

IOWA STATE UNIVERSITY

Department of Agricultural and Biosystems Engineering (ABE)

TSM 416 Technology Capstone Project

Inventory Control Project

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1 PROBLEM STATEMENT

Problem Statement

Sioux City Brick is a manufacturing company that produces four main products in various colors. The products include a residential and architectural brick, brick chips, and thin brick. Sioux City Brick employs over 100 employees and corners of the business extend from Iowa, Nebraska, to Minnesota, and South Carolina. However they service a much larger area including Canada.

Currently the company is experiencing long loading times, a cramped and cluttered yard, and fork lift operators spend a lot of time organizing and moving inventory around. All are a result of their being an excess amount of leftover brick. This brick comes from the remains of orders as well as faulty batches and almost all of the excess brick can meet at least one of many secondary uses so the company tends to accumulate it. For the time being their yard operations are lacking standardization from operator to operator, as well as a lack of accountability throughout their operators. The company is currently scheduling more orders and adding to the waitlist for this year and next year's production schedule. Right now this facility is operating at a fractional value of their full capabilities regarding their yard operation and infrastructure of organization. With the utilization of our suggested SOP we feel that we can assist them with increasing standardization throughout the west lot which could easily translate throughout the facility. A well-organized brickyard creates several opportunities including more inventory space, possibility to start and fill more orders annually, and a higher inventory handling efficiency. Overall the

yard is affecting the company by contributing to excessive product transportation which results in a form of overprocessing. Through implementation and adjunct application of our SOP Sioux City Brick will be able to benefit from standardization of work and how operators are facilitating yard activities. This will allow them to identify areas needing improvement in the future this will also allow for proper measuring of yard activities and efficiencies. This standardization will open pathways for future projects within the capstone area or within the company.

Business Case Statement

As we observed, Sioux City Brick is experiencing long loading/unloading times, excessive travel times, and insufficient amounts of storage room for new inventory. This problem is a very complex, multifaceted situation, from our observations both on site and noted over the phone we determined there are multiple causes contributing to the issue. Some of the causes stem from errors in production volume as well as other processes that produce customized products, which often times aren't easy to sell to a customer who is looking to buy brick. We spoke with one of the operators who works in the west lot of the facility and determined there was room for improvement regarding both the preparation and movement of brick within the lot. The issue seems to be an ongoing and growing problem for the company. Ideally, the left over brick would be kept to be used for secondary processes but, as they accumulate they start to fill up area that should be used by inventory with a higher turnover rate.

This project's main focus was establishing a standard operating procedure for fork lift operators to follow creating a standardized method of operation. We did this in order to make it feasible to measure the efficiency of the yard space usage, the frequency of ordered products, an awareness of a more efficient yard setup, and firm separation of bins that will help maintain an organizational flow to the yard. Resolving many of the timely based issues will most be noticed by the fork lift operators firstly, people picking up orders, and lastly people working in the facility that might notice scheduling changes or additions. If the product does not continue to flow through the yard efficiently then there are some obstacles in the process. This is measured by the time it takes to load an order and ship it out or by the amounts of load sent out in a standard day

2 GOAL STATEMENT

Sioux City Brick is having trouble finding storage space for new products and handling their finished product in a timely manner. When the fork lift operators are preparing shipments or loading trucks, quite often they will have to move several cubes of brick to find a specific product that needs to be sent out for delivery. With all the extra handling of inventory, the shipping process becomes very extensive and the brick is more likely to be damaged while being moved. Our achieved goal has been to propose a standard operating procedure that combines existing procedures, supplemental instructions, as well as additions aimed at addressing the specific problems we saw in the west inventory storage lot, and ensure they are performed the same way by all operators. These problems include additional waiting time, excessive handling resulting in over processing and displaced cubes that need to be replaced back into the row within the day or the week (timely manner).

With our final SOP proposed, they will be able to continue from here by taking and implementing some, or all, of our suggestions into their official operating procedures that are currently in place. With a standard operating procedure implemented and upheld, they may move to further projects of making the lot more efficient. They may now measure specific data points to test operation efficiency and test new ways to improve upon them. This SOP is the beginning of a long-term, multifaceted solution to their inventory control problem.

Objectives

Main objective: Propose a Standard Operating Procedure that addresses observed problems.

Secondary objectives: Propose an implementation plan for the Standard Operating Procedure.

- Client Criteria
 - Sioux City Brick adopts entire or parts of proposed SOP
 - Focus on West Inventory Storage Lot
- Constraints
 - \$10,000 Budget
 - Large time investment required to implement changes/rearrange inventory
 - Pending Yard Manager hiring to uphold operator compliance of SOP

Rationale

- Creating a Standard Operating Procedure is the beginning of a long-term solution to their inventory management--with standard procedures they will be able to measure efficiency of handling activities and identify when they are not using the yard as efficiently as they could be
- Product placement and retrieval times will be shortened
- Reduce the amount of times that products have to be moved

3 PROJECT PLAN/OUTLINE

Our team has produced a standard operating procedure and implementation plan for enacting the standard operating procedure. Within the standard operating procedure we have included sections that contain specific details for safety, responsibilities, procedures, scope, and purpose. Perhaps the most important section is the procedure section, which is a consolidated list of the operating instructions, supplemental instructions, as well as additions to both sets of instructions that target specific problems our group has witnessed within the inventory yard. Our deliverable was to create a standard method that all employees should follow while in the storage yard because one of our observations was that each fork lift driver operated in a manner that worked best for them specifically versus the entire yard.

An additional deliverable was to find multiple options to help implement this standard operating procedure. The most important part of the implementation plan is to fill the Yard Manager position whose main task could be enforcing the set standards of organization, safety, and functionality of the yard. Additional implementation procedures include each employee having a copy of the standard operating procedure, which contains all the procedural instructions. As well as a standard for training new hires and it was mentioned that procedural instructions need to be reviewed in weekly meetings. In the event the procedural instructions do not pertain to the processes in place because of new equipment or adjustments to the process then the instructions must be updated. The life cycle of SOP is displayed in a flow diagram located in **Appendix 1.2**.

Original plans included deliverables that focused on separating mixed brick and creating an organization method to track batches of brick. However in our efforts to find a solution we determined that this is not entirely possible. Sioux City Brick manufactures over 23,000 options of combinations for color and style of brick and they only have 500 - 1000 bin locations so there will be mixed product in some bins. During our analysis of the tagging method that is currently used, it was determined to be an effective method of labeling and tracking each batch of brick.

From time to time, product is moved within the yard to free up bin space for new batches of brick. Ideally, all tag-ends of orders should be located in mixed bins and should put on a retention schedule. Since one of the main problems involves the tag-ends of orders obstructing storage space, it was proposed

that tag-ends should be moved to their own designated locale, to avoid future obstructions throughout the rest of the yard.

Stray brick, whether it be loose or a partial strap or cube, within the yard is caused by several different processes. Many of the partial straps and cubes are the results of another department that performs quality sampling; these employees select ideal bricks from the cubes, but often do not repair the bands that they disassemble in the process. These employees do not fall under the direct authority of the yard manager, and as such are not necessarily held accountable on band restructuring. In our standard operating procedure, we stated that all employees operating in the yard are under the supervision of the manager deeming the employees accountable. This will allow the yard manager to direct other departments' employees so long as they are working in the yard, and will also require them to abide by the same maintenance requirements as employees regularly stationed there. Under the supervisor's authority, any departments that remove bricks must repair the cubes they remove brick from.

We spent a couple of weeks reviewing inventory sheets provided by the clients. These sheets provided us the quantities of product within the yard, by age. We noticed that they have a sizeable portion of their product is over a year old, while some product is approaching a decade on the yard. At this point, the clients are not prepared to utilize any methods to quickly liquidate their existing old stock, and would rather continue to hold the marketable product rather than scrap or sell with heavily discounted prices. Sioux City Brick does an excellent job of tracking their inventory by age and this method of tracking their inventory is one of the most passive ways to accurately gauge the efficiency of space within the inventory yard. They perform inventory counts twice a year, manually counting stacks and rows on the yard. Sioux City Brick does have existing policies that define a maximum product retention, and also employ a secondary method to increase the turnover rate of some products. Select red and brown products can be combined into an assorted mixture and sold under a Western Rustic label. This product allows them to market and sell older brick as a more popular product, providing a profitable method of further reducing the amount of tag end brick.

Some of the skills that this project required included professional communication as well as aptitudes for analytics and problem solving, as well as an understanding of facility layouts and how product moves through the facility. All of these traits allowed for cohesive teamwork with the clients to establish a reasonable scope for the project and to keep client updated the on the progress we, as a team, were making towards the development of an effective method of resolving the specific obstacles we were working to resolve.

4 BROADER OPPORTUNITY STATEMENT

Our project is intended to be implemented by supervisors and operators. They should be able to quickly understand the ideas our SOP introduces and see the value of minimizing the wasted movements and small inventory quantities that create hazards on the yard. It is a set of step by step instructions which are already being used by the client that have been consolidated and improved upon. We are dealing with an intricate system that has problems in a few areas which compound upon each other resulting in the overall issue of the management of inventory. Inventory management problems are not uncommon in most industries, and are issues that many manufacturing/production companies deal with. Our solution is applicable to other brick manufacturers as well as any company that organizes many different products into a small number of locations, without reliable controls or standard operating procedures in place. Lumberyards, grain storage, and other similar facilities would find our procedures useful for helping to streamline storage and retrieval in warehouses and inventory yards. Due to previous employment experiences, we know seed companies could use our solution if they are running into similar issues of insufficient space and bin adjustments because they store their inventory in a similar way. Again, any manufacturer that puts wide varieties of their products on pallets and then stores them into stacks/rows containing multiple different products could benefit from our solution.

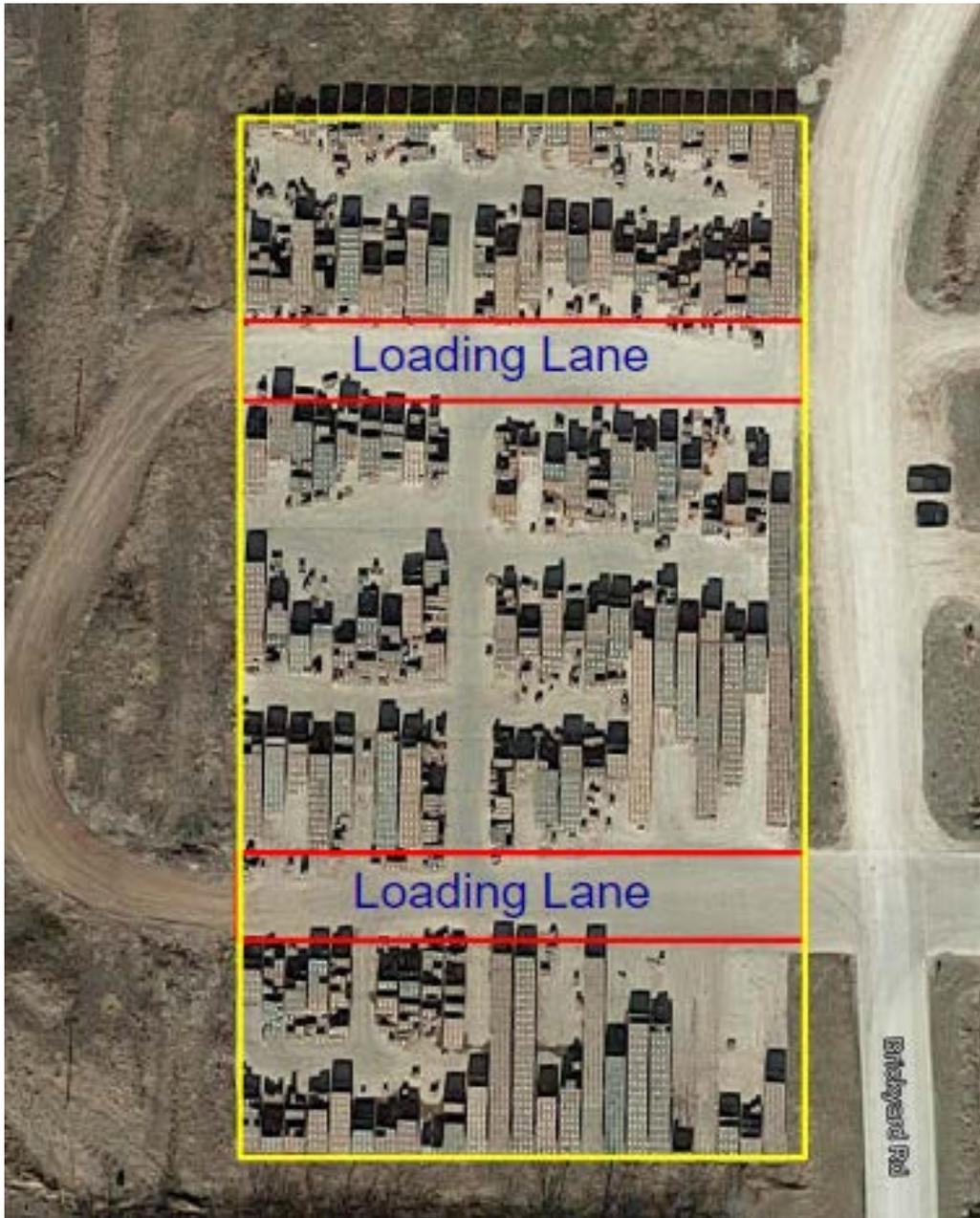
When comparing brick companies specifically it appears that many other companies have less on hand inventory so comparing them can be difficult. To gain a more accurate comparison we compared the yard to shipping ports since they both have a lot of on hand inventory that is moved frequently. Inventory management is sometimes an overlooked subject in manufacturing however this is a pertinent issue that requires time and attention to find a solution. There is a significant cost to the company to redirect manpower to focus on reorganization of trouble areas. Simply put to clean up the yard and relocated tag-ends will take a significant amount of time to accomplish. It is a cost that can be mostly mitigated but never entirely removed. If cleaning and organizational tasks are done weekly most of the cost that will be experienced from mass cleaning and reorganizing will be much lower and budgeted throughout the weekly labor costs. We feel that these costs will be minimal when compared to the benefits of having an efficient yard in terms of monetary value and time saving.

5 PROJECT SCOPE

During this project the scope was significantly modified because of the inability to complete the original deliverable that our client asked of us. Also contributing to the change in scope, our client would benefit greatly from having a standard operating procedure in their inventory yard. This project was meant to create the necessary base for which Sioux City Brick and its associates are able to continue with future projects to address further problems specifically observed within their inventory yard. We used a cause and effect analysis process consisting of a fishbone diagram and a tree diagram to help us narrow down the scope to a set of more attainable goals. The tree diagram is included in **Appendix 1.3**. Our fishbone diagram that specifically identifies contributing issues to obstacles witnessed in the inventory yard is displayed in **Appendix 1.1**.

The scope of our project was to create a standard operating procedure that established a set of guidelines that need to be followed by all employees of Sioux City Brick and their associates while conducting daily operations in the inventory yard. Secondly, we created an implementation plan to help establish the standard operating procedure. Overall, the implementation plan is going to be most effective with the filling of the Yard Manager position, due to this being the primary individual responsible for upholding the new instructions and facilitating required tasks. This person will manage operator tasks and hold them accountable to those tasks.

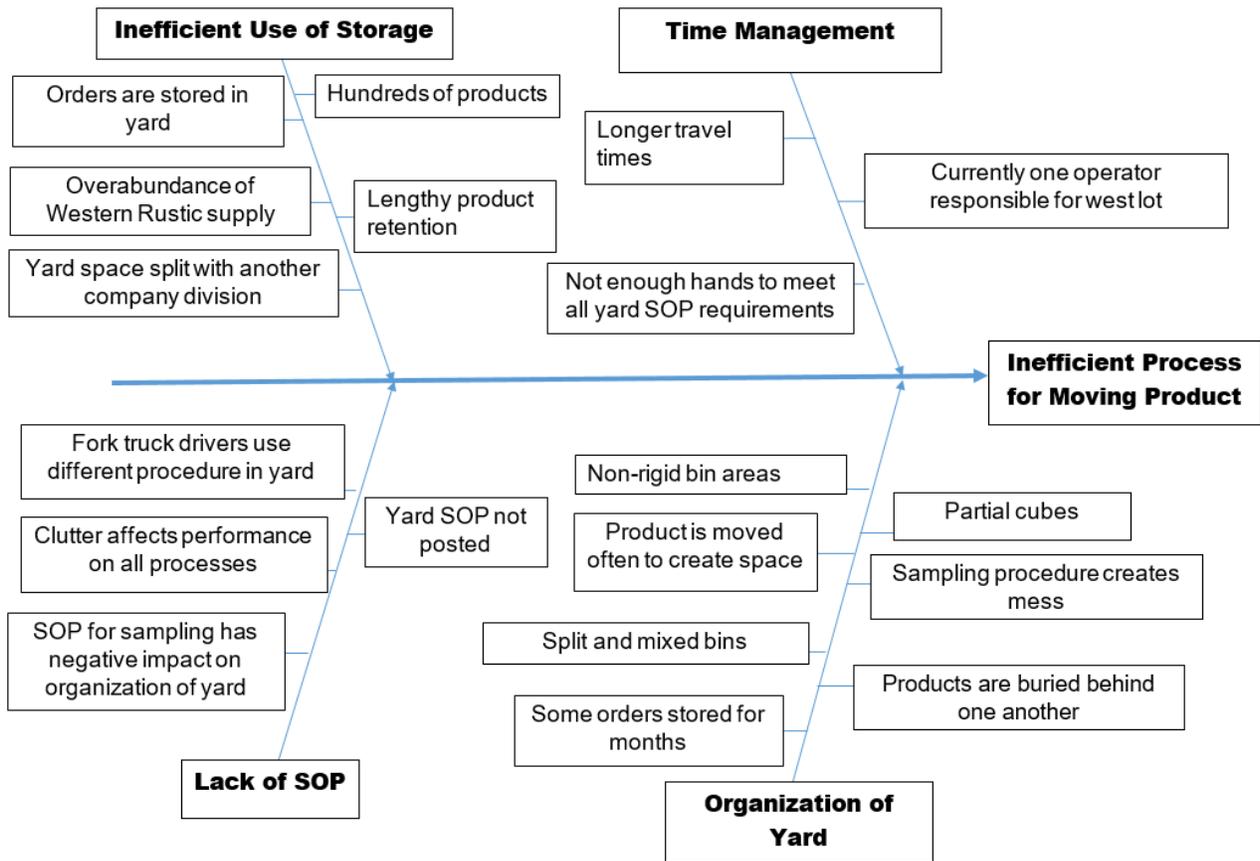
6 GRAPHICAL ABSTRACT



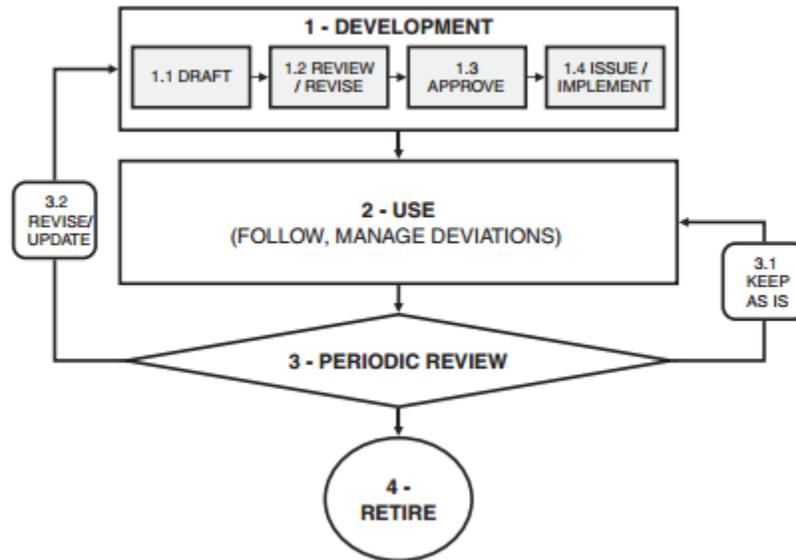
> This is an image of the West Lot in the Adel facility of Sioux City Brick where our standard operating procedure can be implemented. This is also the portion of the yard that we did most of our observations for this project.

7 APPENDICES

> Appendix 1.1 Fishbone Diagram of Inefficient Process for Moving Brick



> Appendix 1.2 Lifecycle of Standard Operating Procedures



> Appendix 1.3 Tree diagram for Narrowing Scope

