Facility Designs to Maximize Transition Cow Health and Productivity

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Take Home Message

- Transition cow housing design starts with management of the cow at the point of calving.
- Cows may be moved at the point of calving to an individual or group calving pen, or be maintained in socially stable groups throughout the pre-fresh period.
- Pens should be sized to accommodate the 90th percentile or 140% of the average weekly calving rate.
- Pens should be designed to provide transition cows at least one appropriately sized freestall with a soft comfortable surface and 30 inches of bunk space per cow in a 2-row design.

Introduction

Over the last few years, my colleagues in the Food Animal Production Medicine group at the University of Wisconsin-Madison have used our clinical experiences troubleshooting fresh cow health problems on farms, research conducted by other groups and our own research findings, to formulate a plan for designing transition cow barns that results in optimal health and performance. In this article, I will summarize the planning process we have devised and used successfully to create these new facilities.

Where to start?

The planning process starts with one simple question:

'How am I going to manage my cows at the point of calving?'

In order to limit the risk for dystocia and stillbirth, and avoid movement and

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social upheaval within the critical period of 2-7 days before calving, there are only two possible strategies:

- Move cows from a prefresh pen with freestalls to an individual or group calving pen at the point of calving.
- Manage socially stable group pens throughout the prefresh period and calve in the prefresh pen, which in this scenario is a bedded pack.

Each strategy has some advantages and disadvantages laid out in the table below that should be discussed before continuing with the plan.

Table 1. Advantages and Disadvantages of Two Calving Systems

Individual or Group Calving Pen	Parameter	Socially Stable Prefresh/Calving Group Pen
Freestalls and individual or group bedded pack	**Type of Housing**	A series of group bedded packs
15% less roof space required, but more concrete and stall construction costs	**Space Requirement and Cost of Construction**	15% more roof space required, but less concrete and stall construction costs
Limited to stall bedding and bedding for individual or group calving pen	**Bedding Costs**	High due to the use of multiple bedded packs
Need to check prefresh pen hourly 24/7	**Need for supervision**	Less need for constant supervision
Elevated if workers move cows too early	**Risk for dystocia**	Decreased, as cows do not have to be moved when they are in labor
Good, provided excellent bedding management in the calving pen(s)	**Disease control**	More difficult and may require separate pens for Johne's cows
Excellent control	**Passive Immunity Transfer**	Depending on level of supervision, opportunity for calves to suck the wrong dam first

Each strategy has different keys for success.

For the individual or group calving pen approach the keys to success are:

- Control social structure in the prefresh pen by limiting new additions to a once per week cycle.
- Locate the calving pens close to the prefresh pen and away from heavy traffic areas
- Train maternity pen workers to identify the stages of labor and monitor what stage of labor the cow is in when she is moved, the time that she is moved to the calving pen, the time when she calves, whether the calving was assisted or not and when the calf received colostrum. Risk for stillbirth will increase if cows are moved to the pen too early (before the water bag shows), the cow is continually disturbed once moved and when

workers are too eager to assist. Target stillbirth rate for the herd is 4%.

- Fresh dry bedding arrives with the cow and leaves with the cow to maintain hygiene in the calving pen
- Utilize a correctly designed pen, such as the one shown below in Figure 1.

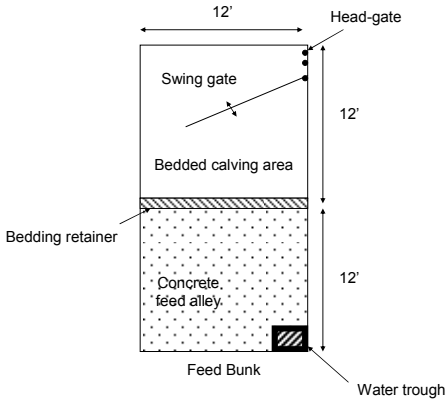

Figure 1. An ideal maternity pen layout, with a concrete apron against the feed bunk in the fore-ground, a bedded area with sand and straw on top in the rear half of the pen, and a head gate in the far corner. The water trough is located in the near right corner, away from the bedded area.

For the socially stable prefresh/calving group pen, the following is required:

- A series of bedded pack pens with sufficient numbers to accommodate a weekly group of cows moving from far-dry to prefresh. Therefore, for a 21 day prefresh period, a minimum of three separate pens are required (Figure 2).
- No further animals are added until all of the animals in the pen calve (this is ideal, but in practice a few straggler cows may have to be moved between pens so that the flow can continue from week to week).
- Each pen is sized to provide a minimum of 100 square feet of bedded area per cow at maximum fill.
- Each pen is bedded fresh daily, and the whole bed removed once the last cow calves.
- Sufficient supervision is still required to make sure that there is adequate control of colostrum feeding.

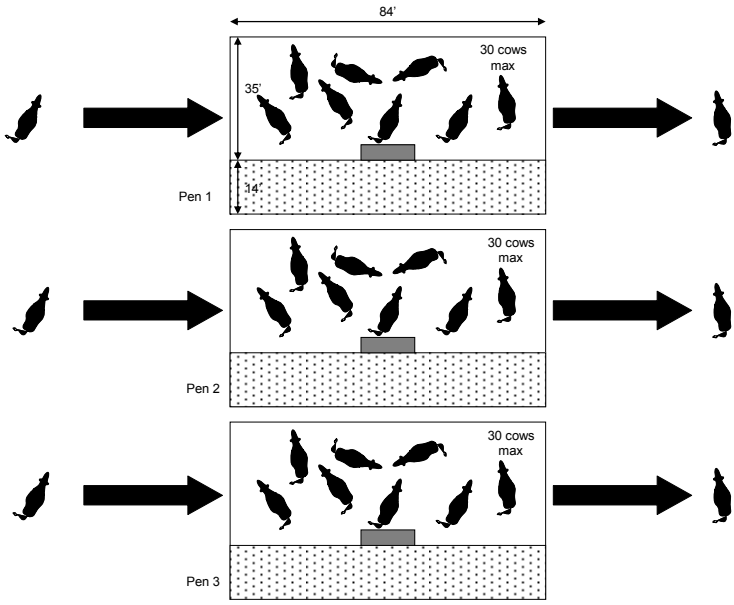

Figure 2. A series of bedded pack pre-fresh pens designed for a 1000 cow dairy. Each pen provides 2940 square feet of bedded area, with a maximum stocking rate of 30 cows per pen. A total of three pens provide capacity to cope with 140% of the weekly average calving rate, with a 3 week pen stay duration. Pens are filled in series – filling pen 1 first to a maximum of 30 cows, then pen 2 and so on. Once the maximum stocking density is reached, no new cows are added. Cows may calve in the pen or in an adjacent calving pen and proceed to the post-fresh group. Once the pen is empty, it is cleaned out and re-bedded and the filling cycle repeats.

Once a decision has been made on a strategy for managing the cow at calving time, the planning process can proceed with an estimation of pen sizes.

■ Sizing the Pens Correctly

The actual duration of stay within any given transition cow pen (which includes the far-dry, prefresh, maternity, calving, colostrum and postfresh management groups) is determined by two factors; the rate of calving and the target duration of stay in the pen.

Recommendations for pen sizes are typically based on the average flow of cows through the transition facility and do not take into account farm management decisions which vary time spent in the pen. For that reason, many transition cow pens are built that fail to accommodate the normal ebb and flow of calving rate over time. We recommend that a facility would be best constructed to accommodate the surges in calving rate, without compromise to stocking density within the pen. In essence we will be over building to some degree.

We have constructed a plan for sizing transition cow pens that allows us to accommodate cows in pens sized to cope with the normal increase in stocking density for 90% of the time. For 5 weeks a year (10% of the time), the farm will need to modify days spent in the pen to maintain the targets for stocking rate or disease screening will need to compensate for a lapse in prevention.

So What Are The Planning Steps?

Calculate the Weekly Rate of Freshenings for the Herd.

For herds that are remodeling we can graph this in programs like DC305 and file out the data into Excel. For new herds, we can estimate the number of calvings to be 104% of the rolling average number of cows in the herd, and the weekly rate will be this number divided by 52.

For example, a 1000 cow dairy will freshen 20 cows and heifers per week on average.

Calculate the 90th Percentile of the Weekly Calving Rate or 140% of the Weekly Average.

Below (Figure 3) is an example of the weekly calving rate for a 1200 cow dairy. The dotted line is the 90th percentile threshold (32), below which 90% of the cows calve and above which only 10% of the cows calve. The solid line is the average (24). Note that by definition, if we build to accommodate the average, the facility will be overstocked half the time.

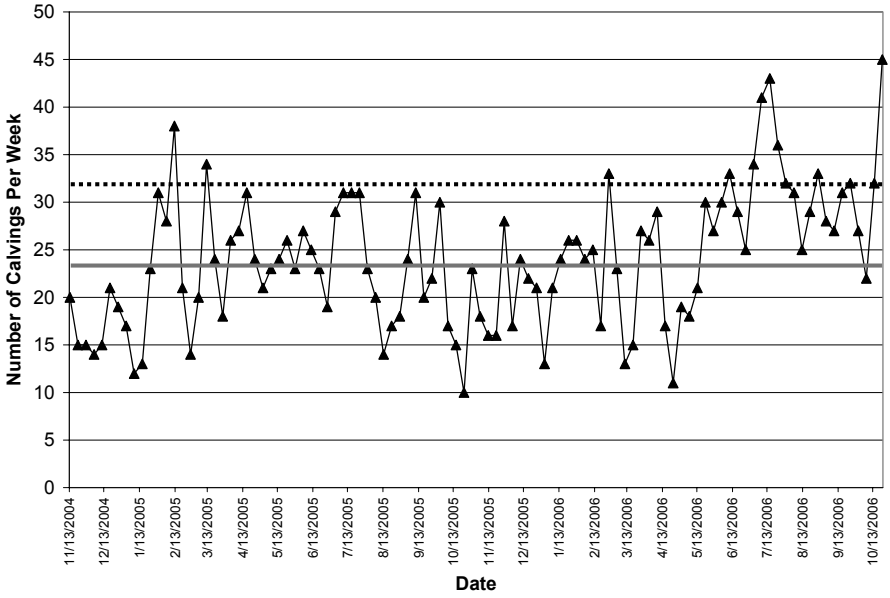

Figure 3. Calving rate by week for a 1200 cow dairy with average (solid line) and 90th percentile (dotted line) calculated.

For new facilities and for expansion herds, we need to use an estimate of the 90th percentile. Using data from 73 large herds we have estimated that 140% of the average weekly calving rate is a reasonable estimate of the 90th percentile.

For example, a 1000 cow dairy would freshen 28 cows and heifers per week for 140% of average (1.4 x 20).

Determine the Target Duration of Stay in Each Transition Cow Pen.

Factors such as target dry days, time of return of heifers to the close-up or far-dry pens, days in prefresh, time in the calving or maternity pen, and days in postfresh need to be decided. These are management decisions that will be farm dependent.

Calculate the Number of Cows in Each Group.

For example, a 1000 cow dairy wishing to accommodate 28 cows and heifers per week in a postfresh pen sized to accommodate these cows to 21 DIM would need 28/7 x 21 = 84 stalls.

We have brought these ideas together in a pen size calculator for use on farm available at http://www.vetmed.wisc.edu/dms/fapm/fapmtools/5house/TransitionCowpenSizeCalculator.xls

The calculator is shown below for a 1000 cow dairy with a 60 day dry period and 21 days spent in the pre- and post-fresh pens.

Table 2. Pen size calculator for a 1000 cow dairy.

	Heifers	Cows	Total
Weekly Calvings (140% of average)	10	18	28
Days in Pre-Fresh Pen	21	21	21
Days in Calving Pen	1.0	1.0	1.0
Days in Post-Fresh Pen	21	21	21
Average Days Dry	NA	60	60
Days pre-calving to return to the dairy	30	NA	30
Far-Off Dry Cow/Heifer Inventory	12	103	115
Pre-Fresh Pen Inventory	29	55	84
Calving Pen Inventory	1	3	4
Post-Fresh Pen Inventory	29	55	84

Once we know the inventory in each group that we need to build for, we can proceed with the rest of the building design.

■ Minimum Design Requirements

Using the calculated pen inventory as a starting point, we can now determine the dimensions and layout of each pen, using the following minimum stall and feedbunk requirements:

- At least one stall per cow pre- and post-fresh.
- Stalls should be of adequate width, resting area and length to accommodate heavily pregnant pre-fresh cows.
- Stalls should have a soft giving surface with good cushion, traction and support and ideally have a sand base.
- There should be a minimum of 30 inches of bunk space per cow for pre- and post-fresh cows, in order allow all of the cows to eat at the same time.
- Allow a target of 24 inches of bunk space per cow for far-dry cows and heifers.

- For bedded packs, provide a minimum of 100 square feet of bedded area per cow

Using the above requirements we know from the predicted inventory how many stalls we need (or square foot of bedded area) and we can calculate the feed bunk length of each pen.

For example, a 1000 cow dairy would need a 21 day prefresh pen feed bunk that was 84 x 2.5 feet = 210 feet long.

Pen and Barn Layout

To accommodate our requirements for stalls and bunk space, transition cow pens should be built with only 2 rows of stalls – either tail to tail or head to tail or head to head.

For ease of cow identification, head to tail is preferred for farms where pen workers need to check cows for signs of labor every hour. Pens of around 30 stalls split with a 27-28 foot crossover with a water trough in the middle provide flexibility to cope with changing numbers of cows in each group over time (Figure 4). Stall width should be determined based on the size of the cows using the pen, with a typical range of between 48 and 54 inches for Holstein cows and heifers.

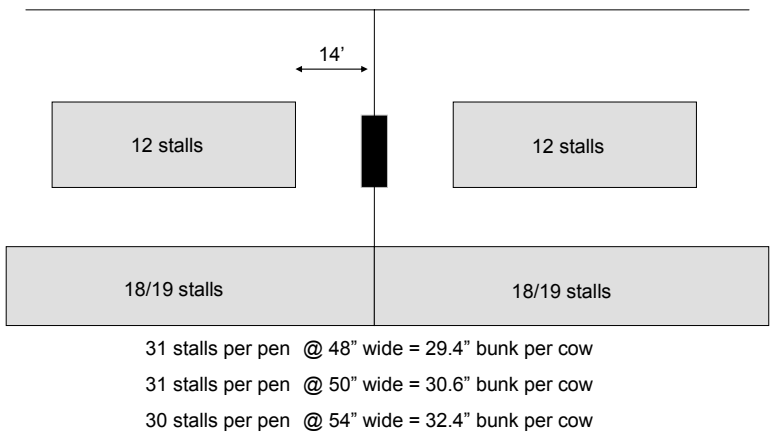

Figure 4. A 2-row head to tail layout around a cross-over with a waterer

An example layout for a 1000 cow facility is given below (Figure 5). It provides for far-dry cows, split groups of prefresh cows and heifers, individual calving pens, a postfresh monitoring pen and a sick cow bedded pack, with a transfer lane around the perimeter.

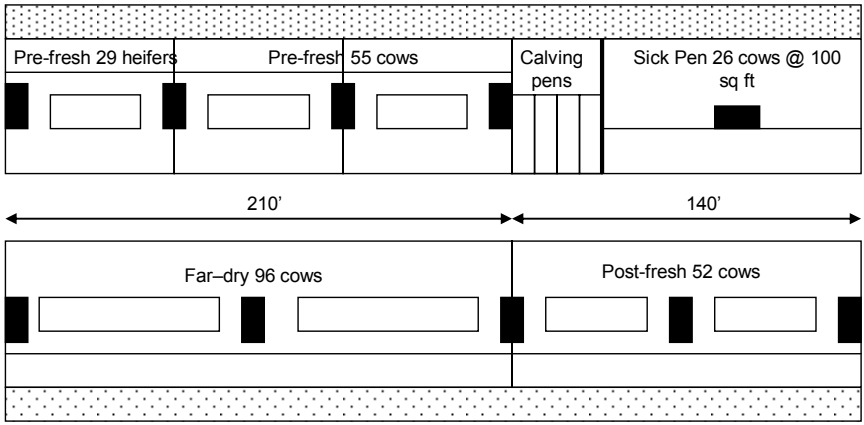

Figure 5. An example special needs barn layout for a 1000 cow dairy.

Once a stylized barn layout has been agreed upon and sketched out (Figure 5) it is time to consult with builders and engineers to put the final plan together.

■ Economics

A 1000 cow facility built to accommodate 140% of the average weekly calving rate would require 61 more stalls than a facility built to accommodate the average. At $3,500 per stall, this equates to $213,500 or $214 per cow.

For us to convince the farm (or the banker) to build this barn, you would need to believe that a facility built to accommodate 90% of the ebb and flow of calving rates would provide 1337 lb (606 kg) more milk per cow than a facility that is overstocked 50% of the time, to pay back the extra cost in one year. Of course – the deal is even better than that, because we can pay off the barn over 5 years, making the required increase in milk only 280 lb (127 kg) per cow.

We have the opinion that when it comes to transition cows you either pay at the beginning – to build the facility that encourages health and productivity, or you pay at the end, with broken cows and elevated culling rates. The choice is easy from our perspective and that of many Wisconsin dairy farmers that have already acted on our recommendations.

References

Cook, N.B, and Nordlund K.V. (2004). Behavioral needs of the transition cow and considerations for special needs facility design. Pages 495-520 In: Veterinary Clinics of North America, Food Animal Practice: Managing the Transition Cow to Optimize Health and Productivity. November 2004, Volume 20, Number 3. W.B. Saunders Co.