



# Designing Cars and Restraint Systems to Protect Child Occupants

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# Requirements for Child Safety

## CRS Performance



- Front and side impact crash with dummies representing 1½ & 3 year old children
- Placed on the rear seat of the car, in the child restraints recommended by the vehicle OEM

## Vehicle Provisions



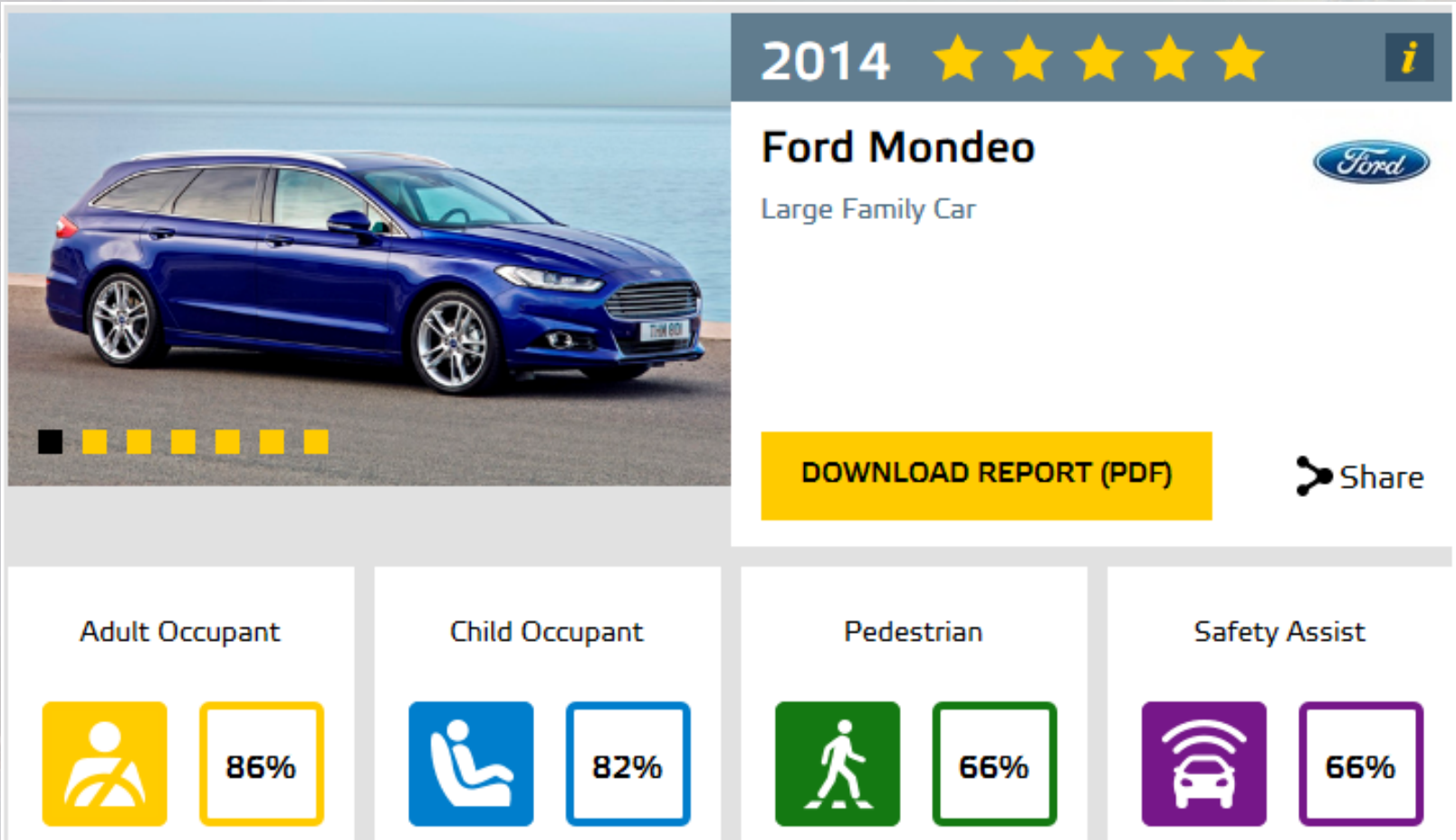
- Ease of child seat fitment
- Standardization of child seat and vehicle interface
- Airbag disabling switch if child seat is present

## CRS Installation Check



- To evaluate if child seats can be easily installed in vehicle seats and secured

# Typical EuroNCAP Vehicle Rating



# Technologies to Enhance Child Safety

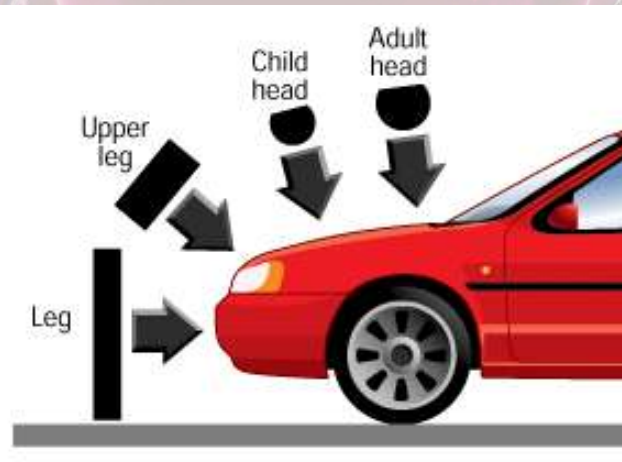


ISOFIX & Upper tether to easily secure Child Seat to the vehicle seat

Courtesy : [www.rearfacingtoddlers.com](http://www.rearfacingtoddlers.com)

Vehicle ISOFIX bars

Courtesy : Chicco Child seat ISOFIX Attachment & Upper Tether



Vehicle hood is being designed to enhance child head protection

Courtesy : EURONCAP

# Restraint Technology- Inflatable Seat Belt



# What is an Inflatable Seat Belt?



1



2



3

## Step 1: The Belt in Everyday Use

Ford's rear inflatable seat belt functions like a standard seat belt in normal everyday use. The vehicle's crash sensing system determines when the inflatable belt should deploy.

## Step 2: Belt Inflates During Crash

Each belt's tubular air bag inflates with cold compressed gas that flows through a specially designed buckle from a cylinder housed below the seat.

## Step 3: Belt Fully Inflated

After the belt's accordion-folded air bag breaks through the belt fabric, it fills with air, expanding across the occupant's body.

# Why Inflatable Seat Belts?

- We have been looking for ways to improve protection in rear seats
- Cannot package airbag in the back of the front seat
- Movable front and rear seats will result in airbag firing and coverage issues
- Challenges with putting traditional airbags in rear seats:
  - Rear seat occupants are largely children
  - Parents are told to place children in rear seats to eliminate exposure to airbags



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## Inflatable Seat Belts "Inflator Sequence"

# Rear Seat Passenger Animation



# Performance Assessment

## Partial List of Test Conditions Assessed

<b>Dynamic Tests*</b>	<b>Quasi-Static Tests</b>
FMVSS 208 Frontal Sled	Dog Chew
- IB v Std Belt	Holes in Belt
- No Fire	Belt Twist
FMVSS 201 Side Pole	Door Jamb Slam
Frontal NCAP	Sleeping w/Head on Belt
IIHS Side Impact MDB	Belt Under Arm
Child Seats	Infant & Child Seats
	Noise Assessment
* Various tests w/H3-6C, 5F, 50M, 95M	Key Life Cycle

# Sleeping Child Posture

- Study with a) Modified dummy neck and b) Very small adult PMHS subjects showed no issue



6-yr old dummy with modified neck

# Evaluated Following Seats



Lava

Infant Carrier



Infant carrier  
w/base



Convertible



Forward Facing Only



Combination

## Child Seat Study

- ❖ Installation manual review
- ❖ Child seat installations
- ❖ Child seat static tests
- ❖ Child seat dynamic tests

# Rear Facing Child Seat Sled Test

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T\_Overall\_Kinematics\_-\_Left  
Run #: H31900  
TA: SLD12307 Matrix: 1  
20XX\_Big Bang Passive Safety

2012-03-07 08:30

Upper left hand inset shows event in ms relative to T-zero

Ford Confidential  
GIS1 Item#: 27.60

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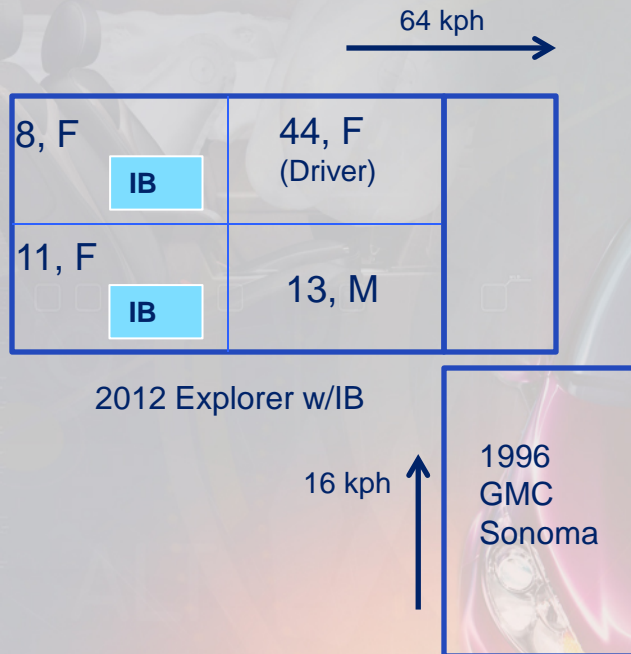
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Standard Seatbelt

Inflatable Seatbelt

# Inflatable Seatbelt Real World Events

## 2012 Explorer vs. 1996 GMC Sonoma



2012 Explorer (post-crash)



2012 Explorer (post-crash)

8-year old 2<sup>nd</sup> row left passenger (secured properly in a booster seat) and 11-year old 2<sup>nd</sup> row right passenger, restrained with inflatable seat belt, DID NOT SUSTAIN INJURY



**Thank You!!!**

**Questions ?**

