STURAA TEST

12 YEAR

500,000 MILE BUS

from

MOTOR COACH INDUSTRIES, LTD.

MODEL RENAISSANCE

MAY 2000

PTI-BT-R9918-04-00

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

Motor Coach Industries, Ltd., submitted a model Renaissance, diesel powered 57 seat/45-foot bus, for a 12 year/500,000 mile STURAA test. The odometer reading at the time of delivery was 4,905 miles. Testing started on September 20, 1999, and was completed on April 28, 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 September 22, 1999 and was completed on April 4, 2000.

The interior of the bus is configured with seating for 57 passengers including the driver. Additionally, free floor space will accommodate 20 standing passengers resulting in a potential load of 77 persons. At 150 lbs per person, this load results in a total vehicle weight of 51,280 lb. The first GVW segment was performed at 51,280 lb. The SLW segment was performed at 48,180 lb and the final CW segment at 38,760 lb. Durability driving resulted in several failures that required unscheduled maintenance. A description of failures, and a complete and detailed listing of scheduled and unscheduled maintenance, is provided 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. Also the problems are listed by class as defined in Section 2. The test bus encountered no Class 1 or Class 2 failures. Of the 55 reported failures, 40 were Class 3 and 15 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. Slight body roll was noted during the 40 and 45 mph runs. 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 26.80 seconds.

The Shakedown Test produced a maximum final loaded deflection of 0.150 inches under a distributed static load of 28,875 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. No water leakage observed during the test. The Static Towing Test was performed using a target load (towing force) of 46,512 lbs. The 20 degree upward pull was not performed due to interference with the front bumper. The 20 degree downward, left and right pulls were all performed to the target test weight with no damage or deformation observed. Rear towing is not recommended by the manufacturer. The Dynamic Towing Test was accomplished by incorporating a heavy duty wrecker equipt with an under lift. A front lift tow was performed with no damage or deformation observed and no problems with the towing apparatus noted. Again, rear

towing is not recommended by the manufacturer. 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 5.9 inches.

A Fuel Economy Test was run on simulated central business district, arterial, and commuter courses. The results were 2.14 mpg, 2.63 mpg, and 5.63 mpg respectively; with an overall average of 2.78 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 NBM test number to the bus, cleaning the bus, completing the vehicle data form, obtaining any special information and tools from the manufacturer, determining a testing schedule, performing an initial safety check, and performing the manufacturer's recommended preventive maintenance. The bus manufacturer must certify that the bus meets all Federal regulations.

III. DISCUSSION

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

The test bus has a front door located forward of the front axle and a dedicated handicap door located behind the rear and tag axles. The engine type is a diesel fueled Detroit Diesel 60 Series. The transmission is an Allison B500.

The interior of the bus is configured with seating for 57 passengers including the driver. Additionally, free floor space will accommodate 20 standing passengers resulting in a potential load of 77 persons. At 150 lbs per person, this load results in a total vehicle weight of 51,280 lbs.

VEHICLE DATA FORM

Bus Number: 9918	Arrival Date: 9-21-99
Bus Manufacturer: Motor Coach Industries, Ltd.	Vehicle Identification Number (VIN): 1M8TRMPAOXPO6O744
Model Number: Renaissance	Date: 9-21-99
Personnel: B.L.	

WEIGHT:

Individual Wheel Reactions:

Weights (lb)	Front Axle		Drive Axle		Tag Axle	
	Right	Left	Right	Left	Right	Left
CW	5,330	5,450	8,570	7,940	5,230	6,240
SLW	7,070	7,250	9,830	9,230	7,370	7,430
GVW	7,830	7,980	9,830	9,230	7,370	7,430

Total Weight Details:

Weight (lb)	CW	SLW	GVW	GAWR
Front Axle	10,780	14,320	15,810	16,000
Drive Axle	16,510	19,060	19,570	23,000
Tag Axle	11,470	14,800	15,900	16,000
Total	38,760	48,180	51,280	GVWR: 54,000

Dimensions:

Length (ft/in)	45 / 6
Width (in)	102.0
Height (in)	143.5
Front Overhang (in)	78.3
Rear Overhang (in)	103.5
Wheel Base (in)	315.0
Wheel Track (in)	Front: 84.7
	Drive: 75.4 Tag: 84.7

Bus Number: 9918	Date: 9-21-99

CLEARANCES:

Lowest Point Outside Front Axle	Location: Skid plate Clearance(in): 12.0
Lowest Point Outside Rear Axle	Location: Muffler Clearance(in): 7.7
Lowest Point between Axles	Location: Body frame Clearance(in): 14.0
Ground Clearance at the center (in)	High ride: 16.5 Normal ride: 14.0 Low ride: 9.7
Front Approach Angle (deg)	11.9
Rear Approach Angle (deg)	8.8
Ramp Clearance Angle (deg)	5.4
Aisle Width (in)	14.4
Inside Standing Height at Center Aisle (ft)	78.2

BODY DETAILS:

Body Structural Type	Semi-monocoque		
Frame Material	T304 stainless steal Suspension bearing parts - steel		
Body Material	Aluminum & fiberglass reinforced plastic		
Floor Material	Plywood		
Roof Material	Aluminum & fiberglass reinforced plastic		
Windows Type	☒ Fixed	☐ Movable	
Window Mfg./Model No.	As-3 / laminated float safety glass		
Number of Doors	1 Front	1 Handicap	
Mfr. / Model No.	MCI / 03-32-1079		
Dimension of Each Door (in)	Front- 30.3 x 89.5	Handicap- 35.0 x 67.0	
Passenger Seat Type	☐ Cantilever	☒ Pedestal	☐ Other
Mfr. / Model No.	Amaya / Gaudi HR		
Driver Seat Type	☒ Air	☐ Spring	☐ Other (explain)
Mfr. / Model No.	ISRI / 6800		
Number of Seats (including Driver)	57		

Bus Number: 9918	Date: 9-21-99

BODY DETAILS (Contd..)

Free Floor Space (ft^2)	31.3
Height of Each Step at Normal Position (in)	Front 1. 17.5 2. 7.2 3. 7.2 4. 7.2 5. 7.2 6. 7.4
	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)	13.5

ENGINE

Type	☒ C.I.	☐ Alternate Fuel	
	☐ S.I.	☐ Other (explain)	
Mfr. / Model No.	Detroit Diesel / 60 Series		
Location	☐ Front	☒ Rear	☐ Other (explain)
Fuel Type	☐ Gasoline	☐ CNG	☐ Methanol
	☒ Diesel	☐ LNG	☐ Other (explain)
Fuel Tank Capacity (indicate units)	192 gals		
Fuel Induction Type	☒ Injected	☐ Carburetion	
Fuel Injector Mfr. / Model No.	Detroit Diesel / 60 Series		
Carburetor Mfr. / Model No.	N/A		
Fuel Pump Mfr. / Model No.	Detroit Diesel / 60 Series		
Alternator (Generator) Mfr. / Model No.	Delco Remy / 34-87 Delco Remy / 868/111		
Maximum Rated Output (Volts / Amps)	24 / 100 24 / 270		
Air Compressor Mfr. / Model No.	Tu Flo / 750		
Maximum Capacity (ft^3 / min)	16.5		
Starter Type	☒ Electrical	☐ Pneumatic	☐ Other (explain)
Starter Mfr. / Model No.	Delco Remy / 50-MT		

Bus Number: 9918	Date: 9-21-99

TRANSMISSION

Transmission Type	☐ Manual	☒ Automatic	
Mfr. / Model No.	Allison / B500		
Control Type	☐ Mechanical	☒ Electrical	☐ Other (explain)
Torque Convertor Mfr. / Model No.	Allison / B500		
Integral Retarder Mfr. / Model No.	Allison / B500		

SUSPENSION

Number of Axles	3		
Front Axle Type	☐ Independent	☒ Beam Axle	
Mfr. / Model No.	Rockwell / FH 945CAX7		
Axle Ratio (if driven)	N/A		
Suspension Type	☒ Air	☐ Spring	☐ Other (explain)
No. of Shock Absorbers	2		
Mfr. / Model No.	Koni / 90 2325		
Drive Axle Type	☐ Independent	☒ Beam Axle	
Mfr. / Model No.	Rockwell / RC23162NFCF 1		
Axle Ratio (if driven)	4.30		
Suspension Type	☒ Air	☐ Spring	☐ Other (explain)
No. of Shock Absorbers	4		
Mfr. / Model No.	Koni / 90 2325		
Tag Axle Type	☐ Independent	☒ Beam Axle	
Mfr. / Model No.	Rockwell / FH 945CAX 8		
Axle Ratio (if driven)	N/A		
Suspension Type	☒ Air	☐ Spring	☐ Other (explain)
No. of Shock Absorbers	2		
Mfr. / Model No.	Koni / 90 2327		

Bus Number: 9918	Date: 9-21-99

WHEELS & TIRES

Front	Wheel Mfr./ Model No.	Alcoa Forged / 22.5 x 9.00
	Tire Mfr./ Model No.	Good Year / G291 315/80R 22.5
Rear	Wheel Mfr./ Model No.	Alcoa Forged / 22.5 x 9.00
	Tire Mfr./ Model No.	Good Year / G291 315/80R 22.5

BRAKES

Front Axle Brakes Type	☐ Cam	☒ Disc	☐ Other (explain)
Mfr. / Model No.	Lucas / 68321657/658		
Middle Axle Brakes Type	☐ Cam	☒ Disc	☐ Other (explain)
Mfr. / Model No.	Lucas / 68321661/662		
Rear Axle Brakes Type	☐ Cam	☒ Disc	☐ Other (explain)
Mfr. / Model No.	Lucas / 68321657/658		
Retarder Type	Hydraulic output shaft		
Mfr. / Model No.	Allison 8500		

HVAC

Heating System Type	☐ Air	☒ Water	☐ Other
Capacity (Btu/hr)	159,000		
Mfr. / Model No.	Carrier / Compressor Model 05G		
Air Conditioner	☒ Yes	☐ No	
Location	Right side center		
Capacity (Btu/hr)	100,000		
A/C Compressor Mfr. / Model No.	Carrier Transcold / 05G		

STEERING

Steering Gear Box Type	Hydraulic assist
Mfr. / Model No.	ZF Servocom / 8098
Steering Wheel Diameter	18.0
Number of turns (lock to lock)	6.0

Bus Number: 9918	Date: 9-21-99

OTHERS

Wheel Chair Ramps	Location: N/A	Type: N/A
Wheel Chair Lifts	Location: Rear right	Type: Hydraulic platform
Mfr. / Model No.	Stewart & Stevens / SS BL3761	
Emergency Exit	Location: windows door roof hatch	Number: 13 1 2

CAPACITIES

Fuel Tank Capacity (gallons)	193 gals
Engine Crankcase Capacity (gallons)	9.5
Transmission Capacity (gallons)	10.0
Differential Capacity (gallons)	5.1
Cooling System Capacity (gallons)	25.0
Power Steering Fluid Capacity (gallons)	1.9

VEHICLE DATA FORM

Bus Number: 9918	Date: 9-21-99

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

Part Number	Description	Qty.
315/80R22.5	Good Year Tires	8
23531000 20-6957	Dayco Belt	1
08-27-1002	Universal Coach Belt	1
08-27-1008	Coach Guard Belt	1
9300	Gates Xl Belt	1
T08-1043	oil filters	2
Mobil I	synthetic gear lube	1
Series 6000	couplings	1
GE - 16	bulb	1
GE - 1156	bulb	1
Sylvania 3156K	bulb	1
Sylvania 3457 KNA	bulb	1
T3157	bulb	1
USRAM 7506 BA155	bulb	1
GE H3	halogen bulb	1
GE 9006	halogen bulb	1
GE 9005	halogen bulb	1
Bobrick	small brackets	2
Peterson 154C	license light	1
12-05-1003	radius rods	4
19-4-247	sway bar clamps	4
FG9095.F69096	sway bar links	2/2
12L-5-66	sway bar brackets	8
Texaco pre-diluted	coolant	36 gal

VEHICLE DATA FORM

Bus Number: 9918	Date: 9-21-99

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

Part Number	Description	Qty.
Na	shock washers	2 bags
Na	shock bushings	96
902327	Koni shocks	6
12-05-1010	radius rods	2
12-05-1014	radius rods	2
Na	sway bar kit	2
902326	Koni shocks	12
902325	Koni shocks	6

COMPONENT/SUBSYSTEM INSPECTION FORM

Bus Number: 9918	Date: 4-28-00

Subsystem	Checked	Comments
Air Conditioning Heating and Ventilation	✓	
Body and Sheet Metal	✓	
Frame	✓	
Steering	✓	
Suspension	✓	
Interior/Seating	✓	
Axles	✓	
Brakes	✓	
Tires/Wheels	✓	
Exhaust	✓	
Fuel System	✓	
Power Plant	✓	
Accessories	✓	
Lift System	✓	
Interior Fasteners	✓	
Batteries	✓	

CHECK - IN

MOTOR COACH INDUSTRIES
MODEL RENAISSANCE

CHECK-IN CONT.

MOTOR COACH INDUSTRIES
MODEL RENAISSANCE
EQUIPPED WITH A STEWART AND STEVENSON
MODEL SS BL 3761 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: 9918	Date: 4-28-00

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	✓	Fill through dip tube.
Drain Plug	✓	
SUSPENSION :		
Bushings	✓	
Shock Absorbers	✓	
Air Springs	✓	
Leveling Valves	✓	
Grease Fittings	✓	

ACCESSIBILITY DATA FORM

Bus Number: 9918	Date: 4-28-00

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

Motor Coach Industries 9918

DATE	TEST MILES	SERVICE	ACTIVITY	DOWN TIME	HOURS
10-22-99	2,012	P.M. / Inspection	Linkage, tie rods, universals/u-joints all lubed; all fluids checked.	4.00	4.00
10-29-99	2,538	P.M. / Inspection	Linkage, tie rods, universals/u-joints all lubed; all fluids checked.	4.00	4.00
12-08-99	3,602	P.M. / Inspection	Linkage, tie rods, universals/u-joints all lubed; all fluids checked.	4.00	4.00
12-17-99	4,724	P.M. / Inspection	Linkage, tie rods, universals/u-joints all lubed; all fluids checked.	4.00	4.00
01-07-00	6,126	P.M. / Inspection	Linkage, tie rods, universals/u-joints all lubed; all fluids checked.	4.00	4.00
01-17-00	7,193	P.M. / Inspection	Linkage, tie rods, universals/u-joints all lubed; all fluids checked.	4.00	4.00
01-25-00	8,116	P.M. / Inspection	Linkage, tie rods, universals/u-joints all lubed; all fluids checked.	4.00	4.00

SCHEDULED MAINTENANCE

Motor Coach Industries 9918

DATE	TEST MILES	SERVICE	ACTIVITY	DOWN TIME	HOURS
02-08-00	9,428	P.M. / Inspection	Linkage, tie rods, universals/u-joints all lubed; all fluids checked.	4.00	4.00
02-17-00	11,003	P.M. / Inspection	Linkage, tie rods, universals/u-joints all lubed; all fluids checked.	4.00	4.00
02-28-00	11,639	P.M. / Inspection	Linkage, tie rods, universals/u-joints all lubed; all fluids checked.	4.00	4.00
03-08-00	12,837	P.M. / Inspection	Linkage, tie rods, universals/u-joints all lubed; all fluids checked.	4.00	4.00
03-16-00	13,591	P.M. / Inspection	Linkage, tie rods, universals/u-joints all lubed; all fluids checked.	4.00	4.00
03-22-00	14,144	P.M. / Inspection	Linkage, tie rods, universals/u-joints all lubed; all fluids checked.	4.00	4.00
04-10-00	15,000	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

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
All four front sway bar brackets.	2.0
Driver's seat ride height selector switch.	1.0
Front sway bar.	1.5
Front sway bar; left sway bar body bushing clamp.	1.0
Front bulkhead.	5.0
Front axle; left stabilizer bar retainer clamp.	4.0
Left front air bag.	1.0
Right front air bag.	1.0

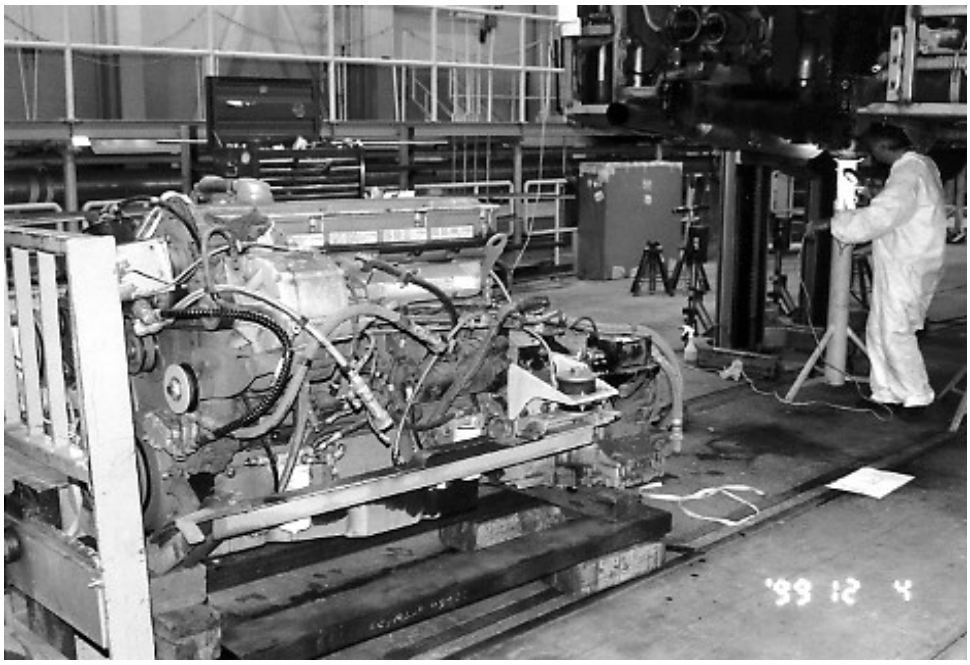
Transmission retarder accumulator actuator valve.	1.0
Tag axle sway bar.	1.0
A/C alternator belt.	0.5
Front suspension V-link.	4.0
Right side engine cradle U-bolt.	1.0
Tag axle; right side wheel seal.	1.5
Fuel tank.	4.0
Handicap device door lock.	1.0
Drive axle radius rod bushings.	1.0
Handicap device power switch.	1.0
All tires.	5.0
A/C condenser.	8.0
Front sway bar link.	1.0

At the end of the test, the remaining items on the list were removed and replaced. The engine/transmission assembly took 12.0 man-hours (two men 6.0 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
Engine/Transmission	12.0 man hours
Wiper Motor	2.0 man hours
Starter	2.0 man hours
Generator	1.5 man hours
Batteries	1.0 man hours

1.3 REPLACEMENT AND/OR REPAIR OF SELECTED SUBSYSTEMS

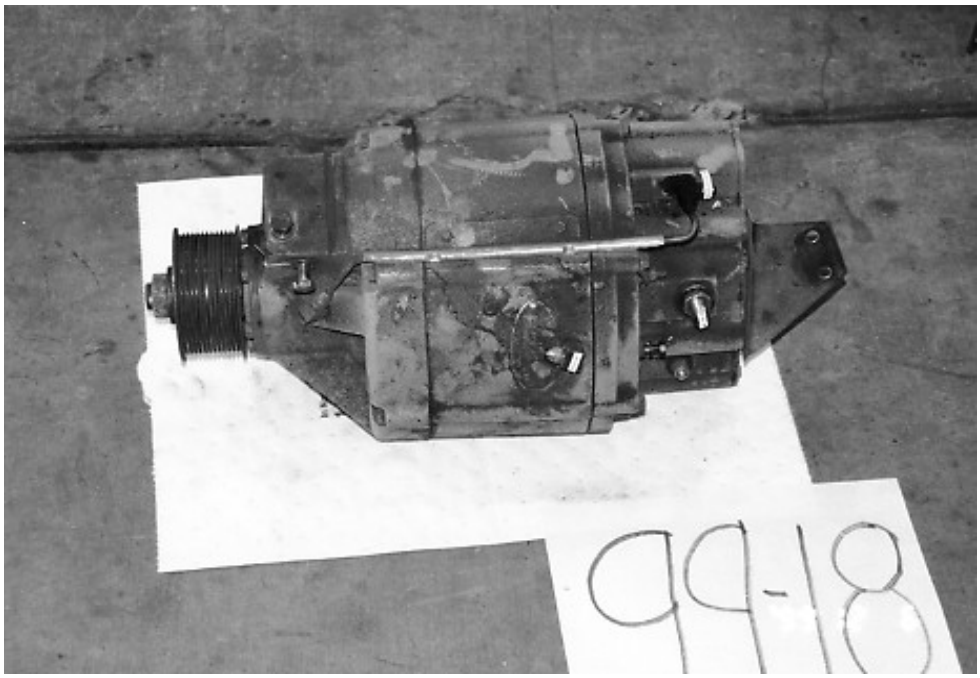


ENGINE/TRANSMISSION REMOVAL AND REPLACEMENT (12.0 MAN HOURS; 2 MEN 6.0 HOURS)

WIPER MOTOR REMOVAL AND REPLACEMENT (2.0 MAN HOURS)

1.3 REPLACEMENT AND/OR REPAIR OF SELECTED SUBSYSTEMS CONT.

STARTER REMOVAL AND REPLACEMENT (2.0 MAN HOURS)



GENERATOR REMOVAL AND REPLACEMENT (1.5 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 40 Class 3 failures, twenty-six occurred in the suspension system, seven in the frame/body, three with axles/wheels/tires and two each with the engine/transmission and electrical systems. These, and the remaining fifteen Class 4 failures are available for review in the Unscheduled Maintenance List, located in Section 5.7 Structural Durability.

RELIABILITY DATA FORMS

Bus Number: 9918	Date: 3-24-00
Personnel: Bob Reifsteck	

Failure Type			
Class 4 Bad	Class 3 Bus	Class 2 Road	Class 1 Physical

RELIABILITY DATA FORMS

Bus Number: 9418	Date: 3-24-00
Personnel: Bob Reifsteck	

	Failure Type					
	Class 4 Bad Order	Class 3 Bus Change	Class 2 Road Call	Class 1 Physical Safety		
Subsystems	Mileage	Mileage	Mileage	Mileage	Man Hours	Down Time
Suspension (continued)		12,221			1.50	1.50
		12,889			1.00	1.00
		13,124			1.00	1.00
		14,144			1.00	1.00
		14,235			1.00	1.00
Frame/Body	2,064				2.00	2.00
		2,538			5.00	5.00
		3,554			6.00	6.00
		6,751			1.00	1.00
		7,193			0.50	0.50
		8,116			4.00	4.00
		8,116			4.00	4.00
	8,591				1.00	1.00
		9,427			0.50	0.50
Axles/Wheels/Tires	882				1.50	1.50
		3,554			1.00	1.00
		5,684			4.00	4.00
		7,193			1.50	1.50
	11,003				5.00	5.00

Bus Number: 9418	Date: 3-24-00
Personnel: Bob Reifsteck	

Subsystems	Failure Type: Class 4 Bad Order Mileage	Class 3 Bus Change Mileage	Class 2 Road Call Mileage	Class 1 Physical Safety Mileage	Man Hours	Down Time
Handicap Device	7,244				1.50	1.50
	8,116				3.00	3.00
	10,100				1.00	1.00
	11,639				1.00	1.00
	14,144				1.00	1.00
Air Conditioning	882				4.00	4.00
	4,723				0.50	0.50
	5,684				4.00	4.00
	11,931				13.00	168.00
Electrical System		383			1.00	1.00
	1,725				.50	.50
		8,300			1.00	1.00
Engine/Transmission		3,554			1.00	1.00
		3,793			1.00	1.00

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. Slight body roll was observed during the 40 and 45 mph phases.

SAFETY DATA FORM

Bus Number: 9918	Date: 4-24-00
Personnel: S.C. & E.D.	

Temperature (°F): 53	Humidity (%): 54
Wind Direction: Calm	Wind Speed (mph): Calm
Barometric Pressure (in.Hg): 29.91	

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.	
Slight body roll was noted during the 40 & 45 mph phases.	
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 26.80 seconds.

PERFORMANCE DATA FORM

Bus Number: 9918	Date: 4-24-00
Personnel: S.C. & E.D.	
Temperature (°F): 54	Humidity (%): 54
Wind Direction: Calm	Wind Speed (mph): Calm
Barometric Pressure (in.Hg): 29.91	
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	3.76	3.76	3.54
20 mph	7.16	7.42	7.01
30 mph	12.20	12.07	12.48
40 mph	19.20	18.79	20.60
Top Test Speed(mph) 50	28.41	27.85	28.54

Clockwise Recorded Interval Times

Speed	Run 1	Run 2	Run 3
10 mph	3.70	3.66	3.61
20 mph	7.08	6.94	6.89
30 mph	11.39	11.25	11.26
40 mph	17.58	17.51	17.26
Top Test Speed(mph) 50	25.90	25.10	24.98

PERFORMANCE SUMMARY SHEET

BUS MANUFACTURER :MOTOR COACH INDUSTRI BUS NUMBER :9918
BUS MODEL :102-EL3 Renaissance TEST DATE :4/24/00

TEST CONDITIONS :

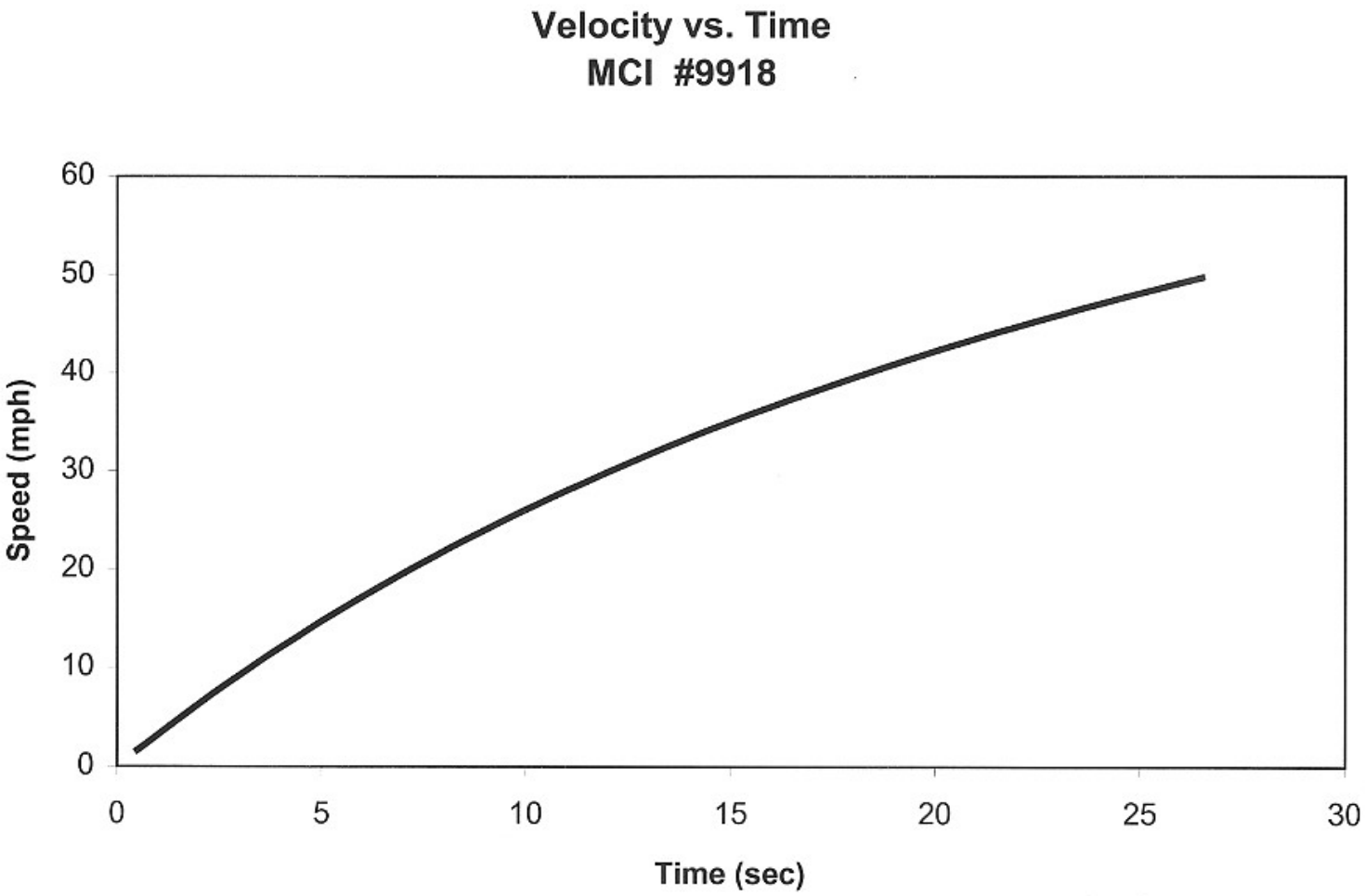
TEMPERATURE (DEG F) : 54.0
WIND DIRECTION : 0
WIND SPEED (MPH) : .0
HUMIDITY (%) : 54
BAROMETRIC PRESSURE (IN. HG) : 29.9

VEHICLE SPEED	AVERAGE TIME (SEC)		
(MPH)	CCW DIRECTION	CW DIRECTION	TOTAL
10.0	3.69	3.66	3.67
20.0	7.20	6.97	7.08
30.0	12.25	11.30	11.78
40.0	19.53	17.45	18.49
50.0	28.27	25.33	26.80

TEST SUMMARY :

VEHICLE SPEED (MPH)	TIME (SEC)	ACCELERATION (FT/SEC^2)	MAX. GRADE (%)
1.0	.30	4.8	15.1
5.0	1.56	4.5	14.1
10.0	3.26	4.1	12.9
15.0	5.13	3.7	11.7
20.0	7.19	3.4	10.5
25.0	9.49	3.0	9.4
30.0	12.07	2.7	8.3
35.0	15.00	2.4	7.3
40.0	18.34	2.0	6.4
45.0	22.22	1.7	5.4
50.0	26.79	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
MCI #9918
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 77 people including the driver. The resulting test load is (77 x 375 lb) = 28,875 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 0.150 inches at reference point 4. The maximum permanent deflection after the final loading sequence ranged from 0.000 inches at reference points 3, 4, 7, 9 & 10 to 0.003 inches at reference points 1 and 12.

STRUCTURAL SHAKEDOWN DATA FORM

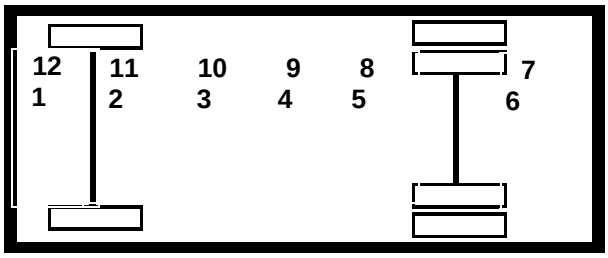
Bus Number: 9918	Date: 9-17-99
Personnel: S.C., B.L., E.L., J.P., C.S. & L.M.	Temperature (°F): 68
Loading Sequence: ☒ 1 ☐ 2 ☐ 3 (check one) Test Load (lbs): 28,875	

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	.030	.030	.012	.012
2	0	.069	.069	.010	.010
3	0	.148	.148	.016	.016
4	0	.173	.173	.020	.020
5	0	.154	.154	.021	.021
6	0	.004	.004	.002	.002
7	0	-.020	-.020	-.005	-.005
8	0	.066	.066	.005	.005
9	0	.100	.100	.004	.004
10	0	.095	.095	.004	.004
11	0	.032	.032	.000	.000
12	0	.010	.010	.005	.005

STRUCTURAL SHAKEDOWN DATA FORM

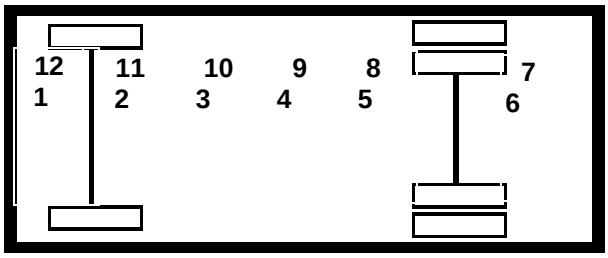
Bus Number: 9918	Date: 9-20-99
Personnel: S.C., E.L., C.S., L.M. & D.L.	Temperature (°F): 64
Loading Sequence: ☐ 1 ☒ 2 ☐ 3 (check one) Test Load (lbs): 28,875	

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	.012	.031	.019	.015	.003
2	.010	.067	.057	.011	.001
3	.016	.142	.126	.016	.000
4	.020	.170	.150	.020	.000
5	.021	.154	.133	.022	.001
6	.002	.002	.000	.003	.001
7	-.005	-.080	-.075	-.005	.000
8	.005	.065	.060	.007	.002
9	.004	.097	.093	.004	.000
10	.004	.091	.087	.004	.000
11	.000	.030	.030	.001	.001
12	.005	.012	.007	.008	.003

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. No water leakage was observed during the test. The results of this test are indicated on the following data forms.

DISTORTION TEST INSPECTION FORM

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

Bus Number: 9918	Date: 9-22-99
Personnel: S. C. & E.L.	Temperature(°F): 59

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	No deficiencies.
☒ 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: 9918	Date: 9-22-99
Personnel: S.C. & E.L.	Temperature(°F): 59

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	No deficiencies.
☒ 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: 9918	Date: 9-22-99
Personnel: S.C. & E.L.	Temperature(°F): 59

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	No deficiencies.
☒ 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: 9918	Date: 9-22-99
Personnel: S.C. & E.L.	Temperature(°F): 59

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	No deficiencies.
☒ 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: 9918	Date: 9-22-99
Personnel: S.C. & E.L.	Temperature(°F): 59

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	No deficiencies.
☒ 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: 9918	Date: 9-22-99
Personnel: S.C. & E.L.	Temperature(°F): 59

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	No deficiencies.
☒ 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: 9918	Date: 9-22-99
Personnel: S.C. & E.L.	Temperature(°F): 59

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	No deficiencies.
☒ 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: 9918	Date: 9-22-99
Personnel: S.C. & E.L.	Temperature(°F): 59

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	No deficiencies.
☒ 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: 9918	Date: 9-22-99
Personnel: S.C. & E.L.	Temperature(°F): 59

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	No deficiencies.
☒ 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: 9918	Date: 9-22-99
Personnel: S.C & E.L.	Temperature(°F): 59

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	No deficiencies.
☒ 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 FRONT 6" LOWER

RIGHT REAR 6" HIGHER

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 bus tow eyes. The test was performed using a target load (towing force) of 46,512 lbs (1.2 x 38,760 lb CW). The 20 degree upward pull was not performed due to interference with the front bumper. The 20 degree downward, left and right pulls were all performed to the target test weight with no damage or deformation observed. Rear towing is not recommended by the manufacturer, therefore a rear test was not performed.

STATIC TOWING TEST DATA FORM

Bus Number: 9918	Date: 4-27-00
Personnel: S.C., E.L. & E.D.	Temperature (°F): 50

Inspect right front tow eye and adjoining structure.
Comments: No damage or deformation.
Check the torque of all bolts attaching tow eye and surrounding structure.
Comments: Welds inspected.
Inspect left front tow eye and adjoining structure.
Comments: No damage or deformation.
Check the torque of all bolts attaching tow eye and surrounding structure.
Comments: Welds inspected.
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: The 20° up pull was not perform due to front bumper interference. The 20° down, left and right pulls were all performed with no damage or deformation observed.

5.3 STATIC TOWING TEST

20 DEGREES DOWNWARD

20 DEGREES LEFT

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 incorporating a hydraulic under lift and a front lift tow was performed. Rear towing is not recommended by the manufacturer. No damage or deformation was observed and no problems with the towing interface was noted.

DYNAMIC TOWING TEST DATA FORM

Bus Number: 9918	Date: 4-25-00
Personnel: S.C.	

Temperature (°F): 59	Humidity (%): 48
Wind Direction: W	Wind Speed (mph): 3 - 5
Barometric Pressure (in.Hg): 29.04	

Inspect tow equipment-bus interface.

Comments: A safe and adequate connection was made.

Inspect tow equipment-wrecker interface.

Comments: A safe and adequate connection was made.

Towing Comments: A heavy duty under lift was incorporated to perform a front lift tow.

Description and location of any structural damage: None noted.

General Comments: A front lift tow was perform with no damage or deformation observed and no problems with the towing interface.

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 12.2 inches to 5.9 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	12.1"
Rear axle - one tire flat	11.0"
Rear axle - two tires flat	10.8"

JACKING TEST DATA FORM

Bus Number: 9918	Date: 9-16-99
Personnel: B.L., S.C., E.L. D.L. & C.S.	Temperature: 73

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	13.5" I 12.1" D	11.9" I 10.1" D	
Left front	13.8“ I 12.2" D	11.9" I 10.1" D	
Right rear--outside	12.2" I 11.8" D	8.3" I 7.7" D	
Right rear--both	12.2" I 11.0" D	8.3" I 6.0" D	
Left rear--outside	12.4" I 11.9" D	8.4" I 7.9" D	
Left rear--both	12.4" I 10.8" D	8.4" I 5.8" D	
Right middle or tag--outside	8.8" I 7.4" D	8.6" I 6.2" D	
Right middle or tag--both	NA	NA	
Left middle or tag--outside	8.8" I 7.3" D	8.3" I 5.9" 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 wheel, rear wheel, 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: 9918	Date: 9-16-99
Personnel: B.L. & E.L.	Temperature (°F): 59

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 September 22, 1999 and was conducted until April 3, 2000. The first 6,250 miles were performed at a GVW of 51,280 lb and was completed on January 12, 2000. The next 2,500 mile SLW segment was performed at 48,180 lb and completed on February 4, 2000 and the final 6,250 mile segment was performed at a CW of 38,760 lb and completed on April 3, 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.

DATE	TOTAL OTHER MILES	TOTAL DURABILITY TRACK	TOTAL
01/19/00 TO 01/25/00	90.00	691.00	781.00
01/26/00 TO 02/01/00	122.00	301.00	423.00
02/02/00 TO 02/08/00	201.00	811.00	1012.00
02/09/00 TO 02/15/00	157.00	950.00	1107.00
02/16/00 TO 02/22/00	131.00	501.00	632.00
02/23/00 TO 02/29/00	76.00	565.00	641.00
03/01/00 TO 03/07/00	42.00	742.00	784.00
03/08/00 TO 03/14/00	136.00	566.00	702.00
03/15/00 TO 03/21/00	133.00	498.00	631.00
03/22/00 TO 03/28/00	0.00	469.00	469.00
03/29/00 TO 04/04/00	0.00	572.00	572.00
TOTAL	2571.00	12518.00	15089.00

01/18/00

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

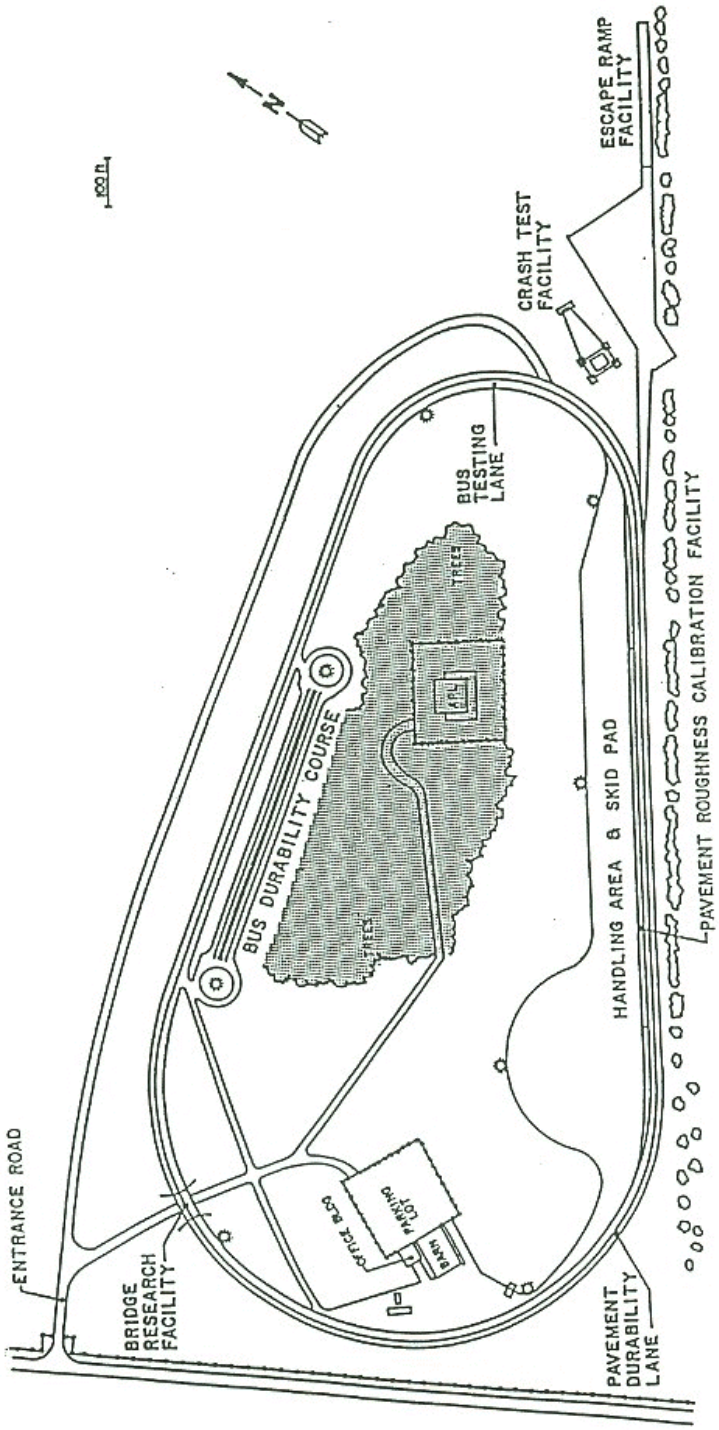
STANDARD OPERATING SCHEDULE

Monday through Friday

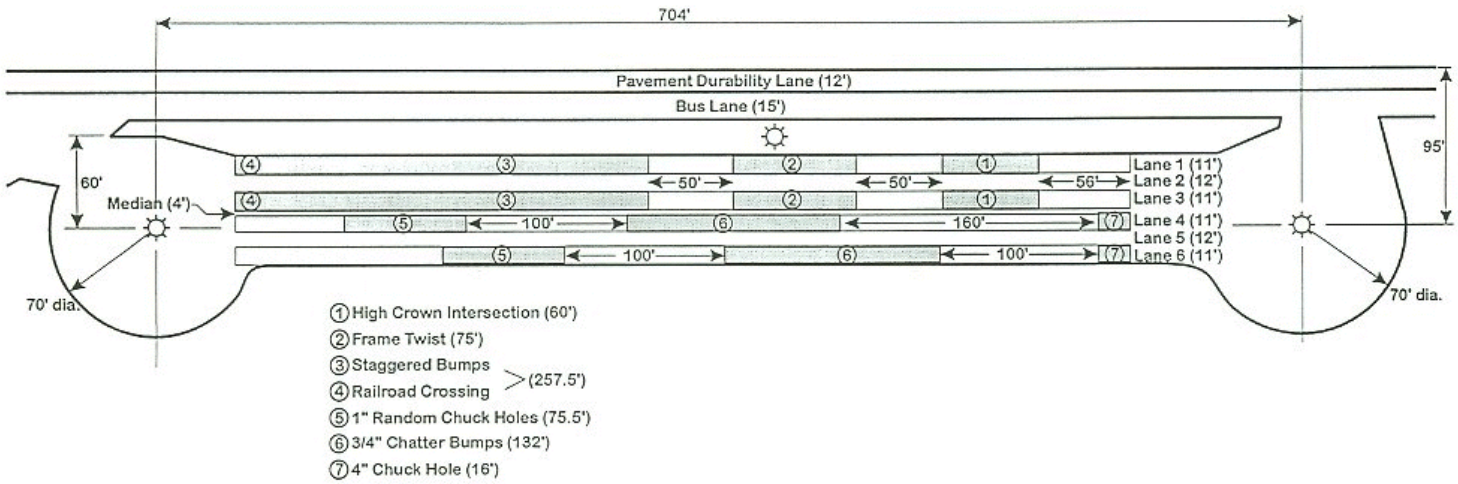
	HOUR	ACTION
Shift 1	midnight	D
	1:40 am	C
	1:50 am	B
	2:00 am	D
	3:35 am	C
	3:45 am	B
	4:05 am	D
	5:40 am	C
	5:50 am	B
	6:00 am	D
	7:40 am	C
	7:50 am	F
Shift 2	8:00 am	D
	9:40 am	C
	9:50 am	B
	10:00 am	D
	11:35 am	C
	11:45 am	B
	12:05 pm	D
	1:40 pm	C
	1:50 pm	B
	2:00 pm	D
	3:40 pm	C
	3:50 pm	F
Shift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



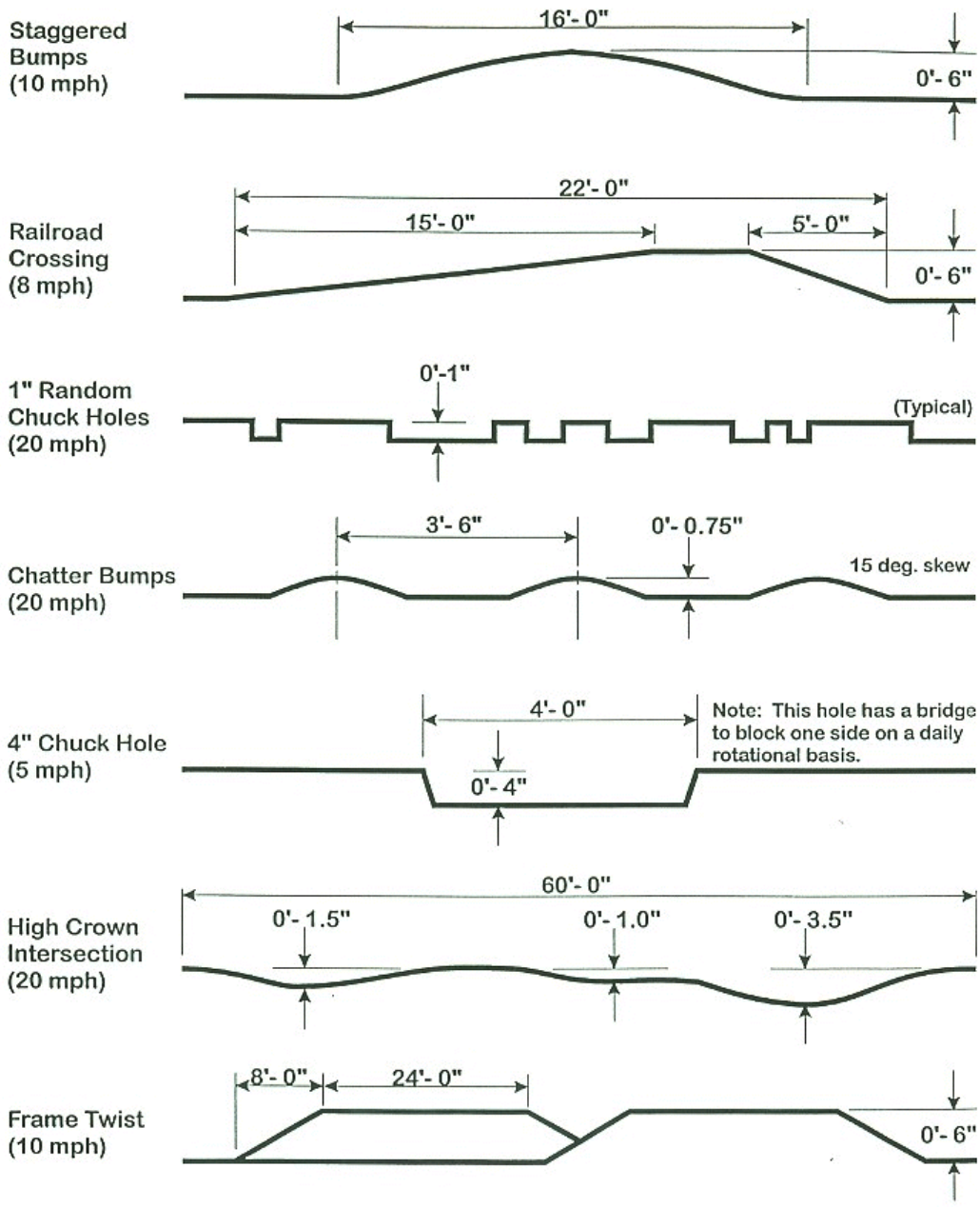
BUS TESTING AND RESEARCH TEST TRACK
UNIVERSITY PARK, PA



Plan View

Vehicle Durability Test Track

The Pennsylvania Transportation Institute
Penn State



Durability Element Profiles

The Pennsylvania Transportation Institute
Penn State

UNSCHEDULED MAINTENANCE

Motor Coach Industries 9918

DATE	TEST MILES	SERVICE	ACTIVITY	DOWN TIME	HOURS
09-24-99	213	The right outside lower sway bar bracket is broken.	Bracket replaced.	1.50	1.50
09-27-99	383	All four front sway bar brackets are broken.	All four brackets replaced.	2.00	2.00
09-27-99	383	The driver's ride height selector switch is broken.	Ride height selector switch replaced.	1.00	1.00
09-30-99	625	Front sway bar; the right outer bracket is broken, and the right inner bracket is bent.	Both brackets replaced.	1.00	1.00
10-08-99	882	Manufacturer requests sway bar retro kit be installed at the front and tag axles.	Retro kits installed.	4.00	4.00
10-08-99	882	Manufacturer requests the fasteners be replaced on all V-links.	Fasteners replaced on the front, drive and tag axle V-links.	1.50	1.50
10-08-99	882	A/C is inoperative. System leaked off, loose fitting at the compressor.	Fitting tightened, system charged.	4.00	4.00
10-15-99	1,599	The front sway bar is broken on the right side.	Front sway bar replaced.	1.50	1.50
10-18-99	1,725	The negative terminal on right battery is pitted and terminal will not tighten.	Battery replaced.	0.50	0.50
10-22-99	2,064	The front sway bar is broken.	Front sway bar replaced.	1.00	1.00
10-22-99	2,064	The left upper engine mounting bolt is missing.	Bolt replaced.	2.00	2.00

UNSCHEDULED MAINTENANCE

Motor Coach Industries 9918

DATE	TEST MILES	SERVICE	ACTIVITY	DOWN TIME	HOURS
10-26-99	2,212	The sway bar body bushing clamp on left side is broken on the front axle.	Bushings and clamp replaced; bolts on the right side body bushing clamp retorqued.	1.00	1.00
10-28-99	2,385	The sway bar body brackets bolts on the front axle are loose.	All bolts retorqued.	1.00	1.00
11-05-99	2,538	The front bulkhead is bent by the front sway bar body mounts.	Bulkhead replaced.	5.00	5.00
11-11-99	2,997	The left side stabilizer bar retainer clamp on the front axle is cracked.	Replaced retainer clamp and bushings.	4.00	4.00
11-22-99	3,048	Manufacturer requested modified front sway bar assembly be installed.	Replaced front sway bar and mounting hardware.	3.00	3.00
11-27-99	3,502	The front sway bar has shifted to the right.	Inspect sway bar for damage. Repositioned sway bar and torqued locators into position.	1.00	1.00
12-01-99	3,554	The left front air bag is leaking air. Parts ordered.	Replaced left front air bag.	48.00	1.00
12-03-99	3,554	The internal stop in the right front air bag has come loose.	Replaced right front air bag.	1.00	1.00
12-03-99	3,554	The actuator valve on the transmission retarder accumulator is leaking air.	Actuator valve replaced.	1.00	1.00
12-03-99	3,554	The cross member above the transmission cracked.	Cross member welded/repaired.	6.00	6.00
12-03-99	3,554	Front axle--the crimped end on the V-link is loose.	V-link replaced.	1.00	1.00

UNSCHEDULED MAINTENANCE

Motor Coach Industries 9918

DATE	TEST MILES	SERVICE	ACTIVITY	DOWN TIME	HOURS
12-10-99	3,793	Engine shutting down. Coolant level is low. Clamp on the charge air hose is broken.	Coolant topped off and charge air line clamp replaced.	1.00	1.00
12-14-99	4,181	The front sway bar is broken on the left side.	Front sway bar replaced.	2.00	2.00
12-14-99	4,181	The tag axle sway bar is cracked 9 ½" from the right side body mount and ending near the center of the bar.	Sway bar replaced.	1.00	1.00
12-17-99	4,723	The alternator belt for the A/C unit is missing.	Belt replaced.	0.50	0.50
01-03-00	5,353	The front sway bar is broken on the left side.	Sway bar replaced.	1.00	1.00
01-05-00	5,684	The V-link retainer ring has come out on the front suspension.	V-link replaced.	4.00	4.00
01-05-00	5,684	A/C is inoperative.	Manufacturer recharged system.	4.00	4.00
01-10-00	6,324	The front sway bar is broken on the left side.	Sway bar and bushings replaced.	1.00	1.00
01-13-00	6,751	The engine cradle u-bolt on the right side (rear of the tag axle) is broken.	U-bolt replaced.	1.00	1.00
01-13-00	6,751	Front sway bar–right side link is loose.	Link tightened.	0.50	0.50

UNSCHEDULED MAINTENANCE

Motor Coach Industries 9918

DATE	TEST MILES	SERVICE	ACTIVITY	DOWN TIME	HOURS
01-17-00	7,193	The front sway bar is broken near the left-side body mount bushings.	New sway bar and links installed.	1.50	1.50
01-17-00	7,193	The right side tag axle wheel seal is leaking.	Inner wheel seal replaced.	1.50	1.50
01-17-00	7,193	The left side bolt is broken on the rear engine mount-to-engine strut.	Bolt replaced.	0.50	0.50
01-18-00	7,244	Handicap device is inoperative.	Replaced wire on the “barrier” switch and ordered new key switch.	1.50	1.50
01-25-00	8,116	The fuel tank is leaking on the left side, 10" from the bottom.	Fuel tank replaced.	4.00	4.00
01-25-00	8,116	The front sway bar is broken at the left body mount.	Sway bar replaced.	1.00	1.00
01-25-00	8,116	Handicap device key switch installed. Lift will not raise or lower.	Loose connection on the proximity switch repaired.	3.00	3.00
01-25-00	8,116	The cross member brackets at the tag and drive axle V-links are cracked.	Cracks welded/repaired and flat steel added for reinforcement.	4.00	4.00
01-31-00	8,300	The negative terminal on the battery is burned.	Battery replaced.	1.00	1.00
02-02-00	8,591	The right side body bracket bolts are loose on the front sway bar.	Body bracket bolts tightened.	1.00	1.00
02-02-00	8,591	The handicap device door will not open	Broken door lock replaced.	1.00	1.00
02-08-00	9,427	The left rear engine mount, strut-to engine bolt is broken.	Bolt replaced.	0.50	0.50

UNSCHEDULED MAINTENANCE

Motor Coach Industries 9918

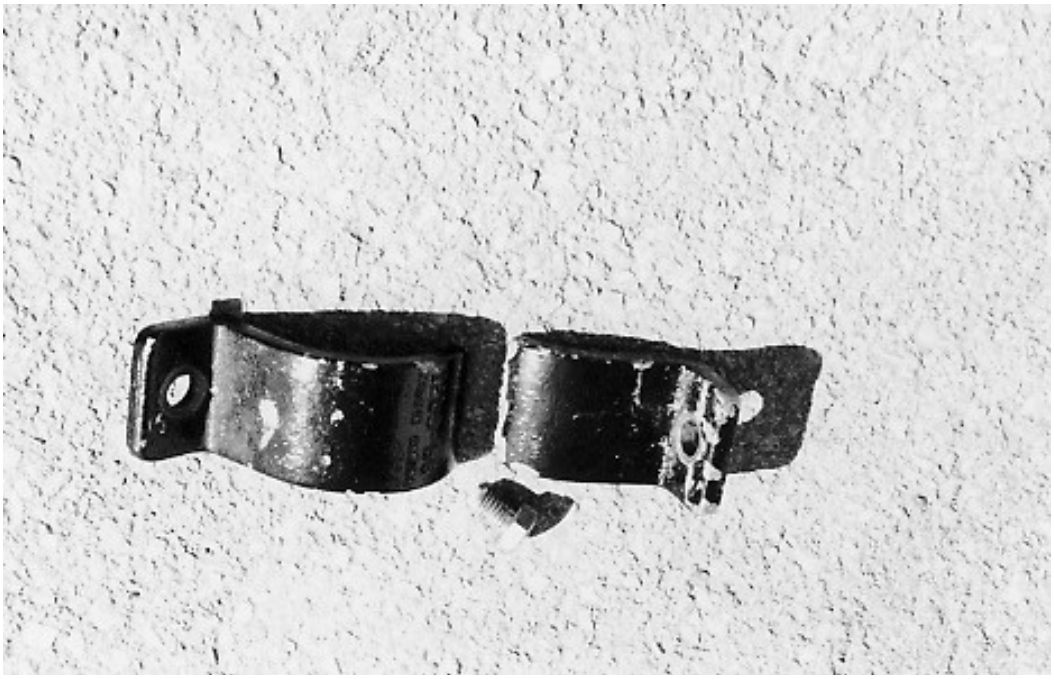
DATE	TEST MILES	SERVICE	ACTIVITY	DOWN TIME	HOURS
02-11-00	10,100	The front sway bar is broken at the left side body mount.	Sway bar, body mounts, and bushings replaced.	1.00	1.00
02-11-00	10,100	The lower radius rod bushings on the drive axle are worn at the axle end.	Replaced all bushings on both radius rods.	1.00	1.00
02-11-00	10,100	The handicap device power switch and lock cylinder is broken.	Power switch and lock cylinder replaced.	1.00	1.00
02-17-00	11,003	All tires are worn and need replaced.	All tires replaced.	5.00	5.00
02-21-00	11,148	The left front air bag chaffed at the bottom of the pedestal and the bumper is loose.	Left front air bag replaced.	1.50	1.50
02-24-00	11,639	The handicap device extends and retracts, but will not function up and down.	At the request of Stewart & Stevenson, replaced the “extend” relief valve cartridge on the crossover relief valve assembly and magnetic switch “SWI.” Device still will not function up and down.	1.00	1.00
03-01-00	11,931	A/C unit will not function.	Troubleshooting found eight alarm codes. Manufacturer requests Carrier technician. Carrier technician replaced the condensor and recharged system.	168.00	13.00
03-03-00	12,221	Front sway bar–left side sway bar bracket is broken.	Left front sway bar bracket replaced.	1.50	1.50
03-09-00	12,889	The left side bushings on the front sway bar are worn.	Bushings replaced.	1.00	1.00

UNSCHEDULED MAINTENANCE

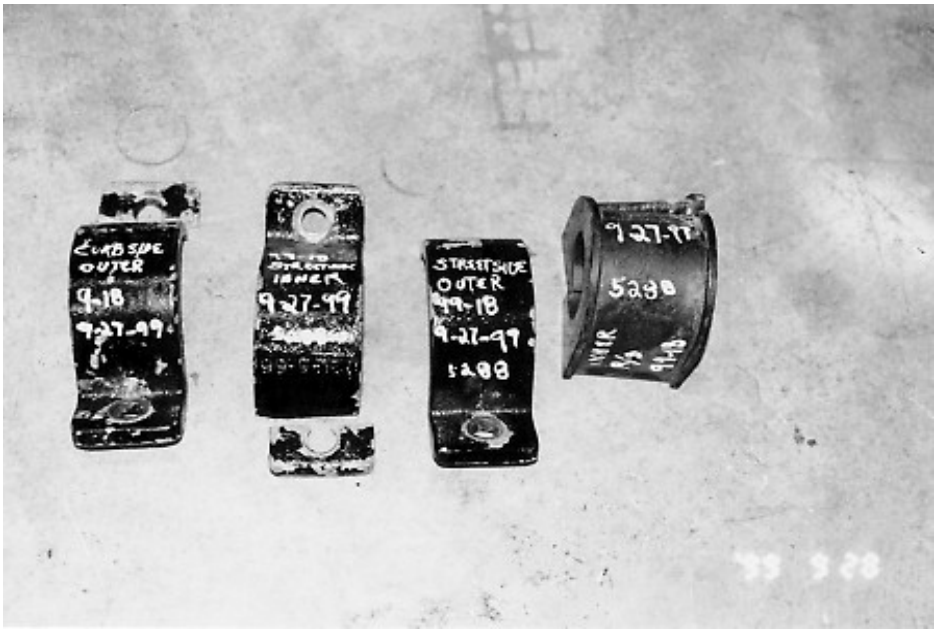
Motor Coach Industries 9918

DATE	TEST MILES	SERVICE	ACTIVITY	DOWN TIME	HOURS
03-13-00	13,124	Front sway bar–the left link is loose and upper nut is missing.	Left link assembly replaced.	1.00	1.00
03-22-00	14,144	Front sway bar–the right side body bracket is broken and the left body bracket is loose.	Both body brackets and all bushings replaced.	1.00	1.00
03-22-00	14,144	The handicap device extend/retract cylinder is broken.	Stewart & Stevenson rep welded/repaired broken cylinder.	1.00	1.00
03-24-00	14,235	Front sway bar–right side sway bar link is broken.	Sway bar link replaced.	1.00	1.00

UNSCHEDULED MAINTENANCE

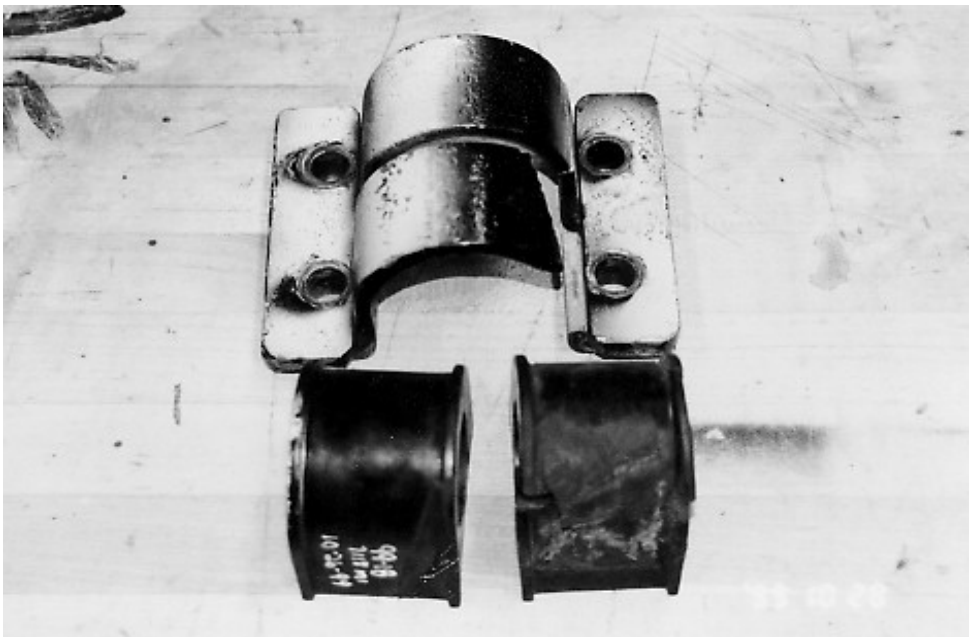


BROKEN RIGHT, OUTSIDE SWAY BAR BRACKET (213 TEST MILES)

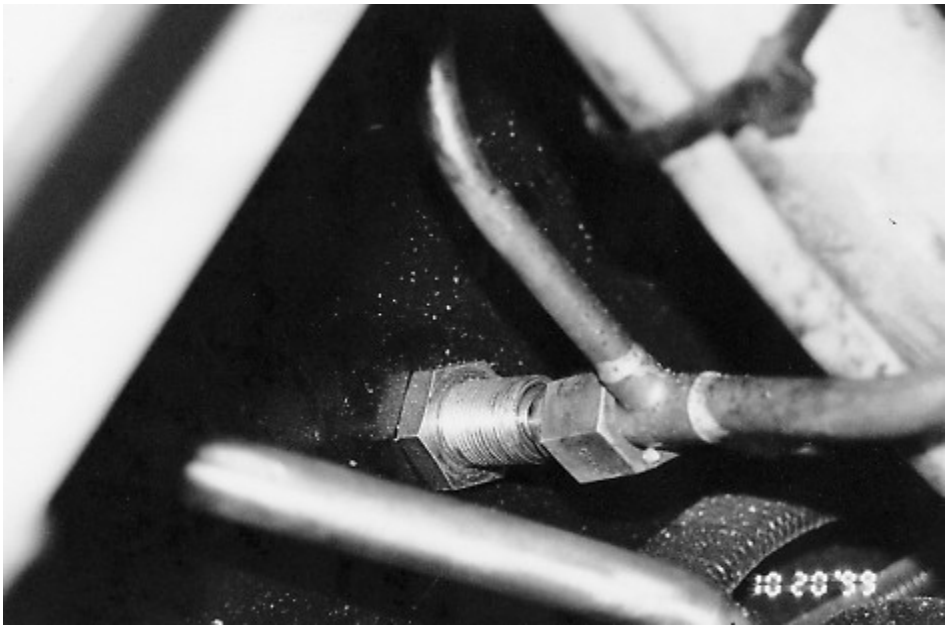


ALL FOUR FRONT SWAY BAR BRACKETS ARE BROKEN (383 TEST MILES)

UNSCHEDULED MAINTENANCE CONT.



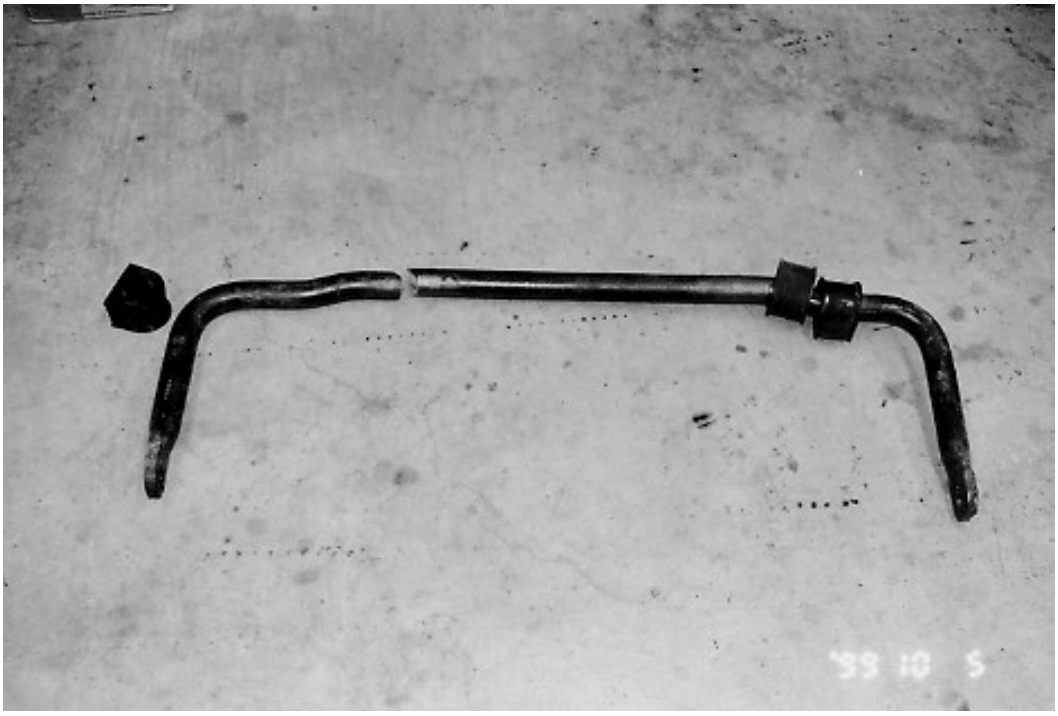
FRONT SWAY BAR; RIGHT OUTER BRACKET IS BENT, RIGHT INNER BRACKET IS BROKEN (625 TEST MILES)



LOOSE A/C FITTING

(882 TEST MILES)

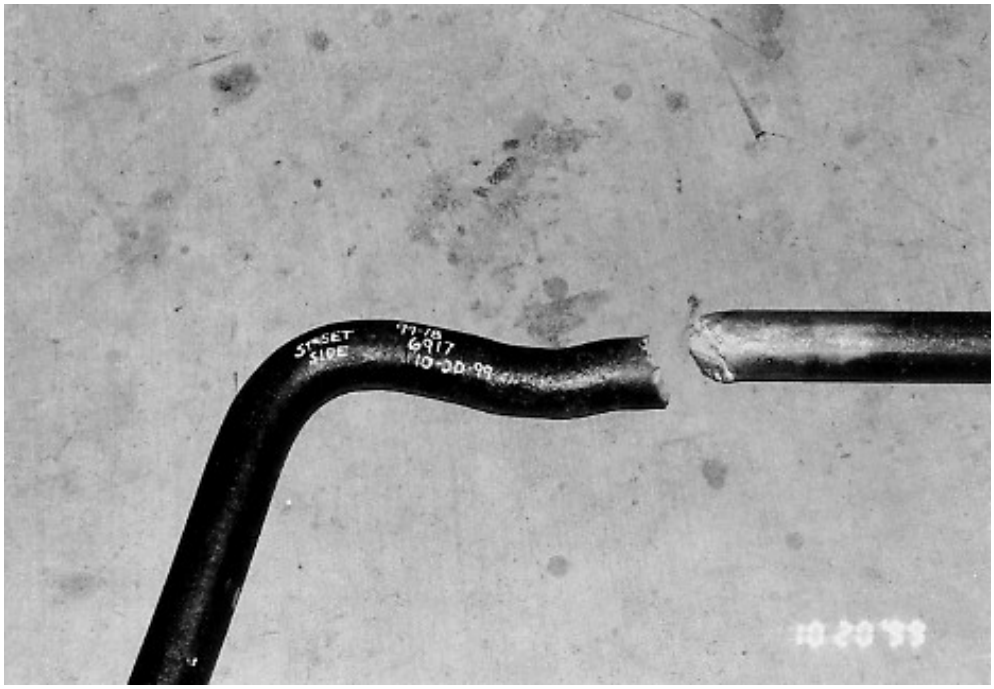
UNSCHEDULED MAINTENANCE CONT.



BROKEN FRONT SWAY BAR
(1,599 TEST MILES)

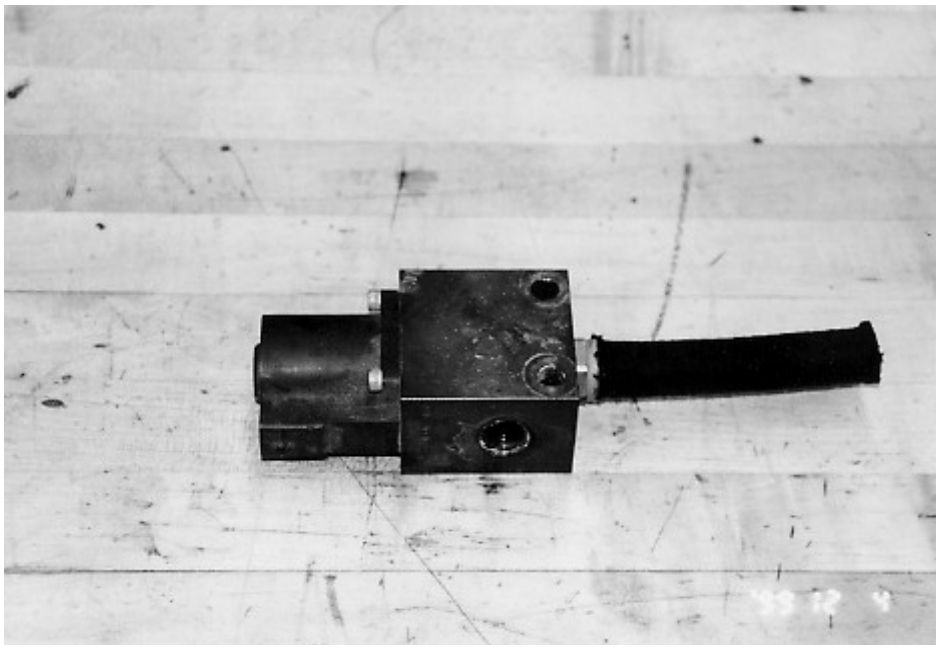
THE NEGATIVE TERMINAL ON THE RIGHT BATTERY IS PITTED (1,725 TEST MILES)

UNSCHEDULED MAINTENANCE CONT.



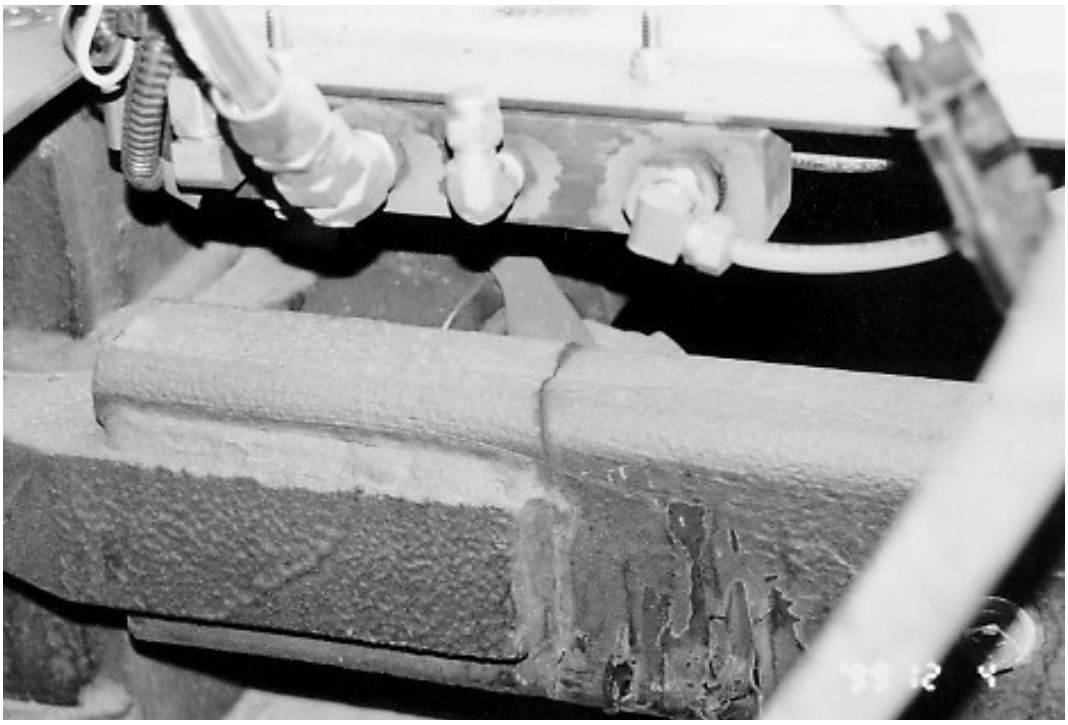
BROKEN FRONT SWAY BAR

(2,064 TEST MILES)



LEAKING ACTUATOR VALVE ON THE TRANSMISSION RETARDER ACCUMULATOR (3,554 TEST MILES)

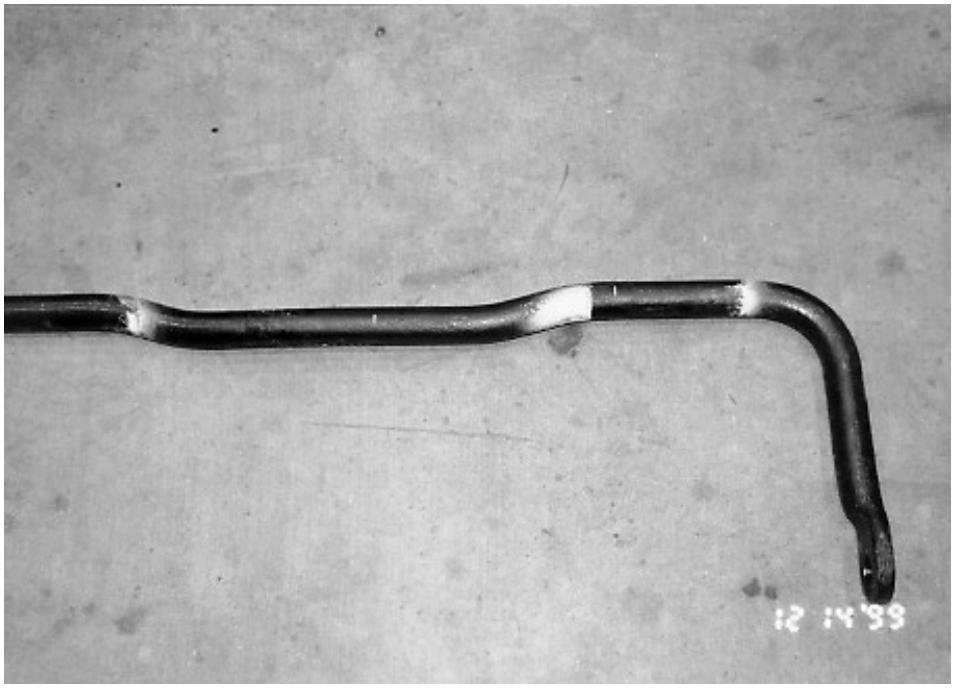
UNSCHEDULED MAINTENANCE CONT.



↑ CRACKED CROSSMEMBER ABOVE THE TRANSMISSION (3,554 TEST MILES ↓

UNSCHEDULED MAINTENANCE CONT.

BROKEN FRONT SWAY BAR
(4,181 TEST MILES)

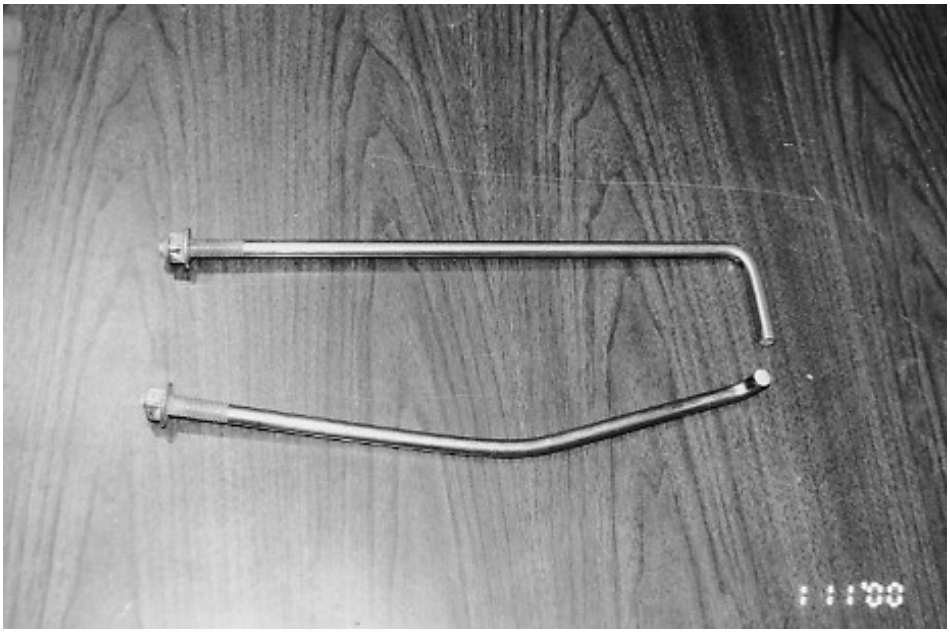


CRACKED TAG AXLE SWAY BAR
(4,181 TEST MILES)

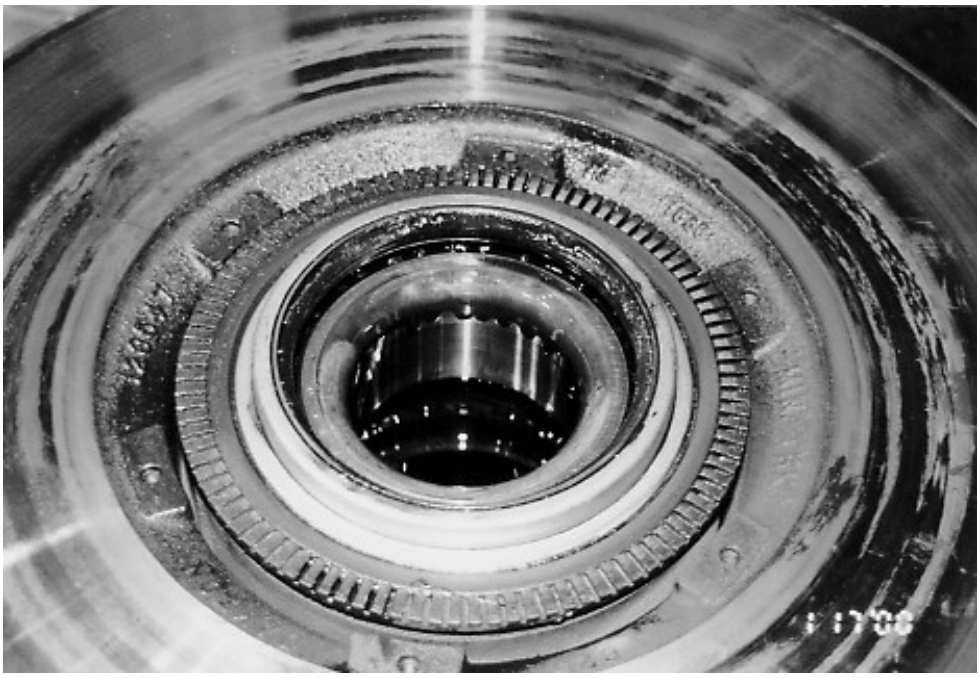
UNSCHEDULED MAINTENANCE CONT.

BROKEN FRONT SWAY BAR (5,353 TEST MILES)

LOOSE RETAINER RING IN FRONT V-LINK (5,684 TEST MILES)



UNSCHEDULED MAINTENANCE CONT. BROKEN FRONT SWAY BAR (6,324 TEST MILES)



BROKEN ENGINE CRADLE U-BOLT
(6,751 TEST MILES)

UNSCHEDULED MAINTENANCE CONT.
RIGHT SIDE TAG AXLE WHEEL SEAL IS LEAKING OIL
(7,193 TEST MILES)

LEAKING FUEL TANK
(8,116 TEST MILES)

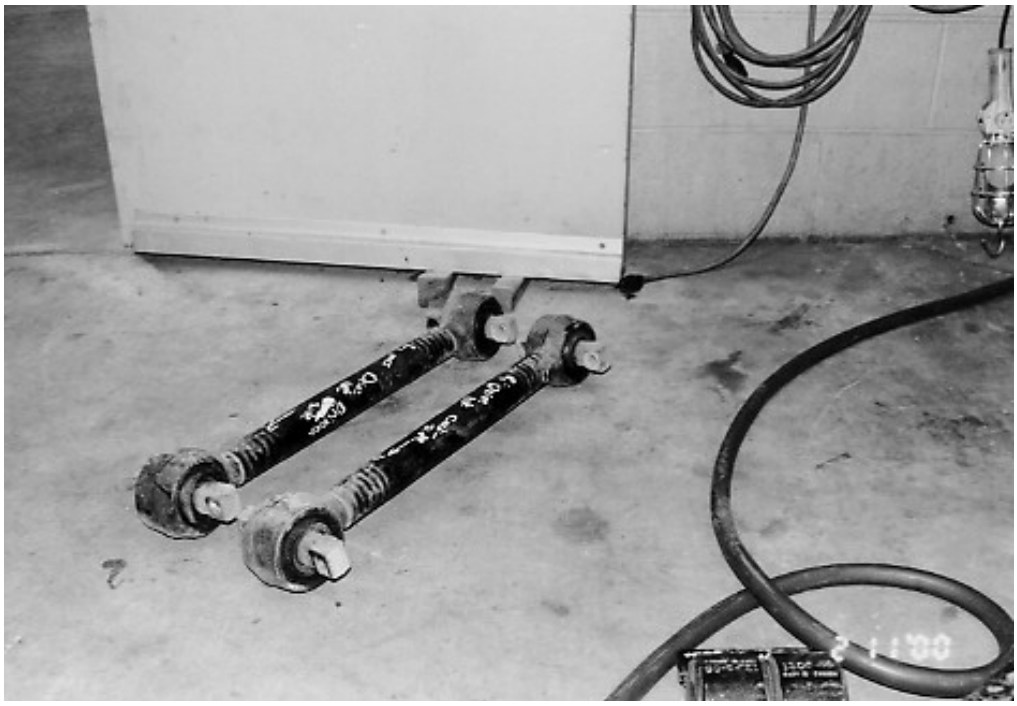
UNSCHEDULED MAINTENANCE CONT.

BROKEN FRONT SWAY BAR
(8,116 TEST MILES)

BROKEN

FRONT SWAY BAR
(10,100 TEST MILES)

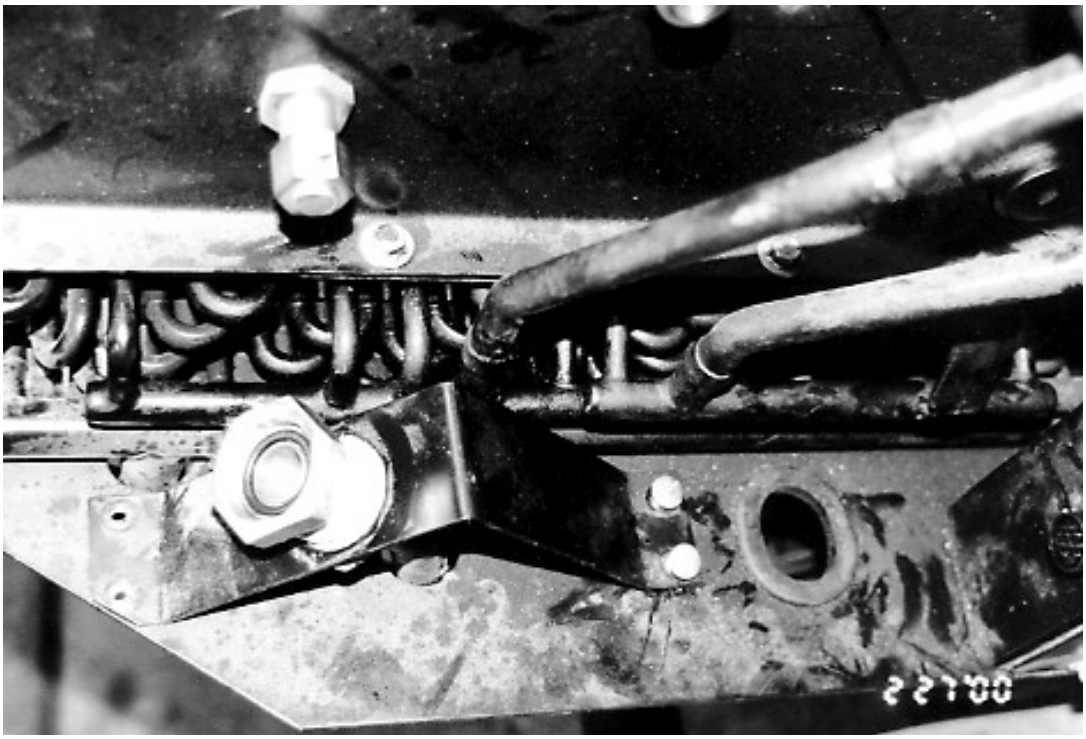
UNSCHEDULED MAINTENANCE CONT.



DRIVE AXLE RADIUS ROD BUSHINGS ARE WORN
(10,100 TEST MILES)
CHAFFED LEFT FRONT AIR BAG

(11,148 TEST MILES)

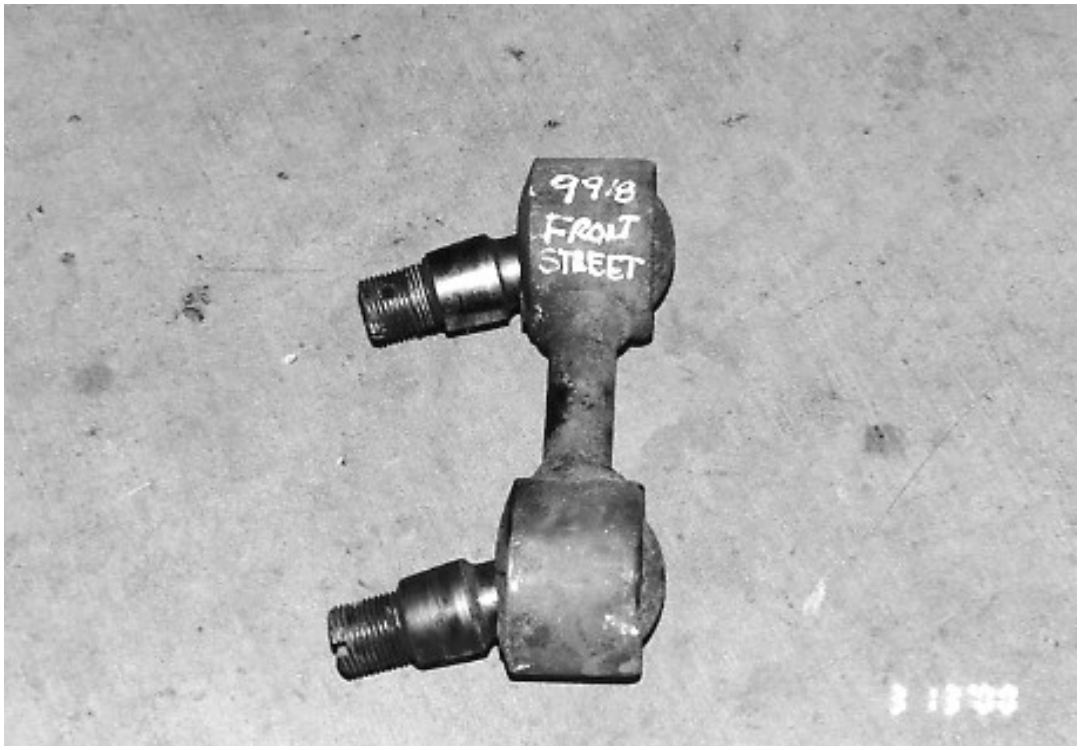
UNSCHEDULED MAINTENANCE CONT.



A/C CONDENSOR UNIT LEAKING
(11,931 TEST MILES)
FAILED HANDICAP DEVICE EXTEND/RETRACT CYLINDER

(14,144 TEST MILES)

UNSCHEDULED MAINTENANCE CONT.



FAILED FRONT SWAY BAR LINK
(14,235 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 PSBRTF. Signs are erected at carefully measured points which delineate the test course. A test run will comprise 3 CBD phases, 2 Arterial phases, and 1 Commuter phase. An electronic fuel measuring system will indicate the amount of fuel consumed during each phase of the test. The test runs will be repeated until there are at least two runs in both the clockwise and counterclockwise directions in which the fuel consumed for each run is within ± 4 percent of the average total fuel used over the 4 runs. A 20-minute idle consumption test is performed just prior to and immediately after the driven portion of the fuel economy test. The amount of fuel consumed while operating at normal/low idle is recorded on the Fuel Economy Data Form. This set of four valid runs along with idle consumption data comprise a valid test.

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

1. The ADB cycle is structured as a set number of miles in a fixed time in the following order: CBD, Arterial, CBD, Arterial, CBD, Commuter. A separate idle fuel consumption measurement is performed at the beginning and end of the fuel economy test. This phase sequence permits the reporting of fuel consumption for each of these phases separately, making the data more useful to bus manufacturers and transit properties.

2. The operating profile for testing purposes shall consist of simulated transit type service at seated load weight. The three test phases (figure 6-1) are: a central business district (CBD) phase of 2 miles with 7 stops per mile and a top speed of 20 mph; an arterial phase of 2 miles with 2 stops per mile and a top speed of 40 mph; and a commuter phase of 4 miles with 1 stop and a maximum speed of 40 mph. At each designated stop the bus will remain stationary for seven seconds. During this time, the passenger doors shall be opened and closed.

3. The individual ADB phases remain unaltered with the exception that 1 mile has been changed to 1 lap on the PSBRTF track. One lap is equal to 5,042 feet. This change is accommodated by adjusting the cruise distance and time.

4. The acceleration profile, for practical purposes and to achieve better repeatability, has been changed to "full throttle acceleration to cruise speed".

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

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

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

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

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

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

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

FUEL ECONOMY CALCULATION PROCEDURE

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

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

The fuel economy correction consists of three steps:

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

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

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

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

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

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

$$\mathbf{FEo_{mi/lb}} = FEo / Gm$$

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 - 2.14 mpg, ART - 2.63 mpg, and COM - 5.63 mpg. Average fuel consumption at idle was 7.22 lb/hr (1.15 gph).

FUEL ECONOMY PRE-TEST MAINTENANCE FORM

Bus Number: 9918	Date: 4-10-00	SLW (lbs): 8,550
Personnel: S.C. & E.D.		

FUEL SYSTEM	OK	Date	Initials
Install fuel measurement system	✓	4/11/00	S.C.
Replace fuel filter	✓	4/11/00	S.C.
Check for fuel leaks	✓	4/11/00	S.C.
Specify fuel type (refer to fuel analysis)	#1 diesel		
Remarks:			
BRAKES/TIRES	**OK**	**Date**	**Initials**
Inspect hoses	✓	4/11/00	S.C.
Inspect brakes	✓	4/11/00	S.C.
Relube wheel bearings	✓	4/11/00	S.C.
Check tire inflation pressures (mfg. specs.)	✓	4/11/00	S.C.
Remarks:			
COOLING SYSTEM	**OK**	**Date**	**Initials**
Check hoses and connections	✓	4/11/00	S.C.
Check system for coolant leaks	✓	4/11/00	S.C.
Remarks:			

FUEL ECONOMY PRE-TEST MAINTENANCE FORM (page 2)

Bus Number: 9918	Date: 4-11-00
Personnel: S.C. & E.D.	

ELECTRICAL SYSTEMS	OK	Date	Initials
Check battery	✓	4/10/00	S.C.
Inspect wiring	✓	4/10/00	S.C.
Inspect terminals	✓	4/10/00	S.C.
Check lighting	✓	4/10/00	S.C.
Remarks:			

DRIVE SYSTEM	OK	Date	Initials
Drain transmission fluid	✓	4/10/00	S.C.
Replace filter/gasket	✓	4/10/00	S.C.
Check hoses and connections	✓	4/10/00	S.C.
Replace transmission fluid	✓	4/10/00	S.C.
Check for fluid leaks	✓	4/10/00	S.C.
Remarks:			

LUBRICATION	OK	Date	Initials
Drain crankcase oil	✓	4/10/00	S.C.
Replace filters	✓	4/10/00	S.C.
Replace crankcase oil	✓	4/10/00	S.C.
Check for oil leaks	✓	4/10/00	S.C.
Check oil level	✓	4/10/00	S.C.
Lube all chassis grease fittings	✓	4/10/00	S.C.
Lube universal joints	✓	4/10/00	S.C.
Replace differential lube including axles	✓	4/10/00	S.C.
Remarks:			

FUEL ECONOMY PRE-TEST MAINTENANCE FORM (page 3)

Bus Number: 9918	Date: 4-10-00
Personnel: S.C. & E.D	

EXHAUST/EMISSION SYSTEM	OK	Date	Initials
Check for exhaust leaks	✓	4/10/00	S.C.
Remarks:			

ENGINE	OK	Date	Initials
Replace air filter	✓	4/10/00	S.C.
Inspect air compressor and air system	✓	4/10/00	S.C.
Inspect vacuum system, if applicable	N/A		S.C.
Check and adjust all drive belts	✓	4/10/00	S.C.
Check cold start assist, if applicable	✓	4/10/00	S.C.
Remarks:			

STEERING SYSTEM	OK	Date	Initials
Check power steering hoses and connectors	✓	4/10/00	S.C.
Service fluid level	✓	4/10/00	S.C.
Check power steering operation	✓	4/10/00	S.C.
Remarks:			

	OK	Date	Initials
Ballast bus to seated load weight	✓	4/10/00	S.C.

TEST DRIVE	OK	Date	Initials
Check brake operation	✓	4/10/00	S.C.
Check transmission operation	✓	4/10/00	S.C.
Remarks:			

FUEL ECONOMY PRE-TEST INSPECTION FORM

Bus Number: 9918	Date: 4-14-00
Personnel: S.C. & E.D.	

PRE WARM-UP	If OK, Initial
Fuel Economy Pre-Test Maintenance Form is complete	S.C.
Cold tire pressure (psi): Front 120 Middle 120 Rear 120	S.C.
Tire wear:	S.C.
Engine oil level	S.C.
Engine coolant level	S.C.
Interior and exterior lights on, evaporator fan on	S.C.
Fuel economy instrumentation installed and working properly.	S.C.
Fuel line -- no leaks or kinks	S.C.
Speed measuring system installed on bus. Speed indicator installed in front of bus and accessible to TECH and Driver.	S.C.
Bus is loaded to SLW	S.C.
WARM-UP	**If OK, Initial**
Bus driven for at least one hour warm-up	B.L.
No extensive or black smoke from exhaust	B.L.
POST WARM-UP	**If OK, Initial**
Warm tire pressure (psi): Front 123 Middle 125 Rear 123	B.L.
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	B.L.

FUEL ECONOMY DATA FORM (Liquid Fuels)

Bus Number: 9918	Manufacturer: MCI	Date: 4-13-00
Run Number: 1	Personnel: S.C., R.H. & E.D.	
Test Direction: ☒CW or ☐CCW	Temperature (°F): 45	Humidity (%): 31
SLW (lbs): 8,550	Wind Speed (mph) & Direction: ESE & 3	Barometric Pressure (in.Hg): 30.50

Cycle Type	Time (min:sec)		Cycle Time (min:sec)	Fuel Temperature (°C)	Load Cell Reading (lb)		Fuel Used (lbs)
	Start	Finish		Start	Start	Finish	
CBD #1	0	9:02	9:02	34.1	100.60	94.95	5.65
ART #1	0	3:57	3:57	36.5	94.95	90.45	4.50
CBD #2	0	9:00	9:00	39.2	90.45	84.85	5.60
ART #2	0	4:02	4:02	39.3	84.85	80.55	4.30
CBD #3	0	8:52	8:52	40.0	80.55	76.00	4.45
COMMUTER	0	5:59	5:59	41.1	76.00	71.45	4.55
						Total Fuel =	29.05 lbs

20 minute idle : Total Fuel Used = 2.25 lbs

Heating Value = 20,214.0 BTU/LB

Comments:

FUEL ECONOMY DATA FORM (Liquid Fuels)

Bus Number: 9918	Manufacturer: MCI	Date: 4-13-00
Run Number: 2	Personnel: S.C., R.H. & E.D.	
Test Direction: ☐CW or ☒CCW	Temperature (°F): 51	Humidity (%): 40
SLW (lbs): 8,550	Wind Speed (mph) & Direction: Calm	Barometric Pressure (in.Hg): 30.50

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	8:57	8:57	35.9	100.50	95.05	5.45
ART #1	0	4:05	4:05	37.2	95.05	90.55	4.50
CBD #2	0	8:43	8:43	40.1	90.55	84.80	5.75
ART #2	0	4:03	4:03	43.5	84.80	80.25	4.55
CBD #3	0	9:00	9:00	45.6	80.25	74.50	5.75
COMMUTER	0	6:01	6:01	46.5	47.50	70.30	4.20
							Total Fuel = 30.20 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: 9918	Manufacturer: MCI	Date: 4-14-00
Run Number: 3	Personnel: S.C., R.H. & E.D.	
Test Direction: ☐CW or ☒CCW	Temperature (°F): 40	Humidity (%): 62
SLW (lbs): 8,550	Wind Speed (mph) & Direction: 7 / Var.	Barometric Pressure (in.Hg): 30.37

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	8:56	8:56	27.5	124.90	119.05	5.85
ART #1	0	4:00	4:00	27.7	119.05	114.35	4.70
CBD #2	0	8:35	8:35	30.7	114.35	108.60	5.75
ART #2	0	4:04	4:04	33.9	108.60	103.90	4.70
CBD #3	0	8:46	8:46	34.2	103.90	98.05	5.85
COMMUTER	0	5:55	5:55	34.7	98.05	93.80	4.25
							Total Fuel = 31.10 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: 9918	Manufacturer: MCI	Date: 4-14-00
Run Number: 4	Personnel: S.C., R.H. & E.D.	
Test Direction: ☒CW or ☐CCW	Temperature (°F): 47	Humidity (%): 53
SLW (lbs): 8,550	Wind Speed (mph) & Direction: 7 / Var.	Barometric Pressure (in.Hg): 30.37

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	8:45	8:45	36.6	93.80	88.00	5.80
ART #1	0	4:03	4:03	41.1	88.00	83.40	4.60
CBD #2	0	8:42	8:42	45.0	83.40	77.75	5.65
ART #2	0	4:05	4:05	45.5	77.75	73.15	4.60
CBD #3	0	8:58	8:58	45.9	73.15	67.40	5.75
COMMUTER	0	5:58	5:58	46.1	67.40	63.35	4.05
							Total Fuel = 30.45 lbs

20 minute idle : Total Fuel Used = 2.56 lbs

Heating Value = 20,214.0 BTU/LB

Comments:

FUEL ECONOMY SUMMARY SHEET

BUS MANUFACTURER :MOTOR COACH INDUSTRI BUS NUMBER :9918
BUS MODEL :102-EL3 TEST DATE :4/13/00

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, CW				
CBD	15.70	5.73	.36	2.29
ART	8.80	3.82	.43	2.72
COM	4.55	3.82	.84	5.26
TOTAL	29.05	13.37	.46	2.88
Run # :2, CCW				
CBD	16.95	5.73	.34	2.12
ART	9.05	3.82	.42	2.65
COM	4.20	3.82	.91	5.70
TOTAL	30.20	13.37	.44	2.77
Run # :3, CCW				
CBD	17.45	5.73	.33	2.06
ART	9.40	3.82	.41	2.55
COM	4.25	3.82	.90	5.63
TOTAL	31.10	13.37	.43	2.69
Run # :4, CW				
CBD	17.20	5.73	.33	2.09
ART	9.20	3.82	.42	2.60
COM	4.05	3.82	.94	5.91
TOTAL	30.45	13.37	.44	2.75

IDLE CONSUMPTION

First 20 Minutes Data : 2.25 Lb Last 20 Minutes Data : 2.56 Lb
Average Idle Consumption : 7.22 Lb/Hr

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

Run 1 : 3.8 Run 2 : .0 Run 3 : -3.0 Run 4 : -.8

SUMMARY

Average Idle Consumption : 1.15 G/Hr
Average CBD Phase Consumption : 2.14 MPG
Average Arterial Phase Consumption : 2.63 MPG
Average Commuter Phase Consumption : 5.63 MPG
Overall Average Fuel Consumption : 2.78 MPG
Overall Average Fuel Consumption : 20.35 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 43.0 dB(A); ranging from 40.4 dB(A) in line with the front speaker to 48.9 dB(A) at the rear passenger seats. The interior ambient noise level for this test was 40.4 dB(A).

The second test measures interior noise during acceleration from 0 to 35 mph. This noise level ranged from 67.9 dB(A) at the front passenger seats to 71.3 dB(A) at the rear passenger seats. The overall average was 69.1 dB(A). The interior ambient noise level for this test was 42.6 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: 9918	Date: 4-10-00
Personnel: S.C.	
Temperature (°F): 51	Humidity (%): 61
Wind Speed (mph): 3	Wind Direction: W
Barometric Pressure (in.Hg): 30.10	
Initial Sound Level Meter Calibration: ☒ checked by B.L.	
Interior Ambient Noise Level dB(A): 40.4	Exterior Ambient Noise Level dB(A): 55.3
Microphone Height During Testing (in): 45	

Measurement Location	Measured Sound Level dB(A)
Driver's Seat	41.8
Front Passenger Seats	40.7
In Line with Front Speaker	40.4
In Line with Middle Speaker	42.0
In Line with Rear Speaker	43.9
Rear Passenger Seats	48.9

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: 9918	Date: 4-24-00
Personnel: S.C. & E.D.	
Temperature (°F): 54	Humidity (%): 54
Wind Speed (mph): Calm	Wind Direction: Calm
Barometric Pressure (in.Hg): 29.91	
Initial Sound Level Meter Calibration: ☒ checked by B.L.	
Interior Ambient Noise Level dB(A): 42.6	Exterior Ambient Noise Level dB(A): 50.7
Microphone Height During Testing (in): 45	

Measurement Location	Measured Sound Level dB(A)
Driver's Seat	68.6
Front Passenger Seats	67.9
Middle Passenger Seats	68.5
Rear Passenger Seats	71.3

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: 9918	Date: 4-24-00
Personnel: S.C. & E.D.	
Temperature (°F): 54	Humidity (%): 54
Wind Speed (mph): Calm	Wind Direction: Calm
Barometric Pressure (in.Hg): 29.91	

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.

7.1 INTERIOR NOISE TEST

TEST BUS SET-UP FOR 80 dB(A) NOISE TEST

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 50.3 dB(A), the average test result obtained while accelerating from a constant speed was 78.5 dB(A) on the right side and 79.3 dB(A) on the left side.

When accelerating from a standstill with an exterior ambient noise level of 51.6 dB(A), the average of the results obtained were 80.6 dB(A) on the right side and 81.6 dB(A) on the left side.

With the vehicle stationary and the engine, accessories, and air conditioning on, the measurements averaged 68.4 dB(A) at low idle, 70.4 dB(A) at high idle and 79.3 dB(A) at wide open throttle. With the accessories and air conditioning off, the readings averaged 2.8 dB(A) lower at low idle, 2.3 dB(A) lower at high idle and 0.3 dB(A) lower at wide open throttle. The exterior ambient noise level measured during this test was 53.3 dB(A).

EXTERIOR NOISE TEST DATA FORM
Accelerating from Constant Speed

Bus Number: 9918	Date: 4-24-00
Personnel: S.C. & E.D.	
Temperature (°F): 56	Humidity (%): 54
Wind Speed (mph): Calm	Wind Direction: Calm
Barometric Pressure (in.Hg):29.91	
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 B.L.	
Initial Sound Level Meter Calibration: ☒ checked by B.L.	
Exterior Ambient Noise Level dB(A): 50.3	

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	78.2	1	79.3
2	77.3	2	79.2
3	77.1	3	79.0
4	77.4	4	78.9
5	78.7	5	78.6
Average of two highest actual noise levels = 78.5 dB(A)		Average of two highest actual noise levels = 79.3 dB(A)	

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

Comments:

EXTERIOR NOISE TEST DATA FORM
Accelerating from Standstill

Bus Number: 9918	Date: 4-24-00
Personnel: S.C. & E.D.	
Temperature (°F): 56	Humidity (%): 54
Wind Speed (mph): Calm	Wind Direction: Calm
Barometric Pressure (in.Hg): 29.91	
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 B.L.	
Initial Sound Level Meter Calibration: ☒ checked by B.L.	
Exterior Ambient Noise Level dB(A): 51.6	

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	80.6	1	81.5
2	80.6	2	80.9
3	80.6	3	81.6
4	80.0	4	81.5
5	80.4	5	81.4
Average of two highest actual noise levels = 80.6 dB(A)		Average of two highest actual noise levels = 81.6 dB(A)	

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

Comments:

EXTERIOR NOISE TEST DATA FORM
Stationary

Bus Number: 9918	Date: 4-24-00
Personnel: S.C. & E.D.	
Temperature (°F): 56	Humidity (%): 54
Wind Speed (mph): Calm	Wind Direction: Calm
Barometric Pressure (in.Hg): 29.91	
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 B.L.	
Initial Sound Level Meter Calibration: ☒ checked by B.L.	
Exterior Ambient Noise Level dB(A): 53.3	

Accessories and Air Conditioning ON			
Throttle Position	Engine RPM	Curb (Right) Side dB(A)	Street (Left) Side db(A)
		Measured	Measured
Low Idle	700	67.7	69.1
High Idle	950	70.0	70.7
Wide Open Throttle	2,200	77.9	80.6

Accessories and Air Conditioning OFF			
Throttle Position	Engine RPM	Curb (Right) Side dB(A)	Street (Left) Side db(A)
		Measured	Actual
Low Idle	705	64.8	66.4
High Idle	950	67.8	68.3
Wide Open Throttle	2,214	78.4	79.5

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