PERANCANGAN KURSI HALTE ANGKUTAN KOTA BANDUNG MENGGUNAKAN KANSEI ENGINEERING

DESIGN OF BANDUNG CITY TRANSPORT STOP SEATS USING KANSEI ENGINEERING

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Abstrak

Saat ini tingkat mobilitas setiap orang semakin meningkat, hal ini terbukti dengan adanya data dari BPS yang menjelaskan bahwa pertumbuhan penduduk semakin meningkat dari tahun ke tahun yang artinya semakin banyak orang yang membutuhkan perpindahan tempat dari titik satu ke titik lainnya, berdasarkan data tersebut maka memunculkan permasalahan dimana prasarana angkutan kota juga dibutuhkan oleh orang – orang yang menggunakan angkutan kota, namun pada kursi halte angkutan kota tersebut pengguna justru merasakan ketidak nyamanan pada saat menggunakan kursi halte angkutan kota. Pada perancangan sebuah konsep desain terdapat berbagai macam metode dalam pelaksanaannya, salah satunya yaitu Metode Kansei Engineering dan yang akan digunakan yaitu Kansei Engineering tipe 1 yang inputnya merupakan keluhan, suara, dan kebutuhan dari pengguna yang akan diolah kedalam bentuk Kansei Word. Kansei Word yang sudah terkumpul, maka akan menjadi patokan dalam pengujian dan akan direduksi yang akan memiliki output yaitu sepsifikasi dari desain yang akan dibuat dan sepsifikasinya akan divisualisasikan menggunakan CAD melalui proses benchmarking sebagai acuan dalam pemilihan desain dan diuji dengan uji RULA. Hasil dari tugas akhir ini yaitu dapat membuktikan bahwa Metode Kansei Engineering dapat digunakan dalam perancangan desain kursi halte angkutan kota sehingga membuat pengguna duduk lebih nyaman dibandingkan produk eksisting.

Kata kunci : Kansei Engineering, Kansei Word, Kursi Halte Angkutan Kota

Abstract

Currently the level of mobility of each person is increasing, this is evidenced by data from BPS which explains that population growth is increasing from year to year which means that more and more people need to move from one point to another, based on this data, it raises problems. Where infrastructure of transportation facilities are also needed by people who use city transportation, but on the seat of the city transportation stop the user actually feels uncomfortable when using the seat of the city transportation stop. In designing a design concept, there are various methods in its implementation, one of which is the Kansei Engineering Method and the one that will be used is Kansei Engineering type 1 whose input is complaints, voices, and needs from users which will be processed into Kansei Word form. Kansei Word that has been collected will be used as a benchmark in testing and will be reduced which will have an output, namely the specifications of the design to be made and the specifications will be visualized using CAD through a benchmarking process as a reference in design selection and tested with RULA Testing. The result of this final project is to prove that the Kansei Engineering Method can be used in designing the seat design for the city transportation stop so that it makes users sit more comfortably than existing products.

Keywords: ***Kansei Engineering, Kansei Word, Seat of City Transportation Stop***

1. Preliminary

Bandung city is one of several big cities in Indonesia. The population of Bandung City is 2,452,179 people in 2018. The increase in the population in Bandung City can have several impacts, one of which is in the field of transportation. The level of population density in an area will significantly affect the ability of transportation to support the needs of the population [1]. The number of residents in an area will be proportional to the high and low needs of population mobility. Residents in a city will always move to a location that can meet their needs. One of the problems that occur is the unpreparedness of urban transportation infrastructure such as bus stops as a place to wait for city transportation passengers. Below is a graphic image of the results of interviews with 40 users of city transportation stops regarding the reasons why people still rarely use city transportation stops to wait

for city transportation.

Picture 1 City Transportation Stop Seat User Complaints.

2. Theoretical Basis and Research Methodology

2.1 Comfort

Comfort is a feeling that results from little or no disturbance in bodily sensations [2]. Comfort or a feeling of security is a state that basic human needs have been met such as [3]:

1. The Need for Peace
   It is a satisfaction that will improve a person's appearance both from clothes and facial expressions.
2. Relief
   It is a feeling of calm when all needs are met.
3. Transcendent
   A condition that is the impact of a problem experienced

2.2 Kansei Engineering

Kansei is a Japanese term used to express the impression of a product, situation and environment. Kansei is generally called sensitivity, sensitivity, feeling and emotion [4]. According to the psychological view, Kansei is a mental state in which knowledge, emotions, and feelings become a harmonious whole. People who master Kansei knowledge are emotional, adaptive, and responsive people [5].

2.3 Type of Kansei Engineering

In the process of the Kansei Engineering method, there are several types with different ways of processing and solving problems according to the needs of each type. The following are the types of Kansei Engineering [5]:

1. Type 1 (*Category Classification*)
   In this type of Kansei Engineering, the first step is to determine the product strategy and create the concept of product design. Furthermore, the collection of Kansei Words that have an attachment to the product concept is carried out. Kansei Words can be collected in various ways, namely interviews, literature studies, questionnaires, and others. Then proceed to categorize and collect Kansei Words based on their respective properties, and finally reduce Kansei Words based on their level, Kansei Word selection is determined based on the level, the highest level is the Kansei Word chosen.
2. Type 2 (*Kansei Engineering System*)
   In this type of Kansei Engineering there is a mathematical and statistical system that aims to relate Kansei to the nature of the product to be developed. A computerized system containing a database of Kansei words is used in this Kansei Engineering Type 2. The database in Kansei Engineering type 2 consists of a combination of Kansei words, images, knowledge, designs, and colors related to data.
3. Type 3 (*Hybrid Kansei Engineering System*)
   Type 3 of Kansei engineering is almost similar to type 2. In this type 3 there are several significant differences. In Kansei Type 2 the design parameters can only be changed from the consumer's Kansei. If in Type 3 the nature of the product to be developed can be predicted its nature is better known as a hybrid system.
4. *Type 4* (*Kansei Engineering Modeling*)
   Kansei Engineering Type 4, better known as Kansei Modeling, is an implemented mathematical model that aims to predict consumer feelings in the form of words. Kansei Engineering Type 4 uses fuzzy measurements and combinations, consumers will be allowed to give a feeling assessment into words or sentences.
5. Type 5 (*Virtual Kansei Engineering*)
   Kansei Engineering Type 5 is a continuation of Kansei Engineering Type 3 (Kansei Engineering System) using VR (Virtual Reality) devices where consumers will be placed in a 3D virtual environment.

6. Type 6 (*Collaborative Kansei Engineering Designing*)
   Kansei Engineering Type 6 is a type of kansei that uses the internet system. The working principle of Kansei Engineering Type 6 publishes the Kansei Engineering System offered on the internet so that certain groups can assess it.

2.4 Kansei Engineering Method Type 1

In this final project, Kansei Engineering type 1 is used. Kansei Engineering type 1 is the easiest and easiest way to understand Kansei Engineering, besides the Kansei Engineering type 1 method also makes a detailed design of a product and divides the characteristics of a product into several levels. The following are the stages in Kansei Engineering type 1 [5]:

1. First Step: Target Identification
   In this stage, identification of the target market group is carried out, including making decisions about where the product will be marketed, targeting can be determined by several experts on a product, it can also be determined from the results of marketing surveys. Retrieval of data that has been obtained aims to facilitate the process of product development.
2. Second Step: Determining Product Concept
   In this stage, the implementation of the product concept in product development will be carried out. The concept of the product that will be decided will be developed by asking directly to the users of the product.
3. Third Step: Dividing Product Concept
   In this stage the product concept will be divided into several levels until the physical characteristics of the design will be determined. The characteristics in question can be in the form of the function of the product, the shape of the product, and the size of the product.
4. Fourth Step: Translating Product Specification
   In this stage, the physical design characteristics are translated into technical specifications. This stage makes it easier to determine the new design.

2.5 *Kansei Word*

Kansei Word is a word that describes a product. Kansei words are generally in the form of adjectives such as efficient, effective, sturdy, strong, and so on. Kansei word can be a verb and a noun. Kansei words can come from magazines, books, manuals, experts, customer experience, linking Kansei studies, ideas [6]. The most important aspect in using Kansei Word is to interpret ideas and visions into Kansei words because consideration of non-existing product solutions must also be considered. This method is the only way to creative and revolutionary product development. The word collection is done often in the amount of 50 to 600 words. Collecting Kansei Word has an important role because the result of the validity of the existing words will be affected. Kansei Word will continue to be searched until no more new words are found.

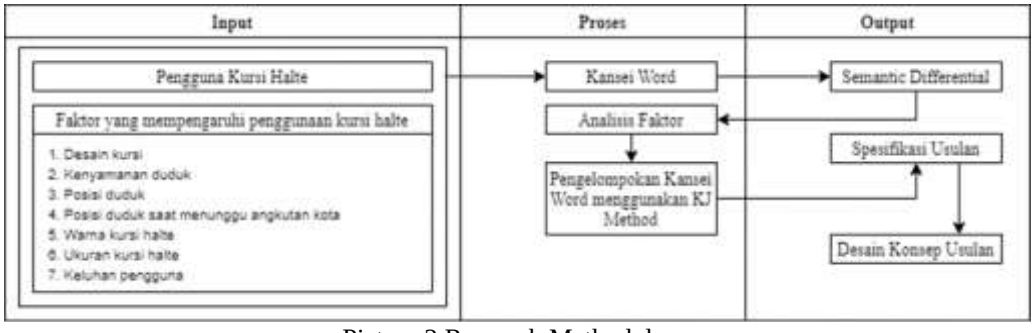
2.6 *Semantic Differential*

The measurement scale on the Semantic Differential aims to measure attitudes whose shape is arranged in a continuum line where the "very positive" answer is located on the right and the "very negative" answer is located on the left or vice versa [7]. The data resulting from this semantic differential is in the form of interval data which is useful for measuring a certain attitude/characteristic. In Semantic Differential researchers will get answers from positive respondents to negative answers. This really depends on the respondent's feelings and perceptions of something being assessed.

2.8 *RULA (Rapid Upper Limb Assessment)*

In testing work posture there are several methods that can be done, one of which is RULA (Rapid Upper Limb Assessment). RULA is a survey method that was developed with the aim of investigating ergonomics in the workplace related to the upper limbs [8]. The RULA method is the most complex method and has been developed by experts to assess potential work injuries [9].

2.9 Research Methodology



Picture 2 Research Methodology

This final project is to redesign the seat of the city transportation bus stop, the output of the design concept of the seat of the city transportation stop. The process of making this concept is done by knowing in advance the factors needed by the user from design, comfort, sitting position to complaints from users of city transportation bus stops. After knowing the problems from user complaints, then a Kansei Word search is carried out which aims to describe the feelings and desires of users regarding the proposed product obtained from literature, observation, and direct interviews with users. After getting the results from the Kansei Word selection, a Semantic Differential is carried out which will produce the impression that the user gives when using the bus stop seat. The Kansei Word obtained will be analyzed for factors with the aim of knowing whether the Kansei Word has described the user's feelings and needs or not, if it still has not described the user's feelings and needs, the Kansei Word will be reduced. Kansei Word output that describes the feelings of the user can be a specification according to the user's wishes which results in the final concept of the city transportation bus stop seat.

3. Discussion

3.1 Identify Target Market

The first stage in Kansei Engineering is to identify the target market for users from city transportation bus stops seats. This final project has a target market, namely city transportation passengers with productive age, namely between the ages of 20-64 years because the age range according to BPS data is the average productive age. Therefore, this target market will be the respondents to the next Kansei Word.

3.2 Collecting Kansei Word

In the Kansei Word Collecting stage in the Kansei Engineering Method, a search and collection of Kansei Words is carried out. This Kansei Word search is obtained from the emotional perspective and feelings of the product user. Kansei Words are obtained in the form of adjectives, nouns, and verbs, namely functions, mechanisms, materials and so on, experiences and behaviors of users when using these products [6]. The sources used to get Kansei Word are through people who are experts in their fields, manual books, magazines, and feedback from users. In this final project, 60 Kansei Words were found which were reduced to the most relevant words for the needs of the bus stop chairs because there are some words from 60 words that have the same meaning. By reducing these Kansei Words, we get the 17 most relevant Kansei Words which can be seen in the following table.

Table 1 *Kansei Word*

1	Comfort	10	Waterproof
2	Backrest	11	Minimalist
3	High Quality Material	12	Easy Maintenance
4	Proportional Dimension	13	Fiture
5	Not Slippery	14	Elegant
6	Soft	15	Futuristic
7	Unique	16	Safety
8	Armrest	17	Bright Color
9	Wide		

3.3 Post – Test Questionnaire

Questionnaire is a way of collecting data which is done by asking several questions both verbally and in writing to respondents to be answered, [7].In order for the data obtained to be valid and reliable, then validity and reliability testing is needed before distributing questionnaires to respondents. This test is conducted with the aim of assessing whether or not the Kansei Word can be continued to the next process, otherwise the Kansei Word will be eliminated.

3.3.1 Uji Validitas dan Reliabilitas

In this validity and reliability test step, a statistical approach is tested with the aim of knowing which Kansei Words that have been collected can be processed at a later stage or not, with the aim of eliminating any Kansei Words that do not pass the validity and reliability tests. After distributing the questionnaires and having been filled in by all respondents, the results of the questionnaire recap will be tested on the SPSS application. According to [10] the validity of a data is tested to be valid if the correlation value is 0.3 while if the correlation value is < 0.3 then the validity of the data is invalid. With the validity test results obtained, then the data reliability test is then carried out. The reliability test aims to determine the consistency of each Kansei Word in the design of the Bandung city transportation bus stop seat. If the coefficient value of Cronbach Alpha 0.7 while if the coefficient value <0.7 then the data is not reliable [11].

Table 2 Validity and Reliability Test Results

No	Kansei Word	Coefficient Correlation	Decision	No	Kansei Word	Coefficient Correlation	Reliability
1	Comfort	0,446	Valid	1	Nyaman	0,947	Reliable
2	Backrest	0,676	Valid	2	Sandaran Punggung	0,943	Reliable
3	High Quality Material	0,647	Valid	3	Kualitas Material Tinggi	0,942	Reliable
4	Proportional Dimension	0,553	Valid	4	Dimensi Proporsional	0,945	Reliable
5	Not Slippery	0,635	Valid	5	Tidak Licin	0,944	Reliable
6	Soft	0,766	Valid	6	Empuk	0,944	Reliable
7	Unique	0,670	Valid	7	Unik	0,944	Reliable
8	Armrest	0,703	Valid	8	Sandaran Tangan	0,948	Reliable
9	Wide	0,624	Valid	9	Lebar	0,943	Reliable
10	Waterproof	0,691	Valid	10	Tahan Air	0,948	Reliable
11	Minimalist	0,706	Valid	11	Minimalis	0,944	Reliable
12	Easy Maintenance	0,776	Valid	12	Perawatan Mudah	0,943	Reliable
13	Elegant	0,583	Valid	13	Elegan	0,945	Reliable
14	Futuristic	0,672	Valid	14	Futuristik	0,948	Reliable
15	Safety	0,784	Valid	15	Aman	0,945	Reliable
16	Bright Colour	0,633	Valid	16	Warna Cerah	0,944	Reliable

3.4 Factor Analysis

The next stage, after obtaining data from the Semantic Differential questionnaire, then carried out the factor analysis stage which aims to simplify Kansei Word into a structure and facilitate concept mapping. Factor analysis using the Kaiser-Meyer-Olkin (KMO) approach and Bartlett's Test. The value of the results of KMO and Bartlett's Test for the correlation between the targeted variables is 0.5 with a significance of Bartlett's Test <0.05. It can be seen in the table above that the KMO test value is 0.683, which means the value is 0.5 and the significance value is 0.000, which means the value is <0.05. So from the results of the KMO test and Bartlett's Test, there is a significant relationship that affects the concept of city transportation stop seats.

Table 3 KMO and Bartlett's Test Results

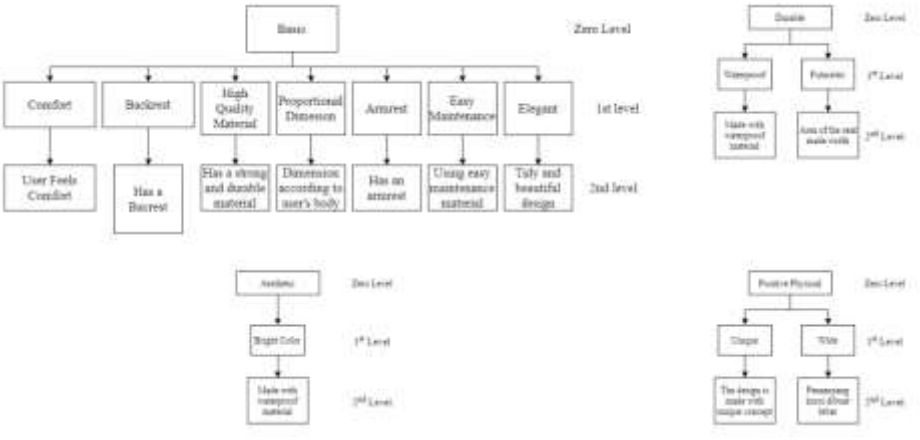
KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.683
Bartlett's Test of Sphericity	Approx. Chi-Square	243.238
	df	120
	Sig.	.000

3.5 Product Concept Mapping

3.5.1 Kansei Word Grouping Using KJ Method

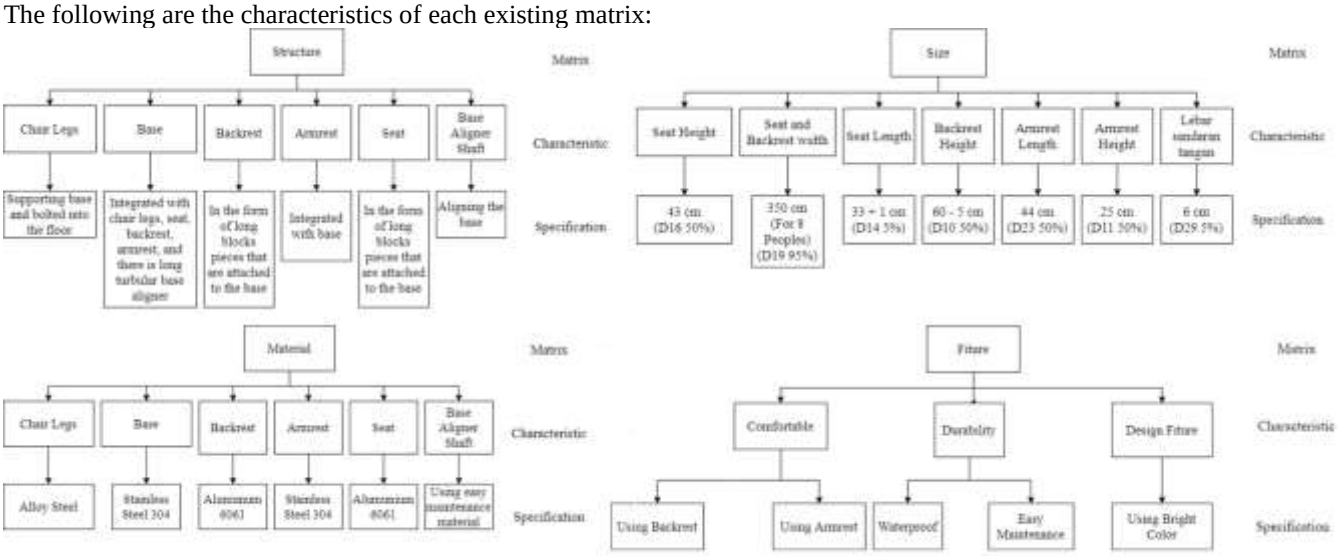
The KJ Method is an approach that aims to map the concept into more detail and divide it into several levels to explain the design characteristics [12]. KJ Method uses affinity diagrams in grouping Kansei Words called affinity clusters. In the cluster there are several levels, namely zero level, 1st level, and 2nd level which illustrates that the higher the level, the more detailed it will be. The following is a cluster of each Kansei Word.



Picture 3 KJ Method Cluster

3.5.2 Determination of Product Characteristics and Specifications

The next stage is to determine the specifications of the product, the goal is to determine the specifications of the city transportation stop seats which in the previous step have been made the appropriate cluster for each need. The following are the characteristics of each existing matrix:

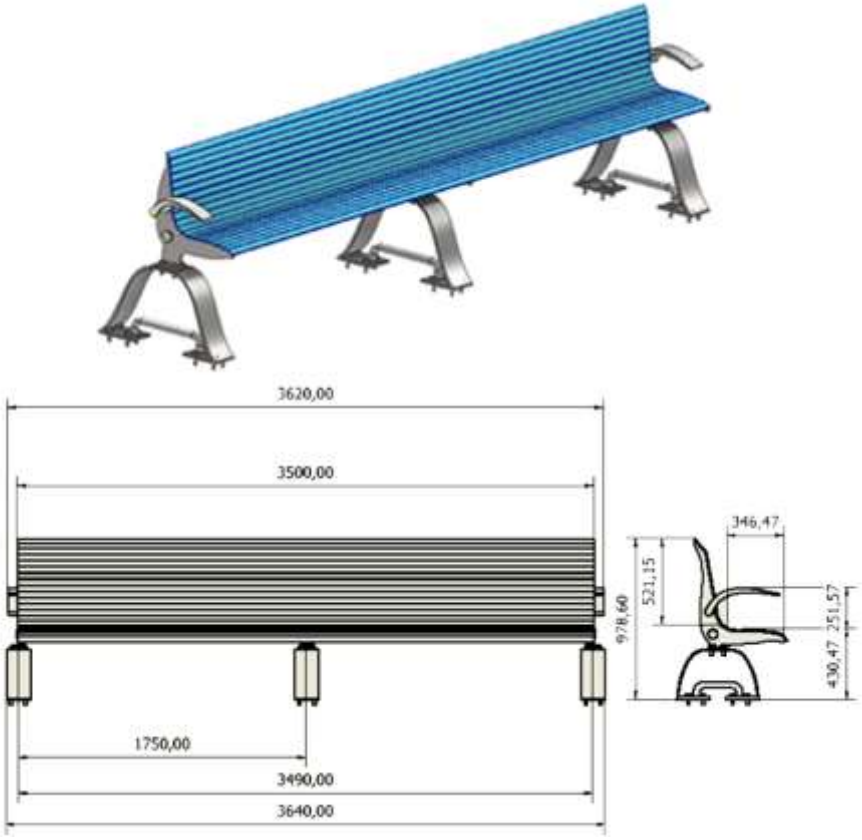


Picture 4 Specification

It can be seen in the matrix and the characteristics above that the specifications have been obtained and are used as a reference in making the design concept which will be carried out at a later stage by visualizing the design concept using CAD (Computer Aided Design) which is carried out on Autodesk Inventor software.

3.6 Product Concept Visualization

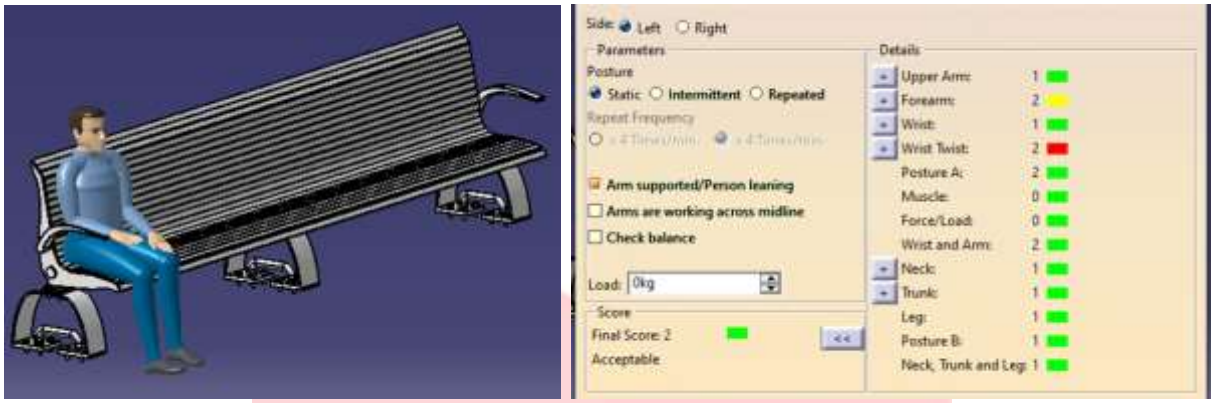
By obtaining the specifications of each matrix, the next step is to visualize or show the results of the design concepts that have been made. The following is a design concept of a city transportation stop chair made using Computer Aided Design (CAD):



Picture 10 Visualization

3.7 Product Design Evaluation

The next stage after visualizing the product design, it is necessary to evaluate the proposed city transportation stop seats, one of which is the RULA test on both products. The following are the results of the RULA test using the CATIA V5 software:



Gambar 11 RULA Score Results

Based on the results of the RULA test for the proposed city transportation stop seat, a score of 2 was obtained, which means that the proposed city transportation stop seat design already has a sitting position and body posture for people who have anthropometric measurements according to Indonesian Peoples Body Dimension.

4. Conclusions

The implementation of the Kansei Engineering method in the design of city transportation stop seats can translate the desires, needs and feelings of users into an appropriate product concept. The collection of 60 Kansei Words through literature study, product observation, and user statements was reduced to 17 Kansei Words and reduced again through the Spearman Validity test, to 16 Kansei Words, which were tested through PCA and the remaining 12 Kansei Words were “Comfortable”, “Backrest” , High Quality Material”, “Proportionate Dimension”, “Armrest”, “Easy to Maintain”, “Elegant”, “Water Resistant”, “Futuristic”, “Bright Color”, “Unique” and “Wide”.

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