IMMI CHILD RESTRAINTS

SUBJECT:
Determine the effect of twist (rotation) on the strength of vehicle restraint seat belt webbing.

INTRODUCTION:
There are times that the vehicle restraint buckle is twisted (rotated) to shorten its length in order to achieve an improved installation of a child restraint seat. A concern has been expressed that the twist may adversely effect the strength of the webbing.

PURPOSE:
Conduct a series of tests to determine the strength of the vehicle webbing in the twisted condition.

REQUIREMENTS:
FMVSS - S4.4 (b) 3 indicates that the structure's components in the seat belt assembly (Type 2) which are common to pelvic and upper torso restraints shall withstand a force not less that 3000 pounds (1360 kgs).

ECE R16 Section 7.5.2 indicates that a buckle or the adjusting device used as a common part of a three-point belt shall be tested to 1470 daN (3304 pounds).

TEST PROCEDURE:
A typical vehicle restraint webbing meeting the specifications of FMVSS 209 S4.2 was used in the test. The webbing is rated at 6000 pounds strength. Three samples were tested at each condition in accordance with FMVSS 209 S5.1 (b). Tests were conducted on plain and treated webbing. The treated samples were soaked in apple juice or Coca Cola for 6 hours, then dried for 24 hours.

TEST RESULTS:
The values recorded are the average of three tests at each condition.

TENSILE STRENGTH OF WEBBING IN POUNDS

	No Twist	½ Twist	1 Twist	1 ½ Twists	2 Twists
PLAIN	6496	6466	6343	6168	5944
APPLE JUICE	6685	6442	6118	5989	5942
COCA COLA	6690	6364	6255	6018	5855

A DIVISION OF INDIANA MILLS & MANUFACTURING, INC.
15881 U.S. 31 NORTH • P.O. BOX 468 • WESTFIELD, INDIANA 46074-0468
317-896-9531 • FAX 317-896-2142

CONCLUSIONS:

The test results show some reduction in strength when twisted. Treated webbing showed slightly more reduction in strength on a % basis than untreated webbing. The average reduction in strength (plain and treated) with one twist was 5.8% and at two twists was 10.7%.

The tensile strength of the plain and treated webbing at the worst condition of two twists is still well above the requirements in FMVSS 209 and ECE 16. In fact, the average tensile strength of the two twist samples (plain and treated) of 5913 pounds is nearly twice the requirements of FMVSS 209.

Since the expected loading on the vehicle belts when used with child restraint seats is even lower, the strength factor of safety for the webbing will be even higher than twice the regulation requirements.

Based on the test results, there should not be a concern about the strength of the vehicle webbing when the buckles are twisted to improve the fit of a child restraint seat.

JERRY THOMPSON

Jerry Thompson
Engineering Manager
IMMI Child Division
September 28, 1998

After review and analysis of the IMMI data by the SAE Child Restraint Sub-Committee, an agreement of no more than 3 complete (360 degree) twists of the safety belt buckle as the maximum allowed was reached in 2006.