Reverse Engineering on Golok Banten Slash Type

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Abstract

Making tools such as machetes in banten area is still widely done, machetes are produced from the process of forging conventionally using a hammer carried out by a blacksmith. Work as a blacksmith in banten area is passed down through generations as a cultural heritage, but over time the machete of traditional blacksmith results began to be shifted with modern machetes. The purpose of this research is to find out the configuration and characteristics of these two types of banten cultural heritage machetes, devoted to slash-type machetes. Research is carried out starting from identifying problems, interviews, recording configurations and finding and analyzing the styles that occur in the process of release. From the results of this research produced configuration data and characteristics of slash machetes so that the data can be information for the public and companies who if they want to make a machete banten slash type.

***Keywords**: Banten, Machete Slash, Slashing*

1. INTRODUCTION

The excellence and safety of a nation is often determined based on the nation's abundance of oil, gas, coal, forests and soil fertility, but few associate it with culture. Whereas lately researchers began to examine the excellence and safety of a nation reviewed from a cultural perspective.

As a matter of consideration, see a flashback of how the Sultanate of Banten was able to form a community culture for the development of Banten which made Banten the largest agrarian state in
Southeast Asia, prospering its population, and becoming the largest city in the archipelago even one of the largest cities in the world in the XVII century is equivalent to the city of Amsterdam and the City of Rouen.

The XVII century was a period of brilliance of the Sultanate of Banten, able to adjust to the political, military, economic, and social situation of the world. As a country based on commerce (producers and exporters of foodstuffs and businesses of imported goods), of course requires the support of technology and a qualified business system.
Now the rest of the legacy of banten state metal processing technology is among them is a machete. Machete (bedog in Sundanese, bendo in Javanese, machete in Malay) is the name of a tool that belongs to tools and sharp weapons. Machetes become an integral part in the culture of the people of Jawara (Banten), used for martial arts (soren or pakarang) or for tools (gawe).

One of the areas in Banten that still maintains the tradition of making machetes is Seuat Jaya Village which is located in the District of Petir Serang Regency. Golok Sulangkar is one of the typical banten machetes that comes from Seuat Jaya Village and has a high magical value. The meaning of Sulangkar is Sulang and Sekar (Sulang–Seling) which means stacked with sidelined between two different materials.

There are many kinds of machetes from slash machetes, slaughter machetes and martial arts machetes. So, there are many mistakes in choosing or grouping the types of machetes, especially slash-type machetes. To solve the problem, in this study in the configuration data and some characteristics of the slash machete so that the configuration of the differentiator from the slash machete with another machete.

2. METHODS

This research focused on several samples of slash-type machetes found in Serang, Banten. In addition, the study also looked for the styles in slash machetes so that the characteristics of the slash machete in the form of hardness and sliding force. Research steps as depicted in Figure 1 contains the following stages.

1. Studying the application of case study.
2. Conducting field surveys.
3. Recording the configuration of a slash machete.
4. Defining the styles and formulas used.
5. Analysing and simulating the force in a slashed machete.
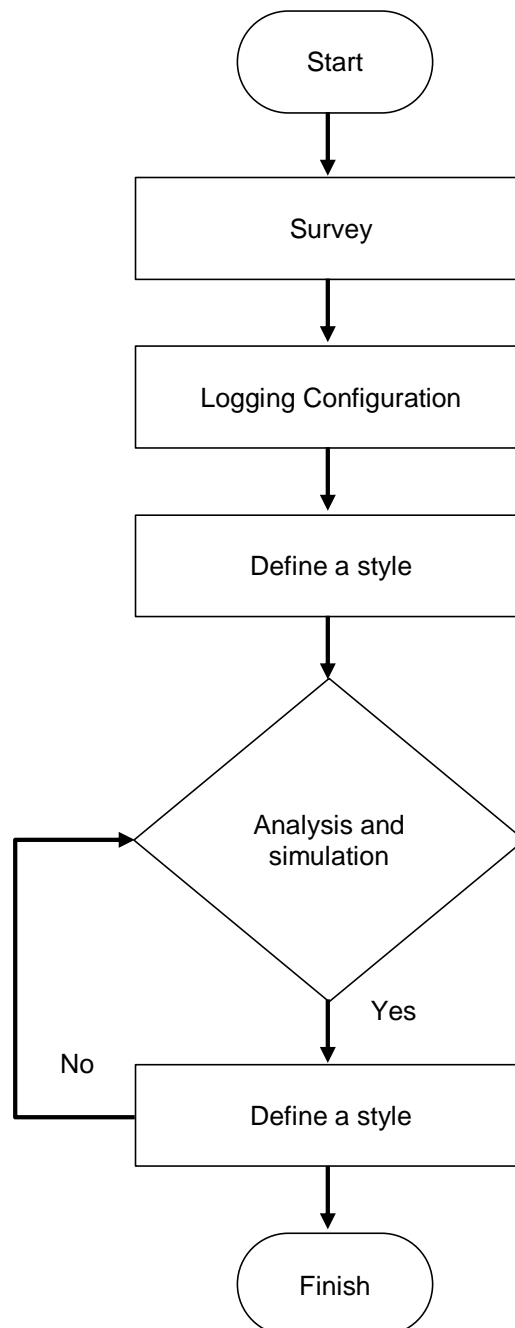6. Recommending solution.
7. Conclusion

Figure 1. Flowchart

3. RESULT AND DISCUSSION

3.1 Survey results

At this stage, researchers conducted a survey conducted on one of the traders, craftsmen, and users in Serang Regency, Banten. The survey was conducted to obtain the configuration and characteristics of the slash-type golok Banten. The configuration data you want to retrieve in this research corresponds to figure 2.
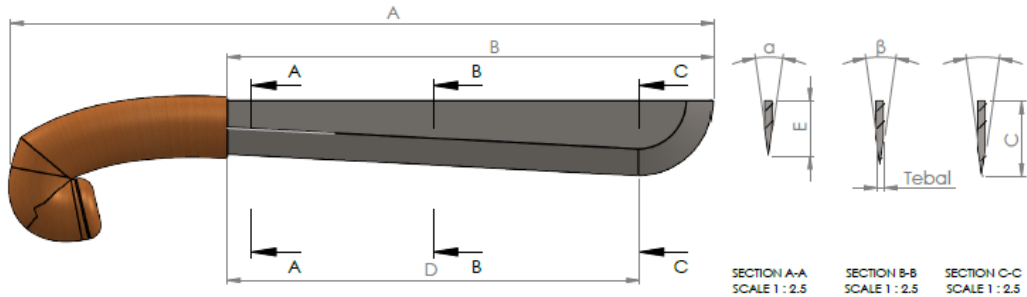

Figure 2. Image of the machete configuration

The tools to record are the term Sorong, bevel protector, meter, and scales. The results of the survey of Banten machete configuration type slash as follows:

Table 1. Configuration data of survey results

A	B	C	D	E	Massa Golok	α	β	γ	Thickness
46	32	4.9	28.5	3.5	481.5	16	16	16	0.49
46.5	31.8	4.5	29.5	3.2	373.5	16.3	16	16	0.49
44	30.2	5.2	26.5	3.5	305.8	14.2	14.2	14.3	0.37
44	29	4.9	27.5	3.5	322	15	14.3	14.1	0.36
43.9	29.9	4.7	27.2	3.6	335	15.2	16	16	0.35
40	27.2	4.7	23.3	3.5	306.8	15.2	15.5	16	0.36
42	27.3	4.4	24.9	3.3	300.2	16	15	15	0.37
42.2	27.5	4.3	25	3.3	293.3	15	15	15	0.38
41	26.5	4.6	23.3	3.4	329.4	15	16	16	0.41
40.5	26.9	4.9	22.9	3.9	381.4	15.1	15.3	15	0.42
41	27.2	4.8	23	3.9	358.8	15	15	15	0.44
41.9	27.4	4.9	23.4	3.8	368.7	16	16	16	0.43
47	32.5	4.5	28	4	371.4	16	16	16	0.44

3.2 Style analysis on slashed golok

From the analysis of the force that occurs in the slash golok can be concluded there are two styles, namely slash style and torn style.
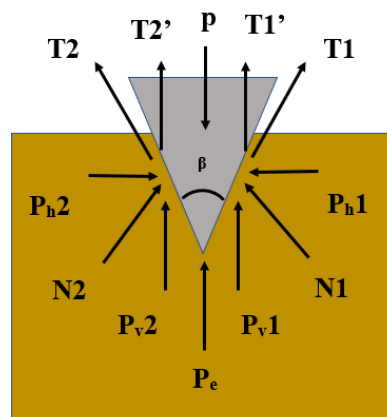
3.2.1 Slash style

Figure 3 Slash style with a sharpened double-sided knife

Judging from figure 3 the author can describe the formula for the slash style as:

$$P = P_e + P_{v1} + P_{v2} + T_1' + T_2' \tag{1}$$

$$P = A\sigma_B + 2[\sigma_B x^2 \tan ß] + 2(\mu[(1/2)(\sigma_B x^2 \tan ß)\sin ß + v\sigma_B x^2 \cos^2(ß/2)] \tag{2}$$

where N is Normal style, P_v is Normal style in vertical direction, A is cross-sectional area at the angle of the machete, P_h is Normal style in horizontal direction, x is length of machete blade, P_e is Swipe style, T1,2 is Tangential Force, T1,2' is Tangential force in vertical direction, σB is Strength of material, µ is String Coefficient, v is Poisson ratio and ß is Angle of the golok.

Table 2. Input Data

Name	
Maximum Style When a person slashes a tree (P)	919,83 N
Base area (A)	1 mm^2
Long (x)	1 mm
String Coefficient (µ)	0,6
Poisson ratio (V)	0,6
Angle of the golok (ß)	14°,15°,16°

After entering the data into the formula above obtained the hardness result (σB) which can be seen in Table 3.

Table 3. Calculation Results

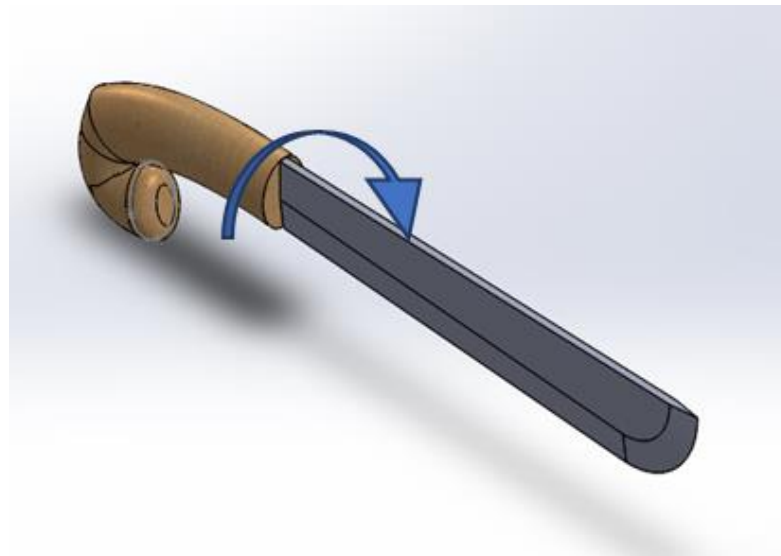| Angle of The Golok		
14	15	16
392,58 N/mm^2	389,75 N/mm^2	385,83 N/mm^2

3.2.2 Torn style

Figure 4. Torn style

This torn style is divided into 4 i.e. the tear style of the blade part and the handle. Here is the data for the calculation for the torn style that can be seen in the table 4.

Table 4. Torn Style Data

Name	
Maximum grip of Indonesians	0,051 m
Torsion kinks on the palm of the hand	4 Nm
Depth of the machete when plugged in	0,03 m
Thick machete	0,005 m
Maximum bar height	0,052 m

a) The tear style of the blade part

$$\sigma = \frac{M_p}{W_p} = T \cdot r / Ip = M.c/I \tag{3}$$

Where Mp is Twist Moment (Kg.M), and Wp is Polar Prisoner Moment (M^3). So obtained the results of the calculation of σ a total of 14047670,5 Pa / 14,048 Mpa

b) The tear style of the handle

$$\tau = \frac{M_p}{W_p} \tag{4}$$

Where Mp is Twist Moment (Kg.M), and Wp is Polar Prisoner Moment (M3). So obtained the results of the calculation of τ a total of 28465483,3 Pa / 28,47 Mpa

3.3 Correlation between the configuration of the golok and the forces that occur in the Banten golok type slash

In finding the correlation between the configurations of the golok its style, the variable of the configuration is set i.e. large angle, and for its styles that is the result of calculation of the hardness of a material.

HARDNESS (N/MM2)		
392.58	389.75	385.83
14	15	16

CORNER
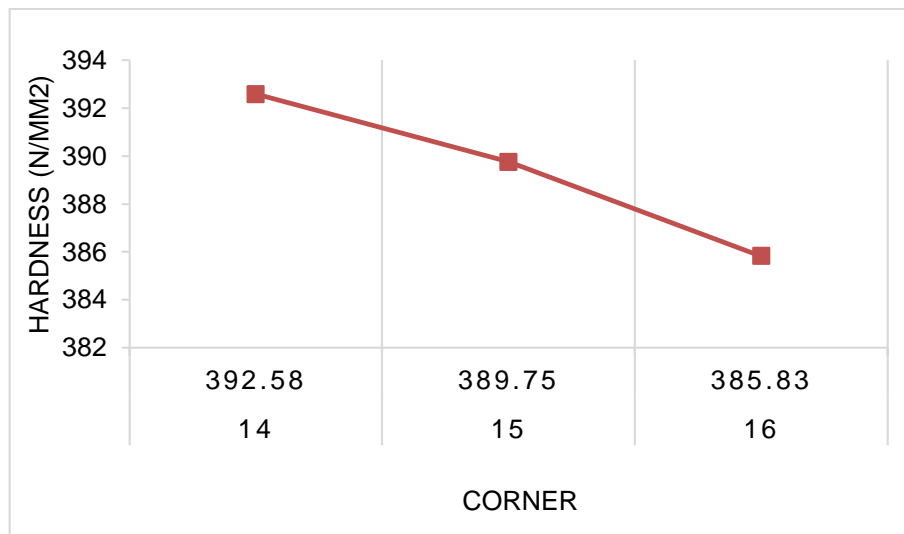
Graphic 1. Pearson Product Moment Diagram

The above diagram and the result of Pearson product-moment diagram -0,9 explain that the configuration and styles in the machete have a very strong correlation and the correlation is negative where the angle is greater, the strength of the material needed is smaller.

3.4 Style Simulation on a Golok

In the analysis process, this study used explicit dynamic in Ansys to see safety factors and for the data used for slash force 919.83 N and torn force 4 Nm, for configuration to take samples of machetes close to the angle of 14°, 15°, and 16° and blade material is data from ss400 because the strength of the material is close to or exceeding the recommended

hardness of 140 HB from 117 HB and for the handle material in use is using teak wood of 212 Kg / Cm^2 of 140.48 Kg / Cm^2 allowed.

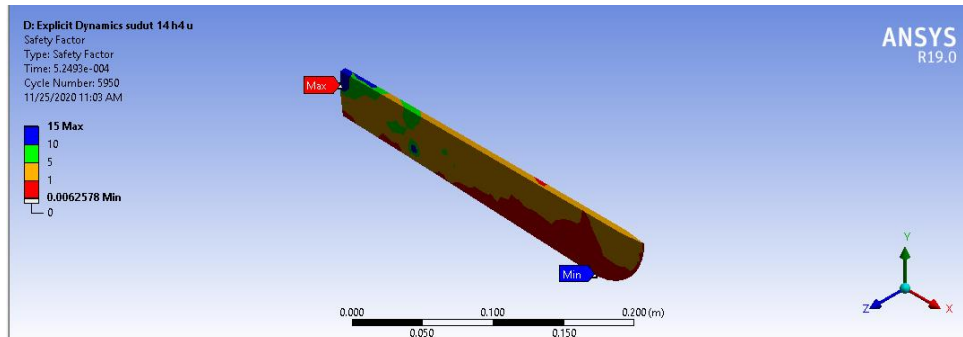### 3.4.1 Simulations of the Slash force

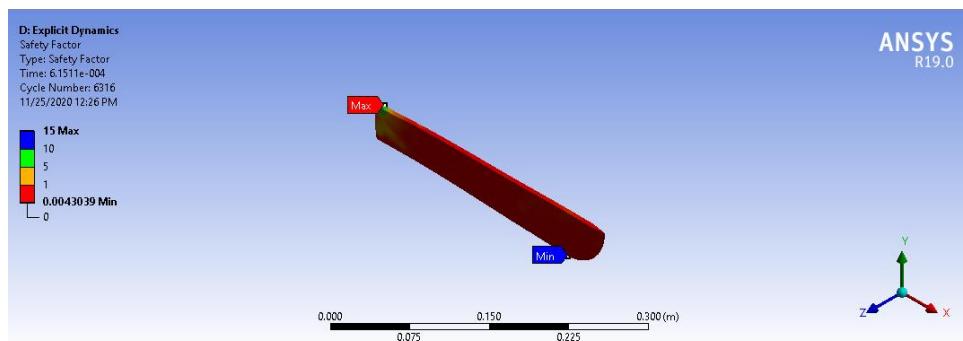Figure 5. Safety Factor Angle 14 Simulation Results

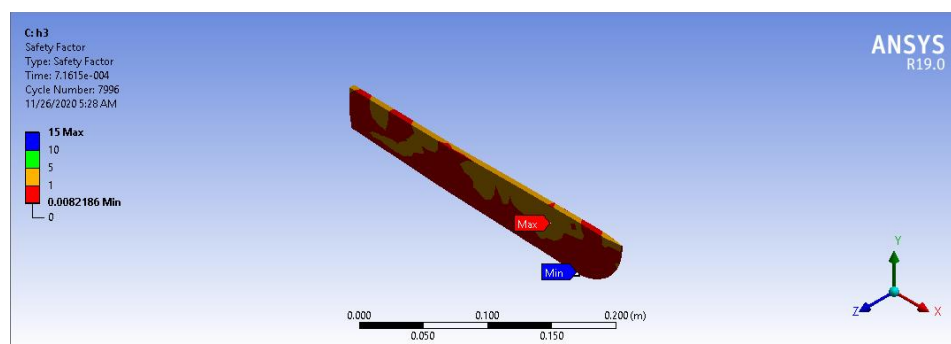Figure 6. Safety Factor Angle 15 Simulation Results

Figure 7. Safety Factor Angle 16 Simulation Results

From the simulation data angle 14, 15, and 16, the material ss400 can be a slash of machete blade material. Yet, for the safety, a factor is less because under one then it can be concluded that the safety factor blade material is good then the hardness must be raised.

3.4.2 Simulations of the Torn force
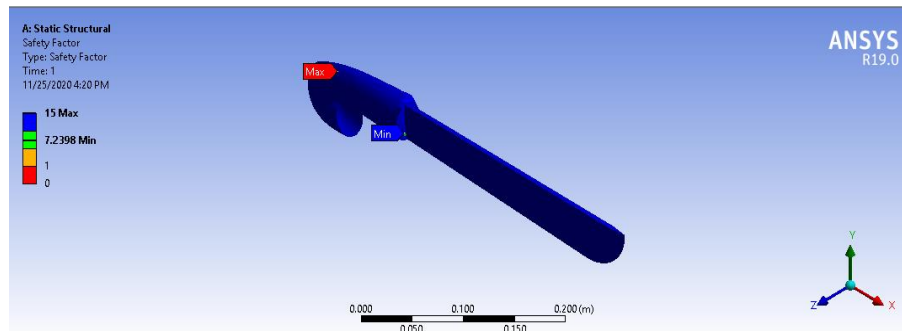#### a) The tear style of the blade part

Figure 8. Simulation result of safety factor force torn on handle

From the simulation results that teak wood is included in the material that must be used in the manufacture of machete handles because the safety factor is safe.

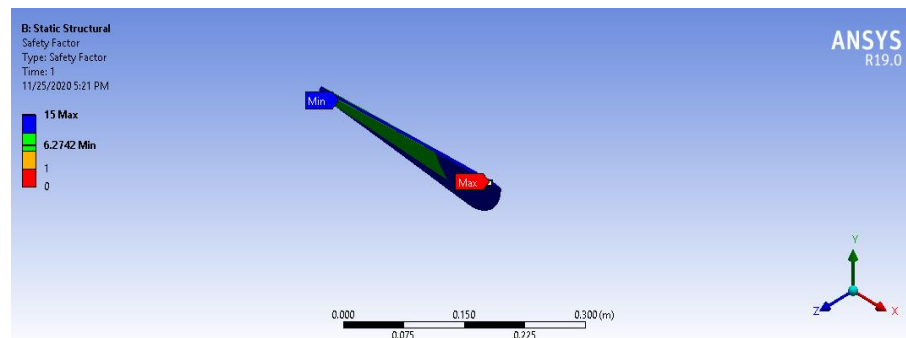#### b) The tear style of the handle

Figure 9 Simulation result of safety factor force torn on blade part

From the simulation result that ss400 is included in the material that must be used in the manufacture of machete blades because the safety factor is safe.

4. CONCLUSION

From the research conducted, the author can deduce the configuration of Banten golok slash type has a size in the form of:

A. Length of golok	: 40 -47 Cm
B. Width of golok	: 4.3 - 5 Cm
C. Thickness of golok	: 0.35-0.5 Cm
D. Angle of golok	: 14° - 16°
E. Machete Mass	: 300-500 Gram
F. Handle diameter	: 4.8 - 5.1 Cm
G. Hardness of machete material	: > 385,83 N/mm^2

For the style that occurs in the slash golok, there are two styles, namely slash style and torn style. Slash style is the style that occurs when the golok hits the wood and the force occurs on the blade of the golok. Torn style is the style that occurs on the golok when the golok is stuck to the wood and moves to the right and left to release the golok from the wood, this style is very influential on the handle of the golok.

REFERENCES

1. Besari, M. S.. Teknologi di Nusantara 40 Abad Hambatan Inovasi. Jakarta : Salemba Empat. 2008
2. Guillot, C. Sejarah dari Peradaban abad X-XVII. Section edition, Jakarta: Kepustakaan Populer Gramedia. 2008
3. Sitkey, G. Mechanics of Agricultural Materials.Elsevier, Amsterdam.1986:439-455
4. D. William . Materials Science and Engineering. Seventh edition. New York : John Wiley & Sons, Inc. 2007
5. Muttaqien, T. Z., . Golok Walahir Sebagai Identitas Budaya Masyarakat Desa Sindangkerta Kabupaten Tasikmalaya. Jurnal Seni Rupa, 7 (1). 2019:41-50.
6. Meriam J.L., Kraige L.G. Engineering Mechanics Statics. 7th edition. John Wiley & Sons, Inc. 2012
7. Knudson Duane. Fundamentals of Biomechanic. 2th edition. Spinger. 2007
8. Martawijaya A., kartasujana I. ATLAS Kayu Indonesia. 1th edition. Bogor : Pusat Penelitian dan Pengebangan Hasil Hutan. 2005