

U.S. DEPARTMENT OF TRANSPORTATION
NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION
LABORATORY TEST PROCEDURE

FOR

FMVSS No. 214, DYNAMIC SIDE IMPACT PROTECTION

-Rigid Pole Side Impact Test Requirements-



ENFORCEMENT
Office of Vehicle Safety Compliance
Mail Code: NVS-220
1200 New Jersey Ave. SE
Washington, DC 20590

OVSC LABORATORY TEST PROCEDURE NO. 214P

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1. PURPOSE AND APPLICATION

This document is a laboratory test procedure provided by the National Highway Traffic Safety Administration (NHTSA), Office of Vehicle Safety Compliance (OVSC) for the purpose of presenting guidelines for a uniform testing data and information recording format, and providing suggestions for the use of specific equipment and procedures for contracted testing laboratories. The data correspond to specific requirements of the Federal Motor Vehicle Safety Standard(s) (FMVSS). The OVSC test procedures include requirements that are general in scope to provide flexibility for contracted laboratories to perform compliance testing and 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. These test procedures do not constitute an endorsement or recommendation for use of any particular product or testing method.

Prior to conducting compliance testing, contracted laboratories are required to submit a detailed test procedure to the Contracting Officer's Technical Representative (COTR) to demonstrate concurrence with the OVSC laboratory test procedure and the applicable FMVSS. If any contractor views any part of an OVSC laboratory test procedure to be in conflict with a FMVSS or observes deficiencies in a laboratory test procedure, the contractor is required to advise the COTR and resolve the discrepancy prior to the start of compliance testing or as soon as practicable. The contractor's test procedure must include a step-by-step description of the methodology and detailed check-off sheets. Detailed check-off sheets shall also be provided for the testing instrumentation including a complete listing of the test equipment's make and model numbers. The list of test equipment shall include instrument accuracy and calibration dates. All equipment shall be calibrated in accordance with the manufacturer's instructions. There shall be no contradictions between the laboratory test procedure and the contractor's in-house test procedure. Written approval of the in-house test procedures shall be obtained from the COTR before initiating the compliance test program.

NOTE: The OVSC Laboratory Test Procedures, prepared for the limited purpose of use by independent laboratories under contract to conduct compliance tests for the OVSC, are not rules, regulations or NHTSA interpretations regarding the meaning of a FMVSS. The laboratory test procedures 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. Recognizing applicable test tolerances, the laboratory test procedures may specify test conditions that are less severe than the minimum requirements of the standard. In addition, the laboratory test procedures may be modified by the OVSC at any time without notice, and the COTR may direct or authorize contractors to deviate from these procedures, as long as the tests are performed in a manner consistent with the standard itself and within the scope of the contract. Laboratory test procedures may not be relied upon to create any right or benefit in any person. Therefore, compliance of a vehicle or item of motor vehicle equipment is not necessarily guaranteed if the manufacturer limits its certification tests to those described in the OVSC laboratory test procedures.

2. GENERAL REQUIREMENTS (S9.2)

This laboratory procedure is to be followed while conducting compliance tests to the requirements of S9 of FMVSS No. 214, "Vehicle to pole requirements." Each vehicle shall be tested by impacting it into a fixed, rigid pole 254 mm (10 inches) in diameter, at any speed up to and including 32 km/h (20 mph). These requirements apply to passenger cars, multipurpose passenger vehicles, trucks and buses with a gross vehicle weight rating (GVWR) of 4,536 kilograms (10,000 lb) or less, except for walk-in vans, motor homes, tow trucks, dump trucks, ambulances and other emergency rescue/medical vehicles (including vehicles with fire-fighting equipment), vehicles equipped with wheelchair lifts, vehicles with a raised roof or altered roof and vehicles which have no doors, or exclusively have doors that are designed to be easily attached or removed so that the vehicle can be operated without doors.

When tested according to the test conditions outlined in this test procedure, each vehicle shall comply with the following criteria;

NOTE: *The vehicle may be tested on either the left side (driver's side) or right side (passenger's side) with a 50th percentile male ES-2re or 5th percentile female SID-IIs dummy placed in the front outboard seating position. The selection of the test dummy and impact speed will be made by the COTR.*

A. Injury Criteria – Part 572, Subpart U, ES-2re 50th percentile Male Dummy

- (1) **HEAD (S9.2.1(a))** - The HIC(d) shall not exceed **1000**. HIC(d) is the maximum HIC value when calculated in accordance with the following formula:

$$HIC = \left[\frac{1}{t_2 - t_1} \int_{t_1}^{t_2} A_r dt \right]^{2.5} (t_2 - t_1)$$

where $A_R = [A_x^2 + A_y^2 + A_z^2]^{1/2}$ is the resultant acceleration magnitude in g units at the dummy head CG, and t_1 and t_2 are any two points in time during the impact event which are separated by not more than a 36 millisecond time.

- (2) **THORAX (S9.2.1(b))** -The deflection of any of the upper, middle and lower ribs shall not exceed **44 mm (1.73 in)**.
- (3) **ABDOMEN (S9.2.1(c)(1))** - The sum of the front, middle and rear abdominal forces shall not exceed **2.5kN (562 lb)**.
- (4) **PUBIC SYMPHYSIS (S9.2.1(c)(2))** - The pubic symphysis force shall not exceed **6.0kN (1,350 lb)**.

2. GENERAL REQUIREMENTS.....Continued

B. Injury Criteria – Part 572, Subpart V SID-IIs 5th percentile Female Dummy

- (1) **HEAD (S9.2.2(a))** - The HIC(d) shall not exceed **1000**. HIC(d) is the maximum HIC value when calculated in accordance with the following formula:

$$HIC = \left[\frac{1}{t_2 - t_1} \int_{t_1}^{t_2} A_r dt \right]^{2.5} (t_2 - t_1)$$

where $A_R = [A_x^2 + A_y^2 + A_z^2]^{1/2}$ is the resultant acceleration magnitude in g units at the dummy head CG, and t_1 and t_2 are any two points in time during the impact event which are separated by not more than a 36 millisecond time interval.

- (2) **SPINE (S9.2.2(b))** - The resultant lower spine acceleration shall not exceed **82 g**.
- (3) **PELVIS (S9.2.2(c))** - The sum of the acetabular and iliac pelvic forces shall not exceed **5,525 N (1,242 lb)**.

C. Door Opening Requirements (S9.2.3)

- (1) Any side door that is struck by the pole shall not separate totally from the vehicle
- (2) Any door (including a rear hatchback or tailgate) that is not struck by the pole shall meet the following requirements;
- i. The door shall not disengage from the latched position
 - ii. The latch shall not separate from the striker, and the hinge components shall not separate from each other or from their attachment to the vehicle.
 - iii. Neither the latch nor the hinge systems of the door shall pull out of their anchorages.

METRIC SYSTEM OF MEASUREMENT

Section 5164 of the Omnibus Trade and Competitiveness Act (Pub. L. 100-418) establishes that the metric system of measurement is the preferred system of weights and measures for trade and commerce in the United States. Executive order 12770 directs Federal agencies to comply with the Act by converting regulatory standards to the metric system after September 30, 1992. In a final rule published on March 15, 1990 (60 FR 13639), NHTSA completed the first phase of metrication, converting English measurements in several regulatory standards to the metric system. Since then, metrication has been applied to other regulatory standards (63 FR 28912).

Accordingly, the OVSC laboratory test procedures include revisions to comply with governmental directives in using the metric system. Regulatory standards converted to metric units are required to use metric measurements in the test procedures, whereas standards using English units are allowed to use English measurements or to use English measurements in combination with metric equivalents in parentheses.

2. GENERAL REQUIREMENTS.....Continued

All final compliance test reports are required to include metric measurements for standards using metrication.

NOTE: The methodology for rounding measurement in the test reports shall be made in accordance with ASTM E29-06b, "Standard Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications."

3. SECURITY

The Contractor shall provide appropriate security measures to protect the OVSC test vehicles and other Government Furnished Property (GFP) 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 and GFP. Any security problems, which arise, shall be reported by telephone to the Industrial Property Manager (IPM), Office of Contracts and Procurement, 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.

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

4. GOOD HOUSEKEEPING

Contractors shall maintain the entire vehicle testing area, dummy calibration 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 test schedule to the COTR prior to conducting the first compliance test. Tests shall be completed at intervals as required in the contract. If not specified, the first test shall be conducted within 6 weeks after receiving the first delivered unit. Subsequent tests shall be completed in no longer that 1 week intervals unless otherwise specified by the COTR.

Scheduling of tests shall be adjusted to permit vehicles (or equipment, whichever applies) to be tested to other FMVSSs as may be required by the OVSC. All compliance testing shall be coordinated with the COTR in order to allow monitoring by the COTR and/or other OVSC personnel if desired. The contractor shall submit a monthly test status report and a vehicle status report (if applicable) to the COTR. The vehicle status report shall be submitted until all vehicles are disposed of. The status report forms are provided in the forms section.

6. TEST DATA DISPOSITION

The Contractor shall make all preliminary compliance test data available to the COTR on location within 30 minutes after the test (or within four hours for equipment testing). Final test data, including digital printouts and computer generated plots (if applicable), shall be available to the COTR in accordance with the contract schedule or if not specified within two working days. Additionally, the Contractor shall analyze the preliminary test results as directed by the COTR.

All backup data sheets, strip charts, recordings, plots, technicians' notes, etc., shall be either sent to the COTR or destroyed at the conclusion of each delivery order, purchase order, etc. ((For equipment testing). The test data shall be retained by the contractor for a minimum of 3 years after conclusion of each delivery order, purchase order, etc. The COTR shall direct final disposition at that time.)

TEST DATA LOSS

A. INVALID TEST DESCRIPTION

An invalid compliance test is one, which does not conform precisely to all requirements/specifications of the OVSC Laboratory Test Procedure and Statement of Work applicable to the test.

B. INVALID TEST NOTIFICATION

The Contractor shall notify NHTSA of any test not meeting all requirements/specifications of the OVSC Laboratory Test Procedure and Statement of Work applicable to the test, by telephone, within 24 hours of the test and send written notice to the COTR within 48 hours of the test completion.

C. RETEST NOTIFICATION

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 2 weeks after receipt of notification by the Contracting Officer that a retest is required.

D. WAIVER OF RETEST

NHTSA, in its sole discretion, reserves the right to waive the retest requirement. This provision shall not constitute a basis for dispute over the NHTSA's waiving or not waiving any requirement.

E. TEST VEHICLE

NHTSA shall furnish only one vehicle for each test ordered. The Contractor shall furnish the test vehicle required for the retest. The retest vehicle shall be equipped as the original vehicle. The original vehicle used in the invalid test shall remain the property of NHTSA, and the retest vehicle shall remain the property of the Contractor. The Contractor shall retain the retest vehicle for a period not exceeding 180 days if it fails the test. If the retest vehicle passes the test, the Contractor may dispose of it upon notification from the COTR that the test report has been accepted.

6. TEST DATA DISPOSITION....Continued

F. TEST REPORT

No test report is required for any test that is determined to be invalid unless NHTSA specifically decides, in writing, to require the Contractor to submit such report. The test data from the invalid test must be safeguarded until the data from the retest has been accepted by the COTR. The report and other required deliverables for the retest vehicle are required to be submitted to the COTR within 3 weeks after completion of the retest.

G. DEFAULT

The Contractor is subject to the default and subsequent re-procurement costs for non delivery of valid or conforming test (pursuant to the Termination For Default clause in the contract).

H. NHTSA's RIGHTS

None of the requirements herein stated shall diminish or modify the rights of NHTSA to determine that any test submitted by the Contractor does not conform precisely to all requirements/specifications of the OVSC Laboratory Test Procedure and Statement of Work applicable to the test.

7. GOVERNMENT FURNISHED PROPERTY (GFP)

GFP consist of test vehicles and test equipment. The GFP is authorized by contractual agreement. The contractor is responsible for the following.

A. ACCEPTANCE OF TEST VEHICLES

The contractor has the responsibility of accepting each GFP test vehicle whether delivered by a new vehicle dealership or another vehicle transporter. In both instances, the Contractor acts on behalf of the OVSC when signing an acceptance of the GFP test vehicle delivery order. When a GFP vehicle is delivered, the contractor must verify:

1. All options listed on the "window sticker" are present on the test vehicle.
2. Tires and wheel rims are new and the same as listed.
3. There are no dents or other interior or exterior flaws in the vehicle body.
4. The vehicle has been properly prepared and is in running condition.
5. The glove box contains an owner's manual, warranty document, consumer information, and extra set of keys.
6. Proper fuel filler cap is supplied on the test vehicle.
7. Spare tire, jack, lug wrench and tool kit (if applicable) is located in the vehicle cargo van.
8. The VIN (vehicle identification number) on the vehicle condition report matches the VIN on the vehicle.
9. The vehicle is equipped as specified by the COTR.

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

A Vehicle Condition form will be supplied to the Contractor by the COTR when the test vehicle is transferred from a new vehicle dealership or between test contracts. The upper half of the form is used to describe the vehicle as initially accepted. The lower half of the Vehicle Condition form provides space for a detailed description of the post-test condition. The contractor must complete a Vehicle Condition form for each vehicle and deliver it to the COTR with the Final Test Report or the report will NOT be accepted for payment.

If the test vehicle is delivered by a government contracted transporter, the contractor should check for damage which may have occurred during transit. GFP vehicle(s) shall not be driven by the contractor on public roadways unless authorized by the COTR.

B. NOTIFICATION OF COTR

The COTR must be notified within 24 hours after a vehicle (and/or equipment item) has been delivered. In addition, if any discrepancy or damage is found at the time of delivery, a copy of the Vehicle Condition form shall be sent to the COTR immediately.

8. CALIBRATION OF TEST INSTRUMENTS

Before the Contractor initiates the vehicle safety compliance test program, a test instrumentation calibration system must be implemented and maintained in accordance with established calibration practices. The calibration system shall include the following as a minimum:

- A. Standards for calibrating the measuring and test equipment will be stored and used under appropriate environmental conditions to assure their accuracy and stability.
- B. All measuring instruments and standards shall be calibrated by the contractor, or a commercial facility, against a higher order standard at periodic intervals not to exceed TWELVE (12) MONTHS for the calibration standards. Records, showing the calibration traceability to the National Institute of Standards and Technology (NIST), shall be maintained for all measuring and test equipment.

Accelerometers shall be calibrated every twelve months or after a test failure or after any indication from calibration checks that there may be a problem with the accelerometer whichever occurs sooner.

- C. All measuring and test equipment and measuring standards will be labeled with the following information:
 - (1) Date of calibration
 - (2) Date of next scheduled calibration
 - (3) Name of the technician who calibrated the equipment

8. CALIBRATION OF TEST INSTRUMENTS...Continued

- D. A written calibration procedure shall be provided by the Contractor, which includes as a minimum the following information for all measurement and test equipment:
- (1) Type of equipment, manufacturer, model number, etc.
 - (2) Measurement range
 - (3) Accuracy
 - (4) Calibration interval
 - (5) Type of standard used to calibrate the equipment (calibration traceability of the standard must be evident)
 - (6) The actual procedures and forms used to perform the calibrations.
- E. Records of calibration for all test instrumentation shall be kept by the Contractor in a manner that assures the maintenance of established calibration schedules.
- F. All such records shall be readily available for inspection when requested by the COTR. The calibration system will need the acceptance of the COTR before vehicle safety compliance testing commences.
- G. Test equipment shall receive a system functional check out using a known test input immediately before and after the test. This check shall be recorded by the test technician(s) and submitted with the final report.
- H. (If applicable) Anthropomorphic test devices shall be calibrated before and the calibration checked after each crash and low risk deployment test. The calibrations and calibration check shall be submitted with the final report. **(Unique for Vehicle Testing)**
- I. The contractor may be directed by NHTSA to evaluate its data acquisition system.

Further guidance is provided in the International Standard ISO 10012-1, "Quality Assurance Requirements for Measuring Equipment" and American National Standard ANSI/NCSL Z540-1, "Calibration Laboratories and Measuring and Test Equipment General Requirements."

NOTE: In the event of a failure to meet the standard's minimum performance requirements additional calibration checks of some critically sensitive test equipment and instrumentation may be required for verification of accuracy. The necessity for the calibration will be at the COTR's discretion and shall be performed without additional cost.

9. PHOTOGRAPHIC DOCUMENTATION

9.1 HIGH SPEED DIGITAL VIDEO CAMERAS – T(0) IMPACT EVENT MARKERS

Document the crash event with 10 high-speed digital cameras that operate at 1000 frames per second for at least 10 ms before the vehicle contacts the pole and for at least 300 ms after the vehicle contacts the pole.

The minimum resolution for these cameras shall be 1536 CMOS sensors per every two rows of pixels, with 80% of the horizontal distance of the two rows covered by effective light sensors. There shall be a minimum of 1024 rows of sensors.

A time zero T(0) impact event marker to indicate when the test vehicle contacts the pole must be present in each high speed video camera view. This may be accomplished by placing strobe lights or flash bulbs that illuminate at T(0) in each field-of-view. The strobes are wired to contact switch plates taped to the test vehicle or pole impact face.

Each frame shall contain the camera speed and the frame number beginning with the time zero frame labeled as "Frame 0." The frame numbers prior to time zero shall be negative numbers.

Digital high speed video files shall be transferred to a compact disc (CD) or DVD as AVI or MPEG format with standard or generally available "codec." Other types of files can be used if approved by the COTR. The digital files shall have a resolution of 1920 x 1035 pixels. Any other resolution level must be approved by the COTR.

9.2 REAL TIME COLOR DIGITAL VIDEO CAMERA

A "real time" color digital video camera that operates at 24 frames per second is used to document the impact event, pre and posttest coverage. The video footage shall be transferred to a compact disc (CD) or DVD as AVI or MPEG files with standard or generally available "codec."

The video shall have the following shots and be edited in the following sequence:

A. A five second segment showing a placard with the following information:

The following Side Impact Protection Test was conducted under the contract with the National Highway Traffic Safety Administration by (laboratory name, city, state).

32 kph Oblique Rigid Pole Side Impact
Test Vehicle Model Year, Make and Model
NHTSA No. CXXXXX
Test Laboratory
Date of Impact Event
Contract No.: DTNH22-0X-X-XXXXX

9. PHOTOGRAPHIC DOCUMENTATION.....Continued

B. Pretest Coverage

- View of the pole
- View of front of vehicle
- View of impact side of vehicle
- View of rear of vehicle
- View of non-impact side of vehicle
- View of test dummy parallel to impact door (door open)
- View of test dummy parallel to impact door (door closed)
- View of test dummy – through opposite window (door open)
- View of test dummy – through opposite window (door closed)
- View of doors being closed
- View of gas cap being attached to filler pipe

C. Pan View of Impact Event

D. Post-Test Coverage

- View of dummy – parallel to impact door (door closed)
- View of dummy – through opposite window (door closed)
- View of front of vehicle
- View of impacted side
- View of impact point – close-up
- View of rear of vehicle
- View of non-impact side of vehicle
- View of inside front door (dummy removed)

E. View of Any Vehicle Failures or Anomalies

F. “The End”

9.3 DIGITAL PHOTOGRAPHS

The contractor shall take digital photographs of the pretest and post test execution procedures. Photographs shall be taken in color and contain clear images. A tag, label or placard identifying the test item, NHTSA number and date shall appear in each photograph and be legible. Each photograph shall be labeled as to the subject matter. The required resolution for digital photographs is a minimum of 1,600 x 1,200 pixels. Digital photographs are required to be created in color and in a JPG format. Glare or light from any illuminated or reflective surface shall be minimized while taking photographs.

9. PHOTOGRAPHIC DOCUMENTATION.....Continued

The test reports shall include enough photographs to describe the testing in detail and shall be organized in a logical succession of consecutive pictures. The digital photographs shall be included in the test report as 203 mm x 254 mm or 215.9 mm x 279 mm (8 x 10 or 8½ x 11 inch) pictures (or for equipment testing -- 125 mm x 175 mm (5 x 7 inch) pictures). All photographs are required to be included in the test report in the event of a test failure. Any failure must be photographed at various angles to assure complete coverage. Upon request, the photographs shall be sent to the COTR on a CD or DVD and saved in a "read only" format to ensure that the digital photographs are the exact pictures taken during testing and have not been altered from the original condition.

Photographic Views

At a minimum, the following photographs shall be included in each vehicle final test report submitted by the Contractor:

- A Pretest Frontal View of Test Vehicle
- B Post Test Frontal View of Test Vehicle
- C Pretest Rear View of Test Vehicle
- D Post Test Rear View of Test Vehicle
- E Pretest Impacted Side View of Test Vehicle
- F Post Test Impacted Side View of Test Vehicle
- G Pretest Left 3/4 Front View of Vehicle and Pole
- H Pretest Left 3/4 Rear View of Vehicle and Pole
- I Pretest Overhead View of Test Vehicle
- J Post Test Overhead View of Test Vehicle
- K Pretest Dummy Thru Opposite Window
- L Post Test Dummy Thru Opposite Window
- M Pretest Close-up of Dummy w/Door Closed (Impact Side)
- N Post Test Dummy w/Door Closed (Impact Side)
- O Pretest Dummy Door Open
- P Pretest Dummy Shoulder and Door Top View
- Q Post Test Dummy Shoulder and Door Top View
- R Pretest Interior of Front Door Closed (thru Opposite Window)
- S Post Test Interior of Front Door Showing Dummy Impact Locations (thru opposite window w/dummy removed)
- T Impact Event (stuck side)
- U Post Test Impact Zone Close-up View
- V Post Test 3/4 Front View of Impact Zone
- W Post Test 3/4 Rear View of Impact Zone
- X Post test Close-up View of Impact Point Target
- Y Close-up View of Vehicle's Certification Label
- Z Close-up View of Vehicle's Tire Placard Label

10. DEFINITIONS

10.1 DESIGNATED SEATING CAPACITY (571.3)

The number of designated seating positions provided.

10.2 DOUBLE SIDE DOORS (S3)

A pair of hinged doors with the lock and latch mechanisms located where the door lips overlap.

10.3 FOOT (S12.3.1(e)(7))

The foot including the ankle.

10.4 H-POINT (571.3)

The mechanically hinged hip point of a manikin which simulates the actual pivot center of the human torso and thigh, described in SAE Recommended Practice J826, "Manikin for Use in Defining Vehicle Seating Accommodations," May 1987.

10.5 LEG (S12.3.1(e)(6))

The lower part of the entire leg including the knee.

10.6 LONGITUDINAL OR LONGITUDINALLY

Parallel to the vehicle's longitudinal centerline.

10.7 MIDSAGGITTAL PLANE (S12.3.1(e)(1))

The vertical plane that separates the dummy into equal left and right halves.

10.8 SEAT CUSHION REFERENCE POINT (SCRCP) (S12.3.1(e)(9))

A point placed on the outboard side of the seat cushion at a horizontal distance between 150 mm (5.9 in.) and 250 mm (9.8 in.) from the front edge of the seat used as a guide in positioning the seat.

10.9 SEAT CUSHION REFERENCE LINE (SCRL) (S12.3.1(e)(10))

A line on the side of the seat cushion, passing through the seat cushion reference point, whose projection in the vehicle vertical longitudinal plane is straight and has a known angle with respect to the horizontal.

10.10 UNLOADED VEHICLE WEIGHT (UVW) (571.3)

The weight of a vehicle with maximum capacity of all fluids necessary for operation of the vehicle, but **WITHOUT** cargo or occupants.

10.11 VERTICAL LONGITUDINAL PLANE

A vertical plane parallel to the vehicle's longitudinal centerline.

10. DEFINITIONS.... Continued

10.12 VERTICAL PLANE (S12.3.1(e)(3))

A vertical plane, not necessarily parallel to the vehicle's longitudinal centerline.

10.13 TRANSVERSE INSTRUMENTATION PLATFORM (S12.3.1(e)(4))

The surface inside the dummy's skull casting to which the neck load cell mounts. This surface is perpendicular to the skull cap's machined surfaced inferior-superior mounting surface.

10.14 THIGH (S12.3.1(e)(5))

The femur between, but not including, the knee and the pelvis.

11. PRETEST REQUIREMENTS

PROJECT PLAN

The Contractor shall submit a detailed project plan to the COTR before initiating the compliance test program. The project plan must include a step-by-step description of the methodology to be used. The project plan shall contain check-off sheets and a complete list of test equipment and instrumentation used to conduct side impact tests. The list of test equipment shall include instrument accuracy and calibration dates.

FACILITY AND EQUIPMENT

The following is a description of the critical facility and equipment requirements necessary for conducting the tests. Contractors shall assure that prior to each test facility is maintained in proper condition and all equipment operates within specifications.

A. TEST PAD AREA

The test pad area shall be a level, smooth and uniformly constructed surface that is large enough such that all four wheels of the test vehicle remain in the same plane throughout the impact event.

B. TOW ROAD

The tow road surface shall be a straight, level, smooth and uniformly constructed surface that is long enough to allow the vehicle speed to stabilize prior to impacting the pole.

C. TEST VEHICLE PREPARATION BUILDING/STRUCTURE

The test vehicle preparation building/structure encloses the area where the test vehicle is prepared during pre-test set-up that occurs just prior to the impact test. This building or structure shall be temperature-controlled and large enough to house the test vehicle, test equipment and instrumentation while allowing room for personnel to move freely about the test vehicle. The temperature inside the test vehicle must be maintained between 20.6°C and 22.2°C (69°F and 72°F) for a minimum of four (4) hours prior to the side impact event.

D. TOW AND GUIDANCE SYSTEMS

The tow system must be capable of ensuring that the test vehicle impacts the rigid pole laterally at a speed of 31 km/h \pm 0.9 km/h.

A guidance system is required to assure that the test vehicle is propelled sideways so that its line of forward motion (for left-side impact tests) forms an angle of 75 degrees (\pm 3 degrees) with the vehicle's longitudinal center line and the pole within \pm 38 mm (\pm 1.5 in) horizontally of the vehicle's impact reference line.

E. RIGID POLE (S10.10)

The impact face of the rigid pole shall be a vertically oriented metal structure with a diameter of 254 mm \pm 3 mm and beginning no more than 102 mm above the lowest point of the tires on the struck side of the fully loaded test vehicle and extending at least 150 mm above the highest point of the roof of the test vehicle. The pole face shall be offset from its mounting and support such that the vehicle will not contact the mounting and support structures within 100 ms from the initial vehicle-to-pole contact.

11. PRETEST REQUIREMENTS...Continued

The pole illustrated in the following figures is from the Federal Highway Administration's Turner-Fairbank Highway Research Center and is provided for illustrative purposes only.

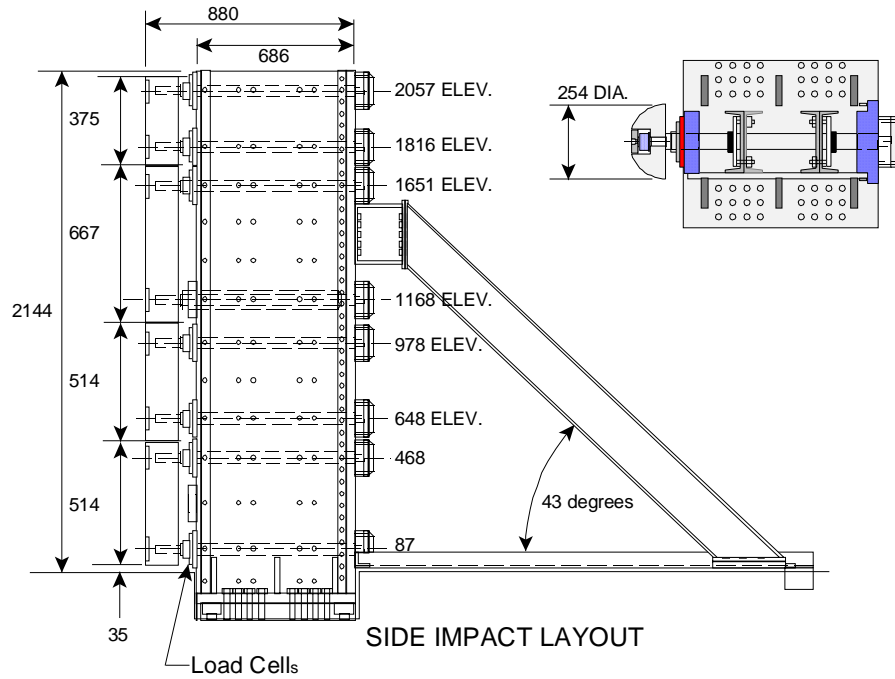


Figure 1 - FOIL 300K Rigid Pole – Side View
(all measurements in mm)

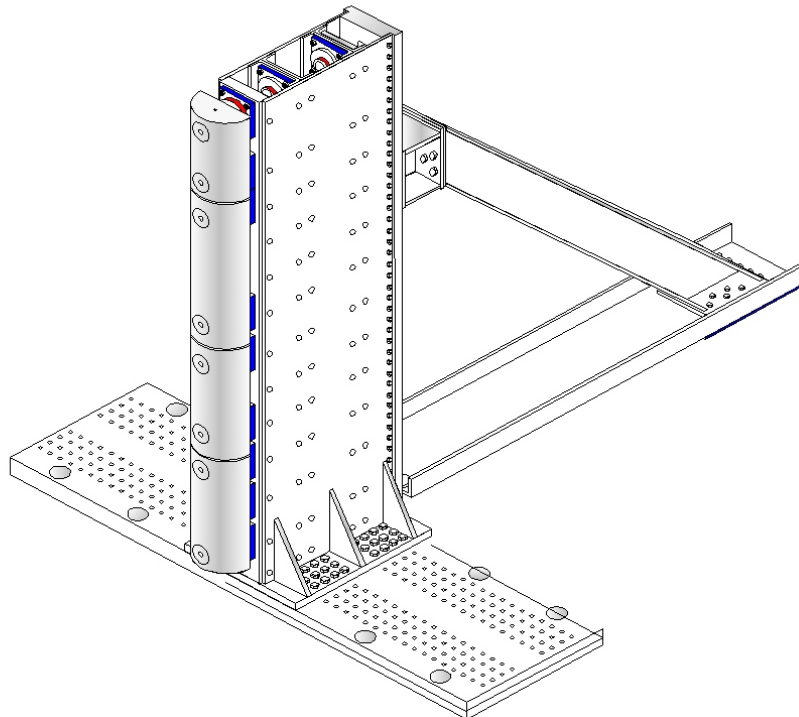


Figure 2 - FOIL 300K Rigid Pole - 3/4 View

11. PRETEST REQUIREMENTS...Continued

F. TEST VEHICLE VELOCITY MEASUREMENT

The test vehicle's velocity shall be constant (essentially having zero acceleration or deceleration) for a minimum of the last 1.5 m of travel before impact. The final impact velocity is measured after the tow system releases, when the test vehicle is within 305 mm \pm 10mm of the initial contact surface of the pole. Final impact velocity is measured by no less than two sets of timing devices accurate to within \pm 0.08 km/h and calibrated by an instrument traceable to the National Institute of Standards and Technology (NIST). The reported final impact velocity shall take into consideration all of the response characteristics of the entire velocity measurement system utilized in its determination.

Note: For test vehicle conveyance systems that utilize a platform upon which the test vehicle rests during towing – The final velocity of the platform is measured by a timing device that meets the specifications listed above. The final velocity of the platform shall be taken within 600 mm \pm 60 mm of vehicle impact.

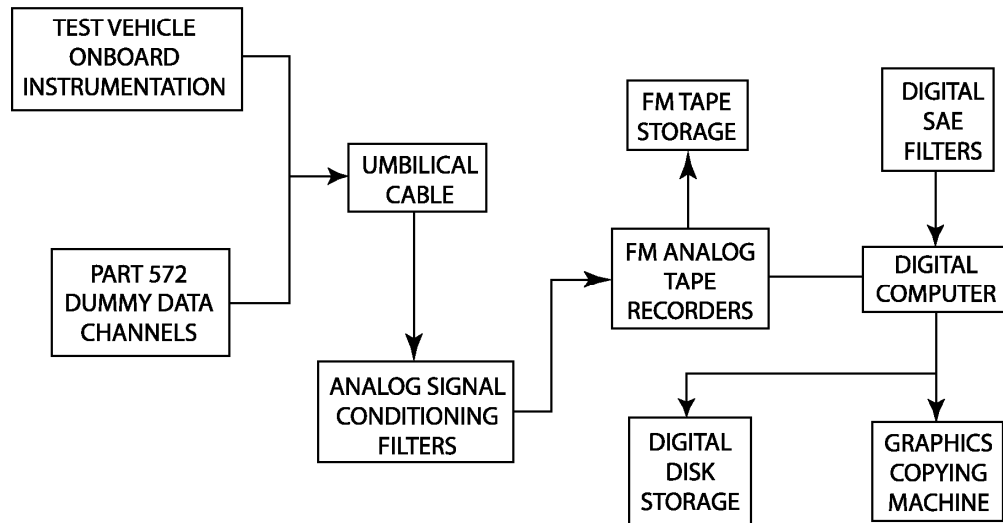
G. TEST BRAKE ABORT SYSTEM

The vehicle conveyance system shall be equipped with a brake abort system that when triggered is capable of preventing the vehicle from impacting the pole. Abort criteria consists of vehicle velocity, data acquisition and instrumentation system readiness, and stability of the vehicle conveyance system on the tow road. The first two criteria are to be automatically monitored by the test brake abort system. The third criteria shall be monitored manually by test personnel.

H. DATA ACQUISITION SYSTEM

The data acquisition system shall have sufficient number of data channels available for recording and processing signals from the test dummies and vehicle sensors. Each data channel shall be comprised of a sensor, signal conditioner, data acquisition device and all interconnecting cables, and must conform to the requirements of SAE Recommended Practice J211/1, Mar 95. The schematic below depicts a typical configuration for a vehicle and occupant impact test data acquisition system.

TYPICAL VEHICLE AND OCCUPANT IMPACT TEST DATA ACQUISITION SYSTEM



- I. The Contractor must meet all the requirements in the NHTSA “Data Tape Reference Guide” which is available from our website. Visit <http://www-nrd.nhtsa.dot.gov/> and click on “R&D Software.” Under “NVS Software Applications,” click “NHTSA Test Reference Guides” and select the latest version of Volume I: Vehicle
- J. Algorithms used to calculate various injury parameters, such as HIC, can be obtained from the agency. Any questions pertaining to the algorithms or requests for the algorithms should be directed to the following organization:

U.S. Department of Transportation
National Highway Traffic Safety Administration
Office of Vehicle Safety Research
Crashworthiness Research Division
1200 New Jersey Ave, SE
Room W46-312
Washington, DC 20590
Telephone No.: 202-366-4712

12. TEST EXECUTION

Complete the tasks in this section by following the step by step instructions outlined on the referenced check sheet. Copies of the check sheets are in Appendix B.

12.1 PRE-CRASH TEST

A. RECORD VEHICLE SPECIFICATIONS

Using the Monroney sticker label, tire placard, Part 567 certification label and tire sidewalls collect and record vehicle specifications, tire data, standard and optional equipment originally installed on the vehicle. (See Check Sheet No. 1)

B. PREP THE VEHICLE FOR THE TEST

- (1) Determine the weight and attitude of the test vehicle in its "as delivered" condition (See Check Sheet No. 2). The "as delivered" condition is the vehicle as received at the test site, with 100 percent of all fluid capacities and all tires inflated to the manufacturer's specifications listed on the vehicle's tire placard. (S10.1 &10.2)
- (2) Calculate the test vehicle's target weight (See Check Sheet No. 2)
- (3) Determine the weight and attitude of the test vehicle in its "fully loaded" condition. The fully loaded condition is the vehicle loaded to its unloaded vehicle weight plus 136 kg (300 pounds) or its rated cargo luggage capacity (whichever is less). Stoddard solvent is added to the vehicle's fuel tank in an amount that is equal to not less than 92 percent and not more than 94 percent of the fuel tank's useable capacity stated by the vehicle manufacturer (S8.1). (See Check Sheet No. 2)
- (4) Affix photographic targets to the test vehicle. (See Check Sheet No. 3)
- (5) Take pre-test measurements of the test vehicle. (See Check Sheets No. 4 &5)
- (6) Attach accelerometers to the test vehicle. (See Check Sheet No. 6)
- (7) Place high speed video cameras at the impact site and attach onboard cameras and lighting to the test vehicle. (See Check Sheet No. 7)
- (8) Mark for reference the range of positions of adjustable seats, adjustable seat belt anchorages and steering wheel (S10.3). (See Check Sheet No. 8).

C. POSITION THE DUMMY IN THE TEST VEHICLE (S10.4, S11.1, 12.2 &12.3)

Place a Part 572 Subpart U or V test dummy configured in accordance with TP-P572U or TP-P572V calibration test procedure in the driver or front outboard passenger position on the struck side of the test vehicle. The test dummy shall soak for 24 hours in an environment that is maintained between 18.9°C and 25.5°C and at any relative humidity from 10% to 70% prior to being placed in the test vehicle. The test dummy is positioned in the test vehicle the morning of the test. **[Do not place the test dummy in the vehicle the day before the test]**. The NHTSA COTR will specify dummy type and which side of the test vehicle to impact. (See Check Sheet Nos. 9, 10, or 11)

12. TEST EXECUTION.....Continued**D. DETERMINE THE “AS TESTED” WEIGHT AND ATTITUDE**

Determine the actual weight and attitude of the test vehicle in its “as tested” condition. The “as tested” condition represents the actual test weight and attitude of the test vehicle prior to impact. It includes the weight of all instrumentation, onboard cameras, lighting equipment, test dummy and umbilical cords, etc.

The weight of the test vehicle in the “as tested” condition must lie within the required weight range (i.e., calculated test target weight – 4.5 kg to 9 kg). The attitude of the test vehicle in the “as tested” condition must lie between the “as delivered” attitude and “fully loaded” attitude, inclusive. Record the weight of the ballast added to the test vehicle and any vehicle parts removed from the test vehicle to achieve the “as tested” condition. (See Check Sheet No. 2)

E. TAKE DUMMY MEASUREMENTS

After positioning the dummy in the front outboard seat, measure its pelvic angle and proximity to the vehicle’s interior. (See Check Sheet No.12)

F. APPLY CHALK PAINT COLOR TO THE TEST DUMMY

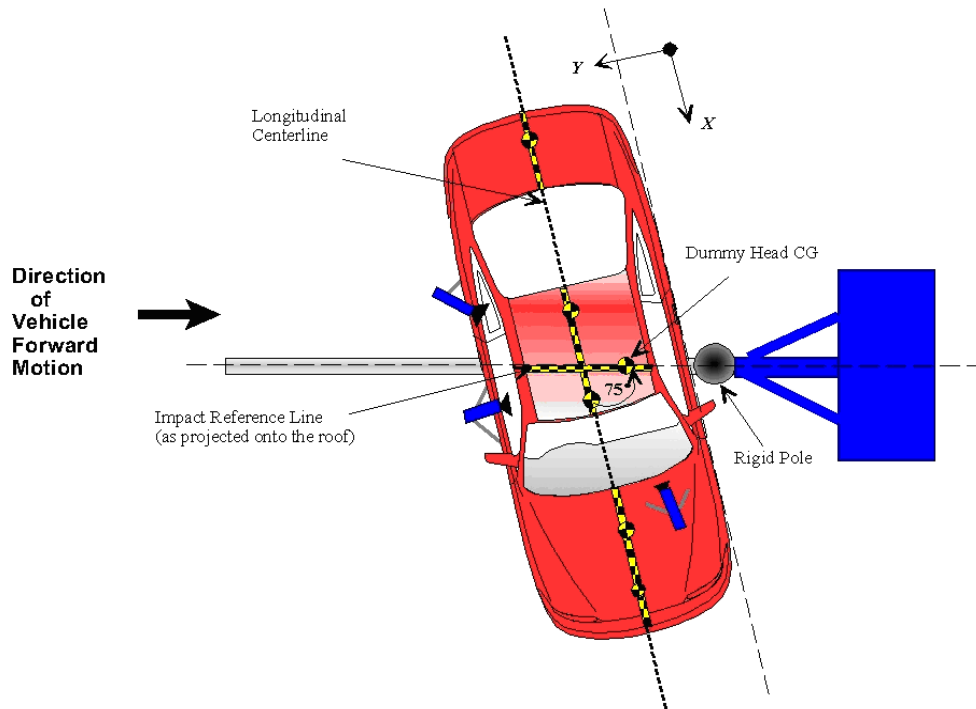
To document the dummy’s interaction with the vehicle’s headliner, side airbags and interior door panel during the impact event, apply chalk paint to the head, face, hip and shoulder of the test dummy. (See Check Sheet No. 13)

G. TAKE PRETEST PHOTOGRAPHS AND VIDEO

Take photographs and video of the test vehicle in its as-tested condition. (See Check Sheet No.14)

12. TEST EXECUTION.....Continued

H. CONDUCT THE TEST



Doors and hatches are closed shut. Automatic transmissions are placed in neutral. Manual transmissions are placed in 2nd gear. The parking brake is fully engaged. The ignition is in the power “On” position. Sunroofs are placed in the closed position. If the vehicle has a convertible top, place it in the closed passenger compartment configuration (i.e., top-up). (S10.6, 10.7, 10.8 & 10.9) (See Check Sheet No. 15)

- (1) Prior to impact, affix a marker to the pole that will transfer into the test vehicle’s sheet metal at the target location upon initial impact.
 - (2) Adjust the vehicle (or pole) for proper alignment (see schematic above). A vertical plane passing through the center of gravity of the head of the dummy forms an angle of 75° (or 285°) with the vehicle’s longitudinal centerline for left (or right) side impact test. (S10.11) (See Check Sheet No. 3 – Impact reference line)
 - (3) Tow the test vehicle sideways, at the designated test speed, toward the stationary pole so that its line of forward motion forms an angle of 75° (or 285°) ± 3° with the vehicle’s longitudinal centerline for left (or right) side impact test. (S10.12.2)
 - (4) At impact, the test vehicle’s impact reference line is aligned with the centerline of the pole ± 38 mm (1.5 in). (S10.12.2)
- I. RECORD POST TEST OBSERVATIONS (See Check Sheet No.16)
 - J. TAKE POST TEST PHOTOGRAPHS AND VIDEO (See Check Sheet No. 17)
 - K. TAKE POST TEST MEASUREMENTS (See Check Sheet Nos. 5 & 6)

13. POST TEST REQUIREMENTS

DATA PROCESSING

NOTE: Instructions below may not apply to on-board data acquisition systems.

- A. Prior to the vehicle crash test, a null reference and a shunt calibration adjustment are performed to set all analog and direct digitized data devices (including FM magnetic tape recorders, if applicable). Immediately following the crash test, a post impact null reference and shunt calibration check will be performed. The pre and post-test zero and shunt calibration check will be recorded and the data submitted with the report as shown below:
- B. As the data is recalled for integration or plotting, the appropriate filter is applied. These filters are in accordance with SAE Recommended Practice J211 "Instrumentation for Impact Tests." Vehicle acceleration data is plotted after the application of an SAE Class 60 filter, and velocity and displacement data is plotted after the application of an SAE Class 180 filter. The filtering requirements for the test dummies are as follows;

(1) ES-2re FILTERING REQUIREMENTS

	Filter Class	Cut-off Frequency
Head Acceleration	1000	1650
Chest Deflection	180	300
Abdomen Force	600	1000
Pubic Force	600	1000

(2) SID-IIs FILTERING REQUIREMENTS

	Filter Class	Cut-off Frequency
Head Acceleration	1000	1650
Shoulder Deflection	600	1000
Chest Rib Deflection	600	1000
Lower Spine T12 Acceleration	180	300
Abdomen Deflection	600	1000
Acetabulum Force	600	1000
Iliac Force	600	1000

- C. Before plotting, the Contractor's program manager or engineer shall determine the "time zero", which is verified with the trigger signal. When a velocity or displacement trace is to be plotted, integration for the appropriate acceleration signal is performed digitally.
- D. Time zero bias should be removed prior to submission of the data tape disk to NHTSA.

14. REPORTS

14.1 MONTHLY STATUS REPORT

The contractor shall submit a monthly status report to the COTR. The monthly status report shall be submitted until all vehicles are disposed of. A sample of the required report is found in the report forms section.

14.2 APPARENT TEST FAILURE

Any indication of a test failure shall be communicated by telephone to the COTR within 24 hours with written notification mailed within 48 hours (Saturday and Sundays excluded). A Laboratory 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 of the 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 an apparent test failure, three paper copies and an electronic copy in both MSWord and pdf formats 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 an apparent noncompliance, one paper copy and an electronic copy in both Word and pdf formats of each Final Test Report shall be submitted to the COTR for acceptance within three weeks of test completion. No payment of contractor's invoices for conducting compliance tests will be made prior to the Final Test Report acceptance by the COTR. Contractors are requested to NOT submit invoices before the COTR is provided with copies of the Final Test Report.

Contractors are required to submit the first Final Test Report in draft form within one week 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.

14.3.2 REQUIREMENTS

The Final Test Report and 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. Instructions for the preparation of the first three pages of the final test report are provided for standardization.

14. REPORTS....Continued**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 214P-ABC-0X-001 where

214P the FMVSS tested, Side Impact Protection
 ABC the initials for the laboratory
 0X the Fiscal Year of the test program ()
 001 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 214
 DYNAMIC SIDE IMPACT PROTECTION
 RIGID POLE TEST

World Motors Corporation
 2000 Ace Super 4-door sedan
 NHTSA No. CX0401

(3) Contractor's Name and Address such as

ABC LABORATORIES
 405 Main Street
 Detroit, MI 48070

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
 1200 New Jersey Ave. S.E.
 West Bldg. (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 NO.

214P-ABC-0X-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 214P Compliance Test
Side Impact Protection Testing of 200X Ace Super Sedan,
NHTSA No. C_____

Block 5 – REPORT DATE

March 1, 200X

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

Block 10 – WORK UNIT NUMBER (Leave blank)

Block 11 – CONTRACT OR GRANT NUMBER

DTNH22-0X-D-12345

14. REPORTS....Continued**Block 12 – SPONSORING AGENCY NAME AND ADDRESS**

US Department of Transportation
 National Highway Traffic Safety Administration
 Office of Vehicle Safety Compliance (NVS-220)
 1200 New Jersey Ave. S.E. Room W43-503
 Washington, DC 20590

Block 13 – TYPE OF REPORT AND PERIOD COVERED

Final Test Report
 Feb. 15 to Mar. 15, 200X

Block 14 – SPONSORING AGENCY CODE

NVS-220

Block 15 – SUPPLEMENTARY NOTES (Leave blank)**Block 16 – ABSTRACT**

A 32 km/h (20 mph), 75° oblique impact compliance test was conducted on the subject 200X Ace Super 4-door sedan in accordance with the specifications of the Office of Vehicle Safety Compliance TP-214P-0X for the determination of FMVSS No. 214 Side Impact Protection compliance. The test was conducted at the ABC Laboratories facility in Detroit, Michigan, on November 15, 200X.

The impact velocity was 31.5 km/h, and the ambient temperature at the struck side of the test vehicle at the time of impact was 28°C. The test vehicle post test maximum crush was 250 mm at level 3. The test vehicle's performance follows:

ES-2re Male Dummy

HIC = ____ Max. Rib Deflection ____ mm Sum of Abdomen Forces__N Pubic Symphysis ____N

The doors on the struck side of the vehicle did not separate from the body at the hinges or latches and the opposite side doors did not open during side impact event.

14. REPORTS....Continued

Block 17 – KEY WORDS

Compliance Testing
Side Impact Protection
Pole Test
ES-2re
SID-IIs

Block 18 – DISTRIBUTION STATEMENT

Copies of this report are available from--

National Highway Traffic Safety Administration
Technical Information Services (TIS)
Room E12-100 East Bldg.
1200 New Jersey Ave.
Washington, DC 20590
Telephone No. (202) 366-2588

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**D. REPORT FORMAT**

The final test report consists of a table of contents, Section 1, Section 2 and Appendices as follows;

TABLE OF CONTENTS

<u>Section</u>		<u>Page No.</u>
1	Purpose and Summary of the Test	1
2	Occupant and Vehicle Information	“
	Data Sheet	
	<u>No.</u>	
	1 Test Vehicle Information and Options	‘
	2 General Test and Vehicle Parameter Data	‘
	3 Seat and Seat Belt Adjustment Data	‘
	4 Fuel Systems and Steering Wheel Position Data	‘
	5 Dummy Longitudinal Clearance Dimensions	‘
	6 Dummy Lateral Clearance Dimensions	‘
	7 Location of Cameras	‘
	8 Test Vehicle Accelerometer Locations	‘
	9 Test Vehicle Accelerometer Data Summary	‘
	10 Dummy Injury Response Data	‘
	11 Post Test Observations	‘
	12 Vehicle Pretest and Posttest Measurements	‘
	13 Exterior Crush Measurements	‘
	14 Vehicle Exterior Crush Profiles	‘
	15 Temperature and Humidity Trace	‘
3	Check Sheets	
<u>Appendix</u>		
I	Photographs	<u>I -1</u>
II	Dummy Response Data	II -1
III	Vehicle Accelerometer Response Data	III -1
IV	Dummy Performance Calibration Test Data	IV -1
V	Test Equipment and Instrumentation Calibration	V -1

14. REPORTS....Continued

NOTE: This section should be double-spaced and requires an entire separate page.

SECTION 1
PURPOSE AND SUMMARY OF TEST

PURPOSE

This section briefly outlines the purpose for conducting the side impact test and states the appropriate test procedure followed during the test. The following is provided as an example;

This side impact test is part of the FY__ FMVSS 214 Side Impact Protection Compliance Test Program sponsored by the National Highway Traffic Safety Administration (NHTSA), under contract No. . The purpose of this test was to evaluate side impact protection in a (description of vehicle being tested). The side impact test was conducted in accordance with the Office of Vehicle Safety Compliance's Laboratory Test Procedure (TP-214P-_____, dated _____, 20__).

SUMMARY

A rigid pole side impact test was conducted on a 200x Ace Super 4-door sedan. The subject vehicle was towed into the rigid pole at an angle of ___ and a velocity of _____. The test was conducted by the ABC Laboratories in Detroit, Michigan, on November 15, 200X. Pre-test and post test photographs of the test vehicle and side impact dummy are included in Appendix A of this report.

One Part 572U dummy was placed in the (left/right) front outboard designated seating position according to instructions specified in TP-214P-__ dated _____. The side impact event was documented by ___ cameras.

The ES2-re male dummy was instrumented with a triaxial accelerometer pack located in the head, 3 rib displacement transducers located in the chest, 3 load cells located in the abdomen and a load cell located in the pubic symphysis.

A summary of the test results follows;

Injury Criteria	Max. Allowable IARV	Measured Value	Pass/Fail
HIC	1000		
Upper Rib Deflection (mm)	44 mm		
Mid. Rib Deflection (mm)			
Lower Rib Deflection (mm)			
Abdominal Load (front) (N)			
Abdominal Load (mid) (N)			
Abdominal Load (rear) (N)			
Sum of Abdomen Forces (N)	2.5 kN		
Pubic Symphysis (N)	6 kN		

14. REPORTS....Continued**SECTION 2
OCCUPANT AND VEHICLE INFORMATION**

This section includes all data sheets (See Appendix A).

**SECTION 3
CHECK SHEETS**

This section includes all check sheets (See Appendix B).

14. REPORTS....Continued**APPENDIX I**
PHOTOGRAPHS

The following photographs shall be included in this appendix in the order indicated below;

TABLE OF PHOTOGRAPHS

No.	Description	Page
1	Pretest Frontal View of Test Vehicle	I-1
2	Post Test Frontal View of Test Vehicle	
3	Pretest Rear View of Test Vehicle	
4	Post Test Rear View of Test Vehicle	
5	Pretest Impacted Side View of Test Vehicle	
6	Post Test Impacted Side View of Test Vehicle	
7	Pretest Left 3/4 Front View of Vehicle and Pole	
8	Pretest Left 3/4 Rear View of Vehicle and Pole	
9	Pretest Overhead View of Test Vehicle	
10	Post Test Overhead View of Test Vehicle	
11	Pretest Dummy Thru Opposite Window	
12	Post Test Dummy Thru Opposite Window	
13	Pretest Close-up of Dummy w/Door Closed (Impact Side)	
14	Post Test Dummy w/Door Closed (Impact Side)	
15	Pretest Dummy Door Open	
16	Pretest Dummy Shoulder and Door Top View	
17	Post Test Dummy Shoulder and Door Top View	
18	Pretest Interior of Front Door Closed (thru Opposite Window)	
19	Post Test Interior of Front Door Showing Dummy Impact Locations (thru opposite window w/dummy removed)	
20	Impact Event (stuck side)	
21	Post Test Impact Zone Close-up View	
22	Post Test 3/4 Front View of Impact Zone	
23	Post Test 3/4 Rear View of Impact Zone	
24	Post test Close-up View of Impact Point Target	
25	Close-up View of Vehicle's Certification Label	
26	Close-up View of Vehicle's Tire Placard Label	

14. REPORTS....Continued

APPENDIX II
TABLE OF DATA PLOTS for ES-2re
Dummy Instrumentation Plots
FILTERED DATA

The following data plots shall be included in this appendix in the order indicated below;

No.	<u>Description</u>	Page
1	ES-2re Head (X) Acceleration vs. Time	II-1
2	ES-2re Head (Y) Acceleration vs. Time	..
3	ES-2re Head (Z) Acceleration vs. Time	..
4	ES-2re Head Resultant Acceleration vs. Time	..
5	ES-2re Head (X) Velocity vs. Time	..
6	ES-2re Head (Y) Velocity vs. Time	..
7	ES-2re Head (Z) Velocity vs. Time	..
8	ES-2re Upper Thorax Rib Deflection Rate vs. Time	..
9	ES-2re Upper Thorax Rib Deflection (Y) vs. Time	..
10	ES-2re Middle Thorax Rib Deflection Rate vs. Time	..
11	ES-2re Middle Thorax Rib Deflection (Y) vs. Time	..
12	ES-2re Lower Thorax Rib Deflection Rate vs. Time	..
13	ES-2re Lower Thorax Rib Deflection (Y) vs. Time	..
14	ES-2re Front Abdomen Force (Y) vs. Time	..
15	ES-2re Middle Abdomen Force (Y) vs. Time	..
16	ES-2re Rear Abdomen Force (Y) vs. Time	..
17	ES-2re Sum of the Abdominal Forces vs. Time	..
18	ES-2re Pubic Symphysis Force (Y) vs. Time	..

14. REPORTS....Continued

APPENDIX II
TABLE OF DATA PLOTS for SIDIs
Dummy Instrumentation Plots
FILTERED DATA

The following data plots shall be included in this appendix in the order indicated below;

No.	<u>Description</u>	Page
1	SID-IIs Head (X) Acceleration vs. Time	II-1
2	SID-IIs Head (Y) Acceleration vs. Time	..
3	SID-IIs Head (Z) Acceleration vs. Time	..
4	SID-IIs Head Resultant Acceleration vs. Time	..
5	SID-IIs Head (X) Velocity vs. Time	..
6	SID-IIs Head (Y) Velocity vs. Time	..
7	SID-IIs Head (Z) Velocity vs. Time	..
8	SID-IIs Lower Spine X Acceleration vs. Time	..
9	SID-IIs Lower Spine Y Acceleration vs. Time	..
10	SID-IIs Lower Spine Z Acceleration vs. Time	..
11	SID-IIs Lower Spine Resultant Acceleration vs. Time	..
12	SID-IIs Lower Spine X Velocity vs. Time	..
13	SID-IIs Lower Spine Y Velocity vs. Time	..
14	SID-IIs Lower Spine Z Velocity vs. Time	..
15	SID-IIs Acetabulum Force vs. Time	..
16	SID-IIs Iliac Force vs. Time	..
17	SID-IIs Sum of Iliac and Acetabulum Forces vs. Time	..

14. REPORTS....Continued

**APPENDIX III
VEHICLE ACCELEROMETER RESPONSE DATA**

The following vehicle data plots shall be included in this appendix in the order indicated below;

No.	Description	Page
1	Vehicle Center of Gravity (X) Acceleration vs. Time	III-1
2	Vehicle Center of Gravity (X) Velocity vs. Time	..
3	Vehicle Center of Gravity (Y) Acceleration vs. Time	..
4	Vehicle Center of Gravity (Y) Velocity vs. Time	..
5	Vehicle Center of Gravity (Z) Acceleration vs. Time	..
6	Vehicle Center of Gravity (Z) Velocity vs. Time	..
7	Vehicle Center of Gravity Resultant Acceleration vs. Time	..
8	Floor Sill – Impact Side (Y) Acceleration vs. Time	..
9	Floor Sill – Impact Side (Y) Velocity vs. Time	..
10	Floor Sill – Impact Side (Y) Displacement vs. Time	..
11	A-Pillar Sill (Y) Acceleration vs. Time	..
12	A-Pillar Sill (Y) Velocity vs. Time	..
13	A-Pillar Sill (Y) Displacement vs. Time	..
14	A-Pillar Low (Y) Acceleration vs. Time	..
15	A-Pillar Low (Y) Velocity vs. Time	..
16	A-Pillar Low (Y) Displacement vs. Time	..
17	A-Pillar Mid (Y) Acceleration vs. Time	..
18	A-Pillar Mid (Y) Velocity vs. Time	..
19	A-Pillar Mid (Y) Displacement vs. Time	..
20	B-Pillar Sill (Y) Acceleration vs. Time	..
21	B-Pillar Sill (Y) Velocity vs. Time	..
22	B-Pillar Sill (Y) Displacement vs. Time	..
23	B-Pillar Low (Y) Acceleration vs. Time	..
24	B-Pillar Low (Y) Velocity vs. Time	..
25	B-Pillar Low (Y) Displacement vs. Time	..
26	B-Pillar Mid (Y) Acceleration vs. Time	..
27	B-Pillar Mid (Y) Velocity vs. Time	..
28	B-Pillar Mid (Y) Displacement vs. Time	..
29	Seat (Y) Acceleration vs. Time	..
30	Seat (Y) Velocity vs. Time	..
31	Seat (Y) Displacement vs. Time	..
32	Engine (X) Acceleration vs. Time	..
33	Engine (X) Acceleration vs. Time	..
34	Engine (X) Velocity vs. Time	..
35	Engine (Y) Acceleration vs. Time	..
36	Engine (Y) Velocity vs. Time	..
37	Firewall (Y) Acceleration vs. Time	..
38	Firewall (Y) Velocity vs. Time	..
39	Roof (Y) Acceleration vs. Time	..
40	Roof (Y) Velocity vs. Time	..
41	Floor Sill – Non Impact Side (Y) Acceleration vs. Time	..
42	Floor Sill – Non Impact Side (Y) Velocity vs. Time	..
43	Rear Deck (X) Acceleration vs. Time	..
44	Rear Deck (X) Velocity vs. Time	..
45	Rear Deck (Y) Acceleration vs. Time	..
46	Rear Deck (Y) Velocity vs. Time	..

14. REPORTS....Continued

**APPENDIX IV
DUMMY PERFORMANCE CALIBRATION TEST DATA
(Subpart U, ES-2re)**

The following data tables and plots shall be included in this appendix in the order indicated below;
(See Subpart U calibration test procedure)

<u>Description</u>	Page
Table U1. External Measurements	IV-1
Table U2. Head Drop Test	..
Peak Resultant Head Acceleration (g's) vs. Time (ms)	..
Head (X) Acceleration (g's) vs. Time (ms)	..
Table U3 Neck Flexion Test	..
Pendulum Velocity (m/s) vs. Time (ms)	..
Flexion Angle (°) vs. Time (m/s)	..
Table U4. Shoulder Impact Test	..
Peak Impactor Acceleration (g's) vs. Time (ms)	..
Table U5. Thorax – Rib Drop Tests	..
Upper Rib Displacement (mm) vs. Time (ms)	..
Middle Rib Displacement (mm) vs. Time (ms)	..
Lower Rib Displacement (mm) vs. Time (ms)	..
Table U6. Thorax – Full Body Impact Test	..
Pendulum Acceleration (g) vs. Time (ms)	..
Impactor Force (kN) vs. Time (ms)	..
Upper Rib Displacement (mm) vs. Time (ms)	..
Middle Rib Displacement (mm) vs. Time (ms)	..
Lower Rib Displacement (mm) vs. Time (ms)	..
Table U7. Abdomen Impact Test	..
Impactor Force (kN) vs. Time (ms)	..
Combined Abdominal Forces (kN) vs. Time (ms)	..
Table U8. Lumbar Spine Flexion Test	..
Pendulum Velocity vs. Time (ms)	..
Neck Flexion Angle (°) vs. Time (ms)	..
Table U9. Pelvis Impact Test	..
Impactor Force (kN) vs. Time (ms)	..
Pubic Force (N) vs. Time (ms)	..

14. REPORTS....Continued

**APPENDIX IV
DUMMY PERFORMANCE CALIBRATION TEST DATA
(Subpart V, SIDIs)**

The following data tables and plots shall be included in this appendix in the order indicated below;
(See Subpart V calibration test procedure)

<u>Description</u>	<u>Page</u>
Table V1. External Measurements	IV-1
Table V2. Head Drop Test	..
Peak Resultant Head Acceleration (g's) vs. Time (ms)	..
Head (X) Acceleration (g's) vs. Time (ms)	..
Table V3. Neck Flexion Test	..
D-plane Rotation (°) vs. Time (ms)	..
Moment About the Occipital Condyle (Nm) vs. Time (ms)	..
Pendulum Deceleration Pulse (m/s) vs. Time (m/s)	..
Table V4. Shoulder Impact Test	..
Shoulder Displacement (mm) vs. Time (ms)	..
Upper Spine Acceleration (g's) vs. Time (ms)	..
Impactor Acceleration (g's) vs. Time (ms)	..
Table V5. Thorax w/arm Impact Test	..
Upper Rib Displacement (mm) vs. Time (ms)	..
Middle Rib Displacement (mm) vs. Time (ms)	..
Lower Rib Displacement (mm) vs. Time (ms)	..
Shoulder Displacement (mm) vs. Time (ms)	..
Upper Spine Acceleration (g's) vs. Time (ms)	..
Lower Spine Acceleration (g's) vs. Time (ms)	..
Impactor Acceleration (g's) vs. Time (ms)	..
Table V6. Thorax w/o arm Impact Test	..
Upper Rib Displacement (mm) vs. Time (ms)	..
Middle Rib Displacement (mm) vs. Time (ms)	..
Lower Rib Displacement (mm) vs. Time (ms)	..
Shoulder Displacement (mm) vs. Time (ms)	..
Upper Spine Acceleration (g's) vs. Time (ms)	..
Lower Spine Acceleration (g's) vs. Time (ms)	..
Combined Abdominal Forces (kN) vs. Time (ms)	..
Impactor Acceleration (g's) vs. Time (ms)	..
Table V7. Abdomen Impact Test	..
Impactor Acceleration (g's) vs. Time (ms)	..
Upper Abdominal Rib Displacement (mm) vs. Time (ms)	..
Lower Abdominal Rib Displacement (mm) vs. Time (ms)	..
Lower Spine Acceleration (g's) vs. Time (ms)	..
Table V8. Pelvis Plug Quasi-Static Test (Optional*)	..
Table V9. Pelvis Acetabulum Test	..
Impactor Acceleration (g's) vs. Time (ms)	..
Pelvis(Y) Acceleration (g's) vs. Time (ms)	..
Acetabulum Force (N) vs. Time (ms)	..
Table V10. Pelvis Iliac Impact Test	..
Impactor Acceleration (g's) vs. Time (ms)	..
Pelvis(Y) Acceleration (g's) vs. Time (ms)	..
Iliac Force (N) vs. Time (ms)	..

* - If pre-certified pelvis plugs are used during the calibration tests, include a copy of the certification data provided by the supplier.

14. REPORTS....Continued

**APPENDIX V
TEST EQUIPMENT AND INSTRUMENTATION CALIBRATION**

In this appendix, identify all test equipment, dummy sensors, potentiometers and load cells used to collect data during the test. Also, provide the calibration dates for each as indicated in the sample tables below;

Table 1 - Dummy Instrumentation (ES-2re)

		ES2-re S/N_____		
		SERIAL NUMBER	MANUFACTURER	CAL. DATE
Head Accelerometers	X			
	Y			
	Z			
Thorax Potentiometers	Upper Rib (Y)			
	Middle Rib (Y)			
	Lower Rib (Y)			
Abdomen Load Cells	Forward (Y)			
	Middle (Y)			
	Rear (Y)			
Pubic Symphysis Load Cell (Y)				

Table 2 - Dummy Instrumentation (SIDIIs)

			SIDIIs S/N_____		
			SERIAL NUMBER	MANUFACTURER	CAL. DATE
Head Accelerometers	X				
	Y				
	Z				
Rib Displacement Transducers	Thorax	Shoulder			
		Upper			
		Middle			
	Abdominal	Lower			
		Upper			
		Lower			
Lower Spine Accelerometers (T12)	X				
	Y				
	Z				
Acetabulum Load Cell (Y)					
Iliac Wing Load Cell (Y)					

14. REPORTS....Continued

**APPENDIX V
TEST EQUIPMENT AND INSTRUMENTATION CALIBRATION**

Table 3 – Vehicle Instrumentation

VEHICLE INSTRUMENTATION	SERIAL NUMBER	MANUFACTURER	CAL. DATE
Vehicle Center of Gravity (X)			
Vehicle Center of Gravity (Y)			
Vehicle Center of Gravity (Z)			
Floor Sill (Impact side) (Y)			
A-Pillar Sill (Y)			
A-Pillar Low (Y)			
A-Pillar Mid (Y)			
B-Pillar Sill (Y)			
B-Pillar Low (Y)			
B-Pillar Mid(Y)			
Seat (Y)			
Engine (X)			
Engine (Y)			
Firewall (Y)			
Roof (Y)			
Floor Sill (Non-Impact Side) (Y)			
Rear Deck (X)			
Rear Deck (Y)			

15. FORMS....Continued

LABORATORY NOTICE OF APPARENT TEST FAILURE TO OVSC

FMVSS NO. 214 TEST DATE: _____

LABORATORY: _____

CONTRACT NO.: _____ DELIV. ORDER NO.: _____

LABORATORY PROJECT ENGINEER'S NAME: _____

TEST SPECIMEN DESCRIPTION: _____

VEHICLE NHTSA NO.: _____ VIN: _____

MFR: _____

APPARENT TEST FAILURE DESCRIPTION: _____

FMVSS REQUIREMENT, PARAGRAPH S___ :

NOTIFICATION TO NHTSA (COTR): _____

DATE: _____ BY: _____

REMARKS:
