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USING DYNAMIC RESPONSE INDEX (DRI) AS A SPINAL INJURY PREDICTOR

R Ahmed and T Pandelani

Landward Sciences, DPSS, CSIR

Abstract

Seats in protected vehicles play a large role in transferring or mitigating forces on occupants due to explosive loading. The protection levels offered by protected seat systems are conventionally evaluated by means of drop testing, where the forces, moments and accelerations on an occupant are measured using an Anthropomorphic Testing Device (ATD). These measurements are then correlated to injury criteria which determine the probability of injury. Seats are typically evaluated in terms of probability of injury to the spine. The Dynamic Response Index (DRI) is the injury criterion most used to determine probability of spinal damage of an occupant due to blast loading; however shortcomings of this criterion have been shown in practical applications. The criterion does not account for additional masses due to PPE, nor does it account for additionally induced loads such as that caused by restraint systems, nor does it account for effects of countermeasures affecting the applied local force. The DRI also assumes that the load applied is axial in nature and thus does not take into account misalignments of the spine. Alternative injury criteria for spinal damage have been proposed such as the Lumbar Spine Force Criterion (LSFC) and the newly proposed Spine Injury Criterion (SIC). These, together with the DRI, were used to evaluate seat protection levels during a comparative seat testing study. The results of the study show that the SIC appears to produce more consistent results, in line with what the expected behaviour of the seats should be. The DRI performed less consistently and in some cases indicated that an occupant in the baseline steel seat would measure a higher DRI than an occupant of the cushioned seats. Until the SIC can be fully validated, it is recommended that the SIC is used as an additional criterion for injury assessment, especially in configurations whereby restraining systems and/or PPE are used, rather than looking at DRI alone.