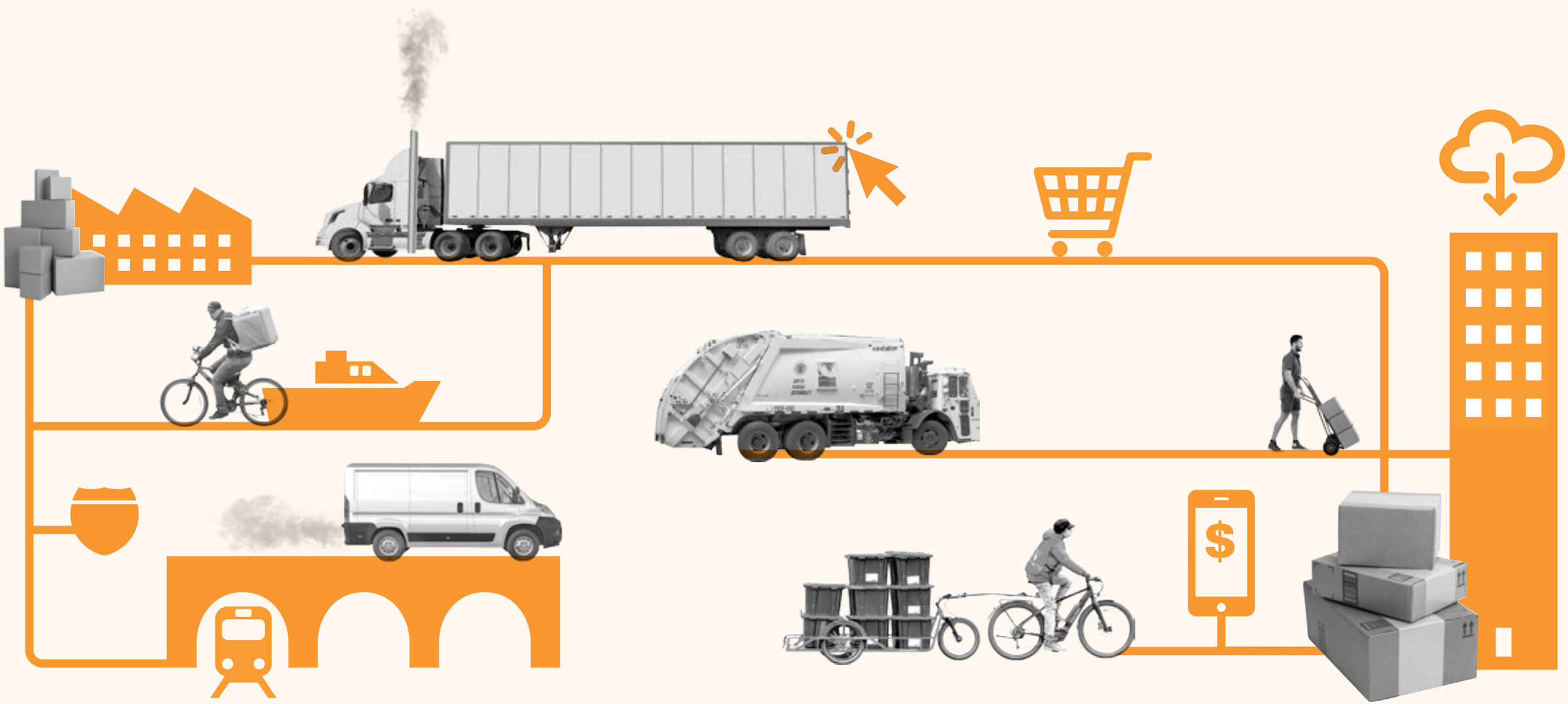
November 2022 | AIANY Freight and Logistics Working Group | AIA New York

DELIVERING THE GOODS:

NYC Urban Freight in the Age of E-Commerce



SECTION OVERVIEW

About Delivering the Goods: NYC Urban Freight in the Age of E-Commerce

Introduction Contents:

The Goal | The goal of AIA New York's Freight and Logistics Initiative is to advance freight policy in New York City by advocating for more efficient, equitable, and sustainable goods movement. By focusing on the middle-mile to last-mile segments of the supply chain with four existing delivery scenarios and offering alternative prototypes to the current state of goods movement, we see opportunities for improvements that will benefit the entire city.

The Situation: Impacts of Urban Freight | Each year, 365 million tons of freight moves through the New York City area.[1] It is a flow of goods that brings the benefits of prosperous business but also gives rise to a set of complex challenges, especially in the final stage of freight delivery, the Last Mile.

As freight moves through city neighborhoods so do its impacts, often in ways that are distributed unevenly. In many cases, the weight of freight falls disproportionately on disadvantaged and vulnerable communities. Typical impacts include vehicle emissions (CO_2 and particulates), congestion (streets, sidewalks, curb), waste issues (inefficient material flows, uncontainerized refuse), and safety risks (crashes, injuries, and deaths).

On the supply side, freight delivery has its own challenges, particularly in New York City, where the geographic configuration of the five boroughs limits and concentrates access. Optimal sites for distribution facilities that are close to the final destination—consumers—often compete with other land uses.

These existing conditions are overlaid with surging downstream freight activity due to increased e-commerce and app use prompted by the COVID-19 pandemic. As consumers demand faster, more reliable, and more convenient goods deliveries and negative impacts continue to intensify, the need for a coordinated, forward thinking, and well-calibrated solution set becomes even more imperative.

Stakeholders | The primary stakeholders in the middle-mile/last-mile segments of this complex freight delivery ecosystem are:

- **Consumers,** who generate demand for products to support their basic needs as well as lifestyle choices
- **Local communities,** which experience the greatest impacts—both positive and negative—from close proximity to freight delivery routes and distribution warehouses along the supply chain
- **Local businesses,** which rely on the supply chain to get products they manufacture to consumer
- **The general public,** which benefits from orderly commercial activity
- **The goods movement industry** with its three main subsets:
  - **Freight haulers,** who deliver goods from point A to point B along the supply chain
  - **The real estate industry,** which develops physical distribution spaces where goods are transferred, stored, and sorted for eventual delivery
  - **Logistics operators,** who are the linchpin in the commercial process of supplying the products that consumers purchase
- **Labor,** which provides the skills to run industry
- **Government agencies,** which manage freight policies, build and maintain transportation networks, and regulate land use

Approach | The initiative developed from a multi-committee task force within the American Institute of Architects New York Chapter and expanded to include experts from academia, urban design, and traffic engineering fields. We began by immersing ourselves in previous research on the subject. We then interviewed various stakeholders affected by goods movement and held three listening sessions with experts in the field, each with a separate focus: best practices from comparable cities, community perspectives, industry perspectives, and agency perspectives. From here, we documented representative local goods movement scenarios in New York City and developed a series of future prototypes illustrating opportunities to improve land use and street/curb conflicts. This analysis resulted in a series of recommendations—some short-term and easier to implement, some longer-term and more visionary— that offer a framework for discussion about how to shape goods movement in the city over the coming decades.

Through this document, key challenges in four categories are called out and identified with the following icons:

Community

Industry

Policy

Design

NYC Urban Freight / The Current Context

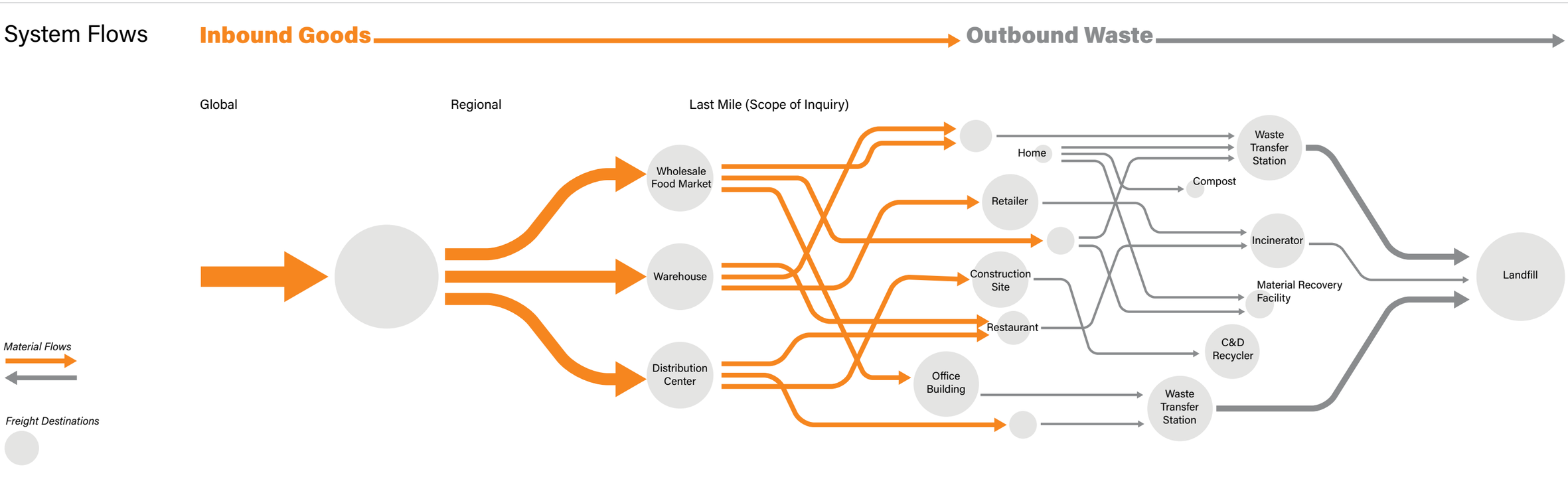
Truck Networks | The effects of freight transportation in New York City occur at a scale that can sometimes be difficult to grasp. Of the 365 million tons of freight that passes through the region's roadways, bridges, and tunnels each year,[2] trucks alone move about 89 percent of that volume.[3] On a daily basis approximately 180,000 truck trips are generated from Manhattan's 37,000 freight-related business establishments.[4] At best, two out of every three trucks leave the city empty.[5]

Middle-mile traffic consists mainly of truck traffic from major regional warehouse and distribution facilities supplying distribution facilities located throughout the city. Commercial trucks encounter the most conflicts during the last-mile segment of the delivery cycle and at the final destination, where trucks compete for curbside loading with pedestrians, bikes, moving vehicles, parked vehicles, emergency and service vehicles, public transit, and trash removal. It is common for delivery vehicles to double park, block bike lanes or use curbside parking spaces and adjoining sidewalks to sort and transfer packages for final delivery. With the innovative Open Streets, Open Restaurants, and Open Storefronts programs created in response to the COVID-19 pandemic, even more uses are competing for limited streetscape.

Rail Networks | The existing regional rail freight infrastructure is very efficient at moving large bulk containers between freight terminals and resupplying distribution centers at rail hubs. However, rail currently handles only about two percent of the city's local freight traffic; mainly construction materials, waste and recyclables, and food products.[6] While a typical railcar typically carries the freight equivalent of four trucks, making it efficient for bulk materials, rail is not as fast as air transport or trucking. Rail freight movement also typically requires time and labor-consuming mode changes (truck to train to truck transloading) to complete deliveries.

The Regional Plan Association (RPA) and other organizations have proposed improvements to derelict rail right-of-ways through Brooklyn, Queens, and the Bronx to improve connectivity between national rail networks west and east of the Hudson. This would allow for the more efficient movement of rail freight through and into the city with fewer mode changes and truck trips.

Maritime Networks | Port of New York and New Jersey (PONYNJ) facilities connect maritime shipping to national rail freight networks and trucking routes. Light, high-value goods move through PANYNJ's Newark Liberty and JFK airports to distribution centers around the region. Connectivity between maritime, rail, and trucking carriers west of the Hudson River provides multiple options for shippers. Connectivity across the Hudson River and to the east is more limited, making trucking the most utilized mode in this direction. Railcars arriving at Port Jersey, destined for freight terminals in Brooklyn, travel by float barge across New York Harbor. From there, trucks are needed to transfer freight containers from harbor facilities to distribution centers and then out for last-mile delivery. Containers arriving on ships at Red Hook or Sunset Park ports are transferred to truck for movement through Brooklyn, out to Long Island, or to New England.



NYC Urban Distribution Facilities / The Current Context

New e-commerce distribution centers have become essential middle-mile infrastructure in cities, necessitating a better understanding of their impact on their neighboring communities and the city.

The challenge of accommodating very large-scale e-commerce distribution centers within the city can be seen in the context of a larger trend in which activities that used to happen everywhere, all at once, and at every scale —such as manufacturing, warehousing, and distribution—now take place in ever larger single-purpose facilities. The "Big Box" retail phenomenon of the 1990s was a harbinger of this trend. These new hubs of industrial activity also concentrate truck traffic, along with their associated impacts. In response to the consumer's expectation of instant gratification, there is pressure to locate these enormous structures as close to population centers as possible, often at the edges of industrial districts.

In some cases, such as recent and planned distribution facilities in Red Hook, Brooklyn, developers are willing to build multi-story structures and make some effort to design street frontages that are more compatible with the context of the mixed-use neighborhood. More typically, however, the result is a single, large-footprint structure that is devoid of articulation and often out of scale with its surroundings.

A preliminary survey of more than twenty current and proposed locations for large-scale e-commerce distribution facilities offers several high-level findings that may point the way towards future policies and design strategies.

As expected, a majority of the new distribution facilities are located in manufacturing districts or manufacturing corridors, since these facilities are currently allowed "as-of-right" by zoning regulations. Developers typically avoid seeking zoning variances or special permits in New York City since it is a time consuming and cumbersome process with sometimes unpredictable outcomes. About half of the sites surveyed are in the core of manufacturing districts, where building scale and adjacency are not an issue. But almost as many sites are located in mixed-use areas where the scale of the proposed facility dwarfs the adjacent residential or mixed-use neighborhoods, sometimes creating jarring streetscape conditions. This suggests the need for additional design guidelines or regulatory reviews.

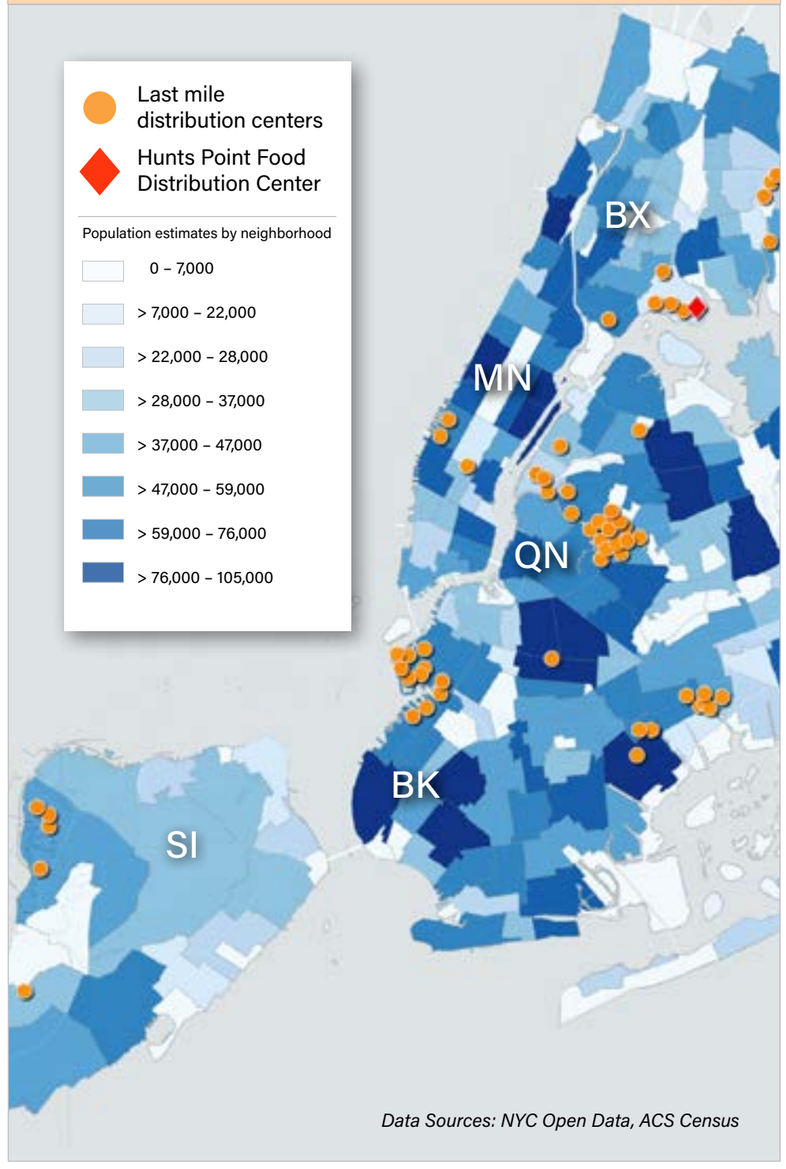
While most of the sites are located where linkages to a larger open space network do not exist, about a third are in places where open spaces could be linked to other nearby open spaces. Six of the sites surveyed are on waterfront-accessible sites where both public access to the waterfront and freight activities are feasible.

Almost all of the sites have some form of public transportation within a few blocks, although in most cases it is by bus and not subway. Only two of the surveyed sites have access to a ferry. About a third are proximate to an existing or proposed bike route, although most are unprotected lanes. This suggests that even if overall job densities are relatively low, site planning can support worker access by connecting the site to transit and accommodating alternative modes of transport like electric bikes.

In terms of freight infrastructure, all of the sites surveyed are located on or near a designated Local Truck Route. But only one third have immediate access to a highway designated as a Through Truck Route. As a result, delivery trucks with destinations outside of the borough end up using local streets to get to the closest truck route.

A few of the sites are adjacent to active freight rail lines. However, more are adjacent to underutilized rail rights-of-way that could be reactivated. About a third of the sites are adjacent to port facilities or have port facilities nearby. This suggests that there is potential to shift some portion of truck freight to rail and maritime modes.

Where are distribution centers in relation to where New Yorkers live?
The map shows key facilities in relation to NYC population density.



Design at the Interface / Where Movement and Place Meet

As a conceptual framing tool for our work we have defined the "Interface" between movement and place as an important opportunity for design and policy intervention. The Interface is a physical place where public meets private. At the micro-scale, it is the threshold over which goods move from a vehicle to a building—the street, the curb space, the sidewalk, and the building doorstep. At a larger, more conceptual scale, the Interface is any area adjacent to freight destinations—the neighborhoods through which delivery vehicles move, even if they are not the final destination.

At each of these interfaces, impacts are imposed on the communities that live, work, and recreate in these spaces, even when they also benefit from goods movement.

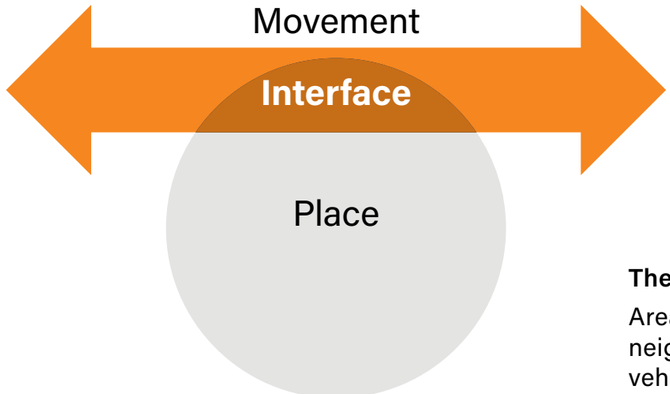
Components of the Interface are often considered independently—building design is independent of street design, for example. But the entire sequence of goods movement—between the street and a building, a building and its neighborhood—is critical to understanding the full range of negative impacts, as well as the strategies that might mitigate them. Logistics operations will optimize conditions within their control in order to increase efficiency and reduce costs. But without looking at the Interface holistically across the various entities that play a role, strategies for improvement will be missed.

Industrial Edge Interface | At a larger scale, the Interface between goods movement and the communities that goods move through is where negative impacts are both amplified and more difficult to capture. Impacts are produced at every link in the freight chain—in the siting and resultant traffic flows that surround distribution centers and warehouses, in the thousands of trucks making last-mile deliveries, and in the street networks that facilitate the circulation and loading of delivery vehicles.

Last-Mile Interface | The Interface at the street and building is where the negative impacts of goods movement are most perceptible to everyday observers. Delivery vehicles parked in bike lanes, packages being sorted in the street and on the sidewalk, piles of packages in mailrooms never designed to handle them, and the stolen packages left on doorsteps for the opportunistic passerby—these are all images that we know well.

There are many factors that contribute to last-mile systems operating this way, but extreme competition for every inch of space in dense urban areas within the public right of way, at the curb, and within buildings drives many of the band-aid solutions that are currently employed to ensure that goods are delivered.

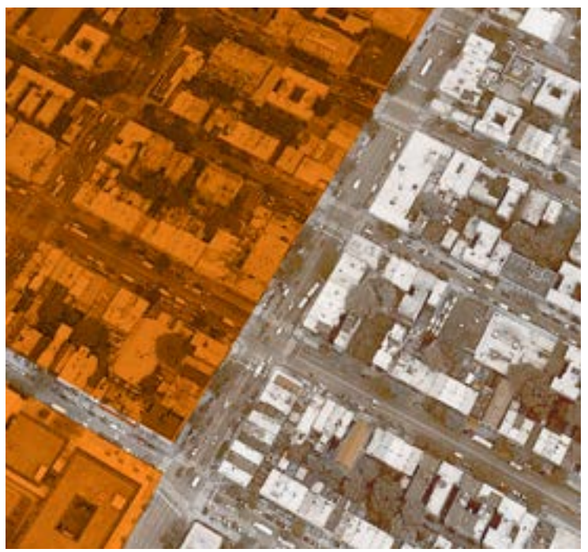
Across both scales, the Interface is both a physical and theoretical space where the impacts of the existing freight system are felt. These impacts are described in the scenarios that follow.



The Interface at macro-scale:
Areas adjacent to freight destinations, neighborhoods traversed by delivery vehicles

The Interface at micro-scale:
Streets, curbs, sidewalks, doorsteps

Design and policy interventions in this report are aimed at the Interface where movement and place overlap.



Interface at macro-scale: residential uses adjacent to industrial uses.

Interface at micro-scale: sidewalks, curbs, streets.

Challenges Today / Maspeth, Long Island City Case Study

Geographic context.

55-15 Grand Avenue.

Nearby Newtown Creek is an industrial waterway with multimodal options.

55-15 Grand Avenue Distribution Facility Under Construction

Why Maspeth?

Maspeth's industrial district—not the most isolated from surrounding neighborhoods nor the district with the most complex mix of uses compared to other rapidly changing districts in the city—illustrates the range of issues that arise when planning for freight delivery in New York City and the tensions that are inherent in the process.

In 2006, New York City established Industrial Business Zones (IBZs) as a strategy to protect and encourage local manufacturing, industrial businesses, and jobs, with the program operating as an economic development tool rather than a technical land use designation. The city's IBZs are comprised entirely of manufacturing-zoned land, although not all manufacturing-zoned land falls in IBZ districts. There are currently 21 IBZs located throughout the city, including the Brooklyn Navy Yard, parts of Sunset Park/Red Hook, parts of Greenpoint/Williamsburg, Long Island City/Maspeth, JFK, Hunts Point/Port Morris, and Staten Island North Shore/West Shore.

Maspeth IBZ is one of the largest, with a range of industrial and manufacturing business types and sizes. It is centrally located in western Queens contiguous with the Long Island City IBZ along the north shore of Newtown Creek. Previously a major freight rail hub for the city, inbound and outbound freight is now primarily delivered to these Newtown Creek IBZs by truck.

Maspeth's industrial district is advantageously situated close to major middle-mile Through Truck Routes through western Queens: the Brooklyn Queens Expressway and the Long Island Expressway. Its central location allows easy last-mile delivery trips to Queens, Brooklyn, and Manhattan.

55-15 Grand Avenue Freight Distribution Facility

Construction is expected to be completed in 2022 on a new five-story freight distribution facility located on the site of a former paper-making factory in the Maspeth IBZ. The 1.1M-square-foot as-of-right facility is located in an M3-1 Manufacturing Zone District flanked by underused freight rail lines or spurs on three sides. It is reported that Amazon has leased the purpose-built facility, with plans for one quarter of the building to be used for an Amazon Flex delivery station intended to be serviced by smaller, privately-contracted vehicles making last-mile deliveries. The remaining three quarters will be used as fleet storage for delivery vans.

Wheelspur Multimodal Facility

Located west of the new Amazon facility along Newtown Creek in the adjoining Long Island City IBZ, the Wheelspur Multimodal Facility is a successful example of the city and rail companies partnering with industrial businesses to restore part of the underutilized rail network for local freight movement, supplementing and providing an alternative to the current truck-dominant supply chain. The facility used for rail-to-truck transloading has the potential to divert 2,000 truck trips per year from city highways and streets.[7]

NYC Economic Development Corporation has identified the Maspeth Wheelspur site as a designated freight rail hub,[8] demonstrating that government investment in multimodal freight infrastructure can benefit the freight industry as well as surrounding neighborhoods.

Community Concerns

Residents of neighborhoods surrounding the new Amazon distribution facility, along with local politicians, have voiced concerns about the hundreds of additional trucks that will descend on surrounding neighborhoods and the increased congestion on the expressways that provide access to the site, along with the corresponding health, safety, and noise impacts. While street traffic improvements initiated by the City in and around the Maspeth IBZ have targeted existing truck traffic problem areas, increased truck traffic associated with new, large distribution facilities remains a concern to the community.

Expressing their frustration with the lack of community input in the City's as-of-right zoning approval process, community groups have increasingly demanded more regulatory control as a way to mitigate adverse impacts from industrial developments of this size to surrounding neighborhoods.

In response, Amazon has said that the facility will provide economic benefits and job opportunities to the area and has cited their commitment to transition their delivery vehicle fleet to electric-powered vehicles in the coming decades.

Challenges Today / Community

Climate Impacts

An increase in truck traffic results in a corollary rise in greenhouse gas (GHG) emissions. Prior to the pandemic, increasing truck volumes in the city resulted in a five percent increase in GHG emissions between 2005 and 2019, a total of 1.8 million tons of CO2 per year for all medium- and heavy-duty vehicles.[9] These numbers will decrease as the trucking industry moves toward electrification and as utility companies increase renewable energy generation. In July 2020, fifteen states, including New York, signed a memorandum of understanding to support "widespread electrification" of medium- and heavy-duty vehicles.[10]

Health Impacts

Even as trucks follow designated truck routes intended to minimize impacts on residential areas, pollutants generated by diesel-fueled trucks are felt across the area. Particulate matter 2.5 (PM2.5), particles measuring 2.5 microns (µg) or less in diameter, are released into the air from tire wear, brake pad wear, and road wear as well as engine combustion. According to the NYC Department of Health and Mental Hygiene, "Exposure to [PM2.5] can . . . affect lung function and worsen medical conditions such as asthma and heart disease. Scientific studies have linked increases in daily PM2.5 exposure with increased respiratory and cardiovascular hospital admissions, emergency department visits and deaths."[11] PM2.5 levels in Maspeth are higher than the rest of Queens and greater New York City with lasting health impacts on surrounding communities.

Safety Impacts

Safety is an issue, especially for vulnerable road users such as pedestrians, cyclists, the elderly, and individuals with restricted mobility. Delivery vehicles impact street safety in a variety of ways. They are often large vehicles with poor sight lines, making the likelihood of striking vulnerable road users higher than that of smaller vehicles. Delivery vehicles often block lanes of street traffic, contributing to a larger pattern of traffic chaos. Distinct from congestion, traffic chaos refers to traffic patterns that create confusion and force drivers and other road users to make quick decisions. This can lead to road rage and angry driver behavior, but it can also contribute to driver mistakes that can be fatal. Lastly, when delivery vehicles block bike lanes and crosswalks, they create dangerous conditions for vulnerable road users.

Noise Impacts

Noise from trucks is generated from many sources: from mufflers and large diesel engines to tire interaction with pavements, making heavy-duty vehicles louder than light vehicles.[12] As a result, heavy, diesel-propelled trucks typically produce noise levels in the range of 80 to 110 decibels, depending on weight and speed. Urban noise pollution is worsened by freight and logistics in other ways, also. Traffic congestion and blocked lanes result in horn honking, a significant contributor to noise pollution in New York City. Noise at these levels has been linked to several poor health outcomes including stress, hypertension, and a reduction in reading skills and oral comprehension in children. Based on these risks, the World Health Organization recommends that cities take action to reduce traffic noise levels to below 53 decibels.[13]

STRATEGIC QUESTIONS

- How can goods movement be considered part of the larger sustainability agenda as it relates to carbon emissions, air quality, and public health?
- How can community stakeholders be engaged as partners in planning for goods movement in their neighborhoods?
- How can neighborhoods that are adjacent to industrial zones and distribution facilities protect their livability?

Challenges Today / Industry

Transportation

New York City's unique geography presents challenges to the development of physical infrastructure to deliver freight quickly, efficiently, safely, and sustainably. Across the US, rail accounts for 28 percent of freight movement,[14] but in New York City rail freight is closer to two percent of the total.[15] Although the five boroughs are largely surrounded by water, the city's local maritime freight infrastructure has been neglected over the last half century, disincentivizing this mode as a viable alternative for the middle-mile segment of the delivery chain.

Meanwhile, micro-distribution modes have emerged as an alternative to delivery trucks servicing the last-mile segment of the supply chain in higher density neighborhoods, but they lack the necessary infrastructure and regulatory framework to operate effectively.

The city's reliance on truck freight leads to the concentration of vehicles at certain bridge and highway crossings, causing chronic congestion and its corresponding negative impacts. Not only does this affect quality-of-life conditions in neighborhoods along freight corridors, but it introduces inefficiencies to the freight supply chain that cause a disproportionate share of costs—estimated to be over 50 percent of total of e-commerce delivery costs—to be incurred during the last-mile delivery segment.[16]

Competition for curb space with private vehicle parking, service and emergency vehicles, buses, bikes, taxi and car service drop-offs, other micro-mobility vehicles, and curbside dining at the final delivery destination leads to more adverse impacts. Inadequate off-street freight loading/unloading areas for large buildings force delivery vehicles to compete for limited curb space or to block sidewalks.

Shifting the city's freight modal share imbalance is hampered by inadequate public investment in infrastructure for alternative freight modes. Compounding all of this are the layers of multiple jurisdictions and regulations that delivery vehicles operate under during their delivery trips.

Distribution Facilities

As New York City's manufacturing sector has declined over the last half century, the city has rezoned former manufacturing areas to other uses. From 2007 to 2016, more than eleven million square feet of the city's manufacturing area has been rezoned to other uses[17]. Coupled with the exponential increase in demand for distribution facilities located ever closer to consumer destinations, quality-of-life conflicts with other land uses in and around manufacturing districts where these facilities are located have become more frequent and difficult to resolve.

Delivery truck parking is an issue that has not received much attention. Distribution warehouses are required to provide minimum parking for employees and loading/unloading staging areas for delivery vehicles, however they are not required to provide space for delivery vehicles that need to park overnight while waiting for the next delivery shift. Independent truckers without an affiliation to the large freight haulers are especially affected by the limited amount of convenient and safe overnight parking for their vehicles. They are forced to find off-street parking lots near their routes or park on the street, contributing to impacts associated with commercial vehicles in surrounding neighborhoods.

STRATEGIC QUESTIONS

- How can freight industry needs be better integrated into the City's planning process?
- How can industry representatives actively engage in New York City's goods movement planning?
- How can the city's freight infrastructure be upgraded and expanded to facilitate multi-modal freight delivery networks?
- How can City agency management policies improve neighborhood quality of life at the final-fifty-feet segment of the delivery cycle?

Principles / About Our Values

At its core, this initiative is centered on building and strengthening livable communities—neighborhoods that are healthy and economically vibrant, where goods movement, fresh food networks, and safe, clean streets are all part of every New Yorker's everyday experience. We envision a post-COVID urban realm transformed by innovative approaches to long-standing problems.

Essential to making that vision a reality is recognizing the importance of freight movement as well as the negative impacts that freight operations impose on communities—and using that understanding as a basis for new thinking around actionable solutions.

This project examines key challenges across the system scale and the site scale and proposes opportunities that, when organized as part of an overall strategic approach, can begin to reduce negative impacts and help shape a built environment that embodies our guiding principles.

Equitable Planning

Establishing just outcomes for all, especially vulnerable and marginalized communities.

Neighborhood quality of life is directly impacted by increased street traffic. Resolving the challenges related to goods movement requires robust, authentic, dialogue between all stakeholders: government, industry, and local residents. It is particularly important to engage with vulnerable and historically marginalized groups because much of the infrastructure for goods movement, especially highways, truck routes, and distribution facilities - are located in or are adjacent to neighborhoods where these communities reside.

Environmental Sustainability

Mitigating negative impacts to climate and building a circular material economy.

The competition over speed of delivery, fueled by consumer expectations for instant gratification, has spawned an explosion of polluting vehicles that crowd our streets, as well as an explosion in waste packaging. The current climate crisis and overall degradation of the environment demand new strategies for reducing the numbers of vehicle trips, a shift to less polluting modes, and the transformation of waste streams into opportunities through the implementation of a "circular economy."

Balanced Goods Movement

Reconciling supply and demand sides for productive, people-centered urban freight.

In planning for New York's streets, buildings, and public spaces, design processes do not always account for the needs of freight, resulting in conditions that force delivery workers to navigate challenging conditions. In addition, the facilities themselves are too often out of scale with neighboring communities and create intimidating streetscape conditions.

To prepare for a new future for freight it is critical to integrate freight networks and facilities into the urban fabric in a way that balances neighborhood needs for available and accessible goods with the actual systems of delivery. This includes ensuring the type of livable streets and high quality-of-life standards that are essential for communities to thrive and contribute to the city's success.

SECTION OVERVIEW

Current-State Scenarios / What Does Goods Movement in NYC Look Like Today?

Scenarios: Contents

The following four scenarios exemplify a range of typical goods movement trips in New York City—highlighting different kinds of goods, modes, times of day, speeds of delivery, destinations, and neighborhoods.

Although the conditions covered in this section are not exhaustive, they begin to capture opportunities for improving the landscape of goods movement in the city.

Each scenario has been assessed to understand related design challenges, strategic questions, resulting impacts, and opportunities for the delivery of consumable products. They condense technical information into image-based narratives that are relatable to broad audiences. Each scenario is organized around four trip segments:

1. Middle Mile refers to the route and the mode by which the product—bulk, finished, or unfinished—makes it way from a regional distribution center to an intermediate destination where it is repackaged or transformed in some way. In general, these trips begin at a port, airport, or freight yard at the edge of the city. Larger vehicles are typically used for this leg of the trip.

2. Intermediate Destination is the first stop for the product. It is where the product may be broken down into smaller packages or where it begins a process that transforms it in some way. This may be a wholesale market, a fulfillment center, or a factory.

3. Last Mile referes to the route and the mode by which the repackaged or modified product is delivered to a final destination. A more diverse range of smaller vehicles is used for this leg of the trip.

4. Final Fifty Feet is the last stop in the delivery chain where the delivery vehicle approaches its destination, finds a place to park, and product is transferred from the delivery vehicle to the final destination. This may be the door of someone's apartment, a restaurant kitchen, a construction site, or a place for export.

Key Locations and Modes for Varied Delivery

Middle Mile		Intermediate Destination		Last Mile		Final Fifty Feet	
Movement/mode	Interface	**Place**	Interface	**Movement/mode**	Interface	**Place**	
Heavy-duty truck		Residential		Heavy-duty truck		Residential	
Light-duty truck		Commercial/office		***Light-duty truck***		Commercial/office	
Van		Grocery		Van		Grocery	
Car		Construction		Car		***Construction***	
Cargo Bike		Export facility		Cargo Bike		Export facility	
Mass transit		***Industrial facility***		Mass transit		Other	
Drone		Other		Drone		Other	
Bot		Other		Bot		Other	

Scope of scenarios does not typically include the First Mile, which brings the product to the region.

Scenario: Consumer Product to Residence / The Freight Route

Abstract: Truck with consumer goods delivers products to a distribution facility in the South Bronx; from there packages are delivered to a Harlem residential complex.

The local supply chain for urban e-commerce consumer product deliveries is characterized by a rapidly expanding and evolving system of freight carriers, distribution hubs, and last-mile delivery operations designed to provide fast, efficient deliveries directly to consumers.

Typical consumer products manufactured beyond the immediate region arrive into the city on large diesel-burning trucks that travel on major, limited-access highways—the middle-mile segment of the delivery trip. The truck's cargo is dropped off and unloaded at the intermediate destination, a large distribution and logistics facility, such as 2505 Bruckner Boulevard in the South Bronx. At these facilities, typically located in industrial and mixed-use districts throughout the city, the products are sorted and packed for shipment to the individual consumers.

From here, individual products are loaded onto smaller trucks or vans that transport the consumer goods—the last-mile segment of the trip—for delivery to the final destination, such as an apartment unit. Due to the lack of dedicated commercial parking and unloading spaces in the street for last-mile delivery vehicles, the trucks are often forced to double park during the final hand delivery—the final fifty feet segment of the delivery chain.

Map shows entire freight route for scenario.
Trip segments described in scenario are:

1→ Middle Mile
From I-95 to South Bronx
From I-80 merging with I-95 near Teaneck, NJ

2 Intermediate Destination
2505 Bruckner Boulevard, The Bronx

3→ Last Mile
From 2505 Bruckner Blvd., The Bronx to West 151st St, Manhattan

4 Final Fifty Feet
Harlem River Houses, W. 151st St., Manhattan

Consumer Product to Residence / Trip Segment: Middle Mile

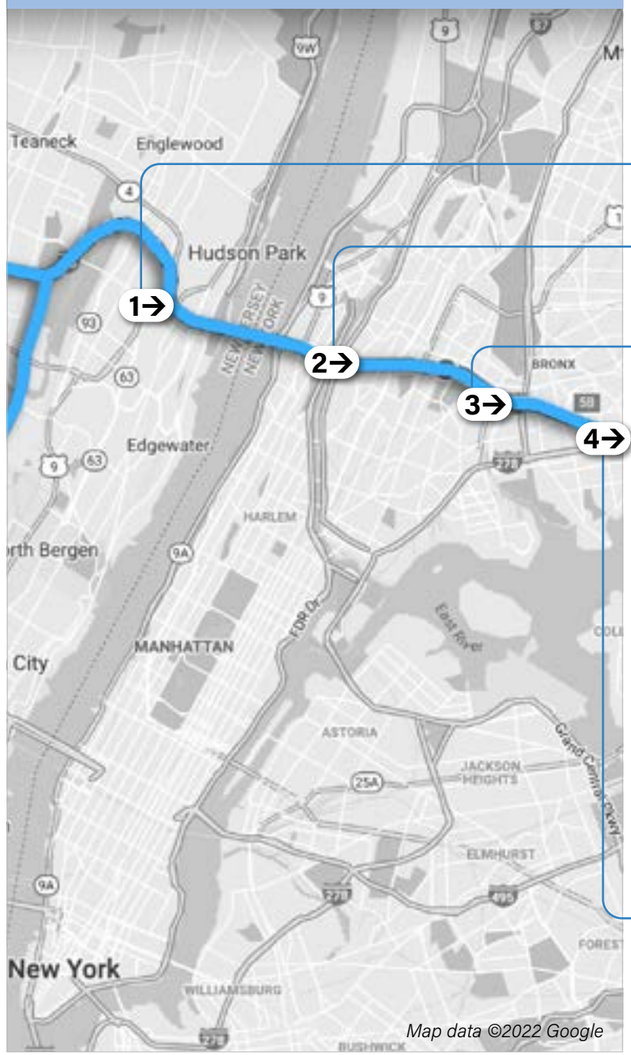
Consumer products ordered online are shipped from regional distribution warehouses located near Trenton, NJ or the Lehigh Valley area of Pennsylvania into the New York City area via heavy-duty 53' semi-trailer trucks. The inbound trucks travel across New Jersey along interstate highways I-95 and I-80, with routes merging at the George Washington Bridge (GWB).

After crossing the GWB into upper Manhattan, the trucks travel east on the Cross Bronx Expressway (I-95) through the South Bronx, arriving overnight at the 2505 Bruckner Boulevard Logistics Facility located at the interchange of the Cross Bronx Expressway, Hutchinson River Parkway, and the Bruckner Expressway. Regionally manufactured consumer products could arrive at the same facility via truck on any of the interstate highways interconnecting the region.

Deliveries to the Bruckner Logistics Facility are typically scheduled at night to facilitate next-day delivery to consumers and avoid traffic congestion on the freeways. Even so, due to the extreme traffic issues on the Cross Bronx Expressway, trucks may detour out of their way to their destination using the Major Deegan Expressway.

Getting to the Logistics Facility

Originating at New Jersey Turnpike Exit 8A regional distribution hub, product is transported by truck northeast on I-95 across George Washington Bridge to 2505 Bruckner Boulevard, Bronx. Product may also originate at regional distribution hub in the Lehigh Valley of eastern PA, transported by truck east on I-80 toward NYC where route merges with I-95.



1. Traffic leading onto George Washington Bridge

2. I-95 in NY, between Weeks Ave. and Monroe Ave.
Map data ©2022 Google

3. I-95 approaching Bronx River Pkwy
Map data ©2022 Google

4. I-95 at Unionport Bridge, leading directly to facility
Map data ©2022 Google

Understanding the Context

Policy

- Limited access freight routes into New York City, coupled with heavy public investment in regional highway infrastructure, incentivize the predominance of trucks for freight delivery.
- In New York City, most major freeways are designated as Through Truck Routes.

Industry

- Truck freight is the fastest, most efficient, and dependable mode for regional deliveries of consumer products.
- Inbound night delivery schedules take advantage of off-peak toll pricing at the GWB crossing.

Community

- Although the Cross Bronx Expressway is a designated Through Truck Route, the heavy-duty delivery trucks, most likely gas- or diesel-powered, contribute to harmful carbon emissions, particulates, and noise in South Bronx neighborhoods located along the route.

Design

- The depressed trench segment of the Cross Bronx Expressway reduces some noise and visual blight to adjacent neighborhoods. Capping of the depressed segment, which is currently being studied, could further reduce localized air pollution, noise, and visual blight as it reconnects the separated neighborhoods.

Consumer Product to Residence / Trip Segment: Intermediate Destination

After exiting from I-95, delivery trucks travel a short distance on a local service road to the 2505 Bruckner Logistics Facility (currently under construction). Located on a 19-acre site in a low-density commercial C8-1 zone district bridging commercial and manufacturing uses, the secured site is isolated from adjacent neighborhoods by the surrounding limited access highways and Westchester Creek.

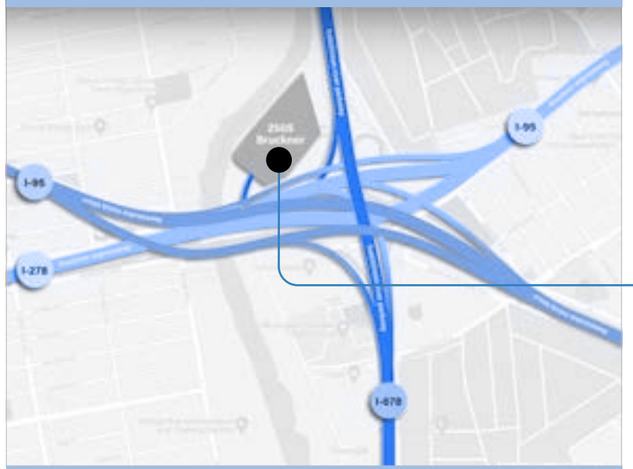
The site's remote location minimizes conflicts from on-site loading and employee parking but limits access to public transit for employees commuting to the facility. The closest MTA subway station is one mile away, although several local and express bus routes have stops near the entrance to the site. A protected bike path along the Hutchinson River Parkway provides access from neighborhoods to the north while a new bike path will be provided on the Unionport Bridge replacement currently under construction near the entrance to the site.

The 1.1M-square-foot, multi-story logistics facility is designed for truck loading/unloading on two sides with two-level structured parking to reduce site coverage. Electricity generated by rooftop solar panels may be sold back to the electric grid via Con Edison's Community Solar program. The facility will also include infrastructure for charging stations for electric-powered delivery trucks and employee vehicles.

After offloading cargo at the loading dock, products are warehoused and then sorted with automated machinery. Individual orders are packaged and sorted by delivery location before being loaded onto light-duty trucks for delivery to their final destinations.

Vehicular Access

2505 Bruckner is located for quick access to/from the George Washington, RFK, Throgs Neck and Whitestone Bridges



Situated for Regional Distribution

Hub accommodates delivery to NYC, Long Island, Westchester County, and lower Connecticut.

Rendering: 28′ ceilings, with 80′ x 80′ column spacing

Rendering: A highly automated and efficient facility

Rendering: Operationalized via fully integrated logistics

Rendering: Rooftop solar reduces facility carbon footprint

Understanding the Context

Policy

- Locating the facility in a limited-use commercial/manufacturing zone district reduces negative impacts to surrounding residential neighborhoods.
- Currently, limited regulations or incentives are available to influence the choice of vehicle technology for freight vehicles. Expanding the Hunts Point Clean Truck Program to other industrial districts could incentivize the use of electric vehicles and particulate filters more broadly.

Industry

- Direct access to multiple regional highways from the distribution hub provides quick delivery routes to a large consumer market.
- The unencumbered, isolated site allows for efficient site use and optimal building design, with minimal impacts to adjacent neighborhoods.
- Federal regulations limit truck driver on-duty hours-of-service in a shift before a break is required. The facility provides on-site delivery vehicle fleet parking for driver shift breaks and overnight storage of vehicles. This eliminates situations where a delivery truck must find convenient and safe overnight parking in private parking lots or park on the street during their shift break.

Community

- The location of the facility at the expressway interchange reduces truck impacts to adjacent neighborhoods.
- Although isolated from residential neighborhoods, the facility is serviced by several MTA bus lines connecting to the Bronx bus network, as well as Express and Select Bus Service to northern Queens via the Whitestone Bridge. The nearest subway station is one mile from the facility which may discourage non-vehicular commuting by some employees.

Design

- Intersections near the site entrance need to be carefully designed to accommodate multi-modal users (motorists, pedestrians, transit riders, and bicyclists) and manage conflicts between vulnerable users and trucks.
- The multi-story logistics facility and accessory two-level structured parking is an efficient use of a difficult site.
- Rooftop solar panels reduce the facility's carbon footprint.
- Infrastructure is in place to allow for the installation of EV charging stations for delivery fleet and employee vehicles by the facility operator.

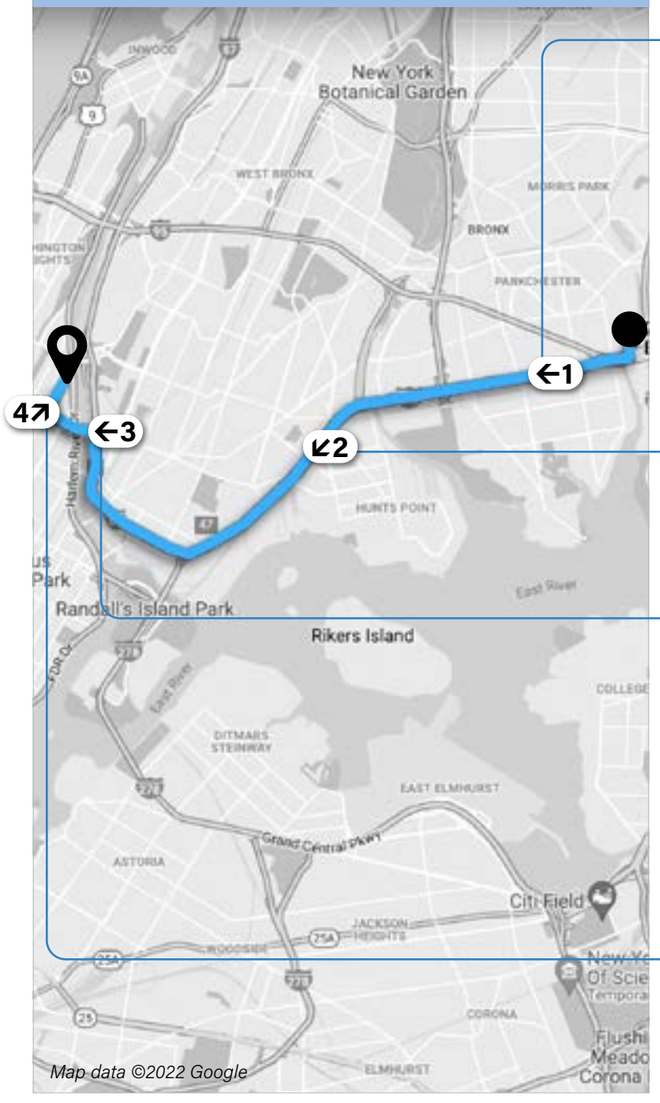
Consumer Product to Residence / Trip Segment: Last Mile

A light-duty truck or van loaded with individual packages departs 2505 Bruckner on local service roads to the on ramp to the Bruckner Expressway (I-278). Traveling southwest through the South Bronx along the Major Deegan Expressway (I-87), the delivery vehicle crosses the Harlem River at the 145th Street Bridge, and continues on local commercial streets to Harlem River Houses at 211 West 151st Street. The delivery vehicle follows designated truck routes through commercial neighborhoods for most of the trip segment.

Since there are no commercial parking spaces on West 151st Street, the driver double parks near the final destination on Adam Clayton Powell Jr. Boulevard, blocking the M2 bus lane. The carrier transfers packages to a hand cart for final delivery to individual apartments in the Harlem River Houses complex.

Moving the Goods to Residences

Medium-size box truck departs 2505 Bruckner in The Bronx, drives to West 151st Street in Harlem.



1. 278/ Bruckner Expwy, South of Castle Hill Ave.
Map data ©2022 Google

2. 278/ Bruckner Expwy, crossing Lafayette Ave.
Map data ©2022 Google

3. 145th St. Bridge. No Tolls. Low vertical clearance (14')
Map data ©2022 Google

4. W. 145th St. at Adam Clayton Powell Jr. Blvd
Map data ©2022 Google

Understanding the Context

Policy

- Delivery vehicles travel on designated Through and Local Truck Routes other than local streets at the trip origin and destination.
- The delivery vehicle driver is forced to double park on the nearest commercial street due to the absence of a neighborhood loading zone on West 151st Street.

Industry

- Delivery routes are optimized to minimize cost and meet customer time demands.
- Delivery vehicle capacity may be constrained if traffic congestion limits the number of deliveries that can be made in one shift or within a certain time window.

Community

- Light-duty delivery trucks or vans, most likely gas- or diesel-powered, contribute to harmful carbon emissions in South Bronx and Upper Manhattan neighborhoods located along the truck delivery route.
- The delivery route follows local residential streets after entering Upper Manhattan, so local traffic, noise, and safety issues may exist.

Design

- The location of the logistics facility near a major highway interchange with easy access to Manhattan minimizes the distance from the intermediate destination in the South Bronx to the final destination in Upper Manhattan.

Consumer Product to Residence / Trip Segment: Final Fifty Feet

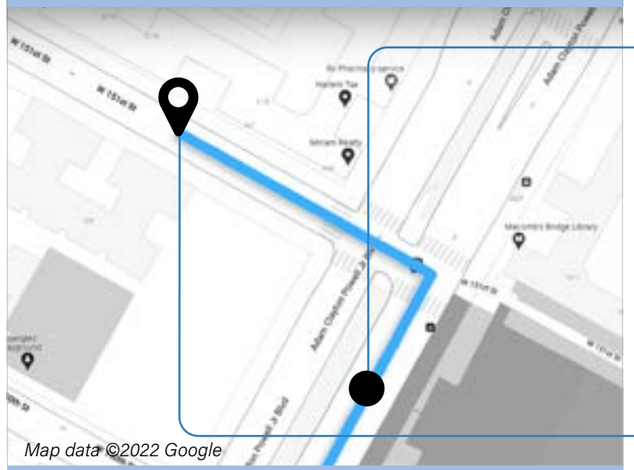
The final destination of the consumer package is the mid-rise Harlem River Houses complex, which spans across a two-block site located in a medium-density residential R7-2 zone district. The primary delivery access point is on West 151st Street, a narrow cross street with free parking but no designated commercial parking spaces. The density of residential units creates high demand for the limited number of street parking spaces, resulting in a low turnover of spaces. The surrounding north-south streets are fronted with a mixture of commercial and residential uses.

After double parking on Adam Clayton Powell Jr. Boulevard, packages are unloaded from delivery vehicles onto hand carts or carried by hand to their final destinations. Separate apartment blocks located along the perimeter of the site are accessed through an interior courtyard. Final hand delivery is made to the front doors of individual apartments since there is no common lobby to receive packages. Unattended packages are not left in apartment corridors or other common areas due to security concerns.

Any other deliveries within the complex or within a one-block radius are hand delivered before returning to the delivery vehicle to drive to the next destination.

Home Delivery

The final destination: NYCHA housing complex in medium-density neighborhood on West 151st Street.



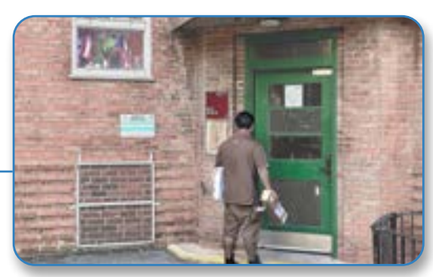
The Site

Overview of Harlem housing complex where the goods are delivered.

Double-parked truck on adjacent commercial street

Entrance to NYCHA housing complex

Housing complex directory



Hand deliveries to individual apartments within complex

Understanding the Context

Policy

- The medium-density residential R7-2 zone district may not have high enough demand to support local shared package consolidation facilities.

Industry

- Efficiency of hand delivery of packages to individual apartments spread across the two-block site is low compared to delivery to a common delivery point.
- If no one is home, the delivery will "fail" and goods may be returned to the distribution center for pickup or for a second delivery attempt.

Community

- Double-parked delivery vehicles create traffic congestion, potentially blocking bus lanes and access by emergency and service vehicles.

Design

- Commercial parking spaces must be large enough to accommodate the delivery vehicle, vehicle maneuvering, and loading activity, including possible use of a ramp or lift gate.
- Existing residential buildings without common package areas may not have adequate space to accommodate a centralized receiving area.

Consumer Product to Residence / Imagine a Different Future . . .

While electric-powered trucks will continue to be the primary long-haul freight mode used to transport consumer goods manufactured outside of the region, more freight enters the New York area by rail or water, connecting to a network of intermediate destination distribution hubs and logistics facilities.

A range of transportation modes connect these hubs to a decentralized network of neighborhood freight consolidation centers that are strategically located in industrial districts throughout the city. Smaller energy-efficient, micro-mobility vehicles transport packaged consumer products from freight consolidation centers to their final destinations.

Most packages are delivered to secured package receiving facilities located in building common areas, storefront receiving centers, or even secured lockers designed as high-quality street furniture located on wider sidewalks or sharing street curb lanes. As a result, delivery vehicles spend less time parking and unloading at final destinations.

The same package receiving centers and common lockers can be used to return products with a reverse logistics system that reduces return deadhead trips by empty delivery vehicles.

With fewer large trucks on city streets, traffic congestion is reduced, air quality is improved, and traffic injuries and fatalities decline. Streets and sidewalks are carefully managed to allow for a wider range of transportation modes and public amenities to co-exist. Freight deliveries are more efficient and reliable, benefiting communities and the e-commerce industry alike.

Moreover, as a result of expanded local freight options, a re-energized regional and local manufacturing industry flourishes, supplying more local consumer goods to city residents. These businesses are part of a growing, environmentally sustainable network of manufacturers and suppliers that provide expanded job opportunities for local residents.

Fewer delivery vehicles will be on the street thanks to consolidation of parcels in secure, accessible lockers in the community.

Scenario: Fresh Produce to Restaurant Table / The Freight Route

Abstract: Refrigerated truck delivers produce to the Bronx; goods are then dispersed throughout the city.

A long-haul reefer truck loaded with perishable food enters New York City via I-95/George Washington Bridge and takes the Cross Bronx Expressway to the Hunts Point Food Distribution Center. At Hunts Point, cargo is broken up and transferred to market vendors, where it is sold and loaded onto smaller vehicles—box trucks, vans, and cars—that are owned and operated by buyers. In this scenario, a restaurant in Manhattan's Greenwich Village is purchasing crates of avocados. Depending on time of day and route, the 11-mile trip between market and restaurant takes anywhere from 55 minutes to 2.5 hours.

Map shows entire freight route for scenario.
Trip segments described in scenario are:

1→ Middle Mile
From I-95 to Hunts Point in the South Bronx

2 Intermediate Destination
Cooperative Market at Hunts Point Food Distribution Center

3→ Last Mile
From Hunts Point to Manhattan's Greenwich Village

4 Final Fifty Feet
Vehicle unloads at Houston Street and Sullivan Street

Fresh Produce to Restaurant Table / Trip Segment: Middle Mile

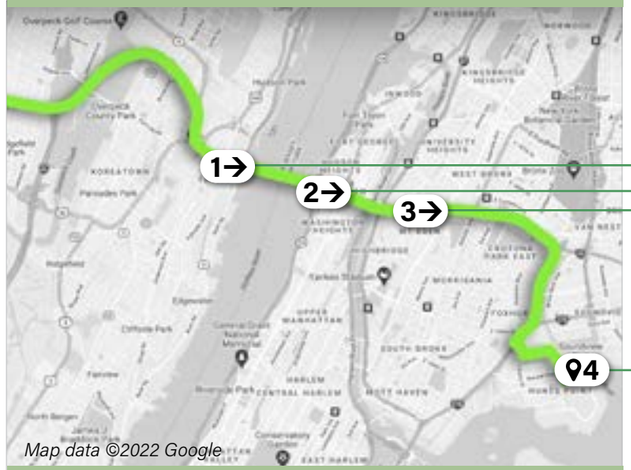
A 48′ long-haul refrigerated truck bound for the Hunts Point Terminal Produce Market in the Bronx enters New York City via the George Washington Bridge (GWB). According to GPS data collected and analyzed by the American Transportation Research Institute, the I-95/Route 4 junction leading onto the GWB is "the most congested stretch of highway in America".[18] The bridge carries over 100 million vehicles per year, and 30 percent of all trucks crossing the GWB are believed to be carrying food.[19]

The truck pays a toll rate of $81 to cross the bridge since it is traveling during off-peak hours (after 8 pm on a weekday), taking advantage of the Port Authority's Truck Volume Discount Plan. To participate in this plan, the company must make more than 100 New York City-bound off-peak trips per month.

The vehicle travels from the bridge to the Hunts Point neighborhood in mixed traffic with passenger cars and other trucks via the interstate highways that make up the city's Through Truck Route network. Even on these designated routes, the truck encounters trench-like channels and constricted overpasses, limiting driver visibility.

Trucking into the Bronx

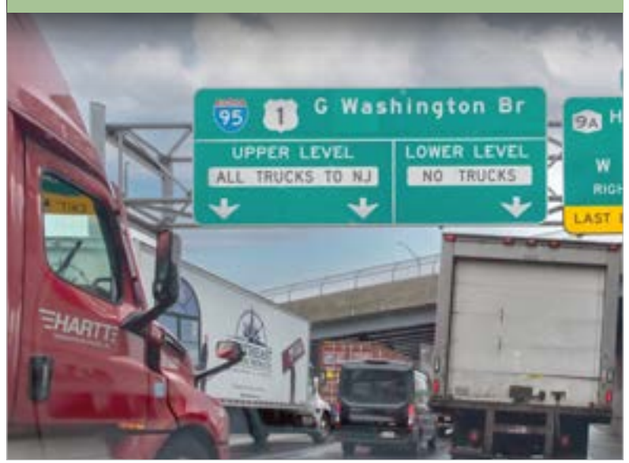
Route: NJ I-95 to Hunts Point Food Distribution Center in The Bronx.



Map data ©2022 Google

Challenges at the Point of Entry

I-95 across George Washington Bridge, the bridge rated as "worst truck bottleneck in the country" by the American Transportation Research Institute.



1. I-95 North, leading onto George Washington Bridge
Map data ©2022 Google

2. Truck heading northeast on I-95/Cross Bronx Expwy

3. Cross Bronx Expwy, at Morris Ave. overpass

4. Exit to Hunts Point Ave. from 278/Bruckner Expwy
Map data ©2022 Google

Understanding the Context

Policy

- In New York City, the truck must travel on the designated Through and Local Truck Route network.
- The truck takes advantage of off-peak pricing on the GWB.

Industry

- Truck is the most cost-efficient freight mode from most producers, although some limited rail access to Hunts Point is available.
- Goods travel on 48-foot semi-trailers, the largest trailer that can typically be carried within the city's maximum 55-foot vehicle length limit.

Community

- The truck adds traffic on the already crowded Cross Bronx Expressway and on local streets in the Bronx.
- Diesel vehicle traffic generates substantial air pollution. Neighborhoods adjacent to the Cross Bronx Expressway are home to heavily minority and low-income populations and have among the highest asthma rates in the US.

Design

- Freeways provide wide lanes and high clearances that are relatively easy to navigate.
- Truck routes are indicated with limited signageage.

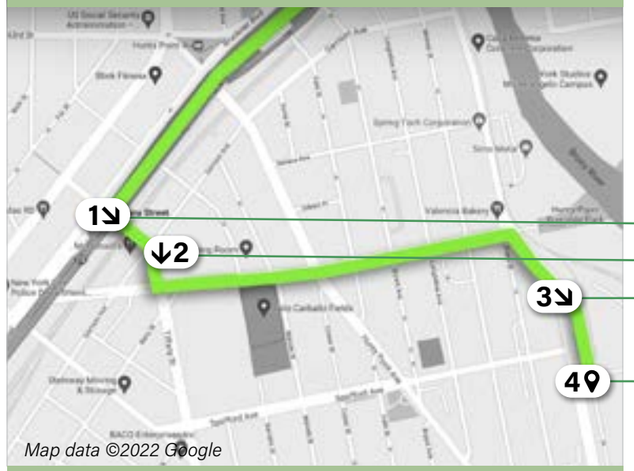
Fresh Produce to Restaurant Table / Trip Segment: Intermediate Destination

After exiting the interstate, the semi-trailer truck travels on local streets through a primarily industrial neighborhood to the market entrance. The driver looks for signage indicating the designated Local Truck Routes. While the wide roads that have been designed to accommodate industrial activity in the area are relatively easy to navigate, the driver must proceed carefully to ensure the safety of other street users, particularly vulnerable pedestrians and cyclists who may be difficult to see in low-light conditions and other vehicles entering and exiting the neighborhood's many driveways and loading docks.

After reaching the market, the truck parks at a loading bay. Products are offloaded from the truck and sorted in a single-story, refrigerated cross-docking facility. The capacity of this facility is limited compared to newer, technology-enabled high-cube warehouses. The sorted goods are then transferred to smaller refrigerated box trucks and vans. Night-time loading activity will generate noise and light pollution during the evening and overnight hours, but the impacts of these on local residents will be limited due to the market's isolated location in an industrial section of the neighborhood. In the early morning, vehicles will depart the market to deliver products to local restaurants and grocery stores before the start of business hours.

First Stop: Hunts Point

A local exit branching off 278 leads to The Cooperative Market at the Hunts Point Food Distribution Center.



Main Hub of City Food Distribution

Hunts Point Food Distribution Center is "the largest food distribution center of its kind in the world." Trucks docked in receiving bays stretch to the horizon.

1. Local truck traffic leading to Hunts Point Market

2. Featureless walls in the surrounding environment

3. Parked trucks and constricted street

4. Entrance to Hunts Point Market

Understanding the Context

Policy

- M1 and M3 zoning limit development of conflicting residential land uses at the terminal location.
- The NYC Department of Transportation's Clean Trucks Program incentivizes the use of cleaner vehicles serving Hunts Point.

Industry

- The terminal is located close to the Bruckner Expressway (I-278) and water (East and Bronx Rivers), and is accessible by rail.
- Goods arrive at Hunts Point Market in the evening for late-night loading to local delivery vehicles that will depart in the early morning.
- If the driver is approaching the maximum permitted hours-of-service per shift, they may need to seek out an overnight parking lot; this is often a challenge in New York City due to limited independent parking facilities for freight trucks.

Community

- The truck may encounter vulnerable roadway users on local streets; safety concerns may be exacerbated in dark evening hours. These risks should be mitigated by the ongoing construction project that will provide direct freeway access from the Bruckner Expressway to the market.

Design

- The single-story terminal buildings require large sites. Multiple loading docks facilitate loading operations.
- Facilities are refrigerated to maintain the quality of goods.
- Local streets in the terminal neighborhood are designed for large vehicle traffic (e.g. wide lanes and adequate turning radii for trucks at intersections), making these streets difficult to navigate for pedestrians and bicyclists.

Fresh Produce to Restaurant Table / Trip Segment: Last Mile

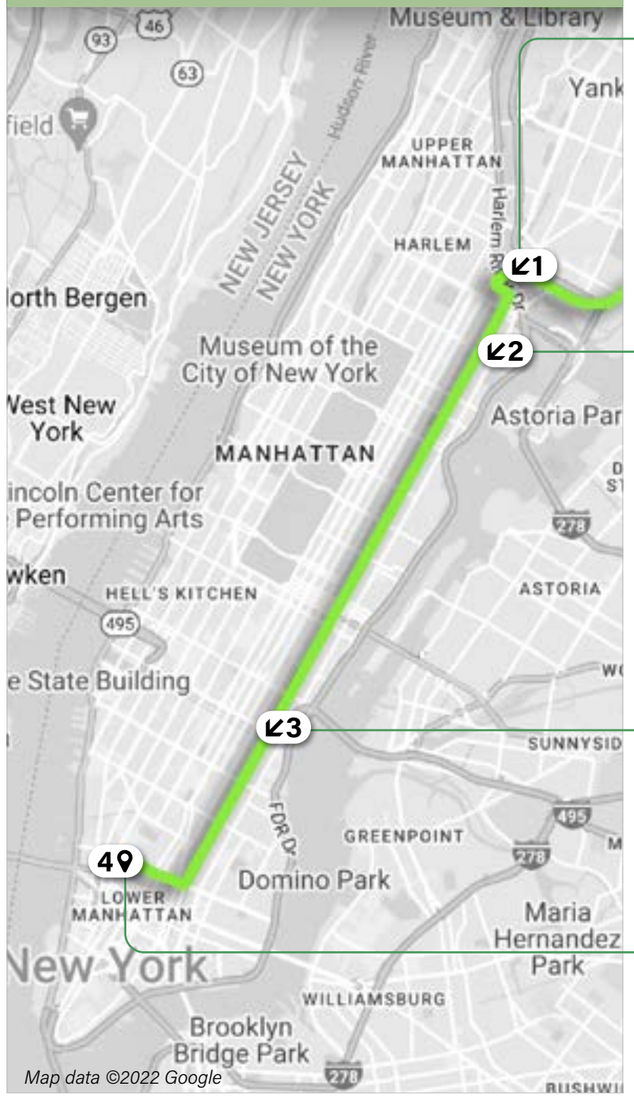
A commercial van departs Hunts Point in the early morning, bound for Manhattan's Greenwich Village, a mixed residential and commercial neighborhood. After crossing the Triborough Bridge, the van travels southbound through Harlem to the Lower East Side on Second Avenue, a major arterial street that is part of the city's designated Local Truck Route network.

The van is not permitted to drive on the FDR Drive since commercial vehicles are not permitted to operate on the city's parkway system. The van crosses from the East Side to Greenwich Village via Houston Street, another busy arterial. Along both Second Avenue and Houston Street, the vehicle travels in mixed traffic during early commute hours, with both passenger and freight vehicles making frequent turns and curbside stops, resulting in "stop-and-go" travel conditions along much of the route.

The driver must navigate through intersections where pedestrians and cyclists frequently cross, even during signal phases when these crossings are prohibited. On some days, the driver faces severe congestion on Second Avenue between 41st and 57th streets due to UN-related street closures.

Moving the Goods Downtown

From Hunts Point to restaurant in Greewich Village, travelling south on Second Avenue.



1. Across the 3rd Ave. Bridge into upper Manhattan
Map data ©2022 Google

2. 2nd Ave. at 116th St.
Map data ©2022 Google

3. 2nd Ave. at 34th St.
Map data ©2022 Google

4. 2nd Ave. at 14th St.
Map data ©2022 Google

Understanding the Context

Policy

- Delivery vehicles will travel on designated Local Truck Routes.

Industry

- Deliveries will be made using 35-foot or smaller box trucks, likely refrigerated; these vehicles are more practical to navigate urban streets
- Local delivery trips in the city can last up to eight hours, reinforcing the need for efficient driving and delivery operations.

Community

- Travel typically occurs between early morning during morning peak travel and mid-afternoon, contributing to traffic congestion.

Design

- Local Truck Routes may not be adequately marked with signage.
- Delivery vehicles operate in shared lanes with all motor vehicle types; with increasing dedication of space for other modes (e.g. bus, bike), motor vehicle capacity is constrained.
- Frequent intersections
  - A lot of stopping and starting will affect travel time, fuel consumption, and emissions.
  - Trucks will interact with all transportation modes, including pedestrians; high visibility cab designs help drivers navigate streets more safely.

Fresh Produce to Restaurant Table / Trip Segment: Final Fifty Feet

Finally, the commercial van arrives at its destination in Greenwich Village on a narrow residential street near an intersection with high pedestrian and automobile volumes. During the COVID-19 pandemic, curbside space that was previously designated for parking and loading was converted to outdoor dining as part of the Open Restaurants program, leaving no direct access for deliveries in front of the restaurant and less parking along the entirety of the block.

Like most of the other vehicles dropping off goods or passengers to the block, the driver double parks within the motor vehicle lane, obstructing through traffic. The driver offloads boxed produce onto a hand cart and walks in the travel lane to a curb cut at the corner nearest the restaurant. Entering the restaurant, which is not yet open for business, the driver offloads the boxes close to the kitchen, where restaurant staff are waiting to receive and unpack the produce. The driver then returns to their vehicle and offloads the rest of the restaurant's order. Once the delivery is complete, the driver departs the location to travel to the next customer.

Vehicle Arrives at Restaurant

Produce delivered to restaurant in medium-density residential area with limited parking and constricted street space.

Map data ©2022 Google

Post-Covid Site Conditions

The challenges of narrow residential streets and limited parking can be compounded by space reallotted to Open Restaurant sheds.

1. Houston St. at Broadway
Map data ©2022 Google

2. Houston St. at Sullivan St.

2. Drivers face limited, regulated parking spaces

3. Goods arrive at constricted local street

Understanding the Context

Policy

- Mixed-use zoning allows ground-floor restaurants and retail with residences on upper levels.
- Curb regulations affect parking availability. On many commercial corridors, dedicated commercial parking times may or may not align with hours when businesses expect deliveries.
- Engine idling is permitted to power vehicle refrigeration units during delivery.

Industry

- Delivery times are typically determined by the receiver. Restaurants typically schedule deliveries when staff are on site but before customers arrive since delivery activity may occur in customer spaces.
- Curbside-to-building handling is completed quickly to maintain product quality and safety.
- The driver will consider ease and safety of loading operations. The weight of goods may limit the distance the operator will park from the destination. If no space is available, or if parking space is difficult to enter or exit, the driver will likely double park.

Community

- Travel lanes, bikes lanes, and sidewalks may be obstructed by loading activity, creating safety risks for motorists, cyclists, and pedestrians.
- Obstructed lanes may increase traffic delays, vehicle emissions, and noise from horn honking.
- Permitted engine idling generates carbon emissions.
- Noise from loading activity, particularly during early morning hours, may be a nuisance to nearby residents.

Design

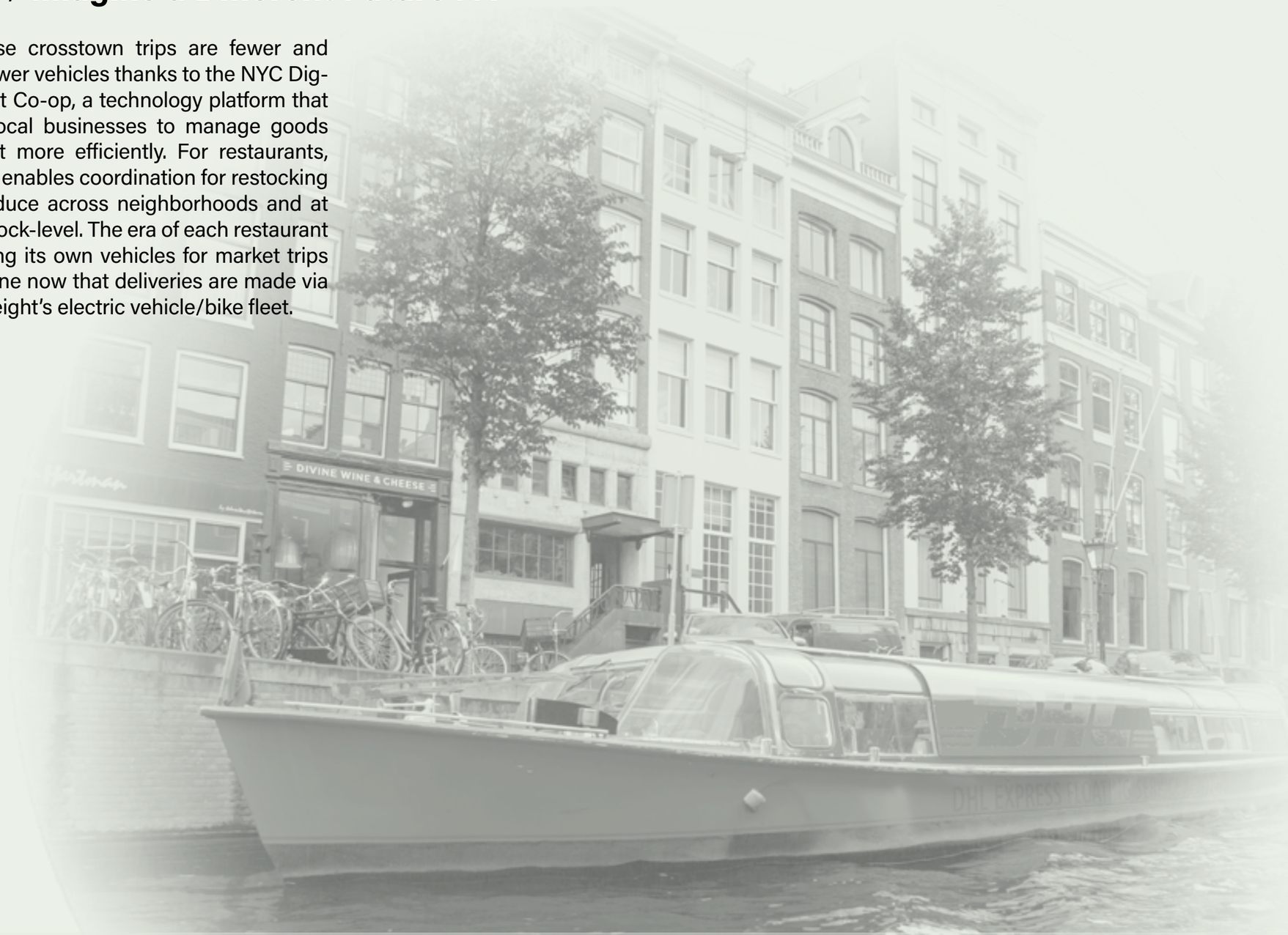
- If goods are being offloaded at street level, drivers may need to walk to a curb cut to access the curb.
- Commercial parking zones must be large enough to accommodate the delivery vehicle, vehicle maneuvering, and loading activity, including possible use of a ramp or lift gate.
- Delivery time may be affected by building characteristics (e.g. Is a freight elevator available? Does on-site activity obstruct delivery operations?)

Fresh Produce to Restaurant Table / Imagine a Different Future . . .

It's 2040 and New York City has fully executed the goals described in the NYC Economic Development Corporation and the NYC Department of Transportation's 2021 vision document, "Delivering Green." Fresh food now comprises most of the cargo carried by ShipNYC, the city's new maritime freight fleet. Hunts Point Food Distribution Center has been right sized and continues to thrive while satellite hubs ring the city with waterfront markets serving wholesale and retail customers alike.

The shift from road to river has significantly reduced congestion and pollution in the Bronx, with associated decreases in mortality rates from crashes and asthma. Travel miles for restaurant and hospitality businesses have dropped since a four-hour round trip is no longer required for a downtown restaurant to get fresh ingredients. For many, what used to be a city-length trip is now a crosstown run to the waterfront, where refrigerated food products arrive by barge around the clock.

Even those crosstown trips are fewer and require fewer vehicles thanks to the NYC Digital Freight Co-op, a technology platform that enables local businesses to manage goods movement more efficiently. For restaurants, the co-op enables coordination for restocking fresh produce across neighborhoods and at precise block-level. The era of each restaurant maintaining its own vehicles for market trips is long gone now that deliveries are made via Digital Freight's electric vehicle/bike fleet.



The working waterways of European cities provide precedents for effective ways of transporting goods, including food and produce, closer to a final destination.

Scenario: Heavy Materials to Construction Site / The Freight Route

Abstract: Heavy construction materials for a new building are shipped across boroughs.

A structural component for a new building—in this case steel lintel angles for a brick facade—arrive in Port Newark by ship or rail and are taken by truck to a manufacturer in Queens to be fabricated to architectural specifications. The finished lintel angles are then transported to a building construction site in the South Bronx. This journey relies entirely on large and intermediate-sized diesel engine trucks, which need to navigate neighborhood streets to arrive at the factory and at the building site. The windowless factory creates an unattractive street condition for nearby residences. At the construction site, the delivery truck blocks the sidewalk and idles noisily as it waits to be unloaded.

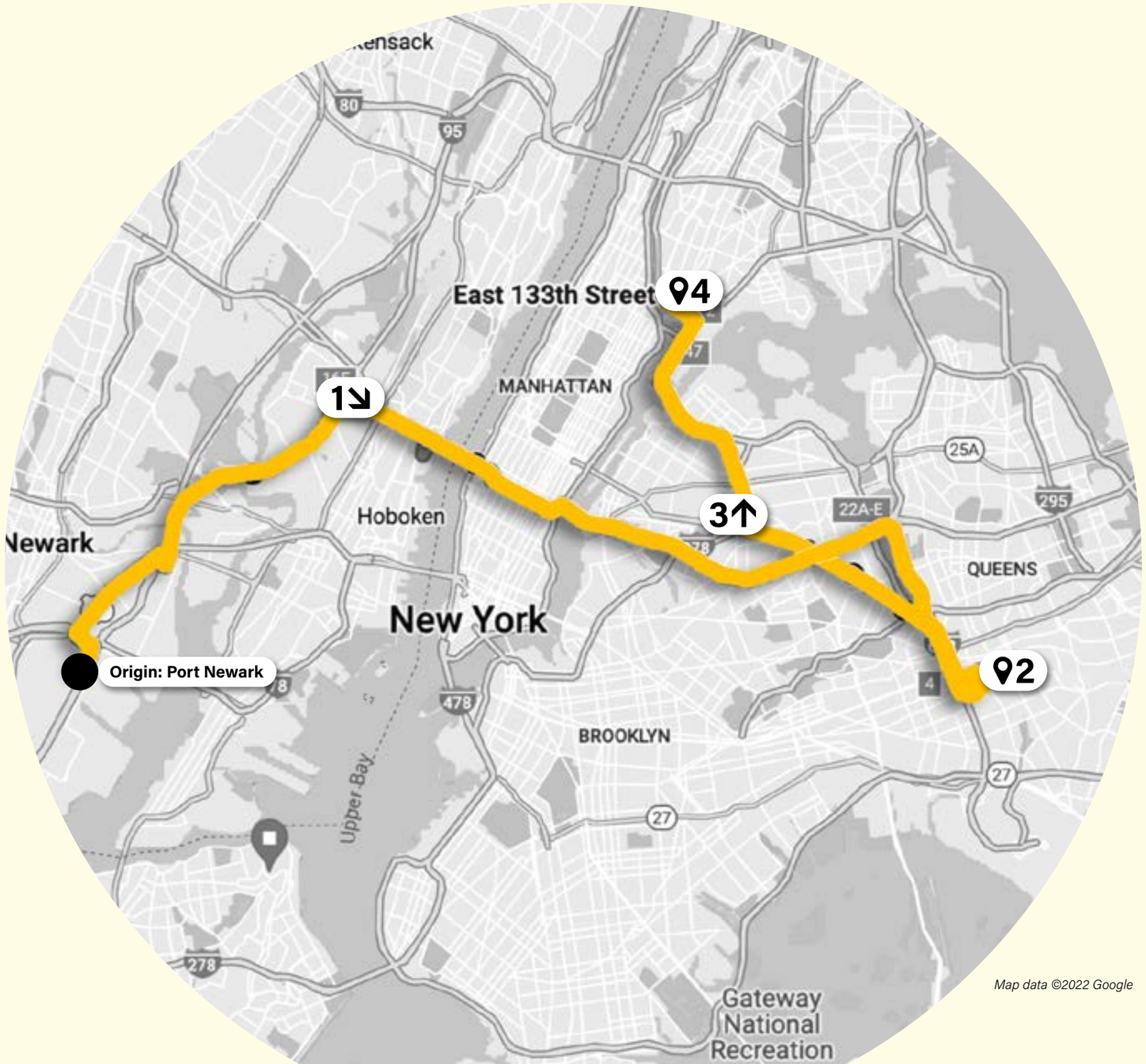
Map shows entire freight route for scenario.
Trip segments described in scenario are:

1→ Middle Mile
From Port Newark Rail Head, to Jamaica, Queens

2 Intermediate Destination
Steel fabricator on 157th Street, Queens

3→ Last Mile
From Queens to Mott Haven, The Bronx

4 Final Fifty Feet
East 133rd Street, The Bronx



Heavy Materials to Construction Site / Trip Segment: Middle Mile

Because construction-weight steel is no longer produced in the New York metro area, it may come in by rail or ship to Port Newark, an intermodal facility, where the steel angle stock is offloaded onto a tractor trailer. To avoid traffic, the truck driver leaves at 6:00 am because the shortest route is through the Lincoln Tunnel, across Manhattan to the Queens-Midtown Tunnel, and the Long Island Expressway (LIE).

But even at 6:00 am, the Lincoln Tunnel is already slowing down; the trip across Midtown is further slowed by double-parked trucks in the Garment District. The truck driver also has a close call with a pedestrian and a bicyclist because, despite zoning controls, the Garment District has become more residential despite the increased noise and exhaust pollution from slow or idling trucks.

Travelling against rush hour traffic, the driver is able to fairly quickly navigate the LIE to the Van Wyck Expressway, but poorly marked lanes and constrained on- and off-ramps slow traffic to a crawl, a nuisance for the many small-scale neighborhoods that line this road. South of Atlantic Avenue the driver exits the highway onto Liberty Avenue, one of New York City's designated Local Truck Routes. However, since the fabricator's shop is located in an industrial zone that is surrounded by residential neighborhoods, the driver has to weave through local streets lined with modest houses, parked cars, pedestrians, and bicyclists.

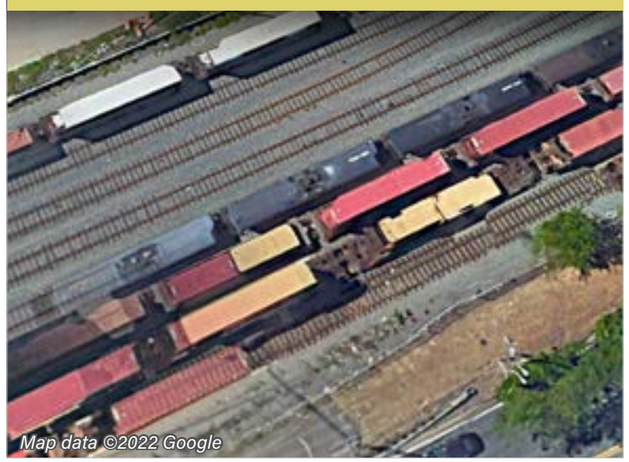
From New Jersey to Queens

Steel arrives via rail at Port Newark, is loaded to heavy duty truck, and driven to Queens for fabrication.

Map data ©2022 Google

Port Newark Container Terminal (PNCT)

Intermodal rail head at PNCT has four track spurs of 2,500 feet each; 10,000 feet of operational rail track. PNCT moves 25 percent of its overall volume via rail.



Map data ©2022 Google

1. I-95, below Secaucus, heading north
Map data ©2022 Google

2. Crossing Manhattan, through midtown

3. I-495 (LIE) in Queens, East of Maspeth
Map data ©2022 Google

4. Van Wyck Expwy south to Jamaica, Queens

Understanding the Context

Policy

- The truck takes advantage of off-peak toll pricing through the Lincoln Tunnel.
- The truck must travel on a designated Local Truck Route through Midtown Manhattan.
- Because no designated truck routes reach the factory location, DOT regulations allow the truck driver to use local streets as long as they take the shortest path between the designated Local Truck Route and the destination.
- There is no platform in place to coordinate truck routing strategies between the community, the City, and delivery carriers to mitigate delivery impacts.
- Even though there is a rail spur adjacent to the factory, the LIRR passenger line does not allow freight traffic.

Industry

- Goods arrive at the regional intermodal facility by ship or rail because steel is a high-volume; low value product that is not time sensitive. But there is no efficient rail connection across the harbor.

Community

- Trucks travel through extremely congested parts of Manhattan, contributing to traffic and emissions and presenting safety risks for pedestrians and bicyclists.
- For the last few miles of the trip, the driver travels on local streets, contributing to noise and safety impacts to surrounding neighborhoods.

Design

- Within New York City, the truck travels primarily on wide arterials that are designed with lane widths, crossing distances, and turning radii more suited for large trucks than for pedestrians.
- Street signage and lane striping is incomplete or inadequate at some locations.
- Curbside loading zones are not well designed and are difficult to enforce.

Heavy Materials to Construction Site / Trip Segment: Intermediate Destination

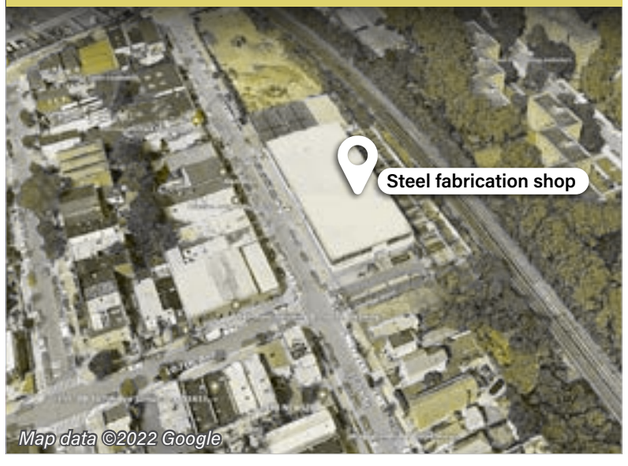
The steel fabricator's building is a typical small-scale factory—a one-story windowless box with a long expanse of blank wall at the sidewalk line, a large rolling door for freight, and a single, unlabeled door for employees. The opposite side of the street is mostly small one- and two-family houses. While there is room inside the building for a full-sized truck to unload, traffic on the roadways and sidewalks is blocked while the truck maneuvers into the building. The street is also poorly designed and maintained since heavy trucks have broken up parts of the sidewalk. There are no street trees to mitigate heat island effects.

Navigating Local Streets

Getting the goods to the steel fabricator means heavy duty trucks need to navigate narrow local streets.

The Intermediate Destination

The fabrication shop is situated at the edge of a residential area.



1. Liberty Ave. and surroundings, Jamaica, Queens
Map data ©2022 Google

2. Liberty Ave. at Sutphin Blvd.

3. Residential street leading to steel fabricator

4. Steel goods fabrication shop.

Understanding the Context

Policy

- City policy is to protect local manufacturing businesses and jobs.
- Since the boundary between the residential and industrial zone districts is down the middle of the street, small-scale one- and two-family houses face the blank, featureless wall of the factory.
- The City's planning and design tools provide limited ability to manage urban design impacts in these legacy mixed-use industrial/residential neighborhoods.

Industry

- Security concerns discourage the addition of windows.
- There are limited urban design regulations to encourage the building owner to make facade retrofits or build a more visible and attractive entrance for workers.
- While there is a rail line behind the building, it is of limited utility for delivery of stock material and shipment of finished products to construction sites scattered across the city.

Community

- The community benefits from access to well-paying manufacturing jobs, but suffers from the noise, pollution, and temporary street blockages that the factory brings.
- Safety issues for pedestrians and bicyclists occur where trucks deliver or pick up products.
- The lack of "eyes on the street" and inadequate lighting create safety issues for residents.
- Hours of operation are often disruptive to the neighborhood.

Design

- The long expanses of blank factory facade make the boundary street feel incoherent and unsafe.
- Off-street loading is difficult to negotiate for larger trucks.
- There are no safety markings indicating where trucks cross sidewalks to load/unload.
- The City lacks adequate regulatory tools that could help mitigate the scale of industrial buildings in mixed-use neighborhoods.

Heavy Materials to Construction Site / Trip Segment: Last Mile

The manufacturer has its own intermediate-size delivery trucks that are branded with the company name. Although smaller in size than the tractor trailers that delivered the angle stock, these trucks are still required to use designated truck routes. But because the factory is not located on a local truck route, the smaller trucks must still negotiate local streets as it heads to its destination, resulting in noise, pollution, and safety issues for neighbors.

The fastest route to the final destination—a construction site in the South Bronx—follows Queens Boulevard to the Brooklyn-Queens Expressway (BQE) and the Triborough Bridge. Queens Boulevard is a particularly complex and dangerous arterial roadway with shifting lane configurations, wide pedestrian crossings, and a dedicated bicycle lane. The many turning actions of the different vehicle types, together with a significant pedestrian and bicycle presence, make this a challenging truck route. The BQE and Triborough Bridge portions of the trip are less complex, but equally congested.

From Shop to Construction Site

After fabrication, the steel lintels are loaded on a truck and transported from Queens to the construction site in Mott Haven, The Bronx.

1. Queens Blvd.
Map data ©2022 Google

2. Queens Blvd., heading northeast

3. Queens Blvd at BQE (I-278)
Map data ©2022 Google

4. 278 North, approaching Mott Haven, The Bronx

Understanding the Context

Policy

- There are limited incentives to replace the delivery trucks with clean fuel vehicles.
- Truck traffic on local streets near the factory, where truck routes are not available, is not well managed.
- Queens Boulevard, the BQE, and Triborough Bridge are on Local and Through Truck Routes.

Industry

- The facility prefers the flexibility and visibility of having its own fleet of three or four trucks, even though the trucks are often inefficiently used—only partially full for deliveries and often empty when returning to the factory in Queens.
- The trucks are older, conventional diesel-powered vehicles; there are limited incentives to replace them with more fuel-efficient or electrical vehicles.
- The manufacturer is not convinced that EV charging station infrastructure exists at this time to make the transition to electric vehicles viable.

Comunity

- Even though these trucks are smaller, local streets around the factory are impacted by noise, pollution, and safety issues.
- The pedestrian environment along many stretches of Queens Boulevard is unsafe because of the complexity of vehicle movements on the road, exacerbated by the trucks from the lintel angle fabricator.

Design

- Queens Boulevard intersections are not pedestrian- friendly or bike-friendly. They should be redesigned to balance truck requirements and pedestrian needs with elements such as mountable curbs, asymmetrical median noses, and recessed stop bars.

Heavy Materials to Construction Site / Trip Segment: Final Fifty Feet

After exiting the Triboro Bridge and I-87, the truck negotiates its way to East 135th Street and then onto Bruckner Boulevard (East 133rd Street), a busy neighborhood arterial lined with shops, apartment buildings, and manufacturing shops. The wide, two-way street is not difficult for an intermediate-sized truck to negotiate.

At Lincoln Avenue, the delivery truck exits Bruckner Boulevard onto the narrow, one-way service street leading to the final destination one block away at Third Avenue. With limited staging areas for trucks making deliveries, the lintel manufacturer's truck is forced to block the street or straddle the narrow sidewalk while it waits to be unloaded. Several trucks may back up on the street if other deliveries occur at the same time, possibly blocking the Third Avenue intersection.

When ready, the steel lintel angles are unloaded with a mechanical lift or by hand, depending on the size of the order, and transferred to a temporary storage area at the construction site. Upon completion of the delivery, the truck must maneuver back onto local arterial streets as it continues to other destinations on its delivery route or returns empty along the same route to the fabricator's shop in Queens.

Steel Arrives by Truck to Site

Delivery at 133rd Street, medium-density location.

The Construction Site

Approaching the site along Bruckner Boulevard.

1. Surrounding Mott Haven neighborhood
Map data ©2022 Google

2. East 133rd St. near Alexander Ave.

3. East 133rd St., approaching the Third Avenue Bridge

4. Construction site below the Third Avenue Bridge

Understanding the Context

Policy

- Despite extensive construction activity in this part of the South Bronx, there is no entity that would enable suppliers of construction materials to coordinate or consolidate deliveries.

Industry

- Due to limited construction material storage space at the construction site, material deliveries are coordinated with construction schedules to achieve "just-in-time" deliveries if possible. However, uncertain traffic and delays in the overall construction schedule make this hard to achieve.

Comunity

- Because of site constraints, sidewalks and bike lanes may be obstructed during staging and unloading of deliveries.
- Repeated delivery of heavier materials damages sidewalks and can create hazardous conditions for cyclists, pedestrians, and drivers.

Design

- Safe and well-lit protective sidewalk scaffolds may be required at construction sites.
- The City requires that alternative sidewalk and bike routes be provided where normal routes are blocked during construction.

Heavy Materials to Construction Site / Imagine a Different Future . . .

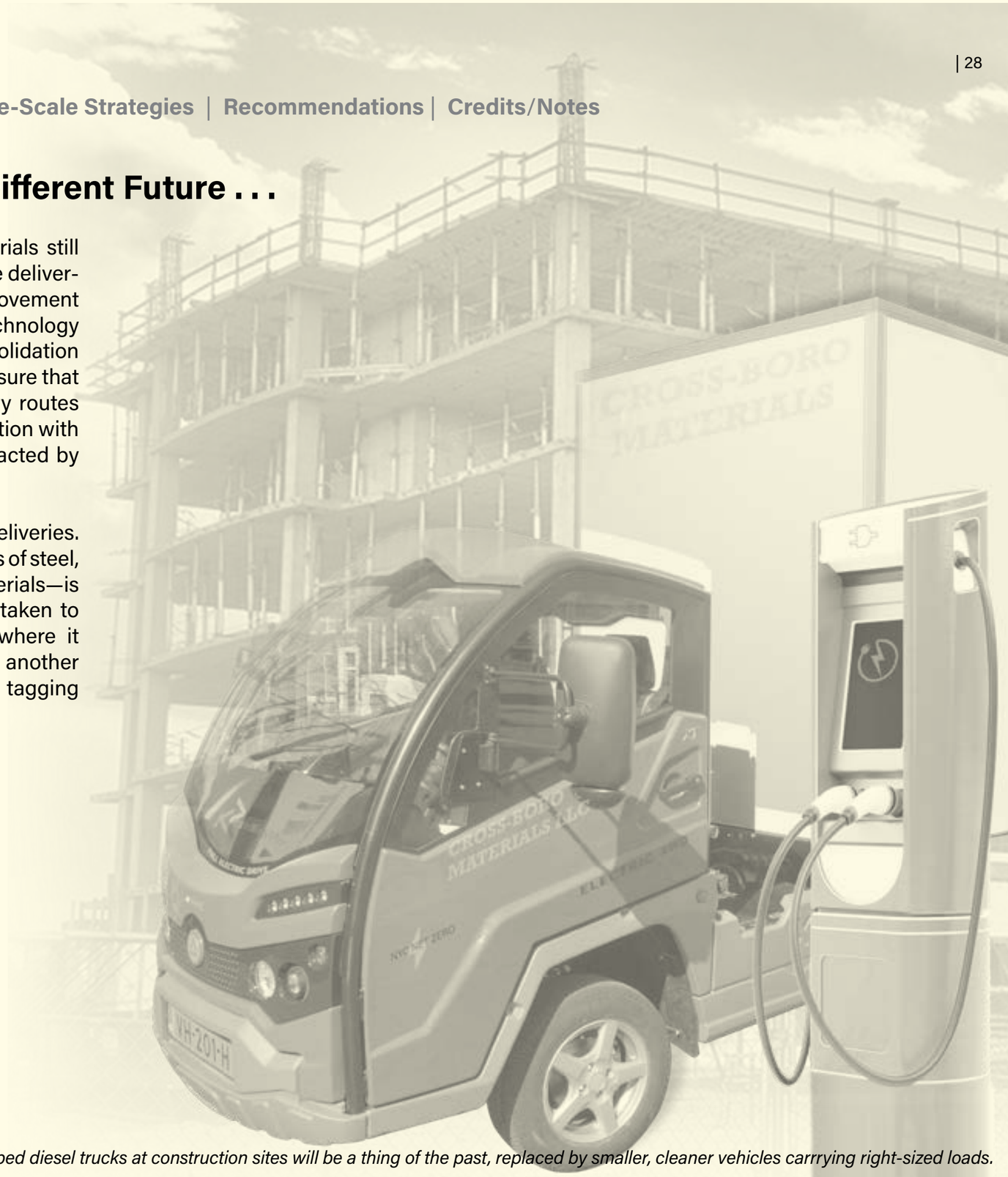
It's 2040 and New York City is still building—but not in the same way . . .

Many of the materials that used to arrive on large flatbed diesel trucks that would idle at the construction site curb now arrive on smaller, cleaner vehicles since the deliveries have been right-sized and organized at a nearby construction consolidation site. Dwell times at the site have also been drastically reduced, as materials are held at the consolidation site until they are needed. Safer operations at the curb improve conditions for pedestrians and workers, many of whom now bike to a secure, onsite storage and charging facility.

The construction consolidation site is strategically co-located at the waterfront and a renovated rail spur to facilitate rail-to-truck or barge-to-truck material transloading, thus reducing the volume of heavy freight trucks needed to deliver goods from the regional freight facility along the middle-mile segment of the supply chain.

Of course, some construction materials still arrive on large trucks that coordinate deliveries to several destinations, an improvement enabled by advanced tracking technology and sorting of materials at the consolidation site. Smart highway technologies ensure that the most appropriate freight delivery routes are followed, determined in consultation with the communities that are most impacted by the truck traffic.

The trucks are not just making deliveries. Construction waste—left over lengths of steel, lumber, sheetrock, and other materials—is loaded back onto the vehicles and taken to the material consolidation facility where it is staged for reuse at other sites, another improvement enabled by advanced tagging and tracking technologies.



Idling flatbed diesel trucks at construction sites will be a thing of the past, replaced by smaller, cleaner vehicles carrrying right-sized loads.

Scenario: Cardboard and Paper to Recycling / The Freight Route

Abstract: Cardboard and paper waste is collected from residences above ground-floor retail.

Bags of cardboard and paper are collected by a NYC Department of Sanitation (DSNY) truck from residences on Columbus Avenue on the Upper West Side of Manhattan. The DSNY diesel truck drives through the Upper West Side to a marine transfer station where waste is transferred to a barge and taken to Pratt Industries Paper Recycling in Staten Island. Here, waste paper and cardboard are made into cardboard boxes, including pizza boxes, some of which are likely used by the pizza restaurant on the ground floor of the building, an example of a circular material loop in New York City.

Map shows entire freight route for scenario.
Trip segments described in scenario are:

91 First Fifty Feet
Waste is loaded onto DSNY truck from a sidewalk on Columbus Avenue in the Upper West Side of Manhattan

↙2 First Mile
From Upper West Side to Pier 99 on Hudson River

93 Intermediate Destination
DSNY Marine Transfer Station at Pier 99

↙4 End Mile
From Pier 99 to Pratt Paper Mill on Staten Island

Cardboard Paper to Recycling / Trip Segment: First Fifty Feet of Waste

528 Columbus Avenue is a mixed-use building in the Upper West Side with five retail units on the ground floor and twelve residential walk-up units above. Residents here, like those all over the city, are increasingly ordering products online, which arrive in cardboard boxes. Residents dispose of waste cardboard and paper in bins squeezed within the hallway of the building. Once a week, after 4:00 pm, the part-time super carries them to the sidewalk, along with bags of trash and metal, glass, and plastic recycling. While the super tries to stack them up neatly so pedestrians can pass, placing them between street trees and the bus stop, they obstruct pedestrians and encourage littering as passersby add their trash to the pile, attracting rats that easily gnaw through the bags to reach any food inside. These bags and bundles sit on the sidewalk all evening and night until they are collected the following morning.

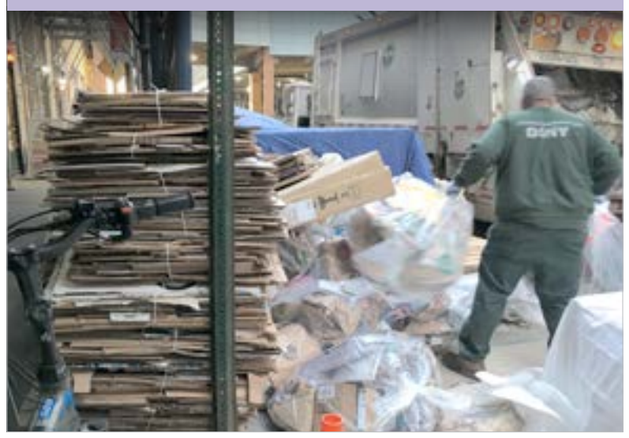
While DSNY workers start their shift at 6:00 or 7:00 am, depending on their route and on traffic they may be picking up this block as late as the morning rush hour. With no designated loading spot, the DSNY worker is forced to block a traffic lane and squeeze through the parked cars to throw the bags into the diesel-powered truck. The paper recycling truck will stop at each building on this side of the street. Two more DSNY trucks will come on the same morning to pick up the metal, glass, and plastic recycling, and the trash.

Waste Collection Locale

DSNY trucks working on Manhattan's Upper West Side with pickup location on Columbus Avenue in the 80 s.

Typical Conditions

At collection time, paper and cardboard recyclables stacked as high as a pedestrian are not unusual.



1. Local conditions: Columbus Ave. and 86th St.

1. Local conditions: Columbus Ave. and 86th St.

2. Heading South on Columbus Ave. to 84th St.

3. Columbus Ave. at intersection of 80th St.

Understanding the Context

Policy

- Since DSNY trucks do not have mechanical lifting devices, all waste needs to be picked up by hand and thrown in the back of trucks. Waste is typically set out in bags or small bales or bins that weigh up to 50 pounds.
- DSNY schedules do not vary much with urban density. Recycling is always picked up once a week, and trash either two or three times a week. The recycling collection day is always a trash day as well, which means that more space is required in buildings and on sidewalks.
- DSNY rules allow waste to be set out after 4:00 pm for collection the following morning. Given quality-of-life issues, this may change to after 8:00 pm.

Industry

- New York State does not yet have Extended Producer Responsibility (EPR) legislation, which would make industry responsible for the disposal costs of packaging and goods. Currently, it is cheaper and easier for businesses to use disposable packaging rather than shift to reusable packaging systems. As an example, while Fresh Direct shifted from cardboard to reusable crates and bags, they have not been able to develop a good system for bag returns following the COVID-19 pandemic.
- Smaller boxes are efficient for deliveries but are hard to put into bundles, so buildings frequently set out voluminous bags full of small boxes that are not broken down. Buildings with cardboard balers can make space-efficient bales out of all sizes of cardboard.

Community

- Engine idling while the waste is manually loaded into the diesel truck, which also compacts the waste, contributes to noise and emissions.
- Setting out waste in bags obstructs sidewalks, creates litter, and attracts rats, all impacting quality of life to city neighborhoods.

Design

- With no designated curbside space, DSNY trucks typically stop in the vehicle travel lane, with workers often needing to throw bags across parked cars.
- There is often not enough sidewalk space to accommodate the growing mounds of waste that must be set out, leading some buildings to block off space on the street and set out piles of bags in the parking lane.
- The DOT/DSNY Clean Curbs pilot program allows for consolidation of waste pick up from waste enclosures in the curb lane, reducing impacts on the streetscape.

Cardboard Paper to Recycling / Trip Segment: First Mile

The diesel-powered DSNY truck will continue through the Upper West Side, stopping at every residential building on its route to pick up cardboard and paper waste. Each truck has two workers; one drives the truck but will jump out and help load when the piles are big. As the truck has two steering wheels, it is easy to change tasks—the curbside wheel also improves the driver's visibility of their partner loading the truck. Waste is thrown into the back hopper, and when it is full a worker will activate the scraper, compacting the waste into the truck's storage area.

Information on DSNY routes is not publicly available, but we assume that trucks will first pick up from busier avenues and then snake back and forth on cross streets until the route is completed. Large buildings with hundreds of residential units will set out huge piles of paper and cardboard waste. As a result, a single stop may take 15 minutes to load and compact in the truck. During early commute hours and on single-lane streets the truck cannot avoid blocking traffic.

Once the route is complete, or the truck is full, it will travel south and west to the DSNY waste transfer facility located at Pier 99 at 59th Street. Depending on driver schedules, it may instead be driven to the DSNY garage two blocks south on 57th Street, where a worker on the next shift will drive it to the pier.

Waste Packaging from Freight

Upper West Side waste is transported to DSNY Pier 99 on the Hudson River.

First Step in a Circular Material Loop

DSNY truck seen outside the mixed-use building on Columbus Avenue.

1. Heading crosstown, west on 79th St.

2. Heading south on West End Ave.

3. West on 59th St., towards waterfront

4. West on 59th St., facing elevated West Side Highway

Understanding the Context

Policy

- Storefront businesses in residential buildings used to have their waste picked up by DSNY. Now a different private carter may serve every storefront, increasing truck traffic and reducing collection efficiency. The city is in the process of implementing commercial waste zones to reduce truck traffic.
- The city had started to study Save-As-You-Throw, a policy mechanism to incentivize waste reduction. However, the study was suspended under the de Blasio administration.
- DSNY plans to transition to electric collection vehicles to reduce emissions and meet city climate goals. The standard DSNY truck has a service life of about seven years.

Industry

- Commercial haulers pick up waste at night, taking advantage of reduced traffic.
- With commercial waste zoning, haulers may be incentivized to increase collection efficiency through the development of neighborhood infrastructure, such as pneumatic waste transport, like that proposed under the High Line, or distributed processing of food scraps.

Community

- DSNY collection typically happens during early morning including peak travel hours, contributing to traffic delays, carbon emissions, and noise.
- Travel lanes, bikes lanes, and sidewalks may be obstructed by waste and waste collection activity, resulting in increased risks for motorists, cyclists, or pedestrians.

Design

- Distributed waste infrastructure is often not permitted by zoning. For example a shared waste compaction and collection site serving multiple residential buildings across zoning lots is not allowed as an accessory use.
- Outdoor dining enclosures in parking lanes are often streetside of a protected bike lane, forcing garbage trucks to use the bike lane to collect waste from the curb.
- Diesel-powered waste hauling and compacting vehicles are large, dangerous, loud, and polluting. Transitioning to electric vehicles will reduce emissions and noise but will not eliminate safety issues if they remain the same relative size/shape.

Cardboard Paper to Recycling / **Trip Segment: Intermediate Destination** (Marine Transfer Station)

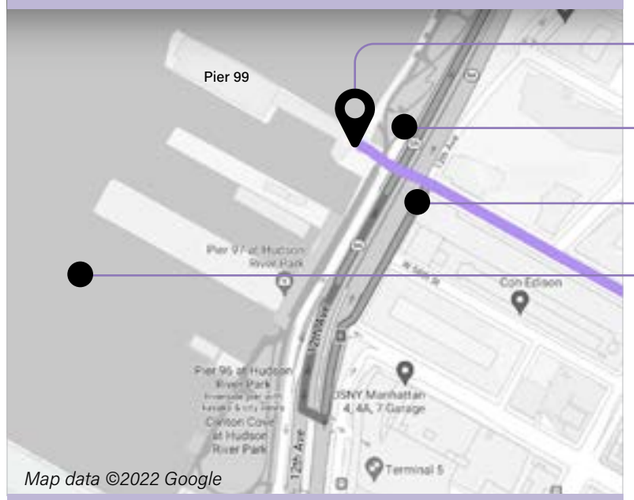
The truck goes underneath the elevated West Side Highway, heading for the entrance to DSNY's West 59th Street Marine Transfer Station (MTS) on Pier 99. As it emerges from the dark underpass it must cross the Hudson River Greenway bike and pedestrian path, which narrows down at this point with a warning sign telling cyclists to yield to trucks. At the entry to the pier, a green traffic light and 5 mph sign indicate that the driver can proceed slowly. The truck is weighed before it backs up on the tipping floor of the MTS to empty its waste onto the barge below. The empty truck is weighed again on the way out so DSNY can collect accurate tonnage data.

The pier operates two slips in continuous operation; after one barge is full they start using the empty one. The facility transfers 80,000 tons of paper and cardboard waste per year. 15,000 truckloads of paper and cardboard waste from all of Manhattan enter the facility and 280 barges leave yearly.[20]

DSNY contracts with tugboat operators who transport the full barges to Pratt Industries Paper Mill in Staten Island. As the tugboat operator pulls out from the pier, they need to be careful of marine traffic, including small kayaks, sail boats, and jet skis using the Hudson River for recreation.

Land to Water Transfer at Pier 99

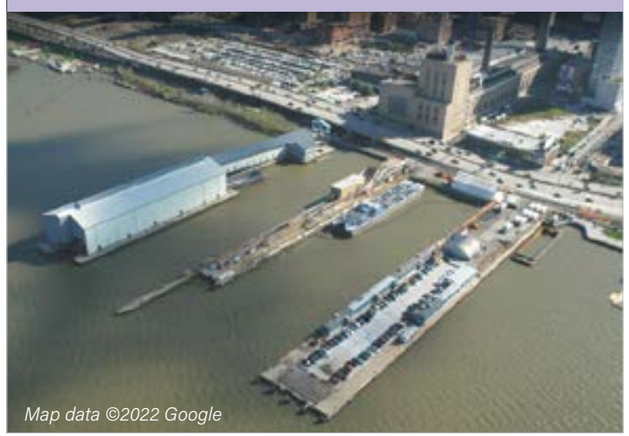
Sited on the Hudson river at 12th Ave. & 59th St., Pier 99 is a Sanitation Department marine transfer station where DSNY trucks load their contents to barges.



Map data ©2022 Google

Freight, Waste, and Community Benefits

The adjacent surroundings include Hudson River Park, cycling and walking paths, and waterfront recreation with free public kayaking facilities.



Map data ©2022 Google

Waterfront shed at NYC Sanitation Pier 99

Recreational lawn area, adjacent to Sanitation Pier

Hudson River Park cycling path in front of Pier 99

Kayakers at Pier 96, Manhattan Community Boathouse

Understanding the Context

Policy

- The City's 2006 Solid Waste Management Plan called for developing more marine transfer stations to disperse the burdens of waste transfer stations more equitably and reduce traffic. The plan called for this station to be converted to commercial waste, moving residential recycling to a new station at Gansevoort Street that has not been constructed.[21]
- Smaller scale transfer or processing of waste materials is typically restricted to manufacturing zones. There is no zoning use category for composting, for example, which could be distributed in green spaces across the city, reducing trucking and allowing for micro-hauling.

Industry

- Commercial haulers do not use the city's marine transfer stations since it is cheaper for them to use private ones.

Community

- 15,000 DSNY trucks enter and leave the West 59th Street MTS per year,[22] crossing the Hudson River Greenway an average of 82 times per day with obvious dangers for the nearly 4,000 cyclists who regularly use the bike path.[23]

Design

- Pier 99 was built in 1901 to receive passenger ships. It was renovated by the Works Progress Administration in 1934, converted to a marine transfer station in the 1950s, and rebuilt in the 1980s, with a "Percent for Art" project adding neon artwork and a neo-classical archway at the entrance. The archway was later removed to improve visibility for truck drivers when crossing the bike path.

Cardboard Paper to Recycling / **Trip Segment: End Mile** (Barge to Staten Island Paper Mill)

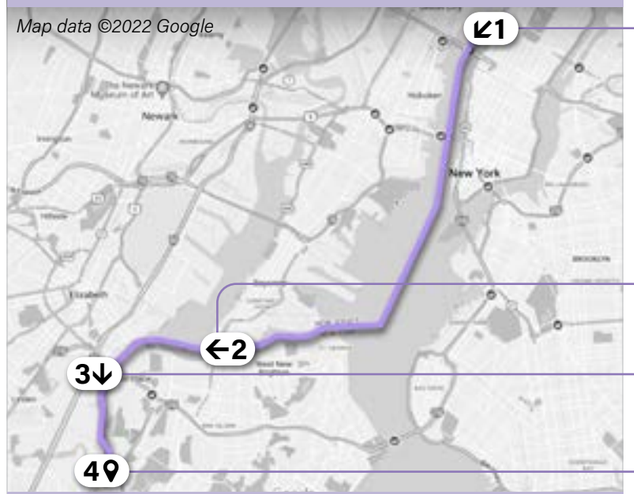
The tugboat pulls the barge down the Hudson River into the Upper New York Bay. It navigates along a narrow waterway between New Jersey and the north shore of Staten Island, under the Bayonne and Goethals bridges to Pratt Industries Paper Mill on the west shore of Staten Island. Pratt Industries accepts about half of the paper and cardboard collected by DSNY.

The barge is staged at the slip and a crane unloads the material into the mill's production line. Waste paper and cardboard arriving on trucks will go through the same process.

After being pulped, filtered, and dried, the post-consumer paper is turned into recycled cardboard, producing more than 1,000 tons per day. The cardboard is used to manufacture different types of boxes, including pizza boxes that may return to Pizza Pete's at 528 Columbus Avenue, representing an example of a circular material loop.

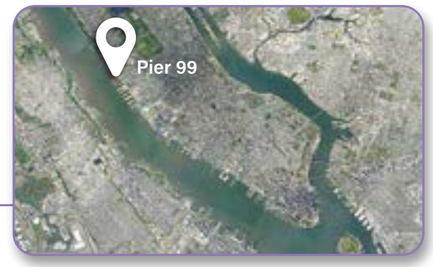
Movement Via Maritime

Recyclable paper and cardboard is transported from DSNY Sanitation Pier 99 to Staten Island paper mill.



Past Solution as Future Precedent

The same low-tech barges that NYC has deployed for generations are fundamental to supporting movement of goods in a circular material economy.



1. Location of DSNY Sanitation Pier on Hudson River
Map data ©2022 Google

2. Hudson River barge route at Bayonne Bridge
Map data ©2022 Google

3. Hudson River barge route at Goethals Bridge
Map data ©2022 Google

4. Staten Island paper mill facility
Map data ©2022 Google

Understanding the Context

Policy

- Pratt Industries Paper Mill provides an automatic end market for about half of New York City's paper and cardboard waste. The rest of the city's recycling goes to Sim's Material Resource Facility, where it is baled and sold on the open market.

Industry

- The mill was developed by Pratt with economic assistance from the NYC Economic Development Corporation. Pratt has a contract to buy paper and cardboard waste at a guaranteed minimum price of $10 per ton.[24]

Community

- The tugboat may encounter other waterway traffic, including cruise-sized ships as well as recreational boats along its route.
- According to a 2021 press release from the NYC Department of Environmental Protection, "Pratt Paper Mill is the largest industrial manufacturing facility in the city, and contributes a substantial amount of organics to the wastewater stream that is cleaned at DEP's Port Richmond Wastewater Resource Recovery Facility (WRRF) on the North Shore." Pratt is currently installing a wastewater pretreatment system at their facility to reduce organic pollution in their effluent.[25]

Design

- The Pratt facility is located in what was once a tidal wetland with high ecological value that helped protect the city from storm surges.

Cardboard Paper to Recycling / Imagine a Different Future . . .

It's 2040 and New Yorkers still want the convenience of deliveries . . .

. . . but these are no longer brand new goods in single-use disposable packaging. Instead food, rental products, and library items (few of which are now books) are delivered in reusable packaging, which is dropped off by residents in central package hubs in buildings or at the curbside. Reusable packaging is picked up by delivery vehicles, eliminating the need for separate transport of waste.

In large buildings, any residual cardboard or paper is compacted by staff and put in bins, which they wheel out to a curbside staging zone when they are alerted of a truck's arrival. In smaller buildings, residents bring their recycling to shared curbside stations. DSNY now uses electric trucks with automated or semi-automated lifting methods, allowing quick and efficient transfer of materials.

Open-data digital platforms will support coordination between buildings and DSNY for timed staging and pickup of bins with cardboard and paper destined for recycling.

SECTION OVERVIEW

System-Scale Strategies / An Overview of Emerging Themes

System-Scale Strategies Contents:

This section highlights four strategies to mitigate the negative impacts that freight movement currently imposes on communities by reshaping the middle-mile and last-mile segments of the freight delivery supply chain.

While these strategies also make goods movement more efficient for operators, their implementation transcends the scale of any individual logistics of freight company, requiring governmental policy intervention. Although they are not without challenges, when considered comprehensively they can dramatically improve the quality of city streets and industrial neighborhoods.

Mode shifting:
Switches the vehicles by which goods move from large trucks to smaller and/or cleaner vehicles.

Consolidation:
Combines freight shipments based on delivery location with the goal of reducing freight vehicle trips.

Decentralization:
Distributes freight activity across the city so that individual neighborhoods are not disproportionately impacted.

Circularity:
Prioritizes Zero Waste and resulting reduction in freight vehicle trips into and out of the city, making freight trips more efficient.

Mode Shifting

Freight vehicle trips negatively impact our city in a number of ways, including through GHG emissions and other pollutants that contribute to poor air quality, noise, road wear and tear, traffic crashes, and congestion. Mode shifting is a strategy that mitigates these impacts by swapping the vehicles that deliver goods from large trucks to smaller and/or cleaner vehicles. Decarbonization of all delivery modes and mode shifting can work together to reduce impacts to our climate and communities.

Many of the climate impacts resulting from our reliance on truck freight vehicles can be reduced by eliminating fossil fuels as the energy source. The city is already moving in this direction with initiatives such as NYC's Clean Trucks Program, which has significantly increased the use of electric vehicles through incentives for operators in local neighborhoods. However, a one-for-one swap of gasoline-powered freight vehicles with electrified vehicles does little to mitigate other negative impacts such as traffic congestion and fatal crashes.

Annual Externality Costs of Traffic Congestion Delays to Commercial Trucks

Annual Truck Delay:	24,288K Truck Hours	Wasted Truck Fuel:	39,435K Gallons
Truck Delay Rank:	1	Wasted Truck Fuel Rank:	1
Annual Congestion Cost (Trucks):	$1,298M	Excess CO2 from Trucks:	431K Tons
Congestion Cost (Trucks) Rank:	1	Excess CO2 from Trucks Rank:*	1

*Rank based on 101 legacy urban areas rather than all 494 urban areas.

Source: US Environmental Protection Agency[26]

Modal shifts are therefore necessary to address the full range of freight impacts by reducing overall truck volume and switching to vehicles that are more compatible with urban quality of life. While trucks will continue to be part of the freight network, rail and marine transfer can replace some portion of heavy-duty trucks operating regionally, and smaller electric vehicles, cargo bikes, and foot trips can replace intermediate-sized trucks currently used for local deliveries. Opportunities for rail, maritime, and micromobility modes are outlined below.

Rail | In the past, New York City relied on an extensive network of rail tracks to transport freight across the boroughs. Today, networks of underutilized tracks crisscross the metropolitan region, connecting docks to rails to distribution centers in industrial districts. State, regional, and local authorities are committed to modernizing and expanding these rail lines and transloading facilities, especially for heavy goods and middle-mile logistics.

Maritime | With its 520 miles of coastline and navigable waterways, the geography of New York City provides ample opportunities for mode shifting to marine freight. Waterways can be used for middle-mile logistics, transporting containers and heavy goods across the Hudson to transloading facilities at ports like Red Hook Terminal. They can also be used for last-mile logistics, transporting goods from industrial facilities located in water-adjacent industrial zones to small marine terminals, or mini ports, for final distribution. Beyond adding or revitalizing large waterfront facilities, additional maritime freight strategies could include the deployment of purpose-built vessels serving terminals and landings across the five boroughs or even the development of flexible, moveable floating docks.

There is an inherent tension in creating space for maritime freight as the city continues to transform our waterfronts for public use. Striking a balance between public access and industrial uses requires that marine terminals be sited to optimize freight movement while minimizing public conflicts. The interface between public and industrial uses, however, is also a design opportunity, as outlined in the City's 2021 Comprehensive Waterfront Plan and the Waterfront Alliance's *Waterfront Edge Design Guidelines*. The design of waterfront sites must also contend with the realities of climate adaptation, sea level rise, and flood mitigation.

Micromobility | To deliver goods to their final destinations, vehicle scale can shrink dramatically to small, zero-emission electric vans and even smaller but capacious cargo bikes that can carry 400 pounds of freight. Several companies are also developing electrified dollies and delivery carts to facilitate on-foot deliveries to people's doorsteps, neighborhood retail stores, and package lockers. These micro-delivery strategies still require a larger vehicle to transport goods to micro-distribution hubs for consolidation prior to the final delivery. This system can be further improved when freight trucks deliver to micro-hubs during off-hours or at night.

Overcoming the incentives that currently favor large trucks requires a coordinated approach. Tools to encourage mode shifts include pricing incentives and disincentives, policy changes, traffic management strategies, and infrastructure investments.

Clean Transportation Strategies

Arlington Yard, Staten Island, a key means of moving municipal waste from incoming barges

Freight dock, Seine River, Paris

Cargo bike moving consumer product goods on 6th Avenue, Manhattan, New York City

Consolidation

For each of the freight scenarios highlighted in this document, thousands of trips are generated daily. Logistics companies determine the optimum routes, modes, and times of days to make these trips. Companies have a strong financial incentive to complete each trip as efficiently as possible, but they also face consumer pressure to deliver products as quickly as possible. This pressure often leads to inefficiencies; less-than-full truckloads and individual carriers serving the same street or residence multiple times in one day are common. These inefficiencies are multiplied when you look at the system beyond an individual carrier.

To address inefficiencies that market forces are not correcting on their own, many European cities have sought to consolidate trips, reducing the number of vehicles destined for an individual building or street by grouping deliveries before they enter congested parts of the transportation system.

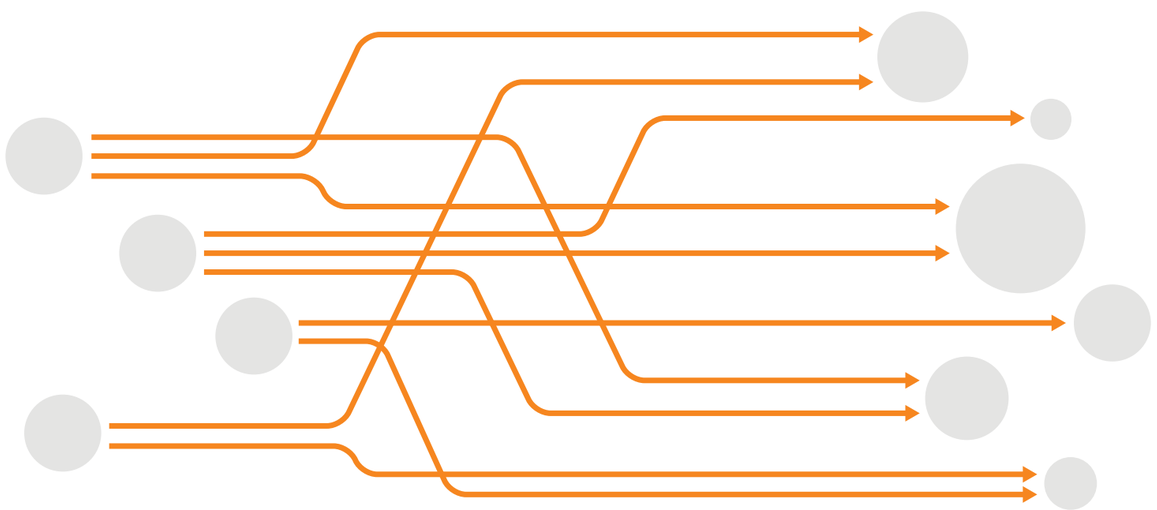
Some forms of consolidation that have been tested include 1) deliveries to a large, single-owner site such as an airport or large commercial development, 2) deliveries to retail clusters in urban centers, 3) deliveries of materials to construction sites, and 4) deliveries to commercial and residential areas via micro-distribution centers or micro-hubs.

Each of these forms of consolidation operates in a roughly similar fashion: goods are first delivered to a consolidation facility located upstream of the delivery site. In many cases, these facilities are sited where the networks that facilitate goods movement—largely road networks—have greater capacity to handle incoming loads. At the facility, goods are sorted and consolidated, after which they are transported to their final delivery locations. Ensuring that delivery vehicles transport full loads and coordinating deliveries for a particular zone results in fewer vehicle trips overall. Deliveries can also be timed to avoid peak traffic hours, further reducing their impact on the transportation network.

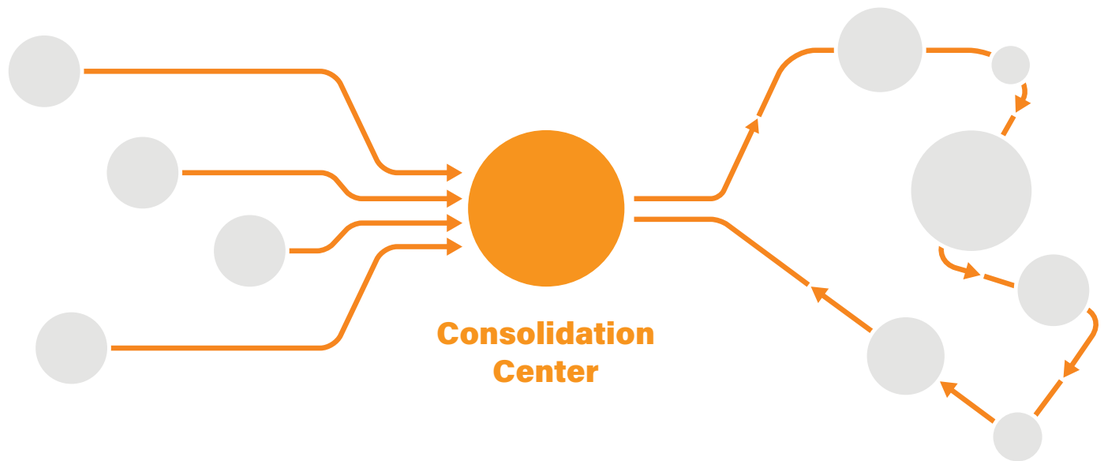
With the rise of e-commerce and the more distributed nature of goods movement, goods are increasingly delivered to homes and residences. In London, new developments are now required to develop Delivery and Servicing Plans (DSPs) as part of their planning conditions. One multi-tenant commercial development at 22 Bishopsgate is enacting a consolidation model whereby all vehicular package deliveries will be routed to an off-site consolidation center while deliveries by foot or bicycle are made directly to the building.[27] Vehicular delivery drops then occur twice per day at designated times. Similarly, in Arlington, Virginia, new startups are providing package consolidation services for high-density apartment buildings on a voluntary basis. Micro-distribution centers, also known as micro-hubs, also reduce vehicular trips in residential neighborhoods. These small-scale consolidation centers are located close to the final destination so that goods can be distributed via modes such as walking or biking. The New York City Council passed legislation requiring the NYC Department of Transportation (NYC DOT) to establish a pilot program by 2023 to support micro-distribution centers.

New York City's waste management system also relies on freight movement consolidation in the form of residential waste collection. Waste is collected by the NYC Department of Sanitation (DSNY) on the same day for all residences within a zone, allowing for efficient routing throughout the city. Another form of consolidation, commercial waste zones, will soon be implemented. Under the City's 2019 Commercial Waste Zone Law, private waste haulers will bid to become one of the three haulers authorized for each of the city's 20 designated commercial waste zones. These two strategies—each resulting in significant reductions in vehicle trips, with knock-on improvements to air quality, street safety, noise, and general quality of life—can serve as models for new forms of goods consolidation for package deliveries.

Standard Urban Logistics



Consolidated Logistics



Decentralization

Re-thinking Fresh Food Logistics in New York City
While consolidation is an effective model for optimizing last-mile modes and facilities, decentralization turns that strategy inside out, allowing New York City to develop opportunities upstream of the last mile that can expand access to local communities while reducing negative impacts from goods deliveries. In the case of food distribution, a decentralized network of freight hubs dispersed across the city's waterfront could unlock new economies and help distribute the benefits and burdens of freight more equitably.

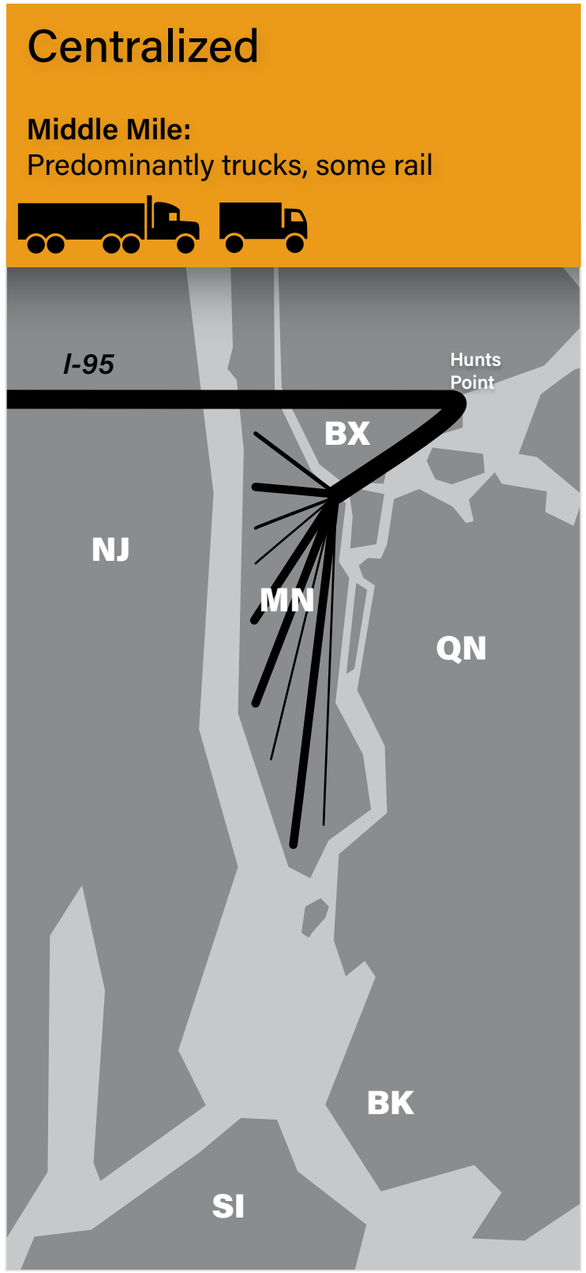
The Hunts Point Food Distribution Center
Envisioning a different approach to food distribution requires an understanding of how food-as-freight flows into the city and the role of Hunts Point in the Bronx. The Hunts Point Food Distribution Center (FDC) is a hyper-consolidated hub and one of the largest facilities of its type in the world. Each day, almost 13,000 trucks travel in and out of the FDC.[28] It is the source of 60 percent of the city's produce[29] and 50 percent of its meat,[30] amounting to 4.5 billion pounds of food annually.[31] According to an NYC Economic Development Corporation (EDC) study, New York City's most-used route for food distribution by truck leads from I-95 in New Jersey, across the George Washington Bridge (GWB), directly to the FDC. Freight traffic on the GWB is typically close to four million trucks per year, with 30 percent of that estimated to be food freight.[32] Concentrating this intense volume in a single location provides commercial benefits by clustering many distributors at one location and enabling B2B "one-stop shopping," resulting in over $3B in annual FDC sales. However, the strategy also generates negative impacts for nearby communities.

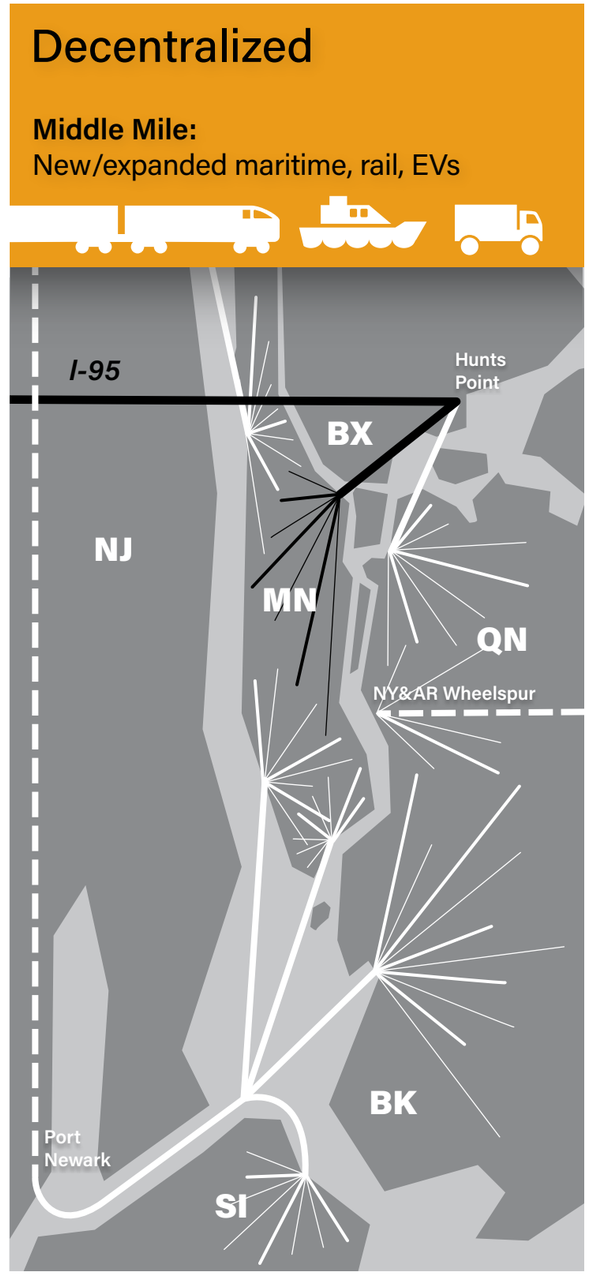
Costs to Communities in the Hunts Point Area
The well-documented negative impacts of transport-based pollution on Bronx communities are compounded by the area's "food desert" conditions. Despite hosting the largest produce market in the US, Hunts Point residents largely lack access to nutritious, affordable food. A majority of adults in the area consume the lowest percentage of fruits and vegetables per day for the city's residents.[33]

Building Maritime Capacity and Local Distribution
Bronx communities can be relieved of some of these burdens by relocating a percentage of the FDC to new waterfront food distribution hubs and shifting freight from the road to the river. Vendors could be incentivized to relocate to lower-cost waterfront spaces with medium-sized facilities and buyers would see reduced travel times to these local waterfront market. Bronx communities would benefit from improved health and safety outcomes while all boroughs would enjoy greater access to fresh food.

To make this decentralized system work, New York City's deteriorated maritime infrastructure needs to be modernized and expanded, along with new development strategies for city-owned waterfront assets, DockNYC sites, and public/private waterfront facilities. The type and scale of waterfront hubs would vary by site, with locale-appropriate plans for B2B and B2C operation. Micro-docks would be fast, easy, and even mobile, solutions arrayed around the boroughs. And while large-scale facility space is scarce, it does exist. Part of the undeveloped Pier 76 on the Hudson River at West 36th Street could be converted into a marketplace for residents and businesses. Pier 36 on the East River could serve NYCHA's 2,600-resident LaGuardia Houses, located one block upland .

Water-based decentralization can also link to a land strategy that establishes the FDC as a distributor of fresh food into surrounding Bronx communities. Light EVs and cargo-bikes could be used to flow reasonably priced produce to pop-up retail produce hubs and to an expanded network of local mobile street vendors such as NYC Green Carts and Bronx Works Farm Stands. The FDC could also complement this with on-site offerings such as a food hall modeling best practices for freight/community integration. Beyond local benefits for the Bronx, a decentralized network of markets and produce hubs could be seeded throughout food deserts in Brooklyn and Queens.





Circularity / New York City Waste Flows

In the current linear economy, freight and waste are two separate systems: valuable new materials come in and worthless garbage is sent away. This transformation from new goods to waste can happen quickly, as 15 to 40 percent of e-commerce products are returned, and many retailers throw out over 25 percent of their returns[34]—goods that end up in landfills. One of the goals outlined in OneNYC 2050 is to transition towards a circular economy where products can be reused, repaired, or recycled. For this to happen, freight and waste need to be integrated into a single circular goods movement system.

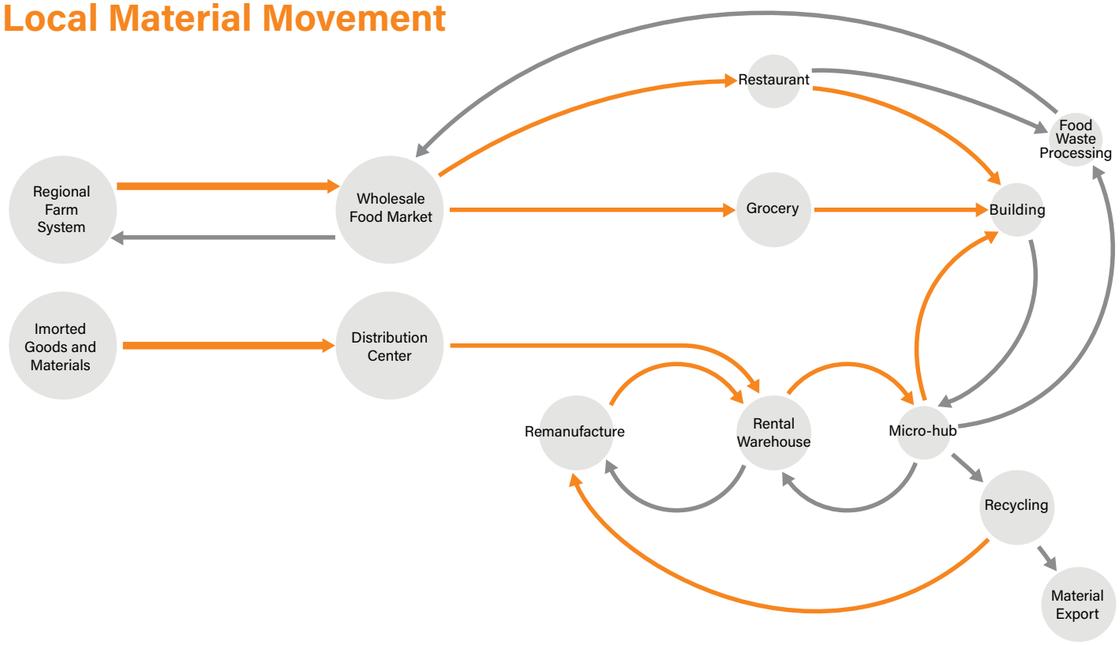
One barrier to this is City zoning regulations, which support the current linear goods system flow (see page 3). While placing warehouses, manufacturing, and waste processing at the edges of the city makes sense with a linear model, a circular model needs many smaller distributed hubs for rentals, repair, refabrication, and organic waste processing. Yet New York City's Zoning Resolution does not include a use group category for compost facilities, only for incineration or garbage reduction. Most zone districts do not permit the creation of small hubs to consolidate waste materials from multiple buildings across zoning lots, as waste storage is no longer considered an "accessory use".

To facilitate a system transformation, we need to consider how zoning regulations should change to allow the design of buildings and the streetscape to support an integrated circular economy. For example, most large residential buildings have a package room on the ground floor and separate refuse rooms on every story. If instead a central room was provided, it could be used by residents to drop off different types of recyclable waste as well as reusable packaging and returned and leased goods. Locating this alongside a package room would facilitate, easy pick up by the next delivery truck. This room could also be used as a central location for the rental of commonly used goods, a service that companies like Tulu are starting to provide across the city.

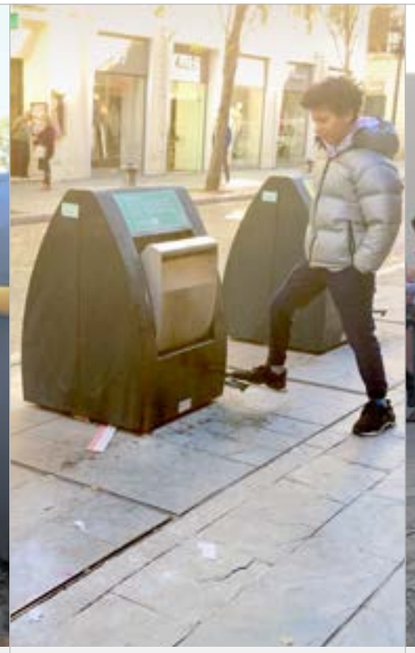
The design and management of the street curb zone also needs to change. While designated curbside commercial vehicle loading zones in higher density areas of the city establish times for delivery trucks to load and unload goods into buildings, there is no similar accommodation for the collection of waste. The movement of materials into and out of buildings needs to be coordinated to make both processes more efficient and reduce the myriad negative impacts to streetscapes.

AIA New York's *Zero Waste Design Guidelines* showcases a number of strategies to reduce waste and its impact on the city's streetscapes, including the development of shared waste collection infrastructure. Recognizing the potential for these ideas, in 2019 the NYC Department of Transportation and NYC Department of Sanitation launched a pilot program, Public Realm Refuse and Recycling Solutions, which led to Clean Curbs, a program that allows waste enclosures at the curb lane under certain conditions. This model of shared waste drop-off at the curb lane is well suited to low- and medium-density neighborhoods (see Street Prototype 3, Page 58). For higher density neighborhoods, a temporal solution like dedicated loading zones can accommodate larger amounts of waste (see Street Prototypes 1 and 2, Pages 54 and 56).

Local Material Movement



Curbside waste containers in Seville, Spain



Submerged containers in Granada, Spain

Wheeled bins staged on street in Seville, Spain

SECTION OVERVIEW

Site-Scale Strategies / Overview of Design Approach

Site-Scale Strategies Contents:

We have begun to define the Interface between movement and place—the physical place where public meets private—as a distinct and important opportunity for design and policy intervention.

At its most micro scale, it is the threshold over which goods move from a vehicle to a building—the street, the curb space, the sidewalk, and the building doorstep. At a slightly larger scale, the Interface is an area adjacent to intermediate destinations—the neighborhoods through which trucks and delivery vehicles move, even if they are not the final destination. At each of the Interfaces, impacts are imposed on the communities that live, work, and recreate there.

Components of the Interface are often considered independently, but it is critical to understand the entire sequence of movement between the street and a building to fully address the whole range of impacts imposed on communities. The design of the Interface must be thought of holistically—considering factors from street design to building services—to ensure that the movement of goods and waste does not contribute to public health, environmental, or quality-of-life problems.

The following pages explore site-scale design interventions at two key Interfaces:

1) The Interface of edge neighborhoods with light industrial facilities, like distribution centers, construction material suppliers, waste processing facilities, or consolidation centers.

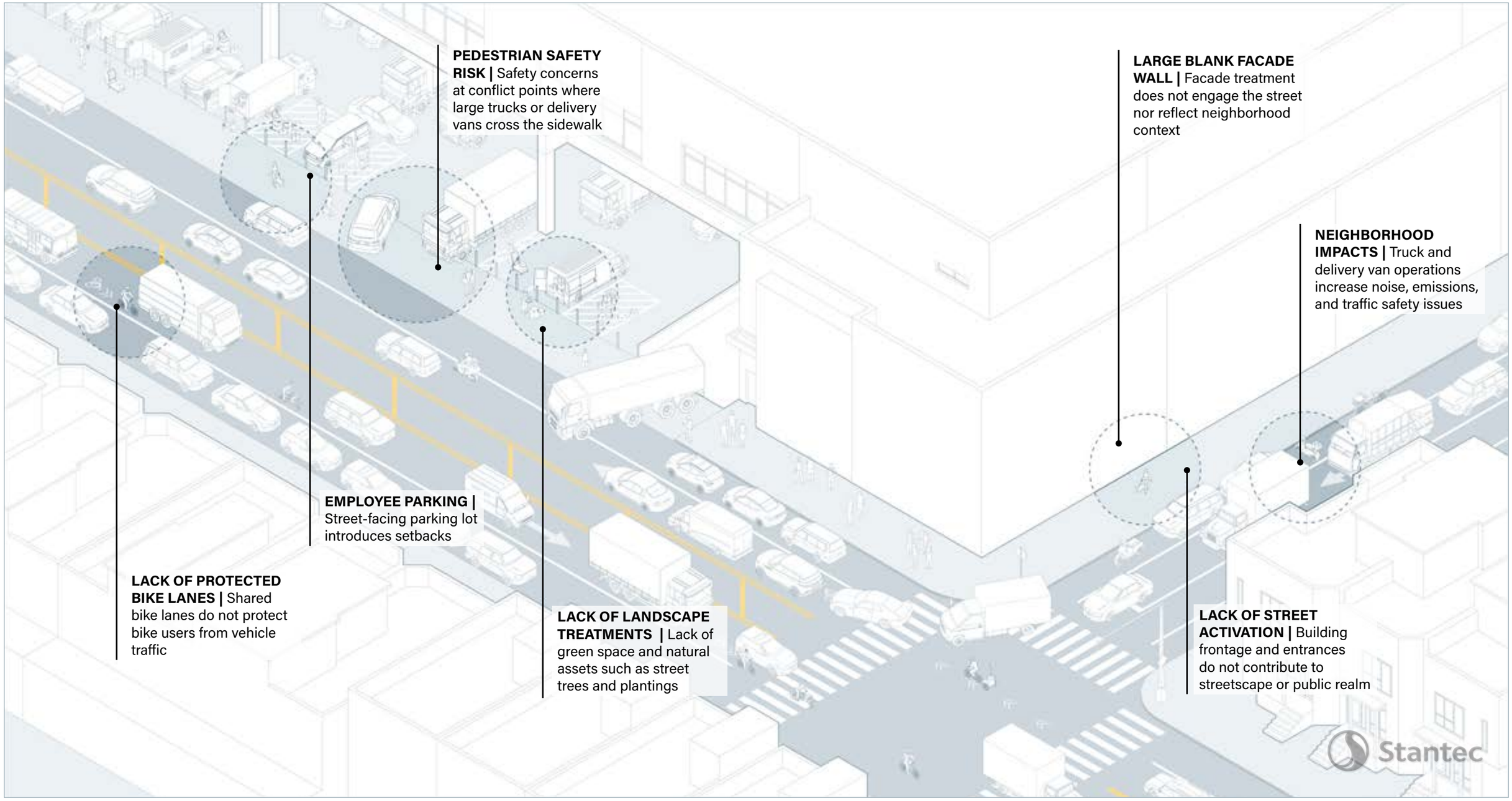
The design approach focuses on the people who are affected by these facilities on a daily basis—the employees who work there as well as the residents who live nearby. These diagrams form the beginning of design guidelines for industrial areas, especially at edge conditions, that are discussed in further detail later in the document.

2) The Interface of streets and the final destination of goods, like homes and office buildings.

The design strategies consider the final fifty feet of the delivery trip holistically to better facilitate goods and waste movement at these locations.

The interventions at each of these conditions range from physical design elements to technology-assisted management that, when coordinated with system-scale strategies, serve to mitigate the adverse impacts of freight movement that we see today.

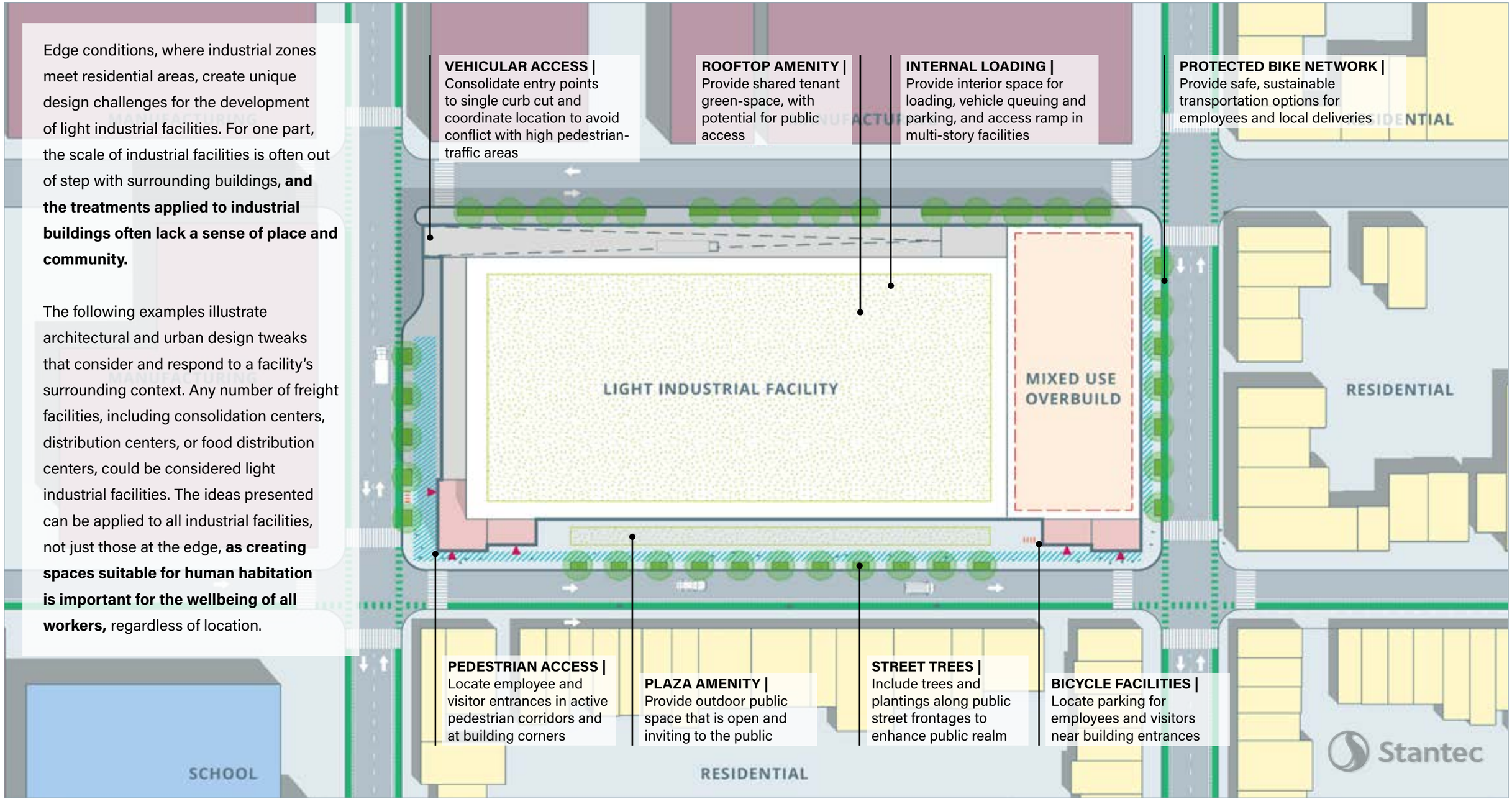
Current Context at the Industrial Edge



A New Interface / Investigating Industrial Facilities at the Edge

Edge conditions, where industrial zones meet residential areas, create unique design challenges for the development of light industrial facilities. For one part, the scale of industrial facilities is often out of step with surrounding buildings, **and the treatments applied to industrial buildings often lack a sense of place and community.**

The following examples illustrate architectural and urban design tweaks that consider and respond to a facility's surrounding context. Any number of freight facilities, including consolidation centers, distribution centers, or food distribution centers, could be considered light industrial facilities. The ideas presented can be applied to all industrial facilities, not just those at the edge, **as creating spaces suitable for human habitation is important for the wellbeing of all workers,** regardless of location.

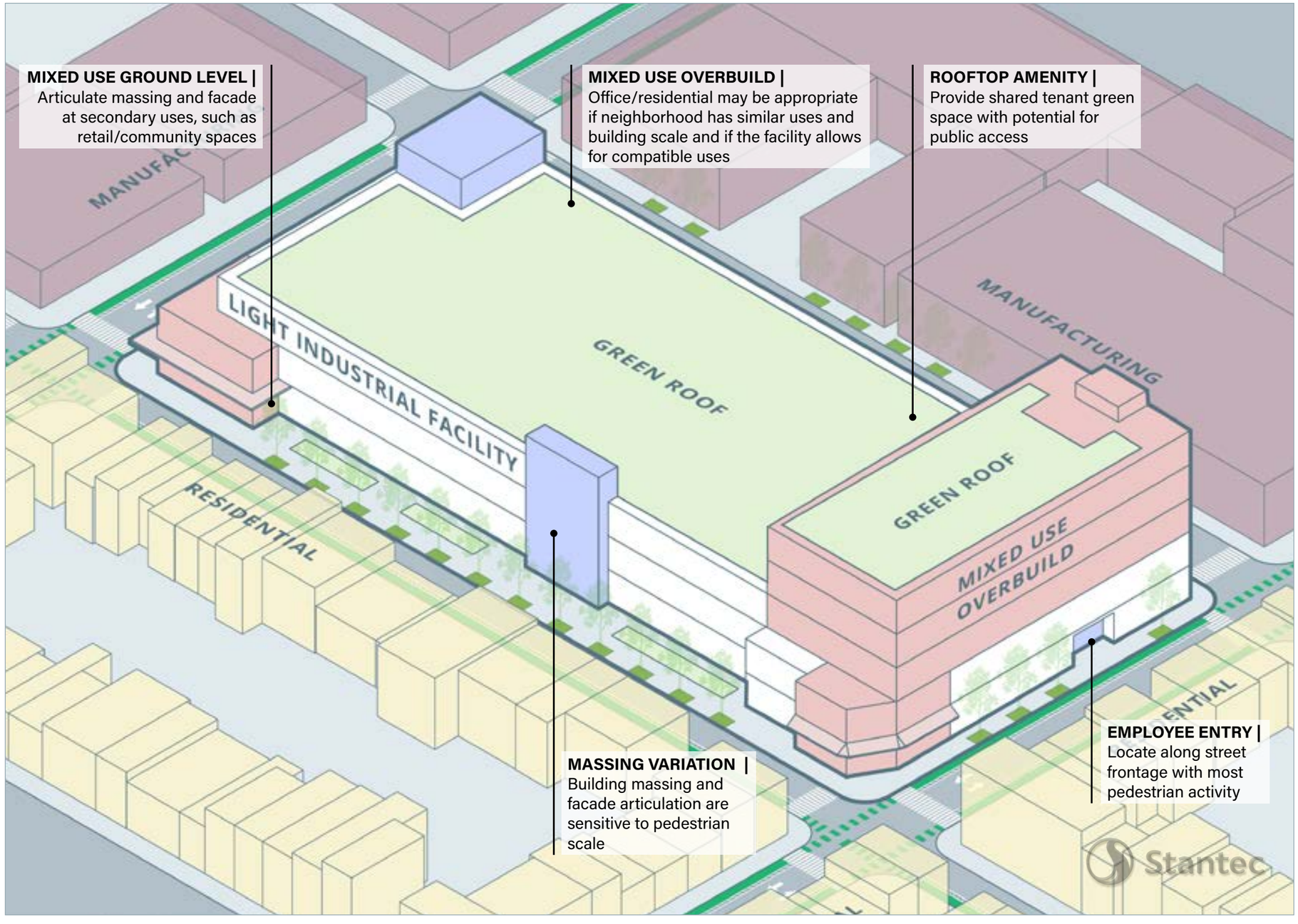


Industrial Edge Interface / Spatial and Massing Features

The design of light industrial development, especially in edge conditions where sites are located adjacent to residential and mixed uses, **should consider the spatial relationship between the building and its neighborhood context.** Building height, massing, and articulation should be sensitive to the public right-of-way. This can be achieved through appropriate pedestrian-scale articulation with context-sensitive building frontages and setbacks, transparency elements on facade materials, compatible vegetation, and a variety of landscaping treatments.

Incorporating these elements in the design of the building and site can help create **high-quality pedestrian environments and support new development that contributes to the public realm.** For instance, locating a mixed-use area with ground-level retail opportunities at key intersections can activate building corners and pedestrian corridors.

Where possible, amenities that benefit both employees and the public should be integrated as part of the development. These include **outdoor plazas, dining areas, rooftop green spaces, and other open spaces that provide fresh air, sunlight, and views.**

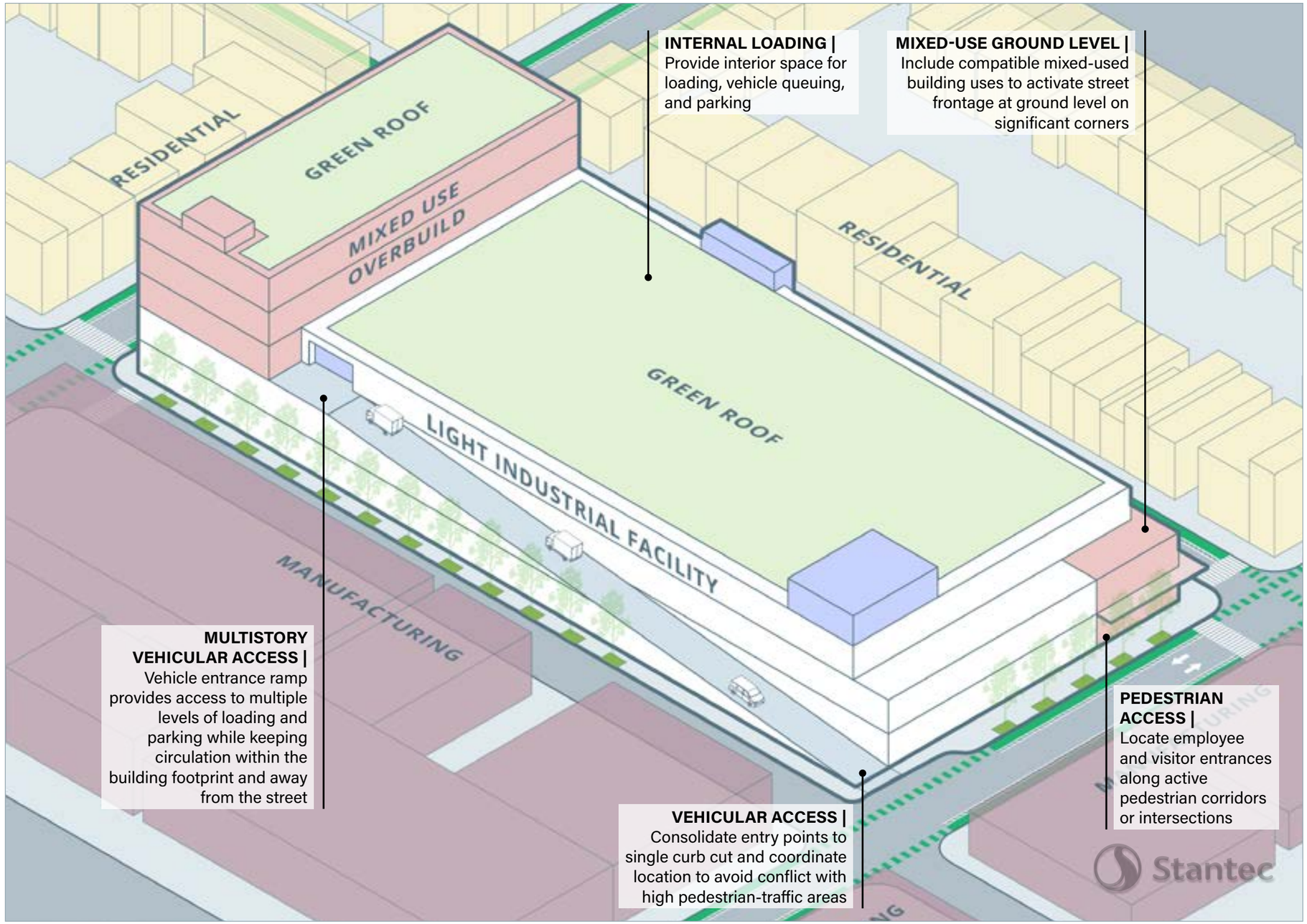


Industrial Edge Interface / Spatial and Massing Features

Massing of industrial facilities should reflect the adjacent neighborhood's scale and context. **In multi-story industrial facilities, internal circulation can shift vehicular movements away from public streets to within the building parcel, creating opportunities for high-quality streetscape treatments for public entrances and open spaces.**

The number of vehicular access points should be limited to avoid potential safety conflicts with other users of adjoining streets, such as pedestrians and bike users, as well as existing vehicle traffic like public transit and service vehicles (waste collection, emergency vehicles, etc). Locating loading and parking areas on upper levels of the building makes available a section of the ground floor for uses that contribute to an active street frontage, such as retail.

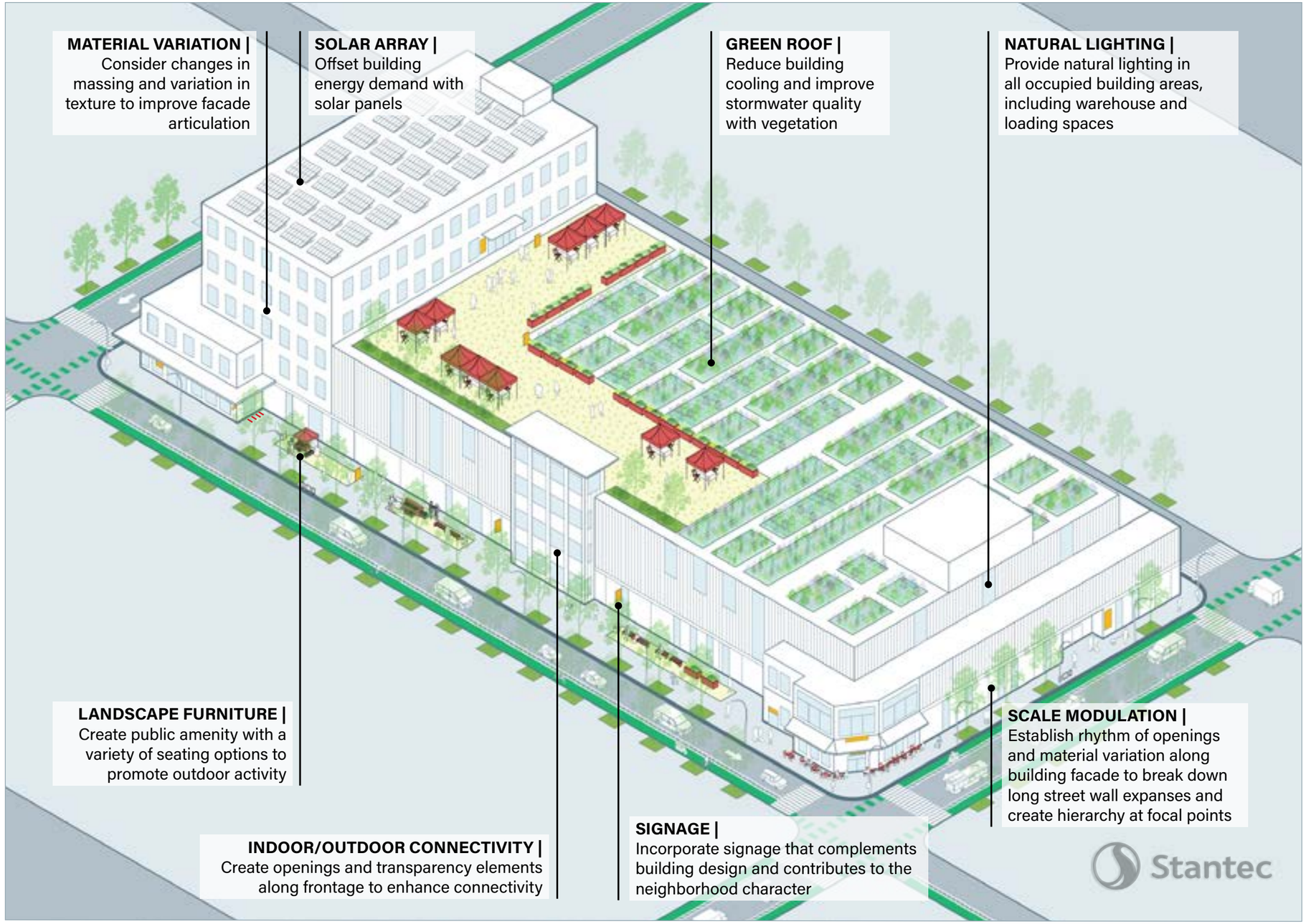
In addition, a mixed-use overbuild area could host a variety of uses that serve workers and local communities, such as vertical farming or the development of certain types of housing units, depending on site context.



Industrial Edge Interface / Facade Design Features

The site layout and building design of light industrial facilities should incorporate human-scaled elements, such as street trees and shaded areas, that enhance the existing urban habitat and activate the street along the edges. **Continuous blank walls along street frontages should be avoided** in favor of a more functional and visually interesting pedestrian streetscape. Wherever possible, **large structures should be visually broken through changes in massing, form, and texture to create an improved facade articulation.**

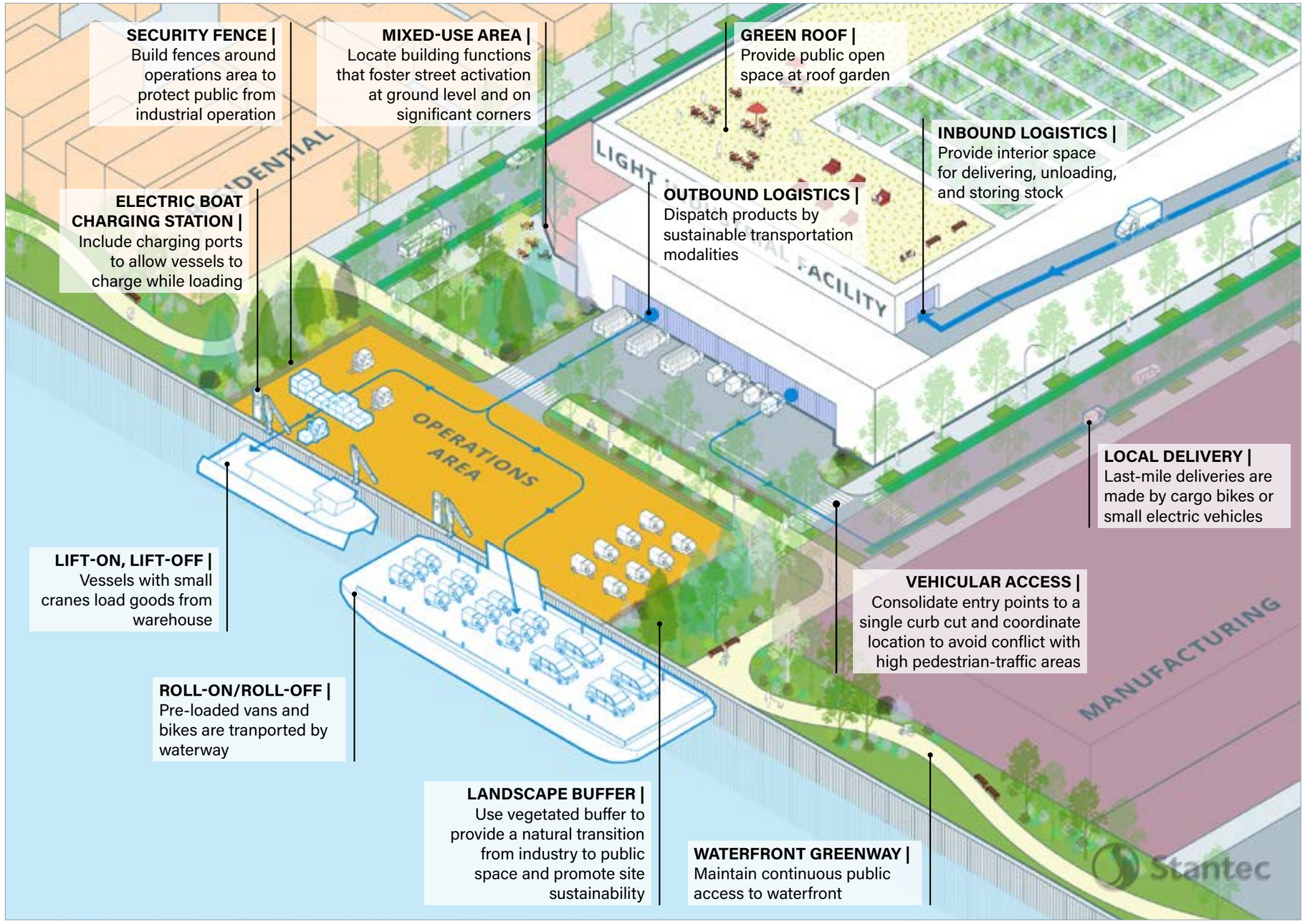
The prototype shown here illustrates some important exterior treatment principles for light industrial facilities, **prioritizing the use of material treatments that reflect the existing context and scale.** Other considerations include the use of effective stormwater management strategies such as green roofs, permeable pavements, and bioswales. Rooftops also provide opportunities for the installation of solar panels to generate renewable energy for building operations.



Industrial Waterfront Interface / Design Features

Light industrial facilities adjacent to navigable waterways should be connected to marine transportation. The diagram here shows a light industrial facility with the same urban design features depicted in previous pages, along with marine loading. It presents **opportunities for roll on/roll off vessels, which would transport loaded vehicles such as small vans or cargo bikes, as well as crane loading for small, standardized containers, also known as lift-on, lift-off vessels.** The type of loading will vary depending on the facility's use.

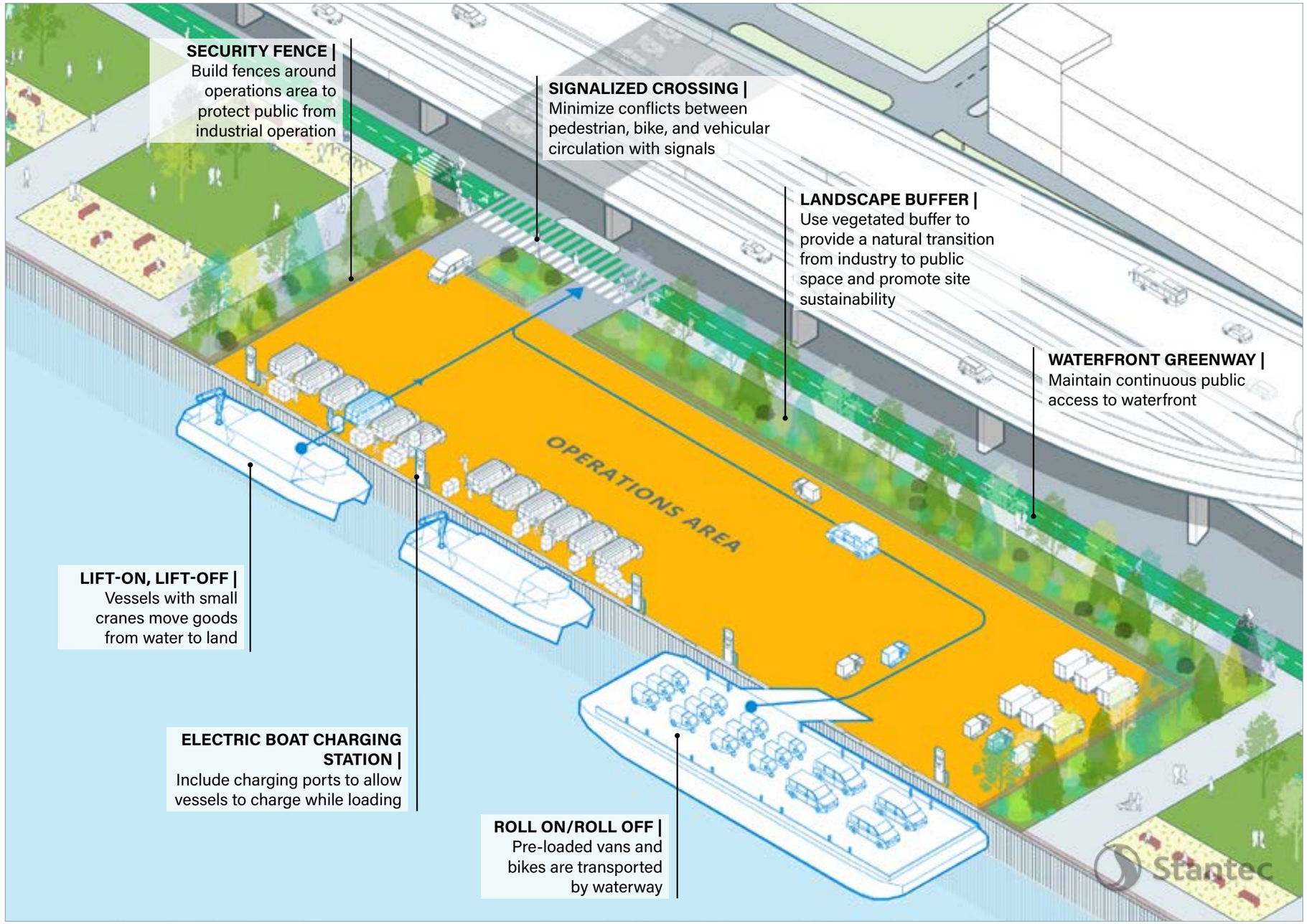
The design of waterfront facilities should balance freight operations with public uses such as greenways, parks, and other open spaces. Vehicular movement between the building and marine loading areas should be consolidated to a single point to **reduce conflicts between different transportation modes** and the design and placement of crossing points should consider the frequency of vehicle movements. Waterfront facility design should also consider climate adaptations.



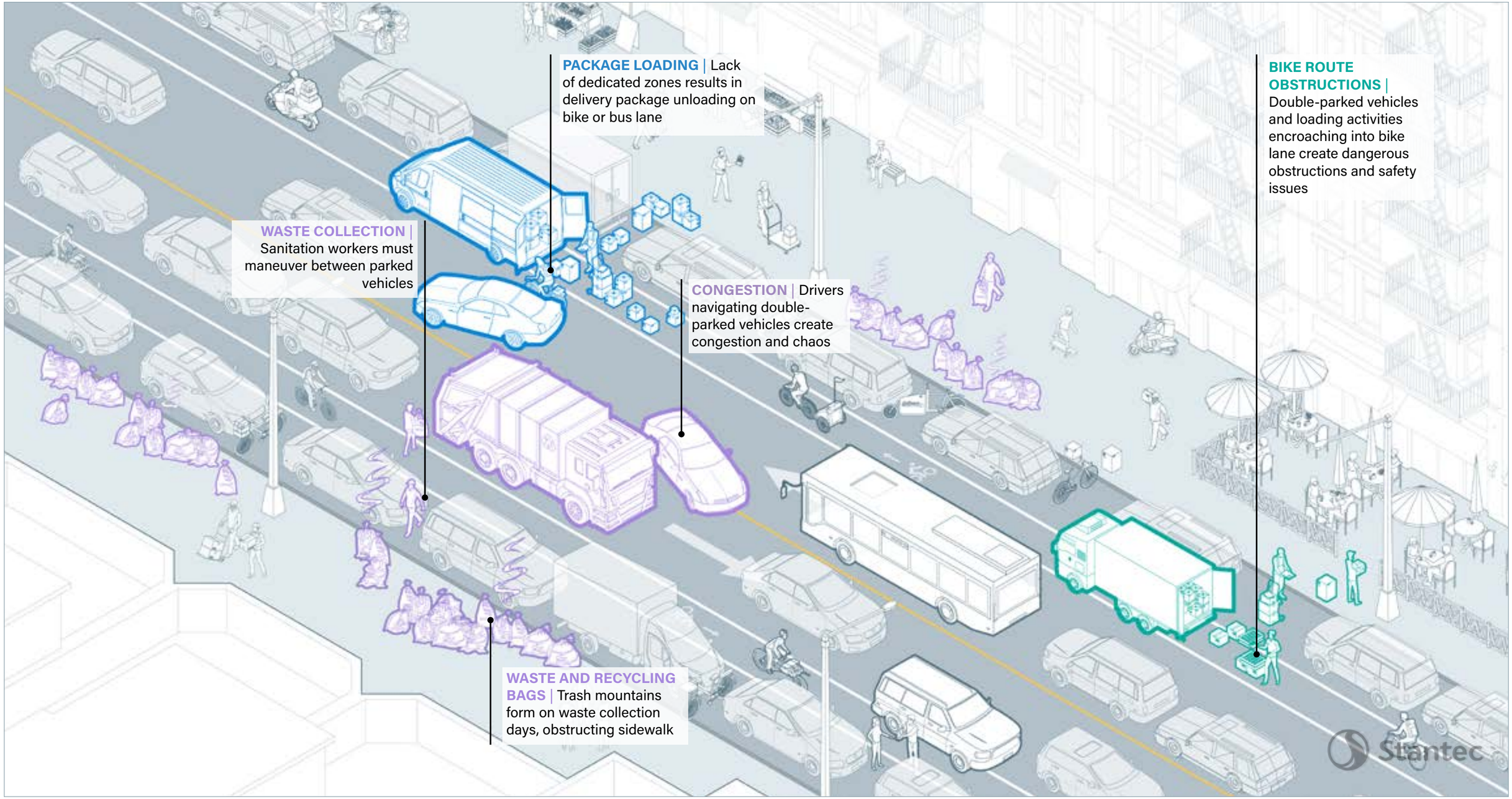
Waterfront Receiving Facilities / Building a Maritime Network

Critical to a future that leverages waterways for freight movement is the development of a network of receiving facilities. Depicted in this diagram is an example of a waterfront receiving facility, or a mini port. In many cases, **existing piers and underutilized waterfronts could be repurposed to provide space for roll on/roll off and lift-on, lift-off vessels.**

This network of receiving facilities relies on small-scale industrial facilities being located outside of Industrial Business Zones. **This is another unique edge condition, or Interface, that requires careful design consideration.** Sites should provide continuous greenway connections and vehicle crossings should be consolidated to a single point. Plantings can also be used to delineate mini-port facilities from adjacent public uses.



Current Context at the Last-Mile Interface

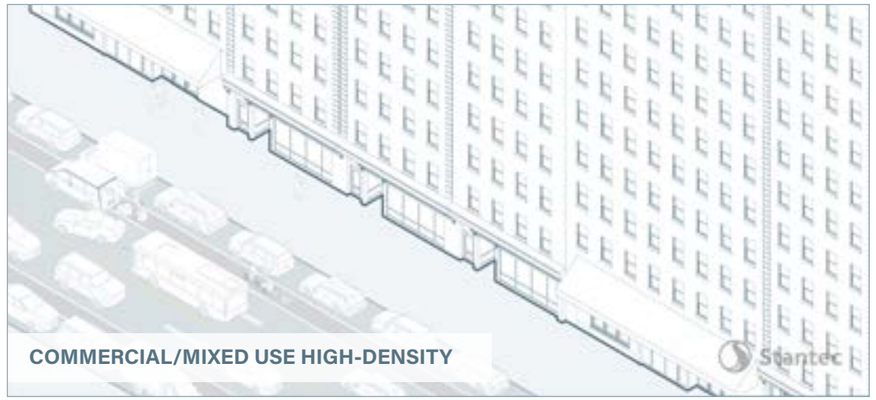


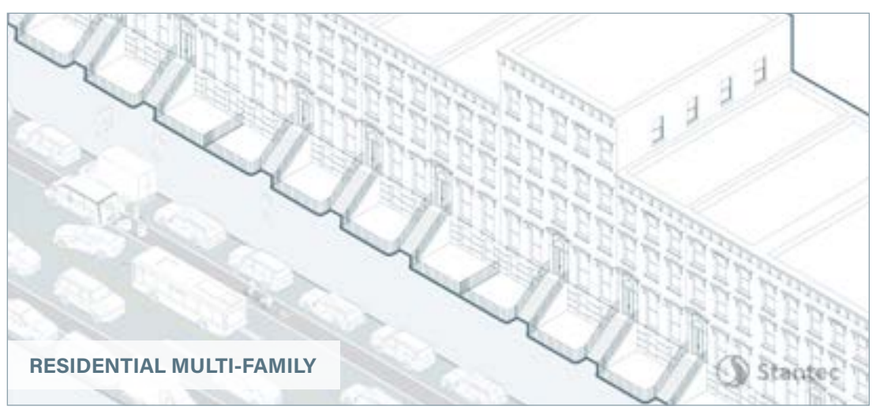
Last-Mile Interface / Understanding Freight Demand

On any city street, there is high demand for the curbside, as different users compete for space throughout the 24-hour cycle. Freight competes with other uses such as private vehicle parking, bike lanes, bus lanes, and passenger pick up/drop off zones. Freight demand also varies spatially and temporally, as different types of deliveries have different loading times and space requirements. Despite being a critical use, however, freight is often underserved and should be better accounted for in street design.

Curb demand is dynamic. Land use and densities inform the demand on a specific curb space or block, while operating schedules create different demands at different times of the day and days of the week. Curb management strategies must consider these variations throughout the city.

SPATIAL CURB DEMAND

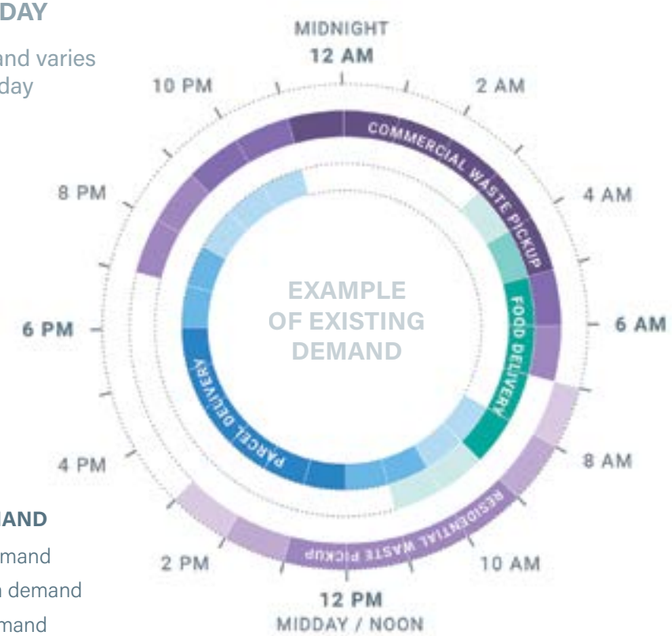




TEMPORAL CURB DEMAND

TIME OF DAY

Curb demand varies by time of day



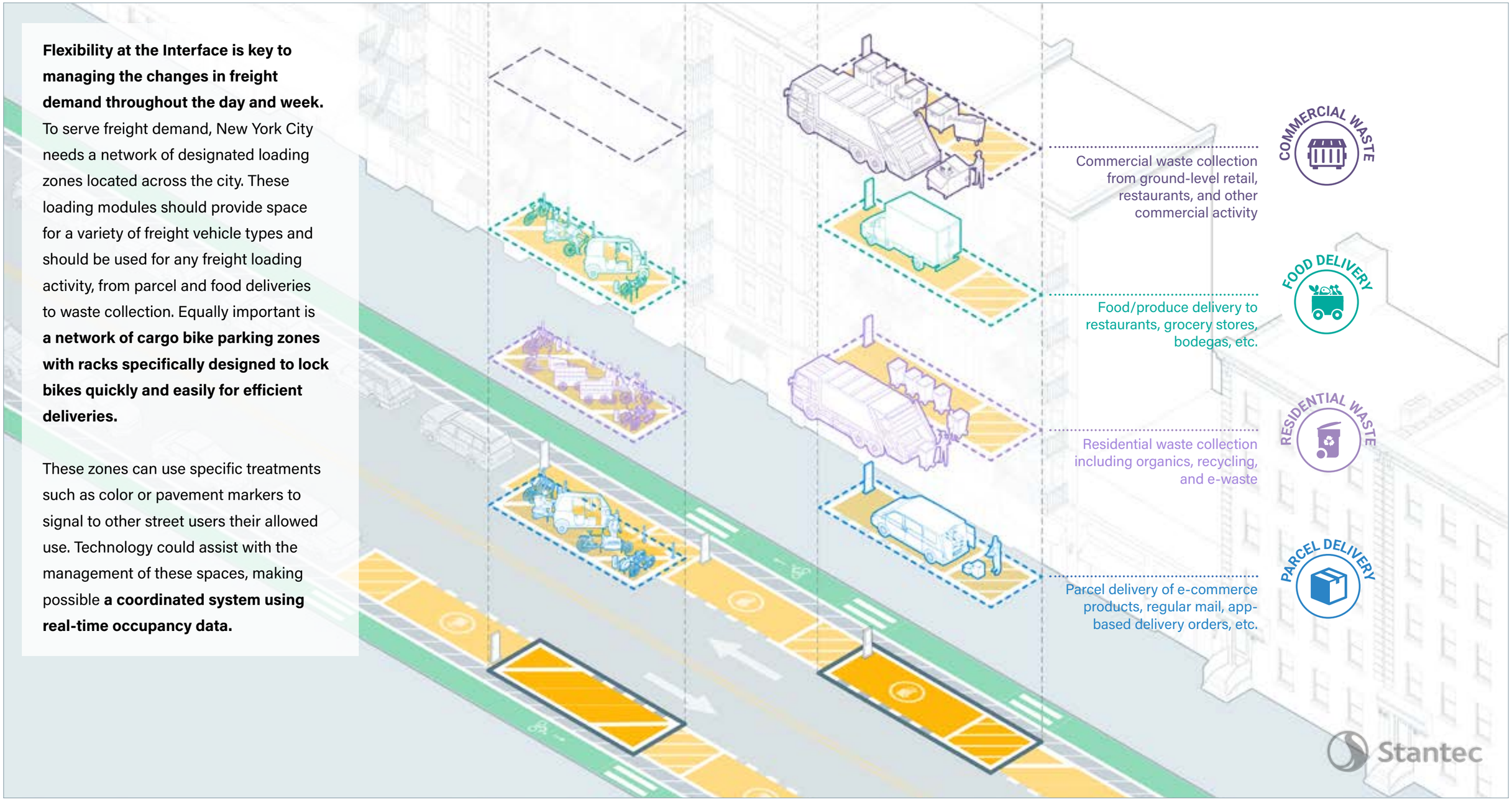
DAY OF WEEK

Curb demand also varies by day of the week

Last-Mile Interface / Developing a Flexible Strategy

Flexibility at the Interface is key to managing the changes in freight demand throughout the day and week. To serve freight demand, New York City needs a network of designated loading zones located across the city. These loading modules should provide space for a variety of freight vehicle types and should be used for any freight loading activity, from parcel and food deliveries to waste collection. Equally important is **a network of cargo bike parking zones with racks specifically designed to lock bikes quickly and easily for efficient deliveries.**

These zones can use specific treatments such as color or pavement markers to signal to other street users their allowed use. Technology could assist with the management of these spaces, making possible **a coordinated system using real-time occupancy data.**

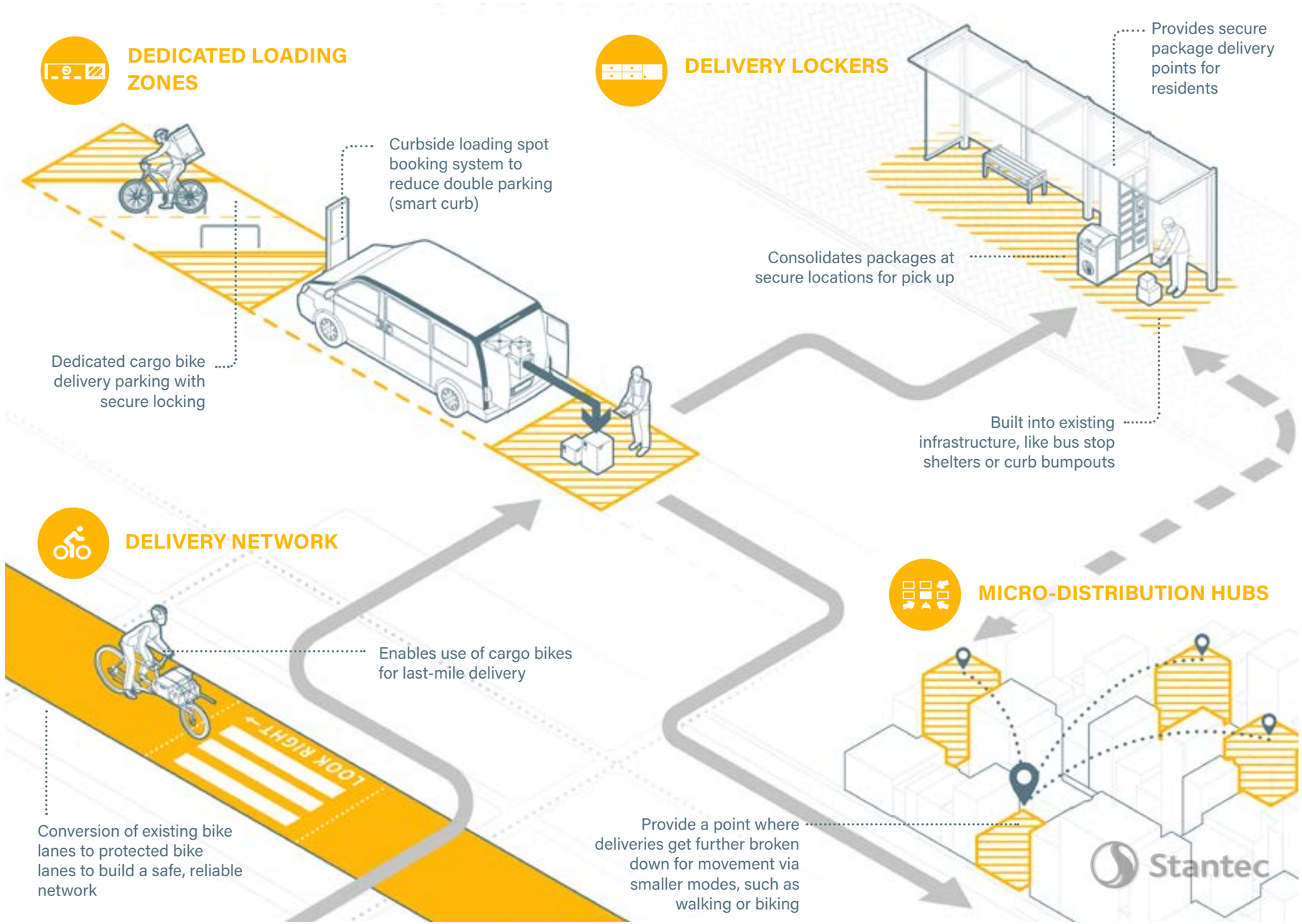


Last-Mile Interface / Developing a Design Tool Kit

The Interface is a point where the last-mile delivery network links with the final destination. It can be managed through a set of coordinated tools that integrate system-scale solutions at the site and accommodate inherent demand variabilities. The design toolkit at the last-mile Interface encompasses the following four elements:

- Delivery network
- Dedicated loading zones
- Micro-distribution hubs
- Delivery lockers

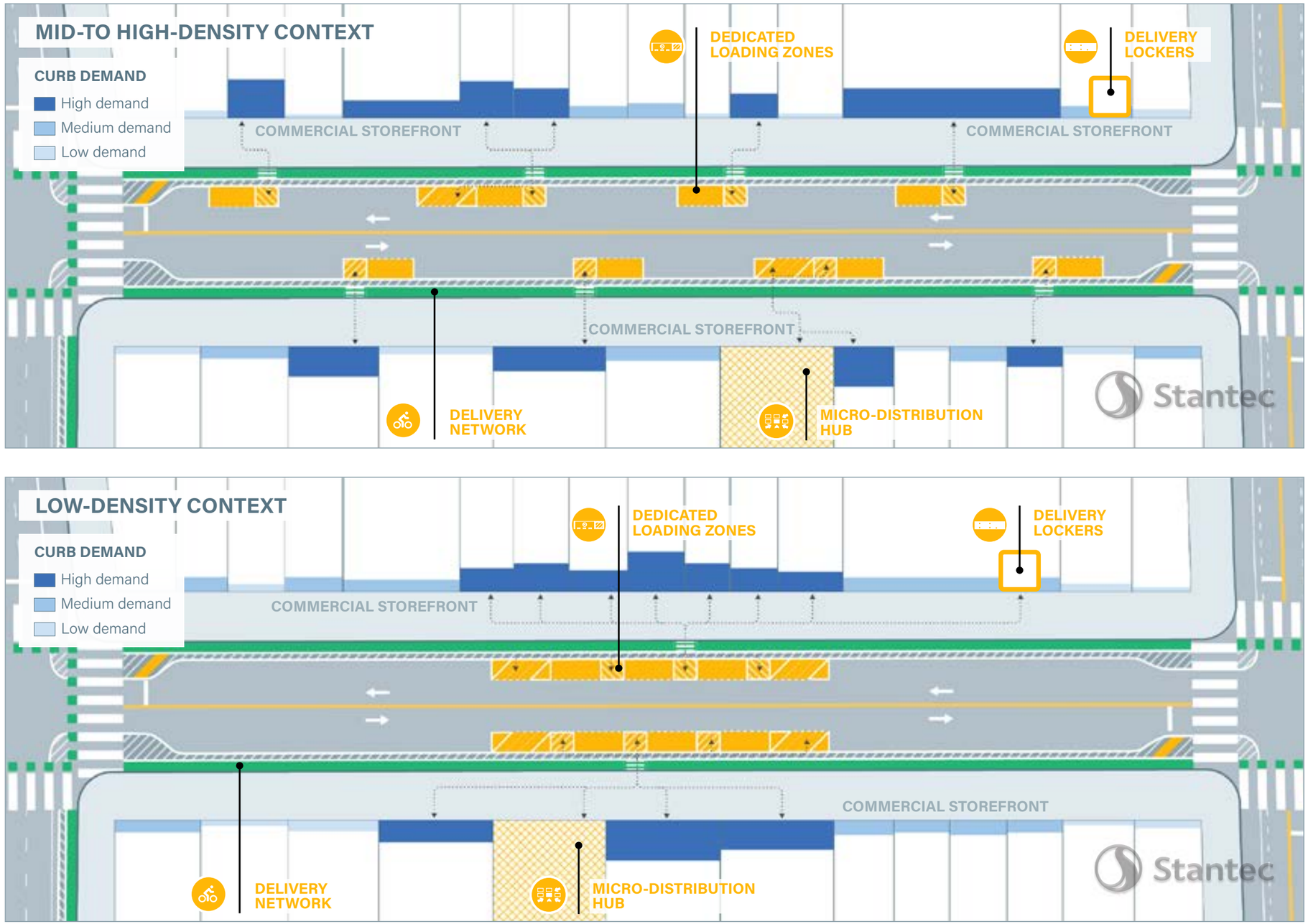
The elements in the design toolkit work together to mitigate the current freight challenges. A coordinated strategy that integrates design across the last-mile Interface is critical to a successful freight system.



Last-Mile Interface / Employing the Toolkit at the Block Scale

On any individual block, the number and placement of designated delivery spaces depends on land uses, density patterns, and **the location of demand generators such as restaurants or building entrances.**

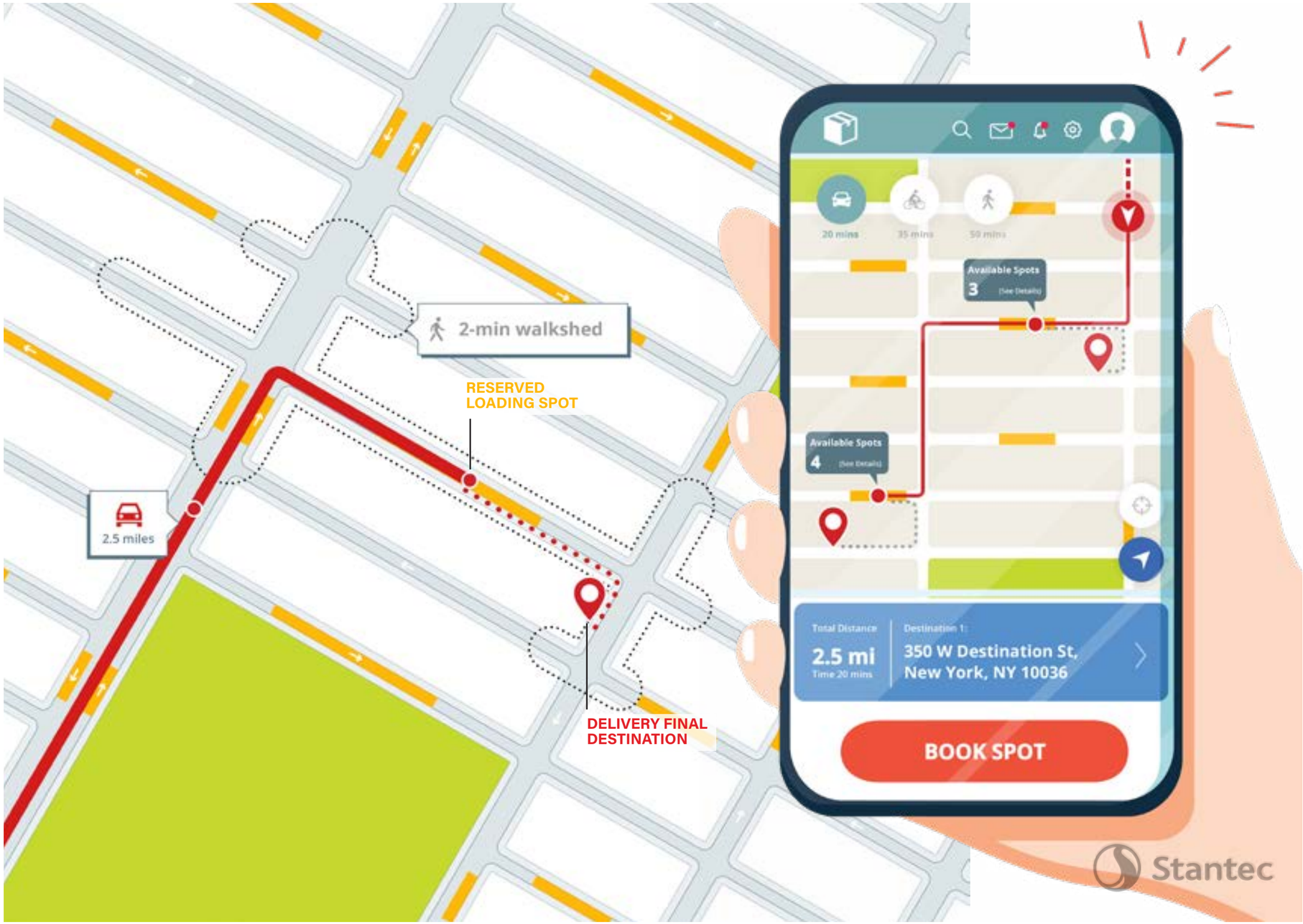
As curbside freight demand intensifies, the placement of designated freight zones should be distributed accordingly. A mid- to high-density context, where deliveries might be more frequent, should maximize available space for delivery vehicles, reducing the distance traveled by freight from the curbside to its final destination. In lower density contexts, freight zones might be consolidated, providing loading areas that are equidistant to each end of the block. Developing a strategy to deploy loading zones based on demand generators and other features of last-mile distribution such as micro-hubs and delivery lockers is a key component of designing the last-mile Interface.



Last-Mile Interface / Employing the Toolkit at the District Scale

At the district scale, dedicated loading zones, micro-distribution hubs, and delivery lockers should be distributed to create efficiencies in deliveries. The distribution of these facilities should consider bike and truck routes as well as significant freight demand generators. The goal is to strategically locate loading zones to create a network of overlapping areas of coverage and leverage sustainable delivery modes.

A well-managed curb does more than allocate space. Smart technology, for instance, has the potential to make deliveries more efficient and ultimately reduce conflicts on the street. Data about loading zones and occupancy can be combined with other open data streams such as traffic information to create a system through which deliveries are routed to the most efficient loading zones. For example, a delivery driver would be able to type in their destination address and the software would generate a route to a general delivery zone. With real-time information, the system would be able to "assign" a specific loading space to the driver once within the delivery zone. The system could work by reservation as well, providing organization to freight deliveries and confidence for delivery workers.

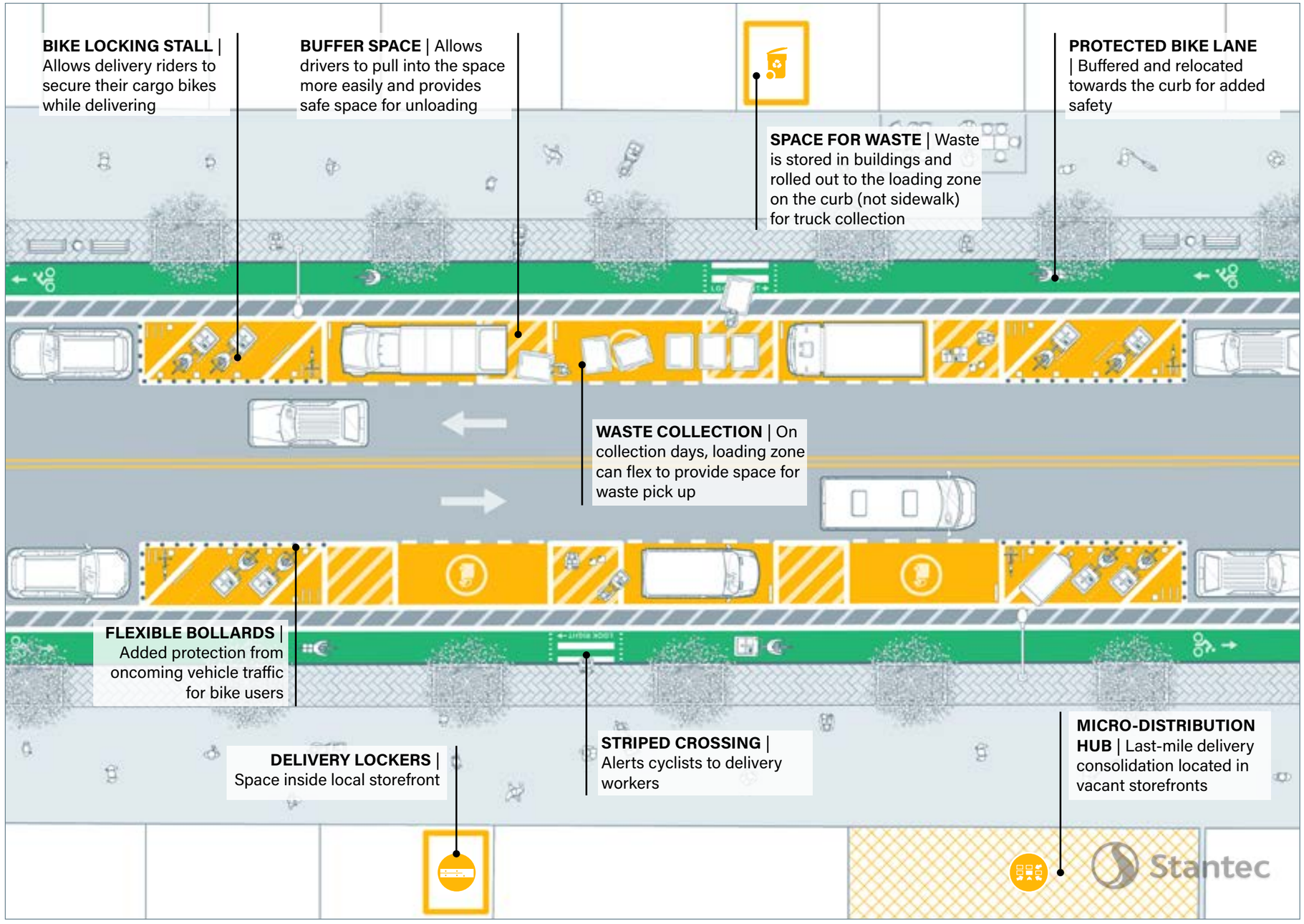


Key Elements at the Last-Mile Interface / Prototype 1

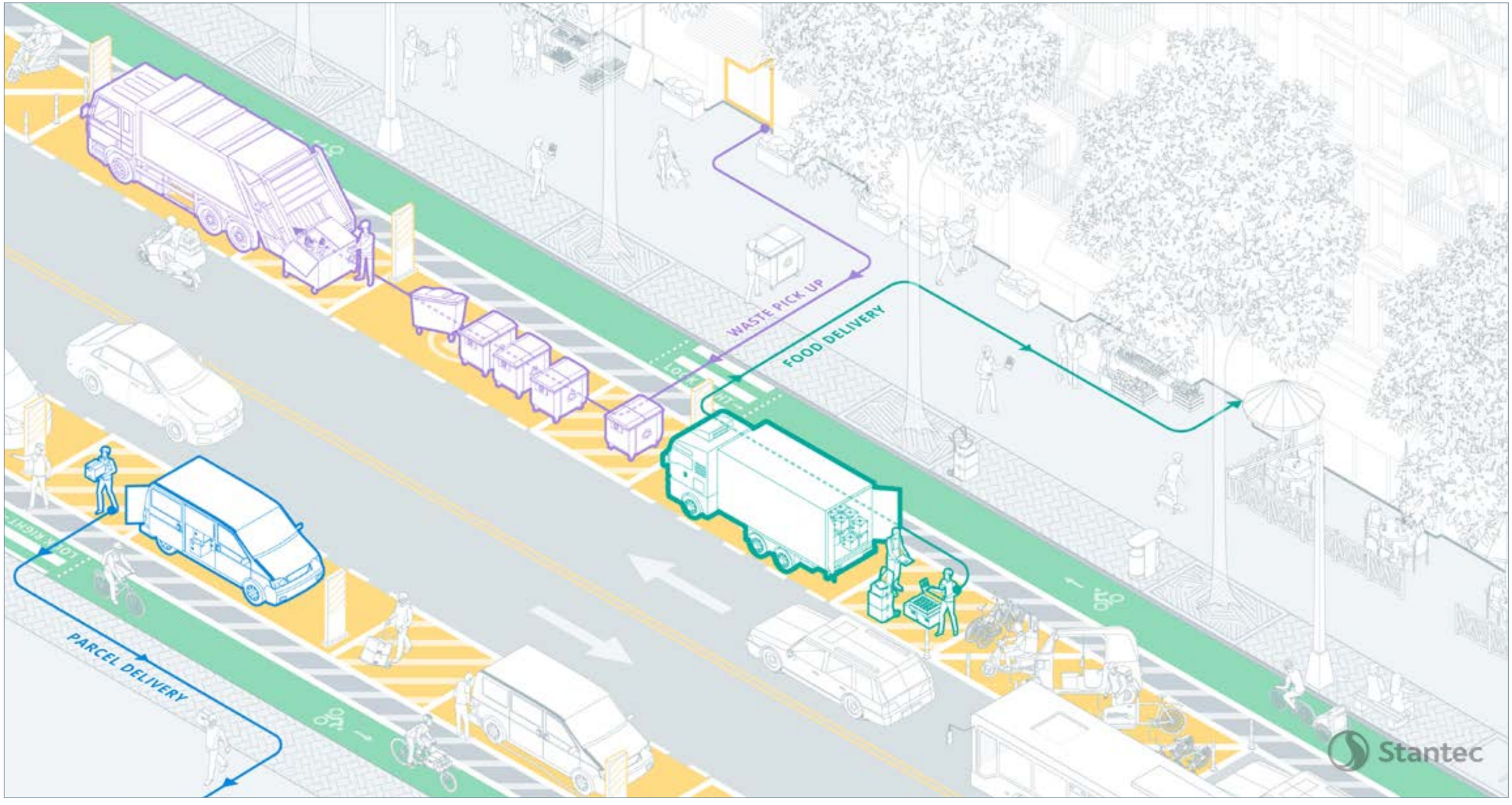
The following pages show a series of street prototypes that illustrate specific Interface conditions. While not a comprehensive compendium of New York City street contexts, these prototypes demonstrate the integrated toolkit's potential to be deployed in a variety of settings.

Prototype 1 considers mixed land uses in a medium- to high-density context with a two-way street with bike lanes. In this prototype, loading zones and cargo bike facilities are located near delivery lockers to provide residents with secure package delivery. Dedicated space within buildings would serve as waste storage until collection day, at which point the loading zones would be used to facilitate the movement of waste from the building to the truck.

The bike lane is located at the curb, with delivery vehicles providing protection from moving traffic. This configuration reduces the conflict of delivery vehicles crossing or blocking bike riders, creating a safer network that further encourages cargo bike deliveries. Designated cargo bike parking stalls are placed at both ends of vehicle loading, protected with flexible bollards from the rest of the parking lane. The strategically located crossing points between the loading zones and the curb aim to reduce conflict between modes.



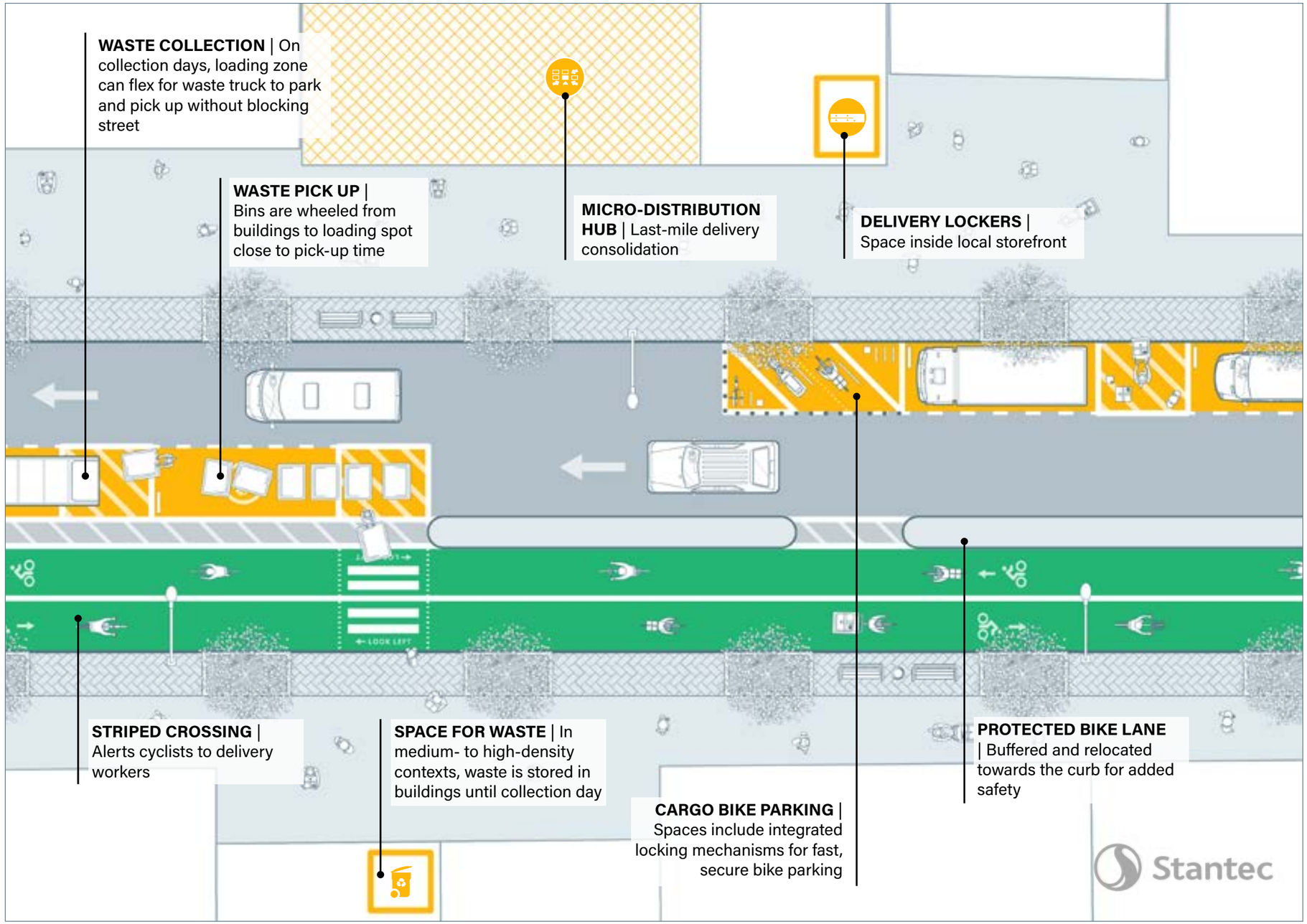
Material Flows at the Last-Mile Interface / Prototype 1



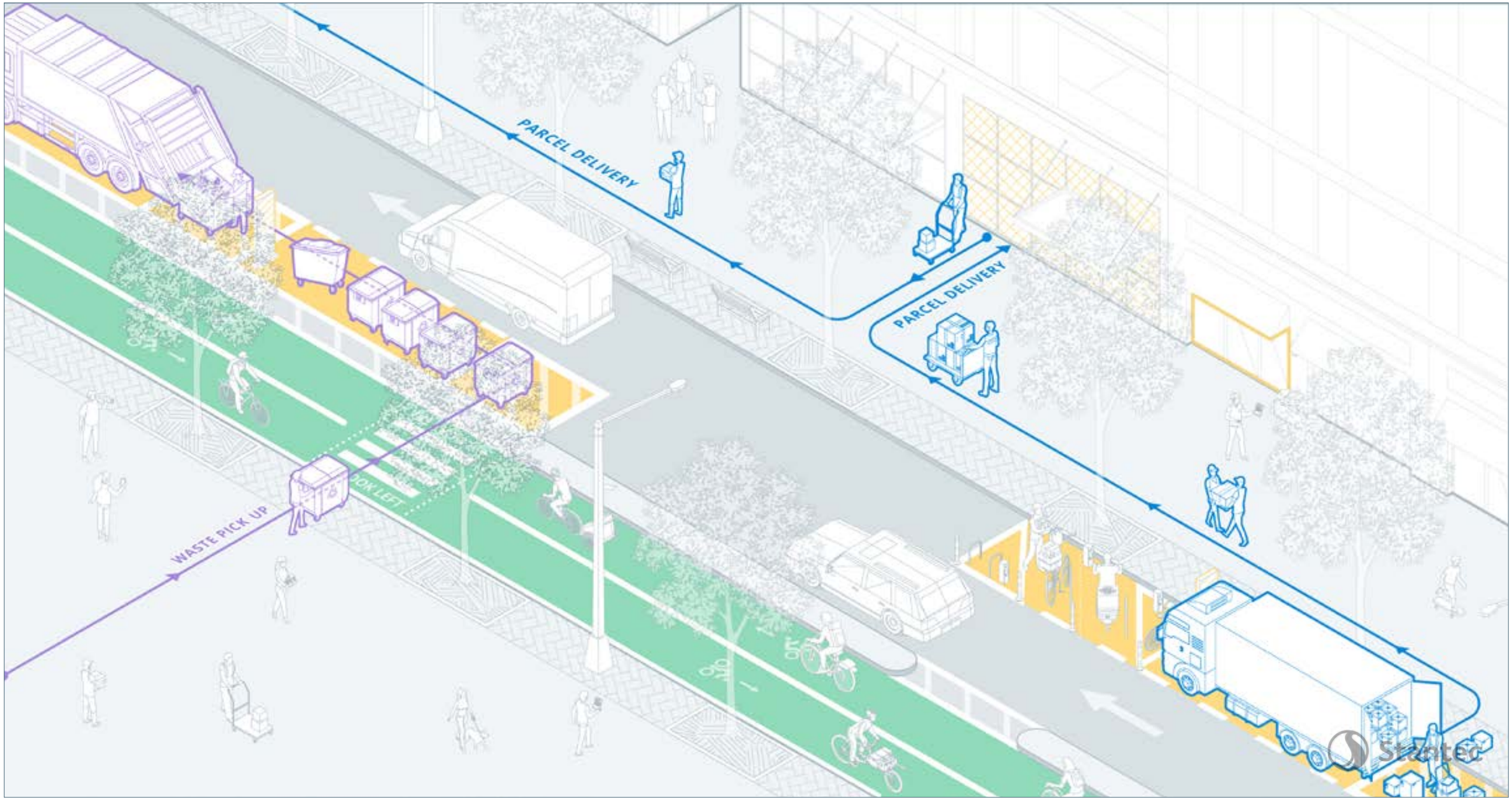
Key Elements at the Last-Mile Interface / Prototype 2

Prototype 2 considers mixed land uses in a medium- to high-density context with a one-way street. In this prototype, loading zones are evenly distributed along both sides of the block, alternating their location based on freight demand generators. The placement of the loading zones acts as a chicane, slowing drivers and improving safety conditions for all users and modes.

A two-way bike lane allows for movement in both directions even though vehicular movement is one-way. This is an important feature for facilitating bike delivery, as it reduces conflicts between bike users who may otherwise drive down one-way streets in the opposite direction to make for more efficient routing. Delivery lockers are located inside existing ground-level retail areas and operated by a private entity. Similarly, micro-distribution hubs are located in underused or vacant ground-level commercial spaces, facilitating handcart and bike deliveries within the district.



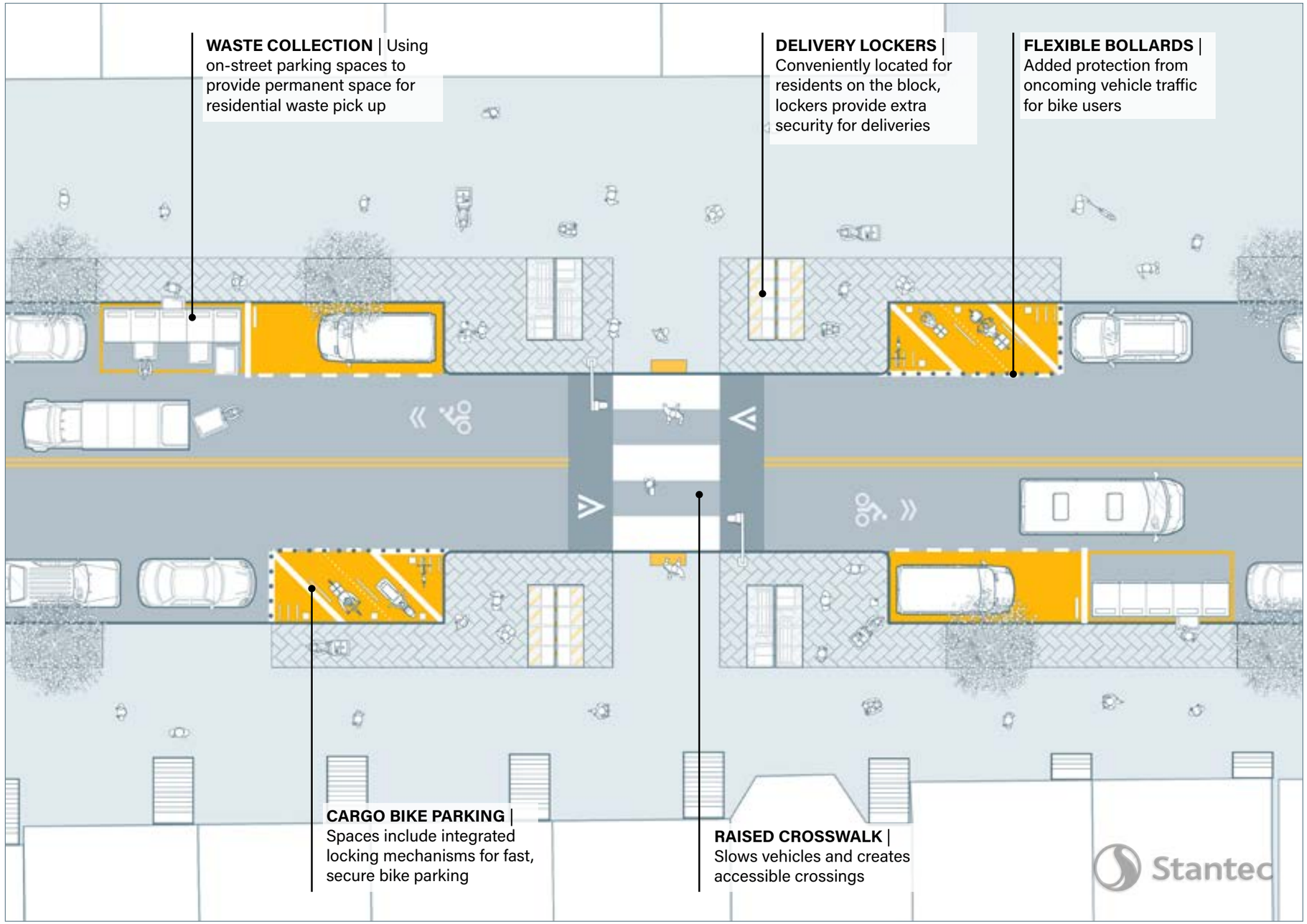
Material Flows at the Last-Mile Interface / Prototype 2



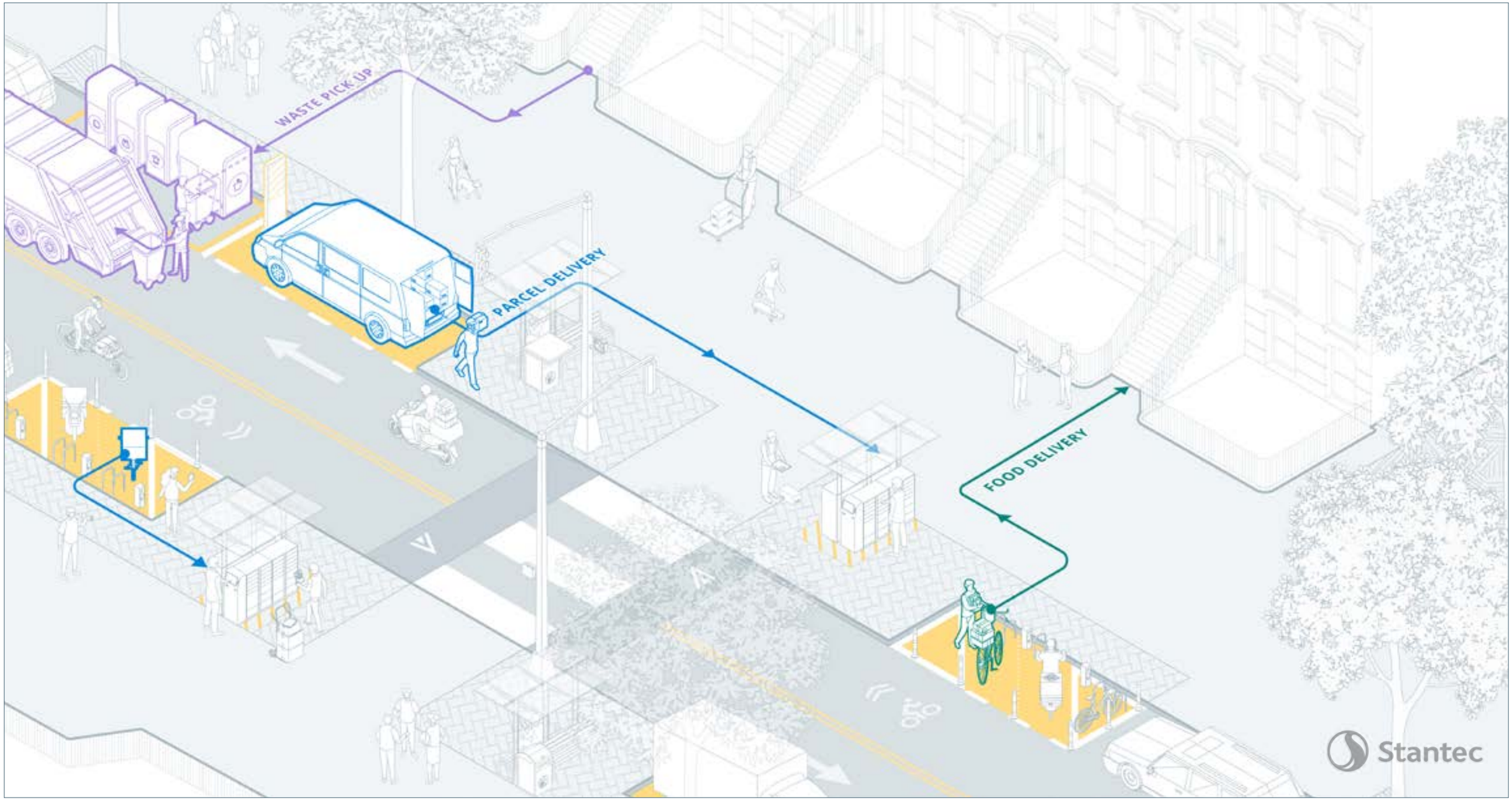
Key Elements at the Last-Mile Interface / Prototype 3

Prototype 3 considers residential land uses in a low- to medium-density context with a two-way street. Because fewer loading zones are needed to serve the block, a freight management area with waste collection points, delivery lockers, and loading zones for vehicles and cargo bikes is provided in the middle of the block. In more residential contexts, delivery lockers can be envisioned as a form of social infrastructure—a space to meet with neighbors while picking up packages. In lower-density contexts, residential waste can be managed in dedicated collection bins rather than stacked on the sidewalk, facilitating collection, reducing sidewalk clutter, and making residential environments cleaner.

A key design feature is curb bumpouts that create space for delivery lockers. These community spaces could also feature public amenities such as restrooms, seating, or space for e-commerce returns. Bumping out the curb at the midblock and providing a raised crosswalk also makes residential streets safer by slowing traffic. In this way, the street is enhanced to become a space meant for neighbors.



Material Flows at the Last-Mile Interface / Prototype 3



SECTION OVERVIEW

Recommendations / Transforming Aspirations into Actions

Recommendations Contents:

This document is guided by principles aimed at creating equitable, sustainable, and balanced outcomes for the broad group of urban freight stakeholders. Despite the inherent complexity in finding common purpose in the varied needs across community and industry, a core proposition of this project is that it is an achievable goal.

Reaching that goal requires listening to the voices of lived experience and centering on that primary knowledge as a key to understanding the issues. For this initiative, we listened to stakeholders including community members, agency representatives, industry leaders, researchers, and design professionals. Their invaluable insights and considerations have informed this document's recommendations.

The recommendations outlined here are a set of actionable strategies for change. They range from easy, short-term actions to ambitious efforts that require the type of physical and institutional change that can only happen over an extended time. Individually, each of these recommendations provides a means to improve specific aspects of goods movement in the city. As a whole, the strategy set provides a basis for weaving urban freight into the city fabric in a way that ensures positive integration of livable communities and vital businesses that benefits all New Yorkers.

PRINCIPLES

Equitable Planning
Establishing just outcomes for all, especially vulnerable and marginalized communities.

Environmental Sustainability
Mitigating negative impacts to climate and building a circular material economy.

Balanced Goods Movement
Reconciling supply and demand sides for productive, people-centered urban freight.

For who/what:

- **Community**
- **Industry**
- **Policy**
- **Design**

Participatory Planning Approaches

- **Create an institutional platform to enable cooperative planning across all stakeholders**
- **Promote stakeholder data collection and open data access**
- **Actively cultivate engagement and knowledge sharing**

The delivery and distribution network for goods and products is inherently cross-jurisdictional, involving multiple governments and impacting multiple stakeholders along the way. Even the simplest local material or product delivery trip illustrates the many challenges related to street design and land use that confront cities, local neighborhoods, and the goods movement industry.

Local community boards have limited tools to influence decision making for the neighborhoods that they represent. The competitive nature of private enterprise discourages transparency and information sharing. And separate government agencies with discrete areas of responsibility often lack a centralized mechanism through which to build trust, coordinate policies, and test new ideas. But there are strategies to address these challenges.

Models for Stakeholder Engagement
Regular meetings between government agencies and the freight industry offer a forum for open communication and collaborative problem solving. Seattle's University of Washington Urban Freight Lab, for example, hosts a structured public/private working group that brings together freight industry partners and city officials to test strategies to improve urban freight management, while the Delaware Valley Regional Planning Commission's Goods Movement Task Force connects regional planning agencies with the freight industry.

Examples of community-based planning in New York City include the 197-a Plan process, which enables community boards and borough presidents to develop community-based plans for their district or borough to inform decision making on land use. While community-drafted 197-a Plans articulate a consensus vision for districts, plan recommendations remain advisory rather than determinative. Furthermore, the capacity and resources needed by community boards to develop such plans and gain City approval are formidable. To date, just 11 197-a Plans representing the city's 59 community boards have been approved, the most recent in 2009. Missing from these examples is a platform that brings together all stakeholders—community, industry, and government—to develop a consensus approach to problem solving.

Building Inclusive Coalitions and Collaborations
The recently released Hunts Point Forward plan[35] exemplifies a more inclusive approach to neighborhood planning. Created by a coalition of community organizations, business and industry representatives, city agencies, and elected officials, the plan lays out a shared vision for the Hunts Point peninsula in the South Bronx, where the massive public/private Hunts Point Food Distribution Center and other industrial uses surround a vibrant residential enclave.

To support community-based planning initiatives like Hunts Point Forward, the City could expand its Freight Advisory Committee to include community representatives, thus providing an inclusive community/industry/government forum to share knowledge, dissolve blind spots, and test strategies. Facilitated by a neutral third-party organization similar to Seattle's Urban Freight Lab, the forum would provide a platform to build consensus and resolve conflicts between stakeholders. The cross-jurisdictional collaborative model would also enable fair and equitable access to innovation and experimentation that may otherwise be prohibitive when approached independently.

Zoning and Land Use

- **Employ the Special Permit process for distribution facilities based on impact criteria**
- **Implement more nuanced as-of-right regulations in Manufacturing Districts**
- **Support community-led neighborhood planning and rezoning initiatives**

The 1961 Zoning Resolution, now over 60 years old, is still the City's primary tool to control land use. Intended to separate uses by district, the Resolution has also tried to accommodate a myriad of existing non-conforming conditions, including residential and industrial mixed-use areas in manufacturing districts. It has been constantly modified and updated with a complex patchwork of Special Purpose Districts meant to provide a more nuanced alternative to the original single-purpose districts.

The City's Manufacturing Districts ('M' designation) allow a range of manufacturing and industrial uses as well as certain commercial, retail, and community uses. Commercial Districts ('C' designation) allow specific light manufacturing uses within their Sub-Districts. Warehouses and freight distribution centers, which are classified under Zoning Resolution Use Group 16, are permitted within M1 (light), M2 (medium), and M3 (heavy) Manufacturing Sub-Districts, as well as within the C8 Commercial Sub-District.

Since its peak in the early 1940s, the decline in demand for manufacturing space in New York City has led to a wave of neighborhood rezonings and zoning variances to convert underutilized industrial sites to commercial and residential uses, essentially creating under-regulated mixed-use districts. While the Zoning Resolution coordinates use and bulk regulations, it largely avoids imposing aesthetic design controls, particularly in Manufacturing Districts. As it has evolved over the decades, Streetscape regulations have been introduced in certain Residential and Commercial Districts imposing a limited degree of urban design control at the interface of private buildings with other surrounding buildings and public space. Meanwhile the 1961-era Manufacturing District regulations have hardly changed, lacking basic urban design controls for street walls, loading, and parking.

The recent growth in demand for industrial sites for the e-commerce industry, coupled with a resurgence in various types of lighter industrial and manufacturing-related activities in the city, has accelerated quality-of-life conflicts between uses. City agencies are faced with the challenge of protecting neighborhood quality of life while encouraging appropriate industrial development through effective land-use policies and regulations.

Manufacturing District land-use regulations and conditions that may negatively impact neighborhood quality of life include:

- Manufacturing District regulations are too broad for the complexity of today's land uses
- Non-conforming uses within Manufacturing Districts create mixed-district conflicts
- Spot rezoning used to address localized development conditions can result in unpredictable neighborhood outcomes and lack of consistency between other similar sites
- Allowable size of distribution facilities may be incompatible with the scale of neighboring Residential Districts
- Concentration of trucks servicing freight distribution facilities negatively impacts air quality and traffic safety

A menu of zoning tools and regulations that could be adopted to address these issues should include:

Employ the Special Permit process for larger distribution facilities

- Require zoning Special Permit for freight distribution facilities based on criteria such facility area, type of operation, truck trip generation, adjacent residential density, and street width. Limits on the number of exterior loading bays and hours of operation could also be considered
- Develop more rigorous urban design Streetscape regulations for distribution facilities
- Include strategies to offset truck traffic and pollution impacts, such as confirmation of designated Truck Route access to distribution facilities, management plan for delivery truck queuing, on-site parking for delivery vehicles, adoption of maritime and rail freight options, and provision for on-site electric vehicle charging
- Incorporate community benefit agreements, including on-site community facilities and local job hiring commitments

Implement more nuanced "as-of-right" development controls in Manufacturing Districts

- Reform citywide Manufacturing and Commercial District regulations with more nuanced as-of-right controls combined with new performance standards
- Develop specific use categories for freight distribution and consolidation facilities
- Expand overlay Contextual Manufacturing Sub-Districts, especially for mixed-use districts and at the edges of Manufacturing Districts
- Develop more rigorous urban design Streetscape regulations for industrial and mixed-use districts

- Require off-street loading with limited curb cuts and screening at large freight distribution facilities
- Reduce off-street employee parking requirements to reflect projected employee demand, with further reductions for proximity to convenient public transit

Support community-led planning and rezoning

- Consider community-led neighborhood rezoning for areas of the city significantly impacted by the proximity of large freight distribution facilities to residential uses
- Retain industrial uses that are compatible with adjacent residential districts and contribute to citywide strategies for the location of these industrial facilities
- Encourage compatible mixed-use development where negative impacts can be controlled
- Incorporate community benefit agreements by developers and the City
- Require that water-dependent industrial facilities consider public access to adjacent waterfront areas where safe

Some of these strategies have been incorporated into recent rezoning actions, such as the Gowanus Neighborhood Plan with its extensive zoning text amendments approved by the City in December 2021. Red Hook, Brooklyn and Port Morris in the Bronx are other candidates for rezoning.

Facility Siting and Design

- **Design guidelines for off-street parking, loading and storage should protect the character of the street**
- **Site planning should respond to orientation, changes at the edges of neighborhoods, the location of parking and loading, and special conditions such as waterfront access**
- **The scale of large buildings should be modulated by changes in massing, increased transparency and the expression of different uses, including non-industrial uses**
- **Promote mixed-use and flexible use where appropriate**

Accompanying the explosion in goods movement induced by e-commerce is a proliferation of warehouses and distribution facilities that are part of the delivery process. It is most efficient for these facilities to be near the heart of the city, where they are closer to the markets they serve. This reduces the distance of last-mile deliveries, which arguably impact neighborhoods the most with traffic, congestion, and air pollution. Yet, accommodating these enormous utilitarian structures, often without out of scale, without character, and virtually windowless, is a real neighborhood design challenge. Like other cities, New York can mitigate the impacts of these facilities on their host neighborhoods by adopting design and development standards. If distribution facilities above a certain size were subject to a Special Permit process, impact fees could be used to mitigate impacts and promote better design, not just of the building but in the larger district as well.

Design guidelines can be organized around three areas: design of the site, building design, and the mix of uses.

The Site

- **Orientation:** The neighborhood context should influence the orientation of the building. Even in large, consolidated industrial areas, some streets are more important than others in terms of pedestrian and bicycle access, transportation routes, and linking corridors between neighborhoods. Building orientation should account for these conditions by, for example, locating office spaces and employee entrances along these corridors while limiting loading docks to less pedestrian-oriented streets.
- **Edges:** Building and street design should respond to the edge conditions of the site. In particular, where one edge of the site is residential or smaller in scale, strategies to reduce the scale of the distribution facility and activate the facade should be combined with streetscape strategies such as landscaping, setbacks, and creative lighting.
- **Special conditions:** Siting should take into account proximity to special situations such as rail spurs or waterways for goods movement or to public amenities such as waterfront access.
- **Parking:** The number of required off-street parking spaces should be based on proximity to public transit and a realistic assessment of how many employees will actually be coming to these facilities, which are often highly automated. Parking areas should be located where they have the least impact on important connecting pedestrian corridors. And they should be well-landscaped and employ passive storm water management techniques.

The Building

- **Scale:** Unrelieved expanses of blank walls should be articulated with plane changes and distinct massing of building volumes. Material choices can also impact the perceived scale of the larger building.
- **Transparency:** Building facades, especially along important neighborhood corridors, should have some level of transparency between inside and outside. This can be achieved in many forms: a continuous clerestory allows natural light into the building and projects light at night while still providing the factory with unobstructed wall space, while panels of structural glass block between sections of the building can help the visual connection.
- **Articulation of functions:** Non-production/distribution spaces, such as office spaces, meeting rooms, and cafeterias, should be articulated outside the building, moderating the structure's scale and animating important neighborhood corridors. The entry is an especially important opportunity to reconnect the building to the neighborhood street with an architectural impact. Building elements associated with production/distribution functions, such as ramps and loading docks, can be treated with architectural interest.
- **Lighting:** Well-designed exterior lighting animates the facade and creates safer streets.
- **Sustainability:** Large expanses of roofs and other impervious surfaces should demonstrate best practices in solar collection and stormwater management strategies.
- **Operations impact:** Noise, odor, and other negative impacts should be mitigated through building design. Internalizing loading functions may be necessary depending on the neighborhood context and hours of operation.
- **Anticipate re-use:** To the greatest extent possible, building systems should be designed to enable subdivision, partial demolition/replacement, or repurposing in the future.

The Uses:

- **Accessory uses:** Mixed-use programming should be encouraged. This can be as minor as having a retail outlet for the product being produced or even enabling on-site pick up from a distribution facility (this is not that far from the existing Ikea model). Designing for these uses is another way to moderate the impact of the "big box."
- **Mixed uses:** Combining other uses in the same facility should be encouraged where appropriate. Residential uses can be located above or along the edge to manage transitions in scale or neighborhood character. Complementary uses such as workforce training and neighborhood community facilities should be considered. Large facilities with greater impacts should be subject to a Special Permit process conditioned on mitigating those impacts and creating public amenity spaces.
- **Flexible uses:** Enable mixed uses in time, not only space. While many facilities will operate 24/7, others may have days of the week or times of the day when other community-based activities can take place in the building or on-site.

Street Design

- **Adopt street design guidelines that balance goods movement with other street activities and facilitate deliveries by micro-delivery modes such as cargo bikes**
- **Develop flexible curb use management strategies and regulations**
- **Design street-scale infrastructure to support goods delivery**

Street design, including curbside spaces, should be reconsidered to allow for and incentivize sustainable freight modes. The range of street designs that should be explored extends beyond the prototypes developed in this document. A comprehensive set of street design guidelines for varying densities and land use patterns would consider how freight movement interacts with bus routes and dedicated bus lanes, truck routes, bike lanes, and traffic patterns. Street design should balance goods movement with other street demands, while recognizing that freight demand is underserved by current street design conventions.

With data and technology, curbside space has the potential to become more flexible and respond to real-time demand, including for freight demands such as parcel delivery, waste pickup, and food distribution. A technology-based approach to curb management can also optimize deliveries, allowing operators to find and even reserve loading zones to make local deliveries from a single location. This would reduce the number of vehicles circulating through neighborhoods and the frequency of double parking to complete a delivery. Dedicated loading zones should also be equipped with electric chargers to incentivize the electrification of delivery fleets.

Meanwhile, the infrastructure networks that support smaller modes for package delivery, such as cargo bikes and hand bikes, need to be bolstered. Bike lanes should be designed with enough capacity to handle cargo bikes and individual bike riders, and a fully developed, two-way bike network needs to be implemented to improve efficiency for cargo bike deliveries. Bike parking corrals should be designed with stalls large enough for cargo bikes.

Finally, a network of vendor-supplied and maintained lockers that can be used by any delivery operator can not only make package delivery more secure for consumers, but can also help organize and optimize goods movement. City agencies should explore ways that parcel consolidation solutions, such as secured delivery lockers, can be built within the public right-of-way, becoming another element in the city's coordinated public-realm street furniture system.

Distributed Networks

- **Advance infrastructure improvements for rail and maritime freight networks**
- **Develop micro-distribution hubs**
- **Introduce package lockers as part of the street design**

Planning for a true distributed network should begin by strengthening the use of rail, expanding maritime, and integrating the two for greater multi-modal freight options. A network of decentralized freight hubs could be dispersed across the city's waterfront, expanding access to goods, increasing community benefits, and decreasing the intensity of freight impacts on vulnerable communities.

Revitalizing the city's moribund maritime freight network will require substantial coordination and investment from the public and private sectors. A key to this effort would be normalizing investment in maritime freight by subsidizing "blue highways" maritime infrastructure in the same spirit as the subsidization of roads and bridges, which is viewed as typical and uncontroversial. To maximize multi-modal opportunities, maritime freight strategies need to be paralleled with rail by reactivating the network of unused or underutilized freight rail rights-of-way crossing through the city's industrial areas.

Distributed networks need to be supported by new kinds of infrastructure. One component is the creation of a network of micro-distribution hubs taking many forms, generally not larger than 10,000 square feet and meant for quick turnover of inventory. Smaller distribution hubs can be located in existing structures, such as underutilized parking garages or storefronts, so they can be relocated as destination land uses evolve. The city of Paris has embraced this strategy with their Urban Consolidation Center program, while in London, GreenLink Cargo has developed micro-hubs for the delivery of goods entirely on cargo bikes and electric vehicles.

Another component of the distributed network is to introduce package lockers, which are already common in residential buildings, as street furniture in residential neighborhoods. These lockers could be located at street curb zones, wider sidewalks, or in other public spaces, allowing patrons to complete the last fifty feet of the delivery themselves. In Europe, successful examples include Packstation by DHL in Germany and ParcelMotel in Ireland. In Canada, BufferBox and Amazon have collaborated to develop their own proprietary Amazon Lockers. The United State Postal Service is also piloting its 24/7 "gopost" package locker system in New York City and Washington, DC. These package lockers can be part of a larger initiative to make certain streets "delivery ready."

Consolidation

- **Develop strategies for adapting consolidation models to the New York City context**
- **Develop siting criteria for consolidation hubs coordinated with last-mile delivery routes**
- **Make recommendations for types of goods that can be consolidated based on concentrations of similar destination types**
- **Develop consolidation sites for construction materials commonly used from site to site**

Goods consolidation models have been tested in some European cities, offering promising outcomes in reducing truck trips and traffic congestion. All consolidation models operate in roughly similar fashion: goods are first delivered to a larger consolidation facility located upstream from the final destinations where they are sorted, consolidated, and transported for final delivery in a single trip. For the greatest impact, trips should be optimized for time of day to reduce peak-hour travel and should consolidate goods across logistics operators. The models tested in European cities need to be adapted to the New York City context, though, and research needs to be developed to understand how these models might be adapted based on local geography, policy, and economic landscapes. NYC DOT's Request for Expressions of Interest for micro-distribution hub pilots is a start to this process. Other models of consolidation such as construction consolidation centers or urban consolidation centers for retail clusters or large apartment buildings should be explored.

Mode Transformation

- **Incentivize the transition to electric vehicles and deploy charging infrastructure**
- **Support the development of a viable local maritime goods movement network**
- **Reactivate and improve existing freight rail infrastructure**
- **Support micro-delivery modes such as cargo bikes**

The goods distribution system has long relied on trucks as the primary mode for both middle- and last-mile goods movement, resulting in many negative impacts on neighborhoods. While trucks will continue to be integral to the system, trends point to the electrification of these vehicles in the next decade. However, to more fully address the impacts imposed on communities, a transformation of goods movement needs to include a more balanced mix of trucks and other modes across the freight chain: maritime vessels, freight rail, and small micro-delivery modes such as cargo bikes and handcarts.

City agencies can help guide and facilitate a modal transformation through policy, infrastructure design and investment, and economic incentives to private industry.

Electrified Modes: Electric trucks, vans, marine vessels, and bikes reduce emissions from diesel and gasoline combustion. Currently, electric truck penetration into the urban delivery market has been limited by high purchase costs and limited production capacity. Electric truck operators must design delivery routes to ensure that vehicles will have adequate power to complete their tours. As such the integration of curbside EV charging stations at "green loading zones" will encourage adoption. Expanding incentives like the NYC Clean Trucks program citywide can also accelerate EV conversion for freight vehicles. City agencies supporting truck electrification must also coordinate with utility companies to ensure adequate grid capacity for electric charging.

Freight Rail: A distributed infrastructure network of freight rail already exists across the city, but many lines are underutilized or do not meet contemporary operational requirements. City agencies need to work with freight rail owners and operators and other freight industry partners to expand and modernize the network's capacity and operation.

Maritime: A new network of mini-ports would provide additional capacity for last-mile goods movement along the city's shorelines.

Delivery Bikes: Many new types of smaller delivery vehicles are being tested across Europe and, to an extent, in New York. To realize the potential of smaller delivery vehicles more fully, city agencies and other policy makers need to ensure that a range of cargo bike styles can operate legally on city streets. Infrastructure improvements needed to support these micro-delivery modes include implementation of a complete network of protected two-way bike lanes with greater capacity, along with provisions for dedicated cargo bike parking and loading/unloading areas on city streets.

Circular Economy

- **Provide for smaller, distributed neighborhood facilities for waste collection and processing**
- **Require a central room within buildings where goods can be borrowed and returned, and discarded packaging and waste can be separated into multiple reusable and recyclable streams**
- **Design delivery centers and goods infrastructure to accommodate reverse logistics and reusable packagingt**

Broadly conceived, "Circular Economy" captures a constellation of practices and policies that keep materials and products in use for as long as possible under the familiar rubric "reduce/reuse/recycle". Creating more flexible, distributed networks and consolidating and rationalizing deliveries should be integral elements of a circular economy since they reduce delivery travel distances and enable alternative methods for both deliveries of goods and the pick-up of waste. In a circular economy model, waste must be considered part of the goods movement trajectory, allowing products and materials to be diverted to different streams to enable reuse and recycling.

In some ways, distributed network strategies can be applied in reverse to waste. Just as we have suggested alternative, flexible models for the delivery of goods, a broader network of smaller, neighborhood collection facilities to sort and store waste should be part of a circular economy strategy. These distributed facilities could be places where repair and reuse of electronic equipment take place, transforming them from dumping grounds to community-centered spaces that facilitate sharing. Similarly, small scale composting facilities can be located within green spaces to convert organic waste to compost and support urban gardens and greening.

A similar symmetry exists at the building scale: just as adequate space should be required on the ground floor of all buildings over a certain size for the delivery and storage of goods, so should a space be required where food waste is separated from materials that can be recycled, repaired, or shared.

PRIORITY RECOMMENDATIONS

Adopt Participatory Planning Approaches

- Create an institutional platform to enable cooperative planning across all stakeholders
- Promote stakeholder data collection and open data access
- Actively cultivate engagement and knowledge sharing

Recalibrate zoning and land use tools to reflect changes in manufacturing, distribution, and warehousing

- Employ the Special Permit process for distribution facilities based on impact criteria
- Implement more nuanced as-of-right regulations in Manufacturing Districts
- Support community-led neighborhood planning and re-zoning initiatives

Provide Guidance on Facility Siting and Design

- Develop design guidelines for off-street parking, loading, and storage that protect the character of the streetscape
- Respond to orientation, changes at the edges of neighborhoods, the location of parking and loading, and special conditions such as waterfront access
- Modulate the scale of large buildings by articulations of the facade, changes in massing, increased transparency, and the expression of different uses
- Promote mixed-use and flexible use where appropriate

Make Goods Movement an Essential Part of Street Design

- Adopt street design guidelines that balance goods movement with other street activities and facilitate deliveries by micro-delivery modes such as cargo bikes
- Develop flexible curb use management strategies and regulations
- Design street-scale infrastructure to support goods delivery

Create Distributed Networks for Goods Movement

- Advance infrastructure improvements for rail and maritime freight networks
- Develop micro-distribution hubs
- Introduce package lockers as part of the street design

Identify Opportunities for Freight Consolidation

- Develop strategies for adapting consolidation models to the New York City context
- Develop siting criteria for consolidation hubs coordinated with last-mile delivery routes
- Make recommendations for types of goods that can be consolidated based on concentrations of similar destination types
- Develop consolidation sites for construction materials commonly used from site to site

Diversify, Adapt, and Transform Modes Used to Move Goods

- Incentivize the transition to electric vehicles and deploy charging infrastructure
- Support the development of a viable local maritime goods movement network
- Reactivate and improve existing freight rail infrastructure
- Support micro-delivery modes such as cargo bikes

Create a Circular Economy for Products and Waste

- Provide for smaller, distributed neighborhood facilities for waste collection and processing
- Require a central room within buildings where goods can be borrowed and returned, and discarded packaging and waste can be separated into multiple reusable and recyclable streams
- Design delivery centers and goods infrastructure to accommodate reverse logistics and reusable packaging

SECTION OVERVIEW

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