



## **Vehicle LATCH Hardware Evaluation Protocol (Version III)**

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## Vehicle LATCH Hardware Evaluation Protocol (Version III)

### Document Revision History

A history of revisions to this document is provided in Appendix B.

### Background

Lower Anchors and Tethers for Children (LATCH) requirements, introduced more than a decade ago, are intended to make it easier for parents to install child restraints by standardizing attachments between vehicles and restraints. But LATCH systems vary, and many parents still struggle to use LATCH correctly. Ratings from the Insurance Institute for Highway Safety will help guide parents to identify vehicles with easy LATCH systems and encourage vehicle manufacturers to make lower anchors more accessible and tether anchors easier to locate. Parents who use LATCH are more likely to get a good, tight installation, so improving LATCH will not only make installations easier for parents but also reduce child restraint misuse. This document outlines the data collection protocol for vehicle LATCH hardware evaluations.

### 1. TestID

- 1.1. Assign a TestID that begins with the letters "LAT," followed by the calendar year and sequence number (e.g., LAT14001, LAT14002). TestIDs can be defined for vehicles before evaluations begin or can be sequentially assigned as vehicles are evaluated.

### 2. Vehicle Data

- 2.1. Record the vehicle model year, make, model, trim level, and vehicle identification number (VIN).
- 2.2. Record the number of rear seat positions, type of seat covering materials [cloth, leather, leatherette], total number of lower anchor sets (2 lower anchors per set, record 0.5 sets for 1 anchor that shares with another in an adjacent seat position), and total number of tether anchors. Vehicles used for LATCH evaluation will be chosen based on the seat covering specified by class in Appendix A, though additional seat coverings may also be evaluated.
- 2.3. Record from information in the owner's manual whether lower anchors can be used in the second row, center seat position [not applicable; no; yes, dedicated anchors; yes, borrowed anchors; yes, 1 dedicated, 1 borrowed from 21; yes, 1 dedicated, 1 borrowed from 22].
- 2.4. Record the temperature of the seat material inside the vehicle at the time of evaluation. Target temperature for evaluations is  $20 \pm 8$  degrees Celsius.
- 2.5. Zero all angle gauges to the vehicle sill.

### 3. Vehicle Owner's Manual Evaluation

- 3.1. Examine the vehicle owner's manual for the following:
  - Diagrams that clearly mark locations of lower and tether anchors [yes/no]
  - Concurrent use of lower anchors and seat belt is allowed [yes/no/not specified]
  - Instructions for both single strap and double strap (v-shaped) tethers [yes/no]
  - Tether anchor weight limit [none stated; Use tether if child is more than 48 pounds; combined weight of 65 pounds; limit of the child restraint (can be used with all forward-facing child restraints)]

#### 4. Seat Position Data

- 4.1. Seat positions are designated as illustrated in Figure 1. Document each rear seat position and whether lower anchors and tether anchor are available. For lower anchors, there are 2 lower anchors per set. Record 0.5 sets for 1 anchor that shares with another in an adjacent seat position.
- 4.2. For seat positions with no lower anchors or tether anchor, no additional data needs to be collected beyond the seat location and the absence of LATCH hardware.

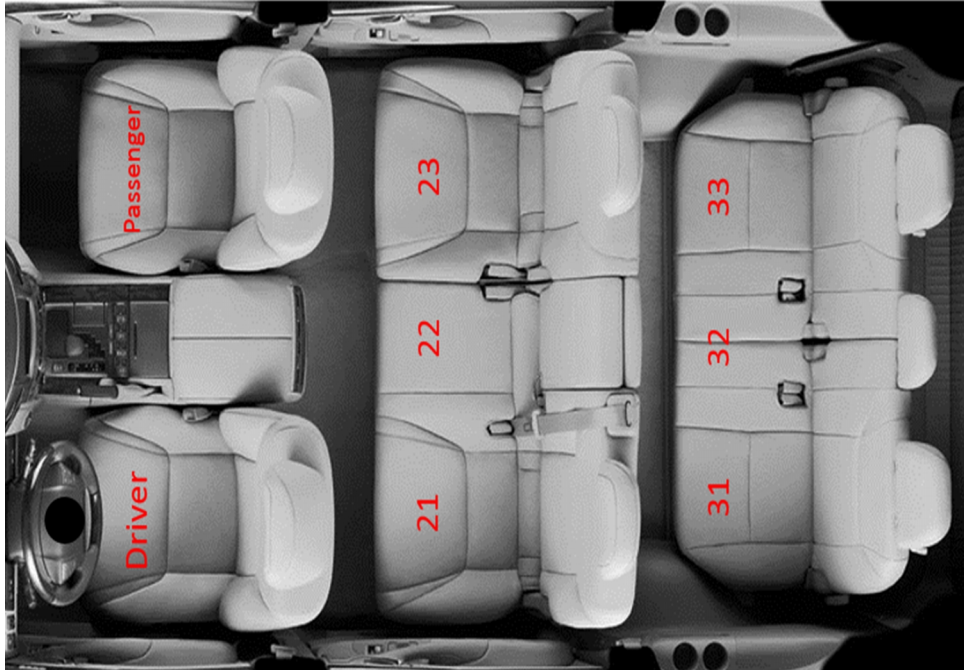


Figure 1. Designation of vehicle seat positions.

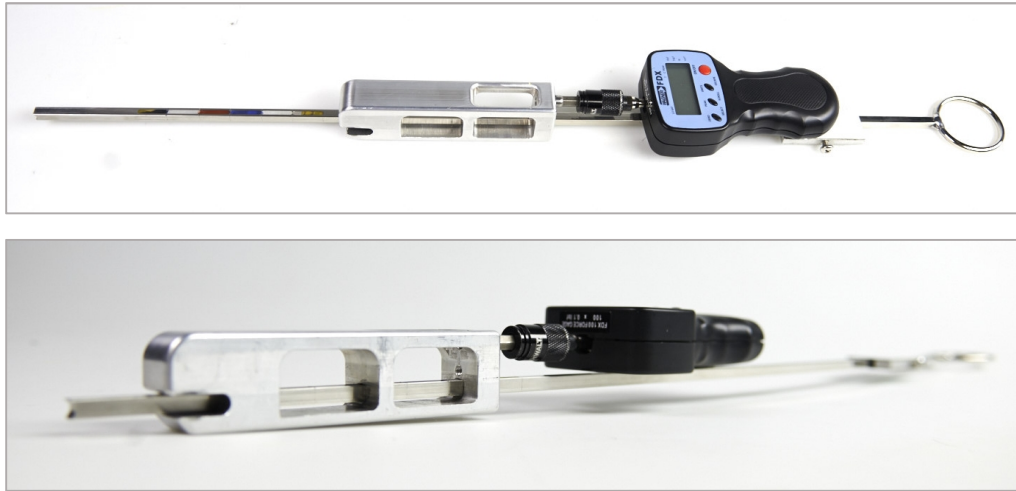
#### 5. Lower Anchor Data

- 5.1. Before collecting lower anchor data, adjust the seatback to a standard position. If the seatback is not fixed, set the seatback as specified by the vehicle manufacturer for the final seatback position for child restraint installations. If no seatback angle is recommended, then set to the most upright, locked position.
- 5.2. If the seatback is not fixed, measure the seatback angle on the head restraint post. If the seatback angle cannot be taken on the head restraint post, the measurement should be taken between the upper and lower transverse members of the seat frame.
- 5.3. For each seat position with lower anchor hardware, lower anchors are designated as A for the anchor closest to the driver side door and B for the anchor farthest from the driver side door. If a seat position has only one anchor and borrows the second anchor from another seat position, then only the dedicated anchor is labeled and measured. The dedicated anchor is assigned A or B based on whether it is closer to (A) or farther from (B) the driver's side door than the borrowed anchor.

- 5.4. Document the anchor depth within the seat bight, anchor attachment force, and clearance angle around the anchors following the procedures described in sections 6-9. Measures should be documented for both A and B anchors.

## 6. Attachment Force Tool

- 6.1. The lower anchor depth within the seat bight and lower anchor attachment force are measured using the attachment force tool (Figure 2). The attachment force tool consists of a square cross-section guide rod, force tool slider, and force gauge. Additionally, an angle gauge (not pictured) is mounted to the guide rod.



**Figure 2. Attachment force tool used to measure depth of lower anchor within seat bight and anchor attachment force.**

- 6.2. With the force tool slider retracted, place the notched end of the guide rod in the approximate center of the lower anchor bar such that the force slider tool will not interact with the side members of the anchor bar. Apply gentle pressure to seat it.
- 6.3. Position the guide rod at the angle that allows the top and bottom front surface of the force tool slider to rest touching the seat cushion (Figure 3). Record the approach angle using an angle gauge on the guide rod. If both the top and bottom front surface of the force tool slider do not



**Figure 3. Initial position of force tool slider, with seat cushion just touching top and bottom of front surface of force tool slider.**

make contact with the seat cushion, position the tool at the lowest angle where at least one surface is touching the cushion and record the angle. If there is an approach angle at which neither the top nor bottom surface of the force tool slider will contact the cushion, and the tool can slide into the tunnel and align with the lower anchor bar with less than 2.0 pounds of force and without obstruction or compressing any foam surrounding the anchor bar, then the anchor is considered open access. While determining if the anchor is considered open access, the seat cushion may be compressed at the distal end of the slider in order to allow the slider to approach the anchor. If an anchor's eligibility as open access is improved by adjusting the seatback angle, then the seatback may be adjusted to the first position from full upright where the anchor can be considered open access, as long as that position is not more than 25 degrees rearward of the full upright angle. For an open access anchor, record the lowest approach angle that allows no interference on approach to the anchor.

## 7. Depth of Lower Anchor within Seat Bight

- 7.1. For lower anchors with open access only (defined in 6.3), the anchor is considered to meet the depth criterion if the anchor is visible at an angle of 60 degrees from horizontal, as measured at the sill. Position the guide rod on the anchor and rotate the guide rod until it interacts with the seat cushion (Figure 4). Record the angle using an angle gauge on the guide rod. This is the largest angle at which the lower anchor bar is visible.

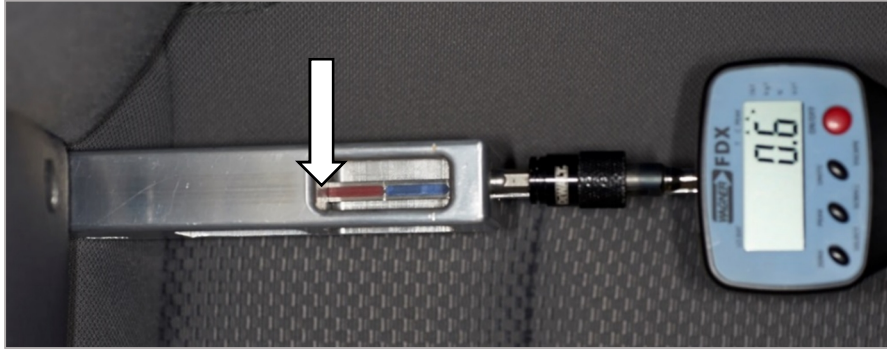


**Figure 4. Guide rod rotated upward to the maximum angle until it interacts with the seat cushion or other trim.**

- 7.2. For all other anchors, depth within the seat bight is measured with the force tool slider in place as described in 6.3. The guide rod is color-coded to measure the depth in 2 cm increments, based on the following color scale: yellow = -2 to 0 cm, white = 0 to 2 cm, red = 2 to 4 cm, blue = 4 to 6 cm, orange = 6 to 8 cm, green = 8 to 10 cm, black = 10 to 12 cm.



- 7.3. Record the color visible at the front edge of the reference window (Figure 5). This indicates the depth of the anchor within the seat bight.



**Figure 5. Depth within bight is estimated from color visible at front edge of viewing window, which is red (2 to 4 cm) in this example.**

## **8. Attachment Force**

- 8.1. Once the guide rod is in place and the depth within the bight has been recorded, the force tool slider must slide into the seat bight (if applicable) and onto the lower anchor bar with a longitudinal force applied to the force gauge with no other assistance, including application of vertical or lateral forces on the force tool slider or manipulation of seat cushions. If covers are provided over the lower anchor, then testing is done with the covers moved out of the way or stored per the vehicle owner's manual. If anchors can be stowed, anchor testing is done with anchors positioned in the manufacturer's recommended position. If funnel guides are provided as standard equipment with the vehicle, place the funnel guide on the anchor before evaluating the anchor.
- 8.2. While maintaining the angle recorded in section 6.3, move the force tool slider along the guide rod (Figure 6) until the force tool slider bottoms out, which occurs when the full yellow section of the guide rod is visible in the reference window (Figure 7).



**Figure 6. Measuring lower anchor attachment force.**



**Figure 7. Force tool slider fully engaged on anchor.**

- 8.3. Record the attachment force using the force gauge. The attachment force recorded should be the peak value that occurs during the entire motion, from initial cushion contact (if applicable) until the force tool has bottomed out. If the force exceeds 40 pounds and it is not possible for the force slider tool to bottom out without extreme force or damaging the vehicle seat, then document that the force tool could not fully engage on the bar. If the force tool cannot fully engage on the bar, then the lower anchor fails the attachment force criteria, as outlined in the Insurance Institute for Highway Safety's *Vehicle LATCH Hardware Evaluation Rating Guidelines (Version II)*.
- 8.4. If the attachment force falls between 38 and 42 pounds, a second measurement should be taken on a second vehicle or on the same vehicle after at least 1 hour has passed. The average is then used as the attachment force value.

## **9. Clearance Angle Tool**

- 9.1. Seatback cushion stiffness and the vehicle anchor structure must be designed to allow a child restraint connector to rotate upward about the anchor bar, a measure called clearance angle.
- 9.2. The clearance angle is measured with the clearance angle tool, force gauge, and angle gauge (not pictured) (Figure 8). The force gauge may be connected to the clearance angle tool in either a push or pull mode.



**Figure 8. Clearance angle tool with force gauge connected in pull mode.**

- 9.3. Record the clearance angle with the clearance angle tool. Attach the clearance angle tool to the approximate center of the lower anchor bar such that the tool will not interact with the side members of the anchor bar. Apply a load of 21.4 N (4.8 pounds) perpendicular to the clearance angle gauge. (Figure 9). The perpendicular load may be applied by either pushing or pulling. Document if attaching the clearance angle tool cannot be attached to the lower anchor bar due to obstruction around the lower anchor. If the tool cannot attach to the bar, then the lower anchor fails the clearance angle criteria, as outlined in the Insurance Institute for Highway Safety's *Vehicle LATCH Hardware Evaluation Rating Guidelines (Version II)*.
- 9.4. If the clearance angle falls between 52 to 56 degrees, a second measurement should be taken on a second vehicle or on the same vehicle after at least 1 hour has passed. The average is then used as the clearance angle value.



**Figure 9. Measuring lower anchor clearance angle in push (left) and pull (right) mode.**

## 10. Tether Anchor Data

- 10.1. For each position with tether anchor hardware, document the location of the tether anchor, whether confusing hardware is present and the distance to any confusing hardware, and whether the tether router, if applicable, accommodates a specified tool. Follow the procedures described in sections 10.2-10.7.
- 10.2. Record the tether anchor location for each seat position [rear deck, middle seatback, bottom seatback, under the seat, floor, roof, other (specify in notes)].
- 10.3. For tether anchors located on the seatback, record the seatback length and the distance from the top of the seatback to the tether anchor.
- 10.3.1. The seatback length is measured on the rear of the seatback between the top-most point of the seatback and the bottom-most point of the seatback (Figure 10).
- 10.3.2. The top-most point of the seatback is defined as the highest point that is repeated across the seating position, exclusive of head restraints and seat belt hardware fixtures. The bottom-most point of the seatback is defined as the lowest point that is repeated across the seating position and moves in accordance with seat adjustment, but does not include the seat pan or other rigid fixtures at the base of the seat. If the bottom of the seatback is obscured by fabric, the fabric should be moved in order to

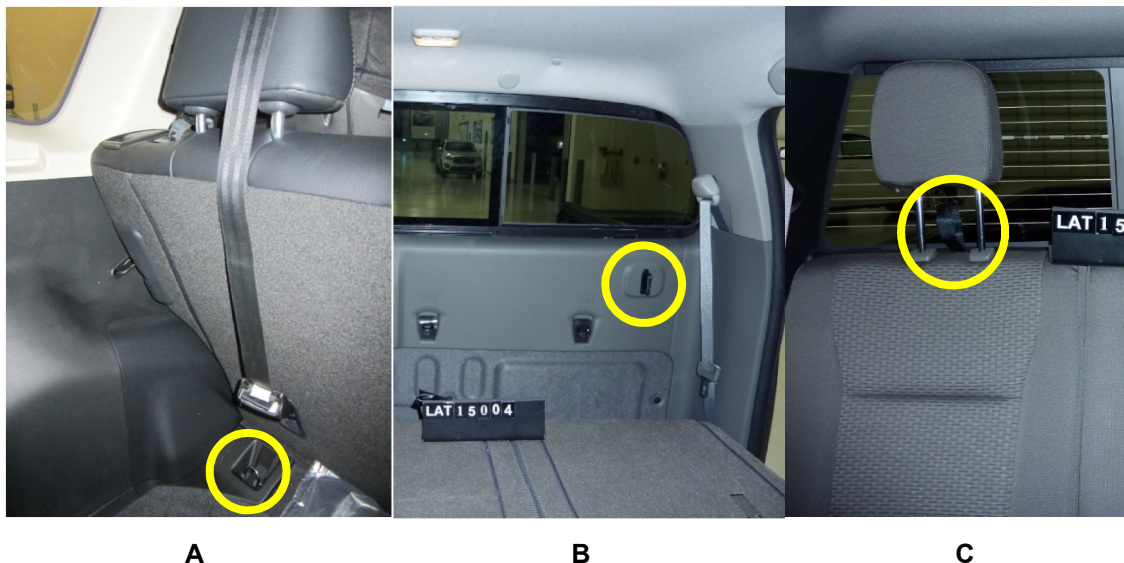


take the measurement. If the seatback falls below the floor of the cargo area, then the measurement is taken to the floor unless there is reasonable access to the bottom of the seatback when the seat is in the rear-most position on the track. Any tether anchor mounted lower than the bottom-most point of the seatback or on the seat pan will be recorded as the full seatback length.



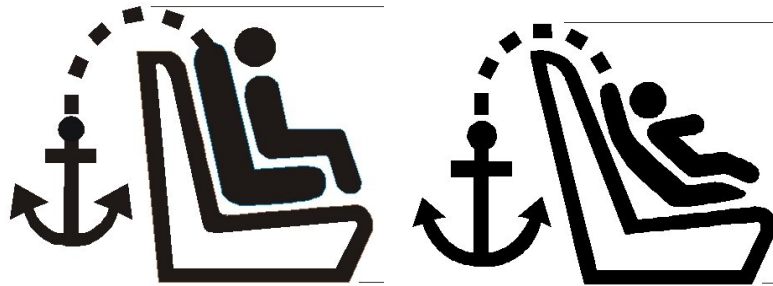
**Figure 10. Seatback length, measured on rear of seatback between top- and bottom-most points of seatback.**

- 10.4. Determine and record whether there is other plausible attachment hardware such as cargo tie-downs or tether routers (Figure 11) near the tether anchor or in a location a parent might expect to find a tether anchor. Hardware may be counted as potentially confusing if it is rearward of the seating position with a tether anchor and a tether anchor hook can be physically attached. Confusing hardware for three-row vehicles should be evaluated for both second and third rows with the third row upright.



**Figure 11 Potentially confusing hardware includes cargo tie-down points (A), seatback latches (B) and tether routers (C).**

- 10.5. Record that there is confusing hardware present, provide a description of the confusing hardware (i.e., cargo tie down, tether router), and the linear distance in cm from the tether anchor to the confusing hardware.
- 10.6. Record whether the tether anchor is labeled/marked with an ISO symbol, as shown in Figure 12 [yes/no/non-ISO label]. Record whether the label is high contrast [yes/no]. Record the linear distance in cm from the label to the tether anchor.
- 10.7. If the label is on a flap or other object that can be moved or stowed away from the anchor, the measurement should be taken in the moved or stowed position. If the vehicle has completely bounded tether routing guides or openings in rigid structure used to route the top tether strap between the restraint and tether anchor, then that tether router must allow complete passage of the tether router gauge. Record whether the tether router accommodates the specified tool (Figure 13) [yes/no/not applicable].



**Figure 12. ISO symbols for tether anchor.**



**Figure 13. Bounded tether routing guide to route top tether strap between child restraint and tether anchor.**

## **11. Additional Seat Position Data**

- 11.1. For each seat position with lower anchors and a tether anchor, record whether the head restraint can be moved or adjusted.
- 11.2. Record whether a rigid LATCH backless booster seat can attach to the lower anchors according to the following directions.

- 11.2.1. The booster and rigid lower connectors should be pushed toward the anchorages until they are engaged, keeping the booster on the vehicle seat cushion. Lifting of the booster from the seat base is not allowed, but some rotation/tilting of the booster is permissible provided there is still contact with the seat cushion.
- 11.2.2. The seat position passes this requirement if a booster that can be attached to the vehicle simply by pushing it toward the anchorages, with some tilting but without any other actions.
- 11.2.3. The seat position does not pass if any of the following occur:
  - Anchorages cannot be engaged without further actions (e.g., where the seat cushions have to be spread apart by hand in order to create access to the anchorages).
  - Booster has to be lifted off the seat cushion to allow engagement with the anchorages.
  - Any part of the seat or cushion prevents attachment of the booster.
- 11.3. Once the booster is installed, record whether the lap/shoulder belt for the seat position can be buckled with the booster in place.
- 11.4. Once the booster is installed, note whether adjacent seat belts can be used with the booster in place.

## **12. Photographs**

- 12.1. Take photographs of the following. For all seat positions, include a placard with the TestID and seat position information.
  - Window sticker
  - Owner's manual section pertaining to child restraints unless an electronic version of the manual is available
  - Each rear seat position regardless of the presence of lower anchors
  - Each tether anchor
  - Any hardware that could be confused for a tether anchor

## Appendix A

Vehicle class	Seat covering for LATCH evaluations
Microcar	Cloth or leatherette
Minicar	Cloth or leatherette
Small car	Cloth or leatherette
Midsized car	Cloth or leatherette
Midsized luxury car	Leather
Midsized convertible	Leather
Large car	Leather
Very large car	Leather
Large luxury car	Leather
Small SUV	Cloth or leatherette
Midsized SUV	Cloth or leatherette
Midsized luxury SUV	Leather
Large SUV	Leather
Minivan	Cloth
Small pickup	Cloth
Large pickup	Cloth

## **Appendix B**

Revisions to Version III of the protocol compared with Version II:

- The procedure for measuring visibility of a lower anchor with open access is described. For lower anchors with open access, anchor visibility at 60 degrees is used as a proxy for anchor depth.

Revisions to Version II of the protocol compared with Version I:

- Clearance angle tool and measurement protocol have been modified to improve reproducibility and the ergonomics of taking the measurement.
- A second measurement is now taken for clearance angles and attachment forces near the threshold values of 54 degrees (clearance angle) and 40 pounds (attachment force). The final value for the lower anchor is the average of the two.
- The seat covering by vehicle class that will be targeted for LATCH evaluations has been added for clarification.