SWOV Fact sheet

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. Infrastructural measures, such as target-group lanes and keeping heavy freight traffic away from urban areas can result in safer lorry and van traffic. In addition, (intelligent) facilities in the vehicle, such as speed limitation devices, can be used. Yet it is also important to encourage a safety culture in haulage companies.

Background and content
Lorries and vans share the road with other vehicles. Their large mass is the reason that crashes between lorries and other vehicles are often serious. The lorries' crash opponents suffer the most casualties. Although delivery vans are smaller and lighter than lorries, when they crash, the majority of the casualties are found at the crash opponent's side as well. In addition, the number of vans has been increasing strongly in the Netherlands in the last decades, from slightly more than 5% of all motorized vehicles in 1986 to nearly 10% in 2009 (CBS Statline, 2009). The proportion of lorries (including truck and trailers and special vehicles) remains quite constant and amounted to 2.3% in 2009, as against 2.5% in 1986.This fact sheet briefly discusses 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 Dutch figures for both parties.

Transport mode	Casualties	2001	2002	2003	2004	2005	2006	2007	2008
Delivery van	Occupants	42	36	55	14	20	21	35	28
	Crash opponents	84	82	102	79	62	62	45	59
Lorry	Occupants	16	11	8	10	11	9	7	10
	Crash opponents	154	111	139	125	92	123	110	89

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

The figures in *Table 1* show that, despite the fact that there are approximately four times more delivery vans than lorries, there are more fatalities among the lorries' crash opponents than among those of the delivery vans.
Lorries, however, travel many more kilometres. Therefore, we take the fatality rate as the comparison unit: the number of fatalities among the crash opponent per billion kilometres travelled. *Table 2* shows the Dutch fatality rates for crash opponents of lorries and delivery vans with the fatality rate for crash opponents of passenger cars as a comparison. Compared to a passenger car, the fatality rate for the crash opponent of a delivery van is almost a factor 2 higher, and is a factor 7.5 higher for the crash opponent of a lorry.

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

Table 2. *The Dutch fatality rate (the average of 2005-2006) defined as the number of fatalities among the crash opponent per billion kilometres travelled (Sources: BRON Ministry of Transport; Statistics Netherlands).*

For 2008, the transport modes of the fatalities among crash opponents of crashes with lorries were traced. The figures of the Ministry of Transport show that in the Netherlands in urban crashes the crash opponents are bicycles in 62% of the crashes, and pedestrians in 23% of the crashes. In non-urban crashes the crash opponents were passenger cars in 56% of the crashes, delivery vans in 13% of the crashes and motorcycles or scooters in 11% of the crashes.

Which types of crashes do lorries and delivery vans have?
Driving a lorry is different from driving a passenger car in more than one aspect. Among other things, this is caused by the characteristics of the vehicle: lorries are larger, less manoeuvrable, they accelerate more slowly than passenger cars and have a longer braking distance. Other differences can be found in characteristics of the task (dealing with freight, often making longer journeys in which there is a danger of fatigue), and in characteristics of the driver in relation to other road users. For example, many road users are not aware that they could be in the blind spot of the lorry, or that a lorry can swerve. What applies to lorries, to a lesser extent also applies to vans. Vans usually are larger and heavier than passenger cars, and a van driver also has a more limited rear view than a motorist. Because of all of these differences, a disproportionately large share of the crashes involving lorries and vans are specific types of crashes.

Manoeuvres
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; AVV, 2006). Annually, an average of 50 crashes in which a lorry turns over on a motorway is registered in the Netherlands. Vans are disproportionately more frequently involved in rear-end collisions in which the van hits a car, 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 (Bos & Twisk, 1999; Schoon, 2001).

Age
Young, novice drivers have a higher crash rate than older, more experienced drivers (see SWOV Fact sheet *Young Novice Drivers*). This is also to the case for lorry and van drivers. Although concrete data is lacking, road haulage companies often seem to employ young van drivers because they are cheaper. 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.

Fatigue
There are indications that lorry drivers are relatively more often than motorists involved in crashes where fatigue plays a role (ETSC, 2001; McKernon, 2008; see also SWOV Fact sheet *Fatigue in traffic: causes and effects*).

Freight
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, lorries can jack-knife. The nature of the freight (e.g. dangerous goods) can result in more serious consequences of a crash. Crashes can also occur when loading and unloading, especially in urban areas.

Blind spot
Lorries have a blind spot: from their position, lorry drivers cannot see other road users properly in certain locations. In the Netherlands, lorries turning right cause around 15 fatalities among cyclists per year (Schoon, Doumen & De Bruin, 2008), despite the fact that the blind spot mirror was made compulsory in 2003 (see SWOV Fact sheet *Blind spot crashes*).

Which measures can make lorry and delivery van traffic safer?

Road

At the road level, both the construction of infrastructure (such as target-group lanes) and traffic organization must be considered. One of the Sustainable Safety principles states that roads should be constructed in such a manner that meetings between vehicles that differ considerably in mass and speed are limited as much as possible. Advancing Sustainable Safety (Wegman & Aarts, 2006) proposes a logistics system that offers a solution for a large part of the so-called incompatibility between freight traffic and other traffic. In this system, heavy freight traffic only uses the main road network with grade separated intersections. Light freight vehicles, which have better safety provisions, only use the secondary road network.

Several Dutch municipalities and provinces, as well as the central government of the Netherlands, are making an effort to construct a so-called Quality Network Freight Transport. This network aims to guide the freight transport along specific road types, taking traffic flow, road safety and the environment into account. Several criteria have been drawn up to which a Quality Network Freight Transport should comply. To encourage use of these networks, the routes would need to be programmed into the companies' route planning and navigation systems.

Another measure at road level is to allow loading and unloading in city centres only at times during which there are few vulnerable road users on the road, and concentrating destinations of heavy vehicles at places where there are few cyclists and pedestrians. A survey of Dijkstra (2009) shows to what extent heavy vehicles are involved in crashes with slow traffic, especially those on 50 or 80 km/h roads. The report presents an overview of measures and provisions that can improve road safety on these road types.

Vehicle

Lower speeds reduce both the risk and the severity of a crash (see SWOV Fact Sheet *The relation between speed and crashes*). Several years ago, the Dutch delivery van trade and the authorities agreed to carry out a study of speed regulating devices in vans. This agreement also arranged that the trade would encourage the use of such equipment if it were shown to increase safety. The study showed that there is much support for such devices, among drivers as well as vehicle fleet owners. However, quantitative effects on speed behaviour were not found (University of Twente & Keypoint Consultancy, 2009).

There is also equipment, such as a fatigue alarm system, that can safeguard the driver's task skills. 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.

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. Anti-crash systems (such as Advanced Cruise Control or Lane Departure Warning Assistant) can help prevent a crash (Eenink, 2009). 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*).

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. Side-underrun protection, compulsory for new lorries in the Netherlands since 1995, to a large extent prevents vulnerable road users from sliding under the back wheels. When a lorry has closed side-underrun protection, the risk of road users getting under the back wheels is even smaller than when it has the open side-underrun protection (Van Kampen & Schoon, 1999).

Driver

Regarding the human factor, we must distinguish between measures that improve competence (knowledge and skills) and measures that 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. Early 2005, the European Commission rejected a separate licence for van drivers. However, as of 2007, drivers of vans with heavy trailers attached need a separate driving licence. Furthermore, there is the possibility of introducing a van driver diploma similar to the lorry driver diploma. This diploma is a certificate of competence , supplementary to the driving licence C/D. 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 crash data recorder. If these were used in combination with improving the company safety culture, the crash rate would decline by 20% (Bos & Wouters, 2000).

Freight
Measures to prevent unsafe situations 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 need to 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 '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 in these companies, 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 the lorry driver as often 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 (for example by not being in the blind spot; TLN & VVN, 2010; ROVG, 2010). Also, more attention to the vehicle characteristics of lorries and vans could 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 it costs to save one death or in-patient using a certain measure. 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 3*).

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 reminder	-	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 the crash 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 a crash data recorder.		

Table 3. *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 figures 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 3.* 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. In order not to worsen the competitiveness of national haulage companies, these road safety measures should preferably be taken at the EU level.

Conclusions and recommendations

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 anti-crash systems, 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, such as separate target group lanes. Separate traffic rules, such as forbidding heavy vehicles in city centres, must also be established.

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