INFOTRONIC
MEDICAL
INDUSTRIAL ENGINEERING

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Material test program dd: 21-09-2000 by Infotronic Holland.

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The problem:

A lot of elderly people have mostly brittle bones.
Elderly people are at high risk when they are falling indoor or outdoor to break a hip or other bones.
The healing will take much time and there are no guarantee they will ever walk again!!
Many people died after a long period of healing in the hospital and this is a very big reason to prevent injury in elderly people.

The solution:

A Dutch Company Lyds international BV in Amstelveen produces a special high damping flexible mat to reduce the high peak forces during a fall to the hip bones to avoid they will break.

Aim:

To find a special material with a high value of the damping factor to prevent injury while falling down by elderly people.

Method:

The method of measurement is a weight fall down from a certain height on the material.
This weight has a certain impact area so we simulate the fall down of a human being.
It is very important to measure under the same conditions.
We will compare the samples with a wooden floor.
The pickup measurement of the peak force will be done by a load cell with a maximum load of 5000 Newton.
The equipment of the measuring system is the Infotronic Ultraflex datalogger at a continue sample frequency of 5000 Hz. The damping factor will be calculated in percentages compared with a wooden floor.

For all graphs:

Falling weight Diameter:	12 mm
Total impact momentum:	1750 kgm/m2
Loadcell:	Kyowa LC-500-KF maximum force 5000 Newton
Sampling frequency:	5000 Hz

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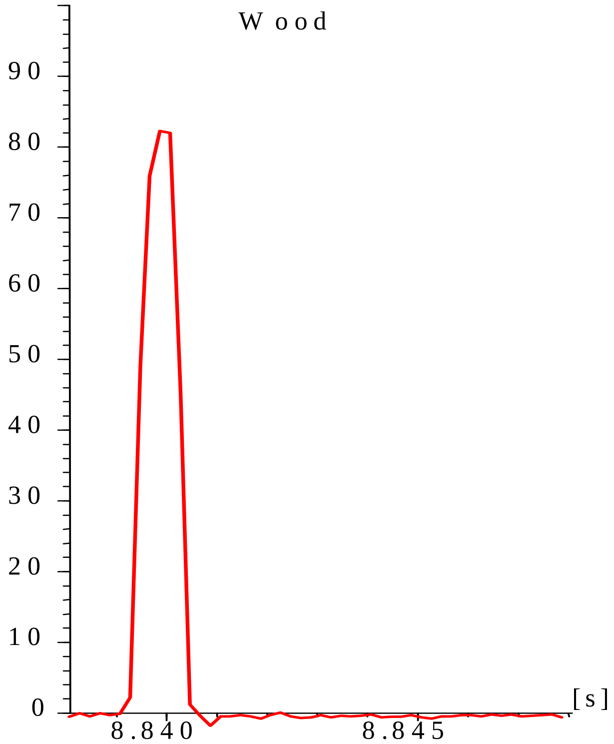
Graph 1: Fall down on wood: Peak force = 82

The first measurement is done to compare the material under test with a common wooden floor.



The total impact time is less than 2 milliseconds, but the maximal force peak is 82.
This is the peak force that will lead to fractures, if it remains undamped.

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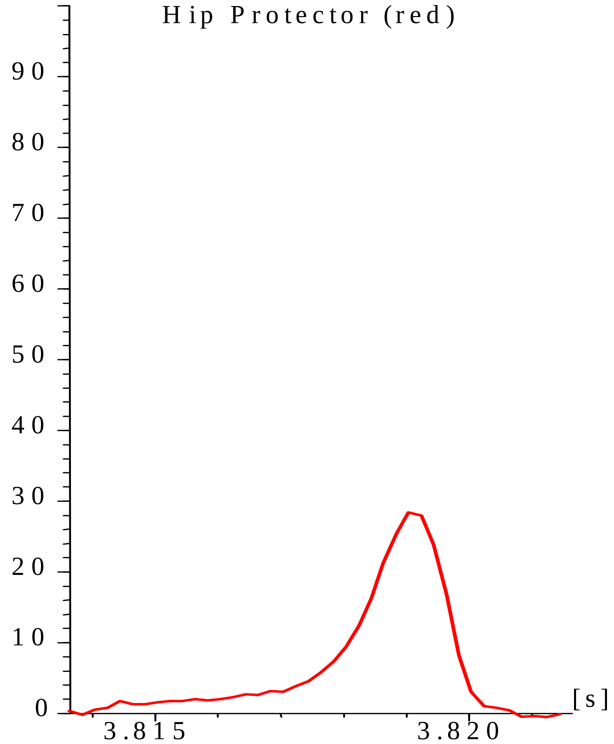
Graph 2: Fall down on the Lyds Hip Protector material: Peak force = 28



We clearly see here that the damping is very high in compare with the wooden floor.
The reduction of the peakforce is tremendous: 60% of the impact force is absorbed by the material.
The Hip Protector material has a pressure time of around 7 microseconds.
This is why there is a strong reduction of the peak force because of the law of preservation of impulse, the intergrated area under the curves must be approximately the same.
The longer the duration of impact, the smaller the maximum peak force will be.

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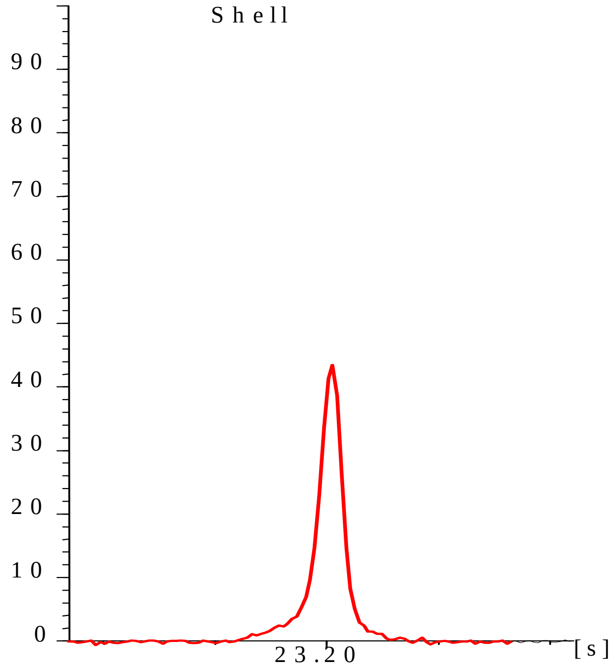
Graph 3: Fall down on hard shell: Peak force = 45



Other manufacturers use hard shells to reduce the impact force.
As shown by our testing, the force reduction by the shell was significantly lower than the reduction by the Lyds Hip Protector material. (45% vs 60% for the Lyds Hip Protector material)

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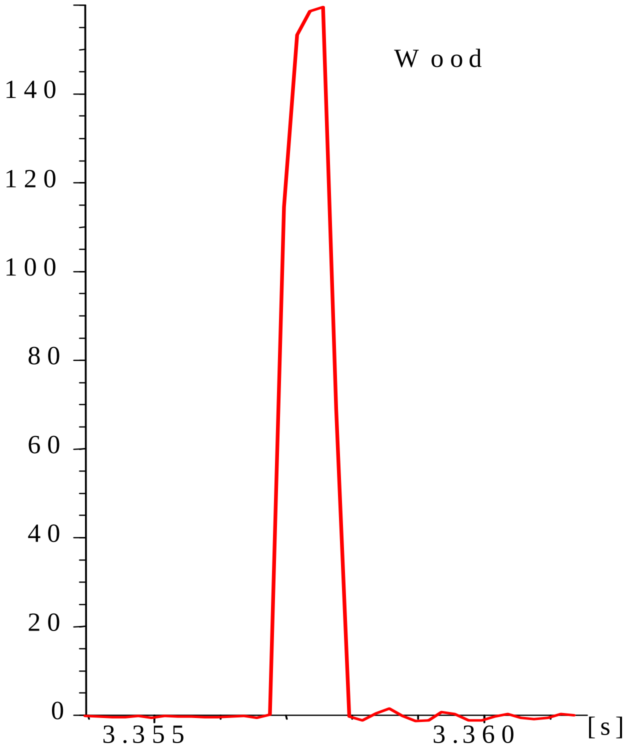
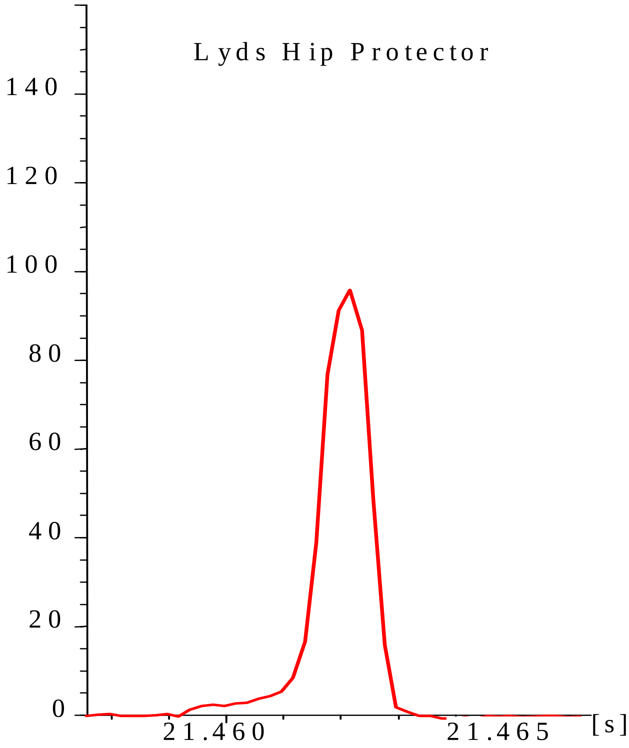
Graph 4: Fall with greater impact momentum:





The experiment has been repeated with a larger impact momentum of 6125 kgm/m2.
As can be seen from the graphs, the maximum force damping here is less. (maximum damping 27%)
This is caused by the material reaching its elasticity bounds.
What needs to be remarked here is that we could not perform this test with the hard shells, because the impact was so high that the shell would be irreversibly damaged.

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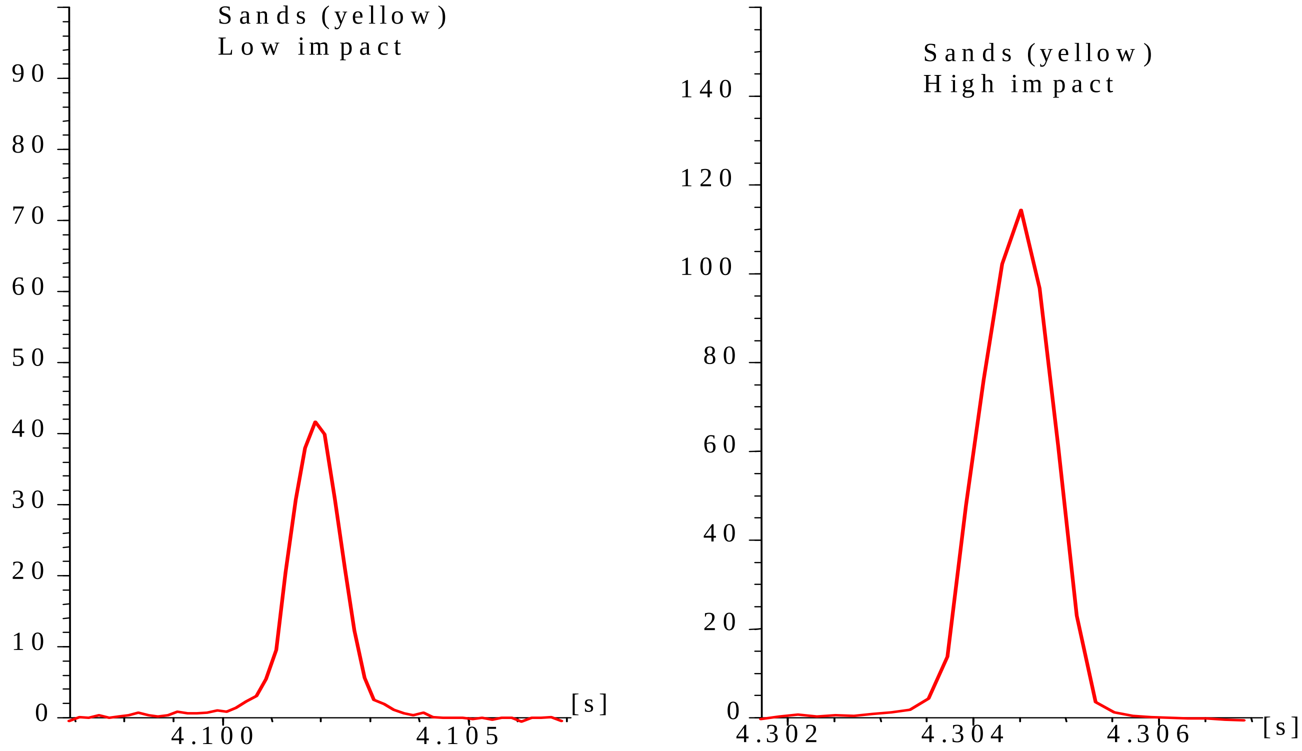
Graph 4: Tested outside competition: Sands Material(yellow)



We also performed the impact tests on 6 mm Sands material, to see if this material might have better properties than the Lyds Hip Protector material (although this was not expected).
The graphs, both for the small impact and the large impact, are shown above.
It is concluded that the Lyds Hip Protector performed better in both light loading and heavy loading conditions.

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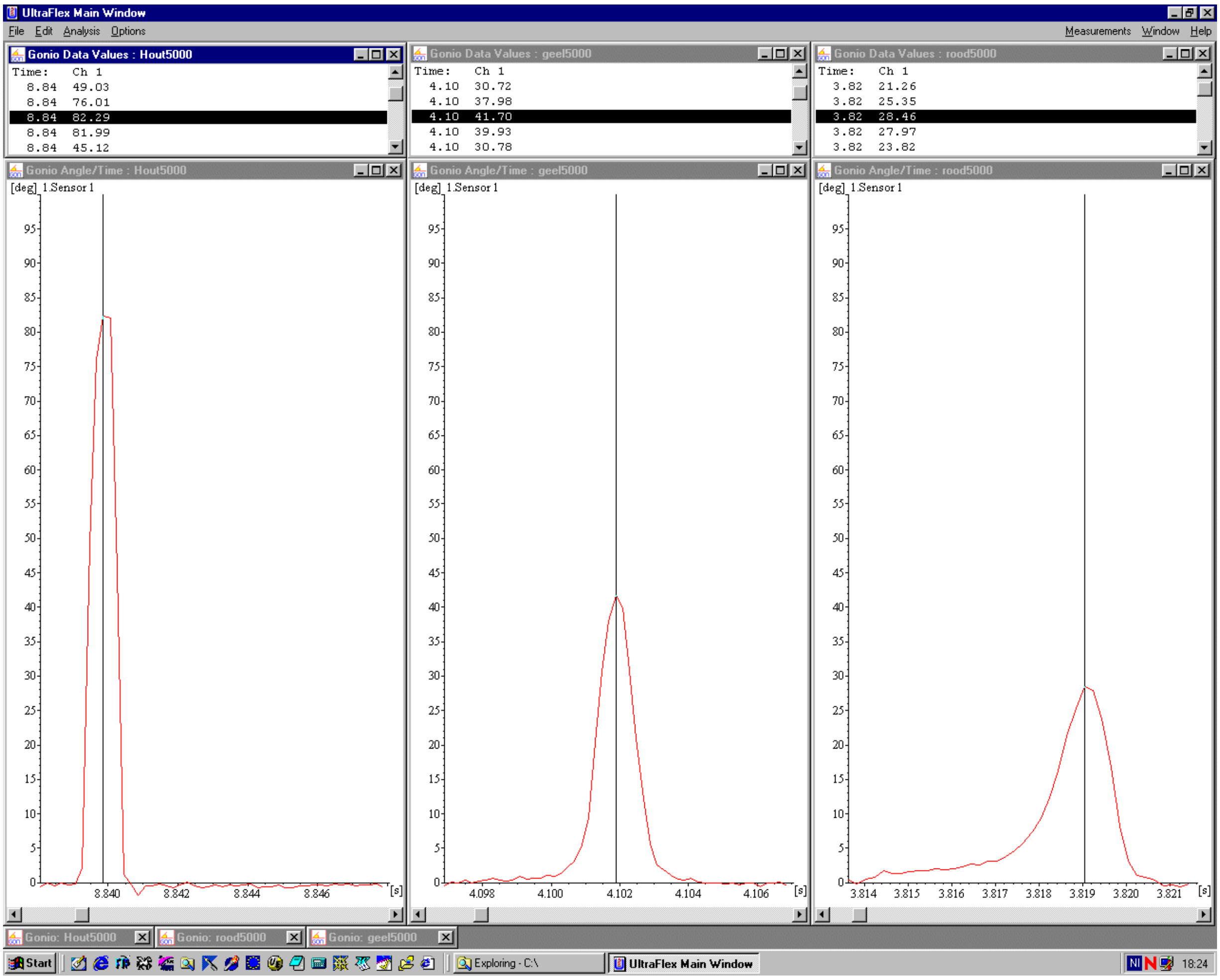
Graph 1: Measured graphs;



These are the graphs taken directly from the computer screen of the testing program.
Graphs like this will be included in the WEB-version of this document (edited to fit the demands)
This is only an example, and must not be included in the printed version of the document.