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German Autobahn: The Speed Limit Debate

Introduction

In Germany, the introduction of a national speed limit for motorways has been on the political agenda of different road safety and environmental groups for decades. However, the debate has gathered pace over the past year. The SPD, one of the main coalition partners in the German government, supported a motion to introduce such a limit at their Party conference in October 2007. Yet immediately after this came an announcement by the Chancellor Merkel that she would not back such a legislative proposal. Instead she called for drivers to take their own responsibility and pointed to the progress made in the recent reduction in deaths on Germany's roads.

While motorway speed limits are a matter for national governments, the absence of a mandatory speed limit on much of the Autobahn network in Germany affects other citizens of Europe. For example the size, economic and cultural importance, and central location of Germany mean that its Autobahn network is used extensively by citizens of other European countries. These many drivers from outside Germany encounter unfamiliar conditions under which even when they are driving as fast as is allowed in their home country, they can be approached from the rear at high closing speeds.

Citizens of other European countries look forward to the debate in Germany being resolved in favour of a mandatory speed limit throughout the German Autobahn network.

Safety on the Autobahn: Current situation

Currently, 52% of the German motorways do not have a speed limit, 15% have temporary speed limits due to weather or traffic conditions and 33% have permanent speed limits. On unlimited sections there is a 130 km/h recommendation.

Speed: a basic risk factor

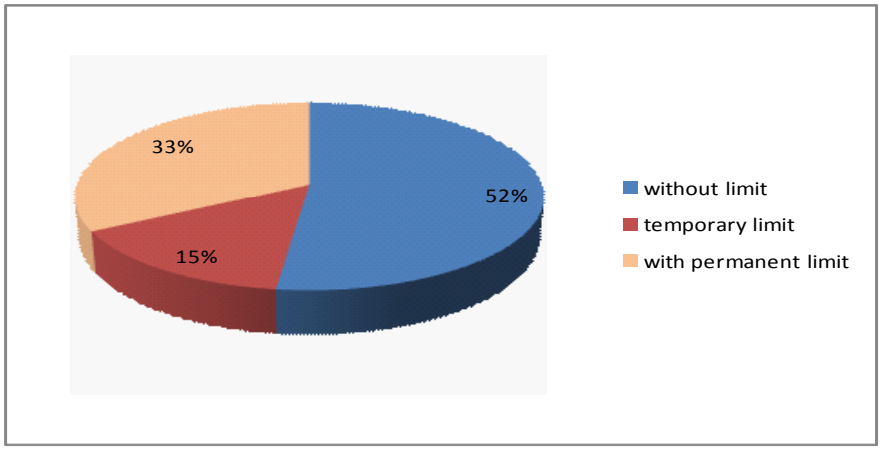
The relationship between speed and road accidents has been studied extensively and is very clear: the higher the speed, the greater the probability of a crash and the severity of crashes. All review studies indicate that:

-Small changes in mean speeds can be expected to result in much larger changes in crash outcomes.
-Severe crashes (resulting in serious injuries and deaths) are much more sensitive to speed changes than crashes in general.

The Power Model: while the risk linked to speed varies from road types to road type, an empirically verified model shows that on average, a modest percentage reduction in the mean speed of traffic will lead to a twofold percentage reduction in injury accidents, a threefold percentage reduction in injury accidents and a fourfold percentage reduction in fatal accidents (Aarts and van Schagen 2006, based on Nilsson 1982). So, for example, a 1% reduction in mean speeds on a given road leads to a 2% reduction in injury accidents, a 3% reduction in serious injury accidents and a 4% reduction in deaths. It follows from the high risk associated with speed that reductions in driving speeds (even apparently minor ones) will make an important contribution to reducing the number and improving the outcome of road accidents.

Information box 1: Speed, a basic risk factor

Figure 1: Proportion of limits on German motorways:



European Transport Safety Council

One argument used in favour of the status quo is that a similar proportion of deaths on the motorways in Germany occur on sections without speed limits as on sections with limits. According to the German Statistics Agency, of the 645 road deaths that occurred on motorways in 2006, 441 or 67% occurred on motorway sections without limits. This is consistent with the figures from the previous year, 2005, when 662 deaths occurred on motorways, 462 (70%) of them on unlimited sections (fig. 3):

Figure 2: Lethal accidents on German motorways:

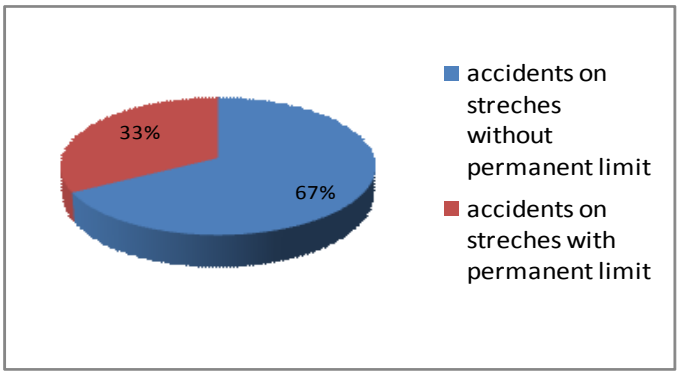
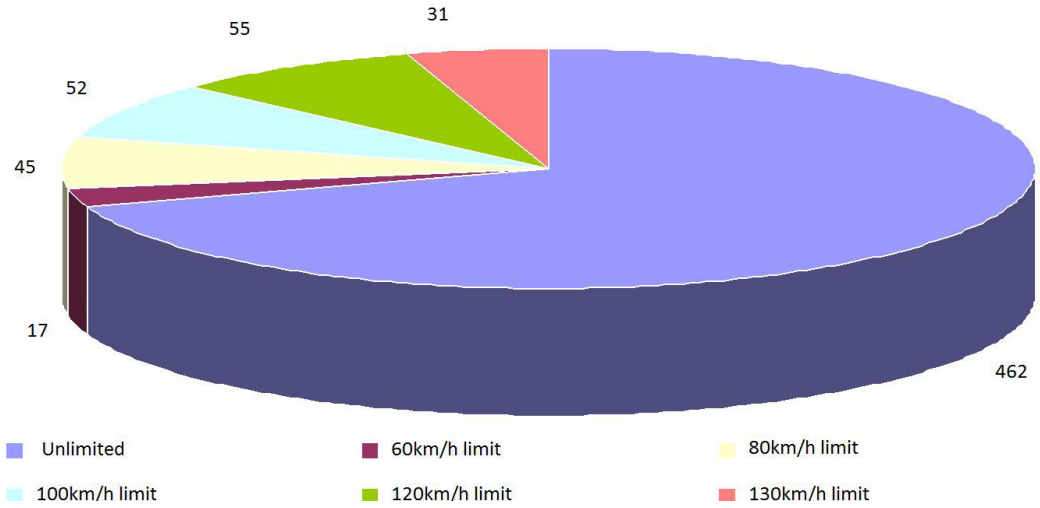


Figure 3: Deaths on the Autobahn for 2005 by speed limit at accident sites (Deutsche Hochschule der Polizei):



But this similarity of percentages takes no account of traffic volumes on the different sections. Traffic volumes on sections without speed limits are likely to differ appreciably on average from those on sections with speed limits. This should be investigated to cast more light on the numbers of deaths on the two kinds of section.

German motorways: How do they compare for Safety?

German motorways are amongst the most safely engineered roads in Europe. However, in terms of deaths per billion vehicles kms driven on motorways, Germany ranks eight in 2006 out of the European countries for which there is data (see figure 4 and Annex 1 for details of Germany's progression from 1997 to 2006). This indicator is the most suitable one to compare motorway safety between countries. Other indicators make little sense because traffic volumes vary greatly between countries (deaths 'per population' or 'per length of motorway' would be of little help).

Comparability of this indicator between countries depends on the quality of their estimates of vehicle kms driven on the motorways. A number of factors influencing fatal accidents on motorways also vary between countries (quality of car fleet; efficiency of rescue system, seat-belt wearing rates and so on) and are likely to have an impact on the accidents rates and outcomes on motorways. Nevertheless, this indicator is a widely used comparator of safety[1].

It is interesting to note that Germany has improved its rate by a yearly average percentage reduction of 5% since 1997 (Annex 1). However, other countries have improved at a faster rate. France for example has improved by an average yearly percentage reduction of 7% since 1997 (Annex 1). Switzerland, a frontrunner in terms of enforcing speed limits, has achieved the highest reduction rates. On the other hand Austria, with similar road infrastructure conditions and permanent speed limits on motorways, shows a poorer safety performance than Germany. Germany remains a rather good performer in terms of motorway safety but this indicator shows that there is room for improvement.

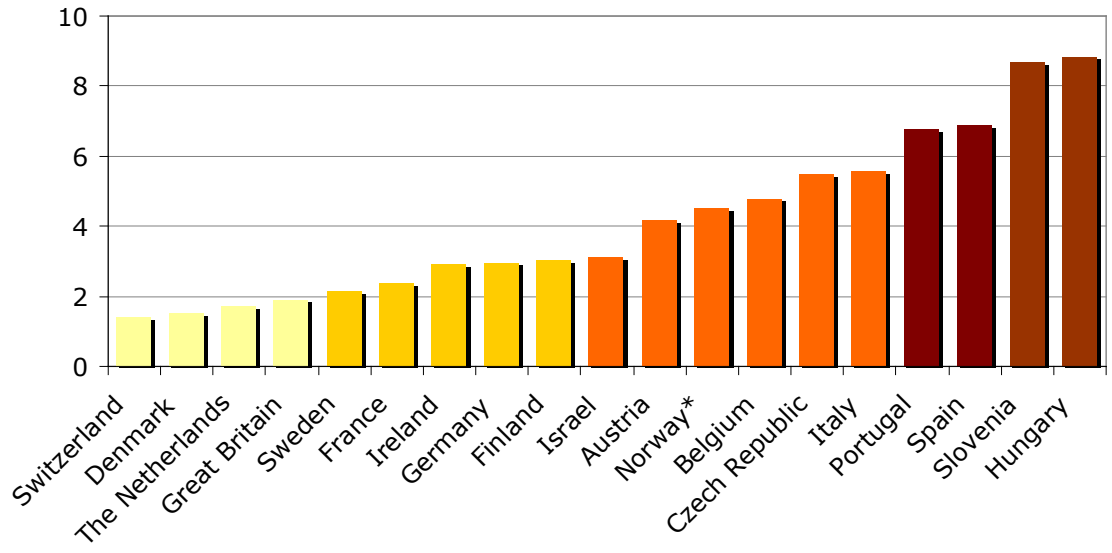


Figure 4: Number of deaths on motorways per billion km in 2006 * NO 2005 (the rate for NO is based on few deaths per year and is therefore subject to wide fluctuation) source: ETSC PIN and IRTAD

Speeds on the Autobahn

In Germany, measurement to estimate mean or average speeds on the motorways network was stopped in 1993, leaving a gap in knowledge of the speeds drivers are actually choosing. The figures that were produced before then indicate an increase of speeds over time (table 1) across all sections (limited and unlimited taken together).

The federal environment agency also differentiates between sections, on unlimited sections the mean speed was considerably higher in 1992: 132 km/h (Umweltbundesamt, 1999). Further, and of relevance for safety is the fact that 51% of drivers were above the recommended speed limit of 130 km/h on unlimited sections.

The trend up to 1992 shows an increase of mean speeds over time (for example as a consequence of the increased average engine power of cars), but there have been no similar measurements since 1993. Further information about mean speeds should therefore be collected to determine current levels and in due course how they are changing over time.

Mean speed is not all that needs to be known in order to investigate crash risk related to speed. Of importance are also speed in relation to the speed of other vehicles using the road, this is generally called the speed differential and helps measure exposure to risk. An enshrined understanding is that higher speed differentials between vehicles tend to lead to higher collision rates (Solomon, 1964). It should therefore be assessed whether speed differentials are higher on unlimited sections than on limited sections on the Autobahn. Since some road users will go above the recommended 130 km/h on unlimited sections while others will stick to it, it may well be that higher speed differentials are to be found on these sections, and this highlights the need for this information to be gathered.

Clearly, to assess the safety of its motorways Germany should resume measuring mean speeds and gather other speed information such as speed differentials.

Case studies: the safety benefit of introducing speed limits

There is clear evidence from sections on which a limit was introduced that the number of road deaths and injuries decreased. In December 2002 a 130 km/h limit was introduced on a 62km section of the Autobahn 24 between Berlin and Hamburg. This is the longest section

Parameters of Passenger Car Speeds		1982	1987	1992
Mean Speed	km/h	112.3	117.2	120.4
V85 Speed	km/h	139.2	145.1	148.2
% Vehicles over 130 KM/H	%	25.0	31.3	35.9

Table 1: Development of speeds on the entire Autobahn network until 1992 (West-Germany only)

on a German Autobahn on which a speed limit has been introduced in the past decade. The number of injury/ material damage accidents decreased by 48% and the numbers of casualties decreased by 57% (comparing the 3 years before and 3 years after introduction).

In Rheinland-Pfalz, a 130 km speed limit was also introduced on a 167km section of the A61 in 1991 and has been retained since then. This measure was combined with a ban on overtaking for heavy good vehicles. The impact of these two measures was a 30% reduction in fatal and severe injury accidents (comparing one year after and one year before their introduction – Rheinland-Pfalz Ministry of Transport).

Finally, the Federal environment agency mentions further field trials that have shown reductions in road deaths and injuries: in one field trail in the Land of Hesse from November 1984 to May 1987, the speed was limited at 100km/h on some motorways, bringing down the number of accidents with deaths or injuries per billion vehicle kilometer by 25% to 50%. A field trial on the Autobahn A2 during 1992 and 1994 also showed a 50% decrease of the accident rate per billion vehicle kilometer (Umweltbundesamt, 1999).

The road safety impacts of speed limits were evaluated in 1984 by the Federal Highway Research Institute. The study estimated that a general limit of 120 km/h on the Autobahn network would lead to a 20% reduction of road deaths, a limit of 100 km/h even to a 37% reduction.

Additional impacts

Safety on the rest of the network

It is not unreasonable to expect that changes in speed limits on the motorways would have an impact on other roads across the network (roads adjacent to the motorway in particular). Research has shown that the speed level on a given section of road is higher for vehicles coming from an adjacent section with a higher speed limit than for vehicles from a section with lower speed limits. One particular study conducted in Norway indicated that changes in speed limits are indeed traceable on adjacent roads (TØI report, 2005). This has been explained by the concept of speed generalisation.

Speed generalisation:

A change in speed behaviour on a road generalises to other roads. The spreading of speed changes to adjacent road sections implies that complex models need to be developed to predict the total effect of speed limit changes on a road network. Unfortunately, most available studies of the effect of speed limits consider only effects on road sections where the changes have been introduced.

Information box 2: The concept of Speed Generalisation

Speed generalisation may well apply to Germany too, but this should be investigated in new studies. If such studies found appreciable effects of speed generalization in Germany, this would strengthen the case for speed limits on the Autobahn as a means to reduce accidents on the rest of the network too (e.g. rural roads with 100km/h limits).

Cross Border Impact

With its central geographical situation Germany is one of the major crossroads of Europe and borders 10 countries (Poland, The Czech Republic, Austria, Liechtenstein, Switzerland, Luxembourg, Belgium, Netherlands, Denmark, and France). One can therefore ask whether unlimited motorways in Germany do not influence the behaviour of drivers most prone to speeding when they cross over to neighbouring countries. This is a legitimate question within a continent that knows no borders, and should be investigated further by appropriate studies.

Environmental impacts

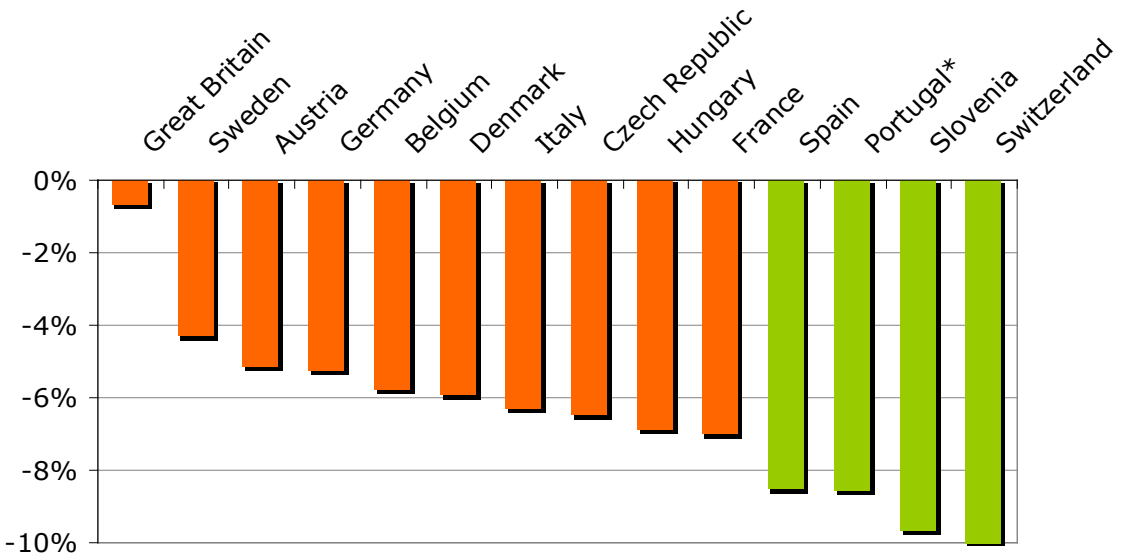
Driven speeds on motorways in particular are well above the optimum level for fuel efficiency (Anable et al., 2006). A number of studies have demonstrated that lowering speed limits on motorways is an effective tool to bring down CO2 emissions. For example, it has been calculated that a 120 and 100 km/h speed limit on German motorways would reduce CO2 emissions from cars on motorways by 10% and 20% respectively (Umweltbundesamt, 2003).

The International Energy Agency also identified the temporary reduction of motorway speed limits to 90km/h as a low cost measure that can lead to 'large oil savings' to respond to energy crisis. In an earlier report on "saving oil and reducing CO2 emissions from transport'', the IEA also recommended a general lowering of motorway speed limits that would not be restricted in time.

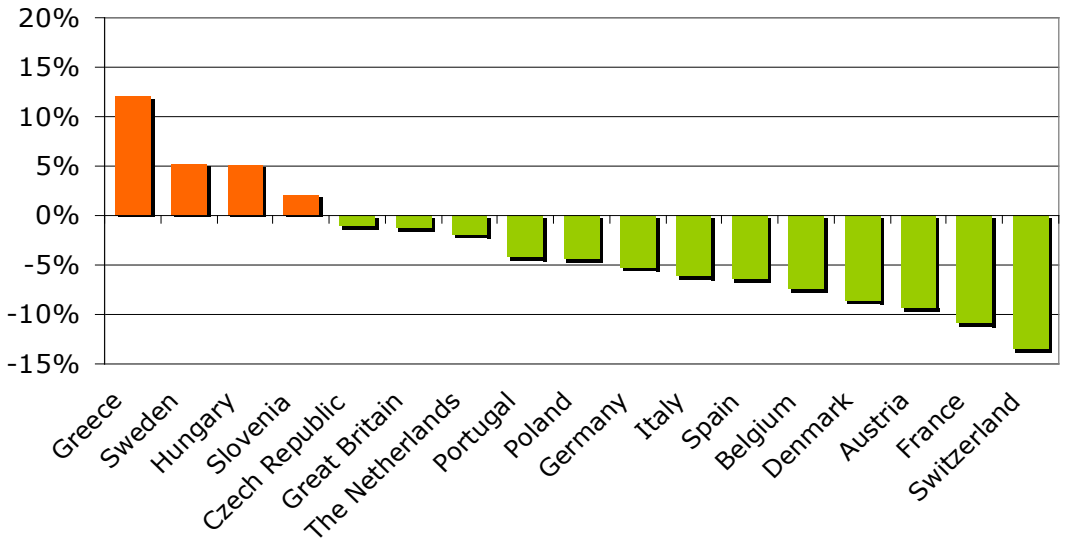
Conclusion

The data available indicates that Germany can make further progress in terms of motorway safety. The best measure is probably to lower vehicle speeds, given that other factors such as the quality of vehicles and infrastructure are relatively good in Germany. Reducing speed, unquestionably identified as a basic risk factor in road safety work, is a widely effective policy instrument to achieve casualty reductions. An early conclusion in favour of a mandatory limit through the Autobahn network is therefore to be hoped for, but in case the debate is futher prolonged, measurement of mean speeds on German motorways is needed to determine current levels and whether these are tending to rise. Further evidence could also be sought to contribute to this debate; in particular the calculation of speed differentials on unlimited motorway sections; studies investigating the cross-border impact of unlimited motorways; and studies indicating whether speed generalisation applies to Germany to determine whether speed limits on the Autobahn can have a positive impact on compliance with speed limits on the rest of the network. In the meantime, empirical evidence indicates that all instances of introduced speed limits on German motorways have caused very large casualty reductions.

Annex 1



Average yearly percentage change over 1997-2006 in deaths on motorways per billion vehicle-km * PT (1999-2006)



Average yearly percentage change in the number of deaths on motorways over the period 2001-2006

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1 For more information on motorway safety and countries' performances see the latest Road Safety Performance Index (PIN) looking at the safety of motorways in Europe. Started in June 2006, the ETSC's Road Safety (PIN) is a new policy instrument which compares Member States' performance in key road safety areas. Learn more about the PIN Programme under www.etsc.be/PIN.

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