



Rear seat safety @ Volvo Cars

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Rear seat safety is important



Protection of "mid-size" occupants in sitting postures as specified in regulatory and consumer testing situations has improved significantly; leaving other situations behind, in comparison.

The rear seat is occupied by all different sizes of occupants; including children who require special attention from a protection perspective.

Safety challenges include:

- Occupant diversity
- Restraint usage
- "Vulnerable" occupants, because of:
 - Individual aspects (body constitution / age / other)
 - Sitting posture at impact, eg. complex situations
 - Non-optimal usage of restraints, pre-crash or during sequence
- Shift in exposure due to advancements in crash avoidance and mitigation systems



Volvo Cars' rear seat safety evolution



1967

Seat belts as standard



1972

3pt belts outer seats



1978

World-first booster



1982

Anti-submarining floor ridge



1986

3pt belt center seat



1990

World-first integrated booster



1992

3pt all positions as standard



1998

Seat belt pretensioners + world first side head airbag (IC)



2007

World-first Integrated 2-stage boosters + child adapted load limiters



2015

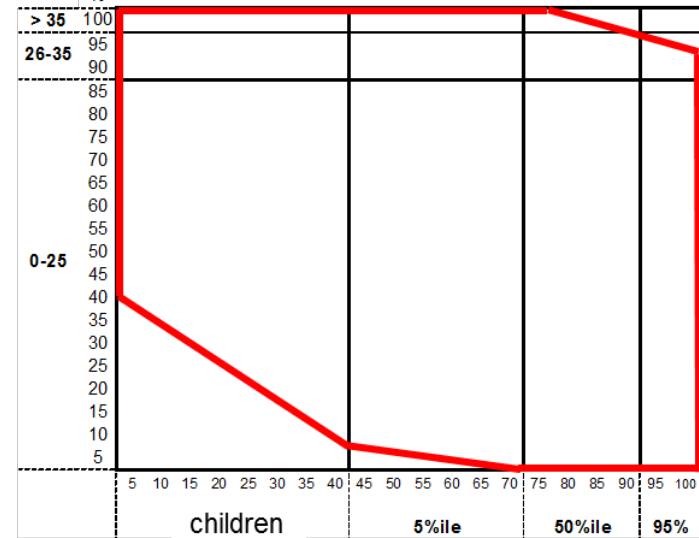
Height adjustability + advanced load limiters

Rear seat occupant protection needs



- Majority of the rear seat occupants are of children-size.
- The majority of all impacts occur at low or medium speed.
- Head injury is the most frequently injured body region.
- Chest injuries more frequently seen among elderly than younger.

% severity distribution
frontal impacts (mph)



*Principle sketch
based on Volvo cars
in Sweden*

In order to achieve best real-world rear seat occupant protection:

- Focus on small to medium size occupants and low to medium speed intervals
- Seat belt fit is essential, address aspects of sitting posture and behaviour, including potential seat belt slack

Integrated 2-stage booster cushion



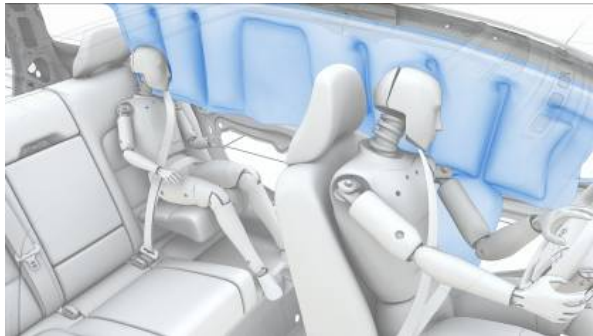
**Encourages usage –
Utilizes vehicle protection**

Performance

- Seating position/belt fit
- Reduce risk of misuse
- Seat belt pretensioner and progressive load limiter
- Side impact protection, incl. inflatable Curtain

Usage

- Availability/ease of use
- Acceptance from older children
- Comfort



Real world behavior, children



Examples of selected postures during riding



Examples of postures due to emergency maneuvers



Addressing real world safety needs



Variety of occupant sizes and crash situations
Understand influencing factors

- Comfortable, easy to use, attractive: **"make the safest the most desired"**
- Adjustability (seat, booster, seat belt...)
- Seat belt pretensioning and advanced load limiting
- Impact surface management

Joint efforts are encouraged to accommodate safest transportation of all sizes/ages based on their needs.

