ALLEY SURVEY TOOLKIT

Toolkit contents:

2.1. **Seattle project synopsis**

Seattle is widely thought to be 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. Cities' alley definitions may vary. Seattle "Streets Illustrated" manual definition reads: "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."

The data methods in this toolkit were designed and used to create a complete GIS database of the 417 alleys in Seattle's Center City area, mapping the alley network's geospatial location and documenting physical (truck-related) attributes measurements of alleys' key. These attributes directly impact alley operations and functionality.

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 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.

As cities grow denser and more congested, the mix of competing alley users grows. Traditional box and parcel delivery trucks, vans and service vans 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. To mitigate congestion, many cities face a growing need to actively manage their load/unload network. An alley survey is a key part of this process, helping policymakers and transportation officials understand how alley features impact the way a city's alley system works at street level.

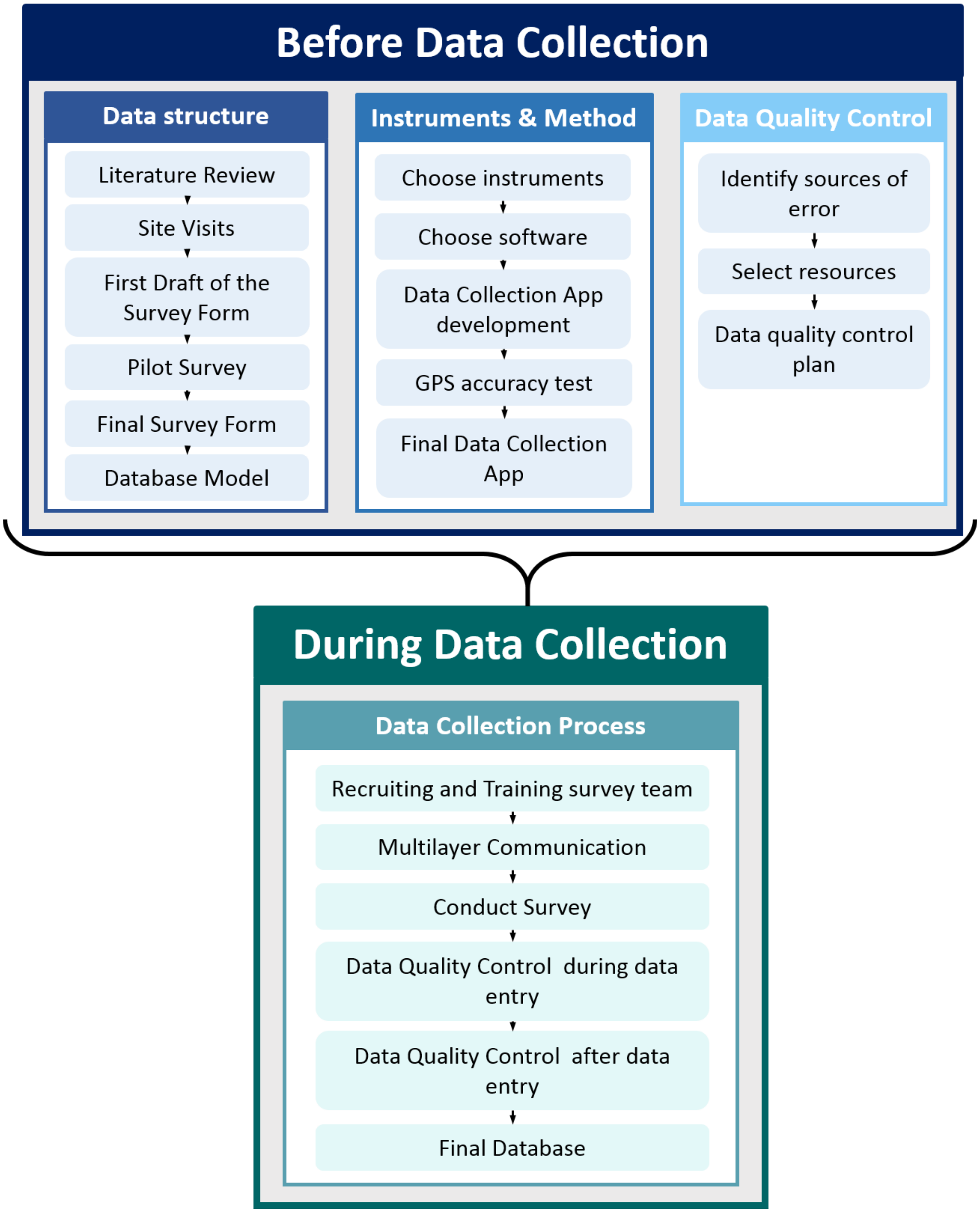
2.2. **<u>Goals</u>**

To build an accurate GIS map of the Center City area alley network's geospatial location and an accurate inventory of measurements of alleys' key physical (truck-related) attributes using methods that are:

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

An alley survey, as outlined here, can help cities actively manage their alleys as part of the comprehensive load/unload network (which includes private loading bays/docks and curb space).

2.3. **<u>Method overview and step-by-step process to conduct an alley survey</u>**



2.3a **<u>Step 1: Determine study parameters</u>**

Including:

- Scope/size of desired study area. Based on budget, time and other constraints.
- Number of alleys to inventory. Use pre-existing GIS databases, like transportation network. If no database or no alleys in database, estimate using the number of city blocks in study area.
- Data-collection hours. Daylight hours only recommended for security reasons. Low-activity periods (e.g. weekends) acceptable.

  Seattle project at a glance:
  Data-collection period: Three weeks, January 2018
  Workforce: 32 data collectors
  Study area: 941 city blocks
  Total person-hours to examine and collect data on the 417 Center City area alleys: 850

2.3b **Step 2: Define alley attributes of interest with broad range of agencies**

The inventory can have broad applications beyond urban freight. Seattle involved agencies such as police, public utilities, and fire agencies, as well as urban freight firms to define the features to map and survey related to alley aspects below.

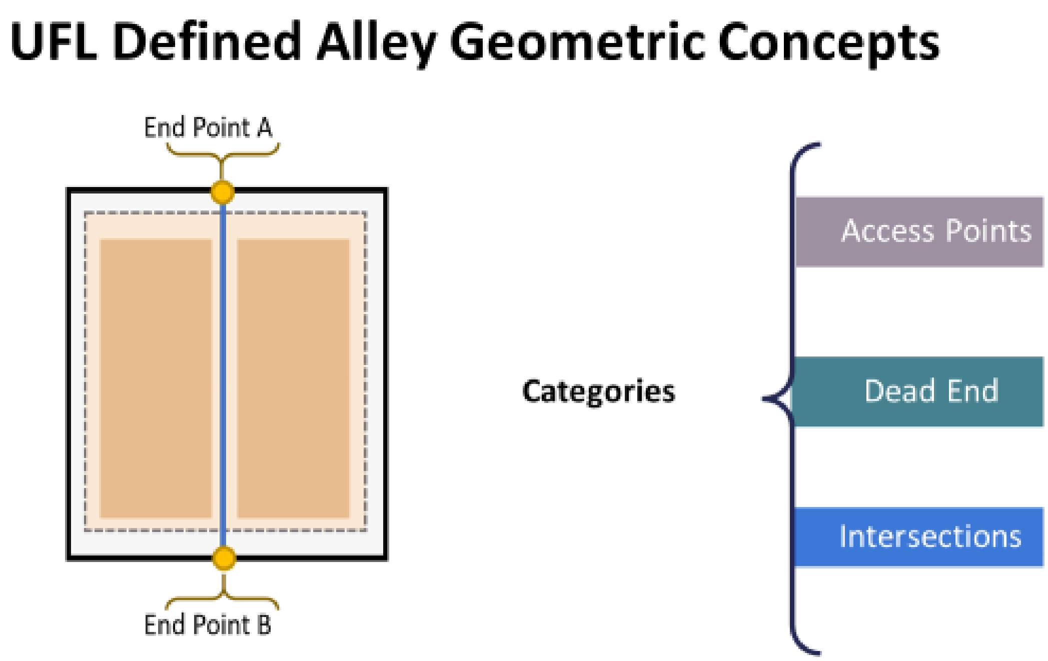
1) Connectivity to street network, including:
    - Name of streets that the alley connects to
    - Street name or number
    - Whether the alley is off a one-way or two-way street
    - Whether the alley is one-way or two-way traffic
    - Direction of one-way alleys
2) Design, including:
    - End points (**width** and **height** with smallest width and height within 30' from the alley entrance to captures most cargo vans' and trucks' bumper-to-bumper length);
    - Aprons[L1] (width, length, and cross slope; slope determines if fully-loaded handcarts can maneuver). 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.
    - Interiors (end-to-end alley length, type of pavement surface, narrowest point; and fixed overhead or on-the-ground obstructions)
3) Accessibility, including:
    - Driveways connected to the alleys
    - Location of buildings' main entrances

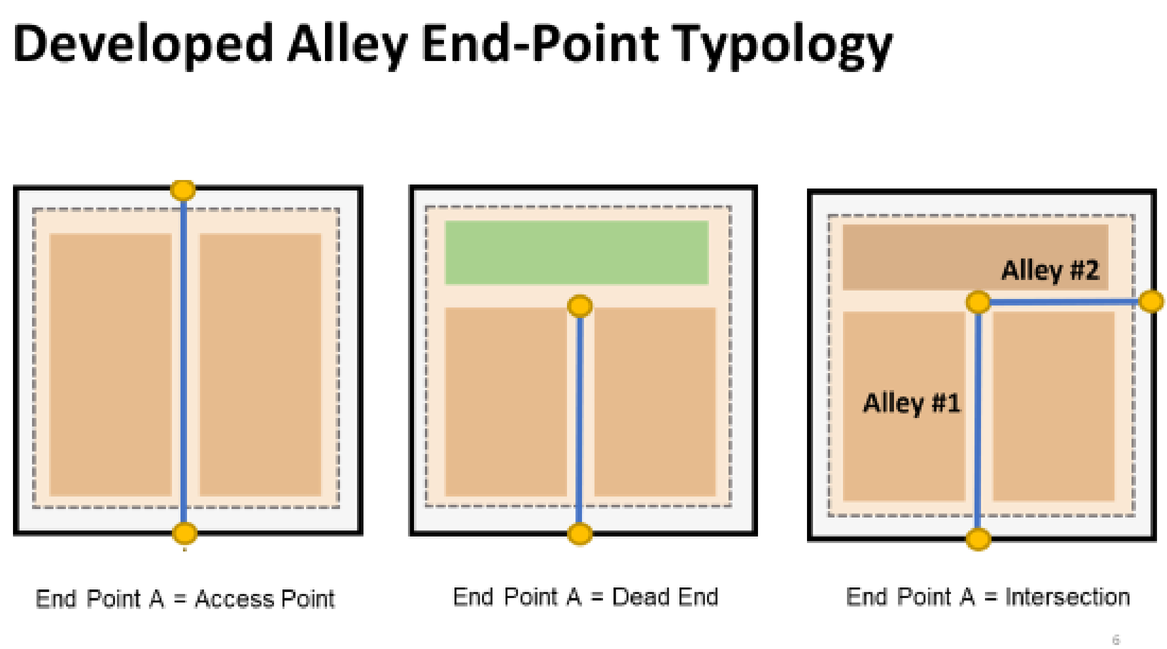
- Restrictions on alley usage as shown on posted signs
- Loading bay entrances
- Passenger parking, if visible or signed
- Presence of furniture or equipment
- Number of garbage containers

4) Pavement condition, based on qualitative assessment of “Good” or “Poor” for delivery people who walk alleys with loaded handcarts.

2.3c **<u>Step 3: Use UFL’s detailed alley typology to categorize significant alley features</u>**.

UFL researchers could not find an existing classification system for alleys, so, they built one. This typology has broad applications for cities and researchers. It allows data collectors in-field to identify alleys with a uniform set of measures. Every alley has two end points and fits one of three categories, shown below at right.





2.3d **<u>Step 4: Select data-collection tools</u>**

The UFL research team created what is thought to be a first-of-its-kind mobile-app-based data-collection instrument[L2]. The app has these advantages over a paper-based survey:

- **Efficient**: Allowing automation of data digitization and photo collection and storage
- **Flexible**: Permitting form revision if surveyors encounter unforeseen infrastructure conditions that require a new data structure
- **Fast**: Offering speedy data input in 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

The map-based app allowed for manual GPS coordinate reading by dropping a location pin, creating an up-to-date geodatabase with detailed alley features, with alleys represented as a point feature on the GIS map. The app allowed manual input of the infrastructure location supported by offline basemaps, enabling teams to avoid wireless Internet plan cost for the tablets in data collection. A hard-copy paper questionnaire may be a viable alternative if a mobile app is not practical.

UFL project tools used with 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

2.3e **Step 5: Choose software and program data-collection app**

Select database management software that allows for:

- 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 allow effective data management, data quality control and scale-up of data collection with multiple staff.

Using ESRI GIS software Survey123, ArcView and ArcGIS Online for the survey form and data-collection process on tablets allows for seamless visualization of the collected data and its editing. Survey123 allows selection of the most appropriate basemap to assist the geolocation input. An appropriate basemap can be created incorporating various elements as needed/available in a given city.

In Seattle, researchers chose the World Street basemap (from ArcGis.com viewer last updated July 2017) preloaded within ArcGIS software. This worldwide street map presents highway-level data for the world. Street-level data includes the United States; much of Canada; Mexico; Europe; Japan; Australia and New Zealand; India; South America and Central America; Africa; and most of the Middle East. Researchers added existing GIS data of the location and key names of alleys and loading bays in Seattle's Center City area from government databases and others.

2.3f **Step 6: Draft and pilot field survey**

Field survey should include the key alley attributes identified in Step 2. UFL researchers field-tested the draft survey with six alleys, located inside a 3x3 city block area, allowing them to:

- Estimate the time needed to survey each alley, including walking time between alleys.
- Identify potential problems with the survey logic, such as how survey questions can be adapted to avoid losing valuable data if an alley interior is blocked or security concerns prevent collectors from entry. (Alley inventory survey demonstrates[L3] these adaptations.)
- Test data-collection methods and instruments.

2.3g **Step 7: Use pilot learning to create final survey, data structure, metadata and data quality-control plan**[L4]

Identify and create plan to prevent 3 common error types in this project type:

1. **Positional**: inaccuracies in GPS coordinate readings due to device issues (e.g. low satellite signal in urban canyons) and human error in manually collecting data on tablets
2. **Attribute**: associated with non-spatial alley data collected (e.g. incorrect data entry due to wrong measurements or mistyped data; lack of access to needed data due to obstructions or safety issues)
3. **Conceptual**: around identification/classification of alley attributes or related information.

Follow quality-control protocols before data collection, during data entry, and after data entry that involve supervisors, data collectors in field, and related technologies and inventory survey app (programmed to limit data-entry inaccuracies.)

Define roles and respective quality-control responsibilities.

Supervisor(s) define/enforce data-collection standards and methodology; train data collectors; monitor/maintain database and handle data-control measures before data collection/after data entry.

Collectors enter data in field and run same-day data quality-control checks after data entry.

Survey app digital and online tool creates entry constraints/eases digitization as data collected.

2.3h **Step 8: Recruit and train data collectors**

Recruiting: Project budget; timeline; survey length/complexity; security concerns; time needed for in-field collection, including commute time to/within study area, and in-office quality-control determine number of data collectors and supervisors needed. Deploying collectors in teams of two can improve security and enable efficient operation of data-collection instruments (e.g. laser measurement device, measuring wheel, iPad, etc.)

Training: At least three distinct data-collector training sessions are suggested, with first and third done in classroom-type setting and second done in field.

1. **First session:** Covers alley concepts, attributes, project overview, shift information and security/safety.

2. **Second session:** Covers practical aspects of data collection such as how to: use questionnaire in tablet app; take accurate measurements with the laser and wheel devices; effectively divide collection work between the two collectors; use hard-copy maps that divide study area into sectors; follow safety/security protocol.

3. **Third session:** Covers how to access survey data results and properly clean data after each field shift.

2.3i **Step 9: Collect data**

Ensure territory assignments formed, hard-copy maps printed for each team/shift.

Develop check-out/check-in process for collectors' needed shift materials.

Form work shifts around geographic area depending on collectors' schedules and shift lengths.

Instruct collectors to work in teams of 2 and search every city block for alleys, even if local basemaps do not show alley.

Establish comprehensive security protocol and multilayer communications plan for all interested parties to avoid unsafe situations in field, including instructing data collectors to:

- Not enter alley if uncomfortable, including due to vehicles obstructing alley access
- Exit alley at any point if uncomfortable while collecting features (per Step 6, survey logic can accommodate interruptions so at minimum data can be collected from either end of alley)
- Carry official documents from sponsoring agency (including agency official contact information) explaining project and granting data-collection authorization.

Recruit and inform police and other relevant agencies to help communicate with all building managers in the survey area.

- In Seattle, police notified all survey area building managers in real time where/when collectors were working via pre-existing information exchange for building operators and the police.
- Seattle Department of Transportation webpage communicated to public and stakeholders where and when data collectors were working.

2.3j **Step 10: Assemble and summarize data**

Assemble data in final format that best meets city and/or researcher needs.

Seattle format included these features:

- Alleys displayed and mapped in GIS software, considered as point feature layer of alley reference end points
- Corresponding attribute table stored most alley information
- Table attachments with one-to-many relationship with alley reference end points layer stored information on passenger parking, driveways, buildings' main entrances, and narrowest points along alley.
- JPEG files with a naming convention allowed stored photos of alley features to easily link to the corresponding alleys

2.4. Takeaways

Cities that want to strategically manage their load/unload space network can use the toolkit to replicate the pioneering UFL alley survey and generate much-needed data and findings to inform policy and practice.

The Seattle alley survey and occupancy study produces several key findings that give policymakers and transportation officials new understanding of the Seattle Center City area alley system and how the system can best be managed to avoid massive gridlock. Among those findings are that:

- 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 Urban Freight Lab team concludes that 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. Rapid changes in the city's built environment call for regularly updated alley surveys, such as every five years.

2.5 Supporting materials:

a. Alley typology (page 25)
b. Alley inventory survey metadata (Appendix B page 80)
c. List of survey materials for inventory survey Appendix C page 88)
d. Software and technology utilized to build app (Appendix A page 72)
e. Alley inventory survey form (Appendix D page 90)
f. Training materials, including security/safety protocol
g. Sample sponsoring agency document for data collectors to carry in field
h. UFL-created survey app
i. Data quality-control process (Figure A-2 in report page 76)
j. Project SOW from SDOT/UFL (Attachment with price edited out; Barb)