Testing Suspension Seats for End-stop Impacts

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Testing Suspension Seats for End-stop Impacts

Desde 1997-10-01 hasta 2000-09-30

Detalles del proyecto

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Objetivo

The principal objective of this project was to develop a laboratory method for measuring and evaluating the effectiveness of suspension seats for controlling the whole-body vertical vibration transmitted to the operators of off-road vehicles in conditions that may result in excessive suspension travel.

Idealised input motions were defined for testing suspension seats of fork-lift trucks, agricultural tractors, forestry vehicles and earth-moving equipment. These are based on a sinusoidal function modulated by a half-sine envelope.

A laboratory method has been defined for testing suspension seats, using an artificial load, so as to avoid the exposure of human subjects to a high vibration dose. The magnitudes of the test stimuli are progressively increased from a level that results in a predefined minimum vibration dose value (VDV) on the seat load, until the measured VDV reaches a predefined maximum. Criteria have been developed for measuring seat performance, based on the rate of increase in the VDV on the seat load, as a function of the increase in the VDV at the seat base.

Inter-laboratory tests showed that the test procedure is practicable, and discriminates between seats with good and poor performance.

Non-linear mathematical models have been developed, making it possible to predict the effect of modifications to seats on test outcomes. These models are being made available to seat manufacturers so as to help them optimise the characteristics of seat suspensions and end-stop buffers.

The test method has been described in test guidelines that are drafted so as to be compatible with, and complementary to, tests for continuous vibration isolation in current suspension seat test standards.

Background

Suspension seats isolate vehicle operators from potentially hazardous vertical whole-body vibration. Off-road vehicles are subjected to shocks that can be severe enough to cause seat suspensions to exceed their range of travel, causing end-stop impacts that may increase the hazard to operators. Current standards call for tests on suspension seats to ensure that under conditions of excessive suspension travel, the suspension end-stops keep the resulting shock acceleration to an acceptable level. However, existing standards do not define satisfactory procedures for testing the isolation provided by a seat exposed to motion that may result in end-stop impacts.

Work Programme

The work has involved measuring the characteristics of representative motions of fork-lift trucks, agricultural tractors, forestry vehicles and earth-moving equipment which cause seat suspensions to exceed their range of free travel. Laboratory measurements have been made of the vertical isolation provided by suspension seats so as to establish a test method.

Laboratory measurements were compared with simulations using non-linear mathematical modelling techniques. Inter-laboratory seat tests were performed to determine the practicality and reliability of the test protocol.
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