Abstract for:
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Title:
CASA Research into Automotive Child Restraints and their installation in Transport Category Aeroplanes – Phase II

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Abstract:
CASA has conducted further research into the accident performance of automotive Child Restraint Systems (CRS) in Transport Category Aeroplane seating. Continuing on from the research project of 2006-2007, CASA focused on determining the comparative performance benefits of various Automotive Child Restraint attachment methods and performing initial tests to determine design load standards and criteria for Child Restraint Lower Anchorages. Additionally, it much expanded the work of determining the effect on injury levels to adult occupants seated behind a CRS.

There were three principle aims to the research. To assess the comparative performance of ISOfix, LATCH and lapbelt restrained Automotive Child Restraint Systems in airline style seating against aircraft forward emergency landing dynamic conditions. Additionally, assessment of baseline performance of a supplementary loop restrained lap held child and a child in its own seat was conducted. Secondly, to measure loads generated in the various attachment mechanisms during those conditions. Finally, to assess the injury levels to adult occupants seated behind a child restraint system and document the variation with the different attachment methods and adult occupant size.

Results showed that most Automotive CRS will perform adequately in transport category seats without a top tether strap. ISOfix and LATCH systems perform better than lap belt restrained CRS. However, the level of occupant protection provided to the child by all CRS, no matter which attachment method, was vastly superior to contemporary systems, i.e. Lap Belt or Supplementary Loop Belt. For the Supplementary Loop Belt, evidence from tests conducted confirmed unsatisfactory interactions between the adult and the child.

A most interesting discovery was that when sitting in a CRS, overall child injury levels were reduced when an adult occupant was seated behind. It was a clear trend identified across numerous CRS types, CRS attachment methods, adult occupant sizes and injury mechanisms.

Lower Anchorage loading profiles were obtained for individual loops in 2 dimensions (horizontal and vertical) for ISOfix and LATCH attachment methods. This data provides for future standards development of Lower Anchorages in aircraft seating.

Injury assessments of adults seated behind CRS were made for ISOfix, LATCH, and lap belt CRS restraint methods. Additionally, assessment of injury to adults nursing children and for baseline data, for an adult with no CRS in front, was conducted. The injury levels to adults seated behind CRS were higher than when not seated behind a CRS, but not by a large margin. This was principally measured by head injury score, however, other injury measures reduced. Injury mechanisms not traditionally measured in aircraft certification were identified as potential hazards. The severe head rotation seen in previous testing was not repeated however, measurements indicate Upper Neck extension/compression may exceed limits. The other injury mechanism of concern was Upper Tibia bending moment, which may reach the limits of human tolerance when interacting with potential Lower Anchorage structures.

The results of this research will lead to changes in CASA's guidance material for the carriage of infants and children in aircraft in Australia.