A PORTABLE MEASUREMENT SYSTEM FOR THE ASSESSMENT OF TIME WEIGHTED AND IMPULSIVE EXPOSURES TO WHOLE BODY VIBRATION

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Introduction

Bus drivers represent a large segment of the US transportation industry and research has shown an association between exposure to Whole Body Vibration (WBV) and the high rates of low back disorders. Impulsive WBV exposures have been recognized as a risk factor for low back injury and new guidelines exist for their measurement and assessment (ISO 2631, Part 5). Methods to accurately and better characterize the impulsiveness of WBV along with the temporal patterns of the exposures are needed. The development of a hardware and software system to measure continuous TWA and raw, impulsive WBV exposures and the design of a subsequent study are presented.

Methods

Using two Larson Davis HVM 100 as accelerometer amplifiers, small external batteries, and a Pocket-PC (PDA) with 1 Gb of compact flash memory, we can collect up to 16 channels of data for a full day 600 Hz. Tri-axial WBV exposures will be measured and characterized at the frame of the bus and at the driver/seat interface (seatpad accelerometer). Using a repeated measures design, 20 bus drivers will drive on selected routes which include both city streets and highways, and within and between subject components of variability and exposure determinants related to the bus, bus seat, the bus driver, and the route will be identified. Global Positioning System (GPS) data will also be collected and integrated with the WBV exposure data to facilitate the identification of the location, velocity and type of road associated with high average TWA and impulsive WBV exposures. This system may be used to develop administrative (alter speed and/or route of bus, systematically vary type of routes) and/or engineering controls (identify and trigger the need for street repair) to reduce high WBV exposures.

Results

Our portable Pocket-PC based data acquisition system is up and running and we can collect seven channels of WBV data (seat pan tri-axial accelerometer, bus frame tri-axial accelerometer and GPS data) continuously for a full shift. The software analysis of the data is complex but nearing completion. We have incorporated the vibration dose calculations from ISO 5321, Part 5 and have obtained a Matlab-based routine to appropriately weight the continuous signals.

Discussion

In summary, the measurement of WBV is complex but new technologies open avenues of collecting and assessing WBV exposures that were previously not possible. The standardization of impulsive WBV exposure assessment methods is needed to further the discipline and better enable comparisons across studies.

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Podium Presentations

Session VII: Biodynamics II

Chairs: John Wu and Kumar Kittusamy

Presenter	Title	Page
P.W. Johnson University of Washington	A portable measurement system for the assessment of time weighted and impulsive exposures to whole body vibration	90
S. Mandapuram Concordia University	Influence of back support conditions on the absorbed power of seated occupants under horizontal vibration	91
A. Pranesh, Concordia University	A multi-body dynamic biomechanical model of a seated human exposed to vertical whole-body vibration	93
S.K. Patra Concordia University	Assessments and refinements of an anthropodynamic manikin for seating dynamics applications	95
R. McCormick MB Dynamics	A novel 3-D hand-arm vibration test system and its preliminary evaluations	97
T. Keller Spectral Dynamics	Multi-axis hand-arm vibration testing & simulation at the National Institute of Industrial Health, Kawasaki, Japan	99
D. Welcome NIOSH	A pilot study of the transmissibility of the rat tail compared to that of the human finger	101