

## RICK WILLIAMS CONSULTING

Parking & Transportation

PO Box 12546

Portland, OR 97212

Phone: (503) 459-7638

E-mail: rick@rickwilliamsconsulting.com

### MEMORANDUM

**TO:** Carolyn Eagan, City of Bend  
**FROM:** Rick Williams, Owen Ronchelli, and Pete Collins, RWC  
Joe Bessman, Phill Worth, and Matt Kittelson, KAI  
**DATE:** March 23, 2016 (v.3)

**Project:** Downtown Bend Parking Study  
**Subject:** Phase 1: Task 1.4.1 - Data Collection Methodology Report - FINAL

This memorandum presents the methodology for collecting and assessing on- and off-street parking supply and demand data, including loading and unloading areas, within the downtown Bend Parking Study Area. It describes the inventory, data collection, data entry, and data analysis processes, the type of information that will be generated, and how this will be used to evaluate existing and projected parking conditions in the study area.

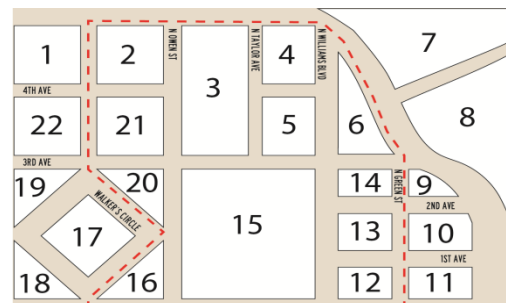
#### I. INVENTORY

The parking inventory will serve as a baseline for evaluating existing and projected parking conditions in the study area, cataloging the total number of off-street and on-street parking stalls by location and type. The inventory area map provided by City of Bend staff (**Attachment A**) will be used to establish initial boundaries for the inventory. Revisions to the study area may be made based on input from the Project Management Team (PMT), Technical Advisory Committee (TAC), and Downtown Stakeholder Advisory Committee (DSAC).

#### *Methodology for On-Street Inventory*

1. Use of aerial map to identify all on-street parking stalls in study area.
2. Assign a unique number to each city block within the area (see **Figure 1** at right).
3. Format the inventory template to include each block face, with the appropriate number of stalls designated by time restriction (see example, **Attachment B**). The template will include columns that identify:
  - a. Block # (see **Figure 2**, next page)
  - b. Space # (see **Figure 2**)
  - c. Time of day (usually in one-hour increments over the period that the City elects to conduct its survey, e.g. 7:00 a.m.–7:00 p.m.)
  - d. Type of space by time restriction.

Figure 1 : Assigning Block Numbers the

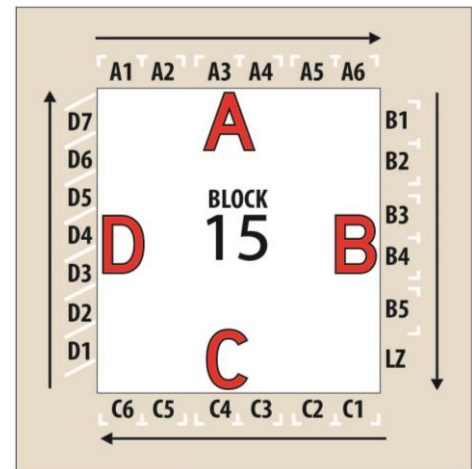


4. Conduct field verification to catalog all on-street spaces in the study area. Use a measuring wheel to estimate the number of stalls on block faces that lack striping.
5. Incorporate initial and field-verified counts into the final inventory template.

**Methodology for Off-Street Inventory**

1. Use of aerial map to identify all parking sites in the study area.
2. Correlate the map to GIS shape files of tax lots to determine the relationship of buildings to parking areas (see example, **Figure 3**).
3. Assign unique descriptors to each building/parking site.
4. Create an inventory template that includes information on each site—descriptor, building name, address, type of use, number of parking stalls, etc. The template will be created in Microsoft Excel.
5. Use aerial maps to count stalls by site.
6. Incorporate these initial counts into the inventory template (see example, **Attachment C**).
7. Record issues related to specific sites (e.g., tree cover, shade, etc.,) that limit a full count of stalls on site. These issues will be resolved through field verification.
8. Conduct field verification to catalog all off-street spaces in the study area.

**Figure 2: Parking Inventory Diagram**



**Figure 3: Example Mapping of Off-street Inventory**



## II. DATA COLLECTION

Data collection will provide the information necessary to evaluate existing and projected parking conditions in the study area. Data will include the total number of vehicles parked in the study area over the course of the selected data collection day(s), with stalls denoted by location and type.

### ***Methodology for On-Street Data Collection***

1. Field-verify all information from the inventory related to on-street stalls.
2. Finalize an on-street inventory/data collection template (see example, **Attachment B**).
3. Develop route maps based on the most efficient format for collecting data (see example, **Attachment D**).
  - a. At sites where stalls are time-limited, data collection templates will be modified to allow for the collection of hourly license plate data, as requested.
4. Collaborate with the DSAC to determine data collection survey dates and hours.
5. Schedule surveyors.
6. Surveyors will survey each on-street stall in the study area on days representing a “typical weekday” and a “typical weekend day”. Surveyors will record the license plate number for any vehicle parked in a time-limited stall.
7. Data will be collected each hour on the hour for a period of at least 10 hours.

### ***Methodology for Off-Street Data Collection***

1. Collaborate with all advisory groups to determine an appropriate process for notifying affected private property sites of the data collection effort.
2. Field-verify all information related to parking sites.
  - a. Field verification will address issues raised in the inventory phase and identify sites with unique characteristics to be surveyed during data collection (e.g., time-limited visitor stalls, handicap stalls, etc.).
3. Finalize an off-street inventory template.
4. Develop route maps based on the most efficient format for collecting data at off-street parking sites.
5. Develop templates to collect occupancy information over a 10-hour study period.
  - a. At sites where stalls are time-limited, data collection templates will be modified to allow for the collection of license plate data.
6. Collaborate with PMT/TAC to determine data collection survey dates and hours.
7. Schedule surveyors.

8. Surveyors will collect occupancy data at all sites on days representing a “typical weekday” and a “typical weekend day,” to be determined with PMT/TAC.
  - a. Data will be collected each hour on the hour for a period of at least 10 hours.
  - b. In facilities with time-limited parking stalls, both occupancy and license plate data will be recorded.
9. Surveyors will record all data in templates developed for each unique site.

### **III. DATA ENTRY**

1. All data from on- and off-street templates will be entered into a database for analysis.

### **IV. DATA ANALYSIS**

Data will be analyzed and evaluated to derive findings for the following metrics.

#### ***Parking Supply***

Parking supply data for on- and off-street facilities will be organized by location, type, and accessory use.

#### ***Parking Demand***

Parking demand data will be analyzed to determine the total number of vehicles parked in the study area, cataloged by location, type, and accessory use and described in terms of occupancy, duration of stay, and turnover, as applicable. These factors, described below, can be quantified for the entire study area and/or sub-areas to provide more specificity regarding use in unique nodes of the downtown.

#### **a. Occupancy**

Occupancy is the total number of occupied parking stalls in the study area and is most commonly shown as a percentage of overall system capacity. Occupancy can be calculated for the combined study area, for sub-areas, and/or for individual lots or garages. Where time-restricted and other stall types exist, additional information on occupancy of these stalls is provided.

A parking system is generally considered to be full or at its effective capacity when occupancies reach or exceed 85% in the peak hour. Where more than 85% of stalls are occupied, users may be discouraged from parking, or may add to congestion by circling the area in search of available spaces.

#### **b. Duration of Stay**

Duration of stay is the average length of time a vehicle remains in a parking stall. For this study, duration of stay is sampled in one-hour increments. Duration of stay information can be used to calibrate posted time stays to accommodate priority users (e.g., retail customers). It can also be used to identify the total

number of vehicles, or percentage of vehicles, that violate posted time restrictions when enforcement hours are in effect, and the rate of vehicle turnover (see below). Duration of stay is calculated by dividing the total number of vehicle hours parked by the total number of unique vehicles captured in the data.

**c. Turnover**

Turnover reflects the total number of vehicles using a parking stall over the course of a day, and is typically measured over a 10-hour period. Parking managers use turnover as a measuring stick for the efficiency of a parking system. For instance, if a stall has a 2-hour time restriction, its intended minimum rate of turnover is 5 (10-hour day divided by 2-hour stall). If turnover were demonstrated to be less than 5, the system would be deemed inefficient. A rate greater than 5 would indicate a system operating very efficiently.

**d. Number of Unique Vehicles**

Number of Unique Vehicles is a measure of how many customers, visitors, and employees are accessing the parking district, and can be used as a baseline for commercial growth—more customers and visitors correlates to a more vibrant district. A “unique vehicle” is captured in license plate numbers recorded each hour of the survey.

**e. Stays of Five Hours or More**

Stays of Five Hours or More can be used to estimate the number of employees using on-street stalls, which is helpful when designing and implementing a district-specific parking management plan and/or calibrating enforcement.

**f. Rate of Violation**

Data will be analyzed to determine the percentage of vehicles that exceed posted time stays. This information can be correlated to actual enforcement data for the survey days, comparing the observed number of violations to actual citations issued. The parking industry targets violation rates of 5-7% as a measure of efficiency. When violation rates are below 5%, enforcement may be over-provided and customers may perceive the area as not customer-friendly. When rates exceed 7%, the system is considered inefficient and enforcement may need to be increased.

**g. Moving to Evade**

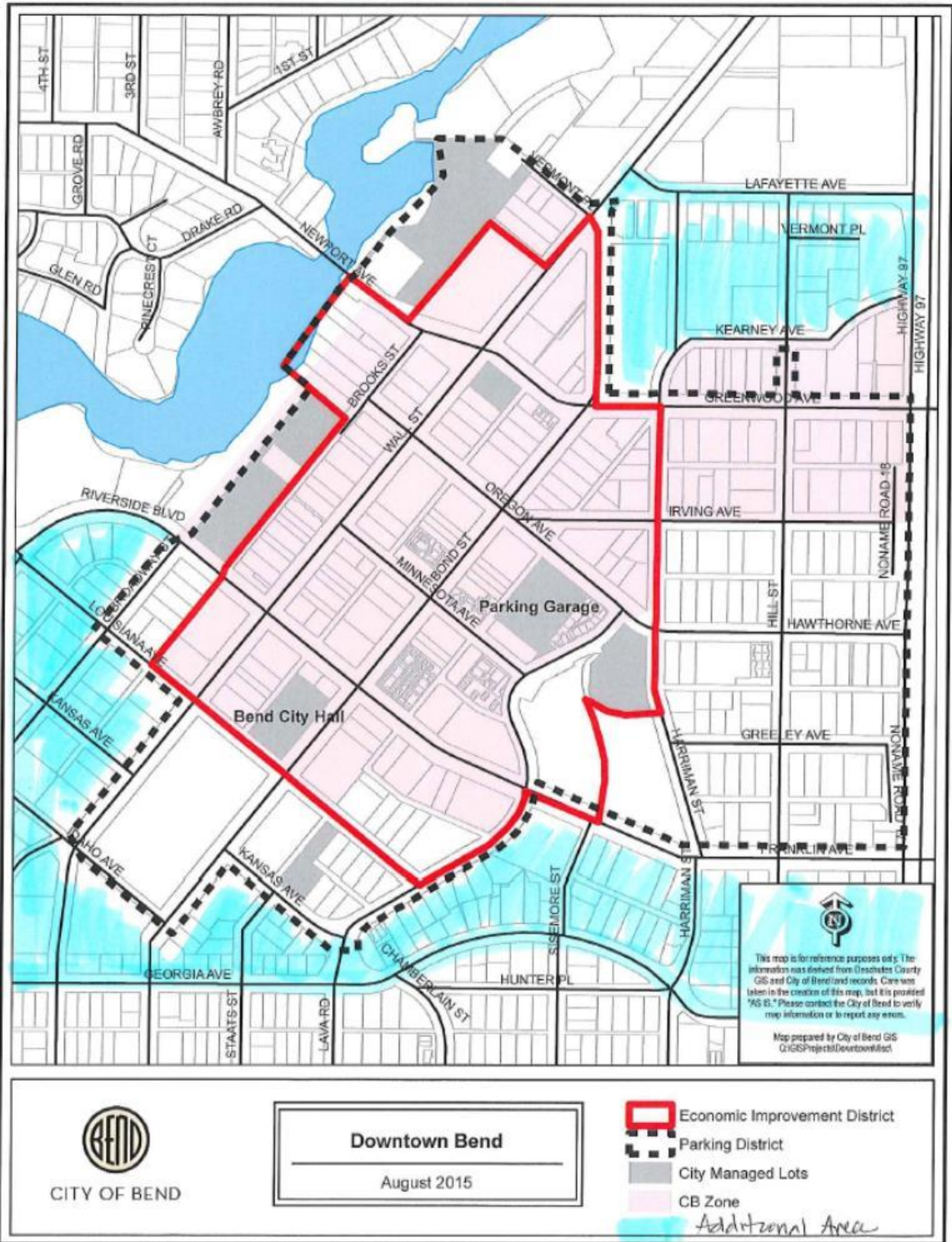
Moving to Evade is measured by capturing unique license plates that move throughout the study area over the course of a survey day. Such vehicles often belong to employees who move them every few hours to avoid parking off-street or in areas where pricing is in place.

**V. SUMMARY**

The methodologies outlined in this memorandum have been presented to the PMT, TAC, and DSAC for review and input. Refinements and revisions have been made to this document, which inform the inventory and data collection effort. This completes the requirements for Task 4 -1.4.1 - of the Phase 1 scope of work.

**ATTACHMENT A**

# Preliminary Inventory and Data Collection Area



**ATTACHMENT B**





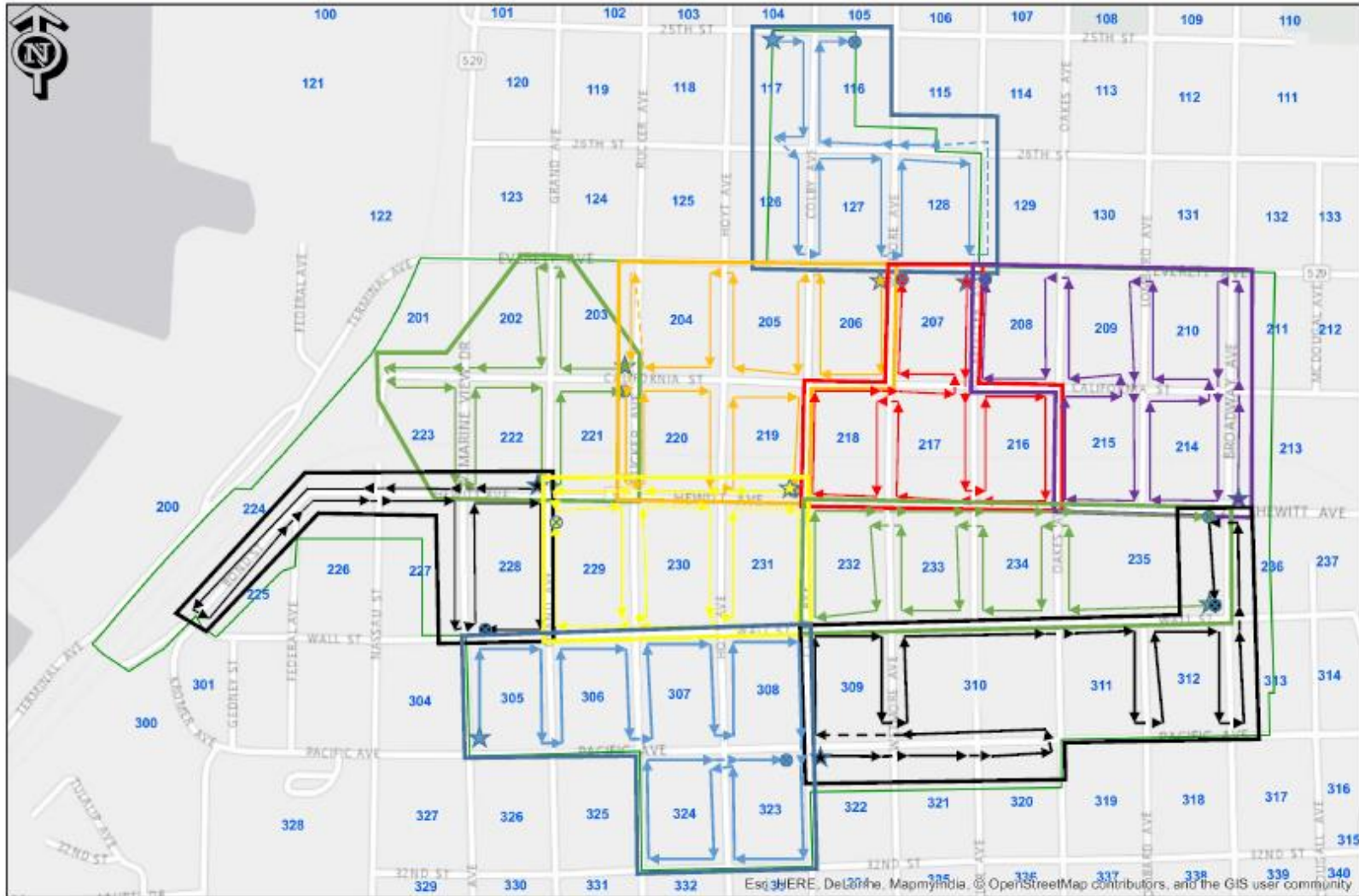
**ATTACHMENT C**

**Example: Inventory of Off-street Stalls**

<b>Lot Number</b>	<b>Lot Descriptor</b>	<b>Stall Total by Lot</b>	<b>% of Total Area Stalls</b>
23/24	<b>2 HR Public Parking (Burnham Lot)</b>	20	11.6%
39	<b>Stevens Marine</b>	8	4.7%
40	<b>Ferguson</b>	12	7.0%
41	<b>B &amp; B Print Source</b>	9	5.2%
42	<b>Mannings Auto</b>	14	8.1%
43	<b>Henderson Auto</b>	41	23.8%
44	<b>Wyatt Fire Protection</b>	9	5.2%
45	<b>Tigard Vision Center (Visitor/Front Lot)</b>	22	12.8%
46	<b>Tigard Vision Center (Employee/Back Lot)</b>	27	15.7%
47	<b>Scott Hookland LLP</b>	10	5.8%
	<b>Total Off-Street Parking Stalls (10 sites)</b>	<b>172</b>	<b>100.0%</b>

**ATTACHMENT D**


Example: Data Collection Route Map (All Routes)



Downtown Everett Parking Study

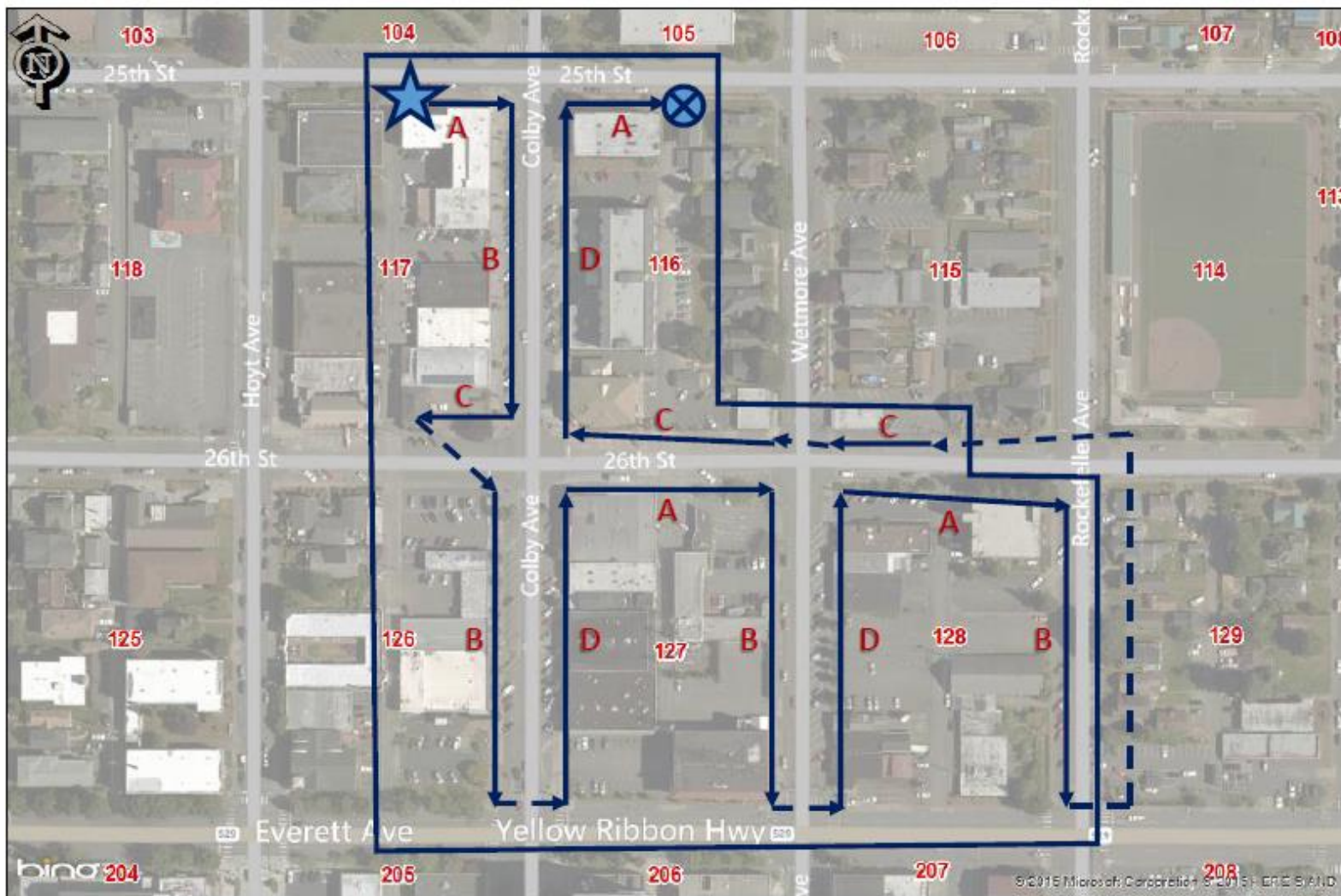
September 2015

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 Downtown Everett Study Boundary



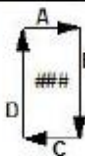
Example: Data Collection Route Map (Single Route)



**Downtown Everett Parking Study**

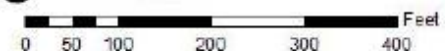
**ROUTE 1**

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- Route Study Boundary Area
- ### Block Number Identification
- A Blockface Identification
- Walking Direction

- ★ Beginning of Route
- ⊗ End of Route



October 2015