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A Case Study at Eicher Motors Limited, Indore (MP) for Optimize Delay Period in Assembly Line using Kilbridge Wester Methods and to Enhance Productivity and Efficiency of Production

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Abstract:
An assembly is a process by which manufacturing parts are put together to make the finished product. An assembly line is a moving conveyer that passes a series of work station in a uniform time interval. The assembly line balancing problem consists in allocating the task to the station subject to the technological precedence relation, the cycle time restriction of the station and the individuality of the tasks. When the assembly line is arranged in a straight line, it is commonly referred to as the Traditional Line Balancing Problem. In this research work Rank Positional Weight Methods for Type 1 Problem (Reducing the work station by keeping cycle time constant) for Assembly Line Balancing problem is described as an analysis for the methods. It consist of assigning task to work stations such that the number of stations is minimized for a given production rate and cycle time for M/S Eicher Ltd. In this Problem, precedence constraints between the tasks have to be considered. The Data were collected in table. 1. Form according to descriptions of tasks.

Key words: Heuristics, scheduling-line balancing, manufacturing systems, model sequencing.

I. INTRODUCTION:

An assembly line consists of a sequence of m work stations which are connected by a conveyor belt. Each station repeatedly has to perform a set of tasks on consecutive product units moving along the line at constant speed. Because of the uniform movement of the line each product unit spends the same fixed time interval, called the cycle time c, in every work station. As a consequence, the cycle time c determines the production rate which is 1/c. Tasks or operations are indivisible elements of work which have to be performed to assemble a product. The execution of each of n tasks j = 1 ..... n requires a fixed time interval, the task time tj which is assumed to be integral. Due to technological restrictions precedence constraints partially specifying the sequence of tasks have to be considered. These constraints can be represented by a precedence graph containing nodes for all tasks and arcs (i, j) if task i has to be completed before task j can be started.

Table .1.Data Collection:-

Sr No.	Task	Activity Description	Task Time (T_e) In Min.
1	A	Main Washing m/c 1	4.50
2	B	Main Washing m/c 2	7.33
3	C	Washing m/c Unload	6.42
4	D	Panting	4.00
5	E	Panting Rear axle	4.00
6	F	Hub & Bolt Washing	4.55
7	G	Hub & Bolt Pressing (150 T Press)	6.22
8	H	Hub & Drum assembly	3.40
9	I	Bearing Races Pressing (20 T Press)	3.20
10	J	Hub Gearing	2.57
11	K	Oil Seal Pressing	1.90
12	L	Bearing Greasing	0.80
13	M	Shim Selection	4.00
14	N	Differential Line Case Crown assembly	7.50
15	O	Press B	3.93
16	P	Checking	1.42
17	Q	Final assembly (Differential)	4.80
18	R	Press C	4.28
19	S	Conveyor 1	3.00

Literature Review: Salvenson first published the article addressing the integer programming problem. They can be broadly categorized by the solution procedures employed to the solve the problem, including integer programming, dynamic programming and heuristic approaches. Kilbridge , Wester and Ignall provided an excellent review of these approaches. Salvenson formulated programming problem incorporating all possible combinations of tasks assignments to stations. Bowman removed this problem by formulating the integer programming problem depicting task assignments to stations Dynamic

programming formulation were contributed by Jackson Held and Kao and Queyranne while Held and Karp and Schrage and Baker presented dynamic programming formulation in the general context of sequencing with precedence relations. Dynamics Programming algorithms. Significant contribution on the implementation of multiple parallel stations problems have been made by pinto using first a Branch and Bound approach to a mixed-integer program having a total cost objective and later a heuristic network procedure based on the shortage path algorithm.

PROBLEM FORMULATION, AT EICHER MOTORS LTD. INDORE

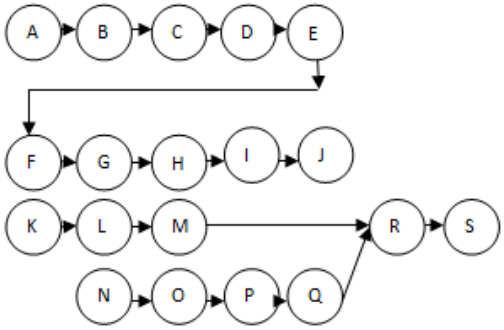


Figure.1. Precedence diagram for RPW methods

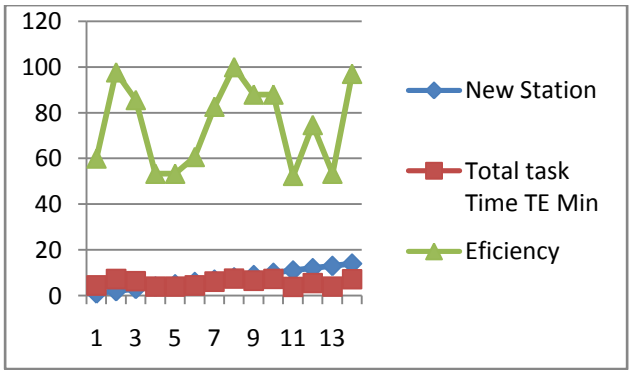
In the present work, the objective to reduce the number of stations or to find out optimum number of stations this is called as TYPE-1 Problem. Heuristic RPW method is used by taking real data from an industry EICHER LTD for MCV EICHER is one of the major and renowned Truck manufacturing companies at Indore. The Company is producing variety of trucks out of these models are the major models for which the existing line has been set up. The cycle time for each work station is 7-5 Min. The Company has large range of the products like HCV, LCV, LCV1090 , and MCV. The company is located in pithampur, indore MP The Company has well equipped modern machineries for its assembly operations. The Company is having multi product mixed model assembly line for producing variety of products at the same time. In multi product mixed model assembly line balancing the model having related same operations are grouped together their operation are considered as the chromosomes of the same family and accordingly grouped. Then as per the requirement of the models in the same part family are assembled at the same time. If the product is the different part family is required the set-up is changed and the assembly operation of the same part family can start. Data for the present work has been collected was as follows: for MCV, 55 % line efficiency, 19 work stations requires and the cycle time is 7.5 min, the total number of tasks 19,. Standard time and precedence of the various activities performed on the assembly line for products are taken from start to end operation. Standards time and precedence of the various activities performed on assembly line for both the products are taken from start to end operation. The collected data is shown in tabular form descriptions of the tasks are presented in table.

Solution:- Kilbridge and Wester's Method (KWM):-

It is a heuristic procedure which selects work elements for assignment to stations according to their position in the precedence diagram. This overcomes one of the difficulties with the largest candidate rule (LCR), with which elements at the end of the precedence diagram might be the first candidates to be considered, simply because their values are large.

Table .2. For Kilbridge wester method and for efficiency

Sr. No.	New Station	Total task Time T_E Min	Eficiency	$T_C - T_E$	$(T_C - T_E)^2$
1	1	4.5	60	3	9
2	2	7.33	97.73	17	0.0289
3	3	6.42	85.60	108	1.1664
4	4	4	53.33	35	12.25
5	5	4	53.33	35	12.25
6	6	4.55	60.67	295	8.7025
7	7	6.2	82.67	13	1.69
8	8	7.5	100	0	0
9	9	6.6	88	9	0.81
10	10	7.4	88	1	0.01
11	11	3.93	52.4	357	12.7449
12	12	5.6	74.67	19	3.61
13	13	4	53.33	35	12.25
14	14	7.28	97.07	22	0.0484



The graphical representation shown in the following graph between the total task time in minute and efficiency for KWM method.

Table.3. Result from Kilbridge –wester method (cycle time is 7.5 minutes)

Sr. No.	Description	Present method	Ranked Position Weight method
1	Cycle Time	7.5 min	7.5 min
2	No. of work station	19	14
3	No. of Operations	19	19
4	Delay Period	45.41 %	25.91 %

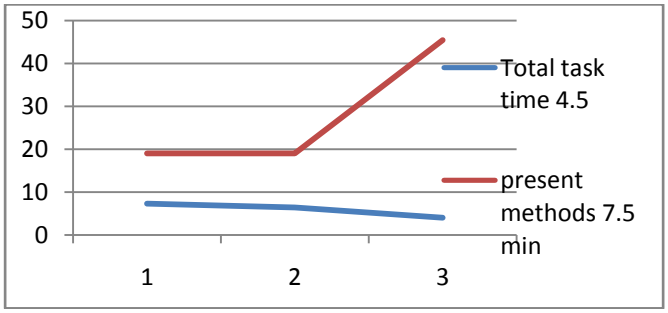


Figure.1. Result between task time and Present Method (Kilbridge wester)

II. CONCLUSION

By the present analysis it is concluded that method applied give the better results than the present methods which is using by EICHER MOTORS LTD. We can say from above conclusion that the delay period can be reduced if we apply these methods in the industry the present traditional method. In present industrial scenario assembly line balancing procedures are commonly implemented by manual procedures.

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