

New Dimensions in Children's Shoes

"ensuring proper fit and comfort for the children during wear"



A CSIR-CLRI endeavour under "Science & Technology Revolution in Leather with a Green Touch"



The Children's feet grow at a rapid rate thus necessitating a frequent change in footwear to accommodate this foot growth. In order to provide correct fitting shoes for them it is essential to gather reliable foot dimensions of children which is done through a 'digital capture' of the foot images. A novel method of 'cluster analysis' leads us to compress the complete children's size range from Children Size 10 to Adult Size 3 into only 5 Groups which helps in optimizing the size range to be manufactured, accommodates the foot growth in children and also reduces the frequency of footwear change.

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The Rationale & CSIR-CLRI endeavor

India foresees a need for growth of leather sector as it generates employment, has high domestic value addition and a large rural population devoted to ethnic product manufacture and is historically an area of strength in the export market. Industry requires an additional 2 billion square feet of leather in the next five years, which can only be met either through import of raw material or value enhancement to the available material through application of appropriate technologies. There is a need to address the technology challenges to sustainable development, such as fluctuations arising out of need for compliance to eco-norms, customer preferences to hi-tech materials, designs, etc proactively. Institutional support from CLRI for the development of Indian leather industry is an advantage for India. CLRI proposes to provide an S&T revolution in leather with a green touch (STRAIT), comprising of elements such as value engineering, chemicals for and from leather, green chemistry, smarter leather and leather products and environmental science support systems. Such an intervention is likely to provide maximum utilization of substrate and process chemicals, newer range of chemicals leading to smarter leather based materials and products such as children footwear, therapeutic footwear and leather composites. In economic terms, a value enhancement of 700 to 800 per cent from the existing average of 400 per cent, leading to the industry in India meeting the national agenda on enhanced export earnings for the 12th plan is envisaged.

The package for "Development of children's Shoes" envisages conversion of technologies for making smarter leathers to development of smarter leather based composites and products of high relevance such as children shoes, therapeutic footwear, ethnic products with leather etc. Such of those technology elements, which are required to be addressed in the conversion of leather to a composite material or product is addressed in this package.

Approach:

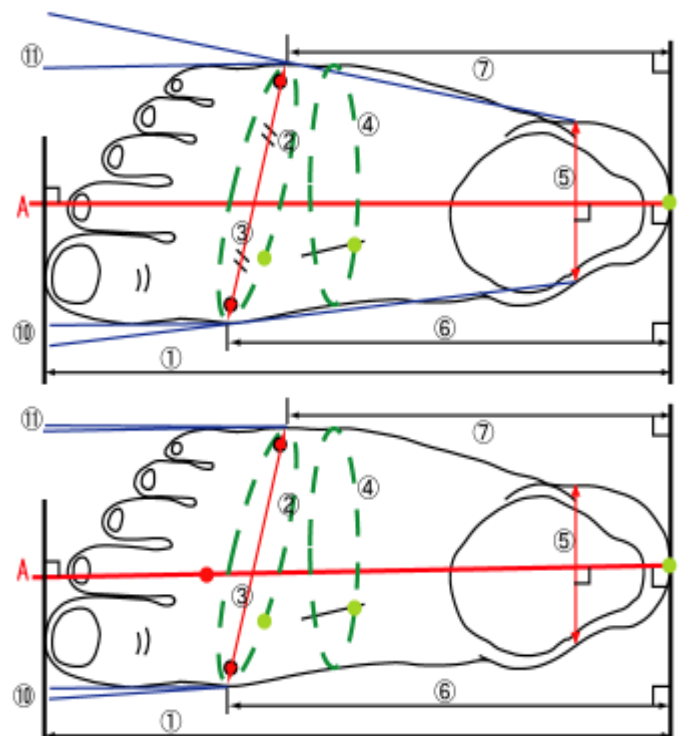
- To establish and fabricate special fitting range of lasts for children from the foot data gathered
- To understand children's shoe trends
- To introduce new materials as well as design concepts and manufacturing methods in Children's shoes
- To identify appropriate components and accessories for children's shoes to enhance their Comfort properties
- To fabricate the improved range of Children's shoes designed
- To carry out wear trials of the newly developed Children's shoes

Methodology:

- Identifying the school children of age 6-10 (includes both boys and girls)
- Measuring the feet as well as some important reference points in the foot of the Children with the help of the 3D foot scanner machine
- Computing the measured data for statistically clustering the groups and arriving at the last parameters
- Material selection for shoe manufacture
- Designing the shoe according to the fashion trends
- Manufacturing the shoe ensuring proper fit and comfort for the children during wear

FOOT DIMENSIONS CAPTURED

1. Foot length
2. Ball Girth circumference
3. Foot breadth
4. Instep circumference
5. Heel breadth
6. Instep length
7. Fibulare Instep length
8. Height of Top of Ball Girth



The anthropometric foot survey has yielded data on the Children's foot parameters

- Statistical Analysis has resulted in 5 distinct size groups for Children's feet dimensions

Existing	Children Size 10 & 11	Children Size 12	Children Size 13	Adult Size 1 & 2	Adult Size 2 & 3
Optimized	I	II	III	IV	V

- The LAST parameters have been arrived at for each of these size groups
- LAST Modelling done and Lasts manufactured

Material:

Special Eco friendly Leathers devoid of banned and toxic substances and which do not produce any health impact on the Children have been developed. These Leathers would accommodate for the natural foot growth and allow for natural foot function of the children.

Design:

The Children's Shoes have been developed in accordance to the Trend forecasts prevalent for the current season. The styling has been done to ensure the 'comfort' and 'safety' of the children. Colours have been incorporated in the styling of these shoes in harmony with the House to which these Children belong in the school.

The salient features of the Children's Shoes designed are:

- **BOYS design:** Derby cut Styling with padded spoiler topline with welt colour, lace tip colour, Flag and eyelets in House colour
- **GIRLS design:** Ballerina with Velcro strap with welt colour, Velcro bar end decoration rivet in House colour
- **Leather:** Golf Nappa and Special Leathers Developed for Children's Shoes by CSIR-CLRI
- **Lining:** Sport mesh
- **Sock:** Mesh with Eva lamination
- **Insole:** Texon with shank board and steel shank
- **Soles:**TPU Soles with colour welt matching to house colour

Testing:

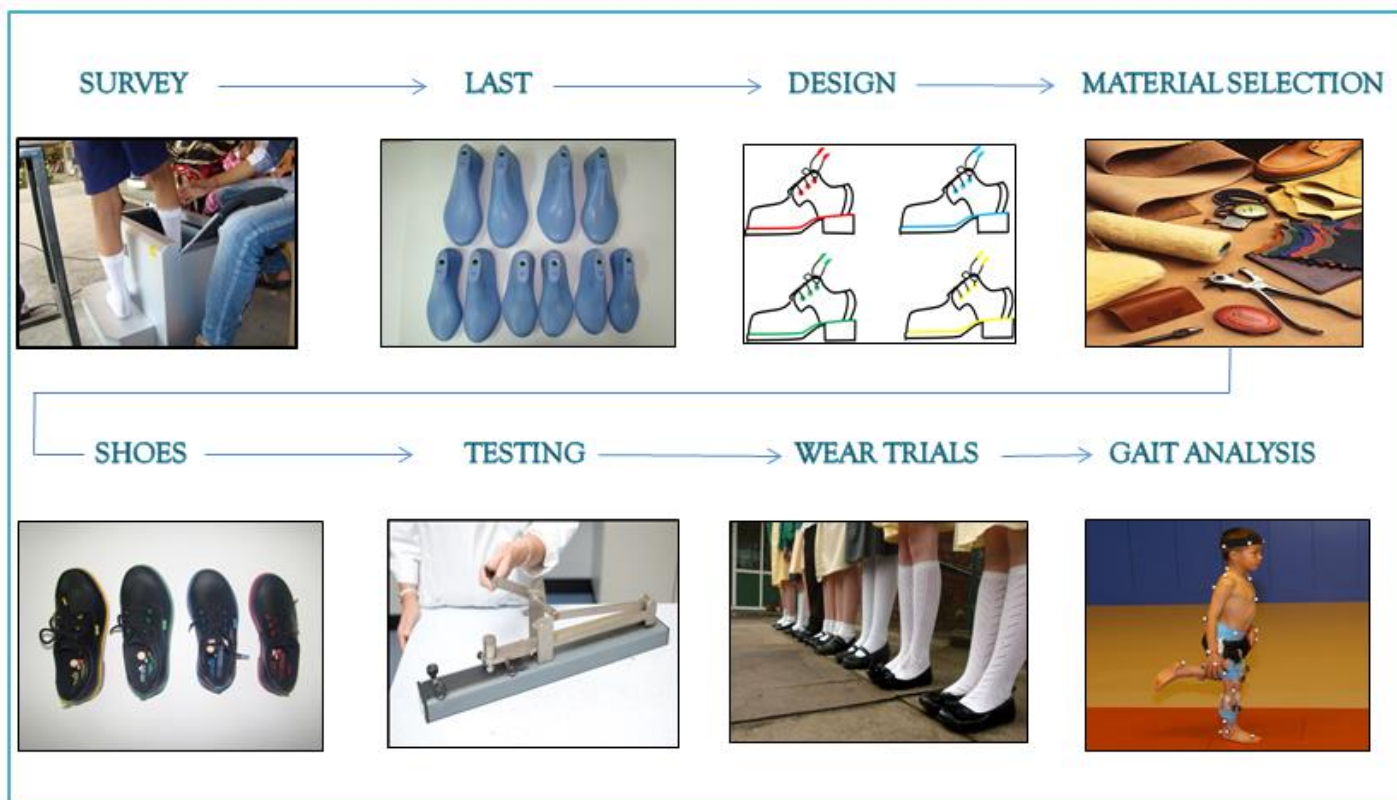
Comprehensive Tests for evaluating the Strength Properties of the Upper Leather, Soling Materials, Lining Materials and Insock Material were carried out and the efficacy of using these materials were established.

Fit and Comfort Trials

The Shoes were fabricated and the 'Fit' and 'Comfort' studies were carried out using the "**Gait Analysis**" system where the walking pattern/ Gait of Children wearing the New Shoes was carried out and the Pressure patterns were studied to establish the efficacy of the new shoes developed.

From the results it is very clear that the peak impact has been reduced significantly on wearing the new shoes, which clearly demonstrates that the new shoes are able to provide better impact absorption and provide for better cushioning and shock absorption.

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Graphical Summary of the Project Stages in the development of Children's Shoes

PILOT Study:

A Pilot Study was initiated and fifty pairs of shoes were manufactured by M/s Bachi Shoes Limited, ranipet with soles from Euro Shoe Components and lasts from Sanghavi Shoe Lasts for 'wear trials' and comfort study. The Shoes manufactured covered all the five size groups defined for both and girls. The shoes were given to the students of KV CLRI where the foot measurements were earlier taken and they were then brought to the gait analysis laboratory of CLRI for their movement analysis on wearing the newly designed footwear.



In Picture: Shoes being fitted on the school children and the children seen posing happily with the shoes presented to them

Significant leads/accomplishments presented to Dr Paramvir Singh Ahuja, Director General , CSIR and to Prof Dr AB Mandal, Director, CSIR-CLRI on 11th July 2014

During the visit of the Director General of CSIR to the CLRI Shoe Design & Development Centre on 11th July 2014, the endeavour was presented and the significant achievements of the STRAIT project were highlighted.





In Pictures: Dr Paramvir Singh Ahuja, Director General, CSIR and Prof Dr AB Mandal, Director, CSIR-CLRI seen interacting with Team CSIR-CLRI Shoe Design & Development Centre

As Anticipated Deliverables	The Significant Achievements
<ul style="list-style-type: none"> Foot dimensions of the growing Children's feet through an Anthropometric survey using Digital Image Capture Technique Statistically Analyse the captured Data for 'Cluster Grouping' of foot sizes Model the derived Last parameters Develop special leathers complete with absence of banned or potentially toxic chemicals suitable for Children's Shoes Incorporate Children's Footwear Trends in styling their shoes Enhance the comfort of their shoes through an appropriate selection of components and accessories Fabricate improved Shoes for the children 	<ul style="list-style-type: none"> Fabricated special fitting lasts Introduced new materials, design concepts & manufacturing methods Special Eco friendly Leathers devoid of banned and toxic substances with CSIR-CLRI know how developed to accommodate for the natural foot growth and allow for natural foot function of the children Children's Shoes developed in accordance to the Trend forecasts prevalent. The styling was done to ensure the 'comfort' and 'safety' of the children. Identified appropriate components and accessories Fabricated improved Children's Shoes Colours incorporated in the styling of these shoes in harmony with the House to which these Children belong Shoes fabricated and the wear trials being carried out for 'Fit' and 'Comfort' feedback

CSIR-CLRI will continue to endeavour to **provide proper fit and comfort on Children's Shoes. The NEXT LEVEL of upscaling the project is underway.** For further details, please contact: sddc@clri.res.in