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Zero-Emission Delivery Zones: Decarbonizing Urban Freight and Goods Delivery in U.S. Cities

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Executive Summary

Rising urban freight and delivery activity in cities produces harmful environmental and health impacts, all of which disproportionately affect low-income and minority communities. In response, some cities have enacted zero-emission delivery zones (ZEDZs), which grant unrestricted road access only to zero-emission delivery vehicles. To inform their ZEDZ planning, policymakers can look to comparable solutions like congestion pricing, off-peak delivery, and low-emission zones for applicable learnings. We reviewed real-world ZEDZ examples in cities across the United States and the Netherlands and found that they are implemented differently depending on local market activity and policy landscapes. We conclude with preliminary guidance for U.S. cities to implement ZEDZs effectively and equitably.

Keywords: Emissions, Freight transport, Policy, Regulation, ZEV

1 Introduction

At the start of the COVID-19 pandemic, urban freight and delivery activity surged, catching the attention of policymakers and the public [1]. However, this rapid growth in e-commerce activity builds on a decade of steady annual growth of ~15 percent, suggesting urban freight and delivery's negative environmental and health impacts will continue to increase unless there is significant policy intervention [2].

Unfortunately, these negative externalities, like greenhouse gas (GHG) emissions and air pollution, have a disproportionate, harmful impact on low-income, minority communities, which are often located near transportation networks and distribution centers [3, 4, 5]. In response, cities have begun to explore new policy options that can decarbonize the freight sector, promote social and economic equity, and improve citizens' quality of life. One solution that has attracted interest in recent years is the zero-emission delivery zone (ZEDZ), a policy whereby delivery vehicles are allowed unrestricted road access to an area only if they are zero-emission vehicles (ZEVs) [6].

Interest in ZEDZs is growing in the United States (U.S.) and around the world, but without robust policy guidance, announced ZEDZs differ from one another, which can confuse affected carriers and communities and produce unintended consequences. Applying insights from interviews with stakeholders in the Netherlands and the United States, this paper provides preliminary guidelines for U.S. policymakers, which were developed by examining comparable policies for best practices and analyzing ZEDZ case studies for key takeaways. Our full working paper can be found on the World Resources Institute's website [7].

2 Methodology

At the onset of this work, we had two main questions:

- How can early ZEDZ examples inform future deployment in U.S. cities?
- What are some considerations in effectively implementing ZEDZs that will further environmental justice and equity goals?

Due to the limited rollout of ZEDZs, there have been only a few attempts to quantify potential outcomes or prescribe best practices [8, 9]. Therefore, we performed a qualitative analysis of current ZEDZ progress through an extensive literature review on related policies and current examples.

We conducted a brief analysis of three comparable policies: congestion pricing, off-peak delivery, and low-emission zones. Our selection of these policies reflects their similar design and intent compared with those of ZEDZs, such as limiting freight and delivery access to designated areas, which could suggest best practices applicable to ZEDZs.

We then conducted more than 15 interviews with city policymakers, logistics experts, industry leaders, and community-based organizations to get a well-rounded perspective of the adverse effect of urban freight and delivery activity and how cities have been planning and deploying ZEDZs.

3 Zero-Emission Delivery Zones

Many cities have implemented regulatory policies and incentives to address the challenges of urban freight and delivery and advance zero-emission delivery. Despite ongoing efforts, the transition to zero-emission delivery is moving slowly and remains years behind the state of passenger electric vehicles. The increasing urgency of mitigating climate change warrants a new strategy, one with the potential to quickly progress zero-emission delivery.

3.1 Zero-Emission Zones and Zero-Emission Delivery Zones

Zero-emission zones (ZEZs) are areas where only ZEVs, pedestrians, and cyclists are granted unrestricted access, with other vehicles either prohibited or forced to pay a fee for limited access [6]. By making internal combustion engine vehicles (ICEVs) more costly and inconvenient, policymakers intend to disincentivize their use and create increased demand for ZEVs. Most announced ZEZs are to cover their respective city centers, usually enforced by license plate recognition cameras at controlled access points or inside the zone. Thus far, ZEZ examples are currently under development or in the early stages of implementation in European cities [6].

Most cities have elected to pursue a phased strategy, first targeting urban freight and delivery vehicles with later ambitions to expand to the larger vehicle market. Early iterations of ZEZs are known as zero-emission delivery zones (ZEDZs), which specifically hinder the operation of diesel and other fossil-fueled delivery vehicles within a designated area, typically through access fees and complementary incentives for operating zero-emission delivery vehicles like electric (e-) trucks, e-vans, and e-cargo bikes. ZEDZs are being implemented before full ZEZ enforcement because cities have prioritized regulating urban freight and delivery activity due to its significant negative externalities and because delivery vehicles, as a relatively small portion of the total vehicle market, represent a more manageable vehicle class to target.

3.2 Types of Zero-Emission Delivery Zones

Cities around the world are taking different approaches to achieve zero-emission delivery. U.S. policymakers can evaluate the ZEDZ iterations detailed in Table 1 and decide which strategy best fits their needs.

Table 1: Types of ZEDZs

ZEDZ Type	Description	Example
Voluntary Restricted Access Area	A specific area that is designated for ZEVs only, but compliance is voluntary.	Santa Monica ZEDZ
ZEV Microhub	A drop-off/pick-up location that serves a small service area and can be targeted to different types of ZEVs.	Seattle Neighborhood Delivery Hub
ZEV Parking Spots and Loading Zones	Reserved spaces that provide valuable curbside access only to ZEVs.	Los Angeles Zero-Emission Commercial Loading Zones
Mandatory Restricted Access Zone	A defined area in which ICEVs are prohibited or charged for entry and violators are penalized.	Rotterdam ZEDZ

4 Informing ZEDZ Planning Via Alternative Policy Analysis

Before ZEDZs, cities were already implementing policies like delivery time restrictions and variable parking pricing to mitigate the negative effects of urban freight and delivery [10]. With ZEDZ deployment just beginning, policymakers can analyze comparable policies to inform their ZEDZ policy planning. This section briefly analyzes congestion pricing, off-peak delivery, and low-emission zones, which have design features and impacts comparable to those of ZEDZs.

4.1 Congestion Pricing

To alleviate traffic congestion in their city centers, some cities have implemented a traffic demand management policy known as congestion pricing [11]. Congestion pricing places a price on vehicle usage within a defined area to shift discretionary traffic to more sustainable modes or off-peak periods [11, 12]. Congestion pricing includes time-, distance- and area-based pricing [13].

Congestion pricing schemes, like London's Congestion Charge Zone, are designed to address each area's particular needs. Policy planners set the boundaries of the congestion zone, depending on the location of congested areas and local air pollution. They need to identify the numerous access points into the zone and install the necessary enforcement infrastructure like automatic license plate readers. Additionally, they must decide on operating hours and designate affected vehicle types and exemptions [14].

4.2 Off-Peak Delivery

To reduce the problems associated with freight traffic, some cities have implemented off-hour delivery incentive programs, encouraging urban freight and delivery activity within a designated area to shift to a time with reduced traffic congestion [15]. The shift to off-peak delivery might be outside of regular business hours, such as overnight or during periods of the day with reduced traffic congestion. This approach seeks to improve transport efficiency so that deliveries can occur more quickly at higher speeds and lower costs [15, 16].

Policymakers need to identify the target congested areas, the preferred delivery periods, and the participating businesses. Some cities have focused on fostering the participation of the businesses that receive deliveries, known as "receivers," because they generate demand for delivery services [16]. For example, New York City's Off-Hour Delivery (OHD) program, created a Trusted Vendor Program that provides receivers with information about trustworthy carriers to encourage participation [17].

4.3 Low-Emission Zones

A low-emission zone (LEZ) is described as a "defined area where access for the most polluting vehicles [is] regulated, either by forbidding the most polluting vehicles to access the zone or by demanding a fee for the polluting vehicles to enter or drive in the zone" [18]. This policy tool has been widely adopted across Europe for the primary purpose of improving air quality. Between 2019 and 2022, the number of active LEZs increased by 40 percent to 320 zones; by 2025, there will be 507 LEZs [19].

LEZ schemes are customizable and usually sited within city centers where traffic flows are highest. When implementing an LEZ, policymakers need to install an extensive system of enforcement infrastructure, typically license plate cameras; decide on operating hours; and determine which vehicle types to restrict and what emissions standard is required for each vehicle type [18]. The LEZ boundaries and covered vehicles and pollutants can be expanded depending on policymakers' priorities and current air quality conditions.

4.4 Lessons for ZEDZ Planning

Locally and nationally coordinated ZEDZ schemes could have different effects on urban freight and delivery businesses.

Cruz and Montenon (2016) compared London's local LEZ scheme with Berlin's, which is part of a national program in Germany [20]. They found that the local scheme minimally influenced fleet renewal in London because large carriers shuffled their fleets and simply redeployed their cleanest vehicles to London. In contrast, Berlin carriers had to upgrade their fleets because the policy was implemented across Germany.

These findings could have significant implications for ZEDZ planning in the United States. The researchers suggest that national schemes are better suited to encourage fleet renewal and ensure uniformity in the criteria to be met, but local schemes take better account of a city's specific characteristics, such as the most economically vulnerable businesses and their locations within the zone. To prevent large carriers from simply relocating their ICEVs elsewhere, cities should coordinate ZEDZ development with other cities and towns to ensure uniformity for carriers and businesses while retaining their ability to refine the policy to fit each city's needs.

City governments must be wary of managing costs, particularly those imposed on stakeholders.

LEZs, off-peak delivery, and congestion pricing schemes can have regressive or inequitable effects on commuters and carriers. For example, Broaddus et al. (2015) noted that freight trips are often not discretionary and that carriers have limited flexibility with their delivery times because these are mostly determined by receivers [21]. This means if carriers cannot make deliveries during off-peak hours or outside of congestion charge hours, they will be unable to capitalize on favorable traffic conditions or avoid congestion charges [15, 22].

As they plan their ZEDZ timelines, policymakers should be aware of their carriers' operational constraints as well as key variables like the spatial distribution of non-compliant vehicles, carriers, and receivers. Research suggests that schemes like off-peak delivery programs, which change receiver freight demand, can achieve immediate environmental and transport efficiency benefits without requiring mass ZEV adoption [16]. Policymakers can also provide purchase subsidies in addition to lengthy notice periods and exemptions, giving businesses and carriers the time and ability to adapt their operations [23]. To maximize equity and efficiency, subsidies and exemptions should be designed to benefit small carriers, which will struggle the most to transition to cleaner vehicles [24].

Poorly planned equity measures might compromise ZEDZ effectiveness.

Exemptions are one common equity measure intended to reduce costs on specific stakeholders. Travel and vehicle exemptions mitigate the financial penalty for drivers entering the regulated area, importantly minimizing regressive impacts on low-income commuters and small businesses. However, analyses of congestion pricing schemes have found that if not enough vehicles are charged, exemptions can incentivize vehicle use, sustain traffic congestion, and reduce raised revenues for public transit investment [25, 26, 27].

ZEDZ planners should consider which equity measures are appropriate, tailoring them to support small freight-dependent businesses and carriers that might be unable to afford ZEVs at their current prices. ZEDZs

should be as equitable as possible, but equity measures like exemptions should not compromise the ZEDZs' ability to accomplish their primary purpose of encouraging ZEV uptake and reducing ICEV entry.

5 City Profiles

As emerging policy solutions, ZEDZs are mostly in the planning or beginning stages, with European cities, mainly those in the Netherlands, leading in ZEDZ commitments. However, interest in ZEDZs has grown in the United States, and several cities have implemented or are planning to implement ZEDZs and related policies.

We connected with private, government, and university stakeholders in cities around the United States and the Netherlands to discuss ZEDZs and the implementation status of local examples. Our brief analysis covers Rotterdam, which pioneered the ZEDZ in the Netherlands, and Santa Monica, Los Angeles (LA), and Seattle, which are the only U.S. cities currently pursuing ZEDZs. Each city has an innovative strategy to combat the social and environmental problems created by urban freight and delivery.

5.1 Rotterdam, Netherlands

In 2014, Rotterdam launched one of the first examples of a ZEDZ along a 1.6-kilometer street to demonstrate zero-emission delivery vehicles [28]. Following the Dutch National Climate Agreement in 2019, the city announced its roadmap strategy to achieve zero-emission delivery by 2025, culminating in a mandatory ZEDZ at the city center [29, 30]. The city's strategy includes its Covenant ZECL (Zero-Emission City Logistics) with local businesses and organizations and plans for multiple other solutions, like urban consolidation centers, that support zero-emission delivery [30].

Rotterdam has formed a strong business and policy bloc through years-long partnerships with local businesses to promote delivery efficiency and, more recently, advance zero-emission delivery [28]. Admitted businesses share information and collaborate on their zero-emission progress and solution opportunities, and the city connects partners with pilot programs and ensures that policy development is cohesive and clear [30].

5.1.1 Key Finding

Businesses can play a key role in forming a cohesive zero-emission policy strategy.

Through its collaborative approach, Rotterdam has connected with fresh produce, general cargo, construction, and other businesses to support pilot projects, design its ZEDZ, and identify challenges [30]. For example, our stakeholder interviews revealed that covenant partners led the push for an expanded ZEDZ to make deliveries simpler and more efficient. Businesses have advocated for the city to implement a cohesive, enforceable strategy while they develop their long-term fleets and operations plans. While every city government's relationship with its respective business community varies, the Rotterdam example illustrates how a collaborative policy environment can simultaneously further ambitious sustainability and economic goals.

5.2 Santa Monica, California

In 2021, Santa Monica launched the first operational ZEDZ in the United States [31]. The ZEDZ was heavily influenced by the Los Angeles Cleantech Incubator (LACI), which selected Santa Monica to deploy the pilot project from a list of applicants. LACI collaborated with the city to develop the voluntary pilot ZEDZ in the Downtown and Main Street commercial districts, which are the hubs of the city's commercial and social activity [31]. The ZEDZ is a one-square-mile area in which partners can use the following innovative zero-emission delivery technologies [31]:

- ZEVs
- Commercial electric vehicle car sharing
- Micromobility for food and parcel delivery
- Priority zero-emission loading zones and curb management

Cameras have been placed at each priority loading zone to gather data and measure how the ZEDZ and restrictions are performing. Due to state regulatory limitations and concerns about costs on businesses, the ZEDZ is voluntary, with participants having to opt-in [32].

5.2.1 Key Finding

The metrics for success for Santa Monica's ZEDZ have not yet been determined.

With Santa Monica as the first city to implement a ZEDZ in the United States, there is a lot of attention on the pilot project and its findings. At the time of interviews, the metrics of success were more anecdotal from businesses than quantitatively supported. Several innovative last-mile delivery technologies and zero-emission loading zones have been implemented, but there have been several challenges. For example, the city has struggled to obtain useful data, gain the interest of risk-averse businesses, and achieve zone compliance. Pilot planners would like to continue the project past its scheduled end date in late 2022, but they will need city council approval and additional funding. A report on ZEDZ impacts and final recommendations was shared with the city council at the end of 2022.

5.3 Los Angeles, California

Wanting to reduce its GHG emissions and improve air quality, Los Angeles has specifically targeted urban freight and delivery activity, and the city has pledged to establish a ZEDZ by 2030 and committed to 100 percent zero-emission delivery by 2035 [33, 34].

In 2021, the city passed an enforceable ordinance that governs curbside access for delivery vehicles [35]. The pilot initiative created five commercial loading zones across the city that are to be used only by zero-emission delivery vehicles [36]. These locations were selected based on traffic density; loading zone demands; air pollution burden; and the city's ability to install, enforce, and monitor the loading zones [36]. Compared to a large access restriction area, LA's action was much simpler and cheaper, costing about $2,000 per loading zone for signage and curb markings [36].

If the planned pilot expansion for 100 zero-emission loading zones comes to fruition, there might be more clearly discernible impacts that could be assessed due to the large effect on parking availability

5.3.1 Key Finding

LA's curbside access regulation can be scaled up to create a de facto ZEDZ without an official ZEDZ policy in place.

Currently, there are only five zero-emission loading zones in LA, in locations prioritized due to their high air pollution burden and traffic density. Even though the current rollout is limited, the city can identify and convert other loading zones around the city to be for only zero-emission delivery vehicles. If hundreds or thousands of parking and loading areas were converted to ZEV-only spaces, this could create a near ZEDZ situation where urban freight and delivery businesses would be compelled to convert their vehicles to ZEVs because using ICEVs would become too inconvenient or expensive. The policy could be scaled citywide to encourage ZEV use throughout the city, or policymakers could concentrate the zero-emission loading zones in priority areas, possibly as part of a larger strategy to bring air quality and traffic benefits to heavily polluted neighborhoods.

5.4 Seattle, Washington

In its GHG inventory report, Seattle identified the transportation sector as the largest contributor to its GHG emissions, and the city has committed itself to adopt a ZEDZ by 2030 [33, 37]. In pursuit of this goal, Seattle partnered with a transportation solutions consultancy firm to analyze the city's freight movement and assess suitable ZEDZ locations [38]. Additionally, the city commissioned an opinion research firm to contact businesses and residents to gauge their opinions on the implementation of a future ZEDZ. While no concrete plans have been established, the report and supportive outreach efforts have provided useful information for city policymakers.

The freight analysis report identified congested areas of interest, vehicle composition, freight distribution, and goods movement. The report identified the Duwamish Valley area as a potentially suitable location for a ZEDZ, noting that the area had the highest medium- and heavy-duty freight activity and a high proportion of distribution centers for major carriers [38].

The stakeholder research effort also evaluated local impressions of a ZEDZ in the Duwamish Valley area and noted that businesses expressed interest in a ZEDZ but would want an incremental approach to minimize any potential negative impacts on their operations.

5.4.1 Key Finding

Effective and equitable ZEDZs do not have to be at the city center.

The city freight report identified the Duwamish Valley area, which is not located in the city center, as a top candidate for the future ZEDZ. Although the downtown area also has high delivery activity, the Duwamish Valley area has a high concentration of distribution centers and medium- and heavy-duty freight traffic, which contributes to air pollution and GHG emissions. Many planned ZEDZs in Europe and similar policies in U.S. cities are focused on the city center with plans for the zones to expand outward over time and encompass additional vehicle types. Seattle and other cities could follow an alternative path that prioritizes maximizing positive benefits in highly polluted, often diverse areas, which may or may not be located at the city center.

6 Preliminary Guidance for Effective and Equitable ZEDZs

ZEDZs are increasingly viewed as potentially effective policies that can advance zero-emission delivery and benefit residents and local businesses. Our interviews reveal that ZEDZ success depends on both near- and long-term measures, such as supportive policies that encourage ZEV adoption, extensive engagement across broad coalitions of various actors, and legislative authority to enable successful deployment. A major gap in implementation is the need for cities to center social and economic equity while designing and implementing ZEDZs—that is, to benefit low-income communities that surround urban freight and delivery hotspots as well as small businesses and carriers that might find it challenging to afford ZEVs and hence be burdened by fines or loss of revenue from this policy.

The guidelines below for U.S. cities focus on centering equity within best practices for ZEDZs, relying on lessons learned from projects underway.

6.1 Engage Stakeholders Early and Often

Cities must engage involved parties early to gain their support for upcoming ZEDZ and ZEV plans. Outreach efforts can identify the current distribution of benefits and burdens, establish the policies' scopes, and determine potential barriers to success. Crucially, stakeholder engagement can help policymakers identify new partners and potential opposition. Roundtables and other outreach efforts, like Rotterdam's Covenant ZECL, reveal local business opinions on ZEDZs and ZEVs and identify advocates interested in helping their cities progress through the ZEV transition. Partnerships and pilot programs can influence the final ZEDZ and supportive policy designs by providing valuable performance data and evaluating which ZEDZ policy features work best.

As cities cultivate buy-in for their ZEDZ and ZEV goals, they also need to listen to concerned stakeholders. These important conversations provide opportunities to determine shared goals and ways to mitigate burdens created by the planned policy. Discussions with the opposition might lead to new solutions that could produce more effective and equitable policy outcomes. For example, this could look like allowing for a transitionary period before ZEDZ implementation or granting a temporary hardship exemption. If policymakers can mitigate harm and convert detractors into champions, they might increase the political support necessary to create lasting change.

6.2 Take a Stepwise Approach and Build Up to a ZEDZ

U.S. cities would benefit from a stepwise approach that quickly deploys effective solutions while preparing stakeholders for later ZEDZ adoption. Directly implementing a mandatory ZEDZ policy would be

challenging as carriers, businesses, and local communities would need to transition their operations rapidly and find the upfront capital to transition to ZEVs. This sudden disruption of the status quo can cause opposition and result in a policy freeze and inaction.

A stepwise approach can offer viable solutions to this challenge by achieving immediate benefits and demonstrating proof of concept. Policies like off-hour delivery, which target freight demand, can quickly reduce emissions and demonstrate the benefits of sustainable urban freight and delivery [39]. Meanwhile, U.S. cities could consider small-scale solutions, like zero-emission loading zones or a voluntary ZEDZ, that prepare carriers and businesses for zero-emission delivery. Cities might pursue a stepwise approach based on ZEV affordability challenges, political viability, community engagement, and buy-in from businesses, among other factors. These strategies can mitigate obstacles while producing tangible benefits, granting urban freight and delivery companies the flexibility and time to evolve their operations and strengthen their capacity to transition their fleets.

6.3 Provide Supportive Policies for Successful and Inclusive ZEDZs

ZEDZs are most effective as part of a supportive system of policies that compel carriers to transition to ZEVs while assisting to overcome the numerous challenges that impede ZEV adoption. One of the biggest challenges to ZEV adoption remains ZEV prices, which have yet to achieve parity with those of ICEVs. Hence, policymakers should consider providing financial assistance and implementing a stepwise policy approach that makes the cost burden of fleet conversion more manageable. Financial assistance like purchase subsidies will be more cost-effective if tailored toward smaller carriers and businesses [24]. Policymakers can also promote the adoption of more affordable, short-range delivery modes like e-cargo bikes and e-scooters through purchase incentives, bike lanes, and microhubs.

The costs and complexities of charging infrastructure also present a challenge to businesses' ZEV adoption. Businesses will need to purchase costly charging infrastructure, and the installation and interconnection process can take months. Electric utilities, through "Make-Ready" programs, can support the build-out of charging infrastructure through fleet planning services and by paying for costs like transformer upgrades and new meters. Cities and higher levels of government can also provide subsidies for equipment purchase and installation, install chargers within the planned ZEDZ, and enable a faster permitting and interconnection process.

6.4 Pursue State and Federal Policy Reform

For many cities, a mandatory ZEDZ might be the end goal for their zero-emission delivery efforts because it places the highest pressure on businesses to switch to ZEVs. Unfortunately, many cities considering ZEDZs may hit a regulatory roadblock. Without legislative authority, they might be limited to a voluntary ZEDZ or forced to pursue alternative options. A stepwise policy approach may be the best strategy for various reasons, but cities should simultaneously pursue state policy reform to ensure they can impose a uniform, stringent policy strategy. State legislation provides a means for more effective measures that incentivize ZEV adoption, such as the ability to prohibit ICEV access to restricted areas. Importantly, it can also set up a standardized ZEDZ framework, which can identify base ZEDZ features, like affected vehicle types and notification timelines, eliminating uncertainty for carriers and businesses that operate in different cities.

Additionally, cities can employ their conversations with stakeholders to petition their states and the federal government for increased funding for ZEV purchase subsidies and charging infrastructure. City budgets may be unable to supply the funds needed to boost ZEV adoption, but states and the federal government can provide grants, tax incentives, and other support, especially within low-income communities that lack financial and technical capacity. With cities as hubs for vehicles from around the country, increased ZEV incentives and supportive policies at the state and federal levels will further ZEDZ success.

6.5 Prioritize Equity at Every Step Along the ZEDZ Process

Throughout the ZEDZ planning and implementation process, city policymakers should prioritize advancing social and economic equity. Our interviews reveal that policymakers recognize that the transition to zero-emission delivery will particularly burden small businesses and carriers, and they are striving to balance these equity concerns with policy performance expectations. Early engagement with stakeholders can help cities

resolve key concerns such as what kind of ZEDZ is needed, what supportive policies should be adopted, and where the ZEDZ should be located.

It is also important that cities prioritize benefiting low-income communities that often suffer the worst impacts during final delivery or by being located near distribution centers. ZEDZs in city centers may benefit areas with heavy commercial activity, but policymakers should also consider aligning ZEDZ locations with the distribution of air pollution, household income, race, and other relevant factors. An equity-centered approach could entail doing one of the following:

- Expanding the ZEDZ to provide zero-emission last-mile delivery to residential areas, as was done in Rotterdam
- Placing the ZEDZ in areas known for historic air pollution, like Seattle's consideration of the Duwamish Valley area
- Using an approach like LA's zero-emission delivery zones to encourage ZEV uptake in priority areas without imposing financial burdens

7 Conclusion

Efforts are underway across the United States to advance zero-emission delivery. However, U.S. cities are not as familiar as those in Europe with access restriction policies like ZEDZs, and without proper design and implementation, ZEDZs could exacerbate existing inequities in pursuit of decarbonizing urban freight and delivery activity.

This working paper encourages U.S. policymakers to refer to comparable transportation policies and existing ZEDZ examples to inform their policy planning and apply best practices to address their city-specific problems. Several pioneering cities in the United States and the Netherlands have implemented or planned their versions of ZEDZs, so other U.S. cities can review and learn from the real-world benefits and challenges of ZEDZs.

Based on our comprehensive research and interviews, we believe ZEDZs can be implemented effectively and equitably if policymakers consider the basic guidelines outlined above. Nevertheless, ZEDZ progress is still in a nascent stage, so these guidelines are likely to evolve as additional cities in the United States and around the world adopt this policy solution. Although there have been some attempts to anticipate the outcomes of upcoming ZEDZs, future research regarding the performance of completed ZEDZ pilots and early iterations is necessary to provide quantitative evidence about which design features and supportive policies most successfully advance zero-emission delivery.

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