

Road safety for heavy vehicles

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This report contains updated versions of six chapters of the Handbook of Road Safety Measures about heavy vehicle safety:

- **Seat belts:** Injury risk is reduced by 21% on average.
- **Safety equipment, technical failures, stability, and load:** Reduced crash risk was found for securing of load, electronic stability control, anti-lock brakes, and underrun-guard; increased crash risk was found for technical failures; uncertain effects were found for mirrors and camera systems.
- **Hazardous goods transport:** Crash risk is on average lower than for transport of other goods by road, but higher than transport of hazardous goods by rail or sea; safety management and culture can reduce risk.
- **Type, weight, and size of heavy goods vehicles:** Combination vehicles, especially multi-trailer combinations, have on average lower crash risk than single-unit trucks.
- **Top speed limiters:** Crash risk is reduced by about 20%.
- **Roadside vehicle inspections:** Increased number of inspections was found to reduce heavy vehicle crashes.

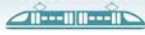
Seat belt use in heavy vehicles

Seat belt use is far lower in heavy vehicles than in light vehicles. It is also lower among bus passengers than among bus and truck drivers. According to empirical studies, seat belt use among heavy vehicle drivers reduces injury risk by 21%. The effect on more serious injuries is even larger. Among bus passengers, seat belt use also reduces injury risk, especially for serious and fatal injuries. However, it was not possible to quantify the size of the effect. Injury risk and severity among bus passengers is also affected by the design of the interior of the bus.

Heavy vehicle safety equipment, technical failures, load and stability

Reduced crash or injury risk was found for:

- **Load securement:** Inappropriately secured load increases rollover risk and the risk of being the triggering part in a collision.
- **Electronic stability and rollover control:** Such measures reduce rollover risk by 25 and 60%. Jack-knifing may be reduced even more.
- **Anti-lock brakes:** Rollover and jack-knifing crashes are reduced by about 20%.



- **Contour markings and side-marker lamps:** Crashes in which a heavy vehicle is hit from the side or rear, are reduced by 7% (side-marker lamps) and 20-40% (contour markings).
- **Underrun guard – front:** Fatality risk is reduced by 10% for car drivers in front collisions with heavy vehicles.
- **Underrun guard – rear:** Injury severity is reduced among car drivers rear-ending a heavy vehicle. Among belted car drivers, fatality risk was found to be reduced by 76% in crashes where the car hits a heavy vehicle from behind at a relative speed of 50 km/h or more.
- **Underrun guard – side:** The risk of being killed or seriously injured is reduced by about 50% among cyclists hit by a heavy vehicle overtaking the bicycle. No effect was found in collisions between cyclists and right-turning heavy vehicles.

Crash risk increases for heavy vehicles with:

- **Brake failures:** Crash risk increases by about 50%
- **Tire failures:** Crash risk increases (unknown size of effect, may be larger or smaller than the effect of brake failures)
- **High center of gravity:** Increases rollover risk.

The effects on crashes are highly uncertain for:

- **Mirrors, blindzone cameras and reversing cameras:** Their effectiveness depends on whether or not they are properly adjusted; behavioral adaptations can have unfavorable effects on safety.

Effects on crashes are unknown for:

- **Rear axle steering:** Steering and stability are improved, both in sharp curves at low speed and at high speed, but the effect on crashes is unknown.
- **Lane departure warning:** Lane departure crash risk may be reduced.
- **Technical failures, other than brakes or tires (steering, lighting, suspension):** May increase crash risk but effects are highly uncertain.
- **Fuel tank baffles:** They affect movements of fluids in the tank to improve stability, but the effect on crash risk is unknown.

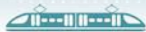
Hazardous goods transport

Transport of hazardous goods is associated with far lower risk than transport of other goods. However, the potential damage in hazardous goods accidents is much higher. Transporting hazardous goods by road is associated with higher risk than transport by rail or sea. Safety management and safety culture in transportation companies may reduce risk.

Heavy vehicles size, weight, and type

Longer and heavier goods vehicles have on average lower crash risk than smaller and lighter goods vehicles, both when comparing combination vehicles with single unit trucks and when comparing multiple-trailer and single-trailer combinations. However, longer and heavier vehicles drive mostly on roads with higher standards and higher safety levels, and drivers of longer and heavier vehicles are often more experienced than other drivers. When such differences are controlled for, the differences in crash risk diminish but the results from empirical studies are highly inconsistent.

Increasing weight in itself (all other things being equal), especially overweight, is associated with increasing crash risk and increasing crash severity.



Since larger and heavier vehicles can transport more goods, increasing weight and length limits and allowing multi-trailer combinations is likely to reduce total crash numbers because of reduced vehicle kilometers.

Speed limiter

Speed limiters on heavy vehicles were found to reduce crash risk by about 20%. Larger risk reductions can be expected from lower top speeds.

Road side inspections of heavy vehicles

Road side inspections of heavy vehicles has been found to reduce heavy vehicle crashes. Doubling the number of inspections may reduce injury crashes with heavy vehicles by 12%.