

FEDERAL TRANSIT BUS TEST

Performed for the Federal Transit Administration U.S. DOT
In accordance with CFR 49, Volume 7, Part 665

Manufacturer: ARBOC Specialty Vehicles
Model: 3400 Liberty

Submitted for Testing in Service-Life Category
7 Year /200,000 Miles

AUGUST 2015

Report Number: LTI-BT-R1502

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Performed for the Federal Transit Administration U.S. DOT
1200 New Jersey Avenue, SE
Washington, DC 20590

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Manufacturer's address: 51165 Greenfield Parkway
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Quality Authorization

Director, Bus Research
and Testing Center

Title

8/20/15

Date

EXECUTIVE SUMMARY

ARBOC Specialty Vehicles submitted a model 3400 Liberty, diesel-powered 34 seat (including the driver) 35-foot bus, for a 7 yr./200,000 mile STURAA test. The odometer reading at the time of delivery was 547 miles. Testing started on January 30, 2015 and was completed on July 29, 2015. The Check-In section of the report provides a description of the bus and specifies its major components.

The primary part of the test program is the Structural Durability Test, which also provides the information for the Maintainability and Reliability results. The Structural Durability Test was started on February 16, 2015 and was completed on July 6, 2015.

The interior of the bus is configured with seating for 34 passengers including the driver. Note: this test bus is not designed to accommodate standing passengers; therefore, GVW and SLW are the same. At 150 lbs. per person, this load results in a measured gross vehicle weight of 23,970 lbs. The first segment of the Structural Durability Test was performed with the bus loaded to a GVW of 23,970 lbs. The middle segment was performed at a seated load weight of 23,970 lbs. and the final segment was performed at a curb weight of 18,930 lbs. Durability driving resulted in unscheduled maintenance and failures that involved a variety of subsystems. A description of failures, and a complete and detailed listing of scheduled and unscheduled maintenance are provided in the Maintainability section of this report.

Effective January 1, 2010 the Federal Transit Administration determined that the total number of simulated passengers used for loading all test vehicles will be based on the full complement of seats and free-floor space available for standing passengers (150 lbs. per passenger). The passenger loading used for dynamic testing will not be reduced in order to comply with Gross Axle Weight Ratings (GAWR's) or the Gross Vehicle Weight Ratings (GVWR's) declared by the manufacturer. Cases where the loading exceeds the GAWR and/or the GVWR will be noted accordingly. During the testing program, all test vehicles transported or operated over public roadways will be loaded to comply with the GAWR and GVWR specified by the manufacturer.

Accessibility, in general, was adequate, components covered in Section 1.3 (Repair and/or Replacement of Selected Subsystems) along with all other components encountered during testing, were found to be readily accessible and no restrictions were noted.

The Reliability section compiles failures that occurred during Structural Durability Testing. Breakdowns are classified according to subsystems. The data in this section are arranged so that those subsystems with more frequent problems are apparent. The problems are also listed by class as defined in Section 2. The test bus encountered no Class 1, 2 or 4 failures. All six reported failures were Class 3.

The Safety Test, (a double-lane change, obstacle avoidance test) was safely performed in both right-hand and left-hand directions up to a maximum test speed of 45 mph. The performance of the bus is illustrated by a speed vs. time plot. Acceleration and gradeability test data are provided in Section 4, Performance. The average time to obtain 50 mph was 26.53 seconds. Top speed obtained on the dynamometer was 63.5

mph. The Stopping Distance phase of the Brake Test was completed with the following results: for the Uniform High Friction Test average stopping distances were 29.51' at 20 mph, 61.26' at 30 mph, 106.95' at 40 mph and 137.92' at 45 mph. The average stopping distance for the Uniform Low Friction Test was 30.23'. There was no deviation from the test lane during the performance of the Stopping Distance phase. During the Stability phase of Brake Testing, the test bus experienced no deviation from the test lane during both approaches to the Split Friction Road surface. The Parking Brake phase was completed with the test bus maintaining the parked position for the full five minute period with no slip or roll observed in both the uphill and downhill positions.

The Shakedown Test produced a maximum final loaded deflection of 0.128 inches with a permanent set ranging between -0.004 to 0.004 inches under a distributed static load of 12,750 lbs. The Distortion Test was completed with all subsystems, doors and escape mechanisms operating properly. No water leakage was observed throughout the test. The handicap ramp was inoperable during the test. All other subsystems operated properly.

The test bus submitted for testing was not equipped with any type of tow eyes or tow hooks; therefore, the Static Towing Test was not performed. The Dynamic Towing Test was performed by means of a front-lift tow. The towing interface was accomplished using a hydraulic under-lift wrecker. The bus was towed without incident and no damage resulted from the test. The manufacturer does not recommend towing the bus from the rear; therefore, a rear test was not performed. The Jacking and Hoisting Tests were also performed without incident. The bus was found to be stable on the jack stands, and the minimum jacking clearance observed with a tire deflated was 4.6 inches.

A Fuel Economy Test was run on simulated central business district, arterial, and commuter courses. The results were 4.37 mpg, 4.99 mpg, and 8.71 mpg respectively; with an overall average of 5.32 mpg.

A series of Interior and Exterior Noise Tests was performed. These data are listed in Section 7.1 and 7.2 respectively.

The Emissions Test was performed. These results are available in Section 8 of this report.