

LINE BALANCING OF SINGLE MODEL ASSEMBLY LINE

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Abstract: Line balancing is an effective tool to improve the throughput of assembly line while reducing non-value-added activities, cycle time. LB is the problem of assigning operation to workstation along an assembly line, in such a way that assignment is optimal in some sense. This paper mainly focuses on improving overall efficiency of single model assembly line by reducing the non value added activities, cycle time and distribution of work load at each work station by line balancing. The methodology adopted includes calculation of cycle time of process, identifying the non –value-added activities, calculating total work load on station and distribution of work load on each workstation by line balancing, in order to improve the efficiency of line.

Key words: Line balancing (LB), Non value added activities (NVA), assembly line balancing (ALB)

I. INTRODUCTION

Quality product and capable to cope with customers demands are important aspects that should be take an account especially for small and medium industry. Management systems are also contributes in order to planning, controlling and measuring parameters related to the performance of the sectors. Companies should realize that the performance is depending on how well the production line in term of output. Line balancing primary focus is on minimizing waste related to over production, inventory, defects, transportation, motion, waiting. Assembly Line Balancing (ALB) is one way to achieve that. Principle of interchangeability and division of labour brought in the concept of assembly line, primary aim of the assembly line was to facilitate mass production, standardization, simplification and specialization. Besides this, assembly line was also useful in dividing complex work structures into number of elemental tasks, which would simplify the complexity of assembly work. ALB also provides flexibility to the employees, thereby reducing the monotonous activity thus improved job satisfaction for the employees. From the manufacturers point of view foremost advantage of ALB is the ability to keep direct labours busy doing productive work. Historically assembly line is designed for high volume production of single item or similar family of items.

II. LITRATURE REVIEW

C Merengo, F Nava, A Pozzetti in their paper ‘Balancing and sequencing manual single model assembly lines’[1] In particular, it presents new balancing and production sequencing methodologies which pursue the following common goals, minimizing the rate of incomplete jobs (in paced lines and in moving lines) or the probability of blocking/starvation events (in un paced lines), reducing WIP. The balancing methodology also aims at minimizing the number of stations on the line; the sequencing technique also provides uniform parts usage, which is a typical goal in just in time production systems.

O E Carcano, A Portioli-Staudacher, in their paper ‘Integrating inspection-policy design in assembly-line balancing’[2]. Different inspection policies yield different manufacturing, reworking, inspection, and external failure costs. While, in the literature, assembly-line balancing and inspection-policy design have usually been addressed as different problems, they are strongly interrelated. Inspection tests require time to be carried out, and thus their assignation directly influences the results of the assembly-line balancing procedure, that is the number of stations that are necessary and hence the line installation cost. Thus, the advantages of integrating inspection policy design in assembly-line balancing are clear, but to our knowledge no such model is available yet. In this paper, a new model that simultaneously defines inspection policy and assembly-line balancing is presented.

Peng Liu, Lang Li in their paper, ‘The Application and Research of a Simulation-Based Line Balancing Method’ [3] paper applies a Line balancing method and the object oriented modelling technology. Firstly, the simulation

model of the box stream Line is set up and, the bottleneck is found out and analyzed with the model. Secondly, the rebuilt strategy based on the principles of ECRS (Eliminate, Combine, Rearrange, and Simple) and the theory of production Line balancing is given and evaluated by the model. Finally, comparing with the former production Line, implementation of the new strategy makes the production efficiency and quality improved greatly.

Waldemar Grzechca in his paper, ‘Cycle Time in Assembly Line Balancing Problem’[4] assembly line balancing problem is discussed. Author focuses on cycle time. The importance of its value is shown. Different measures of final results of assembly line balance are presented. A numerical example is calculated. At the end remarks and final conclusions are given.

M E Salvesson in his paper, ‘The assembly line balancing problem’[5] assembly line balancing problem (ALBP) consists of assigning tasks to an ordered sequence of stations such that the precedence relations among the tasks are satisfied and some performance measure is optimized. In this survey paper we give an up-to-date review and discuss the development of the classification of the assembly line balancing problem (ALBP) which has attracted attention of researchers.

S Ghosh, R J Gagnon in their paper, ‘A comprehensive literature review and analysis of the design, balancing and scheduling of assembly systems’[6] the results of a comprehensive review and analysis of the assembly line balancing literature. Quantitative developments and qualitative issues are addressed at both the strategic and tactical levels. The numerous quantitative and qualitative factors which the literature mentions could impact the design, balancing and scheduling of assembly systems are organized into an eight-level hierarchical, factor/decision taxonomy. This comprehensive taxonomy is used to assess our progress in assembly system design and operation.

III. METHODOLOGY

Methodology adopted for line balancing as follows

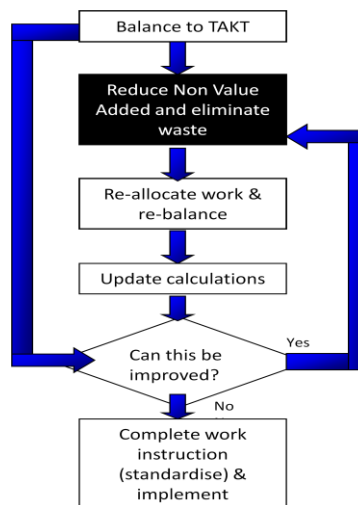


Fig.1 flowchart for line balancing

IV. CALCULATION

Cycle time:

Cycle time (TAKT time) = available time / desired output

Assigning work to workstation:

No of workstation = sum of task time /desired actual time.

A. REMOVING NON VALUE ADDED ACTIVITIES

Value Adding: Any process that changes the nature, shape or characteristics of the product, in line with customer requirements .ex: machining, assembly.

Non-Value adding: Any work carried out that does not increase product value ex. inspection, part movement, tool changing, and maintenance.

Waste: All other meaningless, non-essential activities that do not add value to the product you can eliminate immediately e.g. looking for tools, waiting time.

B. WORK BALANCING AT EACH WORKSTATION

Example:

If cycle time (TAKT time) = 30 min

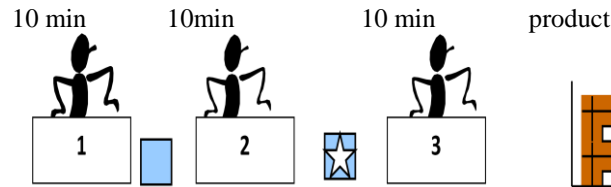


Fig.2 Assembly line balancing

C. DISTRIBUTION OF WORK LOAD

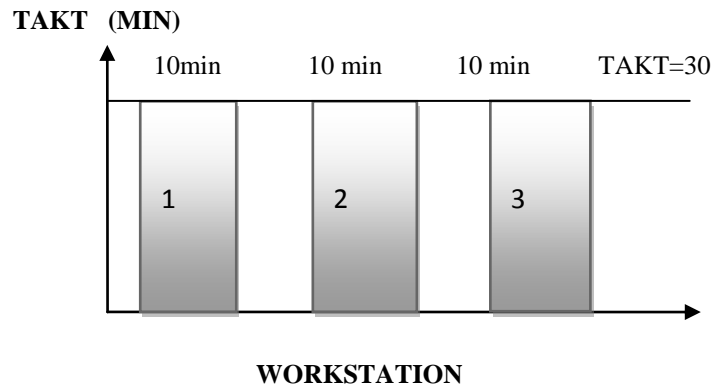


Fig.3 Distribution of work load

Line balance ratio = total work content / no of stations *longest operation

Line efficiency = $e = \frac{\sum tw}{M * T}$

V. CONCLUSION

The key outcome of this paper was the reduction in cycle time for single model assembly line, efficiency increases by reducing non value added activities, other outcomes were that assembly line balanced by recommending new layout.

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