Vibration Injury Network

Research Network on Detection and Prevention of Injuries due to Occupational Vibration Exposures

Description of database to store experimental biodynamic data and definition of data to be stored in the common database

Appendix W3C to Final Report

May 2001

EC Biomed II concerted action BMH4-CT98-3251

WORK PACKAGE WP3W REPORT

Task: Design of a data base to collect existing data of human experiments and provide experimental data to be stored in the common data base

1. General structure of the database

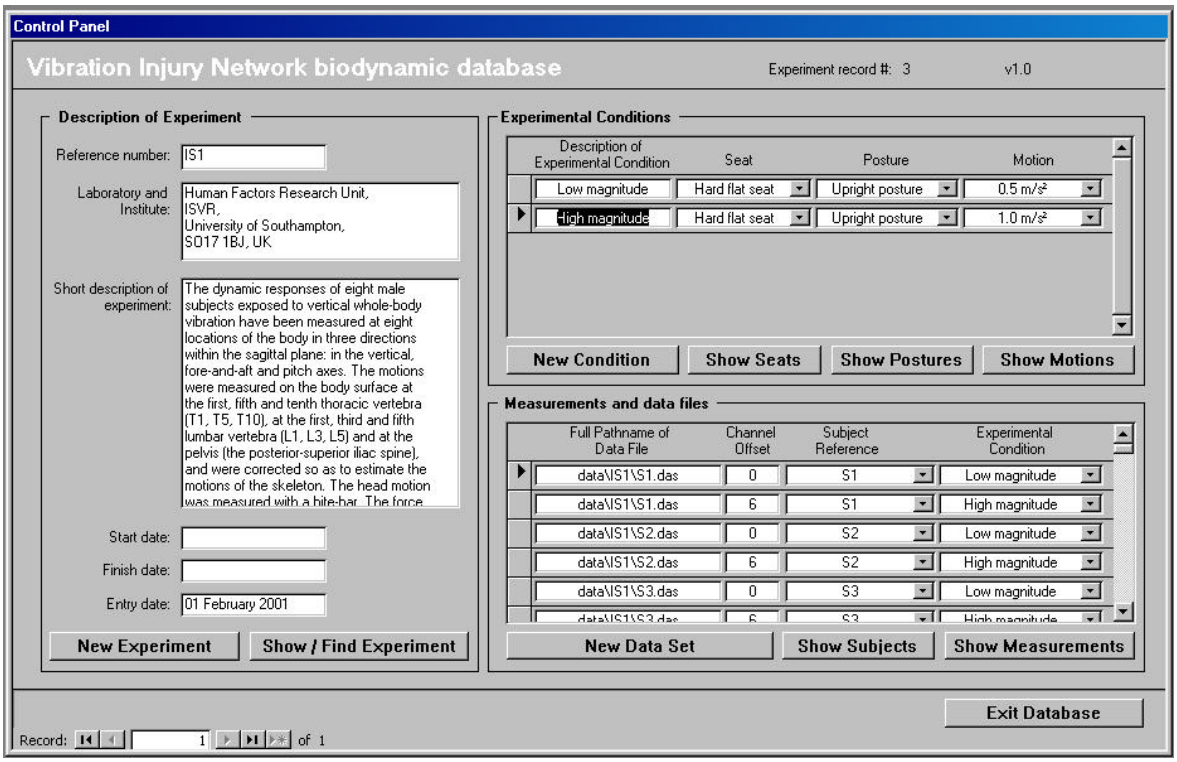
The ACCESS database is intended to hold comparative experimental results from partners of the VINET (FIOSH, ISVR, NIWL). It also provides a tool for archiving data from future experiments in a common format.

Section 1 describes the information that is stored in the ACCESS database itself. Experimental (time history) data are stored in separate files, the pathnames of which are contained in the ACCESS database. The structure of the data files is shown in Section 2. Section 3 shows some proposed functions (launched from the ACCESS database) to import and export data, and to perform summary analyses.

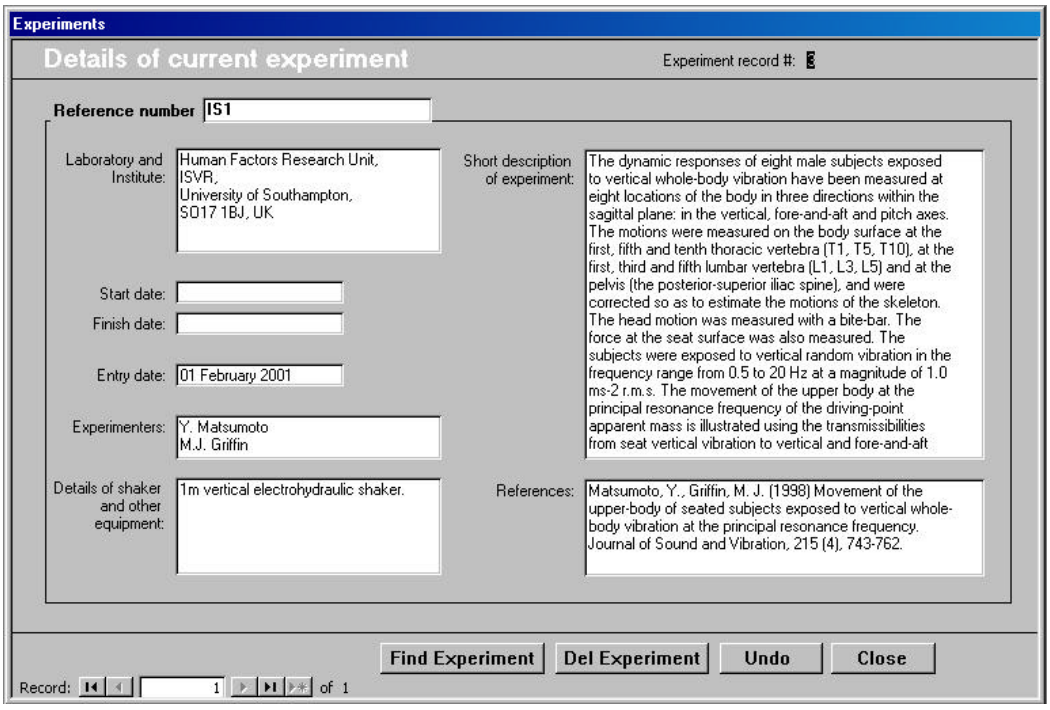
2. ENTERING DATA

2.1 *Viewing experimental details*

When the database file (WP3W.mdb) is opened, the main form (referred to as “Control Panel”) shows details of the last experiment entered (i.e. the last record in the “Experiments” table).

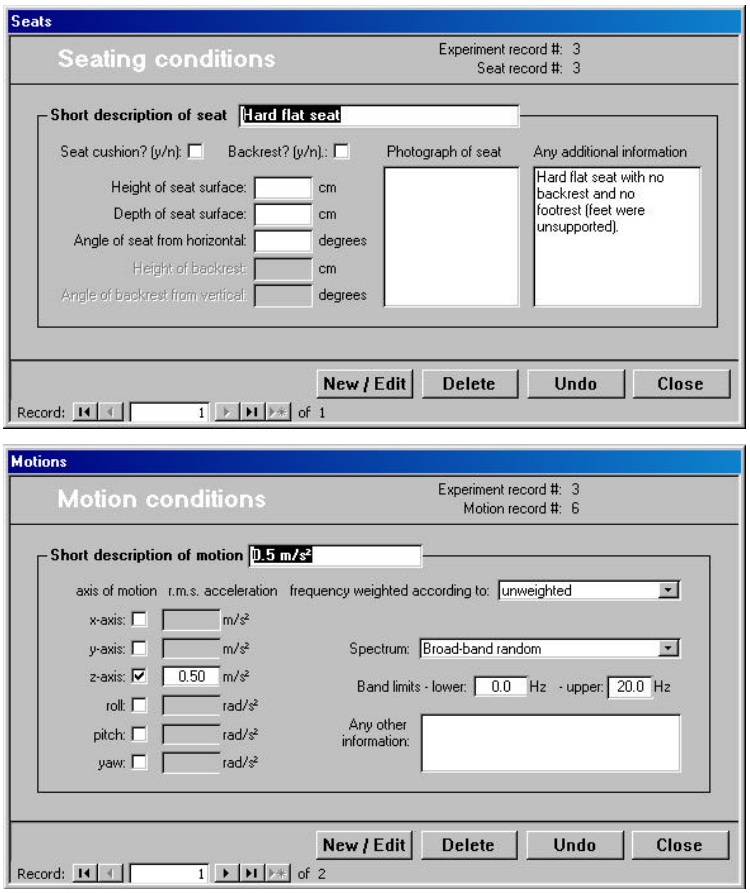


Some details of the experiment are shown in the left-hand ("Description of Experiment") panel. These fields cannot be edited in this form. Use the navigation buttons (in the bottom left of the form window) to move to another experiment in the database. To view more information about the experiment shown in the main form (i.e. the "current experiment"), click "Show/Find Experiment".



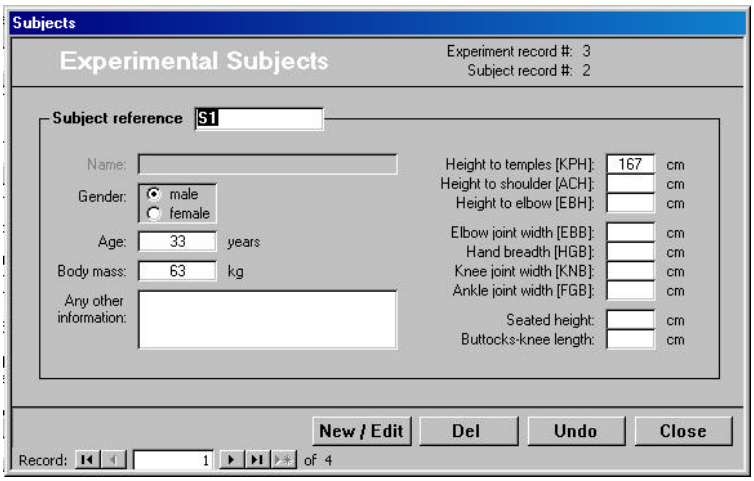
The top right-hand panel of the Control Panel shows a list of experimental conditions, each consisting of the displayed combination of seating condition, posture condition and motion

condition. To view full details of all the seating, posture and motion conditions in the current experiment, click on the relevant button at the bottom of the upper right-hand panel.

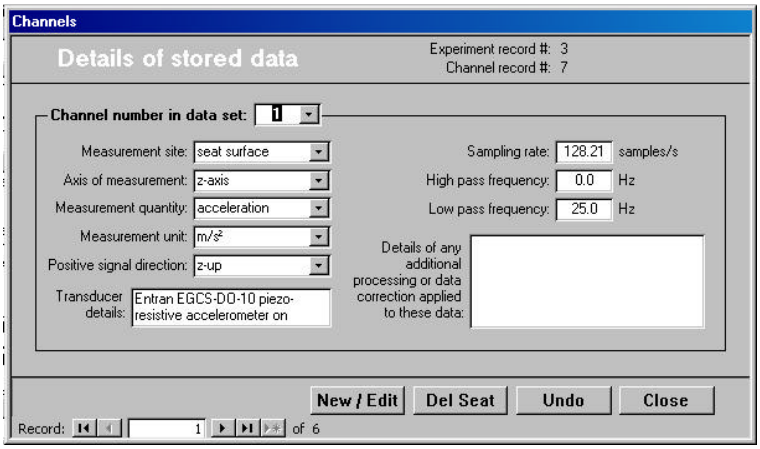


The bottom right-hand panel shows the data file names (and directory path) containing the data for displayed combination of subject and experimental condition (referred to a a “data set”).

To view full details of all the subjects in the current experiment, click on the “Show Subjects” button at the bottom of the lower right-hand panel.



To view specifications of the data stored in each channel of the data file , click on the “Show Measurements” button at the bottom of the lower right-hand panel.



2.2 *To add a new experiment*

Click “New Experiment” in the left-hand panel. This will open the “Experiments” form: enter details in all the relevant fields and click “Close”. When the control panel re-opens, nothing will be displayed in right-hand panels. Click “Show Seats”, then “New/Edit” and enter all relevant details of the first seating condition. Repeat for all further seating conditions used in the experiment the click “Close”. Enter details of all postural and motion conditions in a similar manner. When all seating, postural and motion conditions have been entered click “New Condition” and enter a label for each experimental condition. For each experimental condition select a seat, posture and motion condition in the respective list-boxes.

Click “Show Subjects”, then “New/Edit” and enter information about each subject then click “Close”. Enter definitions of each data channel in a similar manner. Click “New Data Set” and enter the data file pathname and channel offset for each data set in turn, and select the corresponding subject and experimental condition in the respective list boxes.

3. Definition of fields in ACCESS database

3.1 Experiment details

- *reference number for experiment*
- *details of laboratory and institute*
- *short description of experiment*
- *names of experimenters (optional)*
- *references to reports and papers presenting results*
- *dates of experiment*
- *date on which record was created*
- *description of shaker and other equipment used*

3.2 *Subject details*

for each subject:

- *subject reference*
- *name (optional)*
- *date of birth (optional)*
- *age*
- *gender*
- *weight (kg)*
- *height to temples (cm)*
- *height to shoulder (cm)*
- *height to elbow (cm)*
- *elbow joint width (cm)*
- *hand breadth (cm)*
- *knee joint width (cm)*
- *ankle joint width (cm)*
- *seated height (cm)*
- *hip breadth when seated (cm)*
- *buttocks-knee length (cm)*
- *any additional information (text)*

3.3 Experimental conditions

for each seat:

- *short description (label) of seating condition*
- *photograph*
- *height of seat surface (m)*
- *depth of seat surface (m)*
- *seat angle from horizontal (degrees)*
- *backrest height (m)*
- *backrest angle from horizontal (degrees)*
- *any additional information (text)*

for each posture:

- *short description (label) of postural condition*
- *photograph*
- *ankle angle*
- *knee angle*
- *hip angle*
- *elbow angle*
- *inclination of lumbar spine*
- *inclination of thoracic spine*
- *inclination of cervical spine*
- *any additional information (text)*

for each motion condition:

- *short description (label) of motion condition*
- *axes [x-axis, y-axis, z-axis, roll, pitch, yaw]*
- *r.m.s. magnitudes [seperately for x-axis, y-axis, z-axis, roll, pitch, yaw]*
- *spectral description (e.g. sinusoidal, broad-band)*

- *lower frequency*
- *upper frequency (if not sinusoidal)*

3.4 *Measurements*

for each data channel:

- *measurement site*
- *channel of data file in which data are stored*
- *measurement axis [choice of x-axis, y-axis, z-axis, roll, pitch, yaw]*
- *measurement quantity (e.g. displacement, acceleration, force)*
- *measurement unit*
- *sampling rate (samples per second)*
- *high pass cut-off frequency (Hz)*
- *low pass cut-off frequency (Hz)*
- *sign convention*
- *calibration constant to apply (if any)*
- *transducer description*
- *details of pre-processing performed on the data (e.g. mass cancelation, correction for skin response)*

3.5 *Results*

For each combination of subject and condition:

- *file path for time history data*
- *channel offset (channel in data file corresponding first data channel for this combination of subject and experimental condition)*

4. Data File Format

4.1 *Main Header (fixed length)*

headlen	(long)	length of the header (bytes)
nchnls	(long)	number of channels
status	(long)	indicates data precision and if all channels have the same number of points and sampling increment
maintitle	(string(512))	description of the data-set
startref	(double)	origin of the time/x-axis (Days and fractions of days since 0:00, 01/01/1900). 0= not applicable.

4.2 *Channel Header (fixed length)*

for i = 1:chnls

dchnl	(long)	channel number (1...nchnls)
dxvar	(long)	flag indicating variable increment data
dtype	(long)	type of data in channel (real, complex, etc.)
dcols	(long)	number of columns of data
dlen	(long)	number of samples (rows)
dstart	(long)	start of data (byte offset from end of header block)
title	(string(512))	description of the data in this channel
runit	(string(32))	units of real part (SI conventions – see note)

iunit	(string(32))	units of imaginary/phase part (for real/imag and modulus/phase data)
xunit	(string(32))	units of x-axis scale
orig	(double)	offset of the time/frequency (x-axis) scale
incr	(double)	time/frequency increment
offset	(double)	data offset
scale	(double)	signed scale-factor
lpf	(double)	low-pass frequency if applied (Hz)
hpf	(double)	high-pass frequency (Hz)
stats	(double[6])	reserved for statistical information

end

4.3 *Data*

Data points (chnl(1,1...dlen1), chnl(2,1...dlen2)...etc)

5. Experimental Data To Be Stored In The Common Data Base

5.1 *Data supplied by FIOSH*

Subjects:
4 subjects with the characteristics given below:

S-No.	KPM	KPH	Age	FGB	KNB	EBB	HGB	ACH	EBH
131	73.2	172.1	23	6.7	9.1	6.2	5.5	142.2	108.2
156	74.6	176.7	20	6.9	8.4	6.1	5.4	146.5	109.9
113	74.4	175.2	21	6.6	9.0	6.50	6.1	142.4	110.7
224	72.8	175.6	19	7.1	8.6	7.00	5.7	142.5	109.5

Table 1. Selected measured anthropometric characteristics of four subjects (S): KPM = Body mass in kg, KPH = height to temples in cm, Age (in years) FGB = ankle joint width in cm, KNB= knee joint width, in cm EBB = elbow joint width in cm, HGB = hand breadth in cm, ACH = height to shoulders in cm, EBH = height to elbows in cm, MV = mean value, SD = standard deviation.

Exposures:
65 seconds random low-frequency vibration in z-axis, 0.7, 1.0 and 1.4 ms^{-2} rms weighted (ISO 2631, 1985) acceleration, relaxed posture, hands at a steering wheel

Measures:
- acceleration at the hard seat
- input force
- accelerations in z-axis at the head, shoulder, spinous processes L3 and L4

5.2 *Data supplied by NIWL*

Subjects:
24 subjects (11 males, 13 females) with the characteristics given in Table 2.
The following anthropometric data is available.

- Total body mass (kg)
- Sitting weight (kg)
- Body length (cm)
- Age (years)

Exposures:
20 seconds random low-frequency vibration (2-20 Hz) in z-axis with frequency un-weighted acceleration levels of 0.5, 1.0 and 1.5 ms^{-2} r.m.s.
Comfortable upright sitting posture with hands resting on the lap. Horizontal thighs with feet positioned on a footrest which did not move with the seat.

Measures:

- acceleration at the hard seat (x-, y- and z-direction)
- input force (x-, y- and z-direction)
- subjective ratings of discomfort.

5.3 *Data supplied by ISVR*

Subjects:

4 subjects with the following characteristics.

Subject	Age [yr]	Height [m]	Weight [kg]
1	33	1.67	63
2	32	1.81	83
3	23	1.75	73
4	29	1.69	65

Exposures:
60 seconds random low-frequency (0.5 – 20 Hz) vibration in z-axis; 0.5 and 1.0 ms^{-2} rms acceleration (unweighted); no backrest; upright comfortable posture; hands in lap; feet unsupported.

Measures:

- z-axis acceleration at the hard seat;
- z-axis input force (with mass cancellation);
- z-axis acceleration at the head;
- z-axis accelerations at spinous processes T1, L1 and L3.

Effect of local tissue-accelerometer system were reduced by assuming that the system can be represented by single degree of freedom system. Effect of the inclination of the accelerometer axes to the basicentric coordinate were reduced by assuming that the displacement response is small. The motions at the centre of vertebra were estimated by assuming that the vertebra is rigid. The size of vertebra is also assumed.