Freestall Housing Guidelines: Design Details To Enhance Management

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A well planned housing design provides the dairy herd with good access to feed and water, a clean, dry, comfortable resting area, and good ventilation during all seasons. Whether one group or a dozen, good system planning simplifies the process of milking, animal handling, feed delivery and manure collection so that these tasks may be performed properly and consistently. Good design can save time, minimize the amount of labor required and reduce drudgery and frustration. This paper will focus on design details that enhance cow comfort and make the movement of animals, feed, and manure more convenient in dairy freestall housing using fenceline feeding.

Clean, healthy, high producing cows require four basic things from the housing area:

1). Clean, dry, comfortable resting area.
2). Good air quality.
3). Good access to (and a supply of) feed.
4). Good access to (and a supply of) water.

Most other things done in the design of dairy housing are done for the manager, such as:

1). Simple animal handling and observation.
2). Simple animal isolation and restraint.
3). Easy feed delivery.
4). Easy waste collection and removal.

The designer should not compromise the cow's requirements in the layout of a housing system. Careful attention to cow comfort is necessary for good production, animal health, and to promote cow cleanliness.

Of course, the building should be located on a relatively level, well-drained site with a good source of potable water. Access for feed delivery and milk hauling should be convenient. Service roads around the dairy system should be suitable for traffic at all times of the year. Animal housing and manure storage areas should be located downwind and at a reasonable distance away from the residences to reduce odor and insect concerns. Allow adequate space for expansion. Assume that the dairy system will double in the future.

Animal Handling And Movement

Freestall housing systems allow cows to be managed and handled in groups. These groups are moved to, through and from the milking center two or more times per day. However, individual cows must be separated from the group regularly for breeding, treatment or special observation. While cows are in the housing area they must have convenient access to feed, water and the resting area.

Each cow group should be moved to and from the milking center at a comfortable, easy pace, without excitement or unnecessary force, safely, by one person. In addition, the means to isolate and restrain an individual cow for special care should be provided to the handler.

Grouping

Dividing the milking herd into groups allows for better management. Grouping can simplify animal movement, make observation easier, and allow feed rations to be adjusted to fit the group's needs. Grouping of the milking herd is often done according to production, stage of lactation, or age.

The holding area should be large enough to confine each group so that cows do not have to be sorted, or enter the holding area in shifts. Sizing the holding area 25% larger allows another group to be moved into the holding area behind the crowd gate just before the other group is finished milking.

Group size is influenced by the capacity of the milking parlor. Armstrong (1993) suggests that cow groups milked two, three, and four times per day should be milked in 60, 45, and 30 minutes per group, respectively. This recommendation is based on the stress associated with a closely confined group of cows, especially in hot weather. Being away from feed and water for a long period of time is also a concern.

Albright (1983) suggests that group size remain stable and no larger than 100 cows. Each group should be identified clearly by name or number. This can be accomplished with a sign and/or blackboard located for convenient observation. Identification and information should be presented in a way that new/temporary employees can understand easily.

Traffic Lanes And Patterns

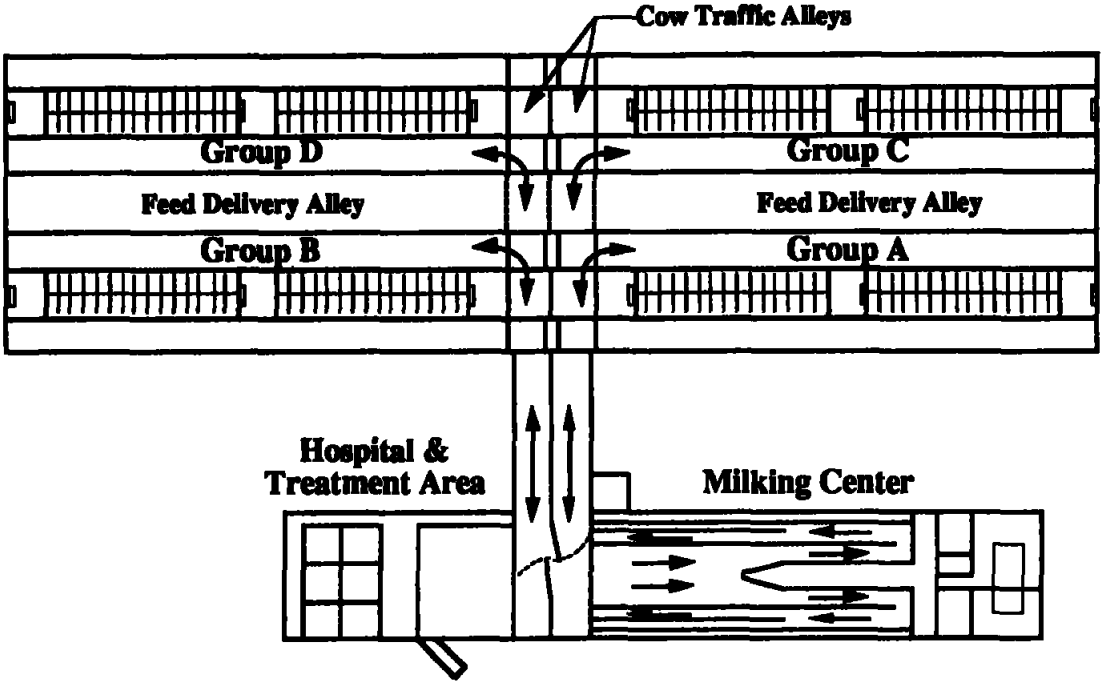


Figure 1: Animal traffic pattern for freestall housing with two central traffic lanes

Making group movement and traffic patterns simple, with a minimum of turns and direction, changes will reduce frustration and excitement. Remember that given the chance, a cow will usually go the wrong way (Graves, 1986). The skill level and temperament of cow handler(s) should also be considered.

Traffic lanes between the housing area and milking center should have a well drained, non-skid surface which provides confident footing for cows during all types of weather. Lanes should not slope more than 6% in the direction of cow flow.

Traffic lanes should be wide enough to accommodate the group being moved. Traffic lanes should be 12'-16' for groups less than 150 cows and 20' wide for groups of 150 cows or more (Welchert, 1992).

The movement of one cow group must not interfere with another. Layouts which require one group to pass through the housing area of another group are not desirable. These arrangements may save building space, but animal movement is usually more complicated, and a group may be restricted from the resting and/or feeding area(s) for a long period of time.

Traffic lane arrangements which allow a group of cows to move to the milking center while another is returning is preferred. Cows tend to linger on their trip back to the housing area from the milking center. Frustration may be increased, and animal movement is delayed, if the cow handler must chase cows out of the traffic lane before the next group can be moved. A second traffic lane allows the handler to briefly close the return lane(s) from the milking center and move the group into the holding area.

Figure 1 shows one layout for freestall housing with four groups. With proper gating, two traffic lanes near the middle of the building allow two groups to be moved without interfering with one another. Cattle guards and/or automatic gates can be used where animals and vehicle traffic cross.

Another layout alternative which provides sim-

ple cow movement is described in Figure 2. Groups are simply moved to, through, and from the milking center in a circular pattern.

Cow Alleys Within The Housing Area

The alleys in the housing area should allow the cows to move freely between the feeding, watering, and resting areas without interfering with other animals. Preferred alley widths at various locations in the housing area are shown below.

	minimum	preferred
Feeding area:		
feed barrier to rear of freestall	12'	14'
feed barrier to front of freestall	10'	12'
Resting area		
rear of freestall to wall	8'	10'
rear of freestall to rear of freestall	8'	10'

Animal Movement Within The Group

Cows within a group should be allowed easy and convenient access to the feeding area, resting area and water. More study needs to be done to find the optimum distances a cow should move between these areas. Some observation indicates that a crossover lane from the resting to the feeding area should be provided every 60'-80', or a row of 15-20 freestalls. Each crossover should contain a waterer and be wide enough, say 10'-12', so that cows using the waterer do not block the lane.

Floor And Traffic Lane Surfaces

All surfaces that cows come in contact with should provide a confident, non-skid footing. A floor surface that provides confident footing reduces the chance of serious injury caused by slipping and falling. Cows are also more likely to mount and show signs of heat in a housing area with a good, non-skid floor surface.

Grooving is a common method for creating an acceptable floor surface. Grooves should be approximately 3/8"-1/2" wide and 3/8"-1/2" deep. The preferred pattern is a diamond shape where the grooves are placed 6"-8" on center. Parallel grooves 2"-4" on center are also commonly used in scrape alleys, traffic lanes and holding areas. Grooves should not run perpendicular to the direction of scraping.

Before animals are allowed onto the surface all sharp edges, or 'wickers', should be removed by chipping or grinding. If the surface is comfortable

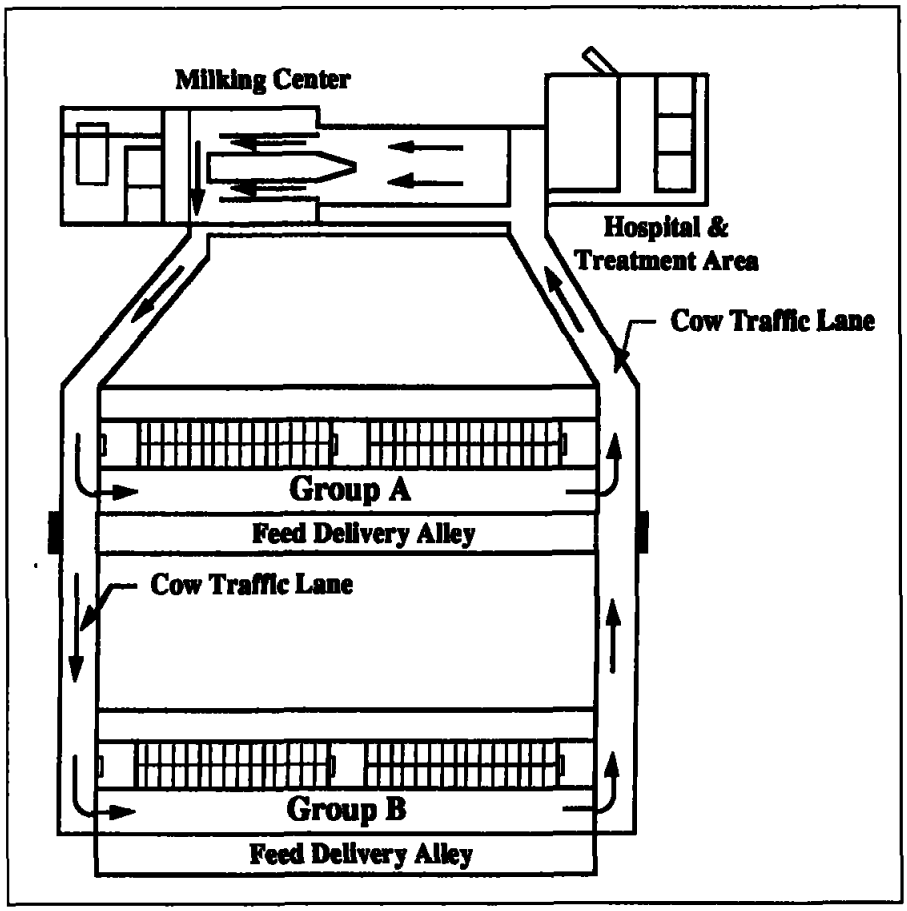


Figure 2: Animal traffic patterns for freestall housing with circular flow.

enough to walk in bare feet, it is probably acceptable for dairy cows (Graves, 1993).

In high traffic areas where cows may be moving and/or turning in groups, a surface with good traction is essential. In the milking parlor the floor surface is usually wet and must be easily cleaned. An anti-slip grit such as aluminum oxide can be troweled into the concrete after floating (Welchert, 1992). Installed properly, these surfaces provide an excellent non-skid surface which is easy to clean and durable. However, due to the abrasive nature of the grit, there is some concern about the amount of wear it may cause to the hoof if the cow is exposed to this floor surface continuously.

Separation, Isolation And Restraint

Individual cows must periodically be separated from the group for breeding, treatment, or special observation. A single handler should be able to isolate and restrain a cow with relative ease. Much of this process is based on animal behavior. Therefore, the handler should be familiar with the best and easiest methods for encouraging cows to move. Headlocks in the housing area and sorting lanes in the milking center can make this task much simpler.

Cows may be separated from the group easily as they exit the milking parlor. Cows are usually in single file in the return lane and can be sorted using a power operated cutting gate. The cutting gate may be controlled manually from the operator's pit in the milking parlor, or automatically by a transponder and identification arch. Catch lanes typically run parallel to the return lanes and can hold several cows briefly for observation. A headgate at the end of the lane provides simple restraint. Proper design of gating and pass-throughs in the catch lane allow the operator complete and convenient access to the restrained animal. A room/office adjacent to this area for the storage of breeding supplies, veterinary care products and instruments, and records is highly recommended. Hot and cold running water should also be available nearby.

A hospital/treatment area is necessary for cows requiring more rigorous examination, or longer term treatment or observation. This area should be separate from the housing area and milking center. The hospital/treatment area should provide the space and apparatus necessary to restrain a cow properly for examination and treatment, elevating and suspending feet, lifting downed cows, and surgery.

At least one treatment pen should be provided for every 50 cows (Graves, 1983). Each pen should be a minimum of 12'x12' (16'x16' preferred) and allow simple animal restraint and support, convenient access (for both handler and cow), easy clean out and downed animal removal, access to feed and water, and contain a non-skid floor.

Animals are transported regularly. An area designed to accept and isolate animals coming into the herd and load animals leaving the herd is desirable. A loading chute or dock of convenient height for the truck(s) used should be provided (Graves and Light, 1980). A durable, non-skid surface is necessary in the loading area.

Ganglock, or self-locking, stanchions are commonly found along the feed manger in many dairy enterprises using fenceline feeding. Some stanchion designs allow one, several, or all of the group to be restrained briefly for routine examinations, such as pregnancy checks and treatment.

In housing arrangements using two rows of freestalls parallel to the feeding area, it is common to have more feed barrier openings than freestalls. This allows the entire group, even with slight overstocking, to be restrained at the fenceline at one time. In housing systems using three rows of freestalls parallel to the feeding area, there are approximately 25% more freestalls than feed barrier openings. Therefore, the entire group may not be restrained at one time, which complicates animal handling during routine examinations.

Access And Observation

Proper design allows each group to be observed easily and completely. Access to each group should be convenient. A person should not have to open a gate to enter any group. Convenient access to a group also allows escape if necessary.

Pass-throughs are commonly placed at each end, and in the middle of, each fenceline along the feed

delivery alley. They are also often placed next to gates used for cow traffic. Some gate designs incorporate a pass-though within the gate. The clear opening of pass-throughs range from 10"-16" depending on the location and person(s) using them. A rule of thumb is to use a 10"-12" opening where cows may face the pass-through, and a 12"-16" clear opening where cows 'pass' the opening. Self-closing, one-way gates should be used in pass-throughs wider than 16".

Some dairy producers use decks strategically placed above groups for observation. The herdsman observes the herd for heat detection and general health from this location.

Freestall barns with fenceline feeding offer the opportunity for the herdsman or manager to drive along the feed delivery alley frequently to observe the herd.

Provide adequate access for a tractor, or skid-loader, to easily enter each group for the removal of a downed animal. Freestall partitions should be designed for easy removal to free an entrapped cow.

Lighting

Lighting in the housing area should allow 24-hour operation and observation (Graves and Light, 1980). The minimum light available at any time should be 200 lux (20 fc) in the feeding area and 100 lux (10 fc) in the general housing area . In areas where close examination or surgery is performed, 1,000 lux (100 fc) is recommended (ASAE, 1992). Fixtures should be placed to minimize shadows and bright spots since animals tend to balk in these areas (Grandin, 1989).

Natural Ventilation

Good ventilation is essential for good animal health. Just by respiration, dairy cows produce three to five gallons of moisture per day. Good ventilation provides the air exchange necessary to remove this moisture, as well as other moisture, gases, heat and dust in the housing area. In most climates, natural

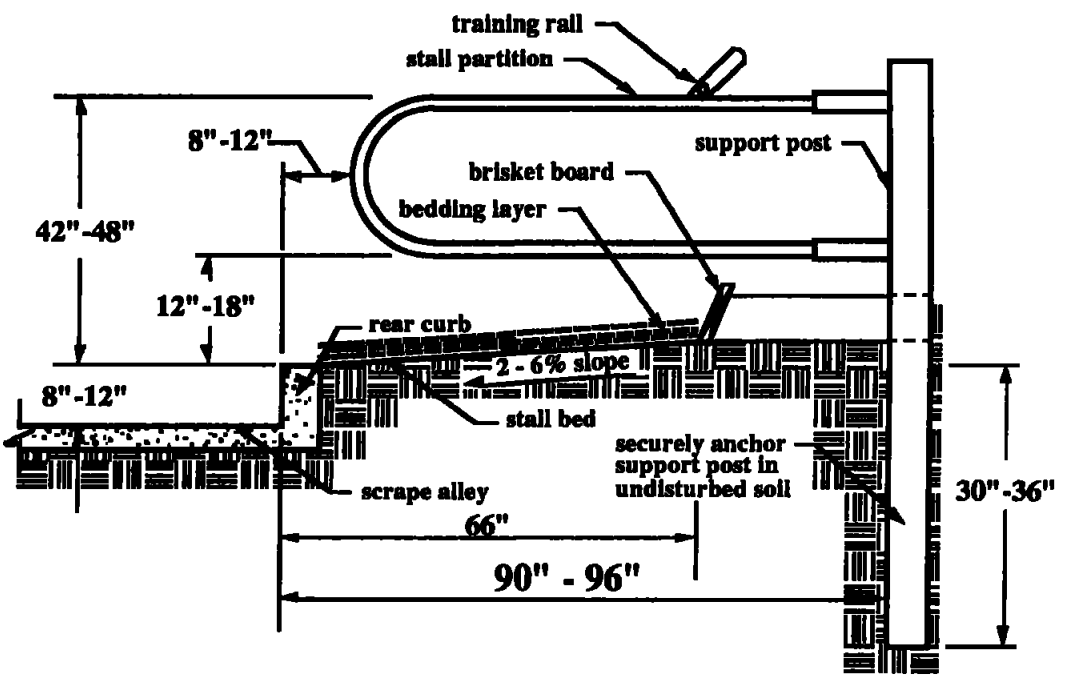


Figure 3: Freestall components and suggested dimensions.

ventilation is the most practical system for freestall housing.

Dairy housing structures should provide shade in the summer and block winds during cooler months. Proper building orientation is important. In most cases the ridge should be oriented perpendicular to prevailing winds. This allows summer breezes to blow across the width of the building when the sidewalls are open, and the ridge opening to 'draw' air more uniformly year-round.

Open-front buildings, especially those with a monoslope roof, should be oriented to provide shading during the afternoon in the afternoon. The building should be located a minimum of 50' from obstructions which might block air flow. The 'wind shadow' created by tall and/or long obstructions may increase the necessary separation distance.

Sidewalls should be 12'-14' high. This height increases the volume of air within the housing area which can improve air quality. The intensity of heat radiation from the roof material is also minimized improving hot weather comfort. The sidewall should be open a minimum of 50%. However, 75%-100% is preferred. When the sidewall is fully open, fresh air should be introduced at the cow's nose level when she is resting in the stalls.

A continuous ridge opening is recommended. Typically, 2"-3" ridge width should be provided for every 10' of building width. An open ridge is preferred, but gutters and ridge caps are sometimes used to reduce the amount of rain and snow which enters the building. Generally, a ridge cap design is acceptable if it does not restrict the opening.

Freestall (resting) Area

Properly designed freestalls provide a clean, dry, comfortable resting area with good air circulation, protection from other animals, and do not cause injury or trap a cow. Ease of maintenance is also important, but animal comfort and cleanliness should be the primary concerns when selecting a freestall combination.

The dimensions of the freestall should be allow adequate space to enter and exit the stall easily, and rest comfortably. A cow rising in a natural way, such as in pasture, lunges forward, shifting her weight forward allowing her hindquarters to be raised more easily. Observations indicate that cows prefer to lunge forward, rather than to the side, given the opportunity. Cows can exit a freestall successfully and without injury, when lunging to the side, but seem more tentative and careful about their movements.

Recommended freestall length for Holsteins is 7'6" for stalls with open fronts, and 8'0" for stalls with solid or slatted front barriers. For Holsteins (up to 1,600 lbs.) stall width of 4'0" is adequate for animal comfort and minimum chance of injury while the cow is entering, resting in, and exiting the stall.

Stall partition height and design are also very important for cow positioning and prevention of injury. In stalls of

animal size	length A	length B	width[1]	partition height[2]
300-400 lbs	46"-52"	36"	27"	28"-32"
400-600 lbs	60"-66"	46"	32"	34"-36"
600-800 lbs	66"-72"	50"	36"	36"-38"
800-1,000 lbs	72"-78"	54"	39"	38"-40"
1,000-1,100 lbs	78"-84"	58"	42"	40"-42"
1,100-1,300 lbs	84"-90"	64"	46"	42"-44"
1,300-1,600 lbs	90"-96"	66"	48"	42"-48"

A – stall length from alley side of rear curb to stall side of partition support. (use upper side of range as minimum when stall front is not open.)
B – brisket board and/or training rail location from alley side of rear curb.
1: – stall width measured from center of one partition to center of next partition.
2: – partition height measured from top of rear curb to top of partition.

proper length, a brisket board and adequate stall base slope help position a the cow in the stall and keep the back of the stall cleaner.

The stall bed should provide good 'cushion' for the occupant. Cushion might be defined as a surface which gives slightly to cradle the bony protrusions of a resting cow, distributing her weight more evenly across the stall bed. A comfortable stall bed will encourage the cows to use the stalls rather than the alleyways.

There are several stall bed alternatives which give adequate cushion. A earth stall bed with a generous bedding layer, and a clean sand stall bed are excellent choices, but should be maintained regularly to encourage cow acceptance, cleanliness, and prevent injuries. Embedding tires into earth or concrete makes a very stable stall base. The tire sections provide a degree of cushion, however, a generous bedding layer is still required.

Many producers have adopted fabric-covered freestall beds in their systems. This option requires less bedding since most of the bedding layer is contained beneath a layer fabric. After a firmly tamped base is established, a generous layer of bedding is added to the stall base. Next, a layer of heavy fabric, such as woven polyester, is placed over the bedding layer and fastened to the brisket board. With organic bedding such as sawdust, straw, shavings, hay and peanut hulls, the fabric may be draped over the rear curb. This allows easier access to the contained bedding layer to remove wet spots, level the bedding, or add additional material. A light layer of bedding on top of the fabric is still required to absorb ma-

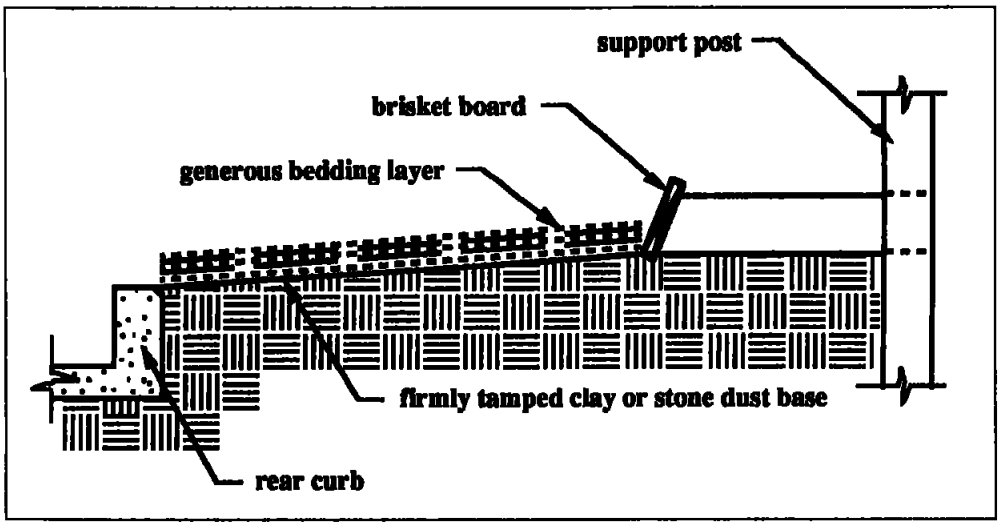


Figure 4: Earth freestall bed.

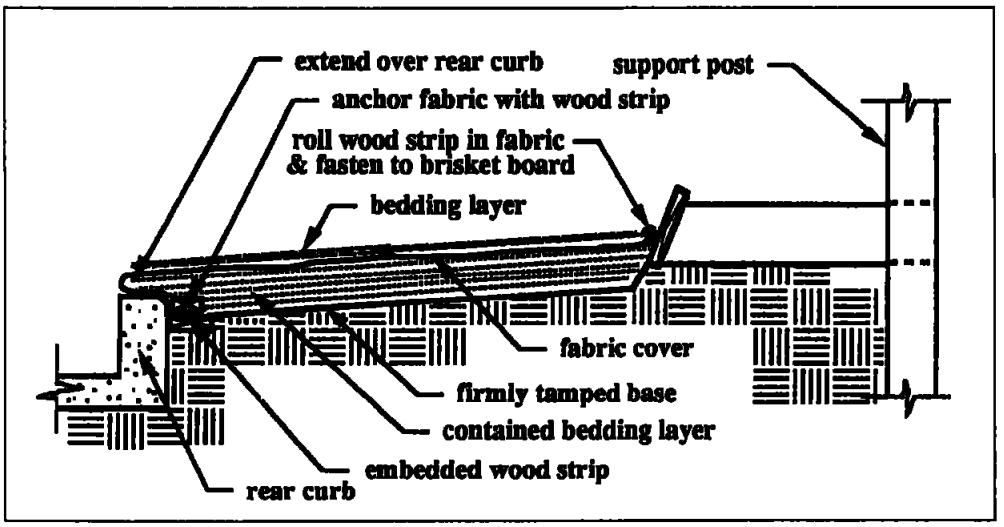


Figure 5: Fabric-covered freestall bed (fastened at rear).

nure and moisture tracked in from the alleys.

More recently, shredded or chopped rubber has become a popular choice as the contained bedding layer in fabric-covered stall beds. The rubber material is resilient and provides excellent cushion if installed properly. Observation indicates that 250-300 lbs. of shredded rubber is required per stall. The fabric is typically fastened at both the front and the rear of the stall to prevent the material from getting into the manure system.

'Freestall' does not mean 'free of maintenance'. The stalls need to be maintained regularly to insure cow cleanliness and acceptance. Manure and wet spots should be removed one or more times per day. The stall bed should be filled and leveled as required. Cows are reluctant to use, and may become trapped in, stall beds which are hollowed out or slope toward the front of the stall.

Feeding Traffic And Delivery

One of the most important materials handling tasks on the farm is the mixing and delivery of the feed ration. The design of the feeding system should provide the following:

1). Simple, convenient delivery of the feed to each group.

2). An area which encourages, and allows, each cow the opportunity to consume the proper amount of the ration.

3). Easy removal of old feed and debris from the bunk or feed manger.

General Layout And Considerations

Fenceline feeding with a mobile mixer/feeder allows flexibility in the location of feed storage and delivery location. Several rations may be mixed and delivered to different groups, buildings and/or other farms using the same equipment. If only a one-feed mixing and delivery vehicle is used, a trailer-mounted model is preferred over a truck-mounted model since an alternative power unit (tractor) may be connected if the regular unit is down.

Forage storage should have convenient access from fields. Supplement and/or commodity storage(s) should have convenient access from the highway. (Brugger, 1990).

Brugger (1990) suggests that the layout of the storage, mixing and feeding areas should be designed around a good traffic pattern. All sites, and the roads between, should be well drained and able to support daily traffic year-round and in all types of weather. The feed delivery unit should move forward with a minimum of backing. Adequate space and reference markers should be provided when the delivery unit must be backed into place.

Wherever animal traffic lanes cross the feed delivery units regular path, cattle guards and automatic gate and door openers allow the feeding unit to pass through without requiring the operator to leave the controls.

The width of feed delivery alleys range in width from 6'-20'. The size and type of equipment used is typically the determining factor. The mobile feed delivery unit should be able to pass through the feeding area without running over feed on the opposite side or endangering animals feeding at the fenceline.

The recommended feed delivery alley width for a drive-through freestall arrangement is 18'-20'. Each feed manger requires 30"-36" for feed delivery. This leaves 12'-15' for vehicle traffic.

The doors to the feed delivery area should provide a clear opening from manger wall to manger wall. This allows easier maneuvering of the feed delivery unit. Also, old feed may be mechanically pushed or swept from the building more easily.

The height of the feed delivery alley doorway should allow the tallest piece of feeding equipment to enter. Door heights of 10'-14' are commonly found. The recommended height is 14' or more.

For drive-by feeding, typically used with open front building layouts, the feed delivery alley may be narrower. However, the mobile feeding unit should run on a well drained, durable all-weather surface.

Feeding Space

The amount of feeding space allowed varies with the type of ration delivered, amount of time the group spends away from the feeding area, frequency of feeding, and personal preference of the dairy pro-

ducer.

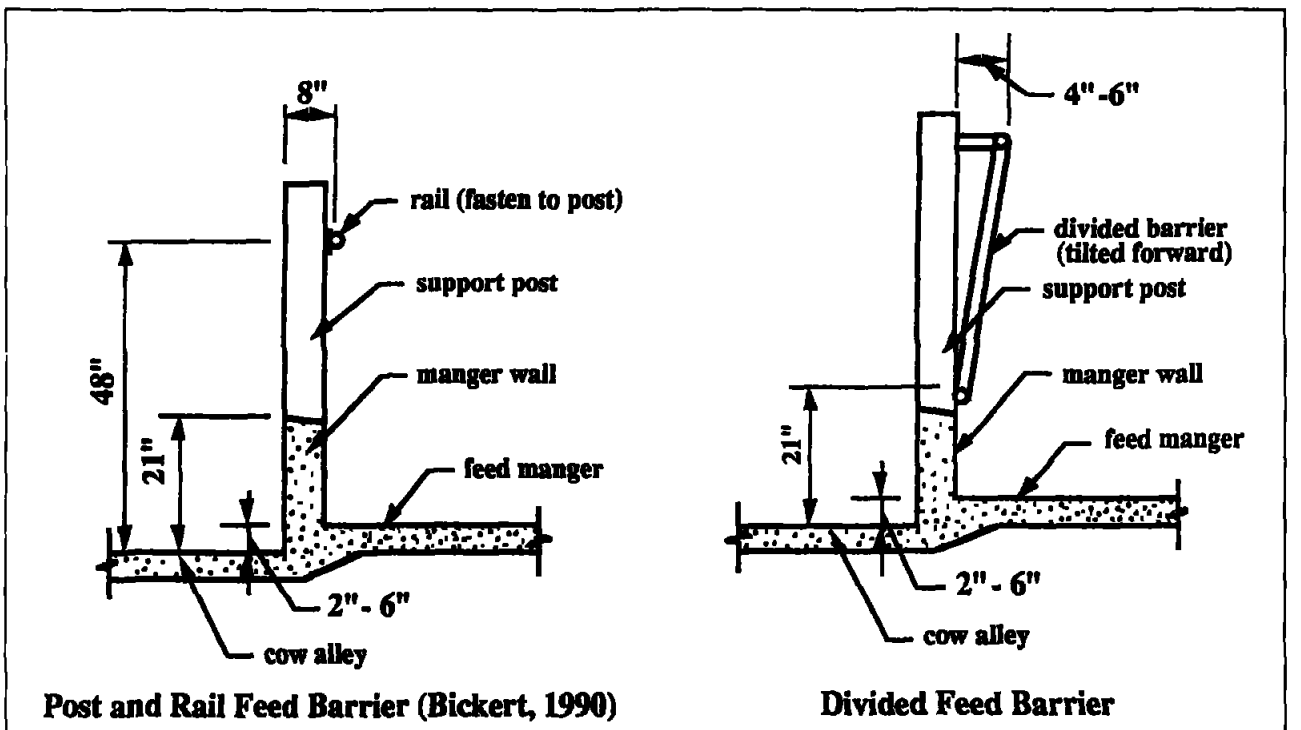
If the entire group is to be fed at once, 28"-30" of feeding space should be provided for each cow in the group (Bickert, 1990). A freestall housing arrangement using two rows of freestalls parallel to the feed manger and properly sized cross over lanes can provide feeding space within this range.

The longer that cows are kept away from the feeding area, or that feed is not available to them, it becomes more important to provide enough feeding space to accommodate the entire group at once. If forages are fed and then top-dressed, space should be provided to give the entire group the opportunity to consume the ration. Some producers who have switched from two to three milkings per day have noticed that more of the group uses the feeding area at the same time. This seems especially true when group size exceeds the number of cows which can be milked in one hour.

If a total mixed ration is fed and readily available to the group, 18"-24" feeding space is adequate (Speicher et al., 1982). However, Bickert (1990) points out that as barns are designed and built to milk cows in the future and higher milk yields are anticipated that stress animals further, the advisability of reduced feeding space must be reexamined.

The Feed Manger

Eating surfaces must be smooth, clean and free from left over feed and other debris in order to encourage good feed intake and aid in the control of disease (Bickert, 1990). The low pH of silage can etch the manger surface, exposing the cow's tongue and mouth to rough edges (Albright, 1983). High-strength concrete and admixtures are often used to improve the durability of feeding surfaces where silages are fed. A 24"-30" ribbon of tile along the length of the feed manger will provide a durable, smooth surface if installed properly. Epoxy type coatings may also provide adequate resistance, but must be applied properly to allow good adhesion.



Post and Rail Feed Barrier (Bickert, 1990) **Divided Feed Barrier**

Figure 6: Feed barrier options

A manger height which allows cows to eat in a natural grazing like position is preferred. Feed tossing is also reduced in fenceline feeding with manger elevations at or near floor level, compared to deep bunks (Albright, 1983). Manger surfaces elevated 2"-6" above the cow alley work well. Minimizing this elevation maximizes the manger wall which the ration can be piled against. The recommended throat height for the manger wall, measured from the cow alley, is 21" (Bickert, 1990).

A flat feed manger surface on the same level as the feed delivery alley is preferred. This allows the manger to be easily cleaned mechanically or by hand. It also allows the opportunity for good air circulation in the feeding area. The feed manger should slope slightly away from the fenceline, approximately 1/8" per foot to help drain away unwanted moisture.

Feed will be pushed out of reach by the cows and must be swept-pushed back regularly. This can be done by hand or mechanically. Several dairy producers have recognized this task as necessary and useful in the observation of the cow groups.

The Feed Barrier

The feed barrier is a divider which separates the animal area from the feed manger. The feed barrier should provide convenient access to feed, yet confine cows to their group. It can also reduce feed waste.

The post and rail barrier is typically made of metal or wood vertical posts which support a horizontal neck rail. The neck rail may be made from pipe, cable or plank. This alternative is inexpensive and allows excellent access to feed. A typical installation of a post and rail feed barrier is shown in Figure 6. In cases where competition for feed is a concern, such as with limited top-dressed feeding, a feed barrier which divides the animals may be preferred (Bickert, 1990).

Tilting the top of a divided barrier forward 4"-6" helps reduce pressure on the shoulders of a feeding cow. It also allows her to reach further for feed. A stanchion design which allows the neck opening to be opened wider at the bottom to quickly release a downed cow is preferred.

Water Stations

The availability of a continuous supply of clean, fresh water is essential for lactating cows. More research is needed to determine the location and type of waterers which should be used. In the meantime, make drinking water plentiful and convenient throughout the housing area, especially during hot weather.

The minimum design guidelines are to provide one waterer location or 2' of tank perimeter for every 15-20 cows in a group (Bickert, 1990). Just as important, the waterers should be conveniently located to allow cows easy access. A water station should be located in each crossover area between the feeding and resting area. Many producers have also found their cows frequently use water stations located along side traffic lanes as they return from the milking center.

Each waterer should be easy to clean and cleaned regularly. Tilting water tanks allow easy cleaning of the tank and the flush of discarded water can be used to clean cross over areas. Water tanks and vats should have drain plugs near the bottom to allow complete removal of water and debris.

Manure Collection And Transfer

The least favorite task on most dairy enterprises is often the collection, removal and distribution of animal waste. Regular and efficient removal of waste from the housing area is essential to provide more sanitary conditions and cleaner cows. With proper planning and design, manure removal can be simplified to allow effective cleaning with a minimum amount of labor.

General Layout And Considerations

To facilitate cleaning, cow alleys should be straight with no turns or dead ends. Moving manure around corners is difficult, time consuming and frustrating. Each side of the cow alleys should have a curb to contain manure and urine within the alley during collection, allowing more efficient waste removal. These curbs should extend to the collection opening. The rear curb of the freestall rows

should be high enough to prevent manure from overflowing into the stalls during removal. At crossover lanes, curb height should not be more than 8". The crossover lane should be crowned slightly to drain moisture into the cow alleys.

Cow alleys should be level across the width. An uneven alley floor results in incomplete cleaning and allows liquid to puddle.

A manure collection opening should be located at the one end of each cow alley. The alley should slope at least 1%, but not exceed 5%, toward the collection opening to give liquids the opportunity to drain. The collection gutter or pit should be at least large enough to accept the amount manure from all of the alleys it services. Tractor-scraped alleys require more collection capacity than mechanically scraped alleys, since the alleys are typically scraped less frequently and more rapidly.

The collection opening should be at least 12" and span the entire width of the alley. The opening should be covered or guarded from animal and people traffic. The opening should not interfere with cow, or vehicle, traffic. Grates are often used to cover collection openings to allow manure to pass through and cow traffic cross. However, a grate with an acceptable opening for cows traffic, say 1", does not allow manure to pass through easily.

A good location for the collection opening is just outside the traffic lane fence. The opening can be fenced to prevent accidental entry, yet remain open to allow manure to be scraped to it without lifting a cover or opening a gate. If the building arrangement allows manure collection between groups a section of the building, say 2' in length and the width of the building, can dedicated to the collection of scraped manure. This area can also cover a gravity-flow gutter to transfer waste from the building.

Collection methods:

The most common methods of removing manure from the cow alleys of freestall barns are tractor scraping, mechanical scraping, flushing, and slatted flooring.

One common method of cleaning alleys in freestall housing is with a tractor-mounted scraper blade or skid-steer and bucket. This can be a very economical and flexible alternative since one piece of equipment can be used in several locations, and also be used for other tasks. The preferred time for alley cleaning is when the cow group is away from the area to reduce stress, excitement and chance of injury.

Metal scraper blades can smooth floor surfaces, making them slippery and hazardous for cows to walk on. For several years, large quartered tires (split lengthwise, then in half) have been used as a scraper blade alternative. 'Tire scrapers' do not wear the floor surface smooth and do an excellent job of cleaning.

Mechanical scrapers are pulled by a chain or cable. They move slowly in the alley allowing cows to step over them when they pass. Mechanical scrapers can be controlled to automatically cycle several times per day, or run continuously if desired. The main advantage is that the alleys can be cleaned frequently with cows in the housing area and without human labor. However, hand cleaning is still required at cross alleys and at the end of the alley where the scraper blade cannot reach.

Slatted flooring has gained popularity with some dairy producers. Openings in the floor allow manure and urine to pass to a collection gutter or storage below. Manure is worked through the openings by the feet of the cows during normal traffic. The result is, typically, alleys that are very clean and dry which may contribute to good foot and leg health.

There does not seem to be a consensus among dairy producers, animal scientists, veterinarians, builders, or agricultural engineers on the use of slatted flooring in lactating cow housing. It seems that this too is a topic that needs more controlled study. Some of the pros and cons seen by those who like and dislike slatted flooring are listed below:

Advantages of slatted flooring:

1). Provides excellent dry floor surface for cows.
2). Don't need to enter cow group to clean alleys.
3). Non-mechanical manure collection.
4). Cows tend to stay cleaner, even if they lay in alleys.

5). Less manure tracked into freestalls.

6). Manure storage under building (saves space and out of sight).

Disadvantages of slatted flooring:

1). Cows hesitant to walk on slatted flooring.

2). Manure builds up on slats making them hard for cows to walk on.

3). Manure storage under building (gases and odors).

4). Cows may injure their feet and legs in the openings (although few users complain of this).

5). Expensive.

'Conventional' slats use a 1.75"-2" opening between treads approximately 6"-8" wide. The opening spans the width of the cow alley. A design becoming popular in some areas is the 'waffle' slat. This design uses a series of openings approximately 1.75"x8" spaced about 3" lengthwise and 5"-6" apart. In use, cows seem to walk very comfortably on this flooring surface and manure passes through quite easily.

The best advice to give producers considering slatted flooring is to go see several installations where it has been used by dairy cows for a few years or more. The combination of the owner and manager comments, and personal observations should be helpful in making a final decision.

Flush systems have been used in warm climates to clean alleys for many years. They have become more popular with new dairy systems in the Northeast and Upper Midwest. Properly designed and managed, a flush system can provide efficient and complete cleaning of the cow alleys. Flushing will not wear the floor surface and cleaning may be done while the cows are in the housing area. If temperatures are too cold to flush the alleys, they can be cleaned with a tractor and scraper easily since there are no obstructions in the alleys.

Flush cleaning is a system that needs to be designed and managed properly. It uses a tremendous amount of water, even if it is recycled. A flush system includes flush tanks or valves, a collection pit, a separator, settling basins, water storage tanks, pumps, and an irrigation system. Careful thought should be given to how both the solid and liquid portion of the waste will be managed.

Alley Cleaning Frequency

The cleanliness of cows is directly related to the frequency which the alleys are cleaned. Producers have noticed a considerable increase in cow cleanliness when scraping frequency was increased from two times per day (approximately 12 hrs. apart) to three times per day (approximately 8 hrs. apart). Mechanical scrapers can be operated continuously or programmed to scrape at selected intervals throughout the day. More frequent scraping allows less manure to collect in the alleys and can provide a better environment for cow cleanliness and foot health.

Hand cleaning of some areas is difficult to avoid. Cross alleys, freestalls, and areas out of reach of the scraper must be cleaned regularly. The secret is to make this task simple and convenient so that it will get done. Place the necessary tools, such as scrapers and brooms, near the required areas. They should be out of reach of the animals and not interfere with animal or feeding traffic.

Summary

Housing designs that keep cow comfort in mind provide the opportunity for good feed intake, milk production and herd health. Proper planning can also make the tasks of feeding, animal handling, milking and waste collection more convenient. When the housing design combines animal comfort and effective use of labor, more time can be spent on management of the dairy enterprise – which often leads to improved profitability.

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