

# The Dutch Bicycle Master Plan and Road Safety

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*Measures to be taken*

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## Summary

The Bicycle Master Plan was launched in 1990 and concluded in 1996. To mark its conclusion, a study was carried out to assess developments in road safety for cyclists. An overview of future measures was also completed. Since 1950, there have been three broad periods:

- 1950-1975: an increase in the number of deaths, mainly among young and old cyclists, coinciding with a sharp increase in car-use;
- 1975-1990: a decline in the number of deaths among cyclists per distance cycled, coinciding with increased bicycle-use; the absolute number of deaths among cyclists either rose or fell depending on age, gender, and injury severity;
- 1990-1995: the number of injured cyclists remained stable, with one exception; the number of deaths per distance cycled fell more slowly than before; bicycle use remained more or less constant.

In the last few years, road injury registrations have become more complete. They reveal that more than 60,000 cyclists are injured and require First Aid each year; 6,500 of these are admitted to hospital and over 250 succumb to their injuries. Serious injuries to cyclists are often caused by collision with another road user; in the case of minor injuries there is often no other party involved. It is not yet known whether the incidence of minor injuries to cyclists is rising or falling; nor is much known about the measures needed to reduce the number of such injuries.

The Death Rate (ratio of deaths among cyclists per distance cycled) contains a very high proportion of older people, since the effects of an accident for such individuals are far more serious. The ratio is especially unfavourable for older male cyclists in small municipalities. The ratio of hospital admissions to distance cycled is especially unfavourable for older female cyclists in small municipalities.

Measures to prevent serious injury as a result of collisions between bicycles and cars focus mainly on changes to the road system, such as those included in the recent proposals for a structurally safe traffic system. This should in the long term result in a substantial decline in the number of seriously injured cyclists. However, these proposals do not contain enough detailed plans to prevent collisions between bicycles and cars at busy intersections and roads, even though it is here that most deaths and serious injuries occur.

Even a structurally safe road system must be backed up by a code of behaviour and supplementary measures in the form of education, instruction and public information campaigns designed to improve road use among drivers, cyclists and pedestrians.

A wide range of other measures could also be used, such as measures to improve observational skills, cycling skills and protection from injury.

The number of road deaths among young adults undertaking short, daily journeys in urban areas is lower among cyclists than among car users. Bicycle use could thereby compare favourably with other types of transport in more situations, certainly if conditions were made safer for cyclists.

# Contents

<i>Foreword</i>	5
1. <i>Introduction</i>	6
2. <i>Use of the bicycle and the car</i>	7
3. <i>Joint use (circumstances)</i>	8
4. <i>Joint use (rules and behaviour)</i>	10
5. <i>Various measures</i>	12
<i>Literature</i>	14

## Foreword

This report consists of excerpts from the recent SWOV publication *Masterplan fiets en verkeersonveiligheid* (Noordzij & Blokpoel, 1997). Its English name being *The Bicycle Master Plan*. This report will give you enough information to be able to follow its recommendations in your own country. It contains the Summary (i.e. of the whole report) together with chapter 6 regarding the recommended measures to be taken in the short term.

# 1. Introduction

The list of possible explanations can assist the search for measures to improve bicycle safety. The first possibility of influencing the number of victims lies in changing the amount of bicycle usage. Another possibility is the reduction of the number of interactions with a potential collision partner. This can be achieved by influencing the usage of other types of vehicles, or reducing the number of interactions by means of the road network design, or at least reducing the danger of interactions. This last possibility can be achieved by facilities on the road network, by behaviour rules for interactions of cyclists and/or collision partners, or other means of influencing behaviour.

Improving the quality of bicycles can contribute to their visibility, keeping them under control, and protection against injury. To achieve this protection there are also other possibilities such as wearing a crash helmet.

A number of these possibilities are discussed below. The emphasis lies on adapting the road network and measures supporting these adaptations.

## 2. Use of the bicycle and the car

Measures aimed at reducing use of the bicycle have not been considered. Quite the contrary, because government policy is aimed at increasing bicycle use, at the expense of the car! Greater use of the bicycle can be good for road safety if it replaces more dangerous means of transport. This depends on who cycles more and under which conditions.

As far as adults are concerned, there is no big difference between the bicycle and the car (1990-1992: c.0.15) in the number of seriously wounded victims per kilometre. This includes all victims: passengers and collision partners. In accidents involving a car, more than half of those seriously injured were collision partners; in accidents involving cyclists, the cyclists are usually the victim.

The victim-ratio (victims per distance travelled) for cyclists in the age-group 15-25 years old is less than half that of the car occupants. Use of the bicycle instead of the car is especially common in leisure-, or short, frequent trips. In the case of leisure trips, the road safety effects depend on the possibilities of using quieter times or quieter roads. In the case of short, frequent trips, a large proportion of the car kilometre will make use of urban through-roads. These through-roads are in fact dangerous per distance travelled by car. If we further assume that cyclists can choose a relatively safe route for their short, frequent trips, it is likely that the number of victims will decline. What does have to be considered is the fact that the average occupancy of cars is approximately 1½ times that of bicycles. The comparison between the use of bicycle and car can favour the bicycle, or is at least undecided.

The comparison with the car can work out positively for the bicycle. Also the comparison with the moped is very much in the advantage of the bicycle. These comparisons use recent accident and exposure data. This does not mean that it will automatically apply to the near future. The future chances of victims per distance travelled can be more favourable still if the circumstances are made safer. The costs of facilities on the roads for a safe bicycle use can be compared with the costs for other modes of transport. Bicycle use is safer and/or cheaper according to some comparisons. This means that the growing bicycle use can certainly be taken into account in the search for solutions.

To make the circumstances safer for cyclists means firstly reducing the number of interactions with cars. This, to begin with, can be achieved by reduction in the use of cars.

In city centres much is being done to keep cars away. All measures contributing to this are also good for cyclists' safety in these areas. As far as other measures are concerned, policy is aimed at slowing down the growth of the number of cars.

### 3. Joint use (circumstances)

The number and type of interactions between cyclists and other vehicles (i.e. the danger to cyclists) are closely related to the design of the road network. This includes various road types; each with their own intersections, facilities, and behaviour rules for cyclists and other road users. Roads with a lot of fast traffic are a danger to cyclists. That is why part of the road network is exclusively reserved for such traffic. The danger can be reduced by limiting such traffic's freedom of behaviour. For example by limiting the access and speed in some streets. In rural areas there is not much experience with speed limits lower than the legal limit of 80 km/h.

In urban areas, however, it is well-known that the number of accidents with cyclists is greatly reduced by creating 'woonerfs' and 30 km/h areas. In both cases, more is done than just reducing the speed limit. This achievement is largely due to keeping out through traffic and reducing the speeds actually driven by cars. This has been done by adapting the road surface and routing. These changes are in general less rigorous in 30 km/h areas than in woonerfs.

Special adaptations for the safety of cyclists include: separate cycle paths, cycle lanes, and right-of-way rules (and traffic lights) at intersections. Intersections can also be replaced by roundabouts. Cycle routes have various facilities including split level crossings with through-roads.

The overview of 1991 includes such facilities. Knowledge about their safety effects is, however, limited. It is in any case clear that adding cycle paths and cycle lanes partly moves the problem of joint use to the intersections. Experts do mainly agree that such facilities favour cyclists' safety and that they should be applied on a larger scale. They must, however, be designed carefully. These conditions mean use of previous experience and that cyclists' wishes are taken into account.

Part of the Bicycle Master Plan included the development of a design guide for a cyclist-friendly road network (C.R.O.W, 1993). This contains all requirements, sequenced and converted into recommendations to traffic-related and technical design.

An important aspect of government policy is the realization of a structurally safe traffic system. There have been suggestions recently for the first phase; a package of measures, of which part is aimed at cyclist safety. These are:

- 30 km/h in residential areas, with a speed-reducing adaptation of the road;
- 60 km/h on country roads, with a speed-reducing adaptation of the road;
- right-of-way on urban through-roads;
- more roundabouts, and right-of-way on new and old roundabouts;
- more cycle paths and cycle lanes;
- mopeds on the main lanes instead of urban cycle paths;
- no exception for cyclists to the regulation "traffic on the right has right-of-way".

As can be seen, some are changes in the road network, the others in the behaviour-rules.

Estimations of the increase in safety have been made, but there is no distinction in the modal split of victims. Research was done not so long ago into a number of these measures. In a study of a large number of 20 km/h areas, the numbers of accidents had decreased by a considerable percentage (Vis & Kaal, 1993). Replacing intersections with roundabouts resulted in a large decrease in the number of accidents and also in the number of cyclist victims. This reduction was partly the result of the facilities on the roundabouts (Van Minnen, 1995).

In a study of the results of mopedists on the road lanes, the number of accidents had greatly declined. Collisions between mopedists and cyclists hardly occurred anymore (Hagenzieker, 1995).

Although a number of the suggested package of measures is important for the safety of cyclists, it should not be concluded that other measures are unnecessary. The package is the first phase before an extensive redivision of a number of road types of the network, together with the relevant designs and behaviour-rules.

The realization of this last will take much longer. The proposed package of measures is certainly insufficient for the first phase. Its purpose is to prevent serious injuries as a result of collisions of cyclists with other vehicles; especially on busy roads and intersections, where most accidents occur. We must also wait and see how the measures are carried out in practice.

## 4. Joint use (rules and behaviour)

Whether changes in the road network will have the required road safety effects depends on other measures. These concern education and information about the use of the road network as driver or pedestrian. According to the present ideas (about a sustainably safe traffic) the road network should be designed so that the wishes of road users are largely met. There should also be little explanation and practice necessary to make road users behave safely. This makes other types of behaviour influencing less necessary, but not superfluous.

Even a structurally safe network needs behaviour-rules regarding which road users can use which road types and which road sections, and which limitations apply. At the same time rules are necessary to determine how road users should relate to each other when they use the same road sections. We can imagine that the rules can be made simpler and more self-explanatory than the present ones. Road users will always have to learn to:

1. Judge certain traffic situations.
2. Choose how to behave in all types of situations.
3. Pay attention to:
  - the behaviour-rules;
  - road safety;
  - their own interests;
  - the interests of other road users.

For cyclist safety it is necessary that the behaviour of car drivers towards cyclists change. In the long term this can be achieved with a package of measures with, among others, information, driver training, behaviour-rules, and police surveillance.

The rules could be partly changed and partly clarified. At the present time there is no rule requiring car drivers to give cyclists the space to overtake on the right-hand side. There is no *clear* rule whether cyclists may hinder traffic catching up with them while overtaking, or move outside the cycle lane when they want to turn right. To make getting in lane less dangerous for cyclists, it can be specified that car drivers catching them up should give them more opportunity. There can also be a rule that stationary vehicles should hinder other traffic (i.e. mainly cyclists and mopedists) as little as possible.

When introducing such rules, a choice can be made between rules with, and rules without punishment for breaking them. To achieve a favourable effect on drivers' behaviour, such rules must be recognized by the various authorities. There are furthermore rules for compensating the damage caused by road accidents. Their effect depends on how well they are known and applied in practice. At this time work is being done to change the rules, so that in the future cyclists' damage will be more often paid for by car drivers than now.

Cyclists' own behaviour can be improved by better traffic lessons aimed at specific age groups. Little is done in practice at the moment, excepting lessons for those in the last two years at primary schools. Within the framework of the Bicycle Master Plan research has been conducted into what happens and what is needed in the way of education (Welleman, 1992).

Nine priorities have been specified:

- children from six to twelve years old: instruction and accompanying in traffic by the parents;
- children of immigrant workers: vehicle control, instruction, and accompanying in traffic by instructors;
- children from twelve to fifteen years old: evaluation and adapted behaviour by school teachers, police, parents, and information;
- immigrant workers: vehicle control, instruction, and accompanying in traffic by instructors;
- young car drivers: instruction and behavioural recommendations about potential conflicts with cyclists by instructors and information;
- adults with little experience of cyclists: advice through information (preferably at meetings);
- the elderly: instruction and advice by instructors.

It is not normally the work of the police supervise the obedience of cyclists to the rules nor the condition of their bicycles. A trial with such a supervision showed that it is difficult to get the police enthusiastic, and difficult to convince cyclists that it's for real (Twisk, 1993). The chance of success is greater when such supervision is coupled with a lot of instruction, kept up for a long time and emphatically, and, at the same time, if cycling is made more attractive.

## 5. Various measures

It is to be expected that eventually a considerable reduction in the number of cyclist victims will be achieved by a change in the road network and other measures aimed at supporting such changes. There are also all sorts of other measures that can contribute, but, for a variety of reasons, little or no use is being made. The application of these measures is partly dependant on technical developments, and partly dependant on yet other measures which are supposed to encourage the (usually voluntary) application. Some of these measures improve safety, but are undesirable because of other reasons. Or there is doubt about their contribution.

Several measures come into consideration for improving the visibility of cyclists for car drivers and improving the visibility of cars for cyclists. More reliable cycle lights, which also work when the cycle stops, is available, but is too rarely bought. Further developments are also being worked on. In the case of some delivery vans and lorries, it is difficult for the driver to see if there is a bicycle on the right-hand side. Research is concentrated on technical solutions so that vehicle demands will also have to change. Bicycle mirrors are seldom used. Daytime Running Lights can help the cyclist see cars (from the side or from behind), but there is doubt about the necessity of making it obligatory.

Practising by the inexperienced cyclist can be achieved by bicycle control, as can improving the design of the bicycle, and adapting these to the quality of the road surface and suchlike. Work is being done, together with the manufacturers, on the required quality for bicycles, among other things meant to prevent injury accidents resulting from shortcomings of the bicycle. It is far from certain that cyclists will be prepared to pay more for a safer bicycle, or which are the conditions it should depend on. Consumer organisations can give advice about the general quality when buying a bicycle or spare parts, and about intended use. Possibilities for improving bicycle control by the elderly are now mentioned.

The elderly would appear to have problems with bicycle control. This would be solved to a large extent by the three-wheeler. They are used very little partly because the supply of suitable three-wheelers is scarce. Just as important is that a three-wheeler is not an attractive proposition because it is so often associated with invalids. It will only become attractive when there is a design that makes it clear that it is suitable for normal use by all ages. A number of three-wheeler sport models is already available in the shops.

For quite some time now there have been bicycles available in which pedalling is helped, or replaced, by an electric engine. In contrast to the combustion engine, the power generated is dependant on the peddling power. The harder one peddles the greater the supporting generating power. In this way the supporting power ceases as soon as a previously determined speed has been reached. Such a design also increases the safety of elderly cyclists because they have trouble getting up speed. The support provided by the engine can, for example, shorten the time needed to cross an intersection.

In general, greater attention could be paid to cyclists' safety when building or repairing a road, by avoiding them hitting obstacles or falling because of a poor road surface.

Lastly, injury prevention can be increased by the cyclists themselves, the bicycle, or the crash opponent. The cyclist can protect himself from injury by wearing a crash helmet. Voluntary use of the cycle helmet is being encouraged in The Netherlands on a small scale.

Consumer organisations are not in favour of a general use of cycle helmets. Encouraging the use of spoke-screens is useful, considering the number of injuries to young passengers. Some research has been carried out concerning the possibility of adapting the shape of cars to protect cyclists. Before this has been achieved, international agreement is needed, as is further research. In The Netherlands a test has been made using closed side-shields on lorries. These shields offer better protection to cyclists during a crash, but are not compulsory.

## Literature

C.R.O.W (1993). *Tekenen voor de fiets; Ontwerpwijzer voor fietsvriendelijke infrastructuur*. C.R.O.W-werkgroep Fietsvoorzieningen. Publikatie 74. C.R.O.W, Ede.

Hagenzieker, M.P. (1995). *Bromfietsers op de rijbaan: ongevallenstudie; Evaluatie van een proef met de maatregel 'bromfiets op de rijbaan'* eindrapport. R-95-33. SWOV, Leidschendam.

Minnen, J. van (1995). *Rotondes en voorrangregelingen; Verslag van een drietal onderzoeken: de ontwikkeling van de veiligheid op nieuwe rotondes, het wijzigen van de voorrang op oudere pleinen en de regeling van de voorrang voor fietsers op ronde rotondes*. R-95-58. SWOV, Leidschendam.

Noordzij, P.C. & Blokpoel, A. (1997). *Masterplan fiets en verkeersveiligheid*. R-97-16. SWOV, Leidschendam.

Twisk, D.A.M. (1993). *Veilig op de fiets in Amsterdam; De campagne 'Veilig op de fiets': effecten, proces en motivatie*. R-93-56. SWOV, Leidschendam.

Vis, A.A. & Kaal, I. (1993). *De veiligheid van 30 km/uur-gebieden; Een analyse van letselongevallen in 151 heringerichte gebieden in Nederlandse gemeenten*. R-93-17. SWOV, Leidschendam.

Welleman, A.G. (1992). *Fietsers in het verkeers- en vervoerssysteem*. Stichting Postacademisch Onderwijs in de Vervoerswetenschap en de Verkeerskunde, Rijswijk.