DATA-DRIVEN WORKER SAFETY IMPROVEMENT AT A HARDWOOD MANUFACTURING COMPANY

Project Background:

This is a real-world case study that illustrates how data gathered from wearable devices can provide valuable insights to improve ergonomics in the workplace and reduce worker injuries. This case study is based on a project conducted at one of the nation's largest manufacturers of hardwood boards by a team of undergraduate industrial engineering students from a leading Midwest university. The company has been piloting the use of MakuSafe devices amongst shopfloor workers. The aim of the student-team project was to analyze MakuSafe device data and the company's manufacturing operations to develop recommendations that can help the company reduce worker injuries and associated worker compensation claims.

Analysis and Findings:

The company has several production lines and this project focused on Line 3. The production line comprises four workstations or line positions where workers perform different tasks. Production is done in two shifts, namely 6:30am – 3:30pm and 4:00pm – 1:00am. In each shift, workers are asked to rotate to a different line position every 2.75 hours. The line produces a variety of board sizes ranging from 8 feet to 16 feet in length and from 2 inches to 8 inches in width.

Through observation of the production line operations and by analyzing data from MakuSafe devices worn by workers at the various line positions, the student-team first conducted a current state assessment. The current state assessment provided various insights into the frequency and types of worker movements including ones that could potentially cause injury over time.

The MakuSafe data showed that "push/pull" hits occurred regularly and were high in count on certain days (see Figure 1).

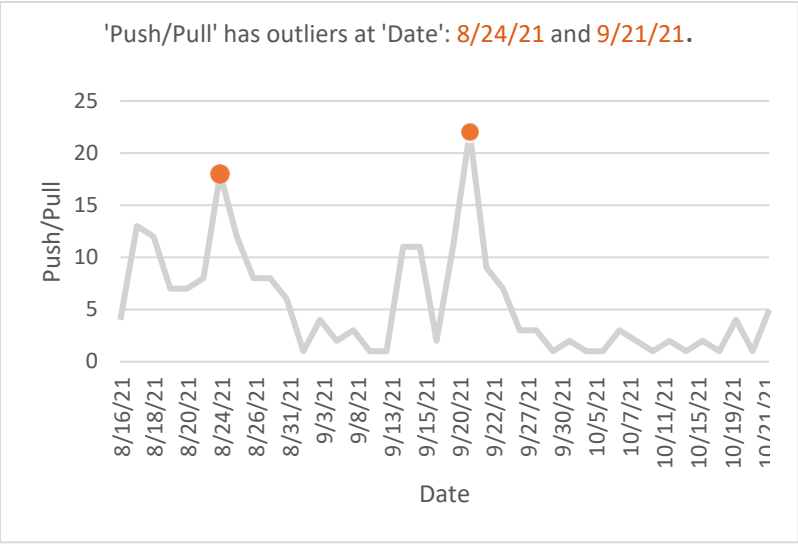


Figure 1: Daily occurrence of Push/Pull hits recorded by MakuSafe devices

By analyzing the production data, it was inferred that the dates on which push/pull rates were high corresponded to the ones when the production line was producing long and heavy boards.

The MakuSafe data analysis further showed that the occurrence of push-pull hits changed during the course of each shift. As shown in Figure 2, while the two morning rotations each registered around 70 push-pull hits, both the two afternoon rotations registered significantly fewer push/pull hits.

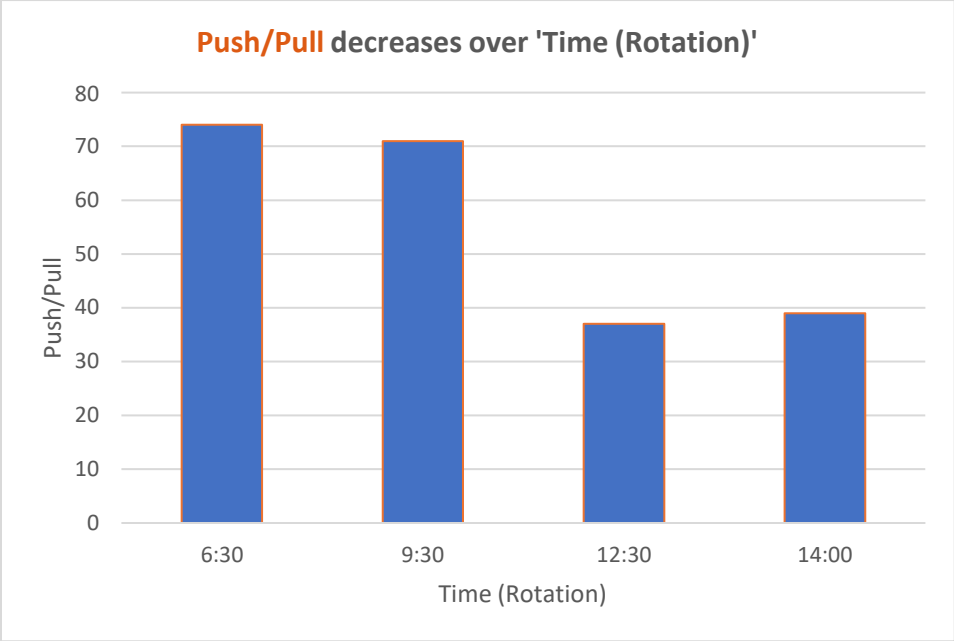


Figure 2: Number of Push/Pull hits during the four rotations within a shift

It was also observed that the number of push/pull hits varied by the line position as shown in Figure 3.

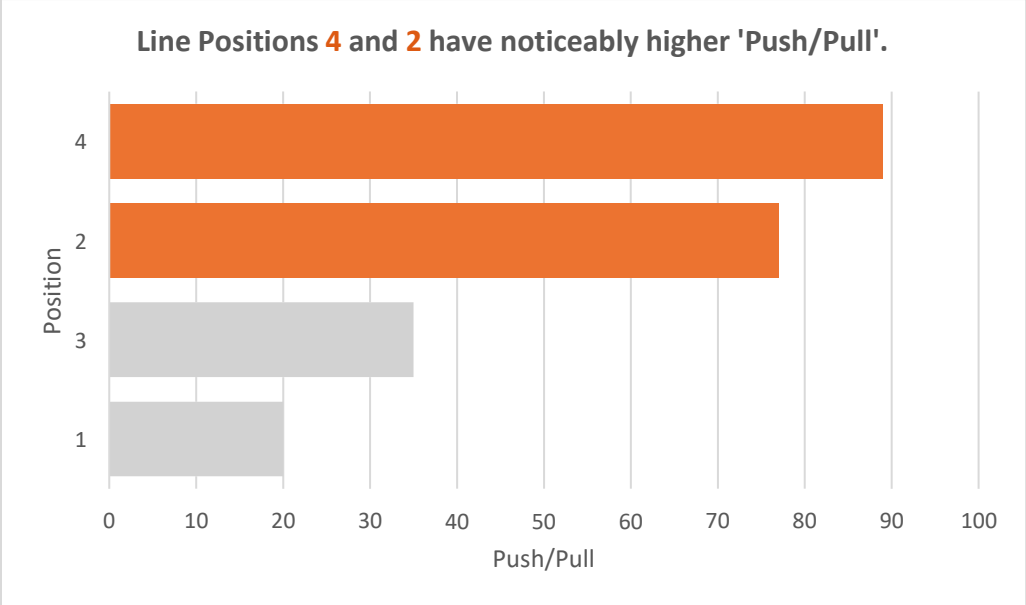


Figure 3: Number of Push/Pull hits registered in each line position

Figure 4 shows a composite view of the number of push/pull hits in each of the four line positions during each rotation period of a shift.

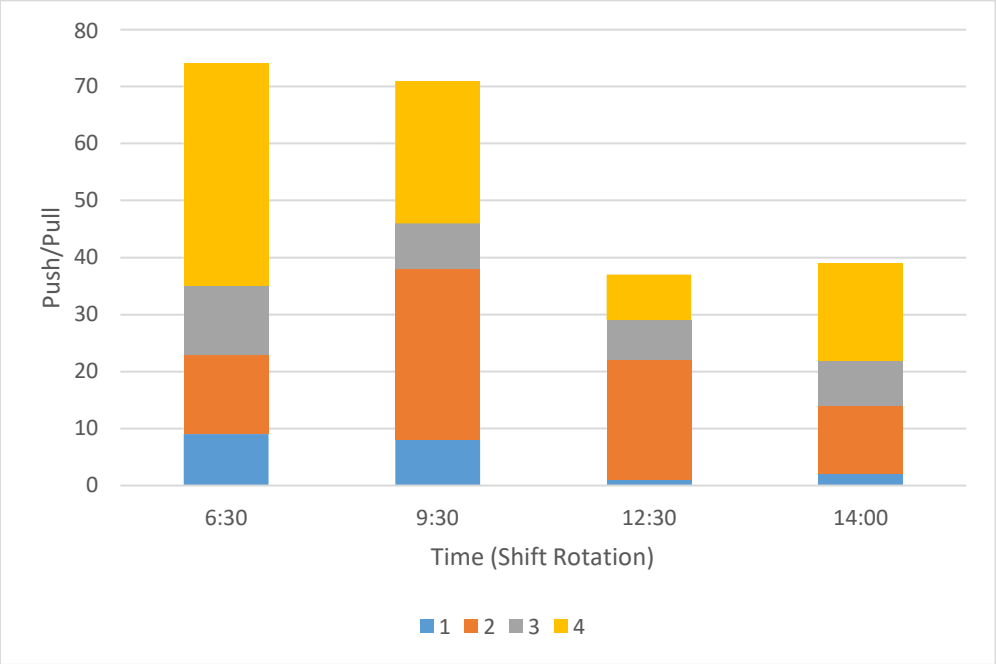


Figure 4: Number of Push/Pull hits in each line position during each shift rotation period

By jointly analyzing MakuSafe data along with production data (e.g., production items, worker assignment at each position, etc.) can help understand the root-causes and contributors to the frequency and variations in the number of push/pull hits. For instance, as shown in Figure 5, by analyzing the data on the daily assignment of workers to the production line, it became evident that certain workers were more prone to push/pull incidents than others.

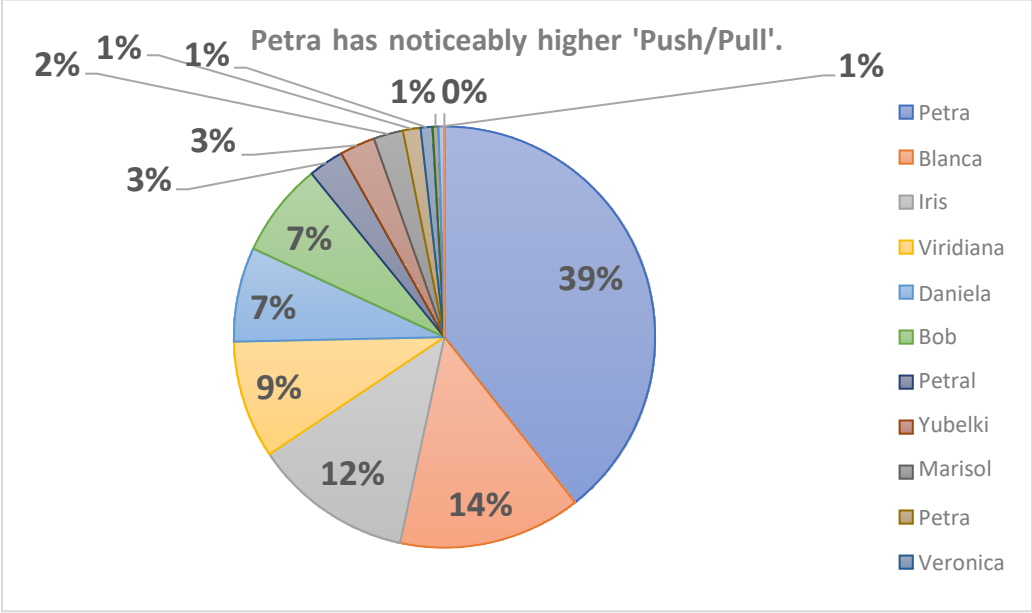


Figure 5: Number of Push/Pull hits registered in each line position

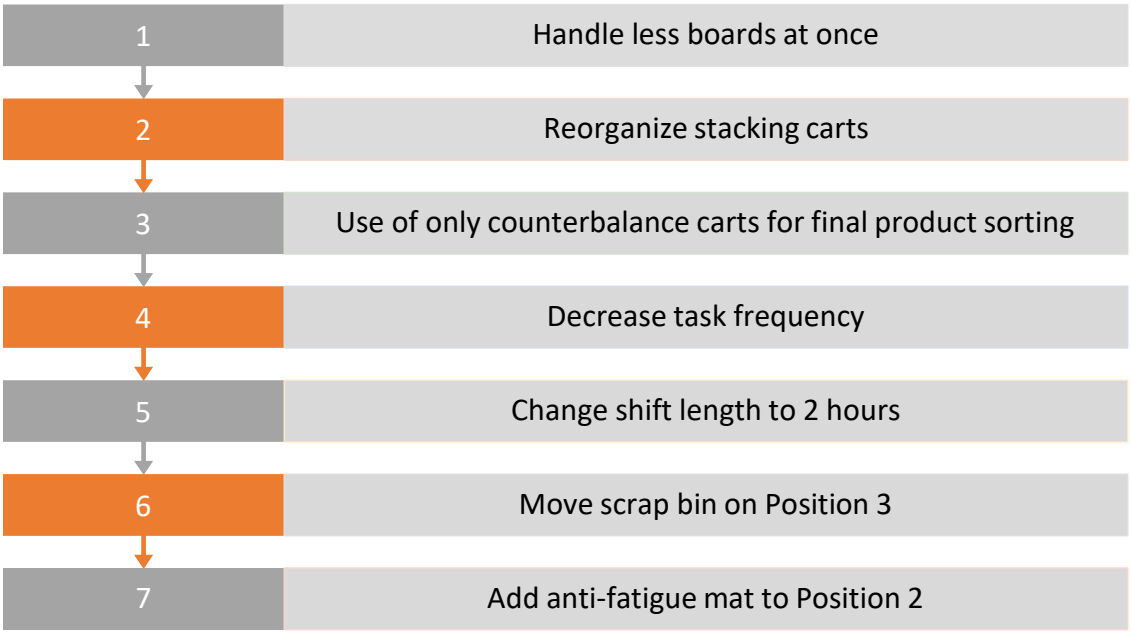
Such analysis of MakuSafe data along with other data (production data, scheduling data, etc.) and shopfloor observations and interviews helped in guiding further analysis into the motions that these workers were performing and in identifying improvement strategies to reduce the occurrence of push-pull hits. The student-team also conducted task analysis at each line position from an ergonomics perspective using the Lifting Equation developed by the National Institute of Occupational Safety and Health (NIOSH). The NIOSH Lifting Equation based task analysis allowed the student-team to consider a variety of factors (such as the weight of the object being lifted, the lift distance and angle, the frequency of lifts etc.) to assess the potential risk of worker injury and to provide improvement recommendations that would optimize the way of performing the task.

Project Outcomes:

The student-team developed several recommendations based on their analysis, and then prioritized the recommendations by considering several criteria including:

- extent of improvement of worker safety
- extent of reduction of push/pull hits
- ability to apply to multiple production lines
- implementation cost
- ease of implementation
- contribution to past insurance claims

Accordingly, the student-team presented the company with following prioritized list of recommendations:



It is anticipated that the implementation of these research-based and data-driven recommendations will reduce worker strain, injury risk and insurance claims while maintaining shopfloor productivity.