

[CASE TITLE]

Post-Crash Analysis Report

Date of Loss: [REDACTED]

[LAW FIRM]

Prepared by:

Rick August, PhD

Smart Drive Test Inc.



[DATE]

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STATEMENT OF QUALIFICATIONS

I provide this report as a Post-Crash Investigation Expert in traffic safety, road user behavior, driver education, and air brakes. I earned my Air Brake Instructor’s license from the Ontario (Canada) Safety League in 1997. Since that time, I have taught air brake courses in both the provinces of Ontario and British Columbia, Canada.

I am currently licensed as a commercial driver and air brake instructor in British Columbia. The bulk of my driving instruction career has been teaching drivers of semi-truck and buses fitted with air brakes.

I've both authored the e-book "*Air Brakes Explained Simply*" and generated numerous videos on air brake systems.¹ These resource materials are in a bid to help CDL students pass their air brake endorsement.

I have a PhD from the University of Melbourne, Australia where I studied legal history. Specifically, policing and law as it works to uphold traffic's social order.

CERTIFICATION

I certify that:

- a) I am aware of my duty to assist the court;
- b) I have prepared this report in conformity with that duty, and;
- c) I am not an advocate for any party in this case.

If required, I can provide additional oral or written testimony in conformity with that duty.

PURPOSE OF REPORT

As requested in your correspondence to me on [DATE], I have investigated the roll-away crash of the concrete truck operated by [DRIVER]. Specifically, I've been asked to determine if he did apply the parking brakes upon parking the vehicle.

SUMMARY OF FACTS

At a job site on [DATE], [AGE] [DRIVER] parked his concrete truck upstream in front of a concrete pumper trailer. [REDACTED] operated the pumper trailer. The job site was [ADDRESS], located in a residential area of [TOWN]. [DRIVER] knew the parking brakes on the cement truck were not working. This serious defect existed

¹ *Air Brakes Explained Simply: An updated step-by-step guide for Truck, Bus, and RV Drivers to pass the CDL Air-Brake Endorsement*. 2018. Smart Drive Test Inc., ISBN (eBook) 978-1-9993932-0-5 <https://www.smartdrivetest.com/airbrakes-cdl-rv/air-brakes-explained-simply> For air brake videos, see: https://www.youtube.com/watch?v=dMxilatT0qw&list=PL0x-bChcUvwG2bSWReQWnk9Tm92L7WN_O&index=2&t=24s

despite the truck being in the shop the previous Friday, [DATE], for its mandatory annual inspection.

[DRIVER] and the pumper truck driver placed a rock under the wheel to secure the vehicle in place. After a short time, the rock failed. The cement truck rolled backward. It slammed into the pumper trailer, crushing PLAINTIFF[. The cement truck pushed the truck and trailer aside, and continued to roll down the hill. When the cement truck started to roll, [DRIVER] stood on the driver's side running boards.

The vehicle rolled almost six truck length before [DRIVER] wrestled himself into the cab and brought the vehicle to a stop with the front service brakes (the brake pedal).

My findings and analysis of the collision are outlined below:

DOCUMENTS REVIEWED

- Vehicle Examination Report - [REDACTED] PD.pdf
- RING doorbell footage.mov
- Police Crash Report.pdf
- NEST doorbell Footage.MOV
- Brake Photo.pdf
- 13712 - PRELIMINARY BULLET POINT SUMMARY OF FINDINGS.pdf

FACTS & ASSUMPTIONS

- I relied on the letter provided by [LAW FIRM] dated [DATE].
- It was a clear, sunny day with little to no traffic.²

AIR BRAKE SYSTEM'S OVERVIEW ON CDL VEHICLES

- The reasons for air brakes applying is the same reasons as on a passenger vehicle:
 1. Service (brake pedal);
 2. Parking;
 3. And emergencies.

² [REDACTED], "Police Crash Report.Pdf," ([REDACTED]), 4 of 8.

- On a passenger vehicle, there are two power sources: hydraulic pressure and levers. On modern cars, parking brakes are applied with electricity.
- The only difference between a braking system on a car and one on a commercial vehicle, is that the emergency brakes on a commercial vehicle will apply automatically in the event of damage to the system. And of course, air brakes are bigger and create more braking force.
- There are **three reasons that brakes are applied** on a commercial vehicle:
 1. Service Brakes: the brake pedal is pushed and the brakes are applied to slow the vehicle in everyday driving. Air pressure is used to apply the brakes and keep the parking/emergency brakes in the OFF position;
 2. Parking Brakes: The vehicle is parked, thus parking brakes. In this event, air is evacuated from the system and large, powerful springs expand and apply the brakes. Parking brakes will remain on indefinitely owing to the mechanical force of the springs.
 3. Emergency Brakes - in the event of a catastrophic air loss in the system, the service brakes will fail. In this event, air is leaking from the system and insufficient air pressure is available to compress the large, powerful springs that act as parking brake. In an emergency event causing loss of air pressure the parking brakes will apply automatically. Thus, acting as emergency brakes.
- Parking/Emergency brakes are only on the rear axles of a commercial vehicle to preserve steering.
- On air brake systems, **the two power sources used** to apply the brakes are compressed air and large, powerful springs.
- There is **one braking system**. At each wheel, or set of wheels, there is one brake that activates for one of the three reasons explained above.

INCREASED DEMANDS ON CEMENT TRUCKS' AIR BRAKES

- In the state of Virginia, a 3-axle concrete truck can have a gross legal weight of 54,000lbs. This truck is fitted with five brakes.
- For comparison, a tandem-tandem axle semi-truck and trailer are allowed a legal gross vehicle weight of 80,000lbs. This truck is fitted with ten brakes.³
- A cement truck weighs 67.5 percent of that of the tandem-tandem semi-truck, but has only 50 percent of the braking capacity.
- Owing to the heavier vehicle weights and turning concrete drum, cement trucks put greater strain on their parking brakes.
- Unlike other parked vehicles where the parking brakes are holding a static vehicle, a cement truck's loaded, turning drum is applying torsion to the chassis and its parking brakes.

CONDITION OF AIR BRAKES - POST-CRASH

- Post-crash investigators measured the push rod travel; it was discovered that the right-rear service brake was out-of-adjustment (See Figure 1).⁴
- The middle-left brake neared maximum pushrod stroke and was within $\frac{3}{16}$ " inch of legal limits (See Figure 1).

³ DMV, "██████████ Size, Weight and Equipment Requirements for Trucks, Trailers and Towed Vehicles," ed. ██████████ Department of Motor Vehicles (2023).

⁴ When authorities test to determine if an air brake equipped vehicles' brakes are in adjustment, they use the service brakes which are applied with air pressure. With a maximum brake application, air pressure exerts more than 3,000lbs of pressure. The parking brake spring on the other hand will exert between 1,800 and 2,000lbs of pressure.



Truck Pushrod Measurements			
Brake Chamber Size	C-24	Brake Chamber Size	C-24
Pushrod Stroke Post-Crash	1 1/8	Pushrod Stroke Post-Crash	1 1/8
Maximum Pushrod Stroke Limit	1 3/4	Maximum Pushrod Stroke Limit	1 3/4
All rear brake chambers are Type 30 with a maximum pushrod travel of two inches. All measurements are in inches.			
All Brakes Released	2 13/16	All Brakes Released	2 3/8
Parking Brakes Applied	4 1/4	Parking Brakes Applied	4 1/16
Service Brakes Applied	4 5/16	Service Brakes Applied	4 3/16
Service Brakes Pushrod Stroke	1 1/2	Service Brakes Pushrod Stroke	1 13/16
Parking Brake Pushrod Stroke	1 7/16	Parking Brake Pushrod Stroke	5/8
Pushrod Stroke Difference Between Service & Parking Brakes	1/16"	Pushrod Stroke Difference Between Service & Parking Brakes	1 3/16
All Brakes Released	3	All Brakes Released	2 7/8
Parking Brakes Applied	3 5/8	Parking Brakes Applied	3 1/2
Service Brakes Applied	5 1/2	Service Brakes Applied	4 3/8
Service Brakes Pushrod Stroke	2 1/2	Service Brakes Pushrod Stroke	1 1/2
Parking Brake Pushrod Stroke	5/8	Parking Brake Pushrod Stroke	5/8
Pushrod Stroke Difference Between Service & Parking Brakes	1 7/8	Pushrod Stroke Difference Between Service & Parking Brakes	7/8

Figure 1 – spreadsheet showing the pushrod travel for the [redacted] cement truck at the time of the collision. Only the left rear is beyond legal limits for service brake applications. However, the difference between the service brake and parking brake applications indicates that the parking brakes were engaged on only one rear wheel (left middle).⁵

- Despite all service brakes, except one, being within legal limits there are many other components in a foundation brake that could potentially fail:
 - Wear of the "S" cam;
 - "S" cam's bushings' condition;

⁵ Authority, "Air Brake Push Rod Measurement Photos.Pdf," (2023); [redacted], "Vehicle Examination Report - Albemarle Pd.Pdf," (2021). In my calculations, the service brake pushrod travel for the right-rear brake is 1 1/2 inches. In the Driver/Vehicle Examination Report [redacted] reported that it was 2 1/2 inches. It is suspected that there's a typo in their report.

- Brake shoes and wear of the brake pads;
- Condition of the brake drum;
- Return springs, roller bearings, and anchor posts.



Figure 2 – with the parking brakes applied, post-crash investigators were able to place pieces of paper between the brake shoes and the drum. The rust and build-up of caked sludge on the brake and suspension components suggests that no mechanical repairs have been made to this truck for more than six months.⁶

- On three of the four rear parking brakes, the brake shoes did not come in contact with the drum. As seen in Figure 1, the difference in pushrod stroke between the service and parking brakes was:
 - Right-rear: 1 7/8"
 - Left-middle: 1 3/16"
 - Left-rear: 7/8"

EVIDENCE THAT PARKING BRAKES WERE APPLIED

- In the doorbell camera, the air pressure can be heard releasing from the service brakes via the quick release valve, and the air pressure being evacuated from the spring-brake chambers.

⁶ Authority, "Air Brake Push Rod Measurement Photos.Pdf."; [REDACTED], "Vehicle Examination Report - [REDACTED].Pdf." In my calculations, the service brake pushrod travel for the right-rear brake is 1 ½ inches. In the Driver/Vehicle Examination [REDACTED] [REDACTED] PD reported that it was 2 ½ inches. It is suspected that there's a typo in their report.



Figure 3 – At 1.23 in the video you can hear the service brakes being released and the parking brakes being applied. This quick sequential application of the service and parking brakes is done to prevent compounding the brakes, which could potentially cause damage to the braking system.⁷

- [DRIVER] deposed that he did in fact apply the parking brake after reversing and stopping uphill from the concrete pumper trailer.⁸
- On concrete trucks there are a set of controls at the back to change the directional spin of the cement drum and dump the concrete. These controls will not work if the parking brake is not applied.
- [DRIVER] would have gone to the back of the truck, positioned the chute into the pumper trailer, and then used the controls at the rear of the truck to start the flow of concrete into the pump trailer.
- Eleven seconds after the parking brakes are applied, the engine on the concrete pumper trailer can be heard starting in the video.⁹

⁷ "Nest Doorbell Footage.Mov," (2021), 01:23.

⁸ Deposition of [DRIVER], Q 106.

⁹ "Nest Doorbell Footage.Mov," 01.34.



Figure 4 – At 1:34 in the video you can hear the engine of the concrete pumper trailer start. The engine starting indicates that [DRIVER] arrived at the rear of the truck to both chock the wheels with a stone and position the concrete truck's chute into the pumper trailer's hopper.¹⁰

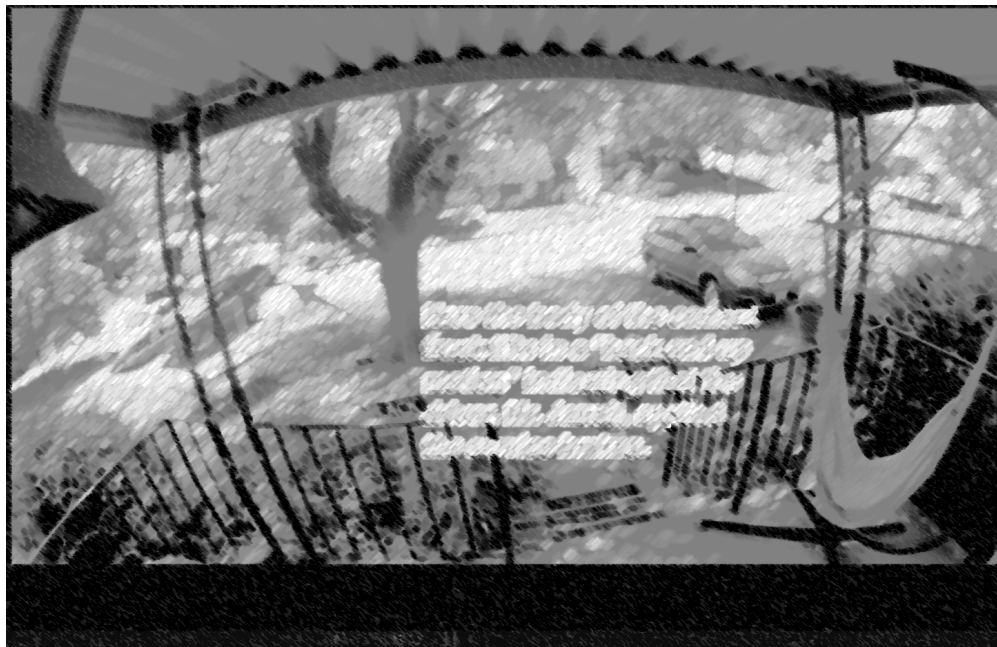


Figure 5 – At 8:12 in the video you can see the cement truck coming to a stop. The cab of the truck lifts up and back from the chassis. This motion indicates that the service brakes were applied.¹¹

¹⁰ Ibid., 01:34.

¹¹ "Ring Doorbell Footage.Mov," (2021), 08:12.

- [DRIVER] stopped the runaway truck using the service brakes. In the doorbell security video, the body of the truck lifted from the front chassis, indicating that the front service brakes were working and able to bring the vehicle to a stop.¹²
- Police reported no skid marks at the site of the collision.¹³
- The truck was in the shop on [DATE] for its mandatory annual inspection of which brakes are a major component.¹⁴
- To measure service brake pushrod stroke, diesel technicians would have most likely pressure washed the underside of the truck to both determine that the brakes were in adjustment and repair any defects to the brakes and vehicle.

OPINION

In is my professional opinion that [DRIVER] applied the parking brakes of the 2005 Peterbilt cement truck. [DRIVER] was an experienced CDL driver.¹⁵ Experienced drivers form the habit of applying the parking brake when the vehicle is parked. The driving action becomes automatic. [DRIVER] deposed that he did apply the parking brakes after positioning it in front of the concrete pumper at the job site.

Although the parking brakes on the vehicle's rear axle did not work, the service brakes on the front axle worked sufficiently to drive the vehicle and stop it in traffic. This fact is evidenced by [DRIVER] bringing the runaway vehicle to stop moments after the crash.

Other evidence corroborates that [DRIVER] applied the parking brakes. Air from the service brake releasing and the parking brakes applying can be heard in the doorbell security video. And the controls to change the direction of the cement drum and start the cement unloading at the rear of the truck will not work if the parking brakes are not applied.

Three days prior to the collision that killed [PLAINTIFF], the [REDACTED] cement truck had had its mandatory annual inspection. Of all the safety features inspected by a diesel technician during an annual inspection, brakes are at the forefront. Post-crash investigators sliding paper into the gap between the brake shoes and drum with the

¹² Ibid., 08:18. If the parking brakes are applied on an air brake system, the front service brakes will work if the brake pedal is pressed.

¹³ [REDACTED], "Police Crash Report.Pdf," 2 of 8.

¹⁴ Annual Inspection Certificate, 2021.

¹⁵ Deposition of [DRIVER], 2022.

parking brakes applied indicated that the truck was devoid of parking/emergency brakes. Further, the rust and buildup of sludge on the vehicle's undercarriage further substantiates that no repairs had been done to the truck within a few months, let alone three days.

The parking brakes on the cement truck were inoperable. [DRIVER] deposed that fact. Post-crash investigation revealed that one of the service brakes was beyond the legal limit for pushrod stroke. Corroborating that the parking brakes were applied was the difference between maximum pushrod stroke of the service brakes and that of the parking brakes - more than an inch on two parking brakes and near an inch on another. This pushrod stroke difference indicates that the spring-brake chambers required repair. Even though [DRIVER] applied the parking brakes, these did not work and led to the runaway truck.

Sincerely,
Rick August, PhD

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