

# Footwear for Overweight/Obese individuals



Presented by

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## Significance of research on Footwear for overweight/obese

- Overweight/Obese individuals' prefer sports footwear as their choice.
- Footwear for customers' available in the retail outlets are predominantly ideal for normal subjects. Hence, overweight/obese individuals face difficulties on choosing footwear of their interest.
- SDDC has geared up on focussing research on the design and development of footwear for therapeutic benefits. This presentation is a part of research activity of SDDC under STRAIT Project.

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## Introduction

- Overweight and Obese individuals are constantly growing and witnessing a major proportion in the world population.
- These People fall under High Body Mass Index category develop problems relating to foot namely foot and ankle pain, musculoskeletal disorders, Arthritis, Plantar fasciitis and other complications.
- It is the need of hour to render pragmatic solution for the beneficiaries to feel at ease.

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## Methodologies towards Last Modelling

- Anthropometry studies carried out to garner data on Foot Parameters of Obese People.
- Standardization on Foot Characteristics was arrived at.
- Shoe Lasts for Obese footwear were modelled.

 <b>CLRI</b> Central Leather Research Institute Council of Scientific and Industrial Research										
<b>ROTUND FOOTWEAR SUBJECTS</b>		AGE/s	HEIGHT	WEIGHT	BMI	FITTING GIRTH	INSTEP GIRTH	HEEL GIRTH	ANKLE GIRTH	LENGTH
antony	26	1.74	116	38.31	280	305	365	260	280	
antony Micheal	57	1.74	94	31.05	295	355	275	270	345	
ashok	29	1.6	110	42.97	265	290	365	266	280	
christo	25	1.67	75	26.89	260	271	330	214	275	
daniel	29	1.73	105	35.08	295	355	275	270	330	
kishore	45	1.71	120	41.04	280	315	370	280	270	
krishnakumar	32	1.7	119	41.18	281	316	370	283	275	
kumaravel	53	1.58	90	36.05	279	295	356	260	275	
micheal	26	1.75	106	34.61	265	295	355	275	270	
mohanraj	51	1.69	77	26.96	260	275	325	215	275	
narayanan	36	1.65	95	34.89	260	287	360	263	284	
prasath	53	1.58	90	36.05	270	293	357	260	270	
rajasekar	55	1.62	80	30.48	240	245	365	300	280	
rajendran	55	1.72	109	36.84	280	295	365	265	275	
rajkumar	22	1.69	73	25.56	245	275	240	236	265	
ramasubramaniam	45	1.68	100	35.43	280	300	380	270	295	
SUBJECT 1	26	1.9	113	31.30	270	270	370	280	320	
SUBJECT 10	25	1.72	98	33.13	282	309	385	270	290	
SUBJECT 11	45	1.89	102	28.55	280	320	390	270	295	
SUBJECT 12	50	1.69	78	27.31	260	270	325	215	275	
SUBJECT 13	12	1.27	51	31.62	240	215	290	250	180	
SUBJECT 14	45	1.68	100	35.43	280	300	380	270	295	
SUBJECT 15	28	1.73	120	40.09	270	290	360	270	280	
SUBJECT 16	53	1.58	90	36.05	278	293	357	260	270	
SUBJECT 17	29	1.6	110	42.97	265	290	365	266	280	
SUBJECT 18	45	1.71	120	41.04	280	315	370	280	270	
SUBJECT 19	27	1.73	115	38.42	280	305	365	260	280	
SUBJECT 2	30	1.7	92	31.83	270	270	365	270	350	
SUBJECT 20	11	1.2	46	31.94	230	212	280	240	175	
SUBJECT 21	55	1.71	108	36.93	280	300	360	265	275	
SUBJECT 22	28	1.75	111	36.24	270	291	370	270	280	
SUBJECT 23	49	1.73	95	31.74	260	275	380	320	218	
SUBJECT 24	43	1.69	96	33.61	268	275	355	328	230	
SUBJECT 25	50	1.61	80	30.86	255	255	335	240	215	
SUBJECT 26	35	1.65	84	30.85	265	270	365	275	274	
SUBJECT 27	49	1.69	88	30.81	265	264	355	275	280	
SUBJECT 28	13	1.35	60	32.92	250	250	310	270	274	
SUBJECT 29	22	1.68	72	25.51	245	270	340	235	265	

## Images of Foot



## Images of Foot



## Prototyping of Shoe lasts



## Shoes constructed for Overweight/ Obese individuals



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## Exploring Research on Footwear

- Plantar Pressure Analysis on Polyurethane inserts exclusive for Overweight/Obese Individuals. This paper was recently presented at International Conference (IMME-2015) at Phuket Island, Thailand and will published in the Journal “Applied Mechanics and Materials”.

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## Footwear inserts (Latex Rubber Foams)



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## Footwear Inserts (PU Foams)



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## Materials and Methods

- Polyurethane foam material is considered as an element of foot care solution in footwear application.
- Polyurethane foam materials have been identified and experimented on physical test methods - Hardness, Density, Compression set & Cushion properties following SATRA Specifications @ laboratory, CLRI.

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## Testing equipments used in scientific analysis



Static Compression  
set apparatus



Universal Testing  
machine



Dynamic Compression  
set apparatus

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## Physical test parameters of PU foam materials

Description	D55	D75	D95	D120
Density (g/cc)	0.047	0.073	0.092	0.102
Hardness (00)	31	33	37	38
Compression (Static) Set	12.0	9.33	6.74	6.17
Compression Set (Dynamic)	3.82	5.9	4.8	2.3
Compression Spread (%)	8.97	8.2	6.7	6.57

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## Comparison of cushion energy with varied density PU foam materials



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## Mean & Standard Deviation for Cushion Energy of PU foam materials

Cushion Energy	Density	Mean $\pm$ S.D.
(Static Condition)	55D	88.33 $\pm$ 4.082
	75D	106.67 $\pm$ 5.164
	95D	125 $\pm$ 5.477
	120D	138.33 $\pm$ 4.082
(Dynamic Condition)	55D	136.67 $\pm$ 5.164
	75D	160 $\pm$ 0.001
	95D	195 $\pm$ 5.477
	120D	215 $\pm$ 5.477

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## Plantar Pressure Analysis – Pedar System



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## Plantar Pressure and Contact Area of PU Foam inserts

Description of PU Foam Inserts	Peak Pressure (KPa)		Contact Area (Cm2)	
	Left Foot	Right Foot	Left Foot	Right Foot
120D PU Insert Material	306	374	148.90	146.32
95D PU Insert Material	307	389	146.32	147.35
75D PU Insert Material	311	430	148.64	140.13
55D PU Insert Material	316	415	148.13	143.23
No PU Insert Material	356	429	125.42	135.23

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## Discussion

- In the scientific evaluation on Polyurethane foams of varying density characteristics, D120 has been considered as an ideal material of choice for comfort to Overweight/Obese Individuals.
- The higher values on hardness, density and compression set properties in the case of D120 regarded as better in functional performance while comparing other density materials. Hence Resiliency/ Recovery behaviour is of key importance for footwear inserts and application.

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- In Plantar Pressure Analysis, D120 Polyurethane foam material possessed minimum peak pressure and maximum contact area would aid in alleviating foot related problems of Overweight/Obese.
- The increased value of area of contact in the case of D120 material would help dissipation of pressure in human locomotion phases.

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## Conclusion

- The material D120 Polyurethane foam is revealed scientifically as a footwear insert component to provide all essential comfort features for the Overweight/Obese individuals.
- In-shoe pressure measurement analysis revealed D120 Polyurethane foam with minimum plantar peak pressure and maximum contact area in human locomotion.
- It is finally concluded Polyurethane D120 material as the best material recommendable for high BMI Segments.

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