

MEMORANDUM

Date:	December 10, 2013	TG:	13142.00
To:	Mary Catherine Snyder and Jonathan Williams – SDOT		
From:	Stefanie Herzstein and Dan McKinney – Transpo Group		
Subject:	Commercial Vehicle Pricing Project – Data Summary		

The purpose of this memorandum is to summarize data collection methods and initial data collection findings for the Commercial Vehicle Pricing project. This project focuses on commercial vehicle load zones (CVLZs) within Seattle's downtown commercial core. First, the different data collection methods are discussed including lessons learned from the initial data collection. Next, the findings of the initial data collection at approximately 30 CVLZs are described.

Purpose of the Data Collection

The data collection at CVLZs for the Commercial Vehicle Pricing project is intended to provide an understanding of CVLZ operations and verify information gathered through stakeholder outreach. Specific characteristics collected during the initial data collection include:

- Occupancy and Duration of Stay
- Commercial vs. Non-Commercial Classification
- Presence of Commercial Vehicle Permit (manual counts)
- Payment Observations (manual counts)
- Citation Observations (manual counts)

The data is used to quantify and better understand the use and availability of CVLZs.

Data Collection Methods

Table 1 provides a comparison of the data collection methods considered for the Commercial Vehicle Pricing project. Although there are other data collection methods, those reviewed were considered to have the most potential for meeting the intent of this initial study.

Table 1. Comparison of Data Collection Methods

Method / Description	Advantages	Disadvantages
Manual Counts – Regular Intervals: Manual counts use people in the field to circulate a defined route/area in regular intervals.	<ul style="list-style-type: none"> • Ability to collect multiple CVLZs • Identify commercial vehicle permits • View citations and use of pay station • Observe driver behavior and general use of the CVLZs • Identify vehicle classification and vendor type • Less cost per space compared to other methods with multiple CVLZs collected 	<ul style="list-style-type: none"> • 30 to 65 percent of the vehicles using the CVLZ were missed with observations every 15-minute (primarily illegal short term use by passenger vehicles); Duration is estimated based on observations every 15-minutes and is less accurate
Manual Counts – Continuous Monitoring: Manual counts use people in the field to observe a designated area.	<ul style="list-style-type: none"> • Ability to collect multiple CVLZs • Identify commercial vehicle permits • View citations and use of pay station • Observe driver behavior and general use of the CVLZs • Identify vehicle classification and vendor type • Less cost per space compared to other methods with multiple CVLZs collected 	<ul style="list-style-type: none"> • Variation in the number of CVLZs observed based on how the CVLZs are clustered and the characteristics of the specific location such that the data collector has an unobstructed view of multiple CVLZs • Potential to miss some observations or vehicle characteristics if data collector needs to move closer to a CVLZs to identify vehicles or permits
Video Camera: The commercial load zones are filmed continuously with a video camera and reviewed by technician.	<ul style="list-style-type: none"> • Continuous surveillance of loading area • Identify vehicle classification and vendor type • Record of data and ability to review • Arrival and departure times provide accurate duration 	<ul style="list-style-type: none"> • One camera required per CVLZ • More costly per space than manual count • Not able to capture commercial vehicle permits • Not able to clearly capture payment or citations
Time Lapse Camera: The photographs are taken of the commercial load zones. The pictures are taken in regular intervals as rapid as twice a second. This method can provide nearly the same information as video data collection.	<ul style="list-style-type: none"> • Near continuous surveillance of loading area based on defined intervals • Identify vehicle classification and vendor type • Record of data and ability to review • Arrival and departure times are as accurate as the interval of photos • Potentially quicker to review than video, dependent on capture interval 	<ul style="list-style-type: none"> • One unit per CVLZ • More costly per space than manual count • Not able to capture commercial vehicle permits • Not able to clearly capture payment or citations

Method / Description	Advantages	Disadvantages
Stationary License Plate Recognition (LPR): A unit is mounted near the load zone to recognize license plates and records the arrival and departure times.	<ul style="list-style-type: none"> • Arrival and departure times provide accurate duration of stay 	<ul style="list-style-type: none"> • One unit per CVLZ • More costly per space than manual count • Potential for license plate to be obstructed in multi-space CVLZs • Interference of the adjacent travel lane skewing results • Unable to identify vehicle classification and vendor type unless data is available to cross-check license plates • Inability to capture vehicle permits • Not able to clearly capture payment or citations
Mobile LPR: A device is mounted to a vehicle to recognize license plates as the vehicle drives by the load zones. Data would be collected at regular intervals similar to the manual counts.	<ul style="list-style-type: none"> • Ability to collect multiple CVLZs in intervals • Capture all parking activity along the route • Less cost per space compared to stationary LPR 	<ul style="list-style-type: none"> • Potential for shadowing in the downtown area making it difficult to locate data with GPS • Potential to miss activity with circulation based on interval observations • Unable to identify vehicle classification and vendor type unless data is available to cross-check license plates • Inability to capture commercial vehicle permits • Duration is an estimated based the interval of circulation on the route • Not able to capture payment or citations

Performance of Data Collection Methods

The initial data collection tested both manual and video data collection methods due to the advantages and disadvantages described above. Based on previous history and coordinating with a data collection vendor, license plate recognition was deemed to be less accurate and more costly. **Figure 1** below illustrates the study boundaries selected for the data collection. With the downtown commercial core, two areas (highlighted in blue) were identified for the study: (1) along 1st and 2nd Avenues between Pine and Main Streets and (2) the financial district between 3rd and 6th Avenues along Union, University, and Seneca Streets. The initial data collection areas for the video and manual counts are also identified in **Figure 1**. The initial collection captured 5 CVLZs with video and 23 CVLZs with manual counts for a total of 28 CVLZs. The video data and manual data for areas 1 (Pike Place Market) and 2 (Financial District) were collected in October 2013. Data along area 3 (Pioneer Square) was collected manually in November 2013.

Figure 1. Data Collection Study Area

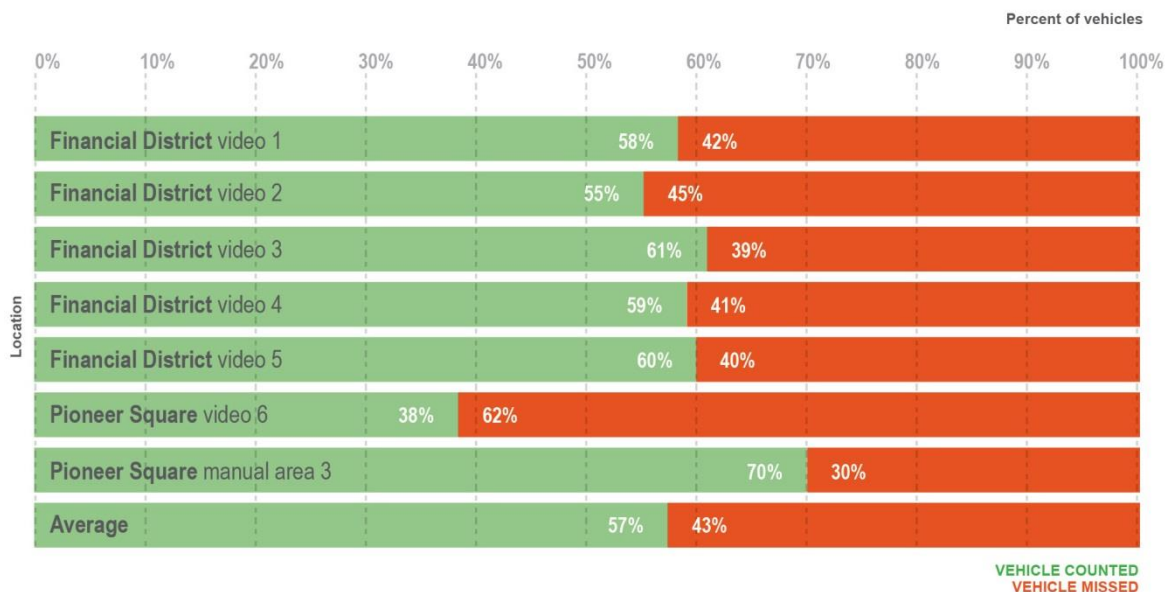


Manual count areas 1 and 2 were collected in 15-minute intervals. A review of the data showed that the number of vehicles observed per CVLZ with the manual counts was significantly lower than observed with video collection. The video data was further reviewed to understand how many vehicles would have been missed if manual counts were conducted at 15-minute intervals.

Figure 2 illustrates the percent of vehicles that would have been observed versus missed if 15-minute interval manual counts were conducted instead of video. As shown on the figure, by conducting manual counts at 15-minute intervals, an average of 43 percent of the vehicles would not have been observed. Given the high proportion of CVLZ activity missed with manual counts at 15-minute intervals, the manual observations for area 3 focused on four CVLZs that could be continuously monitored. This continuous manual count method captures some of the advantages of both the manual 15-minute interval and video count methods. It provides the ability to collect commercial vehicle permits and more than one CVLZ similar to the 15-minute interval manual counts, but it provides continual surveillance of the CVLZs consistent with the video data collection. In addition, continuous manual monitoring of the CVLZs costs less per space than the video data collection. The downside of the continuous manual counts method is that fewer CVLZs would be covered with the project budget and the ability to collect multiple CVLZs manually depends on how the CVLZs are clustered and the characteristics of the specific location such that the data collector has an unobstructed view of multiple CVLZs.

Given the amount of missed vehicles with the 15-minute interval manual counts, future data collection should use video/time lapse cameras, continuous manual monitoring, or other continual surveillance.

Figure 2. Vehicles Counted vs. Missed with Manual Counts at 15-minute Intervals



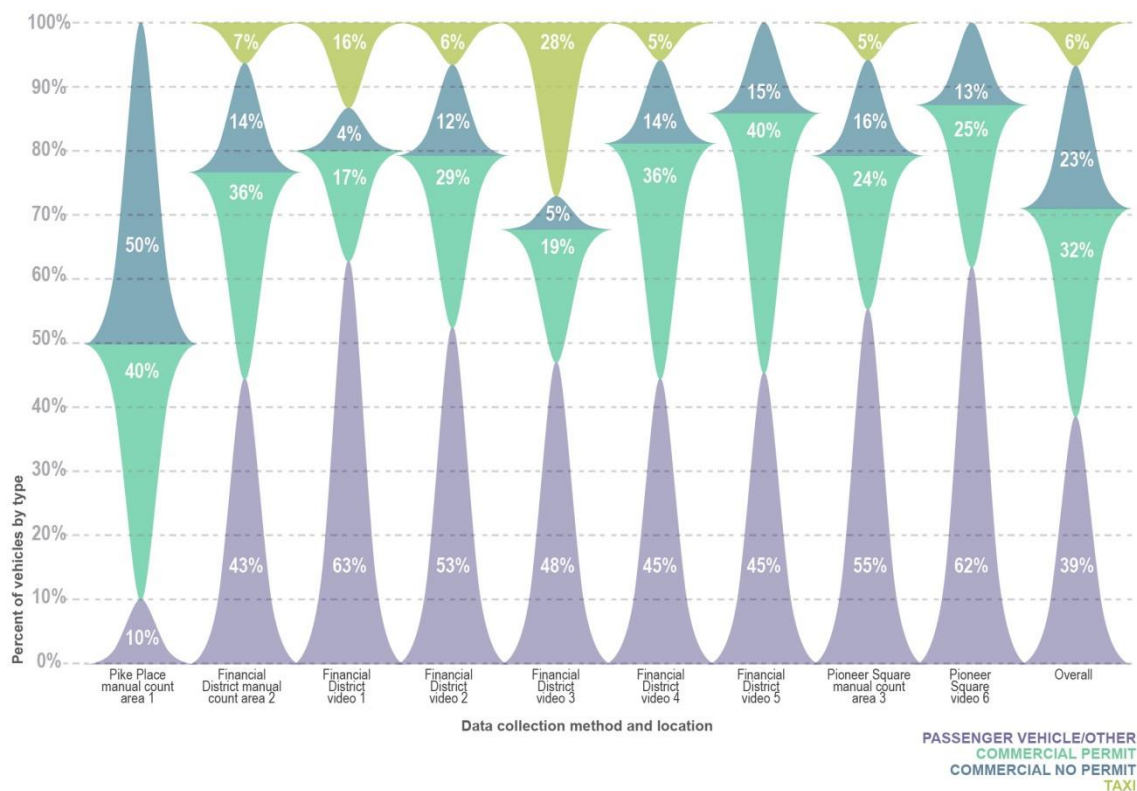
Initial Findings

Figure 1, shown previously, identifies the CVLZs where data was collected. As described above, data was captured at a total of 28 CVLZs. The following provides a summary of the initial findings from the data collection. Data collection was conducted in October and early November 2013 with refinements made to the manual data collection process in November. Although there was data missed with the 15-minute interval manual counts for areas 1 and 2, this data still provides a general understanding of average duration for commercial vehicles and insight on the types of vehicles using the CVLZs. The findings related to areas 1 and 2 are provided, where applicable.

Vehicle Types

The CVLZ activity included commercial vehicles with permits as well as commercial vehicles without permits, taxi, and passenger vehicles. There were a few observations of other types of vehicles including City of Seattle exempt; these were included with the passenger vehicle classification. The passenger vehicle classification excludes passenger vehicles that were identified for commercial use; these commercial passenger vehicles (i.e., vehicles with commercial permits or the company name on the side of the vehicle in at least two-inch lettering) were classified as commercial vehicles. **Figure 3** illustrates the types of vehicles seen during the CVLZ operation period. The figure shows that passenger vehicle use of the CVLZs ranged from approximately 10 to 60 percent with an average of 40 percent and commercial vehicle use was approximately 20 to 90 percent with an average of 54 percent. In general, a majority of the commercial vehicles using the load zone had permits.

Figure 3. Vehicle Types Observed During CVLZ Operations



During the field observations, no commercial vehicles were observed paying to park and no citations were observed. It is understood that citations are typically not given to vehicles when the driver is in the vehicle, but instead the driver is asked to move by enforcement officers. The observations identified that a majority of the non-permitted activity was for short durations and drivers were in the vehicle.

CVLZ data for the remaining sections of this report are categorized as commercial and non-commercial vehicles. The commercial vehicle classification includes both permitted and non-permitted vehicles; this also includes passenger vehicles that were classified for commercial use as described above. Non-commercial vehicles include standard passenger vehicles, taxis, and other non-commercial use vehicles. The data collection did not classify passenger vehicles with truck licenses (i.e., reviewing the license plates to identify truck licenses); therefore, unless the passenger vehicle had the company name in two-inch lettering or a permit, a passenger vehicle was classified as non-commercial vehicle.

Average Length of Stay

Figure 4 shows that on average commercial vehicles are staying for less than 30 minutes. In addition, non-commercial vehicles (i.e., passenger vehicles, taxi, etc.) are staying longer than commercial vehicles but still less than 30-minutes. The length of stay for the manual data conducted in 15-minute intervals is estimated by assuming vehicles observed once stayed for 7.5 minutes, and for vehicles observed more than once the length of stay is based on the time between the first and last observation. This method may over or under estimate the length of stay for commercial vehicles. A comparison of the video, continuous manual, and 15-minute interval manual data showed that the calculated average length of stay was similar; therefore, the 15-minute interval manual count data was considered in the calculation of average length of stay (see **Figure 4**).

Figure 4. Average Length of Stay for Commercial and Non-Commercial Vehicles (minutes)



Although on average the length of stay is less than 30-minutes, some vehicles were observed to stay longer. **Figure 5** illustrates the distribution of duration (or length of stay) for the vehicles observed in the CVLZs. The intervals are broken down from one to ten minutes initially and then by five and ten minute intervals; this helps provide an understanding of the quantity of short CVLZ stays. The data shown is based on the video data and the continuous manual count data; the 15-minute interval manual counts were not included because the data cannot be estimated to the one minute interval. As shown on **Figure 5**, most of the activity in the CVLZs was less than 10 minutes and there was activity within the CVLZs that was longer than 30 minutes.

Figure 5. Distribution of Duration for Observed Commercial and Non-Commercial Vehicles

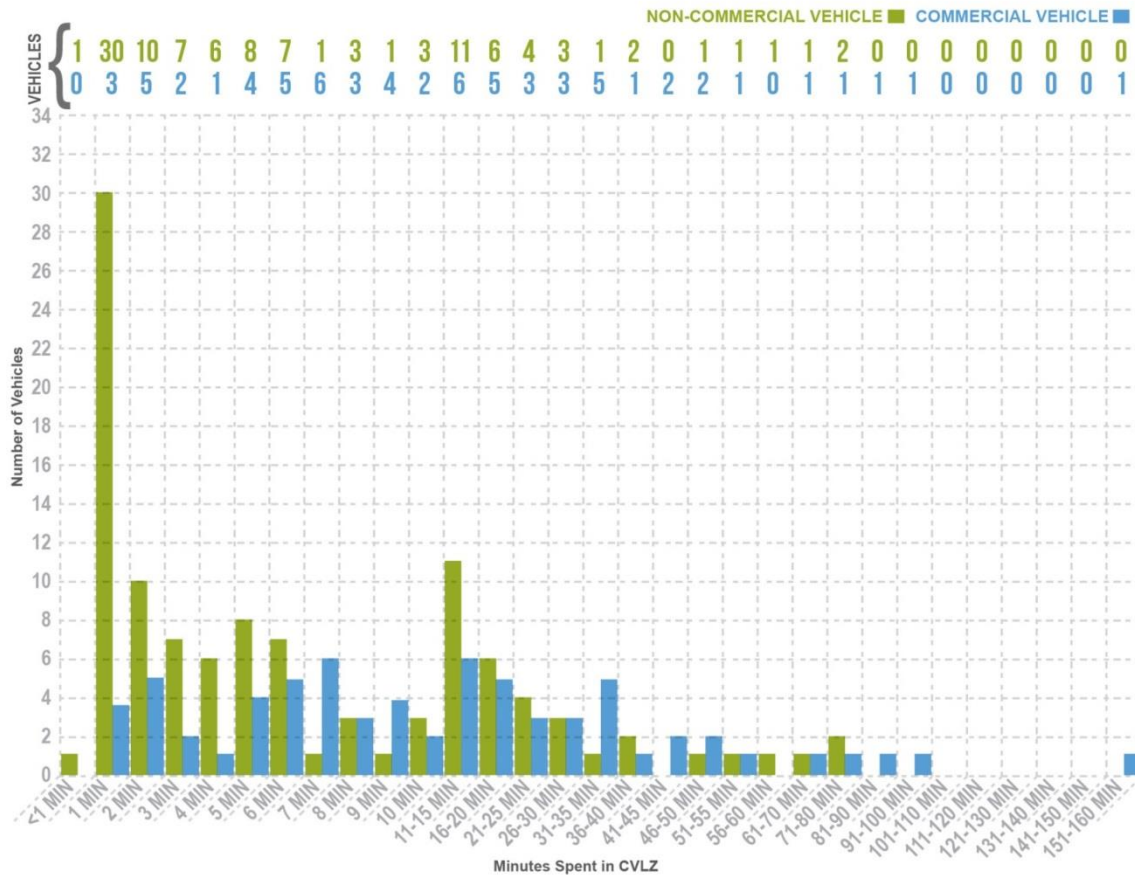


Table 2 provides a summary of the duration for the observed vehicles. There were 178 vehicles observed during the data collection. As shown in the table, almost half of the commercial vehicle stays were less than ten minutes and over 20 percent would more than 30 minutes. For the non-commercial vehicle observations, a majority of the vehicles stayed for less than ten minutes. Further review of **Figure 5** shows that for the non-commercial vehicles most of the short stays are for approximately one minute.

Table 2. Summary of Distribution of Duration for Observed Vehicles

Length of Stay	Percent of Vehicles Observed ¹	
	Commercial Vehicles	Non-Commercial Vehicles
0-9 minutes	49%	67%
10-20 minutes	19%	18%
21-30 minutes	9%	6%
> 30 minutes	23%	9%

1. Represents the percent of the observed vehicles that fall within the length of stay interval.

Utilization of CVLZs

The ability of commercial vehicles to use CVLZs depends on how much they are utilized over the hours of operations. The availability of the CVLZs was determined by examining each hour during operations and the number of minutes within that hour that vehicles were utilizing the CVLZs. This analysis was based on the video data and the continuous manual count conducted in Pioneer Square. Manual count data was not used for the Financial District and Pike Place Market since observations are in 15-minute intervals, which limits the understanding of occupancy over the hour to 15-minute windows. **Figures 6 through 8** below illustrate the average utilization and availability of the CVLZs on an hourly basis during the operation hours. Given the amount of vehicles likely missed for areas 1 and 2 of the manual counts, data for these areas was not used in the calculations to identify average utilization and availability on an hourly basis. The figures illustrate the duration the CVLZ was used over the one-hour period and how that time was divided by commercial versus non-commercial use. As shown in the figures, most of the commercial vehicle activity occurs between 11:00 a.m. and 1:00 p.m. with activity in the late afternoon and evening mainly non-commercial. The exception to this is in Pioneer Square where there is a second peak of commercial activity between 2:00 and 4:00 p.m. The CVLZ are generally occupied for approximately 30-minutes or less during each one-hour period and the analysis shows on average there is additional capacity, even with non-commercial vehicle use, to accommodate more commercial vehicle activity. During the evening hours, commercial vehicle use of the CVLZs is minimal with stays of one to two minutes.

The data indicates that the CVLZs are generally available; however, this data set is limited and may not capture those CVLZs considered the busiest by the commercial vehicle operators. In addition, although the data indicates there is additional capacity over the hour, there should be consideration for a reasonable amount of vacant time to account for time between vehicle turnover.

Figure 6. CVLZ Utilization During Operating Hours

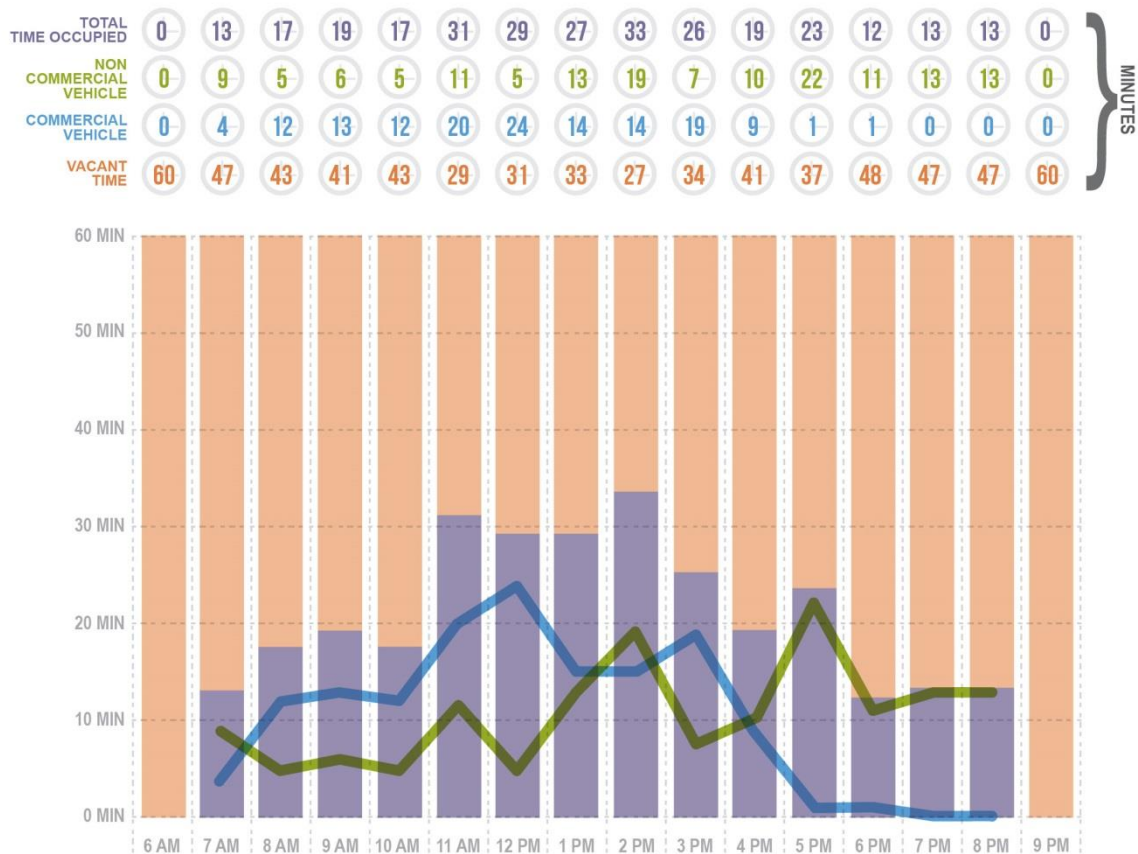


Figure 7. CVLZ Utilization During Operating Hours – Financial District

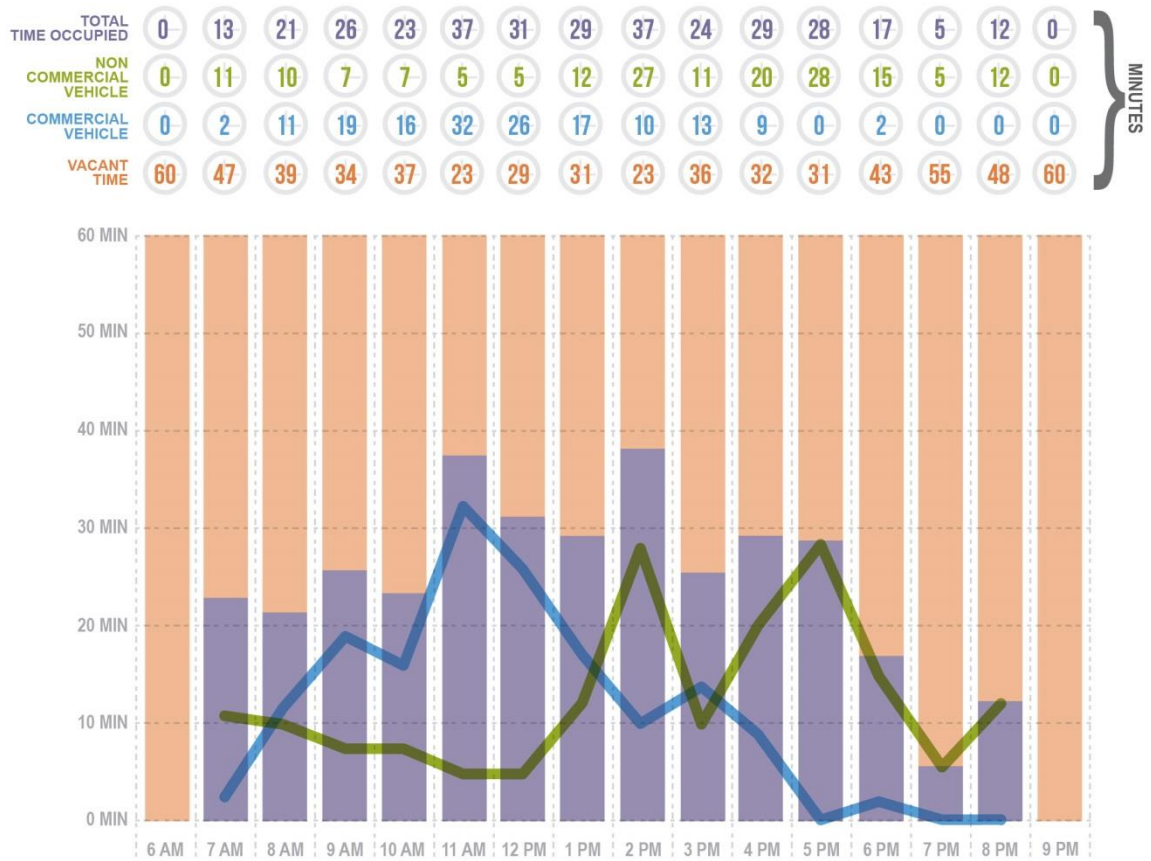
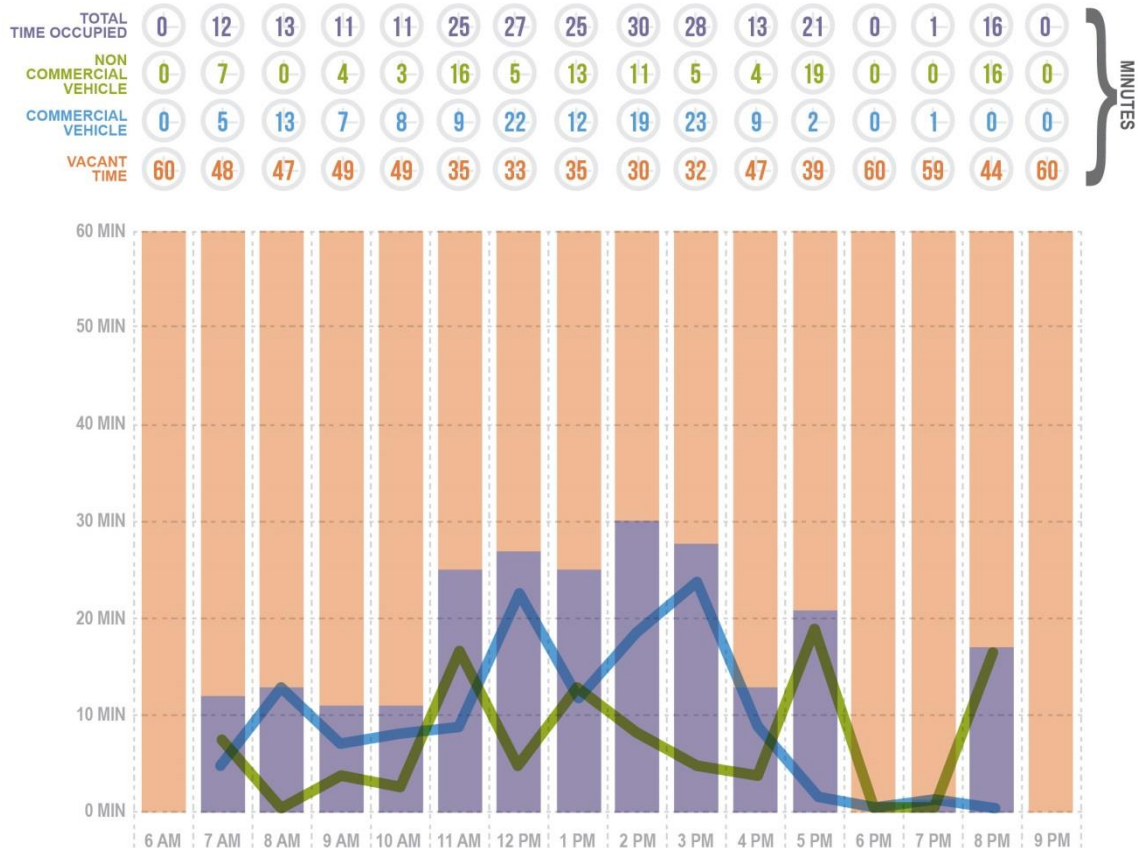


Figure 8. CVLZ Utilization During Operating Hours – Pioneer Square



Summary and Next Steps

Based on the initial data collection for the CVLZs, the key findings and next steps are described below.

Data Collection Methods

- An average of 43 percent of the CVLZ activity is missed using manual counts with 15-minute intervals
- Continual monitoring of CVLZs with either video or continuous manual collection provides the best understanding of load zone activity

Initial Findings

- An average of 40 percent of the CVLZ activity observed was passenger vehicles
- An average of 54 percent of the CVLZ activity was related to commercial vehicles
- Commercial vehicles stay an average of 20 minutes in the CVLZs
- Passenger vehicles stay an average of 22 minutes in the CVLZs
- Approximately 50 percent of the commercial vehicles used the CVLZs for less than 10-minutes and over 20 percent used the CVLZs for more than 30-minutes
- Two-thirds of the non-commercial vehicles stayed for less than 10-minutes

- Most of the commercial vehicle activity occurs between 11:00 a.m. and 1:00 p.m. with activity in the late afternoon and evening mainly non-commercial
- Review of CVLZ operations on an hourly basis shows that the overall utilization is generally 30-minutes or less during a one hour period showing that during most of the hour the CVLZs are vacant
- There appears to be additional capacity even with non-commercial use to accommodate more commercial vehicle activity, particularly outside the hours of 11:00 a.m. to 2:00 p.m
- The data set is limited and although the data indicates there is additional capacity, there should be consideration for a reasonable amount of vacant time to account for time between vehicle turnover

Next Steps

- **Data Collection Method:** Methods providing continual monitoring provide the best understanding of CVLZ activity; video/time lapse cameras or manual monitor of multiple CVLZs is recommended.
- **Study Area:** Determine a refined study area based on the potential pilot project location. Based on the initial data collection, the financial district was the busiest and could be a good candidate for a pilot project. The pilot project should be identified in consideration of the initial data collection, stakeholder interviews, and coordination with the steering committee.
- **Schedule:** Data should be collected in January after additional detail related to the pilot project and potential location of such project is determined.
- **Observations:** The data collected should be refined to include:
 - Detailed vehicle classification for both non-commercial and commercial vehicles including box truck, pick-up truck, passenger vehicle with truck license plate, passenger vehicle with company name on both doors in at least two-inch lettering, and other more detailed descriptions for refining conclusions.
 - Passenger vehicle should be identified to distinguish if they have company name, truck license plate, back seats removed, or other features that would identify this as a commercial vehicle.
 - Notations of meter payment or citations should be made.