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U .S. DEPARTMENT OF TRANSPORTATION

NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION

LABORATORY TEST PROCEDURE FOR OBLIQUE OFFSET MOVING DEFORMABLE BARRIER IMPACT TEST

U.S. Department of Transportation
National Highway Traffic Safety Administration
Office of Vehicle Safety Research
1200 New Jersey Avenue, SE
Washington, DC 20590

SECTION 1 - PURPOSE AND APPLICATION

This document is a laboratory test procedure provided by the National Highway Traffic Safety Administration (NHTSA) Office of Vehicle Safety Research (OVSR) for use by contracted testing laboratories.

The OVSR test procedure includes requirements that are general in scope to provide flexibility for contracted laboratories to perform tests. These requirements are not intended to limit or restrain a Contractor from developing or utilizing any testing techniques or equipment which will assist in performing the test and collecting the desired data. This test procedure does not constitute an endorsement or recommendation for use of any particular product or testing method.

NOTE: This OVSR laboratory test procedure is provided for the limited purpose of conveying requirements to independent laboratories under contract to conduct such tests for the OVSR. This laboratory test procedure is not rules, regulations, or NHTSA interpretations regarding the meaning of an FMVSS. This laboratory test procedure is not intended to limit the requirements of any FMVSS(s).

In addition, this laboratory test procedure may be modified by the OVSR at any time, without notice, and the COR may direct or authorize Contractors to deviate from this procedure, as long as the tests are performed in a manner consistent with this procedure and within the scope of the contract.

Any questions pertaining to the laboratory test procedures or other work requirement must be presented to the Contracting Officer Representative (COR) for discussion and resolution prior to conducting tests.

SECTION 2 - DEFINITIONS

1) Start

(1) **As delivered:** Refers to the vehicle in the unloaded vehicle weight (UVW) condition.

(2) **Designated seating capacity:** The number of designated seating positions provided as defined in 49 CFR Part 571.3.

(3) **Fuel spillage:** The fall, flow, or run of fuel from the vehicle but does not include wetness resulting from capillary action.

(4) **Gross axle weight rating or GAWR:** The value specified by the vehicle manufacturer as the load-carrying capacity of a single axle system as measured at the tire-ground interfaces.

(5) **Gross vehicle weight rating or GVWR:** The value specified by the manufacturer as the loaded weight of a single vehicle.

(6) **H-Point:** The pivot center of the torso and thigh on the three-dimensional device used in defining and measuring vehicle seating accommodation, as defined in Society of Automotive Engineers (SAE) Recommended Practice J1100, revised November 2009, "Motor Vehicle Dimensions"

(7) **Longitudinal or longitudinally:** Parallel to the longitudinal centerline of the vehicle.

(8) **Vehicle width:** Maximum dimension measured across the widest part of the vehicle, including bumpers and molding but excluding such components as exterior mirrors, flexible mud flaps, marker lamps, and dual rear wheel configurations.

(9) **Rated cargo and luggage capacity weight (RCLW):** RCLW = vehicle capacity weight **–** (68 kg x designated seating capacity). Maximum RCLW used in testing a truck, MPV, or bus is 136 kg.

(10) **Seating reference point (SgRP):** The unique design H-point, as defined in SAE J1100 (November 2009), which:

  (i) Establishes the rearmost normal design driving or riding position of each designated seating position, which includes consideration of all modes of adjustment, horizontal, vertical, and tilt, in a vehicle;

  (ii) Has X, Y, and Z coordinates, as defined in SAE J1100 (November 2009), established relative to the designed vehicle structure;

  (iii) Simulates the position of the pivot center of the human torso and thigh;

  (iv) Is the reference point employed to position the two-dimensional drafting template with the 95th percentile leg described in SAE J826 (November 2008), or, if the drafting template with the 95th percentile leg cannot be positioned in the seating position, is located with the seat in its most rearward adjustment position.

(11) **Seat cushion reference point (SCRP):** 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 which is used as a guide in positioning the seat.

(12) **Seat cushion reference line (SCRL):** 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.

(13) **Unloaded vehicle weight (UVW):** The weight of a vehicle with maximum capacity of all fluids 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.

(14) **Vehicle capacity weight (VCW):** The VCW is provided by the vehicle manufacturer and is displayed on the Tire and Loading Information placard as XXX in the statement "The

combined weight of occupants and cargo should never exceed XXX kilograms or XXX pounds."

(15) **Vehicle fuel tank capacity:** The 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 the 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

SECTION 3 - GENERAL REQUIREMENTS

3.1 METRIC SYSTEM OF MEASUREMENT

Section 5164 of the Omnibus Trade and Competitiveness Act (Pub. L. 100-418) established that the metric system of measurement was the preferred system of weights and measures for trade and commerce in the United States. Executive order 12770 directed 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).

Therefore if a testing laboratory has any test equipment which is required to execute this test that cannot provide direct measurement in metric units, the test laboratory shall calculate the exact metric equivalent by means of a conversion factor carried out to at least five significant digits before rounding consistent with the specified metric requirement.

All test reports and injury data 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 E29-13, "Standard Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications."

3.2 GOVERNMENT FURNISHED PROPERTY (GFP)

The Government will furnish the Contractor with the following:

3.2.1 Acceptance of Test Vehicle

The contractor has the responsibility of accepting each NHTSA (GFP) test vehicle whether delivered by a new vehicle dealership or another vehicle transporter. In both instances, the Contractor acts on behalf of the OVSR when signing an acceptance of the GFP test vehicle delivery order.

When a test vehicle is delivered, the contractor must verify all items identified in the "Receipt of Vehicle Form." Should any vehicle damage or discrepancies be discovered at the time of delivery, the COR or an authorized representative of the OVSR is to be notified immediately. The COR must always be notified within 24 hours after a vehicle (and/or equipment item) has been delivered. The "Receipt of Vehicle Form" shall be completed by the Contractor then submitted to the COR within 48 hours after delivery. The COR will provide the appropriate FORM 1 to the Contractor upon vehicle delivery.

GFP vehicle(s) shall not be driven by the Contractor on public roadways unless authorized by the COR.

3.2.2 Anthropomorphic Test Devices (ATDS)

Two (2) assembled THOR 50th percentile male ATDs and the diagnostic equipment necessary for test set-up including a tilt sensor readout shall be furnished to the contract laboratory by OVSR. THOR ATDs shall be stored in an upright sitting position, with their weight supported as described in the User's Manual.

The ATDs shall be stored in a secured room, which is maintained between 18.9° C and 25.5° C (66° F and 78° F) and at any relative humidity from 10% to 70%. For eight hours prior to the test the ATDs shall be in an environment that is between 20.6° C and 22.2° C (69° F and 72° F).

Upon receiving, after each test is performed and prior to performing further tests, the contracting laboratory shall complete a thorough inspection of each ATD for physical damage and complete a Dummy Damage Form that shall be submitted to the COR after each test. The contracting laboratory shall also review all sensor data after each test and notify the COR, of any data anomalies that occurred as a result of that test prior to performing further tests. The contracting laboratory may not proceed with additional subsequent tests unless permission to proceed is provided by the COR or an authorized representative of the OVSR.

The COR shall be kept informed of the ATDs' condition in case replacement parts need to be provided. The Contractor shall keep a detailed record for each ATD, describing parts replaced and the results of qualification tests.

The COR must be notified within 24 hours after delivery of the THOR ATDs. If any discrepancy or damage is found at the time of delivery, a record of this discrepancy or damage must be sent to the COR in writing (e-mail) immediately upon discovery.

3.2.3 Six Axis Degree-of-Freedom Sensor

The Contractor shall be provided with two (2) 6 degree-of-freedom sensors. These sensors measure X, Y, Z accelerations and X, Y, Z angular rate sensors. The six axis angular rate sensors shall have a range of either ± 8000 deg/sec (2000 Hz), 2000g or ± 18000 deg/sec (2000 Hz), 2000g and the accelerometers shall have a range of ± 2000 g.

3.2.4 Belt Movement Sensors

The Contractor shall be provided with a two (2) GFE seat belt movement sensors, which shall be installed to measure the displacement of the shoulder belt during the test for both the driver and right front passenger.

3.3 DISPOSITION OF GOVERNMENT PROPERTY

Upon acceptance of the Contractor's final test reports, the COR will determine if the tested vehicles can be released for disposition from the Contractor's facility. If so, the NHTSA Property Management Specialist will take appropriate steps to arrange for disposition of NHTSA property.

3.4 SECURITY

The Contractor shall provide appropriate security measures to protect test vehicles and Government Furnished Property (GFP) from unauthorized personnel during the entire 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 Acquisition Management, within two working days after the incident. A letter containing specific details of the security problem shall be sent to the IPM (with copy to the COR) within 48 hours.

The Contractor shall protect and segregate data associated with each vehicle test as it evolves from activities that occur before and after each crash test. No information concerning the testing program shall be released to anyone except the COR, unless specifically authorized by the COR or the COR's Division Chief.

3.5 RULES FOR CONTRACTORS

2) Start

(1) No vehicle manufacturer's representative(s) or anyone other than the Contractor's personnel working on contracts associated with this test mode and NHTSA personnel shall be allowed to inspect NHTSA vehicles, ATDs or witness vehicle preparations, ATD qualification and/or crash testing without prior permission of the COR or other authorized representative of OVSR. Such permission can never be assumed.

(2) All communications with vehicle manufacturers shall be referred to the COR or other authorized representative of OVSR, and at no time shall the Contractor respond to any questions, release crash test data, videos, or photos without the permission of the COR or other authorized representative of OVSR.

(3) The vehicle manufacturer's representatives shall only be authorized to visit the Contractor's test facility on the day that the test is scheduled except when their expertise is required for the preparation of the test vehicle (e.g. overriding a restraint suppression system that is unable to recognize an ATD). This work with the vehicle manufacturer must be approved in advance by the COR or other authorized OVSR representative. The representatives must be escorted by NHTSA and/or Contractor personnel.

(4) Test vehicle inspection by the vehicle manufacturer's representative(s) shall be limited to 30 minutes prior to the start of vehicle impact test. Post-test inspection shall be limited to 1 hour after Contractor personnel have completed their test tasks.

(5) Individual data plots and video cannot be viewed by manufacturer representatives until they are reviewed by NHTSA personnel and/or granted express permission by the COR.

(6) Manufacturer representatives shall not be permitted to tamper with or remove any parts from the vehicle without the consent of the COR.

3.6 EVENT DATA RECORDER (EDR)

The Contractor shall download the data from the Event Data Recorder from each test using the latest publically available software. The Contractor shall purchase and maintain the hardware and most-current software. The Contract shall submit the pdf report and binary file. If the Contractor is not able to download EDR, the Contractor shall notify COR via e-mail why the EDR cannot be downloaded.

3.7 CAMERA REQUIREMENTS

A digital file for each high-speed and real-time camera specified in this section shall be delivered in one of the following formats (.avi, .wmv, or .mpeg) using a standard or generally available "codec." Other types of files can be used only if prior approval is granted by the COR. Also, no fisheye lenses shall be used without prior approval by the COR. NHTSA reserves the right to modify the placement of all cameras.

3.8 HIGH SPEED DIGITAL COLOR CAMERAS

The Contractor shall have a minimum of four high speed digital color cameras able to record 1000 fps and have a minimum resolution of 1024 by 1024 pixels. Two of the high speed digital color cameras must be high “g” rated

The Contractor shall have 12 high speed digital color cameras able to record at 500 fps and have a minimum resolution of 512 by 512 pixels. Four of these cameras must be high “g” rated

Cameras must operate for at least 50 ms before time zero and for at least 300 ms after time zero, t0, where t0 is defined as the instant when the oblique moving deformable barrier (OMDB) contacts the test vehicle.

All videos shall have a time zero light in the registered frame to indicate when contact with the test vehicle and OMDB occurs. This may be accomplished by placing strobe lights or flash bulbs that illuminate at time zero in each field-of-view. The strobes can be wired to contact tape switches placed at the point of contact between the target test vehicle and the bullet OMDB.

Each video 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.

Each on-board video shall contain the NHTSA Number in the field of view at time zero.

The impact area must be equipped with sufficient lighting to provide the proper exposure without producing excess glare or shadows. The vehicle interior may require auxiliary onboard lighting to facilitate video analysis.

The contractor shall meet all the field of views specified in the test procedure.

3.9 REAL TIME COLOR CAMERA

The Contractor shall have two (2) real time HD digital color cameras able to record a minimum of 24 frames per second (fps) and have a minimum resolution of 1920 pixels wide and 1080 pixels high.

3.10 DIGITAL STILL PHOTOGRAPHS

Clear and properly focused digital, color still photographs in .jpg format shall be taken to document the test. The minimum resolution for digital photographs 1,600 by 1,200 pixels. Information placards which identify the test vehicle, NHTSA number, and test date, along with an indication of whether the photograph was taken pre-test or post-test, shall appear in each photograph and be legible. All pre-test photographs should be taken prior to impact, and all post-test photographs should be taken following impact. Glare or light from any illuminated or reflective surface should be minimized while taking photographs. Also, the contractor shall meet all the field of views specified in the test procedure.

Two photographs shall be provided to fill each page of Appendix A of the Final Test Report, and each photograph in this test procedure shall be labeled as to subject matter in accordance to the specified picture to be taken.

3.11 CALIBRATION AND TEST INSTRUMENTATION

Before the Contractor initiates the OVSR test program, a test instrumentation calibration system must be implemented and maintained in accordance with established calibration best practices. At a minimum, the calibration system shall include the criteria listed below.

3) Start

(1) Standards for calibrating the measuring and test equipment shall be stored and used under appropriate environmental conditions to assure accuracy and stability.

(2) All measuring instruments and standards shall be calibrated by the Contractor, or a commercial facility, against a higher order standard at periodic intervals. For accelerometers, the interval shall not exceed 6 months, after a test failure, or after any indication from calibration checks that there may be a problem with the accelerometer, whichever occurs sooner. For load cells, instruments, and calibration standards (except for static types of measuring devices such as rulers, weights, etc.), the interval shall be 12 months.

(3) All measuring and test equipment and measuring standards shall be labeled with the following information:
   - (i) Date of calibration
   - (ii) Date of next scheduled calibration
   - (iii) Name of the technician who calibrated the equipment

(4) A written calibration procedure shall be provided by the Contractor, which includes the following information for all measurement and test equipment at a minimum:
   - (i) Type of equipment, manufacturer, model number, etc.
   - (ii) Measurement range
   - (iii) Accuracy
   - (iv) Calibration interval
   - (v) Type of standard used to calibrate the equipment (calibration traceability of the standard must be evident)
   - (vi) The actual procedures and forms used to perform the calibrations
   - (vii) Records, showing the calibration traceability to the applicable National Institute of Standards and Technology (NIST) standard, shall be maintained for all measurement and test equipment for a period of at least 5 years. All such records shall be readily available for inspection when requested by the COR. The calibration system shall need the acceptance of the COR before testing commences.

(5) The Contractor shall perform a polarity check for all ATD and vehicle sensors to ensure that all data is accurately recorded and reported. Also, the contractor shall not zero out the appropriate channels. All checks shall be recorded by the test technician(s).

(6) Test equipment shall receive a system functional check using a known test input immediately before and after the test. This check shall be recorded by the test technician(s).

Further guidance is provided in the International Standard ISO 10012:2003, “Measurement management systems — Requirements for measurement processes and measuring equipment” and American National Standard ANSI/NCSL Z540.3-2006, “Calibration Laboratories and Measuring and Test Equipment General Requirements

3.12 ATD QUALIFICATION

ATDs shall be qualified as defined by the contract. If qualification before and after each test is required, the post-test qualification data obtained after a crash test can be used as the pre-test calibration qualification data for a subsequent crash test as long as the dummy is used within eight (8) weeks of the post-test calibration qualification, and the dummy is not used for any other static or dynamic tests during that time period.

The qualification data for the test device shall be submitted as part of the Quality Control Package, the Draft Test Report, and Final Test Report (see Deliverables). Qualification data must also be available electronically (in UDS format with an .ev5 header) if requested by the COR. Electronic data collected for all ATD qualifications must be retained by the Contractor for at least five years from the test date.

In the event of a test failure (i.e. failure to meet performance requirements) or data anomaly, the ATD must be inspected to identify any type of contributing electrical or mechanical issue. Furthermore, the COR may request that the region be re-qualified before testing can resume. Additional checks of test equipment and instrumentation may be required for verification of accuracy. The necessity for investigations and the qualification will be at the COR's discretion and will be performed without additional cost.

3.13 OMDB STORAGE

The OMDB shall be stored in a temperature controlled room capable of maintaining the ambient air temperature between 20.6° C and 22.2° C (69° F and 72° F). The contractor shall perform normal maintenance required to keep the OMDB within specification.

3.14 TEST SURFACE

The test surface shall be made of any material that is level, rigid, smooth surface and the minimum dimension of test surface shall be 31 m by 11.5 m (Figure 3.1). Inside the test surface is a Test Pad that meets the following minimum requirement:

4) Start
(1) Concrete which is level, smooth, rigid, and of uniform construction
(2) The Test Pad is level with the Test Surface
(3) The minimum Test Pad shall start 4.6 m before the impact point and shall extend past the impact point by 9 m
(4) The minimum width of the Test Pad shall 6.1 m and centered along the rail.

Note: The contractor is responsible for ensuring the test vehicle stays on the Test Surface and the contractor shall avoid any secondary impact of the OMDB and the test vehicle.

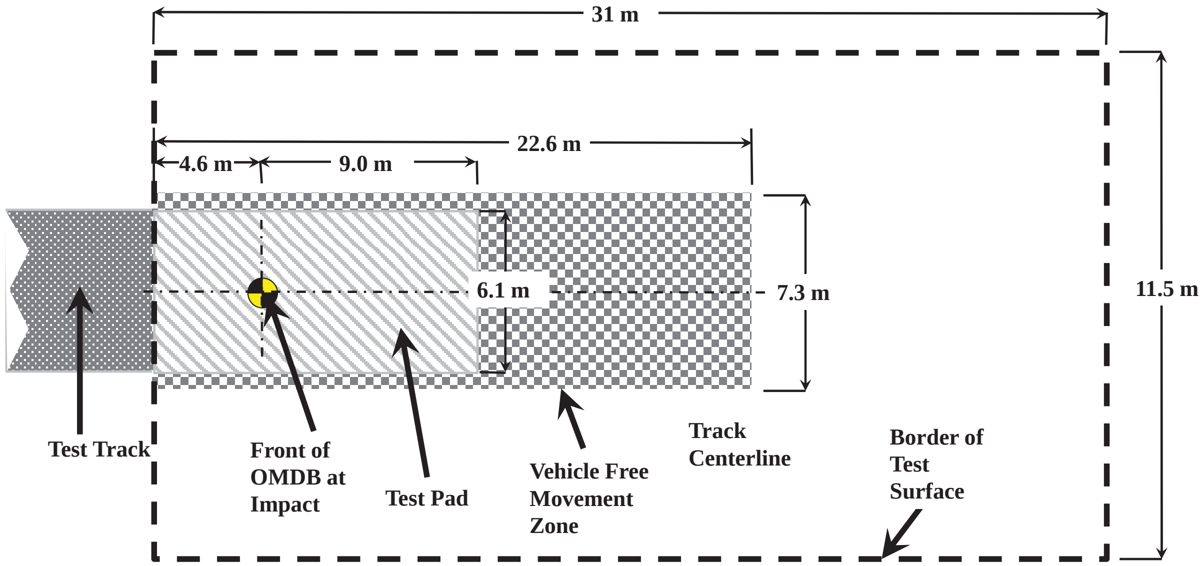


Figure 3.1: Test Surface specification

3.15 TEST VEHICLE FREE MOVEMENT ZONE

The contractor shall not try to stop the test vehicle in the Free Movement Zone. The minimum length of the free movement zone is 18 m at starts at the impact point of the OMDB and the test vehicle and the minimum width is 7.3 m (Figure 3.1). The COR must approve the method of stopping the test vehicle.

3.16 TOW ROAD

The tow road surface must be straight and of a uniform construction. The tow road must have sufficient length to allow for stabilization of the OMDB velocity (zero acceleration) prior to impact with the test vehicle and to allow time for the OMDB to be stopped from a test speed of 90.1 km/h ± 0.80 km/h in the event of a test abort. It must be flat enough to allow for the OMDB's motion to stabilize prior to impacting with the test vehicle.

3.17 TEST VEHICLE PREPARATION BUILDING / STRUCTURE

The test vehicle preparation building/structure encloses the area where the test vehicle is prepped during pre-test set-up that occurs just prior to the impact test. This building or structure shall be temperature-controlled, sealed to keep fine debris out, 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 impact event. For facilities that require testing outdoors, the preparation structure must be capable of being removed quickly prior to conducting the test and the vehicle interior temperature must be maintained within the specified range until just before the OMDB is towed into the test vehicle.

3.18 DATA ACQUISITION SYSTEM

The Contractor-furnished data acquisition system shall have the ability to capture a minimum of 288 channels available for recording and processing signals from the ATDs and vehicle sensors starting 50 ms prior to impact and continuing through 300 ms after impact. The system must record time histories of the instrumentation specified for each ATD used in the test. Each data channel shall be comprised of a sensor, signal conditioner, data acquisition device, and all interconnecting cables, and it must conform to the appropriate section of SAE Recommended Practice SAE J211/2 June 2014. NHTSA reserves the right to add an additional 20 channels.

3.19 CMM MACHINE

The contractor shall have a coordinate measuring machine (CMM) with accuracy of 1 mm. NHTSA reserves the right to add an additional 30 measurement points beyond those identified in this test procedure.

3.20 OBLIQUE MOVING DEFORMABLE BARRIER (OMDB)

The Contractor shall provide an oblique moving deformable barrier (OMDB) as specified in the latest revision of the corresponding NHTSA OMDB drawing package (Figure 3.2). The properties of the OMDB without the honeycomb face shall fall in the following ranges (Table 3.1, Table 3.2, Table 3.3).

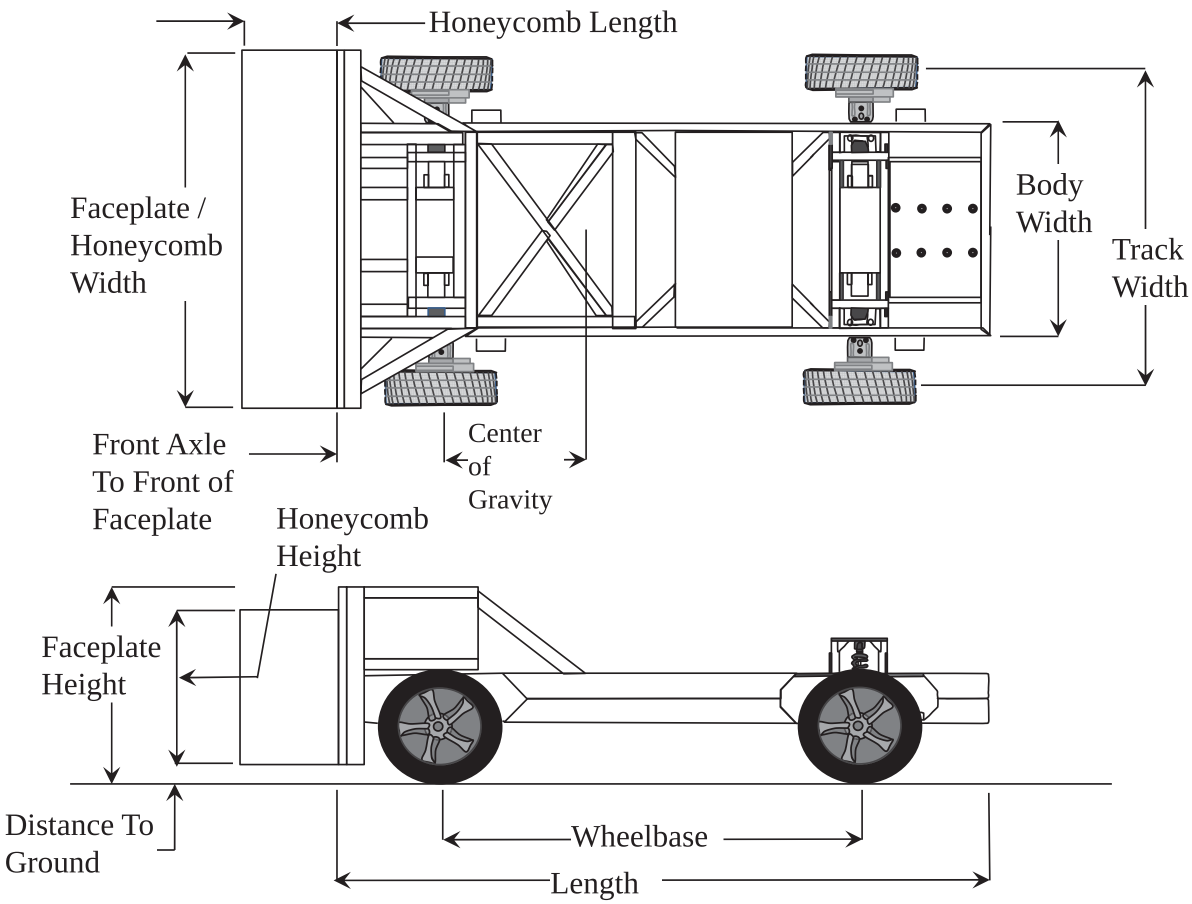


Figure 3.2: Drawing of the basic dimensions of the OMDB without honeycomb face

TABLE 3.1: DIMENSIONS AND TOLERANCES OF THE OMDB			
DESCRIPTION	**UNIT**	**DIMENSION**	**TOLERANCE**
Distance to Ground	mm	TDB	TDB
Faceplate Height	mm	TDB	TDB
Overall Length	mm	TDB	TDB
Wheelbase	mm	TDB	TDB
Front Axle to Front of Faceplate	mm	TDB	TDB
Faceplate Width	mm	TDB	TDB
Body Width	mm	TDB	TDB
Track Width	mm	TBD	TBD
Center of Gravity X Aft of Front Axle	mm	TDB	TDB
Center of Gravity Y from Centerline	mm	TDB	TDB
Center of Gravity Z from Ground	mm	TDB	TDB

TABLE 3.2: MOMENT OF INERTIA AND TOLERANCES OF THE OMDB			
DESCRIPTION	**UNIT**	**MAGNITUDE**	**TOLERANCE**
Moment of Inertia X	N-m	TDB	TDB
Moment of Inertia Y	N-m	TDB	TDB
Moment of Inertia Z	N-m	TDB	TDB

TABLE 3.3: WEIGHT DISTRIBUTION OF THE OMDB				
	UNITS	**FRONT**	**REAR**	**TOTAL**
Left	kg	TDB	TDB	TDB
Right	kg	TDB	TDB	TDB
Total	kg	TDB	TDB	TDB

The contracting laboratory must complete OMDB Measurements, and provide such measurement data of the OMDB to the COR for approval prior to starting any test program. This data shall also include all the above measurements

3.21 ALUMINUM HONEYCOMB BARRIER FACE

The Contractor is responsible for procuring aluminum honeycomb barriers. The Contractor shall conduct a detailed inspection of the honeycomb barrier for shipping damage prior to its installation on the OMDB face plate. The Contractor shall retain a copy of the barrier manufacturer's test data used to certify the barrier and have it available for review by the COR. The properties for the honeycomb barrier shall fall in the following ranges. Insert honeycomb specs or refer to Appendix

3.22 TARGET VEHICLE INFORMATION PLACARDS

Test vehicle identification placards shall be positioned so that at least one placard will be visible and legible in each of the off board high speed cameras' field of view. The test laboratory's name or logo shall not appear on vehicle information placards.

The following information shall be shown:

5) Start
(1) The words "NHTSA Research,"
(2) Words indicating the side of impact ("Left Side Impact" or "Right Side Impact")
(3) The words "90.1 KPH 15° Angle 35% Overlap,"
(4) Target test vehicle's year, make and model,
(5) Target test vehicle's NHTSA number,
(6) Date of test.

3.23 PRE-TEST REQUIREMENT

Prior to conducting a test, the contractor shall:

6) Start
(1) Verify COR approval of Contractor's in-house test procedure
(2) Verify the training of technicians for performance of this test
(3) Verify the calibration and qualification status of test equipment
(4) Review vehicle Owner's Manual and FORM1
(5) Set cold tire pressures according to the vehicle manufacturer's recommendations (where applicable).

3.24 DETAILED TEST AND QUALITY CONTROL PROCEDURES REQUIRED

The Contractor shall submit a detailed test procedure to the COR before initiating the test program. The procedure must include:

7) Start
(1) A step-by-step description of the methodology to be used
(2) A complete listing of test equipment to be used including instrument accuracy and calibration dates
(3) Detailed checklists that sequentially cover all steps of the test including data review

Each separate checklist shall identify the lab, test date, vehicle and test technicians. These check sheets shall be used to document that all requirements and procedures have been completed.

There shall be no contradiction between this OVSR laboratory test procedure and the Contractor's in-house test procedure. If the Contractor observes deficiencies in this laboratory test procedure, the Contractor is required to advise the COR to resolve the discrepancy as soon as practicable, prior to the start of testing.

The Contractor shall also submit a written Quality Control (QC) Procedure which must include: the instrumentation and test equipment calibration process, data review process, report review process, and shall identify the people assigned to perform QC on each task.

Written approval of any and all in-house test procedures and QC procedures shall be obtained from the COR before initiating a test program.

3.25 EV5 SUBMISSION

The contractor shall submit the test videos, pictures, and data according to NHTSA's EV5 and intrusion data format as specified in Version 5 Test Reference Guide, Volume 1: Vehicle Tests (VRTG).

The Contractor shall add a statement after the text in INSCOM if the data is questionable. For example: V2P1 LR CHEST IR-TRACC DX ->QD - NOISE ON DATA

3.26 TEST REPORTS

The contractor shall submit the test report using the attached example test report. The contractor shall not deviate from this example test report without permission from the COR.

3.26.1 Filtering Requirements

The contractor shall use the following filtering class in Table 3.4 for the curves plotted in the test report

TABLE 3.4: FILTERING CLASS OF DATA CHANNELS IN TEST REPORT	
	FILTER CLASS
Head Accelerations	1000
Head Angular Rate	60
Neck Forces	1000
Neck Moments	600
Neck Spring Force	1000
Occipital Condyle Rotation	180
Spine Acceleration	180
Thorax/Chest Acceleration	180
CRUX	180
DGSP	180
Acetabulum Force	600
Femur Force	600
Femur Moment	600
Knee Displacement	180
Tibia Force	600
Tibia Moment	600
Tibia Acceleration	1000
Ankle Rotations	180
Foot Acceleration	1000

3.26.2 Data Plots

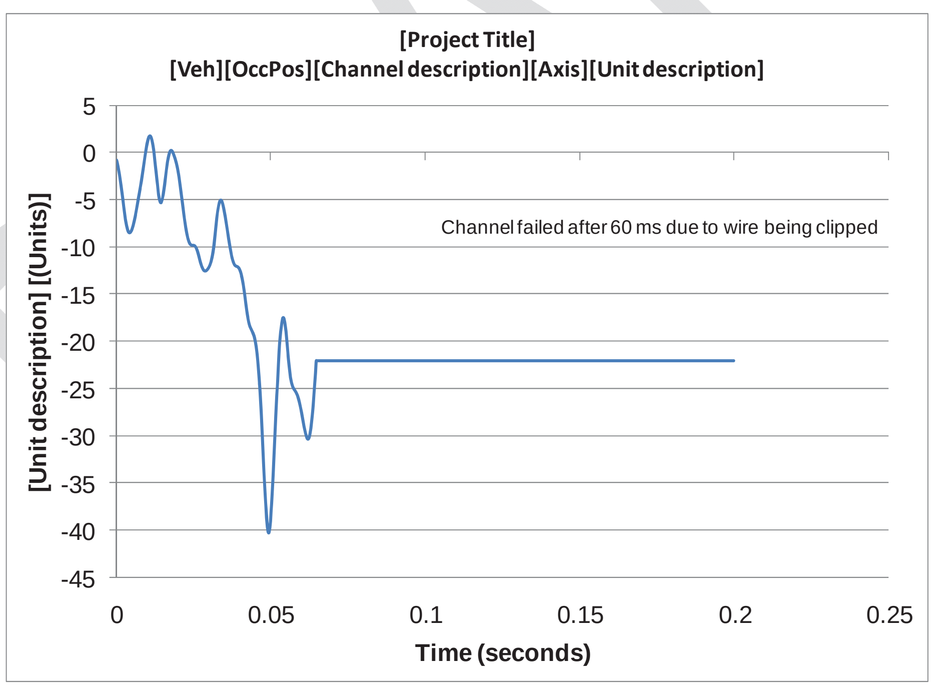
The Contractor shall include the information shown in Figure 3.3 on each data plot. Below provides the details of what to include on the plot.

1) Start

(a) Chart title shall be project title
(b) Chart subtitle shall include the following information.
    (i) Vehno=Target or OMDB
    (ii) Senloc=Driver, Right Front Pass, Left Rear Seat, etc.
    (iii) Senatt= Head, Chest, Neck, etc.
    (iv) Axis=X-Axis, Y-Axis, or Z-Axis
    (v) Unit Description=Acceleration, Force, moment, etc.
    (vi) Yunits=g,N, NM, etc.
(c) The plot shall also include the following information below the plot:
    (i) NHTSA number
    (ii) SAE filter class
    (iii) Min value
    (iv) Min value time
    (v) Max value
    (vi) Max value time

If the channel failed or contains questionable data, include a description of the failure in the plot area.

****Fix Plot



Filter: CFC_60 | Min Value -40 [Units] at 50 ms | Max Value 2 [Units] at 5 ms | NHTSA #: RY2345

Figure 3.3: Example data plot

3.27 GOOD HOUSEKEEPING

Contractors shall keep the vehicle preparation area, test area and ATD qualification laboratory neat, orderly, clean and presentable, which is consistent with good test laboratory practices. Furthermore all test fixtures, equipment, instrumentation, cabling, and GFP shall also be well maintained, stored appropriately, in a neat orderly manner and in good condition which is also consistent with good test laboratory practices.

3.28 TEST SCHEDULING AND MONITORING

Tests shall be completed as required in the contract. The Contractor shall submit to the COR a test date for each vehicle to be tested prior to conducting any test. If not specified in the contract, tests shall be conducted within 2 weeks after receiving the test vehicle and related setup information (Form 1) unless otherwise specified by the COR.

Scheduling and order of tests shall be adjusted based on vehicle and equipment availability or program requirements as required by the COR. All testing shall be coordinated with the COR in order to allow monitoring by the COR and/or other NHTSA personnel, if desired. The Contractor shall submit a monthly test status report and a vehicle status report (if applicable) to the COR. These reports must be submitted to the COR by the 15th day of each month. The vehicle status report shall be submitted until all vehicles are disposed of.

3.29 INVALID TEST DESCRIPTION

An invalid test is one which does not conform precisely to all critical Deliverables in section C.31 and C.32 .

<u>3.29.1</u> <u>Invalid Test Notification</u>

The Contractor shall notify NHTSA of any test not meeting all requirements of the OVSR 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 COR within 48 hours of the test completion.

<u>3.29.2</u> <u>Retest Notification</u>

The CO is the only NHTSA official authorized to notify the Contractor that a retest is required.

<u>3.29.3</u> <u>Waver of Retest</u>

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

<u>3.29.4</u> <u>Test Vehicle</u>

NHTSA shall furnish only one vehicle for each test ordered. The Contractor shall furnish the test vehicle required for any retest. The retest vehicle shall be equipped the same 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 COR that the test report has been accepted.

3.29.5 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 COR.

3.30 CRITICAL DELIVERABLES

3.30.1 Anthropomorphic Test Device (ATD)

Table 3.5 defines the critical channels that must be collected for each THOR in order to have a valid test. If data associated with these channels is not collected, the test laboratory is required to contact the COR within 24 hours of the test. A re-test may be required.

TABLE 3.5	
CHANNEL NAME	**DESCRIPTION**
V2P1 HDCG AX	V2P1 HEAD CG X
V2P1 HDCG AY	V2P1 HEAD CG Y
V2P1 HDCG AZ	V2P1 HEAD CG Z
V2P1 SPNU AX	V2P1 T1 ACCEL AX
V2P1 SPNU AY	V2P1 T1 ACCEL AY
V2P1 SPNU AZ	V2P1 T1 ACCEL AZ
V2P1 HDCG RX	V2P1 HEAD ANGULAR RATE RX
V2P1 HDCG RY	V2P1 HEAD ANGULAR RATE RY
V2P1 HDCG RY	V2P1 HEAD ANGULAR RATE RZ
V2P1 CHLU DX	V2P1 UL CHEST IR-TRACC DX
V2P1 CHLU RY	V2P1 UL CHEST RY
V2P1 CHLU RZ	V2P1 UL CHEST RZ
V2P1 CHRU DX	V2P1 UR CHEST IR-TRACC DX
V2P1 CHRU RY	V2P1 UR CHEST RY
V2P1 CHRU RZ	V2P1 UR CHEST RZ
V2P1 CHLL DX	V2P1 LL CHEST IR-TRACC DX
V2P1 CHLL RY	V2P1 LL CHEST RY
V2P1 CHLL RZ	V2P1 LL CHEST RZ
V2P1 CHRL DX	V2P1 LR CHEST IR-TRACC DX
V2P1 CHRL RY	V2P1 LR CHEST RY
V2P1 CHRL RZ	V2P1 LR CHEST RZ
V2P1 FMRL FZ	V2P1 LEFT FEMUR FZ
V2P1 FMRR FZ	V2P1 RIGHT FEMUR FZ

3.30.2 Test Vehicle

Table 3.6 defines the critical channels that must be collected in order to have a valid test. If data associated with these channels is not collected, the test laboratory is required to contact the COR within 24 hours of the test. A re-test may be required.

TABLE 3.6	
CHANNEL NAME	**DESCRIPTION**
V2 DSLR AX[1]	V2 LEFT REAR SILL X
V2 DSLR AY[1]	V2 LEFT REAR SILL Y
V2 DSRR AX[2]	V2 RIGHT REAR SILL X
V2 DSRR AY[2]	V2 RIGHT REAR SILL Y
V2 VHCG AX	V2 VEHICLE CG ACCELERATION AX
V2 VHCG AY	V2 VEHICLE CG ACCELERATION AY
V2 VHCG AZ	V2 VEHICLE CG ACCELERATION AZ
V2 VHCG RX	V2 VEHICLE CG ANGULAR RATE RX
V2 VHCG RY	V2 VEHICLE CG ANGULAR RATE RY
V2 VHCG RZ	V2 VEHICLE CG ANGULAR RATE RZ

3.30.3 OMDB

Table 3.7 defines the critical channels that must be collected in order to have a valid test. If data associated with these channels is not collected, the test laboratory is required to contact the COR within 24 hours of the test. A re-test may be required.

TABLE 3.7	
CHANNEL NAME	**DESCRIPTION**
V2 VHCG AX	V2 OMDB CG ACCELERATION AX
V2 VHCG AY	V2 OMDB CG ACCELERATION AY
V2 VHCG AZ	V2 OMDB CG ACCELERATION AZ
V2 VHCG RX	V2 OMDB CG ANGULAR RATE RX
V2 VHCG RY	V2 OMDB CG ANGULAR RATE RY
V2 VHCG RZ	V2 OMDB CG ANGULAR RATE RZ

3.30.4 Videos

Table 3.8 defines the critical channels that must be collected in order to have a valid test. If data associated with these channels is not collected, the test laboratory is required to contact the COR within 24 hours of the test. A re-test may be required.

TABLE 3.8	
CAMERA NUMBER	**CAMERA NAME**
Camera 3.1:	**Onboard Driver Over Shoulder**
Camera 3.2	**Onboard Passenger Over Shoulder**

3.31 TESTING REQUIREMENTS

3.31.1 Impact Point

The impact point shall be physically indicated upon contact of the OMDB to the test vehicle and the actual impact point must be within ± 50 mm both vertically and horizontally of the desired target impact point create when aligning the test vehicle and OMDB.

3.31.2 Angle of Test Vehicle

The angle of the Test vehicle shall be 15 degrees ± 1 degree clockwise from the rail for left impact and 15 degrees ± 1 degree counterclockwise from the rail for right impacts.

3.31.3 Tow and Guidance System

The tow system shall be capable of ensuring that the OMDB impacts the test vehicle at a speed of 90.1 ± 0.80 km/h. The OMDB shall be continuously towed until 305 mm from the impact point, with a tolerance window of 610 mm to 150 mm. The tow cable attachment device must release from the tow cable within the tolerance window. The OMDB velocity measurement shall be taken after cable release.

3.31.4 Impact Speed Measurement

Impact speed shall be measured by no less than two sets of independent timing devices, accurate to within ± 0.08 km/h and calibrated by an instrument traceable to the National Institute of Standards and Technology (NIST). The impact speed measurement recorded closest to the point of impact should be regarded as the primary measurement.

The physical locations of the recorded primary and redundant impact speed readouts should remain the same from test to test. For example, the laboratory may always choose to display the primary speed on the left-hand side, etc. These displayed values shall be labeled to indicate which display is the primary and which display is the redundant. The displayed values shall be to the hundredths and shall be in the units of kilometers per hour. The impact speed shall be documented by both digital real time video and digital photography.

A computer screen read-out may be utilized as a secondary display, should the primary display not function as intended.

3.32 OMDB BRAKING / ABORT SYSTEM

The OMDB shall be equipped with a braking system that can be utilized in the event that the test needs to be aborted and/or to prevent secondary impacts between the OMDB and the test vehicle. The OMDB's braking system shall be able to bring the OMDB from 90.1 km/h to 0 km/h within 14 meters. The contracting laboratory shall provide the COR with actual data from a check-out test showing compliance with this requirement prior to starting any test program.

The Contractor shall also provide the OMDB with an onboard braking system that should assist the vehicle to a controlled stop after 300 ms of the impact event. The onboard braking system shall also help to prevent secondary impacts of the test vehicle.

3.33 TEST TEMPERATURE CONDITIONS

The Contractor must verify that the dummy temperature is in the specified temperature range of 20.6° C and 22.2° C (69° F and 72° F). The temperature sensors for both methods shall be accurate at least to within ± 0.3° C (0.54° F).

The dummy must be soaked in an ambient air environment in the specified range as shown above for 8 hours prior to the test and any time after that until just before the movement of the vehicle towards the impact barrier. The ambient air temperature must be monitored and continuously recorded within 36 inches of the dummies.

For facilities that require testing outdoors, the vehicle's interior temperature shall be monitored, continuously recorded, and confirmed to have remained within the specified range following removal of the preparation structure until just before the OMDB is towed into the test vehicle.

The Contractor shall mark the ambient air temperature recording with the date, time and technician name at the beginning of the 8 hour soak and when the OMDB begins to move towards the test vehicle. Temperature recordings shall be supplied to the COR with final test reports.

3.34 QUICK LOOK DATA

The Contractor shall conduct a "quick-look" analysis of test data and cameras to determine if there any anomalies in the recorded data or any indications of that all the critical delevables are not meet. Any anomalies or indication of a test failure shall be discussed with the COR within 24 hours of performing the test.

3.35 INDICANT TESTING

The contractor shall perform the following indicant testing:

3.35.1 FMVSS No. 212, Windshield Mounting and FMVSS No. 209 Windshield Zone Intrusion – Partial (Indicant Test)

Note: In the case of a result that does not meet the requirements set forth in FMVSS No. 212 or FMVSS No. 219, the test laboratory is required to contact the COR within 24 hours of the test.

3.35.2 FMVSS No. 301, Fuel System Integrity (Indicant Test)

The contracting laboratory shall prepare the vehicle fuel system and measure post impact fuel system fluid spillage following the NHTSA test procedure for the FMVSS No. 301 frontal test.

Note: In the case of a result that does not meet the requirements set forth in FMVSS No. 301 and the associated compliance test procedure, the test laboratory is required to contact the COR within 24 hours of the test.

3.35.3 FMVSS No. 305, Electric Powered Vehicles, Electrolyte Spillage, and Electrical Shock Protection (Indicant Test)

Any test vehicle with full or partial electric motive power must be tested to the requirements outlined in 49 CFR §571.305 Sections 5.1, 5.2, and 5.3.

In the case of a result that does not meet these requirements, the test laboratory is required to contact the COR within 24 hours of the test.

SECTION 4 - PRE-TEST TEST VEHICLE CHECKLIST

CHECKLIST 4.1 - RECEIPT OF TEST VEHICLE / INSPECTION

Check the incoming vehicle for the following:

___**4.1.1** All options listed on the "window sticker" are present on the test vehicle.
___**4.1.2** Tires and wheel rims are new and the same as listed.
___**4.1.3** There are no dents or other interior or exterior flaws in the vehicle body.
___**4.1.4** The vehicle has been properly prepared and is in running condition.
___**4.1.5** The glove box contains an owner's manual, warranty document, consumer information, and extra set of keys.
___**4.1.6** The proper fuel filler cap is supplied on the test vehicle.
___**4.1.7** The spare tire, jack, lug wrench and tool kit (if applicable) are located in the vehicle cargo area.
___**4.1.8** The odometer reflects that the vehicle has been driven less than or equal to 200 miles.
___**4.1.9** The VIN (vehicle identification number) matches the VIN supplied by NHTSA.
___**4.1.10** The vehicle is equipped / matches description provided by NHTSA.
___**4.1.11** Vehicle warning lights (i.e. check engine, SRS, etc.) are not illuminated.
___**4.1.12** If the vehicle has any damage or discrepancies at the time of delivery, the COR is to be notified immediately.

CHECKLIST 4.2 - GENERAL TEST VEHICLE DATA AND CONDITION REPORT (FORM 2)

___**4.2.1** Obtain a FORM 1 “Test Vehicle Information” from the COR before testing preparation. Information on this form is supplied by the automobile manufacturer to aid in the initial test setup and shall be considered as reference material. After vehicle preparation is complete, the Test Vehicle Information form shall be discarded. Note: The contractor shall notify the COR if any information on Form No. 1 is in conflict with any requirement in this test procedure.

___**4.2.2** Using the owner’s manual, certification labels, information provided by the COR and/or vehicle manufacturer, and any other data available, complete the vehicle information and options table below (Table 4.1).

TABLE 4.1: GENERAL TEST VEHICLE DATA

VEHICLE INFORMATION		VEHICLE OPTIONS	
NHTSA No.		Auto-Leveling System	Yes/No
Model Year		Automatic Door Locks (ADL)	Yes/No
Make		Instructions to turn off ADLs	Yes/No
Model		Power Window Auto-Reverse	Yes/No
Body Style		Other Optional Features	
VIN		Driver Front Air bag	Yes/No
Body Color		Driver Curtain Air bag	Yes/No
Odometer Reading (km/mi)		Driver Head/Torso Air bag	Yes/No
Engine Displacement. (L)		Driver Torso Air bag	Yes/No
Type/No. Cylinders		Driver Torso/Pelvis Air bag	Yes/No
Engine Placement		Driver Pelvis Air bag	Yes/No
Transmission Type		Driver Knee Air bag	Yes/No
Transmission Speeds		Pass. Front Air bag	Yes/No
Overdrive		Pass. Curtain Air bag	Yes/No
Final Drive		Pass. Head/Torso Air bag	Yes/No
Roof Rack	Yes/No	Pass. Torso Air bag	Yes/No
Sunroof/T-Top	Yes/No	Pass. Torso/Pelvis Air bag	Yes/No
Running Boards	Yes/No	Pass. Pelvis Air bag	Yes/No
Tow Hitch Receiver	Yes/No	Pass. Knee Air bag	Yes/No
Tilt Steering Wheel	Yes/No	Driver Seat Belt Pretensioner	Yes/No
Power Seat - Driver	Yes/No	Pass. Seat Belt Pretensioner	Yes/No
Power Sear – Rt. Front Pass.	Yes/No	Driver Load Limiter	Yes/No
Anti-Lock Brakes (ABS)	Yes/No	Pass. Load Limiter	Yes/No
All-Wheel Drive (AWD)	Yes/No	Other Safety Restraints	
Traction Control System (TCS)	Yes/No		

Please List Other Pertinent Standard or Optional Equipment Below

CHECKLIST 4.3 - RECEIPT OF TEST VEHICLE – PHOTOGRAPHIC DOCUMENTATIONS

___**4.3.1** Place camera on a walking stick or tripod
___**4.3.2** Position the height of the camera halfway between the driver's window sill and the roof (CH)
___**4.3.3** Take the following photographs from the positions shown in Figure 4.1 and field of view in Table 4.2
___**4.3.4** Combine information in CHECKLIST 4.2 and the pictures below to create FORM2-Vehicle Condition Report
___**4.3.5** Send FORM2 to the COR within 48 hours after vehicle delivery.

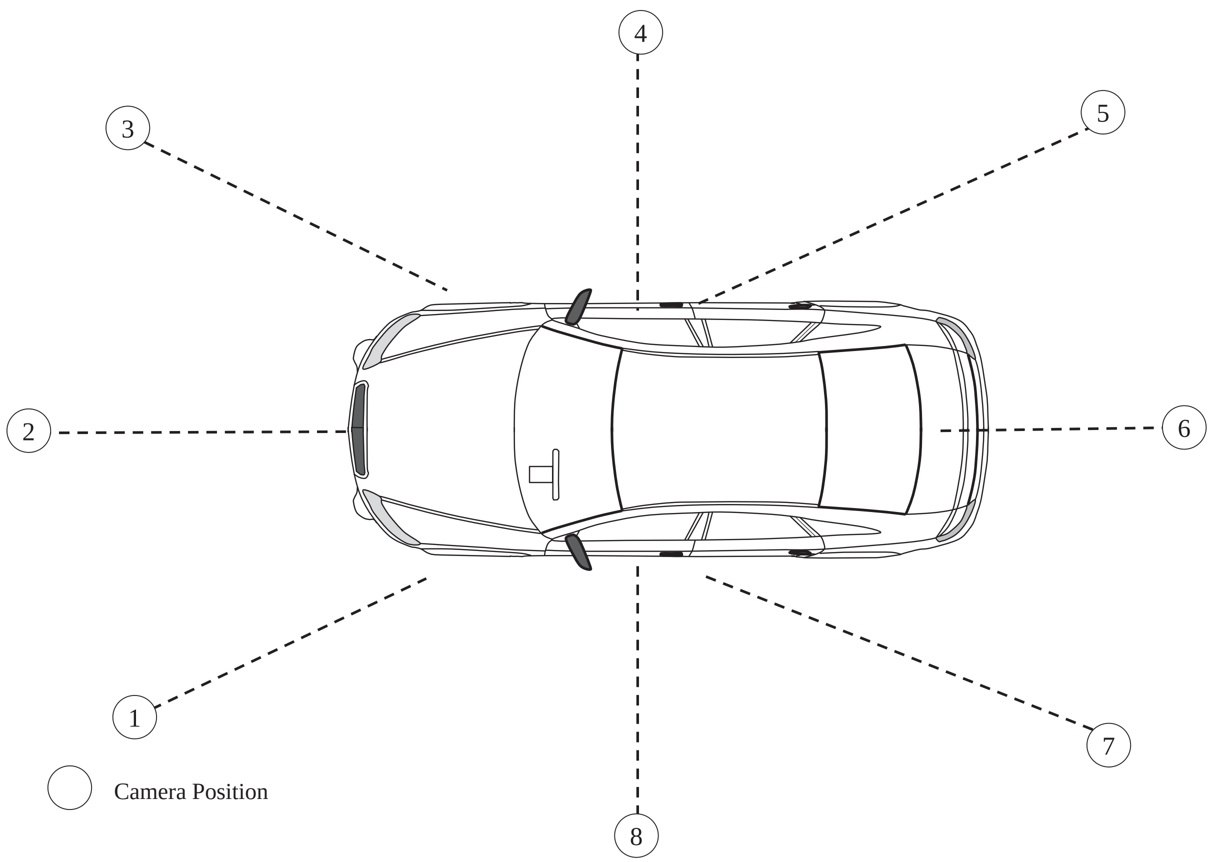
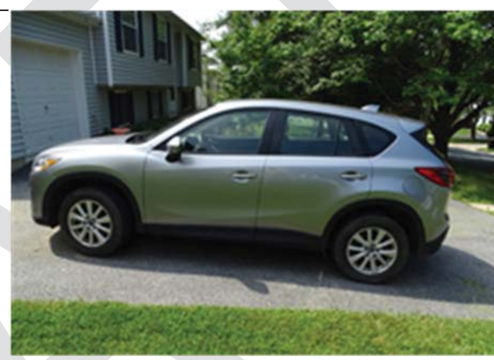
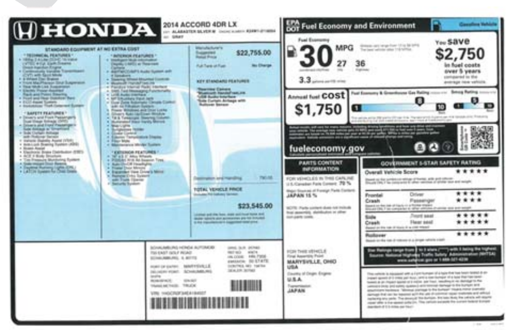


Figure 4.1: As Delivered pictures locations

TABLE 4.2: AS DELIVERED PICTURES	
DESCRIPTION (FIELD OF VIEW)	**EXAMPLE PICTURE**

TABLE 4.2: AS DELIVERED PICTURES	
DESCRIPTION (FIELD OF VIEW)	**EXAMPLE PICTURE**
Picture 4.1: "As Delivered"-Front Left Side Oblique (1) 8) Start (1) The vertical height is at camera height (CH) (2) Move back from the front left corner at 45 degrees to meet the field of view requirement (3) The left field of view is the right front corner of the vehicle (4) The right field of view is the left rear corner of the vehicle (5) The vertical field of view is centered on the vehicle	
Picture 4.2: "As Delivered"-Front View of Vehicle (2) 9) Start (1) The vertical height shall be at CH (2) Move back perpendicular from the front of the vehicle at the centerline of the vehicle to meet the field of view (3) The left field of view shall be the right outer edge of the vehicle (4) The right field of view shall be the left outer edge of the vehicle (5) The vertical field of view shall be centered	
Picture 4.3: "As Delivered"-Front Right Side Oblique (3) 10) Start (1) The vertical height is at CH (2) Move back from the right front corner at 45 degrees to meet the field of view requirement (3) The left field of view is the right rear corner of the vehicle (4) The right field of view is the left front corner of the vehicle (5) The vertical field of view is centered on the vehicle	

TABLE 4.2: AS DELIVERED PICTURES	
DESCRIPTION (FIELD OF VIEW)	**EXAMPLE PICTURE**
Picture 4.4: "As Delivered"-Right Side (4) 11) Start (1) The vertical height is at CH (2) Move back perpendicular from the right side of the vehicle at the center of the vehicle until the following field of view are met (3) The left field of view is the outer edge of the rear bumper (4) The right field of view is the outer edge of the front bumper (5) The vertical field of view is centered on the vehicle	
Picture 4.5: "As Delivered"-Rear Right Side Oblique (5) 12) Start (1) The vertical height is at CH (2) Move back from the right rear corner at 45 degrees until the following field of view are met (3) The left field of view is the left rear corner of the vehicle (4) The right field of view is the right front corner of the vehicle (5) The vertical field of view is centered on the vehicle	
Picture 4.6: "As Delivered"-Rear of Vehicle (6) 13) Start (1) The vertical height is at CH (2) Move back perpendicular from the rear of the vehicle at the longitudinal centerline of the vehicle until the following field of view are met (3) The left field of view is the outer left edge of the vehicle (4) The right field of view is the outer right edge of the vehicle (5) The vertical field of view is centered on the vehicle	

TABLE 4.2: AS DELIVERED PICTURES	
DESCRIPTION (FIELD OF VIEW)	**EXAMPLE PICTURE**
Picture 4.7: "As Delivered"-Rear Left Side Oblique (7) 14) Start (1) The vertical height is at CH (2) Move back from the left rear corner at 45 degrees until the following field of view are met (3) The left field of view is the left front corner of the vehicle (4) The right field of view is the right rear corner of the vehicle (5) The vertical field of view is centered	
Picture 4.8: "As Delivered"-: Left Side (8) 15) Start (1) The vertical height is at CH (2) Move back perpendicular from the left side of the vehicle at the center of the vehicle until the following field of view are met (3) The left field of view is the outer edge of the front bumper (4) The right field of view is the outer edge of the rear bumper (5) The vertical field of view is centered on the vehicle	
Picture 4.9: Monroney Sticker 16) Start (1) Take a picture of the Monroney sticker	

CHECKLIST 4.4 – CERTIFICATION LABEL DATA FOR TEST VEHICLE

___**4.4.1** Take picture of the vehicle's certification label
___**4.4.2** Record data from the vehicle's certification label in the table below.

TABLE 4.3: CERTIFICATION LABEL DATA	
Manufacturer	
Build date (or month and year of manufacture)	
Gross Vehicle Weight Rating (GVWR)	kg
Gross Axle Weight Rating (GAWR) for the front	kg
Gross Axle Weight Rating (GAWR) for the rear	kg

CHECKLIST 4.5 - SEAT TYPE

___**4.5.1** Visually inspect the seat to verify seat type and record the following information from the vehicle's certification label (Table 4.4):

___**4.5.2** Type of front seat – bucket, bench, or split bench

___**4.5.3** Type of front seat back – fixed or adjustable with lever or knob

___**4.5.4** Type of rear seat – bucket, bench or split bench

___**4.5.5** Type of rear seat back – fixed or adjustable with lever or knob

___**4.5.6** Designated Seating Capacity (DSC)

___**4.5.7** Vehicle Capacity Weight (VCW)

___**4.5.8** Rated Cargo and Luggage Weight (RCLW)

TABLE 4.4: SEAT DATA				
MEASURED PARAMETER	**FRONT**	**REAR**	**THIRD**	**TOTAL**
Type of Seats				
Number of Occupants				
Capacity Wt. (VCW) (kg)				
Cargo Wt. (RCLW) (kg)				

CHECKLIST 4.6 - TIRE DATASHEET FOR TEST VEHICLE

Checklist 4.6.1 - Test Vehicle Tire and Loading Placard

___**4.6.1.1** Take picture of the vehicle's tire and loading information placard

___**4.6.1.2** Record data from the vehicle's tire and loading information placard in Table 4.5.

TABLE 4.5: TIRE LOADING INFORMATION PLACARD DATA	
Vehicle Capacity Weight (VCW)	kg
Designated Seating Capacity – Front	
Designated Seating Capacity – Rear	
Designated Seating Capacity – Total	
Recommended Cold Pressure - Front	kPa
Recommended Cold Pressure - Rear	kPa
Recommended Tire Size - Front	
Recommended Tire Size - Rear	

Checklist 4.6.2 - Test Vehicle Tire Side Wall Data

___**4.6.2.1** Record data from the tire sidewalls for both the front and rear tires in Table 9 (see Figure 4.2).

___**4.6.2.2** For the front tires, is the maximum tire pressure greater than or equal to the recommended cold tire pressure recorded in Checklist 4.6.1

___ Yes ___ No (notify the COR)

___**4.6.2.3** For the rear tires, is the maximum tire pressure greater than or equal to the recommended cold tire pressure recorded for Checklist 4.6.1

___ Yes ___ No (notify the COR)

___**4.6.2.4** Do the tire size(s) (including tire class code, section width, aspect ratio, tire construction code, and wheel diameter) match those recorded in Checklist 4.6.1

___ Yes ___ No (notify the COR)

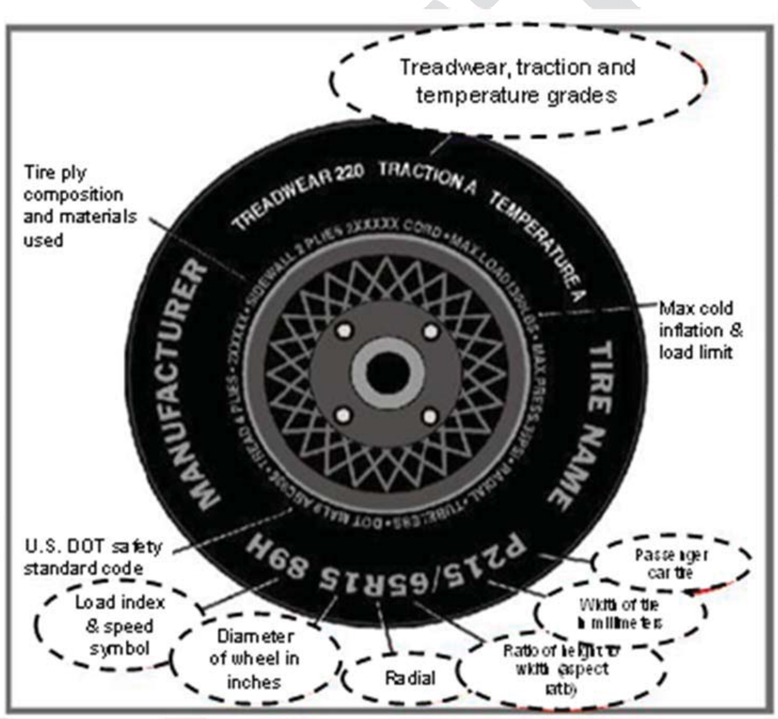


Figure 4.2: Tire side wall picture

TABLE 4.6: TIRE SIDEWALL DATA		
MEASURED PARAMETER	**FRONT**	**REAR**
Maximum Tire Pressure (kPa)		
Tire Size on Vehicle		
Tire Manufacturer		
Tire Model		
Treadwear		
Traction		
Temperature Grades		
Tire Plies Sidewall		
Tire Plies Body		
Load Index/Speed Symbol		

TABLE 4.6: TIRE SIDEWALL DATA		
MEASURED PARAMETER	**FRONT**	**REAR**
Tire Material		
DOT Safety Code Left		
DOT Safety Code Right		

CHECKLIST 4.7 - "AS DELIVERED" UNLOADED TEST VEHICLE WEIGHT CONDITION

___**4.7.1** Fill the transmission with transmission fluid to its normal level.
___**4.7.2** Drain the fuel from the fuel tank.
___**4.7.3** Run the engine until all fuel remaining in the fuel delivery system is used and the engine stops.
___**4.7.4** Describe the fuel pump type, details about how it operates, and the location of the fuel filler neck below.
___**4.7.5** Record the usable fuel tank capacity of both standard and optional (if applicable) fuel tanks as supplied on Form 1 in Table 10.
___**4.7.6** Record the fuel tank capacity of both standard and optional (if applicable) fuel tanks as supplied in the owner's manual.
___**4.7.7** Calculate 1/3 of the usable capacity of the fuel tank(s) (as provided on Form 1) and record the calculated value.
___**4.7.8** Calculate 93% of the usable capacity of the fuel tank(s) and record the calculated value.
___**4.7.9** Using purple dyed Stoddard solvent having the physical and chemical properties of Type 1 solvent or cleaning fluid per ASTM Standard D484-71, "Standard Specifications for Hydrocarbon Dry-cleaning Solvents," fill the fuel tank to 100% usable capacity as supplied on Form 1. Record the amount of solvent added for the "As Delivered" Unloaded Vehicle Weight (UVW) condition.

Note: Stoddard solvent shall be free of debris. It is considered debris-free only if, upon filtering with a 10 micron filter, no solid debris is retained on the filter media or in any conduit, container or vessel upstream from the filter paper (e.g. debris is not allowed to be present in the funnel, pump, or container). The solvent used for NHTSA testing must be designated for NHTSA testing only.

TABLE 4.7: FUEL TANK CAPACITIES	
	LITERS
Usable Capacity of "Standard Tank"	
Usable Capacity of "Optional Tank"	
93% of Usable Capacity	
Actual Amount of Solvent Used	
1/3 of Usable Capacity	
Fuel Filler neck location	[Right / Left]

Fuel Pump Operation

___**4.7.10** Crank the engine to fill the fuel delivery system with Stoddard solvent.
___**4.7.11** Fill the coolant system to capacity.
___**4.7.12** Fill the engine with motor oil to the maximum mark on the dip stick.
___**4.7.13** Fill the brake reservoir with brake fluid to its normal level.
___**4.7.14** Fill the windshield washer reservoir to capacity.
___**4.7.15** Inflate the tires to the cold tire pressure indicated on the tire placard. If no tire placard is available, inflate the tires to the recommended pressure in the owner's manual.
___**4.7.16** Place all adjustable seats in the middle fore-aft and full down position.
___**4.7.17** Weigh the vehicle at each wheel and add the weights together to determine the Unloaded Vehicle Weight (UVW). Record the weight measurements in Table 4.8 below.

TABLE 4.8: UVW				
		UNLOADED VEHICLE WEIGHT (UVW)		
	UNITS	FRONT	REAR	TOTAL
Left	kg			
Right	kg			
Ratio	%			
Totals	kg			

CHECKLIST 4.8 - "AS DELIVERED" UNLOADED TEST VEHICLE WEIGHT – ATTITUDE MEASUREMENT

___**4.8.1** With the vehicle in the "As Delivered" Unloaded Vehicle Weight condition, place it on a flat, level surface.

___**4.8.2** Mark a point on the vehicle body above the center of each wheel.

___**4.8.3** Measure the perpendicular distance from the level surface to the four (4) points marked above the center of each wheel on the vehicle and record in Table 4.9.

___**4.8.4** Calculate and record the longitudinal distance from the front axle to the CG for the Unloaded Vehicle Weight condition in Table 4.9.

$$\frac{\underset{\boxed{\text{mm}}}{\text{XWB}} \times \underset{\boxed{\text{kg}}}{\text{WRear}}}{\underset{\text{WTotal}}{\boxed{\text{kg}}}} = \underset{\boxed{\text{mm}}}{\text{XCG}}$$

Where: XWB = Vehicle wheelbase

WTotal = Vehicle total weight

WRear = Vehicle rear axle weight

XCG = Longitudinal distance from the front axle to the CG

TABLE 4.9: "AS DELIVERED" UNLOADED VEHICLE ATTITUDES AND XCG LOCATION						
ATTITUDE	**UNITS**	**LF**	**RF**	**LR**	**RR**	**XCG**
As Delivered	mm					

CHECKLIST 4.9 - CALCULATION OF VEHICLE TARGET TEST WEIGHT

___**4.9.1** Record the Vehicle Capacity Weight (VCW) displayed on the tire placard.

___**4.9.2** Record the Designated Seating Capacity (DSC) displayed on the tire placard.

___**4.9.3** Calculate the Rated Cargo and Luggage Weight (RCLW) as follows and record below. FOR TRUCKS, MPV's or BUSES - If the RCLW calculated above is greater than 136 kg, use 136 kg as the RCLW.

___**4.9.4** RCLW = VCW – (68.04 kg x DSC)

___**4.9.5** Weigh the fully-instrumented dummies to be used and record below.

___**4.9.6** Calculate the Test Vehicle Target Weight (TVTW) by summing the "As Delivered" weight, the RCLW, and the weight of the fully instrumented THOR ATDs:

TVTW = As Delivered Weight + RCLW + (2 x THOR ATD's Weight)

TABLE 4.10		
MEASURED PARAMETER	**UNITS**	**VALUE**
Total Delivered Weight (UVW)	kg	
Weight of ATDs	kg	
Rated Cargo/Luggage Weight (RCLW)	kg	
Calculated Vehicle Target Weight (TVTW)	kg	

CHECKLIST 4.10 - “FULLY LOADED” TEST VEHICLE WEIGHT CONDITION

___**4.10.1** With the vehicle in the “As Delivered” Unloaded Vehicle Weight condition, ensure the front outboard seats are in the test position.

___**4.10.2** Place the weight of the dummies in the front outboard seating positions.

___**4.10.3** Load the vehicle with the RCLW centered in the luggage or load-carrying/cargo area.

___**4.10.4** Weigh the vehicle at each wheel and add the weights together to determine the Fully Loaded weight. Record the weight measurements below.

TABLE 4.11

		FULLY LOADED		
	UNITS	FRONT	REAR	TOTAL
Left	kg			
Right	kg			
Ratio	%			
Totals	kg			

CHECKLIST 4.11 - "FULLY LOADED" – TEST VEHICLE ATTITUDE

___**4.11.1** With the vehicle in the Fully Loaded weight condition, place it on a flat, level surface.

___**4.11.2** Measure the perpendicular distance from the level surface to the four (4) points previously marked on the vehicle and record below.

___**4.11.3** Calculate and record the longitudinal distance from the front axle to the CG for the Fully Loaded vehicle weight condition

$$\frac{\underset{\text{mm}}{XWB} \times \underset{\text{kg}}{WRear}}{\underset{\text{kg}}{WTotal}} = \underset{\text{mm}}{XCG}$$

Where: XWB = Vehicle wheelbase

WTotal = Vehicle total weight

WRear = Vehicle rear axle weight

XCG = Longitudinal distance from the front axle to the CG

TABLE 4.12: "FULLY LOADED" TEST VEHICLE ATTITUDES AND XCG LOCATION						
ATTITUDE	**UNITS**	**LF**	**RF**	**LR**	**RR**	**XCG**
As Delivered	mm					

CHECKLIST 4.12 - "AS TESTED" – VEHICLE WEIGHT CONDITION

___**4.12.1** Remove dummy weight and RCLW from the vehicle.

___**4.12.2** Drain the fuel system, record the amount of Stoddard removed.

___**4.12.3** NOTE: The removal process must prevent Stoddard solvent contact with substances which may be soluble in the solvent. (i.e. undercoating, paints used for identifying under-vehicle components, etc.).

___**4.12.4** Fill the tank to 93 percent (± 1%) of usable capacity with Stoddard solvent which has been dyed purple, having the physical and chemical properties of Type 1 solvent or cleaning fluid per ASTM Standard D484-71, "Standard Specifications for Hydrocarbon Dry-cleaning Solvents.".

___**4.12.5** Crank the engine to fill the fuel delivery system with Stoddard solvent.

___**4.12.6** Drain transmission fluid, engine coolant, motor oil, and windshield washer fluid from the test vehicle.

CHECKLIST 4.13 - - "AS TESTED" – VEHICLE WEIGHT CONDITION

___**4.13.1** Remove dummy weight and RCLW from the vehicle.

___**4.13.2** Drain the fuel system, record the amount of Stoddard removed.

NOTE: The removal process must prevent Stoddard solvent contact with substances which may be soluble in the solvent. (i.e. undercoating, paints used for identifying under-vehicle components, etc.).

___**4.13.3** Fill the tank to 93 percent (± 1%) of usable capacity with Stoddard solvent which has been dyed purple, having the physical and chemical properties of Type 1 solvent or cleaning fluid per ASTM Standard D484-71, "Standard Specifications for Hydrocarbon Dry-cleaning Solvents.".

___**4.13.4** Crank the engine to fill the fuel delivery system with Stoddard solvent.

___**4.13.5** Drain transmission fluid, engine coolant, motor oil, and windshield washer fluid from the test vehicle.

___**4.13.6** Place the front outboard seats in the test position (See DATA SHEET 2 - DATA SHEET 2 - SEAT SETTING & STEERING WHEEL ADJUSTMENT).

___**4.13.7** Load the vehicle with the appropriate dummies (if not already present) and onboard test equipment (including all instrumentation boxes, cameras, lighting, etc.).

___**4.13.8** Secure the equipment in the load-carrying area

___**4.13.9** Calculate the Target Vehicle Test Weight (TVTW) range as follows:

TVTW = UVW + RCLW + (Weight of ATDs) = ________

Maximum Test Vehicle Target Weight (TVTW) = TVTW - 4.5 kg = ________

Minimum Test Vehicle Target Weight (TVTW) = TVTW - 9 kg = ________

The As Tested weight should fall as follows:

TVTW-9.0kg ? As Tested weight ? TVTW-4.5kg

___**4.13.10** If necessary, to achieve the As Tested weight, adjust the weight of the test vehicle by either adding ballast or removing vehicle components in accordance with the manufacturer's data or direction provided by COR.

___**4.13.11** With the vehicle in the TVTW range, record the vehicle weight at each wheel, the weight of the added ballast (if any) and the weight of each vehicle component that was removed (if any).

TABLE 4.13				
		AS TESTED (ATW) (AXLE)		
	UNITS	FRONT	REAR	TOTAL
Left	kg			
Right	kg			
Ratio	%			
Totals	kg			

Components Removed: ____________________

____

____

____

Ballast Added (kg): ____________ Location of Ballast: ____________

NOTE: If the calculated TEST VEHICLE TARGET WEIGHT (TVTW) is exceeded, the Contractor should consult the vehicle setup information to determine which parts, if any, have been suggested for removal. The Contractor must notify the COR to confirm the removal of vehicle components. If no components were provided with the vehicle setup information, the Contractor must also contact the COR for guidance about parts removal or whether to execute test "as-is".

CHECKLIST 4.14 – “AS TESTED” VEHICLE ATTITUDE MEASUREMENTS

___**4.14.1** With the vehicle in the As Tested weight condition, place it on a flat, level surface.

___**4.14.2** Measure the perpendicular distance from the level surface to the four (4) points previously marked on the vehicle and record below.

___**4.14.3** Do the measurements in item 2 fall between the As Delivered and Fully Loaded attitudes?

__Yes, continue

__No, confirm that the target weight is correct and that the vehicle suspension is evenly settled. If the vehicle attitude still does not fall between the “As Delivered” and “Fully Loaded” attitudes, notify the COR.

___**4.14.4** Calculate and record the longitudinal distance from the front axle to the CG for the As Tested vehicle weight condition.

XWB		WRear		XCG
mm	X	kg	=	mm

―――――――――――――

kg

WTotal

Where: XWB = Vehicle wheelbase

WTotal = Vehicle total weight

WRear = Vehicle rear axle weight

XCG = Longitudinal distance from the front axle to the CG

NOTE: The As Tested vehicle attitude measurements shall be taken within an hour prior to impact to assure the proper attitude is met.

TABLE 4.14						
ATTITUDE	**UNITS**	**LF**	**RF**	**LR**	**RR**	**CGX**
As Tested	mm					

CHECKLIST 4.15 - COLORING REQUIREMENTS INTERIOR OF TEST VEHICLE

___**4.15.1** Apply 25 mm wide checkerboard tape on the top portion of the steering wheel circumference between clock positions 10 and 2.

___**4.15.2** Paint interior surfaces, such as instrument panel, A-pillar trim, both front door trim panels and center console with flat white paint. Note: Air bag covers, the instrument cluster, transmission gear selector and air bag cut-off switch (if equipped) shall not be painted

___**4.15.3** Paint the driver and right front passenger toepan and floorboard with a dusting of flat white paint

CHECKLIST 4.16 - COLORING REQUIREMENTS VEHICLE EXTERIOR COMPONENTS

___**4.16.1** Paint the tires and wheels with two perpendicular white lines that cross at the center of the wheel

CHECKLIST 4.17 - COLORING REQUIREMENTS FOR UNDERBODY COMPONENTS

___**4.17.1** Remove any plastic material in front of the components listed Table 4.15
___**4.17.2** Paint the underbody components according to the requirements in Table 4.15.

TABLE 4.15	
VEHICLE PART	**COLOR**
Floor pan	Light Pink
Frame rail members	Red
Suspension components	Dark Pink
Engine Oil Pan	Blue
All Fuel System Components	Purple
Fuel Filler Neck	Yellow
Steering mechanism	Green

CHECKLIST 4.18 – PRE-TEST UNDERBODY PICTURES

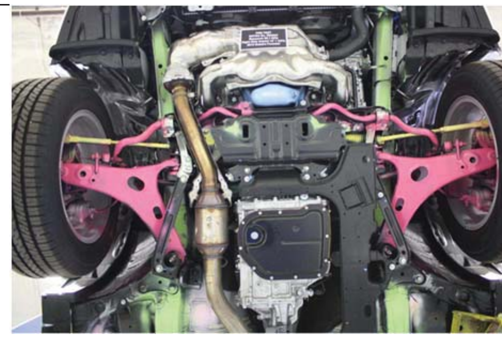
___**4.18.1** Remove any plastic parts covering the bottom of the vehicle. This includes the bottom shield

___**4.18.2** Take the following pictures as specified in

TABLE 4.16	
DESCRIPTION (FIELD OF VIEW)	**EXAMPLE PICTURE**
Picture 4.10 (16): Pre-Test View of Front Underbody (perpendicular to vehicle) 17) Start (1) The camera is perpendicular to the floor (2) The top field of view is the driver's front tire (3) The bottom field of view is the Passenger's front tire (4) The left field of view is the outer edge of the front bumper	
Picture 4.11: Pre-Test View pf Mid-Underbody (perpendicular to vehicle) 18) Start (1) The camera is perpendicular to the floor (2) The top field of view is the bottom sill (3) The bottom field of view is the passenger's bottom sill (4) The left field of view shall start at the right side view of Picture 4.10	
Picture 4.12: Pre-Test View of Rear Underbody (perpendicular to vehicle) 19) Start (1) The camera is perpendicular to the floor (2) The top field of view is the rear tire (3) The bottom field of view is the passenger's rear tire (4) The left field of view shall start at the right side view of Picture 4.11 (5) The right field of view is the outer edge of the rear bumper	

Picture 4.13: Pre-Test View of Steering rack and or sway bar

20) Start
(1) The camera is perpendicular to the floor
(2) The right field of view is the front tire
(3) The left field of view is the passenger's front tire
(4) The bottom field of view is at the intersection of the wheel well and the bottom sill



Picture 4.14: Pre-Test Bumper to Rail Attachments and Crush Initiators

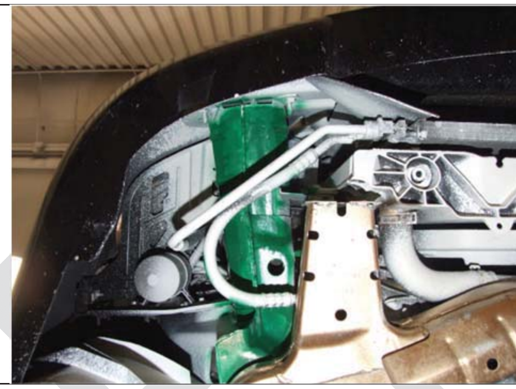
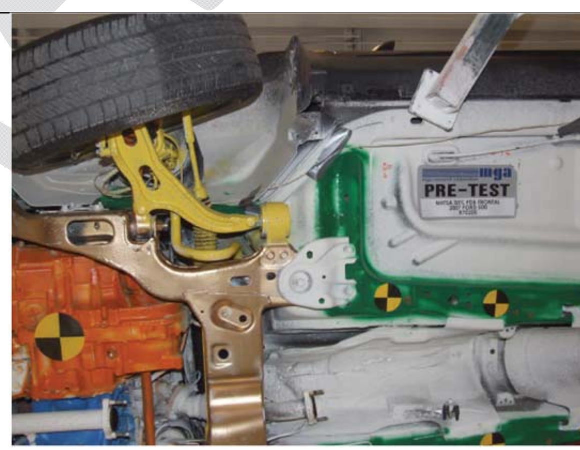
21) Start
(1) The camera is perpendicular to the floor
(2) The right field of view is the outer edge of the frame rail
(3) The left field of view is the outer edge of the passenger's frame rail
(4) The bottom field of view is the front of the front tires
(5) The top field of view is the outer edge of the front bumper

Picture 4.15: Pre-Test Oblique View of the Right Bumper to Rail Attachments and Crush Initiators

22) Start
(1) The camera is below the driver's front tire
(2) The right field of view is the outer edge of the passenger's frame rail
(3) The left field of view is the longitudinal centerline of the vehicle
(4) The top field of view is outer edge of the front bumper
(5) The bottom field of view is the front of the passenger's front tire

Picture 4.16: Pre-Test Oblique View of the Left Bumper to Rail Attachments and Crush Initiators

23) Start
(1) The camera is below the passenger's front tire
(2) The left field of view is the outer edge of

the driver's frame rail (3) The right field of view is the longitudinal centerline of the vehicle (4) The top field of view is the outer edge of the front bumper (5) The bottom field of view is the front of the driver's front tire	
Picture 4.17: Pre-Test Right Bumper to Rail Attachment Bottom View Try capturing the Attachment of the Right Bumper to Rail Attachment from the bottom of the vehicle	
Picture 4.18: Pre-Test Right Bumper to Rail Attachment Top View Try capturing the Attachment of the Right Bumper to Rail Attachment from the top of the vehicle	
Picture 4.19: Pre-Test Left Side Rocker Perpendicular View 24) Start (1) The camera is perpendicular to the floor (2) The left field of view is the front of the passenger's front tire (3) The right field of view is the halfway between the A-pillar and B-pillar along the left sill (4) The bottom field of view is the longitudinal centerline of the vehicle (5) The top field of view is the outboard edge of the right sill	

Picture 4.20 (16): Pre-Test View of Front Left Underbody (perpendicular to vehicle)

25) Start

(1) The camera is perpendicular to the floor

(2) The left field of view is the outer edge of the front bumper

(3) The right field of view is the intersection of the wheel well and the right sill

(4) The bottom field of view is the longitudinal centerline of the vehicle

(5) The top field of view is the outer edge of the driver's front tire

Picture 4.21: Pre-Test Sway Bar Left Side View

26) Start

(1) The camera is perpendicular to the floor

(2) The left field of view is the front of the passenger's wheel well

(3) The right field of view is the back of the passenger's wheel well

(4) The bottom field of view is the longitudinal centerline of the vehicle

(5) The top field of view is the outer edge of the driver's front tire

Picture 4.22: Pre-Test Right Side Rocker Oblique View

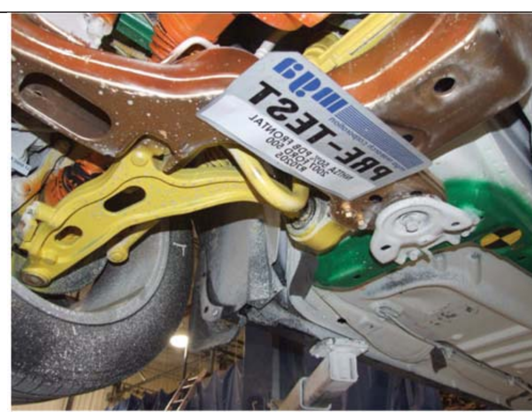
27) Start

(1) The camera is placed under the left front bumper corner

(2) The left field of view is the front of the passenger's front tire

(3) The bottom field of view is the bottom of the passenger's front tire

(4) The right field of view is ¾ the distance between the A-pillar and C-pillar



Picture 4.23 (16): Pre-Test View of Front Right Underbody (perpendicular to vehicle)

28) Start

(1) The camera is perpendicular to the floor
(2) The left field of view is the outer edge of the front bumper
(3) The right field of view is the intersection of the wheel well and the left sill
(4) The top field of view is the longitudinal centerline of the vehicle
(5) The bottom field of view is the outer edge of the driver's front tire

Picture 4.24: Pre-Test Sway Bar Right Side Perpendicular View

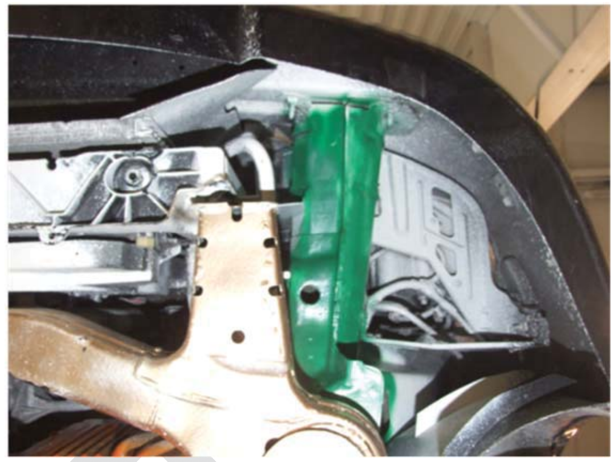
29) Start

(1) The camera is perpendicular to the floor
(2) The left field of view is the front of the driver's wheel well
(3) The right field of view is the back of the driver's wheel well
(4) The top field of view is the longitudinal centerline of the vehicle
(5) The bottom field of view is the outer edge of the passenger's front tire

Picture 4.25: Pre-Test Left Side Rocker Oblique View

30) Start ..

(1) The camera is placed under the right front bumper corner
(2) The right field of view is the front of the driver's front tire
(3) The bottom field of view is the bottom of the driver's front tire
(4) The left field of view is ¾ the distance between the A-pillar and C-pillar

Picture 4.26: Pre-Test Left Bumper to Rail Attachment View Try capturing the Attachment of the left Bumper to Rail Attachment from the bottom of the vehicle	
Picture 4.27: Pre-Test left Bumper to Rail Attachment Top View Try capturing the Attachment of the left Bumper to Rail Attachment from the top of the vehicle	

CHECKLIST 4.19 - TEST VEHICLE BUMPER TAPE

Reference Figure 4.3 as the following steps are completed.

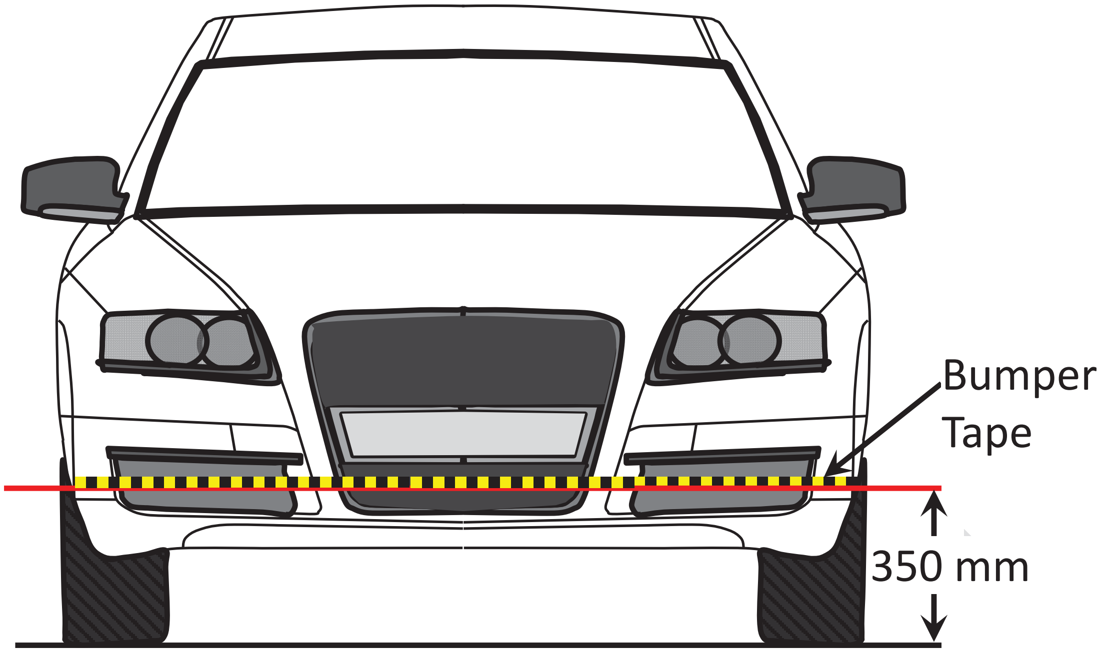


Figure 4.3: Placement of bumper tape

___**4.19.1** With the vehicle in the "As Delivered" Unloaded Vehicle Weight condition, place it on a flat, level surface.

___**4.19.2** Create a horizontal level line along the front of the vehicle 350 mm above the ground.

___**4.19.3** Apply 25 mm wide checkerboard tape from the left side of the vehicle to the right side of the vehicle with the bottom edge of the tape aligned with the laser line (Bumper Tape). Apply the 25 mm wide tape to the contours of the vehicle

CHECKLIST 4.20 – TEST VEHICLE LEVEL CONDITION (TVLC)

Reference Figure 4.4 as the following steps are completed.

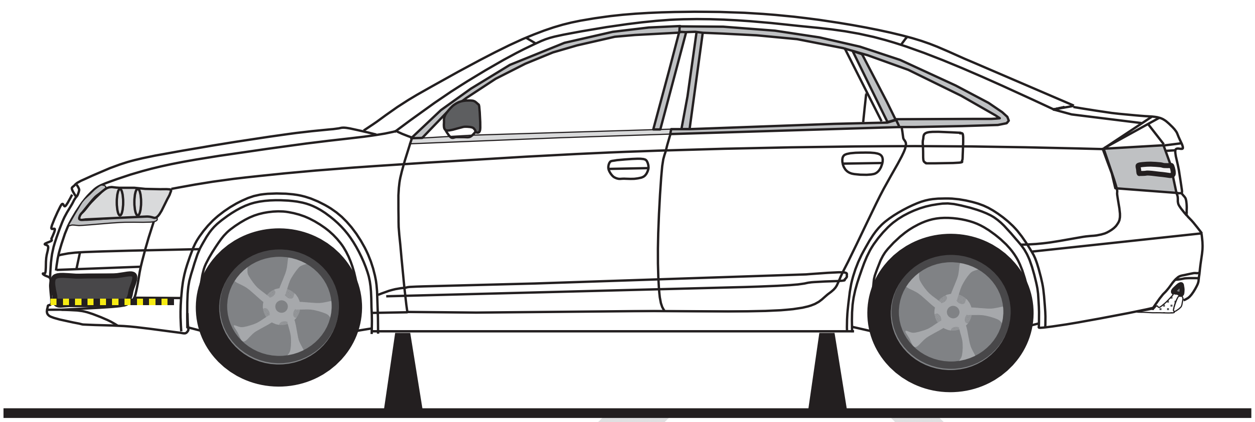


Figure 4.4: Vehicle in TVLC

___**4.20.1** With the vehicle in the As Delivered/UVW condition, place it on a flat, level surface.

___**4.20.2** Place a vehicle jack at each of the manufacturer's recommended positions.

___**4.20.3** Raise each jack until the top of the each jack touches the bottom sill.

___**4.20.4** Measure and record the vertical distance from the flat surface to the bottom sill at each jack

___**4.20.5** Raise each jack up by 50 mm

___**4.20.6** Repeat step ___4.20.5 until the load on the suspension is removed.

___**4.20.7** Check to make sure the bottom of the left sill is parallel to the ground.

___**4.20.8** Check to make sure the bottom of the right sill is parallel to the ground.

___**4.20.9** Check to make sure the bottom of the left sill relative to the right sill is parallel to the ground. All four jack points should have the same relative distance from the ground.

___**4.20.10** If any condition in steps ___4.20.7, ___4.20.8, and ___4.20.9 are not met raise or lower three jacks until conditions in steps ___4.20.7, ___4.20.8, and ___4.20.9 are meet. Do not lower or raise the left rear jack during this step.

___**4.20.11** Measure and record the final vertical distance from the flat surface to the bottom sill at each jack in Table 4.17.

TABLE 4.17: JACK HEIGHTS		
	FRONT	**REAR**
Driver's Side	mm	mm
Passenger Side	mm	mm

CHECKLIST 4.21 – CHECKERBOARD AND TARGETS ALONG THE CENTERLINE OF TEST VEHICLE

Reference Figure 4.5 as the following steps are completed

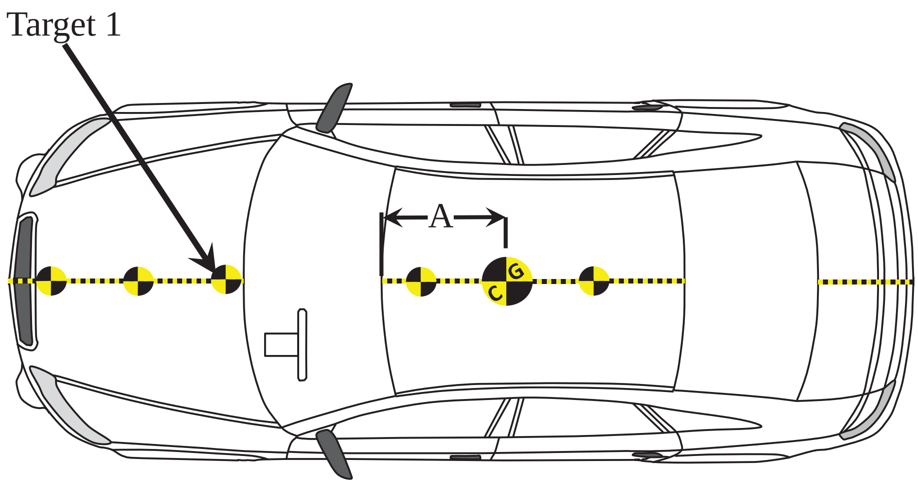


Figure 4.5

___**4.21.1** Make sure the vehicle is in TVLC.
___**4.21.2** Using CMM machine determine the longitudinal centerline of the vehicle
___**4.21.3** Apply 25 mm wide checkerboard tape centered along the longitudinal centerline of the vehicle, including the top of the hood, roof, and deck lid. The tape should not be placed on the front or rear windshield.
___**4.21.4** Apply 152 mm non-glare target (Target 1) on the hood, such that it is centered on the longitudinal centerline of the vehicle and the rear edge of the target is aligned with rear edge of the hood (nearest to windshield).
___**4.21.5** Apply additional 152 mm non-glare targets at 450 mm intervals from this target towards the front bumper until the front of the hood is reached. No targets shall be applied less than 450 mm apart.
___**4.21.6** Apply a 250 mm non-glare target on the roof (CG target), such that the center of target is located along the longitudinal centerline of the vehicle and located at the longitudinal XCG calculated in CHECKLIST D.15 "Fully Loaded" – Test Vehicle Attitude. Write CG on this target.
___**4.21.7** Measure the distance from the center of the CG target and the intersection of the roof and front windshield (A)
___**4.21.8** If A<526 mm then go to ___4.21.11
___**4.21.9** Apply a 152 mm non-glare target 450 mm from the center of the CG target target toward the front of the vehicle.
___**4.21.10** Apply additional 152 mm non-glare targets at 450 mm intervals from the center of the CG target until the back of the roof is reached (towards back windshield). No targets shall be applied less than 450 mm apart
___**4.21.11** Apply 152 mm non-glare targets at 450 mm intervals from the CG target until the back of the roof is reached (towards back windshield). No targets shall be applied less than 450 mm apart.

CHECKLIST 4.22 – VEHICLE COORDINATE SYSTEM

Reference Figure 4.6 as the following steps are completed.

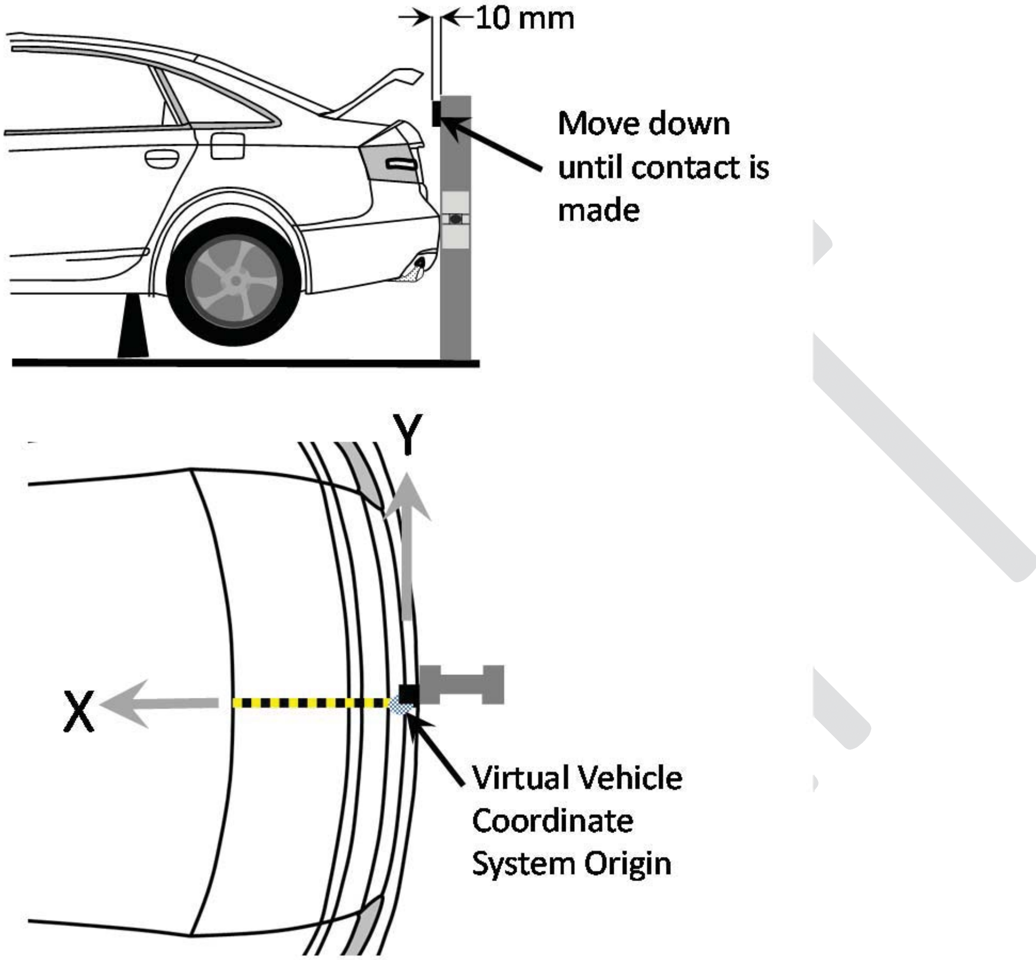


Figure 4.6: Determination of vehicle coordinate system

___**4.22.1** Make sure the vehicle is at TVLC.

___**4.22.2** Open the trunk or hatchback. For a pickup truck, leave the rear gate shut.

___**4.22.3** Position a level behind the vehicle so it is perpendicular to the floor and the left edge of the level is aligned with the longitudinal centerline of the test vehicle

___**4.22.4** Move the level longitudinally toward the rear of the vehicle until it makes contact with the vehicle. Ensure that the level is vertical

___**4.22.5** Slide a 10 mm deep block downward along the front edge of the level until it contacts the vehicle at the vehicle centerline and mark this point. This is the origin of the "Vehicle Coordinate System" (VCS). Note: This point does not have to be on a solid surface.

___**4.22.6** Create a VCS using a coordinate measuring machine (CMM) where the following conditions are met:

2) Start …

(a) Positive X - From the back of the vehicle to the front of the vehicle.

(b) Positive Y - From the driver side of the vehicle to the passenger side of the vehicle.
(c) Positive Z - From the top of the vehicle to the bottom of the vehicle.
(d) The XY plane is parallel to the ground and passes through the origin of the VCS.
(e) The XZ plane is vertical and passes through the longitudinal centerline of the vehicle and the origin of the VCS.

___**4.22.7** Using the CMM, verify that the centers of the top bolt of the left and right strikers are symmetric and the car is level. Record the X, Y, and Z values of each striker with respect to the origin of the VCS in Table 4.18.

TABLE 4.18			
POSITION	**X1**	**Y1**	**Z1**
Center Left Upper Striker Upper Bolt			
Center Right Upper Striker Upper Bolt			

___**4.22.8** Remove the jacks from behind the front tires and the right rear tire

___**4.22.9** Using the CMM, verify that the VCS is created correctly. Record the X, Y, and Z values of the center of each striker bolt.

___**4.22.10** If any of the following conditions are not meet repeat steps 1 through 10:

3) Start …

(a) ABS(X1-X2) <= 1 mm
(b) ABS(Y1-Y2) <= 1 mm
(c) ABS(Z1-Z2) <= 1mm

___**4.22.11** Replace Jacks to the spacing recorded above

___**4.22.12** Create a set of widely distributed reference points on a part of the vehicle that will not deform. These reference points shall be used to reestablish the VCS so the intrusion points can be measured following the test.

CHECKLIST 4.23 – VCS REFERENCE POINTS

These points are created to level the vehicle post-test. Do not use actual targets. These targets are for graphical purposes only.

Reference Figure 4.7 as the following steps are completed

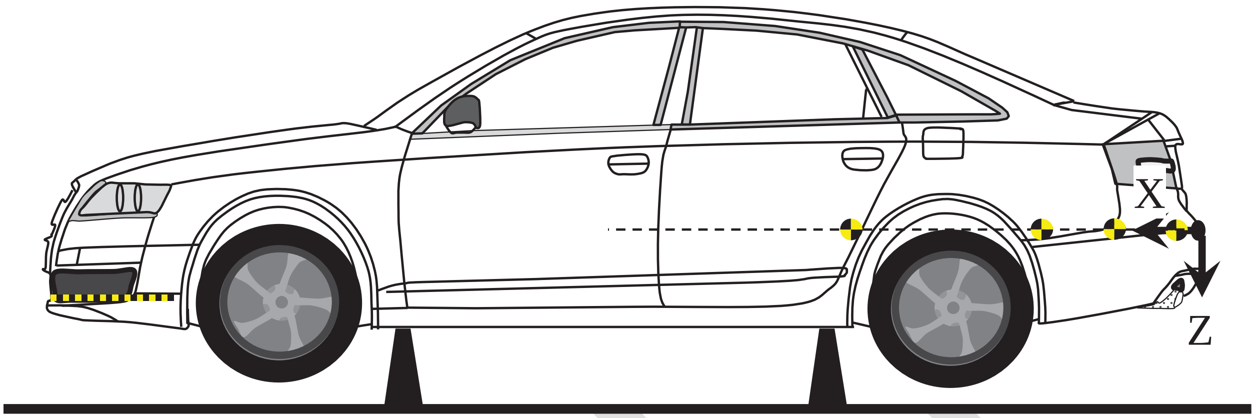


Figure 4.7: VCS Reference Points

___**4.23.1** Ensure the vehicle is in TVLC

___**4.23.2** On the driver side of the vehicle create a point (D1) on the sheet metal of the rear fender such that the Z distance equals zero relative to the VCS

___**4.23.3** Create 3 more points (D2, D3, D4) along the side of the vehicle such that the Z distance equals zero relative to the VCS

___**4.23.4** Follow the same procedure on the passenger side to create P1, P2, P3, and P4

___**4.23.5** Record the distance of each point relative to the VCS in Table 4.19

TABLE 4.19			
	X	**Y**	**Z**
D1			0.0
D2			0.0
D3			0.0
D4			0.0
P1			0.0
P2			0.0
P3			0.0
P4			0.0

CHECKLIST 4.24 - OFFSET CHECKERBOARD TAPE

Reference Figure 4.8 as the following steps are completed.

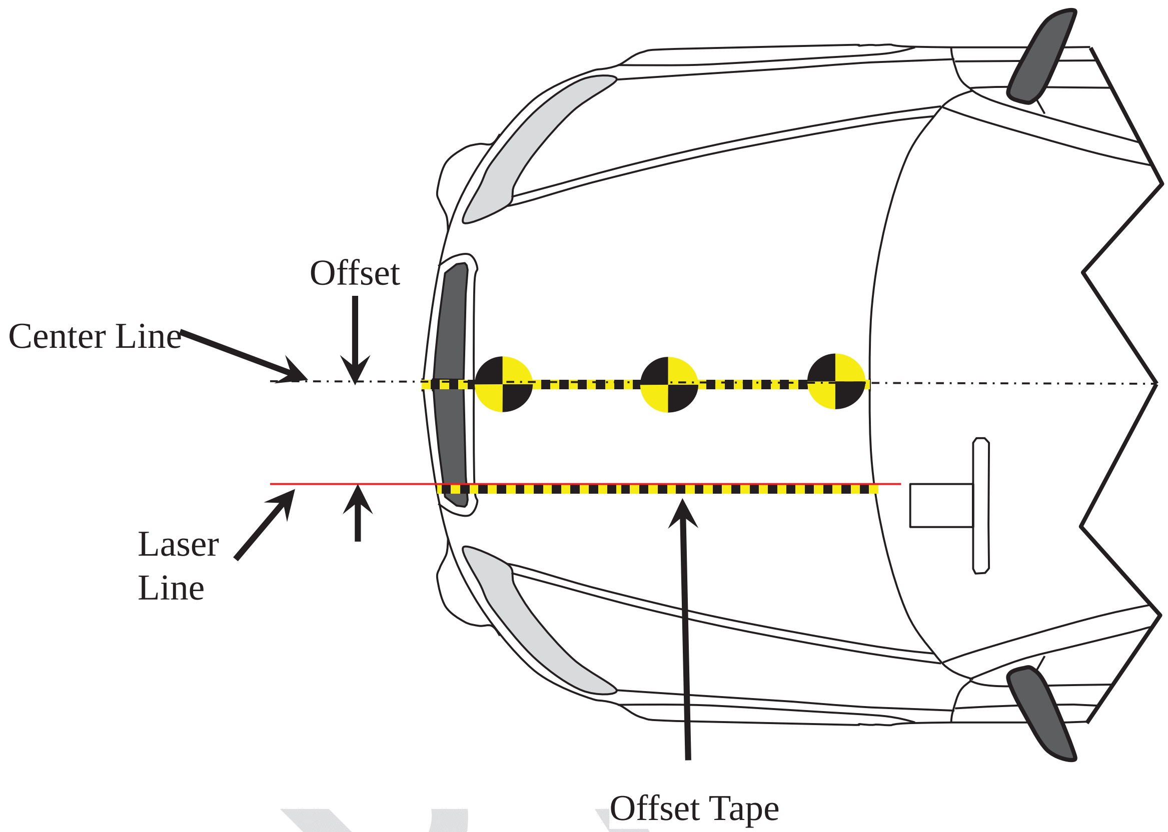


Figure 4.8: Offset checkerboard tape

___**4.24.1** Make sure the vehicle is in the TVLC condition.

___**4.24.2** Calculate the offset (distance from centerline of vehicle) using the below equation where the Vehicle width (Vw) is defined as the maximum dimension measured across the widest part of the vehicle, including bumpers and molding but excluding such components as exterior mirrors, flexible mud flaps, marker lamps, and dual rear wheel configurations

Offset from Centerline = 0.15Vw = 0.15 X ________mm = ________mm

Vw Location of Impact

___**4.24.3** Using the CMM machine, mark two separate points (one on the vehicle's hood and one on the front bumper) that are the same lateral distance away from the vehicle centerline as the offset calculated above.

___**4.24.4** Using a vertical laser line generator, create a line that passes through these two points. This line shall be referred to as the "Offset Line"

___**4.24.5** Apply 25 mm checkerboard tape with the right side (inboard edge) along this laser line. The 25 mm tape shall extend from the bottom of the bumper to the middle of the hood. This shall be referred to as the “Offset Checkerboard Tape”.
___**4.24.6** Check the offset tape line at several points using a CMM
___**4.24.7** Mark on the hood along the edge of the tape to indicate which edge of the tape defines the calculated offset (the inboard edge).

CHECKLIST 4.25 – ALIGNMENT POINTS

Refer to Figure 4.9 as the following steps are completed.

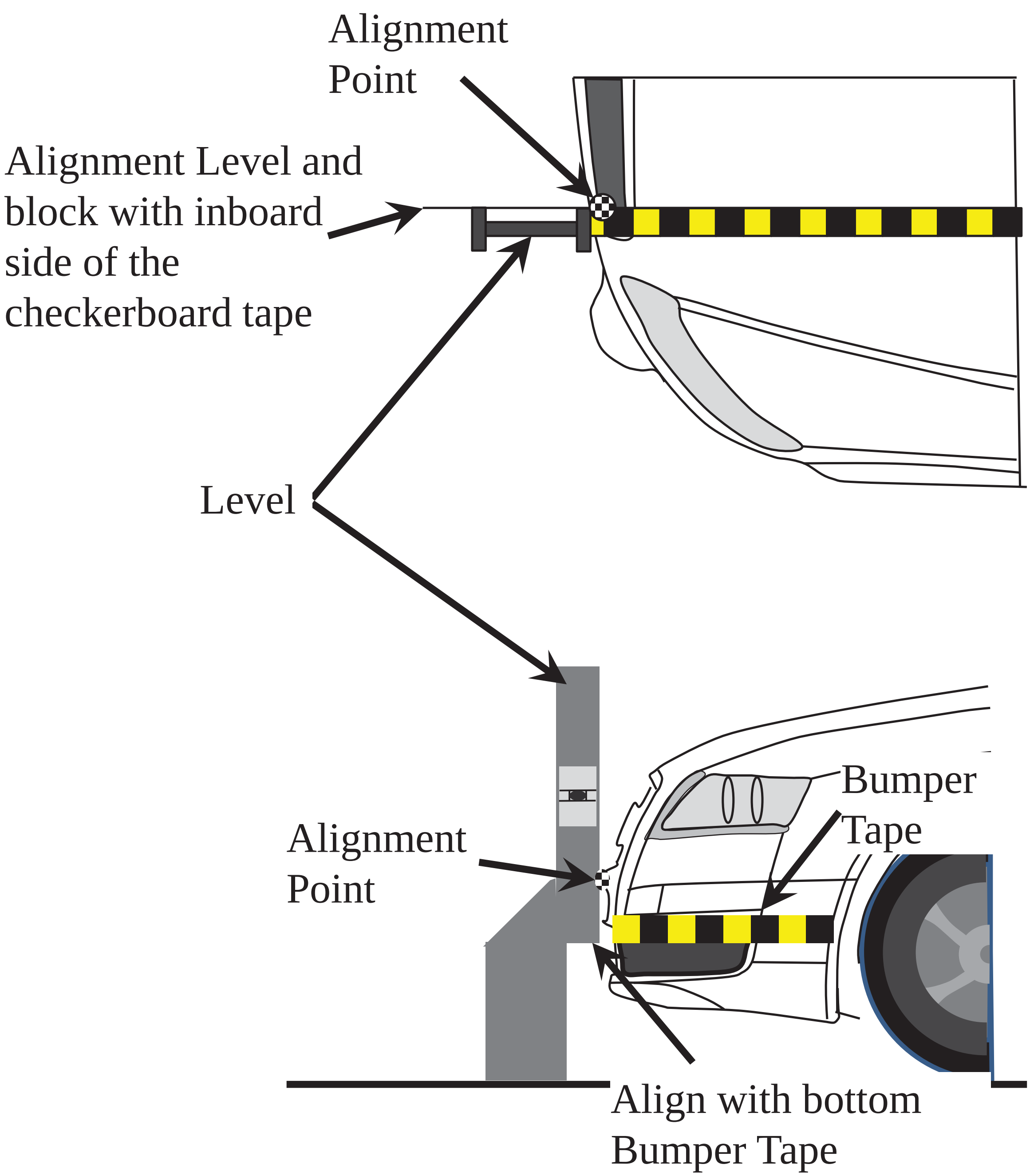


Figure 4.9: Determining Alignment Point

___**4.25.1** Make sure the vehicle is in the TVLC condition.

___**4.25.2** Position a level in front of the vehicle so it is perpendicular to the floor and the inboard edge of the level is aligned with the inboard edge of the offset checkerboard tape

___**4.25.3** Align the bottom of a level with the bottom of the bumper tape.

___**4.25.4** Move the level longitudinally towards the front of the vehicle until it makes contact with the vehicle. Ensure that the level is vertical. Note: if level contacts the vehicle in multiple point use the lowest contact

___**4.25.5** Mark the vehicle at this point.

CHECKLIST 4.26 – ALIGNMENT BOX

Refer to Figure 4.10 as the following steps are completed.

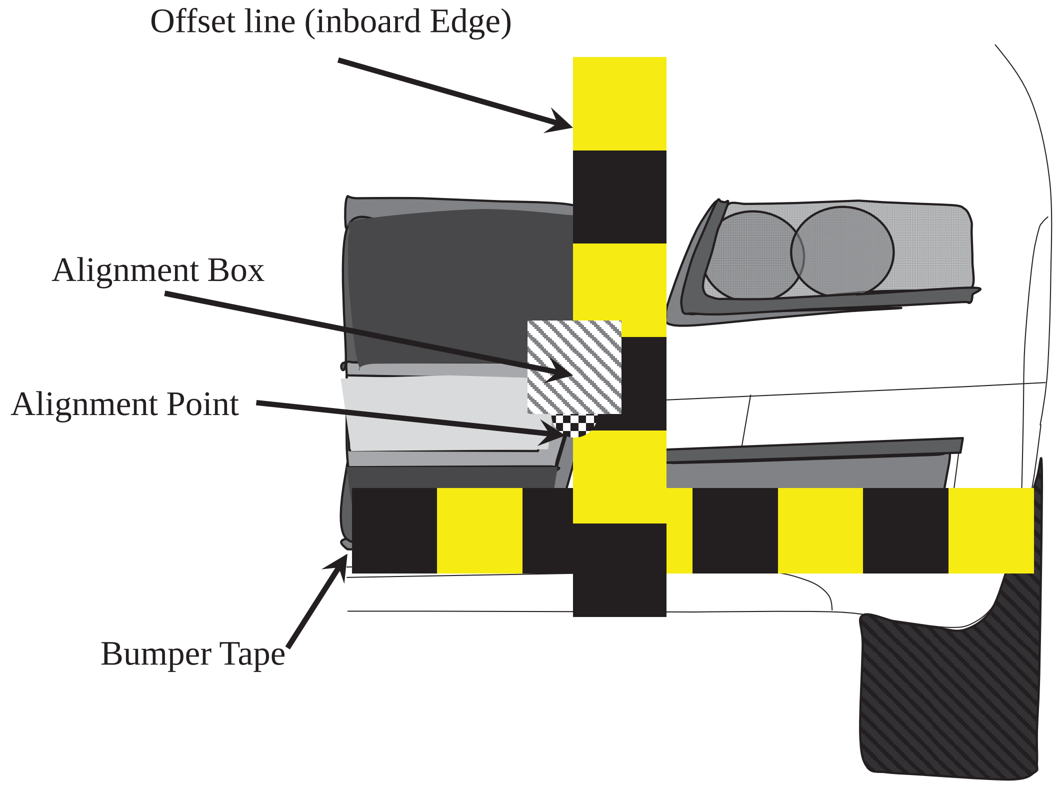


Figure 4.10: Determining the alignment box

___**4.26.1** Make sure the vehicle is in the TVLC condition.
___**4.26.2** Create a piece of tape (Alignment Box) of contrasting color that is 25 mm by 25 mm.
___**4.26.3** Laterally Center the Alignment box with the left side of the Offset Tape
___**4.26.4** Align the bottom of the Alignment Box with the vertical centerline of Alignment point.

CHECKLIST 4.27 - TEST VEHICLE SIDE TARGETING

Reference Figure 4.11 as the following steps are completed.

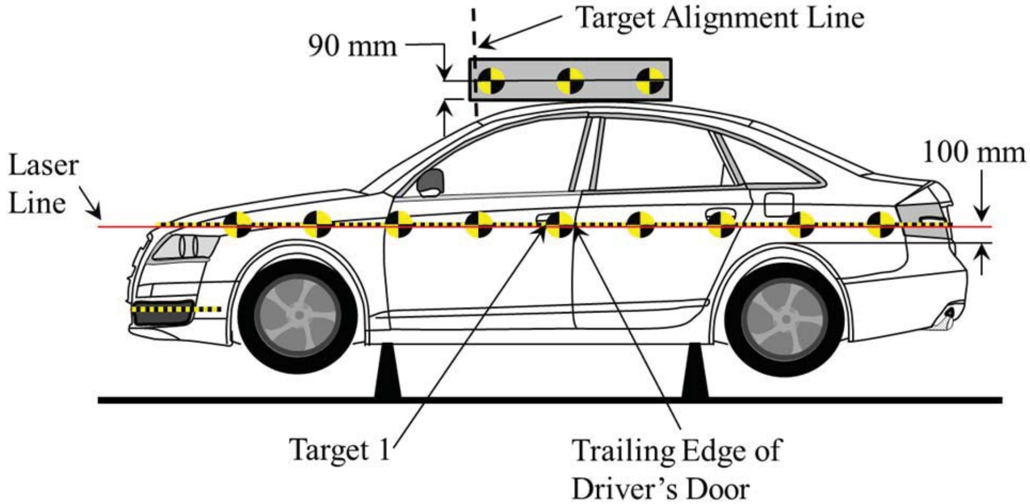


Figure 4.11: Driver side targeting of test vehicle

___**4.27.1** Make sure the vehicle is in the TVLC condition

___**4.27.2** Apply 25 mm wide checkerboard tape horizontally down both sides of the vehicle with the bottom edge of the tape 100 mm above rear wheel well opening with the bottom edge of the tape aligned with the laser line.

___**4.27.3** On the driver's side of the vehicle, apply a 152 mm non-glare target such that the edge of the target is aligned with the trailing edge of the driver's front door. The center of this target shall also be aligned with the center of the 25 mm checkerboard tape.

___**4.27.4** Apply 152 mm non-glare targets at 450 mm intervals (center to center) from this target towards both the front and rear of the vehicle. No targets shall be applied less than 450 mm apart.

___**4.27.5** Repeat steps 1 through 4 on the ride side of the vehicle..

___**4.27.6** Create two target bars, with three 152 mm non-glare targets 450 mm apart (center to center) and the centerline of the targets shall be 90 mm above the bottom edge of the target bar.

___**4.27.7** Rigidly mount the first target bar on the vehicle roof over the center of the driver's seating position. The long edge (bottom edge) shall be horizontal and the targets shall fall in a vertical plane that is parallel to the vehicle's longitudinal centerline. The left edge of the front target shall start at the intersection of the windshield and the roof as viewed from the left of the vehicle

___**4.27.8** Rigidly mount the second lateral target bar on the vehicle roof over the center of the front passenger's seating position. The long edge (bottom edge) shall be horizontal and the targets shall fall in a vertical plane that is parallel to the vehicle's longitudinal centerline. The right edge of the front target shall start at the intersection of the windshield and the roof as viewed from the right of the vehicle

CHECKLIST 4.28 - TEST VEHICLE INTERIOR PRE-TEST PICTURES

___**4.28.1** Make sure the vehicle is in the TVLC condition
___**4.28.2** Place the driver and passenger seats in its full back position
___**4.28.3** Remove any floor mats
___**4.28.4** Take the following pictures that meet the field of view specified in Table 4.20:

TABLE 4.20	
Picture 4.28: Pre-test View of Driver Floor Pan from Outside the vehicle 31) Start (1) The height of the camera is at the height of the center of the front of the front seat (2) The longitudinal placement of the camera is at the front of the driver seat (3) The angle of the camera should be approximately 45 degrees from the longitudinal centerline of the vehicle (4) The left field of view is the bottom of the A-pillar (5) The right field of view is the front of the seat (6) The bottom field of view is half way down the bottom sill (7) The top field of view is the bottom of the instrument panel	
Picture 4.29: Pre-test View of Driver Floor Pan from top of Front Seat 32) Start (1) The camera is placed on the front of the seat at the centerline of the seat (2) The top field of view is the bottom of the instrument panel (3) The bottom field of view is half way between the gas pedal and the front of the front seat (4) The left field of view is the bottom of the A-pillar (5) The right field of view is the edge of the tunnel	
Picture 4.30: Pre-test View of Driver Floor Pan from Center of Vehicle 33) Start .. (1) The height of the camera is at the height	

of the front seat (2) The longitudinal placement of the camera is at the front of the driver seat (3) The lateral placement of the camera is at the longitudinal centerline of the vehicle (4) The left field of view is the bottom of the A-pillar (5) The right field of view is the right side of the gas pedal (6) The bottom field of view is half way down the bottom sill (7) The top field of view is the bottom of the instrument panel (8) The bottom field of view is half way between the gas pedal and the front of the front seat	
Picture 4.31: Pre-test Left Side View of Driver Knee Bolster 34) Start (1) The height of the camera is at the height of the front of the bottom of the steering rim (2) The angle of the camera should be approximately 30 degrees from the longitudinal centerline of the vehicle (3) The left field of view is the bottom of the A-pillar (4) The right field of view is the instrument panel at the longitudinal centerline of the vehicle (5) The bottom field of view is just below the bottom of the IP (6) The top field of view is the top of the instrument panel	

Picture 4.32: Pre-test Center View of Driver Knee Bolsters

35) Start
(1) The height of the camera is at the top of the seat at the centerline of seat
(2) The left field of view is the left edge of the instrument panel
(3) The right field of view is the instrument panel at the longitudinal centerline of the vehicle
(4) The top field of view is the bottom of the steering wheel
(5) The bottom field of view is just below the bottom of the gas pedal

Picture 4.33: Pre-test Left Side View of Driver Knee Bolster

36) Start
(1) The height of the camera is at the height of the front of the bottom of the steering rim
(2) The angle of the camera should be approximately 30 degrees from the longitudinal centerline of the vehicle
(3) The left field of view is the left edge of the instrument panel
(4) The right field of view is instrument panel at the longitudinal centerline of the vehicle
(5) The bottom field of view is just below the bottom of the IP
(6) The top field of view is the top of the IP

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Picture 4.34: Pre-test Driver Inner Door Panel

37) Start
(1) The height of the camera is at the height of the arm rest
(2) The camera is perpendicular to the door
(3) The left field of view is the rearward edge of door
(4) The right field of view is the forward edge of door
(5) The top field of view is the height of the window sill
(6) The bottom field of view is just below the bottom of the door

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Picture 4.35: Pre-test View of Passenger Floor Pan from Outside the vehicle

38) Start
(1) The height of the camera is at the height of the center of the front of the front seat
(2) The longitudinal placement of the camera is at the front of the driver seat
(3) The angle of the camera should be approximately 45 degrees from the longitudinal centerline of the vehicle
(4) The right field of view is the bottom of the A-pillar
(5) The left field of view is the front of the seat
(6) The bottom field of view is half way down the bottom sill
(7) The top field of view is the bottom of the instrument panel

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<tr>
<td>Picture 4.36: Pre-test View of Passenger Floor Pan from top of Front Seat

39) Start
(1) The camera is placed on the front of the seat at the centerline of the seat
(2) The top field of view is the bottom of the instrument panel
(3) The bottom field of view is half way between the front seat and the IP
(4) The right field of view is the bottom of the A-pillar
(5) The left field of view is the edge of the tunnel</td>
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<td>Picture 4.37: Pre-test View of Passenger Floor Pan from Center of Vehicle

40) Start
(1) The height of the camera is at the height of the front seat cushion
(2) The longitudinal placement of the camera is at the front of the driver seat
(3) The lateral placement of the camera is at the longitudinal centerline of the vehicle
(4) The left field of view is the edge of the tunnel
(5) The right field of view is the bottom of the A-pillar
(6) The top field of view is the bottom of the instrument panel
(7) The bottom field of view is half way between the gas pedal and the front of the front seat</td>
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Picture 4.38: Pre-test Left Side View of Passenger Knee Bolster

41) Start
(1) The height of the camera is at the height of the front of the bottom of the steering rim
(2) The angle of the camera should be approximately 30 degrees from the longitudinal centerline of the vehicle
(3) The right field of view is the bottom of the A-pillar
(4) The left field of view is the instrument panel at the longitudinal centerline of the vehicle
(5) The bottom field of view is just below the bottom of the glove compartment
(6) The top field of view is the top of the dash panel

Picture 4.39: Pre-test Center View of Passenger Knee Bolsters

42) Start
(1) The camera is placed on top of the seat cushion at the centerline of the seat The right field of view is the right side of the dash panel
(2) The left field of view is the centerline of the longitudinal centerline of the vehicle
(3) The top field of view is the top of the dash panel
(4) The bottom field of view is just below the bottom of the glove compartment

<table>
<tr>
<td>Picture 4.40: Pre-test Right Side View of Passenger Knee Bolster

43) Start
(1) The height of the camera is at the height of the front of the bottom of the steering rim
(2) The angle of the camera should be approximately 30 degrees from the longitudinal centerline of the vehicle
(3) The right field of view is the bottom of the A-pillar
(4) The left field of view is the instrument panel at the longitudinal centerline of the vehicle
(5) The bottom field of view is just below the bottom of the glove compartment
(6) The top field of view is the top of the dash panel</td>
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<tr>
<td>Picture 4.41: Pre-test Passenger Inner Door Panel

44) Start
(1) The height of the camera is at the height of the arm rest
(2) The camera is perpendicular to the door
(3) The left field of view is the forward edge of door
(4) The right field of view is the rearward edge of door
(5) The top field of view is the height of the window sill
(6) The bottom field of view is just below the bottom of the door</td>
<td></td>
</tr>
</table>

CHECKLIST 4.29 - CREATE DRIVER REFERENCE COORDINATE SYSTEM

Reference

Figure 4.12 as the following steps are completed.

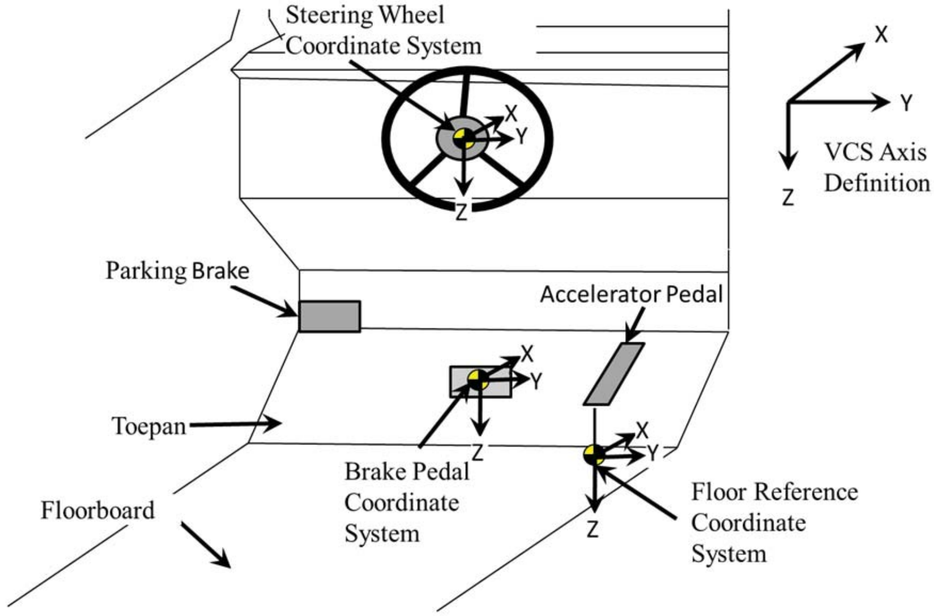


Figure 4.12: Driver interior reference coordinate system

___**4.29.1** Make sure the vehicle is in the TVLC condition.

___**4.29.2** Create the Steering Coordinate System:

___**4.29.2.1** The origin of the Steering Wheel Coordinate System is the point located on the outer surface of the steering wheel hub (air bag cover) at the geometric center of the steering wheel

___**4.29.2.2** Measure and record the x, y, z position of the origin of the Steering Wheel Coordinate System with respect to the VCS.

___**4.29.2.3** The x, y, and z axis of the Steering Wheel Coordinate System Coordinate System are parallel to the x, y, and z axis of the VCS.

___**4.29.3** Create the Floor Reference Coordinate System:

___**4.29.3.1** The origin of Floor Reference Coordinate System can be determined using the following procedure:

___**4.29.3.2** If the vehicle has an accelerator pedal with fore-aft adjustment, adjust the pedal to its forward most position.

___**4.29.3.3** Remove floor mats

___**4.29.3.4** Locate the centerline of the top surface at the bottom of the accelerator pedal (CLAP)

___**4.29.3.5** Project a vertical line down from the CLAP point until contact is made to the floor. This point is the origin of the Floor Reference Coordinate System.

___**4.29.3.6** The x, y, and z axis of the Floor Reference Coordinate System are parallel to the x, y, and z axis of the VCS.

___**4.29.3.7** Measure and record the x, y, z position of the origin of the Floor Reference Coordinate System with respect to the VCS.

___**4.29.4** Create the Brake Pedal Coordinate System:

___**4.29.4.1** The origin of the Brake Pedal Coordinate System is the point located at the geometric center of the brake pedal.

___**4.29.4.2** The x, y, and z axis of the Brake Pedal Coordinate System are parallel to the x, y, and z axis of the VCS.

___**4.29.4.3** Measure and record the x, y, z position of the origin of the Floor Reference Coordinate System with respect to the VCS.

TABLE 4.21: INTERIOR REFERENCE COORDINATE SYSTEM MEASUREMENT			
COORDINATE SYSTEM ORIGIN	**PRE-TEST (MM)***		
	X	**Y**	**Z**
Steering Wheel			
Floor Reference			
Brake Pedal			

CHECKLIST 4.30 - DRIVER INTERIOR UPPER POINTS

Reference Figure 4.13 as the following steps are completed.

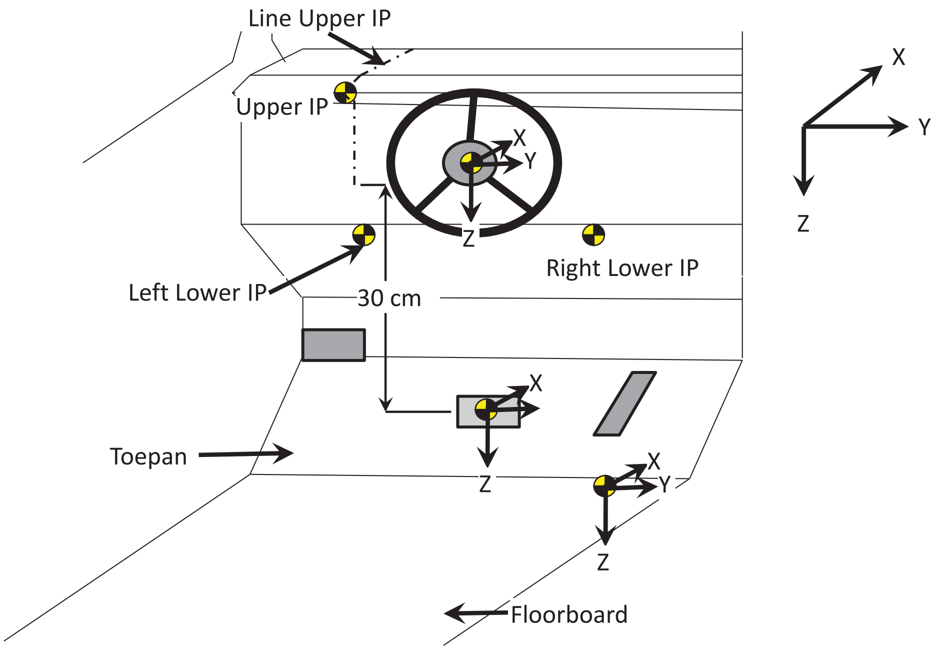


Figure 4.13: Driver Upper Interior Points

___**4.30.1** Make sure the vehicle is in the TVLC condition.

___**4.30.2** Create and measure the Driver Left Lower IP Point.

- ___**4.30.2.1** The lateral coordinate of Left Lower IP Point (knee bolster) is defined by subtracting 15 cm to the Steering Wheel Coordinate System in the lateral direction.
- ___**4.30.2.2** The vertical coordinate is defined by subtracting 45 cm in the vertical direction from the floor reference coordinate system.
- ___**4.30.2.3** The longitudinal coordinate of the Left Lower IP Point is created by holding the lateral and vertical position constant and moving in the longitudinal direction until the Left IP is contacted.

___**4.30.3** Create and measure the Driver Right Lower IP Point.

- ___**4.30.3.1** The lateral coordinate of Right Lower IP Point (knee bolster) is defined by adding 15 cm from the Steering Wheel Coordinate System lateral direction.
- ___**4.30.3.2** The vertical coordinate is defined by subtracting 45 cm in the vertical direction from the floor reference coordinate system.
- ___**4.30.3.3** The longitudinal coordinate of the Left Lower IP Point is created by holding the lateral and vertical position constant and moving in the longitudinal direction until the Right IP is contacted.

___**4.30.4** Create and measure the Driver Upper IP Point:

___**4.30.4.1** Create a XZ plane the passes through the Left Lower IP point

___**4.30.4.2** Create a line at the intersection of the XZ plane and the IP (Line Upper IP) That start of the line is created by subtracting 30 cm from the Brake Pedal Coordinate System in the vertical direction. The end of the line is at the intersection of the IP and the windshield.

___**4.30.4.3** The Driver Upper IP Point is located on the rearward most (toward the rear of the vehicle) point on this line.

NOTE: There may be instances when the upper dash point is located on a "soft component" such as an air vent or control knob (Figure 4.14). To measure a more robust structure, the upper dash point is replaced with two additional points, and the weighted average of their coordinates is used to represent the deformation of a point at the original location (Equation 1). Each new point is determined by moving inboard/outboard to a location that is just off of the soft component.

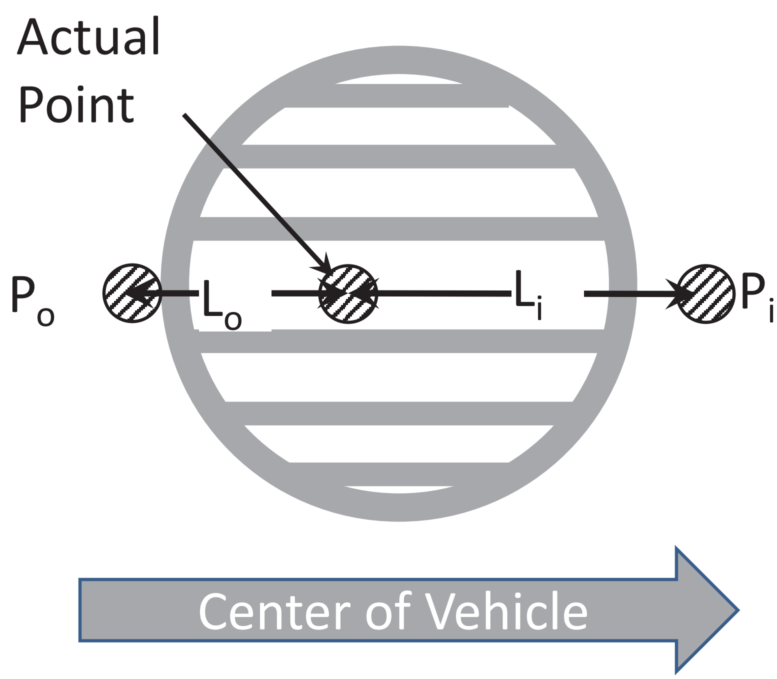


Figure 4.14: Deformation calculation of Upper IP Point if falls on a soft part of the IP

$$dp = \frac{L_i}{L_o+L_i}[X_0, Y_0, Z_0] + \frac{L_0}{L_o+L_i}[X_1, Y_1, Z_1] \qquad (1)$$

TABLE 4.22: DRIVER UPPER INTERIOR POINTS RELATIVE TO VCS			
INTRUSION LOCATION	**PRE-TEST (MM)***		
	X	**Y**	**Z**
Driver IP Left			

TABLE 4.22: DRIVER UPPER INTERIOR POINTS RELATIVE TO VCS			
INTRUSION LOCATION	PRE-TEST (MM)*		
	X	Y	Z
Driver IP Right			
Driver Upper Dash			

CHECKLIST 4.31 - DRIVER LOWER INTRUSION POINTS

Reference Figure 4.15 as the following steps are completed.

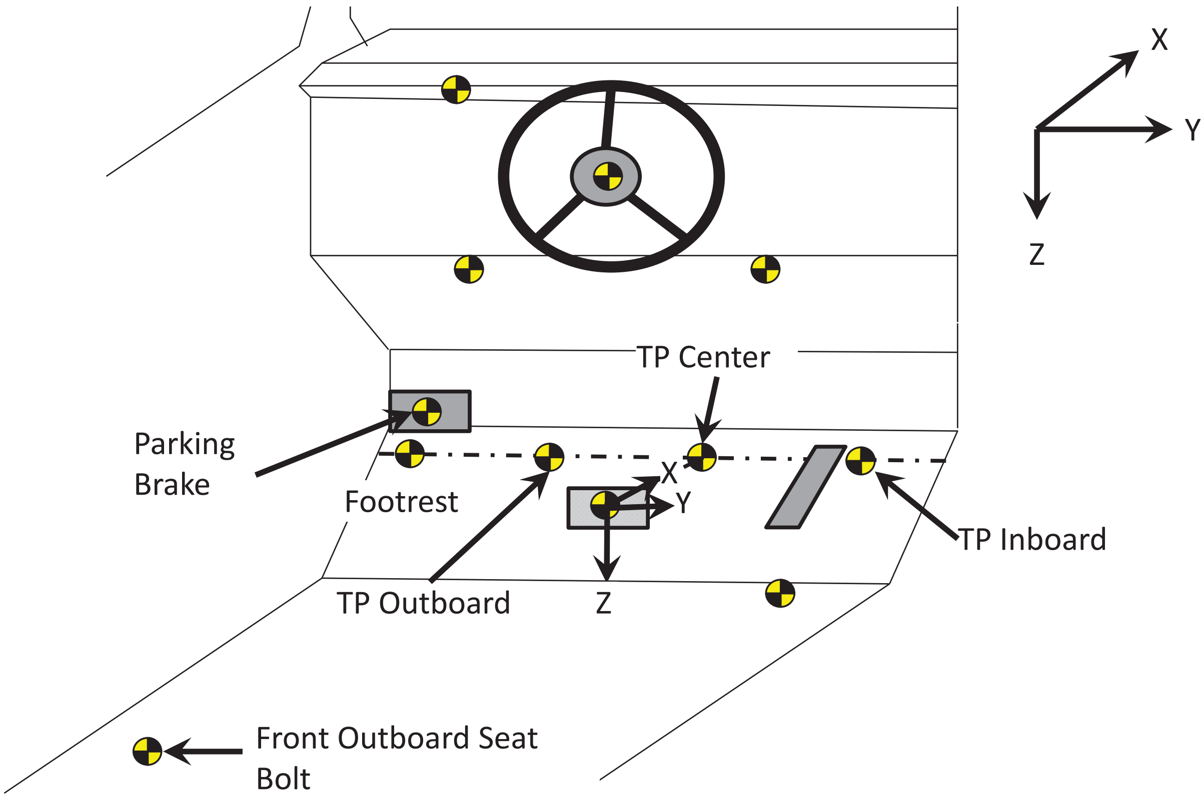


Figure 4.15: Driver Lower Interior Points

___**4.31.1** Make sure the vehicle is in the TVLC condition.

___**4.31.2** Measure the center of Driver Front Outboard Seat Bolt: If no bolt is present, create and measure a point at the center of the front of the outboard seat track.

___**4.31.3** Create and measure the Parking Brake Pedal Point: This point is the geometric center of the parking brake pedal (top surface) when not engaged.

___**4.31.4** Create and measure Driver Footrest point:

___**4.31.4.1** The lateral coordinate of Driver Footrest is defined by subtracting 25 cm from the Brake Pedal Coordinate System lateral direction.

___**4.31.4.2** The vertical coordinate is defined by subtracting 0 cm in the vertical direction from the Brake Pedal Coordinate System.

___**4.31.4.3** The longitudinal coordinate of the Driver Footrest point is created by holding the lateral and vertical position constant and moving in the longitudinal direction until the toepan is contacted.

___**4.31.4.4** A utility knife is used to cut a small "v" in the carpet and underlying padding at this point on the toepan. The point of the "v" is peeled back, and the exposed floor is marked and measured. The carpet and padding are then refitted prior to the crash. This point shall be marked on the sheet metal of the toe pan or floorboard.

___**4.31.5** Create and measure Driver Toepan Outboard (TP Outboard) point:

___**4.31.5.1** The lateral coordinate of TP Outboard is defined by subtracting 15 cm from the Brake Pedal Coordinate System lateral direction.

___**4.31.5.2** The vertical coordinate of the TP Outboard is defined by subtracting 0 cm in the vertical direction from the Brake Pedal Coordinate System.

___**4.31.5.3** The longitudinal coordinate of the TP Outboard rest point is created by holding the lateral and vertical position constant and moving in the longitudinal direction until the toepan is contacted.

___**4.31.5.4** A utility knife is used to cut a small "v" in the carpet and underlying padding at this point on the toepan. The point of the "v" is peeled back, and the exposed floor is marked and measured. The carpet and padding are then refitted prior to the crash. This point shall be marked on the sheet metal of the toepan or floorboard.

___**4.31.6** Create and measure Driver Center Toepan Point (TP Center):

___**4.31.6.1** The lateral coordinate of the TP Center is defined by subtracting 0 cm from the Brake Pedal Coordinate System lateral direction.

___**4.31.6.2** The vertical coordinate of the TP Center is defined by subtracting 0 cm in the vertical direction from the Brake Pedal Coordinate System.

___**4.31.6.3** The longitudinal coordinate of the TP Center point is created by holding the lateral and vertical position constant and moving in the longitudinal direction until the toepan is contacted.

___**4.31.6.4** A utility knife is used to cut a small "v" in the carpet and underlying padding at this point on the toepan. The point of the "v" is peeled back, and the exposed floor is marked and measured. The carpet and padding are then refitted prior to the crash. This point shall be marked on the sheet metal of the toe pan or floorboard.

___**4.31.7** Create and measure Driver Toepan Inboard (TP Inboard) point:

___**4.31.7.1** The lateral coordinate of TP Inboard is defined by adding 15 cm from the Brake Pedal Coordinate System lateral direction.

___**4.31.7.2** The vertical coordinate of the TP Inboard is defined by subtracting 0 cm in the vertical direction from the Brake Pedal Coordinate System.

___**4.31.7.3** The longitudinal coordinate of the TP Inboard point is created by holding the lateral and vertical position constant and moving in the longitudinal direction until the toepan is contacted.

___**4.31.7.4** A utility knife is used to cut a small “v” in the carpet and underlying padding at this point on the toepan. The point of the “v” is peeled back, and the exposed floor is marked and measured. The carpet and padding are then refitted prior to the crash. This point shall be marked on the sheet metal of the toe pan or floorboard.

TABLE 4.23			
INTRUSION LOCATION	**PRE-TEST (MM)***		
	X	**Y**	**Z**
Parking Brake Pedal Point			
Driver Front Outboard Seat Bolt			
Driver Footrest			
Driver TP Outboard			
Driver TP Center			
Driver TP Inboard			

CHECKLIST 4.32 - CREATE RIGHT FRONT PASSENGER REFERENCE COORDINATE SYSTEM

Reference Figure 4.16 as the following steps are completed.

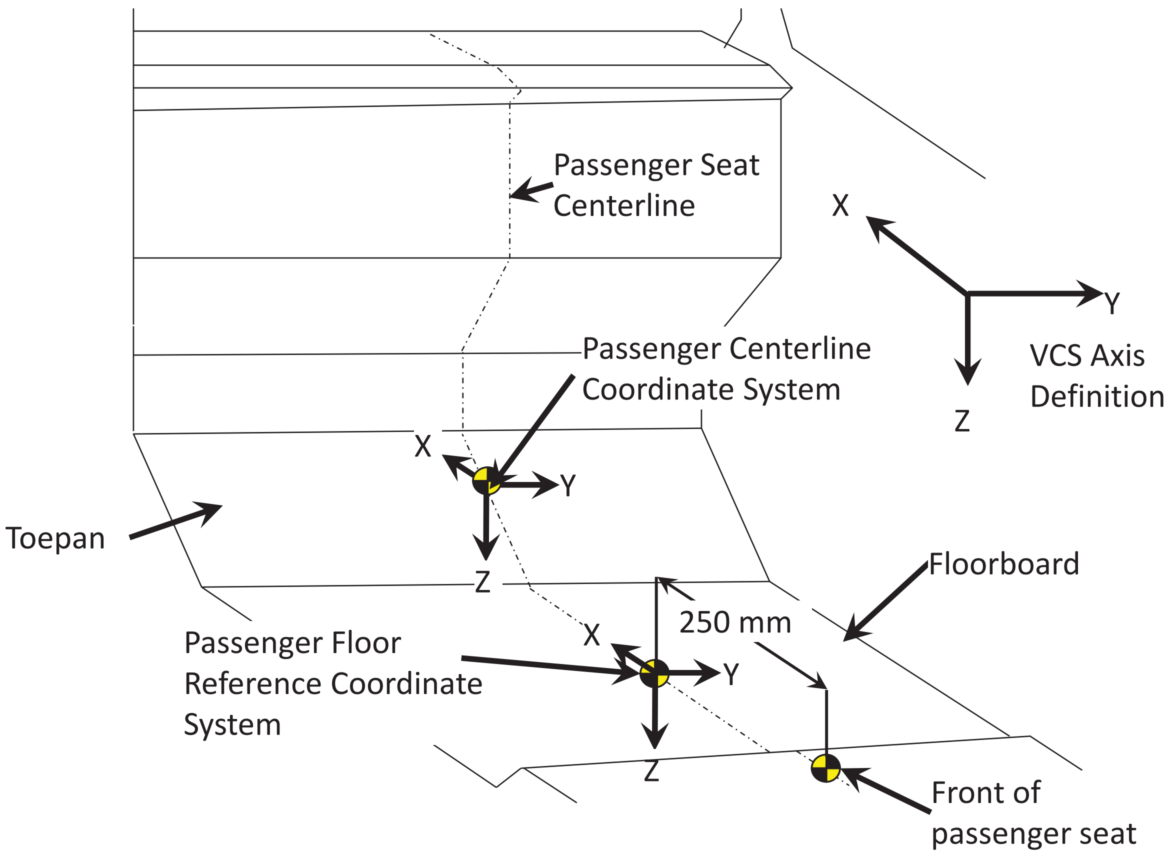


Figure 4.16: Passenger reference coordinate system

___**4.32.1** Make sure the vehicle is in the TVLC condition.
___**4.32.2** Create a XZ plane that passes through the longitudinal centerline of the passenger seat
___**4.32.3** Create a line that at the intersection of the XZ plane and the floorboard, toepan, and IP
___**4.32.4** Create the Passenger Centerline Coordinate System:

___**4.32.4.1** The lateral coordinate of the origin of the Passenger Centerline Coordinate System is located at the longitudinal centerline of the right front passenger seat.

___**4.32.4.2** The vertical coordinate of the origin of the Passenger Centerline Coordinate System is defined by subtracting 0 cm in the vertical direction from the Brake Pedal Coordinate System.

___**4.32.4.3** The longitudinal coordinate of the origin of the Passenger Centerline Coordinate System is created by holding the lateral and vertical position constant and moving in the longitudinal direction until the toepan is contacted.

___**4.32.4.4** A utility knife is used to cut a small "v" in the carpet and underlying padding at this point on the toepan. The point of the "v" is peeled back, and the exposed floor is marked and measured. The carpet and padding are then refitted prior to the crash. This origin point shall be marked on the sheet metal of the toe pan or floorboard.

___**4.32.4.5** The x, y, and z axis of the Passenger Centerline Coordinate System are parallel to the x, y, and z axis of the VCS.

___**4.32.4.6** Measure and record the x, y, z position of the origin of the Passenger Centerline Coordinate System.

___**4.32.5** Create the Passenger Floor Reference Coordinate System:

___**4.32.5.1** Make sure the right front passenger seat is in the testing position

___**4.32.5.2** At the longitudinal centerline of the seat project a vertical line down from the forward most point of the seat cushion

___**4.32.5.3** Remove floor mats, if present

___**4.32.5.4** Move toward the front of the vehicle 250 mm from the front of the passenger seat along the longitudinal axis

___**4.32.5.5** Project a line in the vertical direction toward the ground until the floorboard is reached. This point is the origin of the Passenger Floor Reference Coordinate System.

___**4.32.5.6** The x, y, and z axis of the Passenger Floor Coordinate System Coordinate System are parallel to the x, y, and z axis of the VCS.

___**4.32.5.7** Measure and record the x, y, z position of the origin of the Measure and record the x, y, z position of the origin of the Passenger Centerline Coordinate System.

TABLE 4.24: RIGHT FRONT PASSENGER INTERIOR REFERENCE COORDINATE SYSTEM MEASUREMENT			
COORDINATE SYSTEM ORIGIN	**PRE-TEST (MM)***		
	X	**Y**	**Z**
Passenger Seat Centerline			
Passenger Floor Reference			

CHECKLIST 4.33 - RIGHT FRONT PASSENGER INTERIOR UPPER POINTS

Reference Figure 4.17 as the following steps are completed.

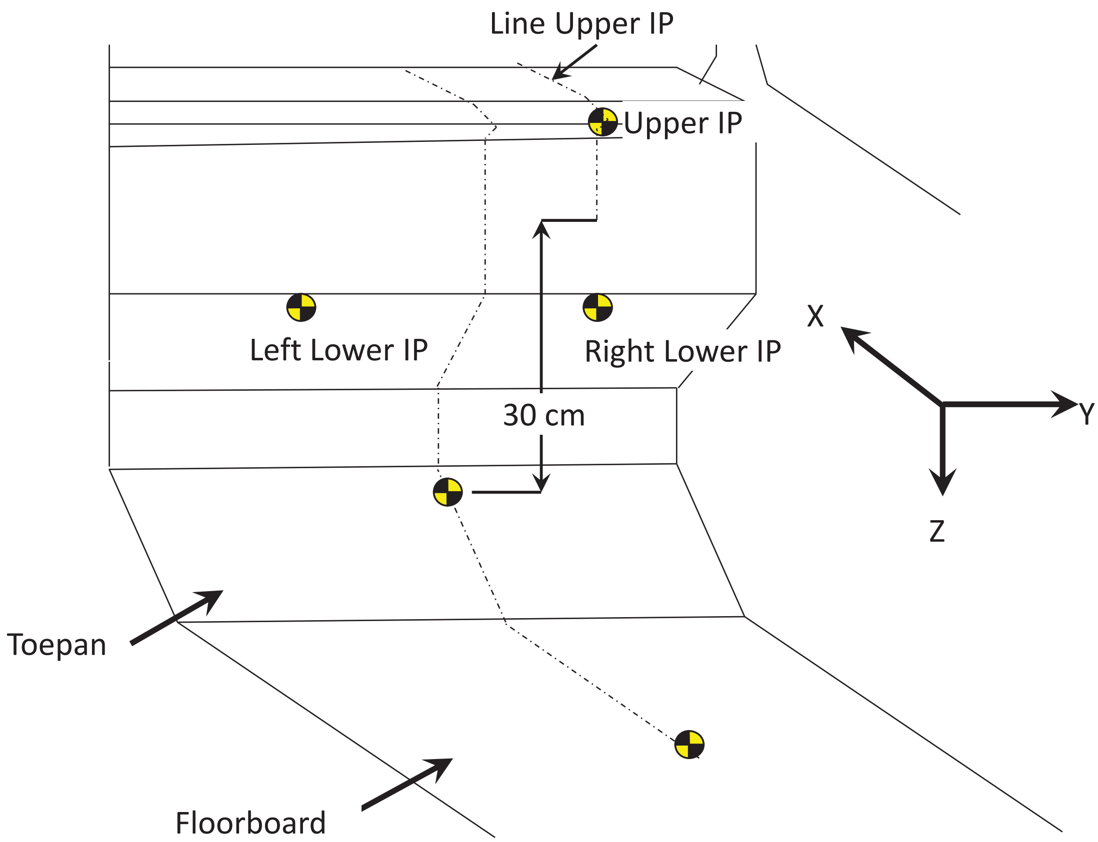


Figure 4.17: Passenger Upper Interior Points

___**4.33.1** Make sure the vehicle is in the TVLC condition.
___**4.33.2** Create and measure the Right Front Passenger Left Lower Dash Point.

___**4.33.2.1** The lateral coordinate of Left Lower Dash Point (knee bolster) is defined by subtracting 15 cm from the Passenger Centerline Coordinate System in the lateral direction.

___**4.33.2.2** The vertical coordinate is defined by subtracting 45 cm in the vertical direction from the Passenger Floor Reference Coordinate System.

___**4.33.2.3** The longitudinal coordinate of the Right Front Passenger Left Lower Dash Point is created by holding the lateral and vertical position constant and moving in the longitudinal direction until the Left Dash is contacted.

___**4.33.2.4** Create and measure the Right Front Passenger Right Lower Dash Point.

___**4.33.2.5** The lateral coordinate of Right Front Passenger Right Lower Dash Point (knee bolster) is defined by adding 15 cm to the Passenger Centerline Coordinate System lateral direction.

___**4.33.2.6** The vertical coordinate is defined by subtracting 45 cm in the vertical direction from the Passenger Floor Reference Coordinate System.

___**4.33.2.7** The longitudinal coordinate of the Left Lower Dash Point is created by holding the lateral and vertical position constant and moving in the longitudinal direction until the Right Dash is contacted.

___**4.33.3** Create and measure the Right Front Passenger Upper Dash Point:

___**4.33.3.1** Create a XZ plane the passes through the Right Front Passenger Right Lower Dash Point

___**4.33.3.2** Create a line at the intersection of the XZ plane and the Dash (Line Upper Dash). The start of the line is created by subtracting 30 cm from the Passenger Centerline Coordinate System in the vertical direction. The end of the line is at the intersection of the Dash and the windshield.

___**4.33.3.3** The Driver Upper Dash Point is located on the rearward most (toward the rear of the vehicle) point on this line.

NOTE: There may be instances when the upper dash point is located on a "soft component" such as an air vent or control knob (Figure 19). To measure a more robust structure, the upper dash point is replaced with two additional points, and the weighted average of their coordinates is used to represent the deformation of a point at the original location (Equation 1). Each new point is determined by moving inboard/outboard to a location that is just off of the soft component.

TABLE 4.25: DRIVER UPPER INTERIOR POINTS			
INTRUSION LOCATION	**PRE-TEST (MM)***		
	X	**Y**	**Z**
Passenger Dash Left			
Passenger Dash Right			
Passenger Upper Dash			

CHECKLIST 4.34 - PASSENGER LOWER INTRUSION POINTS

Reference Figure 4.18 as the following steps are completed.

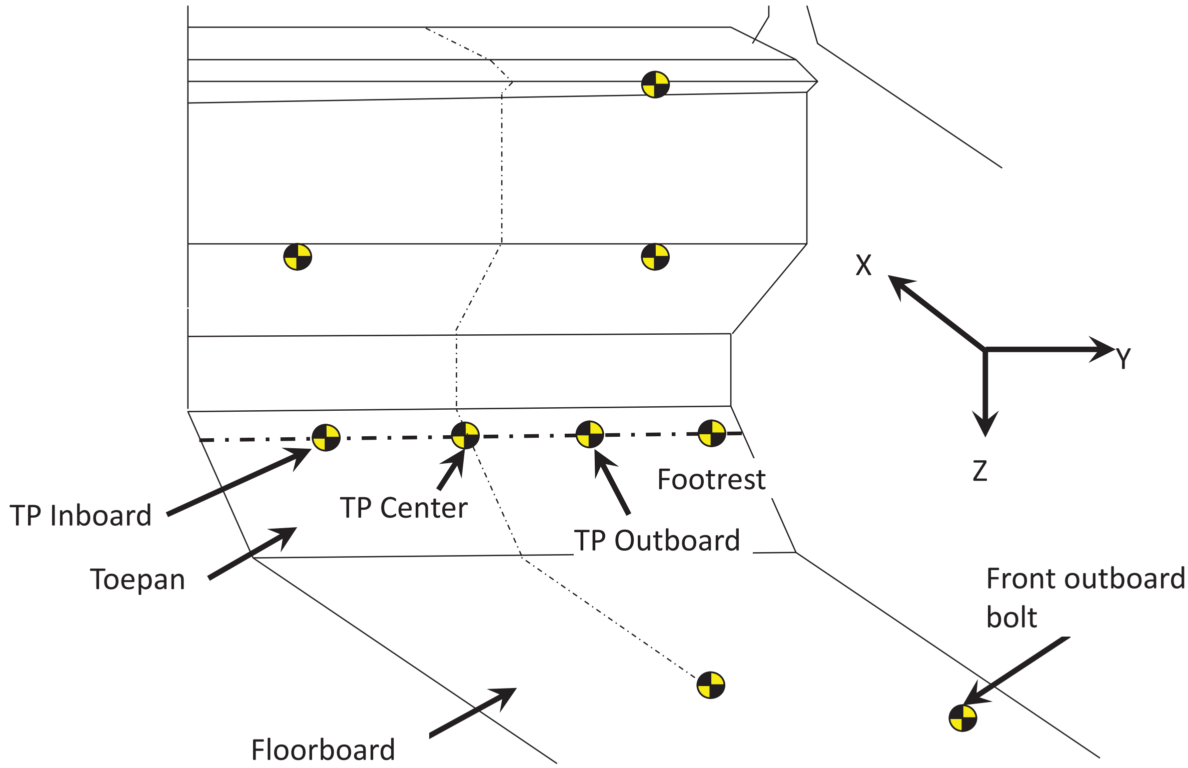


Figure 4.18: Passenger Lower Interior Points

___**4.34.1** Make sure the vehicle is in the TVLC condition.

___**4.34.2** Measure the center of Passenger Front Outboard Seat Bolt: If no bolt is present, create and measure a point at the center of the front of the outboard seat track.

___**4.34.3** Create and measure Passenger Footrest point:

___**4.34.3.1** The lateral coordinate of Right Front Passenger Footrest is defined by adding 25 cm from the Passenger Centerline Coordinate System lateral direction.

___**4.34.3.2** The vertical coordinate is defined by subtracting 0 cm in the vertical direction from the Passenger Centerline Coordinate System.

___**4.34.3.3** The longitudinal coordinate of the Right Front Passenger Footrest point is created by holding the lateral and vertical position constant and moving in the longitudinal direction until the toepan is contacted.

___**4.34.3.4** A utility knife is used to cut a small "v" in the carpet and underlying padding at this point on the toepan. The point of the "v" is peeled back, and the exposed floor is marked and measured. The carpet and padding are then refitted prior to the crash. This point shall be marked on the sheet metal of the toe pan or floorboard.

___**4.34.4** Create and measure Right Front Passenger Toepan Outboard (TP Outboard) point:

___**4.34.4.1** The lateral coordinate of TP Outboard is defined by adding 15 cm to the Passenger Centerline Coordinate System lateral direction.

___**4.34.4.2** The vertical coordinate of the TP Outboard is defined by subtracting 0 cm in the vertical direction from the Passenger Centerline Coordinate System.

___**4.34.4.3** The longitudinal coordinate of the TP Outboard point is created by holding the lateral and vertical position constant and moving in the longitudinal direction until the toepan is contacted.

___**4.34.4.4** A utility knife is used to cut a small "v" in the carpet and underlying padding at this point on the toepan. The point of the "v" is peeled back, and the exposed floor is marked and measured. The carpet and padding are then refitted prior to the crash. This point shall be marked on the sheet metal of the toe pan or floorboard.

___**4.34.5** Create and measure Passenger Center Toepan Point (TP Center):

___**4.34.5.1** TP Center point is equal to the x, y, and z of the origin of the Passenger Centerline Coordinate System

___**4.34.5.2** A utility knife is used to cut a small "v" in the carpet and underlying padding at this point on the toepan. The point of the "v" is peeled back, and the exposed floor is marked and measured. The carpet and padding are then refitted prior to the crash. This point shall be marked on the sheet metal of the toe pan or floorboard.

___**4.34.6** Create and measure Right Front Passenger Toepan Inboard (TP Inboard) point:

___**4.34.6.1** The lateral coordinate of TP Inboard is defined by subtracting 15 cm from the Passenger Centerline Coordinate System lateral direction.

___**4.34.6.2** The vertical coordinate of the TP Inboard is defined by subtracting 0 cm in the vertical direction from the Centerline Coordinate Coordinate System.

___**4.34.6.3** The longitudinal coordinate of the TP Inboard point is created by holding the lateral and vertical position constant and moving in the longitudinal direction until the toepan is contacted.

___**4.34.6.4** A utility knife is used to cut a small "v" in the carpet and underlying padding at this point on the toepan. The point of the "v" is peeled back, and the exposed floor is marked and measured. The carpet and padding are then refitted prior to the crash. This point shall be marked on the sheet metal of the toe pan or floorboard.

TABLE 4.26

INTRUSION LOCATION	**PRE-TEST (MM)***		
	X	**Y**	**Z**
Passenger Front Outboard Seat Bolt			
Passenger Footrest			
Passenger TP Outboard			
Passenger TP Center			
Passenger TP Inboard			

CHECKLIST 4.35 - DRIVER AND RIGHT FRONT PASSENGER DOOR PROFILE

Reference Figure 4.19 as the following steps are completed.

Note: Mark the following points on the pinch weld of the door frame.

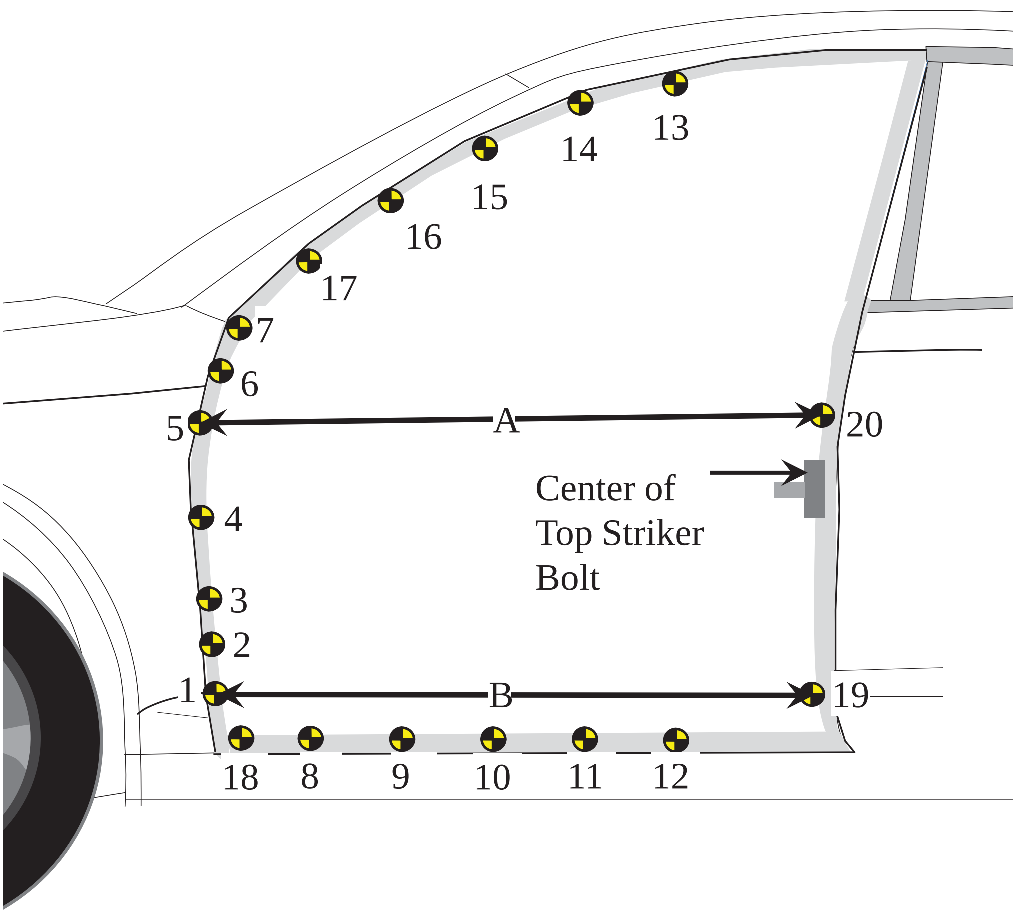


Figure 4.19: Door Profile

___**4.35.1** Verify vehicle is in TVLC and begin establishing measurements around the driver's door opening.

___**4.35.2** Create and measure Point 1: The vertical coordinate of this point is obtained by subtracting 0 cm from the brake pedal reference point.

___**4.35.3** Create and measure Point 2: The vertical coordinate of this point is obtained by subtracting 7.5 cm from the brake pedal reference point.

___**4.35.4** Create and measure Point 3: The vertical coordinate of this point is obtained by subtracting 15 cm from the brake pedal reference point

___**4.35.5** Create and measure Point 4: The vertical coordinate of this point is obtained by subtracting 30 cm from the brake pedal reference point

___**4.35.6** Create and measure Point 5: The vertical coordinate of this point is obtained by subtracting 45 cm from the brake pedal reference point.
___**4.35.7** Create and measure Point 6: The vertical coordinate of this point is obtained by subtracting 52.5 cm from the brake pedal reference point).
___**4.35.8** Create and measure Point 7: The vertical coordinate of this point is obtained by subtracting 60 cm from the brake pedal reference point
___**4.35.9** Create and measure Point 8: The longitudinal coordinate of this point is obtained by subtracting 15 cm from point 1
___**4.35.10** Create and measure Point 9: The longitudinal coordinate of this point is obtained by subtracting 15 cm from point 8
___**4.35.11** Create and measure Point 10: The longitudinal coordinate of this point is obtained by subtracting 15 cm from point 9
___**4.35.12** Create and measure Point 11: The longitudinal coordinate of this point is obtained by subtracting 15 cm from point 10
___**4.35.13** Create and measure Point 12: The longitudinal coordinate of this point is obtained by subtracting 15 cm from point 11
___**4.35.14** Create and measure Point 13: The longitudinal coordinate of this point is obtained by subtracting 600 cm from point 1
___**4.35.15** Mark and measure 4 evenly spaced points between points 13 and 7 (points 14, 15, 16, and 17)
___**4.35.16** Mark and measure 18 which is half the distance along the pinch weld between point 1 and 8
___**4.35.17** Create and measure Point 19: The vertical coordinates of this point is obtained by subtracting 0 cm from the brake pedal reference point.
___**4.35.18** Create and measure Point 20: The vertical coordinates of this point is obtained by subtracting 45 cm from the brake pedal reference point.
___**4.35.19** Mark and measure the center of the top bolt of the striker
___**4.35.20** Calculate the distances A and B
___**4.35.21** Measure from the center of the front tire to the center of the rear tire (Wheelbase)
___**4.35.22** Repeat steps ___4.35.1-___4.35.21 on the passenger side door opening

TABLE 4.27			
POINT	PRE-TEST (MM)		
	X	Y	Z
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			

14			
15			
16			
17			
18			
19			
20			
A			
B			
Wheelbase			

CHECKLIST 4.36 – FRONT BUMPER BEAM POINTS

Reference Figure 4.20 and Figure 4.21 as the following steps are completed.

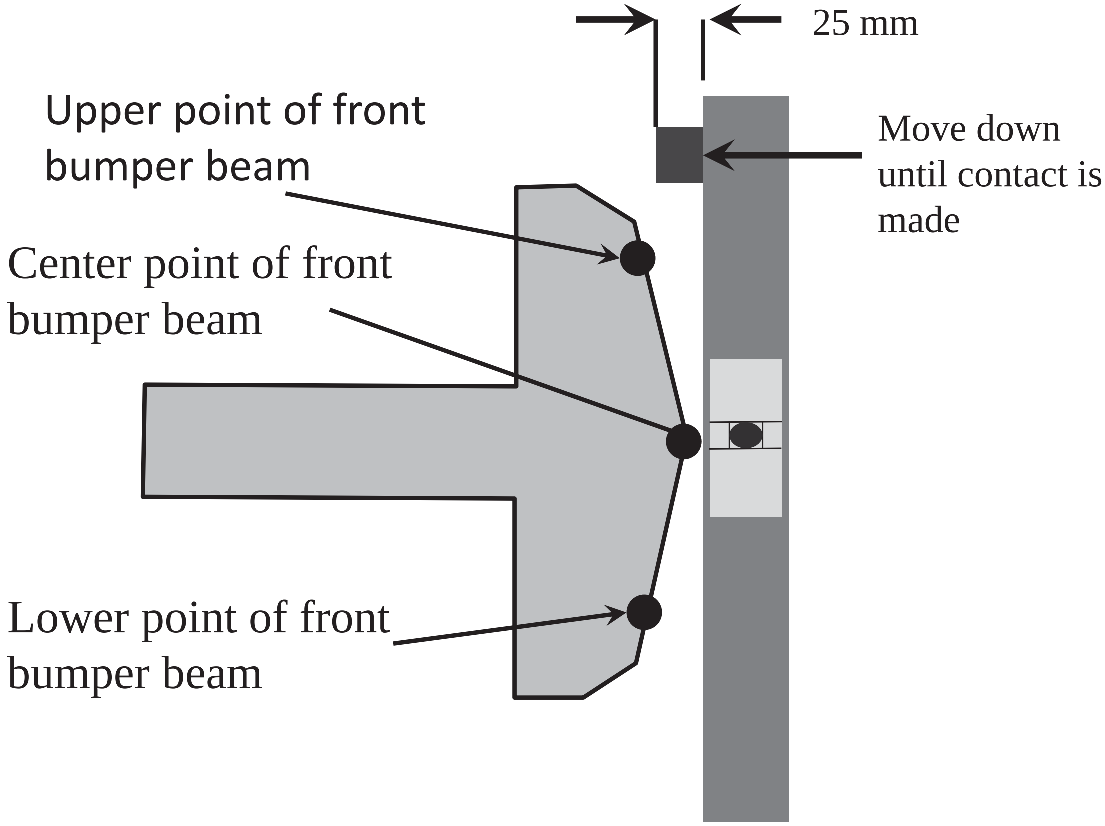


Figure 4.20: Method of determining center of bumper

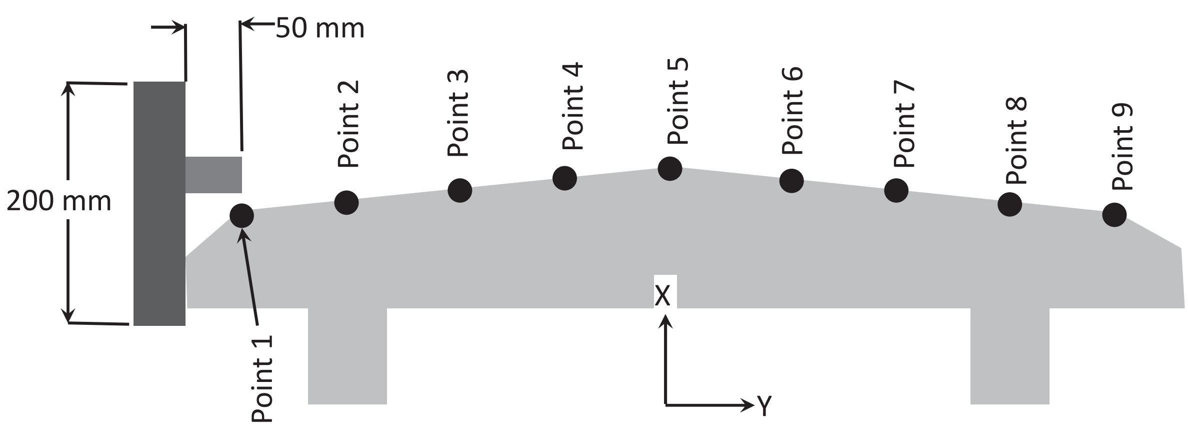


Figure 4.21: Method of determining bumpers edge

___**4.36.1** Make sure the vehicle is in the TVLC condition.

___**4.36.2** Expose the front bumper beam.

___**4.36.3** Find the vertical center point of the bumper beam at the centerline of the vehicle using the following procedure.

___**4.36.3.1** Position a level in front of the bumper beam so it is perpendicular to the floor and aligned with the longitudinal centerline of the vehicle.

___**4.36.3.2** Move the level longitudinally toward the rear of the vehicle until it makes contact with the vehicle. Ensure that the level remains perpendicular to the ground and move the level toward the rear of the vehicle until it contacts the bumper beam.

___**4.36.3.3** Slide a 25 mm deep block downward along the rear edge of the level until it contacts the bumper beam at the vehicle centerline and mark this contact point. This point is the Upper point of the bumper beam.

___**4.36.3.4** Slide a 25 mm deep block upward along the rear edge of the level until it contacts the bumper beam at the vehicle centerline and mark this point. This point is the Lower point of the bumper beam.

___**4.36.3.5** The center point of the bumper beam is half the distance between the Upper and Lower points of the bumper beam.

___**4.36.4** Locate point 1 using the following procedure (point 1 is located on the driver side of the vehicle).

___**4.36.4.1** Position a 200 mm X 50 mm combination square on the side bumper beam such that the plane of square is parallel with the ground and at the same height as the bumper beam center point, and the 200 mm part of the square is parallel to the longitudinal axis of the vehicle.

___**4.36.4.2** Extend the square out in front of the vehicle so that the 50 mm part of the square will not come in contact with the bumper while moving the square toward the bumper beam until it contacts the edge of the bumper beam.

___**4.36.4.3** Move the square toward the rear of the vehicle until it contacts the bumper beam. The point where the 50 mm part of the square contacts the bumper beam is Point 1.

___**4.36.4.4** Perform the same procedure for the other side of the bumper beam. The point where the 50 mm part of the square contacts the bumper beam is Point 9.

___**4.36.5** Mark 7 evenly spaced points along the bumper between Points 1 and 9 at the same height as the bumper beam center point.

TABLE 4.28			
POINT	**PRE-TEST (MM)**		
	X	**Y**	**Z**
B1			
B2			
B3			
B4			
B5			
B6			
B7			
B8			
B9			

CHECKLIST 4.37 - EXTERIOR PROFILE

Reference Figure 4.22 as the following steps are completed

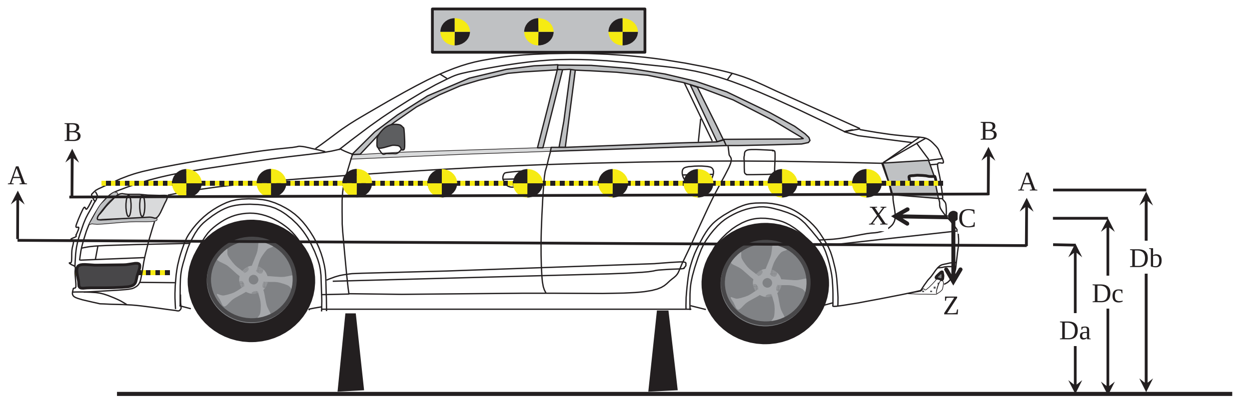


Figure 4.22

NOTE: Cross section A-A is defined as a horizontal plane passing through the center point of the front bumper beam a specified in ___4.36.3.5 at the centerline of the vehicle. Cross section B-B is defined as a plane passing through the top upper radiator support at the centerline of the vehicle

- ___**4.37.1** Make sure the vehicle is in the TVLC condition.
- ___**4.37.2** Expose the front bumper beam
- ___**4.37.3** Record the vertical height of this plane (dA) from the ground. dA=_______ mm
- ___**4.37.4** Using this Z coordinate, mark enough points around the complete circumference of the vehicle along this cross section A-A (horizontal plane) at this height to create an exterior cross-section of the vehicle and record such points.
- ___**4.37.5** Record the vertical height of this plane (dB) from the ground. dB=_______ mm
- ___**4.37.6** Using this Z coordinate, mark enough points around the complete circumference of the vehicle along this cross section B-B (horizontal plane) at this height to create an exterior cross-section of the vehicle and record such points.
- ___**4.37.7** Record the vertical height of the origin of the VCS from the ground (dC). dC=______mm

TABLE 4.29							
CROSS SECTION A-A				CROSS SECTION B-B			
POINT #	X	Y	Z	POINT #	X	Y	Z
1				1			
2				2			
3				3			
4				4			
5				5			
6				6			
7				7			
8				8			

9				9			
10				10			
11				11			
12				12			
13				13			
14				14			
15				15			
16				16			
.				.			
.				.			
.				.			

CHECKLIST 4.38 - EXTERIOR VEHICLE MEASUREMENT

Reference Figure 4.23 as the following steps are completed

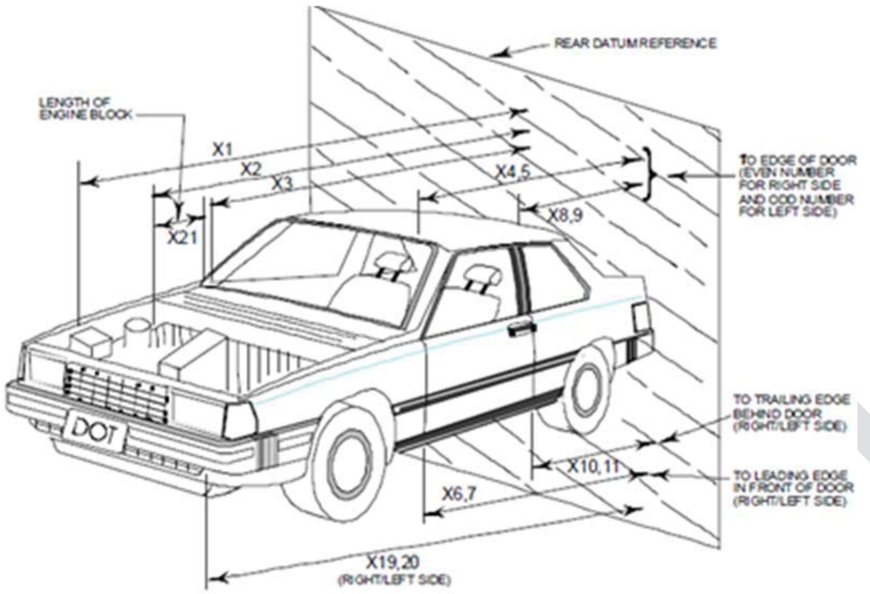


Figure 4.23

___**4.38.1** Establish a fixed reference plane that is perpendicular to the vehicle's longitudinal centerline. (Figure 4.23)

___**4.38.2** Prior to the test, with the vehicle in the "As Tested" configuration, measure and record the dimensions from the fixed reference plane as shown in the below table

TABLE 4.30		
NO.	**MEASUREMENT DESCRIPTION**	**PRE-TEST (MM)**
1	Total Length of Vehicle at Centerline	
2	Rear Surface of Vehicle (RSOV) to Front of Engine	
3	RSOV to Firewall	
4	RSOV to Upper Leading Edge of Right Door	
5	RSOV to Upper Leading Edge of Left Door	
6	RSOV to Lower Leading Edge of Right Door	
7	RSOV to Lower Leading Edge of Left Door	
8	RSOV to Upper Trailing Edge of Right Door	
9	RSOV to Upper Trailing Edge of Left Door	
10	RSOV to Lower Trailing Edge of Right Door	
11	RSOV to Lower Trailing Edge of Left Door	
12	RSOV to Bottom of "A" Post of Right Side	
13	RSOV to Bottom of "A" Post of Left Side	

TABLE 4.30		
NO.	MEASUREMENT DESCRIPTION	PRE-TEST (MM)
14	RSOV to Firewall, Right Side	
15	RSOV to Firewall, Left Side	
16	RSOV to Steering Column	
17	Center of Steering Column to “A” Post	
18	Center of Steering Column to Headliner	
19	RSOV to Right Side of Front Bumper	
20	RSOV to Left Side of Front Bumper	
21	Length of Engine Block	
RD	RSOV to Right Side of Dash Panel	
CD	RSOV to Center of Dash Panel	
LD	RSOV to Left Side of Dash Panel	

CHECKLIST 4.39 - PRE-TEST ACCIDENT INVESTIGATION MEASUREMENTS

___**4.39.1** Determination of Bumper Corner Pre-Test

___**4.39.1.1** A bumper corner, sometimes referred to as an apex, is the location where vehicle end planes and side planes meet; it defines the front, back, left and right planes of the vehicle. The distance from one end plane bumper corner to the other is referred to as the Undeformed End Width (UEW), also used as damage length for the frontal measurement. The contoured design of vehicles makes it necessary to project the geometrical corner to the surface of the vehicle.

___**4.39.1.2** It is important to determine bumper corner locations in an accurate and practical way during field inspections. The contoured design of some vehicles allows bumper corners to simply be identified visually. For vehicles where the corner is not apparent, use the following process to locate the bumper corner:

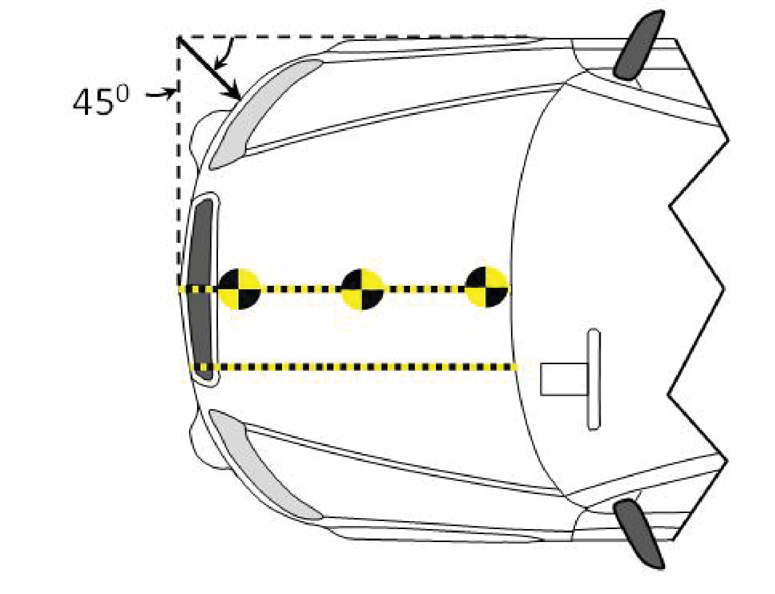


Figure 4.24: Determination of bumper corner

___**4.39.2** Extend the front and side planes in straight lines as illustrated by the dashed lines in Figure 4.24. To extend vehicle planes, create straight lines by using pocket rods, tape measures, or a combination.

___**4.39.3** At the point where the extended lines intersect, project a 45° line to the bumper surface as illustrated by the solid line.

___**4.39.4** The point at which the 45° projection meets the bumper surface is the location of the bumper corner.

___**4.39.5** Determination of C1-C6 Pre-Test

___**4.39.6** Reference Figure 4.25 as the following steps are completed

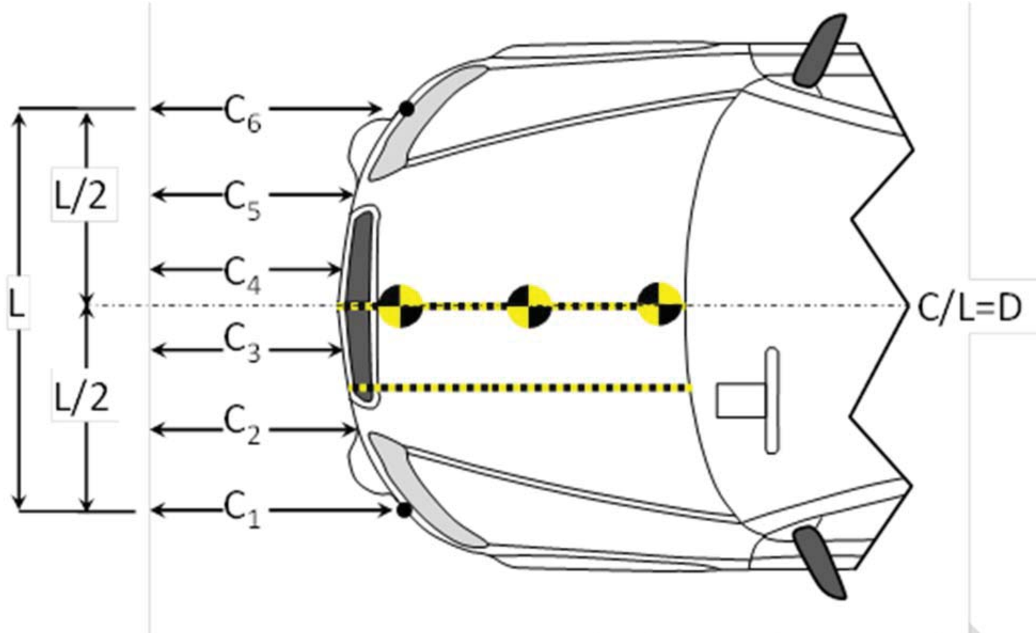


Figure 4.25: Determination of C1-C6

___**4.39.7** Prior to the test, establish a reference plane/line parallel to the lateral axis of the vehicle for the damage profile measurements C1-C6. The reference plane/line can be located at the front most point of the vehicle [tip of the front bumper] or at a distance in front of the bumper. All pre and post C1-C6 are measured from this reference plane/line.

___**4.39.8** On the bumper fascia C1 is at left (driver's perspective) bumper corner and C6 is at right (driver's perspective) bumper corner. See the section above for definition of bumper corner.

___**4.39.9** Measure the distance between the C1 and C6 parallel to the reference plane and record the distance as Undeformed End Width (UEW).

___**4.39.10** Divide the UEW by five to determine the spacing of six C locations C1 through C6. Mark these locations on the bumper fascia. Measure C1 through C6 from reference plane/line in the perpendicular direction. Record the Pre-Test values in table 1. These distances are referred to as freespaces and are subtracted from the post-crash crush measurements.

___**4.39.11** Measure the longitudinal horizontal distance from the front most point of the vehicle [tip of the front bumper] to the center of the base of the windshield.

TABLE 4.31		
ITEM	**DESCRIPTION**	**PRE-TEST (MM)**
C1	Freespace C1 at left side	
C2	Freespace C2 at left side	
C3	Freespace C3 at left side	
C4	Freespace C4 at right side	

TABLE 4.31		
ITEM	**DESCRIPTION**	**PRE-TEST (MM)**
C5	Freespace C5 at right side	
C6	Freespace C6 at right side	
L	Length of damage region (C1 to C6)	
	Longitudinal horizontal distance from the tip of the front bumper to the base of the windshield	

CHECKLIST 4.40 - 6 AXIS MOUNTING PLATE

Reference Figure 4.26 as the following steps are completed.

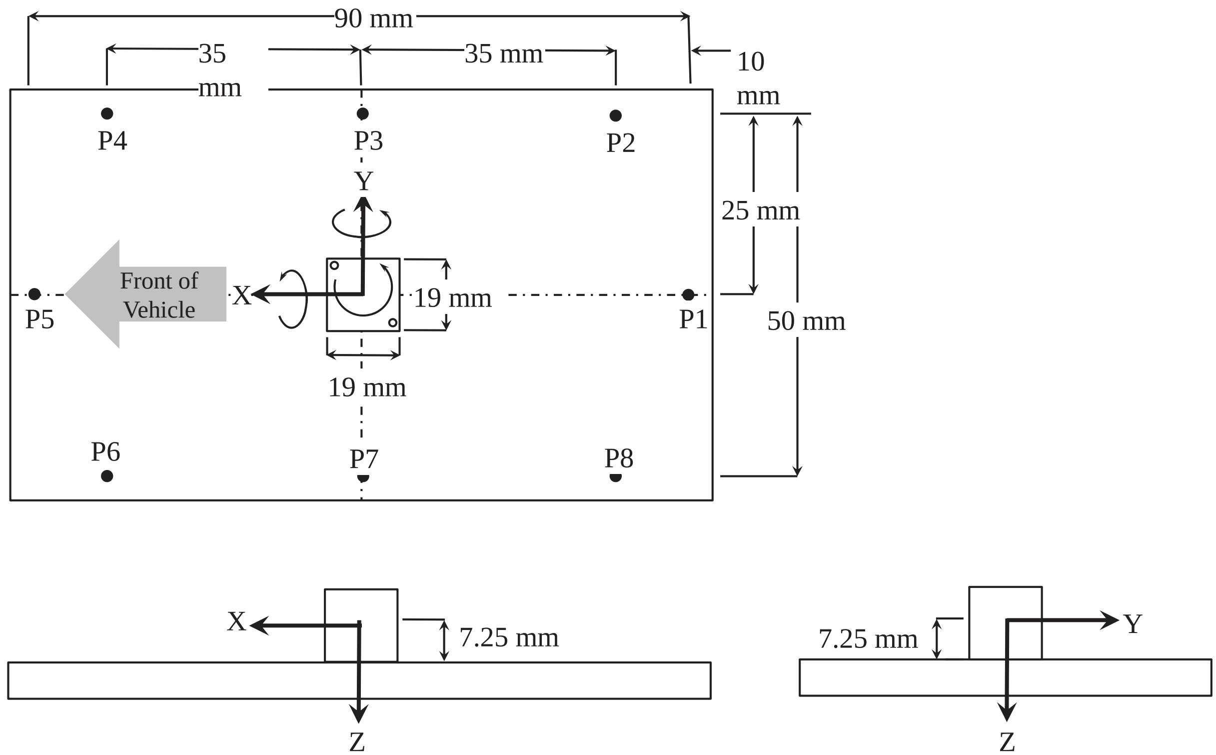


Figure 4.26 Mounting plate

___**4.40.1** Create a steel or aluminum plate according to Figure 4.26. The indent holes shall be identically dimensioned and be compatible with the size of the tip of the CMM

___**4.40.2** Mount the 6 axis block mounting plate and the orientations such that it meets SAE J211.

___**4.40.3** Remove carpet from behind the center console.

___**4.40.4** Securely mount the ARS plate, such that the following conditions are meet:

- ___**4.40.4.1** The plate shall be parallel to the ground
- ___**4.40.4.2** The center of the 6-axis instrumentation shall be 100 mm behind the center console at the lateral centerline of the vehicle
- ___**4.40.4.3** P1 and P5 are located at the longitudinal centerline of the vehicle
- ___**4.40.4.4** P3 and P7 are parallel to the Y-axis of the vehicle
- ___**4.40.4.5** P5 is toward the front of the vehicle
- ___**4.40.4.6** Measure and record x, y, and z for points P1 through P8 in the vehicle coordinate system
- ___**4.40.4.7** Check to make sure that the Z value for P2 though P8 is within ± 0.5 mm of P1.
- ___**4.40.4.8** Check to make sure P1 and P5 are within ± .5 mm from the lonatudinal centerline of the vehicle
- ___**4.40.4.9** Measure and record point P1 through P8.

TABLE 4.32	
POINT	PRE-TEST MEASUREMENTS – MOUNTING

NO.	PLATE RELATIVE TO VCS		
	X	Y	Z
P1			
P2			
P3			
P4			
P5			
P6			
P7			
P8			

CHECKLIST 4.41 - VEHICLE INSTRUMENTATION

Reference Figure 4.27 and Figure 4.28 for a visual representation of instrumentation locations.

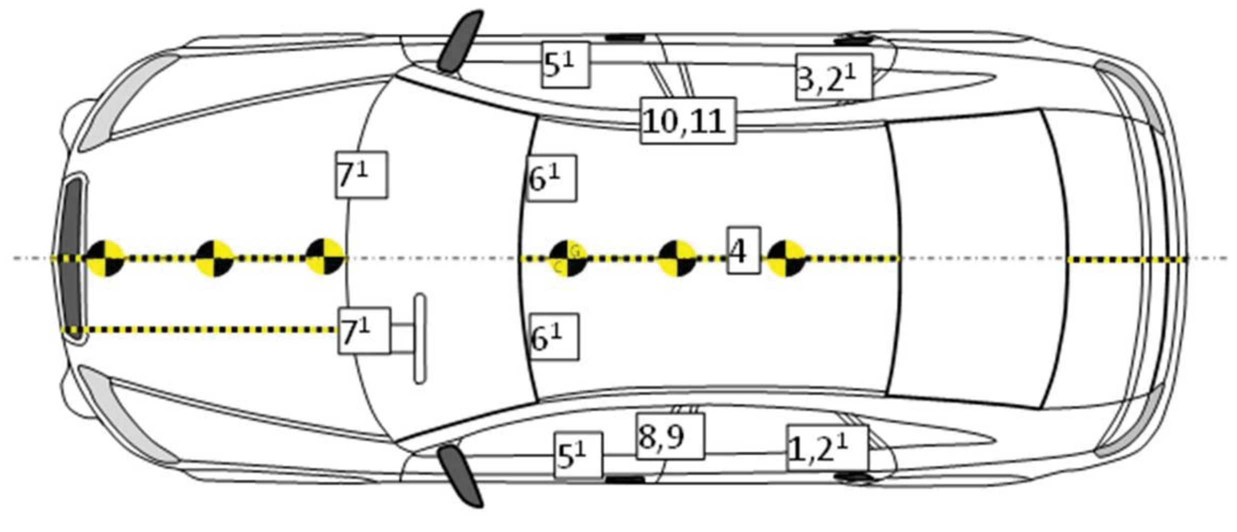


Figure 4.27: Top view of vehicle instrumentation location. 1 Depends on if it is a left or right side impact

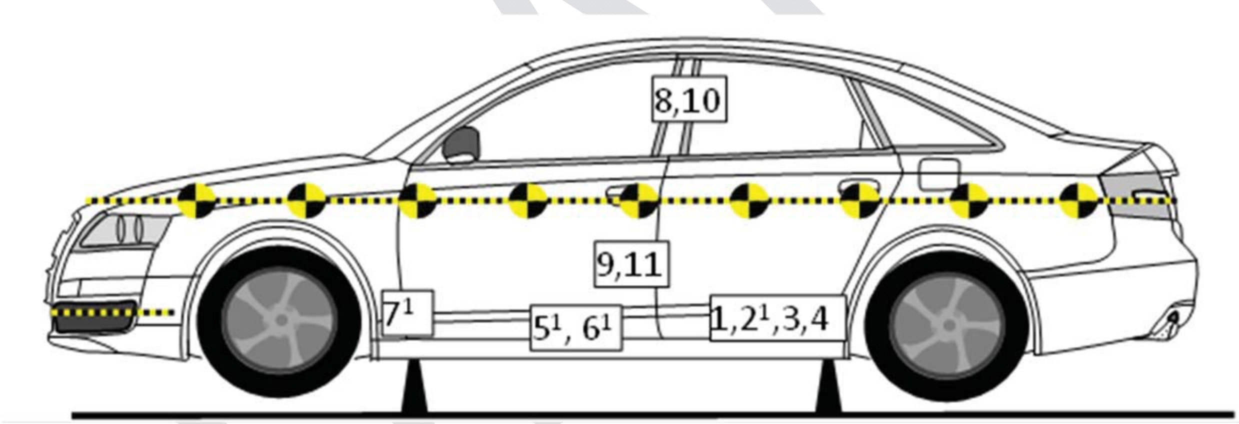


Figure 4.28: Side view of vehicle instrumentation location. 1 Depends on if it is a left or right side impact

___**4.41.1** Verify vehicle is in the TVLC condition
___**4.41.2** Ensure all polarities are set according to SAE J211
___**4.41.3** Install the following instrumentation on the test vehicle.

TABLE 4.33							
#	**LOC**	**SENTYP**	**SENATT**	**AXIS**	**UNITS**	**CH**	**INSCOM**
1	1	AC	DSLR	XG	G’S	P	V2 LEFT REAR SILL X
2	1	AC	DSLR	YG	G’S	P	V2 LEFT REAR SILL Y

TABLE 4.33							
#	LOC	SENTYP	SENATT	AXIS	UNITS	CH	INSCOM
3	2[1]	AC	DSLR / DSRR	XG	G'S	R	V2 LEFT REAR SILL XR / V2 RIGHT REAR SILL XR
4	2[1]	AC	DSLR / DSRR	YG	G'S	R	V2 LEFT REAR SILL YR / V2 RIGHT REAR SILL YR
5	3	AC	DSRR	XG	G'S	P	V2 RIGHT REAR SILL X
6	3	AC	DSRR	YG	G'S	P	V2 RIGHT REAR SILL Y
7	4	AC	VECG	XG	G'S	P	V2 VEHICLE CG X
8	4	AC	VECG	YG	G'S	P	V2 VEHICLE CG Y
9	4	AC	VECG	ZG	G'S	P	V2 VEHICLE CG Z
10	4	AV	VECG	XG	DPS	P	V2 VEHCG ROTATION ABOUT X AXIS
11	4	AV	VECG	YG	DPS	P	V2 VEHCG ROTATION ABOUT Y AXIS
12	4	AV	VECG	ZG	DPS	P	V2 VEHCG ROTATION ABOUT Z AXIS
13	5[1]	AC	STLF / STRF	XG	G'S	P	V2 DRIVER SEAT TRACK X / V2 PASS SEAT TRACK X
14	5[1]	AC	STLF / STRF	YG	G'S	P	V2 DRIVER SEAT TRACK Y / V2 PASS SEAT TRACK Y
15	5[1]	AC	STLF / STRF	ZG	G'S	P	V2 DRIVER SEAT TRACK Z / V2 PASS SEAT TRACK Z
16	6[1]	AC	SELF / SERF	XG	G'S	P	V2 DRIVER SEAT THIGH BAR X ACC / V2 PASS SEAT THIGH BAR X ACC
17	6[1]	AC	SELF / SERF	ZG	G'S	P	V2 DRIVER SEAT THIGH BAR Z ACC / V2 PASS SEAT THIGH BAR Z ACC
18	7[1]	AC	FLLF / FLRF	XG	G'S	P	V2 DRIVER FLOOR PAN X / V2 PASS FLOOR PAN X
19	71	AC	FLLF / FLRF	YG	G'S	P	V2 DRIVER FLOOR PAN Y / V2 PASS FLOOR PAN Y
20	7[1]	AC	FLLF / FLRF	ZG	G'S	P	V2 DRIVER FLOOR PAN Z / V2 PASS FLOOR PAN Z
21	7[1,2]	AC	FLLF / FLRF	NA	MM	P	V2 DRIVER FLOOR PAN STRING POT / V2 PASS FLOOR PAN STRING POT
22	8	DS	SHBT	NA	MM	P	V2 DRIVER SEAT BELT PAYOUT DISPLACEMENT

TABLE 4.33							
#	LOC	SENTYP	SENATT	AXIS	UNITS	CH	INSCOM
23	8	LC	LPBO	NA	NWT	P	V2 DRIVER LAP BELT LOAD CELL
24	8	LC	SHBT	NA	NWT	P	V2 DRIVER SHOULDER BELT LOAD CELL
25	NA	OT	ABTS	NA	AMP	P	V2 DRIVER SW AIR BAG STAGE 1-> TIME TO FIRE: ##.## MS
26	NA	OT	ABTS	NA	AMP	P	V2 DRIVER SW AIR BAG STAGE 2-> TIME TO FIRE: ##.## MS
27	NA	OT	ABTL	NA	AMP	P	V2 DRIVER CURTAIN AIR BAG-> TIME TO FIRE: ##.## MS
28	NA	OT	ABTL	NA	AMP	P	V2 DRIVER SEAT AIRBAG-> TIME TO FIRE: ##.## MS
29	NA	OT	ABTL	NA	AMP	P	V2 DRIVER SEAT AIR BAG-> TIME TO FIRE: ##.## MS
30	NA	OT	ABTL	NA	AMP	P	V2 DRIVER RETRACTOR PRETENSIONER-> TIME TO FIRE: ##.## MS
31	NA	OT	ABTL	NA	AMP	P	V2 DRIVER ANCHOR PRETENSIONER-> TIME TO FIRE: ##.## MS
32	9	DS	SHBT	NA	MM	P	V2 PASS SEAT BELT PAYOUT DISPLACEMENT
33	9	LC	LPBO	NA	NWT	P	V2 PASS LAP BELT LOAD CELL
34	9	LC	SHBT	NA	NWT	P	V2 PASS SHOULDER BELT LOAD CELL
35	NA	OT	ABTS	NA	AMP	P	V2 PASS SW AIR BAG STAGE 1-> TIME TO FIRE: ##.## MS
36	NA	OT	ABTS	NA	AMP	P	V2 PASS SW AIR BAG STAGE 2-> TIME TO FIRE: ##.## MS
37	NA	OT	ABTL	NA	AMP	P	V2 PASS CURTAIN AIR BAG-> TIME TO FIRE: ##.## MS
38	NA	OT	ABTL	NA	AMP	P	V2 PASS SEAT AIRBAG-> TIME TO FIRE: ##.## MS
39	NA	OT	ABTL	NA	AMP	P	V2 PASS SEAT AIR BAG-> TIME TO FIRE: ##.## MS

TABLE 4.33

#	LOC	SENTYP	SENATT	AXIS	UNITS	CH	INSCOM
40	NA	OT	ABTL	NA	AMP	P	V2 PASS RETRACTOR PRETENSIONER-> TIME TO FIRE: ##.## MS
41	NA	OT	ABTL	NA	AMP	P	V2 PASS ANCHOR PRETENSIONER-> TIME TO FIRE: ##.## MS

[1]If left side impact locate instrumentation of the driver side / If right side impact locate instrumentation on the right side

[2] A string potentiometer shall be mounted beside the camera under the seat as high as possible. The string shall be pulled parallel to the floor pan until it reaches the toepan. If the brake pedal interferes with the string move the string pot down. There should be a one inch clearance between the string and the bottom of the brake pedal. The accelerometer behind the brake pedal shall be attached where the string meets the toepan. The coordinate system of this accelerometer shall be parallel to the VCS.

[3] The Contractor shall add a statement after the text if the data is questionable. For example: V2P1 LR CHEST IR-TRACC DX ->QD - NOISE ON DATA

___4.41.4 Measure and record all instrumentation listed below with respect to the VCS listed in the table below

TABLE 4.34

#	LOC	SENTYP	SENATT	AXIS	UNITS	CH	INSCOM
1	1	AC	DSLR	XG	G'S	P	V2 LEFT REAR SILL X
2	1	AC	DSLR	YG	G'S	P	V2 LEFT REAR SILL Y
3	2[1]	AC	DSLR / DSRR	XG	G'S	R	V2 LEFT REAR SILL XR / V2 RIGHT REAR SILL XR
4	2[1]	AC	DSLR / DSRR	YG	G'S	R	V2 LEFT REAR SILL YR / V2 RIGHT REAR SILL YR
5	3	AC	DSRR	XG	G'S	P	V2 RIGHT REAR SILL X
6	3	AC	DSRR	YG	G'S	P	V2 RIGHT REAR SILL Y
7	4	AC	VECG	XG	G'S	P	V2 VEHICLE CG X
8	4	AC	VECG	YG	G'S	P	V2 VEHICLE CG Y
9	4	AC	VECG	ZG	G'S	P	V2 VEHICLE CG Z
10	4	AV	VECG	XG	DPS	P	V2 VEHCG ROTATION ABOUT X AXIS
11	4	AV	VECG	YG	DPS	P	V2 VEHCG ROTATION ABOUT Y AXIS
12	4	AV	VECG	ZG	DPS	P	V2 VEHCG ROTATION ABOUT Z AXIS
13	5[1]	AC	STLF / STRF	XG	G'S	P	V2 DRIVER SEAT TRACK X / V2 PASS SEAT TRACK X

TABLE 4.34

#	LOC	SENTYP	SENATT	AXIS	UNITS	CH	INSCOM
14	5[1]	AC	STLF / STRF	YG	G'S	P	V2 DRIVER SEAT TRACK Y / V2 PASS SEAT TRACK Y
15	5[1]	AC	STLF / STRF	ZG	G'S	P	V2 DRIVER SEAT TRACK Z / V2 PASS SEAT TRACK Z
16	6[1]	AC	SELF / SERF	XG	G'S	P	V2 DRIVER SEAT THIGH BAR X ACC / V2 PASS SEAT THIGH BAR X ACC
17	6[1]	AC	SELF / SERF	ZG	G'S	P	V2 DRIVER SEAT THIGH BAR Z ACC / V2 PASS SEAT THIGH BAR Z ACC
18	7[1]	AC	FLLF / FLRF	XG	G'S	P	V2 DRIVER FLOOR PAN X / V2 PASS FLOOR PAN X
19	71	AC	FLLF / FLRF	YG	G'S	P	V2 DRIVER FLOOR PAN Y / V2 PASS FLOOR PAN Y
20	7[1]	AC	FLLF / FLRF	ZG	G'S	P	V2 DRIVER FLOOR PAN Z / V2 PASS FLOOR PAN Z
21	7[1,2]	AC	FLLF / FLRF	NA	MM	P	V2 DRIVER FLOOR PAN STRING POT / V2 PASS FLOOR PAN STRING POT
22	8	DS	SHBT	NA	MM	P	V2 DRIVER SEAT BELT PAYOUT DISPLACEMENT
23	8	LC	LPBO	NA	NWT	P	V2 DRIVER LAP BELT LOAD CELL
24	8	LC	SHBT	NA	NWT	P	V2 DRIVER SHOULDER BELT LOAD CELL
25	NA	OT	ABTS	NA	AMP	P	V2 DRIVER SW AIR BAG STAGE 1-> TIME TO FIRE: ##.## MS
26	NA	OT	ABTS	NA	AMP	P	V2 DRIVER SW AIR BAG STAGE 2-> TIME TO FIRE: ##.## MS
27	NA	OT	ABTL	NA	AMP	P	V2 DRIVER CURTAIN AIR BAG-> TIME TO FIRE: ##.## MS
28	NA	OT	ABTL	NA	AMP	P	V2 DRIVER SEAT AIRBAG-> TIME TO FIRE: ##.## MS
29	NA	OT	ABTL	NA	AMP	P	V2 DRIVER SEAT AIR BAG-> TIME TO FIRE: ##.## MS

TABLE 4.34							
#	**LOC**	**SENTYP**	**SENATT**	**AXIS**	**UNITS**	**CH**	**INSCOM**
30	NA	OT	ABTL	NA	AMP	P	V2 DRIVER RETRACTOR PRETENSIONER-> TIME TO FIRE: ##.## MS
31	NA	OT	ABTL	NA	AMP	P	V2 DRIVER ANCHOR PRETENSIONER-> TIME TO FIRE: ##.## MS
32	9	DS	SHBT	NA	MM	P	V2 PASS SEAT BELT PAYOUT DISPLACEMENT
33	9	LC	LPBO	NA	NWT	P	V2 PASS LAP BELT LOAD CELL
34	9	LC	SHBT	NA	NWT	P	V2 PASS SHOULDER BELT LOAD CELL
35	NA	OT	ABTS	NA	AMP	P	V2 PASS SW AIR BAG STAGE 1-> TIME TO FIRE: ##.## MS
36	NA	OT	ABTS	NA	AMP	P	V2 PASS SW AIR BAG STAGE 2-> TIME TO FIRE: ##.## MS
37	NA	OT	ABTL	NA	AMP	P	V2 PASS CURTAIN AIR BAG-> TIME TO FIRE: ##.## MS
38	NA	OT	ABTL	NA	AMP	P	V2 PASS SEAT AIRBAG-> TIME TO FIRE: ##.## MS
39	NA	OT	ABTL	NA	AMP	P	V2 PASS SEAT AIR BAG-> TIME TO FIRE: ##.## MS
40	NA	OT	ABTL	NA	AMP	P	V2 PASS RETRACTOR PRETENSIONER-> TIME TO FIRE: ##.## MS
41	NA	OT	ABTL	NA	AMP	P	V2 PASS ANCHOR PRETENSIONER-> TIME TO FIRE: ##.## MS

CHECKLIST 4.42 - PLACARDS PLACEMENT

___**4.42.1** Place placards on the test vehicle as specified in section 3.22:
___**4.42.2** On the front bumper on the opposite side of the impact
___**4.42.3** On the hood on the opposite side of impact
___**4.42.4** Driver’s door
___**4.42.5** Right front passenger door

CHECKLIST 4.43 - INSTALL DATA ACQUISITION

___**4.43.1.1** Mount the data acquisition system to test vehicle

CHECKLIST 4.44 CREATE REFERENCE BOX AND POSITIONING LOCATIONS OF THE CAMERA

Reference Figure 4.29 and Figure 4.30 as the following steps are completed.

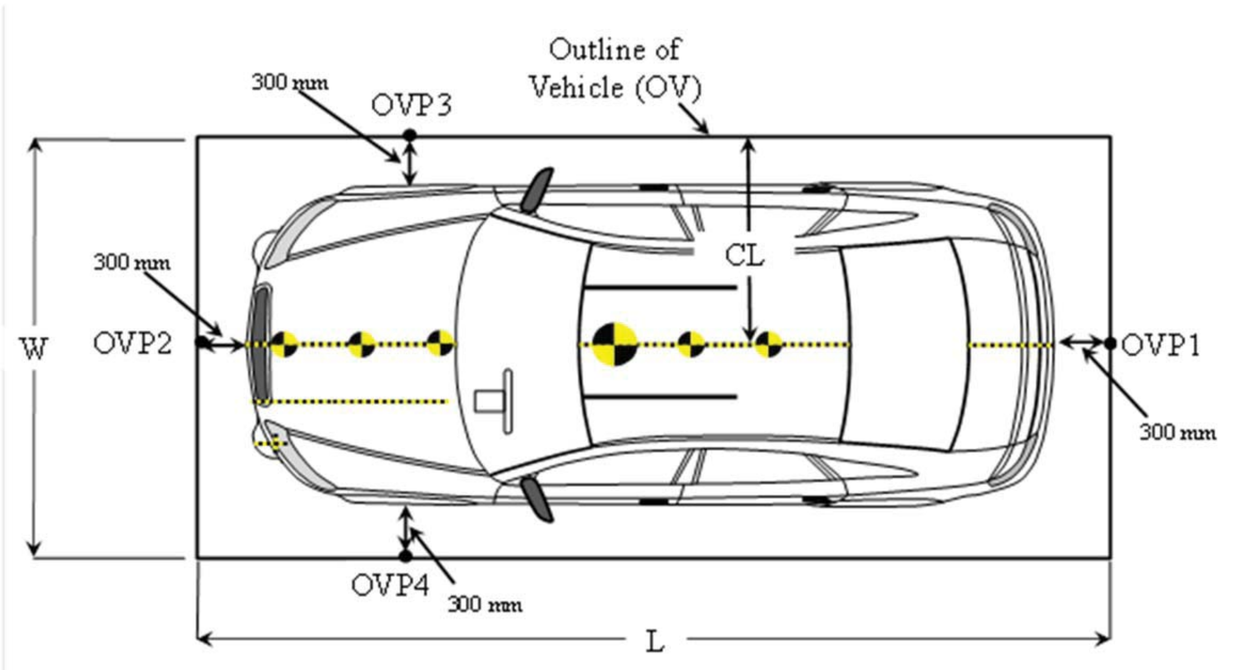


Figure 4.29: Reference box

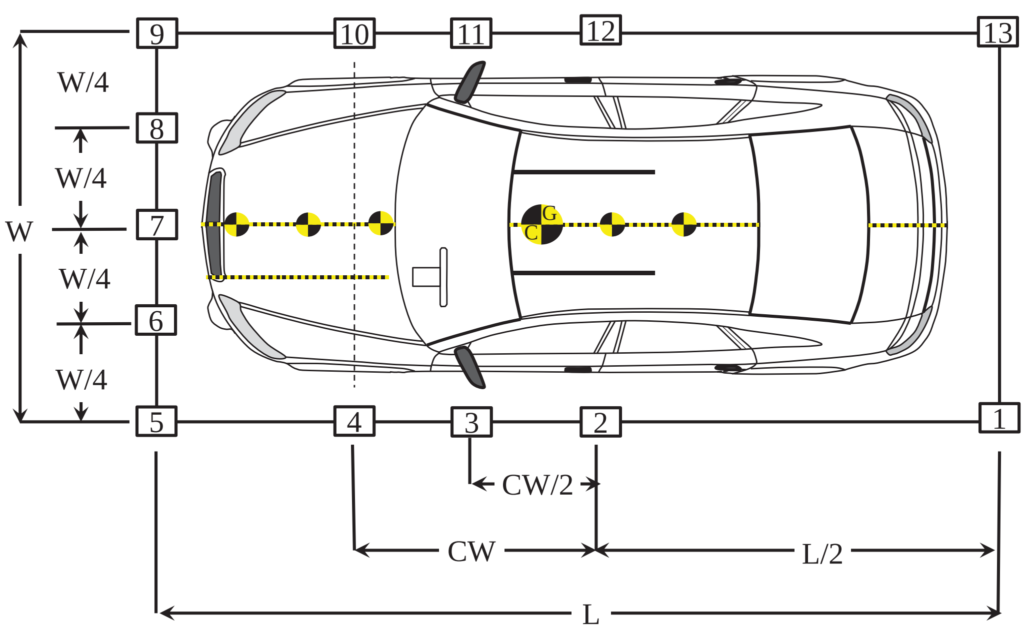


Figure 4.30: Positioning of poles

___**4.44.1** Make sure the vehicle is in TVLC.
___**4.44.2** Create an outline box around the vehicle using the following procedure (Figure 4.29)
___**4.44.3** Place a plumb bob at the rear of the longitudinal centerline of the vehicle
___**4.44.4** From the tip of the plumb bod move back 300 mm and create a point (OVP1)
___**4.44.5** Place a plumb bob at the front of the longitudinal centerline of the vehicle
___**4.44.6** From the tip of the plumb bod move forward 300 mm and create a point (OVP2)
___**4.44.7** Place a plumb bob on the right front outer fender at the front axial
___**4.44.8** From the tip of the plumb bob move in the positive lateral direction of the vehicle 300 mm (OVP3)
___**4.44.9** Place a plumb bob on the left front outer fender at the front axial
___**4.44.10** From the tip of the plumb bob move in the negative lateral direction of the vehicle 300 mm (OVP4)
___**4.44.11** Measure and record the width of the box (W)
___**4.44.12** Measure and Record the length of the box (L)
___**4.44.13** Measure and record the distance from the edge of the box to the longitudinal centerline of the vehicle near the rear of the vehicle
___**4.44.14** Create 13 poles that are 4 feet high and around 10 mm in diameter
___**4.44.15** Place a pole (1) on the left back side of the box (Figure 4.30)
___**4.44.16** Place a pole (2) on the longitudinal centerline of the vehicle
___**4.44.17** Place a pole (4) at the centerline of the left front axle
___**4.44.18** Place a pole (3) halfway between pole (2) and pole (4)
___**4.44.19** Place a pole (5) that is located at the left front corner the outline
___**4.44.20** Place a pole (6) from pole (5) that is 1/4 the width of the vehicle
___**4.44.21** Place a pole (7) from pole (6) that is 1/4 the width of the vehicle
___**4.44.22** Place a pole (8) from pole (7) that is 1/4 the width of the vehicle
___**4.44.23** Place a pole (9) on the right front corner of the box
___**4.44.24** Place poles (10, 11, 12 ,13) on the right side of the vehicle
___**4.44.25** Measure and record the distances

TABLE 4.35: DIMENSION OF OV	
W	mm
L	mm
CW	mm

CHECKLIST 4.45 – PRE-TEST EXTERIOR PICTURES OF TEST VEHICLE

Reference **Error! Reference source not found.** as the following steps are completed.

___**4.45.1** Make sure the vehicle is in TVLC.
___**4.45.2** Place camera on a walking stick or tripod
___**4.45.3** Position the height of the camera at the height of the hood at the front axle
___**4.45.4** Record the height of the center of the camera lens. Camera Height (CH) _____
___**4.45.5** Take the following pictures that meet the specified field of view

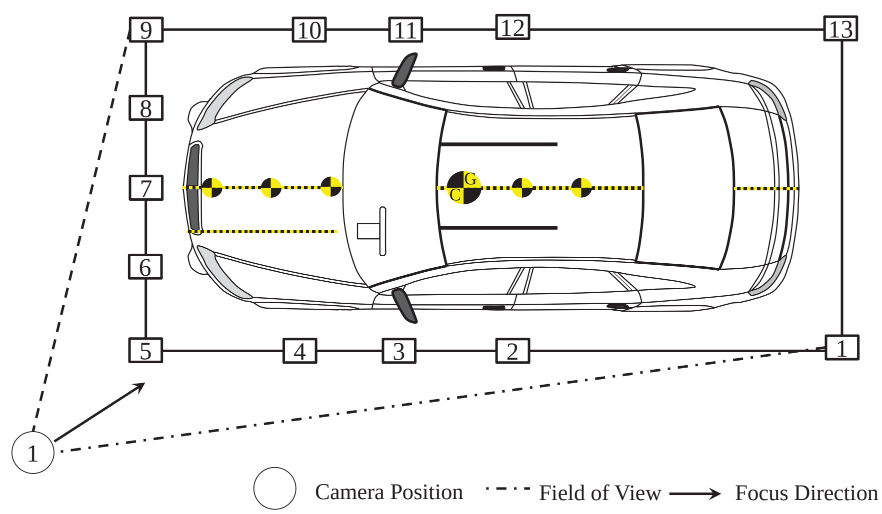
<table>
<tr><th></th><th colspan="2">TABLE 4.36: GENERAL EXTERIOR PICTURES WHILE AT TVLC</th></tr>
<tr><th>PICT LOC</th><th>DESCRIPTION (FIELD OF VIEW)</th><th>EXAMPLE PICTURE</th></tr>
<tr><td rowspan="2">1</td><td>Picture 4.42: Pre-Test Front Left Side Oblique
45) Start
(1) The height of the camera is at CH
(2) Move back from the left front corner at 45 degrees until the following field of view are met
(3) The left field of view is pole (9)
(4) The right field of view is pole (1)
(5) The top field of view is the top of the vehicle
(6) The bottom field of view is the ground</td><td></td></tr>
<tr><td colspan="2">
</td></tr>
<tr><td colspan="3"></td></tr>
</table>

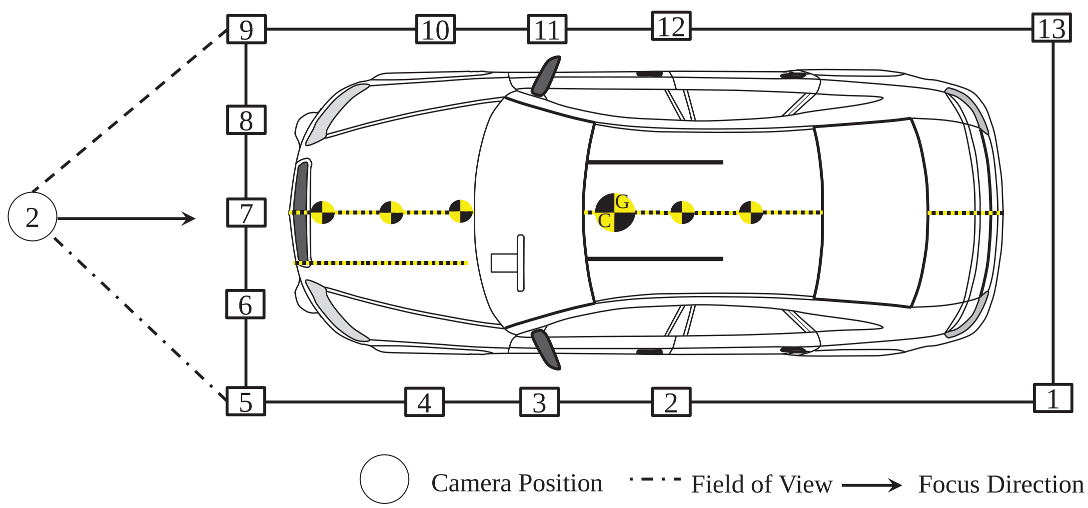
	TABLE 4.36: GENERAL EXTERIOR PICTURES WHILE AT TVLC	
PICT LOC	**DESCRIPTION (FIELD OF VIEW)**	**EXAMPLE PICTURE**
2	**Picture 4.43: Pre-Test Front View of Test Vehicle** 46) Start (1) The height of the camera is at CH (2) The lateral position of the camera is at pole (7) (3) Move back from the pole (7) at 0 degrees until the following field of view are met (4) The left field of view is pole (9) (5) The right field of view is pole (5) (6) The top field of view is the top of the vehicle (7) The bottom field of view is the ground	
		

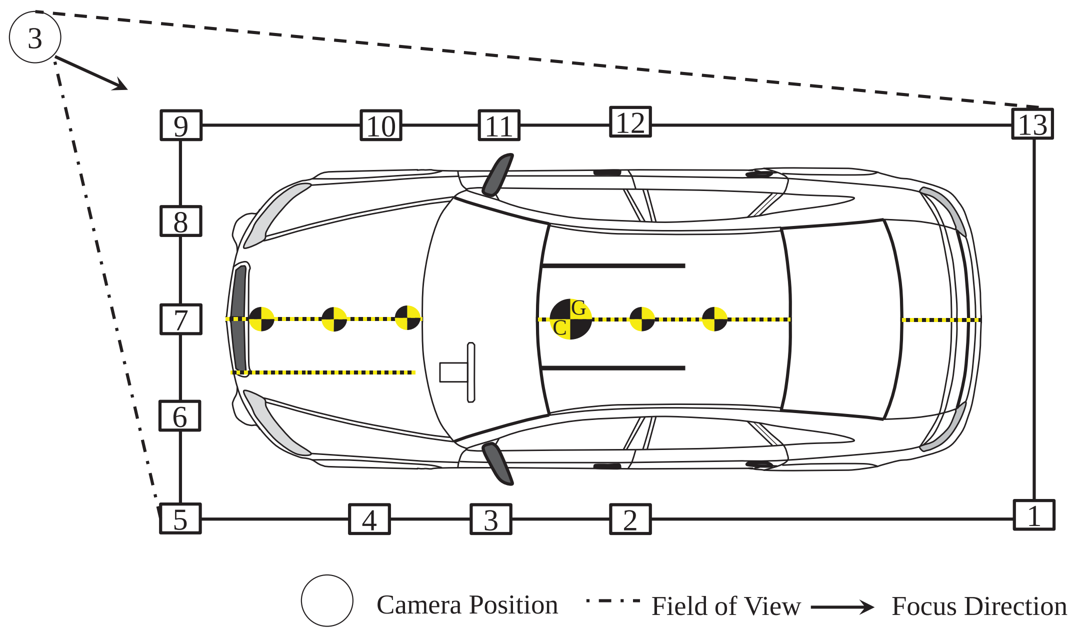
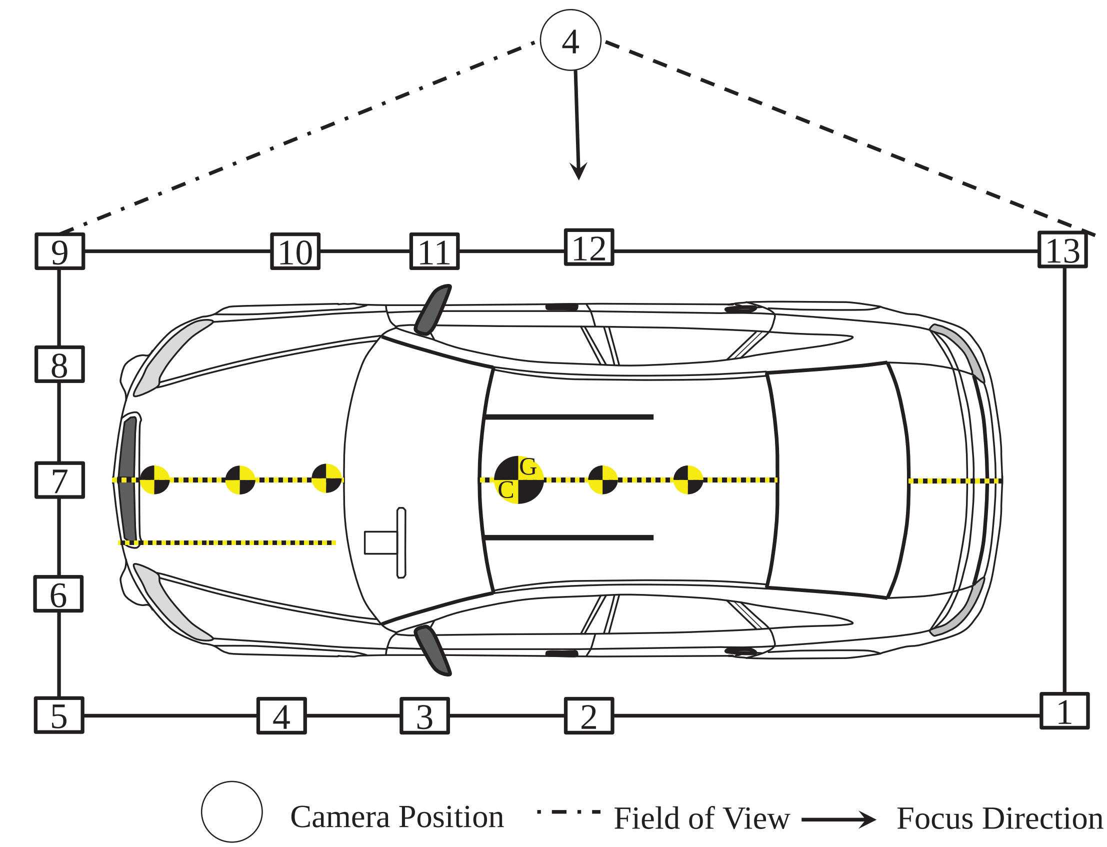
	TABLE 4.36: GENERAL EXTERIOR PICTURES WHILE AT TVLC	
PICT LOC	DESCRIPTION (FIELD OF VIEW)	EXAMPLE PICTURE
3	**Picture 4.44: Pre-Test Front Right Side Oblique** 47) Start (1) The height of the camera is at CH (2) Move back from the passenger side front corner at 45 degrees until the following field of view are met (3) The left field of view is pole (13) (4) The right field of view is pole (5) (5) The top field of view is the top of the vehicle (6) The bottom field of view is the ground	
		
4	**Picture 4.45**: **Pre-test perpendicular View of the Right Side of the Vehicle** 48) Start (1) The height of the camera is at CH (2) The camera is at a perpendicular orientation to the right side of the vehicle (3) The left field of view is pole (13) (4) The right field of view is pole (9) (5) The top field of view is the top of	

	TABLE 4.36: GENERAL EXTERIOR PICTURES WHILE AT TVLC	
PICT LOC	**DESCRIPTION (FIELD OF VIEW)**	**EXAMPLE PICTURE**
	the vehicle (6) The bottom field of view is the ground	



PICT LOC	DESCRIPTION (FIELD OF VIEW)	EXAMPLE PICTURE
5	**Picture 4.46: Pre-Test Rear Angled Passenger Side View of Test Vehicle** 49) Start (1) The height of the camera is at CH (2) Move back from the passenger side front corner at 45 degrees until the following field of view are met (3) The left field of view is the left pole (13) (4) The right field of view is pole (5) (5) The top field of view is the top of the vehicle (6) The bottom field of view is the ground	

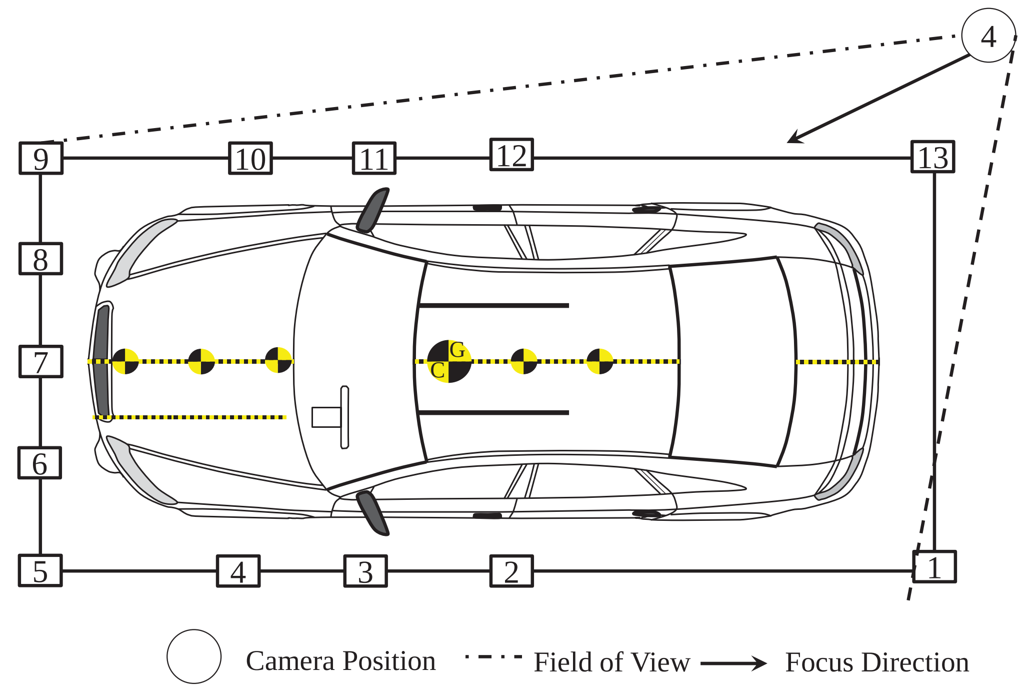
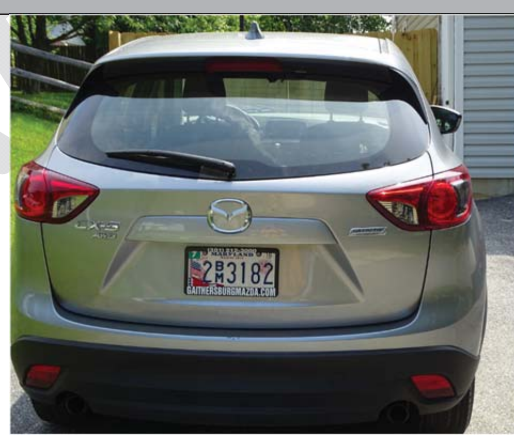
	TABLE 4.36: GENERAL EXTERIOR PICTURES WHILE AT TVLC	
PICT LOC	**DESCRIPTION (FIELD OF VIEW)**	**EXAMPLE PICTURE**
	 	
6	**Picture 4.47: Pre-Test Rear View of Test Vehicle** 50) Start (1) The height of the camera is at CH (2) The camera is at a perpendicular orientation to the rear of the vehicle (3) The left field of view is pole (1) (4) The right field of view is pole (13) (5) The top field of view is the top of the vehicle (6) The bottom field of view is the ground	

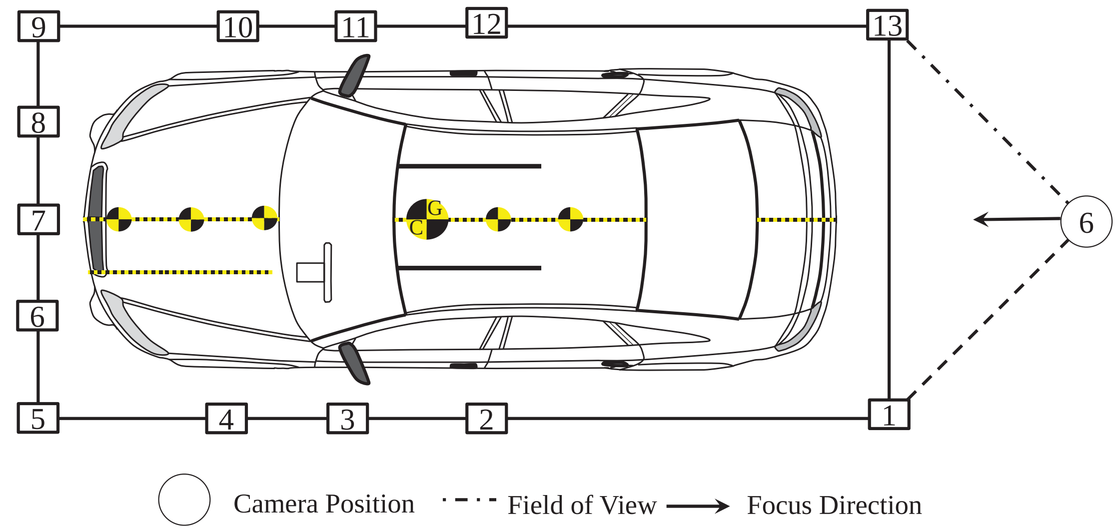
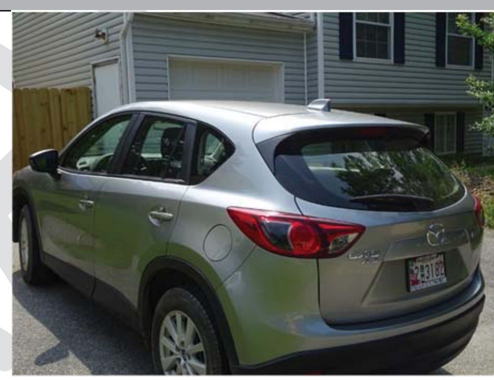
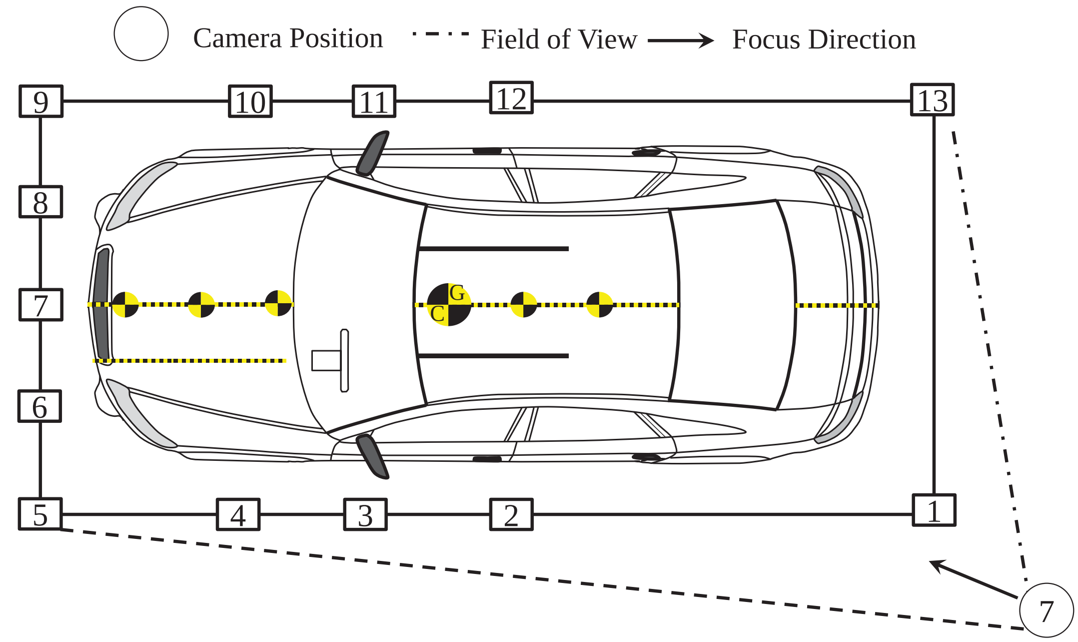
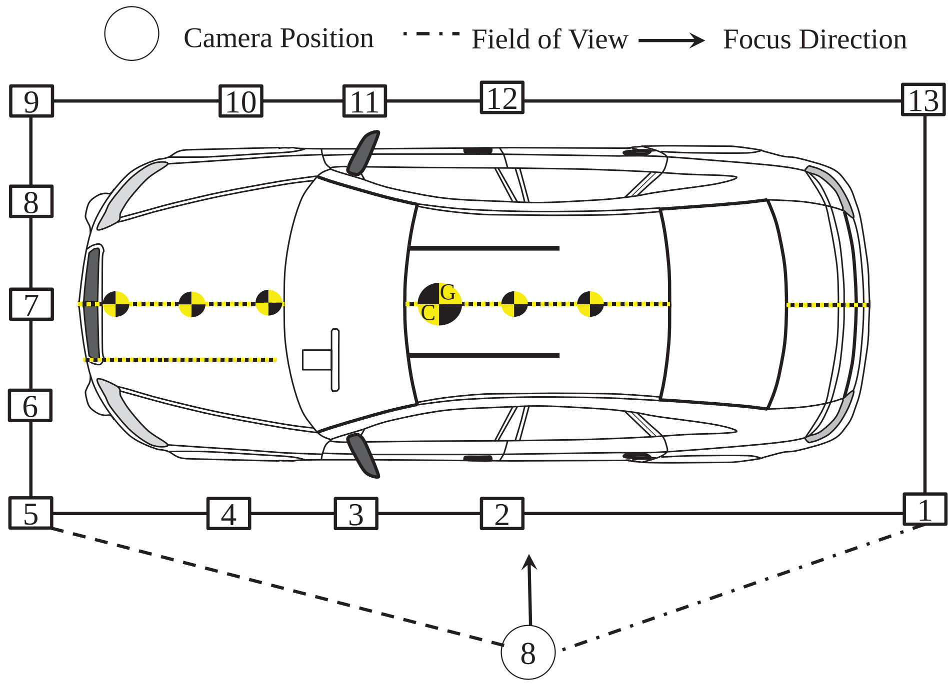
	TABLE 4.36: GENERAL EXTERIOR PICTURES WHILE AT TVLC	
PICT LOC	**DESCRIPTION (FIELD OF VIEW)**	**EXAMPLE PICTURE**
	 	
7	**Picture 4.48: Pre-Test Rear Angled Left Side View of Test Vehicle** 51) Start (1) The height of the camera is at CH (2) Move back from the driver side rear corner at 45 degrees until the following field of view are met (3) The left field of view is the left pole (5) (4) The right field of view is pole (13) (5) The top field of view is the top of the vehicle (6) The bottom field of view is the ground	

	TABLE 4.36: GENERAL EXTERIOR PICTURES WHILE AT TVLC	
PICT LOC	**DESCRIPTION (FIELD OF VIEW)**	**EXAMPLE PICTURE**
		
8	**Picture 4.49**: **Perpendicular View of the Left Side of the Vehicle** 52) Start (1) The height of the camera is at CH (2) The camera is at a perpendicular orientation to the left side of the vehicle (3) The left field of view is pole (5) (4) The right field of view is pole (1) (5) The top field of view is the top of the vehicle (6) The bottom field of view is the ground	

<table>
<tr><th></th><th colspan="2">TABLE 4.36: GENERAL EXTERIOR PICTURES WHILE AT TVLC</th></tr>
<tr><th>PICT LOC</th><th>DESCRIPTION (FIELD OF VIEW)</th><th>EXAMPLE PICTURE</th></tr>
<tr><td></td><td colspan="2">
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</table>

CHECKLIST 4.46 – PRE-TEST PICTURES WITH FASCIA AND PLASTIC REMOVED FROM WHEEL WELL

Reference **Error! Reference source not found.** as the following steps are completed.

___**4.46.1** Ensure the vehicle is in the TVLC
___**4.46.2** Remove front fascia to expose bumper beam
___**4.46.3** Remove the front tires
___**4.46.4** Remove plastic parts from wheel well
___**4.46.5** Take pictures as specified in Table 4.37

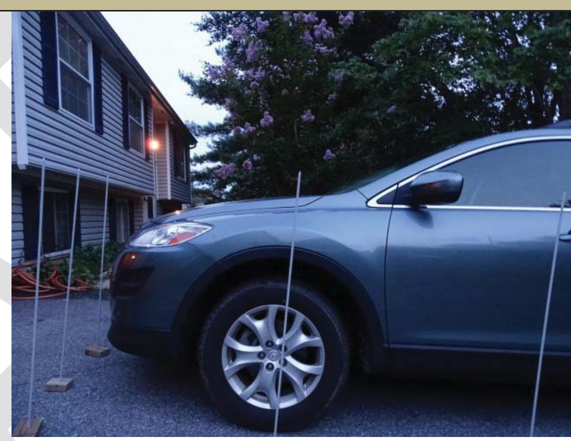
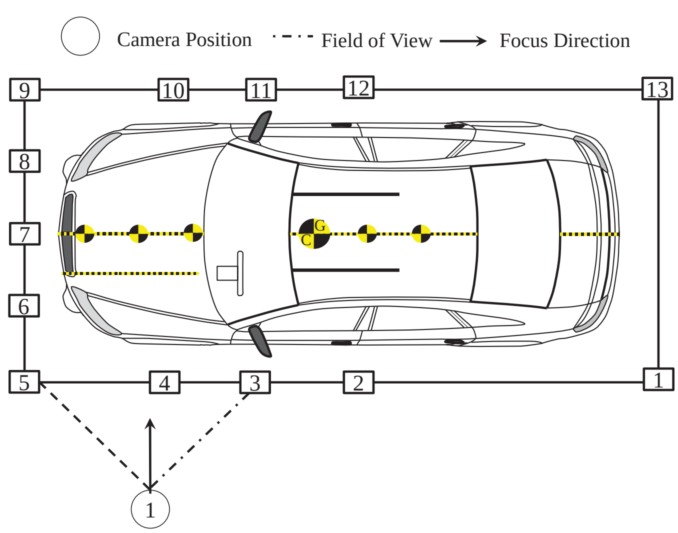
	TABLE 4.37: EXTERIOR PICTURES WITH FACIA REMOVEDWHILE AT TVLC	
CAM POS	**DESCRIPTION (FIELD OF VIEW)**	**EXAMPLE PICTURE**
1	**Picture 4.50**: **Pre-Test Left Front Perpendicular View of Test Vehicle** 53) Start (1) The height of the camera is at CH (2) The camera of is perpendicular to the side of the vehicle and place at the center of the tire (3) The left field of view is at pole (5) (4) The right field of view is at pole (3) (5) The top of field of view is the top of the vehicle (6) The bottom of the field of view is the ground	
		
2	**Picture 4.51: Pre-Test Angled View of Front Left corner 1**	

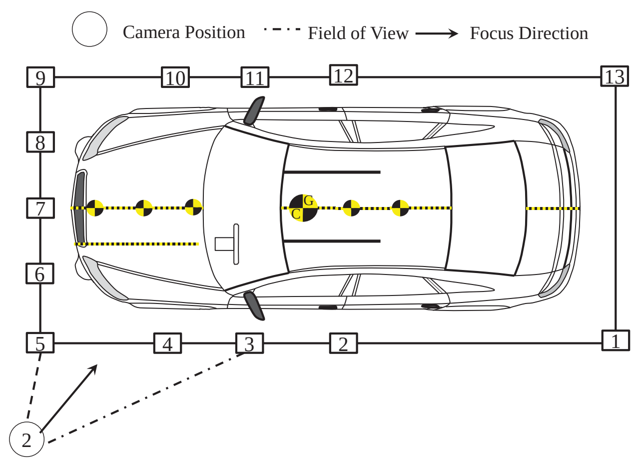
	TABLE 4.37: EXTERIOR PICTURES WITH FACIA REMOVEDWHILE AT TVLC	
CAM POS	**DESCRIPTION (FIELD OF VIEW)**	**EXAMPLE PICTURE**
	54) Start (1) The height of the camera is at CH (2) The left field of view is at pole (5) (3) The right side field of view is at pole (3) (4) Focus direction is toward the front of the front tire (5) The top of field of view is the top of the vehicle (6) The bottom of the field of view is the ground	
		
3	**Picture 4.52: Pre-Test Angled View of Front Left corner 2** 55) Start (1) The height of the camera is at CH (2) The left field of view is at pole (7) (3) The right field of view is at pole (3) (4) The focus direction is toward the front corner (5) The top of field of view is the top of the vehicle (6) The bottom of the field of view is the ground	

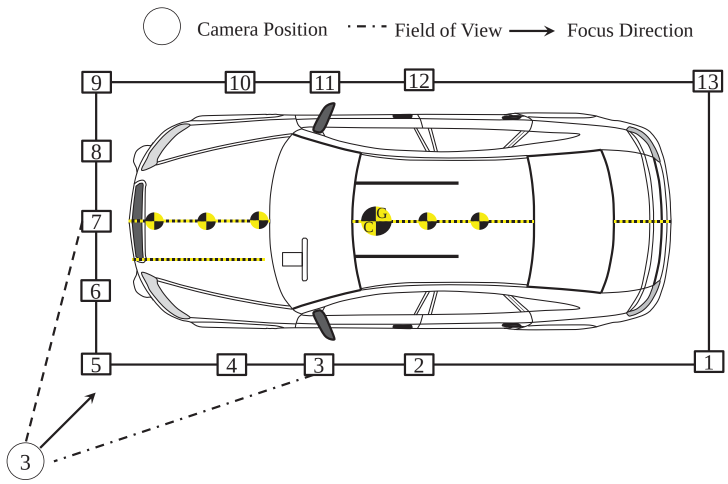
	TABLE 4.37: EXTERIOR PICTURES WITH FACIA REMOVEDWHILE AT TVLC	
CAM POS	**DESCRIPTION (FIELD OF VIEW)**	**EXAMPLE PICTURE**
		
4	**Picture 4.53: Pre-Test Angled View of Front Left corner 3** 56) Start (1) The height of the camera is at CH (2) Move back from the left front corner at 45 degrees until the following field of view are met (3) The left field of view is at pole (8) (4) The right field of view is at pole (4) (5) The focus direction is toward the front corner (6) The top of field of view is the top of the vehicle (7) The bottom of the field of view is the ground	

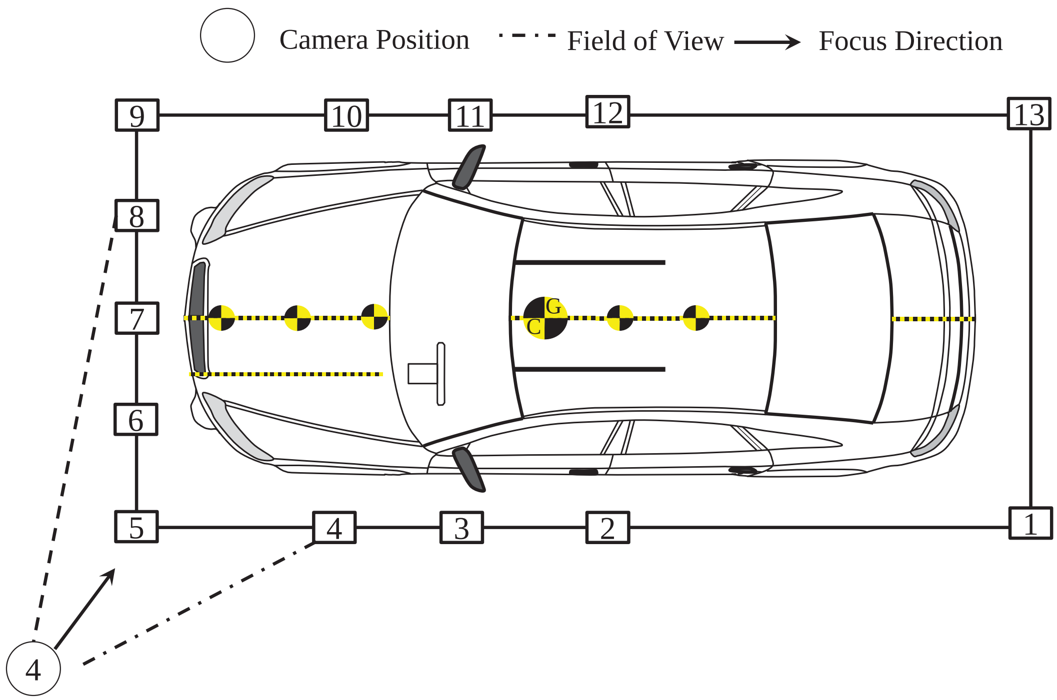
	TABLE 4.37: EXTERIOR PICTURES WITH FACIA REMOVEDWHILE AT TVLC	
CAM POS	**DESCRIPTION (FIELD OF VIEW)**	**EXAMPLE PICTURE**
		
5	**Picture 4.54: Pre-Test Angled View of Front Left corner 4** 57) Start (1) The height of the camera is at CH (2) Move back from the left front corner at 45 degrees until the following field of view are met (3) The left field of view is at pole (6) (4) The right field of view is at pole (4) (5) The focus direction is toward the front corner (6) The top of field of view is the top of the vehicle (7) The bottom of the field of view is the ground	

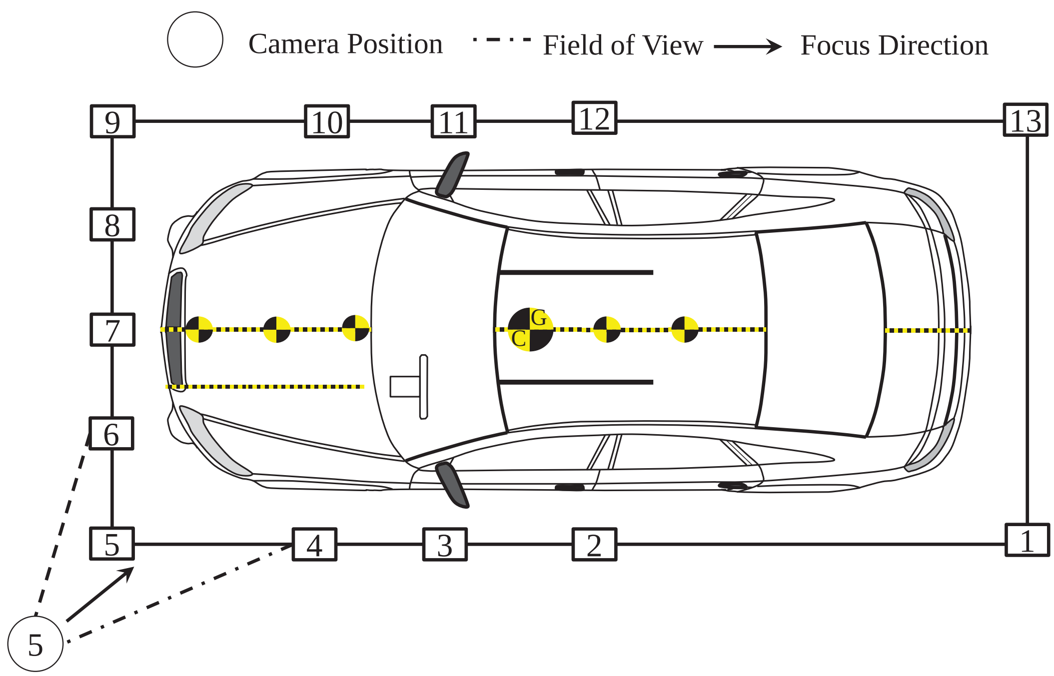
	TABLE 4.37: EXTERIOR PICTURES WITH FACIA REMOVEDWHILE AT TVLC	
CAM POS	**DESCRIPTION (FIELD OF VIEW)**	**EXAMPLE PICTURE**
	 	
6	**Picture 4.55: Pre-Test of Front Left corner view** 58) Start (1) The height of the camera is at CH (2) Move straight back frome the front of the vehicle until the following field of view are met (3) The left field of view is at pole (6) (4) The right field of view is at pole (5) (5) The focus direction is perpendicular to the front of the vehicle (6) The top of field of view is the top of the vehicle (7) The bottom of the field of view is the ground	

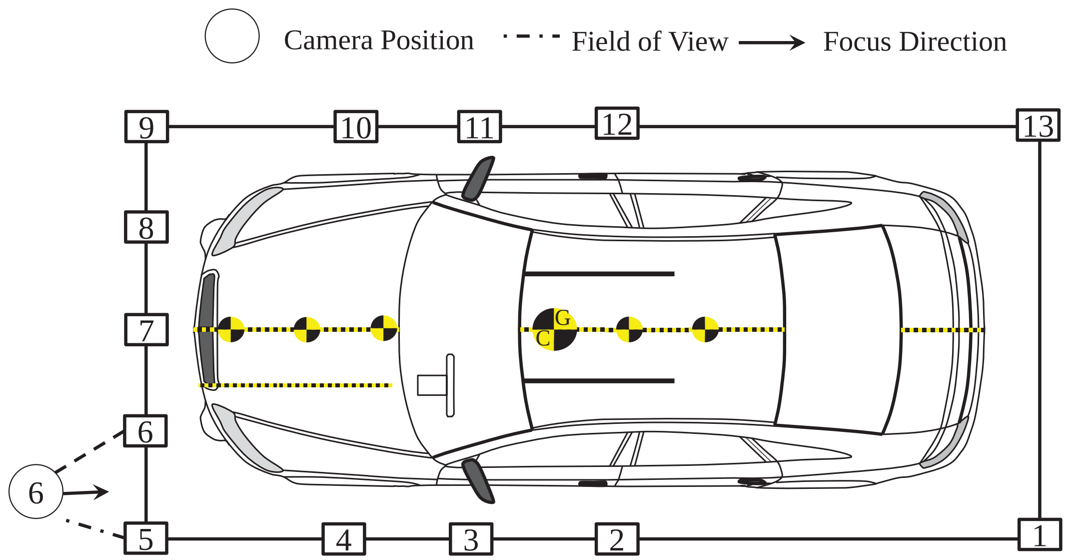
	TABLE 4.37: EXTERIOR PICTURES WITH FACIA REMOVEDWHILE AT TVLC	
CAM POS	**DESCRIPTION (FIELD OF VIEW)**	**EXAMPLE PICTURE**
		
7	**Picture 4.56: Pre-Test Left Front 1/2 View of Test Vehicle** 59) Start (1) The height of the camera is at CH (2) The lateral position of the camera is at pole (6) (3) Move back from the pole (6) at 0 degrees until the following field of view are met (4) The left field of view is pole (7) (5) The right field of view is pole (5) (6) The focus direction parallel to the longitudinal axis of the vehicle (7) The top of field of view is the top of the vehicle (8) The bottom of the field of view is the ground	

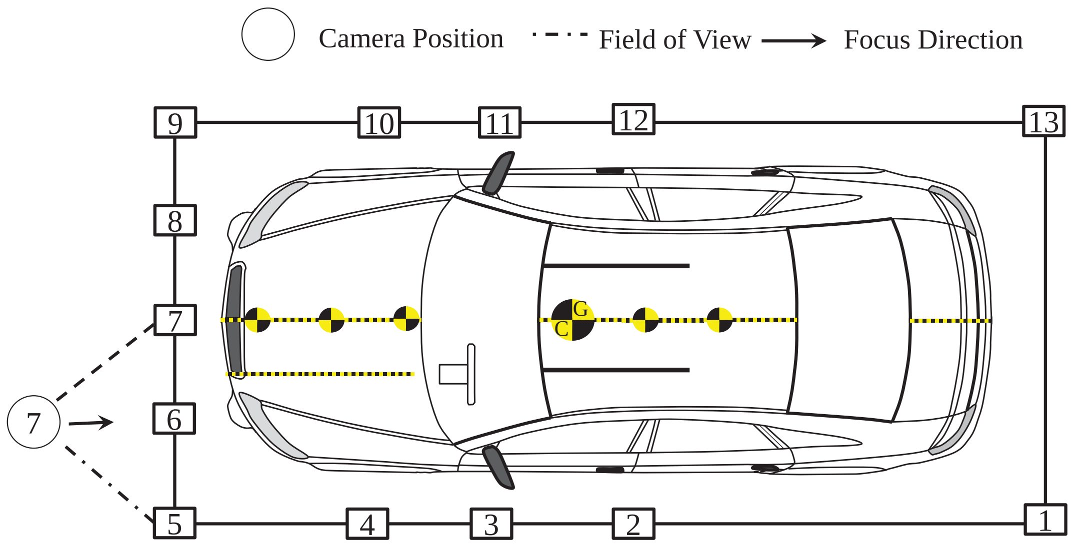
	TABLE 4.37: EXTERIOR PICTURES WITH FACIA REMOVEDWHILE AT TVLC	
CAM POS	DESCRIPTION (FIELD OF VIEW)	EXAMPLE PICTURE
		
8	**Picture 4.57: Pre-Test Front View of Test Vehicle** 60) Start (1) The height of the camera is at CH (2) The lateral position of the camera is at pole (7) (3) Move back from the pole (7) at 0 degrees until the following field of view are met (4) The left field of view is the pole (9) (5) The right field of view is pole (5) (6) The focus direction parallel to the longitudinal axis of the vehicle (7) The top of field of view is the top of the vehicle (8) The bottom of the field of view is the ground	

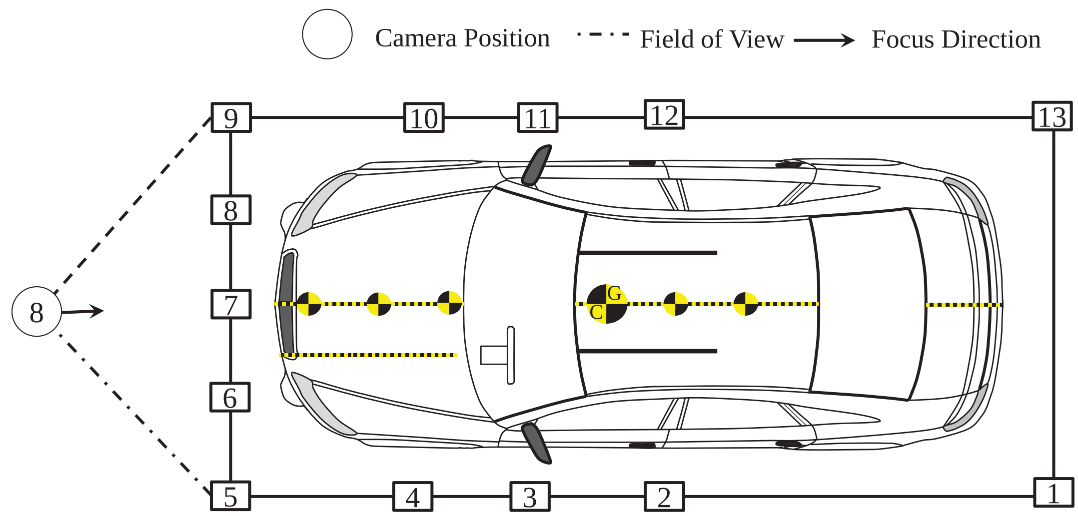
	TABLE 4.37: EXTERIOR PICTURES WITH FACIA REMOVEDWHILE AT TVLC	
CAM POS	**DESCRIPTION (FIELD OF VIEW)**	**EXAMPLE PICTURE**
		
9	**Picture 4.58: Pre-Test Right Front 1/2 View of Test Vehicle** 61) Start (1) The height of the camera is at CH (2) The lateral position of the camera is at pole (6) (3) Move back from the pole (9) at 0 degrees until the following field of view are met (4) The left field of view is pole (9) (5) The right field of view is pole (7) (6) The focus direction parallel to the longitudinal axis of the vehicle (7) The top of field of view is the top of the vehicle (8) The bottom of the field of view is the ground	

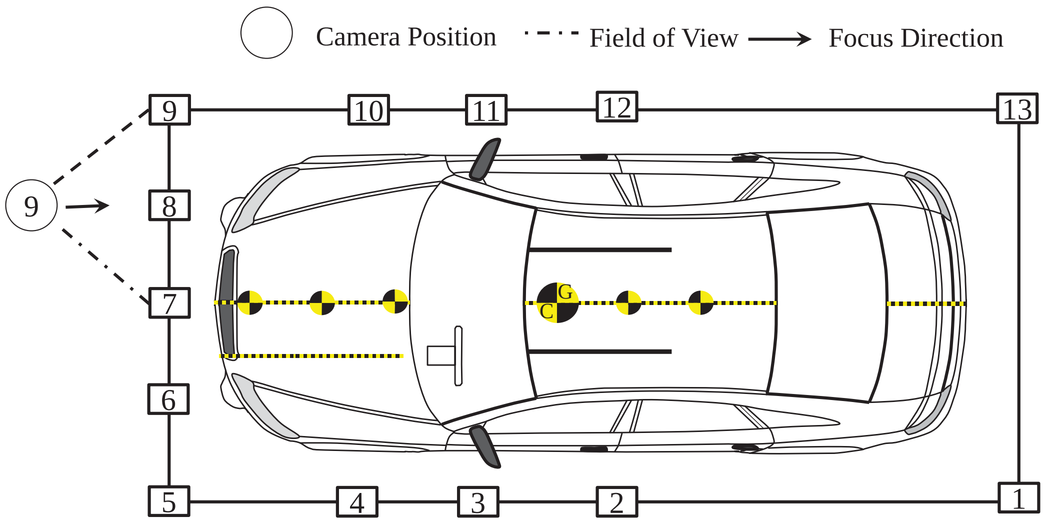
	TABLE 4.37: EXTERIOR PICTURES WITH FACIA REMOVEDWHILE AT TVLC	
CAM POS	**DESCRIPTION (FIELD OF VIEW)**	**EXAMPLE PICTURE**
		
10	**Picture 4.59: Pre-Test of Front Right corner view** 62) Start (1) The height of the camera is at CH (2) Move straight back frome the front of the vehicle until the following field of view are met (3) The left field of view is at pole (9) (4) The right field of view is at pole (8) (5) The focus direction is perpendicular to the front of the vehicle (6) The top of field of view is the top of the vehicle (7) The bottom of the field of view is the ground	

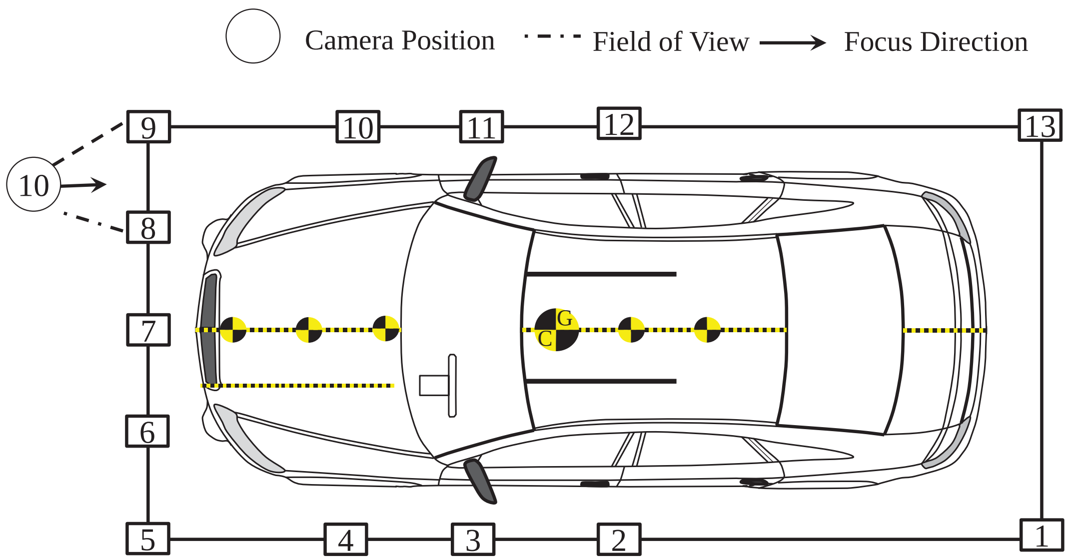
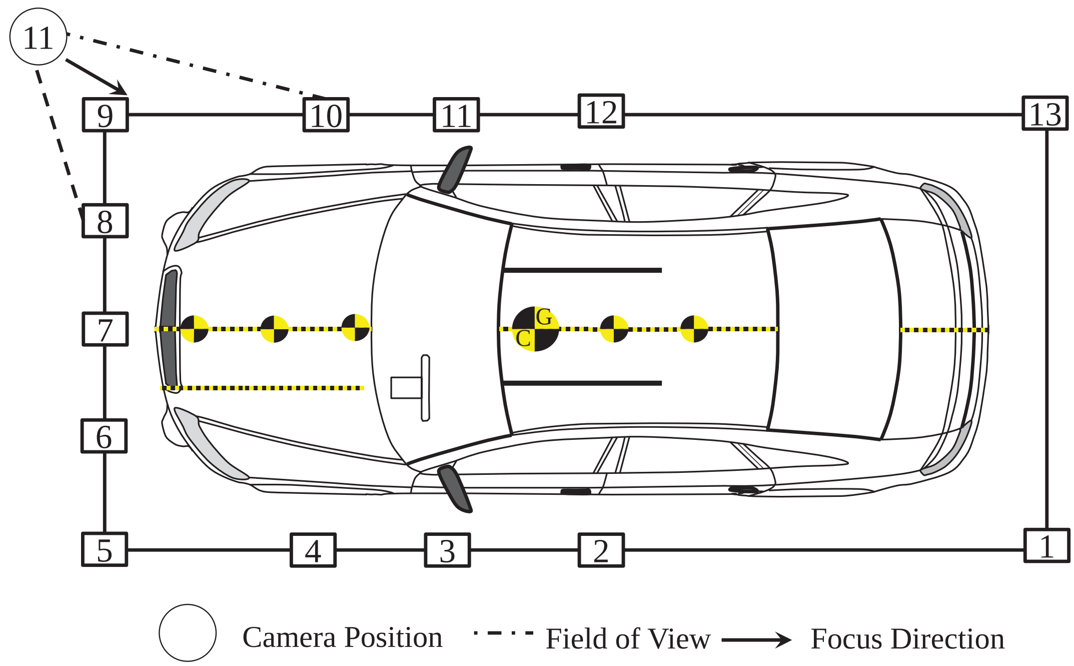
	TABLE 4.37: EXTERIOR PICTURES WITH FACIA REMOVEDWHILE AT TVLC	
CAM POS	DESCRIPTION (FIELD OF VIEW)	EXAMPLE PICTURE
		
11	**Picture 4.60: Pre-Test Angled View of Front Right corner 1** 63) Start (1) The height of the camera is at CH (2) Move back from the left front corner at 45 degrees until the following field of view are met (3) The left field of view is at pole (10) (4) The right field of view is at pole (8) (5) The focus direction is toward the front corner (6) The top of field of view is the top of the vehicle (7) The bottom of the field of view is the ground	

	TABLE 4.37: EXTERIOR PICTURES WITH FACIA REMOVEDWHILE AT TVLC	
CAM POS	**DESCRIPTION (FIELD OF VIEW)**	**EXAMPLE PICTURE**
		
12	**Picture 4.61: Pre-Test Angled View of Front Left corner 2** 64) Start (1) The height of the camera is at CH (2) Move back from the left front corner at 45 degrees until the following field of view are met (3) The left field of view is at pole (10) (4) The right field of view is at pole (6) (5) The focus direction is toward the front corner (6) The top of field of view is the top of the vehicle (7) The bottom of the field of view is the ground	

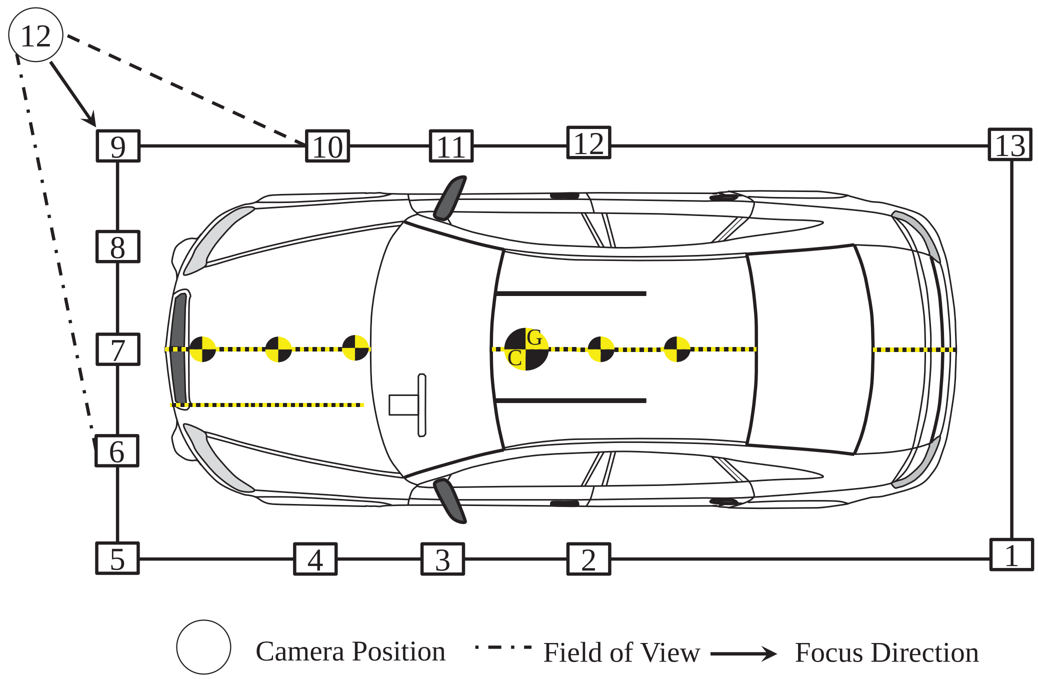
<table>
<tr><th></th><th colspan="2">TABLE 4.37: EXTERIOR PICTURES WITH FACIA REMOVEDWHILE AT TVLC</th></tr>
<tr><th>CAM POS</th><th>DESCRIPTION (FIELD OF VIEW)</th><th>EXAMPLE PICTURE</th></tr>
<tr><td></td><td colspan="2">
</td></tr>
<tr><td colspan="3"></td></tr>
<tr><td>13</td><td>Picture 4.62: Pre-Test Angled View of Front Left corner 3
65) Start
(1) The height of the camera is at CH
(2) The left field of view is at pole (11)
(3) The right field of view is at pole (6)
(4) The focus direction is toward the front corner
(5) The top of field of view is the top of the vehicle
(6) The bottom of the field of view is the ground</td><td></td></tr>
</table>

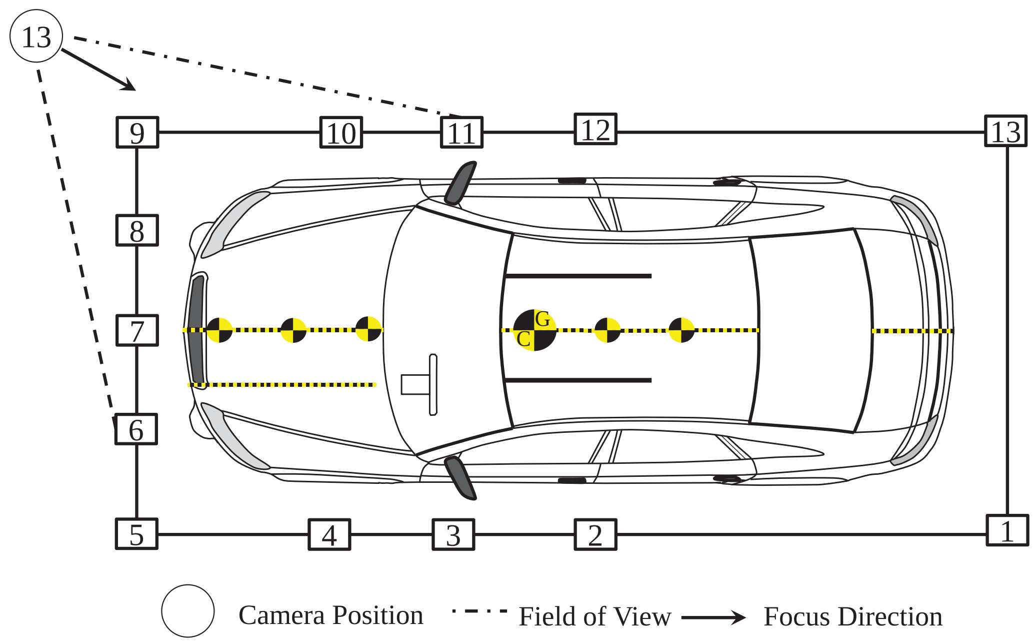
	TABLE 4.37: EXTERIOR PICTURES WITH FACIA REMOVEDWHILE AT TVLC	
CAM POS	**DESCRIPTION (FIELD OF VIEW)**	**EXAMPLE PICTURE**
		
14	**Picture 4.63: Pre-Test Angled View of Front Left corner 4** 66) Start (1) The height of the camera is at CH (2) The left field of view is at pole (11) (3) The right side field of view is at pole (9) (4) Focus direction is toward the front of the front tire (5) The top of field of view is the top of the vehicle (6) The bottom of the field of view is the ground	

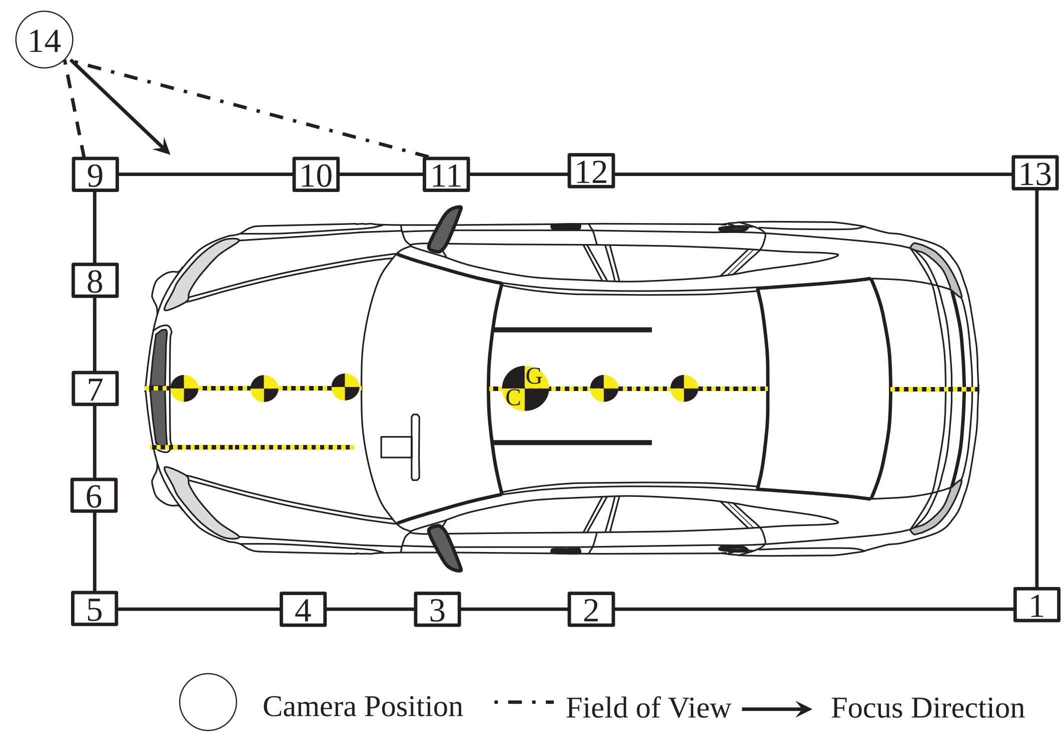
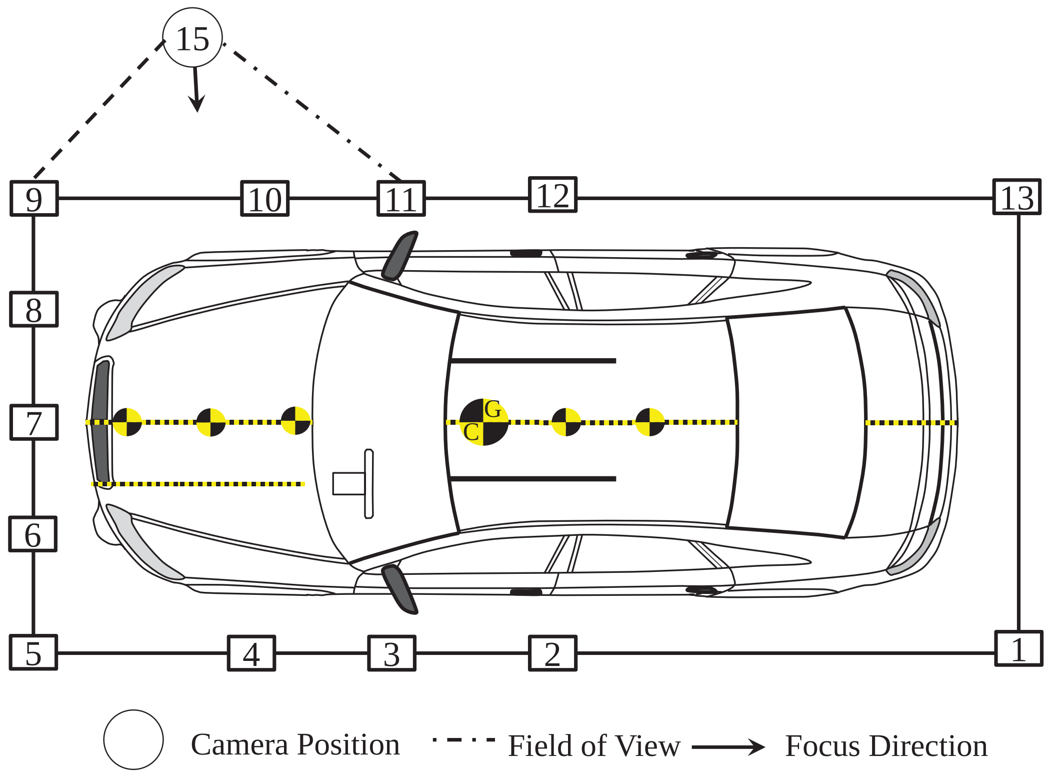
	TABLE 4.37: EXTERIOR PICTURES WITH FACIA REMOVEDWHILE AT TVLC	
CAM POS	DESCRIPTION (FIELD OF VIEW)	EXAMPLE PICTURE
		
15	**Picture 4.64**: **Pre-Test Right Front Perpendicular View of Test Vehicle** 67) Start (1) The height of the camera is at CH (2) The camera of is perpendicular to the side of the vehicle and place at the center of the tire (3) The left field of view is at pole (11) (4) The right field of view is at pole (9) (5) The top of field of view is the top of the vehicle (6) The bottom of the field of view is the ground	

	TABLE 4.37: EXTERIOR PICTURES WITH FACIA REMOVEDWHILE AT TVLC	
CAM POS	**DESCRIPTION (FIELD OF VIEW)**	**EXAMPLE PICTURE**
		

CHECKLIST 4.47 - OVERHEAD PICTURES

___**4.47.1** Ensure the vehicle is in the TVLC
___**4.47.2** Remove front fascia to expose bumper beam
___**4.47.3** Open hood
___**4.47.4** Take pictures as specified in Table 4.38

TABLE 4.38	
DESCRIPTION (FIELD OF VIEW)	**EXAMPLE PICTURE**
Picture 4.65: Pre-Test Engine Compartment View 68) Start … (1) Place camera at the centerline of the vehicle (2) Place the camera height is at the front of the hood (3) The top field of view is the intersection of the front windshield and engine compartment (4) The bottom field of view is the hood latch (5) The left field of view is the left side of the vehicle (6) The right field of view is the right side of the vehicle	

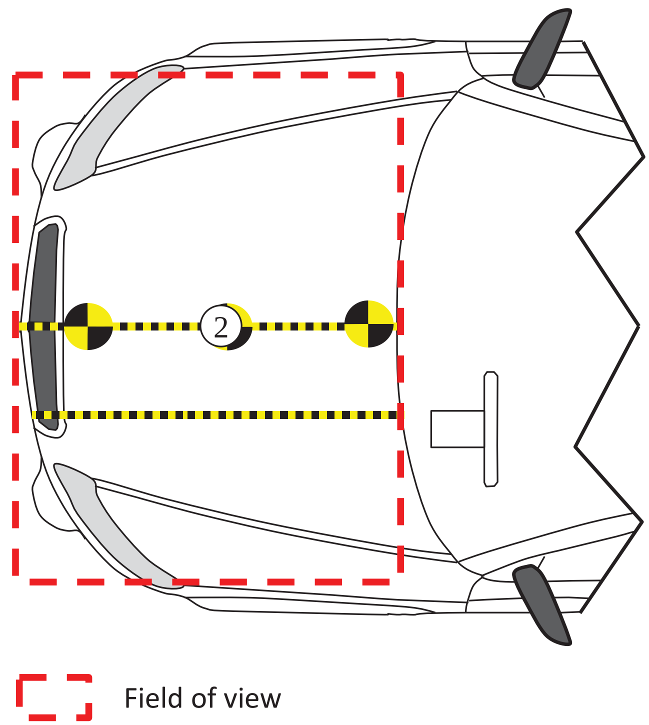
Picture 4.66: Overall perpendicular view of engine compartment

69) Start …

(1) Place camera at the centerline of the vehicle

(2) Move the camera back along hood to get a close as possible to being perpendicular the engine compartment and meets the following field of view

- (i) The top field of view is the intersection of the front windshield and engine compartment
- (ii) The bottom field of view is the hood latch
- (iii) The left field of view is the center of the left shotgeun
- (iv) The right field of view is the center of the right shotgun



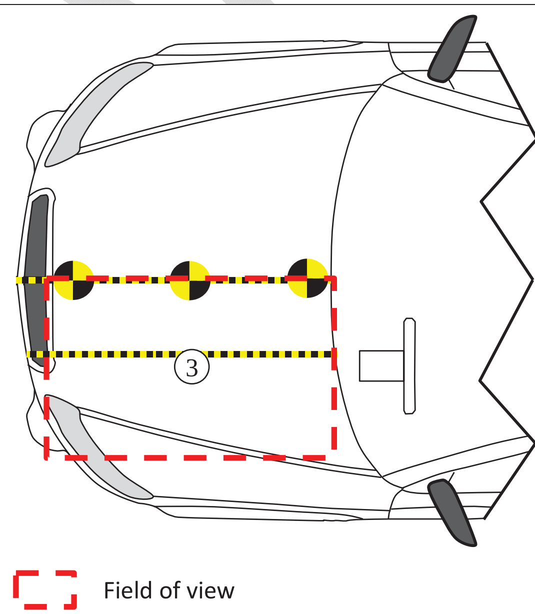
Picture 4.67: Rightside perpendicular view of engine compartment

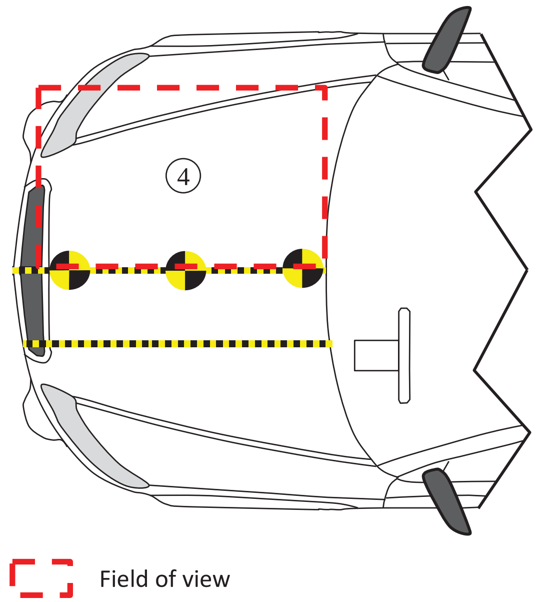
70) Start …

(1) Place camera halfway between the centerline of the vehicle in the inside of the shootgun

(2) Move the camera back along hood to get a close as possible to being perpendicular to the engine compartment and that meets the following field of view

- (i) The top field of view is the intersection of the front windshield and engine compartment
- (ii) The bottom field of view is the hood latch
- (iii) The left field of view is the center of the left shotgeun
- (iv) The right field of view is the center of the right

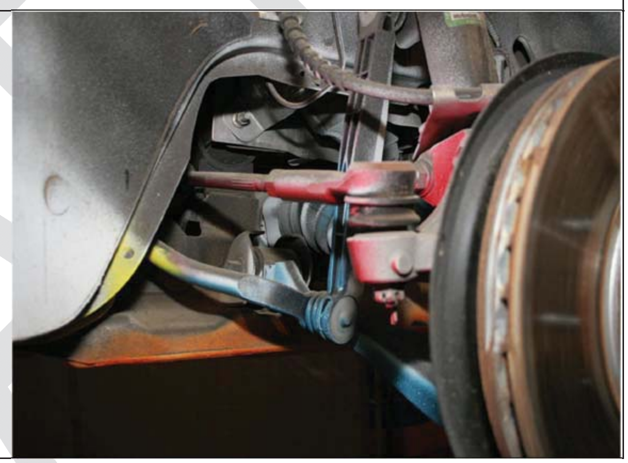


shotgun	
Picture 4.68: Rightside perpendicular view of engine compartment 71) Start … (1) Place camera halfway between the centerline of the vehicle in the inside of the right shootgun (2) Move the camera back along hood to get a close as possible to being perpendicular to the engine compartment and that meets the following field of view (i) The top field of view is the intersection of the front windshield and engine compartment (ii) The bottom field of view is the hood latch (iii) The left field of view is the center of the left shotgeun (iv) The right field of view is the center of the right shotgun	

CHECKLIST 4.48 – WHEEL WELL PICTURES

___4.48.1 Ensure the vehicle is in the TVLC
___4.48.2 Take the following pictures of the wheel well as specified in Table 4.39
___4.48.3 Install all parts removed from the vehicle after taking the following pictures

TABLE 4.39: WHEEL WELL PICTURES WITH FACIA AND WHEEL WELL PLASTIC REMOVED WHILE AT TVLC		
CAM POS	DESCRIPTION (FIELD OF VIEW)	EXAMPLE PICTURE
	Picture 4.69: Front Angled View of Wheel Well with Tire Removed	
	Picture 4.70: Perpendicular View of Wheel Well with Tire Removed	
	Picture 4.71: Rear Angled View of Wheel Well with Tire Removed	

TABLE 4.39: WHEEL WELL PICTURES WITH FACIA AND WHEEL WELL PLASTIC REMOVED WHILE AT TVLC		
CAM POS	**DESCRIPTION (FIELD OF VIEW)**	**EXAMPLE PICTURE**
	Picture 4.72: Pre-Test Driver Close up View of Suspension w/ Tire Removed	
	Picture 4.73: Pre-Test Right Side Tie Rod and Sway Bar Attachments Points	

CHECKLIST 4.49 - ONBOARD CAMERA'S DESCRIPTION

Reference Figure 4.31 as the following steps are completed

___**4.49.1** Set-up cameras as depicted in the below illustrations. A detailed description of each camera's required field of view is included at the end of this data sheet.
___**4.49.2** Ensure the NHTSA Number is in the field view and readable at time zero for each camera
___**4.49.3** Record the X, Y, Z, locations of the cameras relative to the VCS.
___**4.49.4** Record the camera's lens and speed below

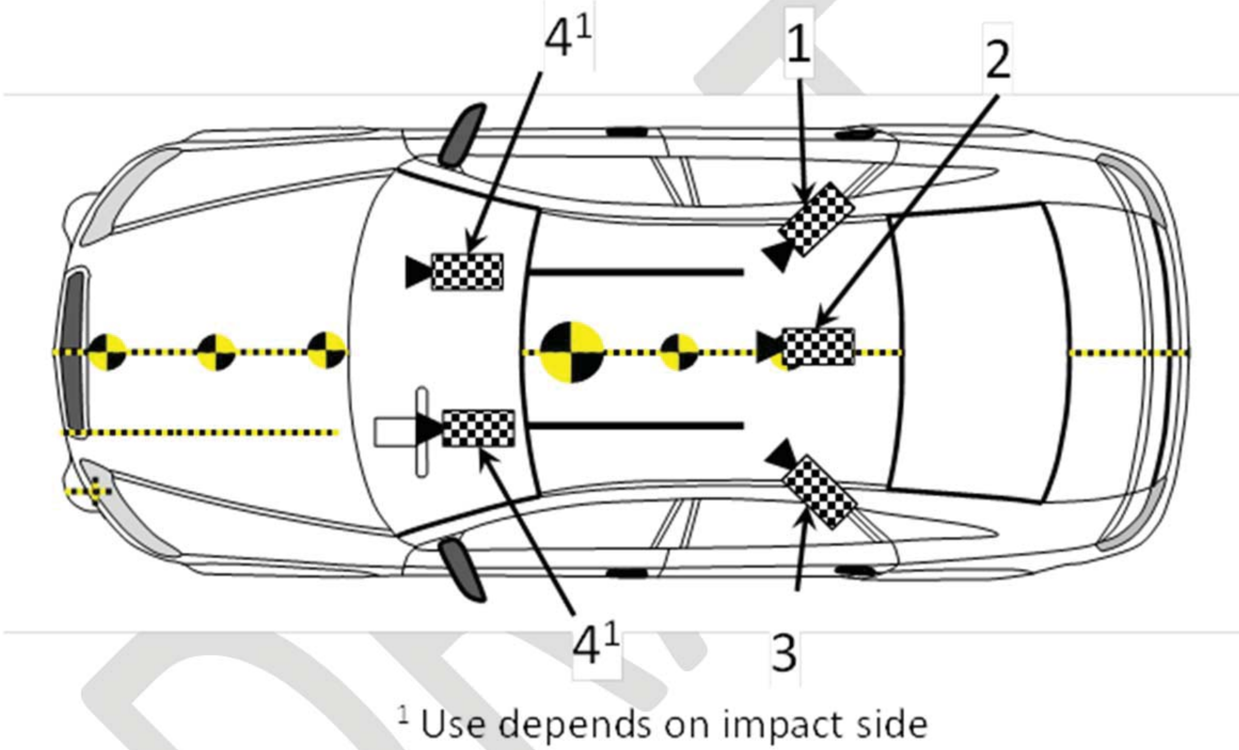


Figure 4.31: Onboard Camera Position

TABLE 4.40	
CAMERA NAME / SPECIFICATIONS	**EXAMPLE FIELD OF VIEW**

TABLE 4.40	
Camera 4.1: Onboard Driver Over Shoulder High speed onboard camera to document the driver's movement during the test. 72) Start … (1) The minimum camera height is THOR's Head CG (2) The left side field of view shall start at the center of the vehicle's left B pillar. (3) The top field of view shall start at the intersection of the front header at the centerline of the vehicle. (4) The right side field of view shall start at the center of the instrument panel. (5) The bottom field of view shall include the left side dummy's right thigh and knee. (6) The top of the left side dummies head and center of the instrument panel is in the field of view at impact.	
Camera 4.2: **Onboard Center Driver Passenger** High speed onboard camera to document both the front driver's and passenger's movement during the test. 73) Start … (1) The minimum camera height is THOR's Head CG (2) The field of view shall encompass from the right side of the passenger's head to the driver's side B pillar. .	

TABLE 4.40	
Camera 4.3: **Onboard Passenger Over Shoulder** High speed onboard camera to document the right front passenger's movement during the test. 74) Start … (1) The minimum camera height is THOR's Head CG (2) The left side field of view shall start at the center of the instrument panel. (3) The top field of view shall start at the intersection of the front header at the centerline of the vehicle. (4) The right side field of view shall start at the center of the vehicle's right B pillar. (5) The bottom field of view shall cover the right side dummy's left thigh and knee. (6) The top of the right side dummy's head and center of the instrument panel is in the field of view at impact.	
Camera 4.4: **Onboard Lower Leg** High speed onboard camera to document the occupant lower leg movement. Placement depends on the test configuration. 75) Start … (1) This camera is mounted under the driver's seat near the centerline of the seat. (2) The camera shall have a horizontal field of view from the outer side wall of the floor pan to the side of the center tunnel just in front of the seat. (3) The vertical field of view is from the floor pan to at least ¾ up the dummy's tibia's skin. (4) The Contractor shall ensure that as the legs and floor pan move back towards the camera that the field of view requirements are still meet.	

CHECKLIST 4.50 - FMVSS 212 WINDSHIELD MOUNTING – INDICANT MEASUREMENTS

Most vehicle windshields are either bonded in place and covered with chrome or plastic strips or they are held to the body by a rubber retainer. It is difficult to determine the exact periphery of the windshield because the glazing edge is hidden from view. The test engineer will measure the perimeter inside the retainer or molding at several locations. After the impact test the covering over the glazing edge may be removed for exact measurement of the windshield periphery. Do not disturb the molding or retainer in the event of test failure.

___**4.50.1** Describe from visual inspection how the windshield is mounted and describe any trim material:

____
____
____
____
____

___**4.50.2** Measure from the edge of the retainer or molding to the edge of the windshield. Dimension G = _____mm

___**4.50.3** Apply 25 mm wide checkerboard tape on the windshield so that its outboard edge follows the entire periphery.

___**4.50.4** Mark the longitudinal centerline of the windshield.

___**4.50.5** Measure pre-crash dimensions A, B, and C along the periphery for the right side and record in the table below.

___**4.50.6** Measure pre-crash dimensions D, E, and F along the periphery for the left side and record in the table below.

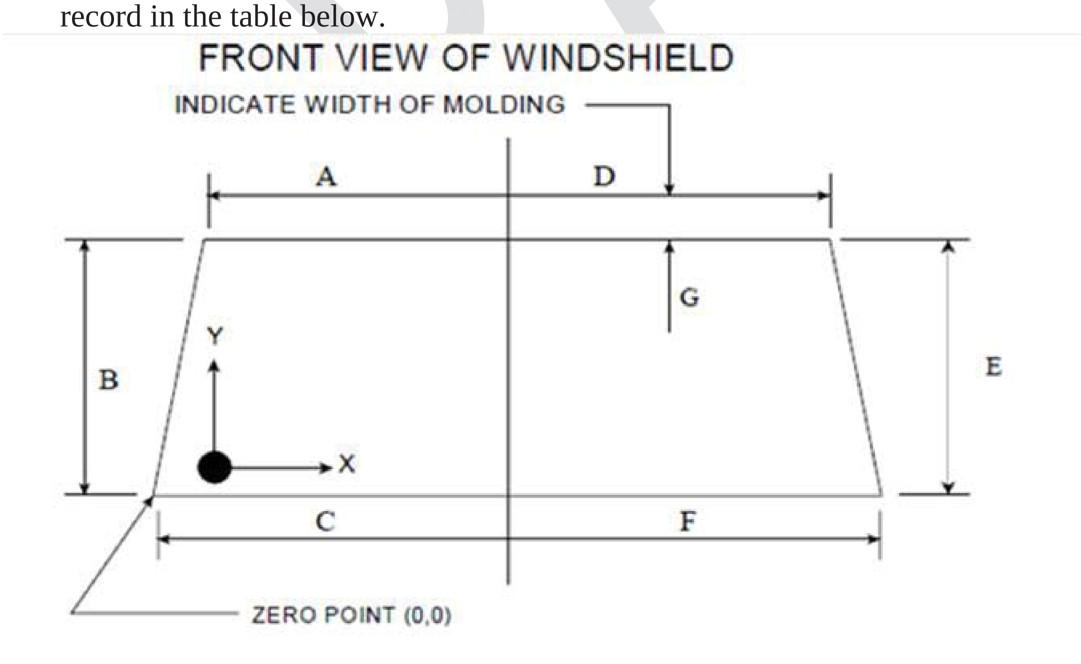


Figure 4.32: Windshield Mounting Measurement

TABLE 4.41: WINDSHIELD PERIPHERY MEASUREMENTS		
MEASUREMENT	**DIMENSION**	**PRE-TEST (MM)**
Right Side (Passenger)	A	
	B	
	C	
	Total	
Left Side (Driver)	D	
	E	
	F	
	Total	

CHECKLIST 4.51 - FMVSS 219 WINDSHIELD ZONE INTRUSION (PARTIAL) – INDICANT MEASUREMENTS

___**4.51.1** Place a 165 mm diameter rigid sphere, with a mass of 6.8 kg on the instrument panel so that it is simultaneously touching the instrument panel and the windshield.

___**4.51.2** Roll the sphere from one side of the windshield to the other while marking on the windshield where the sphere contacts the windshield.

___**4.51.3** From the outermost contactable points on the windshield draw a horizontal line to the edges of the windshield.

___**4.51.4** Draw a line on the inner surface of the windshield that is 13 mm below the line determined in items 2 and 3.

___**4.51.5** Apply brightly colored tape across the windshield so that its lower edge follows the lower boundary of the protected zone determined in item 4. Use tape no wider than 25 mm.

___**4.51.6** Measure pre-crash dimensions A, B, C, D, E, and F and record in the table below.

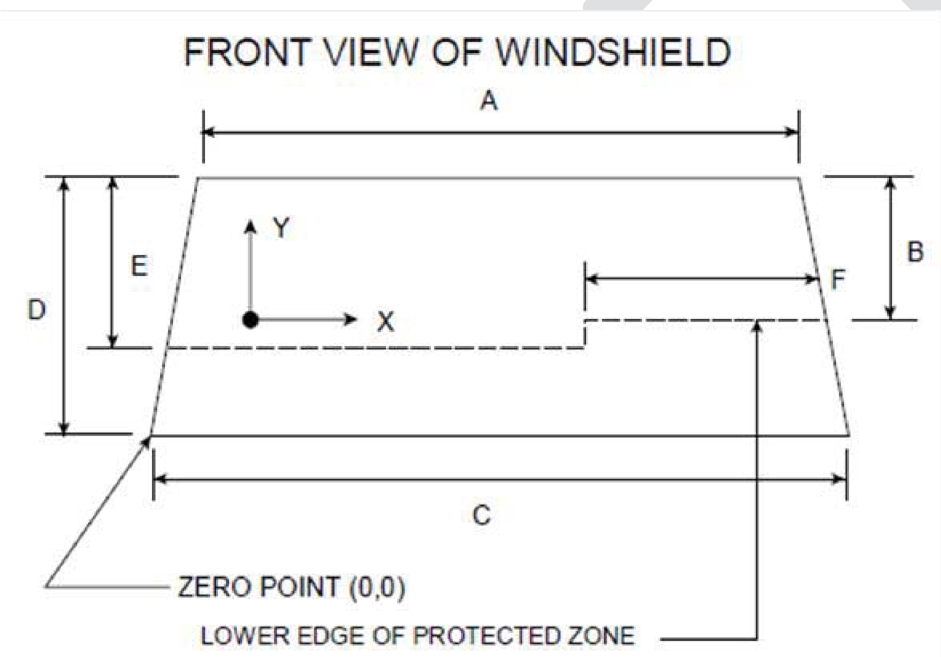


Figure 4.33: Windshield Zone

TABLE 4.42: WINDSHIELD PROTECTED ZONE MEASUREMENTS	
DIMENSION	**VALUE (MM)**
A	
B	
C	
D	
E	
F	

SECTION 5 - PRE-TEST TEST OMDB CHECKLIST

CHECKLIST 5.1 - OMDB LEVEL CONDITION (OLC)

Reference Figure 5.1 as the following steps are completed.

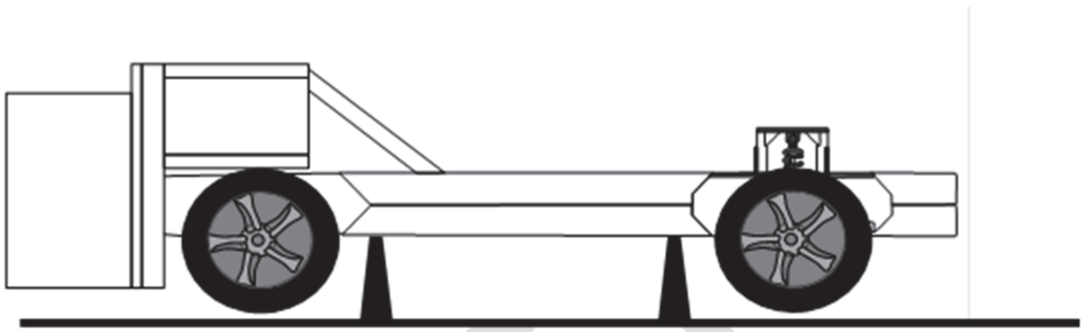


Figure 5.1: OMDB in OLC

___5.1.1 Place the OMDB on a flat, level surface.
___5.1.2 Mount the honeycomb to the face plate
___5.1.3 Place jacks behind each front tire and jacks in front of each rear tires.
___5.1.4 Raise each jack until the top of the each jack touches the bottom frame.
___5.1.5 Measure and record the vertical distance from the flat surface to the bottom frame at each jack
___5.1.6 Raise each jack up by 50 mm
___5.1.7 Repeat step 5 until the load on the suspension is removed.
___5.1.8 Check to make sure the bottom of the left sill is parallel to the ground.
___5.1.9 Check to make sure the bottom of the right sill is parallel to the ground.
___5.1.10 Check to make sure the bottom of the left sill relative to the right sill is parallel to the ground. All four jack points should have the same relative distance from the ground.
___5.1.11 If any condition in steps ___5.1.8 through ___5.1.10 are not met raise or lower three jacks until conditions in steps ___5.1.8 through ___5.1.10 are meet. Do not lower or raise the left rear jack during this step.

CHECKLIST 5.2 - OMDB COORDINATE SYSTEM

Reference Figure 5.2 as the following steps are completed.

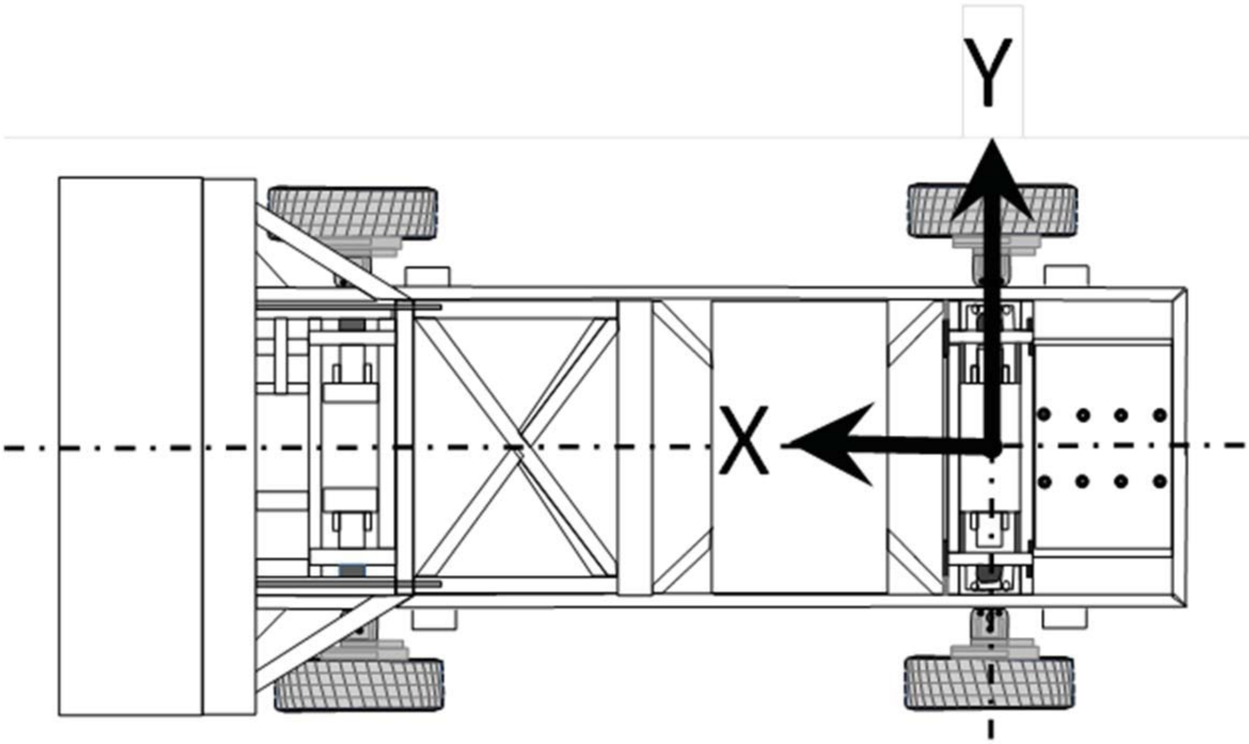


Figure 5.2

___**5.2.1** Ensure the OMDB is in the OLC

___**5.2.2** The origin of the OCS is located at the lateral centerline of the OMDB, the longitudinal centerline of the rear axle, and vertical is the top of the OMDB surface at this longitudinal and lateral location.

___**5.2.3** Verify the top of the left and right frame are comparable and the frame is level

___**5.2.4** Create a "OMDB Coordinate System" (OCS) using a coordinate measuring machine (CMM) where the following conditions are met:

___**5.2.4.1** Positive X - From the back of the OMDB to the front of the OMDB.

___**5.2.4.2** Positive Y – Looking from the front of the OMDB, positive Y is from the left side to the right side of the OMDB.

___**5.2.4.3** Positive Z - From the top of the OMDB to the bottom of the OMDB.

___**5.2.4.4** The XY plane is parallel to the ground and passes through the origin of the OCS

___**5.2.4.5** The XZ plane is vertical and passes through the origin of the OCS.

___**5.2.5** Verify the top of the left and right frame are symmetric and the frame is level

CHECKLIST 5.3 - MDB CG TARGET PANELS

Reference Figure 5.3 as the following steps are completed.

Figure 5.3

___**5.3.1** Create a plate with the minimum dimensions of 1100 mm by 500 mm

___**5.3.2** Apply 25 mm checkerboard tape along the vertical center of the plate

___**5.3.3** Place 250 mm non-glare target in the center of the plate and the center of the 25 mm checkerboard tape

___**5.3.4** Place 152 mm non-glare on both sides of the center target that are 450 mm away (center to center) from the center target along the center of the checkerboard tape..

___**5.3.5** Write or print CG on the center target

___**5.3.6** Create another two Target Panels

CHECKLIST 5.4 - TARGET AND 25 MM CHECKERBOARD TOP OF OMDB

Reference Figure 5.4 as the following steps are completed.

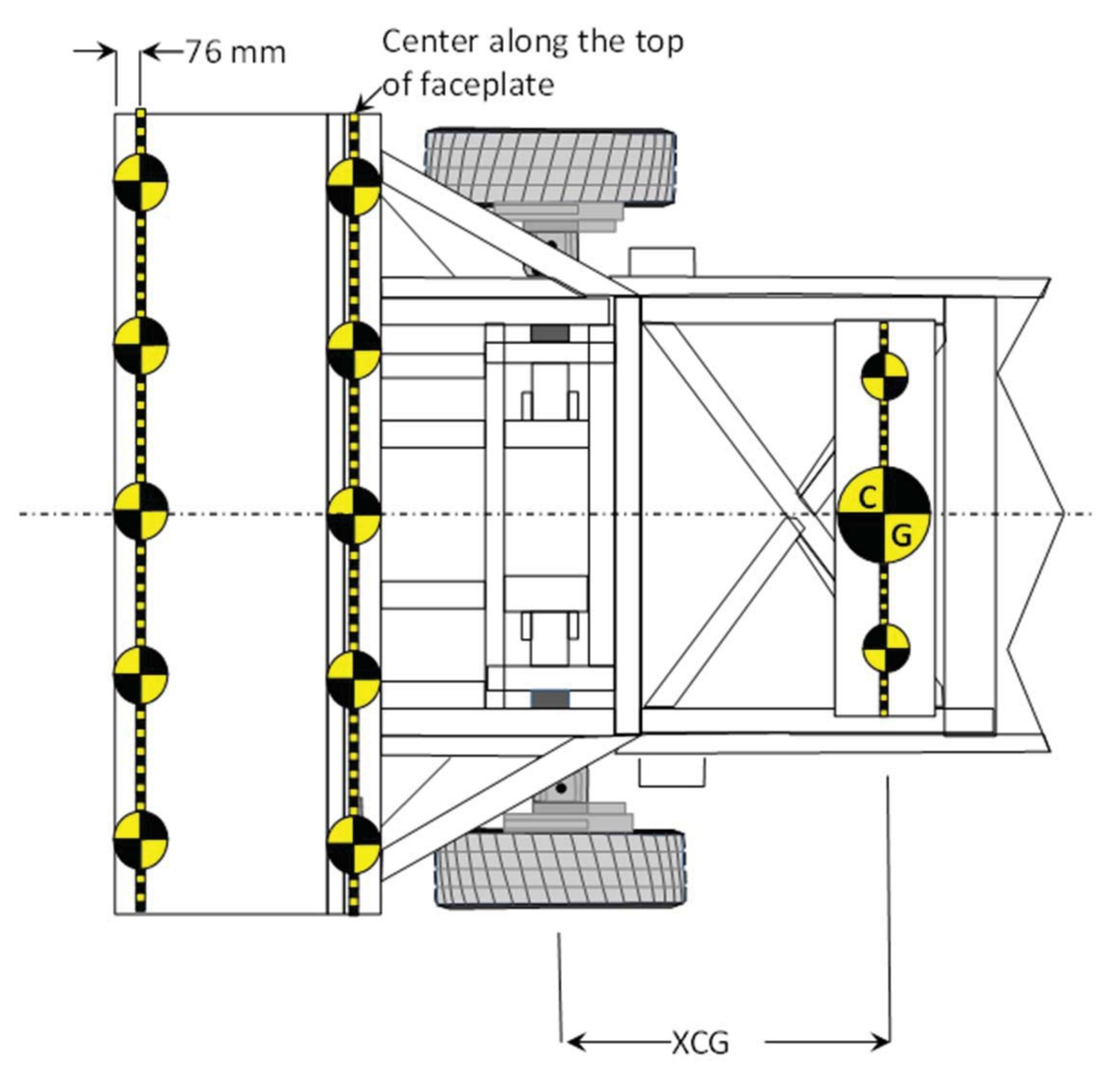


Figure 5.4

___**5.4.1** Ensure the OMDB is in the OLC and use a CMM to complete the following steps.

___**5.4.2** Apply 25 mm checkerboard tape along the top front of the honeycomb with its centerline 76 mm from front of honeycomb.

___**5.4.3** Apply 25 mm checkerboard tape centered along the top of the face plate.

___**5.4.4** Apply a 152 mm non-glare target on the top front of the honeycomb, such that the target is centered on the centerline of the OMDB and the centerline of the 25 mm checkerboard tape 76 mm from the front of the honeycomb.

___**5.4.5** Apply 152 mm non-glare targets spaced 450 mm apart (center to center) to the right of the front target located at the centerline of the OMDB. No target shall be less than 450 mm apart.

___**5.4.6** Apply 152 mm non-glare targets spaced 450 mm apart (center to center) to the left of the front target located at the centerline of the OMDB. No target shall be less than 450 mm apart.

___**5.4.7** Apply a 152 mm non-glare target on the top of the faceplate, such that the target is centered on the centerline of the OMDB and the center of the 25 mm checkerboard tape.

___**5.4.8** Apply 152 mm non-glare targets spaced 450 mm apart (center to center) to the right of the target located at the centerline of the OMDB and the top of the faceplate. No target shall be less than 450 mm apart.

___**5.4.9** Apply 152 mm non-glare targets spaced 450 mm apart (center to center) to the left of the target located at the centerline of the OMDB and the top of the faceplate. No target shall be less than 450 mm apart.

___**5.4.10** Mount the CG target plate such the center target is located at the centerline of the OMDB and at the longitudinal CG (XCG from front axle).

Note: This target plate shall not move relative to the OMDB during the event

CHECKLIST 5.5 - TARGET AND 25 MM CHECKERBOARD SIDE OF OMDB

Reference Figure 5.5 as the following steps are completed.

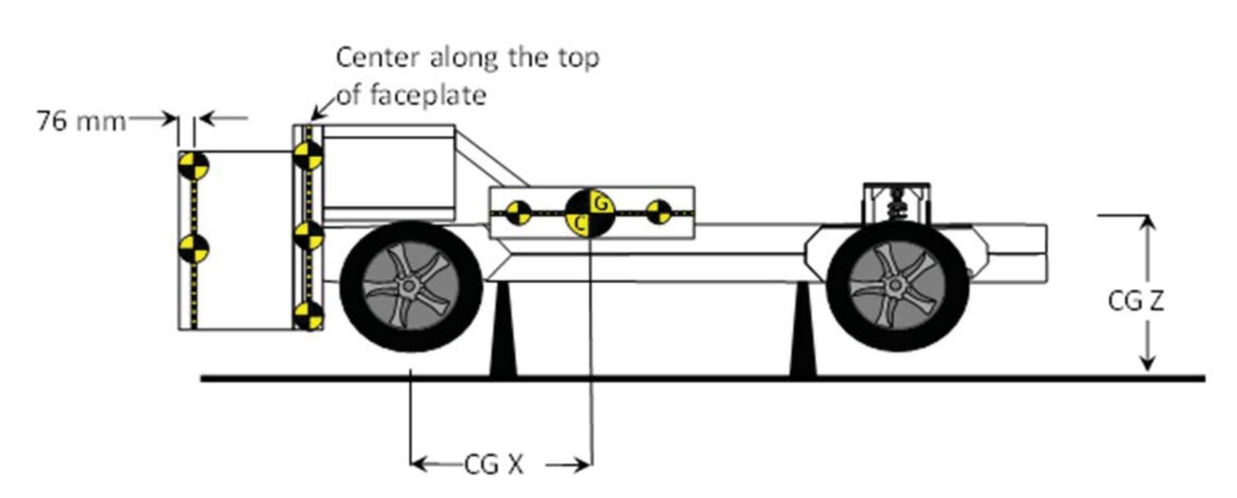


Figure 5.5

___**5.5.1** Ensure the OMDB is in the OLC and use a CMM to complete the following steps

___**5.5.2** Apply 25 mm checkerboard tape vertically 76 mm from the front of the honeycomb.

___**5.5.3** Apply 25 mm checkerboard tape vertically centered along the center of the side of the face plate

___**5.5.4** Place 152 mm non-glare target such that the center is aligned with the center of the checkerboard tape located 76 mm from the front of the faceplate and the top edge of the target aligns with the top of the honeycomb.

___**5.5.5** Place 152 mm non-glare target 450 mm (center to center) directly below the target above.

___**5.5.6** Place 152 mm non-glare target such that the center of the target aligns with the center of the checkerboard tape on the faceplate and the bottom edge of the target aligns with the bottom of the faceplate.

___**5.5.7** Place two 152 mm non-glare target 450 mm apart (center to center) above the target above

CHECKLIST 5.6 - TOP OF OMDB TARGET PANELS

Reference Figure 5.6 as the following steps are completed

Figure 5.6

___**5.6.1** Create a plate with the minimum dimensions of 650 mm by 200 mm

___**5.6.2** Apply 25 mm checkerboard tape along the vertical center of the plate. Apply this tape to both sides of the panel

___**5.6.3** Place two (2) 152 mm non-glare target 450 mm apart (center to center) on each side of the plate.

___**5.6.4** Build one (1) more of these plates for a total of two (2) plates.

CHECKLIST 5.7 - MOUNT OMDB TARGET PANELS

Reference Figure 5.7 as the following steps are completed

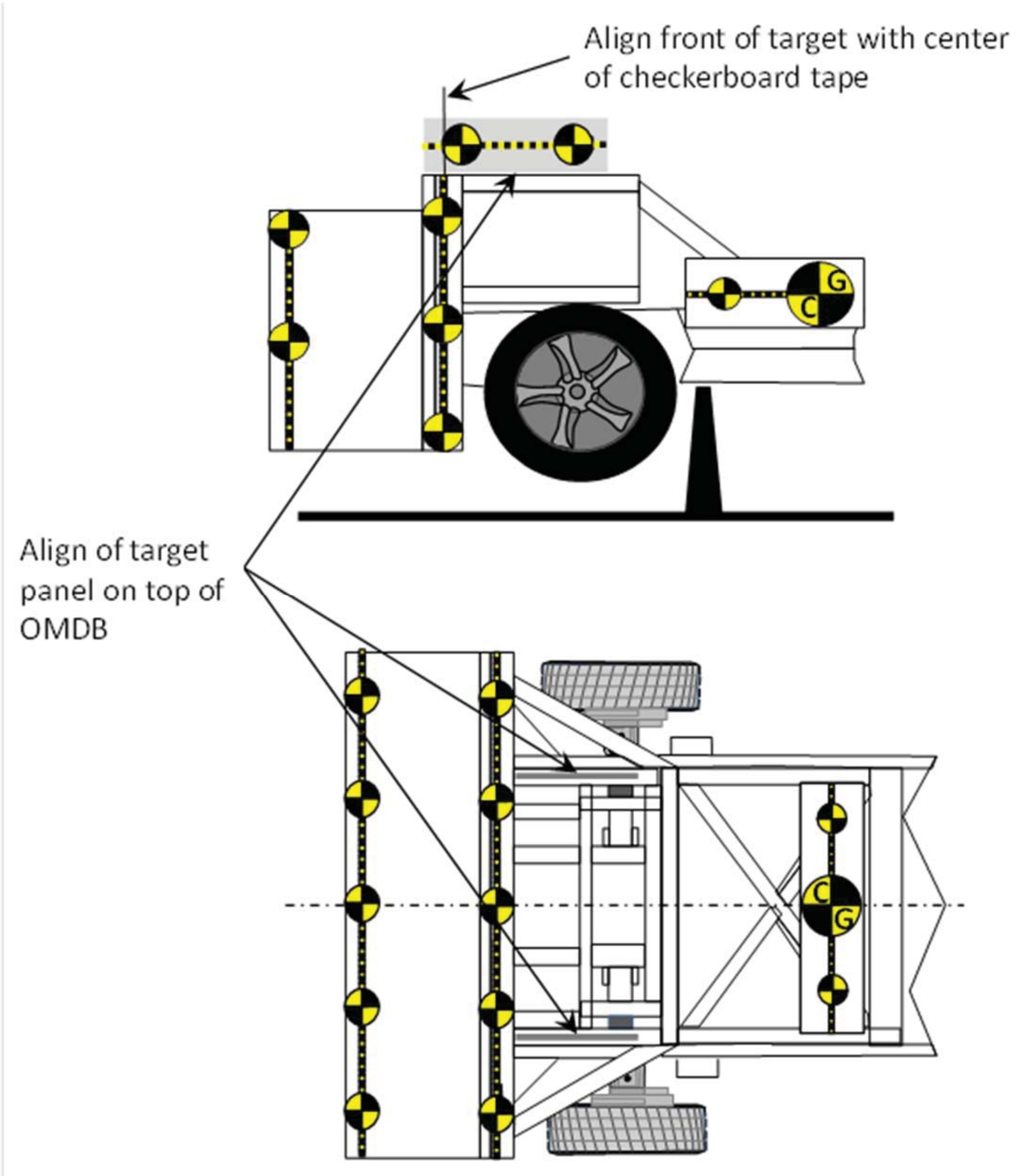


Figure 5.7

___**5.7.1** Mount one target plate on the top left side of the OMDB faceplate support structure, such that left side of the front target is aligned with the center of the checkerboard tape on the left side of the faceplate.

___**5.7.2** Mount one target plate on the top right side of the OMDB faceplate support structure, such that left side of the front target is aligned with the center of the checkerboard tape on the right side of the faceplate.

CHECKLIST 5.8 - OMDB 6-AXIS MOUNTING PLATE

Reference Figure 5.8 below as the following steps are completed.

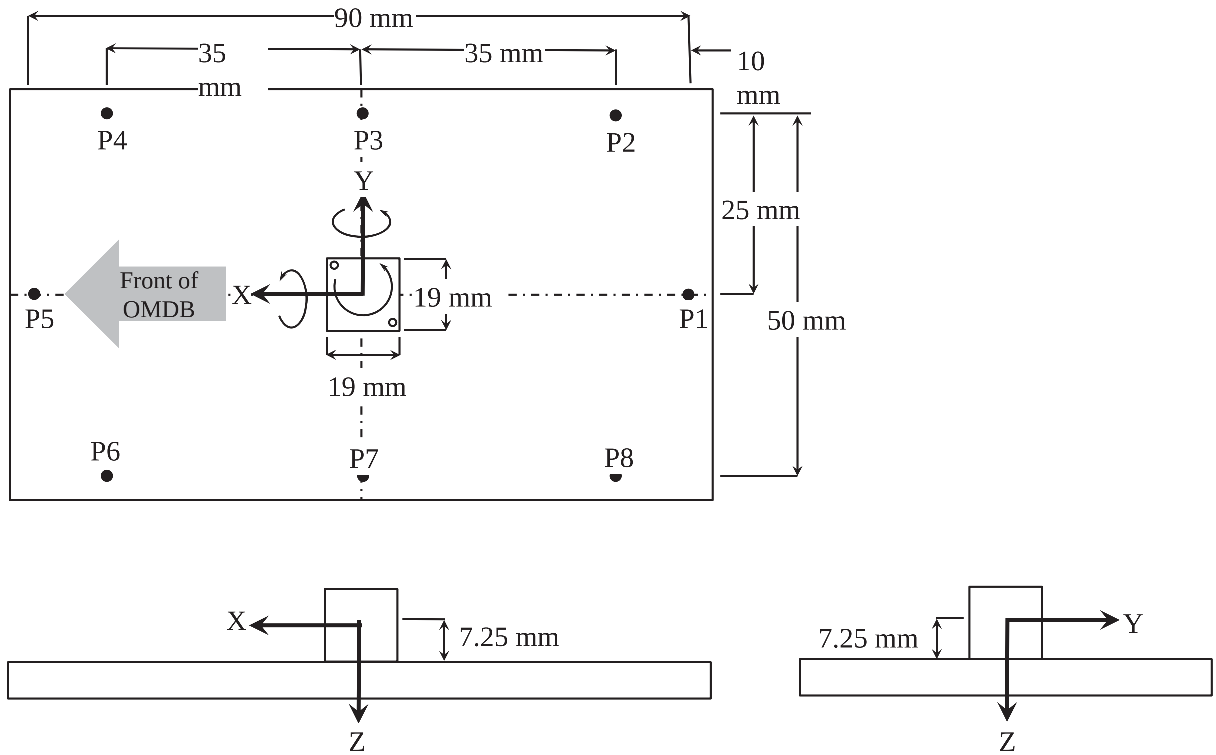


Figure 5.8

___**5.8.1** Create a steel or aluminum plate according to Figure 5.8. The indent holes shall be identically dimensioned and be compatible with the size of the tip of the CMM

___**5.8.2** Mount the 6 axis block using the manufacturer specifications and the orientations shown in Figure 5.8.

___**5.8.3** Securely mount the ARS plate, such that the following conditions are meet:

___**5.8.3.1** The plate shall be parallel to the ground

___**5.8.3.2** The center of the 6-axis instrumentation shall be at the OMDB CG

___**5.8.3.3** P1 and P5 are located at the longitudinal centerline of the OMDB

___**5.8.3.4** P3 and P7 are parallel to the Y-axis of the vehicle

___**5.8.3.5** P5 is toward the front of the vehicle

___**5.8.3.6** Measure and record x, y, and z for points P1 through P8 in the OMDB coordinate system

___**5.8.3.7** Check to make sure that the Z value for P2 though P8 is within ± 0.5 mm of P1.

___**5.8.3.8** Check to make sure P1 and P5 are within ± .5 mm from the lonatudinal centerline of the OMDB

___**5.8.3.9** Measure and record point P1 through P8.

___**5.8.4** Measure and record points P1 through P8.

TABLE 5.1	
POINT	**PRE-TEST MEASUREMENTS***

NO.	X	Y	Z
P1			
P2			
P3			
P4			
P5			
P6			
P7			
P8			

CHECKLIST 5.9 - OMDB INSTRUMENTATION

Reference Figure 5.9 as the following steps are completed.

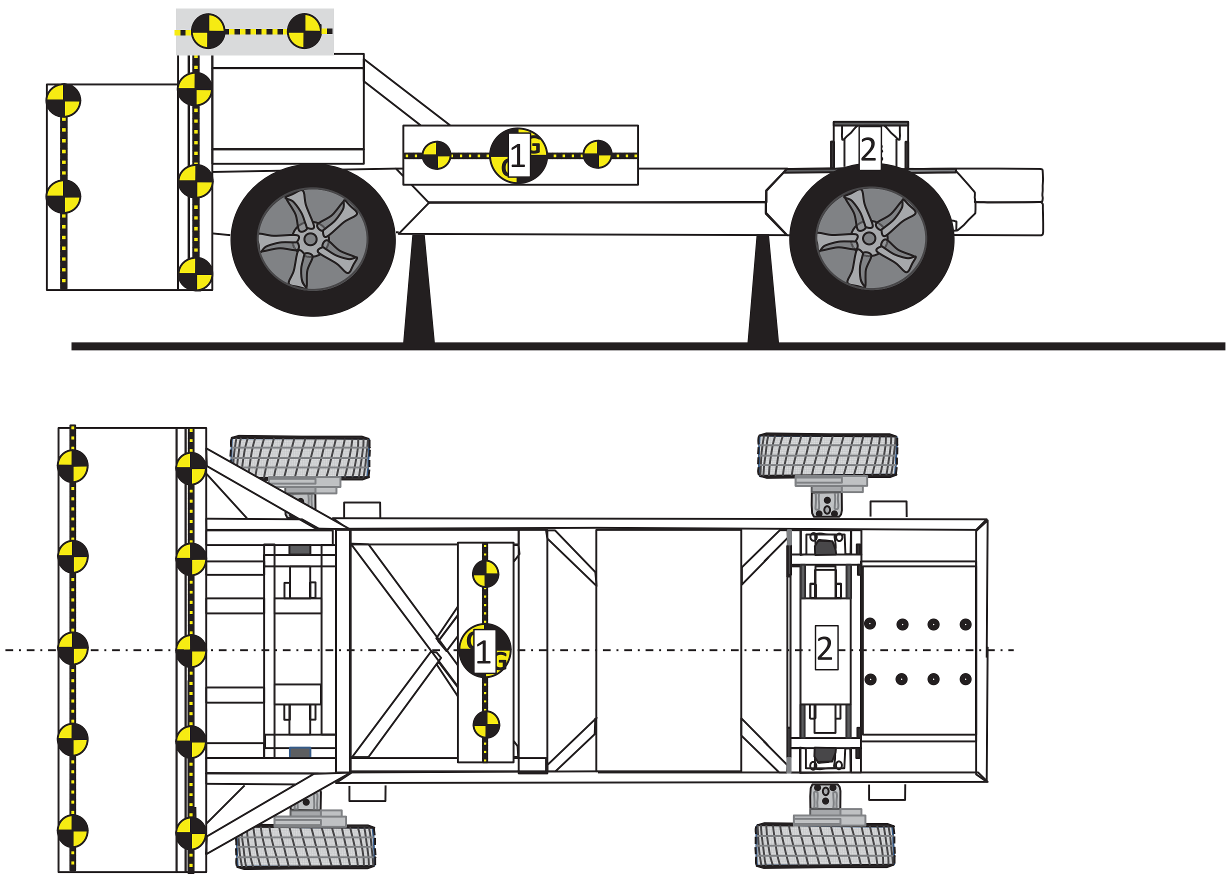


Figure 5.9

___**5.9.1** Ensure the OMDB is in the OLC

___**5.9.2** Ensure instrumentation meets SAE J211

___**5.9.3** Install the following instrumentation on the OMDB vehicle

TABLE 5.2							
#	**LOC**	**SENTYP**	**SENATT**	**AXIS**	**UNITS**	**CH**	**INSCOM3**
1	1	AC	VECG	XG	G'S	P	V1 OMDB CG X
2	1	AC	VECG	YG	G'S	P	V1 OMDB CG Y
3	1	AC	VECG	ZG	G'S	P	V1 OMDB CG Z
4	1	AV	VECG	XG	DPS	P	V1 OMDB ROTATION ABOUT X AXIS
5	1	AV	VECG	YG	DPS	P	V1 OMDB ROTATION ABOUT Y AXIS
6	1	AV	VECG	ZG	DPS	P	V1 OMDB ROTATION ABOUT Z AXIS

TABLE 5.2							
#	LOC	SENTYP	SENATT	AXIS	UNITS	CH	INSCOM3
7	2	AC	FRRR	XG	G'S	P	V1 CENTER REAR AXLE X
8	2	AC	FRRR	YG	G'S	P	V1 CENTER REAR AXLE Y
9	2	AC	FRRR	ZG	G'S	P	V1 CENTER REAR AXLE Z

___**5.9.4** Measure and record all instrumentation with respect to the OCS listed in the table below

TABLE 5.3				
LOC	DESCRIPTION	X	Y	Z
1	V1 OMDB CG X,Y,Z ACC AND ROTATION			
2	V1 OMDB REAR AXLE X,Y,Z ACC			

CHECKLIST 5.10 - PLACARDS ON OMDB

___**5.10.1** Place placards on the OMDB as specified in section C.23:

___**5.10.2** On the top of the honeycomb center along the longitudinal and lateral centerline of the honeycomb. (This should be of contrasting color of the honeycomb)

___**5.10.3** On the left and right side of the honeycomb

CHECKLIST 5.11 - PRE-TEST PICTURES OF OMDB

Reference Figure 5.10 as the following steps are completed

___**5.11.1** Take the following pictures of the OMDB
Note: Shall be able to read the words Pre-Test and NHTSA Number in each picture

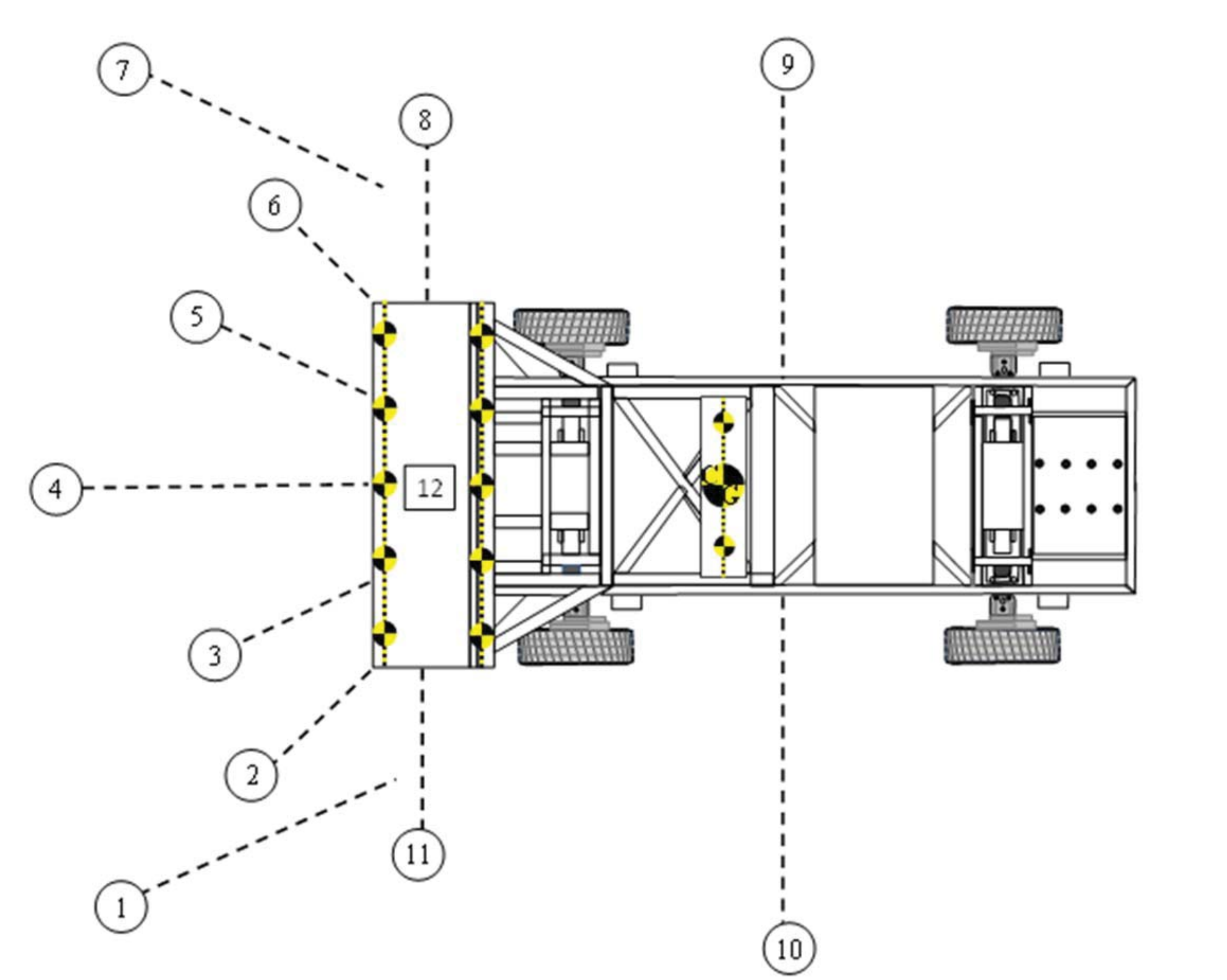


Figure 5.10

TABLE 5.4		
CAM POS	**DESCRIPTION (FIELD OF VIEW)**	**EXAMPLE PICTURE**
1	**Picture 5.1: Pre-Test Front Left Oblique View of OMDB** 76) Start (1) The height of the camera is halfway between the ground and top of the honeycomb (2) Move back from the left front corner at 45 degrees	

	(3) The left field of view is the left front corner of the OMDB (4) The right field of view is the right rear corner of the OMDB (5) The vertical field of is centered on the OMDB	
2	**Picture 5.2: Pre-Test Left Front Zoomed in Oblique View of OMDB** 77) Start (1) The height of the camera is halfway between the ground and top of the honeycomb (2) The camera is 45 degrees off the left front corner of the OMDB (3) The left field of view is at ¾ the width the front of the OMDB (4) The right side field of view is at the center of the OMDB (5) The vertical field of viewis centered on the OMDB	
3	Picture 41**: Pre-Test Left Front 20 degree View of OMDB** 78) Start (1) The height of the camera is halfway between the ground and top of the honeycomb (2) The lateral position of the camera is at ¼ the width of the front of the OMDB (3) The camera is approximately 20 degrees to the longitudinal centerline of the OMDB (4) The left field of view is at ¾ the width the front of the OMDB (5) The right field of view is the right edge of the OMDB (6) The top field of view is the top of the OMDB (7) The bottom field of view is the ground	
4	**Picture 5.3: Pre-Test Front View of Test OMDB** 79) Start	

	(1) The height of the camera is halfway between the ground and top of the honeycomb (2) The camera is perpendicular to the front of the OMDB (3) The left field of view is the right edge of the OMDB (4) The right field of view is the left edge of the OMDB (5) The top field of view is the top of the OMDB (6) The bottom field of view is the ground	
5	Picture 5.4: **Pre-Test Right Front 20 degree View of OMDB** 80) Start (1) The height of the camera is halfway between the ground and top of the honeycomb (2) The lateral position of the camera is at ¼ the width of the front of the OMDB (3) The camera is approximately 20 degrees to the longitudinal centerline of the OMDB (4) The right field of view is at ¾ the width the front of the OMDB (5) The left field of view is the left edge of the OMDB (6) The top field of view is the top of the OMDB (7) The bottom field of view is the ground	\
6	Picture 5.5**: Pre-Test Right Front Zoomed in Oblique View of OMDB** 81) Start (1) The height of the camera is halfway between the ground and top of the honeycomb (2) The camera is 45 degrees off the right front corner of the OMDB (3) The left field of view is at ¾ the width the front of the OMDB (4) The right side field of view is at center of the OMDB	

	(5) The vertical field of view is centered on the OMDB	
7	Picture 5.6**: Pre-Test Right Front Oblique View of OMDB** 82) Start (1) The height of the camera is halfway between the ground and top of the honeycomb (2) Move back 2 meters from the right front corner at 45 degrees (3) The right field of view is the right front corner of the OMDB (4) The left field of view is the left rear corner of the OMDB (5) The vertical field of view is centered on the OMDB	
8	Picture 5.7**:** Perpendicular ¼ View of the Right Front of the Vehicle 83) Start … (1) The height of the camera is at the halfway between the roof and window sill (2) The camera of is the at a 65 degrees from the left front corner of the OMDB (3) The left field of view is at ¾ the width the front of the OMDB (4) The right side field of view is at center of the front door of the OMDB (5) The top of field of view is the top of the vehicle (6) The bottom of the field of view is the ground	
9	Picture 5.8: Left side View 84) Start … (1) The height of the camera is at the halfway between the roof and window sill (2) The camera of is the at a perpendicular view of the Right Side of Vehicle (3) The left field of view is at the intersection of the A-pillar and	

	bottom sill (4) The right side field of view is at front of the vehicle (5) The top of field of view is the top of the vehicle (6) The bottom of the field of view is the ground	
10	**Picture 5.9: Left Side View**	
11	Picture 5.10**:** Perpendicular ¼ View of the Right Front of the Vehicle	
12	**Picture 5.11: Top view of the front of the OMDB** 85) Start … (1) The camera is perpendicular to the floor (2) The top field of view is the top of the honeycomb (3) The bottom field of view is the bottom of the honeycomb (4) The left field of view is the front of the honeycomb	

CHECKLIST 5.12 - PRE-TEST HONEYCOMB BARRIER MEASUREMENTS

Reference Figure 5.11 as the following steps are completed. This particular figure illustrates the frontal view of the aluminum honeycomb barrier's measurements for a left (driver's) side impact. For a right side impact, this measurement grid should be mirrored about the centerline.

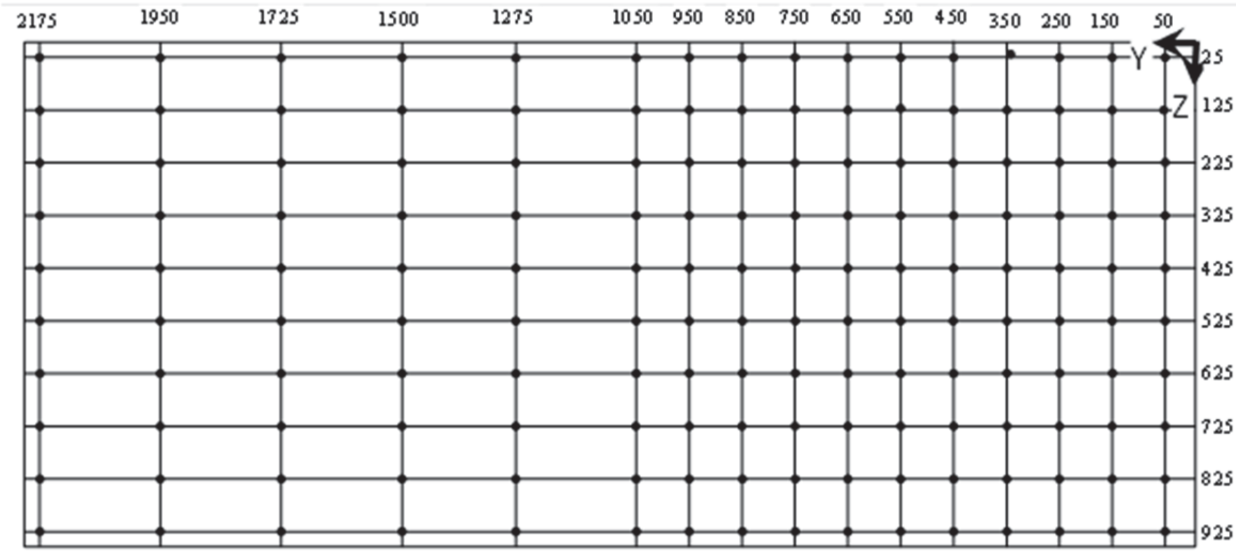


Figure 5.11

___**5.12.1** Ensure the OMDB is in the OLC.

___**5.12.2** The origin of the honeycomb measurements is located at the top right corner of the honeycomb, were it attaches to the face plate, when looking from the front of the barrier.

___**5.12.3** Create points on the front of the honeycomb according to the figure above.

___**5.12.4** Measure the X, Y and Z of each point and record this data. This data does not go into a datasheet in the test report.

SECTION 6 - ANTHOPOMORPHIC TESTING DEVICE

CHECKLIST 6.1 – RECEIPT OF ATDS

___**6.1.1** Verify that each ATD has the instrumentation as defined in this test procedure. If the instrumentation installed on the ATDs does not match instrumentation list in the test procedure notify the COR.

___**6.1.2** Verify all instrumentation for each ATD is in calibration at the start of testing and within the testing time frame.

___**6.1.3** Notify COR which instrumentation is out of date or needs calibration within the testing time frame.

___**6.1.4** For each 3D IR-TRACC obtain the calibration summary (Figure 6.5) and include in test report. The calibration summary shall include the linearization exponent, optimized slope, and optimized intercept for each IR-TRACC, as well as the setup angle of each rotational potentiometer.

Note: It is the responsibility of the contractor to obtain the 3D IR-TRACC calibration summary from the company/government that performed the calibration if not done in-house

___**6.1.5** Obtain all certification sheets for each ATD and include in the test report. Note it is the responsibility of the contractor to obtain all certification data from the company/government that performed the certification if not done in-house.

Note: The COR reserves the right to change the frequency of certification

___**6.1.6** Perform inspection of each ATD using checklist below

___**6.1.7** Send Inspection checklist to COR once filled out

___**6.1.8** Send ATD Inspection checklist (Table 6.1) to COR once filled out

___**6.1.9** Verify that each ATD lumbar spine pitch change mechanism (472-3670, Figure 6.1) is set to the “SLOUCHED” position by confirming that the indicator is aligned with the orange line (Figure 6.2). If it is not in the “SLOUCHED” position, consult the THOR-50M PADI for instructions on adjusting the lumbar spine pitch change assembly.

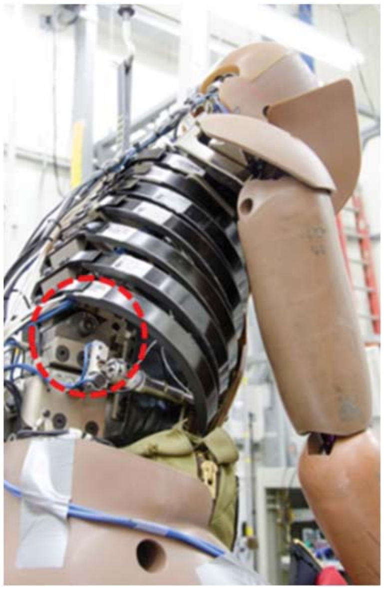
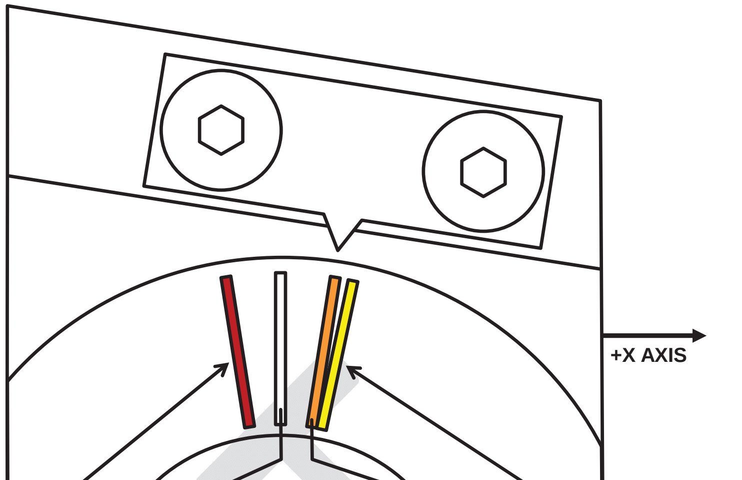


Figure 6.1. Location of lumbar spine pitch change mechanism.



RED	WHITE	ORANGE	YELLOW	COLOR
ERECT	NEUTRAL	SLOUCHED	SUPER SLOUCHED	POSTURE
-9°	0°	9°	12°	ANGLE

Figure 6.2. Lumbar spine pitch change mechanism posture settings. Diagram shows posture in the "SLOUCHED" position.

___**6.1.10** Verify that each ATD neck pitch change mechanism (472-3620, Figure 6.3) is set to the “NEUTRAL” position by confirming that the *lower* indicator on the left side of the sprocket is aligned with the indicator on the right side of the sprocket (Figure 6.4). If it is not in the “NEUTRAL” position, consult the THOR-50M PADI for instructions on adjusting the neck pitch change assembly.

Figure 6.3. Location of neck pitch change mechanism indicator.

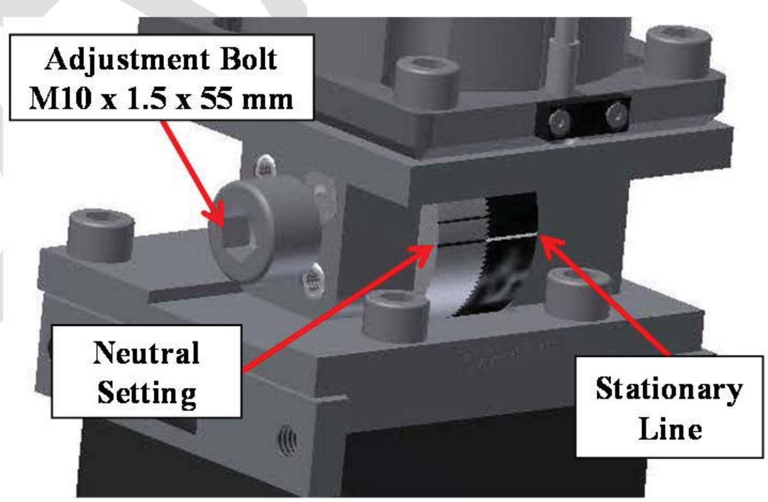


Figure 6.4. Neck pitch change mechanism neutral setting

TABLE 6.1: ATD INSPECTION

NHTSA No.: ______________________________ Test Date: _________________

Test Technician(s): ____________

Complete ATD inspection check lists and send to COR

Dummy S/N:	
Dummy Description:	
Date of last Certification:	
Tests conducted since last full certification or inspection	

Known errors in data channels (no data, clipping, unexpected drops)
Physical evidence of damage
Anecdotal evidence of damage
Equipment delivered to Borrower

HEAD – Check Y or N. If N, explain reason and/or attach picture	
☐ Y ☐ N	**Rear head cap mounts securely to head:**
☐ Y ☐ N	**Head skin fits securely over skull:**

TABLE 6.1: ATD INSPECTION	
NHTSA No.: ______________________	Test Date: ____________
Test Technician(s):	

☐ Y ☐ N	**Head skin shows no sign of tears or damage**
☐ Y ☐ N	**Interior components of skull cavity (ballast, accelerometer mount, accelerometers) securely attached:**
☐ Y ☐ N	**Head securely mounted to OC joint:**
	Other:
NECK – Circle Y or N. If N, explain reason and/or attach picture.	
☐ Y ☐ N	**Neck cables slide freely through holes in neck plates:**
☐ Y ☐ N	**Head can rotate about occipital condyle joint freely until the bump stops are engaged:**
☐ Y ☐ N	**Neck cables show no sign of fraying, broken strands, or kinking**
☐ Y ☐ N	**No evidence of de-bonding between neck pucks and plates** **If N – indicate which interface (i.e.: where plate/puck 1 attach to upper neck load cell):**
☐ Y ☐ N	**No evidence of de-bonding or permanent compression in neck soft stop**

TABLE 6.1: ATD INSPECTION	
NHTSA No.: ______________________	Test Date: ____________
Test Technician(s):	
	assemblies:
☐ Y ☐ N	**Neck securely attached to upper neck load cell:**
	Other:
SPINE – Circle Y or N. If N, explain reason and/or attach picture	
☐ Y ☐ N	**No evidence of de-bonding between thoracic spine flex joint and metal plates:**
☐ Y ☐ N	**No evidence of de-bonding between lumbar spine flex joint and metal plates:**
☐ Y ☐ N	**Lumbar spine pitch change joint mechanism mating teeth are engaged:**
☐ Y ☐ N	**Neck pitch change joint mechanism mating teeth are engaged:**
	Other:
LEFT SHOULDER/ARM – Circle Y or N. If N, explain reason and/or attach picture	
☐ Y ☐ N	**Urethane shoulder pads show no evidence of contact:**

TABLE 6.1: ATD INSPECTION	
NHTSA No.: ______________	Test Date: __________
Test Technician(s):	
☐ Y ☐ N	**Clavicle securely attached to sternum and shoulder:**
☐ Y ☐ N	**No evidence of debonding, tearing, or permanent compression of posterior soft stops**
	Other:
RIGHT SHOULDER/ARM – Circle Y or N. If N, explain reason and/or attach picture	
☐ Y ☐ N	**Urethane shoulder pads show no evidence of contact:**
☐ Y ☐ N	**Clavicle securely attached to sternum and shoulder:**
☐ Y ☐ N	**No evidence of debonding, tearing, or permanent compression of posterior soft stops:**
	Other:
THORAX – Circle Y or N. If N, explain reason and/or attach picture	
☐ Y ☐ N	**No evidence of contact at top, bottom, or interior faces of rib damping material:**
☐ Y ☐ N	**No evidence of debonding between rib damping material and ribs:**

DRAFT

TABLE 6.1: ATD INSPECTION	
NHTSA No.: ______________________	Test Date: ____________
Test Technician(s):	

☐ Y ☐ N	**IR-TRACC tubes securely attached to anterior ribs**
☐ Y ☐ N	**IR-TRACC tubes securely attached to double gimbals, spine:**
☐ Y ☐ N	**Urethane bib is securely attached to ribs with no sign of tearing or washer penetration:**
☐ Y ☐ N	**Ribs securely attached to posterior spine:**
☐ Y ☐ N	**Rib stiffeners show no evidence of bending (no gaps between ribs and stiffeners):**
	Other:
ABDOMEN – Circle Y or N. If N, explain reason and/or attach picture	
☐ Y ☐ N	**No evidence of tearing, cuts, or broken stitches in upper abdomen bag and zipper:**
☐ Y ☐ N	**Upper abdomen insert securely attached to spine:**

TABLE 6.1: ATD INSPECTION	
NHTSA No.: ______________	Test Date: ________
Test Technician(s):	
☐ Y ☐ N	**Upper abdomen insert shows no evidence of permanent set:**
☐ Y ☐ N	**No evidence of tearing, cuts, or broken stitches in lower abdomen bag and zipper:**
☐ Y ☐ N	**Lower abdomen insert securely attached to spine:**
☐ Y ☐ N	**Lower abdomen insert shows no evidence of permanent set:**
	Other:
PELVIS – Circle Y or N. If N, explain reason and/or attach picture	
☐ Y ☐ N	**Pelvis flesh fits securely over pelvis bones:**
☐ Y ☐ N	**H-point tool fits securely into hole on both sides of pelvis:**
☐ Y ☐ N	**ASIS load cells are firmly attached to the iliac bones, and the iliac bones are firmly attached to the pelvis. The iliac bones are free from cracks or fractures, and if welds are present in the iliac bones, the welds are continuous and devoid of cracks:**

TABLE 6.1: ATD INSPECTION

NHTSA No.: ____________________ Test Date: ____________

Test Technician(s):

	Other:
LEFT FEMUR – Circle Y or N. If N, explain reason and/or attach picture	
☐ Y ☐ N	**Acetabular load cells firmly attached:**
☐ Y ☐ N	**Femur load cells firmly attached:**
☐ Y ☐ N	**No evidence of deformation of knee slider bump stop:**
☐ Y ☐ N	**No cuts, tears, or scuffing of knee flesh:**
	Other:
RIGHT FEMUR – Circle Y or N. If N, explain reason and/or attach picture	
☐ Y ☐ N	**Acetabular load cells firmly attached:**
☐ Y ☐ N	**Femur load cells firmly attached:**
☐ Y ☐ N	**No evidence of deformation of knee slider bump stop:**

TABLE 6.1: ATD INSPECTION	
NHTSA No.: ______________________	Test Date: ____________
Test Technician(s):	

☐ Y ☐ N	**No cuts, tears, or scuffing of knee flesh:**
	Other:
LEFT LOWER EXTREMITY (LX) – Circle Y or N. If N, explain reason and/or attach picture	
☐ Y ☐ N	**Rotational potentiometers in ankle securely attached:**
☐ Y ☐ N	**Achilles tendon provides resistance to dorsiflexion:**
☐ Y ☐ N	**No evidence of debonding, tearing, or permanent compression of ankle soft stops:**
	Other:
RIGHT LOWER EXTREMITY (LX) – Circle Y or N. If N, explain reason and/or attach picture	
☐ Y ☐ N	**Rotational potentiometers in ankle securely attached:**
☐ Y ☐ N	**Achilles tendon provides resistance to dorsiflexion:**
☐ Y ☐ N	**No evidence of debonding, tearing, or permanent compression of ankle soft**

TABLE 6.1: ATD INSPECTION

NHTSA No.: ____________________ Test Date: ______________

Test Technician(s):

	stops:
	Other:
JACKET – Circle Y or N. If N, explain reason and/or attach picture	
☐ Y ☐ N	**Rib stiffeners show no sign of permanent deformation:**
☐ Y ☐ N	**No evidence of tears or holes in jacket fabric, velcro, or zippers:**
	Other:

NHTSA
Vehicle Research & Test Center

3D IR-TRACC Calibration Summary

User should enter information into the shaded fields

Date	4/7/2015
Dummy Type	THOR-M 50th Male
Dummy S/N	DL9207
Location in Dummy	Lower Left Thorax

IR-TRACC		Y - Pot		Z - Pot	
Model No.	IF364	Model No.	9945	Model No.	9945
Serial No.	DS6353	Serial No.	DM4781	Serial No.	DS4092
Sensitivity (mm/V)	35.3389	Sensitivity (mV/V/deg)	3.0014	Sensitivity (mV/V/deg)	3.0725
Exponent	-0.45268	Excitation (V)	5	Excitation (V)	5
Excitation (V)	5	Zero Position Voltage (V)	0.0000	Zero Position Voltage (V)	0.0000
Reference Voltage (V)	0.0636	Zero Position Angle (deg)	0.00	Zero Position Angle (deg)	0.00
Reference Length (mm)	160.0				
Lin. Ref Voltage (V)	3.4796				

The IR-TRACC reference information and the potentiometer zero position information are required by processing software to determine initial length and rotation angle of the IR-TRACC assembly within the dummy. The format of the IR-TRACC reference information; *reference voltage*, *linearized reference voltage* or *scaled output*, will depend on the requirements of the post-processing software. The format of the potentiometer zero position; *zero position voltage* or *zero position angle*, also depend on the requirements of the post-processing software.

Note: If the polarity of the potentiometer ouput needs to be inverted to conform to J211 polarity requirements, the polarity of the of the potentiometer zero position information will also need to be inverted. Whether the polarity is inverted prior to entering the information into the post-processing software or is automatically inverted by the processing software will depend on the requirements of the post-processing software being used.

Figure 6.5: Example of 3D IR-TRACC calibration summary

CHECKLIST 6.2 - THOR INSTRUMENTATION

___**6.2.1** Setup dummy to record all channels listed in Table 6.2
Note: The rotation pots and IRTRACCS shall not be zeroed out during the test

___**6.2.2** Obtain or create a program to calculated all channels listed in Table 6.3

TABLE 6.2: THOR INSTRUMENTATION LIST

#	SENTYP	SENATT	AXIS	YUNITS	CHSTAT	INSCOM
1	AC	HDCG	XL	G'S	P	V2P1 HEAD CG AX
2	AC	HDCG	YL	G'S	P	V2P1 HEAD CG AY
3	AC	HDCG	ZL	G'S	P	V2P1 HEAD CG AZ
4	AV	HDCG	XL	DPS	P	V2P1 HEAD CG WX
5	AV	HDCG	YL	DPS	P	V2P1 HEAD CG WY
6	AV	HDCG	ZL	DPS	P	V2P1 HEAD CG WZ
7	LC	NEKU	XL	NWT	P	V2P1 NECK UPPER FX
8	LC	NEKU	YL	NWT	P	V2P1 NECK UPPER FY
9	LC	NEKU	ZL	NWT	P	V2P1 NECK UPPER FZ
10	LC	NEKU	XL	NWM	P	V2P1 NECK UPPER MX
11	LC	NEKU	YL	NWM	P	V2P1 NECK UPPER MY
12	LC	NEKU	ZL	NWM	P	V2P1 NECK UPPER MZ
13	LC	NEKL	XL	NWT	P	V2P1 NECK LOWER FX
14	LC	NEKL	YL	NWT	P	V2P1 NECK LOWER FY
15	LC	NEKL	ZL	NWT	P	V2P1 NECK LOWER FZ
16	LC	NEKL	XL	NWM	P	V2P1 NECK LOWER MX
17	LC	NEKL	YL	NWM	P	V2P1 NECK LOWER MY

TABLE 6.2: THOR INSTRUMENTATION LIST						
#	**SENTYP**	**SENATT**	**AXIS**	**YUNITS**	**CHSTAT**	**INSCOM**
18	LC	NEKL	ZL	NWM	P	V2P1 NECK LOWER MZ
19	LC	NKCA	ZL	NWT	P	V2P1 NECK SPRING LOAD CELL - FRONT
20	LC	NKCP	ZL	NWT	P	V2P1 NECK SPRING LOAD CELL - REAR
21	AD	NKOC	YL	DEG	P	V2P1 OC ANGLE RY
22	DS	CHLU	XL	VOL	P	V2P1 UL CHEST IR-TRACC DX
23	AD	CHLU	YL	DEG	P	V2P1 UL CHEST RY
24	AD	CHLU	ZL	DEG	P	V2P1 UL CHEST RZ
25	DS	CHRU	XL	VOL	P	V2P1 UR CHEST IR-TRACC DX
26	AD	CHRU	YL	DEG	P	V2P1 UR CHEST RY
27	AD	CHRU	ZL	DEG	P	V2P1 UR CHEST RZ
28	DS	CHLL	XL	VOL	P	V2P1 LL CHEST IR-TRACC DX
29	AD	CHLL	YL	DEG	P	V2P1 LL CHEST RY
30	AD	CHLL	ZL	DEG	P	V2P1 LL CHEST RZ
31	DS	CHRL	XL	VOL	P	V2P1 LR CHEST IR-TRACC DX
32	AD	CHRL	YL	DEG	P	V2P1 LR CHEST RY
33	AD	CHRL	ZL	DEG	P	V2P1 LR CHEST RZ

TABLE 6.2: THOR INSTRUMENTATION LIST						
#	SENTYP	SENATT	AXIS	YUNITS	CHSTAT	INSCOM
34LCSPNLXLNWTPV2P1 SPINE LOWER FX35LCSPNLYLNWTPV2P1 SPINE LOWER FY36LCSPNLZLNWTPV2P1 SPINE LOWER FZ37	LC	SPNL	XL	NWM	P	V2P1 SPINE LOWER MX
38	LC	SPNL	YL	NWM	P	V2P1 SPINE LOWER MY
39	AC	SPNM	XL	G'S	P	V2P1 T6 ACCEL AX
40	AC	SPNM	YL	G'S	P	V2P1 T6 ACCEL AY
41	AC	SPNM	ZL	G'S	P	V2P1 T6 ACCEL AZ
42	AC	SPNU	XL	G'S	P	V2P1 T1 ACCEL AX
43	AC	SPNU	YL	G'S	P	V2P1 T1 ACCEL AY
44	AC	SPNU	ZL	G'S	P	V2P1 T1 ACCEL AZ
45	DS	ABDL	XL	VOL	P	V2P1 ABDOMEN LEFT IR-TRACC DX
46	AD	ABDL	YL	DEG	P	V2P1 ABDOMEN LEFT RY
47	AD	ABDL	ZL	DEG	P	V2P1 ABDOMEN LEFT RZ
48	DS	ABDR	XL	VOL	P	V2P1 ABDOMEN RIGHT IR-TRACC DX
49	AD	ABDR	YL	DEG	P	V2P1 ABDOMEN RIGHT RY
50	AD	ABDR	ZL	DEG	P	V2P1 ABDOMEN RIGHT RZ

TABLE 6.2: THOR INSTRUMENTATION LIST						
#	SENT YP	SENA TT	AXI S	YUNITS	CHST AT	INSCOM
51	LC	PVAL	XL	NWT	P	V2P1 PELVIS ACETABULU M LEFT FX
52	LC	PVAL	YL	NWT	P	V2P1 PELVIS ACETABULU M LEFT FY
53	LC	PVAL	ZL	NWT	P	V2P1 PELVIS ACETABULU M LEFT FZ
54	LC	PVAR	XL	NWT	P	V2P1 PELVIS ACETABULU M RIGHT FX
55	LC	PVAR	YL	NWT	P	V2P1 PELVIS ACETABULU M RIGHT FY
56	LC	PVAR	ZL	NWT	P	V2P1 PELVIS ACETABULU M RIGHT FZ
57	AC	PVCN	XL	G'S	P	V2P1 PELVIS CG AX
58	AC	PVCN	YL	G'S	P	V2P1 PELVIS CG AY
59	AC	PVCN	ZL	G'S	P	V2P1 PELVIS CG AZ
60	LC	PILL	XL	NWT	P	V2P1 LEFT ASIS FX
61	LC	PILL	YL	NWM	P	V2P1 LEFT ASIS MY
62	LC	PILR	XL	NWT	P	V2P1 RIGHT ASIS FX
63	LC	PILR	YL	NWM	P	V2P1 RIGHT ASIS MY
64	LC	FMRL	XL	NWT	P	V2P1 LEFT FEMUR FX
65	LC	FMRL	YL	NWT	P	V2P1 LEFT FEMUR FY
66	LC	FMRL	ZL	NWT	P	V2P1 LEFT FEMUR FZ
67	LC	FMRL	XL	NWM	P	V2P1 LEFT FEMUR MX
68	LC	FMRL	YL	NWM	P	V2P1 LEFT FEMUR MY

TABLE 6.2: THOR INSTRUMENTATION LIST						
#	**SENTYP**	**SENATT**	**AXIS**	**YUNITS**	**CHSTAT**	**INSCOM**
69	LC	FMRR	XL	NWT	P	V2P1 RIGHT FEMUR FX
70	LC	FMRR	YL	NWT	P	V2P1 RIGHT FEMUR FY
71	LC	FMRR	ZL	NWT	P	V2P1 RIGHT FEMUR FZ
72	LC	FMRR	XL	NWM	P	V2P1 RIGHT FEMUR MX
73	LC	FMRR	YL	NWM	P	V2P1 RIGHT FEMUR MY
74	DS	KNEL	XL	MM	P	V2P1 KNEE LEFT DX
75	DS	KNER	XL	MM	P	V2P1 KNEE RIGHT DX
76	LC	TBLU	ZL	NWT	P	V2P1 TIBIA LEFT UPPER FZ
77	LC	TBLU	XL	NWM	P	V2P1 TIBIA LEFT UPPER MX
78	LC	TBLU	YL	NWM	P	V2P1 TIBIA LEFT UPPER MY
79	LC	TBRU	ZL	NWT	P	V2P1 TIBIA RIGHT UPPER FZ
80	LC	TBRU	XL	NWM	P	V2P1 TIBIA RIGHT UPPER MX
81	LC	TBRU	YL	NWM	P	V2P1 TIBIA RIGHT UPPER MY
82	LC	TBLL	ZL	NWT	P	V2P1 TIBIA LEFT LOWER FZ
83	LC	TBLL	XL	NWM	P	V2P1 TIBIA LEFT LOWER MX
84	LC	TBLL	YL	NWM	P	V2P1 TIBIA LEFT LOWER MY

TABLE 6.2: THOR INSTRUMENTATION LIST						
#	**SENT YP**	**SENA TT**	**AXI S**	**YUNITS**	**CHST AT**	**INSCOM**
85	LC	TBRL	ZL	NWT	P	V2P1 TIBIA RIGHT LOWER FZ
86	LC	TBRL	XL	NWM	P	V2P1 TIBIA RIGHT LOWER MX
87	LC	TBLL	YL	NWM	P	V2P1 TIBIA RIGHT LOWER MY
88	AC	TBLM	XL	G'S	P	LEFT MID TIBIA AX
89	AC	TBLM	YL	G'S	P	LEFT MID TIBIA AY
90	AC	TBRM	XL	G'S	P	RIGHT MID TIBIA AX
91	AC	TBRM	YL	G'S	P	RIGHT MID TIBIA AY
92	AC	FOTL	XL	G'S	P	V2P1 FOOT LEFT AX
93	AC	FOTL	ZL	G'S	P	V2P1 FOOT LEFT AZ
94	AC	FOTL	XL	G'S	P	V2P1 FOOT RIGHT AX
95	AC	FOTL	ZL	G'S	P	V2P1 FOOT RIGHT AZ
96	AD	ANKL	XL	DEG	P	V2P1 ANKLE LEFT POT RX
97	AD	ANKL	YL	DEG	P	V2P1 ANKLE LEFT POT RY
98	AD	ANKL	ZL	DEG	P	V2P1 ANKLE LEFT POT RZ
99	AD	ANKR	XL	DEG	P	V2P1 ANKLE RIGHT POT RX
100	AD	ANKR	YL	DEG	P	V2P1 ANKLE RIGHT POT RY
101	AD	ANKL	ZL	DEG	P	V2P1 ANKLE RIGHT POT RZ

TABLE 6.3: THOR CALCULATED MEASURES						
#	SENTYP	SENATT	AXIS	YUNITS	CHSTAT	INSCOM
1	DS	CHLU	XL	MM	CM	V2P1 CHEST UPPER LEFT X
2	DS	CHLU	YL	MM	CM	V2P1 CHEST UPPER LEFT Y
3	DS	CHLU	ZL	MM	CM	V2P1 CHEST UPPER LEFT Z
4	DS	CHLU	RS	MM	CM	V2P1 CHEST UPPER LEFT D RESULTANT
5	DS	CHRU	XL	MM	CM	V2P1 CHEST UPPER RIGHT X
6	DS	CHRU	YL	MM	CM	V2P1 CHEST UPPER RIGHT Y
7	DS	CHRU	ZL	MM	CM	V2P1 CHEST UPPER RIGHT Z
8	DS	CHRU	RS	MM	CM	V2P1 CHEST UPPER RIGHT RESULTANT
9	DS	CHLL	XL	MM	CM	V2P1 CHEST LOWER LEFT X
10	DS	CHLL	YL	MM	CM	V2P1 CHEST LOWER LEFT Y
11	DS	CHLL	ZL	MM	CM	V2P1 CHEST LOWER LEFT Z
12	DS	CHLL	RS	MM	CM	V2P1 CHEST LOWER LEFT RESULTANT
13	DS	CHRL	XL	MM	CM	V2P1 CHEST LOWER RIGHT X
14	DS	CHRL	YL	MM	CM	V2P1 CHEST LOWER RIGHT Y
15	DS	CHRL	ZL	MM	CM	V2P1 CHEST LOWER RIGHT Z
16	DS	CHRL	RS	MM	CM	V2P1 CHEST LOWER RIGHT RESULTANT
17	DS	ABDL	XL	MM	CM	V2P1 ABDOMEN LEFT LOWER X
18	DS	ABDL	YL	MM	CM	V2P1 ABDOMEN LEFT LOWER Y

TABLE 6.3: THOR CALCULATED MEASURES						
#	**SENTYP**	**SENATT**	**AXIS**	**YUNITS**	**CHSTAT**	**INSCOM**
19	DS	ABDL	ZL	MM	CM	V2P1 ABDOMEN LEFT LOWER Z
20	DS	ABDL	RS	MM	CM	V2P1 ABDOMEN LEFT LOWER RESULTANT
21	DS	ABDR	XL	MM	CM	V2P1 ABDOMEN RIGHT LOWER X
22	DS	ABDR	YL	MM	CM	V2P1 ABDOMEN RIGHT LOWER Y
23	DS	ABDR	ZL	MM	CM	V2P1 ABDOMEN RIGHT LOWER Z
24	DS	ABDR	RS	MM	CM	V2P1 ABDOMEN RIGHT LOWER RESULTANT

CHECKLIST 6.3 POLARITY VERIFACATION

___**6.3.1** Perform polarity check on all channels using the table below

THOR SN:	
THOR Position:	
Test Number:	
Technician:	

HEAD & NECK					
INSTRUMENT	**DIRECTION**	**MOTION**	**SAE-J211 POLARITY**	**RECORDED POLARITY**	**FLIP ?**
Head Accelerometers *	Ax	Impact back of head	+		
	Ay	Impact left of head	+		
	Az	Impact top of head	+		
Head CG Angular Rate Sensor	ωx	Rotate right ear toward right shoulder	+		
	ωy	Rotate chin away from sternum	+		
	ωz	Rotate chin toward right shoulder	+		
Upper Neck Load Cell	Fx	Move head rear, chest forward	+		
	Fy	Move head left, chest right	+		
	Fz	Move head up, chest down	+		
	Mx	Rotate left ear toward left shoulder	+		
	My	Rotate chin toward sternum	+		
	Mz	Rotate chin toward left shoulder	+		
Lower Neck Load Cell	Fx	Move head rear, chest forward	+		
	Fy	Move head left, chest right	+		
	Fz	Move head up, chest down	+		
	Mx	Rotate left ear toward left shoulder	+		
	My	Rotate chin toward sternum	+		
	Mz	Rotate chin toward left shoulder	+		
Front Neck Spring	Fz	Rotate head rearward	+		

Rear Neck Spring	Fz	Rotate chin toward chest	+		
O.C. Rotary Pot	θ_y	Rotate chin toward chest	+		
Face Load Cells	Fx	Hold back of head, push face rearward	-		

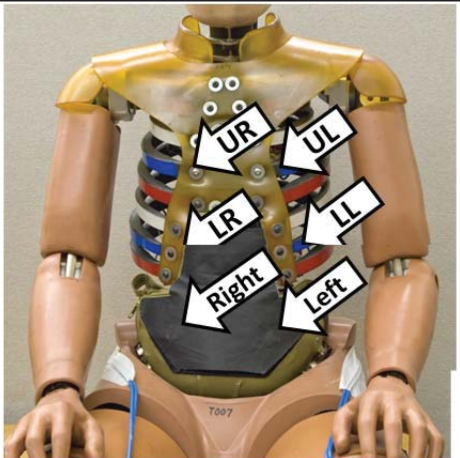
*Head acceleration checks also apply to nine-array head accelerometers

SPINE AND THORAX					
INSTRUMENT	**DIRECTION**	**MOTION**	**SAE-J211 POLARITY**	**RECORDED POLARITY**	**FLIP ?**
T1 Accelerometer	Ax	Impact back of T1Spine	+		
	Ay	Impact left of T1Spine	+		
	Az	Impact top of Spine	+		
Mid Sternum Accelerometer	Ax	Rotate dummy back (face up)	+		
T6 Accelerometer (Chest CG)	Ax	Impact back of T6 Spine	+		
	Ay	Impact left of T6 Spine	+		
	Az	Impact top of Spine	+		
T12 Accelerometer	Ax	Impact back of T12 Spine	+		
	Ay	Impact left of T12 Spine	+		
	Az	Impact top of Spine	+		
T12 Load Cell	Fx	Move chest rear, pelvis forward	+		
	Fy	Move chest left, pelvis right	+		
	Fz	Move chest up, pelvis down	+		
	Mx	Rotate left shoulder toward left hip	+		
	My	Rotate sternum towards front of legs	+		
Left Clavicle Load Cell	FMX	Pull clavicle forward away from spine	+		
	FMZ	Push clavicle down towards pelvis	+		
	FLX	Push clavicle forward away from spine	+		
	FLZ	Push clavicle down towards pelvis	+		

Right Clavicle Load Cell	FMX	Push clavicle forward away from spine	+		
	FMZ	Push clavicle down towards pelvis	+		
	FLX	Push clavicle forward away from spine	+		
	FLZ	Push clavicle down towards pelvis	+		

ABDOMEN					
INSTRUMENT	**DIRECTION**	**MOTION**	**SAE-J211 POLARITY**	**RECORDED POLARITY**	**FLIP ?**
Upper Abdomen Accelerometer	Ax	Impact back of Spine	+		

THORACIC AND ABDOMINAL IR-TRACC



Channel	Motion
DX	Push inward
RY	Push upward
RZ	Push rightward

Upper Right Thorax				Upper Left Thorax			
Channel	**Initial Value**	**Expected Polarity**	**Recorded Polarity**	**Channel**	**Initial Value**	**Expected Polarity**	**Recorded Polarity**
DX (V)		+		DX (V)		+	
RY (Deg)		+		RY (Deg)		+	
RZ (Deg)		+		RZ (Deg)		+	
Lower Right Thorax				**Lower Left Thorax**			
Channel	**Initial Value**	**Expected Polarity**	**Recorded Polarity**	**Channel**	**Initial Value**	**Expected Polarity**	**Recorded Polarity**
DX (V)		+		DX (V)		+	
RY (Deg)		+		RY (Deg)		+	
RZ (Deg)		+		RZ (Deg)		+	
Abdomen Right				**Abdomen Left**			
Channel	**Initial Value**	**Expected Polarity**	**Recorded Polarity**	**Channel**	**Initial Value**	**Expected Polarity**	**Recorded Polarity**
DX (V)		+		DX (V)		+	
RY (Deg)		+		RY (Deg)		+	
RZ (Deg)		+		RZ (Deg)		+	

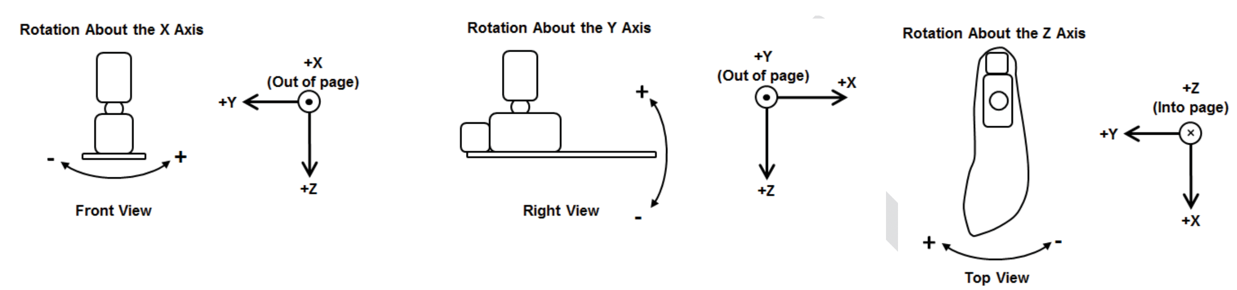
PELVIS					
INSTRUMENT	**DIRECTION**	**MOTION**	**SAE-J211 POLARITY**	**RECORDED POLARITY**	**FLIP ?**
Pelvis CG Accelerometer (Tri-pack)[b]	Ax	Impact back of Pelvis	+		
	Ay	Impact left of Pelvis	+		
	Az	Impact top of Spine	+		
L Acetabular LC	Fx	Move femur forward, pelvis rear	+		
	Fy	Move femur right, pelvis left	+		
	Fz	Move femur down, pelvis up	+		
R Acetabular LC	Fx	Move femur forward, pelvis rear	+		
	Fy	Move femur right, pelvis left	+		
	Fz	Move femur down, pelvis up	+		
L ASIS	Fx	Push in towards back of pelvis	-		
	My	Push top of ASIS towards back of pelvis	+		
R ASIS	Fx	Push in towards back of pelvis	-		
	My	Push top of ASIS towards back of pelvis	+		

FEMUR					
INSTRUMENT	**DIRECTION**	**MOTION**	**SAE-J211 POLARITY**	**RECORDED POLARITY**	**FLIP ?**
Left Femur Load Cell	Fx	Move knee upward, upper femur down	+		
	Fy	Move knee right, upper femur left	+		
	Fz	Move knee forward, femur rear	+		

	Mx	Rotate knee left, hold upper femur	+		
	My	Rotate knee up, hold upper femur	+		
	Mz	Rotate tibia left, hold pelvis	+		
Right Femur Load Cell	Fx	Move knee upward, upper femur down	+		
	Fy	Move knee right, upper femur left	+		
	Fz	Move knee forward, femur rear	+		
	Mx	Rotate knee left, hold upper femur	+		
	My	Rotate knee up, hold upper femur	+		
	Mz	Rotate tibia left, hold pelvis	+		

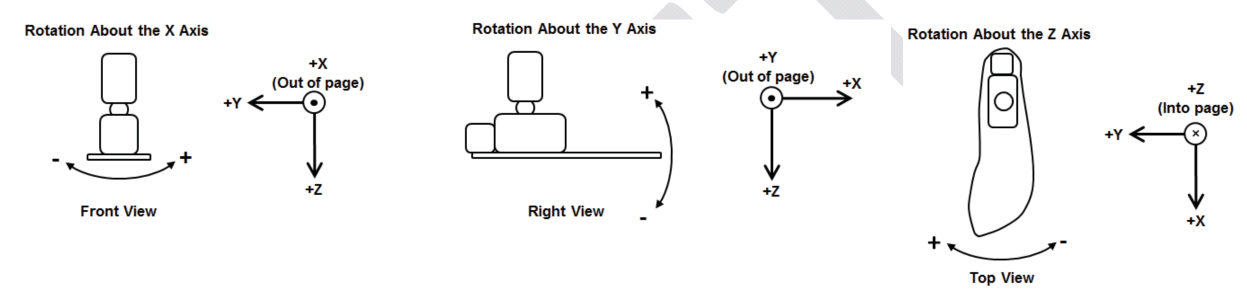
LOWER EXTREMITY LEFT					
INSTRUMENT	**DIRECTION**	**MOTION**	**SAE-J211 POLARITY**	**RECORDED POLARITY**	**FLIP ?**
Knee Shear Displacement	Dx	Hold femur, move tibia forward	+		
Upper Tibia Load Cell	Fx	Move tibia forward, knee rearward	+		
	Fy	Move ankle right, knee left	+		
	Fz	Move ankle down, knee up	+		
	Mx	Impact left of Tibia	+		
	My	Impact front of Tibia	+		
Lower Tibia Load Cell	Fx	Move ankle forward, knee rearward	+		
	Fy	Move ankle right, knee left	+		
	Fz	Move ankle down, knee up	+		
	Mx	Impact left of Tibia	+		
	My	Impact front of Tibia	+		
Tibia	Ax	Impact back of Tibia	+		

Accelerometer	Ay	Impact left of Tibia	+		
Achilles Load Cell	Fz	Rotate foot forward	+		
Ankle Rotation	θ_x	Hold tibia, rotate foot leftward	+		
	θ_y	Hold tibia, push toe upward	+		
	θ_z	From top, hold tibia, rotate foot CCW	+		



Foot Acceleration	Ax	Impact back of Foot	+		
	Ay	Impact left of Foot	+		
	Az	Impact top of Foot	+		

LOWER EXTREMITY RIGHT					
INSTRUMENT	**DIRECTION**	**MOTION**	**SAE-J211 POLARITY**	**RECORDED POLARITY**	**FLIP ?**
Knee Shear Displacement	Dx	Hold femur, move tibia forward	+		
Upper Tibia Load Cell	Fx	Move tibia forward, knee rearward	+		
	Fy	Move ankle right, knee left	+		
	Fz	Move ankle down, knee up	+		
	Mx	Impact left of Tibia	+		
	My	Impact front of Tibia	+		
Lower Tibia Load Cell	Fx	Move ankle forward, knee rearward	+		
	Fy	Move ankle right, knee left	+		
	Fz	Move ankle down, knee up	+		

	Mx	Impact left of Tibia	+		
	My	Impact front of Tibia	+		
Tibia Accelerometer	Ax	Impact back of Tibia	+		
	Ay	Impact left of Tibia	+		
Achilles Load Cell	Fz	Rotate foot forward	+		
Ankle Rotation	θ_x	Hold tibia, rotate foot leftward	+		
	θ_y	Hold tibia, push toe upward	+		
	θ_z	From top, hold tibia, rotate foot CCW	+		
					
Foot Acceleration	Ax	Impact back of Foot	+		
	Ay	Impact left of Foot	+		
	Az	Impact top of Foot	+		

CHECKLIST 6.4 – HEAD BOLT COORDINATE SYSTEM

For the following steps make sure to insert CMM probe into hole of the bolt. See Figure 6.6. Reference Figure 6.7 as the following steps are completed

Figure 6.6

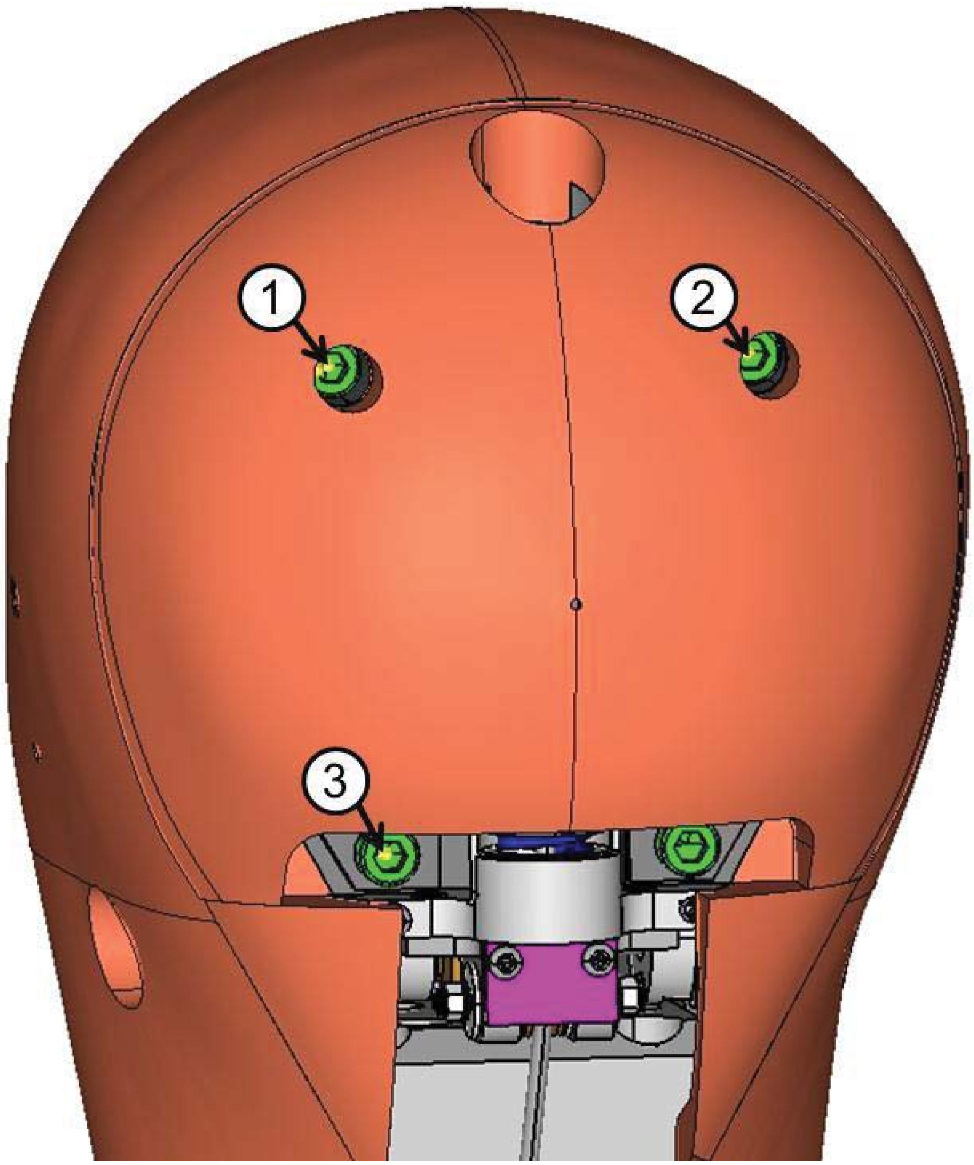


Figure 6.7

___6.4.1 Create the upper left bolt coordinate system (1), such that:

4) Start ..

(a) Positive X is from the back of the head to the front of the head

(b) Positive Y is from the left side of the head to the right side of the head when looking from the rear of the head
(c) Positive Z is positive from the top of head to the bottom of the head
(d) Upper right head bolt (2) is a point on the Y-axis
(e) Lower left head bolt (3) is a point on the Z-axis

___**6.4.2** Measure and record all the points shown on the Figure 6.8 relative to the Head Bolt Coordinate system

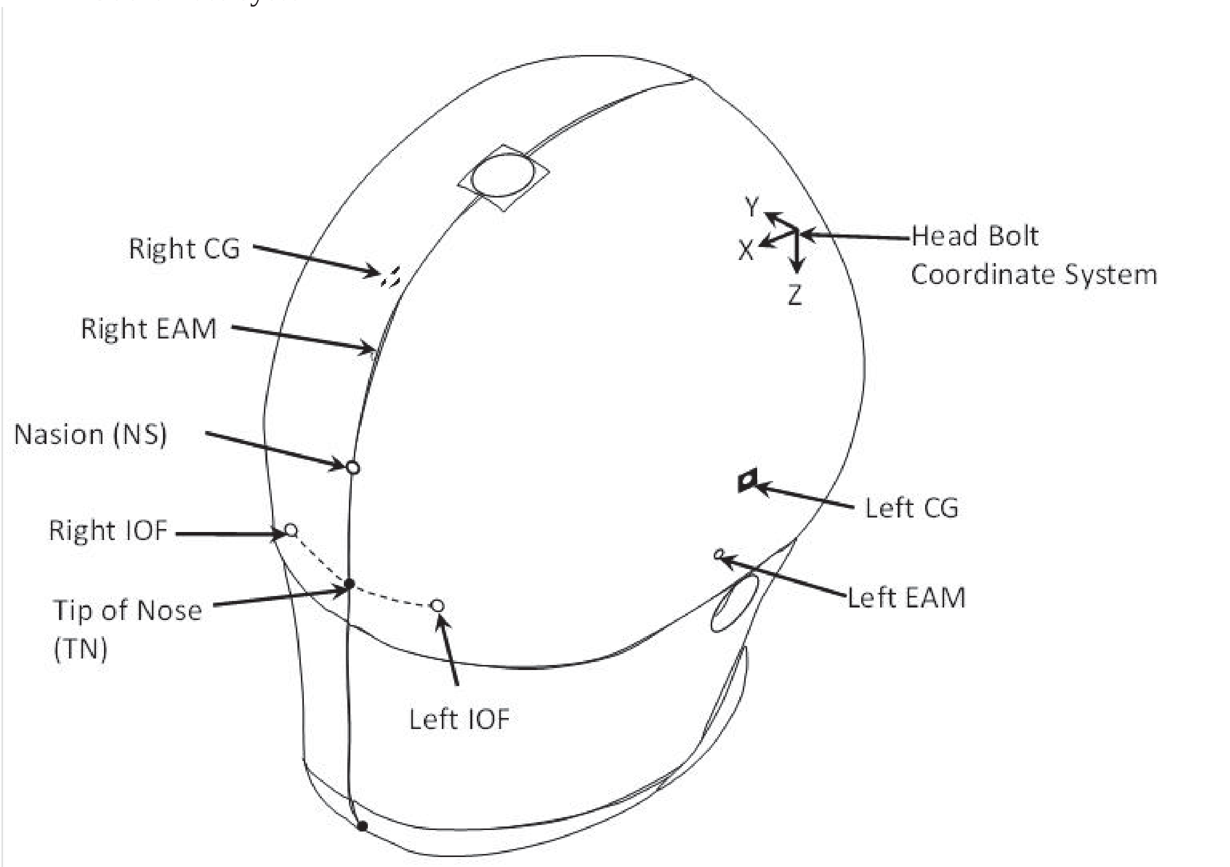


Figure 6.8

___**6.4.3** Calculate the difference from the measured point and the desired point
___**6.4.4** If any of the points have a difference of +/- 2 mm remove head skin and re-install the head skin
___**6.4.5** Measure and record head points again

TABLE 6.4			
LOCATION	**X MEASURED**	**X DESIRED**	**X DIFFERENCE**
CG		65	
Left CG		65	
Left EAM		72	
Left IOF		154	
Right IOF		154	
Nasion		157	

Right EAM		72	
Right CG		65	

TABLE 6.5			
LOCATION	Y MEASURED	Y DESIRED	Y DIFFERENCE
CG		35	
Left CG		-42	
Left EAM		-37	
Left IOF		3	
Right IOF		67	
Nasion		35	
Right EAM		107	
Right CG		112	

TABLE 6.6			
LOCATION	Z MEASURED	Y DESIRED	Z DIFFERENCE
CG		45	
Left CG		45	
Left EAM		72	
Left IOF		73	
Right IOF		73	
Nasion		35	
Right EAM		72	
Right CG		45	

CHECKLIST 6.5 – ATD HEAD TARGETS

Reference the Figure 6.9 for the following steps. Complete these steps on both the driver and passenger ATDs. Non glare targets shall be used.

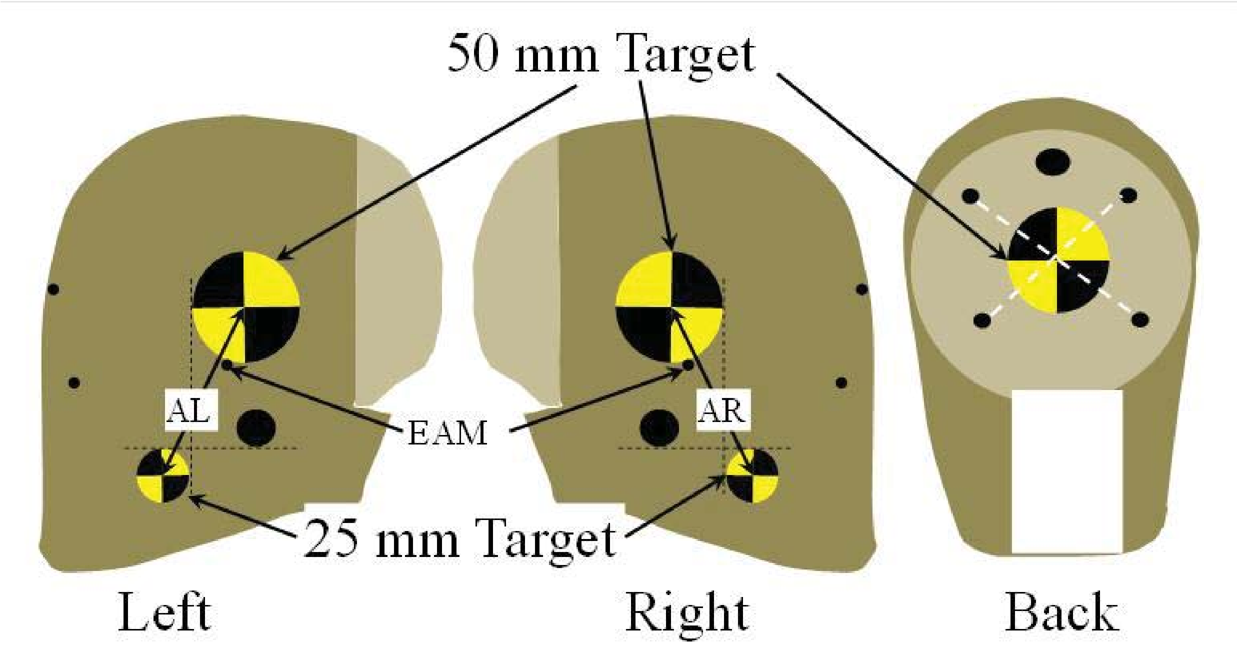


Figure 6.9

LEFT SIDE

___6.5.1 On the left side of the driver's head, while in a leveled orientation, apply a 50 mm target, centered on the head CG (x-z plane). Note: Make sure the EAM marker is not covered by target.

___6.5.2 Apply a 25 mm target, such that:

___6.5.2.1 The back of the 25 mm targets aligns with the front of the 50 mm Target

___6.5.2.2 The top of the 25 mm target aligns with the bottom of the pivot whole of the head.

___6.5.3 Measure and record the distance between targets. AL = _____ mm

RIGHT SIDE

___6.5.4 On the right side of the driver's head, while in a leveled orientation, apply a 50 mm target, centered on the head CG (x-z plane). Note: Make sure the EAM marker is not covered by target.

___6.5.5 Apply a 25 mm target, such that:

___6.5.5.1 The back of the 25 mm targets aligns with the front of the 50 mm Target

___6.5.5.2 The top of the 25 mm target aligns with the bottom of the pivot whole of the head.

___6.5.6 Measure and record the distance between targets. AR = _____ mm

REAR SIDE

___**6.5.7** With the head in a leveled orientation, apply a 50 mm target, such that the center of the target is in the center of the bolts.

SECTION 7 - TEST EXECUTION CHECKLIST

CHECKLIST 7.1 - STABILIZE OMDB SUSPENSION

___**7.1.1** Ensure the weight distribution is within specified tolerances.
___**7.1.2** Position the OMDB such that it is longitudinal centerline of the OMDB is located at the center of the track.
___**7.1.3** Position the front of the OMDB, with honeycomb, at the desired impact point
___**7.1.4** Push the OMDB back to its starting point.
___**7.1.5** Push the OMDB forward from the starting point until the front of the OMDB is aligned with the desired impact point. Note: Do not push the OMDB backwards anytime while performing this step.
___**7.1.6** Verify the OMDB is level from side-to-side and front-to-back.
___**7.1.7** Verify that the distance between the bottom of the aluminum mounting plate and the ground is between 80-85 mm.
___**7.1.8** If the criteria in step ___7.1.6 or step ___7.1.7are not meet, adjust the OMDB's shocks and repeat steps ___7.1.2 and ___7.1.5 until the conditions in steps 6 and 7 are met.
___**7.1.9** Record ground the clearance: _______mm

CHECKLIST 7.2 - GROUND TARGETS AND REFERENCE LINE

Reference Figure 7.1 as the following steps are completed.

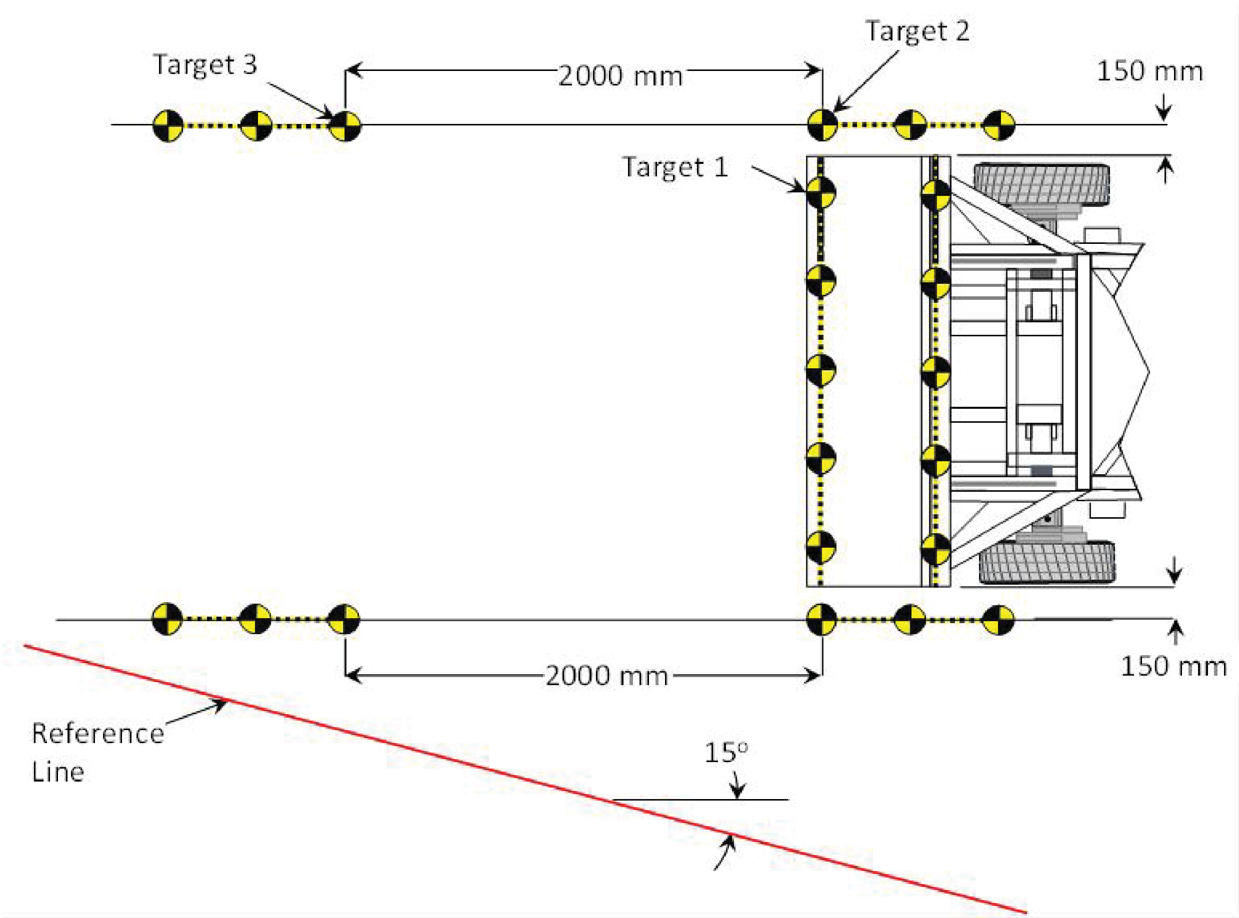


Figure 7.1: Ground targets and reference line

Check one: ____Left Side Impact _____Right Side Impact

___**7.2.1** Ensure the OMDB suspension is stabilized.

___**7.2.2** If this is a "Left Side Impact," construct a reference line on the floor of the test area that is 15 degrees clockwise from the OMDB centerline.

___**7.2.3** If this is a "Right Side Impact," construct a reference line on the floor of the test area that is 15 degrees counterclockwise from the OMDB centerline.

___**7.2.4** Place a 152 mm non-glare target on the ground with its center in the same transverse plane as the center of Target 1 and 150 mm, measured laterally, from the side of the honeycomb. This target shall be referred to as Target 2.

___**7.2.5** Place two 152 mm non-glare targets on the ground at a spacing of 450 mm beginning at Target 2 and extending toward the rear of the OMDB along a line that is parallel to the OMDB centerline and passes through Target 2.

___**7.2.6** Place a 152 mm non-glare target on the ground 2000 mm forward of Target 2 along a line parallel to the OMDB that passes through Target 2. This target shall be referred to as Target 3.

___**7.2.7** Place two 152 mm non-glare targets on the ground at a spacing of 450 mm beginning at Target 3 and extending away from the front of the OMDB along a line that is parallel to the OMDB centerline that passes through Target 3.

___**7.2.8** Place the ground targets for the left side of the OMDB following the same procedure

CHECKSHEET G.3 - INITIAL ALIGNMENT OF TEST VEHICLE

Reference Figure 7.2 as the following steps are completed.

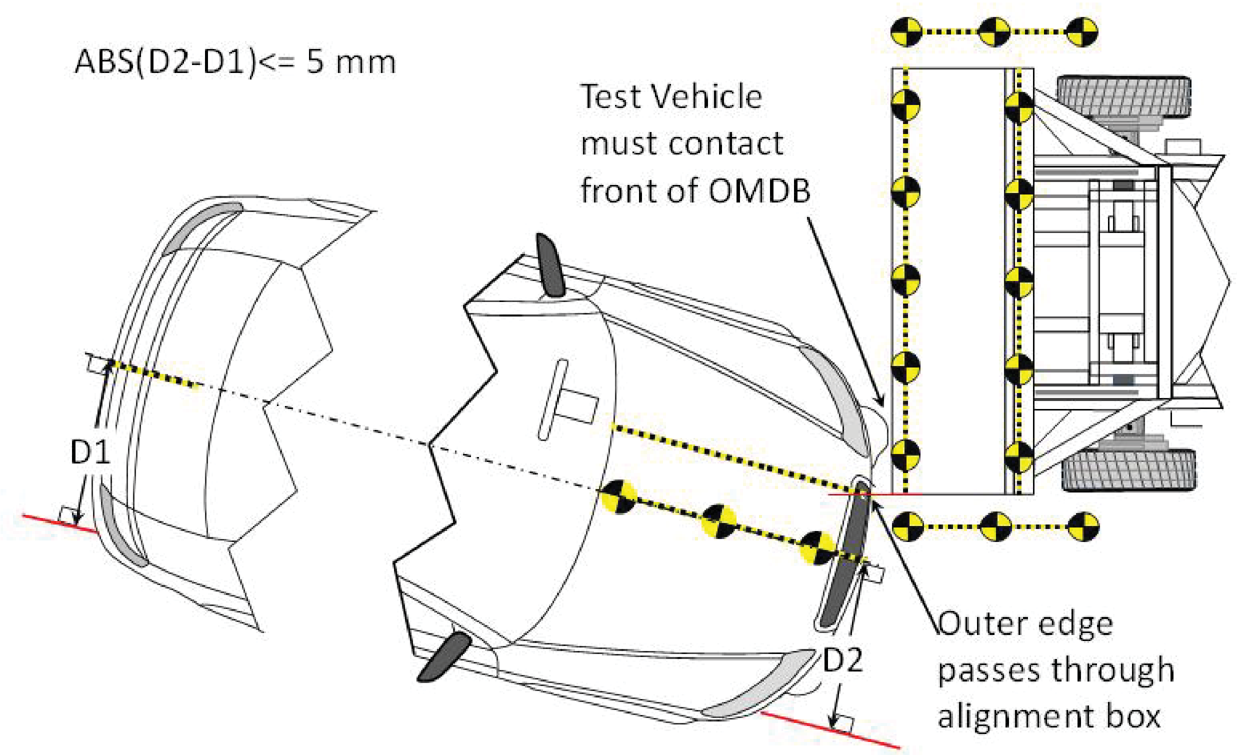


Figure 7.2: Vehicle and OMDB alignment

___**7.2.9** Push the test vehicle by hand parallel to this centerline until the left edge of the OMDB's aluminum honeycomb barrier aligns with the alignment box that was determined in Section D, Alignment Point and the front of the vehicle is contacting the front of the honeycomb.

___**7.2.10** Place a plumb bob at the longitudinal centerline at the front of the vehicle and another plumb bod at the longitudinal centerline at the back of the vehicle.

___**7.2.11** Measure the distance from the rear plumb bob to the reference line (D1) and measure the distance from the front plumb bob to the reference line (D2)

___**7.2.12** Calculate the difference between D2 and D1

___**7.2.13** If the following conditions are not meet re-position the vehicle until they are meet

5) Start ..

(a) The edge of OMDB's honeycomb passes through the alignment box
(b) The vehicle is touching the front of the OMDB's honeycomb
(c) The absolute value of D2 – D1 is less than or equal to 5 mm.

CHECKLIST 7.3 - ATTACHMENT OF ATDS TO DATA ACQUISITION SYSTEM AND INSTALLATION OF ATDS

___**7.3.1** Place each ATD on a chair outside the test vehicle next to the driver and passenger seats, route each ATD instrumentation umbilical cable to the center console and along the centerline of the vehicle to the data acquisition system, and connect all required instrumentation to the data acquisition system.

___**7.3.2** After connecting to the data acquisition system, verify all channels are working properly and the polarities for each dummy are correct (see Polarity Checklist).

___**7.3.3** Install and position the driver ATD according to Checklist ## beginning at Step 16.

___**7.3.4** Install and position the passenger ATD according to Checklist ## beginning at Step ##.

___**7.3.5** Remove excess slack from the ATD instrumentation umbilical cables and secure the cables to the interior of the vehicle. Leave enough slack to allow free movement of the ATDs during the crash test without breaking or straining the cables.

CHECKLIST 7.4 – SEAT BELT LOAD CELLS

Mount load cells on both front outboard lap and shoulder belts (4 load cell units required) if allowed by the vehicle manufacturer per the provided Form 1. If not, contact COR to determine if load cell shall be used or not. Attachment of load cells shall not affect seat belt positioning or function in any way.

___**7.4.1** Position the lap belt load cells on the belt webbing so as to avoid contact with any objects other than the lap belt to which they are attached.

___**7.4.2** Mount the shoulder belt load cells immediately behind the dummy's outboard shoulder such that during the frontal crash test, they do not come in contact with anything other than the belt to which they are attached.

___**7.4.3** Support each load cell by suspending it with masking tape so that the weight of the load cell does not introduce any slack into the belt system. The tape should be strong enough to carry the load cell's weight, but not strong enough to affect belt stretch or loading. Normally, 12.5 mm wide tape is used, and is placed between the load cell and the vehicle's inner roof rail

CHECKLIST 7.5 – CHALKING OF DUMMY

___**7.5.1** Chalk the dummies according to Table 7.1

Note: The driver and passenger ATDs shall have clothes of a contrasting color to each other so that the motion of each dummy can be easily identified during video analysis.

TABLE 7.1

DUMMY PART	DRIVER	PASSENGER
Nose Area	Red	Red
Lip Area	Red	Red
Face	Blue	Blue
Top of Head	Yellow	Yellow
Back of Head	Red	Red
Left Knee	Red	Red
Right Knee	Blue	Blue
Right Tibia	Yellow	Yellow
Left Tibia	Blue	Blue
Outside Upper Torso	Blue	Blue
Outside Lower Torso	Yellow	Yellow
Outside Side Chest	Orange/Green	Orange/Green
Outside Arm	Purple	Purple
Outside Leg	Yellow	Yellow
Outside Tibia	Red	Red

Note: The driver and passenger ATDs shall have clothes of a contrasting color to each other so that the motion of each dummy can be easily identified during video analysis.

CHECKLIST 7.6 – DRIVER AND VEHICLE MEASUREMENT POINTS

Reference Figure 7.3 when completing the following steps. Note: If bolt is hex head measure the center. If bolt requires allen wrench make sure to insert CMM probe into allen wrench whole (Figure 7.4)

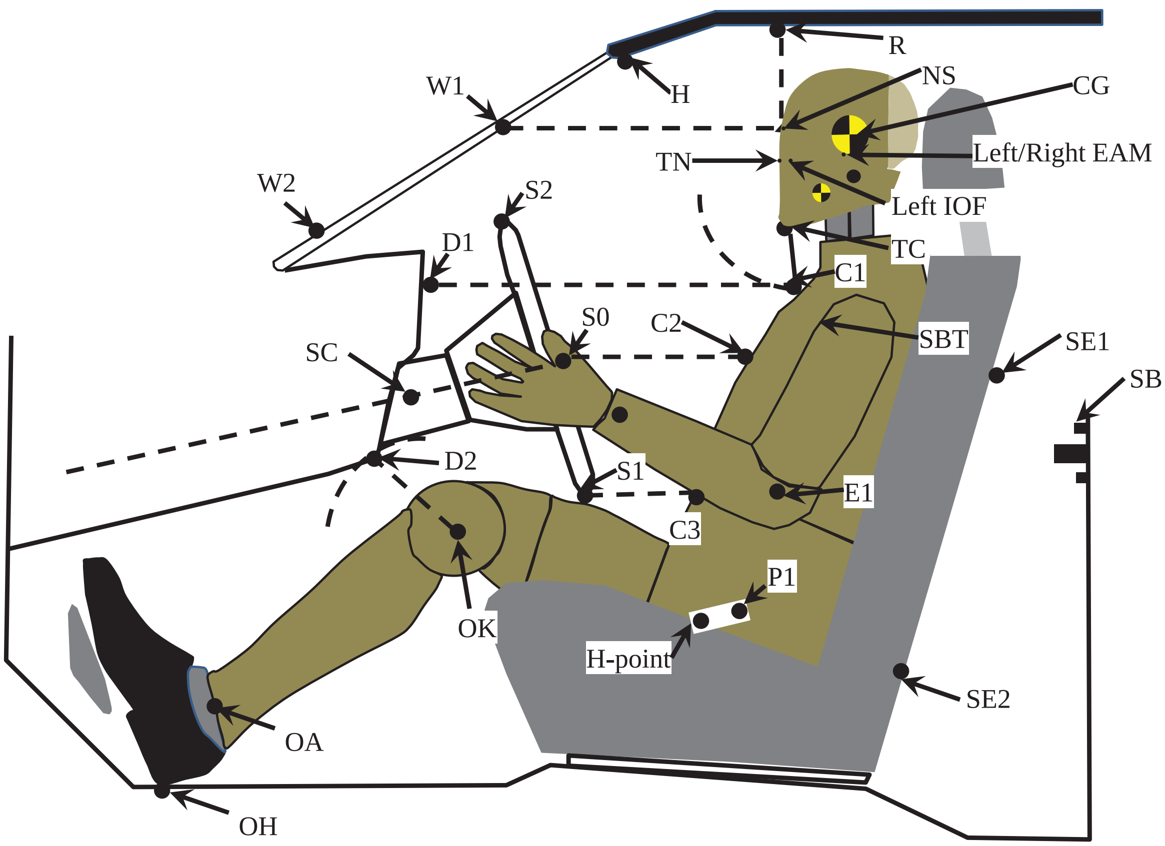
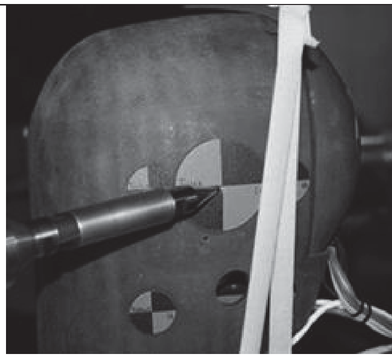


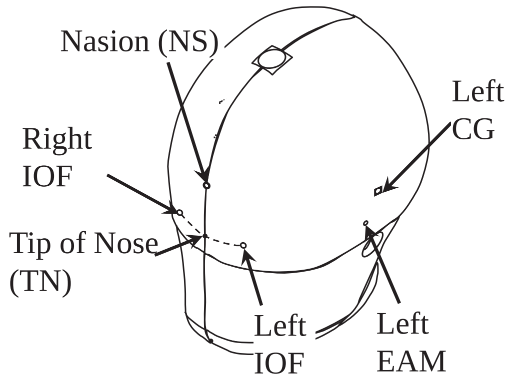
Figure 7.3: CMM points of vehicle and dummy to calculate longitudinal distances

Figure 7.4

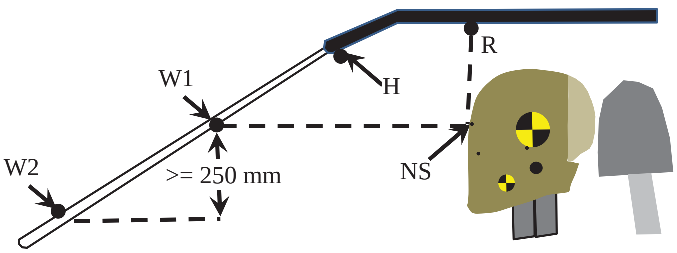
___**7.6.1** Measure the following points relative to the VCS using CMM

___**7.6.2** CG: Measure and record the Left Head CG





___**7.6.3** Nasion (NS): Using CMM measure and record the Nasion



___**7.6.4 W1:** Find the Z coordinate of the Nasion and the moving forward in the XZ plane at the same height of the Z coordinate of the Nasion until the windshield is contacted (Figure 7.3). Measure and record

___**7.6.5 W2:** In the same XZ plane as W1 move down the windshield at least a Z distance of 250 mm (Figure 7.3). Measure and record

___**7.6.6 H:** Find the furthest point forward on the header in the same XZ plane as Nasion (Figure 7.3). Measure and record

___**7.6.7** R: Move up from Nasion in the same XZ plane as Nasion until the roof is contacted Figure 7.3.). Measure and Record

___**7.6.8 Left and Right IOF:** Measure and record the Left and Right Infra-Orbital Foramen Figure 7.3

___**7.6.9 TN:** Measure and record the point between the Left and Right IOF (Figure 7.3)

___**7.6.10 Left EAM:** Measure and record the Left EAM (Figure 7.3)

___**7.6.11 S0:** Measure and record the center of the steering wheel

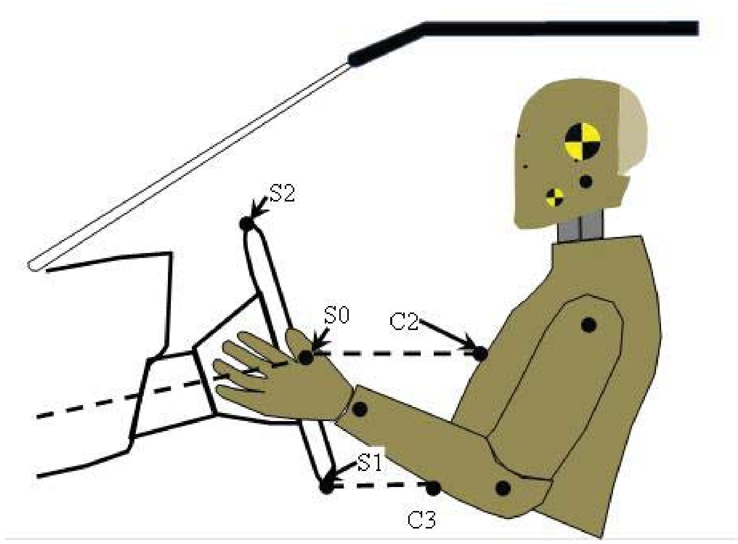


Figure 7.5

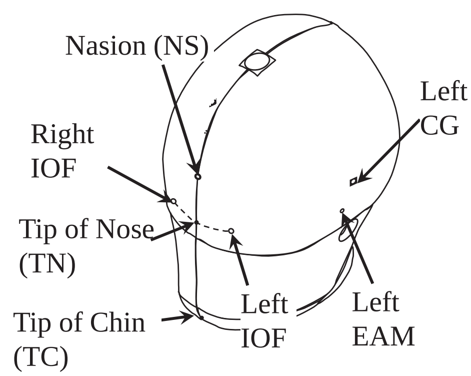
___**7.6.12 C2:** In the same XZ plane and the same Z height of S0 move back until the dummy chest is contacted (Figure 5). Measure and record

___**7.6.13 S2:** The closest point to the ATD on the top of the steering wheel rim in the XZ plane passing through the centerline of the ATD. Measure and record.

___**7.6.14 S1:** The closest point to the ATD on the bottom of the steering rim in the XZ plane passing through the centerline of the ATD. Measure and record.

___**7.6.15 C3:** In the same XZ plane plane and the same Z height of S0 move backwards until the dummy chest is contacted. Measure and record

___**7.6.16 TC:** Measure and record the ATD's tip of chin.



___**7.6.17 C1:** Place a tape measure on the tip of the dummy's chin and rotate 127 mm of it downward toward the dummy to the point of contact on the transverse center of the dummy's chest. Measure and record

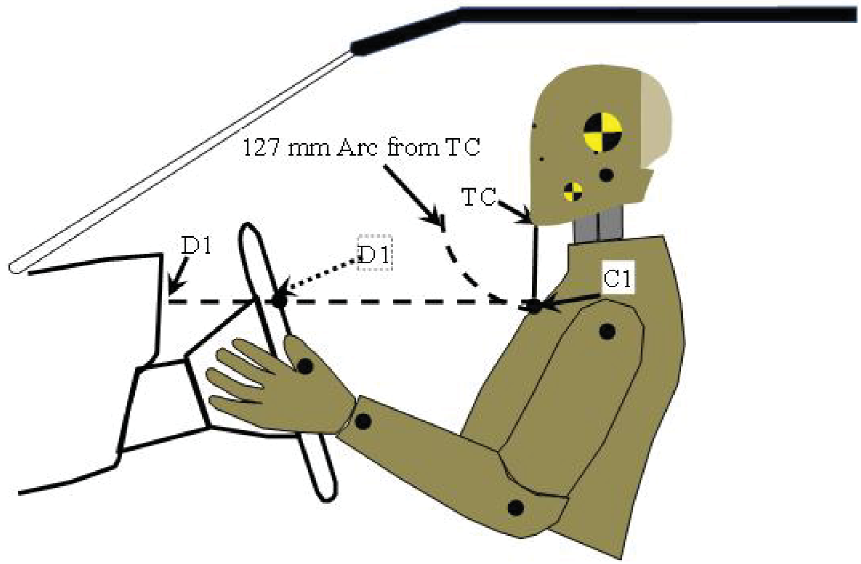
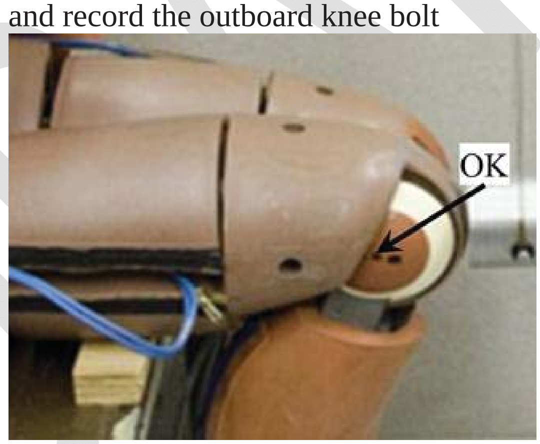


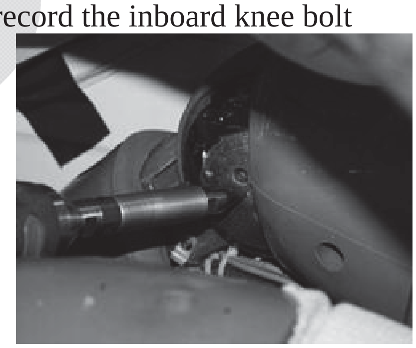
Figure 7.6

___**7.6.18 D1:** In the same XZ plane and the same Z height of C1 move forwards until the closest point on the dashboard either between the upper part of the steering wheel between the hub and the rim, or measure to the dashboard placing the tape measure above the rim, whichever is a shorter measurement.

___**7.6.19 OK:** Measure and record the outboard knee bolt



___**7.6.20 IK:** Measure and record the inboard knee bolt



___**7.6.21 D2:** Taken from the center of the outboard knee pivot bolt's outer surface to the closest point forward acquired by swinging the tape measure in continually larger arcs until it contacts the dashboard (Error! Reference source not found.). Measure and Record

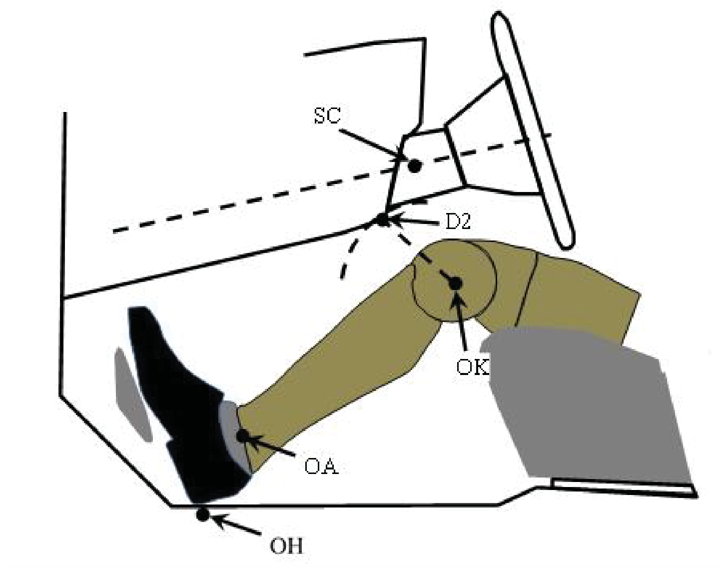


Figure 7.7

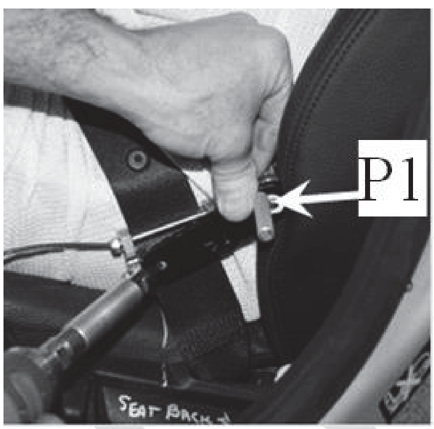
___7.6.22 SC: Create and measure a point along the centerline of the steering column

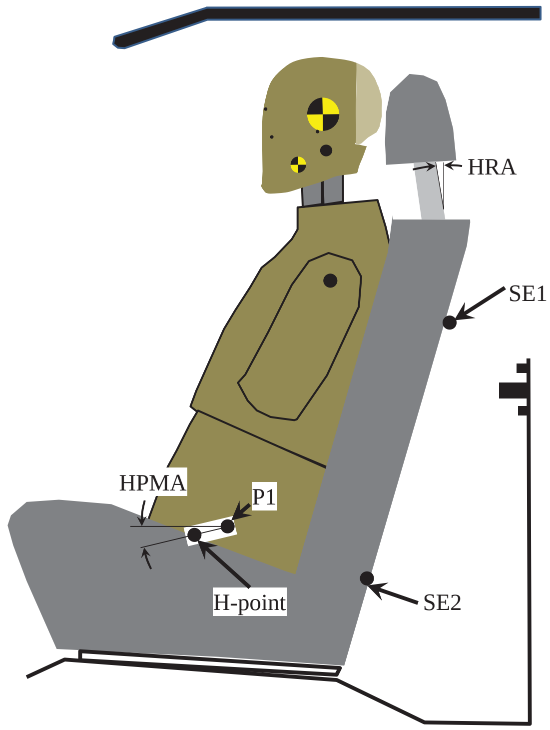
___7.6.23 OA: Measure and record the outboard ankle bolt

___7.6.24 OH: Measure and record the outboard heel point

___7.6.25 IH: Measure and record the outboard heel point

___**7.6.26 H-Point:** Measure and record the H-point location on the H-point tool





___**7.6.27 P1:** Measure and record the center of the H-point tool where it inserts into the pelvis

___**7.6.28 SE1 and SE2:** Measure and record two point on the back of the seat at the centerline of the seat

___**7.6.29 HRA:** Measure and record the head restraint post angle.

___**7.6.30 E1:** Measure and record the outboard elbow

___7.6.31 30 SBT: Measure and record shoulder bolt

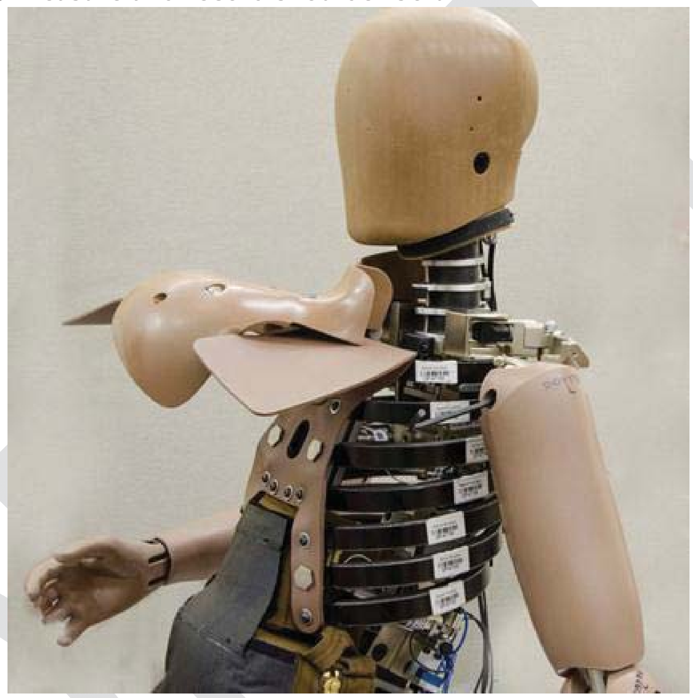
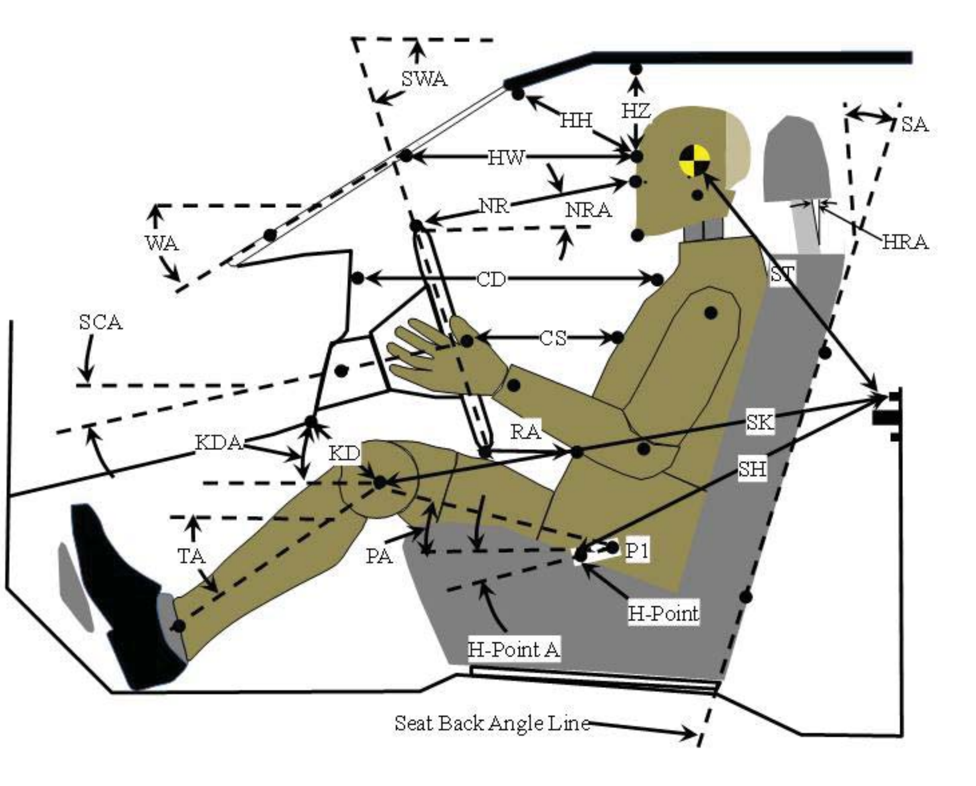


TABLE 7.2: DRIVER AND INTERIOR POINTS RELATIVE TO VCS				
POS	**DESCRIPTION**	**X**	**Y**	**Z**
SB	Center of the upper striker bolt			
CG	Head CG (Left)			
W1	Windshield point 1			
W2	Windshield point 2			
H	Point on the header			
R	Point on the roof			
NS	Nasion			
Left IOF	Left Infra-Orbital Foramen			
Right IOF	Right Infra-Orbital Foramen			
TN	Tip of nose			
S0	Center of steering wheel			
C2	Point on chest 2			

TABLE 7.2: DRIVER AND INTERIOR POINTS RELATIVE TO VCS				
POS	**DESCRIPTION**	**X**	**Y**	**Z**
S2	Top of the steering wheel			
S1	Bottom of the steering wheel			
C3	Point on chest 3			
TC	Tip of the chin			
C1	Point on chest 3			
D1	Point on dash			
OK	Outboard knee bolt			
IK	Inboard knee bolt			
D2	Knee point on IP			
SC	Point of steering column			
OA	Outboard ankle bolt			
OH	Outer heel point			
IH	Inboard heel point			
H-point	H-point			
P1	Center of H-point tool			
E1	Outboard Elebow			
Left EAM	Left External Auditory Meatus (EAM)			
SBT	Shoulder Bolt			

CHECKLIST 7.7 CALCULATE THE DRIVERS LONGITUDINAL MEASUREMENTS

Using the points in Table 7.2 calculate all the longitudinal distances and angles in the figure below



CODE	DESCRIPTION	DRIVER	
		LENGTH (MM)	ANGLE (^{O})
WA^{o}	Windshield Angle		
SWA^{o}	Steering Wheel Angle		
SCA^{o}	Steering Column Angle		
SA^{o}	Seat Back Angle		
HRA^{0}	Outboard Head Restraint Post Angle		
HZ	Head to Roof (Z)		
HH	Head to Header		
HW	Head to Windshield		
NR	Nose to Rim		
CD	Chest to Dash		
CS	Chest to Steering Hub		
RA	Rim to Abdomen		
KDL	Left Knee to Dash		
KDR	Right Knee to Dash		
PA^{o}	Pelvic Angle		
TA^{o}	Tibia Angle		

SK	Striker to Knee		
ST	Striker to Head		
SH	Striker to H-Point		
HAX°	Head Angle (X)		
HAY°	Head Angle (Y)		
TAX°	T6 Angle (X)		
TAY°	T6 Angle (Y)		
LAX°	T1 (X)		
LAY^0	T1 (Y)		

CHECKLIST 7.8 DRIVER EXTRA CMM MEASUREMENTS

___**7.8.1** Measure and record all the points listed below

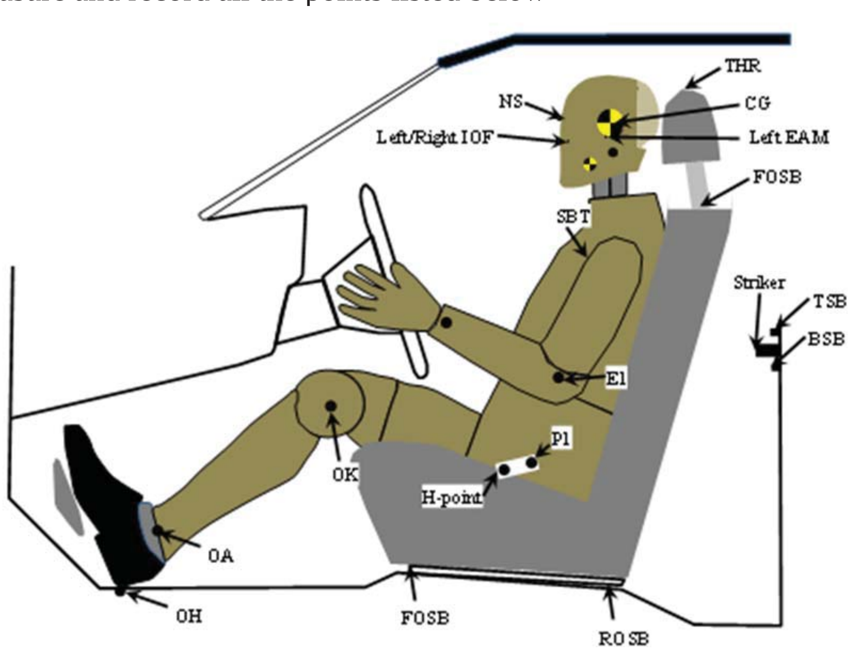
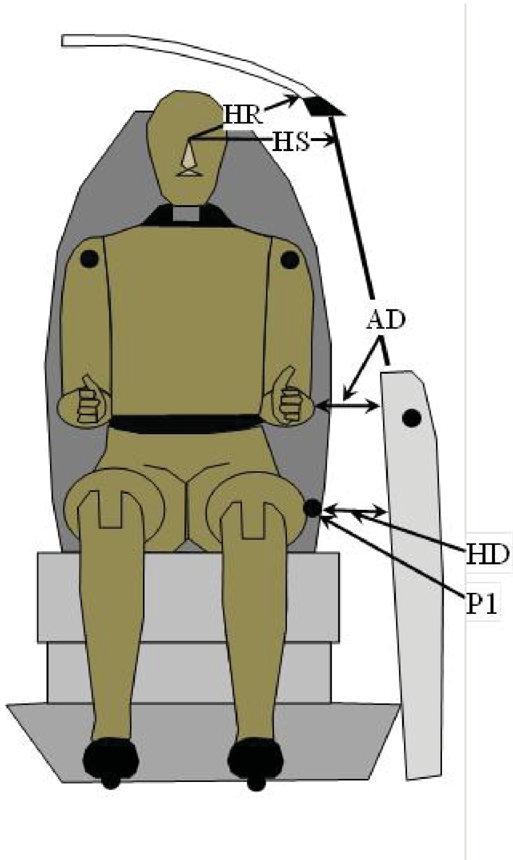


TABLE 3: DRIVER AND INTERIOR POINTS RELATIVE TO VCS				
POS	**DESCRIPTION**	**X**	**Y**	**Z**
TSB	Center Top Striker Bolt			
BSB	Center Bottom Striker Bolt			
Striker	Center of Striker			
FOSB	Front Outboard Seat Belt			
ROSB	Rear Outboard Seat Belt			
OHRB	Most Outboard Part of the Head Restraint Post (Where it enters the seat)			
THR	Top of Head Restraint			
CG	Head CG			
NS	Nasion			
Left EAM	Left EAM			
Left IOF	Left IOF			
Right IOF	Right IOF			
E1	Outboard Elebow			
H-point	H-point			
P1	Center of H-point tool			
OK	Outboard knee bolt			
IK	Inboard knee bolt			
OA	Outboard ankle bolt			
OH	Outer heel point			
IH	Inboard heel point			

CHECKLIST 7.9 DRIVER LATERAL CLEARANCE DIMENSIONS

The following measurements are to be made within a vertical transverse plane



___**7.9.1 HS - Head to Side Window -** Taken from the point where the dummy's nose meets his forehead (between his eyes) to the outside of the side window. In order to make this measurement, roll the window down to the exact height that allows a level measurement. Use a level.

___**7.9.2 AD - Arm to Door** -Taken from the outer surface of the elbow pivot bolt on ATD to the first point it hits on the door.

___**7.9.3 HD -H-point to Door** - taken from the H-point on the dummy to the closest point on the door. Use a level.

___**7.9.4 HR - Head to Side Header** - measure the shortest distance from the point where the dummy's nose meets his forehead (between his eyes) to the side edge of the header just above the window frame, directly adjacent to the dummy.

CHECKLIST 7.10 – SEAT BELT POSITION MEASUREMENTS

For both the driver and passenger ATD's, take the following measurements and record. Use the figure below to perform the following steps .

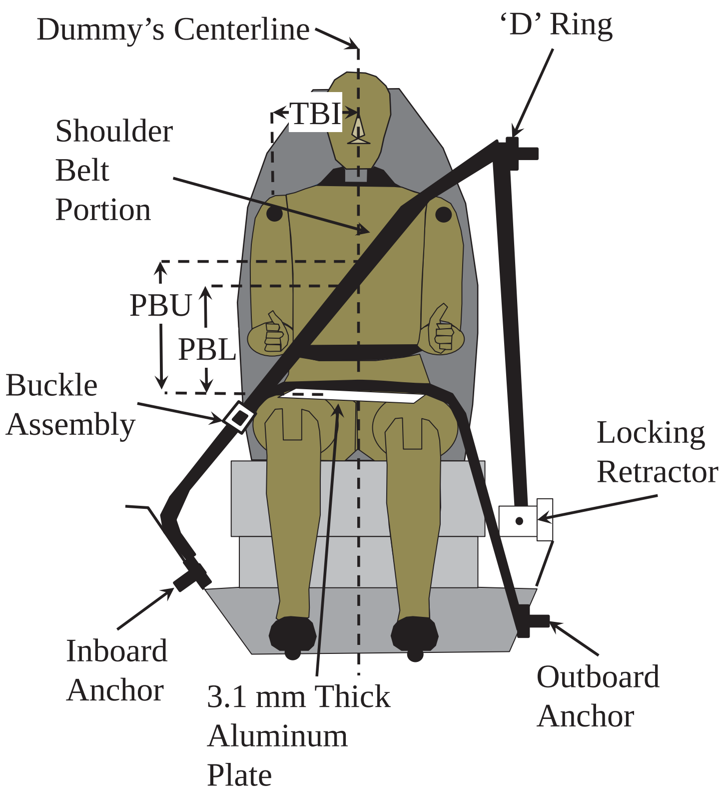


Figure 8

___1 PBU – Top surface of reference (3.1 mm Thick Aluminum Plate) to belt upper edge along dummy centerline

___2 PBL – Top surface of reference (3.1 mm Thick Aluminum Plate) to belt lower edge along dummy centerline

___3 Shoulder belt length as measured on ATD

___4 Lap belt length as measured on ATD

___5 Remainder of belt on reel

___6 Total belt length for continuous webbing systems

SEAT BELT POSITIONING MEASUREMENTS	DRIVER	PASSENGER
PBU – Top surface of reference to belt upper edge	mm	mm
PBL – Top surface of reference to belt lower edge	mm	mm

BELT LENGTH DATA	DRIVER	PASSENGER
Shoulder belt length as measured on ATD	mm	mm
Lap Belt Length as measured on ATD	mm	mm
Remainder of belt on reel	mm	mm
Total belt length for continuous webbing systems	mm	mm

CHECKLIST 7.11 – SETUP FOR GLOBAL MEASUREMENTS OF DRIVER AND VEHICLE MOUNTING PLATE

___**7.11.1** Reference the figure below to perform the following steps

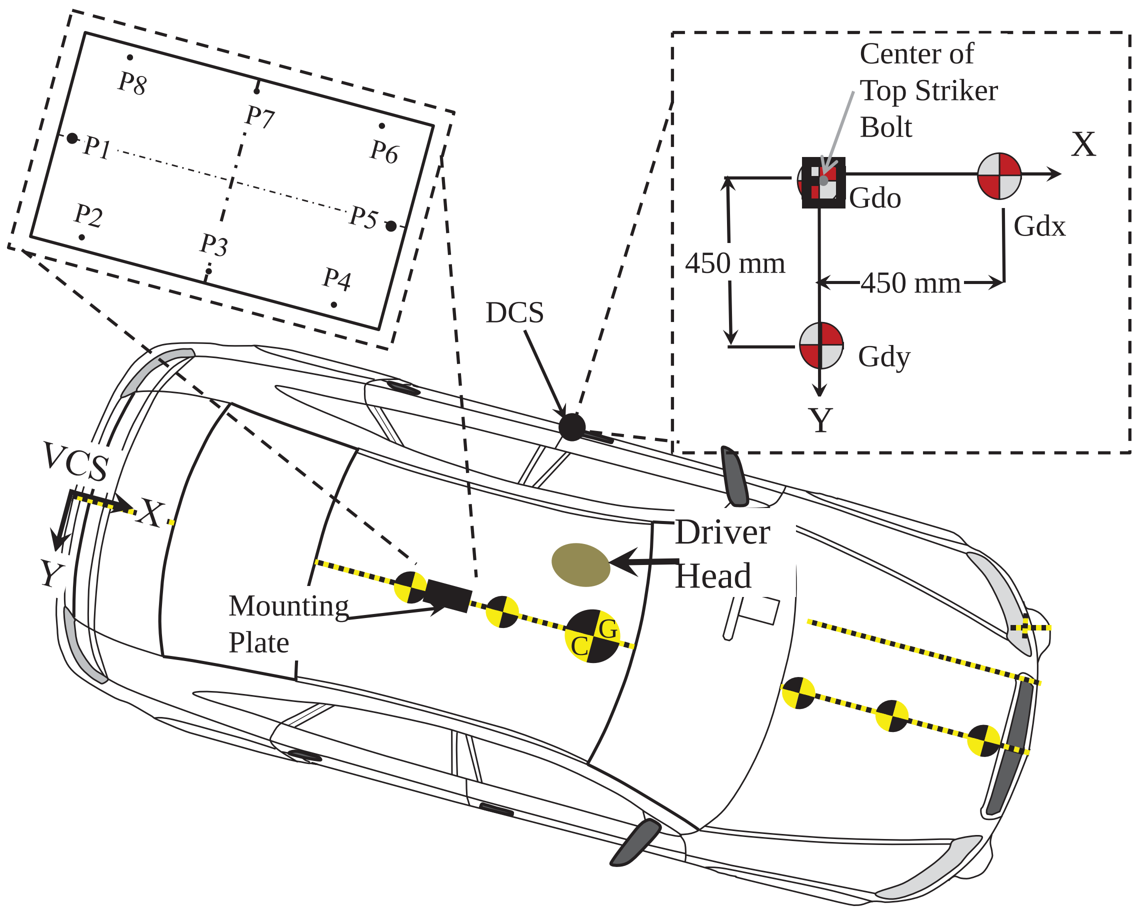


Figure 7.9: Coordinate Systems

___**7.11.2** Create a driver's global coordinate system (DCS) for the driver following the procedure below

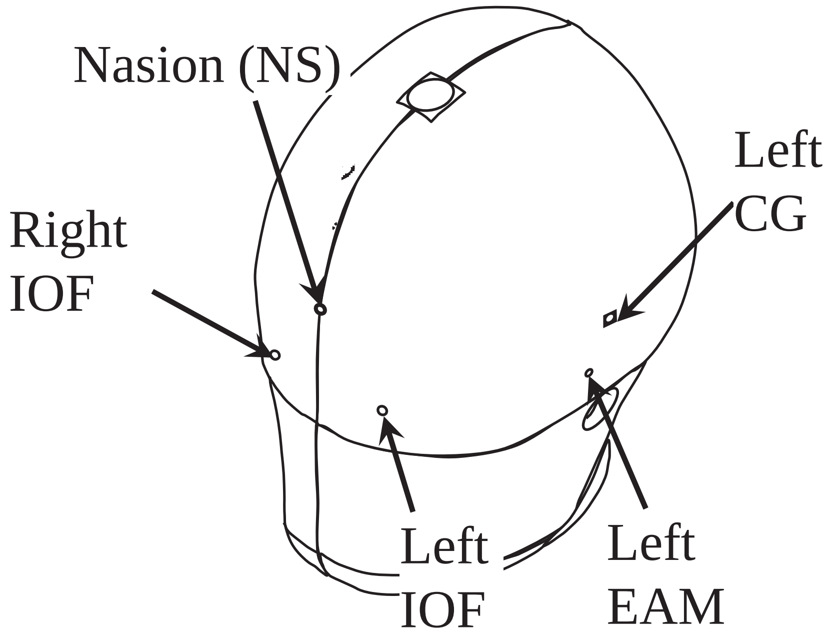
___**7.11.3** Place a target on the floor that has the same XY postion a the center of the top striker bolt on the driver's door in the VCS (GDo)

___**7.11.4** Place a target forward of Gdo parallel to the track (GDx) that is 450 mm from Gdo

___**7.11.5** Place a target in the lateral direction from GDo (GDy) that is 450 mm from Gdo

CHECKLIST 7.12 – DRIVER HEAD AND MOUNTING PLATE POINTS RELATIVE TO THE DCS

___**7.12.1** Measure and record the head points and mounting plate relative to the DCS



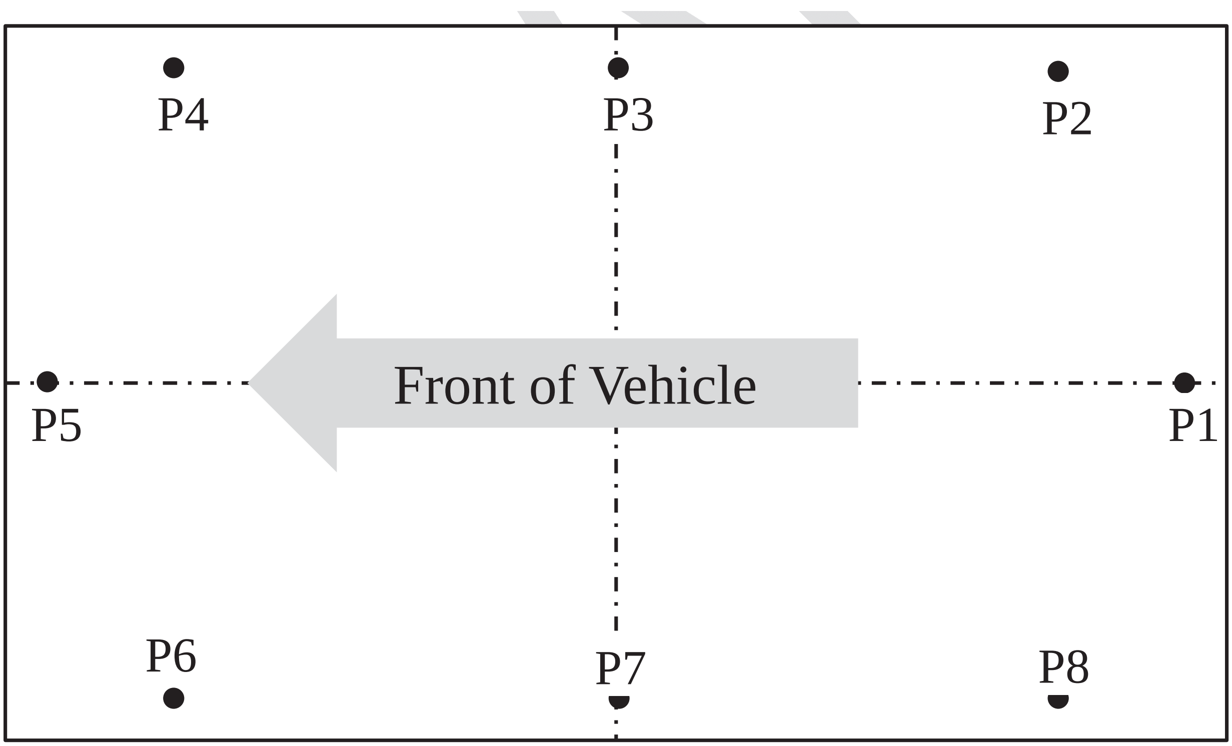


TABLE 4: DRIVER DUMMY AND MOUNTING PLATE POINTS RELATIVE TO DCS				
POS	**DESCRIPTION**	**X**	**Y**	**Z**

TABLE 4: DRIVER DUMMY AND MOUNTING PLATE POINTS RELATIVE TO DCS

POS	DESCRIPTION	X	Y	Z
G_{DO}	Driver's global point origin	0	0	0
G_{DX}	Driver's global point x-axis		0	0
G_{DY}	Driver's global point y-axis	0		0
SB	Center of the upper striker bolt			
CG	Left Head CG			
NS	Nasion			
Left IOF	Left Infra-Orbital Foramen			
Right IOF	Right Infra-Orbital Foramen			
Left EAM	Left External Auditory Meatus (EAM)			
MP1	Mounting Point 1			
MP2	Mounting Point 2			
MP3	Mounting Point 3			
MP4	Mounting Point 4			
MP5	Mounting Point 5			
MP6	Mounting Point 6			
MP7	Mounting Point 7			
MP8	Mounting Point 7			

CHECKLIST 7.13 – PASSENGER AND VEHICLE MEASUREMENT POINTS

Reference Figure 7.10 when completing the following steps. Note: If bolt is hex head measure the center. If bolt requires allen wrench make sure to insert CMM probe into allen wrench whole (Figure 7.11)

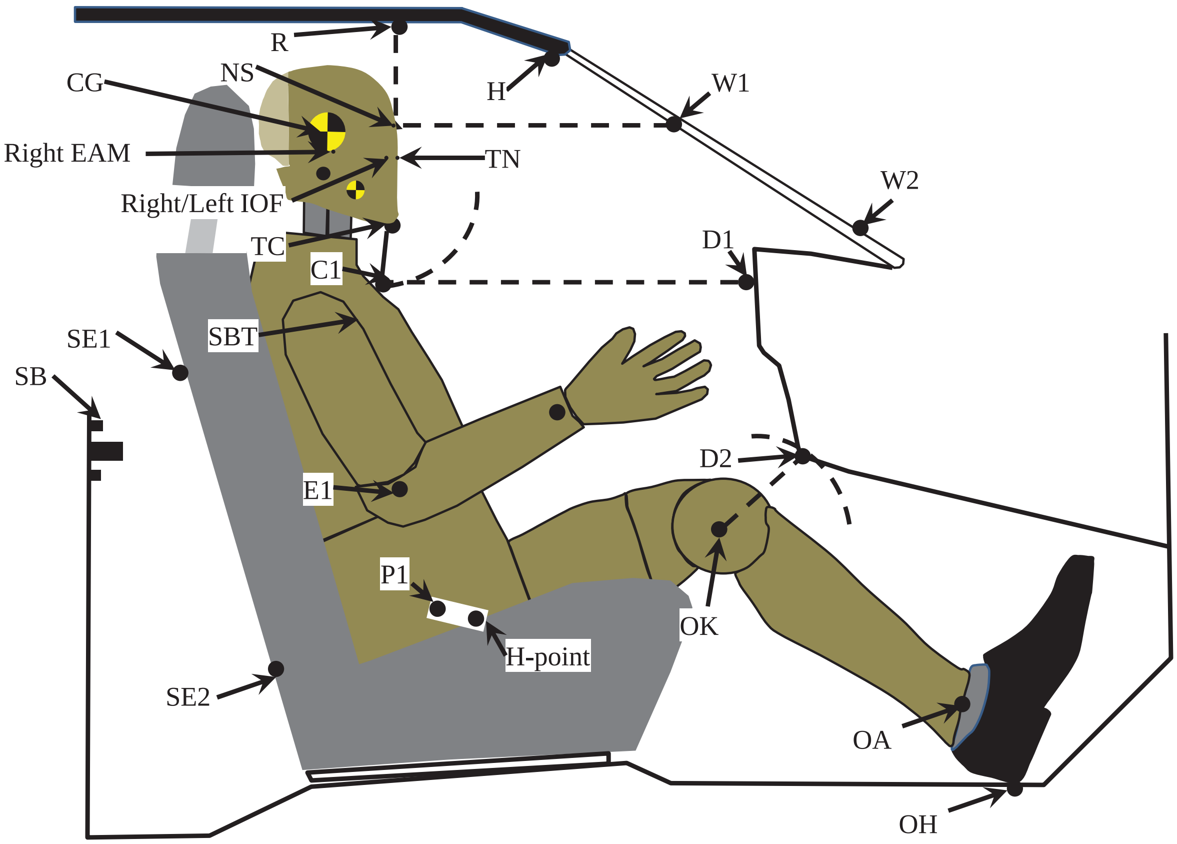


Figure 7.10: CMM points of vehicle and dummy to calculate longitudinal distances

Figure 7.11

___**7.13.1** Measure the following points relative to the VCS using CMM

___**7.13.2** CG: Measure and record the Left Head CG

___**7.13.3** Nasion (NS): Using CMM measure and record the Nasion

___**7.13.4 W1:** Find the Z coordinate of the Nasion and the moving forward in the XZ plane at the same height of the Z coordinate of the Nasion until the windshield is contacted (Figure 7.3). Measure and record

___**7.13.5 W2:** In the same XZ plane as W1 move down the windshield at least a Z distance of 250 mm (Figure 7.3). Measure and record

___**7.13.6 H:** Find the furthest point forward on the header in the same XZ plane as Nasion (Figure 7.3). Measure and record

___**7.13.7** R: Move up from Nasion in the same XZ plane as Nasion until the roof is contacted Figure 7.3.). Measure and Record

___**7.13.8 Right and left IOF:** Measure and record the Left and Right Infra-Orbital Foramen Figure 7.3

___**7.13.9 TN:** Measure and record the point between the Left and Right IOF (Figure 7.3)

___**7.13.10 Right EAM:** Measure and record the Left EAM (Figure 7.3)

___**7.13.11 S0:** Measure and record the center of the steering wheel

___**7.13.12 TC:** Measure and record the ATD's tip of chin.

___**7.13.13 C1:** Place a tape measure on the tip of the dummy's chin and rotate 127 mm of it downward toward the dummy to the point of contact on the transverse center of the dummy's chest. Measure and record

___**7.13.14 D1:** In the same XZ plane and the same Z height of C1 move forwards until the closest point on the dashboard either between the upper part of the steering wheel between the hub and the rim, or measure to the dashboard placing the tape measure above the rim, whichever is a shorter measurement.

___**7.13.15 OK:** Measure and record the outboard knee bolt

___**7.13.16 IK:** Measure and record the inboard knee bolt

___**7.13.17 D2:** Taken from the center of the knee pivot bolt's outer surface to the closest point forward acquired by swinging the tape measure in continually larger arcs until it contacts the dashboard (Error! Reference source not found.). Measure and Record

___**7.13.18 SC:** Create and measure a point along the centerline of the steering column

___**7.13.19 OA:** Measure and record the outboard ankle bolt

___**7.13.20 OH:** Measure and record the outer heel point

___**7.13.21 IH:** Measure and record the outer heel point

___**7.13.22 H-Point:** Measure and record the H-point location on the H-point tool

___**7.13.23 P1:** Measure and record the center of the H-point tool where it inserts into the pelvis

___**7.13.24 SE1 and SE2:** Measure and record two point on the back of the seat at the centerline of the seat

___**7.13.25 HRA:** Measure and record the head restraint post angle.

___**7.13.26 E1:** Measure and record the outboard elbow

___**7.13.27 SBT:** Measure and record shoulder bolt

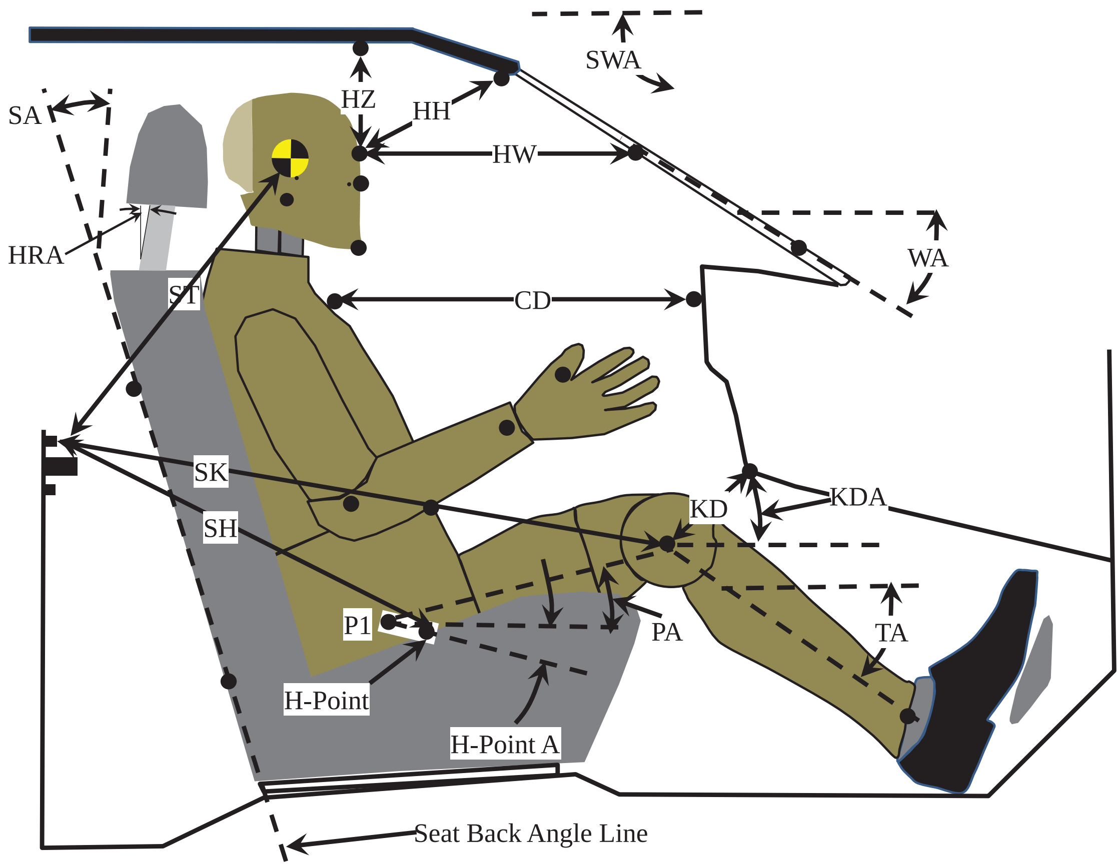
___**7.13.28 SB:** Upper Stricker Bolt

TABLE 7.5: PASSENGER AND INTERIOR POINTS RELATIVE TO VCS				
POS	**DESCRIPTION**	**X**	**Y**	**Z**
SB	Center of the upper striker bolt			
CG	Head CG			
NS	Nasion			
W1	Window point 1			
W2	Window point 2			
H	Point on the header			
R	Point on the roof			
Left IOF	Left Infra-Orbital Foramen			
Right IOF	Right Infra-Orbital Foramen			
TN	Tip of nose			

TABLE 7.5: PASSENGER AND INTERIOR POINTS RELATIVE TO VCS				
POS	**DESCRIPTION**	**X**	**Y**	**Z**
TC	Tip of the chin			
C1	Point on chest 3			
D1	Point on dash			
OK	Outboard knee bolt			
IK	Inboard knee bolt			
D2	Knee point on IP			
SC	Point of steering column			
OA	Outboard ankle bolt			
OH	Outer heel point			
IH	Inboard heel point			
H-point	H-point			
P1	Center of H-point tool			
E1	Outboard Elebow			
Left EAM	Left External Auditory Meatus (EAM)			
SBT	Shoulder Bolt			

CHECKLIST 7.14 CALCULATE THE PASSENGERS LONGITUDINAL MEASUREMENTS

Using the points in Table 7.2 calculate all the longitudinal distances and angles in the figure below



CODE	DESCRIPTION	PASSENGER	
		LENGTH (MM)	ANGLE (°)
WA°	Windshield Angle		
SA°	Seat Back Angle		
HRA⁰	Outboard Head Restraint Post Angle		
HZ	Head to Roof (Z)		
HH	Head to Header		
HW	Head to Windshield		
CD	Chest to Dash		
KDL	Left Knee to Dash		
KDR	Right Knee to Dash		
PA°	Pelvic Angle		
TA°	Tibia Angle		

SK	Striker to Knee		
ST	Striker to Head		
SH	Striker to H-Point		
HAX°	Head Angle (X)		
HAY°	Head Angle (Y)		
TAX°	T6 Angle (X)		
TAY°	T6 Angle (Y)		
LAX°	T1 (X)		
LAY^0	T1 (Y)		

CHECKLIST 7.15 PASSENGER CMM MEASUREMENTS

___**7.15.1** Measure and record all the points listed below

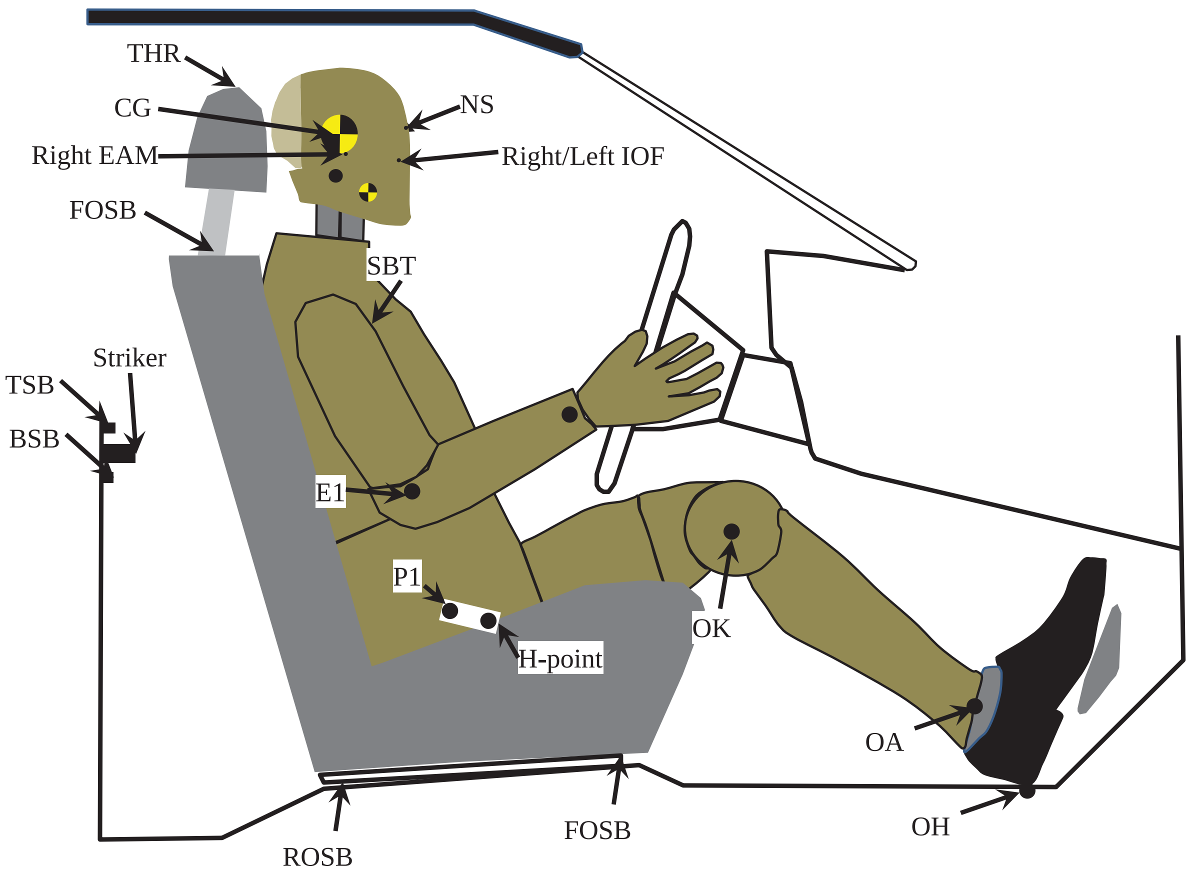
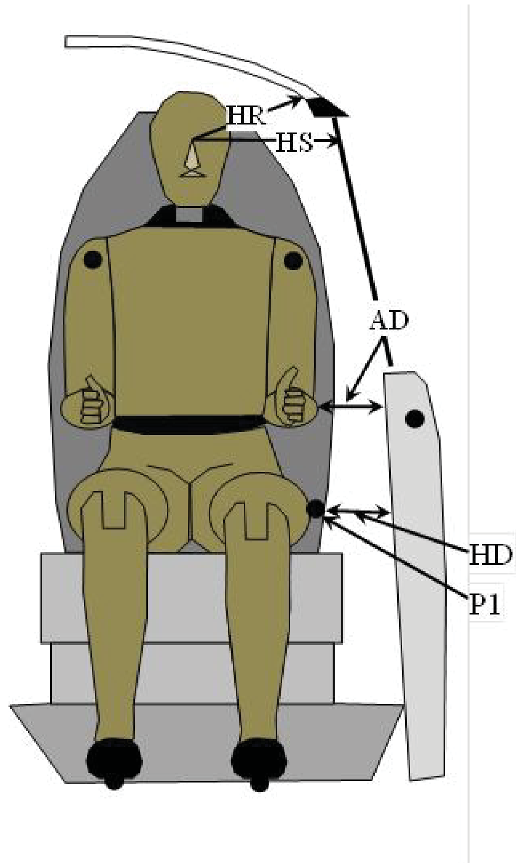


TABLE 6: PASSENGER AND INTERIOR POINTS RELATIVE TO VCS				
POS	**DESCRIPTION**	**X**	**Y**	**Z**
TSB	Center Top Striker Bolt			
BSB	Center Bottom Striker Bolt			
Striker	Center of Striker			
FOSB	Front Outboard Seat Belt			
ROSB	Rear Outboard Seat Belt			
OHRB	Most Outboard Part of the Head Restraint Post (Where it enters the seat)			
THR	Top of Head Restraint			
CG	Head CG (Right)			
NS	Nasion			
Left EAM	Left EAM			
Left IOF	Left IOF			
Right IOF	Right IOF			
E1	Outboard Elebow			
H-point	H-point			

TABLE 6: PASSENGER AND INTERIOR POINTS RELATIVE TO VCS				
POS	**DESCRIPTION**	**X**	**Y**	**Z**
P1	Center of H-point tool			
OK	Outboard knee bolt			
IK	Inboard knee bolt			
OA	Outboard ankle bolt			
OH	Outer heel point			
IH	Inboard heel point			

CHECKLIST 7.16 PASSENGER LATERAL CLEARANCE DIMENSIONS

The following measurements are to be made within a vertical transverse plane



___**7.16.1 HS - Head to Side Window -** Taken from the point where the dummy's nose meets his forehead (between his eyes) to the outside of the side window. In order to make this measurement, roll the window down to the exact height that allows a level measurement. Use a level.

___**7.16.2 AD - Arm to Door** -Taken from the outer surface of the elbow pivot bolt on ATD to the first point it hits on the door.

___**7.16.3 HD -H-point to Door** - taken from the H-point on the dummy to the closest point on the door. Use a level.

___**7.16.4 HR - Head to Side Header** - measure the shortest distance from the point where the dummy's nose meets his forehead (between his eyes) to the side edge of the header just above the window frame, directly adjacent to the dummy.

CHECKLIST 7.17 - SEAT BELT POSITION MEASUREMENTS

For both the driver and passenger ATD's, take the following measurements and record. Use the figure below to perform the following steps .

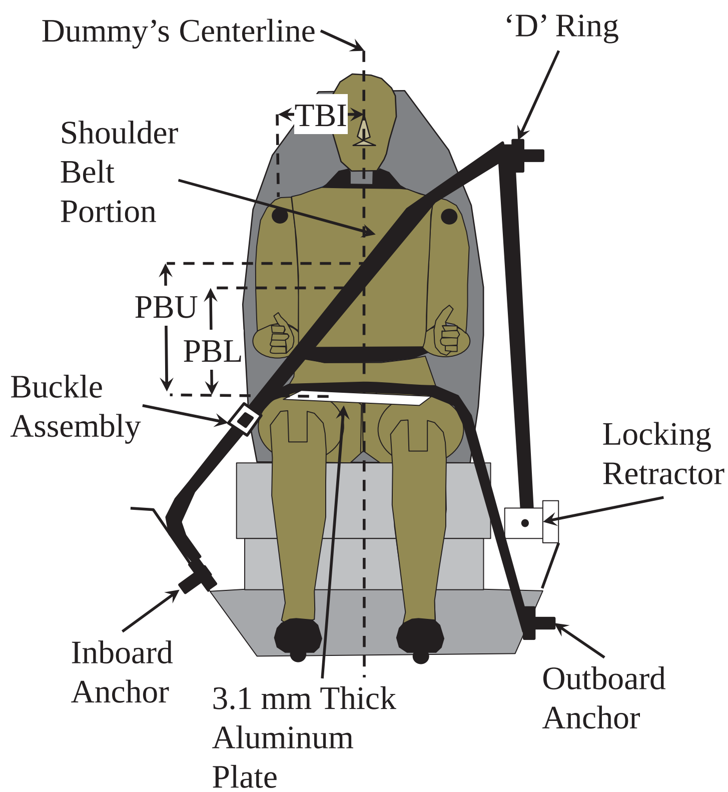


Figure 12

___7 PBU – Top surface of reference (3.1 mm Thick Aluminum Plate) to belt upper edge along dummy centerline

___8 PBL – Top surface of reference (3.1 mm Thick Aluminum Plate) to belt lower edge along dummy centerline

___9 Shoulder belt length as measured on ATD

___10 Lap belt length as measured on ATD

___11 Remainder of belt on reel

___12 Total belt length for continuous webbing systems

SEAT BELT POSITIONING MEASUREMENTS	DRIVER	PASSENGER

PBU – Top surface of reference to belt upper edge	mm	mm
PBL – Top surface of reference to belt lower edge	mm	mm

BELT LENGTH DATA	DRIVER	PASSENGER
Shoulder belt length as measured on ATD	mm	mm
Lap Belt Length as measured on ATD	mm	mm
Remainder of belt on reel	mm	mm
Total belt length for continuous webbing systems	mm	mm

CHECKLIST 7.18 – SETUP FOR GLOBAL MEASUREMENTS OF PASSENGER AND VEHICLE MOUNTING PLATE

___**7.18.1** Reference the figure below to perform the following steps

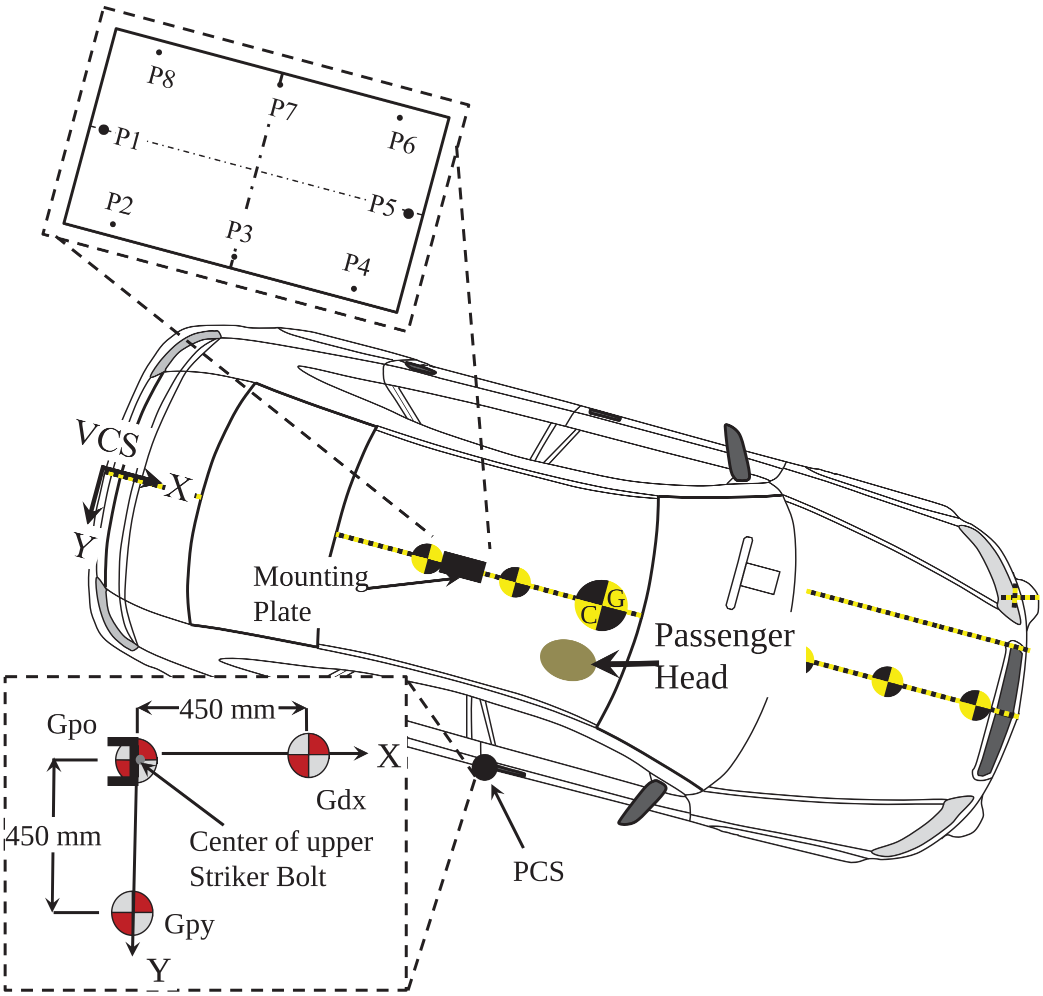


Figure 7.13: Coordinate Systems

___**7.18.2** Create a passenger's global coordinate system (PCS) for the driver following the procedure below

___**7.18.3** Create a point on the floor outside the driver's door (Gpo)

___**7.18.4** Create a point forward of Gdo parallel to the track (Gpx)

___**7.18.5** Create a point in the lateral direction from GPo (Gpy)

CHECKLIST 7.19 – PASSENGER HEAD AND MOUNTING PLATE POINTS RELATIVE TO THE PCS

___**7.19.1** Measure and record the head points and mounting plate relative to the DCS

TABLE 7: PASSENGER DUMMY AND MOUNTING PLATE POINTS RELATIVE TO PCS				
POS	**DESCRIPTION**	**X**	**Y**	**Z**
G_{PO}	Passenger's global point origin	0	0	0
G_{PX}	Passenger's global point x-axis		0	0
G_{PY}	Passenger's global point y-axis	0		0
SB	Center of the upper striker bolt			
CG	Head CG (Right)			
NS	Nasion			
Left IOF	Left Infra-Orbital Foramen			
Right IOF	Right Infra-Orbital Foramen			
Left EAM	Left External Auditory Meatus (EAM)			
MP1	Mounting Point 1			
MP2	Mounting Point 2			
MP3	Mounting Point 3			
MP4	Mounting Point 4			
MP5	Mounting Point 5			
MP6	Mounting Point 6			
MP7	Mounting Point 7			
MP8	Mounting Point 7			

CHECKLIST 7.20 – PRE-TEST INTERIOR PHOTOS WITH DUMMIES

___7.20.1 Take the following photos

TABLE 8: PRE-TEST INTERIOR PHOTOS	
DESCRIPTION	**EXAMPLE**
Picture 12: Pre-Test Driver Seat For-Aft Markings 86) Start (1) The left field of view shall be the front of the driver's seat (2) The right field of view shall be the rotational joint of the seat (3) The top field of view shall be half way up the seat cushion (4) The bottom field of view shall be the bottom sill	
Picture 13: Pre-Test Passenger Seat Back Markings 87) Start .. (1) The left field of view shall be at the start of the femurs (2) The right side field of view shall be the front of the B-pillar (3) The top field of view shall be the elbow of the dummy (4) The bottom field of view shall be the bottom of the pivot of the seat	
Picture 14: Pre-Test Driver Adjustable D-ring 88) Start … (1) The top of the field of view shall be the top of the B-pillar from the inside of the vehicle (2) The bottom field of view shall be the window sill (3) The left field of view shall be the right side of the head of the dummy (4) The right field of view shall be in front of the B-pillar	

TABLE 8: PRE-TEST INTERIOR PHOTOS	
DESCRIPTION	**EXAMPLE**
Picture 15: Pre-Test Overhead View of Driver Thighs on Seat 89) Start … (1) The left field of view shall be the right arm of the dummy (2) The right field of view shall be the left arm of the dummy (3) The bottom field of view shall be at the center of the steering wheel (4) The top field of view shall be at the lower rib of the dummy	
Picture 16: Pre-Test Left Side View of Driver and Interior (Perpendicular view) 90) Start … (1) The height of the camera shall be at the center of the steering wheel (2) The camera shall be perpendicular to ATD (3) The camera shall be located at the elbow of the ATS (4) The left field of view shall be the intersection of the upper dash and A-pillar (5) The right field of view shall be the center of the B-pillar (6) The top of the field of view shall be the roof rail (7) The bottom field of view shall be the lower door sill	
Picture 17: Pre-Test View of Driver Abdomen 91) Start … (1) The camera shall be looking down focused on the top of the abdomen 1) The left field of view shall be the right hand of the ATD 2) The right side shall be just behind the ATD left shoulder 3) The top field of view shall be the chin of the ATD 4) The bottom field of view shall be the top of the left leg	

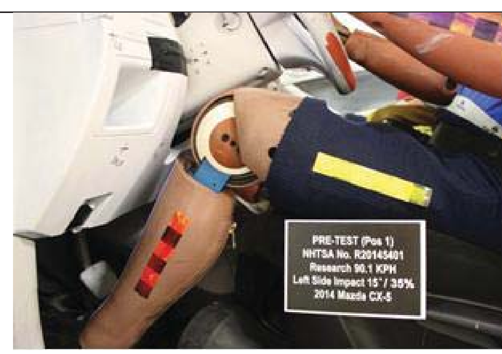
TABLE 8: PRE-TEST INTERIOR PHOTOS	
DESCRIPTION	**EXAMPLE**
Picture 18: Pre-Test Left Side View of Steering Wheel set position 92) Start .. (1) The camera shall be perpendicular to the dummy and focused on the center of the steering wheel (2) The left field of view shall be the intersection of the top of the IP and A-pillar (3) The right side field of view shall be the elbow of the ATD (4) The top field of view shall be halfway between the intersection of the top of the IP and A-pillar and the roof rail	
Picture 19: Pre-Test Left Side Passenger and Interior View 93) Start .. (1) The camera shall be perpendicular to the right front passenger and taken from the driver side of the vehicle (2) The center of focus shall be the front of the ATD at the top of the Abdomen (3) The left field of view shall be the intersection of the right front passengers IP and the A-pillar (4) The right field of view shall be the back of the right front passengers head (5) The top field of view shall the top of the ATD head (6) The bottom field of view shall be the top of the right front passengers right femur	
Picture 20: Pre-Test View of Driver Left Knee and Bolster 94) Start … (1) The camera shall be perpendicular to the ATD (2) The center of focus of the camera shall be half of the left femur and the bottom of the steering wheel (3) The left field of view shall be the intersection of A-pillar and the bottom	

TABLE 8: PRE-TEST INTERIOR PHOTOS	
DESCRIPTION	**EXAMPLE**
sill (4) The right field of view shall be the center of the pelvis (5) The top field of view shall be the center of the steering wheel (6) The bottom field of view shall be the bottom sill	
Picture 21: Pre-Test View of the Driver Left Leg 95) Start … (1) The height of the camera shall be just below the knee (2) The camera shall focus of the left heel of the ATD and show most of the drivers left foot as possible (3) The left field of view shall be the bottom A-pillar (4) The right field of view shall be the B-pillar (5) The top field of view shall be the bottom of the knee (6) The bottom field of view shall be at the bottom sill located halfway between the A-pillar and B-pillar	
Picture 22: Pre-Test View of the Driver's Feet 96) Start … (1) The camera shall be placed on the bottom sill located at the front of the seat (2) The focus of the camera shall be the middle of the left and right foot (3) The left field of view shall be the left side of the drivers left foot (4) The right field of view shall be the front of the sear (5) The top field of view shall be the top of the calf of the driver's left leg (6) The bottom field of view shall be the intersection of the bottom of the seat and the bottom sill.	

<table>
<tr><th colspan="2">TABLE 8: PRE-TEST INTERIOR PHOTOS</th></tr>
<tr><th>DESCRIPTION</th><th>EXAMPLE</th></tr>
<tr><td>Picture 23: Pre-Test Right Front Passenger's Seat For-Aft Markings
97) Start …
(1) The right field of view shall be the front of the driver's seat
(2) The left field of view shall be the rotational joint of the seat
(3) The top field of view shall be half way up the seat cushion
(4) The bottom field of view shall be the bottom sill</td><td>
</td></tr>
<tr><td></td><td></td></tr>
<tr><td>Picture 24: Pre-Test Passenger's Seat Back Markings
98) Start ..
(1)
(2) The right field of view shall be at the start of the femurs
(3) The left side field of view shall be the front of the B-pillar
(4) The top field of view shall be the elbow of the dummy
(5) The bottom field of view shall be the bottom of the pivot of the seat</td><td>
</td></tr>
<tr><td></td><td></td></tr>
<tr><td>Picture 25: Pre-Test Driver Adjustable D-ring
99) Start …
(1) The top of the field of view shall be the top of the B-pillar from the inside of the vehicle
(2) The bottom field of view shall be the window sill
(3) The right field of view shall be the right side of the head of the dummy
(4) The left field of view shall be in front of the B-pillar</td><td>
</td></tr>
</table>

TABLE 8: PRE-TEST INTERIOR PHOTOS	
DESCRIPTION	**EXAMPLE**
Picture 26: Pre-Test Overhead View of Driver Thighs on Seat 100) Start … (1) The left field of view shall be the right arm of the dummy (2) The right field of view shall be the left arm of the dummy (3) The bottom field of view shall be the start of the femurs (4) The top field of view shall be at the lower rib of the dummy	
Picture 27: Pre-Test Left Side View of Driver and Interior (Perpendicular view) 101) Start …. (1) The height of the camera shall be at the center of the steering wheel (2) The camera shall be perpendicular to ATD (3) The camera shall be located at the elbow of the ATS (4) The right field of view shall be the intersection of the upper dash and A-pillar (5) The left field of view shall be the center of the B-pillar (6) The top of the field of view shall be the roof rail (7) The bottom field of view shall be the lower door sill	
Picture 28: Pre-Test View of Driver Abdomen 102) Start … (1) The camera shall be looking down focused on the top of the abdomen (2) The right field of view shall be the left hand of the ATD (3) The right side shall be just behind the ATD right shoulder (4) The top field of view shall be the chin of	

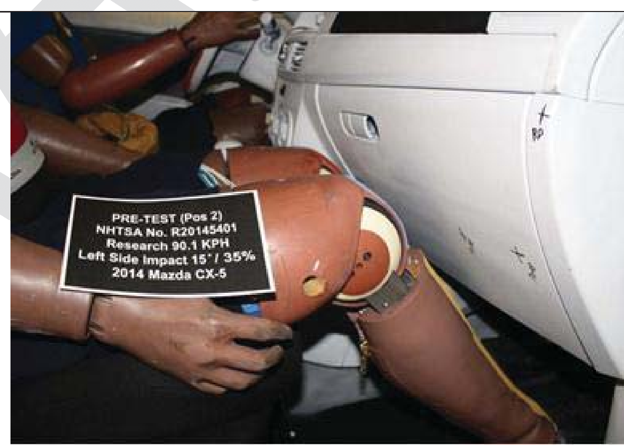
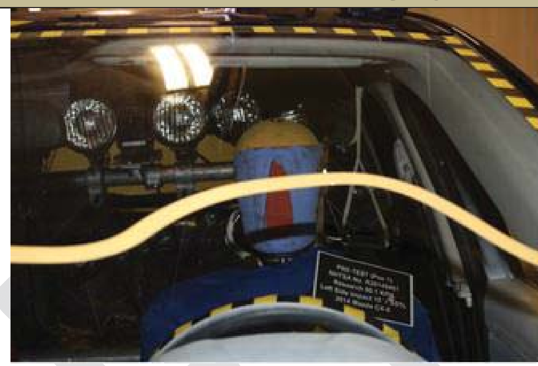
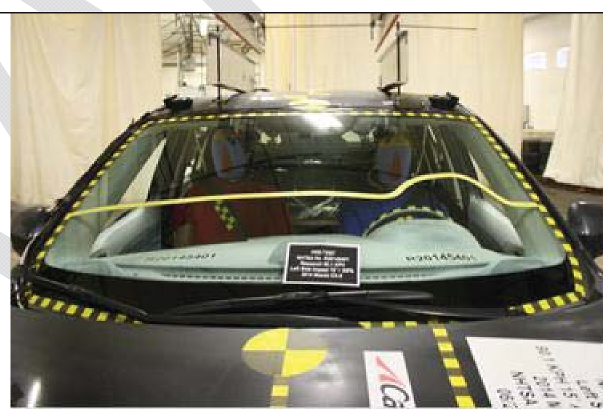
TABLE 8: PRE-TEST INTERIOR PHOTOS	
DESCRIPTION	**EXAMPLE**
the ATD (5) The bottom field of view shall be the top of the right leg	
Picture 29: Pre-Test Right Side of Driver and Interior View 103) Start … (1) The camera shall be perpendicular to the driver and taken from the passenger side of the vehicle (2) The center of focus shall be the front of the ATD at the top of the Abdomen (3) The right field of view shall be the intersection of the drivers IP and the A-pillar (4) The left field of view shall be the back of the drivers head (5) The top field of view shall the top of the ATD head (6) The bottom field of view shall be the top of the drivers left femur	
Picture 30: Pre-Test View of Passenger's Right Knee and Bolster 104) Start .. (1) The camera shall be perpendicular to the ATD (2) The center of focus of the camera shall be half of the left femur and the bottom of the steering wheel (3) The left field of view shall be the intersection of A-pillar and the bottom sill (4) The right field of view shall be the center of the pelvis (5) The top field of view shall be the center of the steering wheel (6) The bottom field of view shall be the bottom sill	

TABLE 8: PRE-TEST INTERIOR PHOTOS	
DESCRIPTION	**EXAMPLE**
Picture 31: Pre-Test View of the Passenger's Right Leg 105) Start … (1) The height of the camera shall be just below the knee (2) The camera shall focus of the right heel of the ATD and show most of the passenger left foot as possible (3) The right field of view shall be the bottom A-pillar (4) The left field of view shall be the front of the seat (5) The top field of view shall be the bottom of the knee (6) The bottom field of view shall be at the bottom sill located halfway between the A-pillar and B-pillar	
Picture 32: Pre-Test View of the Passenger's Feet 106) Start … (1) The camera shall be placed on the bottom sill located at the front of the seat (2) The focus of the camera shall be the middle of the left and right foot (3) The right field of view shall be the left side of the passenger left foot (4) The left field of view shall be the front of the seat (5) The top field of view shall be the top of the calf of the passenger's left leg (6) The bottom field of view shall be the intersection of the bottom of the seat and the bottom sill.	

TABLE 8: PRE-TEST INTERIOR PHOTOS	
DESCRIPTION	**EXAMPLE**
Picture 33: Pre-Test View of Passenger's Left Knee and Bolster 107) Start … (1) The camera shall be placed at the height of the ATD's head (2) The camera shall focus on the left knee (3) The bottom field of view shall be the inside of the right femur (4) The left field of view shall be the front of the ATD's Abdomen (5) The right field of view shall be the intersection of the IP with the inner right inner femur (6) The top field of view shall be the center console	
Picture 34: Pre-Test View of Driver Right Knee and Bolster 108) Start … (1) The camera height should be at the ATD's head (2) The camera shall focus on the center of the driver's right femur (3) The right field of view shall be half the IP (4) The left field of view shall be front of the ATD's Abdomen (5) The top field of view shall be the wrist of the ATD (6) The bottom field of view shall be the center of center console	

CHECKLIST 7.21 - EXTERIOR PICTURE OF THE TEST VEHICLE WITH ATD'S POSITIONED

___**7.21.1** Remove the OMDB away from the test vehicle
___**7.21.2** Take the following pictures:

TABLE 9: EXTERIOR PICTURES AFTER ATD'S POSITIONED	
DESCRIPTION	**EXAMPLE PICTURE**
Picture 35: Pre-Test Driver Front Windshield View 109) Start … (1) The height of the camera shall be at the halfway between the roof and window sill (2) The left field of view shall be the longitudinal centerline of the vehicle (3) The right field of view shall be the intersection of the driver window sill and the A-pillar (4) The vertical field of view shall be centered of the field of view	
Picture 36: Pre-Test Windshield View 110) Start … (1) The height of the camera shall be at the halfway between the roof and window sill (2) The left field of view shall be the intersection of the passenger window sill and the A-pillar (3) The right field of view shall be the bottom of the intersection of the window sill and the A-pillar (4) The vertical field of view shall be centered of the field of view	

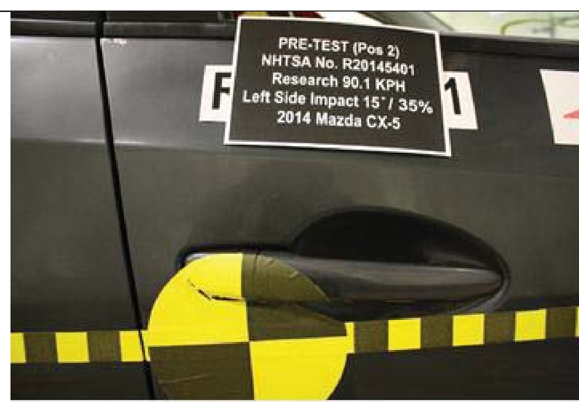
<table>
<tr><th colspan="2">TABLE 9: EXTERIOR PICTURES AFTER ATD’S POSITIONED</th></tr>
<tr><th>DESCRIPTION</th><th>EXAMPLE PICTURE</th></tr>
<tr><td>Picture 37: Pre-Test Passenger Front Close-up View, Windshield
111) Start …
(1) The height of the camera shall be at the halfway between the roof and window sill
(2) The left field of view shall be the intersection of the passenger window sill and the A-pillar
(3) The right field of view shall be the longitudinal centerline of the vehicle
(4) The vertical field of view shall be centered of the field of view</td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td>Picture 38: Pre-Test Right Side Passenger Window View:
112) Start …
(1) The height of the camera shall be at the halfway between the roof and window sill
(2) The left field of view shall be the B-pillar
(3) The right field of view shall be the passenger’s mirror
(4) The upper field of view shall be the intersection of the B-pillar and the roof rail
(5) The bottom field of view shall be just below the window sill</td><td>
</td></tr>
<tr><td></td><td></td></tr>
<tr><td>Picture 39: Pre-Test Close-up View of Passenger Door Latch
113) Start …
(1) The height of the camera shall be at the height of the handle
(2) The left field of view shall show the rear edge of the door
(3) The right field of view shall be in front of the passenger door handle
(4) The vertical field of view shall be centered of the field of view</td><td>
</td></tr>
<tr><td></td><td></td></tr>
</table>

TABLE 9: EXTERIOR PICTURES AFTER ATD'S POSITIONED	
DESCRIPTION	**EXAMPLE PICTURE**
Picture 40: Pre-Test View of Passenger Door Clearance 114) Start .. (1) The height shall be placed at a heith to meet the specified field of view (2) The left and top field of view shall be at the top of the B-pillar (3) The right field of view shall show the front of the instrument panel (4) The bottom field of view shall be the passenger's window sill (5) The left knee shall be in the field of view	
Pre-Test View of Fuel Filler Cap	
Picture 41: Pre-Test Close-up View of Driver's Door Latch 115) Start … (1) The height of the camera shall be at the height of the handle (2) The left field of view shall be in front of the driver's door handle (3) The right field of view shall show the rear edge of the door (4) The vertical field of view shall be centered of the field of view (5) The vertical field of view shall be centered of the field of view	

TABLE 9: EXTERIOR PICTURES AFTER ATD'S POSITIONED	
DESCRIPTION	**EXAMPLE PICTURE**
Picture 42: Pre-Test View of D Door Clearance 116) Start … (1) The height shall be placed at a heith to meet the specified field of view (2) The left and top field of view shall be at the top of the B-pillar (3) The right field of view shall show the front of the instrument panel (4) The bottom field of view shall be the passenger's window sill (5) The left knee shall be in the field of view	
Picture 43: Pre-Test Left Side Driver Window View 117) Start .,.. (1) The camera height shall be the height halfway between the roof rail and window sill (2) The camera shall be focused in front of the dummy chest (3) The left field of view shall be the back of the top of the steering wheel (4) Right field of view shall be the front of the B-pillar (5) The top field of view shall be the top of the roof at the front of the B-pillar (6) The bottom field of view shall be just below the window sill	

CHECKLIST 7.22 - FINAL ALIGNMENT OF TEST VEHICLE

___**7.22.1** Close the vehicle doors and verify the vehicle meets the alignment criteria specified in CHECKLIST G.4

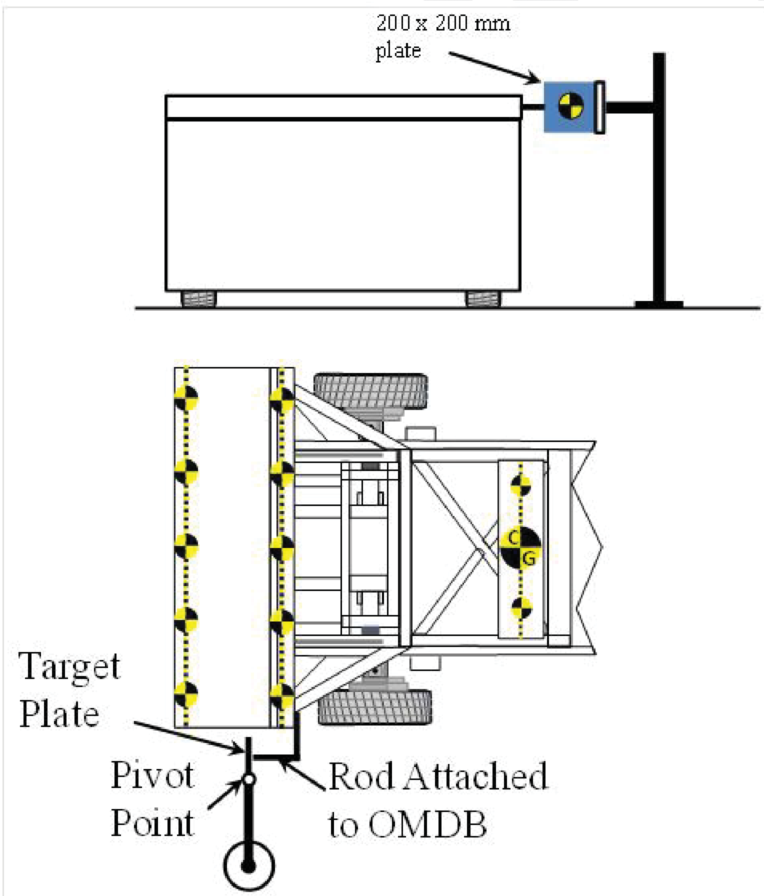
___**7.22.2** If vehicle does not meet the alignment criteria reposition the test vehicle carefully, so that the ATD's in the vehicle do not move, until the conditions are meet as specified in CHECKLIST G.4

___**7.22.3** Mount a pointed rigid steel rod (approximately 3 mm in diameter) to the left side of the face plate. The rod shall stick out 300 mm from the left side of the face plate.

___**7.22.4** Build an adjustable stand in the vertical direction to hold a 200 by 200 mm metal plate that is able to rotate when impacted by the rod mounted on the OMDB. Note: The point the plate rotates about should have some stiffness to prevent it from moving until it is contacted by the rod.

___**7.22.5** Apply paper to the face of the plate and apply a 250 mm target at the center of the plate

___**7.22.6** Align the center of the target on the plate with the rod that is extended out from the left side of the OMDB. This represents the target impact point and will record actual impact point. Note: This target plate shall be in the view of camera showing the front of the vehicle.



___**7.22.7** If vehicle has features (i.e. air dam or skirting) that come in contact with the OMDB before the edge of the OMDB contacts the impact point, 25 mm checkerboard tape shall be utilized to create a visual alignment reference. A line that passes through this first contact feature shall be placed on the hood and bumper of the vehicle and on the front and top of the OMDB's aluminum barrier face. The line shall fall in a longitudinal vertical plane that is parallel to the OMDB's centerline so that the line appears straight when viewed directly from above. The 25 mm tape shall be applied to the vehicle and OMDB so that its inboard edge, relative to the vehicle, follows the line. A second piece of 25 mm tape shall be placed on the vehicle perpendicular to this line. These markings are circled in the figure shown below:

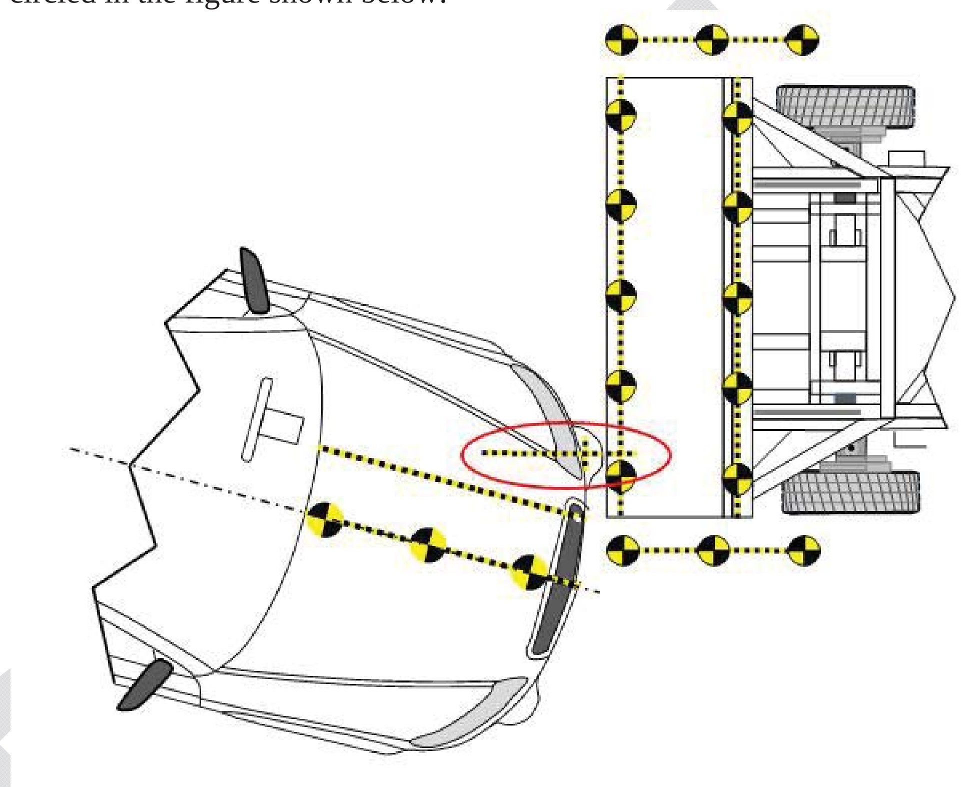
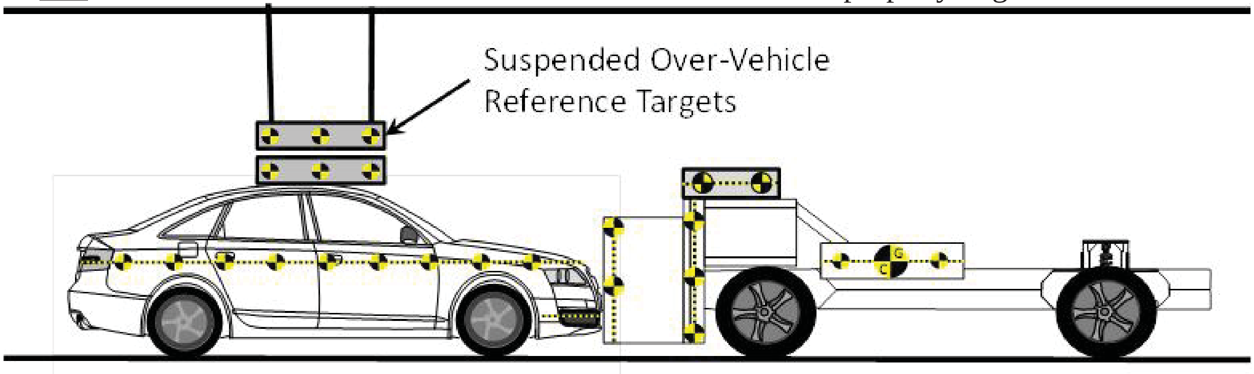


Figure 7.14: Visual alignment reference

CHECKLIST 7.23 - SUSPENDED REFERENCE TARGETS OVER-VEHICLE

___**7.23.1** Confirm that the test vehicle and OMDB have been properly aligned.



___**7.23.2** Create two target bars, each with three 152 mm non-glare targets spaced 450 mm apart and the centerline of the targets the same distance above the bottom edge of the target bar.

___**7.23.3** Mount one target bar directly above the vehicle driver's target bar. The two target bars shall be in the same vertical plane.
Note: This target bar shall remain undisturbed throughout the event.

___**7.23.4** Mount the second target bar directly above the vehicle passenger's target bar. The two target bars shall be in the same vertical plane.
Note: This target bar shall remain undisturbed throughout the event.

CHECKLIST 7.24 - PRE-TEST PICTURES OF OMDB ALIGNED WITH TEST VEHICLE

___**7.24.1** Take the following pictures while the OMDB and test vehicle are aligned at the impact location are the dummies are positioned

Note: Shall be able to read the words Pre-Test and NHTSA Number is each picture

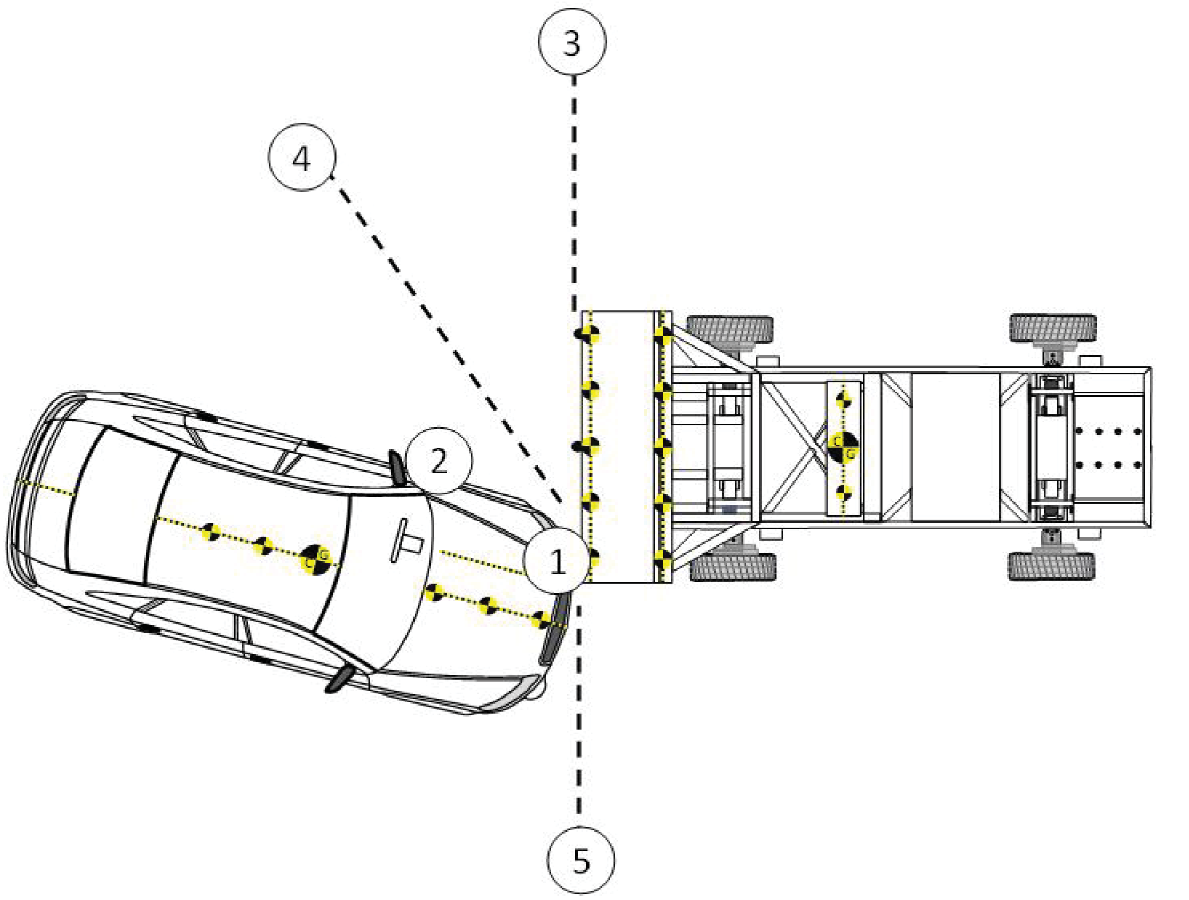


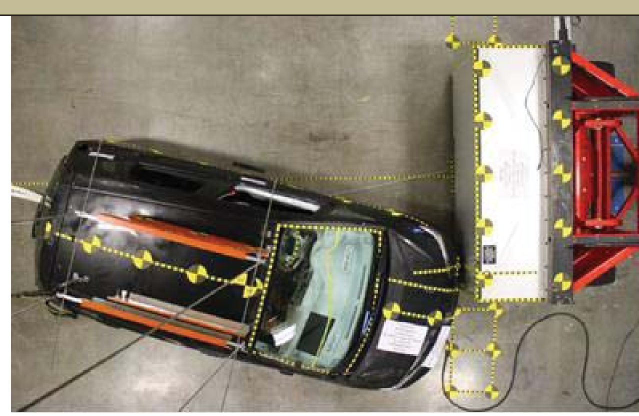
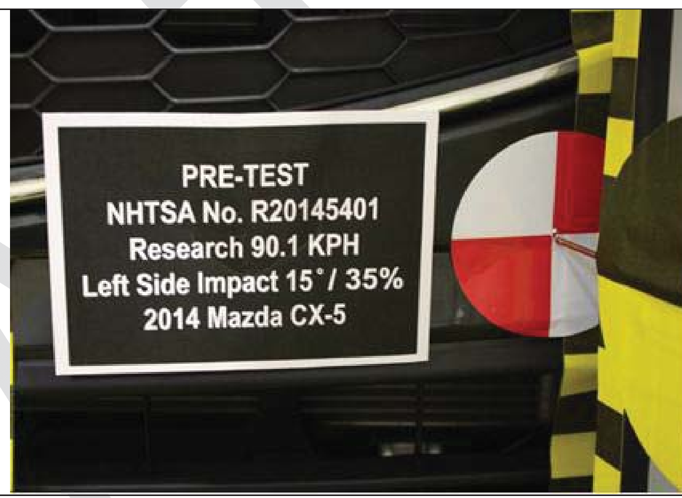
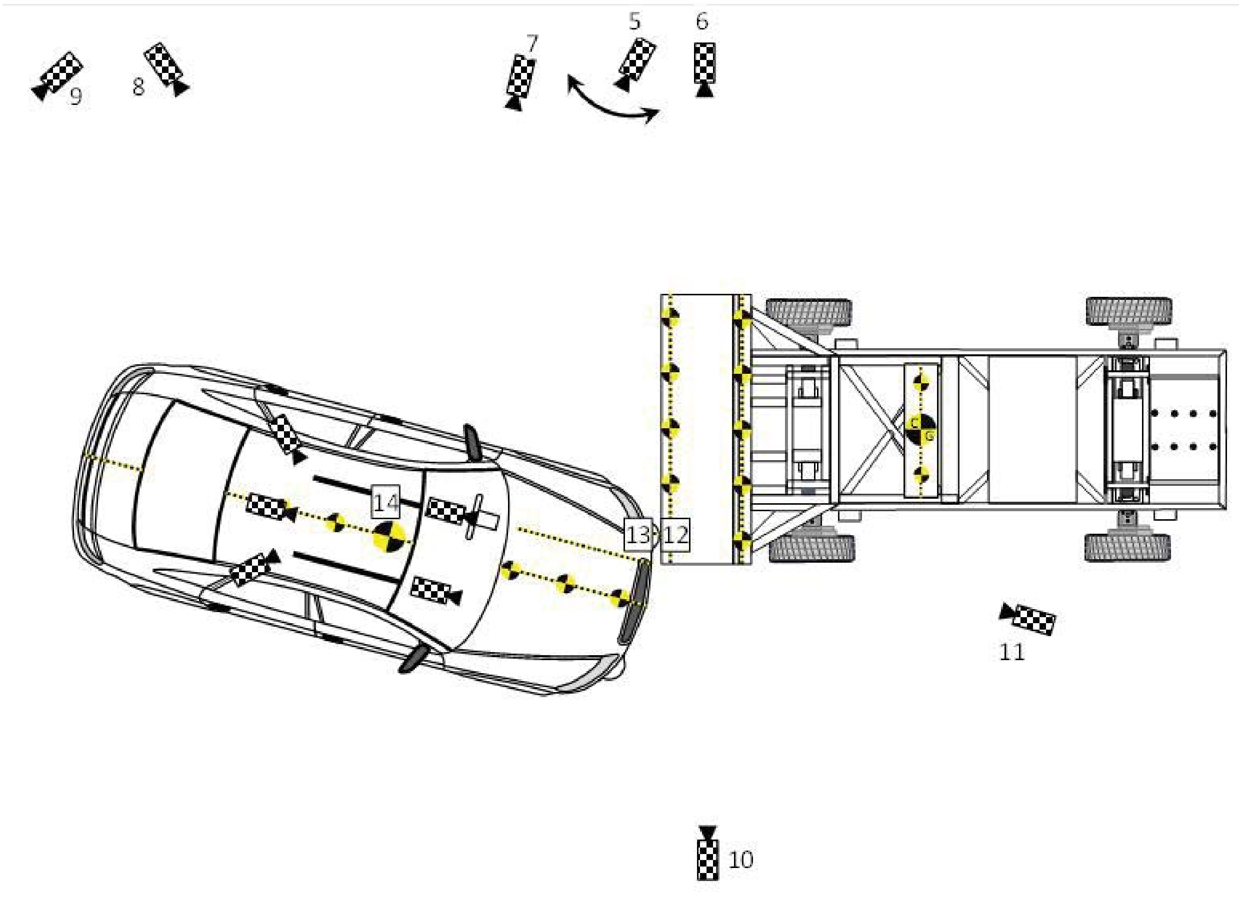
TABLE 10		
CAM POS	**DESCRIPTION (FIELD OF VIEW)**	**EXAMPLE PICTURE**
1	**Picture 44: Pre-Test Overhead View of OMDB against test vehicle at ideal Impact Point** 118) Start …. (1) The camera shall be perpendicular to the ground (2) The Longitudinal field of view shall be from center of OMDB center of the front tire and the rear of the test vehicle (3) The lateral field of view	

TABLE 10		
CAM POS	**DESCRIPTION (FIELD OF VIEW)**	**EXAMPLE PICTURE**
	shall be from the right edge of the honeycomb to the left edge of the test vehicle (4) The camera shall be placed in the center of the field of view	
2	**Picture 45: Pre-Test Zoomed in Overhead View of OMDB against test vehicle at ideal Impact Point** 119) Start … (1) The camera shall be perpendicular to the ground (2) The Longitudinal field of view shall be from the rear of the honeycomb and the B-pillar (3) The lateral field of view shall be centered around the impact point of the OMDB (4) The camera shall be placed in the center of the field of view	
3	**Picture 46: Left side of OMDB aligned with vehicle**	
4	**Picture 47: Left Angled View toward the vehicle while OMDB and vehicle**	

TABLE 10		
CAM POS	**DESCRIPTION (FIELD OF VIEW)**	**EXAMPLE PICTURE**
5	**Picture 48: Right side of OMDB aligned with vehicle**	
6	**Picture 49: Pre-Test Close-up View of Impact Point**	

CHECKLIST 7.25 – LEFT SIDE TEST HIGH SPEED CAMERAS



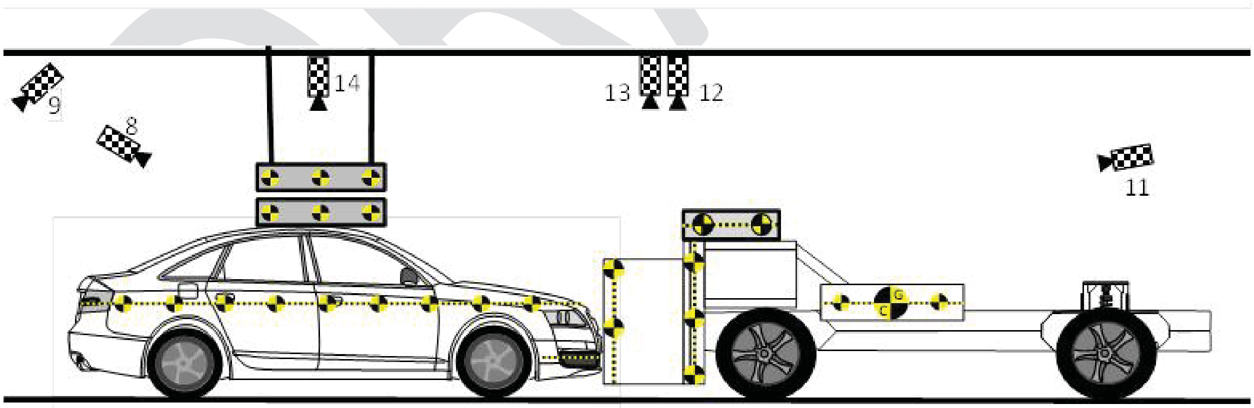


TABLE 11: HIGH SPEED CAMERA'S LEFT SIDE IMPACT	
DESCRIPTION	EXAMPLE FIELD OF VIEW

TABLE 11: HIGH SPEED CAMERA'S LEFT SIDE IMPACT	
DESCRIPTION	**EXAMPLE FIELD OF VIEW**
Camera 5: Real Time Camera to Document Event 120) Start … (1) The camera shall be located on the driver's side of the test vehicle (2) Camera orientated with its centerline perpendicular to the longitudinal centerline of the test vehicle. (3) The field of view shall include the forward ¼ of the OMDB and the approximate distance the test vehicle would travel over 200 ms.	
Camera 6: Left Side of OMDB View High speed, off-board, ground based camera to document the left side of the OMDB's. 121) Start … (1) The minimum resolution shall be 1024 by 1024 pixles (2) The minimum frame per second (fps) shall be 1000 fps (3) The camera centerline shall be perpendicular to the longitudinal centerline of the OMDB. (4) The impact point shall be in the center of the frame. (5) The right field of view shall include the test vehicle's left B pillar. (6) The bottom field of view shall include both the right front tire of the OMDB and the left front tire of the vehicle. (7) The top field of view shall include the vehicle's stationary targets.	

TABLE 11: HIGH SPEED CAMERA’S LEFT SIDE IMPACT	
DESCRIPTION	**EXAMPLE FIELD OF VIEW**
Camera 7: Left Side of Test Vehicle High speed, off-board, ground based camera to document the driver’s motion. 122) Start … (1) The minimum resolution shall be 1024 by 1024 pixles (2) The minimum frame per second (fps) shall be 1000 fps (3) The camera centerline shall be perpendicular to the longitudinal centerline of the vehicle. (4) The left field of view shall start at the intersection of the A pillar and window sill of the vehicle. (5) The right field of view shall be wide enough to include the B pillar of the vehicle in all frames during the event. (6) The top field of view shall include the stationary. (7) The bottom field of view shall include the tires.	
Camera 8: Oblique Overhead Driver Motion View High speed, off-board, overhead camera looking down into the vehicle to document the driver’s interaction with the interior. 123) Start …. (1) The minimum resolution shall be 512 by 512 pixles (2) The minimum frame per second (fps) shall be 500 fps (3) The left field of view of this camera shall start at the steering wheel. (4) The right side field of view of this camera shall include the C-pillar. (5) The top field of view shall include the center line of the vehicle. (6) The camera shall be positioned at a height and angle such that the right	

TABLE 11: HIGH SPEED CAMERA'S LEFT SIDE IMPACT	
DESCRIPTION	**EXAMPLE FIELD OF VIEW**
side of the right driver's elbow is just in view at impact.	
Camera 9: Oblique Rear View of Test Vehicle High speed, off-board, elevated camera to document the OMDB's interaction with the vehicle. 124) Start … (1) The minimum resolution shall be 1024 by 1024 pixles (2) The minimum frame per second (fps) shall be 1000 fps (3) The vehicle's left side B pillar shall be in the center of the frame and the camera shall be elevated to capture the driver's interaction with the vehicle, similar to camera 6. (4) The top view of view shall include the stationary targets. (5) The right field of view shall be wide enough to include the driver's interaction with the vehicle in each frame during the event. (6) The bottom field of view shall include the tires.	
Camera 10: Camera to document how the vehicle is stoped High speed, off-board, elevated camera to document the OMDB's interaction with the vehicle. 125) Start .. (1) The minimum resolution shall be 1024 by 1024 pixles (2) The minimum frame per second (fps) shall be 1000 fps	

TABLE 11: HIGH SPEED CAMERA’S LEFT SIDE IMPACT	
DESCRIPTION	**EXAMPLE FIELD OF VIEW**
Camera11: Right Side of Test Vehicle High speed off-board camera covering the right side of the test vehicle 126) Start .. (1) The minimum resolution shall be 1024 by 1024 pixles (2) The minimum frame per second (fps) shall be 1000 fps (3) The camera shall be evaluated to look into the occupant compartment and moved behind the vehicle (4) The right field of view shall be the front of the test vehicle (5) The bottom field of view shall be the ground (6) The upper field of view shall be the hanging targets	
Camera 12: Right Side of OMDB View High speed, off-board, ground based camera to document the right side of the OMDB’s. 127) Start … (1) The minimum resolution shall be 1024 by 1024 pixles (2) The minimum frame per second (fps) shall be 1000 fps (3) The camera centerline shall be perpendicular to the longitudinal centerline of the OMDB. (4) The impact point shall be in the center of the frame. (5) The right field of view shall include the vehicle’s left B pillar. (6) The bottom field of view shall include both the left front tire of the OMDB and the right front tire of the vehicle. (7) The top field of view shall include the vehicle’s stationary targets.	

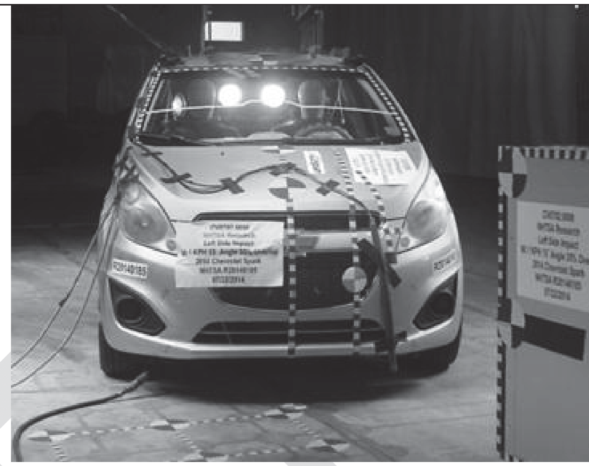
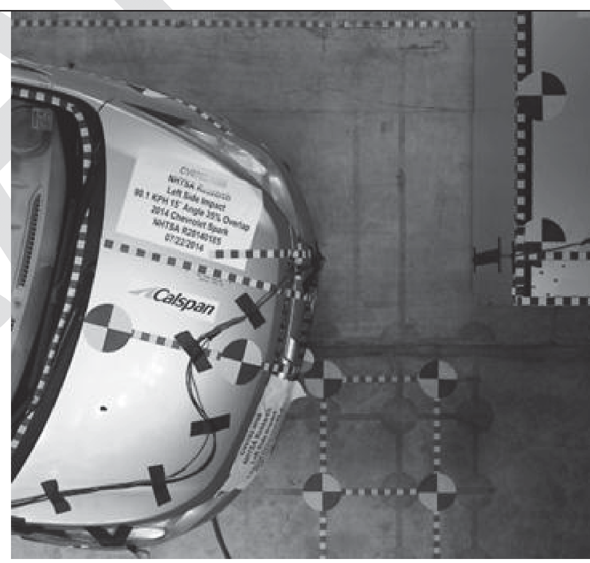
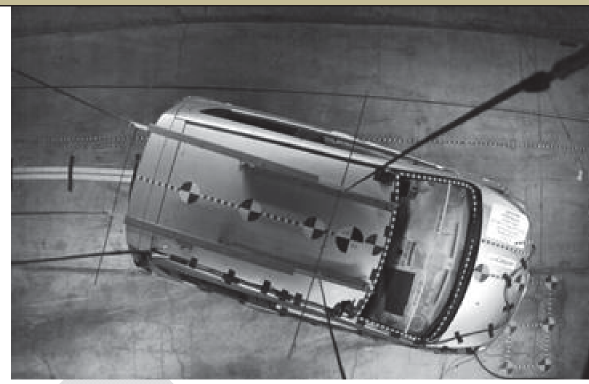
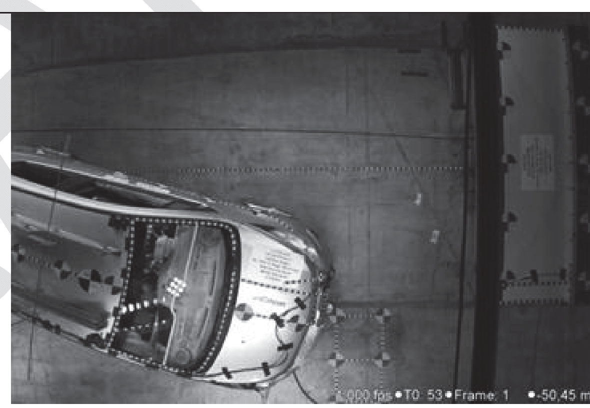
TABLE 11: HIGH SPEED CAMERA'S LEFT SIDE IMPACT	
DESCRIPTION	**EXAMPLE FIELD OF VIEW**
Camera 13: Front of Test Vehicle and OMDB High speed, off-board, ground based camera to document the front of vehicle as it interacts with the OMDB. 128) Start … (1) The minimum resolution shall be 512 by 512 pixles (2) The minimum frame per second (fps) shall be 500 fps (3) The camera centerline shall be parallel to the longitudinal centerline of the vehicle and the vehicle shall be in the center of the frame. This view will be used to validate impact point.	
Camera 14: Impact Point View High speed, off-board, overhead camera to document the interaction between the OMDB and the vehicle. 129) Start …. (1) The minimum resolution shall be 1024 by 1024 pixles (2) The minimum frame per second (fps) shall be 100 fps (3) The impact point shall be centered in the frame. (4) The left field of view shall start at the junction of the windshield and hood. (5) The top field of view shall be parallel with the OMDB's centerline and shall include the left side of the vehicle. (6) The bottom field of view shall include the right side of the vehicle.	

TABLE 11: HIGH SPEED CAMERA’S LEFT SIDE IMPACT	
DESCRIPTION	**EXAMPLE FIELD OF VIEW**
Camera 15: Overhead View of Test Vehicle High speed, overhead camera to track the rotation of the vehicle’s CG for the approximate distance the test vehicle would travel over 300 ms. 130) Start … (1) The minimum resolution shall be 1024 by 1024 pixles (2) The minimum frame per second (fps) shall be 1000 fps (3) The vehicle shall be in the center of the frame. (4) The entire overhead view of the vehicle shall be in the field of view. (5) The left field of view shall be wide enough to include the vehicle’s CG in each frame during the event.	
Camera 16: Overhead of OMDB View High speed, overhead camera to track the rotation of the OMDB’s CG for the approximate distance the test vehicle would travel over 300 ms. 131) Start … (1) The minimum resolution shall be 1024 by 102 pixles (2) The minimum frame per second (fps) shall be 100 fps (3) The impact point shall be in the center of the frame. (4) The top field of view shall cover the left side of the OMDB. (5) The bottom field of view shall cover the right side of the vehicle.	

CHECKLIST 7.26 – PRE-TEST REAL-TIME DOCUMENTATION

___**7.26.1** A real-time video shall be made after ATD final positioning and prior to impact to document pre-test conditions:

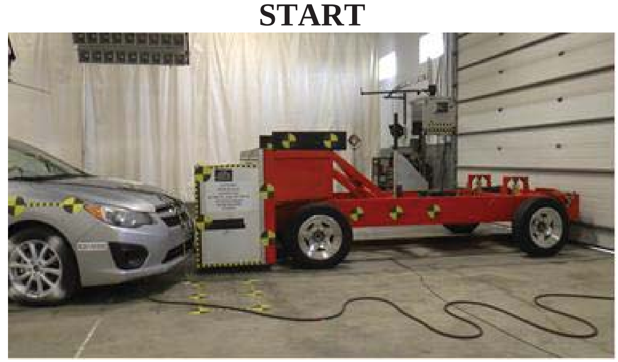
TABLE 12: REAL-TIME DOCUMENTATION	
DESCRIPTION (FIELD OF VIEW)	**EXAMPLE PICTURE**
Pre-Test Real Time Video 1: Pan left hand side of OMDB of test vehicle 5)	**START**  **END** 
Pre-Test Real Time Video 2: Rear of test vehicle	
Pre-Test Real Time Video 3: Pan right hand side of OMDB and test vehicle	**START**  **END**

TABLE 12: REAL-TIME DOCUMENTATION	
DESCRIPTION (FIELD OF VIEW)	**EXAMPLE PICTURE**
	
Pre-Test Real Time Video 4: Close-up of rigid steel rod alignment with impact point target	
Pre-Test Real Time Video 5: Down left side of OMDB looking at test vehicle	
Pre-Test Real Time Video 6: Top view looking down onto aluminum honeycomb barrier	

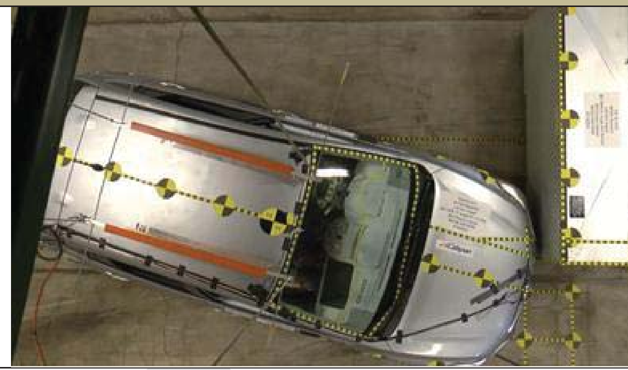
TABLE 12: REAL-TIME DOCUMENTATION	
DESCRIPTION (FIELD OF VIEW)	**EXAMPLE PICTURE**
Pre-Test Real Time Video 7: Top view looking down onto test vehicle	
Pre-Test Real Time Video 8: Right side view of honeycomb barrier on OMDB	
Pre-Test Real Time Video 9: Front side view of honeycomb barrier on OMDB	

TABLE 12: REAL-TIME DOCUMENTATION	
DESCRIPTION (FIELD OF VIEW)	**EXAMPLE PICTURE**
Pre-Test Real Time Video 10: Left side view of honeycomb barrier on OMDB	
Pre-Test Real Time Video 11: Removal, installation and tightening of fuel cap	
Pre-Test Real Time Video 12: Front view of test vehicle	

TABLE 12: REAL-TIME DOCUMENTATION	
DESCRIPTION (FIELD OF VIEW)	**EXAMPLE PICTURE**
Pre-Test Real Time Video 13: Left oblique front view of test vehicle	
Pre-Test Real Time Video 14: Left side view of test vehicle	
Pre-Test Real Time Video 15: Left oblique rear view of test vehicle	
Pre-Test Real Time Video 16: Rear View of test vehicle	

TABLE 12: REAL-TIME DOCUMENTATION	
DESCRIPTION (FIELD OF VIEW)	**EXAMPLE PICTURE**
Pre-Test Real Time Video 17: Right oblique rear view of test vehicle	
Pre-Test Real Time Video 18: Right side view of test vehicle	
Pre-Test Real Time Video 19: Right oblique front view of test vehicle	
Pre-Test Real Time Video 20: View of both ATDs through windshield	

TABLE 12: REAL-TIME DOCUMENTATION	
DESCRIPTION (FIELD OF VIEW)	**EXAMPLE PICTURE**
Pre-Test Real Time Video 21: View of driver ATD through windshield	
Pre-Test Real Time Video 22: View of passenger ATD through windshield	
Pre-Test Real Time Video 23: Side view of driver through driver's door window (door closed)	
Pre-Test Real Time Video 24: Side view of driver with door open	

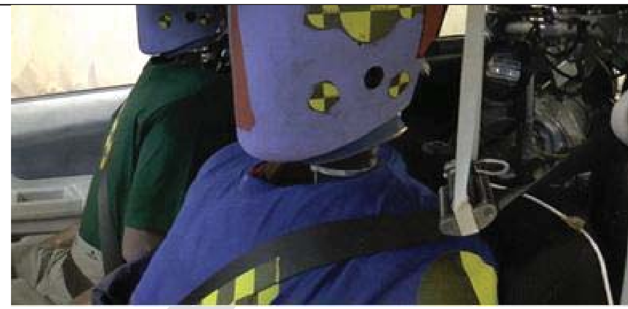
TABLE 12: REAL-TIME DOCUMENTATION	
DESCRIPTION (FIELD OF VIEW)	**EXAMPLE PICTURE**
Pre-Test Real Time Video 25: Driver's Shoulder belt load cell	
Pre-Test Real Time Video 26: Driver's shoulder belt placement	
Pre-Test Real Time Video 27:	
Pre-Test Real Time Video 28: Driver's belt placement	**START**  **END** 

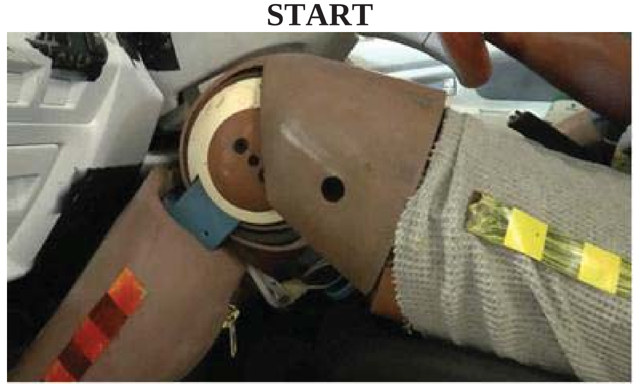
TABLE 12: REAL-TIME DOCUMENTATION	
DESCRIPTION (FIELD OF VIEW)	**EXAMPLE PICTURE**
Pre-Test Real Time Video 29: Driver's waist belt load cell placement	
Pre-Test Real Time Video 30: Driver's seatback markings	
Pre-Test Real Time Video 31: Driver's seat track markings	
Pre-Test Real Time Video 32: Driver's knee and lower leg	**START**  **MIDDLE**

TABLE 12: REAL-TIME DOCUMENTATION	
DESCRIPTION (FIELD OF VIEW)	**EXAMPLE PICTURE**
	 **END** 
Pre-Test Real Time Video 33: Driver's IP	
Pre-Test Real Time Video 34: Air bag / SRS light cycling	

TABLE 12: REAL-TIME DOCUMENTATION	
DESCRIPTION (FIELD OF VIEW)	**EXAMPLE PICTURE**
Pre-Test Real Time Video 35: Passenger air bag light	
Pre-Test Real Time Video 36: Gear shift placement	

CHECKLIST 7.27 – ELECTROMAGNETIC INTERFERENCE

The laboratory shall take all necessary precautions to ensure electromagnetic interference with the test data does not occur. The following vehicle procedures shall be included in those adopted by the laboratory:

___**7.27.1** Ground the head, thorax, and both femurs of the anthropomorphic test devices. This is accomplished by connecting the four components with a wire. A single wire then exits the dummy and is attached to a grounding block on the vehicle. Connect the grounding block to earth ground. The actual wire size and connections are left to the laboratory based on the system it uses.

CHECKLIST 7.28 – VEHICLE SETTINGS BEFORE EXECUTION OF TEST

___**7.28.1** Place all windows in the fully open position.

___**7.28.2** Place all vents in the fully closed position unless otherwise specified by the COR.

___**7.28.3** Verify that the windshield mounting material and all vehicle components in direct contact with the mounting material are between a 69°F and 72°F. This temperature measurement must be made within 15 minutes of the impact test event.

___**7.28.4** Place adjustable cowl tops or other adjustable panels in front of the windshield in the position used under normal operation during inclement weather.

___**7.28.5** Place sunroof(s) in the fully closed position.

___**7.28.6** If the vehicle has automatic door locks (ADLs), verify that they remain unlocked UNLESS the equipment is standard and the dealer is the only entity that can deactivate the system.

NOTE: Vehicles without automatic door locks should remain unlocked during the event. If there are any instructions in the owner's manual describing how a consumer may deactivate the ADLs, the vehicle must be left unlocked during the event.

___**7.28.7** Place convertible tops in the closed passenger compartment configuration.

___**7.28.8** Before performing the final vehicle door closing, knowledge of the door configuration and operation must be acquired (from test vehicle preparation data submitted by vehicle manufacturer). Particular care must be exercised to close doors with 2-stage (primary and secondary) latch systems.

___**7.28.9** Place all doors, hatchback or tailgate, in the fully closed and latched position. Full documentation of final door closings with a real-time camera is required.

___**7.28.10** Do not lock any door, hatchback, or tailgate.

___**7.28.11** Confirm that all doors are properly closed by checking indicators in vehicle instrument panel if so equipped.

___**7.28.12** Place transmission in neutral.

___**7.28.13** Disengage the parking brake.

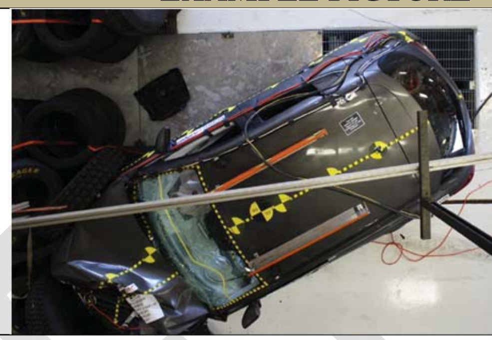
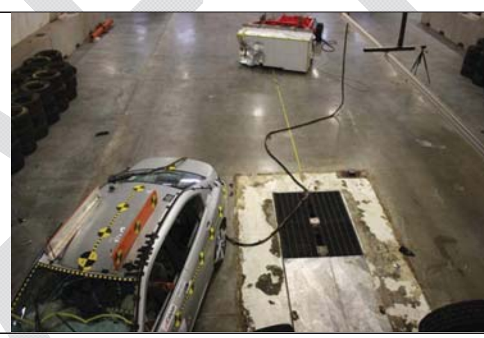
___**7.28.14** Immediately prior to executing the impact event, place the ignition key in the ignition and switch to the power "ON" position. If the vehicle is equipped with a keyless system, press the "Start-Stop-Engine" button to the powered on position.

___**7.28.15** Check to ensure that the "Air bag Readiness Indicator" shows the air bag system as being functional.

SECTION 8 – POST-TEST

CHECKLIST 8.1 – POST-TEST PICTURES BEFORE MOVING TEST VEHICLE AND OMDB

___**8.1.1** The following pictures shall be taken after it is ok to approach the vehicle

TABLE 13: POST-TEST BEFORE MOVINF TEST VEHICLE AND OMDB	
DESCRIPTION	**EXAMPLE PICTURE**
Post-Test Vehicle Overhead View	
Post-Test OMDB & Test Vehicle Front View	

CHECKLIST 8.2 – POST-TEST REAL-TIME DOCUMENTATION

___**8.2.1** A real-time video shall be made after impact to document post-test conditions

___**8.2.2** If necessary, carefully move the vehicle to an open area to allow an unobstructed view of all sides

___**8.2.3** Take the following shots with a real-time video camera

TABLE 14: REAL-TIME DOCUMENTATION	
DESCRIPTION (FIELD OF VIEW)	**EXAMPLE PICTURE**
Speed traps (both primary and redundant)	
Impact Point Target	
Right side of honeycomb barrier on OMDB	
Front side view of honeycomb barrier on OMDB	

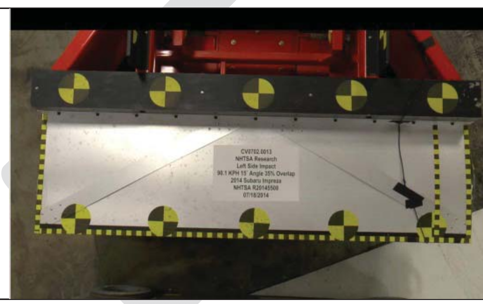
TABLE 14: REAL-TIME DOCUMENTATION	
DESCRIPTION (FIELD OF VIEW)	**EXAMPLE PICTURE**
Left side view of honeycomb barrier on OMDB	
Top view looking down onto aluminum honeycomb barrier	
Front view of test vehicle	
Left oblique front view of test vehicle	
Left side view of test vehicle	

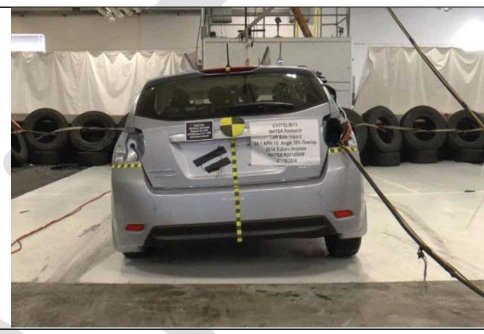
TABLE 14: REAL-TIME DOCUMENTATION	
DESCRIPTION (FIELD OF VIEW)	**EXAMPLE PICTURE**
Left oblique rear view of test vehicle	
Rear View of test vehicle	
Right oblique rear view of test vehicle	
Right side view of test vehicle	
Right oblique front view of test vehicle	

TABLE 14: REAL-TIME DOCUMENTATION	
DESCRIPTION (FIELD OF VIEW)	**EXAMPLE PICTURE**
Other vehicle failures or anomalies, including door openings and any fluid spillage (along with its collection and measurement) after the impact or during the static rollover	

CHECKLIST 8.3 - POST TEST ATTITUDE

____**8.3.1** Record attitude before moving the vehicle in the table below

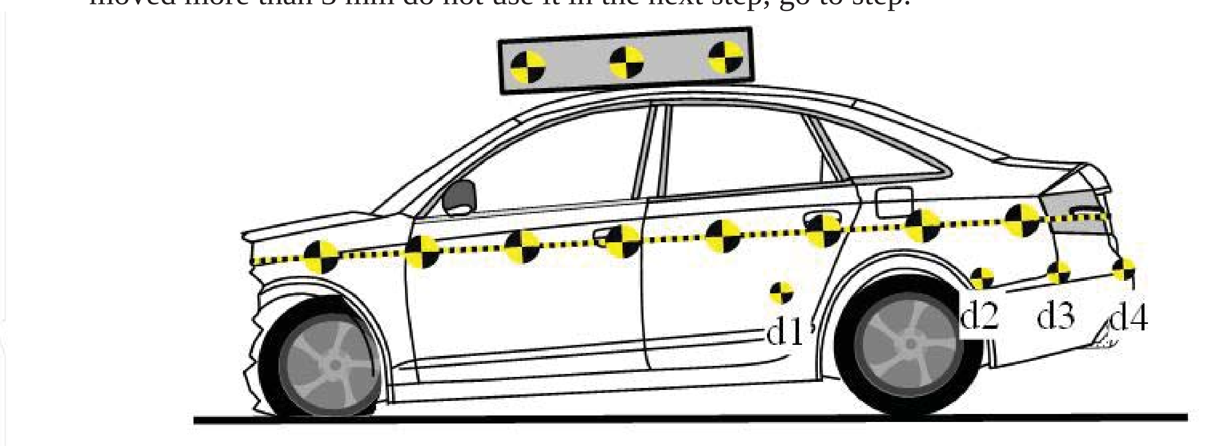
ATTITUDE	UNITS	LF	RF	LR	RR	CG_X
Post-Test	mm					

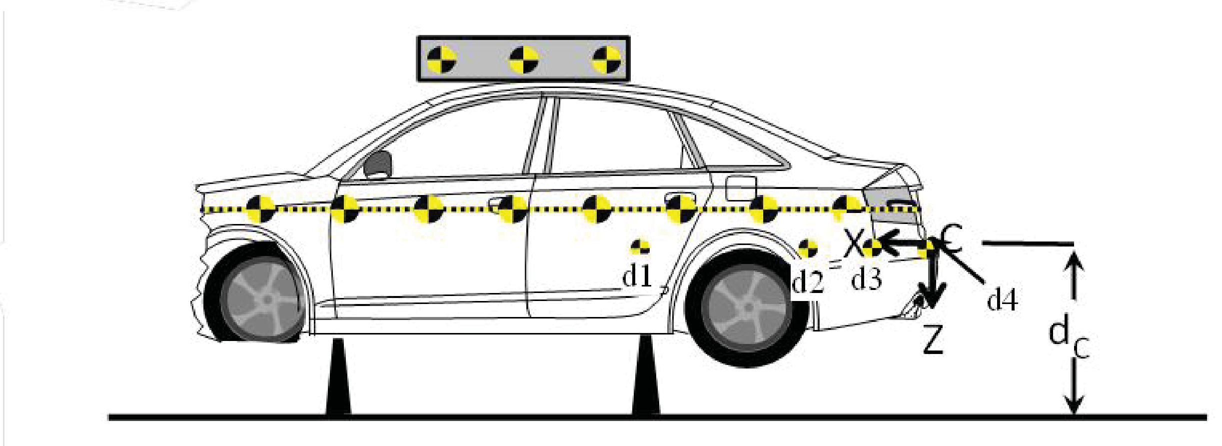
CHECKLIST 8.4 – POST-TEST LEVELING OF CRASHED TEST VEHICLE (PTVLC)

After the test the vehicle may not be level due to crush and tire deformation as shown inf figure below.

___8.4.1 The Contactor can level the vehicle by two different methods. If using CMM go to step ___8.4.14

___8.4.2 Using a CMM machine, verify that points D1 through D4 and point P1 to P4 create in Checksheet D.26 did not move relative to the VCS by more than 3 mm. If a point has moved more than 3 mm do not use it in the next step, go to step.





___8.4.3 Place a vehicle jack at each of the manufacturer's recommended positions. If any of these positions are deformed find an alternate point on the structure to raise the vehicle.

___8.4.4 Raise each jack until the top of the each jack touches the bottom sill.

___8.4.5 Raise each jack up by 50 mm

___8.4.6 Repeat step 3 until the height of the vehicle coordinate system equals Dc recorded in CHECKLIST 4.20.

___8.4.7 Verify that the VCS origin height is within +/- 3 mm of Dc

___8.4.8 Verify that the Z difference between D4 and P4 is less than 3 mm

___8.4.9 Verify that the Z difference between D1 and P1 is less than 3 mm

___8.4.10 Verify that the Z difference between D1 and D4 is less than 3 mm

___8.4.11 Verify that the Z difference between P1 and P4 is less than 3 mm

___**8.4.12** If any condition in step 5, 6, 7, and 9 are not met, raise or lower the appropriate jacks until conditions in steps 5, 6, 7, and 9 are met.

___**8.4.13** Ensure the VCS is parallel to the Global Coordinate system and VCS origin height is within +/- 3mm of D_c

___**8.4.14** Using the VCS and other points created jack the vehicle up until the orgin of the VCS is withing +/- 3 mm of DC and the VCS is parallel to the global coordinate system

CHECKLIST 8.5 – POST-TEST EXTERIOR PROFILE

Note: The number of points taken in the following steps does not have to equal the number of points taken in CHECKLIST 4.37.

___**8.5.1** Make sure the vehicle is in the PTVLC condition
___**8.5.2** Expose the front bumper beam
___**8.5.3** Using CMM take and measure enough points around the complete circumference of the vehicle along this cross section A-A (horizontal plane) at this height Da.
___**8.5.4** Using CMM take and measure enough points around the complete circumference of the vehicle along this cross section B-B (horizontal plane) at this height Db

TABLE 15							
CROSS SECTION A-A				CROSS SECTION B-B			
POINT #	X	Y	Z	POINT #	X	Y	Z
1				1			
2				2			
3				3			
4				4			
5				5			
6				6			
7				7			
8				8			
9				9			
10				10			
11				11			
12				12			
13				13			
14				14			
15				15			
16				16			
.				.			
.				.			
.				.			

CHECKLIST 8.6 – EXTERIOR VEHICLE MEASUREMENT

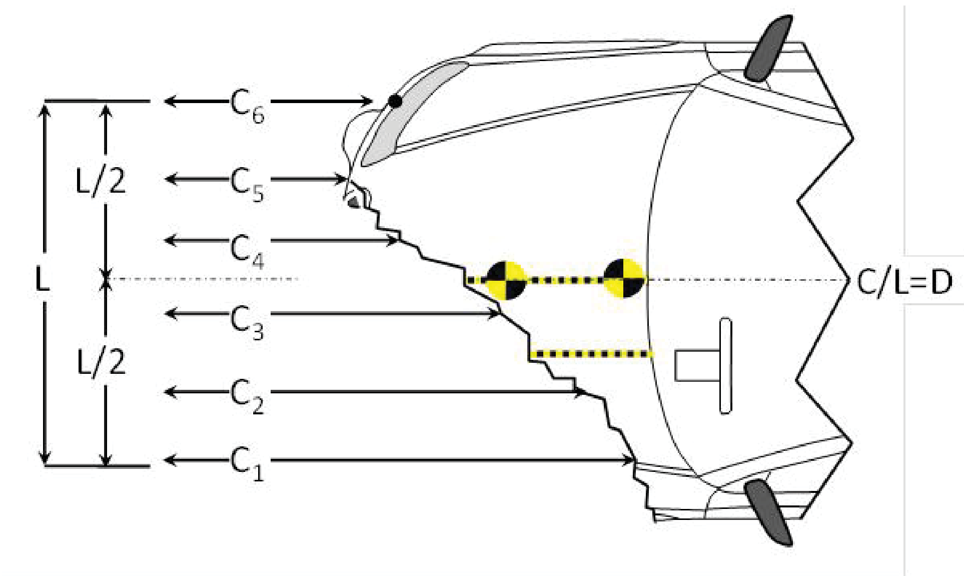
___**8.6.1** Establish a fixed reference plane that is perpendicular to the vehicle's longitudinal centerline. (See figure above)

___**8.6.2** Following the test, with the vehicle leveled measure and record the dimensions from the fixed reference plane as shown in the below table

TABLE 16		
NO.	**MEASUREMENT DESCRIPTION**	**POST-TEST (MM)**
1	Total Length of Vehicle at Centerline	
2	Rear Surface of Vehicle (RSOV) to Front of Engine	
3	RSOV to Firewall	
4	RSOV to Upper Leading Edge of Right Door	
5	RSOV to Upper Leading Edge of Left Door	
6	RSOV to Lower Leading Edge of Right Door	
7	RSOV to Lower Leading Edge of Left Door	
8	RSOV to Upper Trailing Edge of Right Door	
9	RSOV to Upper Trailing Edge of Left Door	
10	RSOV to Lower Trailing Edge of Right Door	
11	RSOV to Lower Trailing Edge of Left Door	
12	RSOV to Bottom of "A" Post of Right Side	
13	RSOV to Bottom of "A" Post of Left Side	
14	RSOV to Firewall, Right Side	
15	RSOV to Firewall, Left Side	
16	RSOV to Steering Column	
17	Center of Steering Column to "A" Post	
18	Center of Steering Column to Headliner	
19	RSOV to Right Side of Front Bumper	
20	RSOV to Left Side of Front Bumper	
21	Length of Engine Block	
RD	RSOV to Right Side of Dash Panel	
CD	RSOV to Center of Dash Panel	
LD	RSOV to Left Side of Dash Panel	

CHECKLIST 8.7 – POST-TEST ACCIDENT INVESTIGATION MEASUREMENTS

___**8.7.1** Make sure the vehicle is in the PTVLC condition



Post-test Measuring On Bumper Fascia

Point-to-Point measurement technique is used to measure the crush. It is defined as the actual distance a specific component moved within the damage plane. Gather the following post measurement data using a CMM machine and record such measured values. All measurements are taken from reference plane/line as used in pre-test. Reference the Figure 1 as the following steps are completed

___**8.7.2** Measure the distance between the C1 and C6 parallel to the reference plane and record the distance as Damage Length L.

___**8.7.3** Measure C1 through C6 perpendicular to the reference plane. Measurements should be made while pushing the plastic bumper fascia cover inward until a solid structure is contacted. The plastic bumper fascia is pushed against the underlying structure to remove any airgap before measuring C1 through C6. Record the values under column Post-test.

___**8.7.4** The crush at a point is the difference between post-test and pre-test measurement at that location. The crush values should always be positive unless the actual point on the vehicle has been moved outward, such as in an offset frontal impact where the non-contacted side of the bumper rotates outward beyond the original overall length, the measurement is negative since it moved out from its original position rather than crushed in.

ITEM	DESCRIPTION	PRE-TEST (MM) A	POST-TEST (MM) B	CRUSH (MM) B - A
C1	Crush point 1 at left side			

C2	Crush point 2 at left side			
C3	Crush point 3 at left side			
C4	Crush point 4 at right side			
C5	Crush point 5 at right side			
C6	Crush point 6 at right side			
UEW /L	Length (C1 to C6)			
	Longitudinal horizontal distance from the tip of the front bumper to the base of the windshield			

Post-test Measuring On Bumper Beam

In situations where the fascia falls off, measure the crush on the bumper beam. If the bumper was snagged and pulled outward during separation or during a subsequent impact, you would ignore that portion of the bumper affected by the snagging and measure to a representative crush plane behind the bumper. Pre-test measurements are taken on bumper fascia as described above.

___**8.7.5** On the bumper beam C1 is at left (driver's perspective) end of the beam and C6 is at right (driver's perspective) end of the beam. Measure the distance between the C1 and C6 parallel to the reference plane and record the distance as Damage Length L under post-test column.

___**8.7.6** Points C2 through C5 on the bumper beam can be found by dividing Damage Length L into 5 equal lengths. Measure C1 through C6 on the bumper beam perpendicular to the reference plane.

___**8.7.7** Measure the thickness of the Energy Absorption Device (EAD) (such as a Styrofoam or plastic honeycomb insert) found between bumper fascia and bumper beam. Record it in table 2 under "Thickness of EAD" column. These values are also considered freespace and should be subtracted from C1-C6 to get the actual crush

___**8.7.8** The crush at a point is the difference between post-test and pre- test measurement (including EAD thickness) at that location. The crush values should always be positive unless the actual point on the vehicle has been moved outward, such as in an offset frontal impact where the non-contacted side of the bumper rotates outward beyond the original overall length, the measurement is negative since it moved out from its original position rather than crushed in.

___**8.7.9** Using the pre-test and post-test measurements, compute the Collision Deformation Classification:______________________

NOTE: This 15 degree 35% left oblique offset typically results in a CDC of 11FYEWX, where the value for X is calculated by taking the pre-test longitudinal horizontal distance from the tip of the front bumper to the center of the base of the windshield and dividing it into 5 equal zones, with Zone 1 beginning at the bumper. Whatever zone the maximum longitudinal crush reaches into is the number that is reported for X. Typically it will be zone “4”,“5”, or “6” in this test.

ITEM	DESCRIPTION	PRE-TEST (MM) A	POST-TEST (MM) B	THICKNESS OF EAD C	CRUSH (MM) B - A - C
C1	Crush point 1 at left side				
C2	Crush point 2 at left side				
C3	Crush point 3 at left side				
C4	Crush point 4 at right side				
C5	Crush point 5 at right side				
C6	Crush point 6 at right side				
UEW/L	Length (C1 to C6)				
	Longitudinal horizontal distance from the tip of the front bumper to the base of the windshield				

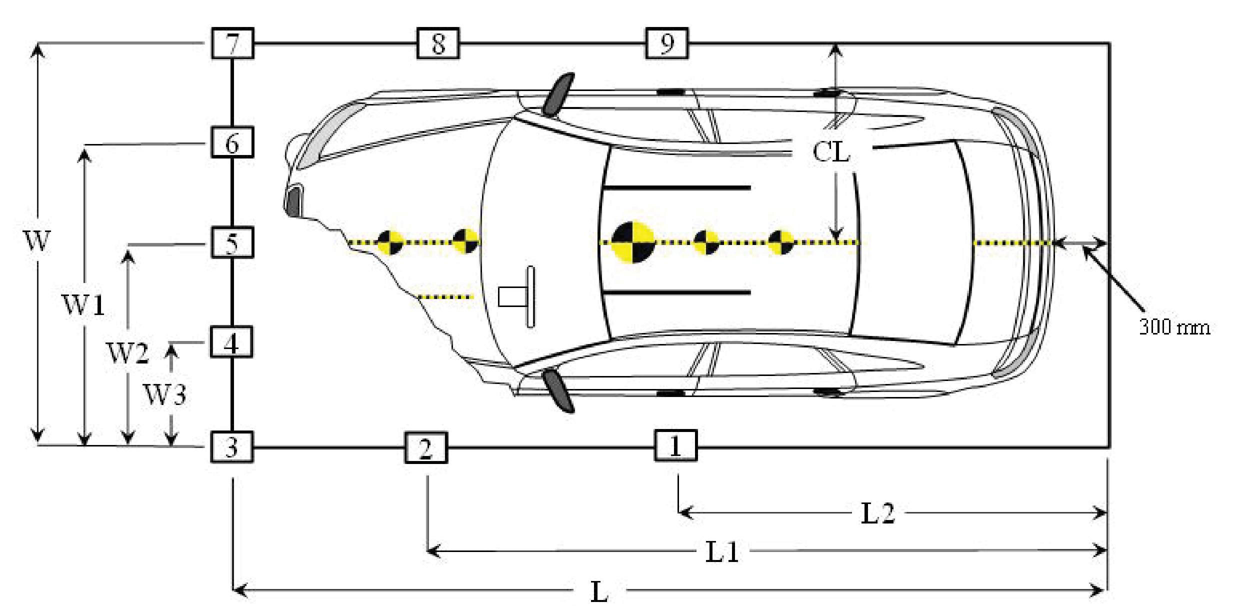
CHECKLIST 8.8 – POST-TEST FRONT BUMPER BEAM POINTS

___**8.8.1** Make sure the vehicle is in the PTVLC condition

___**8.8.2** Measure and record the bumper beam center point

TABLE 17			
POINT	POST-TEST (MM)		
	X	Y	Z
B1			
B2			
B3			
B4			
B5			
B6			
B7			
B8			
B9			

CHECKLIST 8.9 – POSITION OF REFERENCE BOX AROUND POST-TEST VEHICLE



___**8.9.1** Make sure the vehicle is in the PTVLC condition
___**8.9.2** Create the OV around the vehicle such that it is the same position as in the pre-test
___**8.9.3** Using the distance record place the blocks in the same spots as the pre-test box
___**8.9.4** Take the same pictures as CHECKLIST 4.45
Note: While taken these pictures note any post-test observations CHECKSHEET H.10

Insert pictures from section D

CHECKLIST 8.10 POST-TEST INTERIOR PHOTOS WITH DUMMIES

___**8.10.1** Take the same pictures as in CHECKLIST 7.20

Note: While taken these pictures note any post-test observations CHECKSHEET H.10

CHECKLIST 8.11 INTERIOR PICTURES

___**8.11.1** While taken the following pictures record all post-test observation list in CHECKLIST 8.12

___**8.11.2** Take the same pictures from CHECKLIST 4.28

Note: While taken these pictures note any post-test observations CHECKSHEET H.10

CHECKLIST 8.12 - POST TEST OBSERVATIONS

___**8.12.1** Complete the below tables. If unsure how to document any observation, take additional photographs and provide a written description.

TABLE 18: TEST DUMMY INFORMATION AND CONTACT LOCATIONS		
DESCRIPTION	**DRIVER**	**RIGHT FRONT PASSENGER**
Dummy Type/Serial No.		
Lower Leg Type		
Lower Leg Serial No.		
Head Contact		
Upper Torso Contact		
Lower Torso Contact		
Left Knee Contact		
Right Knee Contact		

TABLE 19: DOOR OPENING AND SEAT TRACK INFORMATION		
DESCRIPTION	**DRIVER**	**RIGHT FRONT PASSENGER**
Locked/Unlocked Doors		
Front Door Opening		
Rear Door Opening		
Seat Track Shift (mm)		
Seat Back Failure		
Glazing Damage		

TABLE 20: POST TEST STRUCTURAL OBSERVATIONS		
CRITICAL AREAS OF PERFORMANCE	**OBSERVATIONS AND CONCLUSIONS**	**PHOTO TAKEN (Y/N)**
Pillar Performance		
Windshield Damage		
Window Damage		
Other Notable Effects		

SUPPLEMENTAL RESTRAINT SYSTEM INFORMATION

TABLE 21: SUPPLEMENTAL RESTRAINT SYSTEM INFORMATION				
RESTRAINT TYPE	**DRIVER (OCCUPANT 1)**		**RIGHT FRONT PASSENGER (OCCUPANT 2)**	
	INSTALLED	**DEPLOYED**	**INSTALLED**	**DEPLOYED**
Front Air Bag				
Curtain Air Bag				
Torso Air Bag				
Knee Air Bag				
Seat Belt Pretensioner				

Seat Belt Load Limiter				
Other				

CHECKLIST 8.13 – POST-TEST INTERIOR POINTS

____**8.13.1** Make sure the vehicle is in the PTVLC condition

TABLE 22: POST-TEST INTERIOR POINTS RELATIVE TO VCS						
INTRUSION LOCATION	**DRIVER**			**PASSENGER**		
	X (MM)	**Y (MM)**	**Z (MM)**	**X (MM)**	**Y (MM)**	**Z (MM)**
IP Left						
IP Right						
Upper Dash						
Parking Brake Pedal Point						
Front Outboard Seat Bolt						
Footrest						
TP Outboard						
TP Center						
TP Inboard						

CHECKLIST 8.14 – POST-TEST DOOR PROFILE

___**8.14.1** Make sure the vehicle is in the PTVLC condition

TABLE 23						
POINT	DRIVER POST-TEST (MM)			RIGHT FRONT PASSENGER POST-TEST (MM)		
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						
Striker Bolt						
A						
B						
Wheelbase						

CHECKLIST 8.15 POST-TEST WHEEL WELL PICTURES

___8.15.1 Take the same pictures as in CHECKLIST 4.48

___8.15.2 Remove the fender from the opposite side of the impact and take the same pictures as in step **___**8.15.1

CHECKLIST 8.16 – POST-TEST BUMPER BEAM POINTS

___**8.16.1** Make sure the vehicle is in the PTVLC condition

TABLE 24			
POINT	POST-TEST (MM)		
	X	Y	Z
B1			
B2			
B3			
B4			
B5			
B6			
B7			
B8			
B9			

CHECKLIST 8.17 - AIR BAGS

___**8.17.1** Record the restraint firing times in the below table

LOC.	DESCRIPTION	UNITS	TIME TO FIRE (MS)
1	Driver Air Bag Squib 1	A	
2	Driver Air Bag Squib 2	A	
3	Driver Curtain Air Bag	A	
4	Driver Torso Air Bag	A	
5	Driver Knee Air Bag	A	
6	Driver Pretensioner	A	
7	Passenger Air Bag Squib 1	A	
8	Passenger Air Bag Squib 2	A	
9	Passenger Curtain Air Bag	A	
10	Passenger Torso Air Bag	A	
11	Passenger Knee Air Bag	A	
12	Passenger Pretensioner	A	

CHECKLIST 8.18 POST-TEST UNDERBODY PICTURES

___**8.18.1** Take the same pictures as CHECKLIST 4.18

Note: While taken these pictures note any post-test observations CHECKSHEET H.10

CHECKLIST 8.19 – DETERMINE IF ANY CRITERIA IS NOT MEET DURING TEST

___**8.19.1** Notify if any of the required requirements are met

___**8.19.2** If a requirement is not met let COR within 24 hours

CHECKLIST 8.20 – PERFORM POST-TEST ATD INSPECTION

___8.20.1 Perform the THOR inspection list as specified in **___**6.1.6

CHECKLIST 8.21 – INJURY SUMMARY

___**8.21.1** Create the preliminary injury summary

CHECKLIST 8.22 ELECTRONIC DATA RECORDER (EDR) REMOVAL

___**8.22.1** Immediately following the test, the Contractor shall also remove the Event Data Recorder (EDR) for the vehicle using the information supplied on Form 1 by the vehicle manufacturer. The EDR shall be handled with care and labeled. It shall also be protected from the elements and retained by the test Contractor until requested by the COR.

CHECKLIST 8.23 - POST TEST FMVSS 212,219 (PARTIAL) – INDICANT

Checklist 8.23.1 FMVSS 212 WINDSHIELD MOUNTING – POST TEST

___**8.23.1.1** Can a single thickness of copier type paper (as small a piece as necessary) slide between the windshield and the vehicle body?

__No, skip to the table of measurements, complete it by repeating the pre-crash measurements in the post crash column, and calculate the retention percentage, which will be 100%.

__Yes, continue to 2.

___**8.23.1.2** Visibly mark the beginning and end of the separated portions of the periphery where the paper slides between the windshield and the vehicle body and photograph the windshield with these marks.

___**8.23.1.3** Measure and record post-crash A, B, C, D, E, and F dimensions such that the measurements do not include any of the separated portions.

___**8.23.1.4** Calculate and record the percent retention for the right and left side of the windshield.

___**8.23.1.5** Is total right side percent retention less than 50%?

__Yes, notify COR

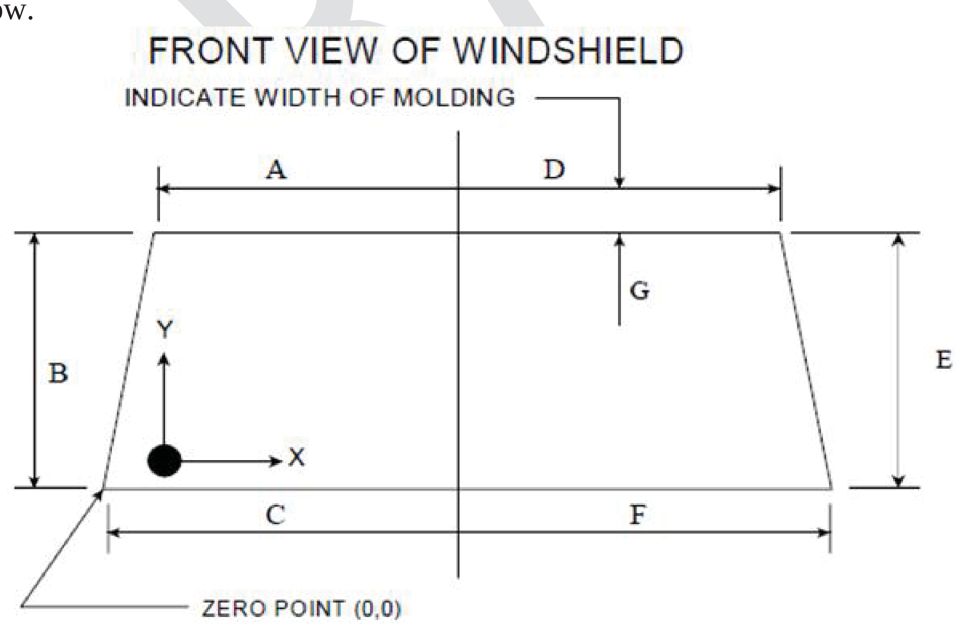
__No

___**8.23.1.6** Is total left side percent retention less than 50%?

__Yes, notify COR

__No

___**8.23.1.7** Indicate the separated portions of the windshield mounting periphery on the figure below.



Checklist 8.23.2 WINDSHIELD PERIPHERY MEASUREMENTS

MEASUREMENT	DIMENSION	PRE-TEST (MM)	POST-TEST (MM)	% RETENTION (POST-TEST/PRE-TEST)
Left Side (Driver)	A			
	B			
	C			
	Total			
Right Side (Passenger)	D			
	E			
	F			
	Total			

Checklist 8.23.3 FMVSS 219 WINDSHIELD ZONE INTRUSION (PARTIAL) – POST TEST

___**8.23.3.1** Did any part of the vehicle exterior, other than components designed to be normally in contact with the windshield, touch, mark, penetrate, or break the windshield within the protected zone?

__Yes, record the coordinates of the contact point, photograph the location, and indicate the location on the figure below. Notify the COR.

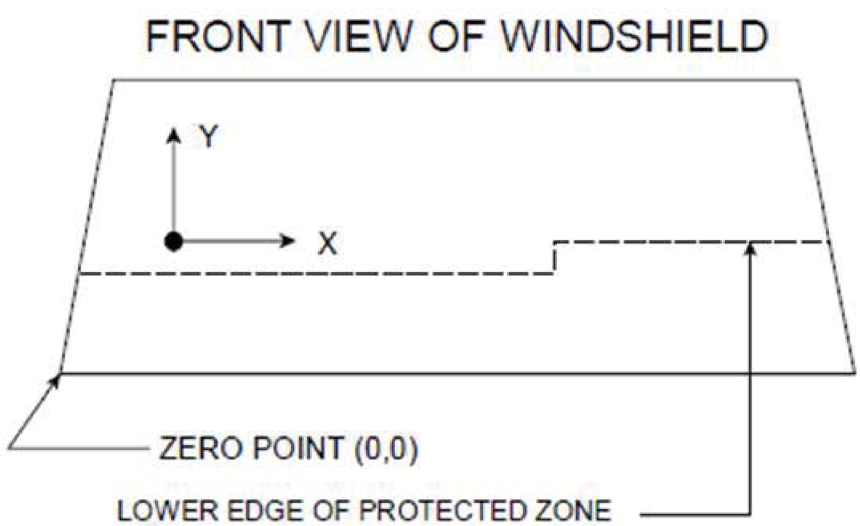
__No

___**8.23.3.2** Did any part of the vehicle exterior, other than components designed to be normally in contact with the windshield, penetrate the windshield within the protected zone?

__Yes, record the coordinates of the penetration point, photograph the location, and indicate the location on the figure below. Notify the COR.

__No

___**8.23.3.3** Provide coordinates of the area beneath the protected zone that the inner surface of the windshield was penetrated by a vehicle component.



Checklist 8.23.4 WINDSHIELD CONTACT WITHIN THE PROTECTED ZONE

CONTACT DESCRIPTION	COORDINATES (MM)	
	X	Y

Checklist 8.23.5 WINDSHIELD PENETRATION BELOW THE PROTECTED ZONE

CONTACT DESCRIPTION	COORDINATES (MM)	
	X	Y

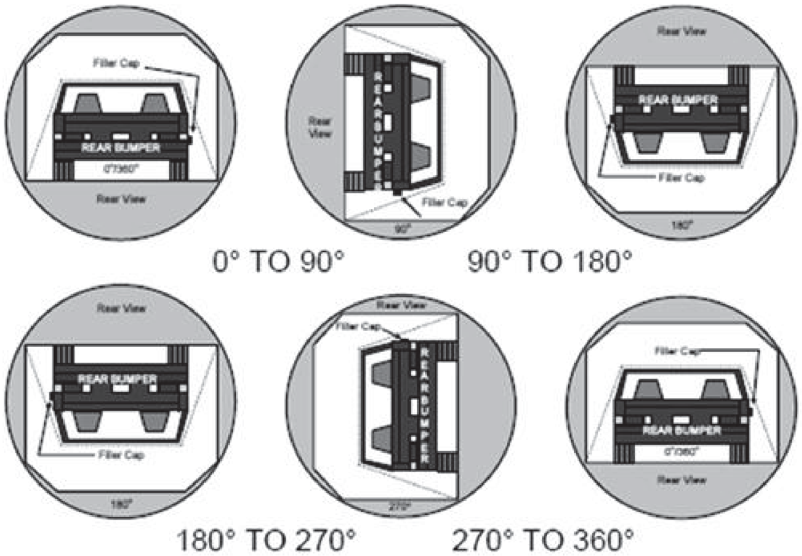
CHECKLIST 8.24 - POST TEST FMVSS 301 FUEL SYSTEM INTEGRITY – INDICANT

___**8.24.1** Record the fuel system integrity post impact data.

MEASUREMENT TIME	STODDARD SPILLAGE
From impact until vehicle motion ceases:	grams
For the first 5-minutes after motion ceases:	grams
For the following 25 minutes:	grams

Spillage Details:

___**8.24.2** Record the fuel system integrity static rollover data.


Filler Cap
REAR BUMPER
Rear View
0° TO 90°
90° TO 180°
180° TO 270°
270° TO 360°

CHECKLIST 8.25 SOLVENT COLLECTION INTERVAL TABLE (MINUTES)

Test Phase	Rotation Time (1 to 3 minutes)	Hold Time (5 minutes)	Total Time (rotation + hold)
0° to 90°		5	
90° to 180°		5	
180° to 270°		5	
270° to 360°		5	

Checklist 8.25.1 STODDARD SPILLAGE TABLE (grams)

TEST PHASE	FIRST 5 MINUTES	SIXTH MINUTE	SEVENTH MINUTE	EIGHTH MINUTE
0° to 90°				
90° to 180°				
180° to 270°				
270° to 360°				

Checklist 8.25.2 STODDARD SPILLAGE LOCATION TABLE

TEST PHASE	SPILLAGE LOCATION
0° to 90°	
90° to 180°	
180° to 270°	
270° to 360°	