International Journal of Automotive Technology, Vol. 13, No. 3, pp. 469–475 (2012)
DOI 10.1007/s12239–012–0044–1

pISSN 1229–9138/ eISSN 1976-3832

DRIVER RECOGNITION OF A RUN-OVER ACCIDENT

S.-J. PARK and S.-W. CHAE*

Department of Mechanical Engineering, Korea University, Seoul 136-713, Korea

(Received 14 May 2011; Revised 17 August 2011; Accepted 6 December 2011)

ABSTRACT–If a driver passes over a pedestrian lying on the road and flees, it is considered a crime. In several cases, even if the driver fled and was arrested, he/she often asserts that they did not know that the victim was a human being. However, the investigation agency often believes that a driver can certainly recognize when he/she passes over a person. Accordingly, such cases frequently lead to disputes due to the lack of criteria for recognizing when a driver was involved in run-over accidents. In this study, tests were conducted both to identify if drivers can recognize whether their vehicles passed over a person and to examine how they feel at the time. A silicon dummy, which was manufactured to have the same characteristic as the human chest, was used in this study. According to the method specified in ISO2631, the vibration delivered to the driver was measured, and eighteen participants drove a vehicle over the silicon dummy to experience how the vibrations felt. When the passenger car for the test ran over the dummy at speeds ranging from 10 km/h to 60 km/h, all participants recognized the delivered vibration, and the VDV that was delivered to the participants ranged from 1.81 $m/s^{1.75}$ to 2.38 $m/s^{1.75}$. The participants thought that the object they drove over was a stone or a piece of wood. This indicates that the driver certainly can recognize the vibrations generated from passing over a human chest even though it feels like a solid object.

KEY WORDS : Pedestrian, Traffic accident, Silicon dummy, Whole-body vibration, VDV, Frequency weighting

1. INTRODUCTION

If a driver passes over a pedestrian lying on the road and flees, it is considered a crime. To prevent drivers from fleeing, Article 54 of the Road Traffic Control Act (2011) requires the driver that caused the accident to aid the victim by stipulating that 'the driver and crew of a vehicle that damaged any person or properties should immediately stop the vehicle and take required action to save the victim'. Violation of this article is subject to strict punishment. When a driver is arrested for causing an accident in which a person is run over by a vehicle, he/she often asserts that they did not know they ran over a person. Because the investigation agency rarely considers the driver's statement as true, arguments between drivers and the investigation agencies occur frequently.

This study was conducted to better understand if a driver can recognize if he/she hit a pedestrian lying on the road. To accomplish this, the following criteria were proposed.

Unlike mechanical structures, a human body is observed differently at different frequencies. Because there are vibrations with uncomfortable or unrecognizable frequencies, a weighting function is often applied to the vibration on the human body with respect to frequency. The resulting signals are expressed in terms of the running r.m.s., vibration dose value (VDV), maximum transient vibration value (MTVV), etc.

**Corresponding author.* e-mail: swchae@korea.ac.kr

To measure the vibration on the human body, M. G. Kim *et al*. (2002) proved that the VDV calculated by applying the frequency weighting function to diverse-impact vibrations from jumping over an obstacle was highly related to human discomfort (Howarth and Griffin, 1991; Spang, 1997; Wikstrom *et al*., 1991).

In a study conducted by Cheung and Byeon (2005), the whole-body vibrations of UH60 helicopter pilots that were in flight over 0.5 h was reported to be between 2.49 $m/s^{1.75}$ and 2.64 $m/s^{1.75}$ (VDV), and the vibration level was considered to be 'fairly uncomfortable' to the pilot. The whole-body vibration of 12 people that were in all-terrain vehicles for 20 min was reported to be 16.6 $m/s^{1.75}$ by Milosavljevic (2010) and the values for all participants exceeded the ISO recommended maximum permissible limits for low back pain. Thus, the VDV can be used to measure the possibility of damage from excessive vibration as well as the amount of human body vibration.

The weighted acceleration signal $x_w(t)$ is represented in terms of the multiplying factor m_f for the vibration measurement axis, the acceleration signal for the measurement axis $a(t)$, and the frequency weighting function $w(t)$, shown in Equation (1). The convolution operator * refers to an analog or digital filter.

$$x_w(t) = m_f \cdot (x(t)^* w(t)) \tag{1}$$

The whole-body vibration can be represented by the running r.m.s. of the continuous vibration on an unpaved