May 22, 2024

Docket Management Facility
U.S. Department of Transportation
1200 New Jersey Avenue SE, West Building Ground Floor, Room W12-140
Washington, DC 20590-0001

Re: Docket NHTSA–2023–0067 Federal Motor Vehicle Safety Standard (FMVSS) No. 213 Test Procedure (TP-213-11) Comments

Dear Sir/Madam,

Please accept this letter as the first response of Dorel Juvenile Group, Inc. ("Dorel"), to your request for comments regarding FMVSS No. 213 Test Procedure TP-213-11 ("the procedure"). Dorel is a leading child restraint manufacturer who imports, domestically manufactures, and distributes all types of child restraints in the United States. Dorel has an internal dynamic crash test lab in Columbus, Indiana and can conduct FMVSS No. 213 dynamic testing using current 213 frontal, 213a side impact and updated 213b frontal configurations.

Dorel has accumulated an extensive knowledge of FMVSS 213a side impact testing after having completed 800 tests internally and 200 tests externally at NHTSA's 3rd party contract labs over the past 19 months since 213a test fixtures have been available to use. Dorel has also been an active participant in a JPMA led coalition of CRS manufacturers and 3rd party test labs working together transparently to identify what the true repeatability and reproducibility of FMVSS 213a side impact testing is. Additionally, Dorel has thoroughly evaluated the details contained in NHTSA's FMVSS 213a document DOT HS 812 791 FMVSS No. 213a Side Impact Test Evaluation and Revision ("the research procedure") published with the Final Rule in June 2022 and the differences between TP-213-10 and TP-213-11 and offers the following information for consideration to minimize within and between lab variation.

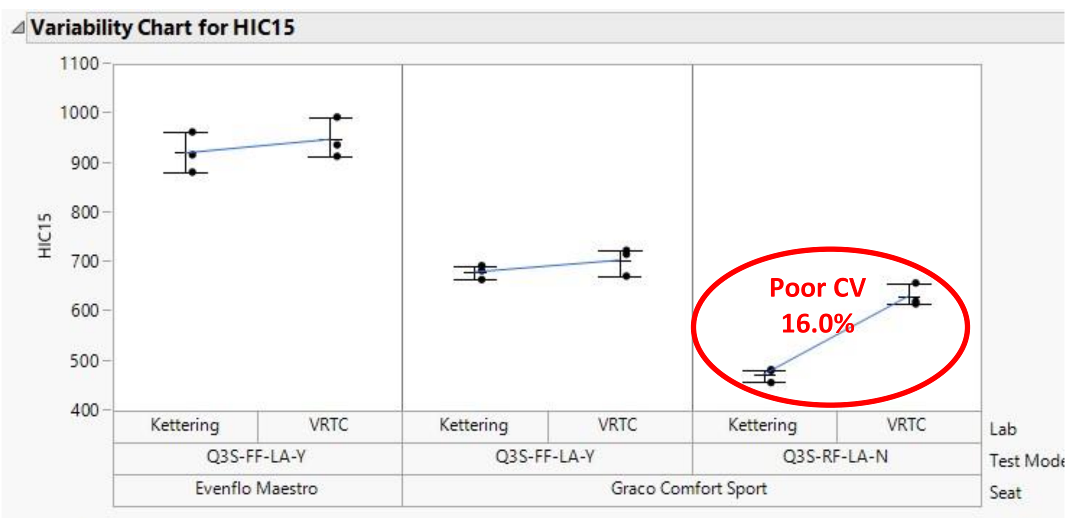
In the 1972 Federal court ruling Chrysler Corporation v. Department of Transportation, the court stated, "tests to determine compliance must be capable of producing identical results when test conditions are exactly duplicated, that they be decisively demonstrable by performing a rational test procedure, and that compliance is based upon the readings obtained from measuring instruments as opposed to the subjective opinions of human beings". In the history of NHTSA rulemaking since then, the coefficient of variation (CV) has been used as the preferred measure of acceptable and unacceptable repeatability and reproducibility. Consistently throughout that decades-long history, NHTSA has used a CV of ≤10% as acceptable and a CV >10% as unacceptable. In many rulemaking efforts, the below score card table is how NHTSA has analyzed and reported research data to determine acceptable/unacceptable repeatability and reproducibility. Note, even as recently as the Final Rule for amended FMVSS 213b published in December 2023 the repeatability and reproducibility study that was included used a CV of ≤10% as acceptable and >10% as unacceptable.

HISTORICAL NHTSA CV SCORE CARD		
CV SCORE	ASSESSMENT	CATEGORY
0.0% < CV ≤ 5.0%	EXCELLENT	ACCEPTABLE
5.0% < CV ≤ 8.0%	GOOD	ACCEPTABLE
8.0% < CV ≤ 10.0%	MARGINAL	ACCEPTABLE
CV > 10.0%	POOR	UNACCEPTABLE

Without precedent or explanation, in the FMVSS 213a Final Rule published in June 2022, NHTSA used a different score card to categorize their data where CV ≤15% was considered acceptable and only data >15% was considered unacceptable. Below is a table showing the score card format described in the text of FMVSS 213a Final Rule.

FMVSS 213A SIDE IMPACT NHTSA CV SCORE CARD		
CV SCORE	ASSESSMENT	CATEGORY
0.0% < CV ≤ 5.0%	EXCELLENT	ACCEPTABLE
5.0% < CV ≤ 10.0%	GOOD	ACCEPTABLE
10.0% < CV ≤ 15.0%	MARGINAL	ACCEPTABLE
CV > 15.0%	POOR	UNACCEPTABLE

In the FMVSS 213a Final Rule, Table 24 shows NHTSA's CV% for assessing repeatability and reproducibility for 3 pairs of repeat test set-ups using the Q3s ATD that were completed at VRTC and Kettering. In the repeatability (within lab) study, 11 of the 12 measures were considered acceptable. However, in the reproducibility (between lab) study only 4 of the 6 measures should have been considered acceptable based on NHTSA's historical use of CV ≤10%. After adjusting their score card to use CV ≤15% as acceptable, 5 of the 6 measures were classified as acceptable to proceed with the Final Rule. Below are HIC15 and Chest Deflection charts from that study and Table 24 from the Final Rule with the CV values identified that should have been considered unacceptable (>10%).



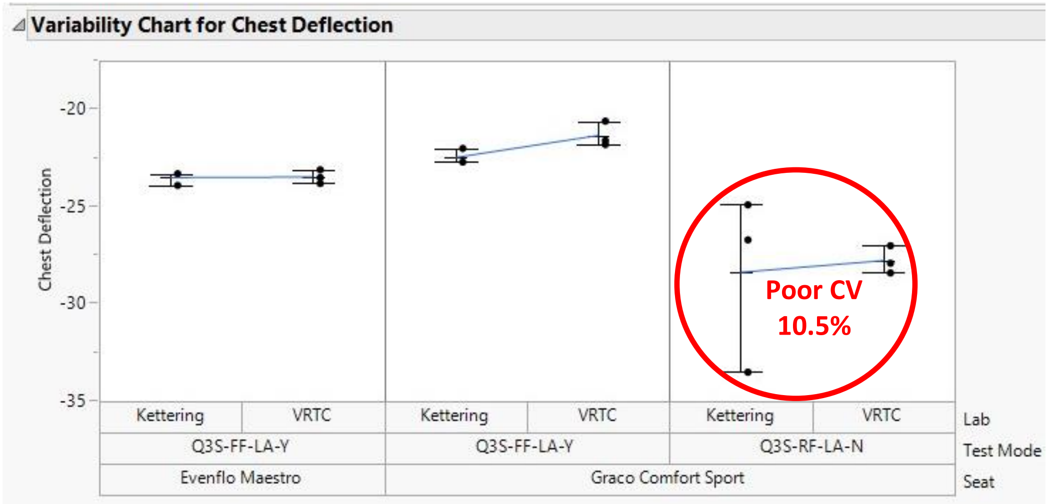


TABLE 24—COEFFICIENT OF VARIATION (CV) FOR ASSESSING REPEATABILITY AND REPRODUCIBILITY

ATD	CRS	Orientation	VRTC CV%		Kettering CV%		VRTC and Kettering	
			H1C15	Chest deflection	H1C15	Chest deflection	H1C15	Chest deflection
Q3s	Evenflo Maestro.	FF Combination**.	4.3	1.3	4.4	1.4	4.2	1.2
Q3s	Grace Comfort Sport.	FF Convertible**.	4	3.1	2.1	1.9	3.4	3.6
Q3s	Grace Comfort Sport.	RF Convertible	3.6	2.5	3	16.1	16	−10.5
Q3s	Diono Olympia*.	RF Convertible					2.3	

Poor CV%

NHTSA’s comment in the Final Rule about these results state “It is unknown why the results for the Graco rear-facing convertible were elevated; NHTSA could not perform additional testing under the contract.” Before and after Table 24 in the 213a Final Rule NHTSA mentions multiple possible sources of variation including:

- Test Fixtures
- Dummies
- Test Procedure
- Pulse Variation
- CRS Test Specimens as Produced
- Limited testing
- Variations in set-up
- Variation in the overall relative velocity at impact time

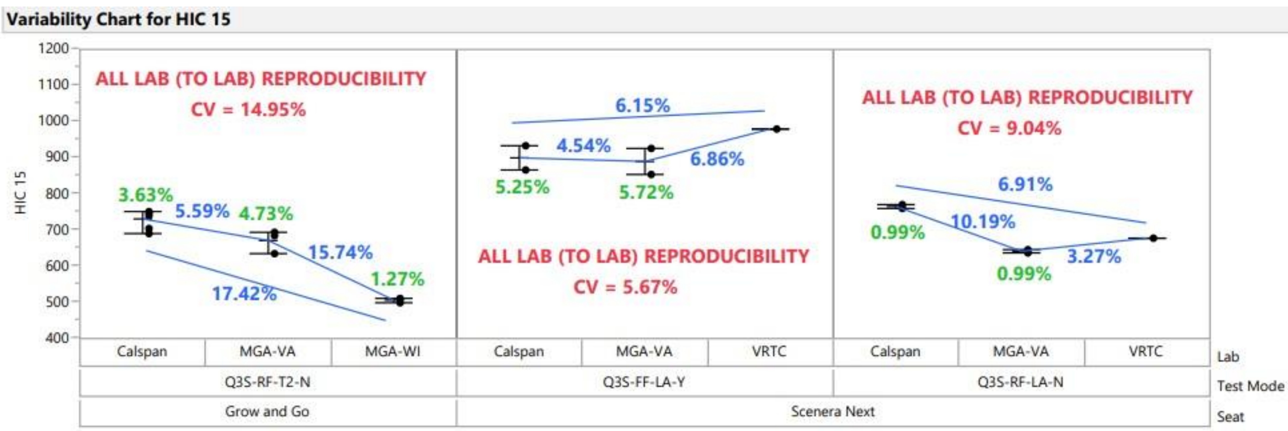
As mentioned, Dorel actively participated in a JPMA led coalition of CRS manufacturers and 3rd party test labs working together transparently to identify what the true repeatability and reproducibility of FMVSS 213a side impact testing is. As part of the multiple design of experiments (DOE) that were conducted, samples of existing Dorel Grow and Go and Scenera Next convertible CRS were subjected to repeatability and reproducibility studies using the Q3s ATD in two ways:

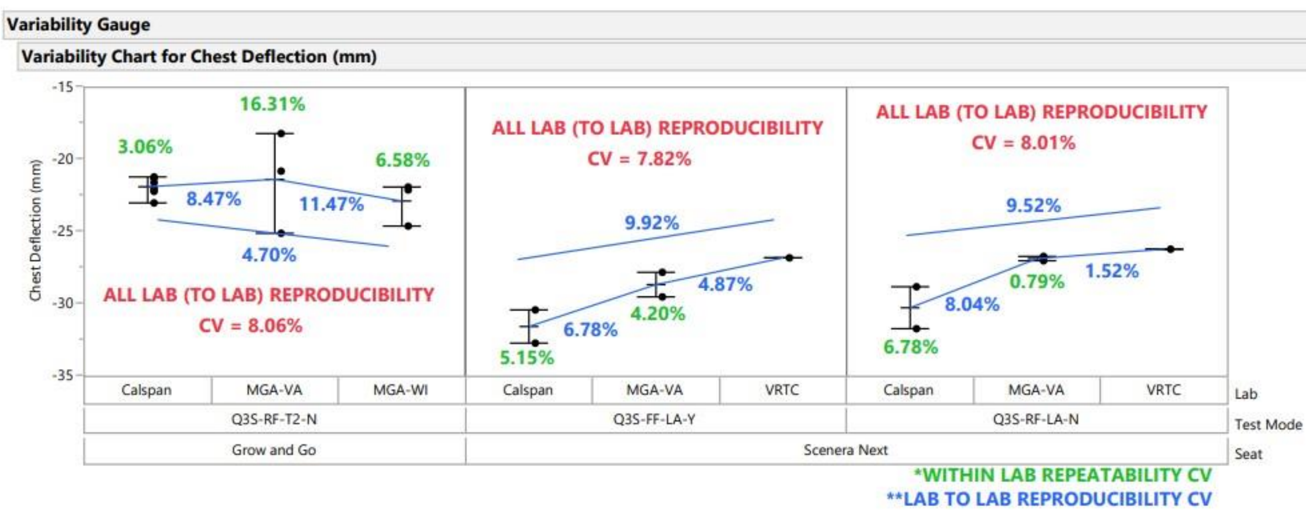
1) Assess Grow and Go and Scenera Next using repeat tests in 3 modes at NHTSA’s 3rd party contract labs to compare repeatability and reproducibility of the HIC15 and Chest Deflection scores. Also included was a comparison of

VRTC test results for Scenera Next that appeared in the 213a Final Rule.

2) Continue assessing Grow and Go beyond just NHTSA's 3rd party contract labs to further study repeatability and reproducibility of the HIC15 and Chest Deflection scores. Repeat tests were completed at internal test labs for Dorel, Nuna, and Graco.

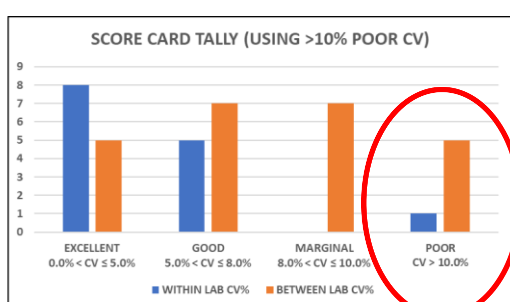
Below are HIC15 and Chest Deflection charts for the 1st study where Grow and Go and Scenera Next were tested at Calspan, MGA-VA and VRTC. The repeatability (within lab) CV%'s are inserted into the chart in green text and the reproducibility (between lab) CV%'s are inserted into the chart in blue text. An all lab (to lab) reproducibility CV% is also inserted into each grouping in the chart using red text.





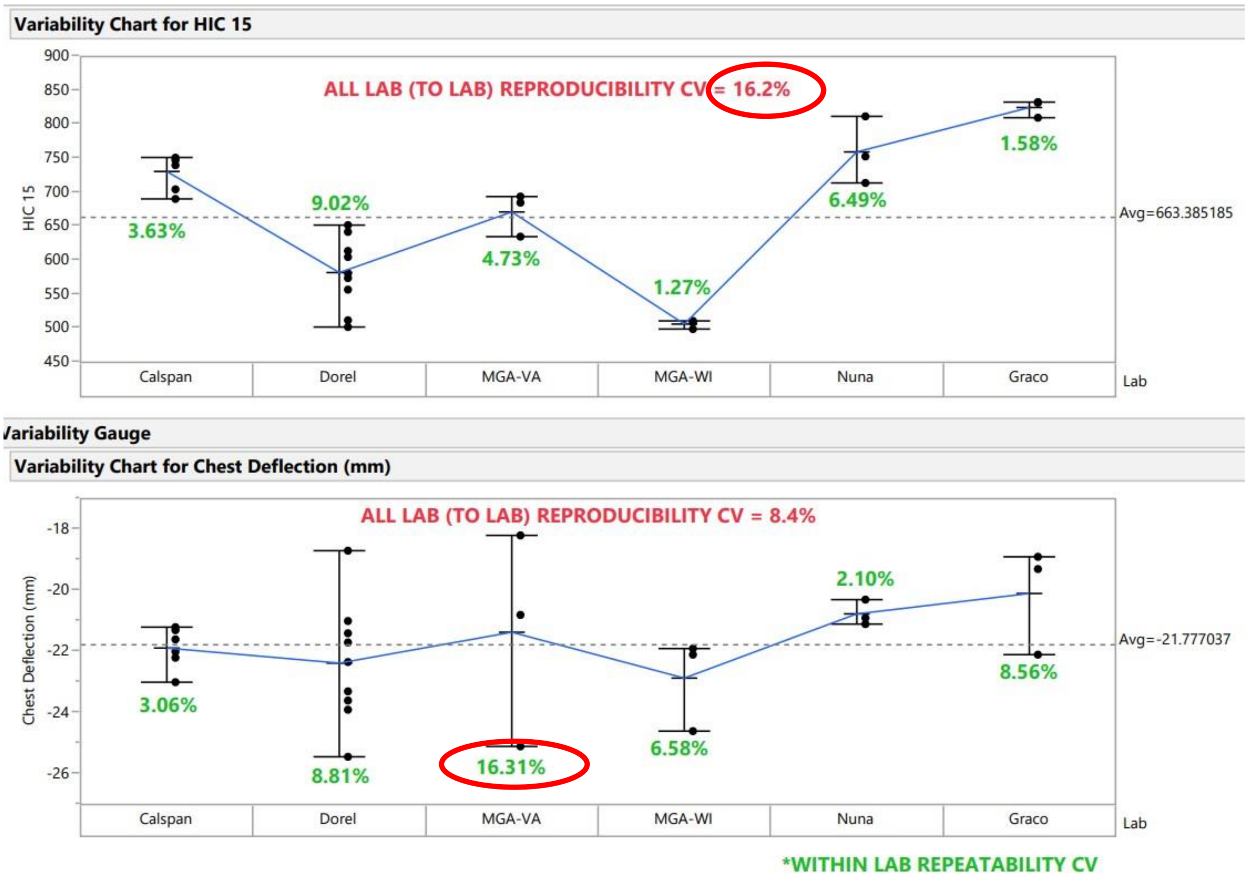
Below are charts with the tally of CV%'s and data table for the above repeatability and reproducibility study categorized using CV >10% as unacceptable.

SCORE CARD (10%)	WITHIN LAB CV%	BETWEEN LAB CV%
EXCELLENT 0.0% < CV ≤ 5.0%	8	5
GOOD 5.0% < CV ≤ 8.0%	5	7
MARGINAL 8.0% < CV ≤ 10.0%	0	7
POOR CV > 10.0%	1	5



Lab(s)	Seat/Mode	Score Measure	Comparison Type	CV%	Category
Calspan	Grow & Go RF-T2	HIC15	Within	3.63%	Excellent
Calspan	Grow & Go RF-T2	Chest Deflection	Within	3.06%	Excellent
MGA-VA	Grow & Go RF-T2	HIC15	Within	4.73%	Excellent
MGA-VA	Grow & Go RF-T2	Chest Deflection	Within	16.31%	Poor
MGA-WI	Grow & Go RF-T2	HIC15	Within	1.27%	Excellent
MGA-WI	Grow & Go RF-T2	Chest Deflection	Within	6.58%	Good
Calspan vs. MGA-VA	Grow & Go RF-T2	HIC15	Between	5.59%	Good
Calspan vs. MGA-VA	Grow & Go RF-T2	Chest Deflection	Between	8.47%	Marginal
Calspan vs. MGA-WI	Grow & Go RF-T2	HIC15	Between	17.42%	Poor
Calspan vs. MGA-WI	Grow & Go RF-T2	Chest Deflection	Between	4.70%	Excellent
MGA-VA vs. MGA-WI	Grow & Go RF-T2	HIC15	Between	15.74%	Poor
MGA-VA vs. MGA-WI	Grow & Go RF-T2	Chest Deflection	Between	11.47%	Poor
All Labs	Grow & Go RF-T2	HIC15	Between	14.95%	Poor
All Labs	Grow & Go RF-T2	Chest Deflection	Between	8.06%	Marginal
Calspan	Scenera Next FF-LA	HIC15	Within	5.25%	Good
Calspan	Scenera Next FF-LA	Chest Deflection	Within	5.15%	Good
MGA-VA	Scenera Next FF-LA	HIC15	Within	5.72%	Good
MGA-VA	Scenera Next FF-LA	Chest Deflection	Within	4.20%	Excellent
Calspan vs. MGA-VA	Scenera Next FF-LA	HIC15	Between	4.54%	Excellent
Calspan vs. MGA-VA	Scenera Next FF-LA	Chest Deflection	Between	6.78%	Good
Calspan vs. VRTC	Scenera Next FF-LA	HIC15	Between	6.15%	Good
Calspan vs. VRTC	Scenera Next FF-LA	Chest Deflection	Between	9.92%	Marginal
MGA-VA vs. VRTC	Scenera Next FF-LA	HIC15	Between	6.86%	Good
MGA-VA vs. VRTC	Scenera Next FF-LA	Chest Deflection	Between	4.87%	Excellent
All Labs	Scenera Next FF-LA	HIC15	Between	5.67%	Good
All Labs	Scenera Next FF-LA	Chest Deflection	Between	7.82%	Good
Calspan	Scenera Next RF-LA	HIC15	Within	0.99%	Excellent
Calspan	Scenera Next RF-LA	Chest Deflection	Within	6.78%	Good
MGA-VA	Scenera Next RF-LA	HIC15	Within	0.99%	Excellent
MGA-VA	Scenera Next RF-LA	Chest Deflection	Within	0.79%	Excellent
Calspan vs. MGA-VA	Scenera Next RF-LA	HIC15	Between	10.19%	Poor
Calspan vs. MGA-VA	Scenera Next RF-LA	Chest Deflection	Between	8.04%	Marginal
Calspan vs. VRTC	Scenera Next RF-LA	HIC15	Between	6.91%	Good
Calspan vs. VRTC	Scenera Next RF-LA	Chest Deflection	Between	9.52%	Marginal
MGA-VA vs. VRTC	Scenera Next RF-LA	HIC15	Between	3.27%	Excellent
MGA-VA vs. VRTC	Scenera Next RF-LA	Chest Deflection	Between	1.52%	Excellent
All Labs	Scenera Next RF-LA	HIC15	Between	9.04%	Marginal
All Labs	Scenera Next RF-LA	Chest Deflection	Between	8.01%	Marginal

In Dorel's 2nd study the focus changed slightly to adding more reproducibility (between lab) data to the Grow and Go results that already existed from the 1st study. Below are HIC15 and Chest Deflection charts for the 2nd study where Grow and Go was tested at Calspan, Dorel, MGA-VA, MGA-WI, Nuna, and Graco. The repeatability (within lab) CV%'s are inserted into the chart in green text and an all lab (to lab) reproducibility CV% is also inserted in the chart using red text.



Dorel's main concern with this data is the CV of 16.2% for the all lab (to lab) reproducibility of the HIC15 score. By any score card categorization method this CV% is unacceptable.

Another concern with this data is that the within lab CV% can remain marginal/acceptable when evaluating a larger sample size but the range of scores take up a significant part of the test limit. In the Dorel test results, HIC15 CV was 9.02% with a range of 150 and the Chest Deflection CV was 8.81% with a range of 6.7 mm, sample size of 9. These results indicate that a +/- 75 HIC15 and +/-3.35 mm Chest Deflection score (from the average score) can exist while still achieving a CV <10%. This represents 26% of the 570 HIC15 score limit and 29% of the 23 mm Chest Deflection score limit. In any test using the Q3s ATD the HIC15 and Chest Deflection score will never be zero so this means these repeatability ranges take up an even more meaningful portion of the available score limit.

Also concerning is that while 22% of the HIC15 scores are within the 570 limit and 78% of the Chest Deflection scores are within the 23 mm limit, only 15% (3 of the 27 tests shown) meet both requirements because of all the variation that exists.

In the FMVSS 213a Final Rule, NHTSA stated that after the creation and improvement of a detailed research procedure they were able to achieve repeatable and reproducible results. This is a critical comment because in the issuance of the procedure, Dorel observed a significant number of omissions and changes compared to the research procedure. Dorel is concerned that if the procedure does not contain the same level of detail and information that existed in the research procedure it would not be possible for NHTSA to achieve acceptable repeatability and reproducibility CV% today.

Dorel agrees with NHTSA's statements in the Final Rule about possible sources of variation that still exist. Only with a detailed test procedure, strict lab adherence to that procedure and significant study at each NHTSA 3rd party contract labs could the true repeatability and reproducibility of the 213a test be truly known prior to compliance enforcement.

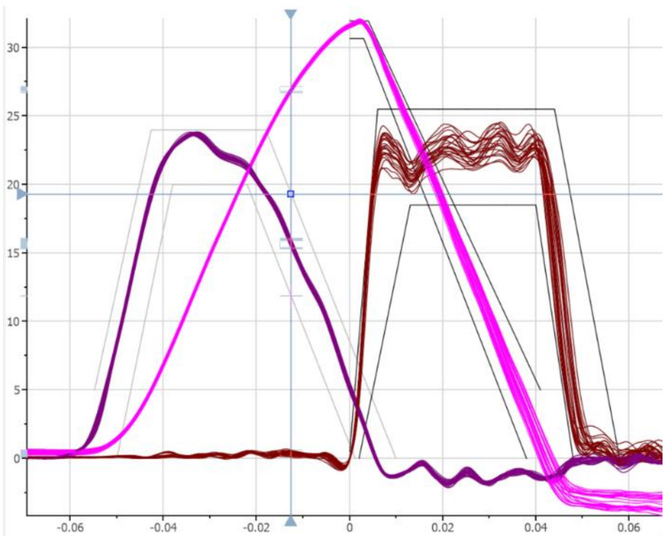
Dorel does not believe that variability from "CRS test specimens as produced" is significant otherwise the repeatability (within) lab CV%'s would not be so much lower than the repeatability (between) lab CV%'s.

In the absence of NHTSA OVSC having ever conducted a repeatability or reproducibility study prior to issuing contracts to multiple 3rd party test labs, Dorel and our fellow CRS manufacturers have invested countless hours and hundreds of thousands of dollars digging into the important details. With data from our internal labs and NHTSA's 3rd party contract labs we can confidently provide useful feedback on the procedure to help improve within and between lab variation. Dorel therefore provides the following suggestions to be taken into consideration:

Pulse Variation

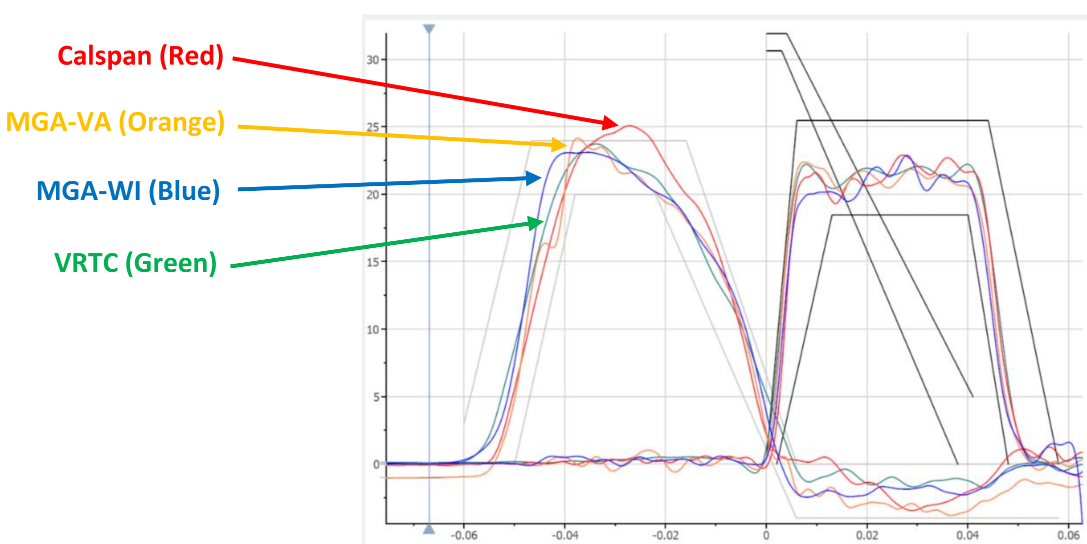
1) Section 12.E.3.3 of the procedure describes the corridors for the 213a SISA sliding seat acceleration (Figure 31) and SISA sliding seat and door fixture relative velocity (Figure 32). While the procedure also includes an acceleration corridor for the sled carriage used in frontal 213 dynamic testing, the procedure is silent with respect to a corridor for the sled carriage acceleration used during 213a side impact testing. Section 12.E.1.2 in the procedure describes a transducer that is required for the test fixture during 213a side impact testing to monitor the sled acceleration but nothing is currently present to control the sled acceleration.

   In the December 15, 2021 meeting, JPMA requested that NHTSA specify an incoming sled carriage pulse corridor to reduce lab to lab test variability, to which NHTSA stated in the Final Rule that they disagreed. NHTSA commented the relative door velocity profile corridor are sufficient to ensure adequate reproducibility of the test not only at different sled facilities but also when using different types of sled systems. Currently, each test lab available to Dorel that is conducting 213a side impact testing has its own unique sled carriage acceleration pulse. Dorel strongly recommends that an acceleration corridor for the sled carriage of the 213a side impact dynamic test be included to control between lab variation. Data provided earlier in this response shows unacceptable between lab reproducibility remains prevalent today. Dorel suggests that the boundaries for a new sled carriage acceleration corridor should be calculated using VRTC's final configuration sled carriage pulse as the guideline. Below is a chart showing pulses from VRTC used in the Final Rule, final series (while using the 90 psi +/- 5% aluminum honeycomb) and a recommended corridor.



Acceleration Function Envelope			
Upper Limit		Lower Limit	
Time (msec)	Accel (g's)	Time (msec)	Accel (g's)
-60.0	3	-50.0	0.0
-46.7	24	-38.0	20
-16.0	24	-22.0	20
6.0	0	1.3	0

To demonstrate the different sled carriage pulses that exist at NHTSA's 3rd party test labs, see below chart showing a recent Calspan, MGA-VA, and MGA-WI sled carriage pulse overlaid on a VRTC Final Rule, final series pulse including the above proposed corridor.



2) Section 12.E.1.1 of the procedure includes information about the aluminum honeycomb on page 82 to be used for 213a side impact testing. While the standard and the drawing package are silent with respect to the crush strength and tolerance of the aluminum honeycomb, the research procedure makes clear that the final specification of the honeycomb used during the final configuration testing was 620 kPa (90 psi) +/- 5%. Dorel recommends that Section 12.E.1.1 have the crush strength and tolerance of 90 psi +/- 5% included in the description of the aluminum honeycomb to be used for 213a side impact testing to ensure testing conducted between NHTSA's contract labs is more consistent. Not specifying the aluminum honeycomb crush strength and tolerance that was stated in the research procedure allows labs to acquire different materials which contributes to poor lab to lab repeatability.

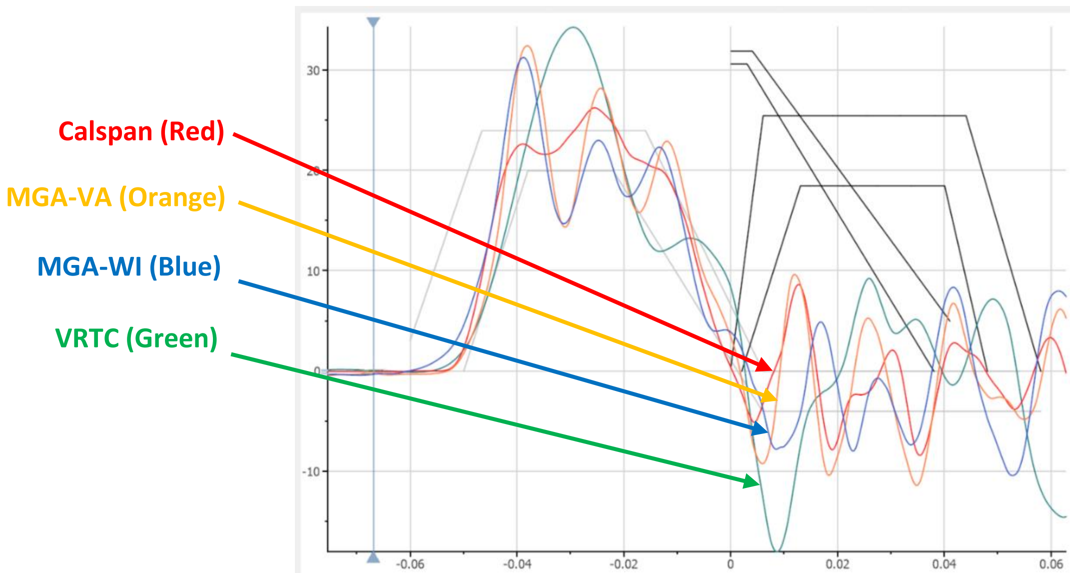
Test Fixtures

1) Section 12.E.1.2 in the procedure describes the transducers that are required for the test fixture during 213a side impact testing to monitor the "sliding seat bench acceleration" and the "sled acceleration and door impact deceleration". The current procedure only describes two accelerometers to monitor these three different locations. The procedure does not currently include a specification for an accelerometer on the door panel itself. On December 15, 2021, JPMA presented concerns to NHTSA about the NPRM side impact specifications that included information about oscillatory motions due to door structure interaction ("door gong"). The research procedure included an x and y direction accelerometers to be mounted on the back side of the door structure at the top (see Figure D-6 in Appendix D, Section 1.2.1). Dorel recommends NHTSA add back the requirement to include (primary and redundant) x direction accelerometers on the back side of the door panel at the top to monitor the door gong on each test. The below image shows the accelerometer location specified for the door panel in the research procedure.

3. Two 7264C[25] accelerometers are mounted on the door structure in the x and y-axis directions of the SISA (Figure D-6).

Figure D-6. Door Accelerometers

This data channel is important to analyze within and between lab test score differences that exist because the frequency, severity, and timing differences of the door gong are unique to every 213a test fixture and lab. The door gong pulse represents the door structure moving toward and away from the CRS as it approaches and interacts with the door foam because of the poor rigidity of the door structure. If the door panel is moving toward the CRS during the HIC15 and/or Chest Deflection score calculation timing, the scores will be elevated. If the door panel is moving away from the CRS during the HIC15 and/or Chest Deflection score calculation timing, the scores will be reduced. This effect creates poor CV% when comparing within and between lab variation. If the frequency, severity, and timing of every lab's door gong were aligned, this variation would not be a factor, but each lab has a different door gong today. The below image shows the different door gongs from Calspan, MGA-VA, MGA-WI and VRTC.



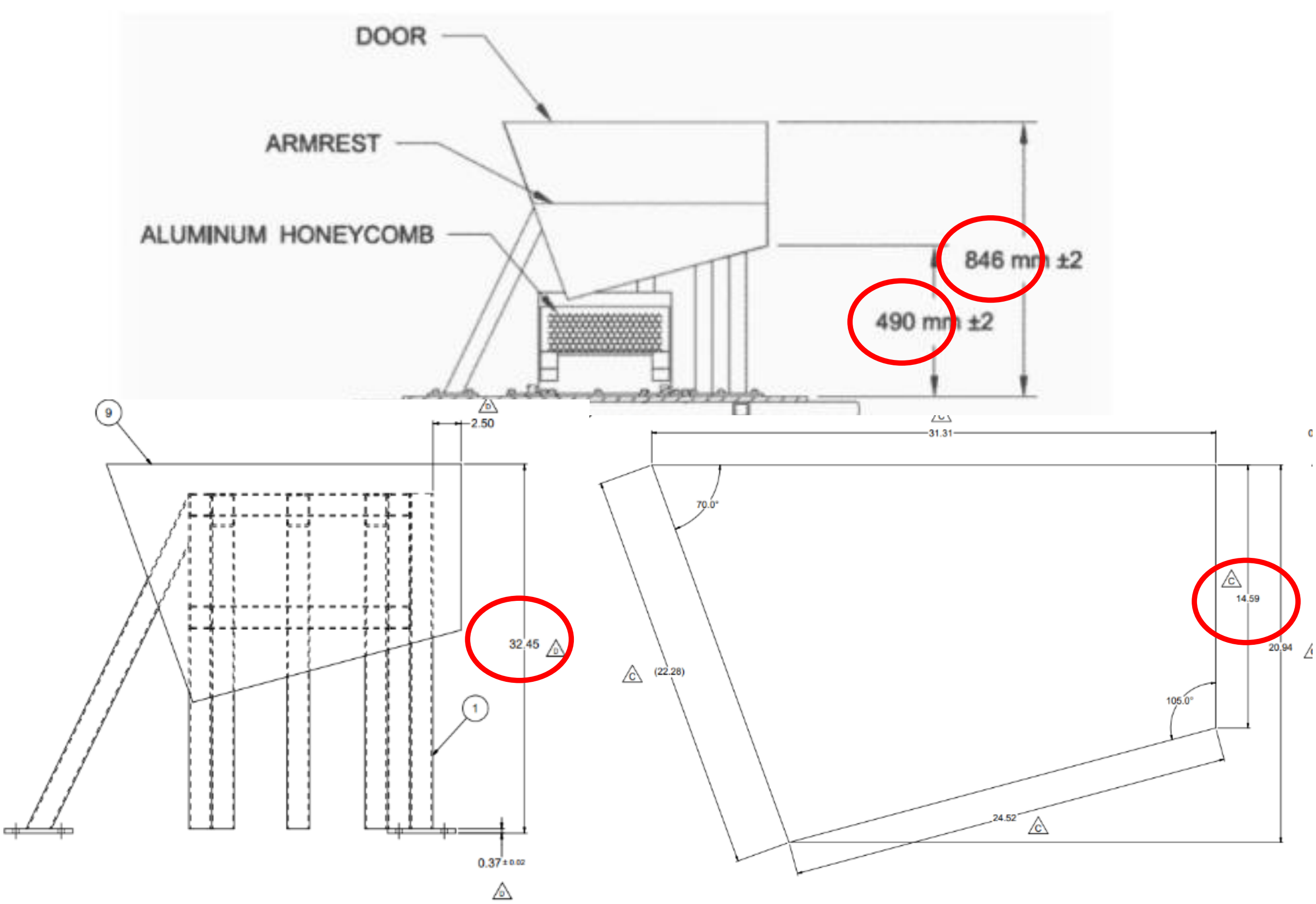
Additionally, this data channel can also help to monitor the integrity of the door structure over time to detect fatigue/deformation. Although NHTSA stated in the FMVSS 213a Final Rule "there is no need to make further structural improvements to the door assembly", additional information regarding the door structure integrity with the 213a test fixtures that exist today will be presented to NHTSA during the JPMA meeting to be held on June 4, 2024. Dorel continues to recommend that the door structure of the 213a test fixture be redesigned or reinforced to improve stability and dampen the door gong.

2) Dorel is concerned that there are some test sleds that are in-use today that can achieve acceptable within and between lab CV% during frontal testing but are not suitable for the 213a side impact test procedure. Some acceleration test sleds (that have higher payload capacity) use a stroke length of the drive piston that remains engaged with the sled carriage during the timeframe of a 213a side impact test when the sliding bench and CRS are crushing the aluminum

honeycomb and interacting with the door foam. When this occurs, that continued engagement with the drive piston and sled carriage adds energy into the test that does not exist when the drive piston is decoupled from the sled carriage during this timeframe. That added energy elevates HIC15 and Chest Deflection scores. NHTSA should acknowledge that not all test sleds in use today are suitable for 213a side impact testing for this reason.

Test Procedure

1) Figure 25 on page 83 of the procedure (as shown below) includes height dimensions 490 mm and 846 mm. This image is taken from Figure 2C in the FMVSS No. 213a Final Rule published June 30, 2022. This image and identical height dimensions also exist in the NPRM for FMVSS No. 213a published January 28, 2014. Dorel believes the 490 mm and 846 mm height dimensions in these images are incorrect because they do not align with the dimensions of door panel shown in the December 2021 drawing package for the 213a side impact fixture released with the Final Rule for FMVSS No. 213a published June 30, 2022. Dorel recommends that Figure 25 should be updated using the actual dimensions that align with the 2021 drawing package. In this case, the 490 mm dimension should be (32.45 in. minus 14.59 in.=) 17.86 in. (453.64 mm) and the 846 mm dimension should be 32.45 in. (824.23 mm). Images of the door panel taken from the 2021 drawing package are also shown below.



2) The procedure describes the use of a “belt tension measurement device” multiple times throughout the procedure. While the procedure does not specify what this device looks like it is Dorel’s belief that the below gauges made by Kent-Moore have been commonly used by NHTSA’s current contract labs to measure belt tension.

2-15 LB RANGE FOR MEASURING T1, T2, LOWER ANCHOR AND TOP TETHER BELT TENSION

2-7 LB RANGE FOR MEASURING INTERNAL HARNESS BELT TENSION

As of the date of this comment, it is Dorel’s understanding that the manufacturer of these devices (Kent-Moore) is no longer taking new orders or repairing existing gauges. Unless a new supplier can be identified, this measurement device will no longer be available, and a new belt tension measurement device will need to be identified to ensure consistent measurement of belt tension between labs. Dorel also recommends separate gauges for measuring internal harness belt tension compared to belt tension on vehicle belts, lower anchors, and top tethers to improve accuracy of the different tension ranges specified.

3) Section 12.E.1.1 in the procedure includes information about the door and armrest foam to be used during 213a side impact testing but is silent on how to align the door foam to the door panel. Because of manufacturing tolerances allowed for the dimensions of the white and black foam pieces, and the door structure for each test fixture, Dorel suggests that a specification should be included in the procedure for how or where the door foam should be aligned to the door structure. Dorel proposes that the top surface of the black armrest foam should be specified as the alignment location, so it is kept as a constant dimension from the base plate of the fixture. Per the 2021 drawing package, the nominal height dimension from the top of the base plate of the fixture to the top surface of the black armrest foam should be 22.86 in. Dorel has observed that the top surface of the black foam can be lower or higher than this nominal if using the top or bottom of the door structure to align the foam, or even unparallel with the base plate of the fixture due to foam construction tolerances. The black armrest foam is a critical interaction point between the CRS and the door panel during 213a side impact dynamic testing, so the installation location of the black foam should be controlled to reduce variability within and between labs.

4) Section 12.D.6.1.A of the procedure states “No supplemental items (such as pool

noodles) are permitted to level the CRS" during current 213 frontal testing. Dorel suggests that this statement (that did not exist in TP-213-10) be removed. How will the test lab "level the CRS" consistently if following the manufacturer's instructions to match a level to ground line or device if the CRS's base does not lay flat on the current 213 frontal test bench? Note also, the procedure does not make the same exclusion when describing the leveling of CRS while installing to the 213a side impact test bench. Many CRS manufacturers allow the use of a pool noodle or rolled towel if needed when installing in a vehicle to achieve the required level angle.

5) Dorel requests that the 213a dummy selection chart shown in Table 12 of the procedure be updated to align with the dummy selection chart in the FMVSS 213b Final Rule that exempts the CRABI-12 ATD from being tested in a forward-facing installation.

6) Section 12.E.1.2 of the procedure provides specifications for the transducers required for 213a side impact testing, however many important details required to properly specify an appropriate transducer that had been present in the research procedure have been removed. Specifically, the following specifications should be added to the specifications already stated in this section to describe an appropriate transducer:

    a) Linearity and hysteresis
    b) Type and Class
    c) Sensitivity (at 100 Hz)
    d) Amplitude response +/-5%
    e) Amplitude response +/-1dB
    f) Mounted resonance frequency
    g) Non-linearity and hysteresis (% of reading full range)
    h) Zero measurand output
    i) Thermal zero shift From -10ºF to +150ºF (-23ºC to +66ºC)
    j) Thermal sensitivity shift At 0ºF and 150ºF (-18ºC and +66ºC)
    k) Warm-up time

7) In Section 3.2 of the research procedure, a detailed step by step procedure is present for how to calculate relative bench velocity during post processing. The procedure does not currently include any information on how to properly calculate relative bench velocity. Dorel has observed that every lab conducting 213 side impact testing is using a slightly different procedure for how they calculate relative bench velocity. Dorel recommends that the procedure must include a detailed step by step procedure for how relative bench velocity is calculated. All valid 213 side impact tests must have the relative bench velocity fit within NHTSA's prescribed corridor so every test lab should be using the exact same calculation method. Dorel has worked together with NHTSA's contract labs to understand their procedures and proposes the below step by step method to include in the procedure.

a) Run Test and Capture:
    a. Sled Carriage Accelerometer
    b. Sliding Bench Accelerometer
    c. Door Structure Accelerometer
    d. Q3s Head X-Y-Z Tri-Axial Accelerometer(s)
    e. Chest Lateral Compression IR-TRACC
b) Filter Sliding Bench to CFC60
c) Time Shift Sliding Using Bench Rise to Time Zero for ALL Data Channels
d) Calculate Sled kph and Multiply Cos(10)
e) Calculate Sliding Seat kph and Offset to Zero at Time Zero
f) Subtract Seat kph from Sled kph to obtain Delta kph

Variations in Set-Up

1) Figures 21 and 26 show a 300 +/-2 mm dimension depicting the SORL for the installation of the CRS onto the sliding bench. While there are no detailed dimensions in the December 2021 drawing package for the 213a side impact fixture released with the Final Rule, measuring the CAD model of the 213a test fixture released by NHTSA, the lower anchors on the sliding bench are not exactly centered on this 300 mm SORL. Dorel recommends the procedure include a specification to use a laser alignment device centered with the 300 mm SORL to ensure the CRS is always centered with the SORL and not the center of the lower anchors when installed to the sliding bench. Dorel has observed that when the CRS is not centered with the SORL or the ATD is not centered in the CRS, excessive within lab variation occurs.

2) Dorel has observed many cases of unacceptable CV (>10%) within and between lab variation for Chest Deflection. Dorel believes that a key pre-test set-up variable that can lead to unacceptable CV is the arm angle and twist of the Q3s ATD. Dorel recommends that the procedure include a specification to verify the Q3s ATD's arm is located properly within the 25º detent by requiring the use of a tilt sensor mounted in the ATD's Thoracic Spine and a digital inclinometer measurement of the top of the arm and the use of a pre-test 25 +/- 2º calculation that is verified. Dorel also recommends the use of a digital inclinometer measurement to verify 0 +/- 2º arm twist exists pre-test. Detailed information on these arm angle and twist angle measurement validation methods and fixtures will be presented to NHTSA during the JPMA meeting to be held on June 4, 2024. Below images show the tilt sensor and mounting location as described in the PADI for the Q3s ATD.

3) Dorel recommends that the procedure include a requirement to mark, measure and record the pre-test back angle of all 213a side impact tests (for both forward and rear-facing installations). The procedure for how to mark the CRS with back angle tape or targets already exists in the procedure Section 12.D.6.6 Restraint Targeting. Part of the post-test analysis to determine why poor CV% has occurred within or between labs is to compare the pre-test set-up of the CRS on the sliding bench.

Dummies

1) Dorel is concerned that there could be a significant amount of unacceptable within and between lab variation coming from the Q3s ATD. Current calibration procedures may not be capable of detecting drifting/changing biofidelity over time as each Q3s ATD in service throughout the industry continually increases the lifetime number of hits.

2) Dorel notes that the adult ATD’s used for side impact testing in vehicles have no lower arms and a different shoulder structure. Given all the previously mentioned poor CV% variation related to arm angle and twist, Dorel recommends possible future improvements to the arm structure of the Q3s ATD be evaluated if they are able to reduce variation caused by a unique child size side impact test ATD design.

Limited Testing

1) Because the current procedure is not able to achieve acceptable within and between lab CV% at NHTSA’s current contract labs intended for future 213a enforcement, Dorel proposes that improvements must be made to the procedure and a repeatability and reproducibility study conducted showing an acceptable (≤10%) CV prior to enforcement. Until that can be completed, enforcement should not be based on limited testing because of the knowledge shared in this response about unacceptable CV% that exists today. Dorel recommends any interim enforcement activities be conducted using repeat tests within and between NHTSA’s contract labs and the average of scores be considered the true measure of a CRS design’s compliance to the standard.

Sincerely,

T.Edwards

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