



RFA

Consultants in Ergonomics and Design

Report on trials conducted to appraise the ease of use of the Exitex WeatherSeal MDS 25/5/2 1 metre threshold design

R J Feeney CEng, MIMechE, FErgSoc.

©RFA. 16 January 2019

1 Background

DETR have published Guidance on accessible thresholds for satisfying Part M of the Building Regulations for New Dwellings.

Exitex Ltd requested RFA to undertake the testing of a new threshold design by means of trials with selected people pushing a person in a wheelchair over the threshold, to ascertain whether it conforms to these Guidelines.

2 Test product

Exitex Ltd submitted a sample of the following product for testing :

- Exitex WeatherSeal MDS 25/5/2 1 metre

3 Location of test

The testing was carried out at a Rest Home in Leicestershire where a large number of elderly males and females are resident. The residential requirement is that due to their frailty, they are unable to live independently e.g. in their own home.

4 Test conditions

The Exitex product was fixed to a large flat wooden board 4 m long x 1.4 m wide. For each test, the threshold was screwed along the mid-line of the board at right angles to its length. The surface up to the front (i.e. the side facing the outside of a doorway) was flat and smooth. On the other side of the threshold (i.e. the side facing the inside of a building) a medium thickness carpet with foam backing (as might be found in a typical dwelling) was firmly fixed

to the board. For part of the testing, the carpet was removed thus providing a flat smooth surface level with the surface on the side facing the outside of a doorway.

The wheelchair used for the experimentation was a NHS Model 8 type that reflected the most commonly used model, with large wheels at the rear and 7 in (177.8 mm) castored front wheels with solid tyres.

5 Test persons

For the purposes of the trials a heavy person was required to occupy the wheelchair to simulate a 'worst case scenario' i.e. a condition that would occur only rarely say 5% of occasions. The most suitable person to simulate this condition was a female resident weighing approximately 12 $\frac{1}{2}$ stone i.e. 79.4 Kg. This is equivalent to an 80th %ile (i.e. top 20 %) by weight of the UK male and female adult population, i.e. less than 8% of the whole population.

Pushers were selected who a) were ambulant but who had mobility difficulties, and/or b) who were very elderly, and therefore represented the most frail persons likely to push an occupied wheelchair, and c) could understand the purpose of the trial.

Seven pushers were used in all the trials. These were as follows :

Subject details	Age yr.	Approx. weight Kg	Approx. height - mm
1) Female resident not significantly disabled	50	66.7 kg	1701 mm
2) Female resident with mobility difficulties, normally relies on walking stick for support	62	88 kg	1570 mm
3) Male resident not significantly disabled	61	61.7 kg	1575 mm
4) Male resident, not significantly disabled, but with heart problems	56	63.5 kg	1727 mm
5) Female resident with mobility difficulties, who has difficulty walking short distances	74	69.9 kg	1600 mm
6) Female resident with mobility difficulties, normally relies on a walking stick for support	76	88.9 kg	1625 mm
7) Male resident who has very mild mobility difficulties	62	78.0 kg	1701 mm

6 Test procedure

The procedure was firstly, that the pusher took up a position behind the wheelchair on the flat board surface side of the threshold selected for testing and at a set distances from its centreline. The pusher was then asked to push the wheelchair forward towards and over the threshold at moderate speed without hesitation. The wheelchair pusher was then asked to comment on the ease or difficulty with which the threshold could be negotiated according to a 5 point scale. The wheelchair occupant was also asked how comfortable they found the movement over the threshold again according to a 5 point scale. A researcher also made comments on the easy/difficult scale.

The ease or difficulty was rated on a five point scale as follows:

- 1 Very easy
- 2 Easy
- 3 Neither easy or difficult
- 4 Difficult
- 5 Very difficult
- 6 Could not complete the task

The comfort for the wheelchair occupant was rated according to the following scale:

- 1 Very comfortable
- 2 Comfortable
- 3 Neither comfortable or uncomfortable
- 4 Uncomfortable
- 5 Very uncomfortable
- 6 Task not completed

The tests were carried out with the initial position of the wheelchair set firstly at 1000 mm and secondly at 100 mm distance from a vertical line through the centre line of the castor wheel to the centre line of the threshold. Movements were from 'outside' the dwelling to the 'inside' i.e. from the hard surface side to the carpet side.

The same trial was then repeated, but this time with the approach from the carpet side.

Previous testing had demonstrated there was a 'technique' in pushing an occupied wheelchair over a threshold. It comprised pushing the wheelchair forward in one continuous movement without any hesitation. In the case of the 100 mm starting position, the movement was found to be easier to accomplish if the wheelchair was first pushed against the threshold, drawn back to the 100 mm point, and pushed forward again over the threshold, in one smooth continuous movement. This ensured the front wheels were 'castored' backwards.

For 4 of the participants the carpet was removed simulating a flat, smooth surface on the dwelling side of the doorway.

7 Results of the test

The results for all trials were tabulated according to the rating score (i.e. 1 to 5) for each condition and the mean scores calculated.

Mean rating scores for each condition

All subjects were able to complete the task at the 1000 mm and 100 mm settings. The mean scores for the subjects pushing the wheelchair, for the occupant and for the researcher's assessment are shown in the following table.

With carpet

Direction of movement	Outside to inside			Inside to outside		
Starting distance away from threshold	1000 mm	100 mm	combined	1000 mm	100 mm	combined
Pusher (ease)	1.667	1.667	1.667	2.000	1.333	1.667
Researcher (ease)	2.333	1.667	2.000	2.000	1.333	1.667
Occupant (comfort)	2.000	1.667	1.833	1.667	1.000	1.333

Without carpet

Direction of movement	Outside to inside			Inside to outside		
Starting distance away from threshold	1000 mm	100 mm	combined	1000 mm	100 mm	combined
Pusher (ease)	2.000	2.250	2.125	2.250	2.000	2.125
Researcher (ease)	2.500	2.250	2.375	1.750	1.500	1.625
Occupant (comfort)	2.000	2.750	2.375	2.250	1.500	1.875

In general scores of 3 ('Neither easy or difficult') and above are considered to be acceptable. Instances where the task is rated as 'Difficult' or 'Very Difficult' (scores 4 and 5 respectively) by the wheelchair pusher, or are considered to be unacceptable in the opinion of the researcher.

With this threshold the great majority of scores were 2 or 3 ('Easy' or 'Very easy'). In two instances (in a total of 28 movements) the wheelchair pusher gave a rating of 4 ('Difficult'). In both movements it was with the same participant (i.e. pusher), and occurred once when pushing from the inside to the outside and once with the reverse. This participant appeared to be very hesitant when pushing and very rarely pushed the wheelchair smoothly and firmly as instructed. In these instances however the Researcher's scores were 3 and 2 ('Neither easy or difficult' and 'Easy') respectively.

In most cases negotiation of the threshold from the 1000 mm starting point for the MDS 25/5/2 was judged to be marginally more difficult than when starting from the 100 mm starting point. This judgment was particularly true when considering the views of the researchers. This is contrary to what has been generally found in previous threshold tests where with the 1000 mm start point, the longer run up made negotiating the threshold easier.

There were no instances where the occupant rated the comfort at the 4 or 5 level ('Uncomfortable' or 'Very uncomfortable').

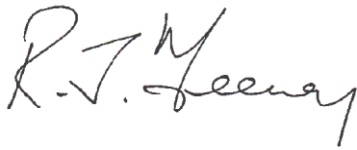
8 Conclusion

The tests were not a scientific test with a truly representative group of elderly persons carrying out repeated trials. The tests nevertheless gave valid results in that the wheelchair

occupant represented a heavy person in the top 8% of the UK adult population and the pushers represented those most frail and elderly of the likely pusher population.

In the author's opinion therefore, the Exitex WeatherSeal MDS 25/5/2 threshold as tested would satisfy the performance requirements of DETR Guidance on accessible thresholds satisfying Part M of the Building Regulations for New Dwellings and also ROI Irish Building Regulations TGD Part M.

Signed :

A handwritten signature in black ink, appearing to read 'R. J. Feeney', written in a cursive style.

R J Feeney
Managing Director