



# Dutch National Bicycle Safety Research Agenda: the way to safer cycling

**Cycling is very popular in the Netherlands and it is promoted because of its positive effects for environment, traffic flow and personal health. However, with a quarter of the road fatalities and more than half of the serious injuries being a cyclist, their safety situation requires serious attention and action.**

The Netherlands is one of the world's leading bicycle countries. With about 16.5 million inhabitants and an estimated 14 million bicycles, almost every Dutchman owns a bicycle. Therefore, bicycle density, in particular in cities and towns, is enormous. Each year Dutch cyclists travel almost 15 billion kilometres, mainly in trips to and from work, school, shops and leisure trips. In comparison with many other countries, with around

25%, the recreational use of bicycles is low in the Netherlands. Being a real bicycle country, the Netherlands has a large infrastructural network for cyclists, with many bicycle paths, lanes and crossings, special conflict-free bicycle traffic lights, and dedicated bicycle parking places. Much to the surprise of 'foreigners', they rarely see a Dutch cyclist wearing a helmet.

Especially for trips shorter than 7.5 kilometres,

national and regional governments actively promote the use of bicycles as a transport mode that is 'green', helps to reduce congestion and is good for your health. However, there is one important aspect that needs to be tackled and that is the road safety situation of cyclists.

In 2009, in the Netherlands, 185 cyclists were killed in traffic and 8,000 were seriously injured. The crash statistics of the last decades indicate that the reduction in fatalities amongst cyclists remains behind that of other road user groups. The number of serious injuries among cyclists has even been

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QUOTE

**"Riding bicycles will not only benefit the individual doing it, but the world at large."**

Udo E. Simonis, Emeritus Professor  
of Environmental Policy at  
the Science Centre, Berlin

# Electric vehicles: road safety effects for cyclists

The use of electric vehicles in the Netherlands is still in its infancy, but their numbers are growing. Therefore, SWOV carried out a first investigation of the effects electric vehicles have on road safety.

National and local governments stimulate the purchase and use of electrically powered vehicles from environmental considerations. In 2010, 0.5% of the vehicle fleet in the Netherlands were hybrid passenger cars; the fully electric passenger car has not yet really begun its rise. Furthermore, there are some electrically powered buses, trucks, delivery vans, and motorcycles in the Netherlands. Electric delivery vans are expected to replace conventional fuel powered delivery vans for urban distribution in particular. At present the number of fully electric moped scooters is growing considerably in the Netherlands.

## Sound and speed

At low driving speeds the engine of an electrically powered motor vehicle produces hardly any sound: international research shows that these cars are almost soundless at speeds lower than about 20 km/h. At higher speeds the sound of the tyre in contact with the road is more prominent. Whether or not this sound is heard by cyclists largely depends on the type of road surface and amount of the city noise. An American crash study performed by the



National Highway Traffic Safety Administration (NHTSA) compared the crash involvement in crashes with cyclists and pedestrians

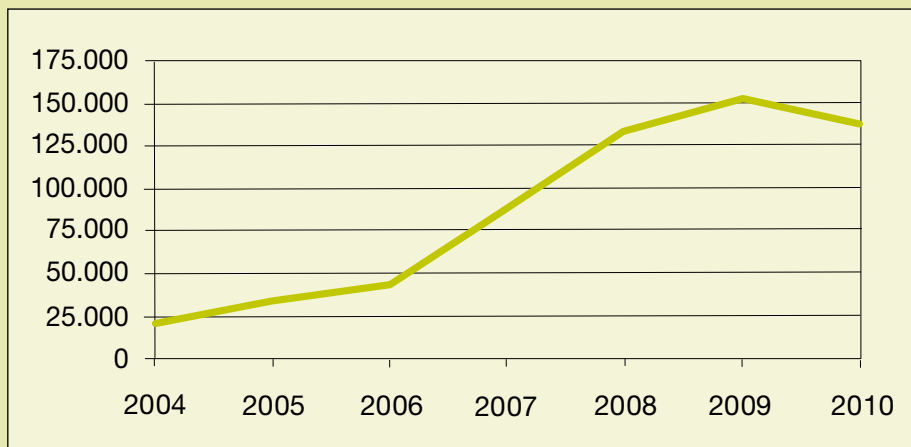
for hybrid vehicles and conventional vehicles. On urban roads with a speed limit of up to 35 km/h, cyclists and pedestrians appeared to be involved in crashes with hybrid cars by a factor of 1.5 more than in crashes with conventional cars. However, exposure was not corrected for. Indeed, if electric vehicles were to drive more kilometres in urban areas than conventional vehicles, this would make a higher number of crashes understandable. On roads with speed limits higher than 35 m/h no differences were found between the involvement of hybrid vehicles and conventional vehicles in crashes with pedestrians and cyclists. The number of crashes in the Netherlands in which electric vehicles are involved, cars as well as mopeds, is too small for conclusions about the risk of being involved in crashes.

## Artificial noise?

There are several developments aimed at adding artificial noise to electric vehicles. The Japanese government has already set a concept standard which makes requirements of the sound level of electric vehicles at speeds up to 20 km/h. Also in Europe acoustic warning systems and possible standards are being developed. At present

## Growing numbers

Data shows that the market for electric bicycle continues to grow. In 2009, more than 150,000 'e-bikes' were purchased, a growth of 30%. This type of bicycle now has a market share of 10 per cent and, with a price of about 1900 euros, constitutes one quarter of the bicycle sales.



Annual sales data of electric bicycles in the Netherlands (BOVAG-RAI, 2010; in Loijen, 2011).



it is not clear whether adding artificial noise to electric cars and other e-vehicles is necessary to prevent crashes with vulnerable road users like cyclists. Balanced judgements require further research using interviews and behaviour and conflict observations in daily traffic. In 2012 SWOV will start a research project into the safety of electric cars.

### Electric bicycle

The electric bicycle or e-bike with amplified pedalling effort is a separate category within the e-vehicles. The e-bike is particularly popular among older road users, but increasingly so among other users like commuters and secondary school pupils (for data see box). Because of their higher speeds, it is to be expected that the risk is higher for e-bike riders than for cyclists riding 'ordinary' bikes; however, no study has been made yet. This raises the question how much higher the risk is for e-bikes, and in which situations this is the case. Increased use of the e-bike is very likely to result in an increase of the number of casualties. ■

## Safety in numbers: more cyclists, lower risks?



A swarm of birds or insects, a school of fish, a flock of sheep, a pack of wolves. Language has many possibilities to indicate a group of animals. Biology has taught us that a group offers protection and increases safety for the individual members of the group. It is more difficult for a predator to attack a group than one single animal. For this reason a predator uses the strategy to isolate an animal from its flock before attacking it.

This is also the thought that occurred to me when studying cyclist safety: why not compare the safety of one individual cyclist with the safety of a group of cyclists. The risk of the one single cyclists is greater than that of a cyclist who is part of a group. The American researcher Jacobsen compared the casualties among cyclists in different countries and tried to establish a relation with the amount of bicycle traffic. He concluded that "Policies that increase the numbers of people bicycling appear to be an effective route to improving the safety of people bicycling". In other words: add more cyclists to traffic and cyclist safety will increase. This is a popular idea among those who put effort into stimulating cycling and therefore Jacobsen's conclusion is quoted frequently in these circles. However, I believe that this conclusion is not correct. I will try to explain why.

If there is much cycling in a country, the risk for cyclists is indeed lower. Comparison of statistics of different countries offers conclusive evidence. The risks in countries that have a lot of cycling like the Netherlands and Denmark are (much) lower than in countries where cycling is a less important mode of transport. The explanation may be twofold. Firstly, there are the expectations of the other road user. If a driver does indeed expect a cyclist on the road, as is the case in the Netherlands and Denmark, the risk is lower. But a second explanation is conceivable: if there are more cyclists, more safe cycling facilities will be constructed (which in turn make cycling more pleasant). We have sufficient evidence that cycling facilities (like bicycle tracks) reduce the risks of cycling. Not only do the Netherlands and Denmark have many cyclists, there are also many cycling facilities.

I do not expect that just a greater number of cyclists will on its own result in a risk reduction for the cyclist. On the other hand, I do expect that more cycling facilities will lead to lower risks. Policy that only focuses on an increase in cycling and at the same time ignores the construction of more cycling facilities, will not have a positive effect on road safety. Unless, of course this policy also takes care of cyclists only cycling close to one another: in a swarm, school, flock, or pack of cyclists.

Fred Wegman (Director-manager SWOV)

## Publications

***Traffic safety consequences of electrically powered vehicles.*** C. Schoon & C. Huijskens (2011). R-2011-11. SWOV, Leidschendam. [In Dutch, with a summary in English]

***Elektrische fietsen in de stroomversnelling.*** J. Loijen (2011). Faculty of Civil Engineering, TU Delft.

## Dutch National Bicycle Safety Research Agenda: the way to safer cycling

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increasing by about 25%. In the Netherlands a quarter of the road fatalities and more than half of the serious injuries is currently a cyclist. A year ago, at the Dutch national road safety conference NVVC, SWOV Managing Director Fred Wegman called upon all key players to join forces and to improve the poor safety position of cyclists. SWOV took the initiative under the expert guidance of Divera Twisk, coordinator of the cycling research programme. One of the first

actions was to look at the existing knowledge, identify the gaps, and bring colleague researchers and stakeholders together to discuss the topic and decide on the research priorities for the coming years: the Dutch National Bicycle Safety Research Agenda. This agenda is expected to be published in the first half of 2012.

This special bicycle issue of Research Activities contains various articles about studies and research topics in relation to cyclist safety in the Netherlands. For example, you will find articles about bicycle crash statistics, blind spot crashes,

distraction while cycling, the bicycle airbag, bicycle helmets, the potential problem of electric vehicles, and many other subjects. As you will see, quite some knowledge from research is available in the Netherlands. Nevertheless, in comparison to what we know about cars and car drivers, surprisingly little is known about bicycle safety. We expect that joining forces and coordinating research efforts in this area will substantially increase our knowledge and speed up the development and implementation of measures to improve safety of cyclists. ■

# Cycling fatalities in blind spot crashes



**The annual number of fatalities among cyclists in blind spot crashes shows large fluctuations, but a slow decline seems to be indicated. Blind spot crashes happen when a truck turns off and fails to notice or is unable to see the cyclist who is positioned immediately beside or in front of the truck. SWOV has been studying the blind spot issue at regular intervals.**

Over the years, several measures were taken to prevent this type of crashes. Some of the blind spot measures were the result of European legislation. During the 1980s, for example, the so-called kerb-mirror was made compulsory, and during the 1990s this was the case for side underrun protection. In 2003, the Netherlands made the blind spot mirror compulsory. The extra attention and media publications accompanying the introduction of this measure were probably the reason for a reduction of the number of blind spot casualties in 2002 and 2003. Unfortunately the reduction was only temporary. In 2007, the EU came with new, stricter rules for the visual field of trucks. The introduction of a front view system which makes it possible to see whether a road user is positioned immediately in front of the truck was new for the Netherlands in those days.

## Three causes

In 2008, SWOV made an extensive study into the causes of blind spot crashes and possible solutions. Three main causes were identified:

- The visual field is still insufficient, especially for high trucks that were manufactured before 2007 and do not have front view system.
- Truck drivers do not make the best possible use of the different mirrors or these mirrors are not adjusted correctly.
- Cyclists insufficiently take account of the fact that trucks have a limited visual field.

## Measures

In SWOV's opinion, the ultimate solution for the blind spot problem is a structural separation of trucks and cyclists. How this must be organised and what the economic consequences will be, requires further study. For the time

being, the solution can be found in separating cyclists and trucks at intersection, both in time and position. Furthermore, it is important to make both the truck driver and the cyclist more aware of the hazards. For drivers this means that it should be an automatism to carry out an "after check" to see if the road is clear when they pull up. This is a task for the driver training. The front view system is important here and SWOV recommends to make this also compulsory for trucks manufactured before 2007. Although several warning systems are being developed to warn drivers that cyclists are



Truck mirrors

present, it is not yet clear whether these systems will be sufficiently reliable.

The traffic mirror, also known as black spot mirror, is mounted on the pole carrying the traffic lights to provide truck drivers with a better view of cyclists at the right-hand side and front of their vehicle. This mirror has been found to barely influence truck driver behaviour and is only effective while the truck is stopped in front of the mirror. Therefore, the mirror is not effective at the location where he driver has to carry out the after check.



### Code of conduct and education

Earlier, SWOV advised that a code of conduct for cyclists should be developed, which makes clear which position they ought to take at intersections when a truck is present.

The Dutch Cyclists' Union and the Ministry of Transport have collaborated in developing such a code of conduct and in 2009 this code was communicated using a public information campaign and the website [www.dodehoek.nl](http://www.dodehoek.nl). Education has already been used for several years to raise awareness in children of the blind spot hazards and to teach them how to deal with them. The evaluation of an educational project indicates that providing children and youngsters with very specific and concrete rules of conduct results in safer behaviour. A more general approach to point out the blind spot hazards, on the other hand, was found to have no effect.

### Improvement

The period has been too brief to conclude that there has been a structural improvement, but in recent years there have been considerably fewer fatalities among cyclists in blind spot crashes than in earlier years (see Figure). ■

## Publications

### *The problem of lorries turning right.*

C. Schoon (2006). R-2006-2. Leidschendam, SWOV. [In Dutch, with a summary in English]

### *The circumstances of blind spot crashes and short- and long-term measures.*

C. Schoon, M. Doumen. & D. de Bruin (2008). R-2008-11A en R-2008-11B. SWOV, Leidschendam. [In Dutch, with a summary in English]

*Blind spot crashes.* SWOV Fact sheet, May 2009.

### *Model design for Blind spot Detection and Observation Systems.*

D. Hoedemaeker, M. Doumen, M. de Goede, J. Hogema, R. Brouwer, & A. Wennemers (2010) Rapport TNO-DV 2010 C150. Soesterberg, TNO Defence, Security and Safety. [In Dutch, with a summary in English]

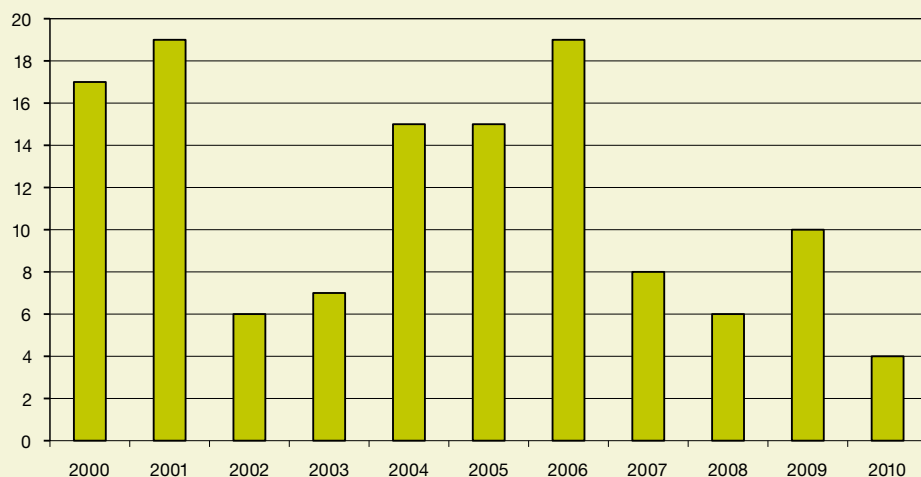
## The Dutch Ministry of Infrastructure and the Environment: Kate de Jager on bicycle safety

“Opportunities for improving bicycle safety can for example be found in joining in with other aspects of cycling like making cycling more comfortable and removing annoyances for cyclists. If we want to cycle more comfortably: we can think of beautiful (and safe) bicycle routes with the fewest possible intersections with motorized traffic, and of bicycle innovations. With electronics ‘on board’ the electric bicycle offers interesting perspectives. One could think of a warning system when the bicycle approaches an obstacle.

Combining knowledge and ideas to a larger degree also offers opportunities for increasing bicycle safety. This can be achieved by more attention for citizen initiatives, closer cooperation with the bicycle manufacturers, and a relationship with health and recreational policy at both regional and national level.” ■



Numbers of cyclist fatalities in blind spot crashes in the Netherlands



Source: Centre for Transport and Navigation, Ministry for Infrastructure and the Environment.



# Infrastructure and bicycle crashes: safety increasing, yet more to do

The road safety investments that were made in the Netherlands during the past 20 years are beginning to pay off. Investments in infrastructure have already made a large contribution, but there are still many possibilities to make the infrastructure even safer for cyclists. This article looks at the effects of Zones 30 and roundabouts and discusses infrastructure in relation with elderly cyclists.



This latter solution is to be preferred: there are considerably fewer casualties on roundabouts with separate bicycle tracks.

Not only does the layout of roundabouts in the Netherlands vary considerably, the priority regulations for cyclists also differ between roundabouts. Whereas cyclists never have right of way on rural roundabouts, there is no univocal regulation for priority on urban roundabouts. Cyclists have right of way on an estimated 60% of the urban roundabouts. SWOV research has shown that it is safer if cyclists do not have right of way. If the priority regulations for urban roundabouts would be changed into a compulsory 'cyclists do not have right of way', the number of serious road injuries in comparison with an ordinary junction would be reduced by 87%. If cyclists would have right of way on



## Zones 30: a success

In the Dutch Sustainable Safety vision, residential areas or Zones 30 should have a 30 km/h speed limit, because crashes at speeds lower than 30 km/h rarely have fatal consequences. Pedestrians and cyclists can mix safely with motor vehicles at this speed limit. The lower driving speeds are mainly enforced by speed reducing infrastructural measures.

The number of injury crashes declines by approximately 25% when a 50 km/h area is converted into a Zone 30. In 2008, 70% of all urban roads in the Netherlands had a 30 km/h speed limit. It is estimated that in 2008 the construction of 30 km/h roads had prevented approximately 51 to 77 fatalities compared to the situation in 1998.

## Roundabouts

The number of road casualties decreases considerably when an intersection is replaced by a roundabout. Roundabouts in the Netherlands may have different facilities for cyclists: they sometime have with bicycle lanes, but they can also be fitted with separate bicycle tracks.

## Confluence of factors

Paul Schepers of the Centre for Transport and Navigation (DVS) in the Netherlands has investigated the extent to which quality and layout of the infrastructure contribute to single-vehicle bicycle crashes, crashes in which no other road users are involved. Not only do unsafe behaviour and poor bicycle quality play a role; the infrastructure also makes an important contribution. Approximately 80% of the single-vehicle bicycle crashes occur in streets, separate bicycle tracks, and on bicycle lanes. The proportion of single-vehicle bicycle crashes on other road types is no more than 20%: 12% occur on footpaths and parking spaces and 6% occur on soft surface or unsurfaced roads, mainly in forests and sometimes in parks. This study indicates that one or more infrastructure-related factors play a role in approximately half of the single-vehicle bicycle crashes. These causes cannot be considered in isolation: bicycle crashes are often caused by a confluence of factors. Schepers has identified the following causes:

- Causes found in the interaction between cyclists and infrastructure, e.g. the space the cyclist needs and the width of the bicycle facilities;
- Causes found in the interaction between the bicycle and the infrastructure, e.g. the tyre grip and the roughness of the road surface;
- Causes related with the policy area of infrastructure, e.g. maintenance policy.

Furthermore, Schepers indicates that further study is required to answer the question of how road authorities can make a contribution to reducing single-vehicle bicycle crashes.



## Visibility of obstacles and road course important

The majority of bicycle crashes are single crashes without other traffic involved. Often these crashes involve elderly cyclists. The visibility of the bicycle infrastructure seems one of the important factors in this type of crashes. A questionnaire and interview study by the University of Groningen (Fabriek et al., to be published) showed that elderly and visually impaired people encountered specific problems with the visibility of bollards and kerbs, and with cycle path markings. Subsequently, the researchers carried out an outdoor experiment to evaluate the identified critical situations in real life. The subjects in the experiment wore special goggles to imitate low contrast sensitivity and a restricted visual field size. The results show that reduced visibility of bicycle infrastructure generally affects the cycling performance in a negative way. Moreover, cyclists feel less safe when visibility is poor. The visibility can be improved by using red-white bollards rather than black or grey ones, by painting the kerbs white and by applying high contrast road markings to mark the edge of the cycle path.

all Dutch roundabouts this reduction would amount to 11%.

### Infrastructure and senior cyclists

Getting older comes with functional disorders that can increase the risk of being involved in a crash. The deterioration of motor functions is one factor in the increased risk of crashes: slower movements, decline in muscular strength, decline in fine motor skills, and a large decline of the capabilities to adjust to the sudden changes in posture. An infrastructure that takes account of these problems can help to reduce the crash involvement of senior cyclists.

If seniors are asked which types of measures they find necessary to make them feel safer when cycling, they mainly suggest the construction of more new bicycle tracks, widening existing bicycle tracks, and better maintenance of these tracks. Other measures that can be taken to increase road safety for senior cyclists are a more predictable road course and the removal of obstacles like bollards. If obstacles cannot be removed, they should be made more noticeable. ■

## Publications

*Frequency and causes of single-vehicle cyclist accidents.* C. Schoon & A. Blokpoel (2000). R-2000-20. SWOV Leidschendam. [In Dutch, with a summary in English]

*Are roundabouts with separate cycle tracks also safe for cyclists?* A. Dijkstra (2004). R-2004-14. SWOV, Leidschendam. [In Dutch, with a summary in English]

*The balance struck; Sustainable Safety 1998-2007.* SWOV, Leidschendam. [In Dutch, with a summary in English]

*The elderly and infrastructure.* SWOV Fact sheet, April 2010.

*Zones 30: urban residential areas.* SWOV Fact sheet, December 2010.

*How to make more cycling good for road safety?* F. Wegman, F. Zhang & A. Dijkstra (2012). In: Accident Analysis & Prevention. doi:10.1016/j.aap.2010.11.010

*Improving the visibility of bicycle infrastructure.* E. Fabriek, D. de Waard, & P. Schepers. In: Journal of Human Factors and Ergonomics (to be published).

*The role of infrastructure in single-vehicle bicycle accidents.* P. Schepers (2008). Rijkswaterstaat Dienst Verkeer en Scheepvaart. [In Dutch].

*Cycling in the dark: how dangerous is it?* M. Reurings (2010). R-2010-32. SWOV, Leidschendam.





# Music and phone calls: increased risk while cycling

**Using a mobile phone or a portable media player while cycling increases the risk of a crash. Young cyclists in particular use such devices while riding their bike. These are two of the findings in a SWOV study into the use of media devices by cyclists.**

In recent years, a few studies have been carried out in the Netherlands into how and how often portable media devices and mobile phones are used by cyclists in the Netherlands and what effects on road safety this may have. An observation study in the city of Groningen by De Waard, Schepers, Ormel & Brookhuis in 2010, for example, showed that about 5% of cyclists were listening to an mp3 player, more than 1% was using a phone, and 0.3% were texting. An experiment in which the participants had to cycle while they were listening to music and using their phones, and were told to stop when they were given an audio signal, indicated that their cycling became less safe than when they did not listen to music. The audio signal often went unnoticed when the participants were listening to music, especially when in-ear headphones were used. When a mobile phone was used the cyclists' reaction was slower than without a phone being used or they didn't react at all, irrespective of whether a handsfree or a handheld phone was used.

## Internet survey

An internet survey that SWOV carried out in 2009, showed similar results: 15% of the Dutch cyclists said they listened to music during (almost) every trip. More than 3% of the

cyclists report making or receiving a phone call during (almost) every trip; 3% of the cyclists sends or read a text message during (almost) every trip; and nearly 2% of the cyclists surf the internet during (almost) every trip. The proportions are highest among the 12-17 year olds. The use of media devices while cycling is very much age-dependent. Three quarters of the young cyclists between 12 and 17 years old sometimes use media players and also 75% sometimes use a mobile phone. Among the over 50s these proportions are an eighth and a third respectively. Much more than young cyclists, older cyclists indicate not using their devices in busy or other complex traffic conditions.

## Risk

The use of these types of devices while cycling appears to increase the risk of being involved in a crash. This conclusion can be drawn on the self-reported use of portable media players and mobile phone and the self-reported involvement in crashes with or without injury. A modest estimate on the basis of self-reported information indicates that the risk of a bicycle crash increases by 30% for a cyclist who uses the mobile phone and listens to music during *every trip* than it is for a cyclist who never

uses media devices. Approximately 9% bicycle crashes with injury are preceded by the cyclist using devices. This means that these are the bicycle crashes in which the use of media devices may have played a role. Other distracting factors like talking with another cyclist, taking out a sandwich or being lost in thought are mentioned three times more frequently than activities preceding a bicycle crash.

## Serious problem

The various research findings give an indication of the higher risk due to listening to music and using the phone while cycling. From a road safety point of view it is wise to refrain from listening to music and conducting phone conversations while cycling. SWOV finds it advisable to use public information and education especially focused on young cyclists to point out the hazards of using media devices while cycling. ■

## Publications

***Mobile phone use while cycling: incidence and effects on behaviour and safety.*** D. de Waard, P. Schepers, W. Ormel & K. Brookhuis. (2010). In: *Ergonomics*, vol. 53, nr. 1, p. 30-42.

***The use of portable media players and mobile phones while cycling.*** Ch. Goldenbeld, M. Houtenbos & E. Ehlers. (2010). R-2010-5. SWOV, Leidschendam. [In Dutch, with a summary in English]



# Bicycle helmets

## The pros and cons

### Helmets in the Netherlands

Bicycles are very popular in the Netherlands and are widely used for activities such as commuting, shopping, transporting children and recreation. However, cycling can also result in injury, often including serious head and brain injury. One third (32%) of the seriously injured cyclists that are admitted to hospital are diagnosed with head or brain injury. Approximately three-quarters of the head or brain injuries are caused by crashes that do not involve motorized traffic; as many as nine in ten young children sustain head or brain injury in cyclist-only crashes. The bicycle helmet, which has supporters and opponents worldwide, is intended to reduce the risk of this type of injury. In general, Dutch cyclists do not wear helmets. If a helmet is worn, it is usually by recreational cyclists, mountain bikers and young children. Since the mid-1990s, the demand for children's bicycle helmets in particular has been increasing in the Netherlands.

### Effects

Research has shown that a bicycle helmet offers protection against sustaining serious head or brain injury in crashes. The most reliable estimates indicate that at speeds of up to 20 km/h helmets *reduce* the risk of head injury by 42%,

the risk of brain injury by 53%, and the risk of facial injury by 17%, whereas they *increase* the risk of neck injury by 32%. These estimates are partly based on research carried out in countries like the United States and Australia, where standards for bicycle helmets are stricter than they are in Europe and can offer protection at higher impact speeds.

### Study group

The European Science Foundation funds a multidisciplinary study group to research efficacy and wearability of cycle helmets. The new study group will consist of scientists from twenty countries and will focus on the impact engineering of bicycle helmets, the thermal comfort and physiological effects of heat, and the effectiveness of helmets from the perspectives from traffic psychology and accident statistics. Recommendations from the study group will be used for drawing up EU standards and could help influence legislators. SWOV will also participate in this group.

### Project

To promote the use of bicycle helmets, all primary school pupils of groups 1 to 4 (ages 4-7) in the Dutch province of Zeeland are given a free bicycle helmet during the period

## Legislation bicycle helmets

In Europe the use of bicycle helmets is currently mandatory in Finland (everyone everywhere), Spain (outside built-up areas), the Czech Republic (children < 16 years), Iceland (children < 15 years), and Sweden (children < 15 years). Outside Europe, wearing bicycle helmets is compulsory in Australia, New Zealand, in twenty states of the USA, and in a number of Canadian provinces. For these countries the legislation usually applies to children and young people. The use of helmets is currently being promoted in a number of other (European) countries.

2011–2015. An evaluation study in which SWOV participates investigates which factors are responsible for children wearing or not wearing their helmet. It will also look at the effects on injury trends. The study monitors the development in helmet wearing, injuries and perception from the start of the project in 2011 until the end of the project in 2015. ■

## Publication

*Bicycle helmets.* SWOV Fact sheet, December 2011.





# From car to bicycle: the safety effects investigated

**The physical exercise of cycling has a positive health effect. A negative aspect of bicycle mobility, on the other hand, is the high number of injuries and fatalities among cyclists. Combining the two effects, the positive health effects outweigh the negative road safety effects. This was one of the conclusions of a recent study that was conducted by RIVM, the National Institute for Public Health and the Environment in the Netherlands.**

## Positive effect by physical exercise

The RIVM study focused on the public health effects of replacing short car journeys, up to 7.5 km, by bicycle trips. The study not only looked at the classic environmental factors like noise and emissions, but also included the effects of the physical exercise of cycling as well as road safety aspects. Not surprisingly, all aspects, apart from road safety, contributed to a positive health effect. The health benefits due to a reduction of traffic-related noise and air pollution were found to be relatively small for individual people. The effect of physical exercise, expressed in terms of 'burden of disease' was larger. 'Burden of

disease' is a measure used in the health sector to quantify the impact of a health problem in an area. RIVM calculated that, if adults replaced their short car trips by bicycle trips, the burden of disease due to physical inactivity would be reduced by up to 1.3% after one year.

## Negative effect by crashes

On request of RIVM, SWOV carried out the road safety part of the study. On average, per travelled kilometre, cycling in the Netherlands is about 4.7 times more dangerous than driving a car. It was then calculated that, if 10% of all car drivers, including the young and elderly, replaced their short car trips to bicycle trips, an annual extra 4 to 8 road fatalities and approximately 500 serious injuries were to be expected. There were substantial differences for different age and gender groups, however. When looking at road fatalities, the shift from car to bicycle for short trips has the largest negative effect for the elderly. For them, due to their physical vulnerability, cycling is even more dangerous than car driving than for the average Dutchman. The reverse is true for men between 18 and 35

years. For them, replacing short car journeys by bicycle would even lead to fewer fatalities, and that is directly related to the high fatality risk of this age group as car driver. When looking at serious injuries, the shift from car to bicycle has a negative effect for nearly all age and gender groups. There is one exception: male road users in the ages of 18 and 19. For them it is safer to cycle than to drive a car.

## Positive net effect on public health

RIVM included SWOV's road safety findings in their overall estimate of the health effect. It appeared that the positive health effects outweigh the negative road safety effects and that there will be a net positive health effect if short car journeys were replaced by bicycle trips. ■

## Publications

*Exchanging car trips by cycling in the Netherlands; A first estimation of the health benefits.* E. van Kempen, W. Swart, G. Wendel-Vos, P. Steinberger, A. Knol, H. & M. Reurings (2010). RIVM, Bilthoven.

*The safety effect of exchanging car mobility for bicycle mobility; Substituting a small number of short car trips with bicycle trips.* H. Stipdonk & M. Reurings (2010). R-2010-18. SWOV, Leidschendam.

*Bicycle Commuting.* E. Heinen (2011). TU Delft, Delft.

QUOTE

"Life is like riding a bicycle - in order to keep your balance, you must keep moving."

Albert Einstein



# Windscreen airbag: protection for cyclists and pedestrians

Since early 2009, the SaveCAP consortium, led by the Netherlands Organization for Applied Scientific Research TNO, has been developing in-car intelligence to protect cyclists and pedestrians in crashes with passenger cars. The method consists of a sensor on the vehicle which operates a windscreen airbag or the application of automatic braking. Crash tests and computer simulations show that a cyclist often sustains serious injury in a crash with a car when his head hits the windscreen. The airbag will therefore cover the most important parts of the windscreen. The airbag inflates automatically when the cyclist or pedestrian makes contact with the front of the car.

Introduction of this type of airbag, possibly combined with automatic braking, can reduce the number of seriously injured pedestrians and cyclists. Presently, it is important to determine the precise sensor algorithms to predict the moment of impact while simultaneously controlling the airbag or braking system. SaveCAP is conducting a yearlong sensor field test to examine and improve the accuracy of this vision system. Five passenger vehicles participate in two major cities in the Netherlands where many situations with mixed and busy traffic are ensured. The cars are fitted with video cameras that register the different

types of interactions and near-crashes with cyclists and pedestrians. The sensor algorithms that are developed will be used for both the airbag and the automatic braking system.

A prototype of the airbag is expected to be introduced in the course of 2012. Several parties, among whom car manufacturing industry and EuroNCAP, have already shown an interest in the method. ■

## Sources

***Pre-development of a Vulnerable Road User (VRU) airbag.*** Van Schijndel-de Nooij et al. (2010). Rapport TNO-033-HM-2010-00695/1P

ESV 2011: ***Holland: VRU paradise goes for the next safety level***

ITS 2011: ***SaveCAP: Cyclist and pedestrian protection: from theory to practice***  
[www.savecap.org](http://www.savecap.org)



## Colophon

Research Activities is published twice a year by SWOV Institute for Road Safety Research in the Netherlands. Research Activities contains articles about road safety research and scientific projects carried out by SWOV and by others.

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Also visit our website [www.swov.nl](http://www.swov.nl)

The SWOV website contains a wealth of information about a variety of road safety topics. SWOV fact sheets are all available in English. The library has extensive possibilities to search for international road safety literature and publications.

# Research Activities: the final issue subscribe to the SWOV newsletter

SWOV finds it important that its relations are always informed about the latest research findings and the latest developments in the road safety field as thoroughly and as early as possible. Research Activities, which has been published three times a year from 1993 onward, has been used as an important tool to convey SWOV information to its international contacts. During the past two years SWOV has also been making a monthly newsletter which is sent by e-mail to all subscribers. This electronic newsletter has been restyled earlier this year

and is now an equivalent source of information to Research Activities. The articles you are accustomed to find in Research Activities are also added to each newsletter to disseminate information even faster.

These benefits have not gone unnoticed: the number of subscribers to the SWOV Newsletter is growing rapidly. SWOV has therefore decided to put extra effort in bringing out a complete and interesting Newsletter and in putting even more up-to-date information on

its website. As a result Research Activities has become redundant and you are now reading the last issue of the magazine.

If you do not wish to go without the SWOV road safety information, we suggest you subscribe to the SWOV Newsletter. This can be done easily on the English homepage of SWOV's website: [www.swov.nl](http://www.swov.nl). There you will find a link *Subscribe to the SWOV newsletter* and after filling in some basic data you will receive all the road safety information even earlier and at regular intervals. ■

## Information on the internet

Many Dutch traffic and road safety organizations also publish (part of) their website in English. Below you find a selection of websites that discuss aspects of cycling and bicycle safety.

### [www.swov.nl](http://www.swov.nl)

SWOV's own website has an English equivalent to the Dutch site. The most important news and all the information SWOV believes to be of international importance is translated into English. All SWOV fact sheets are also published in an English version. The website and some of the fact sheets contain information

about cycling and road safety. The Dutch traffic and traffic safety data (including cycling) is also made available and can be analysed using Cognos Powerplay.

### [www.sustainablesafety.nl](http://www.sustainablesafety.nl)

This website offers information about the Dutch road safety vision Sustainable Safety.

The full text and the abbreviated version of the publication *Advancing Sustainable Safety*, the adapted and updated sequel to the original publication *Towards a sustainably safe road traffic*, can be downloaded in pdf.

### [www.dutchcycling.nl](http://www.dutchcycling.nl)

The Dutch Cycling Embassy is a comprehensive network of traffic and infrastructure consultants, manufacturers, NGOs, universities, research institutions, national and local governments. The Dutch Cycling Embassy facilitates cycling worldwide as the most modern, efficient and sustainable means of transportation by sharing expertise and technology. Their website offers brochures in English, Spanish, and Portuguese.

### [www.fietsberaad.nl](http://www.fietsberaad.nl)

Fietsberaad is a center of expertise on bicycle policy. Among others, its website has a Knowledge bank, which tries to present the most complete overview of information relating to cycling and associated subjects, and an examples bank which presents – often infrastructural – solutions, illustrated by photos and videos and with detailed explanations.

### [www.fietsersbond.nl](http://www.fietsersbond.nl)

The Fietsersbond is the Dutch Cyclists' Union that campaigns for better cycling conditions in the Netherlands. There is currently no English version of its website, but there is a link to the special English edition of its magazine, called *Cycling Cities*. The site also offers an overview of cyclists' unions and organizations in other countries with links to their websites.

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**News**

**SWOV Newsletter November: the relation between traffic offences and crashes**  
There is a relation between the number of traffic offences that is committed in the Netherlands and the crash involvement. This is one of the findings in a SWOV study into the relation between traffic offences and crashes that has recently been completed. The SWOV Newsletter of November provides more information about this study. Furthermore, the newsletter contains more information on policy instruments for managing EU road safety targets, SWOV appearances in the Dutch media, the latest acquisitions of the SWOV library and the new SWOV Twitteraccount.  
[To the newsletter](#)  
22/11/2011

**Short course enables novice drivers to anticipate traffic hazards**  
A short training course in a traffic simulator lasting approximately an hour enhances the way that young drivers recognize and respond to hazardous traffic situations. This is the main finding from research conducted by Willem Vlakveld of SWOV Institute for Road Safety Research. He will be awarded a PhD on 30 November by the University

**Knowledge base**

- Sustainable Safety vision, implementation...
- Road safety developments mobility, risk, casualties...
- Road safety policy targets, costs, benefits...
- Road safety costs crash costs, road deaths...
- Modes of transport pedestrians, bicyclist, cars...
- High-risk behaviour alcohol, drugs, telephone, fatigue...
- High-risk groups children, youngsters, elderly...
- Measures education, enforcement, technology...
- Data and analysis sources, analyzing...

**SWOV fact sheets**  
SWOV publishes fact sheets on a wide range of road safety subjects.  
[To the fact sheets](#)

**SWOV Library**  
In the Netherlands the SWOV library is the national centre for road safety literature. Consult the online catalogue for recent publications

**European Road Safety Observatory**  
Visit ERSO for international road safety information

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