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March 24, 2015

The Honorable Mark R. Rosekind
Administrator
National Highway Traffic Safety Administration
1200 New Jersey Avenue SE
Washington, DC 20590

Request for Comments; Federal Motor Vehicle Safety Standard 225; Child Restraint Anchorage Systems; Docket No. NHTSA-2014-0123

Dear Administrator Rosekind:

The Insurance Institute for Highway Safety (IIHS) welcomes the opportunity to comment on the National Highway Traffic Safety Administration's (NHTSA) Notice of Proposed Rulemaking (NPRM) to amend Federal Motor Vehicle Safety Standard (FMVSS) 225 Child Restraint Anchorage Systems to improve usability of lower anchorages and tether anchorages. IIHS strongly supports the agency's efforts to improve ease-of-use of child restraint anchorage systems, as vehicle designs that improve the ease of installing child restraints with LATCH could improve LATCH use rates and reduce child restraint misuse.

IIHS has been conducting research on child restraint anchorage usability for several years and has found converging evidence that improving anchorage hardware in vehicles will increase the likelihood of child restraint anchorage use and improve the quality of child restraint installations. We collaborated with the University of Michigan Transportation Research Institute (UMTRI) on the research that formed the basis for the lower anchor measures in the current FMVSS 225 NPRM. In that research, parent volunteers were three times as likely to get a tight installation when using the child restraint anchorage system compared with installations with the vehicle safety belt (Klinich et al., 2013). In a more recent study of real-world data, parents who participated in Safe Kids' car seat checkpoints during 2010-12 were nearly twice as likely to get a good installation when using the child restraint anchorage system compared with the vehicle safety belt (Cicchino and Jermakian, in press).

Lower anchor requirements

In the lower anchor study with UMTRI (Klinich et al., 2013), anchorage hardware and rear seat designs were scrutinized in a range of vehicles, and then volunteers installed different types of child restraints in vehicles representing different anchorage setups. As noted in the NPRM, three main vehicle factors were associated with installing child restraints correctly: depth of the anchors less than 2 cm within the seat bight, clearance angles greater than 54 degrees, and force of less than 178 N required to attach a standardized tool. Vehicles meeting all three criteria were 19 times as likely to have lower anchors used correctly compared with vehicles meeting none of the criteria.

We then confirmed these laboratory findings in the real world using data from Safe Kids' car seat checkpoints. Use and correct use of LATCH was determined from records of more than 14,000 child restraint installations that were inspected by child passenger safety technicians when parents arrived at the checkpoints. Anchor depths less than 4 cm, clearance angles greater than 54 degrees, and attachment forces less than 178 N were associated not only with correct use, similar to the laboratory study findings, but also with use of the anchorage system (Cicchino and Jermakian, in press). The threshold for anchor depth differed between the two studies (less than 2 cm in the laboratory study vs. less than 4 cm in the checkpoint study). However, the studies provide complementary evidence that these

vehicle factors are important. IIHS strongly supports incorporating these measures into FMVSS 225, and the thresholds proposed are supported by real-world and laboratory data.

The agency's proposed changes to the attachment force tool should improve repeatability of measurements over the tools used in the original IIHS/UMTRI research, but two outstanding issues remain. First, the attachment force measured and recorded should be the peak force from initial engagement with the seat cushion until full engagement of the tool on the lower anchor. For some vehicles, the peak force occurs as the tool is inserted between the cushions, which will not be captured in the proposed protocol because it records the force only at full engagement with the lower anchor. Second, the changes to the tool do not address the vertical off-axis force (referred to in NHTSA's report "Evaluation of LATCH Usability Procedure") required to align the tool with the lower anchor (Louden et al., 2014). This vertical force was not measured in NHTSA's evaluation but rather was assigned subjective ratings, making it difficult to standardize the measurement procedure and limiting repeatability and reproducibility. IIHS has measured lower anchor attachment force in-house using a tool we developed that eliminates the need to provide additional vertical or lateral forces. The new tool replaces the slide pin, slide tab, and spring assembly with a square cross-section guide rod with a convex notch that prepositions the tool, aligning it with the lower anchor bar before the force is applied. In addition, the new tool replaces the original depth gauge, as the depth scale is inscribed on the IIHS revised tool. (Drawings of the new tool and a more detailed description of its use are provided as attachments to this letter.) IIHS encourages NHTSA to make further refinements to the attachment force tool in order to remove the need for off-axis forces to properly align with the lower anchor bar.

IIHS supports the proposed labeling requirements related to lower anchors and lower attachments, and the associated proposed language requirements for the vehicle and child restraint owner's manuals. This will harmonize labeling across vehicles and child restraints, simplifying the messaging to parents and promoting better use of LATCH lower anchors.

Tether anchor requirements

The NPRM proposes several changes to tether anchorages in order to make tether anchors easier to find and identify. In most respects, IIHS supports these changes. We encourage NHTSA to further reduce the allowable zone for tether anchors to better align allowable locations with where parents expect to find tether anchors.

IIHS, in collaboration with UMTRI, conducted a study of parent volunteers to identify factors associated with tether use and correct use (Jermakian et al., 2014). Tethers were most likely to be used when the anchor was located on the rear deck, as typically found in sedans. For other vehicle types, tethers were more likely to be used and used correctly when tether anchors were located on the middle of the seatback compared with the bottom of the seatback, floor, or roof. This is likely because the anchors are easier to find and access on the middle of the seatback. Given the current designs of vehicles without a rear deck, it is technically feasible to locate tether anchors in the top 85 percent of the seatback in vehicles. This would improve use and correct use of tethers because parents would be able to find the tether anchors within a consistent, relatively small area. Pickup trucks have particular design challenges. However, if parents learn to expect tether anchors in the general vicinity of the seatback, then locating a tether anchor on the seatback of the appropriate seat position or on the back wall in close proximity of that seat position seems reasonable.

In the Jermakian et al. (2014) tether usability study, tethers were less likely to be attached correctly when there was other hardware present that could potentially be confused for a tether anchor. The importance of tether anchor location and absence of confusing hardware was corroborated in our study of data from Safe Kids' car seat checkpoints (Cicchino and Jermakian, in press). The agency's proposed additional

labeling requirements are designed to reduce the likelihood of confusing other vehicle hardware with a tether anchor. IIHS supports the improved labeling but believes a contrast requirement should be incorporated. Labeling itself was not associated with tether use in our study, which may be because the embossed labels that are frequently used are often difficult to see.

IIHS strongly supports the proposed changes to owner's manuals that tethers be used with all forward-facing child restraint installations regardless of child weight. We believe that children would derive benefit from using the tether, even in the rare event of a tether anchor failure under the loads of a severe crash and/or heavier children.

Terminology changes and labeling requirements

IIHS appreciates that there is confusion surrounding the term LATCH and supports the proposed changes to standardize terminology for the individual components of the child restraint anchorage system. However, we believe strongly that the term LATCH has become the main term used to refer to the system of upper and lower anchorages and child restraint hardware, and re-educating parents, child passenger safety technicians, and others in using a different term will require a major communications effort and will likely be marginally successful. The term LATCH is still likely to be helpful to parents, caregivers, and others when referring to the child restraint anchorages in the vehicle and the associated hardware on child restraints. The phrase "child restraint anchorage system" is ambiguous and cumbersome and does not convey the important message that lower anchors and tether anchors are hardware distinct from safety belts, which could also be considered a child restraint anchorage system. It seems prudent to have the ability to refer to all of the anchorage hardware in one efficient phrase, while clearly specifying lower anchors and tether anchors when necessary. Although it is not explicit in the NPRM that use of the term LATCH is discouraged, its absence from the NPRM and NHTSA's website is conspicuous, suggesting a move away from this shorthand.

IIHS supports the use of consistent terminology and the explicit use of the proposed terminology in owner's manuals, but we encourage NHTSA to continue to allow and encourage the term LATCH to refer collectively to the dedicated child restraint anchorage system and associated child restraint hardware. We believe that changing to new terminology at this point in lieu of the term LATCH would confuse parents with no apparent off-setting benefit. In addition, any rule that clarifies terminology should include a term for rigid lower anchor connectors, which are found on several booster seats in the U.S. market.

Additional hardware requirements and removal of vehicle exclusions

IIHS supports requiring additional lower anchors and tether anchors in vehicles. We encourage NHTSA to require tether anchors in all rear seating positions. Parents have the option of installing a child restraint with the vehicle seat belt in lieu of lower anchors, but there is no substitute for a tether anchor when installing a forward-facing child restraint. Providing parents with a tether anchor in all rear seating positions will not only provide additional flexibility in where child restraints can be installed but also potentially increase awareness and use of tether anchors since parents would know they could expect to see a tether anchor in every seat. We encourage NHTSA to require the ability to use lower anchors and tether anchors in the second row center seat position, but we believe the decision of whether to provide dedicated anchors or to allow an improvised position through borrowing lower anchors should be left up to the vehicle manufacturer. Vehicle manufacturers are in the best position to determine the solution that works best in each vehicle, and requiring dedicated anchors in all three second row seats, where available, may increase confusion and the likelihood for misuse if lower anchor sets overlap and it is not clear which anchor pairs are intended for each seat position.

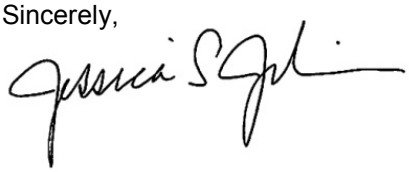
IIHS also encourages NHTSA to require additional lower anchor hardware in the third row of vehicles, if available. The NPRM suggests that there may be limited benefit for LATCH hardware in the third row

because of the relatively short time that children are in forward-facing child restraints, but IIHS believes LATCH can be a benefit for longer than NHTSA anticipates. According to the most recent National Survey on the Use of Booster Seats, nearly three-quarters of children age 1 to 3 years, almost a third of those age 4 to 5 years, and an increasing number of those age 6 to 7 years are seated in forward-facing child restraints. Additionally, booster seats increasingly are available with lower anchor connectors, increasing the likelihood that lower anchors will be used after children transition from the forward-facing child restraints to boosters.

Finally, IIHS supports the removal of current exclusions for any passenger vehicles, including convertibles. Vehicle manufacturers have had sufficient time and experience to overcome any obstacles to equipping all passenger vehicles with anchorage hardware.

In summary, IIHS supports the proposal to improve ease-of-use of lower anchors and tether anchors, standardize terminology and labels, and increase the number of positions available with lower anchors and tether anchors. We encourage NHTSA to review and consider our modified attachment force and depth tools in order to improve repeatability and reproducibility of those measures. We also encourage NHTSA to require higher contrast labeling for tether anchors and further restrict the locations of tether anchors to the rear deck, if available, or the top 85 percent of the vehicle seatback in other vehicle types. We urge NHTSA to retain use of the term LATCH to refer to the system of lower anchors and tether anchors, and associated child restraint hardware. IIHS believes LATCH anchorage hardware that is easy to use will increase the likelihood of child restraint anchorage use and improve the quality of child restraint installations.

Sincerely,



Jessica S. Jermakian, D.Sc.
Senior Research Scientist

cc: Docket Clerk, Docket No. NHTSA-2014-0123

Attachments

Protocol for lower anchor depth and attachment force measurements (IIHS)
Guide rod drawing (IIHS)
Force tool slider drawing (IIHS)

References

Cicchino JB, Jermakian JS. 2015. Vehicle characteristics associated with LATCH use and correct use in real-world child restraint installations. *J Safety Res*, in press.

Jermakian JS, Klinich KD, Orton NR, Flannagan CAC, Manary MA, Malik LA, Narayanaswamy P. 2014. Factors affecting tether use and correct use in child restraint installations. *J Safety Res* 51:99-108.

Klinich KD, Flannagan CAC, Jermakian JS, McCartt AT, Manary MA, Moore JL, Wells JK. 2013. Vehicle LATCH system features associated with correct child restraint installations. *Traffic Inj Prev* 14:520-531.

Louden AE, Sullivan LK, Amenson T, Smith J. 2014. Evaluation of LATCH usability procedure. Washington, DC: National Highway Traffic Safety Administration.

PROTOCOL FOR LOWER ANCHOR DEPTH AND ATTACHMENT FORCE MEASUREMENTS

Revision 0315

Attachment Force Tool

The depth of the lower anchor within the seat bight and lower anchor attachment force are taken with the attachment force tool (Figure 1). The attachment force tool consists of a square cross-section guide rod, force tool slider, and force gauge. Additionally, an angle gauge is mounted to the guide rod.

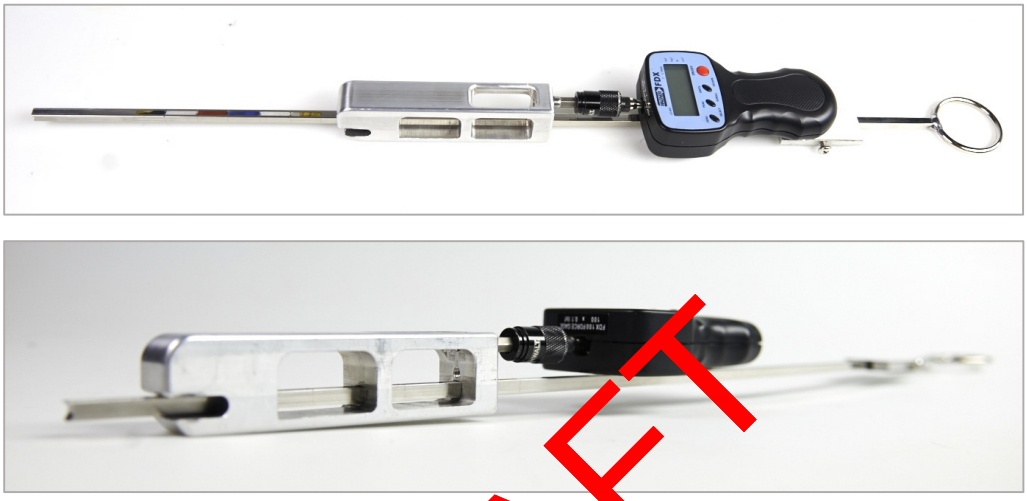


Figure 1. Attachment force tool used to measure depth of lower anchor within seat bight and anchor attachment force.

Step 1. Place the notched end of the guide rod in the center of the lower anchor bar and apply gentle pressure to seat it.

Step 2. 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 2).

Depth of Lower Anchor within Seat Bight

Figure 2. Initial position of force tool slider, with seat cushion just touching top and bottom of front surface of force tool slider.

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.

Step 3. Record the color visible at the front edge of the reference window (Figure 3). This indicates the depth of the anchor within the seat bight.

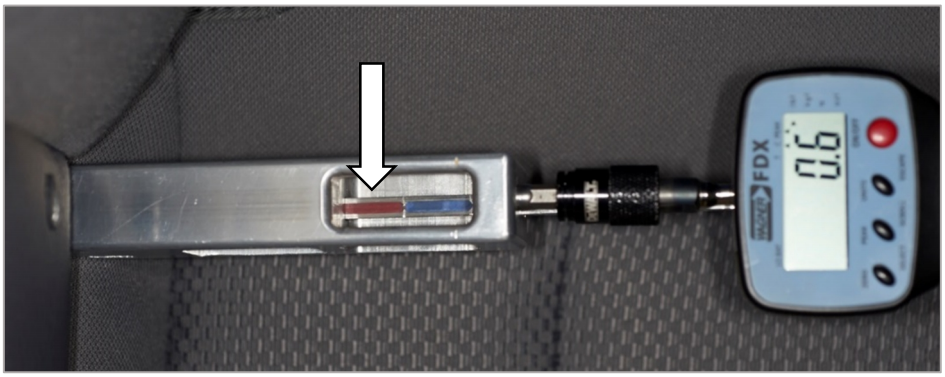


Figure 3. Depth within bight is estimated from color visible at front edge of viewing window, which is red (2 to 4 cm) in this example.

Attachment Force

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 6 mm 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 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 with the vehicle, place the funnel guide on the anchor before evaluating the anchor.

The force should be measured at the approach angle achieved when the top and bottom front surface of the force tool slider comes in contact with the seat cushion (Figure 2).

Step 4. Record the approach angle using an angle gauge on the guide rod.

Move the force tool slider along the guide rod (Figure 4) until the guide rail bottoms out in the slider slot, which occurs when the full yellow section of the guide rod is visible in the reference window (Figure 5).

Figure 4. Measuring lower anchor attachment force.

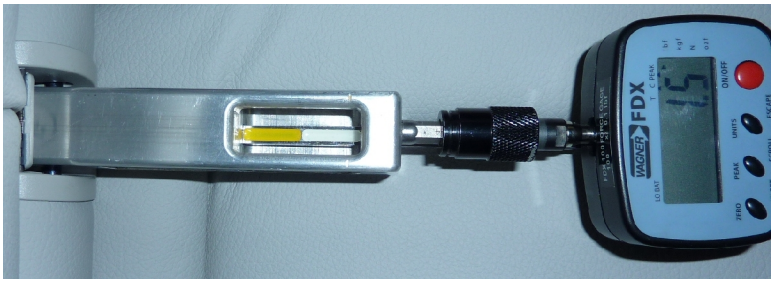
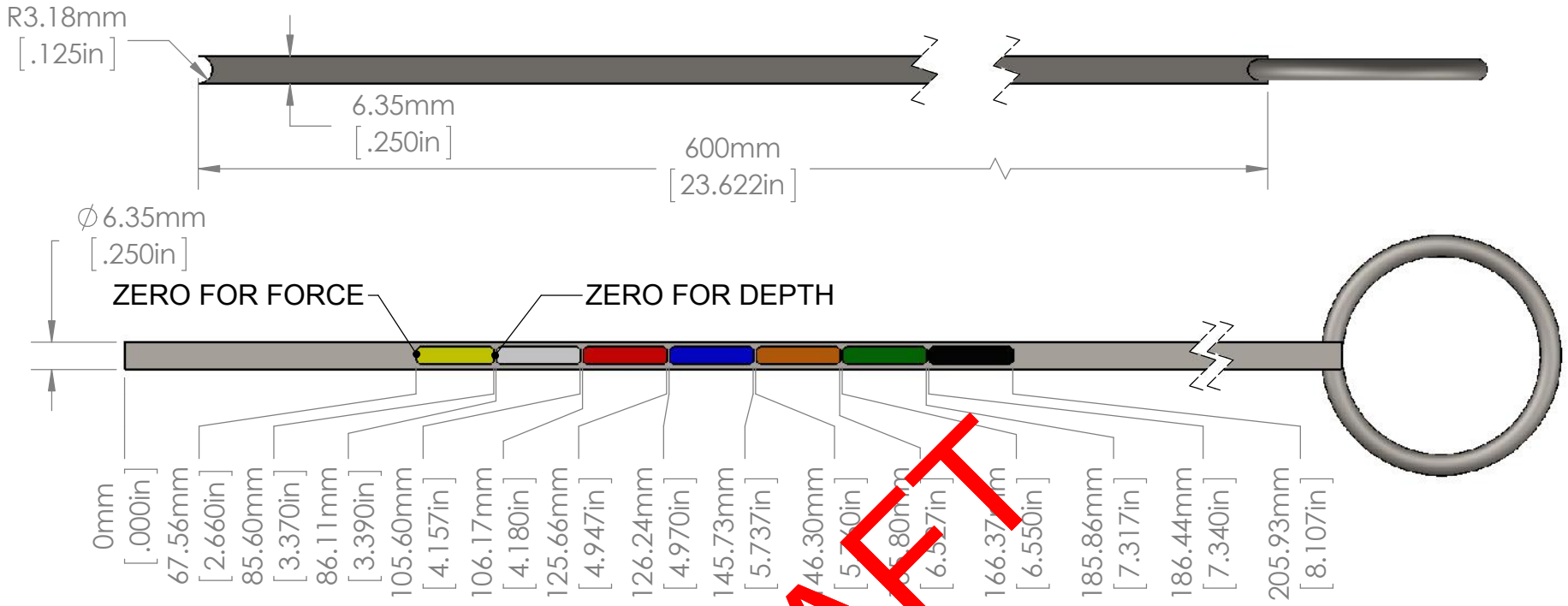
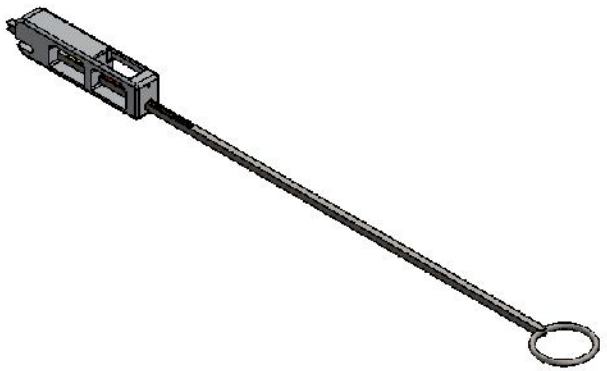


Figure 5. Force tool slider fully engaged on anchor.

Step 5. 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 pin bottoms out in the slot.





SLIDER ON GUIDE ROD

UNLESS OTHERWISE SPECIFIED:		NAME	DATE
DIMENSIONS ARE IN MM[IN] TOLERANCE: ±5[.25]	DRAWN	R Jones	3/18/2015
	CHECKED		
MATERIAL 4140 ALLOY	COMMENTS:		
FINISH			
DO NOT SCALE DRAWING			

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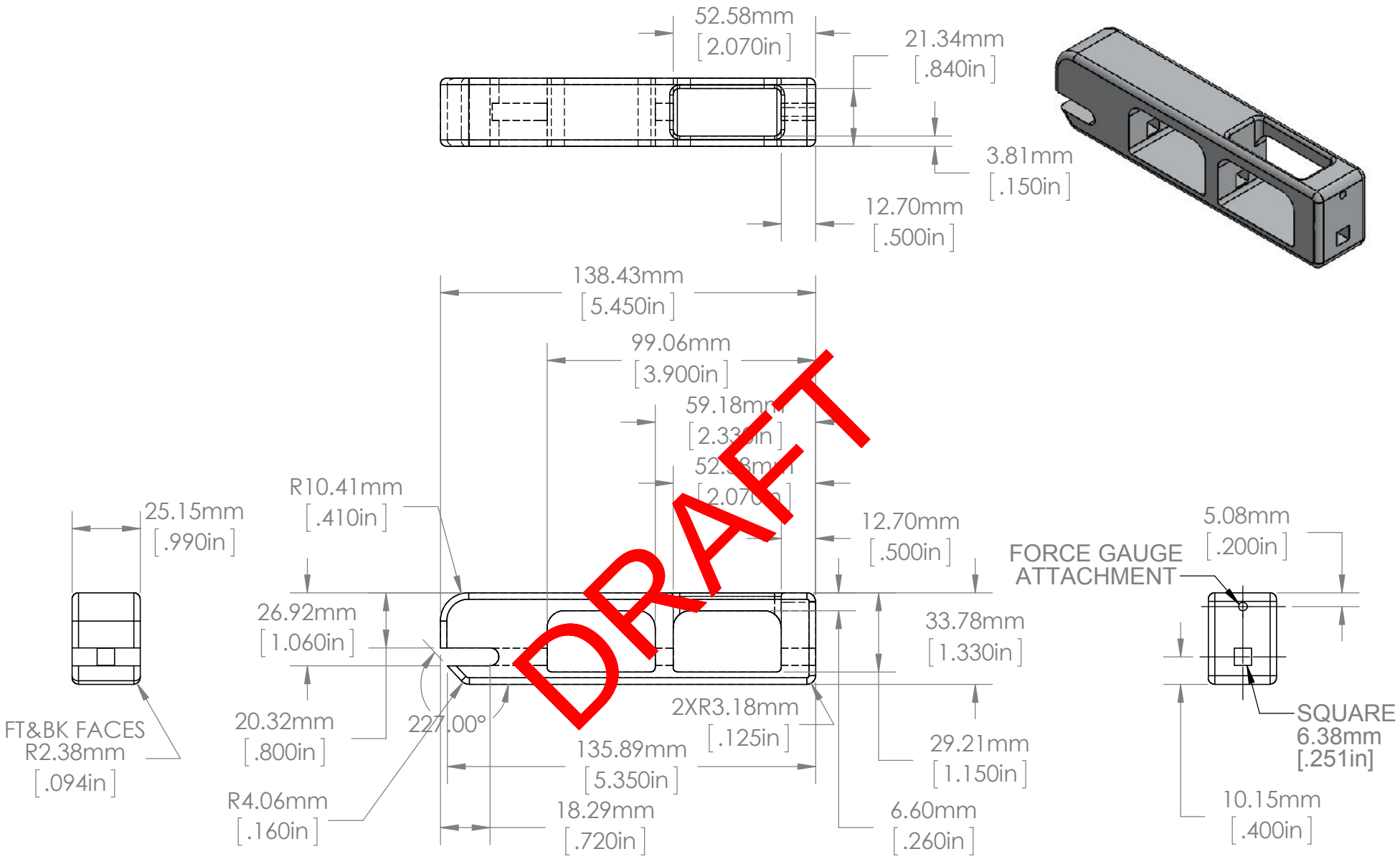
Guide Rod

SCALE: 1:5 WEIGHT: 204g[7.2oz]

5 4 3 2 1



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LATCH F Tool Slider IIHS REV

SCALE: 1:2 WEIGHT: 164g[5.8oz]

5 4 3 2 1