

Propeller Clubs of Northern California and Los Angeles & Long Beach
On-Line Zoom

The Past, Present and the Future of Busan Port

– Korean and U.S. Ports : Learning From Each Other –

2023. 5. 22(Mon) 14:00

- <i>US Pacific Time</i>	: <i>May 22nd 14:00</i>
- <i>Korean Time</i>	: <i>May 23rd 06:00</i>

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Director of Marketing & Int'l Affairs
Busan Port Authority

Contents

(Intro) Liner Shipping

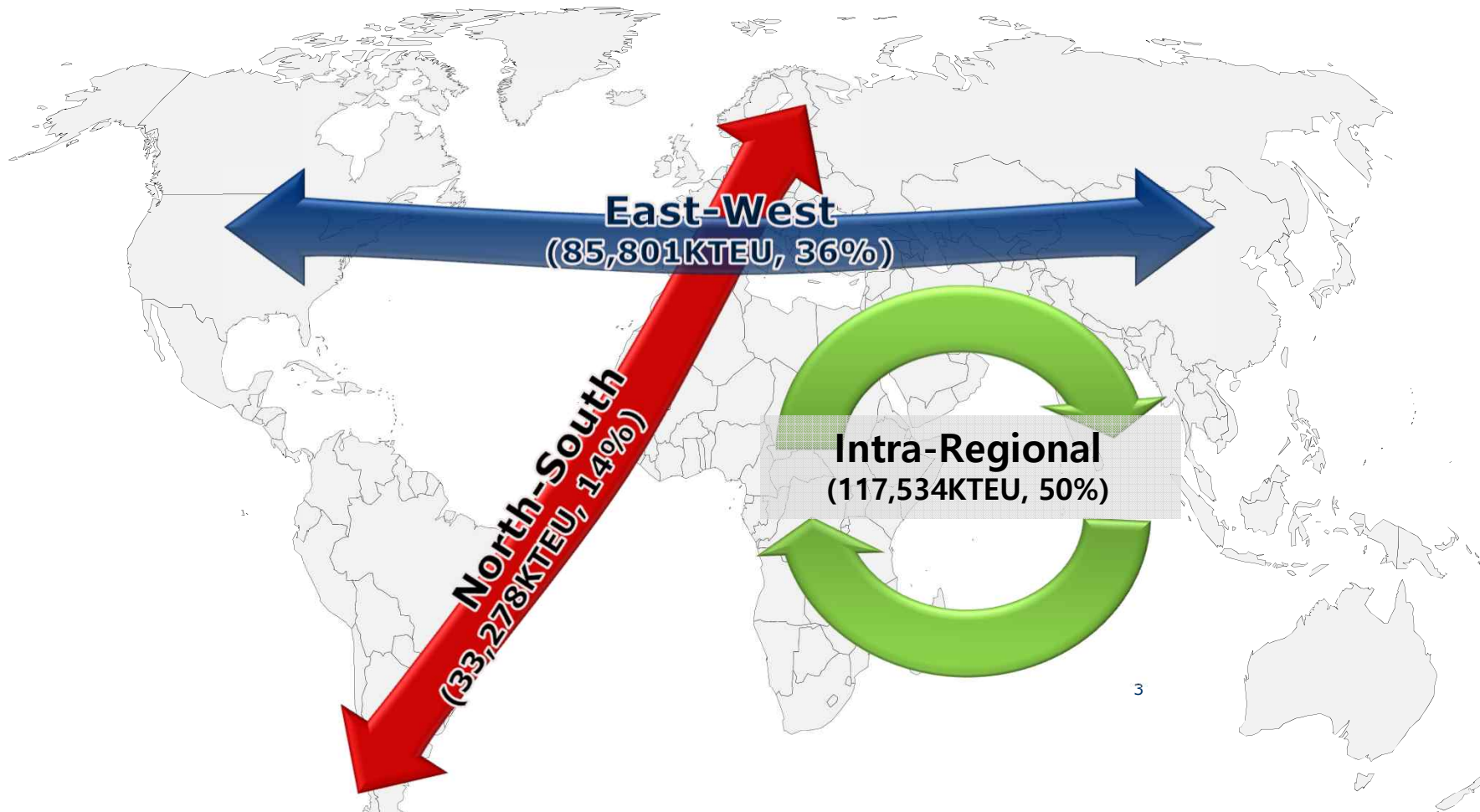
I. The Port of Busan's Transshipment (Japan & China)

II. The Port of Busan's Plans for New Automated Terminal

III. Efforts to transition the Port to zero emissions.

IV. Others

Global CNTR Traffic in Major Trade routes : 237MTEU (Drewry est.)



* Source : Drewry Container Forecaster & Annual Review 2022/23, Visualized by BPA Marketing Dept

North-South Trade Example

Far East to East Africa & Gulf

Ingwe Service *

① FE-Africa

● Westbound & ● Eastbound



U.S.A. No. Atlantic to South Africa

USA to South Africa *

② USA-Africa

● Southbound & ● Northbound



Far East to SAWC

Inca *

③ FE-SA WC

● Eastbound & ● Westbound



U.S.A. West Coast to N.Z. & Australia

Oceania Loop 1 *

④ USA-AUS

● Southbound & ● Northbound



Intra-Regional Example

West Africa to South Africa

Angola Service •

⑤ Africa

● Southbound & ● Northbound



Canada to the Gulf of Mexico

Canada Gulf Bridge •

⑥ N. America

● Southbound & ● Northbound



Singapore Strait Feeders

Malaysia Express • Malindo Express • New Java Express • New Malacca E

⑦ S. Asia

● Roundtrips



Singapore to Australia & N.Z.

Capricorn Service (South Loop) •

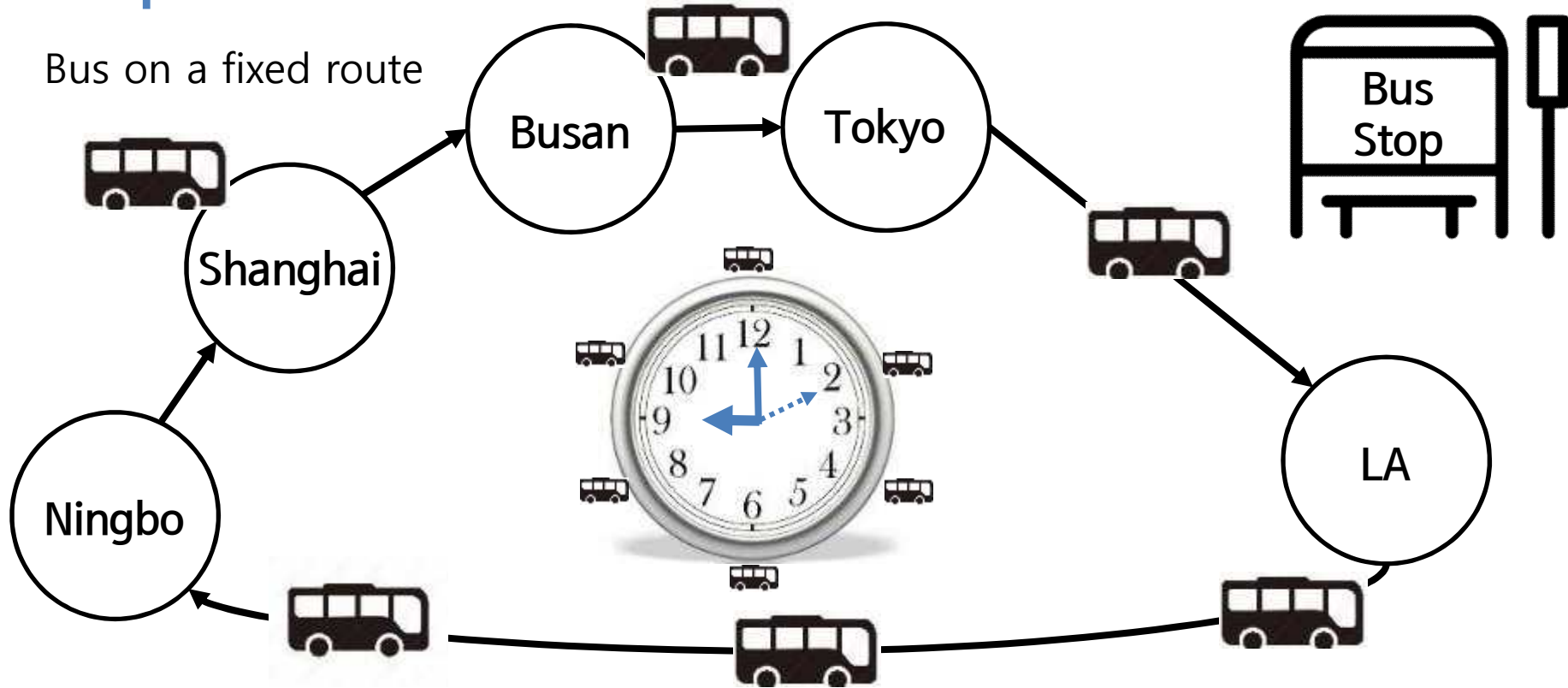
⑧ Oceania

● Eastbound & ● Westbound



Transpacific routes

Bus on a fixed route

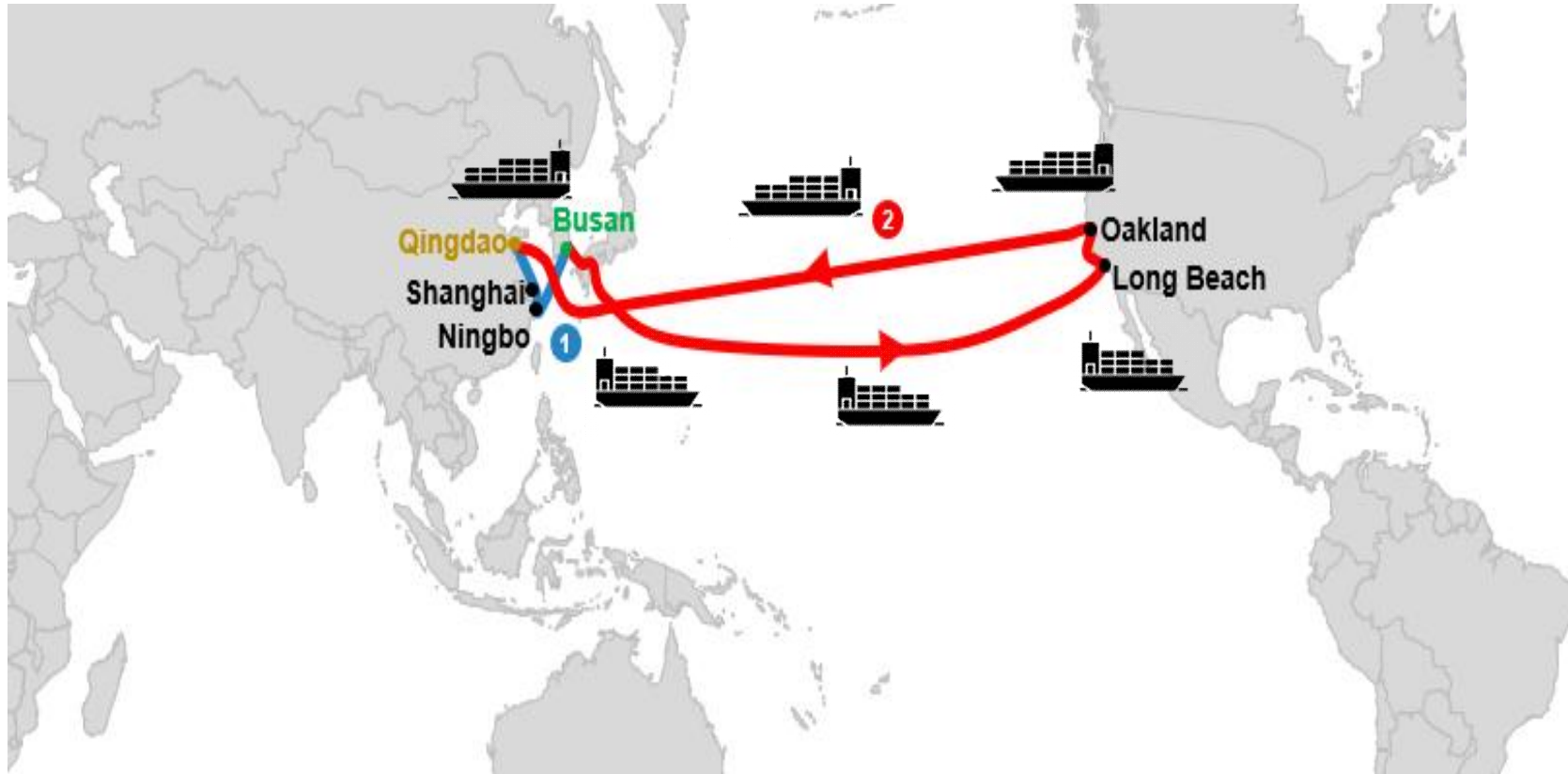


60 min(1 hour) to fully circle the route, every 10 min? → 6 buses



42 day route, every 7 day? → 6 vessels

Transpacific route example: USWC



Carriers	Dur.	Freq.	Ships	Rotation
Maersk / SM Line	42	7	6 x 10,600 – 13,560 teu	Qingdao, Shanghai, Ningbo, Busan, Long Beach, Oakland, Qingdao

Weekly Interval

- 1. Slow Speed
- 2. Added Bus Stops

70 min



x 7

10-min interval

100 min



x 10

70 day



x 10

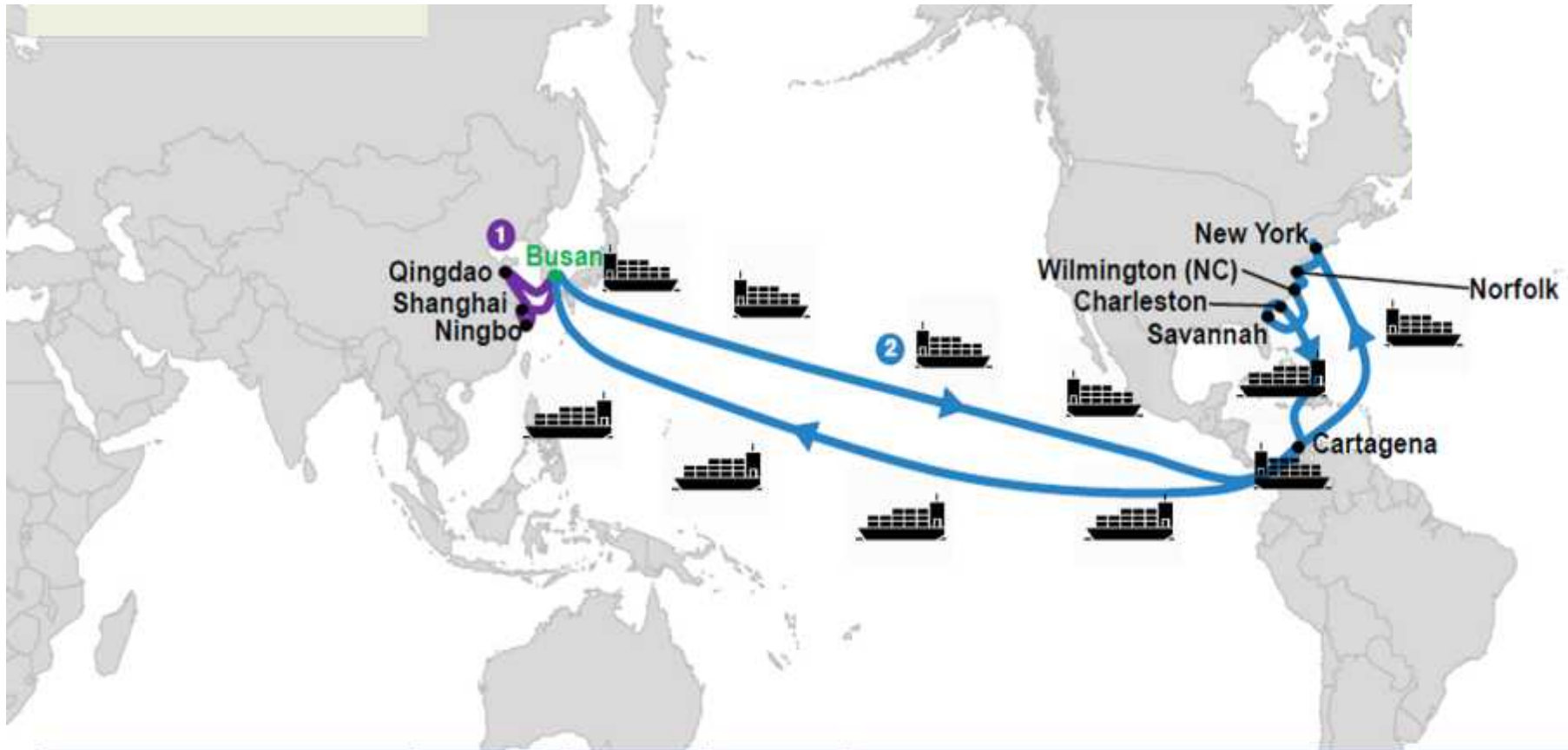
7-day interval

- 1. Slow Steaming
- 2. Added Port of Call

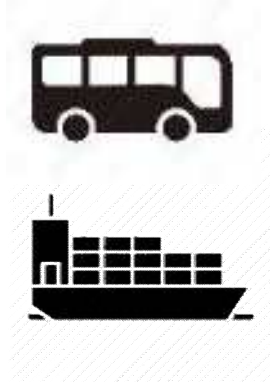
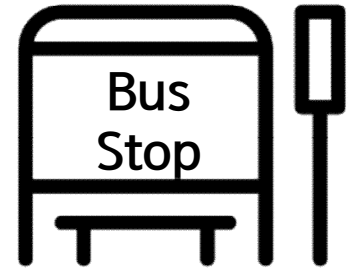
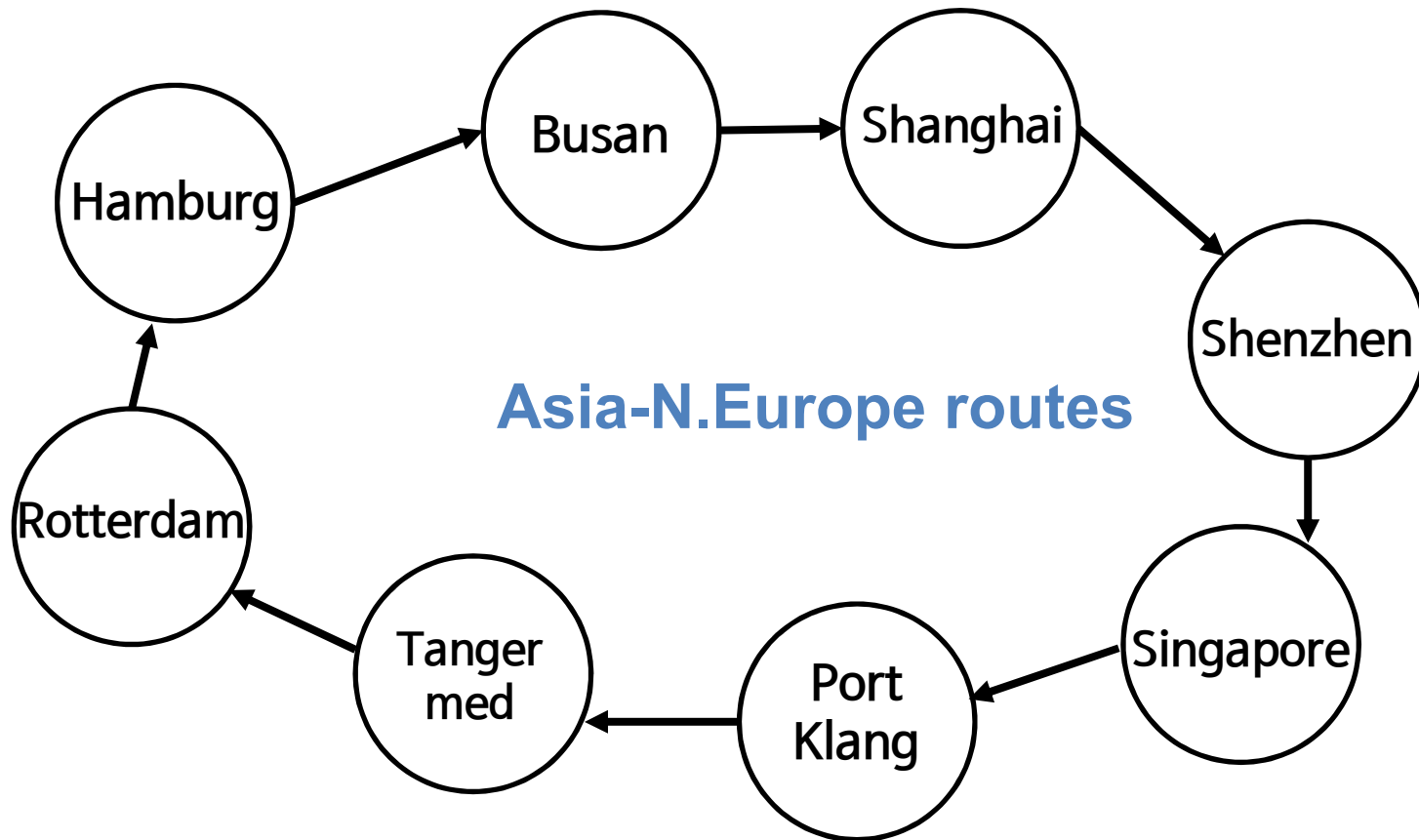
Shippers' Perspective

"Shipping service quality suffers!! "

Transpacific route example: USEC



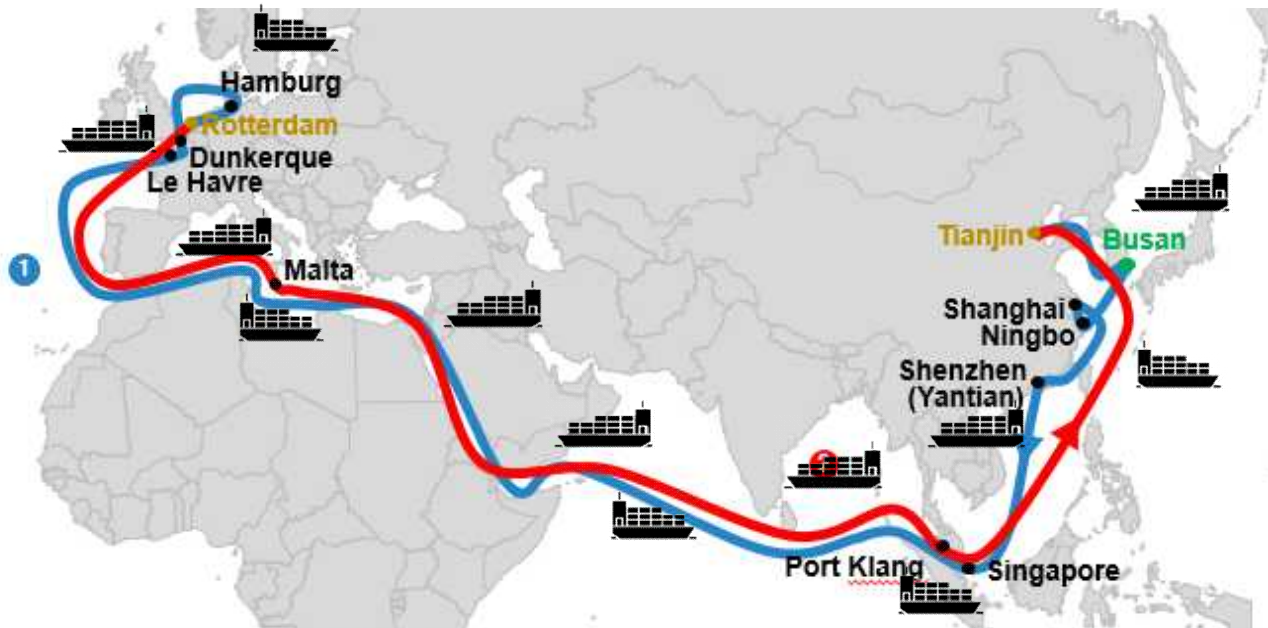
Carriers	Dur.	Freq.	Ships	Rotation
Hapag-Lloyd / HMM / ONE / YM	77	7	11 x 13,092 - 14,220 teu	Busan, Qingdao, Ningbo, Shanghai, Busan, Cartagena, New York, Norfolk, Wilmington (NC), Savannah, Charleston, Cartagena, Busan



120min(2 hour) long-route, every 10 min? → 12 buses

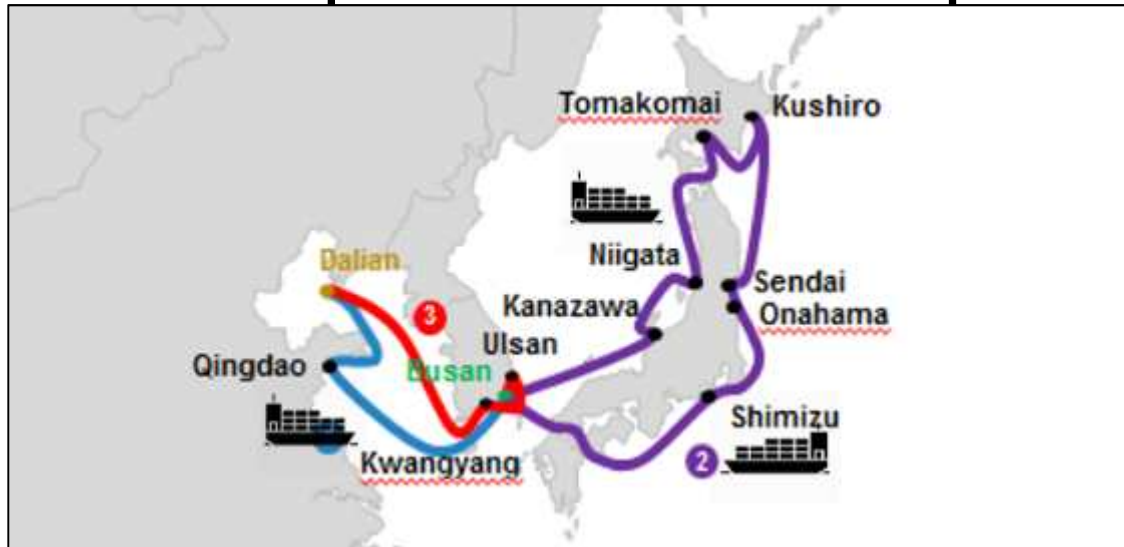
84 day route, every 7 day? → 12 vessels

Asia-N.Europe Service Example



Carriers	Dur.	Freq.	Ships	Rotation
CMA CGM / ONE	84	7	12 x 17,292 – 23,112 teu	Tianjin, Busan, Ningbo, Shanghai, Shenzhen (Yantian), Singapore, Le Havre, Dunkerque, Hamburg, Rotterdam, Malta, Port Klang, Tianjin

Korea-Japan-China Service Example



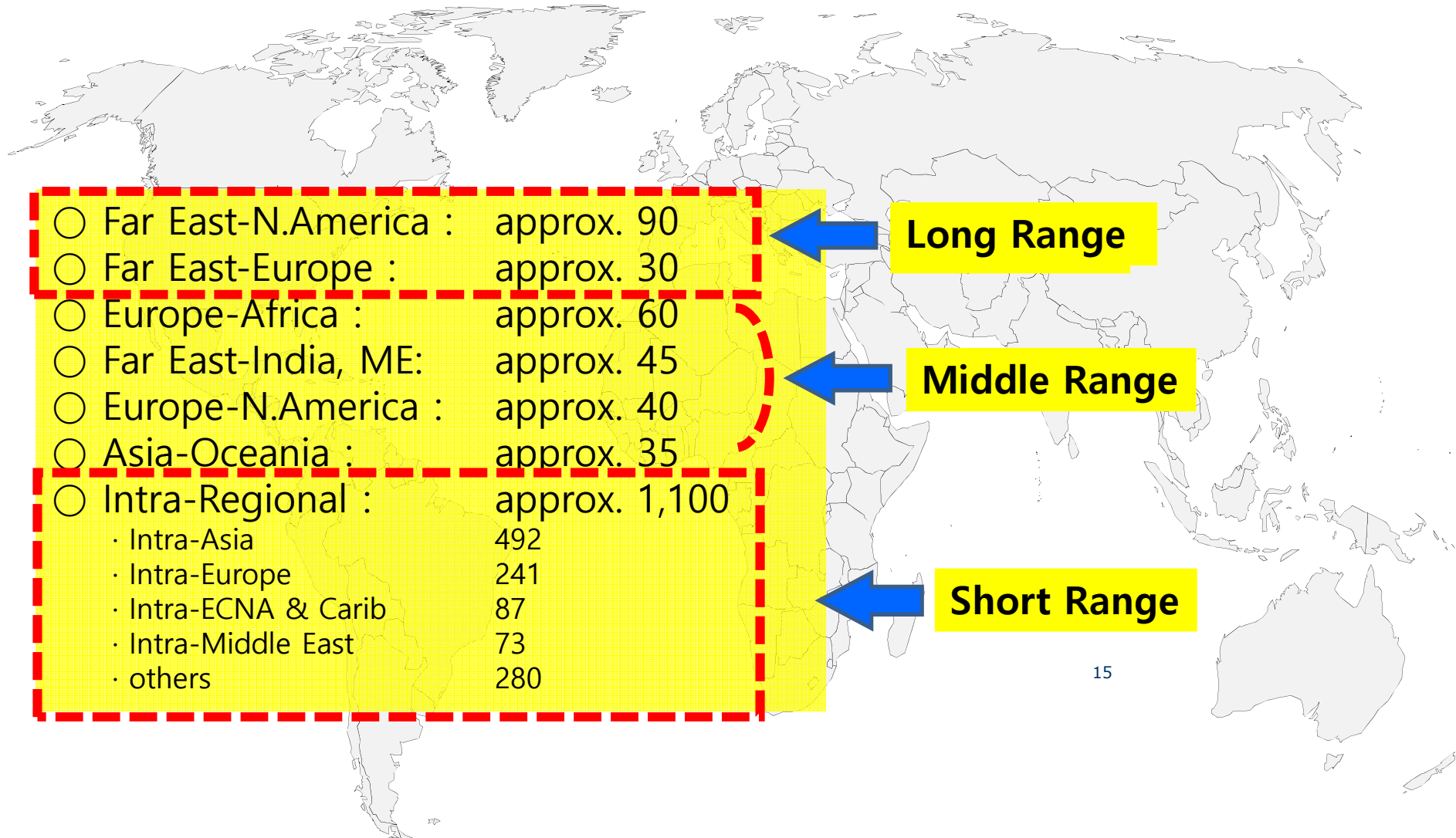
- Duration : 21 days
- 1,000TEU x 3

South East Service Example



- Duration : 63 days
- 3,000TEU x 9

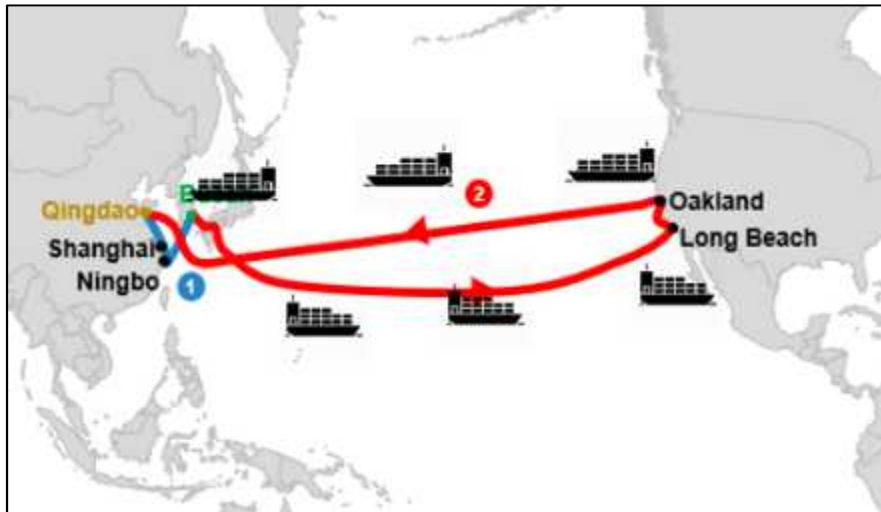
✓ **Number of Global Weekly CNTR Service : about 1,400**



※ Source : Alphaliner

Liner Shipping – High Fixed Cost (USWC & N.Europe)

* Vessel operating cost varies from carrier to carrier depending on vessel ownership, fuel type, etc.



< Annual Cost for one TP Service >

* 8,000 TEU-mark ship

=> Per Ship \$22M~\$60M (약270억원~720억원)

=> 6 ships : \$130M~\$360M (약1,600억원 ~ 4,300억원)

* Chartering => \$25,000~\$100,000 (daily)

* Fuel Cost/ton \$550 ~ \$1,000 (*daily consumption 80ton)

< Annual Cost for one N.Europe Service >

* 16,000~20,000 TEU-mark ship

=> Per Ship \$32M~\$102M (약380억원~1,500억원)

=> 12 ships : \$380M~\$1.5B (약4,500억원 ~ 1조8,000억원)

* Chartering => \$60,000~\$260,000 (daily)

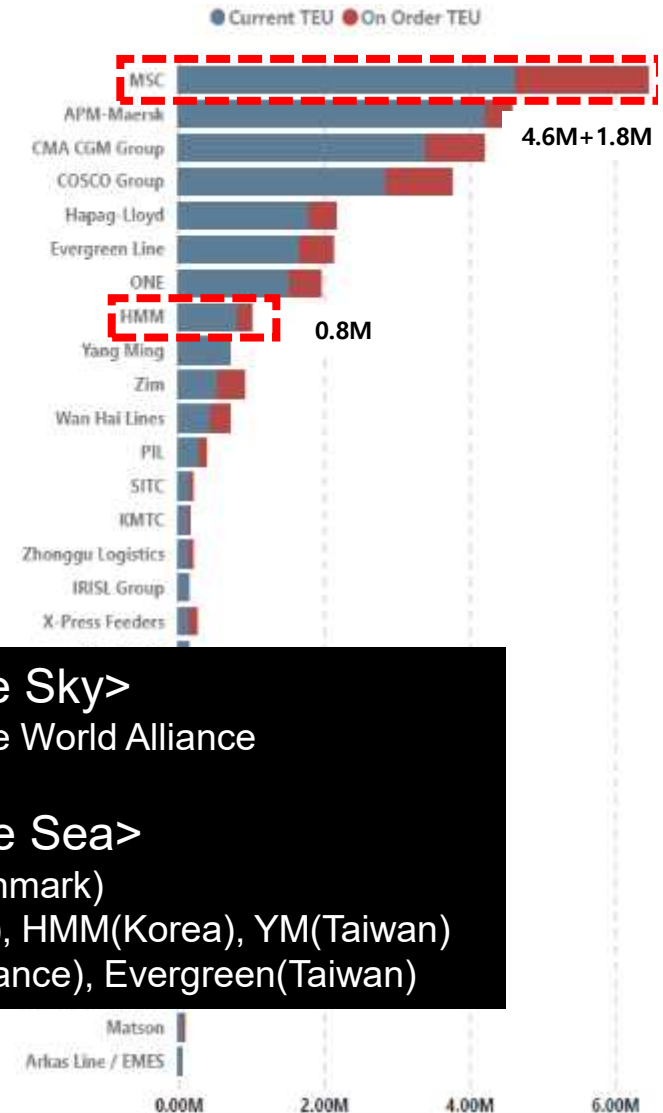
* Fuel Cost/ton => \$550 ~ \$1,000 (*daily consumption 100ton)

(Key assumption : vessels are all time-chartered and vessel speed is 17 knots.)

(USD1=KRW 1,200)

Global Shipping Line Capacity & Market share

Rank	Operator	Current TEU	Current Ships	Owned TEU	Owned Ships	Chartered TEU	Chartered Ships	% Chart	On Order TEU	On Order Ships	O/E %	Market Share
1	MSC	4,634,227	722	2,192,171	435	2,442,056	287	53%	1,825,276	133	39%	17.6%
2	APM-Maersk	4,225,916	702	2,532,757	343	1,693,159	359	40%	358,300	30	8%	16.0%
3	CMA CGM Group	3,396,284	595	1,597,712	232	1,798,572	363	53%	816,476	89	24%	12.9%
4	COSCO Group	2,866,465	465	1,568,820	177	1,297,645	288	45%	884,272	46	31%	10.9%
5	Hapag-Lloyd	1,795,177	248	1,111,479	120	683,698	128	38%	362,544	18	20%	6.8%
6	Evergreen Line	1,662,633	209	951,667	128	710,966	81	43%	463,442	49	28%	6.3%
7	ONE	1,531,624	204	787,587	90	744,037	114	49%	433,930	31	28%	5.8%
8	HMM	816,365	75	555,866	37	260,499	38	32%	184,027	17	23%	3.1%
9	Yang Ming	705,614	93	216,346	51	489,268	42	69%				2.7%
10	Zim	533,823	138	28,681	8	505,142	130	95%	378,034	43	71%	2.0%
11	Wan Hai Lines	433,867	143	346,445	113	87,422	30	20%	273,825	37	63%	1.6%
12	PIL	297,163	91	193,633	71	103,530	20	35%	88,000	8	30%	1.1%
13	SITC	158,653	105	144,494	91	14,159	14	9%	40,146	24	25%	0.6%
14	KMTC	148,517	65	86,464	32	62,053	33	42%	16,000	2	11%	0.6%
15	Zhonggu Logistics	142,674	105	87,238	37	55,436	68	39%	60,268	13	42%	0.5%
16	IRISL Group	136,900	30	136,900	30							0.5%
17	X-Press Feeders	136,798	87	70,027	38	66,771	49	49%	110,992	24	81%	0.5%
18	UniFeeder	135,008	83									
19	TS Lines	109,813	50	79,298								
20	Antong (QASC)	101,696	93	74,720								
21	Sinokor	95,331	75	82,410								
22	Sea Lead Shipping	85,267	23									
23	China United Lines	74,064	29	12,445								
24	Emirates Shipping Line	72,513	16	2,546								
25	Swire Shipping	70,052	35	56,041								
26	SM Line Corp.	68,620	15	59,918								
27	RCL	68,344	34	62,994								
28	Global Feeder Shg	68,126	23	48,089								
29	Matson	67,247	29	42,599	20	24,648	9	37%	10,860	3	16%	0.3%
30	Arkias Line / EMES	52,893	33	51,729	32	1,164	1	2%				0.2%



<Alliances in the Sky>
 Skyteam, Star Alliance, One World Alliance

<Alliances on the Sea>

- 2M : MSC(Switzerland), Maersk(Denmark)
- THE : Hapag(Germany), ONE(Japan), HMM(Korea), YM(Taiwan)
- OCEAN : COSCO(China), CMACGM(France), Evergreen(Taiwan)

※ Source : Alphaliner (Feb. 2023)

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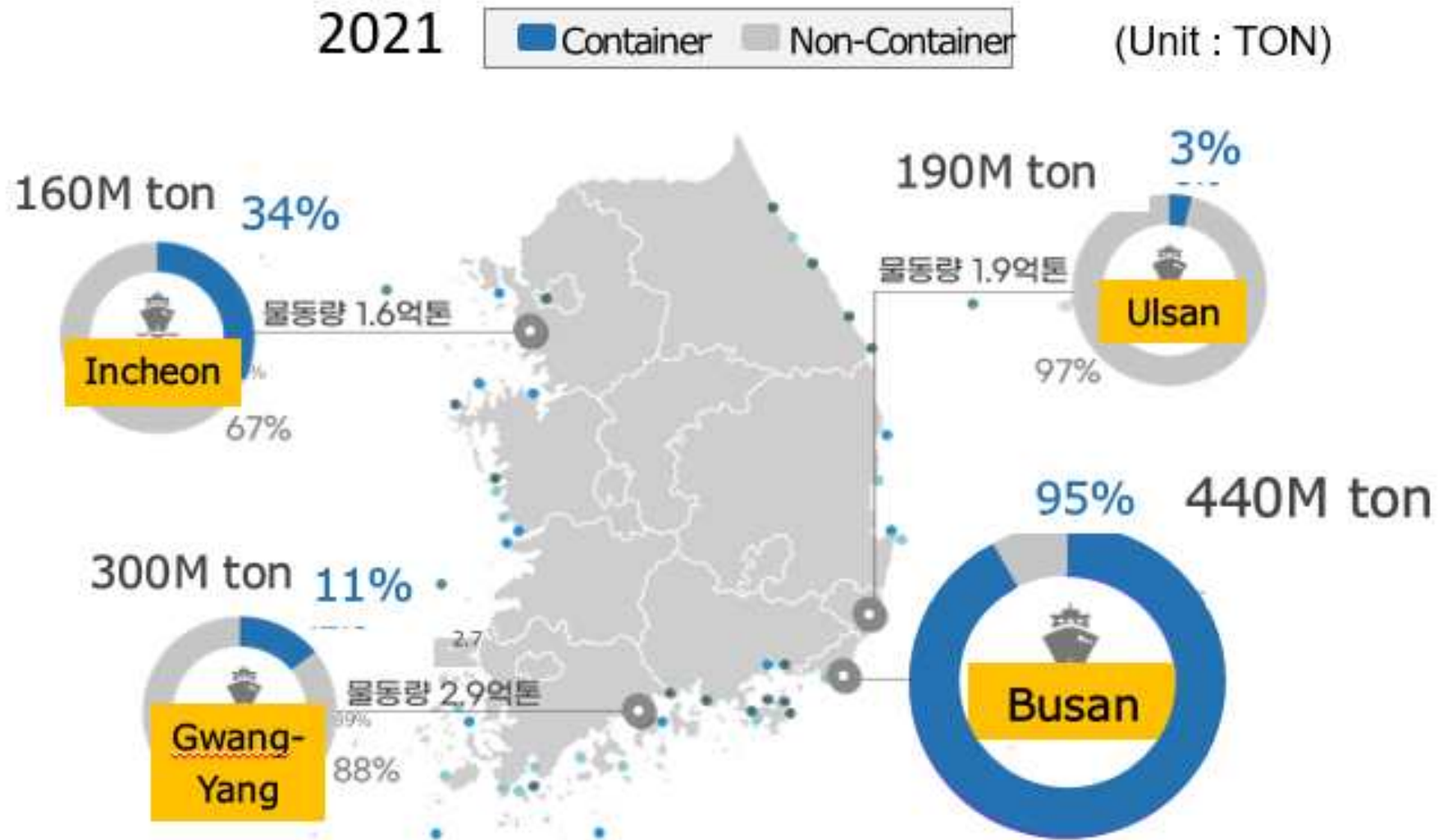
IV. Others

Liner Shipping



TON-based Comparison of Korean Ports

National Port Development Master Plan in every 10 year!!



History of Busan Port

44 times increase in 44 years

2022



22.1M TEU

1978



0.5M TEU

BEGINNING (1876~1940)



- Busan International Port opened in 1876

GROWING (1940~1970)



- General cargo piers developed in 1944

PROSPERING (1970~2005)



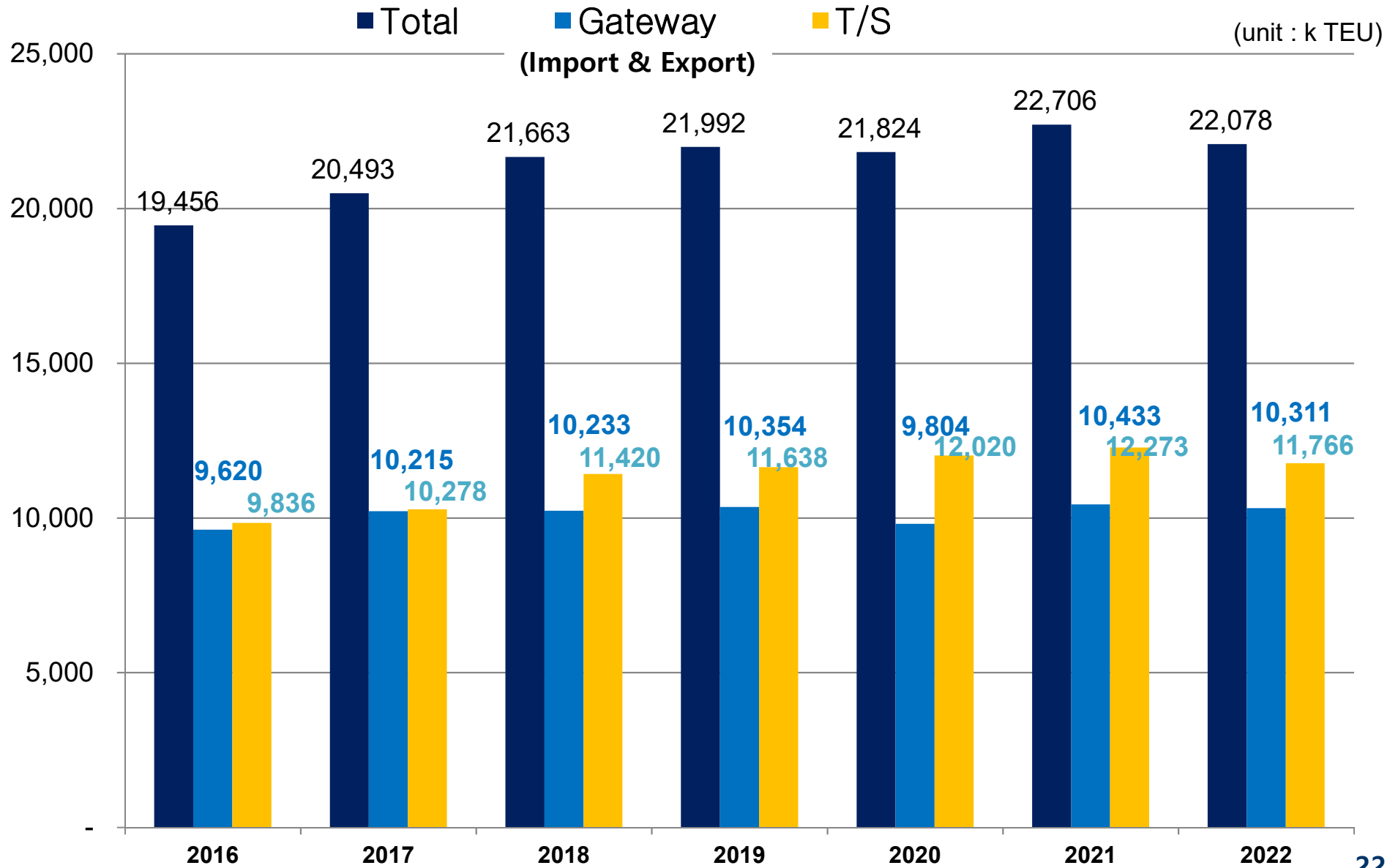
- “Jasungdae”, the first dedicated container terminal opened in 1978

RENAISSANCE (2005~)



- Busan New Port opened in 2006
- Busan Northport Redevelopment Project started in 2008

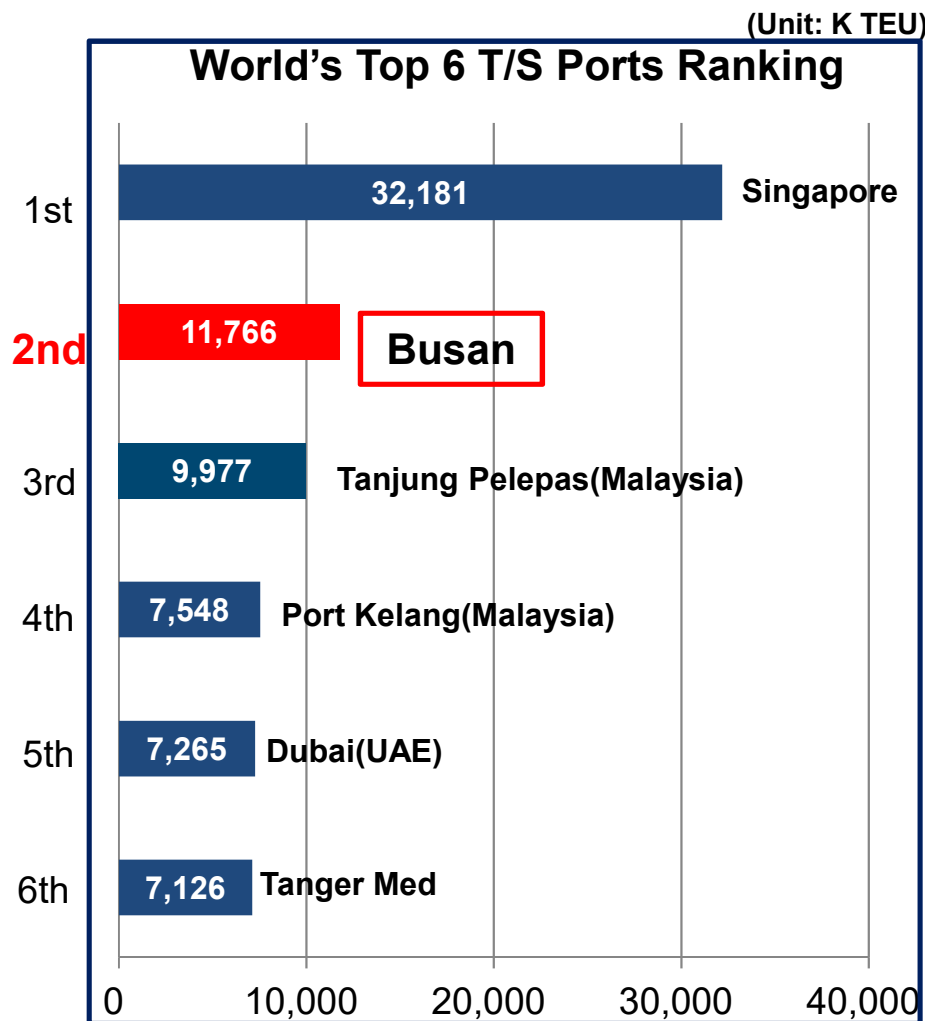
Busan Port Throughput in recent 7 years



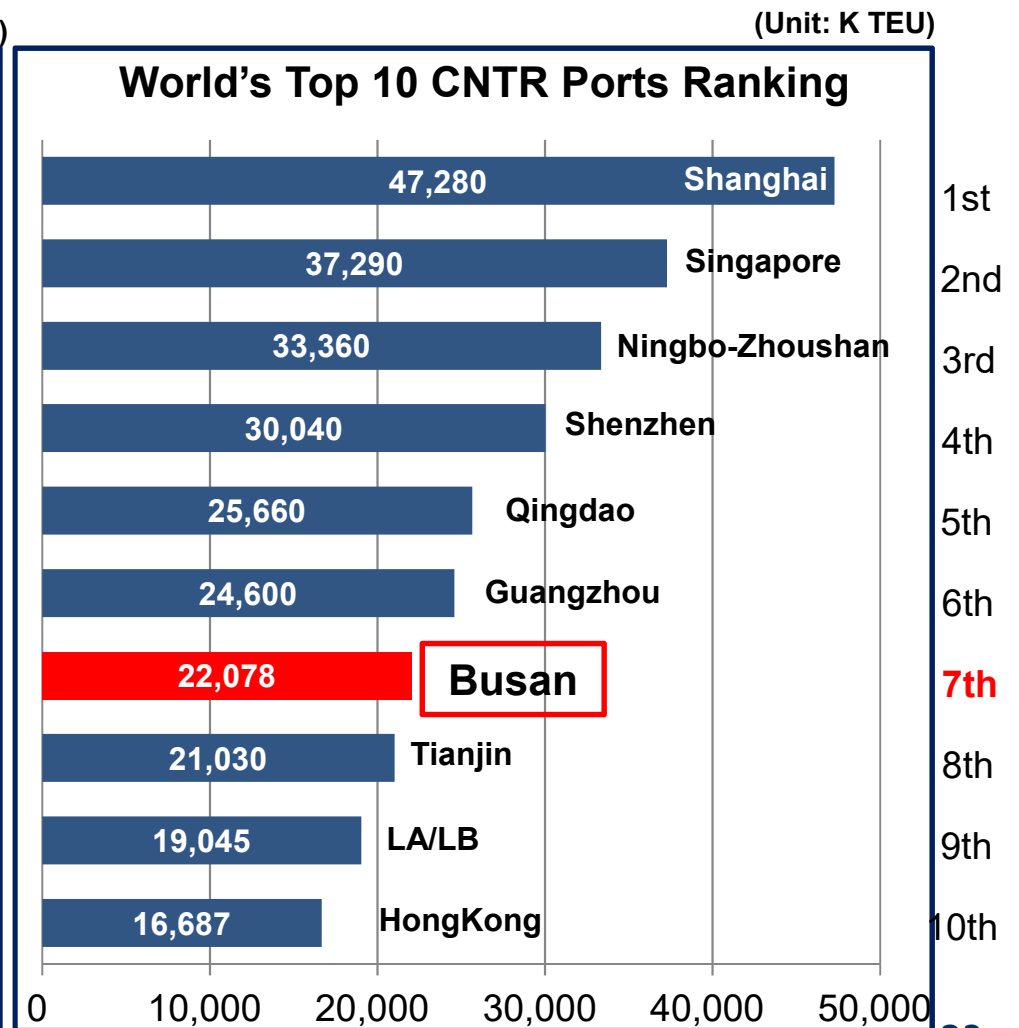
Current Status of Busan Port

▶ The 2nd busiest T/S Port and 7th busiest Port in the world

* 2022 container throughput



출처: drewry maritime research



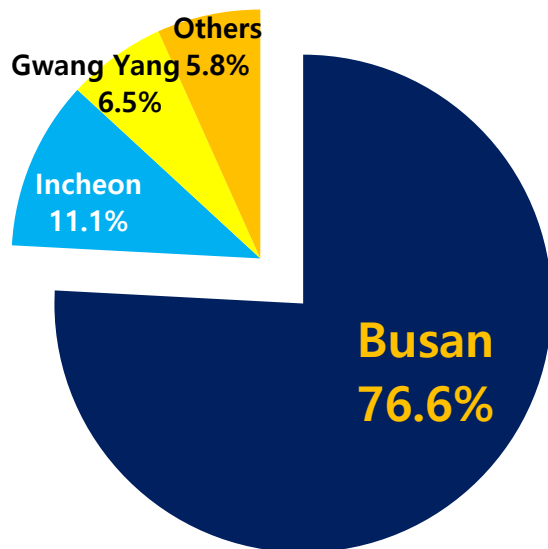
출처: alphaliner(23.4.)

Busan Port Domestic CNTR Market Share

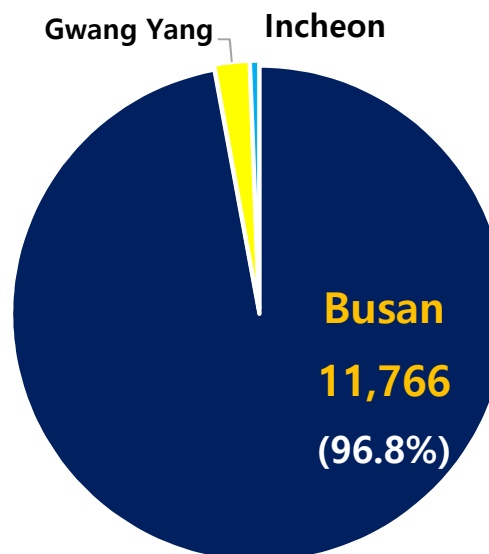
- Domestic CNTR Throughput : 29Million TEU(2022)
- Busan Share : 75.2%(2020) → 75.6%(2021) → **76.6%**(2022)

2022 S.Korea CNTR T/Put by Port

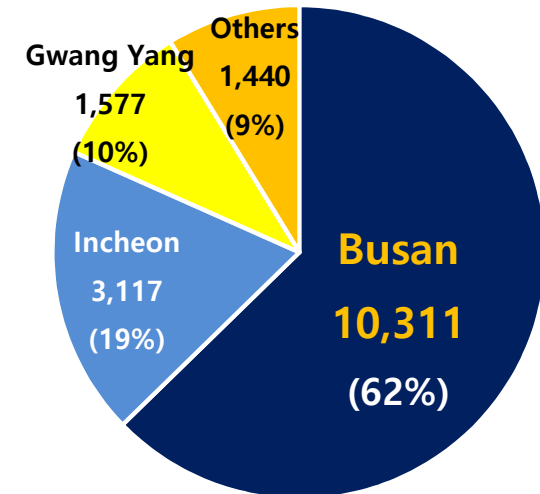
<Total T/Put>



<Transshipment>



<Gateway (Local)>



Busan Port Throughput by Nation (2021)

Top 3 nations(CHA, USA, JPN) account for **55% of total volume**

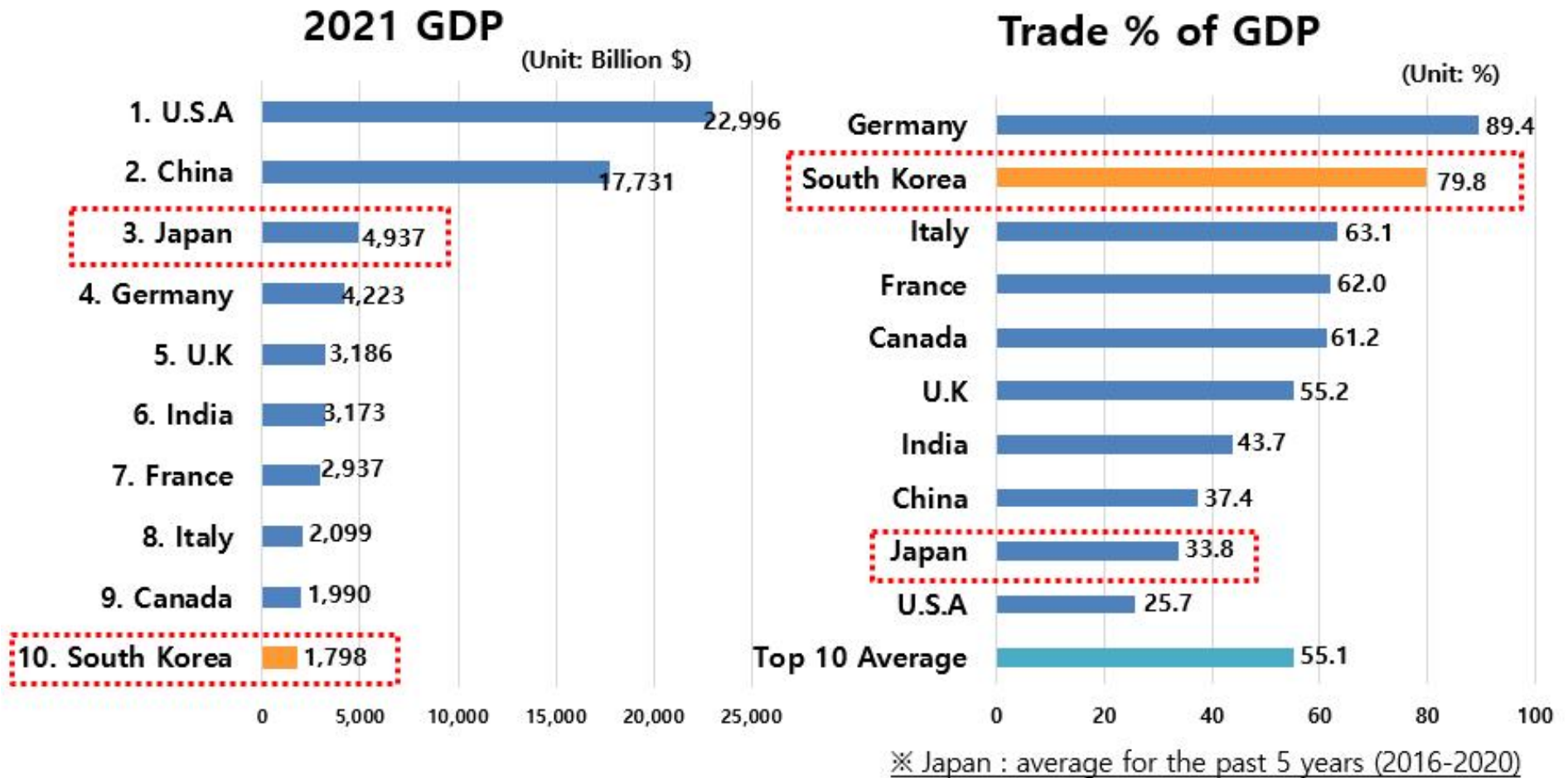
✓ 60% of T/S Volume

(Unit : K TEU)

RANK	PORTS	Throughput(TEU)			YoY Growth Rate(%)		
		TOTAL	G/W	T/S	TOTAL	G/W	T/S
TOTAL		22,706	10,433	12,273	4.0	6.4	2.1
1	China	6,297	2,406	3,891	3.0	5.3	1.6
2	USA	3,296	1,646	1,650	2.0	10.6	△5.3
3	Japan	2,915	1,198	1,717	△2.4	△5.9	0.2
4	Canada	732	231	502	8.2	9.0	7.9
5	Russia	835	304	530	33.6	39.1	30.6
6	Vietnam	628	409	219	5.7	6.7	3.7
7	Mexico	625	276	349	15.4	20.0	12.1
8	Thailand	369	182	188	0.7	0.6	0.8
9	Taiwan	372	223	150	3.4	13.9	△9.1
10	Chile	406	87	319	16.1	△8.4	25.3

※ source : port-MIS

GDP & Trade Comparison : Japan vs S.Korea

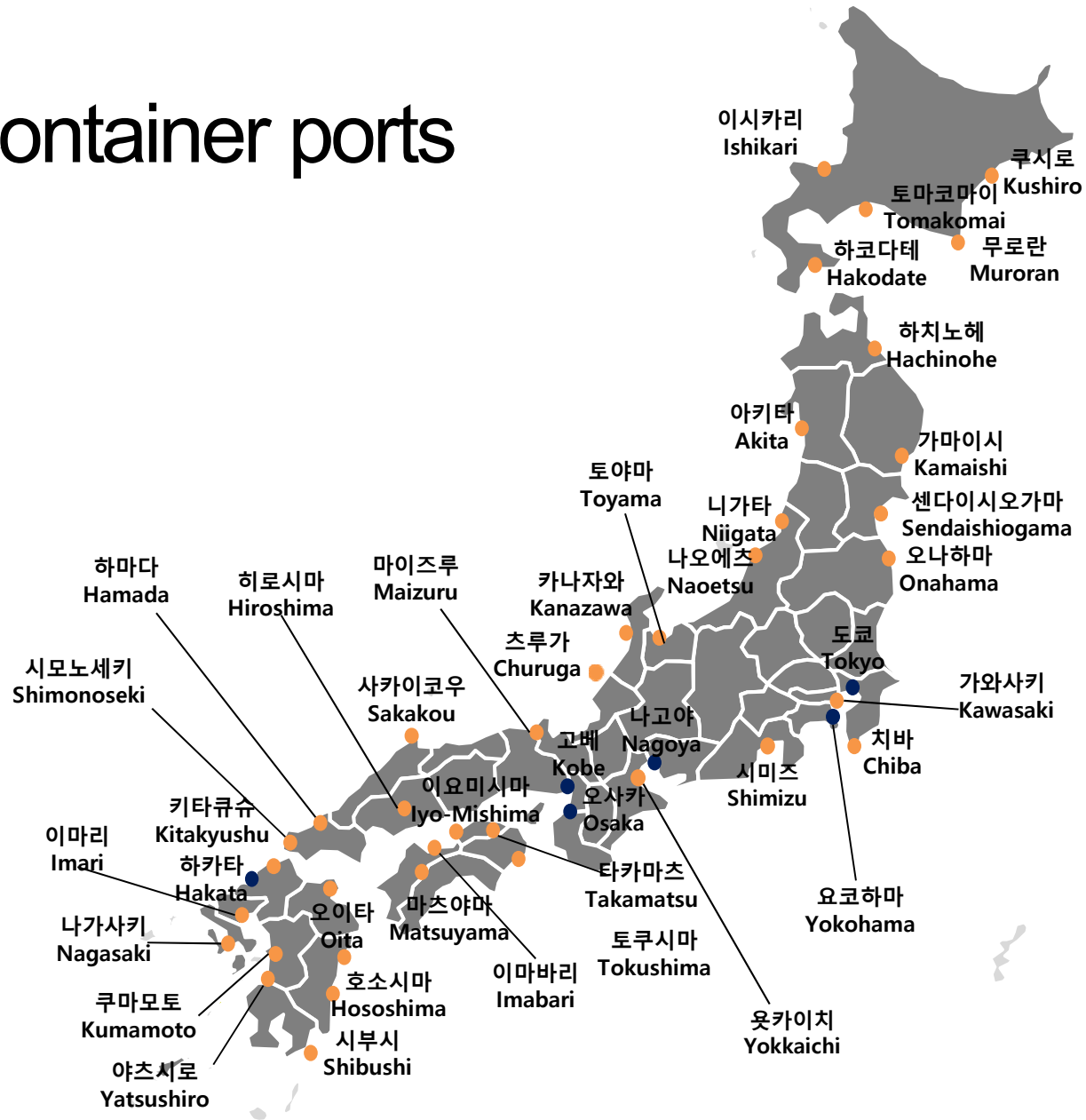


* source : World Bank Data, Statista

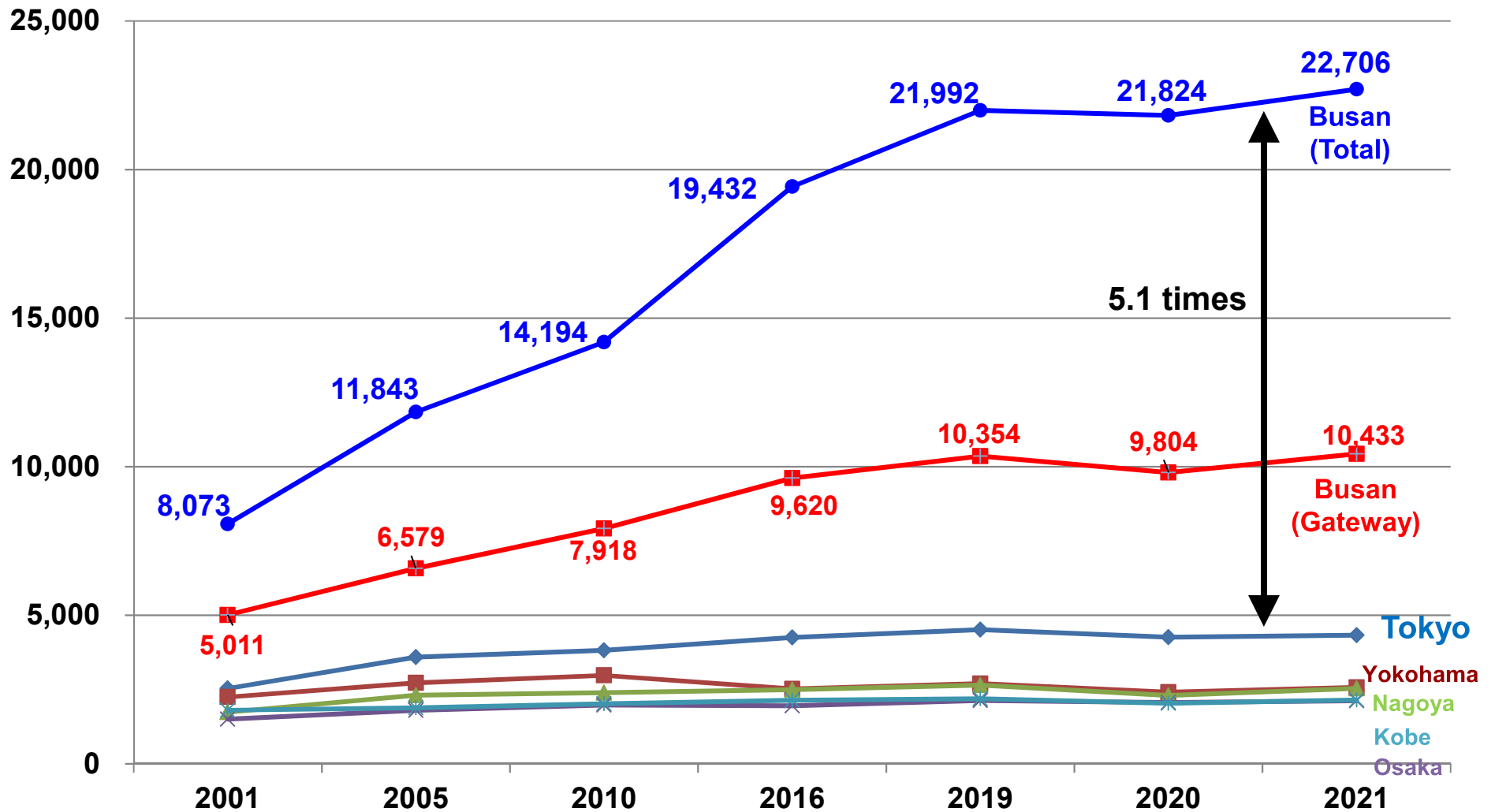
Busan Port's Centrality



65 container ports

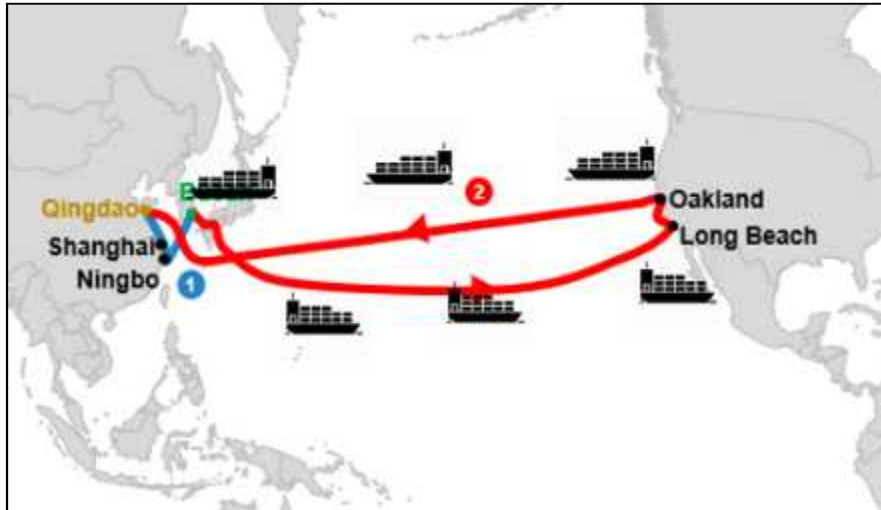


Container throughput trend comparison of 5 major Japanese ports vs Busan



Carrier Perspective – How to best utilize high-value asset

* Vessel operating cost varies from carrier to carrier depending on vessel ownership, fuel type, etc.



< Annual Cost for one TP Service >

* 8,000 TEU-mark ship

=> Per Ship \$22M~\$60M (약270억원~720억원)

=> 6 ships : \$130M~\$360M (약1,600억원~4,300억원)

* Chartering => \$25,000~\$100,000 (daily)

* Fuel Cost/ton \$550 ~ \$1,000 (*daily consumption 80ton)

< Annual Cost for one N.Europe Service >

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=> Per Ship \$32M~\$102M (약380억원~1,500억원)

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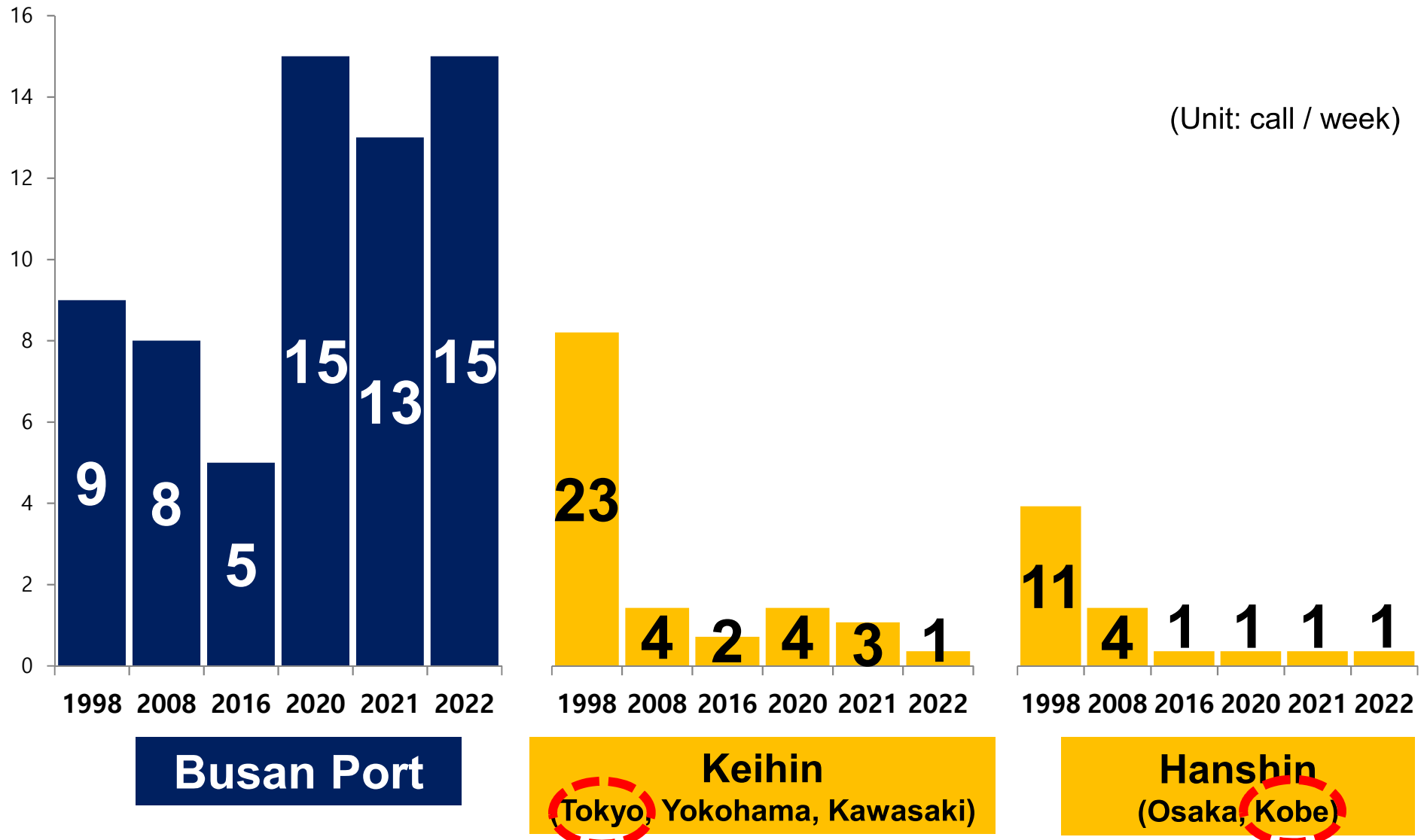
* Chartering => \$60,000~\$260,000 (daily)

* Fuel Cost/ton => \$550 ~ \$1,000 (*daily consumption 100ton)

(Key assumption : vessels are all time-chartered and vessel speed is 17 knots.)

(USD1=KRW 1,200)

Europe Service network comparison : Japanese ports vs Busan



(Source : Alphaliner axs marine system, '22.12.)

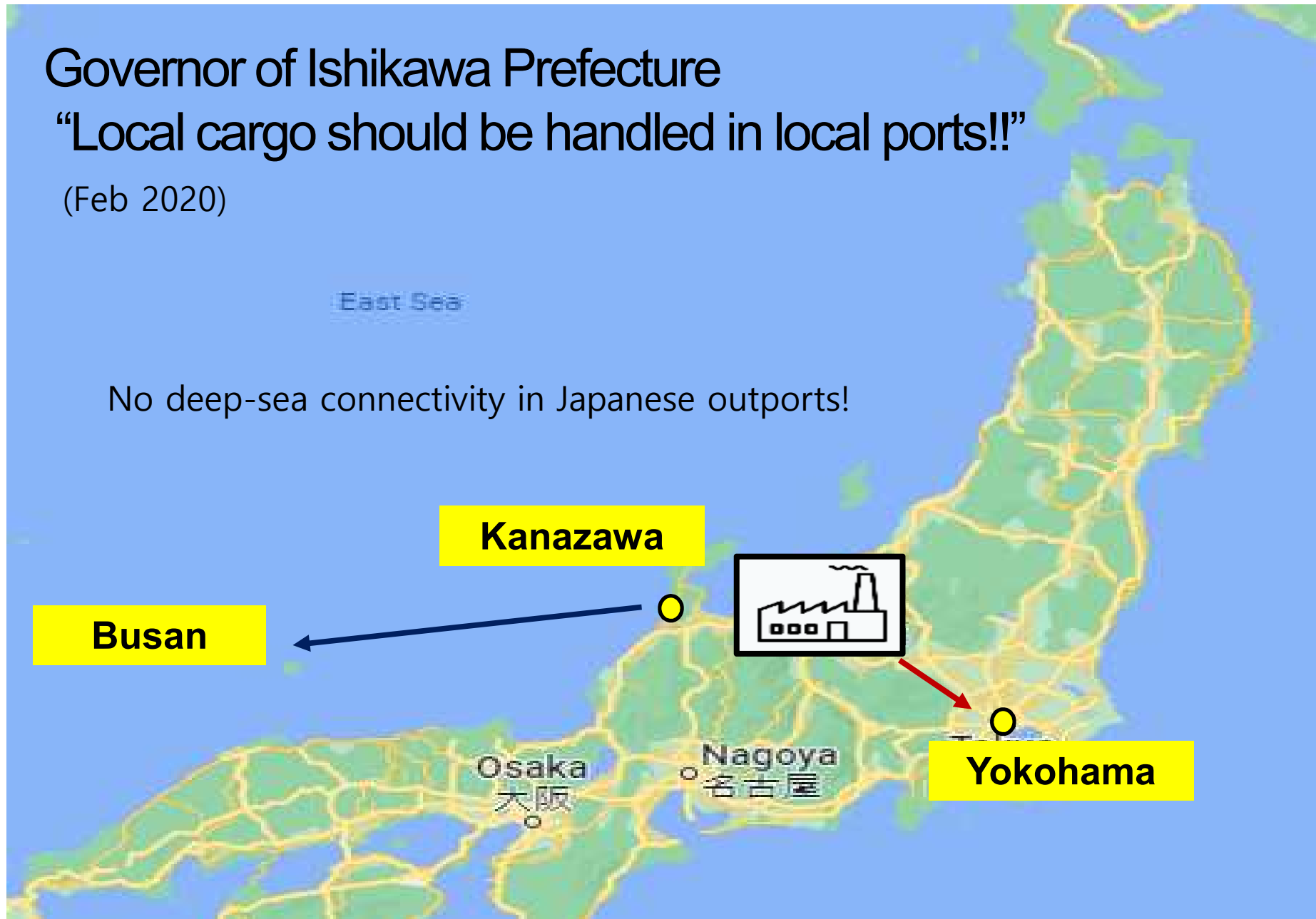
Governor of Ishikawa Prefecture

“Local cargo should be handled in local ports!!”

(Feb 2020)

East Sea

No deep-sea connectivity in Japanese outports!



Japanese Municipal Cities & Busan Port => Win-Win Relation

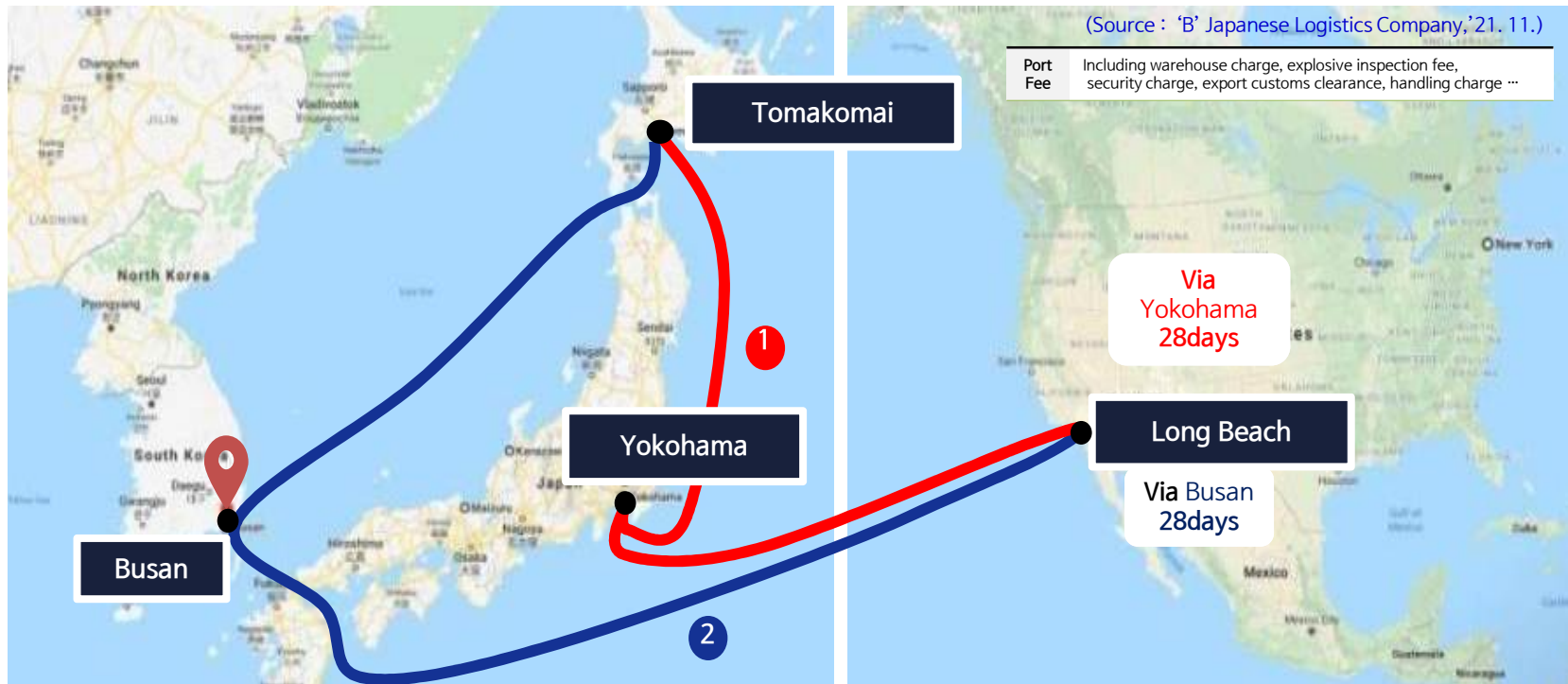
<Kanazawa / Nov 28, 2022>



<Toyama / Feb 14, 2023>



Total Cost & Lead time (from Tomakomai to Long Beach)



Route1

Tomakomai → Yokohama → LB (Dry, 40ft)
 - Total cost : \$10,642 (1\$ = 140¥)



<Savings>
 \$ 1,359 (12.8%)

Route2

Tomakomai → Busan → LB (Dry, 40ft)
 - Total cost : \$9,284

* Source : Several carriers and logistics companies. Prices can vary depending on contract terms and period. (2021)

Total Cost & Lead time (from Kanazawa to Shanghai)



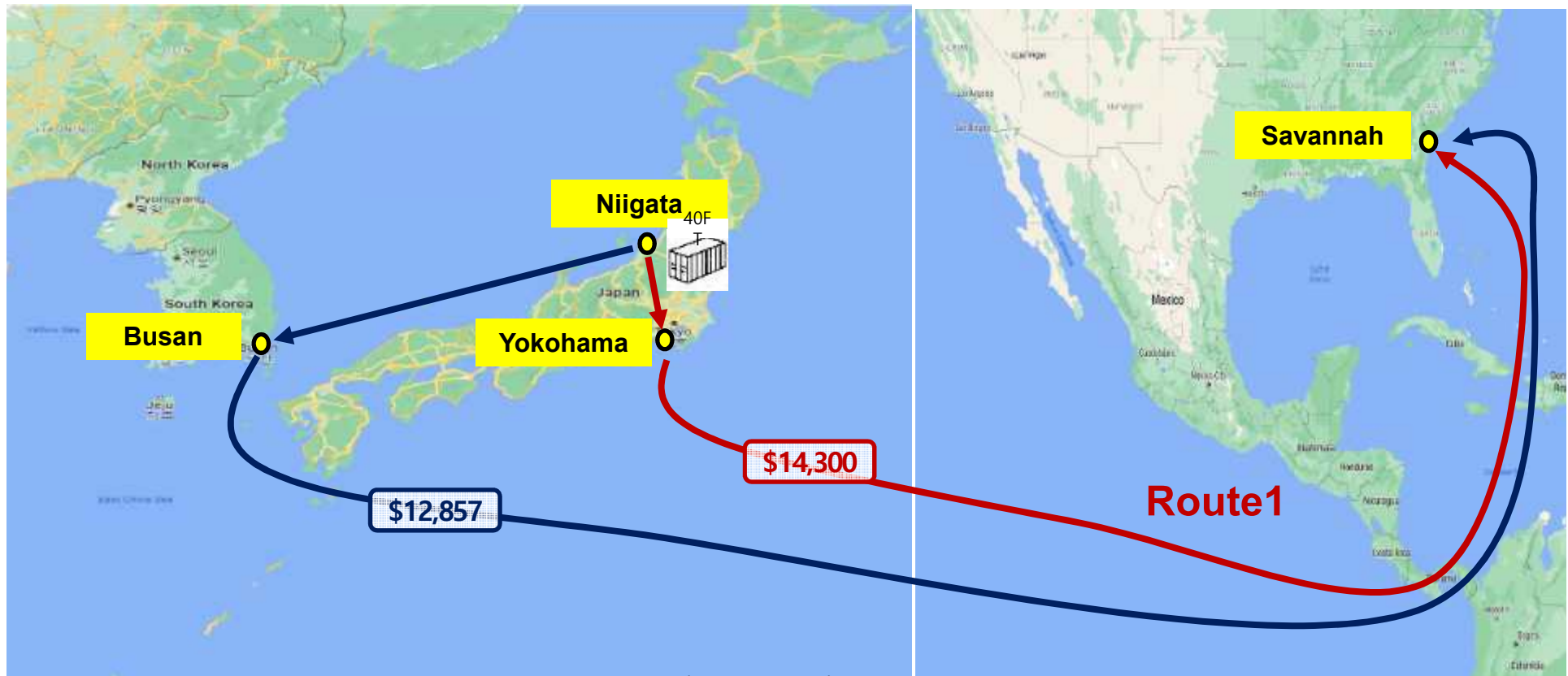
Route1
 Kanazawa → Kobe → Shanghai (Dry, 40ft)
 - Total cost : \$1,614 (1\$ = 140¥)

<Savings>
\$ 500 (31.0%)

Route2
 Kanazawa → Busan → Shanghai (Dry, 40ft)
 - Total cost : \$1,114 (1\$ = 140¥)

* Source : Several carriers and logistics companies. Prices can vary depending on contract terms and period. ('22.12.)

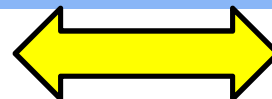
Total Cost & Lead time (from Niigata to Savannah)



Route1

Niigata → Yokohama → Savannah (Dry, 40ft)

- Total cost : \$14,300 (1\$ = 140¥)



<Savings>
\$ 1,443 (10.1%)

Route2

Niigata → Busan → Savannah (Dry, 40ft)

- Total cost : \$12,857 (1\$ = 140¥)

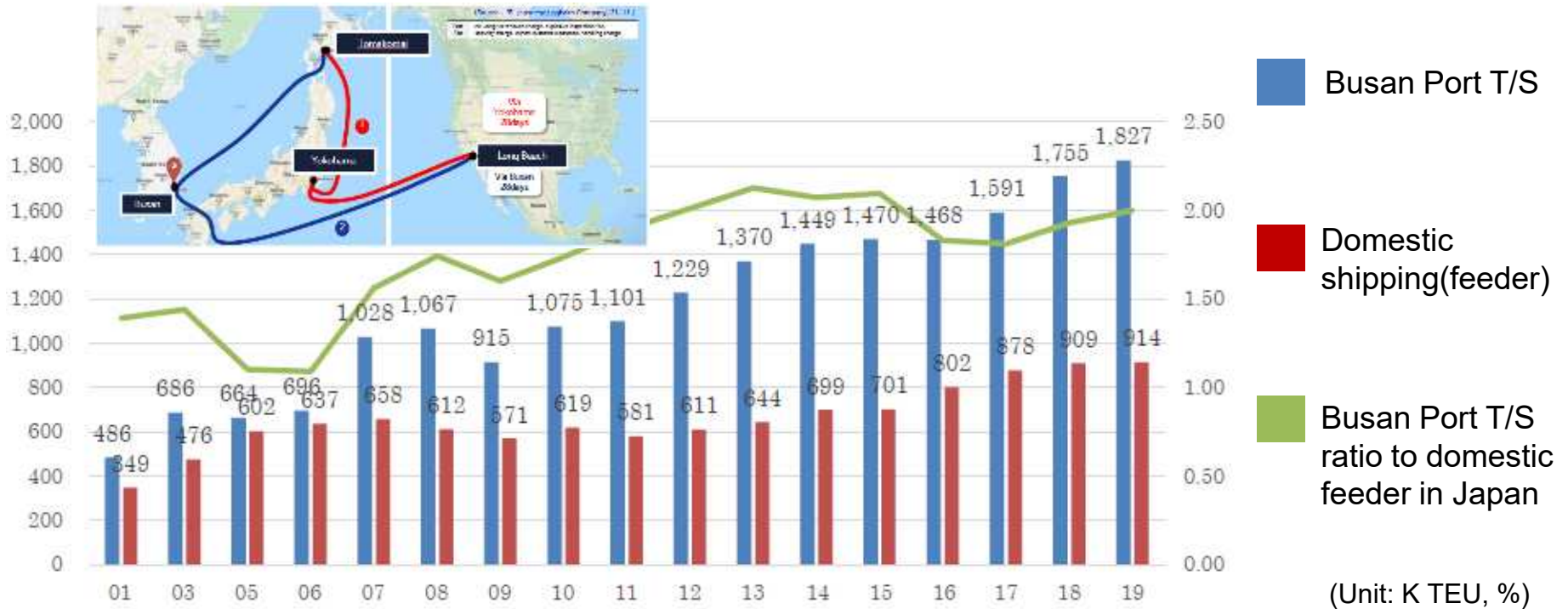
* Source : Several carriers and logistics companies. Prices can vary depending on contract terms and period. ('22.12.)

Weekly CNTR service of Major Asian Container Ports

No.	Ports	Total	China	Japan	S.E. Asia	USWC	USEC	N. Europe	Med	Middle East	Indian sucont.	E. & S. Africa	W. Africa	Oceania	WCSA	ECSA	Russia
1	Singapore	331	48	13	124	6	11	15	11	14	47	10	9	17	1	5	0
2	Shanghai	286	NA	40	77	31	19	14	13	11	21	7	8	17	13	5	10
3	Shenzhen	283	NA	22	101	30	21	17	14	12	22	4	3	16	11	5	5
4	Busan	276	48	66	54	23	14	4	11	4	9	0	2	9	9	3	20
5	Port Kelang	225	59	11	64	4	1	2	4	15	50	4	2	9	0	0	0
6	Ningbo	204	NA	13	44	27	17	18	11	14	19	6	2	9	13	6	5
7	Hong Kong	187	NA	24	102	9	6	3	2	2	11	2	0	11	10	5	0
8	Kaohsiung	175	58	20	53	11	7	2	3	2	7	1	0	8	3	0	0
9	Dubai	164	16	0	18	1	4	3	11	59	39	10	3	0	0	0	0
10	Qingdao	163	NA	17	46	17	9	5	7	9	10	4	4	10	9	2	14
11	Guangzhou	100	NA	7	50	4	2	3	2	4	7	4	8	7	0	0	2
12	Yokohama	87	31	NA	34	7	0	0	0	0	0	0	0	8	6	0	1
13	Tanjung Pelepas	85	18	3	30	1	4	7	0	1	4	6	4	7	0	0	0
14	Kwangyang	77	31	4	25	4	0	1	0	0	4	0	2	1	0	0	5
15	Tokyo	77	32	NA	35	8	0	1	0	0	0	0	0	1	0	0	0
16	Kobe	68	23	NA	34	4	0	1	0	0	0	0	0	5	0	0	1
17	Osaka	64	32	NA	26	4	0	0	0	0	0	0	0	2	0	0	0
18	Incheon	61	22	2	36	1	0	0	0	0	0	0	0	0	0	0	0
19	Tianjin	53	NA	14	20	1	0	4	1	2	3	0	2	1	0	0	5
20	Dalian	39	NA	17	18	0	0	2	1	0	0	0	0	1	0	0	0

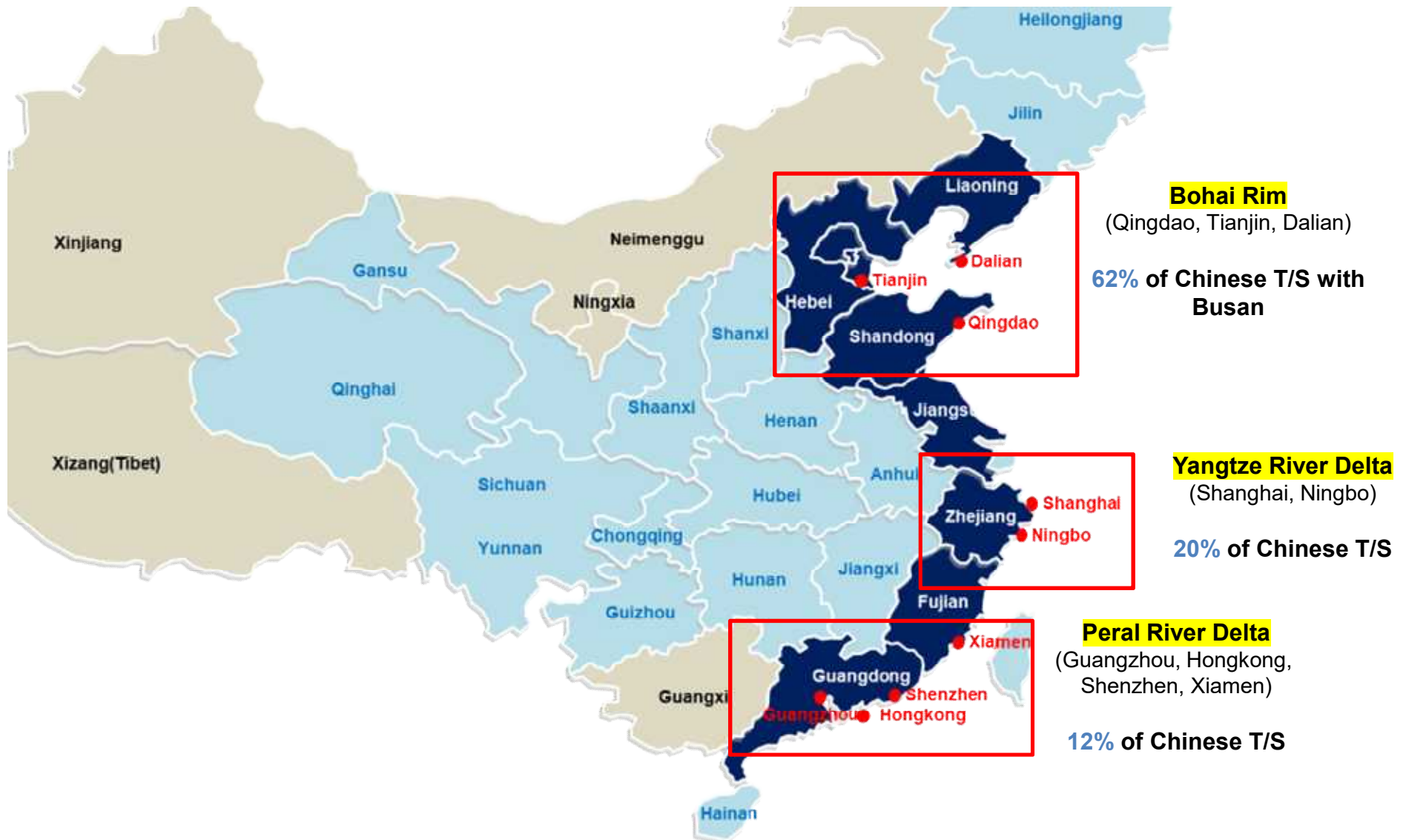
* Source : Linerlytica ('22.12.)

Japanese Domestic Feeder vs Busan Port T/S

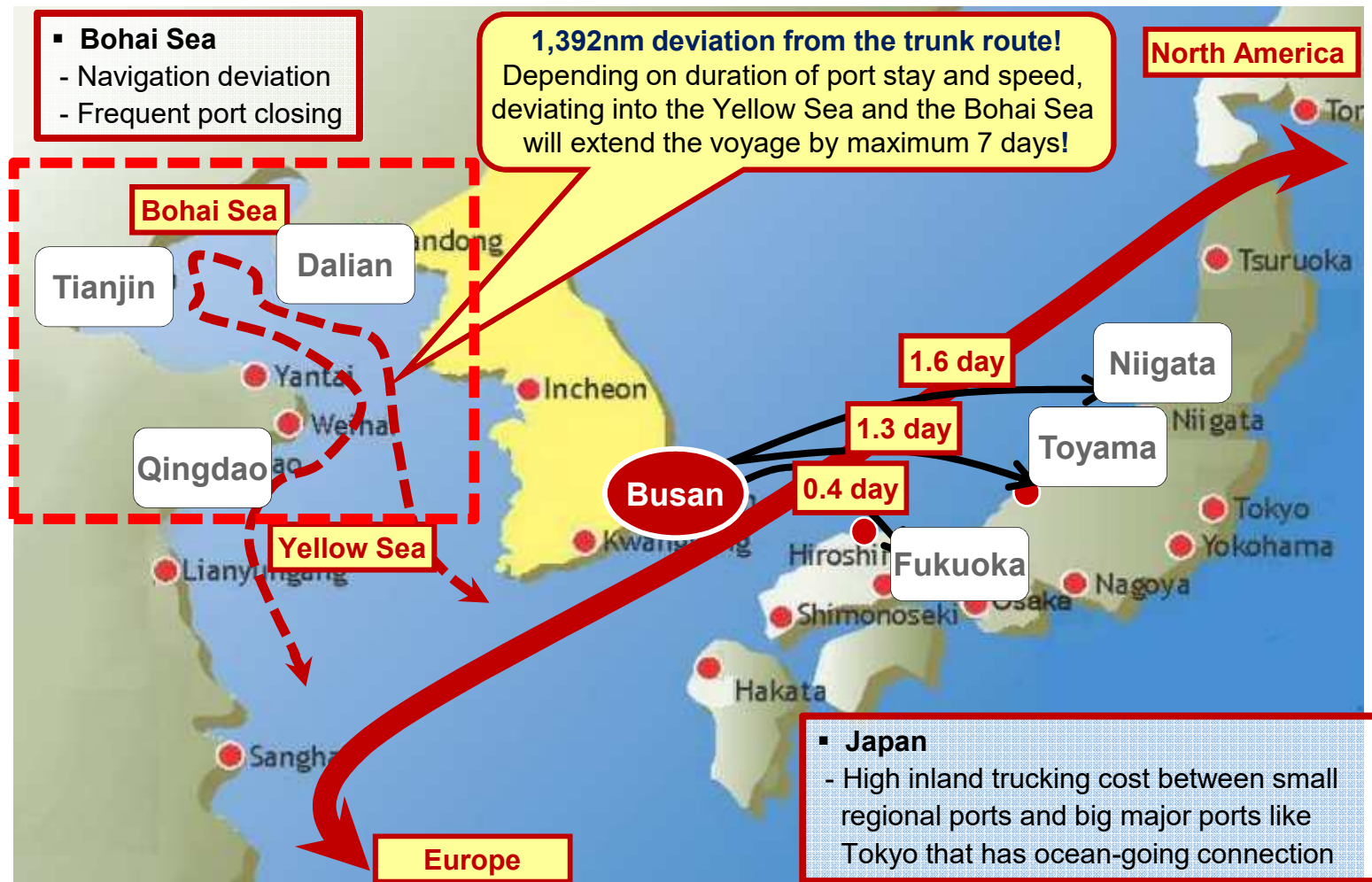


	2001	2005	2010	2016	2021
Total local cargo in Japan(A)	12,411	15,732	16,858	17,559	17,916
T/S cargo @ Busan Port(B) (A/B ratio)	468 (3.8%)	853 (5.4%)	1,081 (6.4%)	1,470 (8.4%)	1,717 (9.6%)

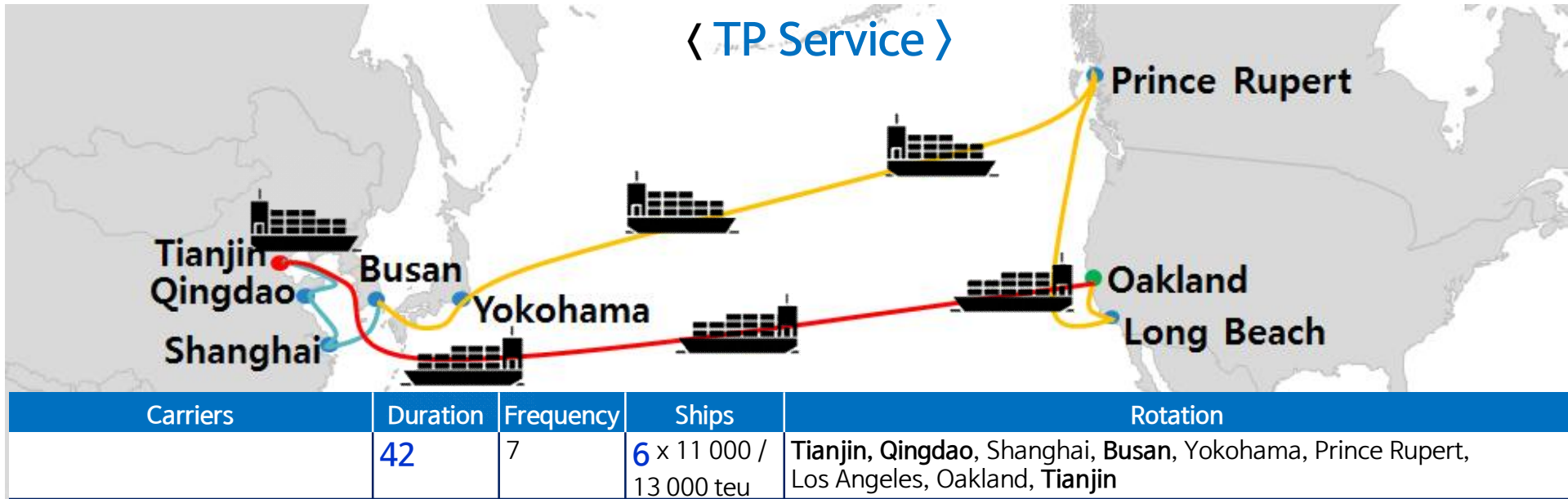
94% of Chinese T/S with Busan comes to/ from nine major ports (Chinese T/S 3.8M TEU, 32% of total Busan Port T/S)



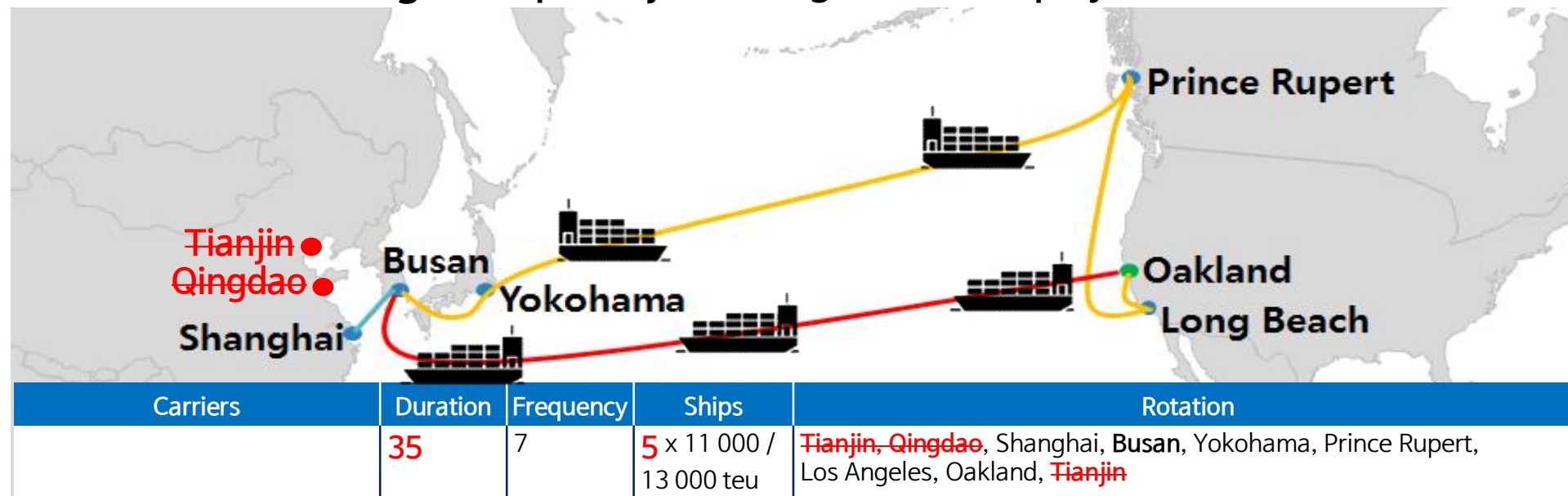
Bohai Causes Big Deviation



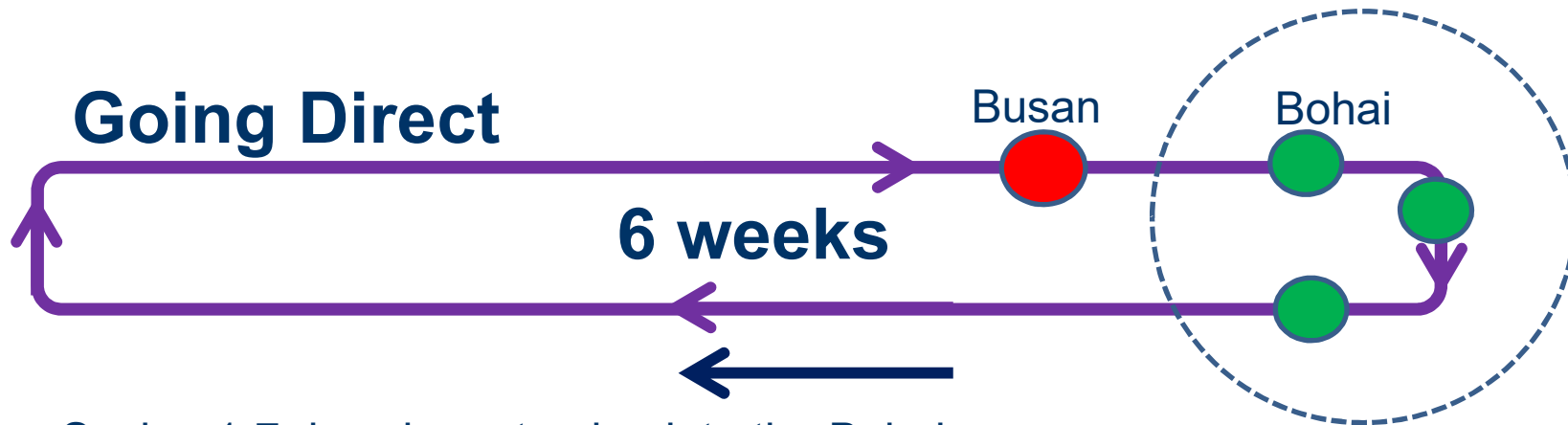
< TP Service >



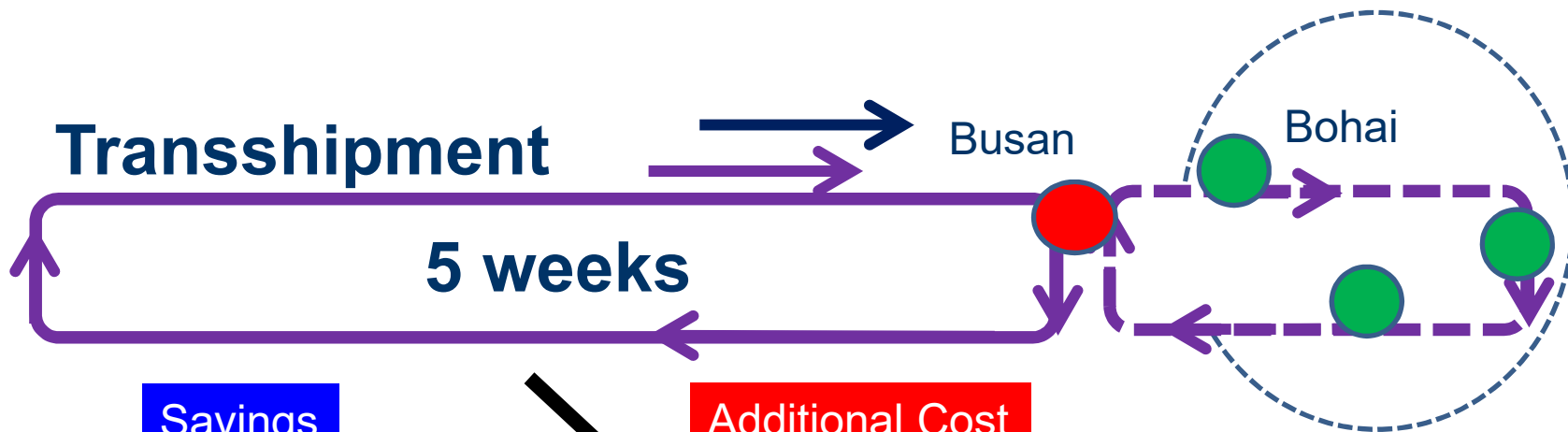
Change : Skip Tianjin & Qingdao and deploy feeder vessel



(Hidden Cost Savings) Bohai Direct Calling vs Busan Port T/S



Saving 1-7 days by not going into the Bohai – instead using a dedicated feeder



Savings

Additional Cost

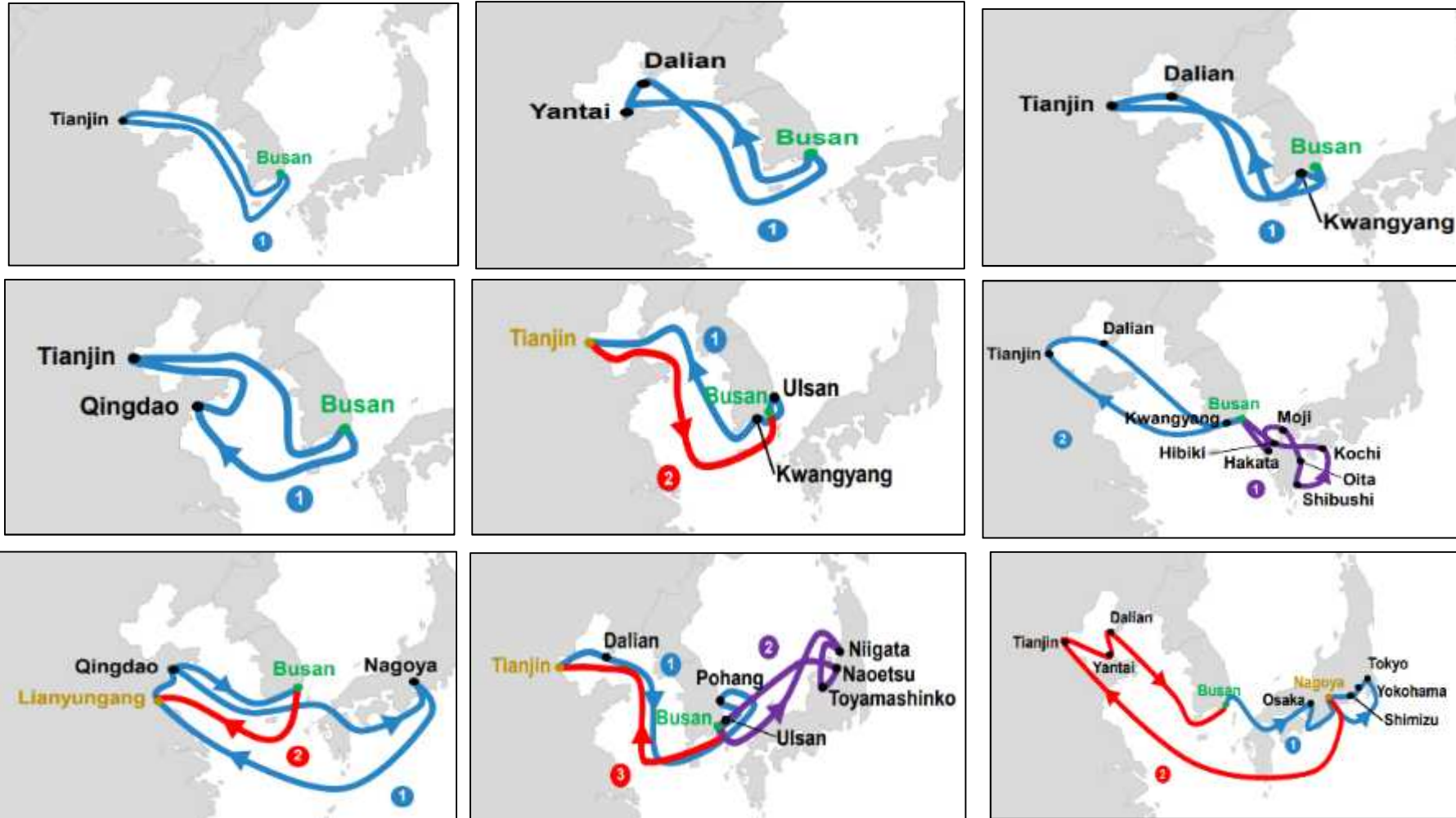
Vessel Operating Cost

THC

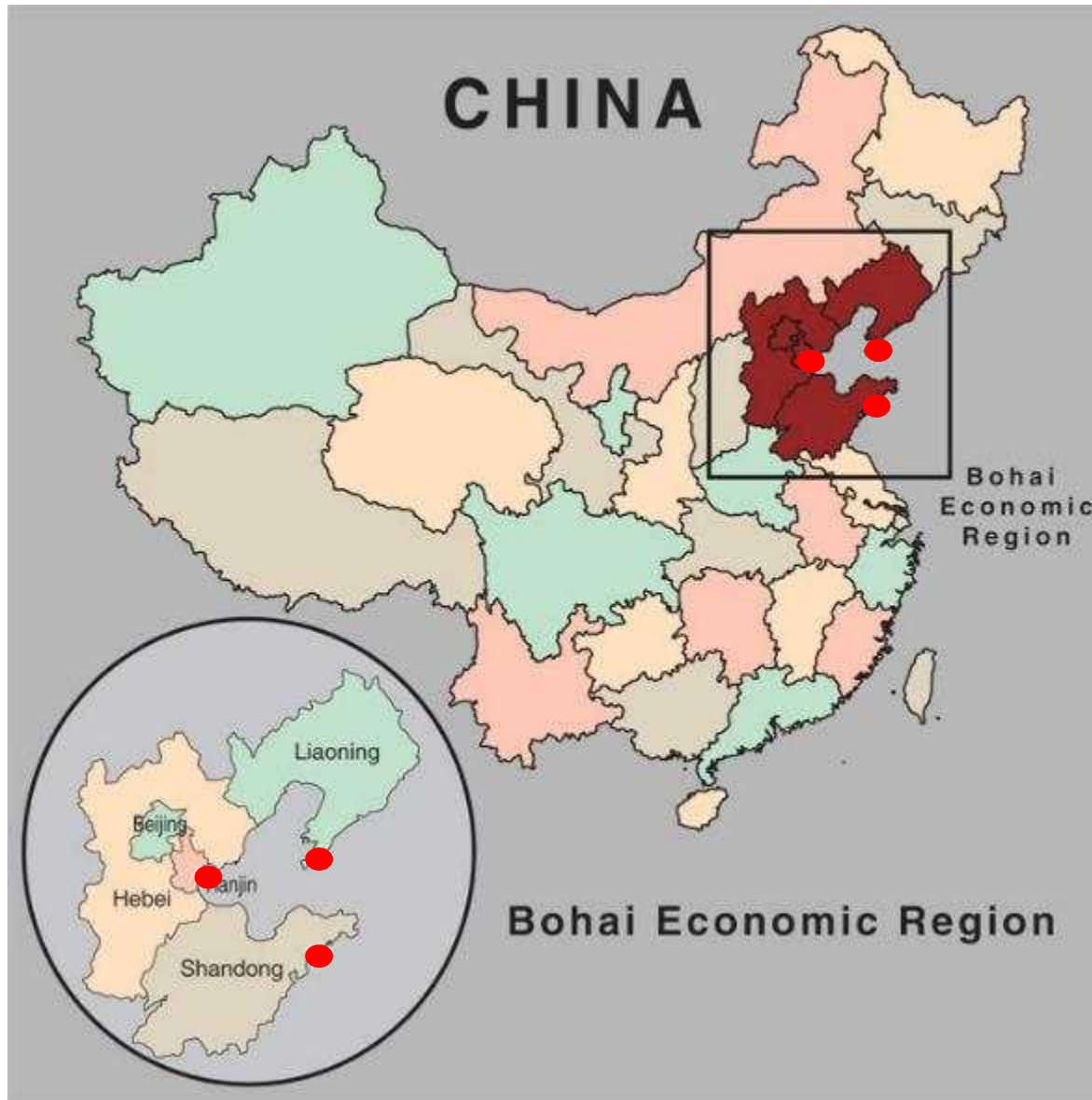
Feederage

(Source : Sea-Intelligence Analysis, '19.)

✓ Bohai ↔ Busan Feeder Service Example (about 40)



Source : Busan Port Authority



Economic
development in
Bohai

Busan T/S volume

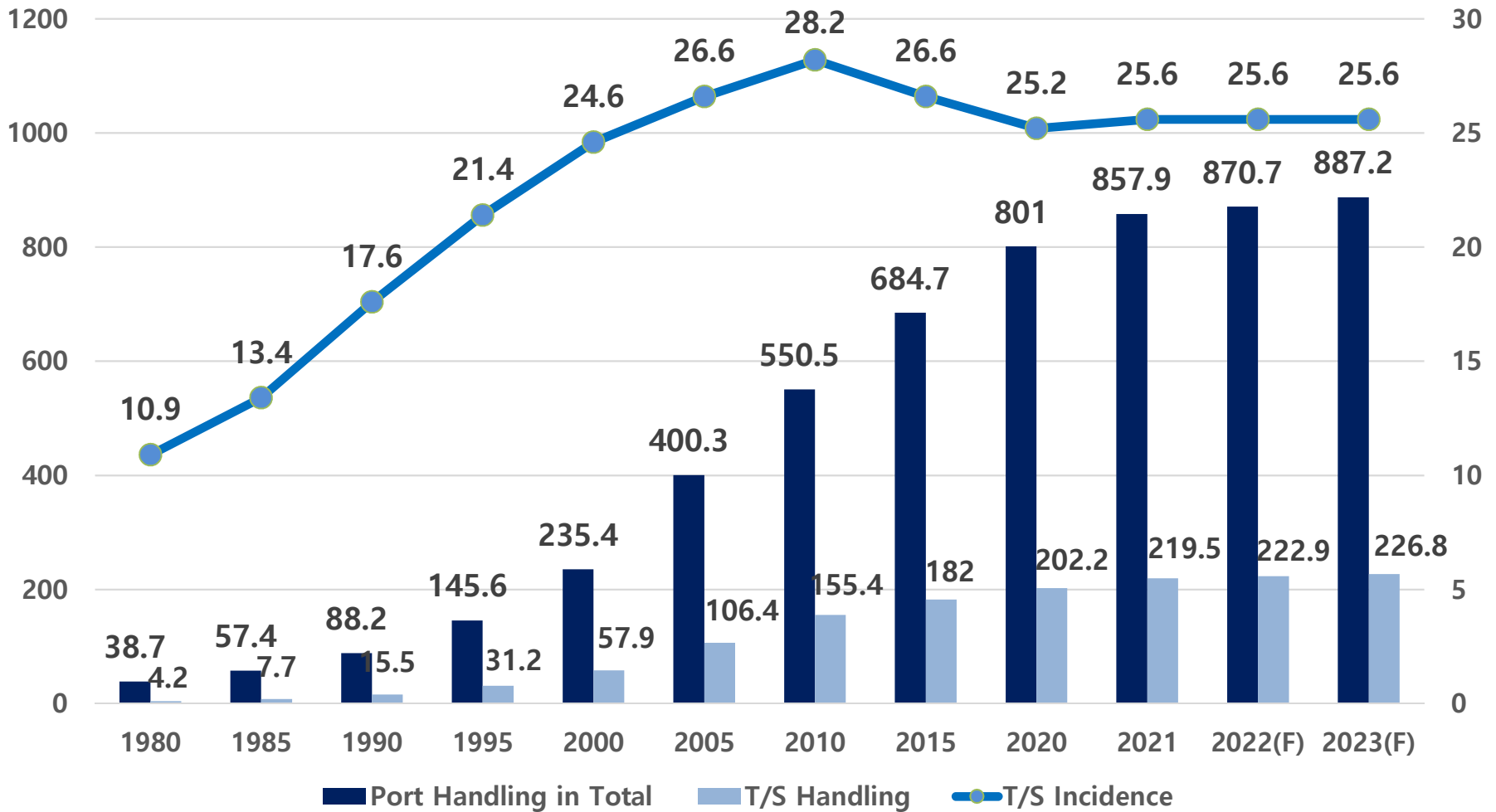
* Source : www.chinaconnect.com

✓ Last Port of Call (to North America) Advantage



Global T/S Incidence

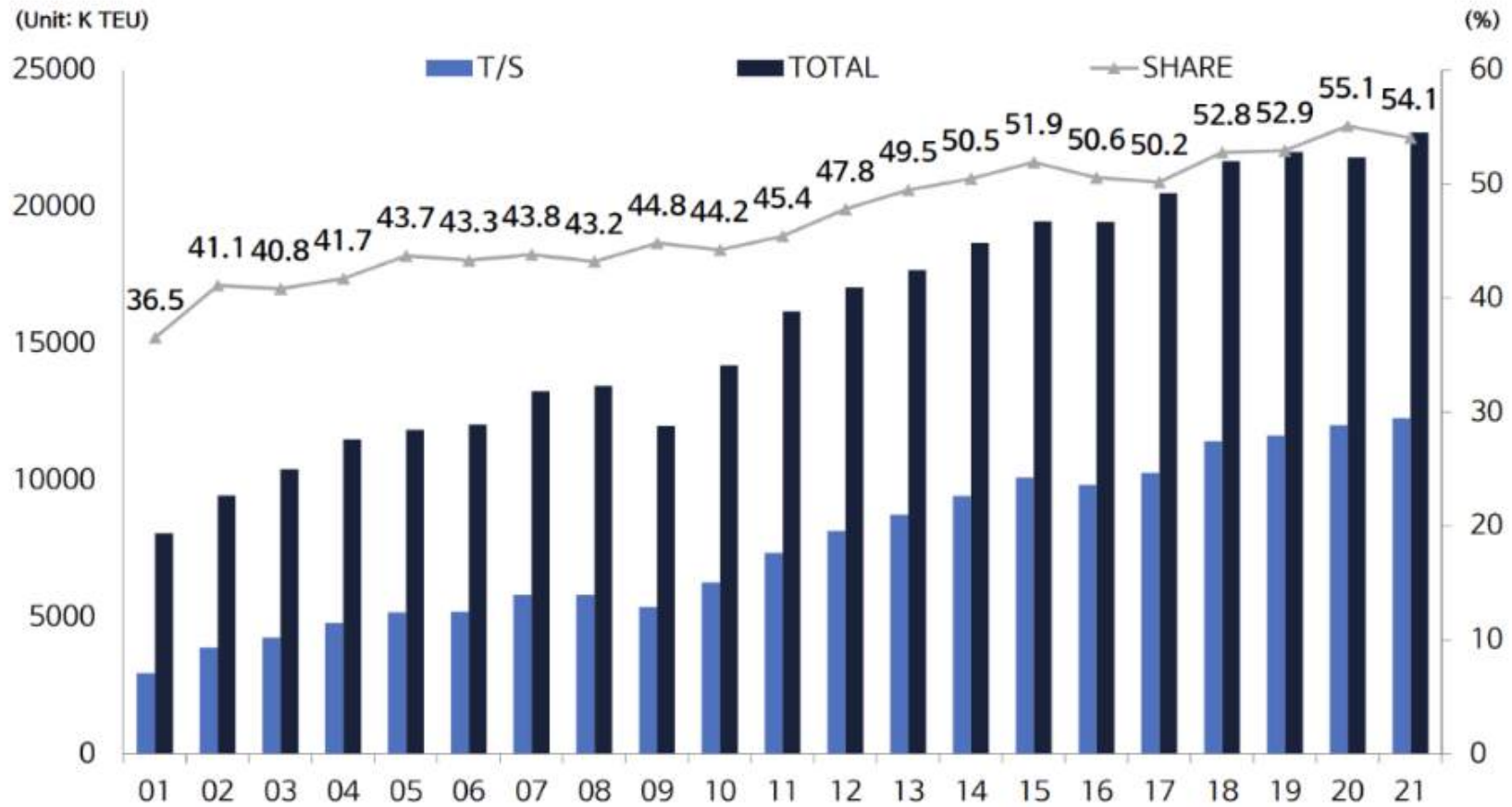
(Unit: M TEU)



출처: Drewry Maritime Research(2022/23), visualized by Busan Port Authority

Busan Port T/S Incidence for the Past 20yrs

Location, Connectivity, Stability => **Transshipment** ↑



Port-related Industry Revenue per 1 TEU of T/S=> \$150 => \$1.8B

Port Industry Revenue per 1 TEU of Transshipment cargo

Item	Detail	Amount (K RW/TEU)
Port Due for cargo	• 무역항등의항만시설사용및사용료에관한규정 (해상수산부제2016-227호)	4,429
Shipping Agency fee	• 선사인터뷰조사결과환적 1TEU당 US 17달러 발생 (2016년 배가 기준 환율 US\$1=1,161.11 적용)	19,739
TML Operator Income	• 부산항터미널운영사 5개사 대상 조사	
Basic	• 부산신항전체 컨테이너 처리량을 각 터미널 별로 분류 • 수출입/환적 화물 분류 • 환적 화물 자부두/타부두 구분, 적컨/공컨 비율 도출 • 20피트/40피트 화물 구성비 도출 • 각 터미널 별 Tariff 적용 • 수입합계를 환적 컨테이너량으로 나누어 환적 1TEU당 선적 및 하역 수입 도출	62,258
	Extra	• 야간할증, 냉동, 경과보관, 위험물할증 등
Truck shuttle for transshipment	• 타부두 환적 시에만 발생 • 신항내 타부두 환적 비율 90% • 북-신항 타부두 환적 비율 10% • 20피트/40피트 화물 구성비 및 공컨/적컨 비율 적용	8,064
Indirect revenue from vessel	• 8440TEU 급 컨선 (표본선박) 1척 입출항 시 발생 경비 추정 • 2016년도 부산항 총 컨물량 대비 환적 화물 비율 (50.55%) 적용	
	• 8440TEU 급 컨선 1척 입출항 시 발생 유류비 추정	31,739
	• 8440TEU 급 컨선 1척 입출항 시 발생 항비 추정	4,665
Revenue per 1TEU of transshipment		150,894

All or Nothing

Revenue Per 1 Transshipment TEU
\$150/TEU

12,273KTEU (T/S Vol in '21)
x \$150
= \$1.8 B

※ Source: "Impact of Port Industry on the National and Local economy, Korea Maritime and Ocean Univ. '18.02.

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New Port Expansion : History of Busan Port

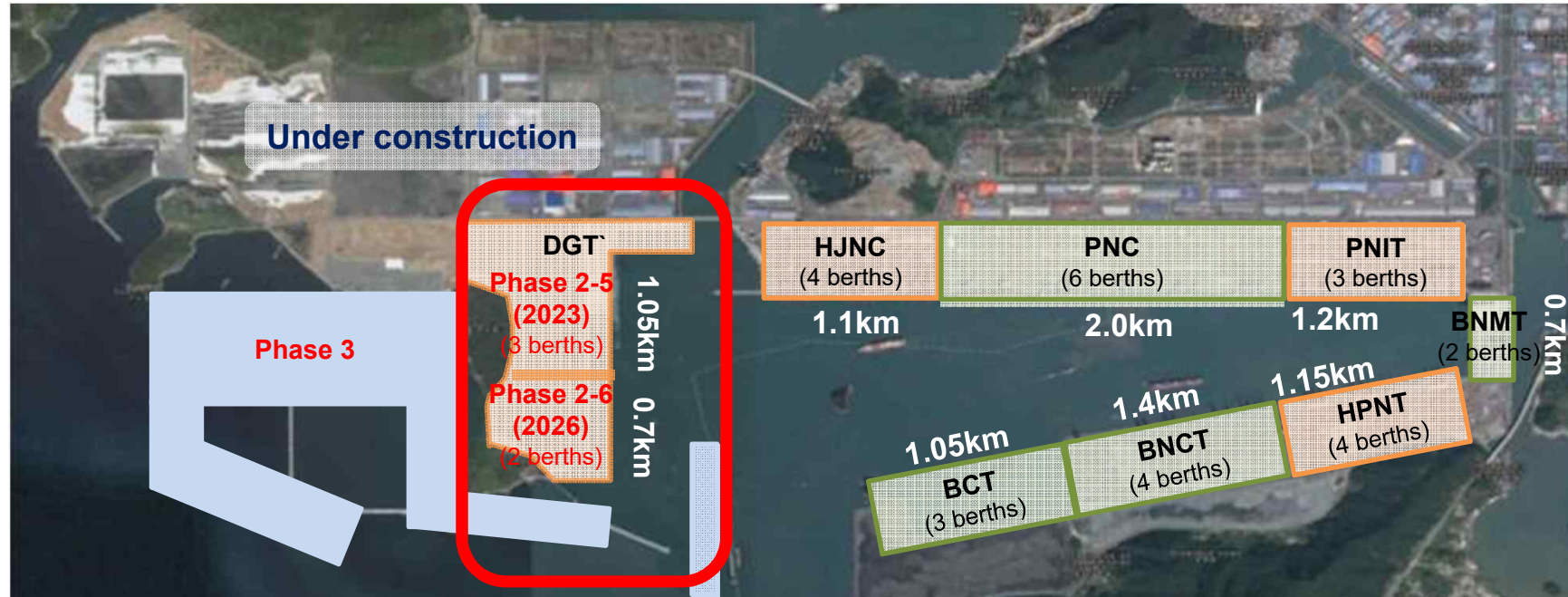


New Port Expansion : future development



- **6 Container Terminal Operators**
- **26 berths** in operation (24 container berths, 1 multi purpose, 1 ro-ro for car)
- **Total 47 projected berths by 2030**
 - **21 additional berths** to be developed over several phases(14container, 3feeder, 4multi-purpose berths)

New Port Expansion : future development



Present		Future			
	Berth (Container)	26 (24)		Berth (Container)	42 (31)
	Quay Length (Container)	8.6 k m (7.9km)		Quay Length	14.71km
	Depth	15~18m		Period	2030 ~

Fully Automated Port Project

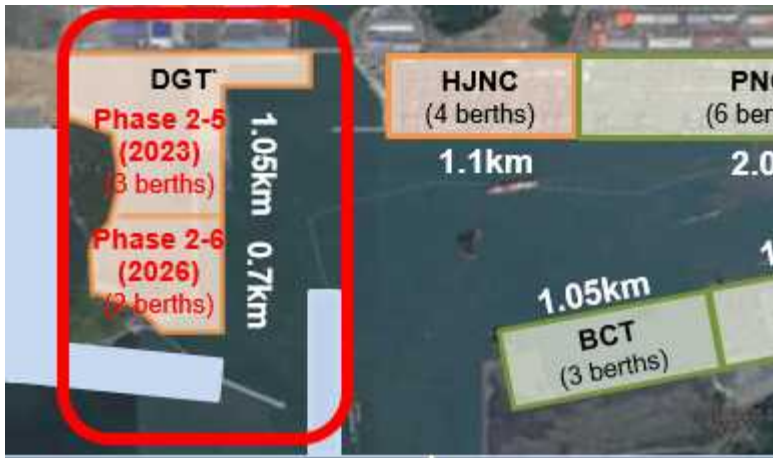




Fully Automated Port Project : Present vs Future







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Busan Port's Green Policy Goals & Projects

59

Vision

Sustainable shared growth, development for Busan Port & the community

Goal

(Carbon) Net-Zero by 2050

254.3ktCO₂eq
(18) base



152.6ktCO₂eq
(30) 40% ↓



Net-Zero
(50) 100% ↓

(PM2.5) Over 72% reduction of PM2.5 in Busan Port by 2025

1,492ton
(18) base



477ton
(23) 68% ↓



418ton
(25) 72% ↓



1

Vessel-side

- ✓ AMP
- ✓ Electric port guide ship
- ✓ Vessel speed reduction incentive

2

Cargo handling equipment

- ✓ Diesel YT to LNG YT
- ✓ DPF for diesel YT&TC
- ✓ LNG-Hybrid SC development
- ✓ Diesel TC to e-RTGC
- DPF for diesel TC

3

Green energy

- ✓ Solar power from Distripark
- ✓ Future Power Plant build for Hydrogen Fuel Cell

4

Other tasks to improve the port area environment

- ✓ Pollution monitoring station
- ✓ Convert to LED lights
- In container terminal

AMP Facilities in Busan Port

- (Low pressure AMP) 78 AMP stations for small ships are currently operating in North Port
 - (High pressure AMP) 8 AMP stations(SPOs) for New Port (6,600V), 12 AMP stations(SPOs) for North Port (6,600V)
- * 2 Terminals(HPNT, HJNC) in New Port (2019), 1 Terminal (BPT) in North Port (2021)

NEW PORT



NORTH PORT



✔ Emission reduction by introducing an electric port guide vessel

- **(Project detail)** A new electric port guide vessel will be built to reduce emissions from the existing port guide vessel (Ship Saenuri) that is aged (20 years old).
- **(Period)** Oct. 2020 – 2023
- **(Total cost)** \$9.4M (USD1=KRW1,200)
- **(Vessel detail)** 300 GT, full length of 40 m, 2MWh battery, approximately 80 passengers



< (Current) Busan Port guide vessel (Saenuri) >



< New Port Guide Vessel "E-Green" >

1

Fine dust reduction by switching fuel from diesel to LNG for yard tractors (YT)

- ✔ 100% reduction of fine dust when changing the fuel to LNG
 - ✔ Progress and future plan (Starting from 2015)
 - (Progress) By 2022, 501 out of 696 YTs converted, achieving 72% conversion to LNG YT
 - (Future plan) 50 more Yts by 2023 and 100% Green YT by 2025
- * 2022 project cost: \$2M (BPA 25%, Ministry of Oceans and Fisheries 25%, Private 50%)
- ※ For one vehicle, the gov't and BPA pay \$10,417 each and private sector pays \$20,833



Diesel YT

34tCO₂/year/YT ↓

LNG YT

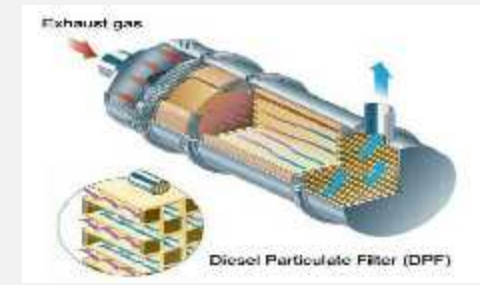
* USD1=KRW1,200

Emissions reduction by installing diesel particulate filter (DPF) on diesel YT.

DPF (Diesel Particulate Filter)

: DPF is an exhaust filtering device that physically captures diesel particulates and combust them for removal.

* 83.3% reduction of fine dusts (PM) on average



✔ Development & installation of YT DPF

- **(Application)** Aged diesel YTs with less than 5 years of remaining life
- **(Progress)** DPF installed for **81** YTs by the end of 2022
- ※ For one vehicle, the gov't and BPA pay \$29,167 each and private sector pays \$650. * USD1=KRW1,200



< YT DPF installation >

✔ Planned pilot projects for other small cargo handling equipment



< Empty handler >



< Forklift >



< Shuttle carrier >



< Reach stacker >

✔ **Development of 2 LNG-hybrid SCs to prevent harmful emissions from diesel SC**

- **(Current status)** 2 LNG-hybrid SCs operating on LNG and charged electric batteries was developed.(2021)
- **(Future plan)** 1SC is leased out to the Korea Port Training Institute for training and demonstration project

* 99% of fine dust can be reduced by using LNG-hybrid engine.



< Shuttle carrier (SC) >

4

Converting diesel transfer cranes (TC) to green e-RTGC systems

- ✔ **89 out of 123 TCs in North Port (72%) were converted to e-RTGC systems.**
* 280 TCs in Busan New Port (100%) are electrically operated.
- ✔ **TCs that cannot be converted to e-RTGCs due to operational reasons are installed with DPF (Pilot operation underway for 1 TC in Singamman Pier)**



< [d-RTGC] Diesel engine >



< [e-RTGC] Electric TC >

5

Installation of DPF on diesel transfer crane (TC)

✔ DPF for TCs that are difficult to be converted to e-RTGC

* Some TCs in North Port are used for support function between yards, so it is difficult to be converted to e-RTGC.

✔ BPA developed DPF with its own budget and is operating 1 TC with the DPF for pilot purpose. (Singamman Pier)

- Continuous consultation is underway to expand DPF installation and to secure government budget.

* Approximately KRW 103M costs to install DPF for 1 TC. (BPA 45%, Ministry of Oceans and Fisheries 45%, Private 10%)



< [d-RTGC] Diesel engine >



< [T/C DPF] Singamman Pier, RTGC with DPF >

1

Busan Port Air Pollution Monitoring Station

- ✔ **4 air pollution monitoring stations are in operation to check air quality in the Port**
 - (BPA) North Port's Gamman Pier/ (Busan) North Port's pier for government ships, New Port's multi-purpose pier/ (Ministry of Environment) New Port's small vessel pier
 - Data is collected through a connected bigdata system, and continuous monitoring is possible.
- ✔ **Additional 21 fine dust monitoring stations installed and operating for thorough fine dust monitoring**
 - 21 fine dust monitoring stations and signal lights are installed across Busan Port (Jan. 2021), and real-time environmental information on fine dust is provided



< North Port's monitoring stations >



< New Port's monitoring stations >

Installing LED lights for the Busan Port container terminal's light towers

- ✔ **Installing LED lights in major terminals to improve brightness and save power consumption**
 - Phase 1 (2020): 504 LED lights in North Port (Gamman Pier) replaced (Oct. 2020)
 - Phase 2 (2021): Replacement project design for the 2,815 LED lights in North Port (Sinsundae, Singamman Pier 7) and Gamcheon Port Central Pier completed (May 2021)
 - Phase 3 (2022~23): 1,101 LED lights in New Port (PNIT, HJNC, HPNT, BNCT) planned to be replaced
- ✔ **When all the lights are replaced with LED lights, 6,290MWh of power will be saved and 2,890tCO₂eq of GHG will be reduced annually.**



< Before installing LED lights >



< After installing LED lights >

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The Port Working 24/7











**Thank you
for your attention.**

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Busan Port Authority