

Beef Cube Chining

LEAP4Beef-Module L4B02 Project 1 – Cube Roll
Chining cell pre-production concept prototype.

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1 Abstract

The project was to build a test rig and demonstrate mechanised chining of the beef cube portion. And provide findings that support the benefit of this strategy and development of a cube chining machine.

A test rig was developed to demonstrate mechanised chining of the beef cube portion. The rig demonstrated the practicality of a clamping means and cutting the chine cut with a circular saw. With the mechanised chine cut trials, the beneficial yield was shown.

A standalone cube chining machine has been proposed, suitable for processing 164 head per hr.

The benefit to a processor has been found to provide a payback of 1.2 years.

On these findings the development of a specialised cube chining machine, ideally with chuck capability, is viable and it is recommended that it should be pursued. However, the commitment to proceed would be subject to findings from a beef processor market review and analysis.

2 Executive summary

Purpose of the research

There is an opportunity to automate the removal of the cube bone from the beef bone-in cube, targeting yield improvement, labour saving and improved operator safety.

This project has focused on addressing the knowledge gaps identified in the previous exploratory project (Thomson A. , 2024).

Target Audience

The main target audience is the Australasian beef processing industry

Benefit of the results

The results of the research will form a business case for proposing a prototype machine development project. With the desired outcome being the development of a prototype which will contribute value, by way of yield, labour saving and improved safety, to the Australasian beef industry.

The objectives and delivery of the project were:

- To develop and trial processing methods for the L4B02 Module – Cube Roll Chine Bone Removal to assess accuracy, and hence yield, compared to a human operator.
- Adapt prior learnings from the L4B01 Module – Striploin Chine Bone Removal unit.
- To trial basic materials handling and cutting methodologies.

- The success of this project will provide the steering group including Scott with the information required to develop a L4B02 Cube Roll production prototype module design and inform the LEAP4Beef strategy moving forward.
- It was anticipated that utilising the existing Striploin chine bone removal concept prototype currently at an Australian processor would be the lowest impedance path, however given the determination that the bandsaw was inappropriate a test rig was developed, with a circular saw, that was able to be trialled at a local processor.

Methodology employed

The background was pre-empted by research performed in (Thomson A. , 2024), where the chining of a bone-in cube was simulated manually. This project developed a test rig that demonstrated mechanised bone-in cube chining.

A key metric is the judgment of the meat quantity that can be retained on a higher value portion by mechanised chining.

Results/key findings

The project has demonstrated that mechanised chining of the cube is possible. And that the yield is in line with what was proposed in (Thomson A. , 2024)

The proposed concept machine has a production capacity of 164 head per hour.

For an example case of 300,000 head processed per year, on two shifts, over 95 head/hour capacity would be required. One machine would be adequate for the example site.

For the example case the yield benefit, ignoring any change to labour input, would have a payback of 1.2 years. The payback will depend on the specific plant number of head processed per year, required rate and other factors such as number of lines.

It is recommended that chuck chining capability is considered in the development of the cube chining module. This would provide additional functionality.

On these findings the development of a specialised cube chining machine, ideally with chuck capability, is viable and it is recommended that it should be pursued. However, the commitment to proceed would be subject to findings from a beef processor market review and analysis.

Benefits to industry

There is a significant benefit to a processor, and by extrapolation to the industry, estimated.

Future research/extension/adoption and recommendations

It is recommended that chuck chining capability is considered in the development of the cube chining module. This would provide additional functionality.

On these findings the development of a specialised cube chining machine, ideally with chuck capability, is viable and it is recommended that it should be pursued. However, the commitment to proceed would be subject to findings from a beef processor market review and analysis.

3 Introduction

There is an opportunity to automate the removal of the cube bone from the beef bone-in cube, targeting yield improvement, labour saving and improved operator safety.

This project has focused on addressing the knowledge gaps identified in the previous exploratory project (Thomson A. , 2024).

The main question was to determine whether mechanised chining of the bone-in cube was practical. And given the achievable accuracy, overall value of the resultant pieces, and the required capital cost, is it economic to develop a viable machine.

The main target audience is the Australasian beef processing industry

The results of the research will form a business case for proposing a prototype machine development project. With the desired outcome being the development of a prototype which will contribute value, by way of yield/improved meat value, labour saving and improved safety, to the Australasian beef industry.

4 Project objectives

Utilising the existing Striploin chine bone removal concept prototype cell at an Australian processor, modifications will be incorporated to trial chine removal from the Cube Roll and prove the fundamental principles required to design and build a production prototype machine.

To trial basic vision, materials handling and cutting technology for the L4B02 Module – Cube Roll Chine Bone Removal to assess accuracy, and hence yield, compared to a human operator.

Modifications to the existing cell will include alternative materials handling devices, sensing software algorithms, cut path calculation and changes to the cut path. The changes will be made in a manner that enables continued un-inhibited development of the Striploin Chine module in parallel.

The success of this project will provide the steering group including Scott with the information required to develop a L4B02 Cube Roll production prototype module design and inform the LEAP4Beef strategy moving forward.

It was anticipated that utilising the existing Striploin chine bone removal concept prototype currently at an Australian processor would be the lowest impedance path, however given the determination that the bandsaw was inappropriate a test rig was developed, with a circular saw, that was able to be trialled at a local processor.

5 Methodology

5.1 Background

In previous project the automation of the beef process has been broken up into the modules shown in Figure 1

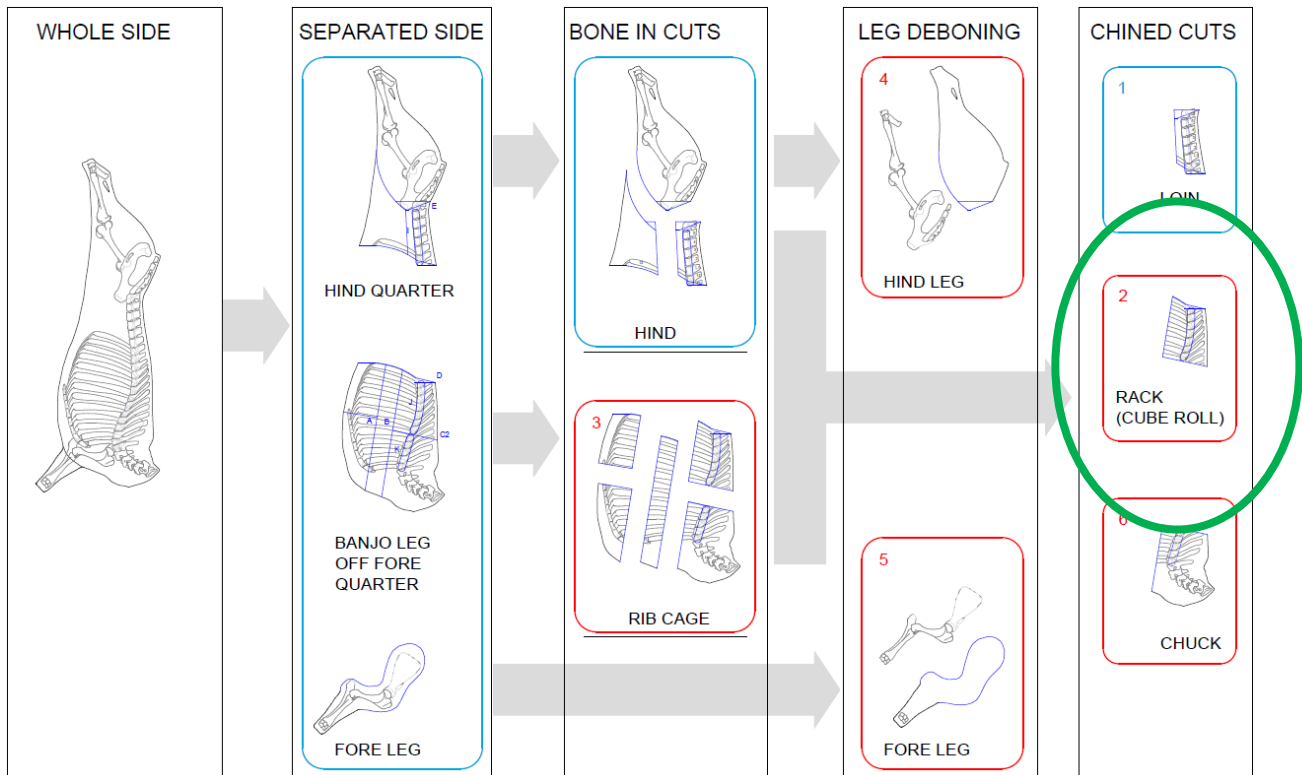


Figure 1: Proposed beef automation modules

Where this project is identified as CHINED CUTS, LOIN. (Marked in green)

The modules are:

- Leap 4 Beef Module 01 Striploin chine bone removal
- Leap 4 Beef Module 02 Cube roll chine bone removal
- Leap 4 Beef Module 03 FQ Cuts processing (less banjo)
- Leap 4 Beef Module 04 HQ Leg bone removal from meat
- Leap 4 Beef Module 05 FQ Leg bone removal from meat
- Leap 4 Beef Module 06 Chuck chine removal

Referring to the previous project, (Thomson A. , 2024), it is stated that for the reference Australian processor, they produce a boneless cap-off cube roll for 95% of their production. Where ribs are cut 75mm beyond the eye.

There are three current processes for harvesting boneless cube roll:

1. Fleecing

The cube roll is fleeced off the skeleton then trimmed to specification. Ribs, including intercostals, are sawn off to make back-ribs. Featherbones are sawn off. The remaining spine and residual meat are sold as spine bones.



Figure 2: Fleeced fore spine separated into back ribs and spine bones.

2. Chined and ribs sheet fleeced off

The bone-in cube roll is chined, and featherbones removed. Ribs with intercostals are sheet-fleeced off the cube (back-ribs). The cube is trimmed to specification. The dorsal edge of the back ribs is band sawn to remove spine remnants.



Figure 3: Bone-in cube roll separated into featherbones (1-not shown), untrimmed cube roll (2), trimmed back-ribs (3), chine bone (4), back-rib dorsal trim strip (5).

3. Chined and ribs scalloped out

The bone-in cube roll is chined, and featherbones removed. The dorsal end of the ribs are scalloped out of the cube then sheet-fleeced off the cube (back-ribs). The cube is trimmed to specification. The dorsal ends of the back ribs are band sawn to remove spine remnants. It has been shown that the meat from between the dorsal ends of the ribs remains on the cube roll, with associated increase in value.



Figure 4: Chined cube roll with back-rib fleecing path to maximise yield (1), untrimmed cube roll (2) and untrimmed fleeced back-ribs (3).

5.1.1 Bandsaw?

It was determined in (Thomson A. , 2024) that if a bandsaw is used, the optimum chining angle would not be possible in an unacceptable percentage of production, because of being constrained to clearing the ribs.

The key knowledge gaps are identified below:

Knowledge gap	Background
Clamping means	The challenge regarding clamping includes establishing clampable real estate on the product that can be achieved with interference with the cutting means path.

Sensing means	Scott has the (Maunsell K. M., 2024) camera upgrade project to determine whether external surface scanning can determine the suitably accurate cut path. The sensing means will need to be proposed and validated so that the view of the required features is not excessively compromised.
Cutting means	Bandsaw, circular saw or alternative. The cutting means selection interacts with the clamping and sensing means.

5.2 Literature review, online searching and review of Scott earlier work, including (Thomson A. , 2024).

5.3 Key metric that drives the business case.

5.4 Mind map process options and candidate selection evaluation

5.5 Product & Process Cross sections

5.6 Develop test plan and build associated test rig

5.7 Trials through the test rig and establish results.

5.8 Concept and estimate price of commercial prototype

5.9 Business case estimation

6 Results

6.1 Literature review, online searching and review of Scott earlier work, including (Thomson A. , 2024).

The internet, including the European patent office, has been searched.

Key phrases and words used include: *“A carcass processing machine that has bone cutting blades for cutting portions from vertebra of carcass”*

There are various handheld breaking saws which can be used in either the pork or beef industry for chuck, cube or short loin chining. Equipment supplies in this space include:

- Kentmaster
- Freund
- Jarvis.

There various chining means in the lamb processing industry. In the automation space, Scott is the most significant provider. The lamb chining, automatically, is performed with the lamb rack as a saddle. (New Zealand Patent No. AU2013257331A1, 2015-01-28). The beef requirement is to chine, as a split product.

Current market offerings for chining of split sides of pork or beef include:

- Frontmatec smart rib saw; the system utilises a circular saw and 3D ruler sensing (Frontmatec, 2025)
- Midwest machine: the system utilises simple fixtures on a moving conveyor and bandsaws with saw height adaption. (Midwest_Machine, 2025)

Scott earlier work has been reviewed, and it significantly contributes to this project.

Previous Scott work includes:

- (Scott Technology LTD, 2018)
- (Thomson A. , 2024)
- (Maunsell K. M., 2024)
- (Weatherall & Maunsell, 2025)

6.2 Key metric that drives the business case.

6.2.1 Key metric that drives the business case

1. Yield, major economic driver
2. Labour saving, economic and enabling driver
3. Product quality
4. Safety
5. Product food safety compliance
6. Hygiene & associated enhanced product shelf life

6.3 Product & Process Cross sections

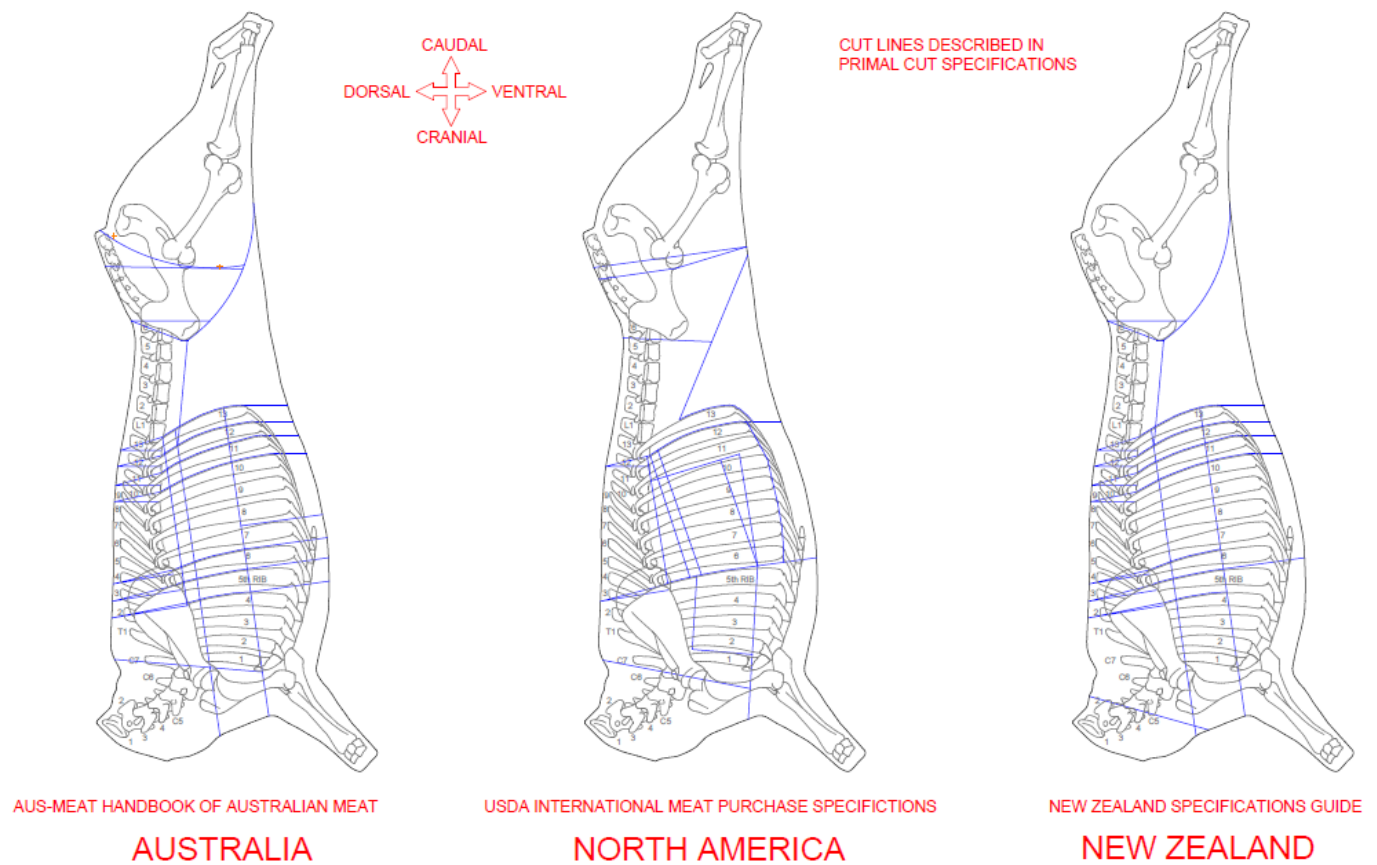


Figure 5: Industry specifications - by country

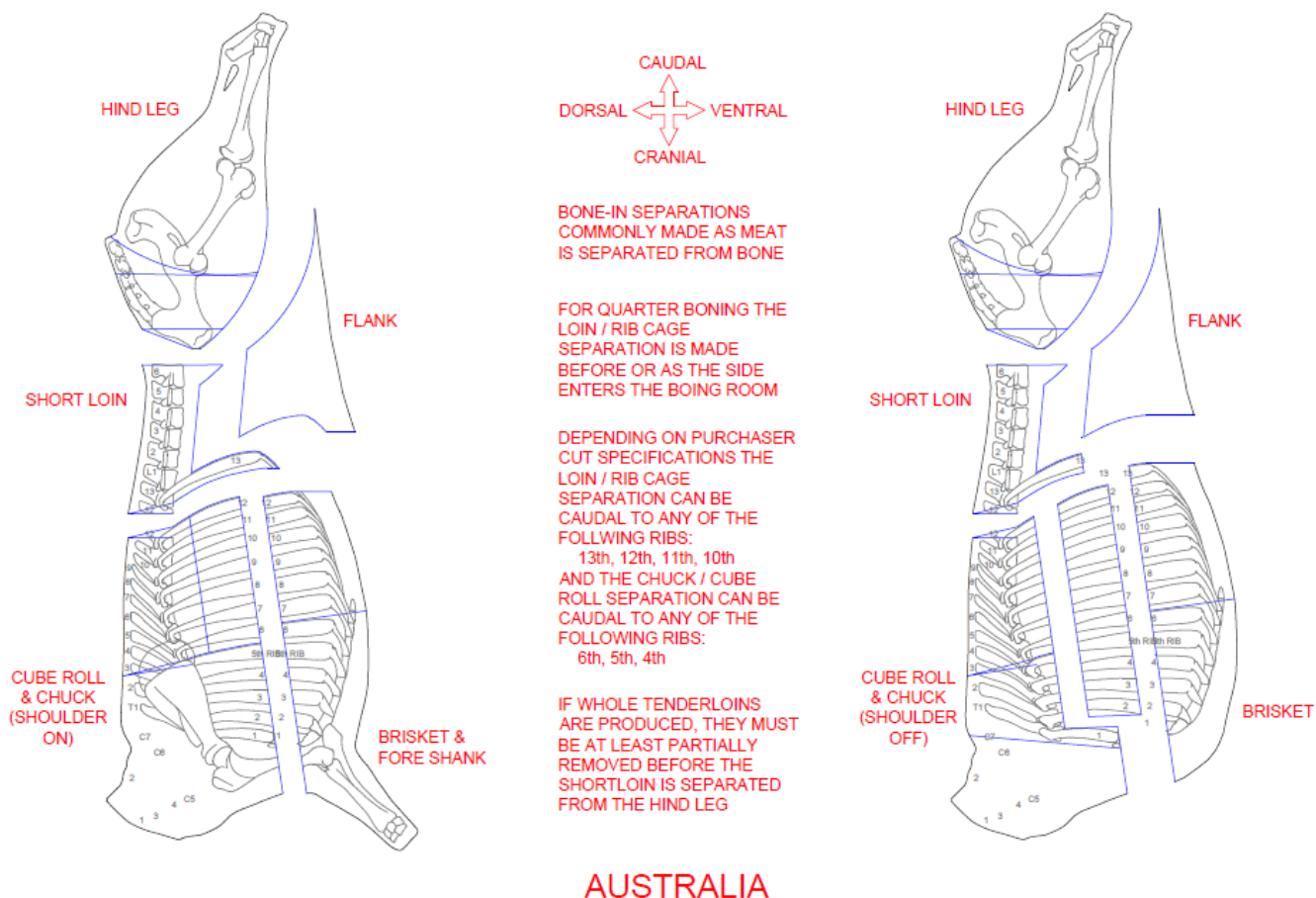


Figure 6: Specification detail - Australia

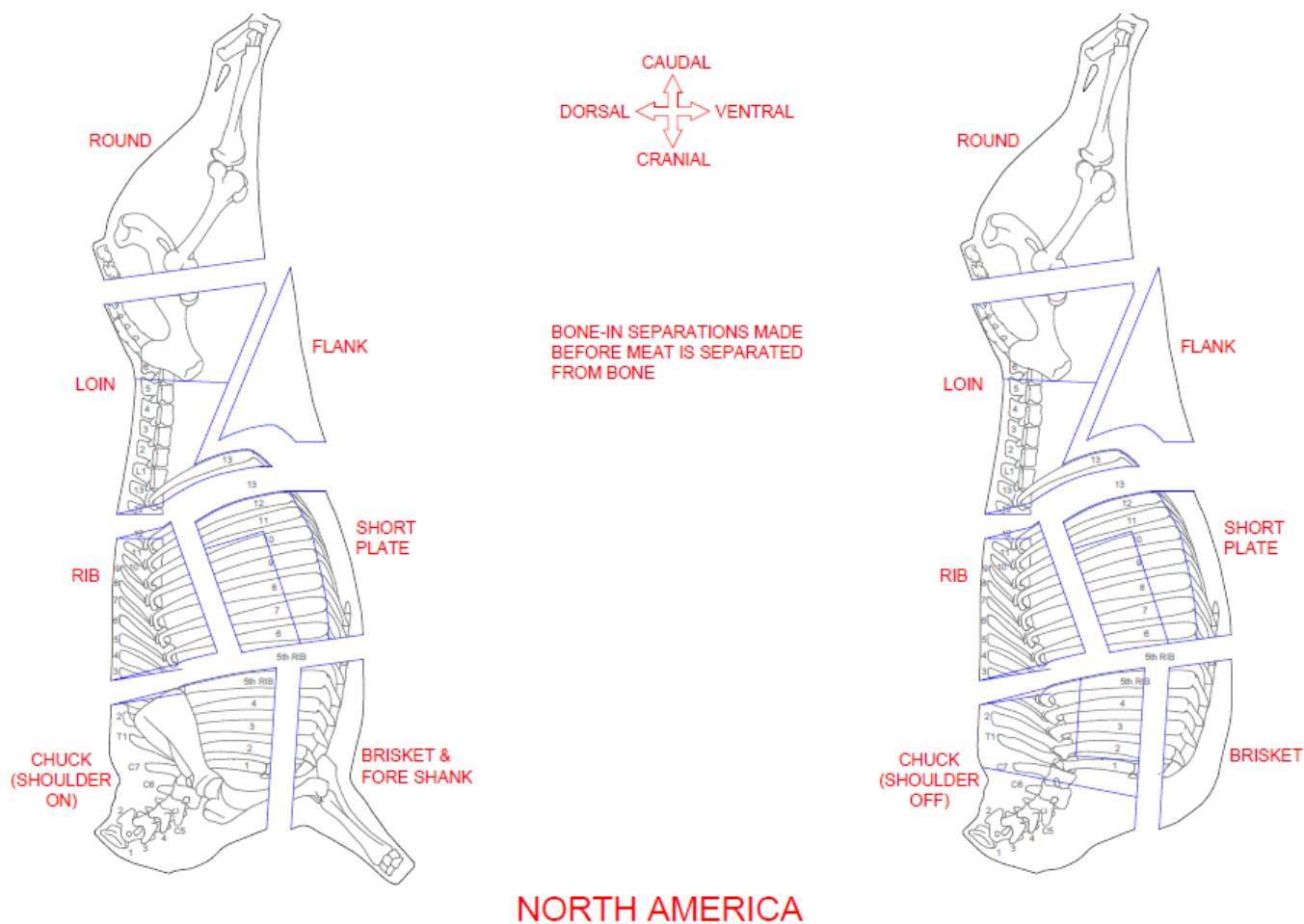


Figure 7: Specifications in detail - North America

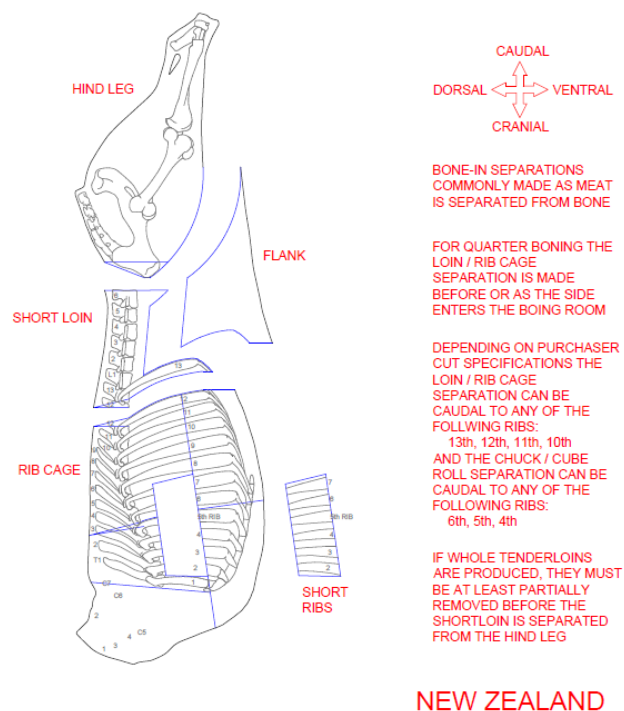
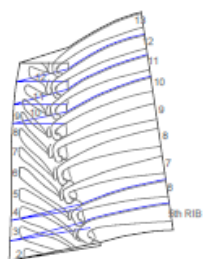
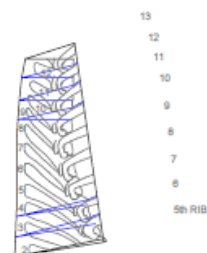


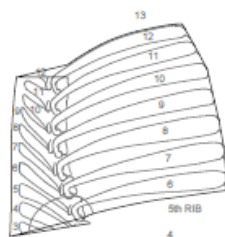
Figure 8: Specifications detail - New Zealand



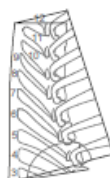
TOMAHAWK RIBS



AUS-MEAT 1600 TO 1605



IMPS No.103 OPTION 1

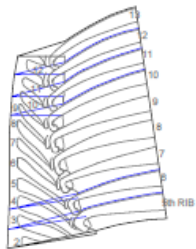


IMPS No.104

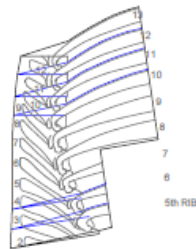


IMPS No.103A

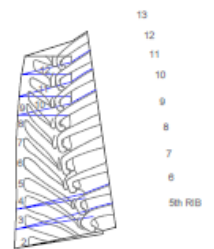
Figure 9: Bone-in primal for bone-in cube roll



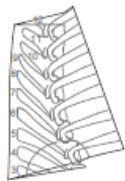
FOR AUS-MEAT 2220 TO 2225



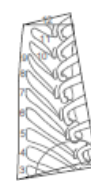
FOR AUS-MEAT 2240 TO 2244



FOR AUS-MEAT 2240 TO 2244



IMPS No.103
FOR IMPS No. 108 & 110 TO 112



IMPS No.103A
FOR IMPS No.108 & 110 TO 112

Figure 10: Bone-in primal for boneless cube roll



Figure 11: Beef skeleton showing relevant geometry to chine

6.4 Develop test plan, design and build associated test rig

6.4.1 Design of experiment - test plan

6.4.1.1 Overview

In the same way that short loins are chine cut (after tenderloin removal) to improve boneless yield, chucks and cube rolls (or ribs) can also be chine cut to improve boneless yield.

Scott has robotically chine cut cube rolls with a band saw and have manually chine cut chucks with a hand saw. In both situations it can be necessary to compromise the chine cut line to avoid cutting ribs, particularly at the cranial end of bone-in primal pieces.

The aim of chine cutting trials at a local processor is to investigate the feasibility of chine cutting bone-in chucks and cube rolls with a circular saw to avoid rib damage.

6.4.1.2 Experimental method

Load

- Isolate the saw
- Lower the clamp to be horizontal
- Load the piece to be cut into the clamp and tighten all clamp
- fingers including those that are empty

Adjust

- Set the jig to cut along the chosen chine cut line by adjusting:
 - Clamp angle from horizontal
 - Clamp horizontal position perpendicular to the saw blade
 - Saw blade depth
- Take photos

Cut

- Clear the safety area
- De-isolate the saw
- Start video recording
- Start the saw
- Use the long handle on the clamp carriage to move the clamp (with piece to be cut) past the saw
- Stop the saw
- Stop video recording
- Isolate the saw
- Inspect results
- Ready the jig for the next test piece

6.4.1.3 Tests

To establish the following operational aspects the first tests are best conducted using fleeced bone sets.

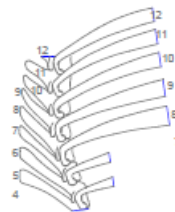
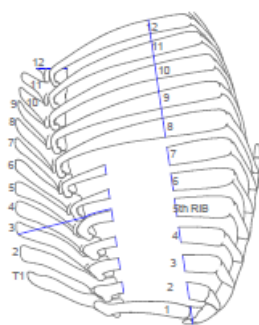
- Is it likely that we can suitably clamp chucks and racks
- Are ribs shortened to the brisket cut line OK, or do we need them shortened to the OP rib / short rib cut line
- Is adjustment best with left (caudal leading) or right (cranial leading) primal pieces
- What cutting discs satisfactorily cut bone

Following satisfactory bone only testing, bone-in primal pieces should be cut. As part of results inspection, chined yield could be compared to non-chined yield of the opposite handed part from the same carcass.

6.4.1.4 Tests

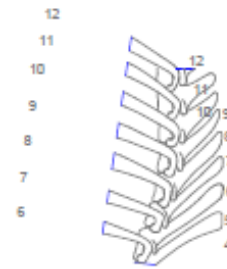
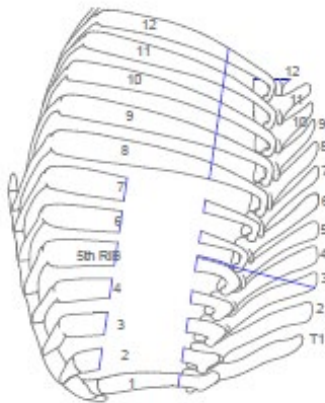
1a) Bone only rib-set including

- ribs 6 to 7 trimmed to the dorsal short rib cut line
- ribs 8 to 12 trimmed to the brisket cut line



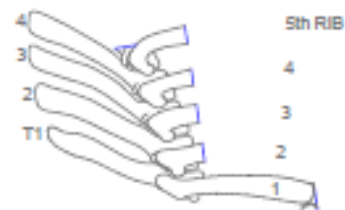
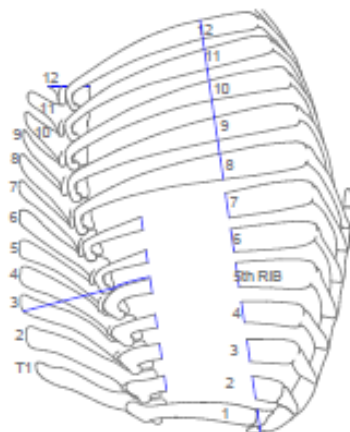
1b) Bone only rib set of opposite hand to test 1

- all ribs trimmed to the short rib cut line



2a) Bone only chuck ribs

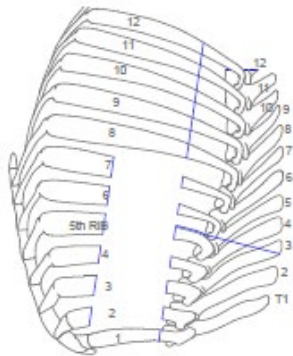
- excluding neck bones
- including ribs 2 to 5 trimmed to the dorsal short rib cut line
- Including rib 1 trimmed to the brisket cut line



2b) Bone only chuck ribs of opposite hand to test 3

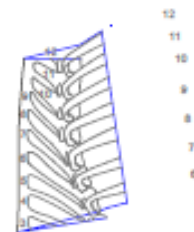
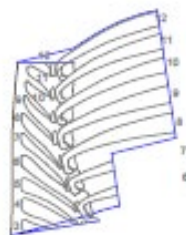
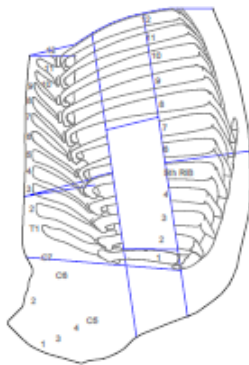
- excluding neck bones

- all ribs trimmed at the dorsal short rib cut line



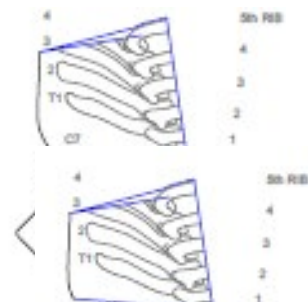
3) Bone in rib set

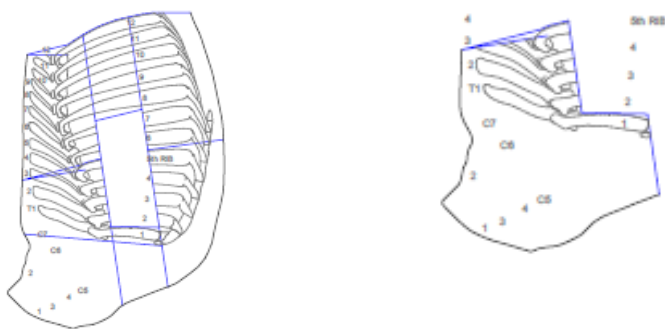
- Preferred rib length established in tests 1a and 1b (also production dependent)
- Required hand established in tests 1a and 1b



4) Bone in chuck

- Neck bones out
- Neck chain out
- Shoulder off or scapula and humerus out (preferred but production dependent)
- Preferred rib length established in tests 2a and 2b (also production dependent)
- Required hand established in tests 2a and 2b
- Neck on / neck off depends on what we can do without unacceptable damage to the neck (also production dependent)





6.4.2 Test rig

Clamping

The clamping onto the spine was selected as the preferred solution. For the test rig, a clamp design was utilised that grips the ventral portion of the spine with detail to resist non opposing forces on the split face. A design was developed using the cross-section constraints to effect clamping while enabling the circular saw to cut on the optimum path. The cross section was developed on Solidworks 3D CAD and built.

Sensing

Sensing prototyping and trialling was not in this projects scope.

Cutting

The preferred solution is the circular saw. Alternative blades were purchased to provide options regarding teeth profile and diameter.

The rest of the test rig included:

- Frame
- Freund cutting head
- Transverse axis
- Electrical cabinet
- Safety controller
- Dead man switch
- Guarding

6.4.3 Test run and results

6.4.3.1 Test rig at local processor

The test rig was transported to the local processor and installed in the innovation room with the assistance and support of their staff.

The supplied product was organized as per the test plan.

Fleeced bone sets were used initially for setup and validation of cut path, clamping and cutting. The bone sets were from prime cattle of weight range (hot carcass weight) of 250 – 350kg.

The blade speed was reduced to 50% of nominal speed (50hertz)

The trials were performed on 10th of June 2025.

The “meat” trials were performed on manufacturing grade cattle.

6.4.3.2 Trials and qualitative results

To produce all boneless cube roll specifications, cube roll meat is fleeced from the appropriate part of a rib cage or the rib cage is fleeced from the cube roll meat.

Because of bone shapes at the rib heads, it isn't possible to economically fleece cube roll meat off bones in one piece in a way that leaves all of the bones clean.



Figure 12: Fleeced and trimmed rib cage (short ribs removed) showing rib head bone shape.

Meat value is typically recovered from fleeced cube roll bones in three areas.

The value of meat is recovered by trimming it from the bones and selling it as trim, or by cutting off the ribs and feather bones and selling the remaining spine bone with the meat still in place.

The value of meat is recovered by trimming it from the bones and selling it as trim, or by cutting off the ribs and selling them with the meat still in place as back ribs.



Figure 13: Cube roll spine bone and back ribs.

By chine cutting the cube roll will remain on the cube roll. Depending on how the ribs are removed from the chined cube roll, meat can also be left on the cube roll.

The cube roll bones show that the tip of the cranial most rib (farthest from the saw blade) is very close to the chine cutting line. If ribs are trimmed to 75mm from the eye muscle there will be damage to the cranial-most rib in some cases if the chine cut is made with a band saw running perpendicular to the spine. From a sample size of 8, 50% of cube rolls would have rib damage. If the optimal chine angle is further from the halving plane or ribs are longer than 75mm from the eye muscle, a higher number of cube rolls would have rib damage if they were chine cut with a band saw.

Correct chine cut placement is expected to be possible using convolutional neural network analysis of images taken from the caudal and cranial ends of a bone in cube roll.



Figure 14: Chined cube roll



Figure 15: Meat recovered from chine cut fleeced cube roll bones

Manual chine cutting using a band saw would permit recovery of some of this value, but the long ribs would compromise the chine cut line.

Test Code	Rib Length	State	Cut Angle	Could be on Cube (grams)	Note
8	All to short rib	Fleeced. Untrimmed.	50	190	Good cut. Meat that could have been on Cube roll if chine cut was scallop cut from rib heads.
9	All to short rib	Fleeced. Untrimmed.	45	120	Good cut. Closer to the bone would be fail. Meat that could have been on Cube roll if chine cut was scallop cut from rib heads.
10	All to short rib	Cube roll (and lip) on.	45		Good cut. Yield improvement on cube roll clearly visible and remained after lip removal.

6.4.4 Tests using the robotic striploin chining cell.

1) Test that the current arrangement will chine cut a cube roll.

- Place a cube roll into the clamps.
- Initiate the chine cut cycle.

This was all that was required to make a successful cut when beef zero work was undertaken using the robotic striploin chining cell.

The result was pretty good.



Figure 16: Striploin chine bone removal concept prototype cell at an Australian processor.



Figure 17: Resultant chine cut

2) Verify the ROI suggested in Beef Zero (Thomson A. , 2024).

Assuming that (Weatherall & Maunsell, 2025) does successfully chine cut a cube roll, we should cut a number of cube rolls and assess the yield. This will require assistance from an Australian processor.

The yield tests should be undertaken as follows:

- Robotically chine cut a cube roll to produce a chine bone and a cube roll that is bone-in and chine cut.
- Remove the feather bones from the cube roll
- Fleece the back-ribs off the cube roll taking care to scallop cut around the rib heads. See photos below showing the cut path.
- Trim the back-ribs on a bandsaw.



(These back-ribs weren't scallop cut at the head. To assess the meat content, the strip can be separated in meat and bone with a knife. This gives the maximum possible yield increase, but not the achievable yield increase.

Parts produced should be:

- Chine bone
- Boneless untrimmed cap-on cube roll
- Back ribs
- Rib ends trimmed from back-ribs
- Feather bones.

Weigh all parts by placing the largest on the scale first, (take photo) then add the next biggest piece (take photo) etc until all parts are on the scale and their total weight is displayed.



Figure 18: Yield measurements

Comparisons should be made with:

- Cube rolls that are not chine cut
- Cube rolls that are manually chine cut

The manually chine cut and processed cube rolls should have the same parts as the robotically chine cut cube rolls.

The cube rolls that are not chine cut should have

- Untrimmed cap on boneless cube roll
- Bones

Bones could be in parts:

- Back ribs
- Feather bones
- Spine bone

For comparison and to minimize scale error, it is important to weigh all parts in a cumulative manner. Ideally, the cap-on untrimmed cube roll should be weighed first, then back-ribs, then spine bone (or chined bone if the cube roll was chined) then trim (if any) and then waste. (ends trimmed off back ribs and then featherbones.) The photos should tell the story and provide the weight records to facilitate yield analysis.

The more we can do the better, but I imagine that something like 10 of each (30 all up) would start to paint a reasonable picture.

6.5 Concept and estimate price of commercial prototype

6.5.1 Machine concept

It is proposed that the preferred concept for a commercial machine would consist of:

- Infeed conveyor to the operator (if machine can be placed on an existing striploin belt – this could be deleted)
- Manually lift cube into clamp
- Clamps as per developed in (Maunsell K. M., 2024)
- Safety means – probably a pull-down door
- Product, in clamp transfers through the saw.
- Product eject means and product outfeed belt.
- On machine Perspex doors for guarding – standalone strategy.
- 11 second cycle time (327 sides per min (164 head per hr))

6.6 Business case estimation

For an example case where cube roll value is \$24 per kg and trim value is \$6 per kg, this equates to increases of \$18 per kg for trim product that can be retained on the cube.

The concept machine has a production capacity of 164 head per hour.

For an example case of 300,000 head processed per year, on two shifts, over 95 head/hour capacity would be required. One machine would be adequate for the example site.

For the example case the yield benefit would, ignoring any change to labour input, give a payback of 1.2 years. The payback will depend on the specific plant number of head processed per year, required rate and other factors such as number of lines.

7 Discussion

The knowledge gaps, regarding providing information to inform the steering group regarding the benefit of the cube chining module have been broken down to clamping, sensing and cutting. With benefit determination being the overriding metric.

7.1 Clamping

Clamping is leveraged off clamps developed in (Maunsell & McCrorie, 2024). If the chuck scope is to be included, a very narrow profile has been proposed. The findings include:

Product Mass: The beef sections are heavy, requiring controlled support throughout the cutting process.

Resulted in the spine pivoting out of the blade's path due to cantilevered weight.

Clamping Performance: The clamp securely held the product, with **no slippage** observed.

Modifications: One clamp finger was shortened by 10 mm to enable chuck clamping, without affecting the cube.

7.2 Analysis strategies

Conventional: Conventional vision analysis strategies incorporate tools such as transformations and determinations using thresholds to give definitive outputs.

Precision requirement: A departure from the ideal cut surface by more than 5mm, can prevent the access for the knife work need to release the meat that is the beneficial yield.

Visibility: The views for the vision system may be compromised..

7.3 Cutting

The knowledge gap regarding cutting is about the cut surface location, the available depth and the force on clamps and associated slippage and accuracy loss.

Future optimisation: Reduce saw dust and meat smearing.

7.4 Activities, project outputs/deliverables and objectives

Aligned with the “knowledge gaps”, a test rig was developed at Scott Technology workshop. “Dry” trials and associated improvements made to resolve issues before introducing meat and boning room constraints. There have been fortnightly meetings with an Australian processor to support the activities. The actual trials were performed at a local processor innovation room. The access to knowledgeable staff and product, pre-worked appropriately, was of significant benefit to cost effectively progressing the development.

Basic materials handling and cutting methodologies, including clamping, alignment, depth and alternative saw blades.

Testing and demonstration included:

- The product and the outputs were photographed, with particular focus on where the meat able to be recovered versus when fleeced manually.
- Products supplied were of variable sizes. The scope does not constitute an establishment of product size limits.
- The trials were videoed.
- In this case the project demonstrated that mechanised chining of a cube was possible and that the meat from areas 1,2 & 3 was weighed for two products.

Representatives from AMPC, MLA and an Australian processor were welcome to view the trials.

Regarding the LEAP4Beef automation strategy, the work in this project is establishing the viability of chining bone-in cube, and the potential of a Leap 4 Beef Module 02 Cube chine removal module. Which would feed into subsequent decisions to develop standalone and/or subsequent integrated systems.

The benefit model has been updated.

7.5 Yield benefit

The project has demonstrated that mechanised chining of the cube is possible. And that the yield improvement is in line with what was proposed in (Thomson A. , 2024)

7.6 Standalone cube chining machine.

A standalone cube chining machine has been proposed, suitable for processing 164 head per hr.

7.7 Business case

For an example case where cube roll value is \$24 per kg and trim value is \$6 per kg, this equates to increases of \$18 per kg for trim product that can be retained on the cube.

The concept machine has a production capacity of 164 head per hour.

For an example case of 300,000 head processed per year, on two shifts, over 95 head/hour capacity would be required. One machine would be adequate for the example site.

For the example case the yield benefit would, ignoring any change to labour input, give a payback of 1.2 years. The payback will depend on the specific plant number of head processed per year, required rate and other factors such as number of lines.

8 Conclusions

It was anticipated that utilising the existing Striploin chine bone removal concept prototype currently at an Australian processor, would be the lowest impedance path, however given the determination that the bandsaw was inappropriate a test rig was developed, with a circular saw, that was able to be trialled at a local processor.

The project has demonstrated that mechanised chining of the cube is possible. And that the yield improvement is promising. Which is in line with what was proposed in (Thomson A. , 2024)

The proposed concept machine has a production capacity of 164 head per hour.

For an example case of 300,000 head processed per year, on two shifts, over 95 head/hour capacity would be required. One machine would be adequate for the example site.

For the example case the yield benefit would, ignoring any change to labour input, give a payback of 1.2 years. The payback will depend on the specific plant number of head processed per year, required rate and other factors such as number of lines.

It is recommended that chuck chining capability is considered in the development of the cube chining module. This would provide additional functionality.

On these findings the development of a specialised cube chining machine, ideally with chuck capability, is viable and it is recommended that it should be pursued. However, the commitment to proceed would be subject to findings from a beef processor market review and analysis.

9 Recommendations

It is recommended that chuck chining capability is considered in the development of the cube chining module. This would provide additional functionality.

On these findings the development of a specialised cube chining machine, ideally with chuck capability, is viable and it is recommended that it should be pursued. However, the commitment to proceed would be subject to findings from a beef processor market review and analysis.

10 Project outputs

Outputs (tangible deliverables) delivered during the project include:

- Technical reports for milestone 1, summarising options evaluated, results from trials and recommended future paths of research
- Data has been collected for the various research, alternative solution evaluation and experimental activities and analysis performed. Presented in the technical reports in various tabular and graphical formats.
- The test rig utilised is in storage at Scott Technology.

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12 Appendices

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