

THE QUARRY TRUCK

The quarry truck is typically a 40 to 100 ton rigid frame dump truck. Following (Figure 1) is a photo of a typical quarry truck.



Figure 1

Quarry trucks are considered off-road vehicles by the Federal government so there are no required Federal standards for the mirror systems that must be placed upon these vehicles by manufacturers. Like their counter-parts, the large mine trucks (150 to 500 tons) the quarry trucks have been historically mirrored with a combination flat glass for ease in backing and a convex mirror for a wider view. Sizes of mirrors vary among manufacturers and clearly even the placement of these mirror systems still leaves the operator with serious “blind spots” in visibility surrounding the machine. Figure 2 provides an illustration of blind spots in visibility of such of 50 ton quarry vehicle.

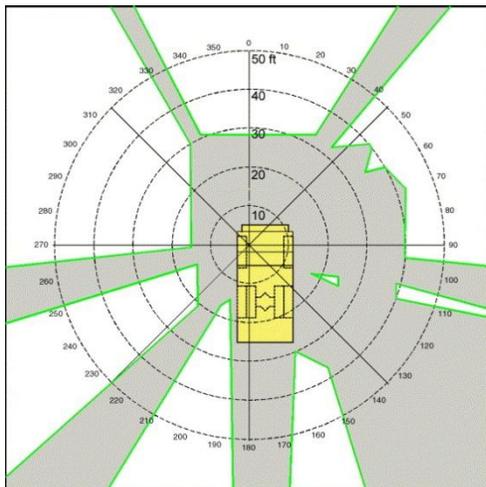


Figure 2 (Source Sciencedirect)

Shaded areas are unseen by the operator because of size of vehicle and cab configuration.

Note:

Bottom two areas in white indicate areas shown to operator by existing mirror systems applied by manufacturer.

The Mine Safety and Health Administration (MSHA) understands the blind spot problems with these vehicles and in 1998 began pushing to make rear, side, and front cameras mandatory as its sole attempt to correct the problem of blind spots. The proposal to make the cameras mandatory was mainly objected to by the industry because of cost of cameras, reliability, and maintenance issues. MSHA then decided to recommend cameras but not to make them mandatory. During this period and to the current day MSHA has never entertained the possibility of requiring better exterior mirror systems. MSHA's approach has had mixed results. In its paper Accident Prevention through the use of New Technologies dated January 4, 2010 MSHA reports the following:

“On average 40 incidents with 5 to 6 fatalities involving powered haulage equipment occur each year at surface mining operations.

Fatalities related to equipment blind areas comprise approximately 7% of all fatal accidents (period of 2000-2005), which POINTS TO A SIGNIFICANT PROBLEM. (emphasis supplied).

These accidents typically result in collisions with other equipment and vehicles, pedestrians, or stationary objects.”

13 years later and MSHA still regards blind spots as a significant problem.

M-C North America Inc. believes that there is place for cameras to see the rear area where mirrors cannot work, but the better, cheaper and more reliable method to solve the blind spot problem on these vehicles is to upgrade the mirror systems being used and this requires new mirror technology.

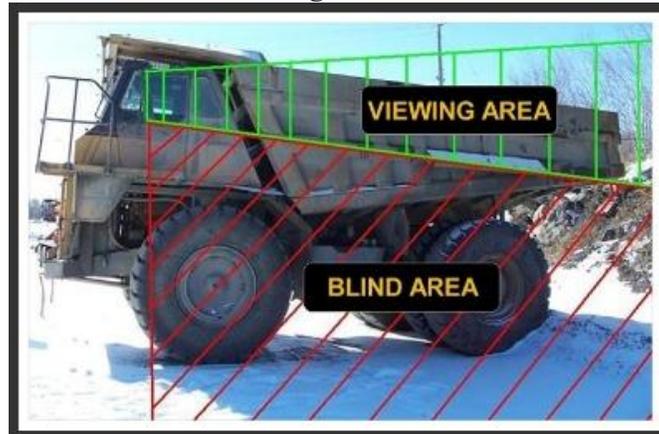
CURRENT MIRROR TECHNOLOGY CANNOT SOLVE THE BLIND SPOT PROBLEM ON THE QUARRY TRUCK.

Mirror technology used with the quarry truck has not changed since it was applied to the first Euclid Mine Truck built in 1930. Mirror technology that was being used for regular commercial vehicles was simply incorporated into larger mirrors and applied to the large trucks without regard to the special requirements the size of these vehicles imposed on the mirrors.

To eliminate the problem the operator of the quarry truck must have a view of the proximity area surrounding the machine to be aware at all times from start-up through travelling that no person or object is adjacent to the vehicle and the view must be provided with sufficient clarity so that the mirrors can clearly show the area to the rear of the truck for backing into unloading areas.

Using current mirror technology the placement of a flat glass mirror provides the clarity but only provides a view consistent with the size of the mirror. As with any vehicle the size and shape and use of the vehicle puts limitations on the size of the mirror used so convex mirrors are many times used to expand the view further. The difficulty with the flat glass mirror and the standard convex mirror presently being used is that the mirrors are so high on the vehicle the ground is not shown in the mirrors until well behind the vehicle. This leaves a blind spot that can be illustrated in the following photo where lines have been superimposed on the photo showing the view provided by the mirrors and the blind area.

Figure 3



To solve this blind spot problem the mirrors must be capable of showing the ground closer to the location of the mirrors on the vehicle. In trying to accomplish this with current mirror technology the standard convex mirror would have to be used and this poses a distortion problem. The standard convex mirror in use today will always produce images that are smaller in size than the real image i.e. distortion. The wider view provided by the convex mirror is produced by bending the glass and the more the glass is bent the greater the amount of distortion. To use such a mirror to produce a view of the ground closer to the location of the mirror on the vehicle would require a very severe cut of glass so much so that the distortion presented would produce images that would be so distorted that the mirror would be useless to the operator.

SOLUTION TO THE BLIND SPOT PROBLEM ON THE QUARRY TRUCK

At M-C North America Inc. we have developed a wide angle glass (U.S. Patent No. 8172411) that uses the principle of placing many rates of curvature in the same glass to produce an overall rate of curvature for the mirror. This approach allows us to control both the field of view provided and the size of images.

Keeping the image size as near as possible to normal size eliminates the perception of distortion. Further, we have developed the technology of fusing different rates of curvature into the same mirror face. This allows us to produce a mirror that has a major face of the glass that is almost flat and borders to the glass that are sharper rates of curvature producing wider fields of view to show the operator the required areas. The fusion is seamless so the transition is not readily apparent to the operator. With this we are capable of producing a view for the operator of the mine truck that shows the ground right behind the front wheel. An illustration of what can be shown to the operator with this mirror is illustrated in the following photo.

Figure 4



M-C North America 15 inch x 25 inch mirror on a quarry truck.

With the clarity of view and actual view provided we suggest consideration of our 360Solution to the blind spot problems on the quarry truck which incorporates a 15 x 25 M-C mirror on both the right and left side of the truck, a mirror on the front of the truck to eliminate the 30 foot blind spot in front of the truck and a rear view camera for the rear of the truck. .

Our 15 x 25 inch mirror (381mm x 635mm) exceeds the vision requirements of ISO 14401-2 and has the following Certification no. 11-E9-02.6485.

Call us for a field demonstration or questions. Also remember our M-C Technology provides the same benefits on your front-end loaders. Our 360Solution mirrors can be demanded when ordering new trucks (spec number 11-E9-02.6485) and are easily retro fitted on existing fleets.

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