Study on a Sequence-Based Materials Flow Procedure for Designing & Manufacturing Cell

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Abstract—This is a case study, in which methodological aspects of cell design for transformation the production process are applied. The cell redesign in this work is tightly focused to reach optimization of material flows under real manufacturing conditions. Accordingly, more individual techniques were aggregated into compact methodical procedure with aim to built one-piece flow production. Case study was concentrated on relatively typical situation of transformation from batch production to cellular manufacturing.

Keywords—, Layout, Design, Manufacturing Process.

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1. INTRODUCTION

HE following research deals with theoretical background for application of one-piece concept by applying the principles of Product/Quantity (P-Q) analysis and Production flow analysis (PFA)**.** Research methodology is applied under real conditions in company, which is manufacturing bicycle components. In generally, companies' reason for radical changes of manufacturing process structures are mainly motivated by recognition that so called process type layout do not suit just-in-time philosophy. That kind of planningoriented production system ends up being a system that requires pushing for sales. The factory push their outputs to retailers, retailers are returning what they cannot sell and returned products ends up as a dead inventory.

The concept of so-called one-piece production differs radically from mentioned systems. By contrast this system outputs products based on the needs of the assembly processes, which are the closest processes to the market and therefore customer. Only when products have been shipped out more products are ordered from manufacturing department.

II. RESEARCH BACKGROUND

The sense of material flow optimisation is to help planners to satisfy customer's needs in shortened manufacturing time cycles. The subject of material flow optimisation falls into production flow management or logistic management, which

V. Modrák is with the Manufacturing Management department, Technical University of Košice, Faculty of Manufacturing Technologies, Slovakia, phone: 00421-51-7722828; fax: 00421-51-7733453; e-mail: vladimir.modrak@tuke.sk includes all aspects of all movements of raw materials, work in process, or finished goods within a plant or warehouse' [1].

Material flows can be implemented as:

1. Discrete flows, which are typical mainly for a batch production. This category involves the manufacture of medium-sized lots of the same item or product. The lots may be produced only once, or they may be produced at regular intervals [2] .

2. Continuous material flows are ordinarily applied in chemical and food industry. While these are examples of flow production, the term also applies to the manufacture of either complex single parts or assembled products. The role of the cell formation is transformation of discrete material flows to almost continuous material flows with the aim to change planning-centered production on one-piece production. According to more authors (see for instance: [3], [4], [5]) by implementing one-piece flow, organizations can obtain dramatic reductions in work-in-process inventory. This reduction in inventory is realized due to:

1) Parts are not being stored in containers (unit

loads) at operations while they are being processed. Instead one piece at a time is processed in cells and ideally only one piece is in transit between operations.

2) Parts are made as they are ordered. Batches or lots of parts are not staged between operations waiting to be scheduled and then to be processed.

Another vantage of this concept is the effect called Zero defect production [6]. It is realized by building mistakeproofing devices into production line, in which work pieces are inspected one at the time. The concept one-piece flow production has been introduced relatively lately, but it seems to be very significant in today's competitive and dynamic manufacturing environment.

The closest theory to one-piece production was brought by Burbridge [7] that is known as Production Flow Analysis (PFA) for planning Group Technology (GT). Sekine [8] purposefully analyzed the basic principles of process flow building and offered detailed case studies of how various Case on Manufacturing Cell Formation Using

PRODUCTION FLOW ANALYSIS

Vladimír Modrák International Journal of Aerospace and Mechanical Engineering 3:4 2009 238 industries designed unique one-piece flow systems (parallel, L-shaped, and U-shaped floor plans) to meet their particular needs. The basic conditions for establishing one-piece flow systems are:

1. Make the factory layout conductive to the overall production flow.

2. The factory must include clear pathways.

3. The production line should clearly distinguish between material input and product output

4. The production line should consist mainly of singleoperator U-shaped cells.

5. Include thorough inspection in the layout.

6. Minimize in-process inventory.

In generally, very small work pieces are not suitable to onepiece production due to the waste involved in the setup, positioning, and removal of such small items. This concept is also inappropriate if changeover times are long.