Facility Design For Large Jersey Dairies

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Like the dairy industry as a whole, many Jersey producers are considering expansion through building a new facility or remodeling an existing one. In addition, some Holstein breeders are switching to Jerseys to take advantage of the higher milk solids content and milk price. Questions arise concerning facilities design for a Jersey dairy, but few published recommendations are available. Most Jersey producers use Holstein numbers and "fudge" to make them work for Jerseys, or they visit other Jersey dairy producers to see what does and doesn't work. That is precisely what the authors here did – visited large dairies in the Southwest and California to see what is currently working.

Building a New Jersey Dairy

When building a new dairy, the builder should consider future needs and plans. A dairy is certainly a large investment that must be meticulously planned with goals and objectives for 15 to 20 years down the road in mind. Dairy producers must be committed to the milk market benefits from Jersey cattle for the life (15-20 years minimum) of the facility.

The first step in building a new facility is to consider parlor and group sizes. Groups should be sized to minimize time in the holding pen, preferably 45 minutes for 3x milking and one hour for 2x milking. For planning purposes, parlor steady state throughput per milking shift should be 6.5 hours for 3x milking and 10.5 hours for 2x milking. This will allow 1.5 hours for clean up and maintenance.

Table 1 provides estimates of group sizes and animal numbers for various size parlors assuming 3x milking, 45 minutes holding pen time, 6.5 hours steady state throughput, and about 4.5 turns per hour steady state throughput. Under these assumptions, a double 20 parlor can accommodate 1,217 lactating cows, with eight (8) pens of 140 healthy lactating cows each, a sick cow pen with 24 cows, a fresh cow pen with 49 cows, and a slow milking pen with 24 cows.

In any expansion or new facility, it is critical to consider dry cows and heifers. Table 1 also provides estimates of heifer and dry cow numbers for planning purposes.

Milking Cow Facilities

Dry-lot Design. Table 2 contains recommendations for sizing corrals and headlocks for milking cows housed in a dry-lot system. The recommendations in Table 2 should be considered minimums. As the herd expands in the future, facilities may be crowded beyond the initial design.

Corrals should have 2.5% to 3.0% primary slope and 0.3% to 0.5% secondary slope to allow adequate drainage. Shades should be oriented north-to-south with a minimum height of 11 feet. The minimum area provided for shade and corrals should be 36 square feet and 500 square feet, respectively, per milking and dry cow.

Good facility design involves long-term planning plus painstaking attention to detail. This dairy illustrates the use of 5-in-10 headlocks mounted in 8" curbs, with 500 sq. ft. of corral space per cow. Note the proper installation of shades.

Headlocks. Most Jersey producers utilize headlocks that allow five holes in 10 feet, or 2 feet per cow. Producers who have six (6) lockups per 10 feet report that approximately one lockup is empty every 20 feet. Thus, for 5-in-10 lockups, new facilities should be designed to allow one lockup per animal. If 6-in-10 lockups are desired, 10% over design should be allowed. For example, for 100 cows, there should be 100 lockups 5-in-10, or 110 lockups 6-in-10.

Curbs for mounting headlocks should be from 8" to 8.5" thick. Some 7" curbs have been used. However, extensive cracks and break-out have occurred with 7" curbs when pipe in excess of 3.5" O.D. is used. A 16" cow side and 12" feed side height are commonplace. A 4" curb-height difference should be maintained.

Free Stall Design. C. A. Russell of Yosemite Dairy in Hilmar, Calif., published an article in *Jersey Journal* (February, 1998) that detailed a desirable free stall design for Jerseys. The recommendations in this paper are very similar to his.

Most stalls in use are 42" wide, and 6.5' to 7' long. For first lactation heifers, some producers find 39" stalls more desirable. However, 39" stalls will limit the pen flexibility by accommodating only first lactation heifers. Loops should be 8" to12" off the bedding. Loops on most dairies we visited were 32" from the top loop to the ground. Wider loops are necessary for higher neck rail placement if neck rails are to be attached to the loops. Wider loops also allow side lounge space. Neck rails and brisket boards should be 54" to 60" from the back of the stall. Some neck rails rested on top of the loop (32" to 34" high) and others were suspended from the ceiling and were 40" to 43" high. In our opinion, neck rails should be about 40" above the bedding for Jersey cows. Thus, a 28" to 32" loop would ideally suit Jerseys. Alley width from headlock to free stall was 12' to 14', and alleys without a feedline were 10' to 12' at the Jersey dairy farms measured for this paper.

Milking Center. Some Jersey producers are milking in parlor stalls designed for Holsteins. Although this scenario is working in certain situations, it is less than desirable. In some cases the indexing rails can be moved to accommodate smaller animals. Stall width, however, is difficult to change. For parallel parlors, a 24" stall is desirable. Herringbone stall width can be anywhere from 30' to 45". Distance from the back

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Table 1. Preliminary sizing of dairy facilities with different parlor sizes

Assumptions	
Milking frequency (times/day)	3x
Steady state throughput	6.5 hours
Parlor turns per hour	4.5
Milking time per group	45 minutes
Milking cow groups	8
Age at first calving	24 months

Group Size Multiples					
Double 10	Double 16	Double 20	Double 30	Double 40	Double 50
50	80	100	150	200	250
60	96	120	180	240	300
70	112	140	210	280	350
80	128	160	240	320	400
90	144	180	270	360	450
100	160	200	300	400	500

	Approximate % of Milking Herd[4]	Double 10	Double 16	Double 20	Double 30	Double 40	Double 50
Steady state throughput/hr		**90**	**144**	**180**	**270**	**360**	**450**
Theoretical Cow Numbers[1]		585	936	1,170	1,755	2,340	2,925
Total lactating cows	**100**	609	974	1,217	1,826	2,435	3,043
Suggested group size[1]		68	108	135	203	270	338
Actual group size[2]		70	112	140	210	280	350
Min. parlor turns/hr required		4.7	4.7	4.7	4.7	4.7	4.7
Healthy lactating cows	**92**	560	896	1,120	1,680	2,240	2,800
Sick cows	**2**	12	19	24	37	49	61
Fresh cows	**4**	24	39	49	73	97	122
Slow milkers, lame cows	**2**	12	19	24	37	49	61
Maternity	**0.33**	2	3	4	6	8	10
Dry cows and heifers	**25**	146	234	293	439	585	731
Freshened cows per year	**115**	673	1,076	1,346	2,018	2,691	3,364
Over-conditioned dry cows	**5**	29	47	59	88	117	146
Under-conditioned dry cows	**5**	29	47	59	88	117	146
Close-up dry cows	**5**	29	47	59	88	117	146
Close-up heifers	**5**	29	47	59	88	117	146
Close-up overflow pen	**5**	29	47	59	88	117	146
Total Cows in Herd	**125**	**755**	**1,208**	**1,510**	**2,265**	**3,020**	**3,775**
Young Heifers[3]							
Age Ranges (months)							
Beginning – Ending							
Birth – 1.5	7	42	67	84	126	168	210
1.5 – 2.5	5	28	45	56	84	112	140
2.5 – 6	17	98	157	196	294	392	491
6 – 12	29	168	269	336	505	673	841
12 – 15	14	84	135	168	252	336	420
15 – 24	43	252	404	505	757	1,009	1,261
Greater than 24 months	0	0	0	0	0	0	0
Total Heifers	115	673	1,076	1,346	2,018	2,691	3,364

[1] Based on milking times and parlor throughput
[2] Round to nearest increment of parlor size from box above
[3] For planning purposes, no death loss assumed.
[4] From Smith et al., *Proceedings from 1999 Western Dairy Management Conference.*

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panel to the brisket area is the limiting factor. For 900- to 1,000-pound cows, this should be 55" to 60".

The milking parlor should be located to avoid excessive cow walking. Forced walks more than 600' with 3x milking or more than 900' with 2x milking should be avoided. A forced walk is defined as the distance from the holding pen entrance to the corral. For free stall barns it is the distance from the holding pen entrance to one-half the length of the free stall barn.

If a wash pen is utilized, it should provide 10 sq. ft. to 12 sq. ft. per cow. Wash pens effectively clean cows when nozzles are spaced 5.5' apart in one direction and 6' in the other. The holding pen should pro-

vide 12 sq. ft. per cow.

Waterers

Lactating dairy cows, particularly in a semi-arid climate, require large quantities of water. The importance of abundant, fresh, and clean water cannot be overstated.

Cleaning waterers regularly (at least weekly) will ensure clean, fresh water. To facilitate easy clean-out, waterers should be constructed so that dumping or emptying is simple and quick. Shallow (10" to 14" deep), rapid-filling troughs also contribute to a clean, fresh, water supply. In hot climates, use concrete or fiberglass tanks. Water temperature should not exceed 86° F. Provide 3" of trough space per cow in a group. It is also critical to make water available after cows leave the parlor, either in an exit alley or return lane. Optimally, there should be 2' of water trough length for each cow in a side of the parlor. For example, in a double 15 parlor, 30' of water trough as cows exit the parlor would be ideal.

It is important to remember that heifers and dry cows also require clean, fresh water. In particular, all calves, regardless of weaning status, should have free-choice access to water. In the hotter months, calves need more fluid than is supplied through milk replacer. Water intake will also encourage dry feed intake, which will promote early weaning and healthier calves.

Dry Cow Facilities

Dry cows should be managed in at least two groups: a close-up group (three to four weeks before expected due date until calving) and a far-off group (from dry off until three to four weeks prepartum). Optimally, large dairies should consider a third group for close-up heifers. Heifers housed separately will not have to compete for feed and water space with older cows and can be fed a different ration if needed.

Design criteria for these groups are listed in Table 2. Close-up cows should be managed with intensity similar to early lactation cows. High dry matter intake during this period is critical to a smooth transition into the milking herd and high peak milk production. Thus, the close-up group should have feed bunk, shade, and corral space similar to milking cows. Facilities should enable TMR feeding to accommodate diets with less palatable ingredients such as anionic salts.

Young Stock Facilities

Baby Calves. Most Jersey producers utilize calf hutches for baby calves. A well ventilated 4' by 8' hutch with an outside exercise area (4' x 4') is optimal. Smaller hutches (4' by 4') generally provide inadequate shade or are poorly ventilated, both of which can stress a young calf. Hutches should provide free choice water from birth, and free choice calf starter from two to three days of age.

Transition Calves. Defined loosely as the one-month period after weaning, the transition period is critical to the success of a young calf program. Calves are under considerable stress during the transition period, since they are adapting to a dry diet and to social interaction with other calves. Thus, properly designed facilities are critical for these calves. Table 2 provides some suggested recommendations. In addition, a critical aspect to successful transition is group size, which is discussed later in the paper.

Older Heifers. Table 2 lists suggested shade and corral areas, curb sizes, headlocks, and platform widths for Jersey heifers of various ages. When animals are grouped together across age ranges, compromises must be made with reason. Shade is recommended to encourage high dry matter intake and optimal feed efficiency.

Headlocks are ideal for any heifer after weaning. Suggested headlocks are listed in Table 2. In particular, breeding pens should have headlocks. However, slasher openings are inexpensive and functional for pre-breeding age or bred heifers. Slasher openings are typically 8", 9" to 10", and 14" for heifers less than 9 months of age, heifers 9 months of age until breeding, and bred heifers, respectively. Slasher openings may be desirable for young calves after weaning as an adjustment to headlocks.

Group Sizes. On most dairies, heifers are housed individually as baby calves before being introduced to other calves shortly after weaning. Group sizes should not exceed five (5) during this transition period after weaning. Following the transition period, group sizes should be less than 20 for a few months. Prior to breeding, group size should not exceed 40 head. After breeding, larger group sizes are warranted.

Summary

Planning is essential to successfully designing a dairy, and proper sizing of corrals and free stalls is critical to cow comfort. Plans should encompass where the dairy will be in the next ten to 15 years, from a production and size standpoint. Allowances for future expansion should be a basic design component. Expansion of existing facilities or new construction must consider all animals, including dry cows and heifers.

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Table 2. Dry-lot design criteria for Jersey cows and heifers.

	Minimum Corral Area	Minimum Shade Area	Curb[1]			Headlocks	Platform Widths[1]	
			Animal side	Feed side	Thickness		Feed	Animal
	Ft^2/head	Ft^2/head	Inches	Inches	Inches	Holes/ 10-feet	Feet	Feet
Lactating cows	500	36	16	12	8	5	12	12
Close-up dry cows	500	36	16	12	8	5	12	12
Far-off dry cows	400	36	16	12	8	5	12	12
Bred heifers (15-24 mo.)	300-400	20-25	16	12	8	5-6	12	10
Breeding-age heifers (12-14 mo.)	200-300	15-20	16	12	8	6	12	10
10-12 mo.-old heifers	200-300	15-20	14-16	10-12	8	6-7	12	10
5-9 mo.-old heifers	150-200	15-20	12	8	6	7-8	12	8
3-5 mo.-old heifers	100-150	30-40	12	8	6	8-9	12	8
Transition calves (post–weaning)	50-100	40-50	12	8	6	9	12	8