CHILD SEAT AND RESTRAINT SYSTEMS
TEST RESULTS

APPENDIX D

THE UNIVERSITY OF MICHIGAN
HIGHWAY SAFETY RESEARCH INSTITUTE
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ANN ARBOR, MICHIGAN 48105

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NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION
WASHINGTON, D.C. 20591
This report contains the data records obtained in a test program studying the safety performance of child car seats and restraint systems. Included with each test result is an HSRI Summary Data Sheet, a copy of an oscillographic record of transducer data, and high speed photographic documentation of occupant kinematics. In cases where the oscillographic record or the photographic documentation is missing, the data was not obtained.
<table>
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<th>Pages</th>
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<td>250-374</td>
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</tbody>
</table>
Test No: A-131
Test Date: 5 August 1969
Restraint Code No: C-14
Restraint Description: International Seat No. 4613

Dummy: 3 year
Sled Velocity: 30 mph
Sled G-level: 18
Impact Direction: Rear-end
Dummy Attitude: Sitting

Test Observation:

The g-loadings experienced by the dummy were moderate. However, the height of the child seat back coincided exactly with the height of the adult seat back. Because there was no headrest on the adult seat, severe whiplash was encountered by the dummy.
HSRI SUMMARY DATA SHEET (FH-11-6962)

<table>
<thead>
<tr>
<th>Test No:</th>
<th>A-132</th>
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</thead>
<tbody>
<tr>
<td>Test Date:</td>
<td>6 August 1969</td>
</tr>
<tr>
<td>Restraint Code No.:</td>
<td>C-16</td>
</tr>
<tr>
<td>Restraint Description:</td>
<td>Klippan Safety Seat</td>
</tr>
</tbody>
</table>

| Dummy:       | 3 year         |
| Sled Velocity: | 30 mph        |
| Sled G-level:  | 18             |
| Impact Direction: | Rear-end     |
| Dummy Attitude: | Sitting       |

Test Observation:
The dummy appeared to receive a very gentle ride and the restraint system performed well.
Test No: A-133
Test Date: 6 August 1969
Restraint Code No.: C-3
Restraint Description: General Motors Standard Seat

Dummy: 3 year
Sled Velocity: 30 mph
Sled G-level: 18
Impact Direction: Rear-end
Dummy Attitude: Sitting

Test Observation:
The dummy received quite high loadings especially in the chest superior-inferior accelerometer. Because the height of the child seat and the height of the adult seat were similar the dummy received a very severe whiplash of the neck. Moderate rebound was observed.
Test No: A-134
Test Date: 7 August 1969
Restraint Code No.: C-5
Restraint Description: Sears Seat No. 5516

Dummy: 3 year
Sled Velocity: 30 mph
Sled G-level: 18
Impact Direction: Rear-end
Dummy Attitude: Sitting

Test Observation:
The loadings experienced by the dummy in this test were quite gentle. However, because of the seat height problem severe whiplash was again observed.
HSRI SUMMARY DATA SHEET (FH-11-6962)

Test No: A-135
Test Date: 7 August 1969
Restraint Code No.: C-5
Restraint Description: Sears Seat No. 5515

Dummy: 3 year
Sled Velocity: 30 mph
Sled G-level: 18
Impact Direction: Rear-end
Dummy Attitude: Sitting

Test Observation:
The loadings experienced by the dummy were quite gentle. However, severe whiplash was again observed.
Test No: A-136
Test Date: 7 August 1969
Restraint Code No.: C-1
Restraint Description: Ford Tot-Guard

Dummy: 3 year
Sled Velocity: 30 mph
Sled G-level: 18
Impact Direction: Rear-end
Dummy Attitude: Sitting

Test Observation:

The dummy received moderately high chest and head anterior-posterior accelerations, but the motion experienced was minimum. The upper part of the Tot-Guard appeared to rotate upward during the deceleration pinning the dummy's head between the front piece and the adult seat.
HSRI SUMMARY DATA SHEET (FH-11-6962)

<table>
<thead>
<tr>
<th>Test No:</th>
<th>A-137</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test Date:</td>
<td>7 August 1969</td>
</tr>
<tr>
<td>Restraint Code No.:</td>
<td>C-31</td>
</tr>
<tr>
<td>Restraint Description:</td>
<td>Sears Auto Harness, small</td>
</tr>
</tbody>
</table>

| Dummy:        | 3 year     |
| Sled Velocity: | 30 mph     |
| Sled G-level:  | 18         |
| Impact Direction: | Rear-end   |
| Dummy Attitude: | Sitting    |

Test Observation:

The dummy appeared to receive a gentle ride in this test. However, the dummy's legs became spread-eagled and rotated upwards toward the seat back causing flexure of the lower spine.
<table>
<thead>
<tr>
<th>Test No:</th>
<th>A-138</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test Date:</td>
<td>8 August 1969</td>
</tr>
<tr>
<td>Restraint Code No.:</td>
<td>C-14</td>
</tr>
<tr>
<td>Restraint Description:</td>
<td>International Seat No. 4613</td>
</tr>
<tr>
<td>Dummy:</td>
<td>3 year</td>
</tr>
<tr>
<td>Sled Velocity:</td>
<td>20 mph</td>
</tr>
<tr>
<td>Sled G-level:</td>
<td>18</td>
</tr>
<tr>
<td>Impact Direction:</td>
<td>Side impact</td>
</tr>
<tr>
<td>Dummy Attitude:</td>
<td>Sitting</td>
</tr>
</tbody>
</table>

**Test Observation:**

The deceleration loadings experienced by the dummy were quite low. However, there was considerable side flexing over the hand bar and the excursion experienced by the dummy was sufficient to allow contact with any side members which would be adjacent to the seat. The seat was badly deformed. The rear frame upright members were badly bent and the plastic shell was deformed.
HSRI SUMMARY DATA SHEET (FH-11-6962)

Test No: A-139
Test Date: 8 August 1969
Restraint Code No: C-19
Restraint Description: Strolee Seat No. 589

Dummy: 3 year
Sled Velocity: 20 mph
Sled G-level: 18
Impact Direction: Side impact
Dummy Attitude: Sitting

Test Observation:

The dummy received a fairly gentle deceleration in this test. However, the excursion was large enough to ensure contact with any side structures which would be present in an automobile interior. The child seat was badly deformed. The tubular frame collapsed sideways and the lower left seat retaining strap tore at the buckle. The headrest jumped out of its sockets.
HSRI SUMMARY DATA SHEET (FH-11-6962)

Test No: A-140
Test Date: 11 August 1969
Restraint Code No.: C-31
Restraint Description: Sears Auto Harness, small

Dummy: 3 years
Sled Velocity: 20 mph
Sled G-level: 18
Impact Direction: Side Impact
Dummy Attitude: Sitting

Test Observation:

Accelerometer readings were moderate. However, excursion was large enough to ensure contact with any side structures of the vehicle interior. No damage was apparent to the restraint system except that the straps over the shoulders slipped in their buckle.
HSRI SUMMARY DATA SHEET (FH-11-6962)

Test No: A-141
Test Date: 11 August 1969
Restraint Code No.: C-31
Restraint Description: Sears Auto Harness, small

Dummy: 3 year
Sled Velocity: 20 mph
Sled G-level: 18
Impact Direction: Side facing
Dummy Attitude: Sitting

Test Observation:
The dummy received moderate acceleration loadings in this test. The excursion was large enough to ensure contact with any vehicle side structures adjacent to the seat.
Test No: A-142
Test Date: 11 August 1969
Restraint Code No: C-16
Restraint Description: Klippan Safety Seat

Dummy: 3 year
Sled Velocity: 20 mph
Sled G-level: 18
Impact Direction: Side Impact
Dummy Attitude: Sitting

Test Observation:
The seat failed, causing both the dummy and the seat to be ejected from the adult seat. The special integral retaining strap on the left side of the Klippan Safety Seat ripped completely out of the shell.
<table>
<thead>
<tr>
<th>Test No:</th>
<th>A-143</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test Date:</td>
<td>12 August 1969</td>
</tr>
<tr>
<td>Restraint Code No.:</td>
<td>C-26</td>
</tr>
<tr>
<td>Restraint Description:</td>
<td>K L Jeenay Child Safety Seat</td>
</tr>
<tr>
<td>Dummy:</td>
<td>3 years</td>
</tr>
<tr>
<td>Sled Velocity:</td>
<td>20 mph</td>
</tr>
<tr>
<td>Sled G-level:</td>
<td>18</td>
</tr>
<tr>
<td>Impact Direction:</td>
<td>Side impact</td>
</tr>
<tr>
<td>Dummy Attitude:</td>
<td>Sitting</td>
</tr>
</tbody>
</table>

Test Observation:

The loadings experienced by the dummy were quite gentle. No excessive excursion was observed, indicating that there was only slight danger of contact with interior structures in the automobile. This seat maintained its integrity in side impact very well.
Test No: A-144
Test Date: 12 August 1969
Restraint Code No.: C-22
Restraint Description: Hamilton Cosco Go-Seat

Dummy: 3 year
Sled Velocity: 20 mph
Sled G-level: 18
Impact Direction: Side impact
Dummy Attitude: Sitting

Test Observation:
The metal structure supporting this pedestal seat was observed to dig deep into the adult seat cushion, causing the dummy to pitch to the side violently, ensuring contact with any adjacent interior structures. High accelerometer readings were observed.
<table>
<thead>
<tr>
<th>Test No:</th>
<th>A-145</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test Date:</td>
<td>12 August 1969</td>
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<tr>
<td>Restraint Code No.:</td>
<td>C-28</td>
</tr>
<tr>
<td>Restraint Description:</td>
<td>Kelly Kiddy Kaddy</td>
</tr>
<tr>
<td>Dummy:</td>
<td>3 years</td>
</tr>
<tr>
<td>Sled Velocity:</td>
<td>20 mph</td>
</tr>
<tr>
<td>Sled G-level:</td>
<td>18</td>
</tr>
<tr>
<td>Impact Direction:</td>
<td>Side impact</td>
</tr>
<tr>
<td>Dummy Attitude:</td>
<td>Sitting</td>
</tr>
</tbody>
</table>

Test Observation:

This pedestal type seat was observed to dig deeply into the cushion of the adult seat. This caused the dummy to flex at the waist so severely that the head bent downwards to a level equivalent to the floorboard of the simulated model. Contact with any adjacent interior structures would be ensured.
Test No: A-146  
Test Date: 13 August 1969  
Restraint Code No.: C-35  
Restraint Description: American Motors Harness No. 8992185

Dummy: 3 year  
Sled Velocity: 20 mph  
Sled G-level: 18  
Impact Direction: Side impact  
Dummy Attitude: Sitting

Test Observation:
The loads experienced by the dummy in this test were moderate. However, the restraint system slid sideways allowing the dummy to move sufficiently far to the side to contact any vehicle structures adjacent to the seat location. No damage to the restraint system was observed, but the button snap on the vest strap, which is independent of the harness, came unsnapped.
Test No: A-147
Test Date: 13 August 1969
Restraint Code No.: C-35
Restraint Description: American Motors Harness No. 8992185

Dummy: 3 year
Sled Velocity: 30 mph
Sled G-level: 18
Impact Direction: Side impact
Dummy Attitude: Sitting

Test Observation:
The g-loadings experienced by the dummy were quite high. Sideways motion of the dummy was sufficient enough to cause contact with any adjacent interior structures in a vehicle. The nylon mesh vest was torn where it was sewed to the upper left shoulder strap.
Test No: A-148
Test Date: 13 August 1969
Restraint Code No.: C-1
Restraint Description: Ford Tot-Guard

Dummy: 3 year
Sled Velocity: 30 mph
Sled G-level: 18
Impact Direction: Side impact
Dummy Attitude: Sitting

Test Observation:
Superior-inferior accelerometer readings in both the head and the chest were fairly high. The dummy torso and head bent sideways over the low support structure at the side of the Tot-Guard. Contact with the vehicle interior side structures is likely.
Test No: A-149
Test Date: 13 August 1969
Restraint Code No.: C-6
Restraint Description: George B. Walker Safety Seat

- Dummy: 3 year
- Sled Velocity: 30 mph
- Sled G-level: 18
- Impact Direction: Side Impact
- Dummy Attitude: Sitting

Test Observation:
The rear seat retaining strap which anchors the ball hooks to the floor parted at the intersection of the Y. Thus, the dummy and the seat were both ejected from the adult seat. The restraint system would have offered no protection whatsoever in this situation.
Test No: A-150
Test Date: 13 August 1969
Restraint Code No.: C-23
Restraint Description: Volvo Child Safety Seat

Dummy: 3 year
Sled Velocity: 30 mph
Sled G-level: 18
Impact Direction: Side impact
Dummy Attitude: Sitting

Test Observation:
The g-loadings experienced by the dummy in this test were moderate. The side structures of this restraint system would have prevented the dummy from contacting vehicle interior structures. In addition to this, no gross relative motion between the head and the torso took place. The side structure of this seat was somewhat bent outward in this test. This is the only seat observed in this test series which offered a substantial degree of protection in side impact.
Test No: A-151
Test Date: 14 August 1969
Restraint Code No.: C-31
Restraint Description: Sears Auto Harness, small

Dummy: 3 year
Sled Velocity: 20 mph
Sled G-level: 18
Impact Direction: Side impact
Dummy Attitude: Standing

Test Observation:
The dummy went through rather wild contortions during this test. The right arm was broken off. Because the restraint system slid to the side, the dummy would have contacted any adjacent vehicle structures.
Test No: A-152
Test Date: 15 August 1969
Restraint Code No.: C-1
Restraint Description: Ford Tot-Guard

Dummy: 3 year
Sled Velocity: 20 mph
Sled G-level: 18
Impact Direction: 45° oblique
Dummy Attitude: Sitting

Test Observation:
The g-loadings experienced by the dummy were moderate and the motion experienced was minimal. Rebound was quite severe.
Test No: A-153
Test Date: 15 August 1969
Restraint Code No.: C-3
Restraint Description: General Motors Standard Seat

Dummy: 3 year
Sled Velocity: 20 mph
Sled G-level: 18
Impact Direction: 45° oblique
Dummy Attitude: Sitting

Test Observation:
The loadings received by the dummy were quite high, especially in the head superior-inferior accelerometer. As is usual with this pedestal type seat, it was observed to dig into the seat cushion structure of the adult seat. The upper part of the upper torso of the dummy and the head pitched forward over the chest restraining strap.
Test No: A-154
Test Date: 17 August 1969
Restraint Code No.: C-17
Restraint Description: Strolee Seat No. 509

Dummy: 3 year
Sled Velocity: 20 mph
Sled G-level: 18
Impact Direction: 45° oblique
Dummy Attitude: Sitting

Test Observation:
The failure of the left bail hook allowed the dummy and the child seat to cartwheel sideways off the adult seat. This would have resulted in impacting the inside of the car. NOTE: Instructions with the seat recommended use of the adult lap belt across the seat behind the dummy's buttock to help restrain the seat. This was not done in this test.
HSRI SUMMARY DATA SHEET (FH-11-6962)

Test No: A-155
Test Date: 17 August 1969
Restraint Code No.: C-20
Restraint Description: Bunny-Bear Seat No. T8905H

Dummy: 3 year
Sled Velocity: 20 mph
Sled G-level: 18
Impact Direction: 45° oblique
Dummy Attitude: Sitting

Test Observation:
The dummy experienced very low g-levels, apparently due to the gradual collapse of the seat. The tubular frame structure of the seat collapsed completely. The seat and dummy were partially off the seat after the test. The excursions appeared to be very large.
HSRI SUMMARY DATA SHEET (FH-11-6962)

Test No: A-156
Test Date: 17 August 1969
Restraint Code No.: C-17
Restraint Description: Strolee Seat No. 509

Dummy: 3 year
Sled Velocity: 20 mph
Sled G-level: 18
Impact Direction: 45° oblique
Dummy Attitude: Sitting

Test Observation:
The failure of the left bail hook allowed the seat and the dummy to cart-wheel sideways until the motion was arrested by the adult lap belt. Acceleration loadings of the dummy were moderate. Extreme excursions were experienced by the upper torso and head of the dummy. The left bail hook was bent nearly straight, the main vertical side tube was fractured and bent, and the crotch strap was torn between the dummy's legs.
HSRI SUMMARY DATA SHEET (FH-11-6962)

Test No: A-157
Test Date: 17 August 1969
Restraint Code No.: C-26
Restraint Description: K L Jeenay Child Safety Seat

Dummy: 3 year
Sled Velocity: 20 mph
Sled G-level: 18
Impact Direction: 45° oblique
Dummy Attitude: Sitting

Test Observation:
The acceleration loadings experienced by the dummy were moderate. The seat appeared to be too narrow for the dummy's shoulders. The seat held up well and retained its integrity. No undue excursions were observed.
HSRI SUMMARY DATA SHEET (FH-11-6962)

Test No: A-158
Test Date: 17 August 1969
Restraint Code No.: C-24
Restraint Description: Union Carbide High Back Sports Car Seat

Dummy: 3 year
Sled Velocity: 20 mph
Sled G-level: 18
Impact Direction: 45° oblique
Dummy Attitude: Sitting

Test Observation:
The left bail hook failed because of severe bending, allowing the seat to be ejected from the back of the adult seat. The dummy was also ejected. The bail was bent at the swivel joint where it enters the seat. The belly strap pulled loose from the seat at the left side where it was anchored with staples.
Test No: A-159
Test Date: 18 August 1969
Restraint Code No.: C-35
Restraint Description: American Motors Harness No. 8992185

Dummy: 3 year
Sled Velocity: 20 mph
Sled G-level: 18
Impact Direction: 45° oblique
Dummy Attitude: Sitting

Test Observation:
The restraint system slid sideways allowing the dummy to be ejected from the seat. Contact with the vehicle interior adjacent to the adult seat would have been assured.
HSRI SUMMARY DATA SHEET (FH-11-6962)

Test No: A-160
Test Date: 18 August 1969
Restraint Code No.: C-31
Restraint Description: Sears Auto Harness, small

Dummy: 3 years
Sled Velocity: 20 mph
Sled G-level: 18
Impact Direction: 45° oblique
Dummy Attitude: Sitting

Test Observation:

The g-loadings received by the dummy were moderate. The dummy moved to the right front portion of the adult seat on the initial deceleration. Upon rebound the dummy slid from the seat and contacted the sled structure violently.
Test No: A-161
Test Date: 18 August 1969
Restraint Code No.: C-25
Restraint Description: General Motors Infant Carrier

Dummy: doll
Sled Velocity: 20 mph
Sled G-level: 18
Impact Direction: 45° oblique
Dummy Attitude: Semi-reclining

Test Observation:
Restraint system appeared to perform well and no gross motions were observed.
HSRI SUMMARY DATA SHEET (FH-11-6962)

Test No: A-181
Test Date: 5 November 1969
Restraint Code No.: C-26
Restraint Description: K-L Jeenay Child Safety Seat

Dummy: 3-year
Sled Velocity: 20 mph
Sled G-level: 16
Impact Direction: Forward facing
Dummy Attitude: Sitting

Test Observation:

Dummy accelerations were moderate, except for a 48 g head A-P spike which occurred when the dummy rebounded into the seat back. Excursion was acceptable, but there was approximately 80° head flexion with respect to the upper torso.
Test No: A-182  
Test Date: 5 November 1969  
Restraint Code No.: C-26  
Restraint Description: K-L-Jeenay Child Safety Seat

Dummy: 3 year  
Sled Velocity: 30 mph  
Sled G-level: 16  
Impact Direction: Forward facing  
Dummy Attitude: Sitting

Test Observation:

Dummy acceleration levels were moderately low but of longer duration than 20 mph test #A-181. Rebound into the seat resulted in 40 g head A-P spike. Excursion was small, but was accompanied by approximately 80° head flexion with respect to torso. Some deformation of the harness grommets was observed where they were pinned. In addition, the seat shell cracked where the lower seat anchor belt bracket was riveted to the shell.