



TRAFIKVERKET
SWEDISH TRANSPORT ADMINISTRATION

Safer cycling

- a common strategy for the period 2014-2020, Version 1.0





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- a common strategy for the period 2014-2020, Version 1.0

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Foreword

Increased travel by bicycle is an important part of sustainable transportation. An increase in cycling will also have positive effects on public health and the development of attractive towns and cities. At the same time, there are major and serious problems associated with the road safety of cyclists.

The strategy for safer cycling has been developed so that it will be possible for the players and stakeholders concerned to contribute effectively towards an improved standard of safety for cyclists. This is part of the joint efforts of the players involved in Tillsammans för Nollvisionen (Together for Vision Zero) and for increased cycling.

The strategy for safer cycling is a means of support for the operational planning of central and local government authorities as well as for various trade organisations and research environ-

ments. The document is the first of its kind, and is referred to as Version 1.0. The strategy is based on what is currently known about the shortfalls in road safety among cyclists. But we can already recognise the need within the foreseeable future for a new version. Consideration should then be given to the development trends for future cycling and be based on fresh knowledge on what affects the safety of cyclists.

For those who wish to make a more detailed study of the statistics and analyses that are presented in the document, reference is made to Faktaunderlag till gemensam strategi för säkrare cykling, (Basic Factual Data for a Joint Strategy for Safer Cycling) published by VTI, Report 801 (2013).

January 2014

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1. The challenge

Cycling must increase...

Increased cycle travel is an important aspect of sustainable transportation. Cycling also has a positive impact on public health and is an important way of dealing with the congestion in cities and large towns. For many decades, the infrastructure has been largely based on the needs and requirements of automobiles. Cyclists and pedestrians have been allocated common areas to share, as though they have the same needs and requirements. Cycling is now beginning to take its rightful place in the transport system and is regarded as its own individual mode of transport with specific requirements in the infrastructure. There is a clear ambition to increase cycling. Despite this, it is today still difficult, on a national scale, to provide evidence of any clear increase in the proportion of travel that is undertaken by bicycle.

...but presupposes an increase in the safety level

The safety level for cyclists is one of the largest single challenges currently faced in the area of traffic safety. Today, cyclists are the passenger group that comprises those individuals who are the most seriously injured¹ – nearly 2 000 of an approximate total of 4 500 in 2012. Each year, there are some 20–30 cyclists killed among a

total of some 300 persons killed in traffic. Safety when cycling is an important factor in making it more attractive to cycle, and this strategy must therefore be regarded as an important contributory factor to increased cycling. An account is given below of how the number of people killed and seriously injured in traffic is distributed according to mode of transport.

The purpose of the strategy is to help achieve the national traffic safety goal of halving the number of people killed and reducing the number of people seriously injured by 25 per cent. This shall be achieved between the years 2008 and 2020, and the level of ambition for cyclists should be the same as for other road users. This means that the reduction must be made even if the amount of cycling increases.

During recent years, we have seen a decreasing trend in the number of cyclists killed on the roads. The development in the number of cyclists who have been seriously injured is uncertain because this registration has only been developed in recent years. When it comes to the number of people who have been severely injured², Trafikanalys reports a decrease over the period 1987 to 2011. However, statistics on the number of injured cyclists who have had to spend at least 24 hours in hospital show an increase during the same period³.

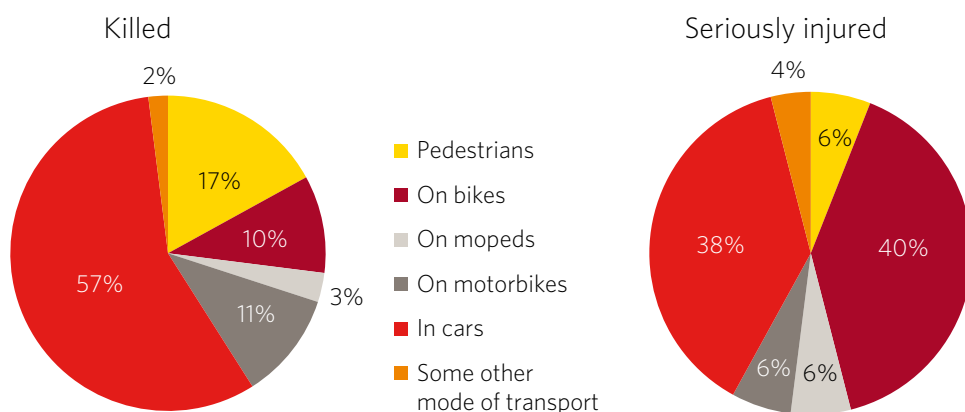


Figure 1: Proportion of people killed or seriously injured in traffic accidents in 2012, divided according to mode of transport.

Source: Road Traffic Accidents 2012, Trafikanalys.

¹ A seriously injured person is defined as someone who, in conjunction with a road accident, has suffered an injury that gives rise to at least one per cent medical invalidity. These injuries are calculated based on medical care reporting of diagnosed injured parts of the body and degree of severity together with the risks of medicinal invalidity based on this data. Medicinal invalidity is a term that is used by insurance companies for assessing permanent functional impairment regardless of its cause.

² Severely injured is assessed and reported by the police and defined as "A person who in connection with an accident has suffered an injury due to breakage, crushing, severance, a serious cut, concussion or internal injury. Seriously injured also includes persons who have suffered injuries that are expected to require admittance to hospital."

³ Injured cyclists – A study of injury trends over the course of time (MSB 2013)

2. Cooperation with breadth and systematics

Shared responsibility for Vision Zero in connection with cyclists

According to the decision made by Parliament on Vision Zero, the responsibility for traffic safety shall be shared between the system designers⁴ and the road users. The system designers have ultimate responsibility for the design and function of the road transport system, whereas the road users are responsible for following the traffic regulations and for giving consideration, making judgements and taking responsibility in traffic. The responsibility of the system designers for the safety of cyclists can be regarded as being especially important because society does not make any demands on cyclists for driving licences or complex protective equipment because the vehicle in itself cannot offer the same protection that cars give for motorists and because everyone – regardless of age – should be entitled to safe transportation.

So far, the road transport system has placed greater responsibility on the cyclist than on, for example, the motorist. The cyclists have been frequently forced to adapt themselves to a road transport system that is ba-

sically not adapted to their requirements. This could in turn lead, for example, to undesirable behaviour. One point of view with regard to the shared responsibility is rather that if an example of wrong behaviour occurs, it is more an outcome of the conditions that have been set for cyclists by the system designers. Consequently, the system designers must take further measures and provide better conditions for the system users. The importance of this is emphasised by the conclusion reached in a government investigation that an infrastructure based on the cyclist's requirements has a greater impact on the behaviour of the cyclist than the design of the regulations⁵.

Development of a system perspective

The work on the safety challenges associated with cycling has for many years been focused on the use of the safety or cycle helmet and safe cycle routes. More recently, however, growing attention has been directed to the importance of operation and maintenance. The analyses show, however, that cycle accidents are caused by a long series of factors. Therefore, a wide choice of measures is needed that are focused on the type of

factors in the chain of events leading up to the accident and later to a possible serious injury. In Section 3, a description is given of the term "sequence of events"..

Common strategy as a basis for business plans

This report presents a strategy for safer cycling by pointing out prioritised action areas and certain strategic measures⁶. It does not deal with how the measures are to be implemented. Instead, it assumes that all players conduct measures on a local, regional, national and international level within their own areas of responsibility. They do this either individually or in cooperation. The players contribute primarily by focusing their operations on the prioritised action areas. As far as possible, the priorities shall be based on facts and scientific grounds.



⁴ The term system designer is understood to mean an organisation that is responsible for the design and operation of different parts of the road transport system and those who are responsible for different support systems for safe road transport (including regulations, monitoring and care).

⁵ Increased and safer cycling – an overview of regulations from the point of view of cycling (SOU 2012:70).

⁶ In the past, similar strategies have been developed, including Increased safety on motorbikes and mopeds – A common strategy, Version 2.0 for the period 2012-2020 (Trafikverket 2012:166).

The target group for the work is those players who are able to influence the safety level for cyclists. The bodies that stand behind the work are Trafikverket, Transportstyrelsen, Sveriges kommuner och landsting, five local authorities (Stockholm, Huddinge, Malmö, Linköping and Eskilstuna), cycling associations (Cykelfrämjandet, Svensk cykling), NTF, Cycleurope, Folksam and VTI.

Together for Vision Zero

The traffic safety work that is conducted in Sweden is based on Vision Zero, and aims at fulfilling the stage goal for 2020. In order to achieve this, use is made of so-called management by objectives. This takes place within the framework of a collaboration of players that is called Tillsammans för Nollvisionen (Together for Vision Zero). The core of this management by objectives is to follow up each year the traffic safety trends on the basis of a number of indicators, or in other words circumstances that influence how many people are killed and seriously injured in traffic. Each indicator has a target for the year 2020. And it is to these indicators that measures and activities can later be tied.

The speeds in the road transport system are a decisive parameter for how many people are killed and injured. This parameter is an indicator that also interacts with most of the other indicators. The speeds travelled by motor vehicles – above all in built-up areas – play a decisive role in accidents involving collisions with cyclists. Low speeds, for example, give a lower collision impact and better opportunities for good interaction between road users. The indicator *Proportion of traffic mileage within speed limits on the municipal road network* reflects this development. Three indicators reflect developments that have an effect on safety specifically for cyclists – *The proportion of cyclists who use cycle helmets*, *The proportion of local authorities with high quality maintenance of pedestrian and cycle routes* and *The proportion of safe pedestrian, cycle and moped routes in built-up areas*. Parts of the strategy will in this way be naturally followed up within the framework of the management by objectives activities⁷.



Focus on serious injury but also on the level of safety experienced

As mentioned, the purpose of the work is to achieve the traffic safety goals. At the same time, there is a level of safety that is experienced when cycling that must also be taken into account. It is not always the risk of serious accident that is experienced as being the traffic safety problem associated with cycling – it is perhaps often the risk of merely being involved in an accident. In order for cycling to increase, it is important for people to experience it as being safe to cycle. This fact is especially important for children and their chances of being able to move around freely and independently. However, measures to reduce the number of serious accidents also affect minor injuries and thus hopefully also the level of safety experienced during cycling. Analyses indicate that it is in fact the same factors that lie behind both minor and serious injuries.

Delimitations and predictions regarding the future

The work is based on an analysis of the traffic safety of cyclists based in the first place on the current situation. It means, among other things, that the problems associated with new types of cycle vehicles, such as electric cycles, are not dealt with in depth. However, we judge

⁷ Read more about the management by objectives process at: www.trafikverket.se/Foretag/Trafikera-och-transportera/Trafikera-vag/Sakerhet-pa-vag/Tillsammans-for-Nollvisionen.

3. Problems and opportunities

even at this stage that the cycle infrastructure will in general have to handle both more and faster cyclists. In The Netherlands, for example, electric cycles are expected to become a significant part of the cycle fleet in the future. In Sweden, the proportion is still small, but even so Sweden is deemed to offer substantial potential for there to be an increase in the number of electric cycles. This will in turn have an impact on the planning of cycle infrastructure and on the safety of cyclists.

The new definition of cycle according to the legislation opens the door for electrified vehicles even without pedals with a maximum speed of 20 kph. The interface between what is considered as being a moped and what is a cycle will probably continue to change. Consequently, a review needs to be made of how cycles and mopeds are to interact in the infrastructure. Altogether the planning for cycling must take into consideration a future with a larger diversity of cycle vehicles and types of cyclists.

Cyclists are most often killed in collisions with motor vehicles...

Head injuries are the most common cause of death among cyclists, regardless of the type of accident involved. The most common type of accident in which cyclists are killed is collisions with motor vehicles. Over twenty per cent of all fatal accidents involving cycles are single accidents. After this, collisions with unprotected passengers are divided fairly evenly between types of accident, i.e. cycle-cycle, cycle-moped and cycle-pedestrian. A few of the deaths resulted from collisions between cyclists and trains. Among collisions with motor vehicles, the most frequent are between cyclists and cars, and thereafter between cyclists and lorries or buses, and a small proportion between cyclists and tractors, or similar types of vehicles. Collisions between cyclists and lorries or buses, i.e. heavy vehicles, occur in two out of five fatal accidents as a result of vehicles turning to the right. The three bars shown in Figure 2 illustrate this.

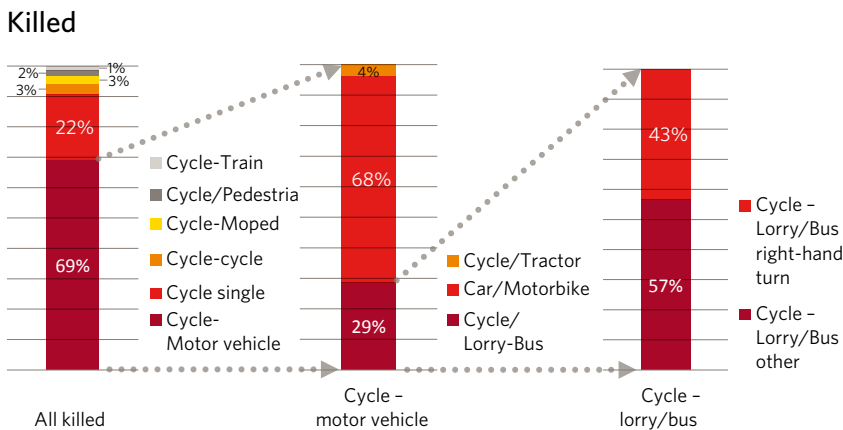


Figure 2: Proportion of the number of cyclists killed over the period 2007-2012 divided into type of accident.

Source: Swedish Transport Administration In-depth Study Material

Serious injury

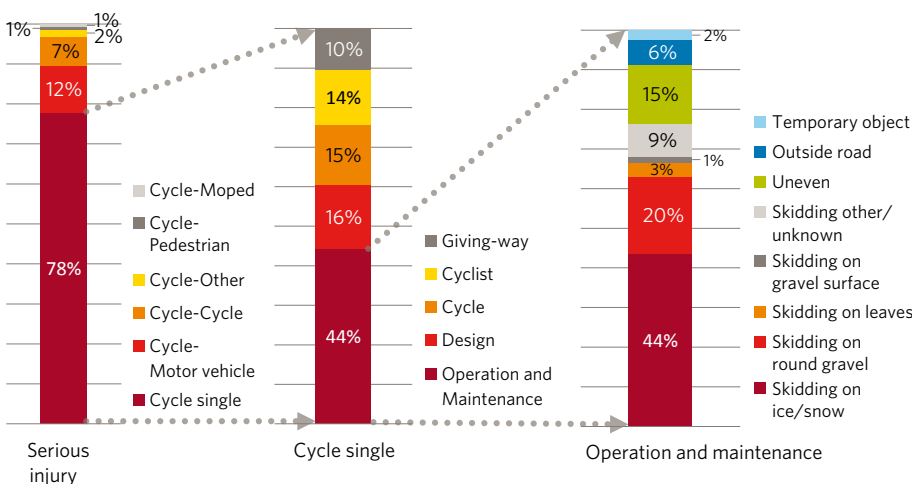


Figure 3: The first bar shows all seriously injured cyclists divided into single accidents and conflicts with other road users. The second bar shows the assessed principal cause of the single accidents and the third bar shows the causes of the single accidents that are related to operation and maintenance.

Source: VTI rapport 801 (2013).

...but are often seriously injured in single accidents

About 50 per cent of the serious injuries are to the arms and 20 per cent to legs and hips, and 10 per cent to the head. But with very serious injuries, the proportion of head injuries is about 40 per cent. Children are more often involved in accidents but older cyclists have brittle bone structures and their injuries have more serious consequences.

Approximately 80 per cent of all serious injuries occur in single accidents, just over 10 per cent in conflict with motor vehicles and a little under 10 per cent with other cycles. If we take a closer look at the single accidents, it can be seen that road-related factors are a contributory cause in just over 60 of the accidents, in the first instance operation and maintenance but also road design. The accidents that are related to operation and maintenance are to almost 70 per cent attributable to skidding as a consequence of ice, snow, gravel or leaves. The three bars shown in Figure 3 illustrate this.

Other common causes are related to the cyclist in interaction with the cycle, the cyclist's behaviour and condition or interaction with other road users. Figure 4 shows the single most common causes according to the analysis

Many accidents occur in connection with the transport of objects or when the cyclist is to about to mount or dismount from the cycle. Another common cause is application of the hand-brake too hard in a panic situation. In 5 per cent of the accidents, the cyclist has, as a result, been thrown head first over the handlebars and struck the ground. Deficiencies in cycle maintenance or in the bicycle and its constituent parts contribute to 5 per cent of the accidents. The fact that the chain has come loose or that the brakes have stopped working are common causes.

Operational faults as a cause of accidents may involve the cyclist having slipped off the pedals, cycled with one hand or similar. Other causes related to the cyclist's behaviour and condition include cycling too fast, playing while cycling, cycling while under the influence of alcohol or that the cyclist has been pulled to the ground by his/her dog. It has also often been the case that the cyclist has lost control over the cycle as a result of being distracted when turning around, having adjusted the bicycle lights or having

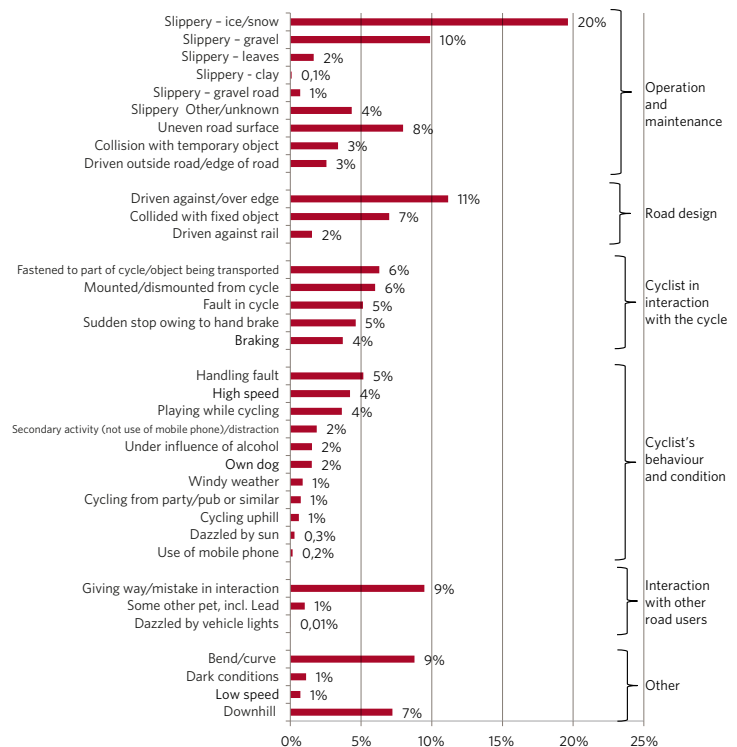


Figure 4: The most common causes of serious injuries among cyclists in single accidents according to a classification of 4 000 randomly selected persons who attended hospital. The percentages are not summed up to 100 since each accident can have several causes. Source: VTI rapport 801 (2013).

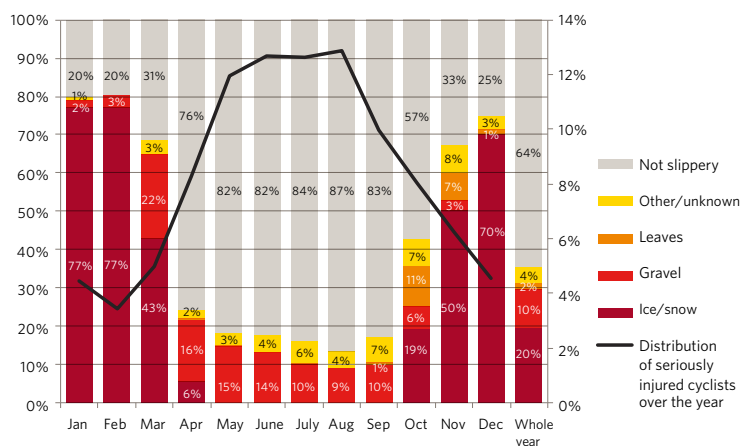


Figure 5: Skid-related causes of single accidents involving a cycle (y axis on the left) and accident distribution (y axis on the right) in connection with accidents that lead to seriously injured persons divided according to month of the year. Source: VTI rapport 801 (2013).



Figure 6: Examples of deviations and measures in a sequence of events in which a cyclist is injured in an accident.

looked at his/her watch or the surroundings, or used his/her mobile phone.

When it comes to interaction with other road users, giving way to cars is the most common situation, and causes about 50 per cent of all such accidents. Giving way to another cyclist or a pedestrian is almost equally common, representing about 25 per cent respectively. A slippery surface is in other words the single most important cause of single accidents. About every third seriously injured cyclist is injured as a result of slippery surfaces. Skidding accidents on ice and snow occur from October to April. Already by March gravel is an important reason why cyclists fall off their bikes. The problem of loosely compacted gravel then continues throughout the six months of the summer. Figure 5 shows the causes of skid-related accidents on a monthly basis. The graph in the figure indicates that the winter months have a lower proportion of injured cyclists (about 5 per cent per month) than the summer months (about 10 per cent per month), which concurs with the seasonal variation in cycling.

Deviations and measures in a sequence of events

In order to reduce the number of deaths and health losses as a consequence of traffic accidents, accident and injury protection is no longer dealt with separately but in an integrated way⁸. With this approach we can study the entire sequence of events leading up to an injury and analyse possible countermeasures for preventing death or serious injury. Figure 6 describes the sequence of events from normal cycling to the point where an accident occurs.

Normal cycling on the part of a cyclist means that he/she is sober and follows the traffic regulations. But departures from normal cycling may occur, for example

that he/she is unaware of a danger, or is unobservant, or that there are patches of ice or gravel on a particular bend. The cyclist can revert to the status of normal cycling by the cyclist him/herself and other road users receiving warnings and support, for example as a result of improved visibility or quicker cycle route maintenance.

If the warning and supporting measures are inadequate or are irrelevant, the sequence of events may continue into the next phase where immediate action is needed in order to avoid the critical situation that is approaching. The situation could, for example, be intersecting traffic with motor vehicles or too high a speed on a bend in a cycle track. One example is a cyclist who notices gravel on a bend and lowers his/her speed. In this way, the sequence of events is hopefully broken and the cyclist can continue cycling normally.

In certain situations, this cannot however take place and critical situations may occur, such as the cyclist skidding or losing control over the cycle. In these cases, countermeasures such as studded tyres or non-locking brakes could be effective ways of avoiding accidents.

After this phase, the accident can no longer be avoided. And here the cycle helmet, other protective equipment and “more friendly” surroundings are a precondition for the avoidance of serious injuries (for example soft asphalt and a better design for cars).

Analysis of potential

An analysis has been made of the theoretical potential a series of conceived measures has for reducing the number of cyclists who are killed or seriously injured. The various action areas and potential offered by the measures largely follow their share of the problem that is presented above. The purpose of the calculations of potential among different action areas is to move from the problem-oriented presentation of facts to a more

⁸ Strandroth J, Rizzi M, Sternlund S, Johansson R, Kullgren A, Tingvall C. A new method to evaluate future impact of vehicle safety technology in Sweden. *Stapp Car Crash Journal*, vol. 56, 2012.

Killed

	Deviation from normal cycling	Approaching critical situation	Critical situation	Crash unavoidable
Operation and maintenance				
Removal of loose gravel/leaves		5-10 %		
Good ice and snow-free maintenance (potholes/cracks)		5-10 %		
Safe use				
Use of cycle helmet				25 %
Sober cycling	10-15 %			
Infrastructure				
Moving over to separated car-free cycle routes – built-up areas	5-10 %			
Moving over to separated car-free cycle routes – sparsely populated areas	15-20 %			
Safe cycle crossings	5-10 %			
Road lighting for visibility	0-5 %			
Kerb adjustment	0-5 %			
Safe cycles				
Cycle lighting and reflectors for visibility	5 %			
Safer motor vehicles				
A combination of emergency brakes and air bags in urban environments			max 30 %	
Lorries with warning systems for cyclists in blind spots		5-10 %		

Table 1: Potential of measures for reducing the number of cyclists killed. The measures are entered in a so-called sequence of events that is described in the text.

Serious injury

	Deviation from normal cycling	Approaching critical situation	Critical situation	Crash unavoidable
Operation and maintenance				
Good skid prevention treatment		15-20%		
Removal of loose gravel/leaves		10-15 %		
Good ice and snow-free maintenance (potholes/cracks)		10 %		
Safe use				
Use of cycle helmet				10 %
Protective jacket and trousers				max 30 %
Sober cycling	5 %			
Correct speed	5 %			
Infrastructure				
Moving over to separated car-free cycle routes	5 %			
Safe cycle crossings	5 %			
Adjustment of kerbstones	5-10 %			
Removal of fixed objects	5 %			
Increase safety of tram lines	0-5 %			
Road lighting for visibility	0-5 %			
Safe cycles				
Winter tyres		15-20 %		
ABS brakes or similar			5 %	
Stabilisation or lower "threshold" (safe mounting/dismounting)		5 %		
Cycle inspection	5 %			
Cycle lighting and reflectors for visibility	0-5 %			
Safer motor vehicles				
Combination of emergency brakes and air bags in urban environments			0-5 %	

Table 2: Potential of measures for reducing the number of seriously injured cyclists. The measures are entered in a so-called sequence of events that is described in the text.

Relatively reliable
 Somewhat unreliable
 Highly unreliable

solution-oriented picture of the traffic safety benefit of different action areas. It could give an impression of which action areas are of great and little importance, respectively, and based on this a prioritisation could later be made of different measures. It should, however, be pointed out that having an impact in practice varies between different types of measures, a factor that has not been considered when assessing the potential offered by the measures. Where there are known cost-benefits, consideration has been given to them – for example when it comes to the benefit of cycle helmets. Where there is an absence of cost-benefit analyses of real accidents, use has been made of the Swedish Transport Administration's in-depth studies of fatal accidents and injuries reported in the medical care register STRADA over the period 2007-2012 as basic input for a potential assessment of each action area. Based on accident descriptions and other parameters (for example basic data and times) an assessment has then been made of which action areas are the most important.

Tables 1 and 2 below show the potentials of different action areas for reducing the number of cyclists who are killed and seriously injured on the roads. At this stage, the calculations do not give any consideration to compensation effects that could follow from certain measures or correlations between different measures (so-called system impacts). The reliability of the potential assessments varies, however, for natural reasons depending on the problem area. In certain cases, for example cycle helmets, they are very reliable (green boxes), whereas in other cases they can only be assessments of maximum benefit (yellow boxes). When the potential is uncertain, the boxes are red, which emphasises the importance of research and better resources within these areas. The Transport Administration's in-depth studies are a very detailed set of material which means that the assessment of certain action areas is more reliable in the case of cyclists who have been killed than for those who have been seriously injured.

The potentials are calculated on the basis of the current traffic safety situation and are placed in that phase of the sequence of events in which they are relevant. The intention is to show clearly how the potential for different action areas may relate to the same accident (for example sober cycling and removal of temporary objects) whereas the potentials for other areas can be added together (for example cycle helmet and high visibility safety jacket). Certain measures may be thought to interact with each other in order to provide further benefit (for example emergency brake, the right speed and cycle helmet).

It is worth pointing out that in certain cases the potential is zero (and then not included in the table) since the action area relates to very unusual types of accidents or sequences of events. For example, the potential of any anti-skid treatment in fatal accidents is zero because no accidents have occurred with a fatal outcome in which the icy road surface has been of decisive importance. This does not mean that the action area is in itself ineffective in preventing fatal accidents.

Better interaction for greater safety

In Section 2, it is stated that on many occasions cyclists have been forced to adapt themselves to a road transport system that is fundamentally not adapted to them. This may in turn lead, for example, to incorrect behaviour. As with the cycling investigation, we judge that the interaction between cyclists and with other road users is of the greatest importance and needs to be developed so that cycling can develop and become safer. Furthermore, the cycling survey feels that available research and competence appear to indicate that it is difficult to control cyclists only through regulations, among other things because cycling is such a flexible mode of transport. The actions of cyclists are influenced more by how the traffic environment is designed than by how the regulations are structured. We share this opinion and judge that a purpose-oriented infrastructure is decisive and that it forms the basis for being able to create better behaviour and interaction.

The cycling survey maintains that cycling must be regarded as its own separate mode of transport but also as a part of the whole journey. This can be interpreted to mean that the status of cycling within the transport system must be raised. It is not only the traffic environment that needs to be developed, but also the areas of behaviour and vehicles. The work on raising the status of cycling also includes influencing in various ways the behaviour of motorists, pedestrians and cyclists and their interaction with each other in traffic. However, undesirable behaviour is not primarily a problem of knowledge but rather a matter of norms or standards. This means that sustainable and long-term change management work is needed in order to change behaviour and interaction. This change in standards can be achieved on the one hand through the design of the physical environment and on the other through regulations and traffic monitoring, primarily focused on incorrect behaviour that has a major impact on traffic safety. There is a great need to develop new knowledge within this area.

4. Priority action areas

In view of the challenges and measures that we presented earlier, we propose that priority be given to the following five action areas:

1. Improve operation and maintenance in both winter and summer
2. Design cycling infrastructure based on the needs of cyclists
3. Start development processes for safer cycles and better equipment
4. Promote safe behaviour and increase the use of helmets and studded tyres
5. Develop knowledge on primarily the risks of accidents and cost-benefit status

1. Improve operation and maintenance in both winter and summer

Potential: Within this area there is today a potential to reduce the number of serious accidents by up to 45 per cent. This means that there is a potential for being able to eliminate all accidents that give rise to these injuries as a result of slippery surfaces or falls owing to ice, snow, gravel, leaves, pot holes and cracks, high asphalt edges and temporary objects.

Measures: Operation and maintenance of the cycling infrastructure need to be developed for both snow and ice-free conditions as well as for winter conditions. In order to be able to develop these activities we need to be able to conduct current status measurements and deficiency analyses, spread new standards⁹, update control documents, perform self-inspections and quality control as well as develop and evaluate new cost-effective methods and new machinery. It is also important to deepen our knowledge of those factors within this area that lead to accidents and to develop links between measures and effects. One way of stimulating development within the area is the planned local authority opinion survey to measure the indicator that concerns the maintenance of cycle routes within the framework of management by objectives. It is of decisive importance for us to develop process support for the road authorities in order to be able successively to develop and evaluate the efficiency within this area of activity.

Players: The Swedish Transport Administration, the local authorities and the Swedish Transport Agency.

2. Design cycling infrastructure based on the needs of cyclists

Potential: Within this area there is today a potential to reduce the number of cyclists who are seriously injured by approximately 15 per cent. The potential is roughly double the size if we instead consider the number of cyclists who are killed. Designing a purpose-oriented infrastructure for cyclists is decisive if we are to be able to create extended and safe cycling in the long term¹⁰.

Measures: The cycling infrastructure must in general be able to cope with more and faster cyclists and to be structured so that it promotes a traffic-safe behaviour. If we look at both the number of cyclists who are killed as well as those who are seriously injured, the most important measure within this area is to move cyclists over from mixed traffic to separated cycle routes and grade-separated intersections. We need to continue analysing the question of how cyclists are to be separated from other road users. Giving way as a result of conflicts between cyclists, and between cyclists and pedestrians, is the reason behind many single accidents. In certain places, mixed traffic can give cyclists the same level of safety as on separated cycle routes, provided the speed of the motor vehicles is low. According to the regulations that apply today, the speed shall be max 30 kph in places where unprotected road users are interspersed with motor vehicle traffic¹¹. The speed and density of motor vehicle traffic are important safety factors, not least from the point of view of children. Important specific measures in this action area include – in addition to creating coherent cycle infrastructure networks – creating safe passages, removing fixed objects and lowering kerbstones, improving diversions in connection with road works and safe tram and light-rail lines. In order to develop the activities we need, among other things, to perform current status surveys and deficiency analyses, produce local and regional cycle plans and cycle accounts, and update and apply control documents such as Vägars och gators utformning (VGU).

Players: The Swedish Transport Administration, the local authorities and the Swedish Transport Agency.

⁹ Read more in Cykelvägars standard – en kunskapssammanställning med fokus på drift och underhåll (Cycle route standards – a knowledge compilation with a focus on operation and maintenance) (VTI Report 726 2011) and Åtgärds katalog för säker trafik i tätort (A catalogue of measures for safe traffic in built-up areas) (SKL 2009).

¹⁰ Read more in GCM Handbook (SKL 2010) and Åtgärds katalog för säker trafik i tätort (SKL 2009). These complement the handbooks TRAST (Trafik för en attraktiv stad Traffic for an attractive city) and VGU (Vägars och gators utformning Road and street design).

¹¹ Rätt fart i staden – hastighetsnivåer i en attraktiv stad (SKL 2010). (Correct speed in cities – speed levels in an attractive city).

3. Start development processes for safer cycles and better equipment

Potential: The most common serious injuries are today injuries to arms and shoulders, followed by legs and hips. If all cyclists were to use arm and leg pads the maximum potential for reducing the number of serious injuries is 30 per cent. Some 15 per cent of the injuries would be avoided if the protective impact was the same as for the cycle helmet¹². Almost the same proportion of injuries could be prevented if faults in cycles were to be eliminated and if cyclists were to use their cycles in the right way. Safety technology for cars has a significant potential for reducing the number of cyclists who are killed but has less of an effect on the number of cyclists who are injured. Emergency braking systems and air bags on vehicles, which absorb the crash impact, together have the potential to reduce the number of people killed by up to 30 per cent.

Measures: In this context, the authorities and industry need to cooperate on the commencement of new development processes. Developing, for example, a rating system or trader requirements could contribute to such processes. We should also consider some form of extended inspection of the quality and safety characteristics of cycles. In certain EU countries there is national legislation requiring that all cycles and components which are distributed and sold must meet safety requirements in standards, and that the cycles shall be fully assembled on delivery to the customers. In Sweden there are no such regulations. We also need to develop technology for cars and heavy vehicles in order to avoid collisions with cyclists when the vehicle turns or reverses. It is a question, for example, of developing better rear mirrors and warning systems. It is possible to avoid the risk of cycle thefts by installing a chip so that it is easier to track down a stolen cycle. In general it is also the case that the crash impact needs to be reduced by changing the design of the vehicle and the traffic environment. For example, the design of the cars can be adapted more to cyclists by making the cars more impact-absorbent. Another example is impact absorption surfacing on roads to make the traffic environment more forgiving. The crash impact can also be reduced by means of protection for, above all, shoulders but also for legs and hips. In addition, we should give consideration to and analyse new technology for improving the safety characteristics of cycles, such as non-locking brakes and stabilisation, as well as new methods for promoting and driving helmet development.

Players: Industry, tradesmen, users, insurance companies, local authorities, the Swedish Transport Agency and the Swedish Transport Administration.

4. Promote safe behaviour and increase the use of helmets and studded tyres

Potential: If all cyclists were to use cycle helmets, the number of seriously injured cyclists would drop by about 10 per cent, the number of very seriously injured cyclists by 35 per cent and the number of cyclists killed on the roads by 25 per cent¹³. Altogether, this analysis shows that the cycle helmet, together with anti-skid treatment (gritting), are the measures that currently have the single largest safety potential. If we only look at the number of cyclists who are killed, the helmet is the most important measure. Using studded tyres when the road surface is slippery is judged to have a maximum potential for reducing the number of serious injuries by 15–20 per cent.

Measures: Since there are no signs of a law coming into force on the compulsory use of helmets by all cyclists, it is important to take action to increase its voluntary use. When it comes to the marketing of protective clothing, the focus must initially be on changing the behaviour of certain groups such as cycle race contestants or regular commuters. We know, however, that it is difficult to spread information unless we at the same time take other measures. It is important to develop new methods and approaches in order to really influence the behaviour and habits of road users in traffic. At the same time, it is unrealistic to believe, for example, that the problems associated with slippery road surfaces can be solved solely by action taken on the part of the road authority. Cyclists also need to be more aware of the greater risks associated with winter cycling. There is, however, a challenge in how information and its impact should be designed in order not to frighten people away from cycling, and thereby counter the overall goal of increased cycling. Important factors for increasing the safety of cyclists are also the behaviour of cyclists and their interaction with other road users. It is among other things a question of countering cycling under the influence of alcohol, increasing the use of cycle lights and reflectors, and seeking to promote safe behaviour among both motorists and cyclists at cycle crossings.

Players: Tradesmen, voluntary organisations, insurance companies, the Police, local authorities, the Swedish Transport Agency and the Swedish Transport Administration.

¹² The use of a helmet gives a 60 per cent decrease in the risk of serious injury (Rizzi M, Stigson H, Krafft M, Folksam, Cyclist Injuries Leading to Permanent Medical Impairment in Sweden and the Effect of Bicycle Helmets, IRCOB Conference 2013).

¹³ According to the Swedish Transport Administration's in-depth studies of fatal accidents..

5. Develop knowledge on primarily the risks of accidents and cost-benefit status

Potential: It is difficult to assess the potential within this area. Developing knowledge among those who influence the safety of cyclists is, however, a precondition for sound development within the other action areas, not least in the long term.

Measures: In addition to the need for development in Points 1–4, we also need to develop new knowledge within other areas. In general, there is no connection between action and effect within the area of safe cycling or with cycling in general. Among other things, we need to improve our knowledge of the mileage covered by cyclists in order to be able to calculate risks and cost benefits. When it comes to the behaviour of cyclists, fresh knowledge is needed on the importance of speed and sober cycling. As far as the vehicle is concerned, more information is needed within the areas of

cycle inspection, the trimming of electric cycles, stabilisation, visibility and lighting, efficient brakes and safe mounting and dismounting. We also need to develop knowledge on factors in the road environment. It may, for example, be criteria for separating pedestrians and cyclists, designing cycle underpasses and developing a system for cycling at higher speeds. We also see a need for greater knowledge about cycling within the educational system, among other places within universities and institutes of higher education. Finally, STRADA needs to be developed in order, among other things, to acquire more user-friendly interfaces and guaranteed quality. Another sub-group should be added to STRADA so that it will be possible to identify injuries that are associated with electric cycle usage.

Players: Institutes of higher education and other research environments, industry, consultants, voluntary organisations, insurance companies, the Swedish Transport Agency and the Swedish Transport Administration.

5. Conclusions

The level of safety for cyclists is one of our greatest challenges at the present time within the area of traffic safety. At the same time, a high safety level is important if cycling is to increase. Many of the challenges that cycling represents are based on the fact that the infrastructure has for many decades been structured on the needs and requirements of motorists.

Viewed historically, the direction with respect to the traffic safety of cyclists has been in the first instance to reduce the number of cyclists who are killed in traffic, primarily by increasing the use of cycle helmets and reducing the risk of collisions with motor vehicles. Through the registration during recent years by hospitals of people injured in traffic a new problem scenario has emerged. In it we see a new challenge in also reducing the number of cyclists who are seriously injured, primarily in single accidents but also in collisions between unprotected road users. A slippery road surface is the cause of every third single accident. The goal of our work for safer cycling is to halve the number of cyclists killed and to reduce the number of seriously injured cyclists by 25 per cent between the years 2008 and 2020, even if there is an increase in cycling.

In order to increase the safety of cyclists, broad-based and systematic cooperation is needed between the players concerned within several prioritised action areas. Core efforts include the improvement of operation and maintenance, an improvement in the design and structure of the cycling infrastructure based on the needs of cyclists and the initiation of development processes for better safety properties with respect to cycles and protection.

Within the framework of this work, we have developed new knowledge that describes the present situation for the safety of cyclists and what is currently known about the potential of different measures. There are still major knowledge deficiencies within a number of areas when it comes to the causal connection for injuries and accidents and the cost-benefit ratio of various measures. During 2014, the work will therefore be directed towards gaining further insight into how the safety level for cyclists can be influenced, among other things within the areas of road surface, protective equipment and the bicycle as a vehicle. Furthermore, the work carried out on the proposed action areas will be followed up. It is our ambition, in time, to update the strategy and that the process will lead to constant improvements in the safety of cyclists.



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