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Handling & Transport of Cattle, Sheep & Goats

CONTENTS

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SUMMARY AND CONCLUSIONS

HANDLING AND TRANSPORT OF CATTLE, SHEEP AND GOATS : A REVIEW

Detailed reviews of the relevant literature for cattle, sheep and goats have been completed, as have reports for each of the six terms of reference. For goats, there is little to add to the report on MRC Final Report DAN.041 and in general goats and sheep should be regarded synonymously.

It is still important to quantify actual losses in both product quantity and quality. Data are scarcer for lambs/sheep than cattle.

Good animal welfare is compatible with increased productivity. Research should continue, prompted by addressing both productivity gains and product losses rather than by animal welfare concerns alone, despite their obvious close relationship. Attention to animal welfare issues and visible implementation of good welfare practices will increasingly become a prerequisite for access to markets for Australian products.

In this review, animal welfare is considered principally in terms of the major causes of product losses from farm to feedlot, saleyard, wharf or abattoir and ways to maximise product quantity and quality. An applied approach has been adopted deliberately.

Substantial losses in product quantity and quality occur between mustering and the final destination. Dehydration of carcass tissues can have the greatest effect and usually reduces weight much more than catabolism (time). Feeding roughages will partly reduce weight losses due to catabolism. The time between mustering on-farm and final destination or slaughter, and the duration of resting periods before slaughter, are key determinants of product losses. Keeping the time from mustering to slaughter as short as possible acts to maximise carcass weight, but may not allow sufficient resting time for animals to maximise tenderness and minimise the number of dark-cutting or high pH carcasses.

Horns are the major cause of bruising in cattle. The contributions of transport and handling are difficult to define, and will become clearer as fewer and fewer horned animals are slaughtered. Dehorning and weaner education are key ways to reduce product losses. Good stock handling is paramount. Minimum design standards and use of animal behaviour principles are essential for stockcrates, yard facilities and ramps.

Under Australian conditions, the duration of the resting time and severity of stress are two of the major pre-slaughter determinants of meat quality. Fasting, feeding and diet are much less important. This is in contrast to overseas research which shows that the social and physical activity among groups of bulls, or groups of heifers in oestrus, and the mixing of pampered animals are the most important factors. As more non-pregnant females are slaughtered in Australia, with consequently more females in oestrus during the selling process, the physical interaction associated with oestrus could assume greater importance as a cause of dark-cutting. The importance of animal behaviour and the temperament of individual animals on meat quality have still to be established conclusively. Inherent susceptibility and predisposing factors (animal and management) to stress and bruising also are inadequately defined.

Direct-to-abattoir selling systems reduce losses in both product quantity and quality. There is no information on the effect of various mustering methods, although self-mustering systems are the least stressful and other on-farm/pre-transport procedures generally have little effect on product losses. Short travelling and very frequent resting periods are harmful.

Pre-slaughter management practices generally affect product quantity and quality much more than animal factors (for example chronological age, genotype) except social interaction among bulls or among heifers in oestrus and pregnancy in females. The most damaging pre-slaughter factors are dehydration and stress immediately before and during slaughter.

Electrical stimulation affects meat quality more than animal factors but it cannot reverse the damaging effects of pre-slaughter stress. The general complaints of toughness and

lack of consistency in quality (including toughness) in Australian beef cannot be, and are not being, ignored. The introduction of Tendertec and video image analysis will not solve this problem and other action is essential.

The increase in our knowledge of the effects of transportation on livestock, coupled with a greater awareness of animal welfare, have markedly improved the handling, loading and transport of animals. The establishment of good communication links and co-operation between all sectors, especially between the producer, transporter and processor, are keys to further improvements.

The key pre-slaughter practices and related management decisions are:-

- minimise time from mustering to slaughter;
- method of selling;
- good planning allied with adequate preparation, transit and pre-slaughter resting periods;
- provide water, and if appropriate feed, during resting periods;
- sell hornless cattle and educate weaners;
- handle livestock carefully, quietly and without imposing stress;
- use appropriately designed and constructed yard and ramp facilities, vehicles, trailers and stockcrates, all of which can be easily and thoroughly cleaned, and are maintained in good repair;
- avoid stress, especially immediately before slaughter;
- the people involved - their motivation, commitment, attitude and education.

Australia has made significant progress in both developing knowledge and adopting new technology to reduce product losses and to improve meat quality.

A continuing research, development, extension, education and training effort promises further advances. It is still important to quantify actual losses in both product quantity and quality.

Recommendations have been formulated on the basis of comment from key industry personnel (including MRC meeting 22 July 1994) and Australian and overseas literature reviews. The major recommendations are:

- Continue efforts to implement selling methods that maximise competition, and provide product discounts/premiums and feedback on financial and product losses (for example, due to bruising and dark-cutting).

  Concurrently, publicise and demonstrate the financial and product benefits of educating weaners and selling hornless cattle.

  Renew efforts to implement realistic bruise scoring and feedback systems, which indicate financial losses.

- Establish better on-farm preparation, transport and destination management procedures, including pre-slaughter at abattoirs, to:

  * minimise weight loss during the selling process, especially the weight and animal health recovery periods of store cattle during finishing in feedlots or on crop;
  * minimise weight loss and the recovery period in cattle transported for live export;
  * maximise carcass weight and meat quality, as well as to minimise carcass processing problems (including condemnations).

  Such strategies should include the provision of feed and water additives (energy, protein, electrolytes) and also, should consider nutritional history, duration of resting times relative to travelling times, resting conditions, the provision of weather protection, animal behaviour and temperament factors. A better understanding of the factors predisposing animals to bruising and stress, and of the underlying physiological effects, are important. Collaborative work with overseas

physiology/biochemistry experts would be advantageous.

- Establish the rate and extent of dehydration and catabolic carcass tissue losses for animals under various conditions, as well as the major causal factors, and develop remedial action and practices. Data are required for all feedlot cattle and cattle intended for the heavy weight grassfed Japanese market.

- Determine the influence of, and interaction between, temperament, social order, behaviour, handling history, and stockhandler skills and attitudes on carcass weight, bruising and meat quality. Their effects, singularly or in combination, on feedlot performance in cattle should also be considered, as well as the interaction between expression of these factors and animal age, weight, sex and genotype.

- Demonstration research and extension are essential to show the effects of driver control and skill on animal welfare (including behaviour and physiology), bruising and muscle pH/tenderness under Australian conditions. Driver training courses should continue to be supported and also extended to other regions.

- Review current minimum design standards for stockcrates being used in some States, in conjunction with transport operators and transport authorities. Further, every effort should be made to extend their adoption nationally.

- Investigate the effects on bruising, meat quality, loading times and intransit behaviour of a greater number of pens (partitions) in stockcrates used in northern Australia under various road conditions and topography (for example hilly versus flat terrain). Side, rear and through loading systems to be assessed.

- Continue novel engineering approaches to resolve issues relating to tare weight, trailer/stockcrate weights, strengths and stability, air flows, drainage and self-cleaning of stockcrate floors. It is suggested that computer modelling and scale model testing be undertaken, and evaluated, before any consideration is given to financing actual trailer or stockcrate manufacture. Novel design, construction

techniques (eg. modules) and materials need to be assessed.

- Establish and implement minimum design features and standards for yards and loading/unloading ramps at trucking yards, permanent wharf yard facilities, saleyards and abattoirs; for loading/unloading ramps on-farm; and for all handling equipment (eg. crushes, weighing scales, head bails). It is strongly recommended that every effort then be made to extend their adoption nationally.

- Commence development and extension project, with industry, to improve the general standards of yard facilities, stockhandler attitudes and skills, and of animal-flow systems at abattoirs. Such a project to incorporate stock handling training and the implementation of best pre-slaughter management practices.

Both industry and government agencies need to be wary of over-regulation, as industry strives to implement new marketing systems and technology. Adequate consultation between all potential parties will enhance industry acceptance.

Producers need to develop an even better understanding of total market demands rather than concentrating solely on market specifications such as age, sex, weight and fat depth. They need to appreciate the bigger picture. They need to implement further advances in on-farm preparation of livestock, both early in the production cycle and at the time of sale.

Better and more detailed planning is one of the keys to further advances in the transport and handling of livestock. Adequate planning will only be forthcoming if producers possess adequate reliable information upon which to make their decisions.

Marketing systems which enable producers both to monitor their performance and to capture the benefits of their innovations must be encouraged. It is absolutely crucial that both incentives and disincentives are clearly evident within these marketing systems. They must be obvious so that the important monetary signals are transmitted to all. The hip pocket nerve is very sensitive.

Facilitators, who are responsible for specific extension and/or training projects, should be put in place. The input is needed of dedicated and respected people who can work closely with industry to effect change. Attitudinal change and subsequent behavioural change is best effected by interaction with people and demonstration of real world benefits and costs, not simply through printed matter or government edict. This model has worked in the past and will be successful again.

Overall, the Australian livestock and meat industries need to adopt a quality management philosophy and champion their interdependence. **All sectors must be committed to preserving product quantity and quality all along the marketing chain and to delivering the best possible product to the end consumer. They must also receive tangible rewards for their efforts otherwise adoption of best practices will be obstructed.** Wider acceptance of animal welfare codes of practices alone may satisfy the general community, but it will not ensure customer satisfaction. The latter will come more readily when all industry sectors are more informed and implement appropriate practices.

GAPS AND DEFICIENCIES IN KNOWLEDGE

(not in order of priority)

ANIMAL FACTORS AND HUSBANDRY

- Effect of age, genotype/breed, sex, weight and carcass fatness on carcass weight losses and bruising.
- Effect of animal behavioural factors such as temperament, social order and handling, history on weight loss/gain, bruising and meat quality (tenderness and pH).
- Effect of heifers in oestrus (extrapolate from overseas findings) on weight loss, bruising and meat quality. Numbers and pregnancy status of slaughter females.

ON-FARM

- Different on-farm strategies to prepare stock for transport, eg. feeding practices.
- Various methods of mustering on product quantity and quality.
- Dehydration and catabolic carcass tissue losses, and the major causal factors, for heavyweight classes of both grainfed and grassfed cattle.

TRANSPORT

- Microclimates in vehicles/weather conditions (heat, cold, wind and rain) and effect on weight loss, bruising and meat quality.
- Method of travel on bruising and site/location of bruises.
- Effect of different number of partitions in stockcrates on animal behaviour and product quality.
- Recovery post transport (liveweight, carcass weight, meat quality, condemnations of offal) in abattoirs and at feedlots, eg. through supply of feed or electrolytes in transit as well as post arrival at destination.

FEEDLOTS

- Diurnal fluctuations in liveweight in feedlots.
- Behaviour of cattle in feedlots and its relationship to productivity.

ABATTOIRS

- Factors immediately pre-slaughter (eg. provision of feed and water additives, animal behaviour, shade/shelter) and effect on meat quality.
- Pre-arrival factors (nutrition, handling, weather, travelling time) and effect on required duration of rest.

YARD DESIGN, CONSTRUCTION AND HANDLING

- Yard design and improvement of facilities (extrapolate from overseas knowledge).

GENERAL

- Reliable, up–to–date estimates for the costs of carcass weight loss, bruising and reduced meat quality (tenderness and pH) to the Australian livestock and meat industries.

- Predisposing factors to bruising and stress.

- Problem of dark coloured meat that is not classic "dark–cutting" (high pH) from sub–clinical factors in some present production systems (eg. feedlots).

PART C(i) - CATTLE

SERIES OF RECOMMENDED PRACTICES BASED ON THE BEST AVAILABLE INFORMATION

by

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Successfully selling cattle depends on consigning quiet, healthy, hornless animals, with attention to good forward planning, good practices and animal welfare.

Traditionally, the main concern regarding transport and handling was in terms of selling slaughter cattle either from farm directly to an abattoir or via a saleyard. The increasing trend to finish cattle in feedlots and the growing export trade in live cattle has broadened the producer's marketing options.

Carcass weight, within various fat limits, is still the principal basis for trading slaughter cattle, either directly to an abattoir or indirectly on an assessment of dressing percentage and actual liveweight at a saleyard. On the other hand, product reputation, and thus industry viability, are based on meat quality. Carcass weight and meat quality are affected by the movement of beef, as a product, from farm paddock to abattoir chiller.

Considerable financial losses can occur during this short selling period, from losses in liveweight, carcass weight and offal weight; from bruising, deaths, condemnations of carcasses and non-carcass parts; and from reduced meat quality. Stress reduces muscle glycogen (muscle energy) concentrations. Inadequate glycogen concentrations at slaughter result in tougher, darker meat with a shorter shelf-life - such beef is called dark-cutting.

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[1] A Director of MRC and therefore prepared without remuneration from MRC

The performance of cattle in a feedlot and consequently financial returns depend on the length of time that the cattle are on feed, their feed intake, rate of feed conversion and liveweight gain. Any reduction in initial liveweight and/or carcass weight retards their progress. The same is true for export cattle on board ship, although in some instances liveweight maintenance, rather than gain, is the objective.

Key recommendations for the management of beef cattle from mustering on-farm to feedlot, to on board ship or to the abattoir for slaughter are given based on available research and related findings, as well as input from key people throughout Australia. The recommendations are often commonsense. They provide a practical, though not a definitive basis for the beef industry to improve animal welfare standards, and at the same time, to minimise liveweight loss and to maximise both carcass weight and meat quality.

- **Minimise the time between mustering on-farm and arrival at the feedlot, wharf, saleyard or abattoir.**

  Cattle lose liveweight most rapidly during the first 12 hours that they are without feed and water, and then the rate of loss slows progressively. Much of the total liveweight loss occurs before cattle leave the farm, particularly if they are yarded overnight, mustered before sunrise, or assembled over several days. In practice, the total time from mustering to the new destination affects weight loss much more than the distance travelled. The rate of liveweight loss exceeds that for carcass weight, because of the additional weight loss in gutfill.

  For cattle without feed and water throughout the selling process, **average liveweight losses** are then **about** 2.5, 4, 6, 10 and 12% of initial liveweight after 6, 12, 24, 48 and 72 hours, respectively.

However, cattle usually have intermittent access to feed and/or water. Liveweight losses are **about** 9% after three days and 10% after five days in **unfed** animals, but only **about** 5.5% and 8%, respectively, in **fed** animals. For longer periods with intermittent access to feed and water, losses have been estimated at less than 12% after eight days and 14% after 11 days.

Average liveweight loss up to 72 hours without feed and water for cattle of various liveweights

Hours Without Feed and Water	Liveweight Loss (%)	Estimated Liveweight Loss (kg)		
		200 kg	400 kg	600 kg
6	2.5	5	10	15
12	4	8	16	24
24	6	12	24	36
48	10	20	40	60
72	12	24	48	72

- **Minimise the time between mustering and slaughter.**

Unnecessary delays between mustering and selling should be avoided to minimise losses in live and carcass weight during the selling process. This time factor is more important than the distance which cattle travel.

Under commercial conditions with access to water, **average daily losses in carcass weight** are estimated at:

- **unfed** cattle **about** 1.3% (recorded range 0.8 to 2.3%), and
- **fed** cattle **about** 0.7% (recorded range 0.3 to 1.8%).

- **Minimise the time that cattle being purchased for finishing are without feed and water.**

  The total time off full feed (of whatever source) and water during the mustering, preparation, transport and post transport periods is more important than the length of any interim fasting period (no feed and water).

  Cattle require at least 7 to 21 days to recover their initial (pre–sale) liveweight, whether they are being finished on pasture or in a feedlot.

- **Offer water to cattle from arrival at feedlots and saleyards (wet curfews) until weighing, and at abattoirs until slaughter.**

  Cattle offered water have heavier carcasses (reported differences due to rehydration 0.8 to 6.0%), with higher muscle water contents than animals denied water. Feeding assists to maintain "normal" muscle water contents. However, continuous access to water until slaughter does not further increase carcass weight. Generally, it has no adverse effect on carcass processing, including the percentages of condemned heads and tongues or burst rumens. Excessive water intakes by unfed cattle can increase the contamination of head and tongue with ingesta.

  Despite the best intentions to improve the welfare of cattle, not all animals in a group will drink and eat. Thirsty cattle drink without hesitation, while others may not drink until left undisturbed in peaceful conditions. Access to feed can also encourage cattle to drink. Weather conditions undoubtedly affect how much water animals drink, as does water taste and smell.

- **Feed cattle, if they are to be held for more than 24 hours at abattoirs.**

  Feeding roughages during the resting period reduces the losses in carcass weight and enables animals to maintain a "normal" hydration status during rest.

Feeding hay does not improve meat quality (tenderness, muscle pH, cooking loss) or enable rest periods to be shortened.

At saleyards, there are advantages in feeding hay to cattle before sale – they will "present better" and be heavier.

Feed only limited amounts of roughage, because adult cattle eat only about 2–3 kg of good quality, palatable (not lush green) hay when fed in unfamiliar circumstances.

- **Dehorn cattle (as calves at branding) or breed polled animals, and in the interim, segregate horned and hornless cattle during selling.**

Horned cattle have about twice as much bruising as hornless animals. Mixing horned and hornless cattle increases bruising of the hornless animals only.

Tipping of horns does not reduce bruising. Dehorning of older cattle slows liveweight gains and will cause weight loss, with setbacks of up to 6 weeks or more.

Scoop dehorners are recommended for young cattle up to weaning, and the dehorning knife for young calves.

- **Educate cattle at every opportunity, especially at weaning, so that they are accustomed to yards, stock handlers and being handled. Recognise the importance of animal behaviour and individual animal characteristics.**

The benefits of training for young cattle are long lasting and reduces stress and bruising during the selling period. To optimise long term effects, training should be undertaken before the most sensitive period for cattle to form social relationships expires at about six months of age. Such cattle are easier and quieter to handle on– and off–farm, and generally have little bruising. Some

producers begin to train their calves at branding – this has particular merit for vealer producers.

Weaner education is just as essential for cattle intended for finishing in a feedlot.

Training of weaners is the first basic step to improve product quality, because selling really begins at weaning. While weaners are held in yards during the weaning period (preferably 10 days), they should be taught to respond quietly to stock handlers and to become accustomed to handling and yards. Many producers also include at least one transportation period. Regardless of the numbers involved and stage of property development, weaner training is a top priority.

- **Cull animals that are flighty, nervous or have poor temperaments**

The temperament of cattle, or the way they react to people, is important from the points of view of both production and selling.

Quiet cattle with good temperaments grow more rapidly, and are easier to handle and transport than flighty nervous ones. They probably suffer less stress and bruising during selling. Poor temperament animals disrupt the flow of cattle through yards, and during loading and unloading. Generally, the more frequently that cattle are handled, the quieter they become.

- **Handle and transport older cattle, especially cows, with great care.**

Older cattle (eight teeth) have more high pH or dark-cutting carcasses and sometimes heavier bruising than young animals. Cows bruise more than steers, and both bruise more than bulls.

- **Avoid selling pregnant females, especially heavily pregnant ones.**

  Cows in the last trimester of pregnancy have the highest percentage of dark-cutting carcasses. Estimates of carcass weight decreases of **about** 3 kg/month during pregnancy and dressing percentage reductions of **about** 0.6%/month should be expected as pregnancy advances.

- **Avoid mixing bulls from different established groups or social orders and transport them separately from other cattle.**

- **Be aware that animal-animal interactions are also a source of bruising and social disruption because of physical activities associated with oestrus in non-pregnant females.**

  Establishment of new social orders occurs rapidly and is not always accompanied by aggression. The physical activity associated with establishing new orders can be a major cause of bruising, especially in bulls and heifers. Order of social dominance and temperament should not be confused, since the dominant animal is not always the aggressor.

- **Handle cattle, and build all yards and ramps, to utilise the natural behavioural traits of cattle. Also, build yards to minimum design standards. The skills and attitudes of stock handlers are often more important than yard design.**

  Proper handling of cattle reduces bruising and stress. Cumulative stress and fatigue during the selling process predispose cattle to bruising at saleyards and abattoirs. Stressors are often multiple and are additive. The longer cattle are in hand, the more carefully they must be handled, because weary cattle are more likely to bruise, or become stressed, than are alert, contented ones.

Skilled stock handlers lead and work cattle without noise and bustle. Animal–friendly yards aid a smooth flow of cattle, reduce animal–human confrontation, stress and bruising. These attributes are particularly important whenever cattle are handled in confined spaces, such as for loading, unloading, drafting and weighing. Overcrowding is poor handling, because even co–operative cattle are unable to move.

Hitting cattle with polypipe, cane flappers, sticks, pipes and other persuaders all cause bruising – they should only be waved as an "arm extension". Electric prodders can be stressful – use them as little as possible.

Good yard and ramp design take advantage of the natural behavioural traits of cattle; using for example, circular yards, curved laneways and races with solid or semi–solid fences, and long tapering entrances. Such yards are also built with smooth fitting rails and gates, and non–slip floors. Any lighting, especially around ramps, should not create shadows. Yards should be kept in good repair.

- **Build ramps to minimum design standards.** (Details attached.)

- **Build double deck loading/unloading ramps at large properties, large feedlots, major saleyards and abattoirs with high throughputs.**

- **Separate loading and wide (at least 3m) unloading ramps are advantageous whenever large numbers of cattle are being handled for example, at major saleyards and abattoirs.**

Ramps should have an incline of not more than 20° and a flat apron of at least 1.5m for single deck and 3m for double deck ramps at the top of the incline – allowing cattle to step on and off a flat surface. Ramps should be sheeted, have smooth sides and non–slip floors which should feel sound and solid when cattle walk on it. Floors that are hollow–sounding will baulk cattle.

The height of single deck ramps, or the lower deck of double deck ramps should be 1170–1200mm, with the top deck 2845mm. The internal width of all ramps should be 760mm. Side loading is essential in extensive areas.

- **Build stockcrates according to minimum design standards endorsed by industry.** (Details attached.)

Minimum design standards incorporate anti–bruising and anti–stress features. These include for example, smooth internal walls, non–slip floors, wide gateways, appropriate internal partitions for the types of animals to be generally transported, and smooth fittings. The stockcrate should be kept clean and in good repair.

Side loading is preferable for double–deck stockcrates and through loading systems for road trains.

- **Volume load stockcrates, so that all decks are loaded at the optimum rate.**

Loading densities or rates are determined according to the average liveweight, size, shape and horn status of the cattle, as well as the prevailing conditions and the distance animals are to be transported. Loading rates must be assessed for each pen or division in the stockcrate.

Animals need to be loaded tightly enough to give each other mutual physical support during travel. Volume loading achieves this. It is good animal welfare. **Preferred loading densities** for adult cattle are given below, with 5% fewer animals to be loaded if they are horned.

Overloading increases the risk of an animal going down and being unable to get up, especially with horned cattle. The possible saving in freight from sending the extra animal, or animals, needs to be balanced against potential product losses, mortalities and animal welfare.

Preferred loading rates for cattle of various liveweights			
Mean liveweight (kg) of cattle	Floor area (m^2/head)	No. of head per 12.2m deck	
		Bottom deck+	Top deck
250	0.77	38	36
300	0.86	34	32
350	0.98	30	28
400	1.05	28	26
450	1.13	26	23
500	1.23	24	21
550	1.34	22	19
600	1.47	20	17
650	1.63	18	15

+ Equates to single deck trailer.

- **Plan, prepare, load, transport, unload and always handle cattle in such a way as to minimise animal – human confrontations, stress and bruising.**

- **Lame, very weak, unfit or diseased animals should not be transported.**

Cattle need time to settle down after mustering, and later after handling, to prepare for transporting. They need 'time to draw breath'. Rushing animals causes stress, which can lead eventually to bruising and/or tough, dark coloured meat.

Excessive mud and manure caked on the coats of cattle, especially feedlot animals, creates hygiene problems. Such cattle should be cleared before transportation.

Cattle should be held off feed (especially green feed) and water for 6 to 8 hours, before transport. The exact time off water will depend on the weather

and distance to be transported. When cattle are fasted (no feed or water) before trucking, the floors are drier, and animals travel better, are easier to unload and are cleaner on arrival. It is advisable to feed cattle dry hay before long journeys, especially those grazing lush green feed.

It is preferable for travelling times not to exceed 36 hours. However, for longer journeys (> 36 hours), it is best to rest cattle for 12 hours, with feed and water, after each 24 hour travelling period.

Loading and unloading are periods of major stress, and careful handling in animal-friendly facilities is essential to give a good flow of animals and to reduce animal-handler confrontations. External ramps should be used rather than ramps inside the stockcrate.

On arrival, cattle need time to readjust, rest and drink in a peaceful, noise-free environment without being disturbed by people. It is essential that they are given access to clean water as soon as possible. This reduces losses in carcass weight due to dehydration. Whether or not cattle are fed depends on how long they will be off feed. Again, feed only limited amounts.

- **Plan, and minimise, inspection stops and spelling periods during travel.**

Cattle become restless and move about while vehicles are stationary. This causes stress and can increase bruising. This is particularly true for horned animals. Inspection stops are essential early in a journey (especially the first few hours). The journey should be planned and completed as soon as possible with minimal interference to animals.

Successful in-transit spelling depends on proper handling by skilled stock handlers and the availability of water, feed and a peaceful environment.

- **Realise that selling cattle through saleyards increases carcass weight loss and the risks of bruising and stress, as well as forfeiting the advantages of *selling hornless cattle*.**

  After the same period from mustering to slaughter, saleyard cattle have lighter carcasses and impaired meat quality relative to those sent directly to an abattoir. After sale in the buyers' pens, hornless cattle are usually mixed with horned animals; thus increasing bruising. Buyers make allowances for bruising costs when determining prices.

  Diseased or faulty cattle (for example, with eye cancer or lumpy jaw) should only be sent directly to abattoirs, with some states enforcing this requirement through their codes of practice.

- **Provide wet curfew conditions at all saleyards.**

  All cattle must have equal opportunity to access water. Wet curfews require cattle to have access to water for a defined period before sale and/or weighing, whichever is the earlier. This reduces the variation in dressing percentage between sale lots with similar on-farm carcass weights, ensures cattle are not dehydrated at the time of weighing, reduces subsequent weight losses and improves both cattle handling and after sale travelling. It is good animal welfare.

- **Maintain bulls in established groups and slaughter as soon as possible after arrival.**

- **Rest steers and females in peaceful conditions at the abattoir, whether or not they have rested previously during a long journey.**

  The effect of rest alone on meat quality varies markedly between groups of cattle, although the predominant trend is for resting periods to **reduce** both

toughness and the percentage of dark-cutting carcasses. This is true whether the total period is spent at the abattoir or includes a rest during the journey. A **rest period at the abattoir is essential. The total rest period should be at least twice the duration of the journey and in peaceful conditions, without noise, disturbances and mixing with unfamiliar cattle.** This ensures that muscle glycogen concentrations are replenished and are therefore adequate at slaughter.

For bulls, it is advisable not to mix them with other cattle (especially other bulls), or to rest them for long periods, because the aggressive interaction to establish new social orders is the major cause of dark-cutting in bulls.

- **Avoid stress during the period immediately before slaughter and stoppages during slaughter.**

  Stress at this time will negate the benefits of adequate rest at the abattoir, because cattle will not have any time to restore muscle glycogen to adequate concentrations before slaughter.

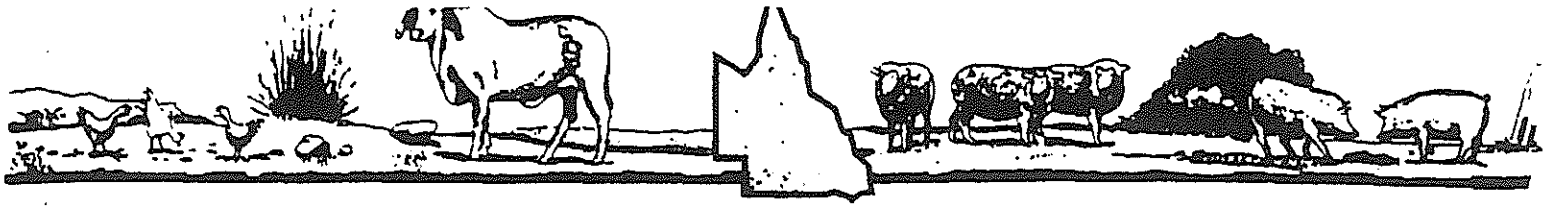
- **Be aware that effective electrical stimulation of carcasses cannot reverse the negative effects of pre-slaughter stress.**

  Effective electrical stimulation, as does tenderstretching, improves the tenderness of the rump, loin, topside, round and to a lesser extent, the silverside. Toughening of muscle due to pre-slaughter stress cannot be reversed. The whole carcass is affected and its commercial value reduced.

- **Use trained, skilled stock handlers and transport drivers.**

- **Dispose of injured animals humanely.**

  The codes of practice for cattle, handling of cattle during transport, at saleyards and abattoirs, all provide details of the ways to dispose of animals in a humane manner.



WET CURFEWS – WHY HAVE THEM AT SALEYARDS?

Dr Jennifer R Wythes,
Chairman, Livestock and Meat Authority of Queensland

Saleyards make a major contribution to pricing efficiency, by providing market information for the livestock and meat industries. Pricing efficiency is a reflection of how accurately prices reflect the market forces of supply, demand and final consumer quality preferences. To maximise pricing efficiency, saleyar operations need to be directed towards minimising sources of pricing error. Evaluation of the live animal (product description) is one of main sources of error.

Product Description

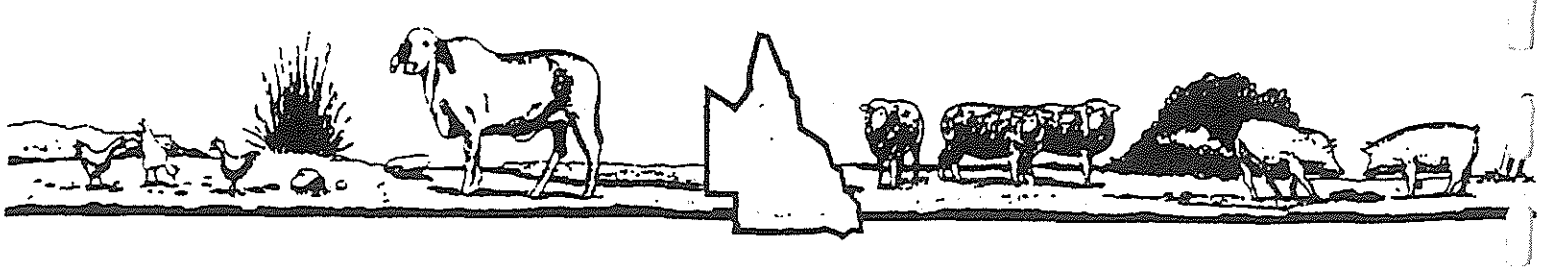
At saleyards, where livestock can be inspected, the major source of misdescription is the mis-estimation of dressing percentage when buyers convert carcass weight bids into auction bids in cents per kilogram liveweight. This process requires buyers to estimate dressing percentages accurately. While some buyers can accurately determine average dressing percentages for a particular class of cattle, they usually over-estimate low dressing percentages for individual lots and under-estimate high dressing percentages for others.

Pricing Efficiency

Procedures which reduce the difference in dressing percentage between sale lots must improve pricing efficiency. Similarly, reducing the variation in dressing percentage between saleyards makes price comparisons valid between saleyards. One such way is to introduce wet curfews which require all cattle to have access to water for a defined period – from the start of the sale (the curfew period) until weighing. Access to feed is prohibited between the start of the curfew and weighing.

Continuous access to water (ie., the wet curfew) greatly reduces the variation in carcass weight, and dressing percentage, between animals which had the same average on-farm carcass weights. Access to water also tends to stabilise weight and dressing percentage, plus all animals should have a similar hydration status. Cattle are also easier to handle, because they settle down and rest more contentedly after drinking, and are subsequently in better condition to travel from the saleyard to the abattoir.

If cattle are deprived of water, large differences in gut fill and dressing percentage exist between cattle with similar carcass weights. Gut fill can account for 12 to 25% of an animal's liveweight depending on the length of time since it last ate and drank. In a survey at a major Queensland saleyard, cattle from within 150 km of the saleyard had generally been without water for up to 33 hours and others from longer



distances for as long as 55 hours. About a quarter of the cattle in these two categories did not have any opportunity to drink between arriving at the saleyard and weighing.

Wet curfews are just as necessary in 1993 as they were almost 12 years ago when they were first introduced.

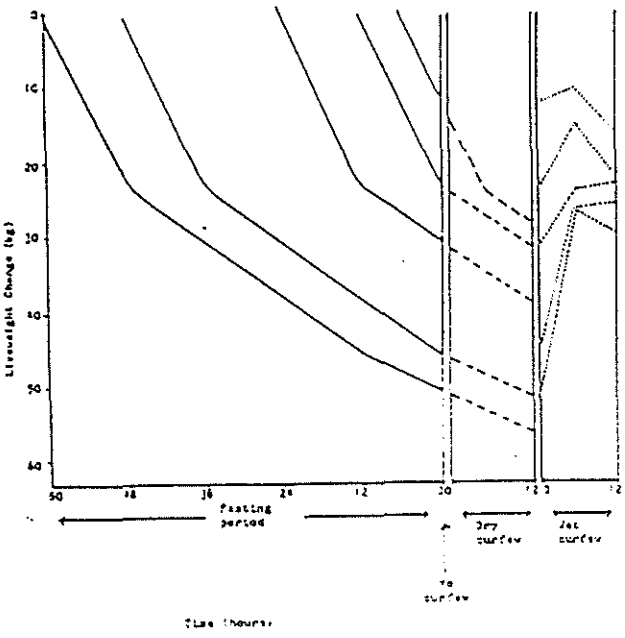


Figure 1. Change in liveweight for groups of cattle with the same mean "on-farm" liveweight fasted for different times before curfew (____) and held during either a dry (- - -) or wet (....) curfew period, or when no curfew operates.

SELLING STORE CATTLE ON LIVEWEIGHT

The common element in trading and pricing beef from consumer to producer is cents per kilo unit weight. It therefore makes sense that all production sectors sell cattle on a cents per kilo unit weight. For the store weaner vendor and buyer, this means cents per kilo liveweight. The days are long gone when any producer should allow others solely to assess his stock, let alone to determine the value of those stock. It is important that vendors know as much about the description and weight of their animals as do the buyers.

It is a logical extension that liveweight selling, on a wet curfew basis, should be introduced for store weaners in the same way as for prime cattle. This will inevitably cause some initial financial disadvantage to store vendors, principally because of many store buyers generally under-estimate weight and, thus, over value weaners.

It is in the long term best interests of the beef industry to introduce selling of store cattle on a wet curfew liveweight basis. Such a move would also generate additional revenue for saleyards and allow them to make better use of their facilities.

Liveweight Recovery

When purchasing store cattle for fattening, it would seem advisable to minimise the time that cattle are without feed and water. The reason – it can take 7-21 days for cattle to recover their initial (pre-sale) full liveweight, whether they are on pasture or on a feedlot.

farm note

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CATTLE TRANSPORT - stock crate design for body trucks

by J. W. Lapworth, Beef Cattle Husbandry Branch

Many producers use body trucks to carry their own livestock to market.

The major role for some body trucks is the transport of grain. Using the same vehicle to transport cattle is quite sound, but appropriate modifications are essential before carrying animals.

Properly designed stockcrates will reduce bruising and improve the welfare of animals during transit. The livestock transport industry has adopted minimum standards for stockcrate design.

Badly designed and poorly maintained stockcrates cause bruising of cattle. Major design problems in body trucks are the very open sides of stockcrates (e.g. weldmesh sides) and the attaching of the boards or sheeting on the external side of the bows.

The following specifications are based on industry standards. They are written for people wishing to build stockcrates to carry cattle on their own body trucks. The same basic principles apply to convertible crates for sheep or pigs.

BOWS

Mild steel bows of 50 x 50 x 3.2 mm RHS are used. The same material is used for the cross members and for the top of the frame. RHS of 450 mPa tensile strength e.g. Greens Tuf 450** may be used but the wall thickness need only be 2.6 mm.

NOGGING

The nogging that holds the sheeting to the frame is 32 x 32 x 2.6 mm RHS. Only three are necessary; one each at the top, bottom and centre of the sheeting.

Where the side sheeting is made higher to take the place of a kickboard an extra piece of nogging will be needed.

WALL CLADDING

All cladding should be placed on the inside of the bows. This presents a smooth interior surface and helps to prevent bruising.

Two types of cladding are recommended:

* Solid sheeting (either steel or plywood).
* Hardwood slats.

Sheeting

Steel sheeting (2 mm thick) is recommended for the sides. Properly prepared it is easier to attach, generally lighter, often cheaper, and normally lasts longer than timber or plywood.

The plywood for sides is similar to marine ply and is called Truckwood*. It is expensive and needs to be about 20 mm thick. Truckwood* is available from Hancock Bros., Ipswich.

* Trademark ** Trademark

Sheet steel is normally stitch welded.

Hardwood slats

Hardwood (Ironbark or Tallow-wood) slats 150 x 20 to 25 mm are long lasting and do not split.

All timber cladding should be attached to the frame with cuphead bolts - the cup head is on the inside. Sheet steel is normally stitch welded.

Spacings of 25 mm or 100 mm between the boards will help reduce injury to animals.

BOTTOM PERIMETER FRAME

The bottom perimeter frame where the crate meets the floor of the tray should be 64 x 64 x 6.5 mm angle iron. This fits over the combing rails of most trucks and will give a flat surface to weld on the bows.

GUSSETS

Triangular steel gussets with two equal sides of 75 - 150 mm may be placed on either or both sides of the bows. They should be at least 6 mm thick.

BOW SPACINGS

The distance between bows should not exceed 1 000 mm. Narrower bow spacings make the crate stronger. The bows should be spaced equal distances along the length of the tray.

It is preferable for the bow at the rear of the crate be doubled. This gives added strength to carry the door, absorbs pressure from the livestock inside the crate and allows the rear section to be fully opened.

For example, a truck with a 4 125 mm tray would need seven bows if the rear bow was doubled.

REAR DOOR

Ideally, the rear door should fully open as well as having a half width sliding door. The vehicle then has much more flexibility and this allows easier loading of a small tractor, hay or other items. The door should fold back against the outside of the crate.

The frame for this door is made of 38 x 38 x 2.6 mm RHS with two equally spaced noggings. Attaching 2.0 mm steel sheeting to the inside of the door is satisfactory.

Guides for the sliding door are made from 64 x 64 x 6.5 mm mild steel angle iron. The top door guide to carry the rollers runs the full width of the vehicle. Only three pieces of angle iron, each about 150 mm long, are needed as guides at the bottom of the door.

If the vehicle carts bulk grain, the base angle iron guide should run the full width of the sliding door to give extra support when the door is closed.

REAR DOOR ROLLERS

Sealed bearings for the rear door should be a tight fit on each shaft. A serial No. 6306-2RS bearing is suitable. It will fit over a 30 mm shaft. A small tack weld around the outside of the shaft will prevent the bearing coming off the shaft.

KICKBOARD

A kickboard of 150 x 25 mm hardwood is preferable. This should run the full length of the stockcrate where plywood is used on the inside of the bows. Two spaces of 50 to 66 mm can be left between the bottom perimeter frame, the kickboard and the bottom nogging.

Kickboards are not necessary if steel sheeting is used.

INTERNAL DIVISIONS

Internal divisions are optional and on smaller body trucks may not be necessary.

Where partitions are used they should have two-thirds of the truck width as a swinging gate. This helps to reduce bruising by lessening the chances of cattle being jammed in the gates and also adds to operator safety.

Making this division open fully will allow greater truck flexability.

The gate catch should be recessed and on the driver's side of the crate.

TOP PIPE RAILS

Pipe at the top of the stockcrate frame need only be 20 mm internal diameter (ID) black pipe. These pipes should be loose fitting to prevent them breaking or cracking away from the bows due to flexing of the crate. See Figure 2.

SIDE HEIGHT OF SHEETING

Side height is generally the height of the combing rail plus 65 to 75 mm plus the standard sheet width of 1 200 mm. This is adequate for most purposes. A kickboard adds 150 mm to the height.

TRAY HEIGHT

At most bigger saleyards the ramp heights suit low profile semi-trailers. This height is 1 170 mm.

When purchasing a new vehicle the tray height at the rear should be as close as possible to 1 170 mm.

Standard tray heights help prevent bruising and leg injuries during the loading and unloading of livestock. The tray and loading ramp heights will then be the same.

FLOOR GRATING

All grating should give animals good grip on the floor and allow the inside of the vehicle to be easily and quickly washed out. The sections of the grating running across the tray should be on the top, with pieces running the length of the tray lying on the floor. Grating is normally bolted to the floor.

The most common materials used for floor grating are 16 mm ID pipe, 25 x 25 mm RHS, 16 mm steel rod or 8 mm heavy weldmesh.

CRATE ATTACHMENT

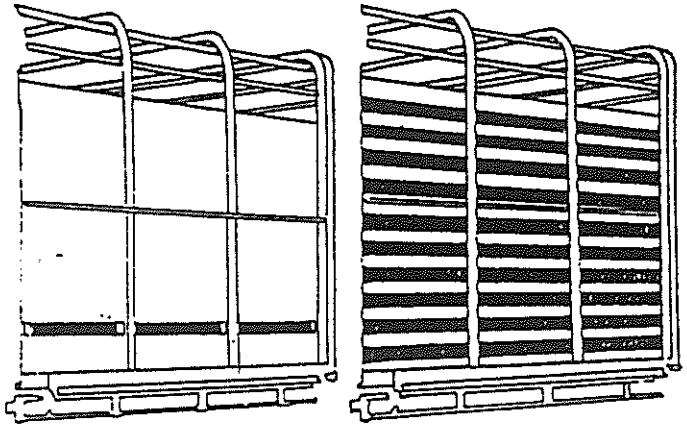
The crate is normally held onto the truck tray with bolt fasteners. These attach to the underside of the tray using angle iron. The attached bolt goes through a piece of pipe welded to the crate and is then tightened.

SUMMARY

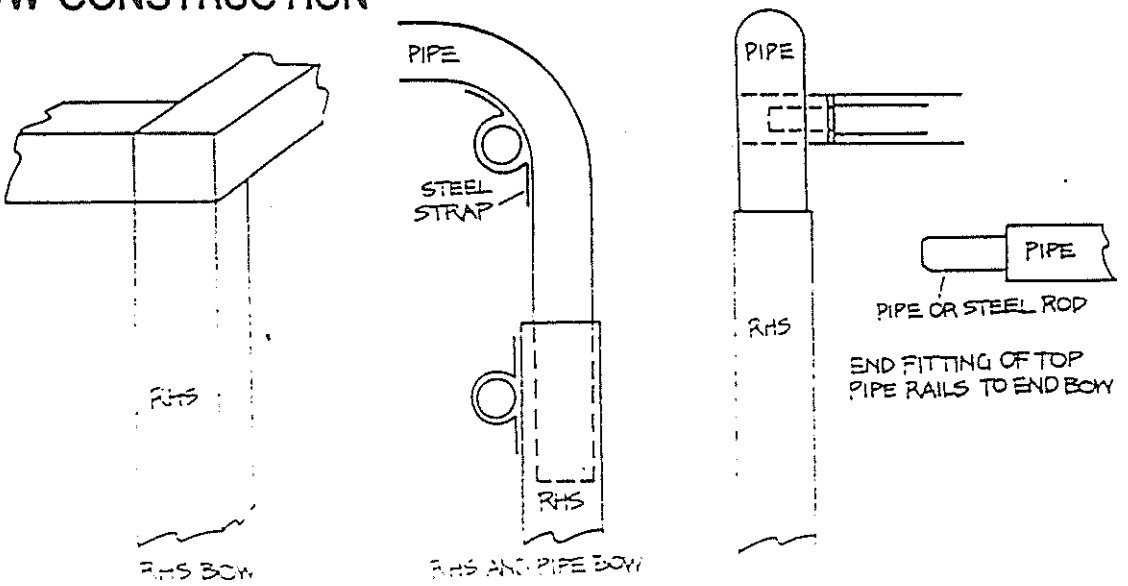
There are many variations and modifications you may wish to make when building your own stockcrate. The most important things to remember are:

1. Put all cladding on the inside to keep the interior smooth.
2. All gate catches should be recessed and the doors or partitions should open to at least 2/3 tray width.
3. The tray height should be as close as possible to 1 170 mm.
4. All joints on pipe or RHS should be fully welded.

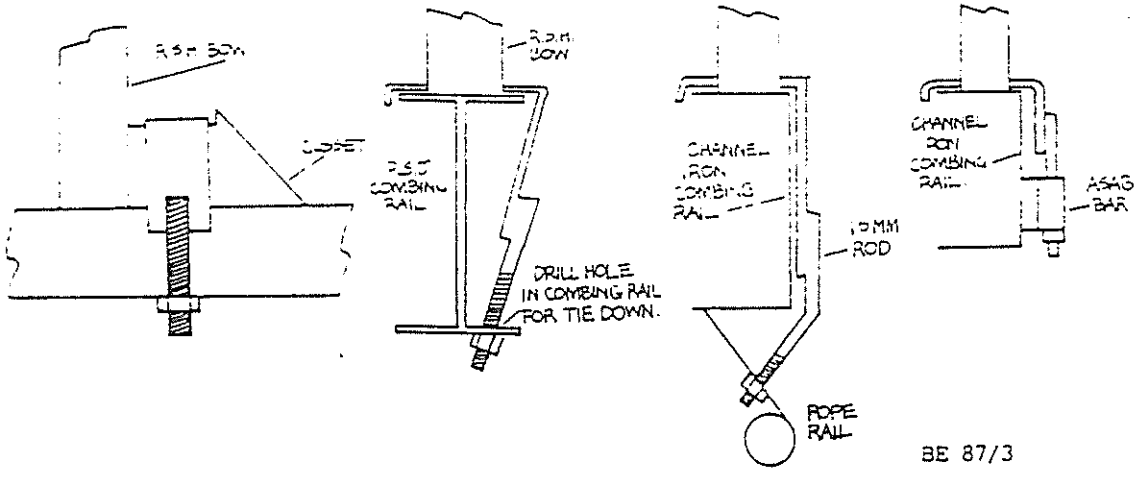
TRUCK



BOW CONSTRUCTION



FASTENERS



BE 87/3

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CATTLE TRANSPORT - minimum design standards for loading ramps

J.W. Lapworth, Beef Cattle Husbandry, Brisbane

There is a need to set minimum design standards for both single deck (SDLR) and double deck (DDLR) loading ramps for cattle. Transport operators through the Livestock Transporters Association of Queensland recently endorsed the following standards.

Design standards for ramps will assist everyone, trucks will be able to use ramps properly, and cattle will load/unload more easily with less hassles, bruising and stress.

Height

The standard floor height for SDLR's and the bottom deck of DDLR's is 1170 mm (maximum 1200 mm). The height for the top deck of DDLR's is 2845 mm.

These heights already apply to most DDLR's in both Queensland and other States. They match the height of low profile trailers.

Truck manufacturers need to consider these standards when building new models.

Width

The standard width is 760 mm.

Most property crushes are 660 to 710 mm and animals negotiate these with little difficulty. Animals tend to turn around in wider ramps-increasing stress, loading time and the risk of injury.

At abattoirs and major saleyards a wide DD unloading ramp is worthy of consideration. These ramps need only be 3000 mm (maximum). They allow stock to unload quickly and give them room to move without jumping over each other.

Sheeting

The sides of all standard ramps should be 1800 mm high and fully sheeted.

Cattle move readily up and down sheeted ramps because they are not baulked by outside distractions.

On SDLR's without catwalks, the offside should be sheeted to about 1200 mm. The handler has good access to the cattle but the sheeting prevents distractions. The near side should be fully sheeted.

Floor

The standard ramp floors is stepped or cleated.

Stepped concrete floors have 100 mm rises and 500 mm treads.

Cleats on wooden or concrete floors are 300 mm apart at the centres, and be about 50 mm high and 50 mm wide.

The cleats should extend beyond the width of the ramp by about 100 mm on both sides if the sheeting does not meet the floor or exist.

Queensland Department of Primary Industries, G.P.O. Box 46, Brisbane 4001.

Ramp floors need to give good grip, be easy to walk on, not slippery or cause a hollow, drumming sound. Steel floors should not move or buckle under weight. Animals should not be able to see through floors.

A maximum slope of 20 is recommended for all ramps, both SD and DDLR's. The lower the incline of the floor the better.

A ramp height of 1170 mm over a distance of 5000 mm works well and is approximately 20 .

Catwalks

Catwalks are necessary on both SDLR's and DDLR's. They help the handler maintain contact with the cattle, giving a better flow onto or off the truck.

On standard SDLR ramps with sheeted sides and no catwalk, the floor should extend 800 to 900 mm on the ramp's offside. The handler can then walk beside the ramp to retain access to the cattle.

Apron

The apron is the flat area at the top of the ramp and gives the cattle a chance to 'steady' themselves before entering or after leaving the truck. It should be 3000 mm long for DDLR and at least 1500 mm for SDLR.

Other features

* Curving or angling the race makes use of animals' natural tendency to follow one another and move in a circle around the handler.

* Self aligning bumpers and flaps should work efficiently, not endanger animals and be well maintained.

* Adjustable ramps generally corrode in a fixed position and it is usually not the right one!

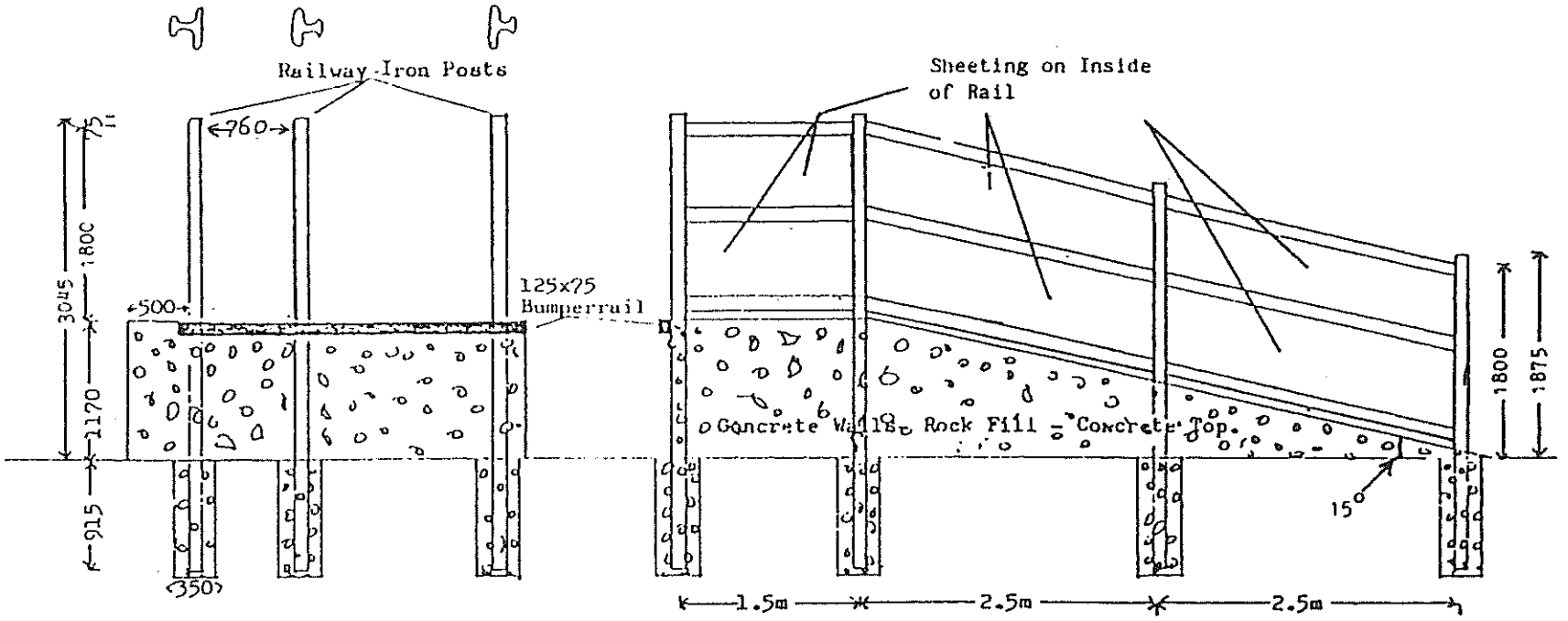
* All weather and easy access to ramps for vehicles is essential to ensure proper alignment and good loading/unloading techniques.

* Side unloading facilities are a boon to abattoirs receiving large numbers of cattle on road trains.

* Designs for DDLR's are available from QDPI. Figure 1 shows a SDLR and Figure 2 a DDLR.

FIGURE 1: SHEETED SINGLE DECK LOADING AND UNLOADING RAMP

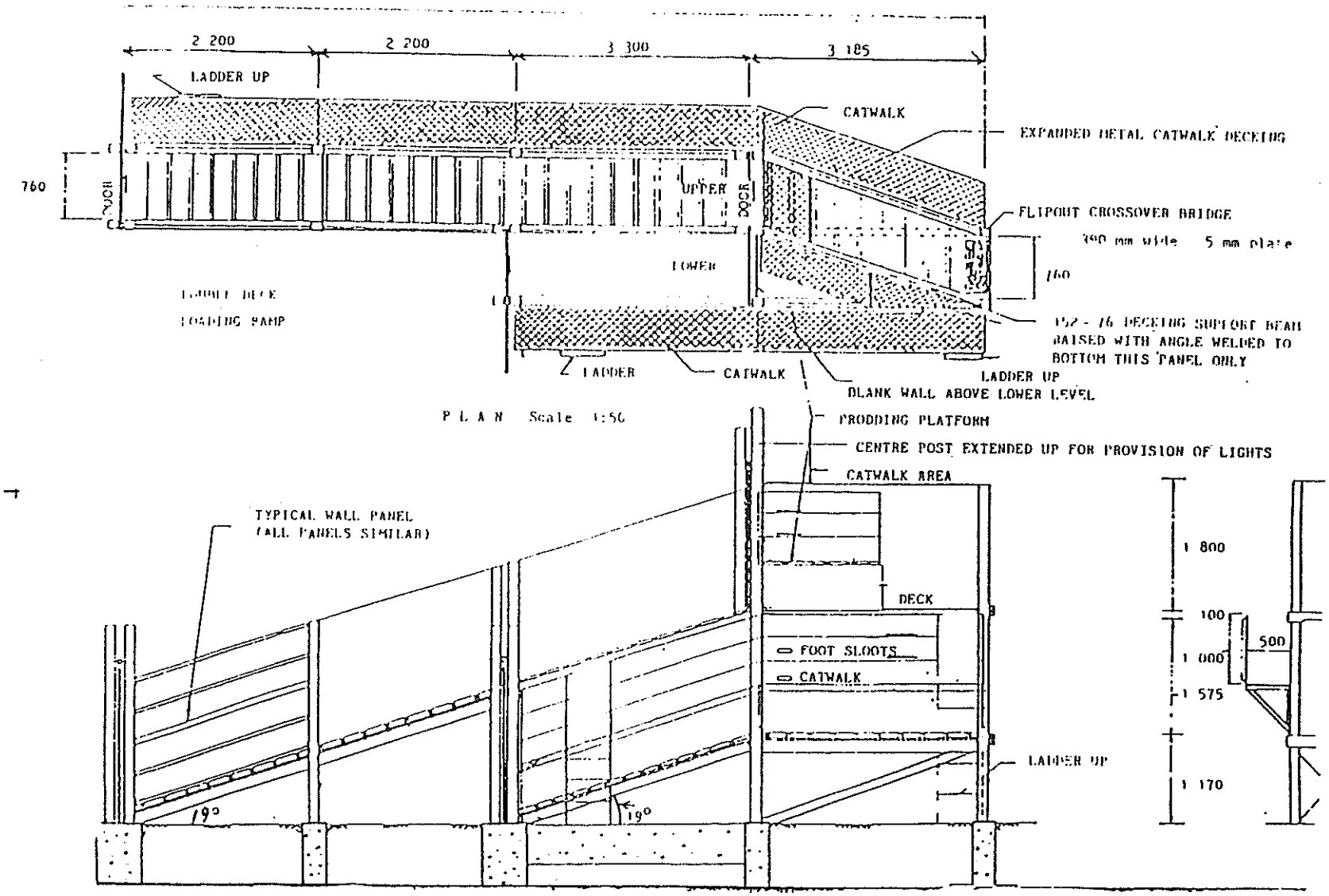
Scale 1 : 50 Approx



Front Elevation

Side Elevation.

FIGURE 2: SHEETED DOUBLE DECK LOADING AND UNLOADING RAMP



BE 87/5

PART C(i) – SHEEP AND LAMBS

SERIES OF RECOMMENDED PRACTICES BASED ON THE BEST AVAILABLE INFORMATION

by

D G Morris

Queensland *Livestock and Meat Authority*

Successful transportation of sheep and lambs depends on consigning quiet, healthy animals, with attention to good forward planning, good practices and animal welfare.

Traditionally, the main concern regarding transport and handling has been in terms of selling sheep from farm to abattoir, either directly or via a saleyard.

Carcass weight, within various fat limits, is the principal basis for trading slaughter sheep and lambs, either directly to an abattoir or indirectly on an assessment of dressing percentage in the paddock or at a saleyard. On the other hand, product reputation, and thus industry viability, are based on meat quality. Carcass weight and meat quality are *affected by the movement of sheep and lambs, as a product, from farm paddock to abattoir* chiller.

Considerable financial losses can occur during the short selling period, from losses in *liveweight, carcass weight and offal weight; from bruising, deaths, condemnations of* carcasses and non-carcass parts; and from reduced meat quality. Stress reduces muscle glycogen concentrations. Inadequate glycogen concentrations at slaughter result in tougher, darker meat with a shorter shelf-life – such meat is called dark-cutting.

Key recommendations for the management of sheep (including lambs) from mustering on-farm to the abattoir for slaughter are given based on the limited available research for sheep, as well as extrapolating from cattle and related research *findings, as well as input from key people throughout Australia.* The recommendations provide a practical, though not a definitive, basis for the sheep and lamb industry to improve animal welfare standards, and, concurrently, to minimise liveweight loss and to maximise both carcass weight and meat quality.

- **Minimise the time between mustering on-farm and arrival at the saleyard or abattoir.**

Sheep lose liveweight most rapidly during the first 24 hours that they are without feed and water, and then the rate of loss slows progressively. Much of the total liveweight loss occurs before sheep leave the farm, particularly if they are yarded overnight, or mustered before sunrise. In practice, the total time sheep spend travelling from farm to their new destination probably affects weight loss much more than the distance travelled. The rate of liveweight loss exceeds that for carcass weight, because of the additional loss in gutfill.

From the limited available data – for **lambs** without feed, but with access to water, throughout the selling process **average liveweight losses** are **about** 3, 5, 7.5, 11, 12 and 14% of initial liveweight after 6, 12, 24, 48, 72 and 96 hours, respectively. Liveweight losses after 48 hours without feed and water are **about** 14%. There are no data for adult sheep.

Average liveweight loss up to 96 hours without feed for lambs of various liveweights

Hours Without Feed and Water	Liveweight Loss (%)	Estimated Liveweight Loss (kg)	
		30 kg	40 kg
6	3	0.75	1
12	5	1.5	2
24	7.5	2.25	3
48	11	3.3	4.4
72	12	3.9	5.2
96	14	4.5	6

- **Minimise the time between mustering and slaughter.**

Unnecessary delays between mustering and selling should be avoided to minimise losses in carcass weight during selling. This time factor is more important than the distance which sheep travel.

From the limited available data – under commercial conditions with access to water, average daily losses in **carcass weight** for **unfed lambs** are estimated at **about** 1.7% (recorded range 1.3 to 2.3%). There are no data for adult sheep.

- **Offer water to sheep from arrival at saleyards and at abattoirs until slaughter.**

It is commonsense and good welfare to offer water to sheep at saleyards and abattoirs, and it also reduces the possibility of dehydration.

Despite the best intentions to improve the welfare of sheep, not all animals in a group will drink and eat. Thirsty sheep drink without hesitation, while others may not drink until left undisturbed in peaceful conditions. Weather conditions undoubtedly affect how much water animals drink, as does water taste and smell.

- **Educate sheep at every opportunity so that they are accustomed to yards, stock handlers and being handled. Recognise the strong flocking and following instincts present in sheep.**

The benefits of special training for lambs and other young sheep are long lasting and probably reduce stress and bruising during the selling period. To optimise long term effects, training should be undertaken before weaning to familiarise lambs with handling and yard facilities while older sheep are present to lead. This also applies to paddock mustering and movement through gateways and the like. Such animals are generally easier to handle on– and off–farm.

- **Handle and transport older sheep with great care.**

Best available information suggests older sheep have more high pH or dark–cutting carcasses and sometimes heavier bruising than young animals. It is common sense to handle older sheep, especially ewes, with greater care because they probably tire more easily, predisposing them to greater stress and bruising.

- **Handle sheep, and build all yards and ramps, to utilise the natural behavioural traits of sheep. Also, build yards to minimum design standards. The skills and attitudes of stock handlers are often more important than yard design.**

  Proper handling of sheep reduces bruising and stress. Cumulative stress and fatigue during the selling process predisposes sheep to bruising at saleyards and abattoirs. Stresses are often multiple and are additive. The longer sheep are in hand, the more carefully they must be handled, because weary sheep are more likely to bruise, or become stressed, than are alert, contented ones.

  Skilled stock handlers work sheep without noise and bustle. Animal-friendly yards aid a smooth flow of sheep, reduce animal-human confrontation, stress and bruising. These attributes are particularly important whenever sheep are handled in confined spaces, such as during loading, unloading, drafting and weighing. Overcrowding is poor handling, because even co-operative sheep are unable to move!

  Hitting or prodding of shorn or short-woolled sheep with sticks, pipes and other persuaders can all cause bruising, as can lifting or pulling all animals by their wool/skin. Use of electric prodders is not recommended.

  Good yard and ramp design take advantage of the natural behavioural traits of sheep; using for example, circular yards, bugle yards, curved laneways and races with solid or semi-solid fences, and long tapering entrances. Such yards are also built with smooth fitting rails and gates, and non-slip floors. Yards should be kept in good repair.

- **Build ramps to minimum detail standards.**

- **Build multi-deck loading/unloading ramps at large properties, major saleyards and abattoirs with high throughputs.**

- **Separate loading and unloading ramps are advantageous whenever large number of sheep are being handled, e.g. at major saleyards and abattoirs.**

  Ramps should have an incline of not more than 20° with closed, smooth sides and a solid, cleated or non-slip floor. Floors that "move" will baulk sheep, while slippery surfaces will increase bruising and slow their movement.

  The height of single-deck ramps, or the lower deck of double-deck ramps should be 1170mm, with the top deck 2975mm and an internal width of 1200mm.

- **Build stockcrates according to minimum design standards endorsed by industry.**

  Minimum design standards incorporate anti-bruising and anti-stress features. These include for example, smooth internal walls, non-slip floors, wide gateways, appropriate internal partitions for the types of animals to be generally transported, and smooth fittings. The stockcrate should be kept clean and in good repair.

- **Volume load stockcrates, so that all decks are loaded at the optimum rate.**

  Loading densities or rates are determined according to the average liveweight and size of the animals, the length of time off-shears, the prevailing weather conditions and the distance to be transported. Loading rates must be assessed for each pen or division in the stockcrate.

  Animals need to be loaded tightly enough to give each other mutual physical support during travel. Volume loading achieves this. It is good animal welfare. Preferred loading densities for adult sheep are given below. Sheep in full-wool should be loaded at 15% below the normal recommended density.

  Overloading increases the risk of an animal going down and being unable to get up.

  Freight costs need to be balanced against potential product losses, mortalities and animal welfare.

Preferred loading rates for sheep of various liveweights		
Average weight (kg) of sheep	**Floor area (m^2/head)**	**Number of head per 12.2m (12.2m) deck**
20	0.17	170
30	0.19	150
40	0.22	130
50	0.27	110
60	0.29	100

- **Plan, prepare, load, transport, unload and always handle sheep in such a way as to minimise animal – human confrontations, stress and bruising.**

- **Lame, very weak, diseased or unfit animals should not be transported.**

Sheep need time to settle down after mustering, and later after handling, to prepare for transporting. They need 'time to draw breath'. Rushing animals causes stress, which can lead eventually to bruising and/or tough, dark coloured meat. Excessive "dags" should be removed.

Sheep should be held off feed (especially green feed) and water for at least 6 to 8 hours before transport. The exact time off water will depend on the weather. When sheep are fasted (no feed or water) before trucking the floors are drier and they travel better, are easier to unload and are cleaner on arrival.

It is preferable for travelling times for adult sheep not to exceed 36 hours and much less for lambs. However, for longer journeys, it is best to rest sheep for 24 hours, with feed and water, after each 24 hour travelling period.

Loading and unloading are periods of major stress, so that careful handling in animal–friendly facilities is essential to give a good flow of animals and to reduce animal–handler confrontations

On arrival, sheep need time to readjust, rest and drink in a peaceful, noise–free environment without being disturbed by people. It is essential that they are given access to clean water as soon as possible. This reduces losses in carcass weight

due to dehydration. Whether or not sheep are fed depends on how long they will be off feed. It is preferable to feed only small amounts of roughage, because animals do not eat normal amounts when held in unfamiliar surroundings.

- **Plan and minimise inspection stops and spelling periods during travel.**

Sheep become restless and move about while vehicles are stationary. This causes stress and can increase bruising. This is particularly true for horned animals. Inspection stops are most essential early in a journey (especially the first few hours). The journey should be planned and completed as soon as possible with minimal interference to animals.

Successful in-transit spelling depends on proper handling by skilled stock handlers and the availability of water, feed and a peaceful environment.

- **Realise that selling sheep through saleyards increases carcass weight loss and the risks of bruising and stress.**

After the same period from mustering to slaughter, saleyard sheep have lighter carcasses and impaired meat quality relative to those sent directly to an abattoir.

- **Rest animals in peaceful conditions at the abattoir, whether or not they have rested previously during a long journey.**

It is commonsense to rest animals after travel to ensure that muscle glycogen concentrations are replenished and are therefore adequate at slaughter.

- **Avoid stress during the period immediately before slaughter and stoppages during slaughter.**

Stress at this time will negate the benefits of adequate rest at the abattoir, because sheep will not have any time to restore muscle glycogen to adequate concentrations before slaughter.

- **Be aware that effective electrical stimulation of carcasses cannot reverse pre-slaughter stress.**

  Effective electrical stimulation, as does tenderstretching, improves the tenderness of the loin and hind leg. Toughening of muscle due to pre-slaughter stress cannot be reversed. The whole carcass is affected and its commercial value reduced.

- **Use trained, skilled stock handlers and transport drivers.**

- **Dispose of injured animals humanely.**

  The codes of practice for sheep, handling of sheep during transport, at saleyards and abattoirs, all provide details of the ways to dispose of animals in a humane way.

PART C(ii) - CATTLE

COMMENT ON CURRENT LEVEL OF ADOPTION OF RECOMMENDED PRACTICES AND REASONS FOR NON OR POOR ADOPTION WHERE APPROPRIATE

The following section is based on discussions and input from key people throughout Australia.

TIMES - MUSTERING TO SLAUGHTER

- **Queensland**

  The increasing use of road transport, particularly of double-deck stockcrates during the past 10-15 years, has reduced times from mustering to abattoirs, and so to slaughter, or to other destinations. Recently, Queensland Railways has become more market-oriented and competitive in their attitudes, and because of this, they have regained some of their former share of long distance livestock transport. In particular special livestock trains have shorter travelling times, although long rail journeys still include in-transit rest periods.

  After a short period during which an increasing number of cattle were being sold direct-to-works, saleyards have regained their former market share. The larger selling centres are tending to become even larger and small centres to close, with some consequent impact, locally, on mustering to slaughter times.

  A greater awareness of market requirements, coupled with better transport planning, by producers has also reduced mustering to slaughter times.

- **Northern Territory**

  Alice Springs is the end of the train line north from Adelaide. All other stock within the Northern Territory rely on road transport to abattoirs and ports. In recent times, rail transport is endeavouring to become more competitive with road.

- **Western Australia**

  More cattle from intensive areas in the south–west are being sold directly to abattoirs, reducing their times from mustering to slaughter.

- **Southern Australia**

  There has been little change in methods of transport or sale, other than a campaign by feedlotters to minimise the time that cattle are off feed (before and after feedlotting).

- **South Australia**

  South Australian pastoral cattle are moved by road more regularly than in the past. Australian National Railways are generally not encouraging the use of rail to transport stock. There is now little or no movement of livestock by rail from saleyards.

  The installation of scales and the introduction of liveweight selling at Gepps Cross in Adelaide has seen a resurgence of selling through the yards.

ACTION

Scope for further reductions in the time from mustering to next destination depends on research developments; more cattle going direct–to–abattoirs; negotiations between the livestock industry (principally transporters) and transport and traffic authorities, and between industry and animal health regulators; general goodwill and, most essentially, general and infrastructure funding.

Specific action needed includes:

- extension and other support for methods of sale that enable cattle to go directly from farm to abattoir (eg. over–the–hooks selling methods, CALM);
- adoption of strategies to reduce resting times at abattoirs without compromising meat quality [see Part C(iv)];
- better road conditions;
- eliminating holdups to reload cattle because of the bans on double–deck transports on certain roads (although the increasing use of B–doubles is advantageous in some areas);
- absence of delays at abattoirs to permit chemical residue and other testing of slaughter lots to meet food safety protocols; and
- easier regulatory movement of slaughter cattle from ticky areas through non–ticky areas in north Australia to abattoirs.

AVAILABILITY OF WATER AND FEED

- **Queensland – Saleyards**

There are both wet and dry curfew (12 hours) yards; although only at the former are cattle guaranteed access to water at all times. Most cattle that have travelled long distances have access to water, and maybe feed, on arrival at saleyards.

Processors, particularly the major meat exporters, are pushing for an extension of wet curfew conditions at all major saleyards. Their pressure is working slowly. There has also been pressure from other industry sections in recent times; this must continue.

In addition, the Standard Rules for selling slaughter cattle at saleyards with wet and dry curfews were revised, and adopted by all sections of industry in 1992. The major parties to the revision were the processors, livestock agents and saleyard operators (both private and local government). These rules are now being used as a model for adoption in Victoria and New South Wales.

The major opposition to wet curfews is still from those operating very traditional saleyards. They believe wet curfews are about "getting good dressing percentages" rather than reducing the variation in dressing percentage to increase pricing efficiency, as well as for good animal welfare. Others also have old sets of yards and the installation of water facilities in these yards would not be economic.

- **Northern Territory - Saleyards**

Both saleyards, at Alice Springs and Katherine, have wet curfews, although with cattle being weighed post sale only at Alice Springs. At Katherine, the yards are being upgraded and provision made for scales, particularly for store sales if the live cattle export trade continues to expand.

- **Western Australia - Saleyards**

Cattle are sold on dry curfews. They may or may not be offered water pre-sale. Cattle which have travelled long distances have access to both feed and water.

- **South Australia - Saleyards**

In South Australia where cattle are sold on live weight they are off feed for a minimum of nine hours in the south east yards and 12 hours at Gepps Cross. They all have access to water before weighing.

The south east uses post sale weighing, while Gepps Cross has presale weighing and at Mount Compass the scales double as the selling pen.

- **Victoria – Saleyards**

Wet curfews operate in conjunction with pre–sale weighing.

- **New South Wales – Saleyards**

Cattle are required to have access to water for at least three hours before weighing and to be fed if they are not to vacate the saleyard until the following day. Observations indicate that good quality hay is eaten, but much of the poorer hay is left. Given the animal welfare implications, feeding small amounts of good quality hay at saleyards may pay dividends in better product quality.

Feedlotters are increasingly asking for cattle to be fed at saleyards.

Meat processing operators are putting pressure on transporters to load animals before the mandatory feeding period commences. This, in turn, acts to increase the risk of stress and bruising.

ACTION

Continuing market place pressure by meat processors and others, is essential to achieve more wet curfew saleyards, so that cattle have access to water before, during and after sale. Regulation is not the easy answer, unless animal welfare requirements are imposed by countries importing Australian meat.

- **All States – Abattoirs**

Cattle at most slaughtering establishments remain on water until soon before slaughter. Cattle travelling long distances sometimes are fed on arrival.

In some instances, saleyard cattle are held at abattoirs for excessively long periods before slaughter – this is not good animal welfare nor conducive to good meat quality.

ACTION

The situation needs to be monitored and unduly long pre-slaughter holding periods discouraged.

- **All States – Feedlots**

Best available information is that most cattle are weighed on trucks on arrival or over the feedlot's scales. Both methods result in "empty weights" being the basis for trading, thus introducing pricing inefficiency and dehydration/rehydration distortions into the transaction.

ACTION

Further research on standardisation of liveweights, selling procedures and meat quality [see Part C(iv)], under commercial conditions, with industry input through close liaison.

HORNS

Best available information is that fewer and fewer horned cattle are being sold, particularly at saleyards. The situation is improving in northern Australia more rapidly than in southern areas. This is most encouraging. However, a continuing extension effort is essential, both to publicise the horns–bruising message and to demonstrate dehorning of calves. Dehorning knives are again available for sale (the manufacturers changed) and scoop dehorners are being recommended for young cattle up to weaning.

Equally encouraging, is the requirement that from 1995 all cattle intended for the live export trade (at least in Western Australia) must be hornless. Exporters are already putting on the pressure in all parts of northern Australia demanding hornless cattle only for this trade.

Any penalties for horned animals, or bonuses for hornless cattle, being purchased for lot feeding, and especially the highest quality markets, are not yet sufficiently obvious as to provide clear market signals to breeders. The same is still true with slaughter cattle. Premiums for hornless animals are most evident when supplies of cattle are plentiful.

ACTION

Market pressure is slowly dehorning the Australian cattle herd, with the most rapid progress being in cattle intended for feedlots or live export.

However, additional action is warranted, especially in southern Australia.

Develop and encourage processors to apply a realistic bruise penalty system. (The AUS–MEAT system is not adequate.) This will require a specific effort by a key facilitator who is widely respected by industry. Meanwhile, current extension efforts should continue.

WEANING

Weaner education has traditionally been practised by more owners in northern than southern Australia. This is still true. Weaner education is essential for cattle intended for feedlots, as well as those going directly to slaughter.

ACTION

Publicise and demonstrate the financial and product benefits from weaner training.

YARDS

There is good evidence of a steady increase in yards being built to utilise animal behaviour traits and to minimise bruising and stress, for example, there is an increased strategic use of sheeting to direct the flow of animals into specific areas. The use of these features at key centres appears to act as a model for others, whether the yards are on-farm, at saleyards or at abattoirs.

Examples of key innovators are the Tartura, Wodonga and Emerald saleyards, Bohle saleyard at Townsville, the lairage yards and race to the knocking box at Warwick Bacon and at Teys' Beenleigh abattoir, as well as the lead-up yards and race to the restrainer at the new Fututech facility at Kilcoy.

ACTION

Develop minimum design standards and features for yards.

Continue extension and projects to improve general yard standards at feedlots, saleyards or abattoirs. [See Part C(iv).]

LOADING/UNLOADING RAMPS

- **Queensland**

Minimum design standards were developed, and adopted by industry, and government in Queensland in 1986. They have gradually been adopted as defacto Australian standards. They need to be reviewed and formally adopted on a national basis.

All major saleyards, abattoirs and feedlots (with only a few exceptions) now provide double-deck unloading/loading ramp facilities. Some also provide separate wide unloading ramps. In addition, loading ramp heights meet the minimum standard of 1170-1200mm for single-deck and the bottom deck of double-deck ramps, and so ramps match stockcrate/trailer heights.

Key factors have been:

* the determination of livestock transporters (especially the LTAQ), processors, saleyards and extension workers (particularly John Lapworth) to build facilities to reduce bruising; and

* the close liaison between ramp builders and stockcrate/trailer manufacturers, again often facilitated by John Lapworth.

These double-deck ramp facilities are still recommended for farms and feedlots with high annual turn-offs.

- **Southern Australia**

Despite the widespread use of double-deck transports in southern Australia, including south-west Western Australia, very few double-deck loading/unloading ramps have been built. Also, ramp heights and stockcrate/trailer heights generally do not match.

The main reason seems to be lack of unloading (either rear or side) gates on the upper deck of double-deck transports. Unloading/loading is via an internal ramp, which becomes part of the upper deck's floor. This is not good animal welfare and it increases the risks of bruising, stress and impaired meat quality. It needs to be discouraged.

The New South Wales Meat Industry Authority has introduced specifications attached to its code of practice relating to separate loading and wide loading facilities.

ACTION

In Southern Australia, the type and quality of communications needs to be assessed between all industry sections, but principally between transporters and double-deck loading ramp manufacturers and if necessary, remedial action initiated.

It is suggested that other action to increase adoption be based on the model that has resulted in successful adoption in Queensland. This means injecting funds to allow a respected, "independent" person to work with all parties to facilitate progress.

STOCKCRATES

- **Queensland**

Minimum standards, which were developed by the Queensland industry and government for stockcrates, have gradually been adopted as defacto Australian standards.

Since being adopted by the LTAQ and stockcrate manufacturers in 1983, they have become widely used throughout Queensland for body trucks, single- and double-deck transports, and most recently for B-doubles Consequently, most crates are

sheeted on the inside (ie. with the supporting framework on the outside) so that internal walls are smooth. More and more road trains have through-loading facilities.

- **Southern Australia**

Most transports in eastern-southern Australia comply with the minimum design standards in regard to their structural framework. The major exception is the south-west in Western Australia, where the framework is still on the inside - supposedly to counter wind problems. There, 80% of all stockcrates are made by the same manufacturer.

The continued use of internal ramps, lack of upper deck gates and wide variation in trailer heights is of concern.

ACTION
A deliberate effort to increase adoption is recommended, in conjunction with action, to increase the number of double-deck loading ramps, as described previously.

TRAILERS

The current research work to develop and trial a robust lightweight trailer needs to continue. For other comments see Part C(iv).

TRAINING

Efforts to establish driver and stockhandling training have been numerous, long and arduous, and generally with little real success - despite the goodwill and enthusiasm of some. **There is growing industry awareness of, and commitment to, the need for stockhandling skills and training.**

The most successful has been the course established in Victoria through the leadership of Neil Farquhar. Other courses are slowly being established at TAFE, Armidale by Ross Delaney, and at the Driver Training School, Mt Cotton, Queensland.

Stockhandler training is generally on-the-job learning, apart from its inclusion in courses at agricultural and pastoral colleges, and general public sector extension activities. An approved, privately operated course is underway at "Planet Downs", Comet.

ACTION

See Part C(iv). Use Victorian model to work with other interested parties to broaden the availability of such courses, inject funds plus engage a dedicated facilitator.

PART C(ii) SHEEP AND LAMBS

COMMENT ON CURRENT LEVEL OF ADOPTION OF RECOMMENDED PRACTICES AND REASONS FOR NON OR POOR ADOPTION WHERE APPROPRIATE

The following section is based on discussions and input from key people throughout Australia.

TIME – MUSTERING TO SLAUGHTER

The principal factors affecting time between mustering and slaughter are method of sale, method of transport and abattoir location.

- **Method of Sale**

  While saleyards are still popular, increasing numbers of sheep and lambs are being traded direct. Increased concern over carcass quality has lead to more lambs being traded on a carcass weight basis, while paddock sales remain popular as an exchange method for sheep. Either way both methods offer the minimum time from muster to slaughter. Saleyards on the other hand will usually involve around one to two days extra time between muster and slaughter due to the sale process itself.

  In South Australia, one large lamb processor is using forward contracts in an attempt to obtain large lean lambs delivered directly to the abattoir on specified dates.

- **Method of Transport**

  Most sheep and lambs are transported by road transport. Rail transport is still used in Queensland to transport sheep but this accounts for a relatively small proportion of the overall slaughter.

- **Abattoir Location**

  In the major lamb producing areas of eastern and southern Australia, abattoirs are generally located close to the centres of production. For sheep, the situation in western New South Wales and Queensland has improved in recent years with the construction of abattoirs at Dubbo, Goondiwindi, St George (no longer operating) and Wallangarra.

ACTION

Scope for further reductions in the time between mustering and slaughter will largely depend on any further changes in the method of sale. It is likely that the emphasis on carcass quality aspects of lamb will continue and that there maybe a further trend towards direct–to–works selling of lambs. No significant changes are expected in the method of sale of sheep.

The almost exclusive use of road transport has minimised the time between muster and slaughter as far as transport is concerned. Better planning of selling and transport procedures and timetables would also reduce mustering to slaughter times.

Further marginal gains may be possible through general improvements to roads, special road–train corridors and general technological improvements in stockcrate and equipment design.

AVAILABILITY OF WATER AND FEED

As young lambs lose carcass weight rapidly off feed and water, processors waste little time in getting them to slaughter. Feeding sheep and lambs is therefore only an issue for those operators who are remote from the mainstream production areas and who have to progressively kill single consignments over several days. Such operators tend to buy older lambs in preference to suckers and try to minimise weight lose through the provision of good quality feed. All sheep and lambs arriving at abattoirs have access to water prior to slaughter.

YARDS AND LOADING RAMPS

The area probably needing the most attention is that of on-farm yards and loading ramps. While the transport industry has made significant gains through the introduction of four deck sheep crates, loading facilities on-farm generally have not kept pace. Lack of suitable forcing yards and adjustable loading ramps can mean significant delays in loading four deck trailers. The stress and sheer energy expended in trying to load sheep through poor facilities can often lead to sheep going down on the trucks even before the truck has got out the gate. In many instances, the loading process itself takes longer than the journey from the farm to the abattoir or saleyard.

Saleyards generally have reasonable facilities for drafting, loading and unloading sheep, with most incorporating variable height loading ramps.

ACTION

Where saleyards are involved, sheep and lambs are handled on and off trucks four times at least between farm and slaughter. Every effort should be made to ensure that stress during this phase of the operation is minimised through use of facilities of an acceptable standard and by experienced, skilled stockhandlers.

Action aimed at improving facilities on-farm is warranted.

PART C(iii) – CATTLE, SHEEP AND GOATS

ANALYSIS OF HOW WELL EXISTING CODES OF PRACTICE REFLECT BEST PRACTICE ACCORDING TO THE INFORMATION REVIEWED

ANIMAL WELFARE CODES OF PRACTICE

In common with many other industries and services in Australia, acceptable standards for animal welfare are set down in Codes of Practice. The animal welfare codes were originally written separately by each State and sometimes by livestock industry bodies. They have gradually been replaced by national codes, called the Australian Model Codes of Practice for the Welfare of Animals or MCOPS.

MCOPS are prepared by the Sub–Committee on Animal Welfare (SCAW) of the Animal Health Committee (AHC) for the Agricultural and Resource Management Council of Australia and New Zealand (ARMCANZ). SCAW members represent the State, the Federal and the New Zealand Departments of Agriculture, the CSIRO and other relevant Government committees. In producing each code, SCAW consults extensively with the livestock industries and with animal welfare and community groups.

Since 1983, codes have been published which relate to this review –

* 'Cattle' published in 1992
* 'Sheep' published in 1991
* 'Animals at Saleyards' published in 1991
* 'Livestock and Poultry at Slaughtering Establishments' published in 1987 and currently being revised – draft 2 cited
* 'Road Transport of Livestock'}
* 'Rail Transport of Livestock'} published in 1983 and being rewritten together as 'Land Transport of Cattle', 'Land Transport of Sheep' and 'Land Transport of Goats' – drafts cited

The Australian beef industry seems relatively unaware however, of the use of animal welfare as a marketing strategy. Phrases such as "Clean, green and animal welfare friendly' and 'Animal welfare friendly from conception to consumption' are well known in

the European Community and New Zealand. These are marketing opportunities which are just waiting to be taken up, particularly in the domestic market. Accreditation schemes and product labelling based on animal welfare standards are benefits that can be demonstrated to sectors of the industry less willing to adopt improved welfare practices.

Up to now these codes have always been voluntary guidelines. But State by State they are being incorporated as Regulations under each State's animal welfare legislation.

Having the codes as regulations will let everyone know where they stand about what is and is not acceptable animal welfare practice. This in turn will make it easier to market products along animal welfare lines.

- **Transport**

  Cattle in Australia may be transported many hundreds of kilometres by road or rail both during production and when they are taken to an abattoir. For any journey, a large number of factors impinge on cattle welfare. These include .mustering, yarding, dipping and spelling, as well as the journey itself. The total time off feed and water, loading density, particularly the quality of all handling procedures, and of driving also contribute to the animals' welfare.

  Queensland has led the way in implementing 'optimum density loading' of cattle and the Senate Report on Transport of Livestock within Australia recommended that other States follow suit.

  If saleyards are to continue well into the next century, there is likely to be close examination of facilities and operations from the animal welfare perspective.

- **Live Export Trade**

  For the northern cattle industry, the live export trade of breeder, store and slaughter cattle to Asia is increasing rapidly. The public is generally unaware and thus unconcerned about this trade – an obvious contrast to the live sheep trade to the Middle East. The relatively short journey and small numbers of animals per vessel should present fewer welfare problems for the export of cattle to Asia.

FINALLY

Comments on the various draft codes will be sent to respective SCAW co-ordinators.

COMMENTS BY EXCEPTION ON DRAFT MODEL CODES FOR LAND TRANSPORT OF CATTLE, SHEEP AND GOATS

Contentious Item Numbers			Comment	Amendment
Cattle	Sheep	Goats		
4.1.1	4.1.1	3.1.1	A 12 hour rest between mustering and loading is impractical and unnecessary in many instances, especially intensively farmed areas. It is supported in extensive areas whenever animals are mustered over several days or by helicopters or fixed-wing aircraft. It is not necessary with any self mustering systems and at feedlots.	Rest periods are beneficial between mustering and preparing cattle for sale, as well as later, between the completion of drafting/weighing/assessment – whichever is the latter – and loading. The duration of such rests depends on the fitness of the animals, and duration of the mustering and expected travelling periods. In extensive areas, 12 hours rest prior to transport is recommended.
4.2.4	4.2.4	3.2.4	Animals should only be fed if they have been "in hand" for at least 36 hours and to be transported for more than 24 hours. Feeding as recommended in the draft code is not good welfare. In fact, animals should be taken off feed and water at least 6–8 hours prior to transport to avoid sloppy truck floors with consequent risks of slipping (especially during unloading), bruising and stress, plus manure (and possible pathogen) contamination of their hides/pelts and later carcasses. Research findings clearly show no adverse effects of removing water for those periods pre-transport, as well as showing the harmful consequences of providing water up until loading. Feeding 5 kg for cattle, 1 kg for sheep and goats is excessive. Much will be wasted.	Offer animals water, and feed, before journeys expected to exceed 24 hours **until 6 to 8 hours before loading.** If fed, feed dry roughages (**not** lush lucerne hay) at rates of 2–3 kg cattle, and 0.3 kg for sheep and goats, less for lambs and kids with functioning rumen.

Contentious Item Numbers			Comment	Amendment
Cattle	Sheep	Goats		
5.3.7	5.3.2	4.3.2	A one metre variation in ramp height is unacceptable. Ramps should be built to the height of most trailers commonly using the facilities. With increasing standardisation, through adoption of minimum standards, more exact heights can be given.	Recommended, as per Code for animals at slaughtering establishments. Appendix I. (a) Recommended minimum height of the floor of loading/unloading ramps from ground level. 1. Fixed single deck and lower deck of two deck ramps. All species – 1 170 mm. 2. Upper deck of two deck ramps. Cattle – 2 845 mm Sheep, goats, pigs – 2 100 mm (b) Recommended minimum internal widths of ramps. Cattle – 760 mm Sheep and goats – 870 mm Pigs – 900 mm (allows 2 pigs side by side) Saleyards, abattoirs, feedlots and farms with high annual throughputs are encouraged to build multi-deck loading/unloading ramps.
5.5.1	–	–	We agree with the intent behind "segregate and transport horned and hornless cattle in separate groups". However, it is still highly impractical. Drafting cattle to comply would cause more stress than it is intended to remove.	Delete.

Contentious Item Numbers			Comment	Amendment
Cattle	Sheep	Goats		
6.1.7	–	–	Any broken foot battens are a hazard.	Food battens should be in squares, 250 x 300mm; 14mm steel rod in preferable; and broken battens be replaced.
Add 6.1.9	Add 6.1.9	Add 5.1.9	Steps need to be taken to discourage the use of internal ramps. Stockcrates should include provision to load/unload animals directly from the upper decks.	Where multi-deck loading/unloading is available, loading should occur directly onto and off the upper decks via side or rear gates on that deck.
7.3	6.1.8	–	Pens 3–4.5 metres are advisable for trucks that are to be driven mostly on good roads in heavy density traffic areas. They are entirely inappropriate and impractical elsewhere.	Main pen lengths should depend on the density of the traffic in which trucks are to be driven, being 3–4.5 metres when mostly in heavy density traffic and 6 m elsewhere.
7.5	7.3	6.4	The 3 and 4 m pen columns in the loading density tables are inappropriate – see above. A compromise is to give per deck minimum and maximum, but preferable average numbers per deck.	Delete the minimum and maximum numbers per pen. Add average numbers per deck.

Contentious Item Numbers			Comment	Amendment
Cattle	Sheep	Goats		
8.3.1	8.3.1	7.3.1	The suggestion to provide feed every 24 hours and preferable twice, as well as to provide water every 12 hours and preferably every 8 hours is nonsense. We are dealing with ruminants being transported, not people. This is not good animal welfare, because it increases stress and bruising. To implement this recommendation would introduce many additional, and unnecessary, in-transit resting periods for animals required to travel long distances. This will increase the total time off full feed. Research findings clearly show that additional, adequate rest at the conclusion of the journey is equally effective for cattle, while additional in-transit rests have actually been shown to increase bruising and stress (as indicated by dark-cutting carcasses.	All animals should have access to water every 24 hours and feed every 48 hours. The amount fed should be the same as given in 4.2.4 for cattle and sheep, and 3.2.4 for goats.
8.4.2	-	-	Allow more discretion.	Use the wording for sheep - within 30-60 minutes.
9.2	9.3	8.3	A maximum travelling period of 48 hours without a rest period is far too long. Fatigue and stress, supported by bruising data and observations, clearly show that animals start to tire after 36-40 hours. Rest periods of 12-24 hours every 24 hours are supported, in fact 18-24 hours is preferable.	Any one stage of a journey should not exceed 30 hours, unless the entire journey can be completed within 36 hours. Animals should be rested for 18-24 hours after every 36 hours or less of travel.
10.6.2	10.4	9.4	It is pointless feeding ruminants resting at abattoirs during the 24 hours immediately before slaughter.	..... provided with food except during the 24 hours immediately preceding slaughter. Amounts as previously stated.

COMMENTS BY EXCEPTION ON DRAFT MODEL CODE FOR LIVESTOCK AT SLAUGHTERING ESTABLISHMENTS

Contentious Item Numbers Cattle, Sheep and Goats	Comment	Amendment
1	**Holding paddocks or yards:** The original code wording is preferable with some slight amendments.	Water troughs used by animals on arrival at the slaughtering establishment should be of sufficient size to permit the majority of animals to drink at the one time. Water troughs in holding yards should allow a minimum of 15 mm of trough length per sheep, 30 mm per beast and 100 mm per pig. Troughs should be not less than 2.5 m long. Drinking bowls should allow one bowl for each 15 pigs. Nipple drinkers are not satisfactory as the only source of water for pigs. Bowls and nipple drinkers are not suitable for sheep and cattle. In earth yards concrete aprons should be provided at watering points.
2	**Pre-slaughter holding pens:** Why **potable** water?	**Amend to** ... as in previous code : drinkable water

Contentious Item Numbers Cattle, Sheep and Goats	Comment	Amendment
4	**Holding times**: A rest of 2 hours is the bare minimum – to allow animals time to drink and rehydrate before slaughter – provided animals on arrival are not dehydrated and have adequate muscle glycogen concentrations to produce low pH level. **Stunning restrainers:** "V" shaped conveyors are **not** suitable for stock where there is not a continuous flow onto the slaughter floor. Animals tend to escape (often onto the slaughter floor), or climb over each other, while conveyors are stopped to permit the preceding animals to be slaughtered and dressed. Conveyors are also very expensive and unnecessary for small establishments with discontinuous animal flows. **The aim is to ensure adequate and proper restraint.**	**Amend to** ...a rest period of a minimum of 6–12 hours between arrival and slaughter is preferable, except for bulls which can be slaughtered sooner. Ruminants that are stressed, or ... Animals should certainly be rested for longer than 6–12 hours, preferably 24–48 hours, and after long journeys for 72 or 96 hours or more (as in the next dot point). **Amend to** ...suitable restraining **devices** for complete restraint.

COMMENTS BY EXCEPTION ON CODE FOR ANIMALS AT SALEYARDS

Contentious Item Numbers Cattle, Sheep and Goats	Comment	Amendment
3.2	**Design Consideration:** (i) Cattle and Horses A one metre variation in ramp height is unacceptable. Ramps should be built to the height of most trailers commonly using the facilities. With increasing standardisation, through adoption of minimum standards, more exact heights can be given. Recommended, as per Code for animals at slaughtering establishments. Appendix I.	(a) Recommended minimum height of the floor of loading/unloading ramps from ground level. 1. Fixed single deck and lower deck of two deck ramps. All species – 1 170 mm. 2. Upper deck of two deck ramps. Cattle – 2 845 mm Sheep, goats, pigs – 2 100 mm (b) Recommended minimum internal widths of ramps. Cattle – 760 mm Sheep and goats – 870 mm Saleyards, abattoirs, feedlots and farms with high annual throughputs are encouraged to build multi-deck loading/unloading ramps.
3.7	**Watering facilities:** Nipple drinkers and bowls should not be used as the sole source of water for cattle or sheep.	**Amend to** ... not to be used for cattle and sheep.

COMMENTS BY EXCEPTION ON CODE FOR CATTLE

Contentious Item Numbers Cattle, Sheep and Goats	Comment	Amendment
4	Cattle handling facilities, mustering and yarding	**Include** ... Ramps should be constructed appropriate to the species of stock and the transports used. A flat platform at the top of the ramp should be level with the deck being unloaded and should be not less than 1.5 metres in length to assist loading and unloading. Suggested ramp heights are 1170–1200mm from the ground for single deck or, where built, bottom deck, and 2845mm for top deck.

PART C(iv) – CATTLE

A SERIES OF RECOMMENDATIONS FOR FURTHER RESEARCH AND DEVELOPMENT HIGHLIGHTING HOW THIS ACTIVITY WOULD IMPROVE EITHER CURRENT RECOMMENDATIONS OR THEIR ADOPTION

These recommendations have been compiled from input from key people **throughout Australia, including MRC's workshop of industry representatives in Brisbane (22 July 1994)**, and on the basis of the literature review (Part A), and other relevant authoritative reviews including those by Tarrant and Grandin (1993), Warriss (1990, 1993), Shorthose, Vowles and Lapworth (1985 Animal Production Committee, Glenormiston Workshop), Shorthose and Wythes (1988) and the AMLRDC Dark–cutting in cattle and sheep workshop (1988).

Comments and recommendations for further research and development are given within the sequence of the selling process. Those areas requiring, and receiving, the most support are shown in bold.

Given the need to maximise both product quantity and quality, is it recommended that wherever possible various effects on (gross hot) carcass weight, bruising and meat quality are studied concurrently. Principles established for carcass weight generally seem to apply to offal weights. Data on injuries, mortalities and condemnations can usually be obtained with minimal additional inputs. Wherever possible, research and development should be conducted with commercial cattle under field/commercial conditions, always using rigorous experimental principles, designs and methodologies.

It is important to realise that the contributions of VIA and Tendertec, valuable as they may be, will not remedy preslaughter losses in product quantity and quality. Similarly, effective application of electrical stimulation is just as important to prevent toughness.

BASE LINE DATA.

- **It is recommended that reasonable estimates be established for at least the costs of carcass weight loss, bruising and impaired meat quality (including dark-cutting) to the Australian livestock and meat industries.**

  The frequently quoted estimates for the cost of bruising and dark-cutting carcasses to the Australian industry are well out-of-date. Moreover, they are based on very small samples. There are no data for the costs of carcass weight loss and condemnations, other than "guesstimates" made by Shorthose in 1982. The national carcass audit, as part of the trading systems key program, will provide some data.

  In the base line survey, unexpected major sources of losses would be identified and so research priorities determined; evidence of progress in improving animal welfare in recent years, and a measure of progress in adoption could eventually be demonstrated. The reliability of condemnation data may vary between agencies and this will need to be assessed in undertaking any review.

SELLING METHODS

It is strongly recommended that efforts continue to reform and implement better selling methods that both maximise competition and provide product discounts/premiums and feedback on financial and product losses (for example due to bruising and dark-cutting).

ANIMAL FACTORS AND HUSBANDRY

- More detailed information on animal factors affecting liveweight and/or carcass weight may lead to better preventative measures for various classes of cattle. It would certainly improve the pricing efficiency for trading cattle on a live or carcass weight basis. With planning, such data can be accumulated as part of other studies.

- **It is recommended that further research and development be undertaken on the influence of, and interaction between, temperament, social order, behaviour, handling history, and handler skills and attitudes on carcass weight, bruising and meat quality. Their effects, singularly or in combination, on feedlot performance should also be considered, as well as the interaction between expression of these factors and animal age, weight, sex and genotype.**

  A greater knowledge of these factors should explain unaccountable differences between animals, herds and handlers in dark-cutting (and hence tenderness), bruising and weight loss. Such information will assist in developing and implementing preventative measures on-farm, during transport and at abattoirs to minimise losses. The importance of these factors may vary between pasture-finished and feedlot cattle, between cows and steers, and between Bos indicus, (Bi) Bos taurus (Bt) and crossbred (BiX, BtX) cattle.

  The expression of temperament and animal behaviour by individual animals may vary during the selling process, but still have the same adverse consequences on bruising and meat quality. Observations are needed on the same animals from preparation-for-sale on-farm through to settling down at feedlots or to stunning at abattoirs.

  It would be naive to presume that the overseas findings on social interactions between bulls, and between heifers, do not have a potential parallel for steers and females in Australia. Social interaction is regarded as a major cause of dark-cutting and bruising in Europe. Few data exist for Australia, where transportation effects are considered to be overriding. This will undoubtedly change as transport improves, fewer horned cattle are sold and preventative product loss measures are implemented. Social/physical interaction in heifers associated with oestrus will assume greater importance.

- Given the available data on heritabilities and large variation in muscle tenderness, dark-cutting and bruising **within** groups of animals (often without reasonable explanation), any genetic control is likely to relate to individual animal/sire traits

rather than to genotype. The availability of AUS-MEAT feedback, and its links to BREEDPLAN and GROUP BREEDPLAN, need to be fully exploited genetically. The marginally tougher muscle from BiX cattle and greater variation in tenderness as noted in a number of Australian reports cannot be ignored, despite the production efficiencies of BiX cattle. I understand this is being addressed separately. Much of this work can be done within the CRC (Meat Quality) program.

ON-FARM

- **It is strongly recommended that research commence to establish suitable sale-preparation, transport and destination management procedures to:**

  * **minimise product losses in feedlot and pasture-finished cattle sent to slaughter;**
  * **minimise weight loss during the selling process in store cattle, as well as their weight and animal health recovery periods during finishing in feedlots or on crop;**
  * **minimise weight loss and the recovery period in cattle transported for live export.**

- Currently, further research is needed to establish the rate and extent of dehydration and catabolic carcass tissue losses under various conditions, as well as the major causal factors.

  Research to date clearly shows that substantial product (quantity and quality) losses occur during the selling of cattle throughout Australia. The key factors are time from mustering to slaughter or return to full feed, provision of water on arrival and until slaughter, provision of feed during extended rest periods, adequate rest in a peaceful environment and absence of immediate pre-slaughter stress.

  However, there has been little effort to develop on-farm strategies to prepare cattle for sale, for example, ways to generate maximum muscle glycogen concentrations

before transport, thereby shortening both mustering to slaughter and resting times. Prevention is better than cure, and both carcass weight and meat quality would benefit. In a review of muscle metabolism and physiology in relation to pH, Lister (1989) concluded that "there are good indications that feeding practices which supply appropriate gluconeogenic precursors may help to protect animals prior to slaughter, or with rest, to make for more rapid restoration of muscle glycogen in animals which have been stressed." A knowledge of the extent and rate of dehydration and catabolic carcass tissue losses under various conditions will enable more effective strategies to be developed. Data are required for all slaughter feedlot cattle and for cattle intended for the heavy-weight grassfed Japanese market.

The application of various preventative measures, or "speedy recovery treatments" may vary with the time and place (on-farm, feedlot, ship, abattoir), production system (via feedlot ration, water or feed supplement or other additives) and type of animal and its handling history.

An examination is needed of various feeds and additives (energy, protein, electrolytes) as measures to reduce, if not minimise, weight losses due to catabolism and dehydration. The work on sugar was not successful. Other work with roughages suggests that weight loss savings are related to energy intake.

The electrolyte and feed additive work being done in Canada may not directly apply to various Australian production systems. I also understand that the Canadians plan to develop their technology as proprietary products (A. Schafer personal communication), which may or may not be available, at a price, to Australia.

Any research on dehydration and catabolic losses should be linked to that on behaviour observation on drinking and feeding (see feedlots/saleyards) and work on weather conditions/heat stress (see transport).

Examination of various feeding, water and electrolyte strategies are advocated before attempts are made to trial feed and water facilities in transports. Also, South African and Canadian work indicates only partial success, plus there is the risk of injury and bruising.

- **It is strongly recommended that the financial and product benefits of educating weaners and selling hornless cattle be widely publicised and demonstrated.**

Such publicity is more urgently needed in southern than northern Australia. It should refer to store (feedlot), slaughter and live export cattle.

TRANSPORT

- Further investigation of the effect of various loading densities is not warranted, because of the limited scope of any one experiment, large variation within many groups of animals including supposedly uniform lines, and difficulty of applying precise recommendations. An extension effort to discourage gross over- and under-loading, and to support volume loading, would be far more productive.

- **Demonstration research and extension are essential to show the effects of driver control and skill on animal welfare (including behaviour and physiology), bruising and muscle pH/tenderness under Australian conditions. Such work to be in conjunction with driver training.**

- **Concurrently, driver training courses should continue to be supported and also extended to other regions.**

Such research would build on overseas efforts, but more importantly, the Victorian work with single-deck transports. Driver-related work needs to be extended to double-deck transports and B-doubles, and to other areas. Doing so, in association with driver training (already operating successfully in Victoria) adds impact to the animal welfare/product vulnerability messages underlying the training objectives. It can also be used to expand the delivery of training to other locations.

- Examination of method of travel on bruising and meat quality is not warranted.

- Any investigation of the effects of various road surface and traffic conditions should be linked to driver training to develop a better understanding of the welfare/product issues as above. There would be an accompanying benefit in the form of hard data, for use in negotiations between livestock transporters and various government transport/main roads/traffic and town planning authorities.

- **It is strongly recommended that the current minimum design standards for stockcrates being used in some States be reviewed, in conjunction with transport operators and transport authorities. Further, that every effort then be made to extend their use, as well as their adoption, nationally.**

  Standards have been operating since 1983 in Queensland, and given the changes in many stockcrates being used and experience gained since then, a review is timely. The review should also be used as a "vehicle" to facilitate the adoption of minimum design standards. **The major need is to extend current knowledge and best practices.**

- **It is strongly recommended that investigations begin on the effects on bruising, meat quality, loading times and intransit behaviour of different numbers of pens (partitions) in stockcrates under various road conditions and topography (for example hilly versus flat terrain). Side, rear and through-loading systems need to be assessed.**

  A research and development effort to facilitate greater use of through-loading of double-deck road train is essential, because this reduces loading time and therefore total transit time. It is also less stressful for man and beast.

- Research is not recommended to assess the relative effects of transport vehicles (eg., single-deck v. double-deck v. B-doubles, top v. bottom decks, front v. back compartments) on bruising and meat quality. It would be expensive and unlikely to yield major advantages. Any research efforts should certainly wait until a review of design standards is completed.

AGENT ONLY TASKS	PRIORITY RANKING	ADVERSE CONSEQUENCES OF				
		Carcass Weight	Bruising	Injury	Meat Quality	Other
Sell and weigh cattle	**					Loss of business

ABATTOIR ONLY TASKS	PRIORITY RANKING	ADVERSE CONSEQUENCES OF				
		Carcass Weight	Bruising	Injury	Meat Quality	Other
Maintain slaughter floor equipment in good repair, to avoid stoppages due to mechanical breakdowns	***		✓		✓✓✓✓	
Load knocking boxes correctly	*				✓	
Stun animals once			✓✓		✓✓	
Related post-slaughter management effects on carcass quality and returns to that sector						
Effectively electrically stimulate all carcasses	****				✓✓✓✓✓	
Use carcass chilling regimes which meet public health and market protocols without inducing cold shortening	****				✓✓✓✓	

TRANSPORTER/DRIVER ONLY TASKS	PRIORITY RANKING	ADVERSE CONSEQUENCES OF				
		Carcass Weight	Bruising	Injury	Meat Quality	Other
Purchase low tare trailers and stockcrates that conform with minimum design standards	****		✓✓	✓✓	✓	
Preparing transport for the task – clean, in good state of repair and having on–board equipment to deal with "downers"	**		✓	✓	✓	
Satisfied that loading density and fitness of the animals will enable all animals to be delivered without loss	**	✓	✓	✓	✓	Mortalities
Load each division in accordance with size/weight/type of animals	**		✓	✓		
Driving in a manner that permits all animals to retain their footing	***		✓✓	✓✓	✓	
Planning and checking load during transit, including rest periods	***		✓	✓	✓	Mortalities
Keep species separate, and also classes of stock as appropriate	***	✓	✓	✓	✓	Mortalities

PRODUCER ONLY TASKS	PRIORITY RANKING	ADVERSE CONSEQUENCES OF				
		Carcass Weight	Bruising	Injury	Meat Quality	Other
Dehorning calves	***	✓	✓✓✓✓	✓✓		
Weaner and young sheep training	****	✓	✓✓	✓✓	✓✓	
Deciding method of sale – and on the basis that it is a direct consignment system – to whom and where animals are sold; – expected time mustering to slaughter; and – calculated carcass weight losses, freight relative to the price expected (taking various grade/grid payment systems into account). With the introduction of bruise penalties, add in expected bruising discounts.	**	✓✓	✓		✓✓✓	
Mustering time relative to later operations	***	✓✓✓	✓	✓	✓	

- **It is recommended that further novel engineering approaches be investigated to resolve issues relating to tare weight, trailer/stockcrate weights, strengths and stability, air flows, drainage and self-cleaning of stockcrate floors. It is suggested that computer modelling and scale model testing be undertaken, and evaluated, before any consideration is given to financing actual trailer or stockcrate manufacture. Novel design, construction techniques (eg. modules) and materials need to be assessed.**

The lightweight trailer work has made good progress, but there is a need to expand engineering creativity and innovation, to learn from other transport and heavy duty industries and materials handling expertise, and, to do so with a sense of urgency.

The problem will be to develop a double-deck livestock trailer that is:

. light in construction, but robust and relatively inexpensive with minimal maintenance requirements under harsh conditions;

. designed to conform with animal welfare requirements as set down in the codes of practice; and

. built in module form of materials that allow maintenance to be quickly and efficiently carried out whatever the locality.

With the increased use of double-deck ramps on properties, feedlots, saleyards and abattoirs, the penning around the internal trailer ramp on the top deck can be removed. This will eliminate a potential bruising hazard and allow the animals to travel better.

The problems associated with various convertible sheep to cattle crates continue. They include design and construction, occupational safety for drivers, potential bruising and injury for livestock, and the costs of building and operating convertible crates. This problem is usually put in the too hard basket and little done. It applies in particular to southern Australia.

The use of multi-purpose cattle crates to allow back-loading and so reduce the costs of freight needs to be seriously addressed. Transport costs are usually the

major cost component in selling cattle. However, any increase in liveweight would be a problem.

- Research to improve micro-climates in various stockcrates under different road conditions, including the effects of vehicles travelling and being stationary within various decks, should be a part of that on stockcrate modifications. There have been sporadic attempts to investigate the effects of heat stress (in rail wagons and stockcrates), and dust/air flows (in double-deck stock crates). I am not aware of any work on the effects of transport wind chill, rain (other than the report by Graeme Eldridge when it rained during one of three trial runs), cold, dust and traffic fumes on cattle behaviour, physiology, bruising and meat quality. Heat/shade and cold/wind are likely to be the main welfare issues of concern to the general public. Research on cold and heat stress is well documented for other production perspective.

FEEDLOTS

- **It is strongly recommended, on both animal welfare and pricing efficiency grounds, that investigations recommence to provide a better understanding of factors affecting the standardisation of animal liveweights (dressing percentages), liveweight recovery and drinking behaviour of cattle at feedlots.**

  There is a great deal of discontent about the procedures being used at feedlots to trade store cattle. The equivalent of saleyard wet curfew procedures are urgently needed. The same need applies to on-arrival/pre-weighing procedures and to the method of weighing.

  Pricing efficiency is improved by minimising variations in dressing percentages, by "standardising" the gutfill of animals with the same on-farm liveweight. Trading depends on equity for both vendor and buyer, on weighing on approved scales, and using appropriate pre-weighing practices.

SALEYARDS

- The debate on the merits of pre–v. post–sale weighing, and of ring v. pen selling, is usually on their relative operational efficiencies. The relative effects of saleyard selling methods on animal welfare, bruising and meat quality rely on two reports – one from Victoria and one from Queensland, both completed in the early 1970s. Some development research may be warranted, given the advances in saleyard design, particularly in southern Australia; the continuing reliance on this method of sale, again predominantly in southern Australia; plus the continuing criticism of saleyards as a source of bruising.

- Cattle from many sources are mixed in the buyers' pens after sale for transport to abattoirs. The extent and nature of any adverse effects are unknown. It may be worthwhile undertaking preliminary behavioural observations in Australian saleyards, given the overseas reports of the potent effects of mixing strange groups of bulls, of heifers and of "pampered" steers, and the Australian work on mixing horned and hornless cattle. This could be done relatively cheaply and is essential before any bruising or meat quality work is even contemplated.

ABATTOIRS

- **It is strongly recommended that research continue to improve animal welfare and to establish appropriate pre–slaughter management strategies at abattoirs to maximise carcass weight and meat quality, as well as to minimise carcass processing problems (including condemnations). Such strategies to include the provision of feed and water additives (energy, protein, electrolytes) and also, to consider nutritional history, duration of resting times relative to travelling times, resting conditions, the provision of shade and other shelter/protection, animal behaviour and temperament factors.**

  A better understanding of the factors predisposing animals to bruising and stress is essential.

Such work logically flows on from, and should be integrated with, any on–farm preventative measure and any observations on drinking and feeding behaviour. It should lead also to better rest management practices at abattoirs.

These studies should consider whether different strategies and/or additives are needed for direct consignment and saleyard cattle.

Feeding studies should include some microbiological work to assess the effect of feeding on rumen and other digestive tract pathogens, such as salmonellae, and in turn, contamination of the carcass and other edible co–products. It is vital to assess any feeding studies (whether on–farm, in transit, at saleyards, or at abattoirs) in terms of pathogen contamination, given the increasingly stringent food safety requirements and market access implications. Such work should identify the source of origin of the animals (via saleyard or direct from on–farm).

- **It is suggested that discussions be held with Drs Vivion Tarrant (Dublin) and Paul Warriss (Bristol) to determine if they plan further work on muscle glycogen physiology to effect faster repletion rates in cattle. It is further suggested that any new work be done in conjunction with these workers, or their colleagues.**

Pre–transport preventative measures may not be successful in all situations in Australia, given the long mustering to slaughter times for cattle in northern Australia, and often for saleyard cattle. This may also apply to cattle destined for feedlots and live export, given the long distances stores are transported to feedlots. Under these circumstances, it is probable that rest and feeding to replenish muscle glycogen concentrations will still be essential to produce optimum ultimate pH values.

More importantly, such management will be necessary to provide a glycogen buffer against stress immediately before slaughter, and more particularly, against unanticipated events (for example, interruptions due to mechanical stoppages).

A better knowledge of muscle glycogen physiology and ways to effect rapid repletion are therefore essential to implementing any measures to prevent dark-cutting. There may be side benefits such as a reduction in carcass weight losses.

- The current regulations require livestock to "be run past the veterinarian". This is hazardous for all parties and not conducive to good animal welfare. Alternate systems could be based, for example, on a quality assurance approval.

YARD DESIGN, CONSTRUCTION AND HANDLING

- **It is recommended that minimum design features and standards be established for yards and loading/unloading ramps at trucking yards, permanent wharf yard facilities, saleyards and abattoirs; for loading/unloading ramps on-farm; and for all handling equipment (eg. crushes, weighing scales, head bails). It is strongly recommended that every effort then be made to extend their use, as well as their adoption, nationally.**

  There is an excellent, but scattered body of local knowledge, expertise and experience on yard design and handling equipment in Australia. It needs to be condensed into appropriate design standards/features, user-friendly extension material and to be publicised widely.

  The review, development and extension of such design standards/features could be advantageously linked to both driver and stock handling training. It should also be linked with other efforts to improve facilities and stock handling at saleyards and abattoirs.

- **It is strongly recommended that a development and extension project be commenced with industry to improve the general standards of yard facilities, stock handler attitudes and skills, and of animal-flow systems at abattoirs. Such a project to incorporate stock handling training and the implementation of best pre-slaughter management practices.**

- Stock handling training courses be established and supported to cater for handlers working on-farm and at other stages of the selling process.

  Unfortunately, many people who handle and oversee the movement of cattle from paddock to slaughter, or who design handling facilities, are often unaware of the consequences of their actions and decisions. This may be due to handlers and designers not observing animals at slaughter for bruising or it may be the result of poor management supervision.

  The need for general improvements in yard facilities and stock handling at major centres, is evidenced by the large variations in bruising and dark-cutting between saleyards and abattoirs, especially those with high throughputs.

  Greater benefits from improved handling will accrue if they are linked to enterprise bargaining and to recognition and reward (monetary and certification) of specialist stock handling skills. Additional remuneration for demonstrated skills is a small cost relative to industry benefits in terms of improved product quantity, quality and reputation. The general reduction in the rural labour force means fewer skilled and experienced handlers are available, and so, fewer skilled handlers to train newcomers. Specialist training is necessary for both stock handlers and truck drivers.

  The Meat Research Corporation's on-farm producer demonstration sites, local consensus data on-farm producer demonstration sites, local consensus data and other related projects, as well as the NZ Pork Producers Board's pig welfare research and development project, all provide a good model to use to facilitate adoption.

- Specific attention needs to be given to developing better flooring materials and surfaces for lairage yards and races at abattoirs. Non-slip concrete floors in lairage yards and races rapidly become smooth in high traffic areas – endangering both livestock and their handlers. This is an important problem at many abattoirs. Any examination of alternate materials needs to consider cleaning and hygiene protocol requirements.

GENERAL

- Further work be considered to identify the sources and occurrence of bruises, in order to demonstrate responsibility for the causes of bruising during the selling process. Only then can realistic bruising penalty systems be implemented.

  The costs of bruising are still being borne by all – whether or not a producer delivers bruised cattle. One of the major obstacles to reducing bruising is the lack of an accurate technique to determine exactly **how or when bruises occur** and thus to apportion responsibility for damage. Histological techniques have been developed to differentiate between bruises occurring immediately before or after stunning as well as 8, 24 and 48 hours before slaughter. Previously, ageing techniques depended on biochemical methods. Ageing a specific bruise relates solely to the cause of that bruise. Ageing a composite of bruises from the same animal, or from a group of cattle, gives only an average indication of the time and cause(s) of bruising.

  The current bruise scoring system adequately records bruising for feedback purposes. However, **it is not suitable for applying bruising penalties through price discounts**. Modifications are essential and need to be tested thoroughly. This work is best done in close association with industry to gain their input, and acceptance and commitment to the final system. Only then will they use it. A properly planned campaign of explanation for producers is equally crucial.

- A detailed review of the physiological/biochemistry changes induced by the selling process, including transport, would assist investigations of preventative product strategies. This review would provide essential background, and baseline, data from which to plan preventative measures. It would build on the last comprehensive review of available information by Leach (1981). An understanding of transportation per se, travelling time and other related stressors on meat quality (muscle tenderness and pH) is necessary to develop appropriate pre– and post–transport management practices, including desirable resting periods and conditions. Some Australian data are available – both published and unpublished.

It is vital to consider stress effects both, singularly and cumulatively, and also in terms of their time of occurrence. There is good evidence that cumulative fatigue is associated with increased dark-cutting and bruising, with stressful events early in the selling process pre-disposing animals to bruising and muscle glycogen depletion at a later stage.

- The effects of chronic disease and metabolic disturbances in animals on subsequent carcass, offal and meat quality attributes are often overlooked, as are the effects of selling and transport on animal health. These losses are probably economically significant and deserve a preliminary examination to establish real priorities for Australia.

The major obstacles to the adoption of new technology are the lack of financial incentives for premium products, a strong price feedback mechanism, and motivation to change present methods and improve the credibility of beef as a product. Traditional methods and attitudes cannot be sustained just because they are currently the accepted method.

PART C(iv) – SHEEP AND LAMBS

A SERIES OF RECOMMENDATIONS FOR FURTHER RESEARCH AND DEVELOPMENT HIGHLIGHTING HOW THIS ACTIVITY WOULD IMPROVE EITHER CURRENT RECOMMENDATIONS OR THEIR ADOPTION

These recommendations have been compiled from input from key people throughout Australia and on the basis of the literature review (Part B), and other relevant authoritative reviews including those by Tarrant and Grandin (1993), Warriss (1990, 1993), Shorthose and Wythes (1988), and the AMLRDC Dark-cutting in cattle and sheep workshop (1988).

Comments and recommendations for further research and development are given within the sequence of the selling process. Those areas requiring, and receiving, the most support are shown in bold.

Given the need to maximise both product quantity and quality, is it recommended that wherever possible various effects on (gross hot) carcass weight, bruising and meat quality are studied concurrently. Principles established for carcass weight generally seem to apply to offal weights. Data on injuries, mortalities and condemnations can usually be obtained with minimal additional inputs. Wherever possible, research and development should be conducted with commercial sheep under field/commercial conditions, always using rigorous experimental principles, designs and methodologies.

It is important that the contributions of VIA and Tendertec (valuable as they may be) will not remedy pre-slaughter losses in product quantity and quality. Similarly, effective application of electrical stimulation is just as important to prevent toughness.

BASE LINE DATA.

- **It is recommended that reasonable estimates be established for at least the costs of carcass weight loss, bruising and impaired meat quality (including dark-cutting) to the Australian livestock and meat industries.**

  There are no reliable estimates for the costs of carcass weight loss, bruising and dark-cutting carcasses for sheep to the Australian industry.

  In the base line survey, unexpected major sources of losses would be identified and so research priorities determined; evidence of progress in improving animal welfare in recent years, and a measure of progress in adoption could eventually be demonstrated. The reliability of condemnation data may vary between agencies and this will need to be assessed in undertaking any review. The national carcass audit should assist.

- An investigation of the extent, and time of occurrence, of bruising in sheep and lambs is required to determine whether it is a major problem to the industry. If there is a problem then work can be undertaken to identify the sources and occurrence of bruises in order to demonstrate responsibility for the causes of bruising during the selling process.

SELLING METHODS

- **It is strongly recommended that efforts continue to reform and implement better selling methods that both maximise competition and provide product discounts/premium and feedback on product and financial losses.**

ANIMAL FACTORS AND HUSBANDRY

- More detailed information on animal factors affecting liveweight and/or carcass weight may lead to better preventative measures for various classes of sheep. This work should consider factors including age, genotype, sex and weaning. The recently developed classes of stock, such as "Elite" lambs, also need to be investigated. It would certainly improve the pricing efficiency for trading sheep on a live or carcass weight basis. With planning, such data can be accumulated as part of other studies.

  Given the available data on heritabilities and large variation in muscle tenderness, dark-cutting and bruising **within** groups of animals (often without reasonable explanation), genetic control is likely to relate to individual animal/sire traits rather than to genotype. The availability of AUSMEAT feedback, and its links to LAMBPLAN, need to be fully exploited genetically.

ON-FARM

- **It is strongly recommended that research commence to establish suitable sale-preparation, transport and destination management procedures for sheep and lambs consigned directly to abattoirs to minimise product losses (including weight, bruising and meat quality) in sheep and lambs sent to slaughter.**

- **Currently, research is needed to establish the rate and extent of dehydration and catabolic carcass tissue losses, under various conditions, as well as other major causal factors.**

  Overseas research clearly shows that substantial product (quantity and quality) losses are likely to occur during the selling of sheep. The most likely key factors are time from mustering to slaughter, provision of water on arrival and until slaughter, provision of feed during extended rest periods, adequate rest in a peaceful environment and absence/presence of immediate pre-slaughter stress.

However, there has been very little effort to develop on-farm strategies to prepare sheep for sale, for example, ways to generate maximum muscle glycogen concentrations before transport, thereby shortening both mustering to slaughter and resting times. Prevention is better than cure, and both carcass weight and meat quality would benefit. In a review of muscle metabolism and physiology in relation to pH, Lister (1989) concluded that "there are good indications that feeding practices which supply appropriate gluconeogenic precursors may help to protect animals prior to slaughter, or with rest, to make for more rapid restoration of muscle glycogen in animals which have been stressed." A knowledge of the extent and rate of dehydration and catabolic carcass tissue losses under various conditions will enable more effective strategies to be developed.

The application of various preventative measures or "speedy recovery treatments" may vary with the time and place (on-farm, ship, abattoir), production system (water or feed supplement or other additives) and type of animal and its handling history.

An examination is needed of various feeds and additives (energy, protein, electrolytes) as measures to reduce, if not minimise, weight losses due to catabolism and dehydration. Work with roughages suggests that weight loss savings are related to energy intake.

The electrolyte and feed additive work being done with cattle in Canada may not directly apply to Australian sheep production and selling systems.

Any research on dehydration and catabolic losses should be linked to that on behaviour observation on drinking and feeding (see abattoirs) and work on weather conditions/heat stress (see transport).

TRANSPORT

- Work is required to validate current loading density recommendations, while an extension effort to discourage gross over- and under-loading, and to support volume loading, is warranted. Basic data on general behaviour and handling effects during transport are also required.

- **It is suggested that demonstration research/extension be undertaken to show the effects of driver control and skill on animal welfare (including behaviour and physiology), bruising and muscle pH/tenderness in sheep under Australian conditions. Such work to be in conjunction with driver training.**

- Concurrently, driver training courses should continue to be supported and also extended to other regions.

  Such research would build on overseas efforts, but more importantly, the Victorian work with single-deck transports. Driver-related work needs to be extended to double-deck transports and B-doubles, and to other areas. Doing so, in association with driver training (already operating successfully in Victoria) adds impact to the animal welfare/product vulnerability messages underlying the training objectives. It can also be used to expand the delivery of training to other areas.

- Any investigation of the effects of various road surface and traffic conditions could be linked to driver training to develop a better understanding of the welfare/product issues as above. There should be an accompanying benefit, in the form of hard data, for use in negotiations between livestock transporters and various government transport/main roads/traffic and town planning authorities.

- **It is recommended that the current minimum design standards for 1, 2, 3 and 4 deck stockcrates being used in some States be reviewed, in conjunction with transport operators and transport authorities. Further, that every effort then be made to extend their use, as well as their adoption, nationally.**

Standards have been operating since 1983 in Queensland, and given the changes in many stockcrates being used and experience gained since then, a review is timely. The review should also be used as a "vehicle" to facilitate the adoption of minimum design standards. **The major need is to extend current knowledge and best practices.**

- **It is recommended that further novel engineering approaches be investigated to resolve issues relating to tare weight, trailer/stockcrate weights, strengths and stability, air flows, drainage and self-cleaning of stockcrate floors. It is suggested that computer modelling and scale model testing be undertaken, and evaluated, before any consideration is given to financing actual trailer or stockcrate manufacture. Novel design, construction techniques (eg. modules) and materials need to be assessed.**

The lightweight trailer work has made good progress, but there is a need to expand engineering creativity and innovation, to learn from other transport and heavy duty industries and materials handling expertise, and, to do so with a sense of urgency.

The problem will be to develop a multi-deck livestock trailer that is:

. light in construction, but robust and relatively inexpensive with minimal maintenance requirements under harsh conditions;

. designed to conform with animal welfare requirements as set down in the codes of practice; and

. built in module form of materials that allow maintenance to be quickly and efficiently carried out whatever the locality.

- It is recommended that particular attention be given to developing more people and animal - friendly convertible sheep/cattle crates. The problems associated with various convertible sheep to cattle crates continue. They include design and construction, stockcrate weights, occupational safety for drivers, potential bruising and injury for livestock, and the costs of building and operating convertible crates. This problem is usually put in the too hard basket and little done. It applies in particular to southern Australia.

- Research to improve micro-climates in various sheep stockcrates under different road conditions, including the effects of vehicles travelling and being stationary within various decks, should be part of that on stockcrate modifications.

- Information is required relating to lambs and off-shears animals under various conditions. I am not aware of any work on the effects of wind chill, rain, cold, dust, and fumes during transport on sheep welfare and behaviour, bruising and meat quality.

  Heat/shade and cold/wind are likely to be the main welfare issues of concern to the general public. Research on cold and heat stress is well documented for other production perspectives.

ABATTOIRS

- Examination of the effects on the drinking and feeding behaviour of sheep using various facilities is also needed, as well as the of effects of yard design and construction, the environment (peaceful v. noisy), weather conditions (hot, cold) and times since mustering and last access to water. Such work at abattoirs would also provide animal welfare safeguards – water may be provided but is it drunk?

- **It is strongly recommended that research to improve animal welfare and to establish appropriate pre-slaughter management strategies for sheep and lambs consigned directly from farm to abattoirs be undertaken to:**
  - **maximise carcass weight and meat quality, and minimise carcass processing problems (including condemnations) with such strategies to include the provision of feed and water additives (energy, protein, electrolytes) and also, to consider previous nutritional history and animal behaviour;**
  - **examine the overall effectiveness of resting periods and conditions; and**
  - **examine the effect of weather protection.**

Such work logically builds on the basic research on dehydration/catabolic weight losses (see on-farm). It also flows on from, and should be integrated with, any on-farm preventative measure and any observations on drinking and feeding behaviour. It should lead also to better rest management practices at abattoirs.

Feeding studies should include some microbiological work to assess the effect of feeding on rumen and other digestive tract pathogens, such as salmonellae, and in turn, contamination of the carcass and other edible co-products. It is vital to assess any feeding studies (whether on-farm, in transit, at saleyards, or at abattoirs) in terms of pathogen contamination, given the increasingly stringent food safety requirements and market access implications. Such work should identify the source of origin of the animals (via saleyard or direct from on-farm).

- **Consider research on muscle glycogen physiology to increase repletion rates in sheep and lambs, and do so in collaboration with workers in the United Kingdom such as Dr Paul Warriss.**

Pre-transport preventative measures may not be successful in all situations in Australia, given the long mustering to slaughter times for sheep in some areas of Australia, and often for saleyard sheep. Under these circumstances, it is probable that rest and feeding to replenish muscle glycogen concentrations will still be essential to produce optimum ultimate pH values.

More importantly, such management will be necessary to provide a glycogen buffer against stress immediately before slaughter, and more particularly, against unanticipated events (for example, interruptions due to mechanical stoppages).

A better knowledge of muscle glycogen physiology and ways to effect rapid repletion are therefore essential to implementing <u>any</u> measures to prevent dark-cutting. There may be side benefits such as a reduction in carcass weight losses.

- **It is recommended that minimum design features and standards be established for yards and loading/unloading ramps at trucking yards, saleyards and abattoirs and for loading/unloading ramps on-farm. It is strongly recommended that every effort then be made to extend their use, as well as their adoption, nationally.**

  There is a sound, but scattered body of local knowledge, expertise and experience on sheep yard design in Australia. It needs to be condensed into appropriate design standards/features, user-friendly extension material and to be publicised widely.

  The review, development and extension of such design standards/features could be advantageously linked to both driver and stock handling training. It should also be linked with other efforts to improve facilities and stock handling at saleyards and abattoirs.

- **It is strongly recommended that a development/extension project be commenced with industry to improve the general standards of yard facilities, stock handler attitudes and skills, and of animal-flow systems at abattoirs. Such a project to incorporate stock handling training and the implementation of best pre-slaughter management practices.**

- Sheep handling be included in training courses established and supported to cater for handlers working on-farm and at other stages of the selling process. Unfortunately, many people who handle and oversee the movement of sheep from paddock to slaughter, or who design handling facilities, are often unaware of the consequences of their actions and decisions. This may be due to handlers and designers not observing animals at slaughter for bruising or it may be the result of poor management supervision.

  There is a need to ensure good yard facilities and stock handling at major centres

generally and abattoirs, especially those with high throughputs. Greater benefits from improved handling will accrue if they are linked to enterprise bargaining and to recognition and reward (monetary and certification) of specialist stock handling skills. Additional remuneration for demonstrated skills is a small cost relative to industry benefits in terms of improved product quantity, quality and reputation. The general reduction in the rural labour force means fewer skilled and experienced handlers are available, and so, fewer skilled handlers to train newcomers. Specialist training is necessary for both stock handlers and truck drivers.

The Meat Research Corporation's on-farm producer demonstration sites, local consensus data and other related projects, as well as the NZ Pork Producers Board's pig welfare research and development project, all provide a good model to use to facilitate adoption.

GENERAL

- A detailed review of the physiological/biochemistry changes induced by the selling process, including transport, would assist investigations of preventative product strategies. This review would provide essential background, and baseline, data from which to plan preventative measures. An understanding of transportation per se, travelling time and other related stressors on meat quality (muscle tenderness and pH) is necessary to develop appropriate pre- and post-transport management practices.

  It is vital to consider stress effects both, singularly and cumulatively, and also in terms of their time of occurrence. There is good evidence that cumulative fatigue is associated with increased dark-cutting and bruising, with stressful events early in the selling process pre-disposing animals to bruising and muscle glycogen depletion at a later stage.

- The effects of chronic disease and metabolic disturbances in animals on subsequent carcass, offal and meat quality attributes are often overlooked, as are the effects of selling and transport on animal health. These losses are probably economically

significant and deserve a preliminary examination to establish real priorities for Australia.

Finally, the major obstacles to the adoption of new technology are the lack of financial incentives for premium products, a strong price feedback mechanism, and motivation to change present methods and improve the credibility of sheep meat as a product. Traditional methods and attitudes cannot be sustained just because they are currently the accepted method.

PART C(v) - CATTLE, SHEEP AND GOATS

A REPORT FORMATTED TO HIGHLIGHT THE DEVELOPMENT (INCLUDING EDUCATION) NEEDS OF SPECIFIC GROUPS, EG. PRODUCERS TRANSPORTERS, LIVESTOCK AGENTS AND ABATTOIR STAFF

The development needs of the specific groups would be best ascertained by widespread direct contact with, and input from, those groups. However, as an interim measure input has been sought from a number of key people throughout Australia.

A common thread which runs throughout the development needs of the individual groups is that the emphasis must be on people, in particular changing their attitudes and behaviours. Only then can adoption of better technologies and practices occur. Whether the initiatives are extension, education or training based, they need to be people oriented.

It is crucial that education and training initiatives are appropriately targeted at personnel in all industry sectors. A shotgun approach will not be successful because the subtle needs of each sector will go unrecognised and hence unsatisfied. Yet it is imperative that each sector appreciates the impact that they have on the other. Transport and handling is like a jigsaw, all the pieces must be in place for the end result to prove satisfactory to the consumer, after all it is the consumer who must be ultimately satisfied.

Unless the people in charge of livestock possess, and use, the appropriate handling skills then industry cannot utilise the advantages of properly designed livestock yards and transports, or of well researched and implemented management practices. Poor handling generally overrides well designed facilities and good management practices, consequently impairing product quantity and quality.

PRODUCERS

Producer attitudes have undergone a dramatic change since the advent of carcass classification and the development of market specifications. Producers now better understand the need to match livestock to target markets. They are becoming increasingly more adept at doing so with the assistance of new technologies (eg. ultrasound), alternative production systems (eg. feedlots), marketing innovations (eg. CALM) and extensive extension and education initiatives (eg. AUS–MEAT producer workshops, local consensus data and producer demonstration sites).

However producers need to develop an even better understanding of total market demands rather than concentrating solely on demands, such as age, sex, weight and fat depth. They must appreciate the bigger picture. They need to implement further advances in on–farm preparation of livestock, both early in the production cycle and at the time of sale. Preventative measures such as cattle dehorning or use of polled breeds are vital. More detailed planning of the sale and transport phase will ensure, for example, that the period from muster to transport is minimised, that animals are drafted quietly and ready for loading when transports arrive and that livestock arrive at the abattoir in adequate time to rest, eat and drink before slaughter.

Better and more detailed planning is one of the keys to further advances in the transport and handling of livestock. Adequate planning will only be forthcoming if producers possess adequate reliable information upon which to make their decisions. **Marketing systems which enable producers both to monitor their performance and to capture the benefits of their innovations must be encouraged. It is absolutely crucial that both incentives and disincentives are clearly evident within these marketing systems. They must be obvious so that the important monetary signals are transmitted to all. The hip pocket nerve is very sensitive.**

Marketing initiatives such as AUS–MEAT feedback, CALM and the Queensland Beef Exchange (QBE) should be fully supported and their benefits consistently and enthusiastically relayed to producers. Current public and private sector extension initiatives should also be maintained and their scope broadened to uncover the bigger picture.

It is also essential that property owners/managers possess an understanding of the codes of practice and other relevant legislation that pertain to the transport and handling of livestock. An education campaign to ensure their knowledge of such codes needs to be put in place.

TRANSPORTERS

Driver training courses such as those currently operating successfully in Victoria should be further encouraged and extended to other parts of the country. The course curriculum needs to include single and double–deck transports, and B–doubles, and apply to cattle, sheep and goats.

As noted in Taylor Byrnes's 1993 Beef Industry Report, in future, livestock transport drivers will need to be better prepared and more proficient in livestock handling. They will require driving skills, to be able to repair and maintain their transports, to keep abreast of innovations (eg. low tare trailers), and have an intimate knowledge of animal welfare codes of practice for the livestock being transported. The new codes of practice give greater responsibility to the drivers who are the final arbiters on whether animals are transported or not.

General people skills and negotiation skills will be crucial, if transport drivers exercise their greater responsibilities. They will require better communication skills, both to interpret the codes and other appropriate regulations and, then, to convey their interpretations to their customers. An example is drivers explaining to a property owner/manager that an animal cannot be transported because of injury or overloading.

The development needs of transporters, therefore, go beyond engineering considerations. They will also involve communication, animal husbandry and people skills. Facilitators, who are responsible for specific training projects, should be put in place. The facilitators of successful adoption, for example, the driver training initiative of Neil Farquhar, the efforts of Bill Vowles in yard design and construction, John Lapworth in stockcrate and loading ramp designs and Rick Beasley in general cattle marketing, all have a common thread. It is the input of dedicated and respected people who can work closely with industry to effect change. Attitudinal change and

subsequent behavioural change is best effected by interaction with people and demonstration of real world benefits/costs, not simply through printed matter or government edict.

These and similar facilitators would liaise closely with and between the various groups. A potential education initiative which could be undertaken with stockcrate manufacturers, particularly those in southern Australia, is one which would help them better link animal needs with their final product. An example is implementing the inclusion of provisions to unload the upper deck of double-deck trailers onto the top deck of a double deck loading ramp. Stockcrate designers and manufacturers need to be educated about the impact of their operations on the total livestock and meat industries.

LIVESTOCK AGENTS AND SALEYARD OPERATORS

Significant attitudinal change is also required within this sector. Both agents and saleyard owners/operators need to appreciate that they have a responsibility beyond just providing a facility or a service. They also have a responsibility to the users and to the livestock, in addition, to broader environmental and waste management responsibilities. Smarter operators are already realising that their reputations rely upon the delivery of unstressed and unbruised animals with the resultant positive impact on product quantity and quality. Their responsibilities do not end with the delivery of animals to its next owner.

Once again, as with the transporters, the involvement of respected and dedicated facilitators will greatly assist to change attitudes and behaviour. Co-operating with existing pastoral company management schools or in-house training would also greatly assist. It may also be necessary to establish such initiatives, for example, three day, live-in (mandatory) workshops have been conducted in the past with pastoral company staff. Those workshops used adult education principles whereby the participants themselves have generated the course agenda in conjunction with a panel of "experts" on various issues. This approach ensured that priority issues of concern to participants were addressed. These workshops were very successful change agent activities and could also be usefully employed with the other groups.

ABATTOIR STAFF

The MRC's Booz-Allen Hamilton report demonstrated that processors considered bruising and other quality defects as a high priority area for action to increase the competitiveness of the Australian meat industry. They ranked bruising and other quality defects as among their top ten priorities. However if abattoir managers are to reflect the importance of the issue, they should more clearly demonstrate their concerns. Understandably, abattoir management need to decide capital spending priorities with scarce resources. Often extra chiller space or engineering improvements for example appear more attractive than improvements to unloading ramps and other handling infrastructure - throughputs can be increased and costs reduced. However, an obvious commitment to improving stock handling facilities is necessary, if they are to change other abattoir staff attitudes. Making do with inadequate unloading facilities does not relay the appropriate message to staff.

The same is true in valuing the skills of their stock handlers. The latter need to be adequately rewarded for their skills, such that, the reward reflects the impact which their job has on final product quality. Everything can be done perfectly until delivery to the abattoir, but if livestock are mishandled just before slaughter, all the previous gains are lost.

These comments apply equally to stock handlers employed on-property. The answer may lie in some type of accreditation system for stock handlers. Once again a greater emphasis needs to be placed on the person in the human/animal equation of stock handling.

Overall, the Australian livestock and meat industries need to adopt a Total Quality Management (TQM) philosophy and champion their interdependence. **All sectors must be committed to preserving product quantity and quality all along the marketing chain and to delivering the best possible product to the end consumer. They must also receive tangible rewards for their efforts otherwise adoption of best practices will be obstructed.** Wider acceptance of animal welfare codes of practices alone may satisfy the general community, but it will not ensure customer satisfaction. The latter will come more readily when all industry sectors are more informed and implement appropriate practices.

Finally the following table lists extension, education and training resources currently available to the industry. It is not at this stage an exhaustive list however it provides a reasonable indication of the material available. It also highlights the disjointed nature of efforts to date and the need to consolidate existing knowledge and resources.

Resource	Species	Applicability			
		Producers	Agents	Transporters	Abattoir staff
VIDEOS/FILMS					
A Training Aid for Handling Sheep and Beef Cattle in New Zealand (Massey University)	S,C	*			
Sheep Behaviour in New Zealand Export Sheep Meat Plants (MIRINZ)	S				*
The "Weean" Cattle Yards (NSW D of A)	C	*			
Better Livestock Handling (QSLAC 1987)	C	*			
Beef Cattle Handling: From the Paddock to the Plate (NSW D of A 1988)	C	*	*	*	*
Good Handling Makes Good Sense (CSIRO 1991)	C	*	*	*	*
Sheep Handling Easy as Leading Lambs (CSIRO 1991)	S	*	*	*	*
Bruising costs money (AMLC, QDPI)	C	*	*	*	*
MANUALS					
To Market To Market, A Guide to Marketing Cattle in North Queensland (QDPI 1993)	C	*	*		
Livestock Transport Drivers Manual (LTAV)	C,S			*	
NEWSLETTERS/FARMNOTES					
Bruising (CSIRO 1972)	C	*	*	*	*
Beef cattle yards (Tas D of A 1973)	C	*			

Resource	Species	Applicability			
		Producers	Agents	Transporters	Abattoir staff
Cattle handling systems for meatworks (CSIRO 1977)	C				*
The problem of dark-cutting meat (NT DPIE 1991)	C	*			
Farm cattle handling (SCA publication No. 35)	C	*			
A circular cattle-handling facility for 10-50 head (VDFA 1980)	C	*			
A circular cattle handling facility for 50-300 head (VDFA 1980)	C	*			
Systems for trap mustering and handling cattle at waters (NTDPIF 1981)	C	*			
Forcing yards with 360° gates (VDFA 1981)	C	*			*
A sliding gate for cattle races (VDFA 1981)	C	*			*
Cattle loading ramps (VDFA 1981)	C	*			
Weight loss when marketing cattle (QDPI 1981)	C	*	*	*	
Funnel bayonet gates for trapping cattle (NTDPIF 1982)	C	*			
Beef cattle yards (1): siting and materials (Tas D of A 1983)	C	*			*
Beef cattle yards (2): yard design (Tas D of A 1983)	C	*			*
Dark cutting beef (CSIRO 1984)	C	*	*	*	*

Resource	Species	Applicability			
		Producers	Agents	Transporters	Abattoir staff
Beef cattle handling – weight loss when marketing cattle (QDPI 1985)	C	*	*	*	
Beef cattle handling – maximise carcass weight and meat quality (QDPI 1985)	C	*	*	*	
Beef cattle handling – dressing percentage (QDPI 1985)	C	*	*	*	
Beef cattle handling – handling skills, yards, bruising and stress (QDPI 1985)	C	*	*	*	*
Liveweight and carcass weight loss in cattle (CSIRO 1985)	C	*	*	*	*
Beef cattle yards for less than 100 head (NSW D of A 1987)	C	*			
Cattle transport – loading strategies for road transport of cattle (QDPI 1987)	C	*	*	*	
Cattle transport – stock crate design for body trucks (QDPI 1987)	C	*	*	*	
Livestock handling pre–slaughter (CSIRO 1989)	C,S	*	*	*	*
Livestock – emergency humane slaughter (QDPI 1990)	C,S	*			
Beef cattle feedlot: animal welfare (QDPI 1991)	C	*			*
Beef cattle feedlot: animal health no. 5 – heat stress (QDPI 1991)	C	*			*

Resource	Species	Applicability			
		Producers	Agents	Transporters	Abattoir staff
Cattle transport: loading strategies for road transport of cattle (QDPI 1993)	C	*		*	
Cattle transport: minimum design standards for loading ramps (QDPI 1993)	C	*		*	*
Cattle transport: stock crate design for body trucks (QDPI 1993)	C,S,G	*		*	
Weight loss in cattle (LMAQ 1993)	C	*	*	*	*
Notes on feeding cattle during selling (LMAQ 1993)	C	*	*	*	*
The influence of cattle behaviour on handling facility design (VDFA)	C	*	*	*	*
Handling cattle at saleyards (QDPI)	C		*	*	
Cattle handling (NSW D of A)	C	*	*	*	*
Reducing stress and injury to stock and handler (NSW D of A)	C,S,G	*			
Preparing cattle for the market (NSW D of A)	C	*			
Safer practices in handling farm animals (Massey University)	C,S	*			
Road transport and Queensland saleyards (QDPI)	C	*	*	*	
JOURNAL (DEPARTMENT OF AGRICULTURE) ARTICLES					
Beef cattle don't need horns (QDPI, QAJ 1974)	C	*			

Resource	Species	Applicability			
		Producers	Agents	Transporters	Abattoir staff
Loading can cause bruising (QDPI, QAJ 1975)	C	*	*	*	
Dehorning beef cattle (QDPI, 1975)	C	*			
Horns bruise cattle (Tas D of A, TJA, 1976)	C	*			
Discontented beef (QDPI, QAJ 1978)	C	*	*	*	
A butchers' picnic (QDPI, QAJ 1979)	C	*	*	*	*
Tail tagging and bruising (QDPI, QAJ 1979)	C	*			
Beef from quiet cattle (QDPI, QAJ 1980)	C	*	*	*	*
Animal welfare – a vital issue! (QDPI, QAJ 1981)	C	*	*	*	*
Cattle will drink at saleyards (QDPI, QAJ 1982)	C	*	*	*	*
The saleyard curfew issue (QDPI, QAJ 1982)	C	*	*	*	*
Let cattle yard themselves (QDPI, QAJ 1982)	C	*			
Bruising in cattle costs money (QDPI, QAJ 1986)	C	*			
Volume loading of livestock (QDPI, QAJ 1987)	C,S	*	*	*	
Handling beef – from paddock to plate (QDPI, QAJ 1987)	C	*	*	*	*
Transporting cattle by road (QDPI, QAJ 1987)	C	*	*	*	
Producer rewards in new bruise system (QDPI, QAJ 1987)	C	*	*	*	*

Resource	Species	Applicability			
		Producers	Agents	Transporters	Abattoir staff
Tenderness and what toughens meat (QDPI, QAJ 1988)	C	*	*	*	*
PAMPHLETS					
Bruising costs money (AMLC, QDPI)	C	*	*	*	*
Livestock Transport Accidents (NSW Dept of Local Government 1989)	C,S	*	*	*	
Hints on educating cattle: Well-educated cattle are easy to handle (NSW D of A)	C	*			
Hints on handling cattle: When working cattle, always: (NSW D of A)	C	*	*	*	*
Hints on transporting stock: Stock transported and handled properly will present better (NSW D of A)	C,S	*	*	*	*
BOOKS					
Livestock Handling and Transport (T. Grandin, CAB International 1993)	C,S	*	*	*	*
Aerial Mustering and Cattle Control (B. Hill, NTDPIF 1981)	C	*			
Dark-cutting in Cattle and Sheep: Proceedings of an Australian Workshop (AMLRDC 1988)	C,S	*	*	*	*
Cattle Yards (E. Powell, QDPI 1986)	C	*			*

Resource	Species	Applicability			
		Producers	Agents	Transporters	Abattoir staff
Grazing Animal Welfare (B. Moore and P. Chenoweth, AVA Queensland 1985)	C,S	*	*	*	*
Design of Saleyards, Liveweight Selling Facilities and Organisational Procedures for Saleyard Selling (W. Vowles, VDFA 1987)	C		*		
Stockyard and Transport Stockcrate Design (NMHB 1977)	C	*	*	*	*
The Attitudes of Stock Crate Manufacturers to the Impositions of Standards on Their Industry (J. Lapworth, QDPI)	C	*	*	*	*
Yards 'n' Yakka : The sheep yard and handling systems manual (Kondinin Group 1990)	S	*	*	*	*
Cattle napping and self mustering R. Cheffins, QDPI 1988)	C	*	*	*	*
Railed-cattle Losses in Queensland (LMAQ 1981)	C	*	*	*	*
Handbook for the Preparation of Livestock for Transport (NSWMIA)	C,S	*		*	
Handling Cattle from Farm to Abattoir (NSW D of A)	C	*	*	*	*
OVERSEAS MATERIAL					
Meat Quality, the pH Factor (Booklet produced by MRDC 1994)	C,S	*	*	*	*

C = cattle; S = sheep; G = goats.

AMLC	Australian Meat and Live-stock Corporation
AVA	Australian Veterinary Association
LTAV	Livestock Transporters Association of Victoria
LMAQ	Livestock and Meat Authority of Queensland
MIRINZ	Meat Industry Research Institute of New Zealand
MRDC	Meat Research and Development Corporation (New Zealand)
NMHB	National Materials Handling Bureau (Department of Productivity)
NSW D of A	New South Wales Department of Agriculture
NSWMIA	New South Wales Meat Industry Authority
NTDPIF	Northern Territory Department of Primary Industries and Fisheries
QAJ	Queensland Agricultural Journal
QDPI	Queensland Department of Primary Industries
QSLAC	Queensland Saleyard Livestock Advisory Committee
Tas D of A	Tasmanian Department of Agriculture
TJA	Tasmanian Journal of Agriculture
VDFA	Victorian Department of Food and Agriculture

PART C(vi) – CATTLE, SHEEP, GOATS

IDENTIFICATION OF KEY PRE-SLAUGHTER MANAGEMENT DECISIONS WHICH AFFECT CARCASS QUALITY AND RETURNS TO EACH SECTION

The major objectives in producing and selling cattle are:–

- delivery of healthy, clean, animals to the point of slaughter;
- maximise carcass weight;
- minimise, if not eliminate, bruising;
- minimise the contamination of carcasses, cuts of meat and co–products with ingesta or pathogens, and condemnations of co–products;
- produce wholesome product and co–products;
- minimise stress, and so produce low pH meat;
- maximise tenderness, flavour, juiciness and shelf life;
- minimise the costs of pre–sale preparation, delivery including transport and handling, and of pre–slaughter preparation; all including labour costs;
- minimise expenditure on capital, repair and maintenance, and cleaning costs of all transports and facilities.

The key pre–slaughter management practices are:–

- minimise time from mustering to slaughter;
- method of selling;
- allow adequate preparation, transit and pre–slaughter resting periods;
- provide water, and if appropriate feed, during resting periods;
- sell hornless cattle and educate weaners;
- handle livestock carefully, quietly and without imposing stress;
- use appropriately designed and constructed facilities, vehicles and stockcrates, all of which can be easily and thoroughly cleaned, and are maintained in good repair;
- avoid stress, especially immediately before slaughter;
- the people involved – their motivation, commitment, attitude and education.

Given this background, the key management decisions which affect carcass quality and returns to each section are:–

TASK	PRIORITY RANKING									
	Producers	Saleyard Operators	Transporters	Agents	Abattoirs	Adverse product consequences of decision and its implementation				
						Carcass wt loss	Bruising	Injury	Impaired meat quality	Other
Best scenario outcome	• quality products reputation • maximise revenue	• continued throughput • reputation for good handling, no bruising	• continued business • reputation as good operator	• continued sales	• continued sales • satisfied customers • quality products					
Worst scenario outcome	• lost revenue • poor supplier reputation	• loss of support	• loss of transport task	• loss of sales	• loss of revenue • unusable or down-graded product					
Training of stock handlers, on-the-job and more formally	***	***	**	****	****		✓✓✓	✓✓	✓✓✓	
Training of drivers, on-the-job and formally	**		****			✓	✓✓	✓✓	✓	Time delays
Build yards and ramps according to animal behaviour principles and minimum design standards	***	***			***		✓	✓	✓	
Keep yards and all other facilities, especially those for water, weighing and restraint, in good repair and clean	***	***		***	***		✓	✓	✓	

TASK	PRIORITY RANKING									
	Producers	Saleyard Operators	Transporters	Agents	Abattoirs	Adverse product consequences of decision and its implementation				
						Carcass wt loss	Bruising	Injury	Impaired meat quality	Other
Prepare yards for operations	*	*		*	*		✓	✓		Time delays
Handle all stock carefully and quietly, without imposing stress	***	***	***	****	****		✓✓✓	✓✓✓	✓✓✓	
Ensure that clean water is available and that stock are given access, also to feed, if appropriate	**	***	**	***	****	✓✓✓			✓	Carcass/ meat contamination
Determine period that animals are on water (and maybe feed) before next operational phase	** on farm	**** pre-curfew wet or dry curfew	**	**** before and after sale	**** pre-slaughter	✓✓✓			✓	pricing inefficiency
Determine period animals to be off water, and feed, before next operational phase	** on farm				* immediately pre-slaughter		✓	✓		
Take steps to ensure holding or resting areas, permit peaceful rest, exclude unauthorised people and animals	*	****		**	**** including lairage and races to knocking area	✓			✓✓✓	

TASK	PRIORITY RANKING									
	Producers	Saleyard Operators	Transporters	Agents	Abattoirs	Adverse product consequences of decision and its implementation				
						Carcass wt loss	Bruising	Injury	Impaired meat quality	Other
Ensure compliance with regulations relating to movement and sale of livestock, and with use of transports, so livestock eligible for sale/slaughter	*** animal health – for sale	** animal health – for sale	** road and traffic	*** animal health – for sale	*** animal health – for slaughter					No sale or slaughter
Check livestock numbers loaded or received against expected, plus the fitness of all animals. Note injuries and/or deaths	****		****	****	****					Loss revenue
Negotiating "pick–up" time and transport schedule	**		**	**	**	✓				Time delays
Final negotiation with transporter of numbers to be loaded for each pen on all decks of the transport and fitness of all animals to be loaded	*		***		*		✓	✓✓	✓	
Loading and unloading, and if necessary reloading, animals in a way that avoids stress and injury	**	**	**	**	**		✓	✓✓	✓	

TASK	PRIORITY RANKING									
	Producers	Saleyard Operators	Transporters	Agents	Abattoirs	Adverse product consequences of decision and its implementation				
						Carcass wt loss	Bruising	Injury	Impaired meat quality	Other
Ensure animals are delivered to the correct pens, given access to water, and if appropriate, feed.		**	**	***	***					Loss revenue