GRSP Informal Working Group on Child safety
Paris Meeting, 25th November 2008

CRS Classification
Introduction

- Informal Working Group on Child restraint Systems of WP29 considers to change the classification of CRS

- When thinking of classification it seems to be crucial to rethink reasons for the mandatory use of CRS
Why Using a CRS

- Size
- Child CoG
- Vulnerability of neck
- Vulnerability of abdomen
Size

- Belt fit especially at
  - neck
  - abdomen

- Depending on seating height
- Child centre of gravity does not necessarily match with three-point-belt load path
  - risk of ejection
- Depending on ???
  - age??
  - stature?
  - seating height

[Snyder, 1975]
Vulnerability of Neck

• High relative head mass in babies
• Lower protection by muscles
• High risk of neck injuries for babies
• Depending on age?
Comparison injured children in cars in Sweden and Germany 1999

Percentage of the population

Age in years

Schweden 1999  Deutschland 1999
More Recent Data Germany

2004-2006

age [years]
Vulnerability of Abdomen

- Less protection in younger children
- Development of iliac crest until puberty
- Depending on age?
- Relevant for classification?
  - Main issue is upper limit of largest group
Who needs which Protection

• Babies:
  • protection of neck

• Young children:
  • protection of abdomen and
  • protection against ejection

• Older children:
  • protection of abdomen (less important for classification as already covered by the mandatory limit for CRS use)
  • protection against ejection
  • protection against wrong belt fit
<table>
<thead>
<tr>
<th></th>
<th>ECE R44</th>
<th>NL Proposal</th>
<th>Q-Dummies</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>FF not allowed</strong></td>
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<tr>
<td>(&lt; 9 kg)</td>
<td>(&lt; 9 kg)</td>
<td>(&lt; 9.5 kg)</td>
<td>Q1:</td>
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<tr>
<td>(&lt; 75 cm)</td>
<td>(&lt; 75 cm)</td>
<td>(&lt; 74 cm)</td>
<td>9.6 kg,</td>
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<td></td>
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<td>74 cm</td>
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<td><strong>ISOFIX / harness system</strong></td>
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<td>(&lt; 18 kg)</td>
<td>(&lt; 18 kg)</td>
<td>(&lt; 14.5 kg)</td>
<td>Q3:</td>
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<tr>
<td>(&lt; 108 cm)</td>
<td>(&lt; 108 cm)</td>
<td>(&lt; 98 cm)</td>
<td>14.6 kg,</td>
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<td></td>
<td></td>
<td></td>
<td>98.5 cm</td>
</tr>
<tr>
<td><strong>“0+“</strong></td>
<td>&lt; 13 kg</td>
<td>(&lt; 11 kg)</td>
<td>Q0:</td>
</tr>
<tr>
<td>(&lt; 91,5 cm)</td>
<td>(&lt; 91,5 cm)</td>
<td>50 – 80 cm</td>
<td>3.4 kg,</td>
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<td>11 kg,</td>
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<td>80 cm</td>
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<td><strong>“I“</strong></td>
<td>9 – 18 kg</td>
<td>(9.5 – 14.5 kg)</td>
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Discussion of NL Proposal

• Why minimum size for 50 – 74?
  • Are children being smaller than 50 cm not allowed to travel in cars?
  • 5th percentile new born 46 cm

• Maximum size 140 cm
  • 2003/20/EC needs to be revised or proposal needs to be adopted to 150 cm

• Why classification for “0+” smaller than in ECE R44?
  • One of the major problems is early change from RF to FF
  • Limitations for size of baby shell within ECE R44
    – belt length in combination with
    – chest Z acceleration
    – Dashboard contact
  • Limitations not necessarily valid for new regulation
    – ISOFIX
    – new dummies

• Why ISOFIX and integral smaller than in ECE R44?
  • Original goal was different
German Proposal

- Most important goal is to have later change from RF to FF compared to today
  - 18 months should be acceptable
  - Overlap between RF and FF class must be as small as possible

- Classification according stature not optimal
  - for structural issues weight is most important

- Two options to deal with stature as classification system and weight limitations
  - definition of stature and maximum weight
    - more complicated than current situation
  - definition of stature taking into account the maximum weight
    - definition of maximum stature according to 95\textsuperscript{th} percentile prevents from late change to the next CRS class

- Both options show considerable short comings
German Proposal

- Although weight seems to be best option the current discussion seems not to allow a classification according weight
- Classification according dummy sizes seems not to be best option
  - Dummies should behave like children and not children like dummies
  - If classification different from dummy sizes => additional geometry check of CRS necessary
- Figures should allow easy handling (e.g. 100 cm better than 98 cm)
- Largest FF class to allow backless boosters for accommodating “oversized” children and to overcome car fit problems
German Proposal

- Definition of stature taking into account maximum weight
- Example ISOFIX
  - Today's ISOFIX anchorages are designed for 22 kg child
  - 95th percentile 22 kg child: stature limit 107 cm
  - Stature of 107 cm reached at 18 kg for 50th percentile
  - Stature of 107 cm reached at 14 kg for 5th percentile
Birth Stature

STANDARDS FOR INTRAUTERINE GROWTH BY GESTATIONAL AGE

Birth weight (g)

Length (cm)

Gestational age (weeks)

http://www.meadjohnson.com/professional/newsletters/ppv4n2a.html
<table>
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<tr>
<td>50-74**+</td>
<td>40-80**+</td>
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<tr>
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<td>75-90**+</td>
</tr>
<tr>
<td>74-98+</td>
<td>85-105+</td>
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<tr>
<td>98-114</td>
<td>100-130</td>
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<tr>
<td>114-140</td>
<td>130-150~</td>
</tr>
<tr>
<td>* not FF</td>
<td>~ without lateral impact requirements</td>
</tr>
<tr>
<td>+ ISOFIX</td>
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</table>
German Proposal

- Proposal does not fit with dummy properties
  - geometrical dimensions
  - weight

- However, check of limits necessary
  - Modified dummies?
  - Definition of geometrical requirements?
  - Additional load?