

# Implementation of the system for alerting drivers at the presence of school children on the road, waiting for a school bus – “BUSko”

Uroš Brumec, MSc, Senior traffic safety officer, Slovenian Infrastructure Agency and Mitja Pajek, MSc, Cestel Ltd., Slovenia

Illustrations © Authors

Using human factors knowledge, the Slovenian Infrastructure Agency (SIA) has, by implementing a colourful urban-architectural design, developed a self-explaining system for alerting drivers at the presence of school children on the school paths and roads in vicinity of schools (school zones).

## SLOVENIAN SYSTEM “SAFER TO SCHOOL”

The need for such a system came from current “status quo” situation in Slovenia in school transport. As this remains in the domain of local community, municipalities usually decide to use already established bus stops for the purposes of school transport. These are often only poorly equipped waiting areas, failing to satisfy basic bus stop criteria. Municipalities also do not have the budget to equip all waiting areas / school bus stops according to regulations, neither is such intervention economically reasonable, as these locations change through time and with each new generation of children (problem of spatial planning), *illustrations 1 and 2*.

On the other hand, Road Traffic Rules Act allows school buses (vehicles with special markings for school transport) to stop on or by the road, outside bus stops, for children entering or exiting the vehicle, while being turned on with all four warning lights blinking. This regulation allows for school buses to stop on the road and pick up school children, waiting for school transport / school buses on such unequipped waiting areas.

## The law restricts, to protect!

Using the system design in colours and pictograms, the SIA has made a step forward by implementing a pilot project for alerting drivers at the presence of school children waiting for a school bus on the road. Together with Municipality of Novo mesto, a pilot project was carried out on a state road R3-664/2501, where school children wait on unequipped waiting areas for school transport / school bus.

The concept idea for active BUSko system was taken from European traffic safety research project SAFEWAY2SCHOOL (<http://www.safeway2school-eu.org/>), while the design concept was taken from SIA's guidelines “Safer to school”.

The pilot project was carried out with two systems: passive and active. While passive system was set up using only



Illustration 1 - Safer to school (promotion)



Illustration 2 - The law restricts to protect! (promotion)

colourful boards on the school bus stops, the active system was additionally upgraded with an active unit, containing two flashing lights, blinking only when school children are present and waiting for a school bus. When considering safety factors for school children, more than the overall speed it is important that drivers are extra cautious and reduce their speed at the time of children's presence on the roads. Therefore active signs alert drivers only and especially when needed, *illustration 3*.

Altogether ten waiting areas were equipped, five with passive colourful boards and five with active colourful boards. Active signs are equipped with solar panels and are fully independent from power supply. They have a battery that supplies a blue-tooth alert LED light activation system. Lights are triggered by blue-tooth chips held by school kids. Chips are small, resistant keychain accessories that can be printed with logos of school, municipality or other donators supporting such actions, *illustrations 4 and 5*.

On four locations (two with active system and two with passive system) before and after monitoring was done, measuring speeds to evaluate the influence on speed adaptation. At the same time an “eye-tracking” research was done by the Faculty of mechanical engineering of University of Ljubljana to evaluate visual perception of the system. With the help of school and local community, a public survey was conducted to check the response of the drivers about the system.

## RESULTS OF MONITORING

### Speed

Average speed has reduced on all locations after BUSko colourful boards were set up (*illustration 6*). In some cases speed did not reduce greatly, the reason can be found in already low average speeds, good safety and visibility on the location in general. Change in speed is the greatest where higher speeds were detected before setting up colourful boards.

We see from *illustration 6* that overall speed has reduced in general after setting up BUSko signs. More importantly though in *illustration 7* we see a big speed reduction, especially when active systems are triggered. Green colour represents the time and number of children waiting for a school bus, while the red colour marks show the speed of bypassing vehicles. In many cases drivers reduce their speed for almost a half.



Illustration 4 - Active BUSko system on location

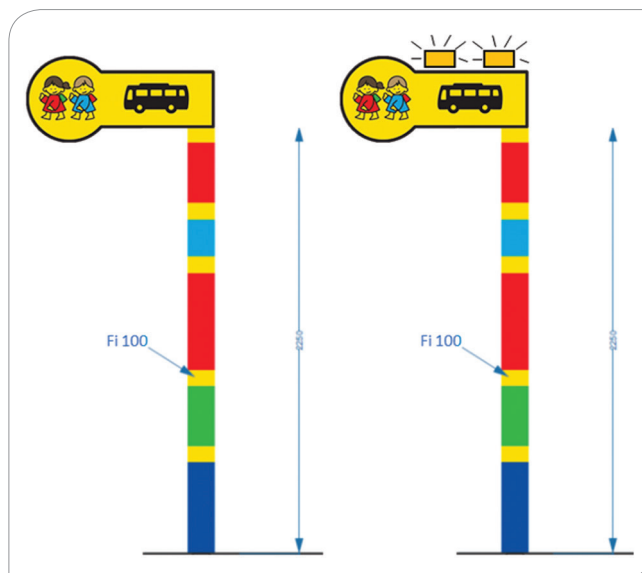


Illustration 3 - Passive and active systems (BUSko) for alerting drivers on the presence of school children

### Eye-tracking research<sup>1</sup> and survey

«...results are satisfying, with high values of reliability, and make us think the new signals will be useful and will contribute to make the road a safer place for children.» (I. Pliego, 2019)

«The new signals modify the behaviour of the drivers. They make them stop accelerating to take a look at the proximities of the signal and examine the possible dangers. If no danger is detected they continue to drive but as they noticed them, they do it in a safer way. This gives an idea of how useful the signals can be.» (I. Pliego, 2019)

Over 91% of drivers understood the message, meaning that the information provided is clear, comprehensible and the design of the board self-explanatory (*illustration 8*). In this way, road-driver communication is improved.

<sup>1</sup> I. Pliego Prim (2019), Research of driver's perception of novel traffic signals using an eye tracker.



Illustration 5 - Passive BUSko system on location

## WHAT'S NEW? Update

Over 68% of drivers reduce speed and more than 68% of drivers also drive more carefully, adjusting speed to the road conditions, driving more alert and in accordance with principles and rules of road traffic (*illustration 9*).

Over 80% of drivers reduce speed and over 68% of drivers drive more carefully, adjusting speed to the road conditions and increase attentiveness and alertness in accordance with the principles and rules of road traffic (*illustration 10*).

Colourful boards clearly have a positive impact on the driver, driving speed, attention and focus of drivers in traffic (especially in relation to school children).

More than 96% of the drivers liked the colourful boards and among them, more than 46% would recommend them for other school bus stops as well (*illustration 11*).

Over 97% of drivers like the BUSko concept. Approximately 9% of drivers prefer the non-flashing colourful board and a little bit more than 39% of drivers prefer the (active) flashing colourful board (*illustration 12*). Slightly more than 48% of drivers like both colourful boards equally.

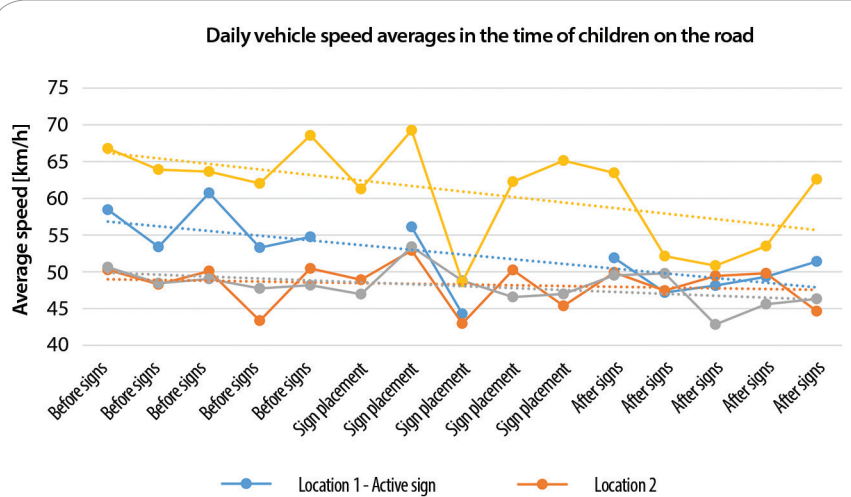
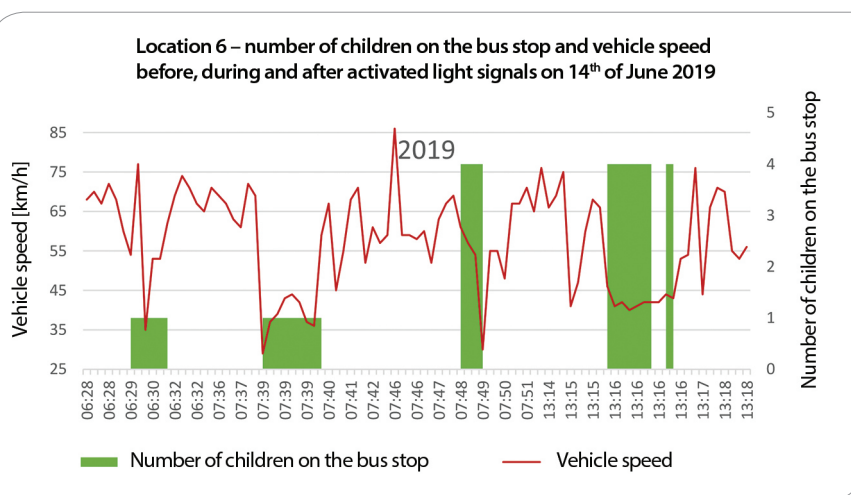


Illustration 6 - Daily vehicle average speeds at monitored locations (with children at school bus stops)



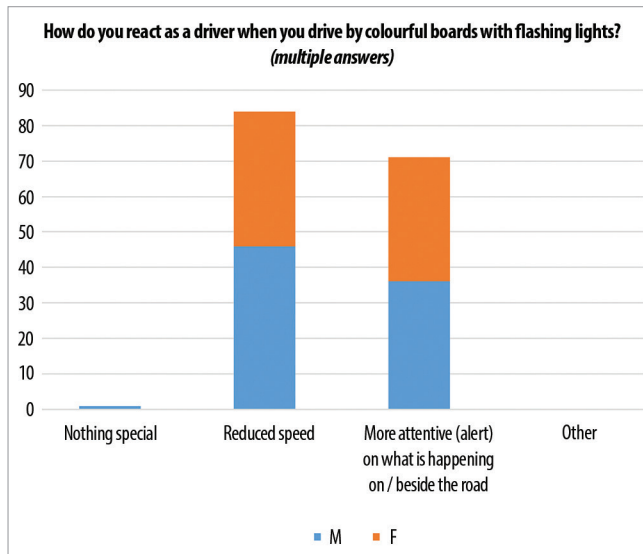


Illustration 10 - Eye-tracking survey answers

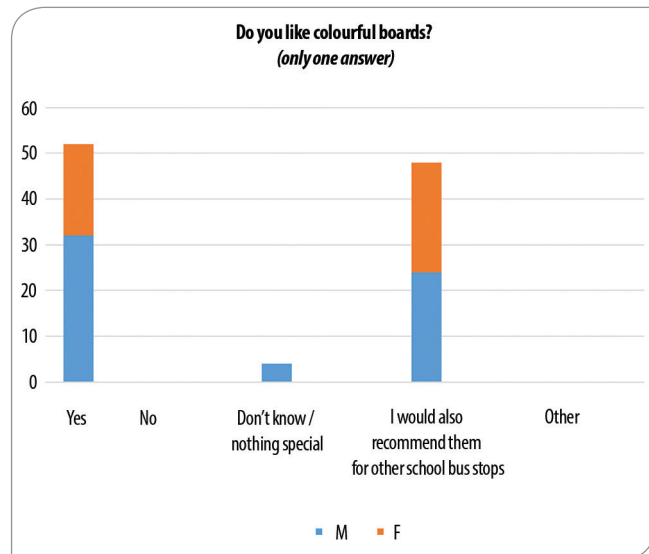


Illustration 11 - Eye-tracking survey answers

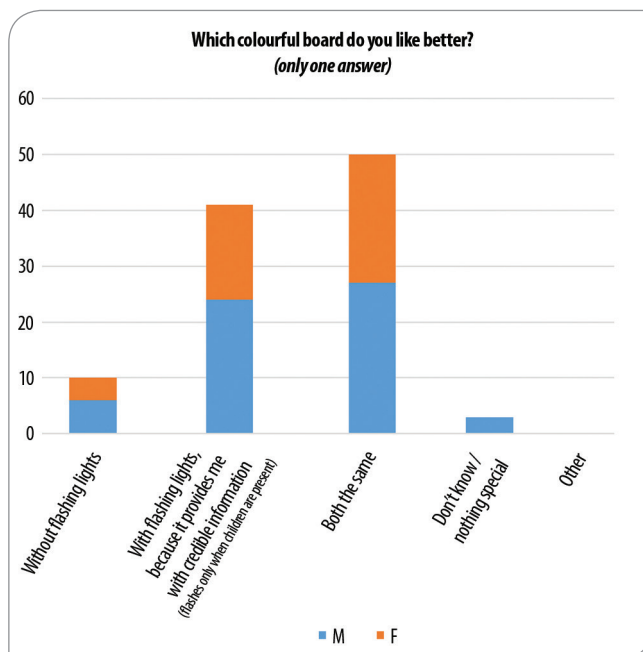


Illustration 12 - Eye-tracking survey answers

## CONCLUSIONS

Pilot project provided extremely positive results, showing usefulness of such systems. Furthermore, the survey has proved that road users clearly understand self-explaining colourful signs, like them and change their driving behaviour accordingly. This statement is proven true also by extensive speed and eye focus measurements, carried out to prove the behaviour of drivers near colourful signs. When comparing active signs to passive ones, results show much higher reduction in speed by active signs. Additionally, the reduction in speed was higher only when needed (when signs were active).

BUSko signs are a superb and much cheaper alternative to creating appropriate bus stops. In many cases it is not possible to make a full bus stop area and active sign is one possible alternative to influence driver's behaviour and raise the level of safety. The system has also proven to be self-explanatory, efficient and accepted by the drivers, as they tend to slow down, increase their attention and drive more cautiously when encountering BUSko signs.#