

**PARTIAL**  
**STURAA TEST**  
**7 YEAR**  
**200,000 MILE BUS**  
**from**  
**CHAMPION BUS, INC.**  
**MODEL CTS**  
**DECEMBER 2000**  
**PTI-BT-R2018-20-00**

PENNS<sup>T</sup>ATE



**The Pennsylvania Transportation Institute**

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The Pennsylvania State University  
University Park, PA 16802

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## **EXECUTIVE SUMMARY**

Champion Bus, Inc. submitted a model CTS, diesel powered 26 seat/33-foot bus, for a Partial STURAA test in the 7 year/200,000 mile category. The Federal Transit Administration determined that the following tests would be performed: 1.2 Servicing, Preventative Maintenance, and Repair and Maintenance During Testing, 2. Reliability and 5.7 Structural Durability Test. The odometer reading at the time of delivery was 1,308 miles. Testing started on August 29, 2000 and was completed on November 30, 2000. The Check-In Section of the report provides a description of the bus and specifies its major components.

The primary part of this test was Structural Durability Test, which also provides the information for the maintainability and reliability results. The Structural Durability Test was started on August 30, 2000 and was completed on November 29, 2000.

The first segment of the structural durability test was performed with the bus loaded to a GVW of 22,450 lbs. The middle segment was performed at a SLW of 19,550 lbs and the final segment was performed at a CW of 14,500 lbs. Durability driving resulted in unscheduled maintenance that consisted of a variety of subsystem failures. These failures can be found in a complete and detailed listing of scheduled and unscheduled maintenance, which is provided in the Maintainability section of this report.

The Reliability Section compiles failures that occurred during structural durability testing. Breakdowns are classified according to subsystems. The data in this section are arranged so that those subsystems with more frequent problems are apparent. Also the problems also are listed by class as defined in section 2. The test bus encountered no Class 1 or Class 2 failures. Of the eighteen reported failures, twelve were Class 3 and six were Class 4.

## 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 Champion Bus, Inc. model CTS. The vehicle is manufactured using an MB55 Freightliner Chassis. Power is provided by a diesel fueled Cummins ISB 205 5.9 L engine coupled to an Allison 2400 Series transmission. The bus is equipped with a front door located to the rear of the front axle. The dedicated handicap access door (located to the rear of the front door and forward of the rear axle) is equipped with a Braun model L917 wheelchair lift.

The measured curb weight is 6,600 lbs for the front axle and 7,900 lbs for the rear axle. These combined weights provide a total measured curb weight of 14,500 lbs. There are 26 seats including the driver, 2 wheelchair position, and room for 20 standing passengers bringing the total passenger capacity to 48. Gross load is  $150 \text{ lb} \times 46 = 6,900 \text{ lbs.} + 1,200 \text{ lb}$  (two wheelchair positions) = 8,100 lbs. At full capacity, the measured gross vehicle weight is 22,450 lbs.

### VEHICLE DATA FORM

Bus Number: 2018	Arrival Date: 8-29-00
Bus Manufacturer: Champion Bus, Inc.	Vehicle Identification Number (VIN): 4UZABFAC6YCG91361
Model Number: CTS	Date: 8-29-00
Personnel: S.C.	

WEIGHT:

Individual Wheel Reactions:

Weights (lb)	Front Axle		Middle Axle		Rear Axle	
	Right	Left	Right	Left	Right	Left
CW	3,300	3,300	N/A	N/A	3,900	4,000
SLW	3,400	3,650	N/A	N/A	6,900	5,600
GVW	3,650	3,900	N/A	N/A	6,800	8,100

Total Weight Details:

Weight (lb)	CW	SLW	GVW	GAWR
Front Axle	6,600	7,050	7,550	8,000
Middle Axle	N/A	N/A	N/A	N/A
Rear Axle	7,900	12,500	14,900	17,500
Total	14,500	19,550	22,450	GVWR: 25,500

Dimensions:

Length (ft/in)	33 / 0.25
Width (in)	95.00
Height (in)	115.00
Front Overhang (in)	46.00
Rear Overhang (in)	114.25
Wheel Base (in)	236.00
Wheel Track (in)	Front: 83.50
	Rear: 72.75

Bus Number: 2018	Date: 8-29-00
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CLEARANCES:

Lowest Point Outside Front Axle	Location: Cross member	Clearance(in): 13.6
Lowest Point Outside Rear Axle	Location: Exhaust pipe	Clearance(in): 9.2
Lowest Point between Axles	Location: Entry step	Clearance(in): 10.0
Ground Clearance at the center (in)	16.5	
Front Approach Angle (deg)	28.0	
Rear Approach Angle (deg)	10.8	
Ramp Clearance Angle (deg)	8.3	
Aisle Width (in)	16.0	
Inside Standing Height at Center Aisle (in)	77.9	

BODY DETAILS:

Body Structural Type	Integral		
Frame Material	Steel		
Body Material	Steel		
Floor Material	Plywood		
Roof Material	Steel		
Windows Type	<input type="checkbox"/> Fixed	<input checked="" type="checkbox"/> Movable	
Window Mfg./Model No.	Hehr / DOT269 AS3 M282		
Number of Doors	<u>1</u> Front	<u>1</u> Rear	
Mfr. / Model No.	Champion / 50409		
Dimension of Each Door (in)	Front - 30.0 x 88.75	Rear - 66.0 x 44.0	
Passenger Seat Type	<input type="checkbox"/> Cantilever	<input checked="" type="checkbox"/> Pedestal	<input type="checkbox"/> Other (explain)
Mfr. / Model No.	Freedom / Mid-hi featherweight		
Driver Seat Type	<input type="checkbox"/> Air	<input type="checkbox"/> Spring	<input checked="" type="checkbox"/> Other (Cushion)
Mfr. / Model No.	Freedman / 19502		
Number of Seats (including Driver)	26 + 2 wheelchair positions		

Bus Number: 2018	Date: 8-29-00
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BODY DETAILS (Contd..)

Free Floor Space ( ft <sup>2</sup> )	30.7				
Height of Each Step at Normal Position (in)	Front	1. <u>12.0</u>	2. <u>8.7</u>	3. <u>8.6</u>	4. <u>8.3</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 / ISB 205		
Location	<input checked="" type="checkbox"/> Front	<input 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)	60 Gals		
Fuel Induction Type	<input checked="" type="checkbox"/> Injected	<input type="checkbox"/> Carburation	
Fuel Injector Mfr. / Model No.	Cummins / ISB 205		
Carburetor Mfr. / Model No.	N/A		
Fuel Pump Mfr. / Model No.	Cummins / ISB 205		
Alternator (Generator) Mfr. / Model No.	Leece - Neville / N/A		
Maximum Rated Output (Volts / Amps)	14 / 200		
Air Compressor Mfr. / Model No.	Wabco / 15.2		
Maximum Capacity (ft <sup>3</sup> / min)	15.2		
Starter Type	<input checked="" type="checkbox"/> Electrical	<input type="checkbox"/> Pneumatic	<input type="checkbox"/> Other (explain)
Starter Mfr. / Model No.	Delco Remy / 28 MT		



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TRANSMISSION

Transmission Type	<input type="checkbox"/> Manual	<input checked="" type="checkbox"/> Automatic	
Mfr. / Model No.	Allison / 2400		
Control Type	<input checked="" type="checkbox"/> Mechanical	<input type="checkbox"/> Electrical	<input type="checkbox"/> Other (explain)
Torque Convertor Mfr. / Model No.	Allison / 2400		
Integral Retarder Mfr. / Model No.	N/A		

SUSPENSION

Number of Axles	2		
Front Axle Type	<input type="checkbox"/> Independent	<input checked="" type="checkbox"/> Beam Axle	
Mfr. / Model No.	Dana / I-80		
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.	Freightliner / 16-156676-000		
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.	Meritor / RS-17-145		
Axle Ratio (if driven)	3.73		
Suspension Type	<input checked="" type="checkbox"/> Air	<input type="checkbox"/> Spring	<input type="checkbox"/> Other (explain)
No. of Shock Absorbers	2		
Mfr. / Model No.	Gabriel / 16-14259-000		

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**WHEELS & TIRES**

Front	Wheel Mfr./ Model No.	Accuride / 28680 PW
	Tire Mfr./ Model No.	Michelin XZE / 245/80R 19.5
Rear	Wheel Mfr./ Model No.	Accuride / 28680 PW
	Tire Mfr./ Model No.	Michelin XZE / 245/80R 19.5

**BRAKES**

Front Axle Brakes Type	<input type="checkbox"/> Cam	<input checked="" type="checkbox"/> Disc	<input type="checkbox"/> Other (explain)
Mfr. / Model No.	Bosch / 16" / OAL 165855		
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 checked="" type="checkbox"/> Disc	<input type="checkbox"/> Other (explain)
Mfr. / Model No.	Bosch / 24/30" OAL 165857		
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)	65,000		
Mfr. / Model No.	Pro-Air /		
Air Conditioner	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No	
Location	Rear - roof    Front - roof		
Capacity (Btu/hr)	104,000		
A/C Compressor Mfr. / Model No.	AC Carrier / 2 TM-16		

**STEERING**

Steering Gear Box Type	Hydraulic gear
Mfr. / Model No.	TRW / TAS 55
Steering Wheel Diameter	18.0
Number of turns (lock to lock)	5.5 turns

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OTHERS

Wheel Chair Ramps	Location: N/A	Type: N/A
Wheel Chair Lifts	Location: Right front	Type: Platform
Mfr. / Model No.	Braun / L917	
Emergency Exit	Location: Windows Doors	Number: 4 1

CAPACITIES

Fuel Tank Capacity (units)	60 gals
Engine Crankcase Capacity (gallons)	4.25
Transmission Capacity (gallons)	5.0
Differential Capacity (gallons)	1.0
Cooling System Capacity (gallons)	5.0
Power Steering Fluid Capacity (gallons)	3.0



COMPONENT/SUBSYSTEM INSPECTION FORM

Bus Number: 2018	Date: 8-29-00
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Subsystem	Checked	Comments
Air Conditioning Heating and Ventilation	✓	Front roof A/C unit has no drip tube.
Body and Sheet Metal	✓	
Frame	✓	
Steering	✓	
Suspension	✓	
Interior/Seating	✓	Interior seating not complete.
Axles	✓	
Brakes	✓	
Tires/Wheels	✓	
Exhaust	✓	
Fuel System	✓	
Power Plant	✓	Water leak from heater hose coming from the engine block.
Accessories	✓	
Lift System	✓	
Interior Fasteners	✓	
Batteries	✓	

## CHECK - IN



## CHAMPION BUS INC.'S MODEL CTS



**CHECK - IN CONT.**



**CHAMPION BUS, INC.'S  
MODEL CTS EQUIPPED  
WITH A BRAUN MODEL L917  
WHEELCHAIR LIFT**

## **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**  
 Champion 2018

<b>DATE</b>	<b>TEST MILES</b>	<b>SERVICE</b>	<b>ACTIVITY</b>	<b>DOWN TIME</b>	<b>HOURS</b>
09-11-00	152	P.M. / Inspection	Linkage, tie rods, universals/u-joints all lubed; all fluids checked.	4.00	4.00
10-10-00	1,152	P.M. / Inspection	Linkage, tie rods, universals/u-joints all lubed; all fluids checked.	4.00	4.00
11-09-00	3,270	P.M. / Inspection	Linkage, tie rods, universals/u-joints all lubed; all fluids checked.	4.00	4.00
11-15-00	4,453	P.M. / Inspection	Linkage, tie rods, universals/u-joints all lubed; all fluids checked.	4.00	4.00
11-20-00	5,730	P.M. / Inspection	Linkage, tie rods, universals/u-joints all lubed; all fluids checked.	4.00	4.00
11-25-00	6,650	P.M. / Inspection	Linkage, tie rods, universals/u-joints all lubed; all fluids checked.	4.00	4.00
11-30-00	Complete	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 enroute interruption of revenue service. Service is discontinued until the bus is replaced or repaired at the point of failure.
- (c) Class 3: Bus Change. A failure that requires removal of the bus from service during its assignments. The bus is operable to a rendezvous point with a replacement bus.
- (d) Class 4: Bad Order. A failure that does not require removal of the bus from service during its assignments but does degrade coach operation. The failure shall be reported by driver, inspector, or hostler.

### 2-III. DISCUSSION

A listing of breakdowns and unscheduled repairs is accumulated during the Structural Durability Test. The following Reliability Data Form lists all unscheduled repairs under classes as defined above. These classifications are somewhat subjective as the test is performed on a test track with careful inspections every two hours.

However, even on the road, there is considerable latitude on deciding how to handle many failures.

The Unscheduled Repair List is also attached to provide a reference for the repairs that are included in the Reliability Data Forms.

The classification of repairs according to subsystem is intended to emphasize those systems which had persistent minor or more serious problems. There were no Class 1 or 2 failures. Of the twelve Class 3 failures, six occurred with the frame/body, two each with the suspension and engine/transmission and one each with the A/c and electrical system. These, and the remaining six Class 4 failures are available for review in the Unscheduled Maintenance List, located in section 5.7 Structural Durability.

**RELIABILITY DATA FORMS**

<b>Bus Number: 2018</b>	<b>Date: 12-8-00</b>
<b>Personnel: Bob Reifsteck</b>	

<b>Failure Type</b>			
<b>Class 4 Bad Order</b>	<b>Class 3 Bus Change</b>	<b>Class 2 Road Call</b>	<b>Class 1 Physical Safety</b>

<b>Subsystems</b>	<b>Mileage</b>	<b>Mileage</b>	<b>Mileage</b>	<b>Mileage</b>	<b>Man Hours</b>	<b>Down Time</b>
<b>Frame/Body</b>		<b>619</b>			<b>10.00</b>	<b>10.00</b>
		<b>724</b>			<b>1.00</b>	<b>1.00</b>
		<b>1,154</b>			<b>0.50</b>	<b>0.50</b>
		<b>3,270</b>			<b>6.00</b>	<b>6.00</b>
		<b>3,270</b>			<b>1.00</b>	<b>1.00</b>
		<b>3,521</b>			<b>1.00</b>	<b>1.00</b>
	<b>6,012</b>				<b>0.50</b>	<b>0.50</b>
<b>Engine/Transmission</b>		<b>775</b>			<b>1.00</b>	<b>1.00</b>
		<b>3,119</b>			<b>2.00</b>	<b>2.00</b>
	<b>6,012</b>				<b>0.50</b>	<b>0.50</b>
<b>Engine</b>		<b>2,201</b>			<b>2.50</b>	<b>2.50</b>
	<b>7,500</b>				<b>1.00</b>	<b>1.00</b>
<b>Exhaust</b>	<b>74</b>				<b>1.50</b>	<b>1.50</b>
	<b>3,020</b>				<b>0.50</b>	<b>0.50</b>
<b>Suspension</b>		<b>1,154</b>			<b>0.50</b>	<b>0.50</b>
		<b>4,721</b>			<b>0.50</b>	<b>0.50</b>



## 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 August 30, 2000 and was conducted until November 29, 2000. The first 3,000 miles were performed at a GVW of 22,450 lbs and completed on October 23, 2000. The next 1,500 mile SLW segment was performed at 19,550 lbs and completed on November 15, 2000 and the final 3,000 segment was performed at a CW of 14,500 lbs and completed on November 29, 2000.

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 PSBRTF and Durability Test Track are attached for reference also, a durability element profile detail shows all the measurement of the different conditions. Finally, photographs illustrating some of the failures that were encountered during the Structural Durability Test are included.



**CHAMPION - TEST BUS #2018**  
**MILEAGE DRIVEN/RECORDED FROM DRIVERS' LOGS**

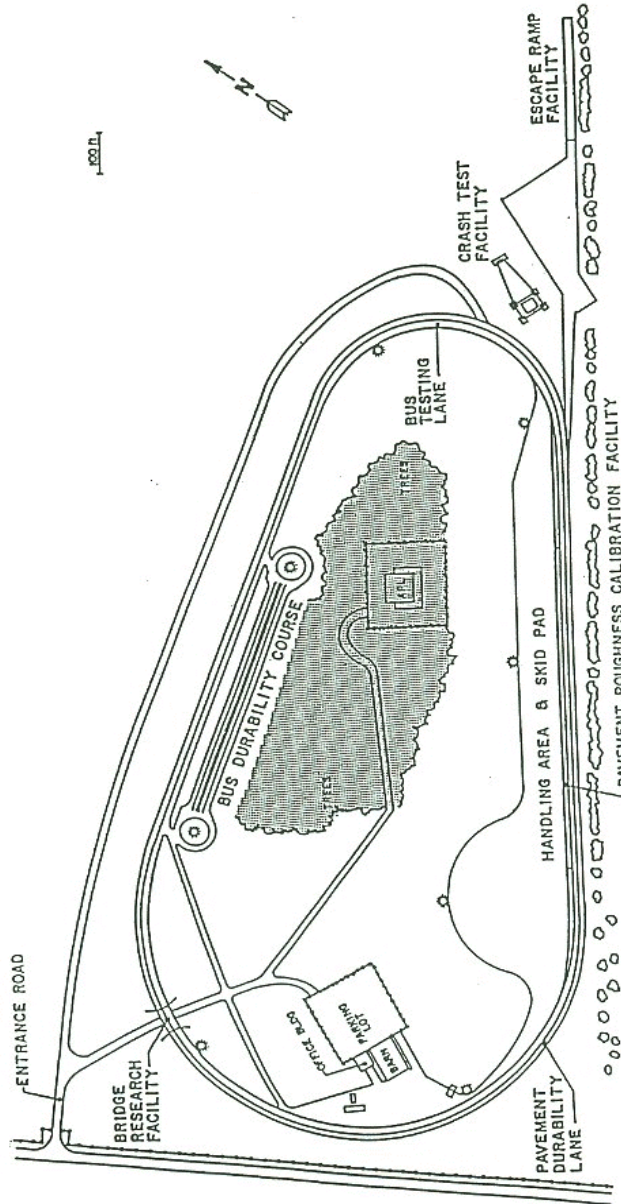
DATE	TOTAL DURABILITY TRACK	TOTAL OTHER MILES	TOTAL
08/28/00 TO 09/03/00	27.00	47.00	74.00
09/04/00 TO 09/10/00	26.00	52.00	78.00
09/11/00 TO 09/17/00	203.00	60.00	263.00
09/18/00 TO 09/24/00	145.00	59.00	204.00
09/25/00 TO 10/01/00	3.00	102.00	105.00
10/02/00 TO 10/08/00	271.00	67.00	338.00
10/09/00 TO 10/15/00	512.00	127.00	639.00
10/16/00 TO 10/22/00	801.00	38.00	839.00
10/23/00 TO 10/29/00	553.00	77.00	630.00
10/30/00 TO 11/05/00	0.00	0.00	0.00
11/06/00 TO 11/12/00	248.00	95.00	343.00
11/13/00 TO 11/19/00	1241.00	904.00	2145.00
11/20/00 TO 11/26/00	932.00	302.00	1234.00
11/27/00 TO 12/03/00	54.00	567.00	621.00
TOTAL	5016.00	2497.00	7513.00

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

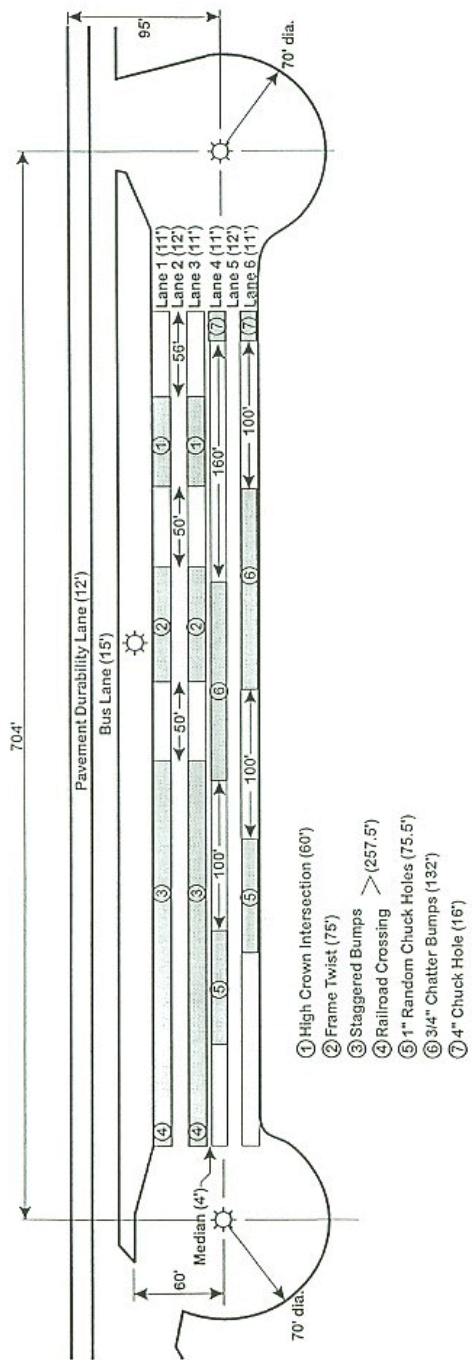
STANDARD OPERATING SCHEDULE			
Monday through Friday			
	HOUR	ACTION	
Shift 1	midnight	D	
	1:40 am	C	
	1:50 am	B	
	2:00 am	D	
	3:35 am	C	
	3:45 am	B	
	4:05 am	D	
	5:40 am	C	
	5:50 am	B	
	6:00 am	D	
	7:40 am	C	
	7:50 am	F	
	Shift 2	8:00 am	D
		9:40 am	C
9:50 am		B	
10:00 am		D	
11:35 am		C	
11:45 am		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

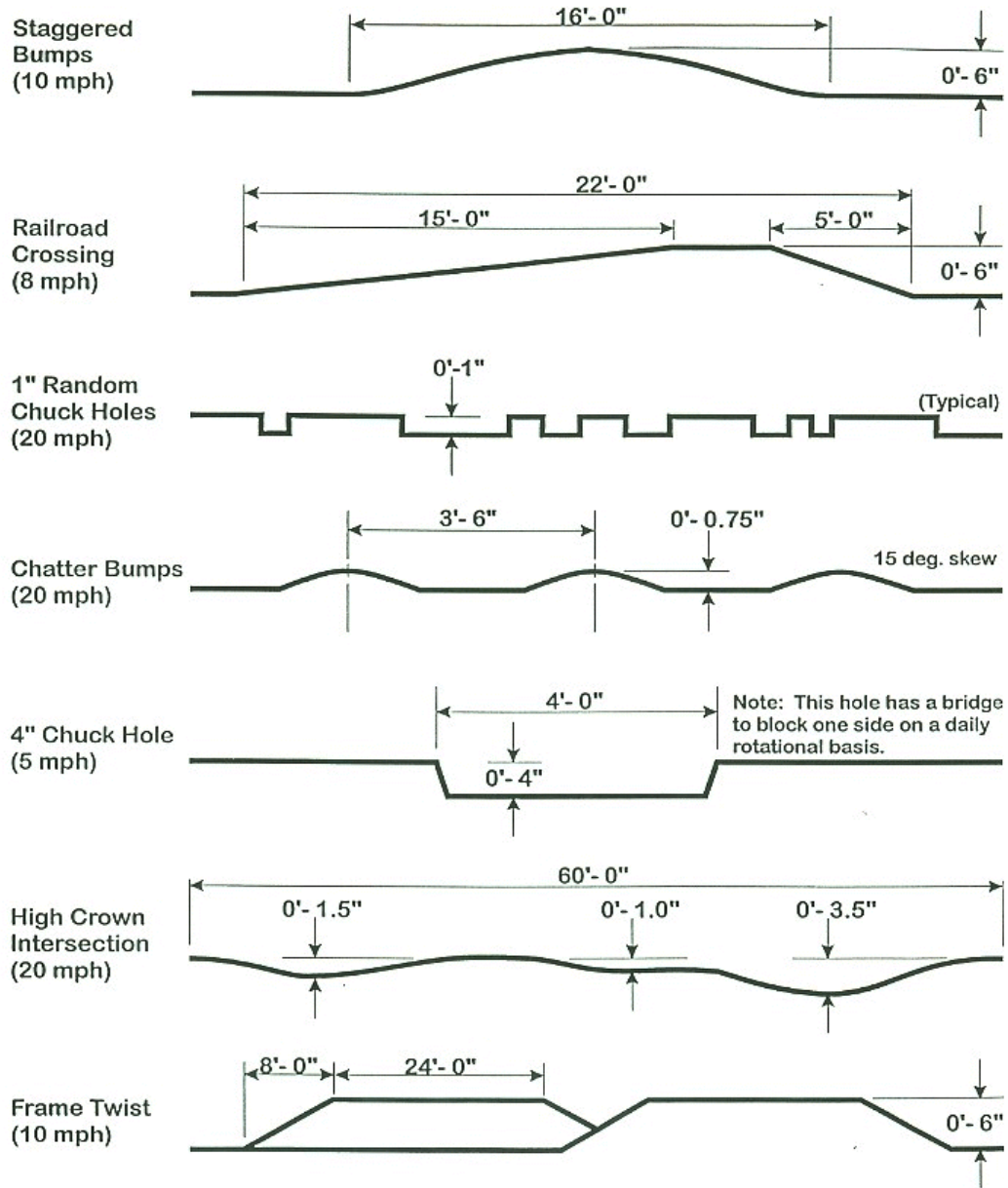
**“PLAN VIEW OF PENN STATE BUS TESTING AND RESEARCH FACILITY”**



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

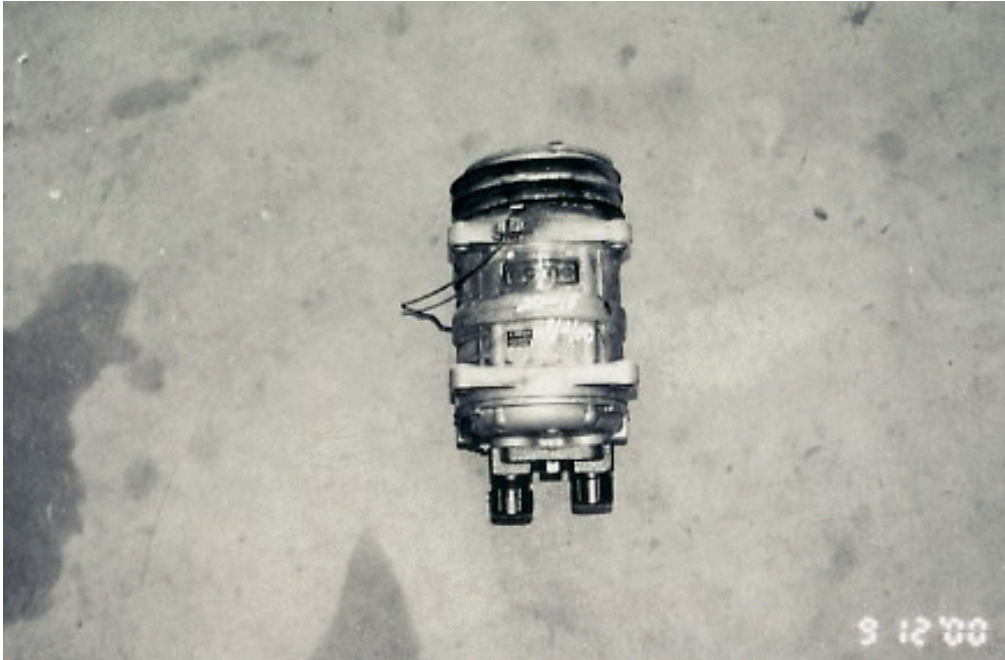
(Page 1 of 2)  
**UNSCHEDULED MAINTENANCE**  
 Champion 2018

<b>DATE</b>	<b>TEST MILES</b>	<b>SERVICE</b>	<b>ACTIVITY</b>	<b>DOWN TIME</b>	<b>HOURS</b>
08-31-00	74	The tailpipe pulled apart.	Reinstalled original equipment. Added additional frame hanger. Installed two sheet metal screws in tail pipe extension.	1.50	1.50
09-13-00	233	Rear A/C compressor clutch burned out.	Warranty work performed. New A/C compressor installed.	3.00	3.00
09-27-00	619	Three body supports are broken on the left side and one on the right side—forward of the rear wheel well.	Broken body supports welded/repared. Twelve inch long square tube installed at each broken support. Two body supports installed on each side.	10.00	10.00
10-03-00	724	The left body rail (rear) is rubbing on the upper shock mount.	Installed additional body mount to frame rail.	1.50	1.50
10-05-00	775	Coolant is leaking from a hole chaffed through the heater hose on the clamp at the cylinder head.	Removed and repaired bad section of hose. Rerouted hose to eliminate chaffing.	1.00	1.00
10-10-00	1,154	The lower eye is broken on the left front shock.	Left front shock replaced.	.50	.50
10-10-00	1,154	The upper fuel tank strap has come off.	Upper fuel tank strap replaced.	.50	.50
10-18-00	2,201	Test bus is disabled on the test track. No electrical power when key is turned on.	Trouble shooting found a blown 50 amp fuse (battery power). Fuse replaced. Repaired shorted wire located to the rear of the upper bulkhead connector behind the coolant surge tank.	2.50	2.50

(Page 2 of 2)  
**UNSCHEDULED MAINTENANCE**  
 Champion 2018

DATE	TEST MILES	SERVICE	ACTIVITY	DOWN TIME	HOURS
10-25-00	3,020	The tail pipe has separated from the exhaust pipe. The hanger is broken.	Reconnected tail pipe and replaced broken hanger.	.50	.50
10-26-00	3,119	Engine cranks but will not start. The fuel lift pump is not running.	Blown 20 amp fuse replaced. Trouble shooting found no cause for blown fuse.	2.00	2.00
11-09-00	3,270	Two body supports located rear of the rear axle and four body supports located forward of the rear axle are cracked.	Cracked body supports welded/repared. Two foot channel installed for reinforcement.	6.00	6.00
11-09-00	3,270	The air tank mounting brackets are broken.	Air tank mounting brackets welded/repared.	1.00	1.00
11-09-00	3,270	The right rear brake caliper seal is leaking.	Warranty work—right rear brake caliper rebuilt.	2.00	2.00
11-13-00	3,521	Both wheelchair lift doors have fallen off. The welds are broken on the lower frame.	Frame secured with self-tapping bolts. Doors reinstalled.	1.00	1.00
11-16-00	4,721	The left front shock is leaking oil.	Replaced the left front shock.	.50	.50
11-21-00	6,012	The front dash panel is loose.	All four missing mounting screws replaced.	.50	.50
11-21-00	6,012	The fuel gauge will not function.	Broken terminal at the tank sending unit repaired.	.50	.50
12-08-00	7,500	The front blower will not function. The speed switch is burned out.	Front blower speed switch replaced.	1.00	1.00

## UNSCHEDULED MAINTENANCE



**REAR A/C COMPRESSOR CLUTCH BURNED OUT  
(233 TEST MILES)**

