

Abstract

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Human Factors Associated with the Certification of Airplane Passenger Seats: Seat Belt Adjustment and Release

Richard DeWeese
Biodynamics Research Laboratory
FAA CAMI

The CAMI Biodynamics Research Team conducted two separate studies to investigate human factors issues that relate to the use of lap belts. Human performance tests were conducted under two protocols to measure and assess: (1) seat belt tension adjustment during normal flight and emergency landing conditions, and (2) the effects on passenger emergency egress performance related to the lift-latch release angle of typical lap belts.

In the lap belt tension adjustment study, subjects were asked to sit in a typical passenger seat and adjust the lap belts as they normally would for take-off or landing during a commercial flight. Participants were then asked to adjust the tightness of the lap belts as if told to prepare for an emergency landing. The airplane seat used in this study was instrumented to measure the tension in the lap belts, and the belt tensions for both normal and emergency conditions were recorded. A total of 1182 subjects participated in this study. An analysis of results from this study indicate that most passengers (90%) tighten the lap belt to a tension less than 7 lb. during normal flight conditions and less than 10 lb. for an anticipated emergency. This data indicates that the tension adjustment of lap belts restraining anthropomorphic test dummies in airplane seat certification tests should not exceed 10 lbs. to be representative of belt tension applied by a typical passenger.

The lift-latch release angle experiments were designed to study lap belt restrained human subjects as they released the belt buckle and proceeded to egress from a typical passenger seat. Some foreign regulatory authorities require the release angle to be between 70° and 95°, whereas, typical U.S. buckles release between 30° and 45°. Three lap belts with latch release angles of 30°, 60°, and 90° were installed on a triple passenger seat. Subjects were observed and timed as they tried to release the belts and exit from the seat. Each was instructed to perform the exercise quickly. Comments on preference or difficulty were also elicited from the subjects. A total of 201 subjects participated in this study. No significant differences in human performance factors related to the lift-latch angle were detected from an analysis of the data.