# Submission to Brooklyn Marine Terminal RFEI

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Firm Description

Continentia Capital is a real estate investment and advisory firm providing innovative solutions to urban challenges. The firm specializes in public-private partnerships that encourage inclusive economic growth.

Financial Capacity

The respondent does not have adequate financial resources to develop the site without participation by other entities.

General Maritime Industry Experience

The respondent was responsible for developing the Subic Bay Freeport's land use and feeder port development plan.

1. The proposed maritime operation is a cross Hudson container service and container freight station (CFS). The primary clients are New York City customers with less-than container international general cargo. The operation also intends to transport municipal solid waste but not at BMT. The business is wholly dependent on waterborne shipping,
2. The operation would be a tenant to the operator, utilizing the wharf three hours daily.
3. The operation would be a new operation.
4. The optimal location would be at the north end adjacent to the Pier 7 inlet. The automated storage and retrieval system (ASRS) would impede access to the existing container cranes at the south end and the tall ASRS would be more appropriate at the northern end. There is the opportunity for additional public space above the CFS and truck circulation area.
5. The proposed operation would require 7 acres at BMT to handle 100,000 TEU annually. The operation would expand dramatically over time by halving cross Hudson customer transportiaton costs, traditional elasticity suggesting 9% growth over the first decade. Future increases in traffic would be handled at other underutilized port facilities owned by DSNY, the closest of which is the Hamilton Ave. MTS.
6. The Container Freight Station permits the consolidation of small shipments into containers for transport to Port Authority container terminals. The CFS is a 25,000 sf open warehouse built with 50' modules. Truck bays are located on one side with the ASRS on the other. The optimal location for the buildings would be immediately adjacent to the berth but if a dedicated path for automated shuttles was provided the buildings could be located elsewhere.
7. Yes
8. An additional pair of container cranes if the operation is located on the north end of BMT.

9. The operation requires a 400 linear foot berth to accommodate the proposed container feeder vessels. The operation could also be accommodated with the restoration of finger piers.
10. The proposal transforms the transportation of containers across the Hudson with a fleet of three electric feeder vessels providing multiple daily calls at ports in Brooklyn and Bronx.
11. Businesses that receive international shipments would benefit dramatically from eliminating the need for transfer to local trucks.
12. Utilization of both facilities for a city-wide container service is essential. The operation alsp proposes to develop the Newton Creek MTS as a third landing providing access to customers in Queens.
13. Given the lack of other publicly owned sites in the Bronx, it would be prudent to reserve 17 aces for the ultimate handling of 300,000 TEU annually. 10 acres would be available for interim uses.
14. The operation has not commenced
15. The operation would eventually be a public traded company owned 50/50 by EDC and investors
16. The operation has two primary functions – feeder container services like Feederlink servicing the port of Rotterdam and operation of an urban Container Freight Station. The closest analog to the proposed operation is the ATL Logistics Centre in Hong Kong, except that most of the goods storage will take place in containers in the ASRS system rather than indoors in multi-level warehouses. The proposed ownership structure is most similar the municipally owned energy and district heating company Exergi.
17. No
18. Given substantial site improvements, the operation would prefer a long-term lease exceeding 25 years.
19. The operation would provide maritime and logistical employment opportunities. The operation anticipates the introduction of onshore remote operations which would transform conditions for maritime labor and increase recruitment.
20. Vessel operations would require 40 FTE, crane operations another 40FTE and landside operations would require at least 60 FTE.
21. The operation is envisioned to have ownership by marine unions as part of a larger strategy to preserve maritime employment in a port dependent on fossil fuel transport under the City and State climate goals.
22. The operation would establish a Center for Urban Maritime Innovation to partner with local public universities and maritime unions to create a workforce development strategy. Remote operations centralized at BMT would dramatically expand access to employment for residents.
23. The Container Freight Station would attract 518 trucks daily with peak hour of 44. Parking would be provided for half the employees in a 80 space lot. Future expansion of cross Hudson activities serving the Brooklyn Market would occur in other locations to distribute truck traffic across multiple locations.
24. The respondent envisions the Center for Urban Maritime Innovation at BMT as a central part of realizing the potential of the Blue Highway. The Center would identify international innovations with applicability to urban distribution and work with international firms to test and develop them.
25. The operation would own 3 electric feeder vessels of approximately 350 feet in length and 2 post-Panamax floating cranes. The vessels would not need to be berthed at BMT.
26. The operation would utilize containerized batteries for vessel propulsion. They would be handling at ports like regular cargo and slow charged with each vessel requiring only 100kw of capacity. With future expansion, 1MW of electrical service would be required
27. The attached document has extensive discussion of the Blue Highway and BMT vision plan.


December 2025

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## Introduction

On September 9 1932, four hundred railroad managers were invited to inspect the nearly complete Union Inland Terminal #1 - the largest building in New York City (NYC) and the Port Authority of New York's (PANYNJ) solution to urban freight distribution. Then as now, New York was a dense city of small businesses largely lacking the large factories and freight customers. For the first time, then or now, businesses in New York could pick their cargo up in a single location instead of traveling along the crowded waterfront picking up cargo at multiple piers. In the other direction, the smaller shipments from small business could be consolidated into a single railcar dramatically reducing traffic and costs for railroads. The terminal was New York's largest building, fully 20% larger than the Empire State Building and capable of distributing all of the freight in Manhattan from Houston Street to 23rd Street. The terminal was an enormous success – fully leased in the depth of the Great Depression. A year later eight hundred shipping firms were using the terminal to ship outgoing freight and another fifty receiving iinbound freight. Twelve of the city's thirteen railroads used the terminal paying the Port Authority ten cents for every ton of freight handled. (Condit 1981) As the name suggests, PANYNJ envisioned building a numerous other terminals to serve the rest of the region.

The original Blue Highway connected the terminal to world. Only one of these railroads had tracks within a mile. The Hudson River was home to more than 1,800 barges and tugs that could exchange freight from 106 points along the waterfront. A factory in Brooklyn could load a railcar on the ground floor of their loft building, have it floated around the Hudson and delivered anywhere in the North American railroad network from British Columbia to the Yucatan peninsula. In all, the Blue highway delivered more than 83% of New York City's railroad freight. (RPA, 1927)

Five years after the opening, the PANYNJ finished its cross Hudson of tunnels and bridges. For then on,it was assumed that the truck had solved the urban distribution problem. No other terminals were built and the agency's attention shifted to international trade.

Fifteen years after the opening, the PANYNJ sought to unify the region's international trade – leasing both of NYC's major airports. However, the two were unable to agree on a similar arrangement for the city's vast array of piers and waterfront land. What followed was a half century of competitive and uncoordinated investments. Both entities forayed into the other's natural activities resulting in a series of costly failures. NYC embarked on a series of massive investments international trade, first to replace its antiquated piers then building two container terminals. PANYNJ entered into economic development even trying to create a hub for a fleet of fishing vessels.

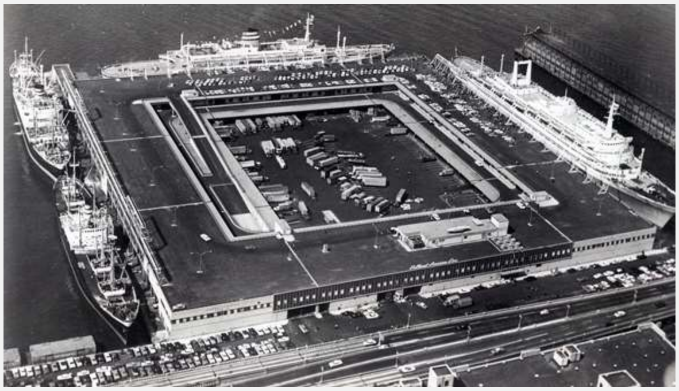
Fifty years after the opening, the first blue highway shut down from a combination of containers, an energy transition away from coal, jet planes and the abolition of a century of subsidies. The residents of New York City were became completely dependent on trucks for a circuitous and costly distribution system. Today, goods often travel 30-50 miles through New Jersey to make the 15 mile trip to New York. All this inefficiency leads to every international product sold in the City New having the equivalent of a 1.6% transportation tax.

Today, the Economic Development Corporation (EDC) is focused on creating a second Blue Highway. After decades of conflict, there is widespread agreement about the delineation of responsibility. The City no longer competes for international trade, while PANYNJ is leaving local distribution and specialized ports with EDC. Unfortunately, the window for success may be short. In the 1970s, marine practices became ossified in response to catastrophic job losses from technological change. While the port no longer handles coal, more than 60% of all vessels travelling in the port carry petroleum and other fuels. Achieving local climate goals will destroy this traffic and the livelihoods of mariners creating a renewed atmosphere of fear and conflict just as the Blue Highway challenges existing practices.

This proposal seeks to build on EDC's focusing on cross Hudson container traffic but provides a long-term strategy to provide all the vehicles on the City's streets the opportunity to use the waterways.

## Failures in the Port of New York

**Pier 40 (1962)**



**NYC Dep of Marine and Aviation**

**Brooklyn Fishport (1984)**


**Port Authority of NY / NJ**


**Oak Point Link**

**New York State / Port Authority**

**Union Terminal 1 (1932)**

**Port of New York Authority**

## The Fall of the First Blue Highway

Despite its enormous scale and importance to the city, the blue highway had two critical vulnerabilities. First, it was subsidized, not by government but by railroad customers. From 1887, rail rates were set by the federal Interstate Commerce Commission (ICC) based on railroads' total operating costs. Despite the additional cost of lighterage, the ICC mandated railroads to offer customers the same prices on both sides of the Hudson River. (Condit, 1981) In this period, customers in New Jersey and the rest of the Nation bore the Hudson River tax.

Second, it was critically dependent on coal traffic. Each resident of New York City used more than 3 tons of coal for all of ther energy heeds - heating, electricity generation, bunkering ships even the manufacturing of gas for industrial and residential uses. In 1914, coal was more than 60% of railroad traffic. Over the next fifty years, each of the direct uses for coal was replaced with oil and interstate natural gas. Energy traffic completely shifted from rail to a series of pipelines.

Historic accidents also played a part. In 1917, the combination of unprecedented ice, snow across the east coast and a railroad network bearly meeting the demands of World War One led to a near cessation of cross-Hudson service. The resulting shortage was so severe, newspapers warned of a "coal famine". (Condit, 1981) In response, the PANYNJ was created to build the Holland Tunell, an all-weather way to cross the Hudson. Within a decade, the George Washington Bridge and Lincoln Tunnel, completed the Port Authority Hudson crossings and trucks could compete with ferries across the Hudson.

**Near shutdown of the Blue Highway in 1917**

Simulaneously, the lighterage system entered a death spiral. Loss of coal traffic led to the merger and eventually the bankruptcy of all but one of the railroads serving the Port. With traffic consolidated, there was no need for interchange railcars shrinking volumes further. The cycles of lower revenue and higher costs reduced the relevance of the Blue Highway and eventually regulatory changes. In 1980, cross-subsidies were eliminated and the remaining services were terminated. Customers east of the Hudson were now dependent on trucks.

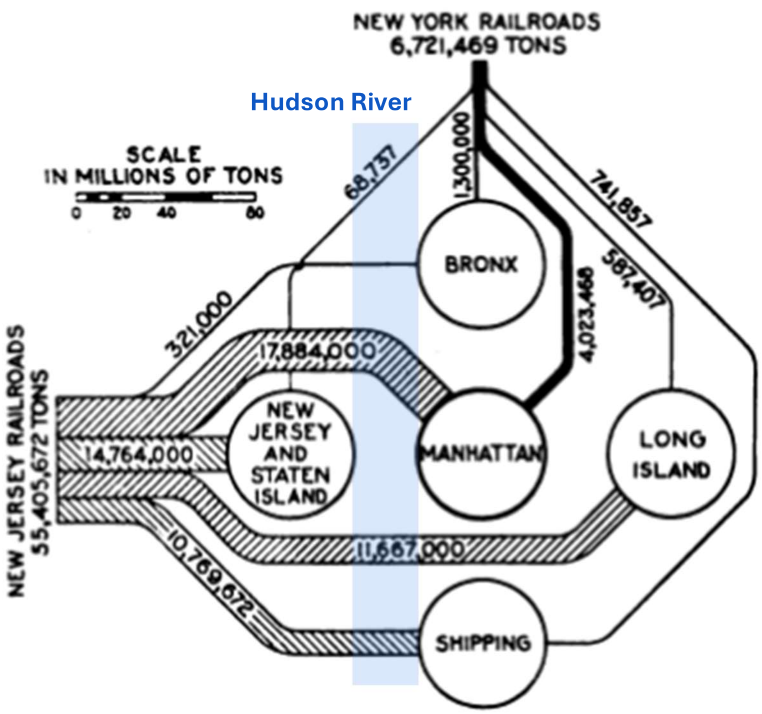
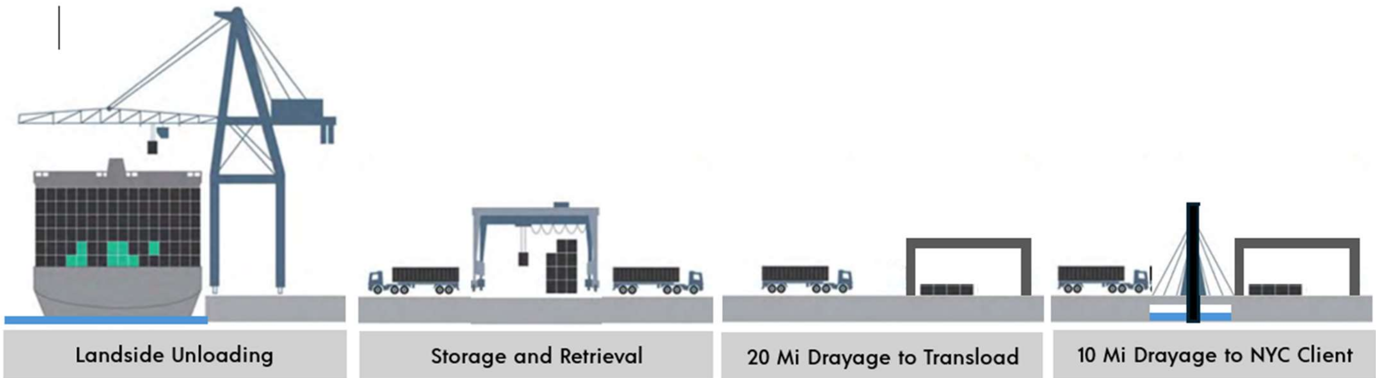




Fig. 47

Diagram Showing Origin and Destination of Railroad Freight, excluding Interchange, Routed to or from Points in the Port District

## The Cross Hudson Tax



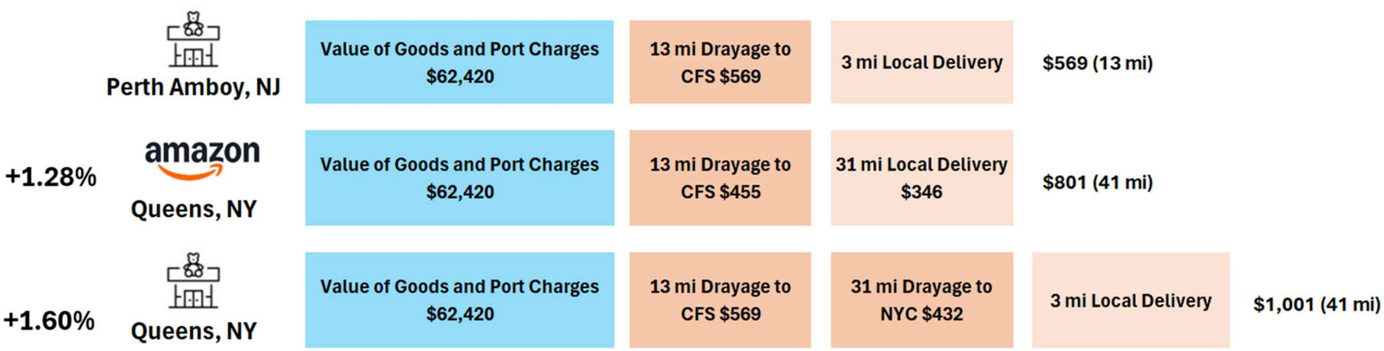

World trade has been transformed by the intermodal container. Containers can travel between 939 ports across the world in at dramatically lower prices in enormous container ships. The average loaded 40' container (FEU or Forty Foot Equivalent) can be transported 11,000 miles halfway across the world from Shanghai to the port of New York for as little as $2,800 though prices can rise to $5,000 at peak times. (VFPA, 2016)

While a railcar could travel across the Hudson river without being lifted, the shift of containerization now requires eight steps for goods to travel from Port to Customer. With few urban customers having the demand or space for a full container of goods, only 4% of the City's international trade comes directly from the port. The remaining 96% incurs an additional another $1,000 in costs. First, the container has to trucked to a Container Freight Station (CFS) - the modern equivalent of Union Terminal #1 to be sorted and combined. With the failure to replicated Terminal #1 in the City, all if this activity takes when in New Jersey. Goods are then loaded on a second truck to a second warehouse in New York City to be separated and transferred to a third truck for local delivery. A single 15 mile trip from the Port has become 30-45 miles of travel with two stops.

In all, this inefficiency adds a 1.60% tax on international goods. The system also puts small firms at a disadvantage. Their competitors like Amazon can avoid an entire step, sending delivery trucks directly from the New Jersey or Staten Island CFS to make local deliveries in New York. While Amazon saves $200 per container, the costs extra traffic congestion and pollution are borne by the public.

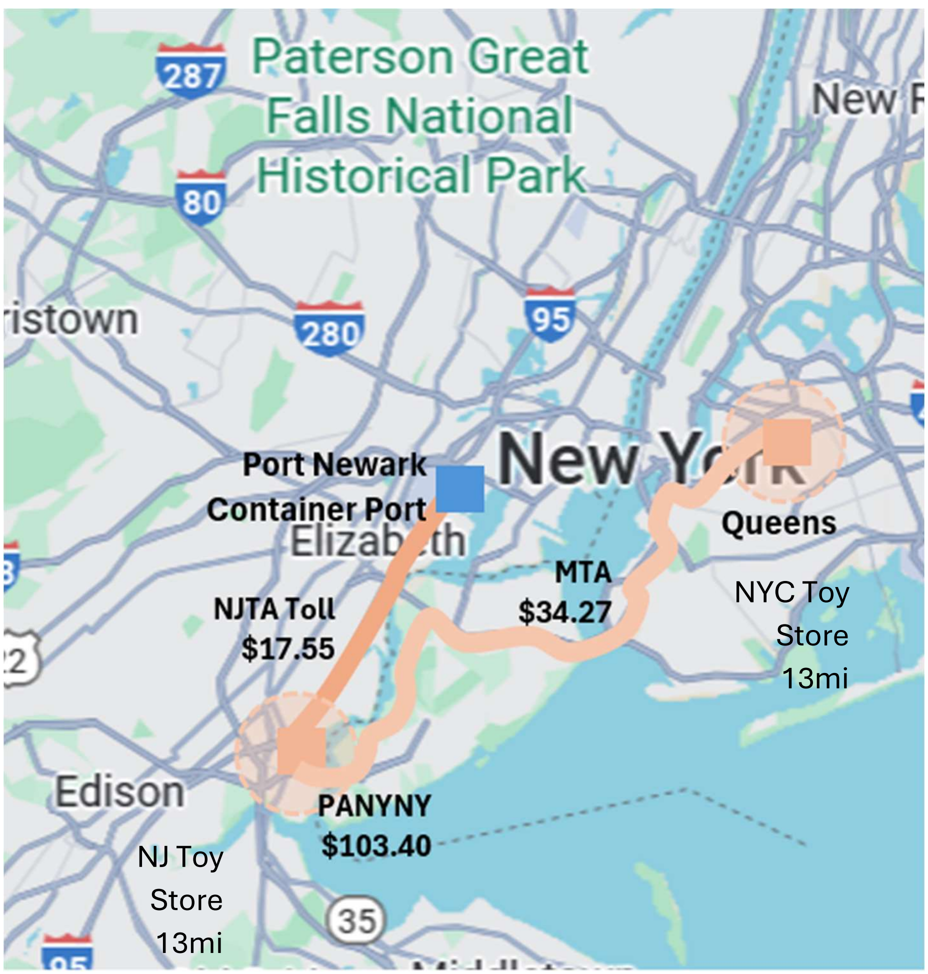
The current system is also inefficient within the container port itself. Since 1974, the number of containers -measured in the original twenty foot equivalent unit (TEU) - has increased eight-fold rising from 583,000 in 1974 to 4.8m in 2024. (FRBNY, 1978). At the same time, the number of shipping lines entering the Port has fallen from 125 to 3 massive global alliances. Direct trips between ports have been replaced by loops serving a string of ports, largely in weekly services. (IJBA, 2015)These changes benefit global shippers but place additional demand on urban distribution, Terminals typically need to store up to seven days of containers, (PPFSWG, 2016). To do so on limited land, they have responded by stacking containers higher adding inefficiencies. 30-60% of the time a container is moved the move is unproductive reshuffling to get access to the specific one required by a customer. (BoxBay, 2025) As this work is done, drayage trucks are left waiting, typically 45 minutes but up to two hours in peak times. (McKinsey, 2016)

**The Cross Hudson Tax**

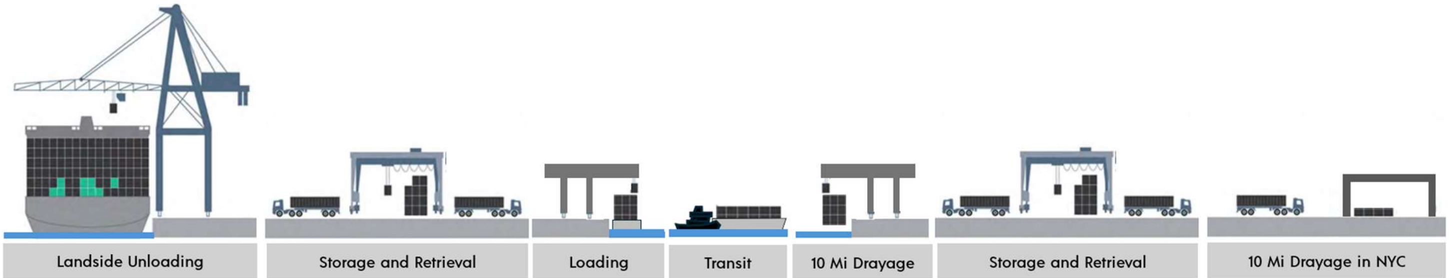



Sources: VFPA,PANYNJ, MTA, ATR

**The path from Port to Customer**



# Blue Highway 2.0




Storage was also a challenge for the original Blue Highway. Unable to stack the 69,540 railcars needed at seasonal peaks, railroads built more than 3,000 acres of railyards surrounding the Port. (Condit, 1981). Today, this shoreline is unrecognizable – completely replaced with parks new development. However, what little water traffic that remains looks identical to the 1920s – tugs and barges transporting fuel, waste and containers are almost identical.

As a result, goods are loaded and unloaded eight times – (1) unloading by pierside crane, (2) loading on to a terminal tractor, (3) unloading for storage, (4) loading onto a second terminal tractor (5) unloading at the gate, (6) loading on a chassis, (7) transport by truck to a transload facility for repackaging, (8) transport by a second truck across the Hudson River to New York City. (PANYNJ, 2019)

The complexity of the current process have defeated attempts to raise productivity in urban distribution. Even automation in global ports without New York's history of labor relations can only reduce costs by 20%. (McKinsey 2011). This proposal recognizes that only way to reduce a step's costs by 100% is by eliminating it. For twenty years, PANYNJ has tried the opposite approach adding more steps. Focused on its storage problem and the congestion, accidents, pavement replacement and pollution caused by truck travel, PANYNJ has proposed the Inland Port Distribution Network (IPDN) to replace trucks with container barges for traffic for New England and the Mid-Atlantic. (Rodrigue, 2024)

The speed and handling costs of container barges are uncompetitive on a commercial basis. As a result, the IPDN consists of a single barge from Red Hook to New Jersey subsidized by PANYNJ. Beyond its own facilities, PANYNJ funded a pilot service to Albany but New York State refused to provide long-term subsidies and the service closed after two years. Barge service to Connecticut and Rhode Island was studied but never implemented because PANYNJ and Connecticut were unable to allocate the need for subsidies. (CDOT, 2001)

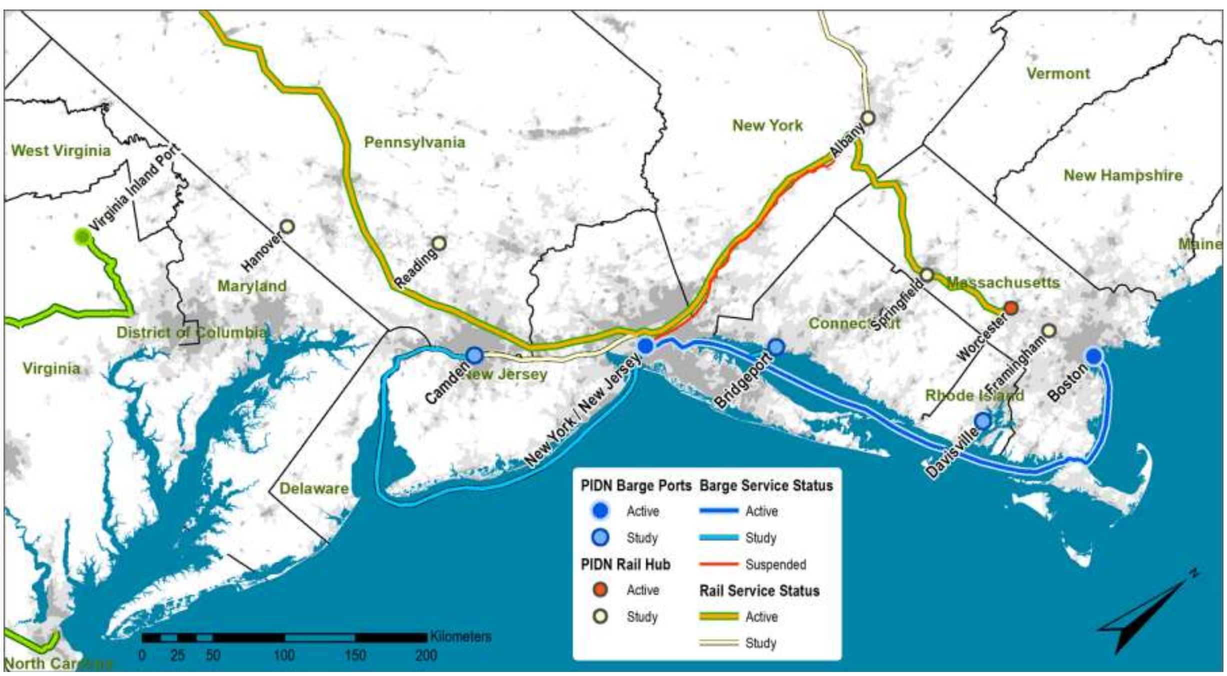
Creating a sustainable blue highway requires a system that can operated without subsidies. If started, any container barge service is vulnerable to changes in public priorities. While public investments in infrastructure like wharves are permanent, but subsidizing the inefficient practices of operators leaves customers vulnerable to political changes. This proposal envisions fully covering its operating costs by (1) halving the number of steps required to cross the Hudson and (2) creating modern versions of Terminal #1 to put the city's freight customers on a even playing field with both Amazon and New Jersey.

### Cost of Blue Highway Alternatives with Time Penalty

| Hunts Point to 37st (East Midtown) | | | | | |
|---|---|---|---|---|---|
| | Dist Mi | Speed mph | $2007/Hr Total | Fuel | Op Cost $/Veh |
| Truck (Offpeak, Peak) | 8.7 | 26-17 | $ 45 | | $15-$22 |
| Truck Barge | 7.3 | 10 | $ 400 | $ 350 | $ 13 |
| Medium Speed Truck Ferry | 7.3 | 17 | $ 880 | $ 300 | $ 29 |
| Fast Truck Ferry | 7.3 | 29 | $ 2,380 | $ 1,500 | $ 79 |
| | Time (min) Total | Travel | Penalty (Peak) Min | $/Veh | Total Cost |
| Truck | 20-30 | 20-30 | - | $ - | $ 22 |
| Truck Barge | 72 | 42 | 42 | $ 42 | $ 55 |
| Medium Truck Ferry | 55 | 25 | 25 | $ 25 | $ 54 |
| Fast Truck Ferry | 45 | 15 | 15 | $ 15 | $ 94 |

Source: (NYMTC 2007)

### PANYNJ Inland Port Distribution Network



## Blue Highway 2.1

In some ways, the Blue Highway's vision from EDC is the expansion of the IPDN to urban distribution. The vast majority of freight, construction materials, solid waste and liquids continue to travel by barge. Public investment is dedicated to municipally owned specialized port facilities.

In other ways, the plan is a radical break with history - truly a blue highway. Like terrestrial highways, multiple users with different vehicles, speeds, cargo and destinations share a single route. EDC also has the entrepreneurial energy to enter into operations as well as infrastructure. Over the next five years, micromobility pilot projects may promote entirely new forms of freight transportation. For a decade and half, EDC has been a maritime operator – building NYCFerry the first municipally owned citywide ferry in the city's history. By itself, NYCFerry increased the region's maritime employment by 4% (Census 2025).

Unfortunately, the skills and creativity of the marine industry in the United States have stagnated for a century under federal policy. (CRS, 2019) The Jones Act requires all vessels used for domestic freight to be crewed by Americans making coastwise transportation uncompetitive. The Act also protects US shipyards from foreign competition, as result, the costs to build and crew domestic ships is three times international rates. (NASSCO, 2009) Lastly, the Coast Guard allows reduced crew sizes for tugboats discouraging the development of new forms of freight vessels.

Elsewhere in the world, the situation is very different. Across the globe, there is a thriving industry serving the medium distances comparable to the US east coast. Europe's river and protected waters have a thriving regional distribution system from their container ports. Vessel innovation continues with electric propulsion and experiments in remote operation. All of the benefits of reduced pollution as well increased productivity and attractiveness of maritime labor can be brought to urban distribution

In Asia, the consolidation of marine traffic into massive transshipment centers has led to planning for ports ten times the size of New York's. (MPA Singapore, 2025. Here advances in automation allow for container handling at massive densities. Again, these technologies can be transferred to New York and modified in size for the urban context.

This proposal transfers and adapts these technologies to the challenges of urban waterborne distribution. At the same time, recognizing that stakeholders are as much, if not more, responsible for success, a new system of maritime municipal enterprise is envisioned. The proposal seeks to combine EDC's efforts to move from passive infrastructure provision to actively investing in users with innovative international practices in governance. This first half of the proposal focuses on mature technologies and the less challenging problems of container traffic to cut the Hudson tax in half. Three international innovations are combined.

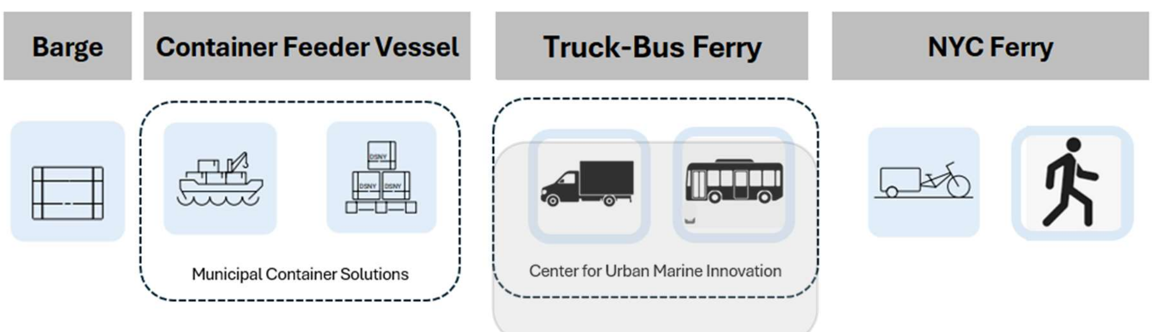
- Water: New cranes and vessels capable of the fast and direct transfer of container cargo to urban destinations
- Land: Automated terminals and container freight stations to consolidate small shipments
- Stakeholders: Joint ownership to engage all stakeholders and maximize public returns.

Fully achieving the vision of the Blue Highway requires new vessels with the speed and capacity to shift local traffic from the streets and highways. Time is much more important for trips measured in hours or minutes than for container trips measured in weeks or literal garbage. Competitive timing doesn't require faster cruising speed than today's NYCFerry but requires reducing the time each stop. The half an hour to load and unload vehicles keeps the City's highway vehicles from joining containers on the water.

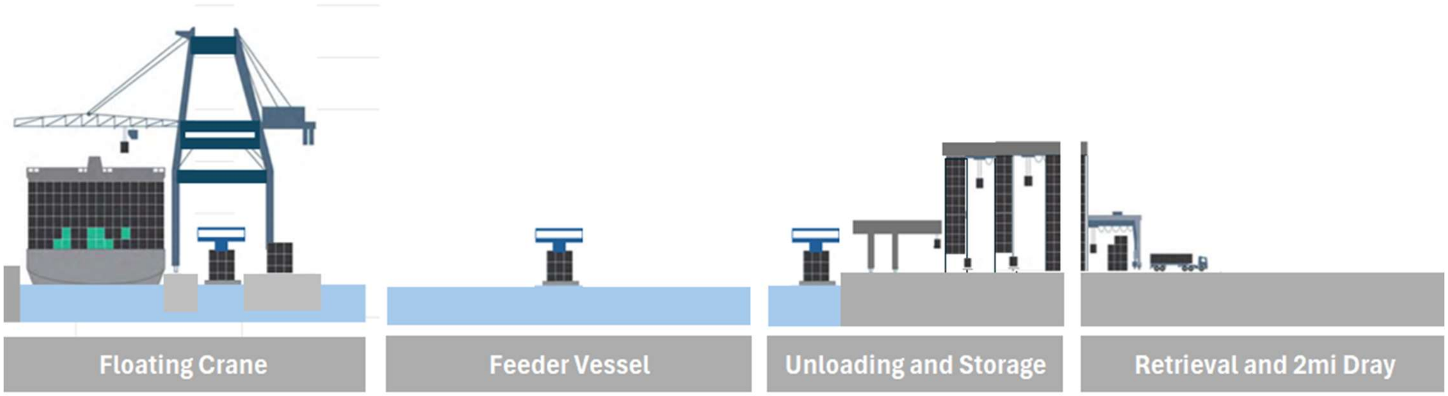
A Center for Urban Marine Innovation is envisioned that builds upon EDC's Waterfront Navigator by providing foreign innovators one-stop for testing and developing their products in New York's waters. The limited maritime market in the US keeps international firms from developing expertise in US regulations and conditions. Working with universities, marine labor and operators and New York's growing climate incubators, the Center will investigate, invite and integrate new technologies with application to urban transportation and distribution. Ultimately, the Center seeks to develop the local expertise for returning New York as global hub for maritime research and development.

## Blue Highway 2.0


## Blue Highway 2.1




# Waterside Innovations




The proposal radically reduces the number of steps to transport containers to New York City. First, containers avoid New Jersey all together by transferring to electric feeder vessels from a floating crane. Second, terminals are designed without the need for yard hustlers. Small urban sites allow containers to travel autonomously from berth to storage to Container Freight Station without direct human intervention.

## Floating Container Crane

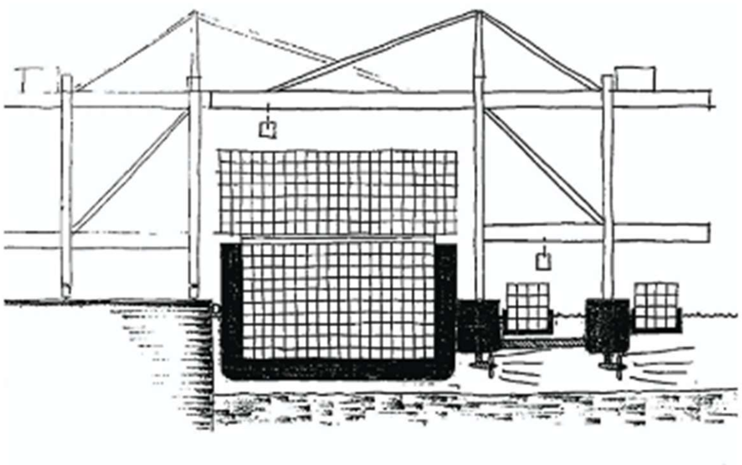
An obvious solution to the growing size of container ships is to place cranes on either side of the container ship. A series of papers from Hans Litgeringen at Delft University from 2004 to 2008 have analyzed the financial and operational feasibility of using floating cranes on the water-side container vessel to load containers directly on to feeder vessels. A floating crane could handle up 25 lifts per hour – raising berth productivity by almost 30%. (B.A. Pilage, 2008).

**Mid-Stream Operation in Hong Kong**

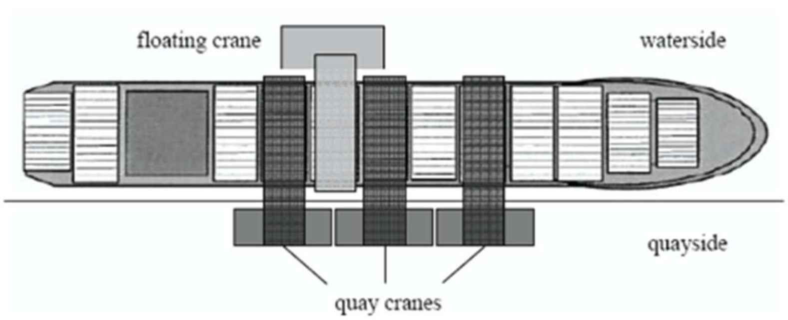
While floating container cranes this size have not been built, floating ship-borne cranes play a significant role in Hong Kong's container operations, transferring 30% of all containers in a process called Mid-Steam Operation (MSO). The practice peaked before dedicated container terminals were constructed. Even after terminals became operational, there was a strong financial incentive since handling fees for MSO are about 40-60% cheaper than traditional container terminals (Tang). By the 1990's, Hong Kong had about 200 lighters designed to handle containers with the help of single derrick cranes. Multiple lighters the size of DSNY's waste barges could handle a 3,500 TEU container vessel within a day.

One major concern addressed by the Delft study was whether floating cranes could be integrated in the current logistic process. If vessel stowage plans remained unchanged, containers bound for the feeder would be randomly scattered throughout the bays and many of the lifts by the floating crane would be unproductive. Unlike the major Dutch ports, the Port of New York is not a major transshipment location and primarily serves local traffic. Typically one-third all containers on a North Atlantic vessel are destined for New York, it is likely that minor stowage changes would enable the efficient clustering of containers for the floating crane. Inevitably, the floating crane would encounter containers destined for another port but these could be stored on the floating crane itself then reloaded when space becomes available.

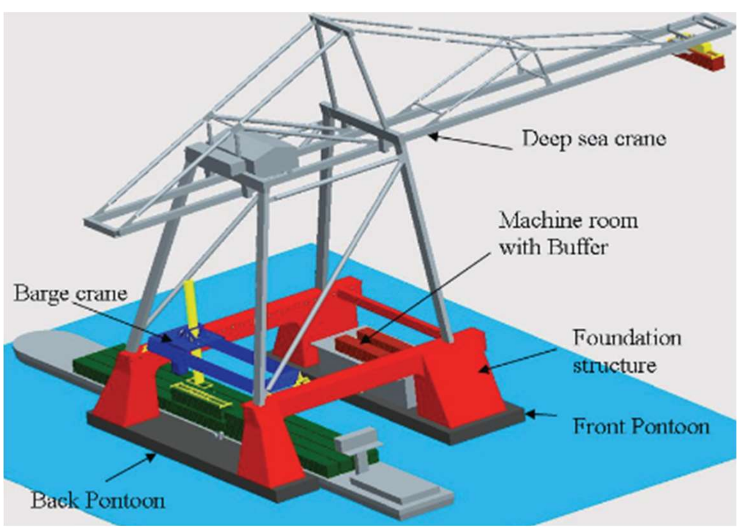
**Floating Crane Cross Section**



**Floating Cane Layout**




Floating Crane Elements



## Electric Feeder Vessel

Another European Innovation is the electric feeder vessel which allows inland distribution of containers from ocean ports along the rivers. The Port of Antwerp has allocated grants to a Dutch company Port-Liner to develop small ships 110m long and 11.4m wide to travel between the Duisburg and the ports of Rotterdam, Amsterdam and Antwerp with a capacity of 270 containers. The vessels are propelled by battery drive electric motors which eliminate the 60% energy loss in traditional marine diesel engines as well as providing 8% more loading space with the elimination of a traditional engine room

New York's sheltered waters enable the proposed feeder vessel can have a nearly identical design. The vessel is the same size as New York's sludge vessels and its low profile allows operation along the Newton Creek without lifting the Pulaski Bridge. The only minor change is an increase in propulsive power to enable 15kt speeds required to navigate the tidal fluxes in the East River and Hell Gate.

The 5MW batteries are swapped upon arrival at the container terminal using the same equipment as the cargo. Each ship has 4 battery containers on board which enable the vessel to sail for 35 hours before exchanging batteries. Swapping batteries allows them to be charged slowly at terminal facilities. Slow charging reduces the peak power requirements for electric charging which was identified as a substantial capital cost the most recent study of electrifying city-owned ferries (NYC, 2022)

Municipal enterprise further reduces energy costs by using low-cost power from the New York Power Authority (NYPA). . Even with the increase in efficiency from 60% to 95% by electrifying, the price of industrial electricity distributed through Con Edison's system is 50% more than the recent peak in diesel fuel. However, a public owned company would have access to the New York Power Authority - the largest state-owned electricity company in the United States with 80% of its generation coming from the large hydroelectric dams at Niagara Falls with NYPA power, electricity is cost competitive even with the lowest diesel prices in recent history.

| | Electricity | | Diesel | |
|---|---|---|---|---|
| | Con Ed | NYPA | Low | High |
| Diesel Cost ($/gal) | | | $ 2.50 | $ 3.50 |
| Electricity Cost ($/wh) | $ 0.211 | $ 0.086 | | |
| Gross Energy Cost ($/mmbtu) | $ 61.59 | $ 25.14 | $ 18.12 | $ 25.36 |
| Propulsion Efficiency | 95% | 95% | 60% | 60% |
| **Useful Energty Cost ($/mmbtu)** | **$ 64.83** | **$ 26.46** | **$ 30.19** | **$ 42.27** |

**Comparison of Energy Costs**

The feeder vessels will also be equipped to transition to remote operation. For three years while regulators grow comfortable with remote operation crews will remain on board. Gradually crew members will move to remote operation. Once complete, the savings in travel time will allow three-shift operation, adding a new round trip for each vessel – increasing capacity by 50%.

**Electric Container Feeder Vessel**


**Swapable Battery Container**

**NYC DEP Sludge Boat**

## Remote Operation

The Feeder Vessels should be equipped for remote operation, and the Brooklyn Marine Terminal should be the location of the nation's first Remote Operating Center (ROC). The ROC will house qualified personnel monitoring or controlling vessels in the harbor remotely using remote workstations. Remote operations provide a significant number of benefits.

Remote operation increases safety by improving situational awareness and reducing risk of human error. Maritime careers on shore without extended time away can increase recruitment and ease shortages of maritime. Build costs can be reduced as fewer crew onboard simplify ship design. Lastly, remote operation increases the productivity of existing employees by eliminating travel time. The entire Port of New York is dependent on only 65 pilots to guide ships in and out the harbor. With half their time spent travelling to and from vessels at the harbor's entrance, each pilot can service only 4 boats a week.

The Yara Birkelano - the world's first electric, autonomous container ship was placed in service in 2022 by Kongsberg Maritime. The ship is monitored from a land-based control center and operates with minimal crew on an 11 km route to transport fertilizer replacing 40,000 truck trips per year.

During initial operations, the ship required a crew of 3 on board. In 2024, Kongsberg received approval to transfer the role of the Chief Engineer from ship to the ROC. The current testing sees one Chief Engineer monitor and control systems from the ROC including the power, ballast and deck machinery across three vessels, rather than one. In three years of operations, no significant issues for full autonomous operation have been identified.

The Center envisions a similar process of testing in New York. Container distribution service would begin with crewed electric vessels. During testing, the ROC would shadow and monitor crew members for training and generating the operational data required for regulatory approval. Over time, vessels would evolve into fully autonomous operation. First, individual crew members' functions would be transferred to the ROC. Later as operations are routinized and automated, ROC staff would monitor multiple vessels, switching back to remote control in emergencies or other situations.

Remote operation could offer substantial benefits for marine labor if the financial benefits are shared. The ILA captured 15% of the value from containerization. A similar share of tripling productivity through automating routine tasks could raise salaries 50% for work that was more convenient and less arduous. An even better outcome would be tripling the marine traffic on the Blue Highway resulting in no job losses at all. Suspicion and fear of union-busting makes such a win-win outcome less likely under commercial ownership. Even If Blue Highway is a new addition to the Prot creating jobs that would otherwise not exist, unions are unlikely to agree to dramatic changes in productivity for fear that these concessions will form the basis of the next round of negotiations for current operations. Municipal ownership with marine union participation eliminates the concern since work rules negotiated as joint owners have no relevance to those negotiated as employees.

While not mature technology, Kongsberg is also experimented with autonomous mooring systems that can use existing lines caught by a seven-axis robotic arm.

**Yara Birkelano**

**Kongsberg Remote Operations Centre**


**Kongsberg Automated Mooring Prototype.**

# Landside Innovations

One of the most promising technological developments for urban distribution in the past five years has been the testing and imminent commercial operation of Automated Storage and Retrieval Systems (ASRS). So far, the scale of these systems is enormous – London is developing one with the volume of one and half World Trade Towers. Reduced in size, this technology allows for and compact urban container terminals. ASRS systems can quintuple storage density by stacking containers up to 16 tiers high and eliminating the need for vehicle circulation between stacks. Each container can be accessed independently without the need for reshuffling - eliminating the long queues of idling trucks that characterize container ports today. So far, ASRS have been deployed in massive uninhabited container ports, but they have the potential to dramatically reduce the environmental impacts of urban container activities. They can be clad in a variety of surface for better aesthetics and noise reductions. Operations also don't require the glaring lighting of today's port, or any lights for that manner.

### Automated storage and Retrieval System

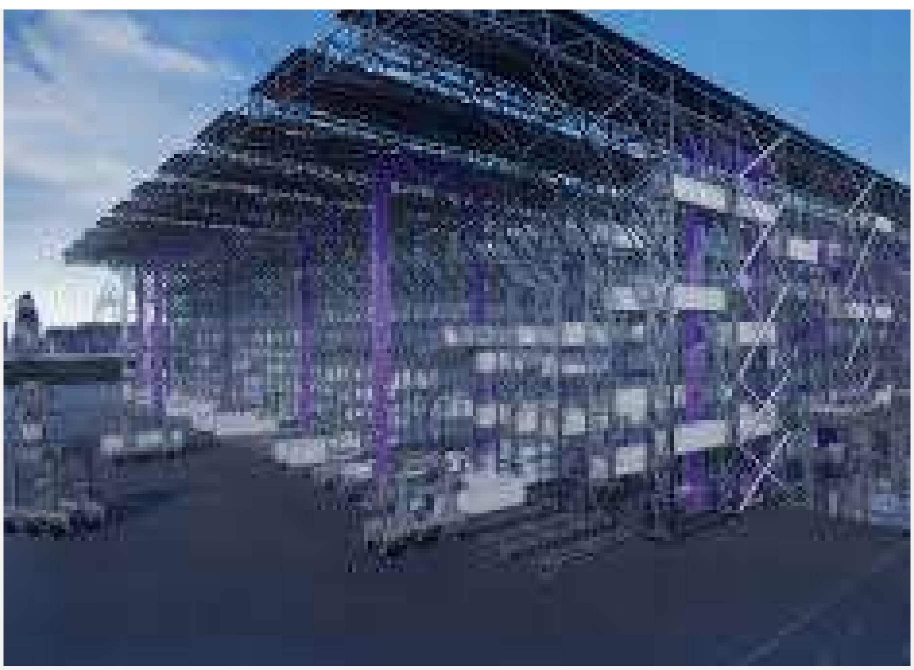
The ASRS is the culmination of fifty years of storing containers in taller stacks and enables 9x the storage density – three times as many containers on one third of the land. A pilot project has been operating at the Port of Jebel Ali since 2021, and work is starting on a 27,000 TEU storage system in the UK – capable of storing two days of all the container traffic in and out of New York City. In the ASRS, each container is stored in its own rack cell, and a completely automated Storage and Retrieval System (SRM) crane allows for direct access to any container without needing to move others. Eliminating the need to shuffle containers can double the equipment's' productivity.

Because the system is automated in both storage and retrieval, ASRS eliminates two-thirds of ILA labor needed at a terminal. (BoxBay, 2025). In addition, waiting time for trucks is reduced by 20%, saving customers an additional $45/FEU in drayage. (ATRI, 2024)

Today's ASRS were developed to solve the problems of mega container hubs and require modifications in urban areas. A pending installation at London Gateway has 40 loading cranes for outgoing trucks and port shuttles delivering containers from multiple berths. To provide these transfer points, Containers enter the BOXBAY system through automated tracked skids below the quay surface. An Urban ASRS only serves a single berth and can utilize a simpler surface system. By keeping paths open among the container the first level and locating the ASRS immediately adjacent to the crane, containers can be directly loaded onto automated shuttles that travel through the ASRS. Without any fixed elements, the full width of the berth can be used for other purposes between feeder vessel calls.

Lastly, ASRS virtually eliminates two of the largest environmental problem with urban port – light and noise. The automated ASRS do not need illumination and the position of the stored containers between the vessel, cranes, gantries and adjacent neighborhoods blocks most the sound from port operations.

**Proposed Traditional Storage at Hunts Marine Terminal**



**Automated Storage and Retrieval System at DP London Gateway**

## Urban Container Freight Stations

Now that containers have replaced boxcars, today's Union Terminal #1 is the Container Freight Station (CFS). Used for both international and domestic freight, CFS operate on the cross-dock process. Loads from larger trucks enter docks on one side. Loads are separated and sorted in the middle then transferred to smaller trucks at docks on the other side.  Only suburban locations have the cheap land that these enormous warehouses need for trucks and storage. In the Port Authority's absence nearly all CFS are located in New Jersey.

ASRS radically changes the situation enabling small distribution terminals in urban areas. Instead of the long and expense detour across the Hudson, small importers can send their own delivery trucks to an Urban CFS to receive their shipments. Exporters can use their trucks to drop shipments at the small, urban CFS instead of hiring specialized drayage firms to wait at the gates of Container Ports.

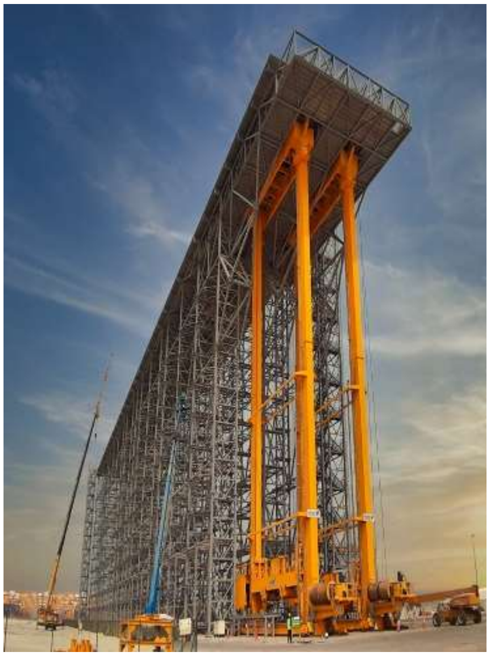
With ASRS delivering containers directly to the handling floor, there is no need for half the trucks at the urban CFS. Eliminating their circulation already reduces the size of an urban CFS by one-quarter. The circulation on the other side is reduced to the bare minimum since containers can be immediately retrieved on demand, eliminating the need for truck waiting areas.

The ASRS itself serves as the storage for the CFS. A 400 FEU ASRS holds the same cargo as a 150,000-sf warehouse. In a multi-berth transshipment port, containers are always arriving and the entire length of the ASRS is used. In a single-berth urban port, SRM operations can change from a 75%/25% port/CFS split when a feeder ship is calling then operate 100% as CFS between ships. In addition, the SRM's productivity can be tripled by concentrating each activity at one end of the ASRS. If the 25% of the ASRS closest to the CFS is used to load and unload the container's contents, the travel distance is reduced by two-thirds and the capacity triples. By locating the ASRS next to the berth and using the first tier of containers shuttle container directly, the center of ASRS activity can follow the cranes unloading the feeder vessel, increasing capacity as well.

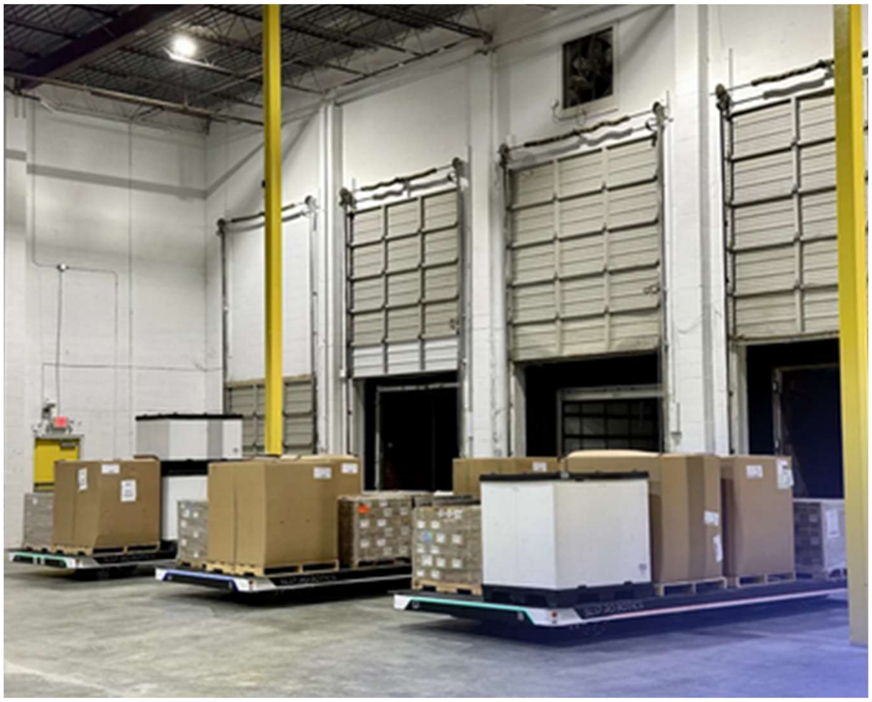
Lastly, advances in automation can reduce the 23% of workday that truckers spend idling at a dock waiting for forklift operators to load and unload their cargo. Automated pallet systems, like those developed by Slip Robotics, can increase the speed of driving by 10x, enabling the loading and unloading of a truck in just 5 minutes while increasing safety. As a result, the productivity of warehouse space increases by a factor of 4.

All these innovations build on each other in a productive cycle, each increasing the capacity and reducing the land requirements by permitting the next to do the same.  No port has put them together but once they are a future of small urban freight stations is a possibility.

Prototype Automated Storage and Retrieval System



Automated Pallet Shuttle



# Institutional Solutions

## The Timeline Problem

Traditionally, public agencies have seen their role solely as providers of infrastructure. This emphasis on long-term investment coupled with the slow process of planning and financing infrastructure projects is unfortunate in eras with technological change.

A year after the first container ship arrived in New York, the City began construction of the largest and last pier in the Port – Pier 40. As shipping lines took advantage of the lower handling costs of containers, the Holland America ended shipping operations only twelve years into a 20-year lease.

New York State and PANYNJ spent almost twenty years on the Oak Point Link, raising bridges and constructing waterfront rail lines to bring intermodal rail to New York City. By the time the project was complete, changing railroad practices made the clearances obsolete and the only user is municipal solid waste.

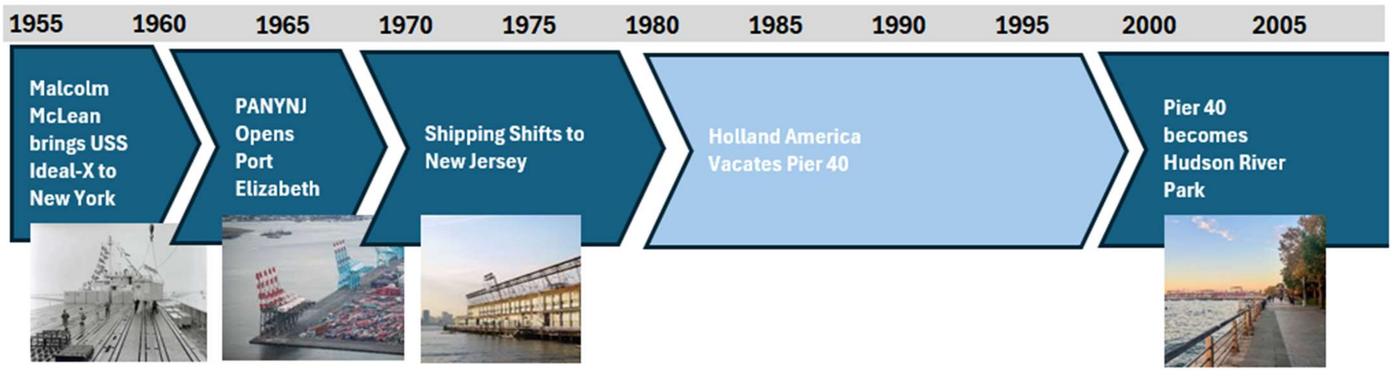
While operations in the Port have remained unchanged for the past half century, the coming decades will see numerous transformations that require more nimble public agencies. In addition to energy transitions, automation of both vessel and port operations is moving quickly. By 2050, market participants expect that 50-100% of water traffic will operate under autonomous or remote control.

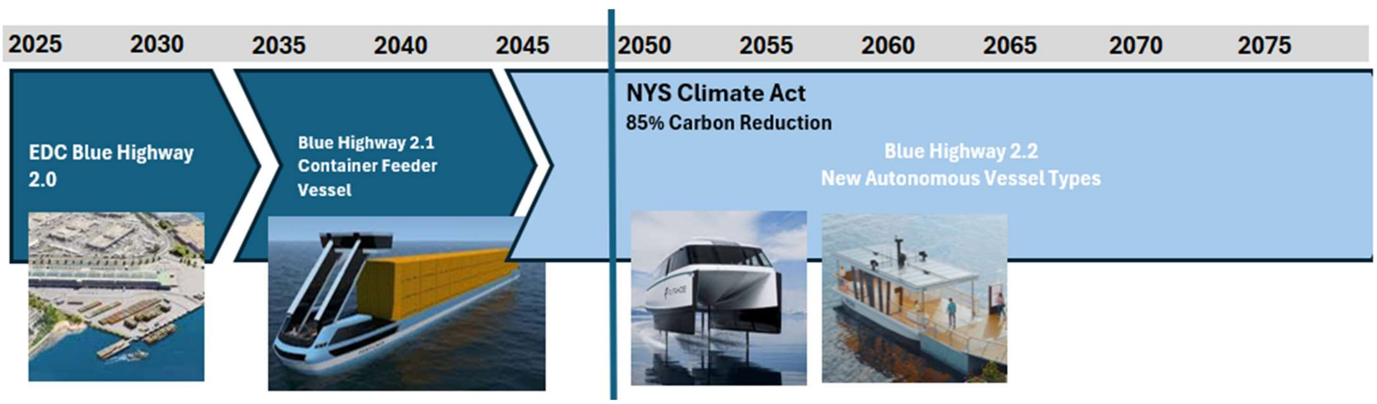
Today we are as far away from these foreseeable transitions as the City was constructing Pier 40. To avoid the same mistakes and decades of wasted investment in vacant ports, EDC must remain abreast of changes abroad. Micromonbility pilots are a start, but EDC needs to enter into commercial distribution. Entrepreneurs like Macolm McLean and Authur Imperatore have always been the source of disruptive innovations in the port. As an active commercial participants, EDC can better understand, financial benefit and ameliorate the disruptions from change. With EDC's Catalyst Fund and extensive waterfront land holdings it has the resources to do so.

Municipal ownership with union participation is likely the only way to move from today's conflict to a more productive relationship between marine unions and terminals. The conditions that allowed labor to weather the last transition no longer exist. Longshoremen benefited from the growing international trade that gave shippers and terminals the revenue to guarantee ILA incomes. The situation was very different for the railroad workers involved in lighterage. Instead of growing, their industry disappeared, but unique among industries, the Railroad Retirement Fund pools contributions from all railroads enabled lighterage workers to receive their pensions. The nationalization of the region's railroads into Conrail and $4 billion in federal subsidies enabled employment buyouts to wind down the lighterage system. Neither solution exists today. If the Blue Highway is to be fully realized and New York to rise to international norms, EDC and other local resources will have to fund it.

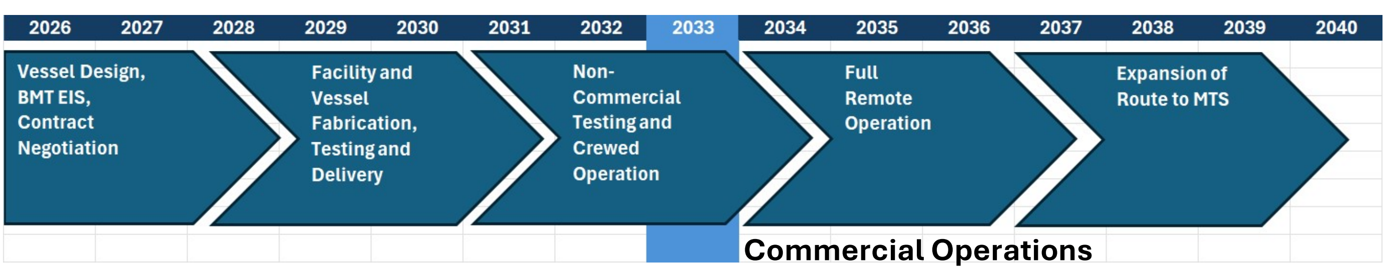
Aware of the pending dislocations from the energy transition, the proposal seeks to begin commercial operations by 2033 and transition to remote operation by 2036. Remote operation will enable the initial assets and staff to expand operations so municipal solid waste traffic can be added in 2037-8 as contracts expire.

## Long Term Transitions in the Port of New York




## Proposed Operational Timeline



## The Financing Problem

As a provider of infrastructure, the City has had a long tradition of public-private partnership. The original subway system was the result of a partnership with two private companies. For long-term investments participants negotiate long leases and parternships, in the recent case of Montreal, 99 years. Such arrangements are costly for the public, the government of Quebec receives less than 2% of the investment returns, despite contributing 30% of the equity.

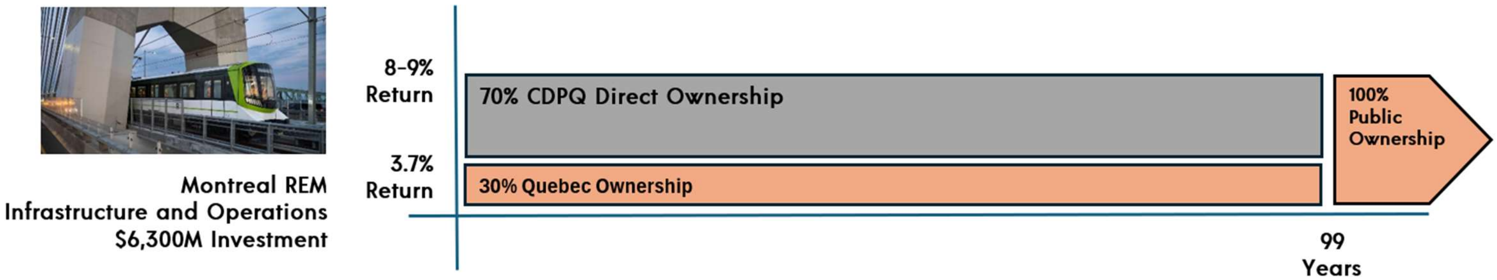
Such arrangements are no longer necessary, especially for operating business. There are now multiple sources of investment with different combinations of return and length. Investors seek to hold investments for as short a time as possible to reach their returns. (America 2050, 2008) Venture funds invest in start-ups then pass the torch in Initial Private Offerings to Special Purpose Acquisitions Funds (SPAC) which finance the steps to Initial Public Offerings. Even infrastructure has dedicated funds with shorter lifetimes, typically only a decade.

At the same time, direct municipal operation has also been problematic. Most new municipal operations are the result of the failure of commercial business. Governments acquire not only the vital assets but vested interests and conflicts that contributed to bankruptcies. Typically, the result is inertia and stagnation with rising costs. For eighty years, New York's Metropolitan Transportation Authority has acquired failing rapid transit, bus and commuter rail operations but operates them as a bankruptcy trustee keeping changes to a minimum and failing to integrate operating companies. Until last year's network redesign, buses across New York had routes unchanged from streetcars ending at the site of maintenance facilities closed for decades. The City's subways are the last major system to operate with two-person crews, and the commuter railroads can't even agree on the spelling of the world railroad.

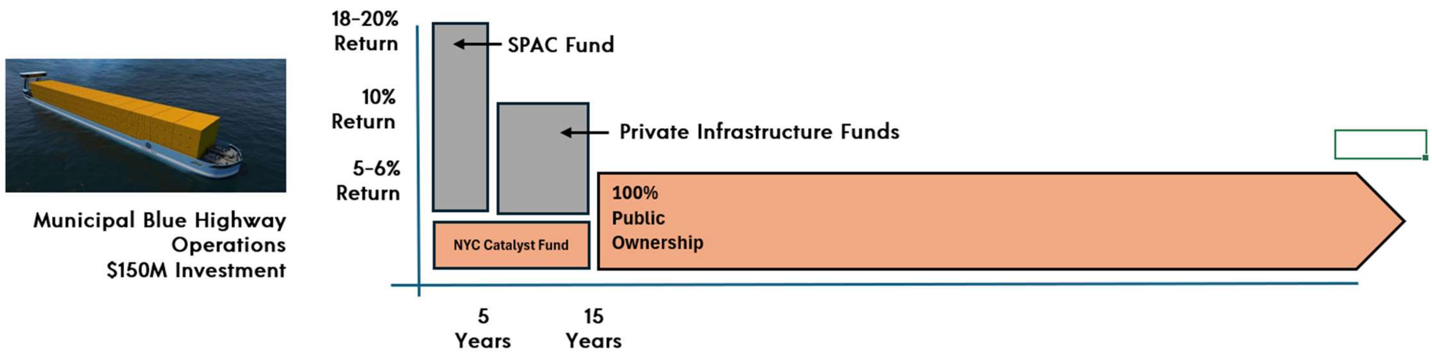
In contrast, many global cities have created new models of municipal enterprise with direct public ownership of publicly traded urban corporations. (Brookings, 2017) This approach combines market discipline with the benefits of public direction and legitimacy. Stockholm's district heating company Exergi provided electricity, heating, cooling ans waste services to 800,000 residents. It has a 50/50 ownership structure between the City of Stockholm, and a consortium of European investors called Ankhiale, which includes APG, PGGM, Alecta, Keva, and AXA IM Alts. This joint ownership, managed through a consortium agreement, gives neither party full control, balancing public and private investment. (Exergi, 2025) The Copenhagen City and Port Corporation is another model, owned 55/45 by Copenhagen and the Danish government, the publicly owned corporation commercially manages waterfront land contributed by its public owners. (Brookings, 2017)

This proposal envisages series of steps to eventual public ownership. EDC's catalyst fund joins with early stage investors during the initial period of high risk. Regulatory, design and operational challenges have yet to be identified let alone overcome. Once commercial operations have begun, these expensive investors can be replaced in an initial private offering to longer-term infrastructure funds, willing to accept revenue risks. Once operations can secure public debt, an initial public offering provides lower cost capital and daily monitoring by the market.

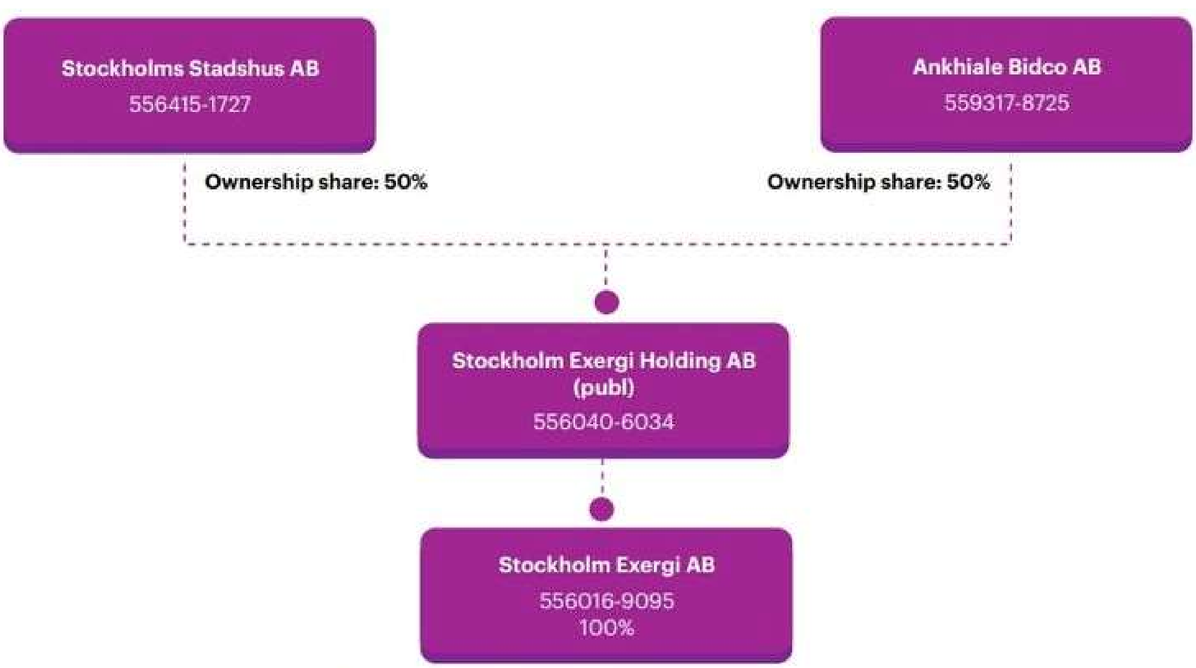
## Traditional Public-Private Transaction




## sMunicipal Enterprise




## Ownership Structure of Exergi



## Market Size

We do not envision any immediate market for less-than-container traffic. Typical ferry cruising speeds of 12-15 mph are barely competitive with congested streets but the 30 minute time penalty in loading and unloading makes water uncompetitive. Overcoming this penalty by doubling cruising speeds to match road is unrealistic - 25 mph speeds quintuples fuel consumption in conventional vessels. (NYMTC 2003) On the other hand, there is a substantial and predictable Cross Hudson market for container traffic. There is an initial opportunity to divert international freight destined for PANYNJ facilities from truck to water. A decade away there is a second opportunity to expand by capturing the market for containerized waste travelling across the harbor.

### International Containers

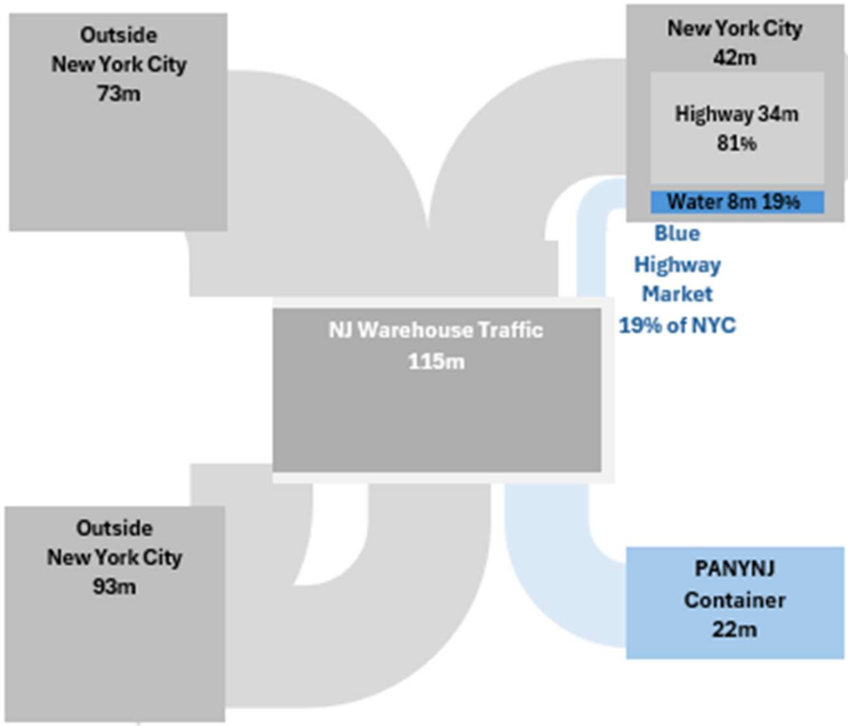
Today, the New York Region receives 4.8m containers (FEU) of international containers – 80% directly across the Atlantic Ocean and another 20% that cross the Pacific Ocean but arrive by rail. In 1936, PANYNJ's predecessor investigated constructing an electrified rail tunnel across New York Bay to carry almost 3,000 railcars a day (Port of New York Authority, 1936) In 2005, the tunnel was studied again to identify the need for a Cross-Harbor Freight Tunnel. While the majority of Cross Hudson containers used to travel to Manhattan, nearly all of Manhattan's warehouse space has been converted to residential and commercial uses and containers now travel to warehouses in the Outer Boroughs. Roughly two-thirds of container freight is headed to Brooklyn and Queens with the remaining third going to the Bronx. (PANYNJ 2008). In 2008, a PANYNJ study found that 528 FEU crossed the Hudson daily. (PANYNJ, 2008)

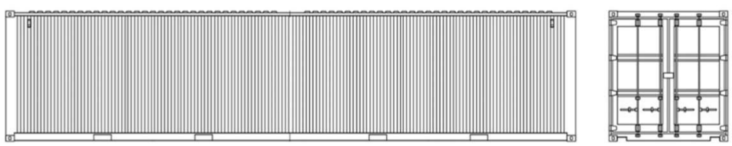
The forecast for the Proposal has used very conservative assumptions from PANYNJ's 2008 Base Case. The forecast also uses conservative assumptions for the traffic induced by the Proposal's reduction in costs. Recent literature has found trade elasticity to range between -2.0 to -4.0 with the long-term effects taking 7-10 years. (Caliendo, 2012 and Levchenko, 2021).

The proposal has also used a conservative market share of 25%. PANYNJ estimated that container barges could capture 10% of the market with only a 10% reduction in the cost to cross the Hudson. (PANYNJ, 2008) Our proposal seeks to reduce the costs in half.

Halving costs will increase volumes substantially. Trade economists have found the trade's price elasticity ranges from -2.0-5.0. At the lower level, total traffic at the port would increase by 6% but the volume of cross Hudson traffic would double. We have assumed that the changes in shipping behavior would take a decade to play out – fully complete by 2045.

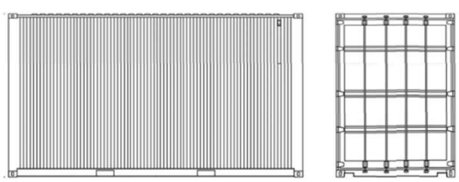
## Flow of NJ Warehouse Traffic



**Intermodal 40' Container**

4 tons Empty
13 tons Average Loaded



**20' MSW Container**

5 tons Empty
19 tons Average Loaded

Cross Harbor Container Intermodal Assumptions

| | Annual FEU | CAGR |
|---|---|---|
| 2005-7 FEU (EIS) | 192,720 | |
| Actual | | 2.90% |
| 2025 FEU | 313,320 | |
| Low PANYNJ Case | | 2.20% |
| 2035 FEU | 453,579 | |
| Low PANYNJ Case | | 2.20% |
| Induced Intl Trade | | 0.58% |
| Induced Warehouse Shift | | 7.18% |
| 2045 FEU | 1,172,665 | |
| Market Share | 30% | |

## Municipal Solid Waste

Municipal solid waste is another major source of potential traffic. While sold waste containers are taller to allow compacting their contents, the equipment and connections are identical. The feeder vessels can carry waste containers, though at 2/3 the capacity.

**Table 4**

| Cranes at Top 25 Container Ports | |
|---|---|
| **Rank** | **Cranes** |
| 1 Los Angeles & Long Beach | 142 |
| 2 New York & New Jersey | 61 |
| 9 Baltimore | 23 |
| 14 Boston | 12 |
| 15 Philadelphia | 11 |
| 23 New Orleans | 9 |
| **24 NYC DOS** | **8** |

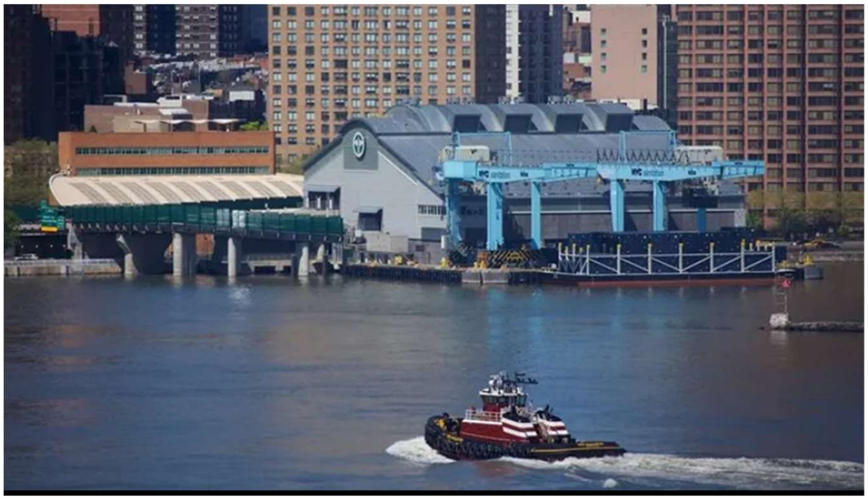
New York City's Department of Sanitation (DSNY) has operated an extensive number of Marine Transfer Stations (MTS) for more than century - barging waste for disposal at sea or outer borough landfills. In the early 21st Century, DSNY built the 24th largest container port in the United States by crane count for nearly half a billion in current dollars. (BTS, 2025) These container barges ending thousands of truck trips across the Hudson, reduced congestion and pollution. (Environmental Defense, 2005) DSNY also saw barging waste directly to rail-served remote landfills on long-term contracts as means of reducing its disposal costs which were rising 6% annually. (DSNY 2008)

Each MTS were built to containerize up 1,800 tons of solid waste daily without odor in negatively pressured facilities. DSNY can load 2-3 truckloads into 20-foot containers each containing of 14 tons of compacted waste. The containers are then loaded by crane onto barges that hold 48 containers with 900-1,100 tons of solid wast. The barges are then transported by with a round trip taking one day with another day to offload the barge on to railcars. (DOS 2019)

Unfortunately, only 5% of DSNY crane capacity is utilized. DSNY has potential of more than 1.2 million lifts annually, but only 210 containers are loaded each day. (DOS, 2025) The most recent DOS forecasts envision a 0.5% reduction in waste as DOS recycles or otherwise diverts 25% of the waste stream. (DOS, 2025) By offering reduced costs through larger, faster vessels, the proposal envisions capturing 100% of the solid waste market by 2038.

Marine Transfer with Open Barges

Containerized Marine Transfer



Inside Marine Transfer Stations

# Operational Requirements

Each of the steps in the proposed system has different level of throughput. The operational requirements for the intermediate steps been driven by the first and last steps.  At the beginning of the distribution chain, container ship calls and their capacities are out of New York's control. The proposal meets the current 15,000 TEU arriving on 5 ships with two container cranes. Additional cranes will be required if trade volumes increase, warehousing moves back across the Hudson, or the service captures more than 25% market share.

At the other end, the minimum urban freight station was sized at 400 FEU to ensure that New York customers could access 90% of the world's 939 container ports with only 2 ship changes. Conveniently, initial traffic is expected to be roughly 1,200 FEU per day spread across three terminals.

The next step is to size the container freight facility. Because of the imbalance of trade, 30% of the containers exported through the port are empty and don't require handling at the CFS. The remaining take 518 daily trucks and 44 at the peak hour assuming the same pattern as local deliveries. (DOT, 2024). Each truck takes 10 minutes to unload and load, requiring 10 bays. Their contents require accessing 50 containers every hour. In the absence of a vessel, the SRMs operating close the CFS have adequate capacity, but when a vessel is in port capacity is reallocated. During that hour, only 20 containers arrive, leaving goods on the handling floor. Assuming 40% of the space is required for circulation, the CFS needs to have roughly 25,000 sf in floor space.

The next strep is determining the storage requirement which a largely driven by time needed for sufficient cargo to accumulate to fill a container. The world's container traffic is highly concentrated with the top 25 ports accounting for nearly half the world's traffic (UNCTAD, 2008). Because urban ports are visited several times a day by feeder vessels, half of the CFS cargo can be loaded within a day, sometimes within hours. The next quarter are destinations who containers can be filled in two days, with the remaining containers waiting for a week. Space at the urban port is at a premium, less popular destinations will have to send shipments to PANYNJ.  Because urban ports are located within 2-6 miles of their customers, it is reasonable to assume that customers are required to pick their cargo up within 24 hours of arrival. In total, the port only requires a day's worth of storage – low for a marine terminal but similar to the requirements for intermodal rail.

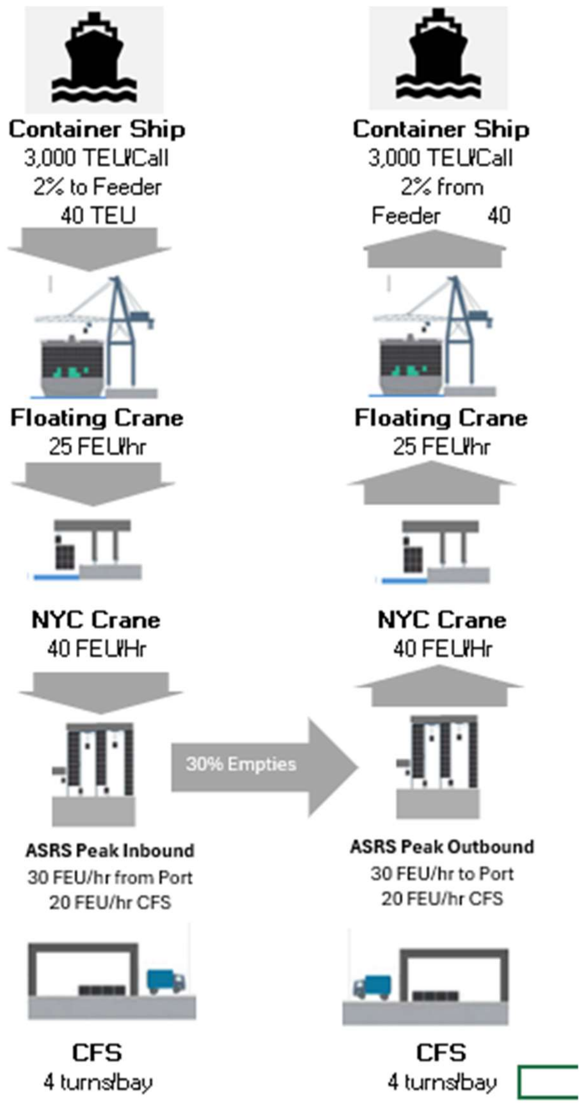
The next step is sizing the number of container cranes. While one crane can handle the average flow, a second crane at each port is necessary for redundancy and fluctuations in demand.

Lastly, the proposal envisions a loop where feeders leave the floating crane, stop at each of the three proposed ports and return directly to New Jersey. The cycle take approximately 7.5 hours, allowing each vessel to make two round trips per day. A third vessel would be acquired in 2037 to provide redundancy and service the solid waste market with a similar pattern – stops at each of the MTS, travel to railheads at New Jersey and a direct trip back.

Put together, these operational requirement form the basis for the proposals capital costs.

**ASRS Storage Size**

| | Share | Ports | FEU | FEU/ Day | Dwell Days | ASRS FEU |
|---|---|---|---|---|---|---|
| Outbound | | | 185 | | 1.5 | 269 |
| Empty | | | 56 | | 0.5 | 28 |
| Nonstop | 45% | 28 | 58 | 2.1 | 0.5 | 29 |
| 1 Stop | 23% | 105 | 30 | 0.6 | 1.6 | 48 |
| 2 Stop | 23% | 294 | 30 | 0.2 | 6.4 | 192 |
| Inbound | | | 185 | | 0.5 | 93 |
| TOTAL | 1.0 ASRS/FEU | | 370 | | 1.0 | 362 |




| **Floating Crane Demand** | | |
|---|---|---|
| Calls/Day | 5 | |
| TEU/Call | 3,000 | |
| NYC | 37% | |
| NYC FEU | 1,110 | |
| Direct Truck | 44 | |
| **FEU @ Market Share** | | Feeders |
| 10% (Barge) | 107 | 1 |
| 20% | 222 | 2 |

| **Landside Capacity** | | |
|---|---|---|
| Vessel | 120 | FEU |
| % of Call | 33% | |
| Daily TEU | 40 | |
| Cranes (2) | 64 | FEU/hr |
| Call Length | 0.6 | hr |
| Shifts | 2 | |
| BOR | 0.6 | |
| Max Calls/Day | 16 | |
| Max TEU | 614 | |

| **CFS Size** | |
|---|---|
| Daily FEU | 370 |
| Daily Trucks | 518 |
| Trucks/Peak Hr | 44 |
| FEU Accessed/hr | 50 |
| ASRS | 20 |
| Dwell (hr) | 2.5 |
| CFS Circulation | 40% |
| sf/FEU | 765 |
| CFS Storage (st) | 24,059 |
| ASRS (sf) | 143,712 |

## Landside Requirements

The proposed urban port requires only 7-17 acres for two-crane operation. 5 acres provides sufficient area for three calls by feeder vessel per day and an annual TEU count of roughly 100,000. By increasing the size of the port with additional ASRS and CFS, capacity can be tripled.

**Berth and Crane**

The proposed feeder vessel requires 350-400 feet of berth space. Designed for riverine traffic, the feeder vessel only requires a minimal 12 foot draft. Each berth requires two 30 Ton container cranes to handle the 40 FEU anticipated at each of the three destinations. Each visit will require only 0.5 hours for handling cargo and the self-propelled vessels eliminate the time required for tying up a barge. The proposal works well with shared terminals – four calls a day take up only two hours of crane time. When not used by feeder ships, both the crane and wharf can be used by other operators.

**Container Storage**

The analysis of operations indicates an initial requirement for 1,000 FEU of terminal storage. BOXBAY's ASRS is comprised of modules 15.6m wide with two rows of containers separated by the Storage and Retrieval Machine (SRM) that handles them. Two modules are required to meet the operational requirements. Stacked 12 high, the storage component of the ASRS would be the same length as the berth. In the long run, if the two cranes are solely dedicated to feeder vessels, throughput could be tripled. An additional 4 ASRS modules would be required requiring 200' in additional depth. From a public policy standpoint, it may be preferrable to accommodate growth by expanding the number of urban ports – reducing travel times and the number of trucks arriving at any given neighborhood.

**Container Transfer Station**

One side of the CFS receives containers from storage by the SRM. From there containers are automatically transferred to a second gantry crane at the Landside Transfer Points (LTP). The operational requirements require the initial installation of 2 Landside Transfer Points located the one end of the ASRS, one for each ASRS module. The LTP moves containers horizontally between the SRM and the ten docks of the CFS. From there they can be loaded as a conventional truck and once full placed back in storage and replaced by another serving a different destination. On the other side of the CFS, an additional 120' in depth is be required to accommodate 90° turns by tractor trailers even though the majority of trucks serving the CFS will be smaller.

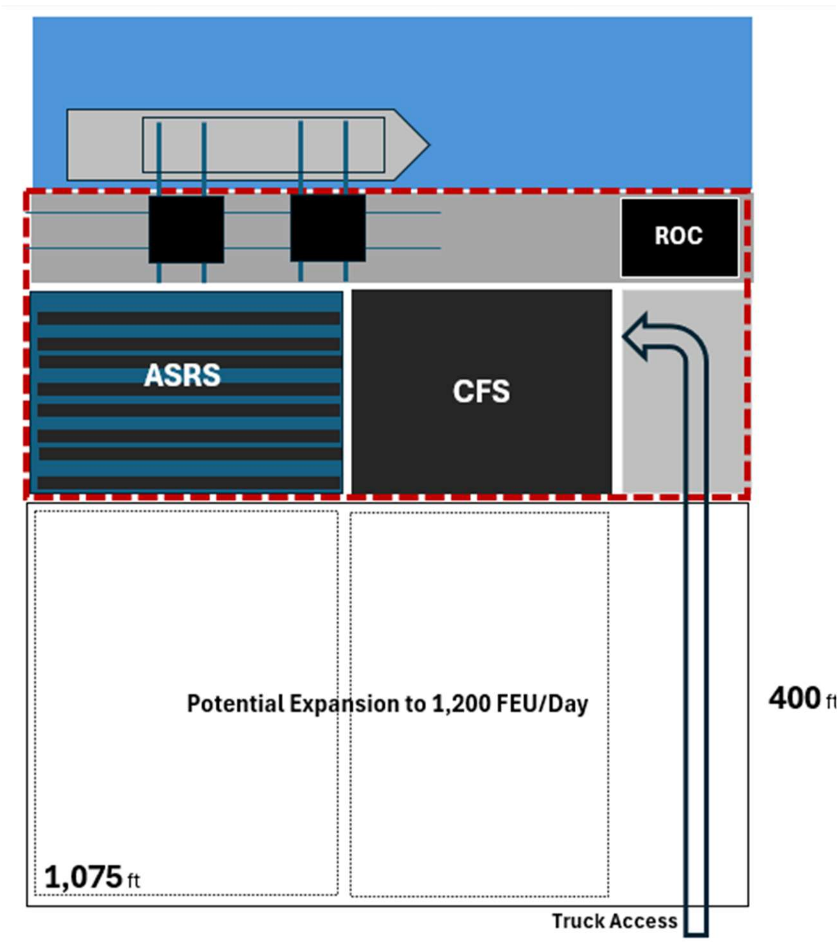
**Battery Recharging**

The E Portliner consumes 150kwh/hr when travelling. Under the operational plan, roughly half the trip will be spent berthed where consumption is likely only 15kwh/hr. Each round trip requires only ~1MWh, roughly the capacity of a battery container. With three vessels in service, the operational plan requires ~6MWh of charging for the6 trips made daily. Spread among the three terminals and over the course of day, each terminal needs only of electrical service - roughly equivalent to 2 DC Fast EV chargers. By contrast a single 149 passenger ferry coming to New York with on-board batteries requires a 2.4MW charger. (Professional Boatbuilder, 2023)

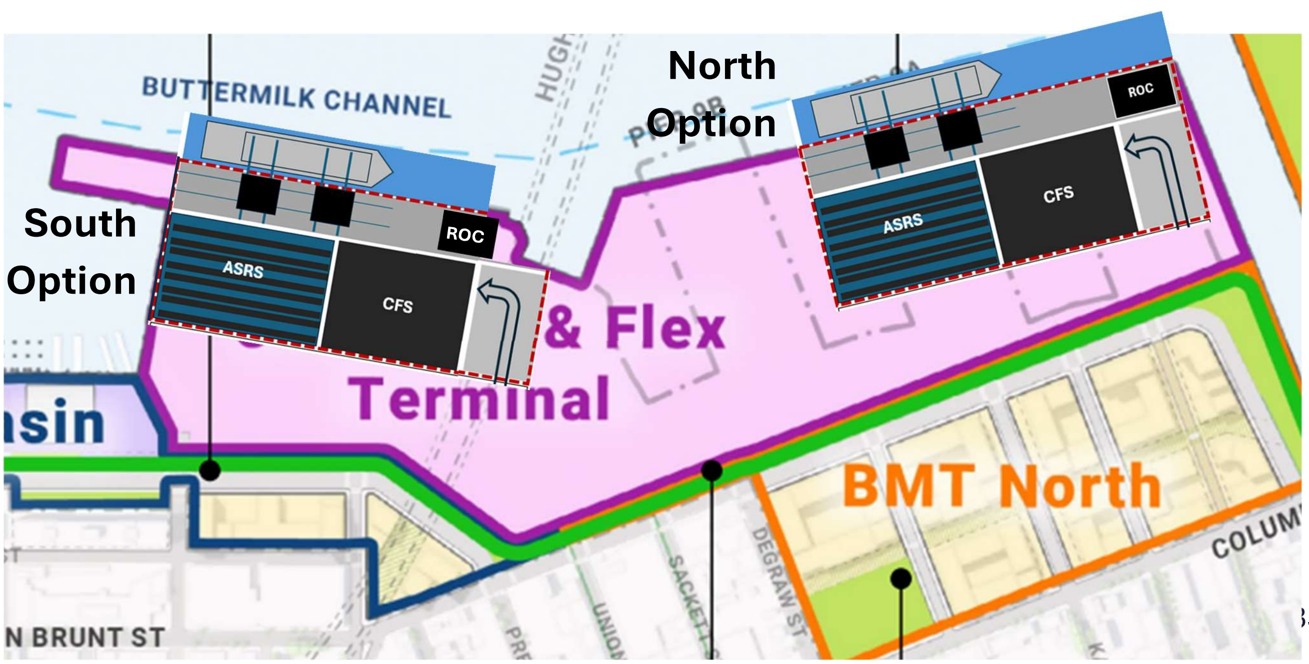
### Brooklyn Marine Terminal

The urban feeder port can be located at either end of the Brooklyn Marine Terminal. The southern location may make shared use difficult because the ASRS and CFS block access to the south. The Remote Operating Center (ROC) will be elevated to ensure that this critical facility can operate during storm surges so access to the North is available. The northern location will require the installation of two additional cranes but facilities shared use. The height of the ASRS (150') may also be more appropriate for the taller buildings at the northern end. The low-rise CFS/ROC can also be topped with an elevated park completing open space around the Pier 7 inlet. Because the ASRS provides storage, adding columns will not be an operational problem.

### Urban Container Port Layout for 400 FEU/Day




| Landside Requirements | Width | Length |
|---|---|---|
| Berth | 90 | 400 |
| ROC/Parking | 90 | 50 |
| ASRS | 200 | 300 |
| CFS | 200 | 250 |
| Truck Circulation | 200 | 125 |
| Initial Size | 290 | 1,075 |
| Final Size | 690 | 1,075 |
| | **SF** | **Acres** |
| Berth | 36,000 | 0.8 |
| ROC/Parking | 25,000 | 0.6 |
| ASRS | 60,000 | 1.4 |
| CFS | 25,000 | 0.6 |
| Truck Circulation | 25,000 | 0.6 |
| Initial Size | 311,750 | 7.2 |
| Final Size | 741,750 | 17.0 |
| | **Max TEU** | **TEU/ Acre** |
| Initial Size | ~100,000 | ~15,500 |
| Final Size | ~300,000 | ~20,000 |



## Operational Costs

The proposal was prepared to reduce Cross Hudson transport costs for small customers by 50% and create a self-sustaining commercial operation under municipal control.  Reducing the number of steps required and substituting automated storage and retrieval reduces operational costs below the target

The operating costs for terminals is reduced by 60%. The installation of floating crane eliminates the need for wharfage and the container handling activities are moved to the urban feeder port.  Here crane operations remain manual, but storage and retrieval are fully automated. Non-crane operations require 75% of ILA labor (CBC, 2013). The proposal assumes only 65% reduction in labor costs with remainder accounted for by the need to maintain and oversee operations of the ASRS

Cross Hudson operating costs are reduced more dramatically. Replacing 45 miles of truck travel carrying a single FEU with a 16-mile round  trip with 120 FEU reduces costs by 90%. Vessel operating costs are conservative, inflated from previous studies with no allowances for remote control or improvements in energy consumption. Waterborne transportation avoids Bridge and Tunnel tolls completely. The proposal envisions municipal ownership will eliminate broker fees.

Reduced operating costs generate substantial excess revenue. This revenue would be allocated amongst the EDC, DSNY, marine unions and facility operators with allocations to be determined.

**Vessel Operating Costs (NYMTC 2008)**

| | $2,008 $/hr | $2,024 $/hr | $/trip | $/trip |
|---|---|---|---|---|
| Operating Cost | $ 500 | $ 750 | $ 6,300 | |
| Crew | $ 300 | $ 450 | $ 3,375 | 8 hours |
| Other | $ 200 | $ 300 | $ 2,250 | 8 hours |
| Fuel | $ 300 | $ 450 | $ 675 | 1.5 hours |
| 120 FEU capacity@ 60% LF | | | **$ 88** | |

**Cross Hudson Costs**

| | Existing | Proposed | |
|---|---|---|---|
| **Terminal Fees** | **$ 520** | **$ 350** | |
| Harbor Maintenance Tax | $ 60 | $ 60 | |
| PANYNJ Rent and Fees | $ 77 | $ 8 | -90% (Floating Crane) |
| ILA Royalties | $ 94 | $ 94 | TBD |
| Terminal Operation | $ 289 | $ 188 | |
| Labor | *$ 145* | $ 51 | -65% (ASRS) |
| Other Costs | *$ 110* | $ 137 | +25% (ASRS) |
| Profit | *$ 35* | $ - | TBD |
| **Cross Hudson Transport** | **$ 1,001** | **$ 88** | |
| Tolls | $ 138 | $ - | -100% |
| Broker Fees | *$ 113* | $ - | -100% |
| Transport Profits | *$ 68* | $ - | TBD |
| Truck Operating Costs | *$ 682* | $ - | -100% |
| Feeder Vessel Costs | $ - | $ 88 | $6,300 per trip |
| **TOTAL COST** | **$ 1,521** | **$ 437** | |
| Tolls | $ 138 | $ - | |
| Profits/Fees | $ 215 | $ 323 | |
| **50% Reduction Target** | | **$ 761** | |

# Blue Highway 2.1 Network

The proposal envisions using existing city resources to develop a seven port network. In addition to the 2 ports in development by EDC and the four existing MTS, the proposal adds a new facility on the Newton Creek to service demand in Queens.

Brooklyn Marine Terminal

The proposal envisions utilizing 5 acres at BMT. Depending on the limits for future truck traffic in Red Hook, an additional 10 acres can be reserved for future expansion. Expansion land can serve interim uses. Since another existing site is located nearby, there is no critical need for expansion land.

Hunts Point Marine Terminal

The proposal envisions utilizing 5 acres initially. The lack of additional publicly owned sites in the Bronx suggests that the the full 10 acres of expansion land should be reserved. An alternative would be to investigate the acquisition of petroleum depots in Mott Haven which will likely become available as climate goals come closer to realization.

Newton Creek Terminal

With one-third of the container market destined for Queens, we proposed the construction of an additional terminal facility on the Newton Creek. While there are numerous private parcels large enough to fit the 5-15 acres required, the proposal envisions utilizing the former MTS adjacent to the Newton Creek sewage treatment plant. While the site is in Brooklyn, it is directly across the Creek with multiple local roads for local customers. The proposed feeder vessel meet the 39' vertical clearance for the Pulaski Bridge over Newton Creek negated the need to inconvenience the 12,000 daily vehicles crossing from Brooklyn to Queens.

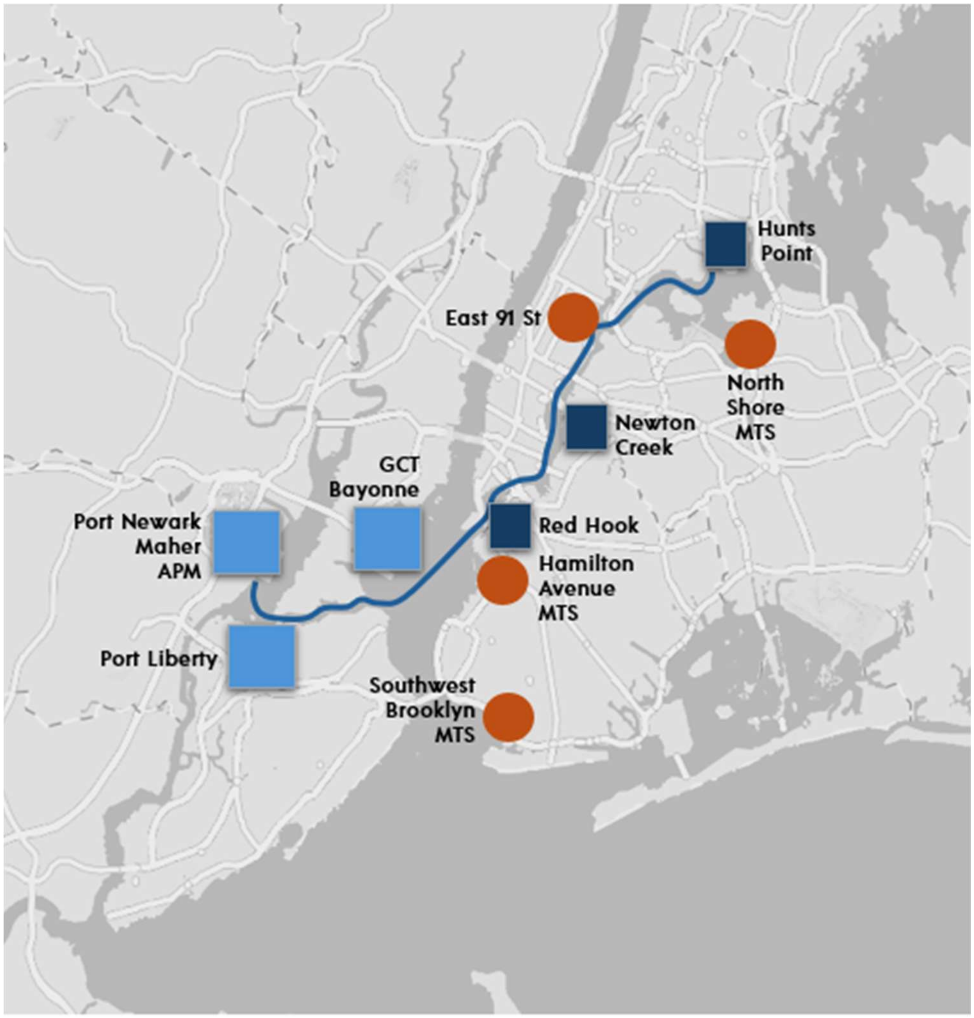
The site is sufficient in size, but requires small modifications to terminal layourts. the The 5 acres for initial operation is available, but additional capacity While the optimal layout has 4 ASRS modules, the narrow shape of the available site will require 5. Adding 1 SRMs will impose additional, but not major, costs. DOS could either sell the site to EDC or lease it as a feeder port and generate annual return. When volumes in Queens exceed the capacity of this site, it is anticipated that traffic to northern Queens can be split with the North Shore MTS.

Marine Transfer Stations

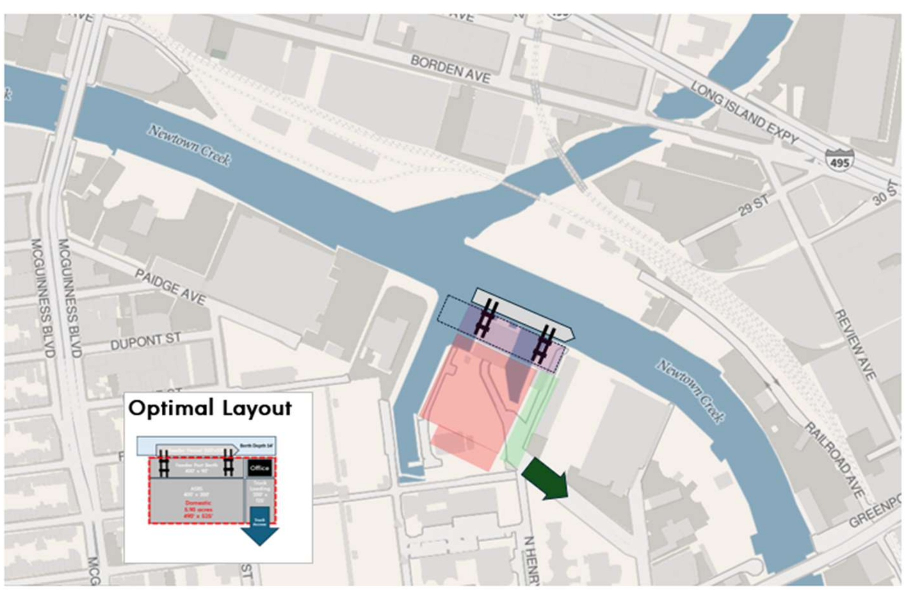
Should sufficient demand or market share capture require additional capacity, DSNY MTS can provide additional capacity. They already have the necessary cranes and existing DSNY operations could continue with shared use of the wharf. Since the existing wharf is used for storing waste containers, an extension to accommodate feeder vessel operation. The Southwest Brooklyn MTS, North Shore MTS and Hamilton Ave MTS have sufficient land available with limited acquisition of adjacent industrial parcels.

East 91$^{st}$ MTS is a more challenging case contrained by the FDR drive, ASRS storage can't be accommodated with expanding from the bulkhead. While costs are well beyond the resources available from freight distributions, storage needs could provide a platform and catalyst for the redevelopment of the entire area from Carl Schultz Park to 96st crossing over the FDR drive to connect the Upper East Side and East River.

**Blue Highway 2,1 Network**




**Newton Creek Feeder Port**



# Capital Costs

The expected capital costs for initial operations are $350m, assuming that any additional landside cranes required will be furnished by EDC as the port owner. The proposal would utilize the Title XI program for U.S. shipbuilders which provides guaranteed, low-interest loans for up to 87.5% of the vessel's value. The floating cranes are anticipated to be eligible for the program because they are self propelled to travel between berthed container vessels. The remaining assets are financed for 60% of their value with total debt service of 7%. The 50% contingency is assumed as 100% equity.

This estimate of the potential capital costs for the proposal using public sources which have been adjusted for inflation and exchange rates. Some of the studies used nearly twenty years old and we have included a 50% contingency in response. Our goal in examining capital costs was to make a first pass to determine whether a commercially viable proposal was possible and if potential revenues were sufficient financial inducement to secure agreement with the stakeholders.

### Vessels

The costs for the proposed feeder vessel are based on the 280 TEU Port Liner ordered in 2018. Two vessels were acquired as part of a €100m project supported by €7m subsidy from the European Union. The project included the shore-based electrical infrastructure for charging and maintaining the battery containers but no other terminal improvements. The vessel's size can be accommodated in New York's existing drydocks but a new facility for repair and maintenance of the battery containers will be required. We have inflated and converted the costs from 2018 then added a 100% contingency for the U.S. shipyard premium, additional propulsion.

The costs for the Floating Crane were estimated in the Delft University study performed by Hans Litgeringen in 2008. The study estimated both capital and operating costs for the crane. No additional maintenance or landside facilities were included but we assume that the PANYNJ resources dedicated to the 61 existing cranes will be sufficient.

**Prelminary Capital Costs**

| | $2024 m | |
|---|---|---|
| Vessels and Charging | $70 | per Vessel |
| 1,000 FEU ASRS | $7 | per ASRS |
| Floating Crane | $30 | per Crane |
| Remote Operations Center | $25 | |
| Contingency | 50% | |

### Terminal Storage

In 2025, DP World announced that a 27,000 TEU ASRS system would be installed at the London Gateway container port at a cost of €91.7m - ~$4,500/FEU. The 10-aisle system has 15 Storage and Retrieval Machines (SRM)dedicated to handling containers stacked up 16 high. The horizontal transfer capacity is comprised of 40 positions: 20 Landside Transfer Points for truck and 20 Waterside Transfer Points for Terminal shuttles. The Blue Highway requires initial systems only 1,000 FEU in size. Assuming costs rise 10% every time the system shrinks in half, ~$7,000/FEU is a reasonable estimate.

### Remote Operations Center

The costs of the Remote Operations Center and vessel accommodations for remote operation were largely d with a grant of NOK 133.6 through the state enterprise Enova SF made in 2018.

### Initial Capital Expenditures

| | Units | $/Unit | Total | Equity | Debt |
|---|---|---|---|---|---|
| Floating Cranes | 2 | $ 30 | $ 60 | $ 8 | $ 53 |
| Feeder Vessels | 2 | $ 70 | $ 140 | $ 18 | $ 123 |
| ASRS at 3 Ports | 1,200 | $7k.FEU | $ 10 | $ 5 | $ 5 |
| ROC | 1 | $ 25 | $ 25 | $ 13 | $ 13 |
| Contingency 50% | | | $ 118 | $ 118 | $ - |
| **TOTAL** | | | **$ 353** | **$ 160** | **$ 193** |

# Ownership

The history of the Port has shown that eventually all subsidies come to an end. Only a commercially viable system can provide a permanent and sustainable Blue Highways. If the technological changes envisioned in the proposal are achieved a dramatic reduction in costs is achievable at the same time as substantial excess revenue.

Automation, the transfer of container storage across the Hudson and remote control require significant changes to work rules and federal regulation. Marine unions have shown increasing flexibility recently, especially for new marine activities. However, more substantial changes raise fears that new work rules will form the basis for negotiations in existing terminals and significant job loses. We believe a solution lies in a municipally owned distribution company were rules negotiated with co-owners are inapplicable in other terminals.

The proposal envisages no initial capital investment from marine unions but that savings from work rule changes are added to the capital account of the marine unions, slowly increasing their ownership stake and eventual revenues. Through EDC's Catalyst Fund or equivalent, NYC would be a co-investor from the beginning through the next three phases of ownership.

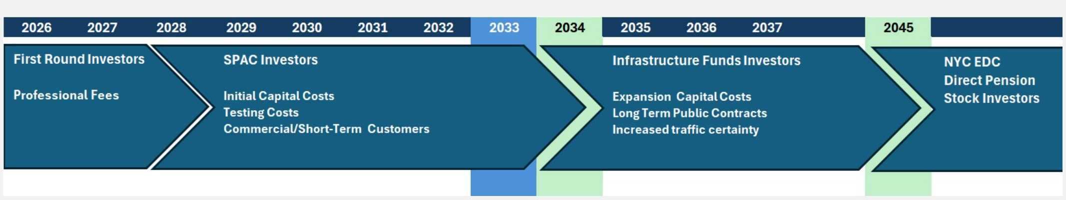
In the first stage, first-round investors and the Catalyst Fund face the risk that the project fails altogether. Contract negotiations could fail or unforeseen vessel design issues might result in infeasible costs or performance. Worst for the public interest, legal or political delays in regulatory approvals could postpone or dramatically limit maritime activities. At stage, EDC and early investors are only funding providing professional and design costs estimated at 5-10% of the capital costs.

In the second stage, acquiring equipment, testing and training requires significant investment though federal subsidies for shipbuilding provide low interest guaranteed loans under Title XI can cover up to 87.5% of vessel costs. Because the floaring crane is self-propelled to move from ship to ship, it is assumed it can be financed as a vessel. Risks remain high until testing is complete and commercial operations begin. The second-round investors, potentially any number of Special Purpose Acquisition Companies, invest in anticipation of 16-20% returns.

In the third stage, commercial operations have commenced – operating and capital costs are known and risks are limited to future revenue uncertainty. At this point, a Private Initial Offering replaces SPAC investors with a limited number of investment and pension funds anticipating 8-10% returns.

In the fourth stage, long-term city contracts to transport solid waste reduce revenue volatility and clarity is increased with additional years of operation. At this point, infrastructure funds can exit by transferring their ownership to EDC in exchange for refinancing proceeds from low-interest tax-exempt bonds. The existing direct pension plan investments may continue. At this point, the cost of capital is reduced to roughly 6%. The proposal assumes refinancing is concurrent with a public offering to provide daily vigilance to keep the company operating on a commercial basis. In the past, municipalities have entered commercial activities believing that the lack of profit motive would reduce prices. In most cases, the lack of daily transparency lead to the capture of surplus revenues by insiders as increased operating costs or diversion to other municipal activities. The marine distribution system is too important to go bankrupt but also too central to the city's economy to be the source of escalating prices.

**Financial Timeline**



## Financial Plan

| | | 2026-45 |
|---|---|---|
| Operating Activities | | |
| Revenue | $ | 2,734 |
| Costs | $ | 1,570 |
| Net Income | $ | 4,305 |
| Debt Service | $ | (237) |
| Operating Cash Flow | $ | 4,067 |
| Financial Activities | $ | 2,048 |
| Initial Capital Costs | $ | (772) |
| Replacement Costs | $ | (358) |
| Loan Proceeds | $ | 544 |
| 2034 IPO Net Proceeds | $ | 972 |
| 2045 IPO Net Proceeds | $ | 1,662 |
| Investor Returns | | |
| First Round | | 30% |
| Second Round | | 15% |
| Stakeholder Returns | | |
| NYC Net Cash Flows | $ | 1,827 |
| ILA Concessions | $ | 2,401 |
| Customer Savings | $ | 2,732 |

A cash flow model utilizing the following assumptions generates substantial value for investors, stakeholders and the public.

Revenues are set at $761/FEU with customers paying 50% of the current cost. In the absence of current transportation prices for MSW, it is assumed that DSNY will pay the same price. Revenues are assumed to rise 2.5% and volumes are taken from the previous market study.

Operating costs are substantially lower at $467/FEU and also anticipated to rise 2.5% annually. Any economies of scale as volumes rise are ignored.

The $353M in capital costs are financed with $193M in Debt. Title XI financing is assumed for vessels, 4.5% interest and 87.5% LTV. Other assets are financed at 60% LTV with annual debt service of 7%. All debt is assumed to the longer than 15 years with no repayment. Lastly, $118m in contingency is assumed as 100% equity.

An initial private offering in 2034 with $136m in annual net revenue valued at a PE ratio of 10. After 5% in sales costs, the IPO generates $972m in proceeds for the 75% ownership stake of the co-investors with the Catalyst Fund. The IPO increases EDC's ownership from 14% to 25% and releases $447m in proceeds to EDC.

A second public offering in 2045 with $585m in annual net revenue valued at a PE ratio of 12.5. The IPO generates $1,662m in proceeds for a 25% ownership stake resulting in final 50/50% public/private ownership. An additional $362m in proceeds are released to EDC.

Over the period, EDC receives $1,827 in cash flows from net income and refinancing proceeds. A negotiated portion will compensate the ILA for work rules concessions totaling $338m. Lastly, freight customers save $2,732 in transportation costs.

Using traditional ratios, 300,000 TEU of port activity would generate 4,000 direct jobs and 6,000 indirect jobs increasing New York City employment by 10,000. (

# Center for Urban Marine Transition

The Center for Urban Maritime Innovation would seek to restore New York City as a hub for maritime innovation, specializing as a global center for waterborne urban transportation. New York has enormous demand for local water transportation because of its unique geography as an densely populated archipelago with an extensive network of protected waters.

## Mission

Almost all of the technologies appropriate to the Blue Highways have been developed abroad and the U.S. marine market is often too small for international suppliers to devote resources to enter. EDC's Waterfront Navigator has created a one-stop for businesses seeking environmental permits. Testing and deploying technology in the city's waterways also face approval from multiple City, State and Federal Agencies. The Center would create a single source for permitting and agency advocacy for marine technologies. Instead of each company starting over, the Center can provide experience and institutional knowledge.

At the same time, the Center would promote an integrated workforce strategy for the new maritime labor requirements. The Center would identify the new operating and maintenance skills required by maritime innovation and promote training and education programs in conjunction with CUNY, SUNY Maritime College as well as private universities and local maritime unions. Over time, the Center would encourage the creation of an industrial cluster of maritime research, design, fabrication and maintenance.

Seeded and initially hosted by the Proposal, operations would be financed by innovative international maritime manufacturers and service providers seeking to bring their innovations to the US market, as well as public grants and local foundations. Eventually, the Center could generate royalty income from research efforts with The Center's initial efforts will focus on the synergies between remote operation, electrification and autonomy to create a path towards fast and frequent urban water transportation.

## Future Vessels

These technologies will enable the creation of completely new forms of marine transportation. With crusing speeds raised to 25 mi and stop times reduced to 15 minutes, truck ferries become competitive with local roads. At that point trucks and buses gain a whole new network for travel – the Blue Highway. Today 15% of New York's 15m daily vehicle trips use a bridge or tunnel and all of these trips have the potential to travel by water.


BIEKER BOATS
Glosten


VIKING GLORY
MARIEHAMN

## Case Study: NYC Ferry Application

EDC's NYC Ferry can be an early adopter of electrification and remote operation. As a publicly owned ferry company, EDC may be the appropriate party to introduce remote controlled operation to New York without the conflict that a profit-making company would incur. Today the operation has a $62.2M deficit and significant future expansion is difficult to imagine. The central problem with current service are the long stops which reduce average speeds to 10- 11mph. Slow speeds reduce the frequency of service with the existing fleet.

A recent study found that electrification would reduce energy consumption by 38%.(NYCDOT, 2022) Remote operation would reduce labor costs by 35%. Remote Control with significant automation could allow captains to control three vessels from the ROC. In addition, monitoring of real time river currents with LIDAR could present optimal maneuvering for each call. The strong currents are challenging and time-consuming requiring 2 minutes at each stop. Remote control could reduce this time by 50%. Combined these innovations increase speeds and frequency by 10%. The 20% increase in ridership with the existing fleet and staff reduces deficits in half.

| | NYC Ferru Vessels | | |
|---|---|---|---|
| | **2024** | **Retrofit** | **New** |
| Passengers (m/yr) | 7.2 | 8.9 | 13.0 |
| Inc. from Speed | | 12% | 20% |
| Inc. from Freq | | 11% | 50% |
| Average Speed | 10.6 | 11.4 | 14.2 |
| Daily Trips/Route Mi | 43 | 46 | 57 |
| Revenue/Trip | $ 3.19 | $ 3.19 | $ 3.19 |
| Load Factor | 27% | 31% | 36% |
| **Operating Revenue** | **$ 23,002** | **$ 28,000** | **$ 41,000** |
| **Operating Costs** | **$ 85,257** | **$ 60,700** | **$ 38,000** |
| Labor | ~$54,000 | $ 35,100 | $ 18,000 |
| Energy | ~$14,000 | $ 8,600 | $ 3,000 |
| Other | ~$17,000 | $ 17,000 | $ 17,000 |
| **Operating Surplus/Loss** | **$ (62,255)** | **$ (32,700)** | **$ 3,000** |

Future vessels may enable EDC to operate the NYC Ferry system at a profit. Hydrofoils and their reduced water resistance can reduce energy consumption by up to 80%. Automated mooring could reduce labor costs by an additional 30%, retaining one deckhand to provide customer assistance. Automated mooring could also enable side loading, increasing the number of doors and reducing the at each stop. A subway car and NYC Ferry both hold 145 passengers but the subway car takes 30 seconds to unload, while NYC Ferry takes 4 minutes. If dwell times at stops could be reduce to 2 mins, the same size fleet could provide 40% more service, nearly doubling ridership and eliminating the operating deficit.

## Sebastian Hardy

The founder of Continentia Capital has been actively involved in public-private partnerships since 1992 and urban industrial activities as the Board Chairman for the Greenpoint Manufacturing & Development Corporation.

He was responsible for urban design and planning at the Subic Bay Freeport responsible for the production of urban design guidelines and development standards as well port planning to guide $110M of investment from the World Bank and Asian Development Bank.

Later as a partner at The Cogsville Goup, he was responsible for acquisition and disposal of a $3 billion portfolio of distressed FDIC commercial real estate loans. He was also responsible for structuring the winning bid for Starrett City, the nation's largest subsidized housing development.

## Kongsberg Maritime

Kongsberg is leading the development of autonomous vessel technology. In addition to 80 locations outside the United States, Kongsberg Maritime operates a locations at Houston and Galveston, TX, Miramar, , New Orleans, LA and Seattle, WA. Kongsberg and its partners have extensive experience with US regulations and requirements through a15 year relationship with Maryland-based Chesapeake Shipbuilding, a leading designer and builder of commercial ships up to 450 feet in length. tests new technologies in U.S. waters including control systems software for uncrewed drones for medical deliveries in partnership with the University of Maryland.

## BOXBAY

BOXBAY is an international joint venture by global port terminal operator DP World and industrial engineering specialists SMS group. The company is offering the BOXBAY high Bay Storage system which achieves a three-fold increase in the storage capacity of container terminals and use only one third the footprint. The company has an operational pilot system at the Port of Jebel Ali operating in Dubai since 2021 and is commencing work on a 27,000 TEU storage system at DP's London Gateway port and the Port of Busan. BOXBAY has its headquarters in Dubai.

## Slip Robotics

Founded in 2020 by former Tesla, Cummins, GE, and Waymo engineers, Slip Robotics has developed Slip Bots, automated pallets that revolutionize warehouse and transfer operations. Slip Bots can reduce trailer loading & unloading time from an average of 50 minutes to just 5. In addition to reducing delays in the logistics chain, Slip Bots reduces the safety risks in forklift operation. Slip Bots are manufactured in Atlanta, GA and serviced through an expert service network.

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