

Real-world protection of booster-seated children



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Protection of children in cars – best practice



Rearward facing child seats
up to at least 4 years old

Belt-positioning boosters
up to stature 140 cm and at least 10 years old

Protection of children in cars – best practice



Booster cushion



Integrated booster



Comfort cover

Booster seat

Rearward facing child seats
up to at least 4 years old

Belt-positioning boosters
up to stature 140 cm and at least 10 years old

For real kids in real cars,
the booster is a part of a system

The car + the booster + the user



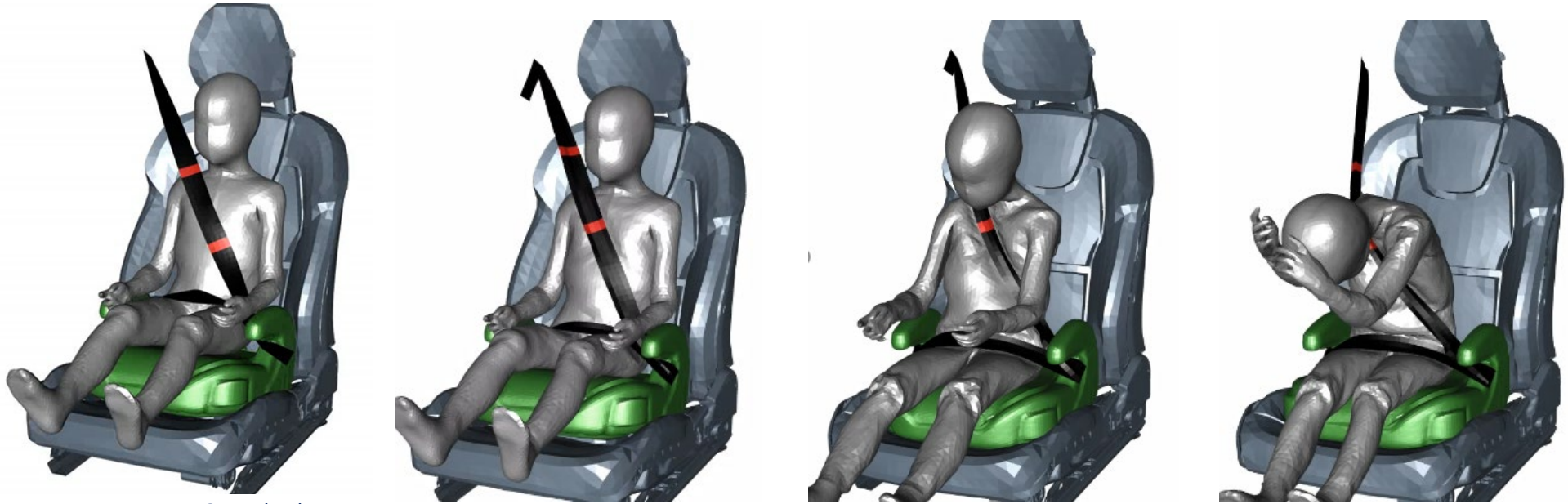
The challenge of shared mobility and
child occupant protection

Real-world data shows that booster-seated children are well protected in cars

- Overall injury reducing effect of 77%, compared to unrestrained (Jakobsson et al., ESV 2005)
- Children aged 4 to 8 years are 45% less likely to sustain injuries using boosters compared to seatbelt-only (Arbogast et al. Pediatrics 2009)
- In frontal impacts, abdominal injuries are almost eliminated (Durbin et al. JAMA 2003)
- Children in side-impacts benefit from using boosters; both in near-side and far-side impacts (Arbogast et al. Pediatrics 2009)
- No differences seen between booster seat and booster cushion; overall nor in side impact specifically (Arbogast et al. Pediatrics 2009, Stapp 2010)

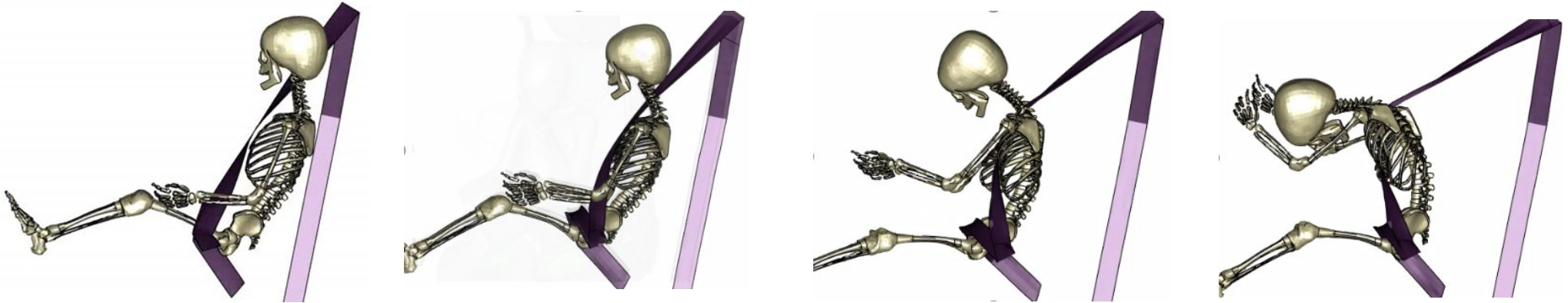


Children benefit from vehicle protection systems,
given they are raised in position using a booster
-frontal impact



Seatbelt pretensioner
activation

Children benefit from vehicle protection systems,
given they are raised in position using a booster
-frontal impact



The seatbelt pretensioner reduces belt slack

A thick jacket provides quite substantial amount of slack



Before

Seatbelt
pretensioner
activation

Static test



After

Children benefit from vehicle protection systems in side-impacts, too



The seatbelt pretensioners can help keep the child in the seatbelt in a side-impact



Q6 seated on the non-struck side on an integrated booster

The seatbelt always strives to take the shortest route!

-although the shoulder belt looks like being in a proper initial position, the re-routing of the seatbelt might not be effective in crash – and if no pretensioner, it will also add slack



What is needed from the booster?

- **Boost!** - Raise the child into a good lap and shoulder belt position.
- Provide comfortable **cushion length**.
- **Move with the child** forward (in a frontal impact).
- **Lap belt guides** to help position the lap belt towards the pelvis, and to restrain the booster cushion.
- **Side support** for comfort and upright sitting posture
 - Could be provided by the booster, but only if not hindering vehicle protection systems to work.
 - It could just as well be an add-on comfort cover.



Instead of:

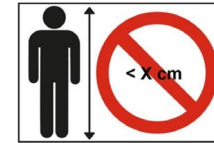


Integrated booster with an add-on comfort cover

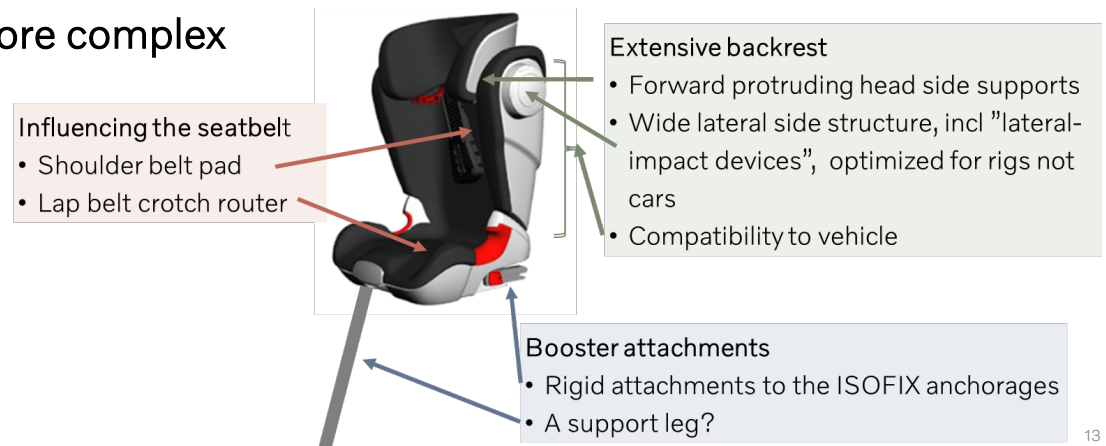
What is the trend for booster developments today?

Some regions are banning the booster cushions, exemplified by:

- Australia: excluded
- UN ECE R129: not possible to type-approve for children <125cm



The booster seats are becoming larger and more complex



Extensive backrest, examples



- Forward protruding head side supports
- Wide lateral side structure, incl "lateral-impact devices", optimized for test rigs not cars
- Compatibility to vehicle

Forward leaning sitting posture

Difficult to fit 3 in the rear seat

Potentially blocking the Inflatable Curtain

Interaction with vehicle seat seatback and head-restraint

Facts behind?

How is it communicated to the customer?

Influencing the seatbelt, examples

Shoulder belt pad



Potential effect on seatbelt pretensioner (if misused)

- Shoulder belt pad

- Lap belt crotch router



Adding slack to the seatbelt

Lap belt crotch router



Facts behind?

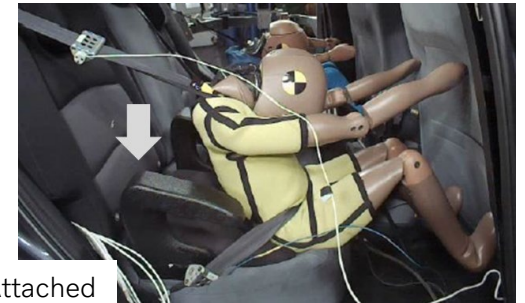
How is it communicated to the customer?

Attaching the booster to the car

- Rigid attachments to the ISOFIX anchorages
- A support leg?



Not attached



Attached

Facts behind?

How is it communicated to the customer?

Images from Tylko et al. Prot. of Children in Cars Conf. 2016

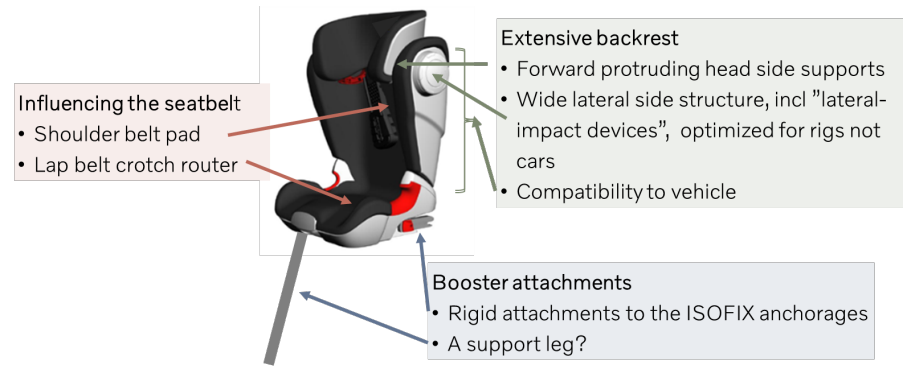
We have a mismatch

The booster offer is not aligned with the needs in shared mobility.



The balance of vehicle and booster protection should be in focus. In this context the booster cushion is an important type of booster.

Some “safety” perceptions are not aligned with real-world safety performance.



Real-world evidence and understanding of the vehicle-booster-user entity should be the foundation for all tests, evaluations and communication to users.

Real world protection of booster-seated children

- the fundamental protection principles

- As for adults, the **seatbelt** is the primary restraint.
- The booster's main purpose is to **raise** the child in position for good lap belt geometry (for reduced risk of submarining in frontal impacts).
- The boost will also provide a more comfortable and safe **mid-shoulder shoulder-belt position**.
- The booster-seated child will **benefit from the advanced seatbelt** functions, such as the pretensioner.
- The booster **shortens** the cushion length, improving comfort and thereby reducing risk of slouching.
- In a side impact, the **vehicle protection system** will help protect the child, as for adults.
- **Side support** for comfort and upright sitting posture could be provided by the booster, but only if not hindering vehicle protection systems to work. It could just as well be an add-on comfort cover.

Do:

Use a booster at every trip!

Don't:

Don't mess up with the seatbelt (avoid re-routing) → negative impact on seatbelt performance.

Avoid intrusive side support – negative impact on vehicle protection.

Be careful when attaching the booster by other means than the seatbelt, when the child is using it.

We need a variety of reasonable boosters



Booster seats



Booster cushions



Integrated (built-in) boosters



Comfort cover

How shall we address the mismatch of users' needs and perception and the booster development trend?



The “safety” perception of the booster development



How shall we address the mismatch of users' needs and perception and the booster development trend?

Let's work together!

Align towards a common goal of sustainable and safe transportation for booster-seated children.

Focus on the essential protection principles and the real-world context (the vehicle-booster-user entity), as the foundation for all tests, assessments and communication to users.



Thank you!



FFI Strategic Vehicle Research and Innovation

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