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The applicability of ride comfort standards to off-road vehicles

P.S. Els *

Department of Mechanical and Aeronautical Engineering, University of Pretoria, Pretoria 0002, South Africa

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Abstract

The correlation between objective methods for determining ride comfort and subjective comments from crew driving in vehicles were investigated. For objective measurements, the ISO 2631, BS 6841, Average Absorbed Power and VDI 2057 methods were used. The emphasis was on the ride comfort of military vehicles operated under off-road conditions over typical terrains. An experiment was devised and executed in order to obtain both objective and subjective ride comfort values. The correlation between the different methods, measuring positions, measurement directions and calculation methods was determined. It is concluded that all the methods can be used to specify and evaluate ride comfort, but that acceptable ride comfort limits vary. The vertical measurement direction was dominant. Due to the frequency content of the measured acceleration, the specific weighing curve is not very important for the type of vehicle considered.

Keywords: Whole-body vibration; Ride comfort; Off-road vehicles; Testing

1. Introduction

Four methods to objectively evaluate ride comfort (human response to vibration) are used throughout the world today. The ISO 2631 standard [1] is used

* Tel.: +27 12 420 2045; fax: +27 12 362 5087.
E-mail address: schalk.els@eng.up.ac.za.

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Nomenclature

a_n	acceleration
AAP	average absorbed power (W)
AP	absorbed power (W)
$A_{i_{rms}}$	root mean square acceleration
BS	British Standard
CF	crest factor
eVDV	estimated vibration dose value ($m/s^{1.75}$)
ISO	international organisation for standardisation
K_i	weight factor
MSDV	motion sickness dose value
MTVV	mean transient vibration value
NATO	North Atlantic Treaty Organisation
NRMM	NATO reference mobility model
RMQ	root mean quad (m/s^2)
RMS	root mean square (m/s^2)
VDI	"Verein Deutscher Ingenieure" or Society of German Engineers
VDV	vibration dose value ($m/s^{1.75}$)
z	vertical acceleration (m/s^2)

mainly in Europe and the British Standard BS 6841 [2] in the United Kingdom. Germany and Austria use VDI 2057 [3] while Average Absorbed Power or AAP [4] is used by the United States of America and by NATO in the NATO Reference Mobility Model (NRMM). A new version of VDI 2057 was published in September 2002 [5] but the current study still refers to the version used in [3]. The need exists to determine which of these four standards or methods are the best suited to the needs of the South African National Defence Force in order to specify and evaluate ride comfort on military vehicles, with the emphasis on ride comfort over predominantly rough, off-road terrain. The relationships between the measures of the various standards can also be very useful when vehicles from manufacturers using different standards must be compared against each other, or to compare measurements with historic data.

2. Objective measures of ride comfort

A short description of the four objective measures used (AAP, ISO2631 (1997), BS6841 and VDI2057) will now be given.