PSYCHOLOGY AND EDUCATION (2021) 58(5), ISSN 1553 - 6939
Article Received: 22th November, 2020; Article Revised: 26th March, 2021; Article Accepted: 26th April, 2021

Development Of Material Management in Store Department of a Dairy Industry: A Case Study

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ABSTRACT

The efficient and effective Material Management leads in progressive growth and success of an Industry. This study observes existing material management in a dairy industry. Various types of perishable products are processed and packed in this industry. Many types of packaging materials are used to packed these products. To identify most revenue generating products which generates most revenue to this industry, ABC analysis was done. This study focuses on low cost techniques to material management eliminating automation (like AGVs, and many more) methods which is highly practised in current market which can only be adopted by big industries. This study involves some tactics in managing materials like material handling equipment (MHE), Stacking, Zone-Picking methods. This improvised combination methodology increases overall space utilization by 18%, overall pallet accommodation by 37.83% and decrease of lead time by 50% as compared to existing material management methodology

Keywords
material management; zone picking method; stacking, packaging materials; low cost techniques

Article Received: 10 August 2020, Revised: 25 October 2020, Accepted: 18 November 2020

Introduction

A dairy industry. It has a no of godowns and no of packaging material. Due to high no of packaging material decrease material management efficiency. They face problem in godown like facing problems like identification of material in each godowns due to this increase man material movement and them effort, random arrangement of material in each godown causes random movement of material, and high lead time. This problem is occurring due to not utilize godown layout, not give particular space of each material. So, this study focusses on these problems how to eliminate these problems.

For improve material management, we collect data like dimension of godown, flow of each packaging material, how much packaging material load on one pallet, average monthly consumption. With the help of this data we eliminate identification of material problem by implementing zone allocation in each godown. That help to minimize material movement and eliminate random arrangement of material. We have given the zone in such a way that it stays close to the production. Arranging material consider FIFO method. We improve stacking so that help to utilization godown of z-axis. Drive-through racks method allows a lift truck to enter the rack from either side to pick up or pull out pallets. Loads are supported by rails attached to upright frames, and lift trucks are driven between uprights to reach pallets. This is done because pallets can slide backwards on a continuous rail. By implementing walkie stacker in godown minimize man material movement and lead time. improve material handling efficiency. And by implementing hydraulic lift help to easily movement of packaging material from one godown to other godown. So, this all method improves material management in godowns.

Literature Review

Effective material management is one of the main issues that every industry deal with. T. Phani Madhavi [1] studied that Material management is required to reduce waste and helps us to easily move material from one place to another. J. Habazin [2] shows problem like (a) identification of material in each godown which increases man-material movement and the effort, (b) random arrangement of material in each godown causes random movement of material and high lead time. This problem occurs due to improper utilization of godown layout and inadequate space between each pallet. Maryam Daraei [3] represents the design and control of a warehouse system is a complex task. Major academic papers are suggested warehouse redesign.

Indresh Nishad [4] identifies EOQ technique from inventory management that results in reduction in holding and ordering cost which reduce the overall total cost of company. He found out in most of the cases, industries do not follow the modern inventory management system because here materials are ordered through experience or when minimum level of inventory is reached, an order ais created, and that order is done to bring back up to maximum level. With this method a Safety Stock (defined earlier) is also used to compensate for an upward variation in demand. As a result, the company faces the problem of overstocking or understocking. Giovanni Mirabelli [5] case study represents warehouse layout optimization in by working on multi-layer pallet allocation that helps in utilization of Z-Axis of warehouse also, on product allocation so different type of products are allocated to their specific zones. That help in reduction of locating time and reducing overall lead time. S. M. Kadane [6] started improve material management with the help of FLEXSIM simulation software. Dhwani Dinesh Joshi [7] represents the use of ABC analysis of inventory, the items generating with higher

revenue but are in less proportion to all items are watched closely and examined by top management team whereas the items generating less revenue but in large proportion may not need for strict control and are in examined by junior executives and so on. Wilson Adarme Jaimes [8] proposed on restructure of existing center warehouse layout of their industry. Warehouse is divided in such a way that aisles are obstructed and unable to fulfil orders on time, storage and collection of materials.

João Mestre [9] represents case study where the existing facility of an industry was redesigned by the merging of two nearby facilities. The main advantage of merging of two facility is reduction of overall handling cost. Carla A. S. Geraldes [10] deals with warehouse operation problems faced by company that affects on manufactured and distribute house appliances. This research addresses the redesigning of different warehouses so customers can get their product without any damage. That shows improvement in material management but warehouse is old enough and solution is not valid for our paper. The study further combines methods and that help to eliminate these problems.

In product classification, products are classified based on production, and size. For example, the milk department produces milk pouches. What are the different roll sizes available for this production?

Sorting determines the sequence of material required for production. Alina Stroie [11] shows the material consumptions on first come first serve basis (FIFO) and represents on AN

Evaluative Framework For Pick And Pass Zone Picking Systems.

In this. godown is split out into several zones. Each picker is allocated solely to a specific zone. That helps in maintaining material quality and easy to locate them.

Mahmoud S.A. Shaheen [12] worked on Drive-through rack that allow a lift jack or truck to enter the rack from either side to pick up or pull out pallets. Case examined fully rack system with load calculation that helps in defining effective length that connect two member of rack system. Shahab Derhami [13] shows that stacking defines as the two or three pallets are placed one on top of others that helps in utilization of Z-axis. Stacking of pallet is done to a specific height based on some criteria such as pallet condition, the weight of the load, height clearance to warehouse roof. In the past, methods for material management are based on the analysis and evaluation of different layouts of godowns. Taking the help of above methodologies, one can know the flow of packaging material and allocating zone pick.

From the above papers, it can be said that the authors gave a whirl to examine the existing material management systems of various industries. After perceiving the major challenges in industries, solutions were presented by the authors. Most of the papers suggested to adopt the EOQ model, inventory management model, just in time, FLEXSIM simulation software and VED analysis whereas, some of them focused on single matter of material management rather than material management as a whole. Listed papers attempted solutions which works best in private conditions. This paper finds a solution for material management issues based on the semiprivate conditions in which the inventory level, which of the products to process and their production amount is governed by the state government at a low cost. Result are achieved by implementing rearrangement of pallets, zone allocation for each product and compare a solution with the current condition of the industry.

A. Objective

1) Main Objective
- Optimize Material Management

2) Sub-Objectives
- Improvement in stock management
- Better material handling
- Remapping of warehouse layout
- Faster material identification
- Reduce lead time

B. Research Methodology

This dairy industry process and packages many different products. Study is been performed considering A-class products which are responsible for generating ~70% of the total revenue. The demand is decided externally, the inventory control is difficult and has a high variety of unexpected demand, arising need of better material management to which industry is failing continuously. Poor material handling and stocking leads to deterioration of finished goods while transporting. Material Requirement Planning (MRP), FLEXSIM simulation software, Min/Max order system, Demand Driven MRP (DDMRP), Zone-picking method, stacking, material flow management, warehouse layout management, material handling system, EOQ model, ABC analysis, VED analysis, FIFO technique and FSN analysis are widely used material management models from which ABC analysis, FIFO technique, Zone-Picking method, Stacking, Material Flow management, and warehouse layout design are used in the present study naming as MIXED METHOD MODEL. ABC analysis helps in identifying A-class materials. By doing so, those products can be examined which are contributes majorly in terms of revenue to the industry. In the present study, the material management of A-class products are the prime and fast-moving inventory.

C. Data collection

The industry does not keep data available to all and thus it was a challenging task. The data was collected by examining the store and warehouse. The industry has 8 main production units which were further divided into sub-systems. The demand to these units were taken into account by collecting annual production data and divided for a month. Then the mean weight for each product's packaging material (for an example, 1 Milk film weight for a pouch of milk) was found. This calculation was done for every A-class product of which one example is shown in table. The number of pallets required for every 3 months was taken into account. The loading capacity for pallet is 3 tonnes.

There was no physical drawing available for any warehouse, afterwards 3D model is prepared for all warehouses. There were 15 workers working and handling material manually by 3 hand jacks for the whole store. Here below show material movement.

TABLE I. SAMAPLE CALCULATION FOR PALLETS REQUIRED

Item Code	Production /annum	Unit/CBx	Unit /annum	CBx /annum	CBx /pallet
	(Tonne)				
FMt	5,000	30	250,000.00	8,33,333	1,800
Cbx pallet /annum	Cans/pallet	Cans pallet /annum	Pallets /annum	Pallets/ month	
463	7,056	3,543	4,006	334	

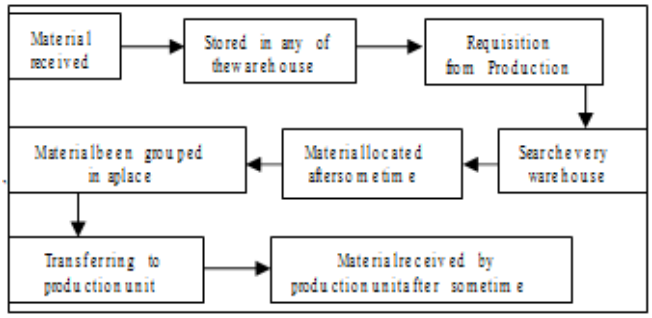

Fig. 1. CurrentMaterialFlow

D. **Warehouse**

The industry has 6 warehouses and 8 main production units which were further divided into sub-systems. Among 6 warehouses, except one all were connected in a certain way, named as WH (23, 24, 25, 26, 27, and Milk). Talking about heights from the ground, there is WH 27, on first floor WHMilk, on second floor WH23, WH25, WH26 and a slight heighted to second floor is the WH24 one. Main entry point to the connected warehouse is WH27, and WH24, from there the material travels along as per need. Usually all the materials travel from WH27 or WH24 to the WH23 warehouse which is the exit point. There were not adequate pathways for each material to move. All items were not accessible instantly, to carry out the items placed behind, the items place in the front has to be relocated somewhere else and then the process can be carried out. There was no standard place assigned to place materials, just put it where your heart says. Every material can be found out in every warehouse.

For material flow they used conveyors and sliders to pass on the material through each warehouse. For material to travel from WH27 to WH26, there is a lift; WH25 and WH26 are on the same floor height; from WH25 to WH24 are on different height, there is rubber belt conveyor; from WH24 to WH23, there are two smooth surfaced steel slider The detailed flow is compared in the results section.

Abcanalysis

ABC analysis is a type of inventory categorization method in which inventory is divided into three categories, A, B, and C, in descending revenue. Generally, Material management and optimization is critical for any industry to help keep their costs under control. It works towards goal by letting management focus most of their attention on the few highest revenue generating material (the A-items). The ABC analysis was applied to classify the packaging materials into three classes of inventory based on collected data. It was found that the A-class materials, which were 35% of all goods contributed to 60-65% of the annual consumption value of the items. The B-class materials i.e. 25% of all goods contributed to 25-30% of the annual consumption value and the C-class inserts which are 40% of all goods contributed only 5-15% of the annual consumption value of the items. This way, the Aclass materials who contributes highest in the revenue generating being the low in quantity (%) are identified. The details of A-class materials identify from the ABC analysis is presented in Table 2.

TABLE II. DETAILS OF A-CLASS MATERIAL

Material Code	Quantity	Revenue Contribution
	%	%
FMt	10.22	12.01
FMc	9.33	1.06
At	7.59	8.58
Atc	6.35	10.49
Bl	5.49	7.89
Bc	5.32	1.24
APl	5.02	6.76
APc	3.86	1.80
Mf	2.98	9.91
Gt	5.45	7.09
Gtc	2.16	2.55

Here, A-class material cover 69.38% of total revenue of material inventory, B-class material cover 22.47% and the remaining 8.15 % is acquired by C-class material. There are total 11 number of A-class material covered the highest value. So, this study focusses on material management of these 11 materials.

Problem Identification

- Poor material handling equipment
- Dead scrap machine is lying in WH23
- Randomness everywhere creating high man-material movement
- Inadequate pathways for man-material movement
- Excess manpower

Solutions

Consumption of incoming materials by implementing First In First Out (FIFO) technique. The slow-moving materials are placed away from the entry and exit point of the warehouse, less obstacle for moving materials. Adequate pathways have been made to avoid any reallocation of materials, keeping in mind that every material is accessible. The light materials like Tins, Corrugated box (CBx), laminates and PET Jar are stacked on each other to utilize the Z-axis of the warehouse also keeping it under loading capacity of a pallet. For comparing, before and after are noted on the basis of number of pallets accommodated in the particular warehouse, and lead time to transfer material from warehouse to production unit.

Implementing over the top material stacking, material handling equipment was replaced from hand pallet truck to Walkie Stackers. The warehouses had a different floor height than each other, this makes the movement of material from one warehouse to another difficult, slow and effortful because of the use of conveyor and slider at height. This required emptying of each item from the pallet at one end and rearranging at another end of the slider. By practising this method, many materials tend to damage and deteriorate, effecting the quality of the finished goods. To solution, the conveyor and slider are replaced with industrial lift, this solved other issues like safety of worker, damage to materials while transferring, high lead time. A dead scrap machine is removed, occupying space in the WH23(As shown in Figure 5.), creating more space for material. Some of the workforce was released due to removal of hand pallet trucks and lifts and walkie stackers. As a result, 7 workers were replaced by lifts and walkie stackers. Return of Investment (ROI) is shown in below.

ROI = I (Rs.) / (n x S (Rs. / month))

(months) = (8,30,000 (Rs.)) / (7 x 10,000 (Rs. / month))

=11.86 ~ 12 months

Where, I = Total Investment n = Total numbers of workers removed

S = Salary of each worker

I = (2 x cost of Industrial Lift) + (3 x cost of Walkie stalker)

= (2 x 1,90,000) + (3 x 1,50,000) = Rs. 8,30,000/-

For randomness issue, the zones were made according to the nearness to production unit and material which is shown in the Figure 6, 9, 12, 15, 17, and 19. For easy identification of zones, yellow lines were drawn on the floor for pallet placing and labels on the ceilings on the warehouses.

Results And Discussion

In present research work, material management of A-class material is improved by implementing of the given solution. By implementing FIFO technique (First received material should be utilized first). With the help of zone picking method study define various zone for each material and the zones are allocated near to production, so that movement of material is reduced, improve utilization of space shown in Fig 2. and thus, reaches on time to production, helping to eliminate randomness that dairy facing in current scenario. Stacking increase storing capacity with the help of this stock increased by 32% and increased utilization of Z-Axis. Before this study industry stacking few product (butter tin) up to two layers but study finds out flavour milk can, asp tin, Pet jar can be also stacked up to two layers without any failure of material. The stacking height is more so difficult to loading and unloading compare to normal and this problem is eliminated by replacing hand jacks with Walkie Stackers. But as a result, investment has increased. Further this study replaces conveyor and slider with hydraulic lift. This conveyor connects WH25to WH24 and slider connects WH24 to WH23. So overall investment is increase but the requirement of seven labour is eliminated, also increase in material management and decrease in lead time. Also, research has calculated ROI to less than 12 months. This all result help to achieve efficient material management. Here shows comparison of various parameters.

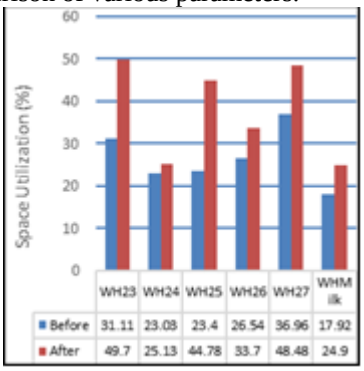

Fig. 2. Volumetric Space Utilization Comparison

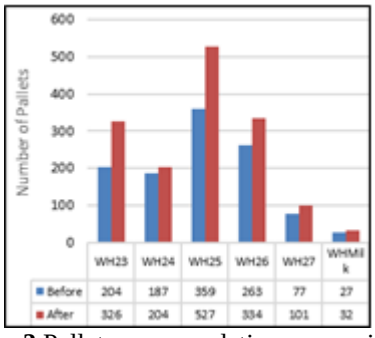

Fig. 3.Pallet accommodation comparison

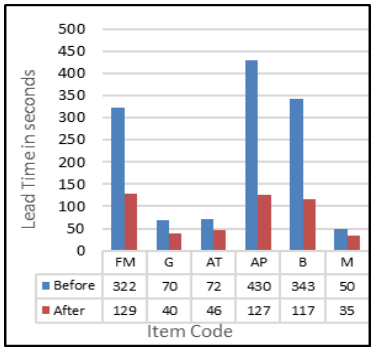

Fig. 4. Lead Time Comparison

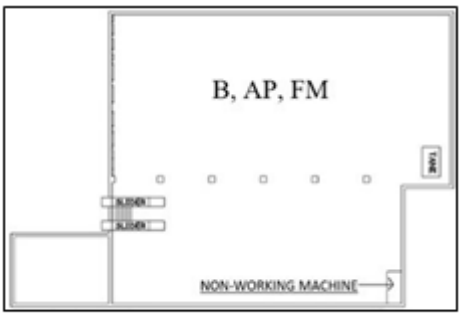

Fig. 5. WH23 before

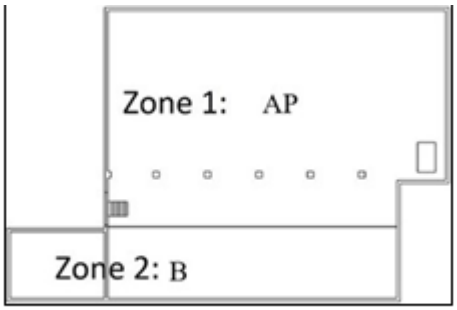

Fig. 6. WH23 after zones

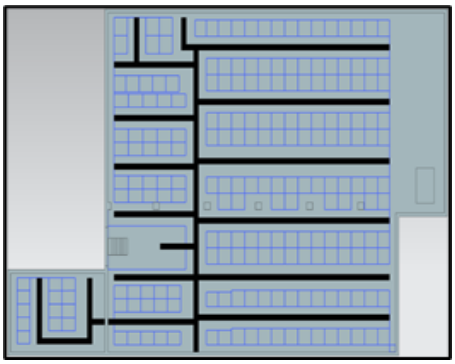

Fig. 7.WH23 after pathways

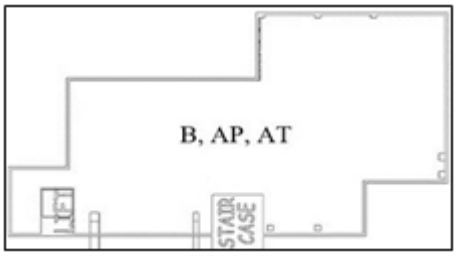

Fig. 8.WH24 before

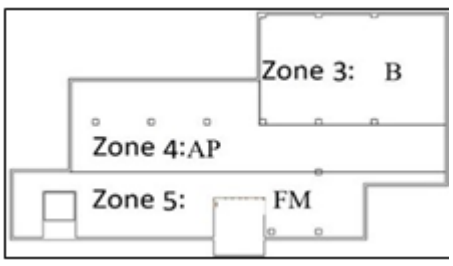

Fig. 9.WH24 after zones

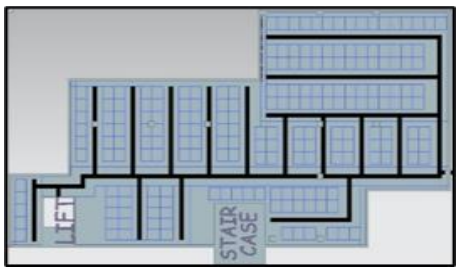

Fig. 10.WH24 after pathways

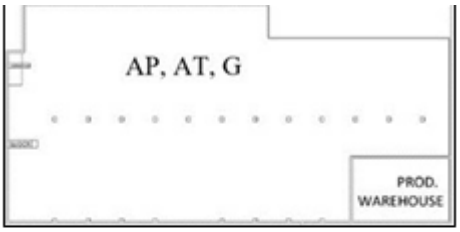

Fig. 11. WH25 before

Fig. 12. WH25 after zones

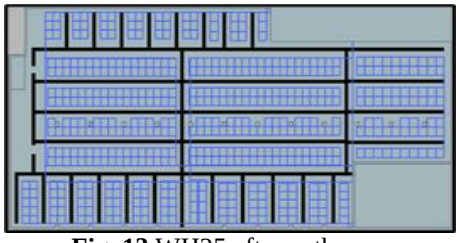

Fig. 13.WH25 after pathways

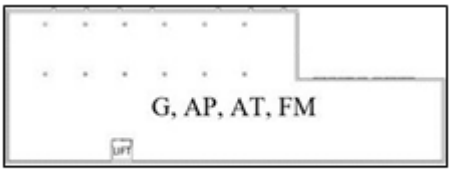

Fig. 14. WH26 before

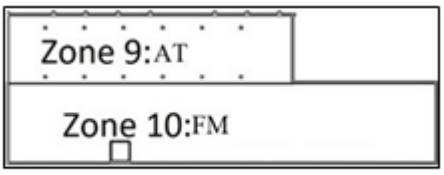

Fig. 15. WH26 after zones

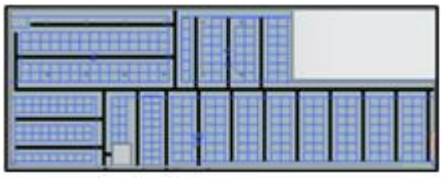

Fig. 16.WH26 after pathways

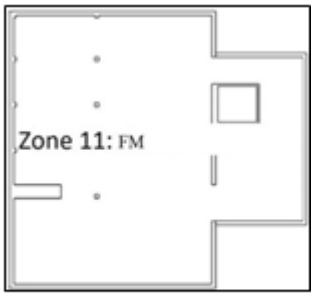

Fig. 17. WH27 after zones

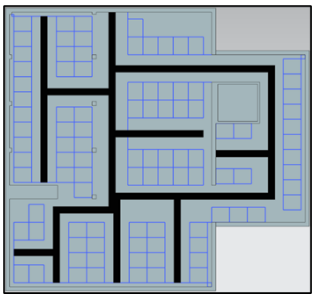

Fig. 18.WH27 after pathways

Fig. 19. WHMilk after zones

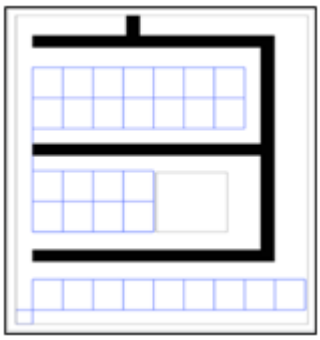

Fig. 20.WHMilk after pathways

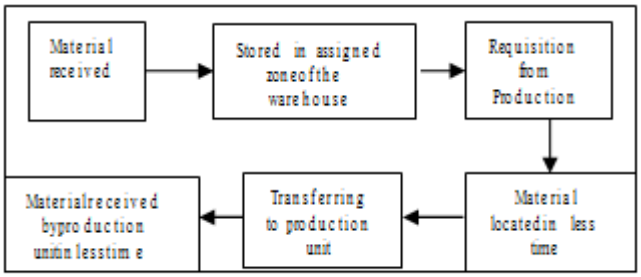

Fig. 21. Lead Time Comparison

This comparison shows that study has benefited the company in all parameters from small to bigger margins. Warehouses are compared in three condition i.e. before the method implementation; after the zone's allocation; and after zones and pathways designed. The material flow has become simple and easy with better understanding of the material movement within the warehouses. Particularly in the WH27 and WHMilk, there has been no change in the material selection but we can still see the impact of placing the material in a sequence and accordingly. This also shows reduction of fatigue and stress of the material manager due to simplicity and easiness in the material management and less dealing with the labours compared to previous condition.

Conclusion

This study shows the solution of optimization material management and picking zone problems. The constant failure of material management due large number of material handling. The industry needs to improve in that area. So, they optimized warehouse layout and Allocation an area of class-A material near to production. so that first reduce locating time and improve worker efficiency. Material which used to damage during sliding or on conveyor has been reduced. The fatigue of man during transferring the material is reduced rapidly. More efficiency and quality is achieved with less manpower. Overall pallet capacity in a warehouse is increased by 40%. Overall space utilization in a warehouse is increased by 12%. Overall lead time to transfer a material from warehouse to the production unit is reduced by 50%. These figures are very well derived from the figure 2, 3 and 4. These figures compares the before and after in the warehouse for the respective entities. This clearly show the improvement in the warehouse after implementing the proposed methodology. This study also shows that the general methods often fails to solve such problems in a practical scenario where finance is an important limitation. The locating time is reduced by 20-30%. Stock of materials is increased by 10-15 days with the help of stacking and stock. Achieved maximum use of warehouse helping in reducing transportation cost. Due to overloading difficult to handle so new machine is eliminate that problem. The purpose of implementing Hydraulic lift is reduce loading and unloading time while moving material from WH25to WH24 and WH24 to WH23. So that allowing greater mobility and flexibility for daily operating activities of warehouses.

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