Transport Canada / Transports Canada

COMMERCIAL VEHICLES AND VULNERABLE ROAD USERS

ASFCA DATA SUMMARY 2004-2014

2015-12-15

DISCLAIMER

The data findings contained in this summary are not necessarily representative of the total number of crashes involving commercial vehicles and vulnerable road users (VRUs) that occurred nationwide during the same time period.

BACKGROUND

Investigations into collisions between commercial vehicles and vulnerable road users (VRUs) began in 2004 under the Special Collision Investigation Programme. This was a result of a British Columbia Coroner's Judgement of Inquiry concerning two pedestrian fatalities involving commercial vehicles. An additional five pedestrian fatalities, also involving commercial vehicles, were referenced in the document. All seven pedestrian fatalities occurred in Vancouver from 2000 to 2003.

The coroner recommended the introduction of legislation to require mirrors on large commercial vehicles that would provide drivers with a continuous view of the area directly in front of the vehicle as well as both sides of the vehicle. The coroner recommended consideration of legislation similar to that pertaining to school buses under CMVSS 111 - Mirrors.

In 2005, sampling of collisions was initiated for a pilot study into the causal factors of fatal collisions. Fatal crashes were documented at various sites across Canada and a number of fatal crashes involving VRUs and commercial vehicles were sampled, as part of this study between 2005-2009. At the conclusion of this study, specific cases of commercial vehicle/VRU collisions continued to be sampled under the Special Collision Investigation Programme.

ASFCA currently has a database comprised of 85 cases sampled during the 10-year period from 2004 to 2014 and these include the seven cases that occurred in Vancouver during the 2000-2003 time period. This analysis was performed on 78 of the 85 cases as seven cases were deemed not relevant for the purpose of this analysis. The 78 files contain a total of 84 VRUs. Of the 84 VRUs, 78 were fatally injured (93%).

DATA SUMMARY

Vehicle Type

There were a wide variety of vehicles involved and both conventional and cab-forward designs were represented. The most common vehicles involved were dump trucks (26%), tractor-trailer combinations (18%), garbage/recycling trucks (14%), transit buses (13%) and straight trucks (10%). The majority of vehicles (70%) were of a conventional cab configuration. None of the vehicles in the sample were equipped with side guards. Five cases involved garbage trucks with dual (left/right) driving positions and drivers in a stand-up, right-hand driving position. Appendix A contains photographs of the different types of vehicles in the sample.

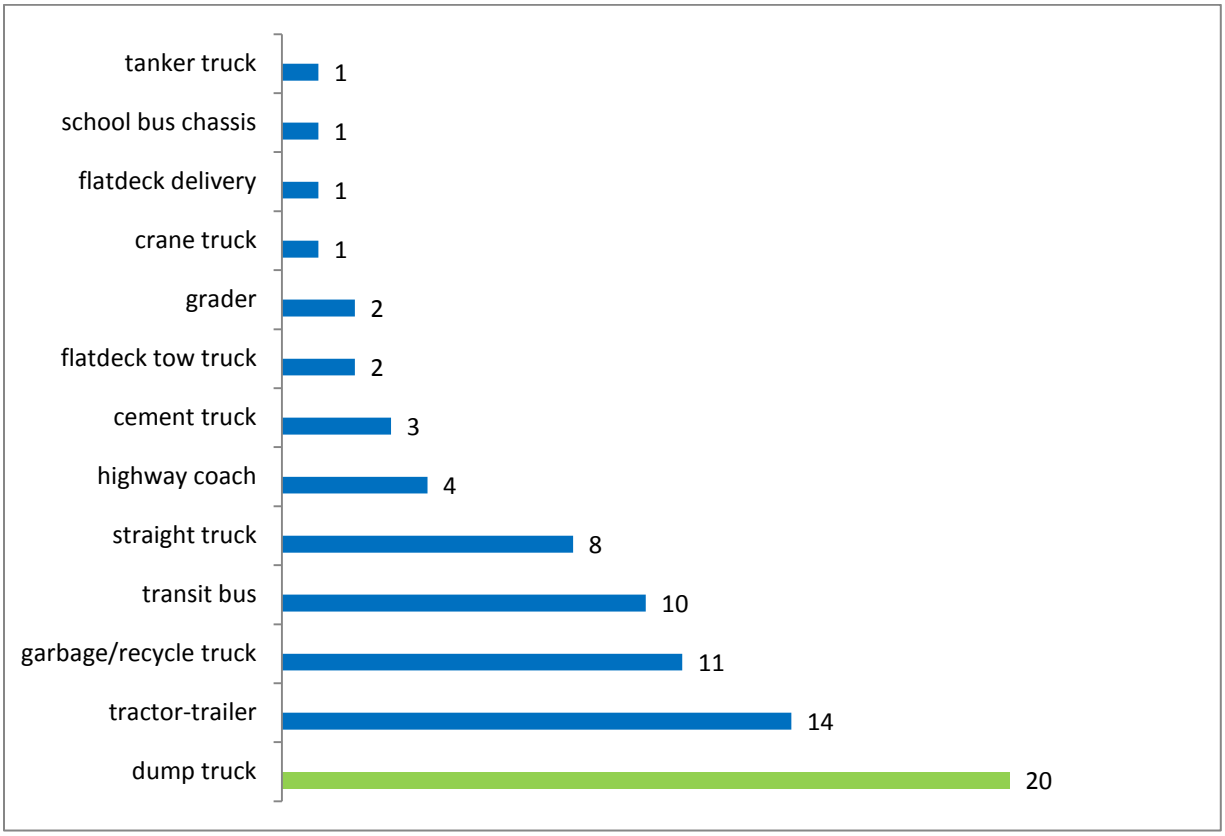

Table 1: Vehicle Type (n=78)

Vehicle Mirrors

All vehicles were equipped with exterior rear view planar mirrors on each side of the vehicle, as specified in CMVSS 111 for vehicles, other than school buses, with a GVWR over 4536 kg (section 27). However, additional mirrors were nearly always installed by the truck operators, or owners, to improve the driver's field of view. Circular convex mirrors near the planar mirrors, fender or hood-mounted circular convex mirrors, and a look-down rectangular convex mirror over the passenger door window were the common type of mirrors installed (see Figures 1 & 2). In fact, 95% of the vehicles had additional mirrors installed. It should be noted that external mirrors often block a driver's direct field of view and create blind spots.

Figure 1: Passenger Side Mirrors on a Tractor

Figure 2: Mirror Installation on a Recycling Truck

Field of View

There are significant blind spots around commercial vehicles as a result of both the physical size of the vehicle, and the higher seating position of the driver. Both characteristics impair the driver's field of view, particularly in front of the vehicle and extending to the sides adjacent to the frontal zone. The vehicle hood, the A and B-pillars of the cab, the trailer and the exterior mirrors, all create blind spot zones for the operator. A number of recent cases contain an analysis of the case vehicle visibility zones. An example is shown in Figure 3.

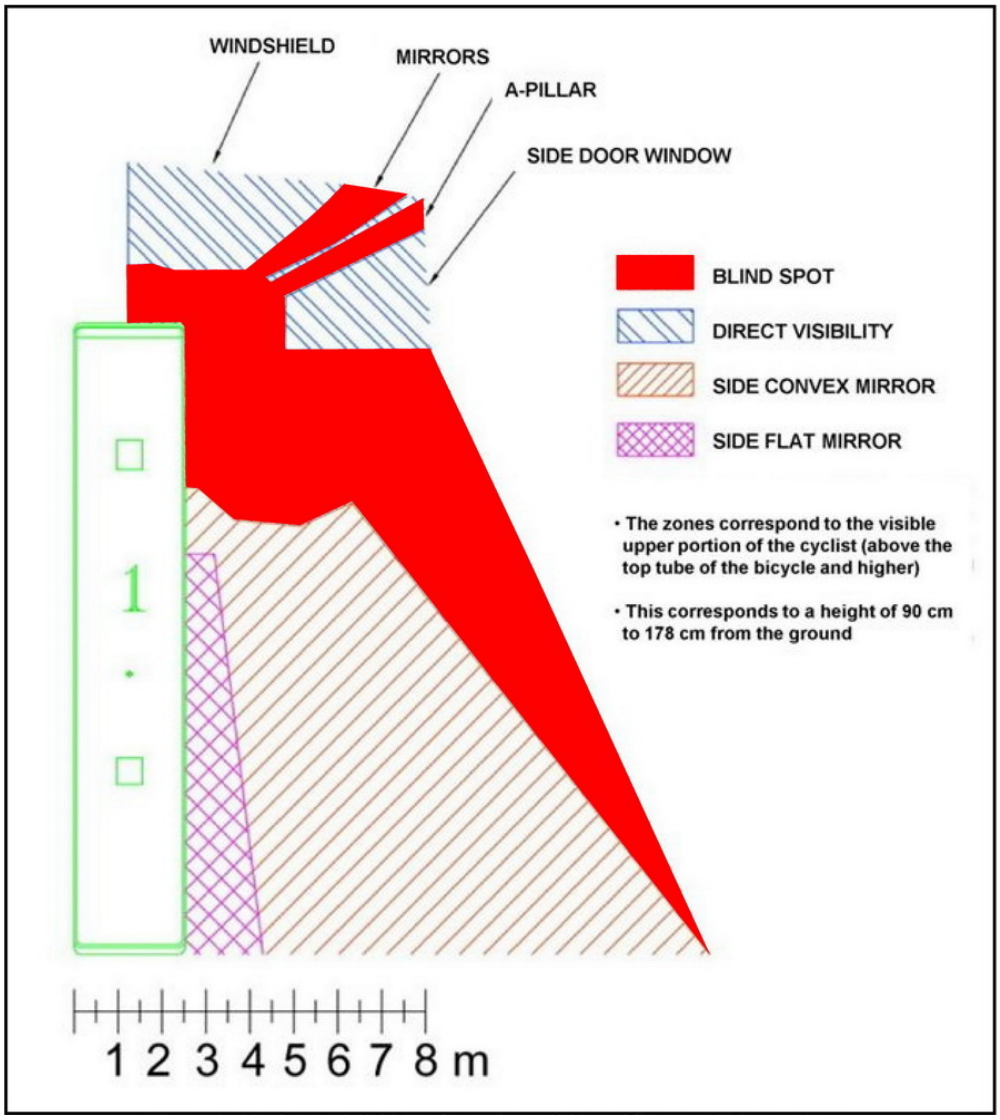

Figure 3: Field of View for 2008 Prevost X3-45 Coach Bus

Pre-Crash Manoeuvre

In 47% of collisions, the commercial vehicle was performing a right turn. This manoeuvre, from a stop or at speed, is typically undertaken at low speeds due to the physical size (length and width) of the vehicle, the small radius that is required to be negotiated, and the roadway obstacles that must be avoided. There is a higher task load on the driver, not only as a result of the manoeuvre itself, but also since the driver must be vigilant of other motor vehicles and VRUs.

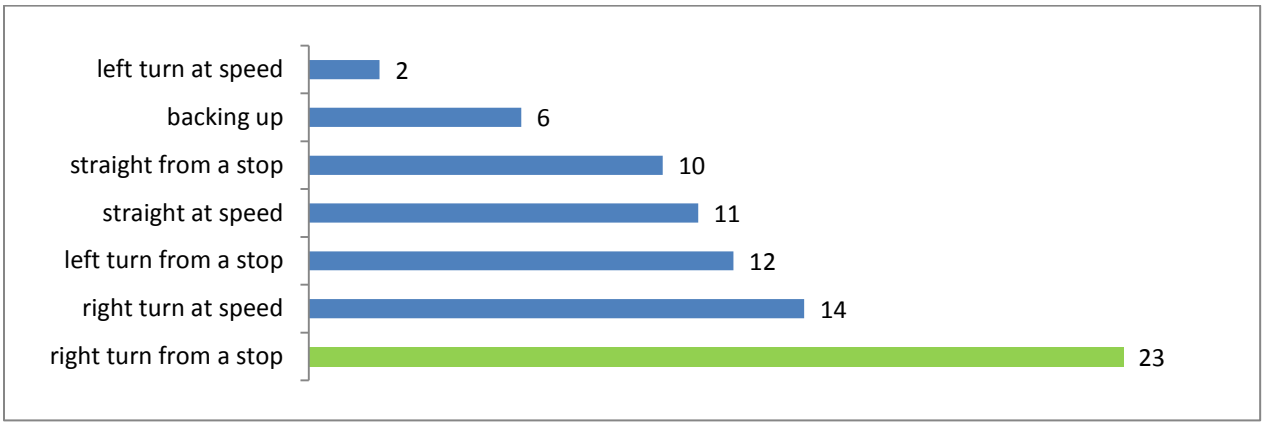

Table 2: Pre-Crash Vehicle Manœuvre (n=78)

Collision Location

The majority of collisions (73%) took place at urban intersections which were almost always controlled by stop signs or traffic signals. The remainder occurred on urban roads (24%), a driveway, and a parking lot.

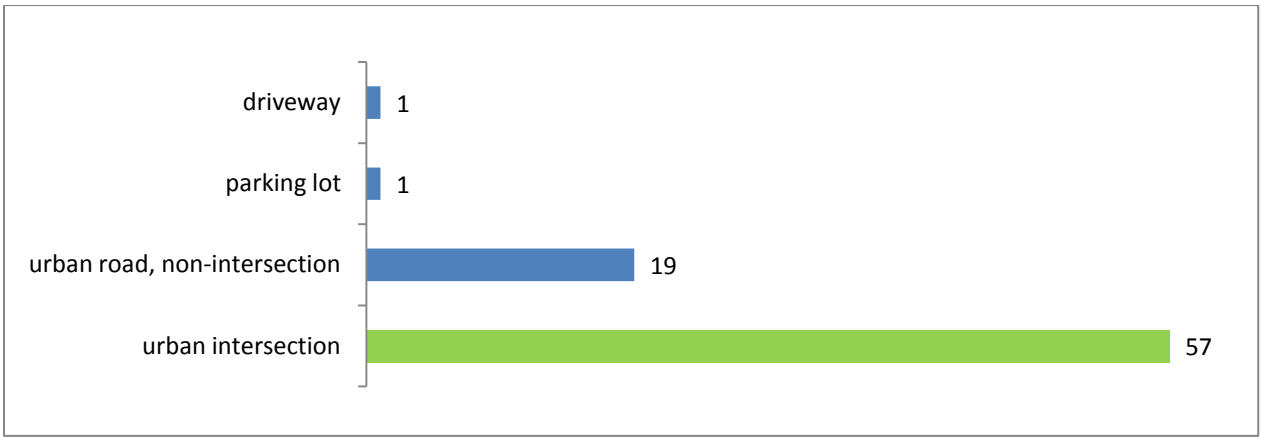

Table 3: Collision Location (n=78)

Weather and Light Conditions

The vast majority of collisions occurred during clear weather (92%) and in daylight conditions (81%). Only 19% of collisions took place in dark conditions, with and without artificial lighting from streetlights.

Table 4: Weather Conditions (n=78)

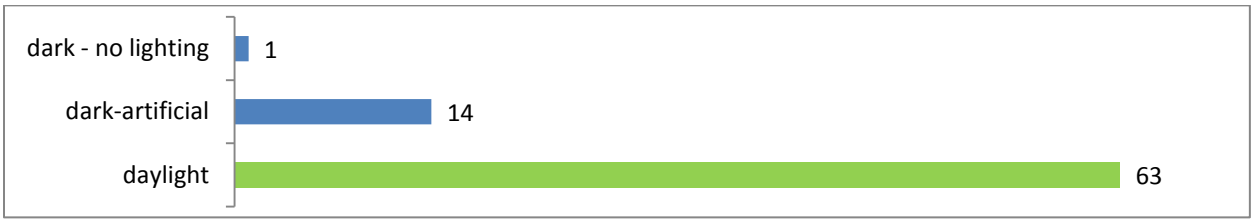

Table 5: Light conditions (n=78)

VRU Type

The majority of cases involved a pedestrian (69%). Two of the pedestrians were using mobility scooters. Two cyclists were riding power-assisted bicycles (PAB). Five cases involved multiple pedestrians.

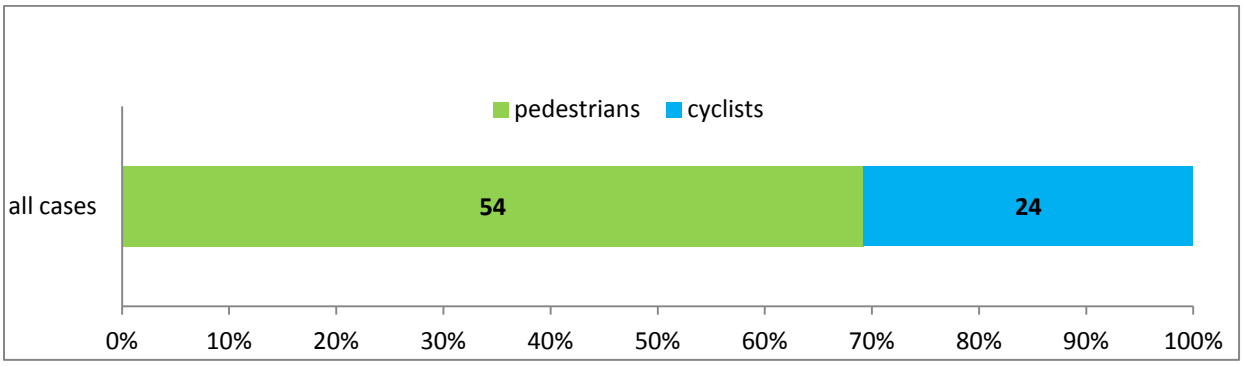

Table 6: VRU Type (n=78)

Pedestrian Action and Location

The majority of pedestrians (57%) were crossing the road at a marked or unmarked crosswalk, and had the right-of-way (ROW). Another 15% were crossing in a marked or unmarked crosswalk without the right-of-way. A number of pedestrians (19%) were crossing a road mid-block. The majority of all pedestrian collisions (61%) involved a vehicle turning left or right, at speed or from a stop.

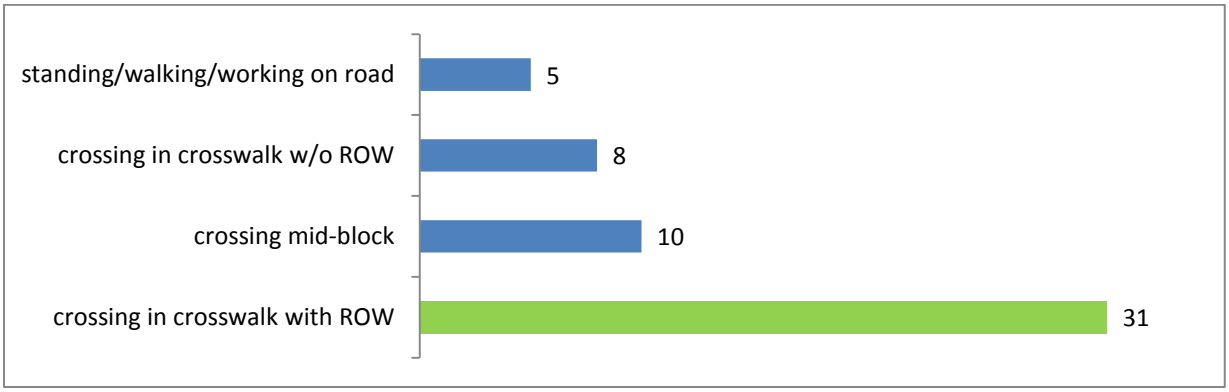

Table 7: Pedestrian Action and Location (n=54)

Cyclist Action and Location

The majority of cyclists (54%) were travelling straight ahead on the road. Cyclists crossing in a crosswalk (29%) were either entering the crosswalk from a bike path or a sidewalk. The majority of all cyclist collisions (75%) involved a right-turning vehicle, either at speed or from a stop.

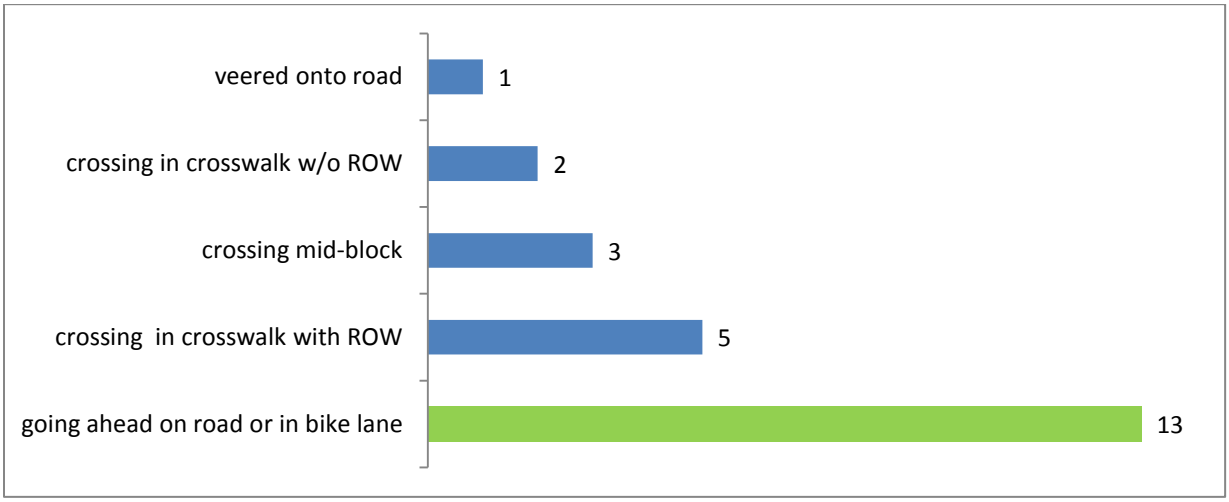

Table 8: Cyclist Action and Location (n=24)

VRU First Contact with Vehicle

In 54% of cases, the first point of contact between the VRU and the vehicle was the front surface of the vehicle. The side surface was the first point of contact in 38% of the cases. Of the cases involving the side structure of the vehicle, 90% involved the right side of the vehicle. The two graders were excluded from this sample due to the vehicle structure.

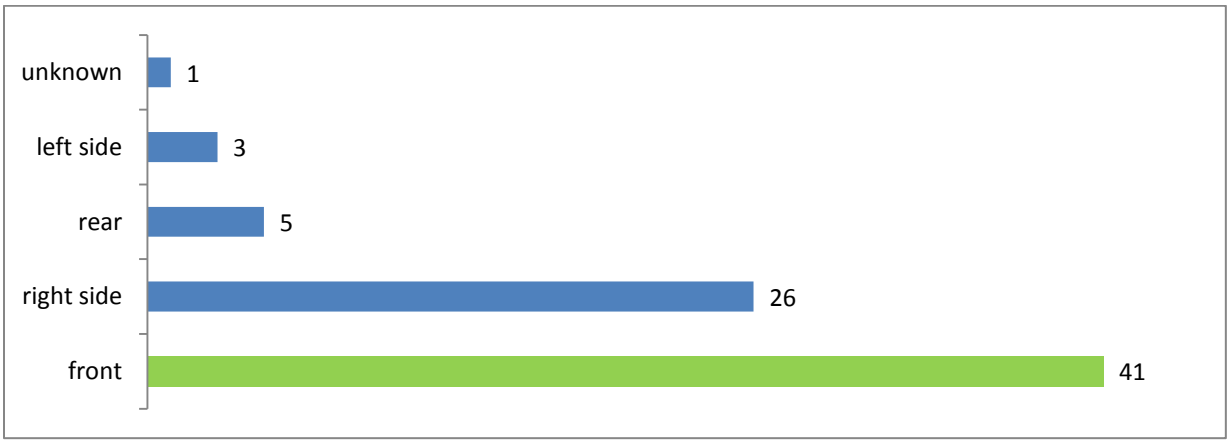

Table 9: VRU first point of contact with Vehicle (n=76)

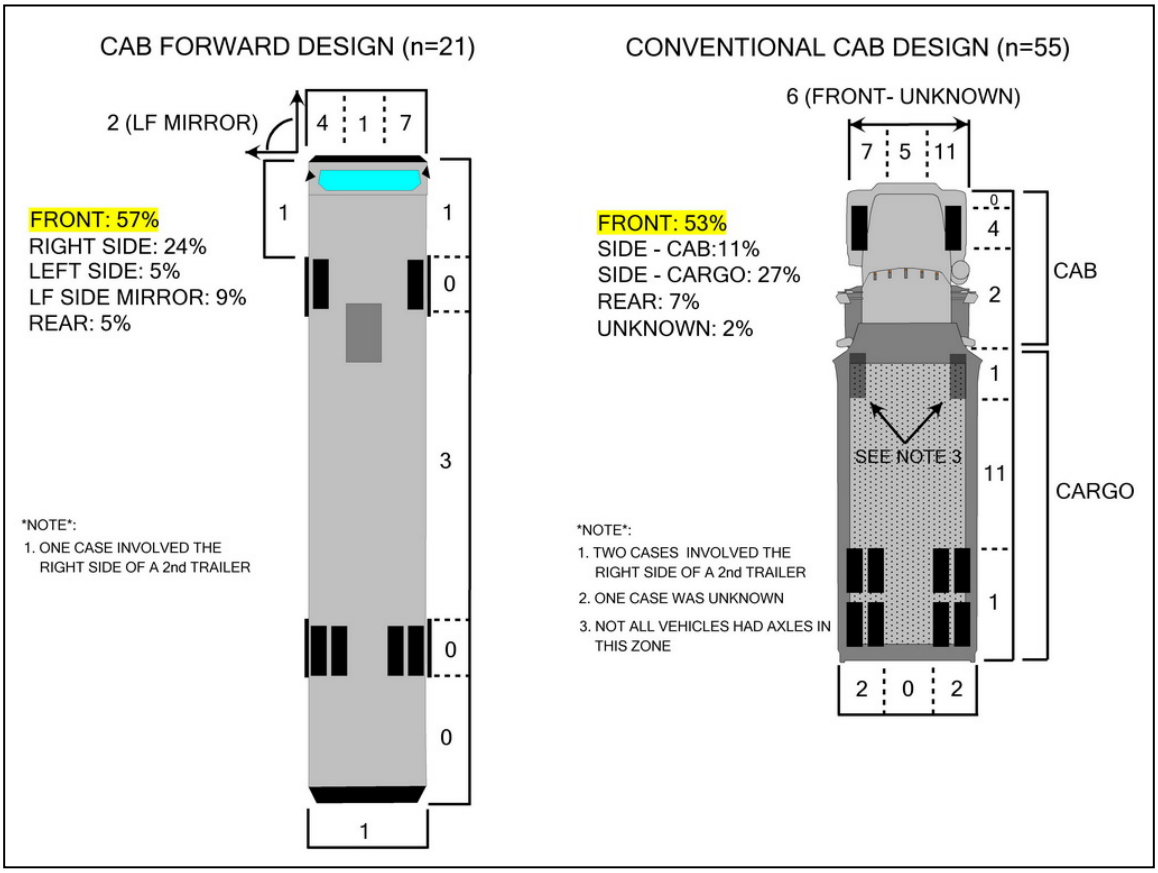

Figure 4: Location of VRU at Impact

A more detailed breakdown of the VRU location with respect to a generic vehicle design is shown in Figure 4. The majority of VRUs were located in the frontal plane of the vehicle at impact and there was no significant difference between cab designs. In 68% of the frontal impacts, the vehicle was either heading straight, or turning left or right, from a stopped position. A further 17% of vehicles were turning left or right at speed, which is typically a low speed manoeuvre in an urban environment.

VRU Age & Type

VRUs ranged in age from 5-89 years and were comprised of 60 pedestrians and 24 cyclists. The majority of pedestrians (52%) were 60 years of age and older. The majority of cyclists (42%) were in the 18-39 age group.

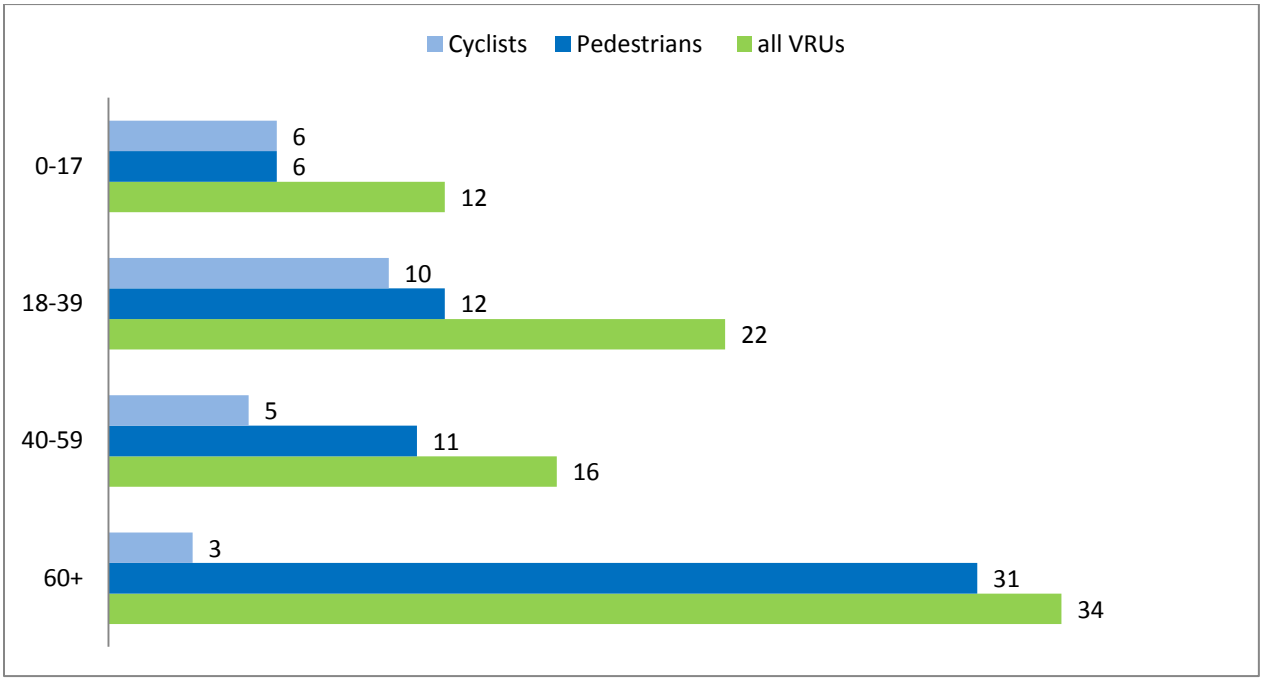

Table 10: Age of VRU (n=84)

VRU Injury Mechanism

The VRU was run over by the commercial vehicle in 90% of the cases. The VRU was projected forward in 10% of the cases. Of the 84 VRUs in the database, 93% sustained fatal injuries.

Case Example #1: Pedestrian Struck by Tanker Truck

This fatal collision took place at the downtown, four-leg intersection of a north/south two-lane road and an east/west two-lane road. The north/south road was controlled by stop signs. The incident took place during the mid-morning of a clear summer day.

The vehicle involved was a three-axle, conventional cab, tanker truck. The truck was equipped with circular convex mirrors near the planar mirrors, front fender/hood-mounted circular convex mirrors, and a look-down, rectangular convex mirror over the passenger door window.

The southbound truck came to a stop at the intersection with the east/west road. The driver waited at the intersection until pedestrian traffic, moving from east-to-west in the north crosswalk, cleared his truck. After the last pedestrian cleared his truck, the driver proceeded to turn right at slow speed. Witnesses indicated that soon after the truck started moving forward, a middle-aged female pedestrian, on the northwest corner of the intersection, started to cross the east-west road in the marked crosswalk. According to witnesses, the pedestrian seemed to be caught by surprise by the turning truck. It was believed that the pedestrian made initial contact with the stairs below the passenger door and a large toolbox located just rearward of the stairs. This initial contact knocked the pedestrian to the ground and she went underneath the truck as a result of the off-tracking of the rear axles. The pedestrian was dragged over a distance of approximately 25 m and came to rest in front of the right second axle. Motorists and pedestrians in the area notified the driver that he had struck a pedestrian. The driver stated that he had not observed the pedestrian. The side structure of the vehicle was well covered from the rear of the cab to the second axle with storage compartments.

Case Example #2: Cyclist Struck by Highway Coach

This fatal collision occurred at the urban T-intersection of a north/south four-lane road and an east/west two-lane road controlled by a stop sign. There was a sidewalk immediately adjacent to the right lane of travel, in the northbound direction, on the north/south road. The speed limit on the roads was 40 km/h. The incident occurred on a clear summer evening in daylight.

The vehicle involved was a three-axle highway coach bus (cab forward design). The bus was equipped with planar mirrors and smaller convex mirrors mounted to both front pillars. The visibility zones for this bus were mapped and are shown in Figure 3. The bus was not carrying passengers at the time of the incident.

The northbound bus slowed to make a right turn on the east/west road. At the same time, a teenage male on a bicycle was travelling north on the sidewalk adjacent to the travel lane of the bus. The bus turned in front of the cyclist and the cyclist struck the side of the bus ahead of the rear axles, fell to the ground, and was run over by the two rear axles and dragged 9 m. It was noted that bus had a side height from the ground, between the front and rear axles, of only 280 mm. The driver reported that he never noticed the cyclist on the sidewalk.

OBSERVATIONS

The data from the in-depth collision investigations highlight a number of common characteristics and issues:

- A wide variety of vehicle-types, with both cab-forward and conventional cab designs, were involved;
- Every vehicle, with few exceptions, had mirrors systems that exceeded those required by CMVSS 111, however blind spots still exist;
- The incidents typically involved a low speed turning manoeuvre;
- The majority of collisions occurred in daylight at urban intersections during clear weather conditions;
- The VRU was frequently located in, or near, a marked or unmarked crosswalk;
- The first point of contact with the VRU was commonly the front or right side of the vehicle;
- The VRU was almost always run over and fatally injured;
- Low side ground clearance and closed-in sides does not guarantee the safety of VRUs, especially in the common, right-turn collision configurations;
- Drivers were not aware that their vehicle had struck a VRU until after the incident when drivers noticed something unusual or were alerted by other motorists or VRUs;
- A number of VRUs displayed a lack of situational awareness and/or inattention.

The above suggests that commercial drivers need assistance in detecting VRUs in close proximity to the vehicle. There are many competing demands for the driver's attention when operating a commercial vehicle in a busy urban environment. Countermeasures should be examined to improve both direct and indirect visibility in combination with detection systems that alert drivers to VRUs.

APPENDIX A

EXAMPLES OF VEHICLE TYPES