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THE REORGANIZATION OF THE INPUT STORE OF STEEL RAW MATERIALS IN THE MANUFACTURING SYSTEM - CASE STUDY

Abstract: The proper warehouse management strongly affects the condition of the company. The paper describes a way to reorganize the input storage layout of steel raw materials of the company that specializes in manufacturing large-size products. In particular, the existing state of the store and next three new conceptions were presented. Attention was paid to the storage area intended for the steel sheets. Some alternative variants of horizontal and vertical steel sheets storing and means of the internal transport were considered in these new solutions. The most important criteria for choosing a solution for implementation were also presented. The designed layout of the magazine, compared to the existing state, enables the elimination of waste associated with the available capacity, reduce time and cost associated with the involvement of the means of production and human resources.

1. Introduction

The proper stock management is essential for the efficiency of production, but in many companies it is not paid the sufficient attention to this issue. As a result, the company may incur significantly higher costs of production and lose competitiveness [1]. Therefore, the storage space should be well thought and organized in a way that minimizes costs associated with available space and as well as in such a way that allows reducing and simplifying manipulation of materials and transport processes. The storage methodology and problems of space design has been widely presented in [2,4].

For storing metallurgical raw materials in the form of sheets, rods and others, dedicated and adapted storage areas are used. Due to the often large weight and dimensions, these materials are often stored in the open space, close to the manufacturing shop. The roles of such magazine often perform storage areas located in such a way that the transport of input materials for production was carried at the shortest possible distance. Small-size items can be stored in the enclosed spaces, on shelves, in transport boxes, etc. In fact, the manner of storage of these materials depends on the availability of space allocated for storing, available means of transport and maximum loads allowable for storage surface (safe stack height on the

ground, racks, platforms, etc.). Selected practical guidance on the storage of various types of materials are presented in [3,6].

This work is the part of scientific research work on the organization of production in the local enterprise that specializes in manufacturing large-size products conducted in the Institute of Automation Processes Engineering and Integrated Manufacturing Systems of Silesian University of Technology.

2. The existing layout of the input store

Steel sheets storage is located in the immediate vicinity of the production system (figure 1). Storage area is restricted by the operating range of the crane. By technological reasons, delivery of raw materials from store to manufacturing area is carried out only through the one, entry gate. Three output gates located at the side of store are used occasionally, but storage of material in this area is not allowed. Due to the limited capacity of the crane the transportation of the largest sheets is performed one by one, which greatly increases the time of the transport process – the total delivery time from identifying the proper sheet by the worker, through manipulation, transportation, loading on the rail truck up to delivery to the manufacturing department is approximately 3h.

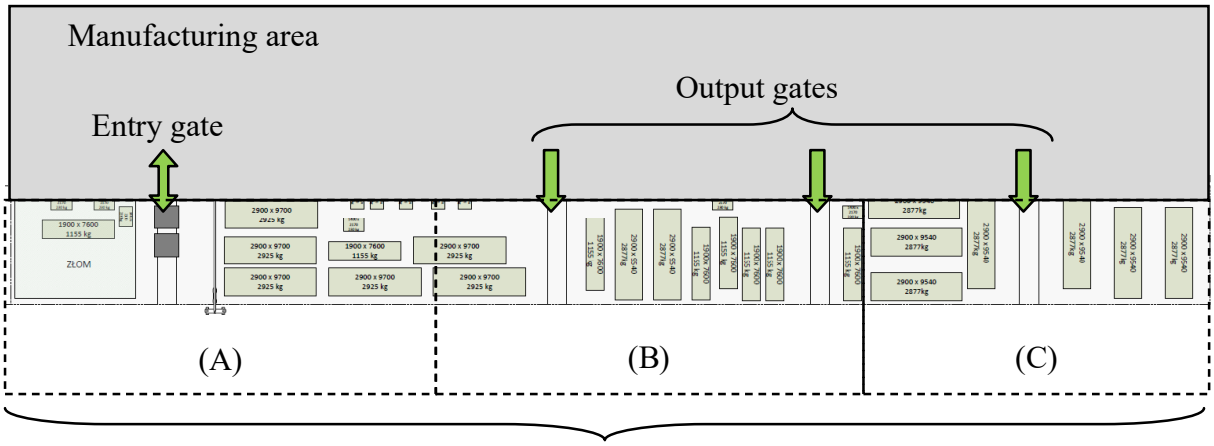

Fig. 1. The location of the input steel sheets store

Currently, the steel sheets are stored horizontally in available free space based on the individual preferences of workers, without clearly defined rules. Very often sheets with different sizes are stack in the same pile (figure 2). Such random arrangement of sheets causes difficulties in finding suitable sheets for production and often significantly increases delivery time and workload, when putting sheets from one stack to another.

In figures 3-5 the existing layout of the input store is presented. Current material storage areas, with the dimensions of the sheets, transportation, gates areas and scrapping area were marked.

Fig. 2. Storing sheets of different sizes - random arrangement of sheets in stocks

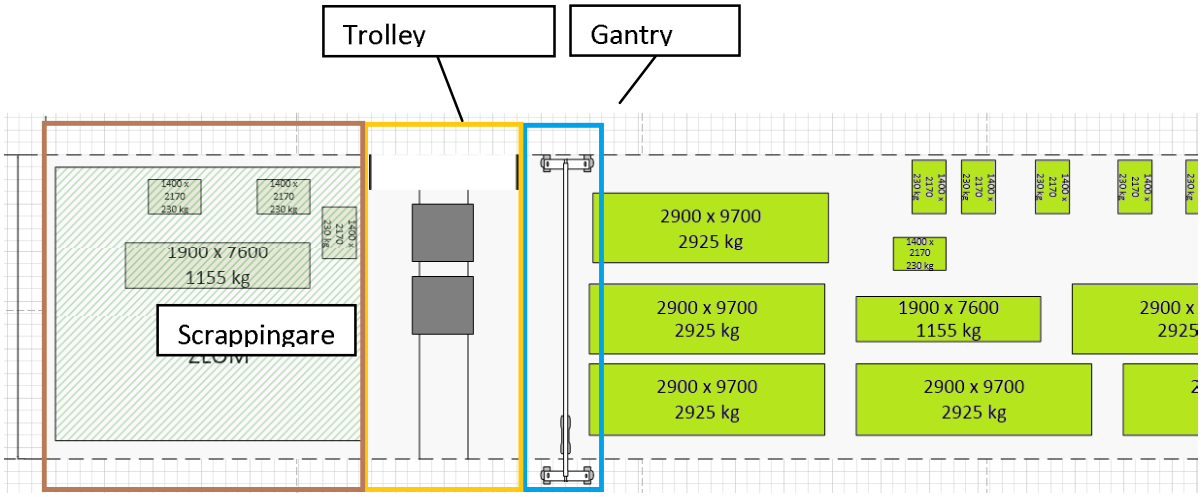

Fig. 3. The existing layout of the input storage, part A

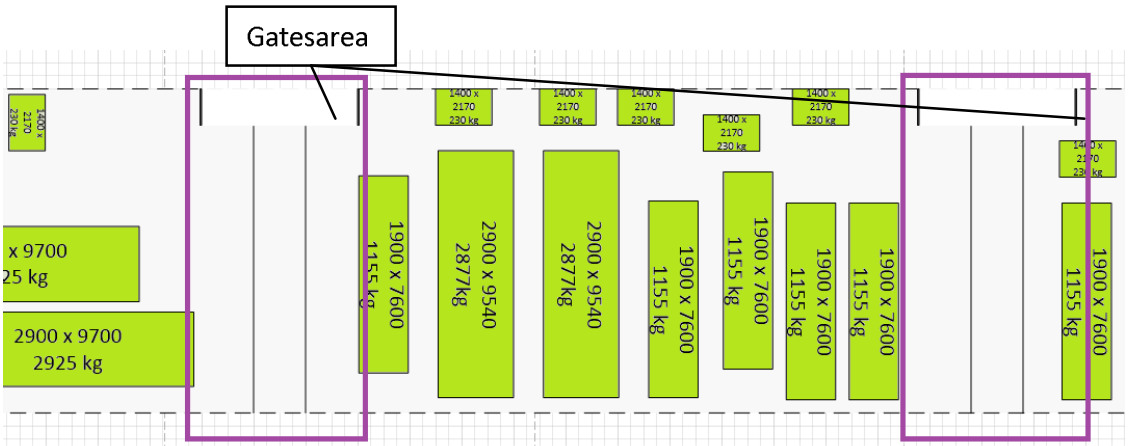

Fig. 4. The existing layout of the input storage, part B

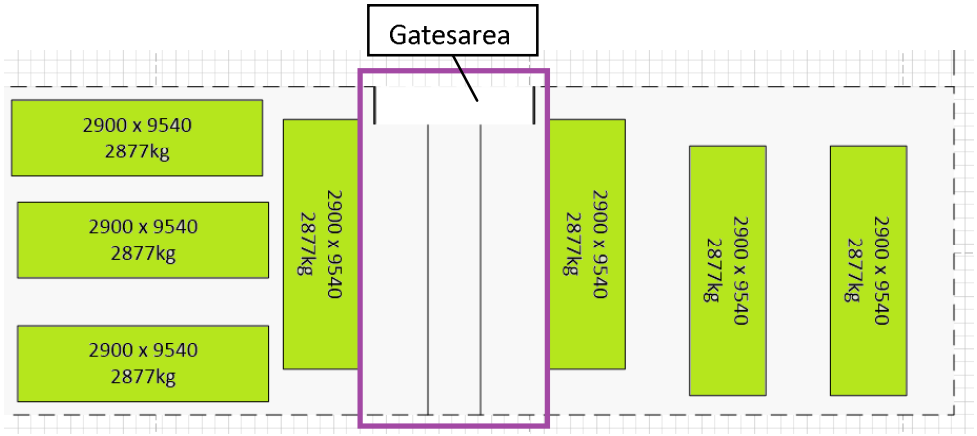

Fig. 5. The existing layout of the input storage, part C

3. The proposed variants of the layout arrangement

On the base of analysis of possible configuration changes in the input store layout described in [5] three variants of the steel sheets arrangement were proposed. The following criteria were assumed:

1. The ability to use an alternative means of transport – e.g. in case of the crane breakdown.
2. Minimizing the transport time of the raw materials from the storage to the production area.
3. Simplicity of the layout and clearly marked storage area in order to avoid mistakes and reduce the searching time for the right material by workers.
4. Easiness of manipulation of materials in the storage.
5. Easiness of unloading materials from the means of transport.
6. Ability to handle the increased supplies of materials.
7. Minimizing the investment and operational costs of storage.

The steel sheets are classified by their dimensions into 4 groups:

- S1: 9540 mm x 2900 mm x 13 mm (2877 kg),
- S2: 9700 mm x 2900 mm x 13 mm (2925 kg),
- S3: 7600 mm x 1900 mm x 10 mm (1155 kg),
- S4: 2170 mm x 1400 mm x 9,5 mm (230 kg),
- S5: other remaining sizes.

The combination of horizontal and vertical stacking sheets was proposed. Stored sheets will be handled mainly by the crane. For transportation of large-size sheets stored vertically ropes/hooks or dedicated magnetic gripper can be used. In order to improve the operation of the horizontally stored sheets an additional mean of transport in the form of a forklift truck was proposed. For easier handling by a forklift sheets stacked in piles should be stored on pallets. In all variants the scrapping area was placed in the opposite side of the raw material entry gate – on the right side of the store (figures 7-9).

In the variant 1 (figure 7), S1 group of sheets are arranged in stacks of up to 10 pieces. Within this area the transportation will run so far – using a gantry crane. S1 sheets are

arranged in the close vicinity of trolley conveyors used for transport sheets to the production system. S2 type sheets are partially stacked and also stored vertically. Stacks of them are up to 8 pieces, which covers the needs of production system for one day.

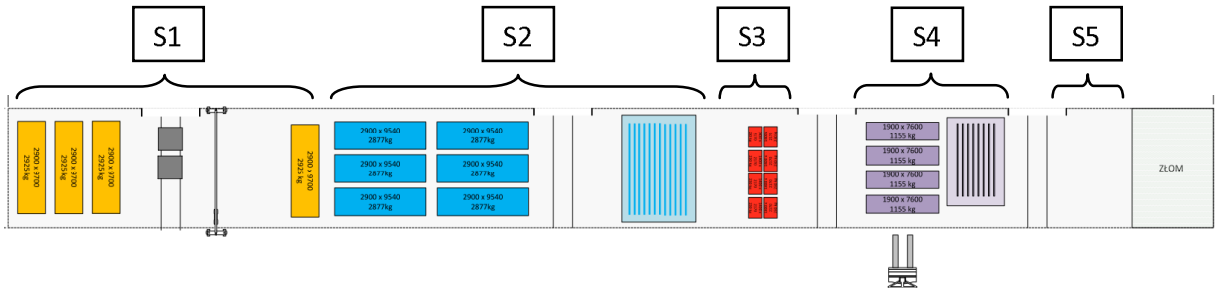

Fig. 6. The arrangement of the steel sheets in the store – variant 1

For covering periodically increased demand and reducing required space a vertical position of storing material sheets was also proposed. Transportation of S2 type sheets can be carried out in two ways – overhead crane and a forklift truck with a high load capacity. The combination of horizontal and vertical storage has also been proposed for storing sheets of S4 group of sheets. S4 sheets are stored up to 9 pieces in a pile, which covers demand for 2 days. Sheets of S3 group, with the smallest size, were placed in stacks of up to 20 pieces in the place that allows easy access and operation of the truck.

The variant 2 (figure 8) considered no vertical storages for large size sheets, so sheets from group 1,2 and 3 are stored in a horizontal position, in stacks. The expected number of sheets in stacks is as follows: for sheets of S1 up to 10, for sheets of S2 up to 8, for S4 up to 9 pieces. S3 sheets were placed at 15 shelves of the rack; each of them can hold up to 10 sheets.

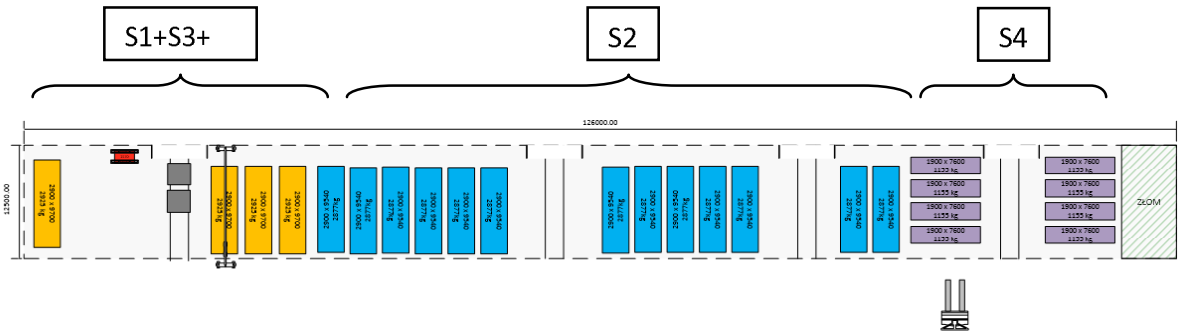

Fig. 7. The arrangement of the steel sheets in the store – variant 2

In the variant 3 (figure 9) storing of S1 sheets mostly in a vertical position is proposed. S2 sheets are stored in stacks of 8 pieces. For S3 sheets the same rack as in variant 2 was proposed.

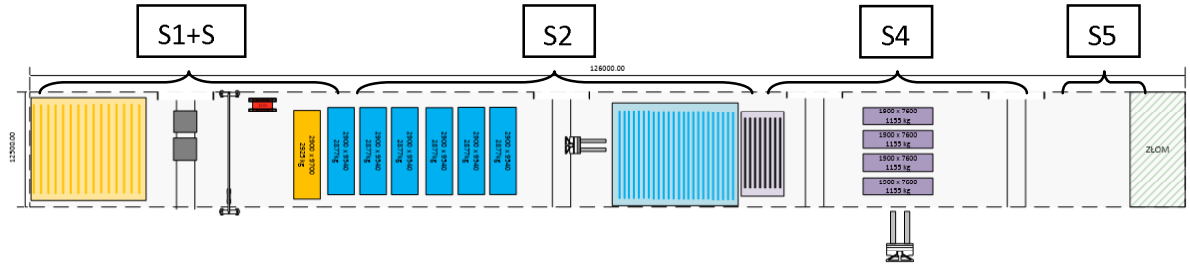

Fig. 8. The arrangement of the steel sheets in the store – variant 3

The conducted multi-criteria analysis, based on set of criteria presented above, showed that the most preferred option is variant 3 but the final decision on the choice of variant has not been made yet.

4. Conclusions

The proposed solution of the input storage layout reorganisation is one of the first steps to improving production organization in the company. The main result of the new layout arrangement is reduction of waste associated with time and cost of the means of production and human resources and possibility of calculation available capacities.

Determination of the maximum storage capacity within the operation area of the crane for the separated groups of raw materials allows for rational stocks management and optimal supply planning. Described changes to the rearrangement are related to location of specific raw materials but also the general improvement of storage operation is provided in further work. The most important are the solutions that enable rapid and clear identification of the place of the sheet storage (localisation) by workers.

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