

Auto Roll Foam Line Design and Optimization

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Abstract – With the impact of globalization, the competition dimensions among enterprises began to differentiate. Businesses should investigate to provide new production methods to adapt new competitive conditions. In order for the enterprises to respond quickly and in the desired quality to the consumer demands; production system depends a new understanding which is kept waiting at a low level and most importantly all wastes are eliminated and without staff. The project has been developed for the production of roll foam. Foam sector is growing fast and 8 million in domestic market in 2017 sales volume reached. 45 percent of the market is composed of roll foam. The annual growth rate of the sector is 5 percent; the market size is close to 1 billion TL. The subject of the project is about the production of sofa, bed, automotive, home textile, medical products, lamination etc. Foam is the main input of the production activities. Today, almost all of the foam production stages in our country are realized with the labor force. Foams coming from the casting and waiting on the shelf are taken to the conveyor by shuttle and transported to the foam peeling machines by crane for cutting. In the scope of the researches, roll foam production machines that work in different logic are examined. There is no roll of foam production machinery manufacturers in Turkey. In this sector, there is no integrated structure or similar work that will produce cylinders that automatically take the foam from the shelf. The project will be the first industrial 4.0 application in the sector. With the machine and special software developed in our company, customer demand will be answered quickly. The aim of the project is to design and implement a system that will produce a roller foam having a diameter of 1.6 m or more and a thickness of 5 mm or less from a 30 mm block foam. One of the main performance indicators of our project is to increase our foam cutting speed to 70m / min. For this purpose, cutting speed parameters have been formed according to foam density by using plc controlled servo motors. The project will produce mixed structure foam and will provide an infrastructure for export. With the new line to be designed in CAD environment, one operator will be used instead of 5 operators, 30 m block foam will be poured instead of 15meter block foam. The foam roll will be cut for less than 5 mm thickness for the first time in the foam cutting plant and rolled into rolls larger than 1.6 meters.

Keywords – Foam, CAD, casting, shuttle, cutting speed

I. INTRODUCTION

In this TUBITAK approved project number 3170934, with manufacturing furniture and foam in Kayseri Industry, Kilim furniture and trade inc. working about optimization and design of automatic foam roll manufacturing machine

The roll foam production line, which is produced by the classical methods in the enterprise will be re-designed as genuine. With the new designed machine, the final roll foam will be produced by feeding from block foam automatically.

With this implementation, wastes will be eliminated in the roll foam production line, thinner size (under 5 mm) foam cutting can be made, standard cut quality will be obtained, in the current situation 15 mt produced and adhesively 30 mt of foam produced instead of monolithic foam production of 30 meters, the rate of waste occurring in the layer will be reduced and the speed and cutting capacity will be increased by 2 times.

In this way, product variety and added value will be increased with thinner segments so export potentially is higher than before. With increase productivity and capacity cause to high competitiveness.

Project are including specify to necessary, create the technical targets for new projection, design in computer

environment (CAD),simulation, studying analysis, creating automation's unit and special software development, choose the material, prototype production, experimental works.

II. MATERIALS AND METHOD

Project be composed of 3 work packages.
Itinerary;

1.Work Package:

- Firstly, make analyses for situation and collecting data acquisition for optimisation.
- Drawing the current work flow and layout
- Determine the sales demand for roll foam
- Determine the process flow chart
- Measurement of process times from production of block roll foam to shipment and calculate MLT (Manufacturing Lead Time)

2.Work Package:

- Making analyses of FMEA for shipment, transfer, production and take the foam in shelves.
- Drawing to Spaghetti Diagram

- Drawing the current production line in scale and showing the line in this drawing, mapping the current situation.
- Taking the statistics of the product-based foams produced from the planning department for the year 2016-2017 and creating the demand statistics for the roll foam and
- determination of stock levels
- Determine the process level
- Make the time study

3.Work Package:

- Testing of assembly suitability and mechanical manufacturing
- Integration of automation system
- Mechanical and software testing and control of the designed mechanisms
- Elimination of deficiencies and development of the system
- Creation and commissioning of new line

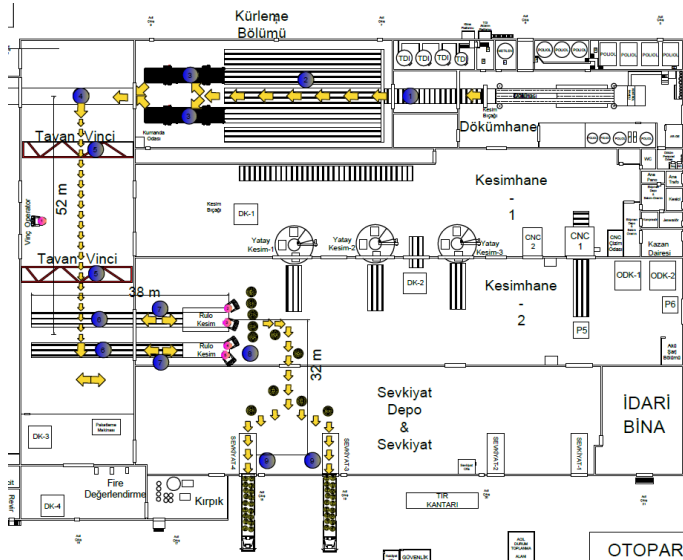


Fig-1 Current layout

III. RESULTS

Current situation 0,5 cm for 210 m roll Fig-1;

- Work step 1:** Transfer of foam from production to rack $35+43+35 = 113$ sn
- Work step 2:** Transfer of foam to rack. $43+35=78$ sn
- Work step 3:** Block transfer to the middle belt 54 sn
- Work step 4:** Transfer of the crane in the middle belt to the stacking place 351 sn
- Work step 5:** Crane transfers the block in the stack to the machine 120 sn
- Work step 6:** Cutting time 840 sn

Total manufacturing lead time (MLT) 1556 second

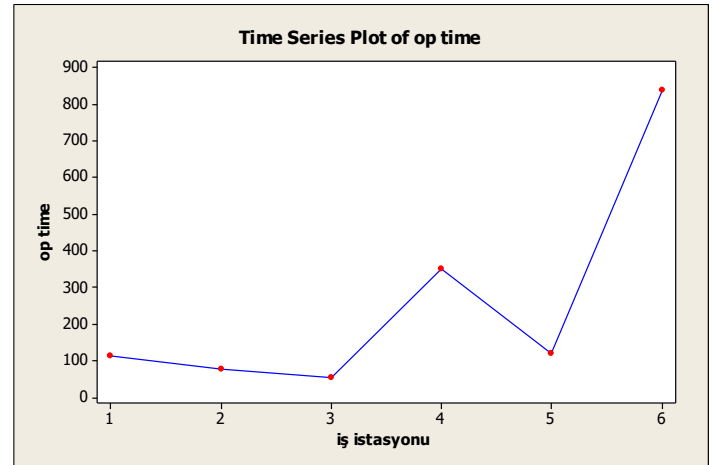


Fig-2; Time series plot of work flow

Future plan situation 0,5 cm for 210 m roll Fig-3

- Work step 1:** Transfer of foam from production to rack $75+43+75=193$ sn
- Work step 2:** Transfer of foam to rack $75+43=118$ sn
- Work step 3:** Block transfer to the middle belt 116 sn
- Work step 4:** Cutting time 180 sn

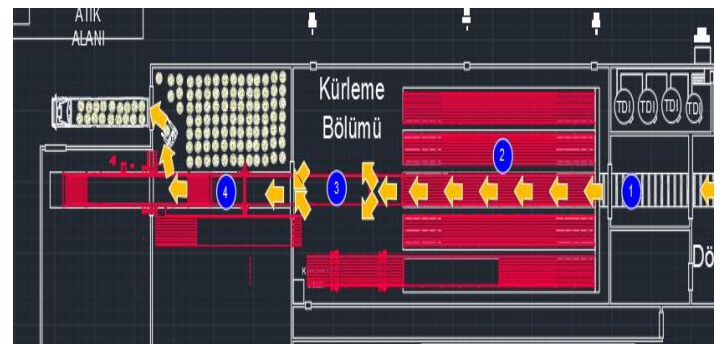


Fig-3 Future plan layout

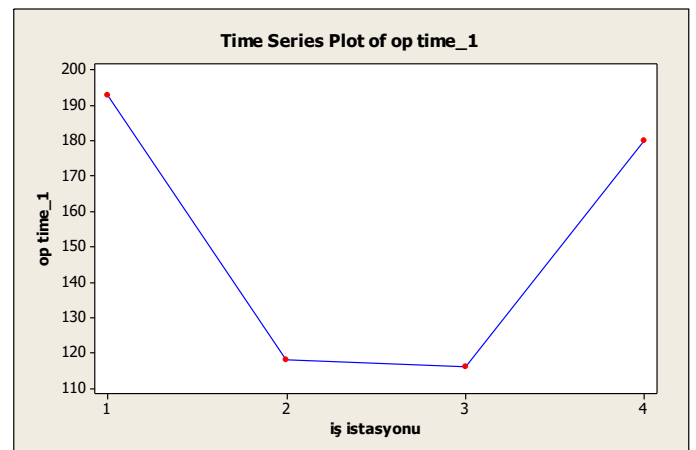


Fig-4; Time series plot of work flow

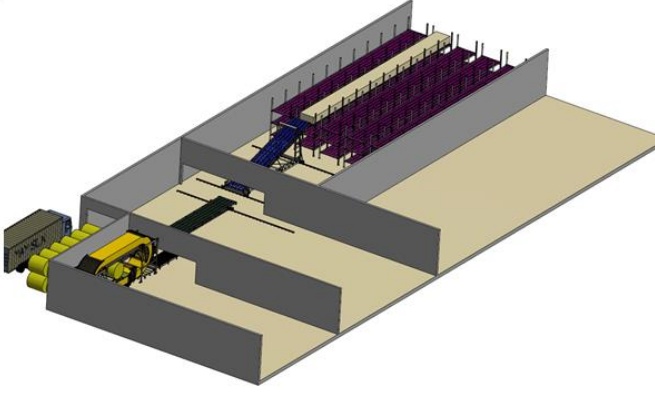


Fig-5 New layout of roll foam production line desing

CONCLUSION

Currently, the production time of a roll will be 607 sec with line placement from 1556 sec and the line will be improved by 61%. Fig-6

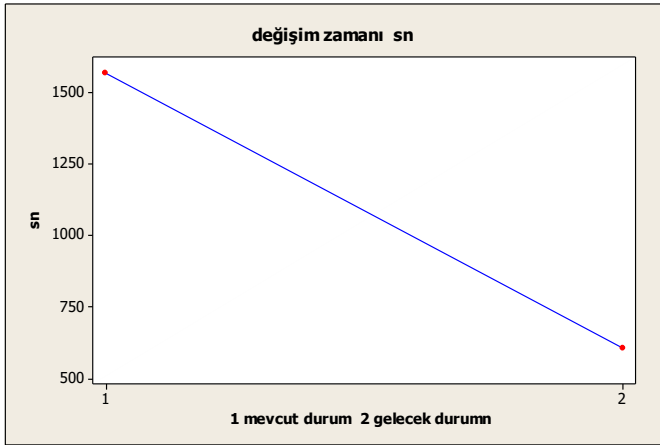


Fig-6 current situation & future situation

REFERENCES

- [1] 1501 Sanayi Ar-Ge Projeleri Destekleme Programı PRJ-NO 3180005