

MAXIMUM EFFECTIVE REAR VIEW MIRRORING OF THE DUMP TRUCK

The rear view mirror system provides the operator an indirect field of vision of all activity around or adjacent to the vehicle. The goal of the rear view mirror system should be to place the operator in a position that while operating the vehicle it is not necessary to take the eyes off the upcoming road to look into areas along side the vehicle before venturing into that area. A glance in the rear view mirror system should provide all the information necessary to make the maneuver. If the rear view mirror system does not provide this coverage, the unseen areas are referred to as blind spots. Blind spots require the operator to turn their head and physically look into the area before turning or making a lane change. The faster the vehicle is moving the more dangerous this condition becomes.

The only requirement for all vehicles over the weight of 4,536 kg (10,433 lbs.) is found in Federal Motor Vehicle Safety Standard 111. Except for school buses, this standard requires a mirror with reflective surface of not less than 323 cm (49 square inches). This mirror is many times referred to as the west coast mirror. The selection of additional mirrors on the vehicle to work with the blind spot problem is then left to the option of the operator and historically this has been by simply placing a convex mirror of some size or shape, either above or below the west coast mirror. The convex mirror is designed to provide an expanded field of vision to the operator but does have limitations. To see more requires going to bigger and bigger sized mirrors and soon the blind spot created by the size of the mirror itself outweighs the advantages. The 8-inch convex appeared to us to be one of the most commonly selected by operators of dump trucks so our study focused on this type of mirror.

First, we wanted to explore mirror technology to see if there was a mirror available that could produce an expanded field of vision that would surpass the convex mirror of comparable size. Our search produced the BDS Dead Angle Spot Mirror which is a 9-inch by 6-inch mirror that is cut out of wide angle glass in such a way that it produces a 65-75% increase in the field of vision over that of a convex mirror of comparable size and does so with less distortion in the objects viewed than does the convex mirror.

Once we had selected the mirror, we then began working with Mr. Bill Ruhr, Director of the Minnesota Highway Safety and Research Center at St. Cloud State University. We asked Mr. Ruhr to select a typical working dump truck that would be indicative of most of the dump trucks on the road. The vehicle selected was an International tandem dump truck with 3 tag axles. The vehicle was mirrored with the west coast mirror and an 8-inch convex mirror mounted below the west coast mirror. Our goal was to find out what the operator could see with this arrangement and what could be seen using the BDS mirror in the proper location on the truck.

We took a series of photos to illustrate our findings. The first photo (figure 1) shows a view of the mirrors on the passenger side of the vehicle from the operators seat.



Clearly, the photo shows the problem of location of the spot mirror. The considerable obstacles provided by the door itself make viewing the mirror difficult and in fact covers almost half of the convex mirror surface and shows that while the operator is attempting to look into the mirrors his/her eyes are not on the road watching for upcoming obstacles. Further, the spot mirror does not show the operator what is present in the area in the back of the mirror so the blind spot created by a door mounted mirror still left the operator with the problem of physically looking into this area before making a move into the area.

To get the maximum advantage of the spot mirror it became evident that the best location on the truck was a front fender mount that could be looked at by the operator with just a glance to the right. This location would then give the operator a view of the entire area along the side of the truck. Much of which would have been blind to the operator by locating the spot mirror on the door.

For the rest of the study we placed the BDS mirror on a tripod mount on the front fender of the vehicle. The view of the spot mirror placed in this location from the operator's seat is shown by figure 2 where it could be seen by the operator with just a glance of the eyes instead of turning the head.



We then had the operator sit in the seat and we marked the edges of the field of vision provided by all the mirrors on the truck. We had four other drivers look into the mirrors to aid us in reaching the conclusion that we had an accurate portrayal of what could be seen in the mirrors. We placed tapes to mark the areas. We attach a photo illustrative of the taped fields of vision.



The tape on the left is the field of vision provided by the west coast mirror. The middle tape is the field of vision provided by the 8-inch convex mirror. The tape on the right is the field of vision produced by the BDS mirror. We measured the distances and found that the west coast mirror provided an indirect view of an area of 2-feet out from the center of the rear drive axle, and the convex mirror provided an indirect view of an area 17.9-feet from the center of the rear drive axle. It must be remembered that these areas are cone shaped up to the mirrors themselves so a very large area from the edge of the convex cone to the front of the truck are not seen by looking in the mirrors. The BDS mirror produced an indirect field of vision along the entire side of the vehicle all the way to the front.

We also found that some companies and many state transportation departments have already gone to placing an 8-inch convex mirror on a front fender mount. So we examined what this accomplished and how it compared to the BDS mirror performance. We attach a photo of a Minnesota Department of Transportation snowplow to illustrate as Figure 4.



The tape at the left of the picture shows the edge of the field of vision provided by the 8-inch convex and the tape at the right shows the edge of the field of vision provided by the BDS mirror. Clearly, with the convex mirror a blind spot still exists, which we measured at 8-feet wide at a distance of 10-feet out from the center of the front axle. As the photo shows this blind spot was eliminated by the use of the BDS mirror.

Considering the increasing congestion on our highways and the high costs associated with any type accident, it is time to examine what we are giving our operators to work with when they are on the road. Proper location of the spot mirrors and use of the proper mirror can solve one of the major problems faced by the operator's blind spots.