International Journal of Business and Management Study – IJBMS
Volume 2 : Issue 2 *[ISSN : 2372-3955]*
Publication Date: 19 October, 2015

Finding Suitable Conveyor Velocity for a Company

İsmet SÖYLEMEZ, Ahmet DOĞAN*, Uğur ÖZCAN

Abstract **– In this study, a simulation model is given for simplify to decide velocity of the new conveyor system. Because high velocity conveyor means high costs investment. Managers have a problem to decide what the most suitable and enough conveyor velocity is. A machine at full capacity never be preferred instead of the required capacity of a machine to decrease investment costs. The semi-finished products will be transported placed on the conveyor line. A new conveyor system to be established for a company is very important for decrease investment costs. Using simulation model helps what the sufficient and enough velocity are for new conveyor system.**

Keywords- **conveyor, cost, simulation.**

I. Introduction

Nowadays, the most appropriate new investment decisions bases on firstly minimum cost and secondly considering unnecessary amount of investment. For instance, a machine at full capacity never be preferred instead of the required capacity of a machine to decrease investment costs. Before the investment decision by managers, they should simulate to evaluate some values (e.g. work in process, waiting time etc.) of their new system. This study is conducted to meet the needs of company. Using simulation models help what the sufficient and enough velocity are for new conveyor system.

Thus, they will be folded to excessive investment costs. Some works have been done for the conveyor system is as follows. Foncesa et al. (2004) decided to select suitable conveyor type using some criteria for real cases. Zhang and Xia (2010) investigated energy efficiency of conveyor belts. They considered to decrease required energy for production process and compared with current situation. Energy efficiency classified under 4 main title: performance, operation, equipment and technology by Xia and Zhang (2010).

İsmet SÖYLEMEZ
Gazi University/ Industrial engineering
Turkey

Ahmet DOĞAN* (Corresponding Author)
Gazi University/ Management Information Systems
Turkey

Uğur ÖZCAN
Gazi University/ Industrial engineering
Turkey

In this study, equipment efficiency considered for conveyor system based on Xia and Zhang (2010). This study is done to prevent unnecessary equipment costs for conveyor velocity.

In this study;

- What the information about the current situation is (products, machines, current product transportation systems etc.)
- The proposed system (new conveyor system and how to perform the procedure)
- The simulation model of the proposed conveyor line of products will be installed and calculated the average waiting time for a different line velocities.
- Evaluation of the results and the selection of which is appropriate for conveyor velocity.

The purpose and scope of the study is given second section of the study. In the section 3, the current and new conveyor system are mentioned for a company. Results are given in the last section.

II. The purpose and scope of the study

The basic elements constituting the cost of a product can be called; raw materials, production, transportation, storage and labor costs. Japanese lean manufacturing production system has seven basic wastages which are described as follows: overproduction, inventory, waiting, motion transportation, rework and over processing. In this study, the purpose is of reducing transportation costs for establishing new conveyor system.

Company that has made this study that has a continuous production system. Two different types of products are manufactured in the company. The differences between these products during packaging process but not with differences in the production stage. Product-1, while has packaging directly, Product-2 has weighing process which is carried out before the product packaging process. Products obtained from the 14 machines are moved using forklifts in the current production system.

There are two basic aim which are removal of the machine and operator costs, secondly easy transportation using conveyor system. Through this line will be completely removed machine and human costs for production. This conveyor system to be established for company is very important for decrease investment costs.

Managers aim to buy a new conveyor systems with features that will be sufficient and enough for them. The average velocity of the conveyor requested the establishment of the company shall be determined by this study. Line system suited to the needs of the business will be determined using this feature.

III. A Case Study

The processing time for this product is given in Table 1. The semi-finished products will be transported placed on the conveyor line. This handling of the processing time must be determined accurately in order to prevent standby. These data are obtained company database and arranged using data mining techniques such as data preprocessing.

TABLE 1. PRODUCTION TIME FOR MACHINES

Machines	Time(min)
M-1	8,88
M-2	9,37
M-3	9,27
M-4	10,05
M-5	7,89
M-6	7,56
M-7	8,93
M-8	5,06
M-9	10,08
M-10	9,73
M-11	8,77
M-12	9,33
M-13	11,36
M-14	11,36

Operation of the production flow system is provided as follows. 14 machines are parallel located. When a product is produced, forklift operator moves towards packing process. If forklift is not available, the machine must stop production until finished product is taken. After the transportation, products are moved either packing directly or firstly weighted and then packing. When this packing process is done, finished products are moved storage area.

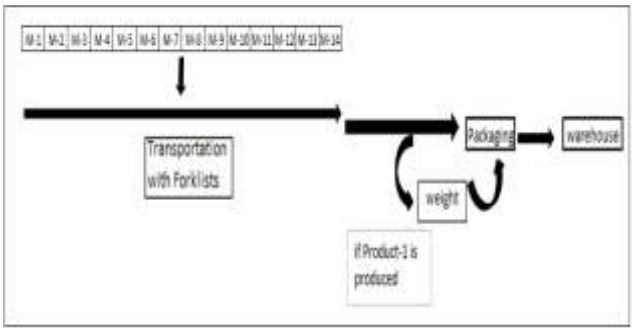

Figure 1. Current production flow

The new production system has a conveyor system unlike previous system. Thanks to new transportation system, forklift will not be used. However, managers have a problem to decide what the most suitable and enough conveyor velocity is. This velocity is defined using simulation model with using Arena 14.0.

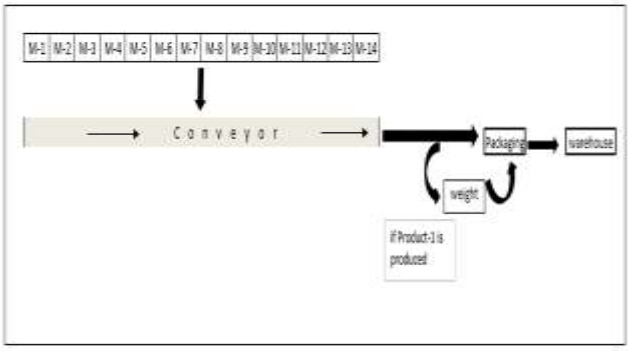

Figure 2. Production flow with conveyor

Simulation model figure is given at Figure 3. There are 14 “create” (for each machines) and a “conveyor” (for transportation) modules. 16 “process” model is used and 14 of them is for first production process, one of them is weighting for Product-2 and last one is packing process for both products. There are a “decision” module shortly before weighting process modules for distinguishing products for weighting process.

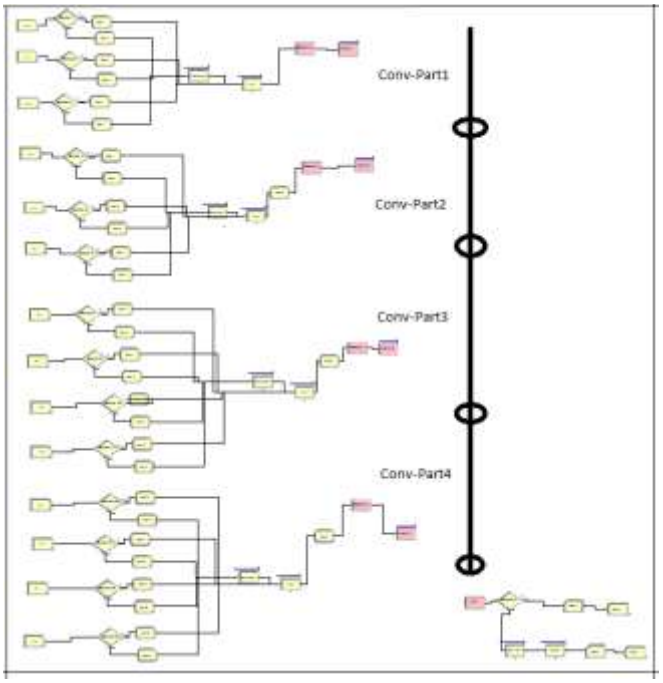

Figure 3. The simulation model of arena 14.0

IV. Results

Consequently, the aim of this work was carried out to determine the velocity of the conveyor line will be sufficient and enough. The conveyor system has four part. Our solution is given according to these each parts. The following Table 2 shows the part of the conveyor for products waiting times and different velocity values. For example, if conveyor velocity is one meter for each

minutes (meter/minutes), waiting time for each product is 0,222 minutes first part of the conveyor and second part of the conveyor waiting time is 0,279 min.

TABLE 2. CONVEYOR VELOCITY AND PRODUCTS WAITING TIME

	Velocity (m/min)					
Part of the conveyor	**1**	**2**	**3**	**5**	**10**	**50**
Conv-Part1	0,222	0,124	0,084	0,033	0,008	0,00032
Conv-Part2	0,279	0,142	0,085	0,042	0,012	0,00024
Conv-Part3	0,478	0,170	0,095	0,053	0,014	0,00029
Conv-Part4	0,637	0,192	0,116	0,065	0,026	0,00036

If a company decide to setup a new conveyor system for moving products instead of forklifts, they must give a decision about conveyor velocity. Because conveyor costs depends on conveyor velocity. There are a bit different between 5, 10 and 50. Therefore velocity of 5 will be efficient and enough for new conveyor.

Providing of minimizing the waiting time will be less costly for businesses to take the smallest velocity of the conveyor. High velocity conveyor means high costs investment. Thus, a simulation model is given for simplify to decide velocity of the new conveyor system.

References

[1] Fonseca, D. J., Uppal, G. and Greene, T. J. A knowledge-based system for conveyor equipment selection, Expert Systems with Applications, 26, (2004), 615–623.

[2] Zhang, S. and Xia, X. Optimal control of operation efficiency of belt conveyor systems, Applied Energy, 87, (2010), 1929–1937.

[3] Xia, X. and Zhang, J. Control systems and energy efficiency from the POET perspective. IFAC Conference on Control Methodologies and Technology for Energy Efficiency, 29-31 March, 2010.

About Author (s): İsmet SÖYLEMEZ

Gazi University/ / Industrial engineering / Research Assistant

Research Interests:

Production And Operation Management, Assembly Line Balancing, Distributed Decision Making, İnteger Programming And Large-Scale İndustrial Optimization, Stochastic Modeling ,Service Parts Logistics, Semiconductor Manufacturing, Simulation.

About Author (s): Ahmet DOĞAN*

Gazi University/ Management Information Systems/ Research Assistant

Research Interests:

Management Information Systems, Decision Support Systems, Fuzzy Logic, Fuzzy Multi-Criteria Decision Support Systems, Production And Operation Management, Supply Chain Management, Costumer Behavior, Decision Making Methodologies

About Author (s): Uğur ÖZCAN

Gazi University/ Industrial engineering/Associate Professor

Research Interests:

Meta-Heuristics, Decision Support Systems, Assembly Line Balancing, Multi-Objective Optimization, System Analysis, Design And Safety, Supply Chain Management, Decision Making Methodologies, Risk And Decision Analysis, Simulation, Flexible Manufacturing Systems, Stochastic Modeling,