Acceptance and Experience of a Vulnerable Road User Detection System among Heavy Vehicle Operators: A year-long Multi-City Field Trial

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EXECUTIVE SUMMARY

The majority of fatal collisions for heavy vehicles involve pedestrians and cyclists (i.e., Vulnerable Road Users - VRUs). Blind spots created by the design of these vehicles can make it a challenge for operators to detect VRUs at risk near their vehicle. The use of VRU detection systems was proposed to reduce and mitigate crashes between heavy vehicles and VRUs. The goal of this study was to measure system performance on extended use under real operating conditions in Canada. A year-long field operational test (FOT) was conducted to evaluate driver acceptance and experience using a VRU detection system. Performance data were automatically collected by the system. Driver acceptance and experience were evaluated using self-report questionnaires and post-FOT debriefings. Forty-nine responses were collected via the questionnaires and debriefing was conducted for each of the 5 trial sites across Canada. System data show positive performance overall, however participants reported very negative impressions towards the system from the questionnaires and debriefings. The main concerns of the system were distraction and system unreliability due to a high number of false alerts. These results highlight the essential need to consider user experience and acceptance of new technologies under real-world testing conditions.

RÉSUMÉ

La majorité des collisions mortelles avec des véhicules utilitaires lourds impliquent des piétons et des cyclistes (c.-à-d., des usagers vulnérables de la route [UVR]). Les angles morts inhérents aux véhicules lourds peuvent faire en sorte qu’il est difficile pour les conducteurs de repérer les UVR à risque à proximité de leur véhicule. L’utilisation de systèmes de détection des UVR a été proposée afin de réduire les collisions entre les véhicules utilitaires lourds et les UVR et d’en atténuer les risques. L’objectif de cette étude était de mesurer l’efficacité des systèmes lors d’une période d’utilisation prolongée, dans des conditions de conduite réelles au Canada. Un essai opérationnel sur le terrain d’une durée d’un an a été effectué afin d’évaluer le taux d’acceptation chez les conducteurs et leur expérience de l’utilisation des systèmes de détection des UVR. Les données sur l’efficacité ont été recueillies automatiquement par les systèmes. Le taux d’acceptation des conducteurs et leur expérience ont été évalués au moyen de questionnaires et de séances de compte rendu après l'essai opérationnel. Quarante-neuf témoignages ont été recueillis au moyen des questionnaires, et des séances de compte rendu ont été organisées avec les participants de chacun des cinq sites d'essai au Canada. Les données recueillies par les systèmes révèlent des résultats positifs dans l'ensemble, toutefois les participants ont fait part d'opinions très négatives à l'égard du système dans les questionnaires et lors des séances de compte rendu. Les principales préoccupations soulevées étaient la distraction et le manque de fiabilité, en raison du grand nombre de fausses alertes générées. Ces résultats mettent en évidence le besoin essentiel de tenir compte de l'expérience de l'utilisateur et de son acceptation des nouvelles technologiques dans des conditions d'essai réelles.

INTRODUCTION

Heavy vehicles are often involved in fatal collisions with Vulnerable Road Users (VRUs) such as pedestrians and cyclists [2]. The blind spots created by the design of these heavy vehicles make it difficult for operators to detect nearby VRUs [1]. The reduced visibility of the VRUs put them at a higher risk of injury and/or fatality. To address this issue, a review was undertaken of potential technical countermeasures to reduce injuries and fatalities of VRUs around heavy vehicles [3-4]. Evidence from collision investigations indicated that the most promising countermeasures would be VRU detection systems that could assist drivers by monitoring blind spots and warning them of VRUs [5].

Transport Canada conducted closed-track tests to identify the best VRU detection systems on the market. The track testing evaluated the performance of 5 different VRU detection systems using scenarios that are most commonly found in real world VRU-truck collisions (two radar plus camera systems, ultrasonic sensors, surround view cameras and a multi-smart camera system). The scenarios were identified from collision investigation reports [6]. The best performing VRU detection system was a smart multi-camera image recognition system designed to identify VRUs and vehicles on the road. The system collects information on distance and relative speeds to assess risk and issues warnings to the drivers of imminent collisions. The advanced warnings give drivers time to safely react appropriately to a VRU detection event [16]. The VRU detection system was then installed on heavy vehicles for further testing in a Field Operational Test (FOT).

Field operational tests are designed to evaluate a function(s) of driver support systems under normal operating conditions in real-world applications and to identify real-world impacts and advantages [12]. FOTs can run on regional, national or international levels. For this particular study, the FOT was conducted year-long and involved multi-cities (Edmonton, Hamilton, Toronto, Ottawa and Montreal) across Canada. Transport Canada received interest from 5 municipalities across the country that volunteered to participate in this FOT. These municipalities provided vehicles from their own fleet based on the following criteria: the vehicles had to be heavy trucks; vehicles that were previously identified by their fleet as “difficult” to navigate in town; vehicles that naturally operate on roads where pedestrians and cyclists are present; vehicles where there is a possibility to expose the greatest number of drivers for feedback and exposure to the system. It was also important for the subject vehicles to be operational year-round to capture data on all potential weather effects on the VRU detection system.

Although these systems are designed to aid the driver, there are known challenges when it comes to system performance under real-world operating conditions and user acceptance of new technology [7-9]. It was important to assess technology on different drivers, vehicles, roads, lighting and weather across Canada. Driver acceptance is vital given that performance of the system ultimately depends on drivers using and responding to the assistance system appropriately. The goal of this study was to measure system performance on extended use under real operating conditions in Canada and to evaluate driver acceptance and experience using the VRU detection system.

METHOD

Background & Procedure

The FOT ran over 12 months from 2018 – 2019. Calibration of the system was completed for each vehicle prior to the FOT. Collectively, a total of 14 vocational vehicles were equipped with different camera/sensor systems and driver-vehicle data loggers to capture the performance of the detection systems under natural driving conditions. Figure 1 shows pictures of the typical heavy vehicles selected for the FOT. Vehicles differed in size and design and were driven on different road types in a variety of different weather, traffic, and operations. During the FOT, operators were responsible for taking appropriate actions to assess and respond to system initiated alerts in the event of a VRU detection. The system only alerts of a potential risk of a collision and does not control the vehicle speed or direction; the driver remains in full control of the vehicle at all times.

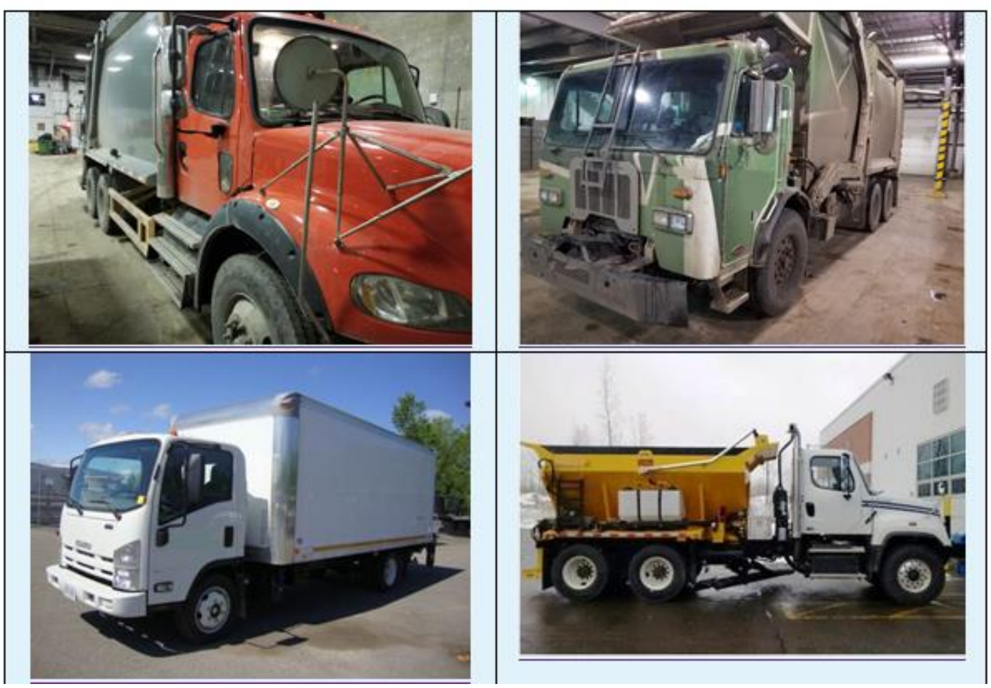

Figure 1 – Typical vocational vehicles used for the FOT included a mix of garbage trucks, forestry trucks, dump trucks and cube vans.

1. Participants

Participants all had experience operating large heavy vehicles. Forty-nine responses were collected from the self-report surveys over the span of a year from the heavy vehicle operators involved in the FOT. Prior to operating the vehicles, the contractor that installed the detection systems provided onsite training for all 5 municipalities. This included a classroom demonstration with videos and system descriptions. Every session was followed by a live demonstration. The majority of the operators received training although 15 reported that they had not. An information sheet about the system and its warnings were handed out and made available for reference in the vehicles after training. Overall, of the 42 individual responses given, prior to filling out the survey, 12 drove the vehicle for less than a week, 13 for 2 – 3 weeks and 17 for 4 weeks or more (range: >1 week – 48 weeks), 7 respondents did not indicate a duration.

2. Equipment and Materials

The Mobileye Shield+ is a smart camera VRU detection system that uses a two-staged alert to increase driver awareness of VRUs at risk near the vehicle. See Figure 2 for the typical setup and configuration of the system on the heavy vehicles. The two-staged system gave drivers more opportunity to respond when the system issued either an audio or visual alert to the driver depending on the proximity of the VRU. The visual alert turned from green (OK) to amber (VRU detected) and red (VRU imminent danger). Other Advanced Driver Assistance Systems (ADAS) functions such as Forward Collision Warning (FCW) and Lane Departure Warning (LDW) were included with the system. The system is connected to a cloud server where information about system status and activities are saved. The system logs the details of every alert along with the GPS locations where they occur. When an alert is generated, a GPS location is recorded, the speed of the vehicle, the heading, the type of alert, the vehicle identifier and lastly the sensor which generated the alert (left, right or front of the vehicle).

Figure 2 – Sensors were installed in multiple locations on the heavy vehicles including central windshield and rear of the vehicle.

Participating vehicle operators were asked to complete paper questionnaires after their experience with the VRU detection system. The questionnaires had items that asked about vehicle driven, city and date as well as information on how long (in days) operators had driven a vehicle with the system. Additional questions such as whether or not they received training, how the system impacted workload, road safety and trust were asked using a Likert scale from 1 –

10. Questions about system performance such as accuracy of system warning alerts and its effectiveness in capturing attention were also asked. See Appendix A for a list of questions from questionnaire. French versions of the questionnaire were also available.

Following the FOT, a debriefing was scheduled for each municipality via telephone conferencing. The group debriefing was conducted to gain further insight on operators' impressions and experience with the system performance and to wrap up the FOT. Each debriefing session had at least one operator within the group that had experience operating a heavy vehicle equipped with the system. Other participants included fleet managers, supervisors and other operators. Questions were administered in a semi-structured interview but, with a heavy emphasis on open-ended discussion. The debriefing started with an introduction of Transport Canada and the FOT project followed by an explanation that notes were being taken but, participants would remain anonymous. Following the initial introduction, discussion was open for participants to comment on their experience with the system. Any questions of interest that were not addressed from the semi-structured interview was redirected to participants for discussion. See Appendix B for list of questions asked during the debriefing.

RESULTS

1. Analysis Approach

The results are divided into three parts. The first section is system data collected during the FOT. The second part is data collected from the self-report questionnaires (n = 49). Descriptive statistics such as median (*MDN*), standard deviation (*SD*) and frequency counts were used to analyze this dataset. Open-ended comments from the self-report questionnaires were categorized using a thematic analysis [13] to identify common themes. The final section contains responses received from the follow-up debriefing. Given that the responses obtained were all open-ended qualitative data, they were categorized into three types of responses, positive, negative and dependent (positive responses with certain caveats).

2. System Data

The system provided data logging capacity. Throughout the FOT, the fourteen vehicles collectively drove 419,540 km, from March 2018 to October 2019. On average vehicles cumulated 389 km per week. The system visually alerted the driver of pedestrians present in the danger zone 305,243 times, or 709 times per 1000 km on average. When the situation became critical, red visual alerts and audio warnings were generated, which occurred 14,854 times or on average 32 times per 1000 km during the trial. The system alerted the driver for an immediate risk coming from the left side, right side or directly in front of the vehicle. Of important notice, the system had other features such as forward collision warning, lane departure warning and headway warning, all of which generated an audio chime to the driver. On average the total of other chimes not related to pedestrians chimed in 328 times/1000km. Combining the different chime together, the drivers received on average 360 audio alerts/1000km. When considering all the alerts together, audio and visual, the average vehicle generated 1069 alerts/1000km. The number of alerts was different based on the environment in which the vehicles operated. Some of them were exposed to denser urban area and more alerts were generated for those locations.

3. Self-report Questionnaire Data

Impact of System on Driver Acceptance and Behaviour

The majority of the operators reported that the system had no impact (n = 31) on workload with a median of 5.0 (*SD* = 1.99). Four individuals reported that the system reduced workload whereas 14 felt a slight increase in workload. There were mixed responses from the operators on how the system improved road safety (*MDN* = 5.0, *SD* = 2.3). The majority of the operators reported that the system made roads safer (n = 23), 13 reported that the system had no impact on road safety and 13 felt that the system made the roads unsafe. There were also mixed responses on driver trust with the system. Eight operators reported no trust in the system at all with a score of 1 on the 1 – 10 scale. Others had a range of trust, however no one reported having complete trust in the system (score of 10).

Operators were mixed when it came to their preference in driving a vehicle with the system. Operators that were more accepting of the technology (n = 19) thought that the system can help prevent accidents by increasing drivers' awareness to their surroundings and hence improving safety. Operators that were more skeptical of the technology (n = 23) felt that the system was too distracting and that the system was not suited for their given task and vehicle. Note that this version of the VRU detection system did not function at night. Other individuals reported that they would use the system if it operated at night. Overall, the system did not change the majority of the operators' driving behaviour.

System Warnings (timing, lighting and audio) and Driver Response

The majority of the operators found the timing of the system warnings were either just right (n = 21) or too late (n = 21; *MDN* = 5.0, *SD* = 2.13). A few operators felt that the system warnings were issued too early (n = 7). Visual alerts issued by the system was positive in that it captured the majority of the operators' attention (n = 44). However, additional comments suggested that the light "caught attention too much" to the point of distraction. One operator thought that the lighting could have been more centralized. Audio warnings were also effective at capturing all of the operators' attention. However, comments indicated that the sound was too loud, annoying and distracting.

In the event that the system issued a visual or audio warning to the operator, the majority of the operators (n = 42) responded to the warning visually (e.g., attending to the warning alert, looking at the source of the warning and potential VRUs). Some operators had a physical response to the system warnings by braking (n = 11). A couple of drivers decided to ignore the system warning altogether (n = 5). Some operators looked at the warning to confirm what they already saw (a VRU in their path; n = 2). Very few operators changed their driving behaviour by driving more attentively in the event of a system warning (n = 2). It is important to note that some operators responded to the system warnings with more than one type of response (e.g., attend warning then brake).

System Performance according to Driver Impressions

Reports show that the warnings correctly detected VRUs only half of the time (n = 22) while the other half incorrectly warned the drivers of a VRU detection (n = 27). This may be dependent on the type of vehicles driven by city, the type of driving task and/or road conditions. Similarly, reports show that the system issued warnings even when no pedestrian or cyclist was at risk half of the time. Twenty two individuals were never or sometimes given a warning when no VRU detection, whereas the other 22 often received false alarms. Five individuals were neutral in their ratings. In the event that the system encountered a VRU at risk, the majority of the operators said that it rarely missed or failed to detect the VRU.

Operators' reasons on why they thought the system did not work in specific situations and circumstance were collected to evaluate the performance of the system. The most common factors were environmental such as lighting (e.g., night time). Other situations was due to weather and physical location / road that the vehicle drove on, reliability issues with the software (e.g., issuing false alarms and misses) as well as hardware issues (e.g., camera stopped working). Common examples that contributed to the negative experience were the system was not suited for the task or vehicle and needed to be configurable to suit the drivers' needs. Operators felt that the system issued warnings were annoying. Some individuals had a positive experience with the system stating that there are safety advantages in using such detection systems when operating a heavy vehicle. It is important to note that not all operators provided open-ended feedback for this question on the survey.

4. Debriefing Data

Participants were asked during the debriefings whether or not the system ever helped them avoid a collision. The majority of the responses were negative stating that the system was not beneficial in avoiding a collision due to its limitations. For instance, high frequency of false alarms due to weather changes making it less accurate or that it simply was not operational during the nighttime. Responses also indicated that the system was unreliable and that operators would detect the VRUs before the system initiated a warning. Many responses indicated that the system falsely detected road signs as VRUs and thus issued a warning even though no actual VRU was seen by the drivers in their surroundings. A few positive responses stated that the system was helpful in downtown traffic and that it was useful during the day.

There were no positive responses when participants were asked if they would like to have the system permanently or possibly having the system for other drivers. Negative responses indicated that new drivers should rely on mirrors and driving training when operating heavy vehicles and that the system cannot replace the "drivers' eyes". Certain responses were positive but only if the system is able to operate in all road conditions and was able to detect children on roads.

In terms of system setup and configurations (e.g., lights, sounds, settings, placements) some participants felt that the visuals, lighting and position was good and easy to spot. However, the majority of the participants responded negatively reporting that the system needed to be integrated better with other technology on-board the vehicle. Participants also felt that the tone / frequency of the warnings were too loud and piercing thus becoming a distraction. One operator even commented that they "would turn up the radio to silence the audio alert from the system". The addition of the system made the operators' tasks worse. Only a few operators felt that the system helped them stay aware of their surroundings.

When it comes to noticing when the system was working properly, responses were mixed. On one hand, operators found it difficult to know when the system was off during operation simply because it issued warnings all the time. Individuals that were able to tell when the system was working properly stated that the cluster goes dark and that it beeps at the start of the day indicating that it was functional. One driver noticed that the system was on only because of the colour changes in the warnings.

The majority of the participants from the debriefing session received training and thought it was useful and straight-forward. However, some individuals felt that the training would have been more effective if it was refined to specific tasks. One individual stated that they did not receive training at all and that they referred to online sources to obtain information about the system.

DISCUSSION

Vulnerable Road Users can be at risk of collision when interacting with heavy vehicles because of the large blind spots created by the vehicles' design. These blind spots make it difficult for operators to detect VRUs that are in close proximity [1]. In order to assess the safety potential of new technology, Transport Canada installed VRU detection systems on heavy vehicles for a year-long FOT. The present research aimed to assess the performance of the system on extended use under real operating conditions in Canada and to evaluate driver acceptance and experience. Results obtained from the data logging system, self-report questionnaires and debriefing yielded mixed results.

System data showed promise when it came to successfully alerting operators of VRUs in proximity of the vehicle. Despite the number of critical red alerts issued to the operators, during the year-long FOT, no collisions occurred (none were expected). In addition, the surveys conveyed that the visual and audio warnings were successful and efficient at capturing the operators' attention when issued. Although the warnings from the VRU detection system were abundant, the operators' experiences using the system reported on the questionnaire and debriefing gave further insight on the disadvantages of the system.

As noted by the operators' responses, auditory alerts issued by the system were loud and annoying. Human factors guidelines for the design of such systems indicate that there is an important tradeoff between alerts and annoyance when using auditory warnings [18]. Failure to address the alert and annoyance tradeoff when designing for auditory signals can increase workload, become distracting or even cause drivers to disable the warnings altogether [21]. These consequences were all evident in this FOT.

Some responses from the questionnaire were different from the feedback given during the debriefing such as the impact the system had on workload and system acceptance. With respect to workload, survey responses reported little to no impact on workload with a few that felt that the system only slightly increased workload. However, during the debrief operators were unanimously negative in stating that the system actually made completing their operational tasks more difficult, an indication that the system increased their workload. The increase of workload may be due to the loud and distracting tone and frequency of the warning sounds and the increased number of false alarms. When it comes to system acceptance, drivers were mixed in the self-report questionnaire where some indicated that they would use the system to help prevent collisions and increase driver awareness. The more skeptical operators felt that the system was too distracting and that it was not suited for their operational task at hand (e.g., night operations). However, no positive responses were given during the debriefing when it comes to having the system permanently in their vehicle or even recommending the system to other drivers. Only a select few of the operators considered having the system permanently dependent on the system's ability to operate at night, fog or was able to detect children. The discrepancy of the responses may be due to the wording of the questions where on the self-report it was a personal preference of using the system, where on the debriefing the question was phrased as a potential permanent aid on the vehicle for VRU detection and the overall use of the VRU in heavy vehicle operations in general. These operator concerns are consistent with previous studies that evaluated the VRU detection system in public transit buses [17]. In the literature, operators found that the system was not very helpful and preferred not to drive a vehicle equipped with the system. The operators also thought that the system was highly distracting and issued too many false positive alarms [17].

Additional information collected from the debriefing gave us further insight on responses collected via the questionnaires. For instance, drivers' perceptions on why the system did not work indicated environmental factors such as lighting, weather, location and reliability issues associated with the system. The debriefing elaborated further such that a great number of the false alarms that were issued was mainly due to false detection of road signs as VRUs. Environmental factors such as lighting and location may have influenced the physical properties of the road signs making the system detect it as a VRU. The debriefing also made it possible for us to understand that acceptance of a detection system relied heavily on its ability to be customizable for the vehicle and operational tasks at hand. For example, operating heavy vehicles at night did not receive any of the benefits provided by the detection system because it was not designed for this circumstance. The reliability of the system is also important when considering using the system as an aid for VRU detection. The VRU detection system issued on average 1069 alerts per 1000 km per vehicle. The high rate of alarms left a negative impression of the system as a whole making it hard for drivers to accept the technology. False and nuisance warning rate should be low [19]. For example, a rate of four inappropriate warnings per hour has been rated as most annoying in a naturalistic driving study [20].

Although the general impression of using the detection system was negative, there were some added advantages that was noted from the responses. Drivers felt that the system was effective at capturing their attention (via audio and light) when warnings were issued and thus raised their awareness to their surroundings. However, this benefit was outweighed due to the increasing number of false alarms issued. The consensus for ADAS technologies (e.g., forward collision warning, lane departure warning, and VRU detection systems) were generally accepted but only if they were reliable and catered to the task. This is advantageous given that drivers are open to accept technologies if improved for future use.

The methods used to assess driver acceptance had some benefits and limitations. Using self-report measures was needed to obtain data on a grand scale given that the FOT ran parallel across Canada in 5 different cities. However, the low number of responses (in this case for a year-long FOT) was contributed by the difficulty in motivating drivers to complete the surveys (no incentives). Furthermore, data obtained from the surveys are not able to identify whether or not completed questionnaires came from the same driver over the course of the FOT because no identifier was collected due to confidentiality and anonymity concerns. This can influence the overall results of drivers' acceptance of the system due to less variability. Certain recall biases and effects are known in self-administered paper questionnaires given that it is visual and heavily reliant on drivers' ability to accurately recall their experience using the detection system. The post-FOT debriefing was administered to collect additional information from the drivers. The presence of an experimenter enabled responses to be more relevant to the topic. Furthermore, experimenters have the ability to probe for further information from comments given. A disadvantage of debriefings is group discussion biases, where an individual's experience with the system may be influenced by the group's consensus despite differing opinions and attitudes [10]. Group polarization may also occur where responses tend to lean towards extreme views of the subject of discussion [14]. The presence of authority figures such as fleet managers and supervisors may also influence the operators' willingness to share sensitive information. Although there are risks of group biases, the debriefings held for each municipality were consistently negative across groups despite no communications with each other. Researcher biases can also occur depending on how questions were phrased and the method and characteristics that the researchers used to obtain information [10]. These limitations must be taken into consideration when analyzing responses obtained through different methodologies.

Driver acceptance of the technology may vary depending on whether or not training was given for the detection system. Due to the variability in the municipalities' operations, it was noted that operators vary throughout the year and that some of the new operators were not given the appropriate information or training regarding the detection system prior to operating a heavy vehicle equipped with it. This can attribute to the mixed responses evident in the self-administered questionnaires because some operators may have more experience using the system more than others thus giving them stronger opinions towards the system. If fleet operations are to use ADAS in the future, proper education must be given to all operators (new and experienced) on the ADAS basic features prior to operating a vehicle equipped with one. Education and training of ADAS are known to increase acceptance and appropriate use of new technology [11].

ADAS technologies are designed to help eliminate and mitigate collisions. However, benefits are undermined when there is hesitation to accept and use the technology [9]. Previous studies have found that police-reported crashes for normal commercial vehicles equipped with systems that actively intervene (e.g., Automatic Emergency Braking) were much more effective at mitigating collisions than warning systems (e.g., VRU detection system) [6]. Further investigations can evaluate how accepting drivers are between these two different types of systems (intervening vs. warning) through naturalistic driving studies. Additionally, future research should address how to improve the physical design of sight lines on heavy vehicles for better visibility. Research and discussions on the development of a direct vision standard for heavy vehicles to eliminate or reduce blind-spots are currently being investigated [15]. By redesigning heavy vehicles, collision risks associated with reduced visibility might be eliminated.

CONCLUSIONS

This study found that distraction, system unreliability and failure to apply the system to different vehicles and tasks were all common factors that decreased operator acceptance with the VRU detection system. Technology continues to improve and future systems will perform better. Testing of these technologies with users and on field operational tests are crucial to evaluate system performance. Given that these systems are designed to help drivers on the road, it is essential to consider the experience of real users when designing and evaluating technologies. The purely objective data from the system data loggers did not provide insight on how ADAS perform in real driving conditions. The challenge was that the system itself could not determine which alarms it issued were false positives or true detections. Future field studies could record confirmation data from the operators to verify the accuracy of every alarm.

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APPENDIX A – Questions of the Self-report Survey

Likert Scale from 1 – 10

Approximately how long did you drive this vehicle with Shield Plus?

Did you receive any training on this system?

How did the system impact your driving workload?

What impact did the system have on road safety?

How much did you trust the system warnings?

Please identify any situations where the system did not work as expected (e.g., nighttime, rain…)? Write on back if necessary.

How often did the Shield Plus system warn you correctly when a pedestrian / cyclist was at risk?

How often did the Shield Plus system warn you when no pedestrian / cyclist was at risk?

How often did the Shield Plus system fail to warn you when a pedestrian / cyclist was at risk?

How was the timing of the warning?

Did the warning light catch your attention? If No, how could it be improved?

Did the warning sound catch your attention? If No, how could it be improved?

Based on your experience, would you rather drive a vehicle with Shield Plus? In a few words, please indicate why?

Has your driving changed since using the system? If Yes, how?

How did you typically respond to the warning (e.g., look at warning, look for pedestrian/ cyclist, brake…)?

Please provide any other feedback about your experience using the Shield Plus system (e.g., comments and observations, issues, advice to users, advice to the designers…). Write on back if necessary.

APPENDIX B – Post-FOT Group Debriefing Questions

Did the system ever help to avoid a collision?

Would you like to have this system permanently? How about for other drivers.

What would you change about the system? Lights, sounds, settings, placement?

As a driver you can be very busy having to pay attention to many things at the same time. Did this help in those situations or make things worse? .

Can you talk a bit about the different tasks you have to do?

Could you tell when the system was working properly?

Training? Did you receive any? Would it be helpful? Would you recommend it? How effective was it?

Is there another type of warning system that would help you. How about the FCW and LDW, were they helpful?

London – improving visibility requirements so there are no blind spots? Do you think that would be helpful?

Mitigation systems (systems that brake by themselves) are coming – what do you think?

Camera wash – did you use them? When did you know to use them? Were they helpful?

Final thoughts? Any issues we missed?

If interested, please contact us for the full questionnaires used in the study.