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Process Improvement for Material Breakdown

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Process Improvement for Material Breakdown

Problem Statement

- Cardinal Glass Industries is a management-owned S-Corporation. They develop residential glass for windows and doors. Cardinal Glass has around 6000 employees in 37 locations across the United States and two research centers located in Wisconsin and Minnesota. Their goal is to design and fabricate the most advanced residential glass products in the industry.
- The problem that they are facing right now is maximizing the efficiency of cutting down foam blocks and sponge material. The foam blocks are used during the key-in process while the sponge material is used for wiping excess glue off the glass.

Disciplines

Bioresource and Agricultural Engineering | Industrial Technology

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Department of Agricultural and Biosystems Engineering (ABE)

TSM 416 Technology Capstone Project

Process Improvement for Material Breakdown

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Client: Cardinal Glass, 716 NE 6th St, Greenfield, IA, 50849, <https://www.cardinalcorp.com/>

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1 PROBLEM STATEMENT

- Cardinal Glass Industries is a management-owned S-Corporation. They develop residential glass for windows and doors. Cardinal Glass has around 6000 employees in 37 locations across the United States and two research centers located in Wisconsin and Minnesota. Their goal is to design and fabricate the most advanced residential glass products in the industry.
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Business Case Statement

Department of Agricultural and Biosystems Engineering (abe@iastate.edu) aims to be a premier team serving society through engineering and technology for agriculture, industry and living systems. ABE welcomes opportunities to discover and improve new technologies for all stakeholders. 1

- A. The material breakdown process is taking up too much time for the cell worker.
- B. The problem is not extensive as it only takes up one cell worker's time.
- C. The process cycle time is longer than it should be and occurs only at one workstation.
- D. Reducing the cycle time would ultimately increase efficiency for the worker involved as well as improve the overall process flow on the floor.

2 GOAL STATEMENT

- **Main Objective(s) and Specific Objectives**
 - **The main objective is to**
 - Minimize labor and increase efficiency with the new process by 50%.
 - Implement the new process and inform the workers on how to use it effectively.
 - Reduce cutting time for foam block from 12 minutes and 20 seconds to six minutes.
 - Reduce cutting time for foam sheets from 4 minutes to 2 minutes. Complete and deliver a finalized project by the beginning of April.
 - **Specific objectives include:**
 - Client Criteria 1: Reduce breakdown time for foam blocks
 - Client Criteria 2: A more efficient process for cutting sponge material
 - Constraint 1: Foam block is not dense and tends to crumble easily.
 - Constraint 2: Sponge material is not replaceable given its material properties.
- **Rationale**
 - The client would be able to designate other responsibilities to the cell worker if the cycle time is reduced.
 - Reducing the cycle time could also improve process flow.
- **Project Scope**
 - Create a value stream map, FMEA, risk assessment, cost-benefit, implementation guide, DMAIC/PDCA for Cardinal Glass.
 - Create new processes for cutting foam blocks and sponge rolls.
 - Implement the new processes for cutting foam blocks and sponge rolls.

3 PROJECT PLAN/OUTLINE

A. Methods/Approach

- **Reference Material:** Foam Block and Sponge (Refer to Appendix for pictures)

Department of Agricultural and Biosystems Engineering (abe@iastate.edu) aims to be a premier team serving society through engineering and technology for agriculture, industry and living systems. ABE welcomes opportunities to discover and improve new technologies for all stakeholders. 2

- **Data gathered:**

We gathered information through the site visit and communicating with the sponsors. From the data collected, these are the times taken to cut down the foam blocks and sponge material to their proposed sizes.

Foam Block

Dimensions : 6.5" x 3.25" x 1"

Total cycle time: 12 minutes and 19 seconds

Sponge material

Dimensions : 3.25" x 3.25"

Total cycle time: 4 minutes and 25 seconds

- **Skills:**

We utilized several skills in order to tackle this project. Among some of the skills we used were our CAD software skills, teamwork, and communication skills. We also did much brainstorming to come up with a proposed solution.

- **Solutions**

As mentioned above, we came up with our proposed solution by using CAD software. Some of us used SolidWorks, while others used AutoCAD to model our ideas. The client was happy to see the proposed design for the cutting jigs, and with their approval, we purchased the necessary material for building the prototype.

- **Organization:**

The team met with the sponsor during the site visit. During the meeting, the team was able to properly gauge the process and determine the expected outcome of the project.

The team also met weekly for at least two hours to work on the project. During the first few months, we did much brainstorming and changed our ideas quite frequently. In the past month, we have finalized our designs of the cutting jigs and are moving forward to the next step. The main setback that we faced was having our prototype not work effectively during testing. To overcome this setback, we created a new jig that would provide less surface area, more rigidity, and add a mechanical advantage. Including these new changes would allow less force required and will overall make it easier to cut the foam to the desired dimensions. Our team is grateful to have responsive clients who were open to accepting and exploring our new and previous ideas we had come up with.

4 RESULTS

We came up with two solutions for the two cutting processes. (Refer to Appendix for pictures of the cutting jigs)

Solution 1 Prototype: Foam Block Cutting Jig

- This jig is a frame that will hold the wire in tension in order to cut the foam down to shape more efficiently than the existing process. The wire used is a piano wire and will be spaced according to the final foam block dimension required.
- Materials used: Steel conduit, conduit clamps, pinewood, piano wire, fasteners

Solution 1: Foam Block Cutting Jig

- This jig will be recreated in-house. It will be based on our prototype and created using metal for the frame and sheet metal in place of the wires. We chose to change our prototype to allow more rigidity, which will then make the jig able to cut the material more easily. This new design will require welding to keep the sheet metal in-place and will be spaced according to the final foam block dimension required. Materials used: Steel conduit, conduit clamps, pine plywood, piano wire, fasteners
- Materials used: Metal and Sheet metal

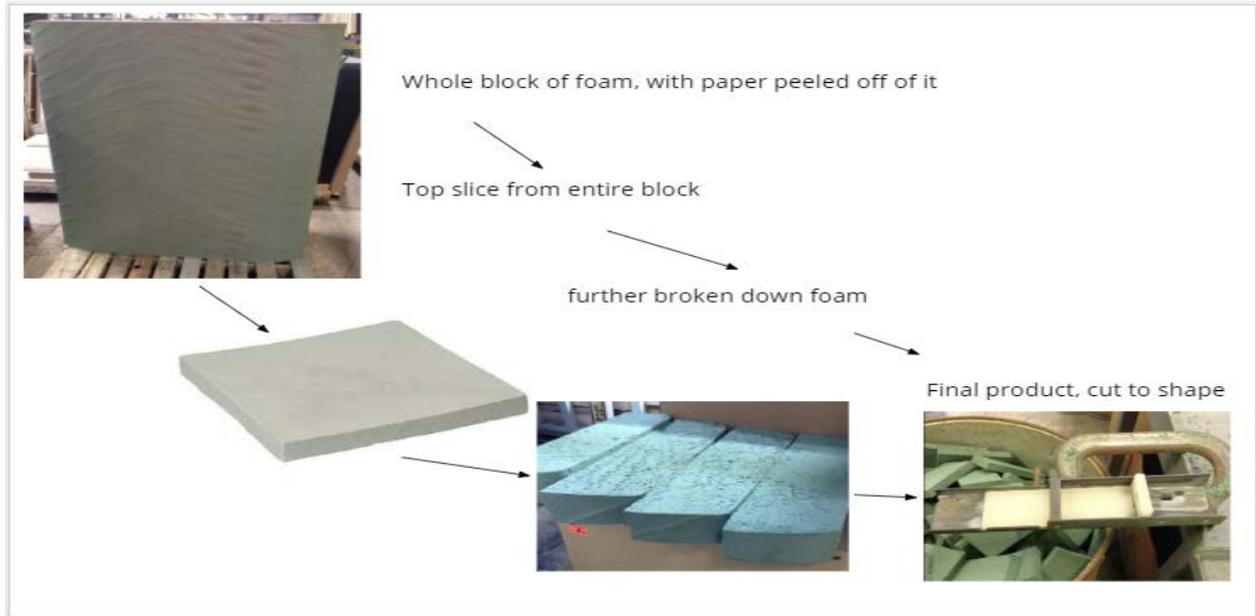
Solution 2: Sponge Material Cutting Jig

- This jig will cut all seven squares out in one pull per direction (one pull vertically, one pull horizontally).
 - Materials used: Pinewood, utility blades, fasteners
- As for implementing these solutions, we have spoken with Cardinal Glass, and they will create the new foam cutting jig out of metal and our sponge cutting jig in-house.

5 BROADER OPPORTUNITY STATEMENT

The two proposed designs can be easily used by the average person. The cell worker should be able to easily identify the right way to use the equipment during the process of cutting up the material. This project saves cost in the long run given the reduction in process cycle time.

6 GRAPHICAL ABSTRACT



7 REFERENCES

1. Grainger
<https://www.grainger.com/>

8 APPENDIX

PROJECT PLAN/OUTLINE

- Reference Material



Foam Block

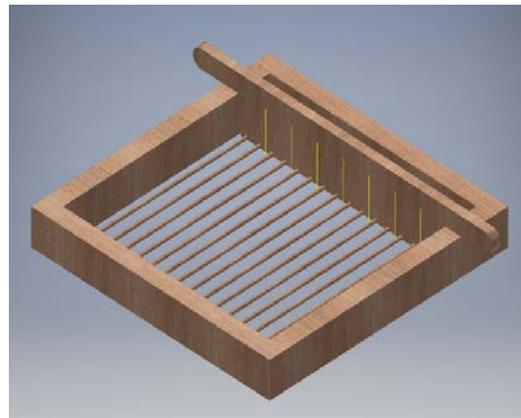


Sponge Material

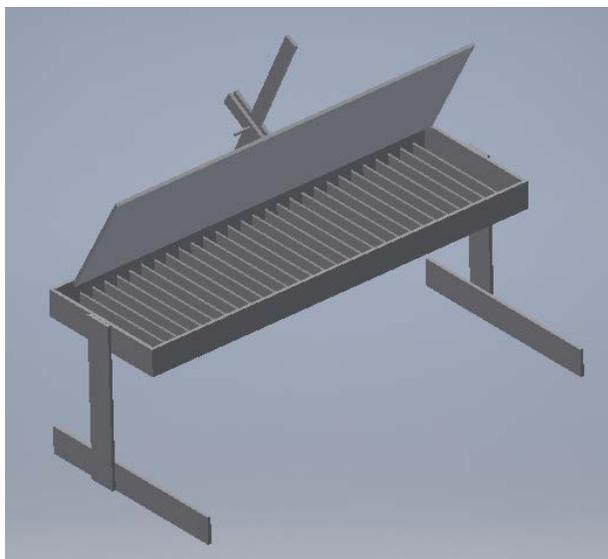
RESULTS



Solution 1 Prototype: Foam Block Cutting Jig



Sponge Cutting Jig



Solution 1: Foam Block Cutting Jig