

Underride: Do Rear Impact Guards Help?

When small vehicles and large trucks meet

Because trucks are typically much heavier than other vehicles in the traffic stream, studies have shown that accidents are more severe when trucks are involved in collisions (Craft, 2001; NTSB, 2001). When a smaller vehicle rear-ends a large truck, the smaller vehicle is likely to ride underneath. Further, studies have shown that of the 400,000 large trucks involved in motor vehicle crashes each year in the United States, 18 percent are involved in rear-end crashes as the struck vehicle (Craft, 2001; Knipling, 2007). This type of crash increases the already high probability of death or serious injury for smaller vehicle occupants because of the intrusion parts from the truck or the smaller vehicle into the passenger compartment of the smaller vehicle (Rechnitzer, 1993). NHTSA reports that a truck is involved in one of every eight traffic fatalities; and that a large truck is 2.6 times more likely than other vehicles to be struck in the rear (NHTSA, 2007).



Photo Source: Underride Network

North Dakota exemption

The North Dakota legislature recently passed a law to exempt the state's agricultural fleet from rear-guard equipment that is mandated for large trucks by NHTSA. The bill exempts rear-end dump trucks and other rear unloading truck or trailers from the rear-end protection requirements while they are being used for hauling agricultural and other farm products from a place of production or on-farm storage site to a place of processing or storage. The law is scheduled to become effective Oct. 1, 2008, or on approval of the state's application to FMCSA for the exemption if it occurs earlier.

If FMCSA does not allow the exemption, it will result in North Dakota's noncompliance with MCSAP. MCSAP is a federal grant program that provides financial assistance to states to reduce the number and severity of crashes and hazardous materials incidents involving commercial motor vehicles (CMV).

North Dakota has been the recipient of approximately \$1.3 million in federal grant funds annually over recent years. If North Dakota's exemption law is deemed to be non-compliant, it may have implications on the level and use of federal infrastructure funds the state receives (NDDOT, 2007a).

NHTSA requirements

To reduce the impact severity of crashes where underride may occur, NHTSA requires that most trailers manufactured after January 1998, with a gross vehicle weight rating (GVWR) of 10,000 pounds and above, have rear impact guards. The guards should be within 12 inches of the rear of the trailer and with a ground clearance of no more than 22 inches (FMVSS, 1996a; FMVSS, 1996b).

Exemptions to the rear-guard requirement:

- Exemptions may be allowed when efforts to develop a practical retractable rear impact guard for trucks have been unsuccessful due to impracticability of compliance (NHTSA, 2002; NHTSA, 2004b).
- Special purpose vehicles, wheels-back vehicles, pole trailers, low chassis trailers, pulpwood trailers, and vehicles engaged in drive-away-towaway operations are exempted from having rear guards, as this would significantly impair their function (Bloch et al; 1998).
- Some single unit trucks since they represent a small portion of the underride safety problem (Knipling, 1992).
- A state may also receive a specific variance from the federal motor carrier safety regulations for interstate commerce (49 C.F.R. sec 350.341; 49 C.F.R. sec 350.333; 49 C.F.R. sec 350.339).
- Some states requested exemptions for agricultural vehicles when they applied for the FMCSA's Motor Carrier Safety Assistance Program (MCSAP).

Estimated crash benefits of having rear impact guards

The present estimate for rear-impact crashes within the agricultural fleet is \$6.9 million over the seven-year life of the truck. The share of the total crash costs is attributed to the agricultural fleet based on the 40 percent representation of the fleet in all trucks, and the 11.5 percent probability that the crash will be a rear impact, based on most recent five years of state crash data. In addition, the value is adjusted downward to account for the 0.40 estimated likelihood that it will be the truck that is the struck vehicle in a rear-end collision between a passenger car and a large truck (Craft, 2001).

If the farm truck fleet were exempt from the underride protection requirement, there would not be an expected increase in crash rates or probabilities associated with rear-end truck crashes, but the injury severity in accidents would be expected to increase.

The estimated benefit ranges from \$3.0 to \$11.8 million considering a range of 5 to 20

percent for the potential upward shift of injury severity in the absence of the rear-guard equipment on the North Dakota agricultural fleet. The total benefits of the rear-guard equipment would also include the \$1.2 million annually in MCSAP grant funds. Therefore, the total benefit over the seven-year life of the truck would be an estimated \$11.4 to \$20.2 million, considering the traffic injury prevention and federal commercial vehicle safety grant funds implications. Any federal infrastructure related funds that are associated with the safety compliance should also be considered in this benefit summation.

NPV Estimated Crash Prevention Benefit, Based on Increased Injury Severity for ND Agricultural Rear Impact Crashes Under Rear-Guard Exemption

	Crash Severity			Total
	Fatal	Injury	PDO	
20 percent upward injury severity				
Estimated Injury Costs	\$14,088,022	\$5,448,647	\$466,984	\$20,003,844
Benefit	\$9,583,962	\$2,394,802	(\$156,414)	\$11,822,541
15 percent upward injury severity				
Estimated Injury Costs	\$11,744,448	\$4,847,076	\$506,043	\$17,097,760
Benefit	\$7,240,388	\$1,793,231	(\$117,354)	\$8,916,457
10 percent upward injury severity				
Estimated Injury Costs	\$9,353,715	\$4,247,948	\$545,119	\$14,146,783
Benefit	\$4,849,655	\$1,194,103	(\$78,278)	\$5,965,480
5 percent upward injury severity				
Estimated Injury Costs	\$6,960,045	\$3,651,732	\$584,252	\$11,196,028
Benefit	\$2,455,985	\$597,886	(\$39,146)	\$3,014,725

Conclusion

North Dakota has requested an exemption from FMCSA for rear guards on the state's agricultural truck fleet under the MCSAP. As the North Dakota agricultural truck fleet continues to evolve to serve market demands, road safety remains a constant critical factor. Cost-benefit analysis shows that the rear-guard safety equipment has injury severity benefits that far outweigh equipment cost. Given a 10 percent reduction in injury severity attributed to the rear-guard devices on agricultural trucks, in the relevant crash population, the benefit is estimated to be \$14.4 million over the seven-year depreciable life of a truck. Total equipment and maintenance cost for the North Dakota agricultural truck fleet is estimated to be \$8.1 million. An estimated safety benefit of \$1.76 is generated from each dollar spent on rear guards for North Dakota's agricultural truck fleet.

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