STURAA TEST

12 YEAR

500,000 MILE BUS

from

NEW FLYER of AMERICA

MODEL XDE 40

APRIL 2010

PTI-BT-R0913

PENNSTATE

1855

The Thomas D. Larson
Pennsylvania Transportation Institute

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EXECUTIVE SUMMARY

New Flyer of America submitted a Hybrid diesel/electric model XDE 40, diesel-powered 42 seat (including the driver) 41-foot bus, for a 12 yr/500,000 mile STURAA test. The odometer reading at the time of delivery was 1,938 miles. Testing started on July 27, 2009 and was completed on April 6, 2010. The Check-In section of the report provides a description of the bus and specifies its major components.

The primary part of the test program is the Structural Durability Test, which also provides the information for the Maintainability and Reliability results. The Structural Durability Test was started on August 24, 2009 and was completed on March 26, 2010.

The interior of the bus is configured with seating for 42 passengers including the driver. Free floor space will accommodate 41 standing passengers resulting in a potential load of 83 persons. At 150 lbs per person, this load results in a measured gross vehicle weight of 40,720 lbs. The first segment of the Structural Durability Test was performed with the bus loaded to a GVW of 40,720 lbs. The middle segment was performed at a seated load weight of 34,760 lbs and the final segment was performed at a curb weight of 28,580 lbs. Durability driving resulted in unscheduled maintenance and failures that involved a variety of subsystems. A description of failures, and a complete and detailed listing of scheduled and unscheduled maintenance are provided in the Maintainability section of this report.

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

The Reliability section compiles failures that occurred during Structural Durability Testing. Breakdowns are classified according to subsystems. The data in this section are arranged so that those subsystems with more frequent problems are apparent. The problems are also listed by class as defined in Section 2. The test bus encountered no Class 1 or Class 2 failures. Of the twenty-three reported failures, 13 were Class 3 and 10 were Class 4.

The Safety Test, (a double-lane change, obstacle avoidance test) was safely performed in both right-hand and left-hand directions up to a maximum test speed of 45 mph. The performance of the bus is illustrated by a speed vs. time plot. Acceleration and gradeability test data are provided in Section 4, Performance. The average time to obtain 50 mph was 37.96 seconds.

The Shakedown Test produced a maximum final loaded deflection of 0.344 inches with a permanent set ranging between -0.005 to 0.006 inches under a distributed static load of 31,125 lbs. The Distortion Test was completed with all subsystems, doors and escape mechanisms operating properly. Water leakage was observed during the test at the side driver's window, the left side of the windshield, and the window above the left rear wheel well. All subsystems operated properly.

The Static Towing Test was performed using a target load (towing force) of 34,296 lbs. All four front pulls were completed to the full test load with no damage or deformation observed. The Dynamic Towing Test was performed by means of a front-lift tow. The towing interface was accomplished using a hydraulic under-lift wrecker. The bus was towed without incident and no damage resulted from the test. The manufacturer does not recommend towing the bus from the rear, therefore, a rear test was not performed. The Jacking and Hoisting Tests were also performed without incident. The bus was found to be stable on the jack stands, and the minimum jacking clearance observed with a tire deflated was 3.7 inches.

A Fuel Economy Test was run on simulated central business district, arterial, and commuter courses. The results were 4.75 mpg, 4.81 mpg, and 7.57 mpg respectively; with an overall average of 5.34 mpg.

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

ABBREVIATIONS

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

TEST BUS CHECK-IN

I. OBJECTIVE

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

II. TEST DESCRIPTION

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

III. DISCUSSION

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

The test bus consists of a New Flyer of America, Hybrid diesel/electric model XDE 40. The bus has a front door equipped with a New Flyer model 7:1 Slope hinged handicap ramp forward of the front axle and a rear door forward of the rear axle. Power is provided by a diesel-fueled, Cummins model ISL 280 engine coupled to an Allison Transmission model EV40 transmission.

The measured curb weight is 8,860 lbs for the front axle and 19,720 lbs for the rear axle. These combined weights provide a total measured curb weight of 28,580 lbs. There are 42 seats including the driver and room for 41 standing passengers bringing the total passenger capacity to 83. Gross load is 150 lb x 83 = 12,450 lbs. At full capacity, the measured gross vehicle weight is 40,720 lbs.

VEHICLE DATA FORM

Bus Number: 0913	Arrival Date: 7-27-09
Bus Manufacturer: New Flyer of America	Vehicle Identification Number (VIN): 2FYH8FV148D034335
Model Number: XDE 40	Date: 7-27-09
Personnel: T.S. & S.C.	

WEIGHT:

Individual Wheel Reactions:

Weights (lb)	Front Axle		Middle Axle		Rear Axle	
	Right	Left	Right	Left	Right	Left
CW	4,450	4,410	N/A	N/A	9,480	10,240
SLW	5,390	5,330	N/A	N/A	11,250	12,790
GVW	7,190	7,030	N/A	N/A	12,380	14,120

Total Weight Details:

Weight (lb)	CW	SLW	GVW	GAWR
Front Axle	8,860	10,720	14,220	14,780
Middle Axle	N/A	N/A	N/A	N/A
Rear Axle	19,720	24,040	26,500	27,760
Total	28,580	34,760	40,720	GVWR: 42,540

Dimensions:

Length (ft/in)	40 / 11.0
Width (in)	102.5
Height (in)	129.0
Front Overhang (in)	87.0
Rear Overhang (in)	120.0
Wheel Base (in)	284.0
Wheel Track (in)	Front: 85.7
	Rear: 75.2

Bus Number: 0913	Date: 7-27-09

CLEARANCES:

Lowest Point Outside Front Axle	Location: Frame Clearance(in): 10.5
Lowest Point Outside Rear Axle	Location: Body Clearance(in): 10.7
Lowest Point between Axles	Location: Frame Clearance(in): 11.2
Ground Clearance at the center (in)	11.2
Front Approach Angle (deg)	8.4
Rear Approach Angle (deg)	7.8
Ramp Clearance Angle (deg)	4.5
Aisle Width (in)	23.4
Inside Standing Height at Center Aisle (in)	Front: 95.5 Rear: 79.2

BODY DETAILS:

Body Structural Type	Monocoque		
Frame Material	Steel		
Body Material	Fiberglass		
Floor Material	Plywood		
Roof Material	Fiberglass		
Windows Type	☒ Fixed	☐ Movable	
Window Mfg./Model No.	Guardian / As-3 M55T3 DOT 22		
Number of Doors	1 Front	1 Rear	
Mfr. / Model No.	Vapor Bus International / Slide Glide		
Dimension of Each Door (in)	Front: 36.6 x 77.7	Rear: 45.7 x 77.4	
Passenger Seat Type	☒ Cantilever	☐ Pedestal	☐ Other (explain)
Mfr. / Model No.	Ster / Prototype		
Driver Seat Type	☒ Air	☐ Spring	☐ Other (explain)
Mfr. / Model No.	USSC / Q90		
Number of Seats (including Driver)	42		

Bus Number: 0913	Date: 7-27-09

BODY DETAILS (Contd..)

Free Floor Space (ft^2)	66.5			
Height of Each Step at Normal Position (in)	Front 1. 13.6	2. N/A	3. N/A	4. N/A
	Middle 1. N/A	2. N/A	3. N/A	4. N/A
	Rear 1. 14.0	2. N/A	3. N/A	4. N/A
Step Elevation Change - Kneeling (in)	5.1			

ENGINE

Type	ε C.I.	ε Alternate Fuel	
	ε S.I.	ε Other (explain)	
Mfr. / Model No.	Cummins Motor / ISL 280		
Location	ε Front	ε Rear	ε Other (explain)
Fuel Type	ε Gasoline	ε CNG	ε Methanol
	ε Diesel	ε LNG	ε Other (explain)
Fuel Tank Capacity (indicate units)	90 Gals		
Fuel Induction Type	ε Injected	ε Carburetion	
Fuel Injector Mfr. / Model No.	Cummins Motor / ISL 280		
Carburetor Mfr. / Model No.	N/A		
Fuel Pump Mfr. / Model No.	Cummins Motor / ISL 280		
Alternator (Generator) Mfr. / Model No.	EMP / P450		
Maximum Rated Output (Volts / Amps)	28 / 450		
Air Compressor Mfr. / Model No.	WABCO / CP9575 (Single)		
Maximum Capacity (ft^3 / min)	18.7		
Starter Type	ε Electrical	ε Pneumatic	ε Other (explain)
Starter Mfr. / Model No.	Allison Transmission / EV40		

Bus Number: 0913	Date: 7-27-09

TRANSMISSION

Transmission Type	☐ Manual	☒ Automatic (Hybrid drive)	
Mfr. / Model No.	Allison Transmission / EV40		
Control Type	☐ Mechanical	☒ Electrical	☐ Other
Torque Converter Mfr. / Model No.	N/A		
Integral Retarder Mfr. / Model No.	Allison Transmission / EV40		

SUSPENSION

Number of Axles	2		
Front Axle Type	☐ Independent	☒ Beam Axle	
Mfr. / Model No.	MAN / VOK-07-F		
Axle Ratio (if driven)	N/A		
Suspension Type	☒ Air	☐ Spring	☐ Other (explain)
No. of Shock Absorbers	2		
Mfr. / Model No.	Koni / 4205 90 2517		
Middle Axle Type	☐ Independent	☐ Beam Axle	
Mfr. / Model No.	N/A		
Axle Ratio (if driven)	N/A		
Suspension Type	☐ Air	☐ Spring	☐ Other (explain)
No. of Shock Absorbers	N/A		
Mfr. / Model No.	N/A		
Rear Axle Type	☒ Independent	☐ Beam Axle	
Mfr. / Model No.	MAN / HY-1336B		
Axle Ratio (if driven)	4.625 : 1		
Suspension Type	☒ Air	☐ Spring	☐ Other (explain)
No. of Shock Absorbers	4		
Mfr. / Model No.	Koni / 2708 90 2518		

Bus Number: 0913	Date: 7-27-09

WHEELS & TIRES

Front	Wheel Mfr./ Model No.	Alcoa / 22.5 x 8.25
	Tire Mfr./ Model No.	Michelin XZU / 305/70R 22.5
Rear	Wheel Mfr./ Model No.	Alcoa / 22.5 x 8.25
	Tire Mfr./ Model No.	Michelin XZU / 305/70R 22.5

BRAKES

Front Axle Brakes Type	☐ Cam	☐ Disc	☐ Other (explain)
Mfr. / Model No.	Knorr / SN7		
Middle Axle Brakes Type	☐ Cam	☐ Disc	☐ Other (explain)
Mfr. / Model No.	N/A		
Rear Axle Brakes Type	☐ Cam	☐ Disc	☐ Other (explain)
Mfr. / Model No.	Knorr / SN7		
Retarder Type	Integrated Hybrid Drive		
Mfr. / Model No.	Allison Transmission / EV40		

HVAC

Heating System Type	☐ Air	☐ Water	☐ Other
Capacity (Btu/hr)	103,000 & 80,000		
Mfr. / Model No.	Thermo King / MCC / Spheros / RLF1-M1 / 12-70206-SS FLR HTR & 12-70208-CS FLR HTR		
Air Conditioner	☐ Yes	☐ No	
Location	Exterior roof		
Capacity (Btu/hr)	105,000		
A/C Compressor Mfr. / Model No.	Thermo King Corp. / S39115		

STEERING

Steering Gear Box Type	Hydraulic gear
Mfr. / Model No.	Shepherd / M110PMB31
Steering Wheel Diameter	22.0
Number of turns (lock to lock)	5.13

Bus Number: 0913	Date: 7-27-09

OTHERS

Wheel Chair Ramps	Location: Front door	Type: Hinged ramp
Wheel Chair Lifts	Location: N/A	Type: N/A
Mfr. / Model No.	New Flyer / 7:1 Slope	
Emergency Exit	Location: Windows Doors Roof hatch	Number: 5 2 2

CAPACITIES

Fuel Tank Capacity (units)	90 gals
Engine Crankcase Capacity (gallons)	6.0
Transmission Capacity (gallons)	7.0
Differential Capacity (gallons)	3.96
Cooling System Capacity (gallons)	23.4
Power Steering Fluid Capacity (gallons)	7.0

VEHICLE DATA FORM

Bus Number: 0913	Date: 7-27-09

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

Part Number	Description	Qty.
358649	Assy-engine strut LH ISL	1
358646	Assy-engine RH ISL	1
312485	Spring-air / bumper	4
203398	Shock absorber Frt Koni	2
240061	Bolt hex M18 x 2.0 x 115	24
344499	Rod radius lower Frt	4
354724	Washer M14	32
240064	Bolt hex M14 x 1.5 x 66	16
203269	Rod radius upper Frt	4
342508	Assy-Frt leveling valve	3
272217	Assy-link leveling	3
312485	Spring-air / bumper	10
204428	Shock Koni RR	6
313019	Rod upper rear radius 70mm	6
40N12000	Nut lock nylon ¾” 10 UNC	8
10B12104	Bolt hex ¾ “ UNC x 6.5	20
10B12064	Bolt hex ¾” 10 UNC x 4” LG	16
223196	Spacer Radius rod mtg	24
356808	Bolt M18 x 1.5 x 100 CL 10.9	16
10B06024	Bolt hex 3/8” 16 UNC x 1 ½” LG	16
30W06000	Washer lock 3/8” NOM	16
20W06000	Washer flat 3/8”	16
203772	Nut flange lock 3/8”-16	8
40N08000	Nut hex lock ½” NC	6

VEHICLE DATA FORM

Bus Number: 0913	Date: 7-27-09

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

Part Number	Description	Qty.
20W08000	Washer flat ½”	6
234815	Elbow 45 ½” OD x ¼” NPT	4
042440	Nut lock prevailing torque ¾”	12
5956376	Connector ½” OD x ¼” PT	2
5956114	Elbow 90 street ¼” MPT x ¼” FPT	2
347212	Assy LH leveling valve	3
247223	Clamp p .625 SS/H	3
335550	Bolt-U rear MAN axle	12
20W14000	Washer flat 7/8”	16
41N14000	Nut lock nylon 7/8” 14 UNF	16
289336	Assy link leveling LH	6
6358265	Element oil filter	3
6356784	Filter fuel	3
6362004	Filter assy secondary fuel	3
6331009	Filter corrosion resistor	3
P60866	Donaldson air filter	3
275163	Fltr-element hydr oil	3
6356984	Filter transmission	3
6356845	Control main filter, drive unit	3
8110071	Mount rubber	6
328612	Shaft upper steering drive	1
328613	Shaft lower steering drive	1
248498	Module VMM 1210	2
345258	Seal windshield	1

VEHICLE DATA FORM

Bus Number: 0913	Date: 7-27-09

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

Part Number	Description	Qty.
8112552	Blade wiper heavy duty	4
na	Rim alum	1
na	Assorted breakers	1

COMPONENT/SUBSYSTEM INSPECTION FORM

Bus Number: 0913	Date: 7-28-09

Subsystem	Checked	Comments
Air Conditioning Heating and Ventilation	9	
Body and Sheet Metal	9	
Frame	9	
Steering	9	
Suspension	9	
Interior/Seating	9	
Axles	9	
Brakes	9	
Tires/Wheels	9	
Exhaust	9	
Fuel System	9	
Power Plant	9	
Accessories	9	
Lift System	9	
Interior Fasteners	9	
Batteries	9	

CHECK - IN

NEW FLYER of AMERICA
MODEL XDE 40

CHECK - IN CONT.

NEW FLYER of AMERICA
MODEL XDE 40 EQUIPPED WITH A NEW FLYER MODEL 7:1 SLOPE HANDICAP RAMP

CHECK - IN CONT.

OPERATOR'S AREA

CHEC K - IN CONT.

INTERIOR
FRONT TO REAR

VIN TAG

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

Accessibility, in general, was adequate. Components covered in Section 1.3 (repair and/or replacement of selected subsystems), along with all other components encountered during testing, were found to be readily accessible and no restrictions were noted.

ACCESSIBILITY DATA FORM

Bus Number: 0913	Date: 4-5-10

Component	Checked	Comments
ENGINE :		
Oil Dipstick	99	
Oil Filler Hole	99	
Oil Drain Plug	99	
Oil Filter	99	
Fuel Filter	99	
Air Filter	99	
Belts	99	
Coolant Level	99	
Coolant Filler Hole	99	
Coolant Drain	99	
Spark / Glow Plugs	99	
Alternator	99	
Diagnostic Interface Connector	99	
TRANSMISSION :		
Fluid Dip-Stick	99	
Filler Hole	99	Fill through dip tube.
Drain Plug	99	
SUSPENSION :	99	
Bushings	99	
Shock Absorbers	99	
Air Springs	99	
Leveling Valves	99	
Grease Fittings	99	

ACCESSIBILITY DATA FORM

Bus Number: 0913	Date: 4-5-10

Component	Checked	Comments
HVAC :		
A/C Compressor	99	
Filters	99	
Fans	99	
ELECTRICAL SYSTEM :		
Fuses	99	
Batteries	99	
Voltage regulator	99	Internal regulator.
Voltage Converters	99	
Lighting	99	
MISCELLANEOUS :		
Brakes	99	
Handicap Lifts/Ramps	99	
Instruments	99	
Axles	99	
Exhaust	99	
Fuel System	99	
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.

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SCHEDULED MAINTENANCE

New Flyer #0913

DATE	TEST MILES	SERVICE	ACTIVITY	DOWN TIME	HOURS
09-16-09	720	P.M. / Inspection	Linkage, tie rods, universals/u-joints all lubed; all fluids checked.	4.00	4.00
09-30-09	1,916	P.M. / Inspection	Linkage, tie rods, universals/u-joints all lubed; all fluids checked.	4.00	4.00
10-14-09	2,998	P.M. / Inspection	Linkage, tie rods, universals/u-joints all lubed; all fluids checked.	4.00	4.00
10-29-09	3,633	P.M. / Inspection	Linkage, tie rods, universals/u-joints all lubed; all fluids checked.	4.00	4.00
11-03-09	4,273	P.M. / Inspection	Linkage, tie rods, universals/u-joints all lubed; all fluids checked.	4.00	4.00
12-17-09	5,298	P.M. / Inspection	Linkage, tie rods, universals/u-joints all lubed; all fluids checked.	4.00	4.00
12-23-09	6,422	P.M. / Inspection	Linkage, tie rods, universals/u-joints all lubed; all fluids checked.	4.00	4.00
01-11-10	7,751	P.M. / Inspection	Linkage, tie rods, universals/u-joints all lubed; all fluids checked.	4.00	4.00

SCHEDULED MAINTENANCE

New Flyer #0913

DATE	TEST MILES	SERVICE	ACTIVITY	DOWN TIME	HOURS
01-18-10	8,207	P.M. / Inspection	Linkage, tie rods, universals/u-joints all lubed; all fluids checked.	4.00	4.00
01-27-10	9,642	P.M. / Inspection	Linkage, tie rods, universals/u-joints all lubed; all fluids checked.	4.00	4.00
02-09-10	10,618	P.M. / Inspection	Linkage, tie rods, universals/u-joints all lubed; all fluids checked.	4.00	4.00
02-15-10	11,716	P.M. / Inspection	Linkage, tie rods, universals/u-joints all lubed; all fluids checked.	4.00	4.00
02-19-10	12,757	P.M. / Inspection	Linkage, tie rods, universals/u-joints all lubed; all fluids checked.	4.00	4.00
02-23-10	13,276	P.M. / Inspection	Linkage, tie rods, universals/u-joints all lubed; all fluids checked.	4.00	4.00
03-05-10	14,496	P.M. / Inspection	Linkage, tie rods, universals/u-joints all lubed; all fluids checked.	4.00	4.00
03-09-10	15,000	P.M. / Inspection	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
Driver's seat air line.	1.0
Left front air bag.	2.0
Upper radius rod.	2.0
Left front air bag hose.	2.0
Right front lower radius rod.	2.0
Transmission relay.	8.0
Rear H-beam.	12.0
Both outside rear view mirrors.	1.0
Right front air bag.	1.0
Belt guard.	4.0
A/C belt.	1.0

At the end of the test, the remaining items on the list were removed and replaced. The transmission assembly took 18.0 man-hours (two men 9.0 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
Alternator	5.0 man hours
Transmission	18.0 man hours
Wiper Motor	0.5 man hours
Hybrid battery pack	1.0 man hours
Alternator	0.75 man hours
Batteries	0.5 man hours

1.3 REPLACEMENT AND/OR REPAIR OF SELECTED SUBSYSTEMS

TRANSMISSION REMOVAL AND REPLACEMENT (18.0 MAN HOURS)

WIPER MOTOR REMOVAL AND REPLACEMENT (0.5 MAN HOURS)

1.3 REPLACEMENT AND/OR REPAIR OF SELECTED SUBSYSTEMS CONT.

HYBRID BATTERY PACK REMOVAL AND REPLACEMENT (1.0 MAN HOURS)

ALTERNATOR REMOVAL AND REPLACEMENT (0.75 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 en route 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 thirteen Class 3 failures, 5 involved the suspension system, 4 occurred with the brakes, 2 were electrical and 1 each occurred with the engine/transmission and frame. These, and the remaining ten Class 4 failures are available for review in the Unscheduled Maintenance List, located in Section 5.7 Structural Durability.

RELIABILITY DATA FORMS

Bus Number: 0913	Date: 03-16-10
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		1,591			2.00	2.00
	2,327				2.00	1.00
	2,375				5.00	120.00
	4,273				2.00	1.00
		4,815			2.00	1.00
		7,751			1.00	0.50
		7,751			1.00	6.00
		13,516			2.00	3.00
Seats/Windows/Body	1,591				1.00	2.00
	4,815				2.50	2.50
	4,815				1.00	1.00
	7,751				3.00	1.50
	7,751				6.00	3.00
Brakes		512			0.50	6.00
		2,327			1.00	8.00
		2,375			2.00	1.00
		4,273			1.00	1.00

RELIABILITY DATA FORMS

Bus Number: 0913	Date: 03-16-10
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
Engine/Transmission		4,396			8.00	72.00
	7,751				4.00	24.00
	7,751				1.00	0.50
Electrical		3,396			5.00	180.00
		4,934			0.50	46.00
Frame		4,815			12.00	519.00

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.

SAFETY DATA FORM

Bus Number: 0913	Date: 3-17-10
Personnel: B.S., T.S. & E.L.	

Temperature (°F): 39	Humidity (%): 66
Wind Direction: Calm	Wind Speed (mph): Calm
Barometric Pressure (in.Hg): 30.10	

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

3. SAFETY

RIGHT - HAND APPROACH

LEFT - HAND APPROACH

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

4-I. TEST OBJECTIVE

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

4-II. TEST DESCRIPTION

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

4-III. DISCUSSION

This test consists of three runs in both the clockwise and counterclockwise directions on the 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 37.96 seconds.

PERFORMANCE DATA FORM

Bus Number: 0913	Date: 3/17/10
Personnel: B.S., T.S. & E.L.	
Temperature (°F): 39	Humidity (%): 66
Wind Direction: Calm	Wind Speed (mph): Calm
Barometric Pressure (in.Hg): 30.10	
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	5.04	5.01	4.82
20 mph	9.76	9.42	9.66
30 mph	16.32	16.29	16.48
40 mph	25.16	26.39	26.19
Top Test Speed(mph) 50	38.12	38.50	38.71

Clockwise Recorded Interval Times

Speed	Run 1	Run 2	Run 3
10 mph	4.80	4.95	4.89
20 mph	9.70	9.45	9.29
30 mph	16.05	16.01	16.23
40 mph	25.45	24.95	25.04
Top Test Speed(mph) 50	37.64	37.28	37.50

0913

PERFORMANCE SUMMARY SHEET

BUS MANUFACTURER :New Flyer
BUS MODEL :Model XDE 40
BUS NUMBER :0913
TEST DATE :3/17/10

TEST CONDITIONS :

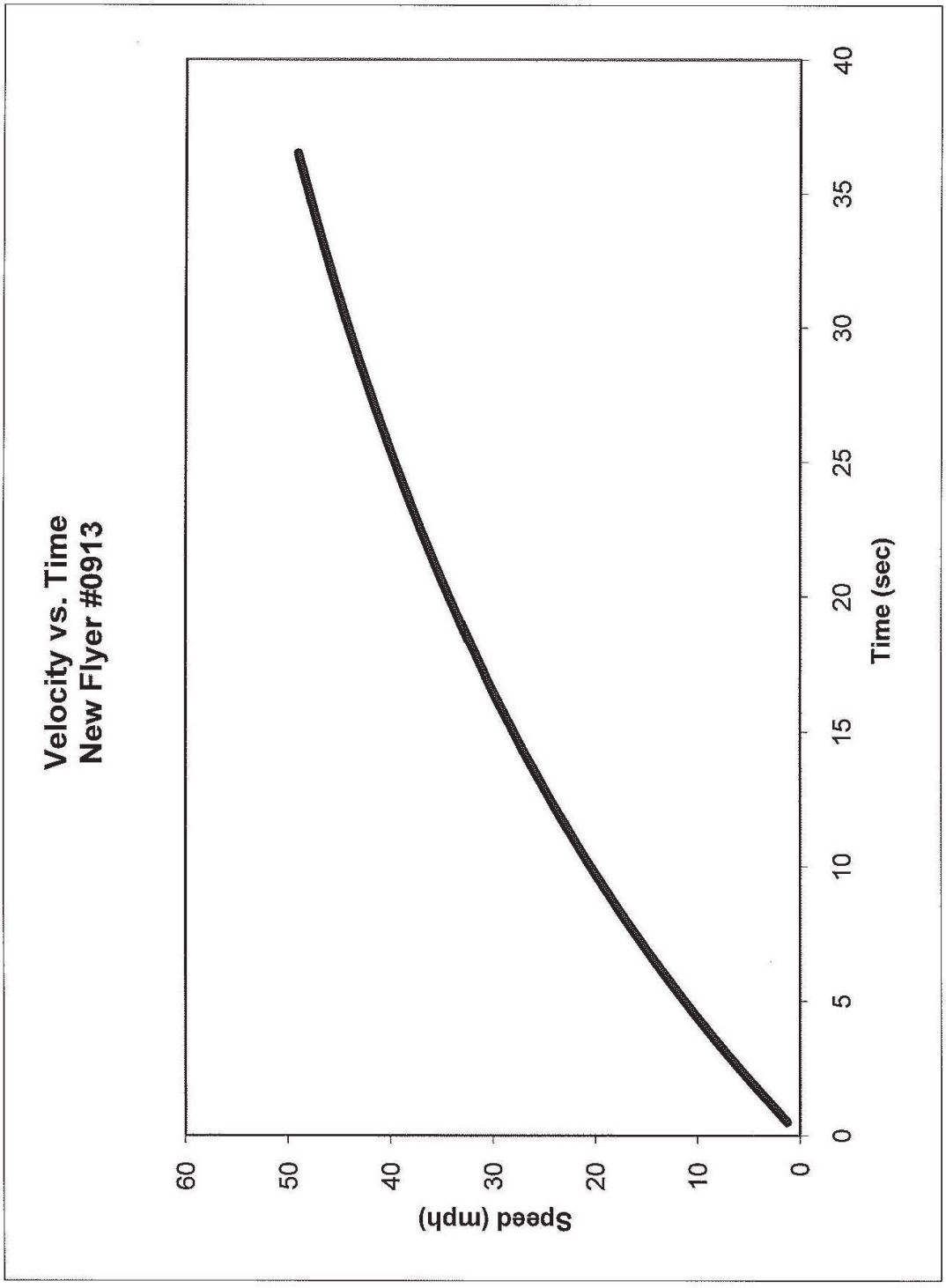
TEMPERATURE (DEG F) : 39.0
WIND DIRECTION : calm
WIND SPEED (MPH) : .0
HUMIDITY (%) : 66
BAROMETRIC PRESSURE (IN. HG) : 30.1

VEHICLE SPEED	AVERAGE TIME (SEC)		
(MPH)	CCW DIRECTION	CW DIRECTION	TOTAL
10.0	4.96	4.88	4.92
20.0	9.61	9.48	9.55
30.0	16.36	16.10	16.23
40.0	25.91	25.15	25.53
50.0	38.44	37.47	37.96

TEST SUMMARY :

VEHICLE SPEED (MPH)	TIME (SEC)	ACCELERATION (FT/SEC^2)	MAX. GRADE (%)
1.0	.40	3.6	11.3
5.0	2.09	3.4	10.5
10.0	4.38	3.1	9.5
15.0	6.91	2.7	8.6
20.0	9.73	2.5	7.7
25.0	12.91	2.2	6.8
30.0	16.51	1.9	5.9
35.0	20.64	1.7	5.1
40.0	25.44	1.4	4.4
45.0	31.11	1.2	3.7
50.0	37.91	1.0	3.0

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
New Flyer #0913
Speed (mph)
0
10
20
30
40
50
60
Time (sec)
0
5
10
15
20
25
30
35
40

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 83 people including the driver. The resulting test load is (83 x 375 lb) = 31,125 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 0.344 inches at reference point 3. The maximum permanent deflection after the final loading sequence ranged from -0.005 inches at reference point 1 to 0.006 inches at reference points 5 and 9.

STRUCTURAL SHAKEDOWN DATA FORM

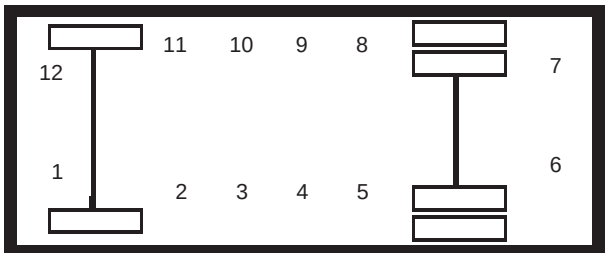
Bus Number: 0913	Date: 8-12-09
Personnel: T.S., E.D., E.L. & G.F.	Temperature (°F): 75
Loading Sequence: ع 1 ع 2 ع 3 (check one) Test Load (lbs): 31,125	

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	.047	.047	.019	.019
2	0	.129	.129	.000	.000
3	0	.247	.247	.019	.019
4	0	.383	.383	.021	.021
5	0	.374	.374	.023	.023
6	0	.007	.007	-.005	-.005
7	0	.004	.004	.000	.000
8	0	.362	.362	.018	.018
9	0	.323	.323	.029	.029
10	0	.257	.257	.018	.018
11	0	.156	.156	.011	.011
12	0	.026	.026	.016	.016

STRUCTURAL SHAKEDOWN DATA FORM

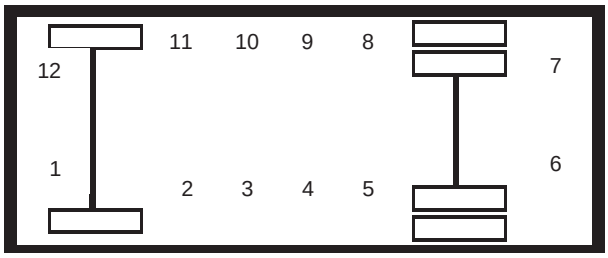
Bus Number: 0913	Date: 8-12-09
Personnel: T.S., E.D., E.L. & J.P.	Temperature (°F): 73
Loading Sequence: ع 1 ع 2 ع 3 (check one) Test Load (lbs): 31,125	

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	.019	.059	.040	.014	-.005
2	.000	.143	.143	.000	.000
3	.019	.363	.344	.024	.005
4	.021	.302	.281	.026	.005
5	.023	.395	.372	.029	.006
6	-.005	.008	.013	-.005	.000
7	.000	.000	.000	.001	.001
8	.018	.243	.225	.023	.005
9	.029	.301	.272	.035	.006
10	.018	.248	.230	.023	.005
11	.011	.253	.242	.016	.005
12	.016	.031	.015	.014	-.002

5.1 STRUCTURAL SHAKEDOWN TEST

DIAL INDICATORS IN POSITION

BUS LOADED TO 2.5 TIMES GVL (31,125 LBS)

5.2 STRUCTURAL STRENGTH AND DISTORTION TESTS - STRUCTURAL DISTORTION

5.2-I. TEST OBJECTIVE

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

5.2-II. TEST DESCRIPTION

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

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

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

5.2-III. DISCUSSION

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

All doors, windows, escape mechanisms, engine, steering and handicapped devices operated normally throughout the test. The undercarriage and body indicated no deficiencies. Water leakage was observed during the test at the side driver's window, the left side of the windshield, and the window above the left rear wheel well. 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: 0913	Date: 8-24-09
Personnel: E.D., E.L., J.P., G.F. & K.D.	Temperature(°F): 67

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

	Comments
ع Windows	Driver's side window leaking.
ع Front Doors	No deficiencies.
ع Rear Doors	No deficiencies.
ع Escape Mechanisms/ Roof Vents	No deficiencies.
ع Engine	No deficiencies.
ع Handicapped Device/ Special Seating	No deficiencies.
ع Undercarriage	No deficiencies.
ع Service Doors	No deficiencies.
ع Body	No deficiencies.
ع Windows/ Body Leakage	No deficiencies.
ع Steering Mechanism	No deficiencies.

DISTORTION TEST INSPECTION FORM

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

Bus Number: 0913	Date: 8-24-09
Personnel: E.D., E.L., J.P., G.F. & K.D.	Temperature(°F): 67

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

	Comments
ع Windows	Driver's side window leaking.
ع Front Doors	No deficiencies.
ع Rear Doors	No deficiencies.
ع Escape Mechanisms/ Roof Vents	No deficiencies.
ع Engine	No deficiencies.
ع Handicapped Device/ Special Seating	No deficiencies.
ع Undercarriage	No deficiencies.
ع Service Doors	No deficiencies.
ع Body	No deficiencies.
ع Windows/ Body Leakage	Windshield, left side, 6" from top.
ع Steering Mechanism	No deficiencies.

DISTORTION TEST INSPECTION FORM
(Note: Ten copies of this data sheet are required)

Bus Number: 0913	Date: 8-24-09
Personnel: E.D., E.L., J.P., G.F. & K.D.	Temperature(°F): 67

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

	Comments
ع Windows	Driver's side window leaking.
ع Front Doors	No deficiencies.
ع Rear Doors	No deficiencies.
ع Escape Mechanisms/ Roof Vents	No deficiencies.
ع Engine	No deficiencies.
ع Handicapped Device/ Special Seating	No deficiencies.
ع Undercarriage	No deficiencies.
ع Service Doors	No deficiencies.
ع Body	No deficiencies.
ع Windows/ Body Leakage	Windshield, left side, 6" from top.
ع Steering Mechanism	No deficiencies.

DISTORTION TEST INSPECTION FORM
(Note: Ten copies of this data sheet are required)

Bus Number: 0913	Date: 8-24-09
Personnel: E.D., E.L., J.P., G.F. & K.D.	Temperature(°F): 67

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

	Comments
ع Windows	Driver's side window leaking.
ع Front Doors	No deficiencies.
ع Rear Doors	No deficiencies.
ع Escape Mechanisms/ Roof Vents	No deficiencies.
ع Engine	No deficiencies.
ع Handicapped Device/ Special Seating	No deficiencies.
ع Undercarriage	No deficiencies.
ع Service Doors	No deficiencies.
ع Body	No deficiencies.
ع Windows/ Body Leakage	Windshield, left side, 6" from top.
ع Steering Mechanism	No deficiencies.

DISTORTION TEST INSPECTION FORM
(Note: Ten copies of this data sheet are required)

Bus Number: 0913	Date: 8-24-09
Personnel: E.D., E.L., J.P., G.F. & K.D.	Temperature(°F): 67

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

	Comments
ع Windows	Driver's side window leaking.
ع Front Doors	No deficiencies.
ع Rear Doors	No deficiencies.
ع Escape Mechanisms/ Roof Vents	No deficiencies.
ع Engine	No deficiencies.
ع Handicapped Device/ Special Seating	No deficiencies.
ع Undercarriage	No deficiencies.
ع Service Doors	No deficiencies.
ع Body	No deficiencies.
ع Windows/ Body Leakage	Windshield, left side, 6" from top.
ع Steering Mechanism	No deficiencies.

DISTORTION TEST INSPECTION FORM
(Note: Ten copies of this data sheet are required)

Bus Number: 0913	Date: 8-24-09
Personnel: E.D., E.L., J.P., G.F. & K.D.	Temperature(°F): 67

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

	Comments
ع Windows	Driver's side window leaking.
ع Front Doors	No deficiencies.
ع Rear Doors	No deficiencies.
ع Escape Mechanisms/ Roof Vents	No deficiencies.
ع Engine	No deficiencies.
ع Handicapped Device/ Special Seating	No deficiencies.
ع Undercarriage	No deficiencies.
ع Service Doors	No deficiencies.
ع Body	No deficiencies.
ع Windows/ Body Leakage	Windshield, left side, 6" from top.
ع Steering Mechanism	No deficiencies.

DISTORTION TEST INSPECTION FORM
(Note: Ten copies of this data sheet are required)

Bus Number: 0913	Date: 8-24-09
Personnel: E.D., E.L., J.P., G.F. & K.D.	Temperature(°F): 67

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

	Comments
ع Windows	Driver's side window leaking.
ع Front Doors	No deficiencies.
ع Rear Doors	No deficiencies.
ع Escape Mechanisms/ Roof Vents	No deficiencies.
ع Engine	No deficiencies.
ع Handicapped Device/ Special Seating	No deficiencies.
ع Undercarriage	No deficiencies.
ع Service Doors	No deficiencies.
ع Body	No deficiencies.
ع Windows/ Body Leakage	Windshield, left side, 6" from top.
ع Steering Mechanism	No deficiencies.

DISTORTION TEST INSPECTION FORM
(Note: Ten copies of this data sheet are required)

Bus Number: 0913	Date: 8-24-09
Personnel: E.D., E.L., J.P., G.F. & K.D.	Temperature(°F): 67

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

	Comments
ع Windows	Driver's side window leaking.
ع Front Doors	No deficiencies.
ع Rear Doors	No deficiencies.
ع Escape Mechanisms/ Roof Vents	No deficiencies.
ع Engine	No deficiencies.
ع Handicapped Device/ Special Seating	No deficiencies.
ع Undercarriage	No deficiencies.
ع Service Doors	No deficiencies.
ع Body	No deficiencies.
ع Windows/ Body Leakage	Windshield, left side, 6" from top. Window above left rear wheel well is leaking.
ع Steering Mechanism	No deficiencies.

DISTORTION TEST INSPECTION FORM
(Note: Ten copies of this data sheet are required)

Bus Number: 0913	Date: 8-24-09
Personnel: E.D., E.L., J.P., G.F. & K.D.	Temperature(°F): 67

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

	Comments
ε Windows	Driver's side window leaking.
ε Front Doors	No deficiencies.
ε Rear Doors	No deficiencies.
ε Escape Mechanisms/ Roof Vents	No deficiencies.
ε Engine	No deficiencies.
ε Handicapped Device/ Special Seating	No deficiencies.
ε Undercarriage	No deficiencies.
ε Service Doors	No deficiencies.
ε Body	No deficiencies.
ε Windows/ Body Leakage	Windshield, left side, 6" from top. Window above left rear wheel well is leaking.
ε Steering Mechanism	No deficiencies.

DISTORTION TEST INSPECTION FORM
(Note: Ten copies of this data sheet are required)

Bus Number: 0913	Date: 8-24-09
Personnel: E.D., E.L., J.P., G.F. & K.D.	Temperature(°F): 67

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

	Comments
ع Windows	Driver's side window leaking.
ع Front Doors	No deficiencies.
ع Rear Doors	No deficiencies.
ع Escape Mechanisms/ Roof Vents	No deficiencies.
ع Engine	No deficiencies.
ع Handicapped Device/ Special Seating	No deficiencies.
ع Undercarriage	No deficiencies
ع Service Doors	No deficiencies.
ع Body	No deficiencies.
ع Windows/ Body Leakage	Windshield, left side, 6" from top.
ع Steering Mechanism	No deficiencies.

5.2 STRUCTURAL DISTORTION TEST

LEFT FRONT WHEEL SIX INCHES HIGHER

LEFT FRONT WHEEL SIX INCHES LOWER

5.3 STRUCTURAL STRENGTH AND DISTORTION TESTS - STATIC TOWING TEST

5.3-I. TEST OBJECTIVE

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

5.3-II. TEST DESCRIPTION

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

5.3-III. DISCUSSION

The load-distributing yoke was incorporated as the interface between the Static Tow apparatus and the test bus tow hook/eyes. All four front pulls were performed to the full target test weight of 34,296 lbs (1.2 x 28,580 lbs CW). No damage or deformation was observed during all four front pulls of the test. The test bus was not equipped with any type of tow eyes or tow hooks therefore a rear test was not performed.

STATIC TOWING TEST DATA FORM

Bus Number: 0913	Date: 3-24-10
Personnel: B.L., E.D., E.L., S.C. & G.C.	Temperature (°F):

Inspect right front tow eye and adjoining structure.
Comments: No damage or deformation observed.
Check the torque of all bolts attaching tow eye and surrounding structure.
Comments: Welds inspected and verified.
Inspect left tow eye and adjoining structure.
Comments: No damage or deformation observed.
Check the torque of all bolts attaching tow eye and surrounding structure.
Comments: Welds inspected and verified.
Inspect right rear tow eye and adjoining structure.
Comments: N/A
Check the torque of all bolts attaching tow eye and surrounding structure.
Comments: N/A
Inspect left rear tow eye and adjoining structure.
Comments: N/A
Check the torque of all bolts attaching tow eye and surrounding structure.
Comments: N/A
General comments of any other structure deformation or failure: All four front pulls were completed to the full target test load of 34,296 lbs (1.2 x 28,580 CW). No damage or deformation was observed. The rear is not equipped with any type of tow eyes or tow hooks therefore a rear test was not performed.

5.3 STATIC TOWING TEST

FRONT 20° UPWARD PULL

FRONT 20° DOWNWARD PULL

5.3 STATIC TOWING TEST CONT.

FRONT 20° LEFT PULL

FRONT 20° RIGHT PULL

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. A front lift tow was performed. Rear towing is not recommended. No problems, deformation, or damage was noted during testing.

DYNAMIC TOWING TEST DATA FORM

Bus Number: 0913	Date: 3-22-10
Personnel: B.L. & T.S.	

Temperature (°F): 60	Humidity (%): 83
Wind Direction: ESE	Wind Speed (mph): 10
Barometric Pressure (in.Hg): 29.75	

Inspect tow equipment-bus interface.
Comments: A safe and adequate connection was made between the tow equipment and the bus.
Inspect tow equipment-wrecker interface.
Comments: A safe and adequate connection was made between the tow equipment and the wrecker.
Towing Comments: A front lift tow was performed incorporating a hydraulic under lift wrecker.
Description and location of any structural damage: No damage or deformation was observed.
General Comments: No problems with the tow or towing interface were encountered during the test.

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 hack 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 3.7 inches to 9.8 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	7.9”
Rear axle – one tire flat	9.8”
Rear axle – two tires flat	7.5”

JACKING TEST DATA FORM

Bus Number: 0913	Date: 7-29-09
Personnel: T.S. & E.D.	Temperature (°F): 66

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	10.6 “ I 8.9 “ D	6.5 “ I 3.9 “ D	
Left front	11.0 “ I 7.9 “ D	6.7 “ I 3.7 “ D	
Right rear—outside	11.0 “ I 9.8 “ D	7.5 “ I 6.9 “ D	
Right rear—both	11.0 “ I 7.6 “ D	7.5 “ I 5.5 “ D	
Left rear—outside	11.0 “ I 9.8 “ D	7.3 “ I 6.8 “ D	
Left rear—both	11.0 “ I 7.5 “ D	7.3 “ I 5.4 “ D	

Additional comments of any deformation or difficulty during jacking:

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: 0913	Date: 7-29-09
Personnel: T.S. & S.C.	Temperature (°F): 66

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.

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

5.7-III. DISCUSSION

The Structural Durability Test was started on August 24, 2009 and was conducted until March 26, 2010. The first 6,250 miles were performed at a GVW of 40,720 lbs. and completed on December 23, 2009. The next 2,500 mile SLW segment was performed at 34,760 lbs and completed on January 20, 2010, and the final 6,250 mile segment was performed at a CW of 28,580 lbs and completed on March 26, 2010.

The following 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. Also, a durability element profile detail shows all the measurements of the different conditions. Finally, photographs illustrating some of the failures that were encountered during the Structural Durability Test are included.

New Flyer - TEST BUS #0913

MILEAGE DRIVEN/RECORDED FROM DRIVER'S LOGS

DATE	TOTAL DURABILITY TRACK	TOTAL OTHER MILES	TOTAL
08/24/09 TO 08/30/09	23.00	101.00	124.00
08/31/09 to 09/06/09	0.00	51.00	51.00
09/07/09 TO 09/13/09	521.00	24.00	545.00
09/14/09 TO 09/20/09	99.00	103.00	202.00
09/21/09 TO 09/27/09	552.00	26.00	578.00
09/28/09 TO 10/04/09	791.00	84.00	875.00
10/05/09 TO 10/11/09	0.00	50.00	50.00
10/12/09 TO 10/18/09	853.00	40.00	893.00
10/19/09 TO 10/25/09	0.00	0.00	0.00
10/26/09 TO 11/01/09	594.00	28.00	622.00
11/02/09 TO 11/08/09	436.00	20.00	456.00
11/09/09 TO 11/15/09	399.00	20.00	419.00
11/16/09 TO 11/22/09	0.00	0.00	0.00
11/23/09 TO 11/29/09	0.00	0.00	0.00

New Flyer - TEST BUS #0913

MILEAGE DRIVEN/RECORDED FROM DRIVER'S LOGS

DATE	TOTAL DURABILITY TRACK	TOTAL OTHER MILES	TOTAL
11/30/09 TO 12/06/09	0.00	0.00	0.00
12/07/09 TO 12/13/09	60.00	53.00	113.00
12/14/09 TO 12/20/09	663.00	33.00	696.00
12/21/09 TO 12/27/09	328.00	662.00	990.00
12/28/09 TO 01/03/10	0.00	0.00	0.00
01/04/10 TO 01/10/10	1033.00	104.00	1137.00
01/11/10 TO 01/17/10	382.00	74.00	456.00
01/18/10 TO 01/24/10	1088.00	50.00	1138.00
01/25/10 TO 01/31/10	241.00	56.00	297.00
02/01/10 TO 02/07/10	707.00	82.00	789.00
02/08/10 TO 02/14/10	1095.00	50.00	1145.00
02/15/10 TO 02/21/10	1190.00	156.00	1346.00
02/22/10 TO 02/28/10	860.00	137.00	997.00

New Flyer - TEST BUS #0913

MILEAGE DRIVEN/RECORDED FROM DRIVER'S LOGS

DATE	TOTAL DURABILITY TRACK	TOTAL OTHER MILES	TOTAL
03/01/10 TO 03/07/10	588.00	282.00	870.00
03/08/10 TO 03/14/10	0.00	97.00	97.00
03/15/10 TO 03/21/10	0.00	119.00	119.00
TOTAL	12503.00	2502.00	15005.00

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

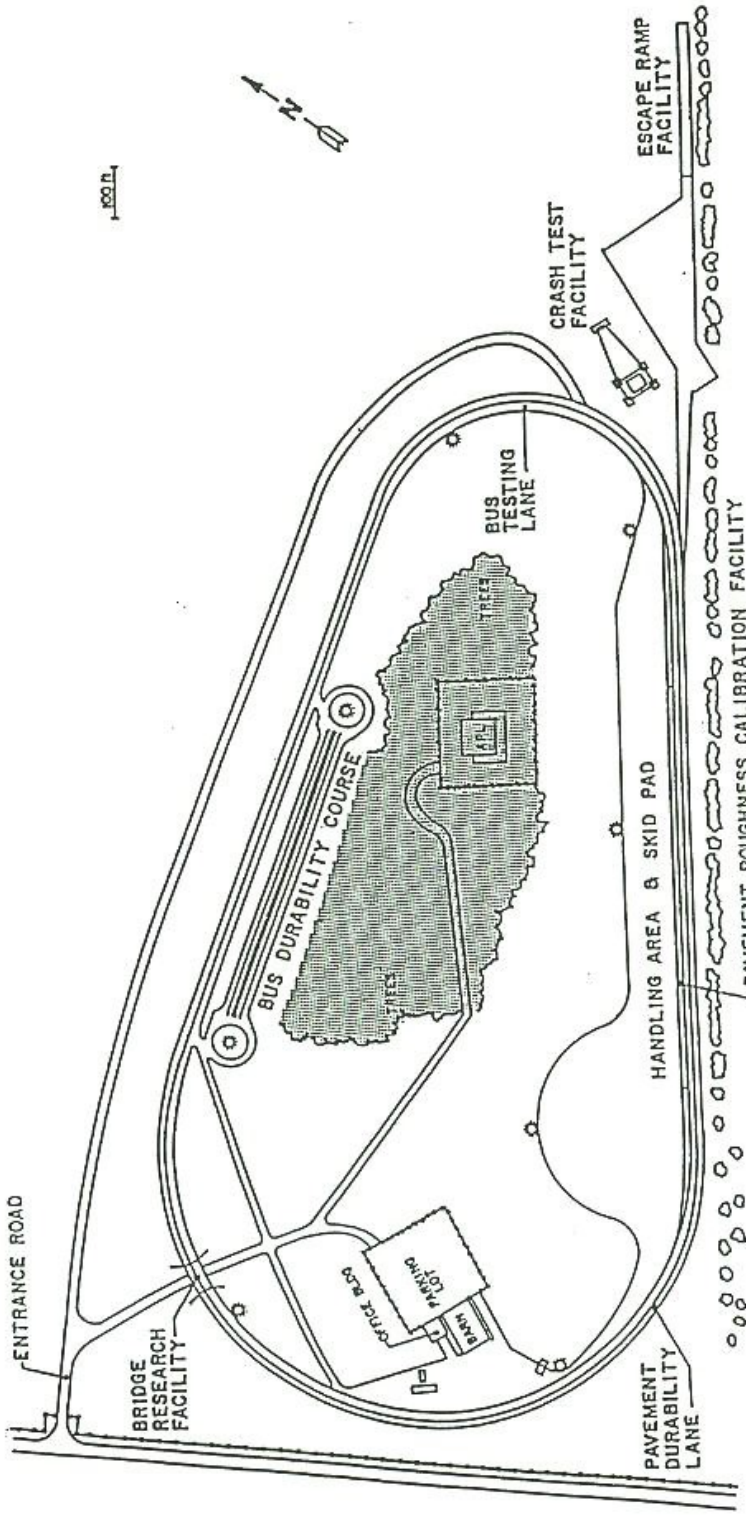
STANDARD OPERATING SCHEDULE

Monday through Friday

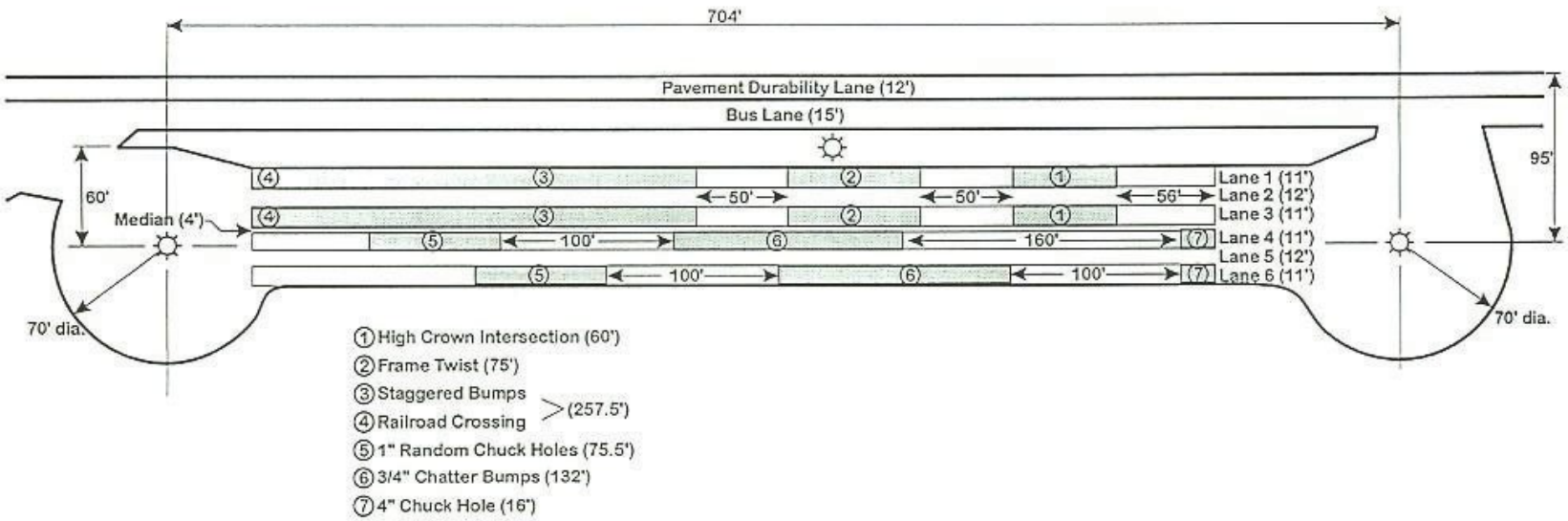
	HOUR	ACTION
Shift 1	midnight	D
	1:40 am	C
	1:50 am	B
	2:00 am	D
	3:35 am	C
	3:45 am	B
	4:05 am	D
	5:40 am	C
	5:50 am	B
	6:00 am	D
	7:40 am	C
	7:50 am	F
Shift 2	8:00 am	D
	9:40 am	C
	9:50 am	B
	10:00 am	D
	11:35 am	C
	11:45 am	B
	12:05 pm	D
	1:40 pm	C
	1:50 pm	B
	2:00 pm	D
	3:40 pm	C
	3:50 pm	F
Shift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



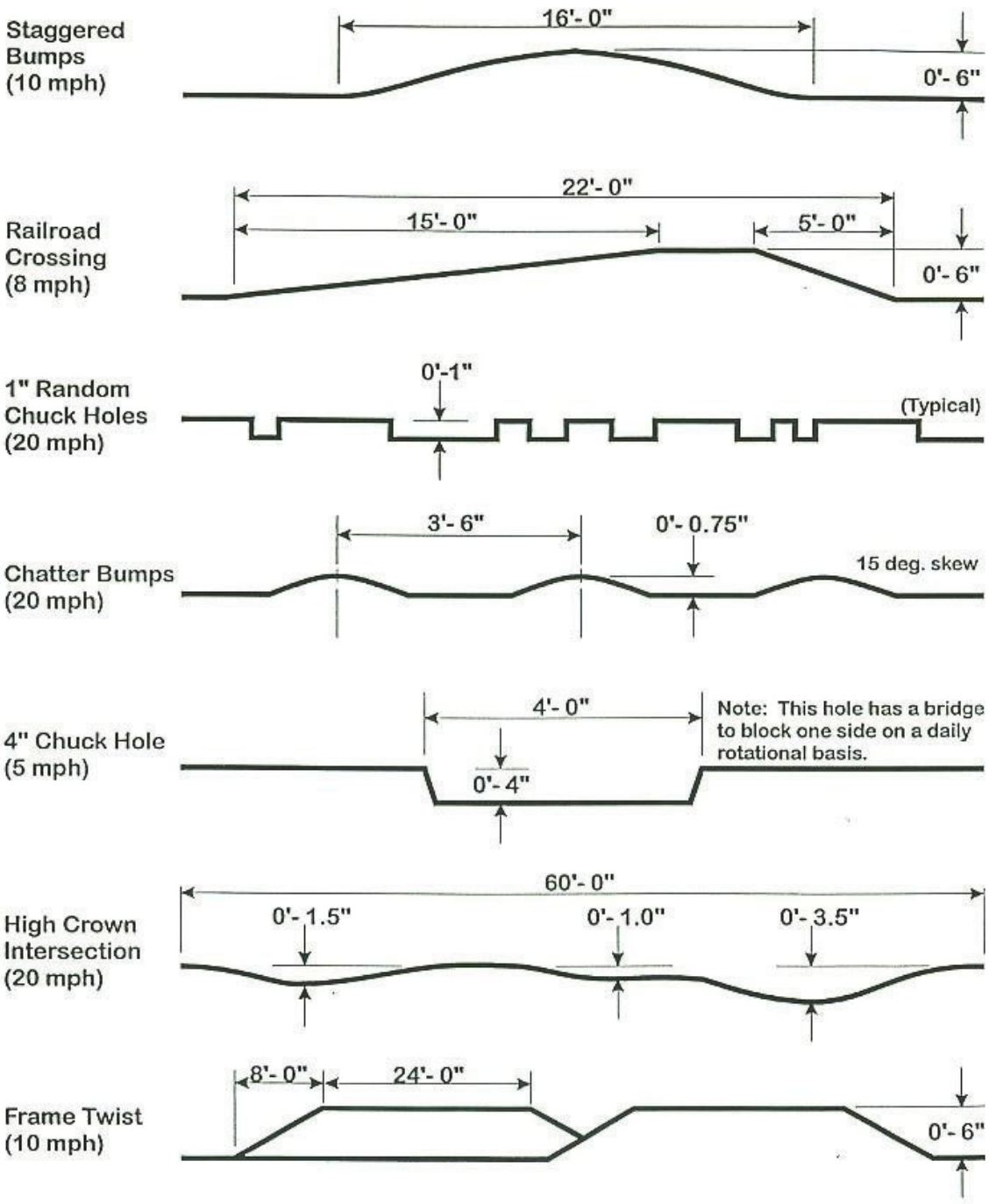
BUS TESTING AND RESEARCH TEST TRACK
UNIVERSITY PARK, PA



Plan View

Vehicle Durability Test Track

The Pennsylvania Transportation Institute
Penn State



Durability Element Profiles

The Pennsylvania Transportation Institute
Penn State

(Page 1 of 4)
UNSCHEDULED MAINTENANCE
NEW FLYER #0913

DATE	TEST MILES	SERVICE	ACTIVITY	MAN HOURS	DOWN TIME
09-10-09	512	Both rear axle ABS solenoids are missing bracket bolts.	Manufacturer's rep installed bolts on rear axle ABS solenoid brackets.	0.50	6.00
09-28-09	1,591	The air line to the driver's seat is leaking air.	Replaced air line to the driver's seat.	1.00	2.00
09-28-09	1,591	The left front air bag is leaking air at the top plate and the lower mount stud is bent.	Replaced left front air bag.	2.00	2.00
10-02-09	2,327	The bushing is worn on the structure mount of the right side upper radius rod.	Replaced upper radius rod.	2.00	1.00
10-02-09	2,327	The right rear ABS valve bracket is broken.	Welded/repaired bracket.	1.00	8.00
10-05-09	2,375	The air brake hose for the left front wheel is leaking air.	Replaced left front air brake hose.	2.00	1.00
10-09-09	2,375	Manufacturer requests front air bags, left front radius rod and front shocks be replaced and set to medium firmness.	Replaced front shocks and set to medium firmness. Replaced both front air bags and left front upper radius rod.	5.00	120.00

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UNSCHEDULED MAINTENANCE
NEW FLYER #0913

DATE	TEST MILES	SERVICE	ACTIVITY	MAN HOURS	DOWN TIME
10-26-09	3,396	"Check Engine," "Battery Charge," and "Equalizer Fail" lights are on.	Troubleshooting found charging system inoperative. Wire "F1" was broken off inside the alternator. Replaced alternator.	5.00	180.00
11-03-09	4,273	The front, right side, lower radius rod bushing on the structure mount is worn.	Replaced right front lower radius rod.	2.00	1.00
11-03-09	4,273	The mounting bracket for the right rear ABS modulator is broken.	Fabricated and installed new bracket.	1.00	1.00
11-06-09	4,396	Bus will not start.	Manufacturer's rep troubleshooting found failed transmission relay. Replaced relay.	8.00	72.00
11-11-09	4,815	The left front air bag blew out.	Replaced left front air bag.	2.00	1.00
12-10-09	4,815	The rear H-beam is cracked.	Replaced rear H-beam.	12.00	519.00
12-10-09	4,815	Roof seam, right side is separating and leaking.	Manufacturer's rep attached (cemented) roof seam and sealed.	2.50	2.50

(Page 3 of 4)
UNSCHEDULED MAINTENANCE
NEW FLYER #0913

DATE	TEST MILES	SERVICE	ACTIVITY	MAN HOURS	DOWN TIME
12-10-09	4,815	The mounting block for the left, outside rear-view mirror is broken.	Both outside rear-view mirrors replaced with new style mirror by manufacturer's rep.	1.00	1.00
12-15-09	4,934	"Check Engine" light comes on intermittently. Found code; intake manifold heater drive. #1 voltage low or shorted to ground.	Manufacturer's rep repaired broken +24 volt post on the intake manifold heater solenoid and replaced heater solenoid.	0.50	46.00
01-11-10	7,751	The right front air bag has a hole in it.	Replaced right front air bag.	1.00	0.50
01-11-10	7,751	The third and fourth seats from the rear, left side have broken from the wall brackets.	¼"x1x1 brackets fabricated and welded/repaired seat mounts.	3.00	1.50
01-11-10	7,751	Manufacturer requests old style belt guard in engine compartment be replaced with new style.	Replaced belt guard.	4.00	24.00
01-13-10	7,751	The left front air bag ruptured at the top.	Replaced left front air bag.	1.00	6.00

(Page 4 of 4)
UNSCHEDULED MAINTENANCE
NEW FLYER #0913

DATE	TEST MILES	SERVICE	ACTIVITY	MAN HOURS	DOWN TIME
01-13-10	7,751	The A/C belt is worn.	Replaced A/C belt.	1.00	0.50
01-13-10	7,751	The third window right side and the fourth window left side are starting to fall out due to rivet fatigue.	1/8" rivets replaced on both windows (15 each).	6.00	3.00
02-25-10	13,516	The bottom stud is broken on the left front air bag.	Replaced left front air bag.	2.00	3.00

UNSCHEDULED MAINTENANCE

LEAKING LEFT FRONT AIR BAG
(1,591 TEST MILES)

WORN BUSHING: RIGHT SIDE, UPPER RADIUS ROD
(2,327 TEST MILES)

UNSCHEDULED MAINTENANCE CONT.

BROKEN ABS VALVE BRACKET
(2,327 TEST MILES)

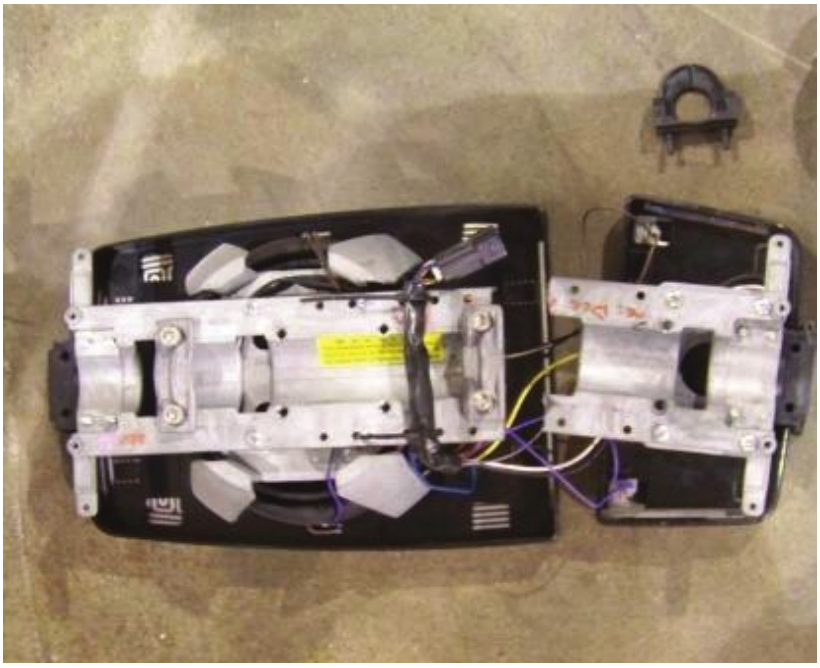
BROKEN “F1” WIRE IN THE ALTERNATOR
(3,396 TEST MILES)

UNSCHEDULED MAINTENANCE CONT.

WORN BUSHING; RIGHT FRONT LOWER RADIUS ROD
(4,273 TEST MILES)

BLOWN OUT LEFT FRONT AIR BAG
(4,815 TEST MILES)

UNSCHEDULED MAINTENANCE CONT.



BROKEN REAR VIEW MIRROR MOUNTING BLOCK
(4,815 TEST MILES)

FAILED SEAT BRACKET
(7,751 TEST MILES)

UNSCHEDULED MAINTENANCE CONT.

BOTTOM STUD BROKEN ON LEFT FRONT AIR BAG
(13,516 TEST MILES)

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

6-I. TEST OBJECTIVE

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

6-II. TEST DESCRIPTION

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

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

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

1. The ADB cycle is structured as a set number of miles in a fixed time in the following order: CBD, Arterial, CBD, Arterial, CBD, and 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 Penn State Test 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), liquefied 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

$FEo_{mi/lb}$ = 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

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

2.) Convert the observed fuel economy to miles per lb by dividing FEo by the density of the test fuel at standard conditions (Lb/ft^3).

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

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

where Gm = Density of test fuel at standard conditions

3.) Convert the observed fuel economy (FEomi/lb) to an energy equivalent of (miles/BTUx10^6) by dividing the observed fuel economy (FEomi/lb) by the heating value of the test fuel at standard conditions.

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

where

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

6-III. DISCUSSION

This is a comparative test of fuel economy using diesel fuel with a heating value of 19,631.0 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 127,700.0 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 – 4.75 mpg, ART – 4.81 mpg, and COM – 7.57 mpg. Average fuel consumption at idle was 0.67 gph.

FUEL ECONOMY PRE-TEST MAINTENANCE FORM

Bus Number: 0913	Date: 3-9-10	SLW (lbs): 34,760
Personnel: B.L., T.S. & S.C.		

FUEL SYSTEM	OK	Date	Initials
Install fuel measurement system	9	3/9/10	S.C.
Replace fuel filter	9	3/9/10	S.C.
Check for fuel leaks	9	3/9/10	S.C.
Specify fuel type (refer to fuel analysis)	Diesel		
Remarks: None noted.			
BRAKES/TIRES	OK	Date	Initials
Inspect hoses	9	3/9/10	S.C.
Inspect brakes	9	3/9/10	S.C.
Relube wheel bearings	9	3/9/10	S.C.
Check tire inflation pressures (mfg. specs.)	9	3/9/10	S.C.
Remarks: None noted.			
COOLING SYSTEM	OK	Date	Initials
Check hoses and connections	9	3/9/10	S.C.
Check system for coolant leaks	9	3/9/10	S.C.
Remarks: None noted.			

FUEL ECONOMY PRE-TEST MAINTENANCE FORM (page 2)

Bus Number: 0913	Date: 3-9-10
Personnel: B.L., T.S. & S.C.	

ELECTRICAL SYSTEMS	OK	Date	Initials
Check battery	99	3/9/10	S.C.
Inspect wiring	99	3/9/10	S.C.
Inspect terminals	99	3/9/10	S.C.
Check lighting	99	3/9/10	S.C.
Remarks: None noted.			
DRIVE SYSTEM	OK	Date	Initials
Drain transmission fluid	99	3/9/10	B.L.
Replace filter/gasket	99	3/9/10	B.L.
Check hoses and connections	99	3/9/10	B.L.
Replace transmission fluid	99	3/9/10	B.L.
Check for fluid leaks	99	3/9/10	B.L.
Remarks: None noted.			
LUBRICATION	OK	Date	Initials
Drain crankcase oil	99	3/9/10	B.L.
Replace filters	99	3/9/10	B.L.
Replace crankcase oil	99	3/9/10	B.L.
Check for oil leaks	99	3/9/10	B.L.
Check oil level	99	3/9/10	B.L.
Lube all chassis grease fittings	99	3/9/10	B.L.
Lube universal joints	99	3/9/10	B.L.
Replace differential lube including axles	99	3/9/10	B.L.
Remarks: None noted.			

FUEL ECONOMY PRE-TEST MAINTENANCE FORM (page 3)

Bus Number: 0913	Date: 3-9-10
Personnel: B.L., T.S. & S.C.	

EXHAUST/EMISSION SYSTEM	OK	Date	Initials
Check for exhaust leaks	9	3/9/10	S.C.
Remarks: None noted.			
ENGINE	**OK**	**Date**	**Initials**
Replace air filter	9	3/9/10	B.L.
Inspect air compressor and air system	9	3/9/10	S.C.
Inspect vacuum system, if applicable	**N/A**	3/9/10	S.C.
Check and adjust all drive belts	9	3/9/10	S.C.
Check cold start assist, if applicable	9	3/9/10	S.C.
Remarks: None noted.			
STEERING SYSTEM	**OK**	**Date**	**Initials**
Check power steering hoses and connectors	9	3/9/10	S.C.
Service fluid level	9	3/9/10	S.C.
Check power steering operation	9	3/9/10	S.C.
Remarks: None noted.			
	OK	**Date**	**Initials**
Ballast bus to seated load weight	9	3/9/10	S.C.
TEST DRIVE	**OK**	**Date**	**Initials**
Check brake operation	9	3/9/10	S.C.
Check transmission operation	9	3/9/10	S.C.
Remarks: None noted.			

FUEL ECONOMY PRE-TEST INSPECTION FORM

Bus Number: 0913	Date: 3-9-10
Personnel: S.C., T.S. & 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 N/A Rear 120	T.S.
Tire wear:	T.S.
Engine oil level	T.S.
Engine coolant level	T.S.
Interior and exterior lights on, evaporator fan on	T.S.
Fuel economy instrumentation installed and working properly.	T.S.
Fuel line -- no leaks or kinks	T.S.
Speed measuring system installed on bus. Speed indicator installed in front of bus and accessible to TECH and Driver.	T.S.
Bus is loaded to SLW	T.S.
WARM-UP	**If OK, Initial**
Bus driven for at least one hour warm-up	T.S.
No extensive or black smoke from exhaust	T.S.
POST WARM-UP	**If OK, Initial**
Warm tire pressure (psi): Front 120 Middle N/A Rear 120	T.S.
Environmental conditions Average wind speed <12 mph and maximum gusts <15 mph Ambient temperature between 30°F(-1C°) and 90°F(32°C) Track surface is dry Track is free of extraneous material and clear of interfering traffic	T.S.

FUEL ECONOMY DATA FORM (Liquid Fuels)

Bus Number: 0913	Manufacturer: New flyer	Date: 3-16-10
Run Number: 1	Personnel: G.G., T.S. & E.D.	
Test Direction: □CW or ■CCW	Temperature (°F): 50	Humidity (%): 51
SLW (lbs): 34,760	Wind Speed (mph) & Direction: 4 / ENE	Barometric Pressure (in.Hg): 30.05

Cycle Type	Time (min:sec)		Cycle Time (min:sec)	Fuel Temperature (°C)	Flow Meter Reading (gals)		Fuel Used (gals)
	Start	Finish		Start	Start	Finish	
CBD #1	0	8:37	8:37	16.2	0	.346	.346
ART #1	0	4:10	4:10	16.4	0	.354	.354
CBD #2	0	8:41	8:41	16.4	0	.383	.383
ART #2	0	4:09	4:09	16.4	0	.385	.385
CBD #3	0	8:30	8:30	16.4	0	.371	.371
COMMUTER	0	6:14	6:14	16.2	0	.469	.469
						Total Fuel =	2.308 gals

20 minute idle : Total Fuel Used = .211 gals

Heating Value = 19,631.0 BTU/LB

Comments: None noted.

FUEL ECONOMY DATA FORM (Liquid Fuels)

Bus Number: 0913	Manufacturer: New Flyer	Date: 3-16-10
Run Number: 2	Personnel: G.G., T.S. & E.D.	
Test Direction: ■CW or □CCW	Temperature (°F): 50	Humidity (%): 51
SLW (lbs): 34,760	Wind Speed (mph) & Direction: 4 / ENE	Barometric Pressure (in.Hg): 30.05

Cycle Type	Time (min:sec)		Cycle Time (min:sec)	Fuel Temperature (°C)	Flow Meter Reading (gals)		Fuel Used (gals)
	Start	Finish		Start	Start	Finish	
CBD #1	0	8:48	8:48	16.4	0	.360	.360
ART #1	0	4:15	4:15	16.8	0	.382	.382
CBD #2	0	8:40	8:40	16.4	0	.388	.388
ART #2	0	4:16	4:16	16.8	0	.370	.370
CBD #3	0	8:53	8:53	17.2	0	.377	.377
COMMUTER	0	6:06	6:06	17.6	0	.441	.441
							Total Fuel = 2.318 gals

20 minute idle : Total Fuel Used = N/A gals

Heating Value = 19,631.0 BTU/LB

Comments: None noted.

FUEL ECONOMY DATA FORM (Liquid Fuels)

Bus Number: 0913	Manufacturer: New Flyer	Date: 3-16-10
Run Number: 3	Personnel: G.G., T.S. & E.D.	
Test Direction: □CW or ■CCW	Temperature (°F): 53	Humidity (%): 34
SLW (lbs): 34,760	Wind Speed (mph) & Direction: 6 / NE	Barometric Pressure (in.Hg): 30.05

Cycle Type	Time (min:sec)		Cycle Time (min:sec)	Fuel Temperature (°C)	Flow Meter Reading (gals)		Fuel Used (gals)
	Start	Finish		Start	Start	Finish	
CBD #1	0	8:17	8:17	20.2	0	.374	.374
ART #1	0	4:14	4:14	22.0	0	.351	.351
CBD #2	0	8:40	8:40	22.0	0	.363	.363
ART #2	0	4:13	4:13	22.2	0	.374	.374
CBD #3	0	8:58	8:58	22.0	0	.367	.367
COMMUTER	0	6:03	6:03	22.4	0	.482	.482
							Total Fuel = 2.311 gals

20 minute idle : Total Fuel Used = N/A gals

Heating Value = 19,631.0 BTU/LB

Comments: None noted.

FUEL ECONOMY DATA FORM (Liquid Fuels)

Bus Number: 0913	Manufacturer: New Flyer	Date: 3-16-10
Run Number: 4	Personnel: G.G., T.S. & E.D.	
Test Direction: ■CW or □CCW	Temperature (°F): 53	Humidity (%): 34
SLW (lbs): 34,760	Wind Speed (mph) & Direction: 6 / NE	Barometric Pressure (in.Hg): 30.05

Cycle Type	Time (min:sec)		Cycle Time (min:sec)	Fuel Temperature (°C)	Flow Meter Reading (gals)		Fuel Used (gals)
	Start	Finish		Start	Start	Finish	
CBD #1	0	9:07	9:07	22.8	0	.359	.359
ART #1	0	4:18	4:18	22.8	0	.367	.367
CBD #2	0	9:08	9:08	23.2	0	.371	.371
ART #2	0	4:25	4:25	23.2	0	.348	.348
CBD #3	0	8:37	8:37	23.2	0	.385	.385
COMMUTER	0	6:18	6:18	24.2	0	.469	.469
							Total Fuel = 2.299 gals

20 minute idle : Total Fuel Used = .199 gals

Heating Value = 19,631.0 BTU/LB

Comments: None noted.

FUEL ECONOMY SUMMARY SHEET

BUS MANUFACTURER :**New Flyer** BUS NUMBER :**0913**
BUS MODEL :**XDE 40** TEST DATE :03/16/10

FUEL TYPE : DIESEL
SP. GRAVITY : .8400
HEATING VALUE : 19631.00 BTU/Lb
FUEL TEMPERATURE : 60.00 deg F
Standard Conditions : 60 deg F and 14.7 psi
Density of Water : 8.3373 lb/gallon at 60 deg F

CYCLE	TOTAL FUEL USED(GAL)	TOTAL MILES	FUEL ECONOMY MPG(Measured)	FUEL ECONOMY MPG (Corrected)
Run # :1, CCW				
CBD	1.100	5.73	5.209	4.80
ART	.739	3.82	5.169	4.76
COM	.469	3.82	8.145	7.51
TOTAL	2.308	13.37	5.793	5.34
Run # :2, CW				
CBD	1.125	5.73	5.093	4.69
ART	.752	3.82	5.080	4.68
COM	.441	3.82	8.662	7.98
TOTAL	2.318	13.37	5.768	5.32
Run # :3, CCW				
CBD	1.104	5.73	5.190	4.78
ART	.725	3.82	5.269	4.86
COM	.482	3.82	7.925	7.30
TOTAL	2.311	13.37	5.785	5.33
Run # :4, CW				
CBD	1.115	5.73	5.139	4.74
ART	.715	3.82	5.343	4.92
COM	.469	3.82	8.145	7.51
TOTAL	2.299	13.37	5.816	5.36

IDLE CONSUMPTION (MEASURED)

First 20 Minutes Data : .21GAL Last 20 Minutes Data : .20GAL
Average Idle Consumption : .62GAL/Hr

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

Run 1 : .0 Run 2 : -.4 Run 3 : -.1 Run 4 : .4

SUMMARY (CORRECTED VALUES)

Average Idle Consumption : .67 G/Hr
Average CBD Phase Consumption : 4.75 MPG
Average Arterial Phase Consumption : 4.81 MPG
Average Commuter Phase Consumption : 7.57 MPG
Overall Average Fuel Consumption : 5.34 MPG
Overall Average Fuel Consumption : 38.81 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 Test Track Facility.

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 Test Track and the Bus Testing Center.

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 80.0 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 51.7 dB(A); ranging from 49.3 dB(A) at the rear passenger seats to 55.5 dB(A) at the driver's seat. The interior ambient noise level for this test was < 34.0 dB(A).

The second test measures interior noise during acceleration from 0 to 35 mph. This noise level ranged from 71.9 dB(A) at the front passenger seats to 76.1 dB(A) at the driver's seat. The overall average was 73.3 dB(A). The interior ambient noise level for this test was < 34.0 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: 0913	Date: 7-27-09
Personnel: S.C. & P.S.	
Temperature (°F): 77	Humidity (%): 61
Wind Speed (mph): 8	Wind Direction: SSW
Barometric Pressure (in.Hg): 30.00	
Initial Sound Level Meter Calibration: ℄ checked by: S.C.	
Interior Ambient Noise Level dB(A): < 34.0	Exterior Ambient Noise Level dB(A): 48.5
Microphone Height During Testing (in): 48.0	

Measurement Location	Measured Sound Level dB(A)
Driver's Seat	55.5
Front Passenger Seats	52.9
In Line with Front Speaker	52.0
In Line with Middle Speaker	50.8
In Line with Rear Speaker	49.6
Rear Passenger Seats	49.3

Final Sound Level Meter Calibration: ℄ checked by: S.C.

Comments: All readings taken in the center aisle.

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

Bus Number: 0913	Date: 3-17-10
Personnel: B.S., T.S. & E.L.	
Temperature (°F): 39	Humidity (%): 66
Wind Speed (mph): Calm	Wind Direction: Calm
Barometric Pressure (in.Hg): 30.10	
Initial Sound Level Meter Calibration: ε checked by: T.S.	
Interior Ambient Noise Level dB(A): < 34.0	Exterior Ambient Noise Level dB(A): 35.0
Microphone Height During Testing (in): 48	

Measurement Location	Measured Sound Level dB(A)
Driver's Seat	76.1
Front Passenger Seats	71.9
Middle Passenger Seats	72.2
Rear Passenger Seats	73.1

Final Sound Level Meter Calibration: ε checked by: T.S.

Comments: All readings taken in the center aisle.

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

Bus Number: 0913	Date: 3-17-10
Personnel: B.S., T.S. & E.L.	
Temperature (°F): 39	Humidity (%): 66
Wind Speed (mph): Calm	Wind Direction: Calm
Barometric Pressure (in.Hg): 30.10	

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)
INTERIOR 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 up shift.
2. Accelerating at full throttle from standstill.
3. Stationary, with the engine at low idle, high idle, and wide open throttle.

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

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

During the test, special attention should be paid to:

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

7.2-III. DISCUSSION

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

With an exterior ambient noise level of 35.0 dB(A), the average test result obtained while accelerating from a constant speed was 67.9 dB(A) on the right side and 67.7 dB(A) on the left side.

When accelerating from a standstill with an exterior ambient noise level of 35.1 dB(A), the average of the results obtained were 66.3 dB(A) on the right side and 66.6 dB(A) on the left side.

With the vehicle stationary and the engine, accessories, and air conditioning on, the measurements averaged 61.1 dB(A) at low idle, 63.3 dB(A) at high idle, and 70.7 dB(A) at wide open throttle. With the accessories and air conditioning off, the readings averaged 1.4 dB(A) lower at low idle, 1.0 dB(A) lower at high idle, and 0.1 dB(A) higher at wide open throttle. The exterior ambient noise level measured during this test was 35.0 dB(A).

EXTERIOR NOISE TEST DATA FORM
Accelerating from Constant Speed

Bus Number: 0913	Date: 3-17-10
Personnel: B.S., T.S. & E.L.	
Temperature (°F): 39	Humidity (%): 66
Wind Speed (mph): Calm	Wind Direction: Calm
Barometric Pressure (in.Hg): 30.10	
Verify that microphone height is 4 feet, wind speed is less than 12 mph and ambient temperature is between 30°F and 90°F: ε checked by: T.S.	
Initial Sound Level Meter Calibration: ε checked by: T.S.	
Exterior Ambient Noise Level dB(A): 35.0	

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	67.1	1	67.5
2	67.4	2	67.6
3	67.6	3	67.5
4	68.1	4	67.5
5	67.1	5	67.8
Average of two highest actual noise levels = 67.9 dB(A)		Average of two highest actual noise levels = 67.7 dB(A)	

Final Sound Level Meter Calibration Check: ε checked by: T.S.
Comments: None noted.

EXTERIOR NOISE TEST DATA FORM
Accelerating from Standstill

Bus Number: 0913	Date: 3-17-10
Personnel: B.S., T.S. & E.L.	
Temperature (°F): 39	Humidity (%): 66
Wind Speed (mph): Calm	Wind Direction: Calm
Barometric Pressure (in.Hg): 30.10	
Verify that microphone height is 4 feet, wind speed is less than 12 mph and ambient temperature is between 30°F and 90°F: ε checked by: T.S.	
Initial Sound Level Meter Calibration: ε checked by: T.S.	
Exterior Ambient Noise Level dB(A): 35.1	

Accelerating from Standstill Curb (Right) Side		Accelerating from Standstill Street (Left) Side	
Run #	Measured Noise Level dB(A)	Run #	Measured Noise Level dB(A)
1	65.6	1	65.5
2	65.6	2	65.9
3	66.6	3	67.0
4	65.9	4	66.1
5	65.6	5	66.0
Average of two highest actual noise levels = 66.3 dB(A)		Average of two highest actual noise levels = 66.6 dB(A)	

Final Sound Level Meter Calibration Check: ε checked by: T.S.
Comments: None noted.

EXTERIOR NOISE TEST DATA FORM
Stationary

Bus Number: 0913	Date: 3-17-10
Personnel: B.S., T.S. & E.L.	
Temperature (°F): 39	Humidity (%): 66
Wind Speed (mph): Calm	Wind Direction: Calm
Barometric Pressure (in.Hg): 30.10	

Verify that microphone height is 4 feet, wind speed is less than 12 mph and ambient temperature is between 30°F and 90°F: ε checked by: T.S.

Initial Sound Level Meter Calibration: ε checked by: T.S.

Exterior Ambient Noise Level dB(A): 35.0

Accessories and Air Conditioning ON

Throttle Position	Engine RPM	Curb (Right) Side dB(A)	Street (Left) Side db(A)
		Measured	Measured
Low Idle	749	60.3	61.9
High Idle	999	62.7	63.9
Wide Open Throttle	2,001	70.2	71.2

Accessories and Air Conditioning OFF

Throttle Position	Engine RPM	Curb (Right) Side dB(A)	Street (Left) Side db(A)
		Measured	Measured
Low Idle	781	58.8	60.5
High Idle	1,001	61.6	62.9
Wide Open Throttle	1,999	69.8	71.8

Final Sound Level Meter Calibration Check: ε checked by: T.S.

Comments: None noted.

7.2 EXTERIOR NOISE TESTS

TEST BUS UNDERGOING
EXTERIOR NOISE TESTING