Consumer Report's Child Seat Test Methods and Findings

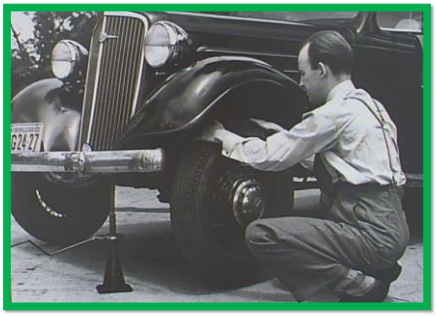
Jennifer Stockburger
March 25, 2017

Consumer Reports

Consumer Reports Auto Test Center

Consumer Reports

Automotive Testing Since 1936



Consumer Reports

Child Seat Testing Since 1972


Crash tests of car safety restraints for children

CR Consumer Reports

Three Tiered Approach

Crash Performance / Sled Test Performance

Ease-of-Use

Fit-to-Vehicle

CR Consumer Reports

Ease-of-Use Factors

- Product assembly
- Seat weight
- Harness adjustment
- LATCH connections and adjustments
- Buckle use and adjustment
- Adjusting and viewing recline angle
- Carrier connection and removal
- Handle adjustments
- Belt routing
- Transitioning: rear-forward-booster
- Storage for extra parts not used
- Seat care

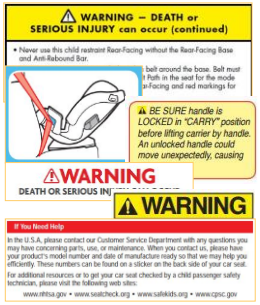
CR Consumer Reports

Labels

- Model information
- Manufacturer contact information
- Expiration date
- Harness height
- Chest clip position
- Owners manual storage
- LATCH and tether storage
- Belt paths clearly labeled
- Allowable handle positions
- Spanish labels
- Accessory use

Consumer Reports

Instructions



- Basic product use criteria
- Clear adjustment criteria
- Clear installation instructions and diagrams
- Are the labels and manual consistent with each other
- Soft goods cleaning, removal and installation
- Accessory instructions
- Availability of online instructions
- Spanish instruction
- Installation videos
- Sources for installation help

Consumer Reports

Fit-to-Vehicle Testing

- 5 vehicles (varying geometry and types).
- Installation in each unique seating position and orientation.
- ≈40 individual installations per model depending on seat type
- Current ratings = +4,000 individual installations

Consumer Reports

Vehicles Used For Fit Evaluations:

- Small sedan
- Small SUV
- Large SUV
- Family sedan
- Minivan

2008 Chevy Aveo

2008 Chrysler Town & Country

2008 Honda Accord

2008 Jeep Liberty

2009 Honda Pilot

Consumer Reports

Fit-to-Child: Boosters

- Fit-to-vehicle cars & crash test bench
- Parent/Caregiver level of assessment
- Evaluation made after dummy is moved – key to result differences

Consumer Reports

CR Child Seat Sled Test Protocol Objectives

Develop a test protocol to be more <u>REPRESENTATIVE</u> of current vehicle geometry run at a higher speed than current testing

Modifications:

1. Test Bench – Use test bench with geometry/stiffness of current vehicle seats
2. Blocker - Add front seatback surface for interaction potential
3. Crash Pulse - Update crash pulse to a 35mph pulse based on vehicle crash tests

Consumer Reports

Vehicle Seat Selection

- Targeting "average" geometry and stiffness
- CR's Vehicle Test Fleet – MY 2008-2010
  - Seatback angle
  - Seat cushion angle
  - Seat cushion length
- Cushion stiffness testing and data comparison

Vehicle Cushion Stiffness

- Will use stiffness at front of the seat (possibly more relevant for CRS bottoming out)

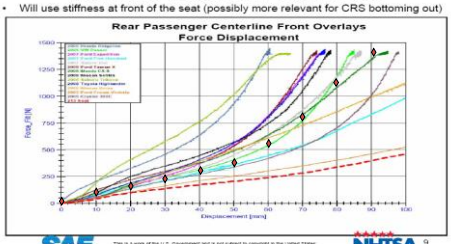
2009-2012 Ford Flex 2nd row outboard (captain's chair)

CR Consumer Reports

Vehicle Seat Selection

Vehicle Cushion Stiffness

- Will use stiffness at front of the seat (possibly more relevant for CRS bottoming out)



SAE NHTSA

CR Consumer Reports

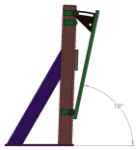
Blocker Plate Development

- Extending FMVSS 201 below the belt line
- Typical seat backs:
  - Hard plastic
  - Fabric covered frame
  - Limited padding

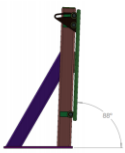
CR Consumer Reports

Blocker Plate Development

- Tested stiffness of front seatbacks from CR test vehicles
- Chose foam with average stiffness
- Video analysis for front seat movement in vehicle frontal crash tests (≈ 4 in.)
- Built-in rotational capability to blocker



Installation Setup



Pre-Test Setup

Consumer Reports

Pulse Development

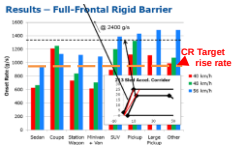
CR Pulse Characteristics

Max acceleration: 35 g

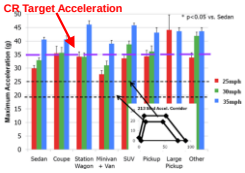
Max speed: 35 mph

Rise Rate: 950-1000 g/s

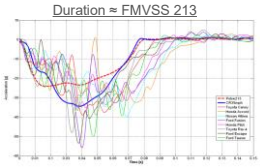
Rise Rate < 213



Max G > FMVSS 213



Duration ≈ FMVSS 213



Consumer Reports

FMVSS213 vs. CR Crash Test

Soft, thick cushion

Excursion/back angle requirement

30mph acceleration pulse

Minimum standard/compliance test / PASS or FAIL based on HIC, Chest g, Back angle and head / knee excursions

Cushion from actual vehicle

Simulated front seatback

35mph acceleration pulse

Comparative ratings for Consumers of BASIC / BETTER / BEST based on HIC, Neck forces and head contact.

Consumer Reports

Crash Performance

- Not pass/fail test
- Comparative ratings of relative performance

Basic – Better – Best

- Note: We consider all seats that get a BASIC rating to be safe

- Scores based on:
  - Statistical analysis
    - Head injury criteria (HIC 15)
    - Upper Neck Axial Force (+Fz, -Fz)
  - Head contact to blocker
  - Structural integrity → could assign a model to "Basic"

Consumer Reports

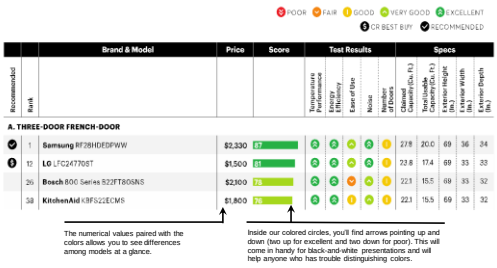
New ratings (Ease-of-Use / Fit-to-Vehicle):

Officially launched September 2016 online and in November issue of Consumer Reports Magazine.

Ratings colors are designed to be more universally intuitive:
Green = GO / Red = STOP

Consumer Reports

How to use the new ratings



The numerical values paired with the colors allows you to see differences among models at a glance.

Inside our colored circles, you'll find arrows pointing up and down (two up for excellent and two down for poor). This will come in handy for black-and-white presentations and will help anyone who has trouble distinguishing colors.

Consumer Reports

Head Contact: Rear-facing Only vs. Convertibles

- Our tests showed greater frequency of head contact with 12 month dummy in rear-facing infant seat than with rear-facing convertible
  - Infant seats: 16 of 30 tested models (excludes those with structural issues)
  - Rear-facing convertible seats: 1 of 23 tested models

Infant Seat Convertible Seat

- **New advice**: **Switch to rear-facing convertible no later than 1st birthday**

Consumer Reports

Head Contact: Rear-facing Only vs. Convertibles

Consumer Reports

Crash Protection Benefit: Load Leg

Consumer Reports:

- 4 infant seats rated "BEST" for crash protection
- Reduced head injury risk by 46% compared to seats without load leg (CR crash testing)

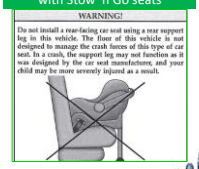
Government Limitation:

- Seats need to comply without using load leg → 213 sled lacks a floor

Industry Limitation:

- Can't use load leg in some vehicles → floors with hatches can't withstand additional forces

2017 Chrysler Pacifica with Stow 'n Go seats



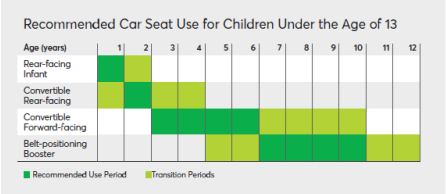
WARNING!

Do not install a rear-facing car seat using a rear support leg in this vehicle. The floor of this vehicle is not designed to manage the crash forces of this type of car seat. In a crash, the support leg may not function as it was designed by the car seat manufacturer, and your child may be more severely injured as a result.

Consumer Reports

CR's Child Seat Timeline

- Our updated Real Child Seat Timeline reflects the recommendation to switch from infant seat to rear-facing convertible seat no later than 1st birthday



Consumer Reports