

Redesigning A Trolley for The Stairs Building Based on Material Aspect

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Abstract In Bandung, some buildings have three levels or more with no escalator and elevator for their daily needs in moving goods. One example is the Telkom University dormitory. As a resident of a building, problems are often found unconsciously and that has not been found a clear solution, for example when moving goods from the ground to the top level. The goods are referred to as suitcases, gallons, dispensers, large bags, etc. Some people will call the services of a porter or friend to help them transport goods. Because of that, a clear solution must be made for goods mobilization activities to be more effective and efficient, therefore, transportation equipment such as trolleys with good material and it can accommodate the load of goods that are usually moved in buildings without elevators is a solution for this problem.

Keywords Stairs trolley, Material, Dormitory, Bandung

1. Introduction

This time in a building that has an elevator, or commonly called an escalator, is used to support residents' needs. But that is an optional thing because it is a secondary or tertiary need for common people, it depends on the owner's desire to arrange the interior of the building. It also depends on the building that will be used for personal needs or other needs such as used for business purposes such as dormitories or boarding houses.

In the Regional Regulation Bandung article 79, 3rd paragraph of concerning the Reliability Requirements of Buildings, it is written that every building with a height above 4 floors must provide an elevator. However, in buildings that have two to four floors, moving goods from the bottom to the top floor is a problem that has not been resolved. These goods mean luggage, gallons, dispensers, big bags, and others. Some people will use porter services or friends to help them carry the goods.

Similar to the university dormitories located in Bandung, there are still many buildings that have three levels or more and no escalators or elevators, for example, dormitories located at Telkom University. The use of tools for transporting goods on stairs is rarely found in everyday life. In fact, for buildings that have no escalators or elevators, the tool is very necessary because student changes in the dormitory are still rolling every year. If the tool is available in the dormitory, it will make it easier to mobilize their items and make it easier for porters there.

Tools for transporting goods that we often encounter are hand pallets, hand stackers, chain conveyors, hand trolley, and stair climbing trolley. Until now, goods transport was very rarely found, especially stair trolleys because of the high prices.

The high price of a product is certainly related to material and not always high prices compare to straight with good quality. High prices can be influential from the brand and high-profit making. In fact, for the people of Indonesia, that is one reason why products are not bought even though they need it.

Dormitory residents need a sturdy product. Sturdy material on the trolley and the suitability of the load limit is a solution for long-term use of the product.

This design is a continuation of previous research with differences in time and place. Previously, "Designing A Trolley for The Stairs" has designed stair trolleys by turning the star wheel into a rubber track. The previous design raised the issue of the difficulty of mobilizing goods in all buildings in Bandung such as dormitories, flats, and small apartments. And the previous results, some parts that are still not needed will reduce the effectiveness of using the product. Therefore, the author wants to redesign to develop the potential of the research results and the final results of the product with adding case studies extra.

2. Material Handling Equipment

Material transportation equipment is a device used to transport cargo from one place to another place in a short

distance. Examples are the place of material in factories, construction sites, locations for storing and unloading loads, and certain distances with the direction of material transfer vertically, horizontally and/or combined.

In industry, transportation equipment is needed, not only to support operational activities, but these tools are also used to save time. If a lot of time is wasted, operational activities will not run effectively.

Several types of goods transport are commonly used in the industrial world, including hand pallets, hand stackers, chain conveyors, hand trolley, and stair climbing trolley.

3. Trolley

A Trolley is a tool for transportation from one area to another area in operational activities at the company. The trolley has a strict iron material structure and good durability. Every time you visit a place such as a supermarket or a restaurant, you will find a trolley because it has many benefits to carry a lot of luggage or heavy shopping items.

Trolley has a version that is quite varied in terms of its use and role, for example, hospital trolleys, load transfer trolley, trolley service, and stair trolley. The function of the stairs trolley is to move items in large quantities or several from the ground floor upstairs through the stairs. Stairs trolley is commonly a combination of three wheels or more wheels into one unit.

4. Material

4.1. Iron

Coarse iron can be obtained by melting it in a high furnace poured into the mold. This iron can also be a raw material for steel.

4.2. Rubber

Rubber is a polymeric material with inherent flexibility and unique extensions, for example, if applying force to rubber, the rubber molecule will follow the direction of the force, after that it automatically returns to its original shape with a random pattern. This default makes rubber very widely used in a variety of finished goods, being the main material or mixing material. Many studies on the part of rubber plants have been carried out to obtain maximum benefits.

5. Stairs Trolley on Previous Design

Stairs trolley (Upstairs) is the final result of designing goods transport through stairs in buildings in the Product

Design Studio course in 2018. The trolley is the solution to the movement of goods on the stairs to make it easier. But the trolley still has system and security deficiencies. User segmentation is also too general then there is no highlight from the product.

6. Qualitative Method

A research and knowledge process that is based on a methodology that analyses a social phenomenon and a human problem, as well as an approach by directly reviewing and assessing conditions in a direct place. This design is for study case in Telkom University.

7. Data Collection Method

7.1. Observation

The author runs observations as one of the data collection processes. Observation is done by participating and examining the problem directly.

7.2. Literature Data

Literature data is widely used as a technique of collecting data in scientific reports. Literature data have a function to search, assess and discuss data following the report title. In this study, the author looks for data that supports the Redesigning A Trolley for The Stairs Building to complete the data in place and provide a technical reference in the design process. Literature data can be taken from journals, newspapers, related books, and others.

7.3. Interview

Interviews were conducted with speakers regarding the problems that occurred. The objective of this interview is to obtain accurate data from the viewpoint of the administrator and users. Interview data has a function for the problem analysis process in detail to get the right solution.

7.4. Documentation

Documentation is to obtain actual evidence of the problem that occurred. According to Sugiyono (2013: 240), documents are archiving of things that happened in the past. Documentation is useful as a complement to the data and the interview process.

8. Analytical Technique

8.1. Data Analysis

Data analysis in this study uses the method of analysis of Milles and Hubberman in (Sugiyono 2013: 246), which consists of:

1. Data reduction (data shortening, sharpening, and categorizing to form a conclusion)

2. Presentation of data (concurrent data to tables)
3. Draw some conclusions (concluding data that has been obtained into the presumption of the initial design solution)

8.2. Analysis of Design Aspects

1. Determine related material perspectives
2. Comparing the design perspective and competitor's products based on material perspectives following the theoretical and empirical reviews
3. Generates a design hypothesis and Term of References (TOR)

9. Result and Discussion

9.1. Term of Reference

Term of Reference is an analysis of explanations regarding the factors that will be used as a reference and basis during Redesigning A Trolley for The Stairs Building Based on Material Aspect (Case Study of Telkom University Dormitory). Based on the analysis of design aspects, the design of a trolley for the stairs building can be explained in the following:

Table 1. Term of Reference (T.O.R)

T.O.R	Action	Result
Design Considerations	Product Perception	<ul style="list-style-type: none"> - Use a rubber track as a wheel to climb stairs - The bottom of the trolley can be folded up - Safety belt - The handle can be extended like a suitcase
	Product Purpose	<ul style="list-style-type: none"> - Facilitate the mobilization of goods - Reducing injuries
	Working conditions	The product works according to use for users not easily tired
Design Limitations	The design does not change the total body of the trolley	Trolley bodies are only re-measured according to the ergonomics of Indonesian people
	The design does not explore material into a new material	Material uses iron, not using other innovative materials such as bamboo, wood, and others
		Products are used manually / not machines
Product Description	Size	The product has the size of an Indonesian body's ergonomics, the product consists of a trolley frame, 2 extended

		handles, a safety belt, and a rubber track
	Material	Iron, rubber, foam
	Colour	Red, Grey, Black
User	Target User	For productive age students, unisex

9.2. Dimensional Analysis

The final result of "Designing Goods Transporters through Stairs in Multilevel Buildings" called Upstairs still has many inefficient parts. The following parts will be redesigned:



Figure 1. Previous Research Details (1)



Figure 2. Previous Research Details (2)



Figure 3. Previous Research Details (3)

1. The selection and arrangement of the rubber track on the trolley are not sturdy: In the previous product, the rubber track was arranged right behind the rear wheels with the aim of the trolley being able to run on a flat plane (no stairs). There are still other ways to eliminate the rear wheels but the trolley can still run on a flat plane (no stairs)
2. Rubber track is stiff: In this redesign, the application of the rubber track will be changed and made smoother when used
3. The size of the width of the rubber track is not strong enough to support the load: The rubber track in this redesign will use a larger size for maximum potential
4. There is no lock for the load: In this redesign, the security will be added to the product
5. The material is getting rusty because there is no maintenance: The product will be given material maintenance again

9.3. Area Analysis

In previous research, products were placed for dormitories, flat, boarding houses, and apartments that did not have elevators in the Bandung area. In this case, it is still too general for product segmentation. In this design analysis, products are designed for college dormitories in Bandung, where products will adjust to the characteristics of the university. The product will be determined by a ladder which according to the author matches the size of the Telkom University ladder.

10. Concepts and Visualization Works

10.1 Materials



Figure 4. Details of Material

10.2 Sketch 3D Model

Looking at the need for a trolley for the stair building based on the material aspect (Case Study of Telkom University Dormitory), the authors describe that the products are designed as a solution to the daily problems described above, especially in matters of effectiveness and making it easier for users. Therefore, the author designed on the bottom of the trolley can be folded, safety belt, two handles that are following with the ergonomics of the Indonesian people, and rubber track wheels that can be used on stairs or flat floors.



Figure 5. Final Render Sketch



Figure 6. Final Render Sketch (2)

10.3 Product Details

1. Product Name: Upstairs
2. Material: Iron, Rubber
3. Function: Mobilizing large quantities of goods on the stairs to make it easier
4. Product Purpose: Facilitate mobilization to be more efficient and effective
5. Product User: Students (Residents of Dormitory), Porter

10.4 Product Operations

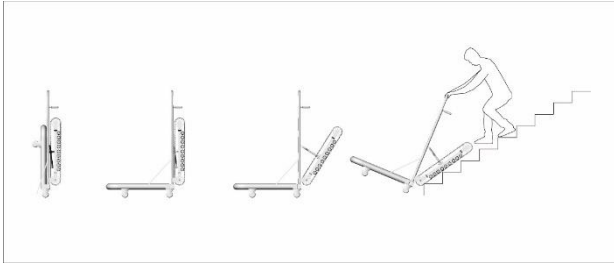


Figure 7. Illustration of Use



Figure 8. Illustration of Place

10.5 Product Prototype



Figure 9. Final Product



Figure 10. Final Product (2)



Figure 8. Final Product (3)

11. Conclusion and Recommendation

1. Conclusion

In previous research, the Design of Goods Transport Through Stairs in Multilevel Buildings Based on Building has designed stair trolleys by replacing star wheels into rubber tracks. The current design is to solve problems in previous research to be a solution.

Mobilizing goods or items on a large scale from one floor to the top floor is a common problem in our daily lives. But without us knowing it is a problem that makes work ineffective and inefficient. That problem can be made into a solution by making a product. Stairs trolley is rarely found in Indonesia. Even the existing trolley stairs still have a disadvantage. The disadvantage is that the goods are shaken when running the product. Which causes items to fall and there is no safety belt on the product.

Redesigning A Trolley for The Stairs Building has the advantage that the road system using rubber track makes the load safer and runs smoothly. There are two comfortable handles used on the stairs or flat floors, the handle can be lengthened and shortened like a suitcase, the bottom can be folded and locked, sturdy trolleys can

accommodate heavy loads, and trolley ergonomics are appropriate to the Indonesian anthropometric.

2. Recommendation

For further development, the authors provide suggestions because in the redesign there are still obstacles. At the level of compatibility of the material used and has not been fully tested. Rubber track material is still very rare in the medium price range because customizing the rubber track requires a new form of mold that makes the price expensive. Also, the weight of the trolley still has excess weight because the pulley and the main material of iron make the trolley heavier. Hopefully, the discussion in this report can be a consideration for readers in designing a trolley for the stairs building by applying similar aspects and increasing knowledge in product design.

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