



TOGETHER
for a sustainable future

OCCASION

This publication has been made available to the public on the occasion of the 50th anniversary of the United Nations Industrial Development Organisation.



TOGETHER
for a sustainable future

DISCLAIMER

This document has been produced without formal United Nations editing. The designations employed and the presentation of the material in this document do not imply the expression of any opinion whatsoever on the part of the Secretariat of the United Nations Industrial Development Organization (UNIDO) concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries, or its economic system or degree of development. Designations such as “developed”, “industrialized” and “developing” are intended for statistical convenience and do not necessarily express a judgment about the stage reached by a particular country or area in the development process. Mention of firm names or commercial products does not constitute an endorsement by UNIDO.

FAIR USE POLICY

Any part of this publication may be quoted and referenced for educational and research purposes without additional permission from UNIDO. However, those who make use of quoting and referencing this publication are requested to follow the Fair Use Policy of giving due credit to UNIDO.

CONTACT

Please contact publications@unido.org for further information concerning UNIDO publications.

For more information about UNIDO, please visit us at www.unido.org



05200



UNITED NATIONS
INDUSTRIAL DEVELOPMENT ORGANIZATION
1911, MIAMI, FLORIDA
19 November 1974
ORIGINAL - BANGALORE

United Nations Industrial Development Organization

Seminar on the development of footwear
manufacturing and leather goods
manufacturing in developing countries

Madras, India, 4 - 13 February 1974

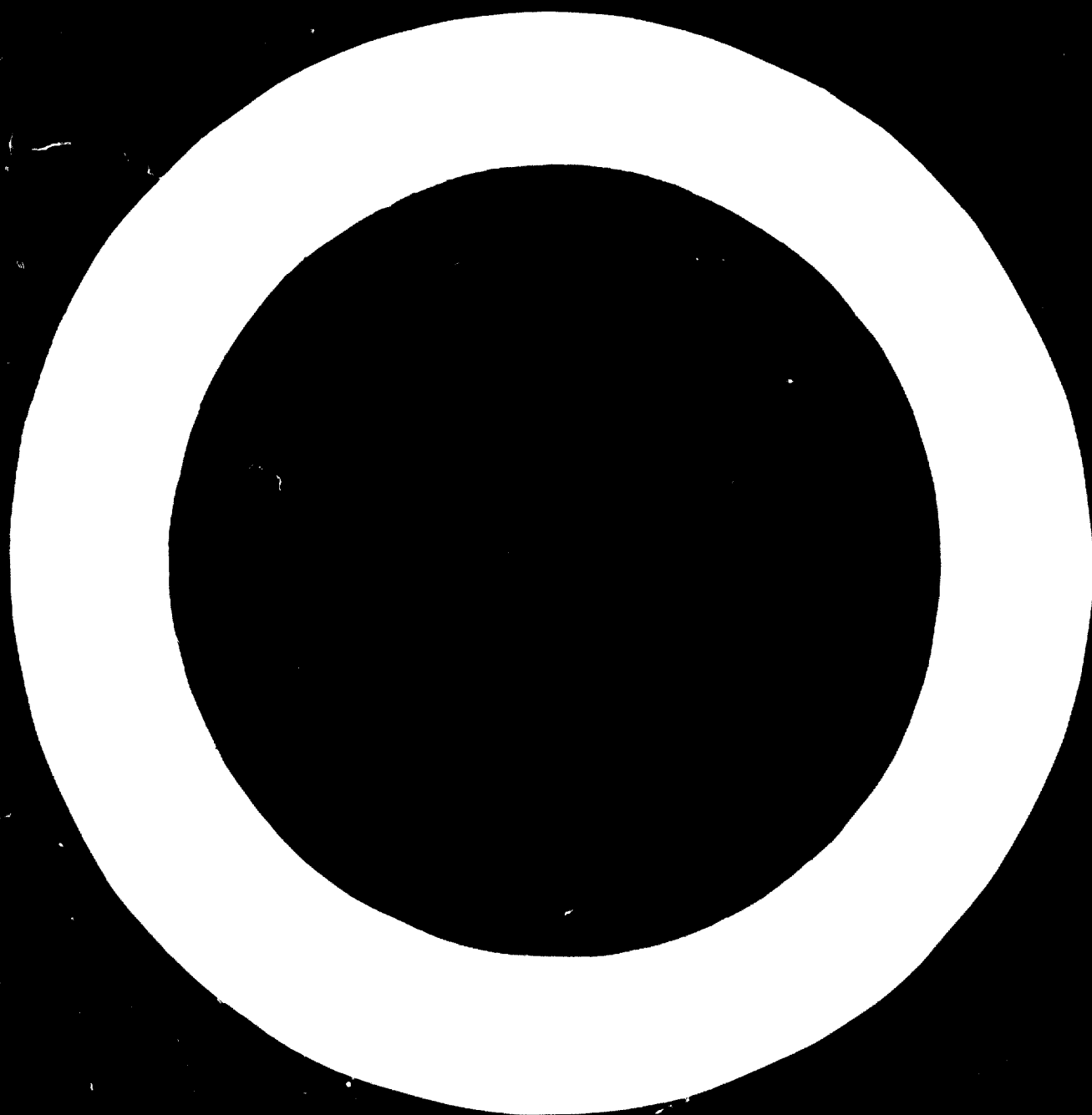
STANDARD FOOTWEAR SIZES FOR CHILDREN 1/

N. Ramanathan*
B. Vekatappaiah**

- * Deputy Director, Central Leather Research Institute, Madras, India
- ** Senior Scientific Assistant, Central Leather Research Institute, Madras, India

1/ The views and opinions expressed in this paper are those of the authors and do not necessarily reflect the views of the Secretariat of UNIDO. This document has been reproduced without formal editing.

We regret that some of the pages in the microfiche copy of this report may not be up to the proper legibility standards, even though the best possible copy was used for preparing the master fiche.



CONTENTS

	<u>Page</u>
INTRODUCTION	1
DIFFERENT SIZING SYSTEMS AND FITTINGS	2
(a) Length scales	
(b) Girth scales	
EUROPOINT AND MONDOPOINT	4
RESULTS OBTAINED BY THE AUTHORS	5
PARAMETERS STUDIED	5
STUDIES ON THE RATE OF GROWTH OF THE FEET OF CHILDREN	12
EFFECT OF THE RATE OF GROWTH OF THE FOOT ON THE RATIO LENGTH OF THE FOOT/BREADTH OF THE FOOT	12
SIZES AND FITTINGS SUGGESTED	13
CONCLUSIONS	16
REFERENCES	17



INTRODUCTION

The footwear wearing habit is slowly catching up in the developing nations even as they are showing keen interest in developing the footwear industry. It is at this time we have to plan for achieving its growth in the right direction so that the foot health of the people is protected. The industry, production, distribution and the management of these units are being organised, managed and financed by foreign companies mostly European. They follow their own standards in sizing and fittings, irrespective of the fact the shoe may fit or pinch. People limping with new ill fitting pinching footwear for a few days until the shoe gets adjusted are quite a common sight and experience. In the case of leather used as footwear material, this sort of adjustment might be possible, but when the material happens to be a synthetic there is trouble and hence a shoe must have a good fitting. There is a need for correct programing and setting up of proper standards for these nations. Most of the children in the developing countries do not wear any footwear either in or outside their homes. Even school going children are barefooted, unless they are compelled to have footwear by the authorities of the school where there is a dress and footwear regulation. Even then, the children go barefooted outside school hours. Shoes, once purchased, are rarely changed even though the foot overgrows the shoes. They wait until the shoe is almost damaged, and then only think about replacing it by a new footwear and in the school, children walk, run, jump and play with the footwear on. This may lead to foot troubles which may even worsen by wearing illfitting shoes, distorting toes, causing calluses and bunions. Bad shoes¹ may even contribute to poor foot posture with accompanying strain

and excessive fatigue. The problem of sizing, fitting and designing of footwear for the normal growing feet of children still remains unsolved. For this there is a necessity for a correct sizing and fitting based on scientific facts and figures. The different sizing systems predominantly used are the British scale, Paris Point (Continental Scale), American scale and so on.

DIFFERENT SIZING SYSTEMS AND FITTINGS

(a) Length Scales

The British system of sizing is said to have been based on the length of barleycorns, three of which make up one inch on an average. The sizes were arrived at by consecutive increase of the length by that of one barley corn viz. $\frac{1}{3}$ of an inch with the scale, starting at 4'' being called the '0' size. The children's sizes are from 1 to 13 i.e. $4\frac{1}{3}$ '' to $8\frac{1}{3}$ '', whereas adult sizes again are from 1 to 12 starting from $8\frac{2}{3}$ '' to $12\frac{1}{3}$ ''. Half sizes of $\frac{1}{6}$ '' are also used in between two full sizes. The size of the shoe corresponding to the length of the foot is obtained from the formula

$$(\text{length of the foot in inches} - 4)3.$$

In the case of adult's foot it is $13 - (\text{length} - 4)3$.

In the American System, the zero position starts at $3\frac{11}{12}$ '' instead of 4'' as in the British System. Excepting for this, it is similar to the British system with a size interval of $\frac{1}{3}$ '' and half sizes intervening. American sizes are shorter by $\frac{1}{12}$ '' as compared to the corresponding English sizes. But their size markings are $1\frac{1}{2}$ sizes greater than the English size.

The Continental system Paris Point has a size interval

of $2/3$ cm with no half sizes intervening and sizes are marked continuously without any break. English sizes are converted into Paris Point from the formula.
 English size converted into inches $\times 2.54 \times 3/2$

(b) Girth Scales

Lasts are made with different girth measurements for the same length and also different girth measurements for different lengths to enable a greater number of feet to be efficiently fitted. These are called fittings. From one fitting to another the increase in girth measurement may be $1/4''$ on the English scale and 7.5 mm on Paris Point. Each fitting for the same size is identified by the letters A, B, C, D, E, F, G, H, XH depending on the nature of the foot fitting the shoe. On Paris Point scale these are represented by the numbers 1, 2, 3, 4, 5, 6, 7, 8 and 9. Though the American sizes are marked $1\frac{1}{2}$ times more than the corresponding English sizes, they are marked two fittings less than the English scale. Thus an English shoe 7D would become $8\frac{1}{2}$ B on the American scale.

The present system of sizes has been subjected to controversy and criticism and yet it is followed. It is considered by many that full size increases of $1/3''$ are too large and half size increases of $1/6''$ are too small for a shoe with good fittings. The size denotes the measurements on last and its relationship with foot length of the given size is not known. Tedious calculations are involved in converting one system to another and also the foot measurements to shoe sizes. Also the fitting intervals vary from one manufacturer to another resulting in the shoes of the same size and fitting made by two manufacturers not fitting the same foot. Proper shoes are fitted on the

foot only by trial and error. In short, a shoe size does not tell us the size of the shoe either in length or in width or the ratio between the length and the width used in the sizing. A particular sizing scale adopted by a country may cater to the needs of that particular country but when it is the question of one country depending on the other for footwear it is disastrous. This may also result in large surplus stocks with the retailers at the end of the season.

EUROPOINT AND MONDOPOINT

The various difficulties experienced by the different scales of sizing have given rise to a new thinking for universal standardisation. The first step in this direction was 'Europoint' and later on modified by Manning into 'Mondopoint'. Europoint² is restricted to only the length scale, the lower and upper fixed points on this scale being 114 mm corresponding to a baby's size of 2½ and 306mm corresponding to the adult size 13. In between there are 193 possible sizes. Eliminating odd numbers the number of sizes can be reduced to 97. The size interval is thereby made 2 mm. Again this size interval depends on the type of construction. The size interval recommended was 6 mm for Derby and Oxford construction, 4 mm for ladies court shoes and 8 mm for Wellington and slippers.

On the Mondopoint scale³, in addition to the length of the foot obtained in the weight on position, one more factor, 'Width index', is also included. In other words Mondopoint size marking will comprise two numbers, e.g. 240/95. The first number is the size; it is an indication of the length of the foot fitted by the shoe, measured in millimeters; the second number is the width index being an indication of the joint girth of the foot fitted, expressed

as a percentage of its length.

Though Manning suggested that the length of the foot in millimeters and the joint girth of the foot expressed as a percentage of its length be marked on the shoe, he later on favoured marking length of the foot in millimeters and the width of the foot⁴ but not the girth of the foot expressed as a percentage of its length as previously suggested. In this connection he referred to the author's work where relationships between the breadth of the foot and the other parameters of the foot were established for the first time.

RESULTS OBTAINED BY THE AUTHORS

A study was initiated by the authors to provide comfortable footwear for children. This study resulted in the establishment of (1) a relationship between the various parameters of the foot⁵ (2) scientific spacing in between sizes based on facts and figures (3) rate of growth of the feet of children⁶ and (4) a sizing scale⁷ based on the above.

PARAMETERS STUDIED

The parameters studied were length, width, instep girth, joint girth, short heel and ankle.

1. Length

The length¹ of the foot is the distance from the heel to the tip of the great toe or the tip of the second toe whichever is longer.

2. Breadth or Width

The Breadth¹ is the distance between the first metatarsal head and the fifth metatarsal head. These are indicated by 'A' in fig. 1 and 'B' in fig.2 respectively.



FIG. 1.



FIG. 2.

A Vernier Calipers with an attachment for making the jaws smooth to avoid hurting of the feet of children while taking measurements was used to measure the length and width of the foot. The length of the foot was measured by keeping one jaw of the calipers in contact with the heel and the other jaw in contact with the longest toe. The breadth was measured by placing one jaw of the calipers in contact with the metatarsophalangeal joint of the big toe and the other jaw in contact with the metatarsophalangeal joint of the little toe.

3. Instep girth

This is the distance around the circumference of the foot touching the tuberosity of navicular and the tuberosity of the fifth metatarsal. This is indicated by C in fig.1 and D in fig.2 respectively.

4. Joint girth

The joint girth is the distance around the foot touching the first metatarsal head and the fifth metatarsal head. This is the circumference around the points measuring the breadth.

5. Short heel

This is the distance around the foot passing the point G (in fig.2) which is the extreme end of the heel and H (in fig.2) called throat, the measurement being made by passing the tape just below the internal Malleolus E in Fig.1 and External Malleolus F in Fig.2 respectively.

6. Ankle

The ankle is the distance around the smallest part of the leg above the internal Malleolus and external Malleolus.

A centimeter tape graduated in millimeters was made

TABLE I
Relation of breadth to various other parameters of the foot

Serial No.	Age Group	Length/Breadth		Circumference/Breadth		Girth/Breadth		Heel/Breadth		Ankle/Breadth										
		R.F.	L.F.	R.F.	L.F.	R.F.	L.F.	R.F.	L.F.	R.F.	L.F.									
MALE CHILDREN WITH FOOTWEAR HABITS																				
1.	5-6	2.56	2.59	0.10	2.58	0.09	2.61	0.09	2.63	0.05	2.64	0.07	3.40	0.10	3.42	0.09	2.10	2.10		
2.	6-7	2.53	2.58	0.11	2.58	0.12	2.55	0.06	2.56	0.06	2.63	0.07	2.64	0.06	3.39	0.12	3.40	0.10	2.09	2.08
3.	7-8	2.55	2.55	0.12	2.55	0.10	2.55	0.07	2.53	0.02	2.57	0.08	2.58	0.07	3.39	0.16	3.39	0.16	2.08	2.08
4.	8-9	2.53	2.53	0.10	2.60	0.08	2.60	0.10	2.57	0.08	2.60	0.10	3.35	0.14	3.41	0.15	2.13	2.14		
5.	9-10	2.58	2.58	0.09	2.53	0.07	2.57	0.10	2.58	0.07	2.56	0.06	3.36	0.17	3.37	0.14	2.10	2.20		
6.	10-11	2.53	2.63	0.09	2.58	0.08	2.57	0.09	2.55	0.06	2.60	0.08	3.36	0.10	3.41	0.09	2.12	2.12		
MALE CHILDREN WITHOUT FOOTWEAR HABITS																				
1.	5-6	2.52	2.54	0.12	2.54	0.07	2.58	0.08	2.59	0.12	2.61	0.11	3.36	0.14	3.40	0.01	2.10	2.13		
2.	6-7	2.53	2.54	0.10	2.58	0.07	2.58	0.09	2.59	0.12	2.58	0.10	3.36	0.08	3.38	0.09	2.07	2.07		
3.	7-8	2.53	2.53	0.13	2.53	0.11	2.58	0.11	2.58	0.12	2.56	0.08	3.35	0.12	3.33	0.12	2.05	2.05		
4.	8-9	2.57	2.58	0.08	2.56	0.06	2.57	0.10	2.51	0.07	2.49	0.07	3.33	0.10	3.32	0.12	2.04	2.04		
5.	9-10	2.54	2.55	0.09	2.56	0.09	2.56	0.10	2.55	0.08	2.55	0.10	3.24	0.09	3.30	0.10	1.96	1.98		
6.	10-11	2.58	2.58	0.11	2.57	0.10	2.58	0.09	2.60	0.01	2.55	0.10	3.37	0.08	3.34	0.09	1.99	1.97		

R.F.: Right Foot; L.F.: Left Foot; Std.Devn.: Standard deviation

TABLE II

Relation of breadth to various other parameters of the foot

Serial No.	Age Group	Length/Breadth		Circumference/Breadth		Girth/Breadth		Heel/Breadth		Ankle/Breadth									
		Std. Devn.	M.	Std. Devn.	M.	Std. Devn.	M.	Std. Devn.	M.	Std. Devn.	M.								
FEMALE CHILDREN WITH FOOTWEAR HABITS																			
1.	5-6	2.63	0.10	2.56	0.10	2.61	0.02	2.59	0.02	2.61	0.10	2.61	0.09	3.41	0.10	3.41	0.01	2.12	2.12
2.	6-7	2.60	0.10	2.62	0.09	2.61	0.12	2.61	0.03	2.68	0.02	2.66	0.07	3.44	0.13	3.41	0.09	2.15	2.15
3.	7-8	2.60	0.13	2.57	0.10	2.62	0.10	2.57	0.08	2.60	0.07	2.56	0.09	3.40	0.11	3.37	0.11	2.12	2.10
4.	8-9	2.59	0.09	2.62	0.10	2.62	0.08	2.59	0.06	2.54	0.07	2.55	0.09	3.40	0.12	3.40	0.11	2.01	2.01
5.	9-10	2.62	0.12	2.61	0.12	2.61	0.09	2.58	0.08	2.56	0.12	2.55	0.07	3.41	0.15	3.39	0.13	2.09	2.09
6.	10-11	2.67	0.11	2.68	0.11	2.62	0.07	2.59	0.10	2.59	0.08	2.58	0.11	3.44	0.11	3.43	0.11	2.14	2.13
FEMALE CHILDREN WITHOUT FOOTWEAR HABITS																			
1.	5-6	2.55	0.03	2.54	0.10	2.57	0.09	2.58	0.08	2.63	0.07	2.58	0.07	3.37	0.14	3.36	0.96	2.12	2.11
2.	6-7	2.57	0.10	2.58	0.09	2.58	0.10	2.57	0.07	2.58	0.10	2.60	0.08	3.38	0.12	3.39	0.12	2.10	2.10
3.	7-8	2.58	0.13	2.61	0.10	2.57	0.10	2.61	0.11	2.55	0.11	2.56	0.10	3.34	0.11	3.35	0.14	2.08	2.09
4.	8-9	2.61	0.09	2.61	0.09	2.59	0.10	2.59	0.01	2.55	0.09	2.53	0.09	3.37	0.13	3.36	0.02	2.08	2.08
5.	9-10	2.57	0.10	2.58	0.10	2.54	0.10	2.56	0.02	2.53	0.09	2.52	0.10	3.33	0.10	3.31	0.09	1.99	2.01
6.	10-11	2.62	0.17	2.63	0.10	2.58	0.12	2.59	0.01	2.51	0.10	2.52	0.07	3.34	0.13	3.35	0.10	2.03	2.03

R.F.: Right foot;

L.F.: Left Foot;

Std.Devn.: Standard deviation

use of to obtain the measurements on instep and joint girth, short heel and ankle. This study was carried on about five hundred school-going children of both sexes aged between five and eleven years and on both habituated to footwear and those who are not habituated to wearing footwear. The data thus obtained was analysed statistically, agewise and sexwise separately for children with footwear and children without footwear habits.

RESULTS

Statistical analysis was carried out to arrive at the ratio of (1) length to breadth (2) instep girth to breadth (3) joint girth to breadth (4) heel to breadth and (5) ankle to breadth. The mean and standard deviation were calculated in each case agewise and sexwise separately for the children with footwear habits and for children with out footwear habits. These results are given in Tables 1 and 2. The results show that the average ratios of length to breadth, instep to breadth and joint girth to breadth is 2.58. The mean ratios of heel to breadth and ankle to breadth are 3.37 and 2.08 respectively. That is for all age groups between five and eleven for both male and female children whether they are habituated to wearing footwear or not, there was no change in the ratios. It is seen that

$$(1) \frac{\text{Length}}{\text{Breadth}} = 2.58$$

$$(2) \frac{\text{Instep}}{\text{Breadth}} = 2.58$$

$$(3) \frac{\text{Joint girth}}{\text{Breadth}} = 2.58$$

$$\frac{\text{Heel}}{\text{Breadth}} = 3.37$$

$$\frac{\text{Ankle}}{\text{Breadth}} = 2.08$$

TABLE III

Ratio	Increase in 4 months in mm			Increase in 8 months in mm			
	Length	Breadth	Mean $\frac{dL}{dB}$	Length	Breadth	Mean $\frac{dL}{dB}$	
Male (19) Female (14)	Less than 2.5	4	1	5	7	2	3.25
		6	1		9	3	
Male (56) Female (53)	Between 2.5 and 2.6	3	1	3	7	3	2.3
		3	1		7	3	
Male (21) Female (31)	More than 2.7	3	2	1.5	6	4	1.25
		3	2		5	5	

Figures in parenthesis in Col.1 represent the number of cases studied.

STUDIES ON THE PATE OF GROWTH OF THE FEET OF CHILDREN

This study was conducted at two different schools where the children are not habituated to wearing any foot-wear so that the rate of growth may be assessed without any impediments to natural growth. Length and breadth measurements were retaken on the same children at intervals of four months and eight months.

EFFECT OF THE RATE OF GROWTH OF THE FOOT ON THE RATIO 'LENGTH OF THE FOOT/BREADTH OF THE FOOT'

It is seen from the foot parameter study that the ratio of length to breadth of the foot is on an average, is 2.58 ± 0.1 . In other words it can vary between 2.5 and 2.7 with an average of 2.58. However, there were cases of children where this ratio was less than 2.5 and more than 2.7. The rate of growth of the feet, lengthwise and breadthwise during four months and eight months was worked out separately for children having their length to breadth ratio less than 2.5 and more than 2.7 and between 2.5 and 2.6. These results are given in Table 3. Table 3 also contains the ratio of increase in length to the increase in breadth (represented by the symbol dL/dB).

It is seen that for a foot having length/breadth ratio below 2.5 increase along its length is more. On the other hand, if this ratio is more than 2.7 the foot development along its breadth is more. Also the dL/dB ratio for children with normal length to breadth ratio of 2.5 to 2.6 is 3, for children with this ratio less than 2.5 the dL/dB ratio is 5 and for children with length breadth ratio more than 2.7, the dL/dB is 1.5. The corresponding dL/dB values in eight months are 2.3, 3.25 and 1.25. It is thus obvious that the growth in length and breadth dimensions of the feet of children studied takes place in

such a manner that the length/breadth ratio adjusts itself to the normal value which lies between 2.5 and 2.6. Perhaps this is referred to as 'spurt growth' in the feet of children.

SIZES AND FITTINGS SUGGESTED

The study on the various parameters of the children together with the rate of growth studies can better be utilised for arriving at a scientific size interval. Now it is seen that on an average the length to breadth ratio is 2.58. The length of the foot can be obtained by multiplying its breadth by 2.58.

It is seen from the rate of growth calculations in Table III that for a normal foot having a ratio of 2.5 to 2.6, breadthwise increase during 4 months and 8 months period is 1 mm and 3mm respectively. In other words average increase during 4 to 6 months period may be $(1 + 3)/2$ or 2 mm. The corresponding length increase would be $2.58 \times 2 = 5.16$ mm or 5 mm. This gives rise to a scientific spacing between any two sizes as 5.16 mm which may be adopted as our future sizing for the feet of growing children.

This results in 14 sizes starting from 149.6 mm and ending with 216.7 mm with a width of 58 mm and 84 mm respectively corresponding to the minimum and maximum length and breadth recorded for the children of 5 - 11 years. The same can also be worked out by taking the minimum length recorded as 150 mm and maximum length recorded as 217 mm and dividing this range in steps of 5 mm, each length being divided by the factor 2.58 to obtain the width of the foot for that corresponding length.

When once the length and breadth of the foot are fixed, the instep girth, joint girth and heel can be worked out

by multiplying the breadth of the foot by 2.58 in the case of joint girth and instep girth, and by 3.37 to obtain the heel measurement. To obtain the various fittings for the same length, the breadth of the foot can be increased in steps of 2 mm (in the case of broad foot) or decreased in steps of 2 mm (in the case of narrow foot) and the corresponding joint girth or instep girth can be obtained by multiplying by 2.58. The same interval of 2 mm can be multiplied by 3.37 to obtain the heel measurement for the same fitting.

For example, the breadth of the foot = 60 mm
 Length of the foot = $2.58 \times 60 = 155\text{mm}$

For the same length, joint girth and instep girth for different fittings are

- | | | | |
|----|------------------|------------|-------------------|
| 1. | 2.58×60 | = 155 mm | Medium fitting |
| 2. | 2.58×62 | = 160 mm |] Broad fittings |
| 3. | 2.58×64 | = 165 mm | |
| 4. | 2.58×58 | = 149.6 mm |] Narrow fittings |
| 5. | 2.58×56 | = 144.5 mm | |

and the corresponding heel measurements are

- | | | | |
|----|------------------|------------|------------------|
| 1. | 3.37×60 | = 202.2 mm | Medium fitting |
| 2. | 3.37×62 | = 208.9 mm |] Broad fitting |
| 3. | 3.37×64 | = 215.7 mm | |
| 4. | 3.37×58 | = 195.5 mm |] Narrow fitting |
| 5. | 3.37×56 | = 188.7 mm | |

The various sizes worked out with the corresponding length and other fittings are given in the Table IV.

In general, if b is the breadth of the foot in millimeters, the length is $2.58 b$, joint or instep girth is $2.58 \times (b+2)$ or $2.58 (b+4)$ mm for broad fittings and 2.58

TABLE IV

S. No. of foot in mm	Breadth of the foot in mm					Instep or joint girth of the foot in mm					Heel in mm					
	b b+2 b+4 B-2 b-4					2.58 x breadth					3.37 x breadth					
	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	
1.	149.6	58	60	62	56	54	149.6	154.8	160	144.5	139.3	195.5	202.2	208.9	183.7	182
2.	154.8	60	62	64	58	56	154.8	160	165.1	149.6	144.5	202.2	208.9	215.7	195.5	188.7
3.	160	62	64	66	60	58	160	165.1	170.1	154.8	149.6	208.9	215.7	224.4	202.2	195.5
4.	165.1	64	66	68	62	60	165.1	170.1	175.4	160	154.8	215.7	224.4	229.2	208.9	202.2
5.	170.1	66	68	70	64	62	170.1	175.4	180.6	165.1	160	222.4	229.2	235.9	215.7	208.9
6.	175.4	68	70	72	66	64	175.4	180.6	185.8	170.1	165.1	229.2	235.9	242.6	222.4	215.7
7.	180.6	70	72	74	68	66	180.6	185.7	190.9	175.4	170.1	235.9	242.6	249.4	229.2	222.4
8.	185.7	72	74	76	70	68	185.7	190.9	196.1	180.6	175.4	242.6	249.4	256.1	235.9	229.2
9.	190.9	74	76	78	72	70	190.9	196.1	201.2	185.7	180.6	249.4	256.1	262.9	242.6	235.9
10.	196.1	76	78	80	74	72	196.1	201.2	206.4	190.9	185.7	256.1	262.9	269.6	249.4	242.6
11.	201.2	78	80	82	76	74	201.2	206.4	211.6	196.1	190.9	262.9	269.6	276.3	256.1	249.6
12.	206.4	80	82	84	78	76	206.4	211.6	216.7	201.2	196.1	269.6	276.3	283.1	262.9	256.1
13.	211.6	82	84	86	80	78	211.6	216.7	221.9	206.4	201.2	276.3	283.1	289.8	269.6	262.9
14.	216.7	84	86	88	82	80	216.7	221.9	227	211.6	206.4	283.1	289.8	296.6	276.3	269.6

1. The size markings refer to foot measurements.

2. The grading suggestions are also for foot measurements.

(b-2) or $2.58(b-4)$ for narrow fittings $2.58b$ can be termed as medium fitting. The heel measurements for the corresponding instep or joint girth work out to $3.37(b+2)$ mm, $3.37(b+4)$ mm, $3.37(b-2)$ mm, $3.37(b-4)$ mm and $3.37b$.

CONCLUSION

The size markings on the shoe suggested are (1) length of the foot in millimeters taken in weight on position and (2) the width of the foot. The other parameters viz., instep, joint girth and heel will have to be taken care of in the manufacture of the shoe, these parameters being obtained by multiplying the breadth of the foot by 2.58 and 3.37.

These results are based on actual measurements and would therefore be nearer to proper sizing and fittings. The method followed here can be profitably made use of, to evolve suitable sizes and fittings for any regions or ethnic groups.

ACKNOWLEDGEMENT

The authors thank Prof. M. Santappa, Director, Central Leather Research Institute, for his kind permission to submit this paper at the UNIDO Seminar.

REFERENCES

1. Hauser, D.W. Diseases of the foot, W.B.Saunders Co., 1950
2. Manning, J.R. Size standardisation - Europoint. J. British Boot & Shoe Inst., 12, 12; 1965.
3. Manning, J.R. Mondopoint - The sizing system of the future. J. British Boot & Shoe Inst., 51, 16; 1969.
4. Manning, J.R. Mondopoint - Latest Developments. J. British Boot & Shoe Inst. 172, 18, No.8, August 71.
5. Venkatappaiah, B and Ramanathan, N. A study on the parameters of ^{the feet of} school children. Leather Science, 17, 312 (1970).
6. Venkatappaiah, B and Ramanathan, N. A study on the rate of growth of the feet of children. Leather Science, 19, 358, 1972.
7. Venkatappaiah, B and Ramanathan, N. A new shoe sizing system for school children. Leather Science, Vol.18, 1971.





13 . 8 . 74