Residential Loading Berth and Delivery Activity and Standards Research

Prepared for:
Seattle Department of Construction and Inspections

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FEHR PEERS

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Executive Summary

As the Downtown and South Lake Union neighborhoods of Seattle have continued to grow over the past several years, the City of Seattle has been addressing an increasing number of concerns about alley and curb loading congestion around multifamily and mixed-use buildings. To assess the magnitude of alley and curbspace congestion, the Seattle Department of Construction, and Inspections (SDCI) retained Fehr & Peers to collect data on alley and curb activities that would inform choices about whether to update land use codes and/or write a Director's Rule related to off-street/off-alley loading areas for residential buildings in the Downtown and South Lake Union areas.

The project team closely examined past research, policies from comparable cities, stakeholder input, and field observations to develop recommendations for SDCI. Reviewed city policies indicated the need of at least one off-street loading area for residential buildings based on square footage or number of dwelling units. This aligns with input from City staff and is responsive to the City's goal of reallocating curbspace from parking and temporary loading, which benefits relatively few users, to other uses like bike lanes, bus lanes, or wider sidewalks, as appropriate.

With less curbspace available for building access activities, there is a need to accommodate more building activities in off-street loading areas. The research for this study focused on the frequency of multifamily building access activities including move-in/out, commercial deliveries, waste collection, and commercial/non-commercial passenger loading. The study data highlights that a strong proportion of commercial deliveries and passenger pick-up and drop-off activities currently occur at the curb. As curbspace becomes more scarce, it is advisable to retain remaining curbspace for passenger pick-up/drop-off activities while shifting as much commercial delivery activity to off-street loading areas as is feasible. Notably, observations of buildings made for this study identified that 12-hour mid-day commercial delivery activity ranged from six to 31 occurrences, depending on the building size (100 units to 500 units). A similar study by University of Washington's Urban Freight Lab estimates approximately 200 parcels are delivered per day for 700-unit residential tower (many of which are delivered in a single delivery vehicle trip), which is consistent with this study's findings. The trend toward increasing online shopping further reinforces the need to adequately accommodate commercial delivery demand at residential and mixed-use sites in Seattle.

The findings below summarize insights from research of peer cities, collected video data, and interviews with city staff, residential building managers, local architects, and developers.

- **Providing at least one off-street/off-alley loading area would be a desirable amenity for residential uses. The sufficient number of off-street loading areas and design needs should relate to the number of residential units and size and type of commercial uses**. The review of peer cities does not suggest a single consensus on rate of provision for residential uses. One interpretation of a sample of other cities' codes that have minimum requirements is that one residential loading space can serve approximately 100-250 dwelling units. This study does not

settle on one specific recommendation, because the City of Seattle's legislative process will decide how many loading areas should be required. This analysis also anticipates that Seattle's code requirements may allow these loading spaces to be shared by multiple kinds of users. The full range of critical users of off-street loading and utility areas include varied types of residential-oriented deliveries, commercial deliveries, tenant move-in or move-out operations, and solid waste and recycling collection and management.[1]

- Seattle's requirement for ground floor retail or other active uses can but does not always trigger the need for an off-street loading area. There are currently no specific off-street loading area requirements for residential uses. Mixed-use buildings with more than 10,000 square feet of ground floor medium-demand commercial uses (such as eating and drinking establishments) may be required by the Land Use Code to have an off-street loading area. The code has flexibility for the SDCI Director and SDOT Director to waive this requirement if loading can occur from the street or will be otherwise addressed on-site, or if evidence is provided as to the nature, size, and operational characteristics of intended uses or tenants. An example of a mixed-use building with retail uses and parking is Via 6 Apartments located in the Downtown area with 17,500 square feet of retail on the ground level (James Luggage Store, The Victor Tavern, Rubenstein Bagels, etc.).
- From observing nine buildings in Downtown and South Lake Union, the data suggest that off-street loading areas themselves are typically not congested or blocked, in part because so many deliveries, service vehicle activities, passenger loading, etc. voluntarily occur either along the street curbspace or by vehicles temporarily stopped in the alley. A lack of accessibility to the off-street loading areas due to security gates may be a factor that affects their rate of use at some buildings. Observations also suggest that enhanced City enforcement at curb loading spaces and in alleys could better address violations such as occasional double parking on streets, and overlong parking in loading zones and alleys.
- **Trends in Seattle point out the shrinking supply of curbspace available for typical residential/mixed-use building activities**. The reduced availability of curbspace is a result of evolving expectations of City residents, businesses, and policymakers that emphasize uses like transit lanes, bike lanes, expanded sidewalk facilities, active street uses like cafes, or vehicle travel lanes rather than parking or loading areas. Recent notable examples include new bike lanes along 2nd Avenue and 9th Avenue and pedestrian and green-space upgrades along Bell Street. With less space available on public property to handle operations like deliveries or loading, more of these activities should be planned to occur on private property. Multi-functional off-street loading areas serve this need for both residential and other ground floor non-residential uses. This shared loading area strategy is also recognized in Washington, D.C.'s building code.
- **For residential uses ranging in size from 100 to 250 dwelling units, this study recommends at least one off-street loading area that can accommodate at least one cargo van (a common model is a Mercedes Sprinter)**. In accommodating this off-street loading area, giving options to respond to site context with flexibility in the design or accommodation of this loading

[1] This study discusses waste management activities because they are relevant to total collection and delivery activities on a property, even though they are separately addressed in the City's regulatory requirements.

area is important. A standard back-in loading area that can accommodate a cargo van and the associated space to load/unload would be ideal, but for smaller parcels, limited ground floor space, potential alley access constraints, and other potential challenges to design should be recognized. Flexibility in the possible requirements for loading areas should be considered. Examples of atypical loading areas could include: a parking alcove in the alley that is fully out of the alley right-of-way; a dedicated loading area within the parking garage that has level elevator access to address move-in/move-out activities by residents and easy access to a package room or lobby to unload packages; or a porte-cochere or other driveway located off the street.

- **For residential uses ranging in size from 251 to 500 dwelling units, at least two off-street loading areas are recommended, which could include a mix of types, such as a move-in space near an elevator in the garage or an alley-side space.** This mid-size category of residential use generates more delivery, loading, and unloading activities, which increases the need for off-street loading areas. Providing one of these recommended loading areas to address move-in/move-out activities would be appropriate. This size of residential use also generates large volumes of solid waste, which are usually too high to be serviced on the alley. This tends to lead to provision of space inside the building for storage and collection of recycling, composting, and garbage. Typical buildings of this size include one or two roll-off dumpsters that are collected by trucks and taken away from the site to be emptied and then returned. These on-site waste collection dumpsters are ideally serviced completely within the building footprint (e.g., trucks do not encroach in the alley while loading/unloading dumpsters). The need for solid waste collection presents an opportunity to also accommodate building loading activities since delivery vehicles can use the same space as garbage collection vehicles since interviews indicate that these activities are scheduled such that they do not generally overlap in time.
- **For residential uses with greater than 500 residential units, at least three off-street loading areas are recommended, which could include a mix of types, such as a move-in space near an elevator in the garage or an alley-side space.** This is informed by a review of land use codes from peer cities, and recent residential construction in Seattle. Buildings of this size range could benefit from the flexibility provided by three off-street loading areas for delivery or move-in/move-out activities. In these buildings, adjacent loading areas should be designed to be usable at the same time if possible, depending on total available space at the site's ground level. Certain ground floor uses like a grocery store that generate regular delivery demands could warrant an additional dedicated commercial off-street loading area. However, there may be opportunities for residential and ground-floor non-residential uses to share loading spaces if their combined delivery volumes can be effectively coordinated through methods like a Loading Dock Management Plan. Similar to smaller buildings, there is the opportunity to overlap loading and waste collection activities.
- Our research shows that there is no universal design for an off-street loading area. The size of the parcel, driveway configuration, and other factors impact the design. However, research and interviews indicate that three critical design vehicles should be considered for residential sites.
    1. For a residential move-in/move-out loading area, the **Mercedes Sprinter van** is recommended as the critical design vehicle. Mercedes Sprinter vans (and other similar

makes) with a high roof are typically observed at residential sites and commonly used as service vehicles, for residential move in-out, and package deliveries; therefore, accommodation of this vehicle type is crucial.

2. The **35-foot-long roll-off waste collection truck** is recommended as a critical design vehicle for solid waste collection spaces using roll-off dumpsters in residential buildings with over 100 units unless there is a unique use in the building, such as a grocery store that generates demand for substantially larger trucks (e.g., WB-67 semi-trucks). Designing for a 35-foot roll-off waste collection truck also accommodates other common delivery vehicles if the City decides loading activity may occur within the solid waste truck's designated space.
3. A **SU-30 truck** is recommended as the critical design vehicle for buildings with 100+ units (although if this vehicle can be accommodated at smaller buildings, this would be ideal) as this is a typical size vehicle for commercial deliveries and professional moving companies. Note that the SU-30 truck fits within the design envelope of the 35-foot roll-off truck identified above (in other words, if the building can accommodate the waste collection vehicle, it by default can also accommodate a SU-30 truck).

- **The dimensions of a residential off-street loading area are recommended to include space for the opening door radius and space behind the vehicle for the driver/courier to organize goods, load accessories, and maneuver with accessories**. Additional space required depends on delivery type, location, and accessories; therefore, these factors should be considered. The common delivery types at residential sites include unassisted delivery and delivery with a hand truck. An additional 6 feet to the design vehicle's width and length would be sufficient to accommodate for these two delivery types. "Roll-off" waste collection trucks also need 14 to 16 feet of overhead clearance to pick up roll-off dumpsters and compactors; compacted and traditional dumpsters (3-cubic yard and larger) require 24 feet of height for tipping. Potential changes to requirements are recommended to consider whether there may be challenges to requiring or encouraging a high loading area ceiling. Such factors could also be considered in permit review and design review process.
- The placement of a residential off-street loading area should be designed to appropriately accommodate on-site maneuvers of the critical design vehicle, allowing for combinations of turning movements to safely avoid impediments created by the building or alley or nearby building dimensions. For cargo van spaces that might be one level down in a parking area, angle of the parking ramp and the overhead clearances on the ramp/loading area should also be taken into consideration in code requirements to ensure ceiling height and overhangs of design vehicles can be accommodated.
- The code should allow for building designs to include spaces in garages, or on or near the ground floor that can accommodate resident moving activity and parcel deliveries, to streamline loading and unloading of residential moving trucks and commercial delivery vehicles and reduce alley and curb congestion. These are often called move-in rooms by architects.

- If possible, designing parking areas or alcoves within the alley (where the drive aisle of the alley remains unobstructed) should allow for service vehicles and short-duration deliveries that may not prefer to use the off-street loading area) to access the building without blocking the alley.
- The code should allow for consideration of non-motorized alternatives to traditional freight vehicles that can be shown to reliably reduce the demand for curbside loading, the physical space required for loading operation, and/or improper loading operations in the right-of-way.

Introduction

As a result of the rapid increase in e-commerce deliveries and continued growth of Seattle's urban residential and mixed-use neighborhoods, there is increased demand for access to curbspace and alleys. With this growth in curb and alley activity have come complaints by urban residents about blocked and/or difficult access to garages and loading areas. These complaints have prompted some residents to call for more off-street loading areas and better management of curb and alley congestion. However, developers, architects, and landowners are quick to point out that additional space for loading adds cost and complexity to their projects when considering other City requirements for active ground floor uses. This problem may be particularly acute on smaller parcels that have less ground floor space available.

Added to this mix is the fact that the City has been reconsidering the highest and best use of curb space throughout the Center City, which sometimes means that parking and loading zones are repurposed for bus, bike, or vehicle travel lanes. Less curb space means that more of the building loading, service, and delivery activity must take place in the alley or off-street loading areas[2]. Therefore, efficient design, use, and management of curb space, alleys, and on-site loading areas is fundamental to facilitate all competing uses at residential and mixed-use buildings in the Center City.

Based on the conditions described above, the Seattle Department of Construction and Inspections (SDCI) is exploring an update to the current land use codes and/or a Director's Rule for off-street loading areas for residential buildings in the Downtown and South Lake Union areas. The City's current land use codes do not have specific off-street loading area requirements for residential uses but rather allocates this responsibility to decide on loading facility needs to the Director. SDCI, in partnership with the Seattle Department of Transportation (SDOT) and Seattle Public Utilities (SPU), sought to investigate a code update need through a data-driven approach to explore curb, off-street loading area, and alley activities to identify issues and potential solutions.

Our team analyzed video data for these areas, conducted research of peer cities, and interviewed building managers, City staff, local architects, and developers. Using this information, our team identified insights on current and future demand for various alley and curb uses at both new and existing multifamily residential/mixed-use buildings in the Downtown and South Lake Union neighborhoods.

The following sections of the report summarize our research process, trends and best practices based on a literature review and interviews, data collection results, recommendations, and areas for future research.

[2] Off-street loading areas or loading berths are also known as load/unload bays which serve as an off-street space provided for cargo vehicles for use when loading and unloading.

Research Process

The process map in **Figure 1** outlines the steps and various data types used by the project team to prepare qualitative and quantitative analyses of policy and functional implications related to alleys, off-street loading areas, and curbspace. A scan of relevant literature from the University of Washington's Urban Freight Lab provided local context on the current trends and best practices related to alleys and curbspace, while research projects from other jurisdictions offered broader insights. The project team relied on data collection from interviews and field monitoring for insights specific to the project's study geography: Downtown Seattle, and South Lake Union. Off-street loading area policy recommendations were then drafted by integrating insights from the literature review and collected data.

Figure 1: Research Process Outline

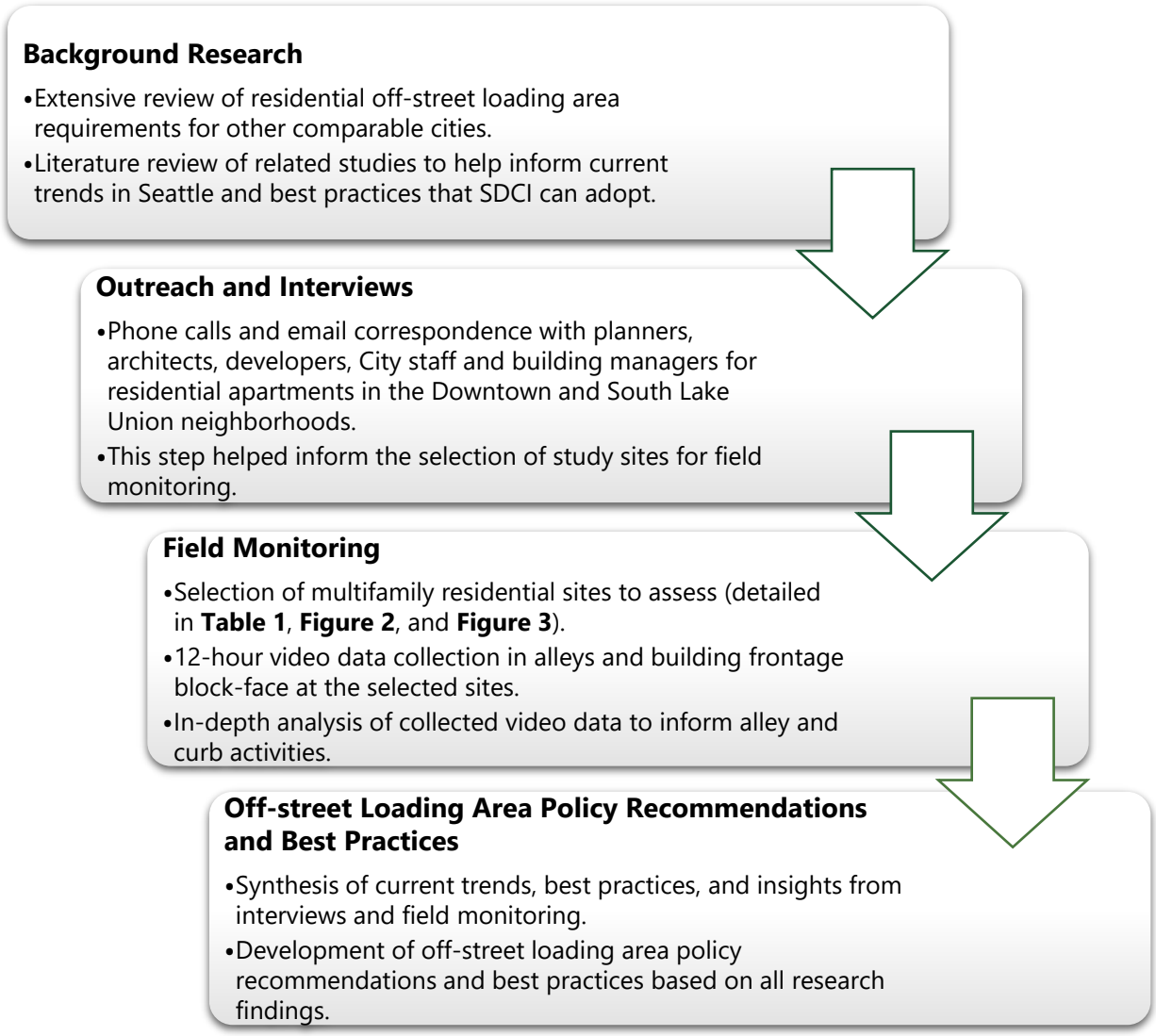
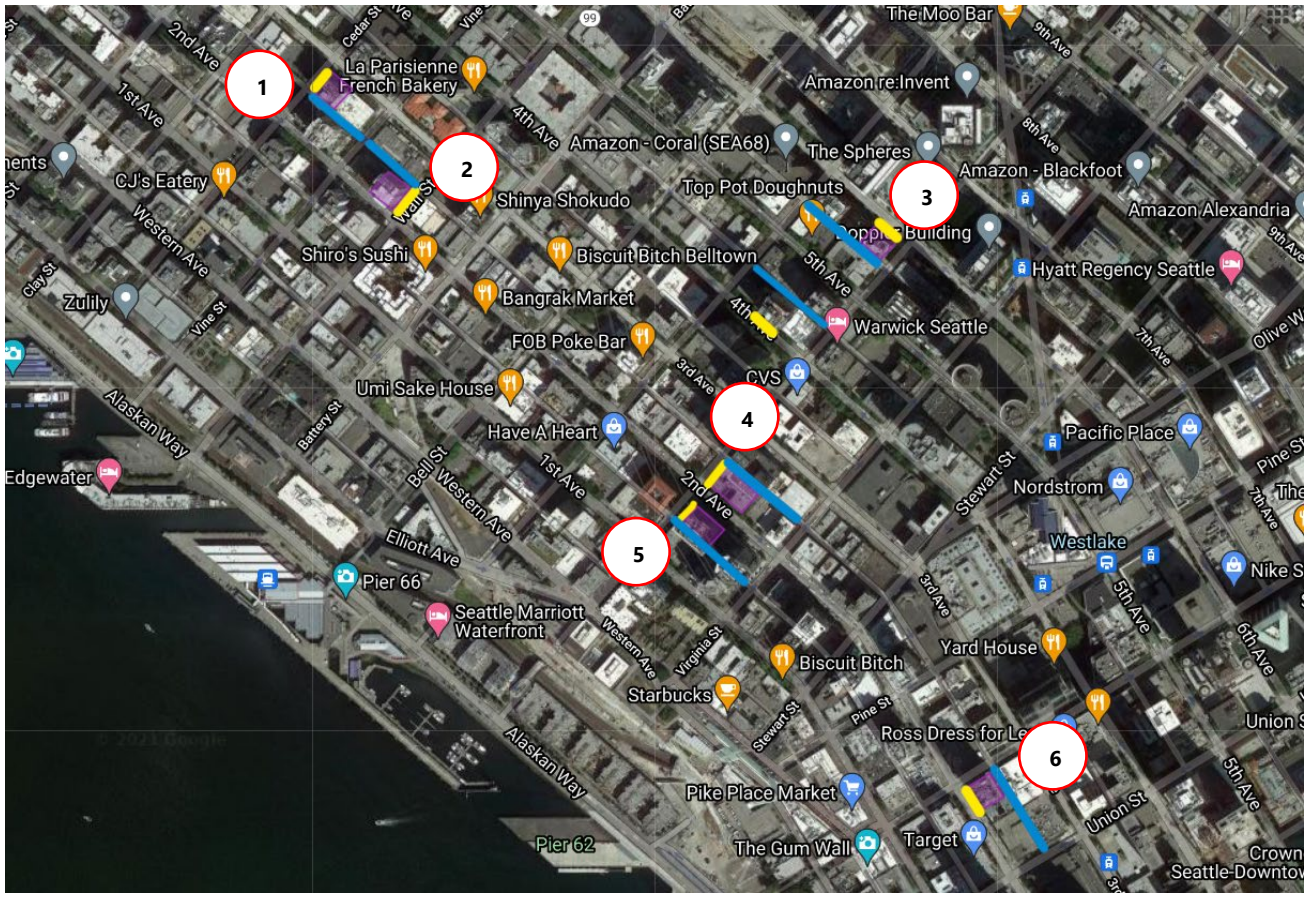


Table 1: Study Buildings Data

Residential Building	Year Built	Number of Units	Lot Size (sq. ft.)	Gross Floor Area (sq. ft.)	Ground Floor Retail	Off-street Loading Area
Dimension Apartments (Downtown Seattle)	2014	298	12,719	269,065	None	✓
West Edge Apartments (Downtown Seattle)	2016	340	18,709	567,403	Kuhl outdoor clothing	✓
Via6 Apartments (Downtown Seattle)	2012	654	25,440	676,169	Rubinstein Bagels	✓
Avalon Belltown Apartments (Downtown Seattle)	2017	275	25,492	397,034	Bartell's Drug Pharmacy	✓
Radius Apartments (South Lake Union)	2014	282	7,080	253,015	None	✓
Stackhouse Apartments (South Lake Union)	2013	278	21,240	295,432	Cycle Bar	–
Cristalla Condominiums (Downtown Seattle)	2005	195	19,452	^	Winery/ Furniture store	✓
Alcyone Apartments (South Lake Union)	2003	162	35,400	201,197	Kati Vegan Thai Restaurant	–
Marq 211 Apartments (Downtown Seattle)	1999	107	19,440	139,650	Starbucks	✓

Source: King County Department of Assessments, Fehr & Peers, 2021.
Notes:
^ Unavailable development data
✓ Feature is present
- Feature is not present

Figure 2: Study Sites in Downtown Seattle



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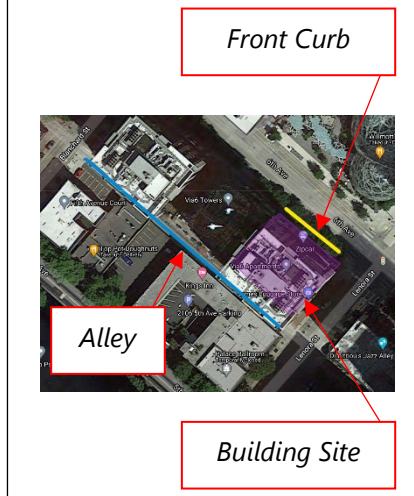
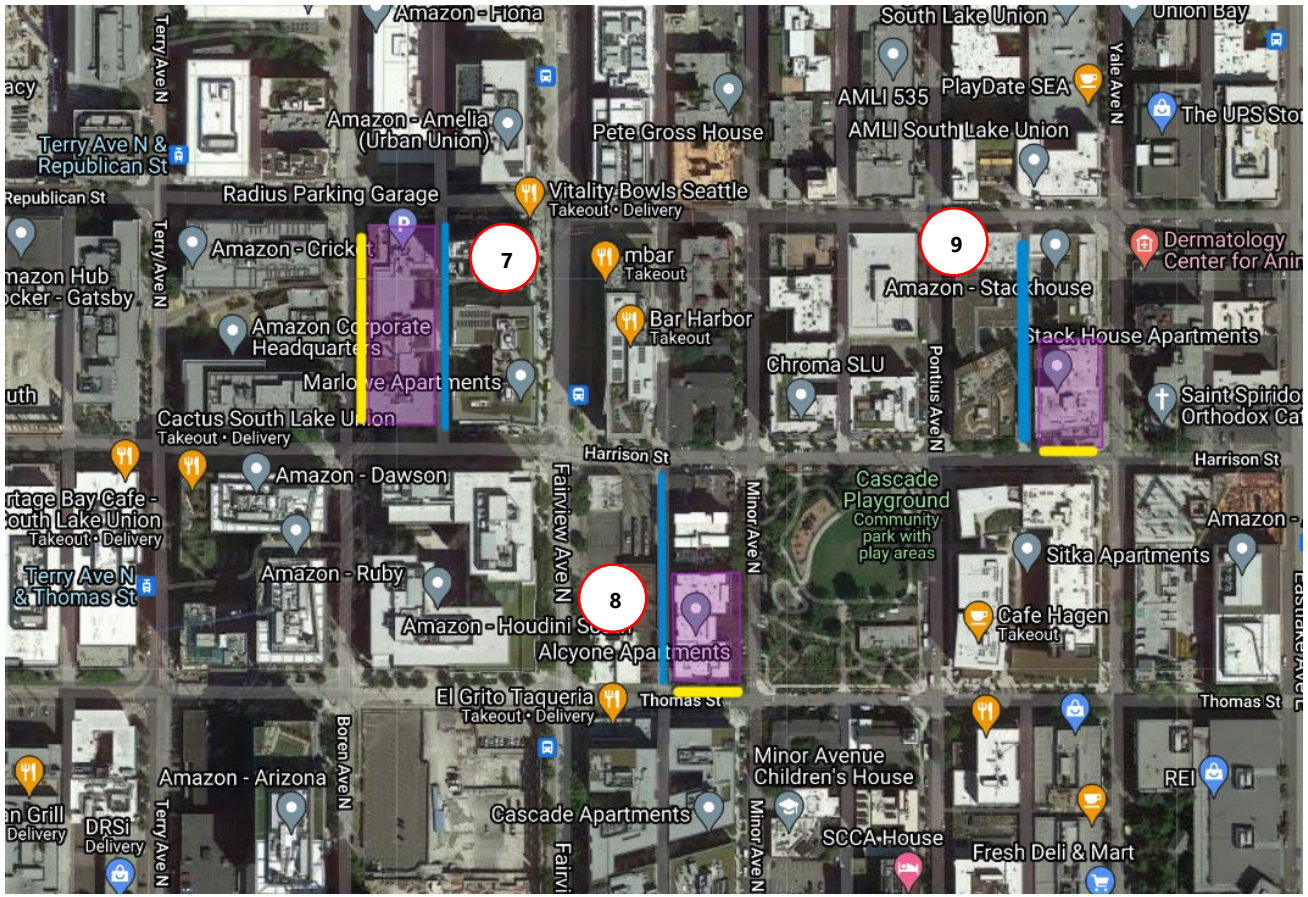


[1] Dimension Apartments
[2] Avalon Belltown Apartments
[3] Via6 Apartments
[4] Marq 211 Apartments
[5] Cristalla Condominiums
[6] West Edge Apartments

Figure 3: Study Sites in South Lake Union



Legend

[7] Radius Apartments
[8] Alcyone Apartments
[9] Stackhouse Apartments

Trends and Best Practices Research

There have been various local efforts in assessing curbspace and alley activity, including the Seattle Central Business District (CBD) Curbspace Study (2015) by SDOT and the research program on the final 50 feet of the urban goods delivery system (2018 – 2020)[3] led by the University of Washington's Urban Freight Lab. All these efforts highlight the rapid transformation of Seattle's urban goods delivery system due to growth in e-commerce and the emergence of new technologies in the supply chain and logistics sectors. Concurrently, Seattle's built environment is also in a period of rapid change with many new residential, mixed-use, and office towers either recently completed or under construction throughout Downtown and South Lake Union.

In addition to a changing built environment, Seattle's street system is also evolving. In the last few years, several blocks of downtown parking or curb loading space have been converted to street uses (bus lane or bike facility) that may influence or interact with short-term delivery activity, including restricting motor vehicle freight access. An example is the 2nd Avenue Protected Bike Lane Project[4] shown in **Figure 4**, which reduced parking and loading curbspace on the east side of 2nd Avenue between Pike Street and Yesler Way. Citywide, the number of paid parking spaces has reduced by approximately nine percent since 2018, although some of those paid parking spaces may have been converted to curb loading spaces. Specific to this study, these trends result in reduced curbspace available for typical residential/mixed-use building activities, including commercial deliveries and passenger pick-up/ drop-off activities. Reduced curbspace puts more demands on the alley and off-street loading areas which also must serve other building activities such as waste collection, large commercial deliveries, and tenant move-in/move-out operations.

[3] University of Washington Urban Freight Lab. The Final 50 Feet Research Program, 2018 - 2020.
[4] Seattle Department of Transportation. 2nd Ave Protected Bike Lane Demonstration Project, 2016.

Figure 4: Protected Bike Lanes along 2nd Avenue

Source: Seattle Department of Transportation, 2016.

Trends in Curb and Alley Use

This section outlines current trends in curbspace, and alley use in Seattle, based on observations from the Urban Freight Lab and national research. Specific to curbspace, commercial and passenger vehicle drivers are utilizing both commercial vehicle loading zones (CVLZs) and passenger loading zones (PLZs) fluidly. In a study by the University of Washington's Urban Freight Lab[5], passenger vehicles made up more than half of all vehicles observed parking in CVLZs, while more than one-quarter of commercial vehicle drivers parked in PLZs.

Similarly, alleys have various users, partly because of the high percentage of parking access via alleys. In the City Center, 73 percent of alleys contain entrances to parking facilities. As a result, garbage trucks, delivery trucks, and service vans (e.g., plumbers and electricians) have to jockey for space with ride-share services such as Lyft and passenger cars that may be queuing in alleys to use off-street garages. Notably, a majority of alley right-of-way in Downtown and South Lake Union were originally platted in the 16-foot width range and numerous blocks' alleys retain this width due to siting of older buildings. Widths in alleys can vary even within a single block, from approximately 16 feet to a preferred 20-foot width. Width limitations can contribute to recurring

[5] University of Washington Urban Freight Lab. The Final 50 Feet of the Urban Goods Delivery System: Tracking Curb Use in Seattle, 2020.http://depts.washington.edu/sctlctr/sites/default/files/research_pub_files/Final-50-Feet-Tracking-Curb-Use-in-Seattle.pdf

delays and partial or full vehicle blockages or bottlenecks for multiple kinds of users. However, our team's observations also indicate that except for the narrowest alleys (which are generally in Downtown), passenger cars often can narrowly pass parked/standing vehicles that are courteously parked and avoid complete blockages (see Appendix B for examples of narrow passing events).

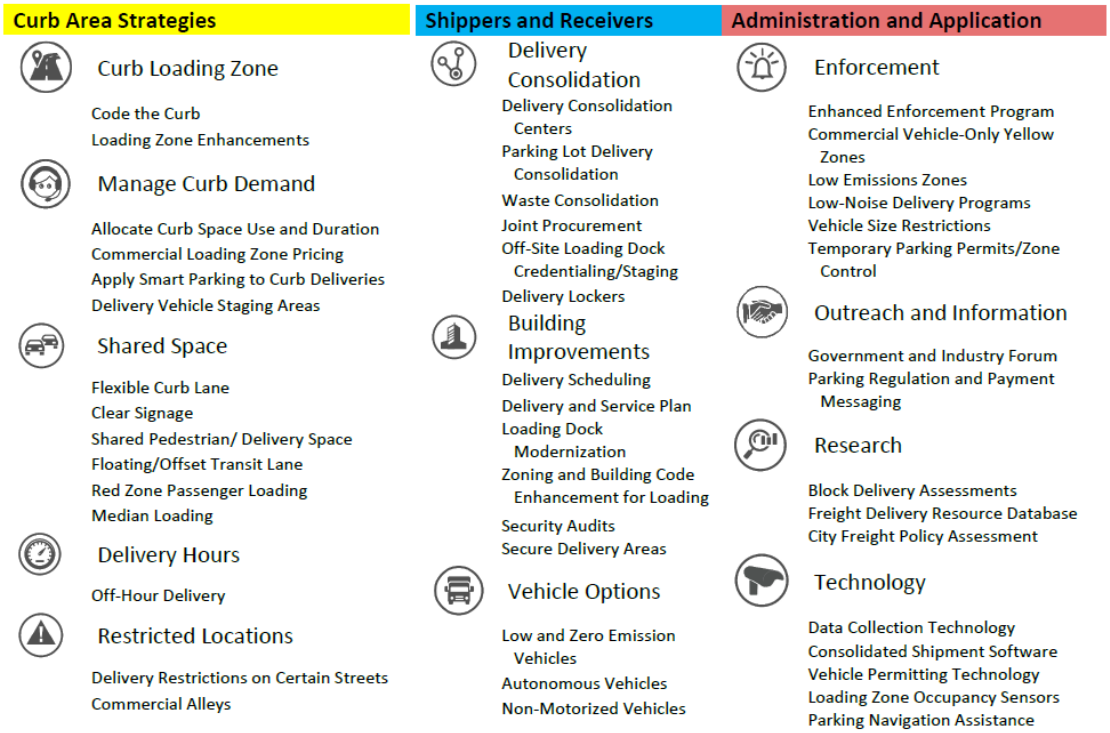
Focusing on trends at residential sites, the National Multifamily Housing Unit Council (NMHC) Package Delivery Survey conducted in 2018 revealed that an average apartment community receives approximately 149 packages per week and 68 percent of staff spend between one to four hours per week managing packages. As a result, 57 percent of the surveyed building managers highlighted the package locker system as the best way to deliver packages to residents. These insights were from community managers from 29 industry-leading multifamily firms and represent responses from 2,098 properties across 44 states. A 2020 study led by the Southern California Association of Governments (SCAG)[6] focusing on last-mile freight delivery offered more insights on building managers' perspectives. Building managers pointed out the following:

- Building designs that lack input from various community stakeholders can often lead to long-term problems that can impact access for delivery vehicles (e.g., affecting vehicle maneuvers, providing insufficient loading dock capacity).
- There is a key difference between the patterns of commercial delivery operators such as the United States Postal Service (USPS) and on-call or shipment-specific services such as food or beverage deliverers. Delivery patterns for the latter are significantly less predictable and more difficult to schedule than the former which could result in more space needed at the off-street loading area, alley and curbspace to accommodate unscheduled deliveries.
- There is increased use of private vehicles without commercial plates for on-demand delivery. This makes it difficult for delivery drivers, store owners, or parking enforcement officers to determine who is and is not a legitimate parking user, and consequently generates more demand for loading spaces.

To address these and other challenges of last-mile freight delivery and curbspace/alley congestion, SCAG identified a set of best practices for last-mile deliveries that include off-peak delivery programs, combination use lanes, low emission zones, urban consolidation centers, commercial loading zone permits and meter payments, delivery and service plans, cargo bicycles, electric delivery fleets, and common carrier lockers as depicted in **Figure 5**.

[6] Southern California Association of Governments. Last-Mile Freight Delivery Study, 2020.

Figure 5: Toolbox of Strategies[6]



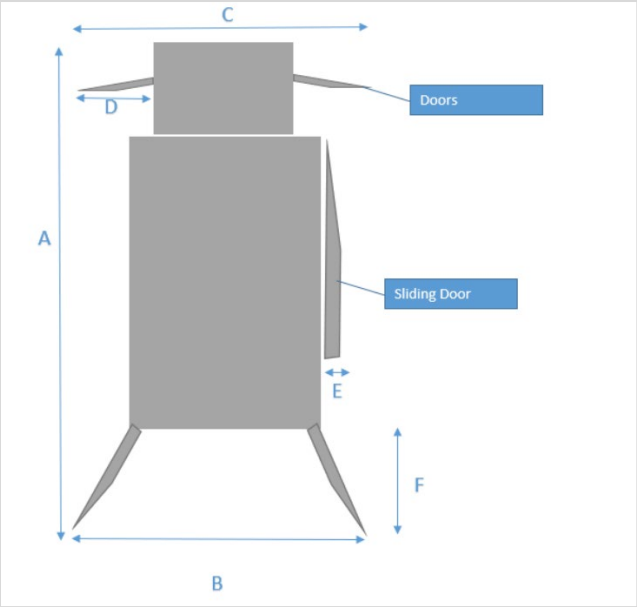
Source: Southern California Association of Governments (SCAG), 2020.

From a design perspective, the University of Washington[7] documented some recommended space requirements for delivery zones based on observations of delivery operations and simulations. At a minimum, a commercial vehicle operating envelope is recommended to include additional space for the opening door radius, especially on the driver's side, for safe and comfortable ingress and egress. The open vehicle footprint presented in **Figure 6** illustrates this need. Additional space is also recommended behind a vehicle for the driver/courier to organize goods, load accessories, and maneuver with accessories. The dimensions in **Table 2** offer minimum and maximum additions to the closed footprint of a truck or delivery vehicle that allow urban street systems to operate more efficiently, safely, and reliably for all users. These design recommendations depend on delivery type, location, and accessories.

The noted trends and best practices, and data collection results in the subsequent section helped inform this study's off-street loading area policy recommendations for SDCI to consider.

[7] University of Washington Urban Freight Lab. Developing Design Guidelines for Commercial Vehicle Envelopes on Urban Streets, 2019.

Figure 6: Open Vehicle Footprint for a Delivery Van



Legend

A: Open footprint, total length

B: Cargo compartment, width

C: Open doors, total width

D: Door, width

E: Sliding door, width

F: Back doors, length

Source: University of Washington Urban Freight Lab, 2019.

Table 2: Ranges of Recommended Additional Space

Delivery Type	Side Delivery Activity (inches)	Back-end Delivery Activity (inches)
Unassisted Delivery (no accessories)	25 - 35ᵞ	29ᵞ
Delivery with hand truck	107	51 - 66ᵞ
Pallet Jack Assisted Delivery	75	111 - 179
Delivery Type	**Back-end Delivery Activity (inches)**	
Lift Gate Assisted Delivery	76^ – 101^	187^^ - 280^^
Ramp Assisted Delivery	158*	227**
Cargo Door Type Back-end of Vehicle	0#	31##

Source: University of Washington Urban Freight Lab, 2019
Notes:
^Back-end with lift gate only
^^Back-end with lift gate and pallet jack assisted delivery
* Back-end with ramp only
** Back-end with ramp and hand truck assisted delivery
# Back-end with roll up door
Back-end with door open out
ᵞThe only common delivery types at residential sites are unassisted delivery and delivery with a hand truck. In the case of delivery with a hand truck, it is typically conducted from the back-end. Side delivery activity with a hand truck is less common at residential sites.

Data Collection Results

Peer Cities Code Review

The project team identified peer cities or comparable neighborhoods with residential off-street loading area requirements, including Washington, D.C., San Francisco, Chicago, and Vancouver, BC. These dense urban centers include a mix of residential and significant business activities. **Table 3** illustrates that it is common for dense urban centers in North America to require off-street loading areas for residential buildings based on dwelling units or gross floor area. However, some cities similar to Seattle do not have these requirements, such as the City of Los Angeles and Miami.

Table 3: Peer Cities Residential Off-street Loading Area Requirements

Peer City	Gross Floor Area or Dwelling Units	Minimum Number of Off-street Loading Areas Required*
Washington, D.C.[8]	More than 50 dwelling units	1
San Francisco, CA	0 - 100,000 GFA (sq. ft)	0
	100,001 - 200,000 GFA (sq. ft)	1
	200,001 - 500,000 GFA (sq. ft)	2
	Over 500,000 GFA (sq. ft)	3 plus 1 space for each additional 400,000 sq. ft
Chicago, IL	0 - 24,999 GFA (sq. ft)	0
	25,000 - 199,999 GFA (sq. ft)	1
	200,000+ GFA (sq. ft)	1 per 200,00 sq. ft. or portion thereof
Vancouver, BC	0 - 99 dwelling units	0
	100 - 299 dwelling units	1
	300 - 499 dwelling units	2
	Each 200 Increment	+1 for any portion
Los Angeles	-	No Requirements
Miami	-	No Requirements
Bellevue	-	No Requirements

Source: District of Columbia, City of San Francisco, City of Chicago, City of Vancouver, City of Los Angeles, City of Miami, City of Bellevue.

* Note: Off-street loading areas are typically in addition to any required waste collection areas. Some communities require that all waste collection be accommodated off-street, including tipping of dumpsters or loading roll-off containers.

[8] In addition to the off-street loading area requirements, Washington, D.C. also requires multifamily residential buildings to have additional space for service/ delivery.

Interviews

Various stakeholders, including architects, developers, planners, building managers, and City staff, were interviewed to help inform current and future trends and issues with high-density residential freight and loading requirements.

Building Managers

Of all the twelve residential buildings in Downtown Seattle and South Lake Union that we contacted, only two of the buildings' managers were interested in being interviewed. Key takeaways from these interviews include:

- Typically, residents use a scheduling system to use an alley/off-street loading area, thereby avoiding conflict with other alley, or off-street loading area activities. Neither of the interviewees identified any issues related to the utilization of off-street loading areas by residents.
- There is no specific pattern to when tenants of residential buildings move in or out, with activity occurring during weekdays and weekends. Many properties require moving activity to be specifically scheduled to ensure access to an off-street loading area, move-in room, or freight elevator (off-street loading areas are usually gated and locked).
- Interviewees indicate no operational issues such as double parking or traffic blocking in the alleys or the front curbspace. The two building managers that were interviewed pinpointed that both buildings have ample loading curbspace nearby.
- Most goods and parcel delivery is conducted at the on-street curbspace at the front of the residential buildings.
- Residential building managers do not enforce delivery personnel to adhere to specific parking/loading area requirements. Couriers generally utilize the loading space that is closest to the building entrance for efficiency.
- Currently, food delivery passenger cars (e.g., UberEATS or DoorDash) are frequent users of the front curbspace.

Architects and Developers

Given the project team's experience with similar projects in San Francisco, we interviewed both Seattle and San Francisco-based developers and architects to obtain the following broader understanding of residential off-street loading area requirements:

- In the Downtown Seattle area, regulations require residential buildings to have ground-floor retail/commercial use. For building operations, that usually means a commercial loading dock is required for the ground floor use. Given an expected low frequency of commercial loading delivery activity in typical mixed-use buildings with ground-floor non-residential uses, building developers and owners tend to believe that residential

loading demands such as for move-ins and move-outs occur in the commercial loading berth without creating overuse or time conflicts in its use. Developers/owners note that move-in/out activities are almost universally scheduled, which greatly reduces the risk for time conflicts. Therefore, they question the need for the requirement of an additional off-street loading area just for residential loading purposes, however this sentiment may not consider the impacts of future curbspace conversions to active uses like bike or bus lanes.

- Providing additional off-street loading areas will take up a substantial amount of ground floor space needed for other back-of-house operations or required ground floor retail/active uses.
- Architects/developers note that food, package, grocery deliveries occur on the front curbspace and not in the off-street loading areas as it is typically locked. Access to the off-street loading areas is only permitted through building management and requires scheduling/coordination.
- New buildings designs are including package rooms five times larger than they were in the early 2010 timeframe, and some now have refrigerator/hot food storage. These are conveniences for the tenants, but they also allow for shorter dwell times for delivery vehicles.

Bellevue Transportation Planner

Similar to Seattle, portions of Bellevue face challenges with high-density residential/mixed-use access, deliveries, and loading. To learn more about some of these challenges and what Bellevue does to address them, the project team interviewed a planner in the Transportation department. One of the notable items that the project team asked about is the lack of off-street loading area requirements for residential buildings in the City code. The planner said this is unnecessary because the City's traffic code prohibits any sort of deliveries, stopping, backing-up, or standing in the arterial streets in downtown Bellevue. As noted, there are very few local streets or alleys in Bellevue and almost all residential buildings front arterials. Because of this fact, the City's design review process requires a developer/architect to show how they will handle loading, waste collection, service, deliveries, etc. on-site and not block the arterial street. Given these requirements, the City does not generally have problems with deliveries, moving vans, or other activities blocking City streets and commercial loading areas are generally open and accessible during normal business hours. However, some building applications are denied because the parcel is too small to accommodate on-site loading and there are no exceptions to the off-street delivery/waste collection requirement. In these cases, the only practical recourse is for a developer to consolidate parcels or seek an access easement from a neighboring parcel. The interview did indicate that the key design vehicle for off-street building access is a waste collection vehicle as other commercial delivery and service vehicles can fit within the operating envelope of waste collection trucks. Older buildings downtown did not accommodate a garbage truck to access the building (the height of the loading area is too low). This results in dumpsters blocking the sidewalks on garbage collection days because the building does not get the dumpsters back into

the garage/loading area in time. This is one of the top code enforcement complaints in downtown Bellevue.

Seattle Public Utilities (SPU) – Solid Waste

Based on research and conversations with staff from other cities, the research team identified waste management or garbage trucks as one kind of critical design vehicle in alleys and off-street loading areas. To better understand this aspect in Seattle's context, we interviewed staff from SPU Solid Waste who shared the following best practices and solid waste service requirements:

- Building managers are often responsible for moving certain kinds of dumpsters to the staging location in alleys for waste collection and returning them for storage inside the building. Dumpsters can be staged from three hours before waste collection to three hours after collection in downtown Seattle. In other parts of the city, the time limit for staging is 24 hours.
- Waste collection in Seattle is typically conducted within a consistent two to three-hour window on scheduled collection days. Due to density and routing, scheduling cannot be more specific.
- Multi-family residential buildings must be designed to provide separation of recycling, garbage, and food waste as described in Seattle's Municipal Code. Residential buildings generally require 1 cubic yard per 10 units per week for garbage and 1.5 cubic yards per 10 units per week for recycling. Smaller buildings can be serviced by one to two cubic yard dumpsters that can be moved by SPU employees of contractors in some circumstances. Larger buildings are best serviced by larger roll-off containers that compact waste, and recycling in small dumpsters that compact.
- SPU faces several challenges in the alleys during waste collection, including narrow and long alleys, competing uses that block service, dumpster staging in the alleys, and lengthy duration of dumpster staging. However, SPU and its waste collection partners are customer-service oriented and can typically work around these challenges. Alley activities are regulated using a complaints-based system. When notified about a dumpster blocking/congestion incident, SPU reaches out to the client in question to rectify the issue. SPU coordinates with SDOT for enforcement, and a client or customer is only fined after three citations.
- Ideally, SPU desires clear alleys for haulers to meet their waste collection time window because any delay has a ripple effect on other customers, and because return-trips are costly for customers who are missed at no fault of SPU. To reduce potential conflicts, SPU staff recommend more enforcement in the alleys such that deliveries occur on-site or in a non-blocking manner at street curbs, and alleys are prioritized for service vehicles. Additional space for solid waste collection is also recommended.
- Many newer buildings use roll-off compactor dumpsters that have higher capacity and do not require alley staging for collection. "Roll-off" service requires 14-16 feet of overhead

clearance to load onto a truck (traditional dumpsters 3 cubic yards and greater require 24 feet height for tipping).

- SPU Solid Waste staff also noted the need for extensive SDOT and SPU coordination to address conflicts between waste collection and both protected bike lanes and activated alleys for pedestrian use.

Downtown Resident

Megan Kruse, an advocate for updating off-street loading areas and city codes has provided pertinent presentation materials on Downtown Seattle loading and alley topics with perspectives on trends and issues related to alleys and off-street loading areas. These reflect interest in how Downtown Seattle's alleys function in relation to existing and new buildings, and also her research into big-picture policy topics such as trends in freight and package delivery, the environment and transportation. Main takeaways include:

- The combination of denser development Downtown, increasing e-commerce and delivery volumes, parking constrictions, and traffic congestion, creates challenges and inefficiencies for deliveries and service vehicles. This also contributes to more carbon emissions.
- Numerous activities occur in alley rights-of-way. More recent residential buildings have space for internal loading; however, most older buildings lack internal space for loading and waste staging and conduct these activities in the alley which reduces functional alley width. Also adding to alley congestion is vehicle access for garages and internal loading, which is preferred by Seattle Municipal Code to occur through the alley.
- The role of off-street loading areas for residential towers could offer a solution to address urban freight needs and lessen burden on alleys.
- The utilization of residential off-street loading areas is often limited because of access issues including alley obstructions and inadequate designs (clearance, width, and length) that cannot accommodate typical vehicles for which they are intended. Additionally, off-street loading areas are often locked, and this presents an operational bottleneck if the building management team is not present to grant access.
- Apart from access and operational issues, internal loading in residential towers is inhibited by disconnected coordination and lack of support from key stakeholders including developers, architects, city government, and delivery companies.
- Adequately designed off-street loading areas that are backed up by a unified voice from close coordination and collaboration of key stakeholders are recommended.

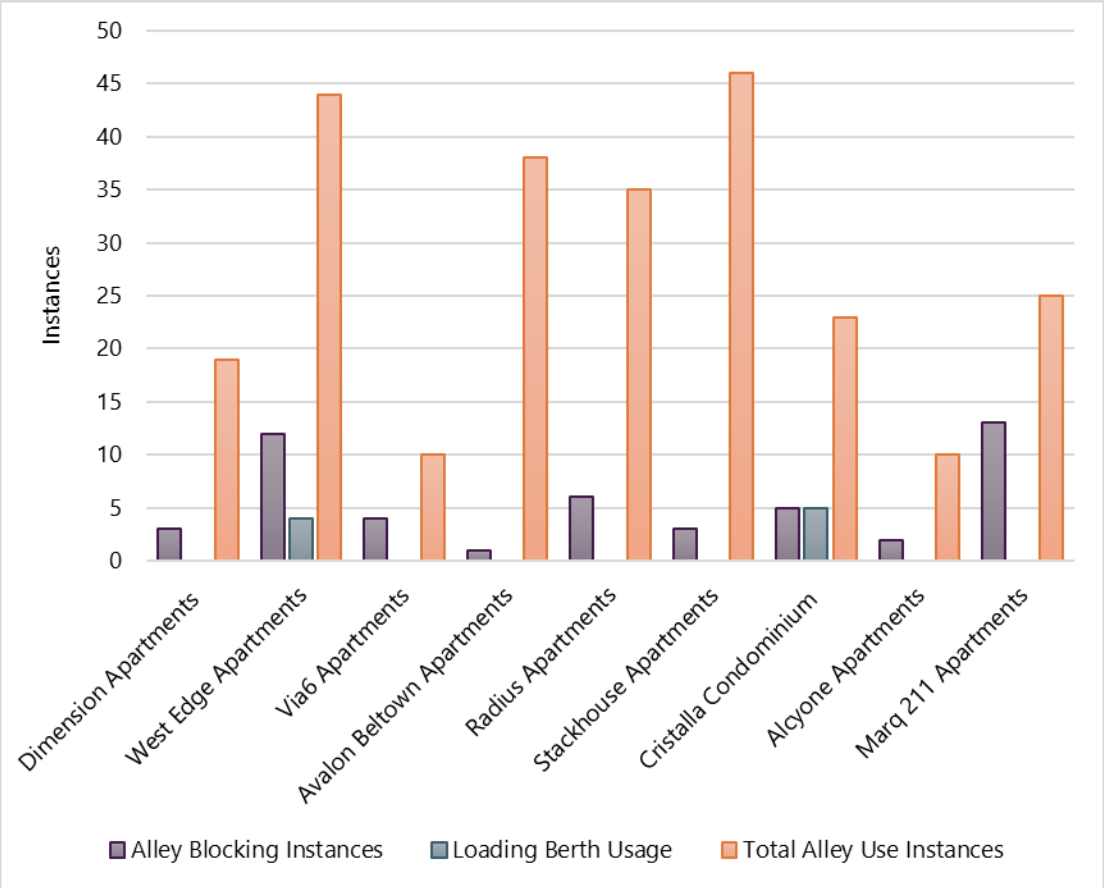
Field Monitoring

To better understand how deliveries, moving operations, pick-up/drop-off and other activities impact the alley and curbspace around residential buildings, the project team collected 12-hour

video data (7 am to 7 pm) at nine multifamily residential buildings on Friday, May 6th, 2021. The selected buildings included Dimension Apartments, West Edge Apartments, Via6 Apartments, Avalon Belltown Apartments, Radius Apartments, Stackhouse Apartments, Cristalla Condominiums, Alcyone Apartments, and Marq 211 Apartments as previously indicated in **Table 1**.

During the 12-hour window, at least 10 vehicles accessed each alley at the various residential sites, including passenger cars, delivery trucks, and garbage trucks. Few vehicles were observed accessing an off-street loading area and most activity took place within the alley, some of which blocked the alley, as shown in **Figure 7**. Unlike in the Downtown area, residential sites in the South Lake Union neighborhood can accommodate frequent alley activities as typical alley dimensions allow vehicle maneuvers even if another vehicle parked in the alley. During a site visit, it was observed that Stackhouse Apartments along Harrison Street does not have an off-street loading area and delivery activities frequently occur along the wide alley between Pontius Ave N and Yale Ave N. The dwell times for alley use at the study residential sites ranged from one minute to more than 60 minutes. Lengthy durations were noted for alleys with parking spaces (e.g., areas to park where vehicles were not blocking a lane). Alley activities observed included waste collection and goods delivery. There was no tenant move-in, or move-out activity observed during the analysis window. Almost 70 percent of vehicles observed in the alleys were private passenger cars. However, specific alley activities related to passenger cars were difficult to identify from the collected video footage.

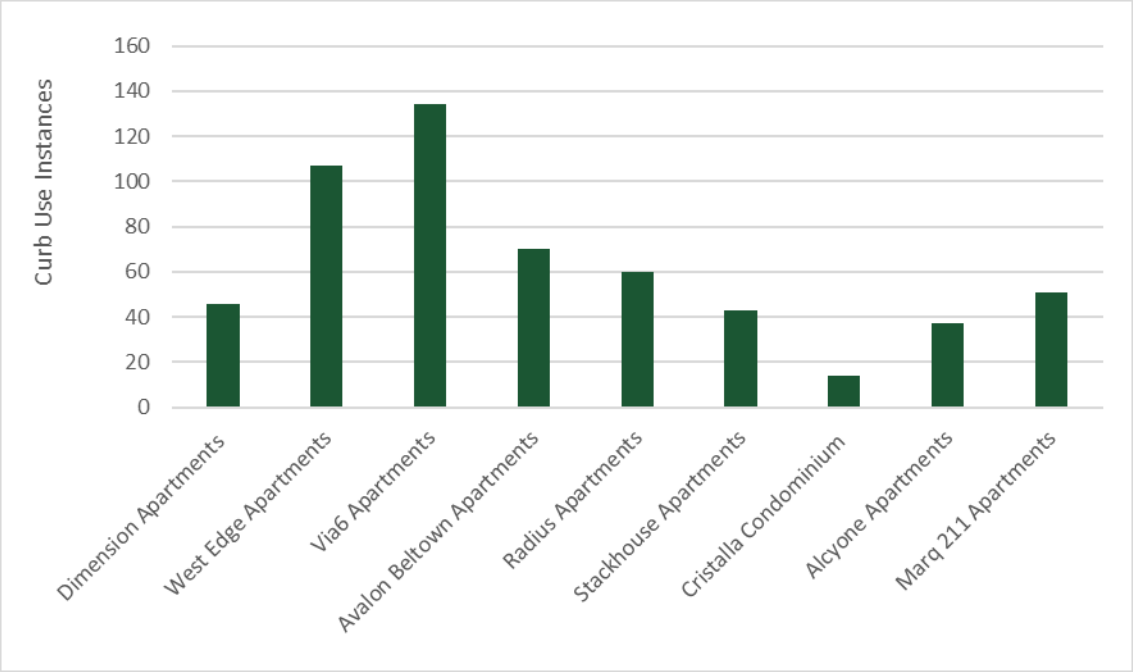
Figure 7: Alley Activity Observations



Source: IDAX Data Solutions, Fehr & Peers, 2021.

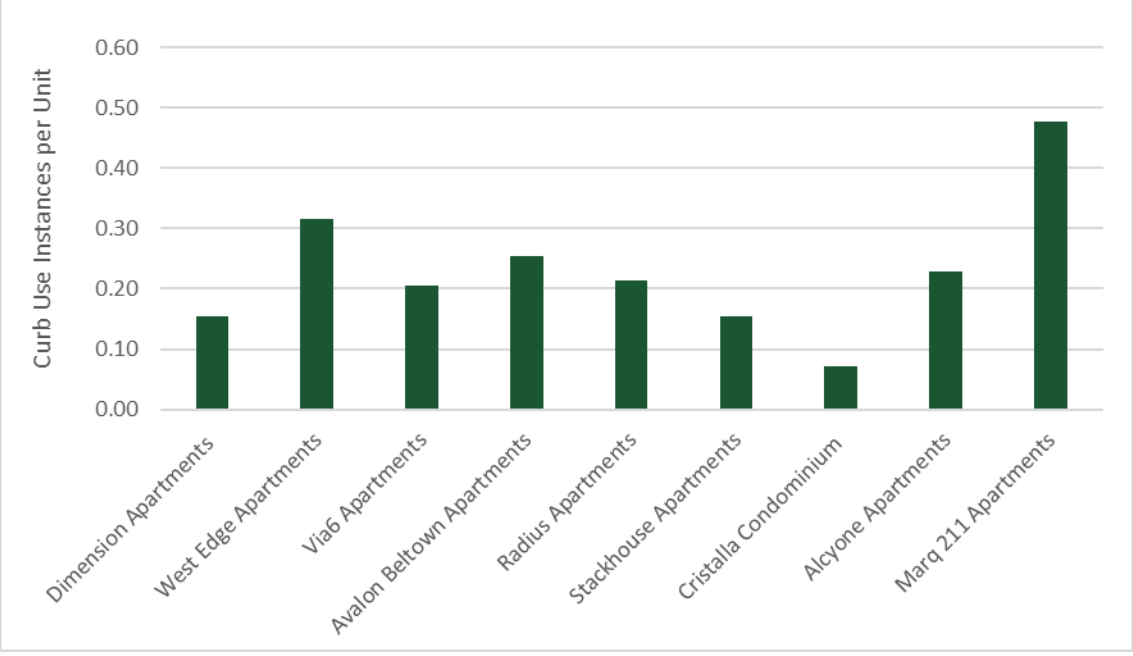
Vehicles observed at the front curb space included private passenger cars, commercial vans, and delivery trucks. During the observed 12-hour window, the magnitude of curb use instances at the study residential buildings varied (**Figure 8**). More curb use activity was noted in the Downtown area compared to the South Lake Union neighborhood, although the residential buildings the study team observed tended to be larger in Downtown. When normalized by the number of units per building, the difference in curb activity is less pronounced between Downtown and South Lake Union. Front curb space for residential buildings in the Downtown core, including West Edge and Marq 211, have the highest curb usage per unit, as shown in **Figure 9**. The video data also indicated that residential buildings with ground-floor retail facilities have higher curb activity.

Figure 8: Total Curb Use



Source: IDAX Data Solutions, Fehr & Peers, 2021.

Figure 9: Normalized Curb Use (per Unit)



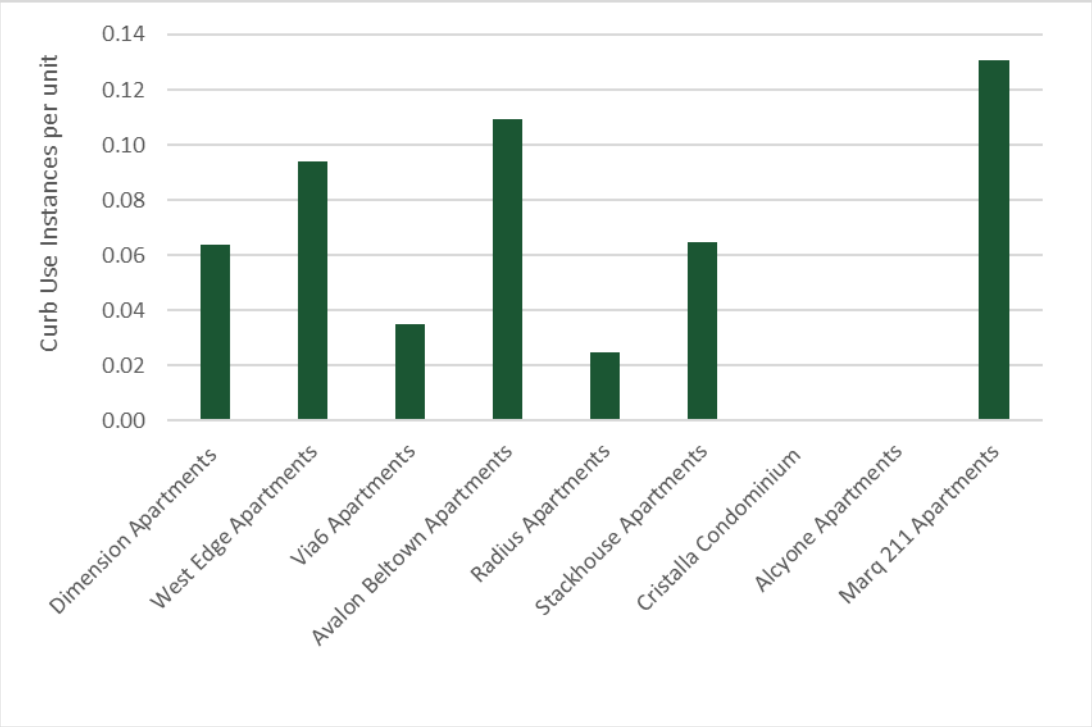
Source: IDAX Data Solutions, Fehr & Peers, 2021.

A review of the video data indicated that the front curb was also not utilized for residential move-in or move-out activities at any of the study buildings during the analysis period. Curbspace was mostly used for commercial purposes varying from food delivery to commercial pick-up/drop-off by passenger cars (TNC or taxi loading).

Figure 10 shows the variation in demand for commercial delivery curb use per residential unit for the full 12-hour day of data collected, illustrating higher demand for Downtown residential sites compared to the ones in the South Lake Union neighborhood. For the purposes of this study, commercial deliveries include traditional parcel and large item delivery from delivery companies or retail/white glove services as well as commercial deliveries to ground floor retailers and food and parcel deliveries from private vehicles acting as contract delivery drivers.

Similar to alleys, passenger cars were also the prominent vehicle type observed utilizing curbspace at the front of the residential building sites. Unlike with alleys, several activity types could be discerned from the video footage as shown in **Figure 11**. Detailed methodology utilized is provided in **Appendix B**. A notable trend shown in **Figure 11** is that the primary passenger car curbspace activity is commercial deliveries at many of the observed buildings. Given the expansion of food delivery and other "instant" delivery services over the past year, it seems likely that this type of curb use will continue to grow unless other delivery options (cargo bikes, sidewalk drones, expanded use of centralized lockers, etc.) gain favor over contract drivers.

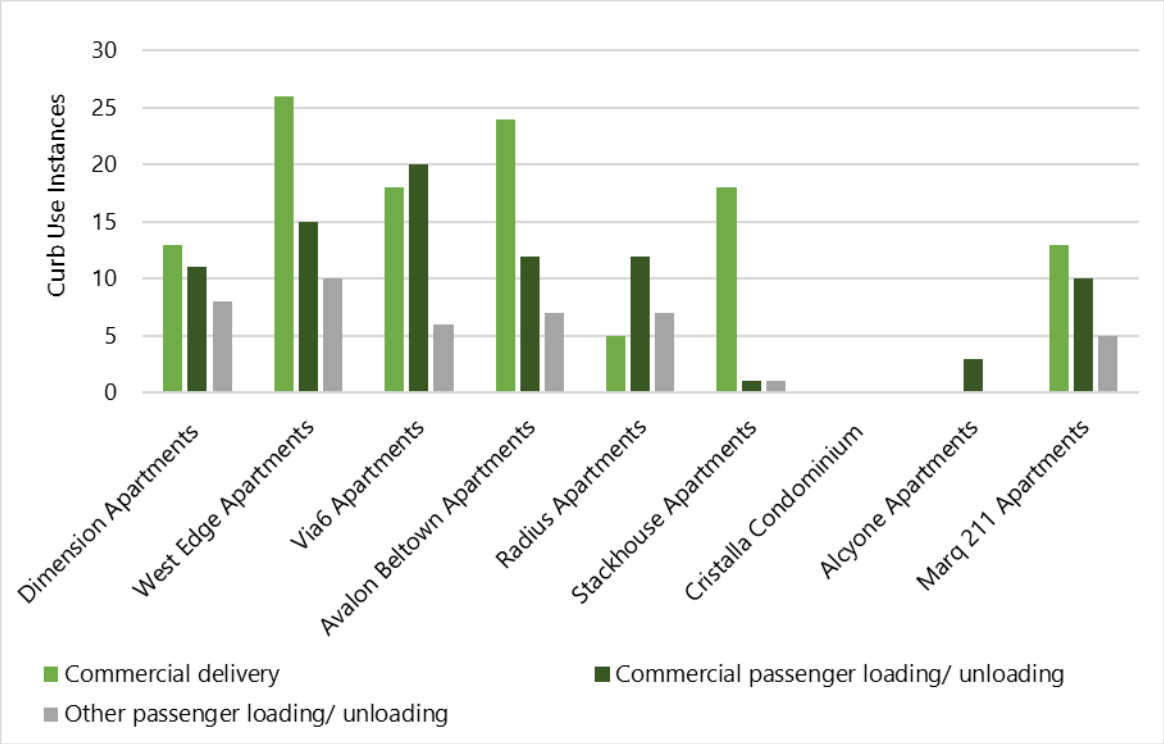
Figure 10: Commercial Delivery Demand per unit[9]



Source: IDAX Data Solutions, Fehr & Peers, 2021.

[9] The Final 50 Feet Urban Goods Delivery System research project conducted by the University of Washington's Urban Freight Lab also looked at a similar metric. The study reported the number of parcels delivered per day for five different types of buildings in the Downtown area including a residential building (Insignia Tower). Approximately 200 parcels per day were estimated by the project team at the 700-unit Insignia Tower by observing and collecting data on the delivery process. Even though the Residential Loading Berth and Delivery Activity study focuses on commercial curb use per residential unit per day, both metrics speak to commercial delivery demand in Downtown Seattle. Note that many parcels tend to be delivered in a single trip so the correlation between the UW data and data collected in this study is reasonable (e.g., 200 parcels per day in a 700 unit building and 75-150 commercial deliveries per day for these types of buildings).

Figure 11: Front Curb Use (Passenger Cars)



Source: IDAX Data Solutions, Fehr & Peers, 2021.

The project team also noted violations to curb use policies from the reviewed video data and site visits at some of the study sites. These violations were limited to frequent double parking on the curbspace, lengthy dwell times exceeding designated time limits, and traffic blocking. For this analysis, traffic blocking is defined as a curb use instance whereby a vehicle blocks at least one lane along a roadway, and double-parking limits the full utilization of available curb space. Common curb use policies that were observed included paid prolonged parking which explains lengthy dwell times noted from field monitoring.

Overall, the collected alley and curb data provides a representative snapshot of vehicle activity at residential sites highlighting fairly low levels of alley activity and comparably more on-street activity. Even though the data is limited to one sample day, findings align with anecdotal insights from building managers and City staff.

Overview Interpretation for Policy Considerations

The collected data are a snapshot in time of a limited sample of residential buildings in Downtown and South Lake Union. The data provides a general indication of residential delivery and passenger pick-up/ drop-off activities at curbs and alleys. Individual buildings have differing

levels of curb and alley activity, but there tends to be a higher use of curbspace at the front of the buildings for passenger pick-up/ drop-off and delivery activities than in alleys or off-street loading areas. Suppose the City intends to implement policies that would encourage shifting these activities away from the curb as suggested by the current trends in Seattle. In that case, the collected data provides a general quantitative indication of the extent to which this spurs on-site loading/unloading occurrences and increases alley traffic. At a high-level, if most curbside activity at a typical residential building were to shift from the curb, the volume of delivery-related activity in alleys and off-street loading areas could approximately double as a worst-case scenario. However, we expect that some passenger pick-up/ drop-off and food delivery activities would still use the curbside locations for convenience if short-term loading spaces are available, which would limit the increased alley traffic.

Table 4 presents the estimated use of alleys and curbspace, based on the study data normalized to the number of residential dwelling units in the sampled buildings. Based on the tabulated rates of activity measured in this study, shifting building activities away from the curb potentially adds approximately 20-25 more occurrences to alleys and off-street loading areas on a given day between 7 am and 7 pm for a 100-dwelling unit building. For a 200-dwelling unit building during a similar time period, the shift may result in 45-50 more occurrences in alleys and off-street loading areas and perhaps up to 100-120 more occurrences for a 500-dwelling unit building. Commercial deliveries are expected to range from six to 31 occurrences, depending on the building size, as indicated in **Table 4**. Given that these estimated rates are over a 12-hour window, it is anticipated that with streamlined scheduling, it will not require much space to accommodate this need within a residential building's footprint to avoid alley blockages. Individual alleys would vary in their ability to effectively accommodate the increase in traffic, depending on alley widths, the frequency they are used by other vehicles (which may include parked vehicles that temporarily block alleys), and other traffic volumes, such as residents using residential parking garage entries.

It should be noted that this study provides high-level insight into delivery types currently occurring at the curb and in alleys but is not robust enough to further speculate about other kinds of building activities, such as residential move-in/out activity or service/maintenance work. This prompts further research and analysis to fully understand all building activities that make use of alleys, off-street loading areas, and curbspace.

Table 4: Estimated Rates of Alley and Curb Use Instances for a 12-hour window (7am – 7pm)

Typical building size	Alley Use Instances	Curb Use Instances	Commercial Deliveries at the Curb*
100 dwelling units	12	23	6
200 dwelling units	23	46	13
300 dwelling units	35	69	19
400 dwelling units	47	92	25
500 dwelling units	58	115	31

Source: IDAX Data Solutions, Fehr & Peers, 2021.
Notes:
Tabulated rates are per 12-hour window between 7am and 7pm. The rates are based on the averaged normalized alley and curb uses with reference to the number of residential dwelling units per study building.
*Subset of total curb use instances.

Off-street Loading Area Policy Recommendations

A synthesis of all the items discussed in the preceding sections aided in the development of off-street loading area policy recommendations that SDCI can consider in code updates. This section tackles SDCI's original question of whether the City should update the land use code or a Director's Rule to refine the number of off-street loading areas for residential and mixed-use buildings in Downtown and South Lake Union. This section also provides the project team's thoughts on design recommendations for off-street loading areas for residential and mixed-use buildings.

The proposed recommendations bulleted below were greatly influenced by a close examination of past research, policies from comparable cities, stakeholder input and field observations. The review of peer city policies suggest the need of at least one off-street loading area for residential/mixed-use buildings based on square footage or number of dwelling units. This aligns with input from City staff and address the current and future trend of reduced curbspace available due to conversions by SDOT. Gathered data also speak to the multi-functional use of off-street loading areas for both residential and other ground floor non-residential uses, a strategy recognized in Washington, D.C.'s building code.

Field observations indicate that buildings in Downtown and South Lake Union currently host numerous commercial delivery and passenger pick-up/drop-off activities along the curbs in front of the buildings. As the City continues to maximize the public value of curbspace, some of these commercial activities will need to relocate, bolstering the need to update off-street commercial loading area policies for residential and mixed-use buildings. Field monitoring over 12-hour window indicated that approximately six to 31 commercial delivery occurrences could shift to an off-street loading area, depending on the building size (100 units to 500 units).

General Recommendations

- **At least one off-street/off-alley loading area is a desirable amenity for residential uses. The sufficient number of off-street loading areas and design needs should relate to the number of residential units and size and type of commercial uses.** Critical uses of off-street loading and utility areas include commercial deliveries, tenant move-in or move-out operations, and solid waste and recycling collection and management. While not all peer cities require an off-street dedicated loading area, discussions with other cities and a Google street view tour of similar neighborhoods indicate that the majority of mid and high-rise residential or mixed-use buildings constructed in the past 20 years have an off-street loading area. The reasons buildings have these spaces is a mix of City design review requiring space to ensure that streets are not blocked (even if there is not a specific off-street loading area requirement) or practical matters like a requirement for garbage to be stored out of the street/sidewalk/alley. Additionally, the fact that SDOT has been converting curb space in Downtown and South Lake Union from parking and

loading areas into other uses suggests that buildings may need to increasingly rely on dedicated loading areas on their own property to accommodate major building functions.

- **For residential uses ranging in size from 100 to 250 dwelling units, this study recommends at least one off-street loading area that can accommodate at least one cargo van (a common model is a Mercedes Sprinter) is recommended**. In accommodating this off-street loading area, giving options to respond to site context with flexibility in the design or accommodation of this loading area is important. A standard back-in loading area that can accommodate a cargo van and the associated space to load/unload would be ideal, but for smaller parcels, an occasional shortage of ground floor space, potential alley access constraints, and other potential challenges to design should be recognized. This should lead to consideration of flexibility in the possible requirements for loading areas. Examples of atypical loading areas could include: a parking alcove in the alley that is fully out of the alley right-of-way; a dedicated loading area within the parking garage that has level elevator access to address move-in/move-out activities by residents and easy access to a package room or lobby to unload packages; or a porte-cochere or other driveway located off the street.
- **For residential uses ranging in size from 251 to 500 dwelling units, at least two off-street loading areas are recommended, which could include a mix of types, such as a move-in space near an elevator in the garage or an alley-side space.** This mid-size category of residential use generates more delivery, loading, and unloading activities, which increases the need for off-street loading areas. Providing one of these recommended loading areas to address move-in/move-out activities could be a good idea. This size of residential use also generates large volumes of solid waste, which are usually too high to be serviced on the alley. This tends to lead to provision of space inside the building for storage and collection of recycling, composting, and garbage. A typical example for buildings of this size is approximately one or two roll-off dumpsters that are collected by trucks and taken away from the site to be emptied and then returned. The City may wish to evaluate on its own whether the recommended off-street loading areas could partly overlap with the spaces where waste collection trucks collect dumpsters, because residential loading activities and waste collection activities may occur at different times of the day.
- **For residential uses with greater than 500 residential units, at least three off-street loading areas are recommended, which could include a mix of types, such as a move-in space near an elevator in the garage or an alley-side space.** This is informed by a review of land use codes from peer cities, and recent residential construction in Seattle. Buildings of this size range could benefit from the flexibility provided by three off-street loading areas for delivery or move-in/move-out activities.[10] In these buildings, adjacent loading areas should be designed to be usable at the same time if possible, depending on total available space at the site's ground level. We note that certain ground floor uses like a grocery store that generate regular moderate

[10] A recent project example is the 2300 6th Avenue towers (1,131 dwelling units + commercial space). Solid waste details: two residential roll-off compactors for recycle and garbage, plus another dual-body roll-off compactor to manage commercial recycling and garbage.

delivery demands could warrant a separate commercial and residential off-street loading area. However, there may be opportunities for residential and ground-floor non-residential uses to share loading spaces, if their combined delivery volumes can be effectively coordinated through methods like a Loading Dock Management Plan.

- SDOT staff highlighted the critical need to shift most responsibility and activity of move-in/move-out operations and urban goods/services for residential building needs towards private property because of the shrinking supply of loading/unloading curbspace and growing delivery demands. A combined review of the collected alley and curb use data indicated that more motorized freight activities for residential buildings are conducted via curbspace than alleys or off-street loading areas. Because of the limited volume of use of existing off-street loading areas in the data, it was difficult to identify which exact loading and delivery activities might best shift from curb-front places to on-site locations. The use of off-street loading areas seems limited primarily by access complexities; they are typically gated and only accessible with the assistance from building staff, and therefore this presents a bottleneck for efficient loading/unloading activities. Based on the observed data, shifting residential curbspace activity seems feasible if there would be a streamlined process of accessing the off-street loading areas. Ideally, voluntarily **widening the alley or providing a widened on-site space next to an alley that can function as an off-street loading area** could be an alternative to off-street loading areas within buildings, to compensate for the growing limitations related to curb availability and address SDOT's concerns. However, this may not be possible for blocks dominated by older buildings in Downtown Seattle, which tend to be built directly to the edge of the original platted alley. Emerging options for non-motorized freight systems can also provide flexibility to move loading operations out of public curb space without requiring dedicated space to stand freight vehicles on-site.
- Based on field observations of both curbspace and alleys, more stringent enforcement of existing curbspace and alley access/stopping/standing rules may be necessary to yield the full benefit of additional off-street/off-alley loading areas. In the field observations, vehicles are repeatedly observed violating existing rules (double parking, non-commercial vehicles parking or stopping in the alley) even when the off-street loading areas are open and available for use. In other words, it may be faster or more convenient for vehicle-based deliveries to improperly use curbspace or the alley when the risk of enforcement is low.

Design Recommendations

- For a residential building with less than 100 dwelling units, the **Mercedes Sprinter Van** shown in **Figure 12** is recommended as the critical design vehicle for the off-street loading area. Mercedes Sprinter vans with a high roof (and other similar makes) are typically observed at residential sites and commonly used as service vehicles, for residential move in-out, and package deliveries; therefore, accommodation of this vehicle type is crucial.
- The **35-foot long roll-off waste collection truck** shown in **Figure 14** is recommended as a critical design vehicle for solid waste collection spaces using roll-off dumpsters in residential buildings with over 100 dwelling units, unless there is a unique use in the building, such as a

grocery store that generates demand for substantially larger trucks (e.g., WB-67 semi-trucks). The roll-off waste collection truck is 10-feet wide and has an optimal vertical clearance of 16 feet for roll-off waste collection service operations. This space also would be able to accommodate other design vehicles if the City decides loading activity may occur within the solid waste truck's designated space.

- Other prominent trucks commonly observed at the study sites include **SU-30 trucks** (**Figure 16**) used for commercial deliveries (for large items like appliances and furniture) and moving (rental trucks like U-Haul and commercial moving companies). These are typically 30 feet in length and have a vehicle width ranging from 9 to 9.5 feet including rear-view mirrors. For the new concept to allow an alley-side off-street loading area, an SU-30 truck is recommended as the critical design vehicle.
- Waste management is a critical use of on-site service/utility areas. SPU notes that there are limited options for handling waste in residential or mixed-use buildings with more than 100 dwelling units of housing. The ability to store, maneuver to and service large dumpsters on-site within the loading area is critical. This can require coordination of competing needs for the space via a Loading Dock Management Plan at some site-constrained buildings.
- The dimensions of a residential off-street loading area are recommended to include space for the opening door radius and additional space is also required behind a vehicle for the driver/courier to organize goods, load accessories, and maneuver with accessories. Additional space required depends on delivery type, location, and accessories; therefore, these factors should be considered by the City in selecting envelope dimensions, such as the ones tabulated in **Table 2**. The common delivery types at residential sites include unassisted delivery and delivery with a hand truck. Deliveries with hand trucks are typically conducted at the back of a truck and should be considered in sizing loading areas, as should side delivery methods using a hand truck. As noted in **Table 2** and depicted in **Figure 13** and **Figure 17**, an additional 6 feet to the design vehicle's width and length would be sufficient to accommodate these two delivery types. For the 35-foot long roll-off waste collection vehicle, 35 feet is the necessary length for design, because the roll-off collection does not require additional length for front-loading dumpsters; and, this length could also accommodate shared loading use with vehicles such as the SU-30 truck (**Figure 16**). Roll-off waste collection trucks also need up to 16 feet of overhead clearance to pick up dumpsters and compactors. Potential changes to requirements could consider whether there may be challenges to requiring or encouraging a high loading area ceiling. Such factors also could be considered in permit review and design review process. **Figures 18 - 20** present illustrations of how the recommended off-street loading area requirements conceptually could be met. However, we note that future City of Seattle requirements may not match this space allowance; the illustrations conceptually portray how design vehicles with space for unloading could be grouped in a way that limits the total floor area obligation if minimizing use of space is desired. Seattle's reviews of loading spaces for buildings accommodate a variety of loading space arrangements that respond to building design opportunities and constraints. We expect that Seattle's codes will be calibrated to allow the degree of specificity and flexibility that the City will prefer, for the sake of reasonable loading space design flexibility. As a practical example, **Appendix E** presents a

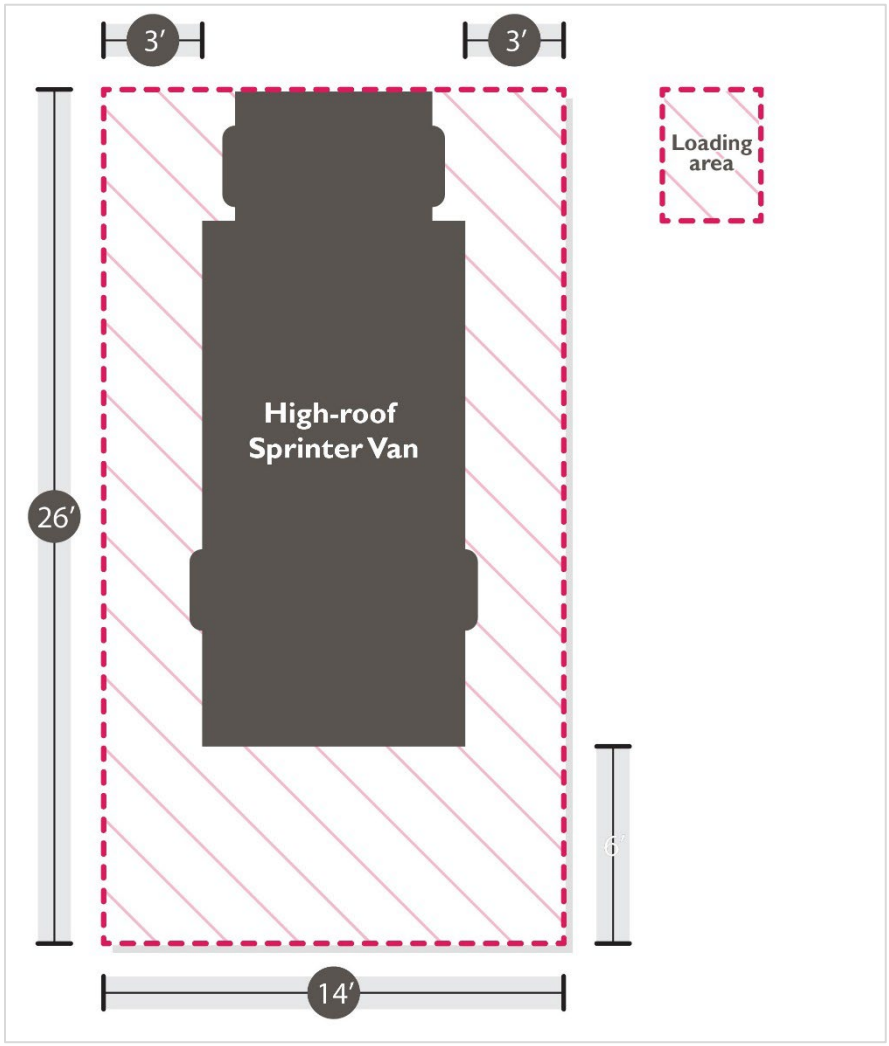
proposed off-street loading area for a research and development facility along Dexter Ave N that is intended to accommodate varying truck types including SU-30 and SU-35 single unit trucks and also SPU roll-off rear loading trucks with a compactor. The presented figures illustrate how the varying truck types may be able to access the off-street loading area via the alley and complete loading/unloading operations.

- The placement of the residential off-street loading area should be designed to appropriately accommodate on-site maneuvers of the critical design vehicle, allowing for combinations of turning movements that could safely avoid impediments created by the building or alley or nearby building dimensions. For cargo van spaces that might be one level down in a parking area, angle of the parking ramp and the overhead clearances on the ramp/loading area should also be taken into consideration in code requirements to ensure the ceiling heights and overhangs of design vehicles can be accommodated.
- If possible, designing parking areas or alcoves within the alley (where the drive aisle of the alley remains unobstructed) should allow for service vehicles and short-duration deliveries that do not use the off-street loading area to access the building without blocking the alley.
- The code should allow for building designs to include “move-in/move-out" spaces in garages or on or near the ground floor that can accommodate resident moving activity, to streamline residential loading activities, parcel deliveries, and commercial delivery vehicles, and reduce alley and curb congestion.
- The code should allow for consideration of non-motorized alternatives to traditional freight vehicles that can be shown to reliably reduce the demand for curbside loading, the physical space required for loading operation, and/or improper loading operations in the right-of-way.

Figure 12: Design Vehicle 1 (High-roof Sprinter Van)

Source: Mercedes-Benz, 2022.

Figure 13: Recommended Off-street Loading Area for Design Vehicle 1



Source: University of Washington Urban Freight Lab, Fehr & Peers, 2022

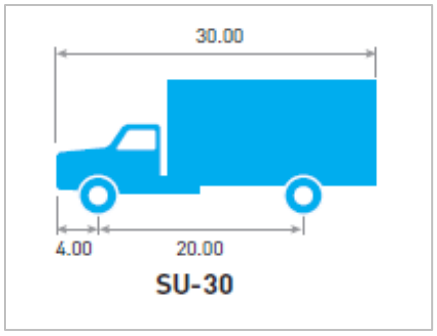
Figure 14: Design Vehicle 2 (Roll-off Waste Collection Truck)

Source: Seattle Public Utilities, 2022.

Figure 15: Recommended Off-street Loading Area for Design Vehicle 2

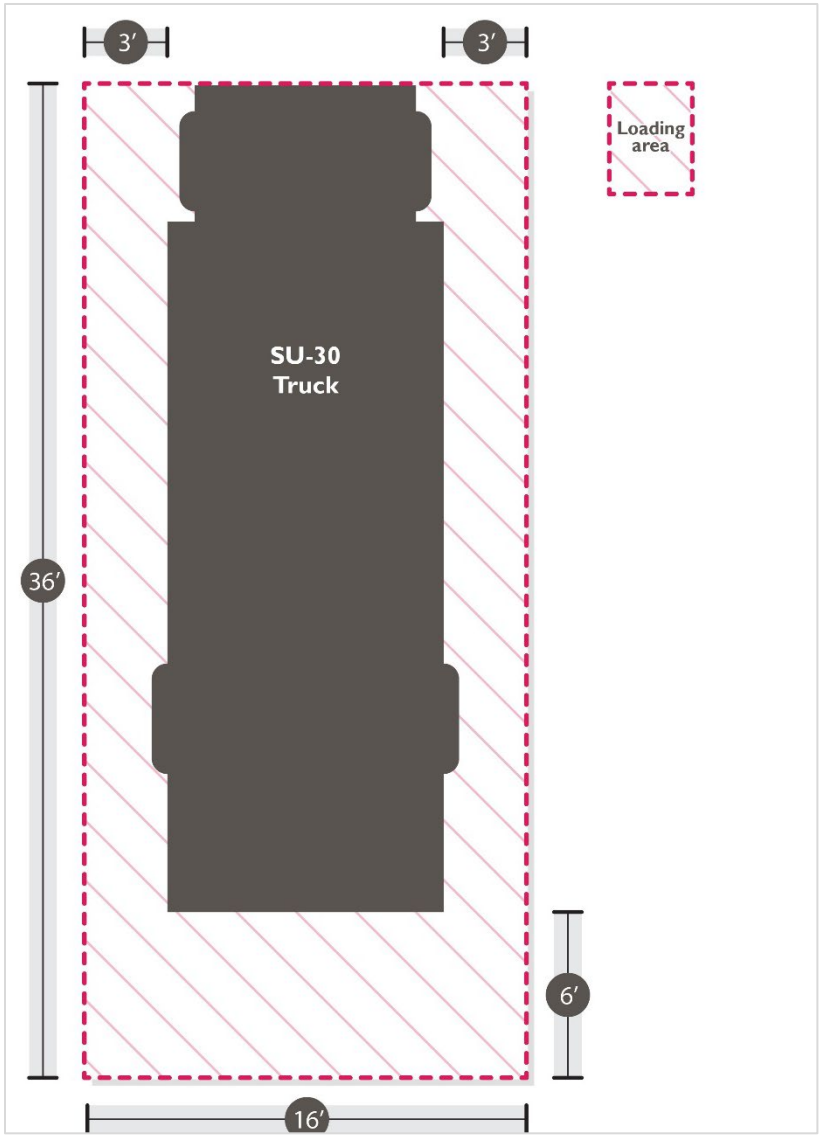
Source: University of Washington Urban Freight Lab, City of Seattle, Fehr & Peers, 2022

Figure 16: Design Vehicle 3 (SU-30 Single-unit Truck)



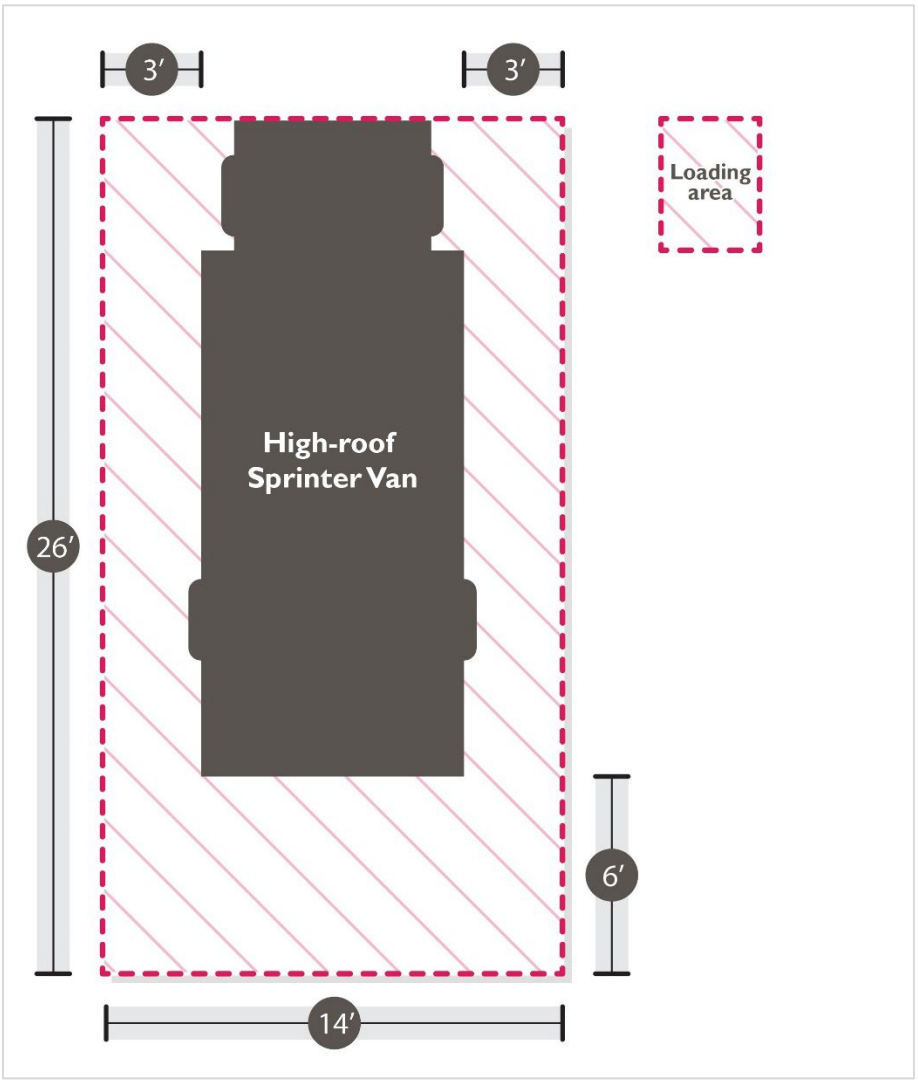
Source: Seattle Department of Transportation

Figure 17: Recommended Off-street Loading Area for Design Vehicle 3



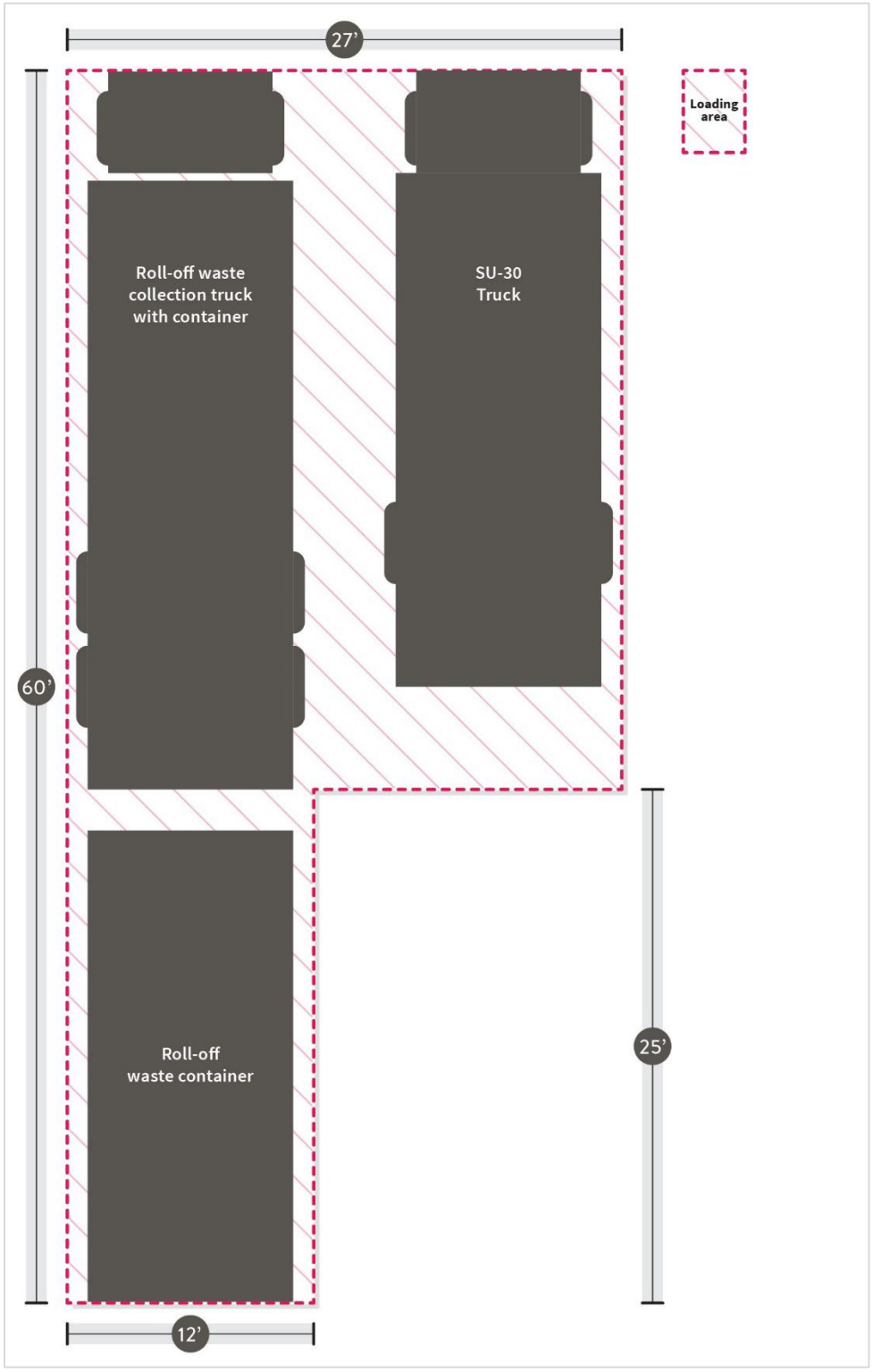
Source: University of Washington Urban Freight Lab, City of Seattle, Fehr & Peers, 2022

Figure 18: Potential Off-street Loading Area for Residential Buildings With Lowest Requirement - Design Vehicle #1



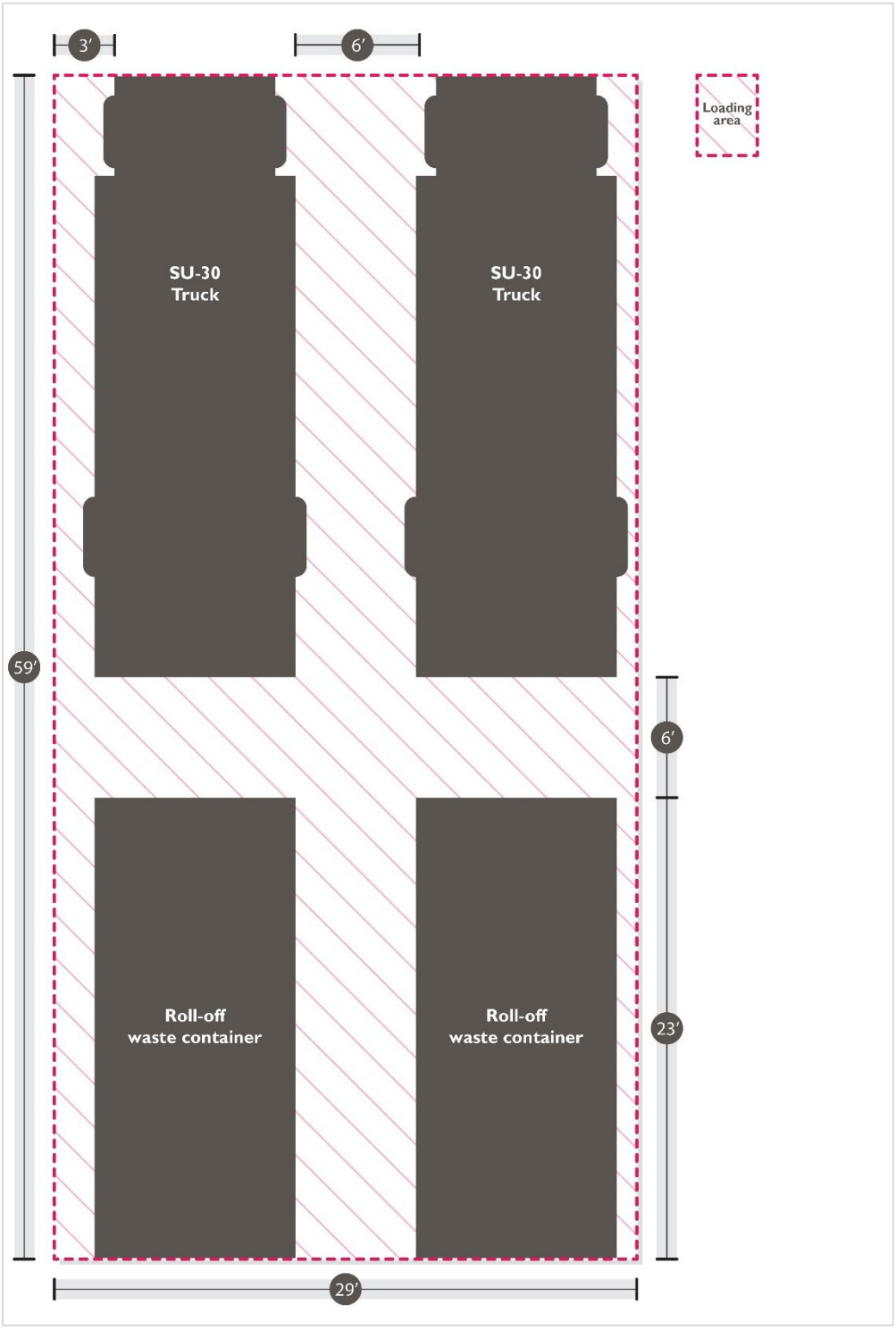
Source: University of Washington Urban Freight Lab, City of Seattle, Fehr & Peers, 2022

Figure 19: Potential Off-street Loading for Residential Buildings One Dedicated Loading Space and One Shared Waste Collection/Loading Space



Source: University of Washington Urban Freight Lab, City of Seattle, Fehr & Peers, 2022

Figure 20: Potential Off-street Loading Area for Residential Buildings with Two Shared Waste Collection/Loading



Source: University of Washington Urban Freight Lab, City of Seattle, Fehr & Peers, 2022

Appendix A: Related Trends and Best Practices

Trends from Related Studies

This section outlines key trends and takeaways from research related to existing challenges for multifamily residential buildings in dense urban areas and future delivery trends. The bulleted trends in this section are from research programs conducted by the University of Washington's Urban Freight Lab (UFL) and the Southern California Association of Governments (SCAG). Additional findings from a survey conducted by the National Multifamily Housing Unit Council (NMHC) are also included.

Front Curb

- Several driving forces are rapidly transforming the urban goods delivery system in Seattle and other cities; these include growth of e-commerce in dense urban centers, strategic imperative for freight delivery firms to match the e-commerce growth curve and provide fast and reliable delivery times expected by online shoppers, and the emergence of new technologies in the supply chain and logistics sectors.[1]

- While the retail sector is reshaping urban goods demand and truck traffic patterns, the contours of the City of Seattle's built environment are also in a period of dynamic change. The City is developing urban centers with walkable and enticing neighborhoods of residential and office towers and planning for increased transit and bike lanes. The Tech sector employees are filling high-rise office and residential towers in the Downtown Seattle and South Lake Union Areas[2]. In essence, the demand for curb space for goods delivery is increasing, but there is no assurance that the currently available curb space will be available in the future. This will likely force deliveries to occur in the alleys.

- Today, the traditional box and parcel delivery trucks, vans, and service vans (for plumbers, electricians, and others) who use alleys as the back door to buildings jockey for space with ride-share services like Lyft and Uber and passenger cars queuing in alleys to use off-street garages. Reports of conflicts and concerns about potential future conflicts (should alleys be inadequately managed to meet demand) are on the rise. [3]

- With the increased use of private vehicles without commercial plates for on-demand delivery and use of rented vehicles, it can be difficult for delivery drivers, store owners, or parking enforcement officers to determine what is and is not legitimate use. [4]

- Information sharing and resource and product visibility across organizations are chief requirements for emerging supply network and logistics management concepts such as integration, collaboration, and synchronization. This helps actively manage the network as a

[1] https://depts.washington.edu/sctlctr/sites/default/files/SCTL_Final_50_full_report.pdf
[2] https://www.geekwire.com/2017/amazon-scoops-yet-another-seattle-office-building-continues-juice-downtown-construction-boom/
[3] https://depts.washington.edu/sctlctr/sites/default/files/SCTL_Alley_Infrastructure_Occupancy_Study_12-11-18.pdf
[4] https://scag.ca.gov/post/last-mile-freight-delivery-study

comprehensive whole, operating it flexibly with the help of emerging technologies that offer real-time data to meet dynamic demand and improve the productivity of finite load/unload spaces

- In Seattle, commercial and passenger vehicle drivers use commercial vehicle loading zones (CVLZs) and passenger loading zones (PLZs) fluidly: commercial vehicles are parking in PLZs, and passenger vehicles are parking in CVLZs. Passenger vehicles made up more than half of all vehicles observed parking in CVLZs (52%). More than one-quarter of commercial vehicle drivers parked in PLZs (26%) This fact supports more integrated planning for all curb space, versus developing standalone strategies for passenger vehicle and commercial vehicle parking.[5]

- Most commercial vehicle (CV) demand is for short-term parking: 15 or 30 minutes. Across the five locations, more than half (54%) of all CVs parked for 15 minutes or less in all types of curb spaces. Nearly three-quarters of all CVs (72%) parked for 30 minutes or less. When considering just the delivery CVs, an even higher percentage, 60 percent, parked for 15 minutes or less. Eighty-one percent of the delivery CVs parked for 30 minutes or less. [5]

- A study by UW indicated that 36 percent of the total CVs parked along the curb were service CVs, showing the importance of factoring their behavior and future demand into urban parking schemes. In contrast to delivery CVs that predominately parked for 30 minutes or less, service CVs' parking behavior was bifurcated. While 56 percent of them parked for 30 minutes or less, 44 percent parked for more than 30 minutes, and more than one quarter (27%) of the service CVs parked for an hour or more. Because service vehicles make up such a big share of total CVs at the curb, this may have an outsize impact on parking space turn rates at the curb.[5]

- 41 percent of commercial vehicles park in unauthorized locations. But a much higher percentage parked in unauthorized areas near the two retail centers (55% - 65%) when compared to the predominately office and residential areas (27% - 30%). The research team found that curb parking behavior is associated with granular, building-level urban land use. This occurred even as other factors such as the total number, length, and ratio of CVLZs versus PLZs varied widely across the five study areas.[5]

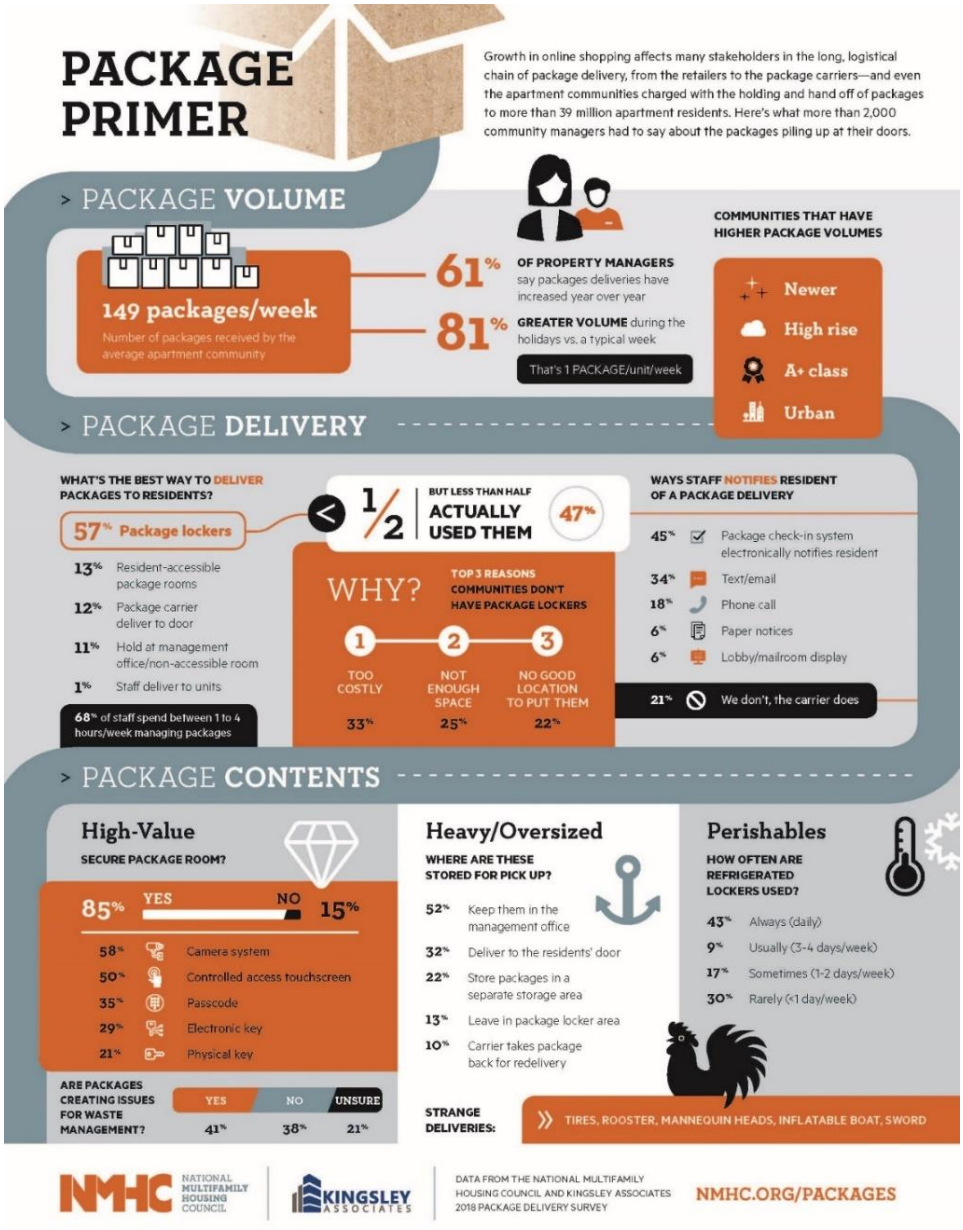
- Both building managers and receivers noted limitations of building design and their impacts on last-mile access - building designs that lack input from tenants or eventual owners often lead to legacy access problems, impacting access for delivery vehicles.[4]

- The National Multifamily Housing Unit Council (NMHC) Package Delivery Survey conducted in 2018 revealed that an average apartment community receives approximately 149 packages per week, 57 percent of the surveyed building managers believe that the package locker system is the best way to deliver packages to residents because 68% of staff spend between one to four hours

[5] http://depts.washington.edu/sctlctr/sites/default/files/research_pub_files/Final-50-Feet-Tracking-Curb-Use-in-Seattle.pdf

per week managing packages. The study included community managers from 29 industry-leading multifamily firms, representing responses from 2,098 properties across 44 states.[6]

Figure 1: National Multifamily Housing Unit Council (NMHC) Package Delivery Survey



- There is a key difference between the patterns of commercial delivery operators such as the United States Postal Service (USPS), United Parcel Service (UPS), FedEx, and on-call or shipment-specific services such as food or beverage deliverers. The major delivery carriers have set routes and driver assignments, with a workload that varies by day but is relatively stable over the long

[6] https://www.nmhc.org/research-insight/research-report/nmhc-package-delivery-report/

run. Pick-up and delivery times rarely vary within a daily window unless there are special customer requirements. [4]

- Innovative practices for last-mile deliveries include off-peak delivery programs, combination use lanes, low emission zones, urban consolidation centers, commercial loading zone permits and meter payments, delivery and service plans, cargo bicycles, electric delivery fleets, and common carrier lockers.[5]

Alleys[7]

- More than 90 percent of Center City alleys in Seattle are only one lane wide. This surprising fact creates an upper limit on alley parking capacity, as each alley can functionally hold only one or two vehicles at a time. Because there is no room to pass by when a truck, van, or car parks, it blocks all other vehicles from using the alley. When commercial vehicle drivers see that an alley is blocked, they will not enter it, as their only way out would be to back up into street traffic. Seattle Municipal code prohibits this, as well as backing up into an alley, for safety reasons.

- 68 percent of vehicles in the alley occupancy study parked there for 15 minutes or less—it is clear that moving vehicles through alleys in short time increments is the only reasonable path to increase productivity. As one parked vehicle operationally blocks the entire alley, the goal of new alley policies and strategies should be to reduce the amount of time alleys are blocked to additional users.

- 87 percent of all vehicles in the seven alleys studied parked for 30 minutes or less. Given the imperative to move alley traffic quickly, vehicles that need more parking time must be moved out of the alleys and onto the curb where they do not block others.

- 73 percent of Center City area alleys contain entrances to passenger parking facilities. Placing garage entrances in alleys has been a city policy goal for years. But it increases the frequency of cars in alleys and adds demands on alley use. Understanding why cars are queuing for passenger garages located off alleys, and providing incentives and disincentives to reduce that, would help make alleys more productive.

- Alleys are vacant about half of the time during the business day. While at first blush this suggests ample capacity, the fact that an alley can only hold one-to-two parked trucks at a time means alleys are limited operationally and therefore are not a viable alternative to replace the use of curb CVLZs on city streets.

[7] https://depts.washington.edu/sctlctr/research/publications/seattle-center-city-alley-infrastructure-inventory-and-occupancy-study-2018

Appendix B: Data Collection and Urban Residential Delivery Trends

Data Collection

Data collection included reviewing peer cities building codes, interviews with key stakeholders (architects, developers, building managers, city staff, and planners), and video monitoring at selected residential sites in the Downtown and South Lake Union areas.

Peer Cities Codes Review

The project team identified peer cities/ comparable neighborhoods with residential loading berth requirements, including Washington, D.C, San Francisco, Chicago, and Vancouver, BC. These dense urban centers include a mix of residential and significant business activities. **Table 1** illustrates that it is common for dense urban centers in North America to require loading berths for residential buildings based on dwelling units or gross floor area. However, some cities similar to Seattle do not have these requirements, such as Los Angeles and Miami. Based on website review, loading berth requirements for Los Angeles and Miami are site-specific and prompted by reports issued by tenants; otherwise, there are no explicit requirements. Other cities in Washington, such as Bellevue, do not explicitly require loading berths but other regulations require them. In Bellevue, on-street parking is scarce, and on-street loading is not allowed; therefore, buildings need alley-loading berths to streamline building operations.

Table 1: Peer Cities Residential Loading Berth Requirements

Peer Cities	Gross Floor Area or Dwelling Units	Minimum Number of Loading Berths Required	Minimum Number of Service/Delivery Spaces Required
Washington, D.C.	More than 50 dwelling units	1	1
San Francisco, CA	0 - 100,000 GFA (sq. ft)	0	-
	100,001 - 200,000 GFA (sq. ft)	1	-
	200,001 - 500,000 GFA (sq. ft)	2	-
	Over 500,000 GFA (sq. ft)	3 plus 1 space for each additional 400,000 sq. ft	-
Chicago, IL	0 - 24,999 GFA (sq. ft)	0	-
	25,000 - 199,999 GFA (sq. ft)	1	-
	200,000+ GFA (sq. ft)	1 per 200,00 sq. ft. or portion thereof	-

Peer Cities	Gross Floor Area or Dwelling Units	Minimum Number of Loading Berths Required	Minimum Number of Service/Delivery Spaces Required
Vancouver, BC	0 - 99 dwelling units	0	-
	100 - 299 dwelling units	1	-
	300 - 499 dwelling units	2	-
	Each 200 Increment	+1 for any portion	-
Los Angeles	-	No Requirements	-
Miami	-	No Requirements	-
Bellevue	-	No Requirements	-

Source: Fehr & Peers.

Interviews

Various stakeholders, including architects, developers, planners, building managers, and city staff, were interviewed to gather an understanding of current and future issues with high-density residential freight and loading requirements. This section outlines the key takeaways from all the conducted interviews.

Building Manager Interviews

We reached out to several residential building managers in the Downtown and South Lake Union neighborhoods via phone and email. This three-week outreach process aimed to understand how alley loading docks are utilized for move-in/move-out activity, large truck deliveries, and truck deliveries for ground floor retail facilities, noting operational issues from building managers' perspective. We also sought insight on activities at the on-street curb space loading zones located at the front of the residential buildings. Of all the twelve buildings we contacted, only two were interested in being interviewed. A detailed template questionnaire in **Appendix C** outlines the specific questions used to engage with building managers. Key takeaways from these interviews include:

- Typically, residents use a scheduling system to use an alley loading berth, thereby avoiding conflict with other alley or loading berth activities. Neither of the interviewees identified any issues related to the utilization of alley loading berths by residents.
- There is no specific pattern to when tenants of residential buildings move in or out, with activity occurring during weekdays and weekends. Many properties require moving

activity to be specifically scheduled to ensure access to a loading berth, move-in room, or freight elevator (loading berths are usually gated and locked).

- Interviewees indicate no operational issues such as double parking or traffic blocking in the alleys or the front curbspace. The two building managers that were interviewed pinpointed that both buildings have ample loading curbspace nearby.
- Most goods and parcel delivery is conducted at the on-street curbspace at the front of the residential buildings.
- Residential building managers do not enforce delivery personnel to adhere to specific parking/loading area requirements. Couriers generally utilize the loading space that is closest to the building entrance for efficiency.
- As of late, food delivery passenger cars (e.g., UberEATS or DoorDash) are frequent users of the front curbspace.

Architects and Developers Interviews

Given the project team's experience with similar projects in San Francisco, we interviewed both Seattle and San Francisco-based developers/architects to obtain broader insights about residential loading berths. Architects and developers provided the following insights on the requirements for designing alley loading docks for residential infill projects and assuring traffic operations on city streets and alleys are not disturbed:

- In the Downtown area, new regulations require residential buildings to have ground-floor retail/commercial. For building operations, that usually means a commercial loading dock is required for ground floor use. Therefore, an additional loading berth dedicated to residential move-in/out operations may not be necessary since the ground floor use does not always occupy the loading berth.
- Providing additional loading berths will take up a substantial amount of ground floor space needed for other back-of-house operations or required ground floor retail/active uses.
- SDCI regulates all loading berth requirements except for height requirements. This may give rise to coordination challenges.
- Architects/developers note that food, package, grocery deliveries occur on the front curbspace and not in the alley loading berth as it is typically locked. Access to the loading berth is only permitted through building management and requires scheduling/coordination.
- New buildings designs include package rooms five times larger than they were in the early 2010 timeframe, and some now have refrigerator/hot food storage. These are conveniences for the tenants, but they also allow for shorter dwell times for delivery vehicles.

Bellevue Transportation Planner

Similar to Seattle, portions of Bellevue face challenges with high-density residential/mixed-use access, deliveries, and loading. To learn more about some of these challenges and what Bellevue does to address them, the project team interviewed a planner in the Transportation department. One of the notable items that the project team asked about is the lack of loading berth requirements for residential buildings in the City code. The planner said this is unnecessary because the City's traffic code prohibits any sort of deliveries, stopping, backing-up, or standing in the arterial streets in Downtown Bellevue. As noted, there are very few local streets or alleys in Bellevue and almost all residential buildings front arterials. Because of this fact, the City's design review process requires a developer/architect to show how they will handle loading, service, deliveries, etc. on-site and not block the arterial street. Given these requirements, the City does not have any problems with deliveries, moving vans, or other activities blocking City streets; however, some building applications are denied because the parcel is too small to accommodate on-site loading. In these cases, the only practical recourse is for a developer to consolidate parcels or seek an access easement from a neighboring parcel. The interview did indicate that the key design vehicle for off-street building access is a garbage truck. Older buildings downtown did not accommodate a garbage truck to access the building (the height of the loading area is too low). This results in dumpsters blocking the sidewalks on garbage collection days because the building does not get the dumpsters back into the garage/loading area in time. This is one of the top code enforcement complaints in Downtown.

Seattle Public Utilities

Based on research and conversations with city planners from other cities, the research team identified waste management or garbage trucks as critical design vehicles in alleys. To clearly understand this aspect in Seattle context, we interviewed staff from Seattle Public Utilities. The primary objectives for this interview included understanding conflicts between waste collection and alley loading dock operations for multifamily residential buildings and also what ideal operations in alleys entail from a waste collection perspective. The Seattle Public Utilities staff shared the following insights and recommendations:

- Building managers are responsible for moving dumpsters to the staging location for waste collection and returning them for storage. Dumpsters can be staged from three hours before waste collection to three hours later in Downtown Seattle. In other parts of the City, the time limit for staging is extended from three hours to 24 hours.
- Waste collection in Seattle is not specifically scheduled, but is typically conducted within a two to three-hour window during the day..
- SPU faces several challenges in the alleys during waste collection, including narrow and long alleys, dumpster staging in the alleys, and lengthy duration of dumpster staging. However, SPU and its trash collection partners are customer-service oriented and work

around these challenges. Alley activities are regulated using a complaints-based system. When notified about a dumpster blocking/congestion incident, SPU reaches out to the client in question to rectify the issue. SPU coordinates with SDOT for enforcement, and a client or customer is only fined after three citations.

- Ideally, SPU desires clear alleys for haulers to meet their waste collection time window because any delay has a ripple effect on its numerous target clients. To reduce potential conflicts, SPU staff recommend more enforcement in the alleys such that all deliveries are performed on the front curb and alleys are dedicated for service vehicles. Additional space for solid waste collection is also recommended.
- Many newer buildings are utilizing roll-off compactor dumpsters that do not require any overhead clearance for servicing and can be accommodated in a smaller area (although there is the need to maneuver a garbage truck to receive the dumpster) than traditional dumpster bins.

Field Monitoring

Study Residential Buildings

To get an in-depth understanding of residential loading berth and delivery activity in downtown/South Lake Union areas, we collected and reviewed 12-hour video data (7 am to 7 pm) at nine multifamily residential buildings on Friday, May 6th, 2021. Discussions between the consulting team and Seattle Department of Construction and Inspection (SDCI) informed site selection. The selected buildings included Dimension Apartments, West Edge Apartments, Via6 Apartments, Avalon Belltown Apartments, Radius Apartments, Stackhouse Apartments, Cristalla Condominiums, Alcyone Apartments, and Marq 211 Apartments. As shown in **Table 2**, the selected buildings vary in lot size, the number of residential units, occupancy, year of construction, whether the building is classified as an apartment or condominium, the presence of ground-floor retail, and whether the building has a loading berth. The collected video data captured both alley activity and curbside activity.

Table 2: Selected Analysis Buildings

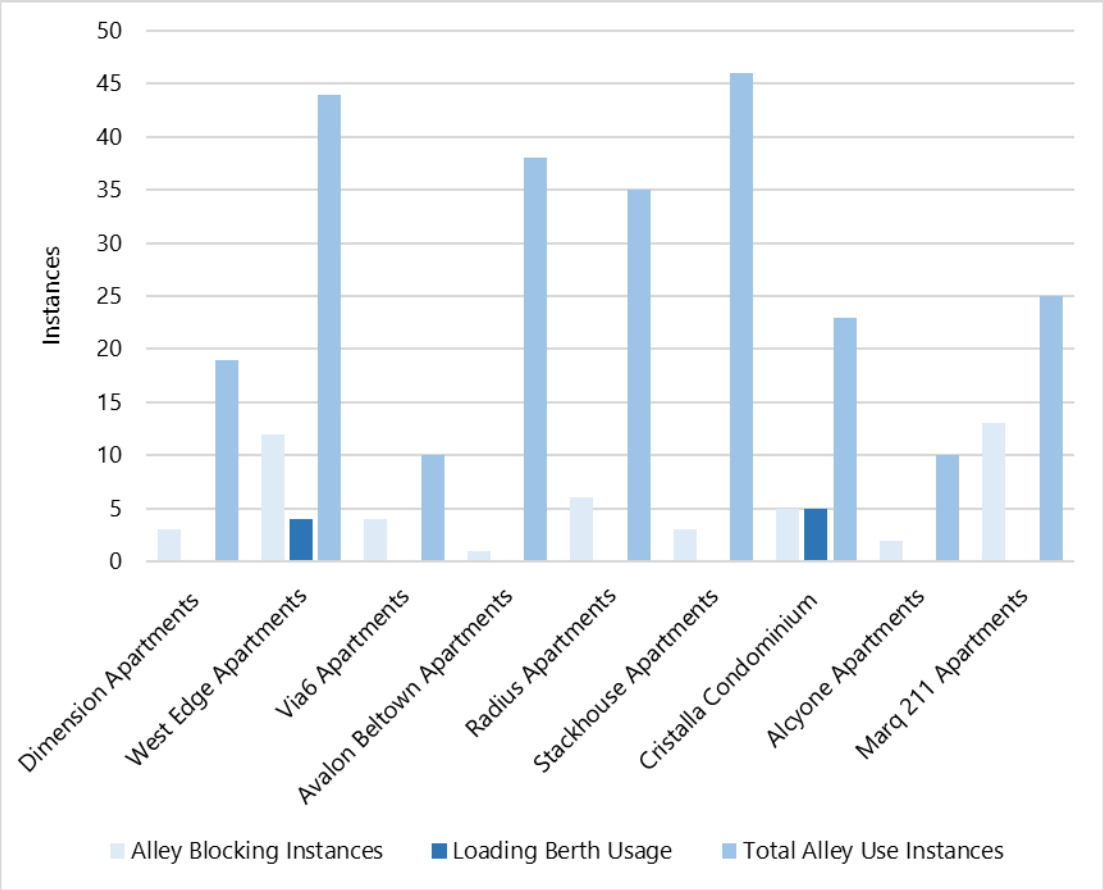
Residential Building	Year Built	Apartment/ Condo; Units	Ground Floor Retail	Alley Loading Berth
Dimension Apartments (Downtown Seattle)	2014	Apt; 298	–	✓
West Edge Apartments (Downtown Seattle)	2016	Apt; 340	✓	✓
Via6 Apartments (Downtown Seattle)	2012	Apt; 654	✓	✓
Avalon Belltown Apartments (Downtown Seattle)	2017	Apt; 275	✓	✓
Radius Apartments (South Lake Union)	2014	Apt; 282	–	✓
Stackhouse Apartments (South Lake Union)	2013	Apt; 278	✓	–
Cristalla Condominiums (Downtown Seattle)	2005	Apt; 195	✓	✓
Alcyone Apartments (South Lake Union)	2003	Apt; 162	✓	–
Marq 211 Apartments (Downtown Seattle)	1999	Apt; 107	✓	✓

Source: King County, Fehr & Peers, 2021.

Field Monitoring and Video Data Collection – Alley Activity

During the 12-hour window, at least 10 vehicles accessed each alley at the various residential sites, including passenger cars, delivery trucks, and garbage trucks. Few vehicles were observed accessing a loading berth, and most activities took place within the alley, some of which blocked the alley, as shown in **Figure 2**. Figure 3 presents observed occurrences of narrow passing events in alleys. The dwell times for alley use ranged from one minute to more than 60 minutes. Lengthy durations were noted for alleys with parking spaces (e.g., areas to park where vehicles were not blocking a lane). Alley activities observed included waste collection and goods delivery. There was no tenant move-in or move-out activity observed during the analysis window. Almost 70 percent of vehicles observed in the alleys were private passenger cars. However, specific alley activities related to passenger cars were difficult to depict from the collected video footage.

Figure 2: Alley Activity Observations



Source: IDAX Data Solutions, Fehr & Peers. 2021.

Figure 3: Narrow Passing Events in Alleys

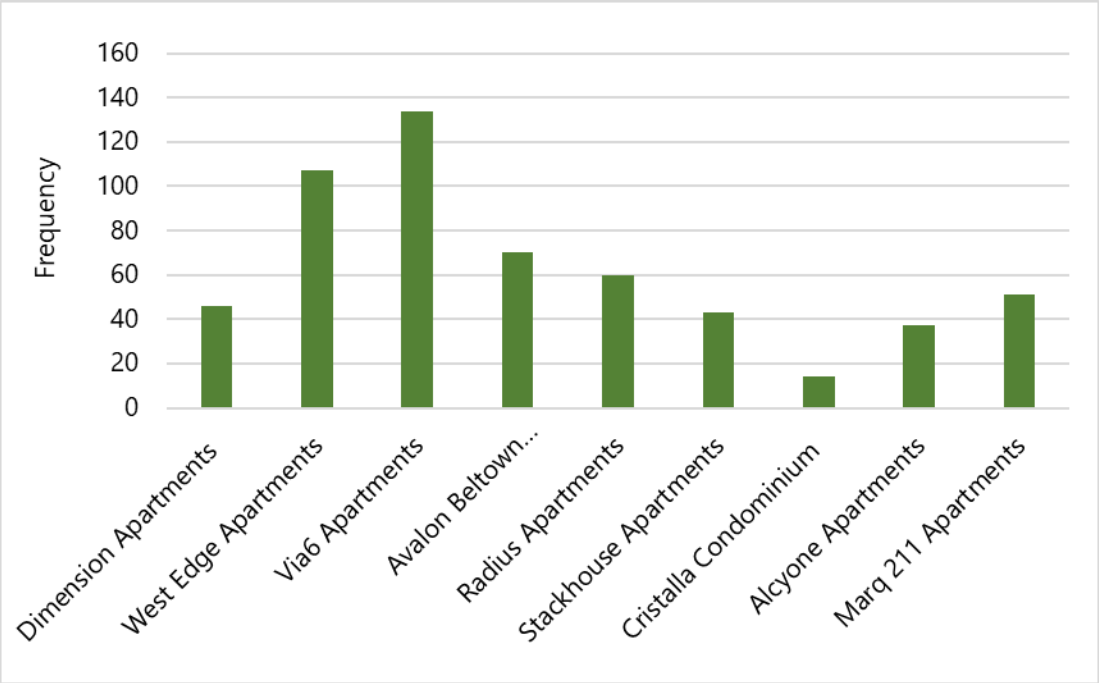
Field Monitoring and Video Data Collection – Curbside Activity

Vehicles observed at the front curb space include passenger cars, commercial vans, and box trucks, as depicted in **Figure 4**. During the observed 12-hour window, the magnitude of curb use instances at the study residential buildings varied. More curb use activity is noted in the Downtown Area compared to the South Lake Union neighborhood. However, when normalized by the number of units per building, the difference in curb activity is reduced. Front curb space for residential buildings in the Downtown core, including West Edge and Marq 211, have the highest curb usage per unit, as shown in **Figure 5**. The video data also indicated that residential buildings with ground-floor retail facilities have high curb activity.

Figure 4: Vehicle Typology

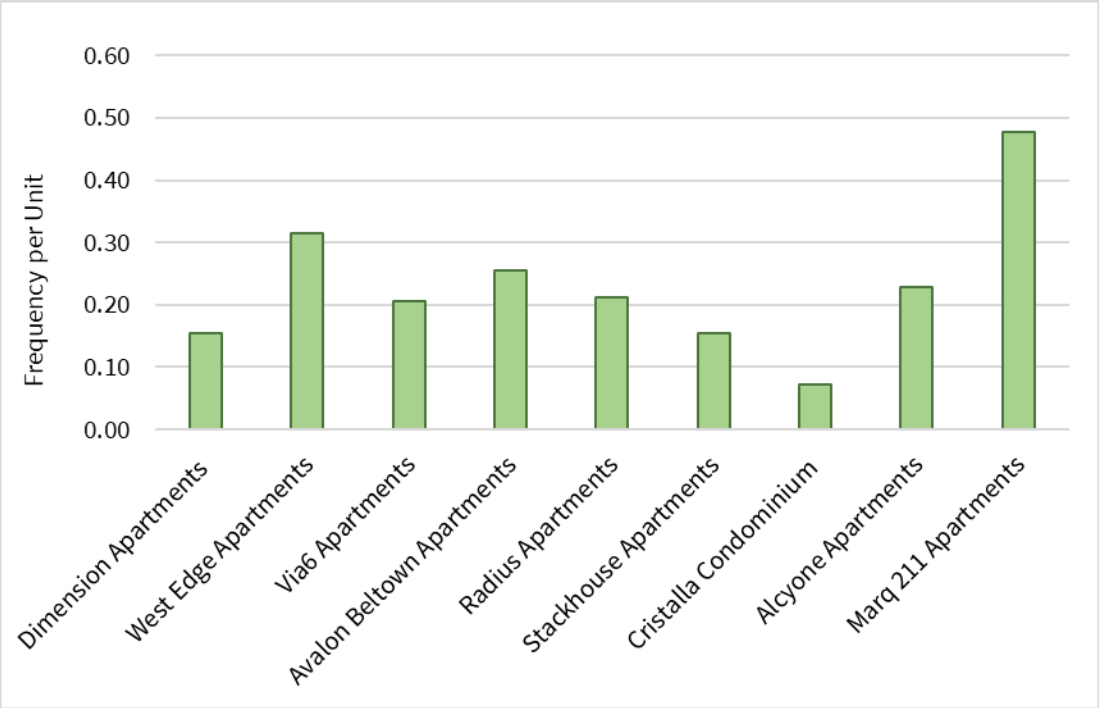
Source: Fehr & Peers, IDAX Data Solutions, U-Haul, 2021.

Figure 5: Total Curb Use



Source: IDAX Data Solutions, Fehr & Peers. 2021.

Figure 6: Normalized Curb Use (per Unit)



Source: IDAX Data Solutions, Fehr & Peers. 2021.

Some of the analysis sites had frequent double parking or traffic blocking instances, as shown in **Table 3**. For this curb use analysis, traffic blocking is defined as a curb use instance whereby a vehicle blocks at least one lane along a roadway, and double-parking limits the full utilization of available curb space. Examples of traffic blocking shown in **Figure 7** were prevalent on low-volume streets such as Boren Ave N adjacent to Radius Apartments. However, the dwell time for these traffic blocking instances was less than 2 minutes.

Table 3: Traffic Blocking at the Front Curb

Residential Building	Traffic Blocking Instances (%)
Dimension Apartments (Downtown Seattle)	4%
West Edge Apartments (Downtown Seattle)	0%
Via6 Apartments (Downtown Seattle)	4%
Avalon Belltown Apartments (Downtown Seattle)	1%
Radius Apartments (South Lake Union)	**37%**
Stackhouse Apartments (South Lake Union)	7%
Cristalla Condominiums (Downtown Seattle)	0%
Alcyone Apartments (South Lake Union)	8%
Marq 211 Apartments (Downtown Seattle)	4%

Source: Fehr & Peers, IDAX Data Solutions, 2021.

Figure 7: Traffic Blocking Illustrations

To discern various activities that occur at the curb space, we aggregated observations into the following activity types:

- Residential Move-in/out
    - U-Haul moving trucks or vans
    - Conventional tenants move-in/ move-out operations
- Commercial delivery

    - Typical commercial vehicles including Amazon, USPS, and UPS trucks or vans
    - Food or goods delivery by unmarked passenger cars, including UberEATS or Amazon Flex
- Commercial passenger loading/ unloading:
    - Taxis and typical Uber/ Lyft vehicle maneuvering
    - Back seat passenger access defines this type of activity as Taxis or Transportation Network Companies (TNCs) do not allow passengers to sit in the front as per COVID-19 protocols.
- Other passenger loading/ unloading:
    - Pick-up/ drop-off activity for acquaintances, friends, and family whereby passengers access the front passenger seat.
- Ground floor retail:
    - Driver accesses retail facility located on the ground floor of the apartment building.
- Other activities related to building
    - An indiscernible activity whereby the driver accesses the study building.
- Activity unrelated to building:
    - Curb use instances unrelated to the study building, e.g., a driver parks to walk his/ her dog.

A review of the collected video data indicated that the front curb was not utilized for residential move-in or move-out activities at all the study buildings. The curb space was mostly used for commercial purposes varying from food delivery to commercial pick-up/ drop-off by passenger cars, as shown in **Figure 11**. **Table 1** shows aggregated curb use for each of the study buildings, highlighting dominant uses. The study sites are unique regarding the number of residential units, loading spaces, and other factors discussed in subsequent sections. This affects curb use demand and how the front curb is utilized. During site visits, there were common curb use policies shown in **Figure 8** that were observed. One of these permits paid prolonged parking which explains lengthy dwell times noted from field monitoring. **Figure 9** presents curb use policies that are unique to the curb space along Boren Ave N adjacent to Radius Apartments

For commercial use related to the study buildings, Dimension Apartments was the most notable, with the front curb being primarily used for food deliveries and commercial pick-up/ drop-off. The three parking or loading spaces available at the front curb and other available parking spaces in the vicinity of the building adequately accommodate these curb activities. Alcyone had the highest percentage of retail curb use. The front curb for Alcyone Apartment Building along Thomas Street mostly serves curb users accessing Kati Vegan Thai restaurant. Residents at this building also can use the curb space along Minor Ave N, which is closer to the building entrance. Based on the observed video data, the five vehicle spaces available for Cristalla Condominiums are used for parking to access the downtown core. The only other option that Cristalla

Condominiums residents have for curb activity is 2nd Ave, but the area in front of the building is a tow-away zone dedicated to buses.

Figure 8: Common Curb Use Policies

Figure 9: Curb Use Policies unique to Radius Apartment Building

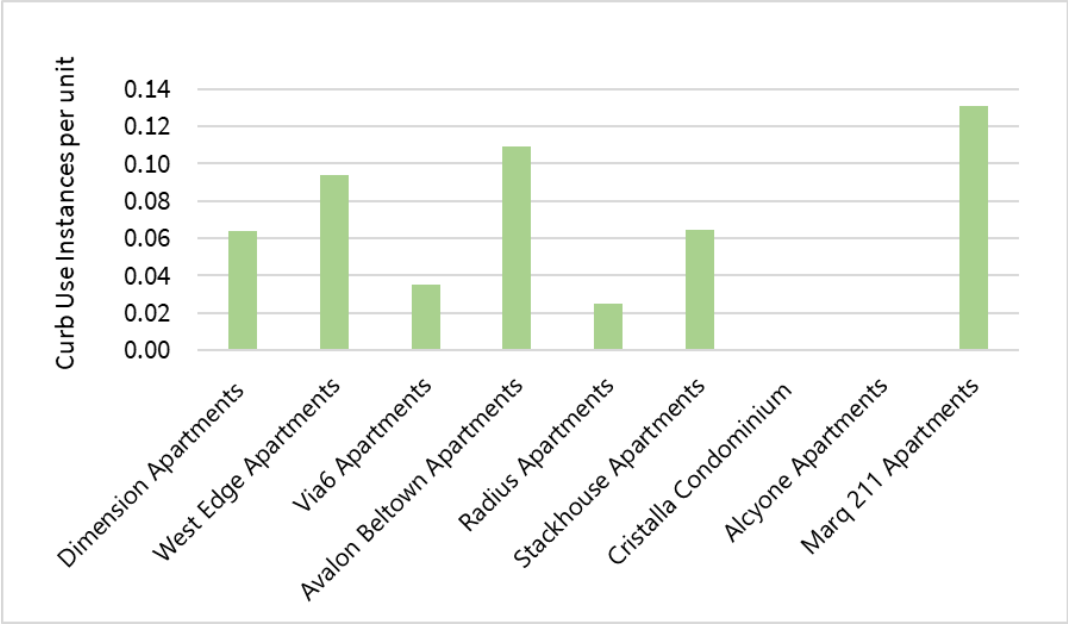
Table 4: Aggregated Curb Use

Residential Building	Commercial use related to building	Ground Floor Retail Use	Other activities related to building	Activity unrelated to building
Dimension Apartments (Downtown Seattle)	**65%**	N/A	33%	2%
West Edge Apartments (Downtown Seattle)	44%	0%	**48%**	8%
Via6 Apartments (Downtown Seattle)	32%	19%	**39%**	10%
Avalon Belltown Apartments (Downtown Seattle)	**60%**	0%	27%	13%
Radius Apartments (South Lake Union)	**32%**	N/A	27%	42%
Stackhouse Apartments (South Lake Union)	**44%**	0%	30%	26%
Cristalla Condominiums (Downtown Seattle)	0%	0%	0%	**100%**
Alcyone Apartments (South Lake Union)	8%	**68%**	16%	8%
Marq 211 Apartments (Downtown Seattle)	**47%**	16%	14%	24%

Source: Fehr & Peers, IDAX Data Solutions, 2021.

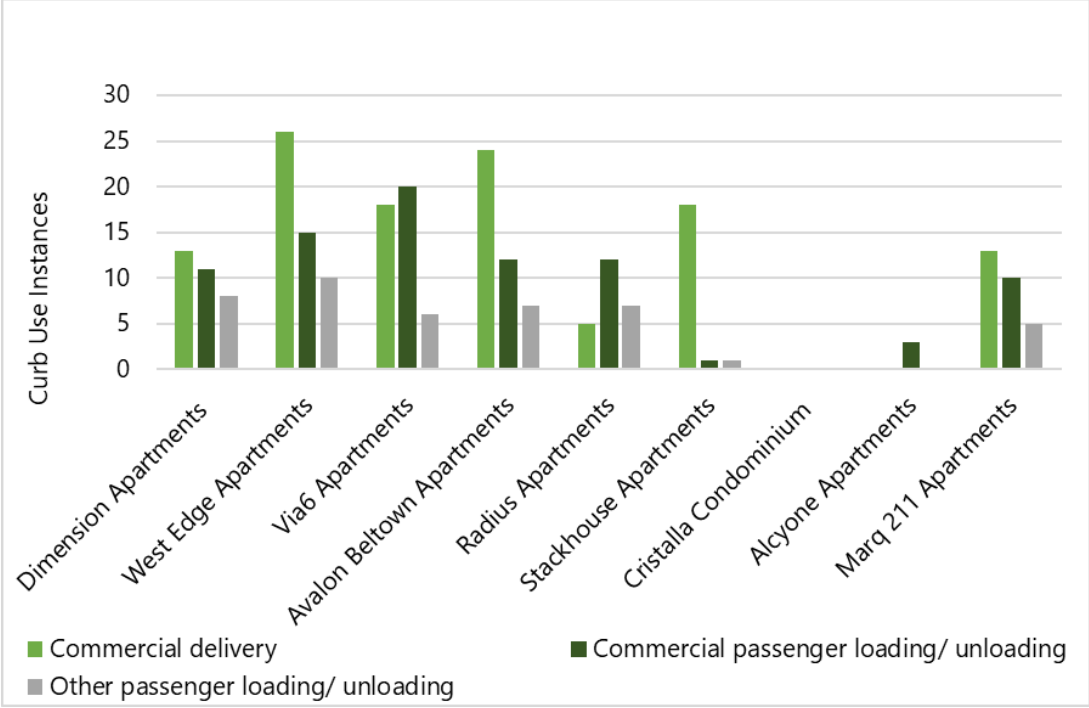
Figure 10 shows the variation in demand for commercial delivery curb use per residential unit, illustrating higher demand for Downtown residential sites compared to the ones in the South Lake Union neighborhood. For the purposes of this study, commercial deliveries include traditional parcel and large item delivery from delivery companies or retail/white glove services as well as commercial deliveries to ground floor retailers and food and parcel deliveries from private vehicles acting as contract delivery drivers. A notable trend shown in **Figure 11** is that the primary passenger car curbspace activity is commercial deliveries at many of the observed buildings. Given the expansion of food delivery and other "instant" delivery services over the past year, it seems likely that this type of curb use will continue to grow unless other delivery options (cargo bikes, sidewalk drones, expanded use of centralized lockers, etc.) gain favor over contract drivers.

Figure 10: Commercial Delivery Demand per unit



Source: Fehr & Peers, IDAX Data Solutions, 2021.

Figure 11: Front Curb Use (Passenger Cars)



Source: Fehr & Peers, IDAX Data Solutions, 2021.

Appendix C: Survey Questions for Building Managers

Move-in/out Operations

1. Number of residential units? Occupied units?
2. Does your apartment building have an alley loading berth for tenants to move in/out? Is this a one-way or two-way alley?
3. When moving do residents use the alley loading berth? Do residents prefer to use the on-street curb loading zone at the building entrance? Why?
4. Does your apartment building have "move-in" rooms to temporarily store tenants' items to limit the time a moving truck occupies the loading dock? Or other on-site moving policies in place to streamline the moving process?
5. When do tenants typically move-in or move-out? (weekends or weekdays? Peak hours, off-peak or nighttime?) Is this scheduled by property management, or can tenants move whenever they want?
6. Who else uses the alley loading berth? (large truck deliveries?) Are there times when the alley loading dock is closed (such as for trash/recycling collection)
7. Do you typically see tenants double parking when moving in/out that cause on-street traffic operation or parking issues? What have you observed?
8. What improvements would you propose to facilitate move-in/move-out operations and why?
9. What do you believe are the most significant obstacles to making these improvements?
10. Any other comments on move-in/move-out operations at your apartment building?

Goods and Parcel Delivery (e.g., Amazon/FedEx)

11. On average how many delivery vehicles arrive per day?
12. On average how many packages do you receive per day?
13. How many units are in your apartment building? How many are occupied?
14. What is the peak time window for package deliveries?
15. Where do delivery vans temporarily park to access your apartment building?
16. For grocery, package, or small goods deliveries, do you see delivery vans doubled parked on the street disrupting traffic flow?

17. Are there sufficient curb space loading zones in the vicinity of your apartment building?
18. Is your preference for temporarily parked delivery vans to use the front-loading zone or the alley loading berth? Why?
19. Are there other on-site restaurant/retail uses that receive deliveries, and where do those vehicles park?
20. Do you enforce or require delivery personnel to adhere to your parking preference?
21. Does your apartment building have door-to-door package delivery service? If yes, who manages it? Or are all deliveries kept in a mail/package room where tenants collect themselves?
22. Are there any other small goods delivery policies in place to streamline the delivery process and limit the number of delivery trucks? (Such as FedEx always arrives at a certain time every day for delivery)
23. Any other comments on how deliveries are operated in your building?

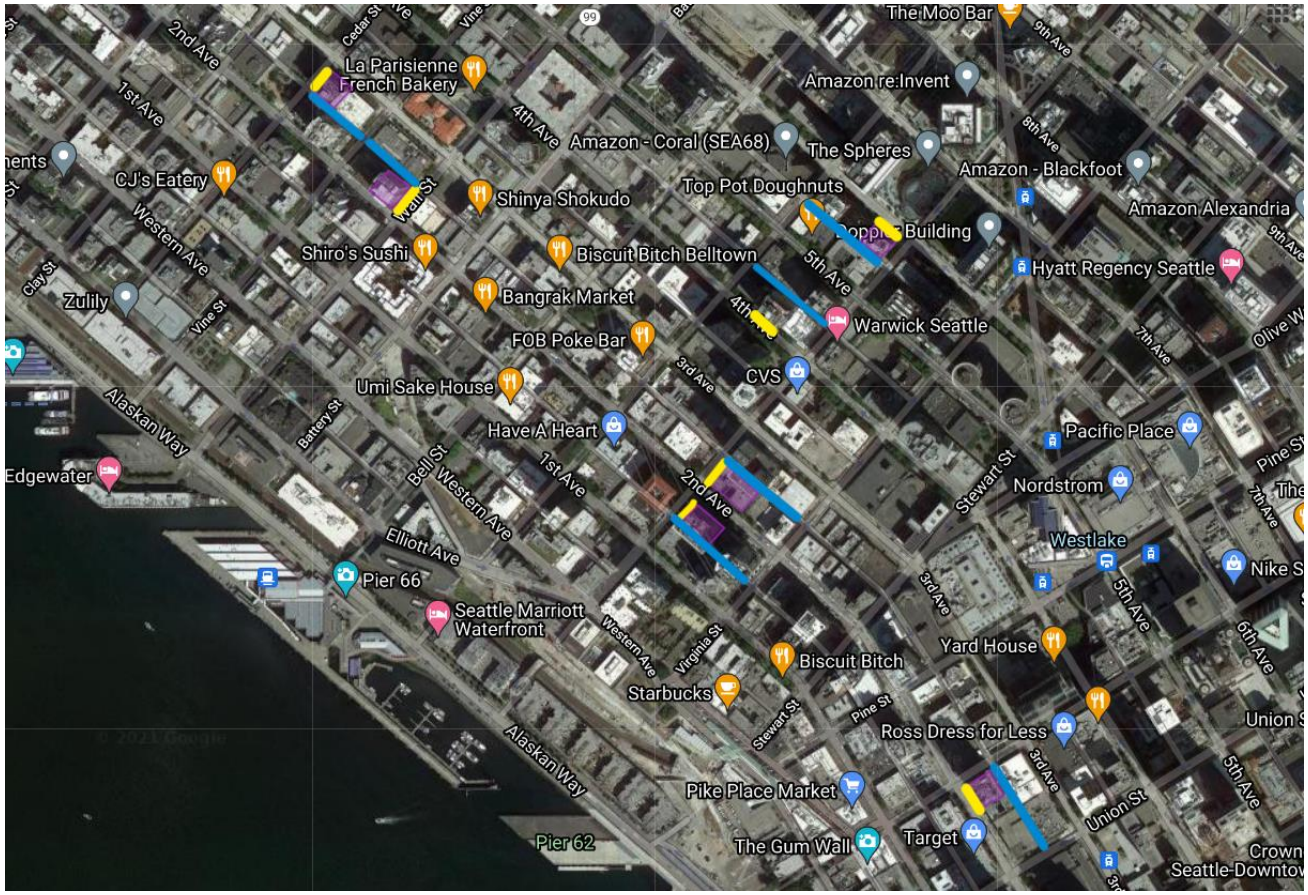
Appendix D: Detailed Information on Study Buildings

Table 5: Study Buildings Data

Residential Building	Year Built	Number of Units	Lot Size (sq. ft.)	Gross Floor Area (sq. ft.)	Ground Floor Retail		Alley Loading Berth
Dimension Apartments (Downtown Seattle)	2014	298	12,719	269,065	–	N/A	✓
West Edge Apartments (Downtown Seattle)	2016	340	18,709	567,403	✓	Kuhl outdoor clothing	✓
Via6 Apartments (Downtown Seattle)	2012	654	25,440	676,169	✓	Rubinstein Bagels	✓
Avalon Belltown Apartments (Downtown Seattle)	2017	275	25,492	397,034	✓	Bartell's Drug Pharmacy	✓
Radius Apartments (South Lake Union)	2014	282	7,080	253,015	–	N/A	✓
Stackhouse Apartments (South Lake Union)	2013	278	21,240	295,432	✓	Cycle Bar	–
Cristalla Condominiums (Downtown Seattle)	2005	195	19,452	^	✓	Winery/ Furniture store	✓
Alcyone Apartments (South Lake Union)	2003	162	35,400	201,197	✓	Kati Vegan Thai Restaurant	–
Marq 211 Apartments (Downtown Seattle)	1999	107	19,440	139,650	✓	Starbucks	✓

Source: King County Department of Assessments, Fehr & Peers.
Notes:
^ Unavailable development data
✓Feature is present
- Feature is not present

Figure 12: Study Sites in Downtown Seattle



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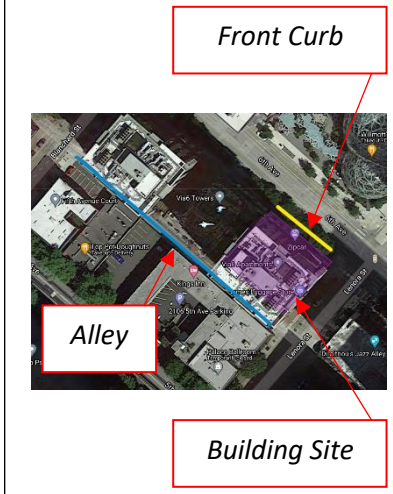


Figure 13: Front curb at Dimension Apartment Building

Figure 14: Alley loading berth at Dimension Apartment Building

Figure 15: Front curb at West Edge Apartment Building

Figure 16: Alley loading berth at West Edge Apartment Building

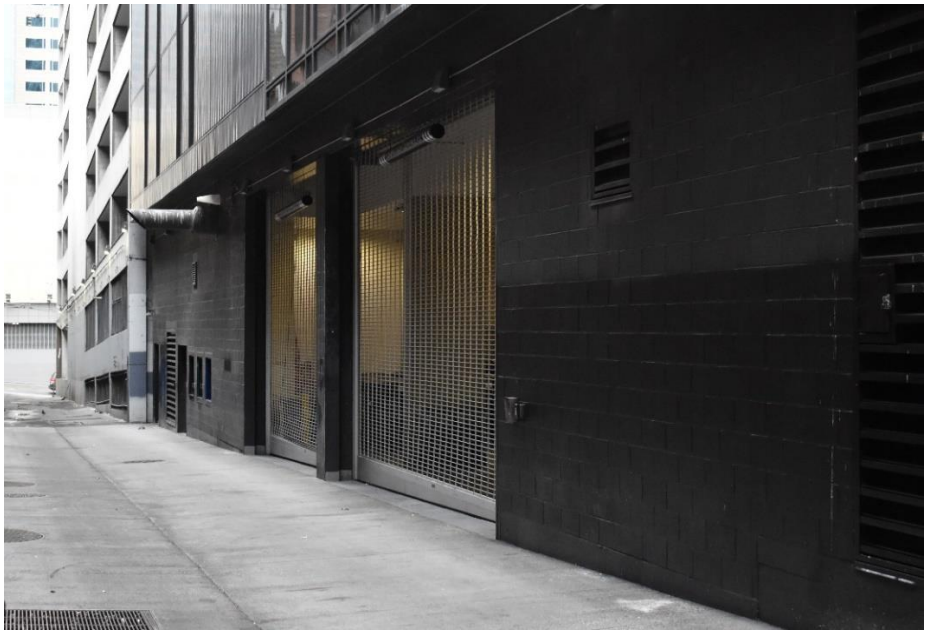


Figure 17: Front curb at Via6 Apartment Building

Figure 18: Alley loading berth at Via6 Apartment Building

Figure 19: Front curb at Avalon Belltown Apartment Building

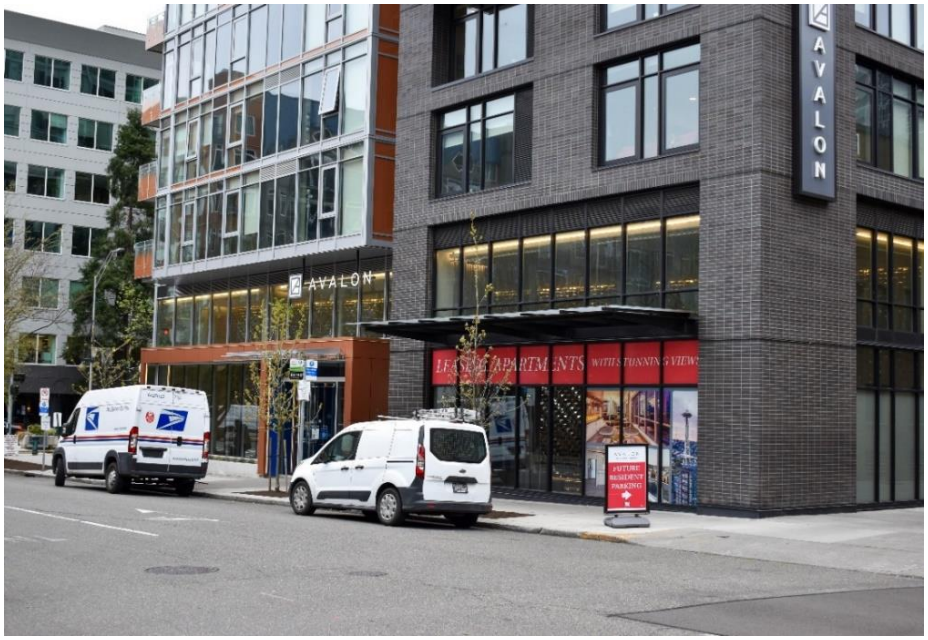


Figure 20: Alley loading berth at Avalon Belltown Apartment Building

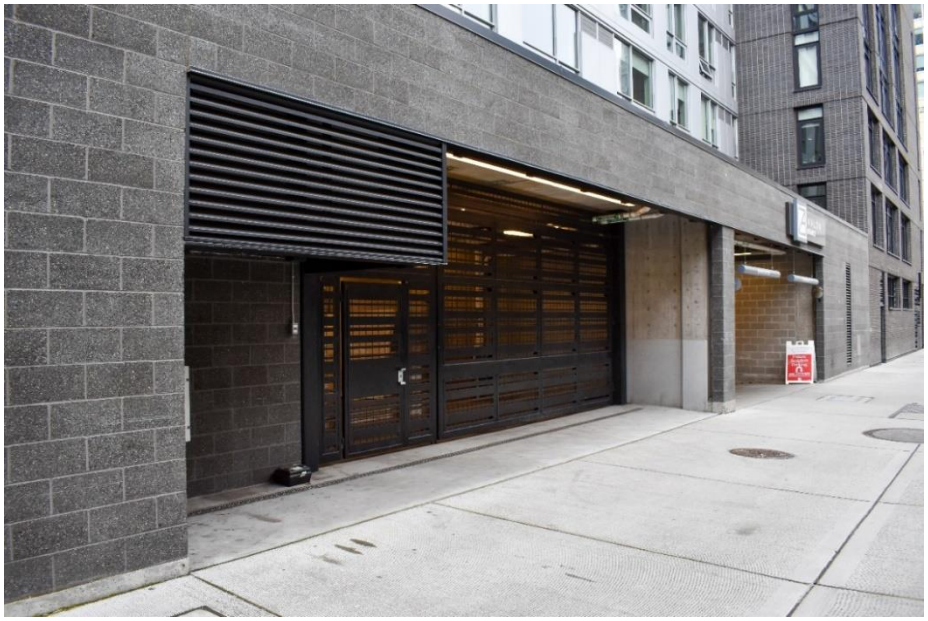


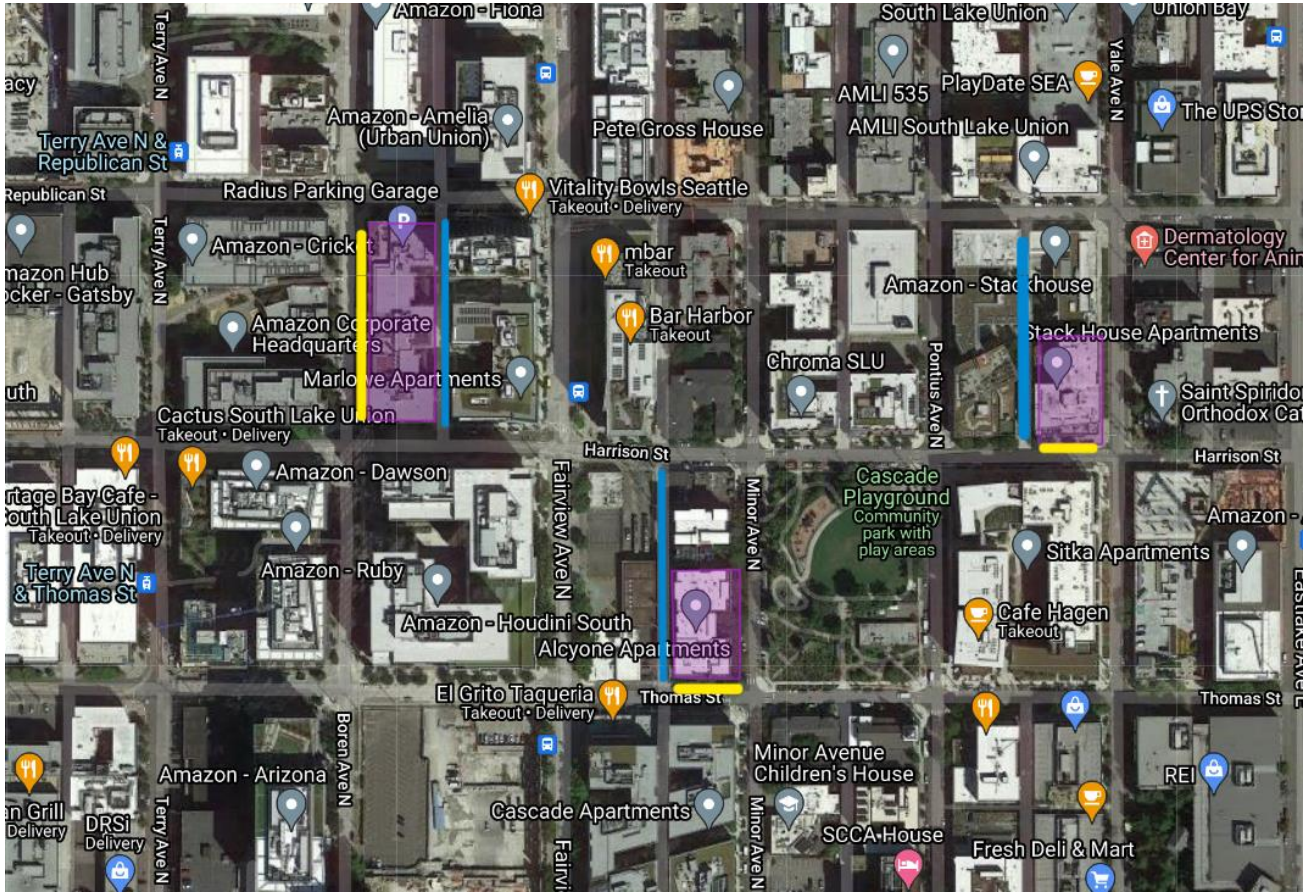
Figure 21: Front curb at Cristalla Condominium

Figure 22: Alley loading berth at Cristalla Condominium

Figure 23: Front curb at Marq 211 Apartments

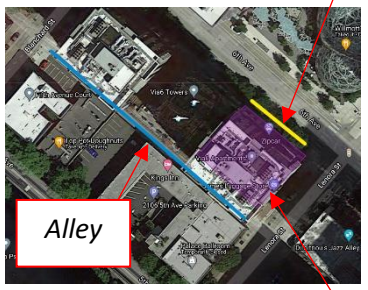
Figure 24: Alley loading berth at Marq 211 Apartments

Figure 25: Study Sites in South Lake Union



Legend

Front Curb



Alley

Building Site

Figure 26: Front curb at Radius Apartment Building

Figure 27: Alley loading berth at Radius Apartment Building

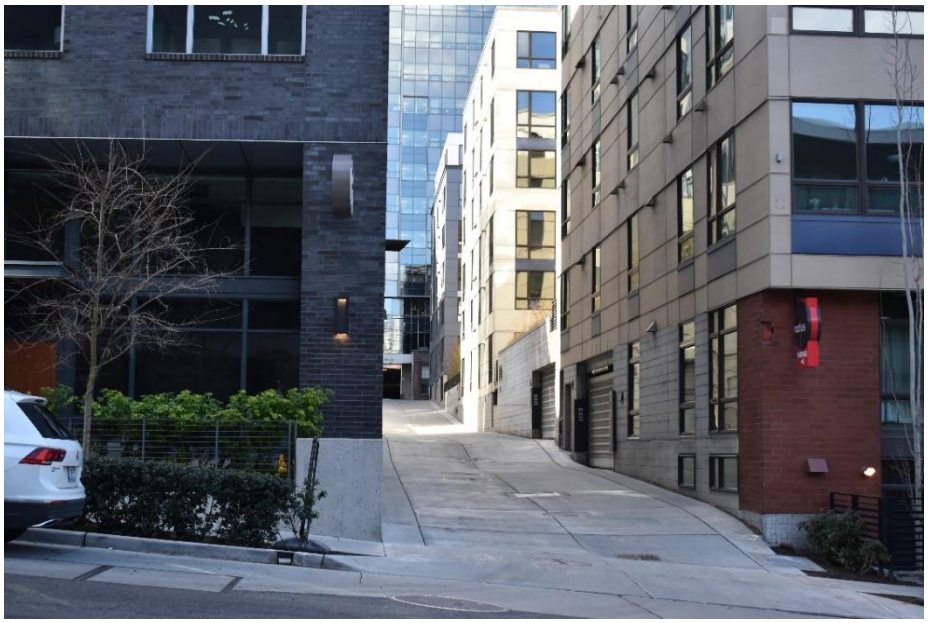
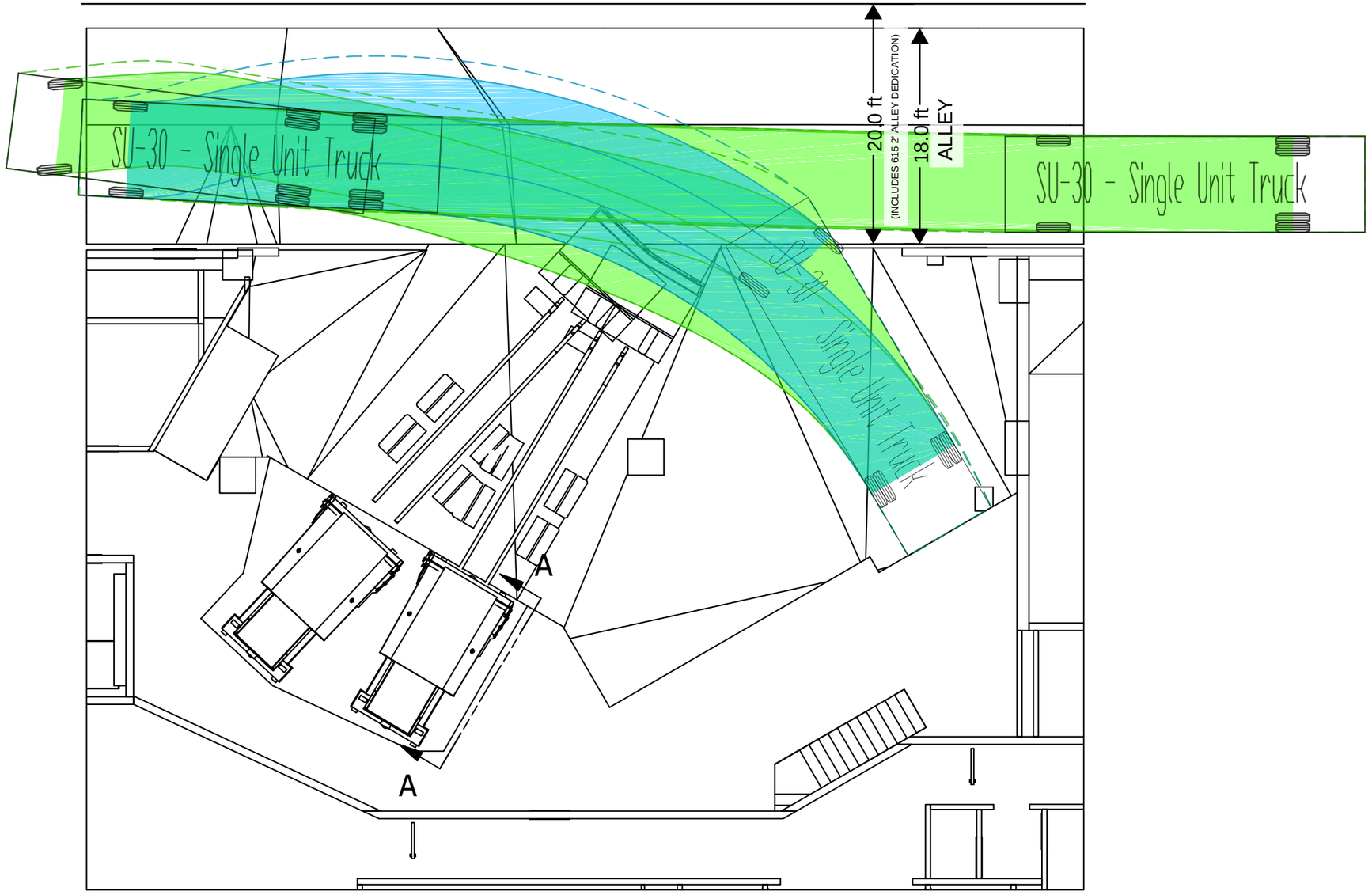


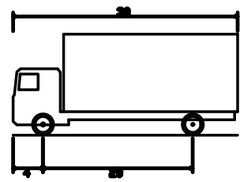
Figure 28: Front curb at Stack House Apartments

Alcyone Apartments

Figure 29: Front curb at Alcyone Apartments

Appendix E: Practical Layout of Off-Street Loading Bays for 601 Dexter Avenue N





SU-30 - Single Unit Truck	
Overall Length	30.000ft
Overall Width	8.000ft
Overall Body Height	13.500ft
Min Body Ground Clearance	1.367ft
Track Width	8.000ft
Lock-to-lock time	5.00s
Max Steering Angle (Virtual)	31.80°

Scale: 1:10

SU-30 Bay 1

Project: **601 Dexter Ave N**

Designed By: **AMS** Date: **03-09-2022**

Project No: **C190025-02** Client:

Checked By: Sheet: **1 of 5**

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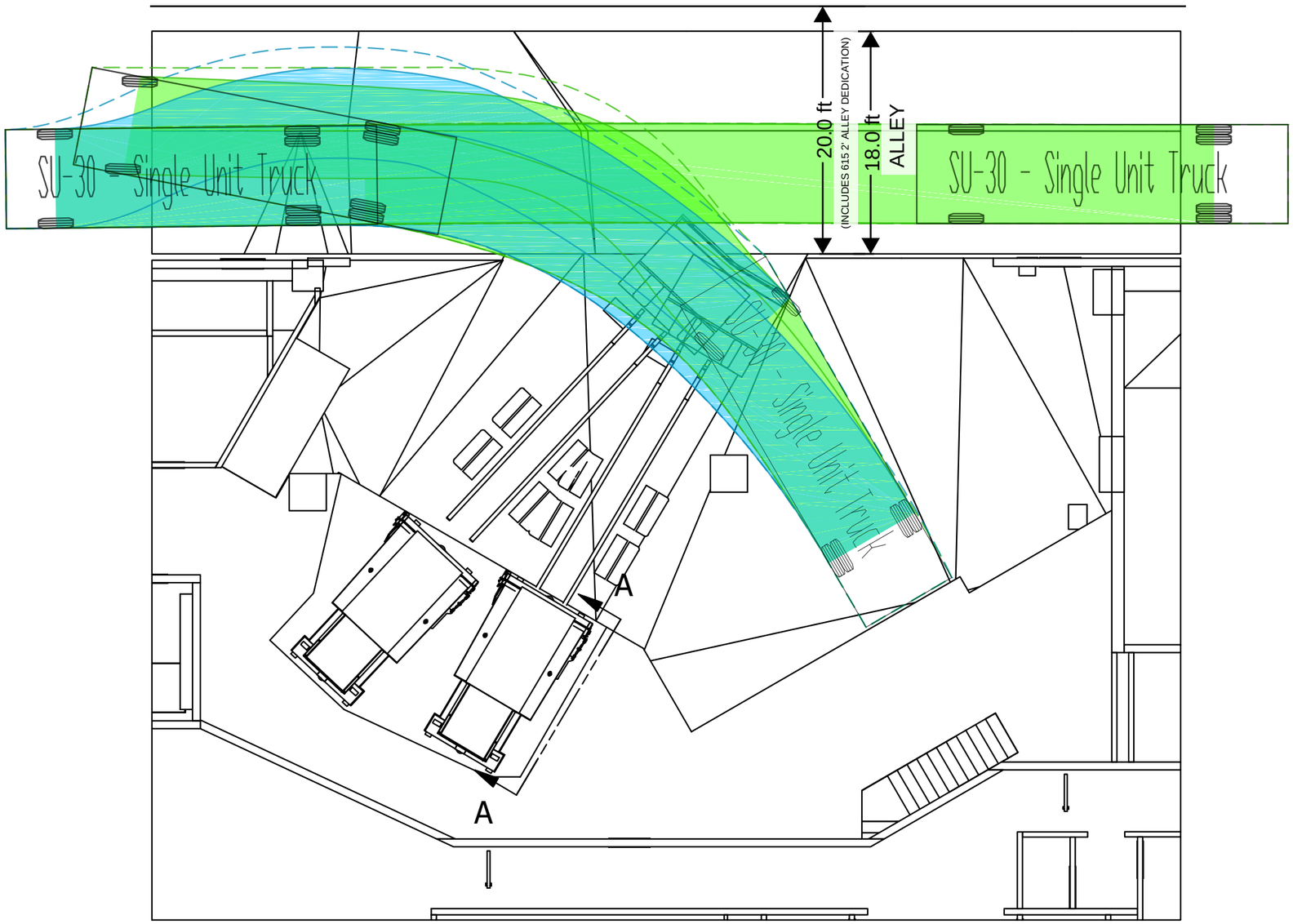

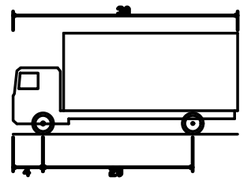

SU-30 - Single Unit Truck	
Overall Length	30.000ft
Overall Width	8.000ft
Overall Body Height	13.500ft
Min Body Ground Clearance	1.367ft
Track Width	8.000ft
Lock-to-lock time	5.00s
Max Steering Angle (Virtual)	31.80°

Scale: 1:10

SU-30 Bay 2

Project: **601 Dexter Ave N**

Designed By: **AMS** Date: **03-09-2022**

Project No: **C190025-02** Client:

Checked By: Sheet: **2 of 5**

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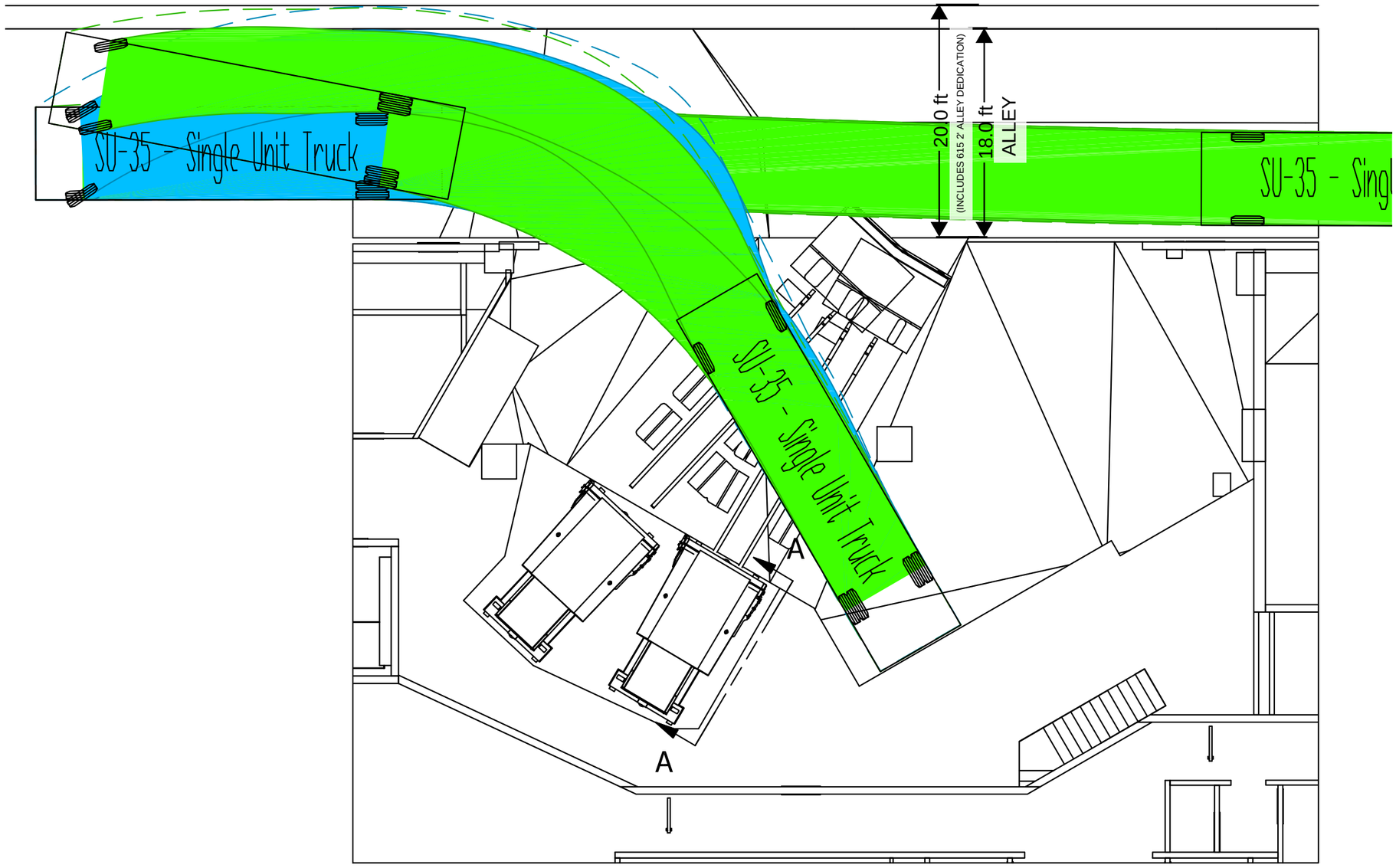
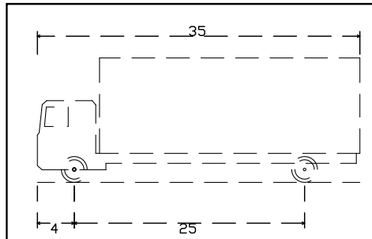
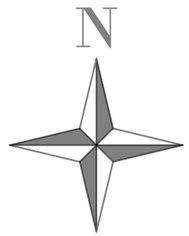




SU-35 - Single Unit Truck	
Overall Length	35.000ft
Overall Width	8.000ft
Overall Body Height	13.500ft
Min Body Ground Clearance	1.367ft
Track Width	8.000ft
Lock-to-lock time	5.00s
Max Steering Angle (Virtual)	31.80°



Scale: 1:10

SU-35 Bay 3

Project: **601 Dexter Ave N**
Designed By: **CAJ** Date: **03-10-2022**
Project No: **C190025-02** Client:
Checked By: Sheet: **3 of 3**

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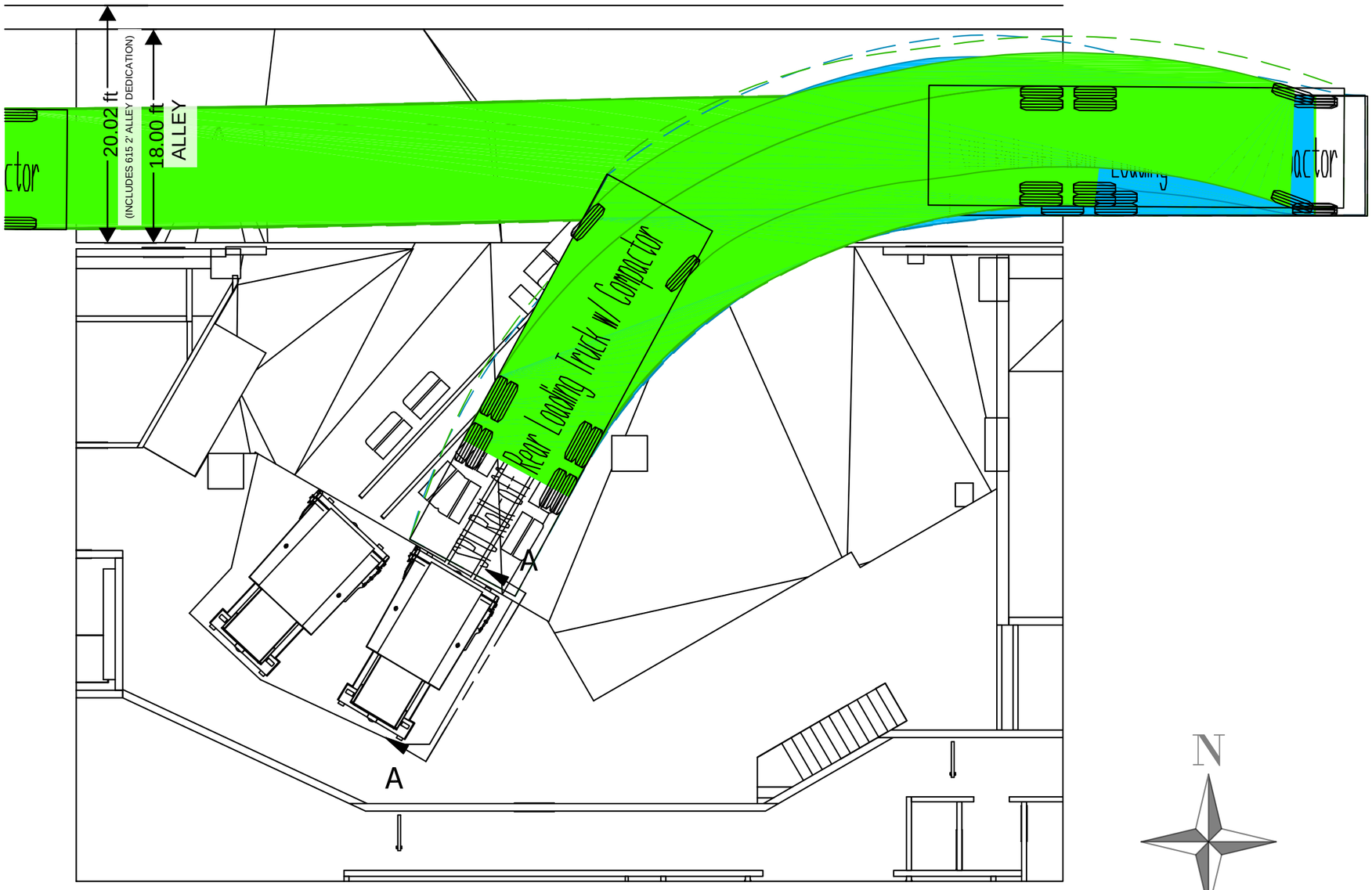

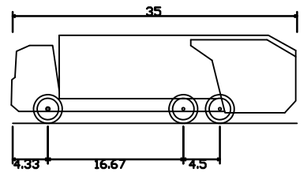

SPU Roll-off Rear Loading Truck w/ Compactor	
Overall Length	35.000ft
Overall Width	10.100ft
Overall Body Height	10.848ft
Min Body Ground Clearance	1.302ft
Track Width	10.100ft
Lock-to-lock time	6.00s
Curb to Curb Turning Radius	35.000ft

Scale: 1:10

SPU Garbage Truck East Bay

Project: **601 Dexter Ave N** Designed By: **CAJ** Date: **03-21-2022**

Project No: **C190025-02** Client: Checked By: Sheet: **1 of 2**

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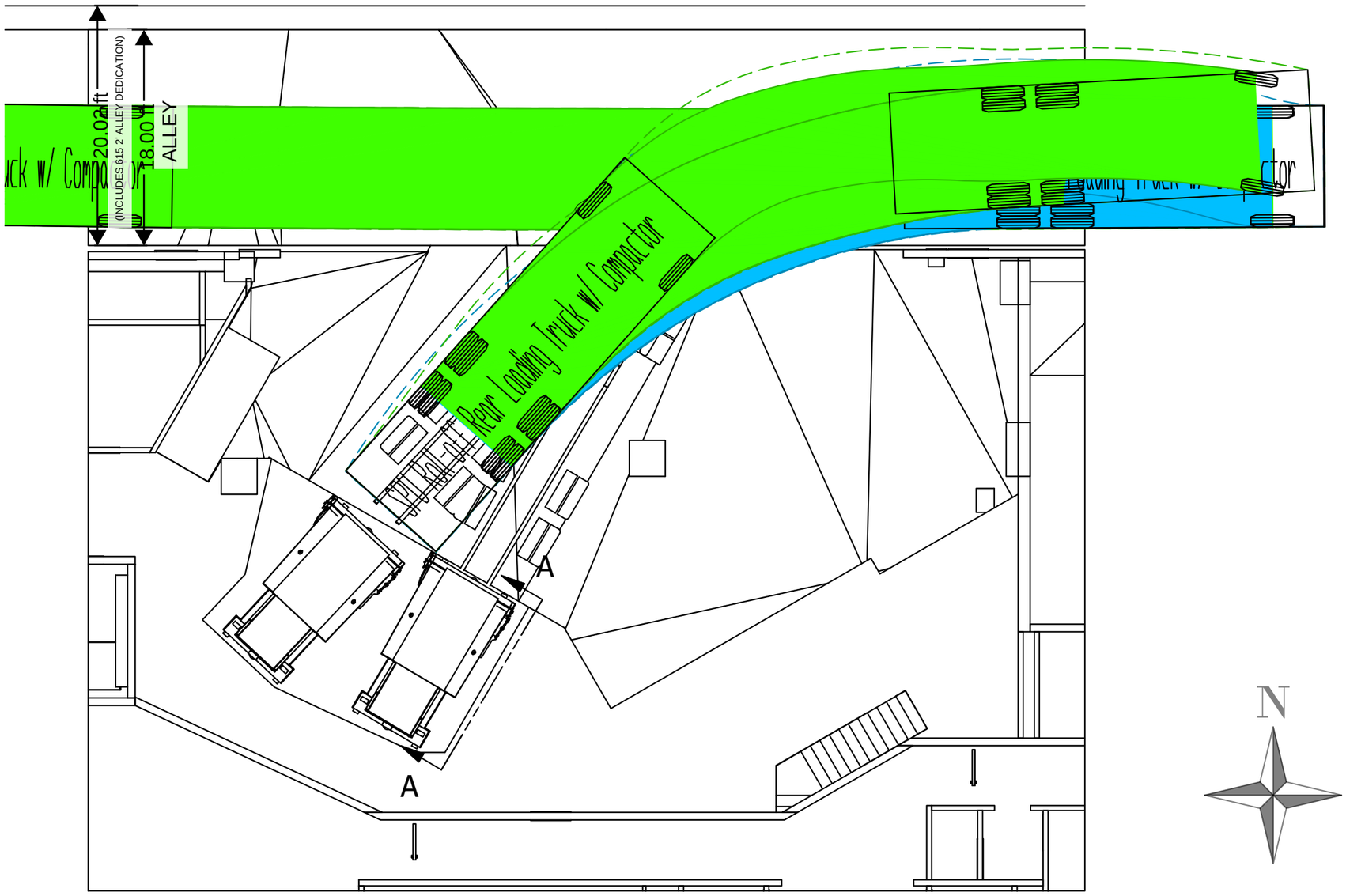

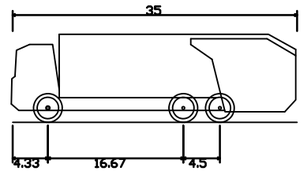

SPU Roll-off Rear Loading Truck w/ Compactor	
Overall Length	35.000ft
Overall Width	10.100ft
Overall Body Height	10.848ft
Min Body Ground Clearance	1.302ft
Track Width	10.100ft
Lock-to-lock time	6.00s
Curb to Curb Turning Radius	35.000ft

N

Scale: 1:10

SPU Garbage Truck West Bay

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