

## **On road tests of a speed limit of 30 km/h when passing a bus at standstill with a variable sign activated showing 30**

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### **Abstract**

In Sweden, some 400,000 children go by school bus every day, either by specially purchased buses or by public transport. Crash statistics show that the level of safety in the school bus system is generally high. The most risky situation is when the child is outside the bus waiting for, boarding or alighting the bus. As an effort to improve children's safety on their way to or from school the Swedish Government initiated an evaluation of a law requiring drivers of all vehicles to limit their speed to 30 km/h when passing a bus, standing still at a bus stop and marked with a 30 sign. The law should apply to vehicles on roads with a speed limit of 70 km/h or lower, approaching in any direction of the bus. The evaluation was a full scale test in one municipality in northern part of Sweden. All public buses and purchased buses (~130 buses) in the municipality were equipped with flashing 30 signs as a reminder of the rule. The law was expected to reduce the risks for bus travellers, in particular children, to be struck by an oncoming vehicle when alighting or boarding the bus. The results showed that many motorists drove more slowly than before the rule was stipulated— even though not all of them reduced their speed right down to 30 km/h. The results also underline the need for a more holistic approach including a door to door perspective in order to guarantee the safety of children.

### **Keywords;**

School bus, safety for children, speed limit, bus stop, full scale evaluation

### **Introduction**

Going to and from school is a daily journey undertaken by millions of children within the European Union (EU) [1]. Whilst many children walk or cycle to and from school; buses, coaches and minibuses are major modes of travel for European children. However, school transport is not just about being a bus occupant [2] it also involves walking to and from the bus stop, waiting at bus stops, and boarding and alighting. As shown in the EU database EC-CARE<sup>1</sup> [1] children aged 6-11 years old are most likely to be killed or seriously injured during afternoons, possibly when going home from school. The pattern of casualties are consistent with several investigations for adults [3-5] showing that boarding and, especially, alighting from the bus is the major injury related event. Moreover, children outside the school bus are exposed to a higher risk compared to those inside [6, 7]. One of the U.S.A studies of school bus crashes has shown that 85% of school bus casualties were pedestrians injured near or around the bus, and of these, many were hit by the actual bus they intended to ride or rode with [8]. However, crash and/or casualty statistics are usually mode specific, and even if the casualties occurred during the school transport they most often lack data taking into account that perspective [9]. In a detailed analysis from UK and Sweden it was shown that the majority of the children who were killed in school transport were not vehicle occupants, they were in the area outside the bus on their way to or from buses, and the afternoon journey was particularly vulnerable, especially the running out behind the bus. [10]. It has also been shown that one reason for crashes may be the lack of routines reflecting that the children's point of view is actually not taken into account [11].

In Sweden, some 400,000 children (6-17 years old) go to school by school bus every day either by specially purchased buses or by public transport. It is mandatory for specially purchased school transportation buses, but not for buses in public transportation, to use an iron sign (400x400 mm – icon with two children on + flashing lights activated) when the bus stand still at bus stops. The safety effectiveness of the sign is, however, limited. At roads with a speed limit of 50 km/h, no significant effect is seen, while at 70 km/h a reduction of 9 km/h is observed [12].

For these reasons, the Swedish Road Administration (SRA) states that children should not be forced to be exposed to such dangerous environments, particularly on their way to and from

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<sup>1</sup>CARE is a Community database on road accidents resulting in death or injuries. The purpose of the CARE system is to provide a powerful tool which makes it possible to identify and quantify road safety problems throughout the European Union, evaluate the efficiency of road safety measures, determine the relevance of Community actions and facilitate the exchange of experience in this field.

the mandatory school attendance [13]. In order to achieve this goal several studies have been performed, starting with a pre-study safety campaign on the island of Gotland, in which an appeal was made to motorists to lower their speed to 30 km/h when passing a bus at stand still with the ordinary school bus sign and the flashing lights turned on [14]. The study was run throughout the municipality and on roads with all different allowed speed limits (30-110 km/h). The evaluation showed that a high proportion of motorists were aware of the message of the campaign (~70%) and were positive to these measures (~95%). In total, the motorists lowered their speeds somewhat while approaching the bus from the rear (reduction of ~20-25 km/h), while oncoming vehicle's speed was not influenced to any significant extent. With help of telephone interviews with a sample of citizens at the island (800 answers – 67% response rate) the pre-study showed that the drivers acceptance about the recommendation was high (61%), but also that 68% thought a law would increase the safety even more than just a recommendation.

In order to increase safety and security for children going by bus even more, the SRA decided to evaluate other possible countermeasures. One, among several, was a mandatory speed limit of 30 km/h when a vehicle passed a bus at stand still at a bus stop with a variable sign activated showing 30.

## **Aim**

The aim of the present study was to evaluate the effects on speed, driver awareness and acceptance of a mandatory speed limit of 30 km/h when passing a bus at stand still at a bus stop with a variable sign activated, showing 30.

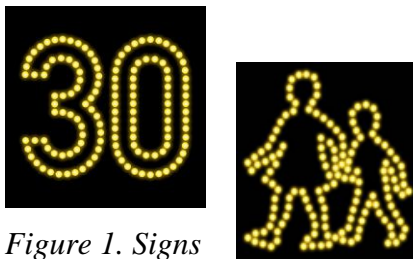
## **Method**

### *Test site*

The law requiring 30 km/h when passing a bus at stand still at a bus stop, all nights and days for both oncoming and passing vehicles, has been in force since 1 September 2007 in the northern municipality of Örnköldsvik in Sweden. The total number of inhabitants in the municipality was approximately 55 000 people. The law was applicable only to roads with speed limits of 50 km/h or 70 km/h. The law was applied to the entire municipality, with the exception of the E4-highway that is passing through, mainly since the speed limits on that road are higher than 70 km/h. Information about the rule was communicated through media;

leaflets to all householders and by road signs when entering the municipality. The bus drivers received specific and detailed information about the activation of the sign.

The buses (approximately 130 buses) were equipped with new flashing 30 signs activated when the bus was standing still at bus stops, as a reminder of the law. The signs that were used were variable, activated by the drivers and deactivated automatically 100 meters after leaving the bus stop. The sign showed either 30 (km/h) or the commonly known warning sign displaying two children, see Figure 1. The reason for using two different messages was due to the fact that the rule only was applicable on roads with the lower speed limits (50 and 70 km/h). Therefore the message of “30” could not be used on roads with higher speed limits.



*Figure 1. Signs used at the buses on the test site (left) and outside the test site (right).*

The total number of travellers that were included is not possible to tell since it concerns all citizens; children and adults that travel with public transportation and purchased buses in the municipality of Örnsköldsvik.

### *Measures*

The evaluation took into account different stakeholder's opinions. Both speed measurements and questionnaires to bus drivers, drivers of passenger vehicles and children were used, in addition to focus groups with children. The focus groups will not be included in this paper. Even though the rule concerned all passengers the evaluation was focused on the children and the buses and bus stops that they used.

In order to stipulate the rule of 30 km/h when passing a bus, an extensive inventory of all bus stops used for school transportation was necessary to perform. Most bus stops that children use in rural areas in Sweden are not marked at all and the inventory was therefore crucial. All stops had to be positioned in a GPS system. Accordingly, all children included in the test had to be identified, and their homes were also positioned in the system. All these data created a

map that gave the responsible people in the municipality and the project the needed information of which roads that could be included in the evaluation of the rule.

### Speed measurements

The measurements were done with help of tubes positioned on the road surface. Those register a passing vehicle, the actual speed and decide type of vehicle. A bus was circulating in a pre-defined scheme in order to cover the situation with a bus at bus stop. The bus stands still at the bus stop for about 10 minutes in order receive enough data from each bus stop to analyse. Before measures were done in May 2007 and after measures were done in May 2008. In total, 12 bus stops were used for the evaluation. The selection of bus stops to include was based on a structure to cover issues such as speed limit and to take into account if the bus needs to stop at the road or if there is a special area for the bus to stop at.

The results from three groups of stops will be presented: 1) 50 km/h, 2)70 km/h without a dedicated area to stop at and 3) 70 km/h with a dedicated area.

### Questionnaires

Behaviour of children as well as bus drivers' and passing drivers were captured with help of questionnaires in May 2008 (after the realization of the pilot). The questionnaires were most of all aimed to captured the feeling of safety, security, acceptance and usefulness of the rule. The sample of passing drivers answered the questionnaire during a telephone interview, the children with help of their parents in a postal questionnaire. In addition all the bus drivers received a postal questionnaire distributed to their home address.

A selection of inhabitants was randomly drawn and with a response rate of 72% in total 309 drivers answered the questionnaire during a telephone interview. Children at three schools were selected to participate in the evaluation. All children at those schools received a postal questionnaire during May 2008. In total 229 answers were received with a response rate of 67%. For the bus drivers the results are based on 77 answers (response rate 73%). No analysis of the non-respondents was done.

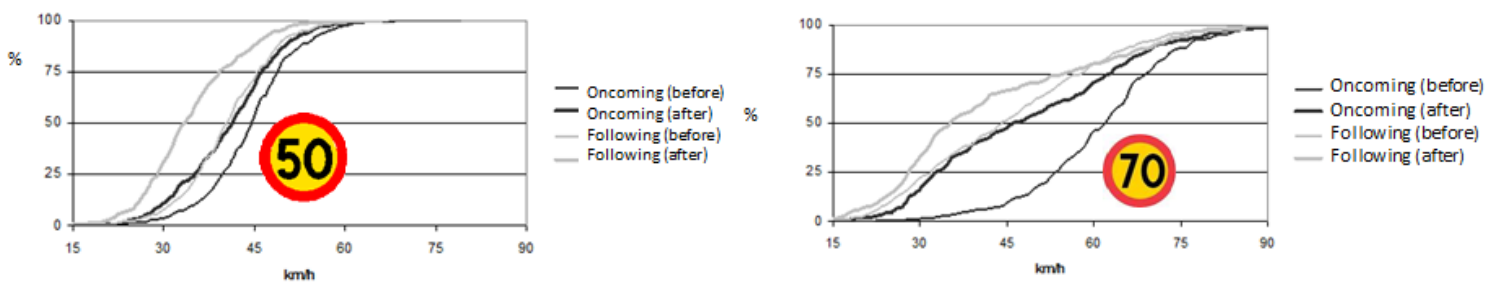
## Results

### Speed

The results from 2007 (before period) are based on 1619 approaching vehicles and 1481 overtaking (coming from the rear) vehicles, the results from 2008 (the after period) are based on 2698 approaching vehicles and 2427 overtaking vehicles. On average, the speeds of the vehicles approaching a bus at stand still from the rear were lowered by 6 km/h in Örnköldsvik. Vehicles that approached a stationary bus (with the sign activated) from the front lowered their speeds by an average of 10 km/h in Örnköldsvik. The speed was affected differently at different types of bus stops and roads; the highest reduction being found on 70 km/h roads without a lay-by for the bus stops, see Table 1 and Figure 1.

**Table 1. Speed changes at different groups of bus stops comparing the speeds before and after the 30 law realization.**

	Type of bus stop	Speed reduction (km/h)	t	df	p
<b>Oncoming</b>	50 km/h	-6	2.993	3	0.06
	70-km/h without lay-by	-12	8.184	5	0.00
	70-väg with lay-by	-14	3.183	1	0.19
<b>Following</b>	50 km/h	-6	3.216	3	0.05
	70-km/h without lay-by	-3	1.471	5	0.20
	70- km/h with lay-by	-15	3.152	1	0.20



**Figure 2 Speed distribution for bus stops with 50 km/h and 70 km/h without lay by.**

Regardless speed limit, including all 12 stops, approximately 15 % of the oncoming vehicles followed the 30-law. This was a significant increase compare to the before period with 13

percentages ( $t=6.153$ ;  $df=11$ ;  $p<0.01$ ). Approximately 30% of the following vehicles followed the 30-law. This was a significant increase with 15% ( $t=4.451$ ;  $df=11$ ;  $p=0.01$ ).

### *Acceptance and awareness*

In total 93% of the motorists were familiar with the 30 law, even though not everyone knew how it exactly worked (77% of the drivers thought it was valid when meeting a bus at stand and 63% of the drivers thought it was valid when approaching a bus from behind). The majority (67%) claimed that they lower their speed to 30 km/h when passing a bus standing still with the sign activated and 95% said that they liked the rule. The rule was supported to be mandatory on roads with 50 km/h by 84% of the drivers, 65% supported a rule on roads with 70 km/h and 25% supported a rule on roads with 90 km/h.

Basically, all children wanted the law to become permanent. The children said that they felt more secure and that the vehicles drove more slowly when the 30 sign was alighted. They especially mentioned an increased feeling of safety when they exited the bus. However, the children reported that the bus did not always have the sign lit up. In addition, the children reported a number of safety shortcomings at the bus stops.

Bus drivers were also positive to a permanent 30 km/h rule (91%). The majority (89%) thought that the safety would increase thanks to the rule. There were fears that the children would be fooled into a false sense of security. The majority of the bus drivers (85%) did not think that the behaviour of the children had changed during the trials. Drivers stated that some bus stops in the municipality were still unsafe. The safety at these bus stops was not considered to have improved as a result of the 30 rule.

### **Discussion**

In Örnsköldsvik, three motorists out of ten lowered their speed to 30 km/h when approaching a bus at stand still from the rear. Fewer of the motorists who approached the bus at stand still from the front lowered their speed. Many motorists drove faster than the mandatory 30 km/h, but a reduction of the average speed was found which means that an increasing number of motorists drove more slowly than in the past. The acceptance was high for the law both among drivers, bus drivers and children. However, since the speed was still too high further

counteractions are needed to guarantee safety for children at bus stops and on their way to bus stops.

Acceptance of a speed reduction proposal is seldom as high as it was for the 30 km/h law and a large majority of motorists wanted a permanent 30 km/h law on both roads with speed limits of 70 km/h and 50 km/h. The lower acceptance for a rule on roads with speed limit on 90 km/h may be due to an opinion that such an environment is not safe for children to be in at all. Unfortunately it is rather common with children in such environments, even though it has been shown that they could be removed for a rather reasonable cost [16].

Even though there was extensive information activities concerning the 30 law there was some uncertainty concerning exactly when and where the law applied and whether it was an appeal or if it was a mandatory law. This may be one reason that even though the majority claimed they reduced their speed this was not seen in the speed distribution.

The lack of total reduction to 30 km/h is a support for the need of more counteractions. There are arguments for the recommendations to look at school transportations from a holistic approach - from a "door to door" perspective [11]. The SAFEWAY2SCHOOL project is an EU-project funded by the 7th Framework (<http://safeway2school-eu.org/>) that has its starting point in this view.

Based on these results the Swedish Road Administration suggests that the Swedish Government should introduce a law requiring drivers of all vehicles to limit their speed to 30 km/h when passing a bus at stand still marked with a 30 sign at bus stops. The proposal for a new law is in line both with the UN Convention on the Rights of Children and with the SRA Zero Vision. i.e. the target that no one should be seriously injured or killed in traffic. The proposal applies not only to school buses but also to all public transport, which means that it would benefit not only children but all bus travellers. This is one out of several countermeasures, taken from a holistic approach, in order to enhance safe situation for children in traffic.

### **Acknowledgment**

This study was supported by the Swedish Transport Administration in close collaboration with the municipality of Örnsköldsvik.



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