STURAA TEST

12 YEAR

500,000 MILE BUS

from

BLUE BIRD CORPORATION

MODEL LTC 40

AUGUST 2000

PTI-BT-R9917-08-00

PENNSTATE

The Pennsylvania Transportation Institute

201 Research Office Building (814) 865-1891
The Pennsylvania State University
University Park, PA 16802

Bus Testing and Research Center

6th Avenue and 45th Street (814) 949-7944
Altoona, PA 16602

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EXECUTIVE SUMMARY

The Blue Bird Body Company submitted a model LTC 40, diesel powered 48 seat/41-foot bus, for a 12 year/500,000 mile STURAA test. The odometer reading at the time of delivery was 3,011.0 miles. Testing started on August 10, 1999, and was completed on August 2, 2000. 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 started on August 24, 1999 and was completed on July 19, 2000.

The interior of the bus is configured with seating for 48 passengers including the driver. Free floor space will accommodate 20 standing passengers resulting in a potential load of 68 persons. At 150 lbs per person, this load results in a GVW of 45,820 lbs. The SLW segment was performed at 43,850 lbs and the final segment of the test was performed at a CW of 36,910 lbs. Durability driving resulted in several failures that required unscheduled maintenance. A complete and detailed listing of failures can be found in Section 5.7, Structural Durability. A listing of the scheduled maintenance can be located in the Maintainability section of this report.

The 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. Problems are listed by class as defined in Section 2. The test bus encountered no Class 1 or Class 2 failures. Of the forty-eight reported failures, thirty-six were Class 3 and twelve were Class 4.

The Safety Test, a double-lane change maneuver 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 26.04 seconds.

The Shakedown Test produced a maximum final loaded deflection of 0.122 inches under a distributed static load of 25,500 lbs. The test resulted in essentially no permanent deflection of the structure. The Distortion Test was completed with all subsystems, doors and escape mechanism operating properly. Water leakage was observed during the test at the top of the front passenger door. The Static Towing Test was to be performed to a target test load of 44,292 lbs. Testing was terminated during the 20° upward pull, when at 33,600 lbs the tow hook deformed up and out. The Dynamic Towing Test was performed using a front, flat tow. The towing interface was accomplished by attaching the tow bar to the front axle. A rubber cushion was inserted to provide protection. The manufacturer does not recommend towing the bus from the rear, therefore a rear test was not performed.

The Jacking and Hoisting Tests were performed without incident. The bus was found to be stable on the jack stands and the minimum jacking clearance, measured with a tire deflated, was 5.5 inches.

A Fuel Economy Test was run on simulated central business district, arterial, and commuter courses. The results were 2.09 mpg, 2.65 mpg, and 4.23 mpg respectively; with an overall average of 2.63 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
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 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 has a front door located forward of the front axle and a dedicated handicap door located between the front and drive axles. The engine type is a diesel fueled Detroit Diesel Series 60. The transmission is an Allison 8500.

The measured curb weight is 10,470 lbs for the front axle, 13,970 lbs for the drive axle and 12,470 lbs for the tag axle. These combined weights provide a total measured curb weight of 36,910 lbs. There are 48 seats including the driver and room for 20 standing passengers bringing the total passenger capacity to 68. Gross load is 150 lb x 68 = 10,200 lbs. At full capacity, the measured gross vehicle weight is 45,820 lbs.

VEHICLE DATA FORM

Bus Number: 9917	Arrival Date: 8-10-99
Bus Manufacturer: Blue Bird Corporation	Vehicle Identification Number (VIN): XF089797
Model Number: LTC 40	Date: 8-10-99
Personnel: B.L.	

Individual Wheel Reactions:

Weights (lb)	Front Axle		Drive Axle		Tag Axle	
	Right	Left	Right	Left	Right	Left
CW	5,020	5,450	7,370	6,600	6,000	6,470
SLW	6,130	6,840	9,630	8,550	5,930	6,770
GVW	6,690	7,410	10,490	9,420	5,980	6,830

Total Weight Details:

Weight (lb)	CW	SLW	GVW	GAWR
Front Axle	10,470	12,970	13,100	14,600
Drive Axle	13,970	18,180	19,910	23,000
Tag Axle	12,470	12,700	12,810	13,000
Total	36,910	43,850	45,820	GVWR: 50,600

Dimensions:

Length (ft/in)	41 / 1.5
Width (in)	101.00
Height (in)	141.00
Front Overhang (in)	87.00
Rear Overhang (in)	109.75
Wheel Base (in)	246.50
Wheel Track (in)	Front: 85.0
	Rear: 73.0 Tag: 84.5

Bus Number: 9917	Date: 8-10-99

CLEARANCES:

Lowest Point Outside Front Axle	Location: Body Clearance(in): 10.00	
Lowest Point Outside Rear Axle	Location: Engine Clearance(in): 10.50	
Lowest Point between Axles	Location: Body	Clearance(in): 7.75
Ground Clearance at the center (in)	10.25	
Front Approach Angle (deg)	8.62	
Rear Approach Angle (deg)	11.85	
Ramp Clearance Angle (deg)	4.50	
Aisle Width (in)	14.20	
Inside Standing Height at Center Aisle (in)	79.30	

BODY DETAILS:

Body Structural Type	Monocoque		
Frame Material	Steel		
Body Material	Steel & Fiberglass		
Floor Material	Plywood		
Roof Material	Steel		
Windows Type	☒ Fixed	☐ Movable	
Window Mfg./Model No.	Excel / Kit		
Number of Doors	1 Front	1 Rear	
Mfr. / Model No.	**Entry**: Blue Bird / P/N 0000554 **Lift:** BODE / 3269		
Dimension of Each Door (in)	Front- 24.3 x 95.9	Rear- 43.5 x 66.1	
Passenger Seat Type	☐ Cantilever	☒ Pedestal	☐ Other
Mfr. / Model No.	Only seat frames installed for testing.		
Driver Seat Type	☒ Air	☐ Spring	☐ Other (explain)
Mfr. / Model No.	USSC Group Inc. / BE-GE		
Number of Seats (including Driver)	48 + 2 wheelchair positions		

Bus Number: 9917	Date: 8-10-99

BODY DETAILS (Contd..)

Free Floor Space (ft^2)	30.6
Height of Each Step at Normal Position (in)	Front 1. 14.5 2. 9.7 3. 9.8 4. 9.8
	Middle 1. N/A 2. N/A 3. N/A 4. N/A
	Rear 1. N/A 2. N/A 3. N/A 4. N/A
Step Elevation Change - Kneeling (in)	3.2

ENGINE

Type	☒ C.I.	☐ Alternate Fuel	
	☐ S.I.	☐ Other (explain)	
Mfr. / Model No.	Detroit Diesel / Series 60		
Location	☐ Front	☒ Rear	☐ Other (explain)
Fuel Type	☐ Gasoline	☐ CNG	☐ Methanol
	☒ Diesel	☐ LNG	☐ Other (explain)
Fuel Tank Capacity (indicate units)	176 gallons		
Fuel Induction Type	☒ Injected	☐ Carburetion	
Fuel Injector Mfr. / Model No.	Detroit Diesel / Series 60		
Carburetor Mfr. / Model No.	N/A		
Fuel Pump Mfr. / Model No.	Detroit Diesel / Series 60		
Alternator (Generator) Mfr. / Model No.	Delco-Remy / III-7860		
Maximum Rated Output (Volts / Amps)	12 / 300		
Air Compressor Mfr. / Model No.	Tu-Flo / 750		
Maximum Capacity (ft^3 / min)	16		
Starter Type	☒ Electrical	☐ Pneumatic	☐ Other (explain)
Starter Mfr. / Model No.	Delco-Remy / 10478895		

Bus Number: 9917	Date: 8-10-99

TRANSMISSION

Transmission Type	☐ Manual	☒ Automatic	
Mfr. / Model No.	Allison / 8500		
Control Type	☐ Mechanical	☒ Electrical	☐ Other (explain)
Torque Convertor Mfr. / Model No.	Allison / 8500		
Integral Retarder Mfr. / Model No.	Allison / 8500		

SUSPENSION

Number of Axles	3		
Front Axle Type	☐ Independent	☒ Beam Axle	
Mfr. / Model No.	Spicer-Dana / I140S		
Axle Ratio (if driven)	N/A		
Suspension Type	☒ Air	☐ Spring	☐ Other (explain)
No. of Shock Absorbers	2		
Mfr. / Model No.	Koni / 902497		
Drive Axle Type	☐ Independent	☒ Beam Axle	
Mfr. / Model No.	Spicer-Dana / W2305		
Axle Ratio (if driven)	4:78		
Suspension Type	☒ Air	☐ Spring	☐ Other (explain)
No. of Shock Absorbers	2		
Mfr. / Model No.	Koni / 901951SP1		
Tag Axle Type	☐ Independent	☒ Beam Axle	
Mfr. / Model No.	Ridewell / RADT-246-25/10		
Axle Ratio (if driven)	N/A		
Suspension Type	☒ Air	☐ Spring	☐ Other (explain)
No. of Shock Absorbers	2		
Mfr. / Model No.	Koni / 881490		

Bus Number: 9917	Date: 8-10-99

WHEELS & TIRES

Front	Wheel Mfr./ Model No.	Accuride / 22.5 x 8.25
	Tire Mfr./ Model No.	Michelin XZE 12R 22.5
Rear	Wheel Mfr./ Model No.	Accuride / 22.5 x 8.25
	Tire Mfr./ Model No.	Michelin XZE 12R 22.5

BRAKES

Front Axle Brakes Type	☒ Cam	☐ Disc	☐ Other (explain)
Mfr. / Model No.	Eaton / ES1656D		
Drive Axle Brakes Type	☒ Cam	☐ Disc	☐ Other (explain)
Mfr. / Model No.	Eaton / ES1658D		
Tag Axle Brakes Type	☒ Cam	☐ Disc	☐ Other (explain)
Mfr. / Model No.	Federal Mogul / NAB-718		
Retarder Type	Integral		
Mfr. / Model No.	Allison / 8500		

HVAC

Heating System Type	☐ Air	☒ Water	☐ Other
Capacity (Btu/hr)	30,000		
Mfr. / Model No.	UWE / P90		
Air Conditioner	☒ Yes	☐ No	
Location	Rear		
Capacity (Btu/hr)	20		
A/C Compressor Mfr. / Model No.	Thermo-King / X4263		

STEERING

Steering Gear Box Type	Hydraulic gear
Mfr. / Model No.	Ross / TAS85
Steering Wheel Diameter (in)	20
Number of turns (lock to lock)	4.5

Bus Number: 9917	Date: 8-10-99

OTHERS

Wheel Chair Ramps	Location: N/A	Type: N/A
Wheel Chair Lifts	Location: Center	Type: Hydraulic platform
Mfr. / Model No.	Ricon / F9A-S012	
Emergency Exit	Location: Windows Door Roof hatches	Number: 5 1 2

CAPACITIES

Fuel Tank Capacity (gallons)	176
Engine Crankcase Capacity (gallons)	9.3
Transmission Capacity (gallons)	12.75
Differential Capacity (pints)	34.5
Cooling System Capacity (gallons)	20
Power Steering Fluid Capacity (gallons)	8.5 power steering and hydraulic cooling systems joined–cannot separate

VEHICLE DATA FORM

Bus Number: 9917	Date: 8-10-99

List all spare parts, tools and manuals delivered with the bus.

Part Number	Description	Qty.
1791 (NAPA)	Oil filter	2
3120 (NAPA)	Fuel Filter	2
508-4-NS	Motor mount	4
22002-13	Mounts	4
SSB33-100	Mounts, front	4
R90P	Racor, fuel filter	2
J-5425-27	Bushings	8
516-4-NS	Bushings	8
90-1951SP1	Koni shocks, front	8
88-1490	Koni shocks, drive	8

COMPONENT/SUBSYSTEM INSPECTION FORM

Bus Number: 9917	Date: 8-10-99

Subsystem	Checked	Comments
Air Conditioning Heating and Ventilation	✓	
Body and Sheet Metal	✓	
Frame	✓	
Steering	✓	
Suspension	✓	
Interior/Seating	✓	Only seat frames installed for test.
Axles	✓	
Brakes	✓	
Tires/Wheels	✓	
Exhaust	✓	
Fuel System	✓	
Power Plant	✓	
Accessories	✓	Equipped with lavatory.
Lift System	✓	
Interior Fasteners	✓	
Batteries	✓	

CHECK - IN

BLUE BIRD BODY COMPANIES
MODEL LTC 40

CHECK - IN

BLUE BIRD'S MODEL LTC 40
EQUIPPED WITH A RICON MODEL F9A-S012
HANDICAP DEVICE

1. MAINTAINABILITY

1.1 ACCESSIBILITY OF COMPONENTS AND SUBSYSTEMS

1.1-I. TEST OBJECTIVE

The objective of this test is to check the accessibility of components and subsystems.

1.1-II. TEST DESCRIPTION

Accessibility of components and subsystems is checked, and where accessibility is restricted the subsystem is noted along with the reason for the restriction.

1.1-III. DISCUSSION

The components covered in Section 1.3 (Repair and/or Replacement of Selected Subsystems) along with all other components were found to be readily accessible and no restrictions were noted.

ACCESSIBILITY DATA FORM

Bus Number: 9917	Date: 8-1-00

Component	Checked	Comments
ENGINE :		
Oil Dipstick	✓	
Oil Filler Hole	✓	
Oil Drain Plug	✓	
Oil Filter	✓	
Fuel Filter	✓	
Air Filter	✓	
Belts	✓	
Coolant Level	✓	
Coolant Filler Hole	✓	
Coolant Drain	✓	
Spark / Glow Plugs	✓	
Alternator	✓	
Diagnostic Interface Connector	✓	
TRANSMISSION :		
Fluid Dip-Stick	✓	
Filler Hole	✓	Same as dip tube.
Drain Plug	✓	
SUSPENSION :		
Bushings	✓	
Shock Absorbers	✓	
Air Springs	✓	
Leveling Valves	✓	
Grease Fittings	✓	

ACCESSIBILITY DATA FORM

Bus Number: 9917	Date: 8-1-00

Component	Checked	Comments
HVAC :		
A/C Compressor	✓	
Filters	✓	
Fans	✓	
ELECTRICAL SYSTEM :		
Fuses	✓	
Batteries	✓	
Voltage regulator	✓	
Voltage Convertors	✓	
Lighting	✓	
MISCELLANEOUS :		
Brakes	✓	
Handicap Lifts/Ramps	✓	
Instruments	✓	
Axles	✓	
Exhaust	✓	
Fuel System	✓	
OTHERS :		

1.2 SERVICING, PREVENTIVE MAINTENANCE, AND REPAIR AND MAINTENANCE DURING TESTING

1.2-I. TEST OBJECTIVE

The objective of this test is to collect maintenance data about the servicing, preventive maintenance, and repair.

1.2.-II. TEST DESCRIPTION

The test will be conducted by operating the NBM and collecting the following data on work order forms and a driver log.

1. Unscheduled Maintenance
    a. Bus number
    b. Date
    c. Mileage
    d. Description of malfunction
    e. Location of malfunction (e.g., in service or undergoing inspection)
    f. Repair action and parts used
    g. Man-hours required

2. Scheduled Maintenance
    a. Bus number
    b. Date
    c. Mileage
    d. Engine running time (if available)
    e. Results of scheduled inspections
    f. Description of malfunction (if any)
    g. Repair action and parts used (if any)
    h. Man-hours required

The buses will be operated in accelerated durability service. While typical items are given below, the specific service schedule will be that specified by the manufacturer.

A. Service
    1. Fueling
    2. Consumable checks
    3. Interior cleaning

B. Preventive Maintenance
    4. Brake adjustments
    5. Lubrication
    6. 3,000 mi (or equivalent) inspection

7. Oil and filter change inspection
8. Major inspection
9. Tune-up

C. Periodic Repairs
1. Brake reline
2. Transmission change
3. Engine change
4. Windshield wiper motor change
5. Stoplight bulb change
6. Towing operations
7. Hoisting operations

1.2-III. DISCUSSION

Servicing and preventive maintenance were performed at manufacturer specified intervals. The following Scheduled Maintenance Form lists the mileage, items serviced, the service interval, and amount of time required to perform the maintenance. Table 1 is a list of the lubricating products used in servicing. Finally, the Unscheduled Maintenance List along with Unscheduled Maintenance related photographs is included in Section 5.7, Structural Durability. This list supplies information related to failures that occurred during the durability portion of testing. The Unscheduled Maintenance List includes the date and mileage at which the malfunction occurred, a description of the malfunction and repair, and the time required to perform the repair.

SCHEDULED MAINTENANCE

Blue Bird

DATE	TEST MILES	SERVICE	ACTIVITY	DOWN TIME	HOURS
01-04-00	1,365	P.M. / Inspection	Linkage, tie rods, universals/u-joints all lubed; all fluids checked.	4.00	4.00
01-10-00	1,895	P.M. / Inspection	Linkage, tie rods, universals/u-joints all lubed; all fluids checked.	4.00	4.00
01-18-00	2,691	P.M. / Inspection	Linkage, tie rods, universals/u-joints all lubed; all fluids checked.	4.00	4.00
01-24-00	3,736	P.M. / Inspection	Linkage, tie rods, universals/u-joints all lubed; all fluids checked.	4.00	4.00
02-08-00	5,091	P.M. / Inspection	Linkage, tie rods, universals/u-joints all lubed; all fluids checked.	4.00	4.00
05-19-00	7,935	P.M. / Inspection	Linkage, tie rods, universals/u-joints all lubed; all fluids checked.	4.00	4.00
05-31-00	8,024	P.M. / Inspection Fuel Economy Prep.	Linkage, tie rods, universals/u-joints all lubed. Oil changed. Oil, fuel, and air filters changed. Transmission oil and filter changed.	8.00	8.00

SCHEDULED MAINTENANCE

Blue Bird

DATE	TEST MILES	SERVICE	ACTIVITY	DOWN TIME	HOURS
06-08-00	8,581	P.M. / Inspection	Linkage, tie rods, universals/u-joints all lubed; all fluids checked.	4.00	4.00
06-19-00	11,797	P.M. / Inspection	Linkage, tie rods, universals/u-joints all lubed; all fluids checked.	4.00	4.00
06-26-00	12,463	P.M. / Inspection	Linkage, tie rods, universals/u-joints all lubed; all fluids checked.	4.00	4.00
07-03-00	13,275	P.M. / Inspection	Linkage, tie rods, universals/u-joints all lubed; all fluids checked.	4.00	4.00

Table 1. STANDARD LUBRICANTS

The following is a list of Texaco lubricant products used in bus testing conducted by the Penn State University Altoona Bus Testing Center:

ITEM	PRODUCT CODE	TEXACO DESCRIPTION
Engine oil	#2112	URSA Super Plus SAE 30
Transmission oil	#1866	Automatic Trans Fluid Mercon/Dexron II Multipurpose
Gear oil	#2316	Multigear Lubricant EP SAE 80W90
Wheel bearing & Chassis grease	#1935	Starplex II

1.3 REPLACEMENT AND/OR REPAIR OF SELECTED SUBSYSTEMS

1.3-I. TEST OBJECTIVE

The objective of this test is to establish the time required to replace and/or repair selected subsystems.

1.3-II. TEST DESCRIPTION

The test will involve components that may be expected to fail or require replacement during the service life of the bus. In addition, any component that fails during the NBM testing is added to this list. Components to be included are:

1. Transmission
2. Alternator
3. Starter
4. Batteries
5. Windshield wiper motor

1.3-III. DISCUSSION

During the test, several additional components were removed for repair or replacement. Following is a list of components and total repair/replacement time.

	MAN HOURS
Front stabilizer bar bushings.	1.0
Kneeling system leveling valve Connecting rod.	1.0
Driver's windshield.	6.0
Outside rear hanger for the lavatory holding tank.	1.0
Front tires replaced and rotated to the tag axle.	2.0
Broken bolts in the luggage compartment sub floor.	2.0

Broken terminal on the +12 volt wire leading the self setting circuit breakers in the battery compartment.	1.0
The right rear pedestal bolt at the left front axle.	0.5
Leaking hydraulic reservoir.	2.0
Right rear brake chamber.	1.0
Right rear leveling valve.	1.0
Both fuel filters.	0.5
Both low beam lamps.	0.5
All tag axle radius rod bushings.	8.0
Center bushing, left tag axle trailing arm.	3.0
All front shock bushings.	0.5
Left cross member above the front axle.	2.5

At the end of the test, the remaining items on the list were removed and replaced. The transmission assembly took 49.0 man-hours (two men 25.5 hrs) to remove and replace. The time required for repair/replacement of the four remaining components is given on the following Repair and/or Replacement Form.

REPLACEMENT AND/OR REPAIR FORM

Subsystem	Replacement Time
Transmission	49.0 man hours
Wiper Motor	0.5 man hours
Starter	1.5 man hours
Alternator	2.0 man hours
Batteries	1.0 man hours

1.3 REPLACEMENT AND/OR REPAIR OF SELECTED SUBSYSTEMS

ENGINE/TRANSMISSION REMOVAL AND REPLACEMENT
(49.0 MAN HOURS)

WIPER MOTOR REMOVAL AND REPLACEMENT
(0.5 MAN HOURS)

1.3 REPLACEMENT AND/OR REPAIR OF SELECTED SUBSYSTEMS CONT.

STARTER REMOVAL AND REPLACEMENT (1.5 MAN HOURS)

ALTERNATOR REMOVAL AND REPLACEMENT (2.0 MAN HOURS)

2. RELIABILITY - DOCUMENTATION OF BREAKDOWN AND REPAIR TIMES DURING TESTING

2-I. TEST OBJECTIVE

The objective of this test is to document unscheduled breakdowns, repairs, down time, and repair time that occur during testing.

2-II. TEST DESCRIPTION

Using the driver log and unscheduled work order forms, all significant breakdowns, repairs, man-hours to repair, and hours out of service are recorded on the Reliability Data Form.

CLASS OF FAILURES

Classes of failures are described below:

(a) Class 1: Physical Safety. A failure that could lead directly to passenger or driver injury and represents a severe crash situation.

(b) Class 2: Road Call. A failure resulting in an enroute interruption of revenue service. Service is discontinued until the bus is replaced or repaired at the point of failure.

(c) Class 3: Bus Change. A failure that requires removal of the bus from service during its assignments. The bus is operable to a rendezvous point with a replacement bus.

(d) Class 4: Bad Order. A failure that does not require removal of the bus from service during its assignments but does degrade coach operation. The failure shall be reported by driver, inspector, or hostler.

2-III. DISCUSSION

A listing of breakdowns and unscheduled repairs is accumulated during the Structural Durability Test. The following Reliability Data Form lists all unscheduled repairs under classes as defined above. These classifications are somewhat subjective as the test is performed on a test track with careful inspections every two hours. However, even on the road, there is considerable latitude on deciding how to handle many failures.

The Unscheduled Repair List is also attached to provide a reference for the repairs that are included in the Reliability Data Forms.

The classification of repairs according to subsystem is intended to emphasize those systems which had persistent minor or more serious problems. There were no Class 1 or 2 failures. Of the thirty-six Class 3 failures, eight occurred in the suspension, seven with the frame, five with the axles, three each to the windshield, engine/transmission and lavatory, two to the brakes and one with the windshield wipers. These, and the remaining twelve Class 4 failures are available for review in the Unscheduled Maintenance List, located in Section 5.7 Structural Durability.

Bus Number: 9917	Date: 7-14-00
Personnel: Bob Reifsteck	

Failure Type			

Subsystems	Mileage	Mileage	Mileage	Mileage	Man Hours	Down Time
Suspension		217			1.0	1.0
		258			1.0	1.0
		464			1.0	1.0
		687			0.5	0.5
		6,419			1.0	1.0
		7,044			4.0	4.0
		8,088			1.0	1.0
		10,937			0.5	0.5
Frame		1,859			2.0	2.0
		6,419			1.0	1.0
		9,727			1.0	1.0
		10,937			0.5	0.5
		10,937			2.5	2.5
		12,463			1.5	1.5
		12,463			1.0	1.0
Wheels/Tires	217				0.5	0.5
	3,816				2.0	2.0
	10,937				0.5	0.5
	11,797				0.5	0.5
	14,170				1.0	1.0

Bus Number: 9917	Date: 7-14-00
Personnel: Bob Reifsteck	

Failure Type			

Subsystems	Mileage	Mileage	Mileage	Mileage	Man Hours	Down Time
Electrical		5,173			1.0	1.0
		6,240			0.5	0.5
		7,689			0.5	0.5
	8,088				0.5	0.5
		8,458			2.5	2.5
Axles		6,092			0.5	0.5
		6,419			1.0	1.0
		8,088			8.0	8.0
		10,937			3.0	3.0
		14,170			1.0	1.0
Body	2,167				3.0	3.0
	3,816				0.5	0.5
	4,975				2.0	2.0
	7,542				2.0	2.0
Windshield	687				6.0	6.0
		914			4.0	4.0
		6,419			3.0	3.0
		8,088			1.5	240.00

Bus Number: 9917	Date: 7-14-00
Personnel: Bob Reifsteck	

Failure Type			

Subsystems	Mileage	Mileage	Mileage	Mileage	Man Hours	Down Time
Engine/Transmission		6,419			2.0	2.0
		7,639			1.0	1.0
		7,639			0.5	0.5
Lavatory		975			1.0	1.0
		3,816			1.0	1.0
		6,419			0.5	0.5
Brakes		6,419			1.0	1.0
		14,305			2.5	2.5
Handicap Device		3,152			1.5	1.5
Misc. Subsystems	464				1.0	1.0

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: 9917	Date: 6-1-00
Personnel: S.C., E.D. and G.M.	

Temperature (°F): 73	Humidity (%): 73
Wind Direction: NW	Wind Speed (mph): 5
Barometric Pressure (in.Hg): 30.12	

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 Test Track Facility. 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 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 26.04 seconds.

PERFORMANCE DATA FORM

Bus Number: 9917	Date: 6-1-00
Personnel: S.C., E.D., and G.M.	
Temperature (°F): 75	Humidity (%): 69
Wind Direction: Calm	Wind Speed (mph): Calm
Barometric Pressure (in.Hg): 30.12	
Air Conditioning compressor-OFF	✓ Checked
Ventilation fans-ON HIGH	✓ Checked
Heater pump motor-Off	✓ Checked
Defroster-OFF	✓ Checked
Exterior and interior lights-ON	✓ Checked
Windows and doors-CLOSED	✓ Checked

ACCELERATION, GRADEABILITY, TOP SPEED

Counter Clockwise Recorded Interval Times

Speed	Run 1	Run 2	Run 3
10 mph	3.89	3.92	3.83
20 mph	7.26	7.04	7.11
30 mph	11.51	11.38	11.42
40 mph	17.98	17.63	18.11
Top Test Speed(mph) 50	27.58	27.17	27.73

Clockwise Recorded Interval Times

Speed	Run 1	Run 2	Run 3
10 mph	3.54	3.29	3.36
20 mph	7.26	6.38	6.48
30 mph	11.14	10.01	10.29
40 mph	16.89	16.10	16.10
Top Test Speed(mph) 50	25.06	24.48	24.23

PERFORMANCE SUMMARY SHEET

BUS MANUFACTURER :Blue Bird
BUS MODEL :LTC 40
BUS NUMBER :9917
TEST DATE :6/1/00

TEST CONDITIONS :

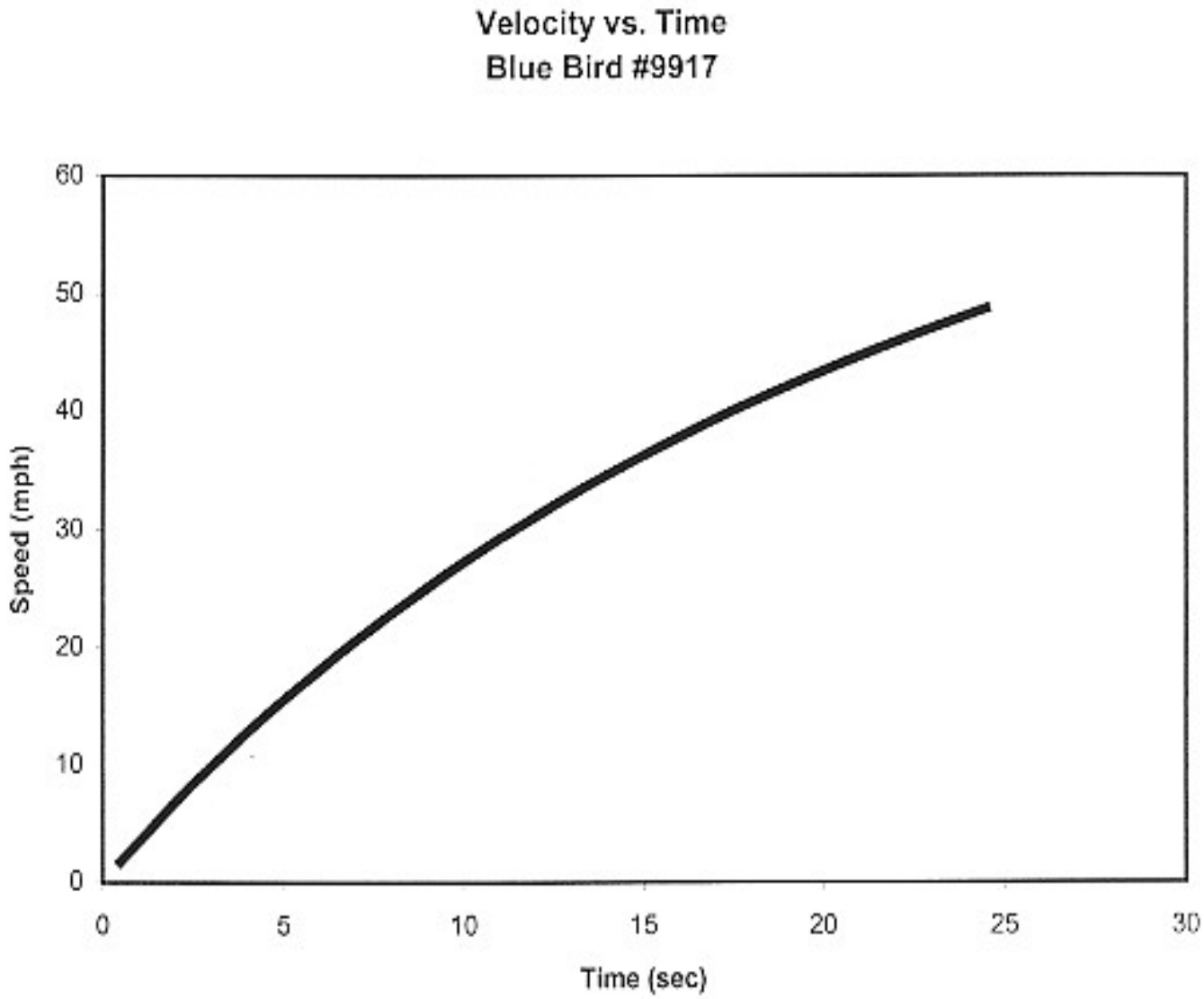
TEMPERATURE (DEG F) : 75.0
WIND DIRECTION : Calm
WIND SPEED (MPH) : .0
HUMIDITY (%) : 69
BAROMETRIC PRESSURE (IN. HG) : 30.1

VEHICLE SPEED	AVERAGE TIME (SEC)		
(MPH)	CCW DIRECTION	CW DIRECTION	TOTAL
10.0	3.88	3.40	3.64
20.0	7.14	6.71	6.92
30.0	11.44	10.48	10.96
40.0	17.91	16.36	17.14
50.0	27.49	24.59	26.04

TEST SUMMARY :

VEHICLE SPEED (MPH)	TIME (SEC)	ACCELERATION (FT/SEC^2)	MAX. GRADE (%)
1.0	.28	5.2	16.2
5.0	1.46	4.8	15.1
10.0	3.05	4.4	13.8
15.0	4.80	4.0	12.4
20.0	6.75	3.6	11.1
25.0	8.93	3.2	9.9
30.0	11.40	2.8	8.7
35.0	14.20	2.4	7.6
40.0	17.44	2.1	6.5
45.0	21.24	1.8	5.5
50.0	25.75	1.5	4.6

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
Blue Bird #9917
Speed (mph)
60
50
40
30
20
10
0
0
5
10
15
20
25
30
Time (sec)

5. STRUCTURAL INTEGRITY

5.1 STRUCTURAL STRENGTH AND DISTORTION TESTS - STRUCTURAL SHAKEDOWN TEST

5.1-I. DISCUSSION

The objective of this test is to determine certain static characteristics (e.g., bus floor deflection, permanent structural deformation, etc.) under static loading conditions.

5.1-II. TEST DESCRIPTION

In this test, the bus will be isolated from the suspension by blocking the vehicle under the suspension points. The bus will then be loaded and unloaded up to a maximum of three times with a distributed load equal to 2.5 times gross load. Gross load is 150 lb for every designed passenger seating position, for the driver, and for each 1.5 sq ft of free floor space. For a distributed load equal to 2.5 times gross load, place a 375-lb load on each seat and on every 1.5 sq ft of free floor space. The first loading and unloading sequence will "settle" the structure. Bus deflection will be measured at several locations during the loading sequences.

5.1-III. DISCUSSION

This test was performed based on a maximum passenger capacity of 68 people including the driver. The resulting test load is (68 x 375 lb) = 25,500 lb. The load is distributed evenly over the passenger space. Deflection data before and after each loading and unloading sequence is provided on the Structural Shakedown Data Form.

The unloaded height after each test becomes the original height for the next test. Some initial settling is expected due to undercoat compression, etc. After each loading cycle, the deflection of each reference point is determined. The bus is then unloaded and the residual (permanent) deflection is recorded. On the final test, the maximum loaded deflection was 0.122 inches at reference point 10. The maximum permanent deflection after the final loading sequence ranged from 0.000 inches at reference points 4, 5 & 8 to 0.003 inches at reference point 2.

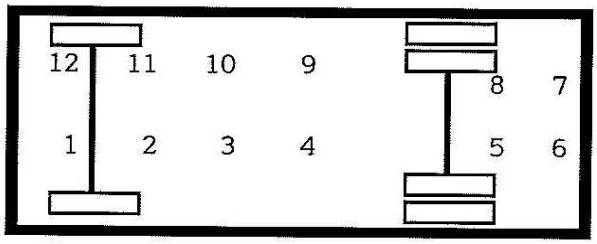
STRUCTURAL SHAKEDOWN DATA FORM

Bus Number: 9917	Date: 8-20-99
Personnel: S.C., G.F., E.L., and C.S.	Temperature (°F): 74
Loading Sequence: ☒ 1 ☐ 2 ☐ 3 (check one) Test Load (lbs): 25,500	

Indicate Approximate Location of Each Reference Point

Right

Front of Bus



Left

Top View

Reference Point No.	A (in) Original Height	B (in) Loaded Height	B-A (in) Loaded Deflection	C (in) Unloaded Height	C-A (in) Permanent Deflection
1	0	-.026	-.026	.008	.008
2	0	.008	.008	.018	.018
3	0	.129	.129	.018	.018
4	0	.187	.187	.081	.081
5	0	.019	.019	.001	.001
6	0	.056	.056	.014	.014
7	0	.057	.057	.012	.012
8	0	.000	.000	.003	.003
9	0	.086	.086	.021	.021
10	0	.140	.140	.031	.031
11	0	.115	.115	.027	.027
12	0	-.037	.037	.001	.001

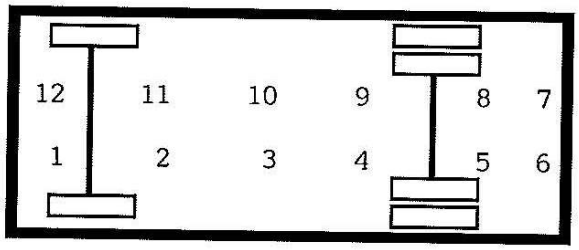
STRUCTURAL SHAKEDOWN DATA FORM

Bus Number: 9917	Date: 8-20-99
Personnel: S.C., G.F., E.L., and C.S.	Temperature (°F): 74
Loading Sequence: ☐ 1 ☒ 2 ☐ 3 (check one) Test Load (lbs): 25,500	

Indicate Approximate Location of Each Reference Point

Right

Front of Bus



Left

Top View

Reference Point No.	A (in) Original Height	B (in) Loaded Height	B-A (in) Loaded Deflection	C (in) Unloaded Height	C-A (in) Permanent Deflection
1	.008	-.026	.018	.009	.001
2	.018	.011	-.007	.021	.003
3	.018	.132	.114	.019	.001
4	.081	.189	.108	.081	.000
5	.001	.020	.019	.001	.000
6	.014	.062	.048	.015	.001
7	.012	.051	.039	.014	.002
8	.003	.008	.005	.003	.000
9	.021	.093	.072	.022	.001
10	.031	.153	.122	.033	.002
11	.027	.121	.094	.029	.002
12	.001	-.037	.036	.002	.001

5.1 STRUCTURAL SHAKEDOWN TEST

DIAL INDICATORS IN POSITION

TEST BUS LOADED TO 2.5 TIMES GVL (25,500 LB)

5.2 STRUCTURAL STRENGTH AND DISTORTION TESTS - STRUCTURAL DISTORTION

5.2-I. TEST OBJECTIVE

The objective of this test is to observe the operation of the bus subsystems when the bus is placed in a longitudinal twist simulating operation over a curb or through a pothole.

5.2-II. TEST DESCRIPTION

With the bus loaded to GVWR, each wheel of the bus will be raised (one at a time) to simulate operation over a curb and the following will be inspected:

1. Body
2. Windows
3. Doors
4. Roof vents
5. Special seating
6. Undercarriage
7. Engine
8. Service doors
9. Escape hatches
10. Steering mechanism

Each wheel will then be lowered (one at a time) to simulate operation through a pothole and the same items inspected.

5.2-III. DISCUSSION

The test sequence was repeated ten times. The first and last test is with all wheels level. The other eight tests are with each wheel 6 inches higher and 6 inches lower than the other three wheels.

All doors, windows, escape mechanisms, engine, steering and handicapped devices operated normally throughout the test. The undercarriage and body indicated no deficiencies. Water leakage was observed during the test at the top of the front passenger door. The results of this test are indicated on the following data forms.

ISTORTION TEST INSPECTION FORM

(Note: Ten copies of this data sheet are required)

Bus Number: 9917	Date: 8-24-99
Personnel: S.C., G.F., E.L., and C.S.	Temperature(°F): 75

Wheel Position : (check one)		
All wheels level	☒ before	☐ after
Left front	☐ 6 in higher	☐ 6 in lower
Right front	☐ 6 in higher	☐ 6 in lower
Right rear	☐ 6 in higher	☐ 6 in lower
Left rear	☐ 6 in higher	☐ 6 in lower
Right center	☐ 6 in higher	☐ 6 in lower
Left center	☐ 6 in higher	☐ 6 in lower

	Comments
☒ Windows	No deficiencies.
☒ Front Doors	Leak at top of door.
☒ Rear Doors	No deficiencies.
☒ Escape Mechanisms/ Roof Vents	No deficiencies.
☒ Engine	No deficiencies.
☒ Handicapped Device/ Special Seating	No deficiencies.
☒ Undercarriage	No deficiencies.
☒ Service Doors	No deficiencies.
☒ Body	No deficiencies.
☒ Windows/ Body Leakage	No deficiencies.
☒ Steering Mechanism	No deficiencies.

DISTORTION TEST INSPECTION FORM

(Note: Ten copies of this data sheet are required)

Bus Number: 9917	Date: 8-24-99
Personnel: S.C., G.F., E.L., and C.S.	Temperature(°F): 75

Wheel Position : (check one)		
All wheels level	☐ before	☐ after
Left front	☒ 6 in higher	☐ 6 in lower
Right front	☐ 6 in higher	☐ 6 in lower
Right rear	☐ 6 in higher	☐ 6 in lower
Left rear	☐ 6 in higher	☐ 6 in lower
Right center	☐ 6 in higher	☐ 6 in lower
Left center	☐ 6 in higher	☐ 6 in lower

	Comments
☒ Windows	No deficiencies.
☒ Front Doors	Leak at top of door.
☒ Rear Doors	No deficiencies.
☒ Escape Mechanisms/ Roof Vents	No deficiencies.
☒ Engine	No deficiencies.
☒ Handicapped Device/ Special Seating	No deficiencies.
☒ Undercarriage	No deficiencies.
☒ Service Doors	No deficiencies.
☒ Body	No deficiencies.
☒ Windows/ Body Leakage	No deficiencies.
☒ Steering Mechanism	No deficiencies.

DISTORTION TEST INSPECTION FORM

(Note: Ten copies of this data sheet are required)

Bus Number: 9917	Date: 8-24-99
Personnel: S.C., G.F., E.L., and C.S.	Temperature(°F): 75

Wheel Position : (check one)		
All wheels level	☐ before	☐ after
Left front	☐ 6 in higher	☐ 6 in lower
Right front	☒ 6 in higher	☐ 6 in lower
Right rear	☐ 6 in higher	☐ 6 in lower
Left rear	☐ 6 in higher	☐ 6 in lower
Right center	☐ 6 in higher	☐ 6 in lower
Left center	☐ 6 in higher	☐ 6 in lower

	Comments
☒ Windows	No deficiencies.
☒ Front Doors	Leak at top of door.
☒ Rear Doors	No deficiencies.
☒ Escape Mechanisms/ Roof Vents	No deficiencies.
☒ Engine	No deficiencies.
☒ Handicapped Device/ Special Seating	No deficiencies.
☒ Undercarriage	No deficiencies.
☒ Service Doors	No deficiencies.
☒ Body	No deficiencies.
☒ Windows/ Body Leakage	No deficiencies.
☒ Steering Mechanism	No deficiencies.

DISTORTION TEST INSPECTION FORM

(Note: Ten copies of this data sheet are required)

Bus Number: 9917	Date: 8-24-99
Personnel: S.C., G.F., E.L., and C.S.	Temperature(°F): 75

Wheel Position : (check one)		
All wheels level	☐ before	☐ after
Left front	☐ 6 in higher	☐ 6 in lower
Right front	☐ 6 in higher	☐ 6 in lower
Right rear	☒ 6 in higher	☐ 6 in lower
Left rear	☐ 6 in higher	☐ 6 in lower
Right center	☐ 6 in higher	☐ 6 in lower
Left center	☐ 6 in higher	☐ 6 in lower

	Comments
☒ Windows	No deficiencies.
☒ Front Doors	Leak at top of door.
☒ Rear Doors	No deficiencies.
☒ Escape Mechanisms/ Roof Vents	No deficiencies.
☒ Engine	No deficiencies.
☒ Handicapped Device/ Special Seating	No deficiencies.
☒ Undercarriage	No deficiencies.
☒ Service Doors	No deficiencies.
☒ Body	No deficiencies.
☒ Windows/ Body Leakage	No deficiencies.
☒ Steering Mechanism	No deficiencies.

DISTORTION TEST INSPECTION FORM

(Note: Ten copies of this data sheet are required)

Bus Number: 9917	Date: 8-24-99
Personnel: S.C., G.F., E.L., and C.S.	Temperature(°F): 75

Wheel Position : (check one)		
All wheels level	☐ before	☐ after
Left front	☐ 6 in higher	☐ 6 in lower
Right front	☐ 6 in higher	☐ 6 in lower
Right rear	☐ 6 in higher	☐ 6 in lower
Left rear	☒ 6 in higher	☐ 6 in lower
Right center	☐ 6 in higher	☐ 6 in lower
Left center	☐ 6 in higher	☐ 6 in lower

	Comments
☒ Windows	No deficiencies.
☒ Front Doors	Leak at top of door.
☒ Rear Doors	No deficiencies.
☒ Escape Mechanisms/ Roof Vents	No deficiencies.
☒ Engine	No deficiencies.
☒ Handicapped Device/ Special Seating	No deficiencies.
☒ Undercarriage	No deficiencies.
☒ Service Doors	No deficiencies.
☒ Body	No deficiencies.
☒ Windows/ Body Leakage	No deficiencies.
☒ Steering Mechanism	No deficiencies.

DISTORTION TEST INSPECTION FORM

(Note: Ten copies of this data sheet are required)

Bus Number: 9917	Date: 8-24-99
Personnel: S.C., G.F., E.L., and C.S.	Temperature(°F): 75

Wheel Position : (check one)		
All wheels level	☐ before	☐ after
Left front	☐ 6 in higher	☒ 6 in lower
Right front	☐ 6 in higher	☐ 6 in lower
Right rear	☐ 6 in higher	☐ 6 in lower
Left rear	☐ 6 in higher	☐ 6 in lower
Right center	☐ 6 in higher	☐ 6 in lower
Left center	☐ 6 in higher	☐ 6 in lower

	Comments
☒ Windows	No deficiencies.
☒ Front Doors	Leak at top of door.
☒ Rear Doors	No deficiencies.
☒ Escape Mechanisms/ Roof Vents	No deficiencies.
☒ Engine	No deficiencies.
☒ Handicapped Device/ Special Seating	No deficiencies.
☒ Undercarriage	No deficiencies.
☒ Service Doors	No deficiencies.
☒ Body	No deficiencies.
☒ Windows/ Body Leakage	No deficiencies.
☒ Steering Mechanism	No deficiencies.

DISTORTION TEST INSPECTION FORM

(Note: Ten copies of this data sheet are required)

Bus Number: 9917	Date: 8-24-99
Personnel: S.C., G.F., E.L., and C.S.	Temperature(°F): 75

Wheel Position : (check one)		
All wheels level	☐ before	☐ after
Left front	☐ 6 in higher	☐ 6 in lower
Right front	☐ 6 in higher	☒ 6 in lower
Right rear	☐ 6 in higher	☐ 6 in lower
Left rear	☐ 6 in higher	☐ 6 in lower
Right center	☐ 6 in higher	☐ 6 in lower
Left center	☐ 6 in higher	☐ 6 in lower

	Comments
☒ Windows	No deficiencies.
☒ Front Doors	Leak at top of door.
☒ Rear Doors	No deficiencies.
☒ Escape Mechanisms/ Roof Vents	No deficiencies.
☒ Engine	No deficiencies.
☒ Handicapped Device/ Special Seating	No deficiencies.
☒ Undercarriage	No deficiencies.
☒ Service Doors	No deficiencies.
☒ Body	No deficiencies.
☒ Windows/ Body Leakage	No deficiencies.
☒ Steering Mechanism	No deficiencies.

DISTORTION TEST INSPECTION FORM

(Note: Ten copies of this data sheet are required)

Bus Number: 9917	Date: 8-24-99
Personnel: S.C., G.F., E.L., and C.S.	Temperature(°F): 75

Wheel Position : (check one)		
All wheels level	☐ before	☐ after
Left front	☐ 6 in higher	☐ 6 in lower
Right front	☐ 6 in higher	☐ 6 in lower
Right rear	☐ 6 in higher	☒ 6 in lower
Left rear	☐ 6 in higher	☐ 6 in lower
Right center	☐ 6 in higher	☐ 6 in lower
Left center	☐ 6 in higher	☐ 6 in lower

	Comments
☒ Windows	No deficiencies.
☒ Front Doors	Leak at top of door.
☒ Rear Doors	No deficiencies.
☒ Escape Mechanisms/ Roof Vents	No deficiencies.
☒ Engine	No deficiencies.
☒ Handicapped Device/ Special Seating	No deficiencies.
☒ Undercarriage	No deficiencies.
☒ Service Doors	No deficiencies.
☒ Body	No deficiencies.
☒ Windows/ Body Leakage	No deficiencies.
☒ Steering Mechanism	No deficiencies.

DISTORTION TEST INSPECTION FORM

(Note: Ten copies of this data sheet are required)

Bus Number: 9917	Date: 8-24-99
Personnel: S.C., G.F., E.L., and C.S.	Temperature(°F): 75

Wheel Position : (check one)		
All wheels level	☐ before	☐ after
Left front	☐ 6 in higher	☐ 6 in lower
Right front	☐ 6 in higher	☐ 6 in lower
Right rear	☐ 6 in higher	☐ 6 in lower
Left rear	☐ 6 in higher	☒ 6 in lower
Right center	☐ 6 in higher	☐ 6 in lower
Left center	☐ 6 in higher	☐ 6 in lower

	Comments
☒ Windows	No deficiencies.
☒ Front Doors	Leak at top of door.
☒ Rear Doors	No deficiencies.
☒ Escape Mechanisms/ Roof Vents	No deficiencies.
☒ Engine	No deficiencies.
☒ Handicapped Device/ Special Seating	No deficiencies.
☒ Undercarriage	No deficiencies.
☒ Service Doors	No deficiencies.
☒ Body	No deficiencies.
☒ Windows/ Body Leakage	No deficiencies.
☒ Steering Mechanism	No deficiencies.

DISTORTION TEST INSPECTION FORM

(Note: Ten copies of this data sheet are required)

Bus Number: 9917	Date: 8-24-99
Personnel: S.C., G.F., E.L., and C.S.	Temperature(°F): 75

Wheel Position : (check one)		
All wheels level	☐ before	☒ after
Left front	☐ 6 in higher	☐ 6 in lower
Right front	☐ 6 in higher	☐ 6 in lower
Right rear	☐ 6 in higher	☐ 6 in lower
Left rear	☐ 6 in higher	☐ 6 in lower
Right center	☐ 6 in higher	☐ 6 in lower
Left center	☐ 6 in higher	☐ 6 in lower

	Comments
☒ Windows	No deficiencies.
☒ Front Doors	Leak at top of door.
☒ Rear Doors	No deficiencies.
☒ Escape Mechanisms/ Roof Vents	No deficiencies.
☒ Engine	No deficiencies.
☒ Handicapped Device/ Special Seating	No deficiencies.
☒ Undercarriage	No deficiencies
☒ Service Doors	No deficiencies.
☒ Body	No deficiencies.
☒ Windows/ Body Leakage	No deficiencies.
☒ Steering Mechanism	No deficiencies.

5.2 STRUCTURAL DISTORTION TEST

LEFT REAR WHEEL 6" HIGHER

LEFT FRONT WHEEL 6" LOWER

5.3 STRUCTURAL STRENGTH AND DISTORTION TESTS - STATIC TOWING TEST

5.3-I. TEST OBJECTIVE

The objective of this test is to determine the characteristics of the bus towing mechanisms under static loading conditions.

5.3-II. TEST DESCRIPTION

Utilizing a load-distributing yoke, a hydraulic cylinder is used to apply a static tension load equal to 1.2 times the bus curb weight. The load will be applied to both the front and rear, if applicable, towing fixtures at an angle of 20 degrees with the longitudinal axis of the bus, first to one side then the other in the horizontal plane, and then upward and downward in the vertical plane. Any permanent deformation or damage to the tow eyes or adjoining structure will be recorded.

5.3-III. DISCUSSION

The load-distributing yoke was incorporated as the towing interface between the Static Tow apparatus and the test bus tow hooks. The test was to be performed to a target test load of 44,292 lbs (1.2 x 39,910 lbs CW). Further testing was terminated during the 20° upward pull, when at 33,600 lbs. the tow hook frame support sheared off the bolts that attach to the main frame and the tow hook deformed up and out. The manufacturer does not recommend towing from the rear, therefore a rear test was not performed.

STATIC TOWING TEST DATA FORM

Bus Number: 9917	Date: 7-31-00
Personnel: S.C., E.D., and E.L.	Temperature (°F): 82

Inspect right front tow eye and adjoining structure.
Comments: 20° up pull; tow hook frame support sheared off bolts, bumper and tow hook deformed up & out. Test terminated at 33,600 lbs.
Check the torque of all bolts attaching tow eye and surrounding structure.
Comments: Bolts sheared off.
Inspect left tow eye and adjoining structure.
Comments: No damage or deformation.
Check the torque of all bolts attaching tow eye and surrounding structure.
Comments: Torques verified.
Inspect right rear tow eye and adjoining structure.
Comments: N/A
Check the torque of all bolts attaching tow eye and surrounding structure.
Comments: N/A
Inspect left rear tow eye and adjoining structure.
Comments: N/A
Check the torque of all bolts attaching tow eye and surrounding structure.
Comments: N/A
General comments of any other structure deformation or failure:
Test terminated at 33,600 lbs. when right front tow hook frame supports sheared off
bolts and tow hook deformed up and out. Test was to be performed to 44,292 lbs.
Manufacturer does not recommend rear towing. A rear test was not performed.

5.3 STATIC TOWING TEST

20° UPWARD PULL

5.3 STATIC TOWING TEST CONT.

DAMAGED INCURRED AT 33,600 LBS OF FORCE

TOW HOOK FRAME SUPPORT BOLTS SHEARED OFF

5.4 STRUCTURAL STRENGTH AND DISTORTION TESTS - DYNAMIC TOWING TEST

5.4-I. TEST OBJECTIVE

The objective of this test is to verify the integrity of the towing fixtures and determine the feasibility of towing the bus under manufacturer specified procedures.

5.4-II. TEST DESCRIPTION

This test requires the bus be towed at curb weight using the specified equipment and instructions provided by the manufacturer and a heavy-duty wrecker. The bus will be towed for 5 miles at a speed of 20 mph for each recommended towing configuration. After releasing the bus from the wrecker, the bus will be visually inspected for any structural damage or permanent deformation. All doors, windows and passenger escape mechanisms will be inspected for proper operation.

5.4-III. DISCUSSION

The bus was towed using a heavy-duty wrecker. The towing interface was accomplished by attaching the tow bar to the front axle. A rubber cushion was incorporated for protection of the front of the vehicle. A front flat tow was performed. Slight upward deformation of the front bumper was noted. No problems were encountered with the towing interface. Rear towing is not recommended by the manufacturer.

DYNAMIC TOWING TEST DATA FORM

Bus Number: 9917	Date: 7-18-00
Personnel: S.C., E.D., and R.H.	

Temperature (°F): 77	Humidity (%): 46
Wind Direction: W	Wind Speed (mph): 8
Barometric Pressure (in.Hg): 30.10	

Inspect tow equipment-bus interface.
Comments: A safe and adequate connection was made between the tow equipment and the test bus.
Inspect tow equipment-wrecker interface.
Comments: A safe and adequate connection was made between the tow equipment and the wrecker.
Towing Comments: A front flat tow was performed. Safety chains and a rubber pad was incorporated to protect the bumper.
Description and location of any structural damage: Slight upward deformation of the front bumper was noted.
General Comments:

5.4 DYNAMIC TOWING TEST

TOWING INTERFACE

TEST BUS IN TOW

5.5 STRUCTURAL STRENGTH AND DISTORTION TESTS - JACKING TEST

5.5-I. TEST OBJECTIVE

The objective of this test is to inspect for damage due to the deflated tire, and determine the feasibility of jacking the bus with a portable hydraulic jack to a height sufficient to replace a deflated tire.

5.5-II. TEST DESCRIPTION

With the bus at curb weight, the tire(s) at one corner of the bus are replaced with deflated tire(s) of the appropriate type. A portable hydraulic floor jack is then positioned in a manner and location specified by the manufacturer and used to raise the bus to a height sufficient to provide 3-in clearance between the floor and an inflated tire. The deflated tire(s) are replaced with the original tire(s) and the jack is lowered. Any structural damage or permanent deformation is recorded on the test data sheet. This procedure is repeated for each corner of the bus.

5.5-III. DISCUSSION

The jack used for this test has a minimum height of 8.75 inches. During the deflated portion of the test, the jacking point clearances ranged from 5.50 inches to 10.25 inches. No deformation or damage was observed during testing. A complete listing of jacking point clearances is provided in the Jacking Test Data Form.

JACKING CLEARANCE SUMMARY

Condition	Frame Point Clearance
Front axle - one tire flat	9.00"
Rear axle - one tire flat	10.25"
Rear axle - two tires flat	9.12"

JACKING TEST DATA FORM

Bus Number: 9917	Date: 8-17-99
Personnel: K.D. and M.H.	Temperature: 85

Record any permanent deformation or damage to bus as well as any difficulty encountered during jacking procedure.

Deflated Tire	Jacking Pad Clearance Body/Frame (in)	Jacking Pad Clearance Axle/Suspension (in)	Comments
Right front	4.25" I 9.00" D	11.25" I 9.00" D	
Left front	11.50“ I 9.50" D	11.25" I 9.00" D	
Right rear--outside	10.25" I 10.25" D	9.00" I 7.25" D	
Right rear--both	10.25" I 9.12" D	7.25" I 7.75" D	
Left rear--outside	10.30" I 10.25" D	9.00" I 7.50" D	
Left rear--both	10.30" I 9.25" D	7.50" I 7.60" D	
Right middle or tag--outside	10.25" I 10.00" D	9.50" I 5.50" D	
Right middle or tag--both	NA	NA	
Left middle or tag--outside	10.25" I 10.00" D	9.50" I 5.50" D	
Left middle or tag--both	NA	NA	

Additional comments of any deformation or difficulty during jacking:

No damage, deformation or problems were observed.

5.6 STRUCTURAL STRENGTH AND DISTORTION TESTS - HOISTING TEST

5.6-I. TEST OBJECTIVE

The objective of this test is to determine possible damage or deformation caused by the jack/stands.

5.6-II. TEST DESCRIPTION

With the bus at curb weight, the front end of the bus is raised to a height sufficient to allow manufacturer-specified placement of jack stands under the axles or jacking pads independent of the hoist system. The bus will be checked for stability on the jack stands and for any damage to the jacking pads or bulkheads. The procedure is repeated for the rear end of the bus. The procedure is then repeated for the front and rear simultaneously.

5.6-III. DISCUSSION

The test was conducted using four posts of a six-post electric lift and standard 19 inch jack stands. The bus was hoisted from the front wheels, rear wheels, and then the front and rear wheels simultaneously and placed on jack stands.

The bus easily accommodated the placement of the vehicle lifts and jack stands and the procedure was performed without any instability noted.

HOISTING TEST DATA FORM

Bus Number: 9917	Date: 8-17-99
Personnel: K.D., G.F., and D.L.	Temperature (°F): 85

Comments of any structural damage to the jacking pads or axles while both the front wheels are supported by the jack stands:
None noted.
Comments of any structural damage to the jacking pads or axles while both the rear wheels are supported by the jack stands:
None noted.
Comments of any structural damage to the jacking pads or axles while both the front and rear wheels are supported by the jack stands:
None noted.

5.6 HOISTING TEST

TEST BUS STABLE ON JACK STANDS

5.7 STRUCTURAL DURABILITY TEST

5.7-I. TEST OBJECTIVE

The objective of this test is to perform an accelerated durability test that approximates up to 25 percent of the service life of the vehicle.

5.7-II. TEST DESCRIPTION

The test vehicle is driven a total of 15,000 miles; approximately 12,500 miles on the Durability Test Track and approximately 2,500 miscellaneous other miles. The test will be conducted with the bus operated under three different loading conditions. The first segment will consist of approximately 6,250 miles with the bus operated at GVW. The second segment will consist of approximately 2,500 miles with the bus operated at SLW. The remainder of the test, approximately 6,250 miles, will be conducted with the bus loaded to CW. If GVW exceeds the axle design weights, then the load will be adjusted to the axle design weights and the change will be recorded. All subsystems are run during these tests in their normal operating modes. All recommended manufacturers servicing is to be followed and noted on the vehicle maintainability log. Servicing items accelerated by the durability tests will be compressed by 10:1; all others will be done on a 1:1 mi/mi basis. Unscheduled breakdowns and repairs are recorded on the same log as are any unusual occurrences as noted by the driver. Once a week the test vehicle shall be washed down and thoroughly inspected for any signs of failure.

5.7-III. DISCUSSION

The Structural Durability Test was started on August 24, 1999 and was conducted until July 19, 2000. The first 6,250 miles were performed at a GVW of 45,820 lbs. and completed March 3, 2000. The next 2,500 mile SLW segment was performed at 43,850 lbs. and completed on May 16, 2000 and the final 6,250 mile segment was performed at a CW of 36,910 lbs. and completed on July 19, 2000.

The mileage summary presents the accumulation of miles during the Structural Durability Test. The driving schedule is included, showing the operating duty cycle. A detailed plan view of the Test Track Facility and Durability Test Track are attached for reference. The amplitude and profile for each element of the durability test track is also included. Finally, a list of unscheduled maintenance is included describing the failures that were encountered along with related photographs during the Structural Durability Test.

BLUE BIRD - TEST BUS #9917
MILEAGE DRIVEN/RECORDED FROM DRIVERS' LOGS

DATE	TOTAL OTHER MILES	TOTAL DURABILITY TRACK	TOTAL
08/24/99 TO 08/30/99	60.00	157.00	217.00
08/31/99 TO 09/06/99	0.00	0.00	0.00
09/07/99 TO 09/13/99	2.00	18.00	20.00
09/14/99 TO 09/20/99	71.00	328.00	399.00
09/21/99 TO 09/27/99	112.00	166.00	278.00
09/28/99 TO 10/03/99	0.00	0.00	0.00
10/04/99 TO 10/10/99	0.00	0.00	0.00
10/11/99 TO 10/17/99	0.00	0.00	0.00
10/18/99 TO 10/24/99	0.00	0.00	0.00
10/25/99 TO 10/31/99	0.00	0.00	0.00
11/01/99 TO 11/07/99	0.00	0.00	0.00
11/08/99 TO 11/14/99	0.00	0.00	0.00
11/15/99 TO 11/21/99	0.00	0.00	0.00
11/22/99 TO 11/28/99	0.00	0.00	0.00
11/29/99 TO 12/05/99	0.00	0.00	0.00
12/06/99 TO 12/12/99	52.00	5.00	57.00
12/13/99 TO 12/19/99	123.00	244.00	367.00

DATE	TOTAL OTHER MILES	TOTAL DURABILITY TRACK	TOTAL
12/20/99 TO 12/26/99	74.00	396.00	470.00
12/27/99 TO 01/02/00	0.00	0.00	0.00
01/03/00 TO 01/09/00	82.00	469.00	551.00
01/10/00 TO 01/16/00	154.00	908.00	1062.00
01/17/00 TO 01/23/00	156.00	930.00	1086.00
01/24/00 TO 01/30/00	245.00	712.00	957.00
01/31/00 TO 02/06/00	197.00	758.00	955.00
02/07/00 TO 02/13/00	0.00	0.00	0.00
02/14/00 TO 02/20/00	0.00	0.00	0.00
02/21/00 TO 02/27/00	0.00	0.00	0.00
02/28/00 TO 03/05/00	111.00	178.00	289.00
03/06/00 TO 03/12/00	141.00	649.00	790.00
03/13/00 TO 03/19/00	32.00	558.00	590.00
03/20/00 TO 03/26/00	0.00	0.00	0.00
03/27/00 TO 04/02/00	0.00	0.00	0.00
04/03/00 TO 04/09/00	0.00	0.00	0.00
04/10/00 TO 04/16/00	0.00	0.00	0.00
04/17/00 TO 04/23/00	58.00	104.00	162.00

DATE	TOTAL OTHER MILES	TOTAL DURABILITY TRACK	TOTAL
04/24/00 TO 04/30/00	0.00	0.00	0.00
05/01/00 TO 05/07/00	2.00	32.00	34.00
05/08/00 TO 05/14/00	120.00	326.00	446.00
05/15/00 TO 05/21/00	246.00	826.00	1072.00
05/22/00 TO 05/28/00	11.00	195.00	206.00
05/29/00 TO 06/04/00	307.00	62.00	369.00
06/05/00 TO 06/11/00	79.00	481.00	560.00
06/12/00 TO 06/18/00	68.00	713.00	781.00
06/19/00 TO 06/25/00	0.00	666.00	666.00
06/26/00 TO 07/02/00	0.00	886.00	886.00
07/03/00 TO 07/09/00	0.00	322.00	322.00
07/10/00 TO 07/16/00	0.00	935.00	935.00
07/17/00 TO 07/23/00	0.00	480.00	480.00
TOTAL	2503.00	12504.00	15007.00

Table 4. Driving Schedule for Bus Operation on the Durability Test Track.

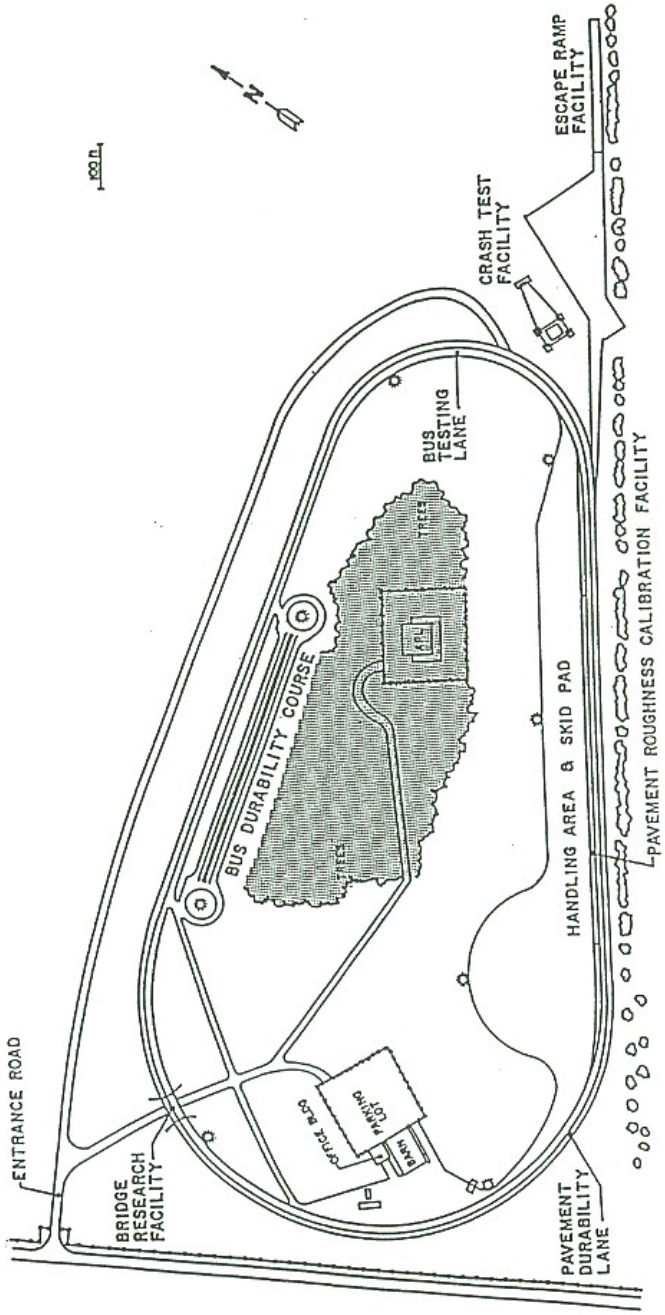
STANDARD OPERATING SCHEDULE

Monday through Friday

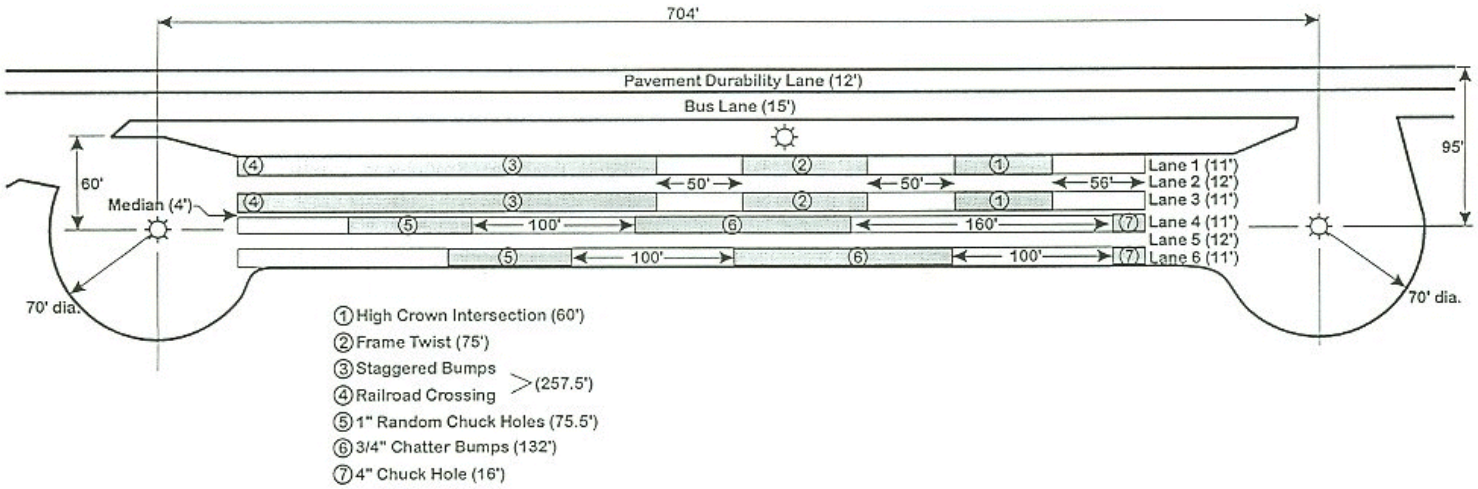
	HOUR	ACTION
Shift 1	midnight	D
	1:40 am	C
	1:50 am	B
	2:00 am	D
	3:35 am	C
	3:45 am	B
	4:05 am	D
	5:40 am	C
	5:50 am	B
	6:00 am	D
	7:40 am	C
	7:50 am	F
Shift 2	8:00 am	D
	9:40 am	C
	9:50 am	B
	10:00 am	D
	11:35 am	C
	11:45 am	B
	12:05 pm	D
	1:40 pm	C
	1:50 pm	B
	2:00 pm	D
	3:40 pm	C
	3:50 pm	F
Shift 3	4:00 pm	D
	5:40 pm	C
	5:50 pm	B
	6:00 pm	D
	7:40 pm	C
	7:50 pm	B
	8:05 pm	D
	9:40 pm	C
	9:50 pm	B
	10:00 pm	D
	11:40 pm	C
	11:50 pm	F

B---Break
C----Cycle all systems five times, visual inspection, driver's log entries
D----Drive bus as specified by procedure
F----Fuel bus, complete driver's log shift entries

"PLAN VIEW OF PENN STATE BUS TESTING AND RESEARCH FACILITY"



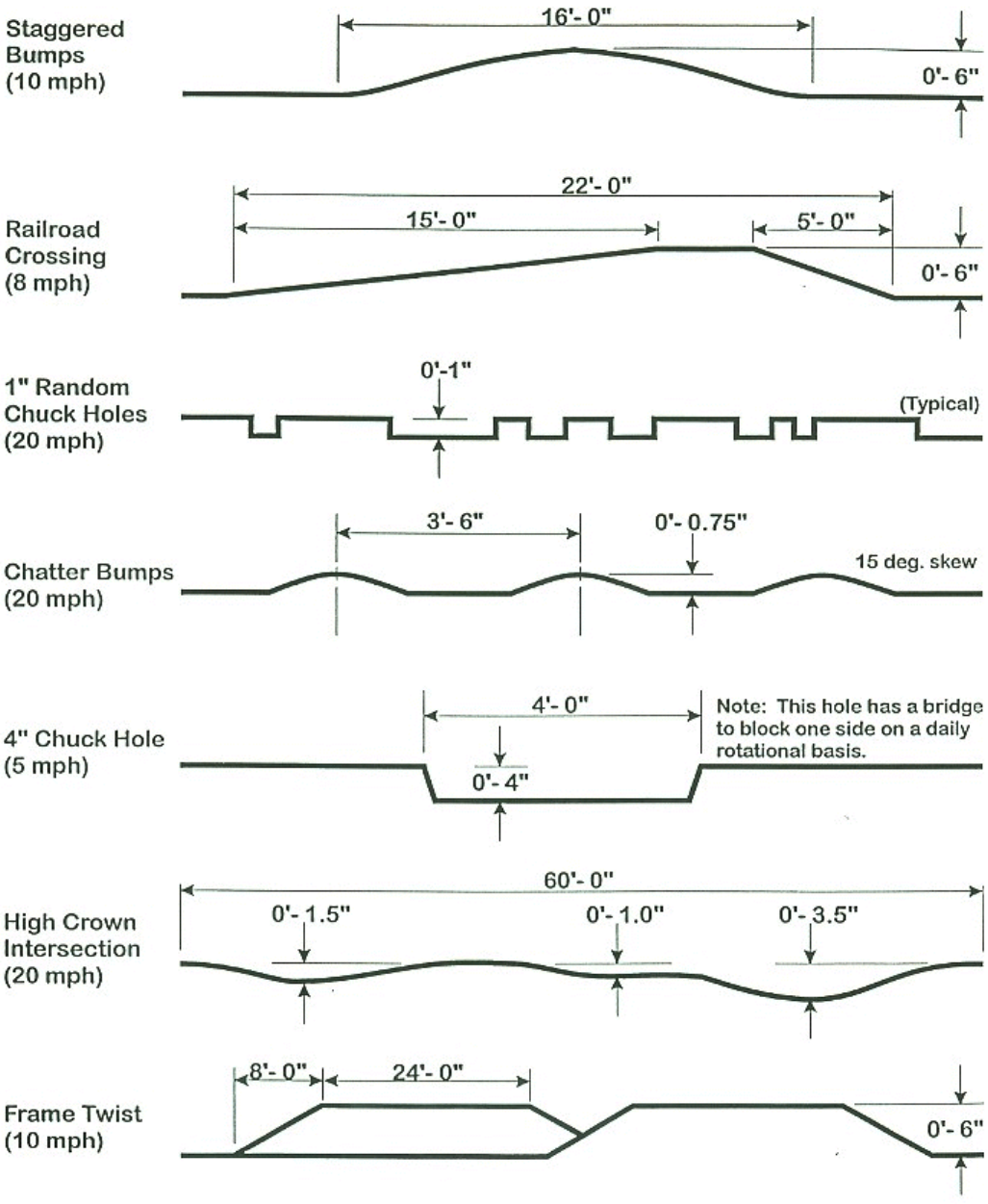
BUS TESTING AND RESEARCH TEST TRACK
UNIVERSITY PARK, PA



Plan View

Vehicle Durability Test Track

The Pennsylvania Transportation Institute
Penn State



Durability Element Profiles

The Pennsylvania Transportation Institute
Penn State

UNSCHEDULED MAINTENANCE

Blue Bird 9917

DATE	TEST MILES	SERVICE	ACTIVITY	DOWN TIME	HOURS
09-07-99	217	The front stabilizer bar bushings are worn.	Bushings replaced.	1.00	1.00
09-07-99	217	The spare tire under the bus is loose.	Spare tire carrier tightened.	.50	.50
09-15-99	258	The front stabilizer bar bushings have worked out of the brackets.	Installed new bushing brackets and bushings.	1.00	1.00
09-16-99	464	The leveling valve connecting rod for the kneeling system is missing.	Replaced leveling valve connecting rod.	1.00	1.00
09-16-99	464	The right windshield wiper is traveling too far.	Right windshield wiper adjusted.	1.00	1.00
09-23-99	687	The left windshield has cracked at the top outside radius.	Left side windshield replaced.	6.00	6.00
09-23-99	687	The right side hold-down clamp on the front sway bar is loose.	Retorqued sway bar hold down clamp.	.50	.50
12-08-99	914	Manufacturer requests steel channels be installed on the windshield post to stiffen frame and eliminate flexing. (See photo page 83).	Channels installed on exterior of front window pillars.	4.00	4.00
12-15-99	975	Two hangers for the lavatory holding tank are broken.	Hangers replaced with all-thread.	1.00	1.00
01-04-00	1,859	Sub-frame vertical member (forward of the right drive wheel) has two broken bolts.	Piece cut out and welded back in place to gain access. Broken bolts replaced.	2.00	2.00

UNSCHEDULED MAINTENANCE

Blue Bird 9917

DATE	TEST MILES	SERVICE	ACTIVITY	DOWN TIME	HOURS
01-06-00	2,167	Both body supports on the right and left side between the drive and tag axles are broken.	New supports fabricated and installed.	3.00	3.00
01-13-00	3,152	Wheelchair lift will not stow.	Repaired broken activating arm on switch.	1.50	1.50
01-18-00	3,816	The outside rear hanger for the lavatory holding tank is broken.	Hanger replaced.	1.00	1.00
01-18-00	3,816	Front tires are worn.	Front tires replaced with new tires. Front tires rotated to tag axle.	2.00	2.00
01-18-00	3,816	The ceiling panel above the handicap entry door has broken from the fasteners.	Ceiling panel removed.	.50	.50
01-26-00	4,975	Two bolts are broken in the luggage compartment sub floor.	Broken bolts drilled out and replaced.	2.00	2.00
01-27-00	5,173	Bus disabled on the test track. Engine cranks but will not start.	Replaced broken terminal on the +12v wire leading to the self-setting circuit breakers in the battery compartment.	1.00	1.00
02-02-00	6,092	The right rear pedestal bolt at the left front axle is broken.	New bolt and lock nut installed.	.50	.50
02-03-00	6,240	Bus disabled on the test track. Engine cranks but will not start.	Repaired broken wire at the +12v circuit breaker feed. Repaired both broken wires on the lower circuit breaker.	.50	.50
02-04-00	6,419	The hydraulic reservoir is leaking at the weld on the center fitting on the bottom of the tank.	Reservoir removed, welded/repaired and reinstalled.	2.00	2.00

UNSCHEDULED MAINTENANCE

Blue Bird 9917

DATE	TEST MILES	SERVICE	ACTIVITY	DOWN TIME	HOURS
02-04-00	6,419	Both bolts are missing on the right side of the front axle cross member above the rear most air bags.	Cross member realigned and new bolts installed.	1.00	1.00
02-07-00	6,419	Right rear brake chamber–lower attaching bolt is broken and the case is cracked.	Brake chamber replaced.	1.00	1.00
02-07-00	6,419	The right rear leveling valve link is broken.	Right rear leveling valve replaced.	1.00	1.00
02-07-00	6,419	The outside rear hanger for the lavatory holding tank is broken.	Hanger replaced.	.50	.50
02-07-00	6,419	Numerous bolts are missing on the right side luggage compartment sub-frame.	Bolts replaced in the luggage compartment sub-frame.	1.00	1.00
03-02-00	6,419	The driver's windshield is working out of the gasket.	Windshield reinstalled.	3.00	3.00
03-08-00	7,044	Right front–the track bar mounting plate and the upper air bag mount are cracked.	Cracks welded/repaired.	4.00	4.00
03-13-00	7,542	The overhead storage and light compartment on right side from the handicap door to the rear has broken loose.	Complete compartment removed.	2.00	2.00
03-14-00	7,639	Bus has a loss of power and exhaust is light blue.	Troubleshoot with Pro-link. Nothing found. Changed air filter.	1.00	1.00
03-15-00	7,689	Bus has a loss of power and exhaust is light blue.	Replaced both fuel filters.	.50	.50

UNSCHEDULED MAINTENANCE

Blue Bird 9917

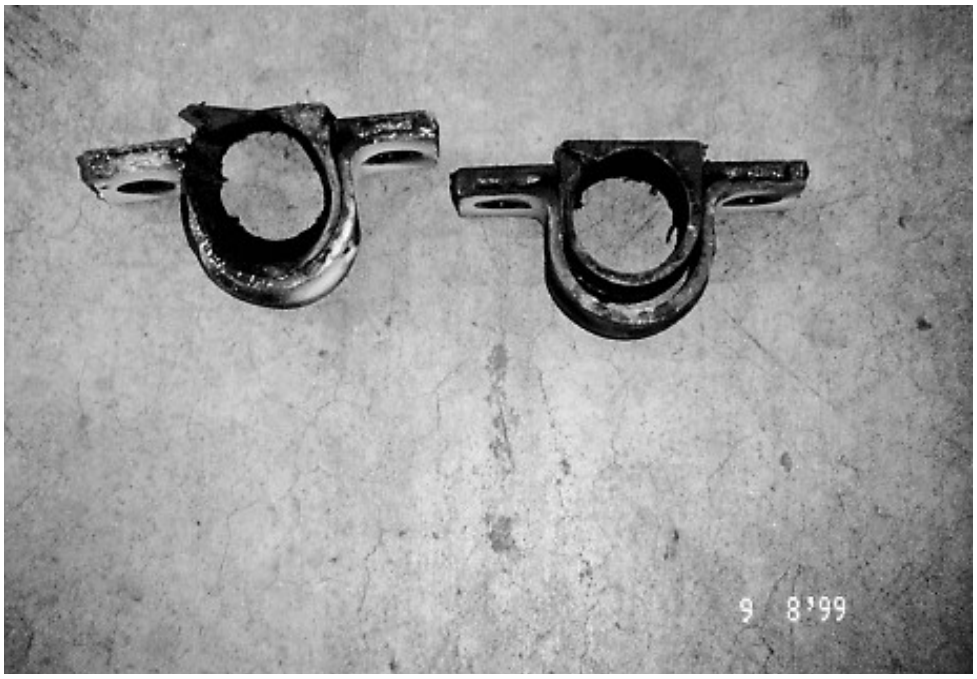
DATE	TEST MILES	SERVICE	ACTIVITY	DOWN TIME	HOURS
03-15-00	7,689	The bottom circuit breaker in the battery compartment has a broken wire.	Repaired broken wire.	.50	.50
03-21-00	8,088	Both low beam lamps are burned out.	Both lamps replaced.	.50	.50
03-21-00	8,088	The driver's windshield is broken.	New windshields ordered.		
03-21-00	8,088	All bushings are worn on both tag axle radius rods.	All tag axle radius rod bushings replaced.	8,00	8.00
03-21-00	8,088	The right front air bag lateral bar bracket is cracked.	Crack welded/repaired.	1.00	1.00
04-10-00	8,088	Windshields ordered on 3/21/00 arrived.	Windshields installed.	240.00	1.50
05-11-00	8,458	Charging system voltage is dropping below 12 volts.	Troubleshooting found no voltage at the ignition terminal on the voltage regulator. Replaced 20 amp fuse for regulator. Repaired shorted wire in the harness, rear of the hydraulic reservoir.	2.50	2.50
05-19-00	9,727	Both bolts are broken in the right rear luggage compartment sub-frame.	Both broken bolts removed and replaced.	1.00	1.00
06-09-00	10,937	The center bushing is worn on the left tag axle trailing arm.	Bushing replaced.	3.00	3.00
06-09-00	10,937	The front shock bushings are worn.	Front shock bushings replaced.	.50	.50
06-09-00	10,937	The right tire on the tag axle is worn.	Right steering tire replaced with new and rotated to right tag axle.	.50	.50

UNSCHEDULED MAINTENANCE

Blue Bird 9917

DATE	TEST MILES	SERVICE	ACTIVITY	DOWN TIME	HOURS
06-09-00	10,937	The sub-frame bolts in the left rear luggage compartment are loose.	All four sub-frame bolts replaced.	.50	.50
06-12-00	10,937	The left cross member above the front axle is cracked by the mounting holes.	Cross member replaced.	2.50	2.50
06-19-00	11,797	The left tire on the tag axle is worn.	Tire replaced with good used tire.	.50	.50
06-26-00	12,463	The center cross member is broken on luggage compartment sub-frame forward of the rear axle.	Broken cross member welded/repaired.	1.50	1.50
06-26-00	12,463	The forward weld is broken on the C-channel below the electrical compartment by the driver.	Broken weld welded/repaired.	1.00	1.00
07-12-00	14,170	The eccentric bolt on the left rear drive axle, lower radius rod is loose.	Reinstalled lock nut and retorqued.	1.00	1.00
07-12-00	14,170	The right tire on the tag axle is worn.	Tire replaced with good used tire.	1.00	1.00
07-14-00	14,305	The right side brake chamber has fallen off the drive axle.	Brake chamber replaced.	2.50	2.50

UNSCHEDULED MAINTENANCE

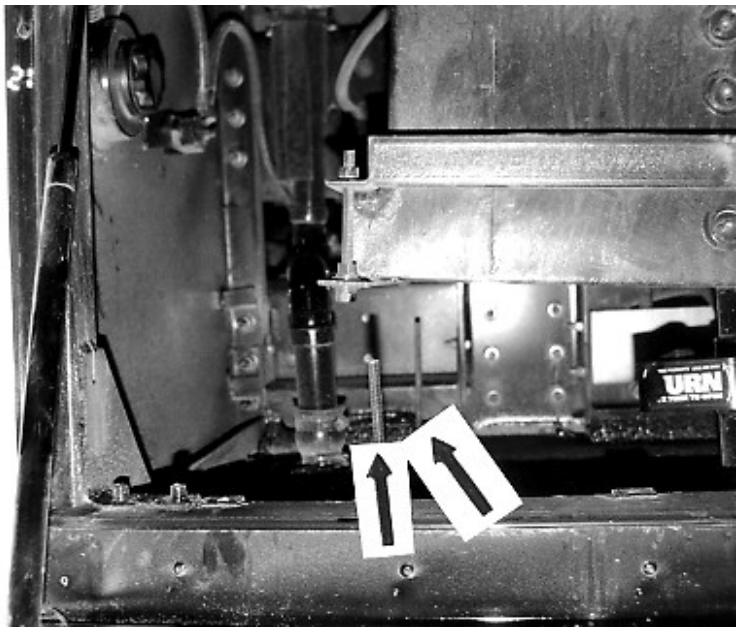


WORN FRONT STABILIZER BAR BUSHINGS (217 TEST MILES)

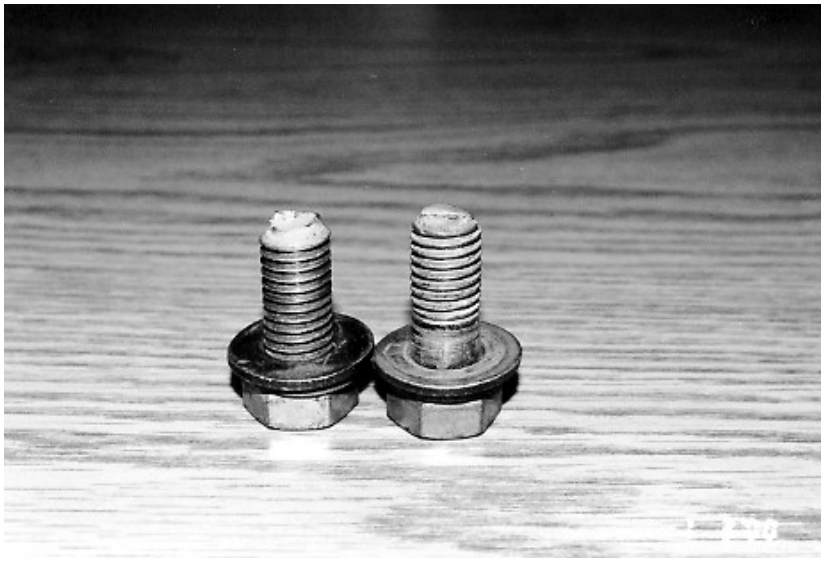
STEEL C-CHANNEL INSTALLED ON EXTERIOR OF WINDSHIELD PILLARS TO STIFFEN WINDSHIELD FRAME. MANUFACTURER DIRECTED MODIFICATION (914 TEST MILES)

UNSCHEDULED MAINTENANCE CONT.

BROKEN LAVATORY HOLDING TANK HANGERS



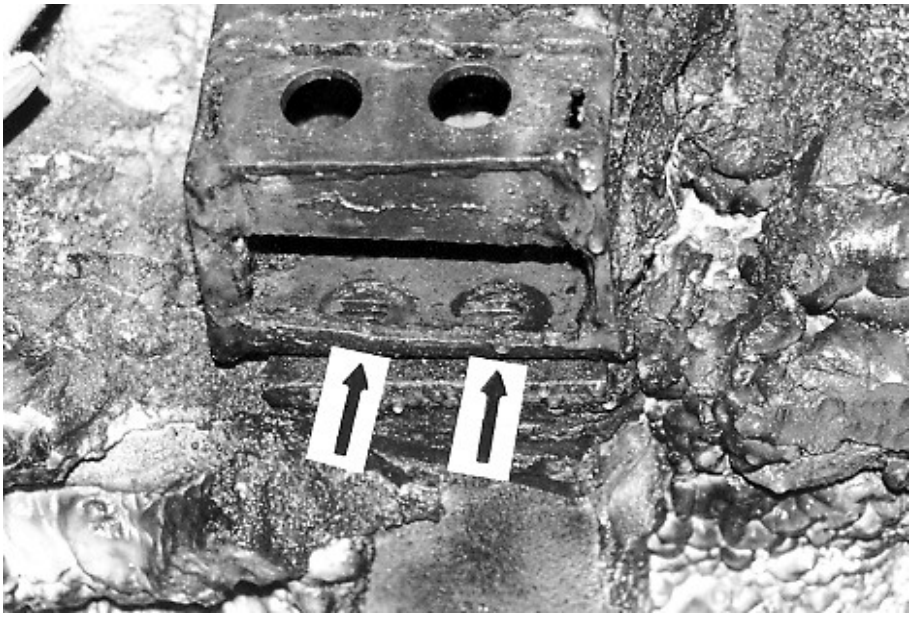
(975 TEST MILES)



BROKEN BOLTS FROM SUB FRAME VERTICAL MEMBER
(1,859 TEST MILES)

UNSCHEDULED MAINTENANCE CONT.

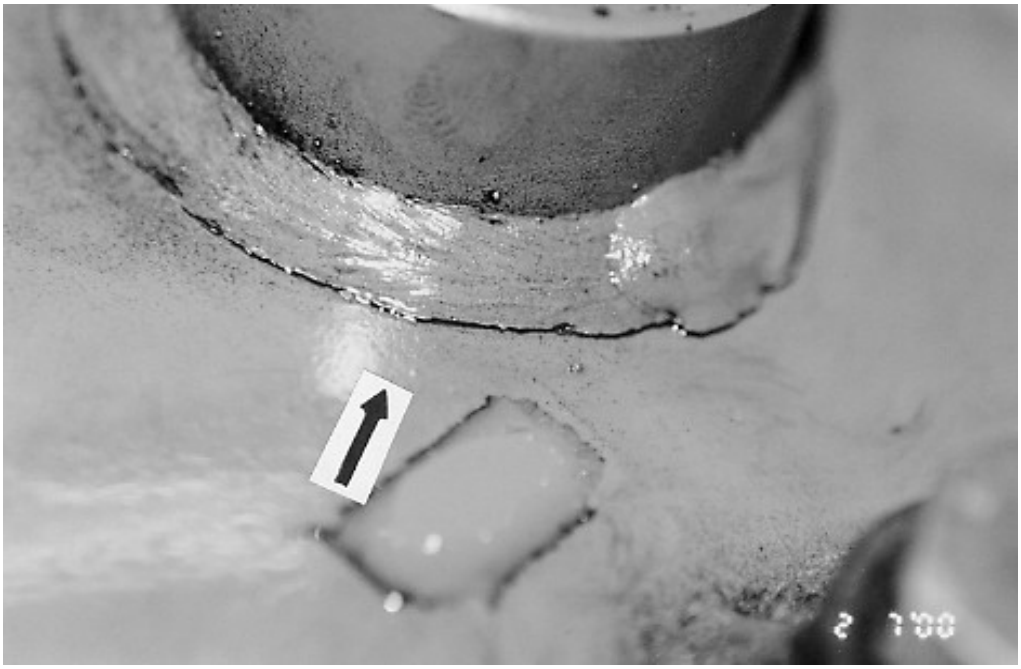
BROKEN BODY SUPPORT BETWEEN THE DRIVE AND TAG AXLES (2,167 TEST MILES)



MISSING BOLTS FROM THE RIGHT SIDE OF THE FRONT AXLE CROSS MEMBER (6,419 TEST MILES)

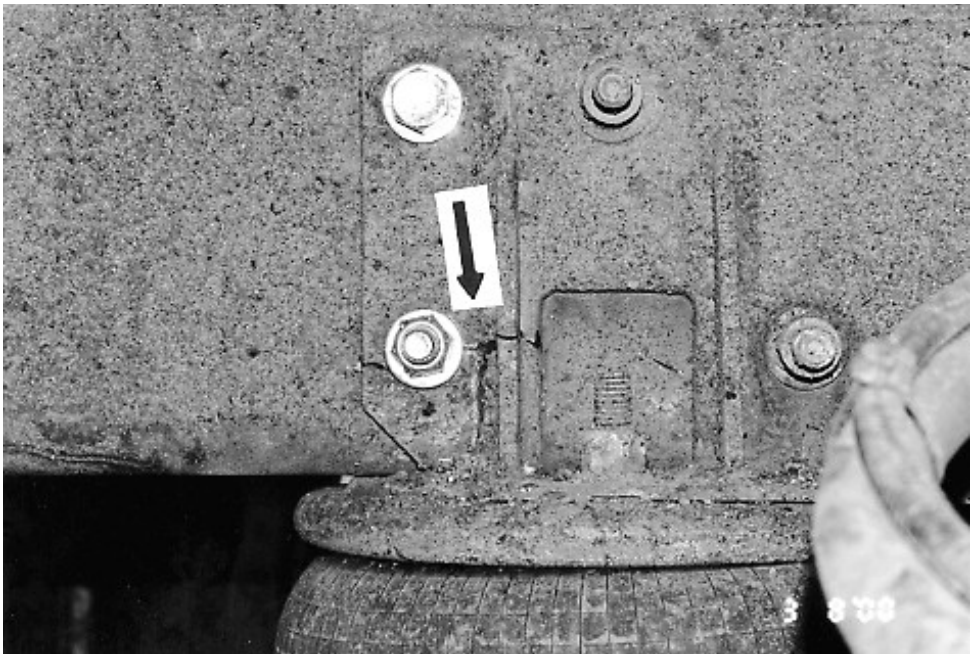
UNSCHEDULED MAINTENANCE CONT.

HYDRAULIC RESERVOIR IS LEAKING AT THE WELD ON THE CENTER FITTING



UNSCHEDULED MAINTENANCE CONT.

MISSING ATTACH BOLT AT THE RIGHT REAR BRAKE CHAMBER (6,419 TEST MILES)



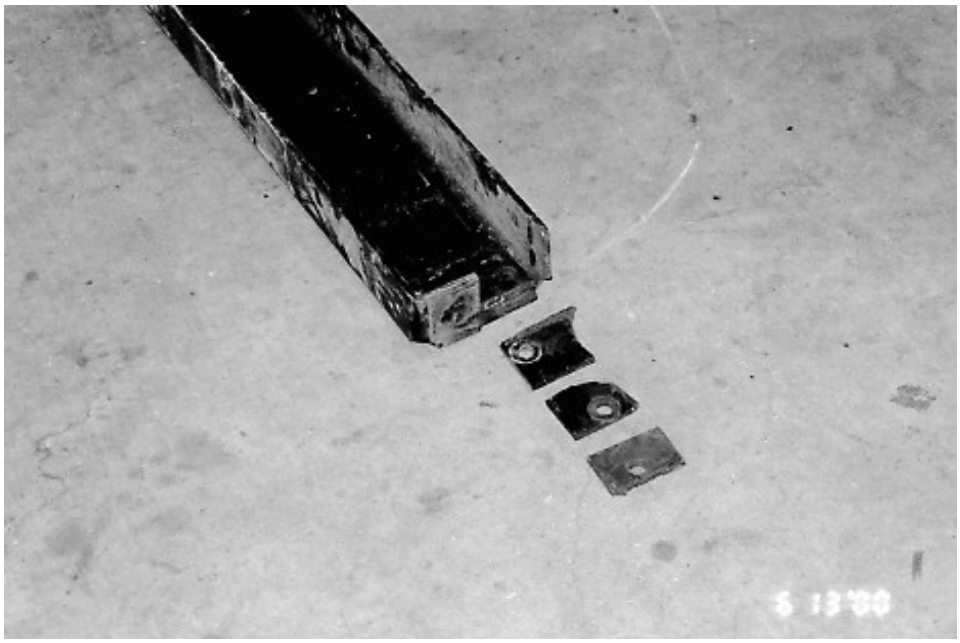
CRACKED UPPER AIR BAG MOUNTING PLATE (7,044 TEST MILES)

UNSCHEDULED MAINTENANCE CONT.

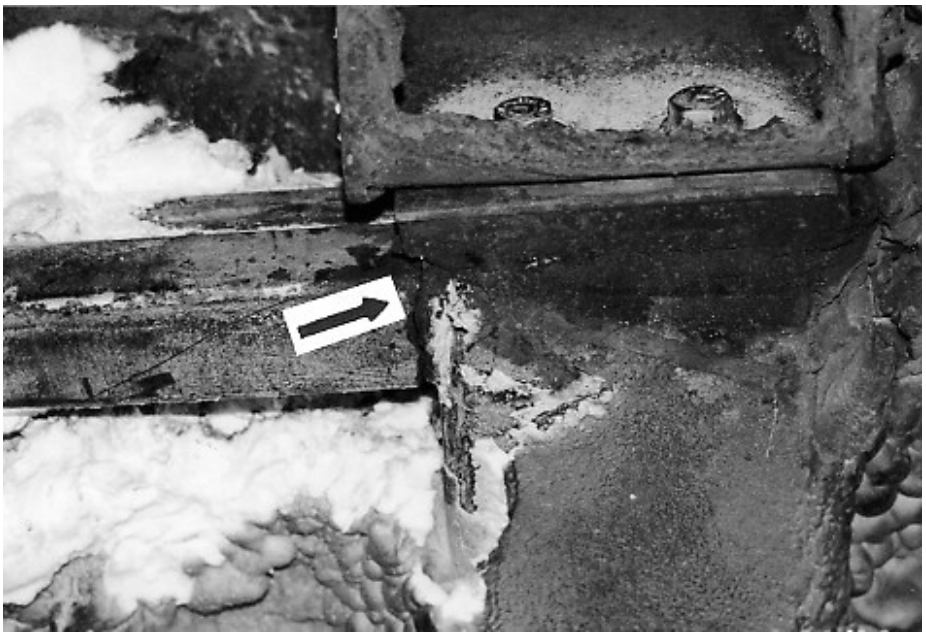
OVERHEAD STORAGE AND LIGHT COMPARTMENT HAS FALLEN DOWN (7,542 TEST MILES)

WORN CENTER BUSHING FROM THE LEFT TAG AXLE TRAILING ARM (10,937 TEST MILES)

UNSCHEDULED MAINTENANCE CONT.



LEFT CROSS MEMBER ABOVE THE FRONT AXLE IS CRACKED BY THE MOUNTING HOLES (10,937 TEST MILES)



BROKEN CENTER CROSS MEMBER IN LUGGAGE COMPARTMENT SUB FRAME (12,463 TEST MILES)

UNSCHEDULED MAINTENANCE CONT.

FAILED RIGHT SIDE BRAKE CHAMBER
(14,305 TEST MILES)

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 Penn State Bus Research Test Facility. 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

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

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

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

$$\mathbf{FEo_{mpg}} = \mathbf{FEc_{mi/lb}} \times Gs \times Gw$$

where **Gs** = Specific gravity of test fuel at 60°F (referred to water)
Gw = 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.

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

where

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

Combining steps 1-3 yields

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

4.) Covert 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/BTUx10^6.

Eq = Energy equivalent of converting mpg to mile/BTUx10^6.

$$Eq = ((mpg)/(H))x10^6$$

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/BTUx10^6) 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

$FEo_{mi/scf}$ = 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/ft^3).

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/BTUx10^6) by dividing the observed fuel economy (FEomi/lb) by the heating value of the test fuel at standard conditions.

$$Eq = ((FEomi/lb)/H)x10^6$$

where

Eq = Energy equivalent of miles/lb to mile/BTUx10^6
H = Volumetric heating value of test fuel at standard conditions

6-III. DISCUSSION

This is a comparative test of fuel economy using number one diesel fuel with a heating value of 20,214.0 btu/lb. 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 - 2.09 mpg, ART - 2.65 mpg, and COM - 4.23 mpg. Average fuel consumption at idle was 8.18 lb/hr (0.1.30 gph).

FUEL ECONOMY PRE-TEST MAINTENANCE FORM

Bus Number: 9917	Date: 5-31-00	SLW (lbs.): 43,850
Personnel: S.C. and E.D.		

FUEL SYSTEM	OK	Date	Initials
Install fuel measurement system	✓	5-26-00	S.C.
Replace fuel filter	✓	5-26-00	E.D.
Check for fuel leaks	✓	5-26-00	S.C.
Specify fuel type (refer to fuel analysis)	#1 Diesel		
Remarks:			
BRAKES/TIRES	**OK**	**Date**	**Initials**
Inspect hoses	✓	5-26-00	S.C.
Inspect brakes	✓	5-26-00	S.C.
Relube wheel bearings	✓	5-26-00	S.C.
Check tire inflation pressures (mfg. specs.)	✓	5-26-00	E.D.
Remarks:			
COOLING SYSTEM	**OK**	**Date**	**Initials**
Check hoses and connections	✓	5-26-00	S.C.
Check system for coolant leaks	✓	5-26-00	S.C.
Remarks:			

FUEL ECONOMY PRE-TEST MAINTENANCE FORM (page 2)

Bus Number: 9917	Date: 5-31-00
Personnel: S.C. and E.D.	

ELECTRICAL SYSTEMS	OK	Date	Initials
Check battery	✓	5-26-00	S.C.
Inspect wiring	✓	5-26-00	S.C.
Inspect terminals	✓	5-26-00	S.C.
Check lighting	✓	5-26-00	S.C.
Remarks:			

DRIVE SYSTEM	OK	Date	Initials
Drain transmission fluid	✓	5-26-00	E.D.
Replace filter/gasket	✓	5-26-00	E.D.
Check hoses and connections	✓	5-26-00	E.D.
Replace transmission fluid	✓	5-26-00	E.D.
Check for fluid leaks	✓	5-26-00	E.D.
Remarks:			

LUBRICATION	OK	Date	Initials
Drain crankcase oil	✓	5-26-00	E.D.
Replace filters	✓	5-26-00	E.D.
Replace crankcase oil	✓	5-26-00	E.D.
Check for oil leaks	✓	5-26-00	E.D.
Check oil level	✓	5-26-00	E.D.
Lube all chassis grease fittings	✓	5-26-00	E.D.
Lube universal joints	✓	5-26-00	E.D.
Replace differential lube including axles	✓	5-26-00	E.D.
Remarks:			

FUEL ECONOMY PRE-TEST MAINTENANCE FORM (page 3)

Bus Number: 9917	Date: 5-31-00
Personnel: S.C. and E.D.	

EXHAUST/EMISSION SYSTEM	OK	Date	Initials
Check for exhaust leaks	✓	5-26-00	S.C.
Remarks:			

ENGINE	OK	Date	Initials
Replace air filter	✓	5-26-00	E.D.
Inspect air compressor and air system	✓	5-26-00	S.C.
Inspect vacuum system, if applicable	N/A	5-26-00	S.C.
Check and adjust all drive belts	✓	5-26-00	S.C.
Check cold start assist, if applicable	N/A	5-26-00	S.C.
Remarks:			

STEERING SYSTEM	OK	Date	Initials
Check power steering hoses and connectors	✓	5-26-00	S.C.
Service fluid level	✓	5-26-00	S.C.
Check power steering operation	✓	5-26-00	S.C.
Remarks:			

	OK	Date	Initials
Ballast bus to seated load weight	✓	5-26-00	S.C.

TEST DRIVE	OK	Date	Initials
Check brake operation	✓	5-26-00	S.C.
Check transmission operation	✓	5-26-00	S.C.
Remarks:			

FUEL ECONOMY PRE-TEST INSPECTION FORM

Bus Number: 9917	Date: 5-31-00
Personnel: S.C. and E.D.	

PRE WARM-UP	If OK, Initial
Fuel Economy Pre-Test Maintenance Form is complete	E.D.
Cold tire pressure (psi): Front 115 Middle 115 Rear 115	E.D.
Tire wear:	E.D.
Engine oil level	E.D.
Engine coolant level	E.D.
Interior and exterior lights on, evaporator fan on	E.D.
Fuel economy instrumentation installed and working properly.	E.D.
Fuel line -- no leaks or kinks	E.D.
Speed measuring system installed on bus. Speed indicator installed in front of bus and accessible to TECH and Driver.	E.D.
Bus is loaded to SLW	E.D.
WARM-UP	**If OK, Initial**
Bus driven for at least one hour warm-up	E.D.
No extensive or black smoke from exhaust	E.D.
POST WARM-UP	**If OK, Initial**
Warm tire pressure (psi): Front 122 Middle 124 Rear 115	E.D.
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	S.C.

FUEL ECONOMY DATA FORM (Liquid Fuels)

Bus Number: 9917	Manufacturer: Blue Bird	Date: 5-31-00
Run Number: 1	Personnel: S.C. and E.D.	
Test Direction: ☐CW or ☒CCW	Temperature (°F): 57	Humidity (%): 67
SLW (lbs.): 43,850	Wind Speed (mph) & Direction: 10/SSW	Barometric Pressure (in.Hg): 30.21

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	9:19	9:19	25.1	131.75	125.60	6.15
ART #1	0	4:17	4:17	31.2	125.60	120.75	4.85
CBD #2	0	9:10	9:10	35.0	120.75	114.90	5.85
ART #2	0	4:19	4:19	38.1	114.90	110.65	4.25
CBD #3	0	9:13	9:13	43.5	110.65	105.15	5.50
COMMUTER	0	6:16	6:16	43.8	105.15	99.55	5.60
						Total Fuel =	32.20 lbs.

20 minute idle : Total Fuel Used = 2.80 lbs.

Heating Value = 20,214.0 BTU/LB

Comments:

FUEL ECONOMY DATA FORM (Liquid Fuels)

Bus Number: 9917	Manufacturer: Blue Bird	Date: 5-31-00
Run Number: 2	Personnel: S.C. and E.D.	
Test Direction: ☒CW or ☐CCW	Temperature (°F): 61	Humidity (%): 63
SLW (lbs.): 43,850	Wind Speed (mph) & Direction: 7/SSW	Barometric Pressure (in.Hg): 30.20

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	9:24	9:24	39.5	99.55	93.90	5.65
ART #1	0	4:23	4:23	41.2	93.90	98.40	4.50
CBD #2	0	9:12	9:12	43.4	89.40	83.70	5.70
ART #2	0	4:20	4:20	43.1	83.70	79.55	4.15
CBD #3	0	9:25	9:25	42.4	79.55	73.80	5.75
COMMUTER	0	6:16	6:16	43.0	73.80	68.10	5.70
							Total Fuel = 31.45 lbs.

20 minute idle: Total Fuel Used = N/A

Heating Value = 20,214.0 BTU/LB

Comments:

FUEL ECONOMY DATA FORM (Liquid Fuels)

Bus Number: 9917	Manufacturer: Blue Bird	Date: 5-31-00
Run Number: 3	Personnel: S.C. and E.D.	
Test Direction: ☐CW or ☒CCW	Temperature (°F): 68	Humidity (%): 60
SLW (lbs.): 43,850	Wind Speed (mph) & Direction: 7 / S	Barometric Pressure (in.Hg): 30.18

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	9:14	9:14	42.4	122.60	117.05	5.55
ART #1	0	4:13	4:13	42.7	117.05	112.25	4.80
CBD #2	0	9:12	9:12	43.0	112.25	106.70	5.55
ART #2	0	4:17	4:17	52.9	106.70	101.65	5.05
CBD #3	0	9:16	9:16	55.0	101.65	95.80	5.85
COMMUTER	0	6:14	6:14	55.8	95.80	90.00	5.80
						Total Fuel =	32.60 lbs.

20 minute idle: Total Fuel Used = N/A

Heating Value = 20,214.0 BTU/LB

Comments:

FUEL ECONOMY DATA FORM (Liquid Fuels)

Bus Number: 9917	Manufacturer: Blue Bird	Date: 5-31-00
Run Number: 4	Personnel: S.C. and E.D.	
Test Direction: ☒CW or ☐CCW	Temperature (°F): 73	Humidity (%): 56
SLW (lbs.): 43,850	Wind Speed (mph) & Direction: 5 / S	Barometric Pressure (in.Hg): 30.17

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	58.1	90.00	84.30	5.70
ART #1	0	4:17	4:17	58.8	84.30	79.65	4.65
CBD #2	0	9:08	9:08	62.1	79.65	74.05	5.60
ART #2	0	4:18	4:18	63.2	74.05	70.00	4.05
CBD #3	0	9:06	9:06	64.6	70.00	64.25	5.75
COMMUTER	0	6:14	6:14	64.7	64.25	58.70	5.55
							Total Fuel = 31.30 lbs.

20 minute idle : Total Fuel Used = 2.65 lbs.

Heating Value = 20,214.0 BTU/LB

Comments:

FUEL ECONOMY SUMMARY SHEET

BUS MANUFACTURER :Blue Bird
BUS MODEL :LTC 40
BUS NUMBER :9917
TEST DATE :5/31/00

FUEL TYPE : DIESEL
SP. GRAVITY : .8095
HEATING VALUE : 20214.00 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	17.50	5.73	.33	2.05
ART	9.10	3.82	.42	2.63
COM	5.60	3.82	.68	4.28
TOTAL	32.20	13.37	.42	2.60
Run # :2, CW				
CBD	17.10	5.73	.34	2.10
ART	8.65	3.82	.44	2.77
COM	5.70	3.82	.67	4.20
TOTAL	31.45	13.37	.43	2.66
Run # :3, CCW				
CBD	16.95	5.73	.34	2.12
ART	9.85	3.82	.39	2.43
COM	5.80	3.82	.66	4.13
TOTAL	32.60	13.37	.41	2.57
Run # :4, CW				
CBD	17.05	5.73	.34	2.11
ART	8.70	3.82	.44	2.75
COM	5.55	3.82	.69	4.31
TOTAL	31.30	13.37	.43	2.68

IDLE CONSUMPTION

First 20 Minutes Data : 2.80 Lb Last 20 Minutes Data : 2.65 Lb
Average Idle Consumption : 8.18 Lb/Hr

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

Run 1 : -1.0 Run 2 : 1.4 Run 3 : -2.2 Run 4 : 1.8

SUMMARY

Average Idle Consumption : 1.30 G/Hr
Average CBD Phase Consumption : 2.09 MPG
Average Arterial Phase Consumption : 2.65 MPG
Average Commuter Phase Consumption : 4.23 MPG
Overall Average Fuel Consumption : 2.63 MPG
Overall Average Fuel Consumption : 19.27 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 47.9 dB(A); ranging from 44.5 dB(A) at the rear passenger seats to 50.6 dB(A) at the driver's seat. The interior ambient noise level for this test was 34.8 dB(A).

The second test measures interior noise during acceleration from 0 to 35 mph. This noise level ranged from 70.1 dB(A) at the driver's seat to 78.1 dB(A) at the rear passenger seats. The overall average was 73.7 dB(A). The interior ambient noise level for this test was 49.2 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: 9917	Date: 8-10-99
Personnel: K.D., E.L., D.L., and M.H.	
Temperature (°F): 75	Humidity (%): 68
Wind Speed (mph): 5	Wind Direction: SE
Barometric Pressure (in.Hg): 30.03	
Initial Sound Level Meter Calibration: ☒ checked by B.L.	
Interior Ambient Noise Level dB(A): 34.8	Exterior Ambient Noise Level dB(A): 55.7
Microphone Height During Testing (in): 45	

Measurement Location	Measured Sound Level dB(A)
Driver's Seat	50.6
Front Passenger Seats	49.7
In Line with Front Speaker	50.4
In Line with Middle Speaker	46.7
In Line with Rear Speaker	45.4
Rear Passenger Seats	44.5

Final Sound Level Meter Calibration: ☒ checked by B.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: 9917	Date: 6-1-00
Personnel: S.C., E.D., and G.M.	
Temperature (°F): 74	Humidity (%): 73
Wind Speed (mph): Calm	Wind Direction: Calm
Barometric Pressure (in.Hg): 30.12	
Initial Sound Level Meter Calibration: ☒ checked by B.L.	
Interior Ambient Noise Level dB(A): 49.2	Exterior Ambient Noise Level dB(A): 58.5
Microphone Height During Testing (in): 45	

Measurement Location	Measured Sound Level dB(A)
Driver's Seat	70.1
Front Passenger Seats	72.7
Middle Passenger Seats	74.0
Rear Passenger Seats	78.1

Final Sound Level Meter Calibration: ☒ checked by B.L.

Comments: All readings taken in the center aisle.

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

Bus Number: 9917	Date: 6-1-00
Personnel: S.C., E.D., and G.M.	
Temperature (°F): 74	Humidity (%): 73
Wind Speed (mph): Calm	Wind Direction: Calm
Barometric Pressure (in.Hg): 30.12	

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 Test Track Facility 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 62.1 dB(A), the average test result obtained while accelerating from a constant speed was 82.5 dB(A) on the right side and 84.7 dB(A) on the left side.

When accelerating from a standstill with an exterior ambient noise level of 62.1 dB(A), the average of the results obtained were 83.3 dB(A) on the right side and 85.6 dB(A) on the left side.

With the vehicle stationary and the engine, accessories, and air conditioning on, the measurements averaged 68.5 dB(A) at low idle and 83.0 dB(A) at wide open throttle. With the accessories and air conditioning off, the readings averaged 0.3 dB(A) higher at low idle and 0.70 dB(A) lower at wide open throttle. The exterior ambient noise level measured during this test was 62.1 dB(A). Note: the test vehicle 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: 9917	Date: 6-1-00
Personnel: S.C., E.D., and G.M.	
Temperature (°F): 81	Humidity (%): 65
Wind Speed (mph): 6 -7	Wind Direction: SSE
Barometric Pressure (in.Hg): 30.12	
Verify that microphone height is 4 feet, wind speed is less than 12 mph and ambient temperature is between 30°F and 90°F: ☒ checked by S.C.	
Initial Sound Level Meter Calibration: ☒ checked by S.C.	
Exterior Ambient Noise Level dB(A): 62.1	

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	82.0	1	84.1
2	82.6	2	84.8
3	82.1	3	84.5
4	82.3	4	84.1
5	82.4	5	84.2
Average of two highest actual noise levels = 82.5 dB(A)		Average of two highest actual noise levels = 84.7 dB(A)	

Final Sound Level Meter Calibration Check: ☒ checked by S.C.

Comments:

EXTERIOR NOISE TEST DATA FORM
Accelerating from Standstill

Bus Number: 9917	Date: 6-1-00
Personnel: S.C., E.D., and G.M.	
Temperature (°F): 82	Humidity (%): 65
Wind Speed (mph): 6	Wind Direction: SSE
Barometric Pressure (in.Hg): 30.12	
Verify that microphone height is 4 feet, wind speed is less than 12 mph and ambient temperature is between 30°F and 90°F: ☒ checked by S.C.	
Initial Sound Level Meter Calibration: ☒ checked by S.C.	
Exterior Ambient Noise Level dB(A): 62.1	

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	83.0	1	85.1
2	83.5	2	85.7
3	82.6	3	85.4
4	82.9	4	85.2
5	82.3	5	84.8
Average of two highest actual noise levels = 83.3 dB(A)		Average of two highest actual noise levels = 85.6 dB(A)	

Final Sound Level Meter Calibration Check: ☒ checked by S.C.

Comments:

EXTERIOR NOISE TEST DATA FORM
Stationary

Bus Number: 9917	Date: 6-1-00
Personnel: S.C., E.D., and G.M.	
Temperature (°F): 84	Humidity (%): 64
Wind Speed (mph): 7	Wind Direction: SSE
Barometric Pressure (in.Hg): 30.12	
Verify that microphone height is 4 feet, wind speed is less than 12 mph and ambient temperature is between 30°F and 90°F: ☒ checked by S.C.	
Initial Sound Level Meter Calibration: ☒ checked by S.C.	
Exterior Ambient Noise Level dB(A): 62.1	

Accessories and Air Conditioning ON			
Throttle Position	Engine RPM	Curb (Right) Side dB(A)	Street (Left) Side db(A)
		Measured	Measured
Low Idle	600	68.7	68.2
High Idle	N/A	N/A	N/A
Wide Open Throttle	2,183	80.6	85.3

Accessories and Air Conditioning OFF			
Throttle Position	Engine RPM	Curb (Right) Side dB(A)	Street (Left) Side db(A)
		Measured	Actual
Low Idle	610	67.6	70.0
High Idle	N/A	N/A	N/A
Wide Open Throttle	2,140	79.9	84.6

Final Sound Level Meter Calibration Check: ☒ checked by S.C.
Comments: