SPEED Fact Sheet
NUMBER 07
January 10

Setting Appropriate, Safe, and Credible Speed Limits

Introduction

Setting appropriate, safe, and credible speed limits is an absolute priority for a good speed management policy. This Fact Sheet lists the main elements that need to be taken into account in setting speed limits.

Speed limits are widely used to define acceptable speeds. They provide a basic indicator to road users of the maximum speed allowed under the law. In this sense, they can be described as representing a society's judgment, through the legal process, of the balance between the various issues surrounding speed choice. Speed limits have evolved over time as societies have set different priorities for their road system.

Sweden is a god example in this sense: in the 1960s limits were set largely to reflect drivers' behaviour and using the 85th percentile speed – in effect saying drivers were making rational choices and only those in the minority 15% would be judged as 'speeding'. As analyses of crash data revealed a growing speed related problem, limits were set that took into account road design factors (sight distance, road curvature and so on). Economic trade-off then was introduced: with cost-benefit analysis of road projects using estimates of the 'value of time' savings to justify investment, there was a natural trend towards faster roads. Finally, with the current philosophy of Vision zero, the Swedish parliament has said that avoiding death and injury is an absolute priority, and the speed management system as a whole must be based on this philosophy (WHO/FIA/GRSP/World Bank, 2008).

A nationwide speed limit regime generally consists of a limited number of general speed limits and a variety of local speed limits. The overall speed limit framework is generally defined within the legislative framework by national governments, whereas the exceptions to these general limits are set by local governments.

General speed limits do not correspond to the appropriate speed on all roads at all times since the road environment is constantly changing. This is why local limits are required. However assigning this responsibility to local authorities might come with a certain dose of uncertainty as different local authorities might have different views as to what are appropriate limits. To respond to that, in the United Kingdom, the Department for Transport published a circular in 2006 entitled 'Setting Local Speed Limits' (http://www.dft.gov.uk/pgr/roadsafety/speedmanagement/dftcircular106) for local authorities. This circular includes the most important considerations and principles in establishing speed limits and is a good example of how to try to harmonise the setting of local speed limits across a national territory.

Factors Determining speed limits, Sweden 1960-1990

Source: WHO/FIA/GRSP/World Bank, 2008

This is how general speed limits vary across Europe:

	SPEED LIMIT, CARS (IN GENERAL), km/h:		
	Built-up areas	Outside built-up areas	Motorways
BE	30-50	90-120	120
BG	50	90	130
CZ	50	90	130
DK	50	80	110-130
DE	30-50	100	(130)
EE	50	90-110	110
IE	50	80-100	120
EL	50	90-110	130
ES	50	90-100	120
FR	50	80-110	110-130
IT	50	90-110	130-150
CY	50	80	100
LV	50	90	110
LT	50	70-90	110-130
LU	50	90	130
HU	50	90-110	130
MT	50	60-80	-
NL	30-50-70	80-100	100-120
AT	50	100	130
PL	50-60	90-110	130
PT	50	90-100	120
RO	50	90-100	130
SI	30-50	90-100	130
SK	50	90	130
FI	40-50	80-100	100-120
SE	30-50	70-90	100-120
UK	32-48	96-112	112
HR	50	90-100	130
MK	60	80-100	120
TR	50	90	130
IS	30-50	80-90	-
NO	30-50-70	80	90-100
CH	30-50	80	120

Notes:

DE: Motorways: No general speed limit, recommended speed limit is 130 km/h (more than half the network has a speed limit of 120 km/h or less).
FR: Dual carriageways 110 km/h. If road is wet: motorways 110 km/h, dual carriageways 90 km/h, other roads outside built-up areas 80 km/h.
IT: 150 km/h on certain 2x3 lane motorways.
FI: in winter 100 km/h on motorways, 80 km/h on other roads.
PL: Built-up areas: 50 km/h from 05h00 to 23h00, 60 km/h from 23h00 to 05h00.

Source: EU energy and transport in figures (2009)

In some countries national or local governments also allow for variable speed limits, whereby the limit is varied according to time of day (daytime/night-time) or time of year (summer/winter). A further step is to introduce dynamic speed limits which take into account the actual traffic and/or weather conditions on the road (OECD/ECMT, 2006).

From a safety perspective the starting point in setting speed limits should always be the threshold of physical resistance of the human body to the energy released during a crash. For example pedestrians incur a risk of being killed of around 80% at 50 km/h, while this is reduced to 10% at a 30km/h impact speed (WHO, 2004). This suggests that in urban areas with high concentrations of pedestrians the proper limit should not be higher than 30 km/h.

It is undeniable that if a government wishes to reduce the death and injury toll in a country, then the Safe-system approach is the way to go. Such a system cannot be achieved overnight, but by accepting the principles of a safe system, and applying them as infrastructure, laws and enforcement develop, so the numbers and severity of crashes will be reduced. In this light it should be understood that ***speed limits on their own will have only modest effects on actual speeds***. It is widely known that a considerable proportion of vehicles drive at excessive speeds, it can therefore be concluded that speed limits influence speed to a limited degree. According to the OECD/ECMT (2006), meta-analyses show that lowering the limit by 10km/h decreases speed by 3 to 4 Km/h. In places where speed limits have been changed and no other action taken, the change in average speed is only about 25% of the change of the speed limit. Changes in speed limits must therefore be accompanied by appropriate enforcement, infrastructure and information measures.

Taking roads' functions into account

This is fundamental for setting speed limits. It is important to define a hierarchy of roads in accordance with their main function, and set appropriate speed limits for them. At the top of the hierarchy are roads that primarily cater for transport of people and goods over long-distances through rural areas. At the other end are local roads that need to be assigned much lower speed limits. Perhaps the best example of putting this into practice comes from the Netherlands, where 'functionality' has been defined as one of the core principles of the Dutch Sustainable Safety Vision. The functionality principle is used to define a hierarchy of roads, not only to set appropriate speed limits, but also to put in place infrastructure measures that render roads' functions clear (SWOV, 2006). In 1998, the Netherlands launched a programme of reclassifying its roads and then modifying them so that every road would have a clear, unambiguous function. An earlier study predicted that this clarification of function for all roads could reduce by more than one third the average number of road traffic injuries per vehicle–kilometer traveled. Roads can be broadly categorised into 3 functions: 'through', 'distribution', or 'access' roads.

Through roads have rapid and uninterrupted movement (motorways, national roads etc.). 'Through' roads are higher-speed roads (motorways, expressways and multilane divided highways) and they should have restricted access; horizontal and vertical curves of large radius; crashworthy shoulders; median barriers; and grade separated junctions with entry and exit ramps. If such features are present, these are the safest of all roads.

'Distribution' roads distribute traffic from different districts or residential areas (regional roads). Rural roads should have periodic lanes for overtaking and for turning across oncoming traffic; median barriers to prevent overtaking in hazardous stretches; lighting at junctions; roundabouts; advisory speed limit signs before sharp bends; regular signs to remind of speed limits; rumble strips; and roadside hazards such as trees and utility poles removed. Transitional roads connecting higher-speed roads with lower-speed roads or moving from higher- to lower-speed stretches (such as rural roads entering villages) should have signs and other design features to encourage drivers to slow down in good time. Rumble strips, speed bumps, visual warnings in the pavement and roundabouts are possibilities.

'Access' roads provide access to final destinations: houses, shops etc. (local roads). Residential access roads should have speed limits of no more than 30 km/h and design features that calm traffic.

Together, these 3 categories make up a road network. Taking account of different road functions by defining a road hierarchy is an important step towards the improvement of road safety. At the moment many roads are multifunctional and used by different types of vehicle users with substantial differences in speed, mass of vehicle and degree of protection.

Speed Zoning

Additionally there are specific zones within each of the three levels of the hierarchy. For example transition zones on arterials connecting high speed roads to towns, school zones or home zones that require very low speeds etc. Establishing a consistent practice of limiting speeds on entire parts of road networks with similar functions assists the drivers in developing proper habits. Drivers come to understand and accept the need to limit their speed when entering a certain type of area. Ideally the areas will be self-explaining or somehow give visual clues as to what is the prescribed speed (WHO/FIA/GRSP/World Bank, 2008).

Towards credible speed limits

A speed limit is credible if it meets the expectations that are aroused by the road and the road environment. The concept of credibility of speed limits as been widely investigated in the Netherlands. The institute for road safety SWOV has produced a number of studies and experiments demonstrating that it is possible to choose a speed limit that is more credible for everybody; and that improving the credibility of the speed limit can be achieved by either adapting the speed limit itself or the road layout. If a speed limit is not credible, there basically are two possibilities to do something about it: either change the limit, or change the layout of the road or its surroundings. If the first option is chosen, raising the speed limit must not increase the number of crashes. A safe limit remains the starting point, no matter what. The possibility remains that for certain reasons neither the speed limit nor the road layout can be changed. An example is an incredibly low speed limit on motorways for environmental reasons. In these cases it is advisable to explicitly communicate the reason for the low limit to the road users.

The premise behind the idea of credible speed limits is that motorists are expected to obey the speed limits better. A credible speed limit is defined as a speed limit that matches the image that is evoked by the road and the traffic situation (Van Schagen et al., 2004). ***If a limit is not credible, drivers will be more inclined to choose their own speed***. If limits are experienced as being incredible too often, it will also harm the trust in the speed limit system as a whole.

In defining credibility it is also important to make a distinction between the 'road image' and 'the situation image'. The 'road image' is formed by the static features of the road and its environment, such as the lining and markings, bends, buildings, and vegetation; the 'situation image' is created by the dynamic features of the traffic situation such as weather conditions and the amount of traffic. The dynamic features are particularly relevant for dynamic speed limits.

Tuning the speed limit and the road and its environment to each other requires the identification of those elements that have an impact on the credibility of speed limits. For example according to one SWOV photography study in which motorists were presented photographs and indicate their preferred and safe driving speeds without being informed of the posted speed limit, the following features influenced the credibility of the limit on 80 km/h roads:

☐ the road width;
☐ the presence or absence of a bend;
☐ the view ahead;
☐ the view to the right;
☐ the clarity of the situation;
☐ the presence or absence of buildings;
☐ the presence or absence of trees on the right hand side.

While there are differences among motorists in how credible they perceive speed limits, there are features that influence everybody such as the presence or absence of a bend, the clarity of the situation, the view ahead, and the view to the right.

Through a number of driving simulator study SWOV demonstrated that in accordance with the expectations, on average less time was spent driving above the speed limits when the limit was credible than when the limit was considered as being too low (SWOV, 2007).

Informing drivers about the limits:

There will usually be an agreed general speed limit for higher standard rural and urban roads, and these are normally referred to as the 'default' speed limits. ***While the general limits are usually not signposted, they should nevertheless be clear to existing and new drivers*** (including visitors) entering the road network. How they may vary should be indicated by specific signs.

Locations where alternative (to default) speed limits apply are usually depicted by regulatory speed limit signposting. These limits may include:

☐ Linear speed limits (including transition/buffer speed limits) i.e. along lengths of roads and streets;
☐ Shared road-space speed limits for combined pedestrian and vehicle use areas, usually less than 10 km/h;
☐ Area-wide residential or commercial speed limits, with signs at entry point to the designated area;
☐ Time based speed zones:
• School speed zone: usually twice daily time-based lower limits for an hour or so at school starting and finishing times;
• Seasonal speed zone: for example at beach resorts in busier summer months when vehicular and pedestrian traffic is greater;
☐ Variable speed limits (limits that change under certain conditions or times of day). These are usually electronic signs

with lower limits applying for example, in wet or windy conditions;
☐ Heavy vehicle speed limits. Regulations may specify a lower limit for heavy or light vehicles on roads in open rural areas and on roads in urban areas. (WHO/FIA/GRSP/World Bank, 2008).

Growing need for Digital Speed Maps

With the gradual introduction of Intelligent Speed Assistance (ISA), the matter of including speed limit information in digital road maps (traditionally used for satellite navigation) becomes particularly important.

A number of countries have understood the link between the need for digital speed maps and the deployment of ISA. As such The Swedish Government has issued a directive to build up a nationwide road database containing up-to-date and quality-assured data. This decision was taken as long ago as 1996. The database called NVDB is managed by the Swedish Road Administration in association with partners including the NLS, the Swedish Association of Local Authorities. The database is seen as a digital infrastructure to be of major importance within many different areas, including the deployment of ISA thanks to the mapping of speed limits. Speed data for the map is supplied both at local level and nationally. Local authorities are required by a traffic regulation to inform the NVDB whenever a speed limit changes. NVDB also relies on the Swedish Road Administration employees, many of whom have ISA installed in their cars and report back in case of inconsistencies.

Another example is Finland where there is a national digital database called Digiroad containing precise and accurate data on the location of all roads and streets in Finland (covering a total of 430,000 km) as well as their most important features, including speed limits. The data is updated regularly, and it is the Finnish Road Administration that is responsible for the implementation of Digiroad, also working with various partners such as local municipalities (The Finnish parliament passed at the end of 2003 legislation requiring municipalities to provide data so that the digital map can be updated regularly) and other partners providing IT and technical support.

Such maps not only need to be poprely set up, but also regularly updated. This is because speed limits are one of the attributes of roads that most frequently change. In fact a project led by ERTICO called ROSATTE on the exchange of road safety attributes (see ROSATTE project: http://www.ertico.com/en/activities/safemobility/rosatte.htm) determined that it is the road attribute that most frequently changes with 7-9% of speed limits changing within a year on the road networks examined within this project (ROSATTE, 2009). One of the best ways of catering for the setup and regular update of digital speed maps is through partnerships between national and local authorities, road administrations, and digital map providers. We can also expect that the recent European Union Intelligent Transport Systems (ITS) Action Plan and Directive will help foster the standardisation of digital speed mapping throughout Europe (ETSC, 2009).

Conclusion

In setting speed limits it is vital to take a number of parameters into account, such as the threshold of physical resistance of the human body to the energy released during crashes, the road's function and its type of users, and as much as possible make sure that the layout of the road and its surroundings match that function, thus rendering speed limits safe and credible. Speed limits should also be communicated properly to existing and new drivers. Finally, to help foster the deployment of Intelligent Speed Assistance (ISA) systems it is also becoming very important that the provision and update of speed limit data into digital road maps be met in a consistent manner through partnerships between public and private actors concerned.

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Speed Fact Sheets

Editor and circulation:

Gabriel Simcic
gabriel.simcic@etsc.eu

For more information about ETSC's activities and membership, please contact:
ETSC
Avenue des Celtes 20
B-1040 Brussels
Tel. + 32 2 230 4106
Fax. +32 2 230 4215
E-mail: evgueni.pogorelov@etsc.eu
Internet: www.etsc.eu

ETSC is grateful for the financial support provided for the Speed Fact Sheets by KeyMed