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Analysis of road safety trends and road safety management in Sweden
Submitted by Sweden

Analysis of Road Safety Trends 2010

Management by Objectives for Road Safety Work, Towards the 2020 Interim targets

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Foreword

This report is the third follow-up of the road safety objectives for road traffic in 2020. The report describes and analyses road safety trends in 2010. As before, the results are analysed on the basis of the number of fatalities and casualties and a number of designated Road Safety Performance indicators. The report will form the basis for the 2011 result conference in Stockholm on 28 April.

The report has been produced by an analysis group consisting of analysts from the Swedish Transport Agency, Transport Analysis, VTI (the Swedish National Road and Transport Research Institute), and the Swedish Transport Administration.

Summary

According to Government Bill 2008/09:9, the number of fatalities on the roads should be halved between 2007 and 2020. This is equivalent to a maximum of 220 fatalities in 2020. The number of those seriously injured on the roads is to be reduced by a quarter. This report describes road safety trends and forms a basis for the work that will lead to meeting the objectives by 2020. The report will be presented at the 2011 result conference. Road safety trends are described and analysed in the report on the basis of the number of fatalities and casualties and also designated Road Safety Performance indicators. In addition, the trends are explained using surrounding world factors and different types of road safety measures as a starting point.

The table shows the present position in 2010 for these Road Safety Performance indicators and an assessment as to whether the change from 2007 has taken place at the pace required in order to reach the objective by 2020.

Road Safety Performance indicator	Starting position	2010	Target year 2020	Trend
Number of fatalities on the roads	440	270	220	In line with required trend
Number of persons seriously injured on the roads	5 500	4 700	4 125	In line with required trend
Percentage of traffic volume within speed limits, national road network	43 %	-	80 %	In line/not in line with required trend
Percentage of traffic volume within speed limits, municipal road network	52 %	-	80 %	Not measured
Percentage of traffic volume with sober drivers	99.71 %	99.74 %	99.90 %	In line with required trend
Percentage of those wearing a seat belt in the front seat of passenger cars	96 %	96 %	99 %	Not in line with required trend
Percentage of cyclists wearing a helmet	27 %	27 %	70 %	Not in line with required trend
Number of new passenger cars with the highest Euro NCAP score.	66 %	74 %	100 %	In line with required trend
Percentage of new heavy vehicles with automatic emergency braking system	0 %	0 %	100 %	Not in line with required trend
Percentage of traffic volume on roads with speed limits of more than 80 km/h and median barrier	50 %	67 %	75 %	In line with required trend
Percentage of safe pedestrian, cycle and moped passages in the municipal road network	Approx 25 %	-	Not defined	Not measured, no target
Percentage of safe crossings in main municipal road network for cars	Approx 50 %	-	Not defined	Not measured, no target

Average time from alarm to satisfactory rescue and care	-	15.7 mins	Not defined	Not measured, no target
Percentage of drivers stating they have fallen asleep or almost fallen asleep while driving	11.9 %	13,7 %	6 %	Not in line with required trend
Valuation of road safety, index	67	65	80	Not in line with required trend

In 2010, the number of fatalities has further decreased, compared with 2009, from 358 to about 270 (290 including suicides). From 2010, suicides will be reported separately in accordance with international practice. Regardless of whether suicides are included or not, this means a great decrease from what was already a low level, historically speaking. The number of those seriously injured has been estimated at 4,700, which is also a decrease compared with the previous year and the starting position in 2007, when the number of those seriously injured was estimated at 5,500.

The reduction in the number of fatalities and casualties is probably not simply due to the trends in the Road Safety Performance indicators. The trend towards a decrease in the numbers of fatalities and casualties that started in connection with the downturn in the economy that began during the financial crisis in the autumn of 2008 has continued in 2010. This is despite the fact that growth figures have gone up again. We know, however, that unemployment is also linked to road fatalities and casualties. Since unemployment continued to increase in 2010, this may be an explanation as to why we have not seen any change in the fatality and casualty figures. Now that unemployment is going down and growth is continuing to be high, previous experience indicates that the fatality figures may go up again. Other important explanations for the reduction in the number of fatalities and casualties are the gradual improvement in roads and vehicles and lower average journey speeds.

The Road Safety Performance indicators that have the greatest potential for saving lives on the roads are compliance with speed limits, safe vehicles and safe national roads. These Road Safety Performance indicators have also developed in a positive direction so far. Speed is the most central factor when it comes to road safety and, according to measurements, average journey speeds seems to be changing in the right direction. Some of the reduction in 2010 is probably due to the snowy winter with wintry conditions on the roads throughout the country. The target of reaching 80 percent compliance with speed limits by 2020 is, however, still the greatest challenge. It is felt that this Road Safety Performance indicator has not changed at a sufficiently fast pace so far.

The Road Safety Performance indicator that has undoubtedly come furthest towards reaching the target for 2020 is safe national roads. Here, median barriers on roads and the lowering of speed limits have meant that as much as 67 percent of traffic is on safe national roads. This situation does not, however, guarantee that the target of 75 percent by 2020 will be achieved, since the current action plan for the Swedish Transport Administration does not include initiatives of the magnitude required.

The development of safe vehicles is in line with the desired trend. The report also shows that even a small increase in safe vehicles among new car sales has a great effect on the total percentage of traffic volume in safe cars. The same applies to motor cycles where ABS will hopefully have a quick impact, not just in new sales but also on the roads. In general, the case is that vehicle-borne technology is solving several problems that have existed on the roads for a long time. But the problems will not be automatically solved. It will be necessary for the car population to be replaced at a sufficiently quick pace and for more technology to prevent high speeds and drink driving to be initiated. Otherwise, we will still not see the good effects of the new technology have an impact by 2020.

Content

1 Background

According to Government Bill 2008/09:9, the number of fatalities in road traffic should be halved between 2007 and 2020. This means that the number of fatalities in 2020 must be a maximum of 220. The Riksdag has also decided that the number of persons seriously injured in road traffic should be reduced by a quarter.

Part of the supporting documentation for this Riksdag resolution was the report the Swedish Road Administration wrote on behalf of the Government for the purpose of proposing a new milestone for road safety trends (The Swedish Road Administration, publication 2008:31). The assignment involved producing supporting documentation for future road safety work according to the Zero Vision. The proposal is based on managing road safety work by objectives, more action-based interim targets and annual result conferences in which road safety trends and the achievement of objectives are evaluated. The aim is to create a long-term perspective and systematics in road safety work. The proposal has been produced in cooperation with other organisations.

The management of objectives is based on measuring and following up the results for different Road Safety Performance indicators towards the targets set. Together, these targets correspond to an overall target for road safety trends. Targets for Road Safety Performance indicators make follow-ups more activity based.

The following Road Safety Performance indicators are followed up in this report with the target levels shown in section 4:

- Compliance with speed limits, national road network
- Compliance with speed limits, municipal road network
- Sober traffic
- Use of seat belts
- Use of helmets
- Safe vehicles
  - Safe passenger cars
  - Safe heavy vehicles
  - Safe motorcycles and mopeds
- Safe national roads
- Safe municipal streets
  - Safe pedestrian, cycle and moped passages in urban areas
  - Safe crossings in urban areas
- Quick and qualitative rescue
- Rested drivers
- High valuation of road safety

1.1 Aim

This analytical report will form the basis for the 2011 result conference and for the future planning of road safety work in Sweden.

The analytical report will describe and analyse road safety trends. It will also provide answers as to which Road Safety Performance indicators it is most important to change in order to improve road safety and halve the number of fatalities by 2020. Road safety trends are described on the basis of both the results of numbers of fatalities and seriously injured and also the designated Road Safety Performance indicators. The analysis seeks an explanation regarding to what extent the road safety situation may have been affected by measures taken and which surrounding world factors could have affected the outcome (e.g., demographic and socio-economic changes).

The analyses during the period up to and including 2020 should also be able to be used as a basis for deciding on new Road Safety Performance indicators or other combinations of today's Road Safety Performance indicators. It will also be important to be able to describe which road safety measures have been most effective and which measures and volumes of measures will need to be implemented in the future.

1.2 Starting points

The starting point for the analysis is the Road Safety Performance indicators and the links between effects that form the basis for the target levels. These were produced by the former Swedish Road Administration in collaboration with a number of national organisations. See the report Management by Objectives for Road Safety Work (the Swedish Road Administration, publication 2008:31). The data the analysis is based on primarily comes from the Swedish Transport Administration and the Swedish Transport Agency's measurements.

According to the plans, the target levels and combination of Road Safety Performance indicators will be reviewed at a general level in 2012. The aim of the review is to make sure the choice of Road Safety Performance indicators and targets to be as relevant and suitable as possible during the entire milestone period. In 2012, there is, therefore, the opportunity to make major revisions to the starting points for this work. In the report, it is stated whether the Analysis Group feels the motive or measurements for a certain Road Safety Performance indicator should be reviewed. The analysis group will then suggest that this Road Safety Performance indicator is included in the review in 2012.

2 Number of fatalities and seriously injured

The numbers of fatalities and casualties in road traffic depend on a number of different factors, such as traffic volumes, surrounding world factors and road safety measures. There is also a random variation in the results of numbers of fatalities and casualties between the years. For the number of casualties, the relative change is less significant, but for the number of fatalities, this may mean as much as ± 10 percent.

2.1 Fatalities

As yet (March 2011), there is no official information on the number of fatalities in 2010. For this reason, the number has been estimated as comparable to previous years. In addition to the estimate, 8 pedestrians have died from injuries they incurred after falling in the road environment and 4 persons have died after being run over by trams. These types of accident are not included in official statistics or in the analysis below.

By definition, suicides have been included in Sweden's official statistics on fatalities in road traffic. The Transport Analysis'[1] remit includes, however, reporting, from and including 2010, on the number of fatalities in regular accidents and the number of suicides separately. The Transport Analysis has, therefore, decided to adapt the definition of fatalities in road traffic accidents to that applying to other types of traffic and to that applying in the majority of countries in the rest of Europe. From and including 2010, suicides will, therefore, be excluded from the official statistics on fatalities in road traffic accidents. This means that the statistics from and including 2010 are not fully comparable with previous years. From 2010, the level will be approx. 20 fewer fatalities than previously.

	2006-2008	2010	Target year 2020	Estimated trend towards target
Number of fatalities	440	270*	220	In line with required trend

**2010 estimated, excluding suicides*

For 2010, it is estimated that the number of fatalities will amount to about 270 persons, which is 88 fewer than in 2009. Compared with the mean value[2] for 2006–2008, the number of fatalities has reduced by 38 percent. In order to achieve the target of a maximum of 220 fatalities in 2020, an annual decrease of 5 percent in the number of fatalities will be required. From 2008 to 2010, the annual decrease in the number of fatalities was 14 percent on average. This means that the number of fatalities for 2008 to 2010 falls well below the curve for achieving the target by 2020.

[1] Transport Analysis (previously SIKA) is responsible for official statistics in the area of communication.

[2] In order to even out annual variations, a mean value for 2006-2008 is used as a base year. See more under chapter 3 Surrounding world factors.

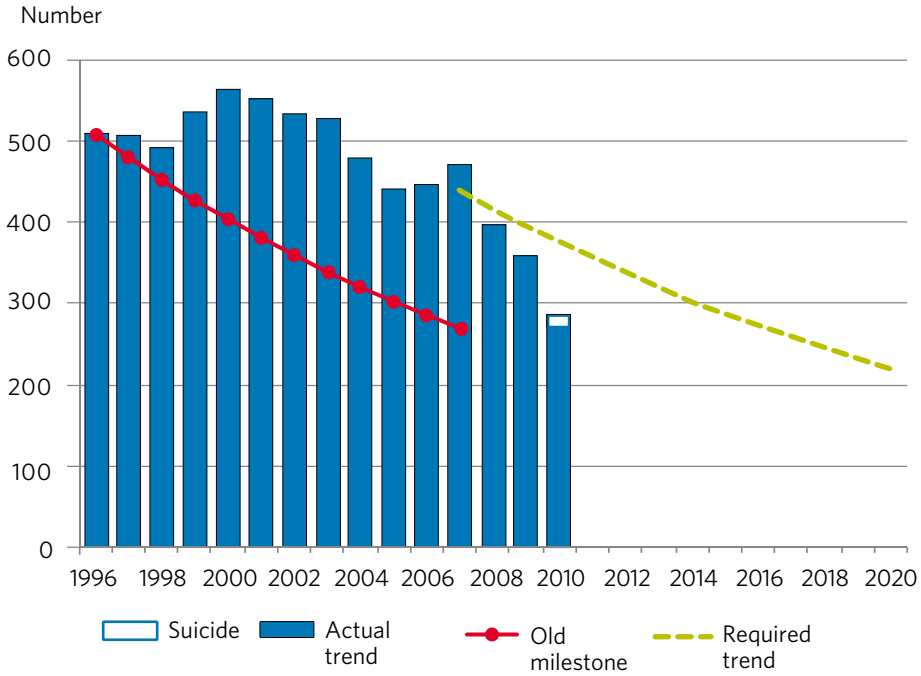


Figure 1. Number of fatalities in road traffic accidents 1996-2010 (2010 estimated and excl./incl. suicides) and the required trend up to 2020. Source: STRADA

In 2010, the number of fatalities decreased for all categories of road-user, except for cyclists, where the number of fatalities increased somewhat. The relative decrease was greatest for the number of car passenger fatalities, which decreased by 32 percent compared with 2009.

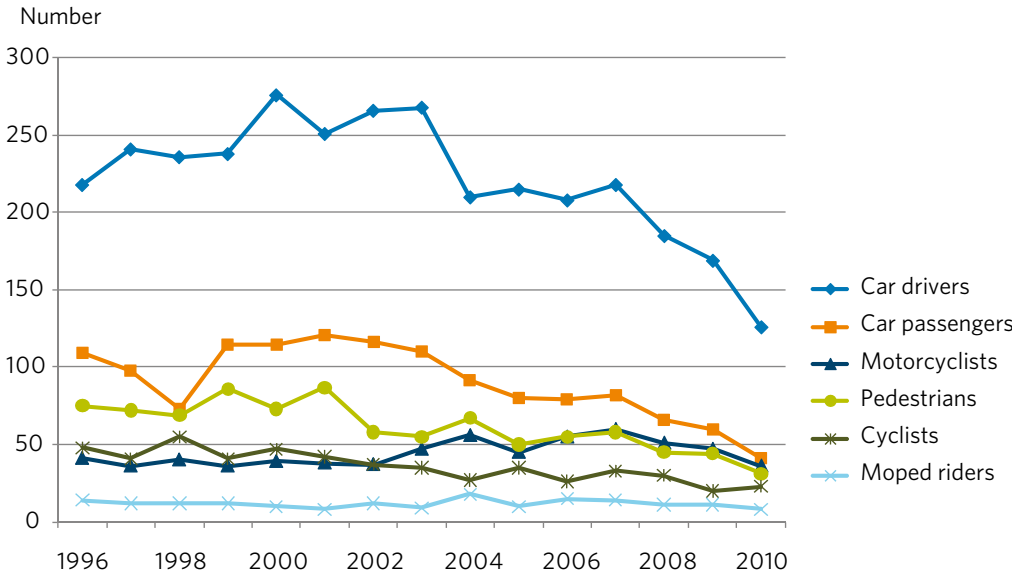


Figure 2. The number of fatalities divided into road-user categories. 1996-2010 (2010 estimated and excluding suicides). Source: STRADA

During the period, 1996–2010, the total number of fatalities decreased by 47 percent. The number of motorcyclist fatalities decreased by 12 percent from 1996 to 2010. Other road-user categories decreased by between 42 and 59 percent during the same period. One reason that the number of motorcyclist fatalities did not

decrease to the same extent as other road-user categories could be that the volume of motorcycle traffic increased by more than double during this period.

In 2010, about 20 children were killed, 0–17 years of age, which means a decrease of 60 percent compared with 1996.

2.2 Seriously injured

The definition of a seriously injured person is someone who has suffered an injury leading to at least 1 percent medical invalidity in connection with a road traffic accident. Medical invalidity is a term that is used by insurance companies to assess disabilities, regardless of cause. The method for estimating the number of seriously injured persons has, however, not yet been fully developed and, for this reason, the levels for the number of people seriously injured may change.

	2007	2010	Target year 2020	Estimated trend towards target
Number of people seriously injured	5 500	4 700	4 100	In line with required trend

The number of people seriously injured in 2007 is estimated at about 5,500 persons and about 4,700 in 2010.

Pedestrians who are seriously injured falling in a road traffic environment are not included in official statistics. If this type of accident had been included in the calculations, the number of people seriously injured would amount to more than 8,600 in 2010. As almost every second seriously injured person in the road transport system in 2010 was a pedestrian who fell, this is, however, such a major problem that it must be mentioned. In figure 3, we can see an increase in the number of accidents involving pedestrians falling, which must be put down to the snowy winter of 2009/2010 and the snowy end of 2010.

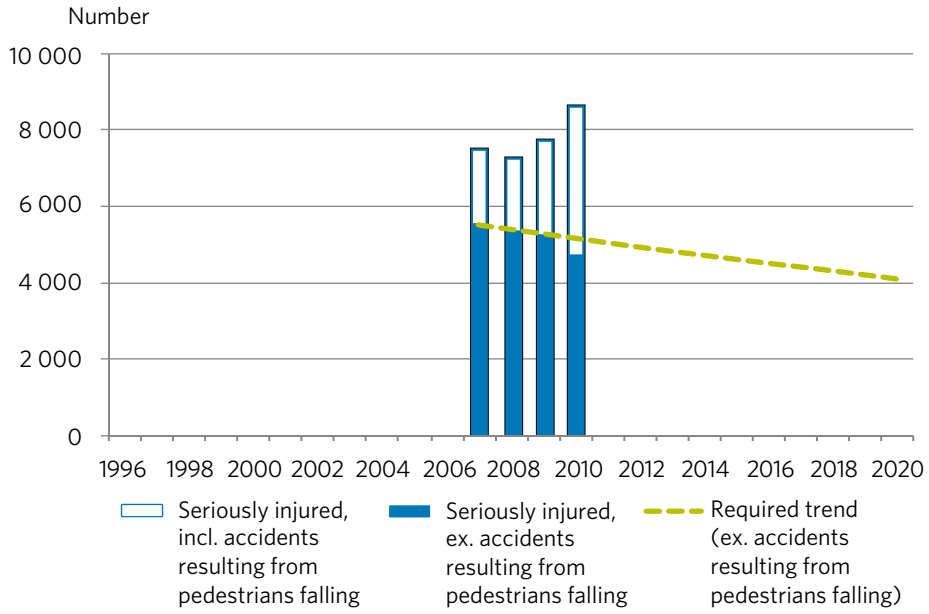


Figure 3. Number of people seriously injured 2007-2010 and the required trend up to 2020 (incl./excl. pedestrians falling in the road traffic environment). Source: STRADA

The milestone means that the number of persons seriously injured may amount to a maximum of 4,100 in 2020, which is equivalent to a rate of decrease of almost 3 percent. From 2007, the number of people seriously injured has decreased by 15 percent, which is well under the required trend. About 700 children between the ages of 0 and 17 were seriously injured in 2010, which is 36 percent fewer than in 2007.

Many people with a low degree of medical invalidity do not see themselves as seriously injured. For this reason, the number of very seriously injured persons is also reported. Very seriously injured means a person who has incurred a medical invalidity of at least 10 percent. In 2010, about 700 people were so seriously injured that they incurred a medical invalidity of 10 percent or greater.

The difference between persons with different degrees of medical invalidity is that those with a higher degree have more often suffered brain injuries. Of all injuries leading to a medical invalidity of at least 1 percent among drivers of passenger cars, brain injuries accounted for 5 percent, while brain injuries accounted for 21 percent among motorists with a medical invalidity of 10 percent or more. The corresponding figures for cyclists were 7 and 33 percent respectively.

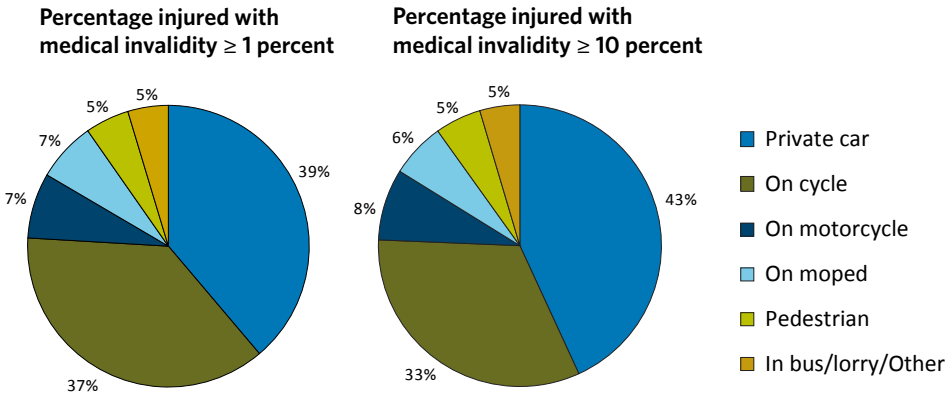


Figure 4. The percentage of people seriously injured (≥1 %) and the percentage of people very seriously injured (≥10 %) divided into means of travel, 2010. Source: STRADA

Drivers of passenger cars are the group of road-users that constitutes the greatest percentage of those very seriously injured, 43 percent. By far the most common injury leading to a medical invalidity of 10 percent or more among drivers of passenger cars is the so-called whiplash injury to the neck. In 2010, just over 40 percent of the seriously injured drivers of passenger cars have suffered whiplash injuries. The second most serious injury is different types of injury to the brain, which 22 percent were affected by. Cyclists also constitute a considerable proportion of those very seriously injured. Every third person seriously injured in 2010 was a cyclist. Cyclists often suffer injuries to the head (48 percent). Other common injuries that lead to permanent disability are wrist and collar bone fractures.

More moped riders than motorcyclists have been very seriously injured, despite the fact that the volume of traffic using motorcycles is more than twice as much. Among both groups, it is injuries to the brain that most often lead to permanent disability. The percentage of pedestrians that have been very seriously injured after being knocked over is much higher than their percentage of traffic volumes. Among this group too, it is injuries to the brain that most often lead to permanent disability.

2.2.1 Seriously injured according to PAR[3]

Changes within the road-user groups over a longer period of time can be demonstrated by means of information from the National Board of Health and Welfare's Patient Register, PAR. This includes information about the number of road-users who have been injured so seriously that they have been admitted[4] to hospital for more than 24 hours (Transport Analysis, 2010).

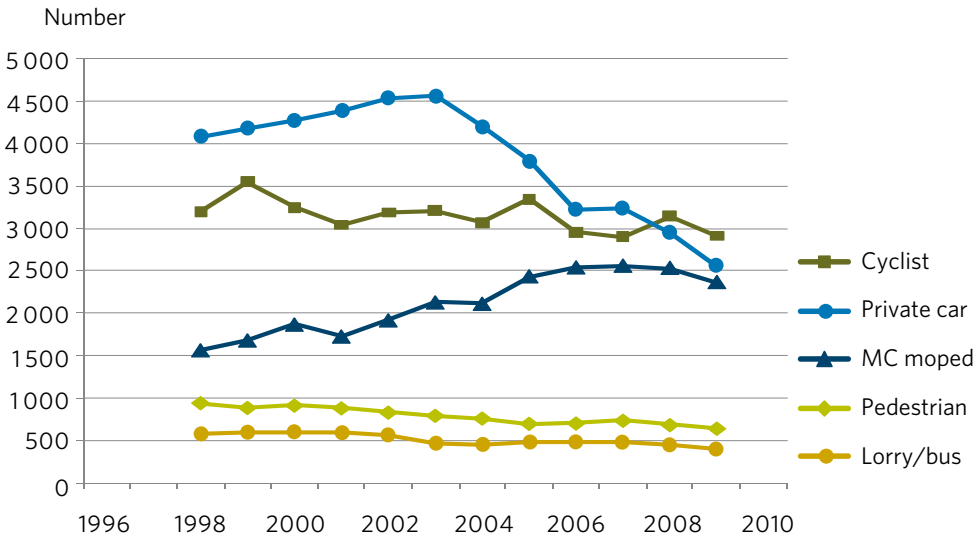


Figure 5. The number of people seriously injured (admitted to hospital for more than 24 hours) divided into means of transport 1998-2009. Source: PAR

Up to 2007, more persons seriously injured had been travelling in a passenger car than by any other means of transport. The number of injured drivers of passenger cars even increased in 2003. Since then the number has shown a striking decrease. This means that cyclists are now the group of road-users that account for most seriously injured persons. A third of the road-users admitted to hospital in 2009 were cyclists.

The number of moped riders and motorcyclists injured so seriously that they were admitted to hospital for at least 24 hours increased by 61 percent from 1998 to 2008. This is the only category of road-user that has demonstrated a negative trend during the period. In 2009, however, the number decreased by 7 percent. The number of pedestrians seriously injured after being run over decreased by 32 percent from 1998 to 2009. The number of road-users injured using other means of transport (bus, lorry or other) has remained low throughout the entire period and even decreased somewhat, from a total of 575 to 400.

2.3 International comparison

In 2009, a total of 34,500 people were killed in road traffic in the 27 countries that are part of the EU. This information is based on data from the EU's database for road traffic accidents (CARE). In 2001, the European Commission decreed that the number of fatalities in road traffic in the EU should be reduced by half by 2010. This would mean a decrease from 54,000 to 27,000. Up to and including 2009, the decrease has been 36 percent. Sweden is deemed to have achieved the target for

[3] The National Board of Health and Welfare's Patient Register

[4] Admitted to hospital is the official term for what is colloquially called being put in hospital.

2010, from 531 to 270 fatalities[5], a decrease of 50 percent. In July 2010, the European Commission made a decision to halve the number of fatalities from 2010 to 2020. They estimate that the number of fatalities in the EU in 2010 has decreased to about 32,000, which means that the number of fatalities should decrease to a maximum of 16,000 in 2020.

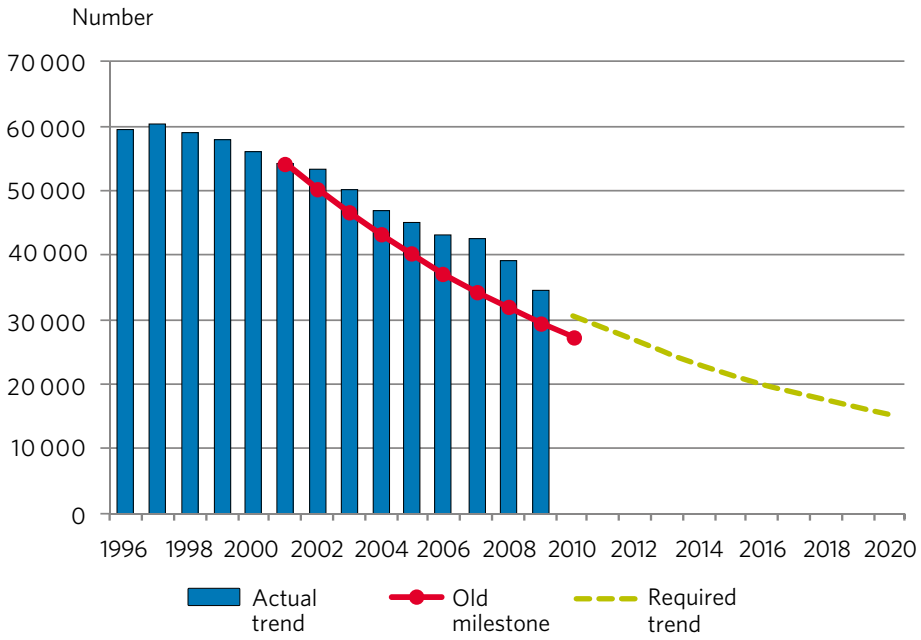


Figure 6. The number of fatalities in the EU, 1969-2009, and required trend up to 2020. Source: CARE

The UK, Sweden and the Netherlands have the lowest number of fatalities per capita within the EU. From 2001 to 2009, the number of fatalities per capita decreased by 35 percent in these countries. In the entire Union, the number of fatalities per capita decreased by 36 percent. In 2009, Sweden had one of the lowest numbers of fatalities per capita with 3.9 fatalities per 100,000 inhabitants. For 2010, this quotient has also decreased to 2.9.

[5] For 2001 and 2010 respectively, 20 suicides (estimated level) have been deducted. Causes of death other than collisions have been excluded in official statistics since 2003 and, for this reason, illness has also been excluded for 2001.

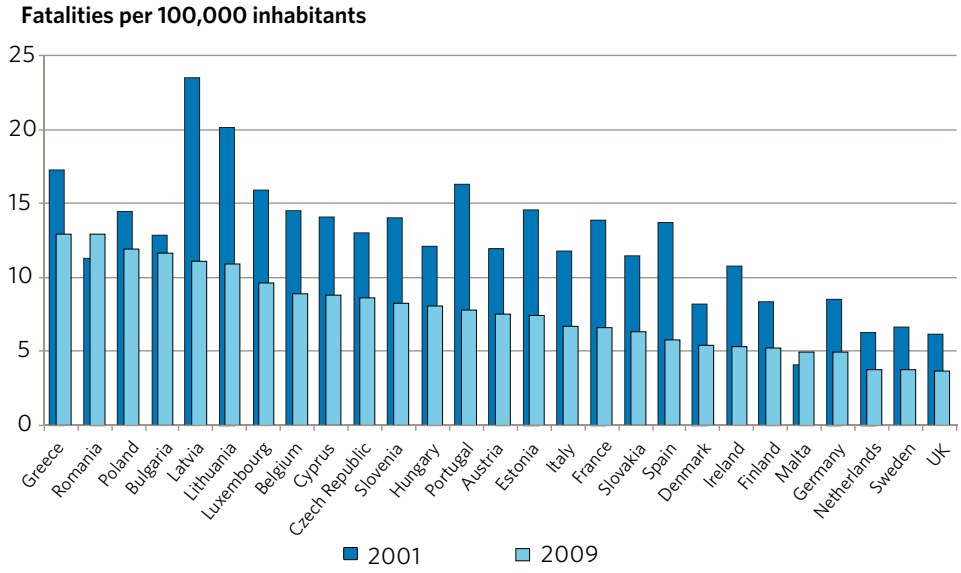


Figure 7. Number of fatalities per 100,000 inhabitants for the 27 countries within the EU, 2001 and 2009. Source: CARE

In Sweden, Denmark, Norway and Finland, the number of fatalities has decreased by 35, 30, 19 and 36 percent respectively during the period, 2001-2009. In Sweden the number of fatalities decreased by 25 percent (20 percent including suicides) from 2009 to 2010. In Denmark, Norway and Finland, according to preliminary information, the number of fatalities has decreased by 13, 1 and 3 percent respectively from 2009 to 2010.

3 Surrounding world factors

There are many factors in the surrounding world that affect the extent and composition of traffic volumes and thereby the road safety position. Surrounding world factors that are important for road safety are primarily economics, demographics and weather and climate. All three of these factors influence who drives which vehicles and when, where, how and how much these vehicles are driven. In turn, the complex composition of traffic volumes is important with regard to trends regarding the number of fatalities and casualties in road traffic.

Figure 8 shows how traffic volumes have grown since 1960 up to and including 2010. Today, passenger cars account for about 83 percent of traffic volumes measured by vehicle kilometres on Swedish roads. Buses and motorcycles account for just over 1 percent each, light lorries for 10 percent and heavy lorries for 5 percent.

In 2010, the total volume of traffic increased by 1.6 percent (+ 0.6 percent 2009). For passenger cars, the change was + 1.4 (0.5 percent in 2009) and for lorries + 2.6 percent (+ 0.8 percent in 2009), according to VTI's model for traffic volumes. Historically, a moderate increase in road traffic of 0.5–1.5 percent has led to the number of fatalities decreasing in the range of 3 percent.

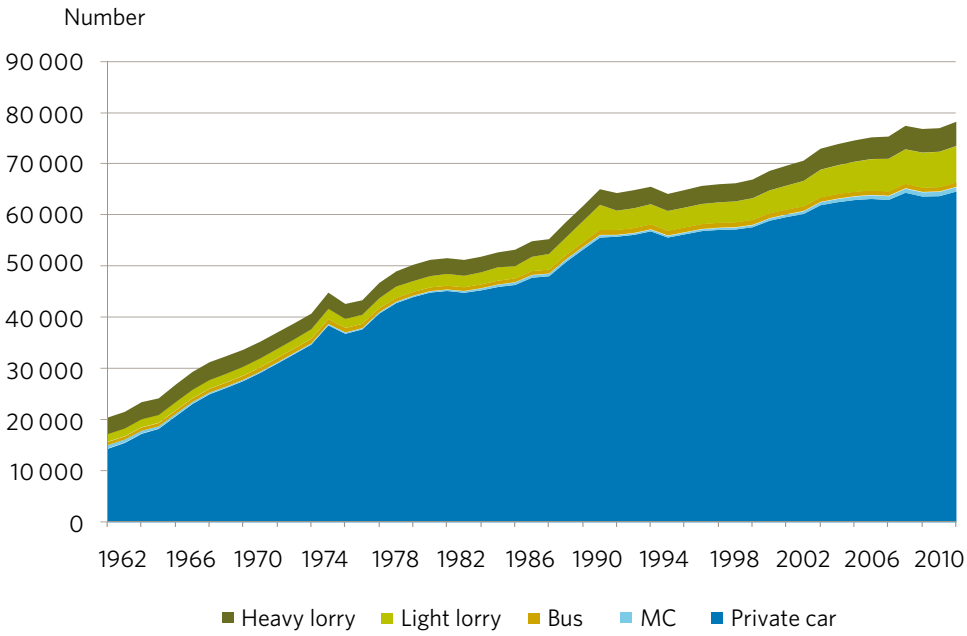


Figure 8. Traffic volumes by vehicle type, the years 1960-2010. Millions of vehicle kilometres. Source: Transport Analysis, except for 2010 where the upward-adjustment figures come from the Swedish Transport Administration's annual report.

3.1 Economics

The number of fatalities on the roads has decreased a great deal over the last three years, by 16 percent in 2008, 10 percent in 2009 and now by a full 25 percent (20 percent including suicide) in 2010. At the same time, GDP in fixed prices decreased by 0.6 percent in 2008 and by a full 5.3 percent in 2009 and then increased by 6.8 percent in 2010.[6] Earlier fears that the decrease in fatality figures on the roads would

[6] According to the National Accounts, SCB (www.scb.se).

come to an end as a direct consequence of a healthier economy have, at least so far, come to nought. Experiences from several countries show that there is a connection between the number of fatalities on the roads and economic trends, whereby an economic downturn in the economy is often accompanied by a decrease in the number of fatalities on the roads. It has not, however, been possible to clarify this link more exactly. It is impossible to quantify for individuals the effect of different factors that affect road safety. This is due to both the fact that many different factors work together (measurable and immeasurable) and also that there is a great random variation in the outcome regarding the number of fatalities between the years.

The diagram in figure 9 shows growth in GDP in fixed prices and the annual change in the number of road deaths since 1960. The correlation between the series is 0.36 (0.41 if 2010 is excluded). The series have, therefore, a positive correlation: put simply, strong growth is bad for road safety and a recession is good. We can see that, during the extreme recession at the beginning of the 1990s, the number of fatalities quickly decreased. But even over the past decade with mostly strong growth, the total number of fatalities has greatly decreased, even if this has increased in individual years. In 2010, the number of road fatalities decreased more than in any year since 1960 and, at the same time, growth was strongest during this same period. The declines in the fatality figures in 2008 and 2009 coincided with a decline in the economy, while the even greater decline in 2010 occurred in a significantly better economic situation. This happened at the same time as the vehicle population increased in size and the total traffic volume was, in principle, unchanged from the previous year.

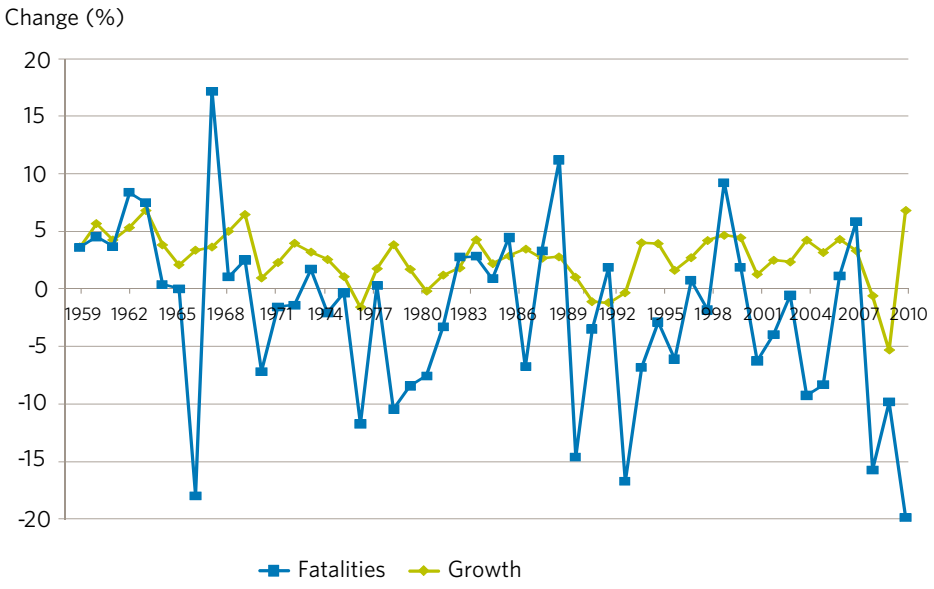


Figure 9. The number of fatalities and growth in GDP in fixed prices, annual change expressed as a percentage. The years 1960-2010. Source: The number of fatalities, official statistics from Transport Analysis, GDP in fixed prices from SCB, the National Accounts.

A variable that, like growth, has an effect on activity in the economy is unemployment. The level of unemployment bears a direct relationship to the distribution of different kinds of traffic on the roads. Figure 10 shows the annual changes in the total unemployment (open unemployment plus participants in programmes as a percentage of the population) and the annual change in the number of fatalities in road traffic. Both are expressed as a percentage change over the years. The correlation between the series is negative: – 0.53. This means that, when unemployment

increases, the figures for fatalities on the roads fall. A worse employment situation is, therefore, good from a road safety point of view.

There is a Swedish study that shows at an individual level that those involved in road traffic accidents also have a poorer connection to the employment market. In a weaker employment situation, people with a weak connection are at a greater risk of falling outside the ordinary employment market. People without an occupation move around less in road traffic than those employed. If those outside the ordinary employment market are more subject to risk than others, this means that unemployment is apparently favourable for road traffic.[7] In 2010, total unemployment increased from 6.0 to 6.9 percent of the population, an increase of 14 percent, at the same time as the number of fatalities on the roads decreased by 20 percent. This relatively high unemployment may have been a factor that has dampened the effect of the strong growth, which is usually detrimental to road safety.

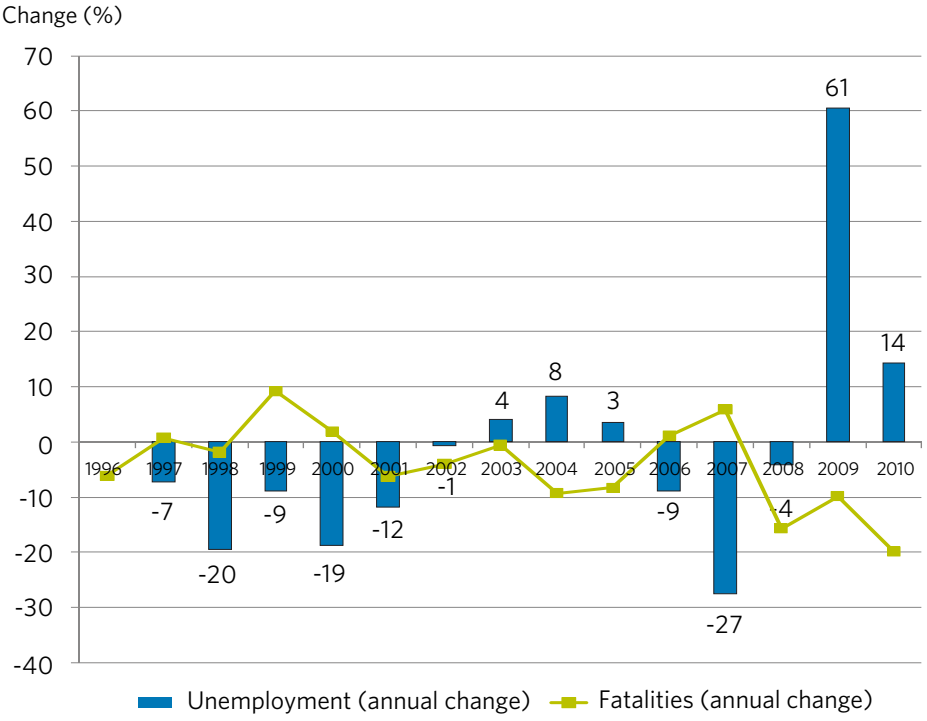


Figure 10. Changes in the number of fatalities and total unemployment (open and in programmes, percentage of the population), annual changes expressed as a percentage. The years 1997-2010. Source: The number of fatalities official statistics from Transport Analysis, unemployment from www.arbetsformedlingen.se

3.2 Demographics

The composition of the population, as regards gender, age and other qualities, largely also determines the composition of road-users on the roads. The number of fatalities in relation to distances travelled in the road traffic environment is greatest for the 75 and over age group and next is the "young drivers" group: persons 18–24 years of age.[8] The size of the different age groups naturally changes very slowly over time. Between 2009 and 2010, the percentage of over 75-year olds was the same, 8.5 percent, while the percentage of 18–24 year olds increased from 9.3 to 9.5 percent (+ 24,000 persons). In figure 11 below, we have defined the high-risk groups as people from 18 to 24 and 75 and older. The medium-risk group is 15–17 years of age and

[7] See the report, How Much Does a Road Traffic Accident cost? (SIKA Report 2008:8).

[8] See risks for different age groups in Road Traffic Injuries 2009 (Transport Analysis Statistics 2010:17).

65–74 years of age, while the low-risk group is the other ages. In 2010, the high-risk group consisted of about 18 percent of the population and the low-risk group, 68 percent. According to SCB's population forecasts, the high-risk group will reduce its percentage of the population somewhat up to 2020. The over 75-years of age group will admittedly increase but the numbers and percentage of those between 18 and 24 is expected to decrease in the longer perspective.

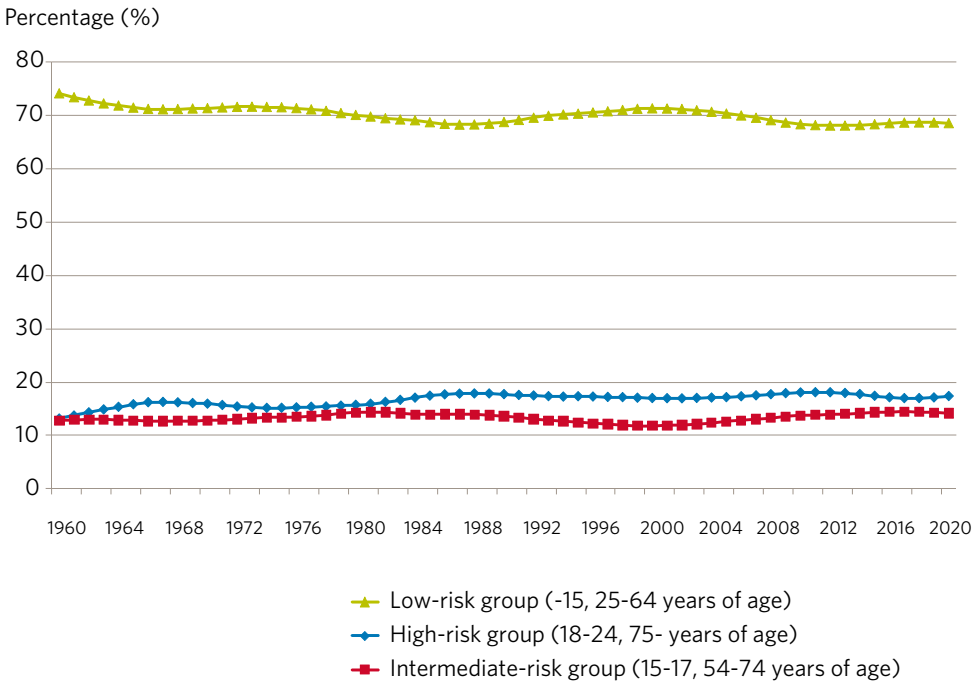


Figure 11. Percentage of the population divided into high, medium and low-risk groups in the years 1968-2020. Source: Population and its forecasts from SCB.

Note: Different age groups are at different risk of being killed in road traffic. Risk is estimated as the number of fatalities in road traffic in relation to travel in accordance with the travelling habits survey of 2005/2006 (see also Road Traffic Injuries 2009, Transport Analysis Statistics 2010:17).

Of the 15–17 year-olds in the high-risk group killed in road traffic, 25 percent are travelling by moped, either as the driver or a passenger. In all other ages, it is approximately 2 percent that are killed riding a moped. A driving licence is required to drive so-called EU mopeds (moped class 1, designed to be driven at a maximum of 45 km/h) from 1 October 2009, while it previously sufficed to have a driver's certificate. The number of EU mopeds has increased rapidly. Just ten years ago, there were only a few thousand on the roads. In June 2010, there were 127,000 mopeds on the road, a decrease from 135,000 in 2009. The number of newly registered EU mopeds decreased by 39 percent. The 15–17 age group decreased by 5 percent (or 17,000 persons) in 2009–2010. Together with the driving licence requirements, this has probably reduced the number of EU mopeds on the roads.[9]

3.3 Weather and climate

The seasons and the weather are of major importance for road safety in the short term. During the period from March to October, there is more traffic, speeds are higher and there are more motorcyclists and moped riders on the roads, which

[9] For moped class II (designed to be driven at a maximum speed of 25 or 30 km/hour) a driver's certificate is required from October 2009. Moped class II does not need to be registered in the Road Traffic Register, so we do not know how many there are.

leads to more road accidents. Wintry conditions on the roads and extreme sub-zero temperatures lead to a decrease in traffic and lower speeds. Winters with a great deal of precipitation mean a lot of snow building up alongside roads, which leads to fewer severe one-car accidents. In addition, it is in conditions like this that the effect of roads with median barriers and cars equipped with ABS is greatest.

Winter at the beginning of 2010 was historically severe and February 2010 was probably the first month since the 1920s that the number of fatalities in road traffic was in single figures: eight persons. The explanation for the low death toll that was provided by the Swedish Road Administration at the time in its press release was low speeds due to the wintry conditions on the roads along with soft banks of snow alongside the roads. In addition, more severe winters mean fewer moped riders and cyclists on the roads, which reduces the fatality figures.

Approximately 45 percent of our journeys in road traffic environments[10] measured in kilometres travelled take place during the winter period (October–March) according to the National Travel Survey of 2005–2006. This percentage has remained stable for a great number of years.[11] On average over the entire 1985–2009 period, 46 percent of fatalities were during the winter period, i.e., roughly the same percentage as the percentage of travel in the winter period (45 percent). Over the more severe winters of the past few years, the percentage of fatalities in the winter period has decreased to 40 percent, which is the same percentage as in 2010. That is to say, a smaller percentage of fatalities than of the traffic volume occur in the winter. The risk does not then increase during the winter period, despite the generally poorer road conditions; it actually decreases compared with in summer.

[10] That is to say kilometres travelled in passenger cars, lorries, buses, MCs, moped, bicycles or as a pedestrian.

[11] We have surveyed the proportion of the traffic volume in the road traffic environment in the annual National Travel Surveys from and including 1995 up to and including 2001 and the National Travel Survey, 2005–2006. SIKA/Transport Analysis has been responsible for these surveys.

4 Follow-up of road safety performance indicators

4.1 Compliance with speed limits – national road network

	2004	2010	Target year 2020	Estimated trend towards target
Percentage of traffic volume within speed limits, national road network	43 %	-	80 %	Not in line with desired trend
Average journey speed (km/h)	82 km/h	-	77 km/th	In line with required trend

The target is for 80 percent of traffic volume to take place within the applicable speed limits by 2020. Assuming that average speeds decrease by 5 km/h, it is estimated that the annual effect by 2020 will be about 90 fewer fatalities.

Performing nationwide measurements of speeds levels is very resource intensive. The latest measurement was carried out in 2004. The Swedish Transport Administration plans to carry out three measurements of speed levels during the period up to 2020. The first measurement will be carried out in 2012.

In order to be able to monitor speed trends on the national road network, a speed index has been produced, which only measures changes in speeds at a number of measurement points (Vectura: Speed index). The index has been designed to reflect general speed trends and not direct changes in the road environment, e.g., changes to the applicable speed limit or automatic speed monitoring.

Trends and projections towards the target for 2020
The latest nationwide measurement of vehicle speeds carried out in 2004 showed that the percentage of the traffic volume travelling within the speed limits was 43 percent on the national road network. Such low acceptance of the speed limits is unique in comparison with other European countries (TÖI 230/2007).

According to a rough estimate of the percentage of the traffic volume travelling within the speed limits in 2010, it is at most about 50 percent of drivers who keep to the speed limits. This estimate assumes an improvement in the speed index of 17 percent. This would mean an improvement of about 7 percentage units over six years and is not in line with the desired trend. In order to achieve the target of 80 percent by 2020, an annual improvement of about 3 percentage units during the remaining period will be required. A further aspect that indicates that we are falling short of the desired trend is that the index measurement does not take account of changes to the applicable speed limit. Just over 10 percent of traffic is on roads for which the speed limit has been reduced in 2008–2009. Measurements show that the percentage of traffic travelling above the applicable speed limit increases by just over 20 percent on these roads.

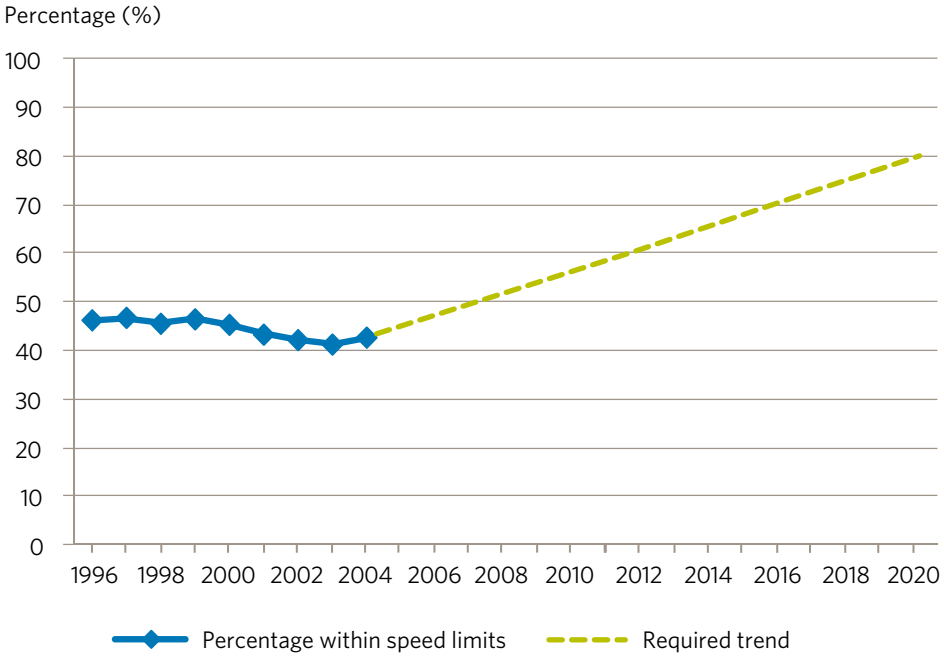


Figure 12. The percentage of the traffic volume travelling within the speed limit on national network, 1996-2004, and desired trend to 2020. Source: The Swedish Road Administration

The speed levels will be measured on only three occasions up to 2020. For this reason, a projection of the desired trend as regards the speed index has been used (see figure 13) in accordance with the target of a decrease by 5 km/h or 6 percent by 2020. The aim is to obtain an indication of whether the speed levels are decreasing at a sufficiently quick pace.

With the reservation that the average speed may have decreased somewhat more than is reflected in the index as a result of changes to the speed limits and Speed cameras, it is still clear that the result is in line with the pace required to achieve the target by 2020. In 2010, the average speed has decreased by 2.1 percent and, during the snowless period when speeds are not affected by wintry road conditions, the decrease was 0.6 percent.

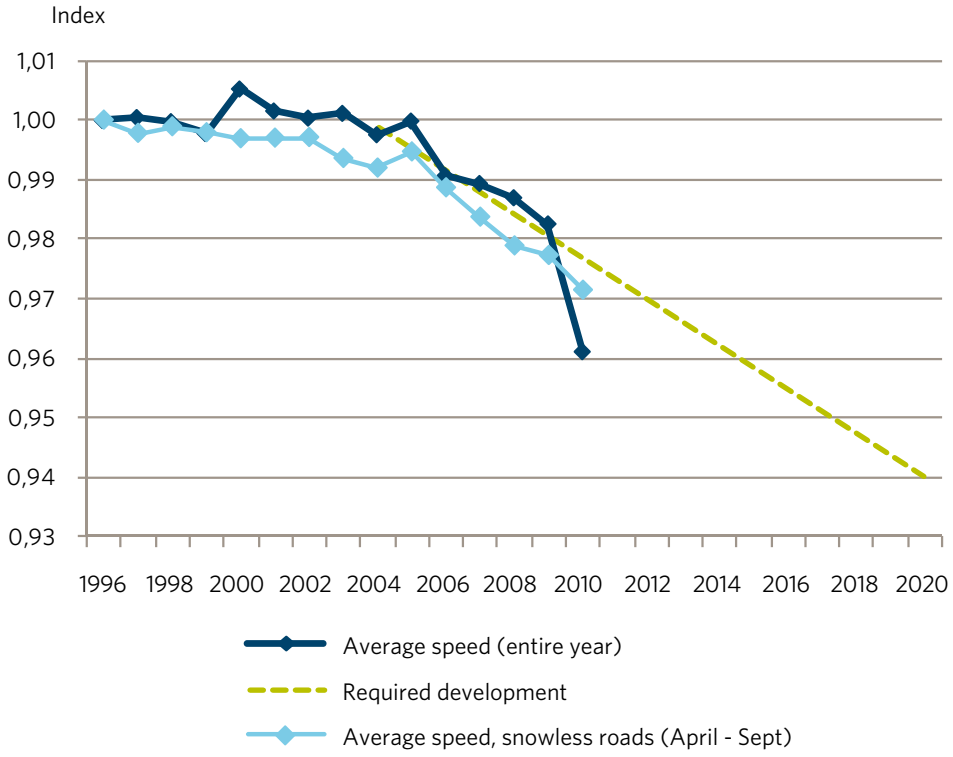


Figure 13. Relative average speed trends and desired trend by 2020, national road network, 1996-2008 (1996=1) Source: The Swedish Transport Administration

The overall opinion of the Analysis Group is that the percentage of people driving in excess of the speed limits is not decreasing at the rate necessary to achieve the target, while the average speed for the total traffic tends to be more in phase with the necessary trend.

Analysis and discussion

The great decrease in average speeds in 2010 was largely a consequence of the severe winter, which led to wintry road conditions throughout the country. But even during the snowless months, the measurements have shown a clear decrease, which indicates that the decrease cannot simply be explained by the severe winter and is probably also due to improved behaviour.

According to the speed index, the number of passenger cars driving faster than the signposted speed limits has decreased by 10.7 percent in 2010, compared with 2009. On snowless roads, the decrease was 2.2 percent. Those driving more than 5 km/h above the applicable speed limit have reduced their transgressions to a greater extent than others.

The average speed for passenger cars has decreased by 2.2 percentage units and by 0.6 percent on snowless roads. Heavy vehicles have not reduced their speeds to the same extent as passenger cars. The average speed for other traffic (80 percent lorries) decreased by 1.4 percent, compared with 2009.

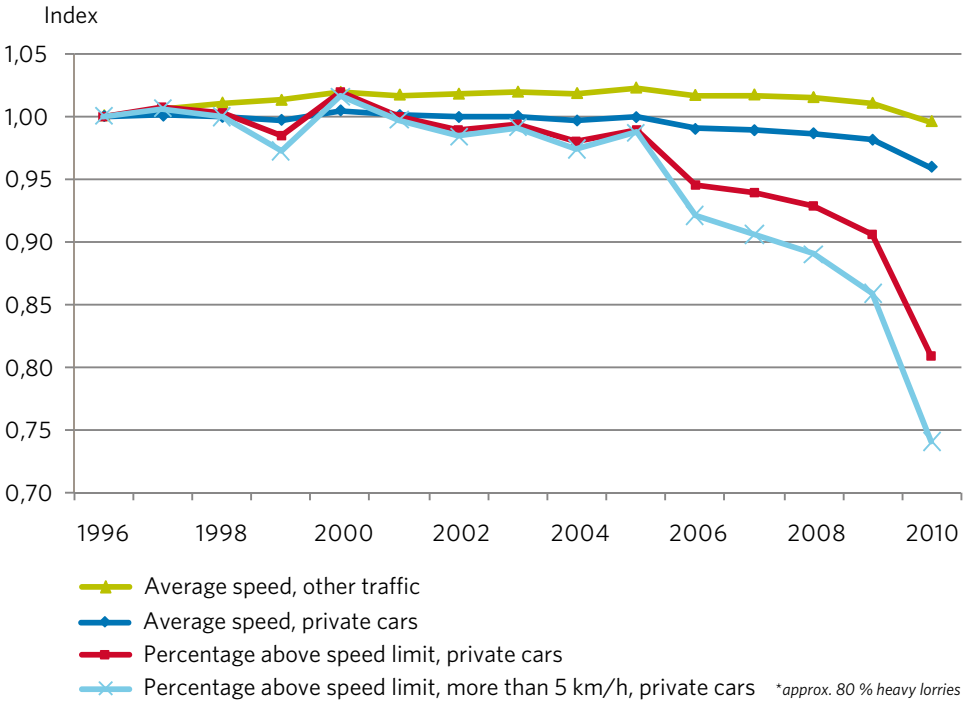
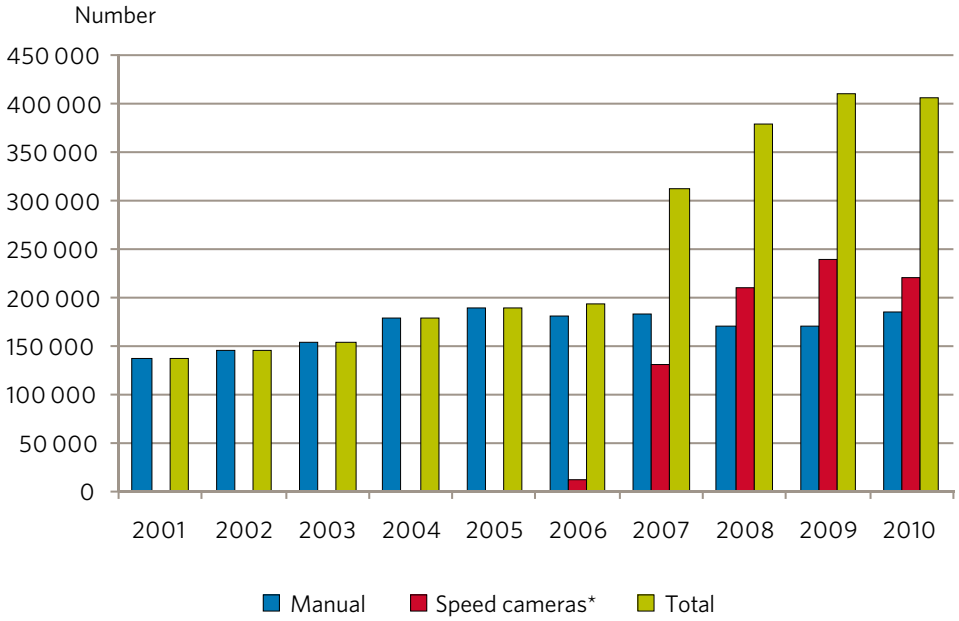


Figure 14. Relative trend in percentage of the traffic volume exceeding speed limits and also average speeds, national road network, 1996-2010 (1996=1) Source: The Swedish Transport Administration

Measurements carried out of various hauliers' speeds indicate that compliance is poor. The results show that only about 40 percent of lorries with loads stick to the statutory 80 km/h limit on roads with a speed limit of 90 km/h. On 110 km/h roads, the corresponding percentage is about 20 percent. For lorries with loads, there are no clear trends regarding trends over time, other than the trend towards an increase in the percentage of drivers sticking to the signposted speed limits of 50 km/h. The hauliers that have entered into a partnership with the Swedish Transport Administration in order to improve road safety generally stick to a lower speed than others.

Motorcycle speeds are not measured in the present speed index. Since 2007, Vectura has carried out random measurements and compared speed levels between motorcycles and passenger cars on 50 and 70 km/h roads. The 2010 measurements show that the average speed of motorcycles is between 3 and 4 km/h more than for passenger cars and that 35 percent drive within the applicable speed limits. Forty percent of motorists drove within the speed limits. This is roughly the same ratio between cars and motorcycles as during the last measurement in 2008.

As shown in figure 15, the police's speed-control operations have increased considerably, particularly through the introduction of speed cameras. The percentage of offences reported has increased from 138,000 in 2001 to 405,000 (in part only recorded on camera) in 2010, i.e., almost trebled. The number of infringements reported through manual surveillance is more or less unchanged since 2004.



** Partly only recorded by cameras that could not be taken further for technical reasons.*

Figure 15. The number of speeding offences, 2001-2010. Source: RPS

During 2010, speed cameras have not featured to any great extent. It is planned to continue to establish speed cameras, however. Experimental work is being carried out using so-called mobile speed cameras, where surveillance on stretches of reads that are already being monitored is reinforced by camera boxes that can be moved between fixed points. It is planned to commission a further 50 camera boxes in 2011.

In 2010, the Swedish Road Administration and the Swedish Transport Agency planned to produce a joint action plan for increased compliance with speed limits. The Analysis Group can state that this has not been delivered. The plan was to discuss monitoring, sanction systems, support systems and heavy transport. In 2011, the Swedish Transport Administration plans, however, to initiate a piece of work in partnership with stakeholders to increase compliance with speed limits, with the focus on heavy transport.

4.2 Compliance with speed limits – municipal road network

	2003	2010	Target year 2020	Estimated trend towards target
Percentage of traffic volume within speed limits, municipal road network	52 %	-	80 %	Not measured

The target is for 80 percent of the traffic volume to be driving within the applicable speed limits by 2020. The traffic safety potential has been deemed to be 30 fewer fatalities.

Previous measurements on the municipal road network have, in principle, only included major roads in urban areas. What primarily need to be developed for this Road Safety Performance indicator are, therefore, measurement methods that reflect the entire municipal road network

Trends and projections towards the target for 2020
The latest nationwide measurement of vehicle speeds on non-national roads (major roads) in urban areas was carried out in 2003. It showed that 52 percent of the traffic volume was driving within the speed limits.

Since no nationwide measurements of speed have been carried out on the municipal network since then, it is impossible to comment on whether trends are going at the right pace.

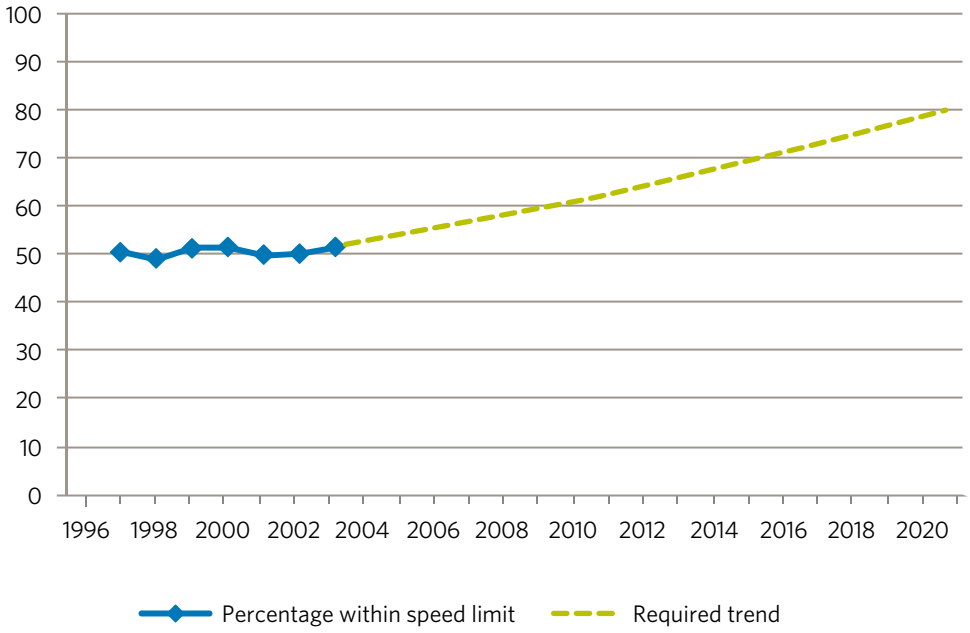


Figure 16. The percentage of the traffic volume driving within the speed limit on the municipal road network, 1996-2003, and desired trend to 2020. Source: The Swedish Road Administration

Analysis and discussion
According to the measurements carried out up to and including 2003, there are great differences in compliance with the different speed limits; on roads with a 70 km/h limit compliance is almost twice as high as the average. Compliance on roads with a speed limit of 30 km/h is worst.

If all municipalities introduce the same amended speed limits, it is estimated this will mean 15–20 fewer casualties. By the end of 2010, 10 percent of the country's municipalities had introduced amended speed limits. The target of the speed project the Swedish Transport Administration is carrying out is for 60 percent of municipalities to have carried out a review during 2011.

The municipalities must also accept the challenge to manage speeds at the points in their road environment where road-users are exposed to risk, such as crossings where motor vehicles are encountered. This is described in section 4.9 Safe Municipal Roads – CGM (Pedestrian, Cyclist and Moped) Passages[12] and crossings.

In section 4.1 Compliance with Speed Limits – National Road Network, an action plan is mentioned that has not been delivered as yet. It was intended that this action plan would also contain proposed measures to influence compliance with speed

[12] Pedestrian/cyclist and moped passages.

limits across all road traffic, regardless of the body responsible for the upkeep of the road.

The Analysis Group feels that this Road Safety Performance indicator should be excluded in the review of Road Safety Performance indicators in 2012 if it is does not have targets set or is not followed up in a satisfactory manner within the near future.

4.3 Sober traffic

	2007	2010	Target year 2020	Estimated trend towards target
Percentage of traffic volume with sober drivers	99,71 %	99,74 %	99,90 %	In line with required trend

The target for sobriety on the roads is for 99.9 percent of the traffic volume to have sober drivers by 2020. A sober driver is defined as a driver with a blood alcohol count of less than 0.2 per thousand.

As a basis for monitoring trends, a measurement series based on data from the police's inspection activities is used (Forsman, 2011). The measurement series that has been produced should be seen as a measurement of drink-driving trends and not the actual level. The Road Safety Performance indicator's starting point has been adapted to the measurement series' value, which was 99.71 percent in 2007. The old baseline published in the Swedish Road Administration's report on Management by Objectives for Road Safety Work was 99.76 percent. As there is not such a great difference between the new and old baselines, we propose that the target of 99.9 percent is not changed.

The police's monitoring methods influence how great a percentage of checks are positive. That is why the measurement series is based on data from so-called fixed checks, where the police check drivers passing through a certain measurement site and where the measurement site is not chosen on the basis of the expectation that there will be a high percentage of drink drivers in that particular place. There is however, also a choice with fixed checks, with regard to both the measurement site and which drivers are stopped, so a certain influence cannot be excluded. When we interpret the results, we should also consider whether the police have made major changes to their strategy with regard to drink driving checks.

In the report Management by Objectives for Road Safety Work (the Swedish Road Administration 2008:31) there is a definition that being a sober driver also includes being free of drugs other than alcohol. In the data that forms the basis for the measurement series, the influence of drugs is not included and it is only sobriety with regard to alcohol that is referred to.

Trends and projections towards the target for 2020

Results from the measurement series based on the police's checks show that there has been a positive trend since 2007. The percentage of sober traffic has increased during the period from 99.71 percent to 99.74 percent in 2010. During the period, 2007 to 2010, there have been no major changes in the police's surveillance strategy at a national level, so the results should reflect the actual situation. The upward trend from 2007 is well in line with the required trend for achievement of the objective.

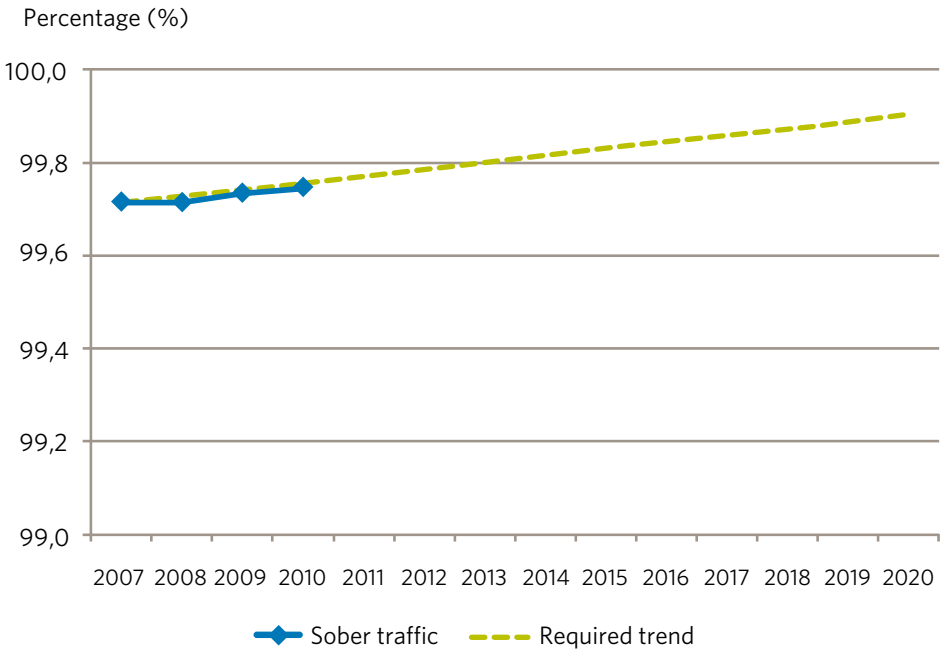
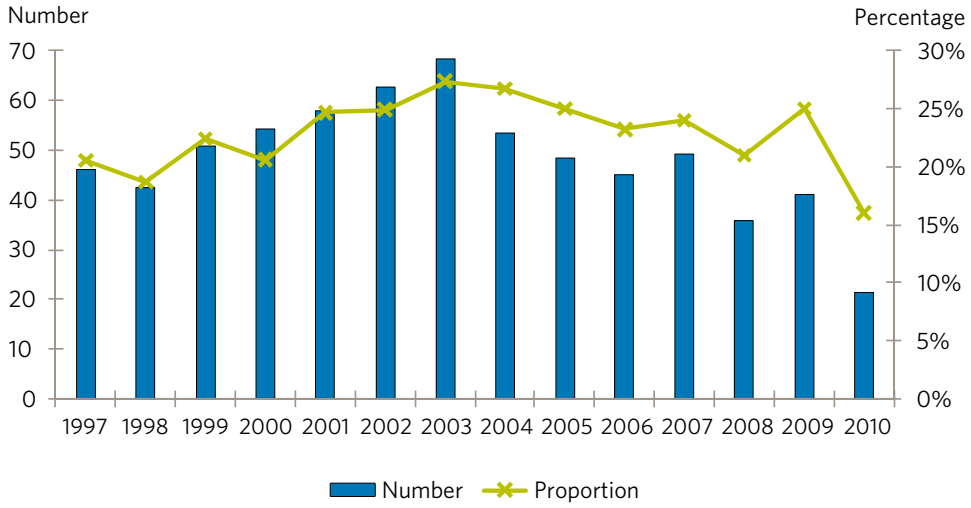


Figure 17. Percentage of sober traffic. Measurement series based on data from the police's checks. Source: RPS, VTI.

Analysis and discussion

The positive trend in the Road Safety Performance indicators over the last few years is supported by the result from the Swedish Transport Administration's in-depth studies of fatal accidents. Figure 18 shows the percentage and number of passenger cars owners under the influence of alcohol killed during the period, 1997-2010 (alcohol concentration ≥ 0.2 ‰). With the exception of a couple of individual years, the percentage of drivers under the influence of alcohol has decreased each year since 2003. In 2010, the percentage was 16 percent, which is the lowest percentage during the period. Between 2009 and 2010, there has been a great decrease, but, in 2009, the percentage of passenger car drivers under the influence of alcohol killed was unusually high. As this involves relatively few people killed, there is also rather a large amount of random variation. For 2010, the data has been recorded in a different way than before. Previously, information has been collected via the Swedish Transport Administration's regions, but now it is possible to obtain this from in-depth studies directly at a national level. A check going backwards in time shows, however, that the difference in the results between the two methods of collection is relatively small.



Data for 2010 has been collected in a different fashion to previously and so the results are not fully comparable with previous values. The difference is, however, felt to be only a small one. For 2010, the information about the number of fatalities is preliminary.

Figure 18. The percentage of passenger car drivers under the influence of alcohol killed among all fatalities and the percentage of passenger car drivers under the influence of alcohol killed (alcohol > 0.2 per thousand), 1997–2010. Source: The Swedish Transport Administration's in-depth studies

The total consumption of alcohol in Sweden has decreased steadily since 2004, when it was at its highest after a great increase at the beginning of the 2000s. It is, however, decreasing relatively slowly and consumption is still higher than what it was at the end of the 1990s and beginning of the 2000s. In 2010, consumption was 9.2 litres per capita (15 years of age or older) according to preliminary studies, to be compared with 8.4 litres in 2000 and 10.5 litres in 2004. Although the rate at which this is decreasing is relatively slow, this may have contributed to drink driving having reduced over the last few years.

The number of breathalyser tests the police perform has increased greatly. In 2001, 1.1 million tests were carried out and, in 2007, 2.7 million tests were carried out. This high level has been largely maintained since then and, in 2010, 2.5 million tests were carried out. We know from previously that there is generally a positive link between monitoring drink driving and road safety (Elvik at al., 2009). It is presumably difficult to reach the remaining group breaking the law by increasing surveillance further (Svensson, M. 2005). Monitoring should, however, continue to remain at a high level in order to ensure social control.

Further measures are, therefore, required in addition to the police's surveillance in order to increase the already high compliance in Sweden. One important measure is increasing the use of . Since the beginning of the 2000s, use of these has also increased greatly. In 2000, there were about 2,000 alcolocks in use in Sweden and, by 2010, this had increased to about 65,000. Compared with the vehicle population in its entirety, this is still a very modest figure. Due to the common provisions within the EU, it is not possible for Sweden to introduce alcolocks as essential equipment in new vehicles as an individual country. We will instead need to try to increase the use of alcolocks in some other way. Several initiatives have been taken recently that could stimulate such an increase, as described below.

In December 2010, the Riksdag decided to introduce legislation on alcolocks for people convicted of drink driving. This legislation means that people who lose their licence due to drink driving can apply to keep their licences if they instead install

an alcolock. There will be two programmes: a two-year programme for high-risk groups and a one-year programme for normal risk groups. The new legislation will come into force on 1 January 2012 and means that the pilot scheme that was previously in operation will now become permanent. The pilot scheme has demonstrated a good effect on those who have been involved in the alcolock programme but participation has been relatively low (Bjerre, 2005). About 11 percent of those convicted of drink driving have opted to take part. In order to increase participation, the time for which those who do not take part in the alcolock programme lose their licences will be increased. In addition, the costs of participation will be reduced by, among other things, the medical checks becoming fewer and the service intervals for locks becoming longer.

At the beginning of 2011, a Government Bill was introduced regarding making alcolocks in company cars exempt from tax (Bill. 2010/11:58). It is proposed that the new provisions will come into force on 1 July 2011 but a decision has yet to be made on the matter. In addition, there is a regulation from 2009 (SFS 2009:1) in which it is stated that the cars that an authority purchases or enters into a leasing agreement regarding should, to the greatest possible extent, be equipped with alcolocks. There are also proposals that alcolocks should be compulsory in vehicles used to transport school pupils.

This legislation and regulations will not lead directly to any great increase in the number of alcolocks in Sweden. But they will hopefully lead to an increase in the long term, particularly by contributing to the development of cheaper and more user-friendly alcolocks. This may in turn stimulate an increase in use among drivers of passenger cars, which is the most important target group.

In order to reduce the number of reoffending drink drivers, work is going on using the Smadit (samverkan mot alkohol och droger i trafiken enligt Skelleftemodellen – partnership against alcohol and drugs on the roads using the Skellefte model) method. Smadit works in a way that everyone suspected of drink driving is quickly offered an appointment with the social services or addiction clinics to get help with potential alcohol or drug problems. At the moment, this contact is voluntary, but there is a proposal from the National Police Board that the police should be obliged to report everyone suspected of drink driving to the social services. This would improve the effectiveness of the model.

When it comes to driving under the influence of drugs other than alcohol, the extent of this is not followed up on over a period of time. It is possible, however, to state that offences for driving under the influence of drugs constituted about 42 percent of all reported driving under the influence offences in 2010 (preliminary figures from the Swedish Council for Crime Prevention (BRÅ)). At the present time, we do not have any clear picture of how great a road safety problem this is compared with drink driving. In the autumn, a large EU project (DRUID) will, however, be submitting its final report, in which it will, among other things, estimate the risks for different types of drugs. We can get a better idea of the extent of the problem using these results.

4.4 Use of seat belts

	2007	2010	Mål år 2020	Estimated trend towards target
Percentage of those wearing a seat belt in the front seat of passenger cars	96 %	96 %	99 %	Not in line with desired trend

The target for the use of seat belts is for 99 percent of all drivers and front-seat passengers in passenger cars to use a seat belt by 2020. The results from VTI (the Swedish National Road and Transport Research Institute's) observational measurements will be used as a basis for following trends. The Road Safety Performance indicator is defined as the percentage of people wearing a seat belt out of the drivers and front-seat passengers observed (for a description of the measurements, see Larsson et al, 2011). The measurements are based on observations at major roundabouts in six urban areas in Central Sweden. The measurements are for the purpose of monitoring trends over time and the level of use of seat belts should not be regarded as representative of drivers and passengers in Sweden in general.

In order to increase the spread of measurement sites, we will also be monitoring a measurement where VTI's measurements have been combined with measurements carried out by NTF (Sweden's National Society for Road Safety) from 2009. Of the NTF's measurement sites (municipalities), 58 were deemed suitable for inclusion in the measurement series.

Trends and projections towards the target for 2020

The results of VTI's measurement shows that 96 percent of the persons observed in the front seat were wearing seat belts in 2010 (figure 19). This is at the same level as in 2007 and 2009 and a bit higher than in 2008. The use of seat belts has, therefore, become stagnant over the last four years. The Analysis Group feels, therefore, that the trend for this Road Safety Performance indicator is not satisfactory.

According to the combined observations of VTI and NTF, 94 percent of adults in front seats were wearing a seat belt in 2010. This is the same percentage as in 2009, so there is no visible change in the use of seat belts here either. The fact that the percentage of people wearing seat belts is lower in NTF's measurements is at least partly because they are carrying out their measurements in many relatively small urban areas where the use of seat belts has proved to be low (Henriksson, 2010).

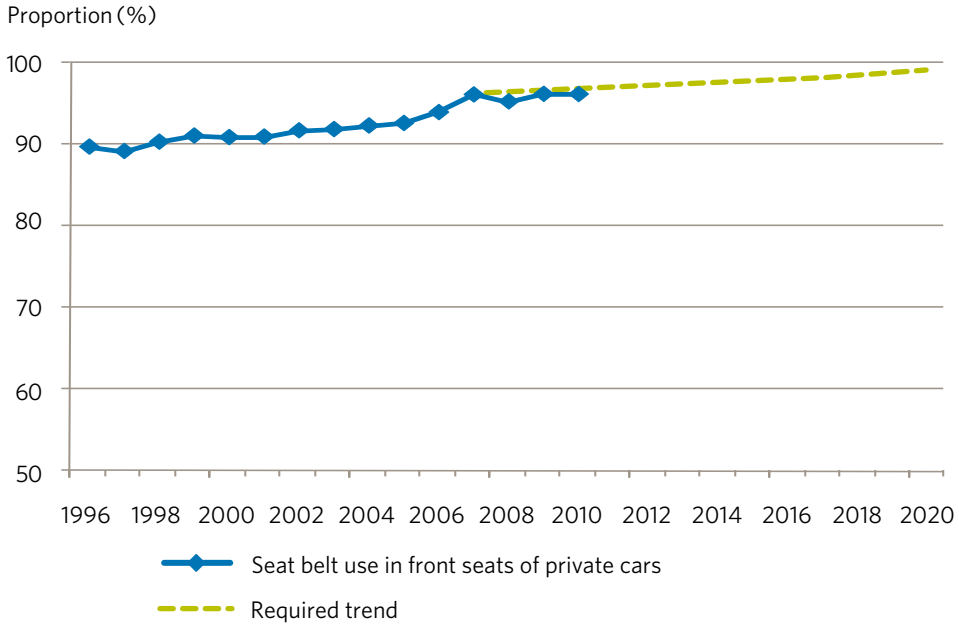
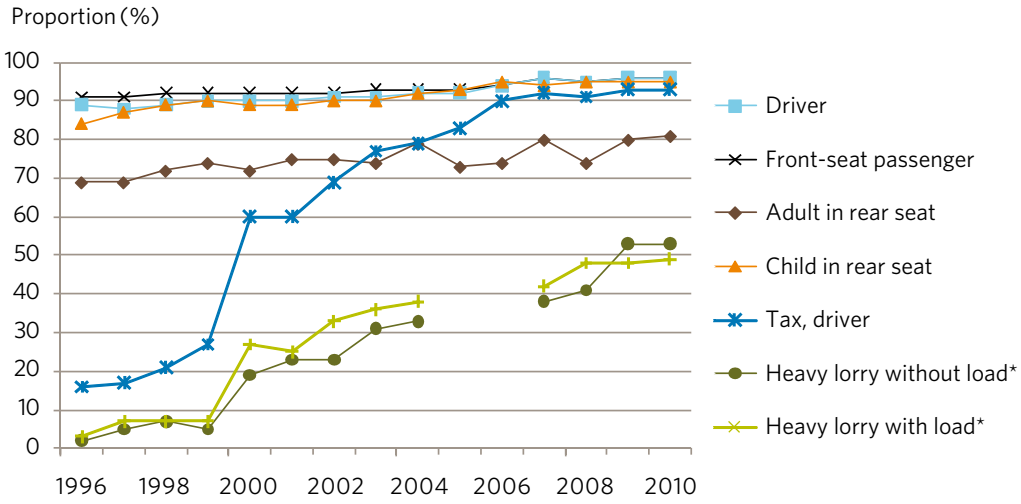


Figure 19. The percentage of persons wearing a seat belt in the front seat of passenger cars at the time of observation. Source: VTI's observation measurements.

Analysis and discussion

The percentage of persons wearing a seat belt in the front seat is high, but the long-term upward trend has come to an end, at least temporarily. Figure 20 also shows that the use of seat belts among different groups of road-user remained largely unchanged between 2009 and 2010. The wearing of seat belts by adults in the back-seat is, however, measured at more than 80 percent for the first time. For children in the back seat, the level is almost as high as for front-seat passengers, but the earlier positive trend appears to have come to a standstill.



**Observations of heavy lorries from 2007 onward are not fully comparable with earlier observations.*

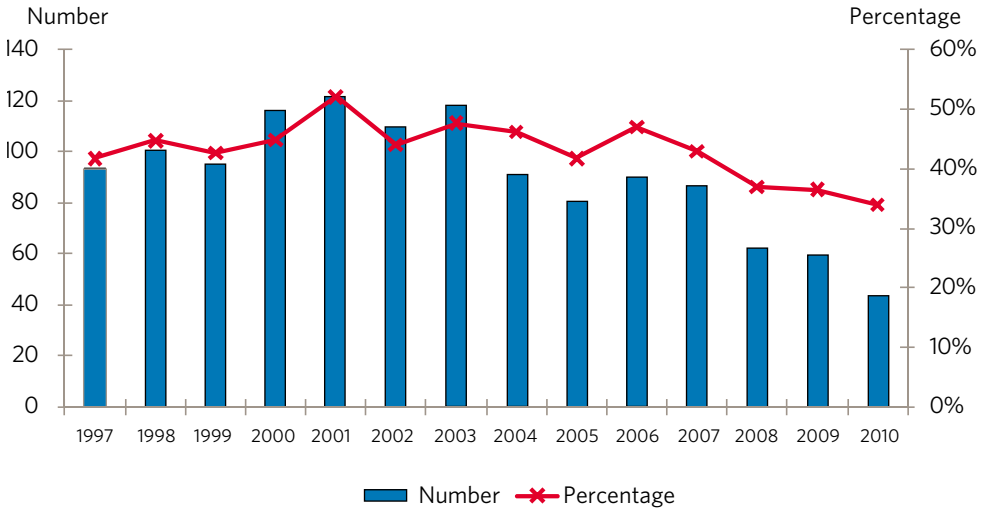
Figure 20. The wearing of seat belts in passenger cars and heavy lorries. Source: VTI's observation measurements.

The percentage of new cars with seat belt reminders is continuing to increase. In 2010, the percentage of new cars sold with seat belt reminders for the driver's seat was 95 percent, compared with 88 percent in 2009. The percentage of the traffic volume in cars with seat belt reminders was about 48 percent in 2010 and 41 percent in 2009. (The type of seat belt reminder referred to in this section is the type that meets the requirements in Euro NCAP's specification.) It is, therefore, difficult to explain why the use of seat belts has stagnated according to the seat belt measurements. One reason could be the uncertainty in the measurements, which means that changes in the actual use of seat belts have not been captured. Another reason could be that those who use seat belts less have somewhat older cars in which the percentage of seat belt reminders is still low.

The results of the Swedish Transport Administration's in-depth studies show a more positive picture of the trend over the last few years than what the general use of seat belts does. The percentage of fatalities among drivers of passenger cars who were not wearing a seat belt at the time of the accident has continued to decrease; in 2010, the percentage was 34 percent (figure 21). Like the measurements for the percentage of sober drivers, data from 2010 has been extracted in a different way than previously. A check going backwards in time shows, however, that the difference in the results between the two methods of collection is relatively small and does not affect the interpretation of the diagram.

A recently published report describes the use of seat belts in fatal accidents during the period 1/1/2005 to 30/6/2009 (Svensson, 2010). In this report, drivers and passengers in passenger cars, buses and lorries have been studied. The report shows,

among other things, that, among male fatalities on the roads, 48 percent were not wearing a seat belt, while the corresponding percentage of females was 24 percent. When it comes to age, the percentage of fatalities not wearing a seat belt was highest in the 30-39 age group, followed by the 40-49 age group (just over 50 percent in both these groups). Of the fatalities in the 18-24 age group, about 48 percent were not wearing a seat belt. It can also be established that there was a considerably greater percentage of fatalities who were not wearing a seat belt among the drivers and passengers under the influence (69 percent) than those who were sober (31 percent).



**Data for 2010 has been collected in a different fashion to previously and so the results are not fully comparable with previous values. The difference is, however, felt to be only a small one. For 2010, the number of fatalities is preliminary.*

Figure 21. The percentage of passenger car drivers not wearing seat belts at the time of the accident as a percentage of all fatalities known to be wearing a seat belt and the number of fatalities among passenger car drivers who were not wearing a seat belt at the time of the accident. Source: The Swedish Transport Administration's in-depth studies.

Although there has been a stagnation in the use of seat belts over the past few years, there is a long-term upward trend. This trend will probably continue, thanks to the fact that the percentage of the volume of traffic in cars with seat belt reminders will increase. A forecast shows that the percentage will increase from today's approximately 48 percent to about 95 percent by 2020 (see section 4.6.1 Safe passenger cars).

We know from previous studies that a seat belt reminder is an effective measure. In Krafft et al. (2006) and Folksam (2009), it is stated that the use of seat belts in cars with seat belt reminders is about 99 percent. In those cases where people have been killed without a seat belt in cars with seat belt reminders, the reminders have probably been of an older, less effective, type or the accident is likely to have been suicide (Svensson 2010).

Despite the fact that seat belt reminders are such an effective measure and despite the large proportion of the traffic volume in cars with seat belt reminders that is expected in 2020, it is uncertain whether the target of 99 percent will be achieved without further measures. This is partly due to the fact that the forecasts refer to seat belt reminders for the driver's seat and the target has been set for all front-seat passengers. It is also by no means certain that the results of the previous studies will still be valid when the user groups that are driving older cars without seat belt reminders today begin to drive cars with reminders. In order to achieve the target,

the use of seat belts would also need to be 99 percent in the remaining vehicles that do not have seat belt reminders, which is unlikely.

Nor should we forget other groups, such as adults in the back seat and lorry drivers, who use them to a relatively low extent. There are seat belt reminders in the backseats of passenger cars and in new lorries, but to less of an extent than for the front seat in passenger cars. The percentage of new cars sold in 2010 with seat belt reminders for the back seat was 38 percent.

4.5 Use of helmets

	2007	2010	Target year 2020	Estimated trend towards target
Percentage of cyclists observed wearing a helmet	27 %	27 %	70 %	Not in line with desired trend

The target for using cycle helmets is for 70 percent of cyclists to be using a helmet by 2020. According to the report, Management by Objectives for Road Safety Work, in order for this target to be achieved it will be necessary to introduce mandatory legislation for all cyclists to wear a helmet. If no mandatory helmet legislation is introduced, the target will be 35 percent of cyclists using a helmet by 2020. The measurement used for the use of cycle helmets is the percentage of cyclists observed wearing a cycle helmet according to VTI's annual measurements (Larsson, 2011). The measurements do not intend to estimate the total use of cycle helmets in Sweden in a representative manner, but they are good enough to provide a picture of changes over time and the approximate level.

As well as studying the use of cycle helmets, the use of helmets among moped riders is also studied. For motorcyclists, the main potential for saving lives lies in measures other than for increasing the use of helmets. For this reason, there will be no further analysis of the use of helmets among motorcyclists in this report.

Trends and projections towards the target for 2020

Figure 22 shows trends in the observed use of cycle helmets from 1996–2010. In 2010, the observed use of cycle helmets was 27 percent, which is lower than the level in 2008 and the same level as in 2007 and 2009. The figure also shows how the use of cycle helmets needs to be changed between 2007 and 2020 in order for the target level of 70 percent (with new mandatory helmet legislation) or 35 percent (with the current helmet legislation only for children) to be achieved. This means an annual increase of 7.6 percent or 2.0 percent respectively. The use of cycle helmets has not increased sufficiently over the last few years. The Analysis Group feels that, unless measures are taken, there is a great risk that the level will remain stable at today's level.

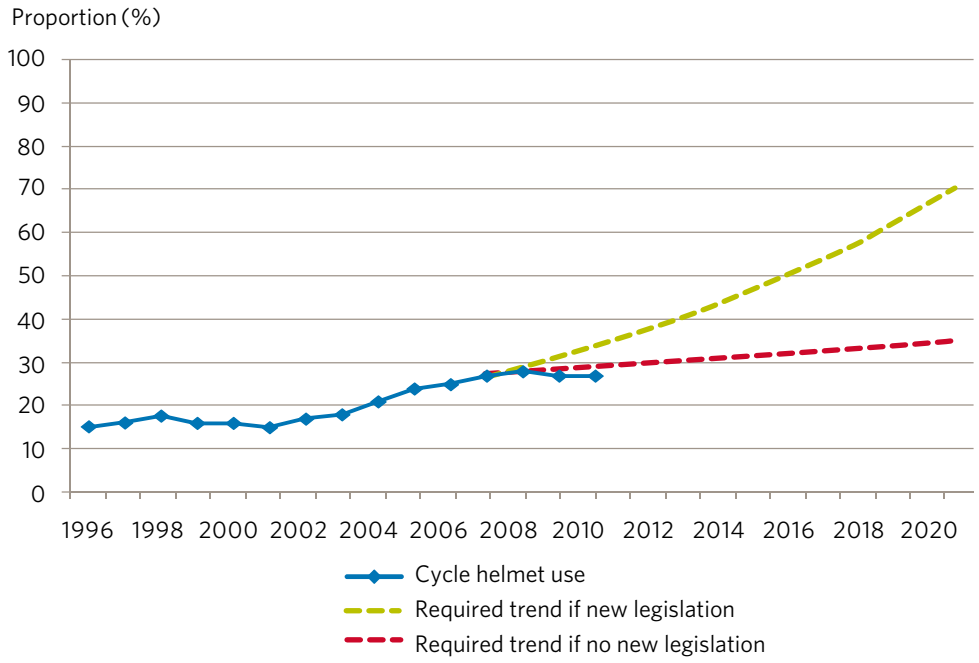


Figure 22. The percentage of cyclists observed wearing a cycle helmet and the required trend with or without mandatory cycle helmet legislation being introduced. Source: VTI's observation measurements.

Analysis and discussion

As the use of cycle helmets in Sweden is at a rather modest level, particularly for adults, there is great potential for increasing the percentage of cycle helmet users.

Figure 23 shows that the observed use of cycle helmets in 2010 was 61 percent for children up to 10 years of age in housing areas and 52 percent for children between 6 and 15 cycling to and from school. For older "grundskola" pupils in the senior stage, the use of helmets is at about 30 percent and, for children at the primary and intermediate stages, about 73 percent. For adults, the use of cycle helmets is considerable lower: In 2010, it was 22 percent for journeys to and from work and 21 percent on public bicycle paths. It has primarily been among children up to 10 years of age that there has been a decrease: from 73 percent in 2008 to 69 percent in 2009 and 61 percent in 2010. For children between the ages of 6 and 15 cycling to and from school, the use of helmets has increased somewhat, from 47 percent in 2009 to 52 percent in 2010. It is primarily at the senior stage that we have seen an increase, from 24 percent in 2009 to 30 percent in 2010 and first and foremost boys that have increased their use of helmets (Larsson, 2011). In the primary and intermediate stages, the use of helmets is higher among girls than boys but, in the senior stage, the boys have a somewhat higher use of helmets than the girls.

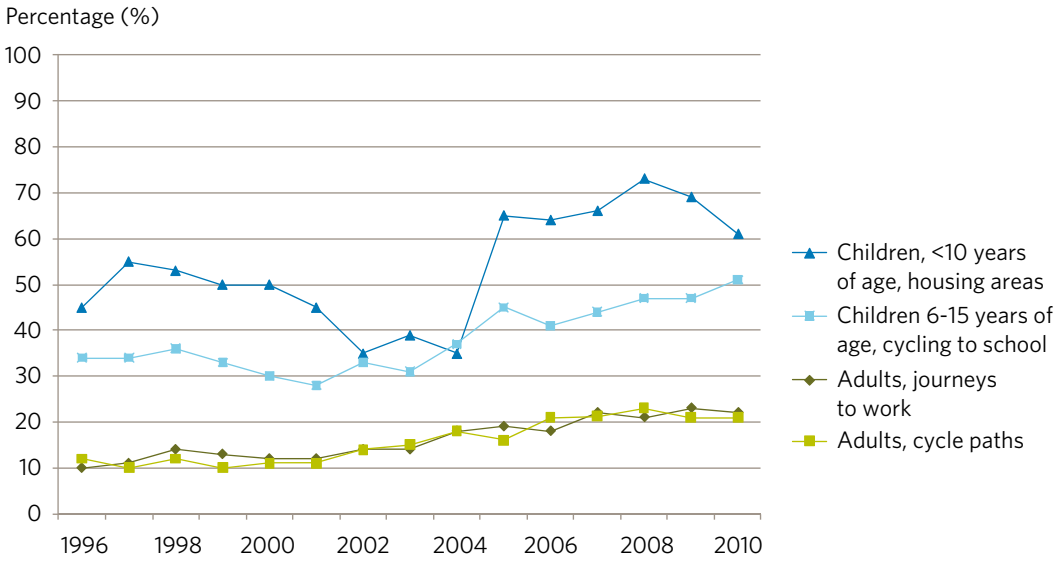


Figure 23. The use of cycle helmets for different groups. Source: VTI's observation measurements.

According to the Swedish Transport Administration's road safety survey, 2010, 18 percent of cyclists (above 15 years of age) state that they nearly always or always use a cycle helmet when they cycle. This level has been relatively stable since 2007.

If we study accident trends and the outcome of accident among cyclists, we can establish that, in 2010, 20 cyclists died on the roads, about 1,740 were seriously injured with more than 1 percent medical invalidity and 230 with more than 10 percent medical invalidity. About 3,000 cyclists are injured so seriously each year that they are admitted to hospital for at least 24 hours. Increased cycle helmet use would, above all, contribute to a reduction in the number of injured cyclists.

Figure 24 illustrates differences in helmet use among injured cyclists with more than 10 percent medical invalidity in accidents where the head has been the part of the body worst injured. Among those who did not use a cycle helmet, the head is the part of the body worst injured in 45–50 percent of cases, while the corresponding percentage among cycle helmet users is just over 30 percent. During 2010, the difference between helmet users and non-helmet users has decreased. What this change is due to should be further investigated. The information about helmet use comes from STRADA medical service. Cases where it is not known if a helmet was used are not reported in the figure. There is no information about helmet use in about 30 percent of the cases.

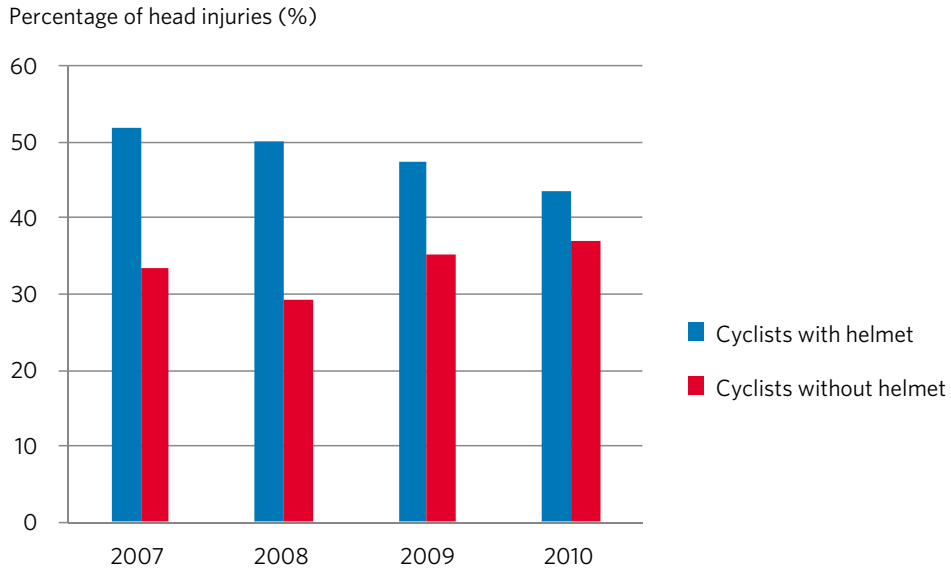


Figure 24: The differences in helmet use among seriously injured cyclists (≥ 10 % - medical invalidity) in accidents where the head is the part of the body most seriously injured. Source: The Swedish Transport Agency Preliminary statistics, 2007-2010 (extracted on 15 March of each year).

Increased helmet use will lead to a reduction in the risk of skull injuries from cycle accidents. According to Nolén (1998), research shows that using a cycle helmet can reduce the number of non-fatal skull injuries by 50 percent.

The use of helmets among moped riders has not been studied in any current observation measurements. During the years, 1999–2003, helmet use among moped riders was, however, estimated at just under 90 percent (Gustafsson, 2004). In 2010, 8 moped riders died on the roads. The number of seriously injured moped riders has decreased by 36 percent over the past year, from approximately 500 in 2009 to approximately 320 in 2010. According to the police, a similar decrease can also be seen in the numbers of those seriously injured. In figure 25, data on the use of helmets among moped riders who have been killed in accidents is reported. Data comes from in-depth studies of fatal accidents during the years 2004–2010. During these years, 81 moped riders were killed. More than 50 percent of these were not wearing a helmet or had lost their helmet during the accident. There is, therefore, great potential for increasing the percentage of riders using their helmet correctly.

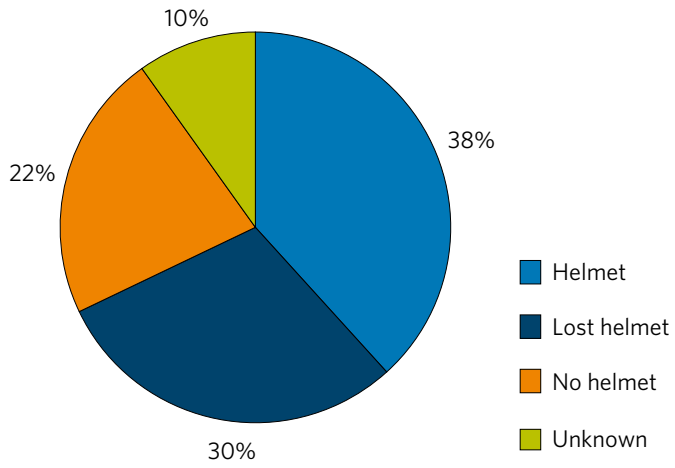


Figure 25. Helmet use among moped riders killed during the years 2004–2010.
Source: The Swedish Transport Administration's in-depth studies. Preliminary statistics for 2010.

Figure 26 illustrates the differences in helmet use where moped riders have been seriously injured with more than 10 percent invalidity and where the head was the most seriously injured part of the body. Among those who did not use a helmet, the head is the part of the body worst injured in 60-70 percent of cases, while the corresponding percentage among cycle helmet users is approximately 30 percent. Unlike in the in-depth studies, there is no information on incorrect use of helmets among those seriously injured. It is, however, reasonable to assume that the percentage using a helmet has been somewhat of an overestimate and that this could lead to an underestimation of the effect of helmets.

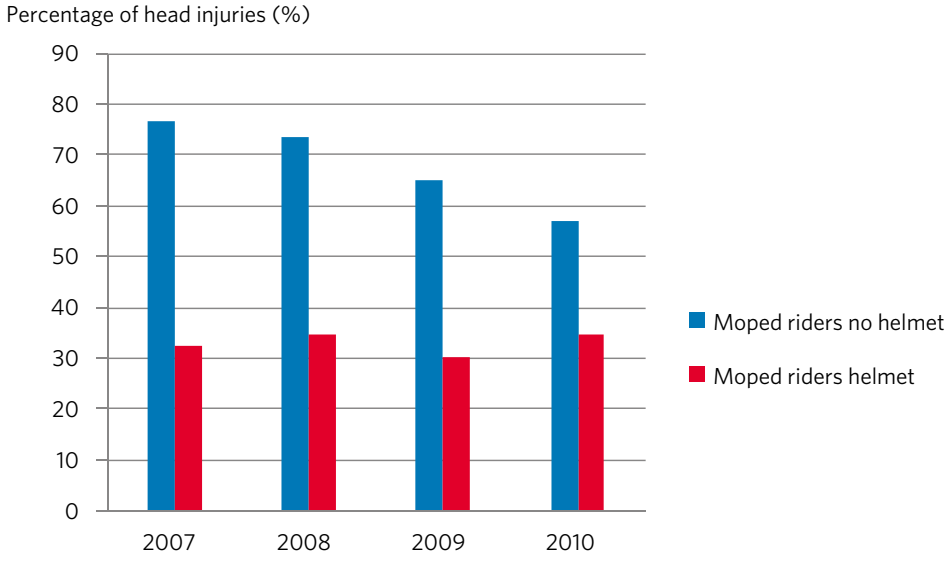


Figure 26. The differences in helmet use among seriously injured moped riders (≥ 10 % - medical invalidity) in accidents where the head is the part of the body most seriously injured. Source: The Swedish Transport Agency Preliminary statistics, 2007-2010 (extracted on 15 March of each year).

In the strategy for mopeds and motorcycles, an increase in and correct use of helmets among moped riders is being emphasised as an priority operational area. Measures such as traditional public opinion forming work are being proposed, where parents, schools, healthcare personnel, police etc. can work together in order to increase helmet use among moped riders. It is also being emphasised that there may be a need to develop ways of working and monitoring methods. If, for example, driver's certificates and moped driving licences could be taken away after a breach of the helmet provisions, compliance could be expected to increase.

In October 2009, a compulsory moped driving licence was introduced for EU mopeds. The training course includes practical and theoretical sections and it should take a total of at least 12 hours. Hopefully the training course could lead to increased awareness of the importance of using the helmet correctly and thereby also lead to more moped riders using their helmets correctly. In 2010, the number of seriously injured moped riders decreased by 36 percent and the number of seriously injured moped riders (according to the police's reports) by almost 50 percent. The decrease in those seriously injured was greatest among 15–17 year olds. It is reasonable to assume that part of the decrease could depend on a decrease in moped travel due to the introduction of the moped driving licence.

For cycle helmet use, an assessment was made as part of the management by objectives work that mandatory helmet legislation covering all cyclists would be the most effective measure for increasing the use of helmets to a considerably higher

level than today's. The Government has, however, decided not to put forward any such suggestion. The analysis group's opinion is that the target of 70 percent helmet use will not then be able to be achieved. In the assignment for the Government, "Increased and Safe Cycling" an interim report was submitted to the Ministry of Industry in March 2011 (Olofsson, 2011). In this, it is suggested that the first step for increasing the use of cycle helmets is investigating the underlying factors that influence cycle helmet use. According to VTI's observation measurements, the use of cycle helmets varies greatly from location to location. In Stockholm, for example, just under 70 percent of cyclists wear a helmet, in Gothenburg just under 50 percent and in Malmö, Linköping and Norrköping only just over 20 percent (Larsson, 2011). There is also a difference depending on sex, age and environment.

Without mandatory cycle helmet legislation, the Swedish Transport Administration's target is that that cycle helmet use should be at 35 percent by 2020. Helmet use has tended to stagnate at today's level, 27 percent and, for this reason, the Analysis Group feels that concrete measures are required to increase cycle helmet use to 35 percent by 2020. In the Swedish Transport Administration's road safety survey (2010), 54 percent agree that is should be compulsory for everyone to wear a helmet when cycling, which shows that there is relatively good support for increased helmet use.

4.6 Safe vehicles

4.6.1 Safe passenger cars

	2007	2010	Target year 2020	Estimated trend towards target
Percentage of new passenger cars sold with the highest Euro NCAP score	66 %	74 %	100 %	In line with desired trend

The target for safe vehicles has been set at 100 percent of new cars having the highest safety score according to Euro NCAP. The estimated potential at this level is around 90 fewer fatalities per year through an improvement in active and passive safety.

Trends and projections towards the target for 2020
The first cars to achieve the highest safety scores, five stars in Euro NCAP, were tested and came onto the market in 2001. By the end of 2007, 66 percent of all new cars sold in Sweden had the highest safety scores in Euro NCAP. The target level of 100 percent by 2020 means that an increase of just over 2.5 percentage units per year is required. This was achieved with a good margin in 2007–2008 when the percentage increased by 5 percentage units.

In 2009 and 2010, the increase has stagnated and the percentage in 2010 is 74 percent. The Road Safety Performance indicator is, however, still on a level with what is required to achieve the target of 100 percent by 2020.

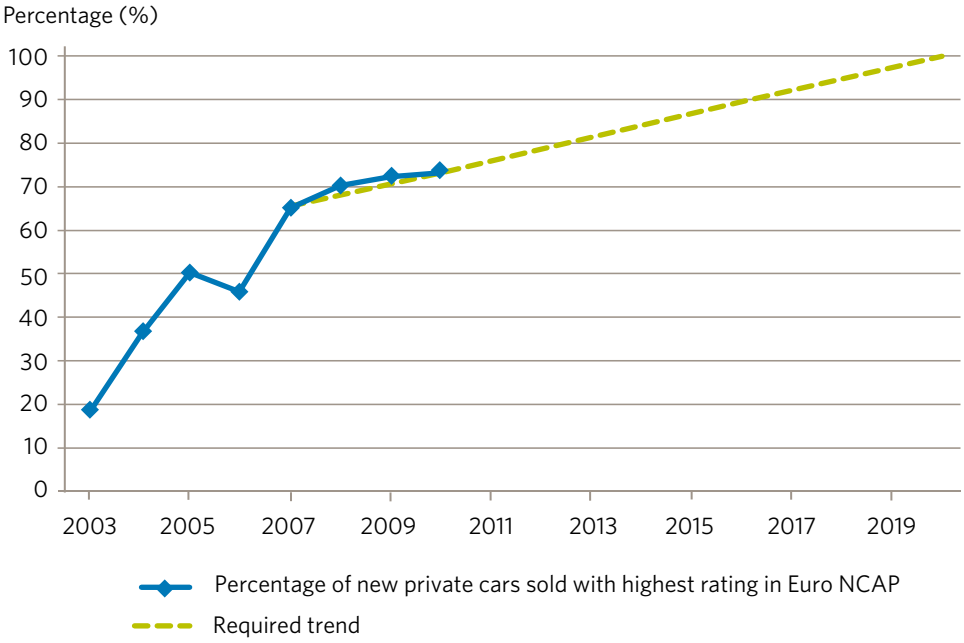


Figure 27. Percentage of new cars with the highest safety scores in Euro NCAP. Source: Bil Sweden, The Swedish Transport Administration.

Analysis and discussion

The percentage of new passenger cars sold with the highest safety scores in Euro NCAP has previously increased greatly. This trend has come to a standstill over the past three years. The percentage is still increasing but only by one percentage unit from 2009 to 2010. This stagnation could be explained by the introduction of more challenging requirements for achieving the highest scores in Euro NCAP. This means that the actual safety level of new cars would increase even if the percentage of new passenger cars sold with the highest scores in Euro NCAP were to remain at a constant level. A trend like this means that the target level of 100 percent is not relevant and it should be revised to a lower level or be based on the underlying point levels in Euro NCAP's score system. It would be appropriate to carry out a revision like this in connection with the review of the Road Safety Performance indicators in 2012, provided that it can be shown that the revised target level will also contribute to 90 fewer fatalities.

A better measure of the safety level of the entire passenger car population would be the percentage of the total traffic volume consisting of passenger cars with the highest scores in Euro NCAP. One possibility for following these developments could be linking the percentage of new passenger cars sold with certain safety systems to the percentage of new cars in the total traffic volume. The assumption that this is possible is based on the distances covered not being appreciably different between new cars with different safety standards. Figure 28 shows the trends in the volume of traffic in cars with electronic stability control (ESC), cars with seat belt reminders for the driver's seat (SBR) and cars with the highest safety scores in Euro NCAP. In 2010, therefore, 35 percent of the traffic volume is in cars that have the highest safety score in Euro NCAP and 53 percent or 48 percent respectively in cars equipped with anti-skid systems or seat belt reminders.

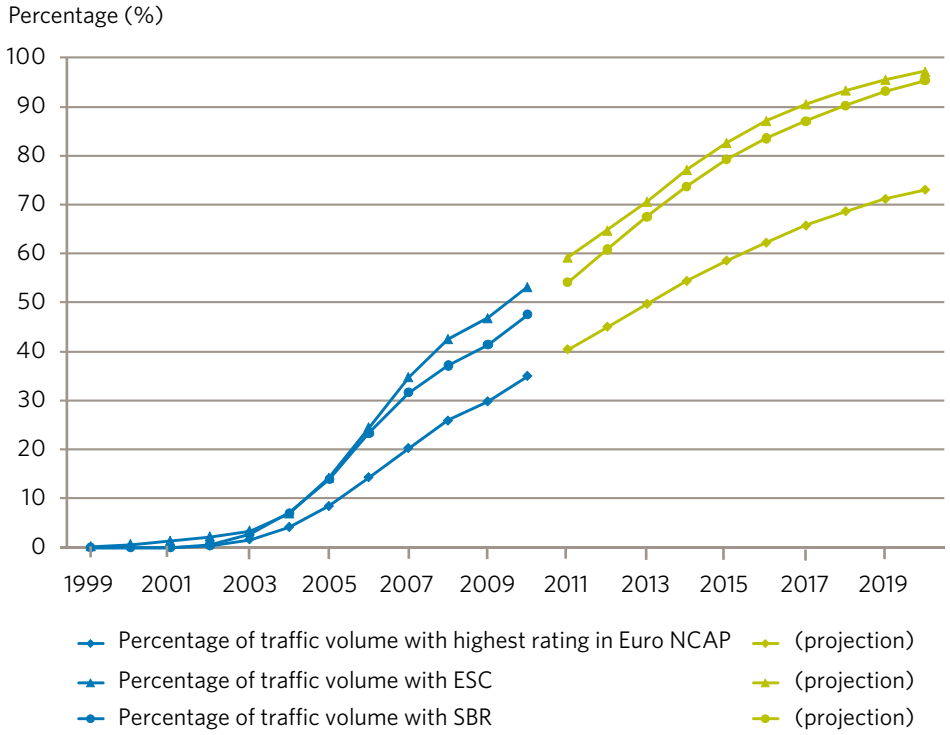


Figure 28. Percentage of traffic volume in cars with the highest safety score in Euro NCAP, electronic stability controls (ESC) and seat belt reminders (SBR). Source: Transport Analysis, the Swedish Transport Administration.

The earlier rapid increase in passenger cars with the highest scores in Euro NCAP along with the fact that new cars account for a greater percentage of the total traffic volume has led to the percentage of the traffic volume in safe cars increasing at a rapid pace. The future new requirements for the highest scores in Euro NCAP make it difficult to estimate the future growth rate.

But, given that the percentage of new passenger cars sold with the highest safety scores in Euro NCAP is at the necessary level, we can see in the diagram above that the level for the traffic volume will also follow the desired level. Future EU legislation means that the increase in cars with electronic stability control can be easily predicted. This makes it likely that the percentage of cars with these safety systems in the traffic volume and not just in new cars sold will approach 100 percent by 2020. Seat belt reminders for the driver's seat are already fitted in almost 100 percent of new passenger cars sold. They are, therefore, expected to follow the same trend as electronic stability control in traffic volume.

Approximately 15 percent of fatalities in passenger cars in 2010 were travelling in cars with the highest score in Euro NCAP. This is the highest proportion to date. This is, however, natural as the proportion of traffic volume in these cars is increasing. Since they account for 35 percent of the traffic volume, they are clearly underrepresented in fatal accidents. In the few cases where someone dies in a car with the highest score, this is often in an accident involving a serious collision, e.g., head-on accidents involving heavy vehicles.

Despite the positive trend, not all new passenger cars achieve the same high safety score. It is, therefore, vital to provide incentives to consumers to choose the safest car models. Through cooperation with trade and industry and public authorities, stakeholders can stimulate stricter requirements for vehicle safety and stricter

environmental requirements for purchases. Future international standards for including road traffic safety in quality work, ISO 39001, should also be able to contribute towards an increase in the requirements for self-monitoring when buying vehicles.

It is also important that there is good, easily accessible consumer information that can support private individuals in choosing a car with high safety standards.

It is not just increased safety in collisions that has made new passenger cars safer. Safety has also been improved through systems that help drivers of passenger cars to avoid collisions or that alleviate the consequences of collisions. One such system with a good safety potential is the so-called automatic braking system[13], which reacts when the car is rapidly approaching other vehicles or pedestrians.

This technology may become even more important if systems are widely introduced to help drivers to keep to the right speed and to prevent drink driving and drivers from becoming sleepy. Classic road safety problems that there were previously no effective measures against may, therefore, be solved to a great extent by vehicle technology. This applies, however, only on the condition that drivers do not adapt their behaviours so that the safety potential disappears or is reduced (so called behaviour adaptation[14]). It would be desirable for the motor industry to take the lead responsibility for showing that the support systems being developed and introduced have a positive impact on safety.

A measure that could have a good effect is differentiated insurance systems. For example, in 2010, Folksam has introduced discounted premiums for cars with automatic braking. Other measures could be a taxation system that favours safety equipment and possibly legislation. The Swedish Transport Agency has submitted a proposal regarding a super environmental car premium to the Government at the start of 2011. Safety requirements are also included in this, which is the first time these have been combined with environmental requirements.

In 2010, the Government proposed that, from July 2011, alcolocks should not be included in the calculation of the taxation of benefits. Neither this proposal nor the legislation on alcolocks for those convicted of drink driving, which was passed in 2010, is deemed to have a sufficient impact on the degree of introduction of alcolocks up to 2020.

Newer passenger cars account for the greatest proportion of traffic volumes. Despite this, the safety of the Swedish car population is not just affected by which new cars are produced but also at what rate older cars disappear and also which cars it is that disappear. Scrapping premiums or similar measures can have a good effect on vehicle safety but they should, at the same time, be linked to requirements for safety and environmental impact in the purchase of a new car. Otherwise older, relatively safe cars are at risk of being replaced by new cars that may have a lower safety level.

It is important that new technical support systems that are not compulsory function as they should over the entire service life of the car. Such checks also need to be carried out in connection with the recurring vehicle testing. From the turn of the year, certain systems will begin to be checked, but it is important that this work is intensified bearing in mind the rapid development of technology.

[13] The automatic braking system can reduce the risk of personal injury by more than 40 percent if the collision speed is reduced by 20 km/h, according to Folksam.

[14] Behaviour adaptation: The entire or some of the safety potential disappears as a result of a change of behaviour in drivers, e.g., increased speeds.

4.6.2 Safe heavy vehicles

	2007	2010	Target year 2020	Estimated trend towards target
Percentage of new heavy vehicles with automatic emergency braking system[15]	0 %	0 %	100 %	Not in line with desired trend

Rapid developments are also underway when it comes to active safety systems for heavy vehicles. This trend will probably have a positive impact on road traffic safety, even if the potential is as yet unknown and probably also varies between different systems. It is, however, clear that the technology that has the greatest road safety potential is the kind that would prevent or alleviate the consequences of head-on collisions between heavy and light vehicles, e.g. automatic emergency braking systems.

Trends and projections towards the target for 2020
At the present time, there is no technology on the market with great potential for preventing head-on collisions between heavy and light vehicles.

Analysis and discussion
It will probably be some time before technology to prevent head-on collisions or to alleviate the consequences of these will begin to be widely introduced in heavy vehicles. At the present time, technology is primarily being introduced in heavy vehicles with the focus on rear-end collisions, technology that supports the driver in staying within his lane (lane-keeping systems) and electronic stability control. Such systems only have limited road safety potential, at least when it comes to fatal and serious accidents. This marginal potential is because the majority of the serious accidents involving heavy vehicles are head-on collisions with light vehicles. In rear-end collisions, the injuries are rarely as serious because the vehicles are usually moving in the same direction. Furthermore, in-depth studies of fatal accidents show that it is rarely the heavy vehicle that crosses over to the opposite lane. For this reason, electronic stability systems and lane-keeping systems have a limited potential for reducing serious accidents. But even if their potential is limited, we can see these systems as important developmental stages on the road to technology that prevents head-on collisions or alleviates the consequences of these.

In 2010, the percentage of new heavy vehicles with electronic stability systems was about 5 percent, i.e., largely the same as in 2009. This percentage is, however, expected to increase in 2011, when Volvo Lastvagnar, for example, introduces electronic stability control as standard on the models of lorries that account for about 80 percent of new sales. From and including 2012, lane-keeping systems and electronic stability control will become compulsory on new heavy vehicles in the EU. It will, however, take a number of years before vehicles with these systems account for a greater proportion of the volume of traffic. As previously mentioned, these systems also have only limited road safety potential.

4.6.3 Safe motorcycles and mopeds

In 2009, the measurement "percentage of new motorcycles sold that are fitted with ABS brakes" was introduced. The measurement is adapted to measure vehicle safety trends in motorcycles and is linked to the percentage of ABS brakes. Studies of actual accidents have shown that ABS brakes on motorcycles have a great impact on

[15] This system has not been defined, but the measurement aims to be a functional requirement where some form of solution to frontal collisions between heavy vehicles and other vehicles needs to be achieved.

reducing accidents (Rizzi et al, 2009). There is no target for how great a percentage of motorcycles sold should be fitted with this type of brakes by 2020. McRF has, however, set a target of 75 percent of new motorcycles being fitted with ABS brakes by 2015.

McRF is part of the MC Council, which consists of important stakeholders in the motorcycle industry and the target has been set with its starting point in, among other things, strategic work on motorcycle and moped safety (The Swedish Transport Administration 2010:039).

This target should, therefore, be the authoritative one until further notice. For moped safety, lower speeds through tuning-down were highlighted as a priority operation in the area of safe vehicles, although there are no explicit targets for 2020.

Trends and projections towards the target for 2020

It is estimated that the percentage of new motorcycles sold with ABS brakes in 2010 was just under 60 percent, compared with about 30 percent in 2009.

An estimate of how great a percentage of the total traffic volume that motorcycles and motorcycles with ABS brakes account for will provide a better picture of what impact the system will have on the actual roads. It is generally the case that newer motorcycles are driven longer distances than older ones, which means that a great percentage of new motorcycles with ABS sold will also have a great impact on the traffic volume. It is estimated that, today, motorcycles fitted with ABS brakes account for about 20 percent of the traffic volume.

Analysis and discussion

The development of ABS brakes as standard equipment on motorcycles has moved quickly over the last two years. From being standard at only one manufacturer and an expensive option in others, ABS has become a natural piece of standard equipment on the majority of the major motorcycle models. Other types of motorcycles, e.g., motorcycles in the supersport class, are also being fitted with ABS as standard among many manufacturers.

There is very little scrapping of old motorcycles as their owners often keep these as a leisure interest and for pleasure trips. This means that the opportunities for renewing the vehicle population lie mainly in the addition of new motorcycles with a high safety level. Moped- och motorcykelbranchens riksförbund (McRF) [The Swedish Association of Moped and Motor-cycle Trade] has been very successful in getting its members to import, as a general rule, only varieties with ABS brakes as standard in cases where a model is available both with and without ABS brakes. But it is imperative that manufacturers and importers continue the trend towards more and more models being equipped with ABS brakes as standard. It is also important that the motorcycle organisations continue to clarify the safety gains in these systems for their members. According to a survey[16] carried out by Sveriges motorcyklister (SMC) [Swedish Motorcyclists] and NTF, 80 percent of SMC's members will ask for ABS brakes they next time they buy a motorcycle. An explanation for this great demand may be the great impact that studies on the positive effect of ABS brakes have had in the media. The great media interest in ABS brakes is expected to continue in the future.

One of the other specific measures worth mentioning for increasing the introduction of ABS brakes is the EU submitting a proposed bill in 2010 involving certain types of motorcycles having to be equipped with Advance Brake Systems from 2017. In this process, it is important that the focus is on ABS brakes in particular as it is

[16] Survey of motorcyclists' behaviours and attitude to road safety, 2010, www.svmc.se.

these that have proved to have an effect on reducing accidents. Folksam has introduced a premium discount of 15 percent for motorcycles with ABS brakes and Länsförsäkringar has included mechanical damage in its motorcycle insurance, with a view to repairing, among other things, ABS brakes, which can be expensive.

In 2009, there were one, or possibly two, fatal accidents and, in 2010, two people were killed on motorcycles equipped with ABS. In all cases, the circumstances of the accident were such that braking was not a decisive factor in the accident.

In the period before 2005, the percentage of tuned-up mopeds in fatal accidents was about 70 percent for drivers in the 15-17 age group. In 2005–2008, the proportion was about 50 percent and, in 2009–2010, the same proportion is now down to about 30 percent. In 2009–2010, we can, therefore, see a reduction of a further 29 percentage units from the previous year, which is positive. The number of moped riders killed is, however, relatively small, which means the estimates are somewhat uncertain. It is mentioned in the strategy for increased MC and moped safety that work is already underway today on reducing the number of dealers selling tuning parts for mopeds. This work should continue and, if possible, be evaluated and streamlined.

4.7 Safe national roads

	2007	2010	Target year 2020
Percentage of traffic volume on roads with speed limit above 80 km/h with median barriers	50 %	67 %	75 %

The target is for the percentage of traffic volume on roads with speed limit above 80 km/h with median barriers to be at least 75 percent by 2020. This target can be achieved by either reducing speed limits to 80 km/h on roads with a 90 km/h limit or by converting them into roads with a median barrier. The annual effect between 2007 and 2020 is estimated at 50 fewer fatalities. Other measures on the national network are primarily side barriers, a corrugated central reservation and few opportunities for overtaking. This is expected to lead to a further decrease of 12 fatalities.

Trends and projections towards the target for 2020

Following the changes carried out in 2010, the percentage of traffic volume on roads with a speed limit of more than 80 km/h with median barriers was 67 percent by the end of 2010. This is far in excess of the desired trend towards the target of 75 percent (figure 29). This is mainly due to the very widespread speed limits implemented in 2009.

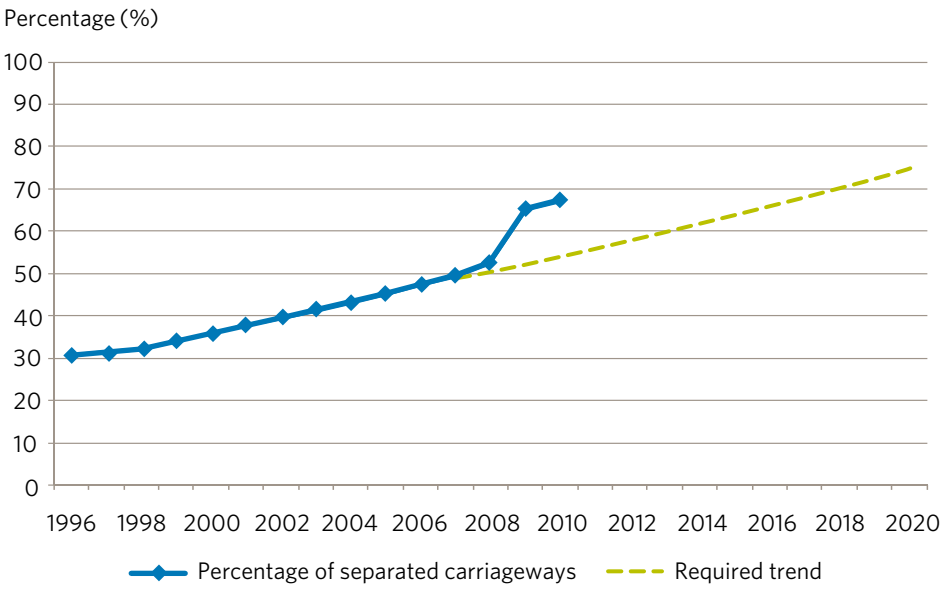


Figure 29. Percentage of traffic volume on roads with a speed limit of more than 80 km/h with median barriers. Source: The Swedish Transport Administration

Analysis and discussion

More than 250 km of roads with median barriers have come into existence in 2010, 60 km of which is motorway. No widespread reduction in speed limits has been implemented. This means that the outcome for the Road Safety Performance indicator increased by two percentage points, to 67 percent, in 2010. Other measures that have been implemented in the state road network in addition to those that directly influence the Road Safety Performance indicator are corrugated central barriers on more than 650 km of road and few smaller measures at crossings and side areas. A total of 4,450 km of road has median barriers and on about 3,000 km of road, there is automatic road safety control using cameras. Fifty-three percent of the traffic volume on the national road network occurs on these roads.

The greatest potential for reducing the number of fatalities lies in measures that have reduced the number of one-car accidents and the number of head-on accidents (see figure 30). On average, almost 70 percent of fatalities have been in one-car accidents and head-on accidents in the last five years. A better outcome for this Road Safety Performance indicator will have an effect on both head-on and one-car accidents.

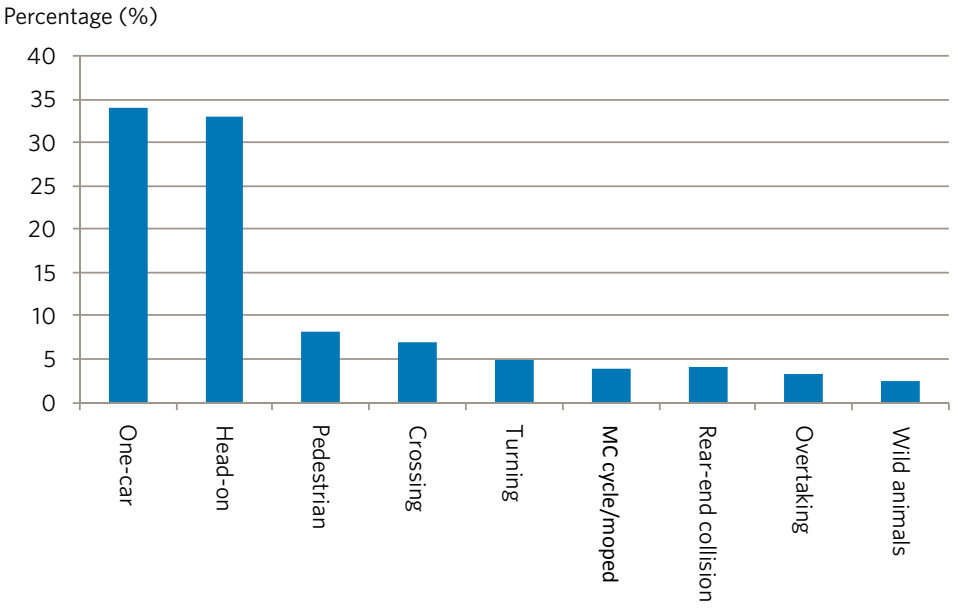


Figure 30. The percentage of fatalities on the national road network divided into type of accident, 2006-2010. Source: The Swedish Transport Administration

There are still 10,000 km of 90 km/h roads without median barriers. As many people are killed on these roads as on the 40,000 km of national 70 km/h roads. A total of 54,000 km of roads are in rural areas and have a 70 or 80 km/h speed limit. Converting a large part of these by 2020 is regarded as unrealistic from a socio-economic perspective. But even at these speeds, a collision with a heavy lorry could mean a fatal collision. It is, therefore, vital that so-called emergency braking systems that reduce collision speeds become standard in new cars and lorries. Collisions may even be fatal when smashing into a fixed object on roads with a 70 or 80 km/h speed limit. Operational measures to reinforce edge and central lines could, together with systems in vehicles, tangibly reduce the risk of fatal accidents. It is important that the car industry and maintainers of roads work together so that it is possible to use the existing systems that read road markings.

Investments in road safety on the state road network are laid down in the long-term action planning. This was adjusted in autumn 2010 so that the resources for road safety were reallocated during the planning period. Instead of being evenly allocated, these resources are, in principle removed during the beginning of the planning period. This will not be compensated for until 2021. The resources that are allocated for the budget item called Safe Transport Systems is now allocated in accordance with the blue column in figure 31. It is from this budget item that resources will be taken for, for example, median barriers on roads.

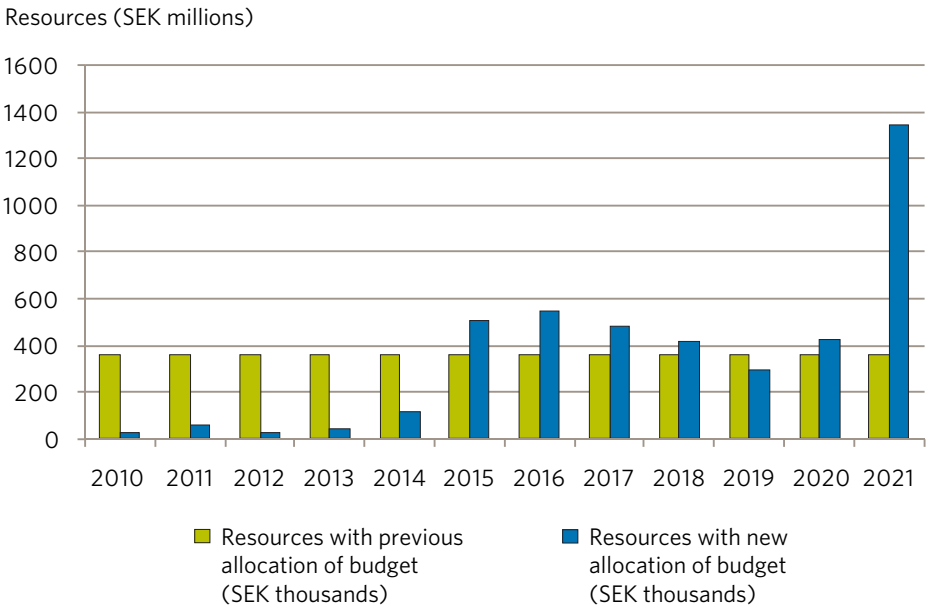


Figure 31. Resources (SEK thousands) set aside in the action plan for 2010–2021 for the allocation area, Safe Transport Systems, previous allocation compared with present allocation.

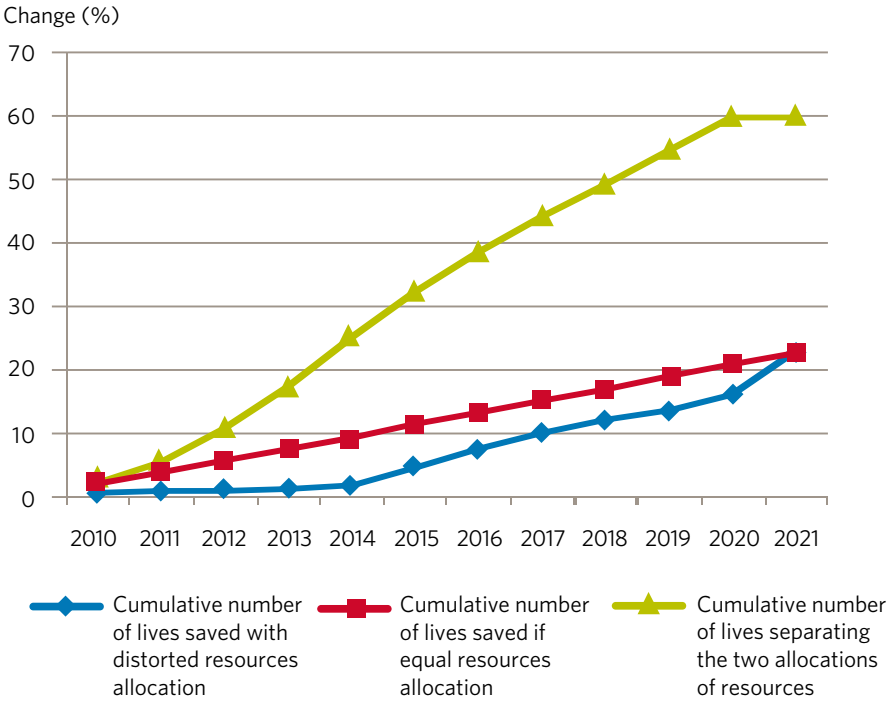


Figure 32. Cumulative number of lives saved by maintaining the combination of measures and different allocations of budgets.

It is, therefore, stated in the action plan for the period, 2010–2021 that median barriers will be implemented at a considerably lower level that what is required to achieve the target level with this kind of solution by 2020. Reducing the speed limits should be the immediate solution if lives are to be saved at the rate in the original plan. This is the option that is available in order to compensate for the lack of an increase in the safety standards in the infrastructure. In the Swedish Transport

Administration's work on adapting speed limits to the road's safety standard, it is planned that the next big step will be taken at the 2015 planning round. Without the reallocation of the resources in the plan or compensatory speed limit reductions, the target for the Road Safety Performance indicator will not be achieved by 2020 and neither will the general milestone of a 50 percent reduction in the number of fatalities by the same year.

4.8 Safe municipal streets

The number of fatalities in the municipal street network has reduced by half over the last ten years, which is the same size as the reduction in the state road network. The reduction in the municipal road network can be explained primarily by the fact that many municipalities have been working systematically on creating safer road designs in their urban areas. There is no collective picture of the measures that have been implemented, however.

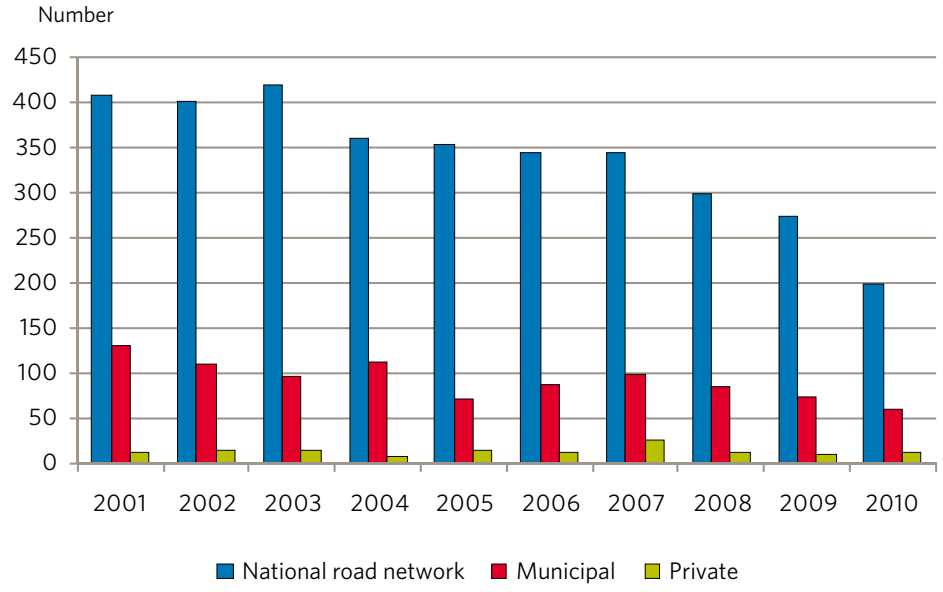


Figure 33. Fatalities in road traffic divided into body responsible for the upkeep of the road. Source: The Swedish Transport Administration.

4.8.1 Safe pedestrian, cycle and moped passages in urban areas

	2007	2010	Target year 2020	Estimated trend towards target
Percentage of safe pedestrian, cycle and moped passages in the municipal road network	Approx 25 %	-	Not defined	Not measured

A pedestrian, cycle and moped passage (GCM passage) is classed as safe if it grade-separated or if 85 percent of motorists drive at a maximum of 30 km/h.

Trends and projections towards the target for 2020

Only 6 municipalities fully report the percentage of safe GCM passages in the national road database, NVDB. In these municipalities, 36.3 percent of passages are safe.

Analysis and discussion
According to an analysis of the Swedish Transport Administration's in-depth studies into fatal accidents, about 30 people are killed each year on GCM passages in urban areas. The majority – over 25 – of these at a passage where speeds are not managed. It is, therefore, likely that a large proportion of these would survive if speeds at the passage were managed.

Municipalities performing inventories of their passages and reporting to NVDB is a prerequisite for making it possible to monitor this Road Safety Performance indicator and thereby view the municipalities' part in road safety work towards the interim targets for 2020. This should be done according to "Instructions for inventories of GCM passages and crossings in urban areas" (Swedish Transport Administration, 2010).

Furthermore, the municipalities must, of course, accept the challenge of safeguarding those points in their road environment where unprotected road-users are exposed to risk. It has been documented that passages where speeds are managed across the car network on municipal roads have an effect on reducing accidents. This can be done by building a grade-separated passage or introducing speed-reducing measures in the lead up to GCM passages. We can also work towards better adaptation of speed and lower speed levels in urban areas, primarily by carrying out a speed limit review of the urban area. About 10 percent of municipalities have done this so far.

The Analysis Group feels that, unless a target is set for this Road Safety Performance indicator or it is followed up on satisfactorily within the near future, it should be excluded in the review of Road Safety Performance indicators in 2012.

4.8.2 Safe crossings in urban areas

	2007	2010	Target year 2020	Estimated trend towards target
Percentage of safe crossings in the municipal road network	Approx 50 %	-	Not defined	Not measured

A crossing is classed as safe if speeds are physically managed through a roundabout or suchlike, or where 85 percent of motorists drive at a maximum of 50 km/h.

Trends and projections towards the target for 2020
The percentage of safe crossings cannot be determined today.

Analysis and discussion
More than 40 persons are killed annually at crossings in urban areas. About 30 of these are killed at crossings that cannot be classed as safe. Note that the definition of what is a crossing overlaps with what is a GCM passage, as a crossing often has one or more GCM passages next to it. This means that the potential in number of lives saved cannot be added up and we must take into account substantial double counting.

Municipalities registering their crossings in the national road database, NVDB, is a prerequisite for making it possible to monitor this Road Safety Performance indicator and thereby view the municipalities' part in road safety work towards the interim targets for 2020.

Furthermore, the municipalities must, of course accept the challenge of safeguarding crossings where motor vehicles are encountered. It has been documented that managing speeds at crossings has an effect in reducing accidents. This may, for example, be done by converting crossings to roundabouts. We can also work towards better speed adaptation and lower speed levels in the urban area. One of the primary tools for this is carrying out a speed limit review in the urban area, which about 10 percent of municipalities have done so far.

The Analysis Group feels that, unless a target is set for this Road Safety Performance indicator or it is followed up on satisfactorily within the near future, it should be excluded in the review of Road Safety Performance indicators in 2012.

4.9 Refreshed drivers

	2007	2010	Target year 2020	Estimated trend towards target
Percentage of drivers stating they have fallen asleep/almost fallen asleep while driving	11,9 %	13,7 %	6 %	Not in line with desired trend

The target for the Road Safety Performance indicator, "refreshed drivers" is that the percentage of car drivers stating in the Swedish Transport Administration's road safety survey that they have "fallen asleep or almost fallen asleep at some time over the past 12 months" should be halved between the years 2007 to 2020. In order for this objective to be achieved, a reduction of about 6 percentage points to 6 percent is required by 2020.

There are a number of studies specifically focusing on driving in a drowsy state. In these, it is estimated that drowsiness among drivers has been a contributory factor in between 10 and 30 percent of all accidents ((Horne and Reyner, 1995a, Horne and Reyner, 1995b, Maycock, 1997, Radon et al., 1974, Radun and Summala, 2004). The number of accidents caused by tired drivers is considered to be in the same range as the number of accidents caused by people driving under the influence. One difficulty, however, is how to measure this. At present, information that drivers themselves have provided in the Swedish Transport Administration's annual road safety survey is used. This measurements needs to be validated against the problem in actual road traffic, however.

Trends and projections towards the target for 2020

Figure 34 shows trends in self-reported tiredness from the Swedish Transport Administration's road safety survey between the years, 2006 and 2010. In 2007, just under 12 percent of the car drivers asked responded that they had fallen asleep or almost fallen asleep while driving in the past 12 months. This percentage has subsequently gradually increased up to 2009, when the level was at 16.2 percent before decreasing to 13.7 percent in 2010. The figure also shows how the outcome for the Road Safety Performance indicator needs to be changed between 2007 and 2020 in order for the target level of 6 percent to be achieved. In 2010, the proportion was just under 14 percent, which means that the results for the Road Safety Performance indicator have not developed in a sufficiently positive direction since 2007.

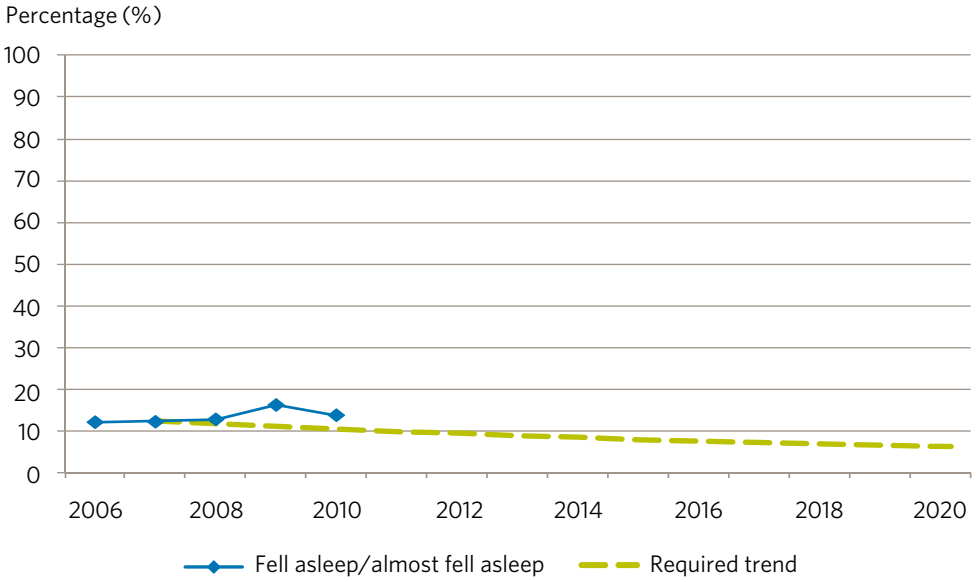


Figure 34. Percentage that state that they have fallen asleep or almost fallen asleep while driving a car in the past 12 months during the years 2006–2010 and the desired trend. Source: The Swedish Transport Administration's road safety survey

Analysis and discussion

The trend for the outcome for the Road Safety Performance indicator, refreshed drivers, has gone in the wrong direction for several years. But, in 2010, the number of persons stating that they had fallen asleep or almost fallen asleep fell by 2.5 percentage points, from 16.2 percent in 2009 to 13.7 percent in 2010.

National studies on tiredness-related accidents (Larsson and Anund, 2002) show that tiredness-related accidents take place at all hours of the day and every day of the year. The risk of a tiredness-related accident is greatest late at night (3 to 5 am) and most drivers have experience of driving when tired. Falling asleep is also impossible to predict. The risk groups identified are young drivers, professional drivers and shift workers (Anund et al., 2008, Lowden et al., 2009, Åkerstedt et al., 2005). From a physiological point of view, there are major differences when it comes to age: younger people need their sleep more and find it more difficult to "resist" when they feel tired. They also drive more at night than older people. The Swedish Transport Administration's road safety survey, 2010 reports on the proportion stating that they have "fallen asleep or almost fallen asleep at some point in the past 12 months" divided into age groups. There are major differences in the responses for different age groups: in the 20–24 age group, 23 percent respond that they have fallen asleep or almost fallen asleep, while only 6 percent in the 65–74 age group reply that they have fallen asleep or almost fallen asleep.

In Sweden we have used milled rumble strips in the roadway as a measure for increasing attentiveness and thereby reducing the number of accidents caused by tiredness and inattentiveness. Results from other countries indicate that the number of accidents is reduced by 15 percent following the introduction of rumble strips in the middle of the road (Mahoney et al., 2003 and Persuad et al., 2005). In Sweden, just over 4,000 km of road has had rumble strips installed in the middle of the roadway during the years, 2005–2009. An accident analysis is underway but the evaluation results do not indicate any clear positive effects (Carlsson et al., 2010). There is, however, still little accident material and the evaluation is continuing.

The compulsory hazard lessons for the class B driving licence has been augmented since 1 April 2009 with a section about tiredness, alcohol and drugs. In the area of tiredness, the training aims to provide the prospective candidate with an understanding of and insight into how tiredness affects driving ability, what the consequences may be and what increases the risks and how these can be avoided. The evaluation shows that the participants have become more aware of what effect tiredness has on driving, but they are not as aware of what is required to counteract this (Forward et al., 2010).

More and more manufacturers are fitting some of their car models with support systems to warn when a driver seems to be lacking attention. In the long term, this is expected to lead to drivers becoming more aware of the risks. At present there is no collective information regarding to what extent these types of support system have been introduced in new cars. Nor are there any evaluations as yet based on outcomes of real accidents showing what effect these systems have on preventing and alleviating the consequences of accidents.

It is unclear how the Road Safety Performance indicator can be linked to the effect on the number of fatalities and casualties on the roads. The Analysis Group feels that, unless this Road Safety Performance indicator can be followed up on satisfactorily within the near future, it should be excluded in the review of Road Safety Performance indicators in 2012.

4.10 Prompt and satisfactory rescue

	2009	2010	Target year 2020	Estimated trend towards target
Average time from alarm to satisfactory rescue and care	15,2 mins	15,7 mins	Not defined	No target

Two thirds of people dying as a result of road traffic accidents die at the scene of the accident and a third in hospital. A few die while being transported in the ambulance. There is no doubt that the speed and quality of the rescue is of importance when it comes to how many people survive road traffic accidents. There is, however, a constant debate about how important the emergency response is in different circumstances. According to more recent studies, it is often decisive for the consequences of injuries sustained in an accident that the emergency response arrives within 25–30 minutes (Sánches-Mangas, R. et al. 2010).

What it is important to monitor are trends regarding the time between an accident and when the ambulance arrives at the scene. This information comes from SOS Alarm. It should, however, be pointed out that SOS Alarm only measures the time between the alarm being received and the ambulance arriving at the scene, which does not take account of when the actual accident occurred.

Trends and projections towards the target for 2020

At present there is no defined target from the time of a road traffic accident to an injured person receiving satisfactory emergency treatment. For this reason, it is impossible to describe the trend towards a desirable level. On the basis of the data analysed in 2009 and 2010, it is, however, clear that the average time from the alarm being raised until the ambulance arrives at the scene has become somewhat longer. It is impossible to decide as yet whether this is a trend or whether this is simply a case of some variation in the outcomes from year to year.

Analysis and discussion
SOS Alarm has data about 23,000 call-outs in Sweden in 2010. For just under three quarters of this body of information, there are details of the time that has elapsed between the alarm being received and an ambulance being at the scene of the accident. Figure 35 shows the split into different time intervals. It can be established that 62.6 percent of all call-outs lead to an operation where the ambulance is at the scene of the accident within quarter of an hour and a full 92.8 percent within half an hour. To these times must be added the time it takes between an accident taking place and the alarm being received at SOS Alarm, which we can assume varies greatly.

The average time between the alarm being received and the ambulance arriving at the scene of the accident is 15 minutes and 42 seconds. The median time is just under 13 minutes and 30 seconds. Both of these values are somewhat higher than the corresponding values for 2009, when the average time was 15 minutes and 24 seconds and the median time was just a few seconds more than 13 minutes. It is, however, impossible to decide as yet whether this is a trend or whether this is simply a case of some variation in the outcomes from year to year.

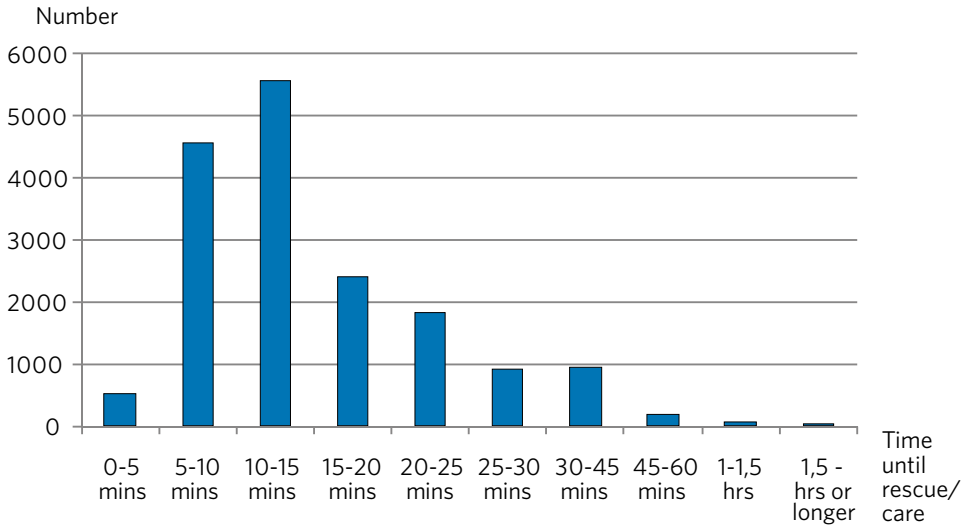


Figure 35. Time from the alarm being received until the ambulance is at the scene of the accident, entire country, 2010. Source: SOS Alarm

These variations depend in part on where in the country the accidents have occurred but it is likely that they may also depend on variations as to how effectively they are handled.

The Analysis Group feels that, unless a target is set for this Road Safety Performance indicator or it is followed up on satisfactorily within the near future, it should be excluded in the review of Road Safety Performance indicators in 2012.

4.11 High valuation of road safety

	2007	2010	Target year 2020	Estimated trend towards target
Valuation of road safety, index	67	65	80	Not in line with required trend

There is a connection between the valuations people have of road safety issues and the way they then behave on the roads (The Swedish Road Administration 2008). It may, however, be difficult to get an answer to an individual's valuations by asking a simple question. We can instead form an index on the basis of a number of questions affecting different aspects of the term valuation of road safety.

The index used here has been taken from the Swedish Transport Administration's road safety survey[17] (Swedish Transport Administration, 2010) In this, the public's attitudes and behaviour on the roads is monitored. The index includes seven questions that have been included since 2000 and that reflect attitudes to effective road safety measures.

1. It is reasonable to reduce the speed limit to 30 km/h on streets where there are many pedestrians and cyclists. (30 km/h at crossings)

2. All major roads should have median barriers erected to prevent head-on collisions. (Median barriers)

3. More crossings should be replaced by roundabouts. (Roundabouts)

4. All cars should be equipped with alcolocks where a breath sample is required every time the car is to be started. (Alcolocks in all cars)

5. All cars should have a technical aid so that the driver can keep to the speed limits more easily. (ISA-system)

6. All cars should have a technical system that reminds drivers and passengers to put on their seat belts. (Seat belt reminder)

7. It should be compulsory for everyone to wear a helmet when cycling (Cycle helmet legislation)

These have been weighed together into an index using weightings corresponding to the measures' potential to reduce the number of fatalities on the roads. According to the international expert panel's report, the potentials for the respective measures are (Elvik et al. 2009): 30, 62, 30, 50, 150, 40 and 10 fewer fatalities respectively.

Trends and projections towards the target for 2020

In 2007, the index was 67, while, in 2010, it had reduced to 65. In order to achieve the target by 2020, the index must increase by 1 unit a year. This means that the index should have been at least 70 in 2010. The Analysis Group feels that what is required in order to achieve the target by 2020 is, above all, the attitude to technical aids that help the driver to keep to the speed limits to be improved.

[17] Through the Swedish Transport Administration's (previously the Swedish Road Administration's) road safety survey, we can see the public's attitudes to a number of road safety issues. The survey has been carried out annually (but not in 2004) since 1981 and is sent to about 10,000 persons chosen at random..

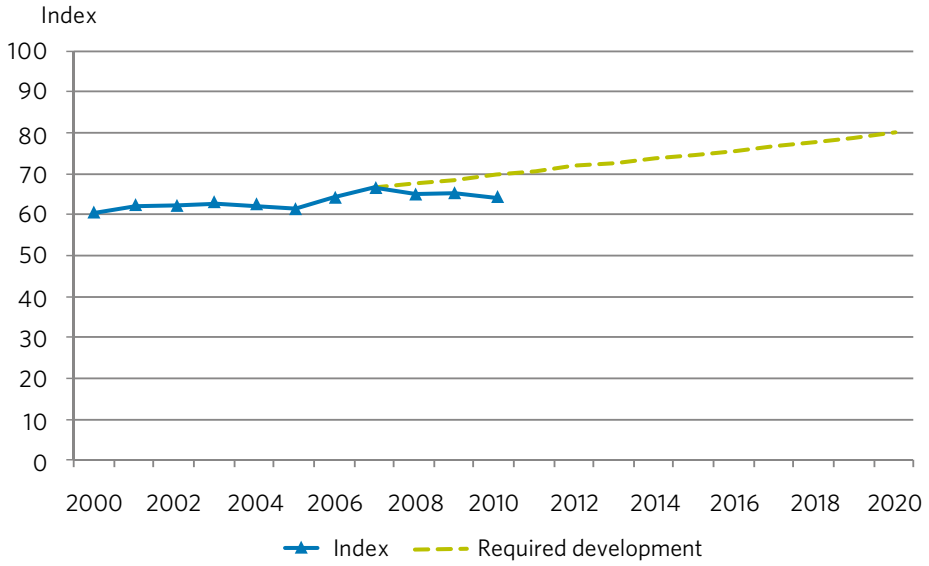


Figure 36. The public's valuation of road safety issues reflected in an index constructed from the Swedish Transport Administration's road safety survey, 2000–2010 and the required trend by 2020. Source: The Swedish Transport Administration

Analysis and discussion

The issues that affect the road safety index most are question 5: "All cars should have a technical aid so that the driver can keep to the speed limits more easily" and question 2: "All major roads should have median barriers erected to prevent head-on collisions". They contribute to more than half of the index's size, but although both of these questions demonstrated a positive trend in 2010, the index's value did not increase. This is due to a negative trend in other questions that form part of the index.

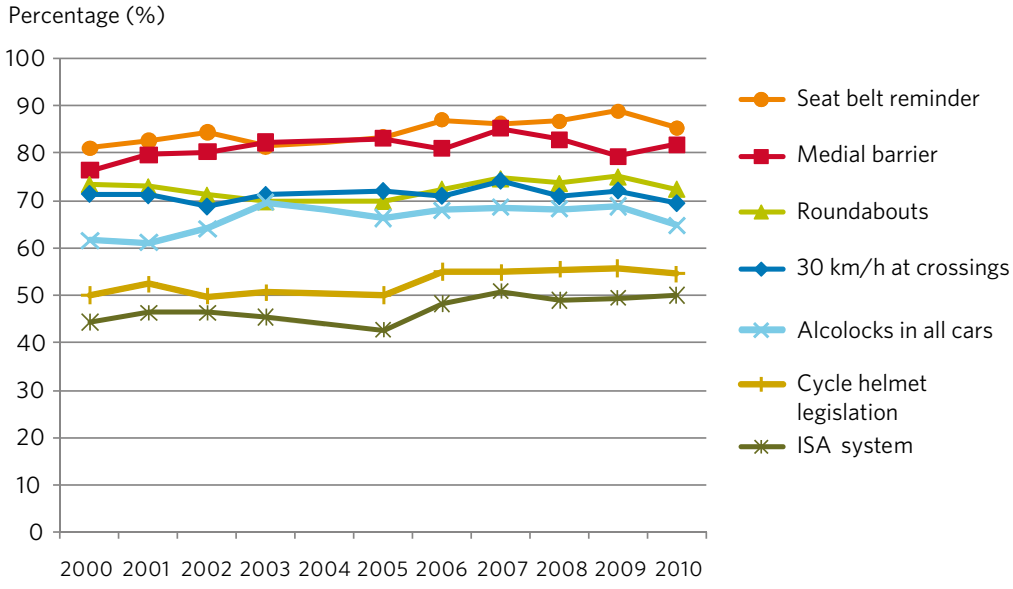


Figure 37. The percentage of respondents who agree with 7 of the questions in the Swedish Transport Administration's road safety survey, 2000-2010. Source: The Swedish Transport Administration

In order to increase the index for the valuation of road safety, measures are required within the seven areas forming the index. Some examples of measures are introducing many zones with speed limits of 30 km/h where unprotected road-users occur, erecting median barriers on more major roads and replacing more crossings with roundabouts. An important element when such measures are implemented is information and training in order to explain the benefits and necessity of the measures. The coordinated work on the use of seat belts and cycle helmets and sobriety and speed checks that the Swedish Transport Administration, the police and NTF carry out are examples of measures to increase the public's valuation of road safety.

Increasing the valuation of road safety issues is important in order to be able to introduce new measures and so that measures introduced will be respected. A high valuation is obtained after the introduction of measures (they eventually create a new norm) and after information and training. This is regardless of in which order they are implemented.

5 Conclusions and discussion

In 2010, the number of fatalities has further reduced, compared with 2009, from 358 to about 270 (290 including suicides). Regardless of whether suicides are included or not, this means a great reduction from what is already a low level, historically speaking. Compared with the mean value for 2006–2008, the number of fatalities up to and including 2010 has reduced by 38 percent. In order to achieve the target by 2020, a decrease of just over 5 percent a year is required. This means that the number of fatalities for 2008 to 2010 falls well below the curve for achieving the target by 2020. The decrease is seen consistently for all types of accidents and ages. The number of those seriously injured has been estimated at 4,700, which is also a decrease compared with the previous year and the starting position in 2007, when the number of those seriously injured was estimated at 5,500.

5.1 Conclusions

How can this historical great decrease in the fatality and casualty figures be explained? There is of course a random variation in the outcome of the number of fatalities between the years that makes it difficult to deduce the trend from one year to another. In addition, different factors are working together, which makes trends even more difficult to deduce. But it is still reasonable to attempt to crystallise the most important explanations.

A trend towards a reduction in the number of fatalities and casualties started in connection with the economic recession that began during the financial crisis in the autumn of 2008. This has continued in 2010, despite growth figures showing an upward turn again. We know, however, that unemployment is also linked to the number of road fatalities and casualties. Since unemployment continued to increase in 2010, this may be an explanation as to why we have not seen any increase in the fatality and casualty figures. Now that unemployment is going down and growth is continuing to be high, previous experience indicates that the fatality figures may go up again.

As well as a gradual improvement in roads and vehicles, lower speeds are considered one of the most important explanatory factors. The great decrease in average speeds in 2010 was largely a consequence of the severe winter, which led to wintry road conditions throughout the country. But even during those months without wintry road conditions, the measurements have shown a clear decrease in average speeds. This indicates that the decrease cannot simply be explained by the severe winter and it probably also depends on a change in behaviour.

The measures considered to have the potential for saving most lives are reduced speed levels, a continued increase in the percentage of the volume of traffic on roads with median barriers and an increase in the rate of the percentage of safe vehicles in the vehicle population. The Sober Traffic Road Safety Performance indicator is also considered particularly important, since drivers under the influence of alcohol killed in an accident have often been driving both too fast and without a seat belt.

Despite reduced speeds, the Analysis group's overall assessment is that the percentage of drivers driving in excess of the speed limits on the national road network is not decreasing at the rate required to achieve the target. This assessment has been carried out on the basis of the more simple speed measurements carried out

[18] In order to even out annual variations, a mean value for 2006-2008 is used as a base year. Read more in chapter 3 *Surrounding world factors.*

annually. The average speed for the total traffic volume, however, tends to be more in phase with the desired trend. Compliance with speed limits is also considered the greatest challenge, on both the national and municipal road networks. Up to now, compliance on the national road network has been improved by in the range of 7 percentage units over the past six years. In order for compliance to reach 80 percent, an annual improvement of 3 percentage units will be required between 2009 and the target year, 2020. A proper evaluation of how the outcome for the Speed Compliance Road Safety Performance indicator is progressing cannot be done until after the nationwide measurement that will be carried out in 2012. Until then, all assessments are based on rough estimates. The challenge of increasing compliance with speed limits will be even greater now that new lower speed limits have come into force.

Both extending roads with median barriers and the comprehensive reduction in the speed limits have, until now, meant that the percentage of the volume of traffic on roads with a speed limit of more than 80 km/h with median barriers is at a level far in excess of the required trend. In order to achieve the target by 2020, investments will, however, need to continue in measures to increase road safety on the national road network during the target period. In the action plan applying for the Swedish Transport Administration for 2010–2021, there are not, however, sufficient resources set aside to achieve this.

The trend for the safe vehicles Road Safety Performance indicator is at a level in order for the desired trend for the target level to be achieved and the number of fatalities reduced. It is even the case that vehicle-borne technology has the potential to save lives in areas that have been traditionally regarded as solely the road-user's responsibility, such as, for example, sobriety.

The trend in the extent of drink driving seems to have gone in the right direction from 2007 to 2010. The assessment on the basis of the police's data is that the trend is progressing sufficiently quickly and the presence of alcohol in car drivers killed has decreased since 2003. The Road Safety Performance indicator still plays a key role in the work up to 2020 since there is an interaction between driving under the influence and other road traffic offences. For example, about half of the fatalities not wearing a seat belt in a passenger car are under the influence of alcohol. Things are moving slowly as regards alcolocks being introduced to any great extent in cars and the increase is far behind other road-safety increasing technical equipment, such as seat belt reminders and electronic stability control.

The use of cycle helmets has not increased since the milestone period began. It is clearly below the level required in order to achieve the target by 2020, both as regards the target, assuming mandatory cycle helmet legislation and the target on the basis of existing legislation Furthermore, there appears to be no intention of introducing mandatory cycle helmet legislation. This is serious, since cyclists constitute more than a third of all those seriously injured on the roads each year. The strategy for increased and safer cycling initiated by the Government in 2010 therefore has a major role in formulating proposed measures that could increase safety for cyclists. It is important that an issue like cycle helmets is not forgotten about in the work on creating safe and accessible cycle traffic.

5.2 Discussion

The trends in the Road Safety Performance indicators should be in tandem with each other so that they can together achieve the best possible effect on road safety. An attempt is made below to analyse the overall trends for the Road Safety Performance indicators, even though there are no models and methods for this ready (see section 5.3).

Despite the fact that the trends look good for several Road Safety Performance indicators individually there are a number of problems that will arise if the trend up to 2020 is to be sustainable. It will be necessary for the road safety effects of the Road Safety Performance indicators to interact in the correct manner. The use of seat belts is still low in fatal accidents, which shows that there is great potential for continuing to increase the use of seat belts, although levels are already high. The long-term positive trend towards wearing a seat belt will probably continue, thanks to the increase in the number of cars with seat belt reminders. It is not, however, likely that the goal will be achieved solely on the basis of this since, given the present turnover, the car population will not have time to be replaced at the rate required for all cars to have seat belt reminders by 2020. This is a challenge that applies to all technology in cars, e.g., it is not believed that that new technology will be able to manage speeds and alcohol by 2020. There should, therefore, be a strategy for how we can work until the anticipated technology is introduced and has an impact on the market.

In tandem with the continued extension of median barriers, the number of serious head-on collisions will probably decrease. This increase in safety will, however, stagnate when the majority of main roads with a speed limit in excess of 80 km/h with a lot of traffic have median barriers. Then there will remain the serious accidents on the network of smaller roads where there are a lot of very heavy vehicles and that will not be rebuilt with a median barrier within the foreseeable future. On these roads, it will be necessary for both drivers' behaviours and the actual vehicle to compensate for the high risk. From a collision perspective, it will then be particularly important for achieving the target for 2020 that the heavy vehicles reduce their speeds. The same applies to motorcycle traffic, which will probably be noticed more in the accident statistics if other traffic becomes increasingly safer. It will then be extra important to take measures in the Road Safety Performance indicators that have a clear impact on the number of motorcycle fatalities. At the present time, it is above all compliance with speed limits and ABS brakes that are important.

5.3 Development of analysis work to 2020

There are a couple of relevant Road Safety Performance indicators in the management by objectives work that cannot be monitored due to a lack of measurements and data. Compliance with the speed limits on the municipal road network and safe municipal streets belong to these. There are also measurements performed where the outcome still cannot be linked to the effect on the number of fatalities and casualties. This applies to the refreshed drivers, prompt and satisfactory rescue and valuation of road safety performance indicators. A consequence of this lack of data is that it has been impossible to deal with certain areas to the desired extent. Starting to measure and monitor these Road Safety Performance indicators in a satisfactory manner is a fundamental requirement in order to be able to provide as complete a picture as possible of the challenges that we face in our work towards the 2020 interim targets. The Analysis Group feels that, unless this happens, they should be excluded from the overview of Road Safety Performance indicators in 2012.

As well as there being a need for better measurements to provide data, the analysis of the interplay between the Road Safety Performance indicators needs to be studied in greater depth. Road safety has been improved to a great extent over the last few years. The trends for several of the Road Safety Performance indicators have taken a considerable turn in the right direction and there are grounds for believing that certain Road Safety Performance indicators have achieved a level where it is becoming increasingly clear that it is vital that there is an interaction between them if fatality figures are to be reduced further. For example, the trend for the outcome for the safe national roads Road Safety Performance indicators means that work on compliance with speed limits must be prioritised even more than before. Different

technical systems in vehicles must compensate for collisions on the roads where it is not realistic to introduce measures on the roads within the foreseeable future.

A systems-theory approach is considered an effective path towards better understanding and managing risks in a number of safety-critical systems where people work together with technology in a social and organisational context (so-called socio-technical systems). Examples of such systems are aviation and nuclear power, but this approach should also be able to be applied to the road traffic system (Larsson et al., 2010).

From a safety point of view, this means, among other things, that an accident can rarely be explained by one individual component in the complete system "breaking down". Each component in such a system (even people) often has a prescribed or permissible variability in its performance. Even if all components included remain within these limits, complex and unforeseen reactions between these can lead to accidents and injuries in the system (see also Leveson, 2011 and Hollnagel, 2004). A further consequence of this is that the safety of a complex system cannot be optimised by the performance of the components included being optimised individually (Leveson, 2002).

Work on the interim targets is based on a number of designated main Road Safety Performance indicators that reflect a certain property of a component in the road traffic system (road-user, vehicle and road/road environment). There is, however, one component that is more system-wide, i.e., speed. By extension, this is vital as regards what collisions the human body is subjected to and how different measures interact.

If, for example, we study the Road Safety Performance indicator for safe passenger cars in isolation, there is, of course, the potential to change it in a positive direction. But the potential is probably considerably greater if, at the same time, we change how safe the road environment is, e.g., through an increase in median barriers and more collision-friendly side areas. The reason for this is that many collisions with a fatal outcome happen far out to the left on the so-called risk curve, see figure 38.

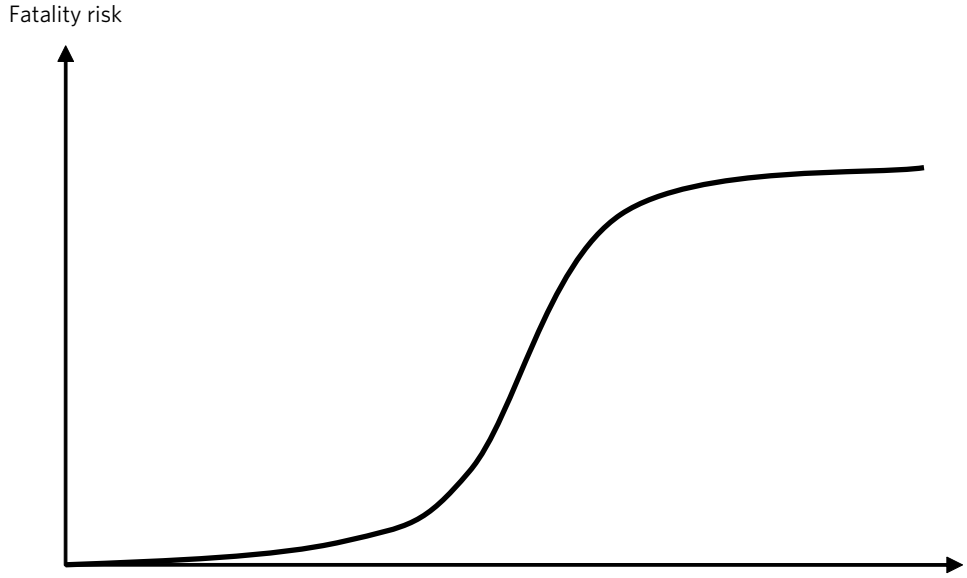


Figure 38. Schematic connection between collisions and death risk.

This means that a small change in the level of crashworthiness will not mean any great reduction in risk. It is not until the level of crashworthiness has increased so much that the collision is in the steep section of the risk curve that a considerable effect is obtained from small changes. If, on the other hand, the safety of the road environment is improved at the same time, the steep section of the risk curve will be reached quicker, which means that even a small change in the crashworthiness of passenger cars will have increased significance in reducing risks. This can, admittedly, also be achieved by lower speeds or automatic braking of the car before the moment of the collision.

Another, more hypothetical, example is the Road Safety Performance indicator for cycle helmet use. It could be the case that a change to the Road Safety Performance indicator in a positive direction would not have the theoretical effect that the link indicates at the present time since, for example, the separation of protected and unprotected road-users has increased.

It is not, therefore, possible to optimise safety work by working on the Road Safety Performance indicators in isolation from each other. There are interactions between the different Road Safety Performance indicators that we must become better at understanding and analysing in order to get the greatest possible returns from our road safety investments. For this reason, work should begin on developing models and concrete methods in order to be able to work in a system-oriented fashion.

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TRAFIKVERKET
SWEDISH TRANSPORT ADMINISTRATION

The Swedish Transport Administration, 781 89 Borlänge, Street address: Röda vägen 1
Telephone : +46 (0)771-921 921, Text telephone: +46 (0)243-750 90

www.trafikverket.se