

**HEAVY-DUTY ARTICULATED 500,000-MILE BUS  
WITH A MINIMUM SERVICE LIFE OF  
12 YEARS**

**5. STRUCTURAL INTEGRITY**

**5.4 STRUCTURAL STRENGTH AND DISTORTION TESTS –  
5.5 DYNAMIC TOWING TEST**

APRIL 2006

## ABBREVIATIONS

ABTC	- Altoona Bus Test Center
A/C	- air conditioner
ADB	- advance design bus
CBD	- central business district
CI	- compression ignition
CNG	- compressed natural gas
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)
FTA	- Federal Transit Administration
GAWR	- gross axle weight rating
GL	- gross 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
hr	- hour
LNG	- liquefied natural gas
mpg	- miles per gallon
mph	- miles per hour
NBM	- new bus models
PSBRTF	- Penn State Bus Research and Testing Facility
PTI	- Pennsylvania Transportation Institute
rpm	- revolutions per minute
SAE	- Society of Automotive Engineers
SCF	- standard cubic feet
SCFM	- standard cubic feet per minute
SCH	- test scheduler
SEC	- secretary
SI	- spark ignition
SLW	- seated load weight (curb weight plus 150 lb for every designed passenger seating position and for the driver)
TD	- test driver
TM	- track manager
TP	- test personnel

#### 5.4-I. TEST OBJECTIVE

The objective of this test is to verify the integrity of the towing fixtures and determine the feasibility of towing the bus using a heavy-duty wrecker and specified procedures.

#### 5.4-II. TEST DESCRIPTION

This test requires the bus be towed at curb weight using a heavy-duty wrecker and the specified equipment and instructions provided by the manufacturer. The bus will be towed for 5 miles at a speed of 20 mph for each recommended towing configuration. After releasing the bus from the wrecker, the bus will be visually inspected for any structural damage or permanent deformation. All doors, windows and passenger escape mechanisms will be inspected for proper operation.

#### 5.4-III. TEST ARTICLE

The test article is a heavy-duty transit bus with a minimum service life of 12 years or 500,000 mi.

#### 5.4-IV. TEST EQUIPMENT/FACILITIES/PERSONNEL

This test will be performed on the track at the PSBRTF. The following test equipment and personnel are required for this test:

1. Heavy-duty wrecker.
2. Manufacturer supplied towing equipment.
3. Test driver (TD).
4. Test personnel (TP).

#### 5.4-V. TEST DATA

The test data consist of the Dynamic Towing Test Data Form. Upon completion of this test, data shall be forwarded to the ABTC manager.

#### 5.4-VI. TEST PREPARATION AND PROCEDURES

Detailed test preparation and procedures are listed in procedure 5.4-1. This section also includes Dynamic Towing Test Data Form - 5.4.

**DETAILED TEST PROCEDURES****TITLE: 5. Structural Integrity****Procedure 5.4-1****NOMENCLATURE: 5.4 Structural Strength and Distortion Tests - Dynamic Towing Test**

<b>OPER STEP</b>	<b>ACTION BY</b>	<b>TEST PREPARATION AND PROCEDURE</b>
1	TP	Record bus number on the data form. Retrieve the Work Order Form for this test.
2	TP/TD	Attach provided towing fixture to test bus as specified per manufacturer's instructions. Note any difficulty on test data sheet. Photograph fixture as attached (close-up).
3	TP/TD	Attach towing fixture to heavy-duty wrecker and, if required, raise the front wheels of the coach to a height suitable for towing. Note any difficulty on Dynamic Towing Test Data Form. Photograph bus prepared for towing (side view).
4	TP	Remove drive axle shafts or disconnect drive shaft as per manufacturer's recommendations. Ensure brakes are released as per manufacturer's recommendations before towing.
5	TD	Tow bus at a speed of 20 mph for a total of five laps around bus test lane.
6	TP	Repeat steps 2 thru 5 for all other manufacturer recommended towing conditions.
7	TP	Replace drive axle or reconnect drive shaft.
8	TD	Release bus from wrecker.
9	TP/TD	Visually inspect coach for structural damage or permanent deformation.
10	TP/TD	Operate all doors, windows, and escape mechanisms to verify normal operation. Record any malfunctions or damage on test data sheet.
11	TP	File completed Dynamic Towing Test Data Form and Work Order Form.

## REVISIONS

All revisions to this test must be identified on this page.  
Briefly describe each revision in the space provided below.

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Revision	Description	Date	Approval
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## DYNAMIC TOWING TEST DATA FORM

Bus Number:	Date:
Personnel:	

Temperature (EF):	Humidity (%):
Wind Direction:	Wind Speed (mph):
Barometric Pressure (in.Hg):	

Inspect tow equipment-bus interface.
Comments:
Inspect tow equipment-wrecker interface.
Comments:
Towing Comments:
Description and location of any structural damage:
General Comments: