

---

# SELECTED ENGINEERING PROBLEMS

NUMBER 4

INSTITUTE OF ENGINEERING PROCESSES AUTOMATION  
AND INTEGRATED MANUFACTURING SYSTEMS

---

Ksenia BURECKA<sup>\*</sup>, Krzysztof KALINOWSKI, Cezary GRABOWIK

Institute of Engineering Processes Automation and Integrated Manufacturing Systems,  
Faculty of Mechanical Engineering, Silesian University of Technology, Gliwice, Poland

<sup>\*</sup>ksenia.burecka@polsl.pl

## THE WORKSTATIONS LAYOUT PLANNING IN MANUFACTURING PLANT USING BLOCH-SCHMIGALLA AND CORELAP METHODS

**Abstract:** The paper presents results of workstations layout reorganization in two manufacturing shops in the company which specializes in production of prefabricated plastered constructions. The proposed solutions were elaborated on the basis of the Bloch-Schmigalla and CORELAP methods. The main criteria of resources location were based on intensity of material flows as well as movement of staff and inconveniences associated with working machines.

### 1. Introduction

Spatial arrangement of production processes is one of the main aspects of the effective labour organization in an enterprise. The concept of spatial production arrangement means the way of layout deployment of production facilities, workshops and production cells in the shop. The problem of workstations deployment concerns both newly designed and existing technological structures. According to the *Lean* philosophy of manufacturing it enables the elimination of waste especially in transport and motion areas. As a result it can lead to a reduction of the production cycle, reduce production costs and improve resources utilization.

The work is a part of the project realized in the Institute of Automation Processes Engineering and Integrated Manufacturing Systems of Silesian University of Technology as an extension of work on integrated environment for production planning and control of variable and multiassortment production to order in small and medium-sized enterprises (SMEs). Proposed solution is the first stage of layout reorganization in the manufacturing shop in the company which specializes in the production of prefabricated plastered constructions.

### 2. The existing distribution of the resources

The described manufacturing system consists of the four groups of resources which are arranged in the two shops: 1 – cutting, 2 – bending, 3 – welding and 4 – spot welding. The existing distribution of the resources in the figure 1 is presented.

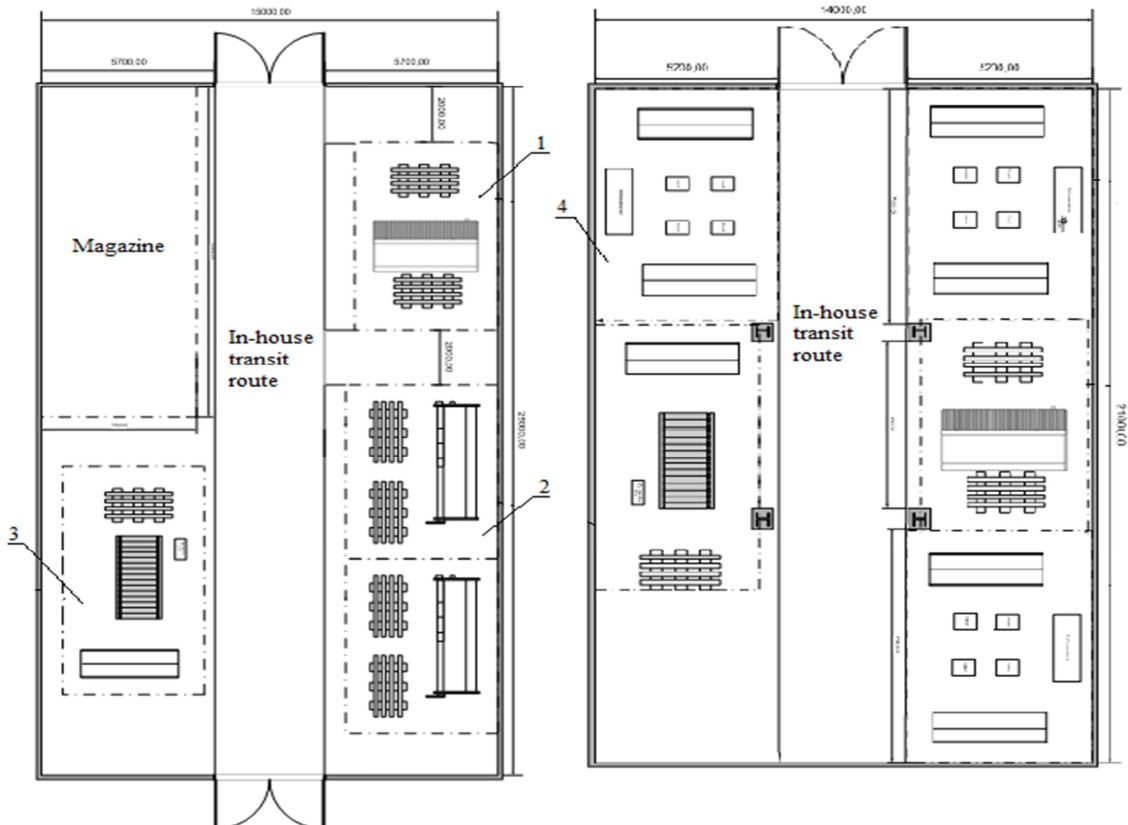


Fig.1. The current arrangement of workstations on the shop floor I and II

### 3. The layout planning using Schmigalla and CORELAP methods

The one of the possible theoretical distributions of workstations groups using Bloch-Schmigalla and CORELAP method in the figure 2 and figure 3 is presented. In both cases workstations are spaced according to the flow of production process.

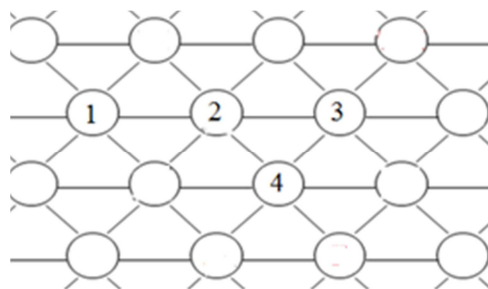


Fig.2. The theoretical distribution of the workstations on a grid of equilateral triangles (Bloch-Schmigalla method)

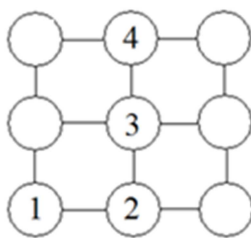


Fig.3. The theoretical distribution of the workstations on a orthogonal grid (CORELAP method)

Presented methods allow distributing workstations on the basis of specific connections between them. The main advantage of the Bloch-Schmigalla method is the simplicity of workstations distribution when determining solutions. In this method the solution is formed on the basis of flows matrix. However, the major disadvantage of them is skipping the actual size of workstations and the distance between them. On the other hand, the size of workstations is considered in the CORELAP method but disadvantage of this method is the computational complexity. In presented example the simplicity of treatment process and small differences in size between workstations resulted in a significant simplification of the calculations, eliminating CORELAP calculations that are necessary to have a modular distance between the workstations.

On the basis of the input data a number of possible variants can be developed in both methods. During the final solution selection process a number of additional criteria were adopted as health and safety conditions, media access points, the length of transport roads, etc. The selected solution was presented in the figure 4.

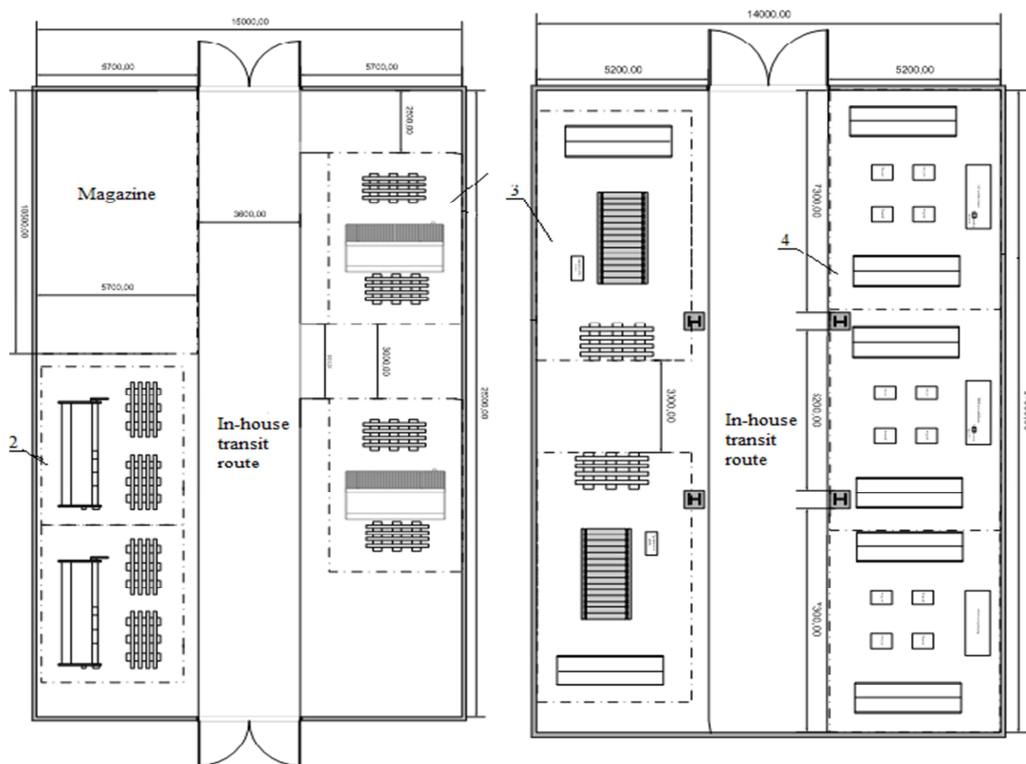


Fig.4. The proposed arrangement of workstations on the shop floor I and II

## 4. Summary

The paper presents results of the project of manufacturing shop floor reorganization. Set of workstations is divided into two separated shops. In search process of the solution two methods were used: Bloch-Schmigalla and CORELAP. The proposed layout, in the context of given evaluation criteria, should help to increase the efficiency of production and improve the flow of materials, semi-finished and finished products. The proposed variant of workstations arrangement is also in compliance with health and safety regulations.

## References

1. Durlik I.: Engineering Management. The strategy and design of production systems (in Polish), Placet, Warszawa 1999.
2. Grabowik C., Kalinowski K., Object-oriented models in an integration of CAD/CAPP/CAP systems. Lecture Notes in Computer Science (including subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics), 6679 LNAI (PART 2), (2011), pp. 405-412.
3. Grabowik C., Kalinowski K.: The layout organization in selected industrial enterprise. (in Polish) Komputerowo zintegrowane zarządzanie. Knosala R. (ed.). Oficyna Wydawnictwo Polskiego Towarzystwa Zarządzania Produkcją, Opole 2006, p. 452-459.
4. Kalinowski K., Skołod B., Grabowik C., Krenczyk D.: Computer aided technological and organisational processes planning. CO-MAT-TECH 2007. Quality assurance of products, safety of production and environment. Bratislava 2007, p. 173-176.
5. Kampa A.: Planning and scheduling of work in robotic manufacturing systems with flexible production. Ed. B. Skołod: Heuristic Methods of Project and Production Scheduling. Journal of Machine Engineering, Vol. 12, No. 3/2012 p. 34-44.
6. Lis S., Santarek K.: Designing of the workstations layout (in Polish). PWN, Warszawa 1980.
7. Lis S., Santarek K., Strzelczak S., Organization of flexible manufacturing systems (in Polish). PWN, Warszawa 2001.
8. Martyniak Z.: Methods of organization and management (in Polish). Wydawnictwo Akademii Ekonomicznej w Krakowie. Kraków 1999.
9. Martyniak Z.: Organization and management. 70 issues of theory and practice (in Polish). Oficyna Wydawnicza: Drukarnia ANTYKWA s.c., Kraków - Kluczbork 2001.
10. Pasternak K.: Outline of production management (in Polish). Polskie Wydawnictwo Ekonomiczne, Warszawa 2005.