

**PARTIAL  
STURAA TEST  
4 YEAR  
100,000 MILE BUS  
from  
METROTRANS CORPORATION  
MODEL CLASSIC 20' RAISED ROOF**

**JULY 1995**

**PTI-BT-R9805-03-98-P**

PENNSSTATE



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## **EXECUTIVE SUMMARY**

Metrotrans Corporation submitted a model Classic 20' Raised Roof, gasoline powered 12 seat/22-foot bus, for partial STURAA testing in 4 yr/100,000 mile category. The Federal Transit Administration determined that the following test would be performed: 3. Safety. Testing started on May 11, 1998, and was completed on May 29, 1998. The Check-In section of the report provides a description of the bus and specifies its major components.

The Safety Test, a double-lane change obstacle avoidance, test was performed in both right-hand and left-hand directions up to the maximum test speed of 45 mph. During the 40 and 45 mph passes, the test driver experienced difficulty with recovery and during the 45 mph passes, the front outside wheel lost ground contact.

## 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
NBM	- new bus models
PM	- Preventive maintenance
PSBRTF	- Penn State Bus Research and Testing Facility
PTI	- Pennsylvania Transportation Institute
rpm	- revolutions per minute
SAE	- Society of Automotive Engineers
SCH	- test scheduler
SEC	- secretary
SLW	- seated load weight (curb weight plus 150 lb for every designed passenger seating position and for the driver)
STURAA	- Surface Transportation and Uniform Relocation Assistance Act
TD	- test driver
TECH	- test technician
TM	- track manager
TP	- test personnel

# TEST BUS CHECK-IN

## I. OBJECTIVE

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

## II. TEST DESCRIPTION

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

## III. DISCUSSION

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

The test bus consists of a Metrotrans model Classic 20' Raised Roof built on a Ford E 350 chassis. Power is provided by a gasoline fueled, Ford 6.8L engine coupled to a Ford E 40 D transmission. The bus has a front passenger door located between the axles and a dedicated handicap entrance equipped with a Braun Corp. Model LZ11U64ARS wheelchair lift located above the rear axle.

The measured curb weight is 3,160 lb for the front axle and 5,930 lb for the rear axle. These combined weights provide a total measured curb weight of 9,090 lb. There are 12 seats including the driver and room for 9 standing passengers bringing the total passenger capacity to 21. Gross load is  $150 \text{ lb} \times 21 = 3,150 \text{ lb}$ . At full capacity, the measured gross vehicle weight is 12,200 lb. In order to avoid exceeding the GAWR of the rear axle (7,800 lb), the weight for all 23 front standing passengers were eliminated. The reduction from full capacity resulted in an adjusted measured gross vehicle weight of 18,050 lbs and was used for all dynamic testing.

VEHICLE DATA FORM

Bus Number: 9805	Arrival Date: 5-10-98
Bus Manufacturer: Metrotrans Corporation	Vehicle Identification Number (VIN): 1fdwe30s6wha84233
Model Number: Classic 20' Raised Roof	Date: 5-11-98
Personnel: B.L. & S.C.	

WEIGHT:

Individual Wheel Reactions:

Weights (lb)	Front Axle		Middle Axle		Rear Axle	
	Right	Left	Right	Left	Right	Left
CW	1,560	1,600	N/A	N/A	3,250	2,680
SLW	1,230	1,730	N/A	N/A	3,960	3,840
GVW	1,230	1,730	N/A	N/A	3,960	3,840

Total Weight Details:

Weight (lb)	CW	SLW	GVW	GAWR
Front Axle	3,160	2,960	2,960	4,400
Middle Axle	N/A	N/A	N/A	N/A
Rear Axle	5,930	7,800	7,800	7,800
Total	9,090	10,760	10,760	GVWR: 11,500

Dimensions:

Length (ft/in)	22 / 5
Width (in)	96.0
Height (in)	118.5
Front Overhang (in)	34.0
Rear Overhang (in)	92.0
Wheel Base (in)	138.5
Wheel Track (in)	Front: 68.0

Rear: 73.0

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CLEARANCES:

Lowest Point Outside Front Axle	Location: Steering Stabilizer Clearance(in): 12.3
Lowest Point Outside Rear Axle	Location: Fuel tank support Clearance(in): 12.7
Lowest Point between Axles	Location: Stairwell Clearance(in): 9.2
Ground Clearance at the center (in)	9.2
Front Approach Angle (deg)	35.3
Rear Approach Angle (deg)	14.0
Ramp Clearance Angle (deg)	8.2
Aisle Width (in)	22.5
Inside Standing Height at Center Aisle (ft)	76.5

BODY DETAILS:

Body Structural Type	Integral		
Frame Material	Steel rail		
Body Material	Aluminum, Fiberglass & Steel		
Floor Material	Plywood		
Roof Material	Aluminum		
Windows Type	<input type="checkbox"/> Fixed	<input checked="" type="checkbox"/> Movable	
Window Mfg./Model No.	HEHR / M282		
Number of Doors	<u>1</u> Front	<u>1</u> Rear	
Mfr. / Model No.	Trimble House / 32		
Dimension of Each Door (in)	Front-31.5 x 54.5	Rear-27.2 x 89.2	W/C-40.0 x 72.2
Passenger Seat Type	<input type="checkbox"/> Cantilever	<input checked="" type="checkbox"/> Pedestal	<input type="checkbox"/> Other (explain)
Mfr. / Model No.	Freedman / Pedestal		
Driver Seat Type	<input type="checkbox"/> Air	<input type="checkbox"/> Spring	<input checked="" type="checkbox"/> Other (Cushion)



Mfr. / Model No.	Ford / Captains
Number of Seats (including Driver)	12

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BODY DETAILS (Contd..)

Free Floor Space ( ft <sup>2</sup> )	14.0		
Height of Each Step at Normal Position (in)	Front	1. <u>14.2</u>	
	2. <u>N/A</u> 3. <u>N/A</u> 4. <u>N/A</u>		
	Middle	1. <u>10.4</u>	
	2. <u>8.1</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	<input type="checkbox"/> C.I.	<input type="checkbox"/> Alternate Fuel	
	<input checked="" type="checkbox"/> S.I.	<input type="checkbox"/> Other (explain)	
Mfr. / Model No.	Ford / 6.8L		
Location	<input checked="" type="checkbox"/> Front	<input type="checkbox"/> Rear	<input type="checkbox"/> Other (explain)
Fuel Type	<input checked="" type="checkbox"/> Gasoline	<input type="checkbox"/> CNG	<input type="checkbox"/> Methanol
	<input type="checkbox"/> Diesel	<input type="checkbox"/> LNG	<input type="checkbox"/> Other (explain)
Fuel Tank Capacity (indicate units)	37 gal.		
Fuel Induction Type	<input checked="" type="checkbox"/> Injected	<input type="checkbox"/> Carburetion	
Fuel Injector Mfr. / Model No.	Ford / 6.8L		
Carburetor Mfr. / Model No.	N/A		
Fuel Pump Mfr. / Model No.	Ford / 6.8L		
Alternator (Generator) Mfr. / Model No.	Leece Neville / 4870		
Maximum Rated Output (Volts / Amps)	13.8 / 200		
Air Compressor Mfr. / Model No.	N/A		
Maximum Capacity (ft <sup>3</sup> / min)	N/A		
Starter Type	<input checked="" type="checkbox"/> Electrical	<input type="checkbox"/> Pneumatic	<input type="checkbox"/> Other (explain)

Starter Mfr. / Model No.	Motorcraft / na
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TRANSMISSION

Transmission Type	<input type="checkbox"/> Manual	<input checked="" type="checkbox"/> Automatic	
Mfr. / Model No.	Ford E 40 D		
Control Type	<input checked="" type="checkbox"/> Mechanical	<input type="checkbox"/> Electrical	<input type="checkbox"/> Other (explain)
Torque Convertor Mfr. / Model No.	Ford E 40 D		
Integral Retarder Mfr. / Model No.	N/A		

SUSPENSION

Number of Axles	2		
Front Axle Type	<input checked="" type="checkbox"/> Independent	<input type="checkbox"/> Beam Axle	
Mfr. / Model No.	Ford / Twin Eye Beam		
Axle Ratio (if driven)	N/A		
Suspension Type	<input type="checkbox"/> Air	<input checked="" type="checkbox"/> Spring	<input type="checkbox"/> Other (explain)
No. of Shock Absorbers	2		
Mfr. / Model No.	Ford CA06R2E		
Middle Axle Type	<input type="checkbox"/> Independent	<input type="checkbox"/> Beam Axle	
Mfr. / Model No.	N/A		
Axle Ratio (if driven)	N/A		
Suspension Type	<input type="checkbox"/> Air	<input type="checkbox"/> Spring	<input type="checkbox"/> Other (explain)
No. of Shock Absorbers	N/A		
Mfr. / Model No.	N/A		
Rear Axle Type	<input type="checkbox"/> Independent	<input checked="" type="checkbox"/> Beam Axle	
Mfr. / Model No.	Dana / M70-ZU		
Axle Ratio (if driven)	4:10		
Suspension Type	<input type="checkbox"/> Air	<input checked="" type="checkbox"/> Spring	<input type="checkbox"/> Other (explain)
No. of Shock Absorbers	2		

Mfr. / Model No.	Ford / CA06R2F
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**WHEELS & TIRES**

Front	Wheel Mfr./ Model No.	Accuride / 16 x 6 K
	Tire Mfr./ Model No.	Firestone / LT225/75 R 16 Steeltex
Rear	Wheel Mfr./ Model No.	Accuride / 16 x 6 K
	Tire Mfr./ Model No.	Firestone / LT225/75 R 16 Steeltex

**BRAKES**

Front Axle Brakes Type	<input type="checkbox"/> Cam	<input checked="" type="checkbox"/> Disc	<input type="checkbox"/> Other (explain)
Mfr. / Model No.	Ford / 12.5 disc		
Middle Axle Brakes Type	<input type="checkbox"/> Cam	<input type="checkbox"/> Disc	<input type="checkbox"/> Other (explain)
Mfr. / Model No.	N/A		
Rear Axle Brakes Type	<input type="checkbox"/> Cam	<input type="checkbox"/> Disc	<input type="checkbox"/> Other (explain)
Mfr. / Model No.	Ford / 12.12 x 3.5		
Retarder Type	N/A		
Mfr. / Model No.	N/A		

**HVAC**

Heating System Type	<input type="checkbox"/> Air	<input checked="" type="checkbox"/> Water	<input type="checkbox"/> Other
Capacity (Btu/hr)	40,000		
Mfr. / Model No.	Trans Air / TA 71		
Air Conditioner	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No	
Location	Front		
Capacity (Btu/hr)	40,000		
A/C Compressor Mfr. / Model No.	Seltic / 512113		

**STEERING**

Steering Gear Box Type	Hydraulic gear
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Mfr. / Model No.	Ford / na
Steering Wheel Diameter	15.25
Number of turns (lock to lock)	4

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OTHERS

Wheel Chair Ramps	Location: N/A	Type: N/A
Wheel Chair Lifts	Location: Right center	Type: Hydraulic platform
Mfr. / Model No.	Braun Corp. / LZ11U64ARS	
Emergency Exit	Location: Roof Windows Door	Number: 1 3 3

CAPACITIES

Fuel Tank Capacity (units)	37 gals.
Engine Crankcase Capacity (gallons)	1.5
Transmission Capacity (gallons)	3.975
Differential Capacity (gallons)	0.825
Cooling System Capacity (gallons)	7.65
Power Steering Fluid Capacity (quarts)	1.50



COMPONENT/SUBSYSTEM INSPECTION FORM

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



## CHECK - IN



**METROTRANS CORPORATION'S**

## MODEL CLASSIC 20' RAISED ROOF



## CHECK - IN CONT.



## METROTRANS CORPORATION'S MODEL

**CLASSIC 20' RAISED ROOF EQUIPPED  
WITH A BRAUN CORP. MODEL  
LZ 11U64ARS HANDICAP DEVICE**

### **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 complete the test course in both the right-hand and left-hand directions up to the maximum test speed of 45 mph. During the 40 and 45 mph passes, the test driver experienced difficulty with recovery and during the 45 mph passes, the front outside wheel lost ground contact.

**SAFETY DATA FORM**

Bus Number: 9805	Date: 5-29-98
Personnel: B.L., S.C. & R.H.	

Temperature (°F): 82	Humidity (%): 58
Wind Direction: N	Wind Speed (mph): 9
Barometric Pressure (in.Hg): 30.04	

<b>SAFETY TEST: DOUBLE LANE CHANGE</b>	
Maximum safe speed tested for double-lane change to left	45 mph
Maximum safe speed tested for double-lane change to right	45 mph
<b>Comments of the position of the bus during the lane change:</b>	
The test was completed to test speed of 45 mph., although driver experienced difficulty was recovery during the 40 & 45 mph runs.	
<b>Comments of the tire/ground contact patch:</b>	
The front outside wheel lost ground contact during the 45 mph runs.	

### 3. SAFETY



**RIGHT - HAND APPROACH**



**LEFT - HAND APPROACH**