The Top Five Tips for Effective Feedlot Design

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1. INTRODUCTION

The lot feeding industry started in Australia in the mid-60’s. Development was steady until 1975 when a major downturn occurred. The industry slowly recovered and by 1985, a new phase of development had commenced. At that time, most Australian designs were based on US ideas that were developed in the late 1960’s and early 1970’s.

The 1980’s expansion coincided with a period of increasing public awareness of environmental and animal welfare issues. Improvements were needed to the design and management of feedlots in Australia. Industry and government agencies responded and, in the early 1990’s, there were numerous research and extension activities aimed at lot feeding. Great improvements were made.

Ten years ago, ALFA and Queensland DPI ran the “Designing Better Feedlots” Workshop. From this workshop, the DPI publication – “Designing Better Feedlots” – was born. This book was the first feedlot design manual specifically aimed at the Australian industry and it has been a useful background document for many lot feeders.

In this past ten years, the industry has matured and while growth has not been as hectic and the late 1980’s and early 1990’s, steady progress has been made. In this paper, I will occasionally look back at the “Designing Better Feedlots” manual and see where changes have been made in the intervening period. This paper looks at “big picture” issues for feedlot design. Other speakers will deal with the detail of certain aspects of feedlot design and management.

2. PLAN TO BE SUCCESSFUL

At present, a number of feedlots are looking to expand. But many face a similar problem – they never planned to be successful. This means that the expansion is more difficult, time-consuming and costly than should have been the case.

From a licensing perspective, our advice is always to apply, within reason, for the largest feedlot than can comfortable fit the site and its constraints. The licensing process is time-consuming, often confusing and sometimes costly. The effort to get a 5000 head licence often can be no more than for a 1000 head licence. Hence, plan to be successful and get a reasonable approval in place from the beginning.

Ten years ago, the main constraints to obtaining a large feedlot licence were separation distance to neighbours and availability of suitable land for manure and effluent reuse. While these factors are still important, availability of guaranteed, good-quality, correctly-licensed water is now the biggest issue for feedlot development or expansion. Hence, this factor alone will probably ultimately limit the size of the feedlot. The next major issue that was not
a factor ten years ago is vegetation clearing. In the past, legislative requirements on land clearing were not a constraint on feedlot development. That is certainly not the case now. Careful examination of the vegetation status around the feedlot is now required and, as with water, the inability to clear land may be the ultimate constraint on development.

Hence, when starting the development, all of the constraints to future development should be assessed. The licence application should be for the maximum comfortable number of head. When these factors are in place, planning of the short and long-term layout of the feedlot can commence.

When designing the feedlot, plan to be successful. That is, prepare a site layout for the maximum number of cattle. The site layout not only includes pens but also roads, drainage and infrastructure. This planning will ensure that when a second stage of pens is to be developed, it is not necessary to re-locate the silage pits or move roads or change drainage layouts. The feed mill can be readily upgraded and extra cattle handling facilities are easy to implement. It may be wise to build a full size holding pond from the start (as shown in the photograph below). With good planning, the second stage can be a relatively-cheap, marginal extra cost. With poor planning, the second stage is more expensive than the initial feedlot due to the need to move and rebuild parts of the existing feedlot.

Planning for Success – the highlighted area is for future pens

Tip No 1 – Plan to be successful. License and design the feedlot so that future expansion is an easy exercise.
3. **DO IT RIGHT FIRST TIME**

It is an old truism to say – “Do it right first time” – but often short-term economic constraints override a long term perspective. This is usually a false economy and applies to feedlot development as much as any other industry.

The first “Do it right” aspect is planning. There is simply no cheaper way to design a feedlot layout than on paper. Making mistakes with earthworks is costly.

The second “Do it right” aspect is earthworks. Many first-timers feel that it is not necessary to grade and compact pens, particularly if light stocking densities are proposed. Dead trees and rocky outcrops are left in pens. When the next wet season arrives, poor drainage becomes evident. Bogging of cattle occurs. Significant maintenance costs are incurred. Later on, an expansion is proposed and it is necessary to upgrade the class of the feedlot. At that time, the whole pen area needs to be re-graded and compacted, after all fences have been removed. The lack of proper pen earthworks in the first instance is a false economy.

A similar principle applies to the layout of pens. In the past, a common layout was the “wrap around the hill” layout. This is the Type A layout in “Designing Better Feedlots”. This layout is done specifically to minimise earthworks by using the natural shape of the hill but means that there are no straight feed alleys or drains. Most managers of major feedlots built with this layout regret the decision. Feed delivery is difficult and feed bunks are often damaged. Straining of fence lines is difficult. Drainage is often poor. The “Do it right” principle is straight rows of pens, not curved.

Another “Do it right” aspect is shade. Shade is currently not mandatory and is not essential for some cattle types or climates. Hence, it may not be perceived as necessary when the feedlot is first constructed. However, if market conditions change, it may be desirable to install shade. This is difficult to do if it is not planned for in the initial stages. If provision for shade posts is made on Day 1, then future installation is a smooth, cost-effective operation.

Tip No 2 – Do it Right first time. It will always be better in the long term to plan for future improvements.

4. **MORE IS BETTER**

Ten years ago, when “Designing Better Feedlots” was written, the industry was making a significant move forward in appreciating the benefits of good drainage from the pens to the ponds. Early feedlot designs in Australia had relatively flat pens, poorly-designed sedimentation basins (if at all) and small holding ponds. Along with poor manure management, this resulted in wet pens, clogged drains and basins, and subsequent odour problems.

Much of the research and extension material at the time promoted better drainage. “Designing Better Feedlots” recommended pen slopes between 2% and 6% and drain slopes from 0.5% to 0.8%. Pen slopes greater than 6% were considered unsuitable due to excessive manure movement and steep drain slopes were not recommended due to the possibility of erosion. Hence, at that time, it was normal to design pens with a slope on 2.5%
and drains with a slope of 0.6%. In fact, the current Queensland guidelines require Class 1 and Class 2 feedlots to have pen slopes between 2% and 4%.

It is our experience that more slope in pens and drains is required. Pens with only 2.5% do not drain or dry as quickly as pens with 4% to 6% slope. With the high standards of manure management now undertaken, heavy manure loss from steep pens is not the issue that it was once perceived to be and the better design of drains and sedimentation basins means that heavy manure loads can be handled. Similarly, we believe that drains can and should be steeper than recommended ten years ago. Except in exceptional circumstances, feedlot drains should be designed to transport manure – not cause manure deposition. Most drain designs are based on soil conservation principles where no movement of soil is the design target and the bed of the drain is usually uncompacted earth. In feedlots, the bed of drains is usually compacted gravel and this is resistant to erosion. Hence, drain slopes over 1% are acceptable and desirable to ensure rapid dewatering and manure movement.

Steeper slopes mean that the inevitable humps and hollows that occur in pens and drains will be more likely to drain leading to less odour.

The current Queensland guidelines would suggest that a feedlot with pens of 6% slope cannot meet the Class 1 or Class 2 requirements. This does not seem reasonable.

Poor drainage due to inadequate drain slope

Tip No 3 – More slope is better. With improved manure management and drainage design, steeper pen and drain slopes ensure rapid dewatering of feedlots.
5. NO CROSSOVERS ARE ALLOWED

A feedlot manager has to live with the feedlot’s layout for the next 10-20 years. This is a long time to be frustrated with inefficient functional operation of feed trucks, cattle movement, drainage and manure movement.

The issue is not as simple as the frustration of feed trucks needing to open and close gates in cattle lanes. Every time that a road (feed alley) crosses a manure-carrying drain, a box culvert or concrete invert is required. This inevitably causes deposition of manure upstream of the crossing and leads to maintenance and odour problems. Poor vehicle access, either by way of difficult gates or boggy conditions, is a disincentive to regular manure management.

Hence, to achieve a functional feedlot layout to maximise operational efficiencies, it is imperative that feed alleys don’t cross cattle lanes or manure drains. Trucks bringing feed commodities and cattle to the site should not enter the feedlot pen area at all and show be able to deliver or dispatch goods without any disturbance to feedlot operation.

Poor solution to feedlot layout – Feed Alley bridge over a cattle lane!

Tip No 4 – No crossovers are allowed. Feed alleys should not cross cattle lanes or manure drains.
Manure always accumulates when a manure drain crosses a feed alley

6. THERE’S MONEY IN MUCK

Ten years ago, while it was known that feedlots produce solid waste (manure, carcases) and liquid waste (pen runoff), feedlot managers were interested in feeding cattle, not managing waste. Hence, the inappropriate handling and disposal of these wastes led to most of the environmental issues (and negative public perceptions) at that time. The research and extension work at that time lead to improved feedlot waste management.

Nowadays, the terms – waste and disposal – are less frequently used and they are replaced with ‘by-product’ and ‘reuse’. Manure is no longer infrequently removed from pens and dumped in stockpiles. Many feedlots have frequent manure removal regimes and windrow-based composting systems are becoming commonplace. Carcase composting – unknown ten years ago - is now the standard. These activities lead to better reuse of the beneficial components of feedlot waste but require changes to feedlot design. A large composting area is required within the controlled drainage area of the feedlot. Better vehicle access is required to the pens and to the manure composting area.

Ten years ago, it was common to locate sedimentation basins close to the end of pens with only a small provision for manure stockpiles. Nowadays, a good feedlot design would probably make provision for a large, well-graded manure-composting pad where carcase composting would also be undertaken. Manure can be windrowed and composted along with carcases and mill waste. Screening of final product allows the sale of a fertiliser described as a recycled organic rather than a waste. Improved vehicle access to these areas is also required in a modern feedlot design.
Proper windrow composting is the future of by-product management at feedlots

Tip No 5 – There’s money in muck. Planning for solid and liquid reuse as a beneficial by-product should be part of modern feedlot design.

7. SUMMARY

Despite a slowing of the growth of the feedlot industry, feedlot designs have continued to improve in the past ten years. Experience remains a great teacher and lessons can be learned from past mistakes. Functional efficiency and environmental management are the key factors driving improved designs.