OREGON FATALITY ASSESSMENT AND CONTROL EVALUATION
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Center for Research on Occupational and Environmental Toxicology
OREGON HEALTH & SCIENCE UNIVERSITY

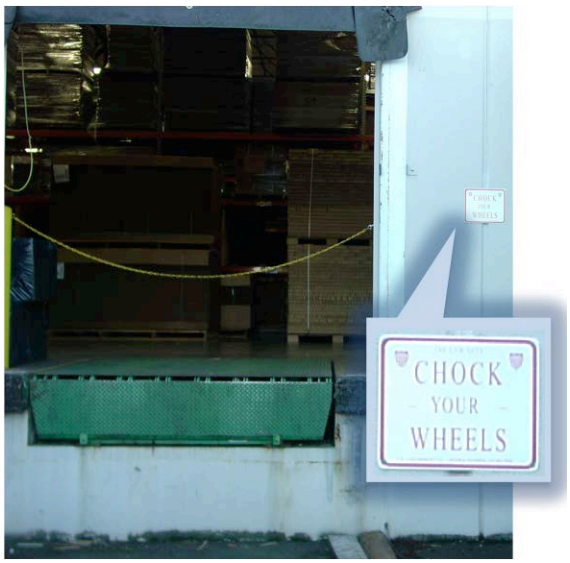
Fatality Investigation Report

OR 2010-6-1

Truck driver crushed between semi-trailer and loading dock

SUMMARY

On February 8, 2010, a 62-year old truck driver was crushed and killed between a 53-foot semi-trailer and loading dock. After the delivery, he realized a tie-down strap was inside the warehouse. He pulled the truck a short distance away from the loading dock and returned to get the strap. Standing between the semi-trailer and loading dock, he banged on the roll-up door. The receiving company employee opened it, handed him the strap, noticed the semi-trailer moving, and yelled a warning, but the driver was pinned. The truck was pulled forward off of the victim by the warehouse employee. The ramp had a 2 degree slope. The wheels of the trailer were not chocked, and the warehouse employee reported that the victim left the truck running and in neutral with none of the brakes set. However, the Fire Department reported that "a trailer brake" was set, but not the tractor parking brake. The Fire Department also moved the truck, chocking the wheels to establish a safe work area. There were no mechanical problems found on the tractor or trailer during the post incident inspection. The brake systems were working properly. Multiple factors may have allowed the truck/trailer movement. Based on interviews with eyewitnesses and with trucking experts, it is likely that the parking brakes were not set, allowing the truck and trailer to move and crush the victim. The slider axle of the trailer was also unlocked, which could have allowed the trailer to move on the rail over the axle as the truck rolled backwards.



The dock involved in the incident where the driver was crushed (with "Kelly" dock plate). The white sign with red letters at right (shown enlarged) reads "chock your wheels."

RECOMMENDATIONS

- **Fully engage tractor and trailer parking brakes before leaving the cab.**
- **Use wheel chocks to secure trailers and tractors against inadvertent movement, especially when parked on a slope.**

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- **Confirm that the sliding axle assembly is locked prior to working in or around a trailer (trailer had potential of 8 feet of movement on this model).**
- **Do not work or stand in pinch points where vehicles could move or roll.**
- **Employers should ensure that workers are trained to operate the controls of rental equipment prior to use, especially key components such as locking mechanisms and brakes.**
- **Employers should periodically monitor worker performance to ensure appropriate and adequate safe operating procedures are being used.**
- **While current options for automatic axle locking and braking mechanisms are limited, employers should seek out built in protective features, such as automatic locks and brakes, when renting or purchasing equipment.**

OR-FACE supports the prioritization of safety interventions using a hierarchy of safety controls, where top priorities are hazard elimination or substitution, followed by engineering controls, administrative controls (including training and work practices), and personal protective equipment.

INTRODUCTION

On February 8, 2010, a 62-year-old truck driver was killed when he was crushed between a 53-foot semi-trailer and loading dock. Oregon OSHA (OR-OSHA) notified OR-FACE of the event on Feb. 11, 2010. OR-FACE investigated the incident using the OR-OSHA report, including employee interview notes, medical examiner report, and police and fire fighter responder reports. In addition, phone interviews were conducted with OR-OSHA's investigator, the medical examiner, and the warehouse Operations Manager (witnessed the incident). Phone and personal interviews were also conducted with a truck driver training instructor, two terminal managers and two mechanics from other companies, and a trailer distributor who were not involved in the incident.

The company provides both local and long distance delivery service 24 hours daily. In addition to the Portland office, they have facilities in Arizona and California. At the time of the incident, they employed 25 people.

The tractor was rented; the trailer belonged to the company and was routinely used. The driver had been a full-time driver for approximately 5 or 6 years at the company. The driver had recently returned from retirement (or partial retirement) to working part-time to maintain company benefits until he could fully retire (approximately 16 hours/week). The driver had received and passed the medical exam for his commercial driver license (CDL) in Oct. 2009. He typically made "local" deliveries within 100 miles of his home terminal. On the day of the incident, he had made other deliveries without incident prior to this one.

The warehouse loading dock involved in the incident included a "Kelly" dock plate to bridge and accommodate minor differences in height between the dock and trailers. There was also a nearby set of stairs and doorway for workers to gain entry into the warehouse.

INVESTIGATION

On the day of the incident, the driver had made deliveries prior to the one that resulted in his death. The company dispatcher did not indicate that the driver had reported any issues or concerns with the rental tractor or the trailer prior to the incident. This was a repeating or routine delivery at the warehouse where the incident occurred. According to interviews with witnesses, the driver had unlocked the rear-sliding axle and it remained unlocked for unknown reasons.

The lever located in front of the sliding rear axle assembly that locks the rear axle in place (shown here in the open/unlocked position). Evidence suggests that the lever was in the open position at the time of the incident, but since the vehicle was moved afterward, investigators could not physically verify the original position.

According to OR-OSHA reports, after off-loading his freight, the driver pulled the truck forward away from the dock about 4 feet. The loading ramp had a slight slope, estimated to be 2 degrees. After pulling forward, the driver left the cab and walked to the rear of the truck, possibly to close the trailer doors (swing type) and either saw a tie-down strap protruding from the warehouse door or realized one of his own was missing. He stood between the trailer and the dock and knocked on the loading dock roll-up door. When it opened, the responding warehouseman noticed the trailer moving toward him, yelled a warning that the trailer was rolling, but the driver was unable to move out of harms way and was pinned against the loading dock.

The truck was pulled forward off of the victim by the warehouseman, who also called 911. The warehouseman reported that the victim had left the truck running, in neutral, with the parking brake not set. Emergency responders pulled the trailer further forward when they arrived and placed chocks behind the trailer wheels prior to providing care. The driver was then flown to a trauma hospital where he died about 1.5 hours later. According to the medical examiner, the driver's death resulted from the crushing injuries tearing or severing the femoral artery, along with his internal injuries.

Based on the sum of all investigatory activities, it is believed that the tractor/trailer rolled back because the parking brakes had not been set, with the possibility of the 53-foot trailer also sliding over an unlocked rear-sliding axle, pinning the driver against the loading dock. The tractor and trailer wheels were not chocked, to protect against a brake or procedural failure. Regardless of the presence or absence of trailer movement over the sliding axle, the driver could not have been crushed without movement of the tractor, which was connected to the trailer at its fifth wheel.

After the tractor had been returned to the rental yard following the incident, the tractor was inspected and there were no deficiencies noted. All braking systems worked properly, the slack adjustment was within safe limits, and the trailer sliding axle release lever worked properly. Based on inspection records for the tractor, it had been inspected multiple times prior to the incident and no deficiencies were found. The trailer was used between Portland, OR and Seattle, WA on a daily basis and there were no reported deficiencies found during these trips.

Based on interviews with the managers at the trucking company involved in the incident, the managers relied on drivers to know and follow both good practices and regulations related to trucking. The workforce consisted of experienced drivers; those interviewed about the incident reported being involved with trucking their entire lives. The victim had a CDL, even though it was not required for the work he was doing at the time. Records of a pre-trip inspection that day could not be located and it is unknown if it was done. However, the employees familiar with the deceased believed it had been, though not necessarily written down.

Management expected drivers to use chocks (carrying them on either the tractor or trailer prior to starting the route, or using chocks available at the delivery destination), but did not confirm that this was done. Management also expected a pre-trip inspection to be completed, but again, did not require it to be completed or submitted on paper. It is possible that just prior to the incident, the driver might have used the trailer trolley valve brake (typically located on the steering column, and also called the "hand valve" or "Johnson bar") instead of the trailer and tractor parking brakes (located on the dashboard). The trolley valve brake is not designed or intended to be used as a parking brake. This would also explain why the warehouseman believed that the "main parking brake was not set," although the truck was "running and in neutral." The firefighter who arrived reported finding a trailer brake set (whether it was the trailer trolley valve brake or the trailer parking brake was not specified), but not the tractor parking brake, which he set and heard activate. Given the combined observations of the warehouseman and firefighter, it is most likely that only the trailer trolley valve brake was set and not the parking brakes. The fire department also placed chocks behind the wheels after arriving on the scene.

CAUSE OF DEATH: Crushing abdominal and pelvic injuries.

RECOMMENDATIONS/DISCUSSION

Recommendation #1: Fully engage tractor and trailer parking brakes before leaving the cab.

- Before exiting a tractor, the vehicle's engine should be shut down, the transmission placed in neutral, and both tractor and trailer parking brakes engaged. The fatal incident could not have occurred without some tractor movement. After the incident, the warehouseman noted that the tractor's engine was running and the transmission was in neutral, with the "main parking brake not set" when he pulled the tractor forward off of the victim.
- The trailer parking brake should also be engaged before exiting the tractor. The trolley valve brake on the steering column (or hand valve or Johnson bar brake) is not designed to secure a trailer in a parked position, but rather, to lock the rear trailer wheels in place

so a trailer can be moved over the sliding axle to balance a load. In the current incident, the trolley valve brake in question (and other forms of trailer brakes located on the steering column) is not designed or intended to be used as a parking brake and could not be relied upon to completely block the trailer from moving.

- Because the tractor was rented, it is possible that the driver was unfamiliar with braking systems of the tractor.

Recommendation #2: Use wheel chocks to secure trailers and tractors against inadvertent movement, especially when parked on a slope.

- The use of wheel chocks on both tractor and trailer wheels on the 2-degree slope may have kept the tractor and trailer from moving and pinning the employee against the loading dock in this incident. Given the unlocked sliding axle and probable exclusive use of the trolley valve brake only, chocks on the tractor wheels would have been a particularly important protective practice in this case.
- Chocks should be used at every loading/unloading location.
- OSHA requires in 29 CFR 1910.178(k)(1) and (m)(7) that brakes be set and wheel chocks are required to be placed in front of the rear trailer wheels when loading/unloading the trailer using forklifts to prevent the trailer from moving away from the dock in reaction to the forklift movement. In this case, placing chocks behind the tractor and trailer wheels would have prevented backward movement of the trailer and tractor.

Recommendation #3: Confirm that the sliding axle assembly is locked prior to working in or around a trailer (trailer had potential of 8 feet of movement on this model).

- The Federal Motor Carrier Safety Administration in 49 Part 393.207 requires that locking pins be in place on adjustable axles prior to loading/unloading and regulates brakes and their use in 393.40, 41 and 42. It is not known why the axle remained unlocked, or if the driver at some point pushed the locking lever arm toward the locked position, but it did not fully engage. Drivers should thoroughly check the position of the lever arm lock for sliding axles on pre-trip inspections, and/or prior to loading/unloading.
- If the trailer had been locked to the axle, assembly prior to unloading it

The image above shows the rear wheels of the sliding axle assembly of the trailer involved in the incident (rear of trailer to right in picture) Chalk arrows mark the potential distance (8 ft.) the trailer could have traveled over the rear axle toward the dock where the worker was crushed.

could not have slid backward over its rail**.** Based on the descriptions of events, it is possible that the driver only set the trolley valve brake relying on it to hold both the tractor and trailer in place while he retrieved the forgotten strap. If this was the case, the tractor could have rolled backward, also pushing the trailer backward causing it to slide over its rail over the locked trailer wheels. In that situation, it is possible that a locked slider axle could have prevented the incident (as long as the trolley valve brake holding the trailer wheels in place did not release).

- It is unknown if the driver was aware the trailer was capable of sliding 8 feet over the axle. The trailer belonged to the company, but it was not normally used for frequent local deliveries, as it was normally dedicated to night trips.

Recommendation #4: Do not work or stand in pinch points where vehicles could move or roll.

- The driver pulled the trailer away from the dock either to close the trailer door or because he realized his strap was left behind. Using an alternate entrance to the warehouse to retrieve straps may have kept the driver out of the pinch point.
- The driver could have also have avoided standing or working in a pinch point by completely moving the tractor and trailer off the loading ramp and away from the loading dock, preferably to level ground, before returning to close the door or retrieve his straps.
    - Moving the truck well away from the loading dock would avoid the potential pinch point, even if other safety controls failed and the trailer and/or tractor had shifted.

Recommendation #5: Employers should ensure that workers are trained in controls of rental equipment prior to use, especially key components such as locking mechanisms and brakes.

- The tractor in the current incident was a rental, so it is possible that the driver was unfamiliar with the braking systems controls (although his actual familiarity was not known). Employers who use rented equipment should provide training or review vehicle features and controls with employees prior to the use of equipment.
- Although all mechanical aspects of the rental trailer were deemed to be working properly post-incident, one theory was that the driver did not realize the use of the spring loaded trolley valve to activate the brake would not hold indefinitely.

Recommendation #6: Employers should periodically monitor worker performance to ensure appropriate and adequate safe operating procedures are being used.

- While it is challenging for employers to provide safety support and coaching in safe operations for dispersed or "lone" workers like drivers, it is best practice to program opportunities for performance and skill monitoring into regular operations. Managers or driver trainers may accomplish performance monitoring and coaching through periodic "ride-alongs" and/or observations of pre-trip inspections.

Recommendation #7: While current options for automatic axle locking and braking mechanisms are limited, employers should seek out built in protective features, such as automatic locks and brakes, when renting or purchasing equipment.

- During a busy work day human error can result in missed steps in safe operations. Thus, equipment with automatic locking or braking features would reduce hazard exposure. For example, an easy to use sliding axle-locking pin such as an automatic pin release may encourage employees to lock the axle after each time they move it. The following two bullets discuss reasons why automatic or low-effort locking mechanisms may encourage greater compliance with safe operations.
    - Trucking industry experts interviewed for the investigation (two terminal managers and two mechanics from other companies, a driver trainer, and a trailer manufacturer) believed the most likely time for unlocking and sliding the axle would be after being loaded with new freight in order balance a load. Other potential reasons for unlocking and moving the sliding axle would be to move it all the way forward to back a trailer into a tight location, or to move the axle all the way backward to provide maximum stability for loading/unloading forklift trucks. It is also possible that if a driver was at a loading dock with a graduated slope, a driver could move the axle to make small adjustments to trailer height if alignment with the dock was poor.
    - If the driver moved the rear axle at the dock involved in the incident, either to back the trailer into a tight loading area or to make minor adjustments to the trailer bed height, the axle would likely need to be moved again before resuming travel. The need to move the axle again in such scenarios could encourage a driver to leave it unlocked once the trailer was against the dock. With the trailer brakes locked and the trailer backed against the loading dock, neither the tractor nor trailer will move over the axel, which could further encourage a driver to leave the sliding axel unlocked for a short time.

REFERENCES

Occupational Health & Safety Administration (Aug 5, 1981). 29 CFR 1910.178(k)(1) and (m)(7): Mechanical means to secure trucks or trailers to a loading dock.

Federal Motor Carrier Safety Administration (Regulations Current to Aug 30, 2012). 49 CFR 393.207: Suspension systems.

Federal Motor Carrier Safety Administration (Regulations Current to Aug 30, 2012). 49 CFR 393.40: Required brake systems.

Federal Motor Carrier Safety Administration (Regulations Current to Aug 30, 2012). 49 CFR 393.41: Parking brake system.

Federal Motor Carrier Safety Administration (Regulations Current to Aug 30, 2012). 49 CFR 393.42: Brakes required on all wheels.

FOR MORE INFORMATION

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