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TEST PROCEDURE SUMMARY

TEST BUS CHECK-IN

I. OBJECTIVE

The objective of the Check-In procedure is to document the "as arrived" condition and configuration of the new model bus. This includes recording the bus weights, dimensions and relevant vehicle information on the Vehicle Data Form. An inventory of all spare parts, special tools and service manuals delivered with bus is compiled and included with the data from this section.

The Check-In procedure is completed prior to the commencement of testing.

II. TEST DESCRIPTION

The test consist of assigning a 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 a component inspection, and performing the manufacturer's recommended preventive maintenance. All relevant vehicle information and specifications will be recorded on the Vehicle Data Form. Finally, the various components and subsystems will be inspected for leaks, cracks, alignment, etc. to ensure that the bus is ready to begin testing. The bus manufacturer must certify that the bus meets all Federal regulations.

III. TEST DATA

The test data consist of the Vehicle Data Form and the Bus Component Inspection Form. Copies of all records shall be forwarded to the Altoona Bus Testing Center manager.

IV. TEST PREPARATION AND PROCEDURES

The detailed check-in procedures are provided in the check-in section of the Procedures document. This section also includes Vehicle Data Form and Bus Safety Inspection Form.

1.1 INSPECT FOR ACCESSIBILITY

1.1-I. TEST OBJECTIVE

The objective of this test is to check the general accessibility of components and subsystems. Items that are checked are typically ones that would normally require maintenance or repair during transit service.

1.1-II. TEST DESCRIPTION

Accessibility of components and subsystems will be checked, and where accessibility is restricted or limited then that particular subsystem or components is noted along with the reason for the inaccessibility.

1.1-III TEST DATA

The test data consist of the accessibility comments section of the Work Order Forms from all scheduled and unscheduled maintenance and repair. Test data also includes the Accessibility Data Form.

Copies of all records shall be forwarded to the Altoona Bus Testing Center manager.

1.1-IV. TEST PREPARATION AND PROCEDURE

The detailed test procedures are listed in procedure 1.1-1.

1.2 MAINTAINABILITY

1.2-I. TEST OBJECTIVE

The objective of this test is to compile all maintenance data regarding the servicing, preventive maintenance, and repair of buses being tested.

1.2.-II. TEST DESCRIPTION

The test will be conducted by operating the bus during the testing period and collecting the following data on Work Order Forms and a Driver Log.

a. Bus number
b. Date
c. Mileage
d. Detailed description of malfunction
e. Repair action and parts used
f. Man-hours required

The bus will be operated in 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. Oil and filter change

C. Periodic Repairs
1. Brake reline
2. Transmission change
3. Engine change
4. Windshield wiper motor change
5. Stoplight bulb change

1.2-III. TEST DATA

The test data consist of the Work Order Forms for all scheduled and unscheduled maintenance and repair and the Driver Logs.

1.2-IV. TEST PREPARATION AND PROCEDURES

The detailed procedures are listed in procedure 1.2-1.

1.3 SELECTED MAINTAINABILITY

1.3-I. TEST OBJECTIVE

The objective of this test is to identify the time required to replace and/or repair selected parts or subsystems.

1.3-II. TEST DESCRIPTION

The test will address components that may be expected to fail or require replacement during the service life of the bus. In addition, any component that fails during the test is included in the data. Components to be included are:

1. Transmission
2. Alternator
3. Starter
4. Batteries
5. Windshield wiper motor

1.3-III. TEST DATA

The Maintainability Evaluation Form is filled out for the items listed in the reliability test procedure section and shall be forwarded to the Altoona Bus Testing Center manager. When the bus is returned for scheduled or unscheduled maintenance or repair, the form is to be updated for additional repairs and shall be forwarded to the Altoona Bus Testing Center manager.

1.3-IV TEST PREPARTION AND PROCEDURES

The detailed test procedures are listed in procedure 1.3-1. This section also includes Maintainability Evaluation Form.

2.0 RELIABILITY

2-1 TEST OBJECTIVE

The objective of this test is to evaluate the reliability of the bus by documenting breakdowns, scheduled repairs, down time, and repair time that occurs during testing.

2-II. TEST DESCRIPTION

All breakdowns and repairs that occur during the performance of testing are compiled on the Reliability Data Form. This form summarizes the type of failure, part, mileage, and repair time. The failure types are classified as follow:

1. Class 1: A malfunction that represents a potential crash situation and could lead directly to passenger or driver injury.

2. Class 2: A malfunction that results in test interruption because the bus cannot be operate. Service is discontinued until the bus is repaired at the site of the malfunction or it is towed to a service workshop.

3. Class 3: A malfunction that results in temporary interruption of testing, and the bus must be returned to a service workshop for repair.

4. Class 4: A malfunction that degrades bus operation but does not require immediate removal of the bus from testing.

2-III. TEST DATA

The type of breakdown and the accumulated bus mileage at the time of each breakdown will be recorded.

Within each type, breakdowns will be further classified by the specific subsystem or component that failed, e.g., engine, transmission, air conditioning per Table 1 in the maintainability procedures. Upon completion of this procedure, all data shall be forwarded to the Altoona Bus Testing Center manager.

2-IV. TEST PREPARATION AND PROCEDURES

The detailed test preparation and procedures are listed in procedure 2.1-1. This section also includes Reliability Data Form.

3.0 SAFETY

3-I. 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, course.

3-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 PTI track on the vehicle dynamics pad. The bus, at seated load weight, will be driven through a double-lane change course at increasing speeds until the test is determined to be 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 100 ft gates, 100 ft apart. The bus will enter the test course in one lane, crossover to the other lane within the 100 ft gate spacing, travel for 100 ft, and then return to the original lane within the next 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 terminated. 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-III. TEST DATA

The test data will consist of the attached Safety Data Form.
Upon completion of this test, data shall be forwarded to the Altoona Bus Testing Center manager.

3-IV. 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.

4.1 PERFORMANCE

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 the test, the bus will be operated at Seated load weight on a smooth and level test track. The bus will be accelerated at full throttle from a standstill to a maximum "geared", maximum "governed", or maximum "safe" speed not exceeding 50 mph. The maximum "geared" speed is defined as the limited output capabilities of the test vehicle's engine and drivetrain. The maximum "governed" speed, if applicable, is the top speed as limited by the engine control system. The maximum "safe" speed is defined as the maximum speed that the test course can be traveled without jeopardizing the safety of the test vehicle or its passengers. The test vehicle speed will be measured using a fifth wheel or a non-contacting speed measurement system. The time intervals between 10 mph increments will be measured and recorded using a stopwatch with a lap timer. Time and speed data will be recorded on the performance data form. When applicable, the "governed" speed will be recorded. The data will be used to generate a speed vs time plot and percent grade versus speed data.

4-III. TEST DATA

The test data consist of the completed attached Performance Data Form. Upon completion of this test, data shall be forwarded to the Altoona Bus Testing Center manager.

4-IV. TEST PREPARATION AND PROCEDURES

The detailed test preparation and procedures are listed in procedure 4-1. This section also includes Performance Data Form.

4.2 BRAKE PERFORMANCE

4.2 I. TEST OBJECTIVE

The objective of this test is to provide, for comparison purposes, braking performance data on transit buses produced by different manufacturers.

4.2 II. TEST DESCRIPTION

The testing will be conducted at the PTI Test Track skid pad area. Brake tests will be conducted after completion of the GVW portion of the vehicle durability test. At this point in testing the brakes have been subjected to a large number of braking snubs and will be considered well burnished. Testing will be performed when the bus is fully loaded at its GVW. All tires on each bus must be representative of the tires on the production model vehicle

The brake testing procedure comprises three phases:

1. Stopping distance tests
    i. High friction surface (high-friction, Skid Number within the range of 70-76)
    ii. Low friction surface (low-friction, Skid Number within the range of 30-36)
2. Stability tests
3. Parking brake test

Stopping Distance Tests

The stopping distance phase will evaluate service brake stops. All stopping distance tests on dry surface will be performed in a straight line and at the speeds of 20, 30, 40 and 45 mph. All stopping distance tests on wet or low friction surface will be performed in straight line at speed of 20 mph.

The tests will be conducted as follows:

1. **Uniform High Friction Tests:** Four maximum deceleration straight-line brake applications each at 20, 30, 40 and 45 mph, to a full stop on a uniform high-friction surface in a 3.66-m (12-ft) wide lane.

2. **Uniform Low Friction Tests:** Four maximum deceleration straight-line brake applications from 20 mph on a uniform low friction surface in a 3.66-m (12-ft) wide lane.

When performing service brake stops for both cases, the test vehicle is accelerated on the bus test lane to the speed specified in the test procedure and this speed is maintained into the skid pad area. Upon entry of the appropriate lane of the skid pad area, the vehicle's service brake is applied to stop the vehicle as quickly as possible. The stopping distance is measured and recorded for both cases on the test data form. Stopping distance results on dry and wet surfaces will be recorded and the average of the three measured stopping distances will be considered as the measured stopping distance. Any deviation from the test lane will be recorded.

Stability Tests

This test will be conducted in both directions on the test track. The test consists of four maximum deceleration, straight-line brake applications on a surface with split coefficients of friction (i.e., the wheels on one side run on high-friction SN 70-76 or more and the other side on low-friction [where the lower coefficient of friction should be less than half of the high one] at initial speed of 30 mph).

(I) The performance of the vehicle will be evaluated to determine if it is possible to keep the vehicle within a 3.66m (12 ft) wide lane, with the dividing line between the two surfaces in the lane’s center. Any deviation from the test lane will be recorded.

Parking Brake Test

The parking brake phase utilizes the brake slope, which has a 20% grade. The test vehicle, at its GVW, is driven onto the brake slope and stopped. With the transmission in neutral, the parking brake is applied and the service brake is released. The test vehicle is required to remain stationary for five minutes. The parking brake test is performed with the vehicle facing uphill and downhill.

4.2 III. TEST ARTICLE

The test article is a transit bus equipped with an anti lock brake system.

4.2 IV. TEST EQUIPMENT/FACILITIES/PERSONNEL

4.2-1 Test Equipment

1. Speed and distance sensor system
2. Ballast to simulate passenger loading at GVW
3. Video recorder with playback capability
4. Non-contacting digital thermometer

4.2-2 Test Facility

The test site is located at the PTI Test Track using the bus test lane's skid pad area. The test site must meet the following conditions:

1. Ambient temperature between 32^{o}F and 90^{o}F and pavement temperature above 32^{o}F.
2. Wind speed less than 12 mph.
3. Brake-test lanes are clearly marked, 12 feet wide, and flat within 1% grade in all directions.
4. Brake-test lanes most be dry and clear of extraneous surface material. The brake test lanes are checked periodically for compliance with the following conditions:

    i. One high friction surface test lane with skid numbers between 70 and 76 as determined by ASTM E-274 at 40 mph, omitting water delivery as specified in paragraph 4.2 of that method.
    ii. One low friction surface test lane with skid numbers between 30 and 36 as determined by ASTM E-274 at 25 mph, omitting water delivery as specified in paragraph 4.2 of that method.

5. The brake slope consists of a clean dry Portland cement concrete surface and has a grade of 20%.

4.2-3 Test Personnel

The PTI personnel consist of the following:

1. Test Driver (TD)
2. Two Test personnel (TP)

4.2 V. TEST DATA

The test data consist of the completed attached data forms (Tables 4.2 6-8). Upon completion of this test, data shall be forwarded to the Test Manager.

4.2 VI. TEST PREPARATION AND PROCEDURES

All stopping distance brake tests will be conducted according to the following sequence of events.

1. Check the brakes temperature using a non-contacting laser digital thermometer. The brakes temperature should be between 150 ^{o}F and 200 ^{o}F.

2. Accelerate to and maintain a speed exceeding the specified test speed by 4 to 8 mph.

3. Close the throttle and coast in gear to approximately 2 mph above the test speed.

4. Shift the transmission to neutral and coast until the test speed is reached, then initiate the stop by means of the service brake control. The service brake is to be applied at +0 or -1 mph of the specified test speed.

The details of the stopping distance and stability test procedures are given in tables 4.2-1-3. The braking test data should be recorded in Table 4.2-6. After completing the tests, the post-test procedure given in Table 4.2-5 will be performed, and any brake system faults or required repairs will be recorded in Table 4.2-7. Test results will be recorded in tables 4.2-8.1 and 2.

5.1 STRUCTURAL SHAKEDOWN

5.1.-I TEST OBJECTIVE

The objective of this test is to determine certain structural characteristics (e.g., bus frame deflection, permanent structural deformation, etc.) under static loading conditions.

5.1-II. TEST DESCRIPTION

In this test, the bus will be isolated from the suspension by removing the necessary suspension components and blocking the vehicle under the suspension points. The bus will then be loaded and unloaded not more than three times with a distributed load equal to 2.5 times gross load. Gross load is defined as 150 lb for every designed passenger seating position, for the driver, and for each 1.5 sq ft^2 of free floor space. For a distributed load equal to 2.5 times gross load, place a 375 lb load on each seat and on every 1.5 ft^2 of free floor space. The first loading and unloading sequence will "settle" the structure. The second, and third if applicable, loading and unloading sequence will determine the permanent deflection. If the maximum permanent deflection after the second loading and unloading sequence is less that .005 inches, then the third sequence is not needed. Deflections will be measured at various locations during the loading and unloading sequence.

5.1-III. TEST DATA

The test data consist of the Structural Shakedown Data Form. Upon completion of this test, data shall be forwarded to the Altoona Bus Testing Center manager.

5.1-IV. TEST PREPARATION AND PROCEDURES

Detailed test preparation and procedures are listed in procedure 5.1-1 which also includes Structural Shakedown Data Form.

5.2 STRUCTURAL DISTORTION

5.2-I. TEST OBJECTIVE

The objective of this test is to observe the operation of various subsystems when the bus is placed in a longitudinal twist (simulating operation over a 6-inch curb and through a 6-inch pothole) and subjected to a water spray mechanism (simulating rain and traffic spray).

5.2-II. TEST DESCRIPTION

With the bus loaded to GVW, each wheel of the bus will be raised and lowered (one at a time to simulate operation over a curb) and operation of the following will be inspected:

1. Body
2. Windows
3. Doors
4. Roof vents
5. Special seating
6. Wheelchair lift
7. Engine
8. Service doors
9. Escape hatches
10. Steering mechanism

Each wheel will then be lowered (one at a time to simulate operation through a pothole) and the same items inspected.

5.2-III. TEST DATA

The test data consist of the completed Distortion Test Inspection Form for the ten test orientations. Upon completion of this test, data shall be forwarded to the Altoona Bus Testing Center manager.

5.2-IV. TEST PREPARATION AND PROCEDURES

The detailed test preparation and procedures are listed in procedures. This section also includes Distortion Test Data Form.

5.3 STATIC TOWING

5.3-I. TEST OBJECTIVE

The objective of this test is to determine the strength characteristics of the bus towing fixtures during static loading conditions.

5.3-II. TEST DESCRIPTION

Using a load-distributing yoke, a hydraulic cylinder is used to apply a static tension load equal to 1.2 times the bus curb weight. The load will be applied to both the front and rear (if applicable) towing fixtures at an angle of 20 degrees with the longitudinal axis of the bus. The first test will be a 20 degree pull upward from the longitudinal axis of the bus, and then a 20 degree downward pull from the longitudinal axis of the bus. The bus will then be positioned to one side at an angle of 20 degrees from the longitudinal axis and then to the other. Any deformation or damage to the tow eyes or adjoining structure will be recorded. The bolts that connect the tow eyes and adjoining brackets must be torqued after each test to the manufacturer's specification to check for any failure.

5.3-III. TEST DATA

The test data consist of the completed Static Data Test Towing Form. Upon completion of this test, data shall be forwarded to the Altoona Bus Testing Center manager.

5.3-IV. TEST PREPARATION AND PROCEDURES

Detailed test preparation and procedures are listed in procedure 5.3-1. This section also includes Static Towing Test Data Form.

5.4 DYNAMIC TOWING

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 DATA

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

5.4-IV. 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.

5.5 JACKING TEST

5.5-I. TEST OBJECTIVE

The objective of this test is to determine the damage caused by a deflated tire, and to determine the feasibility of jacking the bus with a portable hydraulic jack to a height sufficient to replace a deflated tire.

5.5-II TEST DESCRIPTION

With the bus at curb weight, each tire at once corner of the bus is deflated to simulate a flat tire. A portable hydraulic floor jack is then positioned in a manner and location specified by the manufacturer. The jack is used to raise the bus to a height sufficient to provide 3 inches clearance between the floor and an inflated tire. The deflated tire is then inflated to the tires specification and the jack is lowered. Any structural damage or permanent deformation is recorded on the Jacking Test Data Form. This procedure is repeated for each jacking point on the bus.

5.5-III. TEST DATA

The test data consists of the Jacking Test Data Form. Upon completion of this test, data shall be forwarded to the Altoona Bus Testing Center manager.

5.5-IV. TEST PREPARATION AND PROCUDURES

Detailed test preparation and procedures are listed in procedures 5.5-1. This section also includes Jacking Test Data Form.

5. 6 HOISTING TEST

5.6-I. TEST OBJECTIVE

The objective of this test is to determine possible damage or deformation caused by the jack stands on the jacking pads.

5.6-II. TEST DESCRIPTION

With the bus at curb weight, the front end of the bus is raised to a height sufficient to allow manufacturer-specified placement of jack stands under the axles or jacking pads independent of the hoist system. The bus will be checked for stability on the jack stands and for any damage to the jacking pads or bulkheads. The procedure is repeated for the rear end of the bus. The procedure is then repeated for the front and rear simultaneously.

5.6-III. TEST DATA

The test data consist of the Hoisting Test Data Form. Upon completion of this test, data shall be forwarded to the Altoona Bus Testing Center manager.

5.6-IV. TEST PREPARATION AND PROCUDEURES

Detailed test preparation and procedures are listed in procedure 5.6-1. This section also includes Hoisting Test Data Form.

5.7 STRUCTURAL DURABILITY

(12–YEAR, 500,000 MILE SERVICE CATEGORY)

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.

5.7 – II TEST DESCRIPTION

The test article is driven a total of 15,000 miles; approximately 12,500 miles on the Altoona Bus Testing Center durability test track and approximately 2,500 miscellaneous other miles. The durability test track consists of seven different stress elements that subject the bus to the types of events expected to be encountered during transit service. Figures 5.7-1 through 5.7-8 provide a detailed profile for each stress element located on the durability test track. The test will be conducted with the bus operated under three different loading conditions. The first segment will consist of approximately 5,250 miles with the bus operated at GVWR. The second segment will consist of approximately 2,000 miles with the bus operated at Seated load weight. The remainder of the test, approximately 5,250 miles, will be conducted with the bus loaded to CW. If GVWR exceeds the axle design weights and the change will be recorded. All subsystems are operated during the test 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 basis. Unscheduled maintenance and repairs are recorded on the same log as are any unusual occurrences as noted by the driver. Once a week the test article shall be washed down and thoroughly inspected for any signs of failure.

5.7-III. TEST ARTICLE

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

5.7-IV. TEST EQUIPMENT/FACILITIES/PERONNEL

This test is run on the durability facility and high speed lane at the PSBRTF. Test personnel consist of the following:

1. Test technician (TECH)
2. Test track manager (TM)
3. Bus driver (DR)
4. Bus mechanic (MECH)
5. Test personnel (TP)

5.7-V. TEST DATA

The test data consist of keeping the vehicle log for miles and hours driven on the durability or high-speed lanes. In addition the vehicle maintainability log is updated with Work Order Forms when any breakdown or any maintenance is required. Data shall be forwarded to the ABTC manager on a weekly basis.

5.7-VI. TEST PREPARATION AND PROCEDURES

The detailed test preparation and procedures are listed in procedure 5.7-1.

6.0 FUEL ECONOMY

6-I. TEST OBJECTIVE

The objective of this test is to provide accurate comparable fuel consumption data on transit buses produced by different manufacturers. This fuel economy test bears no relation to the calculations done by the Environment Protection Agency (EPA) to determine levels for the Corporate Average Fuel Economy Program. EPA's calculations are based on tests conducted under laboratory conditions intended to simulate city and highway driving. This fuel economy test, as designated here, is a measurement of the fuel expended by a vehicle traveling a specified test loop under specified operating conditions. The results of this test may not represent actual mileage but will provide data that can be used by recipients to compare buses tested by this procedure.

6-II. TEST DESCRIPTION

This test requires operation of the bus over a course based on the Transit Coach Operating Duty Cycle (ADB Cycle) at seated load weight using a procedure based on the Fuel Economy Measurement Test (Engineering Type) For Trucks and Buses: SAE 1376 July 82. The procedure has been modified by elimination of the control vehicle and by modifications as described below. The inherent uncertainty and expense of utilizing a control vehicle over the operating life of the facility is impractical.

The fuel economy test will be performed as soon as possible (weather permitting) after the completion of the GVW portion of the structural durability test. It will be conducted on the bus test lane at the Altoona Bus Testing Center. Signs are erected at carefully measured points which delineate the test course. A test run is comprised of 3 central business districts (CBD) phases, 2 arterial phases, and 1 commuter phase. An electronic fuel measuring system will indicate the weight of fuel consumed during each phase of the test. The test runs will be repeated until there are at least two runs in both the clockwise and counterclockwise directions in which the fuel consumed for each run is within $\pm$ 4 percent of the average total fuel used over the 4 runs. A 20-minute idle consumption test is performed just prior to an immediately after the driven portion of the fuel economy test.

The amount of fuel consumed while operating at normal/low idle is recorded on the Fuel Economy Data Form. This set of four valid runs along with idle consumption data comprise a valid test.

The test procedure is the ADB cycle with the following four modifications:

1. The ADB cycle is structured as a set number of miles in a fixed time in the following order: CBD, Arterial, CBD, Arterial, CBD, Commuter. A separate idle fuel consumption measurement is performed at the beginning and end of the fuel economy test. This phase sequence permits the reporting of fuel consumption for each of these phases separately, making the data more useful to bus manufacturers and transit properties.

2. The operating profile for testing purposes shall consist of simulated transit type service at seated load weight. The three test phases are: a central business district (CBD) phase of 2 miles with 7 stops per mile and a top speed of 20 mph; an arterial phase of 2 miles with 2 stops per mile and a top speed of 40 mph; and a commuter phase of 4 miles with 1 stop and a maximum speed of 40 mph. At each designated stop the bus will remain stationary for seven seconds. During this time, the passenger doors shall be opened and closed.

3. The individual ADB phases remain unaltered with the exception that 1 mile has been changed to 1 lap on the Altoona Bus Testing Center track. One lap is equal to 5,042 feet. This change is accommodated by adjusting the cruise distance and time.

4. The acceleration profile, for practical purposes and to achieve better repeatability, has been changed to “full throttle acceleration to cruise speed.”

Several changes were made to the Fuel Economy Measurement Test (Engineering Type) For Trucks and Buses: SAE 1376 July 82:

Sections 1.1, and 1.2 only apply to diesel, gasoline, methanol, and any other fuel in the liquid state (excluding cryogenic fuels).

1.1. 1SAE 1376 July 82 requires the use of at least a 16-gal fuel tank. Such a fuel tank when full would weight approximately 160 lbs. It is judged that 12-gal tank weighing approximately 120 lb will be sufficient for this test and much easier for the technician and test personnel to handle.

1.2. 2SAE 1376 July 82 mentions the use of a mechanical scale or a flowmeter system. This test procedure uses a load cell readout combination that provides an accuracy of 0.5 percent in weight and permits on-board weighing of the gravimetric tanks at the end of each phase. This modification permits the determination of a fuel economy value for each phase as well as the overall cycle.

Section 2.1 applies to compressed natural gas (CNG), liquefied natural gas (LNG), cryogenic fuels, and other fuels in the vapor state.

2.1 A laminar type flowmeter will be used to determine the fuel consumption. The pressure and temperature across the flow element will be monitored by the flow computer. The flow computer will use this data to calculate the gas flow rate. The flow computer will also display the flow rate (scfm) as well as the total fuel used (scf). The total fuel used (scf) for each phase will be recorded on the Fuel Economy Data Form.

Use both sections 1 and 2 for dual fuel systems.

6-III. FACILITIES/PERSONNEL

The fuel economy test is performed on the bus lane of the Altoona Bus Testing Center. This test requires the following personnel:

1. Test technician (TECH)
2. Test driver (TD)
3. Test personnel (TP)

6-IV. TEST PREPARATION AND PROCEDURES

All vehicles are prepared for testing in accordance with the Fuel Economy Pre-Test Maintenance Form. This is done to ensure that the bus is tested in optimum operating condition. The manufacturer-specified preventive maintenance shall be performed before this test. Any manufacturer-recommended changes to the pre-test maintenance procedure must be noted on the revision sheet. The Fuel Economy Pre-Test Inspection Form will also be completed before making a test run. Both the Fuel Economy Pre-Test Maintenance Form and the Fuel Economy Pre-Test Inspection Form are included in procedure 6.0 Fuel Economy.

The test is initiated after the vehicle completes a warm-up procedure. Warm-up consists of driving the bus for one hour on the bus lane at the Altoona Bus Testing Center. The course layout is defined by green, yellow, and red signs for accelerate, decelerate, and stop points respectively; while different shaped signs delineate the Commuter, Arterial, and CBD cycles of the test. The technician coaches the driver thought the course along with recording cycle run times, fuel temperature, fuel consumption data, and weather conditions using the Fuel Economy Data Form.

All buses are tested at Seated load weight. The base line fuel economy data are obtained at the following conditions:

1. Air conditioning off
2. Evaporator fan or ventilation fan on
3. Seated load weight
4. Appropriate test fuel with energy content (BTU/LB) noted on Fuel Economy Data Form
5. Exterior and interior lights on
6. Heater Pump Motor off
7. Defroster off
8. Windows and Doors closed

The test tanks or the bus fuel tank (s) will b filled prior to the fuel economy test with the appropriate test fuel. The fuel economy test is started adjacent to the entrance of the bus lane with the front of the bus aligned with the white triangular sign. After the cycle is complete, the total fuel used will be recorded on the Fuel Economy Data Form. All data is forwarded to the Altoona Bus Test Manager.

7.1 INTERIOR NOISE

7.1-I. TEST OBJECTIVE

The objective of these tests are to measure and record interior noise levels and check for audible vibration under various operating conditions.

7.1-II. TEST DESCRIPTION

During this series of tests, the interior noise level will be measured at several locations with the bus operating under the following three conditions:

1. With the bus stationary, a white noise generating system shall provide a uniform sound pressure level equal to 80 dB(A) on the left, exterior side of the bus. The engine and all accessories will be switched off and all openings including doors and windows will be closed. This test will be performed at the Altoona Bus Testing Center.

2. The bus will accelerate at full throttle from a stationary position to 35 mph on the noise test area at the PTI test track. All openings will be closed and all accessories will be operating during the test.

3. The bus will be operated at various speeds from 0 to 55 mph with and without the air conditioning and accessories on. Any audible vibration or rattles will be noted. This test will be performed on the test segment between the Altoona Bus Testing Center and the Altoona Bus Testing Center.

All tests will be performed in an area free from extraneous sound-making sources or reflecting surfaces. The ambient sound level as well as the surrounding weather conditions will be recorded in the test data.

7.1-III. TEST DATA

The test data consist of the Interior Noise Test Data From. On completion of the test, the test data will be forwarded to the Altoona Bus Testing Center manager.

7.1-IV. TEST PREPARATION AND PROCEDURES

The detailed test preparation and procedures are listed in procedures 7.1-1, 7.1-2, and 7.1-3. This section also includes Interior Noise Test Data Forms - 7.1-1, 7.1-2, and 7.1-3.

7.2 EXTERIOR NOISE

7.2-I. TEST OBJECTIVE

The objective of this test is to record exterior noise levels when a bus is operated under various conditions.

7.2-II. TEST DESCRIPTION

In the exterior noise tests, the bus will be operated at Seated load weight in three different conditions on a smooth, straight and level roadway:

1. Accelerating at full throttle from a constant speed at our below 35 mph and just prior to transmission upshift.

2. Accelerating at full throttle from standstill

3. Stationary, with the engine at low idle, high idle, and wide open throttle.

In addition, the buses will be tested with and without the air conditioning and all accessories operating. The exterior noise levels will be recorded.

The test is performed on the noise test area at the PTI test track and the test procedures will be in accordance with SAE Standards SAE J366b, Exterior Sound Level for Heavy Trucks and Buses. The noise test area is a paved, open space free of large reflecting surfaces. A noise meter placed at a specified location outside the bus will measure the noise level.

7.2-III. TEST DATA

The test data consist of the test procedure and data where requested. On completion of the test, test data shall be forwarded to the Altoona Bus Testing Center manager.

7-2-IV. TEST PREPARATION AND PROCEDURES

The detailed test preparation and procedures are listed in procedure 7.2-1, 7.2-2, and 7.2-3. This section includes figure 7.2-1 and Exterior Noise Test Data Forms - 7.2-1, 7.2-2, and 7.2-3.