

## Effects of police enforcement of safety devices, of moped helmet use, and of red light running

### Summary

Not wearing a seatbelt or moped helmet, and red light running lead to a higher crash rate or a more serious crash. That is why they have been spearheads of intensified police enforcement in the Netherlands since 1999. The extra seatbelt enforcement together with large-scale media campaigns have led to an improvement in seatbelt use and a saving of lives in traffic. The extra enforcement of moped helmet use has stopped the declining wearing rate. And finally, the extra camera enforcement has led to a decrease in red light running. The road safety effects of this Dutch situation have not yet been systematically studied, but a positive effect is plausible. International research has indeed found that red light cameras lead to a decrease in injury crashes.

### Background

Not using seatbelts and helmets and red light running are three important offences on which police traffic enforcement focuses. Together with speeding and alcohol offences they are the five spearheads of the regional traffic enforcement plans in the Netherlands. Since 1999 these plans have intensified police traffic enforcement even further (Goldenbeld, 2005). Since 2003 all police forces have a regional traffic enforcement plan.

This fact sheet discusses the effects of police enforcement of protective devices, moped helmet use, and red light running. For each subject we describe the problem, and police enforcement as a possible measure and we make use of Dutch research in this field as much as possible. This fact sheet is an addition to the fact sheets [Police surveillance and driving speed](#), [Driving under the influence of alcohol](#), [Driving under the influence of drugs and medicines](#), and [Penalties in traffic](#) which also have police traffic enforcement as a subject. Because this fact sheet discusses three subjects, it is limited to main points and references to relevant studies.

### How is police enforcement organized in the Netherlands?

In the Netherlands, there are special traffic enforcement teams that concentrate exclusively on traffic; in addition, the regular police also conduct traffic enforcement. For special traffic projects, regional traffic enforcement plans, the police forces receive extra manpower and means from the Public Prosecution Office (BVOM). BVOM advises and informs the police and the local Public Prosecution Service (local OM) about traffic enforcement and its results. The local OM steers the police of a district in the carrying out of the traffic enforcement task.

The growth of police enforcement in Dutch traffic seems to have reached its peak and the growth will possibly decrease during the coming years (Weijermars et al., 2008). However, in 2006-2008 the police and the judiciary have made agreements about extra enforcement of red light running by cyclists and moped riders. This has been set down in the regional covenants on spearhead programmes in which agreements between police and the judiciary are set down and signed by heads of police forces, the head of public prosecution, and the BVOM for the Board of Procurators-General.

### How does police enforcement work?

Police enforcement works on the probability of being caught. The roadside checks represent the objective probability, also known as the enforcement pressure. Using the enforcement pressure, what they read in the newspapers, and what they hear from friends and acquaintances, road users estimate the probability of themselves being caught committing an offence; this is known as the subjective probability. This estimated probability of being caught acts as a stimulus to avoid committing offences. Psychologists call this extrinsic motivation because behaviour is steered by external stimuli such as rewards or, in this case, punishment.

In general, the preventive effects of police enforcement are stronger with increasing subjective probability and certainty of punishment, and with punishment quickly following the offence (Goldenbeld, 2005). Each of these elements is a link in the chain of enforcement and - to continue this metaphor - the chain is no stronger than its weakest link. If for example, the subjective probability is small, the penalty, certainty of being punished, and time between punishment and offence will not make much difference in the preventive effect. The subjective probability can be increased by 1) publicity about the enforcement activities, 2) the checks being highly visible, 3) unpredictable sequence and locations of random checks, 4) select checks at times and places with a high probability of offenders being actually caught, and 5) making police checks difficult to avoid.

Every country has a certain basic level of regular police traffic enforcement, often expressed in the annual hours of traffic enforcement or an annual number of traffic police checks. A stable enforcement level is, in the long run, insufficient to further reduce the number of offences. Bjørnskau & Elvik (1992) point to the fact that the regular enforcement level must be increased with a factor of two, three, or even four in order to have effect on behaviour and thus road safety. Based on eleven international studies of speeding enforcement, Elvik (2001) assessed that an ever higher level of speeding enforcement leads to ever less extra safety benefit, expressed in prevented injury crashes. The 'law of diminishing returns' seems to apply here.

### **Why is it obligatory to use safety devices?**

Research has shown that wearing a seatbelt reduces the fatality rate by 40% for the front seats of a car and by 30% for the rear seats. The use of safety devices for children halves the fatality rate. Seatbelts are more effective in front seats than in rear seats because the rear seats are already a safer environment than the front seats. This and other information can be found in the fact sheet [Seatbelts and child restraint seats](#).

The importance of seatbelts has been known for a long time. That is why on 1 June 1975 the seatbelt was made obligatory in the Netherlands for car occupants in the front seats. On 1 January 1990 it was made compulsory to have seatbelts installed on all seats of new cars i.e. including rear seats. Since 1 April 1992 all car occupants, including children, are legally obliged to indeed wear these seatbelts. From 1 March 2006 new rules apply to transporting children safely. Children shorter than 1.35 metres must sit in an approved child seat, and children and adolescents taller than 1.35 metres must wear a seatbelt, if necessary in combination with a booster seat.

### **What is the effect of police enforcement on seatbelt wearing?**

During the 1980s, several provinces in the Netherlands conducted seatbelt campaigns consisting of a combination of police enforcement and various types of publicity (Goldenbeld, 1993). These campaigns had very positive results: they often resulted in an increase in seatbelt use of 20 percentage points or more. This increased seatbelt use often continued for at least 3-6 months after the end of the campaign. More recently, using 2002 data, Mathijssen & De Craen (2004) determined that the front seat seatbelt use in cars was 8-14 percentage points higher in police regions with a regional traffic enforcement plan than in regions without such a plan. In this study seatbelt use was compared in police regions within the Province of North-Holland. Two regions which already had operational regional plans for some years had a seatbelt use of 95% and 98%. Three police regions without operational regional plans had a seatbelt use of 88%, 84%, and 87%. This difference was very probably a result of the increased enforcement of seatbelt use in the areas with a regional plan.

During the last decades an increasing number of drivers have been wearing seatbelts in the Netherlands (see *Figure 1*). There are strong indications that since 1999 intensified seatbelt enforcement, often combined with national or regional publicity campaigns, has increased seatbelt use. On rural roads, seatbelt wearing went up from 80% in 1998 to 96% in 2008; on urban roads the increase went up from 67% to 95%. The difference between urban and rural roads has disappeared. During the last few years seatbelt wearing in the rear seats also increased considerably: from 40% on urban roads in 1998 to 82% in 2006, and on rural roads from 43% to 80%.

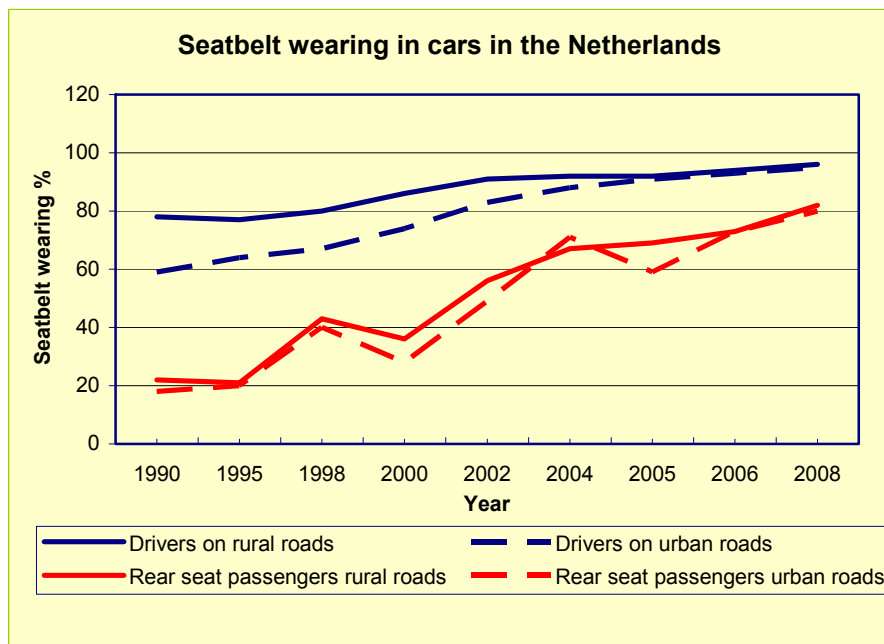


Figure 1. Sources: Mulder, 1998; DVS, 2008a.

In 2008, most children shorter than 1.35 m traveled in a child restraint seat (51%) or on a booster seat with seatbelt (25%) (DVS, 2008a). In comparison to 2006, there has been a large increase in the use of booster seats in combination with seatbelts. This is due to a change in legislation in 2006 which makes it compulsory for children shorter than 1.35 m and with a weight between 15 and 36 kg to use a booster seat with a seatbelt.

From 2006 to 2008, the use of the correct safety devices for children continued to improve (DVS, 2008a). In 2006, 28% of the observed children travelled insufficiently protected; in 2008 their number was 12%. Children are insufficiently protected when they travel: in a seat with a seatbelt, in a seat without a seatbelt, in a carrycot, on someone's lap, or on a booster seat without seatbelt.

### Does police enforcement of seatbelt wearing improve road safety?

Mathijssen & De Craen (2004) have estimated the effect of the intensified police enforcement of seatbelt wearing and how many lives this had possibly saved. They estimate that during the 1995-2002 period the intensified enforcement resulted in an increase in driver and passenger seatbelt use by 23% in those police regions where intensified police enforcement had been regulated in a regional plan. According to their estimate, between 1994-1995 and 2000-2001 this resulted in an extra 4 to 5% decrease in the number of casualties in regions with a regional plan than in regions without one. For the Netherlands as a whole they estimated that the increased seatbelt use resulting from the intensified police enforcement, in combination with campaigns, had saved 3% of all road deaths or approximately 30 deaths a year between 1994/95 and 2000/01 (Mathijssen & De Craen, 2004; p. 55).

In 2003 - 2007 the intensified police enforcement of seatbelt wearing was supported by mass media campaigns about the benefit and necessity of the seatbelt. These campaigns were part of a broader long-term road safety campaign. In 2004 the seatbelt campaign was extended to children as a target group with the Armadillo campaign. The Centre Transport and Navigation (DVS, 2006a) has estimated the annual effect of the combined police enforcement and campaigns to be eleven road deaths and eighty in-patients for all car occupants in 2003-2007 when compared with 2002. This saving of 55 road deaths over the period 2003 - 2007 was slightly less than 0.5%, which, relatively speaking, was less than the 3% fewer road deaths in 1994-2001. This is not so surprising because the law of diminishing returns applies here. The higher the national level of seatbelt use, the more difficult it is to achieve even greater behaviour change and safety benefit (see also Elvik, 2001).

### Why is moped helmet wearing obligatory?

The moped helmet has an important protective working: wearing a helmet correctly reduces motorcyclists' and moped riders' risk of dying in a crash by half (Noordzij et al., 2001). In the Netherlands, it has been mandatory for moped riders and pillion passengers to wear an approved

helmet since 1975. The Dutch Traffic Regulations (RVV 1990) state that this helmet must fit well and must be worn in the proper manner.

### Which effects does police enforcement have on wearing a moped helmet?

The use of moped helmets declined during the 1990s. The wearing rate was 98.5% in 1996 but went down to 92.5% in 1999 (Goldenbeld & Batstra, 2000). This declining rate together with the high crash involvement of young moped riders were reasons to make moped helmets a spearhead in the intensified police enforcement projects.

Every year, the Bureau Traffic Enforcement of the Public Prosecution Office carries out measurements to monitor helmet use, and also proper helmet use. During those measurements, part of the stopped drivers are also interviewed about how they experience the police enforcement (subjective risk of being caught) and how they feel about the helmet being compulsory (attitude). *Table 1* shows the results for the years 2002, 2004, 2006, 2007 and 2008. The previously declining helmet use stabilized from 2000 onward. As opposed to 2006 and 2007, 2008 saw an improvement in the helmet wearing percentage from 91-92% to 96%. Also in 2008, the objective risk of being apprehended is estimated as being higher.

|   | 2002 | 2004 | 2006 | 2007 | 2008 |
|---|------|------|------|------|------|
| <b>Wearing percentage</b>                         |      |      |      |      |      |
| Helmet wearing riders                             | 91%  | 93%  | 91%  | 92%  | 96%  |
| <b>Manner of wearing</b>                          |      |      |      |      |      |
| Chin strap shut (riders)                          | 86%  | 89%  | 88%  | 87%  | 90%  |
| No slack chin strap (riders)                      | 51%  | 74%  | 74%  | 73%  | 60%  |
| Helmet fits forehead (riders)                     | 91%  | 91%  | 89%  | 89%  | 87%  |
| <b>Helmet quality</b>                             |      |      |      |      |      |
| Approval label present                            | 86%  | 89%  | 89%  | 93%  | 93%  |
| No change in helmet surface                       | 79%  | 87%  | 89%  | 88%  | 88%  |
| No damage to helmet surface                       | 49%  | 64%  | 62%  | 54%  | 53%  |
| No mechanical contact (crash/dropped)             | 81%  | 81%  | 72%  | 56%  | 59%  |
| <b>Probability of being caught and attitude</b>   |      |      |      |      |      |
| Large probability of being caught                 | 47%  | 43%  | 45%  | 34%  | 50%  |
| Have seen roadside checks                         | 34%  | 41%  | 31%  | 26%  | 32%  |
| Heard of checks via family/ friends/acquaintances | 37%  | 43%  | 32%  | 29%  | 27%  |
| Heard of checks via newspaper/radio/TV            | 24%  | 29%  | 16%  | 19%  | 21%  |
| Agree with helmet wearing obligation              | 76%  | 81%  | 73%  | 77%  | 86%  |
| Always riding with helmet                         | 63%  | 62%  | 62%  | 60%  | 68%  |

Table 1. *Use of moped helmet, manner of wearing, helmet quality, and attitudes and probability of being caught (Henkens & Hijkoop, 2008, commissioned by the BVOM).*

### Does police enforcement of moped helmet use improve road safety?

We may assume that the police enforcement of helmet use most certainly has made a positive contribution to moped riders' safety, but the effect has not yet been quantified. There are several indications that police enforcement has stopped the decline in helmet use. A quantitative estimate requires an assumption about how the use of moped helmets would have declined without extra enforcement and such an assumption is partly speculative.

### Why is red light running a problem?

Red light running is a worldwide road safety problem. For example, it leads to an estimated 850 road deaths per year in the United States, which is about 2% of all road deaths (IIHS, 2000). In 2007, red light running was the main crash cause in the Netherlands in 4% of the fatal crashes (25 out of 669) and also in 4% of the in-patient crashes (335 out of 8.559). Red light running therefore often has the

most serious consequence: a crash with fatal injury. Comparatively, the problem is greater in the Netherlands than in the United States. This is probably due to the fact that there are more vulnerable road users in the Netherlands: pedestrians, cyclists, moped riders and motorcyclists.

### **How is police enforcement of red light running organized?**

If at an intersection there is a lot of red light running this may be due to the view there or the traffic light phasing. In such cases police enforcement is not the best solution. If red light running is not caused by the design of the intersection police enforcement can be a solution.

On the basis of an accident analysis, the regional steering committee determines the most appropriate intersections for installing the red light cameras which are made available by BVOM for the intensified police enforcement. In the Netherlands in 2008, 500 red light cameras were managed by the special enforcement teams. In addition, several hundreds of cameras were managed by the regular police. A cautious estimate is that each year there are at least 1000 intersections at which red light cameras are working for a short or longer time.

The red light cameras in the Netherlands register offences in the various lanes (straight on, left turn, right turn) from only *one* direction and usually also register speeding offences. Some of the cameras are circulated among various intersections. During the 2006-2010 period the current red light cameras and speed cameras will be replaced by digital cameras that automatically send information about offences to a central computer (BVOM, 2006). As digital cameras do not need a film changed, the police do no longer need to remove the cameras from their boxes and it is no longer practical to circulate them among various intersections.

In the regional traffic enforcement plans 2000-2004, the red light running spearhead mainly focused on motorists. The more recent plans, which started in 2005, also cover intensified enforcement of red light running by cyclists and moped riders. This police check is usually carried out by two policemen, of which one visually detects the offence and the second halts the offending cyclist or moped rider. In 2006, a total of 362,223 motorists were fined for red light running and in 2007 this number was 321,186 (CJIB, 2008).

### **Which effects does police enforcement have on red light running?**

During the 1994-1997 period Oei et al. (1997) studied the effects of red light cameras on offences at four very different locations in Amsterdam: A) a road going straight on, B) a T-junction, C) an intersection, and D) a motorway entry. The offence rate declined at all four locations: at A from 3% to 1%, at B from 2.5% to 1.3%, at C from 8.2 to 3.4%, and at D from 1.6% to 0.5%.

According to BVOM, at intersections where they have installed red light cameras, the number of red light runners has declined to about 1%, but no offence rate was reported for the period before the cameras were installed (BVOM, 2003). It is difficult to establish the offence rate before the camera enforcement objectively, because at a number of intersections the cameras were installed at the same time as the offence rate measuring equipment. However, Oei et al. (1997) reported offence rates varying between 1.6% and 8.2%, from which we could derive that the average initial offence rate amounted to least several percentage points.

Maccubin et al. (2001) made an inventory of the effects of red light cameras on offence rates in 22 enforcement projects, mainly in America. They found that the offence rates declined by 20% to 87%. In about half of the projects the reductions were between 40% and 62%. However, Maccubin et al. point out that for a number of these estimates no good before-rate had been measured.

### **Does police enforcement of red light running promote road safety?**

Retting et al. (2003) concluded from a meta-analysis of eight international studies that red light cameras lead to 25-30% fewer injury crashes. Also when a net positive effect on the total number injury crashes was observed, Retting et al. (2003) often found an increase in the number of rear-end crashes as well. This is probably because some motorists brake suddenly to avoid a red light running fine. This side effect can be avoided by placing the cameras so that they are clearly visible, and by using warning signs. In a later review Aeron-Thomas & Hess (2005) conclude that there is consistent and conclusive evidence that red light cameras reduce the number of injury crashes. One of the most

thorough studies in that survey gives an estimate of a 29% reduction due to red light cameras – a percentage which agrees with the earlier estimate by Retting et al..

A recent meta-analysis based on a selection of the best methodological studies concluded that although red light cameras do indeed decrease the number of side crashes, but at the same time increase the number of rear-end crashes as well as the total number of crashes (Erke, 2008). The meta-analysis, however, does not subdivide into injury severity. Therefore, the effect of red light cameras on the injury severity rate is not altogether clear.

The safety effects of red light cameras rather vary between studies, and, within the same study, also between intersection types. As yet, research has not shown any possible explanations for these differences. Variables that may be of importance are: the phasing of the traffic lights, the offence rate before the cameras were placed, early warning signs about the cameras, and the cameras' visibility. An overall positive safety effect of red light cameras is to be expected mainly at intersections with relatively many serious side crashes which are related to red light running and relatively few rear-end crashes (Shin & Washington, 2007).

The combined effects of red light cameras and other red light enforcement measures to realize safety on intersections in the Netherlands have not yet been investigated. An assessment study in the Dutch city of Amersfoort showed positive safety effects that were comparable to those in the reviews by Retting et al. (2003) and Aeron-Thomas-Hess (2005), viz. a 20% reduction of the number of injury crashes (Dobbenberg, 2006; Via Verkeersadvies, 2005). This study found no increase in the number of rear-end crashes.

## Conclusion

Police traffic enforcement aims at improving traffic behaviour by warning road users that they can be caught committing a traffic offence, i.e. influencing the subjective probability of being caught. This is a necessary supplement to infrastructural and educational road safety measures. Not wearing a seatbelt or moped helmet and red light running at intersections are offences that are accompanied by increased crash severity or crash rate. For this reason they have been designated as spearheads of intensified police enforcement by the Bureau Traffic Enforcement of the Public Prosecution Service (BVOM) and the police.

The more intensive police enforcement of seatbelt wearing has improved seatbelt use. This is partly because the extra police enforcement was supported by a mass media national campaign and by regional media campaigns.

Intensified enforcement of helmet use by moped riders has halted their declining use in the 1990s, but has not resulted in a further improvement. From 1 January 2007, mopeds and light mopeds must have a number plate. This makes it much easier for the police to identify a moving moped and thus optimize enforcement.

It seems plausible that police enforcement of red light running in the Netherlands has a road safety effect. Internationally, positive results have been found, and in the Netherlands a decrease in offences has been registered. Road safety effects in the Netherlands, however, have not yet been systematically studied.

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