

# Dump Truck Tip-Over Prevention Fact Sheet

HS05-041C (11-20)

**D**ump trucks are used in a variety of different industries today to haul material and dump it. Like other large trucks, these vehicles are heavy, difficult to steer, and can take a long time to stop. While they vary greatly in design, many of the operation hazards remain the same. Dump trucks – especially long semi-trailer dump rigs and end-dump truck bodies -- are prone to tipping. Their high center of gravity, the cargo's weight, and the often loose, shifting loads of sand, gravel, or debris make dump trucks unstable and prone to tipping.

## Dump Truck Injuries

Over the past decade, serious accidents involving dump trucks continue to edge up by about 3% per year.<sup>1</sup> While it is hard to pinpoint the number of injuries directly related to dump truck tip-overs, [there are many news stories](#) of workers on the ground or a member of the public suffering fatal injuries from a dump truck tip-over.

Dump truck accidents often result in serious injuries or death for truck operators and people around the truck. In 2018, dump truck accidents resulted in 5,829 serious injuries and 383 deaths in



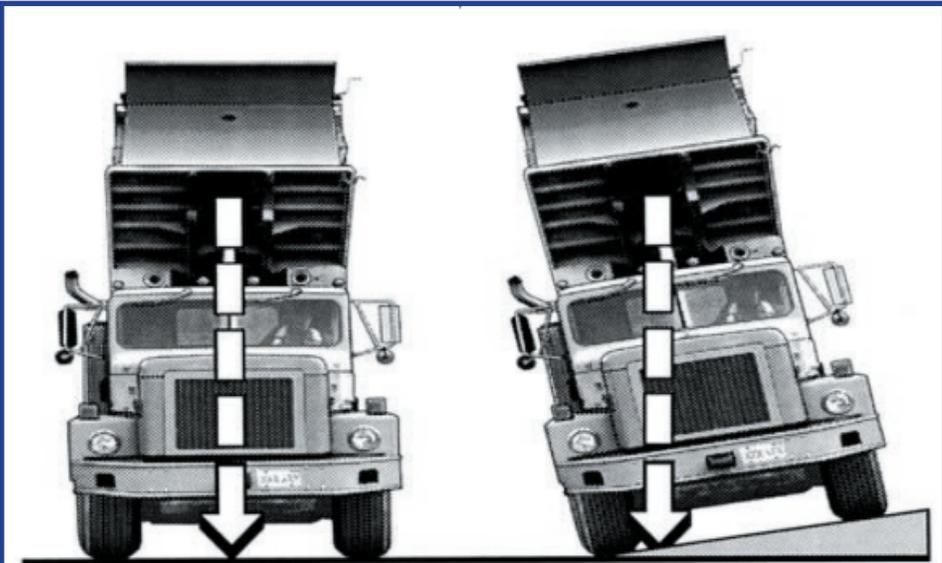
the U.S.<sup>2</sup> Annually, about 41% of dump truck-related deaths involve workers on foot. Approximately 8% of those killed were maintaining dump trucks, and nearly 3% of the deaths resulted from a worker caught between the truck frame and a falling dump truck bed.<sup>3</sup>

## Causes of Dump Truck Tip-Overs

Many factors contribute to dump truck tip-overs depending on the worksite and the type of truck used. However, the main hazard is related to the stability of the end-dump unit when the box is in the raised position. When the center of gravity of the box and load is not between the unit's frame rails, there is a risk of tip-over. (See diagram on page 2.)

Some common factors that can decrease stability and cause tip-overs include:

- **Operating on uneven ground or a slope.** One of the most common causes for a dump truck to tip is operating on an uneven surface or a slope when dumping. Even a slight slope alters the truck's center of gravity and increases the chance of a tip-over as the



*A slight slope can be enough to cause tipping if material sticks in the top of the box.*

weight of the load shifts during dumping. If the bed overturns, the cab often tips over as well, unless the truck has an articulating dump bed.

- Operating on soft surfaces.**  
Construction site dump truck operators may drive onto an area that appears even and solid. However, unless the surface is tightly compacted, the ground under the truck can shift, causing the wheels to settle unevenly. As the center of gravity is altered, an overturn may occur as the weight of the load shifts.
- Materials are loaded unevenly.**  
When a large amount of material is loaded in the upper portion of a raised box, the truck becomes off-balanced and unstable. Always load material evenly in the bed of the truck and pay attention to how the load flows from the bed while dumping.
- The load does not flow during dumping.**  
It takes practice to learn how different materials flow while dumping or spreading. However, sometimes material does not move out of the top portion of the box or does not flow out of one side of the top portion as expected. Also, the end gate may fail to open, lifting the dump body in the air. The uneven distribution of the load can decrease the truck's stability and result in a tip-over. Also, cold weather may cause materials to freeze and stick to the box when dumping. Do not leave loads in dump boxes overnight during the winter.

## Types of Dump Trucks

### Standard Dump Truck

A standard dump truck is a truck chassis with a dump body mounted to the frame. The bed is raised by a hydraulic ram and lever between the frame rails. The back of the bed is hinged to allow the tailgate to swing up or down.



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### Semi-Trailer End-Dump Truck

In a semi-trailer end-dump truck, the trailer itself contains the hydraulic hoist. A typical semi-trailer end-dump truck has a tractor pulling a 2-axle trailer with dual tires. It carries a large payload but is unstable when raised in the dumping position.



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### Transfer Dump Truck with Pups

A transfer dump truck is a standard dump truck pulling a separate trailer with a movable cargo container. The pup trailer(s) has a hydraulic ram and is capable of self-unloading.



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## Types of Dump Trucks

### Super Dump Truck

A super dump truck is a straight dump truck equipped with a trailing axle. When the truck is empty or ready to offload, the back, liftable, load-bearing axle toggles up onto the vehicle's rear and off of the road surface.



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### Semi-Trailer Bottom Dump Truck

A semi-trailer bottom dump truck, also known as a belly dump, is a tractor-trailer with a clamshell-type dump gate in the trailer's belly.



Photo: [https://commons.wikimedia.org/wiki/File:Belly\\_dump\\_2005-12-15.km.jpg#/media/File:Belly\\_dump\\_2005-12-15.km.jpg](https://commons.wikimedia.org/wiki/File:Belly_dump_2005-12-15.km.jpg#/media/File:Belly_dump_2005-12-15.km.jpg), via Wikimedia Commons.

### Double and Triple Trailer Bottom Dump Truck

Double and triple bottom dump trucks consist of a tractor pulling one single-axle semi-trailer and an additional full trailer (or two full trailers in the case of triples). These dump trucks allow the driver to lay material in windrows without leaving the cab or stopping the truck.



Photo: Reprinted with permission from American Truck Simulator.

- **Poor maintenance or mechanical failure.**

From defective lift mechanisms to uneven tire pressure in the rear wheels, any maintenance or mechanical issue that decreases the dump trunk's stability can result in a tip-over. Keep rear suspension systems, lifting cylinders and pins, and tailgates maintained and in good working order. When a tailgate does not open or unlatch, the load shifts to the back of the bed, potentially causing the truck's front to lift and overturn.

- **The force of high winds.** The longer the trailer, the more surface area is exposed to high winds. A cross-wind pressure on the trailer, especially one with a long box as in end-dump trucks and semi-trailers, creates the potential for a tipping incident.

## Dump Truck Tip-Over Prevention

One of the most effective ways to prevent tip-overs is by controlling the following risk factors:

- **Use the right type of dump truck for the job.**

Vehicle selection is not always an option for the contractor, and material suppliers or haulers may not always own the right equipment for the job site. However, when possible, use dump trucks with the most stability for the job. For example, use belly-dump semi-trailers instead of end-dump semi-trailers for spreading aggregate for road construction. Use straight trucks or pup trailers instead of semi-trailers to haul to rough graded or fill areas where surfaces are uneven or loosely compacted. Use straight trucks or pup trailers for highway haulage to dump areas. However, when haulage and dumping are all on-site, off-highway vehicles are a better choice.

- **Stay within regulated weight limits.**

Loading the box from front-to-back must meet allowable gross weight and axle weight limitations set by the [Texas Department of Motor Vehicles](#).

- **Lighten the load when hauling poor flowing materials.**

If working with poorly flowing materials, lighten the load in the top end of the box, use a smaller load instead of a full load, and use box liners if possible.

- **Dump on level ground.**

Check to see that the vehicle is on an even surface before dumping. When spreading material by dumping from a moving truck, ensure the entire length of travel is level. If dumping on a slope is unavoidable, dump with the slope, not against it.

- **Avoid soft, uneven surfaces.**

When operating off-road in loosely compacted fill or in soft material, choose a spot to dump that will not shift with the load's weight. Never dump close to the shoulders of roads or at the edge of newly placed material.

- **Unlock the tailgate before dumping.**

Operators should ensure that the tailgate is unlocked and the vehicle is on a reasonably level surface before dumping.

- **Never dump near people or other vehicles.**

Avoid dumping when trucks are parked side-by-side or when ground personnel are in the dump area. Many dump truck-related fatalities occur to those who were near a bed that tipped. When a dump truck unit tips over, often the operator in the adjoining vehicle is the one who is injured. Warn dozer operators, surveyors, spotters, and other workers not to congregate in areas where dumping is underway.

- **Create a regular maintenance and inspection program.**

Preventive maintenance and regular inspections play an important role in eliminating vehicle tip-overs.

- **Check tire pressure.**

Ensure that tire pressure is checked daily and is equal on all sides of the truck.

- **Examine and lubricate pins and bushings regularly.**

- **Inspect suspension systems.**

Maintain and inspect suspension systems under load to ensure they work properly and provide even suspension. Replace weak suspension systems immediately.

- **Inspect hoist cylinders.**

Check hoist cylinders regularly, and when needed,

## Types of Dump Trucks

### Side Dump Truck

A side dump truck consists of a tractor-trailer with hydraulic rams that tilt the dump body onto its side. It allows the material to spill either to the left or right side of the trailer.



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### Winter Services Vehicles

Many winter service vehicles are based on dump trucks to allow ballast placement to weigh the truck down or hold sodium or calcium chloride salts for spreading on snow and ice-covered surfaces.



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### Roll-Off Trucks

A roll-off truck has a hoist and subframe, but it carries a removable container. The container is loaded on the ground, then pulled onto the truck's back with a winch and cable.



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## Types of Dump Trucks

### Off-Road Haul Trucks

These dump trucks are heavy construction equipment strictly used off-road for mining and heavy dirt-hauling jobs. They have a rigid frame and conventional steering with the drive at the rear wheel.



### Off-Road Articulated Hauler

An articulated hauler is an all-wheel-drive, off-road dump truck. It has a hinge between the cab and the dump box but is distinct from a semi-trailer truck in that the power unit is a permanent fixture, not a separable vehicle.



Photo: Harry Bush, Public Domain, via Wikimedia Commons, <http://www.public-domain-image.com/full-image/transportation-vehicles-public-domain-images-pictures/trucks-public-domain-images-pictures/caterpillar-dump-truck.jpg.html>.

replace them with cylinders of the same size and operating pressure. Never replace worn cylinders with smaller cylinders or with cylinders rated at lower operating pressure.

- **Leave repaired boxes unobstructed.**

When box repairs are needed, leave the bottom and sides clear and unobstructed. Rough patchwork repairs near the top of the box can catch and hold sticky material.

- **Report damaged components.**

Inform a supervisor of all damaged components immediately. Fix all equipment and components before using.

- **Enforce safety procedures.**

Establish safety procedures and policies. Create awareness training based on manufacturer's recommendations.

Recognizing the risks associated with tipping hazards is key to prevention. For more information on dump truck safety and tip-over prevention, contact a Texas Department of Insurance, Division of Workers' Compensation-Workplace Safety Training Specialist at 800-252-7031, Option 2; [www.txsafetyatwork.com](http://www.txsafetyatwork.com); or [safetytraining@tdi.texas.gov](mailto:safetytraining@tdi.texas.gov).

## References

<sup>1</sup>Bureau of Labor Statistics Census of Fatal Occupational Injuries Research File and Case of Demographic Incidence Rates. Website. <https://data.bls.gov/gqt/InitialPage>. Accessed December 2, 2002.

<sup>2</sup>Large Truck and Bus Crash Facts, 2018. Fatal Crashes: National Highway Traffic Safety Administration (NHTSA), Fatality Analysis Reporting System (FARS). Injury and Towaway Crashes: Federal Motor Carrier Safety Administration, Motor Carrier Management Information System (MCMIS), data snapshot as of September 27, 2019. Website. [https://www.fmcsa.dot.gov/sites/fmcsa.dot.gov/files/2020-09/LTBCF%202018-v5\\_FINAL-09-15-2020.pdf](https://www.fmcsa.dot.gov/sites/fmcsa.dot.gov/files/2020-09/LTBCF%202018-v5_FINAL-09-15-2020.pdf). Accessed December 2, 2002.

<sup>3</sup>McCann M, Cheng MT. Dump truck-related deaths in construction, 1992-2007. Am J Ind Med. 2012 May;55(5):450-7. doi: 10.1002/ajim.21028. Epub 2011 Nov 23. PMID: 22113947. Website. <https://pubmed.ncbi.nlm.nih.gov/22113947/>. Accessed December 2, 2020.



*Safety Violations Hotline*

**1-800-452-9595**

[safetyhotline@tdi.texas.gov](mailto:safetyhotline@tdi.texas.gov)

The Texas Department of Insurance,  
Division of Workers' Compensation (DWC)  
E-mail [resourcecenter@tdi.texas.gov](mailto:resourcecenter@tdi.texas.gov)  
or call 1-800-687-7080 for more information.

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