

PARTIAL
STURAA TEST
10 YEAR
350,000 MILE BUS
from
SUPREME CORPORATION
MODEL 34' HD CHEVY
DECEMBER 2005
PTI-BT-R0513

PENNSSTATE



The Pennsylvania Transportation Institute

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EXECUTIVE SUMMARY

The Supreme Corporation submitted a model 34' HD Chevy, diesel-powered 33 seat (including the driver) 32-foot bus, for a 10 yr/350,000 mile STURAA test. The odometer reading at the time of delivery was 7,989 miles. Testing started on August 8, 2005 and was completed on November 21, 2005. 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 9, 2005 and was completed on November 17, 2005.

The interior of the bus is configured with seating for 33 passengers including the driver. Free floor space will accommodate 20 standing passengers resulting in a potential capacity of 53 persons. At 150 lbs per person, this load results in a measured gross vehicle weight of 22,890 lbs. The first segment of the Structural Durability Test was performed with the bus loaded to a GVW of 22,890 lbs. The middle segment was performed at a seated load weight of 19,860 lbs and the final segment was performed at a curb weight of 15,070 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.

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-five reported failures, eighteen were Class 3 and seven 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.

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 Supreme Corporation, model 34' HD Chevy. The bus is built on a Chevy 5500 chassis. The bus has a Chevy OEM driver's door and passenger entrance door rear of the front axle and a dedicated handicap entrance located rear of the rear axle which is equipped with a Braun Corp. model L917F1B handicap lift. Power is provided by a diesel-fueled, Duramax Diesel model 6.6 V8 engine coupled to an Allison model 2200 Series transmission.

The measured curb weight is 5,770 lbs for the front axle and 9,300 lbs for the rear axle. These combined weights provide a total measured curb weight of 15,070 lbs. There are 33 seats including the driver and room for 20 standing passengers bringing the total passenger capacity to 53. Gross load is $150 \text{ lb} \times 53 = 7,950 \text{ lbs}$. At full capacity, the measured gross vehicle weight is 22,890 lbs.

VEHICLE DATA FORM

Bus Number: 0513	Arrival Date: 8-1-05
Bus Manufacturer: Supreme Corporation	Vehicle Identification Number (VIN): 1GBJ5F1193F515505
Model Number: 34' HD Chevy	Date: 8-1-05
Personnel: T.S., & S.C.	Chassis: Chevy 5500

WEIGHT:

Individual Wheel Reactions:

Weights (lb)	Front Axle		Middle Axle		Rear Axle	
	Right	Left	Right	Left	Right	Left
CW	2,860	2,910	N/A	N/A	4,780	4,520
SLW	3,220	3,410	N/A	N/A	6,480	6,750
GVW	3,540	3,750	N/A	N/A	7,590	7,910

Total Weight Details:

Weight (lb)	CW	SLW	GVW	GAWR
Front Axle	5,770	6,630	7,290	8,000
Middle Axle	N/A	N/A	N/A	N/A
Rear Axle	9,300	13,230	15,600	18,700
Total	15,070	19,860	22,890	GVWR: 26,000

Dimensions:

Length (ft/in)	23 / 5.0
Width (in)	121.5
Height (in)	96.0
Front Overhang (in)	36.0
Rear Overhang (in)	113.5
Wheel Base (in)	239.5
Wheel Track (in)	Front: 83.8
	Rear: 74.9

Bus Number: 0513	Date: 8-1-05
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CLEARANCES:

Lowest Point Outside Front Axle	Location: Stabilizer bar	Clearance(in): 13.0
Lowest Point Outside Rear Axle	Location: Tailpipe	Clearance(in): 13.0
Lowest Point between Axles	Location: Exhaust pipe	Clearance(in): 13.8
Ground Clearance at the center (in)	13.8	
Front Approach Angle (deg)	25.3	
Rear Approach Angle (deg)	7.5	
Ramp Clearance Angle (deg)	6.6	
Aisle Width (in)	18.4	
Inside Standing Height at Center Aisle (in)	78.9	

BODY DETAILS:

Body Structural Type	Integral		
Frame Material	Steel		
Body Material	Fiberglass (composite)		
Floor Material	Plywood		
Roof Material	Fiberglass (composite)		
Windows Type	<input type="checkbox"/> Fixed	<input checked="" type="checkbox"/> Movable	
Window Mfg./Model No.	Safety DOT 269 / ASE M282		
Number of Doors	<u> 1 </u> Front	<u> 1 </u> Rear	<u> 1 </u> Handicap
Mfr. / Model No.	Supreme Corp. / DZ5		
Dimension of Each Door (in)	Front– 31.4 x 90.9	Rear – 32.2 x 57.9 Handicap – 46.7 x 70.6	
Passenger Seat Type	<input checked="" type="checkbox"/> Cantilever	<input checked="" type="checkbox"/> Pedestal	<input type="checkbox"/> Other (explain)
Mfr. / Model No.	Freedom Seating Co. / S217		
Driver Seat Type	<input type="checkbox"/> Air	<input type="checkbox"/> Spring	<input checked="" type="checkbox"/> Other (explain)
Mfr. / Model No.	Freedom Seating Co. / S156		
Number of Seats (including Driver)	33		

Bus Number: 0513	Date: 8-1-05
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BODY DETAILS (Contd..)

Free Floor Space (ft ²)	30.7				
Height of Each Step at Normal Position (in)	Front	1. <u>12.7</u>	2. <u>8.0</u>	3. <u>8.0</u>	4. <u>8.5</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.	Duramax Diesel / 6.6 V8			
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"/> Carburetion	
Fuel Injector Mfr. / Model No.	Duramax Diesel / 6.6 V8			
Carburetor Mfr. / Model No.	N/A			
Fuel Pump Mfr. / Model No.	Duramax Diesel / 6.6 V8			
Alternator (Generator) Mfr. / Model No.	Delphi / AD244			
Maximum Rated Output (Volts / Amps)	Not available.			
Air Compressor Mfr. / Model No.	N/A			
Maximum Capacity (ft ³ / min)	N/A			
Starter Type	<input checked="" type="checkbox"/> Electrical		<input type="checkbox"/> Pneumatic	<input type="checkbox"/> Other (explain)
Starter Mfr. / Model No.	Denso / 12V 4KW			

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TRANSMISSION

Transmission Type	<input type="checkbox"/> Manual	<input checked="" type="checkbox"/> Automatic	
Mfr. / Model No.	Allison Transmission / 2200 Series		
Control Type	<input checked="" type="checkbox"/> Mechanical	<input type="checkbox"/> Electrical	<input type="checkbox"/> Other
Torque Converter Mfr. / Model No.	Allison Transmission / 2200 Series		
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.	Meritor / MFS08153BNN12		
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.	GM / 15174898		
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.	Spicer / 19060S		
Axle Ratio (if driven)	4:88		
Suspension Type	<input type="checkbox"/> Air	<input checked="" type="checkbox"/> Spring	<input checked="" type="checkbox"/> Other (Mor-Ride)
No. of Shock Absorbers	2		

Mfr. / Model No.	GM / 15174903
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WHEELS & TIRES

Front	Wheel Mfr./ Model No.	Accuride / 19.5
	Tire Mfr./ Model No.	Michelin XZE / 245/70R 19.5
Rear	Wheel Mfr./ Model No.	Accuride /19.5
	Tire Mfr./ Model No.	Michelin XZE / 245/70R 19.5

BRAKES

Front Axle Brakes Type	<input type="checkbox"/> Cam	<input checked="" type="checkbox"/> Disc	<input type="checkbox"/> Other (explain)
Mfr. / Model No.	Dayton / 15"		
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.	Dayton / 15"		
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)	2 @ 65,000		
Mfr. / Model No.	General Motors Corp / NA		
Air Conditioner	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No	
Location	Front – dash Rear - ceiling		
Capacity (Btu/hr)	88,000		
A/C Compressor Mfr. / Model No.	Delphi / 15068284	ICE / 2521195	

STEERING

Steering Gear Box Type	Hydraulic gear
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Mfr. / Model No.	ZF / 15178827
Steering Wheel Diameter	15.5
Number of turns (lock to lock)	3.5

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OTHERS

Wheel Chair Ramps	Location: N/A	Type: N/A
Wheel Chair Lifts	Location: Right rear	Type: Platform lift
Mfr. / Model No.	The Braun Corp. / L917F1B	
Emergency Exit	Location: Windows Roof hatch Doors	Number: 4 1 2

CAPACITIES

Fuel Tank Capacity (units)	60 gals
Engine Crankcase Capacity (gallons)	3.65
Transmission Capacity (gallons)	8.75
Differential Capacity (gallons)	4.0
Cooling System Capacity (quarts)	6.8
Power Steering Fluid Capacity (quarts)	17.5

COMPONENT/SUBSYSTEM INSPECTION FORM

Bus Number: 0513	Date: 8-1-05
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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		Gasket leaking at engine oil fill tube.
Accessories		
Lift System		Platform lift.
Interior Fasteners		
Batteries		

CHECK - IN



SUPREME CORPORATION'S MODEL 34' HD CHEVY



CHECK - IN CONT.



**SUPREME CORPORATION'S
MODEL 34" HD CHEVY EQUIPPED WITH A BRAUN MODEL
L917F1B HANDICAP LIFT**

(Page 1 of 2)
SCHEDULED MAINTENANCE
 Supreme Corporation 0513

DATE	TEST MILES	SERVICE	ACTIVITY	DOWN TIME	HOURS
08-19-05	1,443	P.M. / Inspection	Linkage, tie rods, universals/u-joints all lubed; all fluids checked.	4.00	4.00
08-30-05	2,381	P.M. / Inspection	Linkage, tie rods, universals/u-joints all lubed; all fluids checked.	4.00	4.00
09-02-05	3,159	P.M. / Inspection	Linkage, tie rods, universals/u-joints all lubed; all fluids checked.	4.00	4.00
09-23-05	4,097	P.M. / Inspection	Linkage, tie rods, universals/u-joints all lubed; all fluids checked.	4.00	4.00
10-11-05	5,205	P.M. / Inspection	Linkage, tie rods, universals/u-joints all lubed; all fluids checked.	4.00	4.00
10-14-05	6,276	P.M. / Inspection	Linkage, tie rods, universals/u-joints all lubed; all fluids checked.	4.00	4.00
10-24-05	7,500	P.M. / Inspection	Linkage, tie rods, universals/u-joints all lubed; all fluids checked.	4.00	4.00

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SCHEDULED MAINTENANCE
 Supreme Corporation 0513

DATE	TEST MILES	SERVICE	ACTIVITY	DOWN TIME	HOURS
10-31-05	1,443	P.M. / Inspection	Linkage, tie rods, universals/u-joints all lubed; all fluids checked.	4.00	4.00
11-07-05	2,381	P.M. / Inspection	Linkage, tie rods, universals/u-joints all lubed; all fluids checked.	4.00	4.00
11-09-05	3,159	P.M. / Inspection	Linkage, tie rods, universals/u-joints all lubed; all fluids checked.	4.00	4.00
11-14-05	4,097	P.M. / Inspection	Linkage, tie rods, universals/u-joints all lubed; all fluids checked.	4.00	4.00
11-17-05	5,205	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 eighteen Class 3 failures, 5 involved the suspension system, exhaust system and engine/transmission each, 2 with tires and 1 occurred in the brake system. These, and the remaining seven Class 4 failures are available for review in the Unscheduled Maintenance List, located in Section 5.7 Structural Durability.

RELIABILITY DATA FORMS

Bus Number: 0513	Date: 11-17-05
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		1,319			0.50	8.00
	1,604				0.50	8.00
	2,872				2.00	8.00
		3,752			2.50	56.00
		3,795			3.00	8.00
		5,581			2.50	5.00
		5,676			2.50	6.00
Exhaust System	434				1.00	3.00
		697			1.50	8.00
		1,648			1.00	8.00
		2,688			1.00	6.00
		3,752			0.50	1.00
		9,535			1.00	2.00
Engine/Transmission		1,220			1.00	2.00
		2,645			0.50	72.00
		2,688			4.00	168.00
		8,706			0.50	2.00
		10,280			0.50	2.00

RELIABILITY DATA FORMS

Bus Number: 0513	Date: 11-17-05
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
Wheels/Tires		4,904			0.50	0.50
		11,250			1.00	4.00
Windows/Lights	4,904				0.50	0.50
	4,904				0.25	0.25
Brakes		6,019			0.50	8.00
Body	9,535				1.00	1.00
Steering	9,774				2.00	2.00

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: 0513	Date: 11-21-05
Personnel: B.S. & S.C.	

Temperature (°F): 37	Humidity (%): 75
Wind Direction: Calm	Wind Speed (mph): Calm
Barometric Pressure (in.Hg): 29.94	

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

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 11,250 miles; approximately 8,750 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 4,625 miles with the bus operated at GVW. The second segment will consist of approximately 2,000 miles with the bus operated at SLW. The remainder of the test, approximately 4,625 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 9, 2005 and was conducted until November 17, 2005. The first 4,625 miles were performed at a GVW of 22,890 lbs. and completed on October 10, 2005. The next 2,000 mile SLW segment was performed at 19,860 lbs and completed on October 21, 2005, and the final 4,625 mile segment was , performed at a CW of 15,070 lbs and completed on November 17, 2005.

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 measurement of the different conditions. Finally, photographs illustrating some of the failures that were encountered during the Structural Durability Test are included.

SUPREME - TEST BUS #0513
MILEAGE DRIVEN/RECORDED FROM DRIVERS= LOGS

DATE	TOTAL DURABILITY TRACK	TOTAL OTHER MILES	TOTAL
08/08/05 TO 08/14/05	185.00	157.00	342.00
08/15/05 TO 08/21/05	842.00	135.00	977.00
08/22/05 TO 08/28/05	708.00	33.00	741.00
08/29/05 TO 09/04/05	477.00	123.00	600.00
09/05/05 TO 09/11/05	26.00	2.00	28.00
09/12/05 TO 09/18/05	0.00	0.00	0.00
09/19/05 TO 09/25/05	538.00	306.00	844.00
09/26/05 TO 10/02/05	41.00	222.00	263.00
10/03/05 TO 10/09/05	657.00	32.00	689.00
10/10/05 TO 10/16/05	946.00	167.00	1113.00
10/17/05 TO 10/23/05	705.00	211.00	916.00
10/24/05 TO 10/30/05	786.00	349.00	1135.00
10/31/05 TO 11/06/05	1152.00	51.00	1203.00
11/07/05 TO 11/13/05	1181.00	155.00	1336.00
11/14/05 TO 11/20/05	506.00	558.00	1064.00
TOTAL	8750.00	2501.00	11251.00

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	

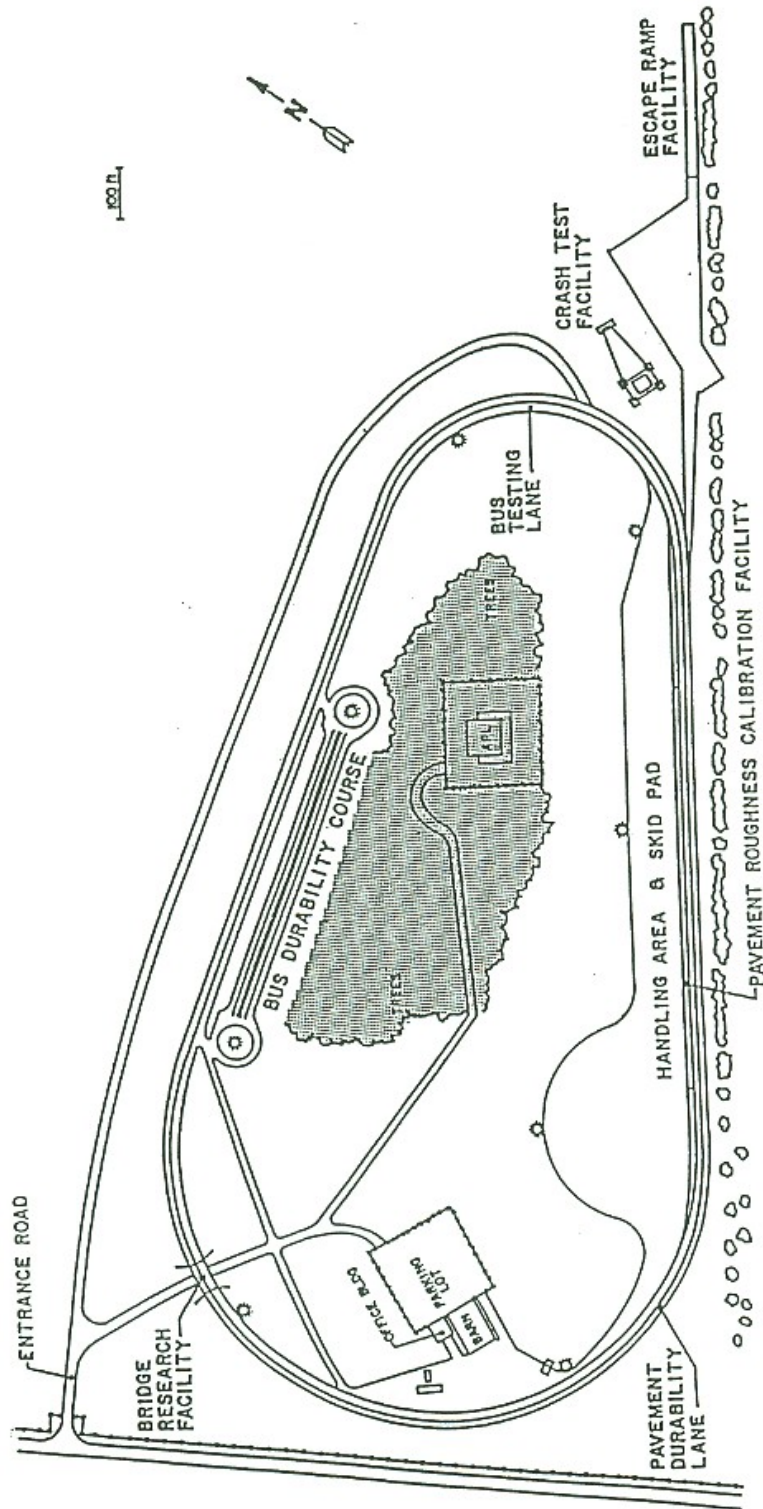
B—Break

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

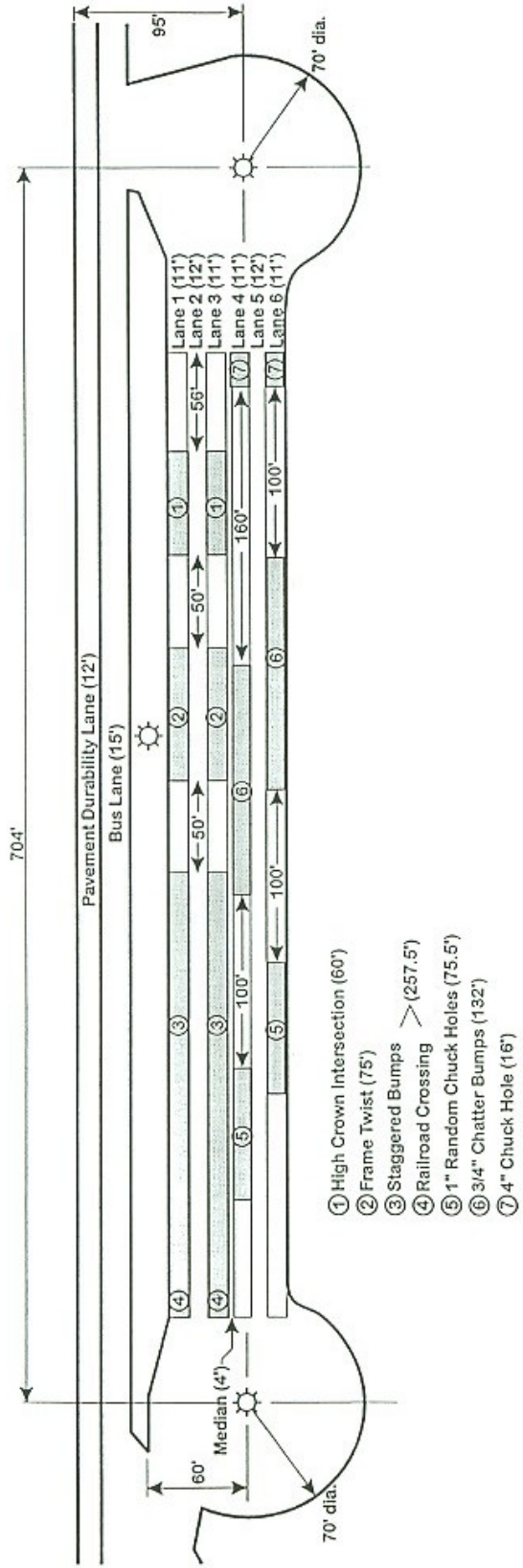
D—Drive bus as specified by procedure

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

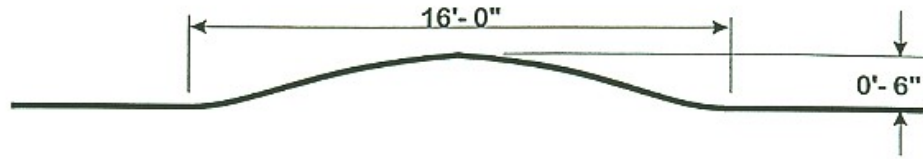


Plan View

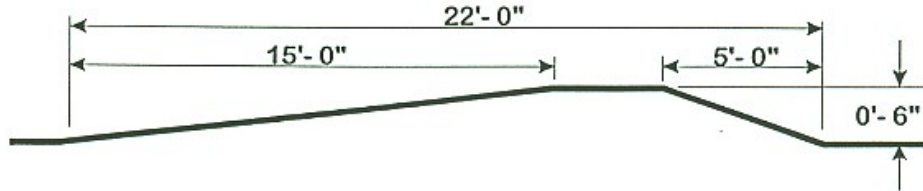
Vehicle Durability Test Track

The Pennsylvania Transportation Institute
Penn State

Staggered
Bumps
(10 mph)



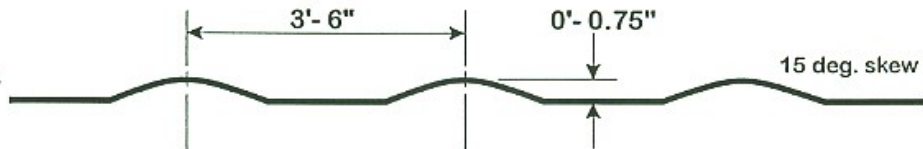
Railroad
Crossing
(8 mph)



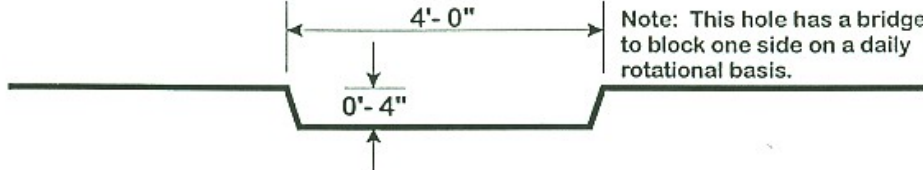
1" Random
Chuck Holes
(20 mph)



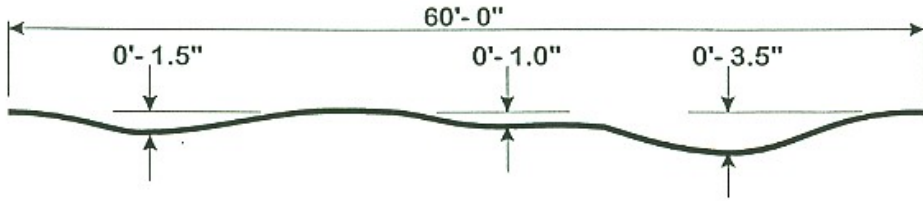
Chatter Bumps
(20 mph)



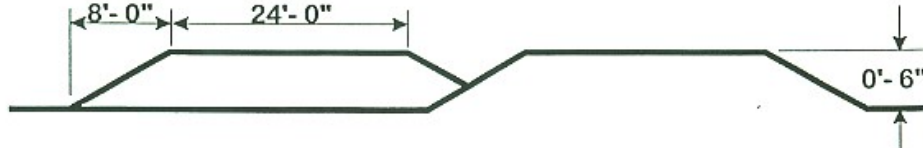
4" Chuck Hole
(5 mph)



High Crown
Intersection
(20 mph)



Frame Twist
(10 mph)



Durability Element Profiles

The Pennsylvania Transportation Institute
Penn State

(Page 1 of 2)
UNSCHEDULED MAINTENANCE
 Supreme 0513

DATE	TEST MILES	SERVICE	ACTIVITY	DOWN TIME	HOURS
08-15-05	434	The tail pipe is loose.	Replaced broken hanger.	3.00	1.00
08-17-05	697	The flange is broken on the drop pie from the engine to the muffler.	Broken flange on drop pipe welded/repared.	8.00	1.50
08-19-05	1,220	The vacuum pump is inoperative.	Replaced vacuum pump.	2.00	1.00
08-22-05	1,319	Three bolts are missing from the left rear spring isolator on the frame side.	Aligned isolator and installed new bolts and nuts.	8.00	0.50
08-24-05	1,604	The left front shock is leaking oil at the bottom stud.	Left front shock replaced.	8.00	0.50
08-25-05	1,648	The flange is broken on the pipe to the exhaust manifold.	Replaced pipe. Note: the new design pipe has a brace added that is anchored to the right side bell housing.	8.00	1.00
09-02-05	2,645	The engine accessory belt is torn.	Replaced engine accessory belt.	72.00	0.50
09-19-05	2,688	Transmission will not shift properly.	Warranty dealer replaced failed speed sensor harness.	168.00	4.00
09-20-05	2,688	The flange is broken on the pipe to the exhaust manifold.	Flange welded/repared.	6.00	1.00
09-21-05	2,872	The right front shock is leaking oil at the lower stud.	Right front shock replaced.	8.00	2.00
09-28-05	3,752	The lower spring leaf is broken on the right rear spring.	Right rear spring assembly replaced.	56.00	2.50
09-28-05	3,752	The tailpipe hanger bracket is broken at the weld on the frame.	Replaced hanger.	1.00	0.50

(Page 2 of 2)
UNSCHEDULED MAINTENANCE
 Supreme 0513

DATE	TEST MILES	SERVICE	ACTIVITY	DOWN TIME	HOURS
10-03-05	3,795	The top leaf of the left rear spring beam is broken.	Replaced spring beam.	8.00	3.00
10-11-05	4,904	The right front tire is flat.	Plugged right front tire.	0.50	0.50
10-11-05	4,904	One emergency window latch left side and on right side are broken	Replaced both latches.	0.50	0.50
10-11-05	4,904	Left side brake lights are burned out.	Replaced left side brake lamps.	0.25	0.25
10-14-05	5,581	The second and third leaves are broken on the right rear spring.	Replaced spring beam.	5.00	2.50
10-17-05	5,676	The second leaf is broken on the left rear spring beam.	Replaced spring beam.	6.00	2.50
10-20-05	6,019	The brake booster pump will not shut down.	Replaced failed relay.	8.00	0.50
11-04-05	8,706	Accessory belt is broken.	Replaced accessory belt.	2.00	0.50
11-09-05	9,535	The flange is broken on the exhaust drop pipe.	Welded/repared flange.	2.00	1.00
11-09-05	9,535	The body seam in the driver's are has nine missing fasteners.	Replaced nine missing fasteners in body seam at driver's area.	1.00	1.00
11-10-05	9,774	The steering link ends are worn.	Steering link replaced.	2.00	2.00
11-14-05	10,280	The under-seat heater is leaking coolant.	Removed and bypassed the heater.	2.00	0.50
11-17-05	11,250	The right rear inside tire is flat.	Replaced right rear inside tire.	4.00	1.00

UNSCHEDULED MAINTENANCE



**FAILED VACUUM PUMP
(1,220 TEST MILES)**



**BROKEN FLANGE ON PIPE TO EXHAUST MANIFOLD
(1,648 TEST MILES)**

UNSCHEDULED MAINTENANCE CONT.



**TORN ENGINE ACCESSORY BELT
(2,645 TEST MILES)**



**BROKEN RIGHT REAR LEAF SPRING
(3,752 TEST MILES)**

UNSCHEDULED MAINTENANCE CONT.



**BROKEN TOP LEAF ON THE LEFT
REAR SPRING BEAM
(3,795 TEST MILES)**



**WORN STEERING LINK
(9,774 TEST MILES)**

UNSCHEDULED MAINTENANCE CONT.



**LEAKING UNDER-SEAT HEATING UNIT
(10,280 TEST MILES)**

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Data\Microsoft\Templates\Normal.dot
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Author: Sondra Hoover
Keywords:
Comments:
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As of Last Complete Printing
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