

RESNA '98 INTERNATIONAL CUSHION DESIGN COMPETITION

Denise A. Chesney, Peter W. Axelson, Jamie H. Noon, Allen R. Siekman
Beneficial Designs, Inc., Santa Cruz, California

BACKGROUND

The use of wheelchair cushions to help prevent the development of pressure ulcers is well established in developed countries. A variety of commercial wheelchair seat cushions are available in the United States. One type of seat cushion cannot meet the needs of all wheelchair users; therefore, different technologies and designs are essential. These seat cushions are designed to provide a comfortable, pressure-relieving area that is durable, easy to clean, easy to maintain, and lightweight.

In developing countries, pressure ulcers are the number one cause of death among people with disabilities. The resources to purchase or manufacture state-of-the-art cushions are not available. The majority of commercial seat cushions cannot be produced in these areas because they require materials or manufacturing techniques that are not obtainable. Currently, there are very few low-cost seat cushion designs for people with disabilities.

PURPOSE OF THE COMPETITION

In order to stimulate designs for low-cost, locally-produced wheelchair cushions, an International Cushion Design Competition was started in 1996 by the RESNA special interest group on International Appropriate Technology (SIG 17) (Haddow, Shapcott & Gonzalez, 1997). The first "SoreButts" Cushion Competition was held in conjunction with the Annual RESNA Conference. The purpose of the competition was to encourage the creation of inexpensive seat cushions for the prevention of pressure ulcers in people with disabilities living in developing countries or impoverished areas of the world. The competition continued in subsequent years and the test procedures and methods used to judge and compare the design and performance of the cushions improved over the years.

CONTEST RULES

Designs were required to be original; therefore, commercially available cushions and previously submitted designs were not eligible for the competition. Contestants completed an entry form and submitted it with their cushion. The entry form was used to obtain more detailed information about the cushion, including:

- materials required
- quantities of each material
- source of each material
- estimated cost in U.S. dollars
- list of equipment/tools used to construct the cushion
- step-by-step, detailed instructions on how the cushion was constructed
- total construction time
- weight of cushion
- maintenance (cleaning and care)
- special features (e.g., adaptability of size and shape)

JUDGING PROCESS

Judging occurred at the RESNA '98 Annual Conference in Minneapolis, Minnesota. The cushions were judged by a team of seven experts that included rehabilitation engineers, clinicians, and a consumer/designer. The cushions were evaluated and rated for:

- comfort
- stability
- pressure distribution characteristics
- intuitive use
- catastrophic collapse
- wash-ability
- breathe-ability
- durability
- weight/portability
- cost of materials
- labor time

Judges were instructed to:

1. Briefly examine all of the cushions before beginning to score them.
2. Score cushions one at a time.
3. Place the cushion on a hard, flat surface and sit on it with feet properly supported.

CUSHION COMPETITION

4. Lean as far as possible forward, to the left and right.
5. Consider: ADL's, transfers, weight shifts, circulation, air exchange, ease of drying, moisture wicking, and temperature control.
6. Consider the questions for each category. Score the cushions using a -10 to +20 rating scale: -10 very poor, hazardous; -5 poor; 0 undecided/neutral; 5 good; 10 very good; and 10 excellent.
7. Provide written comments for each cushion.

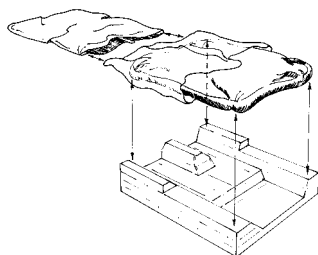
A new anatomical test fixture ("GelButt") was used to load each of the cushions consistently to make repeatable and comparable pressure measurements using an FSA (Force Sensing

Array) Pressure Measurement System (Vista Medical).

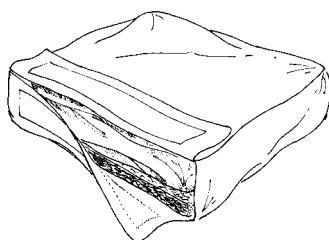
In addition to the judging by rehabilitation experts, a new component was added to the competition – the People's Choice Award. The cushions were set up in the exhibit hall and over 100 conference attendees sat on each cushion and then ranked their top three choices in four different areas: 1) durability/maintenance, 2) stability, 3) comfort, and 4) overall performance.

LOW-COST SEAT CUSHIONS

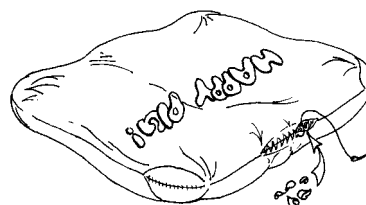
Nine (9) cushions were entered into the competition: six (6) from India, and one (1) each from Hong Kong, Pakistan and the US.



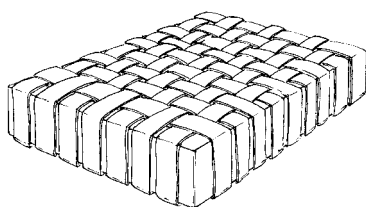
Cushion #1 U.S. ~\$8.00
wood base
wood shavings in fabric cover



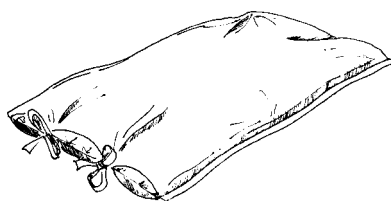
Cushion #2 India ~\$8.00
coconut fiber 'coir' base
thermocool balls in fabric
rubber cloth cover



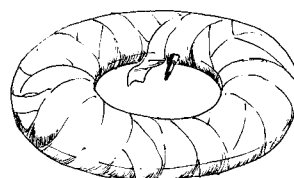
Cushion #3 Hong Kong \$0
buckwheat hulls in T-shirt bag



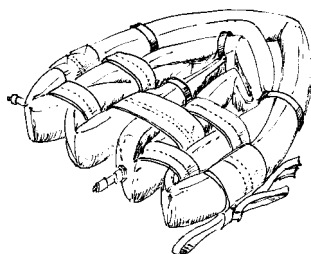
Cushion #4 Pakistan ~\$1.10
rubber tire strips over wood
frame



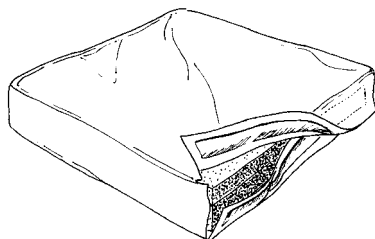
Cushion #5 India ~\$2.00
cotton waste material with a
cotton cover and a rayon
outer cover



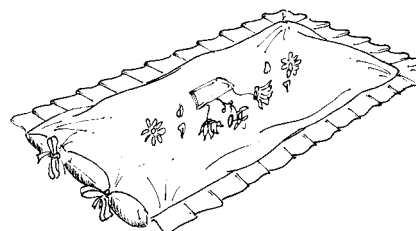
Cushion #6 India ~\$5.00
scooter tire inner tube wrapped
with a bandage or scrap
material



Cushion #7 India ~\$1.00
bicycle inner tube with cotton
webbing and cloth



Cushion #8 India ~\$5.00
expanded polyfoam (packing
foam) in a rubber cloth cover



Cushion #9 India ~\$1.25
cotton stuffing with a cotton
cover and a cotton outer cover

Table 1. Results of Judging by Expert Team: Average Scores

	F	#1	#2	#3	#4	#5	#6	#7	#8	#9
Comfort	2	1.4	7.0	10.6	-4.3	-4.0	-2.0	5.7	5.6	-4.0
Stability	2	5.7	5.3	7.4	2.6	2.9	-7.9	3.6	9.0	3.6
Pressure	4	-2.9	-2.0	5.8	-5.7	-1.1	-0.7	2.4	-2.3	-3.3
Intuitive use	2	4.3	3.6	9.0	9.6	12.9	6.4	2.1	9.7	12.1
Catastrophic clps	1	4.9	8.4	8.6	8.1	7.9	-6.4	-6.4	6.4	7.1
Wash-ability	1	4.3	8.9	2.1	9.9	0.7	10.4	12.4	10.0	2.1
Breathe-ability	1	5.3	1.3	13.0	10.9	5.7	6.9	12.1	1.0	5.0
Durability	1	11.7	12.1	5.7	13.3	7.9	3.1	5.0	9.3	3.6
Weight/Portability	1	-5.7	13.4	12.4	1.6	9.6	14.4	14.9	10.7	9.7
Total		27.6	64.3	110.2	27.0	37.7	5.9	62.0	67.1	25.5
Place			2nd	1st				2nd	2nd	

Catastrophic clps = Catastrophic collapse F = Factor used to weight score when calculating the total score.

Table 2. Results of People's Choice: Computed Score based upon rankings

	#1	#2	#3	#4	#5	#6	#7	#8	#9
Comfort	55	134	125	23	29	48	76	147	44
Stability	112	106	93	52	30	6	44	184	41
Overall	65	142	104.5	30	28	26	66	161	42.5

RESULTS

For each category, the average score of the expert judges was computed for each cushion (Table 1). A total score for each cushion was then calculated by weighting each category according to an assigned factor of importance.

For the People's Choice component of the competition, a total score for each category was computed for each cushion, based upon the rankings submitted (Table 2).

The winners of the competition were:

1st Place – \$1,000

3 by Pui Kong Cheng of Hong Kong

2nd Place (3-way tie) – \$250 each

8 by D. Nanda of India

2 by Ritu of India

7 by Sharad Dahake of India

People's Choice Award – \$250

8 by D. Nanda of India

CONCLUSION

The competition served to help in the development of new designs for low-cost seat cushions. Continuation of the competition will hope-

fully help improve the availability of cushions in developing and impoverished countries.

REFERENCE

Haddow A, Shapcott N, Gonzalez J (1997). Wheelchair Cushion Designs for Developing Countries: Project Sorebutts, *Proceedings of the RESNA '97 Annual Conference*, Pittsburgh, PA, pp 471-473.

ACKNOWLEDGMENTS

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Denise A. Chesney

denise@beneficialdesigns.com

ph 831.429.8447 fax 831.423.8450