TRAFIKVERKET
SWEDISH TRANSPORT ADMINISTRATION

Analysis of Road Safety Trends 2017

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

VISION ZERO
TOGETHER WE SAVE LIVES

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Foreword

This report is the tenth of the annual follow-up of the progress towards the road safety objectives for road traffic safety in Sweden by 2020. It describes and analyses the development of traffic safety in 2017. As in previous years, the results are analysed in terms of the number of fatalities and injuries as well as of a series of safety performance indicators.

The report was written by a group of analysts from the Swedish Transport Agency, Transport Research Institute (VTI), and the Swedish Transport Administration. The following analysists have contributed to the report: Khabat Amin, Karin Bengtsson, Jonathan Hedlund, Peter Larsson and Hans-Yngve Berg (Swedish Transport Agency), Åsa Forsman and Anna Vadeby (VTI) as well as Magnus Lindholm, Simon Sternlund and Matteo Rizzi (Swedish Transport Administration).

The report served as the basis for the results conference in Stockholm on the 25th of April, 2018.

Summary

The road safety work in Sweden is based on Vision Zero and the designated interim targets to achieve its objectives. The current interim target for road traffic safety is to halve the number of fatalities between 2007 and 2020. This means a maximum of 220 road fatalities in 2020. The interim target also means that the number of seriously injured in road traffic should be reduced by one quarter.

In this report, the development of road traffic safety is presented and analysed in terms of the number of fatalities and injured, based on the safety performance indicators.

The report constitutes a basis for the efforts that will lead to achieving the targets by 2020. The table below shows the present level of the indicators and assessments of whether the development of the indicators are sufficient for achieving the target by 2020.

Safety Performance Indicators	Starting points (2007)	2017	Targets in 2020	Assessed development towards target
Number of fatalities on the roads	440	253	220	In line with the required trend
Number of seriously injured on the roads	5 400	4 400	4 100	In line with the required trend
Share of traffic volume within speed limits, national road network	43 %	45 %	80 %	Not in line with the required trend
Share of traffic volume within speed limits, municipal road network (started in 2012)	64 %	67 %	80 %	Not in line with the required trend
Share of traffic volume with sober drivers	99.71 %	99.74 %	99.90 %	Not in line with the required trend
Seat belt use in the front seat of passenger cars	96 %	98 %	99 %	In line with the required trend
Share of cyclists wearing a helmet	27 %	44 %	70 %	Not in line with the required trend
Share of moped riders using a helmet correctly	96 %	98 %	99 %	In line with the required trend
Share of traffic volume for passenger cars with highest Euro NCAP rating	20 %	72 %	80 %	In line with the required trend
Increased rule compliance among motorcycle riders	-	-	-	Not yet measured, no target defined
Share of traffic volume with median barriers on national roads with speed limit above 80 km/h	50 %	76 %	90 %	Not in line with the required trend
Share of safe pedestrian, bicycle and moped crossings	19 %	27 %	35 %	In line with the required trend
Share of municipalities with good maintenance of bicycle paths	18 %	36 %	70 %	Not in line with the required trend
Systematic traffic safety work in line with ISO 39001	-	-	-	Not yet measured, no target defined

The number of fatalities and seriously injured is in line with the necessary development

In 2017, there were 253 fatalities in road traffic crashes in Sweden, which represents the lowest number of annual road fatalities since the 1940s. The number of fatalities is thereby 43 percent lower than the average for 2006-2008. Since 2013, the positive development in traffic safety has stagnated and the trend has suggested that the development is not fast enough to reach the 2020 target. However, the fatalities decreased in 2017, which now means that the outcome is in line with the necessary development. If the decrease in the number of fatalities is a trend break or a coincidence is too early to say. We know that several of the indicators that have been pointed out as the most important to reach the target in 2020 have not been developed in a positive enough outcome. Therefore, the overall assessment of the analysis group is that it is uncertain if the target regarding fatalities in 2020 will be met. This assessment is also strengthened by the prognosis of numbers of fatalities in 2020 that was made in the project *Review of the 2020 interim targets* (Swedish Transport Administration and Swedish Transport Agency, 2016), which showed that the expected outcome is not reaching the 2020 target.

For 2017 the number of seriously injured is calculated to be approximately 4,400. There has been a marginal decrease since 2010 and the outcome for 2017 is at the margin for the necessary yearly development. The planned actions to reduce the number of seriously injured are expected not to be efficient enough. While the analysis group thereby assesses that the development for seriously injured is currently in line with the required development, it may still be difficult to reach the target in 2020.

Single vehicle crashes are more common than head-on crashes

Since the beginning of 2000 until 2013 there was a large decrease in the number of fatalities. Between 2006 and 2013 there was mainly a decrease in fatal head-on crashes on roads with speed limits 70-90 km/h. The number of fatalities in single-vehicle crashes on these roads also decreased during this period, but not to the same extent. It is now more common with fatalities in single-vehicle crashes than in head-on crashes on these road sections. Single-vehicle crashes with motor vehicles is also the only crash type where an increase can be seen in the number of fatalities compared with 2016. By a total of 253 people who died in 2017 in Sweden, almost 100 people died in single-vehicle crashes with motor vehicles. A high proportion of the single-vehicle crashes were alcohol- and/or drug-related.

15 lives per year can be saved on Swedish roads if the travel speed can be lowered with 1 km/h

The road design and car fleet safety gains require that they are combined with the right speed. Starting in 2016/2017 the Swedish Transport Administration initiated a speed revision to adopt the speed limits to the road's safety standard. For a long time, the speed limit has been too high relative to the road's safety standard, and it is not practically possible in a higher extent to achieve an improved speed compliance by changing the design of the roads. Calculations show that 15 lives per year can be saved in Sweden if the travel speed can be lowered with 1 km/h, but the speed levels and the compliance of speed limits on national roads have not improved since 2012 but rather worsened. The analysis group assesses it as very unlikely that the targets for speed limit compliance on national roads in 2020 will be reached.

On municipal streets, it is foremost all the speed compliance on streets with lower speed limits (and foremost all the streets with 40 km/h) that needs improvement.

An effective action will be increased surveillance with automatic speed cameras, but it is far from enough. The Swedish Police's manual speed surveillance has

decreased, and fewer people are being fined for speeding. Therefore, it has become even more important with the implementation of other innovative solutions, such as vehicle-technology, self-monitoring of the speed compliance in company car fleets and new types of insurances. Though, due to limited time, these solutions will probably not contribute enough to achieving the targets in 2020.

Percentage of drunk drivers keep developing negatively

The proportion of sober traffic is high in Sweden, but the indicator for sober drivers has continued to worsen and is therefore not in line with the required development. The negative trend with more fatalities in alcohol- or drug-related traffic crashes has continued. During 2017, 81 people died in those crash types, which is equivalent to 32 percent of the total number of fatalities in road traffic crashes. During 2016, the number of drug-related crashes increased marginally, especially amongst drivers of passenger cars – and it has not reduced in 2017. The Swedish Police Authority and the Swedish Transport Administration has, therefore, started a joint work in order to streamline the sobriety controls.

Rule compliance in fatal motorcycle crashes is low

More than half of the fatal crashes with motorcycles are associated with one or more violations. Currently, there are no fully developed strategies to adapt the road transport system to a safe system for motorcycles, and therefore the rule compliance is even more important for motorcyclists than for other road users. However, we lack effective routines to measure this in traffic. The Swedish Transport Administration's in-depth studies are currently the only source with enough detailed information to, as far as possible, assess the rule compliance amongst motorcyclists. In crashes with fatal outcome, the rider has used the motorcycle correctly in about 25 percent of the cases.

Seat belt reminders are important for the use of seat belts

Since 2015, the proportion of new cars sold in Sweden with the highest safety rating in Euro NCAP is about 90 percent, which indicates that the target for the indicator regarding safe cars with all probability will be reached in 2020. Also, the proportion of traffic volume with passenger cars equipped with seat belt reminders has been predicted to reach approximately 95 percent in 2020. The development in 2017 continues to be in line with these assumptions.

The usage of a seat belt in the front seat of passenger cars was 97.6 percent in 2017, which means that the usage has decreased marginally compared to 2016 when it was 98.1 percent. Despite the high proportion of seat belt usage, almost one-third of all fatalities in a passenger car was not using a seat belt. Of those who died not wearing a seat belt, almost 80% were sitting in cars made before 2003, the year that modern seat belt reminders were introduced. It is possible that the total seat belt usage will reach the target of 99 percent usage in the front seat until 2020 – solely as an effect of the increased proportion of seat belt reminders.

The majority of seriously injured in traffic are cyclists and car occupants

Cyclists and car occupants account for about 80 percent of all seriously injured in the traffic. Although the number of seriously injured car occupants are decreasing and there is a reason to believe that the trend will continue, due to safer cars. The number of seriously injured cyclists, however, has not been improving to the same extent. To reduce these injuries, the responsible road authorities have to provide a good maintenance of pedestrian and bicycle paths, from the short perspective. In a longer perspective, increased attention must also be paid to the needs of vulnerable road users in terms of infrastructure design. The usage of helmets amongst cyclists also needs to increase, as does the development of other

protective equipment. Speed secured crossings for pedestrians, bicyclists and mopedists is another area that is important to keep in focus.

Urgent actions are needed to reach the interim targets in 2020

In summary, the analysis group assesses that too many indicators are not in line with the required development, in perspective of the time left until 2020. It is still possible to reach the interim targets in 2020, but to ensure that this happens as a result of our systematic work in traffic safety, it would demand actions that rapidly improve the status of the indicators.

Contents

1 Introduction

The current interim target for the Swedish traffic safety work was adopted by the Swedish parliament in 2009. The target is to halve the number of fatalities in road traffic between 2007 and 2020 (Govt. Bill 2008/09:93 Objectives for future travel and transports). This means that the number of road fatalities 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.

In the bill, it is also further specified that the targets are to be reviewed in 2012 and 2016. The purpose of the review is a way of ensuring that road safety work always has the most relevant and motivating targets possible. The analysis that was made in 2016 showed that target management for 2020 needs to become more action-oriented and that few adjustments are needed to be made to the current indicators until 2020.

The indicators that were added in 2016 were ”increased rule compliance amongst motorcyclists” and ”Systematic traffic safety work in line with ISO 39001.” The same year, the government also decided on a *New Start for Vision Zero*. The government then gave the Swedish Transport Administration the mission to lead a cooperation of the traffic safety work, to continue with the work that has functioned well, and to further develop what has not functioned well. The Swedish Transport Administration has therefore driven a national project during 2017 to clarify the mission. The project ended in March 2018.

The development of the number of fatalities and seriously injured in road traffic can in simplicity depend on three factors:

1. **Systematic traffic safety work** in form of safer roads, safer vehicles, regulation and law-making, education for road users, enforcement and so on.

2. **External factors** that are not affected by systematic traffic safety work but that affect the road transport system, for example, an increase in traffic, demographic changes and weather variations. These factors are described from an overall perspective in chapter 3.

3. **Random variations** that vary depending on the size of the grouping. For the number of injured, the random variation is of less significance, but for the number of fatalities, it can be as high as up to 10 percent.

The road safety targets for the systematic traffic safety work are managed with the help of a number of indicators. This means that targets have been set up for a number of different areas, termed safety performance indicators. The target completion for the indicators are followed up and evaluated each year, and later presented during the annual result conferences. The aim of this working method is to establish a long-term, systematic approach to road safety work.

The working method is continuously being developed and improved through cooperation between several organisations within the *Group for Vision Zero*. Currently the following organisations are participating in the group: The Swedish Work Environment Authority (Arbetsmiljöverket), Folksam Insurance, the National Society for Road Safety (Nationalföreningen för trafiksäkerhetens främjande), National Police Board (Polismyndigheten), SAFER, Swedish Association of Local Authorities and Regions (Sveriges Kommuner och Landsting), the Swedish National Association of Driver Trainers (Sveriges Trafikskolors Riksförbund), The Swedish Association of Road Transport Companies (Sveriges Åkeriföretag), Toyota Sweden AB, the Swedish Transport Agency (Transportstyrelsen) and the Swedish Transport Administration (Trafikverket).

A key part of management by objectives is thus the follow-up of indicators. Each of the indicators has a target value to be achieved by 2020. Together, these targets are evaluated to correspond to the overall target for road safety development. The keynote is that the target for 2020 should be reached due to the systematic road safety work – regardless of what effects the external factors and other random variations might have on the outcome.

The following indicators are currently being followed-up as part of management by objectives (exact measurement descriptions and target levels are described in chapter 4):

- **Speed limit compliance, national road network**
- **Speed limit compliance, municipal road network**
- **Sober traffic**
- **Use of seat belts**
- **Use of helmets**
  – Bicycle helmet
  – Moped helmet
- **Safe passenger cars**
- **Safe national roads**
- **Increased rule compliance amongst motorcyclists**
- **Safe pedestrian, bicycle and moped crossings**
- **Maintenance of safe pedestrian, bicycle and moped paths**
- **Systematic traffic safety work (in line with ISO 39001)**

In addition to the national target, there is an interim target on EU-level regarding the number of fatalities in road traffic to be reduced by half between 2010 and 2020. In Sweden, this corresponds to a target of maximum 133 fatalities in 2020.

1.1 Aim

The aim of this report is to describe and analyse the Swedish road safety development in 2017. This is done by presenting and analysing the current situation in terms of the number of fatalities and seriously injured, external factors and the development for each of the safety performance indicators.

Taken together, the analysis report will point out which indicators are the most important to change or improve to increase the road safety and, by extension, to achieve the interim target by 2020. The report formed the basis for the 2018 annual result conference and for the continued planning of the road safety work in Sweden.

1.2 Starting-points

The starting point for the analysis is the targets and safety performance indicators that underline the interim targets. These were formulated by the former Swedish Road Administration (Vägverket) in collaboration with several national organisations – see the report entitled “Management by objectives of Road Safety Work” (Vägverket 2008).

In 2012, the Swedish Transport Administration conducted a first review of the targets and indicators to ensure the follow-up methods were relevant and up to date. In 2016, another review was made. The intention was to suggest a smaller revision of the indicators and answer the question of whether the currently planned road safety interventions will lead to the achievement of the target in 2020. The method that was used in 2016 was basically the same as the one that was used on the first review of the interim targets.

The review showed that the interim targets for the number of fatalities by 2020 might be possible to be achieved, given that the further actions are put in quickly, apart from the ones already planned. The stagnation of the number of fatalities that has happened since 2013 and the fact that a few indicators have not developed in line with the required development, makes it more difficult to achieve the current interim targets. For the target regarding seriously injured to be reached, further actions are needed than those identified by the review.

2 Number of fatalities and seriously injured

A person who died within 30 days of a road traffic crash is counted as a fatality that results from the crash. A road traffic crash is defined according to the definition with official statistics as "a crash that occurs in traffic on a public road, used for traffic with motor vehicles, in which at least one moving vehicle is involved, and which causes personal injury". Pedestrians that have been killed or injured as an outcome of falling in road traffic are therefore not included in the statistics over traffic crashes with personal injuries (in the fatality figures).

Suicides in the road transport system were previously included in Sweden's official statistics of fatalities in road traffic. Transport Analysis (Trafikanalys) has the responsibility to present suicid in the road transport system separately from 2010. From 2010, the suicides are thereby excluded from the official statistics of fatalities in road traffic crashes. This causes the statistics from 2010 not to be fully comparable with statistics from previous years. Between 2010-2012 the method used to classify suicides was further developed, which is a contributing factor leading to a rise in the number of assessed suicides during that period. Since 2012, however, the method has been established (Swedish Transport Administration 2014) and shows that suicide is responsible for about 10 percent of all fatalities in traffic. During 2017, 29 road fatalities were classified as suicide.

Seriously injured in relation to a road traffic crash is defined as an injury that will give at least 1 percent permanent medical impairment. Permanent medical impairment is a term used by the insurance companies to value disabilities, no matter what caused it. A problem with using the measurement of permanent medical impairment is that it often takes a long time between injury and confirmed permanent impairment. Since 2007, another method is therefore used that makes it possible to project the number of people with permanent medical impairment. The method was described in Berg et al. (2016). An injury is considered as very serious if it causes 10 percent permanent medical impairment or more.

Strada (a national reporting system for road traffic crashes with personal injuries in Sweden) is used as the source for fatalities and seriously injured. Strada is based on data from the Swedish Police and emergency hospitals. The number of fatalities is registered by the police. The number of seriously injured is calculated based on all injuries being reported by the medical care. This is because it is only possible to forecast the number of seriously injured by medical examined injury information.

In 2015, the hospital's instructions for reporting to Strada changed to make sure that no registration in Strada was made without the patient's consent. The change meant a reduced reporting from the hospitals that changed their routines. The reporting from the hospitals that changed their routine has now been stabilised on a new, lower level and to be able to follow the development of seriously injured the calculations have been adjusted. Until 2015, adjustments were made to handle the external data loss which occurred since not all emergency hospitals were connected to Strada. Apart from these specific data loss types, the reporting frequency can also be affected by factors such as staff turnover, workload or another type of work situation in medical care (Fredlund 2016).

The number of fatalities and injured in road traffic is affected by several factors, for example, actions for traffic safety, traffic volume and external factors. There is also a random variation in the outcome in the number of fatalities and injured between the years. For the number of injured the random variation is of less significance, but for the number of fatalities, the relative margin of error can be as high as 10 percent.

2.1 Fatalities

	Mean value 2006–2008	2017	Target for 2020	Assessed development towards target
Number of fatalities	440	253	220	In line with the required trend

The Swedish parliament finalised an interim target for the traffic safety development in May 2009, saying that the number of fatalities should be halved to a maximum of 220 in 2020. And beyond the national target, there is an interim target on EU-level to halve the number of fatalities in road traffic between 2010 and 2020. This corresponds to an interim target of maximum 133 fatalities.

Development and projection towards the 2020 target

During 2017, 253 people died in road traffic crashes, which is the lowest number in Sweden since the 1940s. This means the number of fatalities in 2017 is 43 percent lower than the average for 2006-2008, and the number is within the required development needed to reach the target in 2020.

Since 2013, the positive traffic safety development has stagnated, and when the development over the past years is studied in relation to the target of maximum 200 fatalities in road traffic by 2020, it appears uncertain if the target will be able to be reached, see figure 1. This is also strengthened by the forecast of the number of fatalities in 2020 that was made in the interim targets review, which showed that the expected outcome is above target.

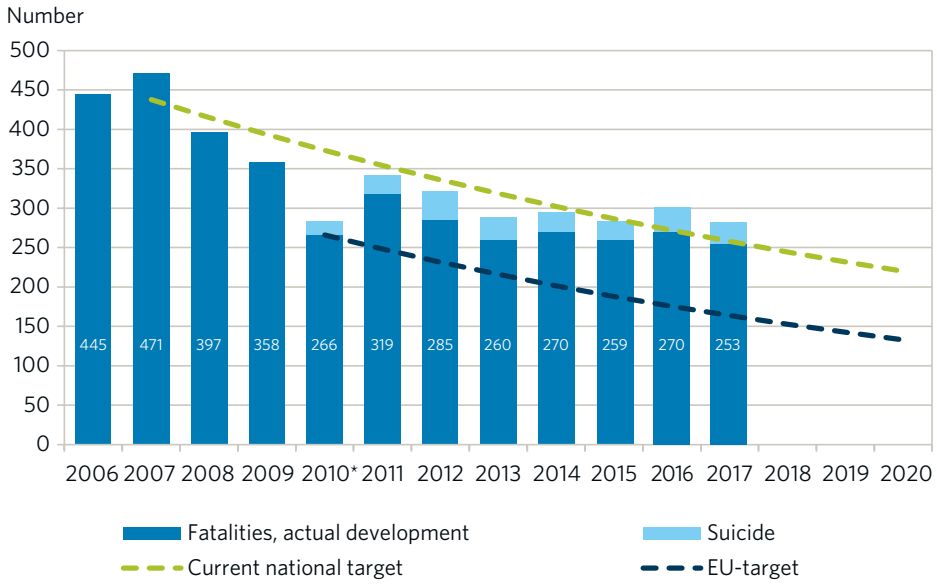

Figure 1. *The number of fatalities in road traffic crashes 2006-2017, and the required development until 2020. *Suicide is excluded since 2010. Source: STRADA.*

Figure 1 also shows the required development in the number of fatalities for meeting the EU-target of halving the number of road fatalities between 2010 and 2020, to a maximum of 133 fatalities in 2020. From the figure, this indicates that the number of fatalities is greater than the required trend for meeting the EU-target.

If the number of fatalities is studied based on the different categories of road users, age and gender respectively (table 1), we see that 196 men and 57 women died in 2017. It is a decrease with 12 percent for women and 4 percent for men, compared

to 2016. The proportion of men and women by the number of fatalities has for a long time been 75 and 25 percent respectively.

	0-17 years	18-24 years	25-44 years	45-64 years	Over 65 years	Woman	Man	Total
Car drivers	0	22	28	29	19	16	82	98
Car passengers	5	7	14	7	12	18	27	45
Cyclists	2	0	3	5	16	3	23	26
Pedestrians	2	2	5	7	21	17	20	37
Moped riders	0	0	1	0	0	0	1	1
Motorcyclists	0	9	15	10	5	2	37	39
Others	1	0	0	1	5	1	6	7
Total	10	40	66	59	78	57	196	253

Table 1. The number of fatalities in 2017 divided by road user category, age and gender. Source: Strada.

In figure 2, it is made clear that the previous year's stagnation applies to all categories of road users, even if it has been in different extents over the years and between different road user categories. However, the stagnation is most obvious for motorists, which is the group where the number of fatalities has previously had the largest decrease.

In 2017, 143 motorists died in road traffic, that compare to an average of 280 per year in 2006-2008. A part of the decrease of fatalities with cars between 2009 and 2010 is due to the suicides being excluded from the statistics from 2010, but it only explains a part of the decrease.

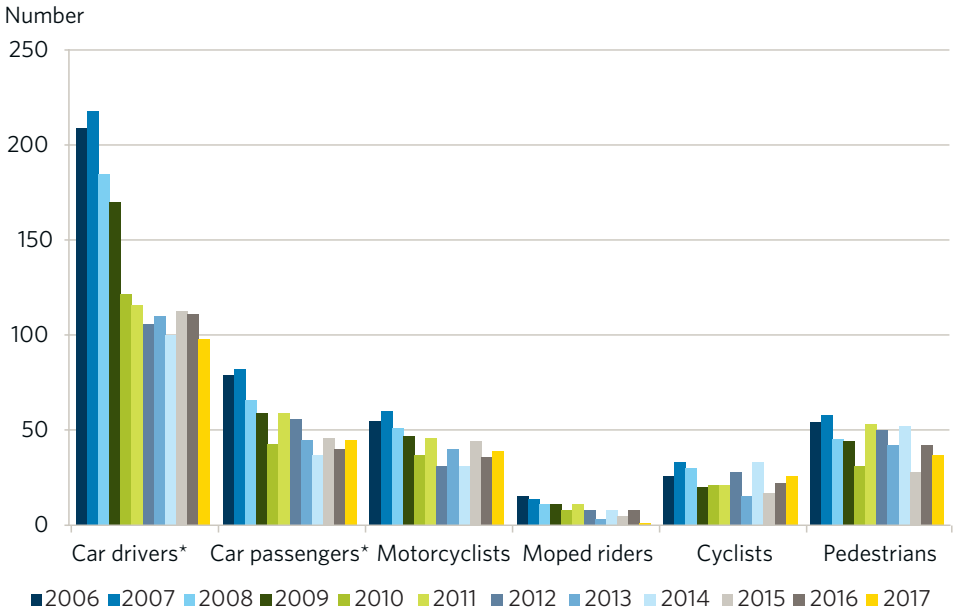

*Figure 2. The number of fatalities divided by road user category 2006-2017. From 2010 onwards, suicide is not included in the statistics for the fatalities of traffic crashes. *By car is meant passenger car, truck and bus. Source: STRADA.*

In 2017, 39 fatalities occurred on motorcycles (where 3 had travelled on four-wheeled motorcycles) compared to 36 fatalities in 2016. Of the people who died on a motorcycle in 2017, 20 died in single-vehicle crashes and 18 in a collision with a motor vehicle.

The number of fatalities on bicycles was 26 in 2017, which is somewhat more compared to 2016 when 22 cyclists died. However, the variations over the years are great; on average 24 cyclists died per year during the period 2007-2017. The most common type of crash amongst cyclists is a collision with motor vehicles, but in 2017 there have been as many crashes in a collision with motor vehicles as single-bicycle crashes.

In 2017, 37 pedestrians died in a collision with a motor-vehicle compared to 42 pedestrians killed in 2016.

Figure 3 shows what the development for the number of fatalities has looked like for the different types of crashes during the years 2006-2017. The most common type of fatal crash is single-vehicle crashes involving motor vehicles. Of those who died in 2017, 97 people died in single-vehicle crashes with motor vehicles.

The second most common type of crashes is head-on crashes. In 2017, 46 people died in head-on crashes. The stagnation from 2013 is also clearest in these two types of crashes, which previously were the ones that decreased the most.

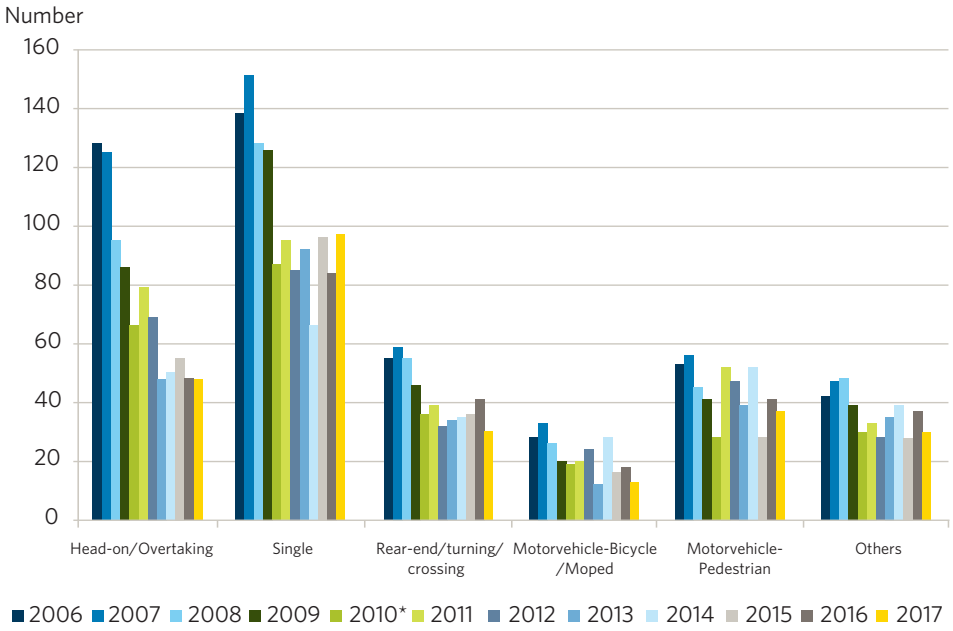

Figure 3. *The number of fatalities divided by crash type, 2006-2017. *From 2010 onwards, suicide is not included in the statistics for the fatalities of traffic crashes. Source: STRADA.*

Single-vehicle crashes with motor vehicles are the only crash type where we can see an increase in the number of fatalities compared to 2016. The number of fatalities within the different types of crash vary between different years (which is made clear in figure 3), but in recent years the number of fatalities in single-vehicle crashes have increased. Of those who died in a single-vehicle crash about 20 percent collided with trees, either in direct connection to the road or outside the side area.

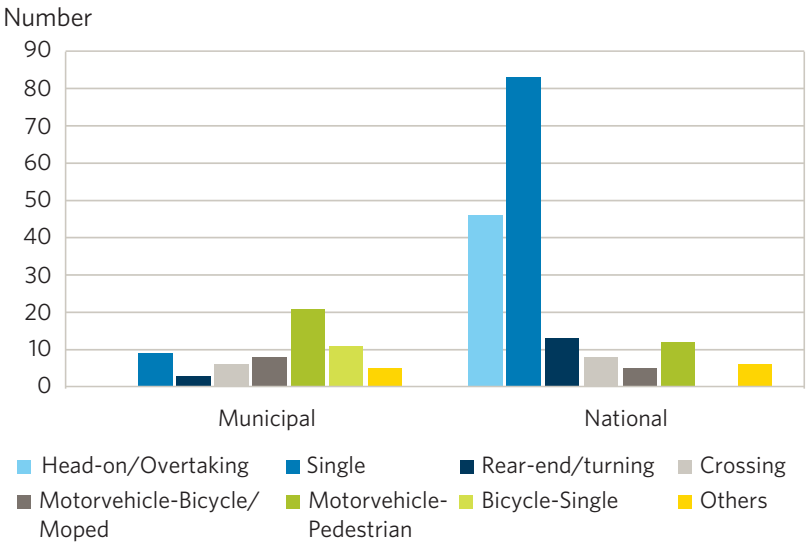

Figure 4. The number of fatalities divided by crash type and road authority, 2017. Source: STRADA.

Figure 4 shows what type of crash people died in during 2017, divided into municipal and national road authorities respectively. About 25 percent died on municipal roads, almost 70 percent on national roads and 6 percent on private roads. The distribution of different types of crashes is different depending on the road authority. In the municipal road network, the highest number of fatalities were in collisions with pedestrians and motor vehicles, and on the national road network, the highest number of fatalities were in single-vehicle crashes with motor vehicles.

A closer investigation of the single-vehicle crashes on the national road network in 2017 (shown in figure 4) shows that 63 of them, which corresponds to about 75 percent, occurred on roads with the speed limits 70-90 km/h. Of these, 9 people travelled on motorcycles and 54 as motorists.

Furthermore, we can see that regardless of the road authority, the highest number of fatalities occur on roads with speed limits 70-90 km/h. Out of all of those who died on national roads in 2017, 77 percent did so on roads with 70-90 km/h and 6 percent on roads with speed limits below 70 km/h. 17 percent had been travelling on roads with a speed limit of 100 km/h or higher.

Since the beginning of 2000 until 2013 there was a large reduction in the number of fatalities. Between 2006 and 2013 there was a decrease in fatal crashes on roads with speed limits 70-90 km/h and in head-on crashes – they decreased with more than half during this time. The number of fatalities in single-vehicle crashes on the 70-90 km/h roads decreased during this period, but not in the same way. It is now more common with fatalities in single-vehicle crashes than in head-on crashes on these roads.

The number of children who died in road traffic decreased by 67 percent during the period 2006-2008 until 2017, but now the positive development has somewhat stopped. In 2017, 10 children died in the age group 0-17 years old, where 8 of them were under the age of 14.

For the age categories up to 64 years old there is a slight reduction in the number of fatalities. However, the trend is not the same for older people. Amongst people over the age of 65 years, it can instead be seen that the number of fatalities has increased over the past years. We do have an ageing population, but it cannot solely be the explanation for the increase.

Figure 5 shows the development in the number of fatalities in different age groups, divided into protected and unprotected road users. The term protected road users includes those who died in a passenger car, bus, truck, tractor and similar and unprotected road users include those who died on a motorcycle, moped, bicycle or pedestrian. Amongst the protected road users who died, the difference between the age groups is not very large but seen over the 2006-2017 period it seems the age group 65 years and older makes for a greater part of the fatalities. Amongst the unprotected road users who died, there are greater differences between the age groups. The age group 65 years and older is just like the protected road users, the biggest, and the percentage has also increased during the same period.

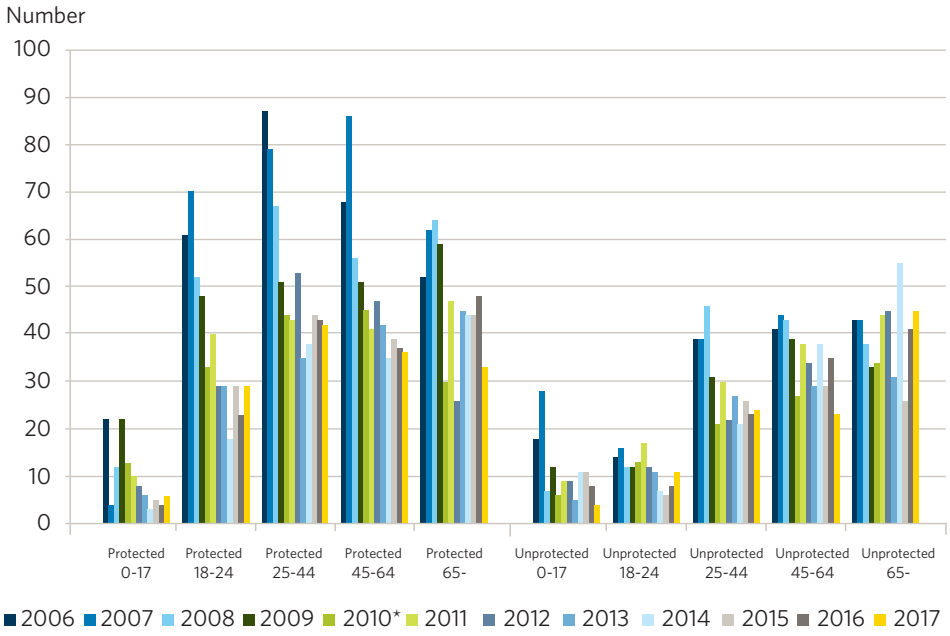

*Figure 5. Number of fatalities divided by unprotected and protected road users per age category and year, 2006-2017 *Suicide is excluded since 2010.*

Analysis and discussion

The number of fatalities in road traffic in 2017 is somewhat lower than previous years and below the line for the target in 2017, therefore the indicator for the number of fatalities is assessed to be in line with the required development. However, if the number of fatalities is looked upon from the recent years' development, it is not possible to state for certain that the stagnation going on since 2013 has been broken. Therefore, it is assessed as uncertain if the current target for the number of fatalities in 2020 will be able to be reached.

An analysis of the development within different types of crashes shows that single-vehicle crashes seem to be somewhat increased. The single-vehicle crashes with motor vehicles mostly occur on the national road network, on roads with speed limits 70-90 km/h. Previously most people died in head-on crashes on that part of the road network. For that reason, interventions to increase traffic safety have been made to decrease the number of head-on crashes. However, the efforts to decrease the single-vehicle crashes have not been carried out to the same extent.

It is more difficult to identify a certain type of road or road authority that is predominant when it comes to unprotected road users who died in road traffic. It is especially clear amongst pedestrians who are involved in crashes both in lower speeds on the municipal road network and in higher speeds on the national road

network. For the unprotected road users, there are large differences between different age groups, where the elders are particularly vulnerable. The recent year's development also implies the number of elders who dies as an unprotected road user has not decreased significantly since the beginning of the measurement period. This is something to take into consideration since we have an ageing population.

2.2 Seriously injured

	2007	2017	Target for 2020	Assessed development towards target
Forecast number of seriously injured	5400	4400	4100	In line with the required trend

The Swedish parliament's interim target for seriously injured in road traffic means the number of seriously injured should decrease with at least one quarter between 2007 and 2020. In the 2016 infrastructure proposition "Infrastructure for the future", the parliament put the target to a maximum of 4,100 seriously injured in 2020, which will be the starting point for the analysis of the seriously injured in this report. Seriously injured is defined as someone who has suffered at least 1 percent permanent medical impairment as a result of a road traffic crash and "very seriously injured" is defined as a permanent medical impairment of at least 10 percent suffered by anyone as a result of a road traffic crash.

Development and projection towards the 2020 target

For 2017 the number of seriously injured is calculated to almost 4,400. This means an annual overall decrease of 2 percent from 2007 to 2017, and that the outcome for 2017 is in line with the required development.

In figure 6, a 95 percent confidence interval is included, showing how big the uncertainty is in the forecast for the number of seriously injured for each year (Forsman et al. 2016). The confidence intervals are small, which shows low statistical uncertainty. However, the intervals do not take into consideration the external or internal data loss, which creates an uncertainty over the one shown in the diagram, even if adjustments are made for the external data loss.

The assessment is that the development is in line with what is required but considering recent years' stagnation it is still uncertain if the target for 2020 will be reached.

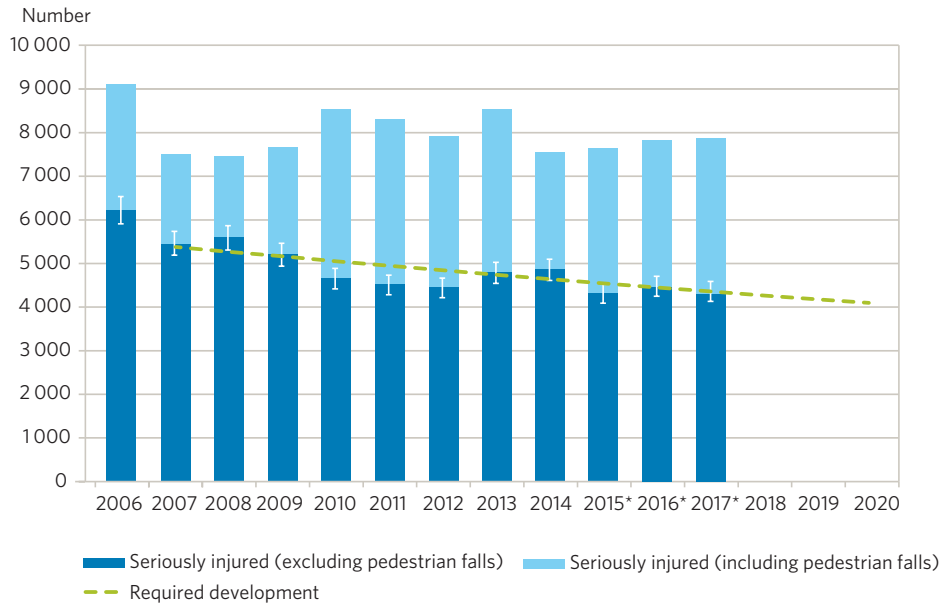

Figure 6. *Forecast number of seriously injured 2006-2017, and the required development until 2020. *Due to routine changes, 2015, 2016 and 2017 have been adjusted for internal data loss. Source: STRADA.*

Many of those who are seriously injured in the road transport system are pedestrians who have fallen to the ground, but it is a type of accident that is not a part of the formal definition of a road traffic crash. In figure 6, it is made clear that the number of seriously injured would be about 7,900 if pedestrian falls were included. A big part of the pedestrian falls occurs during the winter period. During some winter months, the number of pedestrians who are seriously injured in falls can be twice as high as the number of people who are seriously injured in other types of accidents.

In figure 7, the development in the number of seriously injured is shown by road user categories. Between 2010 and 2011 there was a change – from the fact that the seriously injured passenger car drivers being more than the seriously injured cyclists, to the injured cyclists becoming more. It has been like this ever since then.

In 2017, the number of seriously injured cyclists was about 2,000, which is in line with previous years. The number of people being seriously injured in a passenger car is expected to continue reducing. In 2017, it was about 1,400 people, which is the lowest level in Sweden in the period of measurement.

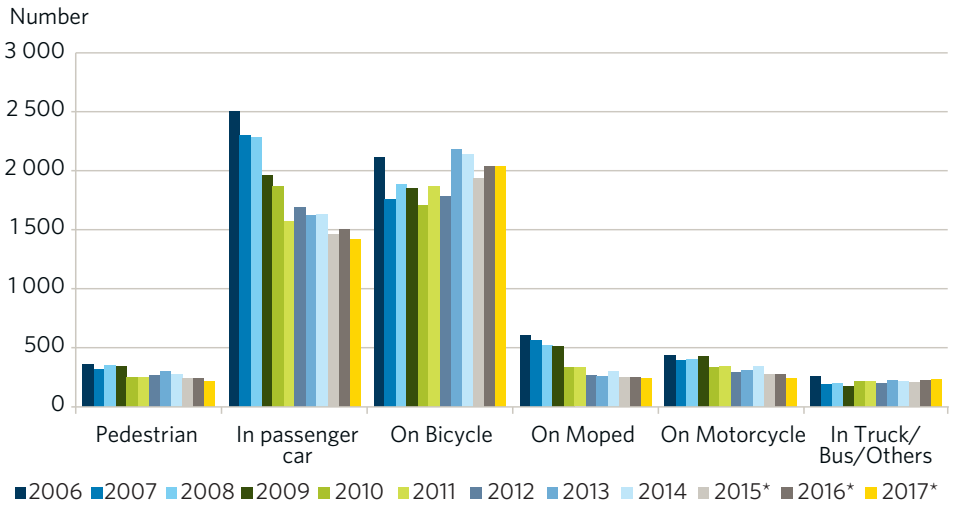

*Figure 7. Forecast number of seriously injured 2006-2017, divided by road user category. *Due to routine changes, 2015, 2016 and 2017 have been adjusted for internal data loss. Source: STRADA.*

Figure 8 shows the various road types where the different injured road user groups are most affected. Over 30 percent is injured on the national road network, 47 percent on the municipal road network, 8 percent on the private road network and in 15 percent of the cases there is no information about the road authority. As the figure shows there are great variations between groups of road users. By looking closer at the largest group of road users who are seriously injured, it is found that that six out of ten motorists are injured on the national road network and almost three out of ten on the municipal road network. Amongst the cyclists, on the other hand, six out of ten are injured on municipal roads and almost one out of ten on national roads. For a relatively large percentage of the cyclists being injured, information is missing regarding road authority. In about half of the cases, the cyclist has been injured on pedestrian and cycling paths in an urban area, which is a part of the municipal road network.

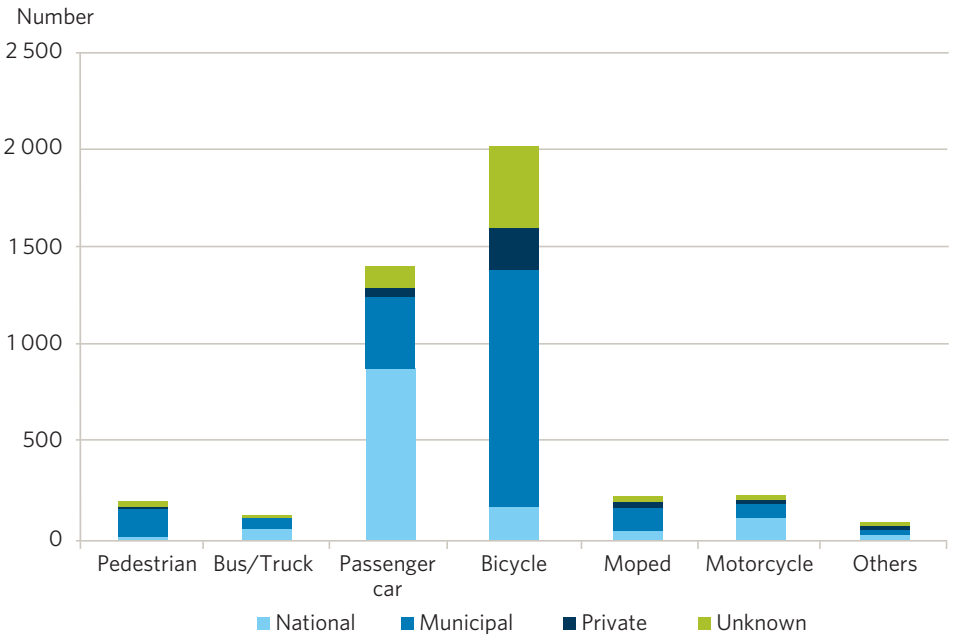

Figure 8. Forecast number of seriously injured 2017, divided by road user category and road authority. Source: STRADA.

Figure 9 shows in what type of accident different crash types different road users are injured. The ones who are seriously injured on bicycles, mopeds or motorcycles most often do so in single-vehicle crashes, whilst the motorists in almost half of the cases have been involved in some type of overtaking or crossing crash. Overtaking and crossing crashes where motorists are seriously injured occur both on the national road network and the municipal road network, whilst the single-vehicle crash mostly takes place on the national road network.

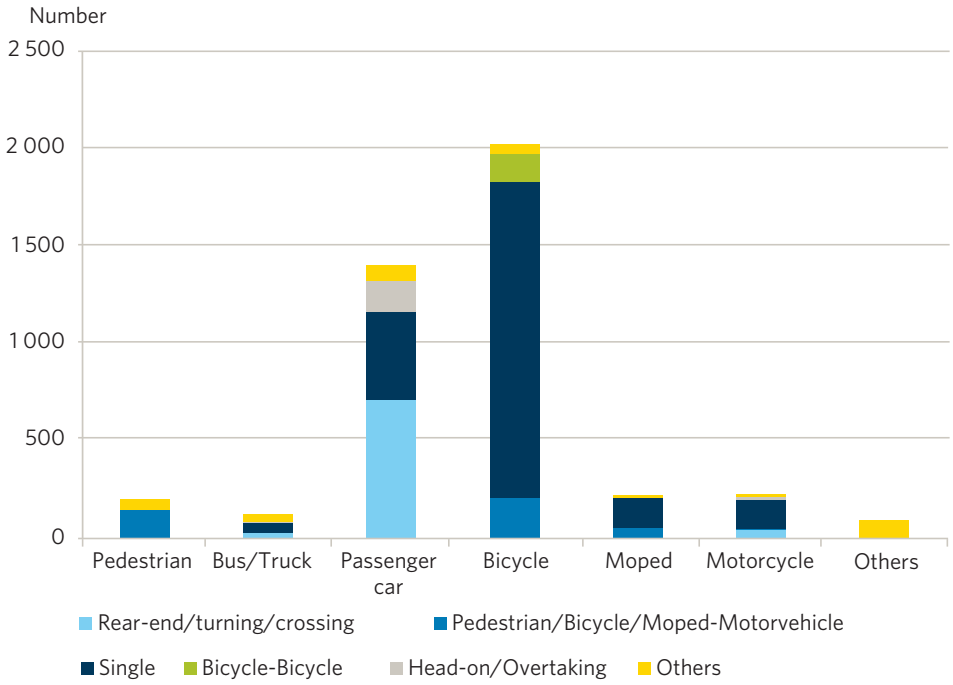

Figure 9. Forecast number of seriously injured 2017, divided by road user category and the crash type. Source: STRADA.

The distribution of seriously injured between the different groups of road users and level of severity can be seen in figure 10. Cyclists and passenger car occupants are the groups of road users who make for the greatest percentage of both seriously injured and very seriously injured. Together these two groups make for 80 percent of all injured within each level of severity.

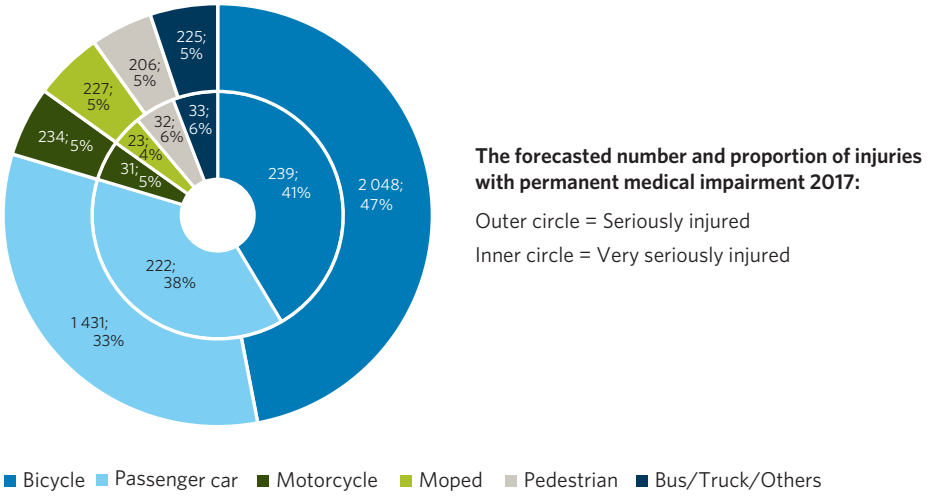

Figure 10. Forecast number and share of seriously injured (outer circle) and very seriously injured (inner circle) by travel modes 2017. The figure does not include pedestrian falls. Source: STRADA.

Amongst motorists who are seriously injured, neck injuries are the most common injuries, regardless of the degree of injury. The injury distribution for cyclists is different between the ones who are seriously injured and very seriously injured. For cyclists who are seriously injured, it is most common with injuries on arms, shoulders and legs, whilst those who are injured very seriously have in a larger scale sustained leg and head injuries.

The total number of seriously injured is presented below, divided into protected and unprotected road users as well as the age and gender, see figure 11. Generally, we can see that the distribution of seriously injured amongst the protected road users is not much difference between the genders. However, men are overrepresented when it comes to unprotected road users. When looking at the age distribution it is made clear that the percentage of elderly and unprotected road users who are injured is much larger than the elderly and protected road users. In the youngest age group, under the age of 18 years, there are also more unprotected than protected road users being injured, especially amongst men.

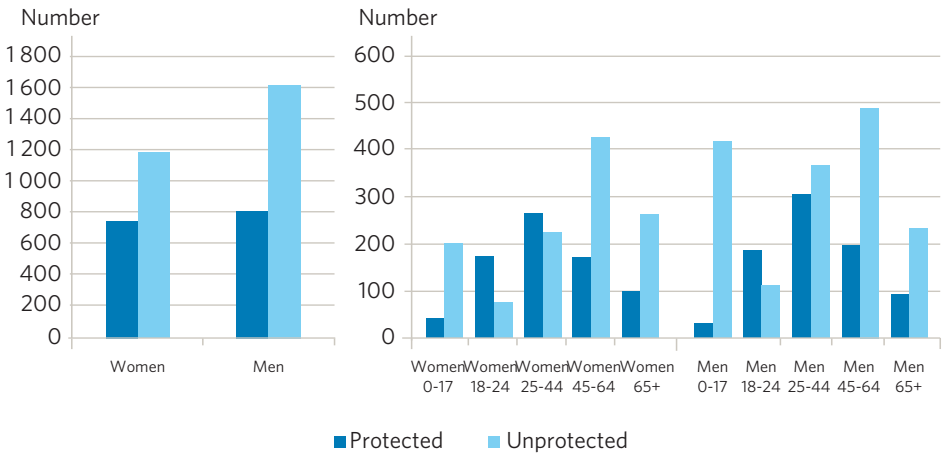

Figure 11. Forecast number of seriously injured 2017, divided into protected and unprotected road users as well as gender and age. Source: STRADA.

Studies have shown that quality of life after a road crash generally decreases and that the loss of quality of life depends on several different factors. Apart from the type of injury, the demographic, clinical, psychosocial and socioeconomic factors also play a role. Some groups are more affected by a road crash, for example, elderly people, women, groups with lower socioeconomic status and people diagnosed with posttraumatic stress-syndrome (Rissanen et al. 2017). Even mild injuries give an increased risk of not being able to regain the previous quality of life and full health. Therefore, a continued focus is needed to reduce a large number of mild injuries and their consequences (Rissanen et al. 2017 and Hasselberg et al. 2018).

Figure 12 presents the distribution of the total number of injuries having been reported to the hospital according to MAIS (Max Abbreviated Injury Scale)[1], the scale is reported by the medical care and measures how life-threatening an injury is on a scale of 1 to 6. By the figure, it is made clear that the large majority of injured people do not have life-threatening injuries. From a prevention perspective it is important to keep this large group of people with mild injuries in mind since there is a risk that despite the mild injuries, they still may not retrieve full health.

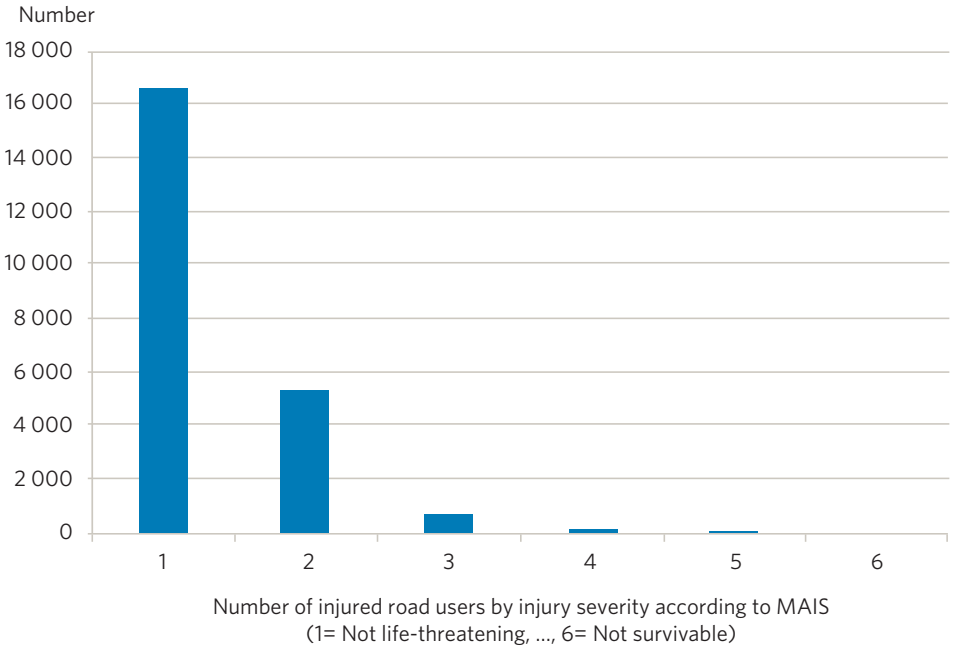

Figure 12. The number of injured in 2017 divided by the MAIS. Source: STRADA.

Analysis and discussion

In 2017, around 4,400 people have been projected as seriously injured and almost 600 as very seriously injured. In addition, almost 3,500 people are calculated to have been injured in pedestrian falls without any motor vehicle being involved – a type of accident not part of the formal definition for a road traffic crash. Cyclists and motorists are the groups of road users that make for the greatest percentage of injured, despite the degree of injury. Together these two groups make up for 80 percent of all injuries. The single-vehicle crashes also stand out amongst the seriously injured. Amongst fatalities, 40 percent occur in single-vehicle crashes with motor vehicles, amongst those who are seriously injured almost 40 percent are in single-vehicle crashes with a bicycle.

[1] MAIS-code (Max Abbreviated Injury Scale), is the risk of not surviving from the most serious injury to a specific body part where 1 represents "minor", 2 "moderate", 3 "serious", 4 "severe", 5 "critical" and 6 "maximum" life threat.

A prerequisite to reaching the target on seriously injured is to increase the safety for vulnerable road users as improving the safety for passenger car occupants. From a health perspective, the focus is also needed in preventing crashes and increased efforts on care, rescue and rehabilitation.

Pedestrians injured in falls do not count as a road traffic injuries according to the official definition of a road traffic crash. Together with the number of injured cyclists, they account for about 70 per cent of the total number of seriously injured in the road traffic environment. To decrease the number of crashes and injuries amongst cyclists and pedestrians the municipalities must improve the maintenance of pedestrian and bicycle paths. It will take great effort if we are going to reach the goal of 70 percent of the municipalities (larger than 40,000 inhabitants) with good quality on prioritised pedestrian and bicycle paths until 2020. Speed secured pedestrian, bicycle and moped crossings is another area important to keep in focus to reduce injuries amongst unprotected. The usage of helmets amongst cyclists also has to increase much faster than it is does currently. Together with actions to increase walking and cycling transportations, this should be able to provide an increased public health.

2.3 International comparison

From a global perspective, the number of fatalities in Sweden per capita is still very low. Only Norway and Switzerland are even lower, according to the latest available full covering international data (2016). In 2016, 2.7 people died per 100,000 inhabitants in road crashes in Sweden. In 2017, that number dropped further, and Sweden is now down to 2.5 people killed per 100,000 inhabitants. The preliminary numbers for Norway in 2017 indicate that their outcome per 100,000 inhabitants will be 2.1 fatalities.

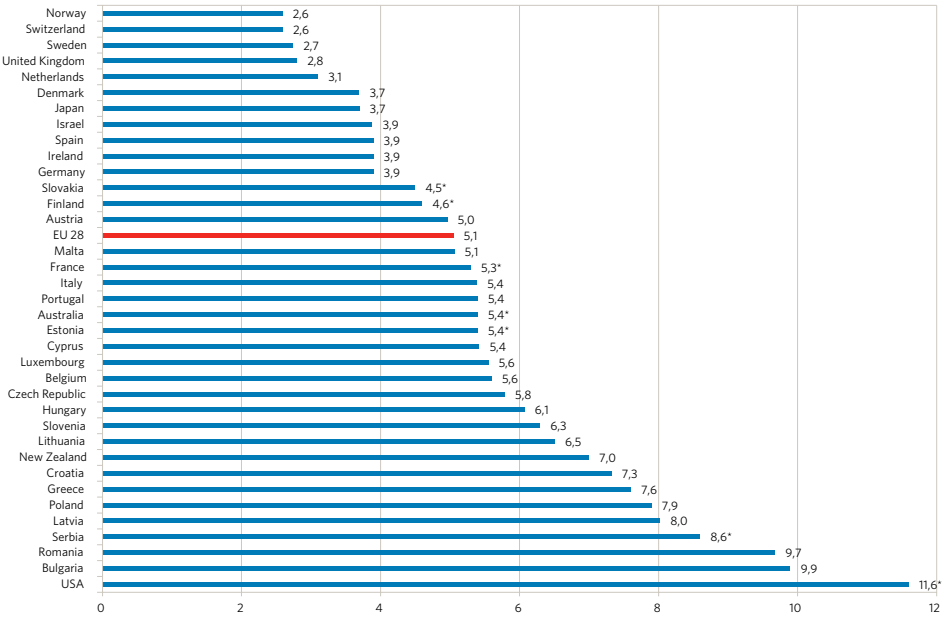

*Figure 13. An international comparison, fatalities in road traffic per 100,000 inhabitants in 2016. *Preliminary figures. Source: ETSC, OECD stat, IRTAD (2017).*

In figure 14, it is possible to see that the development in the number of fatalities over time in Sweden is like the rest of EU and the Nordic countries. The reduction in the number of fatalities has also on a European level been decreasing over the past years. If the EU's target for halving from 2010 to 2020 is going to be achieved, it is going to take an annual reduction of over 11 percent during the remaining period. Also, for non-European OECD-countries the development is similar. The change in the number of fatalities in the road traffic in Japan is in a high extent following the development in EU. Australia and USA have not had an equally positive development as the EU and Japan.

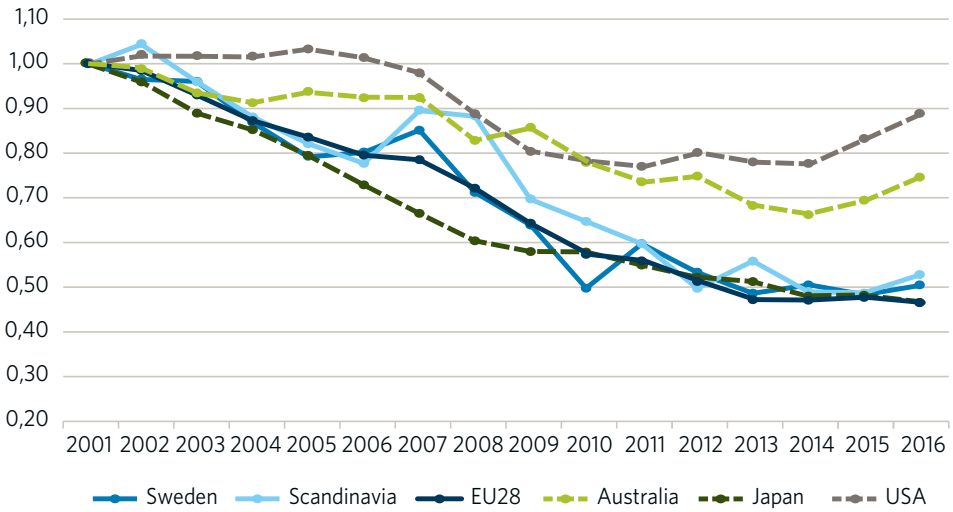

Figure 14. Development of the number of fatalities in Sweden, Scandinavia (Denmark, Norway and Finland), EU 28, Australia, Japan and USA 2001-2016 (index 2001=1). Source: ETSC, IRTAD (2018).

Data for 2017 for the Nordic countries (Finland, Norway, Denmark and Sweden) show a general reduction in the number of fatalities compared to 2016. In a comparison of a three-year average in the number of fatalities in the years 2006-2008 to 2017, it can be seen the number of fatalities in Norway has reduced by 57 percent and Denmark by 51 percent. In Finland, the number has decreased by about 40 percent and in Sweden by about 43 percent, respectively.

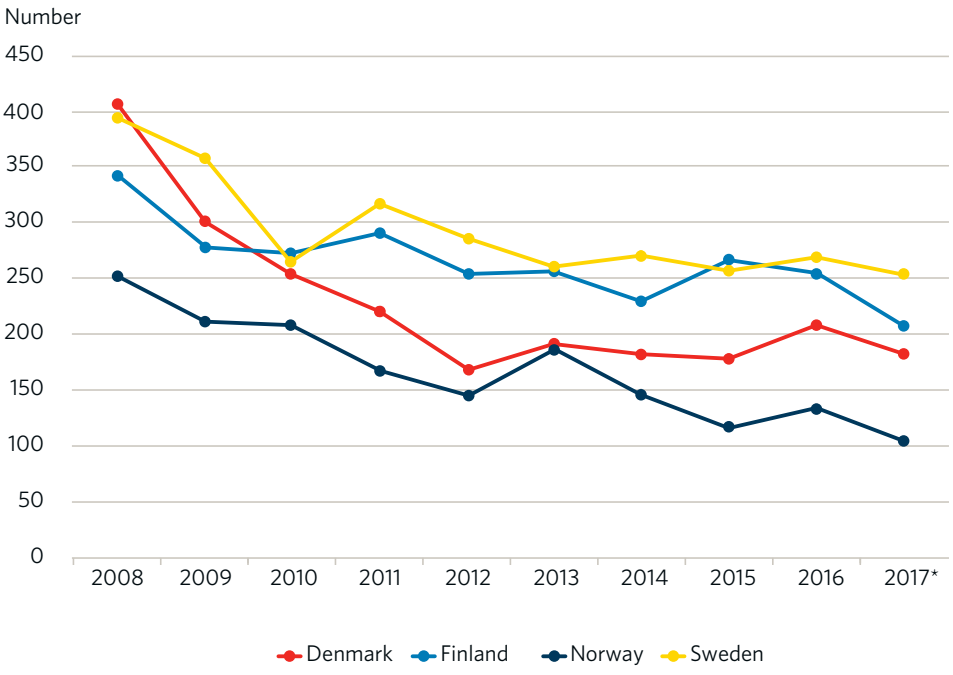

*Figure 15. The number of fatalities in road traffic per year in the Nordic countries 2008-2017. *Preliminary figures for Denmark, Finland and Norway. Source: SSB, Statistics Finland (Statistikcentralen), The Danish Road Directorate (Vejdirektoratet) and STRADA.*

3 External factors

In this chapter, some external factors are presented that can be important to keep in mind before interpreting the development of the number of injuries and fatalities as a result of the traffic safety work that has been conducted. The term external factors mean the factors that affect traffic safety but are outside what can be affected by the actual work in traffic safety. Some external factors can have a direct effect on traffic safety, like the weather for example. Other factors such as the age structure of the population and the economic situation, affect the composition of different transportation methods which then affect how the number of fatalities and injured in road traffic is developed. Different external factors affect the development of the number of fatalities and injured during the different amount of time. Both the economical situation and the age structure of the population usually change relatively slowly and cause a changed composition in average long-time cycles (about 5-10 years). The weather can cause season variation but can also have effect on very short terms (for example temporarily slippery roads) and long-term (for example climate change).

The weather, the age composition and economical situation affect the size of the traffic mileage in vehicle kilometre, which historically has had a clear connection to the development of the number of fatalities. Preliminary figures for 2017 show that the total traffic mileage for motor vehicles has increased with about 1.5 percent compared to 2016. The heavy vehicles traffic mileage has increased more (3.7 percent) than the passenger cars traffic mileage (1.2 percent). The increase of heavy vehicles has occurred on all types of roads, but mostly on European roads (5.0 percent). For passenger cars the increase has taken place on all roads except for on the other county roads (secondary and tertiary). The preliminary increase is relatively large. In comparison, the average annual increase in traffic mileage between 1996 and 2016 was only 1.1 percent. In figure 16, the development of the traffic mileage is presented for different types of vehicles between 1996 and 2017. The dominating group is passenger cars, which account for over 80 percent of the total traffic mileage on Swedish roads.

The traffic volume for motorcycles has been around the same level for the past years, around 700 million vehicle kilometres. The number of motorcycles in traffic is, however, increasing each year and has been doing so for a longer period. Between 2016 and 2017 the number of motorcycles in traffic increased from about 317,000 to about 320,000[2]. The number of mopeds class I[3] in traffic has increased from almost 105,000 in 2016 to almost 108,000 in 2017. The number of mopeds has now increased two years in a row after a previous heavy decrease. Data from the vehicle register also show that since 2012, there are more deregistered (officially put temporarily out of operation) mopeds than actual moped in traffic, as of 30 June. In 2017, there were approximately 164,000 deregistered mopeds.

The total bicycle traffic volume and its variation is difficult to estimate, as no national measurements are made. However, there are some local measurements to use. For example, the three largest cities in Sweden make annual measurements that are relatively comprehensive. The development between 2016 and 2017 shows unchanged or reduced cycling. In the central parts of Malmö, the cycling traffic is largely unchanged[4] and in Gothenburg, it is stated that cycling has decreased by about 4 percent (Gothenburg city, 2018). In Stockholm, the 5-year average values are presented where you can see a reduction by 2 percent between 2012-2016 and 2013-2017[5] (calculated on the inner-city average).

[2]Refers to the number of registered motorcycles in traffic by 30 June of the respective year according to the vehicle register. Source: Traffic Analysis/SCB.

[3]Moped class II are not included.

[4]Personal communication with Biljana Eriksson, Malmö City.

[5]Obtained data from Stefan Eriksson at the Traffic Office, Stockholm.

The total sales of bicycles decreased with about 4 percent between the 2015/2016 seasons and 2016/20176, from 576,000 to 551,000 bicycles. This means that the sales have decreased two years in a row, after a previous rise. However, the sales of electric bicycles increased by about 50 percent and represented 12 percent of the total number of sold bicycles.

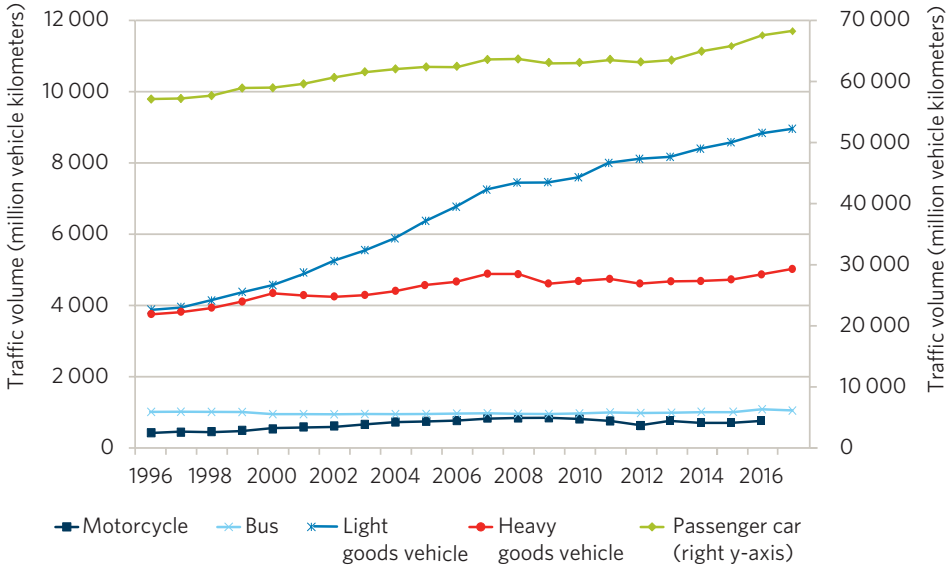

Figure 16. Traffic volumes by vehicle type, 1996-2017 (million vehicle kilometres). Note that the traffic volume for passenger cars is shown along the right-hand y-axis. Sources: Transport Analysis. *Data for 2017 is preliminary and has been adjusted upwards using change factors, as defined by the Swedish Transport Administration, for passenger cars (passenger cars and light goods vehicles) and heavy vehicles (heavy goods vehicles and buses), respectively. For motorcycles, no listing has been made because there are no relevant data yet.*

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. Also, the physical tolerance to blunt force varies with age. Figure 17 shows the change in the age composition between 1996 and 2017. The change between different age groups happens very slowly, but it is possible to see that the age groups 0-17, 25-44 and 75 and up has increased between 2016 and 2017, while the remaining groups have decreased. To look, on the other hand, at the actual number of people, there has been an increase in all age groups except for the age group 18-24 years old, where there has been a decrease with about 20,000 individuals.

The age group with the highest risk of being killed in traffic is the 75 years old group. One of the reasons among others is partly because people over 75 are more fragile and because they are frequently unprotected road users (Traffic analysis, 2011). The second highest risk group is the 18–24 although here it is primarily men who represent the high risk. The percentage of people over 75 years old has been between 8 and 9 percent from 1996 and beyond. Both the percentage and number have however increased during the past years and the population forecast from Statistics Sweden (SCB) indicates that the group will account for about 9.6 percent of the population in 2020. In other words, it means that the age group with the highest fatality risk is set to grow over the next few years, which may lead to an increased number of road fatalities. However, the 18–24 group, which also represents a relatively high risk, is set to decline and may thus compensate somewhat for a possible increased incidence of road fatalities among the elderly. The group with the lowest risk of being killed in traffic are people between 0-17 years old age group, followed by 45-64 and 25-44 years old groups.

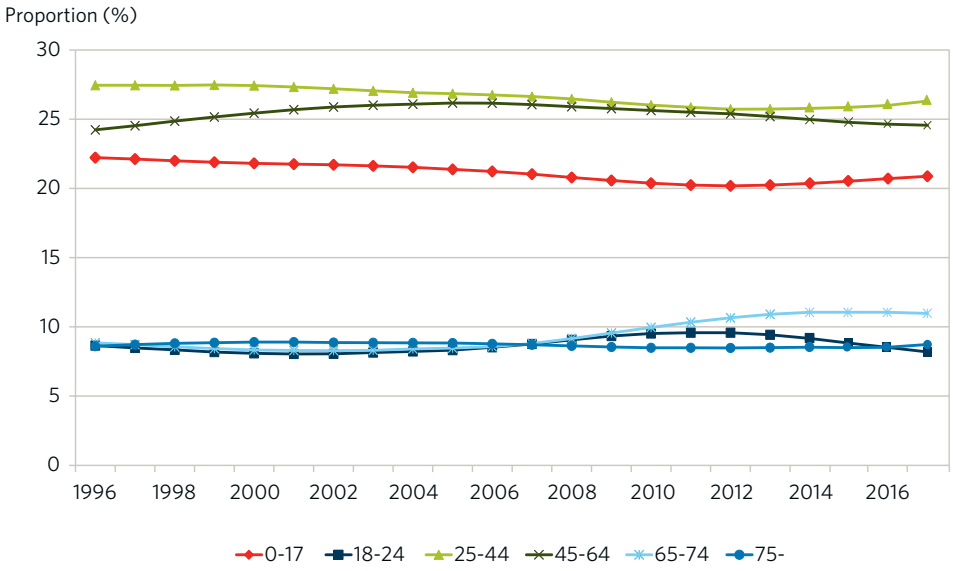

Figure 17. The Age distribution of the population, 1996-2017. Source: Statistics Sweden (SCB).

Experiences from several countries suggest that there is a link between the number of road deaths and economic development: a slowdown of the economy is often followed by a reduction in the number of road deaths (Irtad, 2015). To some extent, this may be due to the decline in travelling associated with a recession, but that is not the whole explanation. There are several hypotheses about the link between the 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 very difficult to figure out how the causality looks like.

The size of unemployment figures is often used in this context as a measure of economic development. Figure 18 shows statistics from the Swedish Public Employment Service on the share of the population who are officially unemployed or participating in a programme with activity support. Unemployment has decreased with 0.1 percentage points between 2016 and 2017. During the entire period of 1996-2017, the unemployment varied quite a lot. It was at its lowest in 2007 and 2008 and then rose heavily to 2009. After that, it has been stable at a high level but is dropping successively. The National Institute of Economic Research (NIER) points in their Economic Tendency Survey Indicators that the Swedish economy has a considerably stronger situation than normal[7]. It could be negative for traffic safety, but it is important to remember that the economical situation is just one of many factors responsible for the number of fatalities.

[7]https://www.konj.se/download/18.bab85a116125e7b54611cdd/1516798994321/Konjunkturbarometern-januari-2018.pdf

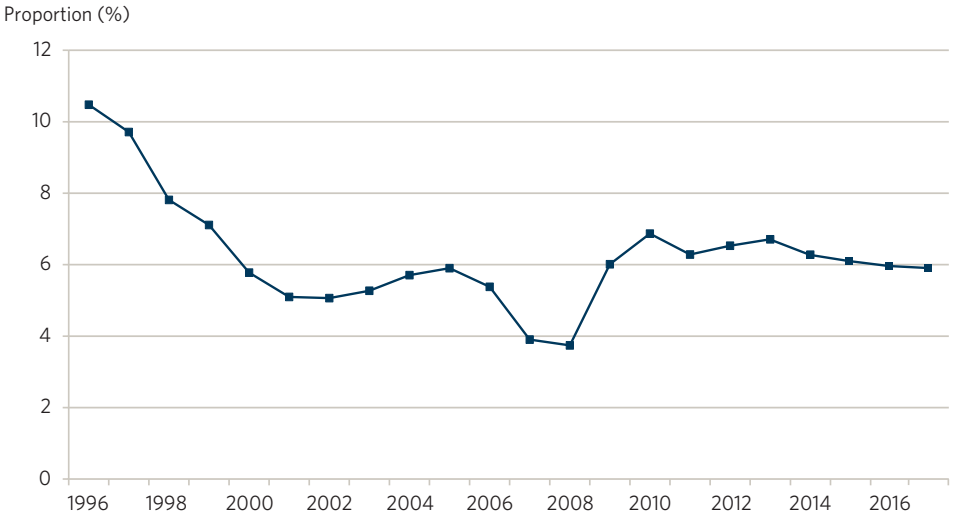

Figure 18. Total unemployment (unemployment plus participants in programmes, the share of the population), 1996-2017. Source: Swedish Public Employment Service (www. arbetsformedlingen.se).

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. However, 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 statistic. 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 crashes caused by cars going off the road. These effects were observable during the winters of 2010 and 2011, both of which had heavy snowfall. By studying the maps of snow depth charts compiled by the Swedish Meteorological and Hydrological Institute (SMHI) it shows that 2017 was not a particularly snowy year. This might have contributed to worse prerequisites for traffic safety considering the car traffic compared to years with a lot of snow. The difference between 2016 and 2017 was however not too great to have had any significant influence.

The changes taking place in different external factors between 2016 and 2017 are both positive and negative for traffic safety. Collectively, however, the changes are not very great, so they should not have had more than a marginal influence on the outcome of the number of fatalities and seriously injured.

4 Follow-up of indicators

4.1 Speed compliance – national road network

	2004	2017	Target for 2020	Assessed development towards target
Share of traffic volume within speed limits, national road network	43 %	45 %	80 %	Not in line with the required trend
Average travelling speed	82 km/h	78,5 km/h	77 km/h	Not in line with the required trend
Share of traffic volume within speed limits on 70-90 km/h roads without median barrier, national road network	47 %	47 %	80 %	Not in line with the required trend

The target is for 80 percent of all traffic to drive within posted 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. Starting from 2016 the indicator has been divided into the percentage of traffic volume within the speed limit on 70-90 km/h roads without a median barrier. This to increase focus on the most speed-critical roads.

It is resource demanding to perform measurements of speed levels that are representative for the entire country. During 2016, the Swedish Traffic Administration performed the second of three measurements (2012, 2016 and 2020) planned for 2020. The latest measurement before the measurement in 2012 was performed in 2004. For 2013-2015 an estimation has been made based on the measurement in 2012 and the Swedish Transport Administrations more simple measurements (speed index), which only shows the relative changes in speeds.

Development and projection towards the 2020 target

Figure 19 presents the share of the traffic volume travelling within speed limits on the national road. The proportion of traffic volume within posted speed limits in 2017 on the national road is estimated to be 45 percent, which is an improvement of the compliance reported in 2016, which was when the last national representative measurement was made. The outcome in 2017 is more than 35 percentage points below the required development to reach the target in 2020. On the roads with 70-90 km/h speed limits without median barriers and therefore more speed-critical, the compliance has somewhat improved – from 46.6 percent (2016) to 47.3 percent in 2017.

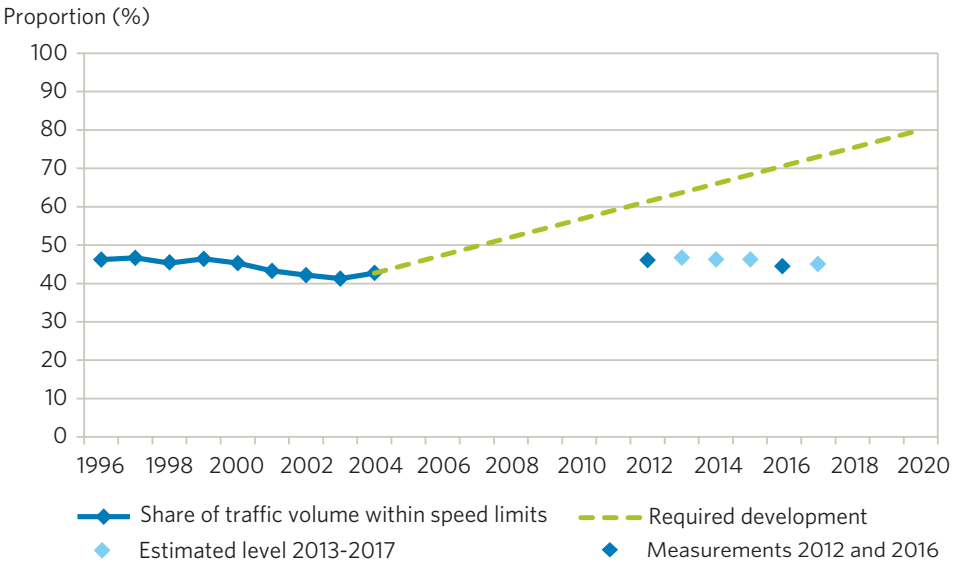

Figure 19. The share of traffic volume within speed limits on national road network 1996-2004, 2012 and 2016. 2013-2015, 2017 estimated level, and the required development until 2020. Source: Swedish Transport Administration.

The average travelling speed is estimated to be largely unchanged compared to the level in 2016, from 78,7 km/h in 2016 to 78,5 km/h in 2017. The annual travelling speed is not in line with the required development.

On the more speed-critical roads without median barriers and with speed limits between 70-90 km/h, the speed is estimated to have decreased with 0.2 percentage points compared to 2017.

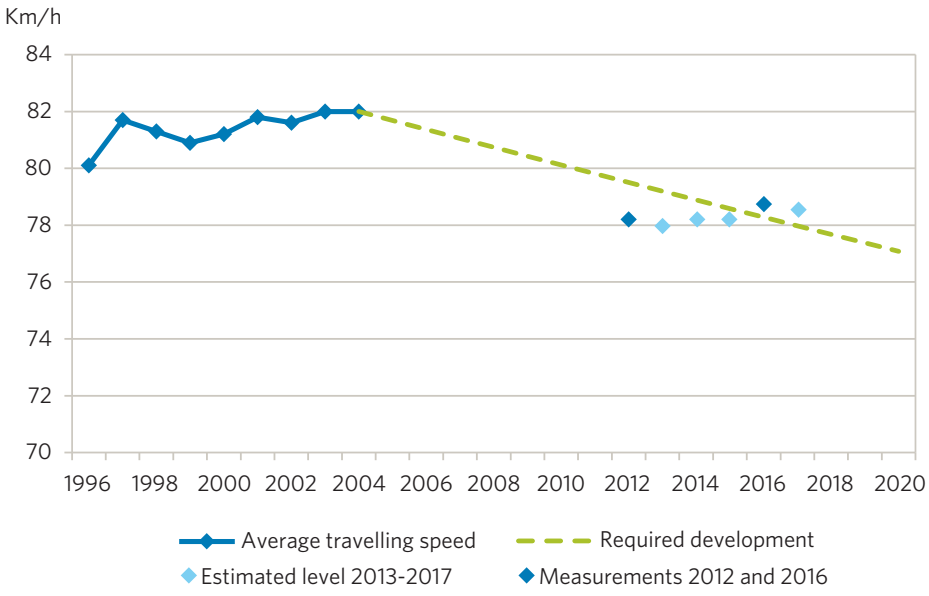

Figure 20. *Average travelling speeds on national road network 1996-2004, 2012 and 2016. 2013-2015, 2017 estimated level, and the required development until 2020. Source: Swedish Transport Administration.*

Analysis and discussion

Using results from the simplified index measurements made annually will make it clear that the trend of declining speed levels, planned out after 2012. An improvement is seen, compared with 2016, see figure 21. It is also not possible to see any differences in development within different speed limits.

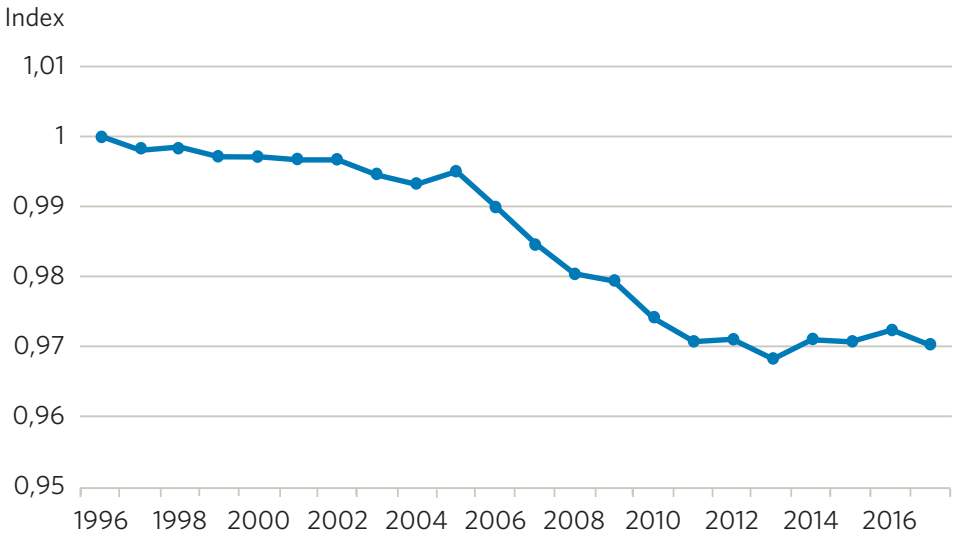

Figure 21. Speed index for average speed in the summer period (April – September), national road network 1996-2017 (Index 1996=1). Source: Swedish Transport Administration.

The speed levels and compliance of the current speed limits have not improved but rather worsened since 2012, see figure 19 and 20. To reach the stated target levels on the relatively short time left until 2020 must be seen as a very difficult task, despite the fact that 150-200 automatic speed cameras are annually installed. On these roads, the cameras have a good effect, but they make up for too little of a part of the total traffic volume to affect the outcome for the indicator in any higher outcome. Today there are about 1,600 automatic speed cameras, with a target of 2,000 in 2020.

Lowered speed limits contribute to a higher safety with lower speed levels, but it also makes it more difficult to reach the target of compliance since lower speed limits tend to lead to a worse compliance.

Starting 2016/2017 the Swedish Transport Administration began a large speed review, focusing on 2019, to adapt the speed limits to the road's safety standard. Primarily the focus is to lower the speed from 90 to 80 km/h. For the period up until 2020, it means that about 2,200 km of 90 km/h roads are being lowered to 80 km/h, at the same time over 400 km of 90 km/h roads are being fitted with median barriers and receiving the speed limit 100 km/h. During 2016, 280 km of road received a reduced speed limit to 80 km/h and in 2017, 170 km of road received it respectively. Some of the routes planned to receive a reduced speed limit has been appealed and lifted to government level. From a traffic safety perspective, it is important to follow the development of this matter.

On average, 15 lives can be saved per lowered km/h in average travelling speed. The collective effect of planned automatic speed cameras and about 2,200 km of 90 km/h road being reduced to 80 km/h is assessed to give a total reduction in the travelling speed of 0,5 km/h. Even if it does not result in the targets being fulfilled, it will cause great effects on the most speed-critical parts of the road network. For the entire 90 km/h road network the travelling speed is assessed to decrease with 2,4 km/h. For the routes where automatic speed cameras are installed and

90 km/h is being reduced to 80 km/h, the travelling speed is assessed to decrease with 4 km/h and the compliance to increase with 35 percent.

Since the planned speed reducing actions on the national road network are not enough, it becomes important with the increased presence of the police with the associated media spread. The number of issued speeding tickets (by manual surveillance) has heavily decreased over the past years, as shown in figure 22. The number of issued speeding tickets by the automatic surveillance has, on the other hand, not decreased but is rather constant with a slight increase.

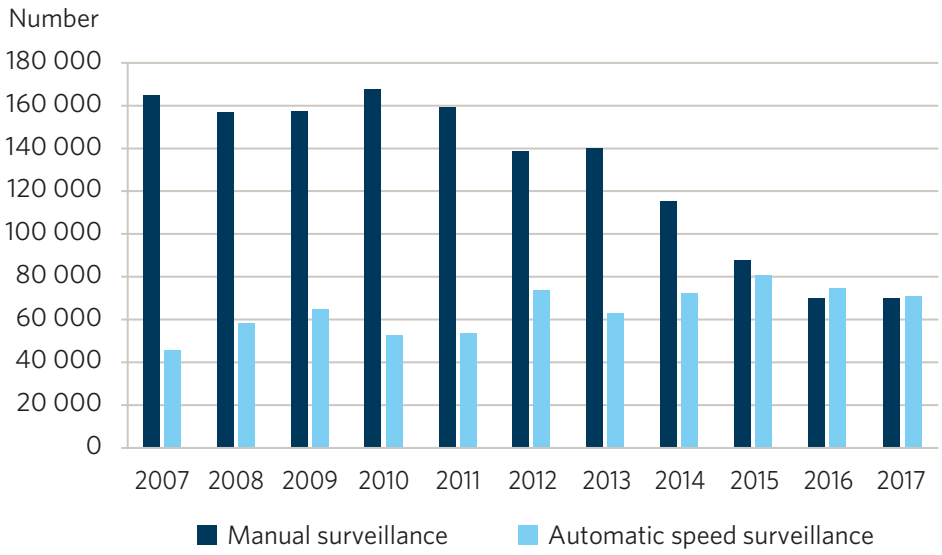

Figure 22. The number of speeding tickets issued divided by manual and automatic surveillance 2007-2017. Source: The National Police Board.

Since the speed compliance is low, more would need to be done than only lowering the posted speed on a road or street. According to Road Marking Regulations, road signs and other setups together with the road and street design and the surrounding environment should give the road user a road guidance for a safe traffic. Furthermore, the Road Safety Act, which applies to parts of the national road network, states that the road authority systematically and continuously should take the actions needed to prevent serious injuries caused by using the roads.

The problem is that for a long time the speed limits have been too high in relation to the road's safety standard and that the design of the road can be experienced as unclear. An example of this is broad rural roads with the speed limit 90 km/h. These roads expose the road users to fatal energy levels in case of a head-on crash, but the design of the road makes it difficult for the road users to maintain the speed limit. In an urban city, it can be easier to understand why the speed limits are being reduced since there are often a lot of unprotected road users in those areas.

The current change of the present 90 km/h roads means that these roads will either be rebuilt into 2+1-roads and receive 100 km/h or be lowered to 80 km/h. During this transition period, similar roads with oncoming traffic will have both 90 km/h and 80 km/h. After the transition period, it will be clear for the road users that national roads without median barriers normally have maximum 80 km/h, regardless of the road's width and surroundings, whilst roads with median barriers have at least 100 km/h. Here, the information to the road users must improve significantly, so that it is made clear why the roads safety standard will not allow a higher speed limit.

However, it is neither cost-effective nor practically possible to achieve a high-speed compliance solely by rebuilding streets and roads. It is therefore important to keep investing in automatic speed cameras and other innovative solutions such as vehicle technology and new insurance systems. These solutions will play a big role in the future, but in the current state, the implementation of such systems is somewhat limited. One-quarter of the cars who were tested by Euro NCAP in 2017 was equipped with technology that automatically reads road signs and shows the current speed limit on the dashboard, and already in 2018, the demands for this is being raised. In recent years the possibility to affect car insurance by driving within the speed limit has been developed, with the method “pay-as-you-speed”. The idea is that an insurance could be much more adjusted to the individual and it is reasonable to expect that the market in a greater extent will request similar products. Also, self-monitoring of the speed compliance of company car fleets is an important effort to encourage.

4.2 Speed compliance – municipal road network

	2012	2017	Target for 2020	Assessed development towards target
Share of traffic volume within speed limits, municipal road network	64 %	67 %	80 %	Not in line with the required trend
Average travelling speed	49 km/h	47 km/h	46 km/h	In line with the required trend

The target is for 80 percent of the traffic volume to be within allowed speed limits by 2020. Starting in 2012 the average travelling speed is measured and the 2020 target for the average travelling speed is 46 km/h. The measuring series began in 2012 and is based on the annual measurements on the municipal main road network. The purpose is not to present the level of the proportion of traffic volume within the speed limit in Sweden in a fully representative way. However, the measurements are assessed to be good enough to follow up the change over time and present the approximate level.

Development and projection towards the 2020 target

Figure 23 presents the proportion of traffic volume within the speed limit on the municipal road network in 2017. The result shows that 67 percent of the traffic mileage is within the current speed limit, which is the same level as in 2016. The outcome is about 7 percentage points below the required development to reach the target in 2020. The analysis group, therefore, assesses that the development is not in line with the required development.

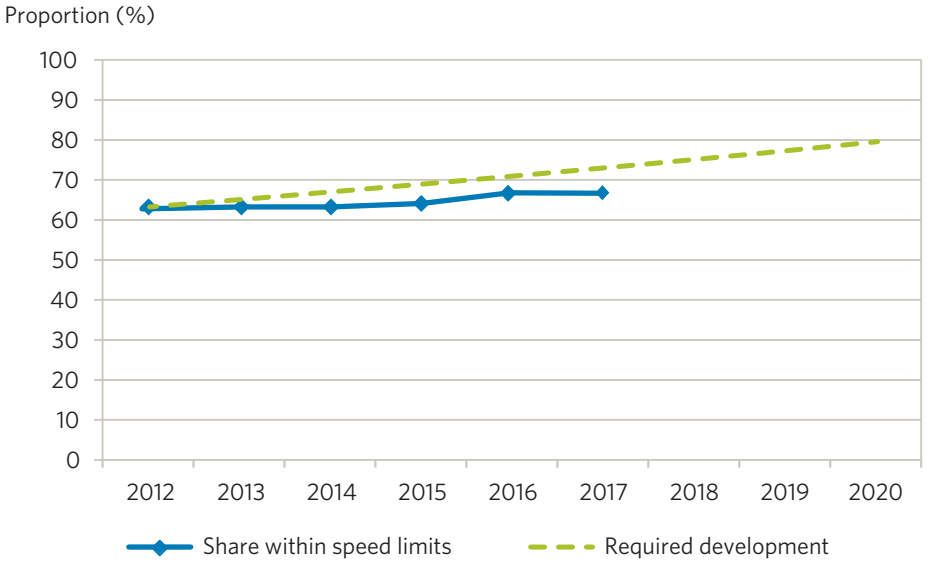

Figure 23. The share of traffic volume within speed limits on the municipal road network 2012-2017, and the required development. Source: Vadeby and Anund (2018).

Figure 24 presents the average travelling speed between the years 2012-2017. The average travelling speed is at 47,0 km/h, which is basically the same level as in 2016. The analysis group assesses that the development is in line with the required development.

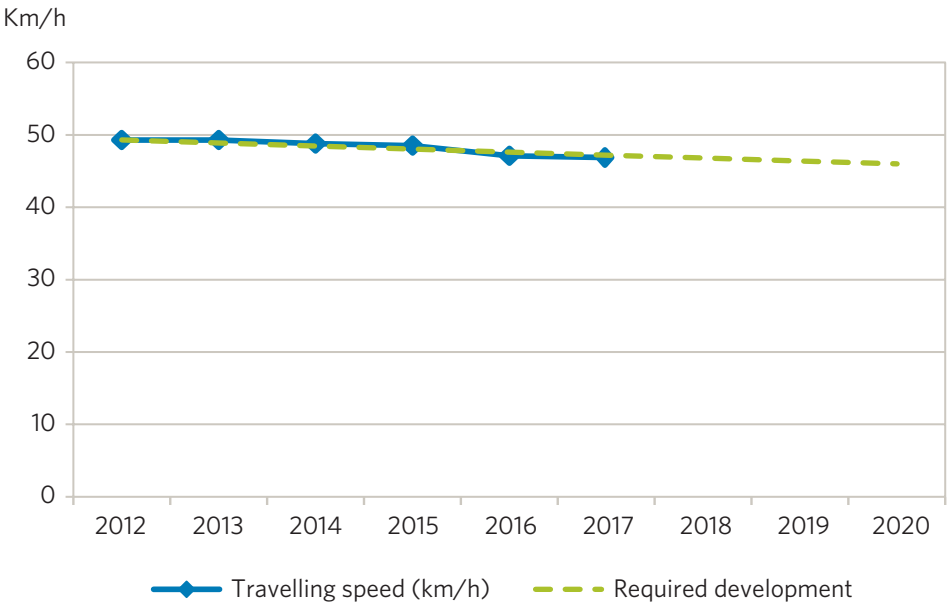

Figure 24. Average travelling speed on the municipal road network 2012-2017, and the required development until 2020. Source: Vadeby and Anund (2018).

Analysis and discussion

The result from the measurements of the speed compliance 2012 to 2017 is shown in figure 25, divided by speed limit. On streets with the speed limit 40 km/h, 53 percent of the traffic drove within the current speed limit in 2016. On streets with the speed limit 50 km/h, 66 percent followed the speed limit and on streets with the speed limit 60 km/h and 70 km/h, 81 percent followed the speed limit. The speed compliance is thereby best on streets with speed limits 60 and 70 km/h and in this year's measurements, the results for these speed limits are on the same target level of 80 percent speed compliance for 2020.

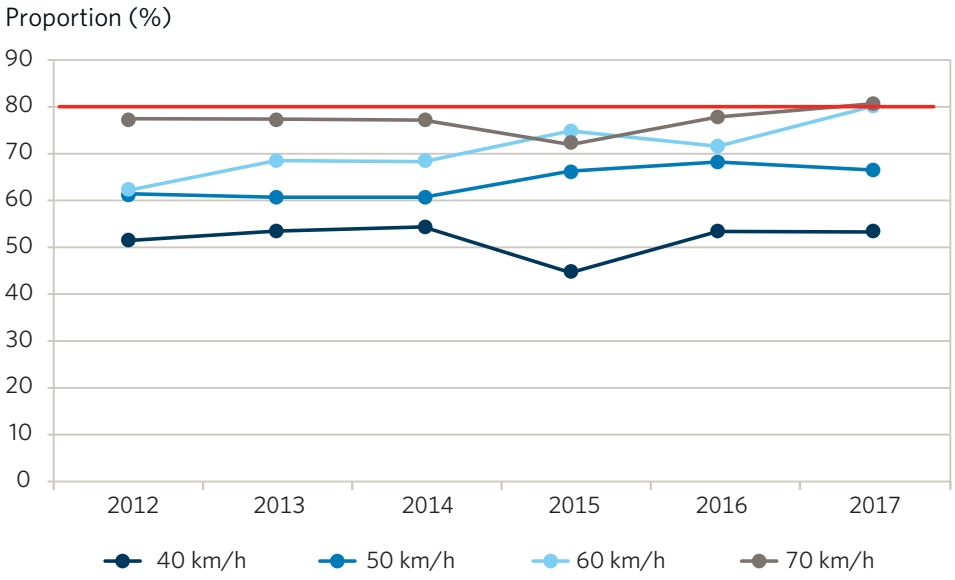

Figure 25. *The share of traffic volume within speed limits on the municipal road network 2012-2017 divided by speed limits. Redline marks the national target of 80 percent speed compliance. Source: Vadeby and Anund (2018).*

With regard to the type of vehicles 66 percent of the passenger cars followed the speed limit. Amongst trucks and buses 73 percent followed the speed limit and amongst trucks with trailer 84 percent. The percentage of non-compliance for motorcycles and mopeds are not presented separately since the measurement equipment cannot tell motorcycles and mopeds apart.

If looked upon the police's reporting limit, a total of 85 percent of traffic drive within 5 km/h over the allowed speed limit. Here as well, the compliance is lowest on roads with 40 km/h. On these roads 77 percent drive within 5 km/h over the posted speed limit, while the corresponding percentage is over 90 percent with the speed limits 60 and 70 km/h. Generally, there are large differences in compliance between the points of measurement. It is natural in urban areas since there are a lot of factors regardless of the speed limit that affects the road user's choice of speed, for example, the intersection frequency, road-width and presence of street parking and sidewalks.

In many municipalities, there is an ongoing work with changing the speed limits. Figure 26 shows how the distribution of speed limits on the municipal road network looks like, measured in road length. If seen in road length, 50 km/h is still the dominating speed limit. Between 2012 and 2017 the road length decreased with 50 km/h, from 25,500 km to 16,500 km. During the same time period, the road length increased with 40 km/h from 7,000 km to 9,300 km.

In November 2017, Traffic analysis handed in a government mission regarding an investigation of the prerequisites and the consequences of a lowered base speed limit in urban areas, for the present 50 km/h and 40 km/h, see Traffic analysis (Trafikanalys, 2017). Traffic analysis argues in their report that a new base speed limit of 40 km/h should be introduced in urban areas. They point out that an advantage with a new base speed limit is that it can receive a quick breakthrough across the country and contribute to a more similar application of the speed limits. In Vadeby, Forsman and Ekström (2017), the effects of traffic safety were studied by lowering the base speed limit from 50 to 40 km/h in an urban area. The results showed that if the lowering of the average speed will be as great a previous evaluation have shown, which would be about 2 km/h, then about 5 lives per year could

be saved. If lowering the average speed with 5 km/h is successful, it can save 10 lives and 17 lives if lowered with 10 km/h respectively.

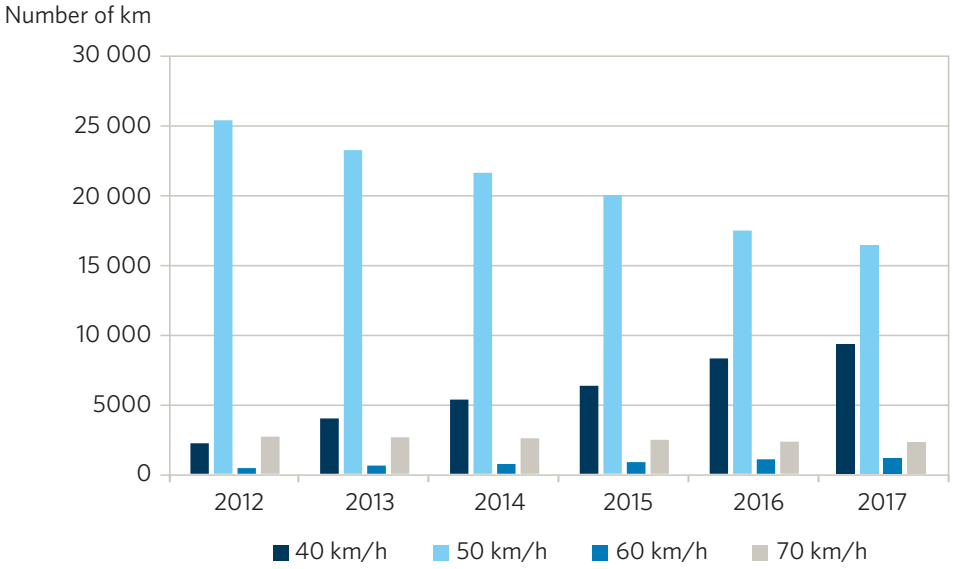

Figure 26. Road length in miles divided by speed limits 40, 50, 60 and 70 km/h on the municipal road network 2012-2017. Source: NVDB, Swedish Transport Administration (2017).

The Swedish Traffic Administration survey of traffic safety from 2017 (Swedish Traffic Administration, 2018) showed that 53 percent of the respondents generally think that it is reasonable to lower the speed limit to increase the road safety. This is basically the same level as in 2016. Women are more supportive than men to this motion of lowering the speed limit, with 60 percent of them compared to 45 percent respectively. Many are especially positive for lowering the speed limit to 30 km/h where there are a lot of pedestrians and cyclists – a whole 72 percent agree on this.

To reach the target of 80 percent speed compliance in 2020, it is foremost the speed compliance on streets with lower speed limits (and foremost streets with 40 km/h) that needs improvement. The compliance can increase by designing more urban streets with for example narrowing's, bumps and change in road-width and so on, so that they will be more "self-explaining" and it becomes more natural for the road users to follow the speed limit. According to road traffic regulation/highway code (2007:90), the road environment total design should support the speed limit that the road is planned for. To increase the rule compliance at a lowering of a speed limit it is therefore, necessary to adjust both the design of the road and the surveillance.

Automatic speed cameras have been shown to be effective to increase the compliance, but on the municipal road network there are only a few cameras, and only 6 more are planned so far. However, technical equipment helping the driver keep the speed limit (Intelligent Speed Assistance – ISA) and economical incentives (Stigson et al., 2012) have a positive effect – for example, the launch of a so-called "pay-as-you-speed-insurance" (mentioned in the previous section of speed compliance on the national road network). Good speed compliance at low-speed limits is essential to gain the full effect of, for example, autonomous emergency break in urban areas, see Rizzi et al. (2014). As well as on municipal streets it is important to encourage self-monitoring of the speed compliance amongst company fleets.

4.3 Sober traffic

	2007	2017	Target for 2020	Assessed development towards target
Share of traffic volume with sober drivers	99.71 %	99.74 %	99.90 %	Not in line with the required trend

The target is for 99.9 percent of the traffic volume to have sober drivers by 2020. 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, rather than the actual levels. The series is developed so that it is as much as possible not dependent on the police administrative work, but it cannot rule out a small influence. A sober driver is defined as a driver with a blood alcohol concentration below 0.02 percent. The indicator is thereby only based on sobriety referring to alcohol, there is currently no reliable material to follow the development of the use of drugs in traffic.

Development and projection towards the 2020 target

The results from the measurement series show that the percentage of sober traffic has somewhat decreased between 2016 and 2017. The proportion for 2017 is 99.74 percent, which can be compared to 99.76 percent in 2016, see figure 27. During the first years after the start year of the measurement series (2007), the proportion of sober traffic increased, but the development has stopped and is now going in the wrong direction. The result for 2017 is below the curve for required development and the analysis group, therefore, assesses that the target for 2020 will not be reached.

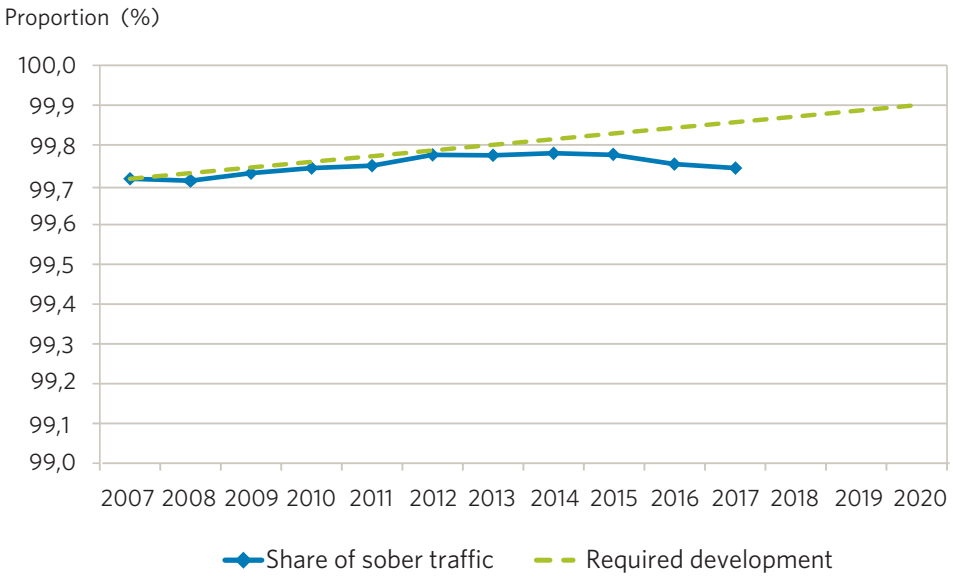

Figure 27. The share of sober traffic, 2007-2017. Measurement series based on data from police checkpoints. Sources: The National Police Board, VTI.

Analysis and discussion

The result from the Swedish Transport Administration's in-depth studies of fatal crashes show that the number of passenger car drivers killed who were under the influence of alcohol (blood alcohol concentration of 0.02 percent or more) in 2017 was almost the same as in 2015 and 2016, see figure 28. However, the percentage has increased from barely 25 to about 28 percent. This is the highest percentage measured in Sweden during the 21st century. A high percentage of the drivers killed under the influence of alcohol were killed in a single-vehicle crash.

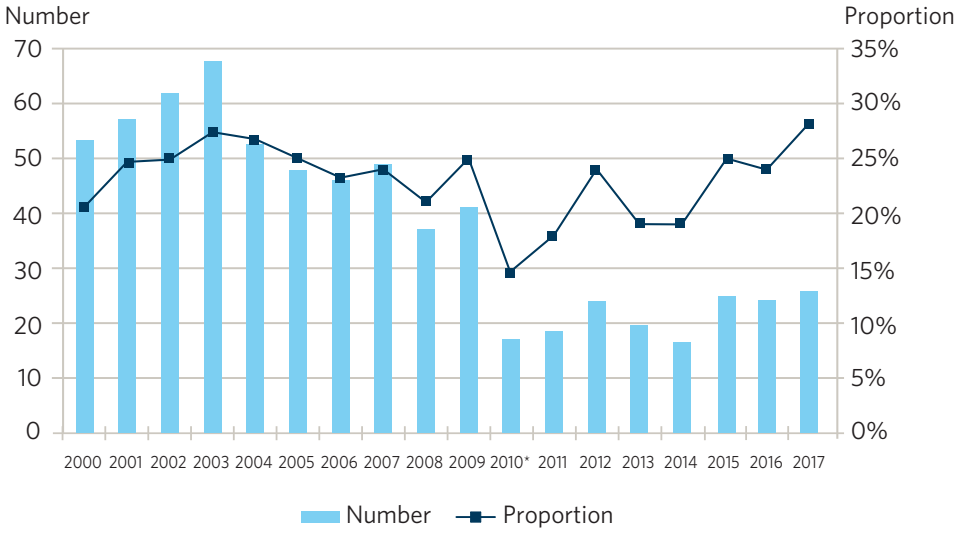

Figure 28. *The share and number of killed passenger car drivers under the influence of alcohol (blood alcohol concentration of 0.02 percent or more), 2000-2017.*
Source: The Swedish Transport Administration's in-depth studies.
** Excluding suicide from 2010.*

The term sober traffic also means that drivers should be free from other drugs than alcohol. Figure 29 shows the number of people killed in alcohol or drug-related crashes during 2008-2017. A crash counts as alcohol or drug-related if it is possible to prove the existence of alcohol and/or drugs in any of the involved drivers of the motor vehicles, pedestrians or cyclists. This refers to only illegal drugs. However, it is important to note that for surviving road users it is relatively seldom that data regarding any possible use of drugs are available, so there is some uncertainty in the results.

In total, 81 people were killed in alcohol or drug-related crashes in 2017. This corresponds to 32 percent of all fatalities in Sweden. In 2016, 83 people were killed in alcohol or drug-related crashes, which corresponds to 31 percent. Of those 81 people killed in 2017, 41 of them were killed in crashes which were solely alcohol-related, 28 of them in crashes which were solely drug-related and 12 of them in crashes which were both alcohol and drug-related. The number of fatalities in alcohol-related crashes (including those which are also drug-related) is lower than in 2015 and 2016 and on almost on the same level as in 2013 and 2014. The number of fatalities in drug-related crashes has, on the other hand, increased from 35 people in 2016 to 40 people in 2017. Between 2015 and 2017 the number of fatalities in drug-related crashes had almost doubled, from 21 to 40 people. The increase has been mostly amongst motorists.

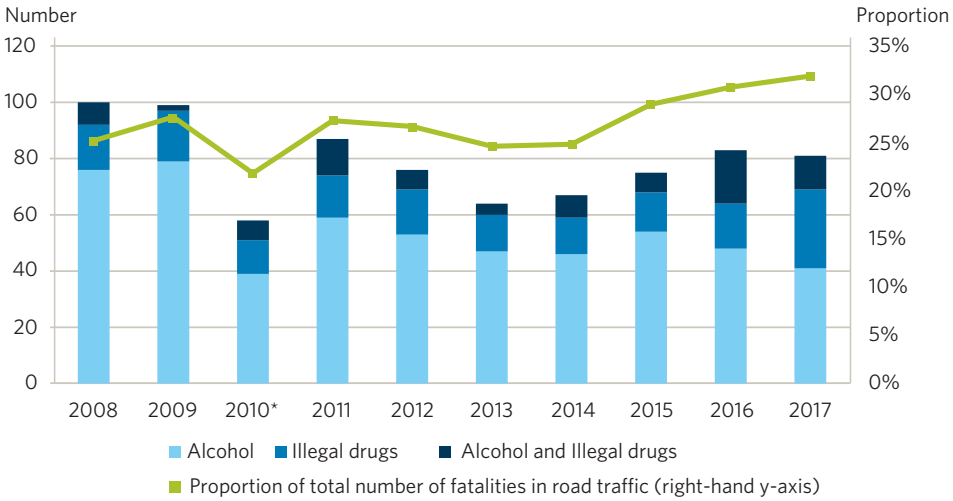

Figure 29. *The number and share (of the total number of fatalities in Sweden, right-hand y-axis) individuals killed in alcohol and/or drug-related crashes, 2008-2017. Source: The Swedish Transport Administration's in-depth studies. *Excluding suicide from 2010.*

Figure 30 shows the fatalities in alcohol and drug-related crashes over the past five years divided by road users. The largest group in both alcohol and drug-related crashes are motorists. The second largest group to die in alcohol-related crashes are pedestrians, followed by motorcyclists. For the drug-related crashes, it is instead the motorcyclists who are the second largest group, and the number of pedestrians is rather few. It can also be stated that during the past five years, no one has died on a moped in a drug-related crash. In most cases, it is the killed road user themselves who have been affected by alcohol or drugs, and the same applies to pedestrians and cyclists.

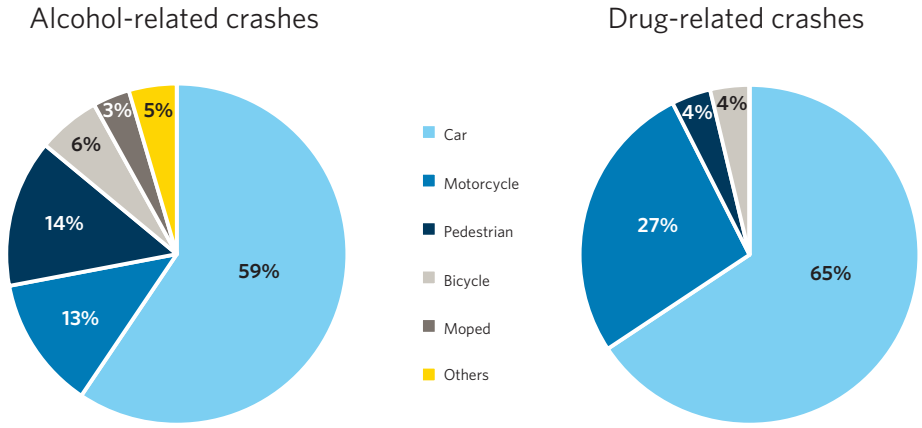

Figure 30. *The share of individuals killed in alcohol-related (the left diagram) and drug-related crashes (the right diagram) respectively, by travel modes. The crashes that are both alcohol and drug-related are included in both diagrams. The distributions are based on all crashes during the period of 2013-2017. Source: The Swedish Transport Administration's in-depth studies.*

The Swedish Transport Administration survey of traffic safety for 2017 shows that 7.5 percent answered yes to the question: "Have you during the past 12 months driven a car after you have had an alcoholic beverage besides light beer?". It is an increase from 2016 with 2.9 percentage points and the highest result in Sweden since 2006.

Figure 31 presents the results from the police's breath tests in relation to the number of reported offences of drunk-driving during the period 2002-2017. The number of breath test increased heavily until 2007 when it stopped and started to decrease again. For 2017, an estimation is presented of the final number of tests and the result shows that the number is approximately at the same level as in 2016. The decrease that has been shown in the past years thereby seems to have subsided. The number of reported offences of drunk-driving follows almost the same curve, but with less relative differences. Between 2016 and 2017 the number of reported offences decreased from about 12,000 to about 11,800.

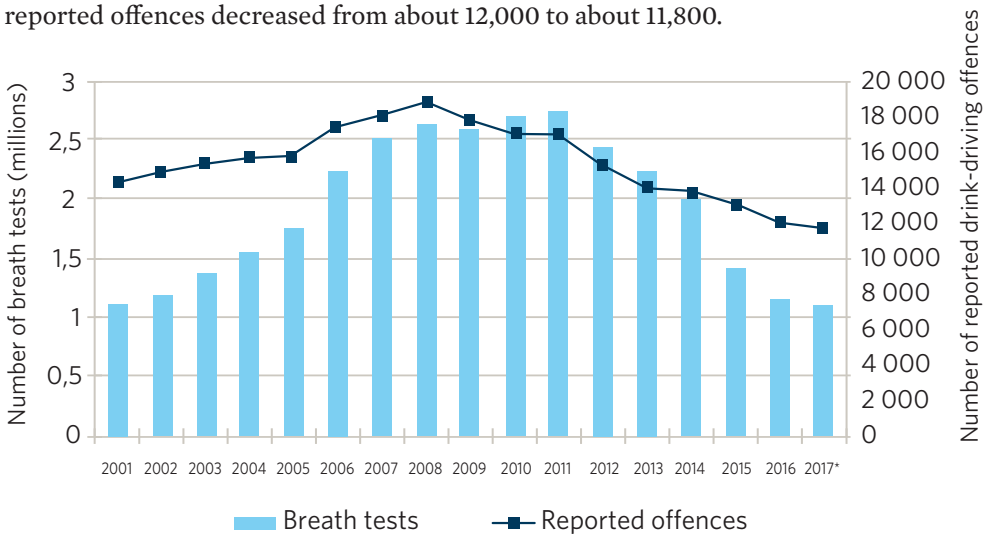

*Figure 31. The number of alcohol breath tests and the number of reported drink-driving, 2001-2017. *2017 data regarding the number of tests has been adjusted upwards and is an estimate of the final number of tests. The number of reported offences is preliminary for 2017. Source: The National Police Board.*

The number of reported drug-driving offences has increased from about 12,600 in 2016 to about 13,800 in 2017 (preliminary data for 2017). The number of reported drug-driving offences has for the past two years (2016 and 2017) been more than the number of reported offences of drunk-driving. In how big extent the increase of reported drug-driving offences depends on the way of working within the police or an actual increase of drug-driving is unknown.

In the long term, there is a big potential in technical solutions when it comes to decreasing the drunk-driving, and it is likely systems will be developed in the vehicles that can detect decreased driving ability. Parallel with this development, other efforts are in progress with the purpose of reducing the drunk-driving.

The Swedish Transport Administration presented at the beginning of 2017 a government mission regarding preparing for the introduction of establishments for sober controls in some ports (Swedish Transport Administration, 2017). An implementation is started in 2018. To increase the benefit of traffic safety it is also suggested that there should be an investigation on how these types of automatized controls can be used in other places than just ports, and if there is a possibility to re-introduce the sober traffic control inspectors to relieve the police and other control authorities. These questions are now being further investigated in a new project Nyktra[8] that was started in 2017, and is a cooperation between the Swedish Transport Administration and the Swedish Police Authority. These actions could give effect in the long term, but will not have any more than a marginal effect until 2020.

Based on the development of the indicators and the lack of planned actions for the next years it is assessed that the target for sober traffic will not be reached by 2020.

[8]https://www.trafikverket.se/om-oss/pressrum/pressmeddelanden/Nationellt/2017/2017-09/automatiserade-nykterhetskontroller-pa-strategiska-platser/

4.4 Seat belt usage

	2007	2017	Target for 2020	Assessed development 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 percent of all drivers and front seat passengers in passenger cars use a seat belt by 2020.

As a basis to follow the developments, results from the Swedish Transport Administration's observation measurements (previously VTI) are being used. The indicator is defined as the percentage of seat belt usage among observed drivers and front seat passengers. The measurements have since 2016 been conducted by the Swedish Transport Administration and build on observations of 37,000 passenger cars at larger roundabouts in six Swedish cities.

The measurements are made to follow the development over time, and the level of seat belt usage in the observations should not be used as representative for drivers and passengers generally in Sweden. The measurements after 2016 have been conducted by a new organisation but with the same method as the previous year, which might have affected the result.

Development and projection towards the 2020 target

The usage of the seat belt in the front seat of passenger cars went up to 97.6 percent in 2017, which means that the usage has marginally decreased compared to 2016 when the usage was at 98.1 percent. The analysis group's assessment is that the usage of the seat belt is still in line with the required development.

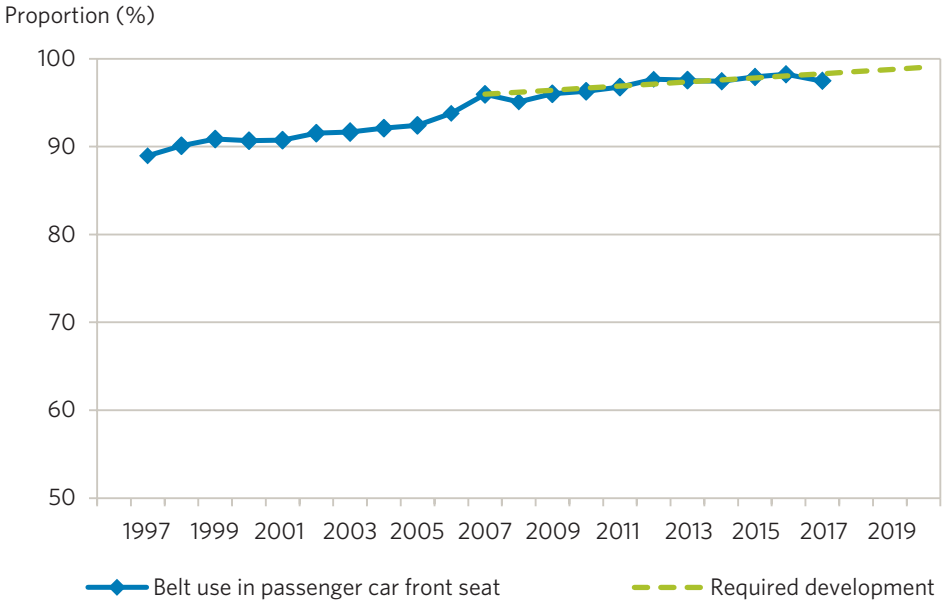

Figure 32. The share of individuals in passenger car front seats who were wearing a seat belt when observed, 1997-2017, and the required development until 2020. Source: VTI (1997-2015), Swedish Transport Administration (2016-2017).

Analysis and discussion

The use rate of seat belts in the front seats is high. With regards to car drivers, it is 98 percent who uses a belt, and 96 percent of the passengers in the front seat respectively, figure 33. The use of a belt in heavy goods vehicles has continued to increase steadily. The share of taxi drivers that use seat belts, like other passenger cars, has remained unchanged in recent years.

The results from the measurement indicate an increase in the belt use among adults in the back seat. However, there is a decrease in the last two years among children.

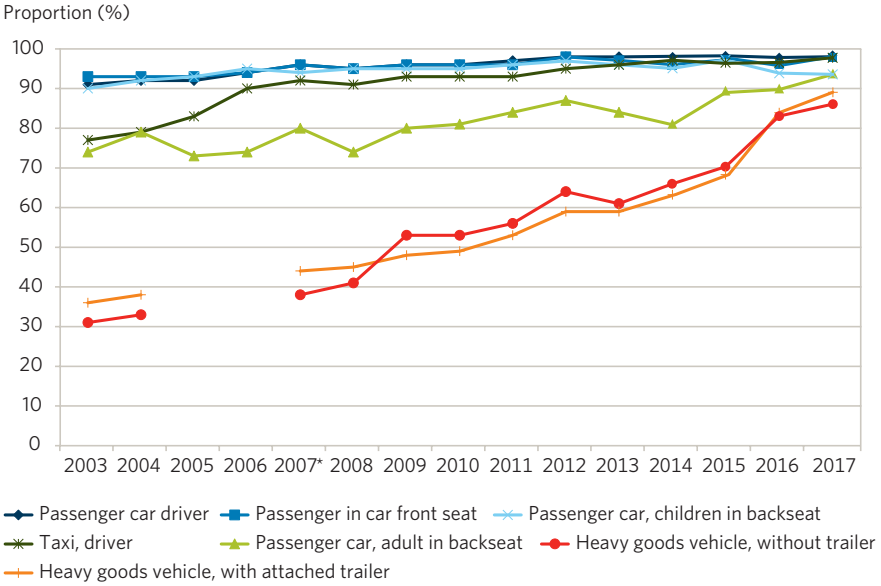

Figure 33. *Seat belt use in passenger cars and heavy goods vehicle, 2003-2017. Source: VTI (2002-2015), Swedish Transport Administration (2016-2017).*

**Observations of heavy goods vehicles from 2007 onward are not fully comparable with earlier observations. From 2016, measurements have been carried out using the same methodology but with new contractor, which may affect the measurement result.*

Despite the high proportion of belts usage, about a third of those who were killed in passenger cars were not wearing a belt at the time of the crash. The Swedish Transport Administration's in-depth studies show that the proportion of killed passenger car drivers who were unbelted at the time of the crash increased slightly compared to 2016. By 2017, the proportion of those unbelted was 39 percent, see figure 34.

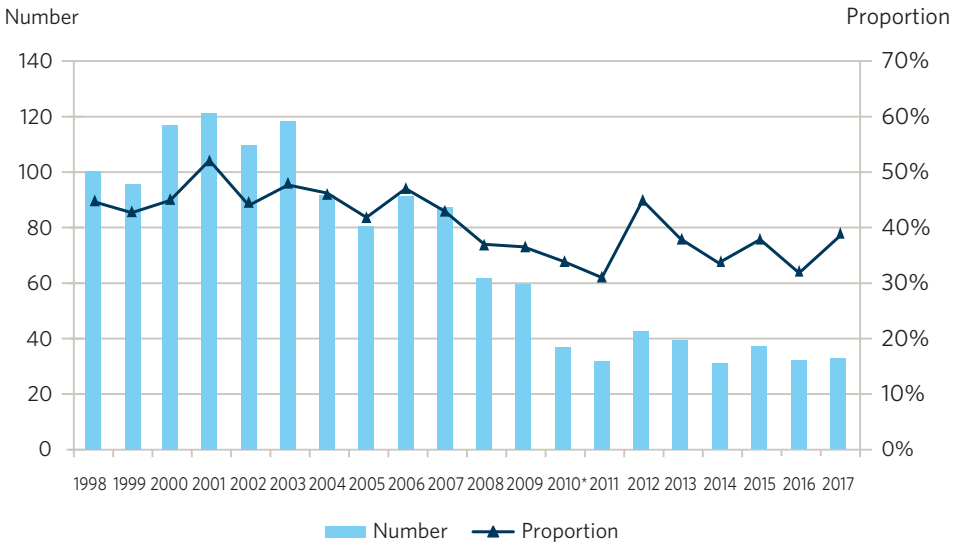

Figure 34. The number and share of passenger car driver fatalities who were not wearing a belt at the time of the crash, 1998-2017. Source: The Swedish Transport Administration's in-depth studies.

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

The belt usage in passenger cars is lowest among younger male drivers aged 18-25 years. This is also the group of passenger car drivers who drive the oldest cars where belt reminders are missing. Of those killed who were unbelted at the time of the crash, almost 25 percent are 25 years or younger. Of those killed who were unbelted, almost 80 percent were in cars that were manufactured before 2003, that is, the year that more modern belt reminders began to be introduced. Analysis of the Swedish Transport Administration's in-depth studies during the period of 2013-2017 shows that the number of unbelted drivers or front seat passengers in fatal crashes declined by almost 80 percent with belt reminders.

The share of traffic volume with passenger cars that have seat belt reminders continues to increase. The share of the car traffic volume with seat belt reminders was 87 percent in 2017 and 83 percent in 2016. As recently as 2005, the share was just under 10 percent. A forecast indicates that the share of the traffic volume with seat belt reminders will increase to about 95 percent in 2020. Even if the vehicle fleet does not become 100 percent equipped with seat belt reminders, the increase of traffic volume with seat belt reminders from 2015 to 2020 is expected to increase the belt usage by approximately 0.5 percentage points. It is thus possible that the use, as an effect of the increased proportion of seat belt reminders, will be able to approach the target of 99 percent use by 2020.

4.5 Use of helmets

	2007	2017	Target for 2020	Assessed development towards target
Share of observed cyclists wearing a helmet	27 %	44 %	70 %	Not in line with the required trend
Share of observed moped riders wearing a helmet	96 %	98 %	99 %	In line with the required trend

The target for bicycle helmet use is that at least 70 percent of cyclists use a helmet by 2020. As a measure of bicycle helmet use, the share of cyclists observed using helmets according to the Swedish Transport Administration's annual measurements is used. The measurements are not intended to estimate overall helmet use in Sweden in a fully representative way but are good enough to give a picture of changes over time and of the approximate level of use. The measurements have been carried out since 2016 with the same methodology as before but by a new organisation, which may have influenced the measurement results and makes the change between 2015 and 2016 difficult to interpret. The measurements in 2017 are based on approximately 36,500 observations, which is about the same number as 2016, but considerably fewer than in 2015 when 65,600 cyclists were observed.

Helmet use among moped riders is studied alongside cyclists' use of helmets. As from 2012, observations of moped riders' use of helmets are conducted in connection with the measurements of bicycle helmet use. These observations are carried out in the same cities and times as the bicycle helmet observations, but at marginally fewer sites in each city (The Swedish Transport Administration, 2017). Only those moped riders who are seen to have their helmets properly used are counted as helmet users. The target for helmet use among moped riders is that 99 percent use helmets by 2020.

Development and projection towards the 2020 target – bicycle helmet

Figure 35 presents the trend for observed bicycle helmet use in Sweden between 1996 and 2017. In 2017, observed bicycle helmet use was 44.2 percent, which is an increase of almost 9 percentage points since 2016 when the level was 35.6 percent. The figure also shows how bicycle helmet use needs to change between 2007 and 2020 in order for the target level of 70 percent to be achieved. This implies an annual increase of 7.6 percent. On average, the proportion of bicycle helmet use has followed that rate of increase between 2010 and 2013 but stagnated in 2014. The decrease in use was noted in 2016, but since 2017, there has been increased in use again. However, since the actual level of bicycle helmet use is 12 percentage points below the curve for the required trend, the assessment is that bicycle helmet use has not increased sufficiently since 2007 to reach the target level by 2020.

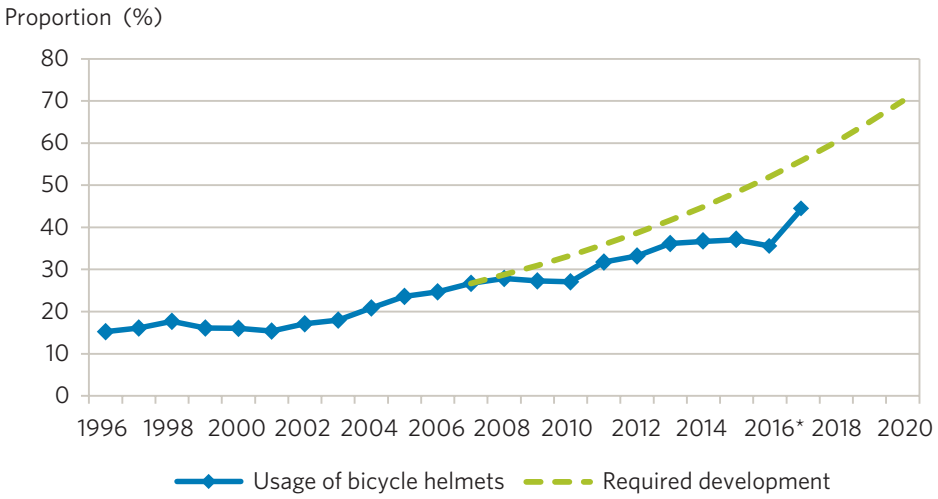

*Figure 35. The share of observed cyclists using a helmet, and the required development until 2020. Source: VTI (through 2015) and new observational measurements 2016, 2017. *Uncertainties due to change of contractor may have occurred in 2016.*

Analysis and discussion – bicycle helmet

Despite a positive trend for bicycle helmet use in Sweden over the past few years, that is quite at a modest level, especially among adults. There is thus a great potential for increasing the proportion of bicycle helmet users. Figure 36 shows that observed bicycle helmet use in 2017 was 85 percent among children up to 10 years of age in residential areas, and 67 percent among children aged 6-15 who ride a bicycle to and from school. Bicycle helmet use among adults is a lot lower: in 2017 it was 37 percent on travels to and from work, and 40 percent on public bicycle paths. It can be argued that there are relatively large changes between 2016 and 2017 – helmets use among all age groups increased in 2017. However, this is after a decrease for several of the groups that occurred between 2015 and 2016 in connection with the change of measurement contractor. Compared with NTF's bicycle helmet measurements in 2017, which is based on about 100,000 observations and the indicator, the results are at the same level: 44 percent.

Between 2016 and 2017, helmet use in Sweden has increased for all categories. Among older secondary school pupils, the use of helmet has increased from 30 percent in 2016 to 48 percent in 2017, which is almost the same level as in 2015 when 44 percent had a helmet. For children at the lower and middle school, the use of helmet has increased from 74 percent to 80 percent between 2016 and 2017.

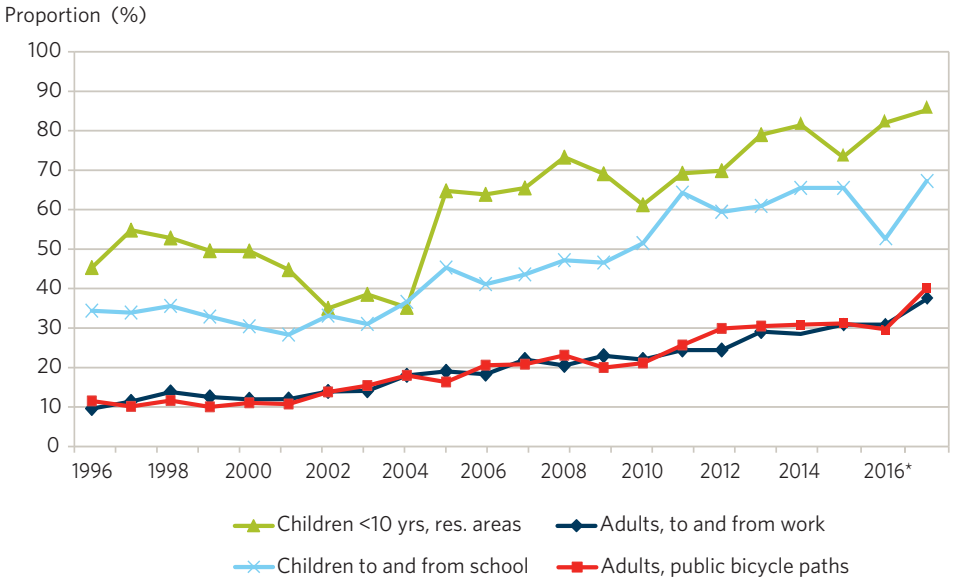

*Figure 36. Bicycle helmet usage among different groups, 1996-2017. Source: VTI (through 2015) and new observational measurements 2016 and 2017. *Uncertainties due to change of contractor may have occurred in 2016.*

In 2017, there were 26 road fatalities among cyclists. Approximately 2,000 cyclists were seriously injured, and 240 very seriously injured respectively. Earlier studies also show that nearly half of all the very seriously injured cyclists sustained head injuries, while the corresponding proportion among the seriously injured cyclists is about 10 percent. A measure such as a bicycle helmet is thus effective primarily in preventing more serious head 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 about 5 percent and the number of killed cyclists by 25 percent.

According to a study by Rizzi et al. (2013), the use of bicycle helmets could reduce the number of serious head injuries by 58 percent and the number of very serious head injuries by 64 percent. A meta-analysis by Elvik (2013) based on 23 different studies shows that bicycle helmets reduce head injuries by 50 percent. In relation to bicycle crashes and quality of life, a recent study by Ohlin et al. (2017) shows that in order to increase the health-related quality of life after a crash, one should prevent, among other things, serious head injuries.

There is ongoing work on developing a new cycling strategy. In the previous strategy (Swedish Transport Administration, 2014), increased use of helmets was raised as a priority area, but since it was not considered to be relevant with a new helmet law for all ages, new methods were proposed to increase voluntary use of helmets. The forthcoming strategy will emphasize that a prerequisite for being able to get a road transport system that is safer for moped riders and cyclists while at the same time acceptable from a user's point of view, for example, such as speeds, is that they use a helmet.

Occasional arguments are made that a helmet law could mean that fewer individuals choose not to use the bicycle as a means of transport. At least, 27 countries currently have some law for bicycle helmets. In a forthcoming literature study (Olivier et al. 2018), the effects of a cycling helmet law on the amount of cycling are studied. Preliminary results from the study show that it is difficult to draw any definite conclusions of the evaluations that have been made. Overall, the study

shows a mixed result; 13 studies showed no change in cycling after the introduction of bicycle helmet laws, 2 studies showed reduced cycling and 8 studies showed a mixed result (both increased and reduced cycling).

The two studies that showed reduced cycling came from New Zealand and the USA, but it should be noted that there are other studies from these two countries that did not consistently show a reduction in cycling in connection with the introduction of a helmet law. Several studies analyzed children's cycling and in some of them, they noted a decrease, connected to the introduction of a helmet law. However, it was found that the observed reductions were due to factors other than the helmet law.

Data from Western Australia indicate that the decline was part of a trend that occurred before the legislation, and data from New South Wales found that the number of children being driven to school by car has steadily increased from the 1970s. Other studies from Australia and Spain showed no significant reduction in cycling. In New Zealand, campaigns were conducted to deter small children from cycling to school in connection with the introduction of helmet laws. Therefore, based on the results from the current study, it is not possible to draw the conclusion that a helmet law generally reduces cycling.

In Sweden, the bicycle helmet law was introduced for children under the age of 15 years on January 1, 2005. Since the year 2000, the Swedish Transport Administration and the Swedish Road Administration have conducted a survey every three years on what means of travel and how children go to school. The surveys show that a larger proportion of children 6-12 years rode a bicycle to school in 2015, compared to the year 2000. Therefore, on this basis, it can not prove that in Sweden the proportion of children cycling to school decreased in connection with the introduction of the bicycle helmet law. After the introduction of the bicycle helmet law for children, the use of helmet increased significantly.

The analysis group's assessment is that the target of 70 percent helmet use will be very hard to achieve without a general helmet law, and would emphasize that concrete measures are needed to further increase the use of bicycle helmet.

According to the Road Safety Survey, the acceptance for a general bicycle helmet law has increased between the year 2016 and 2017, and by the year 2017, 67 percent 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 use of helmet.

Development and projection towards the 2020 target – moped helmet

Figure 37 presents the observed moped helmet usage in 2017. Only those moped riders who are seen to have their helmets properly used are counted as helmet users. The result shows that the observed moped helmet usage was 97.8 percent in 2017, compared to 94.8 percent in 2016, which is an increase of 3 percentage points. The analysis group's assessment is that the development is in line with achieving the target levels for 2020 – but as noted earlier, it is a new contractor of the measurements in 2016, which makes the results between 2015 and 2016 difficult to interpret.

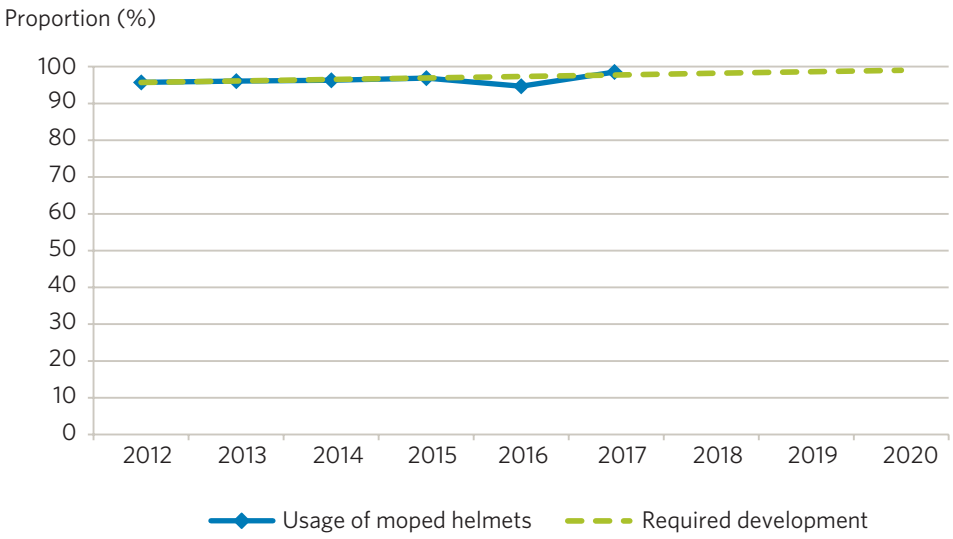

*Figure 37. The share of observed moped riders using a helmet 2012-2017, and the required develop ment until 2020. Source: VTI (through 2015) and new observational measurements 2016 and 2017. *Uncertainties due to change of contractor may have occurred in 2016.*

Analysis and discussion – moped helmet

Despite that the overall helmets usage among the moped riders is relatively high, the usage of helmet among the moped riders who were killed is only about 50 percent. During the year 2010-2017, 49 moped riders were killed, and less than 50 percent of those who were killed at the time of the crash were not wearing the helmets or had already lost their helmet. In the strategy for motorcycle and moped (Swedish Transport Administration, 2014), increased and correct use of helmets was raised as a priority area of action. It is presented that most people who lost the helmet during the crash were under 18 years old and that with the increased and correct use of the helmets it would be possible to save an average of three lives per year in Sweden.

In 2017, at least one moped rider was killed in the road traffic, about 230 were seriously injured and slightly more than 20 very seriously injured. Earlier statistics show that almost 40 percent of all moped riders who were very seriously injured suffered a head injury, while the corresponding share among the seriously injured is only 10 percent. Therefore, with the increased use of helmets by moped riders, has above all, the potential to reduce the number of very seriously injured moped riders. From calculations, it is shown that the use of a helmet reduces the risk of serious injury by 17 percent and very serious injuries by 47 percent.

4.6 Safe passenger cars

	2007	2017	Target for 2020	Assessed development towards target
Share of traffic volume for passenger cars with the highest Euro NCAP safety rating (2007)	20 %	72 %	80 %	In line with the required trend

The target for safe passenger cars is that by 2020 at least 80 percent of the traffic volume, that is, the number of kilometres (mileage) driven on Swedish roads, will consist of passenger cars with the highest safety rating according to Euro NCAP[9]. This means five stars[10] according the Euro NCAP assessment system of 2007, and implies the same level of crashworthiness as five stars under the current assessment system.

Development and projection towards the 2020 target

In 2015, the proportion of new cars sold in Sweden with the highest safety rating was 90 percent. These developments among new cars have led to an increase in safe car traffic volumes by approximately 5 percentage points per year. Between 2016 and 2017, the traffic volume has increased by 5 percentage points, from 67 percent to 72 percent (figure 38). The rate of improvement thus follows the required development towards the target for achieving 80 percent by 2020.

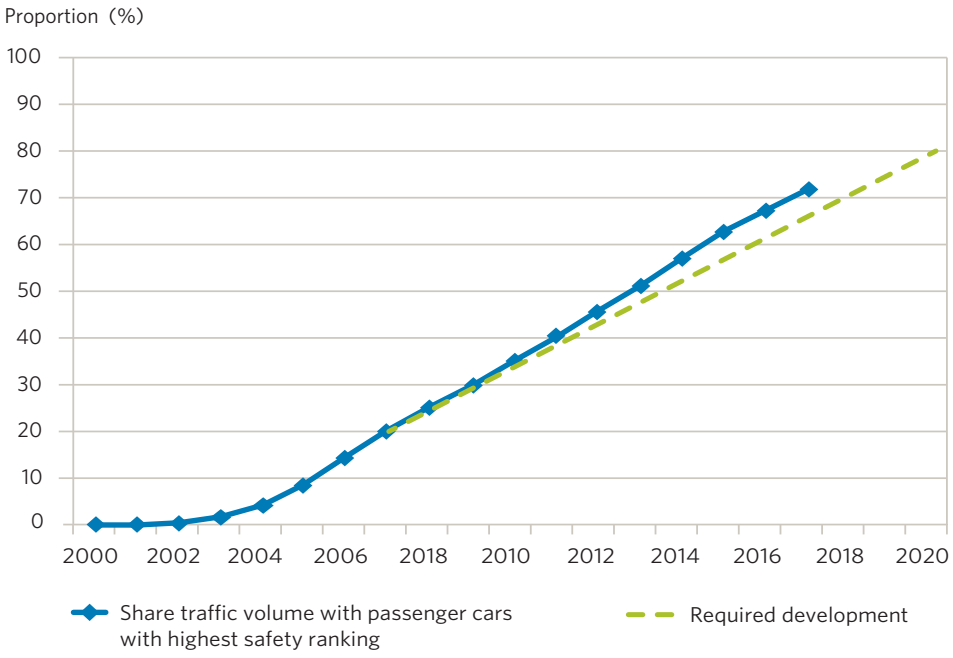

Figure 38. The share of the traffic volume with the highest Euro NCAP safety rating 2000-2017, and the required development until 2020. Sources: Bil Sweden, Transport Analysis (Trafikanalys), Swedish Transport Administration (Trafikverket).

[9]Euro NCAP is an organization that evaluates the safety level of new cars. The rating of 1-5 stars includes crash safety for adults and children, pedestrian protection and driver support systems. More information is available at www.euroncap.com.

[10]Five stars are the highest rating in Euro NCAP.

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. This trend is further accelerated by the fact that newer cars are used to drive longer than older ones. It may be generally assumed that it takes 15-20 years for the majority of the cars in the Swedish vehicle fleet to be replaced, and it is, therefore, the time it takes from the new safer cars to begin being sold until the majority of cars on the Swedish roads have this new higher safety level.

Since 2003 and 2009 respectively, driver support systems such as seat belt reminders (SBR) and electronic stability control (ESC) have also been included in the rating of Euro NCAP, and the proportion of new cars equipped with ESC and front seat belt reminders has been almost 100 percent in Sweden since 2009. The proportion of the traffic volume with vehicles that have these systems has been therefore estimated to be close to 100 percent by 2020. The trend in 2017 continues to be in line with these assumptions. However, it is important to note that there will be benefit from these systems several years after 2020, since the last percentage points of traffic volume without a SBR or ESC can be expected to be heavily overrepresented in fatal crashes (in the same way, if drunk drivers account for an extremely small proportion of traffic volume and at the same time for a much larger proportion of fatal crashes).

At the same time, it is equally important that further systems with documented road safety potential are introduced at a rapid pace to ensure vehicle safety continues to increase. Examples of such systems are Low-speed and High-speed Autonomous Emergency Braking (AEB), which reduces injuries from rear-end crash by about 40 percent (Rizzi et al. 2014 and Cicchino 2017), as well as Lane Keeping Assistance (LKAS) that has been shown to reduce head-on and single-vehicle injury crashes by about 30 percent (Sternlund et al. 2017). In recent years, these systems, along with Intelligent Speed Adaption (ISA), have been credited with rating points in the Euro NCAP's test protocols. Standard Autonomous Emergency Braking is an important component to getting a maximum of five stars, and the requirements will be increased further in 2018 and 2019.

The Euro NCAP's testing programme thus develops over time, and the requirements for the introduction of existing systems are expected to be strengthened even after 2020. The testing program is expected to include more essential safety systems in the future, for example, in the form of systems detecting impaired driving due to distraction, fatigue and possible alcohol or drug influence. It is proposed that the rating should be based both on the detection itself and how the vehicle or system functions if a reduced driving ability is detected.

At the end of 2017, Low-speed Autonomous Emergency Braking was fitted as standard on 61 percent of newly sold cars in Sweden. There was an option at an additional 10 percent[11]. The proportion of traffic volume with vehicles which have this system fitted as standard has been estimated to be approximately 20 percent in 2017, see figure 39. For Lane Keeping Assistance and Intelligent Speed Assistance and other types of Autonomous Emergency Braking systems, there are no compiled figures. It is therefore important to continue to monitor the development of the safety systems' implementation and impact in the Swedish vehicle fleet and traffic volume. The Euro NCAP's test protocol has been a driving factor in increasing the implementation of relevant safety systems by default as standard. When these systems are available as an option, financial incentives through discounted insurance premiums can be a way to encourage consumers to choose these options. This is even more important when purchasing cars in large fleets.

[11]Source: Folksam

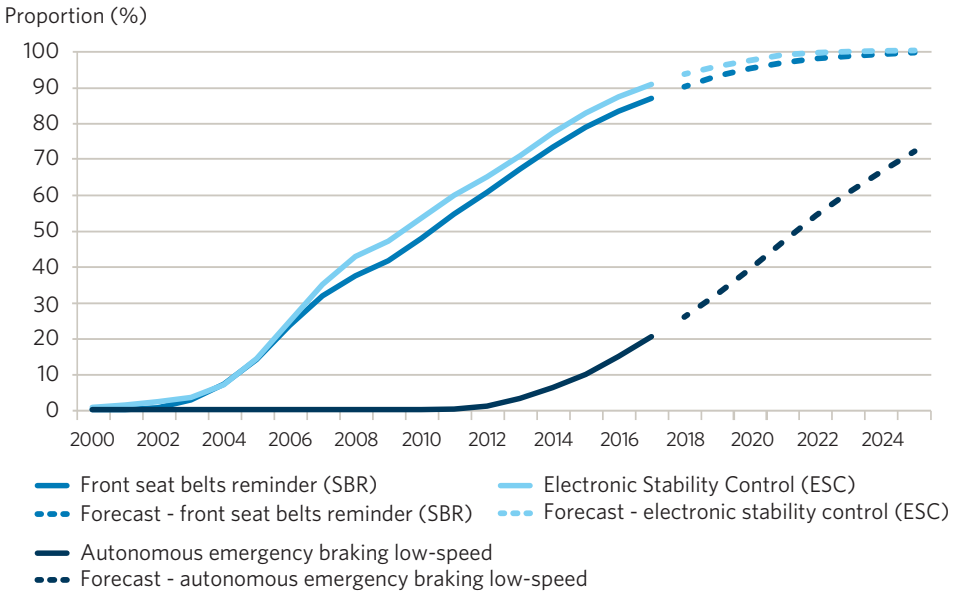

Figure 39. The share of the traffic volume with passenger cars equipped with standard front seat belts reminder (SBR), electronic stability control (ESC) and low-speed autonomous emergency braking (AEB) 2000-2017 and forecast 2018-2025. Sources: Folksam Insurance, Transport Analysis (Trafikanalys), Swedish Transport Administration (Trafikverket).

The safety of the Swedish vehicle fleet is thus not determined only by cars, 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 injuries with passenger cars occur more frequently in crashes involving older cars. As a rule of thumb, in general, when a group of cars has been driven for 80 percent of their lifetime mileage, they have only been involved in 50 percent of the total number of serious crashes they are expected to be involved in during their lifetime. 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 from this fact is that, it may be necessary to either move generally from existing traffic volume from older to newer cars or to scrap older cars that are lacking essential safety equipment, in order to accelerate the development towards a higher proportion of safe vehicles in road traffic.

In conclusion, we can establish that the indicator for safe passenger cars is developing at the required rate. Measures to increase the rate of inclusion of lane assistance systems, autonomous emergency braking and systems detecting impaired driving are important, although the benefit is expected to come late during this period and especially after 2020.

4.7 Increased rule compliance among motorcycle riders

	Starting year not determined	2017	Target for 2020	Assessed development towards target
Increased rule compliance among motorcycle riders	-	-	-	Not yet measured, no targets defined

Since 2016-2017 there has been a legal requirement in the EU for anti-lock braking system (ABS) on all new motorcycles with an engine capacity of more than 125 cubic centimeters. As a result of this, the indicator related to safe motorcycles (ABS) has been replaced by an indicator that relates to regulatory compliance among motorcyclists. The basic idea is that rule compliance is currently considered to be even more important for motorcyclists than for any other road users. Motorcyclists are unprotected road users who travel at the same high speed as protected road users and at present, there are no fully developed strategies to adapt the road transport system to a safe system for motorcycles.

By 2017, work has been ongoing to try to develop this indicator, but at the present, there is lack of effective routines for measuring this indicator in the traffic. Therefore, data from the Swedish Transport Administration's in-depth studies of fatal crashes with two-wheeled motorcycles are instead used. This is because the Swedish Transport Administration's in-depth studies are currently the only source that contains sufficiently detailed information to, as far as possible, assess the correct use among the motorcyclists. Given the complexity of the indicator, it is possible that this approach is the only reasonable option for analysis of the trends.

The purpose of this indicator is not to focus on simple human mistakes, errors or misjudgements, but on violations. With the proper use, it is meant that the motorcycle is used as listed below:

- The rider has a helmet
- The rider is sober (without alcohol or illegal drugs)
- The rider has a valid driving license for a motorcycle
- The rider is driving within the posted speed limit
- The rider does not use the motorcycle in an inappropriate or reckless manner, for example, riding on the rear wheel.

Over the last 5 years, the trend has been relatively stable. In the case of fatal crashes, the motorcycle has been used correctly by the driver in about 25 percent of the cases, see figure 40. There are, however, some missing data during the same period, which vary between 0 and 6 percent.

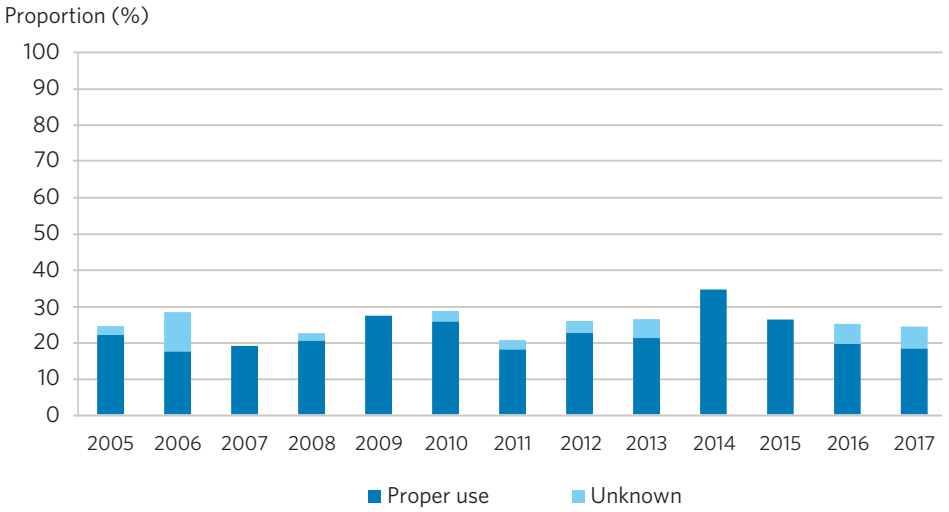

Figure 40. The share of the right use of a motorcycle in fatal crashes with two-wheeled motorcycles, 2005-2017. Sources: Swedish Transport Administration's in-depth studies (Trafikverket).

Slightly more than half of the fatalities with motorcycles (57percent) were associated with at least one violation. In order to better understand the complexity of the problem, it is possible to illustrate how the lack of helmet, drunk driving, drug influence, lack of valid driving license and speeding at least 30 km/h above the speed limit interact with each other in fatal crashes with motorcycles. In figure 41, there are illustrations of every violation with a circle. For example, the top light blue circle illustrates all the killed motorcyclists without a helmet (a total of 7 percent over the period 2005-2017). When two or more circles overlap, it means that these violations were in the same crashes – see example in Figure 41.

During the period 2005-2017, approximately 38 percent of the fatal crashes were associated with at least two combinations of the lack of helmet, drunk-driving, drug influence, lack of valid driving license and speeds of at least 30 km/h above the speed limit. However, in only 1 percent of the cases (which corresponds to a fatal crash every two years), all these violations occurred at the same time. Previous analyses show that among the killed motorcyclists who lacked driving licenses and who had known driving license history, about 50 percent had previously lost their driving license (The Swedish Transport Administration, 2016). In another 19 percent of the cases, the speed of at least 30km/h above the speed limit was the only violations (bottom grey circle). Two-thirds of these cases were with a so-called super-sport motorcycle.

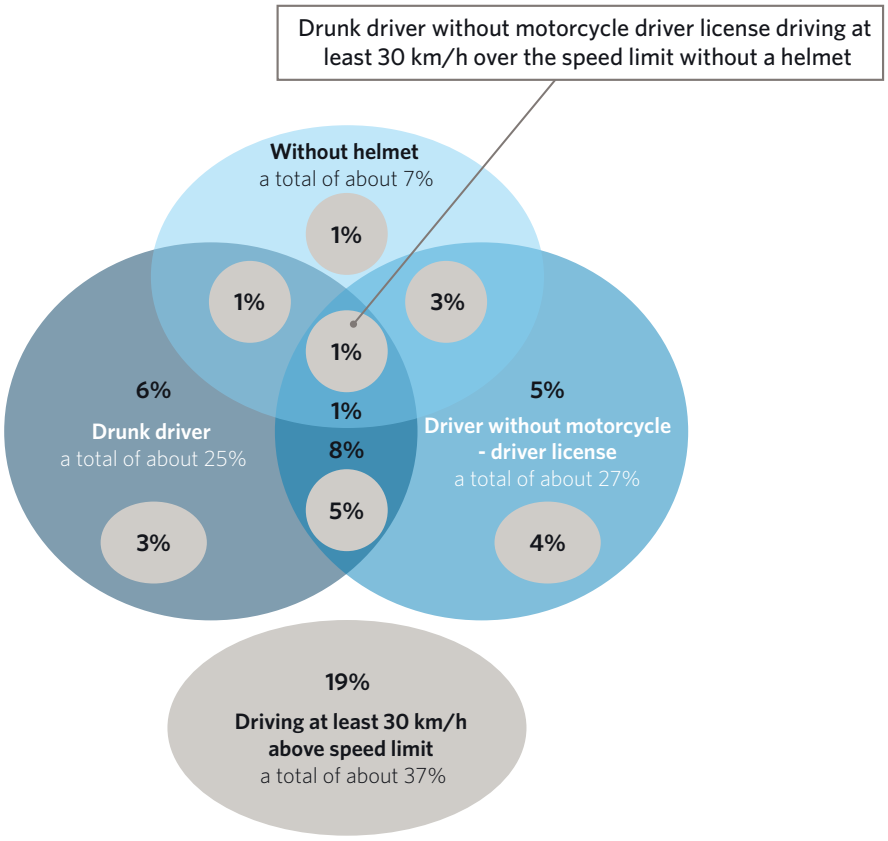

Figure 41. The interaction between lack of helmet, drunk-driving/drug influence, lack of valid driving license and speed of at least 30 km/h above the speed limit in fatal crashes with two-wheeled motorcycles 2005-2017 (100 percent = 516 motorcyclists' fatalities in 2005-2017). Sources: Swedish Transport Administration's in-depth studies (Trafikverket).

Overall, the data from the Swedish Transport Administration's in-depth studies suggest that this indicator is more challenging to measure in traffic than compared with other indicators. The reason is that other indicators aim to measure relatively one-dimensional conditions in the traffic (for example, speed compliance, use of bicycle helmet or seat belt etc.) while the indicator for increased rule compliance among the motorcyclists aims to measure several phenomena that occur both separately and in combination with each other.

The single parameter that could best indicate rule compliance among the motorcyclists in the traffic could be the speed compliance. However, the purpose of the increased regulatory compliance indicator is to address several of the violations that are often observed in fatal crashes. Speed measurements from 2017 showed that the proportion of traffic on motorcycles driving within the speed limit on national roads was about 43 percent, and the corresponding share of traffic with passenger cars without trailers was 46 percent, see Figure 4.

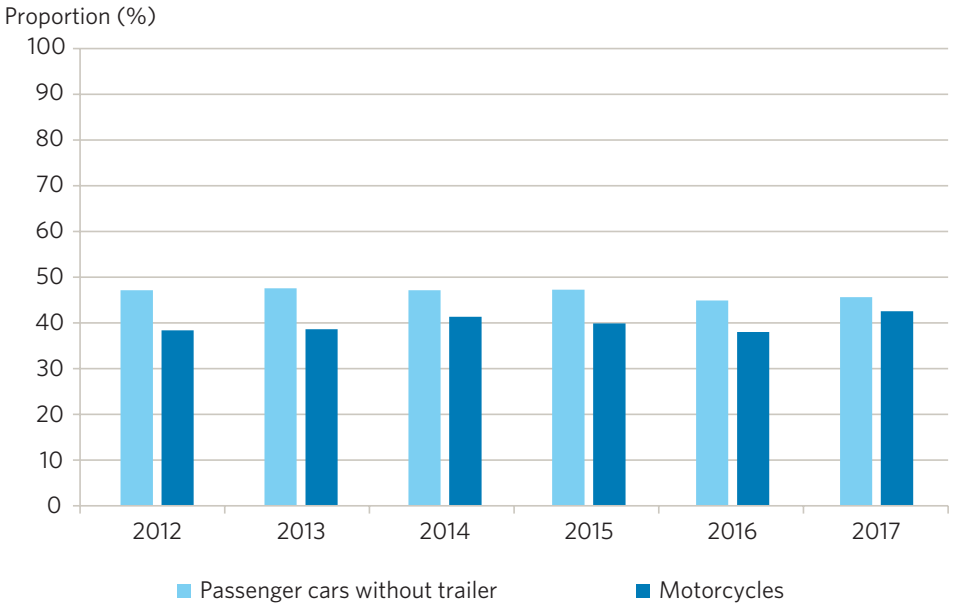

Figure 42. The proportion of traffic volume carried out within the posted speed limit for passenger cars and motorcycles, national road network 2017. Sources: Swedish Transport Administration (Trafikverket).

The other risk factors are more difficult to measure in the traffic – there are at least no fully developed methods to make use of. Examples of this are illegal driving, reckless driving and the influence of alcohol or drugs. Certainly, there are police statistics on legitimate road users, but it is not currently possible to differentiate the motorcyclists from other categories of road users. The use of helmet among motorcyclists can be easier to measure, for example, by manual observation measurement or camera systems. The clear lack of use of protective equipment and clear violations of the speed limit or other traffic rules ought to be observed.

In overall, the current rule compliance indicator is based on data from the in-depth studies of fatal crashes, as there are no effective routines for measuring this traffic condition. The challenge has been to find a way to measure the regulatory compliance that could be used in the observational studies. This should also meet all the requirements currently set for an indicator in the target management of traffic safety work with regard to measurement – namely that it should have good validity (strong causality connection between condition and crash or injury risk) as well as being reliable and repeatable. Therefore, it is possible that the in-depth studies of the fatal crashes will continue to be used for the follow-up of this indicator.

4.8 Safe national roads

	2007	2017	Target for 2020	Assessed development towards target
Share of traffic volume with median barriers on national roads with speed limit above 80 km/h	50 %	76 %	90 %	Not in line with the equired trend

The existing target for 2020 is that at least 90 percent of the traffic volume on roads with speed limits above 80 km/h should be done on roads that are separated with median barriers. This target can be achieved either by lowering speed limits or by rebuilding roads with median barriers. Other measures on the national road network include primarily side barriers, centreline rumble strips, intersection measures, and measures for safer cycling.

Development and projection towards the 2020 target

The share of traffic volume with median barriers on national roads with speed limits above 80 km/h was 76 percent at the end of 2017. As seen in recent years, an increased rate of newly built median barriers or reduction of speed limits is required to reach the target level. The development of this indicator is therefore considered not to be in line with the required development.

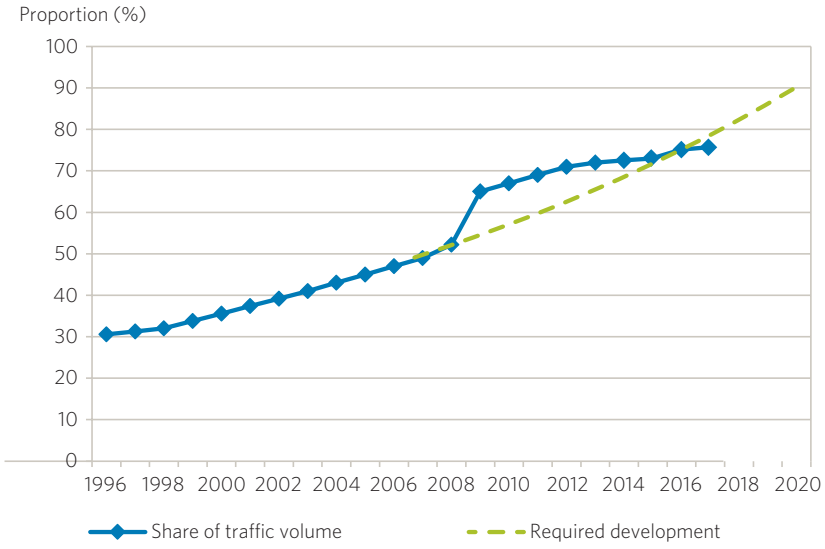

Figure 43. The share of traffic volume with median barriers on roads with speed limits above 80 km/h 1996-2017. Sources: Swedish Transport Administration (Trafikverket).

Analysis and discussion

A total of 70 km of roads separated with median barriers were added in 2017. Nearly 170 km of roads with a speed limit of 90 km/h has been reduced to 80 km/h. This meant that the outcome for the indicator increased by one percentage point to 76 percent in 2017. At the end of 2017, there was a total of 5,270 km of roads with median barriers, which corresponds to just over 5 percent of the Swedish road network. In addition, some number of minor measures were also applied and

implemented to intersections and roadside areas, and 180 km of roads were milled with centreline rumble strips in 2017.

In total, there is about 5,000 km of centreline rumble strips on national roads. Table 2 shows the development of the number of km for roads with median barriers. The annual increase in the number of km of roads separated with median barriers has decreased from the previous 200-250 km to less than 100 km.

	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
2+1-road	950	1130	1300	1510	1770	1950	2120	2330	2500	2620	2680	2790	2870	2940	3000
Motorway	1580	1600	1700	1740	1810	1860	1880	1940	1960	1960	2000	2050	2080	2080	2090
Other w. median barrier	220	230	240	240	250	200	200	200	220	190	170	170	170	180	180
W. median barrier, total	**2750**	**2960**	**3240**	**3490**	**3830**	**4010**	**4200**	**4470**	**4680**	**4780**	**4850**	**5000**	**5120**	**5200**	**5270**

Table 2: Km of roads with median barriers, 2003-2017 (at year's end).

When the *National Plan for the Transport System 2014-2025* was established, the government decided, among other things, that the systematic adaptation of speed limits to road standards should continue. The focus of the plan is that all national roads with a annual average daily traffic (AADT) over 2000 must either be separated with median barriers or have a maximum speed limit of 80 km/h by the end of the plan period, in 2025. The national roads with AADT lower than 2,000 will not be subject to any systematic speed reductions – an exception involving approximately 7,500 km of 90-100 km/h roads without median barriers in sparsely populated areas.

During the spring of 2016, the Swedish Transport Administration issued a proposal for adjusting the speed limits. The proposal means that approximately 1,200 km of national road will get a raised speed limit and that about 4,300 km will get lower speed limits. This means that the number of fatalities is estimated to decrease by approximately 7 people per year as a result of the speed limit change, and with approximately 9 people per year as a result of planned investments until 2025.

Of the roads that get raised speed limits, it is approximately 1,000 km which is raised from 90 km/h to 100 km/h by being converted to a road separated with median barriers. The roads that have lowered speed limit are mainly 90 km/h roads that are lowered to 80 km/h. The systematic reduction from mainly 90 km/h to 80 km/h was commenced in accordance with the proposal in the autumn of 2016, and the Swedish Transport Administration intends to continue this work in the next few years. Some of the Swedish Transport Administration's decision on the 80 km/h road is appealed to the government, but no decision has yet been taken in these cases. If the government repeals the Swedish Transport Administration's decision on 80 km/h, it will in all probability affect the continued work on the systematic adjustment of speed limits to road traffic safety standards.

For the period of 2016-2020, it is planned that more than 400 km of 90 km/h roads should be fitted with median barriers, and get the increased speed limit of 100 km/h, while at the same time approximately 2,200 km of 90 km/h roads will be reduced to the speed limit of 80 km/h. If the measures planned for 2020 are implemented, it is estimated that about 85 percent of the traffic volume on roads with a speed limit above 80 km/h will take place on a road separated with median barriers by 2020. If the government repeals the decision on 80 km/h roads in its reviewing of the Swedish Transport Administration's decision, the 85 percent level will probably not be reached.

4.9 Safe pedestrian, bicycle and moped passages

	2013	2017	Target for 2020	Assessed development towards target
Share of safe pedestrian, bicycle and moped crossing in the main road network for cars	19 %	27 %	35 %	In line with the desirable trend

The defined target level of the indicator for the proportion of safe pedestrian, bicycle and moped crossings is that at least 35 percent of all crossings on main networks for cars should be of good safety standard by 2020.

A pedestrian, bicycle and moped crossing is defined as safe if it is grade separated or if 85 percent 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 pedestrian, bicycle and moped crossing. In this indicator, ”the main network” means streets and roads in the functional road class of 0-5.

Inventories have been made in the field by compiling what types of pedestrian, bicycle and moped crossings and speed control humps are available, as well as where they exist. The crossings are then classified using tools in the GIS map application, based on set criteria. Data on pedestrian, bicycle and moped crossings and speed control humps from about 150 municipalities are registered to the national roads database (NVDB). Some municipalities have also chosen to invent crossings on national roads in the local area. During 2016 and 2017, a more systematic inventory was carried out on the national road network: European roads, arterial roads and county roads (although not comprehensive on county roads).

Development and projection towards the 2020 target

At the end of 2017/2018, the proportion of pedestrian, bicycle and moped crossings with a good safety standard is calculated to be 26 percent, see figure 44. The proportion of pedestrian, bicycle and moped crossings with a good safety standard is at a level in 2017 that the analysis group estimates to be in line with the required development until 2020.

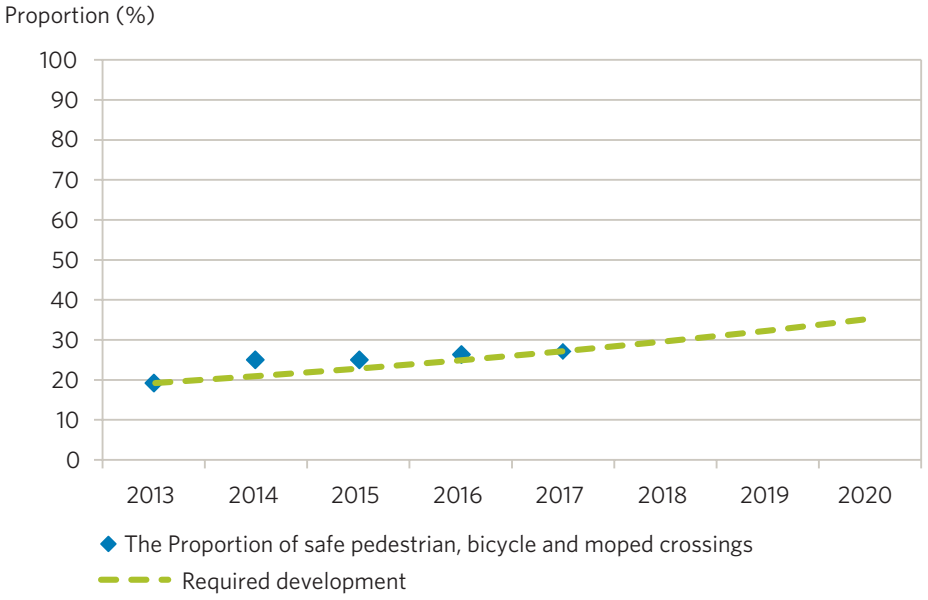

Figure 44. The proportion of pedestrian, bicycle and moped crossings with good safety standard 2013-2017. Sources: Swedish Transport Administration (Trafikverket).

The proportion of crossings of medium safety standard was 21 percent and 53 percent were of low safety standard in 2017, see figure 45. On municipal road networks, 20 percent were of good quality, and the equivalent for national roads was 39 percent.

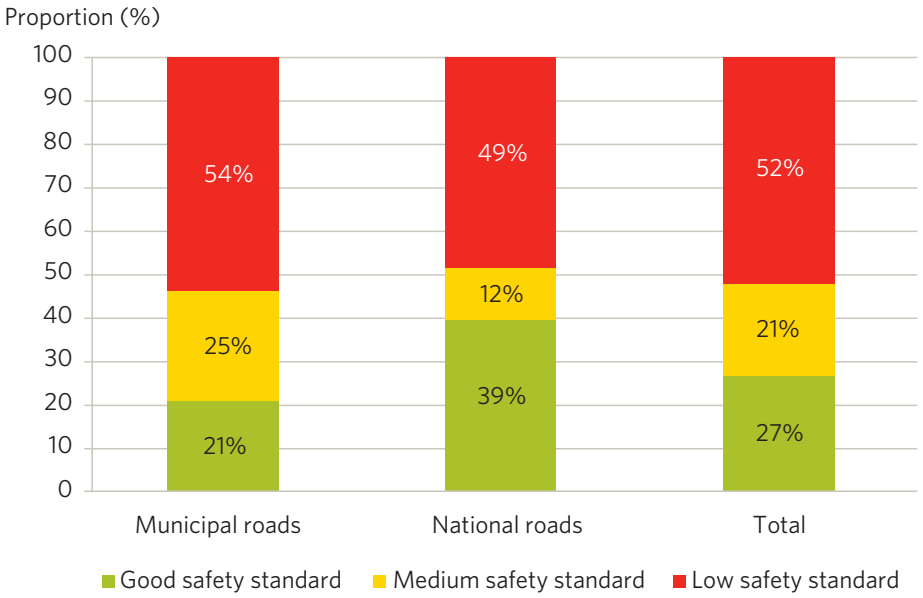

*Figure 45. The proportion of pedestrian, bicycle and moped crossings with good, medium and low safety standard (n=21700), reported in 2017/2018. Sources: Swedish Transport Administration (Trafikverket). *National roads; European roads, arterial (main) roads and county roads.*

Analysis and discussion

The comparison between the different years should be interpreted with great caution, as the number of municipalities included in the measurement has increased significantly between the measurements, from more than 40 municipalities in 2013/14 to almost 150 municipalities in 2017/18. During 2016 and 2017, a more systematic inventory was carried out on the national road network: European roads, arterial roads and county roads (not comprehensive on county roads). At present, there are 21,700 crossings classified within functional road class of 0-5, of which 15,100 are municipal and 6,600 are national.

According to the Swedish Transport Administration's in-depth studies of fatalities, between 10 and 20 pedestrians or cyclists are killed each year at pedestrian, bicycle and moped crossings in urban areas. Most of these individuals are killed in a crash that occurs at crossings on municipal road networks, where they are not protected by any form of speed calming measure. On the national roads, a total of about 10 pedestrians and cyclists are killed annually when they cross the road. Of these, an average of 2 people are killed on any form of orderly crossing, which in most cases is not protected by any form of speed calming measure. The others have occurred where the pedestrian, bicycle and moped crossings are missing completely, of which about half are on semi-urban road sections.

In order to improve this indicator, and thereby road safety in mainly urban areas, municipal and national road authorities must take up the challenge of addressing more crossings, introducing speed reducing measures near crossings, such as humps, or building grade separated crossings. This can also work for better speed adaptation and lower speed levels in the urban area. The map application which has been developed that was mentioned earlier provides a good support for both municipal and national road authorities in terms of addressing more crossings.

The target level of 35 percent seems to be low but poses a significant challenge until 2020. It will require changes in the design of the road environment, which means that plans have to be established and resources have to be set aside to raise the quality of safety on a crossing from red or yellow to green.

4.10 Maintenance of pedestrian and cycle paths in urban areas

	2013/14	2017/18	Target for 2020	Assessed development towards target
Share of municipalities with good maintenance of priority cycle paths	18 %	36 %	70 %	Not in line with the required trend

The target for the indicator is that 70 percent of the municipalities will have good quality on the maintenance of priority bicycle routes by 2020. A closer definition of the indicator is that the proportion of municipalities with populations of at least 40,000 inhabitants that are performing good maintenance for the most prioritized bicycle paths within the municipality's main town. Good quality means quality in terms of standard requirements for winter and summer maintenance, gravel and leaf sweeping, as well as good quality control of the standard requirements made.

The indicator is measured by a survey every two years. So far, the survey has been sent out three times: in 2014 for 2013/14 season, in 2016 for 2015/16, and in 2018 season for 2017/2018 season. The survey has been carried out on behalf of the Swedish Transport Administration and in consultation with the Swedish Association of Local Authorities and Regions (abbreviated SKL in Swedish).

The survey has been sent out to the municipalities with the population over 40,000. In 2014, the survey was sent out to 60 municipalities, and 59 of them responded to it. By 2016, the number of municipalities has increased, but the response rate for the survey decreased: 54 municipalities responded. It appeared almost similarly in 2018 when 55 out of 60 municipalities answered to the survey. The survey that was used in 2016 and 2018 is a further development and simplification of the survey that was used in 2014.

Based on the responses given by the municipalities in the survey on standard requirements and quality control of the set standard requirements, municipalities are awarded different points. These points form the basis for a comprehensive assessment of the quality level for each municipality. The quality level is not an absolute level, but more to be regarded as a relative scale for a comparison between municipalities with at least 40,000 inhabitants. However, the requirements are so high that the municipalities that are judged to be of good quality have a broad and high level on most of the essential requirements that are important for the safety of cyclists.

There was a total of 50 municipalities that responded to the survey both in 2014 and 2016, while 47 municipalities responded to the further developed survey both in 2016 and 2018. The estimated development between 2013/14 applies to the 50 municipalities that responded on those occasions, and the estimated development between 2015/16 and 2017/18 applies to the 47 municipalities that responded on both occasions.

The previous analysis report showed that the proportion of municipalities with good quality was 40 percent in 2015/16. That figure, however, contained an error and was also adjusted further to apply to the 47 municipalities that responded to both surveys in 2015/16 and 2017/18. Therefore, the figure has been adjusted to 34 percent for the 2015/16 season.

Development and projection towards the 2020 target

The proportion of municipalities with good quality on maintenance of their highest priority bicycle paths in 2017/18 is estimated to be 36 percent, see figure 46. The analysis group estimates that the outcome is not in line with the necessary development by 2020.

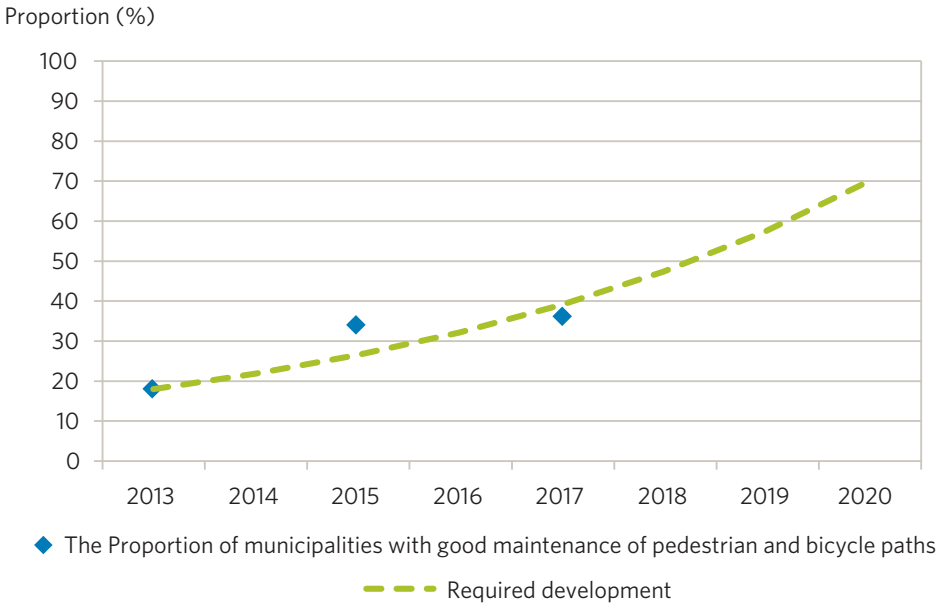

Figure 46. The Share of municipalities with good maintenance of priority pedestrian and cycle paths, 2013 (2013/2014) and 2015 (2015/2016) and 2017 (2017/2018) and the required development until 2020. Sources: Swedish Transport Administration (Trafikverket).

The results show the following for the 47 municipalities that responded to both surveys in 2016 and 2018:

- 36 percent (17 in number) of municipalities with 40,000 or more inhabitants requires operation and maintenance of priority bicycle paths that are considered to correspond to good quality. This is an increase of 2 percentage points compared with the 2015/16 season.
- Another 40 percent (19 in number) of municipalities with more than 40,000 inhabitants were estimated to have medium quality for maintenance of priority bicycle paths. This is an increase of just over 12 percent compared with the 2015/16 season.
- One quarter, barely 24 percent (11 in number) were estimated to end up at a low quality. It is 14 percentage points lower compared with the 2015/16 season.

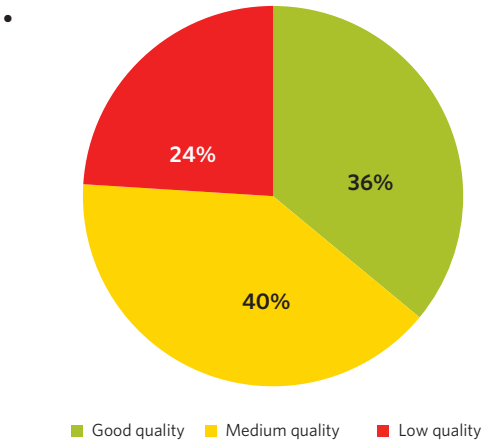

Figure 47. Percentage distribution of municipalities that have good, medium and low quality of operation and maintenance of priority bicycle paths, 2017/18. Sources: Swedish Transport Administration (Trafikverket).

Analysis and discussion

The result for the 2015/16 season was very positive compared with the results for the 2013/14 season. The survey showed that the standard of operation and maintenance of the municipality's most prioritized bicycle road network met the requirements for good quality in basically twice as many municipalities as in the 2015/16 season compared with the 2013/14 season (20 compared to 9). In view of the latest survey for the 2017/18 season, the increase appears to continue, but the rapid rate of improvement seems to have decreased.

The result indicates that several municipalities increased from both low and medium quality to good quality between 2013 and 2015, while the quality increase between 2015 and 2017 was mainly due to the fact that several municipalities have gone from low to medium quality.

By comparison between 2013 and 2015, 19 out of 50 municipalities (38 percent) have moved from a lower to a higher quality level. The corresponding figure for the period between 2015 and 2017 is 14 out of 47 municipalities (30 percent). For the latter period, it can also be noted that 6 out of 47 municipalities (13 percent) have lowered their quality level between 2015 and 2017.

The differences in the results between the various periods are most likely due to the fact that the actual conditions have changed with regard to standard requirements, quality control and maintenance of priority bicycle paths. Some changes in the questionnaire and the awarding of points, as well as the fact that in some municipalities there are different persons who responded to 2014, 2016 and 2018 questionnaires, may have influenced the results of the survey to a minor degree.

At an aggregated level, the results from the 2018 survey show that improvements among the 47 municipalities primarily concern requirements for summer maintenance, while the standard requirements regarding winter road maintenance and gravel sweeping do not appear to have improved considerably.

Winter road maintenance and gravel sweeping are the single most important areas as regards the safety of cyclists. The 2018 survey shows that 50 percent of the municipalities have a maximum of 3 cm as a starting criterion for snow removal. 76 percent of the municipalities have the requirement that the snow clearance to be completed latest by 7.00 am. 24 municipalities (44 percent) use sweep-salting as a method of snow removal and deicing measures on the priority bicycle road network. Of the municipalities that are using traditional deicing, only 6 (19 percent) are performing some sort of gravel sweeping during the winter and early spring before the gravel is picked up in the late spring.

4.11 Systematic traffic safety work in line with ISO 39001

	Starting year not determined	2017	Target for 2020	Assessed development towards target
Systematic traffic safety work in line with ISO 39001	-	-	-	Not yet measured, no target defined

The systematic road safety work in line with ISO 39001 was proposed as a new indicator in connection with the review work in 2016.

The Swedish Standards Institute (SIS), together with the Swedish Transport Administration, has developed a management system standard for road safety: ISO 39001. The standard was adopted in December 2012. The purpose of the standard is that organizations should be able to work systematically with road safety. The impact of the target management on the individual stakeholder is, to a large extent, influenced by how systematic the stakeholder's safety work is.

ISO 39001 refers to and is applicable to all organizations that are willing to improve road safety, regardless of the type, size and product or service they provide. The standard specifies requirements for a management system for road traffic safety, reducing the number of fatalities and serious injury. The requirements of the standard include the development and implementation of an appropriate road safety policy, and that road safety objectives and action plans shall be established, taking into account the legal requirements and other requirements on which the organization is bound.

In the process of defining concrete, monitorable targets and actions, all stakeholders can get some support from the national indicators used in the road safety management by objectives. Both the interim target work and the standard road safety work are also systematic approaches with "plan, do, check, act" in a recurring cycle.

Although it has been more than five years since the standard was established, only a few stakeholders have undergone an accredited certification process or industry-based certification audits. Through the overall work of leading road traffic safety, the ISO 39001 and systematic working methods can become more well-known to suppliers and transport operators, which can contribute to a greater impact on the standard.

With a successively breakthrough among both clients and contractors, the development of measurement methods and a target level for ISO 39001 become more important to follow up and be communicated.

5 Conclusions and discussion

In 2017, there were 253 fatalities in road traffic crashes in Sweden, which is the lowest number of fatalities since the 40's. The number of fatalities is thus 43 percent lower than the average for 2006-2008. Since 2013, the positive road safety development has stagnated and the trend towards the target is not going fast enough. However, in 2017, the number of fatalities was reduced, which means that the outcome is now in line with the required development. It is too early to say if the reduction in the number of fatalities is a trend break or a coincidence. We know that several of the indicators identified as the most important for achieving the target by 2020 have not been developed to a sufficiently positive extent. Therefore, the overall assessment of the analysis group is that it is uncertain if the target for the fatalities in 2020 will be achievable. This is also strengthened by the forecast of the number of fatalities in 2020 that were made in the project *Review of 2020 interim targets* (the Swedish Transport Administration and Swedish Transport Agency, 2016), which showed that the expected outcomes are slightly above target.

A closer analysis of the stagnation of the number of fatalities shows that it is most apparent among motorists, and on national 70-90 km/h roads without median barrier. Above all, the number of fatalities among passenger car occupants in single-car crashes has not decreased in recent years.

On average, 15 lives can be saved per reduced km/h in average travel speed. It is therefore important to implement the measures proposed in the national plan on national roads. For the period up to 2020, the proposal means that more than 400 km 90 km/h roads are fitted with median barriers and get the speed limit of 100 km/h, while at the same time approximately 2,200 km of 90 km/h roads are lowered to 80 km/h. The increased use of automatic speed cameras (with an annual addition of approximately 200 cameras) becomes particularly important on 80 km/h road sections where the median barriers are not installed.

The road design and vehicle fleet safety gains require that they are combined with the right speed. In the current set of safety performance indicators, it is the indicators of speed compliance that have the greatest impact on other indicators. At present, the indicators of speed point to such an unacceptably low level of compliance that the analysis group estimates it is highly unlikely that the indicator targets by 2020 will be reached. This is because it is known that automatic speed cameras do not give enough effect, that the police's manual speed enforcement has diminished, and that other innovative solutions will not manage to deliver enough benefits before 2020.

The proportion of sober traffic volume is high in Sweden, but the indicator for sober drivers is still not in line with the required development. During 2017, 81 road users died in alcohol or drug-related traffic crashes, which is the same as 2016 when 83 people died. This corresponds to 32 percent of the total number of people killed in road traffic crashes. In 2016, the number of drug-related crashes increased significantly, especially among drivers of passenger cars – and it has not decreased in 2017.

In the long term, it is likely that support systems will be developed in vehicles that detect if drivers' driving ability decreases, for example, due to alcohol and/or drug influence. However, in the short and medium term, it is important that other efforts to increase sobriety are intensified. The police's breath tests have declined over several years, from 2.7 million test in 2011 to 1.1 million in 2017. These controls are an important measure to improve the sobriety indicator, but further efforts are also needed.

More than half of the motorcycle fatalities are associated with one or more violations. At present, there are no fully developed strategies for adapting the road transport system to a safe system for motorcycles, and therefore rule compliance is even more important for motorcyclists than for other road users. However, there is a lack of effective routines to measure this in traffic. The Swedish Transport Administration's in-depth studies currently are the only source that contains sufficiently detailed information to, as far as possible, assess the correct use among motorcyclists. In the case of fatal crashes, the driver has used the vehicle correctly in about 25 percent of the cases.

By 2017, the number of seriously injured is estimated at approximately 4,400. There has been a marginal decrease since 2010 and the outcome for 2017 is right at the limit of the required annual development. The planned actions addressing seriously injured are not considered to occur in sufficient extent. The analysis group, therefore, estimates that the development of seriously injured technically is in line with the required development, but it can still be difficult to reach the 2020 target.

Cyclists and motorists account for about 80 percent of all seriously injured in road crashes. The number of seriously injured motorists is decreasing and there is a reason to believe that the trend will continue, thanks to safer cars. On the contrary, the number of injured cyclists has not improved to a great extent.

In order to reduce these injuries, the responsible road authorities in the short perspective must provide a good maintenance for pedestrian and bicycle paths. In a longer perspective, greater attention needs to be paid to the needs of unprotected road users in terms of infrastructure design. Helmet use among cyclists also needs to increase, as well as the development of other protective equipment. In terms of infrastructure and maintenance, the national road authority also has an important responsibility that should not be forgotten. Speed-calmed pedestrian, bicycle and moped crossings are another area that is important.

In summary, the analysis group estimates that too many indicators are not in line with the required development, in relation to the time that is left until 2020. It is still possible to reach the 2020 interim target, but in order to ensure that this happens as a result of a systematic road safety work, very rapid actions would be required to improve the safety performance indicators. However, it is doubtful that this will happen to a sufficient extent until 2020. In the short term, the analysis group estimates that it is mainly the measures for speed compliance and reduced average speed that are most effective, especially on roads without median barriers. For seriously injured cyclists, maintenance of bicycle paths is an important intervention area. In addition, more long-term plans are required ahead of the forthcoming interim targets for 2030. Sweden's road safety work, therefore, calls for quick actions before 2020, but also a long-term work for 2030, which of course is a challenge.

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