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SWOV Fact sheet

Speed choice: the influence of man, vehicle, and road

Summary

Many drivers frequently exceed the speed limit. Often they deliberately choose a speed that is too high; factors that play a role are haste, pleasure, or adapting to other traffic. However, driving too fast sometimes also happens unintentionally. Subjective speed perception is important here, in this case underestimation of one's driving speed. This happens, for example, after having driven fast for a long time, or if there are no buildings or trees alongside the road as a reference for the speed driven. The present quiet and comfortable cars and particular road features can also unintentionally lead to higher speeds than desired. Intentional and unintentional speeding offences can be prevented by an appropriate road layout, credible speed limits, and enforcement.

Background and content

Speeding lies at the heart of the road safety problem. Given a certain road, a higher speed not only increases the probability of a crash occurring, it also increases the risk of serious injury (see SWOV Fact sheet [The relation between speed and crashes](#)). It has been estimated that speeding is involved in one in three of all fatal crashes (OECD/ECMT, 2006). SWOV has calculated that, in the Netherlands, 25-30% fewer people would be injured if everybody were to obey the speed limit (Oei, 2001). At the moment this is certainly not yet the case. Although there are large differences between roads, it is no exception that 40-50% of all drivers exceed the speed limit (Van Schagen et al., 2004).

The present fact sheet discusses the factors that influence the speed choice of drivers. It does not discuss other modes of transport. Furthermore, the fact sheet only looks at situations in which the driver really has a choice, i.e. where a lower speed is not enforced by, for example, speed humps or the presence of other traffic. The fact sheet will indicate that speed choice is influenced by factors such as personal preferences, social pressure, road features, vehicle features, and all kinds of interactions between them.

What do drivers themselves say about their speed choice?

According to the PROV¹ the majority of Dutch drivers claim that they generally obey the speed limit (see *Figure 1*). When they do exceed the limit they give as a reason that they 'adapt to other traffic'. Other reasons are 'haste', 'pleasure', 'unintended', and 'boredom'.

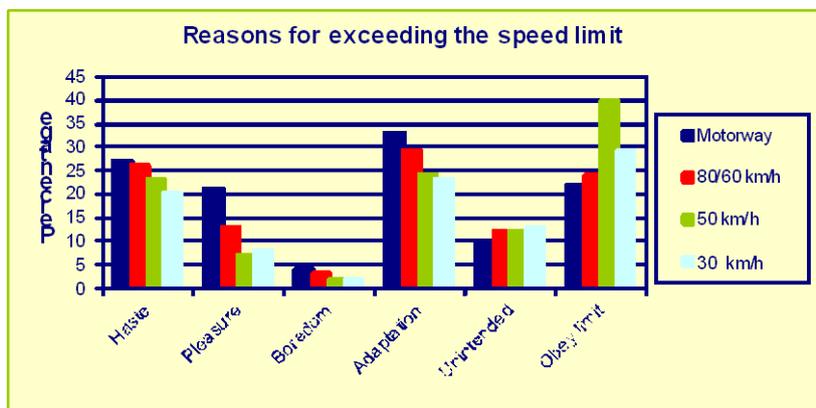


Figure 1. Source: PROV 2009 (Biervliet et al., 2010).

The PROV results of the 1991-2005 period indicate that the percentage of drivers claiming to always obey the speed limit increases. In the 2007 and 2009 surveys, however, fewer subjects say they never

¹ The Periodic Regional Road Safety Survey (PROV) is a regularly repeated large-scale written questionnaire in the Netherlands among subjects in the age group 15 years and older. The last available results are from 2009.

exceed the limit. Over the years there has also been a shift in the reasons for exceeding the limit. This is particularly the case for 'Unintentionally exceeding the limit' which is now mentioned by 12% whereas 40% gave this as a reason in the 1990s. 'Adapting speed to other traffic' and 'Haste' are also mentioned somewhat less frequently. 'Pleasure', on the other hand, is mentioned slightly more than it was fifteen years ago; this is especially the case for motorways.

The self-reported reasons for obeying the speed limit are mainly that the limit is obligatory, that it's good for safety, and that a fine can thus be avoided. The environment and fuel costs are much less important (see *Figure 2*).

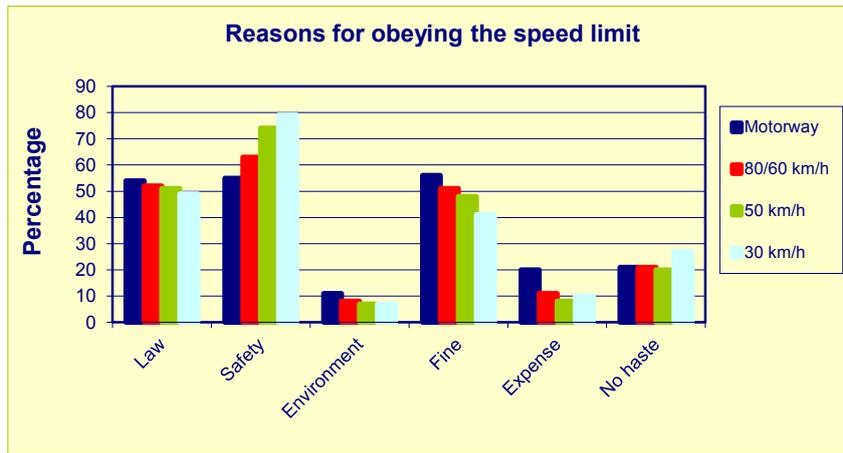


Figure 2. Source: PROV 2009 (Biervliet et al., 2010).

Data like those from the PROV surveys indicate that speed choice is to some extent a deliberate choice. However, this does not signify that drivers use valid arguments in making this choice. Elvik (2010), for example, shows that there is often a large discrepancy between the objective facts and the subjective facts about driving speed, for instance about speed and time gain, and the relation between speed and crashes. He therefore concludes that from an objective point of view speed choice is not rational, but, at the very most, 'subjectively' rational.

Which drivers go faster?

Some drivers obey the limit better than others. Generally speaking, men exceed the limit more often than women, youths exceed the limit more often than older drivers, and commercial drivers exceed the limit more often than people using the car to travel to and from work, who in turn exceed the limit more often than those mainly driving for private purposes (see for example Biervliet et al., 2010).

In addition, there is a clear relation between certain individual characteristics and driving speed (see for example Dahlen et al., 2005). One that has often been shown is the relation between speed choice and sensation seeking, in other words the extent to which someone is generally inclined to take risks and the extent to which that person needs changes and new experiences (e.g. Heino et al., 1992). In general, sensation seekers also have the urge to drive faster (e.g. Goldenbeld & Van Schagen, 2007). In addition, Goldenbeld & Van Schagen also found that all drivers, young and old, men and women, wanted to drive faster than the speed limit that they themselves regard as being safe. This is probably a confirmation of what has already been shown many times, namely that drivers think they can drive better and safer than others. Therefore, they also think that they can safely drive somewhat faster than others.

What influence does the speed limit have?

According to the international survey SARTRE (see Goldenbeld, 2003) 75-80% of Dutch drivers are satisfied with the current general speed limits, with the exception of those on motorways: 50% wants them to be higher. However, being satisfied with the limit does not always mean that one obeys it. One reason being that drivers don't always know the actual speed limit on a given road (Hendriks, 2005). Another reason is that drivers are only influenced by the speed limit to a limited extent. Lowering the limit by, for example, 20 km/h only has a quarter of the intended effect, which is an average speed reduction of only 5 km/h if no other additional measures are taken (OECD/ECMT, 2006).

What influence does social pressure have?

Other traffic and car passengers also influence speed behaviour. As we indicated earlier, adapting to other traffic is an important self-reported reason for exceeding the speed limit. Empirical data confirms that drivers let their speed choice be strongly influenced by how fast they think others are driving (Haglund & Åberg, 2000). Haglund & Åberg also found that drivers generally overestimate the speed of other vehicles. This causes a snowball effect which makes them drive even faster; this is also known as the contamination effect of speed (Connolly & Åberg, 1993).

Car passengers have an equivocal influence on the speed choice of drivers. Some motorists drive faster when there's a passenger, others drive slower, and yet others do not drive faster or slower. This has to do with, for example, the age and sex of the driver, but the age and sex of the passengers also play a role in driving faster or slower (Regan & Mitsopoulos, 2003; Engström, 2003). We can roughly say that it's especially the young men with other young male passengers who drive faster. When the passengers are, for example, parents or children or young females, they drive slower. Female and older drivers are either not influenced by passengers, or they reduce their speed.

Why do people sometimes drive too fast unintentionally?

More than 10% of the drivers say that they sometimes exceed the speed limit unintentionally (see *Figure 1*). Yet all cars have a speedometer that objectively gives the driving speed at any given moment. Many drivers, often unconsciously, also seem to be influenced by the speed they 'experience'. However, this subjective speed perception is not very reliable and often results in over- or underestimation of the actual speed. Underestimation of the actual speed is of course the most dangerous because it leads to higher speeds. Studies of subjective speed perception have been carried out since the 1960s and 1970s. Based on these studies, together with some later overview studies (e.g. ETSC, 1995; Martens et al., 1997; Elliot et al., 2003) we can distinguish four situations that can easily lead to underestimation of the driving speed:

1. If a motorist has been driving at a high speed for a long time, for instance on a motorway, he increasingly underestimates his speed as time goes by and drives faster without noticing it. Correct use of (advanced) cruise control (see also SWOV Fact sheet [Advanced Cruise Control \(ACC\)](#)) can prevent this, as can intervening or warning types of Intelligent Speed Assistance (ISA) (see also SWOV Fact sheet [Intelligent Speed Assistance \(ISA\)](#)).
2. In transitional situations when the driving speed must be reduced considerably, the driver often doesn't decelerate as much as he should. This, for example, is the case after exiting a motorway or when entering an urban area, but also happens if a long stretch of straight road is followed by a series of bends. Physical speed limiters in these transitional situations, for example a roundabout at the end of the motorway exit road, or a narrowing of the road when entering an urban area, can help drivers to adapt their speed better to the following road stretch. Physical speed limiters are not a good option for a sudden series of bends; of course warning signs are then a possibility. Australia has experimented with lateral and longitudinal lines on the road in such situations; these work as psychological and not as physical limiters (Fildes & Jarvis, 1994). Such lines are also used in the Netherlands at the entrances of an urban area. Assessment studies show that they generally have the desired effect, but there is some doubt about whether this is a lasting effect.
3. When there is little peripheral information, for example at night time or with fog, but also on very 'open' roads in flat rural areas, drivers easily underestimate their speed. This is because speed perception is mainly determined by the information that enters via the peripheral field of vision and less by information via the central field of vision. Vertical elements in the peripheral field of vision, such as trees and buildings, lead to higher estimated speeds. A general rule is that a lower speed is chosen if the vertical elements are higher than the width of the road (ETSC, 1995).
4. When the driver's position is considerably above the road surface, he often underestimates his speed. During the last few years, Sport Utility Vehicles (SUVs) and other jeep-like cars have become increasingly popular. These vehicles have large wheels whereby speed experience is distorted; the driven speed appears to be lower. In a driving simulator without a speedometer subjects drove an average of 7 km/h faster when driving at the height of a SUV than at the height of a sports car. Two-thirds of the subjects were unaware that at SUV height they drove faster, and some even thought they were driving slower (Rudin-Brown, 2004).

What is the influence of the road and roadside features?

The features of the road and its direct environment also have a clear effect on speed choice. Everybody can give examples of roads that have a completely different speed limit than you would expect; roads that almost provoke driving too fast. Features of the road and its surroundings that have an effect on the speed choice are the cross section, the alignment, and the direct road environment (Martens et al., 1997; Aarts et al., 2006; Goldenbeld et al., 2006). In general, the relation of speed with these features is as follows:

Cross section

- | | | |
|--|------------|----------------|
| • Number of lanes: | more lanes | → higher speed |
| • Road width: | wider | → higher speed |
| • Width of the obstacle-free zone: | wider | → higher speed |
| • Presence/Absence of emergency lane: | present | → higher speed |
| • Presence/Absence of cycle track or service road: | present | → higher speed |
| • Presence/Absence of road marking: | present | → higher speed |

Alignment

- | | | |
|---|--------------------|----------------|
| • Bendiness of the road (sight length): | fewer bends | → higher speed |
| • Sort and state of road surface: | level road surface | → higher speed |

Road environment

- | | | |
|---------------------------------|-----------------|----------------|
| • Buildings alongside the road | fewer buildings | → higher speed |
| • Vegetation alongside the road | less vegetation | → higher speed |

These features are partly related to subjective speed perception, for example the quantity of peripheral information (see above). They are also partly related to the assessment of the safe speed on such a road and, in some cases, maybe also to the assessed speed limit at that particular location.

Irrespective of how the features of the road and its environment exact their influence, it is in any case very important that speed limits are supported by the road layout, so that they are credible (see also SWOV Fact sheet [Towards credible speed limits](#)). It is not so that the relations between certain road features and a high speed are always bad for safety. Some features, such as a wider road or a wider obstacle-free zone, simultaneously increase the safety which, at least partly, compensates for the higher speed.

Which vehicle characteristics influence speed choice?

Vehicles, and especially cars, are developing all the time. This also affects the drivers' speed choice directly or indirectly.

In the first place, the driving comfort has substantially increased during the past decades. The noise level and vibrations inside the car at high speeds have decreased considerably. This is especially the case for larger and heavier cars, but it also applies to smaller vehicles. Therefore, such signals of driving too fast have almost completely disappeared.

In the second place, the engine power of cars has increased considerably over the years, making greater acceleration and higher top speeds possible (see for example De Mol, 2001). In fact, the top speed of the vehicle can only determine the speed choice on roads where this top speed is also physically possible. This will only be the case on some parts of the motorway network, and only when little or no other traffic is around. However, there are indications that drivers of high-powered vehicles also drive faster on secondary roads (Horswell & Coster, 2002). These researchers found that this should be attributed partly to the fact that a car's greater power leads to choosing higher speeds and partly to the fact that 'speeders' simply choose a high-powered car.

Conclusion

Speed choice is a complex process in which many factors play a role. As all cars have a speedometer, driving speed and speeding offences are actually the result of a deliberate choice. Indeed, drivers often choose their speed intentionally. Reasons for obeying the speed limit are, for example, safety and avoiding a fine; reasons for exceeding the limit are, for example, haste and pleasure or adapting to other traffic. However, driving speed and speeding offences can sometimes also be the result of an unconscious process in which the subjective perception of the speed is important. An example is

underestimating one's speed after having driven at a high speed for a long time, or if peripheral information is missing. Certain vehicle features, such as a lack of feedback from noise or vibrations, and certain road features can also lead to speeds that are higher than intended.

The SWOV Fact sheet [Measures for speed management](#) discusses different measures to prevent speeds that are too high and unadjusted.

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