

# **SOREBUTTS 2000 CUSHION DESIGN COMPETITION**

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## **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.

## **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 has continued since then on an annual basis.

## **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, and source
- estimated cost in U.S. dollars
- list of equipment/tools used
- step-by-step, detailed instructions on how the cushion was constructed
- total construction time
- weight of cushion
- maintenance (cleaning and care)
- special features

## **CUSHION ENTRIES**

Eleven (11) cushions were entered into the competition: four (4) from India, four (4) from the U.S., and one (1) each from Bangladesh, Sri Lanka, and the U.K.

## **PRESSURE MEASUREMENTS**

Pressure measurements were made using a load/deflection test fixture (Figure 1) with a Seating Interface Tester (SIT or "GelButt") as the indenter (Siekman et al., 1998). The anatomical SIT was created by taking a mold of the buttocks and posterior thighs of an adult male with a spinal cord injury. From this mold, a gel material was cast around a pelvis/femur model (Siekman et al., 1998). An FSA (Force Sensing Array) Pressure Mapping System (Vista Medical) was used to measure pressures at the SIT-cushion interface. This testing equipment provided repeatable and comparable pressure measurements. Each seat cushion was loaded consistently and pressure readings were recorded.

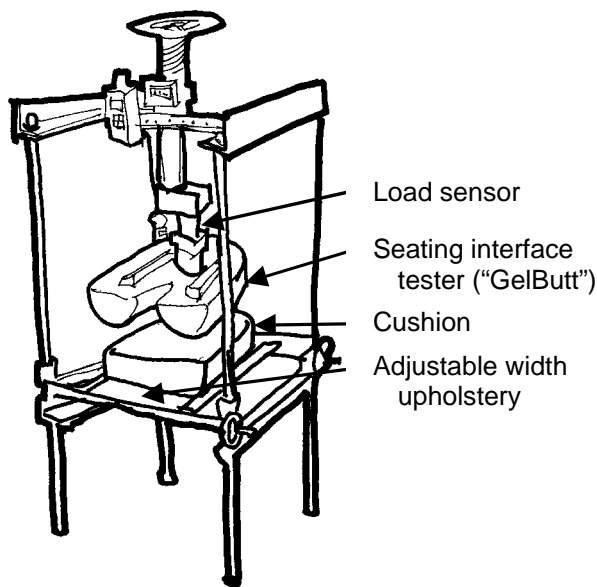


Figure 1. Load/Deflection Test Fixture

**PEOPLE’S CHOICE**

The cushions were set up in the exhibit hall and 93 conference attendees sat on each cushion and then voted for their top three choices in three different areas: 1) stability, 2) comfort, and 3) overall performance. A total score was computed for each cushion, based upon the votes submitted.

**FORMAL JUDGING**

Judging occurred at the RESNA 2000 Annual Conference in Orlando, Florida. The cushions were judged by a team of 10 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 scored 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. Judges ranked the cushions (with one being the best) based upon the overall characteristics of the cushion. Written comments and suggestions for improvement were also recorded. For each category and the overall ranking, the average score of the expert judges was computed for each cushion.

**LOW-COST SEAT CUSHION DESIGNS**

The judging results and seat cushion designs are shown below.

**Formal Judging & People’s Choice Results** (Listed by Cushion Entry Number 00–)

<b>Formal Judging</b>	<b>01</b>	<b>02</b>	03	04	05	<b>06</b>	<b>07</b>	08	09	10	11
Comfort	9	5	0	3	4	12	9	4	-3	3	-3
Stability	7	8	7	7	7	9	8	6	-8	5	0
Pressure	13	1	3	2	2	6	7	4	-3	0	-2
Intuitive use	8	9	7	8	4	8	7	4	3	7	6
Catastrophic clps	9	9	10	9	8	10	6	6	-6	2	4
Wash-ability	6	4	6	7	2	9	2	5	1	6	7
Breathe-ability	5	3	1	-2	5	8	6	5	10	4	4
Durability	7	5	3	5	1	7	3	5	-1	3	4
Weight/Portability	11	12	6	5	6	9	10	7	1	11	13
<b>Total Score</b>	<b>74</b>	<b>55</b>	43	44	38	<b>76</b>	<b>57</b>	45	-6	40	32
<b>Overall Ranking Place</b>	<b>2<sup>nd</sup></b>	<b>3<sup>rd</sup></b>	5.3	4.6	5.7	<b>1.6</b>	<b>4.9</b>	8.0	9.6	7.9	9.3
<b>People’s Choice</b>	<b>01</b>	02	03	04	05	<b>06</b>	07	08	09	<b>10</b>	11
<b>Total Score</b>	<b>109</b>	31	31	15	15	<b>112</b>	66	24	20	<b>99</b>	8

Catastrophic clps = Catastrophic collapse

**WINNING LOW-COST CUSHION DESIGNS**

**1<sup>ST</sup> PLACE & PEOPLE'S CHOICE**



**Moulded Coir Cushion** by Motivation Charitable Trust in Sri Lanka (#00-06): Polyurethane foam over a molded coir base with a shower-proof cover (\$12.00)

**2<sup>ND</sup> PLACE & PEOPLE'S CHOICE**



**Generic Contoured Foam Cushion** by Motivation Charitable Trust & CRP in Bangladesh (#00-01): Foam contoured cushion with water resistant cover (\$4.38)

**3<sup>rd</sup> PLACE (tie)**



**Cushy Tushy** by J.Tipton & J.Ysselstein in the U.S. (#00-07): Packing foam peanuts in socks, layered, with a t-shirt cover (\$1.35)

**3<sup>rd</sup> PLACE (tie)**



**Low Cost ETOM (Easy to Make) Cushion** by C.Thademy & B.Chakardorty in India (#00-02): Plastic bags in a cotton cover with compartments (\$0.90)

**PEOPLE'S CHOICE**



**Recycled Comfort** by J.Ysselstein & J.Tipton in the U.S. (#00-10): Plastic bags with bubble wrap base (\$0.80)

**OTHER LOW-COST CUSHION DESIGNS**



**Paddy Straw Cushion** by D.Nanda in India (#00-03): Three bundles of paddy straw wrapped with t-shirt material in a waterproof nylon cover (\$1.38)



**Jute Fiber Cushion** by A.Kumar in India (#00-04): Jute fiber of different lengths in a t-shirt with stitched compartments with a waterproof nylon cover (\$1.61)



**Indian Hay Foam Cushion** by S.Abraham & S.Kumar in India (#00-05): Foam pieces and hay in separate layers, on a wooden base with a cotton cover (\$0.03)



**The Recycled Plastic** by R.Catricala & J.Roberts in the U.S. (#00-08): Plastic bags and bubble wrap (\$1.64)



**Air Butt** by J.Ysselstein & J.Tipton in the U.S. (#00-11): Air packets in a t-shirt (\$3.00)



**Orthopoise** by D.Bain, M.Ferguson-Pell, G.Nicholson, P.Davies & P.Lennon in the U.K. (#00-09): Wooden cushion using a 2-tier mosaic of biaxial see-saws (\$1.00)

The competition promoted the development of new designs for low-cost seat cushions, and assisted in the dissemination of this information. Continuation of the competition will hopefully help improve the availability of cushions in developing countries.

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