STANDARDISATION OF SPEED LIMITS ON COUNTRY ROADS – PROS AND CONS ON THE BASIS OF AUSTRIAN EXPERIENCES

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ABSTRACT

In Austria, the national speed limit on single carriageways outside built-up areas is 100 km/h (62 mph). Given this high general speed limit – like the corresponding German limit it is the highest in Europe – compared to other similar countries, it is quite frequently necessary to restrict speed with the help of road signs for safety and environmental reasons. Approximately one fourth of the length of the respective roads is affected. The limits set by road signs vary considerably depending on the situation (80, 70 or 60 km/h, sometimes less) and most of the time they only apply to short road sections. Therefore car drivers may be confronted with a "barrage" of quickly changing speed limits.

Since 1997 the region of Salzburg has followed a different strategy. Within the framework of a "50/80/100 limit rule" on most country roads speed limits have been standardised so that in addition to the national limit there are only 80 km/h or 50 km/h limits (the latter is the general limit in built-up areas). The guiding principle is the desire to make it easier for drivers to be aware of an individual speed limit and obey it. This was meant to improve "safety, traffic flow and ease of driving" as requested by the Austrian road traffic regulations. So far, research studies do not indicate any statistically significant change in safety as well as speed behaviour. This is not surprising because the standardisation led to lower limits in some places and to higher ones in others.

Within the framework of a recently completed research project further issues were addressed with the help of focus groups and interviews with car drivers: Have car drivers in the Salzburg region noticed the new strategy? How does it affect the acceptance and awareness of speed limits? Does it have a positive impact upon the willingness to obey speed limits? What do drivers think of the standardisation?

The paper describes advantages and disadvantages of a determined standardisation of speed limits. Since there are plans to extend the strategy to encompass other regions or even the whole country the suitability of the limits chosen for the standardisation is critically analysed. Various pros and cons are considered which might impact the legal framework, e.g. the road capacity, or the drivers' attitudes and acceptance, as well as the suitability in certain critical areas, e.g. road junctions regulated by traffic lights or tunnels.

1. INTRODUCTION

According to the road traffic regulations the following national speed limits apply in Austria: 50 km/h on streets within built-up areas (such areas are indicated by place-name signs [town signs, village signs]), 130 km/h on motorways, and 100 km/h (Figure 1) on all other roads, i. e. mainly single carriageways in rural areas. Such high speeds are generally not permitted on rural roads in any other country in the European Union – with the exception of Germany – unless they are sign-posted accordingly. The authors are not aware of non-European countries which permit such a high speed. With 1.30 km paved roads per km^2 of land area (in comparison: USA 0.48, Mexico 0.07 [2]) Austria has a rather dense road

network. About 6 million people (of a total of 8.3 million Austrians) live outside of towns with 100,000 or more inhabitants, distributed over more than 2,300 municipalities. All in all the country is fairly densely populated but people are spread out over thousands of small towns and villages or live in low density locations which do not warrant place-name signs. In the western high Alpine part of the country this is mainly the case in the valleys while the phenomenon can be observed nearly throughout the hill country or plains in the east.

Figure 1 - Examples of signs indicating speed limits on country roads in Austria: (no sign = national 100 km/h limit) place-name signs (= built-up area with national 50 km/h limit); speed limit signs (= limit as displayed, in built-up areas as well as on rural road sections)

The high national speed limit on the country's dense and winding road network with many junctions and intersections in combination with the overall dense but patchy settlement necessitates many sign-posted speed limits below 100 km/h. Normally the road authorities decide for all critical points on a road or road sections individually which speed limit is most appropriate - for safety reasons (at crossings, on blind summits, in narrow curves and many more places) or to achieve noise protection (roads in low density areas or close to settlements). As a result, approximately one fourth of the length of the respective roads is affected by sign-posted speed limits; the limits as such vary considerably (80, 70 or 60 km/h, sometimes less) as well as in length (from less than one hundred metres to several kilometres). A local speed limit applies until the end-of-speed-limit sign indicates the return to the national speed limit or until another sign indicates a different speed limit. To complicate matters, the same signs which indicate speed limits on rural roads are sometimes used to override the speed limit set by place-name signs (50 km/h) and thus permit drivers a speed of 60 or 70 km/h on main through-roads. All in all, on a typical Austrian country road car drivers may be confronted with a "barrage" of quickly changing speed limits.

Since the 1960s at the latest it has been proved that car drivers do not take notice of all speed limit signs, they overlook some. In 1963 Undeutsch discovered in Hamburg, Germany, that only 75% of car drivers were aware of a sign indicating a speed limit of 20 km/h at a level crossing when they were asked about this immediately after the crossing [19]. Häkkinen (1974) reports the results of a Finnish and Swedish study: only 78% [10] respectively 76% [14] of the drivers interviewed remembered a 70 km/h sign which they had passed seconds earlier. Häkkinen notes that a large majority of drivers who failed to obey the speed limit had simply not noticed the speed limit sign. A study under lab conditions [12] produced similar results: even in the low-clutter road scenes shown to the respondents which often contained only the target sign and never more than one other sign in view, 10% of respondents failed to detect the target sign, and over 20% did so in high-clutter scenes.

The reasons for this lack of awareness have been well researched. Following Wickens & Horrey (2009) one can use the following categories: (i) failure of divided attention – "inattentional blindness" (looked but did not see although the sign was in foveal vision, caused by mental distraction, e.g. absent-mindedness, talking on a mobile phone, emotional discussion with occupants, or by driving inattentively due to fatigue [15] or while "daydreaming") and (ii) failure of focused attention – "inappropriate scanning" when drivers

are busy with other tasks and focused from the roadside where the sign is placed, e.g. when paying attention to other road users or to devices providing information inside the car [13].
In summary, one can expect a certain number of drivers to overlook speed limits although the signs as such are fairly conspicuous and easy to comprehend, and therefore frequently not to be aware of the maximum speed permitted on the road. This might be particularly true for situations like the one in Austria mentioned above because speed limits there do not conform to the concept of uniformity and consistency for the road layout recommended by traffic psychologists (e. g. [20]).

2. RECENT INVESTIGATIONS OF THE "50/80/100 LIMIT RULE" IN SALZBURG

2.1. Background

In the federal state of Salzburg (Austria) a standardisation of speed limits was introduced in 1997 to make it easier for car drivers to be aware of speed limits and to obey them. The objective was to improve both the safety and the traffic flow on the roads in the Salzburg region. In addition to the national limits of 100 km/h outside of and 50 km/h in built-up areas, it was planned to use only one other sign-posted speed limit of 80 km/h on country roads. Within built-up areas already existing signs which overrode the limit of 50 km/h were all removed (thus reducing the permitted speed of 60 or 70 km/h to 50 km/h); in some cases built-up areas were extended by simply moving the place-name signs. Outside of built-up areas gaps between sign-posted sections with speed-limits were closed (thus reducing the permitted speed of 100 to 80 km/h), but in many cases the previously existing (and sign-posted) speed limit of 70 km/h was raised to 80 km/h. In the year 2005 the standardisation was virtually completed with only few exceptions. Of the nearly 1,400 km state roads in the Salzburg region about 300 km run through built-up areas while about 1,100 km are rural roads. Of the latter only about 40% have a sign-posted speed limit of 80 km/h, all others have no signs (= national speed limit, 100 km/h).
The analysis of accidents immediately after the beginning of the standardisation of speed limits [23] and shortly after its completion [18] did not provide any clear statistical proof that the measure had an immediate impact upon road safety. From the traffic psychological point of view the standardisation of speed limits is seen to have a positive impact upon a smooth traffic flow since it is easier for drivers to take in few speed limits.
Several important questions remained unanswered: did the car drivers know that a standardisation was taking place, what did they think of this standardisation, had they noticed the changes, did the changes have a positive impact upon their acceptance of speed limits and their willingness to obey them, did the standardisation make it easier for drivers to notice speed limit signs and did this measure thus really contribute to a more smooth and easy traffic flow? These issues were investigated in a separate study [1] and its results are described on the following pages.

2.2. Methods

The first part of the study was qualitative, followed by a quantitative part. The qualitative part consisted of two focus groups with the objective to gather the overall "mood" regarding the issues mentioned. To select suitable participants more than one hundred people in the Salzburg region were screened on the phone. All drivers among them were invited to participate in a discussion group under the general heading "Traffic regulations and road traffic". This approach was chosen to ensure that the participants would come with an open mind and would, for example, not attempt to gather more information about the standardisation of speed limits in the Salzburg region prior to the discussions. For the invitation people were given preference who had already been driving a car in the

Salzburg region prior to the standardisation of the speed limits ("active experience of the introduction of the new rule“). Despite the low participation – 16 people had agreed to come but only six showed up – the information from the focus groups provided a good base for the development of the questionnaire which was used for the quantitative part of the study.
The quantitative analysis was based on interviews with car drivers at five different points on state roads of the Salzburg region. All points were selected in road sections with a sign-posted speed limit of 80 km/h which had either been raised from 70 km/h or reduced from the national speed limited of 100 km/h during the standardisation process. For the survey the police stopped cars with Austrian license plates as part of "routine checks". In most cases only the car documents were checked but some drivers also got a traffic ticket (for example for unfastened seat belts). Then the interviewers asked the drivers whether they would volunteer to participate in an interview. A response rate of more than 50% was achieved. In total, nearly 300 interviews with car drivers were conducted on two consecutive working days. On the basis of the mobility survey of 2004 the collected data were weighted and analysed by gender and age group.
Some results of the quantitative analysis of the survey are provided in two-way frequency tables, containing two samples of subjects A and B (e.g. males and females) with two different characteristics I and J (e.g. doing something or not), resulting in the values ai, aj, bi, and bj, e.g. representing the weighted numbers of respective responses. The statistical analysis was done by the odds-ratio logit method, with odds ratio OR = (ai*bj)/(aj*bi), and the p% confidence interval ranges between OR*e^±t*s (t = 1,96 for p = 95% and 2,58 for 99%, respectively, and s = √(1/ai+1/aj+1/bi+1/bj). If the obtained confidence interval does not include 1 it implies that the finding of a difference between the samples of subjects is statistically reliable.

2.3. Results of the qualitative survey

The following subjects were covered in the two group discussions:

- Factors which influence the car drivers' choice of speed on rural roads,
- Factors influencing the willingness of drivers to obey traffic signs and regulations,
- Awareness of the current speed limits in and outside of the Salzburg region,
- Knowledge and attitude of the participants to the standardisation of speed limits in the Salzburg region.

The results of the group discussions can be summarized as follows: On country roads, car drivers mainly chose their speed depending on road parameters (width and condition of the traffic lane). The impact of speed limits on the individual speed chosen varies considerably. On country roads, sign-posted speed limits are more frequently followed than the general national speed limit of 100 km/h. The more frequent speed controls by the police on such road sections account for this behaviour. Other factors which are more influenced by the individual's perception or attitude (time pressure and the fear of "being caught") also have an impact upon the choice of speed, but the importance of this impact differs considerably (from no impact at all to strong impact). Some participants in the group discussions questioned the meaningfulness of sign-posted speed limits quite vehemently. Most agreed that there tends to be a "forest of traffic signs" on many roads which goes beyond anyone's subjective perception. In many cases drivers find the frequent changes of speed limits on country roads hard to comprehend; both the limits as such and their changes are questioned. The chain of arguments used by car drivers leads to the conclusion that a lack of comprehension often reduces the willingness to obey the speed limits. Moreover, speeding is frequently considered a minor offence not unlawful behaviour. Participants in the focus groups had not been aware of the strategy of the state of Salzburg to standardise its speed limits but they had a positive attitude towards this

measure and believed that it makes the situation on the roads easier to comprehend. They would approve of an extension of the regulation to other regions. Participants criticised that the reasons for the sign-posting and for the standardisation of the speed limits were not well enough communicated to the people affected. The results of the qualitative survey permit the conclusion that

- a higher degree of information,
- less frequent changes of sign-posted speed limits on country roads or fewer sign-posts in general as well as
- more police checks

might make drivers follow sign-posted speed limits on country roads more frequently. The strategy in the Salzburg region to standardise speed limits was unanimously welcomed by the participants in the focus groups.

2.4. Results of the quantitative survey

2.4.1. Awareness of the speed limit of 80 km/h

With one exception all respondents were regular drivers. Most of the drivers knew the road they were using well (85% of them drove a car with a Salzburg license plate) and more than half of them had known the respective road before the change of the speed limits. Nevertheless about one fourth of the respondents did not know that the permitted maximum speed at the point where they were stopped was limited by signs to 80 km/h. (Figure 2), despite the fact that the first question when being stopped by the police usually concerns the speed ("Did I drive too fast?"). At first this might seem surprising but it confirms the well-known fact mentioned in section 1 that drivers are unable to take in all relevant information – and a speed limit is such a piece of information - in the road environment at all times. Frequently drivers rely on their obviously good memory. A significantly higher share of those drivers who knew the road section well where they were stopped was aware of the speed limit compared to those who were not well or not at all familiar with this section (Table 1).

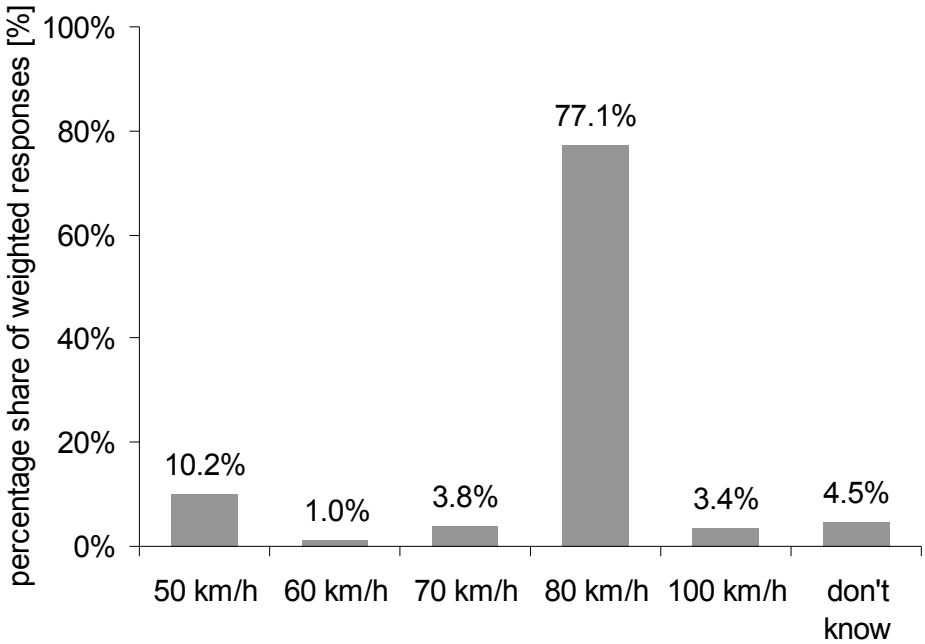


Figure 2 – Share of answers to the question: "Which speed limit does apply here?" – the correct answer was 80 km/h (285 answers)

Of those 18.4% of respondents who thought that a different speed limit than 80 km/h applied at the place where they were stopped, more than 80% (15% of the total) expected a lower speed limit. Even if one assumed a "bad conscience" in some of these cases – no reason for this because the interview took place after the police check and the respondents had not been fined – this vast majority shows that the 80 km/h limit at the five stopping points is obviously higher than these drivers would expect in comparable situations based on their experience.

Table 1 – Share of respondents who were (not) aware of the actual speed limit, depending on their knowledge of the road section

	section of road				
	not or not well known (39 answers)	well known (246 answers)	odds ratio (weighted responses)	95% conf. interval	99% conf. interval
speed limit not known	47.8%	19.0%	0.26	0.13; 0.51	0.10; 0.64
speed limit known	52.2%	81.0%			

2.4.2. Attitude to the speed limit of 80 km/h

About 80% of the respondents find a speed limit of 80 km/h appropriate for the point where they were stopped (Figure 3). This high percentage share is not surprising and can be explained by the so-called mere-exposure-effect [21]. This concept states that in general the majority of people agrees with a given situation and do not request a change as long as a certain lower or upper "pain threshold" is not exceeded. The attitude of the remaining 20% varies considerably: all in all about 7 out of 8 people are in favour of a lower speed limit. At one stop in a section with an access road to a petrol station most respondents would consider a speed limit of 70 km/h appropriate; for all other points with certain characteristics of "built-up areas" a limit of 50 km/h seems most appropriate. The fact that a majority finds a speed limit of 80 km/h appropriate at the place where they were stopped can be interpreted in such a way that a lower speed limit (e.g. 70 km/h) at this place would be as or even more acceptable.

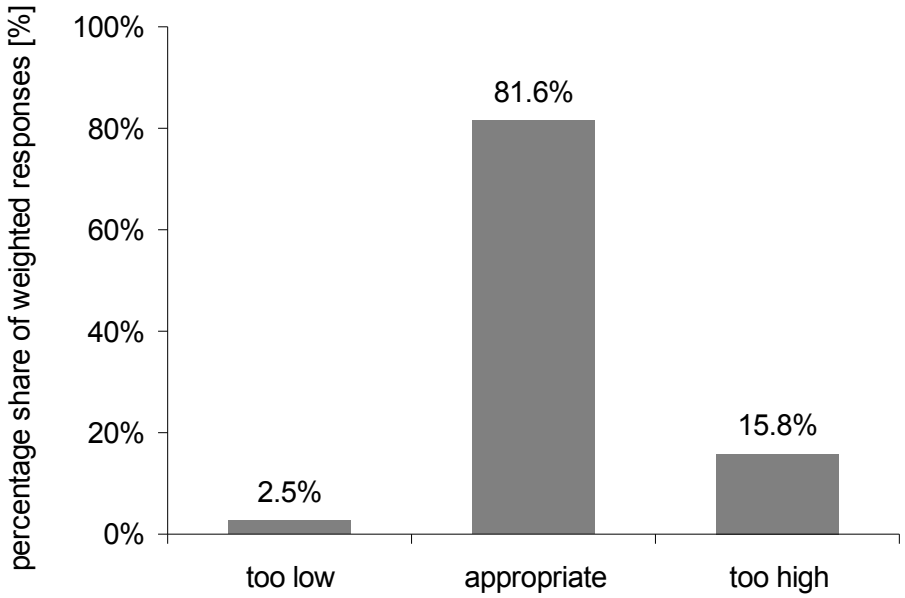


Figure 3 – In this place, do you consider a speed limit of 80 km/h too low, appropriate or too high? (284 respondents)

2.4.3. Speeding

According to their own admission, 90% of respondents occasionally and unintentionally exceed a speed limit on country roads and 20% do this very often, significantly (error probability < 5%) more men than women (Table 2). In general, but the findings are not statistically reliable, drivers who also drive on country roads in other regions of Austria seem to speed unintentionally more often than drivers who stay in the Salzburg region. This might indicate that in regions without standardised speed limits on country roads the danger of unintentionally exceeding the speed limit is higher than in the Salzburg region. Inattentiveness or lack of concentration as well as distraction and in consequence the non-observance of road signs were mentioned most frequently as reasons for unintentional speeding (Table 3).

It happens considerably less frequently that speed limits are intentionally exceeded; more than half of the respondents claimed that they never did this. Less than 10% of respondents are frequently or very frequently and intentionally speeding. Men drive significantly (error probability < 1%) more frequently intentionally too fast than women (Table 2). In general, but the findings are not statistically reliable, people with university entrance qualification are speeding intentionally more frequently than people without this qualification; young people (under the age of 25) do so intentionally more frequently than middle-aged adults and these do it more frequently than older people (aged 65+). About half of the speeders (less than 20% of all respondents) justified their speeding with the claim that speed limits were generally too low or that time pressure / being in a hurry / under stress made them do this (Table 3). This is in line with the explanations provided in the focus groups.

Reasons given for the strict observation of speed limits were the appropriateness of the limits, fear of punishment and the fact that one generally follows regulations (Table 3).

Table 2 – Unintentional and intentional speeding in the case of sign-posted speed limits on country roads, by gender of respondents

	unintentional exceeding of speed limits				
	never or seldom	often or very often	odds ratio (weighted responses)	95% conf. interval	99% conf. interval
males (162 resp.)	75.2%	24.8%	2.22	1.17; 4.22	0.96; 5.18
females (120 resp.)	81.1%	12.9%			
all (285 respondents)	80.2%	19.8%			
	intentional exceeding of speed limits				
	never or seldom	often or very often	odds ratio (weighted responses)	95% conf. interval	99% conf. interval
males (162 resp.)	87.0%	13.0%	5.46	1.64; 18.16	1.12; 26.55
females (120 resp.)	97.4%	2.6%			
all (285 respondents)	91.2%	8.8%			

Table 3 – Reasons for the exceeding or observation of speed limits (multiple answers possible)

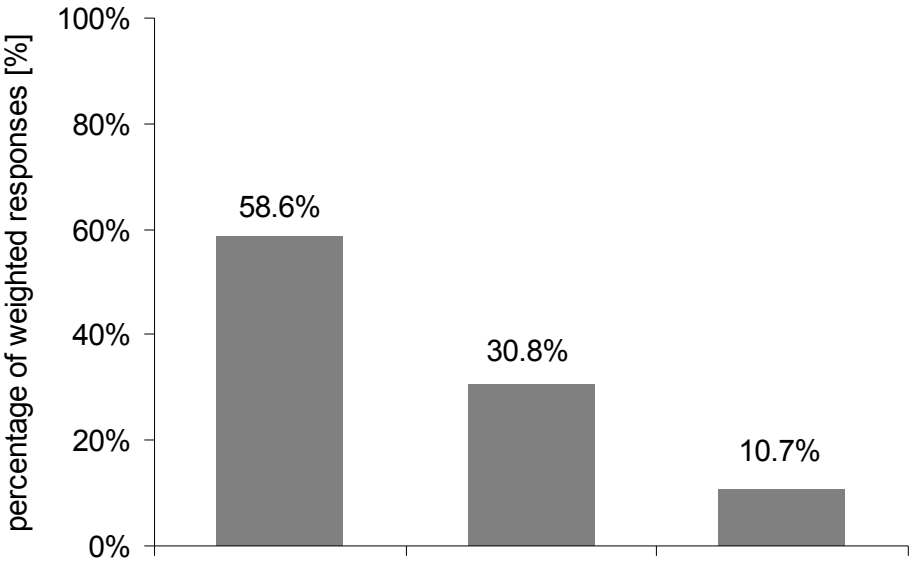
reasons	exceeding of speed limits: unintentional (218 respondents)	exceeding of speed limits: intentional (118 respondents)
lack of concentration/inattentiveness	62.9%	1.7%
active distraction (e.g. by passengers)	14.2%	0%
speed limits are confusing	6.2%	0%
time pressure / being in a hurry / stress	5.8%	47.8%
speed limits seem inappropriate	4.6%	43.5%
sticking to the speed of the queue	2.3%	1.6%
open road / good conditions	5.3%	9.1
usual route	3.0%	1.9%
others	14.7%	7.1%
	observation of the speed limits (163 respondents)	
speed limit is appropriate	49.4%	
fear of punishment	31.2%	
general observation of regulations	26.5%	
safety awareness, responsibility	15.1%	
others	2.5%	

2.4.4. Awareness of changes of the speed limits in a section

Hardly anyone could recall the change of the speed limits from 1997 to 2002 which affected the road section close to the points were drivers were stopped. One third of the respondents who knew the section well before the change thought that they did recall a change but their comments about the kind of change were not always correct. The already mentioned mere-exposure effect might have an impact [21]: Whether the maximum speed of 80 km/h was reduced from 100 to 80 km/h or raised from 70 km/h does not really make a difference for most drivers. They might notice such a change when it happens but most people soon get used to it and after a few years they obviously find it difficult to recall that something had been different in the past.

2.4.5. Attitude to the standardisation of speed limits in the Salzburg region

The results of the interviews show that the standardisation of the speed limits in the Salzburg region was hardly noticed. The standardisation is not noticed in comparison to other regions. After the respondents had been told about the standardisation about 60% expressed the opinion that this improved the situation regarding speed limits on country roads in the Salzburg region. Men felt more positive about the change than women (Figure 4). The original idea that the standardisation should make it easier for drivers to get used to the speed limit, was indeed most frequently mentioned as an essential improvement. Some welcomed the fact that the speed limit was raised (from 70 to 80 km/h). Those few people who were already aware of the standardisation prior to the interview felt most positive about it. This can be taken as a clear signal that a positive attitude can be induced by suitable education.



	better	similar	worse
males (158)	65.3%	27.9%	6.8%
females (117)	48.8%	34.9%	16.2%

Figure 4 – What do you think of the changes (caused by the project)? Do you find the situation compared to the prior one better, the same or worse? (279 respondents)

About 10% of respondents thought that the strategy of standardisation made the situation worse. They did not criticise the measure because they thought that the speed limits were too low, on the contrary: they expressed concern that a limit of 80 km/h might be too high in many cases and/or without the option of setting limits at 60 or 70 km/h it would be more difficult to adapt to the individual situation on country roads.

2.4.6. Impact of the standardisation of speed limits in the Salzburg region

After the strategy to standardise speed limits had been briefly explained the respondents expressed the following opinions regarding the likely consequences:
Three quarters of the drivers interviewed thought that the standardisation makes it easier to be aware of sign-posted speed limits on country roads. About 90% of those respondents who thought that the situation has improved and respondents from other regions shared this opinion. The essential idea that a standardisation should improve the awareness of speed limits is immediately reflected in the positive attitude of the respondents.
In total, about 60% of the respondents believe that they would now less frequently unintentionally exceed the speed limits (Table 4). This is the opinion of about two thirds of respondents who unintentionally drive too fast on occasion and of three quarters of respondents who think that the situation has improved. Quite obviously the standardisation is thought to have a positive impact upon unintentional speeding. The opinions are considerably different as far as intentional speeding is concerned. A significantly lower share of respondents (about 25%) expects a positive impact in that case. Even two thirds of those respondents who think that the situation has improved due to the standardisation do not expect a positive impact upon intentional speeding. The same is true for that half of the respondents who admitted that they occasionally and intentionally exceed the speed limit.

Table 4 – Assessment of the impact of a standardisation of speed limits in the Salzburg region upon speeding

	exceeding speed limits		odds ratio (weighted responses)	95% conf. interval	99% conf. interval
	remains the same	becomes less frequent			
unintentional (276 respondents)	37.5%	62.5%	4.36	3.02; 6.27	2.70; 7.04
intentional (261 respondents)	72.3%	27.7%			

2.5. Summary

Drivers can only obey sign-posted speed limits if they are aware of them. This study shows that the setting of speed limits on country roads concerns drivers obviously less than one might assume. As long as a speed limit seems to fit the road environment reasonably well it is considered appropriate and respondents do not think much about it. Within a certain range (e.g. 80 or 70 km/h) the limit as such is of no big importance. On the one hand, such a difference is hardly noticed, on the other hand, after a change the limit is pretty soon accepted as "a fact". As far as exceeding speed limits on country roads is concerned, Austrians are more "law-abiding" than frequently assumed. On occasion, nearly everyone unintentionally exceeds a sign-posted speed limit. But according to their own statement less than half of the drivers do so intentionally and most of them only rarely. The group of people, more men than women, who are "notorious" for frequent or very frequent speeding is comparatively small. But particularly when in a hurry people tend to speed on occasion. Yet in general the majority of respondents attempt to observe speed limits, because they consider the limits appropriate, because they are afraid of punishment or because they are generally law-abiding.

The main reason for the standardisation of speed limits in the Salzburg region is the desire to thus improve the awareness of speed limits. The results show clearly that car drivers welcome this approach. The majority of drivers believe that a standardisation does reduce the risk of unintentional speeding. The question whether this makes it easier for drivers to note and be aware of sign-posted speed limits and thus contributes to an easy traffic flow can be answered in the affirmative.

It could not be proved that the standardisation reduces intentional speeding in a significant way. In that regard one has to assume that "traditional" speed controls are probably more effective than any standardisation.

Car drivers were not aware of the gradual standardisation of speed limits in the Salzburg region. But it is obvious that with increasing awareness the (already big) share of people who support this measure is also increasing. With more information and education this positive attitude of drivers to the idea of standardisation – and possibly to the need of speed limits, too – could be advantageously used.

3. CONCLUSIONS AND DISCUSSION

The results of the study show clearly that a majority of drivers welcomes a standardisation and that they expect this measure to have a positive impact upon speeding, at least as far as the (fairly frequent) unintentional exceeding of speed limits is concerned. Given the experience in the Salzburg region, the question whether a standardisation of sign-posted speed limits on country roads is desirable can be answered in the affirmative.

When employees of the road authorities of Salzburg had the innovative idea of a standardisation in the 1990s it was not yet clear whether and how it might be implemented. Many efforts at persuasion of various decision makers within the authority were needed. In the beginning it was not clear whether funding would be available for the "additional work" of assessing of every single road. With hindsight one can understand that the question which maximum speed would be most suitable for the standardisation of speed limits on country roads might not have been discussed in sufficient detail. According to information from the authorities the decision to set the limit at 80 km/h was strongly influenced by the high number of road tunnels in the Salzburg region. In these tunnels the speed was (and is) normally limited to 80 km/h and the idea was that drivers would "not understand" that they are permitted to drive faster in tunnels than in sections with speed limits outside the tunnels.
Since by now other regions in Austria consider a standardisation of speed limits, the authors hold the view that it would be worth thinking again about the question which speed limit might be most suitable. The following paragraphs provide thoughts about the pros and cons of a standardisation of sign-posted speed limits at 70 or 80 km/h:
- At first, the argument that a standardisation of the speed limit at 80 km/h as in tunnels is sensible seems quite plausible but less valid if one takes a closer look. Given the "linear", uninterrupted traffic flow in tunnels the risk is reduced to a minimum compared to road sections outside of tunnels (in general, overtaking is forbidden in tunnels, there are no crossings, no entrances or exit roads and thus no turning off or crossing and there is no "risk of distraction" by objects in the road environment, etc.). It would be easy to opt for a reduction of the speed limits in tunnels from 80 to 70 km/h not because of the accident risk but to reduce the possible results of accidents. Drivers would "understand" such a measure.
- As far as the accident risk and the results of accidents are concerned the difference between a permitted maximum speed of 50 km/h and 80 km/h is considerable as research shows (see for example [4], pp. 445-450). If a standardised speed limit of 80 km/h is introduced this leaves a "gap" in this critical range. In the area of some crossings, at access roads to petrol stations but particularly in sparsely built-up transition areas between typical sections of open country and built-up areas a limit of 80 km/h is frequently seen as rather high or to put it in a different way: a limit of only 70 km/h might be more appropriate. This would also help to reduce the frequently observed bad habit of allowing a car to "coast" into built-up areas at a speed far above 50 km/h.
- An 80 km/h speed limit causes considerable problems in regard to junctions regulated by traffic lights in the open country. The respective Austrian directive [4] states clearly: "In the area of traffic signals the permitted maximum speed has to be limited to no more than 70 km/h." Quite obviously this is not a recommendation but an order. This means that admitting a speed limit of 80 km/h is a clear offence against "state of the art" Austrian transport planning. On the other hand, in the case of well developed junctions a speed limit of 50 km/h might be unnecessarily low. It has to be mentioned that the speed limits at junctions regulated by traffic lights in the open country in the Salzburg region (comparatively few by Austrian standards) are among the exceptions from the standardisation mentioned in section 2.1.
- As few exceptions as possible should be permitted to best achieve the obviously positive effects of a standardisation of speed limits. The consistent implementation of the standardisation strategy for the whole road network of one region makes it necessary to include also lower-class roads; in general, municipal and not regional authorities are responsible for them. Lower-class roads are generally particularly narrow and winding. For such roads, a standardised speed limit of 70 km/h seems feasible, a decree to use a sign-posted limit of 80 km/h hardly justifiable. In the Salzburg region as in other parts of Austria one regularly sees speed limits of less than 80 km/h on lower-class roads in the open

country; for drivers it does not make any difference whether municipal or regional authorities are responsible for these roads. This might be one of the reasons why only few drivers are aware of the standardisation strategy (see section 2.4.1).
- As the survey shows there is no need for concern that drivers might not accept a standardisation of the speed limit at 70 km/h instead of 80 km/h. A limit of 70 km/h might even meet with higher approval than a limit of 80 km/h. Quite a few respondents commented that a standardised speed limit of 80 km/h might be too high in many cases. (see section 2.4.2).
- For the performance of country roads it hardly matters whether the speed limit is set at 70 or 80 km/h. In the case of high traffic volume one can assume a more homogeneous traffic flow at 70 km/h compared to 80 km/h and thus a more steady movement over a longer timespan. In synchronized traffic with traffic volumes close to their maximum capacity, 60 km/h [3] is the speed at which the build-up of a traffic jam is always possible, a speed well below the two limits compared above.
- As this survey and one further study [9] show, in Austria the share of "notorious speeders" who remain rather unimpressed by prescribed speed limits is about 10% to 15%. On occasion, a fairly large number of drivers (about half of the total) intentionally exceed the speed limit, mainly for momentary personal reasons (e.g. time pressure; see section 2.4.3). To reduce intentional speeding in a sustainable way the "soft" measure of standardisation is not sufficient. In this case "hard" measures are required, such as constant monitoring and severe sanctions. But a fair number of drivers on principle avoid intentionally exceeding the speed limits in the open country – because they consider the limits "appropriate", because they do not want to be punished or because they generally obey the rules. Therefore one can assume that the reduction of the permitted maximum speed would generally slow down drivers, as a rule of thumb by at least one quarter of the reduction ([6]; [3] p. 19).
- The lower the speed limit, the more drivers exceed it ([16], p. 102). This is understandable in so far as at a low limit the discrepancy between the speed which the road as such seems to permit according to the subjective assessment of the driver and the permitted speed is comparatively big. This can lead to the phenomenon that after a small change of the speed limit (e.g. from 80 to 70 km/h) no change in the average speed can be measured locally. On occasion this fact is used as an argument against the reduction of a speed limit but in the context of a standardisation of speed limits this is no valid argument. If such situations occur they may indicate problems with the awareness of the limit but definitely problems with its enforcement, independent of the permitted maximum speed. The exceeding of (low) speed limits should not lead to the conclusion that higher limits should be set to make people obey them.
- It has been proved that at least within the speed range common on country roads the results of accidents rise faster than the average travelling speed. According to Nilsson 2004 [17] and Elvik (2005) [5] the number of deadly accidents rose four times as quickly as the ratio of two average speeds compared. This means that every percentage point reduction of the average speed leads to an average reduction of the number of deadly accidents by about 4%.
- With its national speed limit of 100 km/h on country roads Austria (as well as Germany) is the big exception in Europe (see section 1) and discussions about a reduction of this limit have started. Should Austria reduce its national limit to 80 km/h, all existing 80 km/h signs would be obsolete. Speed limits – whether set selectively or as part of a standardisation – have always to be justified (traffic safety, noise protection, etc.); at the same time they are also a signal for the driver that "special conditions" apply in this section of the road. With the reduction of the national speed limit this signal would be lost immediately and completely in a region which had previously standardised its sign-posted speed limit at 80 km/h – the situation would be quite different in a region which had opted for a

standardisation at 70 km/h. One can imagine that a new assessment of the situation there might lead to the abolishment of some of these limits. But in all those places where no higher speed than 70 km/h can be permitted (e.g. at crossings regulated by traffic lights), the existing sign-posting would remain in place and thus the signal effect mentioned.

All in all the authors are convinced that a standardisation of sign-posted speed limits is useful to increase the awareness of car drivers of such limits and also a possible change of the national speed limit. But the authors are also convinced that a standardisation – as in the Salzburg region – at 80 km/h on country roads is too high. A standardisation of sign-posted speed limits at 70 km/h would be appropriate. This does not only seem a positive development under the "special" conditions in Austria with its national speed limit of 100 km/h, it might also be worth contemplating in countries with a national limit of 90 km/h.

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