

Summary:

## Evaluation of a pedestrian crosswalk warning system: «SeeMe»

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*SeeMe is a warning system with automatic pedestrian detection that is mounted on crosswalk signs. Amber flashing lights are activated when pedestrians are approaching or crossing the crosswalk. The aim is to attract motorists' attention, to improve yielding behavior and to reduce conflicts. A before-after study with a matched control group has been conducted in the Norwegian municipality of Trondheim. Video observations were made at eight crosswalks (four of which were equipped with SeeMe in the after period) of 1825 pedestrian-motorist interactions. Yielding rate increase by a statistically significant 14% when all crosswalks are taken together. The results are however inconsistent between crosswalks. Yielding rates increased by 39% at two of the crosswalks (statistically significant) and decrease by 4% at the other two crosswalks (not statistically significant). Differences between crosswalks with increased and unchanged yielding rates were initial yielding rates (below vs. above 80%), placement of crosswalk signs (immediately at vs. at some distance from the crosswalk) and false alarm rates (30% vs. 57% on average). The number of crosswalks included in the study is however too small to generalize these differences. The results do not indicate that SeeMe has negatively affected pedestrian behavior or increased the number of conflicts. It is concluded that SeeMe may be effective in increasing motorist yielding rates at crosswalks with similar characteristics – two lane roads in residential areas with moderate motor vehicle volumes and speed limits of 50 kph or below – and that high initial yielding rates and high rates of false alarms may limit its effectiveness.*

A common cause of conflicts at crosswalks is the failure of drivers to detect pedestrians, either because the driver did not expect any pedestrians, because the driver was inattentive or because the pedestrian was inconspicuous. SeeMe is a pedestrian warning system that aims to increase the chances of drivers detecting pedestrians and thereby to increase yielding rates and to reduce conflicts. SeeMe consists of amber flashing lights that are mounted on crosswalk signs (figure S.1) and sensors for pedestrian detection. When the system detects a pedestrian who is about to cross, the flashing lights are activated.



Figure S.1: SeeMe (photo: [www.Safezone.no](http://www.Safezone.no)).

The municipality of Trondheim started in 2010 a pilot project with SeeMe in several crosswalks. The present report describes an evaluation of SeeMe in a before-after study with a matched comparison group and video observations. The experimental group consists of four crosswalks in Trondheim on residential roads with speed limits 30-50 kph. SeeMe was installed at these crosswalks in the end of 2015. The comparison group consists of four similar crosswalks. Video observations were made of a total of 1881 interactions between drivers and pedestrians.

### **SeeMe detects most crossing pedestrians, but is also frequently activated when no pedestrians are crossing**

On average, SeeMe detected 89% of all pedestrians who crossed within the crosswalks. Among pedestrians who crossed wholly or partly outside the crosswalk, 53% were detected. Consequently, pedestrians can expect that SeeMe will announce their crossing in about nine out of ten cases, at least when they cross within the crosswalk.

On the other hand, SeeMe is activated relatively often when no pedestrians were crossing (false alarms), in many cases even when there were no pedestrians at all. On average, there was a crossing pedestrian about half of all times (57%) SeeMe was flashing. The percentage of false alarms varies between 27% and 93% at the four crosswalks. Consequently, drivers can expect to observe a pedestrian in the crosswalk about every second time SeeMe is flashing.

### **Driver yielding has increased with SeeMe in two of the experimental crosswalks**

When all crosswalks are regarded together, the percentage of drivers yielding for pedestrians has increased by a statistically significant 14%. However, in two of the experimental crosswalks driver yielding has decreased (non-significant). In the remaining two crosswalks, driver yielding has increased by a statistically significant 39%. Curiously, yielding rates at crosswalks with SeeMe were higher when SeeMe was *not* flashing than when it was flashing. There are several factors that may have contributed to the lacking effects at two of the crosswalks:

- **High initial yielding rates:** At those two crosswalks where yielding rates did not increase with SeeMe, yielding rates in the before period were over 80% (81% and 91%). In those two crosswalks where yielding rates increased, initial yielding rates were lower (52% and 75%). Yielding rates of 80% or above may be an upper limit which is difficult to exceed unless more drastic measures are taken.

- **Many false alarms:** With high rates of false alarms drivers may not establish an association between the flashing lights and the presence of pedestrians. Moreover, drivers may be distracted. The percentage of false alarms was high at three of the experimental crosswalks. Only at one of the crosswalks with an increased yielding rate the rate of false alarms was relatively low (7%).
- **Inappropriate placement of crosswalk signs:** SeeMe may be ineffective and even cause distraction when it is mounted on crosswalk signs at some distance from the road and the crosswalk. At those two crosswalks where yielding rates did not increase, the crosswalk signs with SeeMe were at the far side of the sidewalks along the road, while the crosswalk signs at the other two crosswalks were directly beside the road and the crosswalk.
- **Orientation reflex in the wrong direction:** SeeMe can be expected to draw drivers attention away from the crosswalk (to the crosswalk sign) instead of directly towards crossing pedestrians. Thus, it imposes more mental load to drivers than if their attention were drawn directly to pedestrians at or in the crosswalk. Similar measures that comply to the principles of Gestalt psychology may be more effective than SeeMe. Examples are in-pavement flashers along the crosswalk and dynamic crosswalk lighting that require less information processing and an immediate impression of “here is a crosswalk and a pedestrian who wants to cross”.

### **Driver-pedestrian conflicts were not observed**

In the absence of driver-pedestrian conflicts, the effect of SeeMe on conflicts could not be evaluated. The fact that there were no conflicts with SeeMe indicates that SeeMe did not provoke behavioral adaptation with negative effects on safety.

### **Adverse effects on pedestrian behavior were not observed**

Possible adverse effects on pedestrian behavior are increasing percentages crossing outside the crosswalk and more careless pedestrian behavior. The results indicate that the percentage of pedestrians crossing outside the crosswalks has increased about five-fold. However, snow and ice in the approaches to the crosswalks are the most likely explanation for this result.

Whether or not pedestrians behaved less carelessly (for example by crossing without looking first) was not possible to evaluate. Other studies of similar measures indicate that such behavioral adaptation may occur: Pedestrians reported increased feelings of safety, but no corresponding improvements of driver behavior were found. However, the absence of conflicts in the after period in the present study may indicate that at least no severe behavioral adaptation has taken place.

### **SeeMe may have a distracting effect on drivers**

Possible adverse effects of SeeMe on drivers are increased distraction and an exaggerated confidence in the system. The flashing of SeeMe may cause distraction when the drivers' attention is “drawn” away from the crosswalk and the drivers may wonder about the meaning of the flashing. Such an effect may have occurred at two of the crosswalks (those where yielding rates decreased with SeeMe).

## **Criteria for installation of SeeMe**

The present study did not explicitly focus on investigating factors that may affect its effectiveness in improving yielding behavior. However, the results allow some conclusions about locations where SeeMe may or may not be expected to have the desired effects.

SeeMe may improve driver yielding behavior if the following factors are present:

- The initial driver yielding rate is not especially high
- The crosswalk sign is directly beside the road and the crosswalk
- False alarms and misses are minimized, which partly depends on the layout of the crosswalk
- Pedestrian volumes are so low that there is some “surprise” effect of actually observing a pedestrian in the crosswalk
- The failure to yield for pedestrians is mainly due to drivers overlooking pedestrians.

SeeMe cannot be expected to improve driver yielding behavior and may have adverse effects if one or more of the following factors are present:

- The initial driver yielding rate is high (e.g. above 80%)
- The crosswalk sign is not directly beside the road and the crosswalk
- The failure to yield for pedestrians is mainly due to high speed and/or traffic volumes
- The crosswalk is in an area with various other light sources in which the flashing of SeeMe may «drown».