**DEPARTMENT OF TRANSPORTATION**

**National Highway Traffic Safety Administration**

**49 CFR Part 571**

**[Docket No. NHTSA - 2020 – 0077]**

**Federal Motor Vehicle Safety Standards;**

**Child Restraint Systems**

**Denial of Petition for Rulemaking**

**AGENCY:** National Highway Traffic Safety Administration (NHTSA), Department of Transportation.

**ACTION:** Denial of petition for rulemaking.

**SUMMARY:** This document denies a petition for rulemaking from SafeGuard/IMMI (formerly Indiana Mills and Manufacturing, Inc.) and C.E. White requesting that NHTSA amend Federal Motor Vehicle Safety Standard (FMVSS) No. 213, "Child restraint systems," to provide for "school bus built-in belt-positioning seats." Under the petitioners' suggested amendment, a school bus built-in belt positioning seat would be a type of "booster seat" and would consist of a school bus seat with a lap/shoulder belt and a shoulder belt height adjuster. The agency is denying the petition because under the requested amendment, designs would be permitted that do not provide the full benefits of booster seats, namely the proper positioning of the child on the vehicle seat to improve the fit of the lap belt to mitigate the risk of abdominal injuries in a crash.

**DATES: [INSERT DATE OF PUBLICATION IN THE FEDERAL REGISTER].**

**ADDRESSES:** National Highway Traffic Safety Administration, 1200 New Jersey Avenue, S.E., Washington D.C. 20590.

**FOR FURTHER INFORMATION CONTACT:** Shashi Kuppa, Office of Crashworthiness Standards, National Highway Traffic Safety Administration, 1200 New Jersey Avenue, S.E., Washington D.C. 20590, telephone: 202-366-3827, or Deirdre Fujita, Office of the Chief Counsel, National Highway Traffic Safety Administration, 1200 New Jersey Avenue, S.E., Washington D.C. 20590, telephone: 202-366-2992, fax: 202-366-3820.

**SUPPLEMENTARY INFORMATION:**

**The Petition**

On January 15, 2013, the agency received a petition for rulemaking from SafeGuard/IMMI and C.E. White requesting that NHTSA amend FMVSS No. 213 to include the following definition in section S4, *Definitions*: *"School bus built-in belt-positioning seat* means a passenger seat used on school buses that is equipped with an integrated Type II seat belt that includes a torso belt height adjuster." A Type 2 (or Type II) seat belt assembly is a combination of pelvic and upper torso restraints, i.e., a lap/shoulder belt.[1] The seat belt height adjuster developed by the petitioners is a clip on the shoulder belt loop that can be moved along the shoulder belt webbing. The petitioners would like to certify their school bus seats with lap/shoulder belts and shoulder belt height adjusters as compliant with FMVSS No. 213's requirements for built-in booster seats.

**Background on Booster Seats and Belt-Positioning Seats**

Booster seats are one of several types of child restraint systems used for child passenger protection before the child is large enough to use the vehicle seat belt alone. A belt-positioning seat is a type of booster seat under FMVSS No. 213.[2] NHTSA recommends that 4 to 7-year-old

[1] See FMVSS No. 209, "Seat belt assemblies," 49 CFR 571.209 S3, *Definitions.*

[2] Under FMVSS No. 213 (S4), "booster seat" means "either a backless child restraint system or a belt-positioning seat." "Belt-positioning seat" means "a child restraint system that positions a child on a vehicle seat to improve the

children be restrained in booster seats when they no longer fit in their forward-facing harnessed child restraints.[3] Booster seats lift (boost) and reposition the child such that vehicle seat belts (designed to fit adults) are routed appropriately relative to the child's body. For the seat belt to fit properly, the lap belt must lie entirely below the top of the pelvis and touch or lie flat across the upper thighs, and the shoulder belt should lie snugly across the shoulder and chest and not cross the neck or face.

An important function of a booster seat is to raise the child up relative to the vehicle seat belt to improve seat belt fit.[4] With a booster seat, the lap belt is positioned such that it loads and restrains the strong bones of the pelvis. Without a booster seat, the lap belt is not positioned effectively and the occupant can slide under the lap belt during deceleration, resulting in the seat belt loading the abdomen, vulnerable internal organs and spine instead of the pelvis. This event is called "submarining." Elevating the position of the child upwards relative to where the lap belt is anchored increases the lap belt angle with respect to the horizontal plane. A steeper lap belt angle is better because it makes it harder for the child to slide under the lap belt (submarine) in a crash. Additionally, boosting the child compensates for the shorter torso of a child by positioning the child such that the shoulder belt is away from the neck and restrains the child through the shoulder structure in a crash.

Booster seats may also have seat belt guides to position the shoulder belt midway between the neck and arm, not so far outboard that it is at the edge of the shoulder or so far

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fit of a vehicle Type II belt system on the child and that lacks any component, such as a belt system or a structural element, designed to restrain forward movement of the child in a forward impact." The petitioners would like to have their product considered a kind of "belt-positioning seat." For simplicity, hereafter in this document, the term "booster seat" means "belt-positioning seat."

[3] https://www.nhtsa.gov/equipment/car-seats-and-booster-seats#age-size-rec.

[4] Klinich, K., Manary, M., Weber, K., "Crash Protection for Child Passengers: Rationale for Best Practice," University of Michigan Transportation Research Institute Research Review, January-March 2012, Volume 43, No. 1, ISSN 0739 7100. Available at http://www.umtri.umich.edu/content/rr_43_1.pdf.

inboard that it is rubbing the neck. However, because belt fit is improved just by boosting the child upward, many booster seats work well even if they lack shoulder belt adjustability or belt guidance.[5]

The second benefit of booster seats is improving occupant posture so the child is more likely to be "in position" in a crash, similar to an older occupant. Ideally, to best distribute crash forces, the occupant is seated in an upright position with the back of the torso resting against the seat back, the pelvis at the seat bight, and the knees bent over the front of the seat cushion. However, several studies have documented that the rear seats of most vehicles are too deep for children to sit upright with their knees bent over the edge of the seat and with their back fully supported for comfort.[6, 7, 8] Consequently, children generally scoot forward so their legs can bend over the front of the seat in a comfortable position and then recline themselves rearward to rest against the seat back. A booster seat provides the child with a seat cushion length that is more fitted to the child's upper leg length. With a booster, a child's legs can bend comfortably over the end of the booster while the child's back rests against the seat back. A booster seat helps the child remain upright and in position.

**Analysis of the Petition**

NHTSA believes that children would be less protected under the suggested amendment. The petitioners' language would allow designs that unreasonably reduce the full benefits of

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[5] Arbogast KB, Jermakian JS, Kallan MF, and Durbin DR. (2009). Effectiveness of Belt-positioning Booster Seats: An Updated Assessment Pediatrics 124:1281-1286.

[6] Huang S and Reed M. (2006). Comparison of Child Body Dimensions with Rear Seat Geometry. SAE Technical Paper 2006-01-1142, 2006, doi:10.4271/2006-01-1142.

[7] Klinich KD, Pritz HB, Beebe MS, Welty K, Burton RW. (1994). *Study of older child restraint/ booster seat fit and NASS injury analysis.* DOT/HS 808 248. National Highway Traffic Safety Administration, Vehicle Research and Test Center, East Liberty, OH.

[8] Bilston LE, Sagar N. (2007). Geometry of rear seats and child restraints compared to child anthropometry. *Stapp Car Crash Conference J* 51:275-98.

booster seats, namely the proper positioning (boosting) of the child on the vehicle seat to improve the fit of the lap belt to mitigate the risk of abdominal injuries in a crash. The suggested amendment would permit designs that do not offer any seat cushion adjustability. The child could sit directly on the vehicle seat.

Booster seats are designed to raise the child with respect to the vehicle seat to improve lap belt fit, as raising the child positions the lap belt entirely below the top of the pelvis and touching or lying flat across the upper thighs. Improved lap belt fit reduces the risk of submarining and abdominal injury.[9,10] The suggested language would permit devices to be certified as "booster seats" even though they lack any feature that reduces the risk of abdominal injuries. NHTSA believes adopting the suggested language would not be in the interest of safety as the devices do not provide the full benefits of a booster seat.

Further, as discussed above, booster seats contribute to occupant protection by improving occupant posture so the child is more likely to be "in position" in a crash.[11] When children recline themselves rearward on the seat to bend their knees comfortably over the edge of the seat, the risk of submarining under the belt in a crash increases. With the child in the reclined position, the lap portion of the seat belt can slide upward during a crash and intrude into the child's soft upper abdomen, thus increasing the likelihood of abdominal injury. Under the suggested amendment, designs could be introduced that have no seating platform with an appropriate cushion length. These designs would not have the raised seat cushion that ensure the

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[9] Jermakian JS, Kallan MJ, Arbogast KB. (2007). Abdominal injury risk for children seated in belt-positioning booster seats. 20th International Technical Conference on the Enhanced Safety of Vehicles, Paper No. 07-0441.
[10] Jermakian JS, Locey CM, Haughey LJ, Arbogast. KB (2007). Lower extremity injuries in children seated in forward facing child restraint systems. Traffic Injury Prevention, 8:171–179, DOI: 10.1080/15389580601175250.
[11] Klinich, K., Manary, M., Weber, K., "Crash Protection for Child Passengers: Rationale for Best Practice," *supra*.

child would be better positioned to ride down crash forces in a manner that best minimizes injury.

Field data have shown booster seats to be effective in reducing child passenger injuries. Children ages 4 to 8 using lap/shoulder belts alone have been found to be at higher risk of abdominal injury due to seat belt interaction compared to children using booster seats.[12] The agency's analysis of real world crash data[13] indicates that, among children between the ages of 4 to 8 years old, there is a 14 percent reduction in injury risk when restrained in booster seats versus when directly in the vehicle's lap/shoulder belts. The petition's language would allow designs that lack the defining features of booster seats that have been critical to their functionality transitioning the child to the vehicle's lap/shoulder belt system. The suggested language would facilitate designs that reduce the safety benefits of booster seats.

**Conclusion**

NHTSA has reviewed the petition for rulemaking submitted by SafeGuard/IMMI and C.E. White requesting that NHTSA amend FMVSS No. 213 to include a definition for "school bus built-in belt-positioning seat." The agency is denying the request because the language that the petitioner would introduce would unreasonably reduce safety by permitting designs that do not address the risks of submarining and abdominal injury that booster seats presently address.

For these reasons and in accordance with 49 U.S.C. 30162 and 49 CFR Part 552, the petition for rulemaking from Safeguard/IMMI and C.E. White is denied.

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[12] Durbin DR, Chen I, Smith R, Elliott MR Winston FK (2005). Effects of seating positon and appropriate restraint use on the risk of injury to children in motor vehicle crashes. *Pediatrics* 115(3):e305-9.
[13] Siviniski, R., "Booster Seat Effectiveness Estimates Based on CDS and State Data," NHTSA Technical Report, DOT HS 811 338, July 2010. http://www-nrd.nhtsa.dot.gov/Pubs/811338.pdf. Last accessed on October 10, 2017.

Authority: 49 U.S.C. 322, 30111, 30115, 30117, and 30166; delegation of authority at 49 CFR 1.95 and 501.8.

Issued in Washington, D.C., under authority delegated in 49 CFR 1.95 and 501.8.

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Raymond R. Posten
Associate Administrator for Rulemaking

Billing Code: 4910-59-P

[FR Doc. 2020-17595 Filed: 9/4/2020 8:45 am; Publication Date: 9/8/2020]