THE UNIVERSITY OF WEST HUNGARY

THE FACULTY OF WOOD SCIENCES

CZIRÁKI JÓZSEF DOKTORAL SCHOOL OF WOOD SCIENCES AND TECHNOLOGIES

President: PROF. DR. ANDRÁS WINKLER

Dissertation directed by:

PROF. DR. ISTVÁN PATKÓ

PROF. DR. SÁNDOR MOLNÁR

DOCTORAL THESIS (PhD)

ANALYSIS OF ECONOMIC BENEFITS FROM OPERATING MACHINERY IN SHOE INDUSTRY IN VIETNAM

Specializes in the field of pattern making

Prepared by:

Quoc Huynh Le

Sopron, 2008

Table of content

1. Antecedents

The Vietnamese shoe industry has a very young story, look back upon about 20 years. In the last years of the 20-th century, the shoe industry has been a main growing power for economic of the country, because it requires low level of technologies and trained labors.

As well as the garment industry, the shoe industry has quickly been developed, and for only a short time, the Vietnamese shoe export turns over second in Asia. However, the shoe industry is facing with many problems, because of shortage of professional education and skillful employees. Many shoe enterprises therefore could not increase their production and export. Vietnamese shoe training course have not been started until 1998.

During the period of Vietnam's developing certain economy, the local trainers was proposed to develop particular shoe training courses, which was assumed to suitable for local persons. Many institutes have endeavored to solve this mission; however, late all of them had to stop. The wrong application of different foreign textbooks to practice made the students fail to get their job late.

The writer luckily worked with many shoe technologies, and obtained a Hungarian study material, whose theory is as perfect as practice. In 2001, he started teaching at a college, His teaching is based on Hungarian shoe technology, which help to correct wrong points under standing of Vietnamese specialists of shoe production, he has also been successful in equip students with good knowledge and skill necessary for their further works.

2. Purposes of the study

- First, writer would like to introduce the Hungarian shoe technology in Vietnam, and then apply it to all of country. At the beginning, the leader of the college had sought for shoe technologies of other Asia countries such as many Korean and Taiwanese shoe factories. The writer however convinced them to learn from original materials, which is actually the Hungarian shoe technology.

- Second, he compares current shoe technology in the world to point out disadvantages and advantages each.

- Third, he analyzes the application of machinery and establishes optimum operation for design process.

- Lastly, he develops special plan for teaching weak students, who came from undeveloped province of country so that they can obtain necessary knowledge and skill to job.

3. Materials of the study

- First, the materials include different technical literature, namely textbooks, lecture notes, company's technical documents adapting to shoe industry.

- Second, the materials are collected the lesson of course that are presented by foreign expert, when a new factory starts to production or new technology is applied and delivered.

- Third, materials are the experiments done by technical department of shoe manufacturing companies. Shoe samples, which are made by shoe companies to test the customer's satisfaction on technical standard, give us usefully solution and knowledge.

- Lastly, the very important materials are result where we analyze an application to the lecture of courses and receive opinion/ comment of learners.

4. Methods of study

- Diagram method helps to explain the different technical solutions numerically and expertly. Many local shoe technicians have used this method for long time, however they can explain with experiences only.

- Mass experiment method uses to correct the diagram formula and technical data. After teaching of each solution, the writer review whole work of the learners and he treat different results, through they came in similar way.

5. Achievements

In 1987, the writer began work in shoe factories, he earned many experience in this time. From year of 2001, he teaches in the college, and he start study the shoe technology systematically. The result of study has summarized below.

First thesis: Technical drawing of shoe design

The writer applies standards of mechanical drawing for design of shell pattern. This solution takes the drawing to useful for cutting rooms as well as for upper closing department / Illustration 1. /

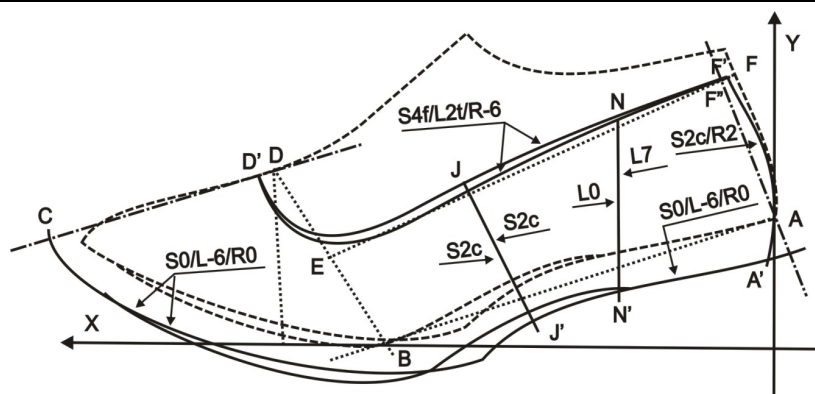| Outer	Lining	Reinforcement	Symbols
Main parts (golosh) ⊖ CD'/F'A'/JJ' Inside parts ○ JJ'F'A'	Toe lining ⊖ CD'/NN' Counter lining ⊖ F"A/NN'	Upper reinforcement ⊖ CD'/F'A'	○ Normal parts ⊖ 1 axis parts ⊕ 2 axis parts

Illustration 1.The technical drawing of shell pattern

Symbols	Explain of symbols
The first capital letter	Show layers of upper: S: outer ; L: lining; R: reinforcement
The second number	Show changing of edge of upper parts before cutting: 0: unchanged; Plus number: increasing; Minus number: decreasing.
The third regular letter	Show type of edge of upper parts: r: row edge; f: folding edge; o: underlay edge; c: edge of closed seam; t: trimming edge.
— · — · — · — ·	Axis lines
- - - - - - - - - -	Forme lines
....	Auxiliary (construction) lines
▬▬▬▬▬▬	Part (pattern) outlines

Second thesis: Selection of the method of forme making

Compared with the garment design, the shoe designers are working to smaller tolerance of measurement, a tolerance of pattern is ~ ± 0.5 of mm; of upper is ~ ± 1.0 of mm and of the shoes is ~ ± 2.0 mm. In these conditions, the designer select the work depending on last forme for better result. However, the last has a convex-concave surface, which could not be flattening perfectly. For synonymous result, the writer analyzes the each parts of last's surface and determine that, after the flattening of the forme shortage of surface is coming. He develops a following process for solve this problem.

- The area-shortage of concave surface must be accept, it will be retrieved later when we design the upper. The concave is being in the joint area of last.

- The area-shortage, which comes from the convex surface can be annihilate with expanding of the forme, thus edge-cutting of the last's cover. The edge-cutting still must be consider, we divide for equal chance to shriveling and area growing, that created from the edge-cutting.

- Briefly, to make the forme we must decide two things, namely the material of the forme and method of flattening of the last's area.

The writer determine that material of forme /cover/ must be inelastic, the measurements of material no changes after it has picked from the last. The material can be paper, plastic PVC foil, glue-fabric or adhesive tape. The elastic materials/ leather/ give different results when we cover that on the last, we need many experience to use it.

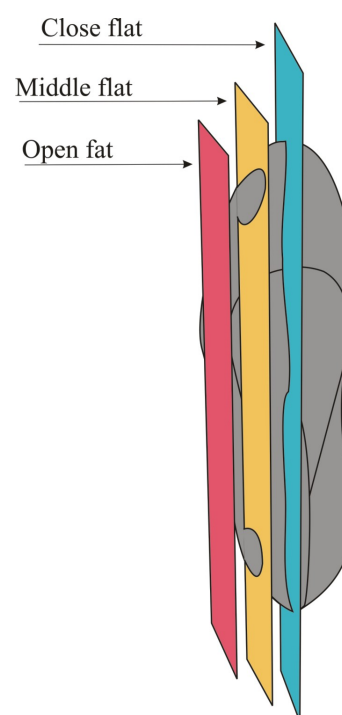At the flattening of the last's area, the writer determines that the best selection is the Middle flat

Illustration 2. The researched flats

because in this position we can allow the cover to shrivel as equal as expanding. To get this flat we must made one cut / about 10-15mm/ in cover at place of the toe and of the heel / at the convex place/ . / Illustration 2 /

If we flatten out the cover to the Close flat, the girth of the forme not changes / don't cut anywhere/, then the convex and concave area are maximums, and the area-shortage is also largest, we must retrieve it from somewhere./ Illustration 3a./

If we flatten out the cover to the Open flat, the girth of the forme will grow at the place of cutting /through cut/, and the convex disappears / Illustration 3b/, because of the through cut, the excess of area rise, we must correct some thing on it.

The above solutions are extremists, those are difficult to apply at school, the writer choice a neutral proposal that we flatten out the cover to the middle flat. To this flattening, we cut the cover on half only. The cover can expand and shrivel at once. The area-shortage remains, but it will be retrieved from a stretch of leather during process of upper lasting. Therefore, the pattern no needs to correct. / Illustration 3c/

The cutting and flattening of cover although determines, the forme making need appropriate practice because materials are different.
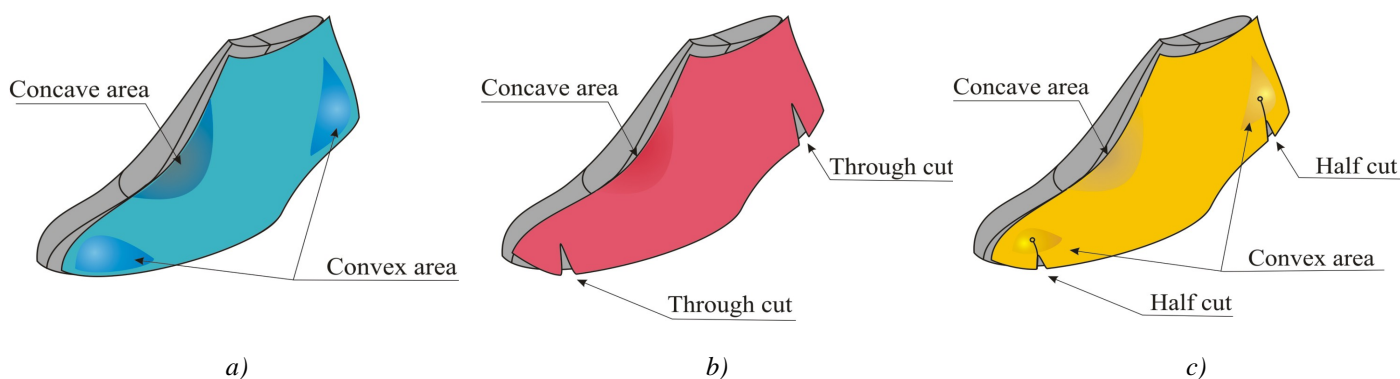

a)   *b)*   *c)*

Illustration 3. A flattening of the forme
a) A flattening to a close flat; b)A flattening to an open flat; c) A flattening to a middle flat

Table 1.The ratio of shriveling and expanding of last's cover after flattening

Ways of flattening / Last's area	Shriveling of area % / Expanding of area %			note
	Flattening to close flat	Flattening to middle flat	Flattening to open flat	
Convex toe area	0 – 22 0	0 – 11 0 – 5	0 0 - 13	Depend on toe shapes
Convex heel area	8 – 12 0	5 – 7 1 - 3	0 4 - 6	Permanent
Concave joint area	7 – 11 0	7 – 11 0	7 – 11 0	Depend on the height of heel

The table 1 shows that the flattening to middle flat reduces the area-shortage much, but it made a few increasing of area. Summary we have advantage, because changes of the area are minimums.

Third thesis: Application of the thickness of material into upper design

Majority of designer handle well in forme making, but many of them do not pay enough attention to use the thickness of material for design.

The thickness of material could take consequence for the fitting of upper to the last, especially in training shoe, which has sponge tongue and sponge collar. Some time, instead of increase the material thickness to the pattern, designer increase a lasting allowance, as result, all of the upper slip to back, and they must correct all of piece of the pattern.

The writer always pays attention to a thickness of material in design when he holds connecting with the last's measurements. The thickness contains the self-material thickness of the part and the thickness of under covered layers of it.

a) Handling on design of heel curve by material-thickness

The heel curve concerns with length of upper, a material-shortage of it causes deformation of toe and collar of the upper, the handling is follows:

In the normal upper, the heel curve follows the sharp of the back of the forme, and the F point is 3mm inside of forme. This handling regains a lost curve of the forme during flattening. If the collar has sponge, the F point is addition by the sponge thickness outside along of forme / Illustration 4. a, b /

In the upper of training shoe, the sponge is thicker than the normal uppers, and lining has sponge too. In this case, the heel curve must be place outside along the forme by thickness of the sponge. The F point is outside of the forme by about 10-15 of mm, the A point is by 2-3 of mm yet. / Illustration 4.c/
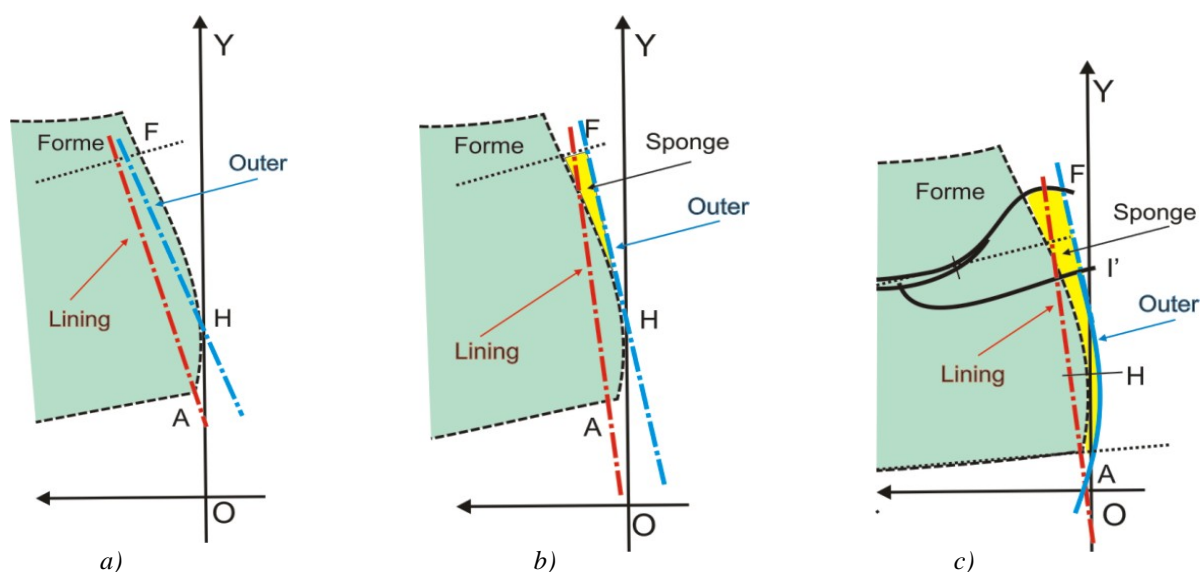

Illustration 4 .Design the heel curve,   a) normal upper;   b) normal sponge upper;   c) training upper

b) Handling on design of cone by material-thickness

In the training shoe, the tongue is thick, because it has sponge. To design the parts of cone, in first, determine the thickness of tongue and add this worth to forme to get increased area, and then design a eyelet stay and a tongue according to that / Illustration 5/

In designing of tongue, cone area of lining must be reduce by thickness of the tongue, the reducing is compare to the outer, because around of the tongue has a closed seam /Illustration 6/
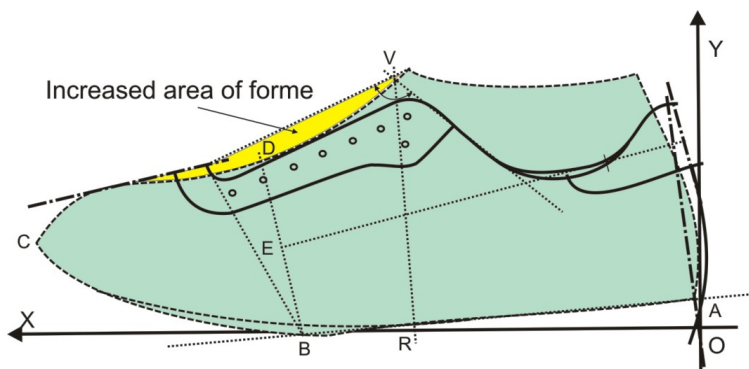

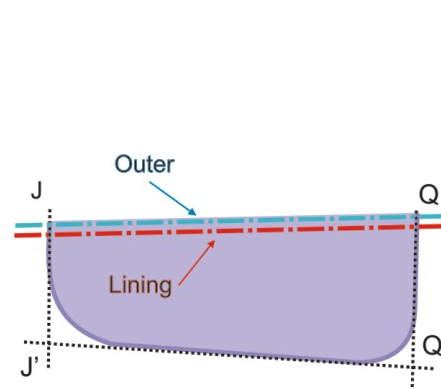*Illustration 5. The forme of training shoe*   *Illustration 6. Design of tongue*

c) Handling on design of bar /strap/ by material-thickness

A special feature of bar that, it has not stiffener which hold it from shrinking after delasting. To design the bar we increase it with thickness of material. The increasable worth is equal to self-material of the bar and material of under covered parts of it.
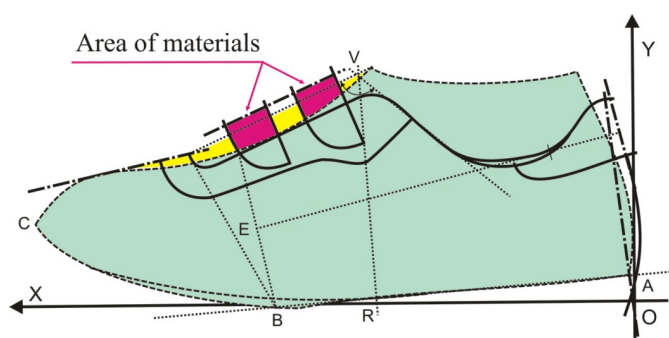
At a design of sandal, the length of bar increases with thickness of the outer and lining. In case of shoe design, besides the self-materials of the bar, we need increase the bar yet with the thickness of materials of eyelet stay and tongue. / Illustration 7/

a)

c)   *b)*
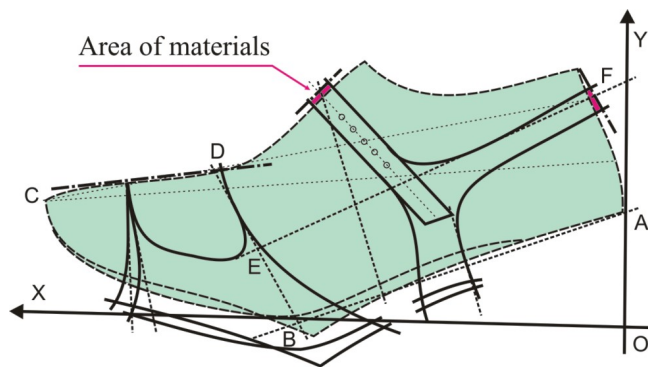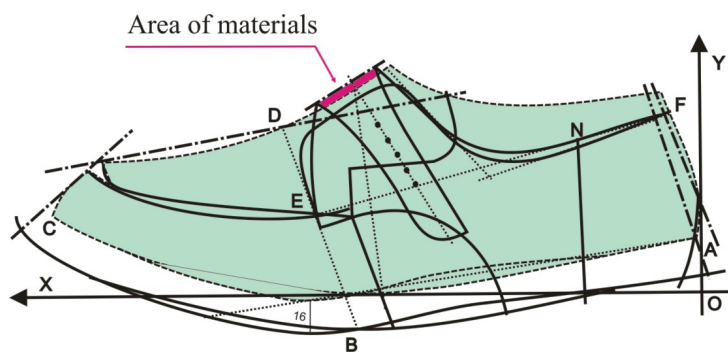
Illustration 7 .a) Design of sandal bar; b), c) Design of shoe bar

Fourth thesis: Determination of a ball line (joint line)

The last always shows the dimensions of our foot. In practice, 10 mm are added to the too end of the last, this addition is so-called safe for the heel-to-toe rocking motion of foot movement.

In surface of the last, anatomy of the foot is not often recognized, this weak point could make trouble for designers, same time a shoes become unusable, because a designer determine wrongly the anatomy of the foot. Many technical literatures in different countries endeavored to find a way to reestablish the anatomy of foot on the last, further on to determine the ball line. In this region, the Hungarian textbook give a best developing, that provides the technicians with valuable method for their designing work.

However, the existing procedures including of ways on graphic and experience are still missing in fashion last which has a long toe. The long toe last give a longer forme, but its anatomy remains. In the longer toe last, the formula to seek the ball line of the normal forme is not applied. The writer introduces a new way to seek the ball line that based on formula of Professor J. P. Zibin and that avoid a toe changing of the last. The formula is follows: / Illustration 8 /
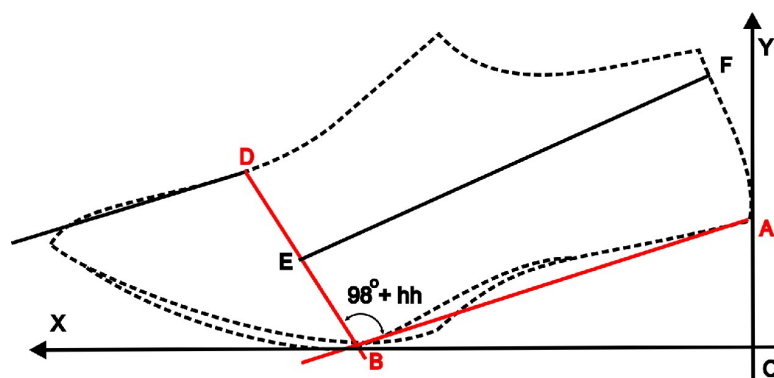
Illustration 8. Determination of the ball line

Draw the forme into a system of XOY coordinates, in the way that the A point laying in Y line and the OA distance equal to heel height of last /hh /. The X line crosses between the two bottom lines of the forme. Measure AB line /raised line/ with followed formula

$$AB \ (mm) \ = N\tilde{o} \ . \ A \ + W \ . \ B \ + C$$

Where: Nõ: Number of the length (point and size)
        W: Number of width
   A, B, C: Coefficients, can be seen in the table

The table of coefficient

Grading systems	A	B	C
EUR	4	0.5	8-16
UK I	5	0.5	71-79
UK II	5	0.5	136-144
CM	6	0.5	8-16

For example:
The length of last is 36 point and the width of last is 6
$$AB_{36/6} = 36 \cdot 4 + 6 \cdot 0.5 + 8 = 155 \text{ mm}$$

From AB line draw up a ball angle $\triangle ABD = 98^0$ + heel height /hh /, this line cuts the cone at D point. The BD line will be the ball line that shows a widest place of the last.

According the formula, change of the size of last made also a change in the raised line. So the change of raised line depend from the A coefficient.

For example: $AB_{37/6} = 37 \cdot 4 + 6 \cdot 0.5 + 8 = 159$ mm
Thus: $AB_{37/6} = AB_{36/6} + A = 155 + 4 = 159$mm

The B co-efficient give a change in raised line, if the last changed in the width

For example: $AB_{36/7} = 36 \cdot 4 + 7 \cdot 0.5 + 8 = 155.5$ mm
Thus $AB_{36/7} = AB_{36/6} + B = 155 + 0.5 = 155.5$mm
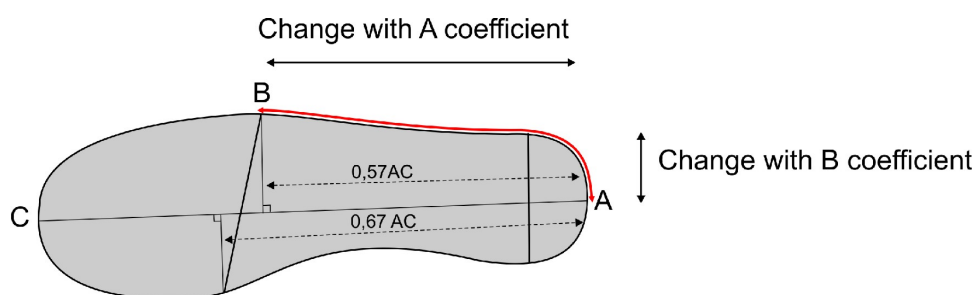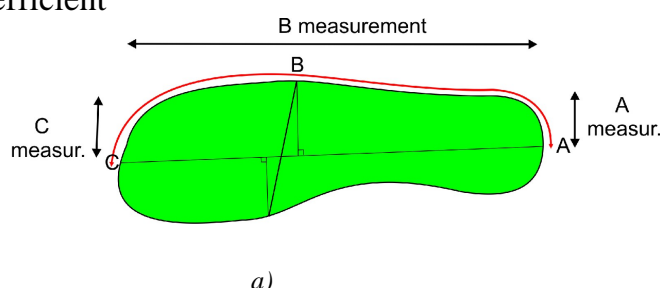/ Illustration 9 /

Illustration 9 Effect of coefficient to the raised line

Fifth thesis: A determination of the long parameter in grading

The shoes are always produced in series, so that the technicians must have a good practice on grading of upper pattern. In Vietnam, the grading remain a hidden and difficult thing among designers, they solve this task with groping or photocopying. As a result, graded patterns are came into deforming and not satisfy a customs' requires. The series of shoe product could be organized in 20 sizes, the grading of upper pattern with photocopying is impossible.

The grading is difficult as a consequense of the grading of all kind of the last. The coefficient of grading however changes, it depends on toe sharp of the last. /Illustration 10./. The illustration shows that the length of upper is not measured on the length of last, but on a girth of insole. It measured with A, B, C measurements, the two preceding ones are fixed and the latter one is changes. In the a) case the C measurement

a)

is bigest and in the c) case it could not be seen.

Illustration 10.
Reviewing of the upper measurements
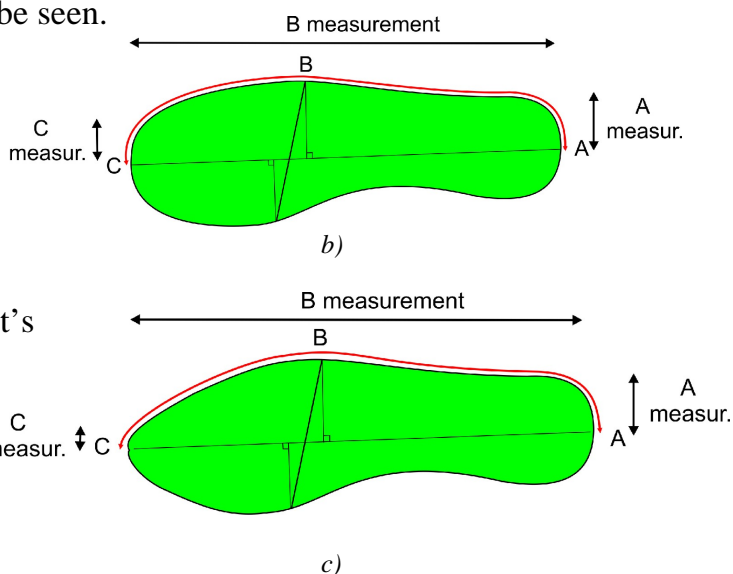
The reviewing show that the C measurement changes according to the sharp of toe last. The finding of it's change could be difficult determined by formula.

To determine the long parameter of grading, writer develops a new way directly by the last. First, prepare two piece of a last. A high difference of their sizes is better to earn accuracy measurements. Then, we make formes from those lasts in similar process. Finally, measure a difference of length of two formes /CH/. We get the parameter of grading for the length. /Illustration 11/.

Defference between formes
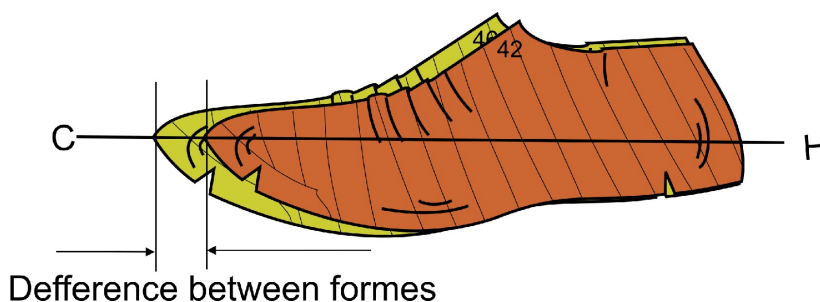
Illustration 11. Measuring a difference between formes

For example, the length of forme of the $H_{42} = 295$ mm, and of the $H_{46} = 322$ mm. The relative grading parameter of length is.

$$\beta = \frac{Hn}{Ho} = \frac{H46}{H42} = \frac{322}{295} x100 = 109, 2 \%$$

Where: H_n = a wanted length, Ho = a start length.

Some times, there is only one last for the grading, in the case the other one must be made first.

The parameter of grading for the width can measured directly on the last, in this girth, the measurement of the upper is equal to the last's.

For example, the girth of ball of $B_{42} = 240$ mm, and of the size 46 will be $B_{46} = 240 + 4 \times 4 = 256$ mm

$$\gamma = \frac{Bn}{Bo} = \frac{B46}{B42} = \frac{256}{240} x100 = 106, 7 \%$$

Where: Bn = a wanted width, Bo = a start width.

Sixth thesis: Economic analysis of operate of the shoe design equipments

a) A period of shoe design process

Many steps of shoe design are artistically, so that the complete mechanization of shoe design could not be economical. Shoe companies organize their technical process on a way on combine of manual and mechanical works considering a size of production.

Table 2. A period of shoe design process

No.	Steps	Period of manual steps (minute)		Period of mechanical steps (minute)		Note
		New pattern	Developed pattern	New pattern	Developed pattern	
1.	Model drawing	8	5	15	5	
2.	Prepare color combination for models	20	20	12	6	
3.	Prepare a last	45	0	60	0	3D equipment
4.	Prepare a forme	8	0	25	0	3D equipment
5.	Prepare a mean forme	5	0	1	0	3D equipment
6.	Design an auxiliary lines	4	4	15	0	
7.	Design a shell pattern	20		25		
8.	Design a developed pattern		20		8	
9.	Design pattern of parts	35	15	5	5	
10.	Prepare a cutting pattern	60	40	10	10	
11.	Pattern grading	240	160	15	15	
12.	Pattern storing	15	15	1	1	
	Sum — Minute	460	279	184	50	
	Sum — Hour	7.67	4.65	3.01	0.83	

The table 2.estimate a necessary work time of each shoe style. With condition, a cost of manual of working hours are 1.5 US$; a cost of using hours of machinery is 3.9 US$; a price of 2D computer and software is 26,800 US$; 3D computer and software is 70,800 US$ and amortization is 10 years, the sum of cost of design process is following:

$$K = E + R + G$$

Where:

K: Sum of costs

E: Cost of manual work

R: Cost of overhead (35% of the E)

G: Cost of amortization of machinery

1. In case of design the new pattern by hand

K = (7.67 x 1.5) + 4.03 = 15.53 US\$;

2. In case of design the developed pattern by hand

K = (4.65 x 1.5) + 2.44 = 9.42 US\$;

3. In case of design the new pattern by machine

K = (3.01 x 1.5) + 1.58 + (3.01 x 3.9) =17.83 US\$;

4. In case of design the developed pattern by machine

K = (0.83 x 1.5) + 0.44 + (0.83 x 3.9) = 4.92 US\$.

b) A proposal to build shoe design process considering an economical operation of machinery

According to the above calculations, each case of the manual work and of the mechanical work shows their advantages. For develop an economical shoe design process, the cases could have selectively combined.

Table 3. The optimum design process

No.	Steps	The period of selected steps for design new pattern (minute)		The period of selected steps for design developed pattern (minute)	
		Manual steps	Mechanical steps	Manual steps	Mechanical steps
1.	Prepare a last	8		5	
2.	Prepare a forme		12		6
3.	Prepare a mean forme	45			0
4.	Design an auxiliary lines	8			0
5.	Design a shell pattern	5			0
6.	Design a developed pattern	4			0
7.	Design pattern of parts	20			
8.	Prepare a cutting pattern				8
9.	Pattern grading		5		5
10.	Pattern storing		10		10
11.	Prepare a last		15		15
12.	Prepare a forme		1		1

		Minute	90	43	5	45
	Sum	Hour	1.5	0.72	0.083	0.75
			133 minutes / 2.22 hours		50 minutes / 0.83 hours	

The combined process is not necessary to apply the 3D machines, therefore the cost of amortization of machinery has been reduced to 1,07 US$. The sum of cost is below

* In case of design the new pattern

K= (1.5 x 1.5) + (0.72 x 1.5) + 1.17 + (0.72 x 1.07) = 5.27 US$;

* In case of design the developed pattern

K= (0.083 x 1.5) + (0.75 x 1.5) + 0.44 + (0.75 x 1.07) = 2.49 US$.

The successfully prepared technology reduces the sum cost by 33.39% in the new pattern design and it earn a half of sum cost of reducing in the developed pattern design. In spite of the calculation, some shoe manufacturing enterprises could not assemble the optimum design process, because understanding of machinery' technical features are difficult to apply for their production.

In Vietnam, the mechanization of shoe design for manufactures is not easy arranged, because machine offers of foreign producer are as disorderly as jungle. Beside of mechanization of shoe design, the manual shoe design is important trained for technician. Like that, they are faster to grasp the machines' functions.

According to the optimum shoe design process, following formula show scale of mechanization

$$Gg = \frac{\sum Tg}{\sum T}$$

Where:

Gg = mechanization's scale

$\sum Tg$ = Sum of time of the shoe design's machine work

$\sum T$ = Sum of time of the shoe design process

* The mechanization's scale of the new pattern design

$$Gg/u = \frac{43}{133} = 0,3233, \text{ *That is 32.33%*}$$

* The mechanization's scale of the developed pattern design

$$Gg/v = \frac{43}{133} = 0,9, \text{ *That is 90%*}$$

6. <u>Applications of the results</u>

The shoe design process was developed by writer is called last-faithful method. It based on Hungarian technique and gone through some correction to Vietnamese specialist of shoe production

The method is able to training, it give a way for trainee to quickly understanding the knowledge and skills. Some years in the past, the shoe design was a difficult lesson, nowadays; the situation has been improved, with this method, the trainees easier to practice and in the fifth semester, about 60% of them have ability to make a shoe themselves.

The method also is able to design with CAD systems. The CAD systems supply many functions for designer and with this method that functions have became more efficient. In the applying of CAD system, almost other CAD systems are developed on similar way. Their functions can be followings.

- Prepare a shoe style

- Prepare a last

- Forme making

- Design of shell pattern

- Prepare a cutting pattern

- Pattern grading

- Storing a technical documents

The method introduces the shoe upper design by hand as well as by computer. Mass of students of the college use well this method in their work, and the shoe manufacturing enterprises also recognize this reality.

7. <u>Acknowledgements</u>

The writer expresses gratitude and appreciation to the all people who have provided invaluable assistance for his graduate study:

To thank **Prof. Dr. István Patkó,** college professor, his supervisor, who is advised to select a theme of the dissertation, helped and encouraged him on area of the study's estimating, publishing of articles and correction of the dissertation;

To thank **Prof. Dr. Sándor Molnár,** Doctor of Science for Dean Works and encouragement;

To thank **Prof. Dr. András Winkler**, Doctor of Science for Program directing works and encouragement;

To thank **Mr. András Horváth ,** associate professor for advices of professional knowledge and helping of study on practical area;

To thank **Mr. Ákos Simon,** HVG newspaper editor, his university friend for 30 years of unceasing helping from Hungary;

To thank **Ms. Khánh Phạm Thị** , M.Ed., the rector of TEIC for the permission of the study and encouragement & her constructive works of cooperation between the two Colleges;

To thank all **Teachers and Employees**, who working in RKK, TEIC and CFT for their constructive works of cooperation between the two Colleges and approval of the study;

To thank all **Family relations** for pleasant environment of the study and encouragements

8. <u>List of publications</u>

Articles:

[1]. <u>Prof. Dr. Patkó István – Huynh Le Quoc</u>: A cipõ ipari gépek és berendezések üzemeltetésének a kõrnyezet védelmi elemzése . Industrial Review of Vietnam. 3/2006.

[2]. <u>Docens Horváth András – Huynh Le Quoc</u>: A kaptafamásolás módszerei. Industrial Review of Vietnam. 4/2006.

[3]. <u>Prof. Dr. István Patkó – Quoc Huynh Le</u>: The ratio of application to machine and equipment (mae) on the shoeindustry. Industrial Review of Vietnam. 4/2006.

[4]. <u>Prof. Dr. Patkó István – Huynh Le Quoc</u>: A cipõipari anyag – elõirányzat meghatározása. Industrial Review of Vietnam. 6/2006.

[5]. <u>Prof. Dr. István Patkó - Quoc Huynh Le – Docens András Horváth</u>: Determining of the auxiliary lines for the shoe upper design. Industrial Review of Vietnam. 4/2007.

[6]. <u>Prof. Dr. István Patkó - Quoc Huynh Le – Docens András Horváth</u>: Describing of diagram for shoe pattern. Industrial Review of Vietnam. 5/2007.

[7]. <u>Prof. Dr. István Patkó - Quoc Huynh Le – Docens András Horváth</u>: A way to grading by computer. Industrial Review of Vietnam. 8/2008.

9. List of references

Textbooks, lecture notes and technical literatures:

[1] <u>Megyei Endre</u>: Bevezetés a gazdaságossági vizsgálatok módszereibe II. Kézirat. Tankõnyvkiadó, Budapest, 1979

[2] <u>Szabados Anna</u>: Mít értünk termelési kapacitás alatt? Kézirat. Tankõnyvkiadó, Budapest, 1979

[3] <u>Megyei Endre</u>: Gazdaságosság és jõvedelmezõség I. Kézirat. Tankõnyvkiadó, Budapest, 1973

[4] <u>Káldor Mihály</u>: Képletgyûjtemény. Kõzgazdasági és Jogi Kõnyvkiadó, Budapest, 1978

[5] <u>Dr.Patkó István</u>: Mûszaki ábrázolás és gépszerkezetek I-II.Kõnnyûipari mûszaki fõiskola 1993

[6] <u>Benkõ László</u>: Gyártmánytervezés és méretezés I – II. Kõnnyûipari mûszaki fõiskola 1986

[7] <u>Dr. Beke János</u>: Cipõgyártás. Mûszaki kõnyvkiadó, Budapest , 1981

[8] <u>Péterfi János – szemenyei Zoltán – Várnai Imre</u>: Cipõ szerkesztése I. Mûszaki Kõnyvkiadó, Budapest, 1982

[9] <u>Péterfi János – szemenyei Zoltán – Várnai Imre</u>: Cipõ szerkesztése II. Mûszaki Kõnyvkiadó, Budapest, 1977

[10] <u>Kováts Julianna</u>:Cipõfelsõrész-készitõ technologia I. Mûszaki Kõnyvkiadó, Budapest, 1976

[11] <u>Schmél Ferenc</u>: Cipõfelsõrész-készitõ szakmai ismeret II. Mûszaki Kõnyvkiadó, Bp, 1986

[12] <u>Dr.Nádasdi Ferenc</u>: Cipõfelsõrész-készitõ szakmai ismeret III.Mûszaki Kõnyvkiadó, Bp, 1980

[13] <u>Alan H</u> : Understanding footwear. The clothing and Footwear Institute. London

[14] <u>A.Wilhelm</u>: Tip for shoe production. Volume 1: Design

[15] <u>Michael H.Sharp</u>:The pattern cutter's handbook. SATRA Footwear Technology Centre 1994

[16] <u>H.J.Patrick</u>: Modern pattern cutting and design. Mobbs & Lewis limited . England

[17] <u>Jan Pivecka & Siegfried Laure</u>: The shoe last. ISMS. Zlin. Czech Republic 1995

[18] <u>Jarmila Zobacova & Stanislav Velikovsky</u>: Designing and styling of shoes .ISMS. Zlin 1995

[19] Toto shoe manufacture's association . Tokyo

[20] Y.Y.Plovnikov – O.V. Pharnieva: Proektirovanie sportyvnoi obuvi. Mockva. 1987

[21] Shoes design course. Pisie. Italy. 2004

[22] Frank: Designer's handbook. Harbor Footwear Group. LTD.1999

[23] Dr.Beke János: Számitógéppel támogatott geometriai cipõtervezés . Jegyzet

[24] Schmél Ferenc: Számitógépes gyártmánytervezés . Kõnnyũipari mũszaki fõiskola 1988

[25] Karl C. Adrial: American Last Making. Brown Shoe Company. 1991

[26] William A. Rossi, D.P.M.: The Complet Footwear Dictionary. Krieger Publishing company. Malabar, Florida. 2000.

[27] Dr. Beke János: CAD/CAM rendszerek a bõrfeldolgozóiparban, COFINEC Petõfi Nyomda, Kecskemét, 2000.

[28] Materials on internet