

Analysis of Road Safety Trends 2013

*Management by objectives for road safety work
towards the 2020 interim targets*



TRAFIKVERKET
SWEDISH TRANSPORT ADMINISTRATION



 Towards Zero
Together

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Foreword

This report is the sixth annual follow-up of the progress towards the 2020 road safety objectives. It describes and analyses road safety trends in 2013. As in previous years, results are analysed in terms of the number of fatalities and injured as well as of a series of designated indicators. The report will provide the basis for the 2014 results conference in Stockholm, on 9 April.

The report was produced by a group of analysts from the Swedish Transport Agency, the Swedish National Road and Transport Research Institute (VTI) and the Swedish Transport Administration. The following analysts contributed to the report: Jan Ifver, Khabat Amin, Hans-Yngve Berg och Peter Larsson (the Swedish Transport Agency), Anna Vadeby and Åsa Forsman (VTI), and Magnus Lindholm, Johan Strandroth, Simon Sternlund and Ylva Berg (the Swedish Transport Administration).

Summary

Swedish road safety work is based on Vision Zero and the designated interim targets. The current interim target for road safety is to halve the number of fatalities between 2007 and 2020. That translates into a maximum of 220 road deaths in 2020. The number of seriously injured on the roads is to be reduced by a quarter. In addition to the current national target, there is an interim target at the EU level, for halving the number of road deaths between 2010 and 2020. This would correspond to a more stringent interim target of a maximum of 133 road deaths in 2020. No decision has yet been made to adjust the Swedish target to this level, and the interim target of no more than 220 road deaths remains.

This report describes and analyses road safety trends in terms of the number of fatalities and injured, as well as of ten indicators. The report constitutes a basis for the efforts that will lead to achieving the targets by 2020, and will be presented at the 2014 results conference. The table below shows the present level of the various indicators and an assessment of whether their rates of change are sufficient for achieving the target by 2020.

Indicator	Starting point (2007)	2013	Target in 2020	Trend
Number of fatalities on the roads	440	260	220	In line with the required trend
Number of seriously injured on the roads	5 400	4 800	4 000	In line with the required trend
Share of traffic volume within speed limits, national road network	43 %	47 %	80 %	Not in line with the required trend
Share of traffic volume within speed limits, municipal road network	64 %	63,5 %	80 %	Not in line with the required trend
Share of traffic volume with sober drivers	99,71 %	99,77 %	99,90 %	Not in line with the required trend
Seat belt wearers in the front seat of passenger cars, share of total	96 %	98 %	99 %	In line with the required trend
Share of cyclists wearing a helmet	27 %	36 %	70 %	Not in line with the required trend
Share of moped riders using a helmet correctly	95,7 %	96,1 %	99 %	In line with the required trend
Share of new passenger cars with the highest Euro NCAP score (2007)	20 %	51 %	80 %	In line with the required trend
Share of motorcycles equipped with anti-lock brakes (ABS)	9 %	34 %	70 %	In line with the required trend
Share of traffic volume on roads with speed limit above 80 km/h and median barriers	50 %	72 %	75 %	In line with the required trend
Share of safe pedestrian, cycle and moped crossings on main municipal road networks for cars	19 %	19 %	Not defined	Starting year for the measurement – cannot be assessed
Share of municipalities with good-quality operation and maintenance of cycle paths	15 %	15 %	70 %	Starting year for the measurement – cannot be assessed

In 2013 there were 260 deaths from road traffic accidents. That is a 9% reduction on 2012, and represents the lowest number of annual road deaths in recent history. In order to achieve the target of no more than 220 fatalities by 2020, an annual reduction of at least 5% is required. Between 2008 and 2013, the annual reduction was 8% on average. The result is thus considerably better than the required trend for achieving the current national target. However, between 2012 and 2013 there was an increase in the number of seriously injured, from just over 4 400 to 4 800, which is a 7% rise. The result remains in line with the required trend, however, as the total result over the last few years has been a decrease.

The rise in the number of seriously injured is cause for concern, but cannot be said with certainty to represent a break in the trend. The rise is due to an increase in the number of seriously injured cyclists – from approx. 1 800 to approx. 2 200. One hypothesis to explain this is that cycling has increased overall. Since cyclists are often injured in single bicycle accidents, there is strong reason to believe that injury figures for cyclists to some extent coincide with their exposure. Support for the hypothesis that cycling has increased between 2012 and 2013 includes a slight increase in sales figures for bicycles and the fact that the weather during the summer was favourable for cycling. The increase in serious injuries also occurred during that period.

With respect to car traffic, preliminary figures indicate that the total traffic volume in 2013 increased by approx. 1.1% from on 2012. An increase in traffic volume of this order will not elevate overall risk as it is usually compensated for by an increase in system safety.

The favourable trend towards the 2020 targets is mainly explained by ongoing improvements to the vehicle fleet and infrastructure, and not least by reduced speeds. Both the safe national roads and safe vehicles indicators are improving at a sufficient rate. Speed as an isolated factor has a decisive influence on the number of road deaths and injuries, but it also interacts strongly with other indicators. Road design and vehicle fleet safety gains are optimised when combined with the right speed. Average speeds on the national road network are estimated to have dropped somewhat, from 78.2 km/h to 78 km/h (target 77 km/h), and the result is considerably better than the required trend. Despite the reduction in average speeds, compliance with speed limits remains at an unacceptably low level. In 2013, the share of traffic volume within speed limits was estimated at just under 47% (target 80%) on national roads and just over 63% (target 80%) on municipal roads.

In terms of sober drivers as well as front seat belt wearers, results are unchanged from 2012. Since measurements of sober drivers began in 2007, the initial share of 99.71% has increased. However, the increase has not been large enough, so results for 2013 are under the curve for the required trend. The front seat belt wearers indicator remains in line with the required trend. It is apparent also from the figures for fatalities among passenger car drivers that the positive trend of lower alcohol levels and more seat belt wearers has levelled out over the past two years.

In light of the increase in cycling and in the number of seriously injured cyclists, the analysis group would like to emphasise particularly that safety considerations must always be taken when promoting increased bicycle traffic (which is society's stated ambition). Municipalities must therefore intensify their road safety work and focus on seriously injured cyclists. Measures for reducing their number are

mainly about providing infrastructure and maintenance that takes the needs of unprotected road users into account, but also about getting them to use a helmet (an indicator which is not improving at a sufficient rate) and other protective equipment. This work should ideally be based on the joint indicators safe PCM junctions and maintenance of cycle paths in urban areas, which will be followed up as from 2013. The assessment is that both of these indicators need considerable improvement by 2020 in order for the number of seriously injured to be reduced at the required rate.

The analysis group would also like to highlight the question of studded tyres on bicycles, which is also addressed in the “Safer cycling” strategy, as a measure with considerable potential. The effect of reducing the number of seriously injured cyclists by deicing/studded tyres is specified there at 15-20%. On this basis, the analysis group’s assessment is that studded tyres may significantly supplement measures for better maintenance of cycle paths.

The overall assessment of the analysis group is that the existing 2020 target for road deaths looks likely to be achieved. The target for seriously injured also looks likely to be achieved, albeit with the reservation that cycling safety must increase if bicycle traffic volumes continue to rise.

If, instead, one looks at the trend for fatalities in relation to the target at the EU level (which corresponds to a maximum of 133 road deaths in Sweden in 2020), then the number of fatalities at present is much higher than the required trend. In order to achieve the more demanding EU target, compliance with speed limits is one of the major challenges for the period ahead, as the analysis group sees it. The decisive factor is what happens on the national road network. The rate of adaptation of speed limits to road design on national roads needs to be increased in the years until 2020. In addition to this, an improvement is needed in compliance with speed limits; surveillance using automatic speed control will be particularly important on those roads where speed limits are lowered and median barriers not installed. However, the analysis group’s assessment is that the target of no more than 133 road deaths by 2020 is still achievable, as long as the right measures are applied and allowed to interact in a well thought-out manner.

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1 Introduction

Swedish road safety work is based on Vision Zero and designated interim targets. The current interim targets were adopted by the Swedish Parliament in 2009 and specify that the number of fatalities on the roads should be halved between 2007 and 2020 (Govt. bill 2008/09:93 Objectives for future travel and transports). This means that the number of road deaths in 2020 should not exceed 220. The bill also specifies that the number of seriously injured on the roads is to be reduced by a quarter during the same period. The bill further specifies that the targets are to be reviewed in 2012 and 2016. This is a way of ensuring that road safety work always has the most relevant and motivating targets possible. Following the 2012 review, there are proposals to adjust the targets in line with the interim target for road safety adopted within the EU. This would mean reducing the 2020 target for the maximum number of roads deaths to 133. At the time of writing, this target had not been expressly adopted by the government.

In order to achieve the road safety targets, road safety work is managed by objectives. This means that there are targets to follow up for a number of indicators, and that road safety trends and target fulfilment are evaluated at annual results conferences. The aim of this working method is to apply a long term, systematic approach to road safety work. The method is continuously being developed and improved through cooperation between a number of organisations within Gruppen för Nationell Samverkan – väg (the Group for National Cooperation – roads). Participating organisations include the National Police Board, NTF (Nationalföreningen för Trafiksäkerhetens Främjande, the National society for the Promotion of Road Safety), Toyota Sweden AB, Folksam, the Swedish Work Environment Authority, the Swedish Association of Local Authorities and Regions, the Swedish Transport Agency and the Swedish Transport Administration.

A key part of management by objectives is thus the follow-up of indicators. Each of these has a target value to be achieved by 2020. Together, these targets make up the consolidated target for road safety trends. The following indicators are currently being followed up as part of management by objectives (precise target levels and descriptions are presented in section 4):

1. Compliance with speed limits, national road network
2. Compliance with speed limits, municipal road network
3. Sober traffic
4. Use of seat belts
5. Use of helmets
 - *Cycle helmets*
 - *Moped helmets*
6. Safe passenger cars
7. Safe motorcycles (ABS)
8. Safe national roads
9. Safe pedestrian, cycle and moped crossings in urban areas
10. Operation and maintenance of cycle paths

1.1 Aim

The aim of the report is to describe and analyse road safety trends in 2013. This is done by presenting and analysing the current situation in terms of fatalities and seriously injured, as well as of the ten indicators. The trend for each indicator is also analysed from a systems perspective, which includes a description of how the indicators are connected. This shows how the indicators' effects sometimes create synergies between them and sometimes make them overlap.

Taken together, this means that the report points out which of the indicators are the most important ones to improve in order to increase road safety and, by extension, to achieve the interim target by 2020. The report will form the basis for the 2014 results conference as well as for continued road safety planning in Sweden.

1.2 Basic assumptions

The analysis is based on the targets and indicators that underlie the interim targets. These were formulated by the former Swedish Road Administration in collaboration with a number of national organisations – see the report entitled *Målstryning av trafiksäkerhetsarbetet* ("Management by objectives of Road Safety Work", Swedish Road Administration, publication 2008:31).

In 2012 a review of targets and indicators was carried out to ensure that targets and follow-up methods were relevant and up to date. The review set out from the new interim target at the EU level of halving the total number of road deaths between 2010 and 2020. In Sweden's case this corresponds to a target of no more than 133 road deaths in 2020. The analysis showed that a more stringent interim target, in line with the EU target, would be challenging but not unachievable. This conclusion owes a great deal to the forecast that developments in terms of vehicle safety characteristics will be very favourable in the remaining years until 2020. The review produced a proposal for a more stringent interim target, in line with the EU target, along with updated indicators with some changes to target levels (Swedish Transport Administration, 2012:124).

At the time of writing, however, no new target level has been adopted and therefore results are analysed in terms of the current target of no more than 220 road deaths by 2020. The target that applies for the EU as a whole is nonetheless shown in the summary diagrams. With respect to indicators, the analysis applies the proposed set of indicators from the 2012 review. Our assessment is that the revised indicators are an improvement in terms of guiding road safety work towards the current interim target as well.

2 Number of fatalities and seriously injured

In May 2009, the Swedish Parliament adopted an interim target for road safety trends which specified that the number of fatalities should be halved and the number of seriously injured be reduced by a quarter between 2007 and 2020. It also stated that measures aimed at improving road safety for children should be given special priority.

The number of fatalities and injured on the roads is influenced by a series of different factors such as traffic volume, road safety measures and other external factors. There is also a random annual variation in the number of fatalities and injured. This variation is not particularly significant for injury figures, but for fatality figures the relative margin of error can be as large as 10%.

2.1 Fatalities

If a person dies within 30 days of a road traffic accident, as a result of that accident, this is counted as a fatality. A road traffic accident is an accident that occurs in traffic on a public road, in which at least one moving vehicle is involved, and which causes personal injury. Pedestrians killed in falls are therefore not included in the fatality figures.

Suicides were previously included by definition in Sweden's official road death statistics. Since 2010, however, suicide figures are reported separately following an adaptation of the definition to what applies for other types of traffic as well as in most other European countries. This means that since 2010, statistics are not fully comparable with those for the years up to 2010. In 2013, there were 28 fatalities through suicide, and 36 fatalities were excluded for 2012 due to the change. Between 2010 and 2012, there was also a change in the way suicide is determined, which led to a rise in the number of assessed suicides during that period. Since 2012, however, the method has been established. A contributing factor to the circumstance that the number of fatalities is lower than the required trend is the improved possibility of knowing which fatalities to exclude due to suicide (see Figure 1). The number of suicides represents approx. 10 % of the number of road deaths, which means that the problem has to be dealt with in road safety work even if the figure is excluded from official statistics.

	Mean value 2006-2008	2013	Target for 2020	Assessed trend towards meeting target
Number of fatalities	440	260	220	In line with the required trend

In 2013, there were 260 deaths from road traffic accidents, which is 25 fewer than in 2012 and the lowest number of annual road deaths in recent history. Compared to the mean value for 2006-2008, the number of fatalities has decreased by 40%. In order to achieve the target of no more than 220 annual deaths in 2020, the number of deaths needs to decrease by 5% every year until then. The average annual decrease between 2008 and 2013 was 8%.

¹"Metod för suicidklassning av dödsfall i transportsystemet" ("Method for suicide classification of fatalities in the transport system"), Publication 2011:128

²In order to take annual variations into account, a mean value for 2006-2008 is used as a base annual figure. Read more in Chapter 3, *External factors*.

Looking over time at the trend in relation to the target of no more than 220 fatalities by 2020, it is clear that the number of fatalities is well in line with required trend for achieving the target in 2020.

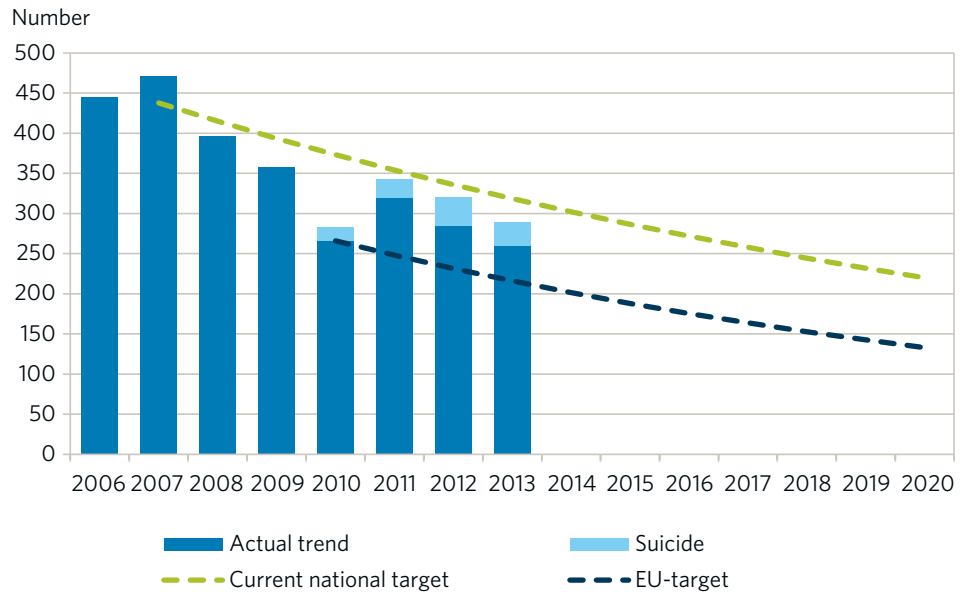
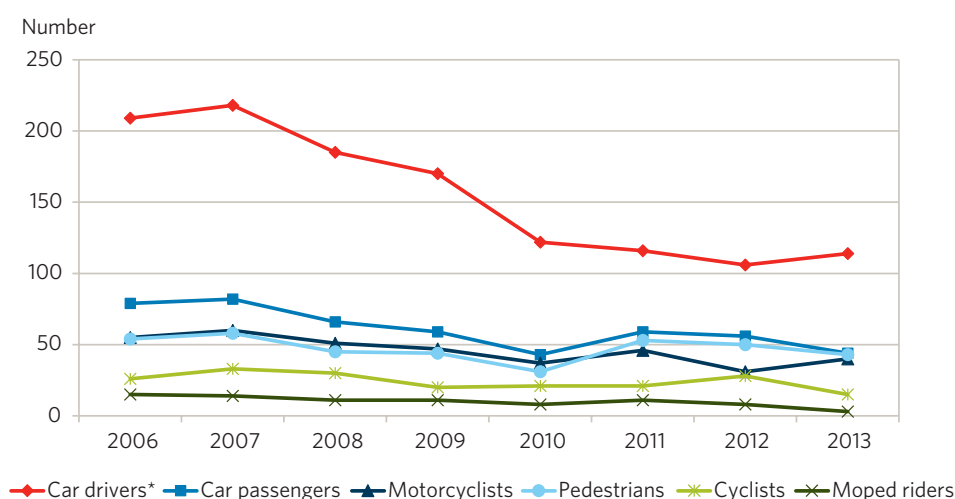


Figure 1. Number of fatalities in road traffic accidents 2006-2013, and the required trend until 2020. Source: STRADA.

Figure 1 also shows the required trend for meeting the EU target of halving the number of road deaths between 2010 and 2020, to a maximum of 133 deaths in 2020. This indicates that the number of deaths is greater than the required trend for meeting the EU target.

The number of cyclists killed in 2013 was 15, which was a reduction of 13 from 2012, when 28 cyclists were killed. The number of fatalities also decreased for all other categories of roads users except motorcyclists and car drivers, for which the increase was 9 (from 31 to 40) and 5 (from 106 to 111) respectively. The relative reduction was greatest for cyclists, with the number of fatalities decreasing by 46% 2012.

³ The Swedish Transport Administration's publication 2012:124



*Car drivers include drivers of passenger cars, lorries and buses.

Figure 2. Number of fatalities by road user category, 2006-2013. Source: STRADA.

In 2013, the total number of fatalities decreased by 40% compared to the mean value for 2006-2008. The relative decrease was smallest for pedestrians (18%). Deaths among other road user categories decreased by between 28% and 78% during the same period. The relative decrease was greatest for moped riders.

With reference to the wording in the government bill Objectives for Future Travel and Transport, that “measures aimed at improving road safety for children should be given special priority”, we can note that the trend remains positive. In 2013, the number of child (0–17 years old) fatalities was 11, which is a 35% reduction on 2012. Seven of these children were between 15 and 17 years old, and four were between 0 and 14. It may be further noted that three children aged 0 to 10 were killed, which means that Vision Zero has almost been achieved with respect to deaths among young children.

2.2 Seriously injured

The definition of a seriously injured person is of someone who has suffered at least 1% medical impairment as a result of a road traffic accident. “Medical impairment” is a term used by insurers to assess degrees of functional disability, regardless of the cause. However, a problem of using medical impairment in assessments is that a long period of time often elapses between injury and confirmed impairment. For this reason another method (Swedish Transport Agency, 2009) is used, which involves forecasting the number of persons with medical impairments on the basis of the injuries reported by hospitals to STRADA, and using a risk matrix developed by Folksam, an insurer.

⁴ Govt. bill 2008/09:93

	2007	2013	Target for 2020	Assessed trend towards meeting target
Forecast number of seriously injured	5 400	4 800	4 000	In line with the required trend

The forecast number of seriously injured was estimated at approx. 5 400 for 2007 and approx. 4 800 for 2013. The interim target sets the maximum number of seriously injured at 4 000 for 2020, which corresponds to an annual rate of reduction of just over 2%. The number of seriously injured has declined by 12% since 2007, which is in line with the required trend. The 7% increase from 2012 to 2013 is notable, however. This break in the trend is due in large part to an increase in the number of seriously injured cyclists, from approx. 1 800 to approx. 2 200, while the number of car drivers/passengers decreased by 6%, from approx. 1 700 to approx. 1 600. The increase in seriously injured cyclists occurred mainly during the summer months of 2013.

Pedestrians who suffer serious injury after a fall in the road traffic environment are not included in official statistics. If this type of accident had been included in the computations, the number of seriously injured would have been approx. 8 400 in 2013. As almost one in every two persons seriously injured in the road transport system in 2013 was a pedestrian who fell, this constitutes a significant problem which must be addressed. Figure 3 shows an increase in falls leading to accidents among pedestrians. Almost half of this type of accident occurs in the period from January to March.

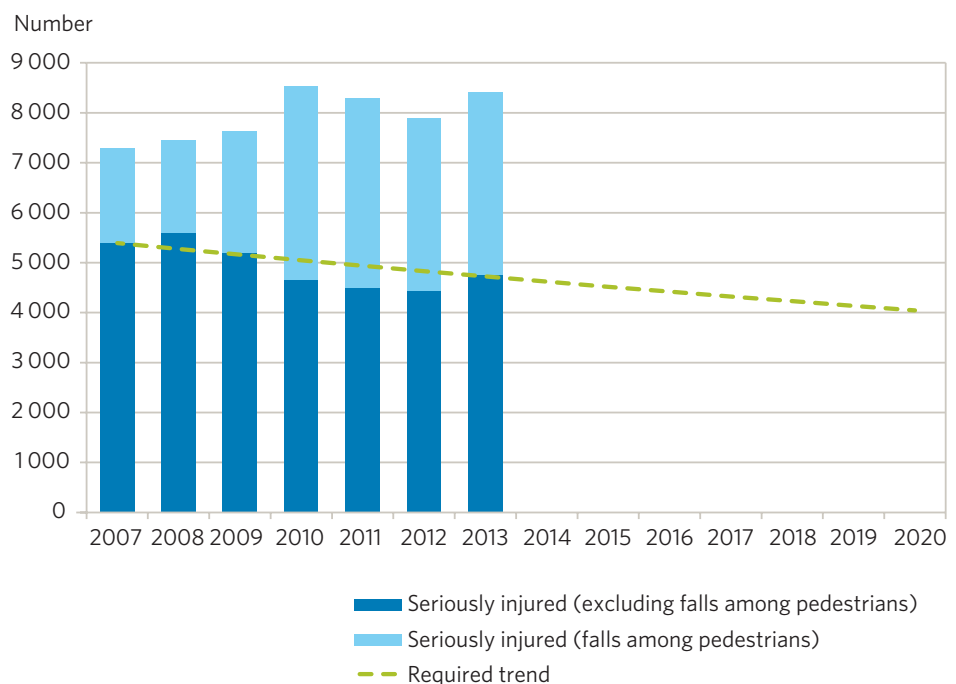


Figure 3. Forecast number of seriously injured 2007-2013, and the required trend until 2020. Source: STRADA.

Many people with a low degree of medical impairment do not regard themselves as seriously injured. In order to distinguish injuries of a more serious nature, the term very seriously injured is also used. This refers to a person who has sustained a medical impairment of at least 10%. The estimate for 2013 is that 672 individuals were so seriously injured that they will sustain a medical impairment of 10% or

more. That represents an increase of 8% on 2012, but a decrease of 21% since 2007. The decrease is due to a smaller number of very seriously injured car drivers/passengers (-35%), while the increase on 2012 is due in large part to an increase by 26% in the number of very seriously injured cyclists. Figure 4 illustrates the distribution between different road user categories who have sustained serious and very serious injuries, respectively.

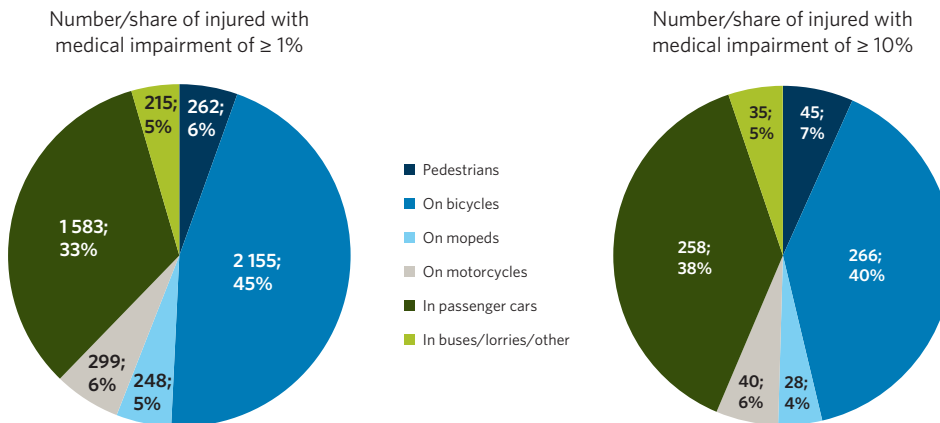


Figure 4. Number/share of seriously injured ($\geq 1\%$ / $\geq 10\%$) divided by mode of transport, 2013. Source: STRADA.

The difference between individuals with different degrees of medical impairment is that those with a very serious injury more often sustain brain damage. Of all injuries that led to a medical impairment of at least 1% in passenger car occupants, 5% were brain injuries, while brain injuries represented 18% of all injuries that led to a medical impairment of 10% or more in passenger car occupants. The corresponding figures for injured cyclists were 6% and 27%, respectively.

Cyclists are the category of road users that represent the largest share of those very seriously injured, approx. 40%. Head injuries are the most common injury among cyclists (44%). The most common injury leading to a medical impairment of 10% or more among car occupants is whiplash. Just over 55% of all very seriously injured car occupants sustain whiplash. Various types of brain damage are the second most common injury, which 18% of seriously injured car occupants sustain. Other common injuries that lead to permanent disabilities are wrist and collar bone fractures (37%). Almost the same number of moped riders as motorcyclists sustain very serious injuries, despite the fact that the volume of motorcycle traffic is more than twice that of mopeds. In both categories of road users, brain injuries are what often causes permanent disabilities. Almost equally as frequent, however, are serious leg or arm injuries. The share of pedestrians who are very seriously injured after being hit by a vehicle is much larger than their share of the total passenger traffic volume. In this category as well, brain injuries are what most often lead to permanent disabilities of at least 10%.

2.3 International comparison

In July 2010, the European Commission decided that the number of fatalities should be halved between 2010 and 2020. In 2010, there were 31 484 fatalities in road traffic accidents within the EU, which means that the number of fatalities should be no more than 15 742 in 2020. According to preliminary figures, the number of fatalities in 2012 decreased to 28 136 (-11%).

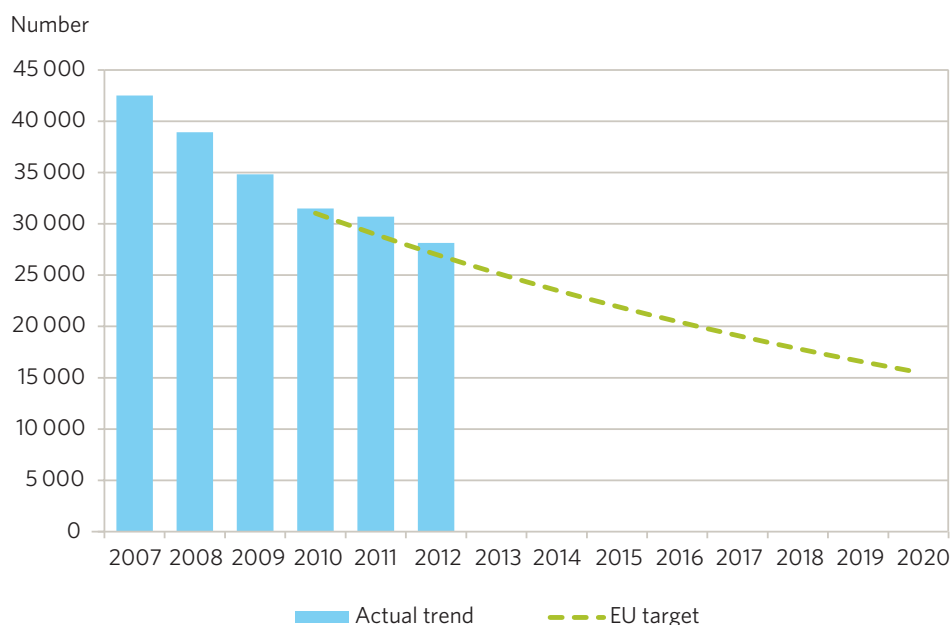


Figure 5. Road deaths within the EU 1996-2012, and the required trend until 2020. Figures for 2012 are preliminary. Source: CARE.

Sweden, the United Kingdom and the Netherlands have the lowest number of fatalities per capita in the EU (with the exception of Malta in 2012). Between 2010 and 2012, the number of fatalities per capita was unchanged in the Netherlands while the number increased in Sweden and decreased in the United Kingdom.

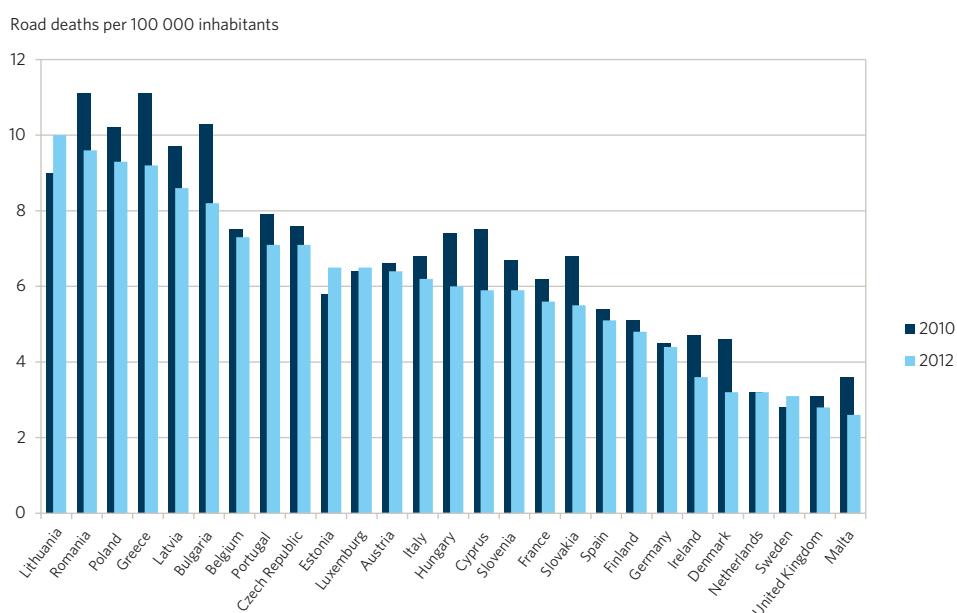


Figure 6. Number of road deaths per 100 000 inhabitants for the 27 EU countries, 2010 and 2012. Source: CARE.

⁵http://europa.eu/rapid/press-release_IP-13-236_en.htm

In Sweden, Denmark, Norway and Finland, the number of deaths has decreased by 39%, 59%, 38% and 33%, respectively, during the period between 2007 and 2012.

Looking at the change between 2012 and 2013 on the basis of preliminary figures, Sweden shows a decrease of 7%, Denmark and Norway an increase of 16% and 31% respectively, while Finland's figure remains unchanged.

3 External factors

There are a number of factors affecting road safety which lie beyond the reach of actual road safety work. Weather is an example of such an external factor that can have a direct impact on road safety. Other factors, e.g. the age structure of the population, affect the composition of different modes of transport which in turn affects the development of the number of fatalities and injured in road traffic. This chapter will present some external factors and how they developed in 2013.

An important external factor is the size and composition of traffic volume. Preliminary figures for 2013 show that total traffic volume increased by 1.1% on 2012. Passenger car drivers/passengers increased slightly more (1.1%) than heavy vehicle traffic (0.8%). Figure 7 shows how traffic volumes for different types of vehicles have evolved between 1996 and 2013. The dominant vehicle type is passenger cars, which currently represents about 81% of the total traffic volume on Swedish roads. Over the entire period, all vehicle types except buses increased until 2008, after which traffic volumes of passenger cars, heavy lorries and motorcycles levelled off or even declined slightly, while the volume of light lorries continued to grow. The volume of bus traffic has remained at just under 1 000 million vehicle kilometres annually throughout the period.

The number of motorcycles on the road increased slightly between 2012 and 2013, from just over 307 000 to almost 310 000. The number of motorcycles has slightly exceeded 300 000 since 2009. The number of Class I mopeds has declined from just over 109 000 in 2012 to just over 105 000 in 2013. This class of moped has declined in number every year since 2009, when there were just over 135 000 registered mopeds on the road. Estimates of moped traffic volumes indicate the total distance driven by mopeds was approx. 190 million kilometres in 2013, and that this figure declined by about 3% between 2012 and 2013, and by about 5% between 2011 and 2012.

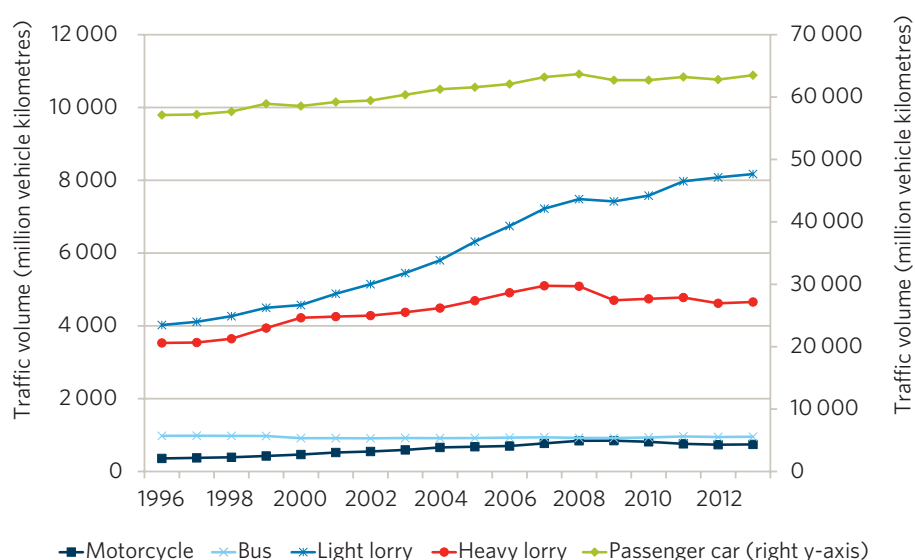
Bicycle traffic volumes, and annual changes to them, are difficult to estimate as no national measurements are made. The only available source is the national travel habit surveys (SIKA 2007; Transport Analysis 2012). A comparison between data collected from 1 October 2005 to 30 September 2006 and from 1 January 2011 to 31 December 2012 shows a marginal increase of about 4%, but this is not statistically significant. Total bicycle traffic volume, estimated on the basis of the 2011-2012 data, is approx. 1 800 million kilometres. Bicycle sales have grown in recent years. During the 2010/2011 season approx. 555 000 bicycles were sold. Increased sales imply an increased interest in cycling, but it is uncertain to what extent this has affected actual bicycle traffic volumes.

⁶Refers to the number of registered motorcycles on the road as of 30 June each year, according to the vehicle register Source: Transport Analysis/Statistics Sweden.

⁷Class II mopeds are not registered.

⁸Data from Svensk Försäkring, processed by VTI. Refers to both Class I and Class II.

⁹Data from FoG, the Swedish Bicycle Manufacturers' and Wholesalers' Association. A season runs from 1 Sept to 30 Aug.



*Data for 2013 is preliminary and has been adjusted upwards using change factors, as defined by the Swedish Transport Administration, for passenger cars (cars, motorcycles, light lorries) and heavy vehicles (heavy lorries, buses), respectively.

Figure 7. Traffic volumes by vehicle type, 1996-2013 (million vehicle kilometres). Note that the traffic volume for passenger cars is shown along the right-hand y-axis. Sources: Transport Analysis and VTI.

The age structure of the population also affects road safety since people of different ages choose different modes of transport and present different risk behaviours on the road. A person's physical ability to cope with being hit by a vehicle, for example, also varies with age. Figure 8 shows changes to the age structure of the population between 1996 and 2013. The changes between different age groups of course occur very gradually over time, but it is possible to discern e.g. that the 65–74 age group has grown somewhat and the 18–24 group declined somewhat between 2012 and 2013.

The age group with the highest risk of being killed in traffic is the 75+ group, which is partly because people over 75 are more fragile and because they are frequently unprotected road users (Transport Analysis 2011). The second highest risk group is the 18–24 one, although here it is primarily men who represent the high risk. The share of the population that is over 75 years old has remained stable at between 8% and 9% since 1996, but population forecasts by Statistics Sweden indicate that the 75+ group will grow between now and 2020. In other words, the group with the highest fatality risk is set to grow over the next few years, which may lead to increased road deaths. However, the 18–24 group, which also represents a relatively high risk, is set to decline and may thus compensate somewhat for a possibly increased incidence of road deaths among the elderly. The group with the lowest risk of being killed in traffic is the 7–14 age group, followed by the 45–64 and 25–44 groups.

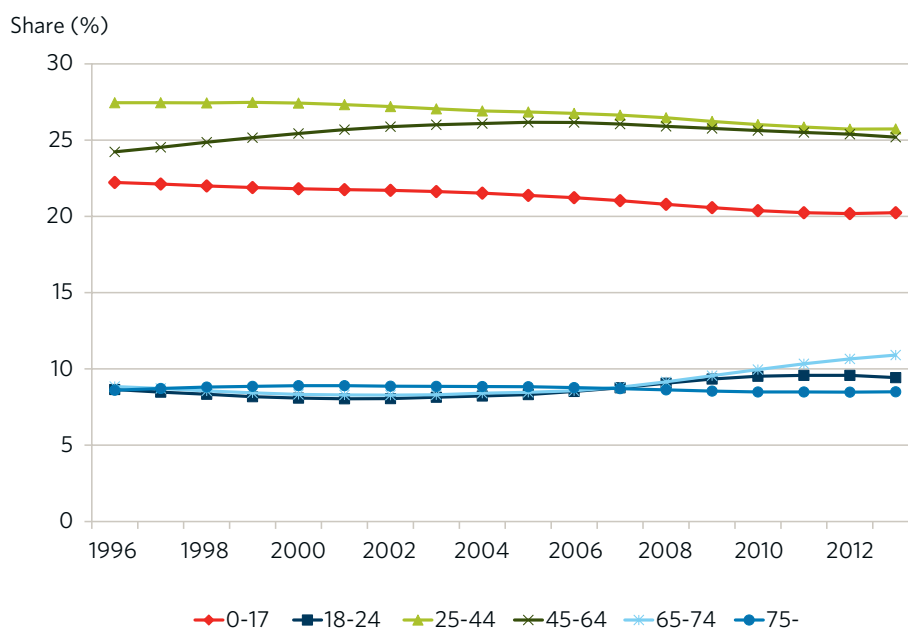


Figure 8. Age distribution of the population, 1996-2013. Source: Statistics Sweden.

Experiences from several countries indicate that there is a link between the number of road deaths and economic development, where a slowdown of the economy is often followed by a reduction in the number of road deaths (Wiklund et al 2011, Ch. 2). To some extent this may be due to the decline in travelling associated with a recession, but that is not the whole story. There are a number of hypotheses about the link between state of the economy and road safety, most of which have to do with patterns of travel. However, there are probably several different effects that influence road safety in different ways, so it is difficult to present any clear causation.

Unemployment figures are often used in this context as a measure of economic development. Figure 9 shows statistics from the Swedish Public Employment Service on the share of the population who are openly unemployed or participating in a programme with activity support. The change from 2012 to 2013 is relatively small, showing an increase of approx. 0.2 percentage points. However, unemployment rates have varied quite a lot during the entire period of 1996-2013. Its lowest level was in 2007 and 2008, after which it rose fairly sharply until 2009. Since then the unemployment rate has remained quite high. This may have contributed to the relatively low number of road deaths in recent years. It should be remembered, however, that the unemployment rate is only one of many factors affecting road death figures, and that there is also a sizeable random variation from year to year which affects the actual outcome.

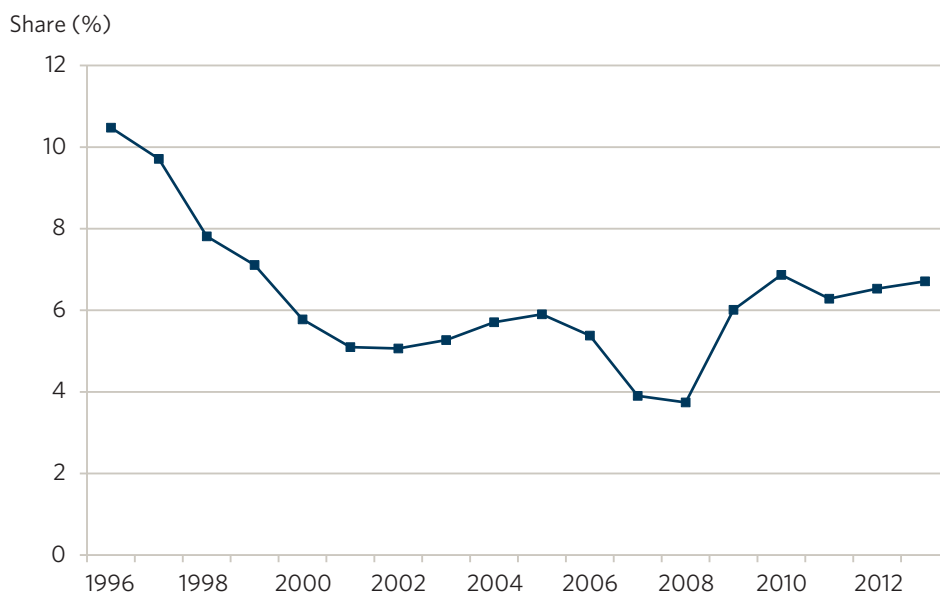


Figure 9. Total unemployment (open unemployment plus participants in programmes, share of the population), 1996-2013. Source: Swedish Public Employment Service (www.arbetsformedlingen.se).

The weather can have a considerable effect on traffic during limited periods of time and in quite specific geographical locations, e.g. during temporary downpours or slippery road conditions. It is very difficult to determine the extent of the effect that such temporary and local weather conditions have on road safety, and how much this impacts national statistics. With respect to the winter season, however, it has been observed that wintry road conditions and low temperatures lead to reduced traffic and lower speeds. During winters with heavy snowfall large amounts of snow accumulate along the roadside, which leads to fewer serious single-vehicle accidents caused by cars going off the road. These effects were observable during the winters of 2010 and 2011, both of which had heavy snowfall. Snow depth charts compiled by the Swedish Meteorological and Hydrological Institute (SMHI) show that 2013 was not a particularly snow-rich year. Relatively large amounts of snow fell during the latter part of the winter and remained on the ground for quite a long time, but there was very little snow in November and December. There is therefore no reason to believe that the winter weather in 2013 affected road safety in any particular direction.

The summer of 2013 was warm and dry in comparison with the previous summer, which created favourable conditions for cycling. The fine weather may have led to increased cycling which in turn may be a contributing factor to the higher number of seriously injured cyclists in the summer of 2013 compared with the previous summer.

4 Follow-up of road safety performance indicators

4.1 Compliance with speed limits - national road network

	2004	2013	Target for 2020	Assessed trend towards meeting target
Share of traffic volume within speed limits, national road network	43 %	47 %	80 %	Not in line with the required trend
Average journey speed (km/h)	82 km/h	78 km/h	77 km/h	In line with the required trend

The target is for 80% of all traffic to drive within applicable speed limits by 2020. The target for average speed corresponds to a reduction by 5 km/h. Lowered speeds are deemed to be among the indicators that have the greatest potential for reducing road deaths.

Carrying out nationwide measurements of speed levels is resource intensive. In 2012, the Swedish Transport Administration conducted one of three measurements planned until 2020. The last measurement prior to that was conducted in 2004. For 2013, an estimate has been made on the basis of the 2012 measurement and the Swedish Transport Administration's simpler measurements (the Speed Index), which only show changes to speeds.

Trend and projection towards the 2020 target

Figure 10 presents the observed share of the traffic volume travelling within speed limits on national roads. The share of traffic volume within speed limits on national roads is estimated to be 46.6% in 2013. The corresponding result from 2012 measurements was 46.1%. The outcome is 16 percentage points below the required trend for achieving the target by 2020.

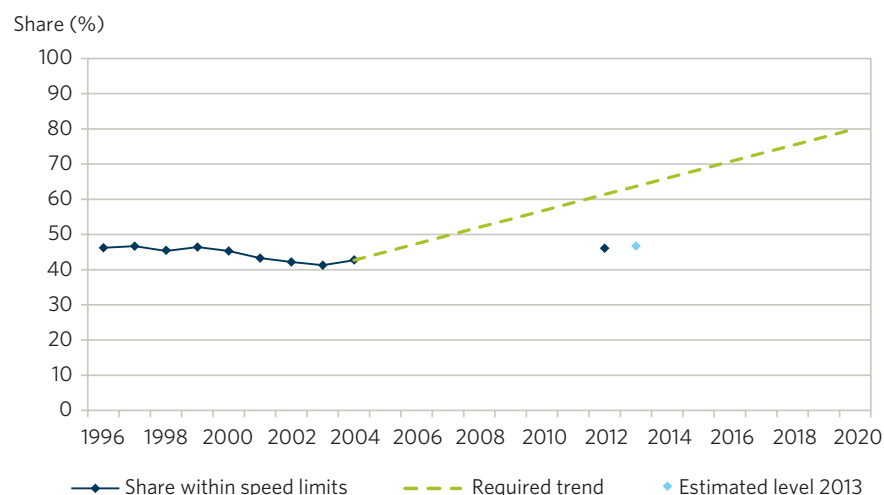


Figure 10. Share of traffic volume within speed limits on national roads 1996-2004 and 2012-2013, and the required trend until 2020. Source: Swedish Transport Administration.

Figure 11, on the next page, shows that average speeds are estimated to have dropped slightly, from 78.2 km/h to 78.0 km/h (target 77 km/h). This outcome is approx. 1 km/h better than the required trend until 2020.

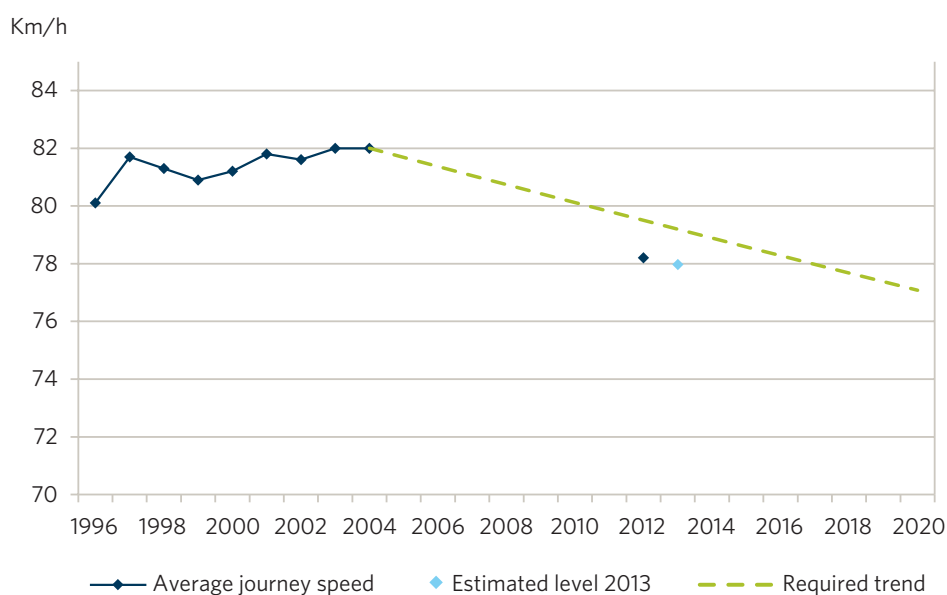


Figure 11. Average journey speeds on national roads 1996-2004 and 2012-2013, and the required trend until 2020. Source: Swedish Transport Administration.

Analysis and discussion

Changed speed limits may be one explanation for the circumstance that the share of traffic volume within speed limits is not in line with the required trend. While the large number of 90 km/h roads which have been changed to 80 km/h is probably compensated for by the increase to 100 km/h and median barrier separation on heavily used roads, it remains the general case that the lower the speed limit, the greater the number of transgressors. The lowered speed from 82 km/h to 78 km/h cannot be explained by changed speed limits, since the average speed limit is largely unchanged. Instead, the reason is regarded as being a result of better driving practices, in which automatic speed surveillance (abbreviated ATK in Swedish) using road safety cameras has had a considerable significance. No major changes to speed limits were carried out in 2013, and only a small number of ATK stations were set up.

Even if the tracking of journey speeds points towards lowered speeds which are in line with the required trend, we still have a long way to go in order to achieve the target of 80% compliance in 2020. And if we want to achieve the tougher EU target of no more than 133 road deaths by 2020, a high level of compliance with speed limits will be that much more decisive. The most important tool for achieving this potential is automatic speed surveillance (ATK). Expanded use of ATK in the national road network is particularly important on 80 km/h stretches of roads. For the period from 2014 until 2020, the Swedish Transport Administration and the police are planning a yearly addition of 200-300 stations. It is also important to continue supporting correct behaviour among drivers by encouraging and creating incentives for the use of Intelligent Speed Adaptation (ISA) in vehicles, e.g. through new insurance solutions. The introduction of ISA into Euro NCAP safety classifications is an important milestone in this regard.

A new addition to the 2012 national speed survey was the separate reporting of motorcycle speeds. The equipment used in the annual, less extensive measurement (the speed index) does not allow for the measurement of motorcycle speeds. For this reason, annual speed surveys are being planned with the aim of making change estimates for various speed parameters for the motorcycle class of vehicle.

The first in this series of surveys was carried out in 2013. It is worth noting that the motorcycle surveys are considerably smaller in scope than the national speed surveys.

The measuring period for motorcycles was from 20 May until 1 October. Speeds were measured at just over 260 locations in 2013. The same locations were part of the survey in 2012. The average speed index for 2013 is 0.993, which represents a 0.7% reduction on 2012. The share of motorcycles travelling above the indicated speed limit has also decreased by 0.7%. The estimated index for the share of motorcycles travelling at more than 5 km/h above the indicated speed limit shows an increase of 0.3%. The estimate for the share within speed limits in 2013 is presented in Figure 12 below. The improvement of the share within speed limits is of the same order as passenger cars, compared with 2012.

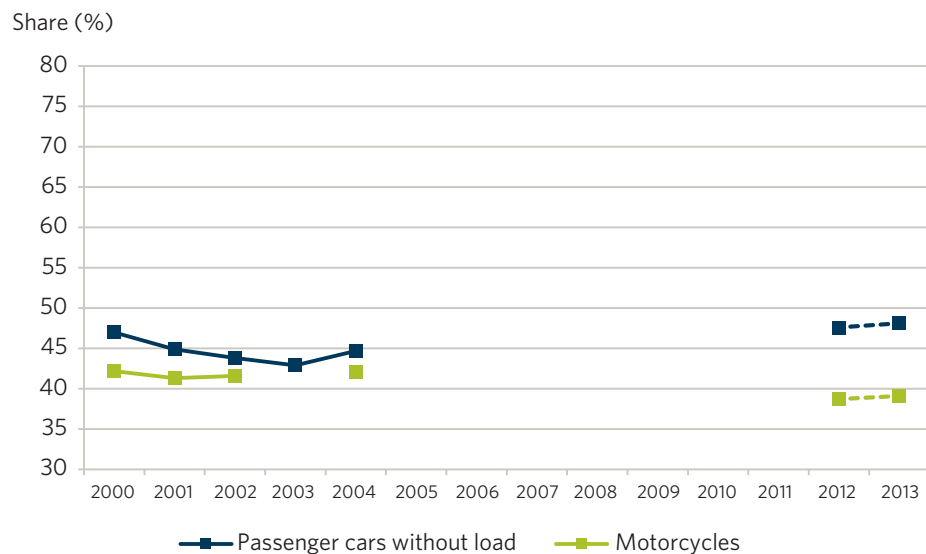


Figure 12. Share of the traffic volume within speed limits, 2000-2004 and 2012. The estimate for 2013 is for heavily used motorcycle road networks and the entire national road network for passenger cars without load, May to September 2013. Source: Swedish Transport Administration.

Compliance with speed limits has been indicated as a priority area for achieving safe motorcycle traffic (Increased safety for motorcycle and moped riders, strategy version 2.0). Because a motorcycle is so unprotected, speed becomes a crucial factor. However, the results of a questionnaire carried out by SMC and VTI during 2013 show that lowered speeds are not regarded as an important safety factor by motorcyclists themselves. The measures that motorcyclists consider as having had the least significance for safety are annual vehicle inspections, private driving practice, median barriers and, at the very bottom, lowered speed limits and police surveillance. In the annual road safety survey conducted by the Swedish Transport Administration, fewer motorcyclists think “It is reasonable to lower speed limits in order to increase road safety” than do passenger car drivers. In response to the statement “It is more important to follow the flow of the traffic than to observe speed limits”, more motorcyclists than car drivers agree fully/mainly.

4.2 Compliance with speed limits – municipal road network

	2012	2013	Target for 2020	Assessed trend towards meeting target
Share of traffic volume within speed limits, municipal road network	64* %	63,5 %	80 %	Not in line with the required trend
Average journey speed (km/h)	49 km/h	49 km/h	to be set in 2015	

*First year of measurements. The measurements are not nationally representative, but are considered good enough as a basis for tracking changes over time.

The target is for 80% of the traffic volume to be within applicable speed limits by 2020. Starting in 2014, average speeds will also be measured. At present there is no target for average speeds, but one will be set in 2015. Increased compliance with speed limits and lowered speeds are regarded as areas with a considerable potential for reducing the number of road deaths. As has been stated above regarding the national road network, the right speed is often a prerequisite for achieving the full effect of other measures. Adapting one's speed to speed limits which have been set in consideration of both the safety standard of the road and vehicle safety systems produces overlapping system gains.

A new series of measurements began on the municipal road network in 2012. This series is based on measurements in 23 different localities, with annual measurements being carried out at three different sites in each locality, see Hastigheter på kommunala gator i tätort ["Speeds on municipal roads in urban areas"] (Vadeby and Anund 2014). The aim of the measurements is not to estimate the overall share of the traffic volume within speed limits in Sweden, but they are nonetheless considered good enough to serve as a basis for tracking changes over time and provide the approximate share.

Trend towards the 2020 target

Figure 13 presents the share of the traffic volume within speed limits on the municipal network in 2013, as observed in measurements. Results show that 63.5% of the traffic volume is within applicable speed limits. This is a marginal decline on 2012, and the analysis group's assessment is therefore that compliance is not in line with the required trend.

The average speed is the same as in 2012, at 49.3 km/h. Although no target has been set for this measurement, we note that no improvement has occurred from 2012 to 2013 in terms of the average speed on municipal roads in urban areas.

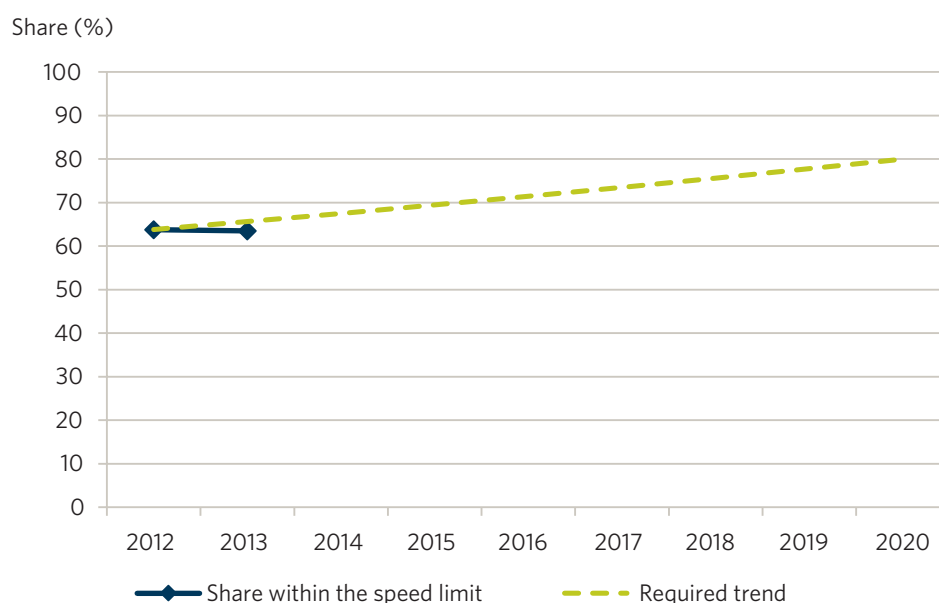


Figure 13. Share of traffic volume within speed limits on the municipal road network 2012-2013, and the required trend until 2020. Sources: NTF and VTI.

Analysis and discussion

The results of the measurements in 2012 and 2013, divided by speed limits, are shown in Figure 14. A more detailed description of the results from the 2012 and 2013 measurements is available in Vadeby and Anund (2014). For 2013, the following applies:

- on roads with a 40 km/h speed limit, 53% comply
- on roads with a 50 km/h speed limit, 61% comply
- on roads with a 60 km/h speed limit, 69 % comply
- on roads with a 70 km/h speed limit, 78% comply.

Compliance with speed limits is thus highest on roads with a 70 km/h speed limit, and lowest on roads with a 40 km/h speed limit. For roads with a 70 km/h limit we are almost at the target level of 80%. If we compare the results with those from 2012, we can note that it is primarily on roads with a 60 km/h limit that compliance has increased (by 6 percentage points). This change is not significant, however. Compliance is furthermore somewhat higher during the daytime, when 64% of the traffic volume travels within speed limits, while only 59% of it does so at night. Dividing the data by type of vehicle we find that 63% of passenger cars comply with speed limits, 73% of lorries and buses, and 83% of lorries with loads. The share of transgressions by motorcycles/mopeds is not reported separately, since that group includes vehicles subject to different speed limits depending on whether it is a moped (and on which type of moped) or a motorcycle. For that reason it is not possible to interpret the significance of the share of this group that complies with indicated speed limits.

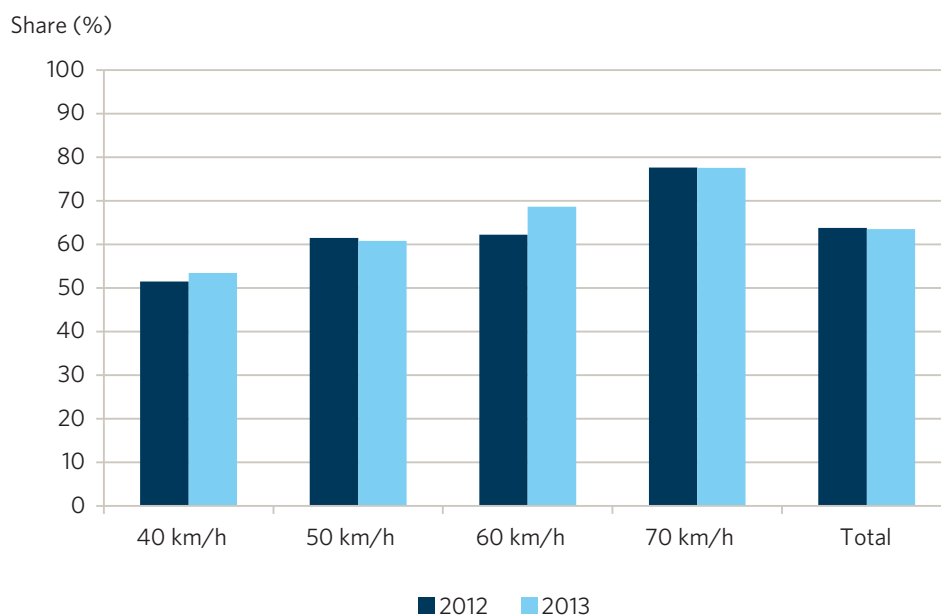


Figure 14. Share of the traffic volume within the speed limit on the municipal road network in 2012 and 2013, divided by speed limit. Sources: NTF and VTI.

The average speed on the studied road network is 49.3 km/h. Overall the speed is on the same level as in 2012. It should be noted that the group with 40 km/h included 18 measuring sites in 2013, compared with 11 sites in 2012. In other words, 7 sites have been added where the speed limit in 2012 was 50 km/h, but despite this the average speed is at the same level. It can also be noted that speeds at the different sites vary quite widely. This is natural in urban areas, where there are other factors besides speed limits that determine road users' choice of speed, e.g. frequency of intersections, road width, the presence of parked vehicles along the road, and pavements.

A national speed limit review has been in progress since 2008, and by the end of 2011, new speed limits were being signposted in 26% of the country's municipalities (Swedish Transport Administration 2012). Between 2012 and 2013, the total extent of roads with a 40 km/h speed limit increased by almost 300 km on the main road network in urban areas. This represents an increase of 65%. Correspondingly, the extent of roads with a 50 km/h speed limit decreased by just over 320 km (7%). This meant that seven of the measuring sites had their speed limit lowered from 50km/h to 40 km/h between 2012 and 2013. Table 1 shows the change for these sites compared with sites with unchanged speed limits of 40km/h and 50 km/h respectively. The speed reduction for sites whose speed limit was lowered from 50km/h to 40 km/h was 2.3 km/h. In the group with an unchanged 40 km/h speed limit there is a tendency for the speed to be reduced, while in the group with an unchanged 50 km/h speed limit speeds were essentially unchanged between 2012 and 2013. The share of transgressions increased by 30.9 percentage points for the 40-50 km/h group, while a tendency to reduced transgressions can be noted for the group with unchanged speed limits.

Group	No. of sites	Journey speed (km/h)			Share of transgressions (%)		
		2012	2013	Difference	2012	2013	Difference (percentage points)
50 km/h 2012 and 40 km/h 2013	7	43,0	40,7	-2,3	20,7	51,6	30,9*
40 km/h unchanged	11	39,1	38,4	-0,7	47,4	44,1	-3,3
50 km/h unchanged	25	47,0	46,8	-0,2	39,8	38,4	-1,4

*The change is significant

Table 1. Journey speed (km/h) and share of transgressions in 2012 and 2013 for sites with lowered speed limits from 50 to 40 km/h, unchanged 40 km/h limits and unchanged 50 km/h limits.

In the Swedish Transport Administration's 2013 road safety survey, 63% of respondents find it generally reasonable to lower speed limits in order to increase road safety. In particular, 70% find it reasonable to lower speed limits to 30 km/h in areas with a lot of pedestrians and cyclists. Also, 72% find that it has become harder to keep track of which speed limit applies since the introduction of more speed limits.

In order to achieve the target that 80% of the traffic comply with applicable speed limits in 2020, improvements to compliance are needed particularly on roads and streets with lower speed limits. When lower speed limits are introduced, compliance often declines initially. More streets in urban areas need to be made more "self-explanatory", thereby making it natural for road users to comply with the indicated speed limit. Stigson et al (2012) describe the results of an ISA trial in which a financial incentive was added via the insurance premium. Almost half of the drivers involved found it hardest to stick to the legal speed on roads with a 30 or 40 km/h speed limit. The participants in the trial showed improved compliance – speed limit transgressions were reduced by more than half in the trial group compared with the control group. According to the Swedish Transport Administration's road safety survey, 58% agree that all cars should be equipped with a technical aid making it easier for the driver to comply with speed limits. Women are more positive to such aids than men. To promote compliance with speed limits, Euro NCAP awards points to cars with ISA as of 1 January 2013 (Schram et al 2013). This has led to an increase in the prevalence of speed reminders in tested cars during 2013, compared with 2012. New and expanded use of automatic speed surveillance (ATK) on municipal roads is another measure which could increase compliance. No new cameras were introduced on the municipal road network in 2013, but the introduction of six cameras is planned for 2014.

¹⁰Intelligent Speed Adaptation

4.3 Sober traffic

	2007	2013	Target for 2020	Assessed trend towards meeting target
Share of traffic volume with sober drivers	99,71 %	99,77 %	99,90 %	Not in line with the required trend

The goal for sobriety on the roads is for 99.9% of the traffic volume to have sober drivers by 2020. A sober driver is defined as a driver with a blood alcohol concentration of less than 0.2mg/ml.

A measurement series derived from police surveillance data is used as a basis for monitoring trends (Forsman 2011). The measurement series shows drink driving trends, not the actual levels. Police surveillance methods influence how large a share of the breath tests are positive. For that reason, the measurement series is based on data from what are known as fixed checkpoints, where police check passing drivers and whose location has not been chosen because a large proportion of drunk drivers are expected to pass there. Still, even with fixed checkpoints there are choices involved, both of the location and of which drivers are stopped, so a certain degree of influence cannot be excluded.

The report entitled Management by Objectives for Road Safety Work (Swedish Road Administration 2008) states that the definition of a sober driver also includes him/her being free of drugs other than alcohol. In the data underlying the measurement series there is no information on the occurrence of drugs; it refers only to sobriety with regard to alcohol.

Trend towards the 2020 target

Results from the measurement series based on police checks indicate that there has been no change in the share of sober drivers in traffic between 2012 and 2013, which remained at 99.77% (Figure 15). There has been an overall increase since the measurement series began in 2007, when the share of sober drivers was 99.71%.

That increase has not been large enough, however, and the results for 2013 are below the required trend. The assessment of the analysis group is therefore that the rate of improvement is insufficient for achieving the 2020 target.

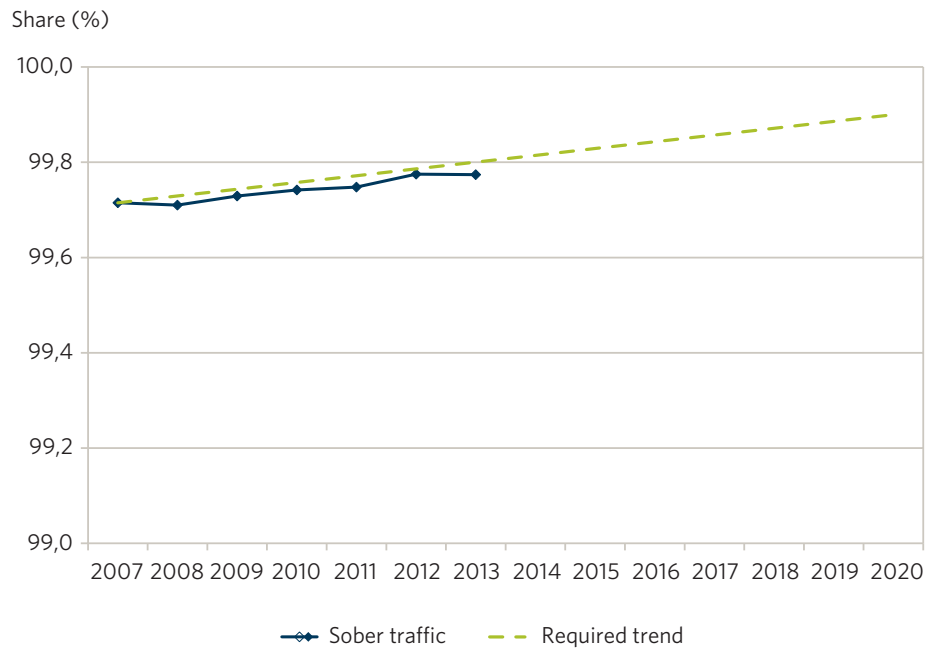
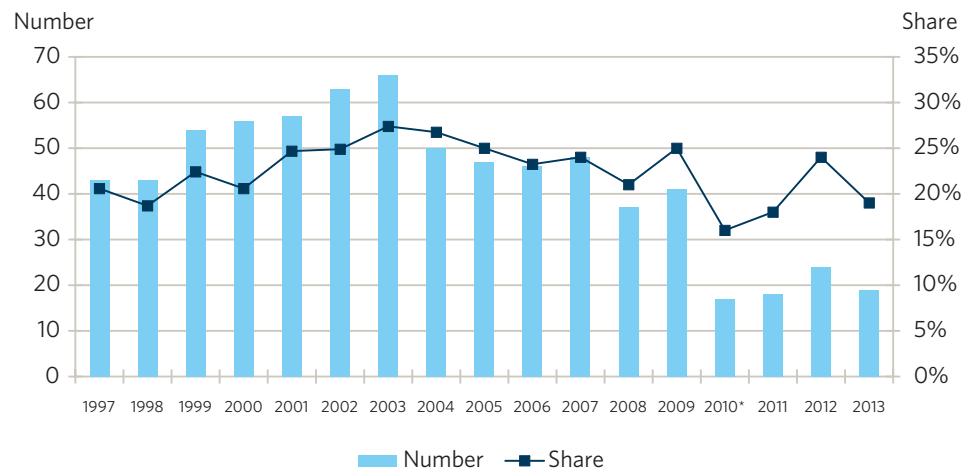


Figure 15. Share of sober traffic and required trend until 2020. Measurement series based on data from police checkpoints. Sources: The National Police Board, VTI.

Analysis and discussion

The Swedish Transport Administration's in-depth studies of fatal accidents show that 19% of passenger car drivers killed were under the influence of alcohol (blood alcohol concentration ≥ 0.2) in 2013. This means that the share has dropped again, after a relatively high level of 24% in 2012 (Figure 16). It should be noted, however, that there is a large random variation from year to year in this data, and the change between 2012 and 2013 is not statistically significant. Looking at the entire period, we can see that the share of drunk drivers has remained relatively stable over the years. This means that when the total number of drivers killed has declined, the share of drunk drivers killed has also declined.



*From 2010 excluding suicide.

Figure 16. Share of drunk drivers (alcohol > 0.2 mg/ml) among all drivers killed and number of drunk drivers killed, 1997-2013. Source: The Swedish Transport Administration's in-depth studies.

A compilation of drivers killed in 2013 who were driving other motor vehicles than passenger cars shows that alcohol (blood alcohol concentration ≥ 0.2) was found in 7 of 39 (18%) motorcyclists killed and that none of the three moped riders killed in 2013 had alcohol in their blood. For lorry drivers, alcohol was found in 3 of 12 drivers (25%). Three of the 12 drivers had been driving heavy lorries, and of them one was under the influence of alcohol.

Figure 17 shows the number of individuals killed in alcohol-related accidents, divided by mode of transport. A fatal accident is defined as alcohol-related if alcohol (≥ 0.2) is found in a motor vehicle driver, a pedestrian or a cyclist. Over the past three years an average of 60 individuals have been killed in alcohol-related accidents; for 2013 the figure was 49, which represents approx. 19% of all road deaths.

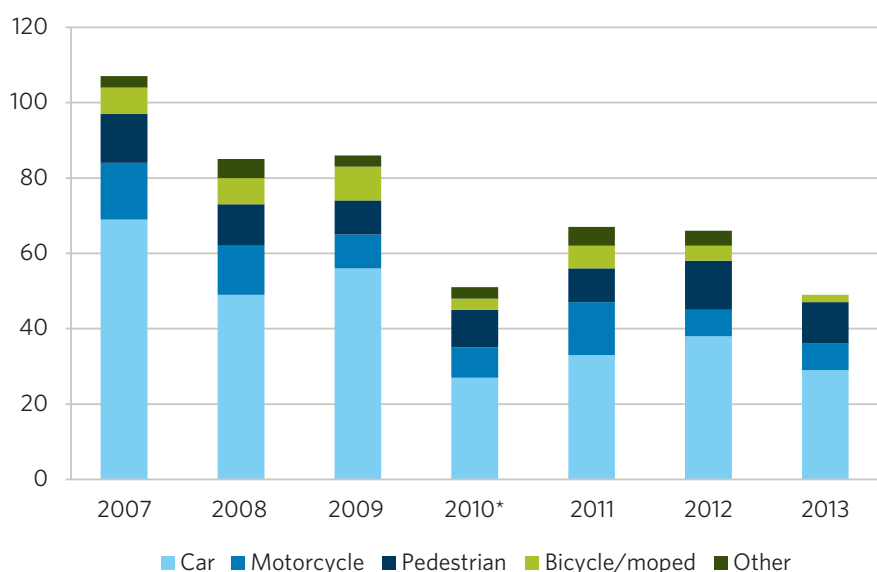


Figure 17. Number of individuals killed in alcohol-related accidents, divided by mode of transport, 2007-2013. Source: The Swedish Transport Administration's in-depth studies.

In the Swedish Transport Administration's 2013 road safety survey, 4.9% of respondents answered yes to the question: "Have you at any time over the past 12 months driven a car after drinking alcohol other than low-alcohol beer?" That is essentially the same level as in 2012 (5.0%), and the second lowest level since measurements began in 1981.

In summary, the share of sober traffic continues to be high in Sweden – but in order to achieve the 2020 target it needs to increase further.

A crucial role in future efforts to combat drunk driving will be played by devices that quickly and reliably identify alcohol in exhaled breath. One such device, automatic sobriety control (also known as alcogates), was tested during the autumn of 2013 at the Germany terminal in port of Gothenburg. The field trial was initiated by MHF (Motorförarnas Hälnykterhetsförbund, the Swedish association of teetotal drivers), and its primary aim is allow for extensive drunk driving checks in locations with large numbers of cars. The trial was evaluated with respect to traffic flows and user friendliness, and results were positive. For heavy vehicles, the check takes about 20 seconds per vehicle, while it is slightly quicker for passenger cars: 10-15 seconds per vehicle.

¹¹Number of drivers whose blood alcohol concentration was known.

LSimilar technology to that used in the automatic sobriety control trial underlies the new vehicle-integrated systems being developed. These systems can potentially become much more user friendly than the current alcolocks, and could eventually facilitate sobriety-promoting technology in our vehicles. The technology is already relatively well developed, and the next step is to test and demonstrate the systems on a bigger scale. But even if the technology is promising, it will be a number of years before it can be implemented to any greater extent, which means that we cannot rely exclusively on sobriety-promoting technology in the period until the 2020 interim target.

With regard to efforts against drunk driving in the shorter term, until 2020, police surveillance will play a key role. Police checks have two aims: prevention, by means of highly visible checks directed towards large numbers of drivers; and protection, by taking drunk drivers into custody in more targeted checks. The police also have an important role in encouraging people to accept offers of treatment for any alcohol or drug problems within SMADIT (Samverkan mot alkohol och droger i trafiken, a partnership against alcohol and drugs on the roads).

Approx 2.1 million breath tests were carried out in 2013, which is quite a large number in historical terms. There has nevertheless been a gradual decline in the number of tests since the peak year of 2009, when 2.7 million tests were carried out. The number in 2012 was 2.3 million tests. The number of reported drunk driving offences has also declined in recent years. About 13 900 drunk driving offences were reported in 2013, compared with 15 200 in 2012. The largest number of reported offences was in 2008, with about 18 800.

Even if the police continue to carry out breath tests on a relatively large scale, there has also been criticism of police working methods over the past year. Holgersson (2013), for example, points to considerable shortcomings in terms of planning and purpose for where and when checks are carried out. This leads to a large number of checks being carried out relatively close to police stations, and that large parts of the road networks further out in the police district are left without surveillance. This is an unfortunate situation since an earlier report has shown that alcohol-related road deaths tend to occur on smaller roads to a greater extent than other accidents (Gustafsson and Forsman 2012). A supervisory report by the National Police Board also indicates shortcomings in strategic work in the area of road safety (the National Police Board 2013). Among other criticisms, the inspection group found that the authorities' various management levels did not have a sufficiently coherent view of how road safety work is to be carried out.

The extent of driving under the influence of drugs other than alcohol has not been followed up over time. Data from 2005-2010 shows that about 7% of vehicle drivers killed on the road had taken illegal drugs (Swedish Transport Administration 2012).

Research suggests that while drugs are not as big a road safety problem as alcohol, they are still a relatively big problem. This should be kept in mind when discussing measures. As an example, the rules for the alcolock programme state that a person with a mixed abuse problem (drugs and alcohol) may not participate, and that a participant will be excluded if they are found to have taken other drugs in testing during the programme. This is unfortunate, as alcohol in

¹²<http://www.trafikverket.se/smadit/>

¹³Data from the Swedish National Council for Crime Prevention, BRÅ (www.bra.se). Figures for 2013 are preliminary.

combination with drugs is very dangerous from a road safety perspective. Since these individuals may not participate in the alcolock programme, it is important that they be attended to by some other means.

With regard to drugs, we cannot for the foreseeable future expect any in-vehicle devices in the same way as for alcohol. This makes police work even more important, and since 2000 the number of reported drug driving offences has increased sharply, from about 3 800 reported offences in 2001 to about 12 800 in 2013 (preliminary figures). This increase should not be seen as reflecting an increase in actual drug driving offences; instead it is due, at least largely, to increased police surveillance. Since 2008, the number of reported drug driving offences has been fairly stable, at around 12-13 000 per year. Still, police efforts against drug driving could be made even more effective if the police had access to screening instruments that can be used directly by the roadside. An evaluation of different instruments has been commissioned by the National Police Board for the spring of 2014. All the instruments being tested are based on saliva sampling, and the trials are to be carried out at several different locations around the country. Over the longer term, access to reliable screening instruments could lead to legislative changes allowing police to test drivers for drugs without any prior suspicion of crime, as is currently the case for alcohol.

4.4 Use of seat belts

	2007	2013	Target for 2020	Assessed progress towards target
Share of front seat passenger car occupants wearing a seat belt	96 %	98 %	99 %	In line with the required trend

The target for seat belt use is that 99% of all drivers and front seat passengers in passenger cars use a seat belt by 2020. Results of the observational measurements by the Swedish National Road and Transport Research Institute (VTI) are used as a basis for monitoring trends. The indicator is defined as the share of the observed drivers and front-seat passengers wearing a seat belt (for a description of the measurements, see Larsson et al 2013). The measurements are based on observations of 58 000 passenger cars at major roundabouts in six urban areas in central Sweden. The measurements are intended to monitor trends over time, and the extent of belt use reported should not be regarded as representative of drivers and passengers in Sweden in general.

Trend and projection towards the 2020 target

The use of seat belts in the front seats of passenger cars was 98% in 2013, which is no change on 2012. Seat belt use is in line with the required target.

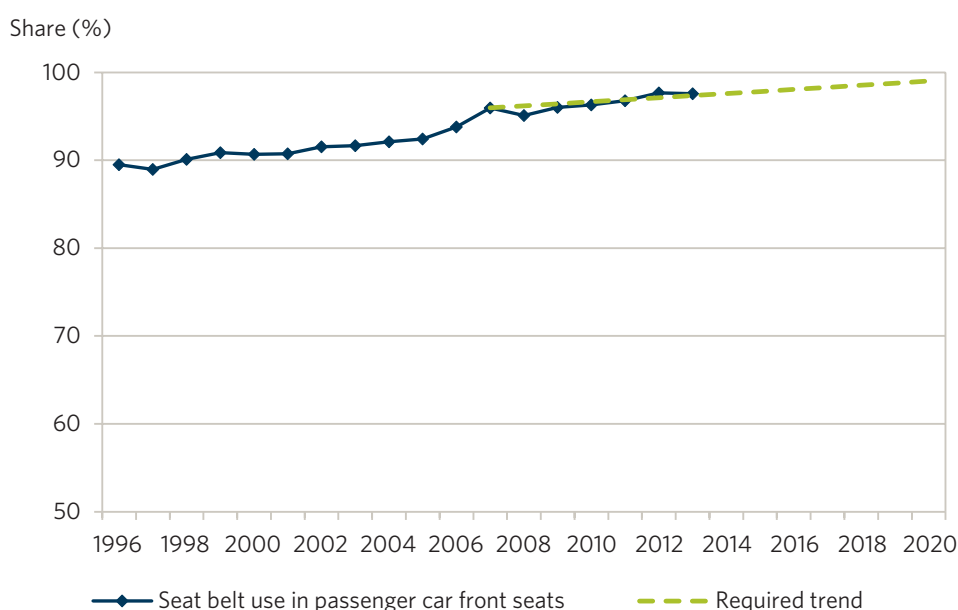
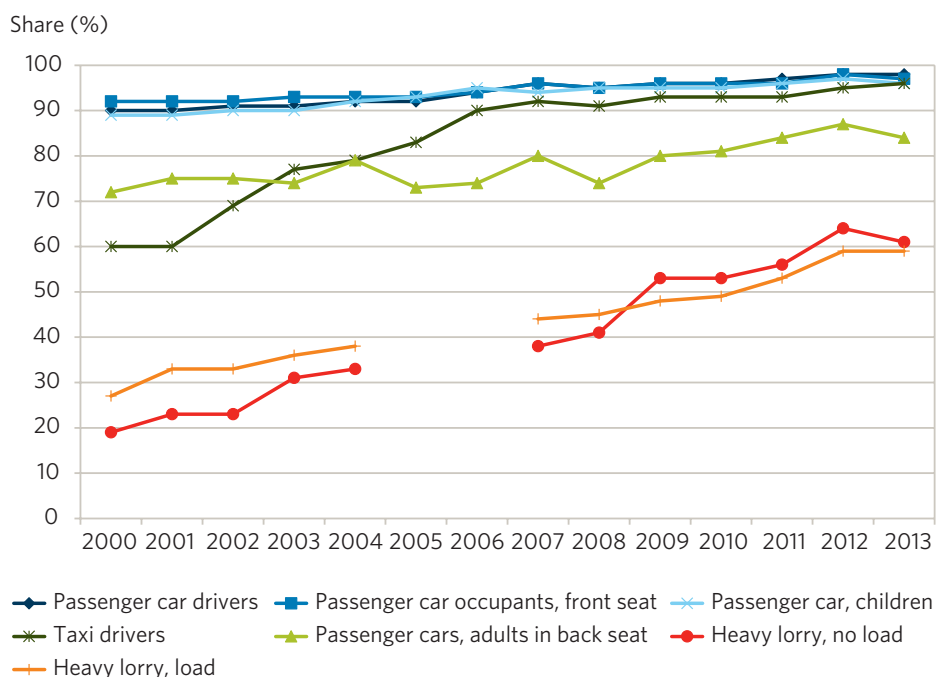


Figure 18. Share of individuals in passenger car front seats who were wearing a seat belt when observed, 1996-2013, and the required trend until 2020. Source: VTI's observational measurements.

Analysis and discussion

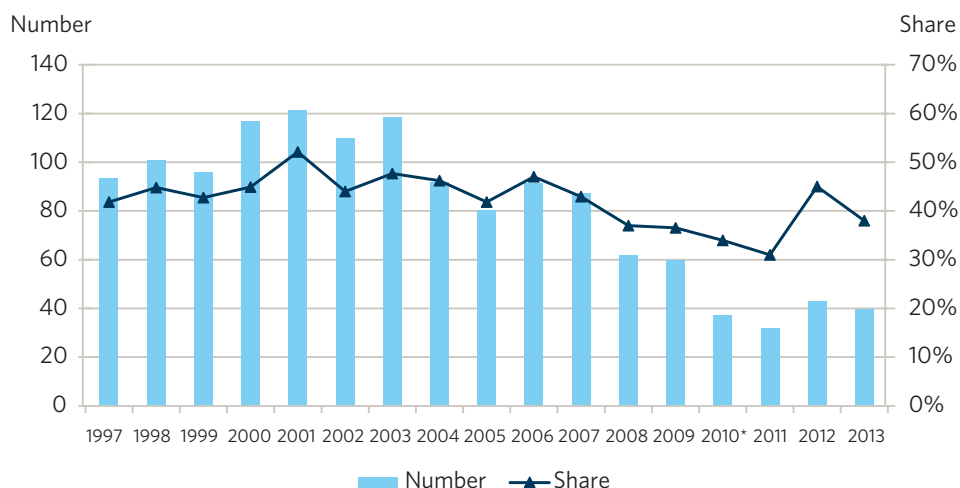
The share of individuals using a seat belt in the front seat is high. Of the drivers, 98% (98) use a seat belt, while 97% (98) of front seat passengers use a belt. Figure 19 shows that seat belt use has tended to stagnate in all groups except taxis, where use is now almost as high as among other passenger car drivers. Belt use among adults in the back seat shows a strong increase over the last two years, but regrettably decreased slightly in 2013. The same is true of heavy lorries without loads.



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

Figure 19. Seat belt use in passenger cars and heavy lorries, 2000-2013. Source: VTI's observational measurements.

Results of the Swedish Transport Administration's in-depth studies show a positive trend, with a reduced share of passenger car driver fatalities who were not wearing a belt at the time of the accident. During the past two years, however, the share has been slightly above the positive trend curve which has applied since 2002. Since an ever greater share of vehicles now have seat belt reminders, the higher outcome among fatalities is judged to be temporary.



* Data for 2010 was collected in a different manner than previously, and results are therefore not fully comparable with earlier values. However, the difference is judged to be small. Figures exclude suicide since 2010.

Figure 20. Share of passenger car driver fatalities who were not wearing a belt at the time of the accident, and the number of passenger car driver fatalities who were not wearing a belt at the time of the accident, 1997-2013. Source: the Swedish Transport Administration's in-depth studies.

The share of new cars with seat belt reminders continues to increase. The share of the car traffic volume with seat belt reminders was 67% in 2013 and 60% in 2012. As recently as 2005, the share was just under 10%. A forecast indicates that the share of the traffic volume with seat belt reminders will increase from about 60% currently to about 95% in 2020 (see the section on safe passenger cars). Even if the vehicle fleet does not become 100% equipped with seat belt reminders, it remains likely that seat belt use will increase from the current 98% to the target of 99% use by 2020. It is important, however, to keep in mind that there are high risk drivers among the last 1-2% who do not use a seat belt, which is illustrated by the fact that 30-40% of those killed were not wearing a seat belt. As has been mentioned earlier, there is also some uncertainty as to how well the measurements reflect the true level of seat belt use across the entire Swedish road network. According to NTF's measurements of seat belt use in all of Sweden's municipalities, seat belt use in 2013 was only 93% within urban areas.

Even if a considerable improvement has occurred among adults in the back seat and lorry drivers, seat belt use in these groups is relatively low, which is important to point out as the target only includes passenger car drivers. Analyses indicate that alcohol and non-use of a seat belt coincide to a great extent. For this reason, measures promoting sober traffic may also affect seat belt use in a positive direction.

4.5 Use of helmets

	2007	2013	Target for 2020	Assessed progress towards target
Share of observed cyclists wearing a helmet	27 %	36 %	70 %	Not in line with the required trend
Share of observed moped riders wearing a helmet	95,7 %	96,1 %	99 %	In line with the required trend

The target for cycle helmet use is that 70% of cyclists use a helmet by 2020. The figure used to gauge cycle helmet use is the share of cyclists observed using a helmet in VTI's annual measurements (Larsson 2014). The measurements are not intended to estimate overall helmet use in Sweden in a representative way, but are good enough to give a picture of changes over time and of the approximate level of use.

Helmet use among moped riders is studied alongside cyclists' use of helmets. As of 2012, observations of moped riders' use of helmets are conducted in connection with VTI's measurements of cycle helmet use. These observations are carried out at the same locations and times as the cycle helmet observations, but at marginally fewer sites in each location. Use of helmets was studied for just over 1 300 moped riders in total (Larsson 2014). Only those riders who are seen to have their helmets properly fastened are counted as helmet users. The target for helmet use among moped riders is that 99% use helmets by 2020. For motorcyclists, the potential for saving lives lies mainly in other measures than increased helmet use. Therefore this report will not further analyse helmet use among motorcyclists.

Trend towards the 2020 target

Figure 21 presents the trend for observed cycle helmet use between 1996 and 2013. In 2013, observed cycle helmet use was 36.2%, which is the highest level since measurements began in 1988. It is an increase by 3 percentage points from the 2012 level of 33.2%. The figure also shows how cycle helmet use needs to change between 2007 and 2020 in order for the target level of 70% to be achieved. This implies an annual increase of 7.6%. On average, cycle helmet use has had that rate of increase since 2010, but as the actual level of cycle helmet use is below the required trend, the assessment is that cycle helmet use has not increased sufficiently since 2007 to reach the target level by 2020.

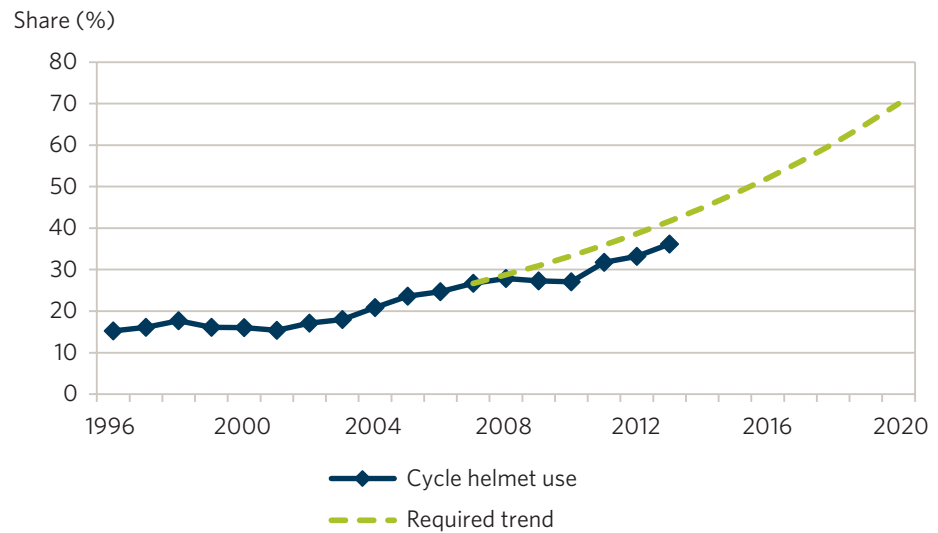


Figure 21. Share of observed cyclists using a helmet, and the required trend until 2020. Source: VTI's observational measurements 2013.

Figure 22 presents the observed use of helmets by moped riders in 2013. It shows that observed moped helmet use was 96.1% in 2013, which is a marginal increase on 2012 (95.7%). The figure also shows how moped helmet use needs to change between 2012 and 2020 if the target level of 99% is to be achieved. Measurements began in 2012, and there has been no great change to moped helmet use between 2012 and 2013, but the analysis group's assessment is that the rate of change is sufficient for reaching the target level by 2020.

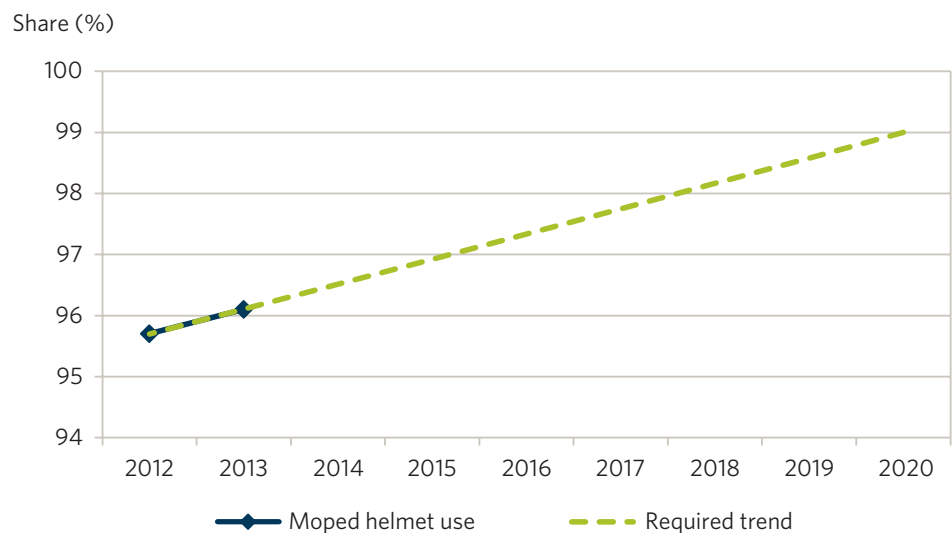


Figure 22. Share of observed moped riders using a helmet, and the required trend until 2020. Source: VTI's observational measurements 2013.

Analysis and discussion

Despite a positive trend for cycle helmet use in Sweden over the past few years, helmet use remains at a fairly modest level, particularly among adults. There is thus considerable potential for increasing the share of cycle helmet users.

Figure 23 shows that observed cycle helmet use in 2013 was 79% among children up to 10 years of age in residential areas and 61% among children aged 6-15 who cycle to and from school. Cycle helmet use among adults is a lot lower: in 2013 it was 29% on journeys to and from work, and 31% on public cycle paths. Between 2012 and 2013, helmet use has increased particularly among children up to 10 years of age in residential areas – but also among adults cycling to and from places of work. No marked change in helmet use has occurred in schools. Among older secondary school pupils helmet use is 34%, while it is 85% among primary school and younger secondary school pupils. Helmet use is slightly higher among girls than boys at all levels of primary and secondary school.

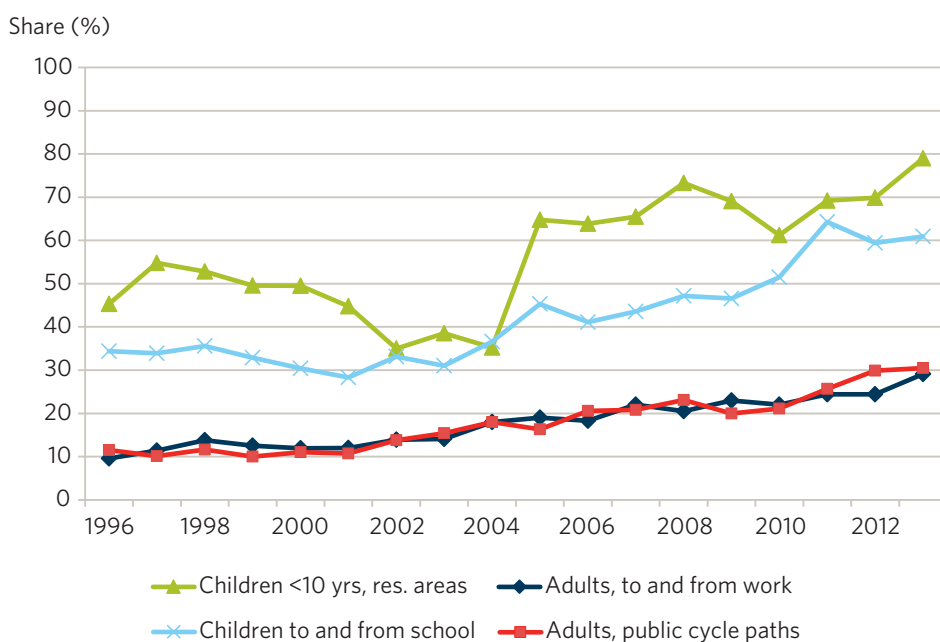


Figure 23. Cycle helmet use among different groups. Source: VTI's observational measurements 2013.

In the Swedish Transport Administration's 2013 road safety survey, about 22% of cyclists (over the age of 15) state that they always or almost always use a helmet when cycling. That is an increase of 3% since 2012, and the highest level since measurements began.

A new strategy for safer cycling was presented at the beginning of 2014 (Swedish Transport Administration 2014), as well as a report on cyclists' accident situation. The aim was to identify measures for reducing the number of injured cyclists (Niska and Eriksson 2014). Helmet use is one of the most important measures and a priority area of action in this strategy, in order to reduce the number of cyclists killed as well as seriously injured. The strategy argues that new methods should be sought that can increase voluntary helmet use, since a new law on helmet use for all cyclists is not on the table at present. Niska and Eriksson also discuss possible evidence of a certain effect of the current helmet law, as the under-15 age group has a lower share of injuries to the head and face than other age groups. A focus group study (Gustafsson 2013) highlights measures that can increase helmet use. In addition to a new helmet law, the study advocates good-

example campaigns and spreading knowledge about single bicycle accidents being the most common type of bicycle accidents, and that accidents can happen even at low speeds. It also suggests that employers be empowered to require their employees to use cycle helmets.

In 2013, there were 15 road deaths among cyclists, and approx. 2 160 cyclists were seriously injured, suffering at least 1% medical impairment – of which approx. 270 with more than 10% medical impairment. Figure 24 shows cyclists' injuries for those seriously injured ($\geq 1\%$) and very seriously injured ($\geq 10\%$). A cyclist can have several injuries, which means that the bars add up to more than 100%. Among other things, the figure shows that 44% of all very seriously injured cyclists sustained head injuries, while the corresponding share among seriously injured cyclists is only 10%. A measure such as a cycle helmet is thus effective primarily in preventing the more serious injuries. The strategy for safer cycling (Swedish Transport Administration 2014) notes that if all cyclists used helmets, the total number of seriously injured could be reduced by 10% and the number of killed cyclists by 25%. According to a study by Rizzi et al (2013), the use of cycle helmets could reduce the number of serious head injuries by 58% and the number of very serious head injuries by 64%.

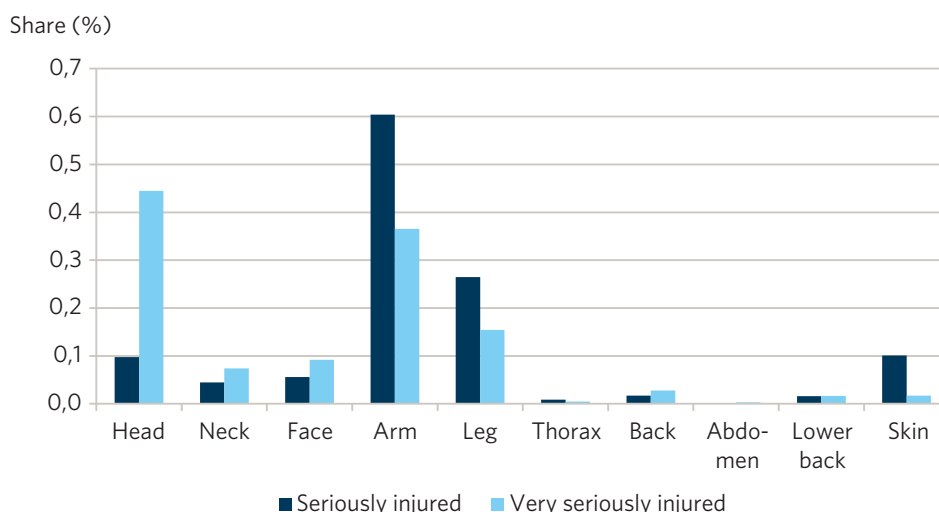


Figure 24. Distribution of cyclists' injuries for those seriously injured ($\geq 1\%$) and very seriously injured ($\geq 10\%$). A cyclist can have several injuries. Source: STRADA. Preliminary statistics for 2013.

Figure 25 presents helmet use among moped riders killed in accidents (road deaths 2004-2013). During this period approx. 100 moped riders were killed. Just over 50% of these were not using a helmet or had dropped it at the time of the accident. In the strategy for motorcycles and mopeds drawn up in 2012, it emerges that most of those who had dropped their helmet were under 18 years of age (Swedish Transport Administration 2012).

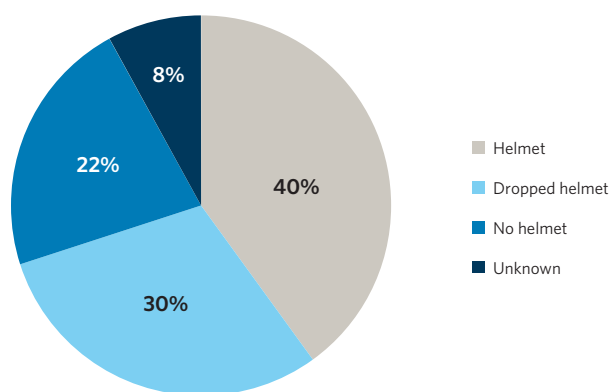


Figure 25. Helmet use among moped riders killed on the road, 2004-2013. Source: the Swedish Transport Administration's in-depth studies. Preliminary statistics for 2013.

In 2013, three moped riders were killed on the road, about 250 were seriously injured and about 30 very seriously injured. Studying the distribution of the moped riders' injuries by the degree of medical impairment they caused (Figure 26), we can see that, just as for cyclists, head injuries represent a considerably large share of those very seriously injured than of those seriously injured. 36% of all moped riders with very serious injuries have sustained a head injury, while the corresponding share of those seriously injured is just 8%. Note that a moped rider can have several injuries, which means that the bars add up to more than 100%. Increased helmet use by moped riders therefore has the potential above all to reduce the number of very seriously injured. Calculations indicate that helmet use reduced the risk of a serious injury by 17%, and the risk of a very serious injury by 47%.

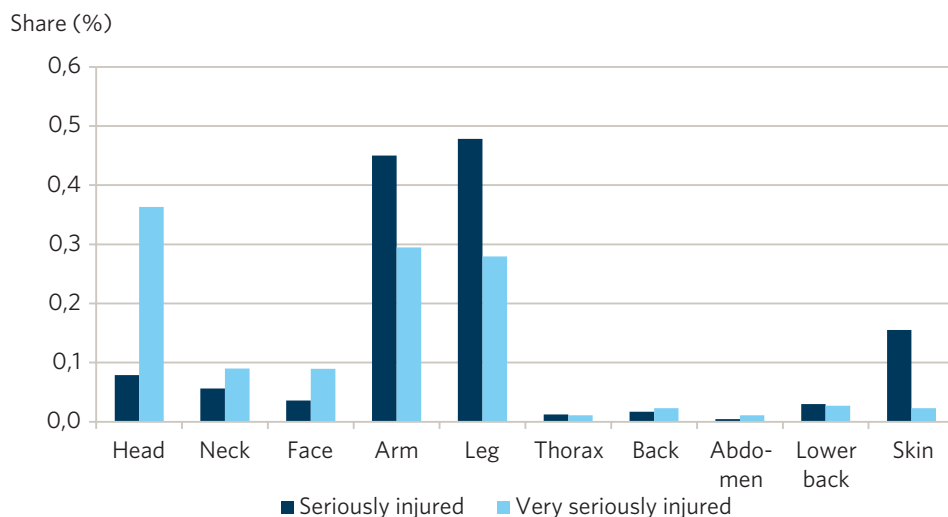


Figure 26. Distribution of moped riders' injuries for those seriously injured ($\geq 1\%$) and very seriously injured ($\geq 10\%$). A moped rider can have several injuries. Source: STRADA. Preliminary statistics for 2013.

A priority area highlighted in the 2012 strategy for mopeds and motorcycles is increased and correct use of helmets among moped riders. The strategy proposes measures such as traditional opinion making, in which parents, schools, health-care staff, the police and others can work together to increase helmet use among moped riders. It further proposes that working methods for surveillance be developed in such a way that compliance increases. The Swedish Transport

Agency will look into what possibilities exist for revoking driving licences and driver's certificates following a breach of helmet regulations. In October 2009, a compulsory moped driving licence was introduced for EU mopeds. It is hoped that training for the licence will lead to an increased awareness of the importance of using the helmet correctly, and thereby also lead to more moped riders using their helmet correctly.

The Swedish Transport Administration's in-depth studies show that shortcomings in helmet use are a major problem in connection with fatal accidents on four-wheelers. There are several types of four-wheelers including four-wheeler motorcycles (quadracycles) for which using a helmet is a legal requirement, and all-terrain vehicles (ATVs) which do not require the driver to wear a helmet. Between 2010 and 2013, a total of 18 individuals were killed on four-wheelers. Five of these were killed on quadracycles and one on a moped, of which three were not wearing a helmet and for which it was judged that they would have survived had they been using helmets. A further ten individuals were killed on ATVs (helmet not a legal requirement), and two on four-wheelers of unknown vehicle class. It has been assessed that three of these could have survived (one of them only possibly) if they had been using helmets. The new strategy for four-wheelers (Swedish Transport Administration 2013) assesses that a helmet requirement for ATVs has the potential of reducing road deaths by 28%. In 2013, the Swedish Transport Administration has presented a proposal to the government that a helmet requirement should apply for drivers and passengers when travelling on an ATV. New registrations of four-wheelers increased sharply between 2005 and 2012, but fell slightly between 2012 and 2013. In spite of this, however, more four-wheelers than two-wheeled motorcycles were sold in 2013, and it will be important to monitor this area in the continuing target follow-up.

The level of cycle helmet use is approaching the level of voluntary seat belt use before campaigning began for a legal requirement, and is the highest observed level since measurements began in 1988. Experiences from Sweden as well as other countries suggest that a rapid increase in the use of protective equipment generally requires new legislation. One example of this is the demand for compulsory seat belt use in Sweden in 1975, when seat belt use increased from 50% before the introduction of legislation to 85% afterwards (Belin 2012). Similar experiences exist for cycle helmet use in e.g. Australia and New Zealand (O'Hare 2002).

The new strategy "Safer cycling" highlights increased helmet use as a priority area of action. It describes how new methods should be found for increasing voluntary helmet use as a new helmet law is not regarded as imminent, but it doesn't specify what these new methods would involve. The analysis group's assessment is that the target of 70% helmet use will be very hard to achieve, and we would emphasise that concrete measures are needed to increase cycle helmet use further. In the 2013 road safety survey, 60% of respondents agree that it should be compulsory for everyone to use a helmet when cycling, which indicates that there is relatively strong support for increased helmet use.

4.6 Safe passenger cars

	2007	2013	Target for 2020	Assessed progress towards target
Share of traffic volume with the highest Euro NCAP score (2007)	20 %	51 %	80 %	In line with the desired trend

The 2020 target for safe passenger cars is that 80% of the traffic volume will consist of passenger cars with the highest safety score according to Euro NCAP (2007). This means five stars under the Euro NCAP assessment system of 2007, and implies the same level of crashworthiness as five stars under the current assessment system.

Trend and projection towards the 2020 target

Euro NCAP has tested and set scores for crash protection since 1997. Since 2003 and 2009, respectively, seat belt reminders and electronic stability control are also included in the scoring. The first cars with the highest score of five stars were tested and released on the market in 2001. Towards the end of 2007, 66% of all new cars sold in Sweden had the highest Euro NCAP score, and in 2013 that share was 87%. These developments among new cars has led to an increase in safe car traffic volumes by approx. 5 percentage points per year, including from 2012 to 2013 (Figure 27). The rate of improvement is thus in line with the required trend for achieving 80% by 2020.

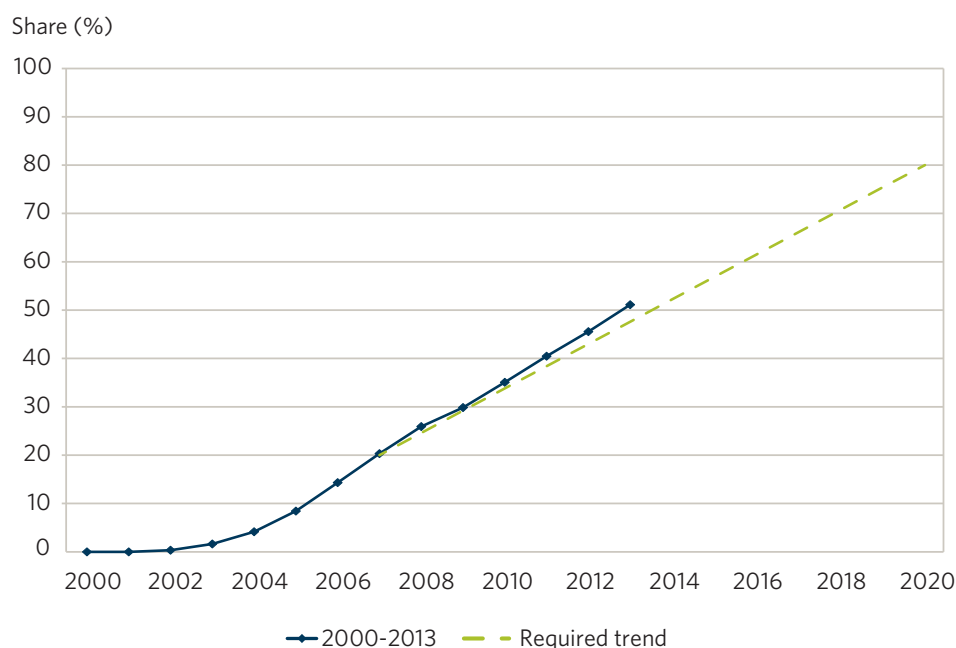


Figure 27. Share of the traffic volume with the highest Euro NCAP score, and the required trend until 2020. Sources: Bil Sweden, Statistics Sweden, Swedish Transport Administration.

Analysis and discussion

As old cars are scrapped and replaced by new, safer cars, the traffic volume on Swedish roads consists increasingly of cars with five star ratings from Euro NCAP. This trend is further accelerated by the fact that newer cars are used more, on average, than older cars. It may be generally assumed that it takes 15-20 years from the introduction of a new safety system for the vast majority of the cars in the Swedish vehicle fleet to be equipped with it, provided the rate of implementation in new vehicles is high (see example in Figure 28). For example, the share of new cars equipped with electronic stability control (ESC) has essentially been 100% since 2009, and the share of the traffic volume with ESC is therefore expected to approach 100% around 2020. This trend presupposes that 2013 will also be in line with the assumptions made in the interim target review.

The safety of the Swedish vehicle fleet is thus not determined only by what new cars are added to it, but also by the rate at which old cars are removed from it – and which cars these are. This is of considerable importance as serious personal injuries occur more frequently in accidents involving older cars. As a rule of thumb, when a group of cars has been driven for 80% of their total lifetime mileage, they have only been involved in 50% of the number of serious accidents they are expected to be involved in (Strandroth, Rizzi, Sternlund, Johansson, Kullgren, Tingvall, 2012). It is therefore important to guarantee that these safety systems continue to function throughout the car's lifetime. This is a challenge, as many of the safety systems are not compulsory and thus not subject to verification at annual vehicle inspections. Another important conclusion that can be drawn is that it may be necessary either to move generally from old to newer cars, or to scrap older cars that lack essential safety equipment such as ESC or seat belt reminders (SBR), in order to achieve the revised interim target proposal of no more than 133 road deaths by 2020.

The Euro NCAP testing programme develops over time, and comprises more essential safety systems than in previous years. As of 2012, for example, higher scores are required in pedestrian tests for a five star rating in comparison with 2007, even if the adult protection requirements in collision tests are largely the same. These developments will continue, and can provide valuable additions to vehicle safety e.g. in the form of intelligent speed adaptation (ISA), lane keeping assistance and autonomous emergency braking. In 2013, the first cars were tested under Euro NCAP's new protocol for ISA, which led to a larger share of speed alert systems among the tested cars in comparison with 2012. Since the requirements in the Euro NCAP protocol will be gradually increased, more cars are expected to be equipped with some form of ISA in the near future.

The interim target review assumes that all new passenger cars have lane keeping assistance systems by 2015, in order for the proposed interim target of no more than 133 road deaths to be reached by 2020. This does not look likely to be achieved, since sales of cars with lane keeping assistance systems remain marginal in 2014. The share varies from 0% up to 40% depending on the model of car, but is expected to rise in the coming years, particularly in connection with the development of more autonomous vehicles. For each year after 2015 that the implementation is delayed, it is estimated that an additional three individuals will be killed in relation to the proposed target. It is therefore important to monitor the development and implementation of systems for lane keeping assistance, even if the benefits are expected to arrive towards the end of the period, and mainly after 2020.

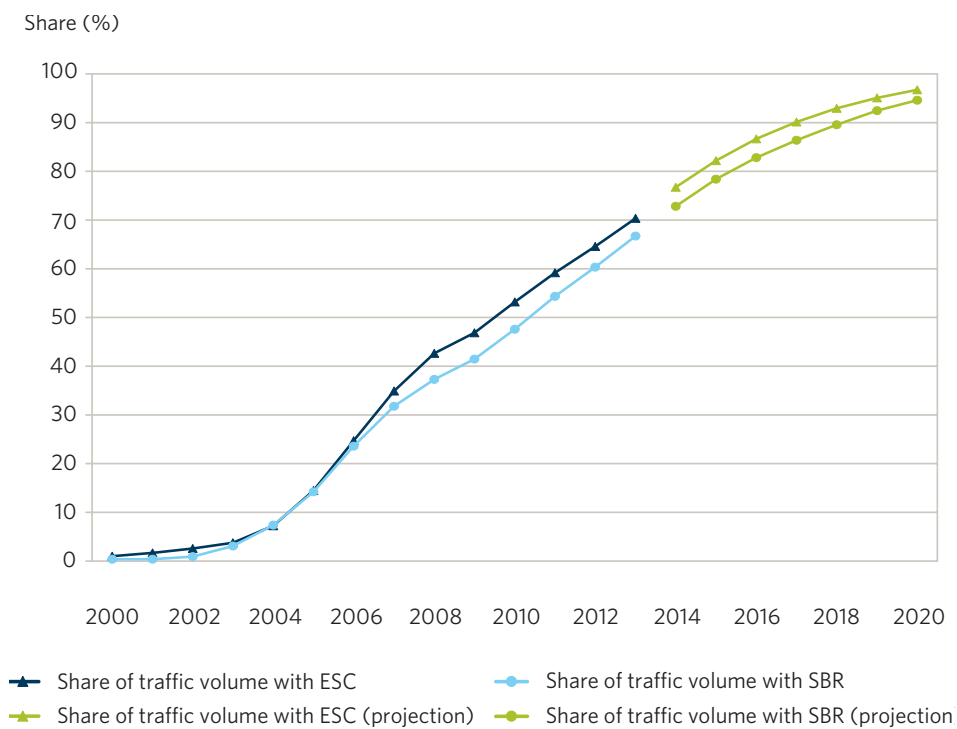


Figure 28. Share of the traffic volume consisting of cars with electronic stability control (ESC) and seat belt reminders (SBR). Sources: Statistics Sweden, Swedish Transport Administration.

4.7 Safe motorcycles

	2007	2013	Target for 2020	Assessed progress towards target
Share of traffic volume made up of motorcycles fitted with anti-lock braking systems (ABS)	9 %	34 %	70 %	In line with the desired trend

The target for safe motorcycles is that 70% of the motorcycle traffic volume by 2020 be made up of motorcycles fitted with anti-lock braking systems (ABS).

Trend towards the 2020 target

The share of new motorcycles with ABS is estimated at 78% in 2013, compared with about 30% in 2009, 60% in 2010 and 70% in 2012. The share of motorcycle traffic with ABS is estimated at 34% in 2013. Even if the current level is slightly below the required trend, the annual rate of increase is judged sufficient for achieving the required level by 2020 (Figure 29).

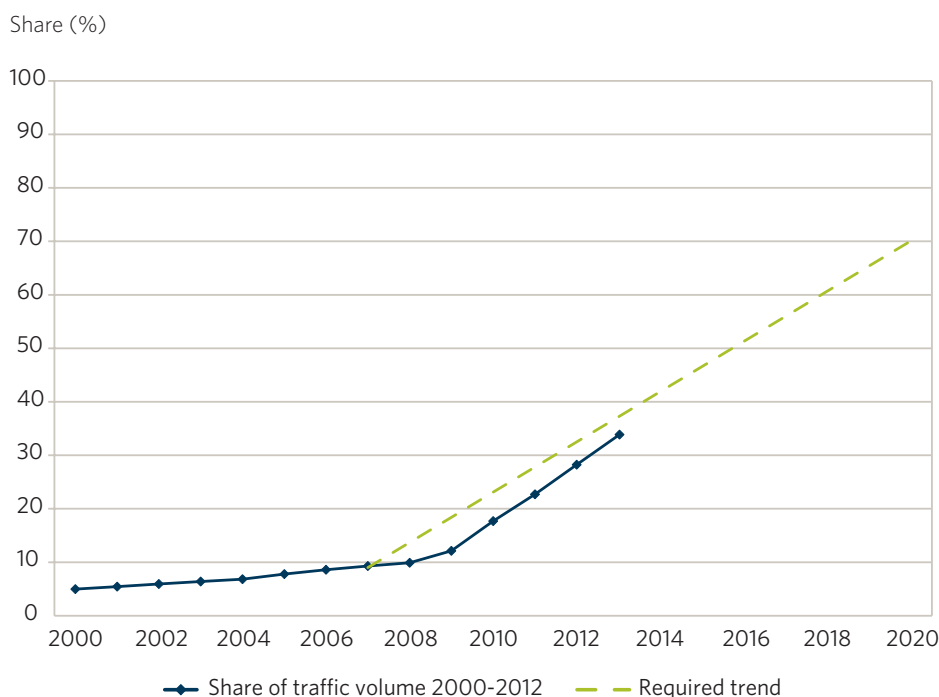


Figure 29. Share of the traffic volume made up of motorcycles fitted with anti-lock braking systems (ABS), and the required trend until 2020. Sources: Statistics Sweden, Swedish Transport Administration.

Analysis and discussion

There is very little scrapping of older motorcycles as owners most often keep them as a leisure interest and for recreational riding. This means that possibilities for increasing the share of motorcycle traffic fitted with ABS lie mainly in the addition of new motorcycles with ABS. The share of newly sold motorcycles with ABS has increased sharply in recent years. In the early and middle 2000s, the share was 10-15%, but then it rose to 30% in 2009, and has then continued to rise. In 2013, just under 80% of new sales were fitted with ABS. From having been standard equipment on only a few models and an expensive option on others, ABS has now become standard equipment on most models from most manufactu-

rers. ABS is currently available as standard or optional equipment on just about all types of motorcycles except small off-road models. This was not the case just a few years ago. The increasing share of ABS-fitted motorcycles in new sales is likely to continue over the coming years, as the EU is introducing a legal requirement for ABS on all new motorcycles with an engine displacement above 125 cc as of 2016. Systems for ABS are also becoming increasingly advanced in technical terms. One example is Motorcycle Stability Control (MSC) from Bosch, which senses the degree of the motorcycle's leaning in order to increase its stability and ability to brake effectively on bends (Bosch 2013).

The rapid rate of increase of ABS-fitted motorcycles in new sales will also lead to increasing their share of the traffic volume. This share is expected to increase by approx. 5% per year, and thus the rate of increase is in line with the desired trend in order to reach the target of 70% by 2020.

4.8 Safe national roads

	2007	2013	Target for 2020	Assessed progress towards target
Share of traffic volume on roads with speed limit > 80 km/h with median barriers	50 %	72 %	75 %	In line with the desired trend

The existing target for 2020 is that at least 75% of the traffic volume on roads with speed limits above 80 km/h be on roads with median barriers. This target can be achieved either by lowering speed limits or by adding median barriers to roads. Other measures on the national road network include primarily side barriers and centre line rumble strips with less frequent opportunities for overtaking.

Trend towards the 2020 target

The share of the traffic volume on roads with speed limits above 80 km/h with median barriers was 72% at the end of 2013. This is far better than the desired trend towards the target of 75% (Figure 30). The very extensive changes to speed limits that took place in 2009 are the main reason for this result.

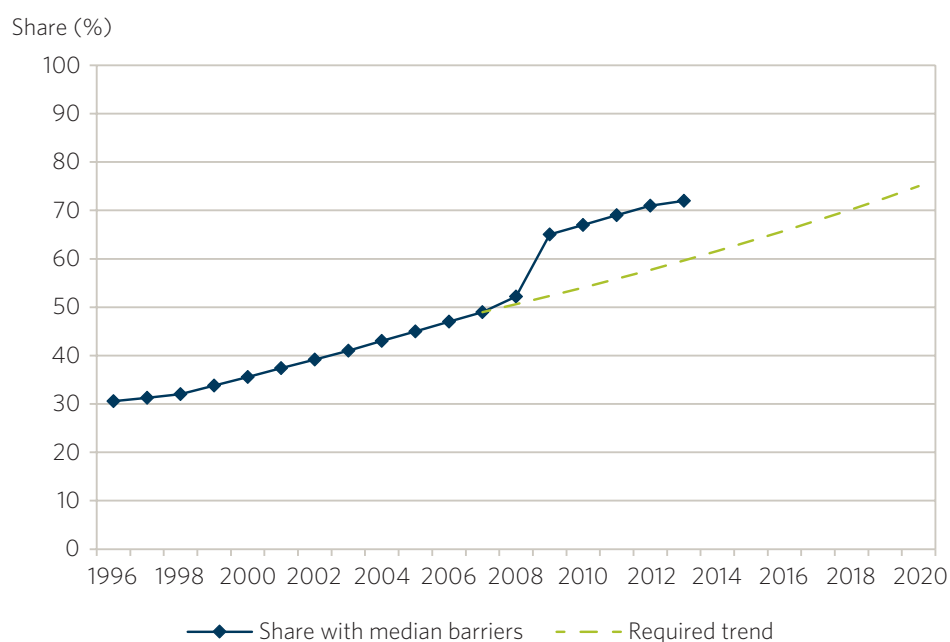


Figure 30. Share of traffic volume on roads with speed limits above 80 km/h with median barriers 1996-2013, and the required trend until 2020. Source: Swedish Transport Administration.

Analysis and discussion

A total of 130 km of 2+1 roads with median barriers were added in 2013. No motorway opened and no extensive change to speed limits was carried out. This meant that the outcome for the indicator increased by one percentage point to 72% in 2013. At the end of 2013 there was a total of 4 970 km of roads with median barriers. Some smaller measures were also applied to intersections and roadside areas, and 110 km of road provided with centre line rumble strips.

	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
2+1-road	68	95	113	130	151	177	195	212	233	250	259	272
Motorway	153	158	160	170	174	181	186	188	194	196	203	203
Other w. median barrier	22	22	23	24	24	25	20	20	20	22	22	22
W. median barrier, total	243	275	296	324	349	383	401	420	447	468	484	497
Centre line rumble strips	0	0	0	25	124	250	334	425	493	493	499	510

Table 2: Roads with median barriers and centre line rumble strips, 2002-2013 (in tens of km at year's end)

In the 2012 review of the interim target ("Review of interim target and road safety indicators between 2010 and 2020, Publication 2012:124"), the effect of an increased share of safe roads and safe vehicles was deemed the basis for fulfilment of the EU target: no more than 133 road deaths in 2020. The prognosis assumes that all roads with a speed limit of 90 km/h, a traffic flow of more than 4 000 vehicles/24 h and a width of at least 12 m (about 1 0000 km of roads) will have median barriers by 2020. On the remaining roads with lower traffic flows or a width of less than 12 m, the speed limit would have to be reduced to 80 km/h. That would involve raising the target level from 75% to 100%.

This ambition can be compared with the proposal for a national plan 2014-2025 that the Swedish Transport Administration submitted to the government in June 2013. The proposal includes installing median barriers on approx. 450 km of 90 km/h roads, which would also have their speed limits raised. The remaining 90 km/h roads without median barriers would have their speed limits lowered to 80 km/h at a rate which guarantees that increased emissions from raised speed limits are compensated for. This correspond to lowered speed limits on about 3 700 km of roads. Roads with a vehicle flow of less than 2 000 vehicles/24 h are not subject to any speed limit changes in the proposal. This exception would apply to approx. 7 700 km of 90km/h and 100 km/h roads with opposing traffic, primarily in inner Norrland.

The ambitions in the proposal for a national plan and the review of road safety targets are not the same in terms of kilometres of roads with median barriers. The focus of the proposal for a national plan is based instead on having stretches of road not fitted with median barriers subject to an 80 km/h speed limit and – to a considerable extent – automatic speed surveillance using ATK. The analysis group's assessment is that the proposal for a national plan could still deliver what is required in order to achieve the tougher EU target, as a result of the use of ATK on roads changed to 80 km/h. However, what this approach leads to is a reduction in mobility as fewer roads will have a 100 km/h speed limit. The analysis group would also emphasise the focus of the proposed national plan must be implemented at an early stage of the planning period in order to generate an effect by 2020.

4.9 Safe pedestrian, cycle and moped junctions in urban areas

	2013	2013	Target for 2020	Assessed progress towards target
Share of safe PCM junctions in main municipal networks for cars	19 %	19 %	Not defined	Starting year for the measurement – progress cannot be assessed

A pedestrian, cycle and moped crossing (a PCM crossing) is defined as safe if it is grade separated or if 85% of motorists drive through it at a maximum of 30 km/h. The latter is most effectively achieved by means of a physical speed control hump in direct proximity to the crossing. For more exact definitions of safe, moderately safe and unsafe PCM crossings, see the memorandum “Kriterier för säkra GCM-passager” [“Criteria for safe PCM crossings”] (Swedish Transport Administration 2013).

Trend towards the 2020 target

In order for the indicator to be monitored, municipalities must have reported data on PCM crossings and speed control humps to the national roads database NVDB, otherwise the indicator cannot be calculated. At the end of 2013, just over 40 municipalities had reported full data to NVDB. In these municipalities, just under 20% of the passages are safe. Another 20% of them are judged to be moderately safe.

No target level has been defined for this indicator at the present time. Looking at what is required to contribute to the 2020 targets, the analysis group has assessed that a target level of around 35% seems reasonable. That would correspond to just over 10% of target fulfilment for seriously injured cyclists would come from efforts with this indicator. It would also contribute to the reduction of road deaths.

Analysis and discussion

According to the Swedish Transport Administration’s in-depth studies of fatalities, between 10 and 20 individuals are killed each year at PCM crossings in urban areas. Most of these individuals are killed at crossings which are not protected by some form of speed reduction device such as a speed control hump.

The indicator for safe PCM crossings is also important for reducing the number of seriously injured. By changing a PCM crossing from not being speed protected to being speed protected, the number of seriously injured is reduced by 50% for cyclists and pedestrians, and the number of very seriously injured (with a degree of medical impairment of 10% or more) is reduced by 80%.

Although no exact target level has been defined for the indicator, it may be noted already at this point that a target level of around 35% would amount to a challenge as there are only a few years left until the target year and the measures required are often changes to the physical design of the road environment. These measures will not only affect road safety in urban areas, they will also lead to reduced emissions and noise as well as create a more attractive urban environment.

In order to improve this indicator, and thereby road safety in urban areas, municipalities must take up the challenge of speed protecting more crossings of the car network in urban areas. This can be done by building a grade separated crossing or introducing speed reducing measures near crossings, such as humps, raised crossings or narrowed roadways. Another possibility is to promote better speed adaptation and lower speeds in the urban area, primarily through local speed supervision. According to the most recent data available (from the beginning of 2012), just over 25% of municipalities have carried out a speed limits review. The analysis groups considers it very important that work on speed limit reviews and speed adjustments continue in Sweden's municipalities.

A prerequisite for continuing to monitor this indicator, and thereby making municipalities' part in road safety work towards the 2020 interim targets visible, is that more municipalities make inventories of their crossings and report them to NVDB. This should be done as described in "Handledning för inventering av GCM-passager och korsningar i tätorter" ["Guidelines for inventories of PCM crossings and intersections in urban areas"] (Swedish Transport Administration 2010). Furthermore, those municipalities that have already reported to NVDB should ensure that data in NVDB is kept updated, so that changes to the road environment can be monitored.

4.10 Operation and maintenance of cycle paths in urban areas

	2013	2013	Target for 2020	Assessed progress towards target
Share of municipalities with good-quality operation and maintenance of cycle paths	15 %	15 %	70 %	Starting year for the measurement – progress cannot be assessed

This indicator is new since the indicators were reviewed in 2012. The reason it is now included among the national indicators is that the results of the 2012 review showed that management by objectives had not focused enough on following up indicators that reduce the number of seriously injured. The indicator is intended to capture a large part of the many cyclists who are seriously injured in single bicycle accidents.

The definition of the indicator is the share of municipalities (with populations exceeding 40 000) that carry out good-quality operation and maintenance of cycle paths, with the highest priority reserved for the central/main town in the municipality. Good quality means quality in terms of standard requirements for winter and summer maintenance of cycle paths, as well as good quality assurance of the standard requirements made.

In order to measure the indicator, the Swedish Transport Administration had a survey carried out of how well Sweden's municipalities organise and carry out operation and maintenance of cycle paths in their charge. The assessment is made in the form of points awarded for the responses which – with present knowledge – can be viewed as positively affecting the safety level for cyclists. The survey was carried out in consultation with the Swedish Association of Local Authorities and Regions (abbreviated SKL in Swedish). For a more detailed description of the measurement and its results, see Rapport Kommuners drift och underhåll av cykelvägar [“Report on municipalities’ operation and maintenance of cycle paths”] (Swedish Transport Administration 2014). The intention is to carry out annual data collections like this on a continuous basis.

Trend towards the 2020 target

It is very difficult to assess what is a reasonable target level for this indicator, as there is very little knowledge about cause-effect relationships between cycle path maintenance and fewer serious injuries. However, the analysis group's very rough estimate is that the target level for the indicator could be 70% for 2020. This target level is based on the unverified assumption that effective maintenance of cycle paths can reduce the share of seriously injured cyclists there by 30%. A target level of 70% would thus correspond to an annual reduction in the number of seriously injured cyclists of almost one hundred. This in turn corresponds to just over half of the reduction in the number of seriously injured cyclists that has to occur by 2020.

Results of the 2013 measurement and assessment of the indicator show that 15% (9) of the municipalities with more than 40 000 inhabitants carry out good-quality operation and maintenance of their highest priority cycle paths. Another 36% (21 municipalities) are judged to provide intermediate quality operation and maintenance of their highest priority cycle paths. 50% of the municipalities in the

study (30) are judged to provide low quality maintenance of their highest priority cycle paths.

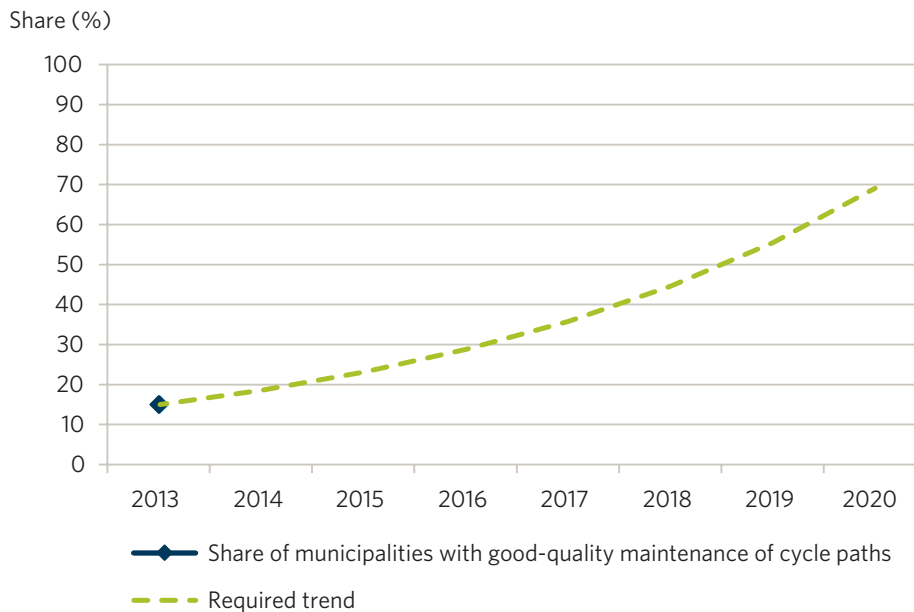


Figure 31. Share of municipalities with good-quality maintenance of cycle paths, and the required trend until 2020.

Since the target is being followed up for the first time in 2013, the rate of the trend cannot be assessed. There is no doubt, however, that the target level of 35% will require measures to be applied quickly.

Analysis and discussion

The measure used for this indicator is to be regarded as an indirect gauging of the actual quality of operation and maintenance of cycle paths. Within a given municipality, actual quality can be both higher and lower than what the indicator states, and it can also vary over time for one and the same municipality. Still, the results of the survey are judged to be reliable for the indicator at a national level.

In the measurement method developed, responses to the survey give a certain number of points. The maximum number of points for each response varies between 1 and 4 points per response depending on how important it is considered for cyclists' safety. The distribution of points means that a maximum of 64 points can be awarded to a municipality for operation and maintenance of priority cycle paths.

Of the maximum 64 points that can be awarded to a municipality, a maximum of 20 points (31%) are awarded for responses that have to do with quality assurance (internal control, training, choice of methods), and a maximum of 44 points (69%) for the standard requirements that the municipality presents for winter maintenance, gravel sweeping and summer maintenance.

The 44 points which can be awarded for standard requirements are distributed as follows: 20 points (45%) for winter, 12 points (27%) for gravel/leaves and 12 points (27%) for summer. This distribution closely matches the potential that operation and maintenance have for reducing the number of seriously injured cyclists, and which is presented in the joint strategy "Safer cycling": 43-44% for winter, 29-33% for gravel and 22-29% for summer.

The highest total number of points awarded to any of the interviewed municipalities in this survey was 33 points, which is 52% of the possible maximum. The lowest total number of points awarded to any of the interviewed municipalities was 9 points. The median number of points awarded was 19.

In order to assess the quality of municipalities' operation and maintenance on the basis of the results described above, a weighting must be done of the areas studied. The table below shows the quality requirements which were applied to the material:

Quality	Basic requirement	Additional requirement
Good (green)	Level 1 for the total number of points	All four component areas are at level 1 or 2
Less good (yellow)	Level 1 or level 2 for the total number of points	One component area is at level 1 OR all four component areas are at level 1 or 2
Low (red)	Level 2 for the total number of points	One or more component areas are at level 3 and none at level 1
Low (red)	Level 3 for the total number of points	-

Table 3: Points requirements for different quality levels for operation and maintenance of cycle paths. Level 1 means good quality, level 2 less good quality and level 3 low quality. The exact specifications of levels 1, 2 and 3 are found in Table 1-5 in PM Mätning och bedömning av indikator 10 [Memorandum re Measurement and assessment of indicator 10].

There are certain regional differences, and it turns out that between 44% and 64% of municipalities with at least 40 000 inhabitants in the Swedish Transport Administration's East, Stockholm, West and South regions are judged to provide good or less good quality of operation and maintenance of priority cycle paths. In the North and Central regions the corresponding share is only 25-33%.

The municipalities in the survey that are judged to provide good-quality operation and maintenance of priority cycle paths are: Falun, Göteborg, Linköping, Malmö, Nacka, Lund, Norrköping, Uppsala and Varberg.

The municipalities in the survey that are judged to provide less good quality of operation and maintenance of priority cycle paths are: Borlänge, Falkenberg, Halmstad, Helsingborg, Huddinge, Hässleholm, Jönköping, Karlskrona, Kristianstad, Lidingö, Luleå, Mölndal, Norrtälje, Skövde, Sollentuna, Stockholm, Trelleborg, Täby, Västerås, Växjö and Österåker. A further 30 municipalities in the survey are judged to provide less good quality of maintenance of priority cycle paths.

The 21 municipalities judged to provide less good quality of operation and maintenance of cycle paths should have ample opportunities to raise the quality of their work to the level required for good quality by 2020. A rough estimate is that at least a further 15 municipalities that are deemed in this survey to provide low quality of operation and maintenance of cycle paths have the opportunity, using reasonable but focused measures, to raise their quality to the level for good quality by 2020. It is also reasonable to assume that most of the municipalities providing low quality have the opportunity to raise their level to less good or good quality by 2020.

In order for it to be possible for municipalities providing low or less good quality to raise their level to good quality, municipalities must review both their working methods and their standard requirements. Most municipalities have both strong and weak points, and just about all municipalities have component areas where they could improve. Improved quality assurance and more stringent standard requirements need not imply increased costs across the board. But if they want to achieve clear improvements, it is likely that certain municipalities will have to try allocating more funds to operation and maintenance of cycle paths, particularly of priority cycle paths.

Overall, the improvement potential is greatest for gravel/leaf sweeping. Very few municipalities score well in this area. It is also important to make requirements for starting criteria and duration of measures more stringent, both for winter and summer maintenance.

5 Conclusions and discussion

In 2013, there were 260 road deaths in Sweden. This is a reduction on the previous year by 9%, and is also the lowest number of annual road deaths in recent history. However, the number of people seriously injured in traffic accidents increased between 2012 and 2013, from just over 4 400 to 4 800, or by seven per cent.

5.1 Conclusions

The outcome in terms of fatalities falls well below the minimum of the required trend, 260 compared to 319 (according to the current target of no more than 220 road deaths by 2020). Despite the increase in the number of seriously injured, the figures are still in line with the required trend. This is the first time since the target for serious injuries was introduced that the number has increased for an individual year. The overall assessment of the analysis group is that the existing 2020 target for road deaths will be achieved. The target for serious injuries also looks achievable, albeit with the reservation that cycling safety must increase if cycling continues to grow in popularity.

The entire increase in the number of seriously injured persons is due to an increase in the number of seriously injured cyclists, from approx. 1 800 to approx. 2 200. In contrast, the number of seriously injured passenger car occupants has decreased by 6%, from approx. 1 700 to 1 600. The increase in the number of seriously injured persons in 2013 is cause for concern, but cannot be said with certainty to represent a break in the trend. One hypothesis as to why the number of seriously injured cyclists grew between 2012 and 2013 is that cycling has increased in Sweden. As cyclists are often injured in single bicycle accidents, there is reason to assume that variations in cyclist injury figures coincide to some extent with cyclists' exposure. The hypothesis that cycling increased between 2012 and 2013 is supported by slightly increased sales figures for the period as well as by the favourable weather for cycling during the summer. The increase in the number of serious accidents also took place during the summer. Still, better data about the volume and seasonal variations of cycling is needed if the hypothesis about increased cycling is to be verified. The analysis group therefore considers it important that good methods are established for measuring the volume of cycling.

The Swedish strategy of promoting cycling must include measures for increased safety, as cyclists are among the most vulnerable road users. Municipalities must intensify their road safety work, with the focus on seriously injured cyclists. Measures to reduce their numbers mainly involve providing infrastructure and maintenance that take unprotected road users' need into account. But it also involves getting cyclists to use helmets and other safety equipment. With respect to infrastructure and maintenance, an important part of the responsibility also falls on the national road operator. Work should ideally be based on the joint indicators Safe PCM crossings and Maintenance of cycle paths in urban areas, which are being followed up as of 2013. The assessment is that both of these indicators need considerable improvement by 2020 if the number of seriously injured is to decrease at the required rate. Guidance for the work to reduce the number of seriously injured is available in the "Safer cycling" strategy as well as the handbook "Trafiksäkra staden" ["Road safety in the city"], which were made

public in 2013 and early 2014.

The analysis group would draw attention to the issue of studded bicycle tyres, which is also addressed in the “Safer cycling” strategy as a measure with considerable potential. The effect on reducing the number of seriously injured cyclists through de-icing/studded tyres is specified there at 15-20%. On this basis, the analysis group’s assessment is that studded tyres may significantly supplement measures for better maintenance of cycle paths.

With respect to car traffic volume, preliminary figures show that the total volume in 2013 increased by about 1.1% on 2012. The volume of passenger car traffic increased slightly more (1.1%) than that of heavy vehicles (0.8%). An increase in traffic volume of this order will not elevate overall risk as it is usually compensated for by an increase in system safety.

The favourable trend towards the 2020 targets is mainly explained by ongoing improvements to the vehicle fleet and infrastructure, and not least by reduced speeds. Both the safe national roads and safe vehicles indicators are improving at a sufficient rate. It is positive in itself that each of these areas is improving, and when they are combined they can reinforce each other. Speed as an isolated factor has a decisive influence on the number of road deaths and injuries, but it also interacts strongly with other indicators. Road design and vehicle fleet safety gains are optimised when combined with the right speed. Average speeds on the national road network are estimated to have dropped somewhat, from 78.2 km/h to 78 km/h (target 77 km/h). Despite the reduction in average speeds, compliance with speed limits remains at an unacceptably low level. In 2013, the share of traffic volume within speed limits was estimated at just under 47% (target 80%) on national roads and just over 63% (target 80%) on municipal roads.

Trends in relation to the EU target

Looking at the trend for fatalities in relation to the target at the EU level (which corresponds to a maximum of 133 road deaths in Sweden in 2020), the number of fatalities is at present higher than the required trend. The curve of the required trend for achieving the more demanding EU target points to a maximum of 215 road deaths in 2013, rather than the actual outcome of 260 road deaths.

The decisive factor for achieving the more challenging EU target by 2020 is what happens on the national road network. The rate of adaptation of speed limits to road design on national roads needs to be increased in the years until 2020. In addition to this, an improvement in compliance with speed limits is needed. Compliance with speed limits is one of the major challenges the analysis group sees in the years ahead, if the more challenging EU target is to be achieved. Not even half of the traffic volume on national roads complies with speed limits, and the figures are worse yet for heavy traffic and motorcycles. Compliance with speed limits on the municipal road network is also far from the level required in order to achieve the target.

A further special challenge is the share of new vehicles with driver support systems such as automatic emergency braking (AEB) and lane keeping assistance. The prognosis for the review of the interim target assumed that all new cars from 2015 would be equipped with these systems, but this now looks overly optimistic, as sales of cars with lane keeping assistance remain marginal even in 2014.

However, the analysis group's assessment is still that the target of no more than 133 road deaths by 2020 is achievable – if the right measures are applied and allowed to interact with each other in a well thought-out way.

5.2 Discussion

Road safety work will not achieve optimal effects if the indicators for management by objectives are addressed in isolation from each other. The cumulative effect of the indicators' target fulfilment is not necessarily the same thing as the sum of the potential of all the indicators. This is because some indicators relate to the same set of problems, which can lead to the number of saved lives being counted twice and thus an overrating of the indicators' road safety effects. Conversely, "system effects" mean that certain road safety measures are a prerequisite for the functioning of others, and sometimes also for reinforcing their effects. This can lead to an underrating of the number of lives saved, if the effects are simply added up. The road safety effects of the indicators therefore have to be analysed from a system perspective.

A concrete example of this is the development of AEB in passenger cars. These systems are directly related to the speed at which the vehicle is travelling. A recent study (Rizzi et al 2014) shows that the injury reducing effects of low-speed AEB are considerable on roads with speed limits up to 50 km/h, as the system is switched off at speeds above 50 km/h. It follows that compliance with speed limits becomes extra important in order for a vehicle safety system such as AEB to achieve its full potential.

In the current set of indicators it is precisely the indicator for speed limit compliance that has the greatest effect on other indicators. The fact that this indicator is not in line with the required trend in 2013 thus also affects the benefit of the indicators for safe passenger cars, safe motorcycles, seat belt use and safe national roads. It is difficult to assess, however, exactly how much speed limit compliance affects the other indicators.

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