Proceedings of the 2016 Winter Simulation Conference
T. M. K. Roeder, P. I. Frazier, R. Szechtman, E. Zhou, T. Huschka, and S. E. Chick, eds.

A SIMULATION STUDY ON THE EVALUATION OF ALTERNATIVE PLANS AND DRAWING AN UPPER LIMIT FOR THE PRODUCTIVITY IMPROVEMENT OF A FLOW SHOP CONSIDERING THE WORK WAITING TIME

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ABSTRACT

Process improvement is a major requirement for a production manager who aims to reduce cost and achieve the target throughput. To achieve a target throughput, load balancing is commonly conducted, and resource investment is examined such as adoption of automation machine or hiring of new employee In this study, the impact of the waiting time caused by a moving conveyor is investigated based on discrete event simulation through a series of improvements scenarios, and the feasible design variables of conveyor line which can satisfy the target throughput is suggested.

1 INTRODUCTION

In this study, to increase the accuracy of inaccurate process capability prediction, a methodology using factory simulation was applied to an actual case, and the results were introduced. An existing methodology for process capability and process improvement was examined. And, for the conveyor assembly line of an actual manufacturing company, the planned process scenario was investigated by performing production process modeling and simulation based on discrete event. Then, a guideline for the design of a production system was suggested by figuring out the factors that are easily overlooked in terms of process capability prediction and process improvement**.**

2 PROCESS MODELING BASED ON DES AND USECASE OF SIMULATION

A discrete event simulation is conducted with respect to the electric module production line shown in Figure 1. The target process manufacture a single product, and 41 work cells are arranged as an 'U' type layout with conveyor system. The use case of the simulation included verification of the process design of the current process, verification of the suggestions for process improvement, and deduction of process design information. The target process should secure a high level of UPH(Unit / Hour), and the plan is to increase the utilization of current operation by 2~3 times.

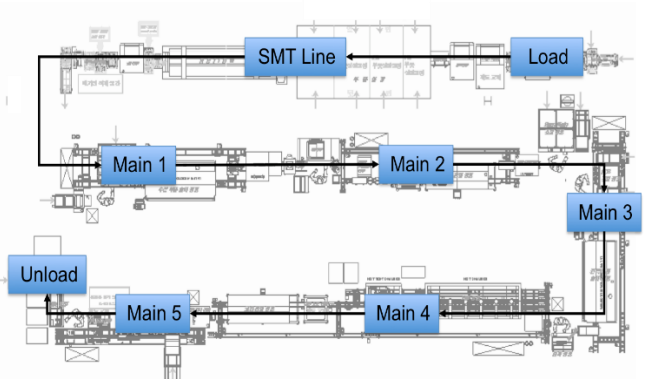

Figure 1: layout of electric circuit production line

3 ANALYSIS RESULT OF SIMULATION SCENARIOS

		Current status		Interim status		Target status		
		Initial Target (EA)	Alternative 1 (EA)	Interim Target (EA)	Alternative 2 (EA)	Final Target (EA)	Alternative 3 (EA)	Alternative 4 (EA)
UPH	Object	62.5	←	144	←	180	←	←
	SMT	121.6 (242.2)	124.7 (249.4)	124.7 (249.4)	124.7 (245.6)	124.8 (245.6)	124.8 (245.6)	124.8 (245.6)
	Main1	39.1 (78.2)	52.1 (104.2)	52.1 (104.2)	63.9 (127.8)	69.4 (138.8)	69.5 (139.0)	68.5 (137.0)
	Main2	74.7	74.7	100.1	123.5	133.3	133.3	132.1
	Main3	71.0	96.4	96.4	118.9	125.9	128.2	129
	Main4	67.3	67.3	94.6	116.1	116.2	121.0	123.1
	Main5	63.0	63.0	89.8	109.5	109.8	113.9	118.5
	Target	62.5	←	144	←	180	←	←
Critical Process	Bottle-neck	OP300, 440, 500	OP500	Improved	-	-	-	-
	Waiting	OP300, 320, 440	OP300, 320, 400	OP440	OP440	OP440	-	-
Significant of model		Huge variation among each production facility Unstable production line	2-fold improvement of production capacity of OP300, OP320, OP440	2-fold improvement of production capacity of OP440 ,OP500 elimination of arithmetical bottle-neck process	Based on the 2-fold improvement of OP500 capacity Max. CT 25sec Line Balancing	Max. CT 20sec Line Balancing	2-fold improvement of conveyor speed	Consideration of safety stock
Elucidatory notes		Capacity of SMT line = Capacity of Main line x 4	Remarkable bottle-neck of OP500	Severe UPH variation of end of Main5	Necessity of line balancing is magnified	Remarkable decrease of UPH from the Main4	Effective result from the increase of the conveyor speed → UPH increase by 5~6	Target UPH is achievable when 7 PCB magazine is secured

4 CONCLUSION

Production capacity is a main factor that is associated with a production plan and a sales plan. If the analysis of production capacity is incorrect or the suggestion for process improvement is planned incorrectly, critical problems would occur such as the inappropriate facility investment cost and the frequent overtime work at production sites or customer dissatisfaction as the requirements of the market cannot be met.

In this paper, a discrete event simulation for examining the suggestion for process design and the plan for process improvement is conducted by selecting a typical line process, and the process improvement elements and the process for drawing an upper limit for process improvement is defined. Also, the effective waiting time of each facility is analyzed, and it is pointed out that the bottleneck process may not be a process that actually requires the longest time within the line and also may not be an upper limit for process improvement.