Seat Belts

ACI 8th Annual Summit on
Automotive Product Liability Litigation
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Buckles

- Inertial Unlatch
- Inadvertent Contact With Push Button
- Partial Engagement
Inertial Unlatch

- Inertial Unlatch

What is Buckle Inertial Release?

With respect to [....] whether inertial release occurs in real world accidents and whether it is an acceptable legal theory, [case law] clearly resolves that issue in favor of plaintiff.


- bottom of the vehicle
- up the buckle stalk
- to inertially actuate the buckle button
- releasing the latch plate
## Does Amplification Exist?

<table>
<thead>
<tr>
<th>Test Conditions</th>
<th>Moncrieff Drop Tests</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drop Height (in)</td>
<td>9.0 in.  34.0 in.  30.0 in.</td>
</tr>
<tr>
<td>Contact Object</td>
<td>Plywood  Plywood  Logs</td>
</tr>
<tr>
<td>Peak G (CFC600)</td>
<td></td>
</tr>
<tr>
<td>CG Resultant</td>
<td>5.3      27.2      26.9</td>
</tr>
<tr>
<td>Buckle</td>
<td>-4.3     -23.0     -14.6</td>
</tr>
<tr>
<td>CG to Buckle</td>
<td>0.81     0.85      0.54</td>
</tr>
</tbody>
</table>

**No! Acceleration at the buckle is Attenuated**
Inertial Unlatch

Plaintiff’s Impact Test

Bolt and nut artificially clamps strap to keep buckle from rotating

No web tension
Inertial Unlatch


Merely showing that similar buckles can be made to inertially unlatch in the laboratory under certain conditions is irrelevant as to whether a buckle will inertially unlatch in a rollover if the laboratory conditions are not present in (or cannot be accurately and adequately related to) a rollover.

*Hoffman, 2012 WL 3518997 at *10.*

- threshold g’s necessary to unlatch buckle in laboratory vs.

- g’s present at the buckle during the rollover accident
Inadvertent Contact

- FMVSS 208-209 Summary

- Buckle must have a single pushbutton

- Pushbutton cannot be too small

- Pushbutton cannot be too difficult to release
Inadvertent Contact

Conditions for Inadvertent Release Occupant Kinematics

- During frontal collisions, near side impacts and airborne phase of rollovers – limbs move away from buckle
Inadvertent Contact
Defendants.

5. Based on what I saw, I decided not to buckle the driver’s seat belt during my inspection. Repeated buckling and unbuckling of the subject seat belt can alter or modify the condition of the buckle from its immediate post-crash condition, causing it to operate in a manner different than on the day of the accident. This is because repeated insertion of the latch plate tongue into the buckle during post-accident examinations disturbs the sand and debris deposited in the buckle from the crash. This can have the effect of interfering with the buckling of the seat belt and ultimately produce conditions ideal for “false” or “partial” latching that were not actually present before the accident. For these reasons, further manipulation of the buckle as I have described needs to be strictly controlled and carefully monitored lest additional modification of the buckle occur and crucial information be lost.

accidents to determine causation. Before that, I worked as an engineer for General Motors
Partial Engagement

Natl Highway Traffic Safety Admin., DOT

§ 571.209

along the test line and its center directly above the point or the buckle to which the load will be applied. The buckle shall be latched, and a tensile force of 334 N shall be applied to the connected webbing during the application of the compressive force. Buckles from three seat belt assemblies shall be tested to determine compliance with paragraph S4.3(d)(3).

(e) Adjustment Force. Three seat belt assemblies shall be tested for adjustment force on the webbing at the buckles moved 200 times through the maximum possible travel against its stop with a force of 133 N ±13 N at a rate not to exceed 30 cycles per minute. The buckle shall be examined to determine compliance with the performance requirements of §4.3(g). A metal-to-metal buckle shall be examined to determine whether partial engagement is possible by means of any technique representative of actual use. If partial engagement is possible, the maximum force of separation when in such partial engagement shall be determined.

Therefore, in order to show that the [buckle] violated the federal regulations, Horton must prove that the buckle partially engages using a method representative of actual use, not under manipulated conditions.

Buckles

- **Crash Data Recorders**
  - record the state of the buckle switch
  - prior to and during the accident.

- **Buckle design more robust as vehicles last longer**

- The advent of better buckles and electronic recorders have greatly reduced the number of these claims.
Pretensioners

Buckle Pretensioner

Anchor Pretensioner

Retractor Pretensioner

Piston
Pyrotechnic Gas Generator
Tensioner Cable
Seat Belt Switch Connector
Pretensioners

Pretensioners increase the buckle’s resistance to inadvertent release

Pretensioners increase the buckle’s resistance to inertial forces
Cinching Latch Plate

Locking Tongue

Desired Performance

- Minimal slippage of webbing from lap to shoulder in a dynamic event.
- Improve restraint performance for the new US-NCAP by reducing chest deflection & femur loads.

How it is Done

- Clamp the webbing between the lock bar and a soft deformable plate.
- Spring loaded lock bar to unlock during normal driving conditions.
Load Limiters

- Minimizes belt-inflicted injury by absorbing energy
- Controlled webbing payout at a constant restraining force for predetermined force levels.
  - incorporates multiple levels of pretensioning
  - to help meet the FMVSS injury criteria.
- Multiple-event accidents
  - greater chance of “excessive” occupant excursion
Investigation

Figure 1. Post-mortem photographs of ejected/entangled occupant showing torso, arm, and abdomen injuries.

Investigation

- Marks on the Restraint

- Normal grime created by typical use of seat belt

- No plowed gouges of melted plastic