

## Road safety aspects of agricultural traffic

### Summary

Agricultural vehicles or tractors are mainly used in rural areas, but also in urban areas. They are also regularly seen on public roads. According to the police registration in the Netherlands, there was an annual average of 13 fatalities and 98 inpatients as a result of crashes involving agricultural vehicles during the period 2005-2009. Most casualties occur in crashes with vulnerable road users (40%) and with passenger cars (37%). At the moment, a compulsory driving licence is being considered for all tractor drivers; presently only a 'tractor certificate' exists for 16 and 17-year olds. In addition, the Dutch Minister of Transport has put forward a proposal to increase the maximum speed of certain agricultural vehicles from 25 to 40 km/h in rural areas. According to the Sustainable Safety principle of homogeneity, agricultural vehicles should not drive on distributor roads, because of their low speed and should neither mix with cyclists and moped riders, because of their mass and other crash-unfriendly characteristics. However, separate service roads for agricultural traffic can often not be realized. Presently, various initiatives are being taken with respect to access to lands and logistic agricultural routes to meet this problem.

### Background and contents

In the Netherlands, agricultural vehicles include both agricultural and forestry tractors, (hereafter called tractors or agricultural vehicles), and self-propelled machinery used for farming, construction industry, development, civil engineering and the maintenance of public green spaces. Tractors are mainly used in rural areas, but also in urban areas as since 1995, tractors are permitted to be used for purposes other than for agriculture. The group of self-propelled machinery is part of the vehicle category 'motorized vehicle with limited speed'. According to estimates by Cumela (2009), in the Netherlands there are a total of 220,000 of this type of vehicles (200,000 tractors and 20,000 self-propelled machinery), but the Dutch Safety Board (OvV, 2010) estimate the number at 97,000 (85,000 and 12,000 respectively). This amounts to 1 to 2.4% of the vehicle fleet in the Netherlands.

In principle, this fact sheet will only discuss the road safety aspects of tractors (or agricultural vehicles), not those of the vehicle category 'motorized vehicle with limited speed'. However, some requirements and measures relate to both categories. This fact sheet will successively discuss the requirements for agricultural vehicles, their drivers and the infrastructure, will briefly discuss some of the characteristics of crashes involving agricultural vehicles, and will look at measures that may improve road safety. Although the hazards of agricultural vehicles are not very striking in absolute casualty numbers, the attention paid in media, politics and among lobbyists is substantial. Subjective safety may play a role as well (see SWOV fact sheet [Subjective safety in traffic](#)), yet this fact sheet will not further discuss this topic.

### What are the requirements for agricultural vehicles?

According to the Dutch vehicle regulations, the loaded weight (mass) of a tractor should not exceed a maximum of 18,000 kg for two axles and 24,000 kg for three axles. The loaded weight including trailer(s) should not exceed a maximum of 50,000 kg. The maximum dimensions are 12 m long, 3 m wide and 4 m high, excluding mirrors, but including load. The maximum length of a combination with trailer(s) is 18 m. The load is allowed to extend a maximum of 1 m in this case. The road authority can grant an exemption for non-standard dimensions.

Similar to other vehicles, tractors should be fitted out with front dipped headlights, parking lights (on mudguards), indicators, rear lights, break lights and a left mirror. In addition, they must have two or four non-triangular red retro-reflectors as contour markers and a yellow revolving or flashing light if they are wider than 2.60 m and carry out works in or alongside public roads (RVV, 1990). A further characteristic of a tractor is the red retro-reflector in the shape of a truncated triangle at the back. In a recently published report the Dutch Safety Board concluded that the visibility and recognizability of agricultural vehicles can be a problem in the dark, despite these lighting regulations (OvV, 2010). Furthermore, tractors must have a rollover safety device or rigid occupant compartment in agreement with the Dutch Occupational Health and Safety Act. Sharp parts that may cause physical harm to road

users have to be covered. Contrary to the practice in many other European countries, tractors in the Netherlands have no registration number and, for this reason, need not undergo periodic testing.

### **What are the speed characteristics of agricultural vehicles?**

In the Netherlands, the legal maximum speed for tractors is 25 km/h, but they can often drive (much) faster. The Dutch Safety Board (2006) stated that this also frequently happens in practice: only 6% of the drivers interviewed indicated that they rarely drive faster than the 25 km/h limit and more than half stated that they often drive faster than 40 km/h.

There are also requirements for the braking power of agricultural vehicles. With a construction speed of a maximum of 30 km/h, the braking deceleration should at least be  $2.4 \text{ m/s}^2$ . With a construction speed of more than 30 km/h, this should at least be  $3.1 \text{ m/s}^2$ . This means that the stopping distance (reaction time + braking distance) of a tractor amounts to circa 15 m with a speed of 25 km/h and to circa 30 m with a speed of 40 km/h. This way, the stopping distance of a tractor is 30 to 50% longer than that of a passenger car. With a trailer, the braking distance even is substantially longer, because trailers do not have to meet any requirements for braking deceleration.

### **What are the requirements for drivers?**

A minimum age of 16 applies for tractor drivers. In the Netherlands, tractor drivers need not have a driving licence at the moment. In many other European countries at least a driving licence B is required. The Dutch Occupational Health and Safety Act requires no more than a 'certificate of competence' for 16 or 17 year-olds who work with an agricultural tractor on public roads. This is no driving licence in terms of the Road Traffic Act, even though it is often called a tractor driving licence. The requirements for this tractor driving licence are low compared to a driving test for cars or motorcycles, and even lower compared to the requirements for truck drivers. No certificate is needed for use of the tractor for private purposes.

### **Which roads are agricultural vehicles allowed to drive on?**

Legally, agricultural vehicles are allowed to drive on all roads with the exception of 1) trunk roads and motorways and 2) roads that are closed to slow traffic in general and agricultural vehicles and other slow-speed motorized vehicles in particular, indicated by the following traffic signs respectively:



In order to prevent large differences in speed, agricultural vehicles are recommended not to have access to distributor roads, at least in rural areas. However, if no suitable route is available via a service road or other access road, this can lead to accessibility problems in practice. For instance, service roads may be absent due to high construction costs, because of lack of space, or because traffic volume is low. In those cases, road authorities do indeed allow agricultural vehicles on distributor roads and provide the opportunity for motorized high-speed traffic to overtake these vehicles. This is not in agreement with the Sustainable Safety requirement of a physical or hard-to-cross separation of driving directions on distributor roads. Furthermore, agricultural vehicles on service roads are also a road safety hazard, when they have to mix with cyclists. For this reason, some road authorities have decided to build a service road as well as a bicycle lane.

In urban areas the position of agricultural vehicles is also a problem. They are often denied access to ring roads around the urban centre, as a result of which tractors have to drive through the centre (Jaarsma, Rienks & Hermans, 2010). However, because of their size, cover and field of vision, agricultural vehicles often do not belong there. In urban areas, agricultural vehicles are in fact only suitable on distributor roads with separate bicycle lanes, crossings and speed-reducing measures at crossings, as required by Sustainable Safety.

### **How many casualties are there in crashes involving agricultural vehicles?**

In the period 2005-2009, the Dutch annual average was 13 fatalities and 98 inpatients as a result of crashes involving agricultural vehicles. In the early 1990s, the numbers were slightly higher, with an average of 20 casualties and 120 inpatients. The rise in the share of inpatients as a result of crashes with agricultural vehicles keeps pace with the developments of other inpatients due to road crashes. However, the rise in the share of fatalities in crashes with agricultural vehicles remains behind that of other crashes. In the early 1990s, circa 1% of all fatal crashes involved agricultural vehicles; in recent years the proportion has been circa 2%.

Yet, these casualty rates are no more than an indication. The interpretation of the 'Agricultural Vehicles' category is not always uniform in the registration of crashes. Moreover, the definition of this category has changed over time. It shows from 45 police registration forms of fatal crashes in the period of 2006-2009 in which, according to the registration, 'agricultural vehicles' were involved, that it was a tractor in circa 80% of the cases; in 20% of the cases mainly self-propelled vehicles such as shovels, cranes and sweepers<sup>1</sup> were involved. The forms showed that 44% of the tractors involved in fatal crashes had a trailer.

### Who are involved in crashes with agricultural vehicles?

In the period 2005-2009, circa 6% of the Dutch casualties (fatalities and inpatients) of agricultural vehicles occurred in single vehicle crashes. The share of casualties in crashes involving two agricultural vehicles was negligible (0.2%). The most important crash opponent is the passenger car; in this period 37% of the casualties in crashes with agricultural vehicles occurred in crashes with a passenger car. The share of casualties in crashes between agricultural vehicles and the entire group of vulnerable road users (pedestrians, cyclists, moped riders and motorcyclists) was slightly higher: circa 40%. Furthermore, 7% of the casualties occurred in crashes with a van or truck and 9% with another vehicle type. Little has altered in this distribution during the last two decades. The only exception seems to relate to the share of cyclists among the casualties. This has slowly risen from 7% to 14%. The reason for this increase is not clear, but the development fits the national trend of casualties among cyclists (see SWOV fact sheet [Cyclists](#)).

Among the drivers of the crash involved agricultural vehicles, in 2009 circa 9% turned out to be younger than 18 years, 18% was between 18 and 24 year of age and 70% was older than 24. This is no indication of the crash rate for young drivers of agricultural vehicles, because exposure data is lacking.

### Where and when do crashes with agricultural vehicles occur?

In the period of 2005-2009, circa three-quarters (72%) of the casualties (fatalities and inpatients) of crashes with agricultural vehicles occurred in rural areas and more than a quarter (28%) in urban areas. Of the remaining crashes, the urban-rural ratio was circa 45%-55%. The share of casualties in crashes involving agricultural vehicles in urban areas has risen these last five years, whereas that of crashes with other vehicles remained the same. When we subsequently look in *Table 1* at the crashes on 30 and 50km/h roads (in urban areas) and 80km/h roads (in rural areas) independently, it turns out that in 2008<sup>2</sup> the majority of fatalities and hospitalized injured, both in absolute and relative terms (casualty rate), occurred on 50 and 80km/h roads (*Table 1*).

Speed limit	Distribution of casualties	Estimate of the road length (km)	Distribution of road length	Casualty rate per 1000 km
30 km/h	11%	50,300	70%	0.2
50 km/h	21%	21,600	30%	1.0
60 km/h	19%	35,400	58%	0.6
80 km/h	48%	25,500	42%	1.9

Table 1. *Distribution in 2008 of the average share of casualties (fatalities and inpatients) and estimated road length on roads with various speed limits in the Netherlands (in the case of casualties: speed limit as registered by the police; sources: Dutch Ministry of Transport; Weijermars & Van Schagen, 2009).*

Around 30% of the Dutch casualties in crashes involving agricultural vehicles in the period of 2005-2009 occurred on junctions and 70% on a road section. This has not changed much over time. For all other crash types the ratio of junction-road section was circa 45%-55%. In crashes with agricultural vehicles, the ratio tends towards more casualties on a road section. The share for crashes involving agricultural vehicles at dusk or in the dark was around 30% during this period. This is comparable with the share for other traffic and has not changed over time.

<sup>1</sup> When the remainder of this fact sheet mentions crashes/casualties with agricultural vehicles, this also implies that part of these in actual fact concerns self-propelled vehicles.

<sup>2</sup> In this case only one year has been considered, because the total length of 60 and 80 km/h roads still changes yearly.

### **Which types of crashes are agricultural vehicles involved in?**

When we compare the types of crashes involving agricultural vehicles with the crash types involving other vehicles, it is striking that in the period 2005-2009 fewer casualties occurred in crashes with a 'fixed object', such as a lamp post or tree (3% agricultural vehicles compared to 17% other), but more in frontal crashes (22% compared to 15%) and in side impacts (50% compared to 36%). The share of rear-end collisions with agricultural vehicles was comparable with that of other types of transport: 13% compared to 12%. Based on in-depth research into eleven crashes, the Dutch Safety Board (OvV, 2010) concluded that especially the width of the (agricultural) vehicles in combination with narrow access roads constitutes an important cause of crashes, as well as the fact that the driver's visibility is often blocked by parts of the vehicle or load.

### **Which are possible safety measures?**

As long as agricultural vehicles are not safe and compatible with other traffic, especially vulnerable road users, they should drive on public roads as little as possible. If this cannot be avoided, measures can be taken to improve the road safety of and in relation with agricultural vehicles. These can be measures with regard to driver, vehicle, position on the road, infrastructure and layout of the road network. It should be taken into account that the insight into the causes of the hazards of agricultural vehicles is limited and that, as a result, the exact effects of the various measures are hard to assess.

#### *Drivers*

At present there are no legal requirements for tractor drivers – aside from the 'tractor certificate' for 16 and 17-year olds. Training safe participation in traffic with these exceptional vehicles could enhance the safety of agricultural vehicles. In 2008, the Dutch Agricultural Vehicles Initiative (VVN, 2008) recommended the introduction of a compulsory driving licence for all drivers of (agricultural) vehicles: a T-driving licence for those aged 18 years and over and a T-driving licence with restrictions for load, trailer and width for 16 and 17-year olds. In reply, the Minister recommended also accepting the B-driving licence for those aged 18-year and over, and not imposing restrictions for 16 and 17-year olds with respect to vehicle characteristics. In October 2010, a resolution was passed in Parliament requesting the Minister to introduce a compulsory T-driving licence for all drivers of agricultural vehicles and not to permit the B-driving licence for this purpose. The Dutch Safety Board (OvV, 2010) recommends paying extra attention in the examination requirements to the hazards of driving agricultural vehicles on public roads, in particular the hazards for other road users, and warranting this attention by means of permanent training and education.

#### *Vehicle*

Presently, Dutch agricultural vehicles have no registration number. For various reasons, registration numbers are often recommended, among other things because it makes enforcement by registration number and checking possible technical certificates easier. As it is not known to what extent traffic violations by drivers of agricultural vehicles result in (extra) hazards, the effect of enhanced enforcement can, however, not be estimated.

The Dutch Safety Board recommends laying down vehicle safety more efficiently in regulations, by introducing type approval requirements for all types of agricultural vehicles and a (periodical) inspection (OvV, 2010). Registration numbers are also a necessary requirement in this case and criteria should also be set up and be maintained. Finally, a type of registration number in accordance with the Agricultural Vehicles Initiative (VVN, 2008) is a prerequisite for the purpose of checking (by means of a type approval) whether tractors that drive 40 km/h are actually constructed for this purpose. The Minister specifically intends to increase the maximum speed in rural areas from 25 km/h to 40 km/h for certain tractors that can be recognized by a special speed sign at the rear. This proposal does not include checking construction speed.

Further safety provisions for and on agricultural vehicles cannot be realized all that easily. Tractors are initially designed for use on farms and in the fields. It will have to be considered how safety provisions, such as bumpers and side underrun protection/covers combine with the necessary functionality of tractors. These provisions and blind spot mirrors are already installed on trucks. Therefore, trucks are preferable to tractors for certain kinds of transport on public roads. It should be noted, however, that the use of (large) trucks on (narrow) access roads and roads in urban areas in particular is equally undesirable from the road safety perspective.

#### *Infrastructure and integrated network design*

The most suitable place on the road for agricultural vehicles cannot be determined easily, considering the Sustainable Safety principle of homogeneity of speed and mass. Preferably, land use and the

organization of farms should be such that agricultural vehicles hardly need to drive on public roads. In this context, Jaarsma, Rienks & Hermans (2010) point towards the options of exchanging parcels and redesigning the structure of rural roads, as a result of which access to lands will only occur via access roads. Previously, CROW (1991) discussed the option of constructing tracks at the rear side of the parcels. In *Advancing Sustainable Safety*, Wegman & Aarts (2006) recommend target lanes for trucks, with respect to the problems with freight transport. Reasoning by analogy, in the long term, (agricultural) vehicles do not belong on public roads at all, but on such a target lane. Fietsberaad, the center of expertise on bicycle policy, (Godefrooij et al., 2008) elaborated this concept using unsurfaced or partly surfaced tracks as service roads. Presently, the concept of so-called logistic agricultural routes is being developed in the Dutch provinces of Zeeland and Fryslân. This has to result in a (regional) quality network for safe and unobstructed agricultural traffic (Blommaert, 2010).

In addition to these structural, network-oriented solutions, road section-oriented measures can also contribute to a short term solution. Assuming that agricultural vehicles cannot be kept away from access roads, it is in any case important to reduce the speed on both road sections and junctions with a view to vulnerable road users. Considering the difference in speed with the ordinary motorized vehicles, it is to be recommended not to allow agricultural vehicles on distributor roads. A service road would be more suitable for those routes. However, considering both the difference in speed and the differences in mass and structure between agricultural vehicles and cyclists, neither should these two modes of transport be advised to mix on these service roads (CROW, 2006). One option to prevent this is the construction of a two-way cycle track along one side of the main road and a two-way service road for agricultural vehicles along the other side. Another option is to still allow agricultural vehicles on the distributor road, possibly at a higher permitted speed plus additional stricter requirements for both vehicle and driver. According to *Advancing Sustainable Safety*, a road should have a physical separation of driving directions or a separation that is difficult to cross with a speed faster than 70 km/h. However, in that case options for passing at so-called 'passing spaces' ahead of or following junctions are important. Such options can reduce the delays for other traffic and, subsequently, may also reduce irritation (Jaarsma et al., 2003). Building left-turning lanes in conformity with the Dutch *Road Design manual (Handboek Wegontwerp)* (CROW, 2002) is also mentioned as a measure for preventing the occurrence of side impact and rear-end crashes on distributor roads (OVV, 2010).

## Conclusions

According to the police registration in the Netherlands, there was an annual average of 13 fatalities and 98 inpatients as a result of crashes involving agricultural vehicles during the period 2005-2009. Most casualties occur in crashes between agricultural vehicles and vulnerable road users (40%) and between agricultural vehicles and passenger cars (37%).

Presently, various developments are taking place with respect to agricultural vehicles. For instance, in 2010 the Minister of Infrastructure and the Environment, previously Transport, Public Works and Water Management, recommended introducing an obligatory driving licence for all tractor drivers in 2010. The Minister also recommended increasing the maximum speed for certain vehicles from 25 to 40 km/h in rural areas, provided that the vehicles to which this higher speed applies can easily be recognized. Also the benefits of registration numbers are often mentioned in this and other contexts.

As long as agricultural vehicles are not safe and not compatible with other road users, especially vulnerable road users, they should only be allowed on public roads as little as possible. Considering the Sustainable Safety principle of homogeneity, tractors should not drive on distributor roads because of their low speed, and should neither merge with cyclists or moped riders because of their crash-unfriendly characteristics. However, a separate service road exclusively for agricultural vehicles is often hard to realize in practice. The various initiatives with respect to access to lands or logistic agricultural routes may solve part of this problem.

In general, for a proper basis of measures, greater insight into the expected effect and, subsequently, the cost-effectiveness of those measures would be required.

## Publications and sources (SWOV reports in Dutch have an English summary)

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