Seattle Center City

ALLEY INFRASTRUCTURE INVENTORY AND OCCUPANCY STUDY 2018

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EXECUTIVE SUMMARY

The research for this report was undertaken by the Urban Freight Lab (UFL) in the Supply Chain Transportation and Logistics Center at the University of Washington, to support the Seattle Department of Transportation's (SDOT's) management of the Center City area alley system to keep up with growing demand for commercial vehicle load/unload space. For this Final 50' project (one of a suite of research projects investigating delivery activities in urban centers) SDOT commissioned the UFL to conduct a very detailed survey of Center City's alley infrastructure, and an occupancy study of select alleys to document the parking behavior of delivery, service, and other vehicles in alleys.

Based on the UFL research team's expertise and discussions with other city transportation professionals in the U.S., Seattle is the first city in the U.S. and the E.U. to comprehensively map the Center City area's commercial vehicle load/unload space network: including its alleys. By commissioning the UFL to GIS map and measure every element of the load/unload space network, SDOT has created a new knowledge base that is fundamental for planning; managing parking operations; emergency management and response; updating traffic, land use and building codes; and modeling future scenarios and needs.

The alley studies described in this report are a pioneering and necessary step for many cities to strategically manage their load/unload space network. Seattle, like other growing cities in the age of e-commerce and ride-hailing services, is experiencing much greater demand on the three elements that combine to form the urban commercial vehicle load/unload network:

- Alleys,
- Curbs,
- Private loading bays and docks beneath or ancillary to buildings.

Very few cities have curb space allocation data or documentation of loading/parking signage in any systematic, digitized format. A step ahead of many, in 2016 Seattle's geospatial databases included one part of the truck load/unload network: curb parking spaces, such as Commercial Vehicle Load Zones (CVLZs), metered parking, and Passenger Load Zones. [1]

This alley inventory contains the final installment of Seattle's load-and-unload-space mapping effort: a complete GIS database of the 417 alleys in the Center City area. UFL researchers have produced both an accurate GIS map of the Center City area alley network's geospatial location, and measurements of the physical (truck-related) attributes. These attributes directly impact alley operations and functionality. Until now, the only alley-related map the city has had to work with was a countywide GIS database that King County maintains but does not regularly update. This alley inventory project recorded 70 new alleys that were not in the countywide database and provided up-to-date information leading to the removal of 26 alleys that no longer exist.

The report also studied commercial and passenger vehicle occupancy of representative Center City area alleys to better understand the current use and operational capacity of the alley system.

Finally, the report includes two step-by-step toolkits that Seattle and other cities may use to capture and/or update alley information. The first tool explains how to conduct an inventory of alley infrastructure that includes truck-relevant features; the second outlines how to execute an alley occupancy study. (Please see Appendix A and Appendix E.) These tools, when added to others created in the UFL's prior Final 50' research, make up a tool kit that any city may use to replicate the work done in Seattle. The UFL plans to continue to add elements to the Final 50' online took kit as it completes additional research in the future.

SDOT and the research team purposefully chose which truck-related features to include in the alley inventory after consulting with both UFL members who deliver goods (such as Charlie's Produce, UPS, and USPS) and with other city agencies (such as police, fire, and public utilities) that regularly use alleys. For security purposes, the police need to know where alley entrances to buildings are located; the fire department must navigate large trucks through alleys; and utility infrastructure is frequently located in alleys. The UFL's current private sector members are Charlie's Produce, Expeditors International of Washington, the Ford Motor Company, Kroger, Nordstrom, UPS, and USPS.

The Center City area in this report comprises five designated urban centers: Downtown, Uptown, South Lake Union, Capitol Hill, and First Hill, as shown in Figure 1 below.

In its alleys, Seattle is fortunate to have an additional parking resource that not all cities have. For many

Figure 1. Five Designated Center City Area Urban Centers Included in Alley Inventory Study

years, Seattle's Center City area alleys have provided an invaluable back door to the city's buildings; this report documents that about 40 percent of these city blocks have an alley. Alleys are designed to provide access for delivery, service, and emergency vehicles to truck loading bays and docks as well as businesses' rear doors in abutting properties. [2] In Seattle, garbage trucks also pick up waste and recyclables that are stored in dumpsters and smaller receptacles in alleys.

Why is this study critical now?

Overall demand for load/unload space in Center City is increasing while the number of spaces along some curbs is being reduced to provide new through lanes for transit and bicycles.

The city is growing denser, and the number of delivery and service trucks needed to serve a 60-story tower from its adjacent alley is much greater (on average) than the number needed for a four-story building. The city is becoming aware of alley congestion, especially when the fixed alley space limitations documented in this report have resulted in conflicts between competing users. And, as this study documents, the mix of competing alley users is expanding. 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.

Meanwhile, Seattle faces both urgent- and longer-term pressures to better manage alleys as part of the full load/unload network. **In the fall of 2018 and winter of 2019, a convergence of mega construction and transit projects in Center City will greatly constrict traffic and create what is being called "the period of maximum constraint."** Although not all cities are facing the build-out of multiple mega projects in the next few years, all growing major cities are dealing with the same net result: dramatically rising congestion.

Seattle's mega projects include the closure of the Alaskan Way Viaduct and its replacement with the tolled Alaskan Way Tunnel; the expansion of the Washington Convention Center along I-5; and the diversion of all buses from the Sound Transit tunnel onto city streets to make way for more frequent trains. The "period of maximum constraint" is expected to last five or more years, making it more urgent than ever to identify and test sound recommendations on how Seattle can improve the goods delivery system and avoid gridlock. Already, the City of Seattle has ranked as the sixth most congested city in North America, and the fourth in the U.S. behind Los Angeles, San Francisco and New York, according to the 2016 TOMTOM Traffic Index. Seattle also ranked sixth among U.S. cities with the largest numeric population increase from July 1, 2016 to July 1, 2017, adding 17,490 people for a total population of 724,745 in 2017, according to the U.S. Census Bureau. [2] SDOT owns most alleys but, to date, has not had a management program for them. Given Seattle's growth and growing density, the following findings and recommendations support SDOT's goal of managing its unload/load spaces as a coordinated network.

The first key finding of this study is that more than 90% of Center City alleys 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.

Seattle Mayor Jenny Durkan

"....as we build our future city, these mega projects often will lead to mega gridlock. Our bad traffic is going to get a lot worse.

It's time to do things differently. We can reinvent our approach to transportation while also reducing carbon pollution. We have an awesome chance to realize a vision for a more vibrant and accessible downtown. We can build this future with fewer cars, more transit, and less pollution.

Achieving that vision will not be easy. We must make hard, smart decisions about how we move residents, commuters, and freight in and out of our city." –

April 6, 2018: "A Vision for a More Vibrant Downtown with Fewer Cars, More Transit, and Less Pollution"[2]

When informed by the second key finding—68% 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.

The study surfaces four additional key findings:

1. **87% of all vehicles in the 7 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 don't block others.

2. **15 percent of alleys' pavement condition is so poor that delivery workers can't pass through with loaded hand carts.** Although trucks can drive over fairly uneven pavement without difficulty, it is not the case for delivery people walking with fully loaded handcarts. The alley pavement rating was done with a qualitative visual inspection to identify obvious problems; more detailed measurements would be needed to fully assess conditions.

3. **73% 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.

4. **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.

These findings indicate that, due to the fixed alley width constraint, load/unload space inside Seattle's existing Center City area alleys is insufficient to meet additional future demand.

RECOMMENDATIONS

Given these findings, the study offers SDOT the following recommendations:

1. **Conduct a one-year pilot test** to inform long-term policy solutions, focusing on developing and testing innovative strategies to keep vehicles moving quickly through alleys, and making longer-term parking available at the curb. The pilot test(s) would combine:

   - 1**5-minute load/unload zones** in high-use alleys; 30-minute load/unload zone in other alleys as per current code. Notably, 68% of vehicles in the alley occupancy study were parked 15 minutes or less.

   - **30-plus minute parking for trucks at the curb** where they don't block other delivery vehicles.

This pilot would aim to quantify and evaluate whether overall alley and curb space (load/unload network) productivity can increase if spaces are managed by length of time parked rather than by type of vehicle.

The research team also contemplated recommending a pilot of late-night delivery strategies or late-night garbage pick-up with noise-reducing equipment. But UFL members provided critical feedback that the real-life application of this approach would prove problematic given constraints around factors such as labor contracts and tight air-freight schedules. Moving vehicles out of alleys more quickly is thought to be a more powerful and practical strategy.

In the short to mid-term, SDOT could also consider policies to:

2. **Encourage use of and/or development of new building and load/unload equipment designs** to get vehicles out of the alley and into adjacent loading bays quickly.

3. **Require building developers/managers to provide trash compactors** in alleys and alley loading bays to reduce garbage pick-up from five days a week to once a week.

4. **Foster building managers' interest in adjacent alleys**, perhaps akin to the city's existing Block Watch program. Researchers observed that when proximate building managers demonstrate ownership of an alley (regardless of whether it is legally their property) they actively manage the alley by:
   - Enforcing rules to ensure intended use
   - Providing security cameras and/or staff
   - Placing speed bumps to slow traffic
   - Getting pavement improvements done
   - Placing clear signage to direct use

5. **Revise alley design standards for future development so that Center City area alleys provide:**
   - Loading bays with entrances that angle in the correct direction for alley flow
   - Sufficient space for trucks to fully extend equipment
   - Smooth-enough pavement for hand trucks in load/unload area
   - Space for trash/recycle containers to be stored out of travel lanes
   - Sufficient height for garbage trucks to complete overhead lift

6. **Create communication systems with alley users to maximize efficiency of alley use by:**

   - Assembling a database of delivery companies that frequently use alleys to communicate with them ongoing to better manage individual alley use.

   - Inviting delivery firms, retailers, building owners and managers, and other users of the full Center City area load/unload network to join a city 'Delivery Alert' database, and send push updates as needed to keep them informed.

   - To cut parking-seeking behavior and lower fuel use, develop data applications to collect, correct, store, and analyze occupancy sensor data from alley and other load/unload spaces in the Center City area and return information to users on a web-based and/or mobile platform to inform real-time decisions. This will make vacant and soon-to-be-vacant load/unload space visible to the public, freight dispatchers, and city officials.

Seattle has an exciting and timely opportunity to leverage this study's findings to strategically manage alleys as part of its entire Center City load/unload network.

SECTION 1

ALLEY INVENTORY

SECTION 1: ALLEY INVENTORY

The Seattle Department of Transportation (SDOT) recognizes the important role alleys play in the transportation system and the City Center load/unload network. But until now the city has lacked accurate, up-to-date, detailed information on Center City area alley locations and relevant alley attributes that could inhibit commercial vehicle travel, such as each alley's width and any obstructions. The only previously existing tool, a King County GIS shapefile of countywide alleys, was limited and out of date, leaving the city without a firm knowledge base from which to strategically manage its alley system.

To rectify this situation, the Seattle Department of Transportation (SDOT) commissioned the Urban Freight Lab (UFL) at the University of Washington to produce an up-to-date GIS map of all alleys in the Center City area and to measure and record the alleys' truck-related features. To the research team's knowledge, this SDOT effort has resulted in the creation of the nation's first comprehensive alley inventory for commercial vehicle use in a U.S. city.

It is important to note that the truck-related alley features measured in this study were chosen not only in consultation with the UFL (whose members are leading retail, logistics and delivery firms) and SDOT. SDOT and the researchers also consulted with the Seattle Police and Fire Departments, and Seattle Public Utilities as they also rely on the alley network. These agencies depend on alleys to provide unencumbered access to buildings in congested urban environments, and to respond to emergencies and maintain security. For example, the research team documented in the alley inventory the presence of all fixed overhead obstructions that were up to 16 feet high (such as trees, fire escapes, or wires) because they could be low enough to impede emergency vehicles. Thanks to the broad agency consultation, the inventory and key findings discussed in this section have applications for a wide range of alley and load/unload network users in the city.

In fact, the alley inventory effort resulted in the mapping of 70 new, previously unrecorded alleys and the removal of 26 alleys that no longer exist. Such information is clearly important to commercial delivery and service vehicle drivers, as well as those responsible for emergency operations. As the city's built environment continues to rapidly change, it is important to regularly update the Center City area's alley inventory.

When the research team set about designing the alley inventory study, they realized that no clear alley typology related to truck size existed in the literature and that the City of Seattle did not have a detailed enough definition of an alley for the study's purposes. As this is true in many major cities, the development of an alley classification system based on alleys' varying design features and functionalities that matter for trucks represents a significant contribution to the field. To conduct the alley inventory, researchers created a new, useful survey app for field work. They trained 30 data collectors to use the app, and managed their work as they collected data in every alley in center city. Over three weeks in January 2018, the data collectors walked 941 city blocks to GIS map and collect data on the 417 alleys in Center City.

This section includes three key findings from the inventory study. The first finding in particular has broad implications for understanding Center City area alley capacity and functionality: <u>The vast majority of Center City area alleys are one-lane wide, limiting parking per alley to one-to-two commercial vehicles at a time</u>. This finding also has clear implications for decisions about how to most effectively manage the entire Center City area load/unload network.

The inventory study also found that:

- 15% of alleys have poor pavement condition for delivery people using hand carts, and
- 73% of alleys contain entrances to passenger parking facilities.

In this section researchers explain the inventory research process, which included creating an alley typology to categorize different alley configurations and functionalities and the different ways alleys connect to the street network. This work is critical to understanding the alley network because alleys do not function in isolation; rather they are one element of the Center City area's broader load/unload network. Cities and other parties interested in the details of how to conduct the alley inventory study may find a step-by-step guide in Appendix A.
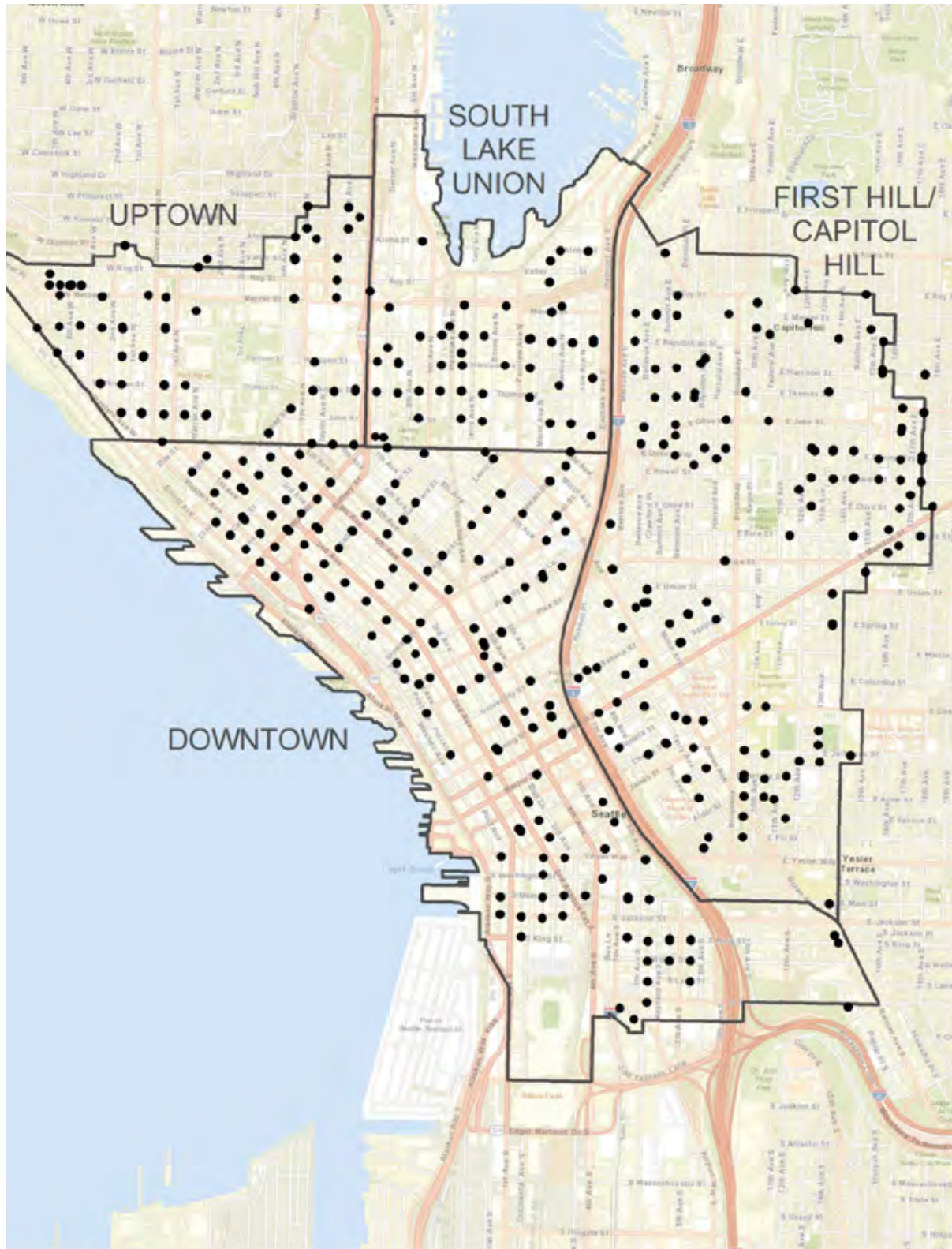
ALLEY INVENTORY STUDY

Figure 1-1. Center City Area's Five Designated Urban Centers Included in Alley Inventory Study
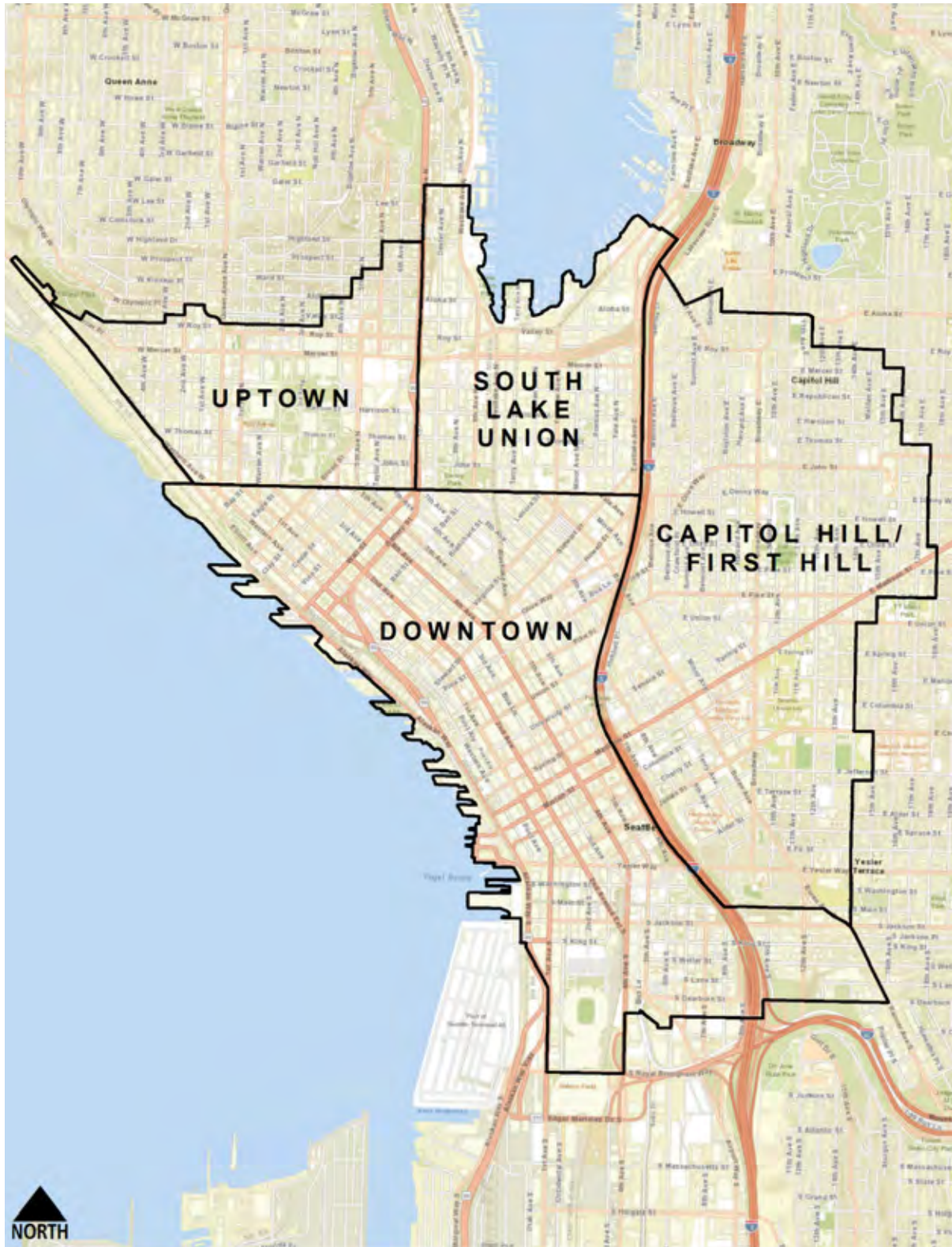
Figure 1-2. Map of Center City area alleys surveyed: Dots represent the alley end point.

Note: Map scale forces dots to overlap, so not all 417 alley end points are discernible.

Inventory: Three Key Findings

1. **The vast majority of alleys in the Center City area are just one-lane wide.**

2. **15% of Center City area alleys have poor pavement conditions for loaded handcarts.**

3. **73% of Center City area alleys contain entrances to passenger parking facilities**

1. The vast majority of alleys in the Center City area are just one-lane wide.

The vast majority of Center City area alleys are constricted to one lane for trucks, cargo and service vans. This limits parking per alley to one-to-two commercial vehicles at a time.

The alley infrastructure survey documented that more than 90% of all Center City area alleys are only wide enough to accommodate a single lane for commercial vehicles. As shown in Figure 3, the study found that:

- More than 90% of Center City area alleys are 19 feet wide or less.
- More than 36% of Center City area alleys are 15 feet wide or less.

As box trucks are 9 feet wide (excluding mirrors) and delivery vans are typically 8.8 feet wide, alleys up to 19-feet-wide provide only one lane for commercial vehicle use.

This fact is critically important to measuring the load/unload capacity of the city's alleys. When a truck, car or van parks in a one-lane alley, it blocks all other trucks from loading/unloading there unless they back into the alley to park, or back out of the alley to exit. Backing into street traffic and backing up into alleys are both prohibited by the Seattle Municipal code for safety reasons. [4]

Figure 1-3 illustrates both the end widths and the narrowest widths of alleys. As Figure 1-3 shows, horizontal restrictions inside the alley can further reduce the alley's overall capacity. On average, within-alley restrictions reduced alley travel width by 0.6 feet; in 13 alleys, they reduced alley travel width by more than one foot.

Figure 1-3. Alley End Widths and Narrowest Widths: Delivery Drivers May Choose Not to Park in An Alley When They See Another Vehicle Will Block Their Exit

*Figure represents 408 of 417 total alleys because nine alleys were missing some alley length values.
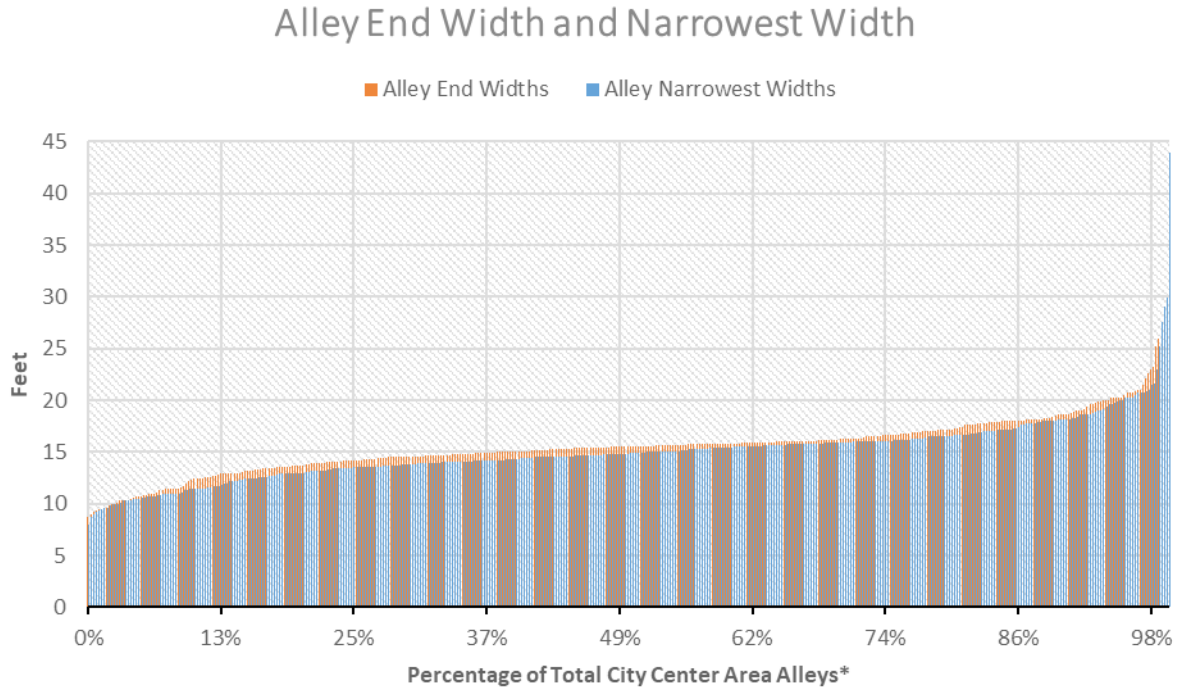
Figure 1-4. Alley Inventory Reveals Wide Alleys Like This Are Scarce

2. **15 percent of alleys' pavement condition is so poor that delivery workers can't pass through with loaded hand carts.**

Although trucks can drive over fairly uneven pavement without difficulty, it is not the case for delivery people walking with fully loaded handcarts. Data collectors were trained to recognize signs of poor pavement quality, which included potholes, places where pavement was settling or faulting, and places where utility vaults were not flush with the surrounding pavement.

Based on these parameters, the data collectors were asked to qualitatively evaluate pavement quality as "good" or "poor." In total, as shown in Figure 1-5, in their visual inspections 15% of the alleys were deemed by data collectors to have poor pavement quality. The alley pavement rating was done with a visual inspection to identify obvious problems; more detailed measurements would be needed to fully assess conditions. As shown in Figure 1-13, there appeared to be no geographic pattern to the location of these alleys.
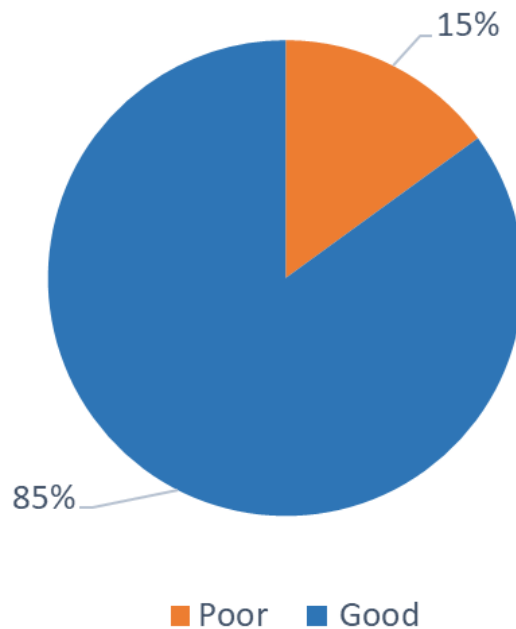
In addition to documenting pavement quality, data collectors also documented pavement type, based on what material covered most of the alley surface. As shown in Figure 1-6, concrete made up the biggest share of alley surfaces (with just over half the alleys), followed by asphalt (with just over one-third of alleys).

Figure 1-5. Alley Pavement Condition

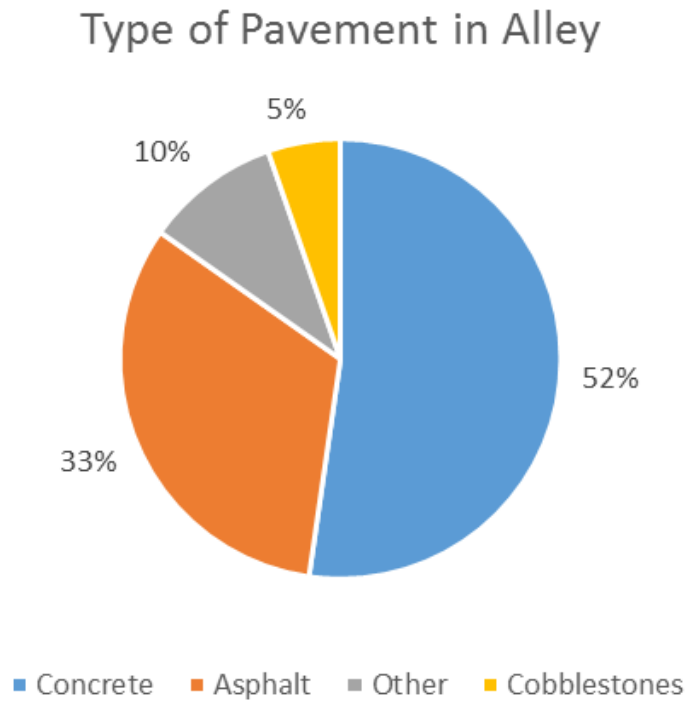## Condition of Pavement in Alley

15%

85%

■ Poor   ■ Good

Figure 1-6. Alley Pavement Type

Type of Pavement in Alley

Concrete 52%
Asphalt 33%
Other 10%
Cobblestones 5%
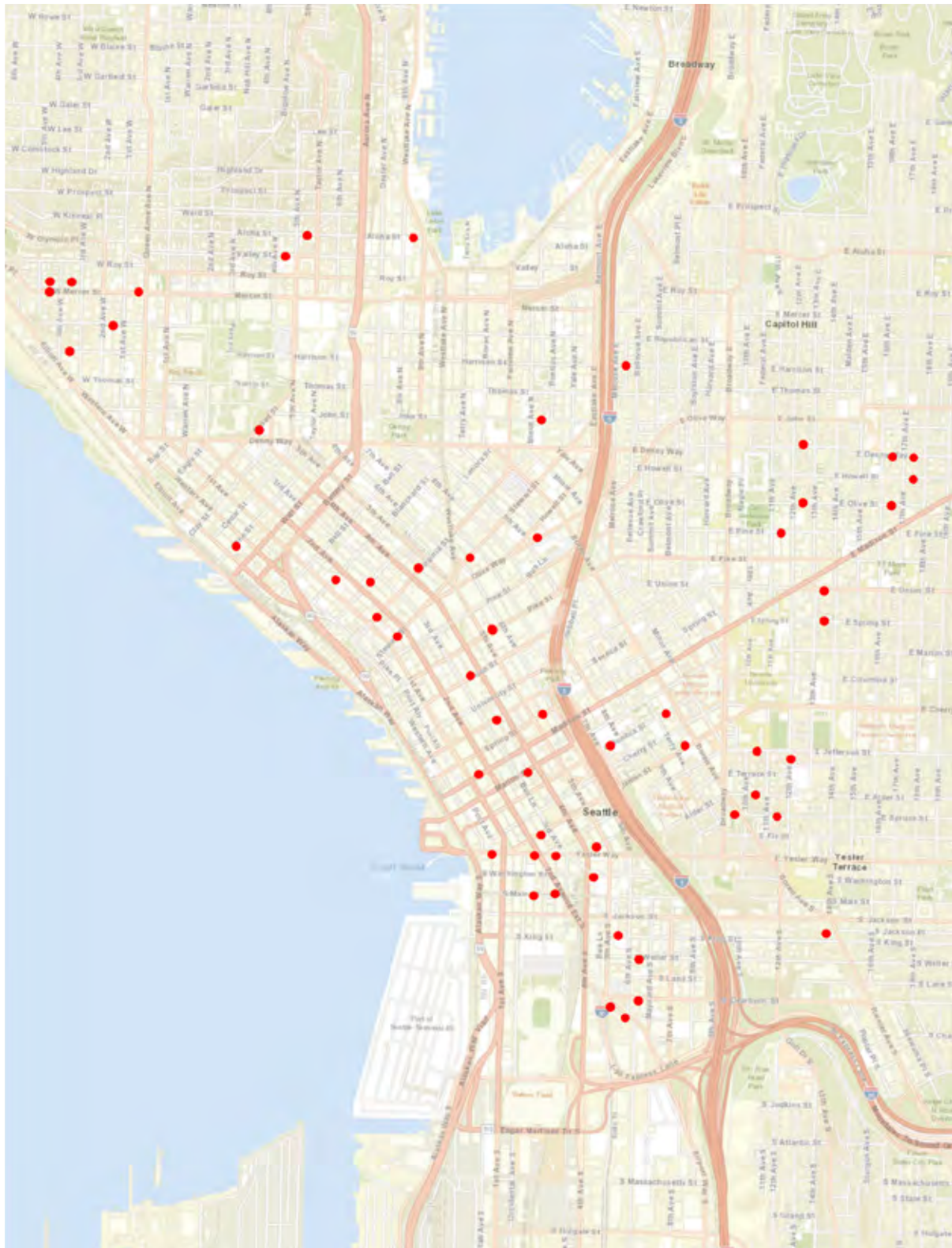
■ Concrete ■ Asphalt ■ Other ■ Cobblestones

Figures 1-7, 1-8, 1-9, 1-10. Examples of Center City Area Alleys with Poor Pavement Condition for Loaded Handcarts

Figures 1-8, 1-9, 1-10.

Figure 1-11. Locations of Center City Area Alleys With "Poor" Pavement Conditions for Loaded Handcarts

3. 73% of Center City area alleys contain entrances to passenger parking facilities.

Data collectors recorded all parking facility access points in each alley. Of 417 Center City area alleys, 311 alleys contain entrances to passenger parking facilities. This within-alley passenger parking access suggests increased frequency of vehicle entry/exit and added demands on alley use.

The common parking facility types found were underground garages, covered surface-level garages, and open-air surface parking lots. The covered facilities often had more than one access point in an alley, such as a separate entrance and exit. A total of 767 parking facility access points across 311 alleys were recorded.

Data collectors also recorded all the freight loading bays and docks inside each alley. About 33% of alleys served at least one freight loading bay or dock. Of those, 75% also contained at least one parking facility access point. In other words, about 25% of the 417 surveyed alleys contain both a freight facility and a passenger parking facility access point. This suggests a confluence of potentially competing users in these alleys.

Figure 1-12. 75% of Center City Area Alleys Contain Entrances to At Least One Passenger Parking Facility
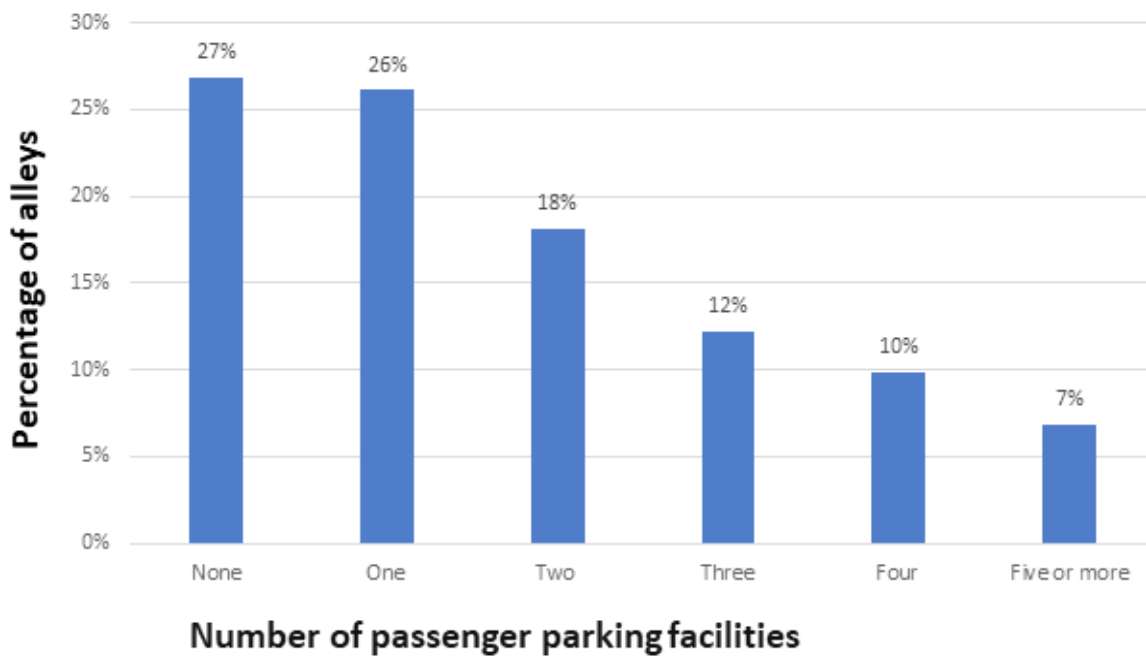
In some cases, albeit rarer, data collectors identified a private building entrance for people, not vehicles, located inside an alley. Of the 417 alleys surveyed, 29 contained one private building entrance. A good example of private building entrances from alleys are in Post Alley, near Pike Place Market in downtown Seattle.

Additional Information

Are one-way alleys a practical solution?

Given that the clear majority of Center City area alleys are essentially one-lane-only, data collectors looked for any signage that identified the alley as restricted to one-way travel. They found that only 5% of all Center City area alleys are officially marked one-way. Nearly 95% of the alleys are not specifically signed as one-way, meaning vehicles are free to enter the alley from either end.

Although making all alleys one-way may seem like a viable strategy to park more vehicles, such an approach could result in negative effects. For example, one-way alleys could add many additional turns to drivers' paths, causing them to go far out of their way to access the alley. This adds to street congestion. In addition, making all alleys one-way does not resolve the larger problem of inadequate alley throughput. One-way alleys still can be blocked by one vehicle parking.

Construction created the biggest barrier to inventory data collection

Data collectors were unable to collect full information inside 6% of all Center City area alleys, most commonly because construction activity in or near the alley resulted in the alley being closed or fenced off, as shown in Figure 1-15 below. Less frequently, a truck operating in the alley did not give the data collectors enough room to safely and accurately record alley interior measurements.

Figure 1-13. An Alley Blocked by Construction

Alley Inventory Method and Typology

To conduct the alley inventory, the research team created the **seven** steps shown below in Figure 1-14. A detailed Step-by-Step Alley Inventory Toolkit is available in Appendix A for city officials and transportation professionals interested in replicating this data-collection effort.

Figure 1-14. Alley Inventory Method Design Steps

1. **Defined the alley attribute of interest with a broad range of agencies**

2. **Created the alley infrastructure concepts**

3. **Created a data-collection app and selected data-collection tools**

4. **Drafted and a piloted field survey using the data-collection app**

5. **Created the final data structure**

6. **Recruited and trained data collectors**

7. **Collected data**

STEP 1. DEFINED ALLEY ATTRIBUTES OF INTEREST WITH BROAD RANGE OF AGENCIES

The research team defined alley attributes of interest with a range of SDOT divisions and other agencies including the Seattle Police Department, Seattle Public Utilities, and the Seattle Fire Department. SDOT divisions involved included Asset Management, Policy and Planning, Transportation Operations Engineering and Design, Information Technology, Maintenance Operations, Street Use, and Transit and Mobility.

SDOT led the outreach to other city agencies to ensure that the data-collection efforts met their functional needs. This outreach and collaboration resulted in a prioritized list of alley attributes that were measured in the inventory, which fall into four categories: 1) Alley connectivity to street network, 2) Alley design, 3) Alley accessibility and 4) Alley pavement condition for handcarts.

1. Alley Connectivity to Street Network

Alleys do not function in isolation, they are part of a dynamic street network. They are also one of the three elements (along with curb space and private loading bays) in the comprehensive Center City area load/unload network. Alley functionality can impact other network elements and vice versa. Constrained and congested alleys can create a queue of vehicles on the street that are trying to access the alleys; this may result in double-parking reduces the affected street's capacity by one lane of traffic. Additionally, sometimes alleys are the only access route to a certain land use. The study included these characteristics:

- Name of streets that the alley connects to
- Street name or number
- Whether the alley is off a one-way or two-way street
- Whether the alley is one-way or two-way traffic
- Direction of one-way alleys

2. Alley Design

The way an alley is designed has a direct impact on its functionality. The inventory examined design features in alley end points, alley aprons, and alley interiors.

Alley **end-point** features include **width** and **height** with measures recorded as the smallest width and height within 30' from the alley entrance. Researchers used the 30' threshold because it captures the bumper-to-bumper length of most cargo vans and trucks conducting Center City area deliveries.

The alley **apron** is a driveway (an entranceway) that starts at the curb and continues until the start of the alley pavement. The apron edge uses a curb cut to provide vehicle access from the street. Alley width, length, and cross slope were recorded; slope can determine whether fully-loaded handcarts can maneuver. (See Figure 1-15 below)

Figure 1-15. Alley Apron Design Characteristics Recorded
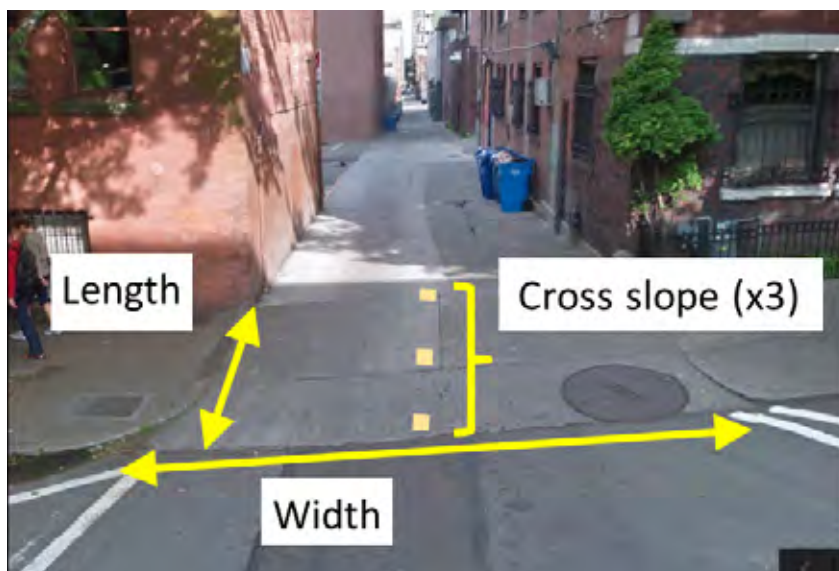
Imagery ©2018 Google

Alley **interior** features measured included alley length (end to end), pavement surface type (e.g. concrete v. asphalt), narrowest point, and fixed overhead obstructions. As most emergency vehicles are 16 feet tall or under, the researchers documented any fixed overhead obstructions under that threshold (such as trees, fire escapes, wires). The research team also documented any fixed on-the-ground obstructions that protrude 1' or more into the alley, as this clearly impacts an alley's functional width.

3. Accessibility

Researchers included the features below to answer questions such as: Does the alley have any attributes that impact what activities the alley is used for and by what types of vehicles? Does the alley have any features that limit duration, hours or frequency of use? Features documented include:

- Driveways connected to the alleys, including each driveway that grants access to a parking lot; driveways that link the alley with a nearby street; and driveways that connect the alley to a private property.
- Location of buildings' main entrances
- Restrictions on alley usage as shown on posted signs
- Loading bay entrances
- Passenger parking, if visible or signed
- Presence of furniture or equipment
- Number of garbage containers

4. Alley pavement condition for handcarts

Researchers included a qualitative pavement condition assessment with two levels: "Good" or "Poor" for delivery people who walk through alleys with loaded handcarts.

STEP 2. CREATED ALLEY CONCEPTS AND CATEGORIES (TYPOLOGY)

When researchers set about designing the alley inventory study, they could find no clear alley typology in the literature. In addition, they could find no clear City of Seattle definition of an alley.

The Seattle "Streets Illustrated" manual (4) defines an alley as follows:

"Alley means a public right of way not designed for general travel and primarily used as a means of vehicular and pedestrian access to the rear of abutting properties. An alley may or may not be named."

Given the lack of an existing classification system, the research team created one based on alleys' varying design features and functionalities (See Figure 1-18 below). This typology grounded the alley inventory study and helped data collectors identify alleys with the same consistent set of measures in the field. This typology has broad applications both for other cities interested in an alley inventory and for researchers in the field.

Figures 1-16. UFL Classification of Alley Design Features and Functionalities
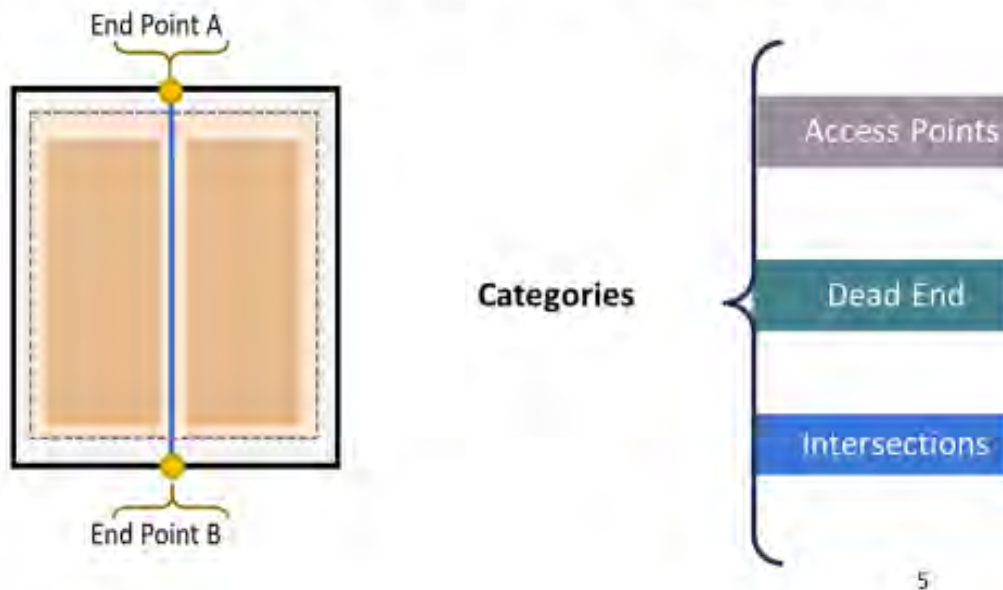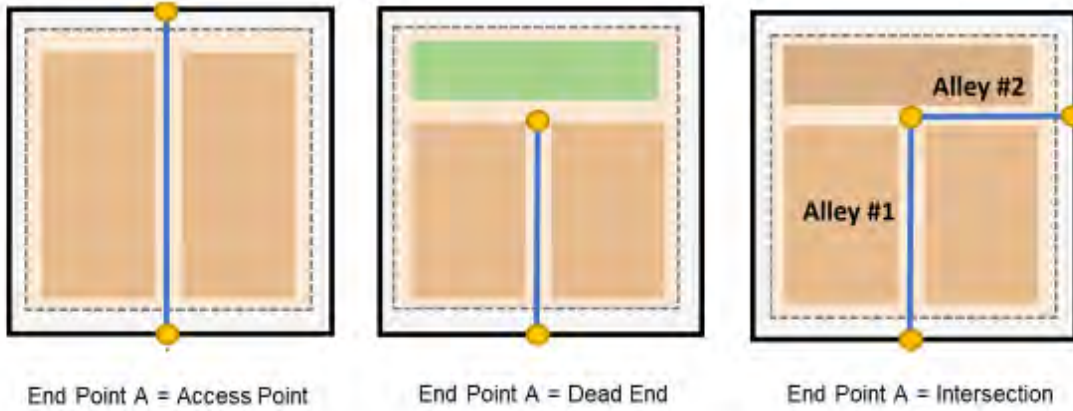

Every alley has two end points and fits one of three categories, shown above.

Below, Figure 1-17 shows the alley end-point typology researchers developed.

Figure 1-17. UFL Classification of Alley Design Features and Functionalities

Developed Alley End-Point Typology

End Point A = Access Point   End Point A = Dead End   End Point A = Intersection

Access Points: Figures 1-18 and 1-19 below show the most common examples of an alley accessed from a street that frames one side of a city block.

Figure 1-18. Alley Access Point With Buildings on Either Side

Figure 1-19. Alley Access Point with Surface Parking Lots on Either Side

Dead End: The alley is only accessible from one end. There are three subtypes of alley dead-ends illustrated in the examples below.

Figure 1-20. Alley Dead-Ends at a Building; Here, at the Dexter-Horton Building in Downtown Seattle

Imagery ©2018 Google

Figure 1-21. Alley Dead-Ends at a Driveway, Which Provides Access to the Street
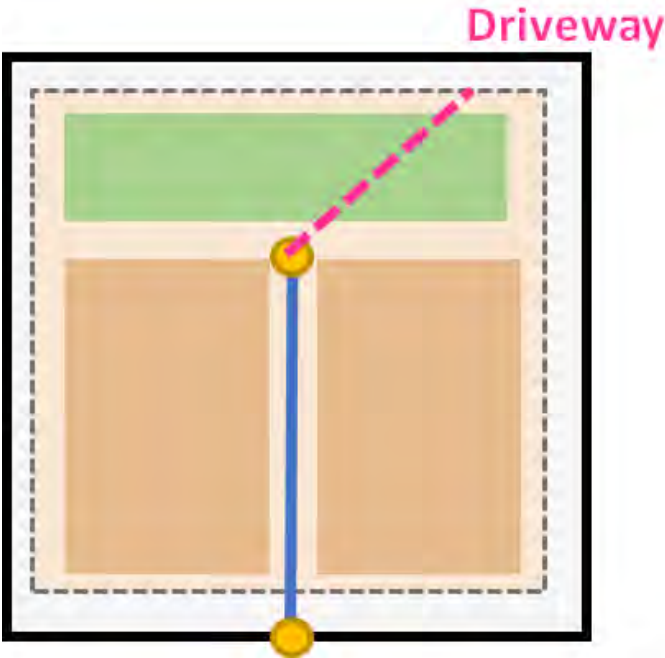
Figure 1-22. Alley Dead-Ends at a Space That Is Not a Street, Driveway, or Building. Alley Below Ends at Westlake Park in Downtown Seattle

STEP 3. CREATED DATA-COLLECTION APP AND SELECTED DATA-COLLECTION TOOLS
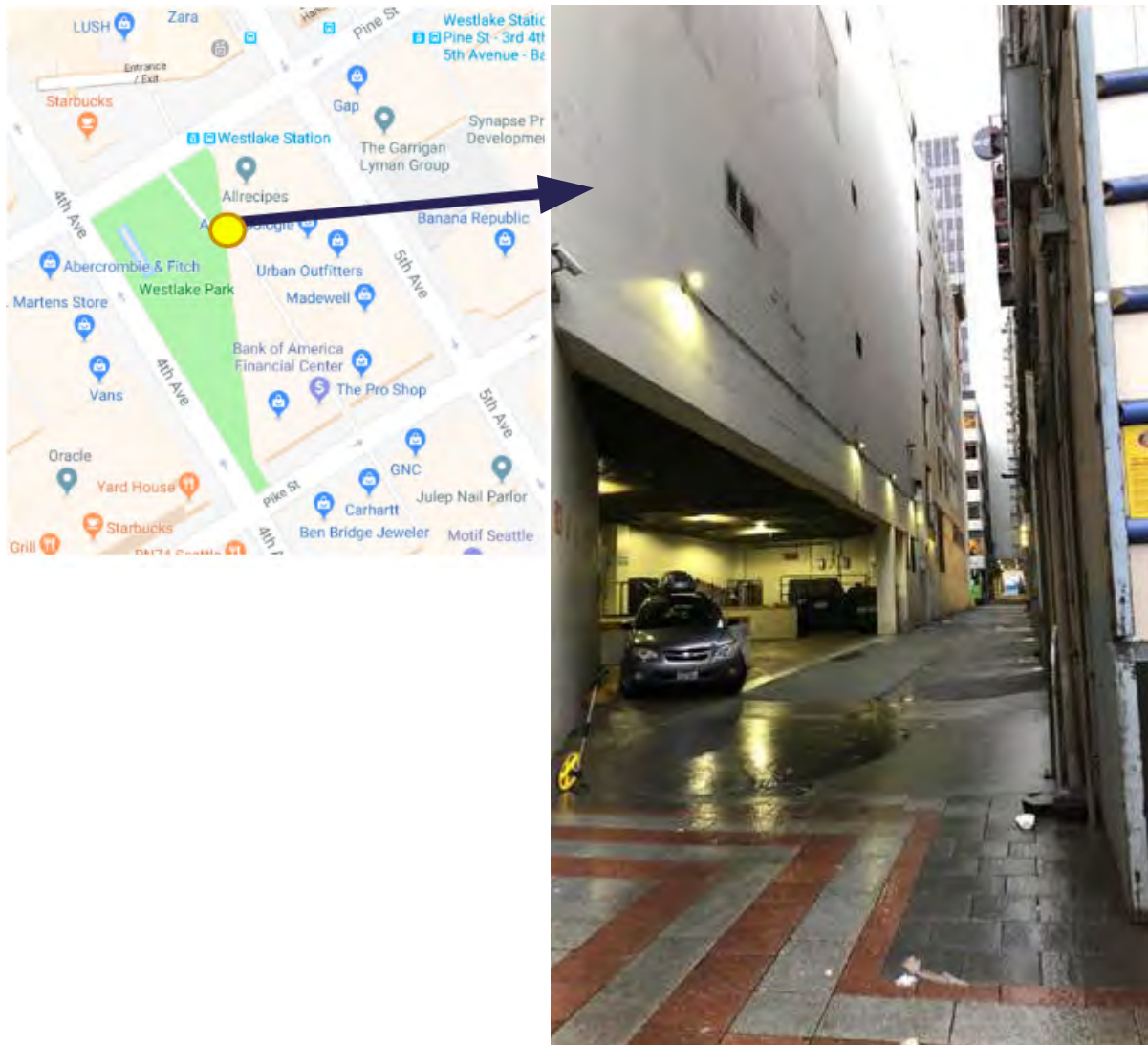
Once the researchers defined the alley attributes to measure and created the alley typology to help categorize those attributes, the effort moved to developing data-collection tools.

Researchers determined data-collection instruments for the field had to be:

- Able to measure metrics with sufficient accuracy
- Easy to transport
- Reasonably priced
- Available as off-the-shelf technology

The research team decided that a **mobile-app-based data-collection instrument** built from an off-the-shelf basemap was a better option than a paper-based instrument because the app would be:

- **Efficient:** Allowing automation of data digitization and photo collection and storage
- **Flexible:** Permitting the form to be revised if surveyors encounter unforeseen infrastructure conditions that require a new data structure
- **Fast:** Offering speedy data input in the field with automated questions and drop-list answers
- **Reasonably priced:** Providing an asset that operates within project budget constraints
- **Accurate:** Enabling reduction of transcript errors and data lost in transit
- **Data quality controlled:** Providing almost real-time data-collection monitoring and spatial visualization of completed surveys

Given these advantages, the research team selected software and created an alley inventory app, thought to be the first of its kind. To collect geolocation data, the research team selected an off-the-shelf basemap (World Street from ArcGis.com viewer) to which researchers added location and key names of alleys and loading bays in Seattle's Center City area, obtained from King County's Metro Transportation Network (TNET) database and SDOT-UW Final 50 Feet Loading Bays and Docks database, respectively. The map-based app allowed for manual GPS coordinate reading by dropping a location pin. The net result of this effort is the creation of an up-to-date geodatabase with detailed features of alleys, with alleys represented as a point feature on the GIS map.

Further details on software and technology utilized, as well as the list of instruments and unit prices, are available in the Step by Step toolkit in Appendix A.

STEP 4. DRAFTED AND PILOTED FIELD SURVEY

Researchers drafted a field survey encompassing all the key alley attributes identified in Step 1. The researchers field-tested the draft survey with six alleys, located inside a 3x3 city block area. The pilot survey allowed researchers to:

- Estimate the time needed to survey each alley, including walking time between alleys.
- Identify potential problems with the survey logic. (For example, researchers' field testing raised questions about how to proceed with data-collection if an alley interior is blocked or if security concerns prevented data collectors from entry. The survey logic could be designed to allow the gathering of all possible data from outside the alley, such as location features and end-point characteristics. A survey question about what was blocking the alley or preventing data collector access could then be included. For the purposes of this alley inventory, researchers incorporated the possibility of data-collection interruptions, building into the survey various options, such as permitting data collectors thwarted entry to an alley interior to collect data from either end point to avoid losing valuable alley data.)
- Test data-collection methods and instruments (including the app and instruments such as a laser measuring device and a measuring wheel).

STEP 5. CREATED FINAL DATA STRUCTURE AND DATA-COLLECTION APP

Taking the learnings from the field testing, the research team developed a final survey form, a resulting final data structure, and a metadata for the project that clearly describes the project's data definitions and database model. Both the final survey form and metadata may be found in Appendix B.

The research team identified the types and possible sources of error specific to this type of project to create a robust data quality-control process designed to prevent such errors. The team established specific quality-control protocols for each step of the project: before data collection, during data entry, and after data entry. This quality control extended to both the supervisors and data collectors in the field as well as to the related technologies and inventory survey app. The app itself is programmed to limit data-entry inaccuracies. Further details on quality control, including the entire data-quality control plan for this project, can be found in Appendix A.

STEP 6. RECRUITED AND TRAINED STUDENT DATA COLLECTORS

The research team recruited and trained 32 University of Washington student data collectors, each of whom received approximately five hours of training in the concepts underlying the alley infrastructure being surveyed, practical aspects of data collection (including security in the field), and data quality-control tasks.

The safety of data collectors surveying alleys was the first priority in this data-collection method. The research team instituted a security protocol and a multilayer communications plan to prevent and avoid unsafe field situations. For example, the Seattle Police Department notified all building managers in

the survey area in real time through the Seattle Shield program, a pre-existing information exchange for building operators and the police. SDOT also established a new webpage to periodically publish information on survey progress and to let the public know where surveyors would be in coming weeks.

As noted in Step 4, the inventory survey was designed to consider possible data-collection interruptions, such as those due to security issues, so that valuable alley data was not lost. Additional security protocol and multilayer communications plan details are available in the Step-by-Step toolkit in Appendix A page 78, Step 8.

STEP 7. COLLECTED DATA

Over three weeks in January 2018, data collectors walked 941 city blocks to examine and collect data on the 417 Center City area alleys, including checking alleys' GIS location against the (outdated) King County's Metro Transportation Network (TNET) database. Data collectors mapped new alleys and deleted no longer existing alleys. A data-collection staff of 32 worked in teams of two, both for security reasons and for efficient operation of the various data-collection instruments. Each team had supervision on their initial alley visit. Data collectors followed a prescribed security protocol each time before entering an alley and once inside an alley.

Data collection occurred during daylight hours on both weekdays and weekends. Data quality-control happened both in field and remotely. As noted on page 57, data collectors were unable to collect full information inside 6% of all Center City area alleys, most commonly because construction activity in or near the alley resulted in the alley being closed or fenced off. Less frequently, a truck operating in the alley did not give the data collectors enough room to safely and accurately record measurements.

SECTION 2

ALLEY OCCUPANCY

SECTION 2: ALLEY OCCUPANCY

Building on the alley inventory project described in the previous chapter, which mapped alleys and documented their key design and functional features, the alley observation study focused on Center City area alley use and operations. Clearly, the inventory and the occupancy study are linked: Alley design and functional features can directly impact how commercial operators use alleys. SDOT commissioned the Urban Freight Lab at the University of Washington Supply Chain Transportation & Logistics Center to study and document the commercial vehicle occupancy of representative alleys to better understand alleys' current use and operational capacity.

The researchers and SDOT selected seven representative Center City area alleys to study; two were selected as case studies for this report to illustrate in more detail the wide variation in alley design and use. The research team deployed 25 student data collectors from the University of Washington working in pairs to observe each of the seven alleys from one to four days over two weeks in February and March 2018.

Data collectors recorded use-patterns such as how long vehicles were parked in alleys; how long and what times of day alleys were vacant; and what types of vehicles were parking in alleys. Observations were made during the business day from 8 a.m. to 5 p.m. Using human observers rather than relying on video or other recording technology to document alley use enabled researchers to generate valuable details— such as picking out windshield permit stickers or company names on vehicles—that would otherwise be challenging to capture accurately.

To make the data produced in this project as useful as possible, the research team designed a highly detailed commercial vehicle typology to track specific vehicle categories consistently and accurately. The typology covers 14 separate vehicle categories, from various types of trucks and vans to passenger vehicles used to deliver goods (such as through Amazon's "Prime Now") to cargo bikes.

The occupancy study surfaced three key findings.

1. It confirms the operational constraints found in the alley inventory: More than 90% of Center City area alleys are constricted to one lane, limiting parking per alley to one-to-two commercial vehicles at a time. Data collectors found the seven alleys studied predominately had just one to two vehicles parked at a time.

2. It found that 68% of all vehicles in the seven alleys studied parked for 15 minutes or less. As one parked vehicle operationally blocks the entire alley, this suggests that moving vehicles through alleys in short time increments is the most viable option to increase productivity. This means vehicles that require longer parking time must be moved out of the alleys and onto the curb where they do not block others.

3. It found that 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.

This occupancy study documents that each alley has unique features that impact operations; this suggests the need for flexible alley management/operation guidelines with myriad options available. The study also drives home the reality that alleys do not function in isolation, but rather form one element of the Center City's broader load/unload network, including the curb and private loading bays. Cities and other parties interested in the details of how to conduct an occupancy study may find a step-by-step guide in Appendix E.

ALLEY OCCUPANCY STUDY

The alley occupancy study was conducted in seven alleys selected by SDOT and the research team to provide a diverse snapshot of alley operations in the Center City area. Some alleys provide access to off-street passenger car garages, some connect to hotel drive-through entrances, and some are used mostly for commercial purposes. Each alley as shown in Table 2-1 was chosen to represent various features (such as the number of access points for freight or passenger parking); characteristics (pavement type, alley width, overall condition); and location (some are near—and therefore serve—office buildings, retail centers, residential buildings, or some mix of these).

Figure 2-1 shows a map of the study alley locations in the Center City area.

Table 2-1. Alley Locations for Occupancy Study

ALLEY #	ALLEY LOCATION	# OF DAYS SURVEYED	TIME FRAME SURVEYED	TOTAL HOURS SURVEYED
1	From Virginia to Lenora Streets, between 4th and 5th Avenues	4	8:00 a.m. to 5:00 p.m.	36
2	From Stewart to Virginia Streets, between 4th and 5th Avenues	3	8:00 a.m. to 5:00 p.m.	27
3	From Columbia to Marion Streets, between 2nd and 3rd Avenues	3	8:00 a.m. to 5:00 p.m.	27
4	From Harrison to Thomas Streets, between Terry and Westlake Avenues	3	8:00 a.m. to 5:00 p.m.	27
5	From Union to Pike Streets, between 1st and 2nd Avenues	1	8:00 a.m. to 5:00 p.m.	9
6	From Pine to Stewart Streets, between 2nd and 3rd Avenues	3	8:00 a.m. to 5:00 p.m.	27
7	From Union to Pike Streets, between 4th and 5th Avenues	4	8:00 a.m. to 5:00 p.m.	36

**Figure 2-1.** Map of 7 Alleys Observed in Alley Occupancy Study
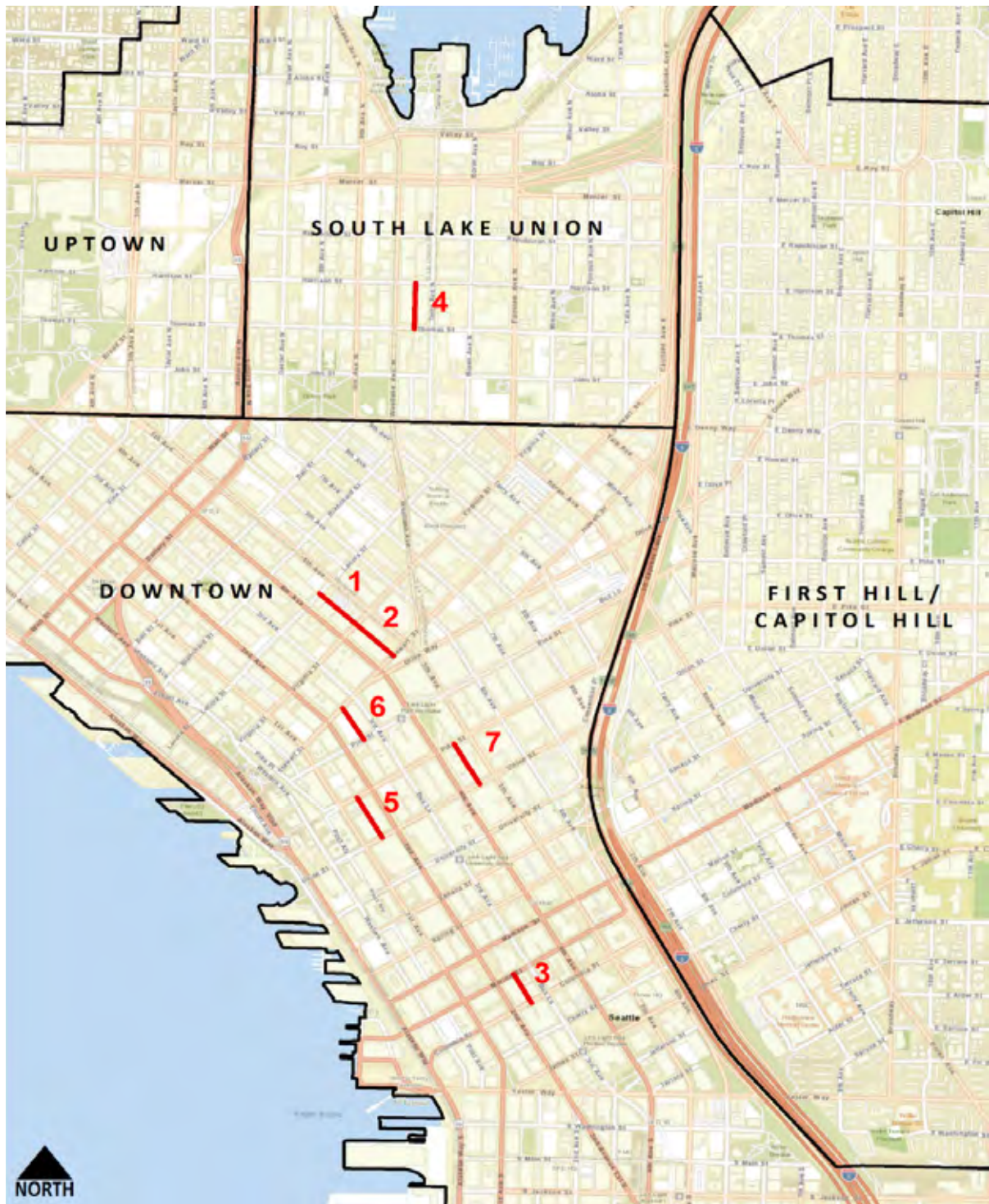
Key Context from Alley Inventory

The alley inventory documented that more than 90% of all Center City area alleys are constricted by width to one lane for trucks, cargo, and service vans. This limits parking per alley to one-to-two commercial vehicles at a time. This fact is critically important to measuring the load/unload capacity of the city's alleys. When a truck, car or van parks in a one-lane alley, it blocks all other trucks from loading/unloading there unless they back into the alley to park, or back out of the alley to exit. Backing into street traffic and backing up into alleys are both prohibited by the Seattle Municipal code for safety reasons. [4]

As box trucks are 9 feet wide (excluding mirrors) and delivery vans are typically 8.8 feet wide, alleys up to 19-feet-wide provide only one-lane for commercial vehicle use. Figure 2-2 below illustrates the distribution of Center City area alley end widths and narrowest widths.

Figure 2-2. Alleys' narrowest widths and end widths in the Seattle Center City area
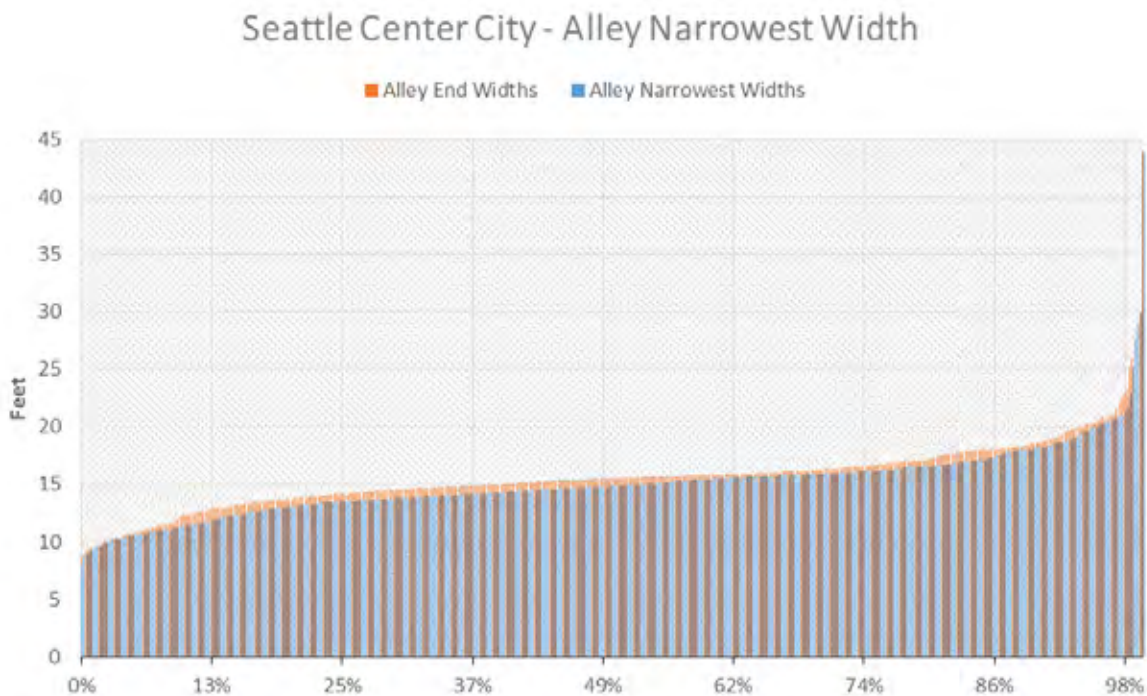
Delivery drivers may choose not to park in an alley when they see that another vehicle will block their exit path. Because Center City area alleys are mostly one-lane wide, only a fraction of their length is available to load/unload vehicles.

This context is critical to understanding the alley occupancy key findings.

Occupancy: Three Key Findings

1. **The occupancy study confirms the operational constraints discovered in the alley infrastructure survey: parking per alley is largely limited to one-to-two commercial vehicles at a time given that 90% of Center City area alleys are constricted to one lane.**

The occupancy study finds all seven study alleys predominately had just one to two vehicles parked at a time. Figures 2-3 and 2-4 below illustrate this phenomenon in two alleys.

Figure 2-3. Average Occupancy Level of Alley #2, Between Lenora and Virginia Streets, and 4th and 5th Avenues, Over 4 Days of Alley Observation
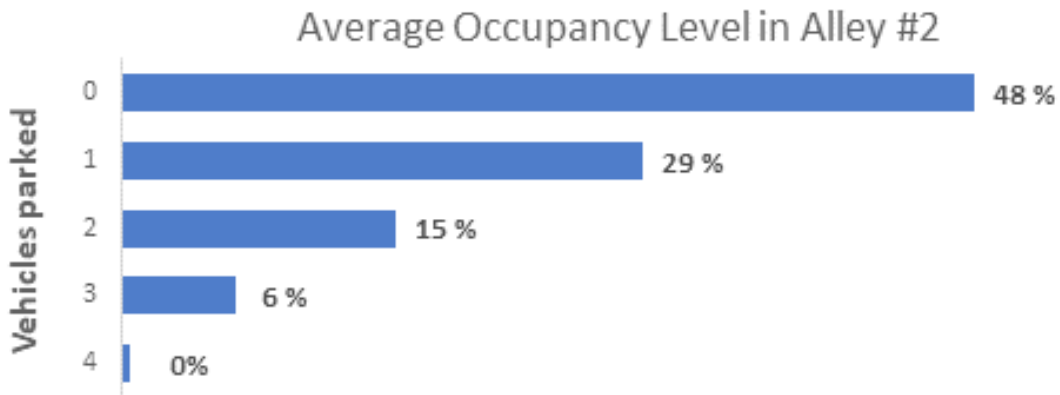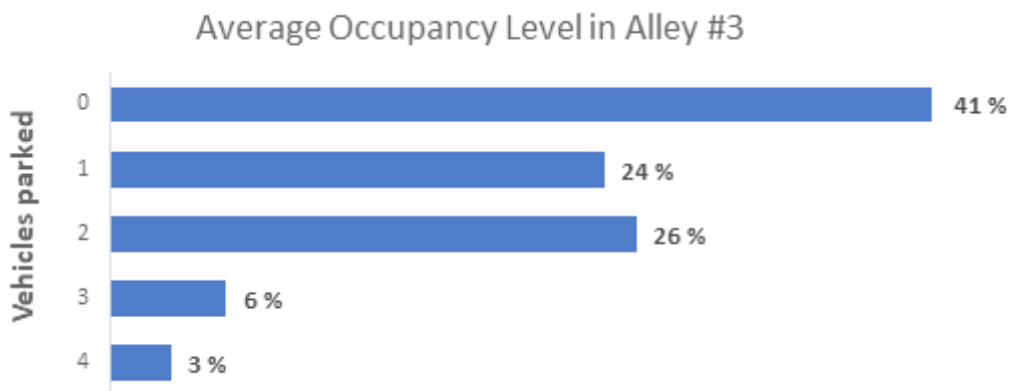

Figure 2-4. Average Occupancy Level of Alley #3, Between Columbia and Marion Streets, and 2nd and 3rd Avenues, Over 3 Days of Alley Observation

2. 68% of all vehicles parked in alleys were there for 15 minutes or less.

In addition, 87% of vehicles were parked in alleys 30 minutes or less. As one parked vehicle operationally blocks the entire alley, this suggests that moving vehicles through alleys in short time increments is the most viable option to increase throughput. Vehicles that require longer parking time should be directed out of the alleys and onto the curb where they do not block others.

In general, the most frequent alley users were truck and cargo vans, at 52% of all recorded vehicles. The second-most-frequent alley users were passenger vehicles, at nearly 20%. Notably, these were not passenger vehicles making a delivery.

Figure 2-5. Dwell Time by Vehicle Type for All Alleys Over Study Period

DWELL TIME BY VEHICLE TYPE FOR ALL ALLEYS

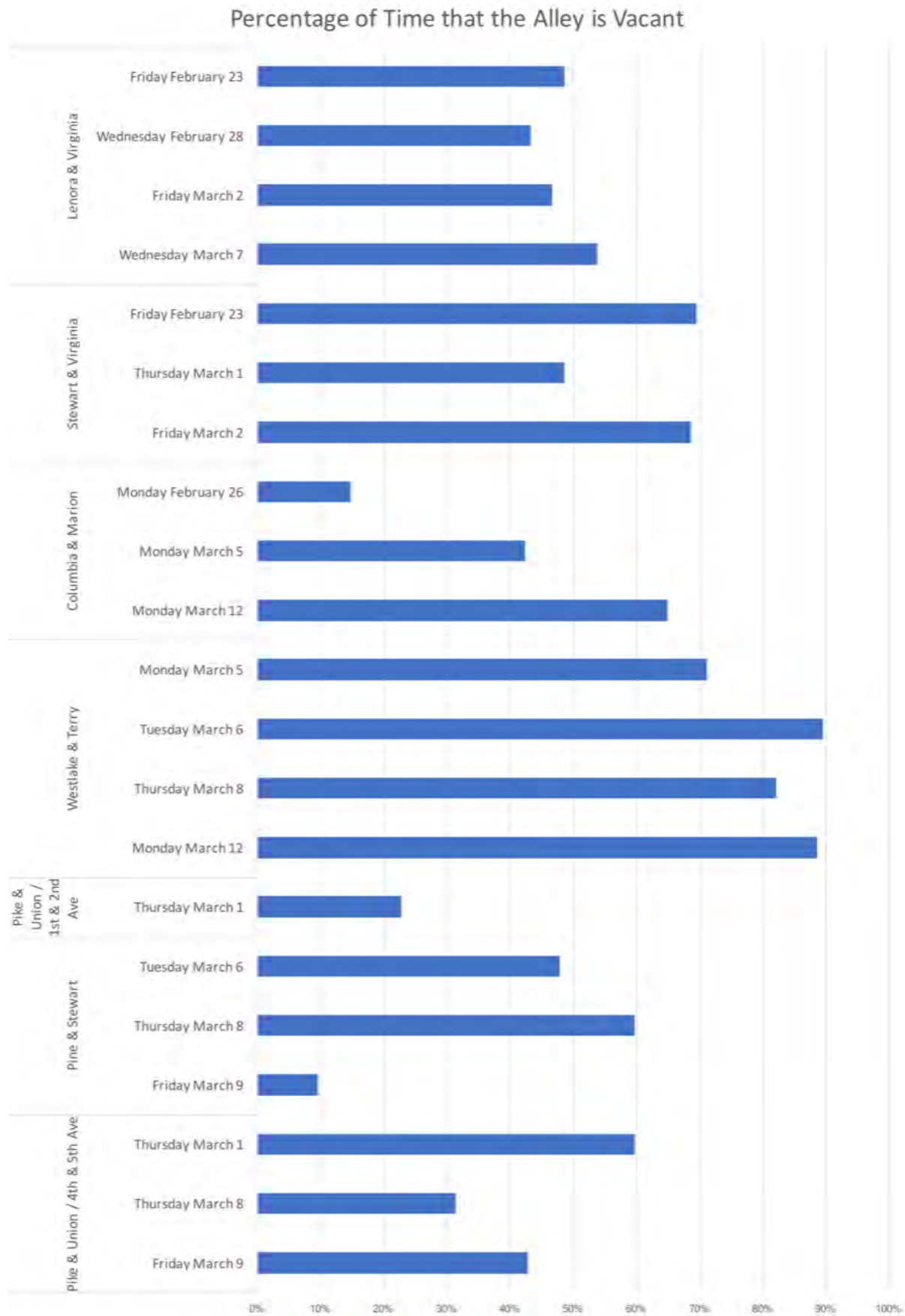| VEHICLES TYPE	NO. OF VEHICLES OBSERVED	15 MIN OR LESS	15-30 MIN	30 MIN -1 HR	MORE THAN 1 HR	TOTAL SHARE OF PARKED VEHICLES
Trucks/Cargo Vans	229	30.0%	12.6%	6.2%	3.7%	**52.4%**
Service Vehicles	31	5.9%	0.9%		0.2%	**7.1%**
Van	42	5.7%	2.5%	0.9%	0.5%	**9.6%**
Passenger	86	16.9%	1.8%	0.5%	0.5%	**19.7%**
Passenger making a delivery	15	2.7%	0.2%	0.2%	0.2%	**3.4%**
Garbage vehicle	17	3.4%	0.5%			**3.9%**
Uber/Lyft	1	0.2%				**0.2%**
Others	15	1.6%	0.5%	0.7%	0.7%	**3.4%**
Unknown	1	0.2%				**0.2%**
Time parked by type of vehicle	**437**	**66.8%**	**19.0%**	**8.5%**	**5.7%**	**100%**

3. **Alleys are vacant about half of the time during the business day. But as alleys typically hold only one-to-two parked trucks at a time, they are not a viable alternative to replace the use of CVLZS along city curbs.**

In the occupancy study, all seven alleys were vacant for a large portion of the business day. Data collectors observed each alley from 8 a.m. to 5 p.m. over a total of three to four days, except for one alley that was only able to be observed for one day due to security concerns, which are detailed on page 9.

As shown in Figure 2-6, some alleys were unoccupied more than 60% of the day. The finding suggests that while alleys appear to have some capacity, that capacity is operationally and functionally limited. It is also limited when compared to the city's overall need, with 417 alleys for 941 city blocks in the Center City area.

Figure 2-6. Percentage of Total Time Each Alley Was Vacant During the Business Day

Percentage of Time that the Alley is Vacant

| Location	Date
Lenora & Virginia	Friday February 23
	Wednesday February 28
	Friday March 2
	Wednesday March 7
Stewart & Virginia	Friday February 23
	Thursday March 1
	Friday March 2
Columbia & Marion	Monday February 26
	Monday March 5
	Monday March 12
Westlake & Terry	Monday March 5
	Tuesday March 6
	Thursday March 8
	Monday March 12
Pike & Union / 1st & 2nd Ave	Thursday March 1
Pine & Stewart	Tuesday March 6
	Thursday March 8
	Friday March 9
Pike & Union / 4th & 5th Ave	Thursday March 1
	Thursday March 8
	Friday March 9

Alley Descriptive Details and Maps

Each alley was jointly chosen by SDOT and the researchers to investigate different features, characteristics, and locations. While each alley is in the broad Center City area, each alley has its own context in terms of how it connects to the street network, what level of development or construction is happening in the vicinity, and what types of buildings surround it. The star "position A" and "position B" in each alley map indicates the two different positions where data collectors were initially stationed to gather their occupancy information on a given alley. Each alley was essentially divided in half, with each data collector covering four zones that met roughly in the middle of the alley.

Alley #1 – In the block formed by Virginia and Lenora Streets and 4th and 5th Avenues

This alley was chosen because SDOT wanted to learn about the impact of nearby development on alley operation. A large surface parking lot is sited just off the middle of the alley. This lot has three driveways that allow vehicles to navigate through the lot and access the alley from 5th Avenue. Additionally, the alley offers access for two parking garages. The north end of the alley has a gated surface parking lot for employees of a nearby movie theater. The alley has no loading bays.

Figure 2-7. Map of Alley #1
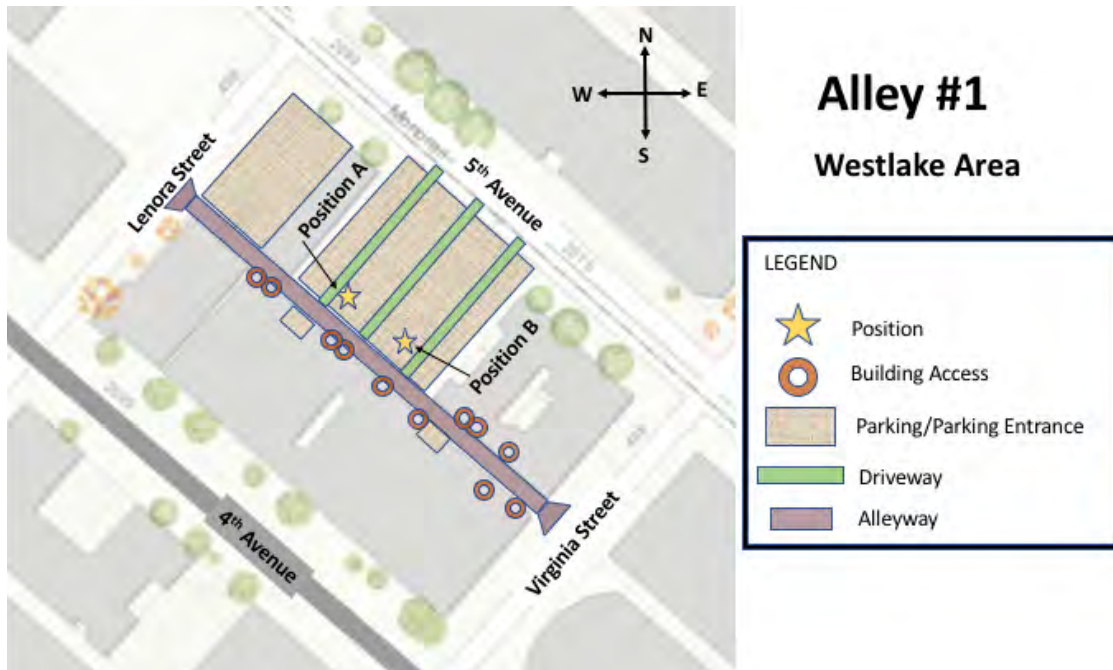
Alley #2 – In the block formed by Stewart and Virginia Streets and 4th and 5th Avenues

This alley is adjacent to the 30-story, 270-unit Escala condominium building, which depends on the alley for delivery access and thus has an active interest in the alley. The building managers requested that the occupancy study include this alley; SDOT also wanted to learn about alley operations given the intensity of new development in the immediate vicinity. The alley contains a surface parking lot at the southern end, which, through two driveways that connect to 5th Avenue, add points of access to the alley. The alley also has one loading bay and one underground parking entrance.

Figure 2-8. Map of Alley #2
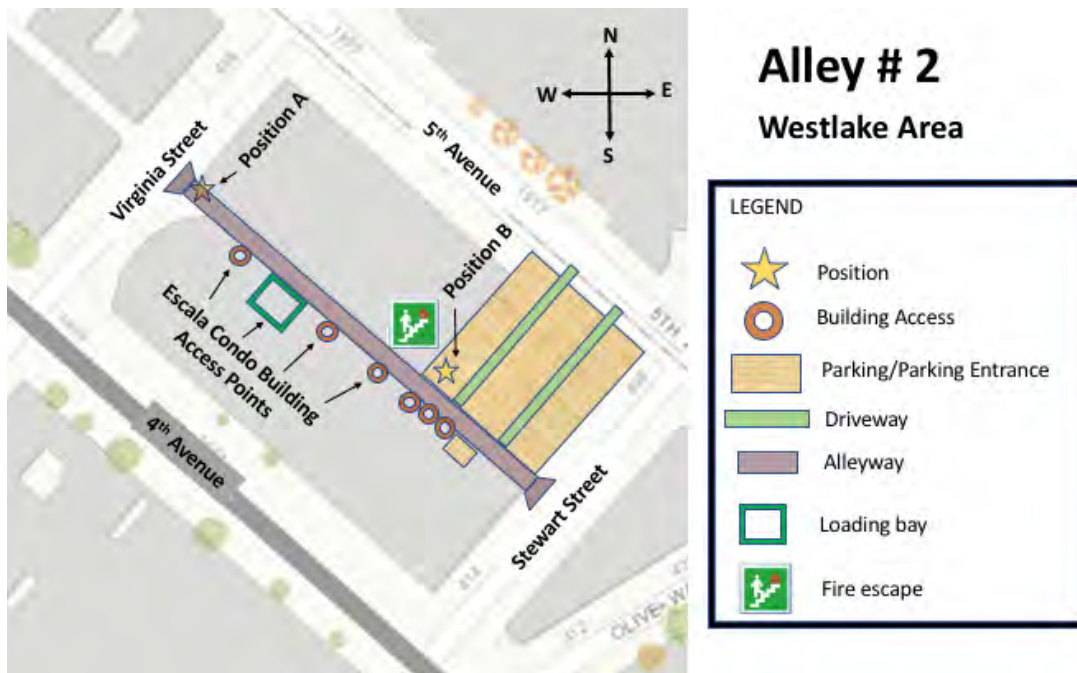
Alley #3 – In the block formed by Columbia and Marion Streets and 2nd and 3rd Avenues

This alley is near the waterfront and Pioneer Square. It is also one block from the Dexter Horton Building (on 2nd Ave. between Columbia and Cherry streets), which the UFL research team studied to track delivery patterns both at the curb and inside the 15-floor building as part of an earlier Final Fifty Feet research project. The UFL research team chose this alley to provide a more complete picture of urban freight movement in the immediate area.

Figure 2-9. Map of Alley #3

Alley #4 – In the block formed by Harrison and Thomas Streets and Terry and Westlake Avenues

This alley was chosen for its unique design and new construction features. This alley also illustrates how building managers taking ownership of an alley can improve alley functionality and operations. (The ownership referred to here is not literal, as in a building owning the alley property. Ownership in this context means a building or buildings assuming a proactive role in managing and maintaining the alley.)

Here, the recently constructed buildings on both sides of the alley are owned and managed by the same company. During the design phase of these mixed office/retail buildings, intentional steps were taken to ensure the alley was designed to accommodate both truck deliveries to the alley's two loading bays as well as frequent passenger vehicle traffic for the two parking garages accessed via the alley. Notably, the alley is clearly signed one-way for passenger vehicles while still allowing trucks to travel in both directions. In addition, the alley has a pedestrian crosswalk connecting two building entrances, a wide width, speed bumps, clear sight-lines, surveillance cameras, and frequent building security patrols. A streetcar line that runs along Terry Avenue and Thomas Street adds to the alley's context.

Figure 2-10. Map of Alley #4
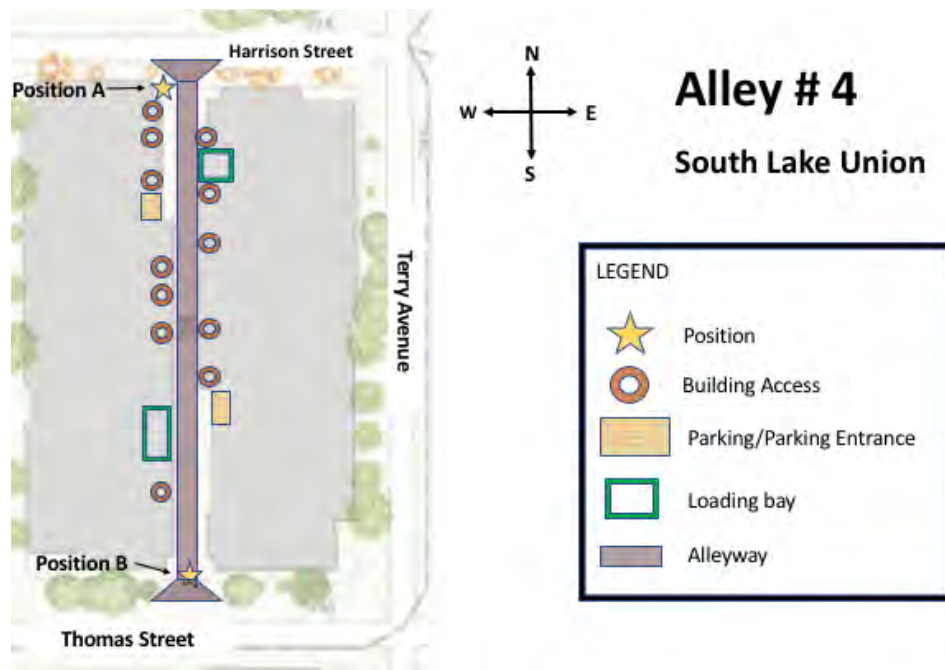
Alley #5 – In the block formed by Union and Pike Streets and 1st and 2nd Avenues

This alley provides access to two loading bays, a parking garage, and a surface parking lot. It is adjacent to the downtown Target store and near Pike Place Market and the waterfront. It is also near the Four Seasons Hotel (on Union just south of 1st Avenue), which, like the Dexter Horton Building in Alley #3, the UFL research team studied previously to track delivery patterns both at the curb and once inside the building. Researchers included this alley in the occupancy study to provide a more comprehensive view of urban freight movement in adjacent blocks.

Data collection was limited to just one day in this alley due to security issues. During alley observation, one student data collector had her bag stolen; several data collectors witnessed activity that made them uncomfortable (such as public defecation and illegal drug use).

Figure 2-11. Map of Alley #5
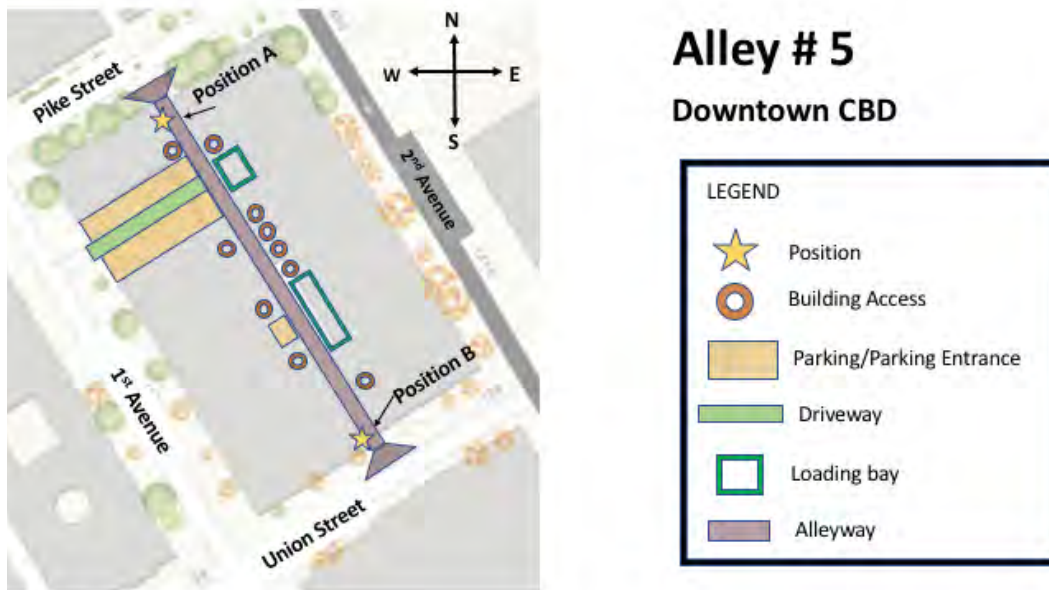
Alley #6 – In the block formed by Pine and Stewart Streets and 2nd and 3rd Avenues

This alley was chosen primarily because construction of a new hotel building at the northern end was impacting alley access. SDOT wanted to understand how alley operations would function in an alley with an active construction zone. At the time of the alley selection process, SDOT also was considering removing parking spaces on 3rd Avenue to accommodate a bus-only lane and wanted to understand alley operations in the context of that possible change. Located two blocks west of Pike Place Market and the waterfront, this alley also has entrances to underground parking lots.

Figure 2-12. Map of Alley #6

Alley #7 – In the block formed by Union to Pike Streets, between 4th and 5th Avenues

This alley was chosen for its ample loading bay infrastructure (four loading bays in total). It substituted for the originally selected alley in the block formed by Union and University Streets and 4th and 5th Avenues, which was completely closed due to construction activities at the time of data collection for the occupancy study.

Figure 2-13. Map of Alley #7
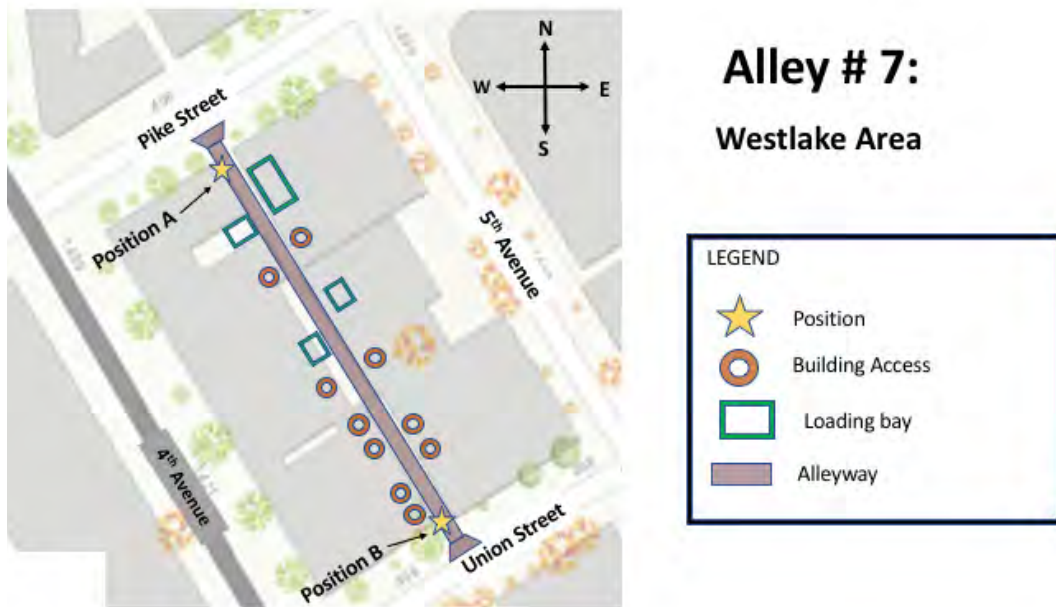
Vehicle Typology

To make the data produced in this project as useful as possible, the research team designed a highly detailed vehicle typology to track specific vehicle categories consistently and accurately. The typology covers 14 separate vehicle categories, from trucks and vans to cargo bikes and passenger vehicles. The typology covers a wide range of vehicle types that can load/unload in an alley and is based on prior field work and knowledge of Center City area alley operations. Passenger vehicle types were included to account for individuals using their own vehicles to deliver packages through services such as Amazon's "Prime Now."

Table 2-2 below shows the list data collectors used to categorize and document the vehicles they observed in the alley occupancy study. Having human data collectors, versus relying on technology to record alley activity, allowed the study to collect details such as windshield permit stickers or company names on vehicles that would otherwise be challenging to capture accurately.

Table 2-2. Types of Vehicles Across 14 Vehicle Categories

NAME	EXAMPLES AND DATA-COLLECTION NOTES
TRUCK OR VAN TYPES Truck (T)	 *Truck with trailer, 3 or more axels*
Box Truck (B)	 *Single-unit trucks, 3 axels or less*
Garbage Truck (G)	
Cargo Van (CV)	
Service Van (SV)	
Van (V)	*A cargo or service van usually displays a business logo. If there was not enough information visible, data collectors marked the vehicle as a van.*

Continued next page

Table 2-2. Continued

PASSENGER VEHICLE TYPES:

For each passenger vehicle type, data collectors were instructed to look for a commercial permit and mark P (permit), NP (no permit), or U (unknown) for the vehicle type.

Service Passenger Vehicle (SP)	*A personal vehicle being used for provision of a service, such as a cleaning company. Often a logo or commercial permit is visible.*
Vehicle Making a Package or Food Delivery (D)	*A personal vehicle being used to deliver packages (such as Amazon Prime Now) or food (such as Amazon Fresh).*
Vehicle Making a Passenger Drop-off (e.g. Uber / Lyft) (U)	
Passenger Vehicle (P)	

OTHER VEHICLE TYPES:

Taxi (X)

Motorcycle (M)

Cargo-bike (C)

Construction Vehicles

Two Alley Occupancy Case Studies

The case studies give greater detail and understanding of usage patterns in the alley, as well as describe who is using the alley. The two examples clearly illustrate how an alley design and its connection to the street network impact its use pattern. The two case studies represent two distinct use cases.

The first alley, in the Westlake area, is dominated by commercial vehicles parking. In contrast, the second alley, near Pioneer Square, is notably dominated by passenger cars parking. In both alleys, 87% of all vehicles were parked 30 minutes or less.

Details on each alley and its use case follow.

Alley Case Study 1: In the block formed by Lenora and Virginia Streets between 4th and 5th Avenues

This alley is located near the downtown commercial business core and shopping district. It provides access to two covered parking facilities and two open-air surface lots. It also contains many building access points. Given that the alley has no dedicated freight loading bays or docks, its function is to provide access to the buildings' backdoors for multiple needs, including deliveries.

Figure 2-14. Case Study 1 Alley Area Map
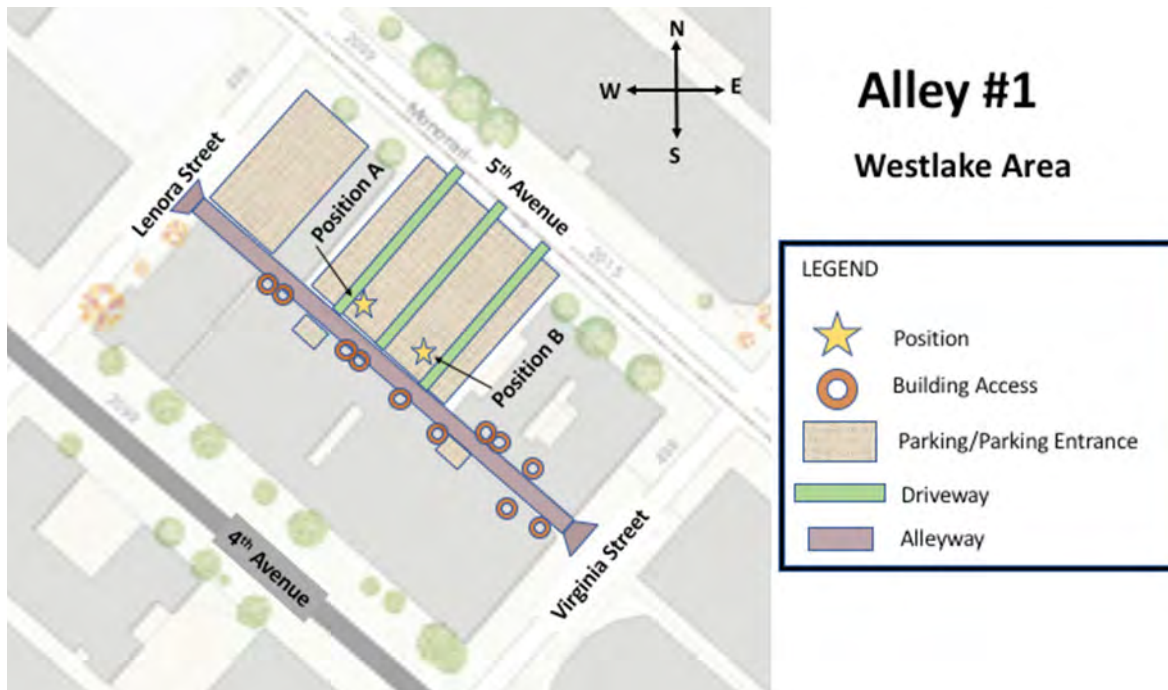
Figure 2-15. End Point on Lenora Street

Figure 2-16. End Point on Virginia Street
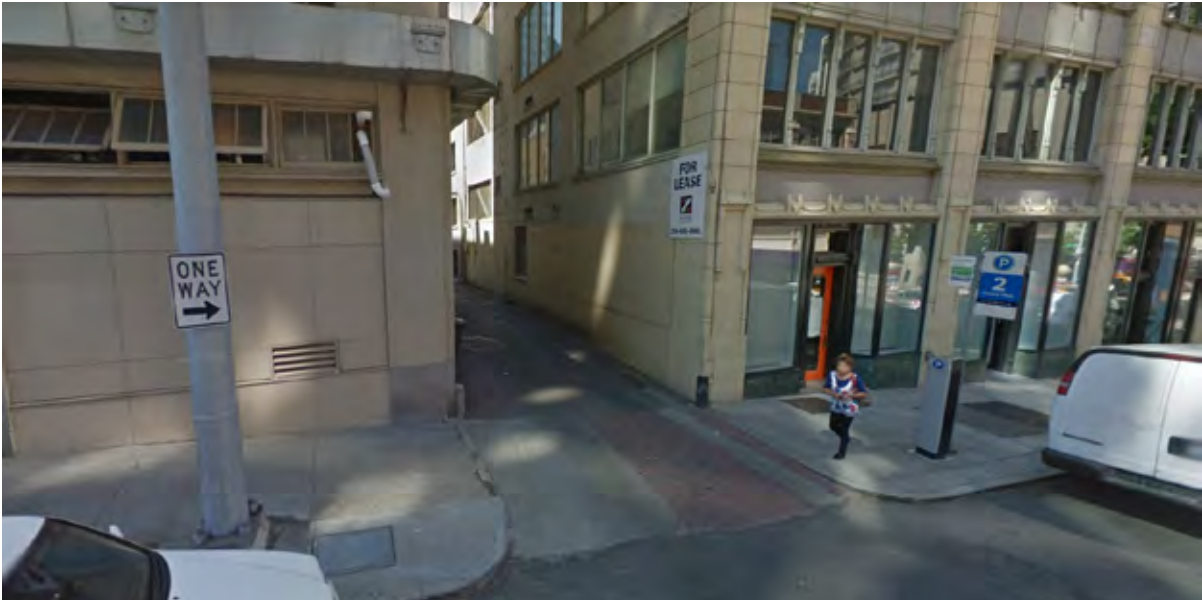
Imagery ©2018 Google

Table 2-3. Alley Case Study 1 General Characteristics

End point width on Virginia St.	15.2 feet
End point width on Lenora St.	16.4 feet
Narrowest point inside the alley	13.8 feet
Length	364.6 feet
Total vehicles observed	104
Days surveyed	4 days
Time-period surveyed	8 a.m. to 5 p.m.

Table 2-4. List of Businesses on The Block or Adjacent (Not Comprehensive)

IN THE CITY BLOCK	ADJACENT BLOCK FACES
Warwick Seattle Hotel	Cinerama
Lola (restaurant)	Cantina Lena (restaurant)
Assaggio Ristorante (restaurant)	Dahlia Lounge (restaurant)
Margaux (restaurant)	Palace Kitchen (restaurant)
The Virginian Apartments	Sub Pop Records
Sheridan Apartment	Money Gram
Sound Community Bank	Tamale Cart (restaurant)
Sound Financial	Escala condominiums
Hot Stove Society (cooking school)	

This alley is primarily used for commercial purposes as delivery trucks, cargo vans, passenger vehicles making deliveries, service vehicles, and garbage trucks made up 82% of all parked vehicles, as shown below. In terms of sheer number of vehicles observed, trucks/cargo vans made up the single largest vehicle type of the 104 parked vehicles observed over four days in this alley.

Figure 2-17. Of 104 Parked Vehicles Observed in Alley for 4 Days, 82% Were Commercial Vehicles

Distribution of Types of Vehicles

Vehicles Type
- Service Vehicles
- Garbage vehicle
- Passenger making a delivery
- Passenger
- Trucks and Cargo Vans
- Van
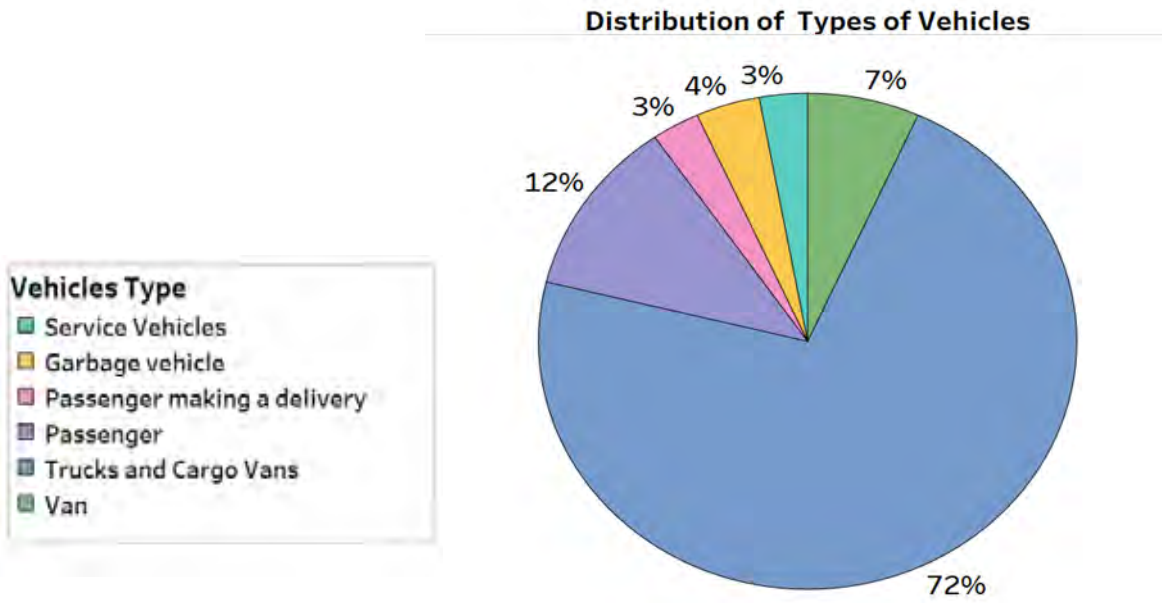
As shown in Table 2-5 below, 87% of all vehicles observed in the alley over four days from 8 a.m. to 5 p.m. parked there for 30 minutes or less. And 63% of vehicles parked in the alley for 15 minutes or less.

Table 2-5. Types of Vehicles and Their Dwell Time in Alley Case Study 1

DWELL TIME BY VEHICLE TYPE IN ALLEY:
LENORA AND VIRGINIA STREETS, 4TH AND 5TH AVENUES

VEHICLES TYPE	NO. OF VEHICLES OBSERVED	15 MIN OR LESS	15-30 MIN	30 MIN -1 HR	MORE THAN 1 HR	TOTAL SHARE OF PARKED VEHICLES
Trucks and Cargo Vans	75	41%	19%	10%	2%	**72%**
Service Vehicles	3	3%				**3%**
Van	7	6%	1%			**7%**
Passenger	12	8%	3%		1%	**12%**
Passenger making a delivery	3	2%		1%		**3%**
Garbage vehicle	4	3%	1%			**4%**
Time parked by type of vehicle	**104**	**63%**	**24%**	**11%**	**3%**	**100%**

Occupancy analysis as illustrated in Figure 2-18 below also shows that this alley:

• on average was vacant 48% of the business day

• when not vacant, <u>on average had only 1-2 vehicles parking 44% of the time-period observed</u>

Figure 2-18. On Average Only 1-2 Vehicles Were Parking 44% of The Time
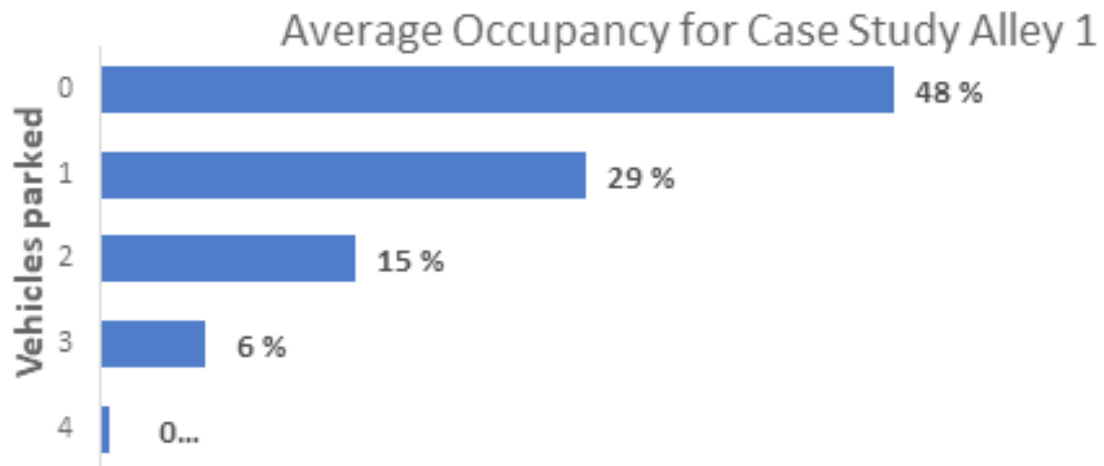
Table 2-6 below illustrates the vehicles data collectors could identify by company name. As shown in Table 2-6 below, 16 of the 25 identifiable companies observed parking in this alley were clearly food- and restaurant-service related. This may speak to the more than half a dozen restaurants and food-related businesses on the block and adjacent.

Table 2-6. Company Vehicles Recorded in Alley Case Study 1

ALLEY CASE STUDY 1:
VEHICLES BY COMPANY IN ORDER OF FREQUENCY OBSERVED

COMPANY	NO. OF VEHICLES OBSERVED
Merlino Foods	6
Charlie's Produce	5
Lusamerica Fish	3
Service Linen Supply	3
Employee Service Center	2
Food Services of America	2
MacDonald Meat Company	2
Rub With Love Shack	2
Waste Management	2
19 Crimes	1
Cedar Grove	1
Columbia Distributing	1
Complete Office	1
FedEx	1
Fikes Pest Control	1
HiTouch Business Services	1
Hopworks Urban Brewery	1
Key City Fish Company	1
Ocean Beauty Seafood	1
Rachels Ginger Beer	1
Recology CleanScapes	1
Southern Glazer's Wine & Spirit	1
Starbucks	1
Tasty Catering	1
Vistar Delivery	1
Unknown (data collectors unable to identify company name)	46

Alley Case Study 2: In the block formed by Columbia and Marion streets between 2nd and 3rd avenues

This alley is in the central business district of downtown Seattle, close to the waterfront and the historic Pioneer Square neighborhood. It serves three parking facility access points as well as a few building access points. As in Alley Case Study 1, this alley has no dedicated freight loading bays or docks.

Figure 2-19. Alley Case Study 2 Area Map
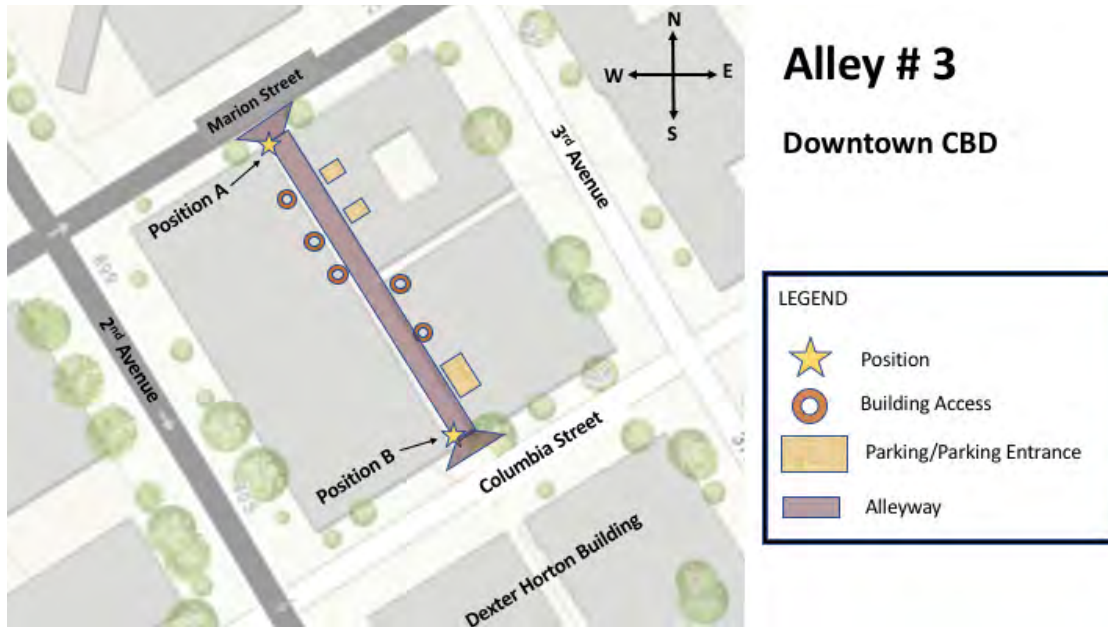
Figure 2-20. End Point on Columbia Street
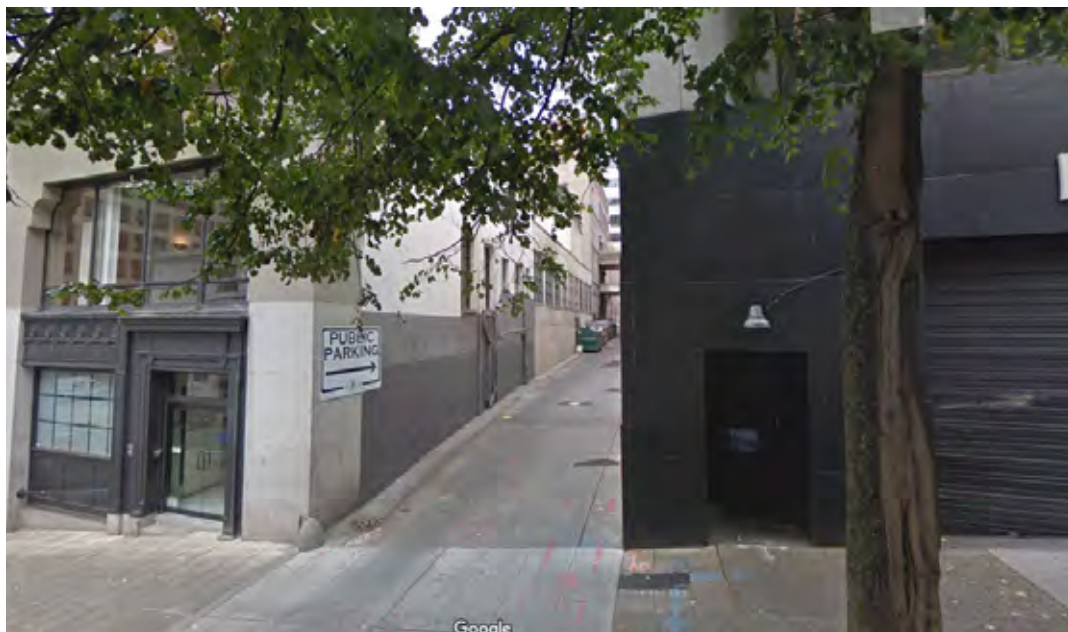
Imagery ©2018 Google

Figure 2-21. End Point on Marion Street

Imagery ©2018 Google

Figure 2-22. Signage Inside the Alley

Table 2-7. Alley Case Study 2 General Characteristics

End point width on Columbia St.	15.4 feet
End point width on Marion St.	16 feet
Narrowest point inside the alley	NA
Length	240 feet
Total vehicles observed	68
Days surveyed	3 days
Time period surveyed	8 a.m. to 5 p.m.

Table 2-8. List of Businesses on the Block or Adjacent (Not Comprehensive)

IN THE CITY BLOCK	ADJACENT BLOCK FACES
Metropolitan Grill (restaurant)	Homegrown (restaurant)
Café Pho (restaurant)	Orca Bay Capital Corporation
Café Zum Zum (restaurant)	Sound Soups (restaurant)
Sharklee & Oliver, PS	DocuSign
Evergreens Salad (restaurant)	Moss Adams
E3 Co. Restaurant Group	7-Eleven
Discovery Institute	FedEx Office Print & Ship Center
Columbia Public Parking	Red Bowls Restaurant (restaurant)
Computer Technical Support Seattle	Seattle Office for Civil Rights
	Rite Aid
	Western Union
	Seattle Credit Union
	Top Pot Doughnuts (restaurant)
	SEIU 755 Benefits Group
	UWKC Volunteer Center
	Columbia Bank
	Custom Smoothie (restaurant)
	Waldron
	Law Offices of John Henry Brown PS
	Key Bank
	Slalom Consulting
	US Social Security Administration

Where Alley Case Study 1 found parked passenger vehicles made up just 12% of the total number of observed parked vehicles during the study period, in this alley, parked passenger vehicles made up a full 50% of the total parked vehicles observed. In terms of sheer number of vehicles observed, passenger vehicles made up the single largest vehicle type observed in this alley. This is perhaps unsurprising, given that the alley is designed to provide access to off-street passenger parking garages.

Figure 2-23. Of 68 Parked Vehicles Observed in Alley over 3 days, 50% were Passenger Vehicles

Distribution of Types of Vehicles

4% 3% 1%
3%
38%
50%

Vehicles Type
- Service Vehicles
- Construction
- Garbage vehicle
- Passenger making a delivery
- Passenger
- Trucks and Cargo Vans
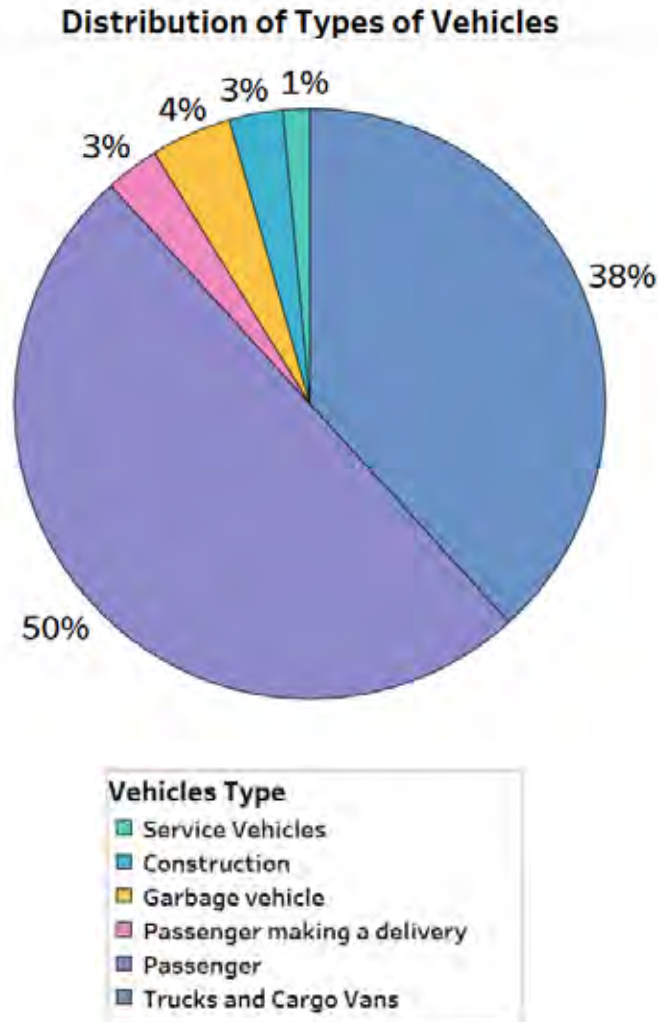
Like the prior case study alley, in Alley Case Study 2, 86% of all parked vehicles were there 30 minutes or less, as shown in Figure 2-24. And 71% parked in the alley for 15 minutes or less. Interestingly, both case study alleys have more than half a dozen restaurants on their respective city blocks and adjacent facing blocks, but have very different use patterns.

Figure 2-24. Types of Vehicles and Their Dwell Time in Alley between Columbia and Marion Streets, 2nd and 3rd Avenues

DWELL TIME BY VEHICLE TYPE IN ALLEY:
MARION AND COLUMBIA STREETS, 2ND AND 3RD AVENUES

VEHICLES TYPE	NO. OF VEHICLES OBSERVED	15 MIN OR LESS	15-30 MIN	30 MIN -1 HR	MORE THAN 1 HR	TOTAL SHARE OF PARKED VEHICLES
Trucks and Cargo Vans	26	21%	7%	6%	4%	**38%**
Service Vehicles	1	1%				**1%**
Passenger	34	44%	4%	1%		**50%**
Passenger making a delivery	2	1%	1%			**3%**
Garbage vehicle	3	3%	1%			**4%**
Construction	2					**3%**
Time parked by type of vehicle	**68**	**71%**	**24%**	**11%**	**3%**	**100%**

Occupancy analysis as illustrated in Figure 2-25 below also shows that this alley:

- on average was vacant 41% of the business day
- when not vacant, on average had only 1-2 vehicles parked 50% of the time-period observed

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Figure 2-25. On Average Only 1-2 Vehicles Were Parking 50% of The Time Observed

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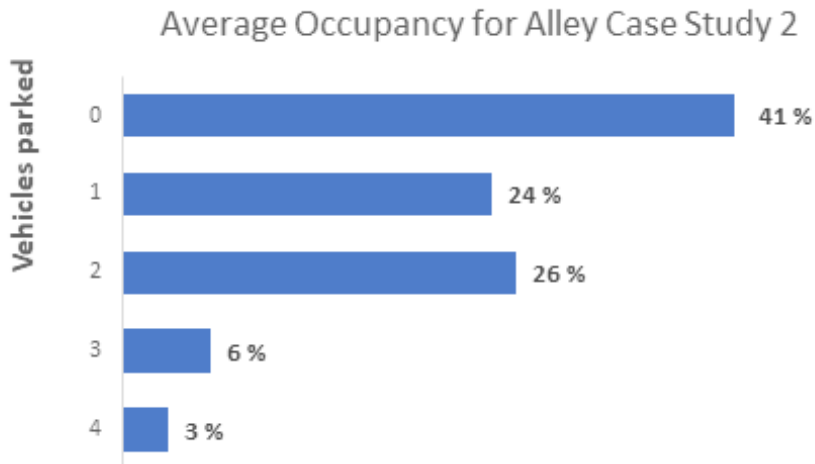
Table 2-9 below illustrates the vehicles data collectors could identify by company name. As shown in Table 2-9 below, 8 of the 13 identifiable companies observed parking in this alley were clearly food- and restaurant-service related. This echoes the pattern found in Alley Case Study 1. Similarly, this may speak to the more than half a dozen restaurants and food-related businesses on the Alley Case Study 2 block and facing streets.

Table 2-9. Company Vehicles Recorded in Alley Case Study 2

ALLEY CASE STUDY 2:

VEHICLES BY COMPANY IN ORDER OF FREQUENCY OBSERVED

COMPANY	NO. OF VEHICLES OBSERVED
Merlino Foods	4
Pacific Fresh Premium Meat	3
Ahern Rentals	2
Cedar Grove	2
Grand Central Baking	2
Olympic Mountain Ice Cream	2
Random.com	2
Charlie's Produce	2
Crystal Spring	2
Pacific Fresh Fish	1
Pacific Rim Distributing & SK Produce Company	1
Recology CleanScapes	1
TCC Printing & Imaging	1
Unknown	8

Both Alley Case Study 1 and Alley Case Study 2 illustrate how differently alleys can be used and how different the predominant users of the alley can be. They also illustrate how each alley has its unique ecosystem in terms of connection to the street network, who and what is served on the block and nearby blocks, and features (or lack thereof) inside the alley.

Occupancy Method Design

To conduct this occupancy study, a team of 25 trained data collectors worked in pairs to survey use of each of the seven alleys over one to four days from February 23 to March 12. Data collectors worked in three-to-five-hour shifts so that each alley would be continuously observed from 8am to 5pm.

Using human data collectors (rather than video or other technology) to track alley usage allowed for the reliable capture of significant details, such as windshield permit stickers and company names on vehicles.

Each data collector was stationed at one of two positions in the alley. Each alley was essentially divided in half, with each data collector covering four zones that met roughly in the middle of the alley. These zones allowed the data collector to easily determine and record where in the alley a vehicle was parked. Each alley had a data-collection sheet for each position. <u>Any vehicle parked in the alley for one minute or more was recorded</u>. The data-collection sheet was divided by zone, with space for the data collector to record:

- The start/end time a vehicle spent parked in the alley (recorded to the minute)
- The type of vehicle parked in the alley
- If visible, the company name for commercial vehicles parked in the alley
- If visible, the presence of a commercial permit on a passenger vehicle parked in the alley

Data collectors recorded their initial field data on a paper-based template. They later transcribed data to a Google Excel document as a first step in data cleaning. Further details on how to conduct an occupancy study can be found in a step-by-step guide in Appendix E.

CONCLUSION AND RECOMMENDATIONS

Cities that need and want to strategically manage their load/unload space network can replicate the pioneering alley studies described in this report. (Step-by-step toolkits can be found in Appendix A and Appendix E.) Seattle, like other growing cities in the age of e-commerce and ride-hailing services, is experiencing much greater demand on the three elements that combine to form the urban commercial vehicle load/unload network:

1. Alleys,

2. Curbs,

3. Private loading bays and docks beneath or ancillary to buildings.

Demand for load/unload spaces in major cities such as Seattle will continue to grow rapidly. While the Urban Freight Lab (UFL) alley studies surfaced several important findings and data points, two findings fundamentally impact understanding of the Seattle Center City area alley system and how the system can best be managed to avoid massive gridlock.

More than 90% of Center City area alleys are only one-lane wide. This creates an upper limit on alley parking capacity, as each alley can functionally hold only one or two vehicles at a time.

When informed by the second key finding—68% of vehicles in the alley occupancy study parked there for 15 minutes or less—it becomes 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. Adding to street congestion and pollution by pushing commercial vehicles onto surface streets to circle until an alley is free is an undesirable outcome.

This study indicates that, due to the fixed alley width constraint, load/unload space inside Seattle's existing Center City area alleys is insufficient to meet additional future demand. This study also points to the need to conduct regular alley surveys, such as every five years, because the city's built environment is changing so rapidly. Regular occupancy studies can capture impacts on Center City area alley use from myriad policy decisions, such as adding more parking entrances in alleys or reducing Commercial Vehicle Load Zones (CVLZs).

The recommendations that follow are intended to help the City of Seattle effectively manage alleys as part of the broader load/unload network.

1. <u>Conduct a one-year pilot test</u> to inform long-term policy solutions, focusing on developing and testing innovative strategies to keep vehicles moving quickly through alleys, and making longer-term parking available at the curb. The pilot test(s) would combine:

• 15-minute load/unload zones in high-use alleys; 30-minute load/unload zone in other alleys as per current code. Notably, 68% of vehicles in the alley occupancy study were parked 15 minutes or less.

• 30-plus minute parking for trucks at the curb where they don't block other delivery vehicles.

This pilot would aim to quantify and evaluate whether overall alley and curb space (load/unload network) productivity can increase if spaces are managed by length of time parked rather than by type of vehicle.

While the research team contemplated recommending a pilot of late-night delivery strategies or late-night garbage pick-up with noise-reducing equipment, UFL members provided critical feedback that the real-life application of this approach would prove problematic given constraints around factors such as labor contracts and tight air-freight schedules. Moving vehicles out of alleys more quickly is thought to be a more powerful and practical strategy.

In the short to mid-term, SDOT could also consider policies to:

2. <u>Encourage use of and/or development of new building and load/unload equipment designs</u> to get vehicles out of the alley and into adjacent loading bays quickly.

3. <u>Require building developers/managers to provide trash compactors</u> in alleys and alley loading bays to reduce garbage pick-up from five days a week to once a week.

4. <u>Foster building managers' interest in adjacent alleys</u>, perhaps akin to the city's existing Block Watch program. Researchers observed that when proximate building managers demonstrate ownership of an alley (regardless of whether it is legally their property) they actively manage the alley by:

• Enforcing rules to ensure intended use

• Providing security cameras and/or staff

• Placing speed bumps to slow traffic

• Getting pavement improvements done

• Placing clear signage to direct use

5. <u>Revise alley design standards for future development so that Center City area alleys provide</u>:

• Loading bays with entrances that angle in the correct direction for alley flow

• Sufficient space for trucks to fully extend equipment

• Smooth-enough pavement for hand trucks in load/unload area

• Space for trash/recycle containers to be stored out of travel lanes

• Sufficient height for garbage trucks to complete overhead lift

6. Create two-way communication systems with alley users to maximize efficiency of alley use by:

- Assembling a database of delivery companies that frequently use alleys to communicate with them ongoing to better manage individual alley use.

- Inviting delivery firms, retailers, building owners and managers, and other users of the full Center City area load/unload network to join a city 'Delivery Alert' database, and send push updates as needed to keep them informed.

- To cut parking-seeking behavior and lower fuel use, develop data applications to collect, correct, store, and analyze occupancy sensor data from alley and other load/unload spaces in the Center City area and return information to users on a web-based and/or mobile platform to inform real-time decisions. This will make vacant and soon-to-be-vacant load/unload space visible to the public, freight dispatchers, and city officials.

Seattle has an exciting and timely opportunity to leverage this study's findings to strategically manage alleys as part of its entire Center City load/unload network.

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[2]   Seattle Right-of-Way Improvements Manual: Seattle Streets Illustrated, "Street Type Standards: 2.16 Commercial Alley," City of Seattle, 2017, 2017. URL: http://streetsillustrated.seattle.gov/street-types/commercial-alley/

[3]   U.S. Census Bureau, "Census Bureau Reveals Fastest-Growing Large Cities," 2018. URL: https://www.census.gov/newsroom/press-releases/2018/estimates-cities.html

[4]   Seattle Municipal Code, "Seattle Traffic Code 11.58.290," Seattle, 2018. URL: https://library.municode.com/wa/seattle/codes/municipal_code/281112?nodeId=TIT11VETR_SUBTITLE_ITRCO_PT5DRRU_CH11.58MIDRRU_11.58.290ALACTO

[5]   ESRI, "World Street Map," 2017. URL: https://www.arcgis.com/home/item.html?id=3b93337983e9436f8db950e38a8629af

APPENDIX A:
STEP-BY-STEP TOOLKIT FOR AN ALLEY INVENTORY

This toolkit describes the step-by-step process that city transportation professionals can follow to carry out an alley inventory survey.

The data-collection and analytic methods represented here are:

- Replicable;
- Available at reasonable cost;
- Ground-truthed;
- Governed by quality-control measures in each step.

The figure A1 below outlines the overall project data process.
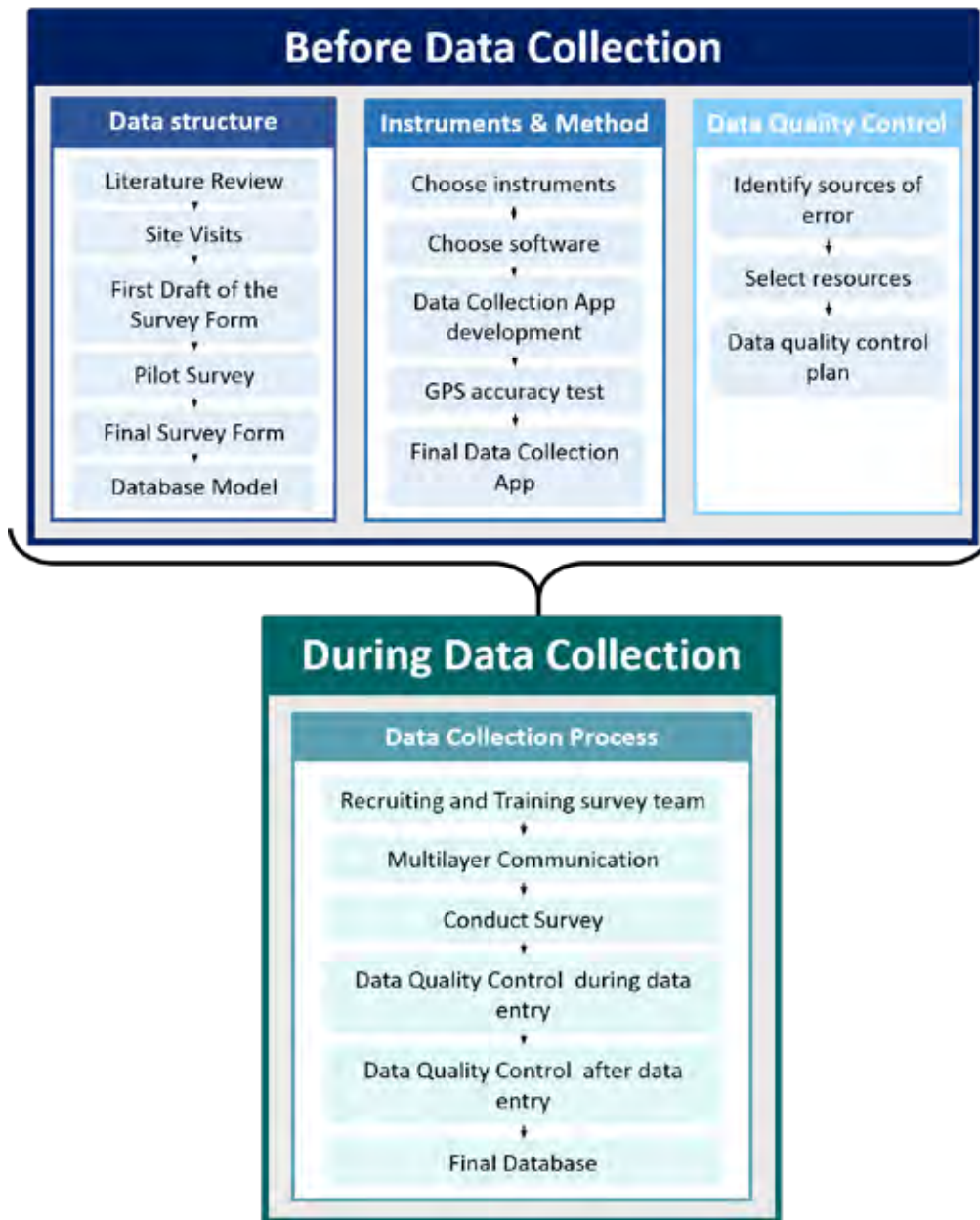
STEP 1: DETERMINE STUDY PARAMETERS

The first step should define these key parameters:

Scope/size of desired study area

Number of alleys to inventory: Pre-existing GIS databases such as transportation network may be a valuable resource as these databases might include alleys. If there is a GIS database of the transportation network but it does not include alleys, the number of city blocks could also be used to assess the scope of the effort involved to complete data collection in the defined study area.

Data-collection hours: For security reasons, it is recommended to work only during daylight hours. As this is not an occupancy study, periods of low activity, such as weekend days, are also candidate times to collect alley data.

STEP 2: DEFINE ALLEY ATTRIBUTES OF INTEREST

Transportation officials should define the specific alley attributes the inventory effort seeks to capture. Cities should decide what agencies, beyond transportation, to include in the definition of attributes as the inventory can have broad applications beyond urban freight. As outlined in the Inventory Method Design, Seattle involved police, public utilities, and fire agencies, as well as firms involved in urban freight. Cities can use (and adapt as desired) the detailed alley typology in the Inventory Method Design to categorize significant alley features. Broadly, Seattle's effort sought to map and inventory various attributes related to 1) Alley connectivity to street network; 2) Alley design; 3) Alley accessibility; 4) Alley pavement condition. Details are available in the Inventory Method Design.

STEP 3: SELECT DATA-COLLECTION TOOLS

The UFL research team decided that a **mobile-app-based data-collection instrument** built from an off-the-shelf basemap was a better option than a paper-based instrument, as detailed in the Inventory Method Design. That said, a paper-based questionnaire may be a viable alternative if a mobile data-collection app is not available or practical.

It is recommended that the chosen tools of the data-collection method be:

- Able to measure metrics with sufficient accuracy
- Easy to transport
- Reasonably priced
- Available as off-the-shelf technology

Below is the list of tools used in the UFL project and their unit price.

INSTRUMENT NAME	UNIT PRICE ($)
Laser measuring device	80
Measuring wheel	50
iPad mini 2 with 32 GB and Wi-Fi and cellular option*	300
Portable power bank	11
iPad Case	90
Security Vest	17.9
Clipboard	2

*This instrument may not be required if the survey instrument is paper-based

STEP 4: CHOOSE SOFTWARE AND PROGRAM DATA-COLLECTION APP

This step requires choosing a database management software that allows for the following functionalities:

- Controlled submission or input of data
- Data storage in different formats, including databases with relationships, geodatabases and cloud storage
- Multiuser data editing
- Set data rules and relationships
- Secure data
- Data-collection app

These functionalities allow effective data management, data quality control and the scaling up of data collection with multiple staff members. It is also recommended to include a data-collection app for the collection of data in field to reduce transcript time and errors. The Urban Freight Lab effort included development of an alley inventory app, thought to be the first of its kind.

The research team implemented the survey form and data-collection process on tablets using ESRI GIS software Survey123, ArcView and ArcGIS Online. These ESRI products offer a seamless data-collection tool that not only allows for visualization of the collected data but its editing.

Additionally, Survey123 allows selection of the most appropriate basemap to assist the geolocation input.

The mobile data-collection app allows manual input of the infrastructure location supported by offline basemaps. This allowed the UFL research team to avoid the cost of having a wireless Internet plan for the tablets to support data collection. During development of the data-collection app, researchers tested the questionnaire in field and in office to prevent logic and other errors in using the survey form.

Based on the UFL research team experience, the collection of geolocation with off-the-shelf GPS devices in urban areas requires:

• Selection of a basemap to support the data collection

• Manual GPS coordinate reading by dropping a pin with a map-based app

• Definition of the data quality control regarding geolocation measures.

UFL researchers selected as a basemap the World Street from ArcGis.com viewer that was last updated on July of 2017 (3). An appropriate basemap can be created incorporating various elements as needed/available in a given city. In Seattle's case, UFL researchers first selected the World Street Map basemap preloaded within ArcGIS software and available from arcgis.com. This worldwide street map presents highway-level data for the world. To supplement this resource and make the basemap more specific within Seattle, researchers added existing GIS data of the location and key names of alleys and loading bays in Seattle's Center City area. The former was from King County's Metro Transportation Network (TNET) database, and the latter was from the SDOT-UW Final 50 Feet Loading Bays and Docks database.

STEP 5: PREPARE ALLEY INVENTORY SURVEY FORM

The survey should encompass all key attributes identified in Step 2. The specific scope of work for each project may require adaptation of the survey form used in this report. If changes are needed, the recommended process is to pilot-test the draft survey form as discussed in the Inventory Method Design section. This pilot test enables cities to:

• Estimate the time needed to survey each alley, including walking time between alleys

• Identify potential problems with the survey logic

• Test data-collection methods and instruments

This step should result in a survey form and metadata document that describe survey data structure.

STEP 6: CREATE DATA QUALITY-CONTROL PLAN

A data quality-control plan must consider the possible sources of error in the data and the resources available to mitigate these errors at different stages of the data-collection process. This helps ensure the quality of the data before it is collected, entered or analyzed. It also helps with monitoring and maintaining the data once collected. The UFL research team identified the types and possible sources of error specific to this type of project to define the quality-control measures needed:

Positional error refers to inaccuracies of GPS coordinate readings due to device issues (e.g. low satellite signal in urban canyons) and mistakes by humans manually collecting this data with tablets.

Attribute error is associated with the remaining non-spatial alley data collected with the survey. Some examples are incorrect data entry due to wrong measurements or mistyped data. Lack of access to the information due to obstructions or safety issues may also result in inaccurate data.

Conceptual error refers to errors around identification and classification of relevant alley attributes or related information. Concepts wrongly used can result in information misclassified and information not captured.

Figure A-2 below shows the UFL project data quality-control design to address the three types of errors above. Figure A-2 illustrates the measures implemented in three stages: before data collection, during data entry, and after data entry.

The Seattle project used three types of resources to carry out quality-control procedures throughout the three project stages:

Supervisor(s) are responsible for defining and enforcing data-collection standards and methodology; training the data collectors; and monitoring and maintaining the database. The supervisor handled the data-control measures implemented before data collection and after data entry.

Collectors are responsible for data entry in field and carrying out same-day data quality-control checks after data entry.

Survey app refers to the digital and online tool that helps create entry constraints, eases the digitization of the data as it is collected and ends the need for manual information digitalization. The survey app plays an important quality-control role because it is programmed to limit inaccuracies in the data-entry stage by considering the data structure rules, attributes and relationships.

Figure A-2. UFL Data Quality-Control Process

	STAGE 1. BEFORE COLLECTION		STAGE 2. DURING DATA ENTRY		STAGE 3. AFTER DATA ENTRY	
	In office	**In field**	**In field**		**In office**	
	Supervisor(s)		Collector(s)	Survey App	Collector(s)	Supervisor(s)
Positional	Establish physical reference of geopoints	Deliver training session to collectors about GPS location collection with survey app	Instructed to be always aware of their location Keep track of surveyed alley locations with hard copies of maps	Includes manual collection of GPS reading by dropping location pin Includes updated base map with city blocks, building outlines, King County TNET alleys and loading bays in alleys.	Conduct same-day check of surveyed alley locations by reviewing alley end points in ArcGIS Online Check street names of alley end points Check alley TNET id the alley exist in King County's TNET database	Check alleys in TNET database to identify alleys not visited (i.e. missed)
Attributes (Infrastructure features)	Build questionaries' data entry constrains in survey app Deliver theoretical training session to data collector	Deliver training session on data collection with survey app and measurement devices regarding infrastructure features	Take clear photos to aid data entries	Includes visual and written aid for data fields	Conduct same-day check of data collected in field using ArcGIS Online platform	Check numeric fields for outliers Conduct revisits to missing alley locations
Conceptual (Infrastructure concepts)	Establish metadata and vocabulary related to the surveyed infrastructure Deliver theoretical training session to data collector	Train collectors in field on how to identify infrastructure relevant to the survey	Write open-ended comments, take additional pictures and use "Other" categories for "undefined" cases	NA = Not applicable	NA = Not applicable	Resolve collectors' observations Check classification of alley end point types with pictures collected and basemap in ArcGIS Online

STEP 7: RECRUITING AND TRAINING OF DATA COLLECTORS

Recruiting

The workforce requirements (number of data collectors and supervisors needed) are determined by the project budget, timeline and survey length. Security concerns and survey complexity may also result in different workforce needs. For instance, data collectors may work better in teams of two to improve security conditions and enable efficient operation of the multiple data-collection instruments (e.g. laser measurement device, measuring wheel, iPad, etc.).

Beyond the time required for data collection in-field, project organizers should also account for the time needed for data-collection staff to commute to/from the study area and conduct data quality-control tasks in office. These tasks will take a varying amount of time depending on the nature, size and location of the study area, and are important to consider when estimating workforce needs in relation to the desired project duration.

Training

Three different data-collector training sessions are suggested:

The first session instructs data collectors in alley concepts and attributes. This training session can be done in a classroom-type setting, with a slide presentation introducing the audience to alleys and the various features and concepts that surround them. The research project should be explained, providing everyone with the goal, process, timeline, and information on shifts. This is also where data collector security and safety protocols can be covered. (See Step 8.)

The second session focuses on practical aspects of data collection, such as how to use the questionnaire in the tablet app and the measurement tools. This training session can be done in-field to give the collectors real-world practice with the materials and process.

The materials needed for alley inventory data collection are detailed in Appendix B. These materials should be acquired before the second training session. Enough should be purchased so every collector and collector pair has what they need. Maps should be prepared that divide up the study area into sectors, allowing data collectors to always have a hard copy map to reference in-field.

This training session should lead the collectors through the actual process of collecting data. Attention should be paid to teaching how to take accurate measurements with the laser and wheel devices and how to effectively divide the collection work between the pair. One person may become very familiar with the measurement tools and always take measurements; the other may become adept at navigating and filling in the survey tool and always take responsibility for this task. Data collectors also had a chance to practice security and safety protocol in field, such as pausing to look down the alley length and determining whether they felt safe before entering. (See Step 8.)

The third session centers on how to implement data quality-control measures. After every shift in-field, one of the data collectors in each pair must clean the data he or she just collected. The third training session should be dedicated to this data-cleaning process: how to access the survey data results and how to properly clean the data, noting common errors to look for and needed changes to make.

STEP 8: DATA COLLECTION

The actual data-collection step depends on the size of the study area and, subsequently, the size of the workforce required. It is recommended that collectors work in pairs on each alley. Depending on collectors' schedules, works shifts can be formed around a geographic area, with more city blocks and alleys included if the shift is longer. A check-out and check-in process can be developed for collectors to pick up and drop off the required materials needed for each shift. Supervisors must make sure territory assignments are formed and hard-copy maps are printed for each team and shift. Data collectors were instructed to inspect every city block searching for alleys, whether the county basemap showed an alley or not.

Security in field

Safety of data collectors visiting and surveying alleys is paramount. It is essential to have a multilayer communications plan in place for all parties with an interest in the study area and the survey. It is also essential to have a comprehensive security protocol to avoid unsafe situations in field.

Data collectors should carry official documents from the sponsoring agency explaining the project and granting data-collection authorization. The documents should include agency official contact information should questions arise in field. Police and other relevant agencies should be informed and recruited to help communicate with all building managers in the survey area.

Relevant agencies can also publish and disseminate information on the survey and its progress to communicate with the public and relevant stakeholders. This communication can indicate where surveyors will be working and when. In Seattle, for example, the Seattle Police Department notified all building managers in the survey area in real time through the Seattle Shield program, a pre-existing information exchange for building operators and the police. SDOT also set up a new webpage at http://www.seattle.gov/transportation/thefinal50feet.htm to communicate with the public and relevant stakeholders.

It is recommended that data collectors follow a security protocol before entering the alley and once they are working inside the alley. In Seattle, data collectors were instructed to not enter in the alley if any staff felt uncomfortable. The presence of obstructions, such as garbage trucks, that made the alley access difficult was sufficient reason to avoid entering the alley. Once inside the alley, data collection teams were directed to exit the alley if any staff felt uncomfortable at any point while collecting features. In some cases, data collectors were able to go around the block to the second alley end point to finish the data collection. The survey logic considered possible interruptions, such as those due to security issues, so that valuable alley information was not lost and data collectors could at a minimum collect data from either end of an alley.

STEP 9: DATA CLEANING

After data collection, data must be cleaned. Both the data collectors and the supervisors play a role in this effort, which is detailed further in Figure A-2, Stage 3. The data collector must conduct a check of the surveyed alley locations after having completed in-field data collection. This step makes the final cleaning of the complete dataset easier and more efficient. The supervisor(s) can conduct their data-cleaning steps during the collection process, but must perform a comprehensive clean *after* all the data has been collected.

STEP 10: PUT TOGETHER AND SUMMARIZE THE DATA

Varying city needs may require different final formats. The final format can be a database made of spreadsheets with relationship between them. In the Seattle project, alleys were considered a point feature layer of alley reference end points, which could be displayed and mapped in GIS software. Most information about the alley was stored in a corresponding attribute table. Information about passenger parking, driveways, buildings' main entrances, and narrowest points along the alley were stored in table attachments that had a relationship one-to-many with the alley reference end points layer. Pictures of alley features were also collected and stored as JPEG files with a naming convention that allowed relating them to the corresponding alleys.

SDOT-UW FINAL 50' PROJECT TO2: TASK 2 AND TASK 3 - METADATA FORM

1. OBJECT INFORMATION

Layer file	Inventory of alleys in Center City area
Metadata Form Date:	03/07/2018

2. DATA SET INFORMATION

Title	Inventory of alleys in Center City area
Abstract:	Location, features and pictures of alleys and its driveways; parking facilities; building main entrances; and narrower points and sections.
Extent:	South Lake Union, Uptown, Belltown, Downtown, Capitol Hill, First Hill, Pike/Pine, 12th Ave, International District (West of I-5).
Data collection dates:	January 2018
Purpose:	Location and features of alleys in Center City area
Supplemental information:	NA: Information that is not applicable to that case. Unknown: Information that is missing or that was not visible or measurable because: the data collection team couldn't access the alley due to (1) construction, (2) temporal obstruction, or (3) safety concerns.
Keyword(s):	Seattle, alley

3. ALLEY INVENTORY TABLE

ATTRIBUTE	CODE DOMAIN	DESCRIPTION
GLOBALID	None	Unique identifier of each survey
TNET_ID	None	King County - Metro Transportation Network (TNET) ID. **NA**: When the alley was not in the King County database.
TY_ED_RF	1 = Access Point 3 = Intersection with another alley 4 = Dead end to a physical barrier 5 = Dead end to driveway with access to street 6 = Dead end to open private property	Type of the alley's end point of reference. See Section 10. Definitions for a further description of the categories of this variable.
X_ED_RF	In linear feet calculated with ArcGIS	GIS X coordinate of the reference end point. Projected Coordinate System: NAD_1983_HARN_StatePlane_Washington_North_FIPS_4601_Feet
Y_ED_RF	In linear feet calculated with ArcGIS	GIS Y coordinate of the reference end point. Projected Coordinate System: NAD_1983_HARN_StatePlane_Washington_North_FIPS_4601_Feet
LONG_ ED_RF	In decimal degrees calculated with ArcGIS	GIS Longitude of the reference end point. World Geodetic System: System: GCS_WGS_1984
LAT_ ED_RF	In decimal degrees calculated with ArcGIS	GIS latitude of the reference end point. World Geodetic System: System: GCS_WGS_1984
STREET_RF	None	**If TY_ED_RF = "Intersection with another alley" or "Access Point",** name of the street closest to the reference end point. Otherwise, **NA.**
ST_WYRF	1 = One-way street 2 = Two-way street	**If TY_ED_RF = "Access Point",** traffic direction of the street closest to the reference end point. Otherwise, "**NA.**"
AP_SLPE_RF	In decimal degrees	**If TY_ED_RF = "Access Point",** cross slope of the apron of the reference end point. Otherwise, "**NA.**"
AP_WTH_RF	In feet	**If TY_ED_RF = "Access Point",** Apron width of the reference end point. Otherwise, "**NA.**"
AP_LEN_RF	In feet	**If TY_ED_RF = "Access Point",** Length from the curb to the reference end point. Otherwise, "**NA.**"
ONE_WY_ALY	Yes or no	Indicates if the alley has a one-way traffic direction. The indication may be vertical signs or pavement markings.

ATTRIBUTE	CODE DOMAIN	DESCRIPTION
ALLEY_DIR	1 = North 2 = South 3 = East 4 = West 5 = Northeast 6 = Northwest 7 = Southeast 8 = Southwest	If ONE_WY_ALY = "yes", Traffic direction of the one-way alley. Otherwise, "NA."
BLOCKED	1 = Construction 2 = Gate 3 = Blocked by a truck 4 = Other	Type of obstruction that impeded measuring inside the alley.
ALY_WTH_RF	In feet	Width of the reference end point measure as the narrowest width within 30ft of the alley.
SIGN_RES	Yes or no	Indicates the existence of a sign restricting the alley usage.
ALY_LENGTH	In feet	Total length of the alleyway.
PAVE_TYP	1 = Asphalt 2 = Concrete 3 = Cobblestones 4 = Other 5 = Gravel	Alley pavement surface type in the majority of the surface.
PAVE_COND	1 =Good 2 = Poor	Qualitative pavement condition assessment based on a subjective evaluation. Pavement in poor conditions are potentially poor for hand carts due to severity of irregular pavement.
GARB_CANS	None	Total number of garbage cans or bins found in the alley.
OIL_CANS	None	Total number of garbage cans or bins for oil found in the alley.
DEBRIS	Yes or no	Indicates the presence or not of debris in the alley.
FURNITURE	Yes or no	Indicates the presence or not of street furniture in the alley.
ALY_WTH_ED	In feet	Width of the opposite alley's end point measure as the narrowest width within 30ft of the alley.
TY_ED	1 = Access Point 3 = Intersection with another alley 4 = Dead end to building outline 5 = Dead end to driveway with access to street 6 = Dead end to open private property	Type of the opposite alley's end point. See Section 10. Definitions for a further description of the categories of this variable.

ATTRIBUTE	CODE DOMAIN	DESCRIPTION
X_ED	In linear feet calculated with ArcGIS	GIS X coordinate of the opposite end point. Projected Coordinate System: NAD_1983_HARN_StatePlane_ Washington_North_FIPS_4601_Feet
Y_ED	In linear feet calculated with ArcGIS	GIS Y coordinate of the opposite end point. Projected Coordinate System: NAD_1983_HARN_StatePlane_ Washington_North_FIPS_4601_Feet
LONG_ ED	In decimal degrees calculated with ArcGIS	GIS Longitude of the opposite end point. World Geodetic System: System: GCS_WGS_1984
LAT_ ED	In decimal degrees calculated with ArcGIS	GIS latitude of the opposite end point. World Geodetic System: System: GCS_WGS_1984
STREET_ED	None	**If TY_ED_RF = "Access Point",** name of the street closest to the reference end point. Otherwise, **NA.**
ST_WYED	1 = One-way street 2 = Two-way street	**If TY_ED_RF = "Access Point",** traffic direction of the street closest to the reference end point. Otherwise, "**NA.**"
AP_LEN_ED	In feet	**If TY_ED_RF = "Access Point",** name of the street closest to the opposite end point. Otherwise, "**NA.**"
AP_SLPE_ED	In decimal degrees	**If TY_ED_RF = "Access Point",** cross slope of the apron of the reference end point. Otherwise, "**NA.**"
AP_WTH_ED	In feet	**If TY_ED_RF = "Access Point",** Apron width of the reference end point. Otherwise, "**NA.**"

4. NARROWER POINTS TABLE

ATTRIBUTE	CODE DOMAIN	DESCRIPTION
GLOBALID	None	Foreign key corresponding to GlobalID in Table Alley Inventory.
NRW_X1	In feet	Distance from the reference end point to the location of (1) the narrower point, or (2) the start of the narrower section. Narrower points and sections are restrictions to the alley effective width (min. 1ft.) or effective height (below 16 ft.)
NRW_TYP	1 = Bollards 2 = Building outline 3 = Camera 4 = Electric Panels 5 = Fire escapes 6 = Mirrors 7 = Parking / Commercial ventilation intakes or exhaust 8 = Projecting lights 9 = Signs 10 = Standpipes 11= Transformer equipment 12 = Trash chutes 13 = Other	Type of physical obstruction(s) that results in narrower points or sections.
NRW_DIM	1 = Point restricting width 2 = Point restricting height and width 3 = Section restricting width 4 = Section restricting height and width	Dimension(s) restricted by the narrower point or section.
NRW_WTH1	In feet	Effective width of the alley at the narrower point or the start of a narrower section.
NRW_HGT	In feet	**If NRW_DIM = "Point restricting height and width" or NRW_DIM = "Section restricting height and width",** Effective height of the alley at the narrower point or section. Otherwise, "**NA.**"
NRW_WTH2	In feet	**If NRW_DIM = "Section restricting width" or NRW_DIM = "Section restricting height and width",** Effective width of the alley at the end of the narrower section. Otherwise, "**NA.**"
NRW_X2	In feet	**If NRW_DIM = "Section restricting width" or NRW_DIM = "Section restricting height and width",** Distance from the reference end point to end of the narrower section**.** Otherwise, "**NA.**"

5. BUILDING MAIN ENTRANCES TABLE

ATTRIBUTE	CODE DOMAIN	DESCRIPTION
GLOBALID	None	Foreign key corresponding to GlobalID in Table Alley Inventory.
MPRV_X	In feet	Distance from the reference end point to where the main private entrance is located.
BLDG_ADDR	None	Building address.

6. PARKING FACILITY ACCESS TABLE

ATTRIBUTE	CODE DOMAIN	DESCRIPTION
GLOBALID	None	Foreign key corresponding to GlobalID in Table Alley Inventory.
PKG_X	In feet	Distance from the reference end point to where the parking access is located. Only includes parking facilities that can be accessed via the alley. The open-air surface parking lots were recorded based on the midpoint of the lot frontage on the alley.

7. DRIVEWAYS TABLE

ATTRIBUTE	CODE DOMAIN	DESCRIPTION
GLOBALID	None	Foreign key corresponding to GlobalID in Table Alley Inventory.
DRIVE_X	In feet	Distance from the reference end point to where the driveway is located
DRIVE_PKG	Yes or no	Indicates if the driveway provide access to a parking lot
DRIVE_CON	Yes or No	Indicates if the driveway connects with a street.
DRIVE_ST	None	**If DRIVE_CON = "Yes",** name of the street connected to the driveway

8. NON-EXISTING KING COUNTY'S ALLEYS TABLE

ATTRIBUTE	CODE DOMAIN	DESCRIPTION
GLOBALID	None	Foreign key corresponding to GlobalID for picture database.
TNET_ID	None	King County - Metro Transportation Network (TNET) ID

9. PICTURE DATABASE

The picture database related to the infrastructure database consists of a folder with all pictures in JPG format collected in the field for each alley. The pictures in the database follow a naming system that allows identifying each of the pictures corresponding to each alley. The JPG files are named as follows:

"GLOBALID of alley_Variable name of the picture.jpg."

GLOBALID variable is described in Section 3 above and consist of an integer that serves as a unique identifier of each infrastructure in the database. *Variable name of the picture* refers to each of the possible variable names of type picture that relate to a specific feature of the infrastructure as described below.

ATTRIBUTE	DESCRIPTION
GLOBALID	Unique identifier of each survey
PIC_ALY_ST	Picture of the reference end point
PIC_DR_SGN	**If ONE_WY_ALY = "Yes",** Picture of the alley "One way" sign
PIC_RES_1	**If SIGN_RES = "Yes",** Picture of the alley usage sign
PIC_RES_2	**If SIGN_RES = "Yes",** Picture of the alley usage sign
PIC_BKED OR PIC_INALY	In case of obstructed alley, picture of the area within the alley
PIC_NRWPT1	Picture of the narrower point or section
PIC_NRWPT2	Picture of the narrower point or section
PIC_MPRV	Picture of the main private entrance
PIC_PKG	Picture of the parking access
PIC_ALYDRIVE	Picture of the driveway
PIC_PAVE	Picture of the pavement surface
PIC_DEND OR PIC_ALY_ED	Picture of the opposite end point
PIC_NOALY1	Picture of location of alleys that no longer exist

10. DEFINITIONS

10. 1 General definitions

Alley end points. The point where an alley begins or ends. By definition, every alley has two end points.

10.2 Code Definitions

TY_ED and TY_ED_RF code dictionary

CODE	DESCRIPTION
Access Point	End point located at the block face of a city block. This is the most common prevalent example of an end point. Often there will be buildings on either side of the alley's access point but in some cases, there may be vacant lots or surface parking lots.
Intersection with another alley	End point where two alleys intersect inside a city block.
Dead end at a physical barrier	End point where an alley ends at a dead-end impassible for vehicles, such as a building outline and staircase.
Dead end at a driveway with access to the street	End point where an alley dead-ends at a driveway, which provides access to the street.
Dead end at open private property	End point where an alley dead-ends at open private or public property, such as a public square.

Laster Measure Tool We used Bosch model GLM 80 Must be able to measure angle of apron, in addition to taking horizontal and vertical measurements	
Measuring wheel We used a model that measured in feet and inches	
iPad for data collection survey	
Protective, waterproof case with neck strap for iPad Allows data collector to wear iPad around his or her neck, preventing him or her from having to carry it in hand. Also allows easy access to it in field, and protects it from weather elements.	

Portable battery charger and cord for charging iPad in-field	
Reflective safety vest	
Clipboard, pen	
Paper maps showing data collector's territory and alleys to be surveyed	

Note: Data collectors will do a walk around the city block before starting any survey of a new city block. During the round, they will indicate the following information on the hard copy map:

➜ Access point(s) width

➜ Access point(s) location

Part A - Existence of the alleyway

1. **Survey date**

2. **Survey time**

3. **What is the survey ID on the hard copy map?**

4. **Is the alleyway shown on the base map?**

   ☐ Yes   ☐ No

   If the answer is No:

   4.1 Proceed to Form1

   If the answer is Yes:

   4.2 What is the TNET_ID?

   4.3 Does the alleyway exist?
   ☐ Yes   ☐ No

      If the answer is Yes:

      4.3.1 Proceed to Form1

      If the answer is No:

      4.3.2 Take a picture of what there is instead of the alleyway.

      4.3.3 Gather additional observations.

      4.3.4 Submit the survey.

Part B - For existing alleys

Note 1: *If the alleyway has two access points start with the narrowest one.*

FORM 1 - ALLEYWAY'S "EXTREME POINT" – Survey Start Point

5. What type of extreme point is being surveyed? (EXTR_TYPE)
☐ Access Point (in the public right away with access to street – most common)
☐ Intersection with street (inside the city block)
☐ Intersection with another alleyway (inside the city block)
☐ Dead end, ending at a building outline
☐ Dead end, ending at a driveway with access to street
☐ Dead end, ending at open private property

If it is an access point:

5.1. What is the name of the street closest to the alley's access point?

5.2. What type of street is it?
☐ One-way street   ☐ Two-way street

5.3. Where is the access point located?
☐ South or West face of the city block   ☐ North or East face of the city block

5.4 . Capture GPS coordinate of access point by dropping location pin at the curb

5.5. Input the apron width.

5.6. Input the apron cross slope. (*The apron slope is the slope measured perpendicular to the direction of travel. To measure the slope, the laser should be placed from **South to North**, **East to West**, **Southwest to Northeast**, or **Southeast to Northwest**. Refer to the Map North Arrow*)

5.7. Input the length from the curb to the alley's access point

If it is an intersection with street:

5.8. What is the name of the street?

5.9. What type of street is it?
☐ One-way street   ☐ Two-way street

5.10. Where is the access point located?
☐ South or West face of the city block   ☐ North or East face of the city block

5.11. Capture GPS coordinate of access point by dropping location pin at the curb

5.12 Input the apron width.

5.13. Input the apron cross slope. *(The apron slope is the slope measured perpendicular to the direction of travel. To measure the slope, the laser should be placed from **South to North**, **East to West**, **Southwest to Northeast**, or **Southeast to Northwest**. Refer to the Map North Arrow)*

5.14. Input the length from the curb to the alley's access point

If it is an intersection with alley:

What is the name of the street closest to the intersection?

Capture GPS coordinate of the alley's extreme point by dropping location pin at the middle of the intersection

If it is a dead end:

Capture GPS coordinate of the alley's extreme point by dropping location pin at the middle of the intersection

6. Take a photo of alleyway extreme point

7. Input the alley's extreme point width (Note: Capture the narrowest within 30ft of the alley)

FORM 2 - ALLEYWAY ACCESS TO THE SURVEY

8. **Is there an indication that it is a one-way alley?**

☐ Yes   ☐ No

If it is a one-way alleyway:

Take a picture of the indication.

What is the direction of traffic in the alleyway?

☐ North   ☐ Northeast

☐ South   ☐ Northwest

☐ East   ☐ Southeast

☐ West   ☐ Southwest

9. **Is there any sign indicating a restriction on alley usage?**

☐ Yes   ☐ No

If There is restriction sign:

9.1. Take a picture of the alley usage sign(s).

9.2. Take a picture of the alley usage sign(s).

10. **Do you feel safe entering the alley?**

☐ Yes   ☐ No

If the answer is No:

10.1. Explain why you don't feel safe.

10.2. Take pictures of the area within the alley. *(Skip this question if you don't feel safe taking a picture)*

Note: Don't enter the alley if any of the team members feel uncomfortable! Go around and survey the alley's second access point (i.e. the end point of the survey); unless the alley ends in a dead end.

10.3. Can you access the other extreme point from the street?

☐ **Yes**   ☐ **No**   ☐ **Not sure**

If the answer is yes:

10.3.1 Proceed to "FORM 4"

If the answer is no:

10.3.2 Submit the survey.

If the answer is not sure:

Close the survey for now.

If the answer is Yes:

10.4. Is there any obstruction that impedes measuring inside the alley?

☐ Yes   ☐ No

If the answer is Yes:

10.4.1 What is the obstruction?

☐ Construction

☐ Gate

☐ Blocked by a vehicle

☐ Other:

10.4.2. Take pictures of the area within the alley.

10.4.3. Proceed to "FORM 4"

If the answer is No:

10.4.4. Proceed to "FORM 3"

FORM 3 - FEATURES WITHIN THE ALLEYWAY (From where the survey starts)

11. **Sub form -** Narrowest Points / Sections

    11.1 Input the distance from the survey's start point to the location of the narrower point or section.

    11.2. What type of restriction is it? (multiple selection)

    ☐ Bollards

    ☐ Building outline

    ☐ Camera

    ☐ Fire escapes

    ☐ Electric Panels

    ☐ Mirrors

    ☐ Parking / Commercial ventilation
       intakes or exhaust

    ☐ Projecting lights

    ☐ Signs

    ☐ Standpipes

    ☐ Transformer equipment

    ☐ Trash chutes

    ☐ Other: _____

    11.3. Input the width

    11.4. What type of dimension restriction is it?

    ☐ Point restricting width *(an obstruction in the floor or close to the floor)*

    ☐ Point restricting height and width

    ☐ Section restricting width (such as a building face)

    ☐ Section restricting height and width

    If the answer is height and width

    11.4.1. Input the effective height of the alley

    If the answer is width in a distance

    11.4.2. Input the distance from the survey's start point where the narrowest section ends.

    11.4.3. Input the width where the narrowest section ends

    If the answer is width in a distance

    11.4.4. Input the distance from the start point where the narrowest section ends.

    11.4.5. Input the width where the narrowest section ends

    11.4.6. Input the effective height of the alley

    11.5. Take a picture of the narrower point or section

    11.6. Gather additional information.

12. Sub form - <u>Main Private Entrances</u> *(i.e. the primary entrance to a private business or establishment)*

12.1. Input the distance from the start point where the main private entrance is located.

12.2. As you stand in the alley and face the main private entrance, what is the block face on the other side of the building?

☐ South or West face of the city block

☐ North or East face of the city block

12.3. What is the building address?

12.4. What type of building?

☐ Residential

☐ Commercial

☐ Historic

☐ Office

☐ Other

12.5. Take a picture of the main private entrance.

12.6. Gather additional information.

13. Sub form - <u>Parking facility access</u>

Note: *Only capture parking facilities that can be accessed only via the alley.*

13.1 Input the distance from the start point where the parking facility access is located.

13.2 Is the parking facility access already in the base map as a loading bay?

☐ Yes   ☐ No

If the answer is Yes:

12.2.1 Input the Loading Bay ID

13.3 If you stand in the alley and face the parking facility entrance, what is the block face on the other side of the parking facility?

☐ South or West face of the city bloc

☐ North or East face of the city block

13.4 Capture GPS coordinate of parking facility access by dropping location pin at the parking facility entrance

13.5 Take a picture of the parking facility access

13.6 Gather additional information.

14. **Sub form** - <u>Driveways</u>

14.1. **Input the distance from the start point where the driveway is located.**

14.2 **As you stand in the alley and face the driveway, what is the block face on the other side of the driveway?**

☐ South or West face of the city block

☐ North or East face of the city block

14.3 **Does the driveway provide access to a parking lot?**

14.4 **Does the driveway connect with a street?**

If the answer is Yes:

14.4.1 **What is the name of the street?**

14.5. **Take a picture of the driveway**

14.6. **Gather additional information.**

15. **Sub form** - <u>Security Protocol inside the alley</u>

Note: *If any of the team members feel uncomfortable at ANY point while collecting the features within the alley,get out of the alley! If able, go to the second access point (i.e. the end point of the survey) to finish your data collection (unless the alley ends in a dead end).*

15.1. **Do you want to close Form 3 because of safety reasons?**

☐ Yes   ☐ No

If the answer is Yes:

15.1.1. **Explain why you don't feel safe.**

16. **Input the length of the alleyway** *(from extreme point to extreme point)*

Note: *Measure length between the two access points of the alley, or between one access point and a dead end or intersection.*

17. **How many dumpsters, garbage cans or bins are in the alley?**
    Note: *Do not count garbage cans or bins located in private property.*

18. **How many garbage cans or bins for oil are in the alley?**
    Note: *Do not count garbage cans or bins located in private property.*

19. **How many fire escapes are in the alley?**

20. **What is the pavement surface type?**

☐ Asphalt   ☐ Cobblestones

☐ Concrete   ☐ Other: _____

21. What is the condition of the pavement?

☐ Good

☐ Poor

Note: *pavements in poor condition show height differences that include uplifts, non-flush utility vault lids, and settling alleyways (SEE PICTURE).*

22. Take a picture of the pavement surface

23. Are debris in the alleyway?

☐ Yes ☐ No

24. Is there street furniture in the alleyway?

☐ Yes ☐ No

If the answer is Yes:

24.1 Take additional observations about street furniture.

25. Is there any mechanical equipment in the alleyway?

☐ Yes ☐ No

If the answer is Yes:

25.1. Take picture of mechanical equipment.

25.2. Additional observations about equipment

26. Additional observations

27. Proceed to "Form 4"

FORM 4 - ALLEYWAY'S EXTREME POINT – Survey end point *(The point where the survey ends)*

28. **Input the alley's extreme point width (Note: Capture the narrowest within 30ft of the alley)**

29. **What type of extreme point is being surveyed?**

☐ Access Point (in the public right away with access to street)

☐ Intersection with street

☐ Intersection to alleyway (inside the city block)

☐ Dead end to building outline

☐ Dead end to driveway with access to street

☐ Dead end to open private property

If the answer is dead end:

29.1. **Take a photo of the dead end.**

29.2. **Submit the survey.**

If the answer is an access point or intersection with street:

29.3 **Input the length from the curb to the alley's access point**

29.4 **What is the name of the street closest to the alley's access point?**

29.5 **What type of street is it?**
   ☐ One-way street
   ☐ Two-way street

29.6 **Where is the access point located?**
   ☐ South or West end of the city block
   ☐ North or East end of the city block

29.7 **Capture GPS coordinate of access point by dropping location pin at the curb**

29.8 **Input the apron width.**

29.9 **Input the apron cross slope.** *(The apron slope is the slope measured perpendicular to the direction of travel. To measure the slope, the laser should be placed from **South to North**, **East to West**, **Southwest to Northeast**, or **Southeast to Northwest**. Refer to the Map North Arrow)*

29.10. **Take a photo of alleyway access point and street intersection**

If UNSAFE = Yes:

29.10.1. **Do you feel safe entering the alley?**

☐ Yes   ☐ No

If the answer is yes:

29.10.1.1. **Proceed to "Form 3"**

If the answer is No:

29.10.1.2. Submit the survey.

Note: *"Form 3" remains empty.*

If the alley exists from Part A:

29.10.2. Is there any obstruction that impedes measuring inside the alley?

☐ Yes   ☐ No

If the answer is No:

29.10.2.1.1. Proceed to "Form 3"

If the answer is Yes:

29.10.2.1.2. What is the obstruction?

☐ Construction

☐ Gate

☐ Block by a vehicle

☐ Other: _____

29.10.2.1.3. Take pictures of the area within the alley.

29.10.2.1.4. Submit the survey.

> **Note:** *"Form 3" remains empty.*

The data-collection and analytic methods represented here are:

• Replicable;

• Available at reasonable cost;

• Ground-truthed;

• Governed by quality-control measures in each step.

The following section details the step-by-step procedure to replicate the alley observation method developed and implemented by the UFL research team.

STEP 1: DETERMINE STUDY PARAMETERS

The first step should define these key parameters at the study's outset based on the project scope and budget:

• Scope/size of study area

• Number of alleys to be observed

• Specific location of each alley to be observed

• Data-collection/observation hours for study alleys (unlike an alley inventory, periods of low activity should be avoided if the project seeks to document "typical" usage)

In selecting sites for data collection, alleys should be assessed to ensure both the safety of the data-collection team and to ensure the alleys offer clear visibility for the data-collection method. (See Step 2).

STEP 2: ASSESS EACH ALLEY

For each alley, it is important to identify the following alley design features and facilities.

1. **Alley design features:**

Note: There is no need to collect these features if this information is already available in an existing alley inventory. Below are the needed features to document in each study alley. Please see page 27 in the Alley Inventory for a detailed explanation of alley typology/design features referenced below.

DESIGN FEATURES	
Feature	**Under what conditions do these require documenting?**
Type of end points	Required
Width of end points	Required
Narrowest point(s) inside the alley	If interior width is at least 1 foot less than the narrowest end point
Length of the alley	Required
Height restriction	If vehicle clearance in alley is less than 14 feet and narrows down the alley by 1ft or more
Apron width for each end point connected to the street	Required
Apron length for each end point connected to the street	Required

2. Facilities accessed through the alley:

FACILITIES ACCESSED THROUGH THE ALLEY
Location of freight parking infrastructure (such as loading bays/docks)
Location of passenger parking facilities
Location of building doors with pedestrian access

Assessing these features and facilities will help with identifying the proper position locations for data collectors to stand. Position locations should assure data collectors are out of the alley's regular traffic flow. They should also grant an unencumbered view of vehicles in the alley so data collectors can accurately gather data on who is parking where, when, and for how long.

STEP 3: PREPARE MAPS AND OCCUPANCY DATA-COLLECTION FORMS

Position maps and data-collection forms should be prepared for each position within each alley.

1. **Position map:**

Each data collector is responsible for observing and collecting information for a particular section of the alley, called a position. Each position is divided into zones. The limits of each zone should be easily ikey dentifiable in-field, using alley features, landmarks and/or facilities. Below are outlined key alley facility terms. Figures E1 and E2 map the positions, zones, and key facilities in an alley.

Table E-1. Key alley features and codes

FACILITY NAME	CODE USED
Building Access	BA
Freight parking facility	LB
Passenger Parking Facility	PG
Driveway	DR

Figure E-1. Map of position A's responsible territory divided into zones

Figure E-2. Map of position A's responsible territory divided into zones

Data-Collection Forms:

A paper form should be created for the data collector to record his/her observations. The form can be made in Microsoft Excel. As shown in Figure E-4, the form should include these components:

1. **Part I - Header**. The alley location, number, and position.

2. **Part II - Shift information**. Space to record the data collector's name, as well as data-collection date and shift.

3. **Part III - Vehicle type code**. A legend listing each vehicle type and its corresponding code, along with any notes.

4. **Part IV - Instructions.** Any instructions for the data collector from the project team.

5. **Part V - Data-collection table**. A table organized by zones in the same order established in the position's map. The table should have:

   a. At least one column for each zone

   b. Space to record information on a vehicle that parks in the assigned position (vehicle code and associated information—logo, company name, etc.)

   c. Space to record the parking start and end time.

Table E-2: Key alley features and codes

STEP 4: RECRUITING AND TRAINING OF DATA COLLECTORS

Recruiting

The workforce requirements (e.g. number of data collectors needed) will be determined by the project budget, timeline and survey length. Security concerns and survey complexity may also result in different workforce needs. The UFL research team used a team of 25 data collectors. Two data collectors per shift were designated for each alley; one for position A, one for position B.

Beyond the time required for data collection in-field, project organizers should also account for the time needed for data-collection staff to commute to/from the study area and conduct data quality-control tasks in office. These tasks will take a varying amount of time depending on the nature, size and location of the study area, and are important to consider when estimating workforce needs in relation to the desired project duration.

Training

Two training sessions are recommended before data collection starts. One can be in a classroom setting for theoretical training of data collectors; the other is designed as an in-field session for data collectors.

1. **Theoretical training session.** A presentation should cover the following aspects:
- The study parameters
- The typology of vehicles
- The data-collection method
- Important alley terms (such as apron, end point, etc.)
- Review of the data collector position's map and data-collection forms

2. **In-field training session.** While visiting an alley, data collectors will ensure they understand its representation on the map and the data-collection method. Data collectors will pilot the recording of vehicles that park in the alley.

STEP 5: DATA COLLECTION

For each data-collection shift, collectors will require a data-collection kit consisting of:
- Position's map
- Clipboard
- Security vest
- Data-collection forms
- A watch or timekeeping device to record the start/end time of each vehicle's parking
- Official letter of permission from the city or relevant entity authorizing data collectors' work and providing contact information for project leads at the city or relevant authority.

For the UFL alley occupancy project, data collector shifts ranged from three to five hours each. Depending on the determined observation time and data collectors' availability, any number of shifts can be scheduled to cover each alley. That said, collectors must not take their eyes off the during the determined data-collection period. To give collectors breaks, data collectors can rotate from being on an assigned position in an alley to being in a role monitoring other collectors in nearby alleys.

STEP 6: DATA TRANSCRIPT

A method must be established for data collectors to transcribe their recorded field observations after their shift ends. For the UFL project, data collectors received a Google Excel sheet for each alley. The sheet was pre-formatted with columns based on data structure defined for this method, as shown in Table E-4. Data collectors should enter in their observations no more than 24 hours after their shift ends. Transcribing the data allows data collectors to double-check their entries for clarity and serves as a first step in data-cleaning.

Table E-4. Excel sheet for data transcript

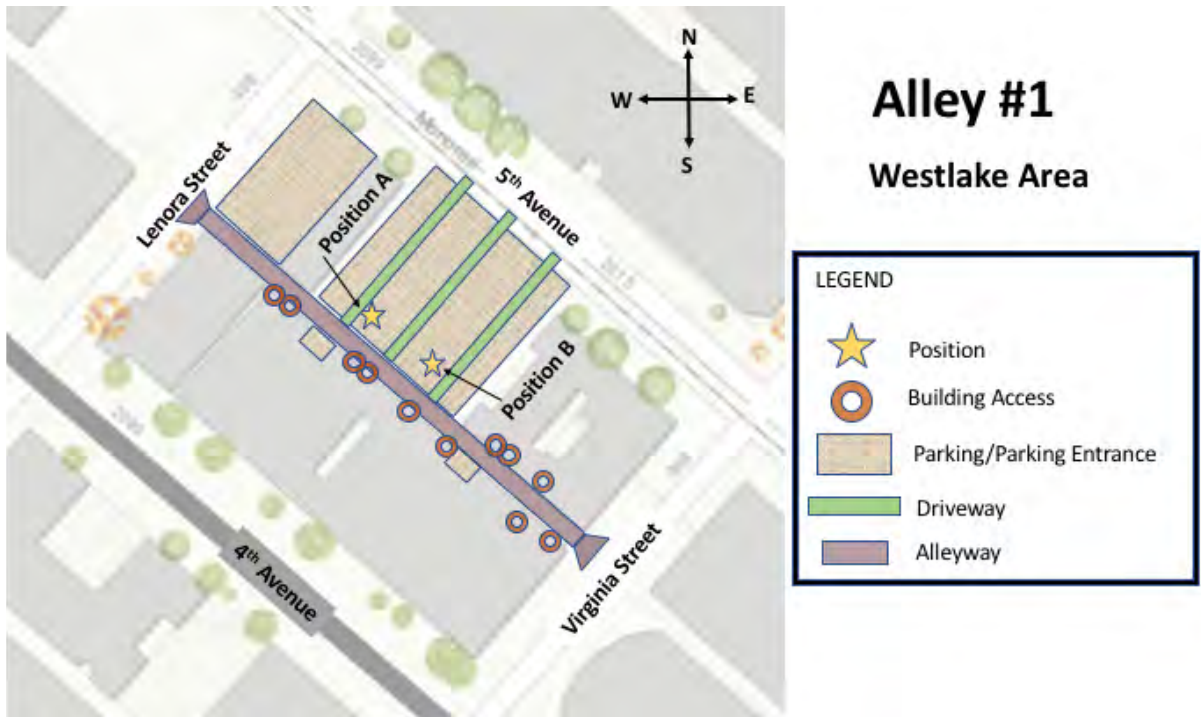| DAY	ALLEY	POSITION	START TIME	END TIME	ZONE	VEHICLE TYPE	COMPANY	PASSENGER PERMIT	ADDITIONAL INFORMATION

STEP 7: DATA CLEANING

A data-collection lead must review the data and check for data transcript errors and missing values.

STEP 8: PUT TOGETHER AND SUMMARIZE THE DATA

The data can be packaged into a final spreadsheet that concisely lists every vehicle and its accompanying details, the alley it was in, and the amount of time it was parked. This allows for data analysis relevant to the study project's goals.

Alley #1

Westlake Area

LEGEND

★ Position
◎ Building Access
▢ Parking/Parking Entrance
▬ Driveway
▬ Alleyway

Alley # 1: Position A

LEGEND

⭐ Position

⊙ Building Access

▬ Driveway

▭ Parking/Parking Entrance

Alley # 1: Position B

LEGEND

⭐ Position

⊙ Building Access

▬ Driveway

▭ Parking/Parking Entrance

Alley # 2
Westlake Area

LEGEND

⭐	Position
◯	Building Access
▭	Parking/Parking Entrance
▬	Driveway
▬	Alleyway
▢	Loading bay
🏃	Fire escape (out of zone 4)

Alley # 2: Position A

LEGEND

⭐ Position

◎ Building Access

🏃 Fire escape (out of zone 4)

▢ Loading bay

Alley # 2: Position B

LEGEND

⭐ Position

◎ Building Access

▭ Parking/Parking Entrance

▬ Driveway

▢ Loading bay

🏃 Fire escape (zone 4)

Alley # 3

Downtown CBD

LEGEND

★ Position
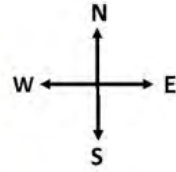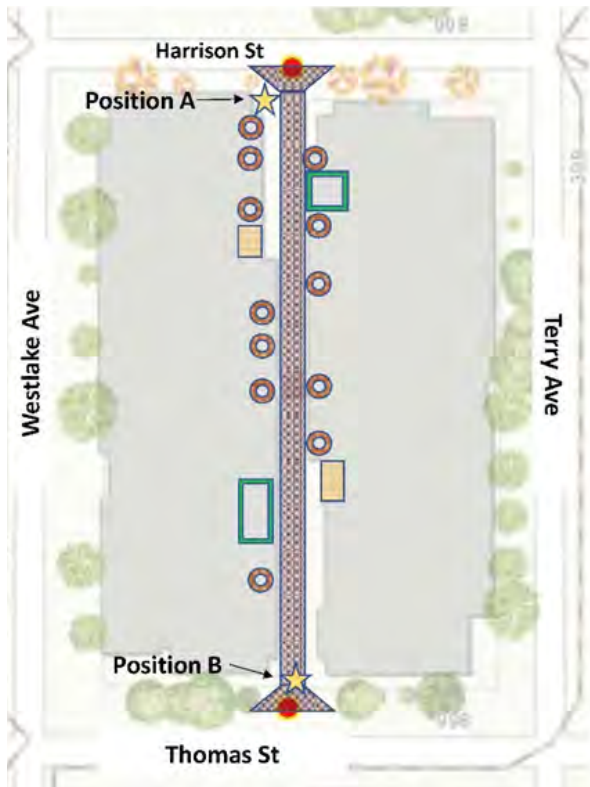
◎ Building Access

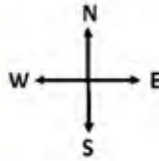▭ Parking/Parking Entrance

▨ Alleyway

Alley # 3: Position A

LEGEND

Symbol	Description
★	Position
◎	Building Access
▭	Parking/Parking Entrance
▨	Alleyway

Alley # 3: Position B

LEGEND

Symbol	Description
★	Position
◎	Building Access
▭	Parking/Parking Entrance
▨	Alleyway

Alley # 4

South Lake Union

Harrison St

Position A

Westlake Ave

Terry Ave

Position B

Thomas St

N
W ← → E
S

LEGEND

★ Position

◉ Building Access
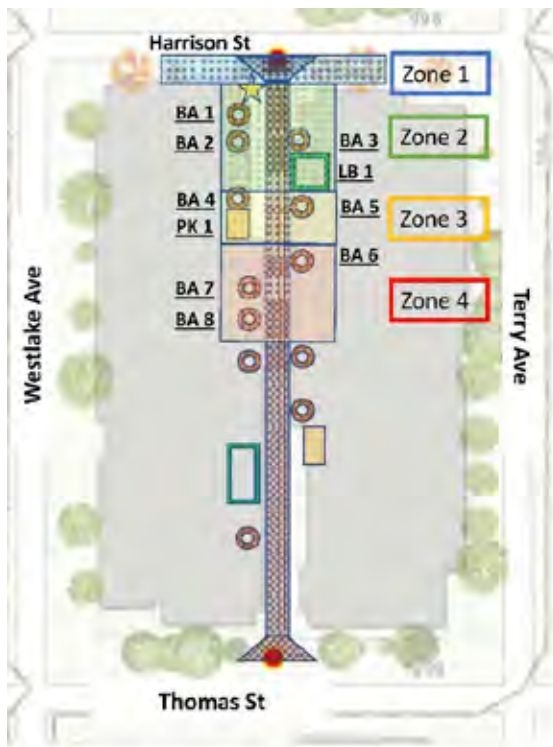
▭ Parking/Parking Entrance

▢ Loading bay

▨ Alleyway

Alley # 4: Position A

LEGEND
- ⭐ Position
- ◎ Building Access
- ▭ Parking/Parking Entrance
- ▭ Loading bay
- ▦ Alleyway

Alley # 4: Position B

LEGEND
- ⭐ Position
- ◎ Building Access
- ▭ Parking/Parking Entrance
- ▭ Loading bay
- ▦ Alleyway

Alley # 5:
Position A

LEGEND

⭐ Position

🔘 Building Access

�yellow▉ Parking/Parking Entrance

▉green▉ Driveway

▢ Loading bay

▉ Alleyway

Alley # 5:
Position B

LEGEND

⭐ Position

🔘 Building Access

▉ Parking/Parking Entrance

▉ Driveway

▢ Loading bay

▉ Alleyway

Alley # 6

Westlake Area

LEGEND

⭐ Position

⊙ Building Access

▭ Parking/Parking Entrance

☐ Loading bay

▨ Alleyway

Alley # 6: Position A

LEGEND

⭐ Position

🔘 Building Access

🟨 Parking/Parking Entrance

⬜ Loading bay

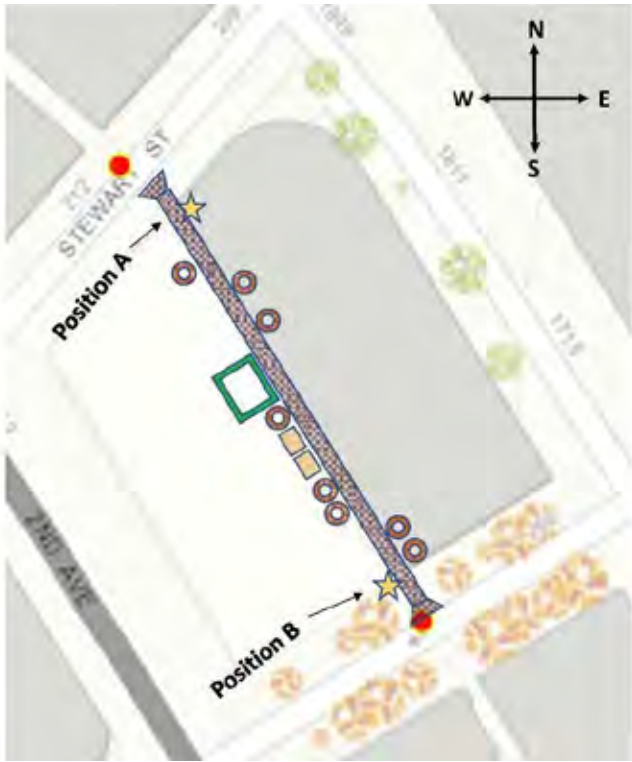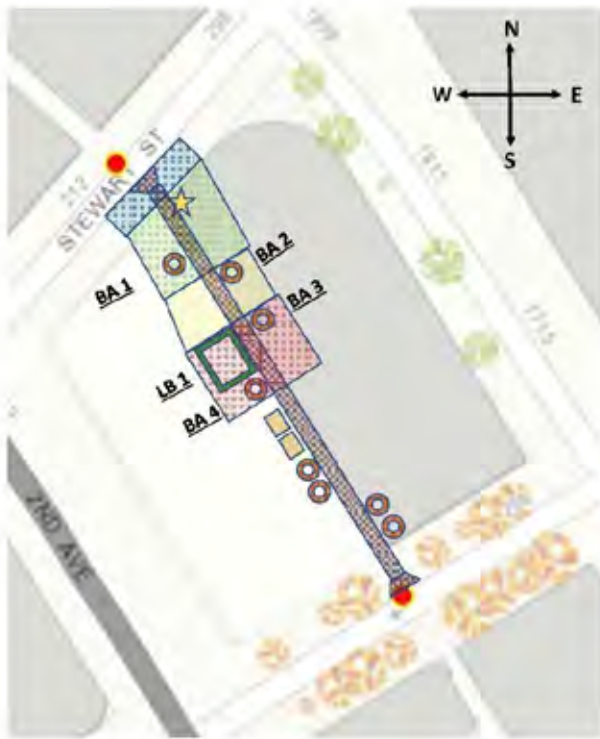▦ Alleyway

Alley # 6: Position B

LEGEND

⭐ Position

🔘 Building Access

🟨 Parking/Parking Entrance

⬜ Loading bay

▦ Alleyway

Alley # 7: Position A

LEGEND

⭐	Position
◎	Building Access
▭ (blue)	Parking/Parking Entrance
▭ (red)	Alleyway

Alley # 7: Position B

LEGEND

⭐	Position
◎	Building Access
▭ (blue)	Parking/Parking Entrance
▭ (red)	Alleyway

W

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