Technology Integration to Gain Commercial Efficiency for the Urban Goods Delivery System

Annual Merit Review Presentation

This presentation does not contain any proprietary, confidential, or otherwise restricted information.
Overview

**TIMELINE**

Start: October 2018  
End: December 2021  
~33% complete

**BUDGET**

- Total: $2.1M  
- DOE share: $1.5M  
- Cost share: $642K  
- Funding for FY 2019: $714K  
- Funding for FY 2019: $714K

**PARTNERS**

- **Project Lead:** University of Washington’s Urban Freight Lab  
- **Project Collaborator:** Pacific Northwest National Laboratory (PNNL)  
- **Cost Share Partners:**  
  - Seattle Department of Transportation  
  - Bellevue Department of Transportation  
  - King County Metro Transit Department, Sound Transit  
  - CBRE, Kroger, Puget Sound Clean Air Agency  
- **Locker Vendor:** Parcel Pending  
- **Other Contributing Partners:** UPS, USPS, Pepsi Co., Building Owners and Managers Association King County (BOMA)

**BARRIERS ADDRESSED**

1. Lack of understanding of commercial impact of insufficient public freight infrastructure and support  
2. Lack of support for urban freight activities from public sector agencies  
3. Lack of digital visibility of complete urban freight network for private sector companies
## Project Objectives

<table>
<thead>
<tr>
<th>Objective</th>
<th>Target</th>
<th>VTO goal</th>
<th>Impact on Milestones</th>
<th>Impact on Barriers</th>
</tr>
</thead>
</table>
| Reduce parking seeking behavior | -20%   | Affordability for business and consumers Reliability/resiliency Economic growth | ● Descriptive analysis of parking behavior  
● Estimate of parking seeking status quo  
● Prototype of app and prediction model | ● Builds digital visibility of urban freight network  
● Builds knowledge of impacts of insufficient commercial parking |
| Reduce parcel truck dwell time | -30%   | Affordability for business and consumers Reliability/resiliency Economic growth | ● Identified and granted study area permission  
● Released sensor RFP  
● Contracted with locker vendor  
● Agreement on locker sites | ● Builds public sector capability to support urban logistics |
| Increase curb and alley space occupancy rates | 80% 60% During peak | Affordability for business and consumers Reliability/resiliency Economic growth | ● Estimate of current occupancy rates  
● Developed model to simulate parking behavior | ● Builds knowledge of impacts of insufficient commercial parking  
● Builds public sector capability to support urban logistics |
**Project Approach**

**YEAR 1: VISION AND PLAN**
- Finalize the plan for placing sensors and lockers on public and private property
- Select pilot test area and obtain permissions to execute the plan
- Issue RFPs and select vendors
- Develop techniques to preprocess the data streams from sensors
- Design and prototype an app to display real-time parking space availability
- Develop model to simulate parking behaviors

**YEAR 2: BUILD AND TEST**
- Oversee installation of sensors, collect and validate data
- Manage the installation, marketing and operations of common locker systems
- Test the prototype app with initial data streams

**YEAR 3: OPERATE AND EVALUATE**
- Expand and improve upon project implementation
- Continue to measure results against project goals and make improvements
- Develop a visual confirmation system to alert drivers if they overstay their authorized time in the space (inducing improved compliance)
- Run the behavior model to evaluate demand and other scenarios
## Milestones

<table>
<thead>
<tr>
<th>Year</th>
<th>Milestone</th>
<th>Type</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1. Obtain permissions from controlling authorities</td>
<td>Go/No-Go</td>
<td>Complete</td>
</tr>
<tr>
<td></td>
<td>2. Form an advisory and technical work group</td>
<td>Technical</td>
<td>Complete</td>
</tr>
<tr>
<td></td>
<td>3. Design and prototype a parking occupancy and information app and a web-based platform</td>
<td>Technical</td>
<td>Complete</td>
</tr>
<tr>
<td></td>
<td>4. Issue RFP, select and contract with sensor vendors</td>
<td>Technical</td>
<td>In Progress (50%)</td>
</tr>
<tr>
<td></td>
<td>5. Issue RFP, select and contract with locker vendors</td>
<td>Technical</td>
<td>Complete</td>
</tr>
<tr>
<td></td>
<td>6. Evaluate and select common carrier locker sites</td>
<td>Technical</td>
<td>In Progress (80%)</td>
</tr>
<tr>
<td>2</td>
<td>7. Perform a descriptive analysis of behavior in test area</td>
<td>Technical</td>
<td>Complete</td>
</tr>
<tr>
<td></td>
<td>8. Develop a model to simulate parking behavior</td>
<td>Technical</td>
<td>In Progress (60%)</td>
</tr>
<tr>
<td></td>
<td>9. Test the prototype app with initial stream of data</td>
<td>Technical</td>
<td>In Progress (30%)</td>
</tr>
<tr>
<td></td>
<td>10. Validate sensor data accuracy within requirements</td>
<td>Go/No-Go</td>
<td>Not Started</td>
</tr>
<tr>
<td>3</td>
<td>11. Install sensors in commercial loading zones, collect and process data</td>
<td>Technical</td>
<td>Not Started</td>
</tr>
<tr>
<td></td>
<td>12. Analyze parking seeking behavior in pilot test area</td>
<td>Technical</td>
<td>In Progress (30%)</td>
</tr>
<tr>
<td></td>
<td>13. Perform a quantitative analysis of pilot test results</td>
<td>Technical</td>
<td>Not Started</td>
</tr>
</tbody>
</table>
✔ Identified and mapped test area

✔ Characterized commercial parking behavior through ride-alongs

<table>
<thead>
<tr>
<th>Objective</th>
<th>Milestone</th>
<th>Barrier</th>
</tr>
</thead>
<tbody>
<tr>
<td>All</td>
<td>1</td>
<td>3</td>
</tr>
</tbody>
</table>

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<tr>
<th>Objective</th>
<th>Milestone</th>
<th>Barrier</th>
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</thead>
<tbody>
<tr>
<td>Reduce parking seeking behavior</td>
<td>3,7,12</td>
<td>1</td>
</tr>
</tbody>
</table>
✔ Estimate commercial vehicles’ parking seeking time

- Designed a prediction model for commercial vehicle parking occupancy, trained on synthetic data

<table>
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<th>Milestone</th>
<th>Barrier</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reduce parking seeking behavior</td>
<td>7,12</td>
<td>1</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Objective</th>
<th>Milestone</th>
<th>Barrier</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reduce parking seeking behavior, Increase occupancy rates</td>
<td>8</td>
<td>3</td>
</tr>
</tbody>
</table>
Project Accomplishments & Progress (Cont.)

✔ Designed and coded a prototype app (currently implemented as a website)

✔ Released sensor RFP

TR0-5020 - Urban Goods Vehicle Sensor Project
City of Seattle

Project Details

- Project: Urban Goods Vehicle Sensor Project
- Ref. #: TR0-5020
- Type: RFP
- Status: OPEN
- Open Date: Mar 18th 2020, 1:00 PM PDT
- Questions Due Date: Apr 15th 2020, 5:00 PM PDT
- Close Date: Apr 22nd 2020, 2:30 PM PDT

<table>
<thead>
<tr>
<th>Objective mi</th>
<th>Milestone</th>
<th>Barrier</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reduce parking seeking behavior, Increase occupancy rates</td>
<td>4</td>
<td>2,3</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Objective</th>
<th>Milestone</th>
<th>Barrier</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reduce parking seeking behavior, Increase occupancy rates</td>
<td>3,8,9</td>
<td>3</td>
</tr>
</tbody>
</table>
Selected and contracted with a locker vendor (Parcel Pending)

Identified locations

<table>
<thead>
<tr>
<th>Objective</th>
<th>Milestone</th>
<th>Barrier</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reduce dwell time, Increase occupancy rates</td>
<td>5,6</td>
<td>1</td>
</tr>
</tbody>
</table>
Project Accomplishments & Progress (Cont.)

- Convened stakeholder groups for engagement and information sharing

<table>
<thead>
<tr>
<th>Objective</th>
<th>Milestone</th>
<th>Barrier</th>
</tr>
</thead>
<tbody>
<tr>
<td>All</td>
<td>1,2,6,7,12</td>
<td>1,2</td>
</tr>
</tbody>
</table>
Collaborations and Coordination Among Project Partners

UW Urban Freight Lab
PROJECT LEAD

• Seattle DOT
• Bellevue DOT
• King County Metro Transit
• Sound Transit
• CBRE
• Kroger
• Puget Sound Clean Air Agency
COST SHARE PARTNERS

Monthly

Pacific Northwest National Lab
PROJECT COLLABORATOR

Parcel Pending
LOCKER VENDOR

• UPS
• USPS
• BOMA
• Pepsi Co
OTHER CONTRIBUTING PARTNERS

Bi-weekly
Weekly
Monthly
## Overall Market Impacts

### Objectives

### Achievements to Date

<table>
<thead>
<tr>
<th>Achievements to Date</th>
<th>Reduce parking seeking behavior</th>
<th>Reduce parcel truck dwell time</th>
<th>Increase curb and alley space occupancy rates</th>
</tr>
</thead>
<tbody>
<tr>
<td>Characterized parking decision making and quantified parking seeking</td>
<td>x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Built prototype app giving commercial vehicle drivers visibility into commercial parking availability</td>
<td>x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Procured lockers in competitive process</td>
<td></td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Worked with SDOT to release RFP for occupancy sensors</td>
<td>x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Designed a prediction model for commercial vehicle parking occupancy, trained on synthetic data</td>
<td>x</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Engaged with both public and private sector partners</td>
<td></td>
<td>x</td>
<td>x</td>
</tr>
</tbody>
</table>

### Planned for Next Year

<table>
<thead>
<tr>
<th>Planned for Next Year</th>
<th>Reduce parking seeking behavior</th>
<th>Reduce parcel truck dwell time</th>
<th>Increase curb and alley space occupancy rates</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ensure installation of occupancy sensors and lockers</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Measure impact of driver application on parking seeking</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Measure impact of locker delivery on truck dwell time</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Measure change in curb and alley space occupancy rates</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## Overall Market Impact

### Barriers

<table>
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<tr>
<th>Lack of understanding of commercial impact of insufficient public freight infrastructure and support</th>
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<td></td>
<td>x</td>
</tr>
<tr>
<td>Engaged with both public and private sector partners</td>
<td>x</td>
<td>x</td>
</tr>
</tbody>
</table>
# Overall Market Impact Barriers (Cont’d)

## PLANNED FOR NEXT YEAR

<table>
<thead>
<tr>
<th></th>
<th>Lack of understanding of commercial impact of insufficient public freight infrastructure and support</th>
<th>Lack of support for urban freight activities from public sector agencies</th>
<th>Lack of digital visibility of complete urban freight network for private sector companies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ensured installation of occupancy sensors and lockers</td>
<td>✗</td>
<td>✗</td>
<td>✗</td>
</tr>
<tr>
<td>Measure impact of driver application on parking seeking</td>
<td>✗</td>
<td>✗</td>
<td>✗</td>
</tr>
<tr>
<td>Measure impact of locker delivery on truck dwell time</td>
<td>✗</td>
<td>✗</td>
<td>✗</td>
</tr>
<tr>
<td>Measure change in curb and alley space occupancy rates</td>
<td>✗</td>
<td>✗</td>
<td>✗</td>
</tr>
</tbody>
</table>
Overall Market Impact

**Sustainability**

We have engaged with independent technology and infrastructure companies to procure and implement solutions. These businesses have economic models that ensure sustaining solutions and implementation in other cities.

**Challenges and Barriers**

COVID-19 has delayed some decision-making and technology implementation. We do not expect this to affect meeting annual milestones.
Summary

Goal & Relevance
- Reduce parking seeking behavior
- Reduce parcel truck dwell time
- Increase network and commercial firms’ efficiency

Approach
- Provide real-time information and prediction on commercial vehicle parking occupancy
  - Common carrier locker systems

Collaboration
- Academia
- National Lab
- Public Agency (Cities, Public Transit Agencies)
- Private Industry (Carriers, Retailers, Real-estate)

Accomplishments
- Identified and mapped test area, and obtained the necessary permissions
- Characterized commercial parking behavior through ride-alongs
- Estimated commercial vehicles’ parking seeking time
- Designed a prototype app and prediction model for CV parking occupancy
- Contracted with a locker vendor and identified locations
- Released RFP for occupancy sensors

Goal & Relevance
Increase energy efficiency
ANNE GOODCHILD
UNIVERSITY OF WASHINGTON
ANNEGOOD@UW.EDU
HTTP://DEPTS.WASHINGTON.EDU/SCTLCTR
# Parking Seeking Time Estimation

<table>
<thead>
<tr>
<th>Data source</th>
<th>Variable of interest</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>GPS trip data</td>
<td>Trip time</td>
<td>Real time between any two parking events in a delivery tour. Includes: driving time (given traffic conditions) + parking seeking time</td>
</tr>
<tr>
<td>Google Maps trip</td>
<td>Driving time</td>
<td>Travel time assuming perfect information on parking availability</td>
</tr>
<tr>
<td>times</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

![Diagram showing trip time, driving time, and deviation](image-url)
Results:

Parking Seeking Time Distribution

- Distribution of estimated parking seeking times for two data samples
Parking Choices

- Curb (authorized)
  - CVLZ
  - Paid parking
  - PLZ
  - Total: 52%
- Curb (unauthorized)
  - No parking zones
  - Total: 24%
- Travel lane
  - Total: 7%
- Others
  - Customer parking
  - Alleys
  - Off-street parking
  - Total: 17%

No parking zones
Queueing and re-routing

Queueing
Re-routing

Trip start
Trip end
Publications and Presentations

MAY 9, 2019
Presentation at Urbanism Next Conference (Portland, OR)

JULY 10-11, 2019
Poster Presentation at Smart & Secure Cities & Communities Challenge Expo (Washington, DC)

OCTOBER 16-18, 2019
Presentation at International Urban Freight Conference (Long Beach, CA)

NOVEMBER 20, 2019
Presentation at FHWA Talking Freight Webinar (Online)

JANUARY 12-16, 2020
Presentation at 99th Transportation Research Board Annual meeting (Washington, DC)