

# FEDERAL TRANSIT BUS TEST

Performed for the Federal Transit Administration U.S. DOT  
In accordance with 49 CFR, Part 665

## Altoona Bus Testing and Research Center Test Bus Procedure

### 3.1 SAFETY-A DOUBLE-LANE CHANGE (OBSTACLE AVOIDANCE TEST)

Pass/Fail  
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## 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
LTI	Larson Transportation Institute
mpg	Miles per gallon
mph	Miles per hour
NBM	New bus models
PSTT	Penn State Test Track
rpm	Revolutions per minute
SAE	Society of Automotive Engineers
SCF	Standard cubic feet
SCFM	Standard cubic feet per minute
SCH	Test scheduler
SA	Staff Assistant
SI	Spark ignition
SLW	Seated load weight (curb weight plus 150 lb. for every designated passenger seating position and for the driver)
TD	Test driver
TM	Track manager
TP	Test personnel

### **3.1-I. TEST OBJECTIVE**

The objective of this test is to determine handling and stability characteristics of the bus by measuring the forward speed through a double lane change, obstacle avoidance, maneuver.

### **3.1-II. TEST DESCRIPTION**

The Safety Test consists of performing an obstacle avoidance maneuver to evaluate the handling and stability characteristics of a bus. The test is conducted at the PSTT on the vehicle dynamics pad. The bus will be driven through a double-lane change course at increasing speeds until the test driver or test personnel determines it is unsafe or a speed of 45 mph is reached. The test will be determined unsafe if the vehicle handling becomes unstable or if any of the tires break contact with the pavement surface.

The layout of the test course will be defined by placing pylons along painted guide lines. The guide lines will mark off two 12 ft. center to center lanes with two 80 or 100 ft. gates, 80 or 100 ft. apart. The bus will enter the test course in one lane, crossover to the other lane within the 80 or 100 ft. gate spacing, travel for, 80 or 100 ft. and then return to the original lane within the next 80 or 100 ft. gate. This maneuver will be performed standing from both the right-hand and left-hand lanes. The layout of the test course is illustrated in Figure 3.1.

A test run is considered valid if the bus is able to perform the maneuver at a constant speed without deviating from the test course or striking pylons. If the test driver is not able to successfully complete the maneuver because of vehicle instability, the test will be halted. The highest speed, up to a maximum of 45 mph, at which the maneuver can be successfully performed will be recorded on the Safety Data Form.

### **3.1-III. TEST ARTICLE**

The test article is a transit bus with a minimum service life of 4, 5,7,10 or 12 years.

### **3.1-IV. TEST EQUIPMENT/FACILITIES/PERSONNEL**

1. Test Equipment
  - a. Non-contacting speed and distance measurement system
  - b. Ballast to simulate passenger loading to SLW
  - c. Video Camera
2. Test Facility – The test site is located at the PSTT on the vehicle dynamics area. The test site must meet the following conditions:
  - a. Dry and free of extraneous surface material
  - b. Free of interfering traffic
  - c. Wind speed gusts less than 12 mph
  - d. Ambient temperature between 30°F and 90°F

The test site will have two lanes with a 12 ft. center-to-center distance. The test course will be marked with pylons and painted lines as illustrated in Figure 3.1

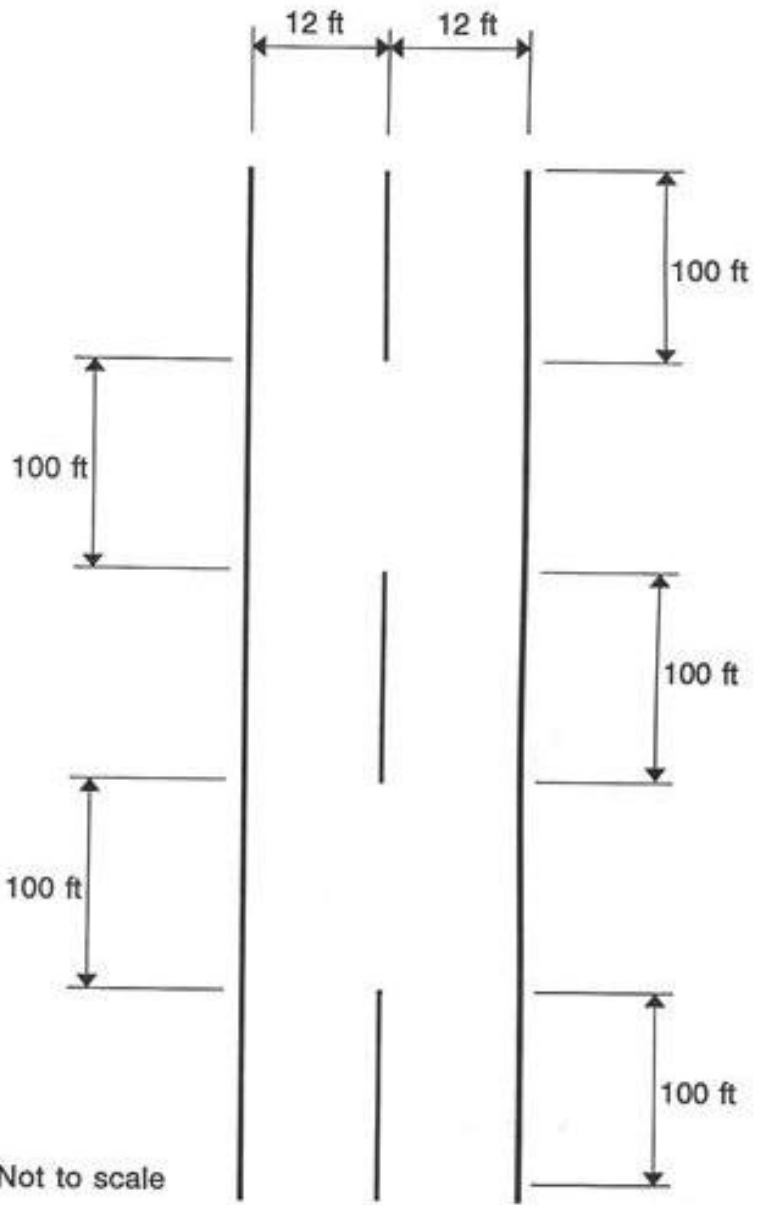
3. Test Personnel – This test requires the following personnel:
  - a. Test Driver (TD)
  - b. Test personnel (TP)

### **3.1-V. TEST DATA**

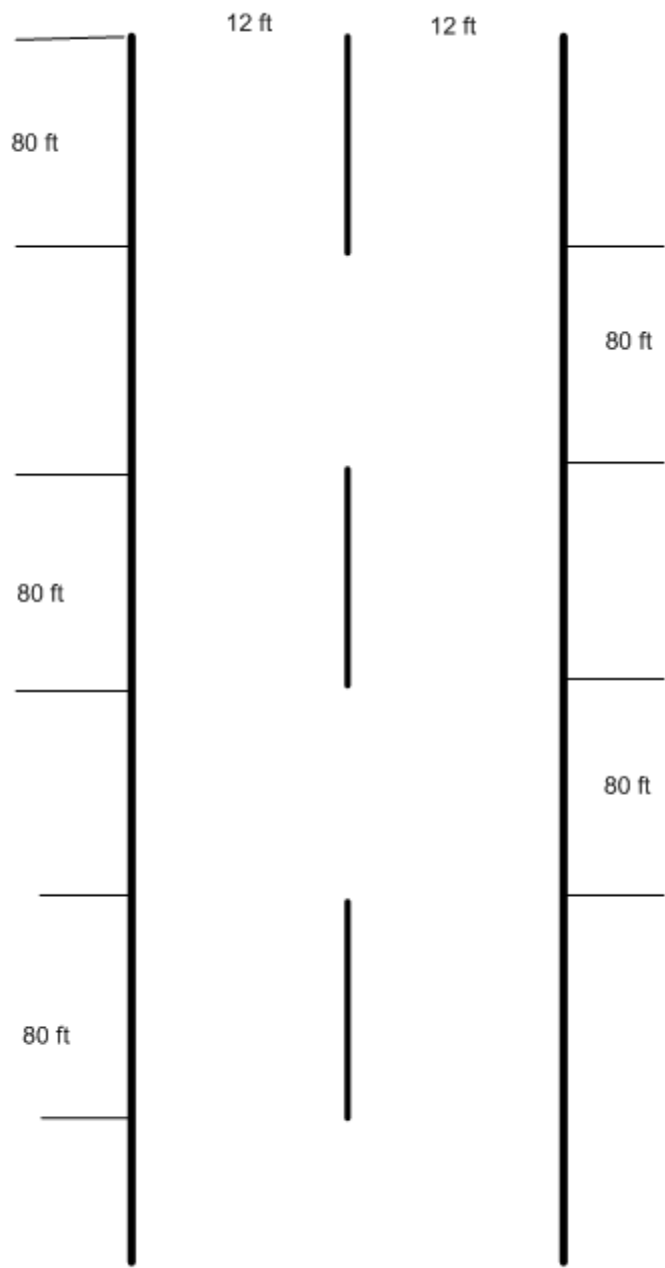
The test data will consist of the attached Safety Data Form. Fill out all forms with a pen. Upon completion of this test, data shall be forwarded to the ABTC manager.

### **3.1-VI. TEST PREPARATION AND PROCEDURES**

The detailed test preparation and procedures are listed in Procedure 3-1 and 3-2. This section also includes Safety Data Form – 3.



NOTE: Not to scale



Note: Not to scale

Figure 3.1. Double lane change test course.

<b>DETAILED TEST PROCEDURES</b>		<b>TITLE: Safety – A Double-Lane Change</b>
<b>Procedure 3.1-1</b>	<b>NOMENCLATURE: 3.1 Safety – A Double-Lane Change (Obstacle Avoidance Test)</b>	
<b>OPER STEP</b>	<b>ACTION BY</b>	<b>TEST PREPARATION AND PROCEDURE</b>
1	TP	Use pen on all forms.
2	TP	Record the bus number, date, and persons performing the test on the data sheet.
3	TD	Fill the fuel tanks
4	TD	Insure that all tires are properly inflated.
5	TP	Install the speed measuring system on the bus. Install speed indicator in the front of the bus so it is visible to the test driver.
6	TP	Insure that the bus is loaded to SLW minus the weight of TD and equipment.
7	TP	Set up video equipment so that the tire-ground contact patch and the position of the bus can be seen during lane changeover.
8	TD	Drive the bus at least three times around the PSTT test track at approximately 45 mph.
9	TP	Make sure the road surface is dry and clean. If not, delay the test until such time that conditions are acceptable.
10	TP	Verify the proper configuration of test course and the correct placement of pylons (see Figure 3.1).
11	TP	Confirm that all preparations have been completed properly.
12	TP	Videotape lane change at an approximately 30 degree angle from the test site at a distance sufficient to capture the tire-ground contact patch as well as the entire bus. Keep personnel at a safe distance from running vehicle.

<b>DETAILED TEST PROCEDURES</b>		<b>TITLE: Safety – A Double-Lane Change</b>
<b>Procedure 3.1-1</b>	<b>NOMENCLATURE: 3.1 Safety – A Double-Lane Change (Obstacle Avoidance Test)</b>	
<b>OPER STEP</b>	<b>ACTION BY</b>	<b>TEST PREPARATION AND PROCEDURE</b>
13	TD	Begin in the right lane at 20 mph (as indicated by the speed indicator) and perform the double-lane change maneuver to the left lane and back as marked off by the pylons. Maintain constant speed (+1 mph) throughout the maneuver.
14	TD	Once through the lane change course, safely proceed around the track and return to the beginning of the course at a speed increase of 5 mph from the previous run.
15	TD	Repeat steps 1 and 2 with speed increase of 5 mph until the maneuver is determined to be unsafe by TD and TP or a speed of 45 mph is achieved successfully.  NOTE: Do not perform this maneuver at unsafe speeds. The maximum safe speed will be determined by the TD in concurrence with TP.
16	TP	Record the maximum safe speed for the double-lane change to the left on the Safety Data Form.
17	TD	Repeat steps 1 through 3 beginning in the left lane and performing the double-lane change to the right lane and back.
18	TP	Record the maximum safe speed for the double-lane change to the right on the Safety Data Form.
19	TP	Remove all test instrumentation not required for further testing.
20	TP	Sign the Safety Data Form to indicate completion, including comments on handling braking.
21	TP	File the completed Performance Data Sheet and Work Order Form.