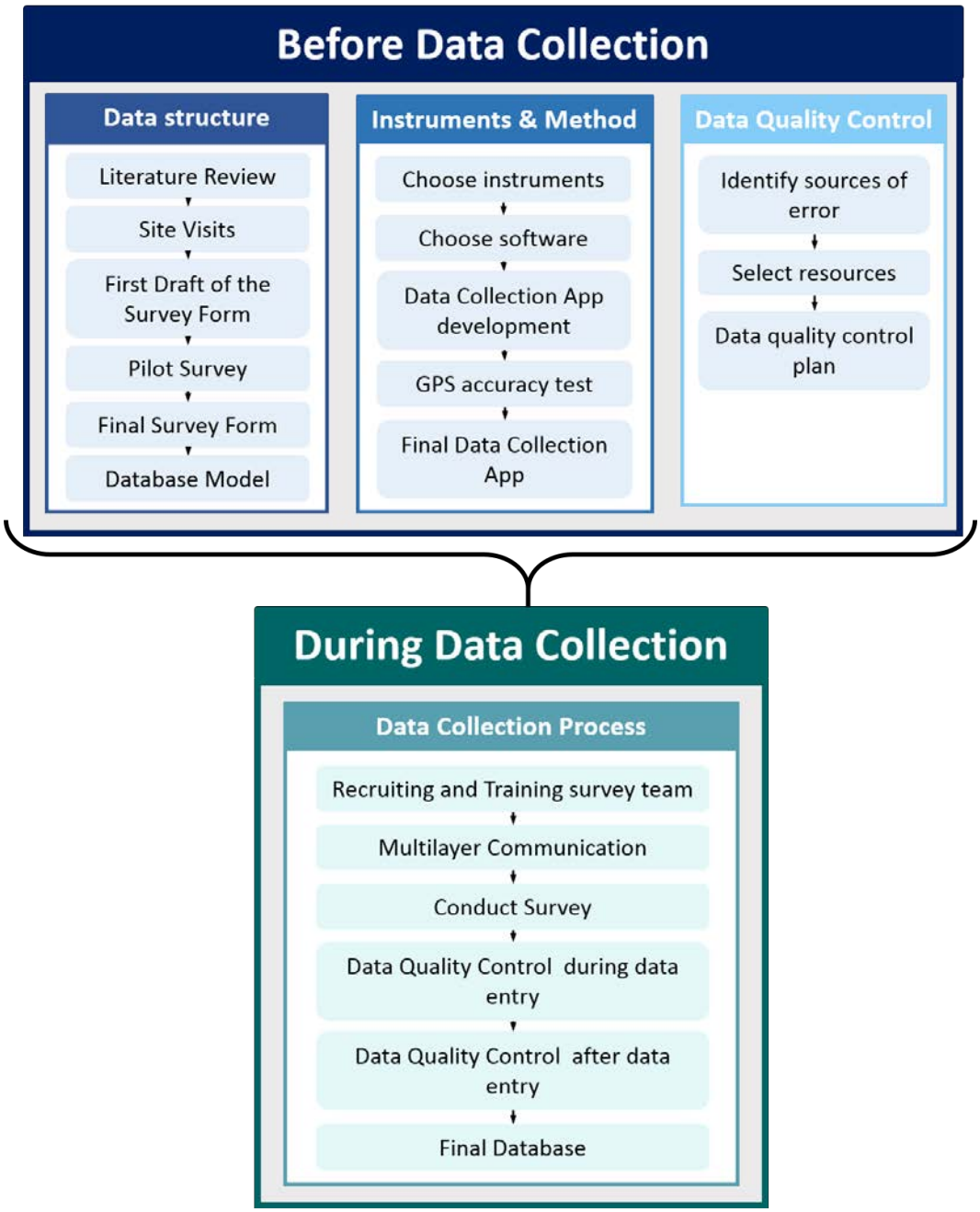
3. METHOD OVERVIEW AND STEP-BY-STEP PROCESS TO CONDUCT AN ALLEY INVENTORY



Step 1: Determine study parameters

Based on project scope and budget, determine at the outset the:

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

Seattle project at a glance:

- Study area: 941 city blocks
- Data-collection period: Three weeks, January 2018
- Workforce: 32 data collectors and 3 supervisors
- Total person-hours to examine and collect data on the 417 Center City area alleys: 850

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 measures recorded as smallest width and height within 30' from the alley entrance in order to capture most cargo vans' and trucks' bumper-to-bumper length)
- Aprons (width, length, and cross slope; slope determines if 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)

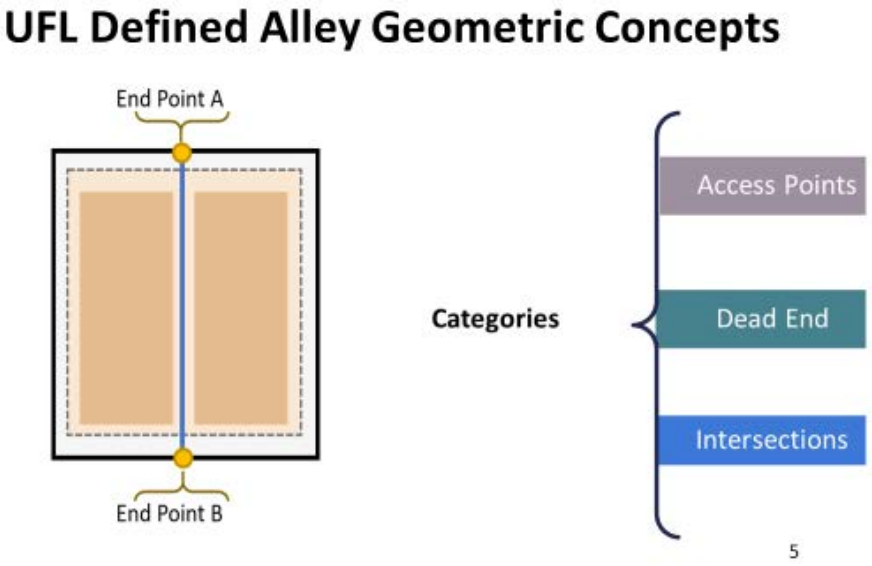
3. Accessibility, including:

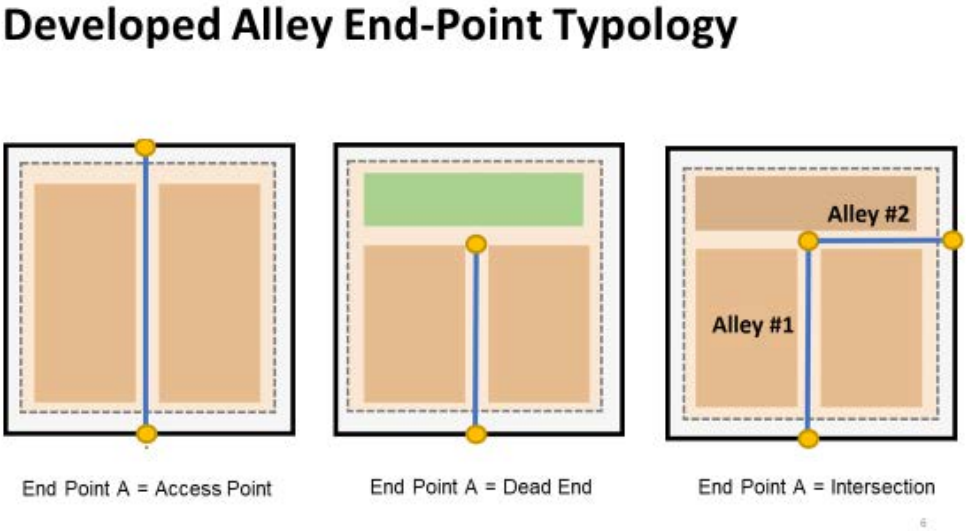
- Driveways connected to the alleys
- Location of buildings' main entrances
- Restrictions on alley usage as shown on posted signs
- Loading bay entrances
- Passenger parking, if visible or signed
- Presence of furniture or equipment
- Number of garbage containers

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

Step 3: Use Urban Freight Lab's detailed alley typology to categorize significant alley features

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.





Step 4: Select data-collection tools

The UFL research team created what is thought to be a first-of-its-kind mobile-app-based data-collection instrument. 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

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. 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.

Step 6: Draft and pilot field survey

The 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 these adaptations.)
- Test data-collection methods and instruments.

Step 7: Use pilot learning to create final survey, data structure, metadata and data quality-control plan

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

1. **Positional error**: 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 error**: 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 error**: 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 are collected.

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 improves security and enables 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.

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.

Instruct collectors to conduct a check of the surveyed alley locations after in-field collection to make more efficient final cleaning of the complete dataset.

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)
- always 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.

Step 10: Clean, assemble and summarize data

Conduct comprehensive data clean.

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

Glossary

Alleys ^back
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."

End Points ^back
According to the alley typology the UFL team developed, every alley has two end points, which fit one of three types: access point, dead end or intersection.

Apron ^back
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.

World Street Basemap ^back
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.