



## REDESIGN OF BREAD BOX WITH CONSIDERING ERGONOMIC ASPECT

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### ABSTRACT

To distribute the products, the company uses tools such as breadbox that is place in the motorcycle seat. However, the tools used for these motorists complain of discomfort, this is due to the rigid box shape (on the back of the rider) and the improper size of the box. Ergonomics or human factors considerations are very influential in the driving comfort. This study aimed to design an ergonomic breadbox, accordance with aspects of anthropometry. Ergonomic breadboxes are useful for bikers to bring bread to the stalls. The purpose of the breadbox design is to enhance the previous design. Specifications of breadbox concept design are; box shaped, forming a body curves and ergonomic seating position on the side of the backrest, made of fiber material, backrest follow the shoulder width, and box cover is not covered with plastic.

**Keywords:** ergonomic, anthropometry, bread box, human factors.

### INTRODUCTION

For a food company, product quality is essential in maintaining a good relationship with the consumer, so the consumer does not easily switch to other similar companies. To distribute the products, company uses tools such as bread boxes that is placed in the motorcycle seat to be distributed to the consumer. But during this the carrier bread box used causes discomfort complaints, this is due to the rigid box shape on the rider's back, and also the size of the box that is not appropriate. Nurmianto said, the wrong sitting posture is one of the problem cause (Nurmianto, 1996). The pressure on the spine increases when sitting, than when standing or even lying. Therefore, a comfortable sitting position should be noted that the driver can work comfortably and safely so that productivity can be increased. Ergonomics or human factors considerations are very influential in driving comfort, but it is often overlooked. Nevertheless ergonomics issues need to be investigated further in order to provide better results and increase the safety and comfort while working, because the rigid boxes and do not follow the body shape and size would cause injury to the rider. Moreover boxes weight should also be considered to reduce the difficulty while riding a motorcycle. Comfort and safety factor very influential to increase labor productivity, as well as good impact on the working attitude. Therefore, research about redesign of the bread box by considering the ergonomic aspects needs to be done. Ergonomic studies are able to identify design evaluation parameters that help designers, buyers and users to choose product and process solutions. In working environments, ergonomic factors are taken into account in product and process development because they are a key component of the human-machine interface (Califano *et al.*, 2016).

Design is a problem-solving activity and technological innovation aimed at finding the best solutions (systems, processes, physical configuration) by formulate the innovative ideas into a model first, and then realize the reality creatively (Cross, 1989). After that, it

would seem implications ergonomics, because the design always aimed to solve human problems (Madyana, 1996). Design related to the objectives problems, optimize the product so that the function of the product "compatible" by the physical configuration, user's psychological factors, and users tastes. The design also requires security for product users, especially if the product known to have a negative impact on the user. Design requires effectiveness work of tools, safety (comfort) in use, and this can only be achieve if we know the extent and limits of human comfort. At the principle, every product use was involved in ergonomics issues.

The problem is what, to what extent, and the possibility of how ergonomic considerations determined, considering the following matters; first, the contextual nature of the product design. Due to differences in consumer taste, the taste of any design should follow the consumer segment. Second, considering the economic principles of product success was determined by how widest that product can reach the possible population. An ergonomic issue that arises is how the product can still be effective despite the different consumer characteristics (heterogeneous).

Another problem, particularly in the product engineering design is how to achieve the totality of aesthetic form, but still ergonomic. Wrong sitting posture can cause problems at the back. Operators with the wrong posture will suffer on the back. The pressure on the spine will be higher when sitting than standing or lying down. If pressure was assumed about 100%, then sitting by tense and stiff (erect posture) can cause pressure at 140%, and sitting in bent down position will cause that pressure reaches 190%. Tense posture requires more muscle activity or nerve tension in the forward leaning posture. The increase in pressure can arise from a change in curvature of the spine when tired. A weariness in the hip around 900 can not be achieved only by the rotation of the thigh bone in the joint (joint thigh bone) (Nurmianto, 1996).



## MATERIAL AND METHODS

Almost all retailers have a large breadbox, even very large, so that they have difficulties. Besides, the material used is also not good. The currently material used is zinc. This material deliver heat very quickly and cause a burning sensation around, so the rider distracted and uncomfortable. Moreover, this material easily corroded and perforated, so when it rains the water get into the box and wetting the bread. During this time, the situation overcome by covering the top of the box with plastic, but it was not durable as the plastic material could torn easily, especially since the box is zinc. Zinc is a sharp material; it can tear or injure people when exposed. Generally, the rider leans on a box he was riding, and the driver could distract when riding a motorcycle if box is hot. Workers are seen to be unaware of ergonomic principles as body postures and movements are seen to be not following standard work procedure (Gurunath *et al.*, 2012).

The box shape on the backrest is flat, do not follow the normal shape of the body when sit, it will cause pain in the back of the body. The following Figure-1 and Figure-2 shows the two-wheeled vehicles as a sales transportation, with a box that is place on the back seat:

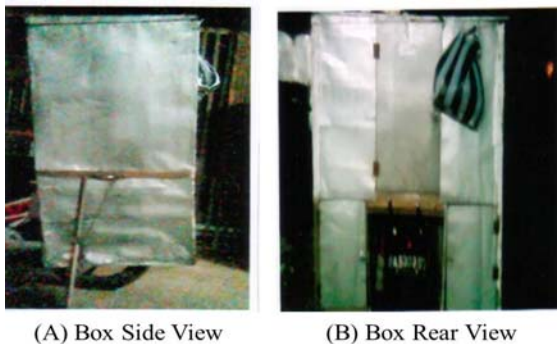


Figure-1. Box view in existing condition.



Figure-2. Riders sitting position in existing condition.

Stages of the research are as follows:

- Clarification of the design objectives includes aspects of ergonomics and Anatomy.
- Analyze the existing breadbox functions.
- Determination of the need, namely:

- Ergonomic include body size according to anthropometry
  - Anatomy of body-shaped backrest covers normal sitting
  - Economic Factors
- Determination of characteristics by creating a matrix design requirements
  - Develop some alternatives, by consider:
    - The shape of the box on the backrest side
    - Materials of the box
    - The backrest width
    - Box cover
  - Perform an alternative selection method, using concept of scoring with parameter Eleven Point Scale.
  - Make a breadbox architecture that consists of:
    - Breadbox components to design
    - Anthropometric data of the rider
    - Determining the bread box size

## RESULTS AND DISCUSSION

From distributed questionnaires, priority order preferred by the rider about the breadbox design improvements obtained as proper box size, good material quality, easy to use, material is easy to obtained, cost of materials is affordable, and large box size. Also the order of preferred safety and comfort are the size of the box is properly, vehicle can turning easily, and do not cause pain in the body (back, hips, arms and shoulders). The size of box design taken from the percentile chosen, using measurements in Table-1 below:

Table-1. Size box design.

No.	Type of Size	Dimensions (cm)
1.	High of Main Box	57.07
2.	Width of Main Box	51.87
3.	Length of Main Box	50.21
4.	High of Side Box	40.00
5.	Width of Side Box	15.00
6.	Length of Side Box	50.21

The material use is fiber. Some reason of using this material are: not heavy, airtight, and waterproof, especially when it rains. This material is also easy to obtain and not too expensive. Drivers sit position was influenced by the box size designed, and the rider spine shape. It's shown at Figure-3 dan Figure-4.

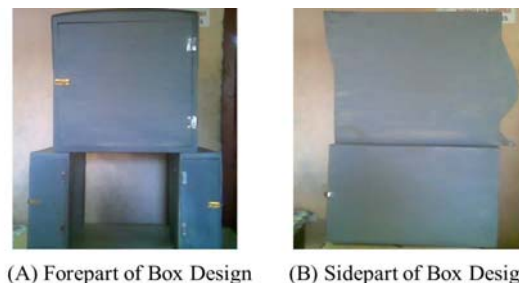


Figure-3. Box of redesign.



**Figure-4.** Riders sitting position.

The design recapitulation shown in Table 2 dan table 3. The results show that all of the design objectives of delivery bread boxes have been met.

**Table-2.** Variable and parameter for bread box design.

Factor	Variable I	Variable II	Parameter
Delivery Bread Box	In accordance by size of the rider anthropometry	<ul style="list-style-type: none"> <li>• TBD</li> <li>• LB</li> <li>• JTD</li> <li>• TSP</li> <li>• TPG</li> </ul>	= Mean
	The spine forming normal sitting posture		= standard Deviation
	Material framework is not too expensive and easy to obtain		

**Table-3.** Summary of bread box design.

Factor	Previous Box	Designed Box	Target
Delivery Bread Box	a.Box hight does not accordance with the heigh of sitting shoulder	a.Box hight accordance with the heigh of sitting shoulder	+
	b.The width of the box does not match the width of the shoulders	b.The width of the box match the width of the shoulders	+
	Shape of front box (in the back of the rider) is flat	Shape of front box (in the back of the rider) in accordance grooves of the normal sitting position	+
	Not too expensive and easy to obtain	Not too expensive and easy to obtain	0

Symbol description:

- Not good
- + Better
- 0 Right / appropriate

## CONCLUSIONS

The results of this study can be summarizing as follows:

- The Box designed using fiber material. If the weather is heat, the material is not so hot so that the rider remains comfortable if the box contact with the body. And if it rains this box does not need to be covered with plastic because water can not get into the box.
- The designed box size is based on anthropometric data that has been performed data processing. The data used are seated shoulder height (TBD) with a size of 57.07 cm, shoulder width (LB) 51.87 cm, front arm reach (JTD) 56.79 cm, backrest high (TSP) 45.17 cm, waist height (TPG) 20.3 cm.
- Box is designed so that the rider feel safe, comfortable, efficient and effective by considering anthropometry size of the workers.

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