Virginia Commonwealth University
Transportation Safety Training Center
Virginia Multi-disciplinary Crash Investigation Team

Report Number 212 – July, 2010

ABSTRACT

While a bus was stopped for a red traffic signal at a four way intersection, a pedestrian crossed in front of the driver, using the crosswalk, then waited at the corner to the bus' right for the signal to change. The traffic signal turned green and the pedestrian signal head lit to indicate the pedestrian could walk. The pedestrian walked forward into the crosswalk, in the direction the bus was facing. The bus driver accelerated forward and turned right, striking the pedestrian in the crosswalk, knocking her to the ground. The front wheels of the bus then rolled on top of the pedestrian, killing her.

This crash illustrates the critical importance of driver attention and pedestrian awareness of traffic. Differences in regulatory requirements for commercial vehicle operators working for private vs. public or governmental agencies are addressed, as well as training, driving history reporting and adjudication of driving violations.

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SYNOPSIS

Day, Time, Season: Wednesday, 8:03 a.m., Fall

Road/Weather: Urban Intersection, Clear & Dry

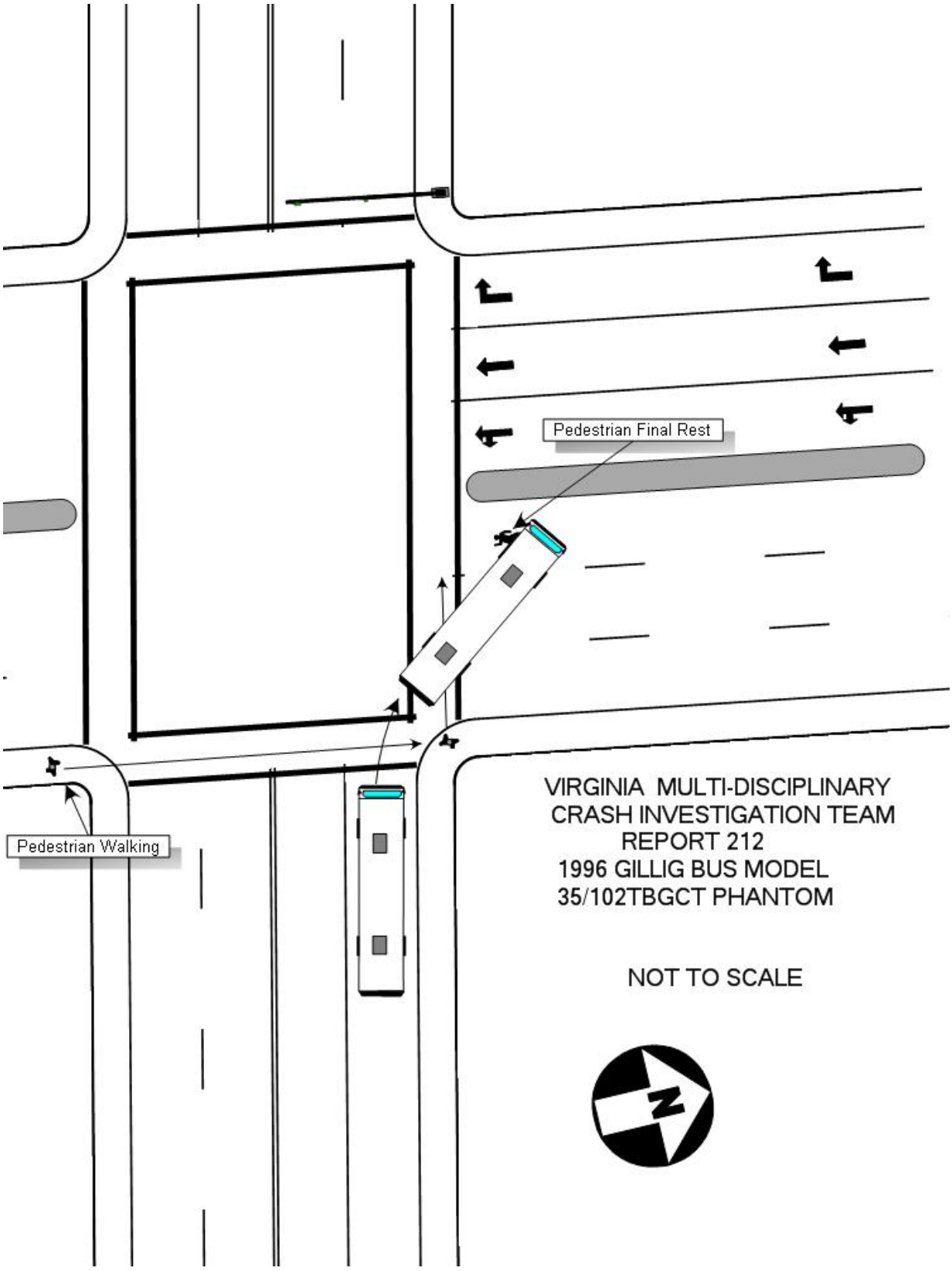
Vehicles Involved: 1996 Gillig Bus Model 35/102TBGCT Phantom

Summary: Bus was turning right, struck and then ran over pedestrian in crosswalk.

Severity: One fatality; minor property damage

Probable Cause: Bus driver failed to yield right-of-way to pedestrian.

Significant Points: Driver inattention, urban intersections, pedestrian awareness, training for commercial bus drivers, reporting of and judicial response to charges for Commercial Motor Vehicle (CMV) operators, CMV regulations for private vs. public companies.


Pedestrian Final Rest
Pedestrian Walking
VIRGINIA MULTI-DISCIPLINARY
CRASH INVESTIGATION TEAM
REPORT 212
1996 GILLIG BUS MODEL
35/102TBGCT PHANTOM
NOT TO SCALE
N

CRASH DESCRIPTION

On a sunny Wednesday morning in autumn, a 55 year old woman was walking north on the east side of the street towards her downtown office building in the heart of a large city. She approached a four leg signalized intersection and crossed the eastern leg when prompted by the pedestrian signal.

The street that traverses the intersection running north and south has four through lanes, two in each direction. Bordering both the northbound and southbound sides are additional lanes. Near the intersection, these lanes are designated for right turns; street parking is permitted midblock. Each lane is approximately 12 feet wide and concrete sidewalks are adjacent to both sides of the street. The northbound and southbound lanes are separated by a concrete median approximately 5 feet wide. The street is concrete and in fair condition. The concrete is polished and has numerous pothole patches. The street is straight and on a slight upgrade. At the location of the fatality, the turning radius of the street is approximately 20 feet. The street is controlled by traffic signals, signs, and pavement markings. The signs and traffic signals are in good condition, but the pavement markings are in poor condition, especially the crosswalk and stop lines. There is overhead lighting. The speed limit is 25 MPH.

When the pedestrian crossed the eastern leg of the intersection, she passed in front of a 1996 Gillig bus, which was being operated by a 46 year old female, an employee of a city-owned transit company. The driver, who wore her lap/shoulder belt, carried a number of passengers commuting into the city. She was stopped in the right lane, waiting to turn right (north) as part of her normal bus route, and her signal was red.

The pedestrian reached the northeastern side of the intersection and turned to face west, waiting with several other pedestrians for the traffic signal to change. As soon as the signal turned to green, the white pedestrian “walk” signal was also illuminated, giving them right-of-way to cross the northern leg of the intersection. The woman stepped into the intersection, heading west, and continued to walk west within the crosswalk. The bus driver accelerated forward into the intersection and began to turn right. The pedestrian continued walking as the bus encroached upon her path. Just prior to contact, the pedestrian rotated to look over her left shoulder and observed the bus within inches of her. The front of the bus struck her and pushed her to the ground. (The bus was not damaged in this collision due to its slow speed and the major mass differences between the bus and pedestrian.) The left front wheel rolled onto the

pedestrian, crushing her pelvis and chest, killing her. The pedestrian also suffered fractures to her left thigh and upper left arm, as well as multiple abrasions and lacerations. The driver stopped when passengers began shouting that she had struck someone.

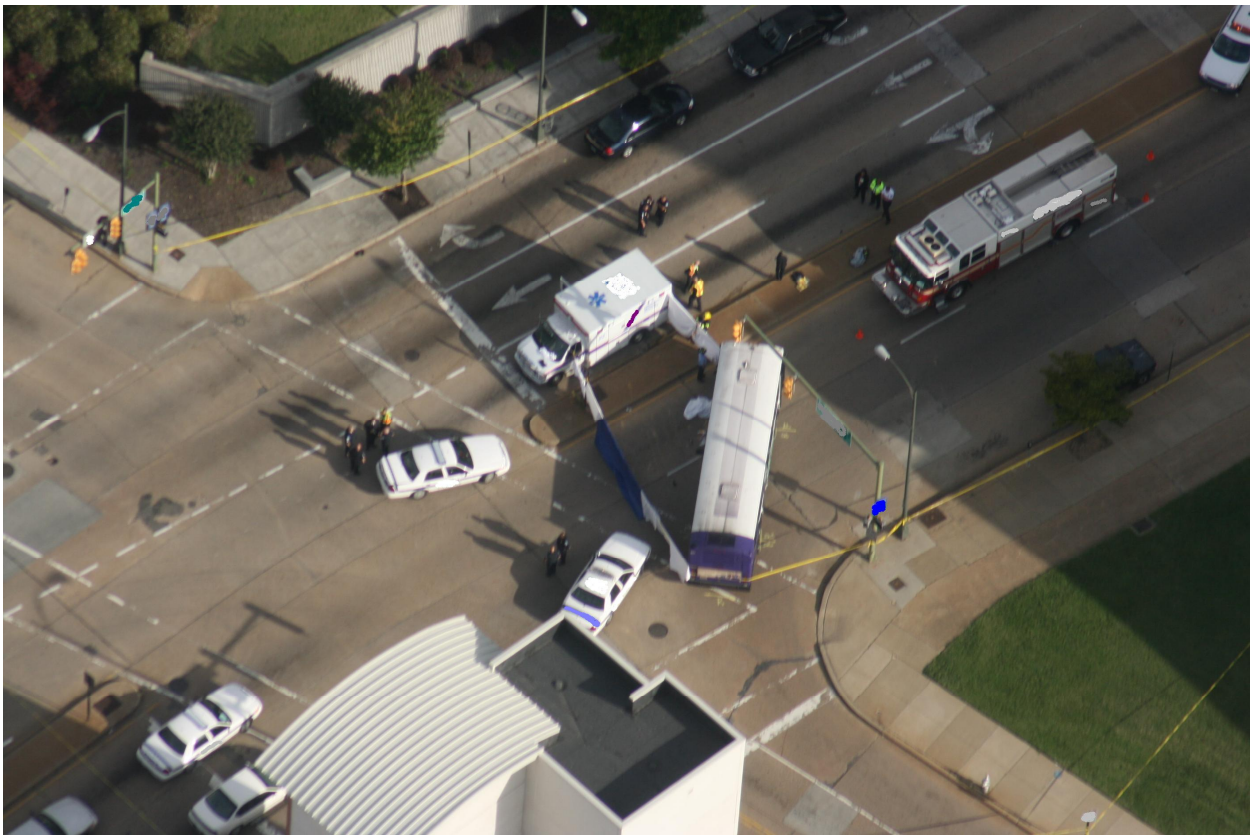


Photo #1: Aerial view of the crash scene with bus at final rest.

The driver exited the bus, observing that the tires were resting on the pedestrian's body. She initially declined to move the bus, because it was against company protocol to move the vehicle after it had been involved in a crash. Witnesses to the crash called 911 and asked for emergency help. Several individuals, who identified themselves as a medical school resident, a nurse and an emergency medical technician, attempted to assist the victim. The medical resident convinced the bus driver to return to the driver seat and moved the bus backward, off the body. The three then began performing cardio-pulmonary resuscitation, repeatedly checking to see if they could regain a pulse. They continued to administer to the victim for the next few minutes, until emergency medical workers arrived, along with police officers who had been dispatched to the scene.

Passengers on the bus disembarked. Although attempts were made to check passengers to ensure that no one had been injured during the crash, many left the scene without leaving any contact information and found other means of completing their trips. A few gave brief statements about their recollection of the crash, including their seat location, and these did not produce any contradictory descriptions.

City police officers took control of the scene, closing the roadway and directing traffic away from the area. The city's crash team members responded as well. The pedestrian had been declared dead at the scene, so the officers began documenting evidence, taking photographs and measurements. They notified the Office of the Chief Medical Examiner and the body was removed and sent to the division office for autopsy and drawing samples for toxicological evaluation. Personnel from the transit company owning the bus responded to the scene as well. Their driver was transported to a local hospital for routine post-crash breath and blood testing, and then released. A motor carrier officer with the city police force examined the bus, which was then removed from the scene. After investigators had completed their evidence gathering, the scene was cleared, approximately seven hours after the crash occurred.

REMARKS

Members of the Virginia Multi-disciplinary Crash Investigation Team (VMCIT) were in another area of the Commonwealth when they first learned of this crash through media reports. Shortly thereafter, a member of the Federal Motor Carrier Safety Administration (FMCSA) suggested that it would be a valuable case to investigate in–depth. He expressed concerns that government-owned transit companies did not consistently implement safety practices with regard to maintenance, training and driver oversight, compared to privately-owned companies. Additionally, the media reported that a judge had wrongfully dismissed a recent reckless driving charge against the driver, in violation of a state law. Due to the complexities involved in this case, members of the VMCIT decided to investigate fully.

The 55 year old pedestrian was on her way to work when she was struck. She had driven into the city from her home, approximately 35 miles away. She parked her vehicle in a parking deck nearby and was walking to the building where she had been working for several years. She was familiar with the area and routinely walked through this intersection during the morning rush hour. However, she may have been running late: the crash occurred at 8:05 a.m. and her normal work hours were from 8:00 a.m. to 4:30 p.m. A check of the pedestrian's driving history showed no record of convictions or accidents and she maintained the maximum driver point balance of +5. Her license required that she wear corrective lenses to drive. The medical examiner's report states that she was had no history of medical or social problems prior to the crash and there are no indications that she was suicidal. Toxicological analysis of blood samples taken after death returned with negative results for alcohol and drugs. Based on evidence found at the scene and video footage of the victim just prior to the crash, it appears that she was carrying a handbag as well as a plastic bag containing food items. She was not talking on a cell phone and did not have earphones in place (which could have been distracting and muffled sounds from the environment).

The pedestrian had walked in the crosswalk directly in front of the bus while it was stopped for a red traffic signal. Her passage is clearly visible in the video footage recorded from within the bus. When she reached the sidewalk to the right of the bus, she turned to her left and waited for the signal to change, displaying the "walk" symbol (the lighted white figure of a walking person contrasted against a black background). Her actions show that she assumed that she could safely cross at that point in time, and she should have been able to do so. She had the

right-of-way, and right turning traffic was required to yield. However, pedestrians are always vulnerable to drivers who act in unexpected ways, violating laws through intention or inattention, and transit bus drivers are no exception. Over 40% of fatalities involving transit bus crashes are pedestrian deaths. Although the drivers were not always at fault, failure to yield was the most common driver error recorded (11.2%) in fatal transit bus crashes (Blower, Green & Matteson, 2009). Inattention was cited in 4.4% of these crashes. Pedestrians should always be cautious before entering intersections, even when they have right-of-way.

Photo #2: View of Traffic Signal and Pedestrian Walk Signal

Once she reached the sidewalk, the pedestrian had moved out of the driver's focal view and into the periphery. Unless the driver looked down and to her right, which she should have done as part of an active visual scan before commencing to turn, she would not have been likely to perceive the woman until she re-entered the driver's visual field while crossing the street. There is no indication on the video tape that the pedestrian looked in the direction of the driver, either while crossing in front of the bus or while stepping onto the roadway to make her second crossing in the intersection.

The 1996 Gillig 35/102TBGCT transit bus had large windows in the front that allowed the driver an expansive forward view. A bicycle rack was attached to the center of the front grill

area, but this did not obscure the driver's view. The window directly in front of her seat was 34.5 inches high and tilted from its base toward the driver. At the top, it was 36 inches across and widened to 43 inches at its base. A second windshield to the driver's right was 43 inches across and 32 inches high and it was placed vertically in the window frame. The "A" pillar

Photo # 3: Gillig transit bus, side view, at final rest. Pedestrian was initially struck with the front of the bus. Note that there is no damage to the vehicle.

created an 8 inch wide vertical gap in visibility to the driver's right. However, two glass panels in the doors, each 12 inches wide and 66 inches long, provided an open view outside that area of the bus. The driver's seat was adjustable. The seat height and position could be altered to allow the driver to reach the pedals on the floor, comfortably steer the vehicle, as well as to see over the fare box, which was situated at about the 2 o'clock position with regard to her seat and orientation. When VMCIT members examined and tested conditions in an exemplar of the bus involved in this crash (same make, model and year), they noted that the 5' 5" driver should have been able to clearly see the 5' 4" pedestrian through the door panel glass and then in the lower right corner of the windshield as she moved the bus forward and began to turn. As mentioned earlier, however, she would have had to include that area in her visual scanning before and

during her turn. Otherwise, her peripheral vision would not have been sufficient to detect the pedestrian's presence, which was an apparent occurrence in this crash.

This transit bus had a valid Virginia State inspection which was not due to expire for approximately six months. There were, however, some defective safety equipment parts on the bus at the time of the crash. A motor carrier safety inspection was conducted at the crash scene and it was found that the left front tire was less than 2/32 inch on the inside tread groove, the left rear brake was out of adjustment, and two top marker lights were inoperable. The bus was placed "Out of Service" by the motor carrier inspection officer of the local police department. Subsequent to this inspection, a second follow up inspection was conducted at the bus facility the next day by the local police department motor carrier inspection officer and an agent of the FMCSA. The motor carrier safety inspection report references an odometer reading of 20, 171.2 but states it is unlikely the actual mileage due to the vehicle age. A check of a recent maintenance report received a few days before the crash indicates the vehicle miles to be 410,337. During the secondary inspection, it was found that there was no windshield washer fluid, no fire extinguisher, and no safety triangles, there was an active leak around the transmission pan, and the speedometer was inoperable due to the cable being wrapped around the left front brake assembly and pulled apart. All of these vehicle defects should have been noted on a pre-trip safety inspection and repaired prior to the vehicle being placed into service to transport passengers. Despite these deficiencies, the safety equipment defects did not play a role.

The effective turn radius of this bus and the roadway configuration, however, may have been a contributing factor. This bus, according to manufacturer's specifications, has a turning radius of 36 feet. The transition radius of the turn from the westbound street to the northbound street is approximately 20 feet. This transition radius would require the bus to encroach into the left lane to complete the turn, instead of staying in the right lane as is required by law (§46.2-846). While this is not necessarily the cause of the crash, perhaps if the bus was able to stay in the right lane, the pedestrian might have moved past the bus or just been knocked down and not run over. If the driver had attempted to stay in the right lane, the bus' "offtracking" (the path of the vehicle's rear wheels tracking inside of the front wheels, which is far more exaggerated in a long vehicle such as a bus) would have caused the rear of the bus to run onto the sidewalk and possibly strike any pedestrian traffic, signs or lamp posts. This bus has an offtracking distance (calculated from the exemplar vehicle) of approximately 5.6 feet. This means the rear wheel path will track 5.6 feet inside of the front wheels. Bus drivers are trained to understand the

concept of offtracking and will routinely make wide turns to accommodate this. Essentially, the driver will drive forward further than is necessary for the front wheels to make the turn, and then cut hard to the right. This could lead to an initial misperception by pedestrians that the vehicle is going to travel straight and not turn, which is a possible scenario in this crash.

In response to a growing concern regarding this and other crashes, the bus company has taken steps to attempt to prevent these issues from re-occurring. The first step was to remove this style of bus from their fleet and replace it with a newer style bus. There were complaints from their drivers that the farebox was too high and the solid pillars at the windshield corners blocked visibility. The newer "low-floor" buses have lower fareboxes and windshields that wrap around the corners of the bus, improving external visibility. The next step was developing in-house technology which would warn pedestrians of the buses intent to make a left or right turn. In the case of a right hand turn, when the driver activates the right turn signal an audible warning will announce to surrounding pedestrians, "Caution: Bus turning right. Pedestrians, look both ways." This will alert pedestrians to the turning intentions of the bus in case they miss the visual clue of the turn signal. At the time this report was released, the company was in the process of installing these warnings in their buses, a procedure that required about five hours per vehicle.

When members of the VMCIT examined the crash site, the intersection did not appear to have any design deficiencies. However, pavement markings and crosswalk lines were in poor condition. The average daily traffic for this street is 12,000 vehicles (Virginia Department of Transportation, 2008). According to the crash history, between September 1, 2006 and September 30, 2009, 15 crashes were reported on this intersection. The crash types were: 6 angle collisions, 4 rear-end crashes, 3 side swipe (same direction) collisions, 1 head on collision, and 1 pedestrian fatality (this crash).

After the crash, city staff reviewed the crash, traffic data, traffic control devices and the general operations at the intersection. They determined the intersection is operating safely and do not recommend any signing or traffic signal changes. Turning vehicle crashes are among the more common types of pedestrian crashes in urban settings (Preusser, Wells, Williams & Weinstein, 2002), and there are many approaches that can help reduce the number such conflicts. Increasing awareness for both pedestrians and drivers can be achieved through public relations and/or educational campaigns, as well as through driver education training. These can create an expectancy set and increase the likelihood that a pedestrian will not be "missed" by inattentive drivers. This expectation can be enhanced by signs alerting drivers to areas where pedestrians

are likely to cross. Pedestrians can take steps to improve their conspicuity by wearing contrasting, light or reflective clothing (especially in dark or dim lighting conditions). Another way to decrease such crashes is to limit the interaction between pedestrians and vehicles. Pedestrian flyover walkways, for example, remove the pedestrian risk from actually being in the roadway. These are not usually economically and physically feasible in urban settings, however, and may not be used when pedestrians are trying to cross a street quickly. Finally, changing the timing of signals (such as adding an "all vehicle stop/all pedestrian walk" phase), or prohibiting right turns or right turn on red under certain conditions can be implemented to prevent crashes. In this case, after the city staff reviewed the traffic data, they recommended against restricting right turn on red on the westbound lane at this intersection. A southbound exit ramp from a major interstate feeds traffic directly into this section of roadway. The ramp is extremely short (approximately 400 feet) and traffic would be very likely to back up onto the interstate during peak periods. It is the city's opinion that restricting right turn on red and subsequent traffic back up on the ramp would negatively impact safety on southbound lanes of the interstate, where many vehicles are travelling at higher speeds.

The bus driver, a 46 year old female, had received her Class B commercial driver's license (CDL) with a passenger endorsement in Virginia in early 2005, after relocating to the Commonwealth from another state. She had no driving restrictions. Her driving history from the Virginia Department of Motor Vehicles (DMV) showed that she had the maximum driver point balance of +5. She had been involved in a property damage crash in 2007, but there was no related conviction. In addition, the record revealed a conviction for a safety belt violation that occurred four months prior to this fatal crash. No point loss was assigned to that violation. She had initially also been charged (while driving a non-commercial vehicle) with reckless driving for speeding 55 MPH in a 35 MPH zone. The judge allowed her to attend a driver improvement clinic, however, and upon successful completion, he dismissed the reckless driving charge. This action was in violation of the Code of Virginia (§ 46.2-505), which states:

> No court shall, as a result of a person's attendance at a driver improvement clinic, reduce, dismiss, or defer the conviction of a person charged with any offense committed while operating a commercial motor vehicle as defined in the Virginia Commercial Driver's License Act (§ 46.2-341.1 et seq.) or any holder of a commercial driver's license charged with any offense committed while operating a noncommercial motor vehicle.

Ironically, this dismissal was finalized by the court seven hours after the fatal crash.

The bus driver's employer, a city-owned public transportation company, required her to report any charges related to possible violations of motor vehicle laws. She did not report the reckless driving or seat belt charges, even though she would have been allowed to remain on duty until they had been adjudicated. At that time, any convictions would have been reviewed and appropriate personnel decisions made. The transit company, however, was unaware of any problems until the fatal crash.

For at least five years prior to this crash, this company had not routinely checked its' operators' driving histories with the DMV, relying on their voluntary participation in a monitoring program conducted by DMV (see next paragraph). FMCSA regulations require private carriers to check their commercial drivers' records at least annually, but publicly owned transportation companies are exempt from this standard. After the fatality, the company conducted a review of records for all employees who held CDLs, discovering that many had multiple convictions and negative safety point balances. Consequently, the company has begun checking employee driving histories every three months. Company officials have also clarified their reporting requirement and instituted stronger conditions, making it mandatory to report any violation charges within three days. Those failing to report such traffic offense charges within that time frame, even if they had been driving their personal vehicle, face disciplinary action and possible termination of their employment. In addition, policy changes now include penalties for employees who have a safety point balance of negative two points or worse.

For at least seven years prior to this crash, the company had been participating in a voluntary monitoring program at DMV, which speeds up the process of identifying operators who have been convicted of a violation that would disqualify them from driving a commercial motor vehicle. Instead of having to wait for the routine check or the employee to report such issues, the DMV notifies the company of the conviction after it is adjudicated. At present, however, the monitoring program only reports on a limited number of criteria, such as driving under the influence of alcohol, license suspensions or revocations, and do not include reckless driving or speeding convictions. This monitoring program is currently required by law for school bus drivers and driver education instructors; other companies may participate voluntarily (§46.2-340). The DMV is adding notification to employers when their drivers have attended driver improvement school and hopes to expand the program in the future to include other charges, such as speeding and reckless driving. Since this crash, the transit company has also

instituted changes to its hiring practices, ensuring that drivers who have a history of crashes and/or serious or multiple violation convictions will not employed to drive transit vehicles.

This driver had been employed by the company since mid-2005. According to the company, new drivers must have at least a CDL learner's permit before they are hired. They receive two weeks of classroom training and four to six weeks of behind the wheel training. This includes (but is not limited to) content focused on defensive driving, blind spots, pedestrian awareness and avoidance, and issues related to driving in an urban environment. Drivers also receive training about required pre-trip inspection of their vehicle, procedures for reporting problems, and post-crash protocol. About every two years, drivers complete eight hours of refresher training, which includes a morning of classroom training and an afternoon of behind the wheel observations. Part of the purpose behind the refresher training is to reinforce appropriate driving behaviors and to identify and correct any driving habits that may deviate from company standards and practices. The company refers to bus drivers as "operators", in part to signify that operating the bus is more than driving per se: it involves a complex set of skills and knowledge that include protocols for customer interaction and safety, vehicle inspections, as well as route and timing requirements.

This driver had eleven separate incidents of problems or company violations noted in her personnel file between her hire date and the date of the fatal crash. All but one resulted in written warnings. The additional violation was to have resulted in a one day suspension, but it appears this was not implemented. Four of the violations involved striking fixed objects while driving a bus (in one case striking a parked vehicle). The driver was required to attend "retraining" after three of these four incidents. Two violations were the result of unauthorized route deviations, and the remaining four were related to inappropriate bus operation and/or interaction with passengers or other vehicles. The last of these violations occurred five weeks before the fatal crash, when others observed and reported the driver running a red light.

According to her license information, the bus driver was 5'5" and weighed 110 pounds. The medical examiner's certificate that is required to accompany a CDL showed that her last check had been less than five months prior to the crash and her health was good. She had no physical impairments and her vision tested within normal limits. A post-crash toxicology screen, routinely performed in motor carrier crashes, showed that she was not under the influence of drugs or alcohol.

The driver's hours of service records showed that she had worked every day for at least the ten days preceding the crash. FMCSA regulations regarding maximum driving times do not allow commercial drivers to operate passenger-carrying motor vehicles after "having been on duty 70 hours in any period of eight consecutive days if the employing motor carrier operates commercial motor vehicles every day of the week" (Part 395.5 of Code of Federal Regulations). These regulations, however, do not apply to drivers operating commercial vehicles that are "publicly owned," such as this city-owned public transportation bus. This driver had worked 68 hours in the previous eight days, including overtime hours on both weekend days. It therefore appears she would not have been in violation of the FMCSA 70 hour limit, if it had applied. "On duty" hours include driving time as well as pre-driving (such as vehicle inspections) and post-driving activities.

The bus driver worked what the company called a "split shift". Her normal weekday hours included driving a morning rush hour route from 4:45 a.m. to 10:06 a.m., going off the clock for the middle of the day, then returning to drive the evening rush hour, from 2:39 p.m. to 5:43 p.m. The company does not monitor any activity in which its employees engage outside of their working hours. Supervisors had no formal way of determining if this driver also worked another job or drove for another company nights or weekends, in addition to the overtime she worked for them. According to the driver, during the break between her split shifts, she would typically run personal errands and sometimes just rest or relax. The investigating officer did not detect any evidence that would indicate this driver was fatigued, impaired, or distracted prior to the crash. At 8:05 a.m., when the crash occurred, she was in the middle of her normal weekday morning run. In an interview, the driver stated that she was having an "average" morning prior to the crash: she had rested well the night before and had nothing occurring in her personal life that was affecting her mental or physical state.

As a result of this crash, the bus driver was convicted of reckless driving. She was fined $100 and required to pay court costs. Her license was not suspended. Once her employer discovered her failure to report the earlier reckless driving charges, they terminated her employment. For more than six months after the crash, she was unable to find full time employment. The family of the pedestrian killed in this tragic crash has filed civil suits against both the driver and the transit company.

RECOMMENDATIONS

1. Even though they may be exempt from the requirements, all public transit companies in the Commonwealth should seek to comply with FMCSA standards for safety practices generally, since these are designed to reduce the incidence of crashes and other mishaps that may result in property damage, injury and/or death. Specifically:

(a) Public transit companies should ensure that their vehicle inspection and maintenance programs are consistent with FMCSA standards.

(b) Public transit companies should routinely check their operators' driving records with the Virginia Department of Motor Vehicles. Failure to report any moving violation convictions should be cause for disciplinary action and possible termination.

(c) Public transit companies in the Commonwealth are urged to require their drivers to report any other hours they may work for another company or agency. This would enable them to ensure their operators are not fatigued, at least from an employment standpoint.

2. Public transit companies across the Commonwealth should consider investing in alarm systems that warn pedestrians when a bus is turning, as well as systems that warn bus drivers when a person or object is in their path of travel (similar to back up alarms available on some trucks, vans and sport utility vehicles).

An example of the auditory alert used by a transit company can be found at:
http://www.vcu.edu/cppweb/tstc/downloads/Bus.wav

3. Agencies and companies across the Commonwealth should consider ongoing programs of educational outreach to promote pedestrian safety, especially in urban and suburban areas.

(a) Employers in urban areas should consider promoting pedestrian safety in their employee communications, such as newsletters and safety training, by including information to educate pedestrians about their risks and ways to reduce the likelihood they will be involved in a collision.

(b) Local media and city officials can also increase awareness of pedestrian safety with regard to both pedestrians and drivers through the use of media campaigns and news stories.

4. The city should erect a “TURNING TRAFFIC MUST YIELD TO PEDESTRIANS” (R10-15) sign westbound to re-emphasize the possible conflict of vehicular and pedestrian traffic. The city should consider erecting this type of sign on the remaining legs of the intersection as well.

5. The city should review the markings and remark this intersection where appropriate.

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