Design of the storage location based on the ABC analyses

Milan Jemelka, Bronislav Chramcov, and Pavel Kříž

Citation: AIP Conference Proceedings **1738**, 120026 (2016); doi: 10.1063/1.4951909
View online: http://dx.doi.org/10.1063/1.4951909
View Table of Contents: http://aip.scitation.org/toc/apc/1738/1
Published by the American Institute of Physics

Design of the Storage Location Based on the ABC Analyses

Milan Jemelka, Bronislav Chramcov and Pavel Kříž

Tomas Bata University in Zlin, Faculty of Applied Informatics,
nam. T.G. Masaryka 5555, 760 01 Zlin, Czech Republic

Abstract. The paper focuses on process efficiency and saving storage costs. Maintaining inventory through putaway strategy takes personnel time and costs money. The aim is to control inventory in the best way. The ABC classification based on Villefredo Pareto theory is used for a design of warehouse layout. New design of storage location reduces the distance of fork-lifters, total costs and it increases inventory process efficiency. The suggested solutions and evaluation of achieved results are described in detail. Proposed solutions were realized in real warehouse operation.

Keywords: ABC classification, putaway strategy, inventory planning.
PACS: 89.20.Bb

INTRODUCTION

It is very popular for many companies to improve storage process efficiency and decrease company costs. There is a large number of authors solving this issue [8], [9]. There is also a lot of stock systems, and put away strategies. It is very important to decide, what approach is the best for a concreate situation. The main indicators, which are also important to manage is the put away efficiency and items in inventory. It is also beneficial to know several methods to measure the moving materials and its price [4]. There are more approaches to improve these methods [10]. The ABC classification based on Villefredo Pareto theory is used for design of a warehouse layout in our case. Let us assume that there will be not any changes of total aisle length or width, number of aisles, number of blocks, cross aisle width. Let us consider to keep this physical unchanged. These physical changes would increase costs and the return of investment could be challenging. This paper focuses on rearranging products on the storage space. The ABC classification is used to divide the inventory material to new sections [11], [12]. Based on this we will do a new warehouse layout and new measurements.

There are also multiple approaches such as Super-size the Receiving Area, Segmentation, Random location strategy, etc. [1], [2], [7], [13].

PROBLEM FORMULATION

An inefficient layout of a warehouse can have a negative effect on business. It can decrease efficiency, productivity, aggravate inventory control issues, can cause higher costs of shipping. Properly utilized warehouse will keep overhead costs to a minimum and increase productivity [4]. The ABC classification was used for inventory materials. The focus in on reducing the distance of fork-lifters [6], they need to drive. As a result increase productivity and reduce total costs [3]. Logistics process simulation will be done by a dynamic simulation. Original storage is done randomly. New storage sections were defined based on the ABC analyses and classification. Based on this analysis, materials were marked by ABC letters. A letter is designed for high-rotation material, B letter for medium-rotation material and C letter for the least rotation material. The put away strategy needs to be changed for material from one batch. High-rotation material has to be always stored as high-rotation material [5]

Description of Current Storage Location

The storage hall has a total size of 23,520 square meters. The width of the hall is 210 meters and 112 meters in length. This hall is logically divided into two areas. On the left hand side and a right hand side. The left hand areas of this hall is used for all the inbound delivery and the right hand area is used for outbound delivery.

Shelves are used for each of these sections, which are disposed in rows. The material is placed randomly in these shelves. Putaway strategy is done by forklifts. Operation of this storage area is 24/7.

International Conference of Numerical Analysis and Applied Mathematics 2015 (ICNAAM 2015)
AIP Conf. Proc. 1738, 120026-1–120026-3; doi: 10.1063/1.4951909
Published by AIP Publishing. 978-0-7354-1392-4/$30.00

NEW DESIGN OF THE STORAGE LOCATION

New design of the storage location is based on the ABC analyses. Based on this analyses, it is designed a new layout of the storage hall divided into three new areas (see the Figure 1). The biggest storage section is the area A. The second one is smaller and it is the B area and the smallest part in the top right hand corner is the area C.

All the deliveries are shipped on the docks below, at the bottom of the map. It is the place, where all the trucks are coming at. All the trucks are coming from the bottom of the picture to load the material The ABC analysis was realized for inbound delivery area (see Figure 1a) and also for outbound delivery area (see Figure 1b).

(a) Inbound delivery area

(b) Outbound delivery area

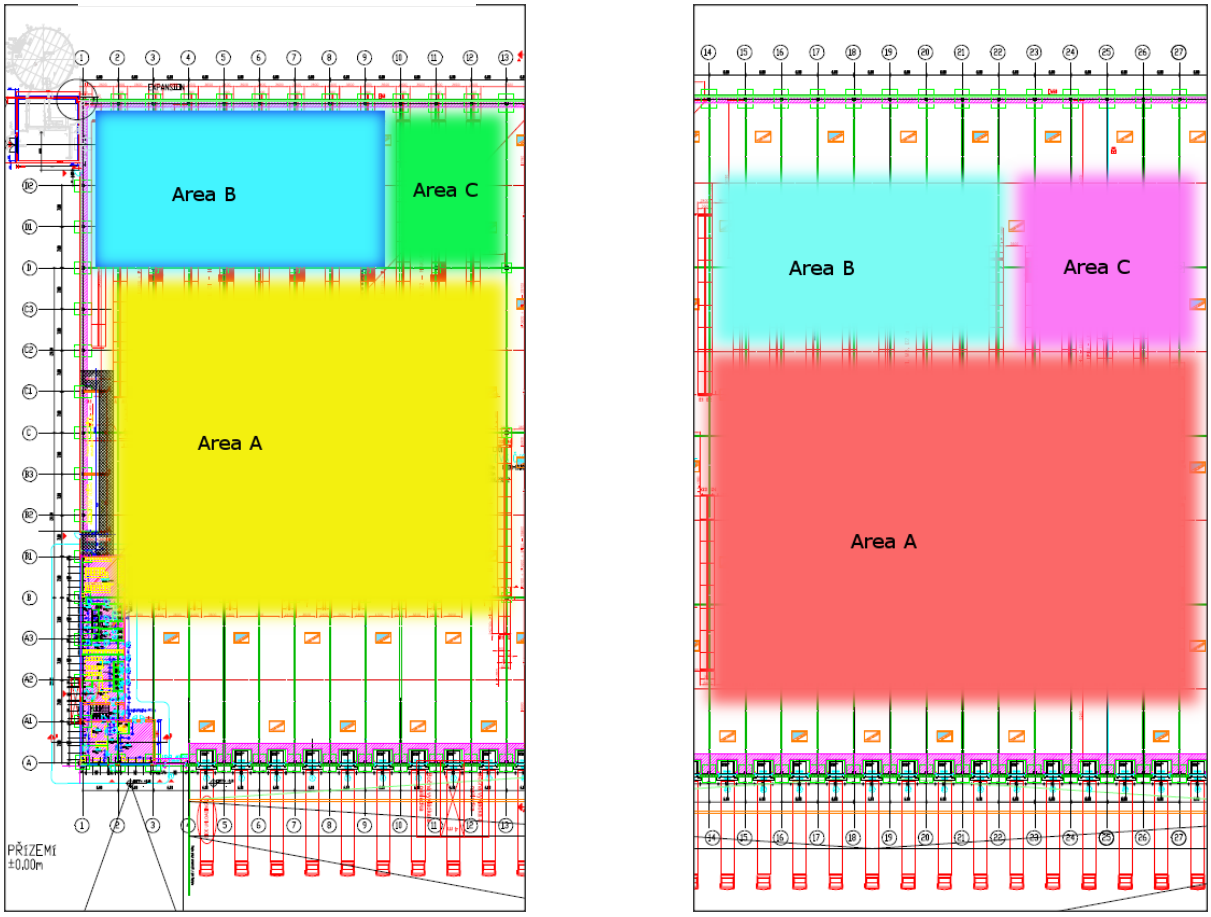

FIGURE 1. Design of sections for inbound (a) and outbound (b) delivery area.

The average total length of forklift route is a 112 m in inbound delivery area. This length includes both way forklift route. After the application a new layout it was achieved reduction of forklift route by 10.71%. Table 1 presents the detailed achieved results. The total number of forklifters is 10 in the non-warehouse managed stock. Due to the new design is possible to reduce number of forklifters (from 10 persons to 9 persons). The total direct cost for wages was reduced by wage of one forklifter.

TABLE 1. Results for inbound deliveries.

	Not Warehouse managed stock	Warehouse managed stock
Number of forklift movements per one day	56	50
Total Length of forklift route	6440	5750
Number of forklifters	10	9

The average total length of forklift route is a 100 m in outbound delivery area. This length includes both way forklift route. In this case, it is not possible to reduce the number of forklifters. The 6% reduction of the forklift route would have a positive effect on reducing the amount of employees work and has a positive effect to their work comfort and reduction of other direct costs. Table 2 presents the detailed achieved results.

TABLE 2. Results for outbound deliveries.

	Not Warehouse managed stock	**Warehouse managed stock**
Number of forklift movements per one day	50	47
Total Length of forklift route	5000	4700
Number of forklifters	10	10

From the above presented results it is obvious that inbound delivery process has a significant improving efficiency by 10.71 %. This new result enabled the company to reduce its staff by one person and to save wage of one forklifter every month. Outbound delivery process has also significant improving efficiency by 6 %. This new result enabled the company to increase productivity and decrease the amount of other direct costs.

CONCLUSIONS

Our article targets on rearranging products on the storage space. The ABC classification was used to divide the inventory material to new sections. Based on this a new warehouse layout was designed. The overall layout change brought two positive results. On the one hand, costs were reduced for one fork-lifter and on the other hand, efficiency of inbound and outbound delivery process was increased. Proposed solutions are tested and realized in real warehouse operation in the automotive industry. It is already planned to do the detailed simulation study in the future. Some experiments with random number of sections will be tested and compared.

ACKNOWLEDGMENTS

The work was performed with financial support of research project NPU I No. MSMT-7778/2014 by the Ministry of Education of the Czech Republic and also by the European Regional Development Fund under the Project CEBIA-Tech No. CZ.1.05/2.1.00/03.0089 and in part by Internal Grant Agency within the project No. IGA/FAI/2015/050.

REFERENCES

1. S. M. Bragg, *Inventory Management*, Accounting Tools, 2013.
2. D. Waters, *Inventory Control and Management (Business)*, John Wiley and Sons, 2 edition, 2003.
3. D. J. Piasecki, *Inventory Management Explained*, Ops Publishing, 2009.
4. D. Granville, *Excellence in Inventory Management: How to Minimise Costs and Maximise Services*, Cambridge Academic; First edition, 2007.
5. C. Milner, *Inventory Management: Advanced Methods for Managing Inventory within Business Systems*, Kogan Page; 1 edition, 2015.
6. S. Grinsted, *The Logistics and Supply Chain Toolkit: Over 90 Tools for Transport, Warehousing and Inventory Management*, Kogan Page; 1 edition, 2013.
7. M. Muller, *Essentials of Inventory Management*, Amacom, 2 edition, 2011.
8. E. Bottani, R. Montanari, M. Rinaldi and G. Vignali,.Intelligent algorithms for warehouse management, *Intelligent Systems Reference Library*, **87**, pp. 645-667 (2015).
9. J. A López, A. Mendoza and J. Masini, A classic and effective approach to inventory management, *International Journal of Industrial Engineering: Theory Applications and Practice*, **20** (56), pp. 372-386 (2013).
10. Y. Xiao, R. Zhang and I. Kaku, A new approach of inventory classification based on loss profit, *Expert Systems with Applications,* **38** (8), pp. 9382-9391 (2011)..
11. P. Paweł, F. Marek and G. Paulina, "Using ABC Classification to determine production sequence in automotive industry", In *Proceedings of 2008 World Automation Congress, WAC 2008*, IEEE, 2008, pp. 1-6.
12. A.D. Smith, Inventory management and ABC analysis practices in competitive environments, *International Journal of Procurement Management*, **4** (4), pp. 433-454 (2011).
13. E. Volna, M. Kotyrba and M. Janosek, „Knowledge discovery in dynamic data using neural networks." In Kuinam J. Kim, K. J. (ed.) *Information Science and Applications. Lecture Notes in Electrical Engineering (Book series)*, Springer Verlag Berlin Heidelberg, 2015,Volume 339, pp. 575-582.