COZYING UP TO COW COMFORT

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INTRODUCTION

Each year, thousands of cows tragically leave our herds because of health and safety issues in their workplace. The loss of valuable animals to lameness, mastitis, entrapment, or injury is both frustrating and costly to milk producers. The experience of some innovative producers who designed their facilities to fit the normal behavior of their cows has proven that something can be done about it. The objectives of this paper and the video presentation at the Midwest Dairy Herd Health Conference are to create awareness about cow behavior and comfort, to question standard recommendations for stall dimensions, and to stimulate change in beliefs and barns.

Benefits of our choices. What's in this for me? For economic and humane reasons, savvy cattle care professionals are adopting housing and management practices to reduce environmental risks and improve cattle health and dignity. Choices in new husbandry systems provide benefits from better cow health and performance, cow behavior and dignity, the use of less drugs to chase bugs, and a contribution to consumer confidence and milk's image. For some, their choices have put fun back into going to the barn and helped them hire and retain workers.

AUDITING AND SCORING COMFORT

A cow comfort audit should include an assessment of the facility for meeting the behavioral and safety needs of the cow and an assessment of the cow for signs of injury, lameness, or behavioral abnormalities.

Time-lapse video recordings. Video time-lapse recordings (VTR) show the effects that our choice of barn, husbandry system or management have on our barter of feeding, housing, safety and comfort in exchange for milk. Time-lapse, real time, and slow motion video also help us to question the common advice and the standards of practice for dairy cattle husbandry systems. In addition, video allows us to critically assess current practices and dogma, increase awareness and knowledge, change attitude and opinion, assess compromises, and enable change. Video opens our eyes to what cows do in our barns. It is a useful tool for consultation, diagnosis, and outreach programs.

Normal resting positions and freedoms. In Ontario, confinement housing is the norm on most dairy farms for several months of the year and the entire year on many farms. Because of confinement housing, we may be unfamiliar with normal cow behavior or

become desensitized to abnormal behavior. Common behavior may not be normal and common housing may not be best for our cows.
Cows rest in wide, narrow, short or long positions described by Kammer in 1982, or completely on their side (dead cow position) (Figure 1). To allow for normal resting positions, the resting area must provide cows with six freedoms:

- to stretch their front legs forward,
- to lie on their sides, with unobstructed space for their neck and head,
- to rest their heads against their sides without hindrance from a partition,
- to rest with their legs, udders and tails on the platform,
- to stand or lie without pain or fear from neck rails, partitions, or supports, and
- to rest on a clean, dry, and soft bed.

To rise or lie down, the resting area also must provide cows with freedom of vertical, forward and lateral movement without obstruction, injury or fear. The rising motion includes the freedom to lunge forward, to bob the head down and up, and to stride forward. The resting motion also includes the freedom to lunge forward and to bob the head. The space needed for the lunge and stride is difficult to visualize in tie stalls or free stalls built to common specifications. However, the space can be seen easily using video images of cows rising and lying on pasture, and by superimposing a grid on the images. Video taken inside barns shows cows auditing the facility by showing signs of pleasure or displeasure. Several examples of normal, abnormal and unwanted behavior appear in the video portion of this presentation.

Injuries, apprehension, locomotion. Our contract with cows includes responsibility for their safety - freedom from danger, risk or injury. A careful inspection of our cows reveals how well we are living up to this part of our contract. The audit should include scoring for injuries to necks, hocks, stifles and knees, and the top line or rib cage. Their reluctance to use stalls, to move quickly in or out of the parlor, or their actions at feed bunks or waterers also may alert us to issues of safety. Locomotion or claw scores also are valuable for assessing cow comfort and their husbandry. The heel-off-the-stall standing position provides a useful indicator of pain in the claws of the hind feet and a means of scoring lameness without observing locomotion.

Fear, intention, head pressing. Cows in unsafe facilities exhibit fear - feelings of alarm or disquiet caused by the expectation of danger, pain, or disaster. For example, intention behavior, or hesitation waltz, can last for several minutes before a cow lies in a stall. While doing the hesitation waltz, cows move their heads from side to side (but low to the ground) as if they are checking traffic before crossing a busy street. Some cows also use a front foot to paw at their bed or bedding. Intention time has been considered a surrogate measure of cow comfort. However, some cows in paddocks demonstrate the same behavior and the behavior may persist for several minutes before they rest. Head pressing is another unusual behavior. In two case study barns where cows pressed their muzzles into brisket boards while standing in free stalls, the head pressing ceased after removal of the brisket boards.

Avoidance, comfort zone, and dominance. Cows may show avoidance behavior from experiencing pain or discomfort while using a facility. Cows also may show apprehension from dominance behavior or intrusion on their comfort zone. Submissive heifers are apprehensive about drinking from water bowls in tie stall barns when dominated by the cow in the adjacent stall. Similar behavior can be seen at water troughs in free stall barns - especially at water troughs located in narrow (less than 12 ft) crossovers. Apprehension may arise from the design of equipment or facilities that is beyond the ability of the cow to cope comfortably. Design or construction features of the facility, or characteristics of the husbandry system, can lead to diseases in cattle that are not associated with fear.

Signs of discomfort and making them fit. Sometimes the introduction of a new technology highlights an area of discomfort that has gone unnoticed. Rubber mats in feed alleys are an example. When installed in barns with discomfort stalls, cows choose to rest on the rubber mats in alleys, much to the annoyance of their owners. Dirty tails, dirty cows, dirty stalls, mastitis, lameness, or injury are signs of cow discomfort, failures of husbandry, or sick husbandry systems. Producers cope with sick barns in several ways. The amputation of tails (trim to fit) is one controversial example. In many barns, a longer bed would have spared tails by keeping them on the stall and out of the alley. In addition, a quality concrete floor, with slope towards the center of the alley and no depressions at the stall curb, would have prevented pooling of waste, minimized soiling of tails, and spared tails. Other methods of fitting cows into a husbandry system include bathing, medicating, or vaccinating to control various diseases associated with the system.

Diagonal lunging. Diagonal standing and lying in stalls are of interest because of stall cleanliness, labor, and mastitis related to defecation on the corners of the stalls. At a study farm with 16-foot, open-front, head-to-head free stalls, cows lunged diagonally 34% of the time with the facing stall empty and 81% of the time with the stall occupied ($p<0.000$). At another farm, cows lunged diagonally 68% of the time with the original 8-foot closed front stalls and 44% of the time with modified stalls - open fronts and loops with 38-inch wide openings ($p=0.0002$). Obstructions or short stalls may be the greatest contributor to diagonal lunging, and thus diagonal lying in the stall.

Stall cleanliness and cleaning. In tie stall barns, electric cow trainers, narrow and short stalls, and low tie rails are strategies to keep the stall clean. In free stall barns, narrow stalls, neck rails placed low and to the rear of the stall, short resting surfaces, and the lower pipe of the loop extended 24-inches behind the brisket locator also are strategies to keep the stall clean.
Cleaning stalls or barns is the most disliked work on UK dairy farms (Seabrook 2000). The same is likely true in North America. This dislike for cleaning stalls probably explains several design strategies implemented to keep stalls clean. When built to keep cows out, stalls stay clean, workers are happy, and the discomfort of the cows may go unnoticed.

Nonetheless, cows defecate in their resting-places and cleanliness is not the top reason that cows use to pick a resting site. Our astute dairymen recognize the need for stalls that cows

will use and choose to cope with stall cleaning in several ways. On some farms, workers maintain stalls manually several times per day. On others, owners strive to solve the worker and barn-cleanliness issue with some form of automation. To succeed, automation must replace manual cleaning of stalls. Challenges and opportunities await those looking for and finding automatic or mechanized methods of stall cleaning.

Contrariness - What am I doing wrong? When assessing contrariness of cows, ask, "what am I doing wrong?" rather than "what's wrong with the cows?" More freedom rather than control often changes unwanted behavior to acceptable behavior. Some producers are leading the way in dairy cow ergonomics - building tie stalls with open fronts, longer and wider platforms, higher tie rails, and longer tie chains. These changes to tie stall barns virtually eliminate the difficulties in rising experienced by "dumb heifers" or frail older cows. In these stalls, the heifers and special needs cows have the freedom to lunge forward and take a stride as if they were on pasture or in a bedded pack barn. Heifers adapt very quickly and easily to the new tie stalls. For similar cow comfort concerns in free stall barns, producers are building open front stalls, raising and repositioning the neckrail, making stalls wider and longer, and changing the position and style of brisket locator.

COW ERGONOMICS - COW SIZE AND STALL SIZE

Cow ergonomics concerns the improvement of cow health and performance through the careful design of her work environment. Ergonomic innovations in dairy barn design and construction aim to increase the health, safety and longevity of all cows. The relationship of the husbandry system to comfort, injuries, or lameness is of particular interest (Barkema 1994, Bell 2001, Colam-Aimsworth, 1989, Haley 2000, Norell 2000, Philipot 1994, Tucker 2001, Weary 2000, Weschsler 2000). To build ergonomically correct stalls, normal-resting positions, rising motions, and lying motions must be known. The dimensions of our dairy cows and their space requirements for normal behavior also must be known.

When choosing stalls for comfort, producers must know the weight of their cows and then select from several choices of dimensions for cows of that weight (Appendix 1). Moreover, their choice must be made on faith because there are neither performance data for the stalls nor audit reports for appropriateness of fit. For the most part, stalls have been and are being built for the average Holstein cow - one believed to be 1400 lbs.

Space requirements and an audit in the UK. A recent report of space requirements for cows comes from Faull and Hughes (1996). After observing cows freely lying and rising in a field, they concluded that Friesian/Holstein cows needed 95 x 47 inches living space and a further 24 inches of head lunging space for rising (Appendix 2). After conducting barn audits, they found 87% of cubicles were too short, 50% were too wide or too narrow, and that only 12% of the cubicles permitted real freedom of movement. Fully 10% of cows appeared moderately or severely restricted when lying down, 33% when rising and 55% when standing.

Matching cow dimensions and stall dimensions. Cermak (1988) and Irish et al (1986) advised sizing stalls by using cow dimensions but gave no cow measurements for reference. Current North American extension publications show neither cow dimensions nor space requirements for normal standing, resting, rising or lying behavior. The publications show cow weight and recommended stall dimensions.

Resting, standing, and perching (standing with two feet in the stall) behavior are of interest because of an association between uncomfortable stalls or dominance behavior and increased standing time and lameness (Leonard 1994, Galindo, 2000). The contrariness of cows to appropriate stall use may be because of mismatching of cow dimensions and stall dimensions. For example, nose-to-tail length and head-lunging space would be essential measurements for sizing stalls for forward lunging. Dimensions for modern dairy cows are not easy to find.

Holstein Canada and Holstein Association USA. Fully 25% of Canadian Lactation 1 Holstein cows stand 59 inches or higher at the rump and weigh greater than 1325 lb. at the time of type classification (Table 1). According to the information from Holstein Association USA, the average weight for the breed is 1500 lb. and rump height is 58 inches.

Weights of Cows at an Ontario Research Farm. While on feeding trials, researchers weighed 87 Holstein cows, at an Ontario research farm, four to seven times during their lactation. This yielded 448 weights to describe the weight distribution for cows in the herd. Thirty-one, 27, 13, 6, 4, 3, 2 and 1 cows were in Lactation 1 to 8, respectively. Weight changed by stage of lactation. The median weight was 1448 lb., and the 3rd quartile was 1563 lb. By 200 days in milk, the lactation 1 cows weighed greater than 1400 lb.

Cow Measurements. After placing a duct tape grid on a 8.5-foot wall adjacent to a water trough at a study farm, cows were recorded on video while standing or drinking. The technique showed that Holsteins measured greater than 102 inches from nose-to-tail. Measurements of rump width revealed that 50% of the cows in another Ontario herd measured greater than 25 inches at the hook bones and the top 25% measured 27 inches. Rump width may be useful to calculate imprint width while resting in the narrow position. Rump height is a surrogate measure of withers height - a useful measurement for positioning the neck rail. Cows used for a behavior study in Quebec had a mean nose-to-tail length of 97.5 ± 3.7 inches (Haley 2001).

Although there are scant measurements for predictions, the top 25% of Canadian Holstein cows in a herd should weigh greater than 1550 pounds, stand 59 inches at the rump, and span 27 inches at the hook bones. A nose-to-tail length greater than 102 inches should be common. When managing all cows as a group, should the stalls be built for the top 25% or the average cow?

CASE STUDY - RESTING, STANDING AND PERCHING IN STALLS

At Study Farm 1, the presenting complaint concerned poor milk production. Holstein cows were in a single group (84 cows and 70 stalls) in a three-year-old free stall barn with rubber filled mattresses. The stall dimensions appear in Table 2. Video recordings captured activity in a group of original stalls. About 4 days after remodeling the stalls, video recordings captured activity in the same location but with the modified stalls. The loops for the original stalls had a 28-inch opening and the new loops had a 38-inch opening. Stocking density, bedding (wood shavings) and other husbandry remained the same during the observation period, but bedding changed to chopped straw three weeks later.

Study Farm 1 - Findings - Resting Time. The percent of time a stall was used for resting increased from 40% in the original stalls to 55% in the new stalls (Figure 2). The cows used the new stalls an additional 3.6 hours per day for resting. The median resting time in the old stalls was 36 minutes whereas the median resting time in the new stalls was 59.5 minutes. The difference in the duration of resting time is significant, (K-W = 7.1, P=0.008). Figure 3 shows a shift to resting times of greater duration in the new stalls.

Study Farm 1 - Findings - Standing Time. The percent of time a stall was used for standing was 10.1% in the original stalls and 10.3% in the new stalls (Figure 2). However, the median standing time in the old stalls was 5.5 minutes whereas the median standing time in the new stalls was 3 minutes. The difference in the duration of standing time is significant, (K-W = 8.3, P=0.004). Figure 3 shows a shift to standing times of shorter duration.

Study Farm 1 - Findings - Perching Time. The percent of time a stall was used for perching decreased from 14% in the original stalls to 4% in the new stalls (Figure 2). Cows used the new stalls 2.4 hours less per day for perching. The median perching time was 8 minutes in the old stalls whereas the median perching time was 4 minutes in the new stalls. The difference in the duration of perching time is significant, (K-W = 9.4, P=0.002). Figure 3 shows a shift to perching times of shorter duration in the new stalls.

Study Farm 1 - Unused Stalls. Original stalls were empty 36% of the time and new stalls were empty 33% of the time (Figure 2). With a stocking density of 120%, the new stalls were empty about 8 hours per day and the original stalls approximately 8.6 hours. The unused time represented time spent during milking (2x), eating, or standing in alleys.

Study Farm 1 - Milk Production. Weigh slips from milk pickups were used to monitor milk production before and after changes to the stalls. Milk per cow per day was 22 kg at the time of observation in the original stalls. Milk production was 25 kg per cow per day, seven days after the stall changes and 25.5 kg six weeks later.

Study Farm 1 - Hock Injuries. Fully 100% of the cows had open lesions on their hocks. At the end of six weeks, the hocks had improved (Table 3).

At Study Farm 1, cows and stalls were mismatched. With the larger new stalls, there was a significant change in the percent of time a stall was used for resting and perching. There also were improvements in the duration of resting, standing, and perching time, production, and hock health, indicating greater comfort had been achieved. The cost of materials and labor was Cdn$17,000 for 129 stalls (milking cow, dry cow, and bred heifer groups) - $132.00 per stall. The pay back time (using increased milk production for income) would be about 6 months. The new loops had a wider opening to permit easier diagonal lunging and the front of the stall was opened to encourage forward lunging into the feed alley. When given a choice, the cows chose forward lunging about 56% of the time in the new stalls. The owners built the original stalls to control cow position in the stall, to minimize labor to twice daily cleaning of stalls, and to minimize the cost of the barn on a per stall basis. They blamed feeds and nutritionists for poor production, seemed desensitized to the discomfort of their cows, and rejected outright the role of the stall in cow behavior and health. Regrettably, cows suffered in this new barn for three years before economic factors and humane care countered contrariness to change beliefs and stalls.

Other case studies, or controlled experiments, would test this case study observation that mismatching stall and cow dimensions is detrimental to cow safety and performance. The new stalls were wider, provided an opportunity for greater ease of both forward and diagonal lunging, and had a higher neck rail. The dimensions were chosen empirically based on field observation without the benefit of data from controlled experiments. It is unknown if alternative dimensions would be better or if herds with fewer injuries and greater production would see an improvement by changing stalls.

TIE STALLS

Several tie stall operators have built new barns or remodeled old barns with larger stalls. The majority of stalls are being built with a 48-inch head rail, 72-inch platform, 54-inch width, and 36-inch chain (Table 4 and Figure 4). The height and forward location of the tie rail allow the cow to rise unimpeded and to stand with her muzzle below and behind the rail while positioned to the rear of the stall - hind feet ahead of the curb. The longest cows in the herd will stand diagonally in the stalls described above. Most barns have several 60-inch wide stalls for their largest cows. Although, 74-inch platforms can be found on some farms (often the stable is tapered to make 72-74-inch long stalls), 76-inch long stalls are uncommon in Ontario but can be found in Quebec. Owners report small cows and Lactation 1 heifers stay clean and comfortable in the 72 x 54-inch stalls built. Several said, if building again, they would not build a section of smaller stalls for these cows. When transitioning from loose housing to tethering, heifers adapt very quickly in the new stalls because of the freedom to lunge when lying and rising.

Water bowls. With the new high tie rails, the water bowl can be placed over the manger with 24-32 inches of space for the cow’s head and considerable room below it for easy cleaning of mangers. The length of a cow’s head is generally greater than 22 inches.

Electric trainers. Producers discovered that electric trainers work best when placed over the chime - 48 inches forward of the gutter curb. With proper placement of the trainers, many owners reported that their concerns about stall cleanliness in the larger stalls were unwarranted. They found the frequency of cow pies on the new freedom stalls is no different than they experienced with their old discomfort stalls - labor is the same and cow comfort improved. In tie stalls, the greatest frequency of defiling the stalls occurs during feeding time when cows step forward to reach for feed.

Freedom to lie, rest and rise - long chains and high tie rail. In the new tie stalls, cows have freedom to lunge forward, rise easily without hitting the tie rail, groom, and show signs of heat. Fewer injuries, cleaner cows, better reproduction, and more milk are common claims by producers who modified their stalls. By giving their cows the freedom to rise easily, owners also are finding the bedding stays on the stall much better. The long chains allow the cows to rest in the short resting position and to lunge easily. With the high tie rail, hair loss, swellings or bruising of the neck is rarely seen.

Restlessness in tie stalls. The manger curb at the front of a tie stall is often 8 inches higher than the mattress on the platform. This curb acts like a high brisket locator (board) in free stall barns. The manger curb can either restrict or prevent cows from stretching their legs forward into normal resting positions. While shifting positions, the restlessness can contribute to hock sores. To get the stall space needed to stretch their legs forward, some cows must, and often do, rest diagonally in their stalls. A lower manger curb that permits extension of the forelegs leads to bedding in the feed manger or feed in the bedding. Nonetheless, most of the new barns have manger curbs - and many are rounded for comfort of the outstretched legs.

Challenges and Opportunities. The long chain gives cows freedom to demonstrate normal signs of heat. Wrapping the chain around the tie rail for 24 hours will restrain them from jumping over partitions. However, they also have more freedom to groom themselves and their neighbors - and cows are cleaner. Most owners report having to pick their hat off the floor more often because the cows have the freedom to groom them as well. A few owners have not been pleased with 74 x 60-inch stalls - claiming that defiling of stalls is unacceptable and beyond their available labor.

FREE STALLS

In Canada, Artex Fabricators, Ltd., Langley, BC and ProMat, Seaforth, ON, seem to be leading with longer stalls, loops with wide openings, and higher placement of the neck rail (Appendix 1). In Ontario, several owners have barns with those measurements. However, they also built their stalls with 70-72-inch platforms, loops on 48-inch centers, neck rails 68-72 inches from the curb, and a brisket locator (Poly Pillow™) that rises no higher than 4 inches above the bed. Some stalls for dry cows are being built 54 inches wide.

Neck rail location and perching. **N**eck rails position the cow while standing in the stall. When positioned too close to the curb, the neck rail will make cows perch in the stall. Ideally, the neck rail is placed close to or over the brisket locator. A benefit of correct location is foot health. Research reports indicate that perching is a significant risk factor for sole ulcers of the hind feet (Bell 2001, Philipot 1994). The neck rail location should allow cows to stand with four feet on the platform.

Stride space. The platform in front of the brisket locator should be approximately the same level as the bed to allow for the normal stride when rising. Piles of bedding or concrete curbs in front of the brisket locator either restrict or prevent the normal stride. These items also restrict or prevent extension of the front legs when lying and appear to contribute to restlessness and stall sores. The brisket locator should be no higher than 4 inches, a recommendation from old extension publications and a regulation in Switzerland (Friedli 2001).

Challenges with free stalls. A few producers experienced wrecks with several cows injuring their backs in stalls with neck rails placed less than 48 inches above the mattress and 64 inches forward of the curb. The tragedies ended after raising the neck rail and moving it forward and over the brisket locator. Bedding stored in the front of open-front, head-to-head free stalls also is a danger to the submissive cow using this route of escape from a dominant cow or one in heat. When doing so, the step up onto the bedding pile could lead to injury to the back - especially when the neck rail also is too low. In some barns, a single restraint (e.g. pipe, nylon strap) has been positioned at the front of the open-front, head-to-head stalls, and approximately 10 inches lower than the neck rail height, to discourage travel through the stall.

What is the ideal stall length for forward lunging? From case study herds, diagonal lunging is about 3 times more likely in short stalls with obstructions at the front. At a farm with 16-foot, open-front free stalls, diagonal lunging was 8 times more likely when the facing stall was occupied. When cows lunge diagonally through the loop to avoid an obstruction, they rest diagonally in the stall.

It is reasonable to expect an 8.5-foot long cow to stand, lunge and lie diagonally in a common 7.5 or 8-foot stall. Cows lunge diagonally to avoid obstructions. Often, stall width is considered the reason for diagonal lunging and lying. The space requirement for forward lunging must be known. In head-to-head, open-front stalls, the space could be nose-to-tail length plus head lunging length - stalls 18 feet, curb-to-curb. In stalls facing a wall, it could be stalls 10-10.5 feet long.

There could be several reasons to consider giving cows the space and freedom to lunge forward. The head-to-head separation could provide air space and may decrease heat stress and losses in milk production during the hot months of the year. The unobstructed space could encourage cows to stand, lunge and lie straighter in the stalls. Lastly, the separation may decrease the effects of dominant social behavior and enhance resting opportunities for

submissive cows in the herd. Producers and their cows might benefit from research designed to answer this speculation.

Restlessness and stall sores. In some barns, brisket boards prevent cows from stretching their legs forward into a normal resting position. However, they try, often extending their front legs laterally - an unnatural position unless she rests more on her side - which she will do when stretching her legs laterally. In stalls with short beds (<72 inches) and brisket boards, cows often position towards the curb, with the upper leg and tail hanging in the gutter. VTR studies showed the top hindlegs of these cows moved into and out of the alley 15-30 times per hour (contaminating the bed) and their bottom hindlegs moved across the mattress 6 - 10 times per resting hour. The leg movement across the bed leads to hock sores. At a few study farms, after removing brisket boards and letting the cows assume normal resting positions, restlessness decreased, and hocks healed.

CONCLUSION

Information from case studies may not be applicable to the general population and the findings may not be repeatable in other herds. However, these case studies and video images have been presented to stimulate awareness, discussion, additional case studies, or research.

Humane care and performance should be justification for determining the ideal matching of cows and stalls. Resting, standing or perching behavior may be as important as position control for sizing stalls because those behaviors have an impact on foot health, leg injuries, production, or longevity. Although stall dimensions have been chosen to keep stalls clean, or because of what the neighbor built, the contractor's preference, an expert's opinion, barn cost per stall, or extension recommendations, most producers also base the decision on cow comfort. Regrettably, the performance of the stall (e.g. resting, standing, and perching times, diagonal lying, or injury scores) is not available for making the decision.

Until stall performance information is available, the standard advice to match stall dimensions to <u>average</u> dimensions of cows is as unsatisfactory as providing medium sized coveralls for everyone visiting a farm. The larger half of the population of visitors would either not fit or fit uncomfortably into the coveralls. Building stalls to fit the top 25% of the herd could assure the majority has the freedom for normal lying, resting, or standing behavior.

Cow size. Knowledge of cow dimensions and space requirements for normal behavior is essential for building a husbandry system. Research projects to get the measurements and observe the behavior are a definite asset to our dairy industry. The new larger stall sizes appear to be based more on cow size, behavior and needs than the standard recommendations or common practice of the past.

Test the concept. Many producers test the concept before changing the barn. They alter a few stalls, observe carefully, and often convince themselves within a few days. Visit barns and study cow behavior and comfort in those barns. Look for features that enhance normal behavior and include those in your plans.

Attitude and Opinion – Benefits of Change. Dairy producers, sensitive to injuries and disease, often lead the way or actively look for safety features to minimize apprehension and abnormal behavior, and to improve cow health, comfort, dignity and performance. Many recognize that productivity alone is not a measure of welfare.

Progress in changing beliefs and barns is gaining momentum - near epidemic proportions in some areas of Ontario. It is a good news epidemic. Consumers believe that those who have dominion over the cows will take care of them. Moreover, our innovators are showing us a better way to husband our cows. They welcome guests, share their knowledge, and make a difference. Many veterinarians, feed company consultants, milking equipment dealers and dairy industry advisors also have become excellent advocates.

For those accustomed to restricting cow freedoms, changing their beliefs is difficult. When answering their concerns, the converted often reply "I used to believe that too, but I don't anymore." Do what several Ontario producers have done - change a few stalls and observe for yourself. In addition, ask for and watch videos - they are powerful tools for changing attitude and opinion and enabling change. VTR show what cows do in barns - something producers need to get from contractors and designers before building their barns.

Best wishes to you as you husband your cows. May the thoughts of Bernie Rollin (Colorado State) guide your choices in husbandry and husbandry systems - "We have dominion over the cows and we will take care of them."

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Table 1. Distribution of Rump Height and Weight for 93,000 First Lactation Holstein Cows - April 2001 - March 2002. (Courtesy of Holstein Canada)

	Median (mid point)	3rd Quartile (top 25%)
Rump Height (inches)	58	59
Weight (lb.)	1255	1325

Table 2. Dimensions for original and modified stalls at Study Farm 1.

	Original Stalls	Modified Stalls
Length	8 ft to pipes	8 ft to open front
Bed length	69 in	72 in
Stall width (on centers)	44 in	48 in
Neckrail location Vertical from bed Forward of curb	 43 in 67 in	 50 in 70 in
Brisket locator height	8 in	4 in

Table 3. Hock scores at 0 and 6 weeks after changing the stalls at Study Farm 1.

Hock Score	Original Stalls %	New Stalls %
0 = no hair loss, no swelling	0	11
1 = hair loss or swelling	0	74
2 = open lesion	100	15

Table 4. Dimensions for commonly recommended and new larger tie stalls for Holsteins.

	Standard / Common	**New larger stalls**
Platform length	68 - 72 in	72 - 76 in
Stall width	48 - 54 in	54 - 60 in
Tie rail (headrail) height	38 - 40 in above stall base	48 - 50 in above mattress
Tiechain length	15 - 18 in	36 - 38 in
Headspace at water bowls	14 - 22 in	24 - 32 in

Table 5. Dimensions for commonly recommended and new, larger free stalls.

	Standard / Common	**New larger stalls**
Length - curb to wall	8 ft	10 ft
Length - head-to-head	15 ft	16 - 18 ft
Bed length	66 - 68 in	72 in
Stall width (on centers)	45 - 46 in	48 in
Neckrail location Vertical from bed Forward of curb	 44 - 48 in 64 - 66 in	 50 in 70 in
Brisket locator height	6 - 8 - 12 in	4 in

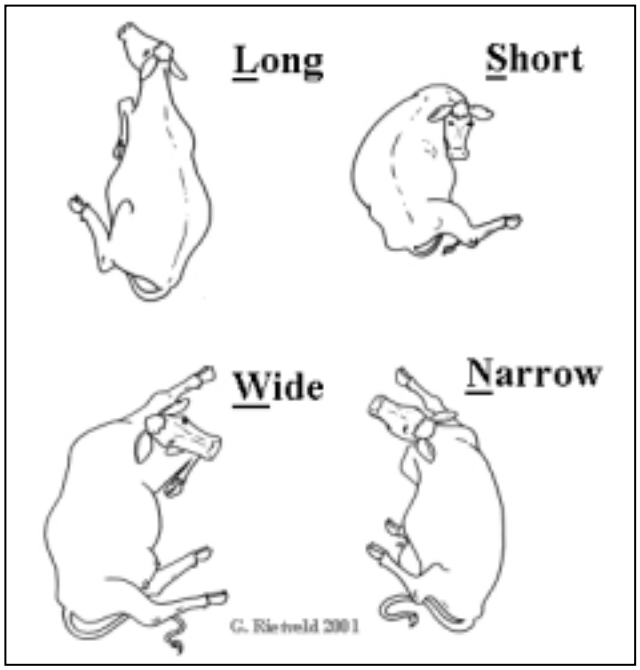


Figure 1. Normal resting positions of cattle. Courtesy of G. Rietveld, OMAF.

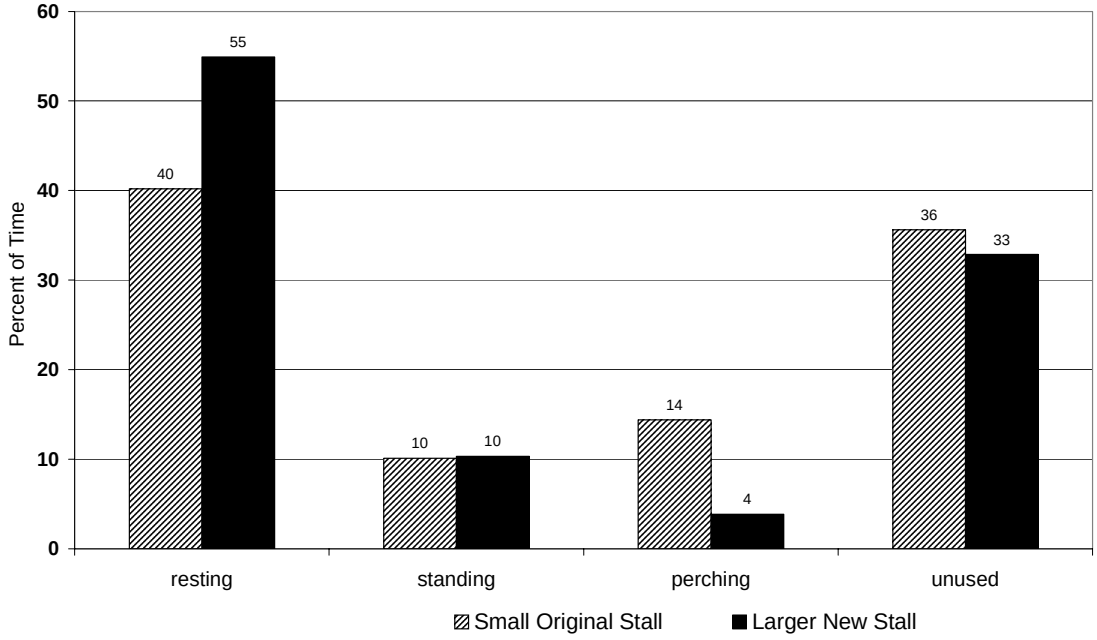


Figure 2. Percent of time in a 48-hour period that original and new stalls were unused and used for resting (lying), standing, and perching.

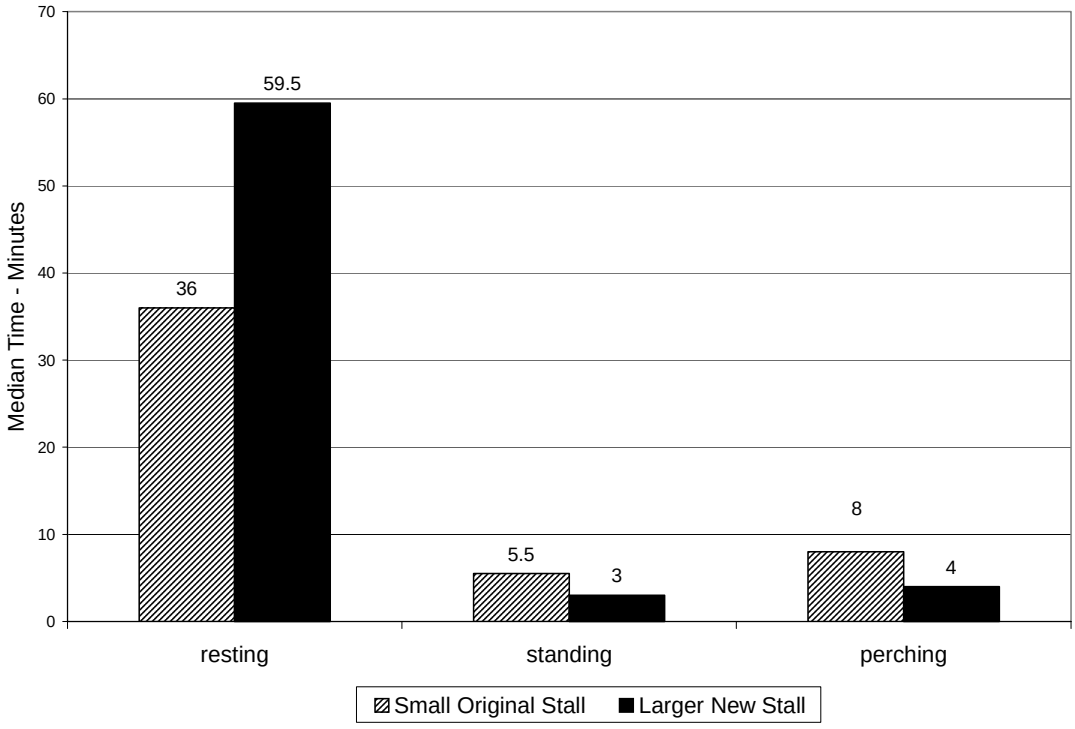
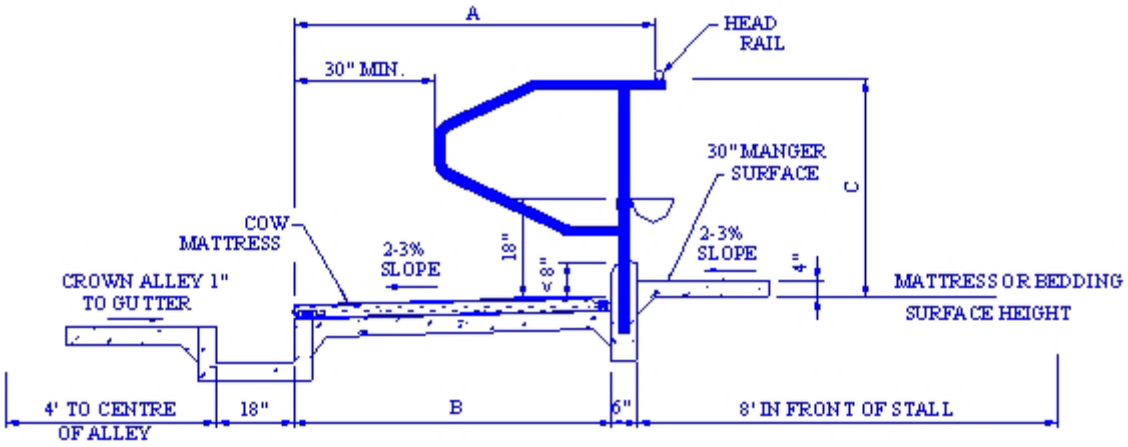


Figure 3. Median resting, standing and perching times (minutes) in original and new stalls.



		DIMENSIONS (IN)				
COW SIZE	WEIGHT	A	B	C	WIDTH	CHAIN LENGTH
LARGE	1800	90	76	50	60	38 + Snaps
MEDIUM	1600	86	72	48	57	36 + Snaps
SMALL	1400	84	70	46	54	34 + Snaps

Figure 4. Dimensions for tie stalls for Holsteins. (Courtesy of H. House, OMAF)

Appendix 1. Free stall dimensions being used or recommended for Holstein cows.

Source	Cow Weight (lb.)	Width (in)	Stall Length (in)	Platform Length (in)	Neck rail Location From curb (in)	Neck rail Height (in)
Common Stall	1400+	45 - 46	96	66 - 68	64 - 66	44 - 46
Artex Y2K[1]	Cows	46 - 48	120	68 - 70	63 - 66	50
Bickert, WG[2]	1500+	48 - 52	102 - 108	71	71	42
BSM Agri[3]	1400+	47 - 48	96 - 108	66 - 70	64 - 66	49 - 51
Chastain, J.[4]	14-1600	48	90 - 96	66 - 72	66 - 72	43 - 48
House, H.[5]	1540	48	90 - 96	66 - 72	66 - 72	43 - 48
Johnson, A.[6]	Cows	45	90 - 108	66	60 - 63	46 - 48
Midwest Plan Service[7]	1500+	48 - 52	102 - 108	71	71	46 - 48
McFarland, D.F.[8]	Cows	48	96 - 108	68 - 70	66	42 - 48
Nordlund, K.[9]	1600	51	106	70	70	48
Troelstra, C. Spinder[10]	Cows	43 - 45	86 - 94	71	61	47
Vokey, F.[11]	Cows	48	93	66	64	47

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Appendix 2. Measurements of cow length, width and rising space for UK Friesian-Holsteins (Faull 1996).

Length - nose-to-tail	95 inches
Imprint length	71 inches
Imprint width	47 inches
Length of head lunging space	24 inches
Length of front-leg stride to rise	18 inches