NATP-303S-00
June 30, 1995

U.S. DEPARTMENT OF TRANSPORTATION

NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION

LABORATORY TEST PROCEDURE

FOR

FMVSS 303S

Fuel System Integrity — CNG Fueled School Buses

ENFORCEMENT
Office of Vehicle Safety Compliance
Room 6115, NVS-220
400 Seventh Street, SW
Washington, DC 20590

REVISION CONTROL LOG
FOR OVSC LABORATORY
TEST PROCEDURES

TP-303S
Fuel System Integrity for CNG Fueled School Buses

TEST PROCEDURE		FMVSS 303S		DESCRIPTION
REV. No.	DATE	AMENDMENT	EFFECTIVE DATE	
00	06/30/95	59FR19659	06/30/95	Original release signed by O.D.
01				
02				
03				
04				
05				
06				
07				
08				
09				
10				

OVSC LABORATORY TEST PROCEDURE NO. 303S
TABLE OF CONTENTS

1. PURPOSE AND APPLICATION

The Office of Vehicle Safety Compliance (OVSC) provides contracted laboratories with Laboratory Test Procedures (TPs) which serve as guidelines for obtaining compliance test data. The data are used to determine if a specific vehicle or item of motor vehicle equipment meets the minimum performance requirements of the subject Federal Motor Vehicle Safety Standard (FMVSS). The purpose of the OVSC Laboratory Test Procedures is to present a uniform testing and data recording format, and provide suggestions for the use of specific equipment and procedures. Any contractor interpreting any part of an OVSC Laboratory Test Procedure to be in conflict with a Federal Motor Vehicle Safety Standard or observing any deficiencies in a Laboratory Test Procedure is required to advise the Contracting Officer's Technical Representative (COTR) and resolve the discrepancy prior to the start of compliance testing.

Contractors are required to submit a detailed test procedure to the COTR before initiating the compliance test program. The procedure must include a step-by-step description of the methodology to be used.

The OVSC Laboratory Test Procedures are not intended to limit or restrain a contractor from developing or utilizing any testing techniques or equipment which will assist in procuring the required compliance test data.

NOTE: The OVSC Laboratory Test Procedures, prepared for use by independent laboratories under contract to conduct compliance tests for the OVSC, are not intended to limit the requirements of the applicable FMVSS(s). In some cases, the OVSC Laboratory Test Procedures do not include all of the various FMVSS minimum performance requirements. Sometimes, recognizing applicable test tolerances, the Test Procedures specify test conditions which are less severe than the minimum requirements of the standards themselves. Therefore, compliance of a vehicle or item of motor vehicle equipment is not necessarily guaranteed if the manufacturer limits certification tests to those described in the OVSC Laboratory Test Procedures.

2. GENERAL REQUIREMENTS

FMVSS 303S sets the minimum performance requirements relative to the integrity of school bus CNG fuel systems. For all applicable vehicles, the maximum fuel system pressure drop (P_{drop}) in the high pressure portion of the fuel system through the 60 minutes following impact by a 4,000 pound moving barrier traveling 30 mph shall NOT exceed the greater of P_{drop} = 1,062 kPa (154 psi) or $P_{drop} = 895*(T/V_{FS})$ kPa; where T is the average temperature of the test gas (in Kelvin), and V_{FS} is the internal volume of the fuel container and fuel lines up to the first pressure regulator (in liters).

This standard applies to school buses that have a Gross Vehicle Weight Rating (GVWR) greater than 10,000 pounds and use CNG as a motor fuel.

The purpose of the standard is to reduce deaths and injuries occurring from fires that result from fuel leakage during and after school bus crashes.

3. SECURITY

The contractor shall provide appropriate security measures to protect the OVSC test vehicles (school buses) from unauthorized personnel during the entire compliance testing program. The contractor is financially responsible for any acts of theft and/or vandalism which occur during the storage of test vehicles. Any security problems which arise shall be reported by telephone to the Industrial Property Manager (IPM), Office of Contracts and Procurement (OCP), within two working days after the incident. A letter containing specific details of the security problem will be sent to the IPM (with copy to the COTR) within 48 hours. The contractor shall protect and segregate the data that evolves from compliance testing before and after each vehicle test. No information concerning the vehicle safety compliance testing program shall be released to anyone except the COTR, unless specifically authorized by the COTR or the COTR's Branch or Division Chief.

NO INDIVIDUALS, OTHER THAN CONTRACTOR PERSONNEL DIRECTLY INVOLVED IN THE COMPLIANCE TESTING PROGRAM OR OVSC PERSONNEL, SHALL BE ALLOWED TO WITNESS ANY VEHICLE COMPLIANCE TEST UNLESS SPECIFICALLY AUTHORIZED BY THE COTR.

4. GOOD HOUSEKEEPING

Contractors shall maintain the entire vehicle compliance testing area, test fixtures and instrumentation in a neat, clean and painted condition with test instruments arranged in an orderly manner consistent with good test laboratory housekeeping practices.

5. TEST SCHEDULING AND MONITORING

The contractor shall submit a vehicle test schedule to the COTR prior to conducting the first compliance test. Tests shall be completed as required in the contract. Scheduling of vehicle tests shall be adjusted to permit vehicles to be tested to other FMVSSs as may be required by the OVSC. All vehicle compliance testing shall be coordinated with the COTR in order to allow monitoring by the COTR and/or other OVSC personnel if desired.

6. TEST DATA DISPOSITION

The contractor shall make all vehicle preliminary compliance test data available to the COTR at the test site within four hours after the test. Final test data, including digital printouts and computer generated plots (if applicable), shall be furnished to the COTR within five working days. Additionally, the contractor shall analyze the preliminary test results as directed by the COTR. All backup data sheets, strip charts, recordings, plots, technician's notes, etc., shall be either sent to the COTR or destroyed at the conclusion of each delivery order, purchase order, etc.

7. GOVERNMENT FURNISHED PROPERTY (GFP)

ACCEPTANCE OF VEHICLE

In general, the OVSC will notify the contractor in advance of the arrival of test vehicles assigned to the contract. New test vehicles are usually delivered by or for a manufacturer, distributor, or dealer. Vehicles may also be reassigned from one OVSC contract to another, which sometimes involves the use of a government-contracted transporter. When possible, a "Vehicle Condition" form for each vehicle will be supplied to the Contractor before the vehicle is delivered, alternately, blank forms are available from the COTR. The upper half of the form describes the vehicle in detail. The lower half provides space for a detailed description of the vehicle condition after each FMVSS test performed by the Contractor. **NOTE:** A completed (upper and lower halves) "Vehicle Condition" form must be submitted with the final test reports for each FMVSS or the reports will NOT be accepted.

The Contractor has the responsibility of accepting these test vehicles. The COTR must be notified by telephone or FAX within 24 hours after each vehicle arrives at the contractor's facility, unless otherwise specified below.

In accepting a vehicle, the contractor must visually examine it and must verify that it contains all of the items in the list of requirements shown below before signing any delivery form, receipt, etc. or providing any such record to the person delivering the vehicle. During the examination, check for obvious defects or flaws not previously identified by OVSC. If these defects or flaws are serious enough to question the suitability of a vehicle for the intended testing, the contractor must attempt to consult with the COTR by telephone as soon as possible and preferably before the vehicle is accepted. If this is not possible, make a record of the defects or flaws, including photographs as necessary, and request that the person delivering the vehicle sign the record (a copy may be provided to this person or to his/her company). Mail and, if possible, FAX these documents to the COTR within 48 hours of vehicle arrival.

Requirements for all test vehicles:

A. All options listed on the "window sticker" are present on the test vehicle.

B. Tires and wheel rims are new and the same as listed.

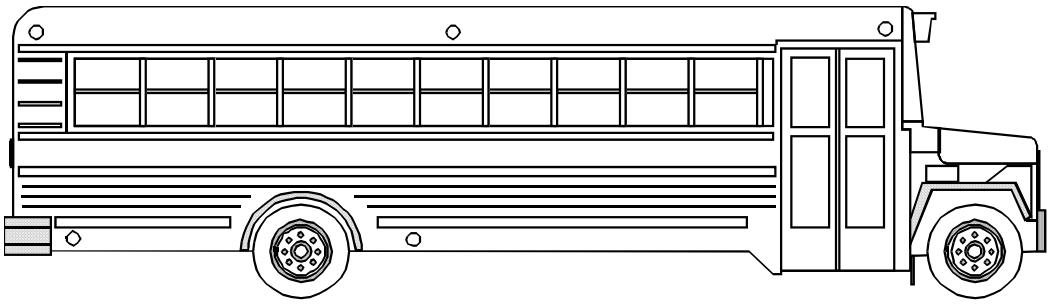
C. There are no dents or other interior or exterior flaws.

D. The vehicle has been properly prepared and is in running condition.

E. The glove box contains an owner's manual, warranty document, consumer information, and an extra set of keys.

7. GOVERNMENT FURNISHED PROPERTY (GFP)....Continued

F. If applicable, proper fuel filler cap is supplied on the test vehicle.



8. TEST INSTRUMENTS

Before the Contractor initiates the safety compliance test program, a list of measuring and test equipment and a description of the test instrument calibration system shall be provided to and approved by the COTR.

The measuring and test equipment list shall include the following information:

A. Type of instrument, manufacturer, model number, etc.

B. Measurement range

C. Accuracy

D. Calibration interval

E. Calibration facility

A test instrument calibration system will be implemented and maintained in accordance with established calibration practices. Guidelines for setting up and maintaining such calibration systems are described in MIL-C-45662A, "Calibration System Requirements." In addition, the calibration system must meet the following conditions:

A. All measuring and test equipment shall be calibrated by the contractor or a commercial facility against a higher order standard at periodic intervals not to exceed 12 months. The contractor's written procedure must list the information A through E above for each standard and include the details of how the standard will be used to calibrate the test instruments. The procedure shall also include, for each measuring and test equipment item, an assessment of the as-used environment (i.e., shock, temperature, moisture, high measurements indicating failure, etc.) and define how these and other factors will affect the interval between calibrations.

B. Each higher order standard must have a calibration history traceable to the National Institute of Standards and Technology (NIST) within 12 months of its use to calibrate the measuring and test equipment. The standards will be stored and used under appropriate environmental conditions to assure their accuracy and stability.

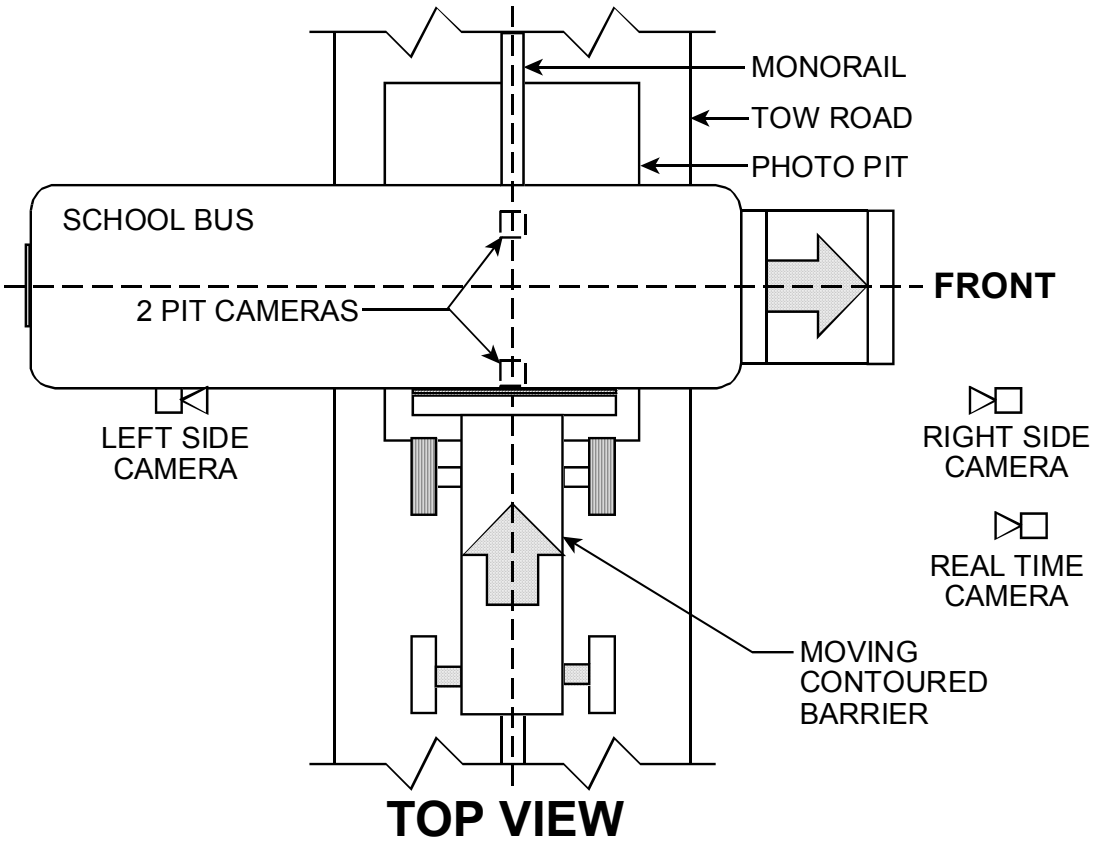
C. Records of calibrations for all standards, measuring and test equipment shall be kept by the Contractor in a manner which permits inspection by the COTR or copies to be provided upon request, and assures the maintenance of established calibration schedules. In addition, all measuring and test equipment must be labeled as to date of present calibration, date of next scheduled calibration and the name or initials of the person who last calibrated it.

9. PHOTOGRAPHIC DOCUMENTATION

Photographs shall be glossy black and white, 8-1/2 x 11 inches, and properly focused for clear images. A tag, label or placard identifying the test vehicle model, NHTSA number and date shall appear in each photograph and must be legible. Each photograph shall be labeled as to the subject matter.

Motion pictures (16 mm) of the school bus/moving barrier impact will be recorded in color at a minimum speed of 500 frames per second (FPS) except for the 24 FPS real time cameras. Timing marks will be registered on the film edge every five milliseconds as a minimum along with a time zero impact mark in order to permit possible kinematic analysis on a film analyzer. A strobe light with a duration of at least 1.5 milliseconds will be placed in the field of view of each camera to indicate first contact or "TIME ZERO" for the impact event. Light from the strobe should cover three frames on the film.

A minimum of one camera in each of the positions shown below and described on the next page will be used to record the event.



9. PHOTOGRAPHIC COVERAGE....Continued

A. Side View Cameras

(1) A "real time" camera (24 FPS) will be used to document the moving barrier's run down the tow road and through the school bus impact event. It shall also be used to document the pretest and post test condition of the test vehicle including footage of the front, rear, left and right side of the vehicle and any further detail worthy of inclusion (such as close up footage of the post test impact area, etc).

(2) A second "real time" camera (24 FPS) must be available to record any CNG fuel system breaches/damage or, for bi/dual fuel vehicles, Stoddard solvent leakage and its collection after the impact.

(3) Right and left side view high speed cameras (500 FPS minimum) will record the school bus/barrier impact. The cameras will be positioned so that they will record penetration of the moving barrier into the school bus from both sides. Photographic targets will be placed at one foot intervals along both sides of the moving barrier. A stadia pole will be located on the tow road and aligned with one of the targets on the left side of the moving barrier. A gross approximation of moving barrier velocity and penetration should be possible by observing the photographic targets as they travel past the stadia pole.

B. Photography Pit Camera

Two high speed cameras (500 FPS minimum) will be located in the photography pit located in the tow road beneath the school bus to record any fuel system leak, breach or damage. One camera will be placed directly under the estimated position of the school bus fuel tank(s) after the vehicle comes to rest after impact by the moving barrier. The fuel tank, filler pipe, and retainer straps will be painted white to contrast with the vehicle's underbody. If possible, the fuel lines, pressure regulator(s), shut-off valves, etc. should also be painted white. The second high speed camera should be positioned in the pit to photograph a larger area of the bus underbody to show other areas associated with the fuel system which are not rear of the fuel tank.

C. Still Photographs

Pretest and post test still photographs will record overall school bus deformation and details which pertain to FMVSS 303. Photographs of all parts of the school bus that may be important to the compliance test should be taken in excess and developed only if the need arises.

9. PHOTOGRAPHIC COVERAGE....Continued

As a MINIMUM, the following STILL pretest and post test photographs are required and shall be included in each vehicle final test report. The contractor should take an excess of photographs so that documentation is available in the event of a test failure. If there is no test failure, only the following photographs are required.

(1) Front view

(2) Side view

(3) Rear view

(4) Right front three-quarter view

(5) Left rear three-quarter view

(6) School bus certification label and FMVSS 120 label (pretest only)

(7) Fuel tank(s), tank mounting straps and brackets, connecting lines, vent lines, pressure regulators, shut-off valves, etc.

(8) Speed trap counter displays

(9) Any photographs requested by the COTR

NOTE: Vehicle identification placards shall be positioned so that at least one placard will be visible in each camera's field-of-view (FOV). The placards should identify the vehicle, test laboratory, type test and test data.

10. DEFINITIONS

AVERAGE TEMPERATURE

For calculating fuel system pressure drop, the average temperature measurement (in degrees Kelvin) either ambient air near the vehicle, or, when possible, fuel system (N_2) temperature is made at the start of fuel leakage test time and every 15 minutes following until the test time of 60 minutes is complete. The sum of the temperatures taken, divided by 5, yields the average temperature.

BI-FUEL CNG VEHICLE

A vehicle equipped with two independent fuel systems, one of which is designed to supply CNG and the second to supply a fuel other than CNG.

CNG FUEL CONTAINER or CNG FUEL TANK

A tank or container designed to store CNG as motor fuel onboard a motor vehicle.

CNG FUEL SYSTEM

All components used to store or supply CNG to a vehicle engine.

DEDICATED CNG VEHICLE

A vehicle equipped with one fuel system and designed to operate on CNG

DUAL FUEL CNG VEHICLE

A vehicle which is fueled by two fuels simultaneously, one of which is CNG and the second of which is a fuel other than CNG.

DESIGNATED SEATING POSITION (DSP)

Any plan view location intended by the school bus manufacturer to provide seating accommodation while the bus is in motion for an occupant at least as large as a 5th percentile adult female.

DESIGNATED SEATING CAPACITY (DSC)

Number of DSP's provided in the school bus.
NOTE: DRIVER'S SEAT TO BE INCLUDED AS A DSP.

10. DEFINITIONS....Continued

FUEL LEAKAGE

The loss of fuel system pressure due to system breaches, loss of fitting integrity, etc. other pressure losses due to variations in ambient temperature.

FUEL SYSTEM VOLUME V_{FS}

The internal volume (in liters) of the fuel container and the fuel lines up to the first pressure regulator.

GROSS AXLE WEIGHT RATING (GAWR)

Value specified by the vehicle manufacturer as the load-carrying capacity of a single axle system, as measured at the tire-ground interfaces.

GROSS VEHICLE WEIGHT RATING (GVWR)

Value specified by the manufacturer as the loaded weight of a single vehicle.

HIGH PRESSURE PORTION OF A FUEL SYSTEM

All the components from and including each CNG fuel container up to, but not including, the first pressure regulator.

LONGITUDINAL OR LONGITUDINALLY

Parallel to the longitudinal (fore-aft) centerline of the vehicle.

SCHOOL BUS

Bus that is sold, or introduced in interstate commerce, for purposes that include carrying students to and from school or related events, but does not include a bus designed and sold for operation as a common carrier in urban transportation.

SCHOOL BUS IMPACT POINT

Single impact by a moving contoured barrier at the most vulnerable point on the periphery of the school bus body as determined by the COTR.

SERVICE PRESSURE

The internal pressure of a CNG fuel container when filled to design capacity with CNG at 20ºC (68ºF).

10. DEFINITIONS....Continued

SHUT OFF VALVE

Valve used to stop the flow of fuel system lading from one portion of the fuel system to another. Theses devices may be operated either manually or automatically and are, regardless of type, to be in the open (allowing flow) position during testing. The COTR will provide the test laboratory with any pertinent manufacturer-derived information as to vehicle-particular procedures and/or additional test apparatus or equipment that is required to ensure that all shutoff valves are in the open position during the FMVSS 303 test.

TEST SURFACE

Concrete surface upon which the school bus is tested is level, rigid, and of uniform construction, with a skid number of 75 when measured in accordance with ASTM Method E-274-65T at 40 mph, omitting water delivery as specified in paragraph 7.1 of that method.

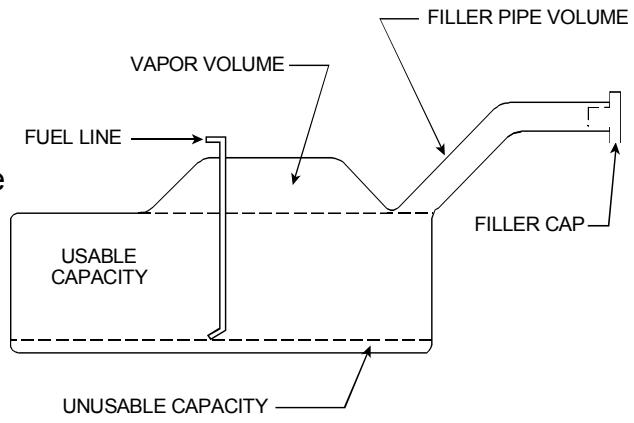
UNLOADED VEHICLE WEIGHT (UVW)

Weight of a vehicle with maximum capacity of all fluids (and maximum capacity of **ALL** fuels) necessary for operation of the vehicle, but without cargo, occupants, or accessories that are ordinarily removed from the vehicle when they are not in use.

VEHICLE FUEL TANK CAPACITY (LIQUID FUEL)

For Bi-Fuel or Dual fuel vehicles where the second fuel is a liquid, the fuel tank's unusable capacity (i.e., the volume of fuel left at the bottom of the tank when the vehicle's fuel pump can no longer draw fuel from the tank) plus its usable capacity (i.e., the volume of fuel that can be pumped into the tank through the filler pipe with the vehicle on a level surface and with the unusable capacity already in the tank). The term does not include the vapor volume of the tank (i.e., the space above the fuel tank filler neck) nor the volume of the fuel tank filler neck.

VEHICLE FUEL TANK ASSEMBLY



NOTE: The "usable capacity" and "unusable capacity" figures will be furnished by the COTR. This information is obtained from the vehicle manufacturers.

11. PRETEST REQUIREMENTS

Prior to conducting any compliance tests, contractors are required to submit a detailed in-house compliance test procedure to the COTR which includes a step-by-step description of the methodology to be used. Written approval must be obtained from the COTR before initiating the compliance test program so that all parties are in agreement.

The contractor's test procedure shall contain a complete listing of test equipment and a detailed check-off list. There shall be no contradiction between the OVSC Laboratory Test Procedure and the contractor's in-house test procedure. The list of test equipment shall include instrument accuracy and calibration dates.

TEST DATA LOSS

A compliance test is not to be conducted unless all of the various test conditions specified in the applicable OVSC Laboratory Test Procedure have been met. Failure of a contractor to obtain the required test data and to maintain acceptable limits on test parameters in the manner outlined in the applicable OVSC Laboratory Test Procedure may require a retest at the expense of the contractor. The retest costs will include the cost of the replacement vehicle (with the same equipment as the original vehicle) and all costs associated with conducting the retest. The original test specimen (vehicle) used for the invalid test shall remain the property of OVSC, and the retest specimen shall remain the property of the contractor. If there is a test failure, the contractor shall retain the retest specimen for a period not exceeding 180 days. If there is no test failure, the Contractor may dispose of the test specimen upon notification from the COTR that the final test report has been accepted.

The Contracting Officer of NHTSA is the only NHTSA official authorized to notify the contractor that a retest is required. The retest shall be completed within two (2) weeks after receipt of notification by the Contracting Officer that a retest is required. If a retest is conducted, no test report is required for the original test.

VEHICLE PREPARATION

A. The contractor will inspect the school bus upon delivery and record any damage that could affect the results of the compliance test. Then wash and clean the school bus as necessary. Identify the vehicle with an assigned NHTSA number (900 series) which shall be utilized as a primary identification number throughout the test program.

B. Obtain and record the Unloaded Vehicle Weight (UVW) of the school bus at each wheel with the maximum capacity of all fuel(s), oil, transmission fluid, coolant, etc.

11. PRETEST REQUIREMENTS....Continued

C. Obtain and record the school bus attitude.

D. Fuel System Capacity

CNG Fuel Systems —

(1) Prior to beginning the actual fuel system preparation and N_2 fill procedure, fill the fuel system to the service pressure with CNG (corrected accordingly for the ambient fill temperature). Check the fuel system for leakage via any method(s) available (acoustic detection, fuel odorant sniffers, pressure hold periods, visual inspections with soapy water solutions, etc.) to ensure that the system contains no inherent leaks or breaches as delivered. If any fuel system leaks are detected in the fuel system, contact the COTR immediately before beginning any further test preparation.

(2) With the vehicle on a level surface and all manual and automatic shutoff valves open, remove the fuel from the vehicle fuel system by depressurizing the high pressure side of the fuel system to atmospheric pressure, then operate the engine until the engine stops and will not again start.

(3) Install pressure transducer(s) (with the properties specified in the following paragraph G, "CNG FUEL SYSTEM PRESSURE MEASUREMENT" of section 11, SCHOOL BUS MOVING CONTOURED BARRIER TEST EQUIPMENT REQUIREMENTS, on the high pressure side of the fuel system in location(s) specified by the manufacturer in a manner as to ensure that there is no leakage through the transducer(s) or the fuel system/transducer interface. If the fuel storage cylinder(s) is equipped with an unused second (rear) fitting and plug, at this time, install plug mounted temperature transducer(s) in a manner as to ensure that there is no leakage through the transducer(s) or the fuel system/transducer interface. Also ensure that **all** transducers are attached in such a manner as to maintain the fuel system integrity at the transducer and transducer/fuel system interface during the crash (i.e. ensure that there will be no leakage from the fuel system caused by the transducers or their connection to the fuel system during or after the crash).

(4) Prior to beginning the actual fuel system equilibration procedure, with the fuel system filled to the service pressure with N_2 (corrected accordingly for the ambient fill temperature) and all pressure and temperature transducers installed, ensure that there is no leakage in

11. PRETEST REQUIREMENTS....Continued

any sensor, sensor-fuel system interface or any fuel system connection or fitting affected by the test preparation via the application of a soapy water solution to these areas.

(5) Fill each fuel storage container to 90% to 120% of its service pressure with Nitrogen (N_2) gas (correcting the fill pressure accordingly for the ambient temperature at the time of filling). A slow fill rate is preferable to limit the temperature rise in the tank and fill gas and to reduce the number of iterative fill-equilibration cycles required to obtain final test pressurization. Crank the engine several times to pressurize the low pressure side of the system. Recheck fuel container pressure to ensure the system is still pressurized to 90% to 120% of service pressure. Equilibrate (stabilize) the vehicle to the target ambient test temperature (with the associated ± 5º range) for a minimum of 12 hours, recording ambient temperature and fuel container pressure measurements at a minimum of every 15 minutes. The system can be considered stabilized if —

(A) After the first 9 hours, the pressure measurements taken over any 3 hour stabilization period changes less then 60 psi, or

(B) If a temperature sensing device(s) has been mounted in a fuel storage container(s), then the system can be considered in equilibrium when the temperature reading in the tank is within ± 5ºF of the ambient test (stabilization) temperature and the temperature change within the tank is less then 3ºF per hour for a time period of at least 3 hours.

The fuel system cannot be considered stabilized until one or both of these conditions are met.

(6) After completing the stabilization period specified in step 5, and with all electric (automatic) shutoff valves that are normally open when the electrical system is activated open, all manual shutoff valves normally open when the vehicle is in operation open, and any shutoff valve on the fuel container open as well, ensure that the fuel storage system is pressurized to no less than 96% and no greater than 98% of its service pressure (corrected accordingly for the ambient test temperature).

(A) If the pressure is not within this range, but is between 91% and 103% percent of the service pressure, add or remove gas from the system and stabilize for a minimum of 4 hours, checking the pressure reading every 15 minutes. The system

11. PRETEST REQUIREMENTS....Continued

can be considered stabilized and filled if —

[1] The pressure change during any 3 hour period following the first hour of this stabilization is less than 60 psi and the pressure reading at the end of the period is between 96% and 98% of service pressure (corrected accordingly for the ambient test temperature), or

[2] If a temperature sensing device is placed in a fuel storage container and there is less then a 3ºF per hour temperature change within the tank for a minimum period of 3 hours and the temperature within the tank is within ± 5ºF of the ambient test (stabilization) temperature and the pressure reading at the end of the period is between 96% to 98% of service pressure (corrected accordingly for the ambient test temperature).

If not, then repeat step (6).

(B) If the pressure is not within this range, and is not between 91% and 103% of the service pressure, add or remove gas from the system and stabilize for a minimum of 6 hours, checking the pressure reading every 15 minutes. The system can be considered stabilized and filled if —

[1] The pressure change during any 3 hour period following the first 3 hours of this stabilization is less than 60 psi and the pressure reading at the end of this stabilization period is between 96% and 98% of service pressure (corrected accordingly for the ambient test temperature), or

[2] If a temperature sensing device is placed in a fuel storage container and there is no more than a 3ºF per hour temperature change within the tank for at least a 3 hour period and the temperature within the tank is within ± 5ºF of the ambient test (stabilization) temperature and the pressure reading at the end of this stabilization period is between 96% to 98% of service pressure (corrected accordingly for the ambient test temperature)

If not, then repeat step (6).

11. PRETEST REQUIREMENTS....Continued

Liquid Fuel System of Bi/Dual Fuel Vehicles —

(1) With the test vehicle on a level surface, pump the fuel from the vehicle's fuel tank and then operate the engine until it stops, simultaneous with step 1 of B(1).

(2) Add Stoddard solvent (which has been dyed red) to the test vehicle's fuel tank in an amount which is equal to not less than 92 percent and not more than 94 percent of the fuel tank's USABLE CAPACITY as stated by the vehicle's manufacturer (value furnished by COTR).

(3) Add the amount of Stoddard solvent needed to fill the entire fuel system from the fuel tank through the engine's induction system. Prior to the test, operate the engine to assure that Stoddard solvent is present throughout the entire fuel system.

E. Electric Fuel Pump Operation & Shutoff Valve Operation —

If the vehicle has an electrically driven fuel pump that normally runs when the vehicle's electrical system is activated, it shall be operating at the time of the barrier crash.

If the vehicle has any electric shutoff valves that are normally open when the electrical system is activated, they (and all manually operated shutoff valves) are to be open at the time of the barrier crash. Further, any electric shutoff valve that prevents sensing of system pressure by the pressure transducer when closed must remain open for both the initial pressure measurement and the pressure measurement 60 minutes after the impact. Any valve shall be open for a period of one minute to equalize system pressure.

NOTE: Since acid is drained from vehicle's battery prior to impact test (for protection of test personnel), it may be necessary to install a 12 volt dry cell battery in the test vehicle to be connected to the vehicle's battery terminals. The vehicle's ignition switch shall be placed in the "ON" position prior to the impact test.

F. Paint the fuel tank, retainer straps, filler pipe, lines, pressure regulators, shut-off valves, etc. bright colors to facilitate photographic analysis during the impact event.

G. Determine the School Bus Test Weight (SBTW) as follows:

SBTW = UVW + (N x 120 pounds), where --

11. PRETEST REQUIREMENTS....Continued

UVW is the Unloaded Vehicle Weight or the actual weight of the school bus with maximum capacity of fuel (all fuel systems), oil, and coolant.

N is the number of Designated Seating Positions (DSPs) in the school bus INCLUDING the driver's seat.

NOTE: The 120 pounds of ballast weight (sand or shot bags) will be UNSECURED.
Record the SBTW.

NOTE: Due to the difference in the physical properties between N_2 and CNG, the actual unloaded vehicle weight measurement taken from a vehicle with an N_2 pressurized fuel system may be greater than that of the vehicle with a CNG pressurized fuel system. Correction for this difference must be made to ensure proper vehicle test weight.

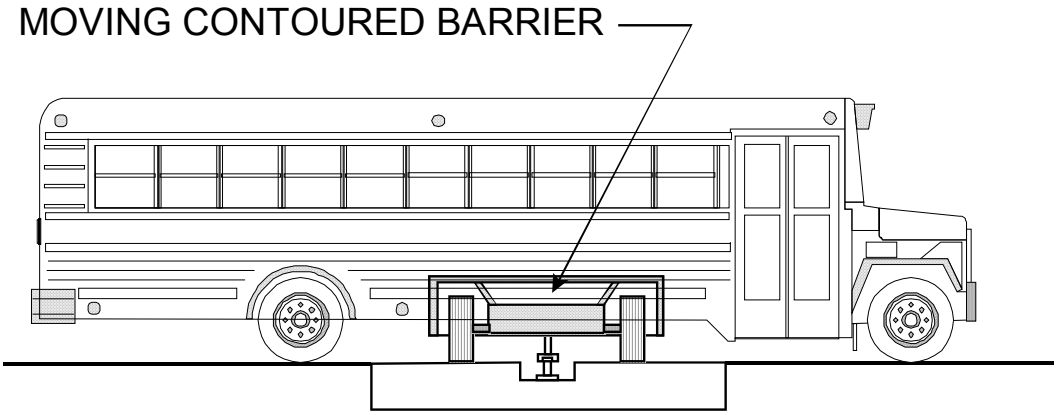
Reweighing and verification of the actual vehicle test weight with the fuel system filled with N_2 is required to ensure that the vehicle is loaded to the correct test weight, calculated for the vehicle loaded (filled) with CNG.

H. The COTR will consult with the contractor to select the impact angle. Place the school bus across the tow road monorail so that moving barrier will impact the bus at the chosen point as shown on the next page.

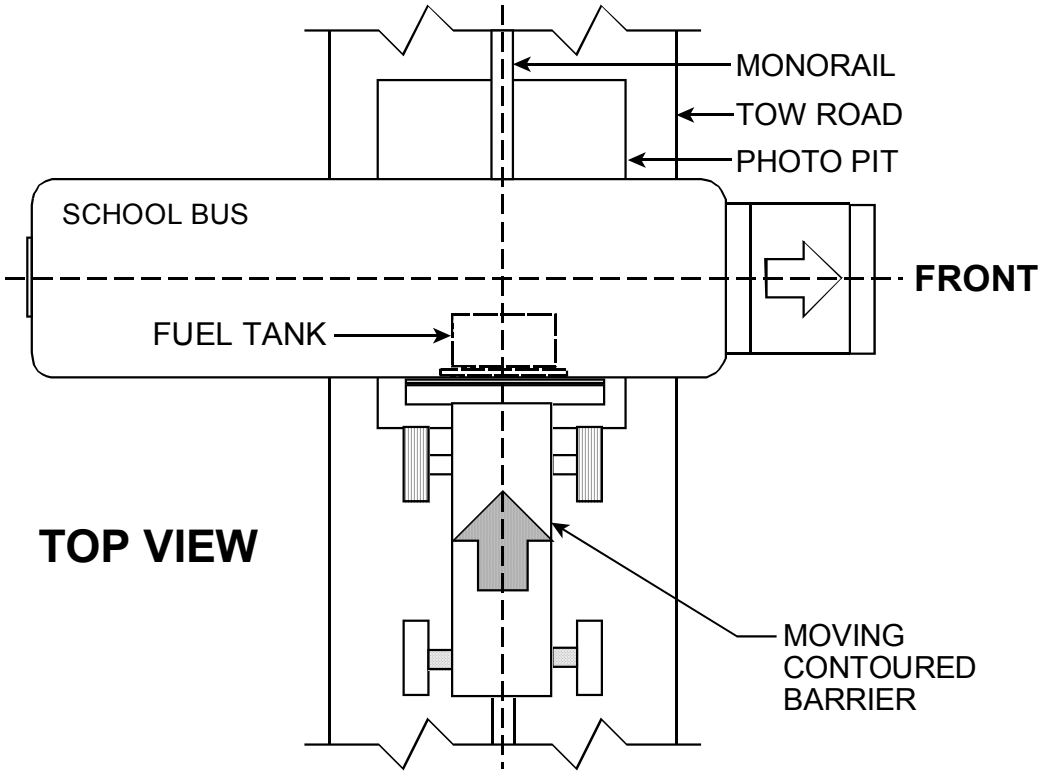
I. Position the speed trap timers, stadia pole, and electronic readout equipment and check operation of all timing equipment.

J. Aim, load, focus, and check operation of all photographic equipment.

11. PRETEST REQUIREMENTS....Continued



CROSS-SECTION OF TOW ROAD



11. PRETEST REQUIREMENTS....Continued

K. Tire Inflation Pressure —

All tires (including spare if it is a full sized type) are inflated to the vehicle manufacturer's specifications as listed in the owner's manual for the test vehicle and also listed on the vehicle's tire placard.

L. Vehicle Fluids (Other Than Stoddard Solvent in Bi/Dual Fuel Vehicles) —

Prior to an impact test, drain all vehicle fluids such as battery acid, cooling system antifreeze, windshield washer fluid, power steering fluid, automatic transmission fluid, etc. so that any Stoddard Solvent (dyed red) leakage from the liquid fuel system of a bi or dual fuel vehicle will be evident and to protect test personnel (reason for draining acid from battery).

R. Pretest Fuel System Pressure —

Fuel system pressure shall be measured and recorded just prior to impact. The pressure shall be between 96 and 98% of the rated system operating pressure.

S. Pretest Temperature —

The crash site ambient temperature, measured at the vehicle, shall be measured and recorded just prior to and just after the test.

TEST TEMPERATURE CONDITIONS

The Contractor must verify that the ambient temperature surrounding the vehicle from the execution of the pretest soak, through the crash, and through the completion of the ensuing leak detection period does not vary by more than 10ºF. The target range for the test temperature shall be within 66ºF and 78ºF. At least one primary and one secondary temperature sensor must be used. The temperature sensors shall be accurate to within ± 0.5ºF. The ambient temperature must be monitored and continuously recorded from the time of initiating the pretest equilibration temperature soak until the conclusion of the post crash leak detection period. The ambient air temperature measurement must be continuously taken within 36 inches of the test vehicle.

The contractor shall mark the ambient air temperature recordings with the date, time, and technician name at the beginning and end of the pretest equilibration soak, the beginning of barrier or vehicle motion, the cessation of vehicle motion, and the beginning and the end of the post crash leak detection period. Any excursions from the specified temperature must be noted on the recording along with the reason(s) for the excursion.

11. PRETEST REQUIREMENTS....Continued

SCHOOL BUS MOVING CONTOURED BARRIER TEST EQUIPMENT REQUIREMENTS

A. MOVING CONTOURED BARRIER CARRIAGE PER S7.5 AND FIGURES 1 AND 2 IN FMVSS 301 SHOWN AS APPENDIX A

(1) Rigid construction symmetrical about a longitudinal-vertical plane, with a solid nonsteerable front axle and fixed rear axle attached directly to the frame rails WITH NO SPRING OR OTHER TYPE SUSPENSION SYSTEM on any wheel.

(2) The total weight shall be between 3,900 and 3,980 pounds with weight distribution of 895 pounds plus 0 pounds and minus 25 pounds at each REAR wheel and 1,095 pounds plus 0 pounds and minus 25 pounds at each FRONT wheel.

(3) The center of gravity (CG) shall be 54.0 inches plus or minus 1.5 inches REARWARD of the FRONT wheel axis, in the vertical- longitudinal plane of symmetry, 15.8 inches plus or minus 0.5 inch ABOVE the GROUND.

NOTE: The contractor must provide the COTR an analysis which shows that the Contoured Moving Barrier meets the design criteria of the standard, including the moments of inertia around the CG before test begins.

(4) Moving Barrier Carriage shall have an onboard braking device capable of stopping it.

(5) Front and rear tire tread width will be 60 inches ± 1 inch.

(6) The Moving Barrier Carriage will have a wheelbase of 120 inches ± 2 inches.

(7) The Moving Barrier Carriage will use G-78 x 15 pneumatic tires (or equivalent) on all wheels with a minimum inflation pressure of 24 psi.

(8) The moment of inertia about the CG will be as follows:

$I_x = 271 \pm 13.6$ slug/ft^2

$I_z = 3475 \pm 174$ slug/ft^2

B. MOVING BARRIER CONTOURED IMPACT SURFACE PER S7.5 AND FIGURE 2 IN FMVSS 301 SHOWN AS APPENDIX B

11. PRETEST REQUIREMENTS....Continued

The impact surface of the moving contoured barrier will measure 78 inches wide and 24.75 inches high. It will be attached to the carriage such that the moment of inertia about the CG is as specified above. The barrier surface will NOT BE COVERED WITH PLYWOOD, and the ground clearance to the lower edge of the impact surface will be 5.25 inches plus or minus 0.5 inch.

C. BARRIER TOW ROAD

The tow road surface must be straight, level, smooth, and of uniform construction. The concrete surface on which the impact test is conducted must have a skid number of 75 when measured in accordance with ASTM Method E-274-65T at 40 mph, omitting water delivery as specified in paragraph 7.1 of that method. The tow road must have sufficient length to obtain stabilization of moving barrier velocity (essentially-zero acceleration) before impact. A photography pit will be located in the tow road at the impact area (at least 100 feet from any fixed barrier) so that any leakage from the fuel system can be photographed during the moving barrier impact event. A minimum of obstructions (grating, rails, etc.) will be placed in the camera field-of-view (FOV).

D. TEST VEHICLE AND MOVING BARRIER GUIDANCE

A guidance system is required to assure that the test vehicle or the moving barrier impacts the target at the proper angle. Normally the monorail which extends along the center of the tow road is used for lateral guidance with a small dolly or guide shoe "riding" on the monorail and engaging the drive cable through a set of jaws which grip the cable. **SOLID CONNECTIONS between the guide shoe and the test vehicle or moving barrier ARE NOT ALLOWED** — cables with tensioning turnbuckles extending from the test vehicle's left and right side lower control arms to the guide shoe should be used. The guide shoe is normally released from the monorail at the entrance to the photographic pit and the test vehicle or moving barrier free wheels into the barrier face or target vehicle. The monorail should not extend over the photographic pit. The release of the barrier should take place between 6 and 24 inches from the impacted side of the test vehicle. The actual impact shall be within ±2 inches of the target impact location.

There should be a minimum amount of steel grating over the fixed collision barrier photographic pit in order to allow for maximum photographic coverage of the test vehicle's underbody area.

11. PRETEST REQUIREMENTS....Continued

E. MOVING BARRIER IMPACT VELOCITY REQUIREMENT

The moving contoured barrier velocity, which will be in the range of 28.9 to 29.9 mph, will be approximately constant (essentially-zero acceleration) for the last 5 feet before impact with the school bus.

F. BARRIER IMPACT VELOCITY MEASUREMENT

The final velocity shall be measured when the front of the barrier is within 1 foot of the vehicle surface, and the reported impact velocity will take into consideration all of the response characteristics of the entire velocity measurement system utilized in its determination. Impact velocity will be measured by no less than 2 sets of timing devices, and the timing devices shall be accurate to within plus or minus 0.05 mph and be calibrated by an instrument traceable to the National Bureau of Standards. The impact velocity shall be permanently recorded. A photograph of the digital readout from the timing device will be kept on file by the contractor for this purpose.

A third timing device will be placed along the tow road at a sufficient distance form the vehicle face for monitoring the velocity of the barrier and permit aborting the test if the barrier's speed is outside of the specified velocity range of 28.9 to 29.9 mph.

Redundant barrier impact speed measurement will be available since the impact speed can also be calculated from the high-speed photographic film. While the barrier is resting against the vehicle face for pretest preparations, a stadia pole will be placed directly in line with one of the 12 inch photographic targets as viewed through the broadsides camera bore sight.

G. CNG FUEL STORAGE SYSTEM PRESSURE MEASUREMENT

Test vehicle fuel storage system pressure shall be measured by at least one electronic pressure transducer with an accuracy of at least 0.1% over the pressure range of at least 0 to 4,000 psi and together with the recording equipment, shall have a potential error of no greater than ± 15.4 psi under test conditions. The transducer(s) must further be capable of making pressure measurements prior to, during and post vehicle-barrier impacts of up to 30 mph (including shock loads of 50 Gs). The pressure measurement system shall be calibrated by an instrument traceable to the National Institute of Standards and Technology (NIST). **A permanent record of the test pressure readings, continuous or discrete, shall be made during the test and filed.**

11. PRETEST REQUIREMENTS....Continued

H. ABORTING SYSTEM

The moving contoured barrier is required to have an onboard abort system which could consist of a remote, gas actuated, brake machine installed in the brake line. When an abort function is initiated, the moving contoured barrier service brakes are actuated by releasing high-pressure gas into the hydraulic system. Abort criteria consists of barrier speed, data acquisition and instrumentation system readiness, and stability of the moving barrier on the tow road. The first two criteria are automatically monitored by the test control system while the third is visually monitored. Manual abort provisions are available. Upon verifying the moving contoured barrier target impact speed, the test control system automatically deactivates the abort system to preclude inadvertent test abort immediately prior to impact. The abort command can be transmitted from the control console to the moving contoured barrier through a trailing umbilical cable up to the "point-of-no-return" or the location on the tow road beyond which it would be impossible to stop the moving contoured barrier without an impact with the school bus.

12. COMPLIANCE TEST EXECUTION

A. FUEL SYSTEM TEST REQUIREMENTS

The school bus fuel system leakage requirements for the moving contoured barrier impact test are as follows:

When the test vehicle is contacted by the moving contoured barrier traveling forward at a speed of 29.4 mph ± 0.5 mph, fuel system leakage (measured via pressure drop) for the time period from vehicle impact until 60 minutes following cessation of motion, shall not exceed the greater of either:—

(1) 1062kPa (154 psi)
OR
(2) 895 (T/V_{FS}) kPa, where --
- T is the average temperature of the test gas (in Kelvin)
- V_{FS} is the internal volume of the fuel container and fuel lines up to the first pressure regulator (in liters).

B. GENERAL TEST CONDITIONS

(1) The school bus fuel system(s) will be filled as specified in Section 11.

(2) If the school bus is equipped with an electronically driven fuel pump that normally runs when the electrical system is activated (without the engine running) it shall be operating at the time of moving barrier impact.

(3) All electric (automatic) shutoff valves that are normally open when the electrical system is activated are open, all manual shutoff valves open when the vehicle is in operation are open, and any shutoff valve on the fuel container are open.

(4) Ballast weight of 120 pounds (sand or shot bags) will be placed unsecured at EACH DSP INCLUDING THE DRIVER'S DSP. The bags holding the ballast will be strong enough to retain the ballast material when dropped from seat height.

(5) Tires will be inflated to the manufacturer's specifications.

(6) The transmission will be placed in neutral.

(7) The parking brake is SET.

12. COMPLIANCE TEST EXECUTION....Continued

C. BARRIER IMPACT TEST EXECUTIVE

(1) Conduct the moving contoured barrier impact test at a point on school bus body selected by the COTR and Project Engineer.

(2) Execute the post impact leak detection period on the vehicle.

(3) Inspect entire CNG fuel system for leakage or breaches and the liquid fuel system of bi/dual fueled vehicles for Stoddard solvent leakage.

(4) Record post impact data.

13. POST TEST REQUIREMENTS

A. Protect the school bus from further damage.

B. Safely depressurize CNG fuel system (vent to atmospheric pressure in a controlled manner)

C. Move bus to secure area.

D. Prepare final test report.

14. REPORTS

14.1 MONTHLY STATUS REPORTS

The contractor shall submit a monthly Test Status Report and a Vehicle Status Report to the COTR. The Vehicle Status Report shall be submitted until all vehicles are disposed of. Samples of the required Monthly Status Reports are contained in the report forms section.

14.2 APPARENT NONCOMPLIANCE

Any indication of a test failure shall be communicated by telephone to the COTR within 24 hours with written notification mailed within 48 hours (Saturdays and Sundays excluded). A Notice of Test Failure (see report FORMS section) with a copy of the particular compliance test data sheet(s) and preliminary data plot(s) shall be included. In the event of a test failure, a post test calibration check of some critically sensitive test equipment and instrumentation may be required for verification of accuracy. The necessity for the calibration shall be at the COTR's discretion and shall be performed without additional costs to the OVSC.

14.3 FINAL TEST REPORTS

14.3.1 COPIES

In the case of a test failure, **SEVEN** copies of the Final Test Report shall be submitted to the COTR for acceptance within three weeks of test completion. The Final Test Report format to be used by all contractors can be found in the "Report Section".

Where there has been no indication of a test failure, **FOUR** copies of each Final Test Report shall be submitted to the COTR within three weeks of test completion. Payment of contractor's invoices for completed compliance tests may be withheld until the Final Test Report is accepted by the COTR. Contractors are requested to NOT submit invoices before the COTR is provided copies of the Final Test Report.

Contractors are required to submit the first Final Test Report in draft form within two weeks after the compliance test is conducted. The contractor and the COTR will then be able to discuss the details of both test conduct and report content early in the compliance test program.

Contractors are required to PROOF READ all Final Test Reports before submittal to the COTR. The OVSC will not act as a report quality control office for contractors. Reports containing a significant number of errors will be returned to the contractor for correction, and a "hold" will be placed on invoice payment for the particular test.

14. REPORTS....Continued

14.3.2 REQUIREMENTS

The Final Test Report, associated documentation (including photographs) are relied upon as the chronicle of the compliance test. The Final Test Report will be released to the public domain after review and acceptance by the COTR. For these reasons, each final report must be a complete document capable of standing by itself.

The contractor should use **detailed** descriptions of all compliance test events. Any events that are not directly associated with the standard but are of technical interest should also be included. The contractor should include as much **detail** as possible in the report, including the contractor's test procedure.

Instructions for the preparation of the first three pages of the final test report are provided below for the purpose of standardization.

14.3.3 FIRST THREE PAGES

A. FRONT COVER —
A heavy paperback cover (or transparency) shall be provided for the protection of the final report. The information required on the cover is as follows:

(1) Final Report Number such as 303S-ABC-9X-001 where --
303S is the FMVSS tested (S = School Bus)
ABC are the initials for the laboratory
9X is the Fiscal Year of the test program
001 is the Group Number (001 for the 1st test, 002 for the 2nd test, etc.)

(2) Final Report Title And Subtitle such as

SAFETY COMPLIANCE TESTING FOR FMVSS 303S
Fuel System Integrity — CNG Fueled School Buses
* * * * * * * * * * * * * * * * * *
SAFERIDE BUS COMPANY
199X DELUXE 65-PASSENGER SCHOOL BUS
NHTSA No. CX0900

(3) Contractor's Name and Address such as

COMPLIANCE TESTING LABORATORIES, INC.
4335 West Dearborn Street
Detroit, Michigan 48090

14. REPORTS....Continued

NOTE: DOT SYMBOL WILL BE PLACED BETWEEN ITEMS (3) AND (4)

(4) Date of Final Report completion

(5) The words "FINAL REPORT"
(6) The sponsoring agency's name and address as follows

U. S. DEPARTMENT OF TRANSPORTATION
National Highway Traffic Safety Administration
ENFORCEMENT
Office of Vehicle Safety Compliance
400 Seventh Street, SW
Room 6115 (NVS-220)
Washington, DC 20590

14. REPORTS....Continued

B. FIRST PAGE AFTER FRONT COVER —
A disclaimer statement and an acceptance signature block for the COTR shall be provided as follows

This publication is distributed by the U. S. Department of Transportation, National Highway Traffic Safety Administration, in the interest of information exchange. The opinions, findings and conclusions expressed in this publication are those of the author(s) and not necessarily those of the Department of Transportation or the National Highway Traffic Safety Administration. The United States Government assumes no liability for its contents or use thereof. If trade or manufacturers' names or products are mentioned, it is only because they are considered essential to the object of the publication and should not be construed as an endorsement. The United States Government does not endorse products or manufacturers.

Prepared By: _____

Approved By: _____

Approval Date: _____

FINAL REPORT ACCEPTANCE BY OVSC:

Accepted By: _____

Acceptance Date: _____

14. REPORTS....Continued

C. SECOND PAGE AFTER FRONT COVER —
A completed Technical Report Documentation Page (Form DOT F1700.7) shall be completed for those items that are applicable with the other spaces left blank. Sample data for the applicable block numbers of the title page follows.

Block 1 — REPORT NUMBER

303S-ABC-9X-001

Block 2 — GOVERNMENT ACCESSION NUMBER

Leave blank

Block 3 — RECIPIENT'S CATALOG NUMBER

Leave blank

Block 4 — TITLE AND SUBTITLE

Final Report of FMVSS 303S Compliance Testing of 199X Deluxe 65-Passenger School Bus, NHTSA No. CX0900

Block 5 — REPORT DATE

March 1, 199X

Block 6 — PERFORMING ORGANIZATION CODE

ABC

Block 7 — AUTHOR(S)

John Smith, Project Manager / Bill Doe, Project Engineer

Block 8 — PERFORMING ORGANIZATION REPORT NUMBER

ABC-DOT-XXX-001

Block 9 — PERFORMING ORGANIZATION NAME AND ADDRESS

ABC Laboratories
405 Main Street
Detroit, MI 48070

14. REPORTS....Continued

Block 10 — WORK UNIT NUMBER

Leave blank

Block 11 — CONTRACT OR GRANT NUMBER

DTNH22-9X-D-12345

Block 12 — SPONSORING AGENCY NAME AND ADDRESS

US Department of Transportation
National Highway Traffic Safety Administration
ENFORCEMENT
Office of Vehicle Safety Compliance (NVS-220)
400 Seventh Street, SW, Room 6115
Washington, DC 20590

Block 13 — TYPE OF REPORT AND PERIOD COVERED

Final Test Report
Feb. 15 to Mar. 15, 199X

Block 14 — SPONSORING AGENCY CODE

NVS-220

Block 15 — SUPPLEMENTARY NOTES

Leave blank

Block 16 — ABSTRACT

Compliance tests were conducted on the subject 199X Deluxe 65-Passenger School Bus in accordance with the specifications of the Office of Vehicle Safety Compliance Test Procedure No. TP-303S-XX for the determination of FMVSS 303S compliance.

Test failures identified were as follows:

None

NOTE: Above wording must be shown with appropriate changes made for a particular compliance test. Any questions should be resolved with the COTR.

14. REPORTS....Continued

Block 17 — KEY WORDS

Compliance Testing
Safety Engineering
FMVSS 303S — School Bus

Block 18 — DISTRIBUTION STATEMENT

Copies of this report are available from —

NHTSA Technical Reference Division
Room 5108 (NAD-52)
400 Seventh St., SW
Washington, DC 20590
Telephone No.: 202-366-4946

Block 19 — SECURITY CLASSIFICATION OF REPORT

Unclassified

Block 20 — SECURITY CLASSIFICATION OF PAGE

Unclassified

Block 21 — NUMBER OF PAGES

Add appropriate number

Block 22 — PRICE

Leave blank

14. REPORTS....Continued

14.3.4 TABLE OF CONTENTS

Final test report Table of Contents shall include the following:

A. Section 1 — Purpose of Compliance Test

B. Section 2 — Compliance Test Data Summary

C. Section 3 — Compliance Test Data

D. Section 4 — Noncompliance Data (if applicable)

E. Section 5 — Photographs

15. DATA SHEETS

DATA SHEET 1
SCHOOL BUS DATA

School Bus Manufacturer: _____

School Bus Model: _____ ; Build Date: _____

Incomplete Vehicle Manufactured By: _____

Build Date: _____

School Bus GVWR = _____ lbs. ; GAWR Front = _____ lbs.

School Bus VIN: _____ ; No. of DSP's: _____ (inc. driver)

School Bus NHTSA No.: _____ ; Bus Body Color: _____

Engine Displacement: _____ cu. in.; No. of Cylinders: _____

Fuel Pump Actuation: ___ Electrical ___ Mechanical

___ Pump "ON" with Ignition

___ Pump "ON" with engine

Type of fuel system(s) found on vehicle: _____

School Bus Width: _____ inches; School Bus Length: _____ inches

Bus Unloaded Vehicle Weight (UVW): _____ pounds

Bus Occupant Load: DSP's (above) x 120 lbs. = _____ pounds

Bus Test Weight (SBRW): _____ pounds (SUM OF TWO ABOVE ITEMS)

School Bus Tire Manufacturer: _____

Recommended Cold Tire Inflation Pressure: Front = _____ psi

Rear = _____ psi

Tire Size and Load Range: _____

Recommended Tire Size & Load Range: ___ or ___ same as above

15. DATA SHEETS....Continued

School Bus Attitude: (ALL DIMENSIONS IN INCHES)

As Received: RF= ____ ; LF= ____ ; RR= ____ ; LR= ____

As Tested: RF= ____ ; LF= ____ ; RR= ____ ; LR= ____

FUEL SYSTEM DATA:

CNG Fuel System Capacity Listed in Owner's Manual: _____ psi @ ____ ºF

Usable Capacity Figure Furnished By COTR: _____ psi @ ____ ºF

Test Pressure Range (96 to 98% of Usable Capacity) —

_____ psi TO _____ psi @ _____ ºF

ACTUAL TEST PRESSURE = _____ psi (with entire fuel system filled) @ _____ ºF

Test Gas Type: Nitrogen _____

Type of Vehicle Fuel Pump: _____

Electric Fuel Pump Operation with Ignition Switch ON and Engine OFF —

_____

Liquid Fuel System Capacity Listed in Owner's Manual = _____ gallons

Fuel Tank Capacity: _____ gal. (From COTR) x .92 = _____ gal.

Fuel Tank Capacity: _____ gal. (From COTR) x .94 = _____ gal.

Tank Test Volume: _____ gallons

Test Fluid Type: Stoddard _____

Type of Vehicle Fuel Pump:_____

Electric Fuel Pump Operation with Ignition Switch ON and Engine OFF —

RECORDED BY: _____ ; DATE: _____

APPROVED BY: _____

15. DATA SHEETS....Continued

DATA SHEET 2
SCHOOL BUS IMPACT DATA

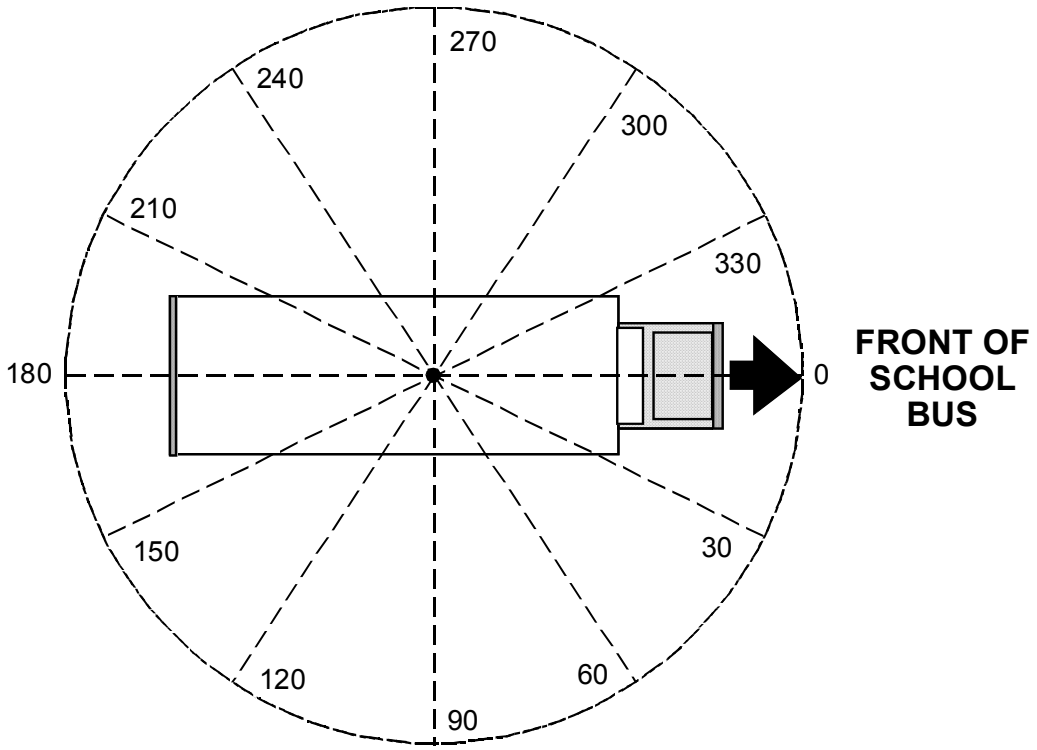
LABORATORY: _____

LOCATION: _____

TEST DATE: _____ ; TIME: _____ ; AMBIENT TEMP.: _____ ºF.

BARRIER VELOCITY: _____ mph; BARRIER PENETRATION: _____ inches

INDICATE IMPACT POINT BELOW:



TOP VIEW

LEGEND: Mark the above sketch as follows —

Use ARROW to indicate point and angle of barrier impact (centerline of arrow coincides with centerline of tow road monorail)

Use dotted rectangle to indicate location of fuel tank

15. DATA SHEETS....Continued

CNG FUEL SYSTEM LEAKAGE MEASUREMENT:

A. Initial pressure and temperature reading at start of test —
Pressure reading = _____ psi

Temperature reading = _____ ºF

B. For 60 minute period after vehicle motion ceases —

0 minute readings: Pressure = _____ psi

Temperature = _____ ºF

15 minute readings: Pressure = _____ psi

Temperature = _____ ºF

30 minute readings: Pressure = _____ psi

Temperature = _____ ºF

45 minute readings: Pressure = _____ psi

Temperature = _____ ºF

60 minute readings: Pressure = _____ psi

Temperature = _____ ºF

For 60 minutes: Total Pressure Drop = _____ psi

Average Temperature = _____ ºF

C. Pressure drop from initial reading to end of 60 minutes —

Actual = _____ psi

Maximum Allowable = The greater of 154 psi OR $129.8(T/V_{FS})$ psi (where T is in degrees Kelvin and V_{FS} is in liters) = _____ psi.

D. Provide Leakage Details: _____

_____

15. DATA SHEETS....Continued

LIQUID FUEL SYSTEM SPILLAGE NOTED:

_____ YES; _____ NO;

_____ FAILURE

FAILURE DETAILS:

Stoddard solvent spillage in excess of FMVSS 301 maximum allowable determined to start __ minutes, _____ seconds after TIME ZERO (T0).

A total of _____ ounces by weight of Stoddard solvent spilled during _____ minutes, ____ seconds.

Maximum spillage amount allowed by FMVSS 301 = _____ ounce(s) in _____ minute(s).

ADDITIONAL FAILURE DETAILS:

REMARKS:

RECORDED BY: _____ ; DATE: _____

APPROVED BY: _____

16. FORMS

LABORATORY NOTICE OF TEST FAILURE TO OVSC

FMVSS NO.: 303-School Bus ; TEST DATE: _____

LABORATORY: _____

CONTRACT NO.: _____ ; DELV. ORDER NO.: _____

LABORATORY PROJECT ENGINEER'S NAME: _____

SCHOOL BUS DESCRIPTION: _____

_____

BUS NHTSA NO.: _____ VIN: _____

MANUFACTURER: _____

TEST FAILURE DESCRIPTION: _____

_____

_____

_____

FMVSS REQUIREMENT, PARAGRAPHS : _____

_____

_____

_____

NOTIFICATION TO NHTSA (COTR) : _____

DATE: _____ ; BY: _____

REMARKS:

16. FORMS....Continued

MONTHLY TEST STATUS REPORT

FMVSS No. 303S

DATE OF REPORT: _____

NO.	BUS NHTSA NO., MAKE & MODEL	COMPLIANCE TEST DATE	PASS/ FAIL	DATE REPORT SUBMITTED	DATE INVOICE SUBMITTED	INVOICE PAYMENT DATE
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						

16. FORMS....Continued

MONTHLY VEHICLE STATUS REPORT

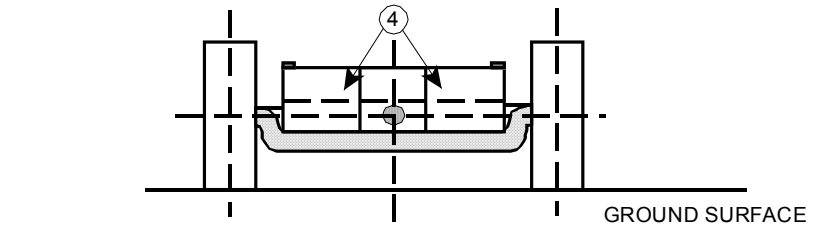
FMVSS NO. 303S

DATE OF REPORT: _____

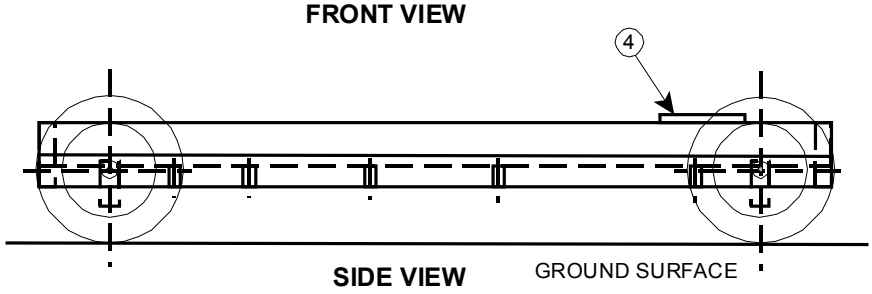
NO.	BUS NHTSA NO., MAKE & MODEL	DATE OF DELIVERY	ODOMETER READING	TEST COMPLETE DATE	BUS SHIPMENT DATE	ODOMETER READING
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						

APPENDIX A

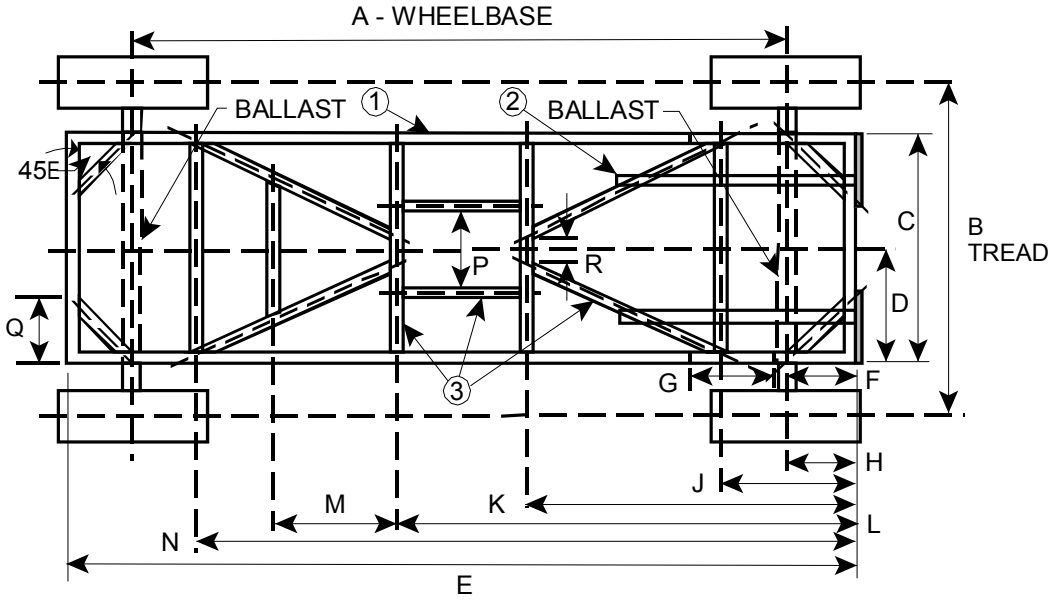
COMMON CARRIAGE FOR MOVING BARRIERS



FRONT VIEW



SIDE VIEW



TOP VIEW

DIMENSIONS SHOWN IN TABLE ON NEXT PAGE

NOTES:
1. OUTER FRAME 6.0 x 2.0 x 0.19 in. (152 x 51 x 5 mm) STEEL TUBING, TWO PIECES WELDED TOGETHER FOR A 12.0 in. (305 mm) HEIGHT.
2. BALLAST TIE DOWNS.
3. ALL INNER REINFORCEMENTS AND FRAME GUSSETS OF 4.0 x 2.0 x 0.19 in. (102 x 51 x 5 mm) STEEL TUBING
4. REINFORCE AREAS FOR BOLTING ON FACE P;LATES.

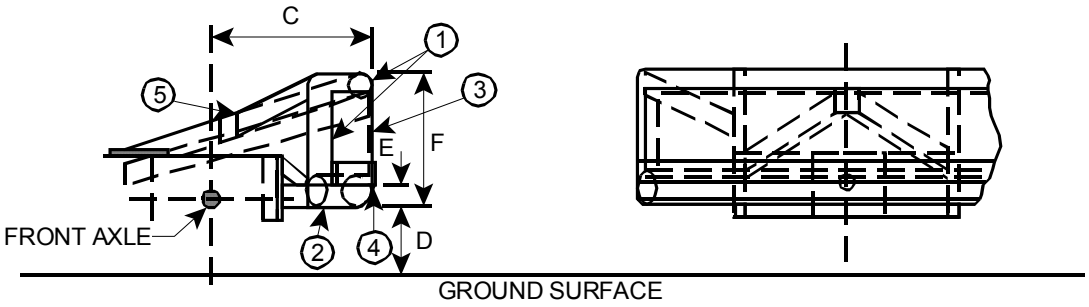
APPENDIX A....Continued

DIMENSIONS FOR COMMON CARRIAGE FOR MOVING BARRIERS

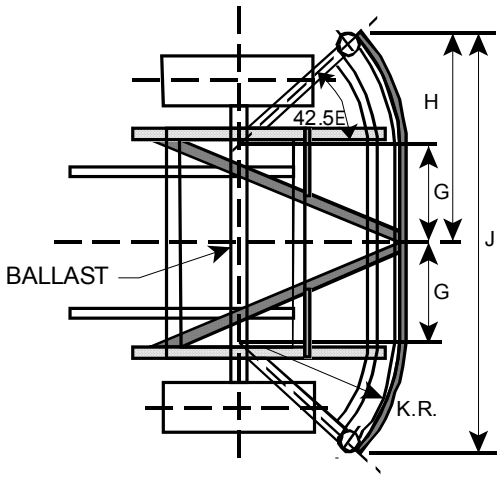
LETTER	INCHES	MILLIMETERS
A	120.0	3048
B	60.0	1524
C	42.0	1067
D	21.0	533
E	144.0	3658
F	15.0	381
G	16.0	406
H	12.0	305
J	24.0	610
K	60.0	1524
L	84.0	2134
M	22.0	559
N	120.0	3048
P	16.0	406
Q	12.0	305
R	6.0	152

APPENDIX B

CONTOURED IMPACT SURFACE FOR COMMON CARRIAGE



SIDE VIEW **FRONT VIEW**



TOP VIEW

DIMENSIONS SHOWN IN TABLE ON NEXT PAGE

NOTES:
1. Upper Frame 4.0 in. dia x 0.25 in. wall (102 mm dia x 6 mm wall) Steel Tubing (3 Sides)
2. Lower Frame 6.0 in. dia x 0.50 in. wall (152 mm dia x 13 mm wall) Steel Tubing
3. Face Plate 0.75 in. (19 mm) thick cold rolled steel
4. Leading Edge 1.0 s 4.0 in. (25 x 102 mm) steel band, sharp edges broken
5. All Inner Reinforcements 4.0 x 2.0 x 0.19 in. (102 x 51 x 5 mm) steel tubing

Total Weight = 4,000 ± 50 lbs (1,814.1 ± 22.7 kg)
Weight at each Rear Wheel =
900 ± 25 lbs (408.2 ± 11.3 kg)
Weight at each Front Wheel =
1,100 ± 25 lbs (499.0 ± 11.3 kg)
Moments of Inertia:
I_X = 271 ± 13.6 slug-ft^2 (367 ± 18.4 kg-m^2)
I_Z = 3,475 ± 174 slug-ft^2 (4,711 ± 236 kg-m^2)

APPENDIX B....Continued

DIMENSIONS FOR CONTOURED IMPACT SURFACE

LETTER	INCHES	MILLIMETERS
A	54.0	1372
B	15.8	401
C	30.0	762
D	5.25	133
E	3.75	95
F	24.75	629
G	18.0	457
H	39.0	991
J	78.0	1981
K	30.0	762