United States
Consumer Product Safety Commission

April 28, 2025

TRANSMITTED VIA EMAIL

Corey Campbell
ASTM F15.12 Firmness and Breathability of Juvenile Products Subcommittee Chair
ASTM International
100 Bar Harbor Drive
West Conshohocken, PA 19428

Dear Mr. Campbell:

To reduce the risk of infant suffocation or positional asphyxiation in seated infant products such as hand-held carriers, bouncers, swings, rockers, and strollers, CPSC staff[1] developed a simplified concavity evaluation method based on Boise State University's Seated Product Characterization and Testing report.[2] In the report, the concavity of various seated products was characterized in weighted and unweighted conditions by first measuring the width of the product, L, at the intended head position and seat bight position; then measuring the depth from the midline of L to the surface of the product, D; and determining the radius of a best fit circle, using the equation below:

$$r = \frac{D}{2} + \frac{L^2}{8D}$$

The concavity assessment developed by staff uses the infant hinged weight gauge to simulate the weight of an infant sitting in the product and replaces the measurements and calculation with a template. A drawing of the template is shown in Figure 1. The template is placed on the head support line, located 4 inches from the top of the infant hinged weight gauge; it is then slid up and down 3 inches from that line. If the product touches the template, then it fails the test. The product is tested in any designed, marketed, or intended use configurations, including any inserts that are provided with the product.

[1] The views in this letter are those of the staff and have not been reviewed or approved by, and may not reflect the views of, the Commission.
[2] The report was forwarded to ASTM for distribution on June 20, 2023, and can be found at: https://www.cpsc.gov/content/Report-Boise-State-Universitys-Seated-Products-Characterization-and-Testing.

U.S. Consumer Product Safety Commission
4330 East-West Highway
Bethesda, MD 20814
cpsc.gov

National Product Testing & Evaluation Center
5 Research Place
Rockville, MD 20850

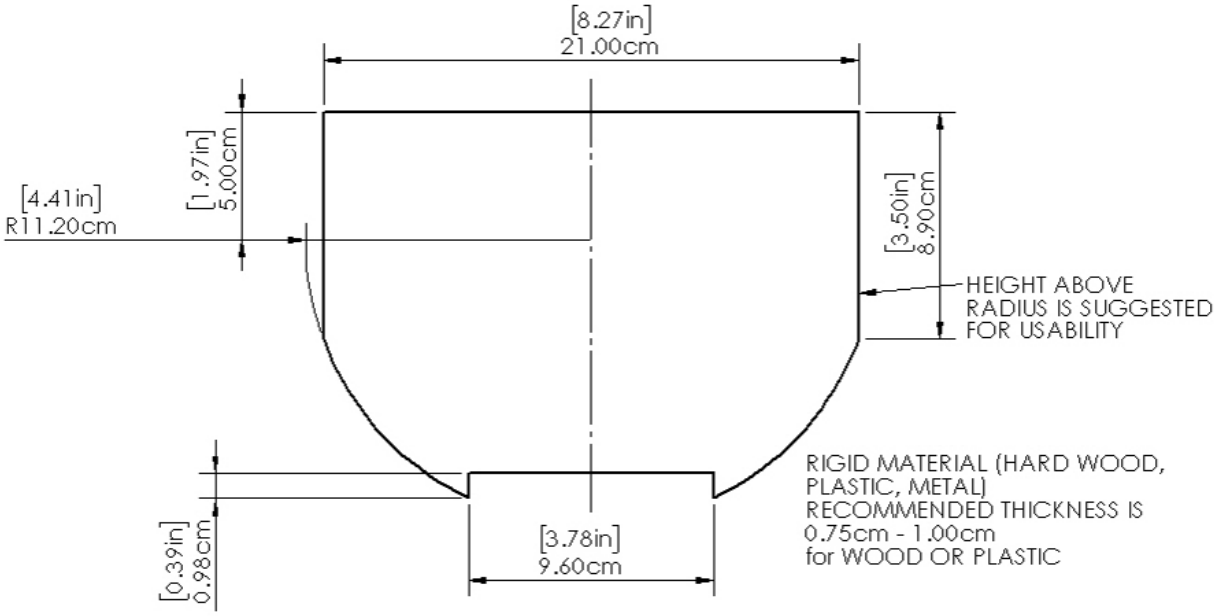

Figure 1 – Seated Infant Concavity Template

To develop the template, staff evaluated several publicly available images of children sleeping in seated products to identify where infants were resting their heads relative to their body positions. From those images, staff identified shoulder breadth (bideltoid) as a key measure beyond which infants could not extend their faces. Staff used 21 cm to approximately represent the shoulder breadth for a 95th percentile 0 to 6-month-old child.[3] Staff calculated the curvature radius of 11.2 cm using the equation above, with an infant head radius of 7.3 cm as D and shoulder breadth of 21 cm as L, to approximate an infant head's ability to rotate through the length of the shoulder breadth. The 6-inch test zone is an estimate of the area in which a 0 to 6-month-old child's nose might rest. Figure 2 demonstrates this zone with a newborn CAMI, an infant CAMI, and the infant hinged weight gauge.

[3] 95th percentile 0-6 month male & female: 21.5 cm (Pheasant, 1986, Bodyspace: Anthropometric ergonomics & design, Taylor&Francis, London, UK). 97th percentile 3-5 month male: 20.6 cm (Steenbekkers, 1993, Child development, design implications & accident prevention. No.1 in Physical Ergonomics Series, TU Delft, The Netherlands). 97th percentile 6-8 month female: 22.1 cm (Steenbekkers, 1993).

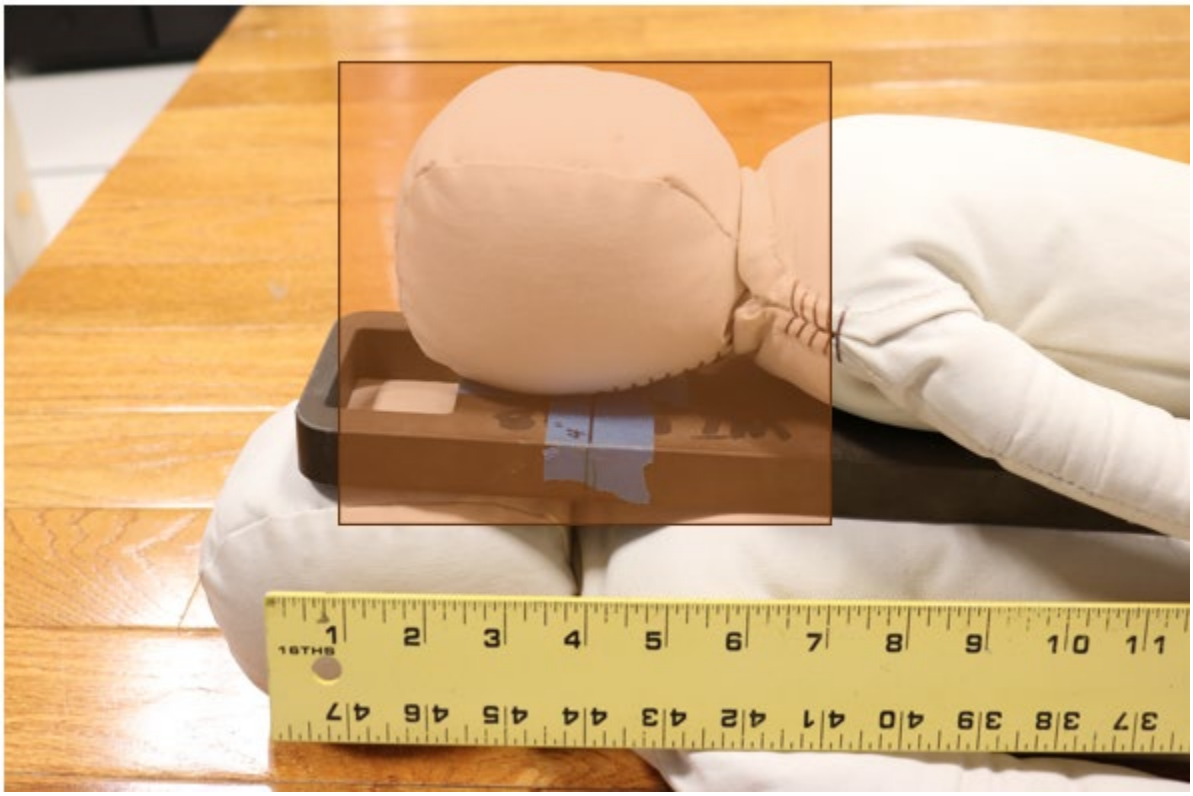

Figure 2 – 6-inch Test Zone with Anthropometric References (Feet are Aligned)

This concavity test method also functions as an evaluation of firmness: the hinged weight gauge applies weight to the product which approximates the weight of a seated 6-month-old, and the template evaluates whether that weight is enough to cause the material to contact an infant's face in the supine position.[4] Furthermore, as shown in Figure 3, the template ensures that a child's head will remain relatively free of obstruction in the prone position.

[4] Estimated head weight of a 50th percentile 6-month-old child is 1.88 kg based on the head weight/body weight ratio of 23 percent discussed in Coats, B., & Margulies, S. S. (2008). Potential for head injuries in infants from low-height falls. *Journal of neurosurgery. Pediatrics*, *2*(5), 321–330. https://doi.org/10.3171/PED.2008.2.11.321. Staff used the 50th percentile weight of 6.5-month-old boys (8.16 kg) listed in CDC data at https://www.cdc.gov/growthcharts/data/zscore/wtageinf.xls.

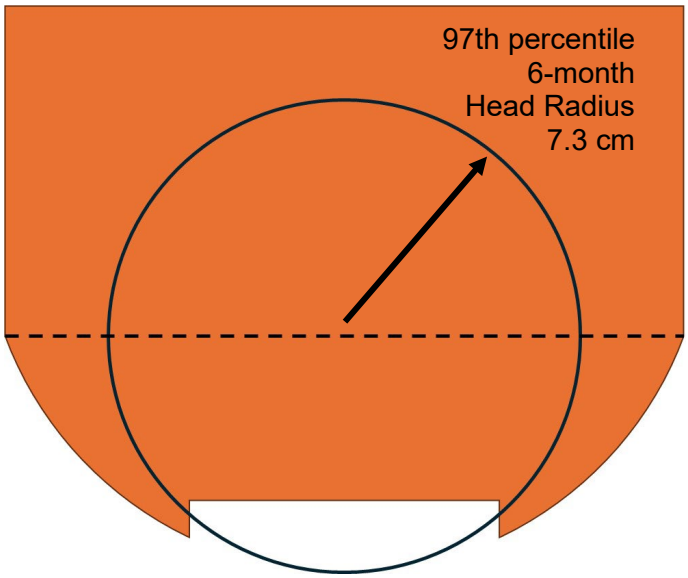

Figure 3 – Comparison of Template to Infant Head Radius

This concavity test method fails a seated infant product that has been recalled because, when used for sleep, the head rest and body support insert on the seat pad can increase the risk of suffocation. The template passes the recalled product's remedy, in which the head rest and body support insert are removed. Some, but not all, seated products with inserts pass this method. Figure 4 shows examples of failing and passing test results.

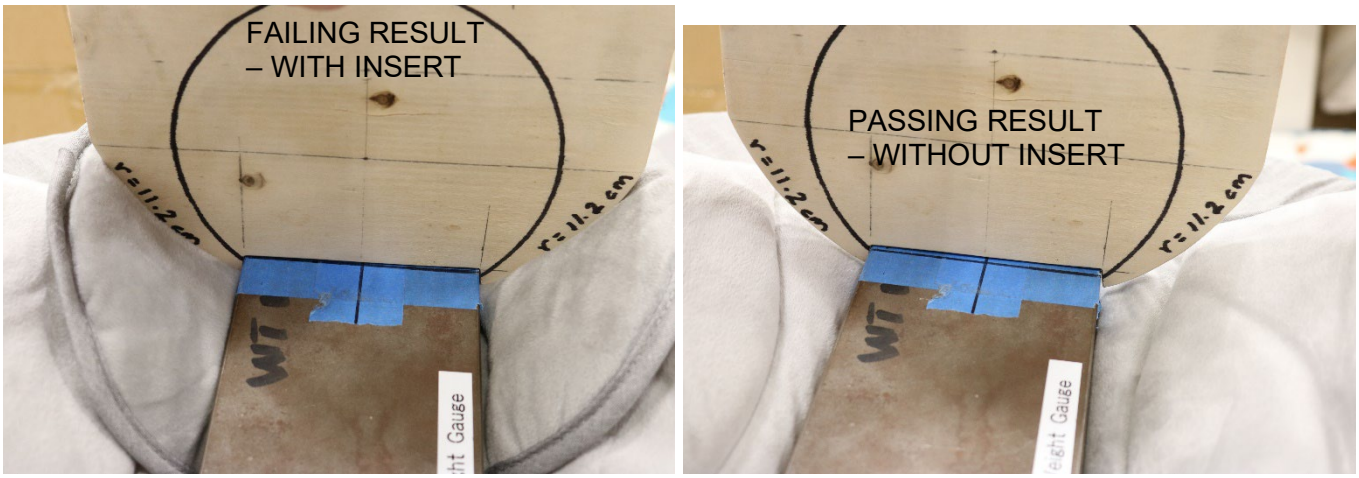

Figure 4 – Examples of Failing and Passing Test Results with Concavity Template

Staff asks the ASTM F15.12 Subcommittee to evaluate this test method along with other test methods currently being considered by the subcommittee for seated infant products, and to consider development of a standard test method based on this or other firmness or concavity evaluations, which could then be referenced by other juvenile product standards. Staff encourages the subcommittees responsible for standards for seated infant products to participate in this effort.

Staff thanks you for your continued efforts to improve the safety of durable infant or toddler products and looks forward to working with ASTM to reduce the risk of infant suffocation or asphyxiation in

seated infant products.

Sincerely,

Daniel Taxier

Daniel Taxier
Children's Program Manager
Division of Mechanical and Combustion Engineering
Directorate for Engineering Sciences

cc: Michael Leshner – ASTM F15.12 Task Group Chair on Firmness and Breathability
Randy Kiser – ASTM F15.21 Subcommittee Chair on Hand-held Carriers
Eric Childs – ASTM F15.21 Subcommittee Chair on Infant Bouncers
Julia Costello – ASTM F15.21 Subcommittee Chair on Infant Swings, Infant and Infant/Toddler Rockers
Aaron Clark – ASTM F15.17 Subcommittee Chair on Carriages and Strollers
Molly Lynyak – Staff Manager, ASTM Committee F15 on Consumer Products
Donald Mays – Chairman, ASTM Committee F15 on Consumer Products
Jacqueline Campbell – CPSC Voluntary Standards Coordinator