



# Carni Boning System- Prototype Comparison

## Final Report

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## 1. INTRODUCTION

### 1.1. Background

Some of the issues facing meat processors are

- The lack of potential employees willing to work in the meat industry
- The training and skill required to ensure maximum returns from raw material, especially in the boning room
- Occupational health and safety issues (OH&S) especially related to the heavy “pulling” and “stripping” required in both the kill floor and the boning rooms

Currently, many companies are looking at systems to reduce the operator skill level and training required, the number of employees needed, and the effort required to maintain the same boning room throughput while maintaining the quality of the finished product. No written reports exist from companies in Australia that have taken the step of installing and evaluating/trialing options available, or on offer from overseas.

This project is to investigate one such system, the Carni system. The Carni system has the following claimed benefits

- *Ergonomic design* – as the operators work at the correct level at all times while boning
- *More hygienic* – as the product does not contact a table or floor until boned
- *Improved yield* – as operators work at the same pace and same quality of workmanship all day because there is less lifting, pulling, pushing and carrying
- *Shorter training period* – easier and quicker to teach the necessary boning skills
- *Increased productivity* – higher throughput per boner in the same time period
- *Reduced cost of injuries* – a reduction in lost time injuries from knife cuts, RSI and strains, with a consequential reduction in Work Care Premiums, reduction in Work Care administration staff, and improved OH&S classification
- *Increased manpower base* – some operators who cannot acquire the skill or strength to become qualified boners, can under the Carni system. Also, reduced strength and flexibility is needed so older qualified boners can have a longer working life as a boner
- *Reduced cost* - improved yield, increased productivity, higher throughput, lower training time

The aims of this project are to evaluate the Carni system in comparison with the present side chain boning system at Yarrawonga. The following Key Performance Indicators (KPIs) were to be investigated as benchmarks.

- OH&S claims
- Yield
- Resources required per kg product produced

A Milestone 1 report was produced for comment in August 2003 and a Milestone 2 report was produced for comment in March 2004 for comment. These two reports have been combined together for this Final report.

## 1.2. Yarrawonga

TGS decided they would install the Carni system at their recently acquired Yarrawonga processing works. A visit was made to the site on 11<sup>th</sup> July 2003 to view the general operation, have discussions with personnel on the data available, how it is collected, and to gather some preliminary data. Arrangements were made to have some data sent later using a template designed for the project. A further extended visit was organized to gather more data.

It was decided that the individual side chain boning system would be replaced by the Carni system.

### 1.4.1 The Side chain boning system

The Yarrawonga boning room operation was carried out by 6 or 7 individual boners each boning out the complete carcass and each using a dedicated slicer who may occasionally do some table boning. One operator was used to deliver sides of beef to each station and to take away the bones. The meat cuts & trim, and trim/fat were taken away from the slicer tables by two conveyors.

There were a number of other operators who pack, weigh and test the meat. These latter operations did not change under the Carni system.

### 1.4.2 The Carni System (<http://www.qed.eu.com>)

The Carni system is explained in detail on the attached CD ROM that was supplied to MLA, TGS and the author by QED. It is a chain method of boning which on the CD was demonstrated using 5 stations in boning a Forequarter, and 5 stations in boning a Hindquarter. The carcass may be raised and lowered at each station to a comfortable height by each boner individually and a computer controlled hook and chain system pulls the meat at a variable speed/force controlled by the individual boner while the boner frees the meat from the bone.

TGS installed the Carni system at their Yarrawonga processing works in October 2003. A visit was made to the site on the 12<sup>th</sup> November 2003 to view the general operation, have discussions with personnel on the data available, how it was collected, and to gather some preliminary data. Arrangements were made to have data sent after a three week continuous run in December when preliminary problems had been overcome and operators had got used to the new system.

The Carni system has been set up as a team boning system. The side is trimmed, and the sawman marks out the forequarter and cuts the featherbone and may do sawcuts for short ribs or brisket etc depending on market requirements, then the featherbone is removed and a Carni puller system separates fore and hind quarters.

The entire side is deboned by 8 to 10 boners and 5 (occasionally) or 6 slicers who all work as a team as the side is physically moved down the chain.

Station 1 and 2 in the forequarter area remove neck bone and brisket bone and lower vertebrae, remove meat from shin and clod bone with the meat left suspended by the scapula. The intercostals are cleaned off the ribs and necks cleaned up. Station 3 removes shin and clod meat if not previously done and then station 4 removes all forequarter meat from the foreleg with the assistance of a puller and the bone is discarded

on to a conveyor. Breakers then separate brisket, plate with ribs in, spare ribs, cube roll, chuck tender, chuck, blade, clod and shank.

Station 1 for the hindquarter removes flank, tenderloin, rump, strip loin and trims ribs. Station 2 removes popes eye, hooks on to the pelvic bone and frees the vertebrae and pelvic bone. Station 3 frees the topside and thick plank or knuckle. Station 4 frees meat from the leg bone and trims the bone.

The meat that is hanging from the two parallel chains is then moved to the end of the meat conveyor where it is cut by two breakers into appropriate primal cuts that fall on to the conveyor.

The remaining operations to trim, pack, weigh and test the meat is unaltered from the side chain boning period of operation.

## **2. RESULTS**

### **2.1. OH&S claims**

Yarrowonga abattoir has only been part of TGS for a short period of time. OH&S records are unavailable for the time before it became part of TGS. Further investigation revealed that due to a change in employment agencies, OH&S records are not available for the period prior to June 2003. For a numerical comparison of injuries under the side chain boning system and the Carni system, records of at least two years would need to be compared. These are not available for Yarrowonga and would not be available for the Carni system for at least two years after the system was installed. Hence another alternative method of comparison is required to judge the relative effect of the physical stress of the two systems.

After discussion with TGS personnel and contact with MLA, it was decided that a series of photographs showing boners in action on each of the two systems would be the only way in the short term of showing the comparative physical strength, stress and flexibility.

#### **2.1.1 The Side boning system**

A series of 55 photographs were taken of the present boners in action at Yarrowonga, listed in Appendix A. They attempted to show the range of movements required.

#### **2.1.2 The Carni boning system**

The Carni system is claimed to put less stress on the boners reducing OH&S costs, reducing absenteeism and enabling operators to work at a more consistent pace throughout the day and allow them to extend their working life. This has the potential to reduce costs, by reducing premiums, reducing claims and reducing new operator training plus make creation of daily manning schedules easier. In such a short period of operation that the Carni has been running, none of these claims could be substantiated. There was a noticeable difference in the degree to which operators had to bend, stretch and twist using the Carni system. Under the Carni system, operators are rotated through the various boning stations. This was not necessary under the side boning system as each boner boned out a complete side.

A series of 46 photographs were taken of the Carni system operation listed in Appendix B and shown in folder Yarrowongacarniboning (35Mb). Again, they attempted to show the range of movements required.

## 2.2. Yield

### 2.2.1 The Side chain boning system

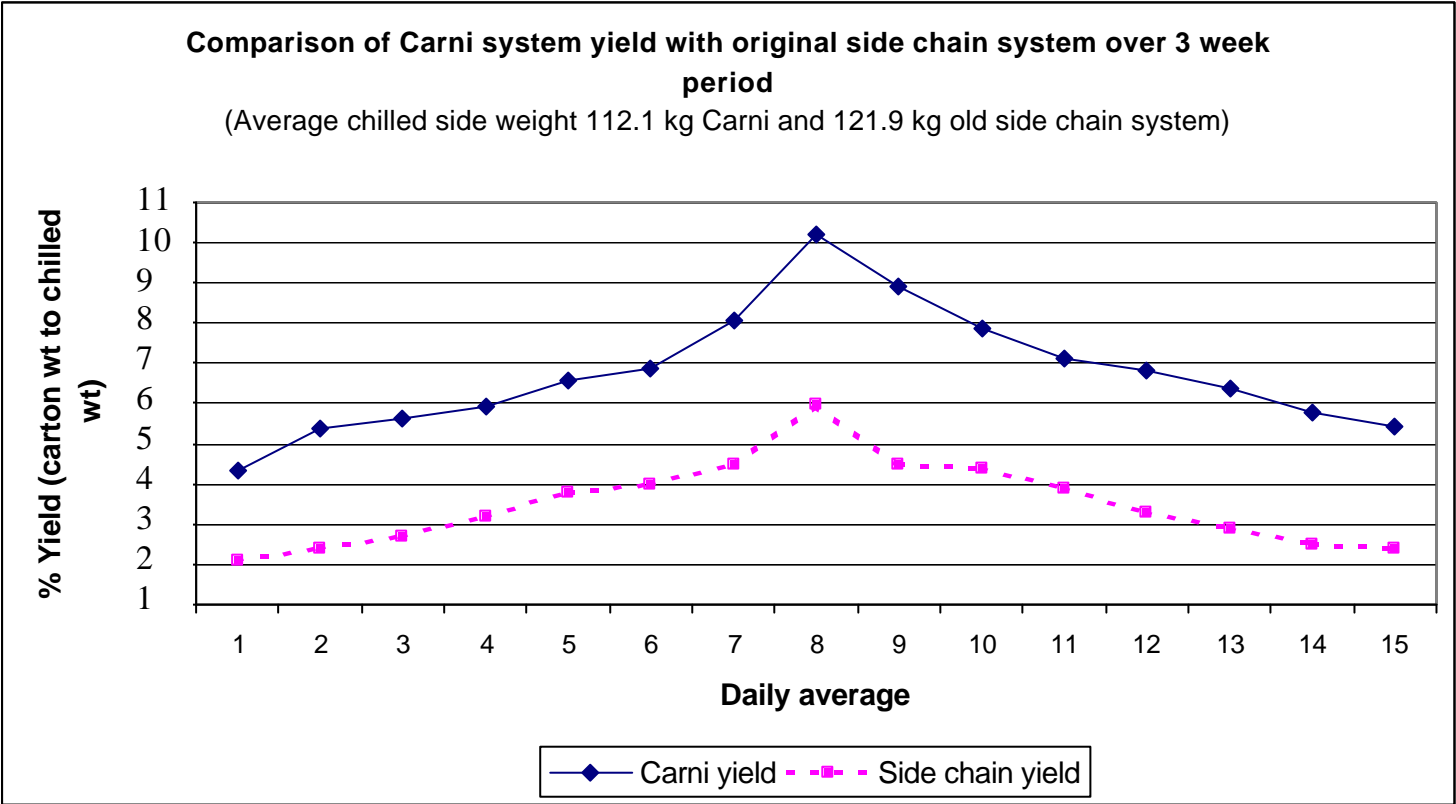
Yield records were difficult to obtain prior to April 2003 because of the archiving system and after that date they were still sporadic and difficult to retrieve before the installation of a computer recording system in July 2003. The abattoir operational requirements meant that it did not operate every day from that time until shutdown to install the Carni system. Approximately 30 days of operation were randomly chosen within the April to August 2003 period for analysis including 9 days in April and June, 10 days in July, and 14 days in Aug.

The chilled carcass weight was monitored daily. Every day the records show the number of sides removed from the chillers and their individual and cumulative weight. The total weight of full and part cartons of meat packed each day is recorded together with the weight of fat & trim cartons. The company records the % yield daily as the weight of full cartons and part cartons of meat as a percentage of the chilled sides boned that day.

The % yield for 15 days in July/August 2003 under the old side chain system was compared with 15 days in Dec 2003 under the Carni system. The Carni system had an average yield increase of 3.3%.

	Day	Yield Increase
	1	2.20%
	2	3.00%
	3	2.90%
	4	2.70%
	5	2.80%
	6	2.90%
	7	3.50%
	8	4.20%
	9	4.40%
	10	3.50%
	11	3.20%
	12	3.50%
	13	3.50%
	14	3.30%
	15	3.00%
<b>Average</b>		<b>3.24%</b>
Maximum		4.40%
Minimum		2.20%

This set of daily yields are graphically shown on the next page. It was noticed that the % fat & trim went down 1.5% under the Carni system.



Note: Yield Values have been replaced with reference numbers 1-11 for comparison between charts and to show increase, each horizontal bar is worth 1% in yield.

## 2.3. Productivity

A suggested KPI was “Resources required per kg of product produced” ie number of operators required. The side chain system generally used 6 or 7 boners with a dedicated slicer for each, with the slicer doing some boning on the table depending on the speed of the boner and the way the team work together. Under the Carni system, there is no dedicated slicer per boner, rather the slicers work as a part of the overall team with two breakers at the end of the chains, generally 5 or 6 breakers/slicers are used within the team of 14 to 16 in total.

One operator was used to supply the sides to each of the boners, to remove the bones, and to clean up the floor at the end of every run under the side chain system. The Carni system still uses this same resource.

The “Boning Production Manning Sheet” (see Yarrowongaforms/Dscn0482.jpg) daily records all of the other operators that produce a fully functioning boning room including the

- Chiller operator
- Pre trimmer
- Input scale
- Floor cleaner
- Pre vacuum packer
- Vacuum machine
- Carton packers
- Scale operator
- QA/CL testing
- Labourers
- Cleaners

The Carni system uses the same number of all of the above (see Yarrowongaforms/Dscn0483.jpg). The records were kept of the side boning period under review so they can be compared post Carni.

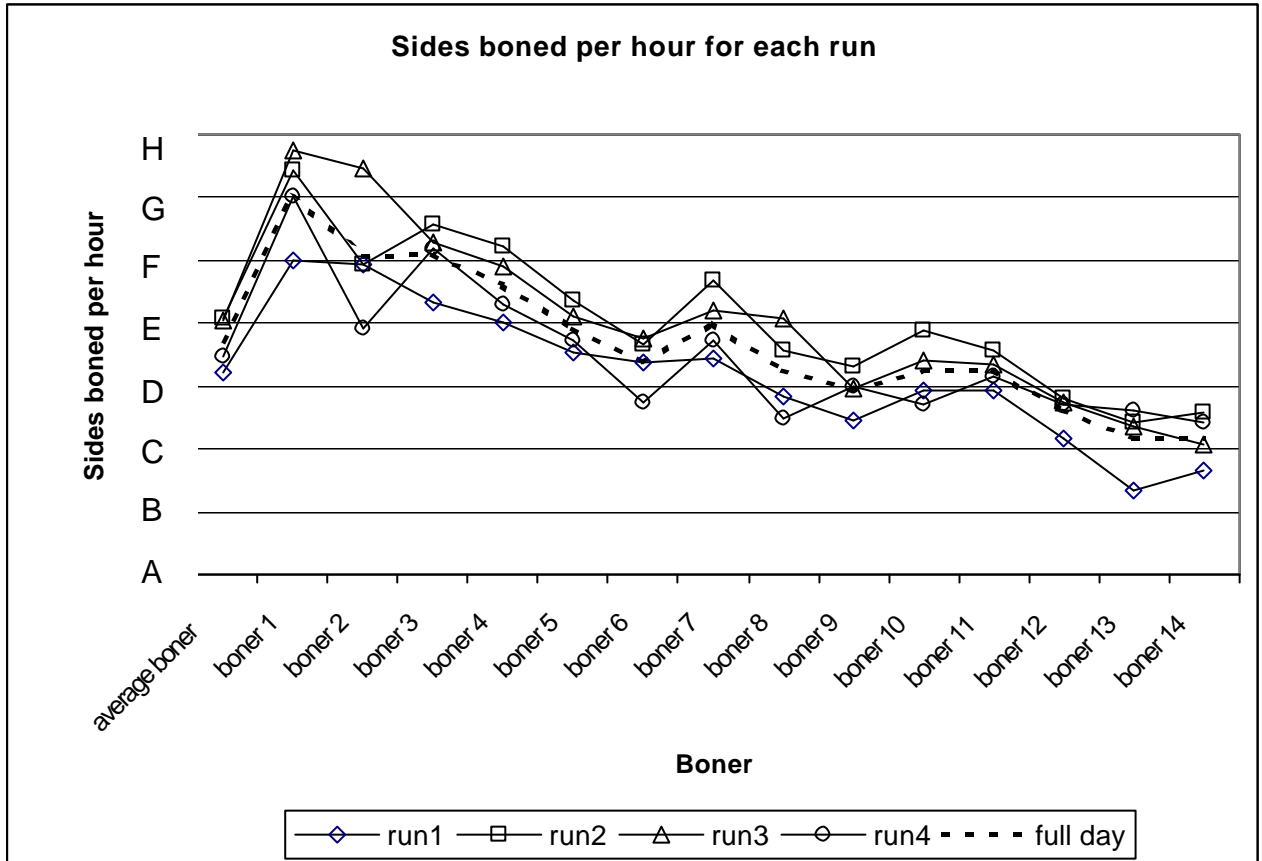
### 2.3.1 The Side chain boning system

For the side chain system, the “Boning Production Manning Sheet” recorded the tally in number of sides each boner completes in each run. There are four runs per day and one shift per day. The runs are

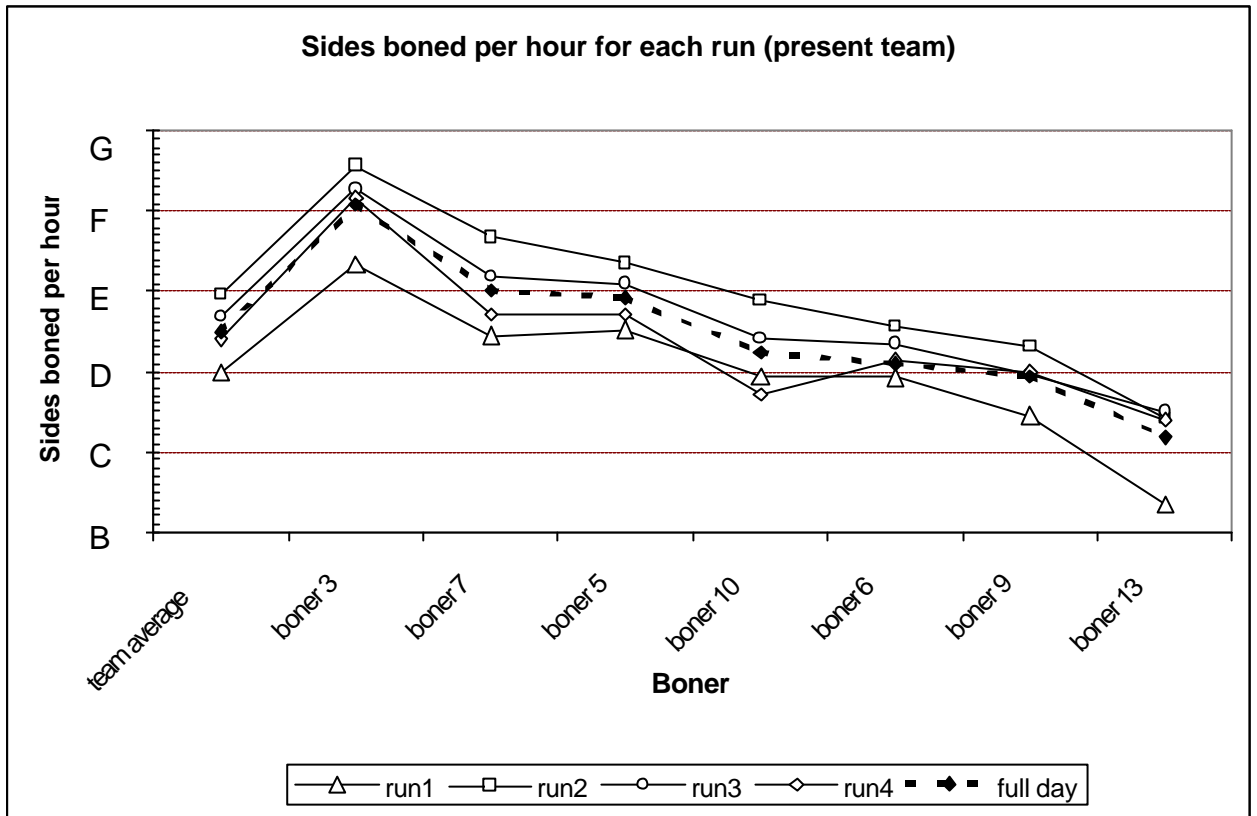
- 6.00 am to 8.00 am (run 1)
- 8.25 am to 10.30 am (run 2)
- 10.50 am to 1.00 pm (run 3)
- 1.15 pm to 3.00 pm (run 4)

A graph was produced showing the productivity of each boner in sides per hour per run. This was to be able to compare systems not only on a daily basis but also to compare how tiring each system may be during the day. The Carni system is supposed to be less tiring and therefore a system in which a boner can maintain the work rate better.



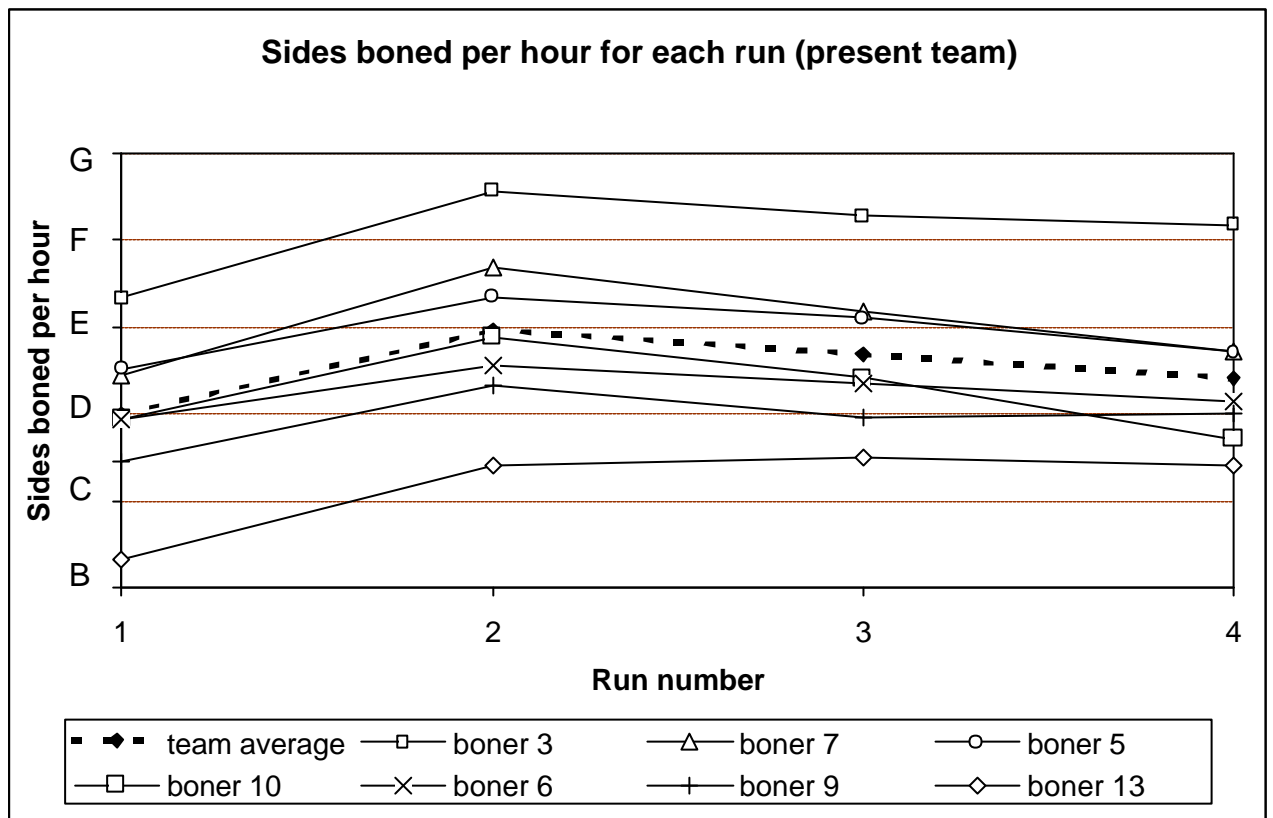


Note: Sides Boned per Hour Values have been replaced with reference letters A-H for comparison between charts and to show increase, each horizontal bar is worth 1 side per hour.



Note: Sides Boned per Hour Values have been replaced with reference letters A-H for comparison between charts and to show increase, each horizontal bar is worth 1 side per hour. B on this chart is the same value as B on other charts

The above graph shows the individual productivity of the team used just before the change to Carni.



Note: Sides Boned per Hour Values have been replaced with reference letters A-H for comparison between charts and to show increase, each horizontal bar is worth 1 side per hour. B on this chart is the same value as B on other charts

The above graph shows that the group of seven boners start boning slowly then increase productivity in run 2 and run 3 then productivity falls in the final run.

### 2.3.2 The Carni system

The identical four runs are used under the Carni system but the tally each run is no longer recorded, only the tally each day, as the chain is not cleared of meat in the 15 to 25 minute stops between each of the runs. Occasionally, overtime is worked and this was recorded.

When the side chain was operating, boners productivity was shown to be very variable both between different boners and for different runs during the day.

When the side chain was operating, records showed boner productivity dropping by 8% between run 2 and run 4 on average for all 14 boners the Company employed on different days. The Carni system is supposed to be less tiring and is therefore a system in which a boner can maintain a better work rate for longer.

The productivity was measured for each individual boner when the side chain was operating. Records were examined covering 14 boners who boned over 6,000 sides in total showing the best two boners still employed now the Carni system is operating each did almost 7.1 sides per hour on average whereas the slowest boner still employed now, did only 4.9 sides per hour on average. The average for all boners was 5.7. The Carni system

operates under a team system where to some extent the team operates at the level of the slowest person.

Over the three Carni weeks, the average was 3.04 sides boned per operator per hour. The average under the side chain system was 5.7 for each boner/slicer combination ie 2.85 sides boned per operator per hour. Actually looking at the specific boners used each day during the three weeks under the Carni system and knowing their productivity under the old side chain system the actual productivity of the team would have averaged 5.85 sides for each boner/slicer combination ie 2.93 sides per operator per hour.

So, under the Carni system, the actual team are 3.8% higher in productivity based on sides per operator per hour boned. Because the yield is also higher with the Carni system this equates to an increase of 20.8 kgs of meat in cartons (8.9% increase) from 233.8 kgs on the side chain system to 254.6 kgs of meat in cartons per operator per hour. Operators are the boners, breakers and slicers working on the chain and do not include the packing line.

There are a number of parameters which may affect % yield apart from the boning system. They are

- type of carcass
- carcass weight
- season
- individual boner skill
- boner speed
- carcass temperature
- daily work load.

Some of these have been discussed and addressed though type of carcass, season and carcass temperature were not. The animals being boned out under the side chain system were said to be similar to those boned out when the Carni system is installed.

### 3. DISCUSSION

The side chain system may have encouraged good boners to work faster but this may have been at the expense of lower yield which was not measured on an individual basis. The comparison of the side chain system and the present Carni system was done on similar animals of similar weight.

There was no plan to compare hygiene levels. The claim is that the Carni system is more hygienic as the meat is boned out on a hook rather than on a table. However, in both systems, the meat is boned out on a hook and the slicer then prepares the cuts of meat on a table. So, there is no reason to expect a change in hygiene. The Carni system also has restraining plates on which the meat rests during boning.

### 4. CONCLUSIONS

- 4.1. The % yield under the Carni system was increase by 3.3% over the side chain system
- 4.2. The %fat & trim decreased by 1.5% under the Carni system
- 4.3. The productivity increased by 3.8% using the Carni system.
- 4.4. The overall yield under the Carni system was 20.8 kgs higher per operator per hour of meat in cartons compared to the side chain system ie a 8.9% increase.
- 4.5. The only way of comparing the OH&S situation for the Carni system with the side chain system of boning was by using a series of photographs to illustrate the difference in the way the boner has to bend, stretch, twist, pull, push and carry.
- 4.6. OH&S data was not available for the Yarrowonga site operating as a side chain system
- 4.7. OH&S data would need to be gathered for at least two years under the Carni system to be able to compare with any other boning system data
- 4.8. There are a number of parameters which may affect % yield apart from the boning system. They are type of carcass, carcass weight, season, individual boner skill, boner speed, carcass temperature, and daily work load. Some of these are difficult to quantify.
- 4.9. There was a small increase in yield with carcass weight.

**APPENDIX A**

There were 55 photographs taken at Yarrowonga on 19<sup>th</sup> August 2003 to show the bending, twisting, pulling, pushing and carrying of the boning operation.

Dscn0008	Full carcass for boning	Skirt removal from sternum
Dscn0009	Forequarter - Bending	Marking down featherbone
Dscn0010	Forequarter - Bending more	Freeing neck
Dscn0011	Forequarter	Removing blade
Dscn0012	Forequarter - Bending/twisting	Cutting behind scapula
Dscn0013	Forequarter - Bending	Pulling clod free
Dscn0014	Forequarter – Side on bending	Removing clod
Dscn0015	Forequarter - pushing while cutting	Intercostals
Dscn0016	Forequarter - Rib	Intercostals
Dscn0017	Forequarter - Rib intercostals cleaning	Intercostals
Dscn0018	Throwing ribcage	
Dscn0019	Hindquarter - standing	Removing tenderloin
Dscn0020	General view of boners	Removing pelvic bone
Dscn0021	Hindquarter - cutting while pulling	Removing butt muscle group
Dscn0022	Hindquarter	Taking off shank meat
Dscn0023	Hindquarter – bone closeup	
Dscn0024	Forequarter - bending	Freeing neck
Dscn0025	Forequarter - squatting down	Removing skirt
Dscn0026	Forequarter - bending	Removing clod
Dscn0027	Forequarter - bending further	Removing clod
Dscn0028		Removing clod
Dscn0029	Slicer table view	Removing intercostals
Dscn0030	Slicer table view	
Dscn0031	Ribs	Taking intercostals out of ribs
Dscn0032	Floor view	
Dscn0033	Floor view and ribcage	
Dscn0034	Ready to throw ribcage	
Dscn0035	Adjusting carcass height	
Dscn0036	Hindquarter, twisting to put meat on table	Loin off hindquarter, boning on table
Dscn0037	Slicer with meat for slicing	Trimming striploin
Dscn0038	Slicer with meat for slicing	Removing flank
Dscn0039	Boner – bending/ pulling/ knifing	Removing flank
Dscn0040	Hindquarter - pulling	Removing silverside
Dscn0041	Hindquarter – pulling while cutting	Removing shank meat
Dscn0042	General view - two boners bending	Opening back of clod
Dscn0043	Forequarter - bending	Removing front shank, clod bone
Dscn0044	Forequarter - bending/twisting	Opening clod
Dscn0045	Hindquarter - pulling while cutting	Removing clod
Dscn0046	Forequarter - twisting while cutting	Removing clod
Dscn0047	Boner	Taking chuck meat off ribs
Dscn0048	Boner - throw	intercostals
Dscn0049	ribcage	intercostals
Dscn0050	Boner – throwing ribcage	intercostals
Dscn0051	Boner - pulling while cutting	Removing flank
Dscn0052	Floor view	
Dscn0053	Hindquarter – pulling while cutting	Taking off silverside
Dscn0054	Hindquarter – pulling while cutting	Taking off silverside
Dscn0055	Hindquarter – pulling while cutting	Taking off silverside
Dscn0056	Boning room - general view six stations	
Dscn0057	Boning room – general view of six boners	
Dscn0058	General view - slicers	
Dscn0059	General view - meat / trim on conveyors	
Dscn0060	General view - meat / trim on conveyors	
Dscn0061	General view - meat / trim on conveyors	
Dscn0062	General view - meat / trim on conveyors	

## APPENDIX B

There were 46 photographs taken at Yarrawonga on 12<sup>th</sup> November 2003 to show the bending, twisting, pulling, pushing and carrying of the boning operation.

Dscn0336	Full carcass for boning	Leaving chill room
Dscn0337	Prior to station 1	
Dscn0338	Prior to station 1	
Dscn0339	Prior to station 1	
Dscn0340	Prior to station 1	Removing neck bone
Dscn0341	Station 1	Removing brisket bone
Dscn0342	Station 1	Forequarter restrainer
Dscn0343	Central conveyor	Background-chains coming together
Dscn0344	Central conveyor	Background-chains coming together
Dscn0345	Central conveyor	Background-chains coming together
Dscn0346	Torque controlled pull by chain	
Dscn0347	Chain pull	Vertebrae removal
Dscn0348	Station 3 Forequarter Pulling clamp	Neck vertebrae removal
Dscn0349	Central conveyor	Hindquarter(RHS), Forequarter (LHS)
Dscn0350		
Dscn0351	Clamp pulling	Operator freeing bone
Dscn0352	Boned forequarter	Ready for breaker
Dscn0353	Station 3 forequarter	Removing clod and shin
Dscn0354	Boneless forequarter	Ready for breaker
Dscn0355	Boneless forequarter	Ready for breaker
Dscn0356	Clamp doing pulling	Boner doing skilled work
Dscn0357	Bone free of all meat	
Dscn0358	Breakers at work	Nearside fore, farside hindquarter
Dscn0359	Breakers at work	Nearside fore, farside hindquarter
Dscn0360	Breakers at work	Nearside hind, farside forequarter
Dscn0361	Breakers at work	Nearside hind, farside forequarter
Dscn0362	Breakers at work	Nearside hind, farside forequarter
Dscn0363	Start of Carni system	Bone&fat conveyor under steps
Dscn0364	Start of Carni system	Meat conveyor in foreground
Dscn0365	Start of Carni system	Side inspection at rear
Dscn0366		
Dscn0367	Station 1 restrainer	Restrainer holding meat
Dscn0368	Station 1 restrainer	Restrainer retracted
Dscn0369	Station 1 restrainer	Restrainer holding meat
Dscn0370		
Dscn0371		
Dscn0372		
Dscn0373		
Dscn0374		
Dscn0375	Hind quarter-removal of bone	Freeing topside
Dscn0376	Hind quarter bone	
Dscn0377	Table	Build up of work
Dscn0378	Packers	intercostals
Dscn0379	Packers on LHS	Breaker RHS
Dscn0380	Boned meat hanging on hooks	Two breakers at work
Dscn0381	Breaking down meat	Falls on to conveyor