

**PARTIAL
STURAA TEST
12 YEAR
500,000 MILE BUS
from
CHAMPION BUS INC.
MODEL LOW FLOOR SO304T2**

APRIL 1999

PTI-BT-R9903-03-99-P

PENNS^TATE



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* NOTE: Partial STURAA Testing was performed on this bus. Only those tests (contracted by the manufacturer) are included in this report. In order to remain consistent with the Time and Fee Schedule, the tests included in this report retain their original numbers and are not numbered sequentially.

EXECUTIVE SUMMARY

Champion Bus Inc. submitted a model Low Floor SO304T2, propane powered 20 seat/32-foot bus, for partial STURAA testing in the 12 yr/500,000 mile category. The Federal Transit Administration determined that the following test would be performed: 3. Safety, 4. Performance, 6. Fuel Economy, 7.1 Internal Noise and 7.2 External Noise. Testing started on February 22, 1999, and was completed on March 31, 1999. The Check-In Section of the report provides a description of the bus and specifies its major components.

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 49.09 seconds.

A Fuel Economy Test was run on simulated central business district, arterial, and commuter courses. The results were 3.00 mpg, 3.48 mpg, and 6.46 mpg respectively; with an overall average of 3.72 mpg.

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

ABBREVIATIONS

ABTC	- Altoona Bus Test Center
A/C	- air conditioner
ADB	- advance design bus
ATA-MC	- The Maintenance Council of the American Trucking Association
CBD	- central business district
CW	- curb weight (bus weight including maximum fuel, oil, and coolant; but without passengers or driver)
dB(A)	- decibels with reference to 0.0002 microbar as measured on the "A" scale
DIR	- test director
DR	- bus driver
EPA	- Environmental Protection Agency
FFS	- free floor space (floor area available to standees, excluding ingress/egress areas, area under seats, area occupied by feet of seated passengers, and the vestibule area)
GVL	- gross vehicle load (150 lb for every designed passenger seating position, for the driver, and for each 1.5 sq ft of free floor space)
GVW	- gross vehicle weight (curb weight plus gross vehicle load)
GVWR	- gross vehicle weight rating
MECH	- bus mechanic
mpg	- miles per gallon
mph	- miles per hour
PM	- Preventive maintenance
PSBRTF	- Penn State Bus Research and Testing Facility
PTI	- Pennsylvania Transportation Institute
rpm	- revolutions per minute
SAE	- Society of Automotive Engineers
SCH	- test scheduler
SEC	- secretary
SLW	- seated load weight (curb weight plus 150 lb for every designed passenger seating position and for the driver)
STURAA	- Surface Transportation and Uniform Relocation Assistance Act
TD	- test driver
TECH	- test technician
TM	- track manager
TP	- test personnel

TEST BUS CHECK-IN

I. OBJECTIVE

The objective of this task is to log in the NBM, assign a NBM number, complete the vehicle data form, and perform a safety check.

II. TEST DESCRIPTION

The test consists of assigning a NBM test number to the bus, cleaning the bus, completing the vehicle data form, obtaining any special information and tools from the manufacturer, determining a testing schedule, performing an initial safety check, and performing the manufacturer's recommended preventive maintenance. The bus manufacturer must certify that the bus meets all Federal regulations.

III. DISCUSSION

The check-in procedure is used to identify in detail the major components and configuration of the bus.

The test bus consists of a Champion Bus Inc.'s model Low Floor SO304T2. Power is provided by a propane fueled, Cummins B195-AA2-006 engine coupled to a Allison B300R transmission. The front door is equipped with a Braun Corp. model 21435A-12 handicap device located forward of the front axle, and a rear door forward of the rear axle.

The measured curb weight is 6,440 lb for the front axle and 17,360 lb for the rear axle. These combined weights provide a total measured curb weight of 23,800 lb. There are 20 seats including the driver and room for 17 standing passengers bringing the total passenger capacity to 37. Gross load is $150 \text{ lb} \times 37 = 5,550 \text{ lb}$. At full capacity, the measured gross vehicle weight is 29,180 lb. In order to avoid exceeding the GAWR of the rear axle(19,000 lb), all 17 standing passengers and 5 rear seated passengers were eliminated. The reduction from full capacity resulted in an adjusted measured gross vehicle weight of 26,000 lbs and was used for all dynamic testing.

VEHICLE DATA FORM

Bus Number: 9903	Arrival Date: 2-22-99
Bus Manufacturer: Champion Bus Inc.	Vehicle Identification Number (VIN): 4V2NN0596WC028549
Model Number: Low Floor SO304T2	Date: 2-22-99
Personnel: B.L. and S.C.	

WEIGHT:

Individual Wheel Reactions:

Weights (lb)	Front Axle		Middle Axle		Rear Axle	
	Right	Left	Right	Left	Right	Left
CW	2,060	4,380	N/A	N/A	9,400	7,960
SLW	2,110	5,000	N/A	N/A	10,200	8,690
GVW	2,770	5,470	N/A	N/A	11,160	9,780

Total Weight Details:

Weight (lb)	CW	SLW	GVW	GAWR
Front Axle	6,440	7,110	7,110	12,000
Middle Axle	N/A	N/A	N/A	N/A
Rear Axle	17,360	18,890	18,890	19,000
Total	23,800	26,000	26,000	GVWR: 31,000

Dimensions:

Length (ft/in)	31 / 11.5
Width (in)	97.0
Height (in)	122.75
Front Overhang (in)	86.13
Rear Overhang (in)	115.00
Wheel Base (in)	182.40
Wheel Track (in)	Front: 81.00
	Rear: 72.50

Bus Number: 9903	Date: 2-22-99
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CLEARANCES:

Lowest Point Outside Front Axle	Location: Front skid plate	Clearance(in): 11.2
Lowest Point Outside Rear Axle	Location: Muffler	Clearance(in): 8.2
Lowest Point between Axles	Location: Frame	Clearance(in): 11.1
Ground Clearance at the center (in)	11.1	
Front Approach Angle (deg)	11.3	
Rear Approach Angle (deg)	7.0	
Ramp Clearance Angle (deg)	8.0	
Aisle Width (in)	17.7	
Inside Standing Height at Center Aisle (ft)	79.6	

BODY DETAILS:

Body Structural Type	Monocoque		
Frame Material	Steel		
Body Material	Fiberglass and Aluminum		
Floor Material	Plywood		
Roof Material	Fiberglass		
Windows Type	<input checked="" type="checkbox"/> Fixed	<input type="checkbox"/> Movable	
Window Mfg./Model No.	HEHR / AS-3		
Number of Doors	<u>1</u> Front	<u>1</u> Rear	
Mfr. / Model No.	Vapor / NA		
Dimension of Each Door (in)	Front-39.2 x 79.5	Rear-75.5 x 42.0	
Passenger Seat Type	<input type="checkbox"/> Cantilever	<input checked="" type="checkbox"/> Pedestal	<input type="checkbox"/> Other (explain)
Mfr. / Model No.	Seats Inc. / NA		
Driver Seat Type	<input type="checkbox"/> Air	<input checked="" type="checkbox"/> Spring	<input type="checkbox"/> Other (explain)
Mfr. / Model No.	Seats Inc. / Magnum 100		
Number of Seats (including Driver)	20		

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BODY DETAILS (Contd..)

Free Floor Space (ft ²)	26.6				
Height of Each Step at Normal Position (in)	Front	1. 14.0	2. N/A	3. N/A	4. N/A
	Middle	1. N/A	2. N/A	3. N/A	4. N/A
	Rear	1. 15.0	2. N/A	3. N/A	4. N/A
Step Elevation Change - Kneeling (in)	10.2				

ENGINE

Type	<input type="checkbox"/> C.I.		<input type="checkbox"/> Alternate Fuel	
	<input checked="" type="checkbox"/> S.I.		<input type="checkbox"/> Other (explain)	
Mfr. / Model No.	Cummins / B195-AA2-006			
Location	<input type="checkbox"/> Front		<input checked="" type="checkbox"/> Rear	<input type="checkbox"/> Other (explain)
Fuel Type	<input type="checkbox"/> Gasoline		<input type="checkbox"/> CNG	<input type="checkbox"/> Methanol
	<input type="checkbox"/> Diesel		<input type="checkbox"/> LNG	<input checked="" type="checkbox"/> Other (Propane)
Fuel Tank Capacity (indicate units)	79 scf @ 215 psi.			
Fuel Induction Type	<input checked="" type="checkbox"/> Injected		<input type="checkbox"/> Carburetion	
Fuel Injector Mfr. / Model No.	Cummins / B195-AA2-006			
Throttle Body Mfr. / Model No.	N/A			
Fuel Pump Mfr. / Model No.	N/A			
Alternator (Generator) Mfr. / Model No.	Leece-Neville / 8R13013			
Maximum Rated Output (Volts / Amps)	14 / 200			
Air Compressor Mfr. / Model No.	Holset / QE338B			
Maximum Capacity (ft ³ / min)	NA			
Starter Type	<input checked="" type="checkbox"/> Electrical		<input type="checkbox"/> Pneumatic	<input type="checkbox"/> Other (explain)
Starter Mfr. / Model No.	Delco Remy / NA			

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TRANSMISSION

Transmission Type	<input type="checkbox"/> Manual	<input checked="" type="checkbox"/> Automatic	
Mfr. / Model No.	Allison / B300R		
Control Type	<input type="checkbox"/> Mechanical	<input checked="" type="checkbox"/> Electrical	<input type="checkbox"/> Other (explain)
Torque Convertor Mfr. / Model No.	Allison / B300R		
Integral Retarder Mfr. / Model No.	Allison / B300R		

SUSPENSION

Number of Axles	2		
Front Axle Type	<input checked="" type="checkbox"/> Independent	<input type="checkbox"/> Beam Axle	
Mfr. / Model No.	Granning / NA		
Axle Ratio (if driven)	N/A		
Suspension Type	<input checked="" type="checkbox"/> Air	<input type="checkbox"/> Spring	<input type="checkbox"/> Other (explain)
No. of Shock Absorbers	2		
Mfr. / Model No.	Gabriel / 8160A		
Middle Axle Type	<input type="checkbox"/> Independent	<input type="checkbox"/> Beam Axle	
Mfr. / Model No.	N/A		
Axle Ratio (if driven)	N/A		
Suspension Type	<input type="checkbox"/> Air	<input type="checkbox"/> Spring	<input type="checkbox"/> Other (explain)
No. of Shock Absorbers	N/A		
Mfr. / Model No.	N/A		
Rear Axle Type	<input checked="" type="checkbox"/> Independent	<input type="checkbox"/> Beam Axle	
Mfr. / Model No.	Eaton / 19050S		
Axle Ratio (if driven)	5.29		
Suspension Type	<input checked="" type="checkbox"/> Air	<input type="checkbox"/> Spring	<input type="checkbox"/> Other (explain)
No. of Shock Absorbers	2		
Mfr. / Model No.	Gabriel / T611190C		

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WHEELS & TIRES

Front	Wheel Mfr./ Model No.	Accuride / 22.5 x 7.50
	Tire Mfr./ Model No.	Goodyear G159 / 275/70R 22.5
Rear	Wheel Mfr./ Model No.	Accuride / 22.5 x 7.50
	Tire Mfr./ Model No.	Goodyear G159 / 275/70R 22.5

BRAKES

Front Axle Brakes Type	<input checked="" type="checkbox"/> Cam	<input type="checkbox"/> Disc	<input type="checkbox"/> Other (explain)
Mfr. / Model No.	Spicer / NA		
Middle Axle Brakes Type	<input type="checkbox"/> Cam	<input type="checkbox"/> Disc	<input type="checkbox"/> Other (explain)
Mfr. / Model No.	N/A		
Rear Axle Brakes Type	<input type="checkbox"/> Cam	<input type="checkbox"/> Disc	<input type="checkbox"/> Other (explain)
Mfr. / Model No.	Eaton / NA		
Retarder Type	Transmission		
Mfr. / Model No.	Allison / B300R		

HVAC

Heating System Type	<input type="checkbox"/> Air	<input checked="" type="checkbox"/> Water	<input type="checkbox"/> Other
Capacity (Btu/hr)	125,000		
Mfr. / Model No.	Thermo King and SGM / NA		
Air Conditioner	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No	
Location	Roof mount		
Capacity (Btu/hr)	NA		
A/C Compressor Mfr. / Model No.	Thermo King / X426		

STEERING

Steering Gear Box Type	Hydraulic gear
Mfr. / Model No.	Ross / TAS65014
Steering Wheel Diameter	17.75
Number of turns (lock to lock)	3.50

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OTHERS

Wheel Chair Ramps	Location: Front	Type: Platform
Wheel Chair Lifts	Location: N/A	Type: N/A
Mfr. / Model No.	Braun Corp. / 21435A-12	
Emergency Exit	Location: Roof hatch Windows Doors	Number: 2 2 2

CAPACITIES

Fuel Tank Capacity (units)	79 scf @ 215 psi
Engine Crankcase Capacity (gallons)	1.75
Transmission Capacity (gallons)	2.25
Differential Capacity (gallons)	1.25
Cooling System Capacity (gallons)	3.00
Power Steering Fluid Capacity (gallons)	1.50

COMPONENT/SUBSYSTEM INSPECTION FORM

Bus Number: 9903	Date: 2-22-99
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Subsystem	Checked	Comments
Air Conditioning Heating and Ventilation	✓	
Body and Sheet Metal	✓	
Frame	✓	
Steering	✓	
Suspension	✓	
Interior/Seating	✓	
Axles	✓	
Brakes	✓	
Tires/Wheels	✓	
Exhaust	✓	
Fuel System	✓	
Power Plant	✓	
Accessories	✓	
Lift System	✓	Inoperative.
Interior Fasteners	✓	
Batteries	✓	

CHECK - IN



CHAMPION BUS INC.'S MODEL LOW FLOOR SO304T2



3. SAFETY - A DOUBLE-LANE CHANGE (OBSTACLE AVOIDANCE)

3-I. TEST OBJECTIVE

The objective of this test is to determine handling and stability of the bus by measuring speed through a double lane change test.

3-II. TEST DESCRIPTION

The Safety Test is a vehicle handling and stability test. The bus will be operated at SLW on a smooth and level test track. The bus will be driven through a double lane change course at increasing speed until the test is considered unsafe or a speed of 45 mph is reached. The lane change course will be set up using pylons to mark off two 12 foot center to center lanes with two 100 foot lane change areas 100 feet apart. The bus will begin in one lane, change to the other lane in a 100 foot span, travel 100 feet, and return to the original lane in another 100 foot span. This procedure will be repeated, starting first in the right-hand and then in the left-hand lane.

3-III. DISCUSSION

The double-lane change was performed in both right-hand and left-hand directions. The bus was able to safely negotiate the test course in both the right-hand and left-hand directions up to the maximum test speed of 45 mph.

SAFETY DATA FORM

Bus Number: 9903	Date: 3-24-99
Personnel: B.L., S.C. and R.H.	

Temperature (°F): 36	Humidity (%): 75
Wind Direction: N	Wind Speed (mph): 3
Barometric Pressure (in.Hg): 29.98	

SAFETY TEST: DOUBLE LANE CHANGE	
Maximum safe speed tested for double-lane change to left	45 mph
Maximum safe speed tested for double-lane change to right	45 mph
Comments of the position of the bus during the lane change:	
A safe profile was maintained through all portions of testing.	
Comments of the tire/ground contact patch:	
Tire/ground contact was maintained through all portions of testing.	

3. SAFETY



RIGHT - HAND APPROACH



LEFT - HAND APPROACH

4. PERFORMANCE - AN ACCELERATION, GRADEABILITY, AND TOP SPEED TEST

4-I. TEST OBJECTIVE

The objective of this test is to determine the acceleration, gradeability, and top speed capabilities of the bus.

4-II. TEST DESCRIPTION

In this test, the bus will be operated at SLW on the skid pad at the PSBRTF. The bus will be accelerated at full throttle from a standstill to a maximum "geared" or "safe" speed as determined by the test driver. The vehicle speed is measured using a Correvit non-contacting speed sensor. The times to reach speed between ten mile per hour increments are measured and recorded using a stopwatch with a lap timer. The time to speed data will be recorded on the Performance Data Form and later used to generate a speed vs time plot and gradeability calculations.

4-III. DISCUSSION

This test consists of three runs in both the clockwise and counterclockwise directions on the PSBRTF Test Track. Velocity versus time data is obtained for each run and results are averaged together to minimize any test variability which might be introduced by wind or other external factors. The test was performed up to a maximum speed of 50 mph. The fitted curve of velocity vs time is attached, followed by the calculated gradeability results. The average time to obtain 50 mph was 25.78 seconds.

PERFORMANCE DATA FORM

Bus Number: 9903	Date: 3-24-99
Personnel: B.L., S.C. and R.H.	
Temperature (°F): 36	Humidity (%): 75
Wind Direction: N	Wind Speed (mph): 3
Barometric Pressure (in.Hg): 29.98	
Air Conditioning compressor-OFF	<input checked="" type="checkbox"/> Checked
Ventilation fans-ON HIGH	<input checked="" type="checkbox"/> Checked
Heater pump motor-Off	<input checked="" type="checkbox"/> Checked
Defroster-OFF	<input checked="" type="checkbox"/> Checked
Exterior and interior lights-ON	<input checked="" type="checkbox"/> Checked
Windows and doors-CLOSED	<input checked="" type="checkbox"/> Checked

ACCELERATION, GRADEABILITY, TOP SPEED			
Counter Clockwise Recorded Interval Times			
Speed	Run 1	Run 2	Run 3
10 mph	3.89	4.49	4.24
20 mph	10.23	10.86	10.87
30 mph	19.83	20.49	20.62
40 mph	30.40	34.78	34.82
Top Test Speed(mph) 50	55.96	53.28	53.57
Clockwise Recorded Interval Times			
Speed	Run 1	Run 2	Run 3
10 mph	4.17	4.83	4.52
20 mph	10.64	10.54	10.36
30 mph	18.23	18.74	18.83
40 mph	30.56	30.09	30.15
Top Test Speed(mph) 50	43.56	43.43	44.72

PERFORMANCE SUMMARY SHEET

BUS MANUFACTURER :Champion
 BUS MODEL :SO304T2

BUS NUMBER :9903
 TEST DATE :3-24-99

TEST CONDITIONS :

 TEMPERATURE (DEG F) : 36.0
 WIND DIRECTION : N
 WIND SPEED (MPH) : 3.0
 HUMIDITY (%) : 75
 BAROMETRIC PRESSURE (IN. HG) : 30.0

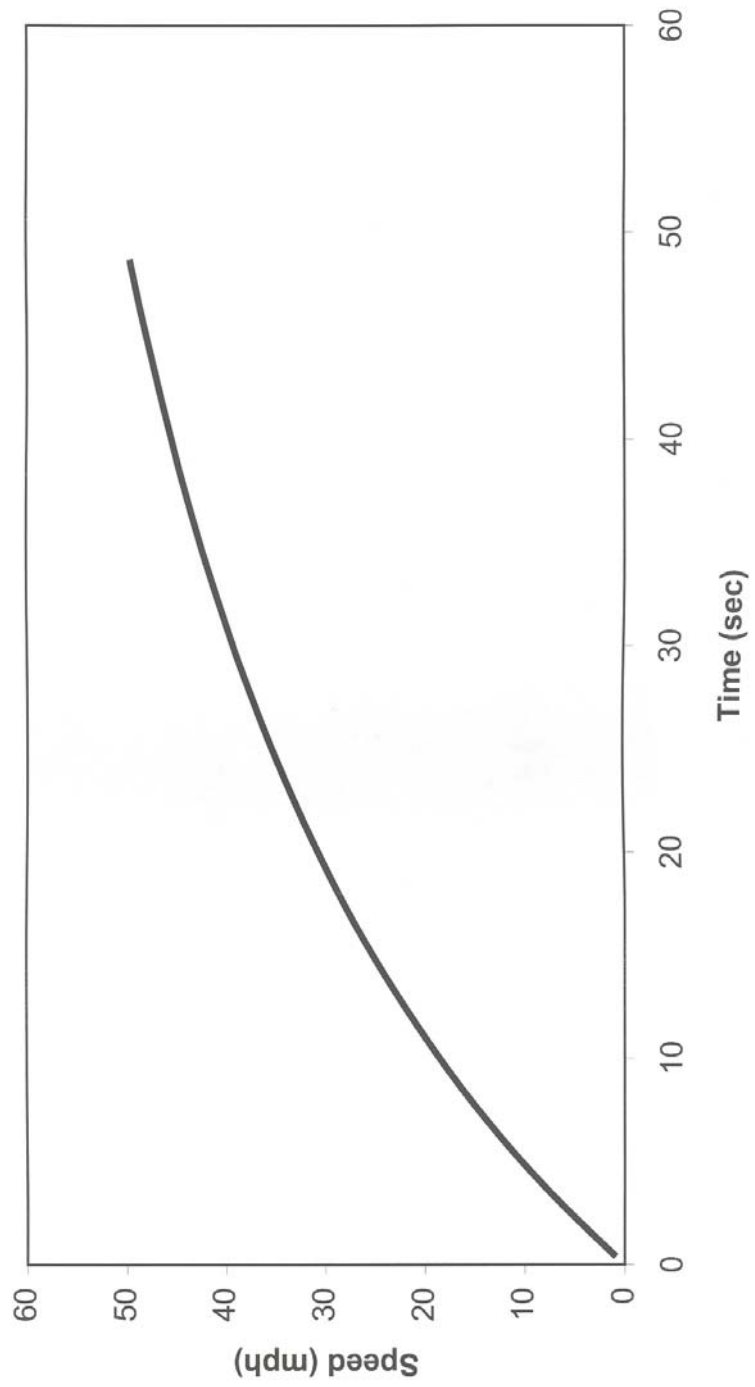
VEHICLE SPEED (MPH)	AVERAGE TIME (SEC)		
	CCW DIRECTION	CW DIRECTION	TOTAL
10.0	4.21	4.51	4.36
20.0	10.65	10.51	10.58
30.0	20.31	18.60	19.46
40.0	33.33	30.27	31.80
50.0	54.27	43.90	49.09

TEST SUMMARY :

VEHICLE SPEED (MPH)	TIME (SEC)	ACCELERATION (FT/SEC ²)	MAX. GRADE (%)
1.0	.44	3.3	10.3
5.0	2.29	3.0	9.5
10.0	4.85	2.7	8.4
15.0	7.73	2.4	7.4
20.0	11.02	2.1	6.5
25.0	14.82	1.8	5.6
30.0	19.27	1.5	4.7
35.0	24.58	1.3	3.9
40.0	31.04	1.0	3.2
45.0	39.12	.8	2.5
50.0	49.57	.6	1.9

NOTE : Gradeability results were calculated from performance
 ---- test data. Actual sustained gradeability performance
 for vehicles equipped with auto transmission may be
 lower than the values indicated here.

**Velocity vs. Time
Champion 9903**



6. FUEL ECONOMY TEST - A FUEL CONSUMPTION TEST USING AN APPROPRIATE OPERATING CYCLE

6-I. TEST OBJECTIVE

The objective of this test is to provide accurate comparable fuel consumption data on transit buses produced by different manufacturers. This fuel economy test bears no relation to the calculations done by the Environmental Protection Agency (EPA) to determine levels for the Corporate Average Fuel Economy Program. EPA's calculations are based on tests conducted under laboratory conditions intended to simulate city and highway driving. This fuel economy test, as designated here, is a measurement of the fuel expended by a vehicle traveling a specified test loop under specified operating conditions. The results of this test will not represent actual mileage but will provide data that can be used by recipients to compare buses tested by this procedure.

6-II. TEST DESCRIPTION

This test requires operation of the bus over a course based on the Transit Coach Operating Duty Cycle (ADB Cycle) at seated load weight using a procedure based on the Fuel Economy Measurement Test (Engineering Type) For Trucks and Buses: SAE 1376 July 82. The procedure has been modified by elimination of the control vehicle and by modifications as described below. The inherent uncertainty and expense of utilizing a control vehicle over the operating life of the facility is impractical.

The fuel economy test will be performed as soon as possible (weather permitting) after the completion of the GVW portion of the structural durability test. It will be conducted on the bus test lane at the PSBRTF. Signs are erected at carefully measured points which delineate the test course. A test run will comprise 3 CBD phases, 2 Arterial phases, and 1 Commuter phase. An electronic fuel measuring system will indicate the amount of fuel consumed during each phase of the test. The test runs will be repeated until there are at least two runs in both the clockwise and counterclockwise directions in which the fuel consumed for each run is within ± 4 percent of the average total fuel used over the 4 runs. A 20-minute idle consumption test is performed just prior to and immediately after the driven portion of the fuel economy test. The amount of fuel consumed while operating at normal/low idle is recorded on the Fuel Economy Data Form. This set of four valid runs along with idle consumption data comprise a valid test.

The test procedure is the ADB cycle with the following four modifications:

1. The ADB cycle is structured as a set number of miles in a fixed time in the following order: CBD, Arterial, CBD, Arterial, CBD, Commuter. A separate idle fuel consumption measurement is performed at the beginning and end of the fuel economy test. This phase sequence permits the reporting of fuel consumption for each of these phases separately, making the data more useful to bus manufacturers and transit properties.
2. The operating profile for testing purposes shall consist of simulated transit type service at seated load weight. The three test phases (figure 6-1) are: a central business district (CBD) phase of 2 miles with 7 stops per mile and a top speed of 20 mph; an arterial phase of 2 miles with 2 stops per mile and a top speed of 40 mph; and a commuter phase of 4 miles with 1 stop and a maximum speed of 40 mph. At each designated stop the bus will remain stationary for seven seconds. During this time, the passenger doors shall be opened and closed.
3. The individual ADB phases remain unaltered with the exception that 1 mile has been changed to 1 lap on the PSBRTF track. One lap is equal to 5,042 feet. This change is accommodated by adjusting the cruise distance and time.
4. The acceleration profile, for practical purposes and to achieve better repeatability, has been changed to "full throttle acceleration to cruise speed".

Several changes were made to the Fuel Economy Measurement Test (Engineering Type) For Trucks and Buses: SAE 1376 July 82:

1. Sections 1.1, and 1.2 only apply to diesel, gasoline, methanol, and any other fuel in the liquid state (excluding cryogenic fuels).

- 1.1 SAE 1376 July 82 requires the use of at least a 16-gal fuel tank. Such a fuel tank when full would weigh approximately 160 lb. It is judged that a 12-gal tank weighing approximately 120 lb will be sufficient for this test and much easier for the technician and test personnel to handle.

- 1.2 SAE 1376 July 82 mentions the use of a mechanical scale or a flowmeter system. This test procedure uses a load cell readout combination that provides an accuracy of 0.5 percent in weight and permits on-board weighing of the gravimetric tanks at the end of each phase. This modification permits the determination of a fuel economy value for each phase as well as the overall cycle.

2. Section 2.1 applies to compressed natural gas (CNG), liquified natural gas (LNG), cryogenic fuels, and other fuels in the vapor state.

2.1 A laminar type flowmeter will be used to determine the fuel consumption. The pressure and temperature across the flow element will be monitored by the flow computer. The flow computer will use this data to calculate the gas flow rate. The flow computer will also display the flow rate (scfm) as well as the total fuel used (scf). The total fuel used (scf) for each phase will be recorded on the Fuel Economy Data Form.

3. Use both sections 1 and 2 for dual fuel systems.

FUEL ECONOMY CALCULATION PROCEDURE

A. For diesel, gasoline, methanol and fuels in the liquid state.

The reported fuel economy is based on the following: measured test quantities-- distance traveled (miles) and fuel consumed (pounds); standard reference values-- density of water at 60°F (8.3373 lbs/gal) and volumetric heating value of standard fuel; and test fuel specific gravity (unitless) and volumetric heating value (BTU/gal). These combine to give a fuel economy in miles per gallon (mpg) which is corrected to a standard gallon of fuel referenced to water at 60°F. This eliminates fluctuations in fuel economy due to fluctuations in fuel quality. This calculation has been programmed into a computer and the data processing is performed automatically.

The fuel economy correction consists of three steps:

- 1.) Divide the number of miles of the phase by the number of pounds of fuel consumed

<u>phase</u>	<u>miles per phase</u>	<u>total miles per run</u>
CBD	1.9097	5.7291
ART	1.9097	3.8193
COM	3.8193	3.8193

$$FE_{mi/lb} = \text{Observed fuel economy} = \frac{\text{miles}}{\text{lb of fuel}}$$

- 2.) Convert the observed fuel economy to miles per gallon [mpg] by multiplying by the specific gravity of the test fuel G_s (referred to water) at 60°F and multiply by the density of water at 60°F

$$FE_{mpg} = FE_{mi/lb} \times G_s \times G_w$$

where G_s = Specific gravity of test fuel at 60°F (referred to water)
 G_w = 8.3373 lb/gal

- 3.) Correct to a standard gallon of fuel by dividing by the volumetric heating value of the test fuel (H) and multiplying by the volumetric heating value of standard reference fuel (Q). Both heating values must have the same units.

$$FEc = FEo_{mpg} \times \frac{Q}{H}$$

where

H = Volumetric heating value of test fuel [BTU/gal]

Q = Volumetric heating value of standard reference fuel

Combining steps 1-3 yields

$$\Rightarrow FEc = \frac{\text{miles}}{\text{lbs}} \times (Gs \times Gw) \times \frac{Q}{H}$$

- 4.) Convert the fuel economy from mpg to an energy equivalent of miles per BTU. Since the number would be extremely small in magnitude, the energy equivalent will be represented as miles/BTUx10⁶.

Eq = Energy equivalent of converting mpg to mile/BTUx10⁶.

$$Eq = ((\text{mpg})/(\text{H})) \times 10^6$$

B. CNG, LNG, cryogenic and other fuels in the vapor state.

The reported fuel economy is based on the following: measured test quantities-- distance traveled (miles) and fuel consumed (scf); density of test fuel, and volumetric heating value (BTU/lb) of test fuel at standard conditions (P=14.73 psia and T=60 °F). These combine to give a fuel economy in miles per lb. The energy equivalent (mile/BTUx10⁶) will also be provided so that the results can be compared to buses that use other fuels.

- 1.) Divide the number of miles of the phase by the number of standard cubic feet (scf) of fuel consumed.

phase	miles per phase	total miles per run
CBD	1.9097	5.7291
ART	1.9097	3.8193
COM	3.8193	3.8193

$$FEo_{mi/scf} = \text{Observed fuel economy} = \frac{\text{miles}}{\text{scf of fuel}}$$

- 2.) Convert the observed fuel economy to miles per lb by dividing FEO by the density of the test fuel at standard conditions (Lb/ft³).

Note: The density of test fuel must be determined at standard conditions as described above. If the density is not defined at the above standard conditions, then a correction will be needed before the fuel economy can be calculated.

$$FEO_{mi/lb} = FEO / Gm$$

where Gm = Density of test fuel at standard conditions

- 3.) Convert the observed fuel economy (FEOmi/lb) to an energy equivalent of (miles/BTUx10⁶) by dividing the observed fuel economy (FEOmi/lb) by the heating value of the test fuel at standard conditions.

$$Eq = ((FEOmi/lb)/H) \times 10^6$$

where

Eq = Energy equivalent of miles/lb to mile/BTUx10⁶

H = Volumetric heating value of test fuel at standard conditions

6-III. DISCUSSION

This is a comparative test of fuel economy using HD-5 propane fuel with a heating value of 91,690 btu/cf. The driving cycle consists of Central Business District (CBD), Arterial (ART), and Commuter (COM) phases as described in 6-II. The fuel consumption for each driving cycle and for idle is measured separately. The results are corrected to a reference fuel with a volumetric heating value of 127,700 btu/gal.

An extensive pretest maintenance check is made including the replacement of all lubrication fluids. The details of the pretest maintenance are given in the first three Pretest Maintenance Forms. The fourth sheet shows the Pretest Inspection. The next sheet shows the correction calculation for the test fuel. The next four Fuel Economy Forms provide the data from the four test runs. Finally, the summary sheet provides the average fuel consumption. The overall average is based on total fuel and total mileage for each phase. The overall average fuel consumption values were; CBD - 0.71 mpg, ART - 0.82 mpg, and COM - 1.52 mpg. Average fuel consumption at idle was 4.34 G/hr (6.00 lb/hr).

FUEL ECONOMY PRE-TEST MAINTENANCE FORM

Bus Number: 9903	Date: 3-12-99	SLW (lbs): 26,000
Personnel: K.D., B.L. and S.C.		

FUEL SYSTEM	OK	Date	Initials
Install fuel measurement system	✓	3-12-99	B.L.
Replace fuel filter	✓	3-12-99	K.D.
Check for fuel leaks	✓	3-12-99	B.L.
Specify fuel type (refer to fuel analysis)			
Remarks:			
BRAKES/TIRES	OK	Date	Initials
Inspect hoses	✓	3-12-99	S.C.
Inspect brakes	✓	3-12-99	S.C.
Relube wheel bearings	✓	3-12-99	K.D.
Check tire inflation pressures (mfg. specs.)	✓	3-12-99	S.C.
Remarks:			
COOLING SYSTEM	OK	Date	Initials
Check hoses and connections	✓	3-12-99	B.L.
Check system for coolant leaks	✓	3-12-99	B.L.
Remarks:			

FUEL ECONOMY PRE-TEST MAINTENANCE FORM (page 2)

Bus Number: 9903	Date: 3-12-99		
Personnel: K.D., B.L. and S.C.			
ELECTRICAL SYSTEMS	OK	Date	Initials
Check battery	✓	3-12-99	B.L.
Inspect wiring	✓	3-12-99	B.L.
Inspect terminals	✓	3-12-99	B.L.
Check lighting	✓	3-12-99	B.L.
Remarks:			
DRIVE SYSTEM	OK	Date	Initials
Drain transmission fluid	✓	3-12-99	K.D.
Replace filter/gasket	✓	3-12-99	K.D.
Check hoses and connections	✓	3-12-99	B.L.
Replace transmission fluid	✓	3-12-99	K.D.
Check for fluid leaks	✓	3-12-99	B.L.
Remarks:			
LUBRICATION	OK	Date	Initials
Drain crankcase oil	✓	3-12-99	K.D.
Replace filters	✓	3-12-99	K.D.
Replace crankcase oil	✓	3-12-99	K.D.
Check for oil leaks	✓	3-12-99	K.D.
Check oil level	✓	3-12-99	B.L.
Lube all chassis grease fittings	✓	3-12-99	S.C.
Lube universal joints	✓	3-12-99	S.C.
Replace differential lube including axles	✓	NA	K.D.
Remarks:			

FUEL ECONOMY PRE-TEST MAINTENANCE FORM (page 3)

Bus Number: 9903	Date: 3-12-99		
Personnel: K.D., B.L. and S.C.			
EXHAUST/EMISSION SYSTEM	OK	Date	Initials
Check for exhaust leaks	✓	3-12-99	B.L.
Remarks:			
ENGINE	OK	Date	Initials
Replace air filter	✓	3-12-99	K.D.
Inspect air compressor and air system	✓	3-12-99	B.L.
Inspect vacuum system, if applicable	✓	3-12-99	K.D.
Check and adjust all drive belts	✓	3-12-99	B.L.
Check cold start assist, if applicable	N/A	3-12-99	B.L.
Remarks:			
STEERING SYSTEM	OK	Date	Initials
Check power steering hoses and connectors	✓	3-12-99	B.L.
Service fluid level	✓	3-12-99	B.L.
Check power steering operation	✓	3-12-99	B.L.
Remarks:			
	OK	Date	Initials
Ballast bus to seated load weight	✓	3-12-99	B.L.
TEST DRIVE	OK	Date	Initials
Check brake operation	✓	3-12-99	S.C.
Check transmission operation	✓	3-12-99	S.C.
Remarks:			

FUEL ECONOMY PRE-TEST INSPECTION FORM

Bus Number: 9903	Date: 3-24-99
Personnel: B.L., S.C. and R.H.	
PRE WARM-UP	If OK, Initial
Fuel Economy Pre-Test Maintenance Form is complete	RLL
Cold tire pressure (psi): Front <u>120</u> Middle <u>N/A</u> Rear <u>120</u>	RLL
Tire wear:	RLL
Engine oil level	RLL
Engine coolant level	RLL
Interior and exterior lights on, evaporator fan on	RLL
Fuel economy instrumentation installed and working properly.	RLL
Fuel line -- no leaks or kinks	RLL
Speed measuring system installed on bus. Speed indicator installed in front of bus and accessible to TECH and Driver.	RLL
Bus is loaded to SLW	RLL
WARM-UP	If OK, Initial
Bus driven for at least one hour warm-up	RLL
No extensive or black smoke from exhaust	RLL
POST WARM-UP	If OK, Initial
Warm tire pressure (psi): Front <u>121</u> Middle <u>N/A</u> Rear <u>121</u>	RLL
Environmental conditions Average wind speed <12 mph and maximum gusts <15 mph Ambient temperature between 30°(-1°) and 90°F(32°C) Track surface is dry Track is free of extraneous material and clear of interfering traffic	RLL

FUEL ECONOMY DATA FORM (Liquid Fuels)

Bus Number: 9903		Manufacturer: Champion		Date: 3-25-99			
Run Number: 1		Personnel: B.L., S.C. and R.H.					
Test Direction: <input type="checkbox"/> CW or <input checked="" type="checkbox"/> CCW		Temperature (°F): 32		Humidity (%): 69			
SLW (lbs): 26,000		Wind Speed (mph) & Direction: 9 / N		Barometric Pressure (in.Hg): 30.12			
Cycle Type	Time (min:sec)		Cycle Time (min:sec)	Fuel Temperature (°C)	Load Cell Reading (lb)		Fuel Used (lbs)
	Start	Finish			Start	Finish	
CBD #1	0	9:05	9:05	10.4	171.70	168.00	3.70
ART #1	0	4:26	4:26	10.3	168.00	164.85	3.15
CBD #2	0	9:08	9:08	10.4	164.85	161.10	3.75
ART #2	0	4:24	4:24	10.6	161.10	157.90	3.20
CBD #3	0	9:14	9:14	11.0	157.90	154.25	3.65
COMMUTER	0	6:02	6:02	11.1	154.25	150.80	3.45
Total Fuel = 20.90 lbs							
20 minute idle : Total Fuel Used = 2.05 lbs							
Heating Value = 91,690 BTU/LB							
Comments:							

FUEL ECONOMY DATA FORM (Liquid Fuels)

Bus Number: 9903		Manufacturer: Champion		Date: 3-25-99			
Run Number: 2		Personnel: B.L., S.C. and R.H.					
Test Direction: <input checked="" type="checkbox"/> CW or <input type="checkbox"/> CCW		Temperature (°F): 39		Humidity (%): 57			
SLW (lbs): 26,000		Wind Speed (mph) & Direction: 5 / N		Barometric Pressure (in.Hg): 30.05			
Cycle Type	Time (min:sec)		Cycle Time (min:sec)	Fuel Temperature (°C)	Load Cell Reading (lb)		Fuel Used (lbs)
	Start	Finish		Start	Start	Finish	
CBD #1	0	9:02	9:02	12.3	150.60	146.85	3.75
ART #1	0	4:22	4:22	12.0	146.85	143.65	3.20
CBD #2	0	9:04	9:04	11.0	143.65	140.00	3.65
ART #2	0	4:24	4:24	11.6	140.00	136.80	3.20
CBD #3	0	9:09	9:09	11.7	136.80	133.20	3.60
COMMUTER	0	6:02	6:02	11.7	133.20	129.80	3.40
Total Fuel = 20.80 lbs							
20 minute idle: Total Fuel Used = N/A							
Heating Value = 91,690 BTU/LB							
Comments:							

FUEL ECONOMY DATA FORM (Liquid Fuels)

Bus Number: 9903		Manufacturer: Champion		Date: 3-26-99			
Run Number: 3		Personnel: B.L., S.C. and R.H.					
Test Direction: <input type="checkbox"/> CW or <input checked="" type="checkbox"/> CCW		Temperature (°F): 35		Humidity (%): 60			
SLW (lbs): 26,000		Wind Speed (mph) & Direction: Calm		Barometric Pressure (in.Hg): 30.28			
Cycle Type	Time (min:sec)		Cycle Time (min:sec)	Fuel Temperature (°C)	Load Cell Reading (lb)		Fuel Used (lbs)
	Start	Finish		Start	Start	Finish	
CBD #1	0	9:07	9:07	11.4	168.45	164.65	3.80
ART #1	0	4:21	4:21	10.9	164.65	161.35	3.30
CBD #2	0	9:01	9:01	11.9	161.35	157.60	3.75
ART #2	0	4:22	4:22	11.4	157.60	154.40	3.20
CBD #3	0	9:06	9:06	12.1	154.40	150.70	3.70
COMMUTER	0	6:00	6:00	11.8	150.70	147.20	3.50
Total Fuel = 21.25 lbs							
20 minute idle: Total Fuel Used = N/A							
Heating Value = 91,690 BTU/LB							
Comments:							

FUEL ECONOMY DATA FORM (Liquid Fuels)

Bus Number: 9903		Manufacturer: Champion		Date: 3-26-99			
Run Number: 4		Personnel: B.L., S.C. and R.H.					
Test Direction: <input checked="" type="checkbox"/> CW or <input type="checkbox"/> CCW		Temperature (°F): 40		Humidity (%): 55			
SLW (lbs): 26,000		Wind Speed (mph) & Direction: Calm		Barometric Pressure (in.Hg): 30.10			
Cycle Type	Time (min:sec)		Cycle Time (min:sec)	Fuel Temperature (°C)	Load Cell Reading (lb)		Fuel Used (lbs)
	Start	Finish		Start	Start	Finish	
CBD #1	0	9:15	9:15	13.9	145.60	141.75	3.85
ART #1	0	4:22	4:22	13.5	141.75	138.55	3.20
CBD #2	0	9:02	9:02	13.3	138.55	134.85	3.70
ART #2	0	4:23	4:23	13.2	134.85	131.60	3.25
CBD #3	0	9:05	9:05	13.3	131.60	127.80	3.80
COMMUTER	0	6:01	6:01	13.5	127.80	124.30	3.50
Total Fuel = 21.30 lbs							
20 minute idle : Total Fuel Used = 1.95 lbs							
Heating Value = 91,690 BTU/LB							
Comments:							

FUEL ECONOMY SUMMARY SHEET

BUS MANUFACTURER :Champion
 BUS MODEL :SO304T2
 BUS NUMBER :9903
 TEST DATE :3/25/99

FUEL TYPE : HD-5 PROPANE
 SP. GRAVITY : .5100
 HEATING VALUE : 21625.00 BTU/Lb
 Standard Conditions : 60 deg F and 14.7 psi
 Density of Water : 8.3373 lb/gallon at 60 deg F

CYCLE	TOTAL FUEL USED (Lb)	TOTAL MILES	FUEL ECONOMY M/Lb (Measured)	FUEL ECONOMY MPG (Corrected)
Run # :1, CCW				
CBD	11.10	5.73	.52	3.02
ART	6.35	3.82	.60	3.52
COM	3.45	3.82	1.11	6.49
TOTAL	20.90	13.37	.64	3.75
Run # :2, CW				
CBD	11.00	5.73	.52	3.05
ART	6.40	3.82	.60	3.50
COM	3.40	3.82	1.12	6.58
TOTAL	20.80	13.37	.64	3.77
Run # :3, CCW				
CBD	11.25	5.73	.51	2.98
ART	6.50	3.82	.59	3.44
COM	3.50	3.82	1.09	6.39
TOTAL	21.25	13.37	.63	3.69
Run # :4, CW				
CBD	11.35	5.73	.50	2.96
ART	6.45	3.82	.59	3.47
COM	3.50	3.82	1.09	6.39
TOTAL	21.30	13.37	.63	3.68

 IDLE CONSUMPTION

First 20 Minutes Data : 2.05 Lb Last 20 Minutes Data : 1.95 Lb
 Average Idle Consumption : 6.00 Lb/Hr

RUN CONSISTENCY: % Difference from overall average of total fuel used

 Run 1 : .8 Run 2 : 1.2 Run 3 : -.9 Run 4 : -1.1

SUMMARY

Average Idle Consumption : 1.02 G/Hr
 Average CBD Phase Consumption : 3.00 MPG
 Average Arterial Phase Consumption : 3.48 MPG
 Average Commuter Phase Consumption : 6.46 MPG
 Overall Average Fuel Consumption : 3.72 MPG
 Overall Average Fuel Consumption : 40.45 Miles/ Million BTU

7. NOISE

7.1 INTERIOR NOISE AND VIBRATION TESTS

7.1-I. TEST OBJECTIVE

The objective of these tests is to measure and record interior noise levels and check for audible vibration under various operating conditions.

7.1-II. TEST DESCRIPTION

During this series of tests, the interior noise level will be measured at several locations with the bus operating under the following three conditions:

1. With the bus stationary, a white noise generating system shall provide a uniform sound pressure level equal to 80 dB(A) on the left, exterior side of the bus. The engine and all accessories will be switched off and all openings including doors and windows will be closed. This test will be performed at the ABTC.
2. The bus accelerating at full throttle from a standing start to 35 mph on a level pavement. All openings will be closed and all accessories will be operating during the test. This test will be performed on the track at the PSBRTF.
3. The bus will be operated at various speeds from 0 to 55 mph with and without the air conditioning and accessories on. Any audible vibration or rattles will be noted. This test will be performed on the test segment between the PSBRTF and the ABTC.

All tests will be performed in an area free from extraneous sound-making sources or reflecting surfaces. The ambient sound level as well as the surrounding weather conditions will be recorded in the test data.

7.1-III. DISCUSSION

This test is performed in three parts. The first part exposes the exterior of the vehicle to 80 dB(A) on the left side of the bus and the noise transmitted to the interior is measured. The overall average of the six measurements was 47.1 dB(A); ranging from 43.3 dB(A) at the rear passenger seats to 51.5 dB(A) to the driver's seat. The interior ambient noise level for this test was 35.7 dB(A).

The second test measures interior noise during acceleration from 0 to 35 mph. This noise level ranged from 71.5 dB(A) at the driver's seat to 75.5 dB(A) at the middle passenger seats. The overall average was 73.6 dB(A). The interior ambient noise level for this test was 35.1 dB(A).

The third part of the test is to listen for resonant vibrations, rattles, and other noise sources while operating over the road. No vibrations or rattles were noted.

INTERIOR NOISE TEST DATA FORM
Test Condition 1: 80 dB(A) Stationary White Noise

Bus Number: 9903	Date: 3-30-99
Personnel: B.L. and S.C.	
Temperature (°F): 40	Humidity (%): 60
Wind Speed (mph): 7	Wind Direction: SW
Barometric Pressure (in.Hg): 29.97	
Initial Sound Level Meter Calibration: <input checked="" type="checkbox"/> checked by R.L.L.	
Interior Ambient Noise Level dB(A): 35.7	Exterior Ambient Noise Level dB(A): 52.5
Microphone Height During Testing (in): 45	

Measurement Location	Measured Sound Level dB(A)
Driver's Seat	51.5
Front Passenger Seats	47.3
In Line with Front Speaker	50.1
In Line with Middle Speaker	46.4
In Line with Rear Speaker	43.7
Rear Passenger Seats	43.3

Final Sound Level Meter Calibration: <input checked="" type="checkbox"/> checked by R.L.L.
--

Comments: All readings taken in the center aisle.

INTERIOR NOISE TEST DATA FORM
Test Condition 2: 0 to 35 mph Acceleration Test

Bus Number: 9903	Date: 3-24-99
Personnel: B.L., S.C. and R.H.	
Temperature (°F): 36	Humidity (%): 75
Wind Speed (mph): 3	Wind Direction: N
Barometric Pressure (in.Hg): 29.98	
Initial Sound Level Meter Calibration: <input checked="" type="checkbox"/> checked by R.L.L.	
Interior Ambient Noise Level dB(A): 35.1	Exterior Ambient Noise Level dB(A): 47.2
Microphone Height During Testing (in): 45	

Measurement Location	Measured Sound Level dB(A)
Driver's Seat	71.5
Front Passenger Seats	74.1
Middle Passenger Seats	75.5
Rear Passenger Seats	73.2

Final Sound Level Meter Calibration: <input checked="" type="checkbox"/> checked by R.L.L.
--

Comments: All readings taken in the center aisle.

INTERIOR NOISE TEST DATA FORM
Test Condition 3: Audible Vibration Test

Bus Number: 9903	Date: 3-24-99
Personnel: B.L., S.C. and R.H.	
Temperature (°F): 36	Humidity (%): 75
Wind Speed (mph): N	Wind Direction: 3
Barometric Pressure (in.Hg): 29.98	

Describe the following possible sources of noise and give the relative location on the bus.

Source of Noise	Location
Engine and Accessories	None noted.
Windows and Doors	None noted.
Seats and Wheel Chair lifts	None noted.

Comment on any other vibration or noise source which may have occurred that is not described above: None noted.

7.2 EXTERIOR NOISE TESTS

7.2-I. TEST OBJECTIVE

The objective of this test is to record exterior noise levels when a bus is operated under various conditions.

7.2-II. TEST DESCRIPTION

In the exterior noise tests, the bus will be operated at a SLW in three different conditions using a smooth, straight and level roadway:

1. Accelerating at full throttle from a constant speed at or below 35 mph and just prior to transmission upshift.
2. Accelerating at full throttle from standstill.
3. Stationary, with the engine at low idle, high idle, and wide open throttle.

In addition, the buses will be tested with and without the air conditioning and all accessories operating. The exterior noise levels will be recorded.

The test site is at the PSBRTF and the test procedures will be in accordance with SAE Standards SAE J366b, Exterior Sound Level for Heavy Trucks and Buses. The test site is an open space free of large reflecting surfaces. A noise meter placed at a specified location outside the bus will measure the noise level.

During the test, special attention should be paid to:

1. The test site characteristics regarding parked vehicles, signboards, buildings, or other sound-reflecting surfaces
2. Proper usage of all test equipment including set-up and calibration
3. The ambient sound level

7.2-III. DISCUSSION

The Exterior Noise Test determines the noise level generated by the vehicle under different driving conditions and at stationary low and high idle, with and without air conditioning and accessories operating. The test site is a large, level, bituminous paved area with no reflecting surfaces nearby.

With an exterior ambient noise level of 49.9 dB(A), the average test result obtained while accelerating from a constant speed was 77.8 dB(A) on the right side and 80.2 dB(A) on the left side.

When accelerating from a standstill with an ambient noise level of 47.6 dB(A), the average of the results obtained were 77.8 dB(A) on the right side and 80.4 dB(A) on the left side.

With the vehicle stationary and the engine, accessories, and air conditioning on, the measurements averaged 62.0 dB(A) at low idle, and 82.0 dB(A) at wide open throttle. With the accessories and air conditioning off, the readings averaged 3.0 dB(A) lower at low idle, and the same 82.0 dB(A) at wide open throttle. The exterior ambient noise level measured during this test was 47.9 dB(A). Note: the test bus was not equipped with a fast idle mode, therefore, data for that condition is not available.

EXTERIOR NOISE TEST DATA FORM
Accelerating from Constant Speed

Bus Number: 9903	Date: 3-24-99
Personnel: B.L., S.C. and R.H.	
Temperature (°F): 38	Humidity (%): 72
Wind Speed (mph): 5	Wind Direction: N
Barometric Pressure (in.Hg): 30.04	
Verify that microphone height is 4 feet, wind speed is less than 12 mph and ambient temperature is between 30°F and 90°F: <input checked="" type="checkbox"/> checked by R.L.L.	
Initial Sound Level Meter Calibration: <input checked="" type="checkbox"/> checked by R.L.L.	
Exterior Ambient Noise Level dB(A): 49.9	

Accelerating from Constant Speed Curb (Right) Side		Accelerating from Constant Speed Street (Left) Side	
Run #	Measured Noise Level dB(A)	Run #	Measured Noise Level dB(A)
1	77.9	1	80.0
2	77.7	2	80.1
3	77.6	3	80.3
4	77.2	4	79.8
5	77.4	5	79.7
Average of two highest actual noise levels = 77.8 dB(A)		Average of two highest actual noise levels = 80.2 dB(A)	

Final Sound Level Meter Calibration Check: <input checked="" type="checkbox"/> checked by R.L.L.
Comments:

EXTERIOR NOISE TEST DATA FORM
Accelerating from Standstill

Bus Number: 9903	Date: 3-24-99
Personnel: B.L., S.C. and R.H.	
Temperature (°F): 38	Humidity (%): 72
Wind Speed (mph): 5	Wind Direction: N
Barometric Pressure (in.Hg): 30.04	
Verify that microphone height is 4 feet, wind speed is less than 12 mph and ambient temperature is between 30°F and 90°F: <input checked="" type="checkbox"/> checked by R.L.L.	
Initial Sound Level Meter Calibration: <input checked="" type="checkbox"/> checked by R.L.L.	
Exterior Ambient Noise Level dB(A): 47.9	

Accelerating from Standstill Curb (Right) Side		Accelerating from Standstill Street (Left) Side	
Run #	Measured Noise Level dB(A)	Run #	Measured Noise Level dB(A)
1	77.7	1	80.5
2	77.9	2	79.9
3	76.8	3	80.2
4	77.3	4	80.0
5	77.5	5	79.8
Average of two highest actual noise levels = 77.8 dB(A)		Average of two highest actual noise levels = 80.4 dB(A)	

Final Sound Level Meter Calibration Check: <input checked="" type="checkbox"/> checked by R.L.L.
Comments:

EXTERIOR NOISE TEST DATA FORM Stationary

Bus Number: 9903	Date: 3-24-99
Personnel: B.L., S.C. and R.H.	
Temperature (°F): 38	Humidity (%): 72
Wind Speed (mph): 5	Wind Direction: N
Barometric Pressure (in.Hg): 30.04	
Verify that microphone height is 4 feet, wind speed is less than 12 mph and ambient temperature is between 30°F and 90°F: <input checked="" type="checkbox"/> checked by R.L.L.	
Initial Sound Level Meter Calibration: <input checked="" type="checkbox"/> checked by R.L.L.	
Exterior Ambient Noise Level dB(A): 47.9	

Accessories and Air Conditioning ON			
Throttle Position	Engine RPM	Curb (Right) Side dB(A)	Street (Left) Side db(A)
		Measured	Measured
Low Idle	798	61.2	62.7
High Idle	N/A	N/A	N/A
Wide Open Throttle	3,158	80.9	83.0

Accessories and Air Conditioning OFF			
Throttle Position	Engine RPM	Curb (Right) Side dB(A)	Street (Left) Side db(A)
		Measured	Actual
Low Idle	802	56.6	61.3
High Idle	N/A	N/A	N/A
Wide Open Throttle	3,185	80.3	82.7

Final Sound Level Meter Calibration Check: <input checked="" type="checkbox"/> checked by R.L.L.
Comments:

