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Speed in a high-speed society

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Speed in a high-speed society

Christer Hydén

1 INTRODUCTION

Speed control is probably the most important aspect of promoting road safety world-wide. Rune Elvik, Christensen, and Amundsen (2004) concluded that there is a very strong statistical and causal relationship between speed and road safety. Even small reductions of travel speed result in significant reductions of injuries and fatalities. e.g. 1 % reduction of average speed results in 4% reduction of fatalities (R. Elvik, 2014). Speed has the great advantage that it relates to all potential risks; irrespective of environmental factors, infrastructure, road users' status, or any other risk related factor.

The main reason behind the strong relationship between speed and risk of crashes/injuries is that it works twofold:

(a) The lower the travel speed, the greater the chance of detecting a potential hazard and thereby preventing a crash or – at least – decreasing impact speed.

(b) The lower the impact speed, the less severe will the consequences be.

The relationship between speed and risk is well established scientifically and it now seems as if governments and organisations all over the world appreciate the importance of speed: The UN – General Assembly resolution 64/255 of March 2010 - proclaimed 2011–2020 the Decade of Action for road safety. A Plan of Action was prepared for the Decade where it was stated that one of the measures was to produce effective interventions e.g. "by effective speed management by police and through the use of traffic-calming measures". The serious considerations behind the document is clearly stated in the following statement:

> "Road users, vehicles and the road network/environment are addressed in an integrated manner, through a wide range of interventions, with greater attention to speed management and vehicle and road design than in traditional approaches to road safety. It is particularly important that speed management is linked with vehicle and road design."

Speed is nowadays high on the WHO agenda: "Speed management, which lies at the heart of an effective approach to reducing deaths and injuries, is notably poor in many countries". An analysis is made of how the world's 10 most populous countries - accounting for almost 4.2 billion people and 56% of the world's road traffic deaths (703,000) - meets best practice legislation regarding the five risk factors Speed, Drink-driving, Helmets, Seat-belts and Child restraint. Legislation shows that none of the 10 countries meet best practice criteria across all 5 risk factors; and, no country meets the best practice criteria for speed. If these countries were all to bring their road safety laws in line with best practice, and adequately enforce them, there would be huge potential to save lives and reduce injuries resulting from road traffic crashes. Furthermore, this would go a long way towards reaching the target reduction in road traffic deaths identified in the Sustainable Development Goals (WHO, 2015).

It is particularly alarming that best practice criteria for speed control are not met in many countries. For instance, only 47 countries, representing approximately 950 million people, have urban speed laws that meet best practice. And regarding enforcement only 27 countries (15% of

participating countries) rate their enforcement of speed laws as "good" (8 or above on a scale of 0 to 10 (WHO, 2015). Even though quality of data can be questioned it is quite clear that there is a lot more to do regarding speed legislation.[1]

Setting the relevant speed limits is one side of coin. The other side is the acceptance and compliance with the limits. Estimates from some 50 OECD and ECMT-countries show that "Speeding -- i.e. excessive and inappropriate speed -- is a widespread social problem as, typically, at any time 50 % of drivers are above the speed limits" (OECD/ECMT, 2006).

It is particularly alarming that best practice criteria for speed control are not met in many countries

If (at least) 50% of drivers are exceeding the speed limit we can assume that the average speed in a fictive flow consisting of all these vehicles – presupposing a normal distribution of speeds – will have to be reduced by at least 8% in order to reach an 85-percentile speed below the speed limit. An 8% reduction of average speeds would, according to the power model, result in approximately 30% reduction of the number of fatalities (R. Elvik, 2014). This is in line with results of similar reductions of average speed e.g. when speed cameras were installed; an 8% reduction of average speed resulted in a 35% reduction of the number of fatalities (Vadeby & Forsman, 2014). This estimation is also in line with the average value of the estimations made by 20 IRTAD-countries; saying that speeding is a contributory factor in 30% of all fatalities on the roads. There are also other studies showing the consequences if every driver, always, was complying with the prevailing speed limit. In Sweden, according to the Swedish Transport Administration there would be between 100-150 fewer fatalities (STA, 2015a) corresponding to a reduction between 37% and 55%. In Norway, a 21% reduction is simulated (Høye et al., 2014) and in Belgium 35, 50 and 52% depending on road type (Simcic & Townsend, 2008). Even though the figures are varying the conclusion is clear; there is a very large potential benefit if drivers "just" kept to the law. This dramatically large potential, raises a lot of critical questions:

Setting the relevant speed limits is one side of coin. The other side is the acceptance and compliance with the limits. Estimates from some 50 OECD and ECMT-countries show that "Speeding -- i.e. excessive and inappropriate speed -- is a widespread social problem as, typically, at any time 50 % of drivers are above the speed limits".

- How are things developing today in an historical perspective? Have speeds gone up or down during the last decades? This is of course the most basic question.
- Attitude and behaviour among ordinary users of the traffic system?

Speeding is a contributory factor in 30% of all fatalities on the roads.

- Attitude and behaviour among politicians and decision makers on different levels
- What is the role of the automobile industry?
- Measures and their potential effects
- What is the role of different organisations?

[1] (https://injurymetrics.wordpress.com/2015/10/23/2015-who-global-status-report-committees-are-not-a-source-of-reliable-statistics/)

2 HISTORY

The most relevant starting point is speeds in individual countries or regions. The European Transport Safety Council (ETSC) in 2006 established a number of Performance Indicators (PIN) to be used as surrogates in order to analyse safety performance (Achterberg, 2007). ETSC's PIN programme covers 32 countries: the 28 Member States of the European Union, together with Israel, Norway, the Republic of Serbia and Switzerland. An initial report gives an overview European countries' performance in five areas of road safety (Achterberg, 2007). Regarding speed ETSC concludes:

> "The impact of speed on road traffic crashes has been studied extensively, and measures to reduce speed are known. Yet there is little progress on reducing speeds in Europe. Average speeds and numbers of speed limit violations remain high with only few encouraging signs."

In spite of the poor results there does not seem to be any major follow-up of these results. The main follow up was published in 2015 (Adminaite, Allsop, & Jost, 2015), but even then, only 11 countries presented monitoring over a couple of years, minimum 7 years, and only for motorways. These 11 countries represent 34% of all countries for speeds on motorways. Motorway fatalities stand for 7% of all fatalities, which means that the speed data for the 11 countries only "covers" a bit more than 2% of all the fatalities with private vehicles involved in the 27 countries. There were only two countries – of the 28 countries - that could demonstrate clear downward trend of mean speeds. In France, motorways with speed limit between 110 and 130 km/h had a downward trend of mean speeds by 0,7 and 0,9 km/h per year between 2003 and 2009. In Switzerland, the decrease on motorways with 120km/h speed limit was 1.0 per year. The compliance rate varied from 25% to 85%, average 60%, which means that 40% of all vehicles are driving above the prevailing speed limit.

After 2013 no speed data are presented at all. This is very unfortunate in view of the fact that progress in reduction in fatalities since then seems to have been very poor. Besides many countries have presented a negative development of fatalities during the last years, and without data we do not know what role speed has played – if any – during these years.

The conclusion regarding Europe's efforts to lower speeds – even though ambitious from the beginning (2006) – is that very little progress has been made. The main exception seems to be France. France has apparently had the most active decision makers. According to the French newspaper *The Local,* the number of deaths on roads in France fell by 11 percent in 2013[2]. Importantly, speed related measures were in the front line, e.g. new mobile speed cameras and cutting speed limits on roads. France has considered a plan to install "black box" recorders in French vehicles. Even though this is just one case, it still represents one of few cases where the politicians are taking a clear stand point, and also focusing specifically on the speed issue.

The main problem is the lack of comprehensive data for most of the countries. One exception is Sweden – one of the safest countries in fatalities per population. Data from Sweden supports the generally poor results on speeds in Europe. The compliance rate has not changed over the last 20 years, still being 45% (Bengtsson, Forsman, & Strandroth, 2017). The travel speed, however, on the same roads have decreased a bit less than 4 km/h over the same period (from almost 82km/h to a bit more than 78km/h – thus only around 0.2 km/h per year on average). The reason behind the reduction is – according to the authors - probably lowered speed limits and – perhaps - more congestion.

Israel is one of the few countries that has established a national system for monitoring Safety Performance Indicators. Speeding is one of six indicators. As an example, speed SPIs are estimated for the Israeli road network in 2012. All rural road types are associated with a significant share of non-compliance with speed limits, where the highest level of non-compliance (60%-70%) was observed on dual-carriageway roads with at-grade junctions and on single-

[2] https://www.thelocal.fr/20140120/driving-france-sees-record-drop-in-road-deaths

carriageway roads (Gitelman, 2014). In 2009 and 2013 national speed surveys were undertaken in Israel showing that mean speeds on dual-carriageway roads without at-grade junctions had gone up 8 km/h, average 2 km/h per year, on other dual-carriageway roads 3 km/h, 0.75 km/h per year and on single-carriageway roads by 1 km/h, 0.25 km/h per year. On motorways mean speeds were unchanged. In urban areas, the differences were rather small, between 3km/h down and 1 km/h up.[3]

The main conclusion built on available speed data is that generally, no major speed changes have taken place in almost any country covered in this survey. And the percentage of drivers exceeding the prevailing speed limits is very high, most often above 50%.

One country that has been working extensively on the speed issue is Australia. Speed limit setting policy in Australia is different in each state. All states conform broadly to a national policy (produced by Austroads) and the Australian Standard (AS1742), but application can be different. The main conclusion from Australian data is that on most roads, in most states, there is a downward trend regarding mean speeds. However, the reduction is quite small, the median reduction per year is 0.3 km/h. Compliance rate varied between 40% and 80%, with a plain average of 60%. Even if these are rough estimates, based on different time periods, again changes are small compared to the changes in fatalities. Over the last decade, the rate of annual deaths per 100,000 population has declined by a total of 30.3 per cent in Australia, equating to an estimated trend reduction of 4.4% per year.[4]

It is striking that in the EU almost no data are available for the last 4-5 years, especially in view of the fact that fatalities in EU have had an almost stand still during this period. The lack of speed reductions makes it important to analyse the possible reasons behind this.

USA has two comprehensive national studies of speed, carried out in 2007 and 2009 (Huey, DeLeonardis, & Freedman, 2012). Results show that overall, there was a decrease of mean speeds on major arterials of 0.34 mph (0.55 km/h), from 53.62 mph (86.3 km/h) to 53.28 mph (85.7 km/h), and an increase of 0.27 km/h on minor arterials - from 75.4 km/h to 75.7km/h. These correspond to an increase of 0.3% per year and a decrease of 0.2% per year. On limited access roads, the situation is different where mean speeds went up 9.3 km/h, from 104.1 km/h to 113.5 km/h, corresponding to an increase of 4.5% per year for the two years. The compliance rates were varying from 30% on limited access roads to 40% on minor arterials and 45% on major arterials.

The attitude among people in general seems to give low priority to the speed issue.

In order to collect speed monitoring data from other parts of the world a number of cities are approached without any real possibility of finding representability in any way. One city that was approached is Sao Paulo, Brazil. The city has vast amounts of data on volumes and speeds and a number of 5 to 7 km long routes.[5] In a comparison of data from 2010 and 2016 the result was that, for 16 speed measurements in the morning hours, the mean speed was 23.2 km/h in 2010 and 22.3 km/h in 2016, thus a reduction of mean speed by 0.9 km/h, i.e. on average 0.14 km/h per year. Corresponding figures for the evening hours was that mean speed is 21.7 km/h in 2010 and 18.1 km/h in 2016, a reduction of mean speed by 3.6 km/h, i.e. on average 0.5 km/h per year.[6] These results are of course very difficult to interpret, but the very small

[3] Gitelman, V. *National speed survey* - summary of data. Private copy

[4] https://bitre.gov.au/publications/ongoing/road_deaths_australia_annual_summaries.aspx.

[5] http://www.cetsp.com.br/sobre-a-cet/relatorios-corporativos.aspx

[6] Based on speeds and volumes results from annual reports 2010 and 2016 from city authorities by the author.

differences in the morning hours leads to the conclusion that the evening results are due to differences in traffic volumes and congestion. Therefore, there is no reason to believe that the decrease of speeds should be due to any general change of drivers' behaviour. At the same time, it is important to note that data on speeds and volumes are impressive in Sao Paulo. Detailed analysis, street section by street section at different times of the day and in different years, would provide Sao Paulo with an excellent foundation for the formulation of a speed management strategy.

China is a country where motorisation is fairly new. Interventions to curb speeding and drink driving are being implemented in the cities of Suzhou and Dalian since late 2010. A research team made observations from the beginning of 2011 to mid-2012 (Bhalla et al., 2013). The result was that thus far the prevalence of speeding had not been reduced in any of the two cities, except for one site in Dalian where compliance rate went down from 70% to 10%. The reason was the introduction of an interval-based speed enforcement system. This result is very similar to the result of the trial of speed cameras and Section Control in Norway (Høye et al., 2014).

2.1 Conclusion

The main conclusion built on available speed data is that generally, no major speed changes have taken place in almost any country covered in this survey. And the percentage of drivers exceeding the prevailing speed limits is very high, most often above 50%. So, the conclusion is clear - in spite of a very high potential in reducing speeds very little has occurred. Besides, it is striking that in the EU almost no data are available for the last 4-5 years, especially in view of the fact that fatalities in EU have had an almost stand still during this period. The lack of speed reductions makes it important to analyse the possible reasons behind this.

3 ATTITUDE AND BEHAVIOUR AMONG PEOPLE IN GENERAL

The attitude among people in general seems to give low priority to the speed issue. Sweden, makes an annual survey with 2,000 representatives of the public in Sweden. One of the questions is: "What are the three most important behaviours from a safety point of view?" By far the most common answer is 'alcohol'. It is more than three times as common as speed. Besides, four other behaviours are mentioned more frequent than speeding: 'not using the safety belt', 'driving against red', 'talking in the mobile phone', and 'keeping too short distance' (STA, 2015b). In addition, almost 60% of the respondents consider 'follow the flow of traffic' more important than 'keeping the speed limit'. At the same time respondents are quite positive about reducing speed in some circumstances. For instance, 50% think 'it is reasonable' to lower the speed limit for the sake of improved safety and 55% think that speed limit at zebra crossings should be 30 km/h).

A comparison of attitudes to drinking and driving and speeding has also been done. People were asked to answer the question: 'Should penalties for speeding/drink-driving offences be much more severe'. Regarding speeding 52% answered 'strongly agree' or 'agree', while regarding drink driving the corresponding figure was 84%. The results present the same tendency as the Swedish survey; drinking and driving are looked upon as a more severe misbehaviour than speeding. Interestingly these results can be compared with an Australian study where drinking and driving was compared with speeding in urban areas in Australia. Exceeding the speed limit (60 km/h in built-up areas) by 20 km/h resulted in a 30 times higher risk. The same risk increase was true for a blood alcohol level of 0.21g/100 ml (compared with 0 g). It is quite obvious that even with the same risk increase – 30 times – the respondents in the Swedish survey consider drinking and driving as much more serious than speeding.

There is one large international survey that supports the results from Sweden and Australia. It was done under the EU-umbrella and called SARTRE. In a fourth survey - The SARTRE 4 - altogether 12,507 car drivers and other road users in Europe were interviewed (SARTRE group, 2012). Speed related findings included:

- Car drivers in Europe believe that driving 20 km/h above the legal speed limit would be pleasant and that it will take them to their destination quicker. However, they did not believe that it would result in an accident. A large proportion was opposed to reducing the speed limit to 30 km/h in built up areas.

- Drivers in Europe have a relatively positive attitude towards speeding, although this tends to be most common among young drivers and men. They believe that speeding is rather widespread among other drivers. The attitude towards speed enforcement and speed reduction tends to be rather negative, although a fairly large proportion would not object to punishments becoming more severe.

Car drivers in Europe believe that driving 20 km/h above the legal speed limit would be pleasant and that it will take them to their destination quicker. However, they did not believe that it would result in an accident.

Peoples' attitude to speed was also surveyed in Australia (Austroads, 2012; Pennay, 2008): 26% believed that it is okay to exceed the speed limit if driving safely. At the same time 84% felt that speed limits are generally set at reasonable levels, and 46% supported an increase in the amount of speed limit enforcement.

Even US has done attitudinal surveys nationwide. The 2011 National Survey of Speeding Attitudes and Behavior (NSSAB) (Schroeder, Kostyniuk, Mack, & Abt, 2013). There was strong agreement – 91% positive - that 'Everyone should obey the speed limits because it's the law'. At the same time drivers answered that it is unacceptable to exceed the speed limit by more than 20 mph (32 km/h). A great deal of the respondents felt that people should keep pace with the flow of traffic; 52% of drivers strongly agreeing and 30% somewhat agreeing with this statement.

The main conclusion is that measures to prevent speeding seems to have a rather low priority among people all over.

Generally, the difference between Swedish, European, Australian and US data does not seem to be very significant. Most examples show a rather high similarity among the respondents. It seems though as if the Australian respondents give more pro speed compliance answers than in Europe, and the US. In the Australian survey only 26% said it was ok to exceed the speed limit.

Similar information is not available from low and middle-income countries. Anecdotal accounts suggest that 'speeding' as a cause of serious crashes is recognised in most countries. China and Iran have installed speed cameras at a large number of locations (Bahadorimonfared et al., 2013; He, King, Watson, Rakotonirainy, & Fleiter, 2013; Shabaniverki, Thomas, Figueira, & Sheikhlari, 2014), but no studies are available to judge the effectiveness of these measures. A recent report from the Ministry of Road Transport and Highways of the Government India (Transport Research Wing, 2015) states that 'of the total road accident killings, the share of over speeding comes to 44.2 per cent (64,633 out of 1,46,133 deaths)'. This assessment is based on police reports and not a scientific analysis of road traffic crashes, however, it does reflect the fact that the government recognises the importance of speed in crash causation. The report does not mention any policy measures regarding control of speeds on Indian roads.

It is an enormous task to change this situation, especially as long as politicians and other decision makers seems to be a lot in harmony with the general public.

The main conclusion is that measures to prevent speeding seems to have a rather low priority among people all over. The answers were not very consistent. Is it alright to drive faster than the speed

limit, and how important is the pace of traffic? The vital question is to what extent these statements by the public represents anything more than just statements without any strong bearing on norms or behaviour. It is an enormous task to change this situation, especially as long as politicians and other decision makers seems to be a lot in harmony with the general public.

4 ATTITUDES AND BEHAVIOUR AMONG POLITICIANS AND OTHER DECISION MAKERS

There are number of examples where the views of politicians and decision makers coincide with the general public. Drinking and driving compared with speeding is a good example where people in Europe find drinking and driving significantly more severe than speeding. In an Australian study drinking and driving was compared with speeding in urban areas in Australia. Exceeding the speed limit (60 km/h in built-up areas) by 20 km/h resulted in a 30 times higher risk. The same risk increase was true for a blood alcohol level of 0.21 g/100 ml (compared with 0 g). In Sweden, it is quite obvious that law and enforcement considering drinking and driving is much stricter than speeding when compared with the Australian example. Sanctions in Sweden when drinking and driving: above 0,05 g/100ml - imprisonment at least one month, withdrawal of the license at least one year, above 0.10 g/100ml drunken driving renders maximum 2 years imprisonment and withdrawal of the license up to two years. Sanctions in Sweden when speeding: more than 20 km/h above speed limit - fine maximum 2800SEK (corresponding to 2 days' salary).

4.1 The role of the car industry and the interaction with politicians, decision makers and other stakeholders

The 'car regime' is the regime in which the planning of the traffic system takes place. Marletto (2011) has produced a comprehensive analysis of the importance of this 'regime'. He explains: 'the car regime was established thanks to the ability of purposeful private actors to use the technology of internal combustion to influence markets and institutions, and finally society as a whole'. Attempts to deliberately destabilise the automobility regime has shown that this regime is based on a strong actor network involving the automobile industry (and associated sectors), transportation policy, and customer behaviour, which mutually reinforce each other and creates a highly stable regime (Hoffmann, Weyer, & Longen, 2017). Cohen (2012) adds: 'Automobile society has been triumphant for a century. While this success is often ascribed to entrepreneurial tenacity and indefatigable demand, it is more correctly credited to auspicious political, economic and cultural trends'. In large this stable situation of the automobility regime prevails and remains considerably stable, in spite of various challenges.

However, the regime of automobility produces negative externalities, such as road congestion, pollution, traffic accidents, noise, loss of space in urban areas, dependency on oil or global warming (Hoffmann et al., 2017). A central issue in research is, therefore, how to be able to discontinue these incumbent socio-technical regimes by means of deliberate governance, and thereby reduce and eliminate these externalities (Hoffmann et al., 2017). In the following section, we will approach 'the behaviour of the car regime' in relation to speed.

5 POWER AND SPEEDS

The most obvious example is the fact that car performance, both regarding power and speeds, has never been approached by decision makers in order to try and urge the automobile industry to limit the performance. Around 1970 the maximum speed of most cars was approaching 150 to 200 km/h. At the same time, no country – except for Germany had speed limits above 120-130 km/h. Development has continued with more and more powerful cars and higher and higher speeds, while speed limits have remained the same.

In Germany, it has gone so far that the car industry itself has agreed on a speed limiter in their cars, set to 250 km/h(!). Neither the German Government – nor the European Union - seems to

have been involved. Today modern motor vehicles most often have a speed performance capability that means a maximum speed of 200 to 250 km/h and an acceleration 0 to 100 km/h in a few seconds. Even though, with higher demands on environmental aspects, car manufacturers are promoting their cars with arguments as “the driving pleasure” and speed and acceleration performance. Authorities have followed this development without any demands to assess the consequences, in terms of speed and acceleration behaviour and its implications for interaction and safety. Generally, there is very little research at all elucidating the question what role more power plays from a safety point of view. Those few examples which exist indicate primarily negative safety effects. In an analysis by Høye et al. (2014) only 5 relevant studies were identified. Four of them indicates significant increase of accident risk with increasing power, while one of the studies indicates the opposite. The conclusion from the researchers is that “most of the studies indicate that cars with particularly high power has higher risk than cars with ordinary power”. There is also a French study, even though old, the only one that tried to include confounding factors like driver age and mass (Fontaine, 1995). The study shows that at a young age (<25 years) of the driver the risk (accident Involvement per million km for vehicles) increases rather dramatically with power while in other age categories no such relation seems to exist.

The conclusion from the researchers is that “most of the studies indicate that cars with particularly high power has higher risk than cars with ordinary power”.

The conclusion is that no actors in the car regime have demonstrated any great interest to the question of how the vehicles are actually used from a speed and acceleration point of view in relation to safety. This is rather alarming in view of the “low respect” for speed limits among the public. And, it has never been demonstrated why and in what way strong acceleration power is important from a safety point of view. The main reason behind this is probably that safety in terms of fatalities has improved in most countries all the way since the beginning of the 1970s. One of the success stories is car safety in terms of crash protection measures. That might be one reason why the car regime has been able to ignore the fact that high-performing cars might have had a negative impact on safety. Even though large improvements are made in terms of fatalities, it is still so that quite a significant proportion of all fatal accidents, has a link to “speeding” or “excessive speeds”. Quite a critical question in this context, is how the situation is in LMICs. To what extent are heavy, high-performing cars compatible with all the autorickshas, other small vehicles and vulnerable road users, and what is the safety outcome?

The conclusion is that no actors in the car regime have demonstrated any great interest to the question of how the vehicles are actually used from a speed and acceleration point of view in relation to safety.

6 SPEED LIMITERS

The ultimate speed management tool is of course a so-called Speed Limiter which prevents drivers from driving faster than the set speed limit. Once installed in the vehicle it works in all kinds of environments all over the world. This presupposes that information is given to the vehicle on prevailing speed limits. To-day this is not a problem anymore; there are different techniques that can be

The longitudinal speeds were strongly harmonised and kept under the speed limit in the after situation (with Speed Limiter). Behavioural observations showed an improvement in behaviour in interactions with other road users, e.g. drivers more frequently giving the right of way to pedestrians, cyclists and other.

used: reading of speed signs, GPS-data, etc. These techniques are already used on a large scale in many vehicles.

Speed Limiters actually exist already, also called Speed Governors. Authorities introduced Speed Limiters in many jurisdictions controlling the maximum speed of vehicles, primarily buses and trucks. However, these limiters are set on plus 10 km/h in relation to the highest speed limit on the roads in the country. This means that it is still possible to exceed the speed limit on all roads, especially on roads with lower speed limit than the maximum. The result is, therefore, very limited effects in total (Vaa, Assum, & Elvik, 2012) even if all vehicles are so equipped. However, the measure could also be seen as a first step towards an understanding and a mental preparedness by drivers, that controlling maximum speed of (all) cars in the future is a possible scenario.

A Speed Limiter concept that is limiting speed to the prevailing speed limit, has never been tried by any of the car industries, as far as we know. In the 1980s there was a research trial in Eslöv, Sweden, one in Tilburg (The Netherlands), and one in Leeds (UK). In Eslöv (speed limit 50 km/h) 25 private cars were used for the half year trial (Almqvist, 2006). The main results were that average speed for the whole test route for all drivers decreased from 43.5 km/h to 41.5 km/h. The total effect is relatively small (– 4.6%), as the speeds were rather moderate in the city even before. Still it represents a theoretical reduction of deaths by 15-20%. The effect of the Speed Limiter can be clearly seen on major streets where speeds were considerably higher in the before situation. The longitudinal speeds were strongly harmonised and kept under the speed limit in the after situation (with Speed Limiter).

Behavioural observations showed an improvement in behaviour in interactions with other road users, e.g. drivers more frequently giving the right of way to pedestrians, cyclists and other. The test drivers stated that the Speed Limiter Function should be mandatory. Moreover, it was definitely possible to imagine a mandatory speed assisting system for built-up areas.

From 1999 to 2000, the Dutch Ministry of Transport ran a mandatory ISA field test in the city of Tilburg using 20 passenger cars and a bus (Information collected from (Driscoll, Page, Lassarre, & Ehrlich, 2007; Loon & Duynstee, 2001)) The test zone contained 30, 50 and 80km/h speed limits.

The main conclusions of the Tilburg trial were:

- The ISA system as tested in the Netherlands is technologically feasible; minor improvements are needed.
- As expected, the ISA test in Tilburg has had a positive effect on driving behaviour and speed patterns. Ninety-five percentile speeds went from well over speed limit on 30 and 50 km/h roads without the SL to somewhat under with the SL
- The ISA Tilburg test shows that great deal of public support can be gained; adequate communication however is essential.

In Leeds, an on-road study was carried out, as part of an External Vehicle Speed Control project. A vehicle was equipped with two versions of EVSC, Driver Select and Mandatory. The main findings were:

- The Mandatory system trial in this experiment successfully reduced speeds, particularly in areas where drivers are renowned to being poor at adapting their speed.
- There were no negative behavioural compensation effects. Although drivers were initially unfavourable towards the mandatory system, they reported that driving with the system was safer due to enhanced awareness of potential hazards.
- The effectiveness of the Driver Select system is roughly half that of the mandatory one (Carsten & Fowkes, 2000).

The results of all three studies indicated clearly that there was a great potential from a behavioural and safety point of view. However, further research on the Speed Limiter concept

was abandoned, in the 1990s. No similar project, with mandatory use of a device that totally prevented speeding, has taken place since. Instead, ISA - Intelligent Speed Adaptation – was introduced.

ISA is the general term for advanced systems in which the vehicle "knows" the speed limit for any given location and is capable of using that information to give feedback to the driver.

ISA is the general term for advanced systems in which the vehicle "knows" the speed limit for any given location and is capable of using that information to give feedback to the driver. ISA is a voluntary measure where the driver is assisted in keeping the speed limit by some kind of signal, auditory, visually or haptic (resistance in the gas pedal). ISA can be operated in many different ways. The main point is that the use is voluntary; you can always override the system, in one way or another. Today ISA has been introduced in many car models, however, the driver always decides whether the system should be in operation or not. This kind of voluntary ISA has so far not proven to be a very effective speed management tool in large scale trials, even though research shows that advisory ISA can achieve up to an 18% reduction in fatal accidents and intervening ISA can achieve a 37% reduction in fatal accidents in the U.K. (Simcic & Townsend, 2008). Prediction based on actual speed changes observed in an ISA project in UK is that an ISA system targeted purely at compliance with existing speed limits could, in its strongest variant (i.e. a non-over-rideable version), deliver a 29% reduction in injury accidents (Carsten, 2012). Applying the power model of R. Elvik (2014), that translates into a 50% reduction in fatal accidents.

However, concerning Speed Limiter Systems there are still no major breakthroughs, neither in France or anywhere else, in spite of thirty years of research on Intelligent Speed Adaptation (ISA). And in spite of the fact that speeds can be reduced significantly, and that users have been found to have generally positive attitudes and some sections of the public have been shown to be willing to purchase ISA systems.

At a political level, there is one national leader who has indicated his desire to take ISA forward. President Sarkozy of France, in his speech of 30 November 2011 to Association Prévention Routière, stated: "I am convinced that the Intelligent Speed Limiter system can bring us remarkable results. A roadmap for its deployment in our country is to be produced within three months. France must be a forerunner in this area."

However, concerning Speed Limiter Systems there are still no major breakthroughs, neither in France or anywhere else, in spite of thirty years of research on Intelligent Speed Adaptation (ISA). And in spite of the fact that speeds can be reduced significantly, and that users have been found to have generally positive attitudes and some sections of the public have been shown to be willing to purchase ISA systems (Carsten, 2012).

Emergency braking and Electronic Stability Control (ESC) and similar measures assist the driver when he/she is about to lose control or reacts too late. Safety assessment of these systems indicate quite positive effects.

ISA is extremely cost-efficient: benefits of up to 4.8:1 can be expected depending on the country (ETSC, 2013). European Council (2017) presents a benefit to cost ratio for ISA-systems of 1.95. Results from UK indicate that ISA could deliver a very healthy benefit-to-cost ratio, ranging from 3.4 to 7.4, depending on the deployment scenario – either market driven (a scenario in which users choose to have ISA because they want it) or authority driven (a scenario in which adoption of ISA, particularly 'stronger' forms of ISA, is initially encouraged and eventually required). Under both deployment scenarios, ISA can recover its implementation costs in less than fifteen years. Of the two deployment scenarios, the market driven one, is substantially outperformed by the authority driven one. The benefits of ISA are

mainly safety related; up to 98% of the benefits are attributable to accident savings.

In spite of research funding in large scale by the UK Department for Transport, and in spite of quite promising results, in UK, Governmental authorities were not interested: *"In other words, it is the Department's intention to do absolutely nothing to promote ISA as a tool for encouraging compliance with speed limits….."* (Transport Committee, 2011).

Even though UK is a single example there are still no other examples where politicians are pushing for "authority driven ISA-scenarios". Acceptance or public acceptance as perceived by politicians would seem to be the obstacle to research and deployment (Carsten, 2012). This should be seen in view of studies of acceptability. From a survey of a representative sample of British drivers, we learn that "While a non-negligible part of the sample population has such strong opposition to ISA that no reasonable discounts or incentives would lead to them buying or accepting such a system, there is also a large part of the population that, if given the right incentives, would be willing or even keen to equip their vehicle with an ISA device" (Chorlton, Hess, Jamson, & Wardman, 2012).

It is important to add to this picture that the car industry does a lot for safety. They have been, and are, extremely successful in improving the crashworthiness of cars. Much of this work has been enhanced thanks to the NCAP program where the industry has been encouraged – and, in practise, forced - to improve the performance. Lately EuroNCAP has introduced speed assistance which could be the accelerating factor for the implementation of ISA. However, Euro NCAP only promotes installation of voluntary Systems.[7] They assess different functions of Speed Assist Systems, informing, warning or actively preventing. Besides, Speed Assist is one of five systems under the heading Safety Assist. The other four are "Electronic Stability Control", "Seatbelt reminders", "AEB Interurban" and "Lane support". This means that Speed Assistance only contributes to one fifth of the Safety Assist score. ETSC has found that "…*few new models offer the more advanced version of the technology – which has the potential to prevent significantly more deaths than the warning-only function* (ETSC, October 26, 2016).[8] It should be added again, that even with the "advanced version of the technology" the use is still voluntary.

The EuroNCAP approach is of course encouraging. However, the assessment does not guarantee any actual change of speeds. The other included safety systems: AEB, Electronic Stability Control, etc, are automatic systems which work once they are installed in the car. Speed Assist does not work automatically, but presuppose an active step by the driver. In line with all other systems that are assessed by NCAP, with crash tests etc., Speed Assist should be assessed based on the actual speed effect, not a fictive one.

To conclude regarding ISA: The car regime still seems to be very homogeneous regarding the unwillingness to include Speed Limiter (SL) on their agenda. It is obvious that the car industry has managed to set the scene, so as to exclude all discussions – and research – on the most promising measure that could prevent all speeding.

6.1 Active safety measures and Naturalistic driving

One reason why the car industry has managed to "avoid SL" so far is the rapid development of active safety measures. It has become a great safety success for the car industry. It includes measures that intervene with the driving process, e.g. emergency braking and Electronic Stability Control (ESC) and similar measures, which assist the driver when he/she is about to lose control or reacts too late. Safety assessment of these systems indicate quite positive effects.[9] The technology behind these kinds of measures has also made it possible to do studies of driver behaviour in the real world. The first Naturalistic Driving Study (NDS) was carried out in the US (Dingus et al., 2006). One-hundred drivers were involved. "A primary goal was to provide vital

[7] https://www.euroncap.com/en/vehicle-safety/the-ratings-explained/safety-assist/speed-assistance/.

[8] http://etsc.eu/speed-limit-displays-on-new-car-models-not-enough/

[9] http://etsc.eu/commission-report-gives-green-lights-for-mandatory-fitting-of-new-safety-tech/

exposure and pre-crash data necessary for understanding causes of crashes, supporting the development and refinement of crash avoidance countermeasures…..". EU has supported a similar approach: UDRIVE – European Naturalistic Driving Study. UDRIVE has defined risky behaviour where "Speeding (speed choice in relation to speed limit, max speed, etc)" is one example (Eenink, Barnard, Baumann, Augros, & Utesch). In theory, there should be a great opportunity to study the naturalistic speed behaviour in relation to speed limits and risks and also speed adaptation behaviour. With UDRIVE "the camera data also provides a good overview of what is happening around the vehicle, it allows us to study how drivers interact with pedestrians and cyclists: when are they recognised and how does the driver respond in terms of speed?"[10] Would this inform us whether there is any speed adaptation, does the driver react well in advance, e.g. 10-20 seconds before the rendezvous? Another speed aspect which is not specifically mentioned is the "general" travel speed of drivers (tactical level). In view of the great safety potential in eliminating speeding, to learn more about "general" travel behaviour will be very important. What is the role of road design and what role does the car play, etc. UDRIVE has already produced some quite interesting results in this area: "Cruise Control is used more often than Speed Limiter but all together they are used only in approximately 10% of the trips. 17% of the equipped drivers don't even know they have this function. Drivers generally don't use the 2 functions (they specialize either in CC use or SL use). The road types where CC and SL are used are equivalent."[11] This result not only indicates the "true behaviour" of car drivers, but also indicates that there is still a long way to go regarding speeding.

In view of the great safety potential in eliminating speeding, to learn more about "general" travel behaviour will be very important. What is the role of road design and what role does the car play, etc.

It has become obvious that the car regime has played a crucial role in setting the "speed scene". All measures that are presenting options for reducing travel speeds are so far countered systematically.

The UDRIVE approach seems very interesting and promising, however, it is still unclear what approach UDRIVE is going to use in order to be able to understand the speed problem.

6.2 Conclusions regarding in-vehicle systems to control speed

It has become obvious that the car regime has played a crucial role in setting the "speed scene". All measures that are presenting options for reducing travel speeds are so far countered systematically. What is even more ostentatious is that there is no research going on either. This is extremely ignorant in view of the positive results of those Speed Limiter trials that are carried out, including the great positive support (Driscoll et al., 2007), the positive benefit to cost ratio, and, the potentially large savings of lives. Besides, without any presumptions of use it would be very informative for the "traffic safety society" to learn more about driver's reactions and behaviours when they are forced to keep all speed limits. To-day this is a completely dark area which is rather embarrassing to say the least.

Without any presumptions of use it would be very informative for the "traffic safety society" to learn more about driver's reactions and behaviours when they are forced to keep all speed limits.

[10] http://cordis.europa.eu/news/rcn/123051_en.html.

[11] http://results.udrive.eu/?s=speed&is_v=1

7 COMFORT AND SPEED

One special aspect on travel speed is the relation to comfort. New technology has made it possible to make very advanced comfort systems. One example of this is the so called “Magic Body Control” developed by Mercedes Benz. A clever combination of sensors and suspension adaptation transforms the new S-Class into a "flying carpet ...”.[12] In promoting the system, it is demonstrated how the system eliminates the discomfort perceived by car users when negotiating a bumpy road, including when they negotiate a speed hump. As the latter is built with the purpose of creating discomfort when the speed is “too high” it is of course urgent to find out how travel speed is influenced by this kind of comfort device. However, so far, no results are reported.

8 MEDIA

It is impossible not to mention media’s role in the car regime. There is a large interdependence between industry and media. Advertising accounts for a large share of a newspaper’s total revenues around the world (Beattie, Durante, Knight, & Sen, 2017). Car manufacturers are among newspapers’ largest advertisers. As of 2006, total advertisement spending by the automotive sector amounted to over 20 billion dollars, 40% of which benefited the printed press. Newspapers’ reliance on advertising raises the concern that editorial decisions may be vulnerable to the influence of advertisers, especially the biggest ones (Beattie et al., 2017). In a study they draw the conclusion that: “Consistent with the predictions of our theoretical model, we find that recalls involving a given manufacturer receive significantly less coverage in newspapers in which that manufacturer advertised more over the previous two years. This result indicates that a medium-to-long term advertising relationship between firms and newspapers is conducive to friendly coverage”.

Dewenter, Heimeshoff, and Thomas (2016) supports the importance of the relation. They studied the impact of media coverage on new cars’ registrations: “Overall, we find a positive and significant number of sales influenced by the news. An additional report per month leads to about 1.2 more registrations. In case that reports have a positive (or at least neutral) tonality, the effect is even higher. Not only product specific information but also general news therefore have a rather strong impact on consumer behaviour”. There is a lot of product specific information available in papers and on the net. The portal https://www.edmunds.com is an example of a big actor. They not only produce general information of tested cars but they also add a lot of “seductive” characteristics. Two examples from Edmunds.com:

- 2016 Mercedes-Benz GLC300: ”This impressively engineered, ultra-refined and stylishly rendered compact luxury SUV looks and feels like a step above the pack. It puts literal meaning to the words "luxury sport-utility" and earns a resounding "A" rating from our editors. GLC felt like a bullet train at high speeds: smooth, stable, vaultlike. The ride quality is especially impressive...”
- 2016 BMW M6: “The broad-shouldered 2016 BMW M6 lacks the nimble feel of smaller performance cars, but its prodigious power and plush cabin make it a superb grand touring machine….. have squeezed an extra 107 hp out of it, giving you 552 hp….”

Almost every paper and journal has their own expert on traffic which in most cases is equal to being an expert on cars. These experts have been handed new cars to assess, of course without any cost. These experts are treated as VIPs by the car industry. As Mr Smith (2004) expresses it in the Guardian “…..Those boys are the A-force, ready to mobilise with just a couple of months' notice and deplane, all expenses paid, in some resort or another on the European mainland in order to observe how pretty a Daewoo Matiz looks coming down a Spanish mountain”. Obviously, the procedure around presenting of new cars in this way makes the interdependence considerably stronger.

[12] https://www.youtube.com/watch?v=ScpgI1w5F6A

9 SPEED RELATED MEASURES AND THEIR POTENTIAL EFFECTS

9.1 Speed limit changes

Education and publicity are conditional on other speed reduction measures, such as speed enforcement and the acceptance of legal changes. On its own, the effect of education and publicity in changing actual speed behaviour is likely to be limited.

Lowering the speed limit lowers travel speeds. A Norwegian study found that decreasing the speed limit produced a larger reduction of mean speeds per speed limit km/h, than an increase of the limit. A reduction of the speed limit by 10, 20 and 30 km/h resulted in a reduction of mean speed by 3 km/h, 8km/h and 14km/h respectively, while an increase of the limit by 10 and 20 km/h resulted in an increase of mean speed by 2 and 3 km/h respectively.

On a 90 km/h road the effect would be a reduction of fatalities between 9% and 17% if the power model is used to predict the outcome based on change of average speeds, thus quite a considerable effect (R. Elvik, 2014). This decrease of compliance with speed rules, might have negative long-term effects with less respect for speed management activities. At the same time with more drivers disobeying the speed rules enforcement can be more effective in catching more drivers and thereby might lower the speeds further.

9.2 Campaigns

According to meta-analysis by Høye et al (2014) the summarized effect for all types of mobile controls is a decrease of injury accidents by 17%. It seems to be the same no matter what design of the control (visible or hidden).

Speed campaigns have a very small effect. Meta-analysis has shown that while drinking and driving campaigns have an effect of minus 18% on all accidents, speed campaigns only have an effect of minus 4%. Besides it seems as if the effect of the campaign goes down over time. In the 1980s the overall effect was minus 16% which came down to minus 5% in 2000-2010 (Høye et al., 2014).

The limited effect is supported by the EU Information page about Education and Publicity Campaigns: “Education and publicity are conditional on other speed reduction measures, such as speed enforcement and the acceptance of legal changes. On its own, the effect of education and publicity in changing actual speed behaviour is likely to be limited.”

9.3 Enforcement

Speed cameras seem to be one of the few measures that can have quite a significant effect on speed behaviour on rural roads.

Compliance with speed limits is dependent on the efficiency of enforcements activities. There are two main types of speed enforcement: manual with mobile control and speed cameras.

9.3.1 Manual with mobile control

Effectiveness depends on many factors, such as the actual enforcement effort, the initial speed and safety level, the distance from the camera, the time after installation, and the type and amount of supporting publicity.

According to meta-analysis by (Høye et al., 2014) the summarized effect for all types of mobile controls is a decrease of injury accidents by 17%. It seems to be the same no matter what design of the control (visible or hidden).

9.3.2 Speed cameras

Speed cameras seem to be one of the few measures that can have quite a significant effect on speed behaviour on rural roads. There are a number of meta analyses made:

Høye et al. (2014): Speed cameras were found to reduce total crash numbers by about 20%. The greatest effect was found at the camera locations and only a slight reduction was found at a distance of two or more kilometres from the speed cameras. Fatal crashes were found to be reduced by 51%, this result may however be affected by regression to the mean.

Pilkington and Kinra (2005): Reductions in outcomes across studies ranged from 5% to 69% for collisions, 12% to 65% for injuries, and 17% to 71% for deaths in the immediate vicinity of camera sites. The reductions over wider geographical areas were of a similar order of magnitude. The conclusion from this meta-analysis is that existing research consistently shows that speed cameras are an effective intervention in reducing road traffic collisions and related casualties. The level of evidence is relatively poor, however, as most studies did not have satisfactory comparison groups or adequate control for potential confounders.

Wilson, Willis, Hendrikz, Le Brocque, and Bellamy (2010b): Compared with controls, the relative reduction in average speed ranged from 1% to 15% and the reduction in proportion of vehicles speeding ranged from 14% to 65%. In the vicinity of camera sites, the pre/post reductions ranged from 8% to 49% for all crashes and 11% to 44% for fatal and serious injury crashes.

9.3.3 Conclusions

The quality of the studies included is questionable: "… the level of evidence is relatively poor, and most studies lack adequate comparison groups" (Pilkington & Kinra, 2005). Wilson, Willis, Hendrikz, Le Brocque, and Bellamy (2010a) agree on the quality, but add: "Despite the methodological limitations ….. the consistency of reported reductions in speed and crash outcomes across all studies show that speed cameras are a worthwhile intervention for reducing the number of road traffic injuries and deaths. However, whilst the evidence base clearly demonstrates a positive direction in the effect, an overall magnitude of this effect is currently not deducible due to heterogeneity and lack of methodological rigour". The actual effectiveness depends on many factors, such as the actual enforcement effort, the initial speed and safety level, the distance from the camera, the time after installation, and the type and amount of supporting publicity. It is not possible from these studies to relate the effectiveness to any specific of these factors. More studies of a scientifically rigorous and homogenous nature are obviously necessary, to provide an answer to the magnitude of the effect.

The importance of enforcement can also be identified by looking at the opposite, i.e. what happens when you remove an activity. In Russia, a new policy was introduced where fines for driving up to 20 km/h above the speed limit was eliminated. Speeds were measured periodically in 13 districts of two Russian regions during 2011–2013 and analysed the effect of the policy using difference-in-differences to control for seasonality. The prevalence of speeding was declining steadily but half of the gains since mid-2011 were lost immediately after the new policy. Road traffic injuries will likely increase in Russia unless speeding fines are reinstated (Bhalla et al., 2015). The analysis indicates that there is too little police enforcement. Fairly drastic increases of police enforcement are cost-effective. It is cost-effective to treble the amount of speed enforcement (European Council, 2017)

Slowly an invention of the camera enforcement which measures speed over a section of the road. The section control system compares the passing of vehicles, based on virtual vehicle features, at two specific spots. It measures the speed of the vehicle, in accordance with the distance between the two spots and the time needed to cover that distance. Section control is more effective with a reduction of average driving speed by up to 10% (from approx. 90 km/h to 80 km/h (Ragnøy, 2011), with a compliance rate of very close to 100%, as Høye et al. (2014) showed. They studied the safety effects of section control at 14 sites in Norway. For injury crashes a non-significant reduction by 12% was found. The number of killed or severely injured was found to be significantly reduced by 49% at the section control sites. Downstream of the section control sites (up to 3 km in each direction) injury crashes were found to be significantly reduced by 46%. However, the size of the effects that were found should be interpreted with caution because of the relatively short after periods for some of the sites and the sensitivity of the results to the outcomes of individual crashes. Besides, it is more expensive and complicated to

implement section control, so it is still a question of how cost-effective it is. In addition, there are also private and legal issues involved. The Directorate of Public Roads in Norway made a trial at two locations with Automatic section speed control (ASSC) where these issues were studied carefully (Ragnøy, 2011). Still, there is a need for larger studies, to include other countries, especially in LMICs.

The results from this review suggest that area-wide traffic calming in towns and cities may be a promising intervention for reducing the number of road traffic injuries and deaths.

In spite of all the positive results and experiences with speed cameras there still seems to be very low activity levels almost everywhere in the world.

9.4 Infrastructure

9.4.1 Traffic calming

In cities Traffic Calming (TC) is the key word. 'Traffic calming refers to a combination of network planning and engineering measures to enhance road safety as well as other aspects of liveability for the citizens' (van Schagen, 2003)

The success of TC is related to speeds. Calming means low speeds, primarily 30 km/h. To reach these low speeds measures have to be effective. There are two basic elements: speed humps and small roundabouts. These two fulfil the criteria of maximum 30 km/h, if they are of the right design. However, there are lots of alternative elements that can be used. To be effective though, speed has to be lowered to maximum 30 km/h.

Converting junctions to roundabouts is associated with a reduction of fatal accidents of about 65% and a reduction of injury accidents of about 40%.

As with enforcement, effects are primarily local, with a relatively short area of influence. To make area-wide in 30 km/h zones efficient speed reducing measures have to be installed at a distance of approximately 100 metres between every measure. Efficient speed management on a large scale can be expensive. Still many cities are working hard and systematically to change the infrastructure in the favour of vulnerable road users, and to produce a more liveable city. So, if the strategy is durable it will produce gradual improvement in terms of lower speeds and higher safety, and be cost-effective. The city of Gothenburg in Sweden, with half a million inhabitants, has systematically used traffic calming, and other pedestrian and bicycle friendly measures for many years. Hospital records show the success of these initiatives: over a period of 15 years, the number of injured pedestrians and cyclists on the streets of Gothenburg decreased by 75%. Evaluations have shown that speed calming measures have been the most important contributing factor to the injury reduction. Moreover, it has been shown that such measures are good investments, with a high rate return on investment of 22 (ITF, 2016)

Reducing vehicle speeds may be one of the most effective interventions to stem traffic crashes in low-income countries. must also look to other speed reduction measures such as speed bumps and rumble strips.

In a meta-analysis nine trials reported the number of road traffic crashes resulting in deaths; pooled rate ratio 0.79 (95% CI 0.23 to 2.68) (Bunn et al., 2003). Eighteen studies reported the number of road traffic crashes resulting in injuries (fatal and non-fatal); pooled rate ratio 0.85 (95% CI 0.75 to 0.96). The authors' draw the following conclusions: "The results from this review suggest that area-wide traffic calming in towns and cities may be a promising

intervention for reducing the number of road traffic injuries and deaths. However, further rigorous evaluations of such interventions are needed".

The effectiveness of local measures is essential: in a meta-analysis of a bit more than 40 studies, it was shown that converting junctions to roundabouts is associated with a reduction of fatal accidents of about 72% and a reduction of injury accidents of about 47% (Høye et al., 2014).

Efficient speed reducing infrastructural measures in non-urban areas, in LMIC, is rather uncommon. In HIC they do not exist at all. However, there are some striking examples of the need for them and the potential in LMICs. The Thika Super Highway, the first in Kenya, was built with three lanes in each direction, and with a service area on the road's outer edges. There are lots of pedestrians on both sides of the motor way. Crossing was organised with pedestrian overpasses. However, as the distance between overpasses was up to 2 kilometers, they were from the beginning complemented with rumble strips at one location between each overpass. The result was speeds of around 5-10 km/h at the rumble strips.[13] The highway was completed in 2012. Since then the University of Nairobi (2015) has been doing an assessment study. Their conclusion regarding rumble strips is: "In areas with high pedestrian activity, there is provision for pedestrian crossings (also known as Zebra Crossing). They are painted white so that the drivers can see from a distance. In addition to the painting, there is a warning to drivers by provision of rumble strips and speed bumps." So, this supports the idea that traffic calming is actually possible to use even on a motor way when there are no safe alternatives for pedestrians. Besides, an interesting side-effect of the measures was that they have become bus stops.

A similar experience comes from Ghana: A study concluded that the 'speed factor' alone accounted for more than 50% of all Ghanaian road traffic crashes between 1998 and 2000. While the enforcement of speed limits by traffic police may not be affordable for most developing countries, rumble strips and speed humps were found to be effective on Ghanaian roads. Rumble strips installed on the main Accra-Kumasi highway reduced crashes by about 35% and fatalities by about 55%.

In India, almost every village and a large number of residential neighbourhoods now have rumble strips or speed humps on roads passing through them. These have been installed because local residents put pressure on local authorities or construct them themselves after an injury or fatal crash in that area. Very often this is done in spite of opposition from the road building or police authorities.[14] This indicates that widespread use of traffic calming measures should be possible in LMICs.

Reducing vehicle speeds may be one of the most effective interventions to stem traffic crashes in low-income countries. must also look to other speed reduction measures such as speed bumps and rumble strips, roads that segregate high- and low-speed users, and technological solutions such as speed governors, as well as greater public awareness of the problem.

For some LMICs the cost for efficient speed camera strategies may be high in the near future. The alternative is then infrastructural measures. There will be a great need of research to find out both about feasibility and cost/benefit. But as there are no alternatives, and the safety potential is so big, it is time to put it on the agenda.

9.4.2 The International Road Assessment Programme (IRAP)

iRAP provide tools and training to help countries make roads safe.[15] The main activity is to inspect high-risk roads and develop Star Ratings and Safer Roads Investment Plans, and track road safety performance so that funding agencies can assess the benefits of their investments".

[13] Observations of author on site in 2012.

[14] Personal communication, Dinesh Mohan.

[15] https://www.irap.org/

The document *iRAP Star Rating and Investment Plan – Implementation Support Guide* (iRAP, 2017) is analysed with regard to how speed is treated generally and in relation to the star rating. Below are some of the central statements:

- The risk of death or serious injury on a road is highly dependent on the speed at which traffic travels….. You can adjust the speed limit and 85th percentile speed attributes in the Speeds tab.

It is important to ensure that improvements such as lane widening, resurfacing, additional lanes and paved shoulders do not result in excessive vehicle speeds, particularly where vulnerable road users such as pedestrians and bicyclists are present

- It is important to ensure that improvements such as lane widening, resurfacing, additional lanes and paved shoulders do not result in excessive vehicle speeds, particularly where vulnerable road users such as pedestrians and bicyclists are present. In such cases vehicle speeds must be effectively managed in order to minimise risk…..

- … Those sections where speed restrictions applied, incorporating traffic calming features such as road humps and transverse rumble strips were coded with speed set to 'less than 40km/h'. It is important to note that if speeds cannot be managed within these thresholds the Star Ratings will drop……

The document gives a generally positive picture of how speed is treated. But theory and practice are two different sides of the coin. When iRAP says "….reducing speed limits and operating speeds through villages with high numbers of unprotected pedestrians and cyclists to 30 mph or less" (iRAP, 2014), one would believe that 50 km/h (~ 30 mph) would be the maximum speed allowed through every village. It is not clear what road engineering standards would be used to ensure that no vehicles exceed 50 km/h in that location.

It is still early to tell whether iRAP ratings are effective in judging roads in LMICs which have very different mix of traffic compared to HICs.

To be able to control how speed is treated, case studies presented by iRAP are used. There is one with special bearing on speeds, namely the pedestrian channelization project in Wuhan, China. Even though many of the proposed measures seems to be valid from a safety point of view, there does not seem to be any speed reduction. Most importantly, when discussing pedestrians the focus in this project seems to be "efficiency for vehicles", "to clear the junction quickly" and similar aspects (Frame, 2009).

There is reason to believe that there is a significant influence of speed on perceived safety, emissions, noise, mobility of car users and vulnerable road users, accessibility, attractivity and the economy.

Average Star Rating Scores are produced based on Risk Rate (fatal and serious crashes per billion vehicle km). However, using per vehicle km produces a different scenario – and different priorities - than per inhabitant (population). The latter is the societal risk and should therefore be used. It is still early to tell whether iRAP ratings are effective in judging roads in LMICs which have very different mix of traffic compared to HICs.

10 SPEED AND OTHER ASPECTS THAN OBJECTIVE SAFETY

Even though objective safety is the primary aspect on travel speeds there are many other quality aspects with an obvious relation to speed. There is also perceived safety, that is, the feeling of unsafety. There is reason to believe that there is a significant influence of speed on perceived safety, emissions,

noise, mobility of car users and vulnerable road users, accessibility, attractivity and the economy. Knowledge about the relation with speed is, however, relatively scarce. There is reason to believe, however, that with most of these aspects there is a positive relationship - decreased speed leads to improvements in most cases. This should of course make speed management strategies even more important.

11 ACTORS

There are many global actors including the UN, WHO, IRTAD, IRAP, GRSP, Bloomberg Philanthropies, and WRI who are promoting road safety around the world. There are also big consultant firms and other NGOs operating on different levels and in different scales. Road safety has become good business for many.

WHO is of course a central actor, coordinating activities all over the world. The over-arching question in view of this paper is of course how speed is treated. From a theoretical point of view the scene is set. In a WHO Discussion paper the target for safer road users is: “Reduce the proportion of vehicles travelling over the posted speed limit by at least 10% per year”. This is a very ambitious target. Besides in urban areas the speed limit should be no more than 50 km/h, and where there is a high concentration of pedestrians, cyclists and moped riders, the speed limit must be under 30 km/h.

There is not much more to be asked for, so the remaining question is of course how this is going to be achieved. What kind of tools will be used? So far, regarding speed there is almost no progress in achieving these goals and targets. The best possibility to study the implementation in practice is to look at the action of the main contributor, and the largest single sponsor of road safety, namely Bloomberg Philanthropies. They have funded “Road Safety in 10 Countries Project (RS-10)” with US$125 million over a 5-year timeline (2010–2014).[16] The RS-10 project brings together 6 partners to address the global burden of RTIs: WHO, Johns Hopkins International Injury Research Unit, the World Bank Global Road Safety Facility, the Global Road Safety Partnership, the Association for Safe International Road Travel, and EMBARQ—the World Resources Institute Center for Sustainable Transport.

The primary goal of RS-10 was to reduce deaths and serious injuries in LMICs by focusing on proven preventive and care interventions, identifying high-performing, experienced partners for implementation, and rigorously evaluating outcomes. The project targets 10 countries that account for almost half (48%) of all traffic deaths globally: Brazil, Cambodia, China, Egypt, India, Kenya, Mexico, Russia, Turkey, and Vietnam. Two or more focused intervention sites (cities and districts or regions) were identified in each country based on the following criteria: high RTI death rates, political support, readiness to implement interventions, presence of appropriate partners, data availability, ease of geographic access, and the perceived potential to serve as models for neighboring regions. Each site was encouraged to focus on at least 2 of 4 potential risk factors (i.e., drunk driving, excessive speed, lack of seatbelt and child restraint use, and lack of helmet use) based on data associated with increased RTIs. Each participating country has decided on these intervention sites and targeted risk factors together with interventions. From a speed point of view interventions were conducted in Egypt, Russia, India, China, Turkey and Brazil (Hyder et al., 2012). The progress regarding speed studies in the project are summarized below.

11.1 China

Interventions to curb speeding and drunk driving were implemented in the cities of Suzhou and Dalian since late 2010 (Bhalla et al., 2013). Five roadside surveys, seven rounds of observational studies, and analysis of crash statistics in the two cities were made. The prevalence of speeding has not been reduced in either city with the notable exception of one site in Dalian, where the percentage of speeding vehicles declined from nearly 70% to below 10%

[16] http://www.who.int/violence_injury_prevention/road_traffic/countrywork/en/

after an interval-based speed enforcement system was installed. The broader deployment of such speed control technologies across China and other countries should be explored.

11.2 Turkey

Very little seems to have been achieved so far when it comes to speed. One reason is probably that all countries were encouraged to focus on at least two of four potential risk factors.

From 2010 to 2014, interventions including social marketing campaigns; enhanced police enforcement; legislative advocacy; and training for police, journalists, and academics were implemented in the cities of Ankara and Afyonkarahisar (Afyon). The monitoring and evaluation findings revealed limited improvements in speed reductions. In one of the two cities the average speed increased significantly from 46.3 km/h in 2012 to about 52.7 km/h in 2014 on roads where the speed limits were 50 km/h. In the other city, the average speed remained less than 55 km/h during the program period for roads where the speed limits were 50 km/h; however, the average speed on roads with speed limits of 70 km/h decreased significantly from 80.6 km/ h in 2012 to 68.44 km/h in 2014 (Gupta et al., 2017). There is no clear explanation for decreases or for increases in speeds.

11.3 Russia

There were clear voices from global actors like UN and WHO that speed is killing many people on the roads: 30% or even more of all deaths occur when people are driving with excessive speed. The disappointing fact is that these dramatic statements are not followed up by any of the governments or decision makers.

Interventions were carried out in the provinces of Lipetskaya and Ivanovskaya. The main findings were: (a) In Lipetskaya, the overall prevalence of speeding (vehicles driving above speed limit) declined from 47.0% (baseline, July 2011) to 30.4% (final round, October 2014), (b) and a similar pattern was observed in Ivanovskaya where the prevalence of speeding decreased from 54.6% (baseline, March 2012) to 46.6% (final round, October 2014). Unlike the steady increase in seat belt use, the decline in speeding was uneven. After an initial steady decline in speeding, a sharp increase in speeding was observed in the fall of 2013. This increase was likely associated with a change in enforcement regulation according to which tickets were not issued for vehicles exceeding the speed limit up to 20 km/h over the limit. The decline in speeding was likely associated with enhanced enforcement campaigns, consisting of increased police checks, widespread use of mobile and fixed-speed cameras, and strict implementation of penalties. Despite the overall decline over time, the burden of speeding remained high in the final rounds in both oblasts with at least one in three vehicles (or higher) observed to be speeding.

11.4 Conclusions regarding actors

The car regime has to be challenged, and the relation between speeding and safety has to be discontinued. The ever-going struggle has to come to an end.

Very little seems to have been achieved so far when it comes to speed. One reason is probably that all in the RS10 countries were encouraged to focus on at least two of four potential risk factors (i.e. drunk driving, excessive speed, lack of seat belt and child restraint use, and lack of helmet use). So far, only Russia has demonstrated any impact of measures (enforcement) that is promising, but as this enforcement is not valid any more the way forward is still very long. Kenya has taken some measures and done some demonstration projects. This is demonstrated when they have installed (a few but still) traffic calming measures – max 10 km/h – on the new super highway.

12 FINAL COMMENT

The starting point for this article was that there were clear voices from global actors like UN and WHO that speed is killing many people on the roads: 30% or even more of all deaths occur when people are driving with excessive speed. The disappointing finding is that these dramatic statements are not followed up by any of the governments or decision makers. It is almost impossible to find any projects or programs, big or small, which takes its starting point in the fact that speed is the biggest safety problem. It is about time that strategies are found that could translate the nice words presented globally into action. The basic problem is that the individual driver has great difficulties in understanding and accepting the fact that "+1 km/h leads to +3-4 more fatalities", because he or she will never be able to experience these differences themselves. This puts the greatest demand on the decision makers who must accept the necessary conclusion that many drivers will never change their behaviour on a "voluntary basis". As someone in the business phrased it: "If you are doing something that saves lives in traffic, you will *never* be acclaimed for that". So, it is all about courage; courage to collect relevant information, courage to sell it to potential customers, courage to implement.

The responsibility lies on all levels, but of course most important are the demands coming from the highest level. That would make decision making at the lower levels easier and – hopefully – let everybody dare to do the unprecedented thing that they never have dared to do. The car regime has to be challenged, and the relation between speeding and safety has to be discontinued. The ever-going struggle has to come to an end. Who will take the leading position?

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