

Improving Layout and Efficiency of Assembly Area

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Abstract

Within industrial engineering, student teams are hand-picked to work on a company sponsored project. Hoffer Plastics is sponsoring a project aimed to optimize one of their machines, which had an inefficient layout as well as high variation between processes from worker to worker. Using time and motion studies, data analysis, and 5S, we studied and analyzed the current state of the production area. Our recommendations are based on implementing lean tools like 5S+1 audits, layout improvements, and an analysis of ergonomics.

Introduction

Hoffer Plastics was founded in 1953 by Bob and Helen Hoffer. Hoffer Plastics soon became a leader in custom injection molding offering a variety of injection molding services. The current workstation and surrounding areas have a less than optimized layout along with cluttered workstations which hinders worker efficiency. The lack of standard processes cause variation from worker to worker and creates waste in the area.

Objectives

- Identify and reduce the amount of waste produced
- Update and create SOP for liner 7
- Implement a 5S+1 audit
- Improve layout for liner 7 and surrounding area

Data Collection & Results

The current layout of Liner 7 is a U-shape flow with opposite inbound and outbound sides. Figure 1, shows the flow of material through liner 7.

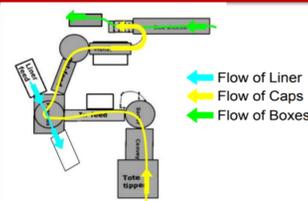


Figure 1: Map of Liner 7

To measure the current state, spaghetti diagrams were used to visually represent the path of the worker operating Liner 7. Spaghetti diagrams were used to visually represent the path of the worker operating liner 7, for tote- and box-filling layouts. From spaghetti diagram workers showed variation in completing tasks, long travel distances of walking around liner 7 and clutter around the machine.

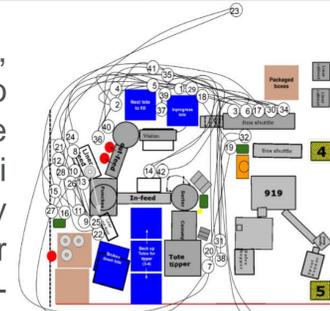


Figure 2: Spaghetti Diagram 1

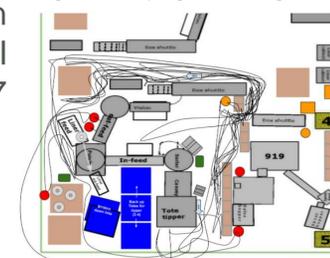


Figure 3: Spaghetti Diagram 2

A current state flow process chart was created based on video that was used in a previous spaghetti diagram. For roughly 20 minutes the operator did a total of 50 tasks. The total travel distance by the operator was 965 feet, and 4:32 (mm:ss) was spent on the operator walking around the liner machine.

	Operation	Transport	Inspection	Delay	Storage
Count:	25	21	1	3	0
Time per process step:	11:20	04:32	01:10	00:55	00:00
Total VAs	14	Total NVAs	25	Total ENVAs	11
VAs Time	07:33	NVAs Time	06:30	ENVAs Time	03:54
Distance traveled	965	Lead Time	17:57	VS Ratio	42.061%

Figure 4: Results of Process Flow Chart

Ergonomics was taken into consideration once it was noted many of the tasks forced the worker to bend over, reach outside of their immediate area, and lift heavy objects. To analyze the worker's ergonomics, pictures were captured and put into 3D Static Strength Prediction Program as seen in Figure 5.



Figure 5: Ergonomic picture of lifting box off shuttle

Recommendations & Conclusions

The following layout alternatives were developed to address the areas of waste:

- Proposal 1: Reverse outgoing filled boxes. Finished boxes share a packing area with machine 919.
- Proposal 2: Tote-tipper & conveyor are rotated, along with the box shuttle. U-shape flow
- Proposal 3: Box shuttle is rotated 180 degrees. New free space is used for WIP and equipment storage against the back wall.

The company can implement 5S:

- Sort: Tag area to identify waste
- Set in order: Floor markings, designated tool/equipment storage
- Shine: Visual aids, cleaning schedules
- Standardize: Update and create SOPs
- Sustain: Management given tool to enforce changes

Layouts and corresponding cost analysis will be presented to the company. On top of the layouts, recommendations for how to implement each stage of 5S will be given for Hoffer to slowly implement until all stages are live on Liner 7. This ranges from keeping the area clean, creating a proper storage for WIP, personal workstations for each machine, and visual aids.

Acknowledgements

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