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Design of Powered Wheel Dolly for Construction Stair Case

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Abstract*: *New Product Development (NPD) plays a major role in this fast-moving market. Depending on functionality of the product, which is existing or an unmet by considering other aspects, new product can be developed. Considering these voids in the field of construction, in the areas of logistics while there will be lots of manpower required in transporting construction goods. Considering this as the problems effecting the health and time duration of the work, this new product is designed to carry the heavy load to the top floor using less man-power and consuming less time by using a slab dolly. In this project, a designed dolly which can carry heavy loads of Marble slabs on to the top floor using normal constructed stair cases using less man power. The dolly is designed and simulated using CATIA and desired factor of safety (FOS).

Keywords* : *New Product Development, Powered Wheel Dolly, Construction Purpose, CATIA

I. INTRODUCTION

Within the last two decades, the fast rate of technological amendment shortened product life cycles, and increasing global competition have created new product development a crucial concern of U.S. manufactures. In this competitive environment, the path to create and develop new products is a series of adverse trials. Considering the good potential impact that new product development may wear a product's performance. Every organization has to design, develop, and introduce new products as a survival and growth strategy. Product design is an idea that is conceptualized about a product and transformation of the idea into a reality. The specification of the new product has to be prepared before the product is to be sent to the design the product. It is also depending upon the different constrains such as production process, customer expectations etc. In product design stage, various aspects of the products are analysed. Final decision of the product is taken on the basis of analysis, dimensions, tolerances, types of material.

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II. NEED OF A NEW PRODUCT DESIGN

Organizations are required to design the new products for the following reasons:

1. To be stand for the long time in the business.
2. To satisfy the unfulfilled needs of the customers.
3. Too much competition in the existing product line.
4. The profit margin is on the decline for the existing product.
5. The company's existing product line becomes saturated and the sale is on the decline.

III. NPD STRATEGY

Reasons for new product failure

- Overestimation of market size- Depends on the usage and purpose of the product we should know the market size.
- Poor design- The design of the product should be rigid and efficient.
- Quality, Reliability and Robustness- This orientation is typical of industries requiring high quality because of the significant costs to correct a problem (e.g., recalls in the automotive or food processing industries), the need for high levels of reliability (e.g., aerospace products) and This orientation requires added time and cost for planning, testing, analysis and regulatory approvals.
- Incorrect positioning- Product should launch in the right location to achieve good sales
- Wrong timing- Product has to launch in-time with-respect to season.
- Priced too high- Price of the product should be affordable by the customer.
- In effective promotion- The promotions to the product had to effective.
- High development cost- While developing the product
- Competition- The product should be new to the market to overcome the competition.

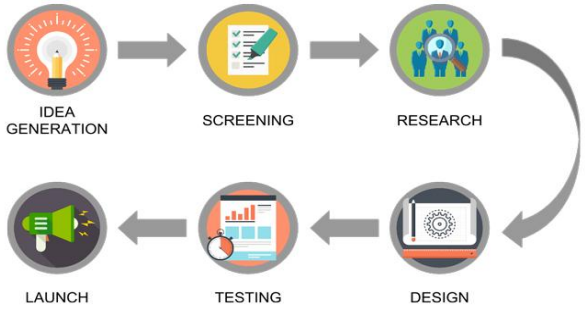

Fig .1: New Product Development cycle

IV. NEW PRODUCT DEVELOPMENT STAGES

4.1. Opportunity Identification and Idea Generation

In this stage, we go through the old, new or unmet products for a particular purpose in any field. Mainly in the field of construction there are products to transport material, so we have developed an idea to transport the material with less number of labour and increasing the safety for them.

4.2. Idea screening

As we generated an idea to transport the material in the construction field with less labour, product should sustain high loads and carry them to higher floors without any damage to the material and by keeping the safety for the labour. The cost of the product should be comparatively less, so that it can be used in any type of constructions.

4.3. Research

In the field of construction, the marbles and granites are carried to the top floor, which needs more number of labours where there is no safety and time taken is also high. As there are many material transferring equipment, but there is no such equipment which can carry the marbles to the top floor. So the design is developed to carry the marbles with rigid support considering the safety of the labour.

4.4. Design

Considering the features like safety of the labour, reducing work time, safety of the marbles which can sustain high loads the design is developed. The design employs the equipment for the transportation of marbles or granites to the top floor which is nowhere available in the market. As it is new product idea, can be further developed for the future use. In this project, we designed the powered wheel dolly using CATIA Software, which carries the marbles to the top floor with only one labour considering the safety and time.

4.5. Testing

The designed powered wheel dolly is simulated with structural loads and the strength can be calculated so that it can't be deformed. The factor of safety is also calculated for this design and the value is obtained as 3.12.

V. PROBLEMS IN CONSTRUCTION FIELD

Manual material handling pointers are tables areuseful in determining maximum acceptable weight limits for lifting and carrying tasks. We cannot measure the actual load on the lower backspine in the workplace and we can't correlate measured load with the risk of back pain. For sporadicloads, a labour can carry around 89lbs(nearly 40 kgs).

In our application, labour have to carry heavy loads i.e., around 200 to 400 kgs. It can require more labour to transport the marble to the top floor.It also increases the risk of injury embrace the load being too heavy, Troublesome to grasp or unstable, the task being too strenuous or involving awkward postures or movements and therefore the operating environment lacking sufficient space area, having slippery, uneven or unstable stair case, having extreme temperatures or poor lighting.

Inlifting heavy material whereas loading, unloading and distributing construction materials will cause injury to muscles, nerves, discs and ligaments of the lower back. Non-specific low back pain isn't the result of a fall or another acute traumatic injury.Thus it may be difficult to identify a particular event that led to the injury. Repetitive lifting will resultin low back muscle strain, ligament sprain,ruptured intervertebral disc, a bulging or herniated disc, nerve damage, or other back problems.

While transporting the marbles to the top floor requires more man power as they are heavy to carry. While carrying the marbles,labourwitness heavy pain and may lost energy so quickly and rest for some time by this work can be delayed ormarble may slip from the labour. This leads to the damage of both labour and material which is a loss of time and money invested.

Transporting the marbles by manually to the top floor will require long time, the labour cost and days of work may increase which may leads to poor efficiency of work. As the marble size and weight increases number of labours will also increase, which leads for more daily wages and will take long time to complete with unsatisfied work.

VI. INTRODUCTION TO POWERED WHEEL DOLLY

Powered wheel dolly is an idea which is developed from new product development method. It can be used in the construction field to transport the marble to top floor, with this dolly we can carry marbles with high load capacity. This dolly uses constructed stairs i.e., unfinished stair case to reach floors in a building.

The powered dolly is equipped with battery setup for power the dolly to transport the marble without extra labour except one who drives. It also equipped with the clamp to arrest the marble for rigid support to the marble while transporting, so that the person who drives the dolly is safe. It also equipped with a tyre and handle so that it is driven smoothly.It has a motor to transmit power through the chain and sprocket arrangement which is semi- automatic dolly with electric power. As the wheel are rubber so that it has smooth movement will obtained. It also equipped with the handle to guide the dolly and support given through the operator. This design is analysed with the factor of safety around 3.

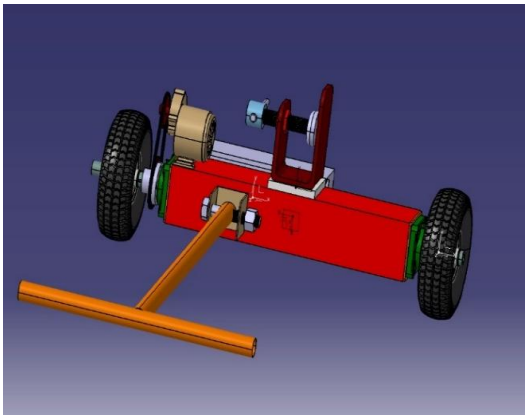

Fig.2:Design of powered wheel dolly.

VII. COMPARING THE MANUAL LIFTING AND POWERED WHEEL DOLLY

In manual handling, the labours had to carry the marbles having heavy load are transported to top floor by human effect which endangers the human. By this, the human may undergo musculoskeletal disorders e.g. lower back pain etc., and the intensity of the risk increases, time taken is more.With powered wheel dolly heavy loads can be carried with in less time without damaging the marble which cannot be achieved be manual handling. Compare with manual handling, powered wheel dolly has more safety for who drives it.As human cannot make or hold load for long time this equipment can be for holding purpose also, which reduces human effort and number of labours. Most of the constructions usemore number of labours for transporting heavy loads like granites, marbles etc, which increase in transport time and money paid for the labours. Transporting manually causes injuries to the labours who carries the heavy loads where there will be no safety, using Powered wheel dolly these can be achievedwithout damaging the material including safety for labours.

VIII. CONCLUSION

The powered wheel dolly can reduce the man power in the construction field. Time taken to transport the marble to the top floor is also minimized. Risk for the labour in the field will also reduce with this dolly. Number of labours used will also decreased to transport the marble to the top floor. In Further this product can be developed be reducing its weight and carrying capacity, not only the marble and granites all the building material can be transported. In further, this can be also developed as automated transfer vehicle which works without the labour.

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