WALK-IN VANS/STEP VANS and LLV’s

The Walk-In/Step Van

This is a very common type vehicle on our roadways. Used with minor variations by companies such as FedEx, United States Postal Service, UPS, Canada Post, Frito Lay, Krispy Kreme, Canadian Linen and Uniform, Cintas, Ameri-Pride and many other companies.

With this type of vehicle, aid to operator visibility has not changed since the vehicle was first produced. The mirror
system that has been consistently maintained is the placement of a 6.5 x 10 inch flat mirror and below this mirror is found a 6.5 x 6 inch convex wide angle mirror, attached to the vehicle by a pole mount located on the post between the door and the small front side window.

The flat glass is a required mirror by the Federal Motor Vehicle Safety Standards (FMVSS 111) and convex wide angle view mirror is added as a supplemental mirror to widen the field of view of the operator.

In reviewing the mirror system it is important to remember the exterior mirror system should be designed to provide the operator with a view of the proximity area surrounding the vehicle and out from the side of the vehicle to allow a view of adjoining lanes for turning and merging maneuvers. The necessary view of these areas cannot be seen by the operator’s direct vision so it becomes necessary for the exterior mirrors to provide the operator with an indirect view by means of the mirrors. Any areas that are not shown to the operator by direct and indirect vision are blind areas or blind spots and the operator is unable to see persons or objects in these areas while the vehicle is in motion.

The National Highway Traffic Safety Administration (NHTSA) has determined that blind spots cause accidents. Our goal at M-C North America Inc. is to determine the blind spots left by existing mirror systems and using our new mirror technology to eliminate the blind spots.
BLIND SPOTS IN THE CURRENT MIRROR SYSTEMS ON WALK IN VANS

Blind spots can exist because the view provided out from the side of the vehicle is not sufficient for safe lane changes and turning maneuvers.

and

Blind spots can exist because the view provided does not provide the operator with a view of the ground level along the entire side of the vehicle.

To determine the blind spot area out from the side of the vehicle we have, sitting in the operator’s seat, physically measured the areas out from the side of the truck the operator can see while sitting in the driver’s seat directly with the driver’s peripheral and indirectly with the use of the exterior mirrors.

On the following photo the areas seen directly and indirectly can be illustrated:
As the photo illustrates the driver’s peripheral vision provides approximately 30 degrees of view and the combined flat mirror and convex mirror provide approximately 30-35 degrees of view, leaving a blind area along the side of the truck of approximately 30-35 degrees. On the driver’s side of the vehicle this blind area can only be seen if the operator physically turns the head to look into the area before turning or making a lane change maneuver, taking the eyes off the road ahead risking the danger of oncoming traffic.

Taking the eyes off the road ahead can be extremely dangerous.

As stated in Loss Control, a handout presented by Scottsdale Insurance Company:

“A National Highway Transportation Safety Association study found drivers should limit their mirror and blind spot scanning to less than 2 seconds, ideally 1 second or less. Taking your eyes away from the forward roadway for more than 2 seconds greatly increases your crash risk.”

On the passenger side of the vehicle the operator does not have the opportunity to turn the head and look into the blind area because of the vehicle configuration, leaving the blind area blind while the turn or lane change is made.

Another factor affecting the driver in the lane change and turning maneuver is the location of the mirrors on the vehicle and the operator’s ability to make the maximum use of the view provided by the mirrors.

As stated above, the mirrors on the Step Van are typically located on the post between the door and small front window
on the side of the truck. Figure 3 illustrates that to see the mirrors on the passenger side of the vehicle the driver is required to focus on the small triangular window, find the mirrors and then assess what they are showing, again increasing the time the eyes are taken off the road ahead.

![Figure 3](image)

Another factor affecting the driver’s ability to gather the necessary information to safely drive the vehicle is the fact that the wide angle mirror used to expand the view of the area uses the single rate of curvature convex mirror. The single rate of curvature convex mirror has two physical characteristics that will always affect its usefulness as an exterior mirror:

1. The element of distortion

Single rate of curvature wide angle mirrors always will produce images that are smaller than they would appear if shown in the flat glass mirror. An illustration of this factor
can be shown by the following photo of a case type mirror containing both a flat glass and a single rate of curvature wide angle mirror:

Figure 4
The operator is left with making mental calculations as to where the car is actually located in relation to the vehicle being operated to know if there is enough time to make the lane change maneuver. The time this takes will vary from individual to individual and will affect the time the operator’s eyes are taken off the road ahead.

2. The second physical characteristic of the single rate of curvature convex mirror is that the view provided will always be cone-shaped starting at the face of the mirror and expanding the field of view as distance from the face of the mirror to a point where the ground is first shown in the mirror. This creates a blind spot along the side of the vehicle.
that starts at the face of the mirror which gets smaller towards the rear of the vehicle which we personally checked by finding a point on the ground towards the rear of the vehicle that is first shown in the mirrors. Three examples illustrate:

a. The Post office step van;

![Figure 5](image-url)
b. The FedEx Step Van;

c. The UPS Step Van
This blind spot poses a major danger for persons or objects close to the truck and are of a size that they are not shown to the operator, and causes much stationary object damage to the vehicle during turning maneuvers.

BACKING ACCIDENTS

The step-van is one vehicle where reversing accidents cause from 60% to 90% of the accidents. The driver does not have a view to the immediate rear of the truck because of lack of windows or cargo limitations. In order to limit the effect of rear motion accidents many companies simple prohibit backing the vehicle, only backing the vehicle with a spotter behind the vehicle, various electronic methods including sensors, and video cameras. Many companies also use a rear cross-view system where a mirror is placed on the rear of the truck. The system requires the driver to look into the side mirrors to see the cross-view mirror at the back of the truck and attempt to identify what is reflected such as persons or objects.

The Federal Government studied the mirror to mirror rear detection system in DOT-HS 810 865 on a 1996 Grumman-Olsen step van with a 12 foot box.

The rear-cross view mirror was a 10 inch standard one radius of curvature convex mirror, 200mm rate of curvature, located on the rear of the truck as shown in the following photo:
Looking at back of truck:
The mirror is viewed by the driver seeing the mirror in the side mirror on the trucks which view appears as follows

![Figure 10](image)

The object of the study was to review the mirror-to-mirror detection system based upon clarity of view, with the recognition of the distortion factor inherent in the single rate of curvature mirror technology discussed previously on page 5 and 6 of this report.

A magnified view of the images presented is shown in Figure 11 below. In reviewing the image remember there is a 1 year old child standing the viewing area of the mirror:
My personal observation was that the child could not be detected by the operator of the truck and the Federal Government agreed, leading to the Report’s conclusion:

“In summary, the quality of the rear cross-view mirror image is insufficient to allow drivers to resolve small objects behind the vehicle. It is very hard to impossible to see small children over much of blind zone behind the vehicle. Identifying larger children and adults is somewhat easier, although there are still concerns that the combination of high distortion plus much minification will reduce detection likelihood in certain portions of the blind zone. Precipitation accumulation on the surface of the mirror or darkness will obscure the driver’s view of images in the rear cross-view mirror.

Based on these concerns, the authors do not believe that rear cross-view mirrors are an effective means of allowing the driver to see behind the
vehicle. All of NHTSA’s human factors concerns for rearview video (which are currently being researched) also apply to rear cross-view mirrors.”

The important thing to remember with the cross-view mirror is that to accomplish the required view the rate of curvature is increased, which increases the distortion factor. A 200mm rate of curvature is such a severe rate of curvature that images produced are not of much use to the operator. The same effect can be seen in the front cross-over mirrors used on school buses.

ONE THING IS CERTAIN  BLIND SPOTS CAUSE ACCIDENTS

Figure 12

LEFT TURN ACCIDENTS HAVE CAUSED USPS TO ASK CUSTOMERS TO MOVE MAIL BOXES TO OTHER SIDE OF ROAD AND UPS DRIVERS ROUTES ARE SET UP SO NO LEFT TURNS ARE NECESSARY.
A VARIATION OF THE STEP-VAN IS THE LONG LIFE VEHICLE (LLV) or the FLEXIBLE FUEL VEHICLE (FFV) USED BY THE POST OFFICE

This is small version of the walk-in van that was designed specifically for the United States Post Office, which is currently in use in the US and Canada. The vehicle was designed to work on city streets from the curb where mail boxes are located. The driver actually sits on the right side of the vehicle for easy ingress and egress that does not require getting into and out of the vehicle on the left side into oncoming traffic. The dimensions of vehicle are 15 feet long, 7 feet high and 6 feet wide.

The vehicle main mirrors are as described above a 6.5 by 10 flat glass and a 6.5 by 6 inch convex mirror on each side of the vehicle. The critical areas for the driver to see clearly are the left side of the vehicle and because the vehicle has no rear window the back of the truck. Various attempts have been made to provide the driver with vision aids for these 2 areas by placing 2 convex mirrors on the front of the vehicle, one directed along the side of the vehicle and one directed across the front of the vehicle. On the rear of the truck a large convex mirror is placed for the driver to view by looking into the door mirrors to see the rear of the truck.

The following photos illustrate the vehicle and mirroring:
The discussion above regarding the bigger step-van (the LLV is 6 feet wide and the bigger step-vans are about 7.5 feet wide) are equally applicable here.

A major distinction of the LLV is that the driver is on the right side of the truck. This is because the truck is consistently pulling up to mail boxes etc. and having the driver on the curb side of the vehicle makes for safer ingress and egress from the truck, without continually facing road traffic every time a stop is made. This safety feature for the operator becomes one of the major causes of accidents, because when the operator has concluded his/her functions at the stop they are required to move their vehicle out into on-coming traffic and they must perform this task from the opposite side of the truck. Post Office vehicles also have a difficult time with left turn accidents because the driver sits on the right side of traffic.

THE EXTERIOR MIRRORS ON THE LLV

The mirrors on the left side of the truck have to be viewed through the small triangular window on the left side of the vehicle.
Figure 15 illustrates the driver’s view of the side mirrors on the opposite side of the LLV.

The lower convex mirror is a single rate of curvature wide angle mirror. Such a mirror will always produce images that are smaller in size and provide the operator with difficulty as to the location of oncoming traffic. Further, while the driver is moving the vehicle ahead, the location of the mirrors requires the operator to take the eyes off the road ahead while moving the vehicle.

The side mirrors located, in this area also pose a blind spot problem by the mirrors themselves. This could cause problems with left turns unless the driver uses a bob and weave.
approach to make certain nothing is behind the mirrors, another argument for moving the mirrors ahead of the windshield.

To complete its mirror system the USPS has also included an 8 inch convex mirror on the passenger side of the LLV on the front of the vehicle which provides a view along the side of the vehicle. The nose of the LLV makes this a good location for a mirror, but we want to remember the distortion factor inherent in the single rate of curvature convex mirror. Objects are always smaller in size that they are in real time requiring the operator to make mental judgments as to where the vehicle or object is before deciding it is safe to make a decision. Another 8 inch convex is used to view the front area of the vehicle and a larger convex is placed on the rear of the vehicle leaving the driver with a mirror-to-mirror view of the rear of the vehicle for backing.

Backing the vehicle is a serious cause of accidents for the USPS leading to Safety statements such as found in Postal Bulletin 22214

“Next time you are on your route and need to decide whether or not to back up, consider the following:

- All backing accidents are preventable. Postal Service employees average about 10 backing accidents a delivery day. And here’s the worst part — some involve children.
- Through the end of Quarter 3, 2007, the Postal Service has experienced 2,222 motor vehicle accidents caused by vehicles backing up. You don’t have to be a math wizard to know that’s way too many.”
And can lead to serious consequences for the driver:

“All Backing Accidents are chargeable/at fault accidents to the driver. They are indefensible!!!”

(Eastern Area Guide to Prevent Backing Accidents)

**VISIBILITY SOLUTIONS  FOR WALK-IN/STEP VANS AND THE LLV OR FFV VEHICLE**

1. The preferred location of the driving mirrors should be on the vehicle as suggested by the Liberty Mutual Insurance Loss Prevention Note on Mirrors for Walk-In Vans and Medium Straight Trucks;

   “Locate the mirrors on a line parallel to the windshield and up to 18 inches (maximum) forward of the driver.

   The centerline of the mirrors should be at eye level”. Positioning the driving mirrors in this location allows the operator to maintain the eyes on the road ahead while at the same time and obtain all necessary information on the proximity area of the vehicle with just a glance, keeping in mind the National Highway Traffic Safety Administration recommendation for ideally a 1 second or less for scanning noted on page 4 of this paper.

2. The mirrors placed on the vehicle should be distortion free so the operator can take immediate action on what is being seen.
We have noted in this paper that all wide angle mirrors being made available by mirror manufacturers use the single radius of curvature mirror technology which always will produce a smaller image (distortion).

To overcome the distortion problem at M-C North America Inc. we have developed a multi-radius mirror technology (US Patent NO. 8,172,411). This M-C mirror technology is composed of a number of different radii of curvature in the same piece of glass to develop the overall rate of curvature of the mirror, which allows us to control the size of the image presented, thus eliminating the distortion factor. We can provide a wider field of view and eliminate the distortion factor, so the images are presented with the necessary clarity that allows the operator to use the information necessary to take what action is appropriate. This multi-radius glass allows us to produce a multi-radius mirror where a larger flatter area can be surrounded with wider angle glass to obtain a view up, down, or out, depending upon what is required and this view can be incorporated in a single piece of glass seamlessly. Such a mirror cannot be made with the single rate of curvature glass because the distortion factor of the glass would be too distracting when fused with a flat glass.

For the standard size Step vans and the USPS LLV We would recommend our 6 ¾ by 8 inch multi-radius mirror that would replace the 6.5 by 6 inch convex mirror now in use.
Figure 16 shows a comparison of the existing mirror on the LLV and other step-vans, along side a photo of the M-C Mirror in place of the existing convex mirror. In the two pictures note in the M-C mirror the size of the background buildings as opposed to the size of the buildings with the regular convex. This illustrates the lack of minification of objects which leads to less distortion there by allowing the operator to use the information presented when making decisions.

This mirror could be immediately retroed on any existing fleet, and would provide the operator with a clear view of the entire
side of the vehicle and out from the side approximately 1 ½ lanes to ensure a safe leave from the curb into oncoming traffic. The same mirror would produce the desired results on the larger step-vans and would be easily retroed on such vehicles, and would be even better if the mirrors were located to the front of the windshield.

The convex mirrors placed on the front of the LLV. As noted earlier the USPS places an 8 inch convex mirror on the front of the LLV facing down the side of the truck. Many operators inform us that this is one of the mirrors they use constantly. It is important to note that this mirror is more in line with our recommendation as to where driving mirrors should be located because they can be viewed with just a glance while maintaining the eyes on the road ahead. The critical importance here is that the mirror must present images with clarity so the operator can react to what is seen immediately.

When the M-C Glass replaces the 8 inch convex mirror the result is as shown in Figure 16:
The clarity of view and field of view would allow this mirror to function as a driving mirror. Since the mirror also provides a view along the entire side of the truck the convex glass on the side of the door could be removed.

The rear of the LLV

Here the USPS continues to use the large convex mirror on the back of the vehicle which provides a view as follows:

Figure 17

For the rear of the vehicle, we believe as the European Union has now concluded and the National Highway Traffic
Administration has concluded, that a mirror to mirror solution is not the answer. Here we would recommend our video camera that produces an image with lines to aid in backing the vehicle. When backing is such a large proportion of the USPS accidents payback for a good video camera on each vehicle could result in the saving of maybe one accident.

Conclusion: With our M-C Mirror technology we have the ability to analyze any piece of equipment and to develop a solution for that specific piece of equipment. We do not just sell mirrors at M-C North America Inc. we sell solutions.

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