The data-collection and analytic methods represented here are:

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

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

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 the study area
- Number of areas to be observed
- Location of each study areas to be observed
- Data-collection/observation hours for the study areas
- Vehicle typology

The research team created specific categories covering a wide range of vehicle types that could load/unload on the curb. See Section 2 of the report for a chart of the defined vehicle types. The proposed vehicle typology was established based on fieldwork and knowledge of the curb operations in downtown Seattle. Passenger vehicle types were included to account for non-commercial vehicles occupying areas dedicated to commercial vehicles (e.g. commercial vehicle load zones, or CVLZs).

While a video camera-based data-collection could be considered, a camera can be blocked by a large vehicle or other impediment. Human observers have the advantage of being nimble in the field where traffic conditions are dynamic; observers can easily sidestep potential obstacles to ensure clear sightlines along the curb.

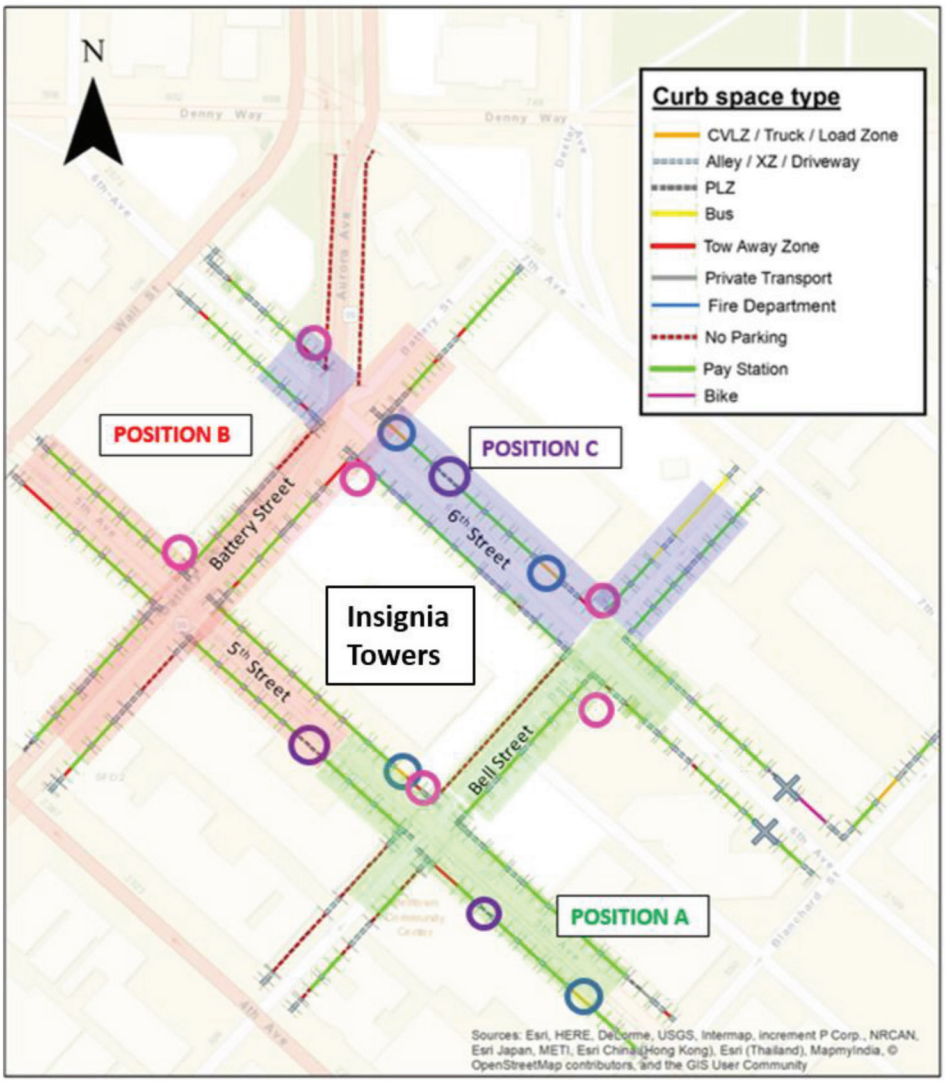
STEP 2: ASSESS EACH STUDY AREA

For each study area, it is essential to identify the different types of curb parking and their characteristics (e.g. length, location, use restrictions). Additionally, assessing the study area's curb configuration and built environment will help determine how to properly configure the positions where data collectors will stand to ensure clear sightlines.

The number and location of positions for each prototype building should be based on the study area characteristics, including the visibility, number, and distribution of the CVLZs and passenger load zones (PLZs) serving the building. If, as in the UFL occupancy study, a GIS curb space database is used, the relevant study areas should be double-checked in the field to confirm accuracy and corrected, as needed.

Position locations should assure data collectors are out of the regular traffic flow and places where vehicles are entering/exiting. The locations should also grant data collectors an unencumbered view of the vehicles parking at the curb so they can accurately record where, when and for how long the observed vehicles are parking. Below is a position map from the UFL occupancy study to indicate curb features of interest and how positions are designed to capture them.

Figure 1: Sample Map with Three Positions from UFL Occupancy Study



CURB SPACES IDENTIFIED IN FIELD:

- Commercial vehicle loading zone
- Passenger load zone
- Hydrant
- Zones where other commercial vehicle activity is collected
- Curb space does not appear in field as it is indicated in curb use GIS data
- Commercial vehicle loading zone not considered in analysis
- Passenger load zone not considered in analysis

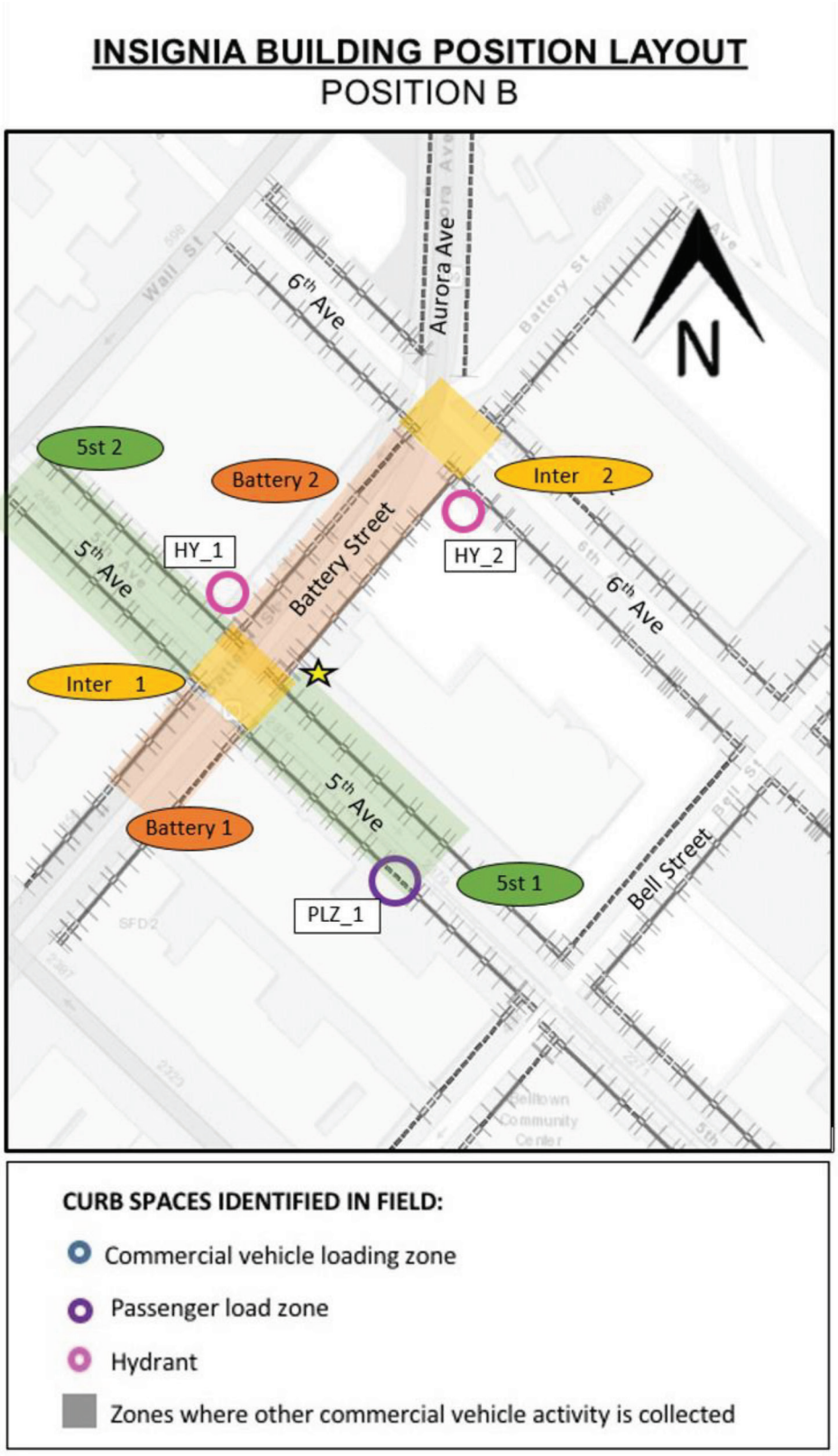
STEP 3: PREPARE MAPS AND DATA-COLLECTION FORMS

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

1. Position map:

Each data collector is responsible for observing and collecting information for a section of the study area, called a position. Each position is divided into zones that contain CVLZs, PLZs, and curbs or areas where possible inadequate commercial vehicle parking behavior might occur (e.g., turn lanes, bus lanes, hydrant). The boundaries of each zone should be easily identifiable in field, using specific built-environment features, landmarks and/or facilities. This map (Figure 2) corresponds to the data-collection form (Figure X) and helps data collectors correctly locate vehicles in the correct column on the form depending on where the vehicles parked within a given data collector's area.

Figure 2: Map for One Position in Insignia Towers Study Area



2. Data-Collection Forms:

The data-collection forms are hard-copy spreadsheets customized with the specific curb spaces and zones to be monitored at each position. The curb spaces and zones in the spreadsheet are ordered to allow the data collector to easily scan the area; they are also color-coded to make it easier for the data collector to find their location on the position layout map.

The research team recommends piloting the data-collection form and related maps, as was done in the UFL study. After field testing, the research team decided to use hard-copy spreadsheets for data collection because it proved faster than using a tablet, enabling data collectors to focus more on scanning the curb areas than on transcribing data. The data was collected on paper forms and then transcribed to a Google Drive Sheets document.

These forms can be made in Microsoft Excel. As shown in Table 1, the form should include these components:

1. **Part I - Header**. The name of the prototype building and position.
2. **Part II - Shift information.** Space to record the data collector's name and data-collection date.
3. **Part III - Vehicle type code.** A legend listing each vehicle type and its corresponding code, along with any notes.
4. **Part IV - Vehicle color code.** A legend listing each possible vehicle color and its corresponding code, to help data collectors track each parked vehicle.
5. **Part V - Data-collection table.** A table organized by area and curb type in a clockwise direction from the data collector's position. Every row in the data collection table corresponds to one minute of data collection. Data collectors scanned the area in a clockwise direction looking for commercial vehicles in their position's area and passenger vehicles in CVLZs, if applicable. Data collectors did the scans once per minute and noted the found vehicles under the corresponding minute and column of their form.

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 color, if needed.)

Table 1: Hard-Copy Data Collection Form Customized with Relevant Curb Features for Each Position in a Study Area

	Curb Space Data Collection: Insignia Building - Position B							Collector initials:				Date:						Sheet						
	Vehicle type code: Truck (T) | Box truck (B) | Cargo Van (CV) | Service Van (SV) | Van (V) | Passenger & Pick-up (P) | Motorcycle (M) | Cargo-bikes (C)																							
	Vehicle color code: USPS (US) | Blue (B) | Black (BK) | Brown (BW) | Green (G) | Gold (GO) | Red (R) | Silver (S) | White (W)																							
Time	PLZ 1		5th 1					Battery 1				5th 2						Battery 2						
	a	b	Right Curb a	Right Curb b	Center	Left Curb a	Left Curb b	Turn lane	Center	Left curb	HY_1	Right Curb a	Right Curb b	Center	Left Curb a	Left Curb b	Inter 1	Right Curb a	Right Curb b	Center	Left Curb a	Left Curb b	HY_2	Inter 2
08:48																								
08:49																								
08:50																								
08:51																								
08:52																								
08:53																								
08:54																								
08:55																								
08:56																								
08:57																								
08:58																								
08:59																								
09:00																								
09:01																								
09:02																								
09:03																								
09:04																								
09:05																								
09:06																								
09:07																								
09:08																								
09:09																								
09:10																								
09:11																								
09:12																								
09:13																								
09:14																								
09:15																								
09:16																								
09:17																								
09:18																								
09:19																								
09:20																								
Observations																								

STEP 4: RECRUIT AND TRAIN 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 the characteristics of the study area may also result in different workforce needs. The UFL research team used a team of 7 data collectors for five study areas, each of which was a three-by-three city block grid. For the UFL occupancy study, the research team assigned three to five data collectors for each study area; the number varied based on visibility and built environment.

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 the 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 regarding the desired project duration.

Training

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

1. **Theoretical training session. A presentation should cover the following:**

- The study parameters
- The typology of vehicles
- The data-collection method
- The typology of curbs
- Review of the data collector position map and data-collection forms

2. **In-field training session. While visiting a study area, data collectors ensure they understand its representation on the map as well as the data-collection method. Data collectors field-test the recording of vehicles that park in the area.**

STEP 5: COLLECT THE DATA

For each data-collection shift, collectors require a data-collection kit comprising:

1. Position map
2. Clipboard
3. Security vest
4. Data-collection forms
5. Binoculars, if needed
6. Digital watch to record the start/end time of each vehicle's parking
7. 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 curb occupancy project, data-collector shifts ranged from four to five hours each. Depending on the project's defined observation hours and data collectors' availability, any number of shifts can be scheduled to cover each study area. That said, collectors must not look away from the curb during their determined data-collection period. A data-collection monitor assigned to each study area granted breaks to the data collectors at assigned positions. The monitor also can collect data in case of a gap between shifts.

STEP 6: CREATE 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 study area. The sheet was pre-formatted with columns based on data structure defined for this method, as shown in Table2. 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 the first step in data-cleaning.

Table 2: Excel Sheet for Data Transcript to Be Completed Within 24 Hours After Data-Collector Shift Ends

Day	Study Area	Curb ID	Curb Type	Start Time	End Time	Vehicle Type

STEP 7: CLEAN THE DATA

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 captured, the study area it was in, and the amount of time it was parked. This allows for data analysis relevant to the study project's goals.