

PARTIAL
STURAA TEST
10 YEAR
350,000 MILE BUS
from
THOMAS BUILT BUSES, INC.
MODEL CITILINER

JANUARY 1997

PTI-BT-R9702-01-97-P

PENNSSTATE



The Pennsylvania Transportation Institute

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*NOTE: Partial STURAA Testing was performed on this bus. Only those tests required by the Federal Transit Administration are included in this report. In order to remain consistent with the Time and Fee Schedule, the tests included in this report retain their original numbers and are not numbered sequentially.

EXECUTIVE SUMMARY

Thomas Built Buses, Inc. Submitted a model Citiliner, diesel powered 30 seat/35-foot bus, for partial STURAA testing in the 10 yr/350,000 mile category. The Federal Transit Administration determined that the following test would be performed: 4. Performance Test. The odometer reading at the time of delivery was 0,425.0 miles. Testing started on January 7, 1997 and was completed on January 8, 1997. The Check-In Section of the report provides a description of the bus and specifies its major components.

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 31.32 seconds.

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 Thomas Built Bus model Citiliner. Power is provided by a diesel fueled, Cummins ER6CTA-250 (C 8.3) coupled to an Allison B 400 R transmission. The bus is equipped with a front door located forward of the front axle. A dedicated wheelchair access door is located to the rear of the front axle. The test bus is equipped with a Ricon model S5003 wheelchair lift.

The measured curb weight is 7,600 lb for the front axle and 16,350 lb for the rear axle. These combined weights provide a total measured curb weight of 23,950 lb. There are 30 seats including the driver, two wheelchair positions and room for 17 standing passengers bringing the total passenger capacity to 49. Gross load is 150 lb x 47 = 7,050 lb. + 1,200 lb (wheelchair position) = 8,250 lb. At full capacity, the measured gross vehicle weight is 31,750 lb.

VEHICLE DATA FORM

Bus Number: 9702	Arrival Date: 1-3-97
Bus Manufacturer: Thomas Built Buses, Inc.	Vehicle Identification Number (VIN): 1T7CN2B23V1144185
Model Number: Citiliner	Date: 1-7-97
Personnel: Bob LaMorte and Stan Crawford	

WEIGHT:

Individual Wheel Reactions:

Weights (lb)	Front Axle		Middle Axle		Rear Axle	
	Right	Left	Right	Left	Right	Left
CW	3,800	3,800	N/A	N/A	8,550	7,800
SLW	4,500	4,900	N/A	N/A	10,100	10,650
GVW	5,100	5,300	N/A	N/A	10,700	10,650

Total Weight Details:

Weight (lb)	CW	SLW	GVW	GAWR
Front Axle	7,600	9,400	10,400	13,220
Middle Axle	N/A	N/A	N/A	N/A
Rear Axle	16,350	20,000	21,350	23,000
Total	23,950	29,400	31,750	GVWR: 36,220

Dimensions:

Length (ft/in)	35 / 2.5
Width (in)	96.00
Height (in)	125.50
Front Overhang (in)	91.50
Rear Overhang (in)	122.25
Wheel Base (in)	208.75
Wheel Track (in)	Front: 80.00
	Rear: 72.50

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CLEARANCES:

Lowest Point Outside Front Axle	Location: Bottom of steps	Clearance(in): 9.5
Lowest Point Outside Rear Axle	Location: Transmission line	Clearance(in): 10.6
Lowest Point between Axles	Location: Body	Clearance(in): 11.6
Ground Clearance at the center (in)	12.5	
Front Approach Angle (deg)	10.5	
Rear Approach Angle (deg)	11.0	
Ramp Clearance Angle (deg)	6.0	
Aisle Width (in)	20.5	
Inside Standing Height at Center Aisle (ft/in)	6 / 4.5	

BODY DETAILS:

Body Structural Type	Monocoque		
Frame Material	Steel		
Body Material	Steel / Fiberglass-front / Aluminum-compartment doors		
Floor Material	Plywood		
Roof Material	Steel		
Windows Type	<input type="checkbox"/> Fixed	<input checked="" type="checkbox"/> Movable	
Window Mfg./Model No.	Safelite / M-39		
Number of Doors	<u>1</u> Front	<u>1</u> Rear	
Mfr. / Model No.	Bode / 2557.00A		
Dimension of Each Door (in)	Front-26.5 x 91.0	Rear-41.7 x 66.3	
Passenger Seat Type	<input type="checkbox"/> Cantilever	<input checked="" type="checkbox"/> Pedestal	<input type="checkbox"/> Other (explain)
Mfr. / Model No.	AMSECO / 033950		
Driver Seat Type	<input checked="" type="checkbox"/> Air	<input type="checkbox"/> Spring	<input type="checkbox"/> Other (explain)
Mfr. / Model No.	Recaro / B 100		
Number of Seats (including Driver)	30		

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BODY DETAILS (Contd..)

Free Floor Space (ft ²)	26.7				
Height of Each Step at Normal Position (in)	Front	1. <u>12.4</u>	2. <u>8.9</u>	3. <u>9.2</u>	4. <u>9.6</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	<input checked="" type="checkbox"/> C.I.	<input type="checkbox"/> Alternate Fuel	
	<input type="checkbox"/> S.I.	<input type="checkbox"/> Other (explain)	
Mfr. / Model No.	Cummins / ER6CTA-250 (C 8.3)		
Location	<input type="checkbox"/> Front	<input checked="" type="checkbox"/> Rear	<input type="checkbox"/> Other (explain)
Fuel Type	<input type="checkbox"/> Gasoline	<input type="checkbox"/> CNG	<input type="checkbox"/> Methanol
	<input checked="" type="checkbox"/> Diesel	<input type="checkbox"/> LNG	<input type="checkbox"/> Other (explain)
Fuel Tank Capacity (indicate units)	100 gal		
Fuel Induction Type	<input checked="" type="checkbox"/> Injected	<input type="checkbox"/> Carburetion	
Fuel Injector Mfr. / Model No.	Cummins / ER6CTA-250 (C 8.3)		
Carburetor Mfr. / Model No.	N/A		
Fuel Pump Mfr. / Model No.	Cummins / ER6CTA-250 (C 8.3)		
Alternator (Generator) Mfr. / Model No.	Leece-Neville / A0012800JB		
Maximum Rated Output (Volts / Amps)	14 / 160		
Air Compressor Mfr. / Model No.	Holset / Qe 296C		
Maximum Capacity (ft ³ / min)	13.2		
Starter Type	<input checked="" type="checkbox"/> Electrical	<input type="checkbox"/> Pneumatic	<input type="checkbox"/> Other (explain)
Starter Mfr. / Model No.	Leece-Neville / M001094132		

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TRANSMISSION

Transmission Type	<input type="checkbox"/> Manual	<input checked="" type="checkbox"/> Automatic	
Mfr. / Model No.	Allison / B400 R		
Control Type	<input type="checkbox"/> Mechanical	<input checked="" type="checkbox"/> Electrical	<input type="checkbox"/> Other (explain)
Torque Convertor Mfr. / Model No.	Allison / B400 R		
Integral Retarder Mfr. / Model No.	Allison / B400 R		

SUSPENSION

Number of Axles	2		
Front Axle Type	<input type="checkbox"/> Independent	<input checked="" type="checkbox"/> Beam Axle	
Mfr. / Model No.	Thomas / F3W-1400		
Axle Ratio (if driven)	N/A		
Suspension Type	<input checked="" type="checkbox"/> Air	<input type="checkbox"/> Spring	<input type="checkbox"/> Other (explain)
No. of Shock Absorbers	2		
Mfr. / Model No.	Knoi / 1901968		
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.	Rockwell / RC22145NFNN		
Axle Ratio (if driven)	5.29		
Suspension Type	<input checked="" type="checkbox"/> Air	<input type="checkbox"/> Spring	<input type="checkbox"/> Other (explain)
No. of Shock Absorbers	2		
Mfr. / Model No.	Koni / 901868		

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WHEELS & TIRES

Front	Wheel Mfr./ Model No.	N/A / 8.25 x 22.5
	Tire Mfr./ Model No.	Goodyear / G159 11R 22.5
Rear	Wheel Mfr./ Model No.	N/A / 8.25 x 22.5
	Tire Mfr./ Model No.	Goodyear / G159 11R 22.5

BRAKES

Front Axle Brakes Type	<input checked="" type="checkbox"/> Cam	<input type="checkbox"/> Disc	<input type="checkbox"/> Other (explain)
Mfr. / Model No.	Eaton / 16.5 x 6.0		
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 checked="" type="checkbox"/> Cam	<input type="checkbox"/> Disc	<input type="checkbox"/> Other (explain)
Mfr. / Model No.	Eaton / 16.5 x 10.0		
Retarder Type	Intergral		
Mfr. / Model No.	Allison / B400 R		

VAC

Heating System Type	<input type="checkbox"/> Air	<input checked="" type="checkbox"/> Water	<input type="checkbox"/> Other
Capacity (Btu/hr)	45,000		
Mfr. / Model No.	Webasto / DBW 2010		
Air Conditioner	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No	
Location	Rear		
Capacity (Btu/hr)	72,000		
A/C Compressor Mfr. / Model No.	Harrison / A6		

STEERING

Steering Gear Box Type	Hydraulic gear
Mfr. / Model No.	Ross /
Steering Wheel Diameter (in)	20
Number of turns (lock to lock)	5.25

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OTHERS

Wheel Chair Ramps	Location: N/A	Type: N/A
Wheel Chair Lifts	Location: Center right	Type: Platform
Mfr. / Model No.	Ricon / S5003	
Emergency Exit	Location: Windows Roof hatch	Number: 11 2

CAPACITIES

Fuel Tank Capacity (units)	100 gal
Engine Crankcase Capacity (gallons)	6.0
Transmission Capacity (gallons)	4.3
Differential Capacity (gallons)	4.1
Cooling System Capacity (gallons)	13.0
Power Steering Fluid Capacity (gallons)	3.2

VEHICLE DATA FORM

Bus Number: 9702	Date: 1-7-97
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List all spare parts, tools and manuals delivered with the bus.

Part Number	Description	Qty.
N/A	N/A	N/A

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



THOMAS BUILT MODEL CITILINER



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 PSBRTF 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 31.32 seconds.

PERFORMANCE DATA FORM

Bus Number: 9702	Date: 1-7-97		
Personnel: Bob LaMorte, Stan Crawford, and Ron Harter			
Temperature (°F): 32	Humidity (%): 68		
Wind Direction: NW	Wind Speed (mph): 9		
Barometric Pressure (in.Hg): 30.05			
Air Conditioning compressor-OFF	<input checked="" type="checkbox"/> Checked		
Ventilation fans-ON HIGH	<input checked="" type="checkbox"/> Checked		
Heater pump motor-Off	<input checked="" type="checkbox"/> Checked		
Defroster-OFF	<input checked="" type="checkbox"/> Checked		
Exterior and interior lights-ON	<input checked="" type="checkbox"/> Checked		
Windows and doors-CLOSED	<input checked="" type="checkbox"/> Checked		
ACCELERATION, GRADEABILITY, TOP SPEED			
Counter Clockwise Recorded Interval Times			
Speed	Run 1	Run 2	Run 3
10 mph	3.95	3.83	3.97
20 mph	7.38	7.09	7.18
30 mph	12.34	12.09	12.41
40 mph	20.41	20.65	20.86
Top Test Speed(mph) 50	32.43	33.63	33.16
Clockwise Recorded Interval Times			
Speed	Run 1	Run 2	Run 3
10 mph	3.71	3.61	3.73
20 mph	6.84	6.66	7.12
30 mph	11.81	11.72	11.75
40 mph	18.91	18.95	19.06
Top Test Speed(mph) 50	29.60	29.13	29.95

PERFORMANCE SUMMARY SHEET

BUS MANUFACTURER : THOMAS BUILT BUS NUMBER : 9702
 BUS MODEL : CITILINER TEST DATE : 1/08/96

TEST CONDITIONS :

 TEMPERATURE (DEG F) : 32.0
 WIND DIRECTION : NW
 WIND SPEED (MPH) : 9.0
 HUMIDITY (%) : 68
 BAROMETRIC PRESSURE (IN. HG) : 30.1

VEHICLE SPEED (MPH)	AVERAGE TIME (SEC)		
	CCW DIRECTION	CW DIRECTION	TOTAL
10.0	3.92	3.68	3.80
20.0	7.22	6.87	7.04
30.0	12.28	11.76	12.02
40.0	20.64	18.97	19.81
50.0	33.07	29.56	31.32

TEST SUMMARY :

VEHICLE SPEED (MPH)	TIME (SEC)	ACCELERATION (FT/SEC ²)	MAX. GRADE (%)
1.0	.29	5.0	15.9
5.0	1.50	4.7	14.6
10.0	3.16	4.2	13.1
15.0	5.03	3.7	11.5
20.0	7.15	3.2	10.1
25.0	9.58	2.8	8.7
30.0	12.42	2.4	7.4
35.0	15.77	2.0	6.2
40.0	19.82	1.6	5.1
45.0	24.82	1.3	4.1
50.0	31.18	1.0	3.1

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

Thomas Built 9702

