Total			$ 9,521

Compliance with California Clean Air Regulations – Incremental Cost Per Container

Further analysis allows the Starcrest results to be expressed on a cost per container basis:

DRAYAGE TRUCK COMPLIANCE COSTS

- The $6.9 billion cost to replace the drayage truck will raise the cost of container drayage in SPB, and be paid by local, transload, and off-dock intermodal volumes.
- Based on 2020 estimated volume splits and expected growth, we estimate that over the next 10 years the volume of such import drayage containers will total about 71 million TEUs (about 40 million containers).
- Dividing the expected compliance cost for drayage trucks ($6.9 billion) by the estimated headhaul (import) drayage volume (about 40 million containers) yields a **cost per import drayage container of about $170 per unit.**
  - This cost would not impact most San Pedro Bay intermodal traffic (which mostly moves via on-dock intermodal facilities and so avoids the increased drayage costs), but would severely impact those intermodal containers that for a wide variety of reasons cannot be handled on-dock and which must be drayed to a near-dock intermodal terminal.
  - This extra cost differential would make the use of off-dock intermodal terminals much less competitive and make it significantly more difficult to serve smaller intermodal markets that cannot be effectively served via on-dock loading.

OTHER COMPLIANCE COSTS

- The other compliance costs total about $2.6 billion and would be incurred by containership ocean carriers, port service providers (tugs and pilots), and by terminal operators.
- These costs would be applicable to all headhaul volumes, and as such Intermodal containers would have to pay a full pro-rata share.
- Considering total import volume of about 89 million TEUs (about 49 million containers) over 10 years, the $2.62 billion in estimated new clean air regulation compliance costs would increase the cost per import container by **a little more than $50 per import container.**
- ***This additional $50 per container would further increase the competitive cost disadvantage of the SPB gateway for Intact Intermodal import cargo as compared to non-California gateways, and would undoubtedly stimulate further diversion of discretionary import traffic to US East Coast and Gulf Coast gateways***
- *Moreover, although this study did not address the Transload segment, it is clear to Mercator that this additional cost per container will diminish the relative attractiveness of Southern California as a destination zone for Transload import containers*

Additional Risk for USWC Ports
Near-term Capacity Expansion in East Coast Ports

Several key projects are underway that are expanding the ability of selected East Coast ports to handle more Asian imports destined to inland rail-served destination markets in the Ohio Valley, Midwest, and other zones

Southeast port zone

- Georgia Ports Authority is completing a major revamping of its on-dock intermodal rail transfer facilities that will double its lift/track capacities for handling intermodal import boxes (shown in the photo to the right)
- South Carolina Ports Authority will soon complete the first phase of a new marine container terminal that will include a near-dock rail transfer facility, enabling Charleston to compete more effectively for Asia imports destined to Atlanta, Memphis, and parts of the Ohio Valley

Northeast port zone

- Maryland Port Authority (MPA) and Ports America are rebuilding a second berth at the Seagirt Terminal to be able to handle Neo-Panamax ships of 14000 TEU capacity. In concert with the previously mentioned project underway to revamp the Howard Street Tunnel thru downtown Baltimore, the MPA project will enhance this port's ability to compete for Asian imports destined to the Ohio Valley and Core Midwest zones
- Virginia Ports Authority completed an expansion project last year that almost doubled the capacity of its Virginia International Gateway Terminal, and separately this year is completing its multi-year redevelopment of its Norfolk International Terminal. With both projects encompassing additional working tracks in their respective on-dock rail transfer facilities, the Hampton Roads gateway is now capable of increasing its intermodal container traffic by at least 35%

These five projects, coupled with recent improvements in marine terminals and rail transfer facilities in the Port of New York/New Jersey, will enable these five East Coast ports collectively to handle approximately 500,000 TEUs per year of additional Asia Intact Intermodal imports

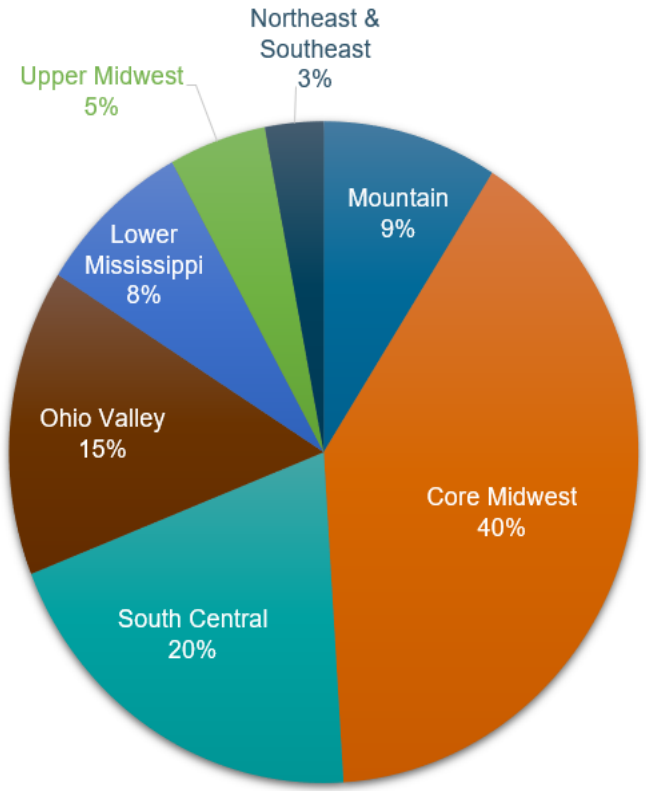
Aerial view of GPA's Mason Intermodal Terminal redevelopment

Aerial view of VPA's expanded Virginia International Gateway Terminal

Geographic Composition of Asia intermodal imports thru USWC ports

The distribution within the USA of the intact intermodal imports from Asia that move thru container terminals in San Pedro Bay, the Puget Sound, and San Francisco Bay is highly concentrated among a handful of major metropolitan areas, as shown in the graphic to the right (based on statistics from US Census):

Share of USWC Intact Intermodal Imports (TEUs) - by Region



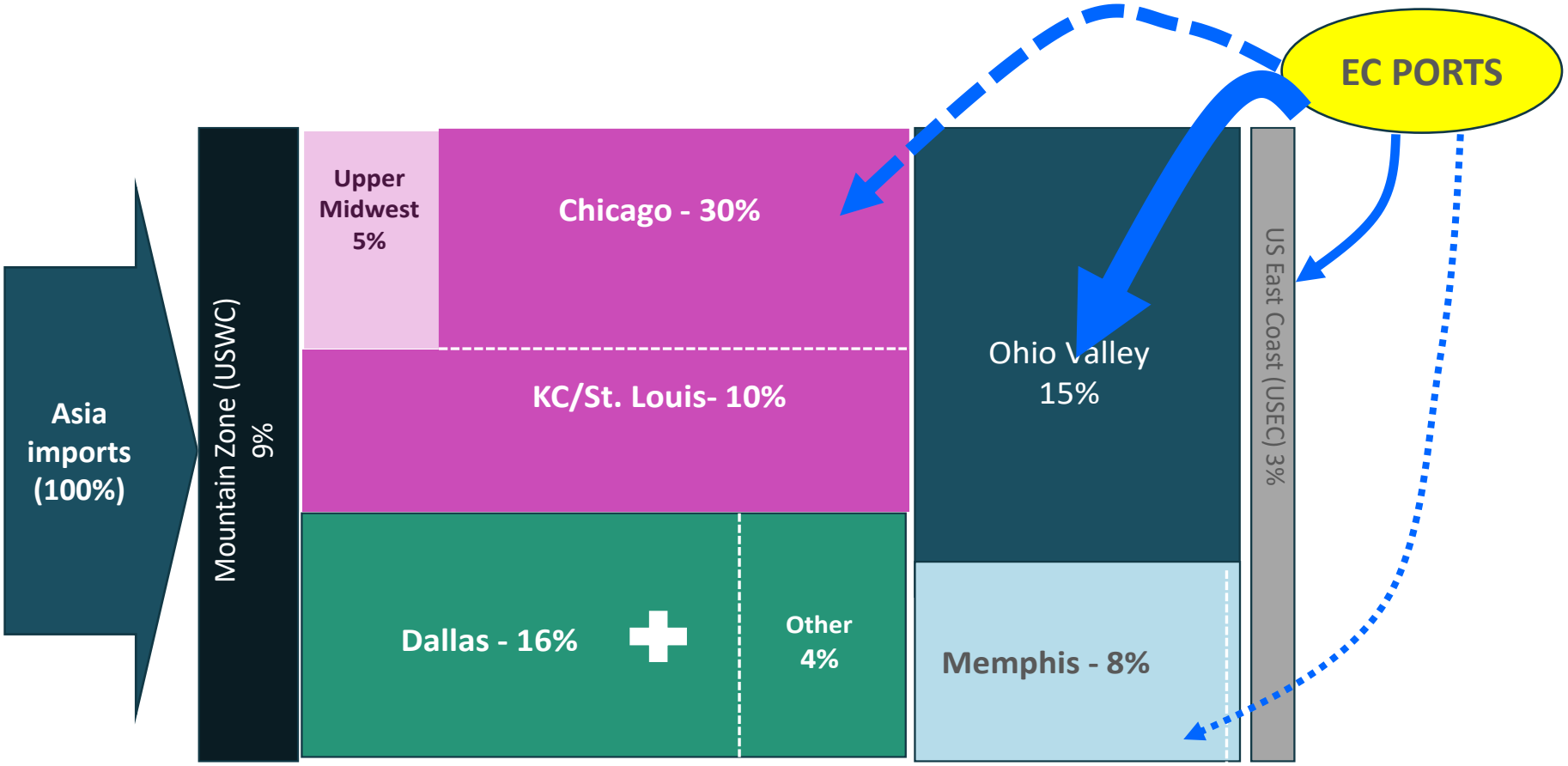
Existing, Significant Route Cost Disadvantages

The two main US West Coast port gateways (specifically, for Asian-origin container imports into the interior of the United States have significant cost disadvantages versus other US port gateways

- The two main Northeast US container ports – New York/New Jersey and Norfolk/Portsmouth – have route cost advantages of about $650-1000 per import FEU for Asia loads destined to Columbus, Detroit, and other Ohio Valley markets, although the transit times for routing those boxes via these two East Coast ports (instead of thru San Pedro Bay or Puget Sound) are typically longer by 3-4 days or more (depending on exactly where within Asia the boxes are originating). These route cost advantages of NY/NJ and Portsmouth over SPB and Puget Sound are underpinned by:
  - Much lower rail transport costs that offset the higher ocean transportation costs of all-water services
  - Lower unit costs for marine terminal labor and lower terminal lease rates
  - (For SPB only), avoidance of the ACTA transit fee
- The major Southeast US port for Asian imports – Savannah – has route cost advantages of about $215-285 per import FEU for Northeast Asia loads destined to Chicago, and about $365-475 for loads destined to Memphis, although the transit times for routing those boxes via Savannah to either of those two inland hubs could be longer by 3-4 days or more (depending on exactly where within Northeast Asia the boxes are originating). These route cost advantages of Savannah over SPB and Puget Sound are underpinned by:
  - Much lower rail transport costs that offset the higher ocean transportation costs of all-water services
  - Lower unit costs for marine terminal labor and lower terminal lease rates, as a state-operated port
  - High stevedoring productivity rates, with extensive use of tandem lifts
  - (For SPB only), avoidance of the ACTA transit fee
- In the US Gulf, Houston has a route cost advantages of about $350 per FEU for Northeast Asia loads destined to Dallas, while Mobile has a route cost advantage of about $265 for loads destined to Memphis, but transits for such routings could be longer by 3-4 days or more (depending on exactly where within Northeast Asia the boxes are originating). These route cost advantages of over SPB and Puget Sound are underpinned by:
  - Much lower rail transport costs (Mobile – Memphis) and trucking costs (Houston – Dallas) that offset the higher ocean transport costs of all-water services
  - Lower unit costs for marine terminal labor and lower terminal lease rates
  - (For SPB only), avoidance of the ACTA transit fee

Ramifications of Major Route Cost Disadvantages for USWC Gateway Ports

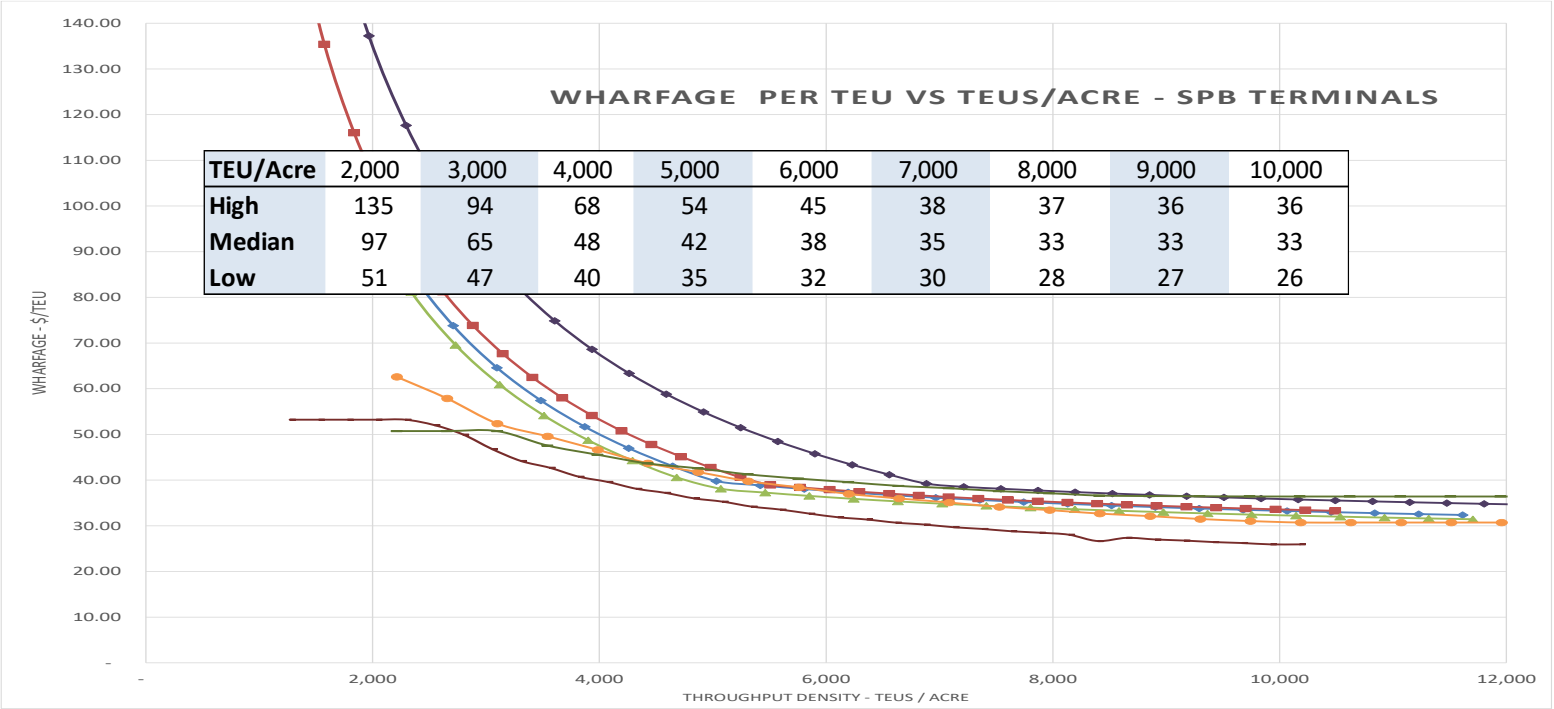
Given the route cost disadvantages outlined in this report and summarized on the prior page, a significant portion of the existing intact-intermodal Asia import traffic base is highly vulnerable to further diversion to the major US East Coast gateway ports



Even without considering sourcing shifts away from China to Southeast/Southwest Asia (which benefit all-water routings via the Suez Canal), the USWC ports are vulnerable to losing volumes to three interior market zones (Chicago, Ohio Valley, Memphis) that collectively account for 53% of the current Intact Intermodal traffic base for the SPB and Puget Sound gateways

San Pedro Terminal Lease costs per TEU

Costs per TEU fall as throughput density (expressed in TEUs / acre / year) increases



TEU/Acre	2,000	3,000	4,000	5,000	6,000	7,000	8,000	9,000	10,000
High	135	94	68	54	45	38	37	36	36
Median	97	65	48	42	38	35	33	33	33
Low	51	47	40	35	32	30	28	27	26

- As illustrated above, the typical terminal agreement in San Pedro Bay features declining costs per unit as volume rises.
  - *There is normally a Minimal Annual Guaranteed rental payment that could vary between 200,000 and 400,000 per acre, depending on when the agreement was signed.*
  - *Above a certain threshold volume as specified in each lease, wharfage per unit is typically 50% of the rate paid for the initial volume. Other agreements have a pre-defined "sliding scale" with continuously declining unit rates as volume grows, which achieve the same result of a declining unit cost as volumes rise.*
  - *Agreements are subject to market re-setting at 5 year intervals, but the process is difficult and uneven because the characteristics of terminals are quite different, and non-container port uses are unhelpful in setting a value of the facilities.*

Key Terminal Cost Components
West Coast Terminal Facility Costs

Comparison of terminal facility costs in the main North American West and East Coast ports

Approximate Costs for Terminal Facilities - $/Container Basis

Port Complex	Effect. "Lease Rate" Per Container @4000 TEU/Acre Low	@4000 TEU/Acre High	@6000 TEU/Acre Low	@6000 TEU/Acre High	Leasehold / Property Tax Per Container	Crane Investment Paid By	Civil Works Investment Paid By
San Pedro Bay	$72	$122	$58	$81	abt. $10	Tenant	By Port
Puget Sound		$62		$41	abt. $4-5	Tenant	By Port
NY / NJ	$25	$43	$23	$36	minimal, if any	Tenant	Shared
Baltimore		$32		$27		Tenant	By Tenant
Norfolk			$55 - see note			Landlord *	Landlord

- **Southern California:** In addition to "lease payments" (abt $60-80/box at the 6000 TEU/acre throughput), operators in SPB pay significant Leasehold and property taxes, adding another $10/box. Infrastructure improvements are made by the port; ship-to-shore gantry cranes and operating equipment and systems are provided by the tenant.
- **Puget Sound:** terminal arrangements in Seattle and Tacoma follow a property rental model with an annual charge per acre. A recent lease in Seattle was concluded at a rate of $137,000 per acre per year, which works out to $60/box at 4000 TEUs/acre, or $40/box at 6000 TEUs/acre. Operators provide cranes or pay for crane usage, adding about $22 per box. Leasehold Excise (Property) taxes are a bit lower than in SPB.
- **New York / New Jersey:** Terminal operators at PANYNJ pay a base land rent of $59,000 per acre ($19,000 for APMT). The base rent includes a certain number of "free moves" per acre, above which the charge is presently $25/container. The number of free moves varies by agreement. Figures quoted are averages for the port. Operators are responsible for cranes and most capital improvements made to suit their operations.
- **Baltimore:** Seagirt, the main terminal in Baltimore is operated under a 50 year concession signed in 2010. The terminal operator made a $140 million up-front payment and agreed to spend an additional $100 million to construct a new berth and acquire STS gantry cranes. Having invested in major upgrades and made a large up-front payment, the fixed and variable concession payments are modest - $3.2 million per year plus $15/container, subject to inflation. The operator is presently spending an additional $100 million to upgrade/deepen a 2nd mega-ship berth and acquire 4 additional cranes, bringing the total terminal infrastructure investment plus up-front fee to about $250 million, which is financed by 25 year municipal bonds. We have calculated the effective facility cost per box to be about $32 at the 4000TEU/acre volume level, and $27/box at the 6000 TEU/acre volume level. Note that these costs include the costs of the STS gantry cranes, which are NOT accounted for in the facility lease costs in USWC ports.
- **Norfolk:** The facility cost in Norfolk is estimated based on the 2016 agreement between the owner of the Virginia International Gateway to lease the completed and fully operational Phase 1 VIG terminal to Virginia Port Authority, on a turnkey basis, for $51.07 million. With a capacity of 1.2 million TEUs, the lease rate works out to$77/box. This appears high, but it included all of the operating equipment and systems for highly automated and fully operational ph1 terminal, including the gantry cranes and automated stacking machines which at USWC terminals are an additional cost. If we assume these items normally supplied by the terminal operator had accost of $250 million and deduct the annual amortization of these costs from the Port of Virginia lease payment, we estimate a facility cost (which can be compared to USWC terminals) of about $55/box.
- Comparing on the same basis (assuming terminal operators provide STS cranes and operating equipment, with throughput of 6000 TEUs/acre), we estimate the terminal facilities in Northeast / Mid-Atlantic ports cost terminal operators **between $30 and $55/box**, as compared to costs of **$45 to $90 per box** for SPB terminals.

Southeast USA Terminal Facility Costs – Charleston and Savannah

The principal southeastern USA ports are in South Carolina and Georgia (Charleston and Savannah), and are operated directly by State-owned Port Authorities. These state-owned operations have unique cost structures which are also rather difficult to discern due to the lack of lease contracts between the port authorities and private operators

South Carolina Ports Authority (SCPA): Port of Charleston

The SCPA's main active container terminal is the Wando Welch Terminal which was originally opened in 1982, but has been expanded and improved many times over the last 30+ years. Estimating investment in the underlying infrastructure would be difficult because the investments have been made over many years and are often not clearly broken out by category.

The SCPA is developing the new Hugh Leatherman Terminal (HLT) which will open in 2021. Costs for this terminal are provided in SCSPA's annual reports, and based on this, we can estimate the terminal infrastructure cost per TEU of capacity.

Charleston: Hugh K. Leatherman Terminal Estimate of Infrastructure Costs Per TEU		
	HLT Ph1	HLT Thru Ph 3
Reported Cost	833	1500
Est Cost for Site Develop / Term Infra	493	900
Developed Acres	130	286
Capacity - containers	600,000	1,400,000
Capacity - TEUs	1,050,000	2,450,000
Annual Financing Costs For Terminal Infrastructure		
Investment ($millions)	493	900
Term	30	30
Rate	4.50%	4.50%
Annual Payment, $ **millions**	$29.0	$52.9
Annual $ per TEU of Capacity	$28	$22
Est'd. Facility Infrastructure Cost Per TEU at various throughput levels:		
$/TEU at 4000 TEU/Acre:	$56	$46
$/TEU at 6000 TEU/Acre:	$37	$31
$/TEU at 8000 TEU/Acre:	$28	$23

- At a throughput level of 6000 TEU/acre, the new Charleston terminal would initially have a unit cost of about $37/TEU, falling to about $31 when fully built (after phase 3). These costs exclude the costs of equipment and systems, to facilitate comparison with west coast facility lease costs, which also exclude equipment.
- While higher than what we estimate for Northeast / Mid-Atlantic ports, this cost is still less than most ports in SPB.
- The relatively higher cost may be related to HLT's site-specific development issues which increased costs. The SCPA model is quite efficient and the underlying costs for existing capacity at the Wando terminal were probably less.

Georgia Ports Authority: Savannah

- The GPA's Garden City terminal at Savannah has been developed and expanded many times over the years,. making it difficult to know underlying development costs.
- The GPA has shown a willingness to make significant investments in facilities. We would expect, however, that the unit development costs were almost certainly no higher than for the HLT terminal.

Estimated Terminal Labor Cost Differentials

Using a variety of labor productivity measures and hourly wage and benefit costs, Mercator has estimated the labor cost per intact-intermodal container moved through each of the major port gateways.

Estimated Container Terminal Labor Costs For On-dock or Near-dock Intermodal Containers

Estimated Cost Per Hour / Cost Per Move By Port Area

Port Complex	Actual Wages Paid - $/Hr	Benefits $/Hr	Total Cost $/Hr	Total (Vsl+Term+Rail) Labor Hrs/Move	**Labor Cost per Inland Container**	**$ / Container Advantage vs. SPB**
San Pedro Bay	$58	$64	$122	2.3	$281	
Puget Sound	$58	$64	$122	2.2	$269	($12)
NY/NJ	$53	$48	$101	2.4	$242	($38)
Mid-Atl (Balt, NRF)	$53	$38	$101	2.1	$212	($69)
Southeast (CHS, SAV)	$53	$38	$101	1.6	$162	($119)

- Productivity (labor hours required per move) varies by terminal, and detailed data on hourly costs is not available across all ports, so some assumptions and estimates are required, making precise comparative analysis not possible. However, the above estimates illustrate the directionality and approximate magnitude of the cost differences.
- Compared to the SPB ports, Mercator estimates the East Coast gateways enjoy a labor cost advantage of between about $40 and $120 per container.

Note - Gulf Coast ports were not included in the table above due to Mercator having a lack of comparable labor hours data for those ports

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