

PARTIAL
STURAA TEST
7 YEAR
200,000 MILE BUS
from
GLAVAL BUS,
A DIVISION OF FOREST RIVER INC.
MODEL TITAN II

SEPTEMBER 2009

PTI-BT-R0910



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EXECUTIVE SUMMARY

Glaval Bus, a Division of Forest River Inc. submitted a model Titan II, diesel-powered 26 seat (including the driver) 26-foot bus, built on a GM G33803 chassis for a partial STURAA test in the 7 yr/200,000 mile test category. The odometer reading at the time of delivery was 1,345 miles. The Federal Transit Administration determined that the following tests would be performed: 1.2 Servicing, P.M., Repair & Maintenance, 2. Reliability and 5.7 Structural Durability. Testing started on June 11, 2009 and was completed on August 31, 2009. The Check-In section of the report provides a description of the bus and specifies its major components.

The primary part of this partial test was the Structural Durability Test, which also provides the information for the Maintainability and Reliability results. The Structural Durability Test was started on June 17, 2009 and was completed on August 28, 2009.

The interior of the bus is configured with seating for 26 passengers including the driver. Free floor space will accommodate 11 standing passengers resulting in a potential load of 37 persons. At 150 lbs per person, this load results in a measured gross vehicle weight of 15,250 lbs. In order to avoid exceeding the GAWR (4,600 lbs) of the front axle and (9,600 lbs) of the rear axle, ballast for 6 standing passengers was eliminated. This reduction from full capacity resulted in an adjusted measured gross vehicle weight of 14,260 lbs and was used for all dynamic testing. The middle segment was performed at a SLW of 13,670 lbs and the final segment was performed at a CW of 9,820 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 is provided in the Maintainability section of this report.

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 Glaval Bus, model Titan II. The bus has a front door rear of the front axle. The test bus was not equipped with a handicap ramp or lift. Power is provided by a diesel-fueled, General Motors Corp. model Duramax Diesel 250 hp engine coupled to a General Motors Corp. model 4-SPD4L80E transmission.

The measured curb weight is 4,120 lbs for the front axle and 5,700 lbs for the rear axle. These combined weights provide a total measured curb weight of 9,820 lbs. There are 26 seats including the driver and room for 11 standing passengers bringing the total passenger capacity to 37. Gross load is $150 \text{ lb} \times 37 = 5,550 \text{ lbs}$. At full capacity, the measured gross vehicle weight is 15,250 lbs. This value was used for all static tests. In order to avoid exceeding the GAWR (4,600 lbs) of the front axle, and (9,600 lbs) of the rear axle, ballast for 6 standing passengers was eliminated. This reduction from full capacity resulted in an adjusted measured gross vehicle weight of 14,260 lbs and was used for all dynamic testing.

VEHICLE DATA FORM

Bus Number: 0910	Arrival Date: 6-11-09
Bus Manufacturer: Glaval	Vehicle Identification Number (VIN): 5NHBGNB269F009244
Model Number: Titan II	Date: 6-11-09
Personnel: S.C.	

WEIGHT: *Values in parentheses indicate the adjusted weights necessary to avoid exceeding the GAWR. These values were used for all dynamic testing.

Individual Wheel Reactions:

Weights (lb)	Front Axle		Middle Axle		Rear Axle	
	Right	Left	Right	Left	Right	Left
CW	2,070	2,050	N/A	N/A	2,900	2,800
SLW	2,200	2,240	N/A	N/A	4,660	4,570
GVW	2,410 (2,260)	2,470 (2,350)	N/A	N/A	5,250 (4,900)	5,120 (4,750)

Total Weight Details:

Weight (lb)	CW	SLW	GVW	GAWR
Front Axle	4,120	4,440	4,880 (4,610)	4,600
Middle Axle	N/A	N/A	N/A	N/A
Rear Axle	5,700	9,230	10,370 (9,650)	9,600
Total	9,820	13,670	15,250 (14,260)	GVWR: 14,200

Dimensions:

Length (ft/in)	26 / 4
Width (in)	96.5
Height (in)	112.0
Front Overhang (in)	40.0
Rear Overhang (in)	86.0
Wheel Base (in)	190.0
Wheel Track (in)	Front: 68.0
	Rear: 74.6

Bus Number: 0910	Date: 6-11-09
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CLEARANCES:

Lowest Point Outside Front Axle	Location: Cross member	Clearance(in): 8.2
Lowest Point Outside Rear Axle	Location: Exhaust pipe	Clearance(in): 14.2
Lowest Point between Axles	Location: Step well	Clearance(in): 8.3
Ground Clearance at the center (in)	9.9	
Front Approach Angle (deg)	19.0	
Rear Approach Angle (deg)	9.4	
Ramp Clearance Angle (deg)	5.9	
Aisle Width (in)	16.8	
Inside Standing Height at Center Aisle (in)	78.5	

BODY DETAILS:

Body Structural Type	Integral		
Frame Material	Steel		
Body Material	Steel & fiberglass		
Floor Material	Plywood		
Roof Material	Fiberglass		
Windows Type	☐ Fixed	☒ Movable	
Window Mfg./Model No.	KTG / DOT 620 AS3 M3		
Number of Doors	<u>1</u> Front	<u>1</u> Rear	
Mfr. / Model No.	A&M / na General Motors Corp. / OEM		
Dimension of Each Door (in)	Front – 31.0 x 82.5	Driver's – 34.2 x 56.0	
Passenger Seat Type	☐ Cantilever	☒ Pedestal	☐ Other (explain)
Mfr. / Model No.	Freedman Seating Co. /Featherweight 17.5"		
Driver Seat Type	☐ Air	☐ Spring	☒ Other (Cushion)
Mfr. / Model No.	General Motors Corp. / O.E.M.		
Number of Seats (including Driver)	26		

Bus Number: 0910	Date: 6-11-09
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BODY DETAILS (Contd..)

Free Floor Space (ft ²)	17.5
Height of Each Step at Normal Position (in)	Front 1. <u>10.4</u> 2. <u>7.9</u> 3. <u>7.9</u> 4. <u>N/A</u>
	Middle 1. <u>N/A</u> 2. <u>N/A</u> 3. <u>N/A</u> 4. <u>N/A</u>
	Rear 1. <u>N/A</u> 2. <u>N/A</u> 3. <u>N/A</u> 4. <u>N/A</u>
Step Elevation Change - Kneeling (in)	N/A

ENGINE

Type	☒ C.I. ☐ S.I.	☐ Alternate Fuel ☐ Other (explain)	
Mfr. / Model No.	General Motors Corp. / Duramax Diesel 250 HP		
Location	☒ Front	☐ Rear	☐ Other (explain)
Fuel Type	☐ Gasoline ☒ Diesel	☐ CNG ☐ LNG	☐ Methanol ☐ Other (explain)
Fuel Tank Capacity (indicate units)	57.0 gals		
Fuel Induction Type	☒ Injected	☐ Carburetion	
Fuel Injector Mfr. / Model No.	General Motors Corp. / Duramax Diesel 250 HP		
Carburetor Mfr. / Model No.	N/A		
Fuel Pump Mfr. / Model No.	General Motors Corp. / Duramax Diesel 250 HP		
Alternator (Generator) Mfr. / Model No.	General Motors Corp. / Dual 145 Amp O.E.M.		
Maximum Rated Output (Volts / Amps)	12 / 145		
Air Compressor Mfr. / Model No.	N/A		
Maximum Capacity (ft ³ / min)	N/A		
Starter Type	☒ Electrical	☐ Pneumatic	☐ Other (explain)
Starter Mfr. / Model No.	General Motors / O.E.M.		

Bus Number: 0910	Date: 6-11-09
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TRANSMISSION

Transmission Type	☐ Manual	☒ Automatic	
Mfr. / Model No.	General Motors Corp. / 4-SPD4L80E		
Control Type	☒ Mechanical	☐ Electrical	☐ Other
Torque Converter Mfr. / Model No.	General Motors Corp. / 4-SPD4L80E		
Integral Retarder Mfr. / Model No.	N/A		

SUSPENSION

Number of Axles	2		
Front Axle Type	☒ Independent	☐ Beam Axle	
Mfr. / Model No.	General Motors Corp. / O.E.M.		
Axle Ratio (if driven)	N/A		
Suspension Type	☐ Air	☒ Spring	☐ Other (explain)
No. of Shock Absorbers	2		
Mfr. / Model No.	Tennaco / 88967414		
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.	Dana / 70D		
Axle Ratio (if driven)	4.10		
Suspension Type	☐ Air	☒ Spring	☐ Other (explain)
No. of Shock Absorbers	2		
Mfr. / Model No.	Tennaco / 25856176		

Bus Number: 0910	Date: 6-11-09
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WHEELS & TIRES

Front	Wheel Mfr./ Model No.	ArcWheel / 6 ½ x 16
	Tire Mfr./ Model No.	Uniroyal Laredo HD/H / LT 225/75R 16
Rear	Wheel Mfr./ Model No.	ArcWheel / 6 ½ x 16
	Tire Mfr./ Model No.	Uniroyal Laredo HD/H / LT 225/75R 16

BRAKES

Front Axle Brakes Type	☐ Cam	☒ Disc	☐ Other (explain)
Mfr. / Model No.	Raybestos / 25926349		
Middle Axle Brakes Type	☐ Cam	☐ Disc	☐ Other (explain)
Mfr. / Model No.	N/A		
Rear Axle Brakes Type	☐ Cam	☒ Disc	☐ Other (explain)
Mfr. / Model No.	Raybestos / 20850250		
Retarder Type	N/A		
Mfr. / Model No.	N/A		

HVAC

Heating System Type	☐ Air	☒ Water	☐ Other
Capacity (Btu/hr)	Dash – 35,700 Rear – 65,000		
Mfr. / Model No.	Dash – Delphi / O.E.M. Rear – na		
Air Conditioner	☒ Yes	☐ No	
Location	Dash & rear interior ceiling		
Capacity (Btu/hr)	Dash – 15,000 Rear – 69,000		
A/C Compressor Mfr. / Model No.	Dash – Denzo / 19130456 Rear – ProAir		

STEERING

Steering Gear Box Type	Hydraulic gear
Mfr. / Model No.	Delphi / O.E.M.
Steering Wheel Diameter	15.3
Number of turns (lock to lock)	3.5

Bus Number: 0910	Date: 6-11-09
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OTHERS

Wheel Chair Ramps	Location: N/A	Type: N/A
Wheel Chair Lifts	Location: N/A	Type: N/A
Mfr. / Model No.	N/A	
Emergency Exit	Location: Window Door Roof Hatch	Number: 3 1 1

CAPACITIES

Fuel Tank Capacity (units)	57.0 gals
Engine Crankcase Capacity (gallons)	6.0
Transmission Capacity (gallons)	1.9
Differential Capacity (gallons)	1.0
Cooling System Capacity (gallons)	9.0
Power Steering Fluid Capacity (quarts)	1.75

VEHICLE DATA FORM

Bus Number: 0910	Date: 6-15-09
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List all spare parts, tools and manuals delivered with the bus.

Part Number	Description	Qty.
AC Delco GM# 25856176	Shock absorber rear	2
AC Delco GM# 88967414	Shock Absorber front	2
Uni Royal LT225/75R 16	Mounted tires	4
AC Delco GM# 15102546	Air cleaner	2
PF 2232	Oil filter	2
NA	Manuals	4

COMPONENT/SUBSYSTEM INSPECTION FORM

Bus Number: 0910	Date: 6-15-09
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Subsystem	Checked	Comments
Air Conditioning Heating and Ventilation	✓	
Body and Sheet Metal	✓	
Frame	✓	
Steering	✓	
Suspension	✓	
Interior/Seating	✓	
Axles	✓	
Brakes	✓	
Tires/Wheels	✓	
Exhaust	✓	
Fuel System	✓	Diesel
Power Plant	✓	
Accessories	✓	
Lift System	✓	Not equipped.
Interior Fasteners	✓	
Batteries	✓	

CHECK - IN



GLAVAL BUS MODEL TITAN II



CHECK - IN CONT.



OPERATOR'S AREA



ENGINE COMPARTMENT

CHECK - IN CONT.



INTERIOR, FRONT TO REAR



UNDERCARRIAGE, REAR TO FRONT

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.

(Page 1 of 1)
SCHEDULED MAINTENANCE
 Glaval Bus #0910

DATE	TEST MILES	SERVICE	ACTIVITY	DOWN TIME	HOURS
07-15-09	1,137	P.M. / Inspection	Linkage, tie rods, universals/u-joints all lubed; all fluids checked.	4.00	4.00
07-23-09	1,738	P.M. / Inspection	Linkage, tie rods, universals/u-joints all lubed; all fluids checked.	4.00	4.00
08-03-09	3,190	P.M. / Inspection	Linkage, tie rods, universals/u-joints all lubed; all fluids checked.	4.00	4.00
08-17-09	4,975	P.M. / Inspection	Linkage, tie rods, universals/u-joints all lubed; all fluids checked.	4.00	4.00
08-24-09	5,310	P.M. / Inspection	Linkage, tie rods, universals/u-joints all lubed; all fluids checked.	4.00	4.00
08-31-09	6,202	P.M. / Inspection	Linkage, tie rods, universals/u-joints all lubed; all fluids checked.	4.00	4.00
09-04-09	7,517	P.M. / Inspection	Linkage, tie rods, universals/u-joints all lubed; all fluids checked.	4.00	4.00

Table 1. STANDARD LUBRICANTS

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

<u>ITEM</u>	<u>PRODUCT CODE</u>	<u>TEXACO DESCRIPTION</u>
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

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 two Class 3 failures, one involved an emergency window falling out and one was the result of a coolant leak. These and the remaining three Class 4 failures are available for review in the Unscheduled Maintenance List, located in Section 5.7 Structural Durability.

RELIABILITY DATA FORMS

Bus Number: 0910	Date: 09-03-09
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		1,137			4.00	2.00
Windows		4,780			2.00	1.00
Exhaust System	4,975				1.00	0.50
Body	4,975				1.00	0.50
Suspension	5,413				1.00	0.50

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 7,500 miles; approximately 5,000 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 3,000 miles with the bus operated at GVW. The second segment will consist of approximately 1,500 miles with the bus operated at SLW. The remainder of the test, approximately 3,000 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 June 17, 2009 and was conducted until August 28, 2009. The first 3,000 miles were performed at a GVW of 14,260 lbs. The number of standing passengers was reduced from 11 to 5. The ballast for 6 standing passengers was eliminated. This reduction in passenger weight was necessary to avoid exceeding the GAWR (4,600 lbs) of the front axle and (9,600 lbs) of the rear axle. The GVW segment was completed on July 28, 2009. The next 1,500 mile SLW segment was performed at 13,6710 lbs and completed on August 3, 2009, and the final 3,000 mile segment was performed at a CW of 9,820 lbs and completed on August 28, 2009.

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.

GLAVAL- TEST BUS #0910
MILEAGE DRIVEN/RECORDED FROM DRIVER'S LOGS

DATE	TOTAL DURABILITY TRACK	TOTAL OTHER MILES	TOTAL
06/15/09 TO 06/21/09	20.00	49.00	69.00
06/22/09 TO 06/28/09	83.00	5.00	88.00
06/29/09 TO 07/05/09	193.00	10.00	203.00
07/06/09 TO 07/12/09	277.00	14.00	291.00
07/13/09 TO 07/19/09	715.00	31.00	746.00
07/20/09 TO 07/26/09	534.00	26.00	560.00
07/27/09 TO 08/02/09	1098.00	51.00	1149.00
08/03/09 TO 08/09/09	1109.00	51.00	1160.00
08/10/09 TO 08/16/09	669.00	40.00	709.00
08/17/09 TO 08/23/09	210.00	125.00	335.00
08/24/09 TO 08/30/09	99.00	793.00	892.00
08/31/09 TO 09/06/09	0.00	1315.00	1315.00
TOTAL	5007.00	2510.00	7517.00

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
Shift 2	7:50 am	F
	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
Shift 3	3:40 pm	C
	3:50 pm	F
	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

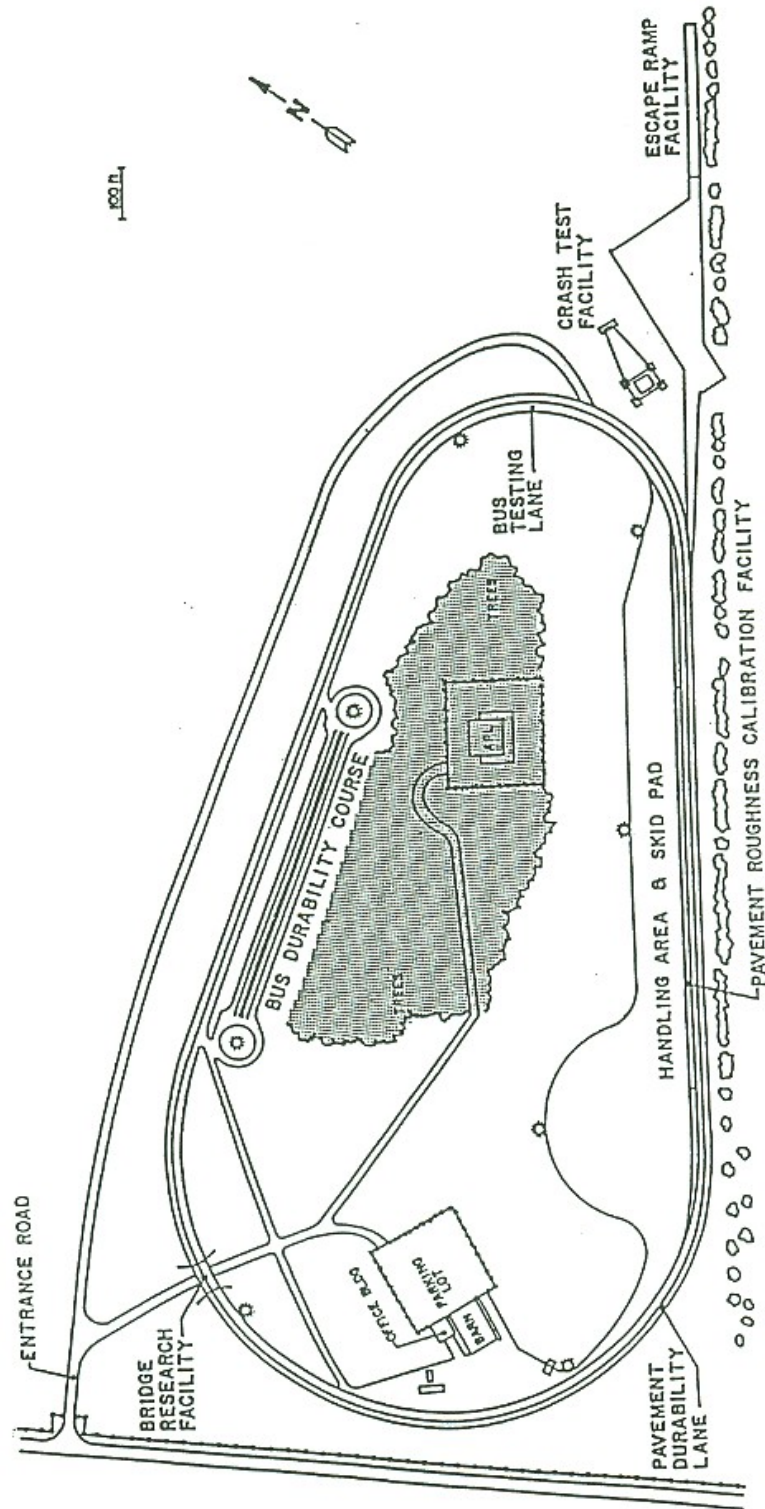
B—Break

C—Cycle all systems five times, visual inspection, driver's log entries

D—Drive bus as specified by procedure

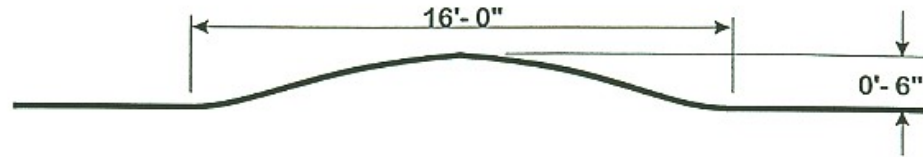
F—Fuel bus, complete driver's log shift entries

“PLAN VIEW OF PENN STATE BUS TESTING AND RESEARCH FACILITY”

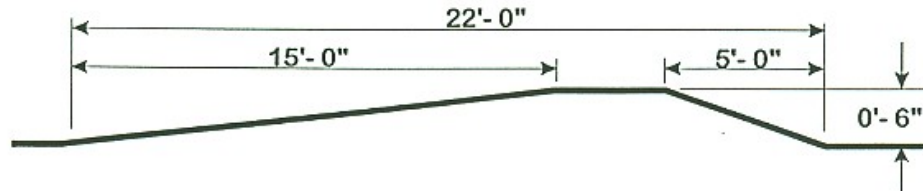


**BUS TESTING AND RESEARCH TEST TRACK
UNIVERSITY PARK, PA**

Staggered
Bumps
(10 mph)



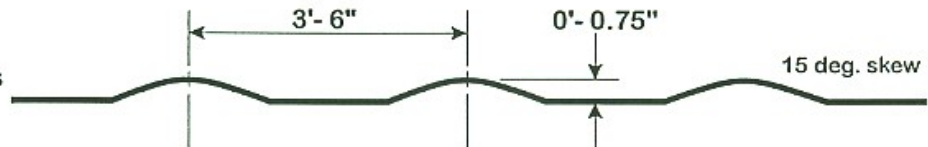
Railroad
Crossing
(8 mph)



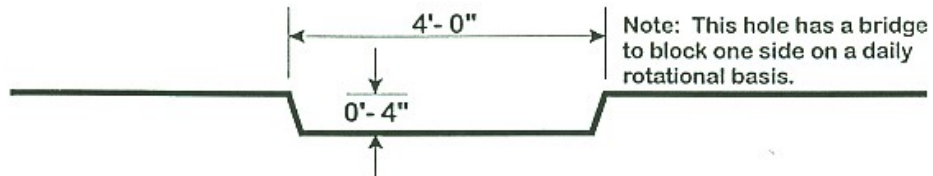
1" Random
Chuck Holes
(20 mph)



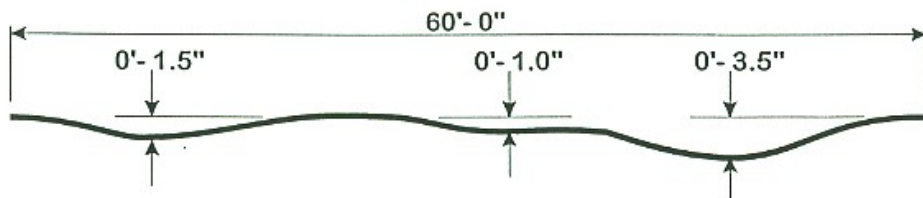
Chatter Bumps
(20 mph)



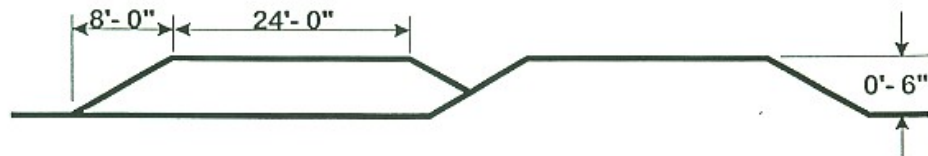
4" Chuck Hole
(5 mph)



High Crown
Intersection
(20 mph)



Frame Twist
(10 mph)



Durability Element Profiles

The Pennsylvania Transportation Institute
Penn State

(Page 1 of 1)
UNSCHEDULED MAINTENANCE
 Glaval Bus #0910

DATE	TEST MILES	SERVICE	ACTIVITY	MAN HOURS	DOWN TIME
07-15-09	1,137	Check for coolant leak near the right rear wheel. A heater hose near the right rear wheel is chaffing on the leaf spring.	Repaired heater hose and relocated away from leaf spring.	4.00	2.00
08-13-09	4,780	The right side emergency exit window has fallen out. The screws attaching the hanger to the window frame are stripped out.	Straightened bent window frame and installed window with new screws.	2.00	1.00
08-17-09	4,975	The tailpipe hanger is broken.	Replaced tailpipe hanger.	1.00	0.50
08-17-09	4,975	The grill is missing three fasteners.	Replaced three fasteners in grill.	1.00	0.50
08-26-09	5,413	The upper bushing on the left rear shock is working out.	Replaced left rear shock.	1.00	0.50

UNSCHEDULED MAINTENANCE



COOLANT LEAK NEAR RIGHT REAR WHEEL (1,137 TEST MILES)



EMERGENCY WINDOW FELL OUT (4,780 TEST MILES)