# Growth of E-Commerce and Ride-Hailing Services is Reshaping Cities
Connecting State and City DOTs, and Transit Agencies for Innovative Solutions

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AASHTO's 2018 Joint Policy Conference: Connecting the DOTs
July 19, 2018

Total U.S. Retail Sales
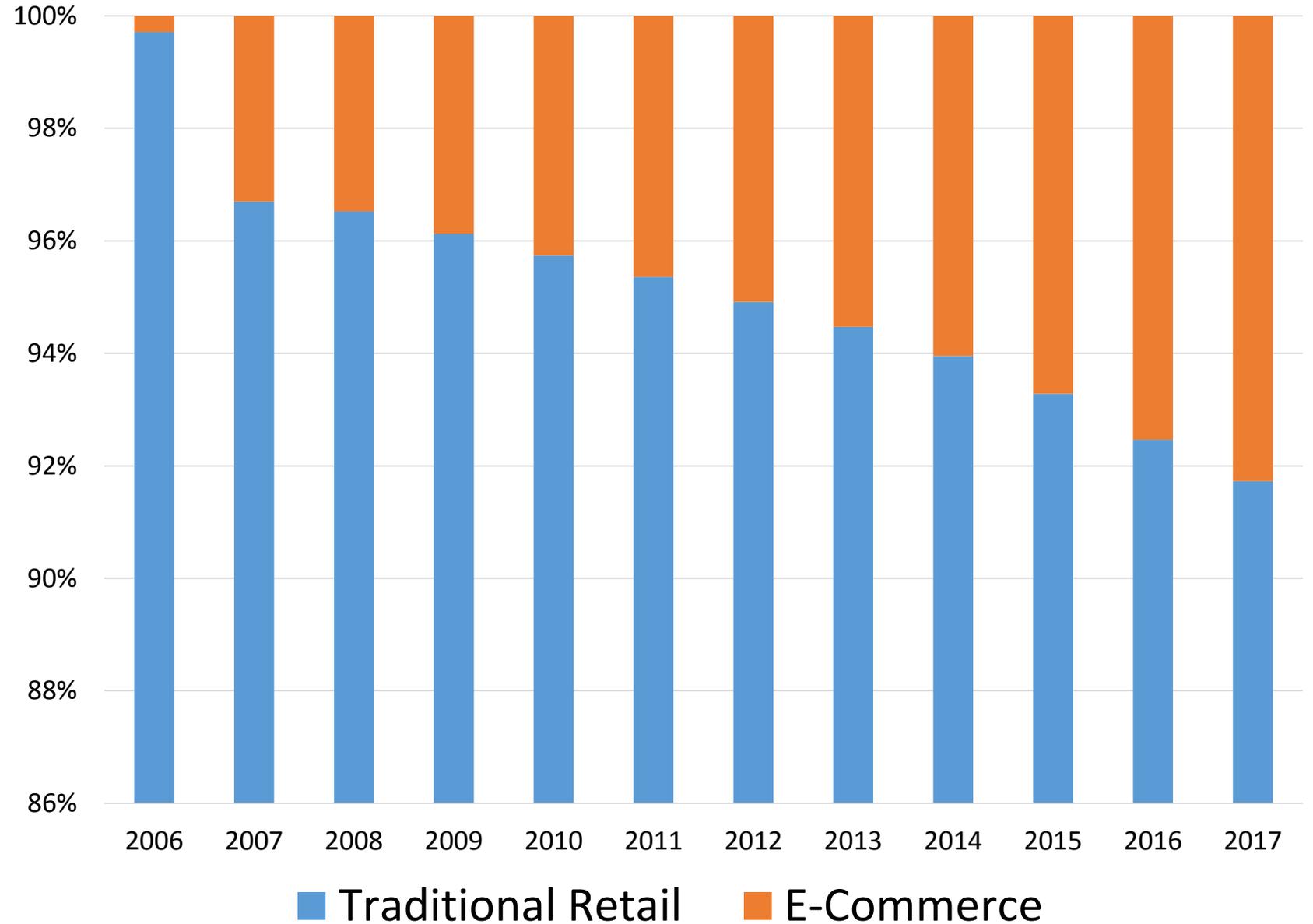
E-Commerce sales were $453.5 billion in 2017, up 16% from 2016.

Legend: Traditional Retail, E-Commerce

Are cities ready for an explosion of e-commerce and ride-hailing growth?

A 20% e-commerce compound annual growth rate (CAGR) would more than double goods deliveries in 5 years.

If nothing changes, this could double delivery trips in cities; thereby doubling the demand for load/unload spaces.

City load/unload space strategies have not kept pace with change

Innovation is needed to manage scarce curb, alley and private loading bay space in the new world of on-demand transportation, 1-hour e-commerce deliveries, and coming autonomous vehicle technologies.

There is not enough curb capacity, now

A recent curb parking utilization study in the City of Seattle indicated 90% or higher occupancy rates in Commercial Vehicle Load Zones (CVLZs) for some areas for much of the workday.

Photo by Chris Eaves, Seattle Department of Transportation (SDOT)

Growth in on-demand passenger services

Ride-hailing services such as Uber and Lyft are also creating new demand for load/unload spaces at city curbs.

In 2017 more than 23 million people took a Lyft, up from 12 million in 2016; while Uber completed 4 billion rides.

These services create a negative feedback loop affecting curb demand, as parking problems are the top reason people use the service instead of driving.

Photo by AP, Feb. 25, 2018

The Urban Freight Lab

- The Urban Freight Lab at the University of Washington (UW), in partnership with the City of Seattle Department of Transportation (SDOT), is using a systems engineering approach to solve delivery problems that overlap cities' and businesses' spheres of control.

- The Urban Freight Lab is a living laboratory where potential solutions are generated, evaluated, and pilot-tested inside urban towers and on city streets.

- Members of the Urban Freight Lab - Charlie's Produce, Ford Motor Company, Kroger, Nordstrom, UPS and USPS - fund the Lab and dedicate senior executives' time to solving problems in it.

Final Fifty Feet Research

The final 50' of the urban delivery system:

- Starts when a truck driver parks in a load/unload space;
- Includes delivery persons' activities as they maneuver goods over curbs, along sidewalks and through intersections;
- Ends inside urban towers when they complete their deliveries.

Photo by Urban Freight Lab, UW

The Final Fifty Feet is a New Research Field

The Final 50' project is the first time that researchers have analyzed both the street network and cities' vertical space as one unified goods delivery system.

It focuses on:

- The use of scarce curb, buildings' internal loading bays, and alley space;
- How delivery people move with handcarts through intersections and sidewalks; and
- On the delivery processes inside urban towers.

Photo by Anna Alligood, UW

Final 50' Research Goal #1

Reduce dwell time, the time a truck is parked in a load/unload space.

Public and private benefits include:

- Lower costs for delivery firms, and therefore potentially lower costs for their customers;

- More efficient use of truck load/unload spaces creates more capacity without building additional spaces; and

- Room for other vehicles to move through alleys.

Photo by Urban Freight Lab, UW, 2017.

Final 50' Goal #2

Reduce failed first deliveries to:

- Improve urban online shoppers' experiences and protect retailers' brands;

- Lower traffic congestion in cities, as delivery trucks could make up to 15% fewer trips while still completing the same number of deliveries;

- Cut costs for the retail sector and logistics firms;

- Cut crime and provide a safer environment.

Photo by Urban Freight Lab, UW, 2017.

Four Data Collection Principles

The Urban Freight Lab adheres to four principles when designing data collection methodologies. To be widely used it must be:

1. Replicable;
2. Available at a reasonable cost;
3. Groundtruthed;
4. And have quality control measures built into each step.

How should cities innovate to meet demand?
Step 1: Map and measure the <u>complete</u> truck load/unload space network

Very few cities have curb space allocation data or documentation of loading/parking signage in a systematic, digitized format. A step ahead of many, in 2016 Seattle's geospatial databases included one part of the truck load/unload network: CVLZs at the curb.

In 2017 – 2018 the UFL GIS-mapped and measured two additional elements of the urban goods delivery network in Seattle's Center City:

1. Privately-owned loading docks and bays, and
2. Truck spaces in alleys.

The Urban Freight Lab Defined the Three Elements of the Commercial Vehicle Load/Unload Space Network

Curb Parking Spaces

Alleys

Private Loading Bays and Docks

Photos: G. Giron, Urban Freight Lab, University of Washington, Seattle, 2018

Seattle is the First City in the US or EU to Map and Measure all Three Elements of The Load/Unload Space Network

Most major cities have databases of their curb parking spaces.

The Seattle Department of Transportation (SDOT) engaged the Urban Freight Lab (UFL) to identify the geospatial locations and truck-related features of the two additional load/unload elements in the Center City area:

1. Privately-owned loading bays and docks under and next to buildings, and

2. Alleys.

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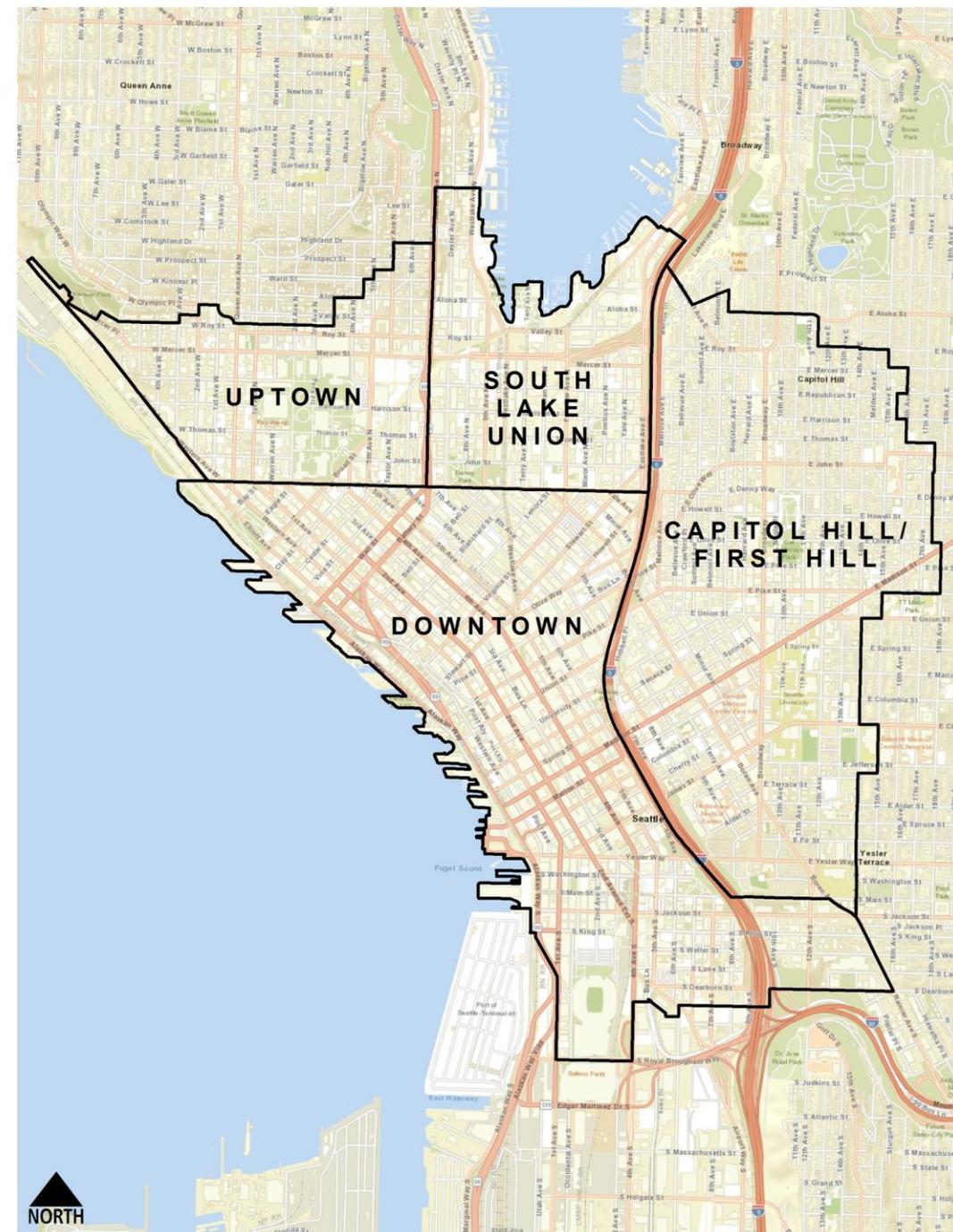
UFL Survey of Center City Loading Bays and Docks

- 87% of Seattle's Center City buildings rely solely on deliveries from curb and alley load/unload spaces, documenting the importance of public spaces.

- There are 338 private loading bays and docks in the urban core.

Legend

- ● Exterior loading area
- ○ Exterior loading dock
- ● Internal loading bay entrance

UrbanCenters

- Capitol Hill & First Hill
- Downtown
- South Lake Union
- Uptown

0   0.125 0.25   0.5 Miles

Esri, HERE, DeLorme, MapmyIndia, © OpenStreetMap contributors, and the GIS user community
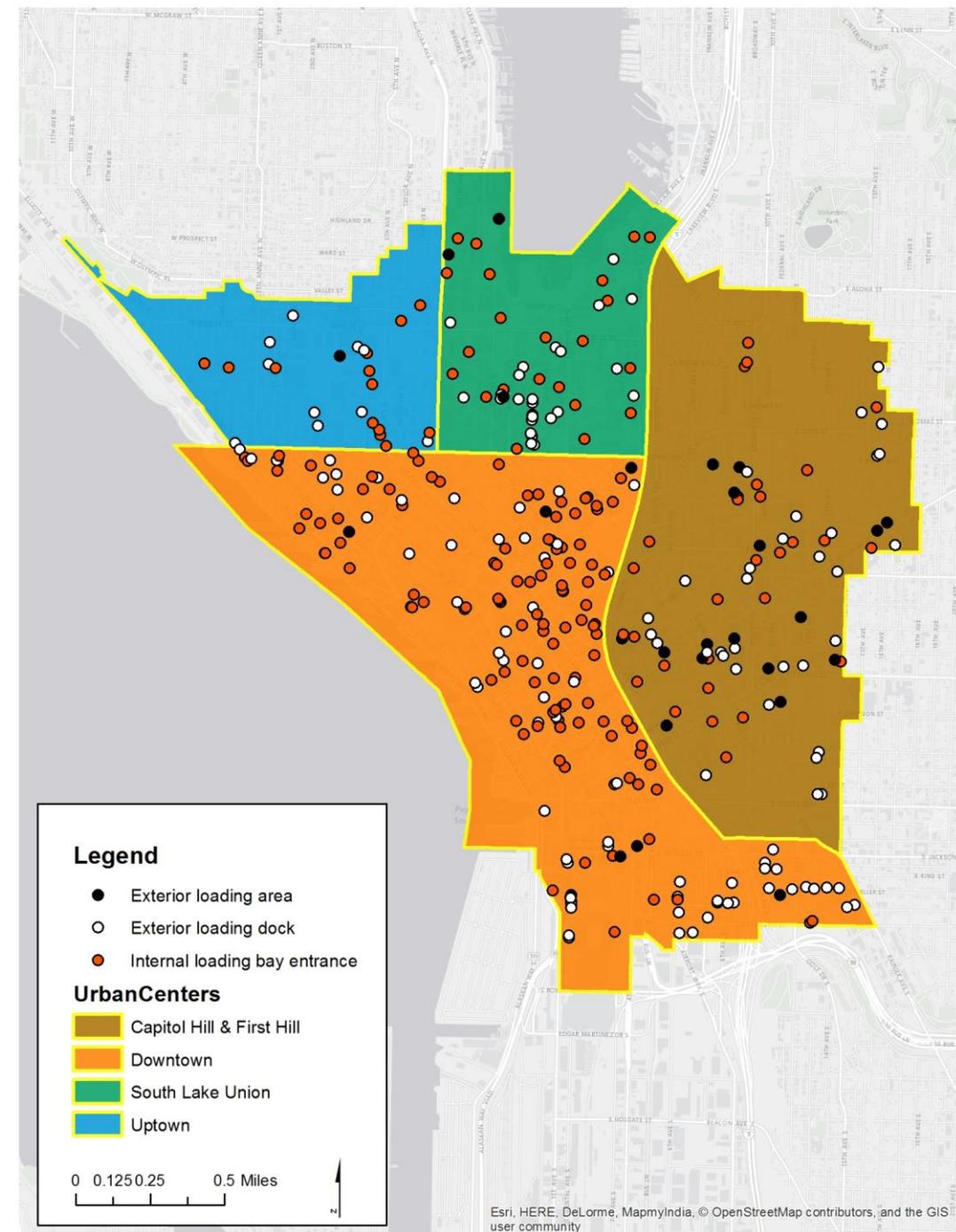
Collaborating with the Private Sector Greatly Reduced Uncertainty

- Data collectors in the field identified **548 potential loading bays**.

- However, in **206 cases the doors were closed**.

- UPS had their local drivers review the closed door locations, based on their extensive knowledge of the area. The Urban Freight Lab provided photos and location information.

- That review allowed the Lab to rule out 90% of the locations behind closed doors, **reducing uncertainty from 38% to <1%.**

Truck Curb Occupancy Study

The Seattle Department of Transportation (SDOT) commissioned this study to understand the current commercial vehicle use of curb load/unload zones in Seattle's Center City area.

Urban Freight Lab data collectors observed vehicles loading and/or unloading at the curb around five buildings. They documented the 'minutes vacant' and 'minutes occupied' for:

1. Commercial vehicles in all curb load/unload spaces, and
2. Passenger and other vehicles in Commercial Vehicle Load Zones (CVLZs).

Research Findings:

53% of Trucks and Vans Parked in Passenger Load Zones

Case study near the Four Seasons Hotel and Harbor Steps Apartments, on 1st Avenue between Pike and Seneca Streets.

	CVLZ	PLZ	Paid Parking	Illegal Parking	Grand Total
Box Truck	19	58	12	12	101
Truck	3	3	1	3	10
Cargo Van	11	43	4	8	66
Service Van	13	30	19	9	71
Van	2		1		3
Grand Total	48	134	37	32	251

Half of the Vehicles Parked in the CVLZs Were Cars

6%
Taxi

18%
Box Truck

10%
Cargo Van

12%
Service Van

3%
Truck

49%
Passenger
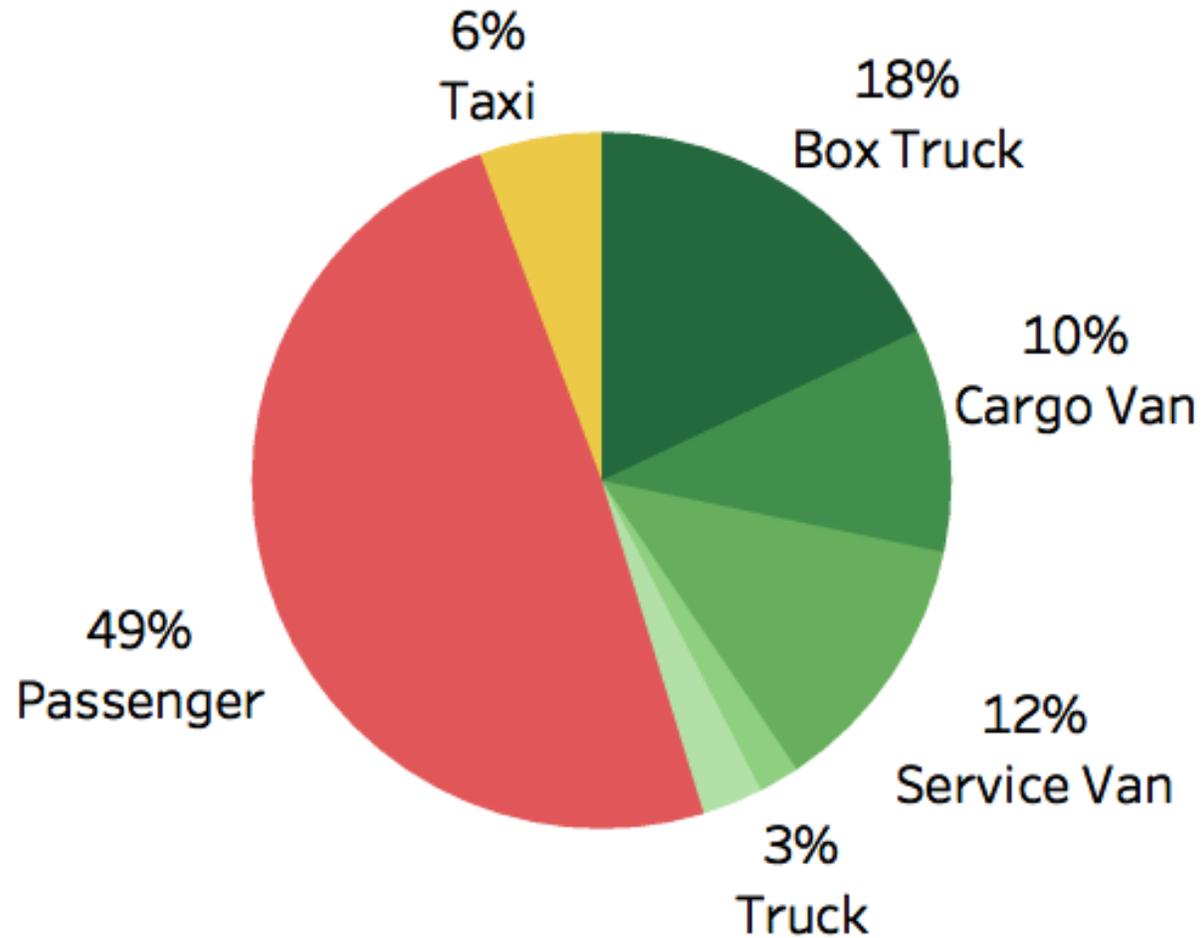
67% of Commercial Vehicles Parked for 15 Minutes or Less

Type of vehicle	t <= 5 min	5 min < t <= 15 min	15 min < t <= 30 min	30 min < t <= 1 hour	t >1 hour	Grand Total
Truck	2.4%	0.4%	0.4%	0.4%	0.4%	4.0%
Box Trucks and Cargo Vans	24.2%	22.6%	13.7%	3.6%	3.2%	67.3%
Service Van	8.9%	8.1%	3.6%	3.6%	4.4%	28.6%
Grand Total	35.5%	31.0%	17.7%	7.7%	8.1%	100.0%

Count of Vehicle Type

1 ▭▭▭▭▭▭▭▭▭▭ 60

Most Passenger Vehicles Parked in CVLZs Less Than 5 Minutes
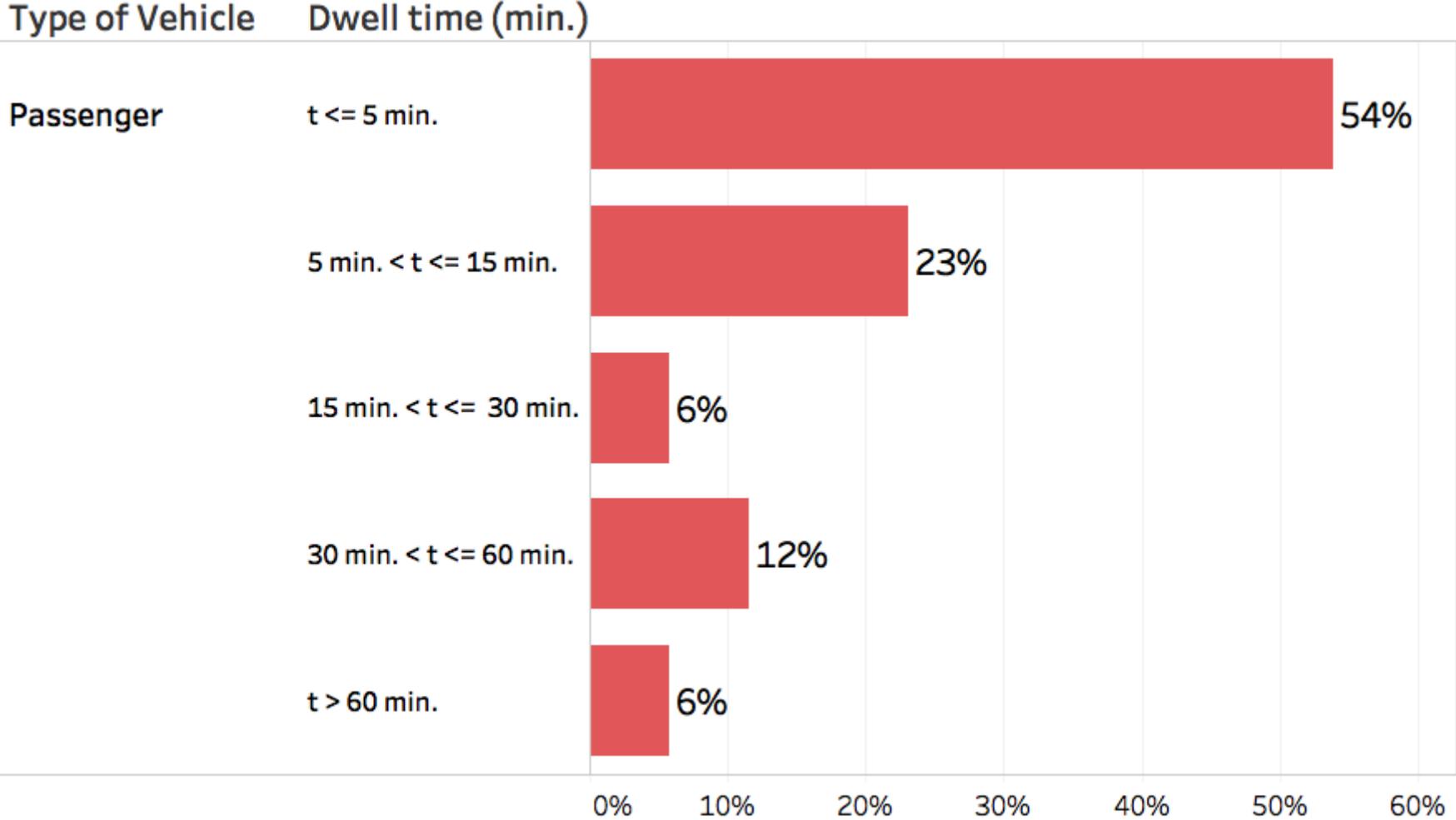
Percentage of total passenger vehicles in CVLZs

Alley Purpose and Design

Alley grids were originally built to provide access to the backs of buildings for:

- Goods deliveries,
- Electrical, plumbing and other service calls,
- Trash pick up, and
- Fire/emergency services.

Many major U.S. cities have alley grids including:

- Seattle
- Chicago (1,900+ miles)
- Detroit
- Minneapolis

Key Finding: Vast Majority of Center City Alleys are 1-Lane Wide

Seattle Center City - Alley Narrowest Width

■ Alley End Widths   ■ Alley Narrowest Widths

4
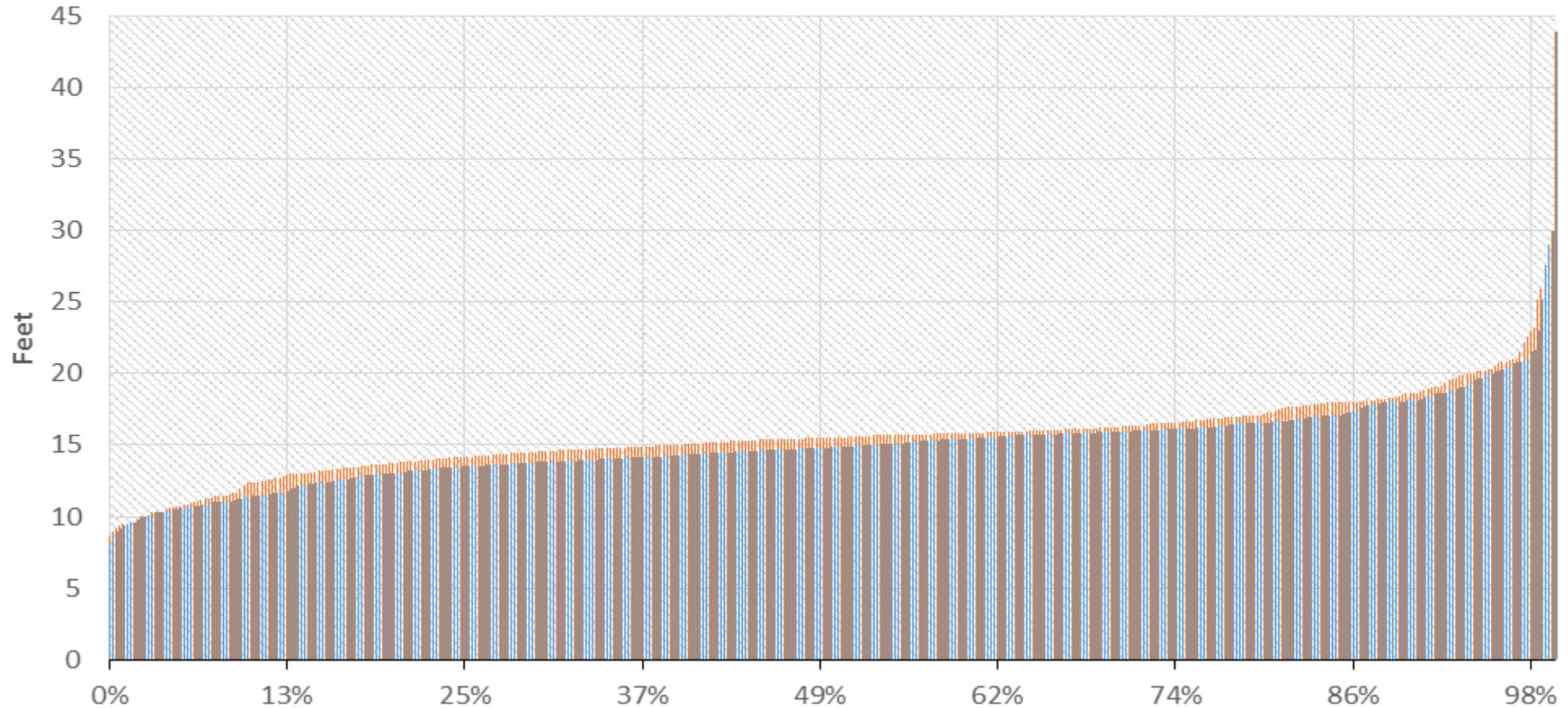
Over 90% of the 417 alley blocks in Center City are constricted to one lane for trucks, cargo and service vans

This limits parking per alley to one-to-two commercial vehicles at a time.

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.

Center City Alley Occupancy Study

SDOT commissioned this research to understand current commercial vehicle operations in urban alleys.

The UFL research team observed all types of delivery vehicles loading/unloading in alleys.

Researchers quantified the time alleys were occupied by:
- Various types of trucks and vans,
- Passenger vehicles used to deliver goods, and
- Cargo bikes and trikes.

Key Findings: 87% of all vehicles in the 7 alleys studied were there 30 minutes or less

Vehicles vs Dwell Time

Vehicles Type	15 min or less	15 min < x <= 30 min	More than 30 minutes	Grand Total
Trucks and Cargo Vans	30.8%	12.9%	10.1%	53.8%
Van	6.1%	0.9%	0.2%	7.3%
Service Vehicles	5.9%	2.6%	1.4%	9.9%
Passenger	17.4%	1.9%	0.9%	20.2%
Passenger making a delivery	2.8%	0.2%	0.5%	3.5%
Garbage vehicle	3.5%	0.5%		4.0%
Uber/Lyft	0.2%			0.2%
Others	0.7%		0.2%	0.9%
Unknown	0.2%			0.2%
Grand Total	67.6%	19.0%	13.4%	100.0%

Vehicle Count

1   131

Step 2: Offer Goods Trip Reduction Strategies to building developers and managers

Emerging strategies include:

- Install Common Carrier Locker Systems(mini-distribution nodes in buildings to gain delivery density);

- Use integrated technologies to actively manage and increase the productivity of all load/unload spaces in the city's network.

- Require developers to provide loading bays in every new building.

Seattle Municipal Tower, a 62-story office building studied in the Urban Freight Lab

Seattle Municipal Tower Common Carrier Locker Pilot Test
March - April 2018

The aim of this research pilot project was to:

 1. Test whether creating delivery density via a smart locker system reduces the:
- Number of failed first delivery (FFD) attempts, and
- Parcel delivery time in an urban tower.

2. Begin to develop a functional business model to provide Common Carrier Locker Systems in public spaces that any retailer, goods delivery firm, and user may access.

How Does the Truck Load/Unload Space Network Connect to Buildings?

Building managers set the conditions that control truck dwell time in curb, alley and private truck parking spaces, and the number of failed-first-delivery attempts.

For example, research showed that on average, 61% of the time parcel delivery workers spent in the Seattle Municipal Tower could be eliminated by creating artificial delivery density near the loading bays.
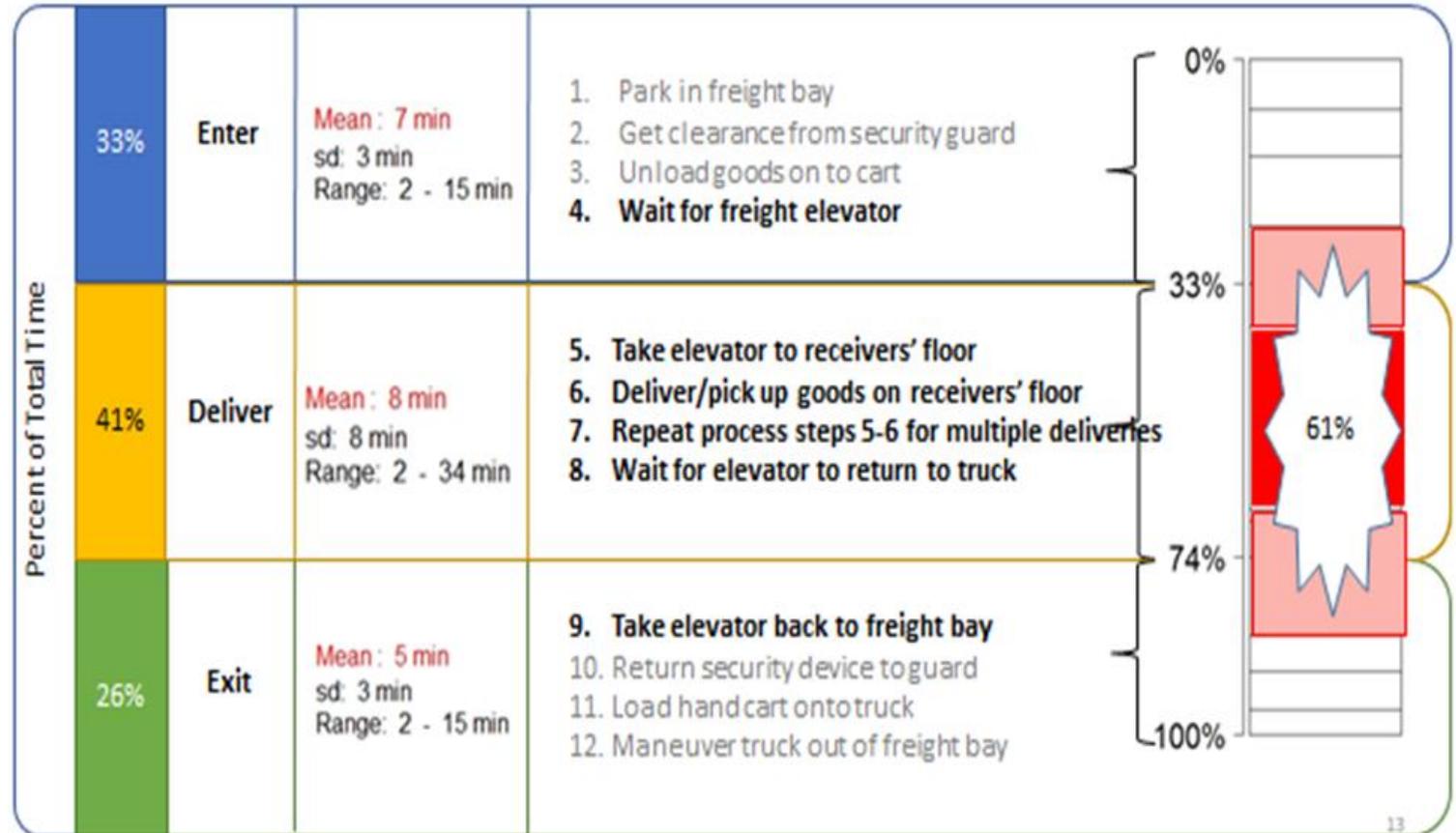
Analysis of the Average Total Delivery Time in the Seattle Municipal Tower, Urban Freight Lab, UW; 2017.

Common Carrier Locker Solution Can Reduce the Parcel Failed First Delivery Attempt Rate to 0%

But over-sized goods still need to be delivered to the tenant's door.
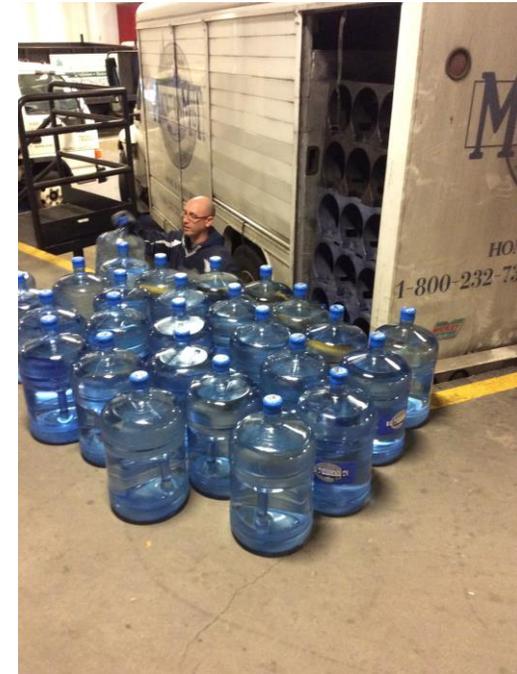
Pilot test of the Common Carrier Locker strategy

SEATTLE DEPARTMENT OF TRANSPORTATION
'Goods Trip Reduction' Pilot

The University of Washington's Urban Freight Lab and the Seattle Department of Transportation are pilot-testing the effectiveness of lockers at the Seattle Municipal Tower to reduce truck dwell time (making parking spaces more productive) and to cut the number of failed attempted deliveries (reducing truck trips) in the City.

This 4-week study will test package management lockers that may be used for both personal and work-related packages.

What's in it for you?
· Convenience
· Security
· Accessibility

How do the lockers work?
Couriers will deliver packages straight to lockers. Upon drop off, Parcel Pending will notify recipients immediately by text and/or email. Recipients can come according to their schedule, push in a code provided in the notification, and retrieve their package. All of your packages delivered to a Parcel Pending electronic locker will be safe and secure.

Questions about the study? Please see
http://depts.washington.edu/sctlctr/members/urban-freight-lab

Seattle Municipal Tower Pilot Test Results:
Average Delivery Time to Multiple Floors Before the Test

UPS visited 7 different floors on average (n = 8)

SD: 6 min

Range: 15 – 34 min

Mean: 27 min
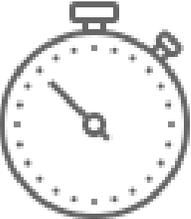
Floor 52

Floor 48
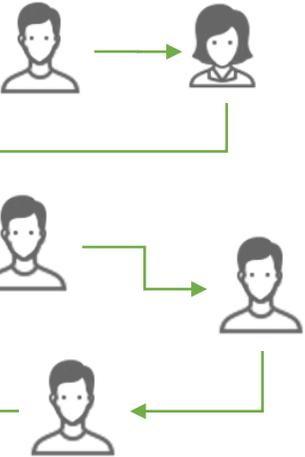
Loading bay

Loading bay

Pilot Test Results: Common Carrier Locker System Reduced Total Delivery Time By 78%

Loaded locker

| 2.6 min | 0.6 | 2.4 min |

78 % Reduction

Walked from loading bay to locker

Walked from locker to loading bay

Loading bay

(n = 1)

Locker

Loading bay

34
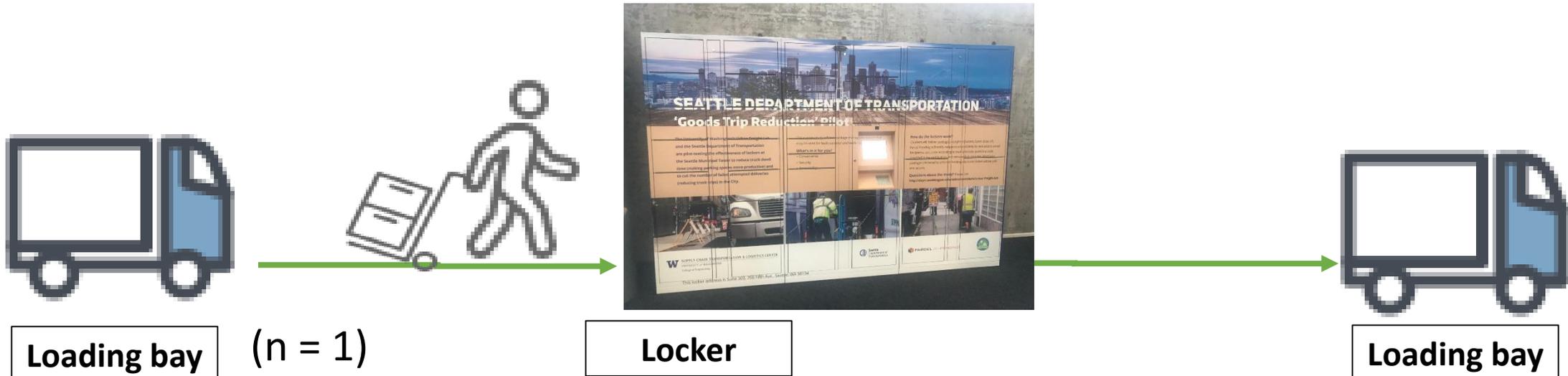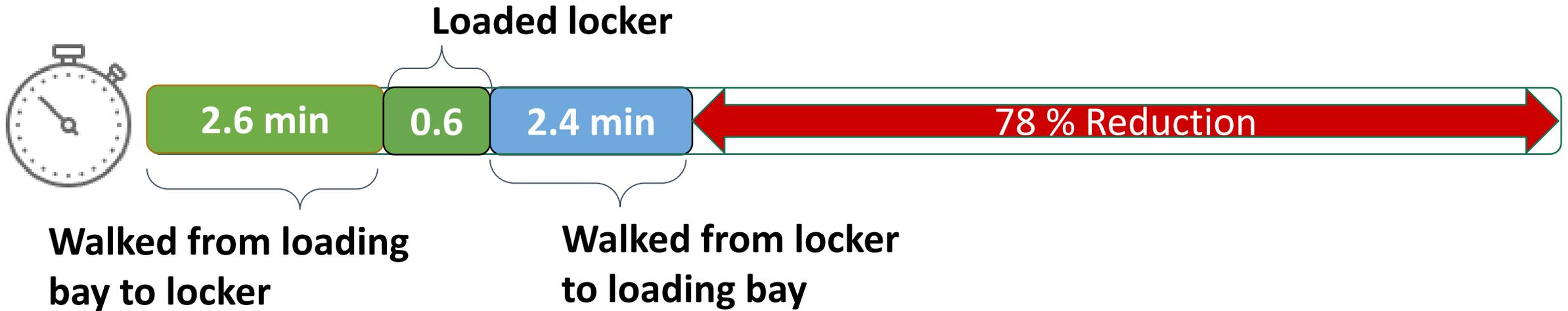
Why are Common Carrier Locker Systems a Promising Solution to Urban Congestion?

King County Metro Transit (KCMT), the Seattle Department of Transportation (SDOT), and Sound Transit (ST) are exploring providing public right of way for Common Carrier Lockers at commuter train stations and/or in the Transit Oriented Development (TOD) areas near them. This research project supports the agencies' mobility goals, as smart locker systems in cities may:

- Reduce the number of truck trips caused by the rapid growth of e-commerce and urban densification; and

- Make urban truck parking spaces more productive.

Common Carrier Locker Systems

Lockers do this by creating delivery density, so trucks can deliver many packages at one stop rather than driving, parking, and/or pulling handcarts to multiple locations.

Parcel lockers also support the three agencies' mobility hub efforts, which call for rider amenities that create lively public spaces.

Research Project Plan: Phase 1 and 2

Phase 1 - Complete

Phase 2 - Future

Develop evaluation criteria to select viable sites

Apply criteria to identify viable locations at Sound Transit Stations or in the Transit Oriented Development (TOD) area nearby

Implement common carrier locker pilot test(s) at Sound Transit Stations and/or TOD areas

Smart Locker Business Models in the EU

DHL Parcel Lockers

German Train Station - BahnhofsBox

Surveys Find Security Matters Most to Online Shoppers

2,000 responses

45% of Americans have had package stolen/ know someone who has.

75% of Americans concerned about porch piracy.

49% have adjusted schedules to be home during delivery.

31% have reduced their online shopping.

Created by Magicon from Noun Project

Created by Andrew Doane from Noun Project

Created by Daryl Vandemont from Noun Project

Created by joe pictos from Noun Project

Created by Dennis Nicolai Andersen from Noun Project

Vivint Smart Home. Vivint.Online, 2016.

Why would you pick up your packages from a locker at this station?

	UW Station	Capitol Hill	Westlake
Security	59%	65%	86%
Convenience	27%	27%	7%
Reliability	14%	8%	7%

Survey of Sound Transit ridership conducted by the Urban Freight Lab, Jan. 2018
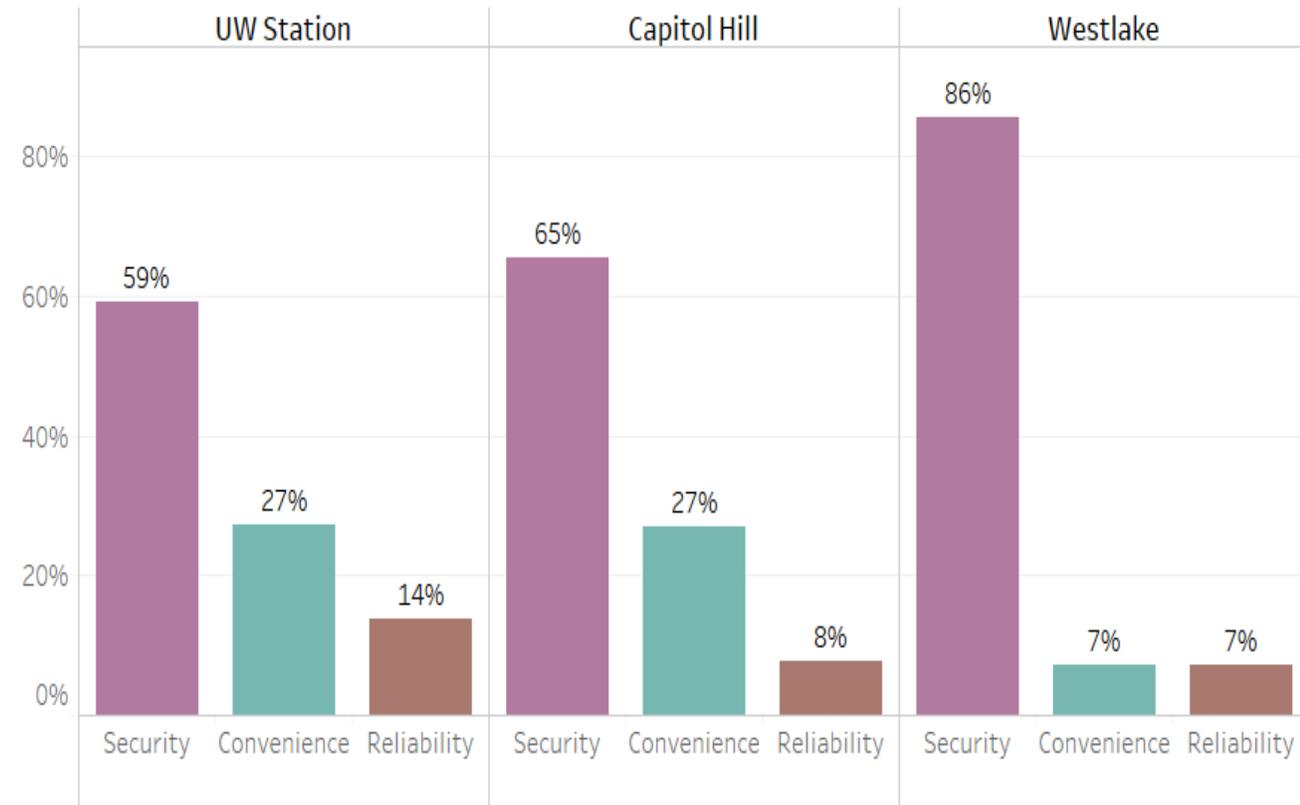
Research Scan and Ridership Survey Findings

Pioneering Research and Solution

There are no common carrier parcel locker systems on public property in the U.S. or Europe, nor has the topic been studied.

Strong Transit Rider Interest

The survey of 185 riders at 3 Link Light Rail stations found that 67% of those interviewed at the UW Station would use common carrier lockers at that station, and nearly half the respondents at the other two stations said they would use lockers or consider using them.

The vast majority of these riders expressed a willingness to carry a package 3 - 6 blocks.

Multitudes of Potential Users

Approximately 137,000 people live within a 30-minute walk of one of these three stations.

Each station has residential housing within a 5-minute walk or less.

From 2 of the stations – Capitol Hill and Westlake – the majority of housing is less than a 15-minute-walk away.

This suggests that, since a significant percentage of riders expressed willingness to walk considerable distances with packages, tens of thousands of Seattle's urban residents may be willing to use common carrier parcel locker systems located at transit stations.

Location & Logistics Evaluation Criteria

1. Reliable source of electricity near site
2. Live Ethernet and/or strong cellular signal
3. ADA compliant
4. Well-lit at all times
5. Access for delivery vehicles
6. Parking for delivery vehicles
7. Few-to-no obstructions to see the locker
8. Does not impede vehicle traffic flow
9. Does not impede pedestrian traffic flow

The nine criteria were prioritized by UFL members and representatives from SDOT, ST and KCMT in January 2018.

SUPPLY CHAIN TRANSPORTATION & LOGISTICS CENTER
UNIVERSITY *of* WASHINGTON
Urban Freight Lab

Bikes Under Cover (Capitol Hill Station)

Rating - Completely meets 8 criteria.

Superb amenities for a mobility hub, fully accessible, strong perception of security, well-lit and fenced on one side.

Retail Hub (Westlake Station)

Rating - Completely meets all 9 criteria.

Rare, priceless asset in downtown Seattle - ample space. Alley for truck load/unload across from the site. Lockers would complement the TOD along Pine Street. Secure behind a locked door when the station closes.

Connecting State and City DOTs with Transit Agencies to Implement Innovative 'Goods Trip Reduction' Strategies

Effective Goods Trip Reduction (GTR) Strategies require partnerships. The UFL and SDOT are developing a GTR tool kit with a variety of strategies that may be adapted for specific uses across the US.

Common carrier locker systems are one GTR tool:
- State DOTs may own Park and Ride lots in urban and suburban locations that are used by transit agencies.
- Transit agencies want to create new amenities for riders in mobility hubs.
- Cities are stewards of the public load/unload space network.
- The UFL - SDOT Muni Tower pilot test provides proof of concept for them to reach common goals by placing common carrier lockers next to city CVLZs and transit hubs.

Questions?

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http://depts.washington.edu/sctlctr/