REDESIGN OF STORES LAYOUT TO IMPROVE STORAGE SPACE UTILIZATION AND MATERIAL HANDLING

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Abstract: This research paper discusses about the existing store layout and problem related to it. After finding major problem in layout redesign exiting layout of u-power according to its consumption and improve the function of new store layout by using lean tools like 5s, 7 Waste reductions and Kaizen. This will help to manage inventories that are stored in large quantity and improve the space utilization of stores. Improve store function of material handling by introducing material handling trolley so it can eliminating wastes like waiting time, Motion and defect that present in the store. 5s is also one of the important methods for organizing the store layout. Those tools help to organize a workspace efficiently and decrease waste and optimize quality with productivity. Main aim of this research paper is to achieve lowest transportation as possible with movement easily.

Key words- **5s, inventory management, material handling, ABC analysis, material flow.**
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I. INTRODUCTION

Store is simply defined as "To collect and put the material or things into a fixed location for its use in future."
There are three sections in store department
Incoming Area: New Material Receipt, Unloading, Quantity Verification, Tagging, GRN
Dispatch Area: Collection, Quantity Verification Packing, Posting, Loading, Dispatch
Issuing Area: Material Receipt, Quantity Verification, Binning, Line feeding, Triggering

Now a day in 21st century industries may carry inventories of a large variety of items like finished goods, spare parts, and raw materials. Sometimes the numbers will run into the thousands and this kind of industries has to face critical issue if they not arrange all items in proper way as well as in order to inventory level.
The systematic management of Stores is an essential part for any Organizations. The store management function assumes special significance in Manufacturing Industry where identification of the materials, Receiving, proper storage, material traceability, issuing, dispatch, Material handling, and accuracy in accounting during issue is of paramount importance in the efficient operation of the Stores.

  i. This kind of problem can manage by arranging item in according to its consumption and segregate according to production station wise.
 ii. In ABC inventory method we have given rate to all item from A to C, and this rating is based on A-items are those goods which consumption rate is high. C-items are those whose consumption rate is low and B- items are those whose consumption is in between.
iii. In further all materials are segregate according to its dimension like small, medium and large size item as well as it's also sub divide according to its station wise location and it's give very effective result in searching time.
 iv. To match with demand and improve productivity as well as profitability faster, smooth and defect-free production was necessary. So, we decided to eliminate or to reduce different types of wastes i.e. searching time by various lean tools and improve material handling. Material handling is important part of any stores department if material handing is well mannered than delivery time is automatically reduce and cycle time is also improve.
  v. To identify bottleneck and wastes in process of stores department, we understand all functions and activities carried out by the store department and our goal is to eliminate or reduce them effectively to get the better performance.

II. PROBLEM FORMULATION

* In existing layout, there was poor space utilization as well as poor material handling.
* All line station material is stored in common location so searching time high
* Vertical space not utilized.
* Material are not arrange according to its consumption.
* Discrepancy in omega store is high.
* Manpower is less.
* Poor material handling
* Damage material while movement of material

III. AIMS AND OBJECTIVE

The aim of this research paper is to reduce wastes and improve space utilization by applying lean tools. 0

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- To improve storage space by redesign layout of U-Power store.
- Material handling improvement.

1.1]. Terminology of current storage location

The storage hall has a total size of 330 square meters. The width of the hall is 33 meters and 10 meters in length. This hall is logically divided into two areas. On the left hand side and a right hand side areas of this hall is used for all the bulky material and the right hand area is used for costly and small material. There is no boundary for old store layout so facing major problem of pilferage.

One of the main goals of a manufacturing system is the maximization of its productivity. This depends upon several factors, such as the kind of complexity of the product made, the quality of the raw materials, the complexity of the manufacturing process and the arrangement of the workstations constituting the production process.

Production can only runs smoothly if the material availability to production system is continuous and stores department deliver material regularly to the production system. Smooth working of stores is only possible if the layout of stores is properly designed. So, proper layout of store is mandatory for industries. Rearrangement of stores is based on multiple factor but here two important factors are considered, on which improvements can be done in store one is based on consumption of material and second is based on size of material as well as usage of material at line station or arrange according to station wise [3].

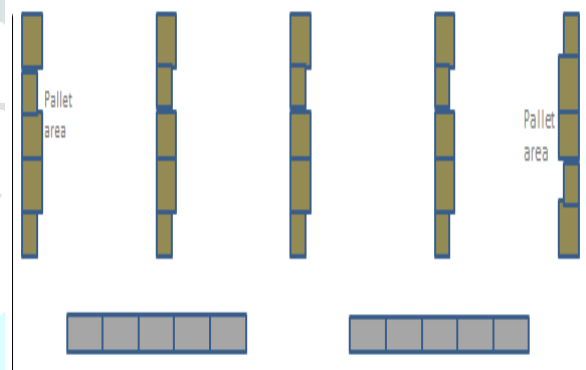### 1.2]. Photograph and design of old U-power layout

Figure 1: Old photograph of U-power (Real photo and design)

To prepare the new layout of u-power store first we have to measured floor area availability in existing store layout.

According to size and dimension of components, we segregate all the components and base on that we distributed the whole store area in three parts,

1) **Bin area** (small size and costly component)
2) **Pallet area** (medium size component)
3) **Bulky component area** (large component)

Then, the layout is divided according to the consumption rate of material in production line in which racks are dived in three layers. [2]

1.3]. Redesigned U-power layout

1] "A" category materials are those materials which consumption is more (fast moving) and they are placed at ground floor of rack. "A" category material use on daily basis. Top 70-80% of the annual consumption. [3]
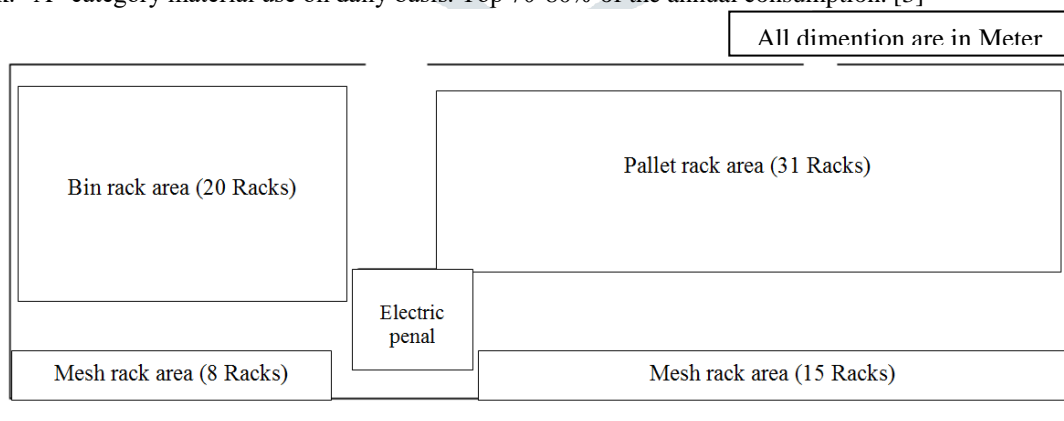
BIN RACK = 24 X 10.5,　　PALLET RACK = 23.5 X 10.5,　　MESH RACK = 15.2 X 11,　　TOTAL AREA OF REDESIGN STORE = 331 X 100

Figure 2: Auto CAD layout design of rearranged store

2] "B" category materials are those materials which consumption is less (slow moving) and they are placed in middle floor of rack. "B" category material used under one week to one month time duration. Value typically accounts for 30% of total inventory items. [3]

3] "C" category materials are those materials which consumption is very less (not moving) and they are placed on top floor of rack. "C" category material is use in one month to one year time duration. This "C" category material is lower 5% of the annual average. [3]
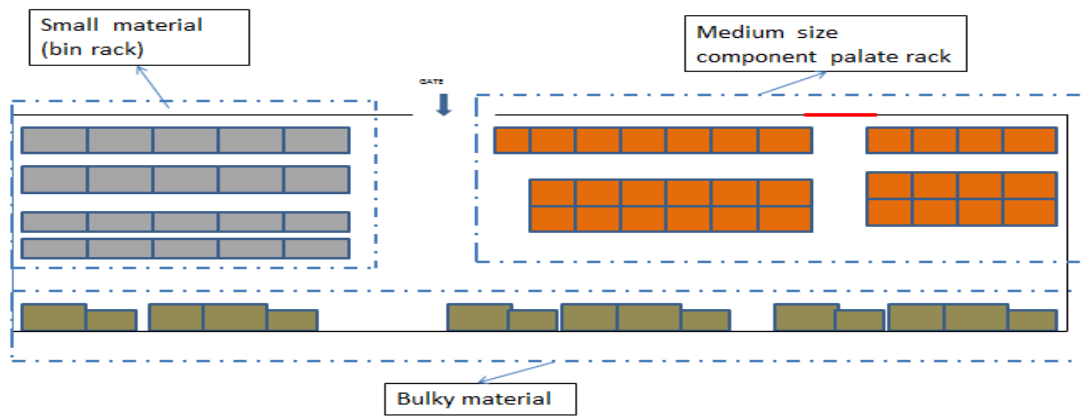

Figure 3: Segregated material according to size of component

Orange colored bin area indicate medium size of component and in area maximum component are stored so further classified of those component are done according to station. Medium size component are then sub divided in 4 sub-stations.

Gray color area is for small or costly component and this material are store in bin. The component that is larger in size are store in bulky material rack area those are indicated by green colored in design.

We calculated required number of different racks in store and where to place them in store. Sitting arrangement for supervisor and identified where to put the gate so material movement will be minimum and operator has to travel minimum distance.

Two Gates are provided for movement of material from which one is main entrance which is use for daily movement of material in or out of stores and second gate is mostly closed or you can say emergency exit gate.

For this layout we got idea from existing main stores layout which is place for another product.

We have only focus on distance between work stations to store this particular material so we have used minimum distance tool used for resign new layout.

Figure 4: Photograph of U-power layout (work in progress picture)

Figure 5: Photos of redesign layout.

2.1]. Material handling improvement in stores (from stores to production line)

Material handling means providing the right amount of the right material, in right condition, at right place, at right time, in right position and for the right cost, by using right method. [5]

It is simply picking up, moving and putting down of material through manufacture. [6]

There are more issue occurs in handling of Copper coil material due to improper loading and unloading of it. There is much scope to improvement in material handling.

Problem facing in material handling

- Material damage due to poor handling
- Poor at ergonomically
- Delivery time is high
- Space is not proper utilized.
- Searching time is more.

2.2]. Design of trolley

In below trolley you can see front view and side view. Its length is 70 cm and its width is 80 cm and height is 86 cm. trolley rode thickness is 2.5 cm light weight and it handle is 20 cm in length.

Trolley is design that it can be stores copper coil of 75mm to 90mm thickness coil.

Other extra material also can be place at top floor of the trolley and its top floor height is 200mm so up to 200mm thickness material can place at its location.

Trolley is design like that its weight is light so it can easily move from one place to another place. Trolley's base is made from M.S material.
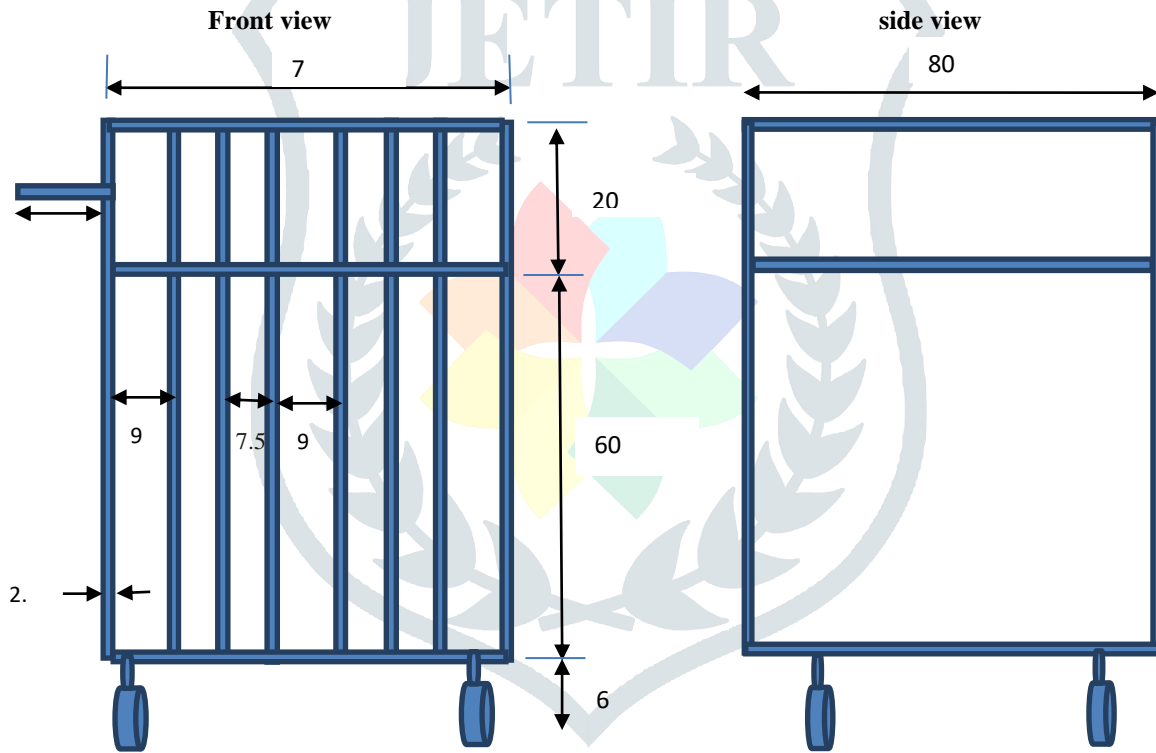

Figure 6: Auto CAD design of material movement trolley (**All dimensions are in CM**)

2.3]. Damage of copper coil due to poor handling

Before   After

Figure 7: Before and after photos of trolley implement

You can see in above image open stored coil material. There was problem of damage occurs in coil material when it is in handling from store to production line and also it is poor in terms of operator safety.

Table 1: Month wise data of damaged material

Sr. no	Month	Damage of material	Safety issue
1	September	4	1
2	October	3	0
3	November	7	0
4	December	5	1
5	January	3	0

In this above table number of accident and accrued safety issue are mention in month wise.

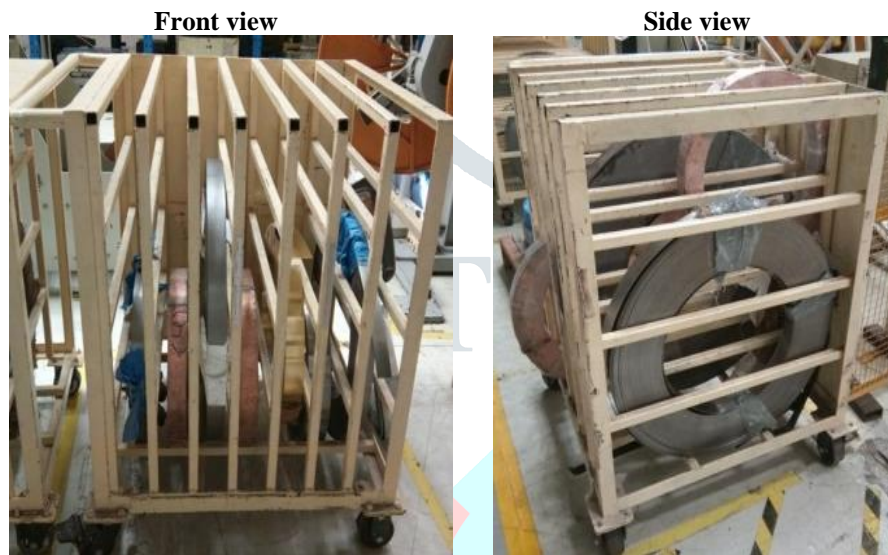**Front view**   **Side view**

Figure 8: Front view and side of copper coil trolley

In above photos front view and side view of implemented trolley is mention. In this trolley we can place 7 same kinds of trolley as well as different copper coil are placed at same time.

IV. RESULT

- **Due to implement three more layer to rack vertical space is properly utilize**

Actual calculated figure of achieve more space utilization

Before store capacity of U-power layout

Total area = 33 x 10

         =330sq. meter

After rearrangement of U-power store we increase area

Total area = existing floor space + (rack dimension x no. of rack) no. of layer

Total area = (33 x 10) + ((1.2 x 1.1)31)3

         =330 + 122.76

         = 452.76sq. Meter

Increase in Space available: 452.76 – 330 = 122.76 sq. m

So we have 27.11% more space is available by using vertical space.

- **Reduce searching time**

Searching time is more due to not fix location of u-power material as well as there was a multiple location of material so it takes more time to find out the material.

There was not much space in old U-power stores so some component has to allow multiple locations, If we store production line material at the same location as well as its fix location we can reduce searching time and also delivery time but it only possible when we create some space in stores.

Time reading was taken by stopwatch for a single delivery of material with help of operator. Delivery time is observed before and after for different component like bin, pallet, and bulky material component and all those are mentions in the table as well as those are plotted in the graph.

Table 2: delivery time for different component

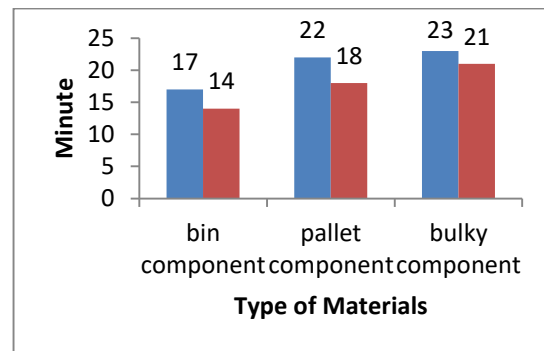|		One time delivery	
		Stop watch time	
		Before	After
Type of material	Bin component	17min	14min
	Pallet component	22min	18min
	Bulky component	23min	21min

Figure 9: Delivery time chart

- Delivery time is not same for all components it changes according to it size of component and its location. Times taken by different component are mention in table.
- All component have its separate location so they can easily find out by SAP software
- Pallet component are arrange according to its consumption in floor by floor so operator does not feel fatigue by loading and unloading.
- Reduce discrepancy in physical and SAP quantity of U-power store material.
- Easily handling material from one place to another place.
- It will be comfortable for operator to use.
- Achieve unit load with reduce delay and less damage.
- Promote safety and improve working conditions.
- Move more material at once.

V. Conclusion:

After redesigning the stores layout, now 27.11% more space is available for material storage to store. All materials are classified according to station. Then material are classified according to consumption rate in three layers which are fast moving material, slow moving material and no moving material. Due to which material searching time is reduced. Therefore, overall delivery time of component from store to line is reduced. The delivery time of component from store to production line is reduced from 10 minutes to 8 minutes. Effective utilization of vertical space results into improve floor space utilization and material handling ultimately improve the productivity.

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