Instrumentation Corner

Instrumentation requirements for BS6472-1 : 2008

Guide to the evaluation of human exposure to vibration in buildings Part 1: Vibration sources other than blasting by Ken Brown.

This standard is a revision of the earlier standard introduced in 1992, which was superseded in June 2008. The older standard had come in for a lot of criticism, some of which was voiced at a recent Instrumentation and Measurement Group one-day meeting *Rumble in the (Urban) Jungle* organised by John Shelton. Most of the criticism related to assessments made using the eVDV (estimated vibration dose value), which is an optional method of estimating the VDV (vibration dose value) based on *rms* measurements. Of course VDV has the slightly unusual units of $ms^{-1.75}$, and this has never worked in its favour.

There are four major changes which affect the instrumentation to be used.

1. The frequency range is no longer in the title, but the range to be considered is now from 0.5 to 80 Hz. The standard refers to BS.6841 for mathematical definitions of the weightings. In BS.6841 (and ISO8041) the band limiting filters are 0.4 and 100 Hz (nominal frequency range of 0.5 to 80 Hz.). The change in the lower frequency to 0.5 Hz therefore makes BS.6472 consistent with other standards. Although this means that the instrumentation has to perform a full octave below the previous lowest frequency, it also means that manufacturers can, more simply, provide the same instrument for a wider range of applications.
2. The weighting filters have changed: W_b is preferred to W_g.
3. The coordinate system has changed. The basi-centric coordinate system has been changed to a geocentric coordinate system. Hence weightings for supine subjects exposed to motion in the back-to-chest and foot-to-head axes are exchanged.

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4. The final major change is in the presentation of the frequency weighting curves. These are now presented as the modulus of the frequency weighting to be applied to the incoming acceleration signal. This is a similar presentation to the acoustic weighting curves (A, B, C, *etc*) with which we are all familiar. Previously, these had been presented as the base curves, in terms of acceleration and velocity. A factor was applied to these base curves to indicate the level of adverse comment in various situations. This led to a number of ways of measuring vibration data, and interpreting the results, which were incorrect, and never, as far as I can ascertain, intended by the authors.

So, the standard makes it perfectly clear that the quantity measured should preferably be acceleration measured in ms^{-2}. This signal should be weighted in the time domain, by one of two weighting filters, W_b or W_d, and the required VDV obtained. Modern instrumentation has made this measurement a much simpler operation than when first proposed, and in my view, it is unfortunate that other options are still allowed. I have always been of the opinion that velocity sensors (primarily geophones) are unsuitable for this type of measurement, as they only operate successfully above their natural frequency. The extension of the frequency range downwards to 0.5Hz reinforces this view.

Unfortunately, the **eVDV** is also still allowed, although the advice on when **eVDV** can be used is much clearer and more specific in the new version of the standard. Most of the intermittent or transient vibration we encounter as sources of complaint and adverse comment are non-stationary signals, and only a dose approach based on the true **VDV** is appropriate. It is for exactly the same reason that Sound Exposure Level, LAE is used in acoustics. Once again, the calculation of the fourth root of the fourth power is much easier with modern instruments - primarily because they are all things digital! Much of the disagreement has centred, in my view, on the use of an *estimated* dose value, rather than a true dose value.

Fortunately, we are now seeing dedicated instrumentation appearing on the market which will enable consultants, environmental health officers and researchers to build a database of accurate vibration dose data. This will lead to increased confidence in true VDV as a parameter; in spite of the slightly unfamiliar units!

Ken Brown BSc MIOA MIET is Associate Consultant with ISVR Consulting