



8th Railway Working Group Meeting

22–24 May 2024 • Baku, Azerbaijan

8-е заседание Рабочей группы по железнодорожному транспорту

22–24 мая 2024 года • Баку, Азербайджан



Session 3: Port-rail connectivity along the Caspian Sea; requirements and opportunities

Based on a series of field visits and analyses of current rail/port transportation practices, this session will present an overview of current port-rail connectivity, including recent developments in various ports along the Caspian. The session will highlight the requirements increase intermodal efficiency in ports.

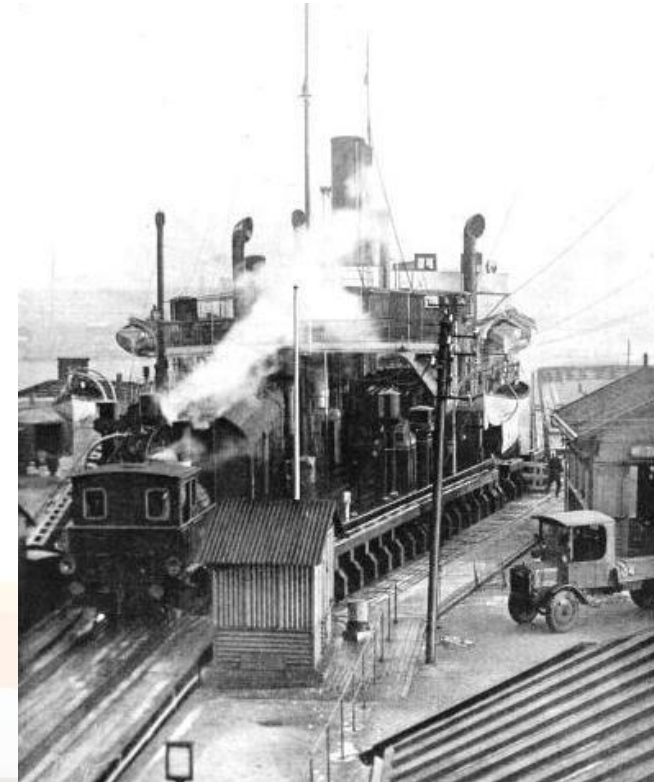
Adrian Sammons

Ports and Shipping Specialist



History of Rail Ferries

- The world first train ferry service was launched in 1851 operating a short voyage of 9 km across the Firth of Forth in Scotland, it closed in 1887 after the opening of Bouch's Tay Rail Bridge.

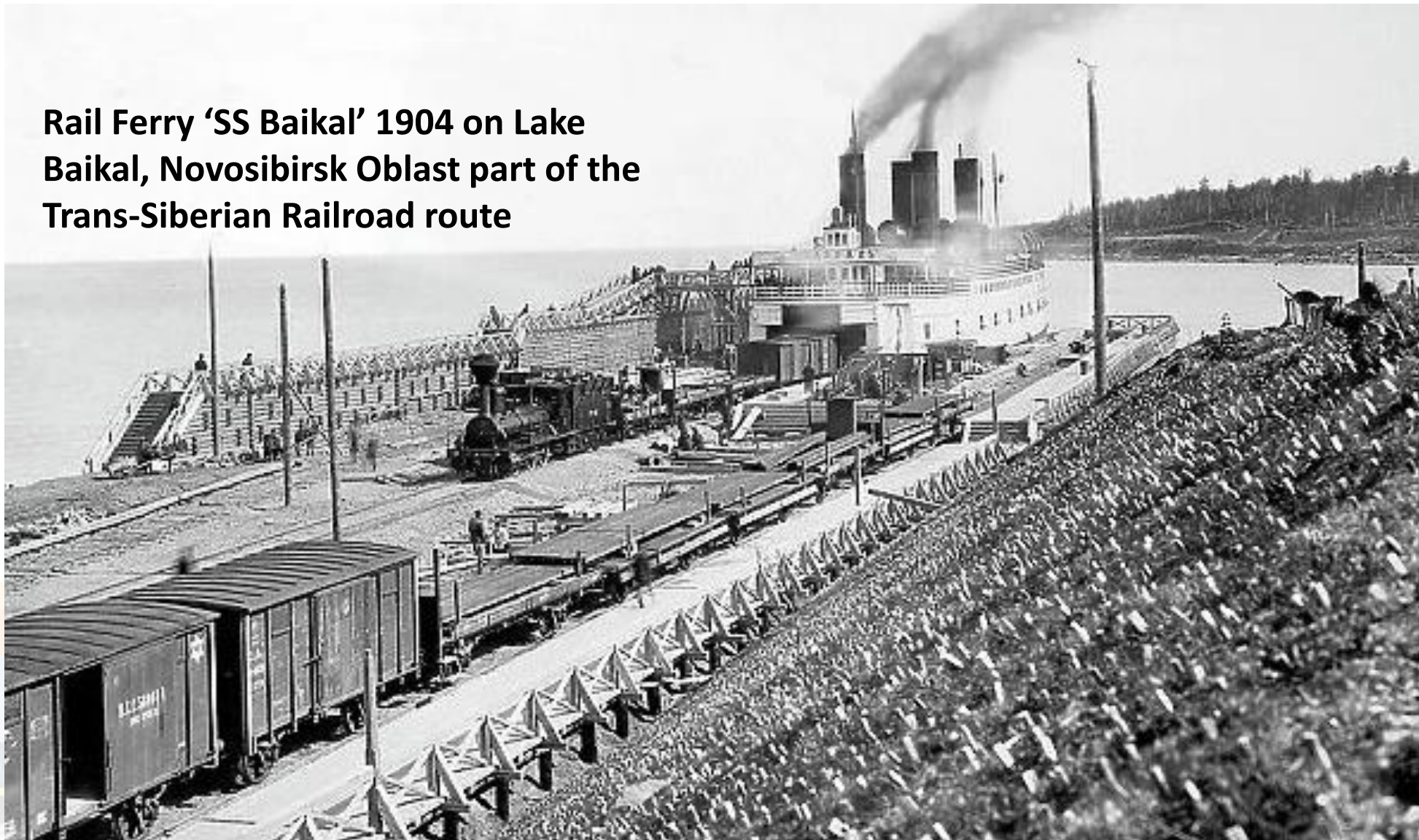


History of Rail Ferries

- Thereafter Rail Ferries developed in scale and voyage range to accommodate larger volumes of rail cars over longer distances.
- Scandinavia, Black Sea, Trans-Siberian and Baltic regions saw major take up of rail ferry services linking ports to rail networks.
- The Caspian Sea first rail ferry began operations in 1905* from Baku to the Russian ports on north coast of the Caspian Sea.
- The first modern design train ferries 'Soviet Azerbaijan' and 'Hamid Sultanov' began operations in 1962 ports between Baku and Krasnovodsk (160 miles). These vessels were 134 m long, with maximum draft 4.4 m with capacity for 30 rail cars.

History of Rail Ferries

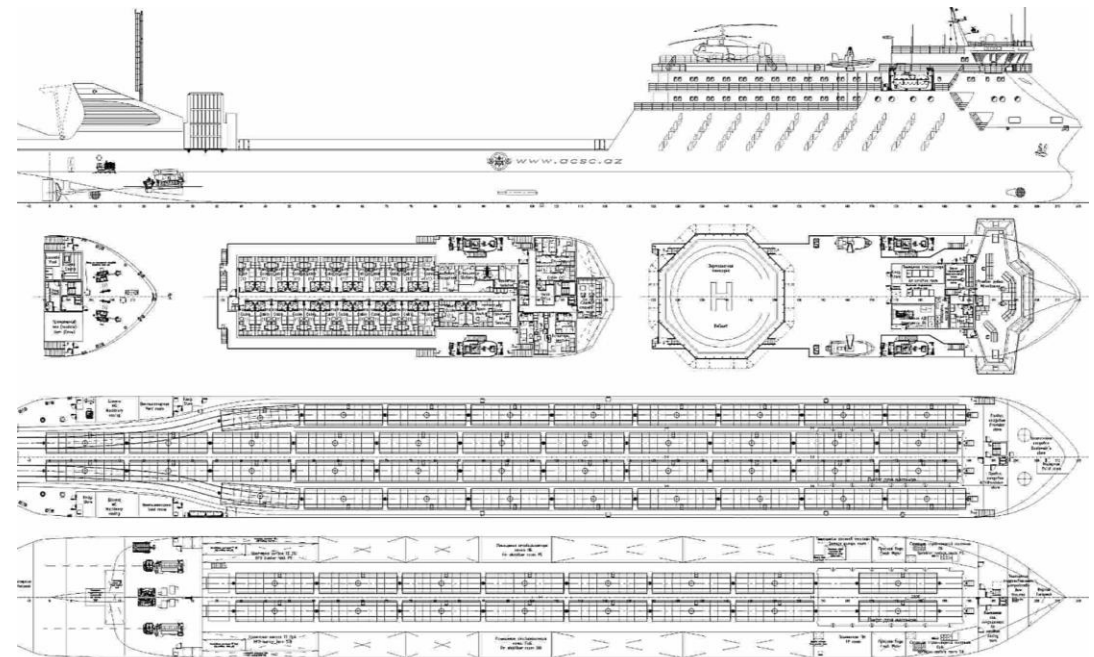
Rail Ferry 'SS Baikal' 1904 on Lake Baikal, Novosibirsk Oblast part of the Trans-Siberian Railroad route



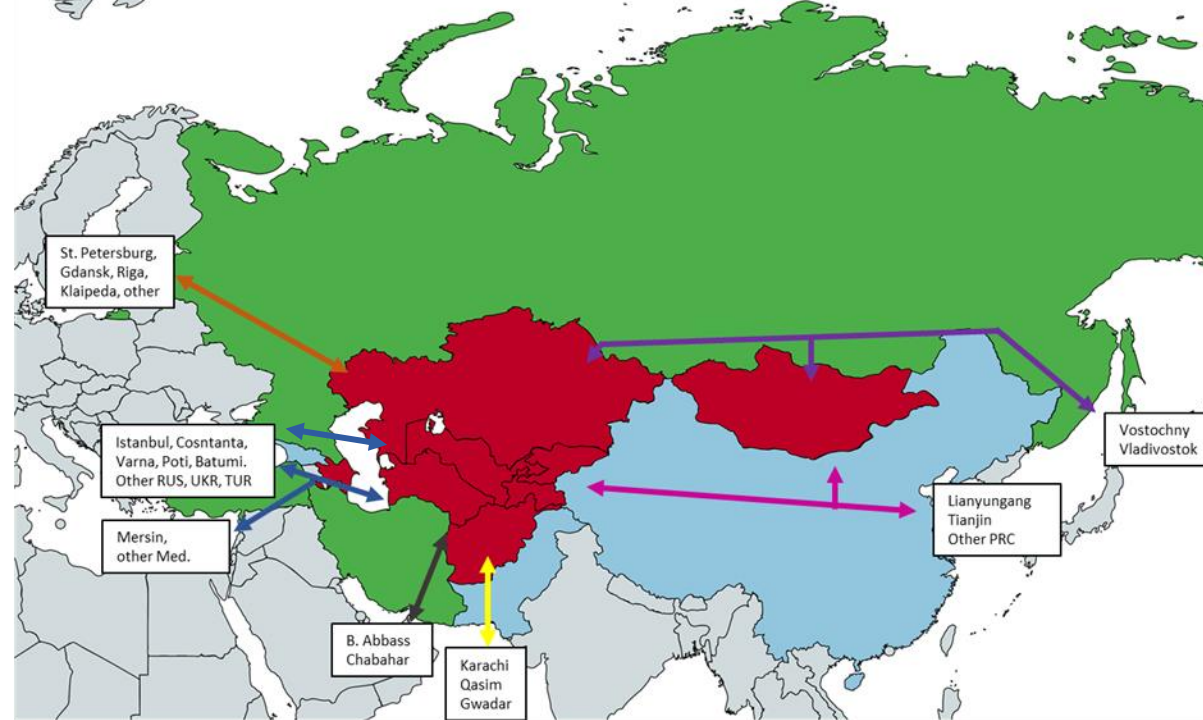
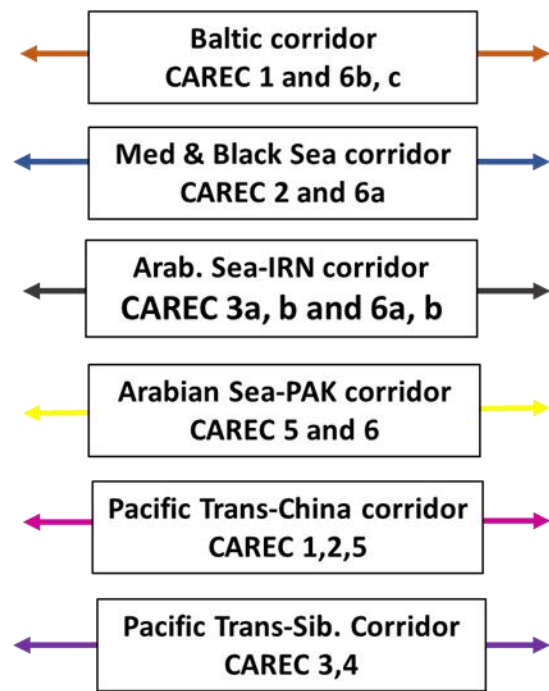
Modern Rail Ferries

- Rail Ferries were built at Ukrainian, Romanian and Croatian shipyards – delivered to Caspian via Volga-Don Canal.
- Rail Ferries operating on the Caspian retains scale limits of the Volga Canal connecting Black Sea and Caspian Sea –Volga-Don MAX vessels at a maximum size of 5,000 DWT.
- Max vessel transit size Volga-Don canal is 140 m Length, 16.6 m wide and 3.5 m draft.
- Azerbaijan Baku Dock Yard builds ships and has delivered the recent new Rail Ferry ‘MV Azerbaijan’ built 2021
- MV Azerbaijan has a capacity of 56 railcars

MV Azerbaijan 2021



Source: ASCo 2024



CAREC Landlocked

CAREC Non-landlocked

Non-CAREC

Observations of trade Routes via CAREC Ports

- Landlocked CAREC countries include Afghanistan, Azerbaijan, Kazakhstan, Kyrgyzstan, Mongolia, Tajikistan, Turkmenistan and Uzbekistan
- Six of the eleven CAREC countries host seaports though three of these countries (Azerbaijan, Kazakhstan, and Turkmenistan) host ports on the landlocked Caspian Sea
- Georgia has ports on the Black Sea which feed into the Mediterranean Sea through the Bosphorus Strait
- Pakistan and China are the only two CAREC countries that host open-sea ports capable of serving large bulk and container ships. China has the higher capacity port infrastructure that attracts the widest range of shipping services

The Middle Corridor - Definition

- Middle Corridor is the shortest route between western China and Europe, compared with the Northern Corridor through Russia and transcontinental sea lanes via Indian Ocean and Suez Canal.
- Middle Corridor roughly follows the route of the ancient Silk Road - modern Middle Corridor links ports in Kazakhstan and Turkmenistan to transport goods across the Caspian Sea to ports in Azerbaijan.
- From there, cargo makes its way to Europe from Georgian Black Sea ports, or across the Turkish interior and / or via Mediterranean.
- Maritime connectivity via
 - Rail Ferries linking the major rail networks
 - Ro-Pax Ferries linking the road networks
 - Lo-Lo Container ships linking the road and rail networks

Rail ferry loading operations at port of Turkmenbashi



Source: Authors photo at Turkmenbashi port 2023.

Rail Ferries

- Transporting whole trains on ferries, primarily for short-distance sea operations, is more efficient than standard procedures for containers or break-bulk
- Speed is the main characteristic of the rail ferry service, together with the fact that trains remain intact during the trip.
- Substantial investments in port infrastructure including rail links required to be operational.
- Rail ferries are less flexible as their operators are 'locked' between two ports.
- Building rail ferries is more expensive than building a conventional ferry

Ro-Pax Ferries

- Ro-Pax ships combine the features of a passenger vessel with cabins and roll-on/roll-off capacity for trucks and cars
- Ro-pax describes the combined roll on/roll off and passenger design
- Ro-Pax ferries are much cheaper to build than cruise ferries so can compete economically on sea voyages.
- Ro-Pax ferries need large port-based terminal storage areas for receipt and parking bays of trucks and cars and accommodation / waiting areas for passengers – often with customs and immigration facilities if border crossings

MV Bagtyyar 2015



Source: Authors Photo Turkmenbashi Port 2023

Lift on Lift off Container Ship



Source: Journal of Commerce 2023.

Lo-Lo Container Ship

- There are three types Lo-Lo ships
 - Gearless ships that rely upon port supplied cranes to load and discharge
 - Geared self-sustained ships that are equipped with their own ships' cranes.
- Lo-Lo ships are reliable in lifting containers and outsized heavy break-bulk cargo.
- LoLo ships are more flexible and economical than Ro-Ro ships as they use their onboard cranes to lift on and lift off cargo instead of driving it onto the vessel. They are therefore more eco-friendly. The Lolo transport option also accommodates more containers as the ships don't need to accommodate wagons or truck-trailers

Maritime linkages across Caspian and Black Sea

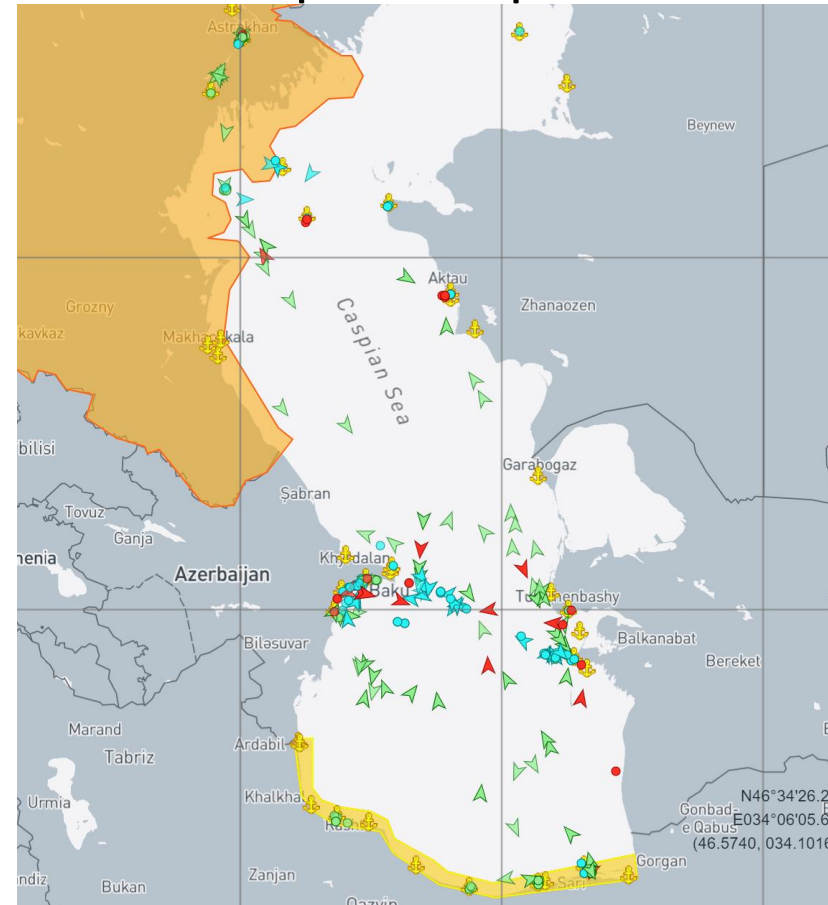


Route	Port to Port	Transit	Route	Port to Port	Transit
First mile CN/KZ	Xian – Turkmenbashi / Aktau	11 – 13 days	Last mile Rail	Baku – Constanta/Varna - Duisburg	24 – 25 days
Rail Ferry mile	Aktau / Turkmenbashi - Baku	1 – 2 days	Last mile Road	Baku – Duisburg direct truck	10 – 11 days

Caspian Sea Ports

- Multi-modal and specialist ports are featured
- Port relocation has occurred at Caspian ports
- Depth of port channels and berths is on basis of a Caspian maximum size vessel
- Terminal Operators are mostly govt. owned or JS ventures – potential for PPP's
- Utilization of berths and terminal areas varies
 - Higher utilization of ferry berths and lower utilization of general / bulk berths
 - Capacity is available to expand
- Opportunities
 - Productivity improvements to turn vessels around faster
 - Dredging of channels and berth pockets
 - Private sector port management

Caspian seaports



Source: Marine Traffic 2024

Aktau Port Kazakhstan



Source: Ports Europe 2019

Aktau Port

- Aktau is the largest port in Kazakhstan
- Aktau provides services to oil and grain exports to Azerbaijan and Europe and a key node of the Middle Corridor.
- It features three dry cargo terminals and three oil terminals and is currently undergoing modernization worth about US\$25 million as well as the construction of an additional container hub worth about US\$29million. Aktau port retains a rail port link that attracts rail ferries between Aktau and Baku.
- Handles bulk liquid (petroleum products) and dry bulk (grain) and break-bulk cargoes (metal, steel products, timber)

Aktau Port Rail Access



Kuryk Port

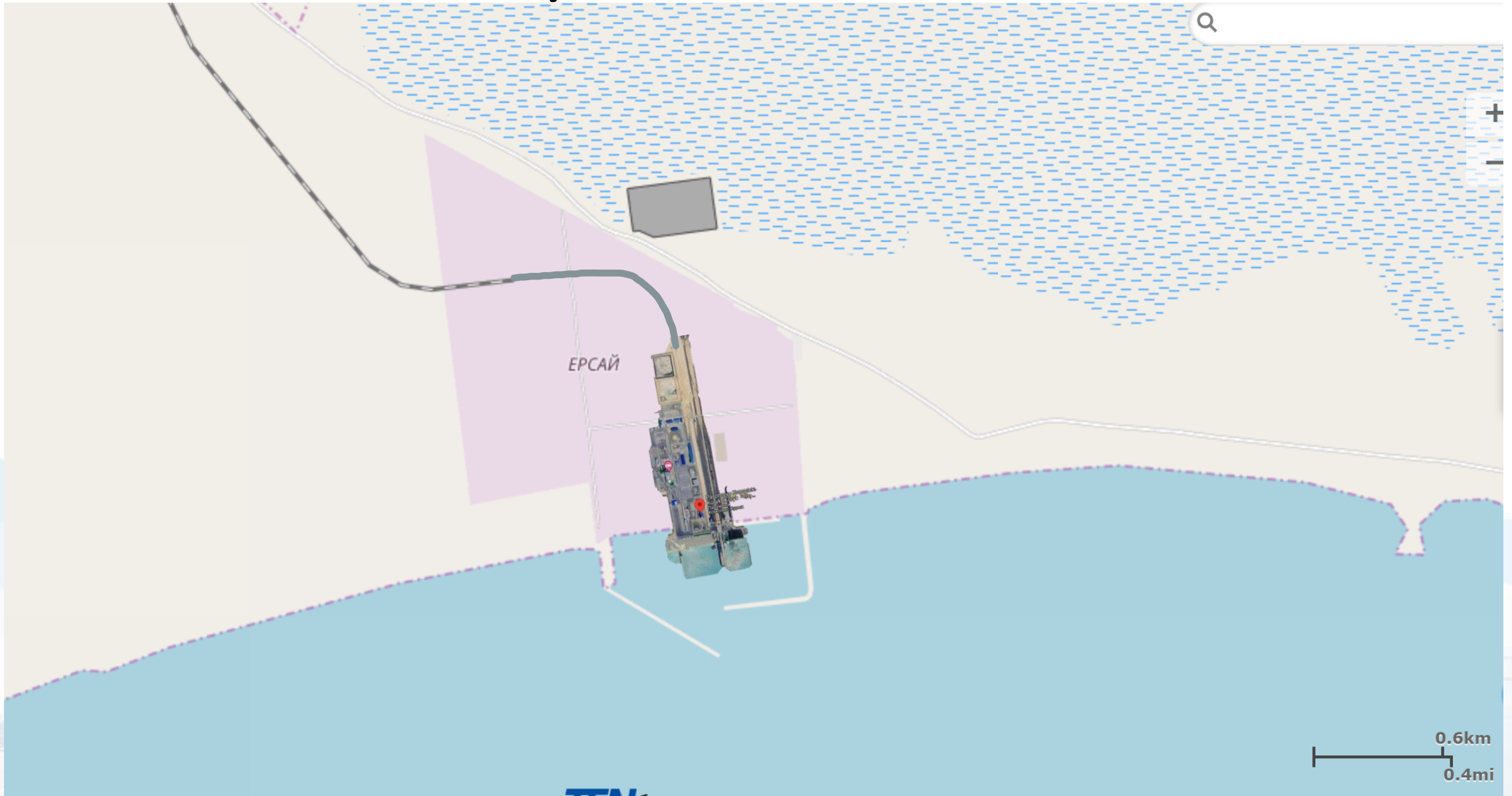
- Kuryk port was developed in a strategic location linked by new rail operations that connect the port with road and railway services along the Kuryk – Tazhen Customs Point and Kuryk – Khorgos Gateway dry port
- Kuryk is developing a universal reloading terminal with capacity for 3 million tons of container, general, bulk cargoes and liquid cargo terminal capacity 2.9 million tons.
- The rail ferry terminal capacity is 6 million tpa at Kuryk.
- The Ministry of Transport in Kazakhstan has instructed urgent dredging to take place at both Kuryk and Aktau in response to reducing Caspian Sea levels

Kuryk seaport Kazakhstan



Source: Authors photo at Kuryk port 2020

Kuryk Port Rail Access



Baku – Alat Port Azerbaijan



Source: Ports Europe 2019

Baku Alat Port

- Baku – New Alat port was opened in 2014
- Port of Alat is the primary commercial port for Rail-ferry, Ro/Ro ferries and dry bulk cargoes in Azerbaijan
- Phased development of Alat is in 3 stages;
- Stage 1
 - General Cargo Quay – 650 m (4 berths)
 - Ro-Ro Quay – 300 m (1 berth)
 - Service Berth – 450 m (multiple berths)
- Stage 2 -3
 - Phase One: 10–11.5 million tons of general cargo + 40,000–50,000 TEU;
 - Phase Two: 17 million tons of general cargo + 150,000 TEU;
 - Phase Three: 21–25 million tons of general cargo + up to 1 million TEU.

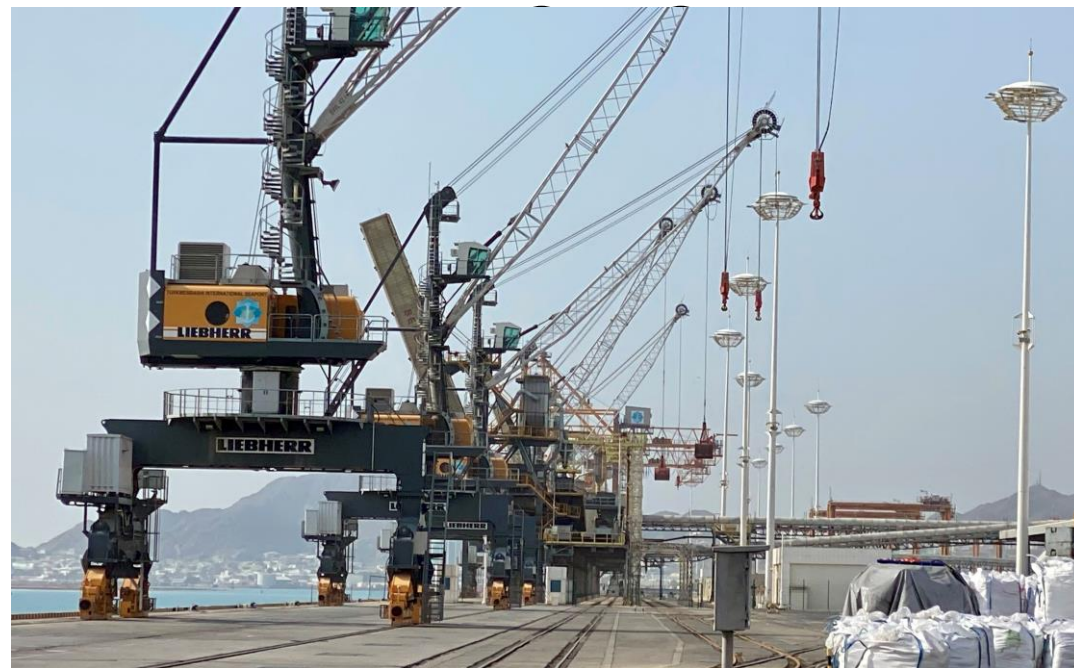
Baku – Alat Port Rail Access



Turkmenbashi Port

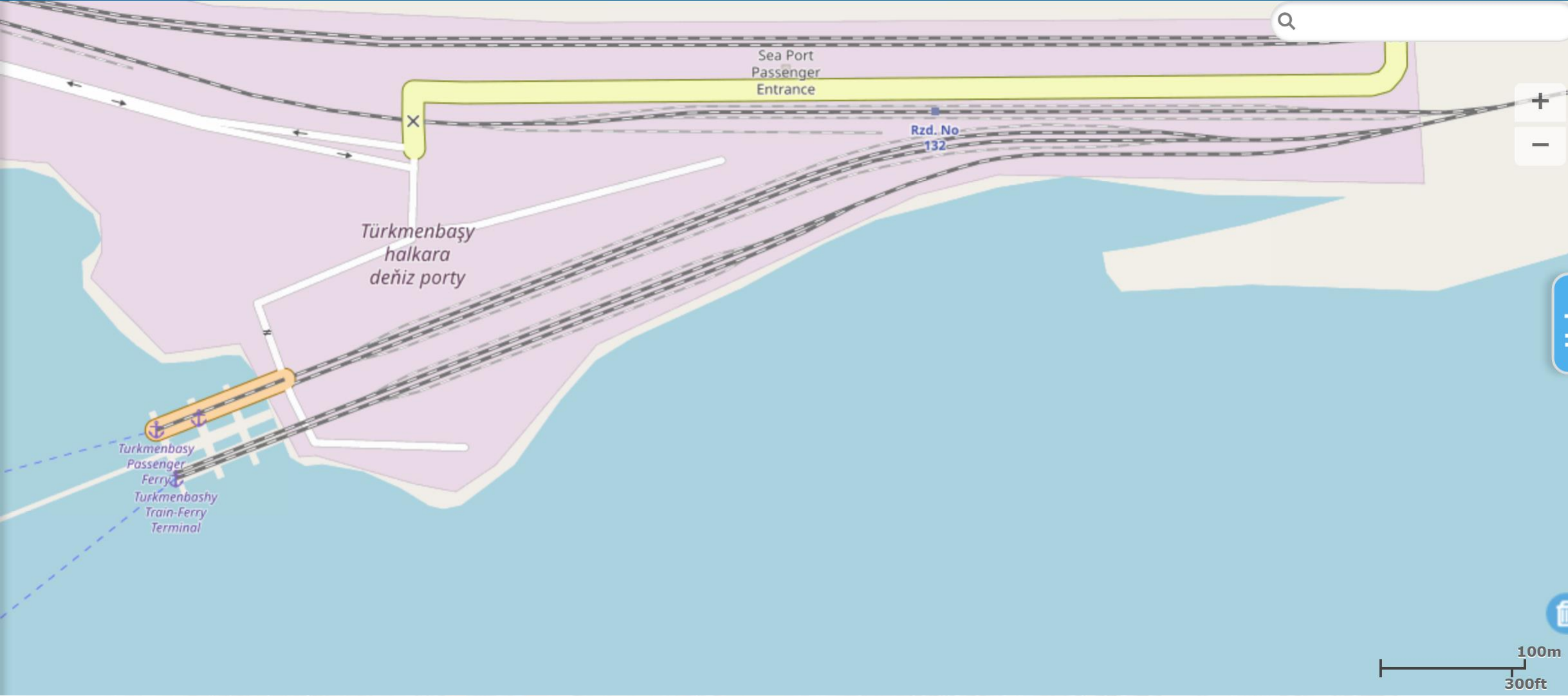
- Turkmenbashi International Seaport (TIS) was opened in 2018.
- It provides a dedicated port facility for all non-petroleum bulk liquid products.
- The port has container handling facilities, dry bulk, rail ferry linkspan piers, Ro-Ro ramps and berths, and a dedicated bulk polypropylene cargo terminal.
- 150 hectares with capacity to handle 17 million tons of freight per year excluding oil products, 300,000 passengers, 75,000 trucks, 400,000 containers (TEU), 3 million tons bulk & 4 million tons general cargo.
- With a total quay line of 1.8 km that can handle 17 vessels simultaneously

Turkmenbashi seaport TKM



Source: Authors photo at Turkmenbashi port 2023

Turkmenbashi Port Rail Access



Rail ferry underway



Source: Marine Traffic 2023.

Caspian Sea Shipping

- Diversity of specialist vessels with concentration of capacity in Rail Ferries and Ro-Ro operations – vessel design is single purpose
- Potential to improve shipping schedule reliability – sea state conditions
- Caspian max vessel design limits capacity per ship and overall transport economies
- Potential to diversify vessel ownership / operations JS govt to private sector
- New pipeline installations have replaced many tanker ship operations
- Opportunity to enhance traditional management processes
- Dry Bulker ships used for grains and base materials (steel, fertilizer, cement & clinker) .

Caspian Vessel Size

- Volga Don Max class is defined by overall dimensions of Volga-Don shipping Canal locks
- Maximum loading capacity 4200-5500 tons at characteristic river draft 3,60m
- Allows vessels to transit between the Caspian Sea and the Black Sea – Mediterranean Sea.
- Volga-Don canal scale limits means that vessels max. dimensions are;
 - 141 m length
 - 17.0 m beam
 - 3.20-3.70 m draft
 - 13.2 m air draft

Baku Shipyard 2021



MV Academician Khoshbakht Yusifzade 141 m, 16.9 m beam, 57,875 dwt 15,447 dwt. Launched September 2021.

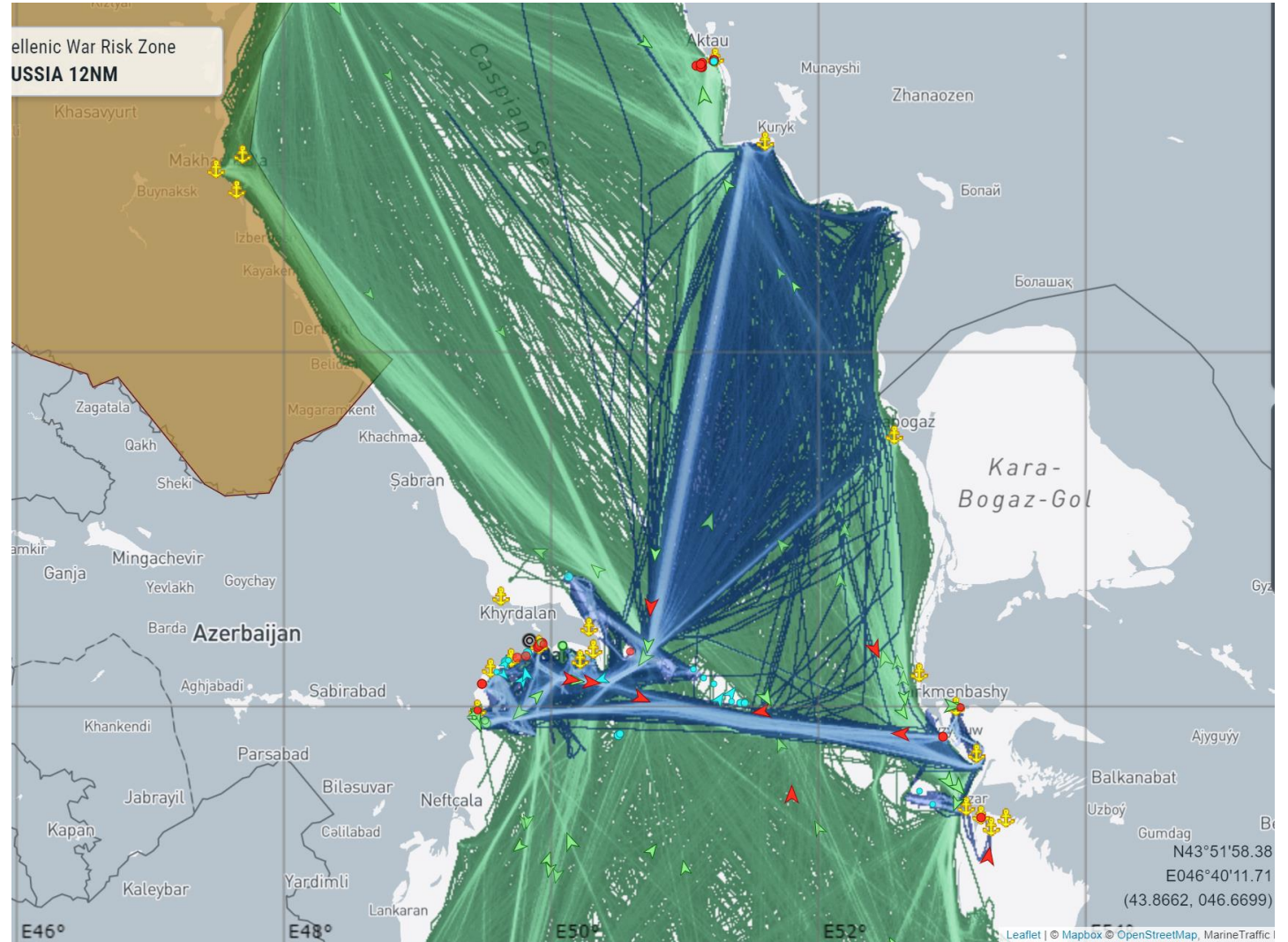
Source:22 Sep 2021 by Craig Jallal for Riverea Merchant Marine

Caspian Main Trade Routes

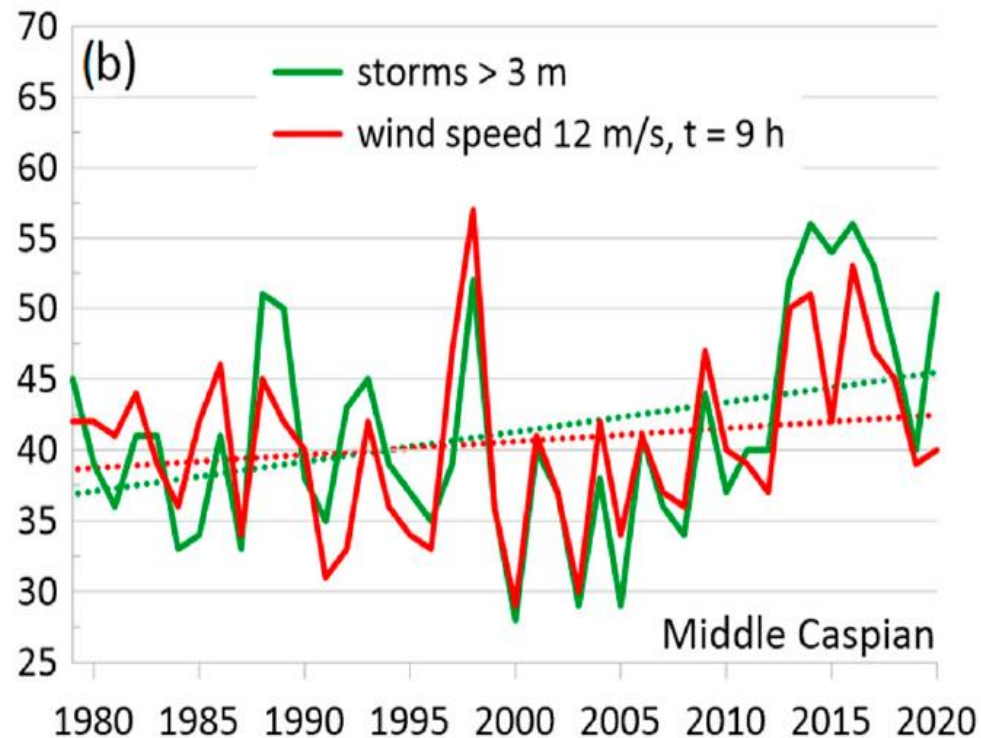
Dedicated Rail ferries and Ro-Pax vessels are operated by Azerbaijan, Turkmenistan and Kazakhstan government Joint Stock fleets. There is emerging dedicated Lo-Lo container vessels deployed in the Caspian Sea.

Ferries connect Kazakhstan and Turkmenistan, to Azerbaijan, for further transportation of freights by rail or road through Azerbaijan, Georgia, and Turkey to Europe.

The Azerbaijan Shipping Company (ASCo) plays a connecting role in the TRACECA program by providing marine transportation of goods and passengers along the Caspian Sea. There are more than 25 Rail ferries and 10 Ro-Pax ships operating on the Caspian Annual transportation capacity of Caspian ferries equals 95,000 railway wagons or 4,5 million tons of cargo



Number of Storms and Wind p/year



Source:Kruglova, E.; Myslenkov, S. Influence of Long-Term Wind Variability on the Storm Activity in the Caspian Sea. Water 2023

Caspian Sea Storms

- The maximum SWH = 8.17 m and the maximum long-term mean Significant wave heights (SWH) ~1.5 m were observed in the Middle Caspian in winter.
- The mean multiyear number of storms with SWH > 2 m was 90.
- Storms with SWH > 3 m but also for SWH > 2 value was 2 days duration.
- In 2003 the Mercury II (11,000 ton) rail and passenger ferry sank in bad weather between Aktau to Baku – 36 people died.
- Nov 2023 unstable weather with wind speeds up to 30 m/s and SWH 4.5 m delayed shipping across the Caspian for several weeks.

Caspian Sea Crisis

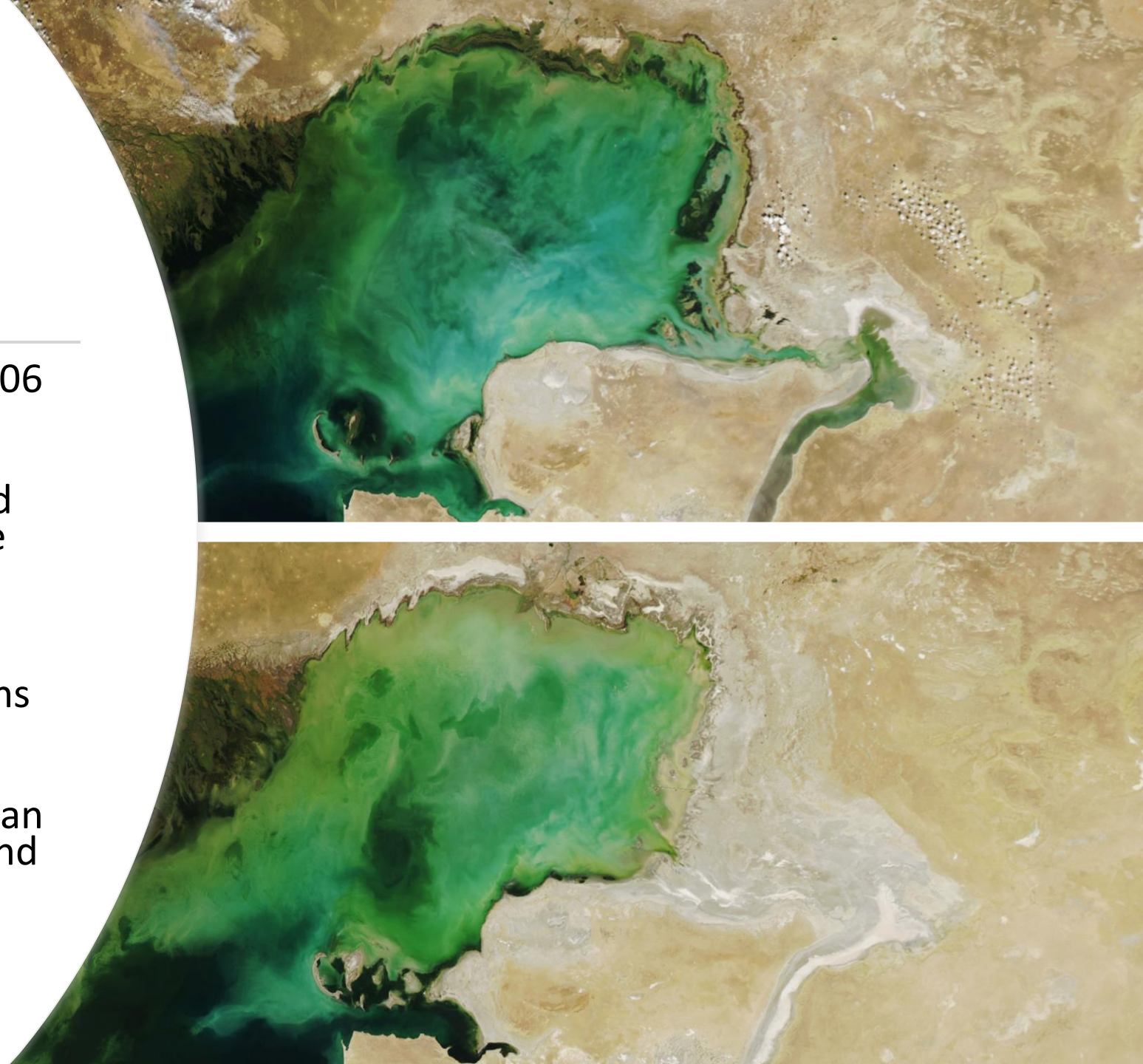
Real-time images compare 20 Sept 2006 with 19 Sept 2022 and show very different shorelines.

2022 image shows light grey areas and patches of white along the sea's shore and to the southeast where the Sor Kaydak inlet once sat.

Patches are likely salt and mineral deposits left after evaporation, explains NASA Earth Observatory. Patches that you can't see in 2006.

Warning that water levels in the Caspian Sea could fall by 9-18 metres by the end of 2100

Source: NASA Earth Observatory images by Lauren Dauphin, using MODIS data from NASA EOSDIS LANCE and GIBS/Worldview.



Caspian Sea Crisis

- The Caspian Sea, Earth's largest enclosed water body, with 130 rivers, including major ones like the Volga, Ural, Terek, Sulak, and Emba, flowing into it, the sea's water level is influenced by a balance of inflow and evaporation due to its closed nature.
- Historical measurements since 1837 show fluctuations, from the highest in 1882 to the lowest in 1977. Recent trends indicate a significant drop since 2006, with a 30-centimeter decrease in 2021 and a cumulative 119-centimeter drop since 2005.
- Based on the presented data, the short-term forecast suggests a continued dropping of sea levels over the next 2-5 years by 1-2.5 meters. Industries are recommended to urgently undertake preparatory measures, such as dredging, to safeguard critical infrastructure.
- Long-term forecast: By 2026, a reduction in the rate of shallowing is anticipated, leading to a stabilization of water levels. Subsequently, a gradual reversal could occur, resulting in the gradual rise of the Caspian Sea's water levels in the future. There is possible to reach water level up to -27m maximum in 2060.

Relative Advantages of the Middle Corridor

- potential for dramatically reduced transit times. The projected 14–18 days of transit time, when compared with the 19-day journey through Russia or the 22–37 days of travel along the southern sea routes, make the Middle Corridor an attractive alternative for commercial shipping.
- At the beginning of 2023, cargo transported through the Middle Corridor totaled over 1 million tons, a nearly 65 percent increase compared with the previous period in 2022. While the throughput capacity is a fraction of what is seen in the Suez Canal, the reduction in total days of transit time could convince commercial shipping companies to divert some of their cargo to this route.



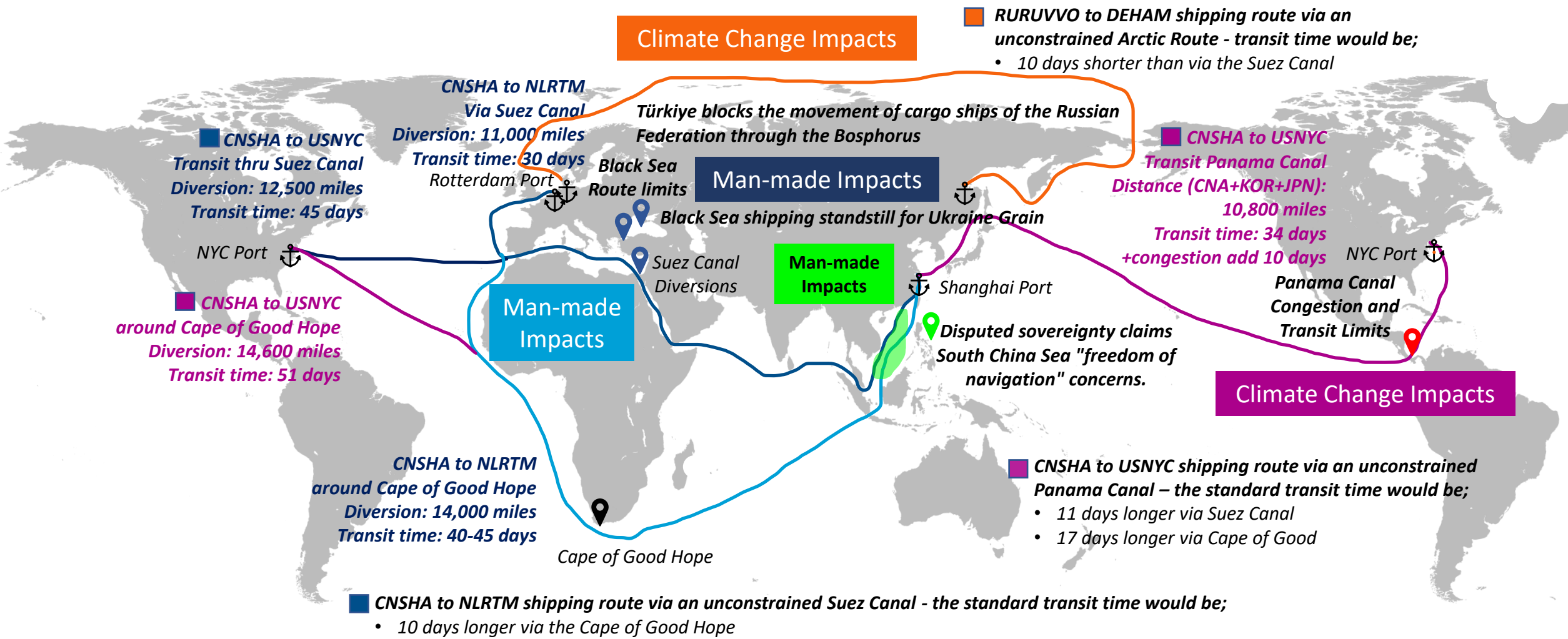
Challenges for the Middle Corridor

- The biggest challenge is the low capacity of the Middle Corridor, which is currently estimated to be only about 5% of the capacity of the Northern Corridor.
- The vessels operated on the Caspian Sea have low capacity and there is a shortage of locomotives and wagons in Azerbaijan and Georgia.
- The increased volume of traffic led to transport times extended up to 40 days and in some cases even significantly beyond that.
- Associated delays jeopardize time advantage over competing sea routes.
- Another challenge is the unstable price development. Due to the increased demand, transport prices have risen sharply, in some cases at short notice. The lack of transparency of the increases makes it difficult for freight forwarders to calculate prices (currency risks also play a role here), which also reduces the attractiveness of the route.

Unprecedented Global Supply Chain Events

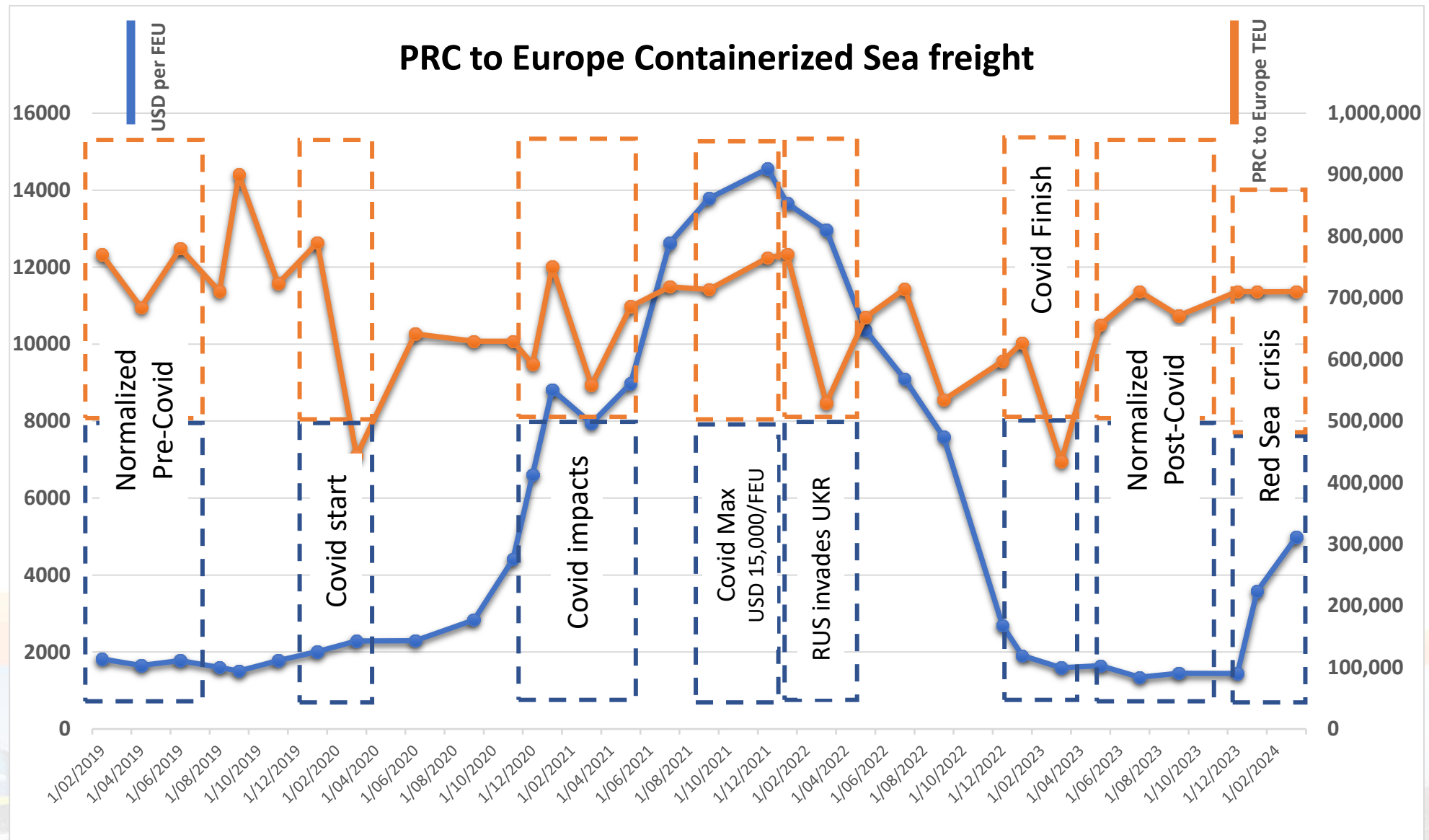
- Covid-19 pandemic; 1 March 2020 - 5 May 2023
 - Port congestion / ships withdrawn from service / freight \$ escalation
- Russia-Ukraine **conflict**; 24 February 2022 – ongoing
 - Black sea port closures / route limits / sanctions / freight \$ escalations
- Red Sea crisis; 19 November 2023 – ongoing
 - Suez canal diversions extra \$ voyage time / EU med ports most affected
- Panama Canal; 1 Jan 2020 – ongoing
 - Diminished water levels / limits shipping capacity / freight \$ escalations
- Decarbonization of shipping; 13 April 2018* - ongoing
 - Retiring fossil fuel ships / renewable energy replacements / \$ escalations





Source: Authors construction of events with base line data from

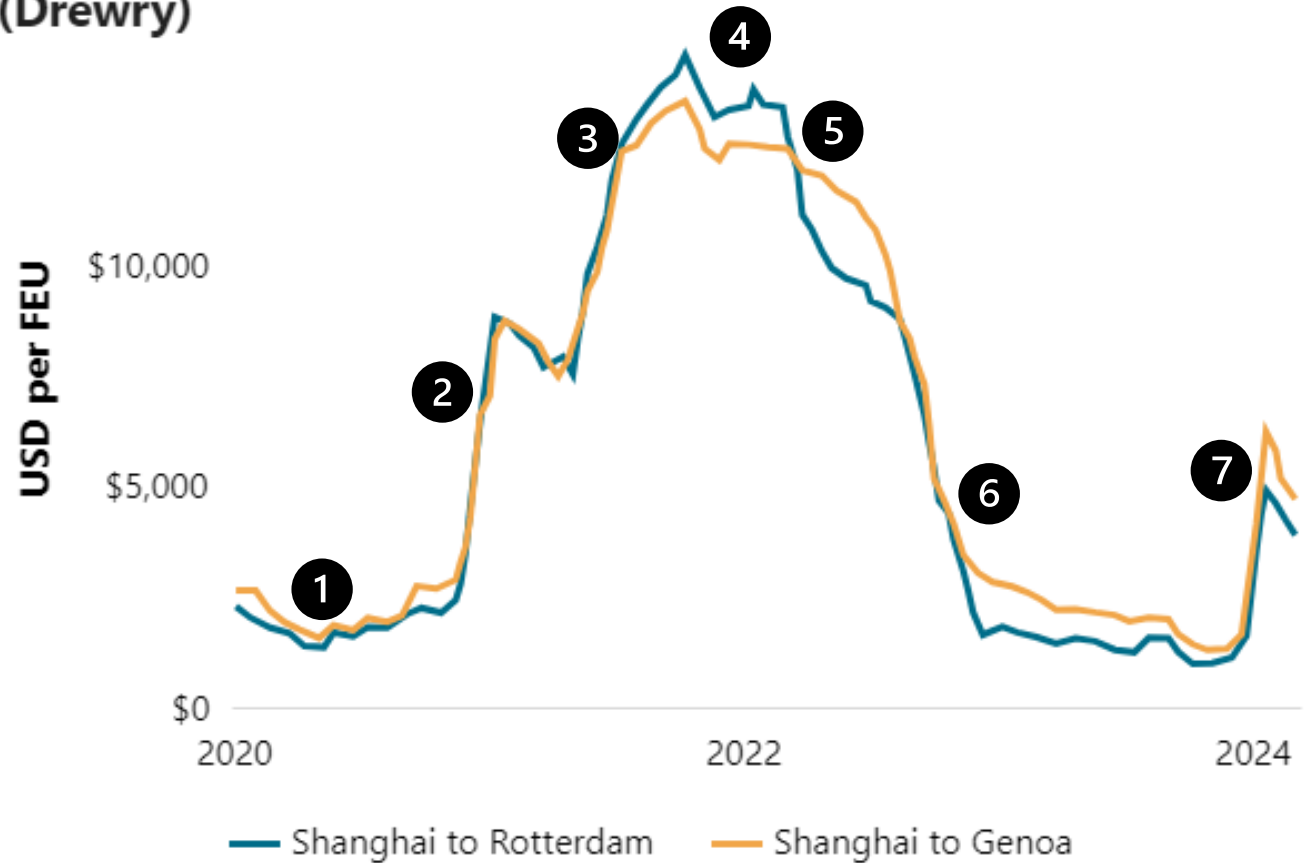
Relationship -|- Demand & Freight Price



Source: Authors construction of events with base line data from S&P Global – Drewry World Container Index

1. Initial slowdown in merchandise trade and global uncertainty with Covid lockdowns
2. Escalation in container pricing between Nov – Jan 2020 freight demand increased
3. Capacity adjustments as shipping lines laid up vessels and ‘added’ blank sailings
4. Peak of container pricing resulting from lower capacity and surge in freight demand
5. Russia-Ukraine **conflict** uncertainty-maintained freight pricing at the 2021 plateau
6. Post Covid – shipping lines increased capacity to 2019 levels market competitive tension returned
7. Red Sea crisis with attacks in shipping

Shanghai to Rotterdam, Genoa container spot rates (Drewry)



Source: S&P Global – Drewry World Container Index

Russia Ukraine Conflict

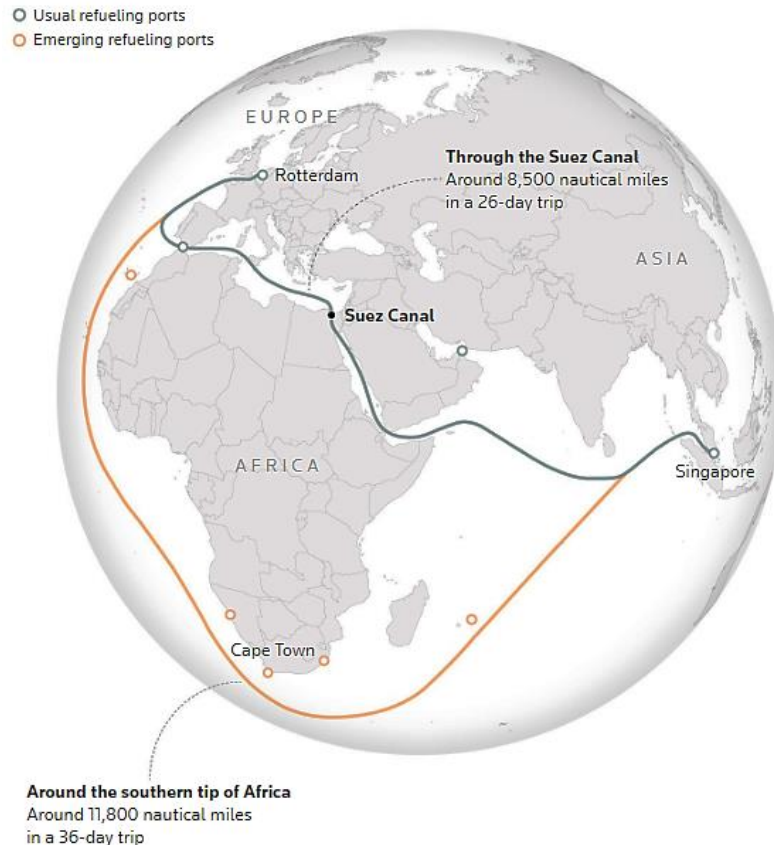
1. Increased daily charter rates on global index noting the increase from Feb 2022
2. An increase of 35% in 2022 saw ship charter rates surge because of geopolitical conflicts including the Russia-Ukraine war and higher demand from PRC for ships post-pandemic
3. The ship brokers are commenting that this is largely due to increased demand for bulkers and tankers.
4. War Risk surcharges for all types of ships and cargoes is evident on global fixtures
5. There has been a normalizing of ship charter rates in 2023 calendar year, yet brokers indicate volatility will remain

Rising shipping prices (daily vessel earnings, in US\$/day)



Source: June 2022 UNCTAD & Clarkson Charter index for vessel earnings across major shipping sectors

Vessel re-routing - example of from Singapore to Rotterdam.)



Sources: The Maritime Security Centre – Horn of Africa (MSCHOA)

Red Sea Crisis

- The Suez Canal is used by roughly one third of global container ship cargo. Redirecting ships around the southern tip of Africa is expected to cost up to US\$1 million in extra fuel for every round trip Asia to N. Europe.
- Disruption to Middle Eastern supply after the latest Red Sea attack drove oil prices higher in the first trading session of 2024.
- Container freight rates have surged as a result. Rates on Asia–Europe routes have increased by 284% and more than doubled on other main East–West lanes, Fitch said.
- Cost of insuring a seven-day voyage through the Red Sea has risen by US\$100,000 since the attacks began.

Panama Canal Crisis

1. Panama Canal Authority cut ship numbers allowed to pass Panama Canal -36% in 2023
2. As of 18 Jan 2024, wait time for a ship to get through the canal was from two to 55 days, depending on type of ship and N or S bound
3. Options include sailing south via S America or Africa or transiting the Suez Canal
4. Longer routes +2 weeks to shipping times, fuel, crews and ship charter rates
5. Ship brokers indicate volatility will remain
6. Panama Canal Authority (ACP) announced a slight increase in the number daily vessel transits through the drought-hit waterway.

Source: Global port agency WaterFront Maritime Services

The cost of shipping via the Panama Canal has jumped in 2023

Average cost of shipping a 40ft container within one-month's notice between China and the US Gulf Coast via the Panama Canal, \$

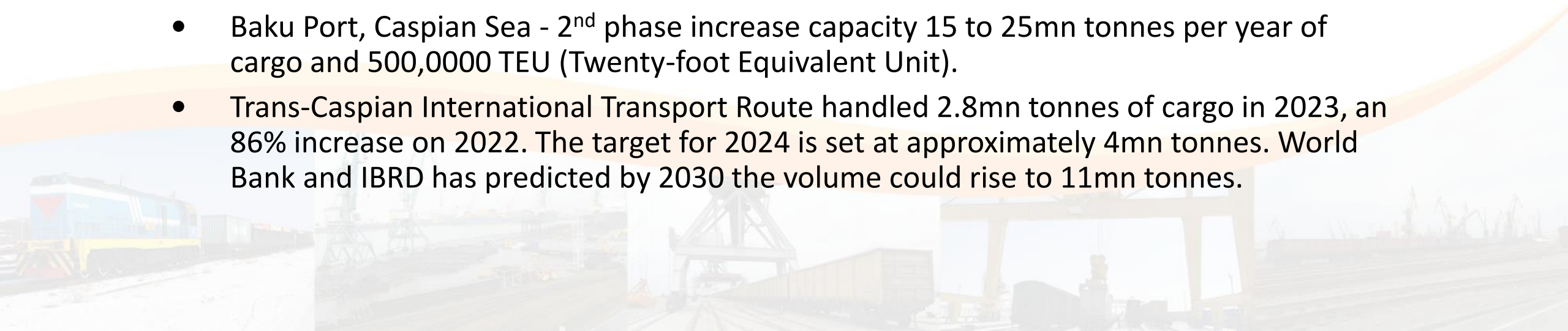


PRC main ports to USEC has risen 36% to U\$2400/FEU by the end of June 2023

Source; Xeneta

Multi-Modal Trans-continental Opportunities

- CAREC Transport Strategy 2030
 - Middle Corridor connects Central Asia to Europe emerged as an alternative to the Northern Corridor (Russian controlled rail territory), and the conventional sea route through the Malacca Straits, Indian Ocean, Red Sea or Cape of Good Hope.
 - Middle Corridor's multi-modal transport infrastructure links the Caspian and Black Sea ferry terminals with the rail / multi-modal systems of China, Kazakhstan, Azerbaijan, Georgia, Romania, Bulgaria, and/or Turkey, (Ukraine) and Poland to EU. Trains operating along this corridor deliver cargo from China to Europe on average in 20-25 days.
 - Baku-Tbilisi-Kars railway opened 2017 is part of the Middle Corridor, deliveries from Asia to Turkey via the South Caucasus take only 15 days.
 - Baku Port, Caspian Sea - 2nd phase increase capacity 15 to 25mn tonnes per year of cargo and 500,000 TEU (Twenty-foot Equivalent Unit).
 - Trans-Caspian International Transport Route handled 2.8mn tonnes of cargo in 2023, an 86% increase on 2022. The target for 2024 is set at approximately 4mn tonnes. World Bank and IBRD has predicted by 2030 the volume could rise to 11mn tonnes.



Middle Corridor

- Middle Corridor provides transit trade connectivity; Altynkol / Dostyk - Aktau/Kuryk–Baku/Alat, Turmenbashi-Baku/Alat, Batumi/Poti – Constanta, Burgas or Istanbul and reverse direction
- Overland infrastructure features rail and road networks that interface with rail and RoPax ferries that transit the Caspian.
- Opportunity to modernize the traditional methods of freight handling dominated by rail loading services less upon truck+trailers
- Port relocation occurred at some ports, urban encroachment constraints is evident

Source: Authors interpretations of CAREC and Transit Trade opportunities

The Opportunities for Transcontinental Trade



1. Depth of voyage routes, port channels & berths dictates the Caspian maximum size vessels – design alternatives
2. Terminal Operators are mostly govt. owned or JS ventures – potential for PPP's – Private sector investments
3. Opportunity to improve vessel schedule integrity which has potential to improve productivity and reliability for end-to-end supply chain beneficiaries and decision makers

THANK YOU

CAREC

Railway Working Group

BAKU, AZERBAIJAN

22 May - 24 May 2024

