INCLUDING ALL USERS: MEASURING COMMERCIAL VEHICLE ENVELOPES ON URBAN STREETS[1]

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Introduction

Street observations by the research team suggest that the observed commercial vehicle curb allocation is not aligned with use. Commercial vehicles using designated loading zones are not allocated an envelope, or space adjacent to the vehicle to accommodate loading and unloading activities. When performing loading and unloading activities, drivers are required to walk around the vehicle, extend ramps or handling equipment, and manoeuvre goods; all of these activities require space around the vehicle beyond the dimensions of the vehicle itself. A parallel can be drawn to parking for disabled drivers, where an extra physical buffer is allocated next to a disabled parking space in order to allow a wheelchair to exit from the vehicle. Unlike disabled parking, trucks are typically not allocated this buffer space, and as a result, drivers and couriers partake in high-risk behaviour in response to these infrastructure insufficiencies.

Due to these insufficiencies, drivers of commercial vehicles and couriers are observed using and obstructing pedestrian pathways and bicycle infrastructure in order to complete deliveries. These actions create uncertainty and disrupt the predictable flow of traffic. As a result, it puts the driver and other road users in direct conflict and ultimately, in harm's way. Currently, there are no explicit commercial vehicle load zone (CVLZ) design standards that incorporate the functional design elements a commercial vehicle would need to load and unload safely. The goal of this research project was to understand and provide the minimum operating space required during urban loading/unloading activities around a commercial vehicle through observed and simulated urban deliveries.

Field Observation Research Method

The purpose of the field observation was to capture current delivery practices and examine how these delivery operations are impacted by both delivery characteristics and surrounding infrastructure. The research team designed a data collection form that captures fifteen critical aspects regarding delivery characteristics including:

- Delivery Location, Date, and Time
- Truck type
- Driver and passenger truck door type
- Cargo compartment door location
- Cargo vehicle door type
- Exiting/Entering Truck Behavior
- Accessories Used and Accessory Path
- Courier Path to Access Cargo
- Delivery Characteristics and Goods
- Number of couriers
- Type of Field observations

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In the twenty-five field observations in the Seattle area, the majority of vehicles were two-axle, six-tire, single-unit trucks. Eighty percent of the deliveries were completed by a single person who was both the driver and courier. These data indicate that adequate door opening space be certainly provided on the driver's side of the vehicle for safe and comfortable ingress and egress. A majority of the observed vehicles had open out or swing-out doors, which indicates that at a minimum, a commercial vehicle operating envelope should include additional space for the opening door radius.

A majority of the observed vehicles have cargo compartments located at the back end of the vehicle. This may indicate that additional space required for the driver/courier to organize goods, load accessories, and manoeuvre with accessories. Close to half of the observed vehicles had cargo compartments on the passenger side.

A majority of the vehicles did not have a lift gate, but those that did have one needed significantly more space to operate. Curb cuts or narrow parking lanes were observed as a hindrance for the convenient use of the lift gate. Narrow parking lanes would mean that the lift gate was overhanging into the adjacent transit lane. Curb cuts may obstruct the lift gate operations and may not allow for the lift gate to sit flush against the pavement.

Hand trucks were most commonly used during deliveries. Note that the hand truck category includes both hand trucks and 2-way convertible hand trucks. This indicates that the turning radius of a hand truck around the vehicle is important to consider. Other accessories observed were ramps, cones, hampers, and bins.

A majority of the drivers/couriers operated behind the observed vehicle. This includes walking past the back end or participating in loading/unloading activities at the back end of the vehicle..

One person who was both the driver and courier completed a majority of the observed deliveries. Therefore, it is not surprising that there a majority of the observed vehicles had activity on the driver side. This includes ingress/egress, walking past this side of the vehicle, or participating in any loading/unloading activities on this side of the vehicle.

There was a general split between activities occurring on the passenger side of the observed vehicles. Some of these observed vehicles had cargo compartments on the passenger side. There was little to no activity observed in front of the observed vehicles. This includes walking past this side of the vehicle, or participating in any loading/unloading activities on this side of the vehicle.

Simulated Deliveries

The research team collected quantitative measurements of the movements around commercial vehicles during a delivery. It was not possible to measure movements of the twenty-five observed deliveries due to safety concerns and time constraints. The research team collaborated three delivery companies: United Postal Service (UPS) and Charlie's Produce, as well as the University of Washington's Moving Services team to simulate urban deliveries so that the research team could observe and record courier driver and accessory movements around parked commercial vehicles. The research team requested participating organizations to volunteer one hour at their respective facilities, and to make their typical urban delivery vehicles, accessories, and goods available for the simulated delivery. The goal of the data collection method is to measure and record movements around a vehicle during, so that the research team could understand the minimum operating envelope needed around a commercial vehicle.

During the seven simulated deliveries, three to four people from the research team participated. One researcher was responsible for directing and interviewing the courier driver, and 2-3 researchers were responsible for measuring and documenting the closed, open, and active vehicle footprints. The three companies provided 7 trucks of different sizes and types.

Step 1 – Closed Vehicle Footprint: The closed vehicle footprint is the commercial vehicle's measurements at rest without any possible extensions engaged. The truck's overall dimensions, including its length, width and height are to be recorded. The team measured at the widest possible space, including wheel nuts, protruding blinkers and other details of the vehicle.
Step 2 – Open Vehicle Footprint: The open vehicle footprint is the vehicle's measurements when all parts of the vehicle are extended. This includes opening all doors and hatches, and extending all accessories, such as ramps and lift gates.

Step 3 – Active Vehicle Footprint (Courier & Accessory): The active vehicle footprint is the area around the vehicle used by the courier and accessory to complete the simulated delivery. A member of the research team asked the courier driver to complete a typical delivery in an urban environment like Downtown Seattle, and to express the amount of space they need and the amount of space they desire. As the courier responds by physically showing the space needed and space desired, the location of the courier and accessory's movements are marked using chalk. The chalk markings indicated the courier's movement, as well as the location, dimensions and movements of the delivery equipment, including turning radii and dwelling spots. These chalk markings were then denoted using letters, measured, and documented by the research team. For measurements located directly to the side or directly behind the vehicle, the measurements were documented as distance from the vehicle, and for measurements located at a diagonal, i.e. the corner of the truck was the nearest location to the measured point, both the diagonal measurement, along with the catheti were documented.

Step 4 – Interview: The courier driver was interviewed and asked a series of eight questions to better understand courier behaviours, their experience making urban deliveries, and the decision-making deployed during deliveries. A schematic of the vehicle and movements of the courier driver and accessory are provided for each step.

Conclusions
Following the twenty-five field observations and seven simulated deliveries, the workable range of dimensions for an operating envelope can be recommended so as to provide a safe workspace around a CVLZ. The measurements for an unassisted delivery can be seen in the table below.

Unassisted Workable Minimum and Maximum (cm)

Unassisted Delivery		
	Workable Minimum	Workable Maximum
Driver	64	89
Backend	74	NA
Passenger	48	117

Overall, three major factors were found to significantly impact the workable range of an operating envelope:

1. the driver and passenger door wingspan;
2. the delivery type (assisted or unassisted)

3. the cargo door type at the back end of the vehicle;

Following these field observations and simulations, it is clear that an envelope of space must be provided around a commercial vehicle to safely accommodate truck drivers, cyclists, and other road users. Synthesizing the observations, we recommend than three feet of space be provided on the sides of the vehicle, and three feet of space beyond the extended gate or ramp at the rear of the vehicle.