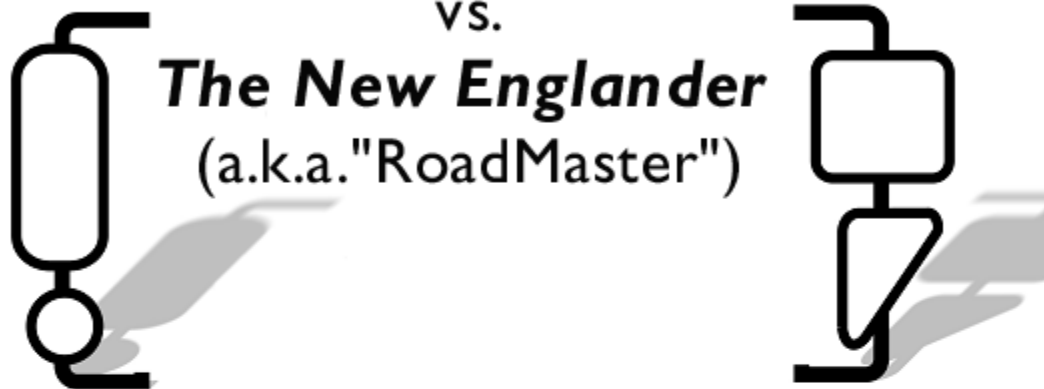


West Coast Style Mirrors

vs.



The New Englander
(a.k.a. "RoadMaster")

An Operational Test Report

October 9, 2001

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October 9, 2001

Mr. Harold Campbell
Transportation Director
Sheridan County School District No. 2
1514 Brundage Lane
Sheridan, WY 82801

Dear Mr. Campbell,

I have completed the operational evaluation of the "West Coast Style" v/s "RoadMaster" mirror assemblies. A completed test report is attached.

If additional copies of the report are desired please let me know.

Respectively submitted,

Stan Woinoski

BACKGROUND:

In August 2001 the 1995 72 Passenger Thomas Saf-T-Liner School bus that I operate on a daily basis was retrofitted with Mirror Lite Company New Englander™ style mirrors (also marketed by Mirror Lite as “RoadMaster™”). These mirrors replaced the West Coast Style original equipment mirrors that were factory installed when the bus was purchased new by the school district. I was tasked with evaluating the New Englander style mirrors. I chose to conduct an operational comparison evaluation test using two identical 1995 Thomas Saf-T-Liner School Buses. Bus #2 was equipped with the factory installed “west coast” style mirrors and Bus #12 was equipped with the retrofitted New Englander™ style mirrors.

THE TYPES OF MIRRORS:



West Coast Style

An upper rectangular shaped flat mirror approximately 6” X 16” and in this case accompanied by an 8” round convex spot mirror mounted directly below.



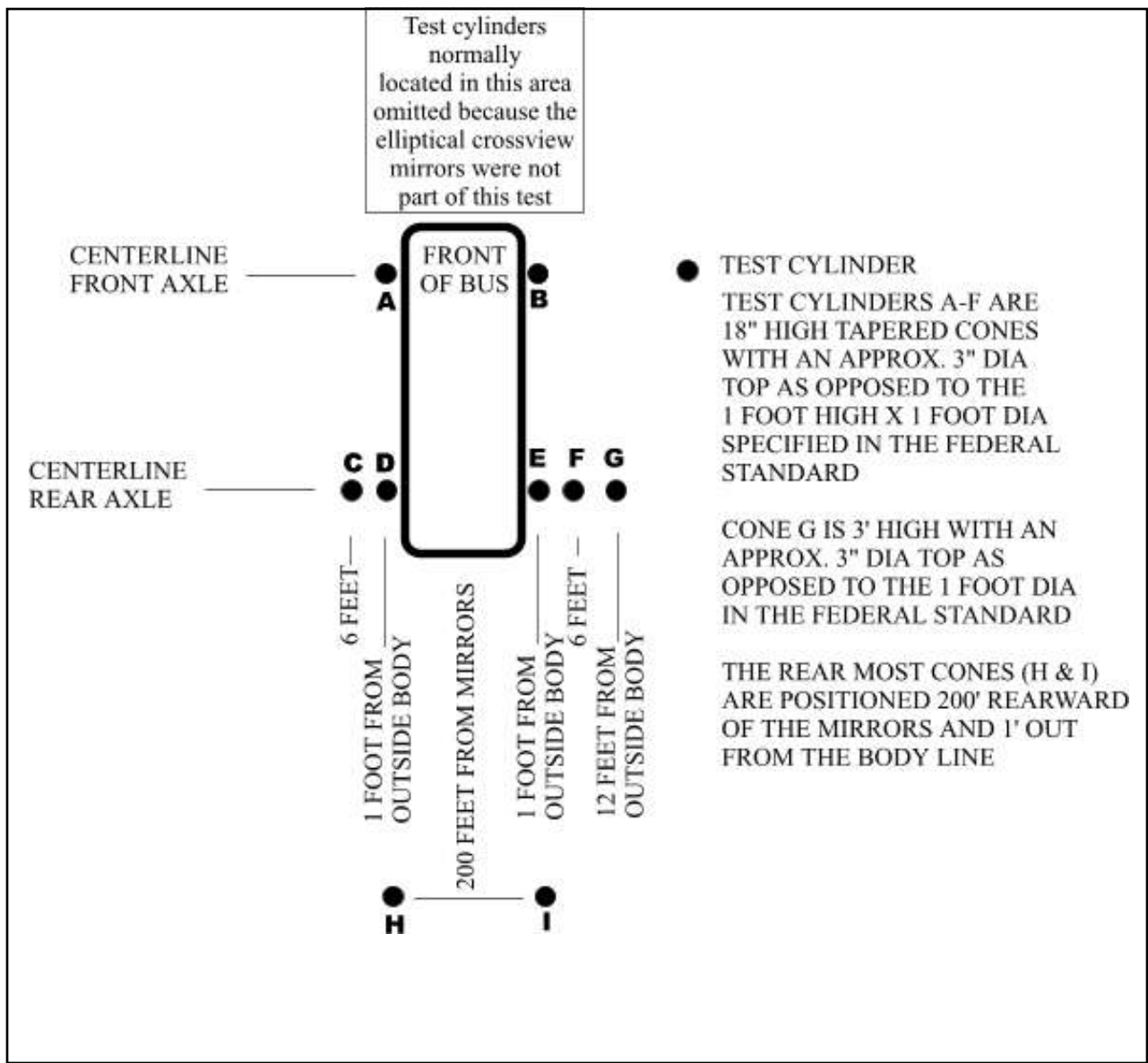
New Englander™ Style

An upper almost square shaped flat mirror with approximately 75 square inches of viewing surface and a “set and forget” convex lens that views 85 degrees out and 85 degrees down mounted below. Additional information about mirrors manufactured by the Mirror Lite Company can be viewed at: <http://www.solidwaste.com/storefronts/mirrorlite.html>

TYPE OF TESTS CONDUCTED:

Two types of tests were conducted. The first test consisted of comparing the ability of each style of mirror to meet the viewing areas required by Federal Motor Vehicle Standard 111. The second test was a non-scientific driver preference test.

THE FEDERAL MOTOR VEHICLE SAFETY STANDARD 111 (VERY ABBREVIATED): The entire federal standard can be viewed by clicking on FMVSS No. 111 at: <http://www.thomasbus.com/products/school/federal.asp>



In conducting this test the following steps were performed:

1. Adjust the driver's seat to the desired position.
2. Adjust the right-side flat driving mirror so that the tops of the side windows are visible in the upper edge of the mirror, and so that the right side of the bus body is visible in the inside edge of the right-side flat mirror.
3. Adjust the right-side convex driving mirror so that the view in the top of the convex mirror overlaps the view provided by the right-side flat driving mirror, and so that the right side of the bus body is visible in the inside edge of the right-side convex mirror.
4. Adjust the left-side flat driving mirror and the left-side convex driving mirror following the same procedures described for the right-side mirrors.
5. Make final adjustment to the mirror system so that the seated driver can view the areas required by Federal Motor Vehicle Safety Standard 111, including the top surface of cylinders/cones D & E as shown above and rearward a minimum of 200 feet to cylinders/cones H & I (measured from the mirror surface) using the outside rearview driving mirrors. The convex mirrors should be adjusted to provide the seated driver a view of the entire surface of any cylinder/cone A-G (when located as illustrated). Note that in the photos of exhibit 1 an additional cone, one not required in the federal standards, is located 12 feet outward from the left rear axle line.

RESULTS OF THE MIRROR SYSTEM TEST:

Photo exhibits 1 and 2 show the results of the test described above. Photo Exhibit 1 shows a side-by-side comparison between the two mirror types (west coast on left – New Englander on right) as viewed from the driver's seat and looking into the left side mirrors. Photo Exhibit 2 does the same for the right side mounted mirrors.

Photo Exhibit 1:

1. The glowing arrows point to cones referred to as cones A, C, D & H described in the diagram shown above
2. Note that required portions of the bus are visible in all four mirrors
3. Notice how a good portion of the 8" convex spot mirror shows nothing but bus while the 85 degree "fang" mirror gives an almost undistorted view of the side of the bus similar to the upper mirror

Photo Exhibit 2:

1. As in Photo exhibit 1 all required cones can be seen. In this case cones B, E, F, G & I of the diagram.
2. All required portions of the bus are visible in all four mirrors
3. Note the extra wide view in the upper square shaped mirror
4. Look at the clarity with which the 85 degree "fang" mirror shows the row of buses beyond the 12' cone

In my opinion a picture, or in this case four pictures, are worth thousands of words when the views between the two types of mirrors are studied in detail. For example, compare the view of the modular trailer in the two upper mirrors of photo exhibit 1 and then look at the tree and motel in the two lower mirrors. In photo exhibit 2 imagine that the row of buses seen in the lower mirrors were students instead of buses. Which mirror would you rather have?

The bottom line in test one is that both types of mirrors appear to pass the federal requirement test.

TEST TWO: The non-scientific user preference test.

To date I have driven bus #12 approximately 10,000 miles with "west coast" mirrors and 2,000 miles with "New Englander" style mirrors. This driving has consisted of rural and urban driving on the same bus route in various weather, lighting and road conditions with each of the mirror types. Every morning and afternoon I make backing turnarounds from narrow county roads onto private drives that have drop-offs on each shoulder leading down to culverts. I have found the 85 degree "fang" mirrors to be particularly helpful in accomplishing these turnarounds. The views in the lower portions of the 85 degree mirrors show the roadway and the area of the bus near the rear wheels much clearer and with less distortion than the 8" spot mirror. Note the difference in clarity of the road surface (and the leaves on the road) between the two types of mirrors in the two photo exhibits.

In my opinion the New Englander style mirror system is by far the better of the two mirror systems.

SUGGESTIONS:

1. The New Englander style mirrors installed on bus #12 were not of the remote control type. I believe that the right side upper flat mirror should be of the remote control type especially if mounted on buses that have multiple drivers. In conducting test one of this report I found it time consuming to get the right flat mirror adjusted "by myself" so that it would properly show the required areas. A remote controlled right side mirror could easily be adjusted while sitting in the drivers seat.

2. The New Englander style mirrors tested on bus #12 were of the heated type and I believe that if any mirrors of this type are purchased they should be of the heated type because of the local climate in which they would be used.
3. If other styles of mirrors are ever considered for purchase, such as the “one unit” type found on the new Blue Bird All-American bus, I offer the following: I find it convenient and safer to be able to glance between the upper and lower mirrors of the west coast/New Englander styles to see “what’s out there” than to move my body and head to see around the “one unit” mirror assemblies.
4. In my opinion the square style flat mirror and 85 degree (fang) complement one another. Where the view in the flat mirror ends at the bottom edge, the top of the 85 degree mirror takes over. Because of this complementary nature between the two mirrors I do not recommend ever mixing the square flat mirror with an 8” convex spot mirror. Also because of space limitations installing a 6” X 16” flat “west coast” style mirror in conjunction with a 85 degree (fang) mirror is not feasible.
5. The 85 degree (fang) mirror mounted on the right side of bus #12 (as shown on the bottom right side of photo exhibit 2) should be raised slightly to keep the lower tip of the fang from showing the backside of the elliptical crossview mirror. The black area under the 1’ glowing arrow is the reflection of the elliptical crossview mirror.

FINAL NOTE:

The photos in the two exhibits were not doctored in any way – only the background was removed to allow the mirrors and their images to stand out better. All four of the photos were taken from the drivers seat with the camera being held at eye level while in a driving position.



PHOTO EXHIBIT 1

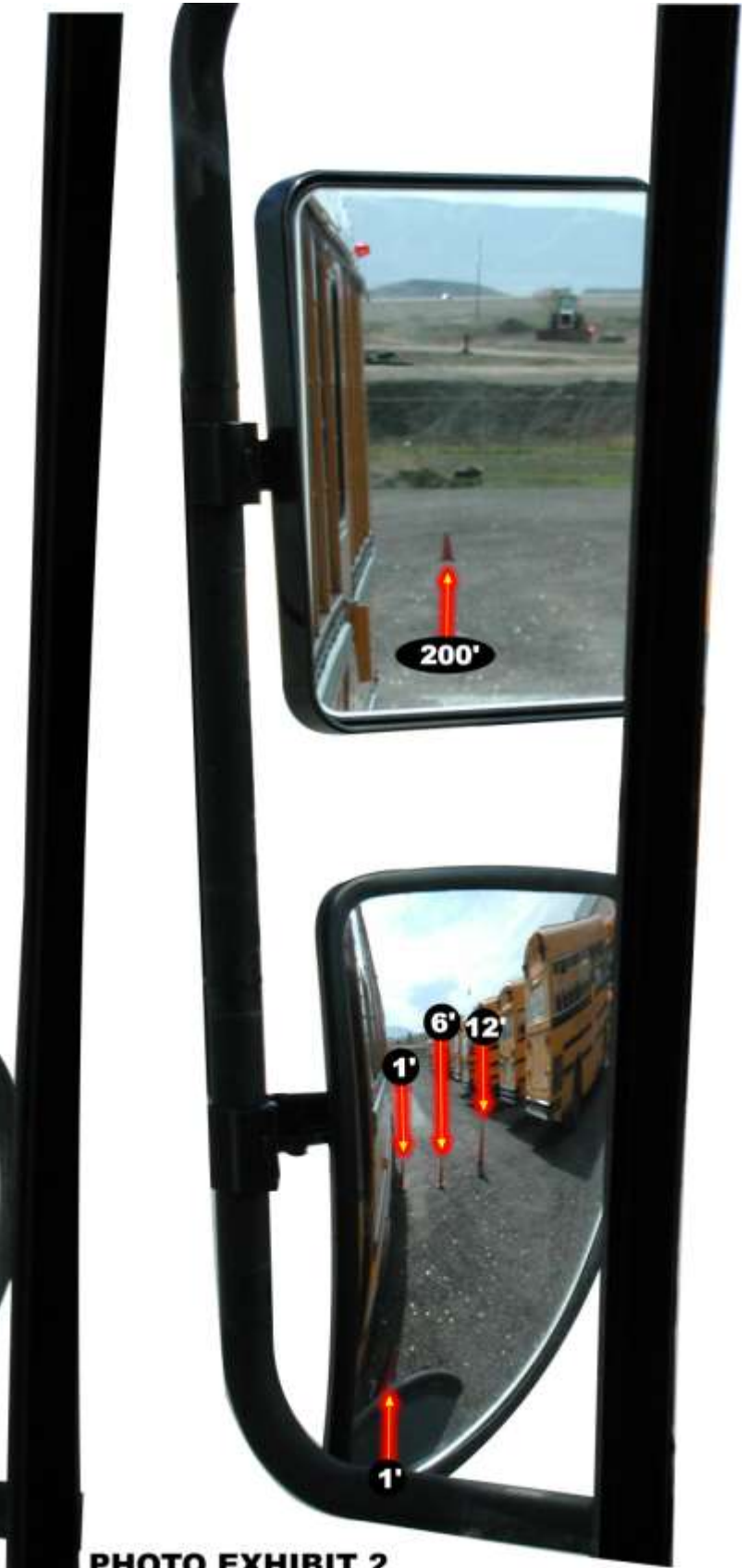


PHOTO EXHIBIT 2