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# Table of Content

*(Proceeding of ICETIA 2014)*

### Group of Industrial Engineering

No	Paper ID	Title of Paper	Page
1	ICETIA2014 - 8	Wahyu Susihono, "Technology Assessment to Determine Total Contribution Of Coefficient, Technoware, Humanware, Inforware, And Organware in Metal Industry of Creative Community "	249 – 253
2	ICETIA2014 - 21	Buchari, Haikal Karana and Mangara Tambunan, "Identification The Behavior of Laboratory Assistant As the Effort To Develop Safety And Health In University (Study Cases In Laboratory Under Industrial Engineering Department, University of North Sumatera)"	255 – 261
3	ICETIA2014 - 27	MasrulIndrayana, Ambar Rukmini and Rika Ampuh Hadiguna, "Strategy for Export-Oriented Fresh Vegetable Suplly Chain in Yogyakarta"	263 – 270
4	ICETIA2014 - 29	Novita Setyamichelle, Catharina Badra Nawangpalupi and CarlesSitompul, "Developing A Two Person Game Theory To Improve Performance in Vertical Partnership Alliances"	271 – 275
5	ICETIA2014 - 33	Rosleini Ria PZ, Adhie Tri Wahyudi and Bagus Ismail AW, "Designing Package Travel in Ex-Surakarta Region with Semantic Trip Planning Plan"	277 – 282
6	ICETIA2014 - 35	Nur Khasanah, Rizkysari Meimaharani and Tri Listyorini, "Build Educative Game as Tool Teaching Science Nahwu Jurumiyahfor Android Based"	283 – 288
7	ICETIA2014 - 37	Yulita Veranda Usman, M. Yudi M. Sholihin, AsrulHarun Ismail and Rini Prasetyani, "Model of Risk Gas Pipeline Managementto Determine Maintenance Strategy"	289 – 291
8	ICETIA2014 - 39	Sendy Gunawan, Catharina Badra Nawangpalupi and Carles Sitompul, "A Network Model for Spare Parts Distribution Based on Customer Segmentation and Demand Characteristics"	293 – 299
9	ICETIA2014 - 41	AntonoAdhi, AdiSusanto and Santo Priyanto, "Tracking System of Locationand LevelLeak of Distribution Pipein PDAM Tirta Bumi Serasi Kabupaten Semarang"	301 – 305
10	ICETIA2014 - 42	Andi Widiyanto and Affan Rifa'i, "User Manual with Augmented Reality to Support Packaging Products"	307 – 310
11	ICETIA2014 - 44	Tiena G.Amran, Triwulandari S.D, Dedy Sugiarto, and Dorina Hetharia, "Applying Green Industry Criteria To Raw Material Supplier Assessment And Trend In Aluminium Alloy For Automotive Parts"	311 – 317
12	ICETIA2014 – 53	Ika Ratniarsih, Akhmad Busyairi, Hanendra Rimau, Januar Rukmanto and UnaiYilanda, "Design of Clothes Line for Flats in Surabaya"	319 – 324

# Design of Clothes Line for Flats in Surabaya

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**Abstract** - Flats in Surabaya had the limited land for drying clothes, how to utilized the limited space for enough capacity of drying clothes with a clothesline. Descriptive reasearch method that used survey methods and case studies was a method of direct observation through questionnaires and interviews to object field case studies (Gunungsari Flats in Surabaya), that obtained physical data was taking picture where drying clothes, plans of utilities, environmental conditions and non-physical data how to activitied of drying clothes, positions of a clothesline, dimensions of a clothesline. Then performed the analysis was the analysis of space, the resident behavior analysis, the number and size of clothing analysis, anthropometry, the materials & systems clothesline analysis, the forms & colors clothesline analysis, competitors qualitatively. Research results of clothes line products was placed in ceiling kitchen space, with the horizontal position, had the size: length of clothes line product maximum of 200 cm & width 60 cm. There are 2 (two) stainless steel rods as a clothes line hanger and additional bars in the middle for an extra clothesline; average number of clothing was 4-7 clothing per - day; used in the ceiling suspension system and a folding system to lower position that assisted the hook tool to up & down the clothings.

**Keywords:** clothes line product, flats

## I. INTRODUCTION

The house is one of the basic human needs that will continue to exist and evolve according to human life. Socially, the house also serves as a symbol of status, a level of prosperity and the way of investment (Subkhan, 2008). Flats is one type of house, which is essential in order to overcome the limitations of land, especially in urban population densities. One of the slum conditions that look in the flats, is the activity of drying clothes. Activities of drying clothes carried out all residents of flats in daily life at a particular time and place. Differences behavior of each person for drying clothes depends on their understanding and perceptions of these activities. The space of clothes line is a part of the zoning service in residentials, which have a major role in determining the life style, culture and aesthetics inhabitants (Masiming, 2008). Residents often overlook the place of drying clothes in a building, which can interfere with the comfort and aesthetics.

Look at the following picture:



Figure 1. Clothes Drying Line in Flats  
Sources: Personal Documentation (2013)

Flats have the limited land for drying clothes. Residents of flats use anyland in room for drying clothes, so that the result is irregularity flats, appears dirty and looks dirty. It is necessary for research that can develop design of clothesline product, which suitable for flats and many capacities of clothing.

## II. LITERATURE REVIEW

### A. The Design

The design is a human activity, to create an environment and artificial object, which is processed from nature. This object is, then to evolve through innovations that create a life of human culture for the better (Sachari, 2007).

Some aspect of the design are:

1) Anthropometry is the science related to the measurement of the dimensions and the way to apply certain characteristics of the human body (Roebok, 1994).

2) The shape is determined by three dimensions: length, width, and height. The shape of object can be closed and filled, be sealed and contains, be opened.

3) The color is able to provide beauty and aesthetic value. In addition, the color is also considered to have an influence on a person's psychology.

#### *B. The Clothes Line*

The clothesline is a product for drying clothes that have been through the washing process. There are still a lot of residents wear process of clothes drying manually by using the energy of sunlight, although today many tech tools for drying clothes. The space of clothes line is a part of the zoning service in residential, which have a major role in determining the life style, culture and aesthetics inhabitants (Masiming, 2008). The position of clothesline can be attached to the wall or can be placed on the floor. The system of clothesline can be folded or hung. The materials of clothesline are plastic, aluminum, wood, stainless steel, bamboo and mix of materials. The sizes of clothesline are the large size 150x 95 x138 cm, the medium size 115 x 68 x 101 cm and the small size 86 x30 x 90 cm.

#### *C. The Clothing*

The term popular in the Indonesian language can be interpreted as fashion apparel. Scope of clothing in this discussion is not entirely related to clothing, also includes all household items made from fabrics and shirts like sleeping room fixtures: sheets, pillow cases, fixtures living room, dining room and kitchen: tablecloths, napkins, curtains, bath fixtures : towels and so forth.

#### *D. The Flats*

According to Republik Indonesia Law No.16 of 1985 concerning the Flats. "The Flats became the answer to limited land for housing in urban areas. The purpose of the government to put the groups of low-income citizens, in order for them to live decent lives in the home healthy, humane and simultaneously leads his life".

Based on the principal activity of flats unit, the type of space available in each unit of flats is: (1) living /family room, 3 meters x 3 meters, contains a minimum of guest chairs and tables, (2) bedroom, contains a king sized bed No. 2, table and cupboards, (3) kitchen, approximately 1.2 meter x 2.4 meter, (4) bathroom & WC, a minimum of 1.2 meters x 1.2 meters, contains the tub and toilet.

### III. RESEARCH METHODS

The research methods use descriptive survey methods and field case studies, which the data obtained from direct observation via questionnaire or interview. The scopes of the

unit flats are studied, is a case study of unit flats in Surabaya (Flats Gunungsari), which is inhabited by the family, consisting of father, mother and a child with a life of more than one year and focuses on the design, without discussing in the field of civil construction.

Through observation, documentation and interviews obtained primary physical data (the plans of flats unit, the plans of drying clothes space, the plans of utilities, the plans of environmental conditions, infrastructure) and primary non-physical data (an explanation of how activism drying clothes, the position of clothesline and the dimensions of clothesline in flats).

The collected data are primary data (the result of observation, questionnaire, documentation and interviews in units of flats in Gunungsari flats Surabaya) and secondary data ( the scientific study on the clothesline, clothes and flats, study of anthropometry (body dimensions), study materials (material clothesline) through the Journal. Books, internet), then performed the analysis was the analysis of space, the resident behavior analysis, the number and size of clothing analysis, anthropometry, the materials & systems clothesline analysis, the forms & colors clothesline analysis, competitors qualitatively, the spatial analysis (analysis of rooms used for drying clothes), clothing analysis (analysis of the amount of clothes respondents), anthropometric analysis (dimensional analysis the human body), material analysis (analysis of materials for product clothesline clothing), systems analysis (analysis system suitable for product clothesline).

Based on the analysis of use & need clothes line at flats, obtained the concept of product design is Easy Use and Strong, which aims to provide the clothesline product used easily in the limited space conditions.

### IV. RESULTS & DISCUSSIONS

#### *A. The Object Observations on the Family Case Unit Flats*

The object case study house rental flats Gunungsari Surabaya inaugurated in 2011, is a relatively new flats in South Surabaya as well as one of the best house rental flats in Indonesia, located in the heart of Surabaya.

The flats of Gunungsari consist of 3 (three) blocks (Blocks A, B - Right and B -Left), five floors per block, 268 units of dwelling. The size of dwelling units is 34 square meter, feasible to be occupied for residents for four persons, are father, mother, and two children.

The most of population are occupied by families who are victims of demolition stren Jagir river. Gunungsari Flats have 22 stands of store and the public facilities (badminton court, mosque, parking lots, sewage, reading garden, children's playground and other infrastructure).



Figure 2. Gunungsari Flats in Surabaya  
Sources: Personal Documentation (2013)

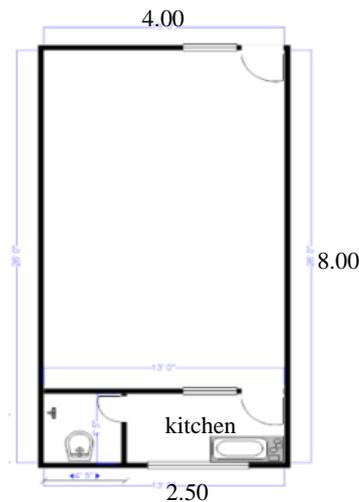


Figure 3. The plan of dwelling Units  
Sources: Personal Documentation (2013)

Some of the families surveyed, namely:

1) Bashori family was 32-year-old, lived on the 2nd floor, Block B-Left, No.11. They use horizontal wooden clothesline which ends attached to the wall. The activities of drying clothes were carried out by hanging clothes on the front of the room. The length size of clothesline was +2.3 meters.



Figure 4. The drying clothes at Bashori dwelling Units  
Sources: Personal Documentation (2013)

2) Family of Surya Adi was 33-year-old, lived on the 3rd Floor, Block B-Left, No.9. They use aluminum clothesline strung horizontally attached to the ends of the wall. The activities of drying clothes were carried out by hanging clothes on the kitchen space. The length size of clothesline was 2.22 meters.



Figure 5. The drying clothes at Surya Adi dwelling Units  
Sources: Personal Documentation (2013)

3) Family of Agus Ali was 27 years old, lived on the 3rd Floor, Block A, No.2. They use wooden clothesline hung horizontally. The activities of drying clothes were carried out by hanging clothes on the kitchen room. The length size of clothesline was +1.12 m.

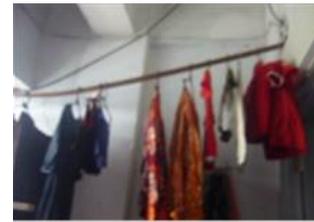


Figure 6. The drying clothes at Agus Ali dwelling Units  
Sources: Personal Documentation (2013)

The conclusion of case study was the most of family put down clothesline in the kitchen room. The most model of clothesline was the hang models. The material of clothesline were alluminum, wire and wood. The placement of clothesline was vertical and horizontal clothesline. The size of clothing were the varies size of small (S) to Large (L).

### B. Analysis & Result

The activities of analysis & the result were included :

The analysis of space determined the space of using for drying clothes, the location and the position of clothesline. The results of the questionnaire were:

1) the determination of the questionnaire results in Space Flats unit were 71% of the respondents chose the room in the kitchen, 29% of respondents chose in the front room and in the bathroom. The balcony and the other did not have the option of respondents.

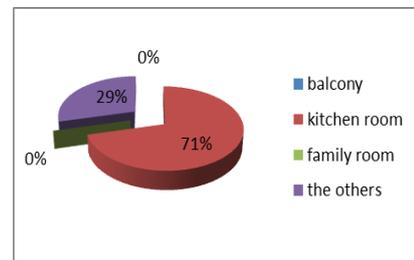


Figure 7. The analysis of the space of drying clothes  
Sources: Personal Analysis (2013)

2) the determination of the questionnaire results at location of a clothesline were 86% of respondents put the clothesline to hang on the ceiling, 14% of respondents put a clothesline on the wall.

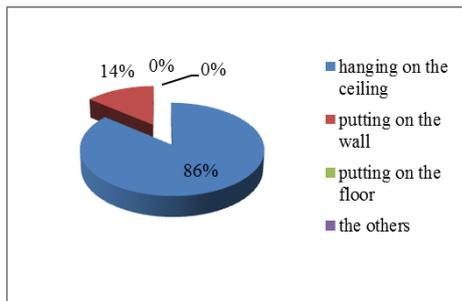


Figure 8. The analysis of the location of drying clothesline  
Sources: Personal Analysis (2013)

3) the determination of the questionnaire results at clothesline position were 100% chose the above position, 0% chose the position to the right or left.

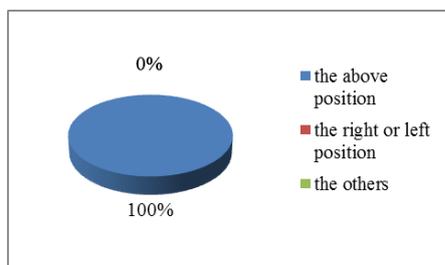


Figure 9. The analysis of the position of drying clothesline  
Sources: Personal Analysis (2013)

The analysis of the quantity determined the amount of clothing at clothesline. The results of the questionnaire were: the determination of the questionnaire results of the amount of clothing were 4-7 clothings which the size Large (L), Extra Large (XL), Medium (M) and Small (S). The placement of the clothes on a clothesline position was opposite direction, so that it can accommodate the ideal number of 15 clothings.

The anthropometric analysis determined the size of the clothesline. The anthropometric data needed by researchers that adapted to the needs of the product. Reach your hand up: 194.3 cm, arm reach forward: 70 cm, to the side: 59.9 cm, height standing upright: 153.3 cm, length of the palm of the hand: 17.1 cm.

The analysis of materials and systems determined the clothesline of material and system. The results of the questionnaire were:

1) The determination of the questionnaire results of the material clothesline was: 57% of respondents wanted a clothesline of stainless steel, 29% of respondents chose

aluminum material and 14% of respondents chose a plastic material.

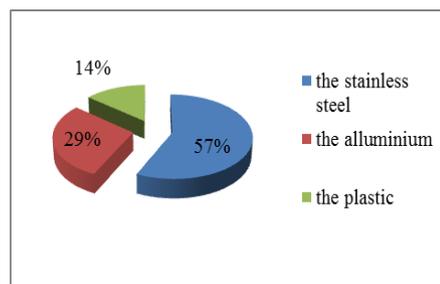


Figure 10. The analysis of the materials of drying clothesline  
Sources: Personal Analysis (2013)

2) The determination of the questionnaire results of the clothesline system was: 78% of respondents wanted a clothesline with a suspension system, 11% of respondents want the folding system and the stuck system.

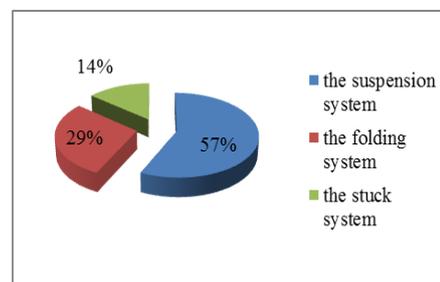


Figure 11. The analysis of the systems of drying clothesline  
Sources: Personal Analysis (2013)

The shape & color analysis determined the shape and color of a clothesline. The results of the questionnaire were:

1) the determination of the questionnaire results of the shape clothesline were: 71% of respondents chose the form of a straight, 29% of respondents chose the combined form, 0% of respondents chose the form of curved and diagonal.

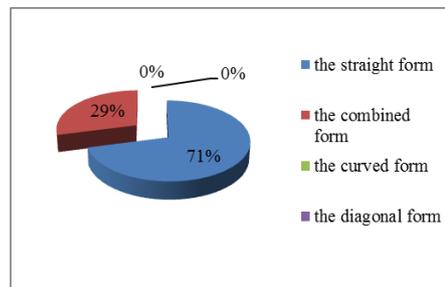


Figure 12. The analysis of the shape of drying clothesline  
Sources: Personal Analysis (2013)

2) the determination of the questionnaire results of the color clothesline were: 100% of respondents wanted a bright color clothesline (pink, yellow, light blue, etc) , 0% of respondents chose dark colors clothesline (black, grey, purple, etc).

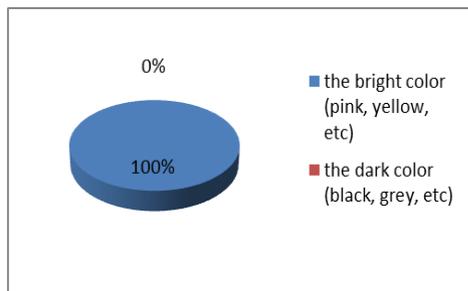


Figure 12. The analysis of the color of drying clothesline  
Sources: Personal Analysis (2013)

Based on the result of analysis and user needs clothesline for flats, can be concluded that the clothesline was in the room, which the placement of clothesline was horizontal position. There had a maximum length size of 200 cm and a width size of 60 cm. The clothesline material was stainless steel. The average number of clothes in the sun was 4 -7 clothing per-day. The system of clothesline was the hang system which the position clothesline was hung at the ceiling, to lower position that assisted the hook tool to up & down the clothings. The colors of clothesline was bright colors.

### C. Design Concept & Implementation

Based on the analysis of use & need clothes line at flats, obtained the concept of product design is Easy Use and Strong, which aimed to provide for the residents of the flats that use clothesline products easily. The users can hang clothesline with limited space conditions. The product was made from steel steel material, which had a strong resistance clothesline and also had a good resilience to corrosion.

The product of clothesline was placed at the top of the kitchen space, which hung at the ceiling of the kitchen space, that used when the clothes are a little dry. If the clothings were still wet, be placed at a clothesline that hung at the bathroom ceiling.

The application of the concept of easy to use and strong product design clothesline was: 2 (two) stainlees as iron hanger clothes line, each one (1) size 60 cm iron rod mounted vertically straight shape, combined with the end of the rod shaped box corners are not taper measuring 40 cm x 40 cm, stainless steel bottom given the size of 5 cm x 60 cm which serves as the clothesline. Then 3 (three) stainless steel rods along the horizontal length of 125 cm - 200 cm mounted parallel to a distance of about 13 cm, associated with iron hanger on the left and right. Designs can be seen as shown below :

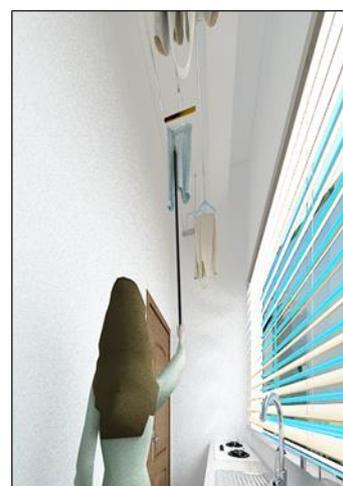
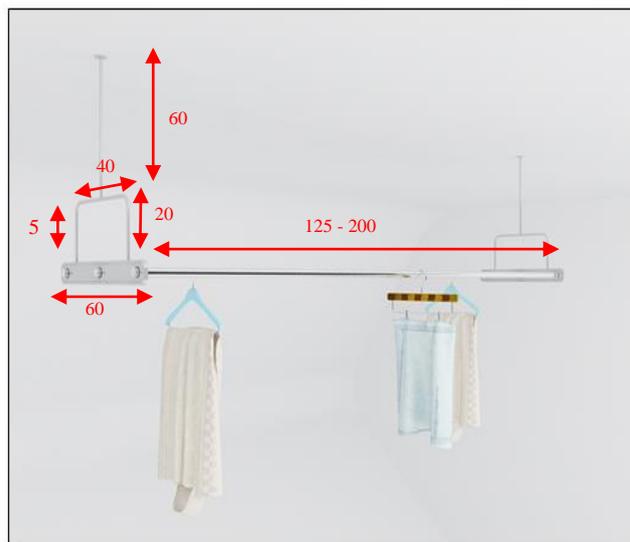


Figure 13. Designs of clothesline at Gunungsari Flats in Surabaya and equipment for drying  
Sources: Personal Documentation (2013)

The positive aspects clothesline design was the position clothesline at the ceiling of the room with a hang system, that did not interfere the furniture below. There was made of stainless steel so it is not easy to corrosion and hold the load of laundry. There was 2 stainless steel rod as a clothesline hanger with each rod ideally accommodate 15 clothesline with a distance of 13 cm, with a standard design but still sturdy and strong in the weight-bearing clothesline. The negative aspects clothesline design was a system did not have to up and down the clothesline. Because there was not any systems then there was difficulty when using a clothesline.

### V. CONCLUSIONS

The service facilities of dwelling units in flats have limited space. Residents have difficulty for drying clothes, then required a clothesline products that can utilize the space limitations. After conducting a scientific study , obtained an

easy use and strong of clothesline products concepts, which is expected to be a solution and in accordance with the needs of residents in flats as well as reduce slums for the bad clothesline. The results of the product design put clothesline hanging above the kitchen ceiling space (could also hang on the ceiling of the bathroom space), so isn't disturb the position of the furniture and the activity in the kitchen, wearing stainless steel that hold the load of laundry and not easy to corrosion. Design of clothesline is easy to use and powerful so fit the size of a kitchen / bathroom space and can hold enough laundry. There are still many lacks such as when using a clothesline is still struggling to raise and lower the clothesline, then that needs a tool to put the laundry on the clothesline. So for the future, design of clothesline product still needs to be refined.

## REFERENCES

- [1] P, Handoyo, *Teknik Menggambar Dekor dalam Gambar Interior*, Yogyakarta, Kanisius, 1987.
- [2] Sachari, Agus, *Desain, Gaya dan Realitas: Sebuah Penafsiran tentang Desain Grafis, Produk, Interior, Tekstil dan Arsitektur di Indonesia*, Rajawali, Jakarta, 2007.
- [3] Subkhan, Mokh, *Pengelolaan Rumah Susun Sederhana Sewa Di Cengkareng Jakarta Barat*, thesis, Universitas Diponegoro, Semarang, 2008.
- [4] Masiming, Zulfitria, *Sikap Masyarakat Terhadap Perletakan Ruang Jemur Berkaitan dengan Estetika*, Jurnal SMARTEK, Vol. 6, No. 1, Pebruari 2008, Palu, 2008.