

Salted hide handling system

Salted hide handling system for movement and logistics within the hide processing facility

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Prepared by
Michael Finucan

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Contents

Contents	2
1.0 Executive Summary	3
2.0 Introduction	3
3.0 Project Objectives	4
4.0 Methodology	4
5.0 Project Outcomes	6
5.1 Project process overview:	7
5.2 Hide folding specification:	8
5.3 Virtual open day	9
6.0 Conclusions	9

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1.0 Executive Summary

JBS Australia is the country's largest meat and food processing company, operating technologically advanced production and value-added facilities and feedlots. whilst also owning and operating a leading high-quality meat cutting and case ready production facility.

JBS owns and operates a hide processing facility at its Dinmore site processing on average 21,000 hides a week, with over 1.1 million hides processed 2020.

The processing of hides is very manual and presents a number of operational challenges and risks. These included heavy lifting, staff forklift interaction, wet environment, safety risks, absenteeism and high turnover. There is a significant cost associated with hide handling at the processing facility reducing the total achievable value for livestock processed.

This project looked at how reduce cost and risk at one of the labour intensive heavy lifting components of the process by automating the palletisation of hides. The project anticipated that automating the hide palletising process would replace of 6-8 full time operators per shift over 11 shifts per week. With a the total savings due to labour related costs of \$1.2M/year.

2.0 Introduction

Beef processors in Australia sell hides in either a wet-green / salted state (most common), dry salted or a wet-blue sammied state either to local tanneries or to offshore processing facilities. Hides are often graded at the processing facility in order to ascertain defects such as branding, insects, parasites, scratches, holes, thickness and an estimated total saleable area or alternatively using broad brush grades based on cattle breed, age and source locations. Graded hides are sorted, folded and packed onto pallets or into bins for storage and transport from the processing facility to value adding businesses further down the value chain. From the point the hide is removed from the carcase to when it is shipped from the primary processing facility there exists a harsh labour intensive process of treating and handling the hide to protect against degradation, pre-sort and to form efficient transportable arrangements.

The handling of hides is currently performed manually and has a number of associated risks and costs including heavy lifting, staff forklift interaction, wet environment safety risks, absenteeism, turnover and training that make the process of hide handling difficult to staff, costly and risky to the processor. There is a significant cost associated with hide handling at the processing facility reducing the total achievable value for livestock processed.

As a result of fleshing and salting hides the processing environment becomes wet, humid and corrosive. For this reason there is little automation currently available. Equipment that does exist is by-and-large simplistic and subject to a shortened lifespan and often a high level of maintenance. Most off the shelf hardware components are unable to withstand the harsh operating environment meaning any automation solutions are limited in the sensing and actuation options available.

This project builds on work performed in an initial high-level technical investigation into hide handling which explored concepts for the collection, movement and placement of folded hides which opens the door to a device that will have use in removing operators from the areas of highest danger and operating risk within the hide processing plant.

3.0 Project Objectives

The objectives of the project are to:

- Develop a prototype system that can collect, transfer and place hides onto pallets and into bins.
- The ability to handle a range of 8 hide grades between 20-80kg at rates of up to 450 hides/hr.

4.0 Methodology

This project developed a prototype system that can collect, transfer and place hides onto pallets and into bins. The system will have the ability to handle a range of 8 hide grades between 20-80kg at rates of up to 450 hides/hr. As traditional robots and electric actuation solutions are not capable of operating in this environment a robust gantry concept is going to be developed using fit for purpose components that are able to withstand the harsh environment and are easily maintained and serviceable. The system will have two key elements of development. Firstly the hide handling end effector will need to be developed to handle a full range of hides and have the ability to pick and place hides effectively. Secondly a gantry style transfer mechanism based on proven and robust hardware that is resilient in the harsh environment as well as easily maintainable and serviceable will be designed, built and trialled in production.

The prototype was designed to integrate into the existing JBS Dinmore hide process in the following manner:

- The hide will be inspected by a grader whose function is to classify the hide's grade prior to the hide dropping onto a folding table.
- The grading and folding process will continue as currently handled.
- Operators will fold incoming hides whereupon the folded hide will be conveyed into the automated cell through the product access opening.

Within the system the gantry end effector will move to pick the folded hide automatically, move to the designated pallet or bin (based on grade) and place the hide in one of four orientations with the hide fold aligned with the outside of the pallet/bin. The gantry will then return to await the next hide.

A series of "smarts" will be built into the system to identify how to orient the hide and when a storage location is full. On completion of the hide sorting and stacking, completed pallets are able to be collected by forklift without interrupting the continuous operation of the gantry.

Detailed design was conducted of hide handling end effector and gantry transfer (including site trials where necessary to prove core design elements). The design process developed key functional elements and included a series of trials completed at Dinmore using a robot and gripper and conveyor.

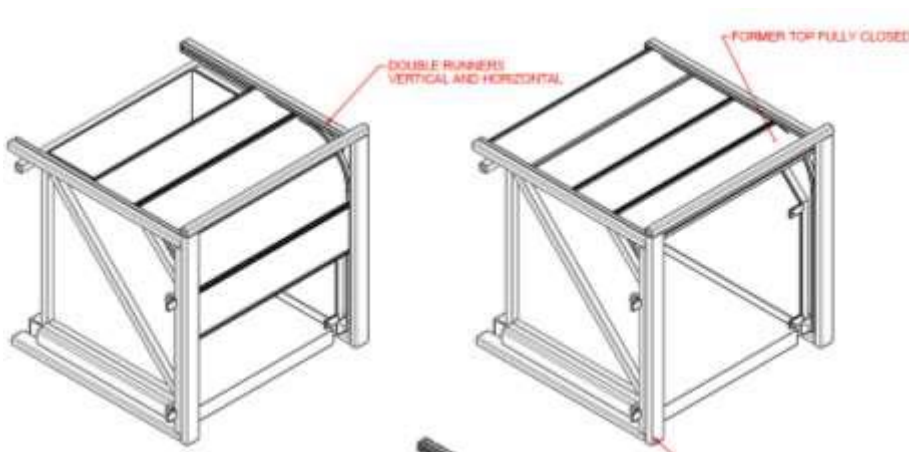
The design and development of the project work through key functional areas such as:

- Conveying of Hides
- Hides of different shapes, sizes, weight
- Quality of folded product relies on client processes
- Slipperiness of Hide impacted by Wringer
- Gripping hides with a robotic gripper

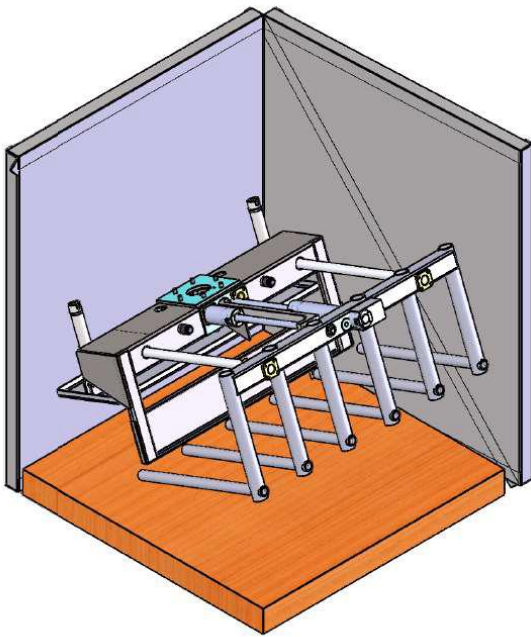
- Palletising hides into a pallet frame
- Detecting height of hides on a pallet
- Gantry not meeting rate of production
- Stability of hides on pallet

Through the early stage concept development key elements of the design covered:

- Cycle time Analysis
 - Fast actuation to minimise cycle time impact
- Hide contact area
 - Round bar vs. flat bar
 - Pressure of hides on side walls
- Hide stability
 - Superior support
- Hide ejection
 - Tilting tines vs retracting tines



- Door actuation
 - Fast actuation to minimise cycle time impact
- Pallet tolerances
 - Draft angles
 - Adjustable sides
- Safety
 - Separate safety zone
 - Operator / Fork interaction



5.0 Project Outcomes

The Salted hide handling system has successfully been delivered and has automated the movement and logistics within the hide processing facility. The system has effectively handled over 1.1 million hides and reduced labour and increased safety. One of the main objectives of the project was to improve safety in the hide plant. Since the instillation of the facility in March 2020 there have been no injuries. This is a significant drop from 11 injuries in the 12 months prior.

The project was delivered by Scott's Automation successfully. The design features such as the tag identification and sorting process and the hide handling end effector system to pick and stack has been very successful. A video of the final solution can be found in the following youtube link: <https://www.youtube.com/watch?v=8Ntlj56lfu4>

5.1 Project process overview:

Project delivery process flow overview



Figure 4: Simplified process flow. Green processes indicate dependency on manual operations.

The system is comprised of one large structure that supports two large four-axis gantry systems that operate over two slatted belt conveyors, and 10 pallet boxes as shown in Figure 5 and Figure 6.

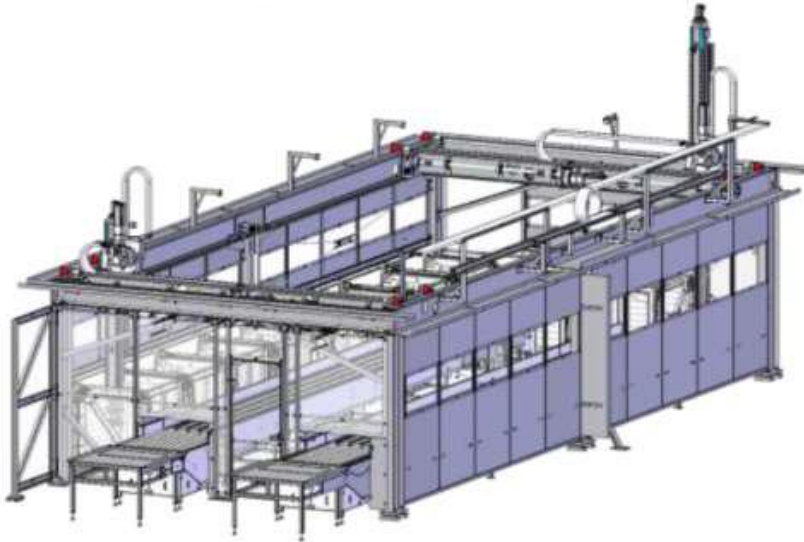
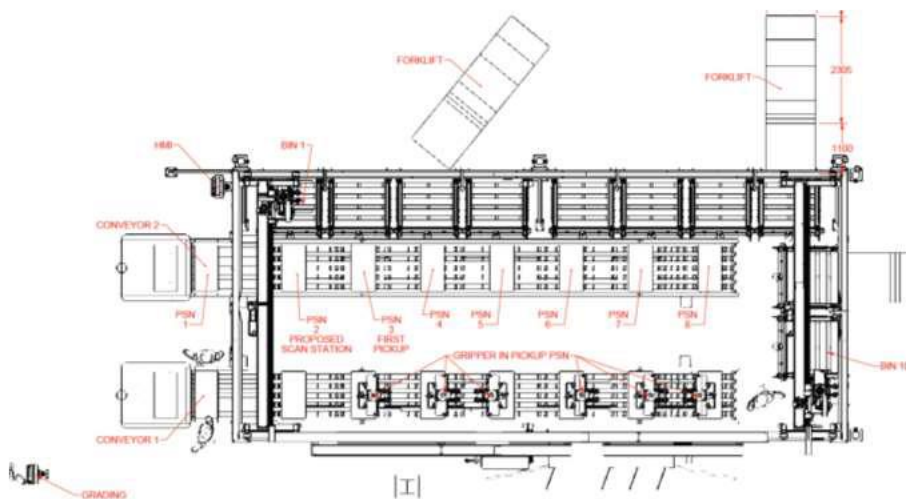
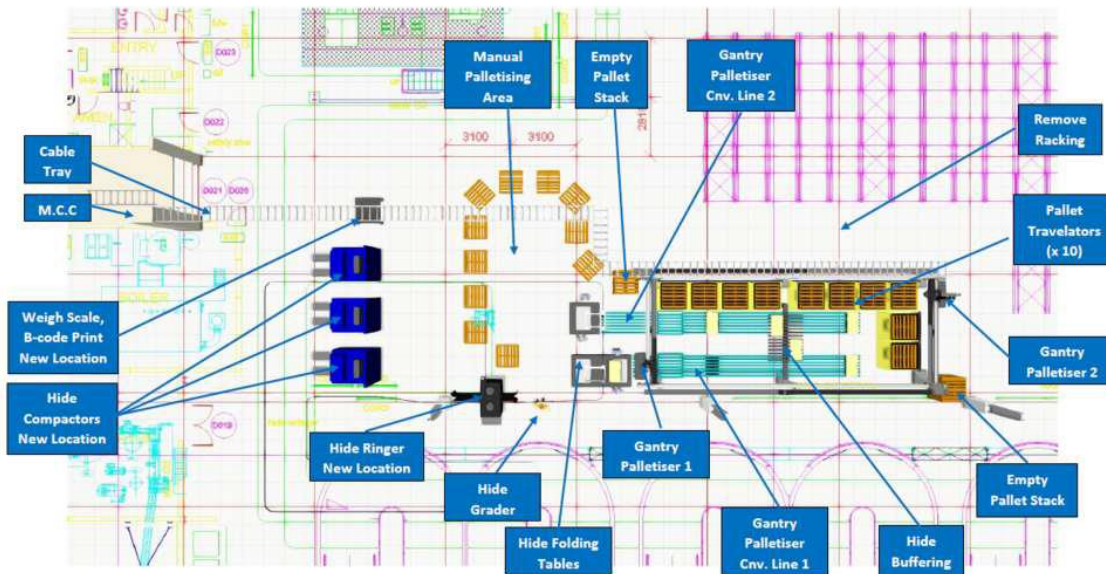


Figure 5: North view load side of main structure.





5.2 Hide folding specification:

Ensuring folded Hide Specification was a key consideration

- Overall length of 1000mm with ± 50 mm tolerance
- Maximum width of 500mm with ± 25 mm tolerance
- Height of folded hide will vary but should remain relatively uniform when folded, and will have a minimum height of 25mm and maximum height of 300mm.
- Folded hides are to have all 'bits' tucked in such that there are no significant protrusions and the hide is stable.
- Fold of hide to be placed on the conveyor with the following orientation:
 - Wide face leading
 - Hide fold at the trailing edge
- Unsuitably folded hide for Palletising System. Overhanging hide to be tucked in.

Figure 1 - Example of Folded Hide Dimensions



Figure 2 - Example of Folded Hide



Figure 3 - Example of Palletised Hides exiting the palletiser



5.3 Virtual open day

A virtual open day was held on the 25th June to demonstrate the outcomes of the project. A technical overview presented by Scotts was delivered and a virtual tour of the facility was conducted using Bondi lab smart glasses. The tour gave patients a live walk through of the site covering:

- Introduction of the hide facility - process from hides arriving to stacking
 - Grading and sorting process
 - Cleaning and treating
 - Drying and stacking
- Overview of the automated palletiser
 - The folding process and the robotic pallet loading

A video of the open day can be provided upon request to AMPC.

6.0 Conclusions

The project has been an overall success with over 1.1 million hide being processed through the plant since commissioning in March 2020. One of the main objectives of the project was to improve safety in the hide plant. Since the instillation of the facility there has been a 100% reduction in injuries and there have been significant labour savings.

The design process and integration of hide tracking technology has seen significant efficacies through the plant.