

NATIONAL TRANSPORTATION SAFETY BOARD

Office of Research and Engineering
Materials Laboratory Division
Washington, D.C. 20594



April 1, 2011

MATERIALS LABORATORY FACTUAL REPORT

Report No. 11-034

A. INVESTIGATION INFORMATION

Place : New York, New York
Date : March 12, 2011
Vehicle : 1999 Prevost H3-45 56-Passenger Motorcoach
NTSB No. : HWY11MH005
Investigator : Jennifer L. Morrison, HS-20

B. COMPONENTS EXAMINED

1999 Prevost H3-45 Motorcoach, 2007 Freightliner CL12 tractor, and a 2010 Hyundai Translead VC2480152-AJRS van trailer.

C. DETAILS OF THE EXAMINATION

A focused examination of the motorcoach and combination tractor/trailer was conducted on March 16 and 17, 2011. The examination focused on dimensional measurements and documentation of features on the left (driver's) side and left front portion of the bus, the right (passenger's) side of the tractor, and the right and rear sides of the trailer. Examination of the tractor/trailer was completed on March 16, 2011 at the New York State Police Troop L headquarters in East Farmingdale, New York. An overall view of the tractor/trailer is shown in figure 1. The examination began late in the morning shortly after a rainfall. Examination of the motorcoach was completed on March 17, 2011 at the New York State Police Troop K headquarters in Salt Point, New York. In addition, another investigator from the NTSB Office of Research and Engineering provided additional measurements of features on the left side of an exemplar 2001 Prevost H3-45 motorcoach.

1. Tractor Examination

A view looking along the side of the tractor is shown in figure 2. On the right side of the tractor, the side-view mirror mounted to the door extended the furthest from the centerline of the tractor. The outer edge of the mirror was 57.8 inches from the tractor centerline. The handle on the muffler was the next furthest out at approximately 53 inches from the centerline. The outer edge of the lower step was 50.3 inches from the centerline. As shown in figure 2, the lower edge of the side-view mirror was located 76 inches above the ground, and the upper edge of the side-view mirror was located 100.5 inches above the ground.

Additional views of the right rear-view mirror are shown in figure 3. Multiple scrape marks were observed on the outer edge of the rear view mirror. One mark approximately 8 inches above the lower end of the mirror extended around the mirror housing, had a consistent width, and appeared deeper around the curved edges of the mirror housing consistent with contact with an object wrapped tightly around the mirror. Other marks were generally less prominent and more varied and irregular consistent with sliding contact. The mirror was black in color, but a light green color was observed in the area of the sliding contact marks including areas near the top of the mirror shown in the lower right photo in figure 3.

A black mark measuring 22 inches long was observed on the fender above the right front wheel as shown in figure 4. The black mark was located between 47 and 48 inches above the ground.

Sliding contact marks were observed on the right side of the front bumper. The marks were located between 22.5 inches and 32.5 inches from the ground. The marks were oriented in varying angles relative to the horizontal plane and some intersected each other. The marks on the right side of the bumper were continuous around to the front face of the bumper.

2. Trailer Examination

Views of the right rear side of the trailer are shown in figures 6 and 7. The trailer had an underride guard located 20.4 inches above the ground. The horizontal piece of the guard was 4.1 inches high. The trailer was wider than the underride guard. The right side of the underride guard was 3.9 inches inboard of the right side of the trailer as shown in figure 6. The underride guard was not painted. A red and white reflective adhesive strip was attached to the rear face.

The trailer had 2 stringers per side that ran longitudinally along the right and left sides of the trailer. The stringers had a semi-hexagon shape and extended 1.5 inches out from the side of the trailer (see figure 8). The lower corner of the lower stringer was located 65.8 inches above the ground as shown in figures 6 and 7. The lower corner of the upper stringer was located 139.9 inches above the ground. The vertical face of each stringer was 1.4 inches wide.

Dashed lines in figure 7 indicate the approximate height from the ground corresponding to the upper and lower surfaces of a left side-view mirror on a 1999 Prevost H3-45 motorcoach. No evidence of sliding contact, metal transfer, or paint transfer was observed during a close visual inspection of the area between the dashed lines in figure 7, including the surfaces of the longitudinal stringer as shown in figure 8.

At the rear of the trailer, the rear face of the rear door frame was in line with the vertical plane of the rear face of the underride guard up to 63 inches above the ground as shown in figure 7. The rear face of the rear door frame angled forward above 63 inches from the ground, and above 65.3 inches from the ground, the rear face was 2.3 inches forward of the rear face at the lower portion of the frame.

An oblique view of the right rear corner of the trailer is shown in figure 9. An unlabeled bracket in figure 9 indicates the approximate height from the ground corresponding to a side-view mirror support arm and bracket on a 1999 Prevost H3-45 motorcoach. No evidence of sliding contact, metal transfer, or paint transfer was observed during a close visual inspection of the corner in the vicinity of the unlabeled bracket shown in figure 9.

3. Motorcoach Examination

An overall view of the right and front sides of the accident motorcoach is shown in figure 10. The motorcoach was painted black. Letters and graphics on the side of the motorcoach were decals applied to the surface. Colors of the decals included orange, yellow, light blue, dark blue, green, white, black, and red.

During initial stages of the examination on March 17, 2011, the motorcoach was mounted on jackstands to facilitate examination of the undercarriage by other investigators. At the time of the examination, the air-ride suspension for the motorcoach was depressurized, and when the motorcoach was removed from the jackstands, the motorcoach was closer to the ground than would be expected for normal highway operation. Next, air pressure was applied to the air suspension system to inflate the air springs. However, the suspension raised the front end higher than normal, and the abnormal height was attributed to accident damage to the front suspension. As a result, measurements from the ground to the features on the accident motorcoach were not considered representative of normal operation. To obtain measurements of features with the suspension at a normal level, features on an exemplar 2001 Prevost H3-45 motorcoach were measured by another NTSB investigator on March 18, 2011.

Results of measurements from the ground up to a corner on the front bumper and to a point on the left side-view support arm are shown in table 1 for the accident motorcoach before and after air pressure was applied to the suspension and for the exemplar motorcoach. It is noted that the difference between the height of the side-view mirror support arm and the corner of the front bumper is 2.3 to 2.4 inches greater for the accident motorcoach than for the exemplar motorcoach. On the accident motorcoach, the right side of the front bumper was damaged, and the bumper appeared displaced slightly downward across the front of the motorcoach.

Views looking along the left side and along the front of the motorcoach are shown in figures 11 and 12. The photograph in figure 11 was taken with the motorcoach on jackstands, and the photo in figure 12 was taken after air was applied to the suspension system. As indicated in figures 12 and 13, the left side-view mirror was attached to a support arm that was connected to a support bracket attached to the front side of the bus.

Table 1. Features Measured from the Ground

| Component | Distance from ground (inches) | | |
|--|--------------------------------|-------------------------------|-------------------------------------|
| | Accident motorcoach before air | Accident motorcoach after air | Exemplar motorcoach normal position |
| Corner on front bumper | 16 | 21.1 | 19.5 |
| Bottom of side-view mirror support arm | 58.3 | 63.5 | 59.5 |

On the left side of the motorcoach, the side-view mirror was the feature that extended the farthest from the plane of the left side of the motorcoach. The left side-view mirror housing extended up to 9 inches outboard from the plane of the driver's side window. (On the exemplar motorcoach, the left side-view mirror extended up to 10.5 inches outboard from the plane of the driver's side window.). As indicated in figure 11, the 2-part mirror was 17.3 inches high, and the lower surface of the mirror was 2.8 inches above the lower surface of the support arm. The lower surface of the support arm at the point intersecting the axis of the mirror attachment hardware was measured on the exemplar motorcoach, and as indicated in figure 11 was 59.5 inches above the ground.

At the front of the bus, the bumper and the side-view mirror support arm and bracket extended outward from the front face. The rear edge of the driver's side panel, located 30 inches forward of the center of the front wheel, was used as a vertical reference line for measurements of the relative lengthwise positions of these components. The left corner of the front bumper was located 41.8 inches from the rear edge of the driver's side panel. The left side of the front bumper was aligned with the plane of the left side of the motorcoach.

The front faces of the support arm and support bracket were 40.8 inches from the rear edge of the driver's side panel. At the bracket end of the support arm, the axis of the attachment hardware between the support arm and the bracket was located 3.5 inches inward from the plane of the left side of the motorcoach. The lower side of the support bracket was 1.5 inches lower than the support arm lower surface that measured 59.5 inches from the ground on the exemplar motorcoach, and the difference of 58 inches from the ground to the lower surface of the support bracket is indicated in figure 12. At the mirror-end of the support arm, the axis of the mirror attachment hardware was located 30 inches from the rear edge of the driver's side panel and 5 inches outward from the plane of the left side of the motorcoach.

A close view of the left side-view mirror, support arm, and bracket are shown in figure 13. The support bracket and the support arm were painted black and showed no evidence of marks or missing paint on the bracket or on the support arm above the support bracket. As shown in figure 14, multiple contact marks were present on the

outboard face of the support arm with missing paint and primer layers at a location closer to the mirror end of the support arm. The marks included a number of regularly-spaced parallel lines with heavier marks near the upper and lower corners of the support arm. A similar pattern was observed on the inboard face of the support arm as shown in figure 15.

Contact marks with missing paint layers were observed on the side of the motorcoach in the vicinity of the left side-view mirror. Several of the marks are shown in figure 16 labeled A and B. The marks labeled A in figure 16 corresponded to the position of the inboard edge of the side view mirror housing with the support arm rotated inboard. Similar marks (not shown) were also observed closer to the top of the mirror. As shown in figure 16, mark B was located inboard of the area of regularly-spaced marks on the side-view mirror support arm at a height near the top surface of the support arm. A closer view mark B is shown in figure 17. The mark did not correspond to contact with any feature on the motorcoach at the time of the examination.

A close view of the inboard edge of the front face of the left side-view mirror is shown in figure 18. A vertical crack was observed on the inboard side of the mirror housing. White deposits were observed at higher concentrations along the edges of the crack and in the crack opening, particularly near the lower end of the crack as shown in the detail in figure 18. The mirror face of the left side-view mirror had a spall fracture at the lower inboard edge as indicated in figure 19. A horizontal crack was also observed at the lower inboard edge of the mirror housing as shown in figure 19. The location of the horizontal crack corresponded to the location of the lowest contact mark among the marks labeled A in figure 16.

The outboard edge of the lower part of the left side-view mirror as viewed looking transverse to the length of the motorcoach is shown in figure 20. The outboard edge of the left side-view mirror showed multiple sliding contact marks along its front and outboard face as shown in figures 20 and 21. The corner between the front and outboard faces was missing paint in the area indicated by a bracket in figure 20. The area corresponded to the location where the mirror extended furthest from the plane of the side of the motorcoach. Multiple sliding contact marks were observed within and above the region indicated by the bracket in figure 20. These sliding contact marks were deepest on the front face at the corner between the front and outboard edges.

Another sliding mark was observed at the lower corner of the left side-view mirror below the bracket shown in figure 20. A close view of the sliding contact mark at the lower corner of the left side-view mirror is shown in figure 21. At the corner between the front and outboard faces of the mirror, the mark was approximately 1 inch wide, and material appeared to be rolled over the front edge of the corner. On the forward face, the mark was approximately 1.3 inches long in the transverse direction and was approximately parallel to the ground. On the outboard face, the mark extended across approximately 2/3 of the face in the longitudinal direction.

The tape measure in figure 21 shows the distance from the ground on the accident motorcoach after air pressure had been applied to the suspension system. However, the left side-view mirror on the exemplar motorcoach with the suspension at the normal operating condition was 4 inches lower than the accident motorcoach with the damaged suspension system. Based on measurements on the exemplar motorcoach, the position of the sliding contact mark shown in figure 21 is expected to be approximately 63 to 64 inches from the ground under normal operating conditions.

In figure 22, the lower portion of the left side-view mirror is shown from a view looking forward along the left side of the motorcoach. The broken driver's-side window is shown reflected in the mirror. As in figure 21, the ruler shown in figure 22 shows the distance from the ground after air pressure had been applied to the suspension system. A bracket in figure 22 indicates the approximate location of the sliding contact mark on the lower outboard corner of the mirror. The outboard edge of the side-view mirror was curved as shown in figure 22, and the height at which the outboard edge was furthest from the side of the bus was 73 inches from the ground in the accident motorcoach with air pressure on the suspension, a height that would correspond to 69 inches on the exemplar motorcoach.

A close view of the left side of the front bumper of the motorcoach at the lower front corner is shown in figure 23. The left side of the bumper adjacent to the corner showed a sliding contact mark with white paint transfer on the surface.

Green-colored decals were included in the image of the world on the left side of the motorcoach (see figure 10). The top of the world was approximately 6.5 inches below the lower edge of the passenger windows. As measured on the exemplar motorcoach, the lower edge of the passenger windows was located 90.5 inches above the ground. The green decals in the upper half of the world were examined and showed no evidence of longitudinally-oriented sliding contact marks.

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Figure 1. Overall view of the tractor/trailer at the state police Troop L headquarters. Photo was taken by an NTSB investigator on March 13, 2011.

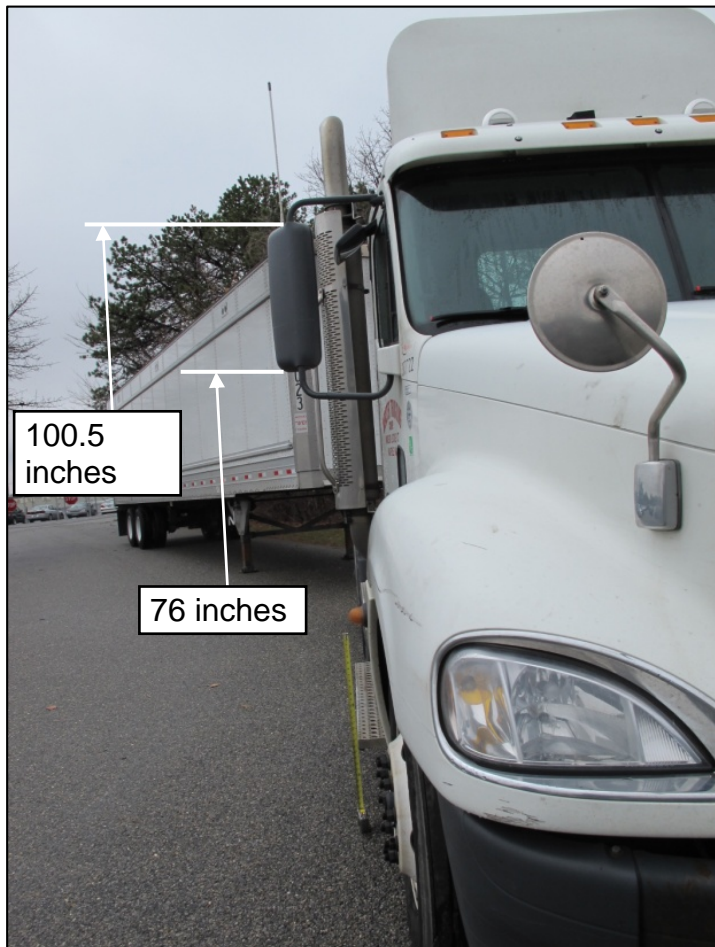


Figure 2. View along the right side of the tractor looking toward the rear. Measurements from the ground up to the top and bottom edges of the side-view mirror are indicated.



Figure 3. Oblique view of the right side of the tractor (top left photo) with additional closer views of the side-view mirror (upper and lower right photos).



Figure 4. Black mark on the fender above the right front wheel of the tractor.



Figure 5. View of sliding contact marks on the right side of the front bumper of the tractor.

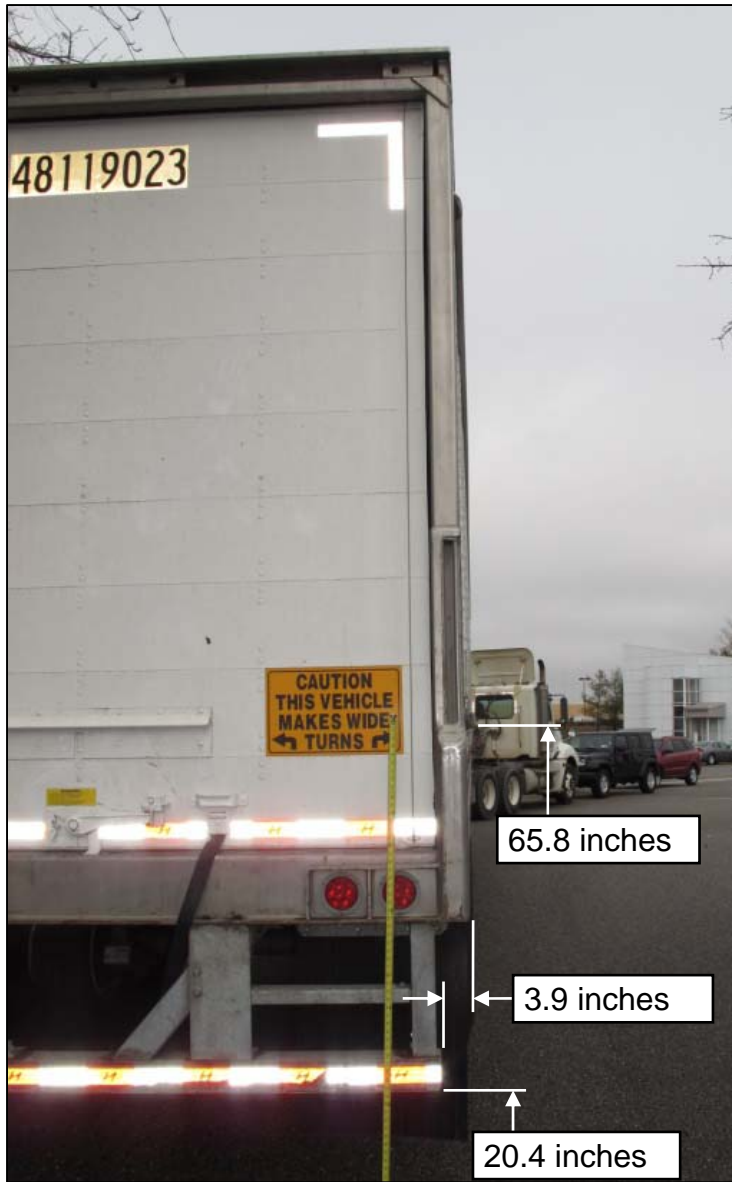


Figure 6. View looking forward along the right side of the trailer. Distances from the ground up to the lower surface of the underride guard and the lower corner of the longitudinal stringer are indicated. The side of the trailer extended 3.9 inches beyond the underride guard as indicated.



Figure 7. View of the lower rear end of the trailer. Distances from the ground up to a corner feature on the rear face and to the lower corner of the longitudinal stringer are indicated. Dashed lined indicate approximate height corresponding to the upper and lower surfaces of a left side-view mirror on a 1999 Prevost H3-45 motorcoach.

Figure 8. Oblique view of the rear end of the lower stringer on the right side of the trailer.



Figure 9. Oblique view of the right rear corner of the trailer. An unlabeled bracket indicates the approximate height corresponding to a side-view mirror support arm and bracket on a 1999 Prevost H3-45 motorcoach.



Figure 10. Overall view of the accident motorcoach at the state police Troop K headquarters. Photo was taken by an NTSB investigator on March 13, 2011.



Figure 11. View looking along the left side of the motorcoach toward the rear while the motorcoach was on jackstands. The indicated distance of 59.5 inches from the ground to the bottom of the side-view mirror support arm is as measured on an exemplar Prevost H3-45 motorcoach.

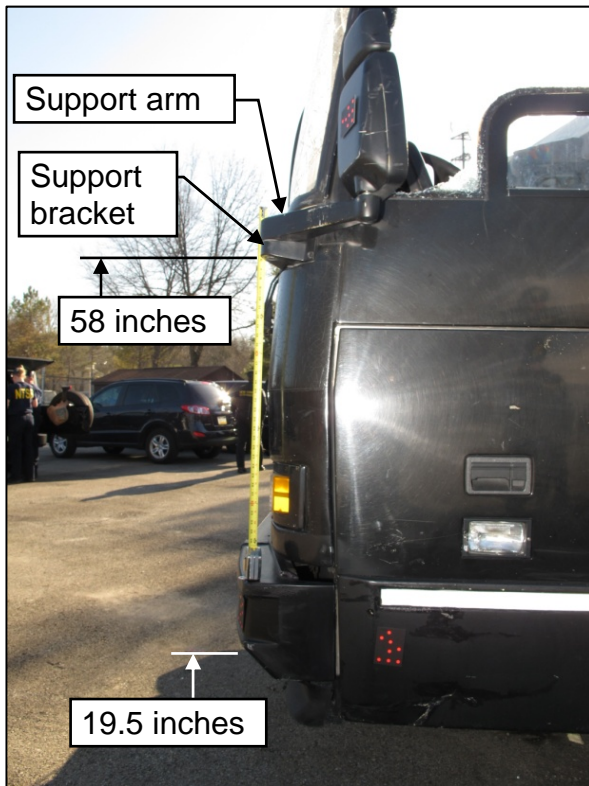


Figure 12. Side view looking toward the right along the front of the bus. Distances from the ground to the point on the front bumper and to the lower surface of the side-view mirror support bracket are as measured from an exemplar Prevost H3-45 motorcoach.

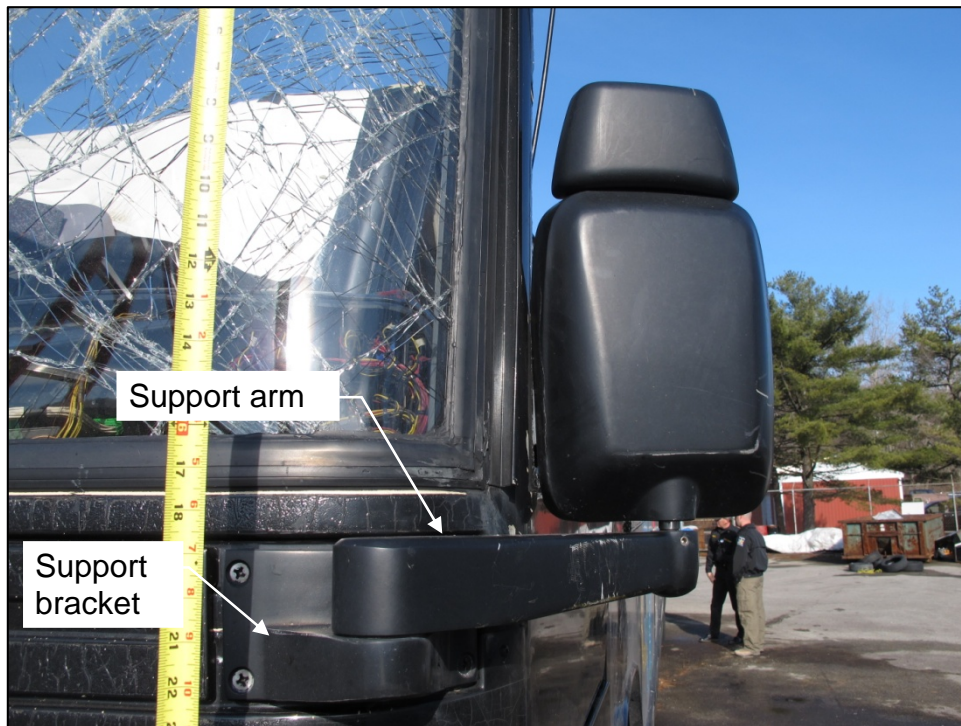


Figure 13. Close view of the left side-view mirror, support arm, and bracket.



Figure 14. View of the outboard face of the left side-view mirror support arm.



Figure 15. View of the inboard face of the left side-view mirror support arm.

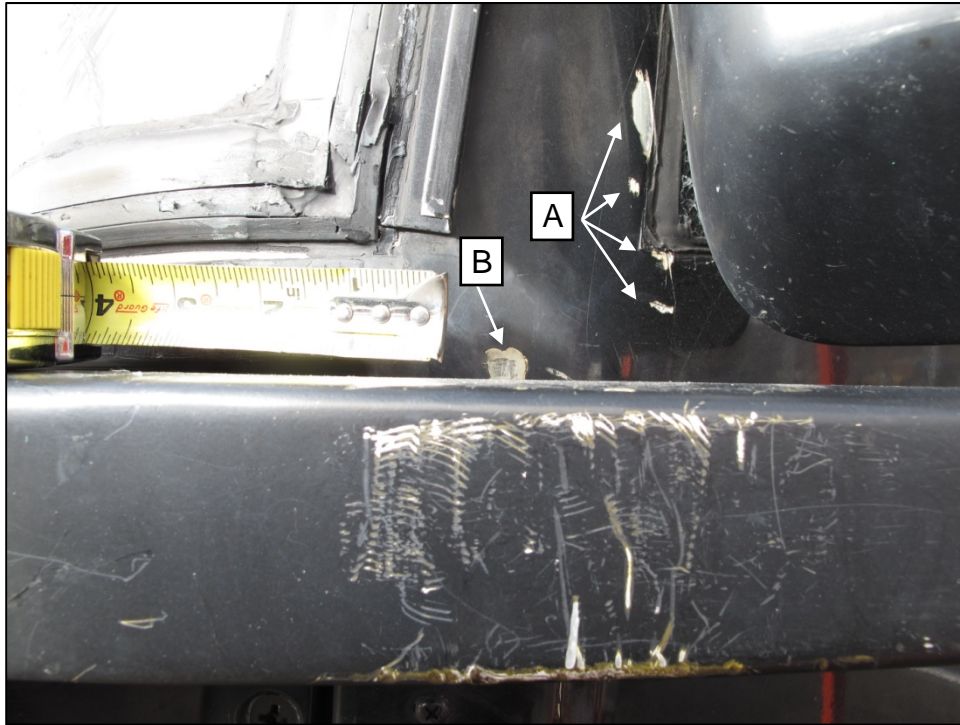


Figure 16. Areas of contact damage on the side of the motorcoach in the vicinity of the left side-view mirror.



Figure 17. Closer view of contact damage labeled B in figure 16.

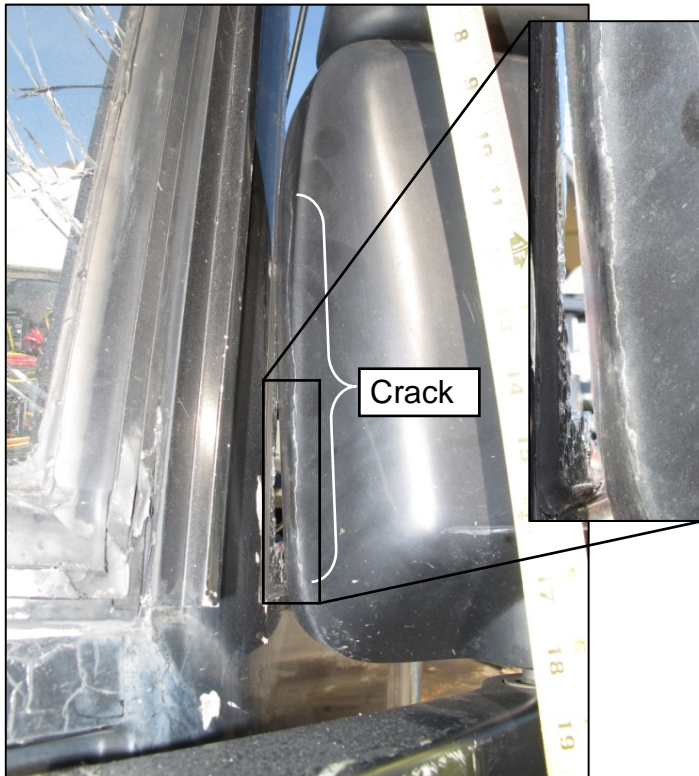


Figure 18. Close view of the inboard side of the left side-view mirror viewed looking rearward where a vertical crack was observed in the mirror housing as indicated. The detail view shows a closer view of the lower end of the crack with accumulated white deposits along the crack surfaces.

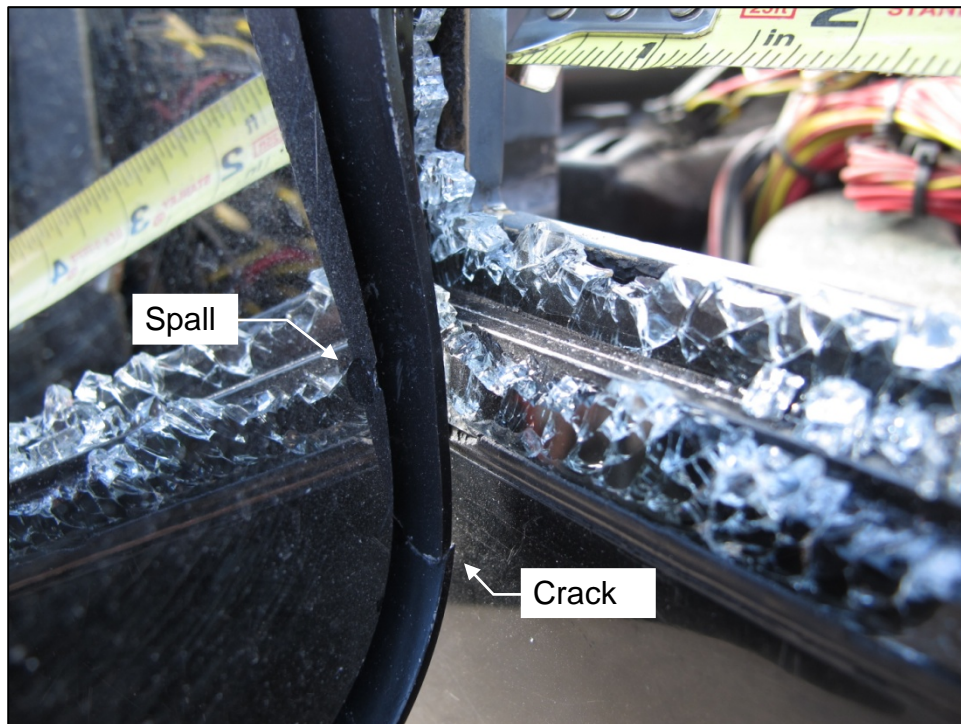


Figure 19. Close view of the inboard lower edge of the left side-view mirror viewed looking forward showing a horizontal crack in the housing and a spall crack at the edge of the mirror.



Figure 20. Left side-view mirror as viewed looking transverse to the length of the motorcoach. An unlabeled bracket indicates where paint was missing at the corner between the front and outboard faces.



Figure 21. Close view of sliding contact marks at the lower corner of the outboard edge of the left side-view mirror.



Figure 22. View showing curvature of the outboard edge of the left side-view mirror as viewed looking forward. The measure at right shows height from the ground after air pressure was applied to the suspension, heights that are approximately 4 inches higher than the exemplar motorcoach.



Figure 23. Close view of a sliding contact mark at the left corner of the front bumper showing white paint transfer. On an exemplar motorcoach, the location at the end of the tape measure was 19.5 inches above the ground.