



Production Enhancement

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Group #32

Introduction

- Tolko Industries Ltd. Lake Country Division
- Fruit harvest bin manufacturer for Western Canada & USA
- Increase in demand → increase in productivity
- lean manufacturing, preventive maintenance, technology, final assembly, and layout strategies are presented to increase productivity

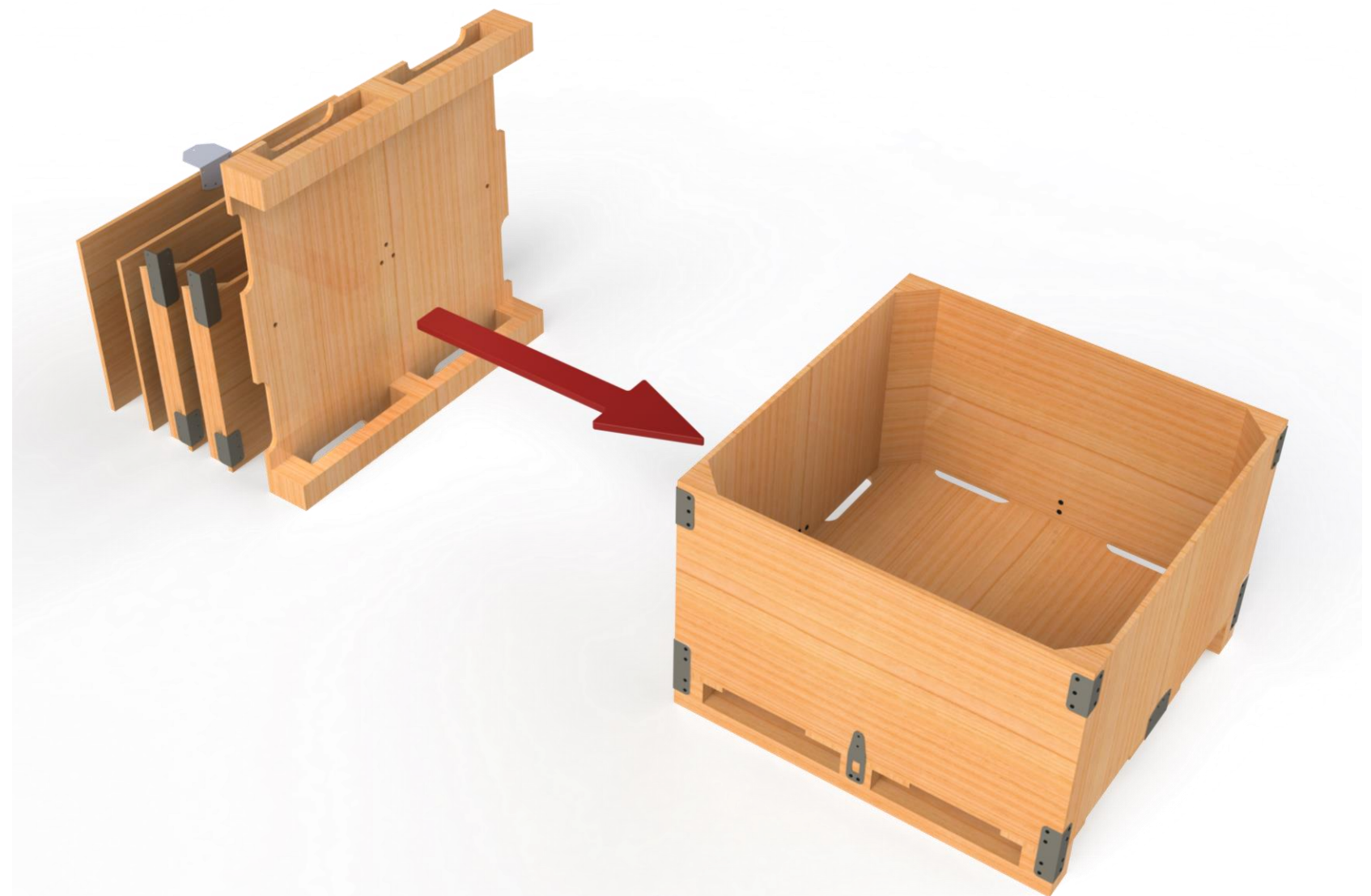


Fig. 1. Fruit Harvest Bin

Manufacturing Process

- 12 machine centers used to complete the bin
- Colour coded according to production error (%)
- Target rate of 46.875 bins/hour
- Green = exceeding target; Red = below target

$$\text{Production Error} = \frac{[\text{Produced Part (s)/hr}] - [\text{Required Part (s)/hr}]}{[\text{Produced Part s/hr}]}$$

Table 1. Machine Center Production Error	
Machine Center	% Production Error
Final assembly	91.47
Block nailer	91.18
Corner posts (Stenner)	62.88
End riveter	61.60
Skid nailer	51.36
Side Riveter	31.73
Posting table	31.73
Dip line	18.08
Bottoms table	6.13
Bottoms venter	-0.69
Sawline sides/ends	-87.73
Sawline bottoms	-275.47
Skids (trimline)	-486.24

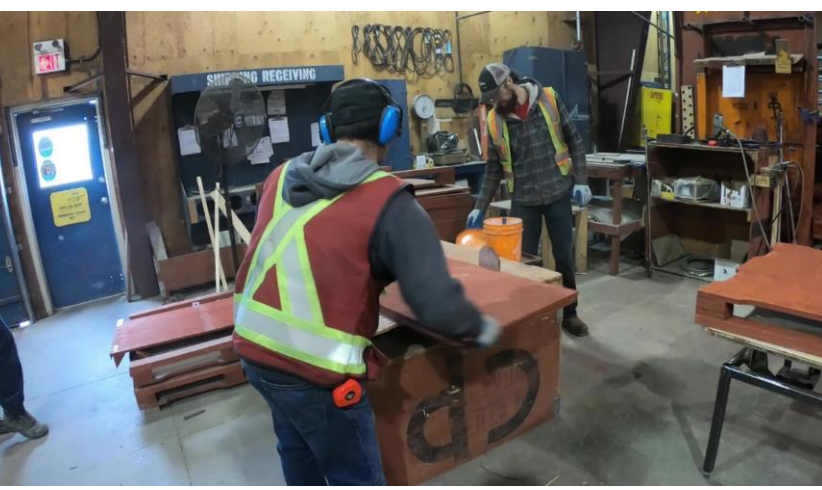


Fig. 2. Manual Final Assembly



Fig. 3. Block Nailer

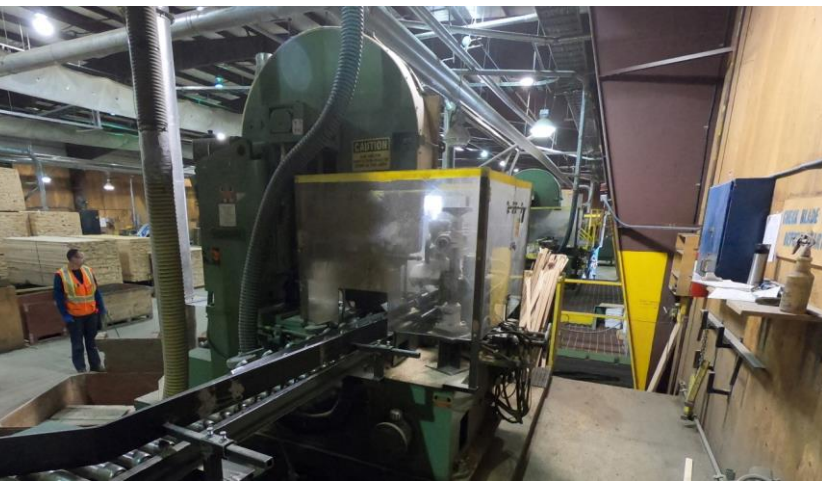


Fig. 4. Corner Posts (Stenner)



Fig. 5. End Riveter

Deliverables

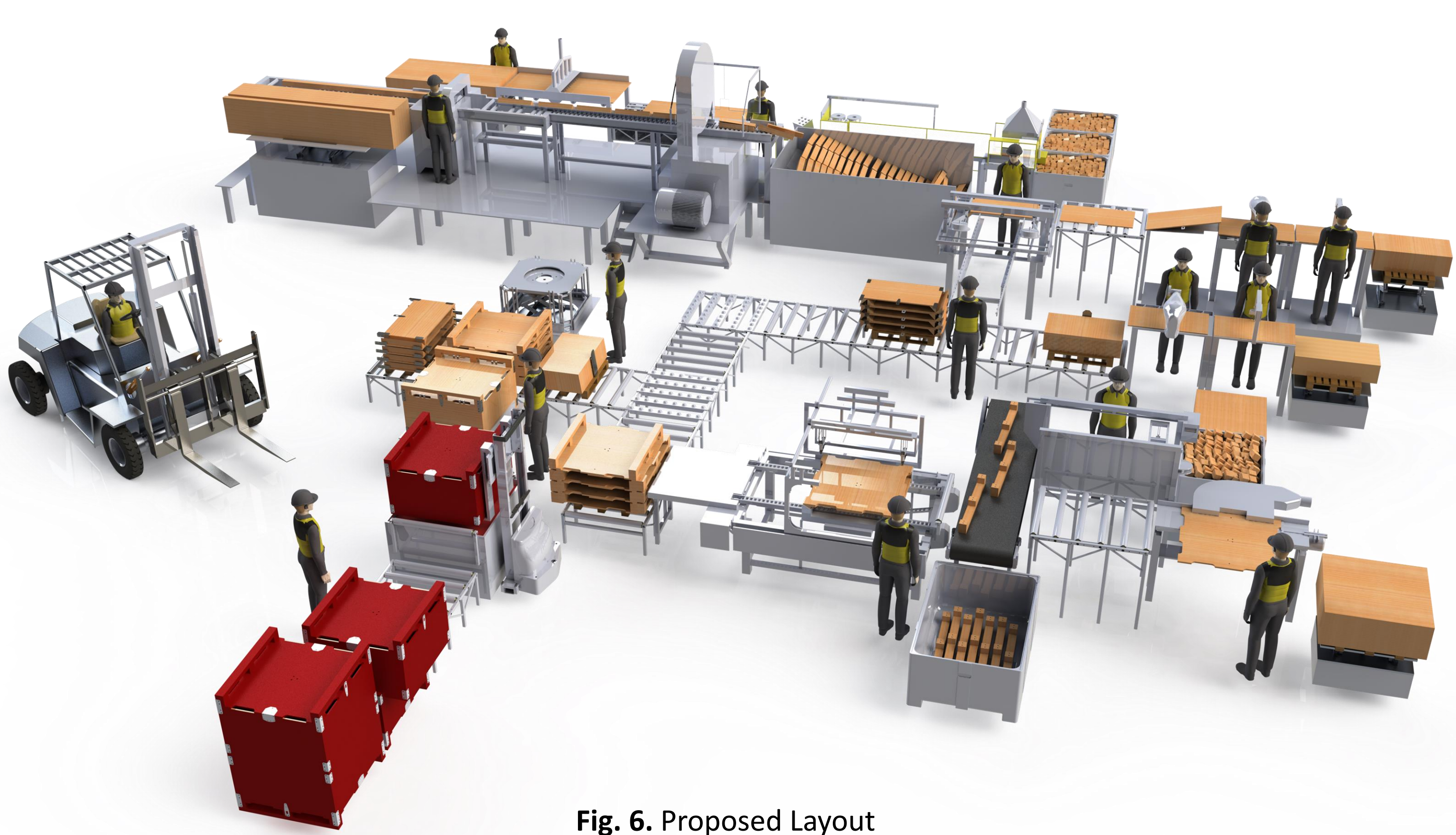
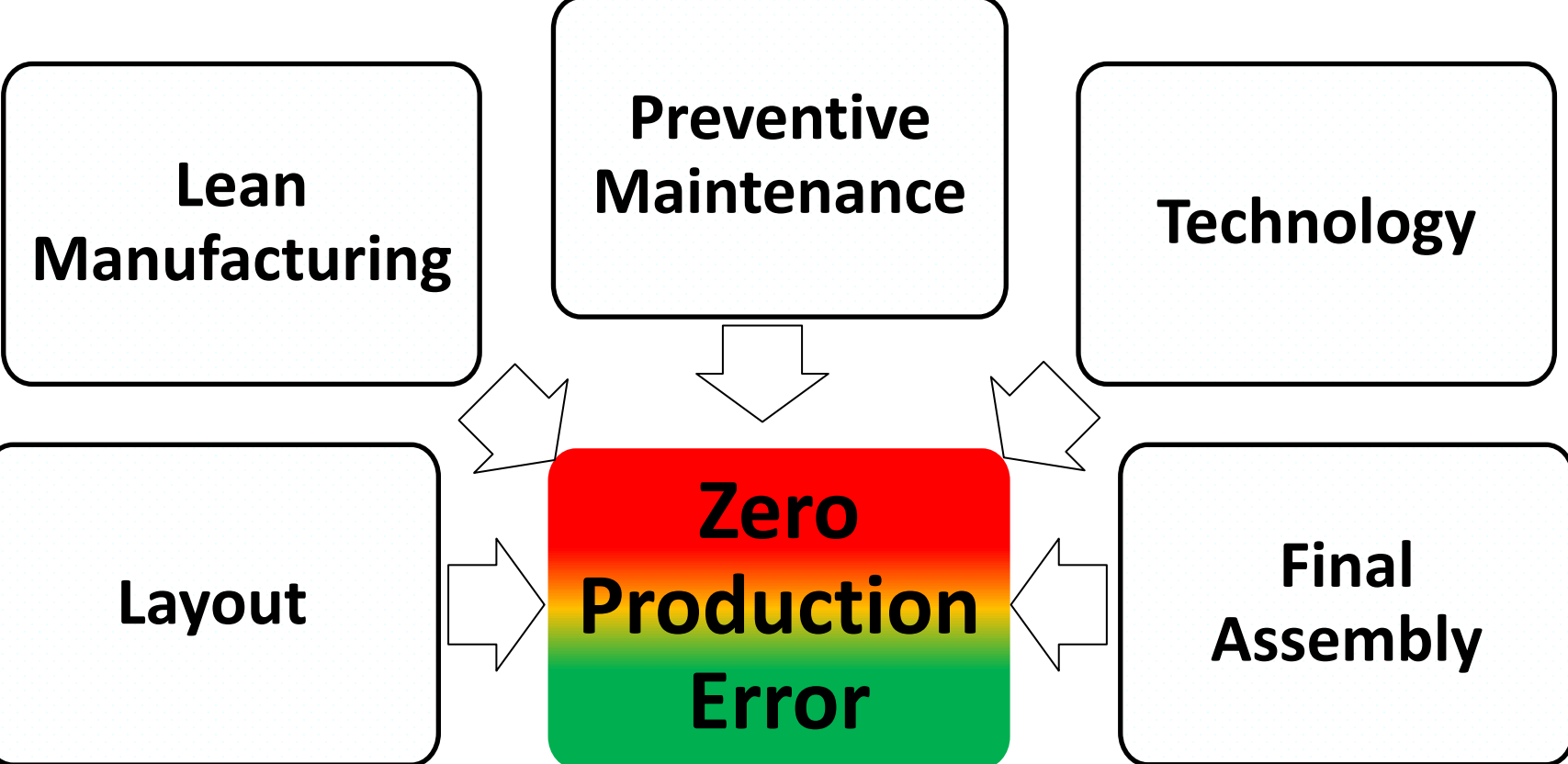


Fig. 6. Proposed Layout

Lean Manufacturing

- Simple, least resource demanding improvement to productivity
- Lean → Kaizen → 5S+1
- Scorecard and identification of problems
- Simplification for daily use
- Changes in tool/part locations, glue use, and waste disposal

Technology

- Current technology is outdated, 20+ years
- Programmable Logic Controller upgrades will allow communication with machine centers previously impossible
- Variable Frequency Drives will allow different operating speeds allowing processes to be speed up when possible
- Incorporation of different industrial sensors such as photoelectric sensors
- Object recognition and inspection cameras

Final Assembly

- Design a system to complete a bin quicker while reducing ergonomic strains
- Iterative process from fully automated to semi-automated to prototype turntable

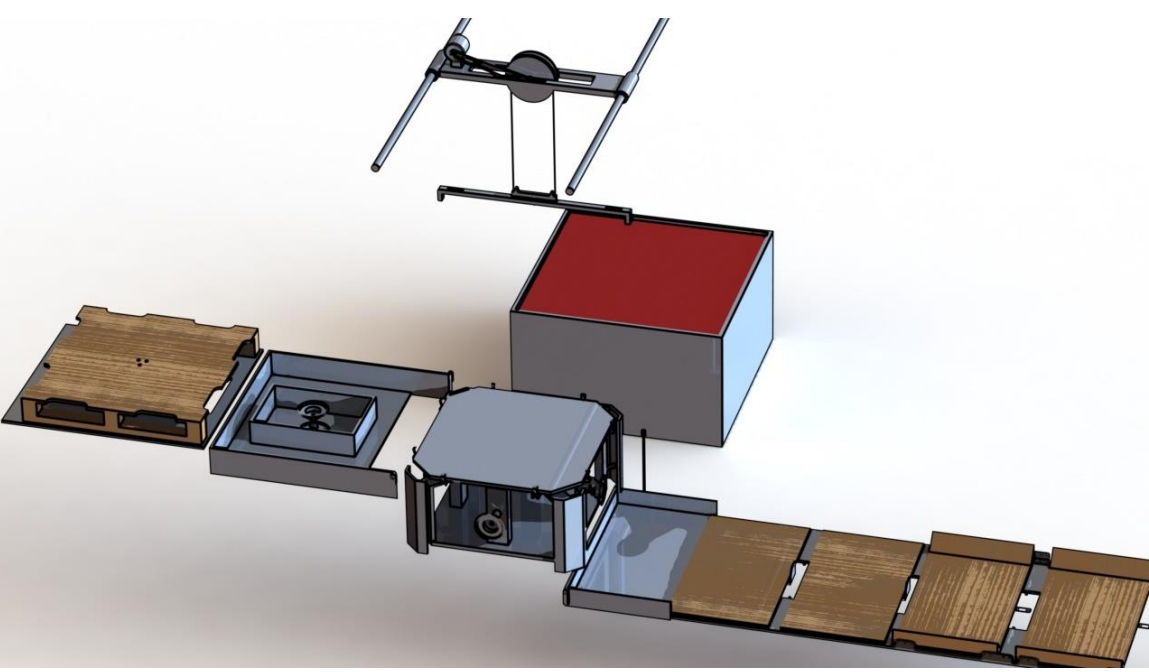


Fig. 8. Fully Automated Design Iteration

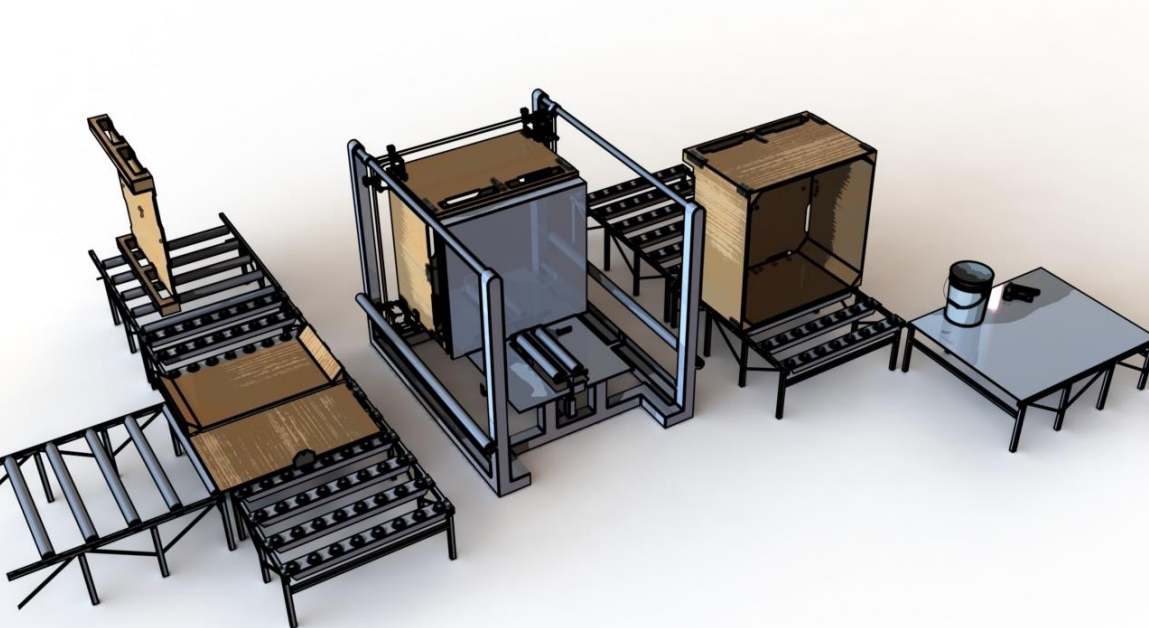


Fig. 9. Semi Automated Design Iteration



Fig. 10. Third Design Iteration with Improved Ergonomics and Speed



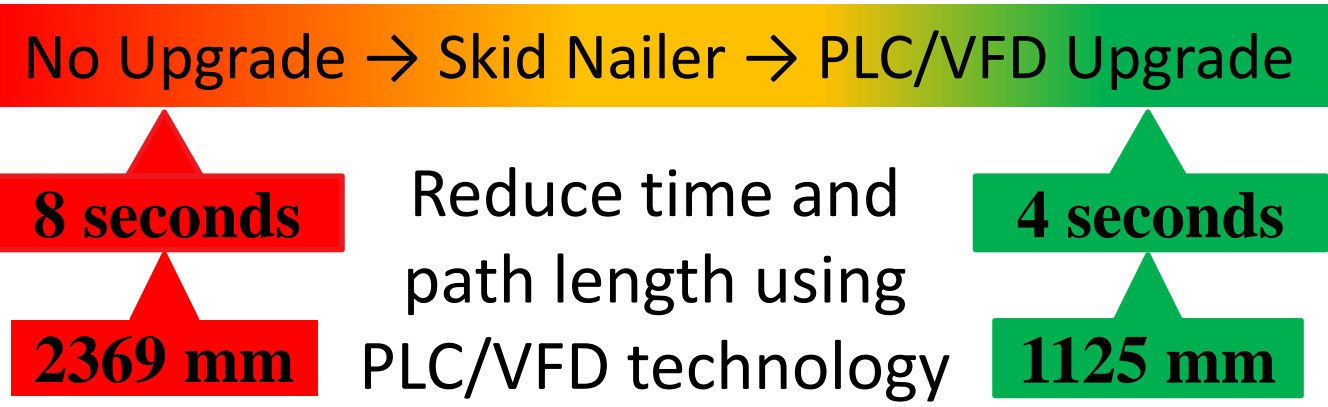
Fig. 11. Turntable Prototype

Preventive Maintenance

- Identification of issues in machine centers and their commonalities
- Compile potential solutions and create a preventive maintenance schedule
- Minimize downtime, reduce misfires, and increase reliability



Fig. 7. Skid Nailer



Layout

- Combine machine centers into cells that deal with each component of the bin: blocks, posts, ends, sides, bottoms
- Organize machine cells in such a way that improves the efficiency of a parts movement through the warehouse
- Video of each process was used to estimate the reduction in production error for the respective changes
- Respective changes resulted in all production errors ≤ 0%

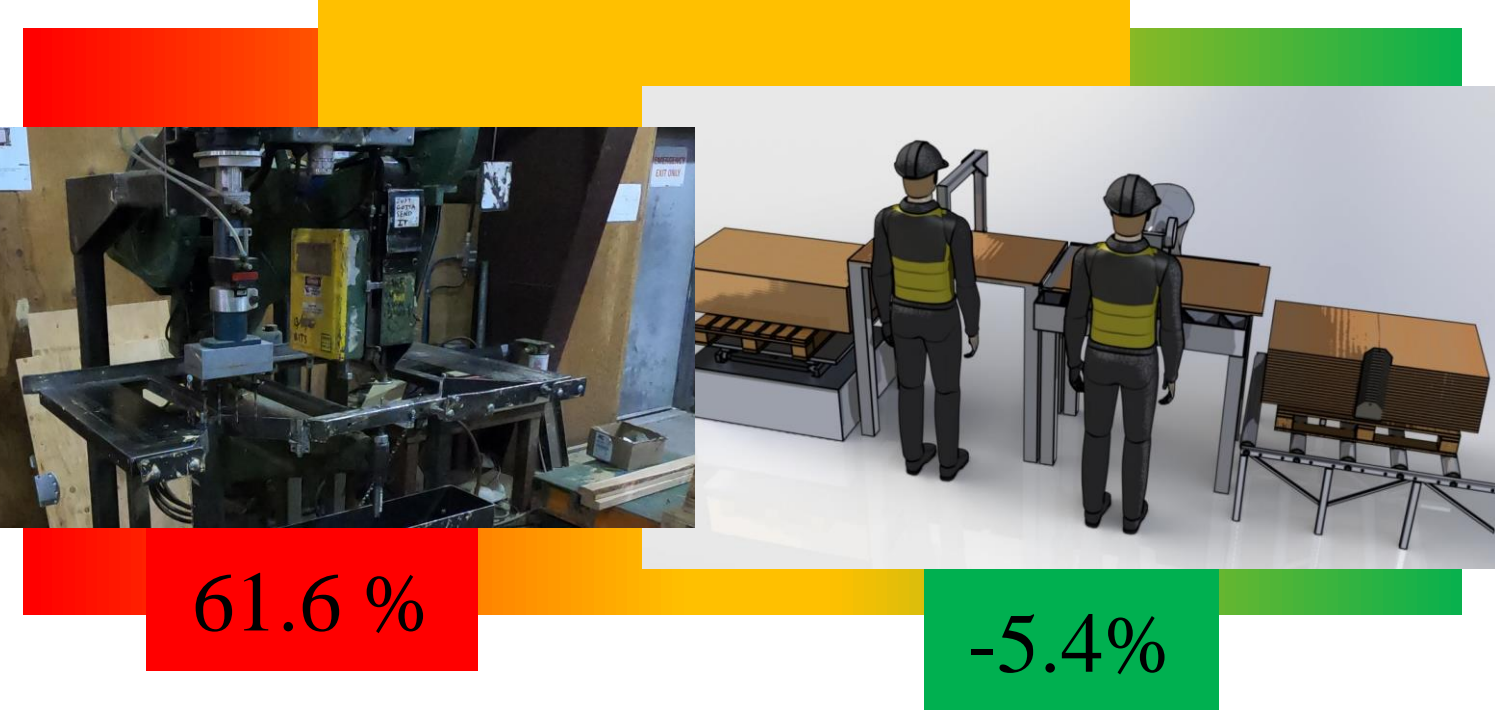


Fig. 12. & 13. Before and After Ends Process

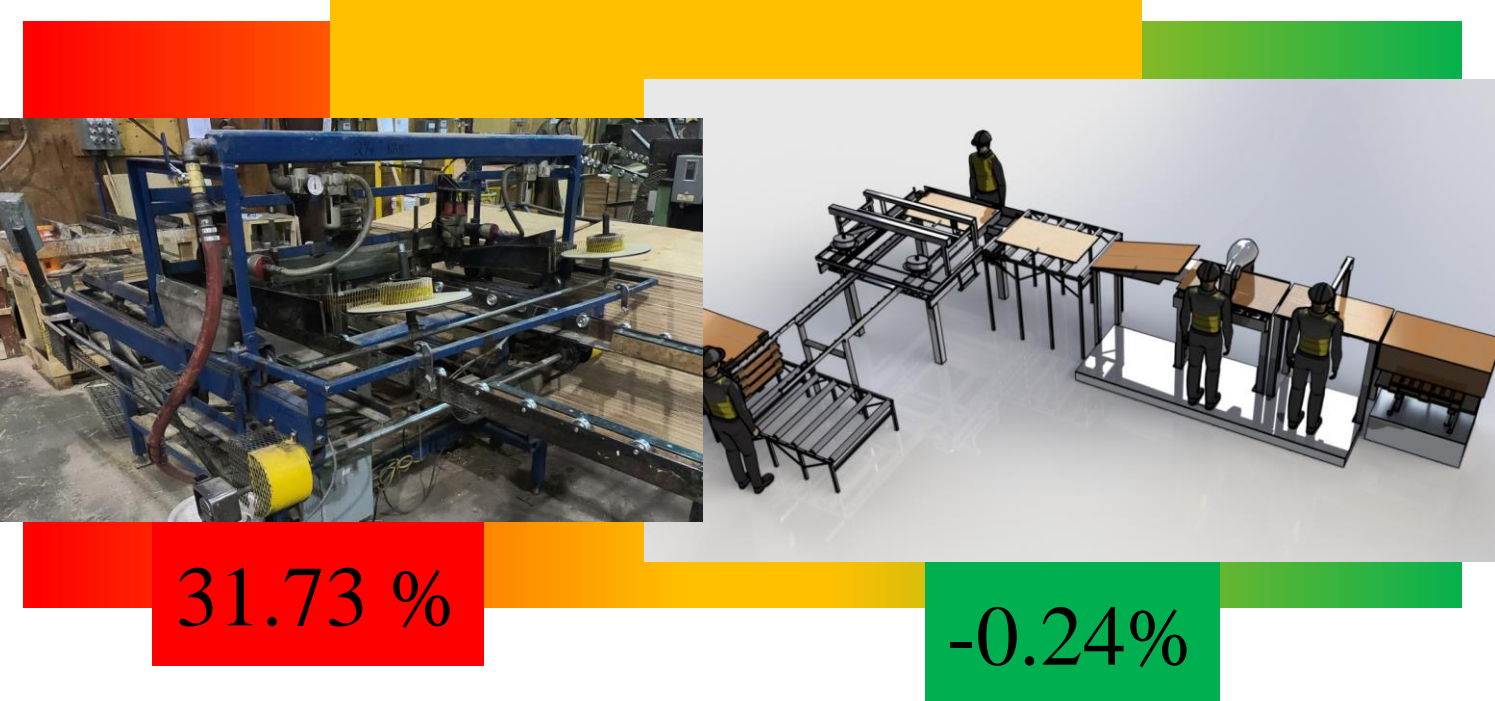


Fig. 14. & 15. Before and After Sides Process



Fig. 16. & 17. Before and After Bottoms Process

Recommendations

- Continued use of 5S+1 system for housekeeping tasks and eliminating nonproductive tasks
 - E.g. less time spent wandering around the bin shop looking for misplaced items because it is now labelled and located at their workstation
- Follow the suggested flexible preventive maintenance schedule
 - Vital for Tolko as they progress towards automation and adapt to other changes in the warehouse
- Complete the addition of Programmable Logic Controller upgrades to assist with further automation and object recognition subprojects.
- Implement the final assembly design with two stations that reduce production error from 91.47% to -28%
- Other machine cell improvements should also be implemented as soon as possible to increase production
- Reorganize layout to improve process flow of parts allowing all production errors to be below 0%, exceeding target rates
 - Implementing the layout proposed in Fig. 6. will decrease bin shop space requirements by 65.9% and reduce production error to target to meet or exceed target rates

Results to Date

- Tolko confirmed this project provided significant impacts
 - Cost of a bin has decreased from \$13.44/bin labour to \$9.83/ bin labour, a 26.9% reduction in labour/unit costs based on an equivalent productivity increase according to mill month end financials, confirmed by accounting staff
 - Turntable prototype has proven successful and is well liked among operators, especially regarding ergonomics and speed
- Conservatively estimates another 20-25% reduction in cost and increase in productivity based on machine setups and improved layout and material handling
- Recommended improvements are planned to continue taking place in stages over the summer/fall of 2020

Conclusions

- This project has provided immense benefits to Tolko's production rate
- The generated strategies to improve production rates will continue to be used, refined, and implemented by Tolko
- Thought many easily accomplishable small tasks in different areas, bin production can continue to be sufficiently streamlined to meet target production goals

Acknowledgments

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Check out our video!