

## Lorries and delivery vans

### Summary

Crashes in which lorries or vans are involved are often serious, especially for the crash opponent. Lorries are not only involved in crashes because of their drivers' unsafe behaviour (freights falling off, rollovers, jack-knifing), but also because other road users take too little account of them. Many road users do not realize that they can be positioned in the lorry's blind area or that a lorry can swerve out. Although delivery vans are smaller than lorries, they still are bigger and heavier than cars and their rear view is not as good. That is why the crash causes of delivery vans are often different from those of cars. Moreover, the number of delivery vans on the road is increasing considerably in the Netherlands. All this makes separate road safety measures for vans necessary. Infrastructural measures, such as opening bus lanes to lorries and delivery vans, can result in safer lorry and van traffic. In addition, (intelligent) facilities in the vehicle, such as speed limitation devices, can be used. But it is also important to encourage a safety culture in haulage companies.

### Background

Lorries and vans share the road with others. Their large mass is the reason that crashes between lorries and other vehicles are often serious. Although delivery vans are smaller and lighter than lorries, when they crash, the casualties are generally in the crash opponent. In addition, the number of vans is increasing rapidly in the Netherlands, from slightly more than 5% of all motorized vehicles in 1986 to slightly under 10% in 2007. The proportion of lorries remains quite constant and amounted to 2.3% in 2007. This fact sheet deals briefly with the road safety problems of lorries and delivery vans, the causes of these problems, possible measures to improve road safety, and the cost-effectiveness of a number of these measures.

### What is the size of the problem?

The casualties in crashes with lorries or delivery vans are much more frequently among the crash opponents than among the occupants of the lorries and delivery vans themselves. *Table 1* contains the figures for both parties.

Transport mode	Casualties	2001	2002	2003	2004	2005	2006
Delivery van	Occupants	42	36	55	14	20	21
	Crash opponents	84	76	102	78	69	67
Lorry	Occupants	16	11	8	10	11	9
	Crash opponents	154	110	139	131	96	120

Table 1. Numbers of road deaths in crashes involving lorries and delivery vans, divided by fatalities among 'their own' occupants and occupants of the crash opponents. (Source: BRON, DVS).

The figures in *Table 1* show that, despite the fact that there are approximately four times more delivery vans than lorries, there are more casualties among the lorries' crash opponents than among those of delivery vans.

Lorries, however, travel many more kilometres. Therefore, we take the death rate as the comparison unit: the number of fatalities among the crash opponent per billion kilometres travelled. *Table 2* shows the death rates for lorries and delivery vans with the death rate for passenger cars as a comparison.

Transport mode	Crash opponent's death rate
Delivery van	4.0
Lorry	16.7
Passenger car	2.2

Table 2. *The fatality rate defined as the number of fatalities among the crash opponent per billion kilometres travelled (Source: BRON, DVS; CBS).*

The figures in *Table 2* show that, compared to a passenger car, the fatality rate for the crash opponent of a delivery van is almost a factor 2 higher, and a factor 7.5 higher for the crash opponent of a lorry.

For 2006, the transport modes for the casualties among crash opponents of crashes with lorries were traced (*Table 3*). The figures show that in urban crashes the crash opponents are mainly bicycles and in non-urban crashes mainly passenger cars.

Transport mode	Urban crashes		Non-urban crashes		Total	
	Abs.	%	Abs.	%	Abs.	%
Pedestrian	2	5.1%	1	1.2%	3	2.4%
Bicycle	27	69.2%	13	15.5%	40	32.5%
Light moped	3	7.7%	2	2.4%	5	4.1%
Moped	1	2.6%	7	8.3%	8	6.5%
Motor/scooter	0	0.0%	3	3.6%	3	2.4%
Passenger car	5	12.8%	48	57.1%	53	43.1%
Delivery van	0	0.0%	5	6.0%	5	4.1%
Lorry	1	2.6%	5	6.0%	6	4.9%
Total	39	100.0%	84	100.0%	123	100.0%

Table 3. *Transport modes of fatalities among lorries' crash opponents in 2006 (Source: BRON, DVS).*

### Which types of crashes do lorries and delivery vans have?

Crash types that are directly linked to transporting freight are more or less unique to lorries. Freights can for instance be lost on the way. The combination of a high centre of gravity and high speed (especially in bends) can cause lorries to roll over, and when they pull trailers they can jack-knife. The nature of the freight (e.g. dangerous goods) can cause the crash to be more serious. Crashes can also occur when loading and unloading, especially in urban areas.

Lorries are larger, less manoeuvrable, and accelerate slower than cars. Their braking distance is also longer, but especially the use of better tyres in the last few years has much improved their brake delay.

Lorries also have a blind spot: from their position lorry drivers cannot see other road users in certain locations properly. Despite the fact that the blind spot mirror was made compulsory in the Netherlands in 2003, lorries turning right cause almost 20 fatalities among cyclists per year (Schoon, 2006). In 2008 SWOV will make further analysis of this type of crash.

The side underrun protection which in the Netherlands was made compulsory for new lorries in 1995, largely prevents vulnerable road users ending up under the rear wheels. Closed side underrun protection reduces this to a larger extent than the already obligatory open side underrun protection (Van Kampen & Schoon, 1999).

In comparison with collisions between passenger cars, there are relatively many rear-end, flank, and frontal collisions between lorries and cars (Van Kampen & Schoon, 1999). Flank collisions frequently occur on motorways when changing lanes; changing towards the right causes more collisions than changing towards the left (AVV, 2006). Annually, an average of 50 crashes in which a lorry turns over is registered.

With regard to factors that interfere with driving skills (alcohol, drugs, certain medicines, fatigue, distraction, etc.), drink driving is less common among lorry drivers than among motorists. However, there are indications that fatigue more frequently influences lorry drivers than motorists (ETSC, 2001).

Crashes involving lorries are not only caused by their drivers' unsafe behaviour, but also because other road users insufficiently allow for the fact that lorry traffic simply is different. For example, not all road users realize that they could be situated in a lorry driver's blind spot, or that a lorry can swerve out.

That which applies to lorries, to a lesser extent also applies to vans. Vans usually are larger and heavier than passenger cars. A van driver also has a more limited rear view than a motorist. Vans are disproportionately more frequently involved in rear-end collisions in which the van hits a car while reversing, in crashes where priority is not given at crossroads, in single vehicle crashes, and in crashes on 100 km/h and 120 km/h roads. However, vans are less frequently involved in crashes in which the van is hit from behind and in urban frontal collisions (Bos & Twisk, 1999; Schoon, 2001).

Young, novice drivers have a higher crash rate than older, more experienced drivers and this is also the case for lorry and van drivers. Furthermore, road haulage companies often seem to employ young van drivers, because they are cheaper but concrete data is lacking. Bos & Twisk (1999) found that young, novice van drivers more often have crashes with oncoming traffic, and are more often involved in rear-end collisions in which the van is crashed into. It is remarkable that a driving licence for a passenger car is sufficient to drive a van, whereas the dimensions and driving properties of the average van are distinctly different from those of the average passenger car. In early 2005, the European Commission decided not to introduce a separate driving licence for van drivers. However, from 2007 a separate driving licence will be obligatory for vans pulling heavy trailers.

### **Which measures can make lorry and delivery van traffic safer?**

#### *Road*

Measures can intervene in traffic at different levels. At the 'road' level we must consider the 'hard' as well as the 'soft' infrastructure (i.e. traffic organization). Hard infrastructure refers to how roads can be constructed according to one of the Sustainable Safety principles: meetings between vehicles that differ considerably in mass and speed must be limited as much as possible. A structural solution could be to create a separate infrastructure for heavy goods vehicles. This also has several other advantages: no more problems with merging when entering or leaving the motorway because there will no longer be columns of lorries, and a lesser need of strong foundations for roads that aren't used by lorries ('light roads'). The bottlenecks for these measures, however, are the cost and the lack of space.

In Advancing Sustainable Safety (Wegman & Aarts, 2006) a vision has been developed that offers a solution for a large part of the so-called incompatibility between freight traffic and other traffic. This vision comprises a logistics system in which heavy freight traffic (tractors and lorries with trailers) only use the main road network with grade separated intersections. Light freight traffic can only use the secondary road network. The light freight vehicles offer good protection on all sides and the driver has a good view of the other traffic because of his low seating position and the extensive use of glass in the doors.

Several municipalities in the Netherlands are making an effort to construct a so-called Quality Network Freight Transport. This network aims at guiding the freight transport along specific road types, taking account of traffic flow, road safety and the environment. To encourage use of these networks, the routes should be programmed into the companies' route planning and navigation systems.

Soft infrastructure refers to adapted traffic rules for heavy vehicles, such as different speed limits and bans on overtaking on motorways. These measures are usually not taken to improve road safety, but to improve traffic flow or protect the environment. The road safety effects are not known. It is also possible to affect the traffic organization, e.g. by measures that a) only allow loading and unloading in city centres at times during which there are few vulnerable road users on the road, and b) concentrate destinations of heavy vehicles at places where there is little other traffic.

#### *Vehicle*

Lower speeds reduce both the risk and the severity of a crash. In 2007, the delivery van trade and the authorities agreed to investigate speed regulating facilities in vans. This agreement also arranged that the trade would encourage the use of such equipment if it were shown to increase safety.

There is also equipment that can safeguard the driver's task skills of: fatigue alarm systems and lane departure warning systems. This equipment is only effective if its warning is timely and correctly, i.e. only if necessary. At present, the specificity and sensitivity of fatigue warning systems are still insufficient. Even if this equipment were to work well, its road safety effects would be unclear. There is always the possibility that drivers with such equipment adapt their behaviour and are prepared to take more risks.

Parts of the driving task have been made simpler by IT developments. For example, navigation systems prevent searching for the best route and unnecessary detours. However, operating the navigator and reading its results could distract the driver from the driving task. It must therefore be prevented that driving task support systems intervene with the primary driving task (see SWOV Fact sheet [Intelligent Transport Systems \(ITS\) and road safety](#)). As a result of the rapid IT developments, equipment has also come available that has nothing to do with the driving task, such as the mobile phone. Although in the Netherlands hands-free use of the mobile phone is allowed, it is hardly any safer than using the phone hand-held (see SWOV Fact sheet [Use of mobile phone while driving](#)). EU efforts are aimed at improved collision safety at the front and back of lorries to prevent underriding or overriding of other road users: sliding under the lorry at the front or the rear of the vehicle.

#### *Driver*

With regard to the 'human' factor, we must distinguish between measures that improve competence (knowledge and skills), measures to increase task capability (the degree of fitness to drive) and task readiness (the willingness to drive safely). Improving competence involves matters such as driver training, driving examination, professional driver diploma, driving experience, and extra training. Now that the European Commission has rejected a separate van driver's licence, there is always the possibility of introducing a van driver diploma similar to the lorry driver diploma.

Increasing the task capability and task readiness involves fitness and motivation. A driver is less hindered by fatigue if the legal working hours and driving time regulations are adhered to. To check the compliance, the tachograph was introduced. Relatively new are the journey data recorder (black box) and the accident data recorder. If these were used together with improving the company safety culture, the crash rate would decline by 20% (Bos & Wouters, 2000).

#### *Freight*

Measures to prevent unsafety caused by freight are, for instance, checks on overloading and incorrect loading, and rollover warning systems. The specificity and sensitivity of rollover warning systems in the vehicle must be high, which as yet is not the case.

#### *Transport trade*

What is special about lorries and vans is the fact that their drivers are nearly always professional drivers. This means that haulage companies and their customer companies also have a road safety responsibility. This is often referred to as a safety culture. There is a healthy safety culture if safety is regarded as being of great importance at all layers of the company and is a factor in all its acts and decisions.

Although a study of five Dutch haulage companies (Gort et al., 2002) showed that promoting the safety culture had no priority, there are various possibilities to achieve this, e.g. with the use of damage prevention plans (Lindeijer, Rienstra & Rietveld, 1997). The *Safety Scan* computer application, which was developed in 2004 by haulage companies together with the Dutch Ministry of Transport, can help companies in selecting road safety measures, thus getting a safety culture going. The agreement between the van trade and the authorities said that the trade would stimulate the use of the *Safety Scan* in their branch.

#### *Other road users*

The registered crashes show that the 'guilty party' in crashes between lorries and other road users is as often the lorry driver as it is the crash opponent (Van Raamsdonk, 2002). The solution to the problem must, therefore, come from both sides. Traffic education in primary and secondary schools should, more than is now the case, deal with how crashes with lorries and vans can be prevented by, for example, not being in the blind spot. More attention to the vehicle characteristics of lorries and vans can also be given in the regular driver training and public information campaigns.

### How cost-effective are certain measures?

The cost of road unsafety for society can be expressed in money. If the costs to society of introduction and enforcement of a measure are known, and a good estimate can be made of the road safety benefits (casualties and damage saved), it is possible to estimate the cost-effectiveness of that measure. The cost-effectiveness indicates how much money a measure costs to save one death or in-patient. The lower the cost the more cost-effective a measure is. Langeveld & Schoon (2004) calculated the cost-effectiveness for a number of lorry measures and ECORYS (2002) did this for a number of van measures (*Table 2*).

Measure	Cost-effectiveness for lorries	Cost-effectiveness for vans
On-board computer	0.1-0.5 *	0.4
Blind area mirror or camera	0.3 (mirror)/1.0 (camera)	3,0 (together)
Retroreflective contour marking	0.3	-
Speed and revolutions limiter	-	0.9
Stimulating seatbelt wearing by seatbelt alert	-	1.0
Closed side-underrun protection (remaining effect after blind spot mirror has been mounted)	2.9	-

\*) 0.1 is for the journey data recorder and 0.5 is for de accident data recorder. Because it is assumed that a journey data recorder can be linked to the already present on-board computer, the costs are less than those for an accident data recorder.

Table 2. Cost-effectiveness in €millions (per traffic death or in-patient) for a number of lorry and van traffic measures (Langeveld & Schoon, 2004; ECORYS, 2002).

Cost-effectiveness amounts are only interesting when many different measures are compared. It is difficult to accurately estimate the road safety effect of 'softer' measures such as promoting a safety culture, education, and information campaigns. Therefore, we have not included this type of measure in *Table 2*. This by no means indicates that such measures cannot be cost-effective. We must also remember that when a measure is cost-effective for society, it does not necessarily mean that it is also cost-effective for a haulage company. If measures are not profitable for the company, but they are socially beneficial, it is the government's task to find ways to introduce the measures. In order not to worsen the competitiveness of national haulage companies, these measures should preferably be taken at the EU level.

### Conclusions

Road crashes with lorries and vans cannot be tackled by generic road safety measures only. Because of their unique features, lorries and vans need specific measures. According to SWOV, much safety benefit can be achieved by modern vehicle equipment such as intelligent speed assistance (ISA), journey data recorders, and blind spot facilities. Considerable safety benefits can be expected in the future from rollover warning systems and fatigue warning systems, provided their specificity and sensitivity are improved. In addition, developing a safety culture within companies is of major importance. The large differences in mass between lorries and other road users are reason not to ignore infrastructural measures like separate target group lanes. Separate traffic rules, such as forbidding heavy vehicles in city centres, must also be taken.

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