

VEHICLE RESEARCHES ON IMPROVED SAFETY SYSTEM

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Abstract

The article presented analyses situations and propositions of chosen actions. Their effects will be decreases of chances in which collisions and accidents will occur. Proposed equipment of vehicles, which are currently being exploited, are additional mirrors for lowering the area of so called "blind spots". The necessity of installing additional reverse lights, in the area of rearview mirror, in busses as well as in trucks has been discussed and assessed. Another issue is the necessity to introduce appropriate regulations about back rear bumpers. It will obligate producers and users of vehicles to install them (especially in self-unloading vehicles). Doing so will also reduce the weightiness of accidents with participation of other cars. Analyzed and discussed propositions in the article are actions directed towards reducing number of collisions and accidents in developing road transport. Aspiration after achieving safety for traffic participants should be most important while executing road transport needs. It is essential to allow the driver to observe hitherto unseen areas while backing up by installing additional devices of indirect visibility, such as camera at the back of the vehicle or display in the cabin. Without radical decisions it is impossible to limit accidents (especially fatal), which are originating in traffic. Retrofitting means of road transport, we reduce their susceptibility to accidents and collisions.

Keywords: *vehicles operations, road transport, technical rules*

1. Introduction

The participation in the road traffic is not the safe activity. It is the permanent threat of participants of this traffic with collisions and accidents. It is indispensable to diagnose and programmed the early phase of development of this type of undesirable cases. In spite of putting of (in conviction of decisive men and participants of road traffic) the big accuracy in the range of training and creating of new rules, the accidents take place [1]. By the proper activities, we should aim at the decrease of the number of accidents and we should enable to lower the heaviness of accidents arising in transport. By the proper re-equipment of transport road means, we decrease their susceptibility to accidents and collisions.

2. The limitations of visibility in the light duty trucks

In trucks, it results from the opacity of the sidewall and the rear one, which create the goods space. The truck driver can observe decidedly smaller region. Observed technical progress and development of devices allow introducing such solutions, which liquidate the existence of invisible regions. It should strive to equalization of possibilities of surroundings observation, at last such as in the version of the passenger car. One of the manners of assistance of the driver is to place the additional properly chosen mirrors in the truck. Below the example of this solution was presented. Drawings no 1 and no 2 present the placement of the mirrors proposed by the authors in the proposed and tested vehicle. The results of simulation tests of direct and indirect visibility after the use of the additional mirrors were presented on Fig. 3. It shows the placement and extensivity of the areas which are embraced by these additional mirrors. As we can see the areas, which the driver is not able to observe underwent the significant reduction – almost to zero. The driver in this vehicle at last has the possibility to observe the regions, which are important because of active safety. These regions have been so far beyond the range of the observation [2, 4, 8, 10].



Fig. 1. The placement of the mirrors in the tested vehicle, view from outside of the left side of the vehicle (from the back and from the front) and the view from the place of the driver to the left through the window of the left door



Fig. 2. The placement of the mirrors in the tested vehicle, the view from outside of the right side of the vehicle and the view from the driver's place to the right on the right pile A

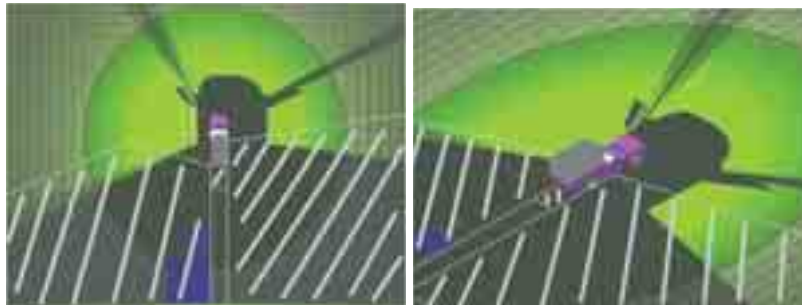


Fig. 3. The simulation of the visibility on the testing wheel, the view from the top and from the side after the instalment of additional mirrors – areas that are lined obliquely

3. The additional reverse lamps in the range of mirrors

In the vehicles with the considerable lengths (buses, big trucks), the back reverse lights in the darkness illuminate only the region at the rear of the vehicle. The driver manoeuvring backwards does not have the lighted region on which the front wheels run into during the turn and side of the



Fig. 4. The bus with additional reverse lamps placed aside the mirrors, the view from outside of the left side

vehicle. The big help is gained when the back reverse lights in the range of the outer mirrors are used. The example of this solution is shown on Fig. 4, 5. The proposed solution enables the driver the observation at night but formally it is not conformable with the binding regulation no 48 EEC [9]. It seems indispensably to infer such a change to make the proposed solution legal [3, 5].



Fig. 5. The placement of the reverse lamps aside mirrors in the tested bus, the view from outside of the left and right side in the range of mirrors

4. The additional marking and lamps lighting the road

In Poland in the road unlighted pedestrians, cyclists, horse equipages move. During passing round unlighted objects, the driver is not able to define the placement of the side of the driven truck against the unlighted objects. The similar situation takes place when the manoeuvres are made in the unlighted places and from the side in the surroundings of the vehicle the objects are unlighted.

The tractor with the semi-trailer move in other wider corridor than the truck without the semi-trailer – Fig. 8. Until now, the semi-trailer is not equipped with lamps, which would illuminate the region on which the semi-trailer wheels run into during the turn. In this case, at night (without the street lighting) the driver has the unlighted region on which the semi-trailer wheels run into. Although the driver can look at the mirrors but he is not able to see the side of his vehicle and watch where and on what the semi-trailer wheels run into. To avoid the above situations it was made the experiment in which during the turn, the lighting was selected in a way that indicated to the drivers the contour of the vehicle and it illuminated the road on which the semi-trailer wheels run into. The fulfilment of these assumptions is incompatible with the demands of binding rules in this range in Europe – regulation 48 EC UN. The authors of this rule did not regard the demand of lighting of these regions in this way that the driver could observe on which the vehicle runs into. There were used additional white contour lights, placed at the rear of the semi-trailer in its upper and lower parts. Besides there were mounted the lamps of white lights directed down-wards on road, placed one lamp on each of two side walls in the range of wheels of Fig. 7. The sidewalls and the rear walls (particularly in the big trucks) especially at night should be marked in a way that other participants of the traffic could notice this vehicle sufficiently early.

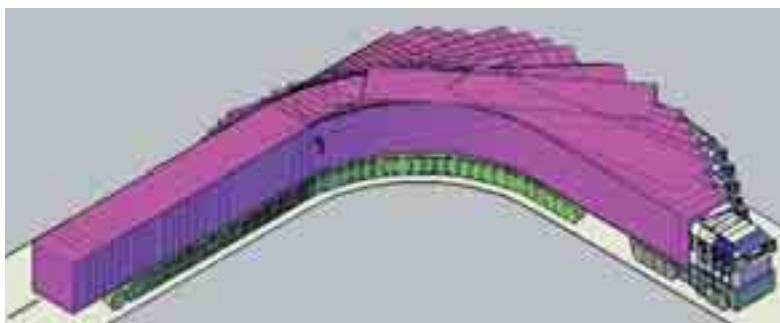


Fig. 6. The roads of the corridor during the driving of the tractor with the semi-trailer on the bend

The instalment of the additional marking on the sidewalls of the vehicles (trucks, trailers, semi-trailers, buses) which do not have them will make easy and simply frequently will enable earlier observation of these vehicles by other participants of traffic. Particularly it is important during manoeuvring in the darkness.



Fig. 7. The view of the semi-trailer and the placement of the additional lights



Fig. 8. The view of the semi-trailer, the placement of the sidelights and contour marking in the daily light



Fig. 9. The view of the semi-trailer, the placement of the sidelights and contour marking - the view in the artificial and daily light



Fig. 10. The view of the semi-trailer, the placement of the rear lights and contour marking – the view in the daily and artificial light

5. The cameras with the screen of projector in the cab of the driver

It is necessary to enable the driver to observe until now invisible areas during the moving back of the vehicle by the instalment of the additional devices of the indirect visibility: camera at the rear of the vehicle, the projector in the cab. Similarly there can be used the ultrasonic sensors with the signal unit on the rear wall, with the audiovisual unit – in the driver cab. In the articulated bus because of its length, it is particularly important, during moving back, to observe the area beyond the vehicle. The example of the situation with the use of the camera with the projector mounted in the bus was shown at the Fig. 11 [6, 11, 13].



Fig. 11. The view of the bus, the placement of the camera and the screen of the projector in the cab

6. The assistance of the drivers in observation with the help of mirrors on the roads with insufficient visibility

The possibility of the observation of the sufficient long stretches of the road, on which the participant of the road traffic is to move, is the precondition to unthreatened by the collision or accident the contribution in the traffic. Besides it is important not only the observation of the region in which the participant is to move and also the areas of other roads of access for the rest of participants of the traffic in such a range not to create the surprising for other participants of the traffic. Everybody should have the possibility to observe sufficient enough long stretches of the road to make e.g. the manoeuvre of braking to stop the vehicle and to avoid the collision. In the most of the cases the roads are made in this way that driver has the possibility of the direct observation of the sufficiently big area. However when the natural blinds appear, the drivers should be assisted by e.g. the devices of the indirect visibility [4].

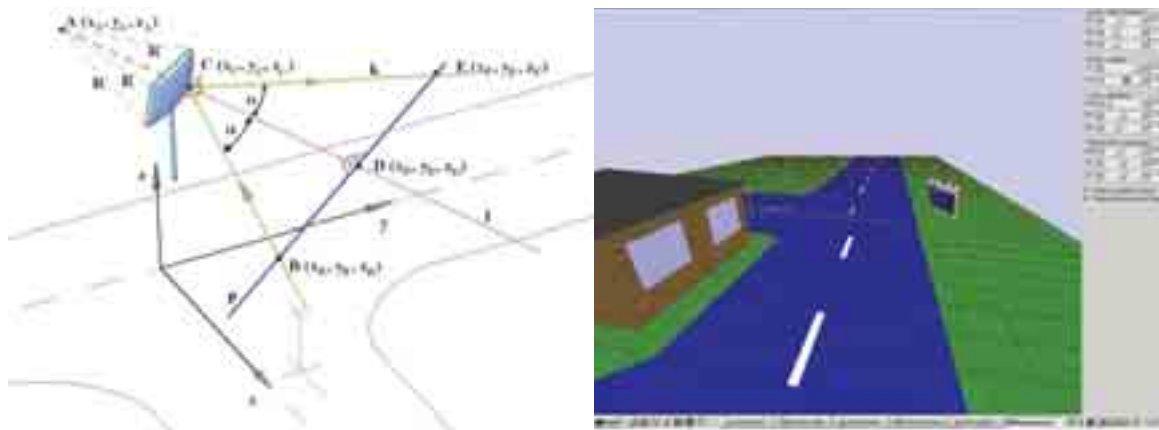


Fig. 12. The model of the subject of the reflection in the mirror for the reflector placed on the road and the computer simulation of the indirect observation by them

In the particular configurations of the terrain, the drivers have the impediments in observation of the vehicle's surroundings. They hinder the assurance of the possibilities of the direct observation of the sufficiently long stretches of the road because of the unthreatened by collision continuing of the movement. These situations appear in the places where e.g. there is the building (colliding with the enlargement of the road) which covers the region which is important because of the accidents' threats. Similar impediments appear when in the surroundings of the roads there are steep erections e.g. in the mountainous terrain. To assure (in such places) participants of the traffic the possibility of the observation on borders of the road there should be put the special spherical mirrors. By their intervention we can observe the invisible directly areas. The proper computer programs facilitate the choice of the place and the parameters of the mirrors. At the drawing no 12 the idea and the example of program are presented. The example of the placements of the mirrors on the road was shown at the Fig. 13.



Fig. 13. The mirror placed on the road for the indirect observations

7. The rear underrun protections in the self-unloading vehicles

The self-unloading vehicles move also on the public roads and unfortunately take part in the road accidents and collisions. The possibility not to install the rear under run protections by the trucks producers exposes other participants of the traffic to the additional threat of the loss of the health and the life. The lack of the rear under run protections enables to drive deeply under the unloading box and in the effect to destroy the cage of the survive. It concerns both the passenger cars and trucks and buses and the above influences unfavourably the system of the passive safety of the road participants [7, 12].



Fig. 14. The examples of protruding of bodies of the self-unloading trucks

The under run protections at the rear of the vehicle are the elements of the equipment of the passive safety system. Since 1 May 2004 Poland is one of 27 membership's countries of EC. It means among other things that we must systematically update our domestic legislation adapting them to the rules included in the directives issued by the EC organs. We should also test the adaptation of rules to the needs and needs to rules. In EC directives define the legal normalizations in the various fields of life, among other things the technical conditions of the rear under run protections for the self-unloading vehicles. These demands are described in the directive 70/221 EC. There are defined conditions which decide when the rear under run protections should be mounted in the vehicles and in which way they should be installed. The specific appropriation of the self-unloading vehicles (tipping trucks) in some situation causes that the rear under run protection makes difficulties in the unloading of the transported goods. The effective way to eliminate this problem is the folding or raising protection. It is elastic solution facilitating driver's work of the tipper during the unloading of the transported material. It simultaneously protects other participants of the traffic from the big heaviness of accidents during the collision or accident in situation of running into the back of the vehicle when the vehicle moves on the public roads.



Fig. 15. The examples of the self-unloading vehicles of the same make and type with / without the rear under run protection

The obligation of the equipment of the self-unloading vehicles with the rear under run protections will cause the improvement of the system of the passive safety of the traffic participants. Observed technical progress and the development of the devices enable the introduction of such a obligation. Besides the law binding in EC imposes on the authorities in Poland the obligation of the introduction of this demand.

8. Recapitulation and the conclusions

Transport is a life-giving bloodstream of the economy. When developing, it also has negative effects on the environment. Besides contaminating the atmosphere by automobile pollution, it also causes new road expansion, sudden increases in the driving population, and an increase in accidents. Therefore, taking part in traffic leads to ones' own risk and endangerment. It is essential for drivers to diagnose and predict premature developing phases of unwanted occurrences. In spite of creating of new regulations and educating of drivers, accidents still happen. Using appropriate procedures, it is necessary to aim at decreasing of the number of accidents as well as enabling to lower weightiness of accidents originating in road transport. Retrofitting means of road transport, we reduce their susceptibility to accidents and collisions.

The article presented analyses situations and propositions of chosen actions. Their effects will be decreases of chances in which collisions and accidents will occur. Proposed equipment of vehicles, which are currently being exploited, are additional mirrors for lowering the area of so called "blind spots". It will allow drivers to collect information from regions, which until now have been invisible, and avoid unnecessary occurrences. The necessity of installing additional reverse lights, in the area of rearview mirror, in busses as well as in trucks has been discussed and assessed. It will allow lighting of regions, hitherto unseen by drivers, while they are backing up, and in result coming up with a conscious decision to avoid future collisions. Installing additional outline white lights, at the back of the vehicle, will allow drivers to identify the location of the back of the car, which is currently being driven.

Installing lights in the premises of semitrailer wheels, that light the road in this region, allows to observe the area of the road, on which the wheels of the semitrailer are overrunning while turning. Installing side position lights in vehicles (trucks, trailers, semitrailers, busses), which lack in them, will make it easier or even allow earlier signs other traffic participants. It is especially important while manoeuvring in the dark. It is essential to allow the driver to observe hitherto unseen areas while backing up by installing additional devices of indirect visibility, such as camera at the back of the vehicle or display in the cabin. Likewise it is possible to apply ultrasound sensors at the back wall of the vehicle with a signal unit in the driver's cabin.

It is extremely important to change regulations, so that truck and car drivers will have same equal direct visibility from the driver's seat. This is particularly vital when comparing the car's body to the truck's body one of the only differences is that there are no windows behind driver's cabin and no rear windows. The space founded for carrying freight is opaque. Because of that, direct visibility of the surroundings of the truck is limited.

There is also an opportunity, (but also a need) to support drivers by installing of big road mirrors at oblique intersections. At such intersections, direct visibility is limited. Observation difficulties at these intersections result from topographic features and limitations, which are caused by the construction of the vehicle cabin.

Another issue is the necessity to introduce appropriate regulations about back rear bumpers. It will obligate producers and users of vehicles to install them (especially in self-unloading vehicles). Doing so will also reduce the weightiness of accidents with participation of other cars.

Analyzed and discussed propositions in the article are actions directed towards reducing number of collisions and accidents in developing road transport. Without radical decisions it is impossible to limit accidents (especially fatal), which are originating in traffic. Aspiration after achieving safety for traffic participants should be most important while executing road transport needs.

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