

**2014 SESPTC**

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**Passenger Restraints – Proper Use of Car Seats**

PRESENTED BY CHARLEY KENNINGTON  
JUNE 29, 2014

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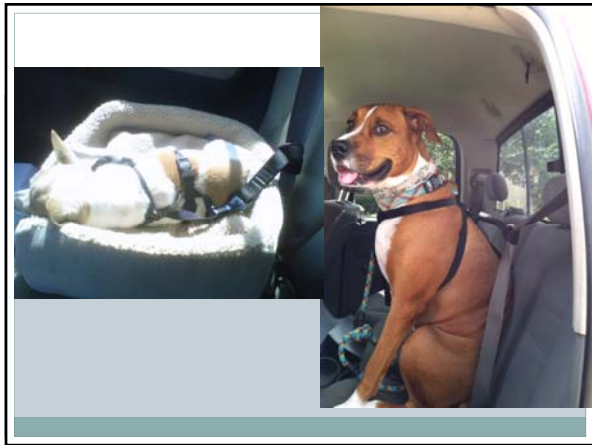
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**Occupant Protection Systems**

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- Occupant protection reduces the crash forces affecting a child passenger
- Three collisions in a crash
  - Vehicle
  - Human
  - Internal

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### Occupant Protection Systems

- Occupant protection works by:
  - Holding occupants in place
  - Spreading crash forces over a wide part of body
  - Spreading crash forces over strongest parts of body
  - Allowing body to "ride down" crash
  - Protecting head and spinal cord

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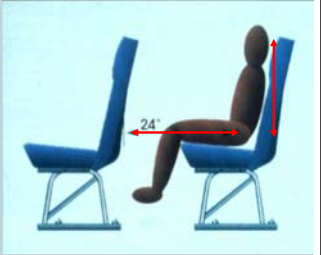
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### Compartmentalization

- Protective envelope with 2 features:
  - Closely spaced seats
  - Seat backs that are:
    - High
    - Flexible
    - Energy-absorbing



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### FMVSS

<ul style="list-style-type: none"><li>• Federal Motor Vehicle Safety Standards</li></ul>	<ul style="list-style-type: none"><li>• 208</li><li>• 209</li><li>• 210</li><li>• 213</li><li>• 222</li><li>• 225</li></ul>
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### FMVSS 208

- **Seat belts are required:**
  - In ALL seating positions of small buses
  - For drivers only in large school buses

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### FMVSS 209

- **If a school bus didn't come from the factory equipped with lap belts and it now has lap belts, make sure that:**
  - Lap belts were installed according to the manufacturer's instructions
  - Retrofitted equipment is certified to meet FMVSS 209

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### Loops versus anchor attachments



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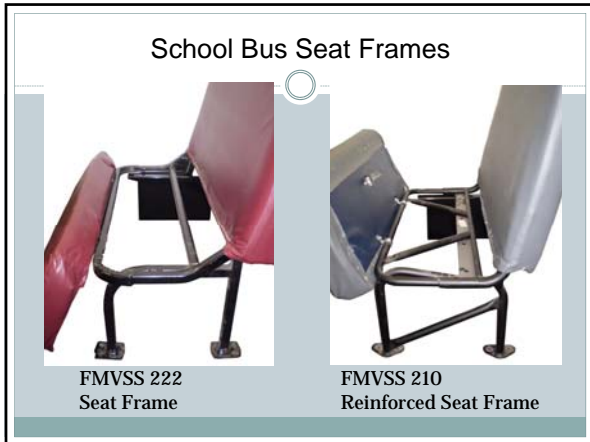
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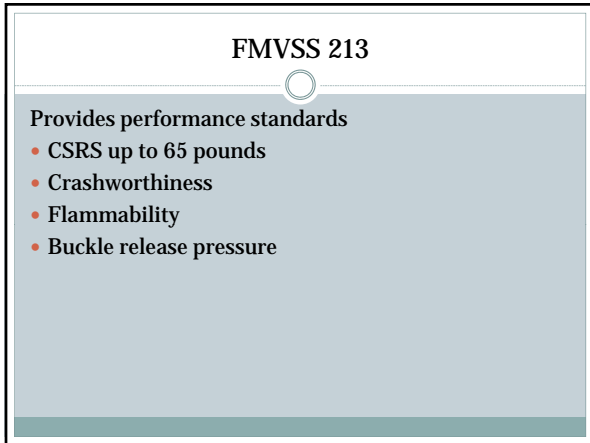
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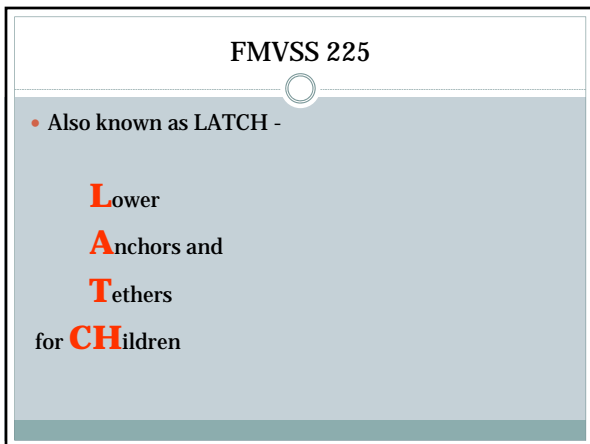
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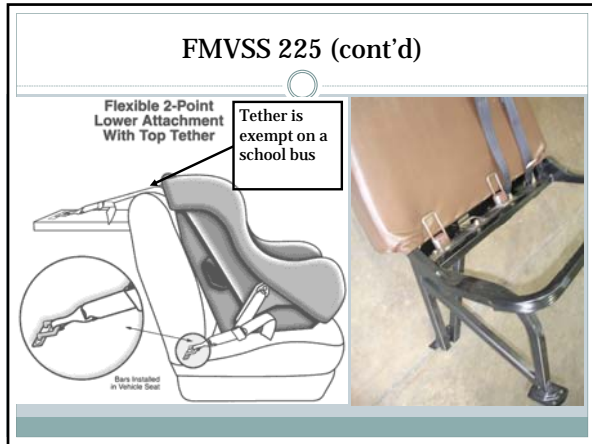
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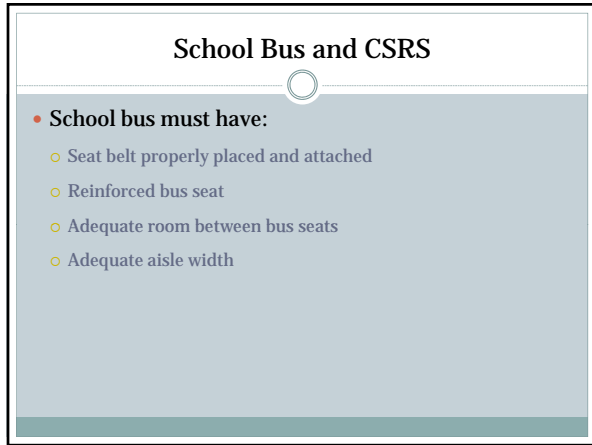
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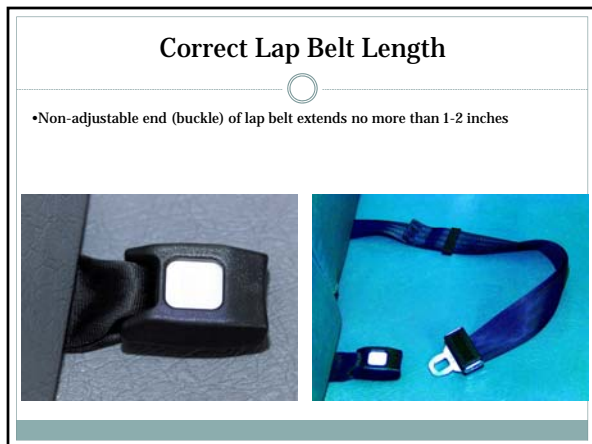
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### Correct Lap Belt Position

- Non-adjustable end of lap belt at aisle or at center



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### Before Selecting a CSRS, You Need to Know...

- Child's weight, height, and age
- Physical, developmental, and behavioral considerations of all the children on the school bus
- Types of CSRS available
- Who else will ride in the school bus?
- It is important to have all the correct information!

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### Types of Child Restraints

- Infant only
- Convertible (rear facing, forward facing)
- Forward Facing only with harness/Combination FF
- Booster (belt positioning)
- Special Needs Seats
- Seat Belts
- Add-on School Bus Specific Seats
- Safety Vests
- Integrated School Bus Seats

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### What is the "Best" Child Safety Restraint Systems?

- Correct for child's
  - Age
  - Height
  - Weight
  - Physical development
- Fits the school bus seat
- Easy to use
- Comfortable for child
- Meets FMVSS 213
- Instructions available
- Recall status known
- Date of manufacture

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### When Do You Use a Rear Facing Seat or Forward-Facing Seat?

At a minimum:

- Child is at least 1 year of age **and** at least 20 pounds
- AAP says children should remain rear facing to the highest allowed rear-facing weight of the CSRS



VIDEO



VIDEO

12 month old – rear and front-facing  
Courtesy MGA Research

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### Why Children Should Travel Rear-facing

- Increased crash protection
- Spreads crash forces along the entire head, neck, and back
- Protects head, neck, and spinal cord
- CSRS absorbs forces of the crash

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### Rear-Facing Infant-Only CSRS

- This CSRS is rear facing only
- Use rear-facing CSRS to the highest weight or height allowed by the manufacturer's instructions
- Note head should be 1 inch below the top of the shell
- Use in semi-reclined position
- Use harness straps at or below shoulder level



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### Selection – Easy to Use

- Front versus back harness adjustment
- Seat belt versus lower anchors



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### Rear-Facing Harness Adjusters



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### Location

- CSRS should be placed in the front seats of a school bus
- 1<sup>st</sup> installation on a school bus seat should be by the window
- Consider needs of other passengers
- Choose seat belt or lower anchor system (Do not use both)
- Never in front of an emergency exit

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### Installation – Rear Facing Basics

- Correct belt path
- Appropriate recline angle
- Tighten and locked in place
  - Using seat belt or
  - Using lower anchors
  - (Do not use both)

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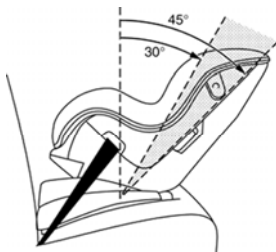
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### Installation – Angle



- The driver should use angle given in CSRS manufacturer's instructions (30 to 45 degrees)
- CSRS spreads crash forces along the entire head, neck, and back
- Correct position helps keep airway open
- CSRS may be moved more upright as child grows & ages

Courtesy of Kathleen Weber  
Child Passenger Protection Research Program  
University of Michigan Medical School

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### Pinch Test



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### Demonstrate Installation

- Rear Facing Seat
- Convertible Seat Rear Facing

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### Forward-Facing Convertible Seat

Forward-facing:

- CSRS in upright position
- Use the correct belt path
- Some manufacturers allow a semi-reclined position



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### Installation Errors - Wrong Belt Path



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### Selection: Types of Harnesses Forward-Facing CSRS

- Forward-facing convertible CSRS
- Combination seat with harness
- Forward-facing-only CSRS
- Large medical seats/vests

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### Forward-Facing Convertible Seat

Forward-facing:

- CSRS in upright position
- CSRS does not move side to side more than one inch
- Harness at or above the shoulders
- Harness clip at arm pit level
- Harnesses tight



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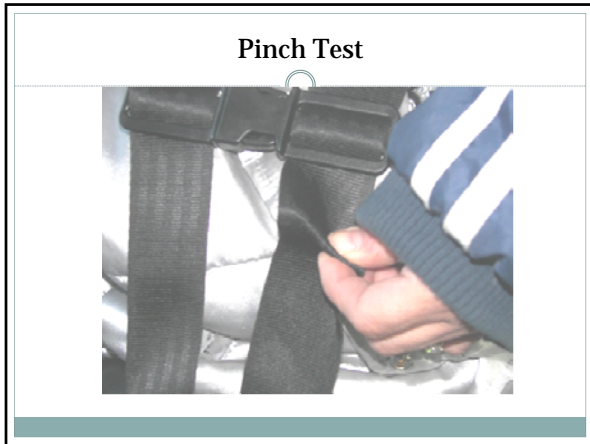
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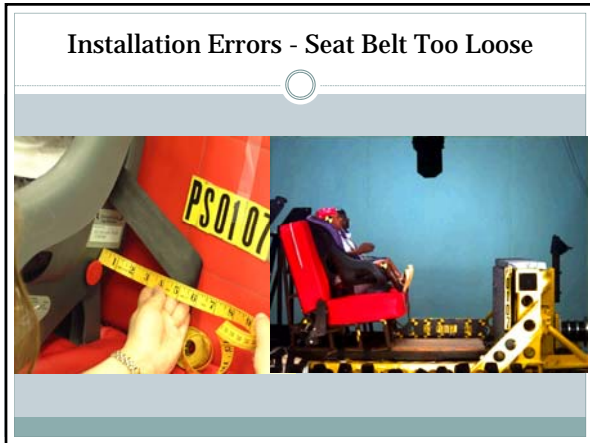
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### Identify Reinforced Harness Slots

**Harness:**

- Some CSRS must use top slots when turned to face forward
- Reinforcement is not always visible



Only top harness slot is reinforced



Top two harness slots are reinforced

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### Harnessing Errors - Wrong Slots



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### Harnessing Errors - Wrong Slots

- Frontal impact 38 mph into tree
- 16-month old secured FF in rear-center seat
- Harness in lowest slots contributed to injury severity
- Spinal cord injury resulting in quadraplegia



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### Combination CSRS

- Forward facing only
- Multipurpose
- Follow weight limit for internal harness (refer to CSRS instructions)
- Choose harness slot at or above shoulders



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### Harness Adjustments

- Child's back and bottom flat in CSRS
- Correct harness slots and crotch strap slot
- Harness snug (pinch test)
- Retainer clip at armpit level
- Use to highest weight and height limits



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### Pinch Test



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### Harnessing Errors - Harness Straps Too Loose



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### Location: Other Factors in School Buses

- Position of other occupants
- Width of bus seat
- Size of CSRS
- Seat belt or LATCH system
- Emergency exits



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### Booster Seats



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### Special Considerations



22-105 pounds and 56 inches or less



22-102 pounds and 36-60 inches



65-130 pounds and 54-66 inches

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### Tethering Special Seats

- Follow the manufacturer instructions regarding when to tether special seats.



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### Special Considerations: Casts and Other Conditions

- Follow weight limits using casted weight
- Specialized CSRS for children



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### Seat Belt or Lower Anchors

- Tightly securing the CSRS
- Install tightly using seat belt or lower anchor system
- Grip CSRS at belt path to check
- Keep in mind that CSRS should not move forward or side-to-side more than 1 inch



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### Demonstrate Installation

- Convertible Seat Forward Facing
  - Combination Seat

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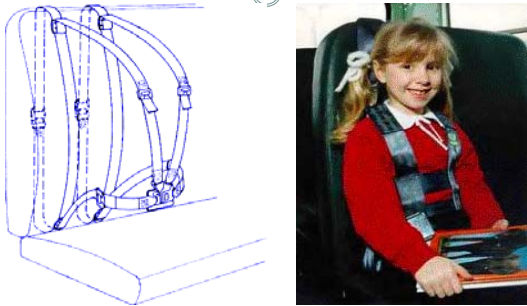
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### Safety Vest



The diagram shows a blue safety vest with multiple straps and buckles. To the right, a photograph shows a young girl with blonde hair wearing a similar safety vest over a red shirt, sitting in a school bus seat.

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### Reasons for Using a Safety Vest

- Child is too big for a CSRS (must be at least 20 lbs.)
- No lap belts available on school bus; no other school bus available
- Behavioral problems or when a child's actions cause safety concerns.
- Child needs positioning assistance
- Other medical problems

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**Safety Vest**

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- **Entire seat directly behind must be unoccupied or have restrained occupants**
  - *Restrained means any form of restraint IE: lap belt, lap/shoulder belt, car seat, safety vest, or add-on seat*

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**Demonstrate Installation**

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- **Safety Vest**

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**Add-On School Bus Specific Seat**

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- A 5 point restraint system that is added onto a school bus seat and attached by means of a cam wrap technology
- Can be used on a non FMVSS 210 bus seat
- Entire seat directly behind must be unoccupied or have restrained occupants

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## Securing Students in STAR Restraint



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## Pro Tech II & III



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## Demonstrate Installation

- STAR
- BESI Pro Tech III

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## Integrated Seat

- Forward-facing CSRS with a 5-point harness built into the bus seat



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## After a Crash

- CSRS, seat belts, and air bags are in most cases, made to withstand one crash
- CSRS replacement is not always required:
  - Review NHTSA criteria for assessing crash severity and CSRS replacement
  - Check with CSRS manufacturer for guidelines to replace the product

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## QUESTIONS?

THANK YOU!

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713-744-4495

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