The effect of different types of cut markers on the utilization of textile materials

Utjecaj različitih vrsta krojnih slika na iskoristivost tekstilnih materijala

Scientific paper / Znanstveni rad

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Abstract
The largest percentage of the costs of making clothes belongs to the textile material from which the clothes are made. The essential process in making clothes is the process of cutting the clothes. Before cutting, the cutting pieces and their positions are placed in the cutting marker closer to each other, which will achieve a minimum consumption of the fabric. This paper aims to show the effect of different types of cutting markers on the utilization of textile materials. Emphasis is made on fitting fewer and more sizes in one cutting marker, all in order to practically prove that the type of cutting marker significantly affects the consumption of the textile material from which the clothes are made. In the experimental part, two different orders are shown, with two different models of women's trousers, but equal size representation and identical fabric. A comparative analysis was made between the efficiency of cut markers with fewer and more sizes contained in the cut marker. The obtained results give a direct conclusion that different types of cutting markers can significantly affect the consumption of textile material, that is, that, using cutting marker in which pieces of more sizes are integrated into one cut marker, the consumption of textile material is significantly reduced.
Keywords: pattern; clothes; fabric; cut marker

Sažetak
Najveći postotak troškova izrade odjeće pripada tekstilnom materijalu od kojeg je odjeća izrađena. Osnovni proces u izradi odjeće je krojenje odjeće. Prije krojenja, krojni dijelovi i njihove pozicije postavljaju se na krojnoj slici bliže jedan drugome, čime se postiže minimalna potrošnja tkanine. Ovaj rad ima za cilj pokazati utjecaj različitih vrsta krojnih slika na potrošnju tekstilnog materijala. Naglasak je stavljen na uklapanje manje i više veličina u jednu krojnu sliku, a sve kako bi se praktično dokazalo da vrsta krojene slike bitno utječe na potrošnju tekstilnog materijala od kojeg je odjeća izrađena. U eksperimentalnom dijelu prikazane su dvije različite narudžbe, s dva različita modela ženskih hlača, ali jednake veličine i identične tkanine. Napravljena je usporedna analiza učinkovitosti slika presjeka s manjim i većim veličinama koje sadrži slika presjeka. Dobiveni rezultati daju izravan zaključak da različite vrste krojnih slika mogu značajno utjecati na potrošnju tekstilnog materijala, odnosno da, korištenjem krojnih slika u kojima su dijelovi više prikazanih veličina objedinjeni u jednu krojnu sliku, potrošnja tekstilnog materijala značajno je smanjena.
Ključne riječi: kroj; odjeća; tkanina; krojna slika

DOI: 10.34187/ko.73.2.3

1. Introduction

Cutting is the first technological process in making clothes. Cutting is the separation of clothing into all its components, that is, it is a process of cutting out the cutting pieces of the clothing that are drawn with a precise size and form in a marker. Or in other words, the process in which the given cutting pieces of a precisely made pattern, according to shape and size, with scissors, tailor's knife, laser or automatic cutting system are cut from a piece of fabric or a cutting layer, is called cutting [1]. In order to cut the clothes exactly and in the required size, it is necessary to make a suitable pattern beforehand. The pieces of the pattern should be skillfully arranged, that is, they should fit into a cut marker. Each cutting piece of the appropriate pattern needs to be adjusted according to the dimensional stability and elastic properties of the material [2].

An important step for the cutting process is the creation of a cut marker [3]. There are several stages in the production of cut markers: planning, or arrangement of cutting pieces to meet technical requirements and save material; production of the cut markers which includes: transferring the arranged cutting pieces directly to the fabric, drawing the cutting pieces on a cut marker from paper by hand or with an automatic plotter [4] and memorizing the information about the cut marker in a computer and further transfer to paper or on fabric without practically drawing the contours of the cutting pieces of the fabric.

The cut marker has a direct impact on the consumption of the textile material [5]. The arrangement of the cutting pieces in the cut marker should be made so that the consumption of the textile material will be minimized, but at the same time all the requirements and standards of the style and the material itself will be satisfied [6]. With the help of good organization and correct sequence, additional costs and losses will be avoided, and at the same time the process will be accelerated and the precision of cutting will be increased [7].

The cut marker utilization (I_{clu}) in % is calculated as the quotient of the net (A_n) and the gross (A_b) cut marker area multiplied by 100. Where, the net area is the area occupied by the cutting pieces, and the gross area is the sum of the total length and width of the cut marker.

$$I_{clu} = \frac{A_n}{A_b} \cdot 100 \qquad (1)$$

The inter-cutting loss (A_{icl}) in % can be calculated as the quotient of the difference between the gross (A_b) and net area (A_n) of the cut marker multiplied by 100.

$$A_{icl} = \frac{A_b - A_n}{A_b} . 100 \qquad (2)$$

From here we can also calculate the consumption of the material with the following expression:

$$L = n(LK_{lc} + \Delta L) \qquad (3)$$

Where, L is the length of the cut marker, ΔL is the length of the addition at the beginning and end of the cut marker, K_{lc} is the coefficient related to the loss of material during cutting, n is the number of cutting layers. The loss coeficient, on the other hand, is the sum of the percentage of the material loss coefficient due to roll debris, the percentage of the material loss coefficient due to cut or folded layers, and the percentage of the loss coefficient due to re-cutting of damaged cutting pieces [8]. The cost of the fabric which is the raw material of apparel constitutes approximately the half of the total product cost. Consequently, it is very important that the fabric is used efficiently [9].

Experimental part

1.1. Materials and methods

Two similar models of women's trousers from a well-known international buyer were selected to make cut markers for this experiment. The cut markers were made using the AccuMark-Gerber Technology software. The number of pieces ordered from the two orders is different, but the size and length representation is the same. Identical fabric was used, with an identical width. The useful width of the cut markers is fixed and is 138 cm, and their length will define the consumption of the fabric. The cut markers made for the first order are with four sizes included in the cut marker, while for the second order cut markers are made with two sizes included in each cut marker.

2. Results and discussion

The women's trousers that are the subject of analysis in this paper (Figure 1 and 2) contain two front pockets and one small pocket on the right side. Pocket bags are made of lining. They have two pockets at the back, one on the left and one on the right with decorative embroidery.

DOI: 10.34187/ko.73.2.3

The belt is machine-made and consists of two parts, an inner and an outer part of the belt, on which belt loops are arranged. This trousers have a standard hem of 2 x 1.5 cm.

Figure 1. A sketch of the model 5240-87 (Angela)

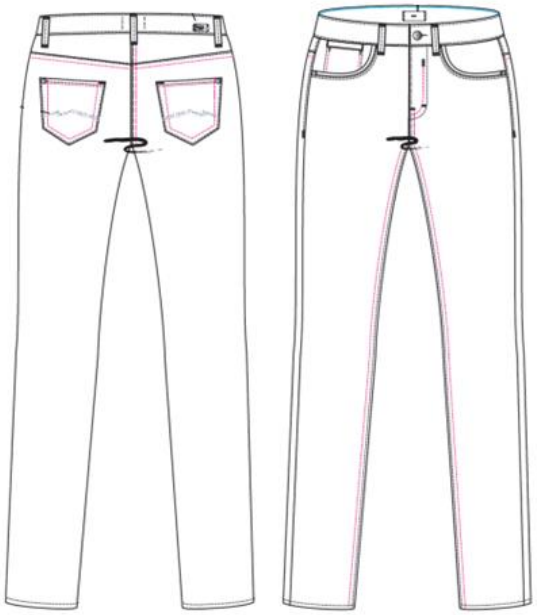


Figure 2. A sketch of the model 5954-80 (Carrie Pipe)

The first order 107832/01 is with a request of 1000 pieces of trousers (Table 1), with a size range of 34-46 and a length range of 30 to 34 inches. The second considered order 108163/01 is with a request for 300 pieces of trousers (Table 2), but with the same size and length as the previous order.

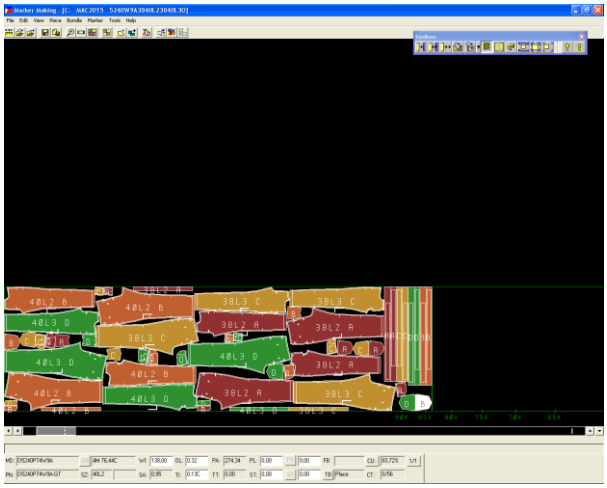
Table 1. Trousers size chart for order 107832/01

Lengths		Sizes							Σ
		34	**36**	**38**	**40**	**42**	**44**	**46**	
L2	**30”**	15	65	95	95	80	50	25	425
L3	**32”**	10	55	90	95	80	55	30	415
L4	**34”**	5	15	30	40	35	25	10	160
Σ		30	135	215	230	195	130	65	1000

Table 2. Trousers size chart for order 108163/01

Lengths		Sizes							Σ
		34	**36**	**38**	**40**	**42**	**44**	**46**	
L3	**30”**	6	19	26	28	21	17	9	126
L4	**32”**	3	26	27	28	28	23	9	144
L5	**34”**	0	2	6	7	6	6	3	30
Σ		9	47	59	63	55	46	21	300

In the first case, the cut markers were made (Figure 3, 4, 5, 6) with 4 sizes included. The arrangement of the cutting pieces in this case gives a lower percentage of fabric usage, that is, the fabric usage in this case is about 83.77 %, which automatically means that the percentage of unused fabric or waste is 16.23 %. The average fabric consumption of a pair of trousers in this case is 1.22 m.



Fgure 3. Mini bild of cut marker 5240W9A-3840L23840L3O

$$A_b = 4.7644\ m,\ A_n = 3.9886\ m$$

$$I_{clu} = \frac{3.9887}{4.7644} \cdot 100 = 83.72\ \%$$

$$A_{icl} = \frac{4.7644 - 3.9887}{4{,}7644} \cdot 100 = 16.28\ \%$$

$$4.7644 \cdot 90 = 428.796\ m$$

DOI: 10.34187/ko.73.2.3

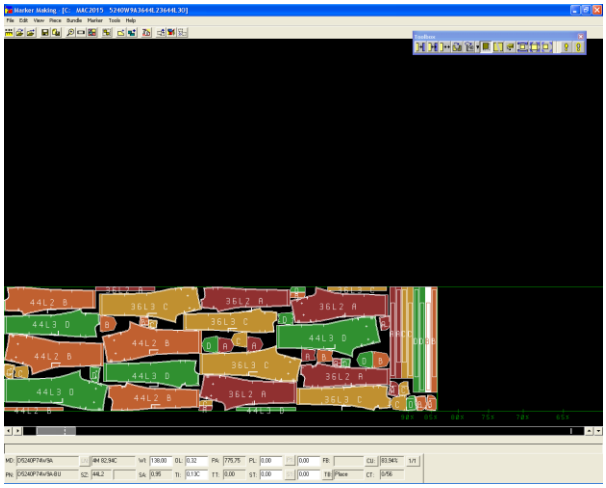


Figure 4. Mini bild of cut marker 5240L9A36-44L23644L3O

$$A_b = 4.8294\ m,\ A_n = 4.0538\ m$$

$$I_{clu} = \frac{4.0538}{4.8294} \cdot 100 = 83.94\ \%$$

$$A_{icl} = \frac{4.8294 - 4.0538}{4.8294} \cdot 100 = 6.06\ \%$$

$$4.8294 \cdot 50 = 241.47\ m$$

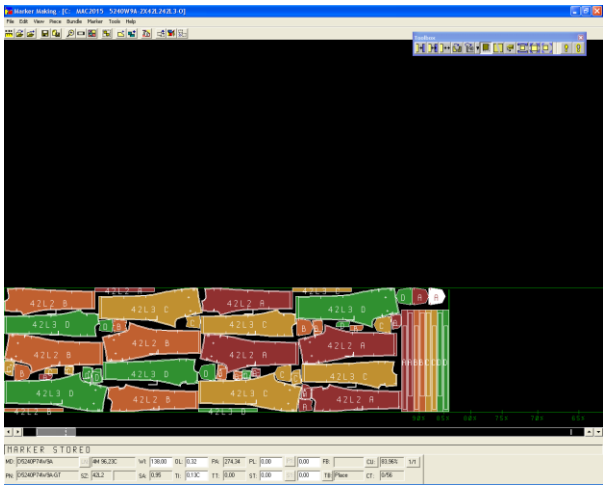


Figure 5. Mini bild of cut marker 5240W9A-2X42L22X42L3-O

$$A_b = 4.9623\ m,\quad A_n = 4.1663\ m$$

$$I_{clu} = \frac{4.1663}{4.96234} \cdot 100 = 83.96\ \%$$

$$A_{icl} = \frac{4.9623 - 4.16638}{4{,}96234} \cdot 100 = 16.04\ \%$$

$$4.9623 \cdot 40 = 198.49\ m$$

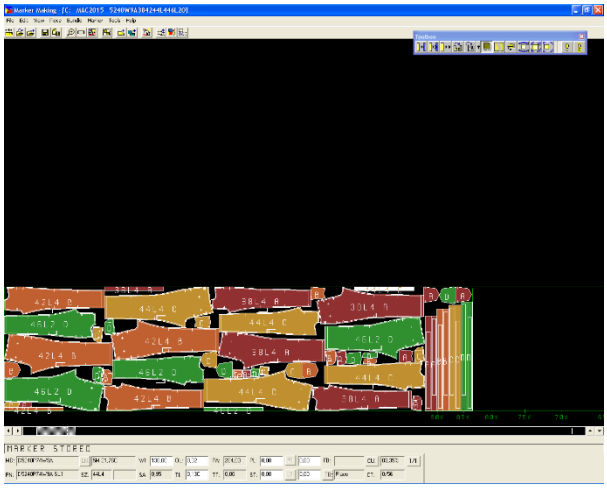


Figure 6. Mini bild of cut marker 5240W9A-384244L446L2O

$$A_b = 5.2176\ m,\ A_n = 4.3488\ m$$

$$I_{clu} = \frac{4.3488}{5.2176} \cdot 100 = 83.35\ \%$$

$$A_{icl} = \frac{5.2176 - 4.3488}{5.2176} \cdot 100 = 16.65\ \%$$

$$5.2176 \cdot 25 = 130.44\ m$$

In the second case, the cut markers were made with cutting pieces of 1, that is, 2 sizes included in one cut marker (Figure 7, 8, 9, 10). It is evident that in this case we got a worse layout of the cutting pieces in the cut marker, and with that, of course, a worse utilization of only 81.23%, a higher waste percentage of even 18.77% and a higher average fabric consumption of making one pair of trousers, 1.25 m.

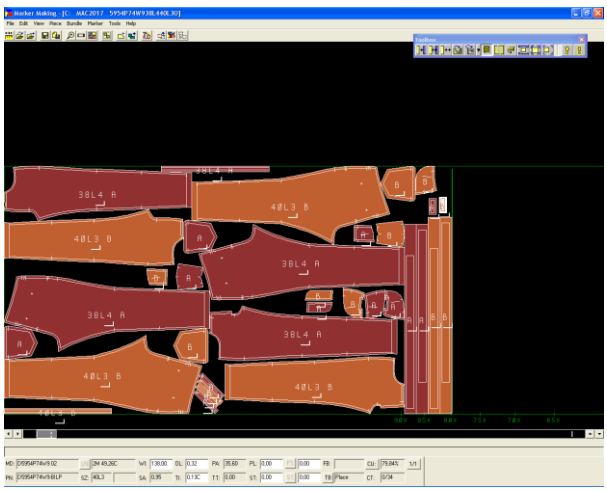


Figure 7. Mini bild of cut marker 5954P74W-938L440L3O

DOI: 10.34187/ko.73.2.3

$$A_b = 2.4926\,m, \quad A_n = 1.9901\,m$$

$$I_{clu}=\frac{1.9901}{2.4926}\cdot 100 = 79.84\,\%$$

$$A_{icl} = \frac{2.4926 - 1.9901}{2.4926}\cdot 100 = 20.16\,\%$$

$$2.4926 \cdot 27 = 67.3002\,m$$

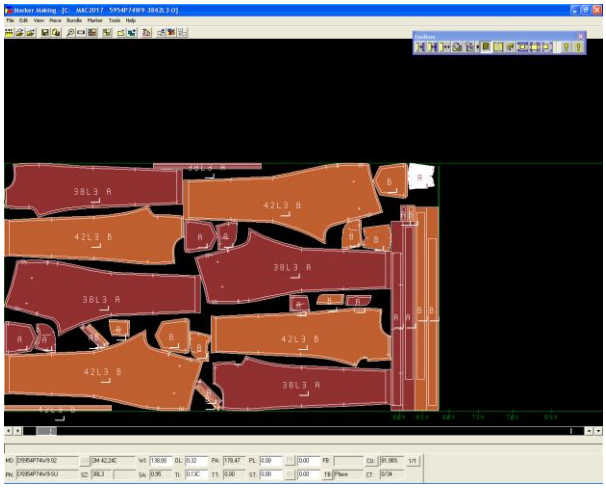


Figure 8. Mini bild of cut marker 5954P74W9-3842L3-O

$$A_b = 2.4224\,m, \quad A_n = 1.9858\,m$$

$$I_{clu}=\frac{1.9858}{2.4224}\cdot 100 = 81.98\,\%$$

$$A_{icl} = \frac{2.4224 - 1.9858}{2.4224}\cdot 100 = 18.02\,\%$$

$$2.4224 \cdot 21 = 50.8704\,m$$

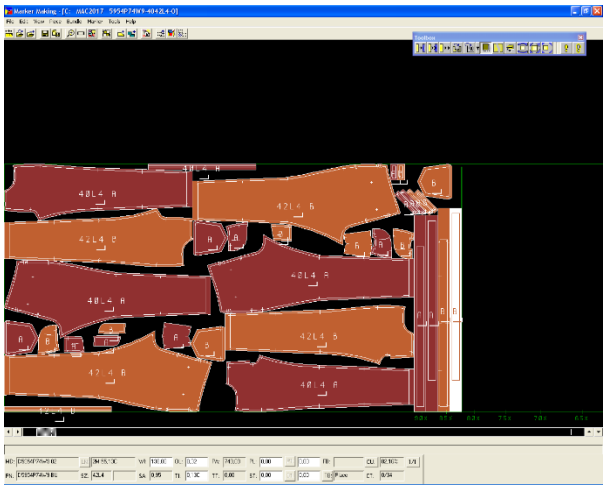


Figure 9. Mini bild of cut marker 5954P74W9-4042L4-O

$$A_b = 2.5513\,m, \quad A_n = 2.0961\,m$$

$$I_{clu}=\frac{2.0961}{2.5513}\cdot 100 = 82.16\,\%$$

$$A_{icl} = \frac{2.5513 - 2.0961}{2,5513}\cdot 100 = 17.84\,\%$$

$$2.5513 \cdot 26 = 71.4364\,m$$

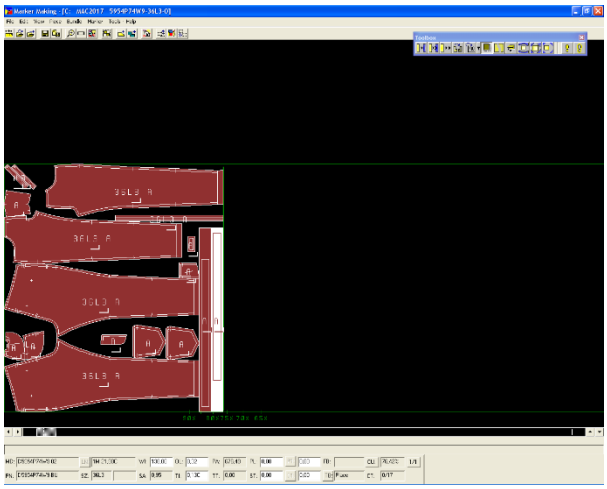


Figure 10. Mini bild of cut marker 5954P74W9-36L3-O

$$A_b = 1.2190\,m, \quad A_n = 0.9315\,m$$

$$I_{clu}=\frac{0.9315}{1.2190}\cdot 100 = 76.42\,\%$$

$$A_{icl} = \frac{1.2190 - 0.9315}{1.2190}\cdot 100 = 23.58\,\%$$

$$1.2190 \cdot 2 = 2.438\,m$$

In previous research on this topic [10] concerning woman's trousers as the first case, the cut markers with 1 or 2 sizes in one image were made, while in the second case cut markers were with 3, 4 and 5 sizes in one image. The results obtained show that the average cost is lower and the percentage of fabric utilization in the second case is higher. In numbers, it would be 14.14 m more wasted fabric in the first case.

3. Conclusions

The cut marker and the consumption of the textile material are closely related to each other. The type of cut marker can increase or it can reduce the consumption of textile material. In the experimental part, two orders with two different cut markers are shown. In both cases it was worked with the same fabric of identical width. In the first case, the cut marker was made with 4 sizes in one image, and in the second, the cut marker was with 1 and 2 sizes. In the first case there is an average fabric consumption of 1.2 m per piece.

DOI: 10.34187/ko.73.2.3

The second is with an average fabric consumption of 1.25 m per piece and 2.54 % less fabric utilization. So, the difference of the average fabric consumption and utilization of fabric in both cases is evident. The average fabric consumption is lower and the percentage of fabric utilization is higher in the first case. Or in numbers, that would be 30 m of less used fabric from which 24 more trousers could be made, and waste was reduced by 2.5 %. Since the cost of the fabric represents approximately half of the total cost of the product, it is very important to use it efficiently. That is why very often the cut layers for main fabric are long and with a small number of layers.

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DOI: 10.34187/ko.73.2.3