Cow Comfort:
Can It Be Improved In Your Barn?

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Seven Ways to Improve Cow Comfort & Productivity

- Improve air quality
- Increase bedding amount & frequency
- Have feed & water available at least 21 hours per day
- Provide relief from heat stress
- Increase alley & stall cleaning frequency
- Don’t overcrowd groups
- Allow more space for ‘special cows’

com-fort

noun

A state of physical ease and freedom from pain or constraint.

Source: The Oxford Dictionaries

Five Freedoms

- Freedom from Hunger and Thirst
  - Ready access to fresh water & diet to maintain full health & vigor
- Freedom from Discomfort
  - Appropriate environment including shelter & comfortable resting area
- Freedom from Pain, Injury or Disease
  - Prevention or rapid diagnosis & treatment
- Freedom to Express Normal Behavior
  - Sufficient space, proper facilities & company of the animals' own kind
- Freedom from Fear and Distress
  - Ensuring conditions & treatment which avoid mental suffering

Source: UK Animal Welfare Council, 1993


When cows are moved into shelter, inside environmental conditions need to **similar or better** than outside environmental conditions.

Benefits of Improving Cow Comfort

- Improved milk production
- Improved milk quality
- Improved health
- Reduced lameness
- Improved reproduction
- Improved longevity

www.everybodylovesyourmoney.com

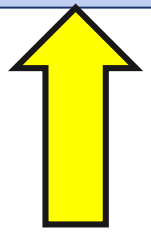
Productive cows are most affected by comfort

Improved Longevity

- “One more” lactation
  - Additional milk production
  - One less replacement
  - Another calf
  - Reduced cull rate
- Less involuntary culls
  - Improve herd genetics

The Power of One More Lactation

RHA	Milk Price	Replacement Cost
24,000 lbs.	$17.00/cwt.	$2,000 - $700 = $1,300



The Power of One More Lactation

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Years Milked	Milk per Lactation (lbs)	Profit per Year	Replacement Cost	Lifetime Profit
1	20,400	$507	$90 - $1,300	-$792
2	24,000	$756	-	-$36
3	25,200	$869	-	$832

Culled after 3rd Lactation (~5 years old)

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4	26,400	$982	-	$1,814

Culled after 4th Lactation (~6 years old)

The Power of One More Lactation

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24,000 lbs.	$17.00/cwt.	$2,000 - $700 = $1,300

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3	25,200	$869	-	$832
4	26,400	$982	-	$1,814
5	25,200	$869	-	$2,683

Dairy Housing Basics

- Excellent ventilation
- Dry, comfortable resting area
- Good access to feed
- Good access to water
- Confident footing
- Protection from weather extremes

Allows animals to be more productive

Other Desirable Features

- Good observation & access
- Simple sorting, isolation & restraint
- Convenient feed delivery
- Efficient manure collection
- Expedient ‘housekeeping’
- Worker Safety

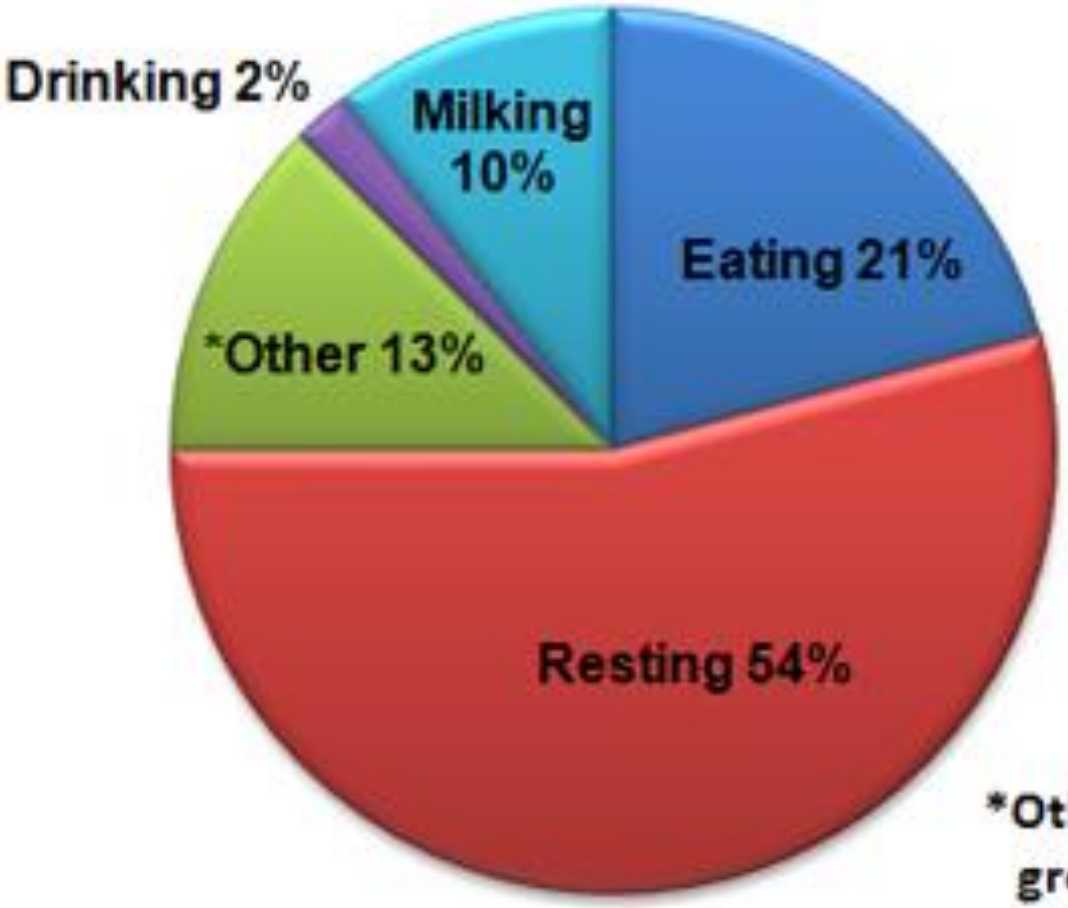
Allows caregivers to be more productive

“Typical” Cow Behavior

- Eat ~12 meals/day
  - 20+ min/meal
  - 3 to 7 hrs/day
- Drink 20 to 30+ gallons water/day
- Ruminate 4 to 10 hrs/day
- Rest 10 to 14 hrs/day
- Urinate ~ 10 times/day
- Defecate 12 to 18 times/day
- Tend to do things as a group

Sources: Albright & Arave; Grant

Time Budget in Freestall Environment



Activity	Hours/Day
Eating	5
Resting	12.0-14.0
*Other	2.0-3.0
Drinking	0.5
Milking	2.5-3.5

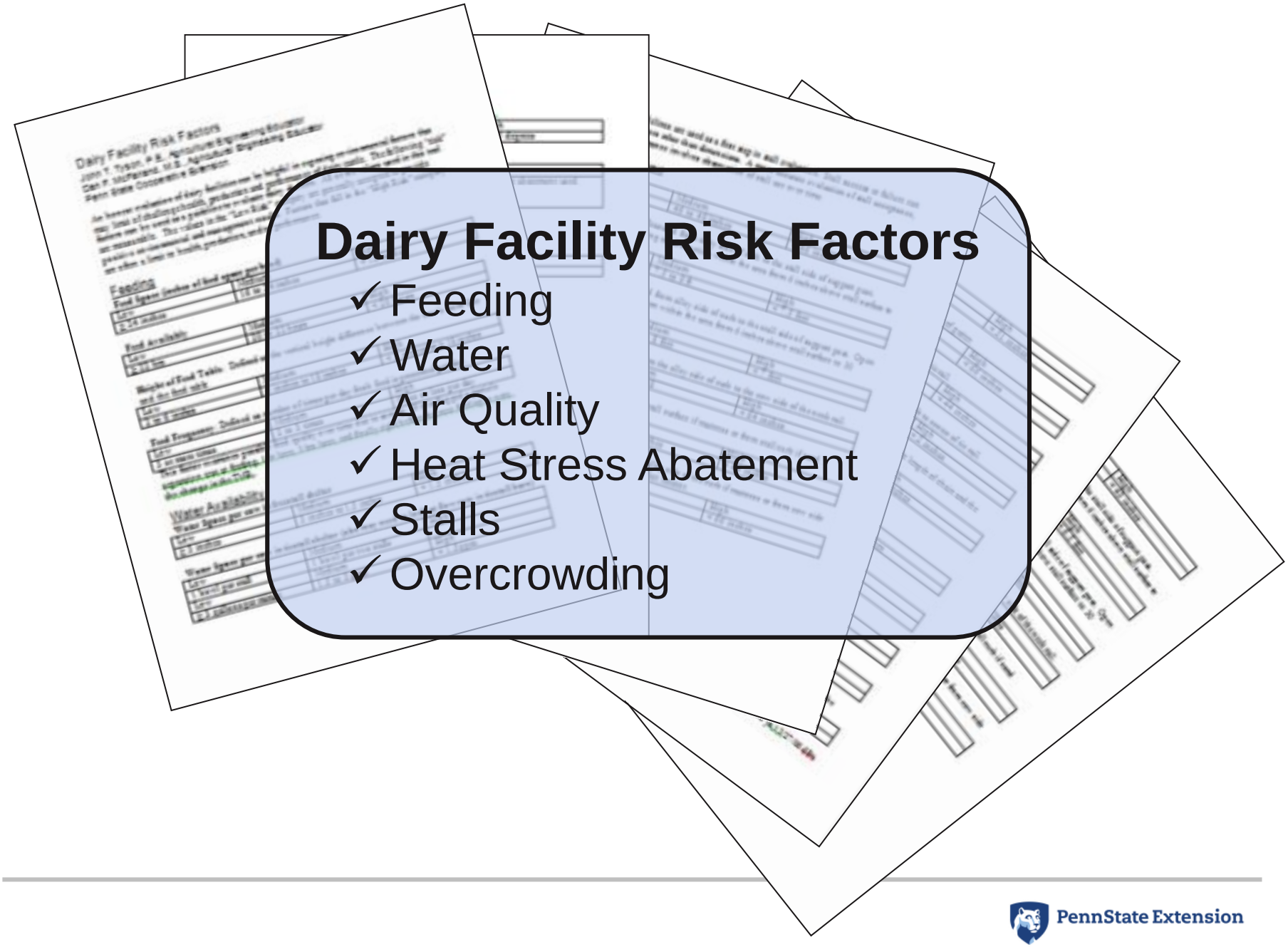
*Other includes standing, walking, grooming, agonistic, & idling.

Troubleshooting Cow Comfort Issues

- Need to measure
  - Space
    - Length, width, height
  - Time
  - Percentage

$$\frac{(110 - 96)}{96} \times 100 = 14.6\%$$

- Need to observe
  - Takes time
  - Time-lapse photography


Dairy Facility Risk Factors
✓Feeding
✓Water
✓Air Quality
✓Heat Stress Abatement
✓Stalls
✓Overcrowding

Dairy Facility Risk Factors

John T. Tyson, P.E., Agricultural Engineering Educator
Dan F. McFarland, M.S., Agricultural Engineering Educator
Penn State Cooperative Extension

An honest evaluation of dairy facilities can be helpful in exposing environmental factors that may limit of challenge health, production and performance of dairy cattle. The following "risk" factors can be used as a guideline to evaluate dairy shelters. All of the values used in this tool are measurable. The values in the "Low Risk" category are generally accepted to provide positive environmental and management results. Factors that fall in the "High Risk" category are often a limit to health, production, and/or performance.

Feeding

Feed Space (inches of feed space per head)

Low	Medium	High
≥ 24 inches	16 to 24 inches	< 16 inches

Feed Availably

Low	Medium	High
≥ 22 hrs	20 to 22 hours	< 20 hours

“What does a cow live on?
She lives on food, drink and air,
And you take away the air and she will die the quickest, won’t she?.”

-W.D. Hoard, 1885

Good Ventilation

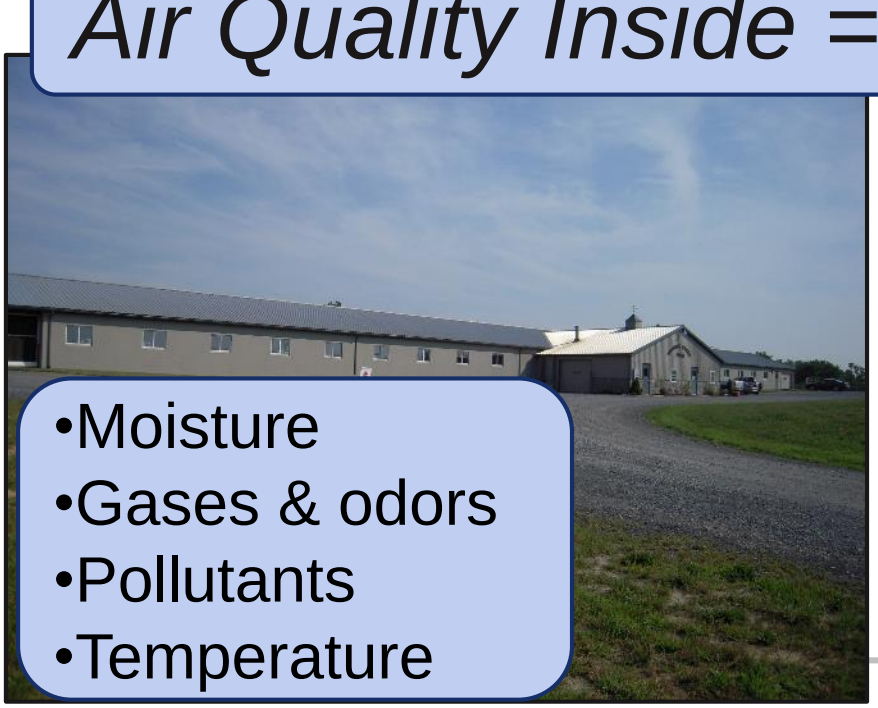
- Maintain excellent air quality
  - Control moisture, gas & pollutant levels
- Protection from weather extremes
  - Protection from cold wind & precipitation
  - Heat stress
- Proper air exchange
  - Seasonal adjustment

Seasonal Air Exchange

- Recommended air exchange rates
  - Cold weather rate: 4 to 6 ACH
  - Mild weather rate: 12 to 15 ACH
  - Warm weather rate: 30 ACH
  - Hot weather rate: 50 - 60+ ACH

ACH = air changes per hour

Air Quality Inside = Air Quality Outside



- Moisture
- Gases & odors
- Pollutants
- Temperature

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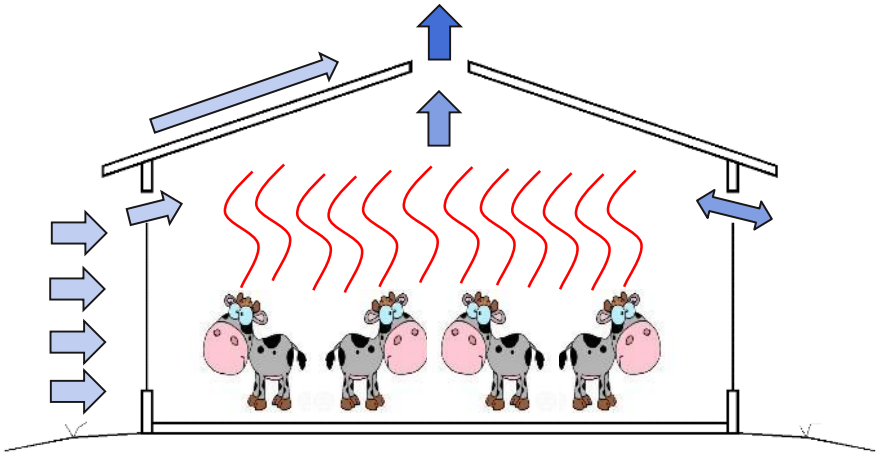
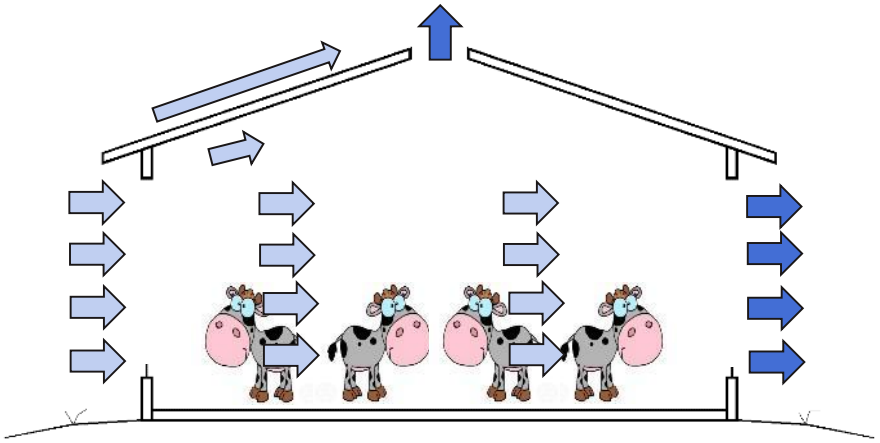
Natural Ventilation Systems

- Wind pressure differences between inlets & outlets
- Temperature differences between inside & outside



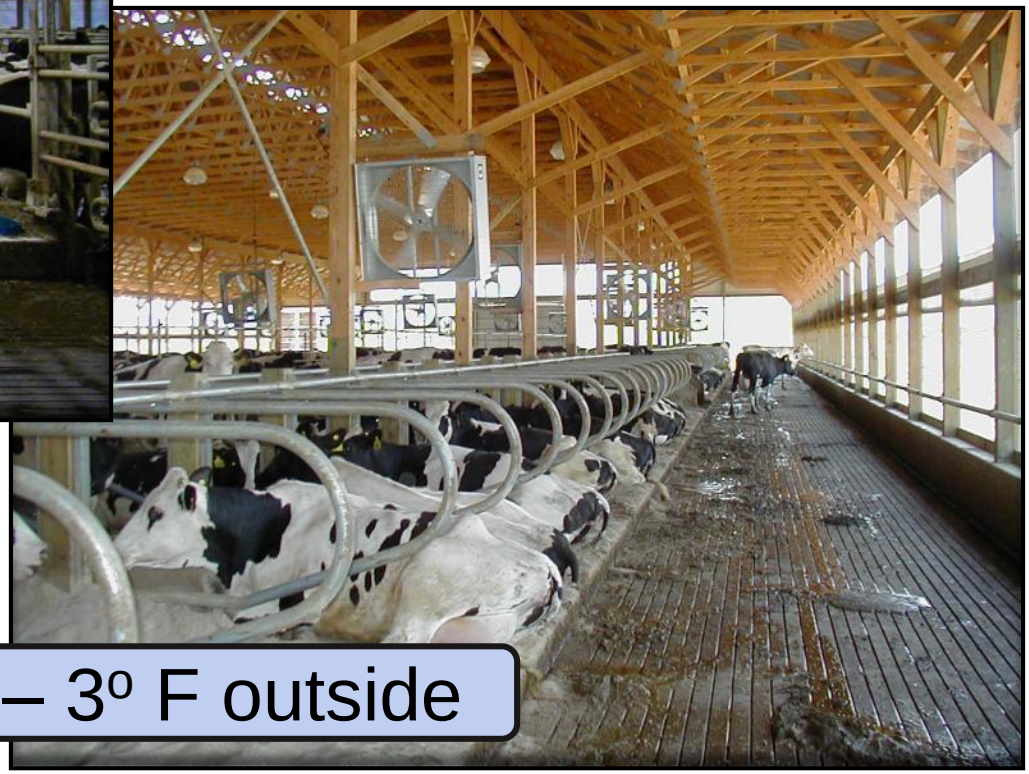


Natural Ventilation

- Orientation to prevailing winds
  - Long axis of building within 45^{o} of wind direction?
- Obstructions upwind
  - Topography? Buildings? Silos? Corn?
  - Minimum 50’ from upwind obstruction
- Available side & end wall openings
  - Wall height? Wall opening? Opening adjustable?
- Ridge opening
  - Minimum 2” per 10’ of building width

Natural Ventilation Management

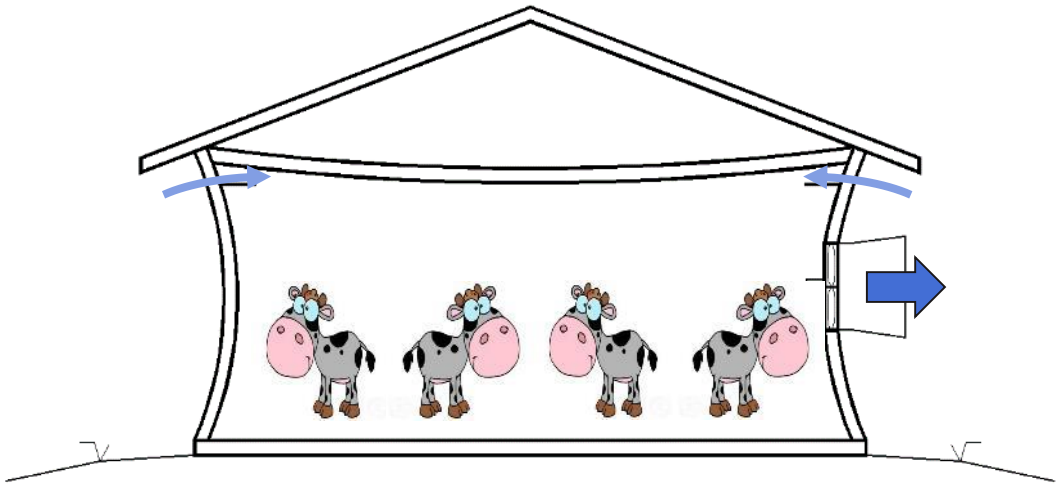
Cold Weather: Within 5 – 10º F outside



Hot Weather: Within 1 – 3º F outside

Mechanical Ventilation

- Exhaust or negative pressure ventilation
  - Fans & inlets create slight negative pressure difference between inside & outside



Mechanical Ventilation Example

- Recommended ventilation rates (Mature Dairy Cow)
  - Cold weather rate: ~ 50 cfm /cow
  - Mild weather rate: ~ 250 cfm / cow
  - Warm weather rate: ~ 500 cfm / cow
  - Hot weather rate: ~1,000 -1,500 cfm

JAMES BARN MAGAZINE 7

How Much Air Does A Cow Need

Does She Get Enough of This Vital Element in Your Barn ?

Have you ever gone to bed and been unable to sleep? And then did you ever pull the covers up over your head and pass away into dreamland before you knew it?

Did you ever stop to think why it was you could win sleep that way? Did you ever stop to think that you had really *dosed* yourself to sleep?

Well, you had. You'd breathed the same air over and over again; you'd taken out of it most of the oxygen, that element which keeps the spark of life glowing; you'd been breathing what was left—carbon dioxide, which in concentrated form is a deadly poison. And as a consequence your heart slowed down, your senses dulled, you went to sleep.

Oxygen is the energy and life-producing element; without it there is no animal life.

Men have lived for forty days without food; for seven days without water; but only for a few minutes without air.

When you build a fire you open up all the drafts, don't you? And why do you open the drafts? To let a lot of air in. And why do you want to let a lot of air in? To make the fire burn, you say. And what is it in the air that makes the fire burn? I'll tell you. It's the oxygen in the air that makes the fire burn.

And now supposing that you check your fire immediately so that little of the smoke and soot can escape up the chimney. What happens?

The fire dies down, doesn't it. Why? Because the smoke and soot choke it. The smoke is the burned air, the air that passing through the fire has had all of its oxygen removed. It is dead air. It is carbon dioxide, the same stuff that put you to sleep in the first paragraph.

Before the fire will burn properly fresh air must be supplied and the dead air (smoke and soot) must be removed.

Just as you cannot long burn coal without supplying oxygen to your furnace, so, too, you cannot digest the food you eat unless you supply your lungs with oxygen.

Air that is breathed once loses much of its oxygen. Breathed over and over again it soon ceases to be of benefit; in fact, it most certainly menaces life.

A constant supply of fresh, pure air is absolutely necessary for the proper functioning of any body, animal and human. It is a thousand times more important than food or water.

cfm = cubic feet per minute

Mechanical Ventilation

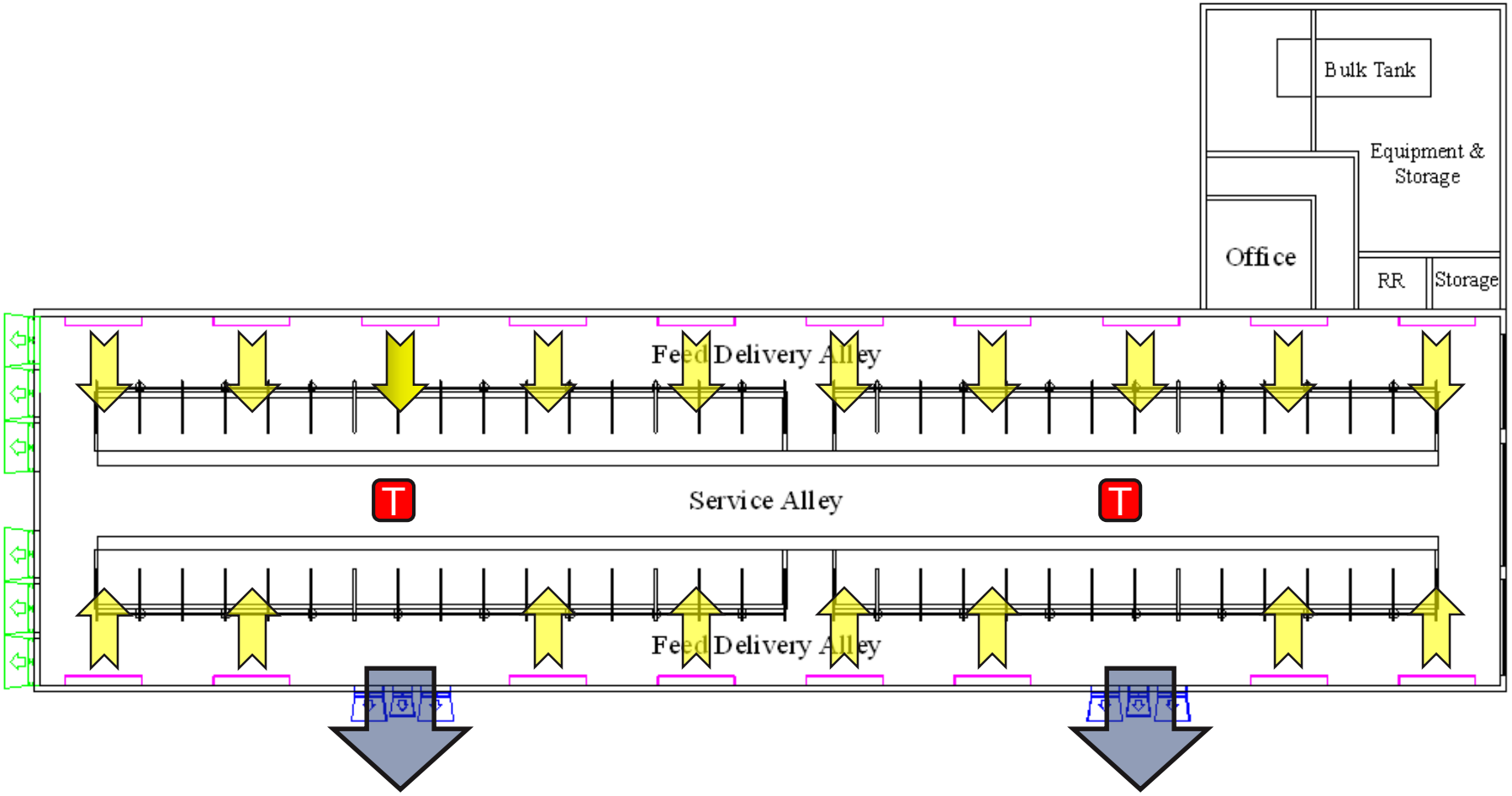
- Design exchange rate range:
  - Infinite from 50 to 1,500 cfm /cow

Multiple Fans

Adjustable Inlets

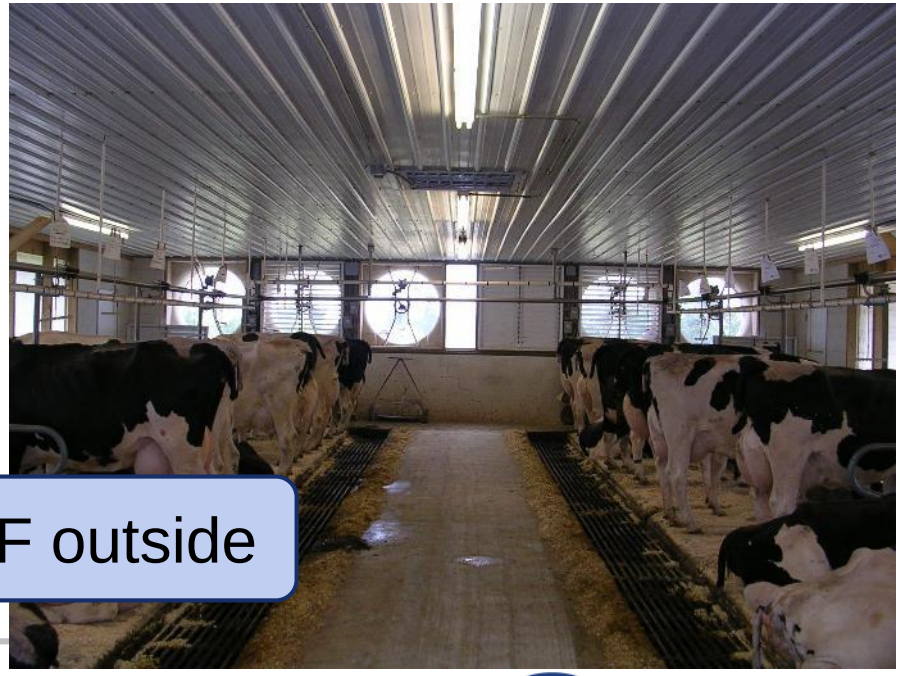
Accurate Controls

Tie Stall Mechanical Ventilation



Tie Stall Mechanical Ventilation Management

Cold Weather: 40 – 60º F

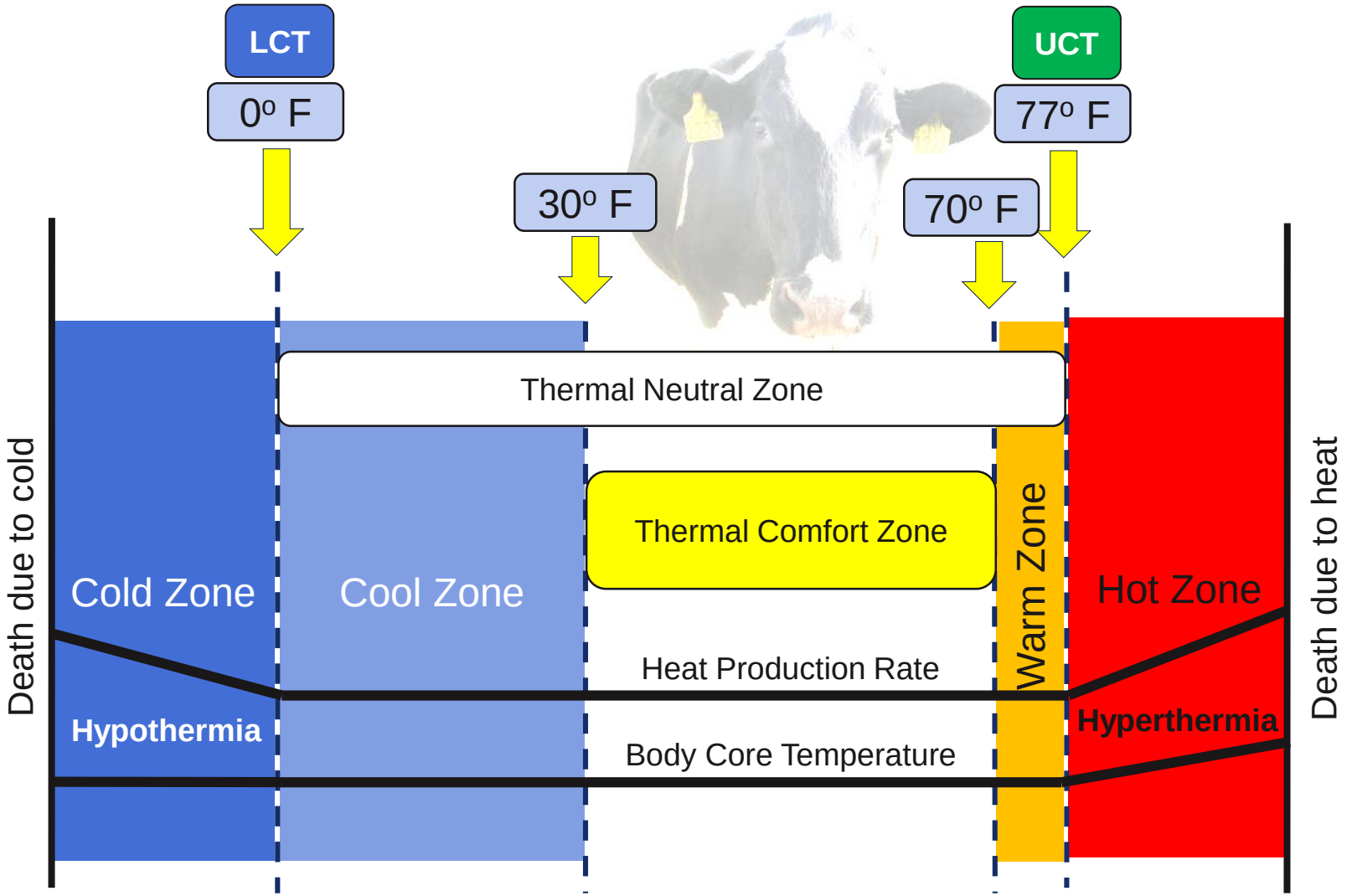


Hot Weather: Within 1 – 3º F outside

Milk production and reproductive efficiency is reduced by heat stress in dairy cattle caused by high ambient temperatures within all ranges of humidity."

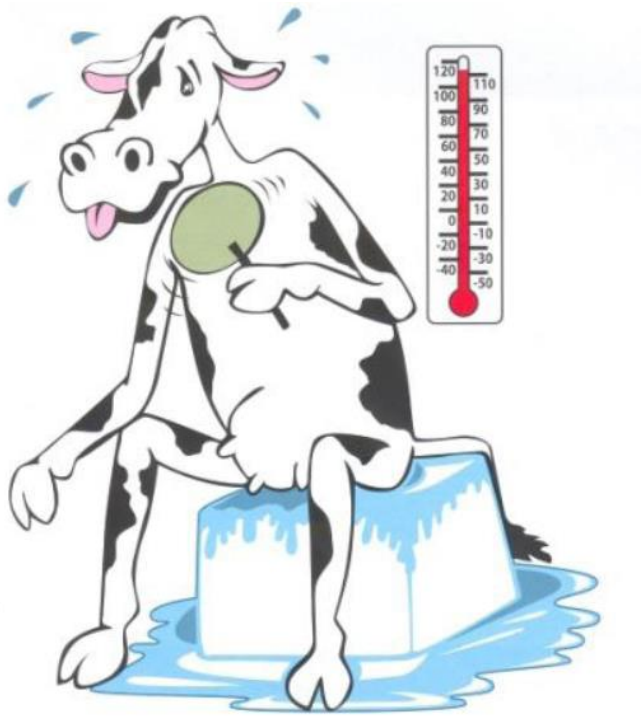
– D. Armstrong, 2000

Cows are Homeotherms



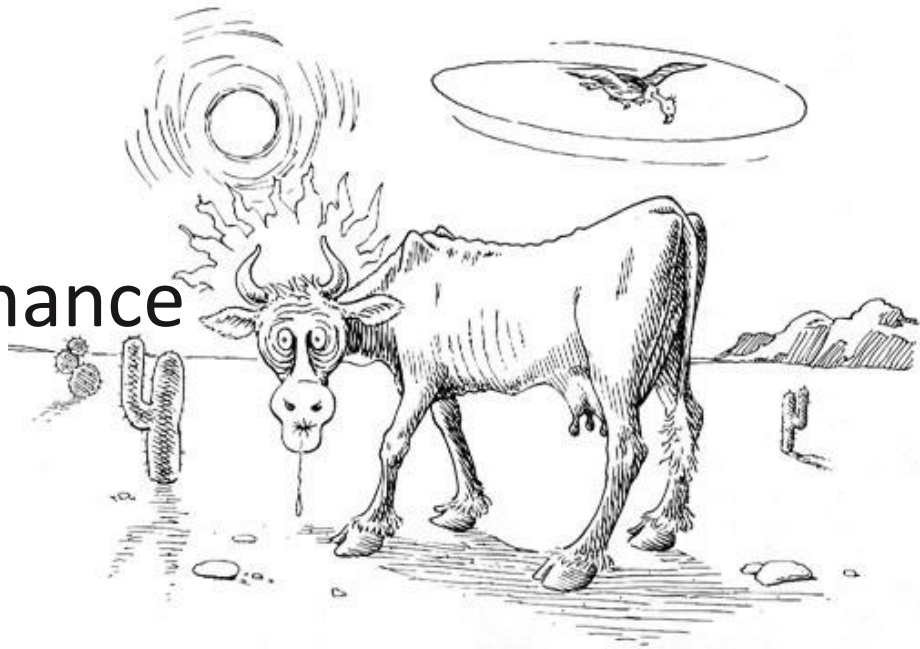
Dairy Cattle Heat Stress

- Cow's heat gain is greater than heat loss
- Time plays a role
  - Goal: Balance heat gain & loss over 24 hr period



Heat Stress Affects Lactating Cows

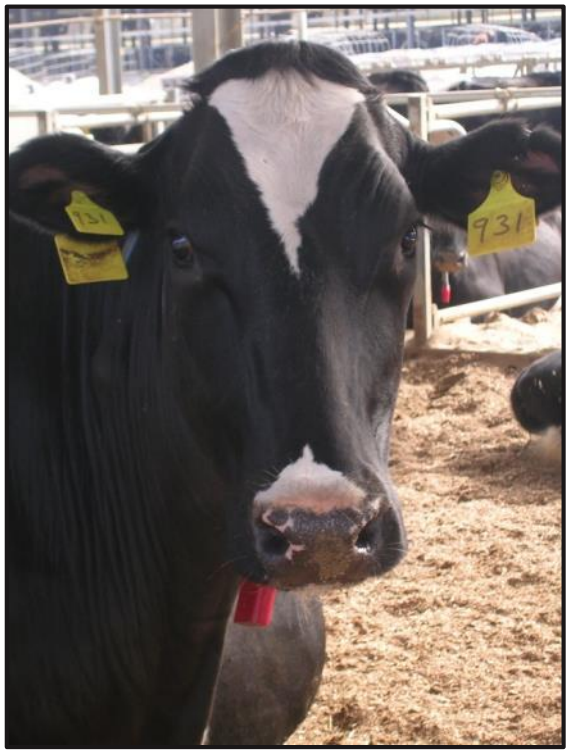
- ↓ DMI
- ↓ Milk Production
- ↓ Reproductive Performance
- ↑ Lameness



Stress is cumulative

Heat Stress Affects Dry Cows

- ↓ Milk in subsequent lactation
- ↓ DMI, BW & BS during dry period
- ↓ Immune status during transition



Source: Dahl, 2014

Heat Stress Affects Unborn Calves

- ↓ Birth weight
- ↓ Immunoglobulin G (IgG)
- ↓ Immune status early life
- ↓ Heifer performance

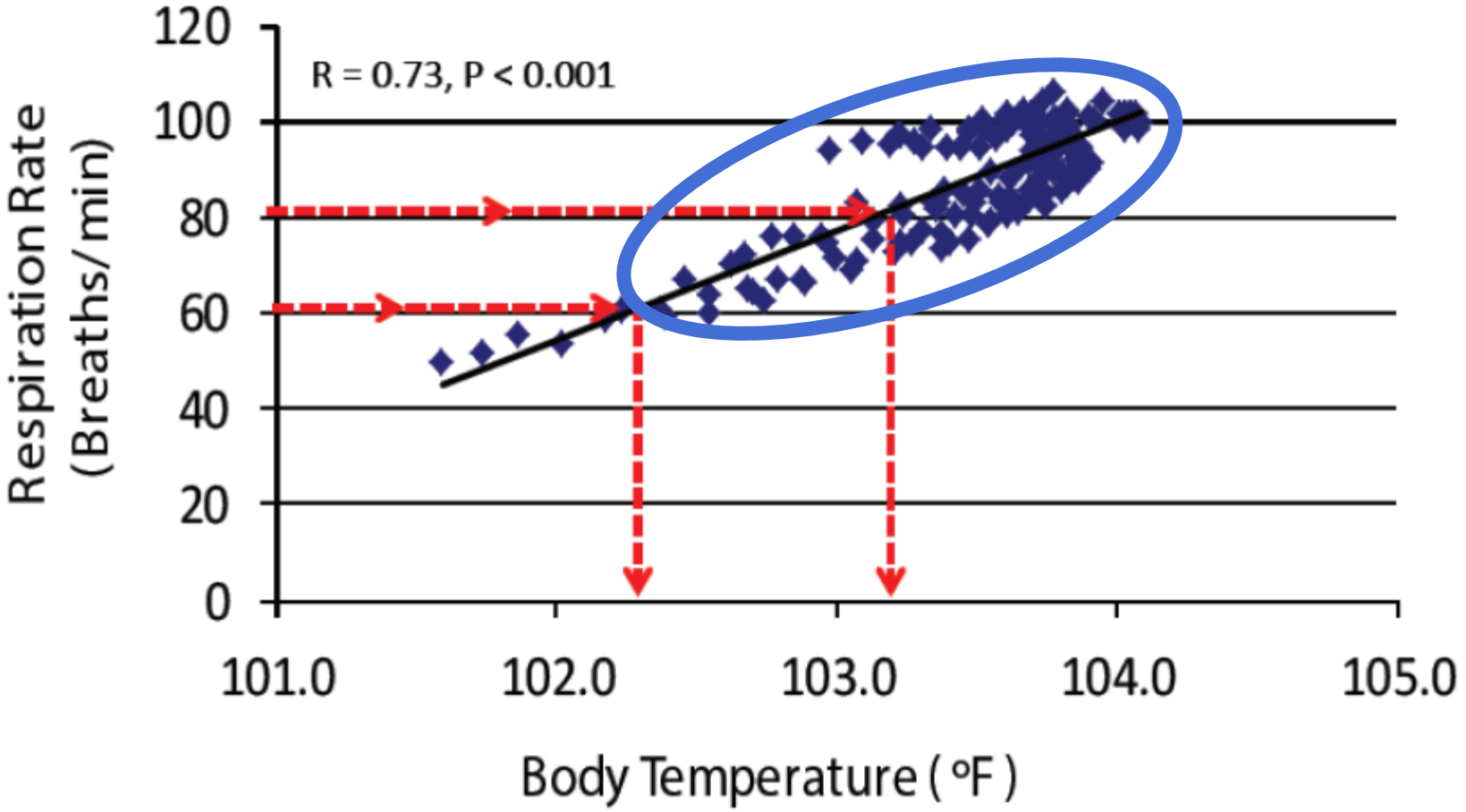
Source: Dahl, 2014

Need Heat Stress Abatement?

- Check rectal temperatures
  - Select 10 cows on a hot day & take temperatures
  - If 8 out of 10 exceed 102.5^{o} F hot – they need it!
- Count respiration rates
  - Select 10 cows on a hot day & count breaths/minute
  - If respirations are over 80 bpm– they need it!
- Check DMI & milk production in hot weather
  - If DMI & MP drop 10% in hot weather – they need it!

Source: D. Bray & R. Bucklin, U of Florida

Need Heat Stress Abatement?



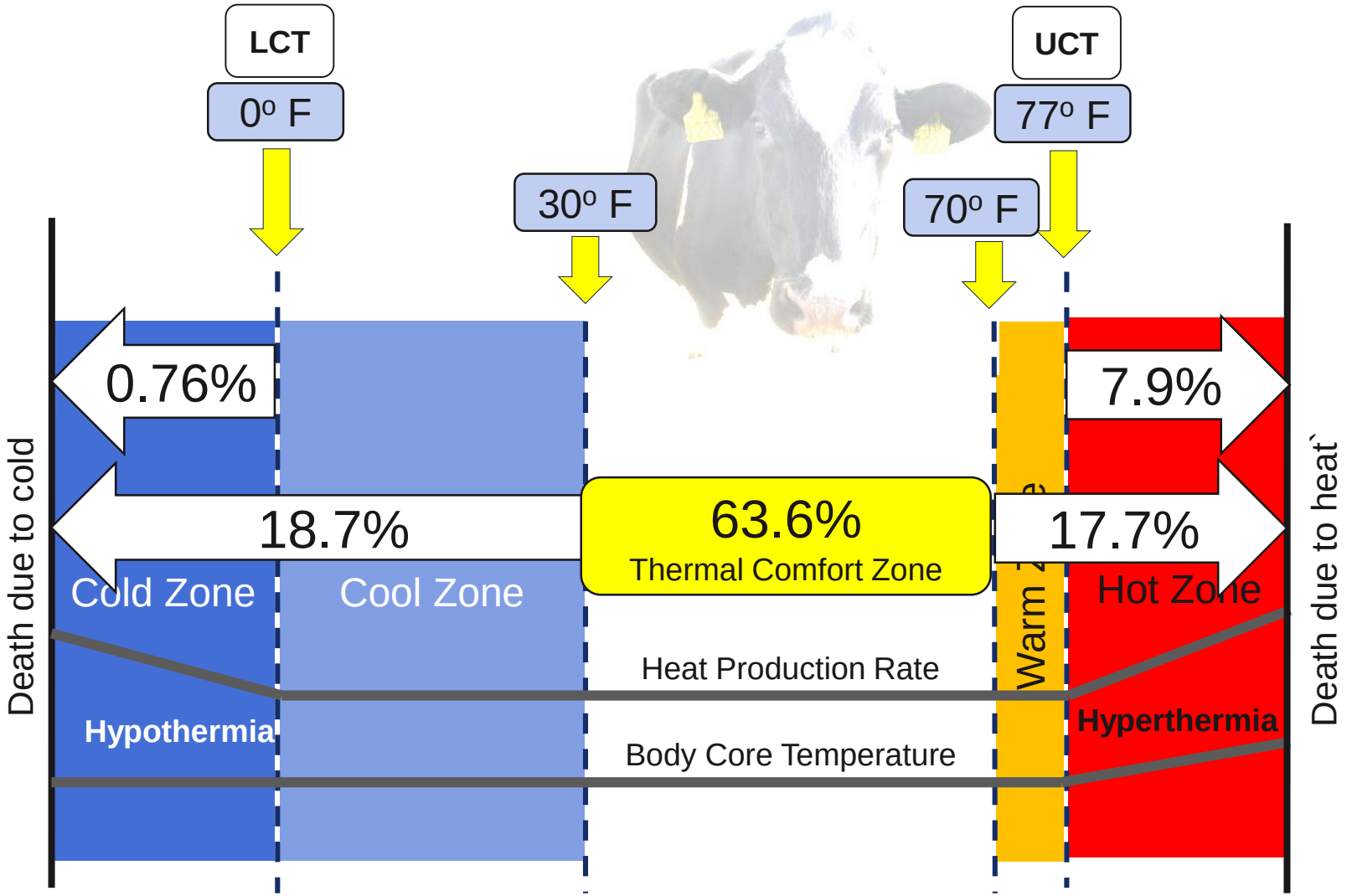
Cow Climate in Burlington, VT

- Weather Data from Burlington Airport
  - Latitude/Longitude: 44.4683°, -73.1499°
  - Jan 1, 2016 – Dec 31, 2020 (5 yrs)

- Hourly data
  - Dry Bulb Temp, Relative Humidity
  - 43,790 data points (1 per hour)
    - 58 hrs of data missing
    - 99.9% complete

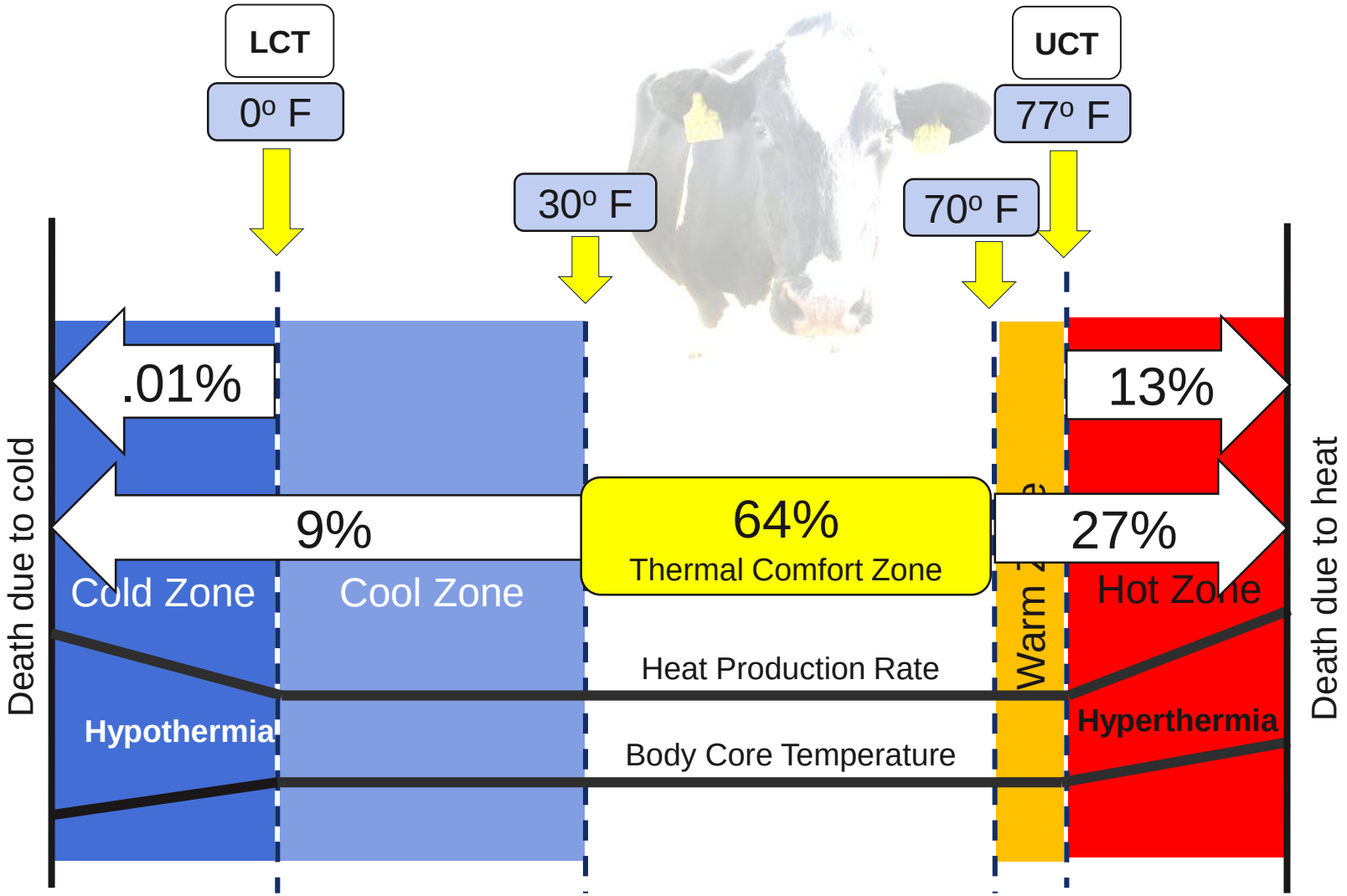
Source: NOAA: National Centers for Environmental Information

Temperatures Near Burlington, VT



Burlington, VT (2016-2020)

Temperatures Near Middletown, PA



Middletown, PA (2015-2019)

Data prepared by John Tyson

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Temperature Humidity Index (THI)

$$THI = T_{db} - (0.55 - 0.55\ RH)\ (T_{db} - 58)$$

Dairy cows are stressed when **THI > 72**

High production dairy cows are stressed when **THI > 68**

Pregnancy loss as soon as **60 – 64 THI**

THI does not take radiation or air speed into account

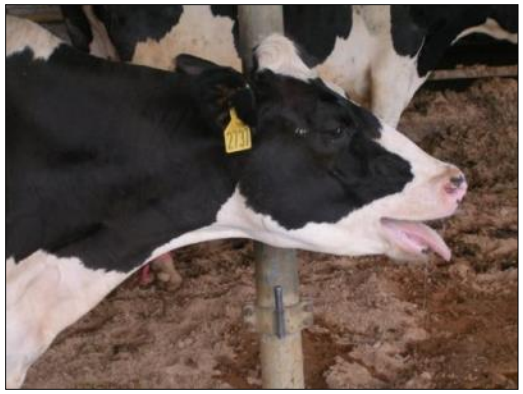
Percentage of Hours at THI …

THI	Burlington
≥62	31%
≥65	27%
≥68	18%
≥72	10%
≥76	4%
≥80	0.6%

Source: NOAA: National Centers for Environmental Information
Hourly Weather Data Jan 1, 2016 through Dec 31, 2020

Reducing Heat Stress

- Shade
- Air
  - exchange
  - movement
- Water
  - drinking
  - cooling



Air Exchange

- Controls levels of moisture, gases, pollutants & heat
  - Warm, moist, stale air out
  - Fresh, dry air in
- Exchange driven naturally and/or mechanically
  - At least one air change per minute
- Inside T_{db} approximately 1 to 3ºF shaded outside T_{db}

All other heat stress abatement methods limited by poor air exchange

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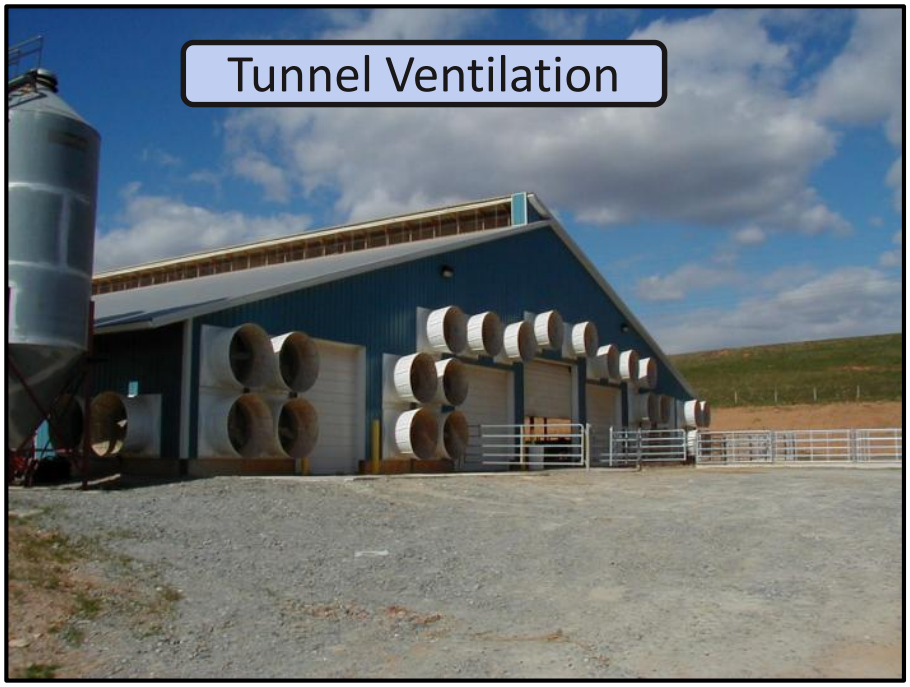

Tunnel Ventilation


Cross Ventilation


Hybrid Ventilation

Forced Convection

- Helps carry heat away from cow's body
  - Turbulent air movement around cow's body
- Increases rate of evaporation
- 3 ½ - 5 mph (308 -440 fpm) required

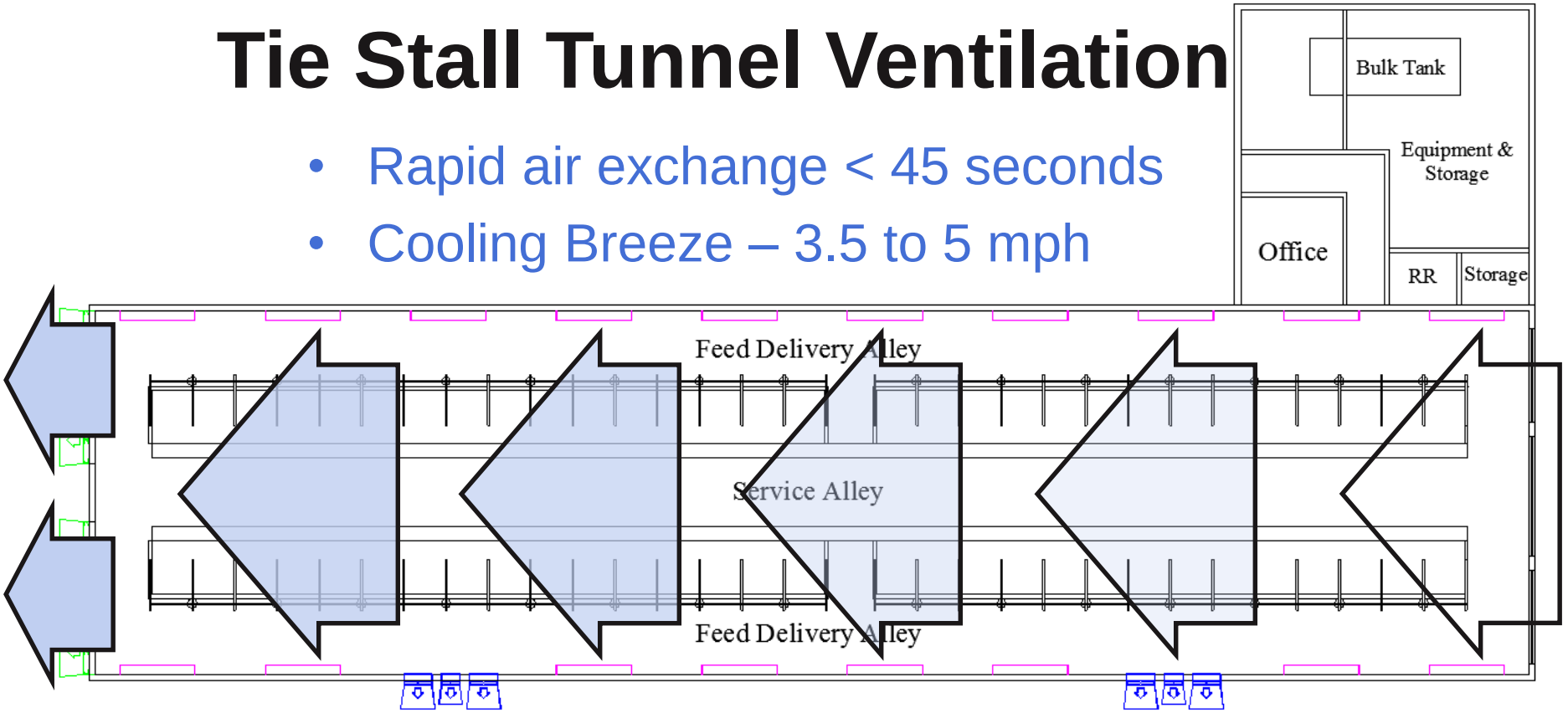
Axial Circulation Fans

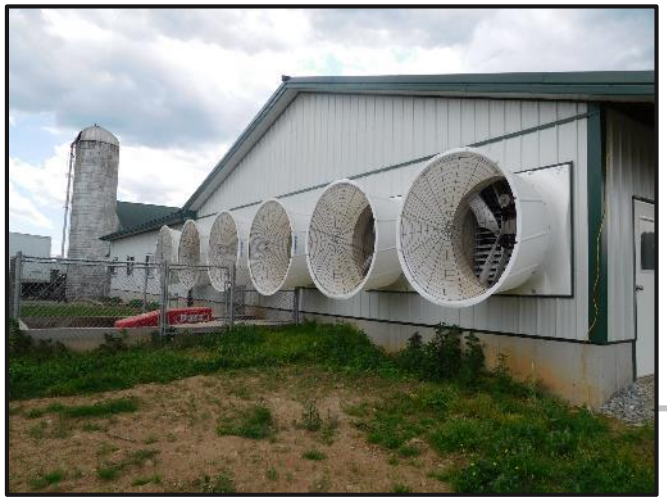
Fans over each freestall row

Fans at the feeding area

Tie Stall Tunnel Ventilation

- Rapid air exchange < 45 seconds
- Cooling Breeze – 3.5 to 5 mph

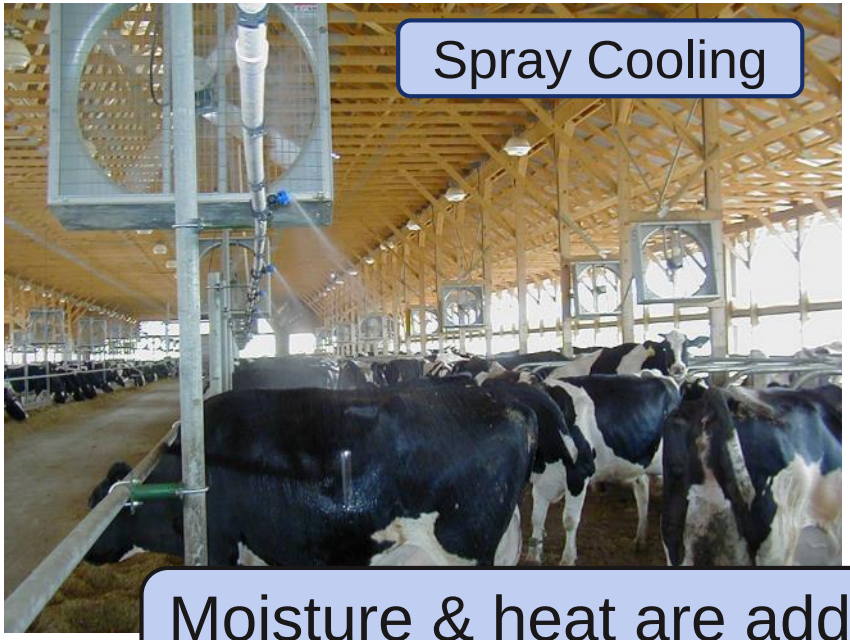




Water for Drinking

- Cows may drink 25% more during hot weather

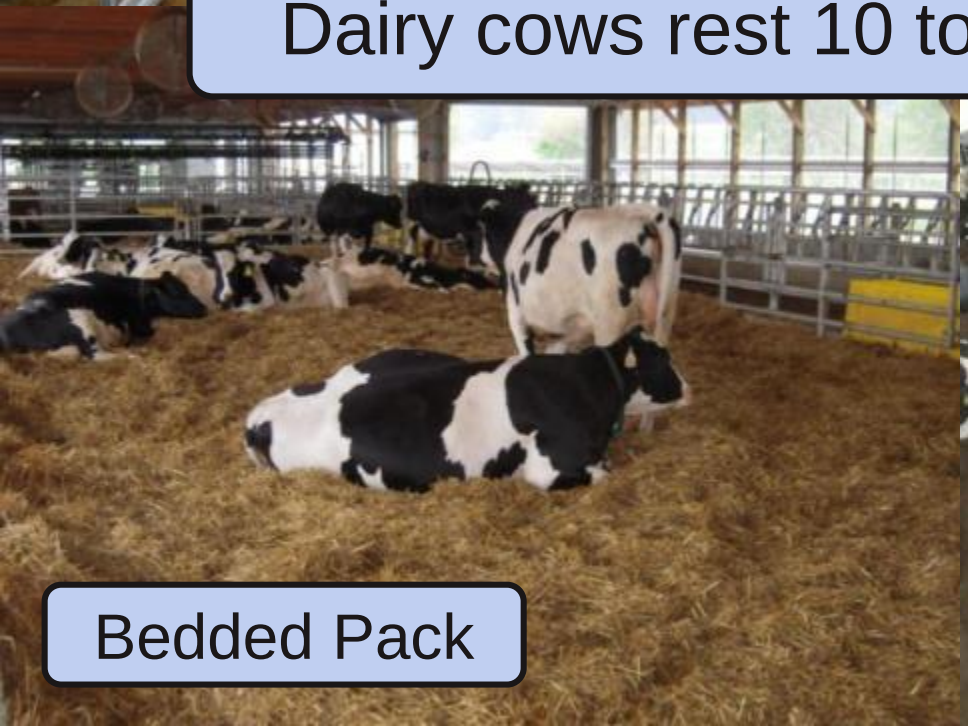
Water for Cooling



Moisture & heat are added to the animal space

- Good air exchange & forced convention are essential

Dairy cows rest 10 to 14 hours per day



Indicators of Resting Area Comfort

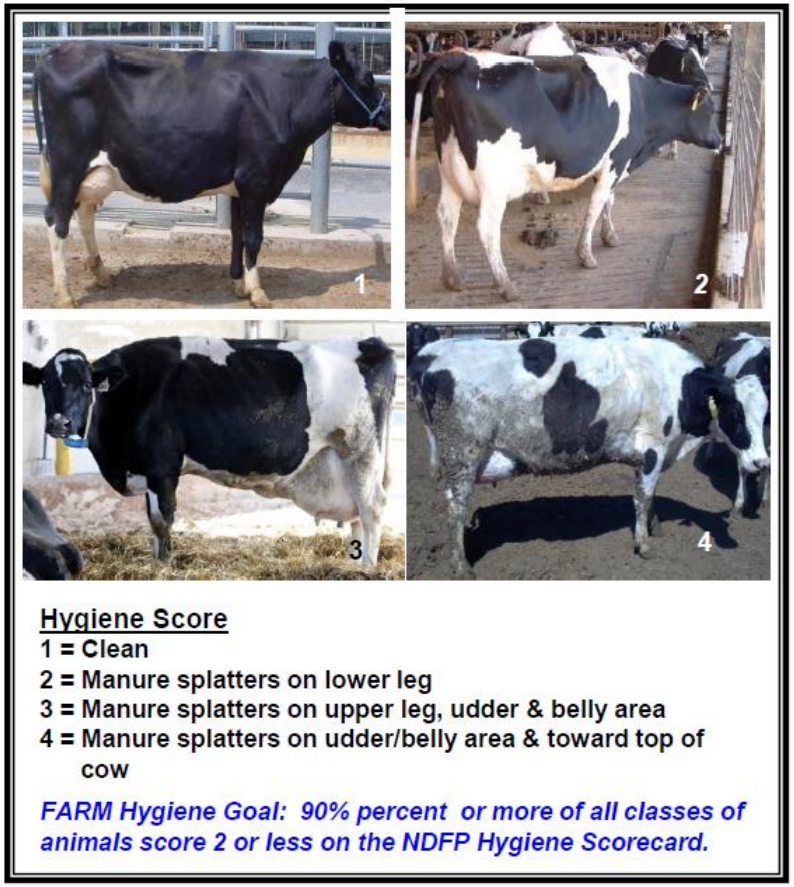
- Locomotion
  - Indicator of stall use, reluctance & refusal

Indicators of Resting Area Comfort

- Hock & knee lesions
  - Indicator of resting surface cushion, comfort & condition

Indicators of Resting Area Comfort

- Hygiene
  - Indicator of stall & cow alley management

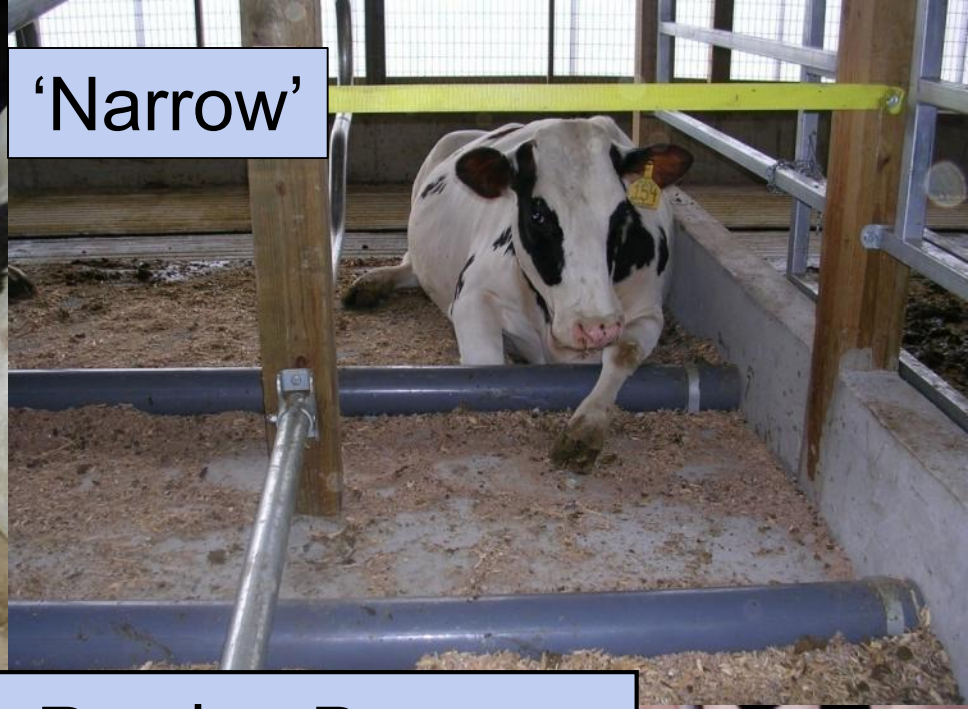


Benefits of a Quality Resting Area

- Reduced stress on feet
- Less injuries
- Cleaner cows
- Increase longevity
- Improved milk production

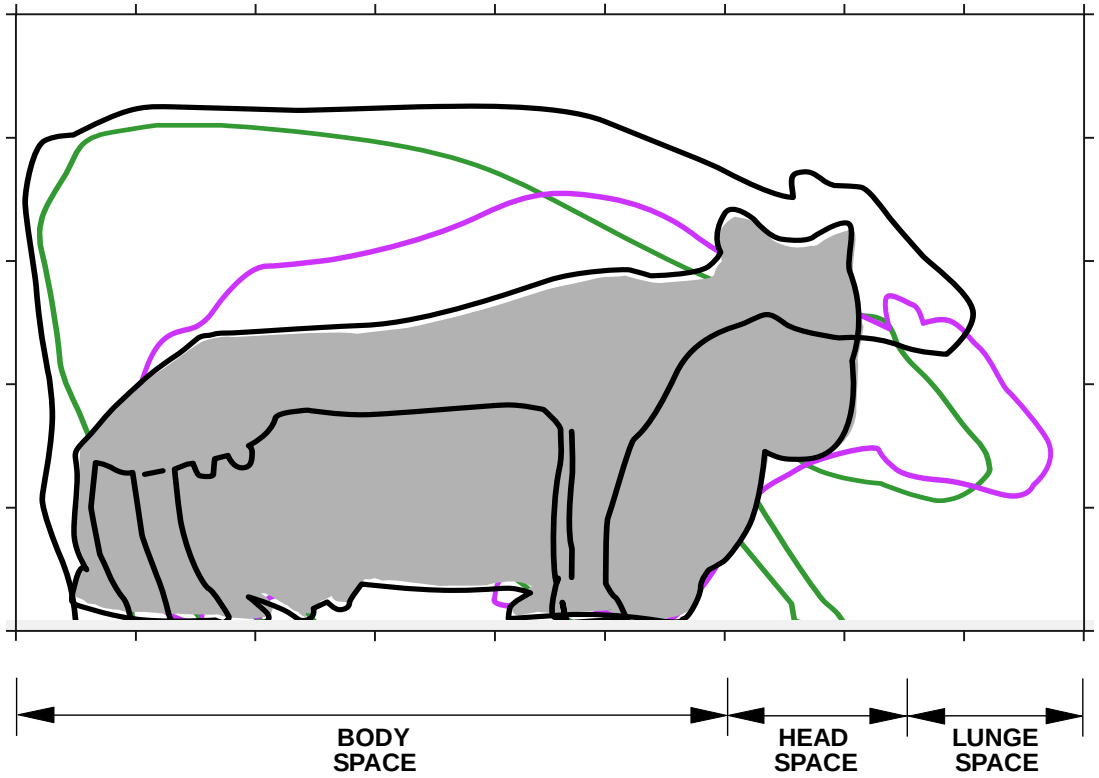
"The greatest effect of poor stall design may be on lame cows within any given herd." - Marin et al. (2007)

Common Bovine Resting Postures



Physical Freestall Components

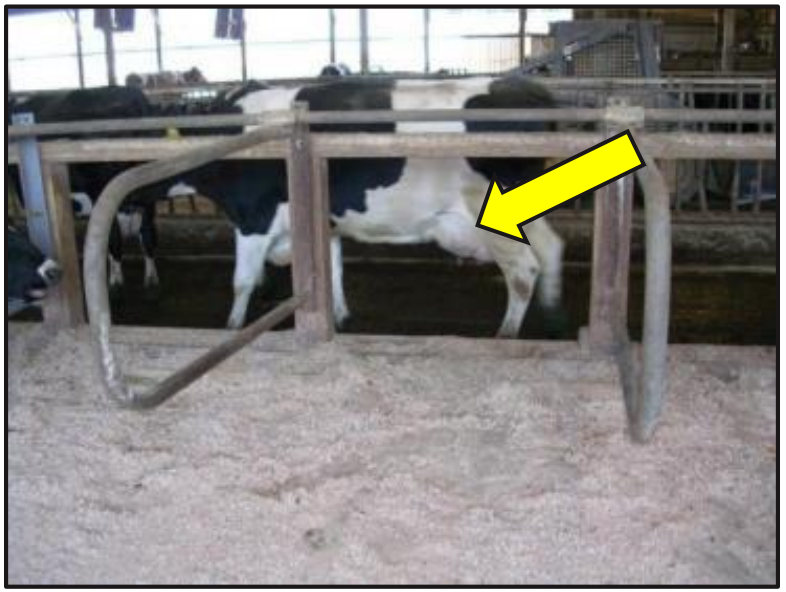
- Dimensions
- Structure
- Stall Bed
- Bedding



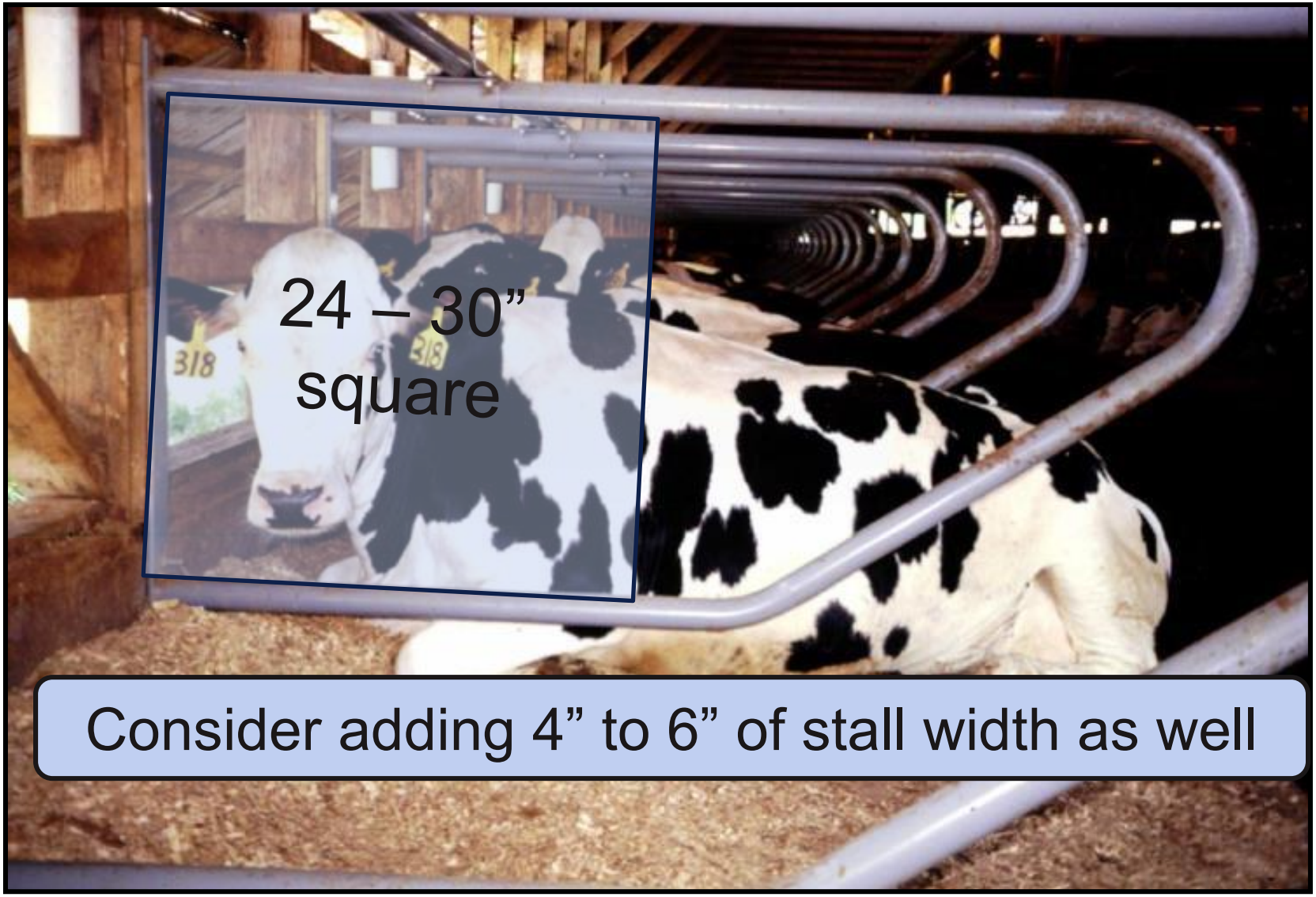
Freestall Dimensions

- Freestall length
  - Closed-front freestalls - 8’-6” to 9’-6”
  - Open-front freestalls - 7’-6” to 8’-6”

Determined by the LARGEST cow in the group



Can’t add length?



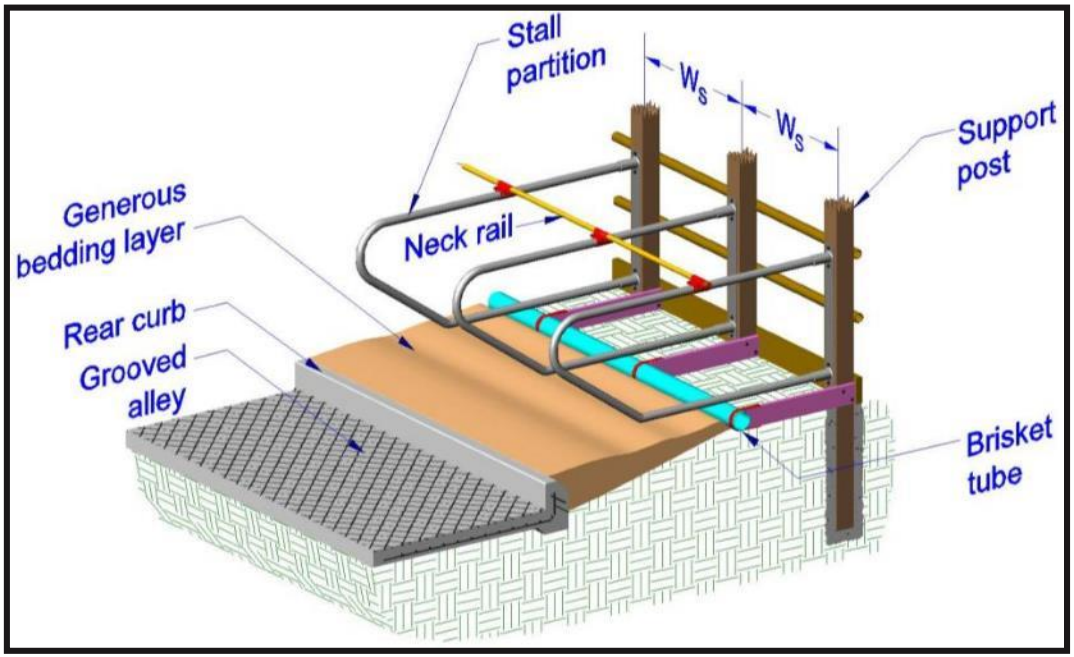
Freestall Dimensions

- Freestall width
  - 48” – 52” center-to-center

Determined by the LARGEST cow in the group

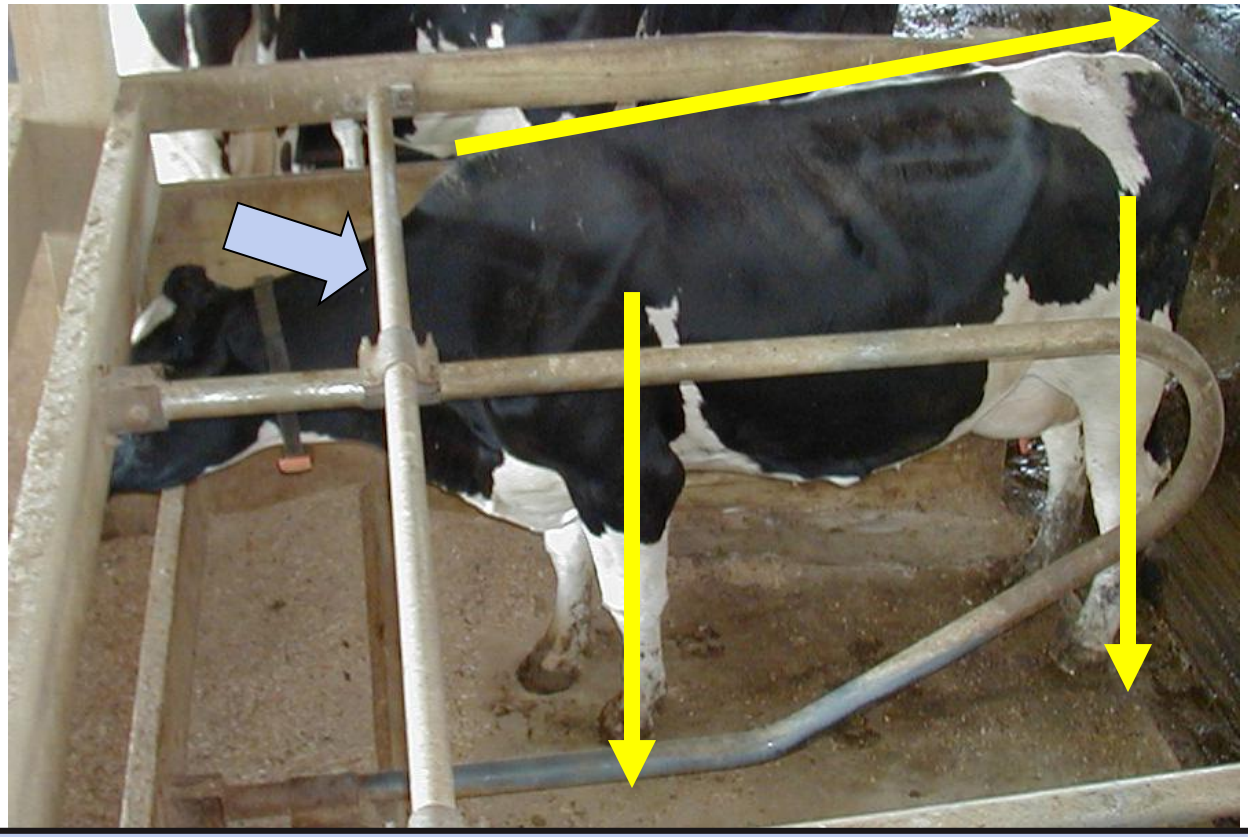
Freestall Structure

- Stall divider
- Stall divider support
- Neck Rail
- Brisket locator



Freestall Structure

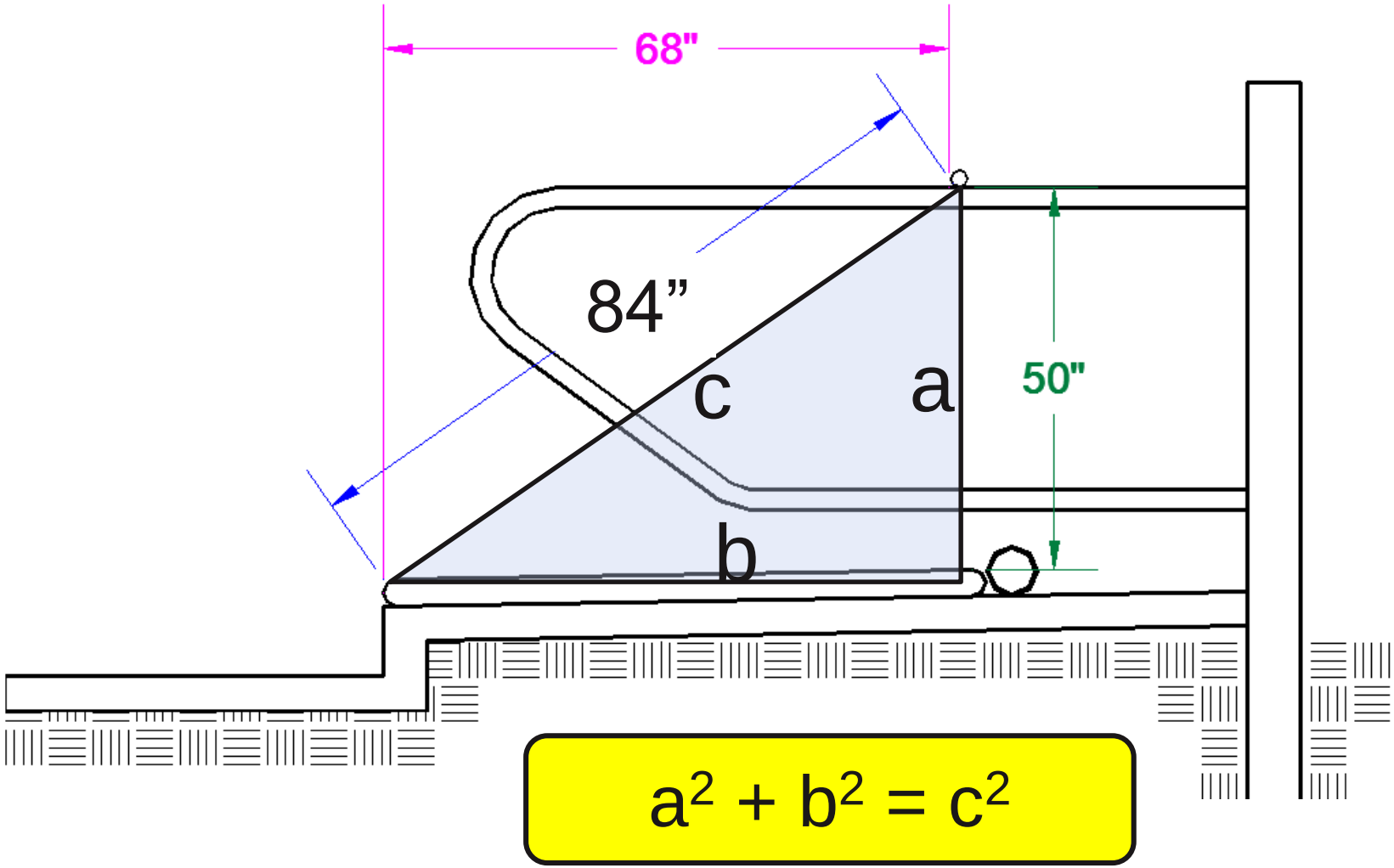
- Neck rail
  - Discourages cow from moving too far forward



Positon for the LARGEST cow in the group

Improper Neck Rail Position

Neck Rail Location



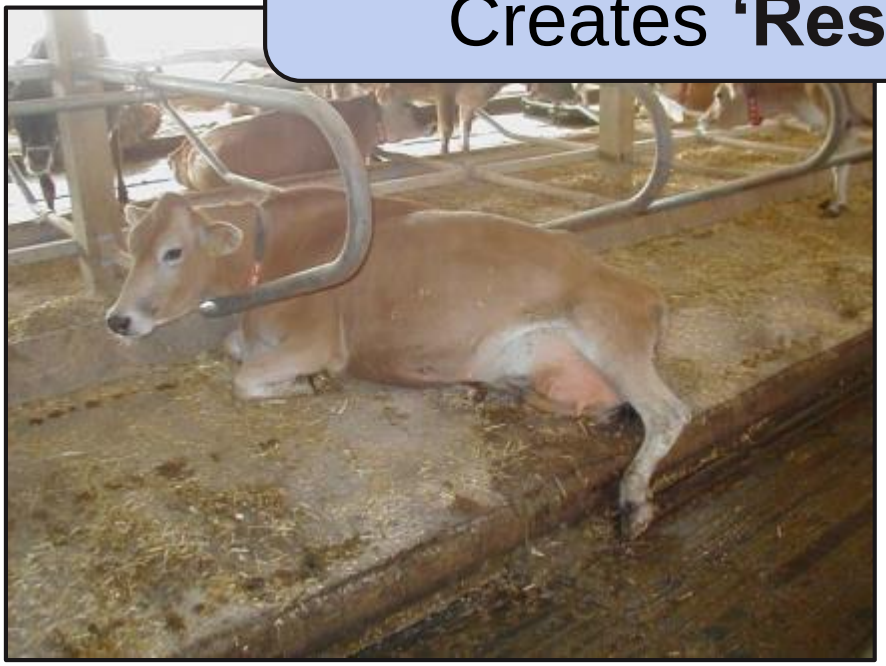
$$a^2 + b^2 = c^2$$

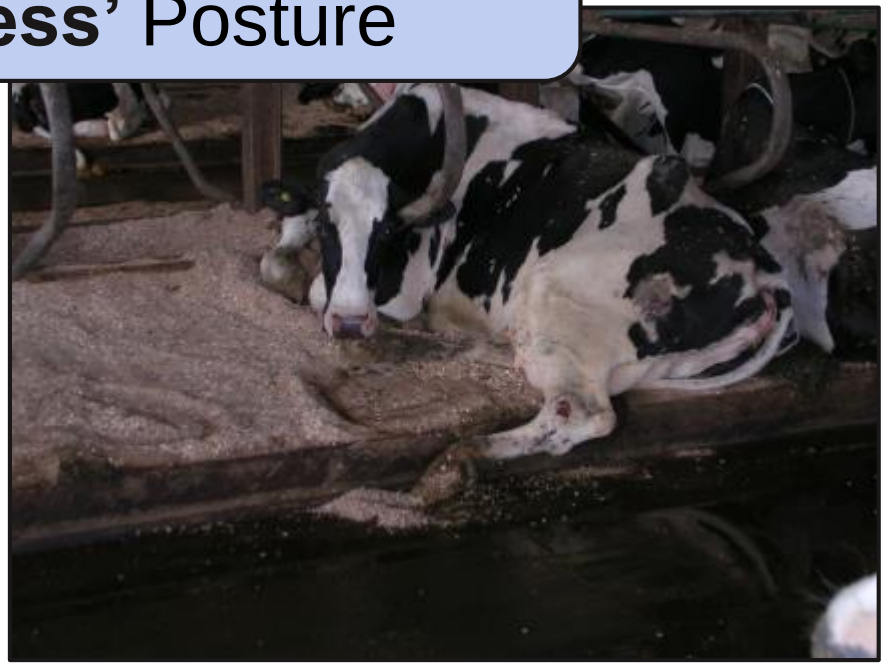
Brisket Locator Position

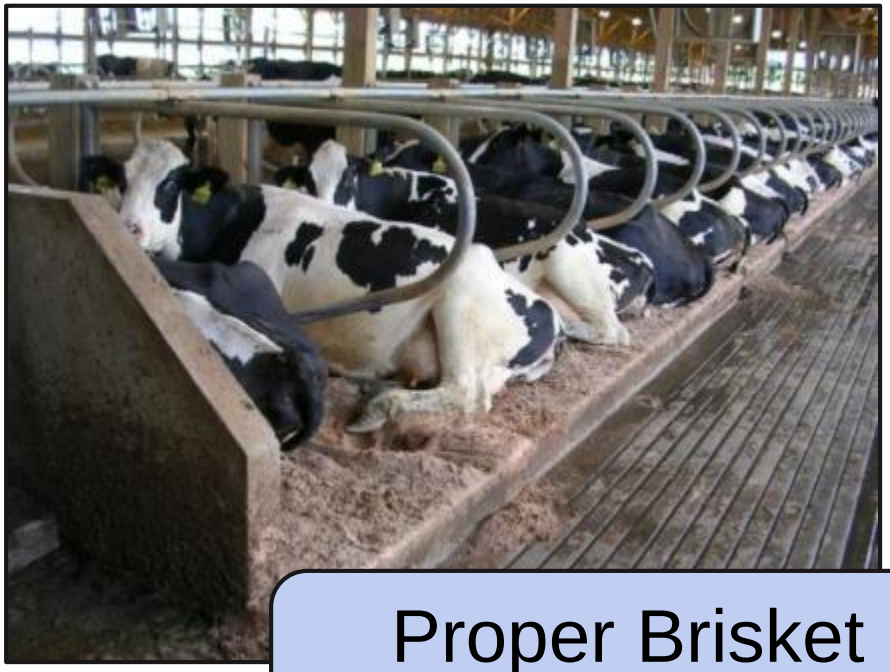
- Discourages forward movement when resting
- Adequate body space for comfortable resting

Positon for the LARGEST cow in the group

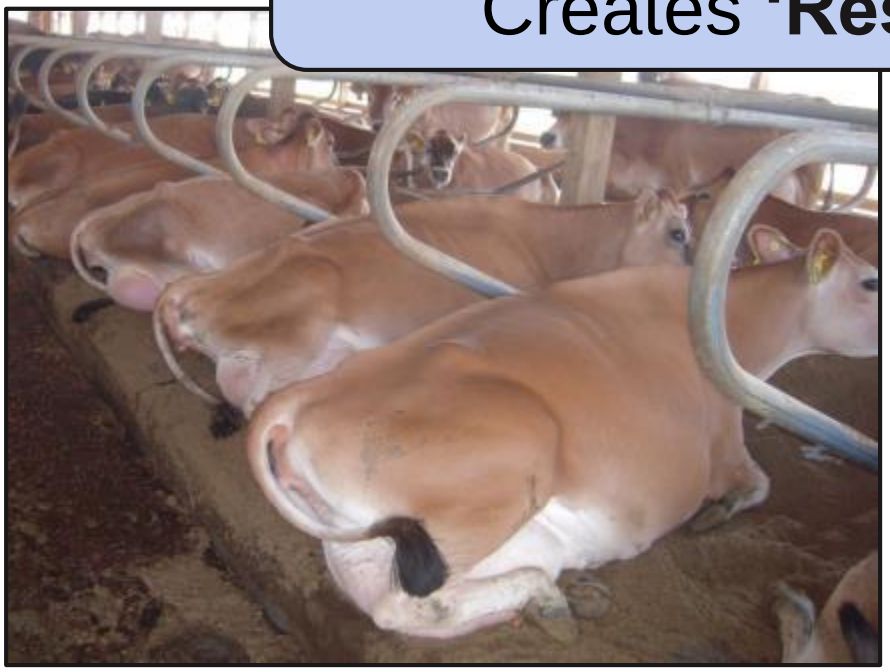
Improper Brisket Locator Position Creates '**Restless**' Posture

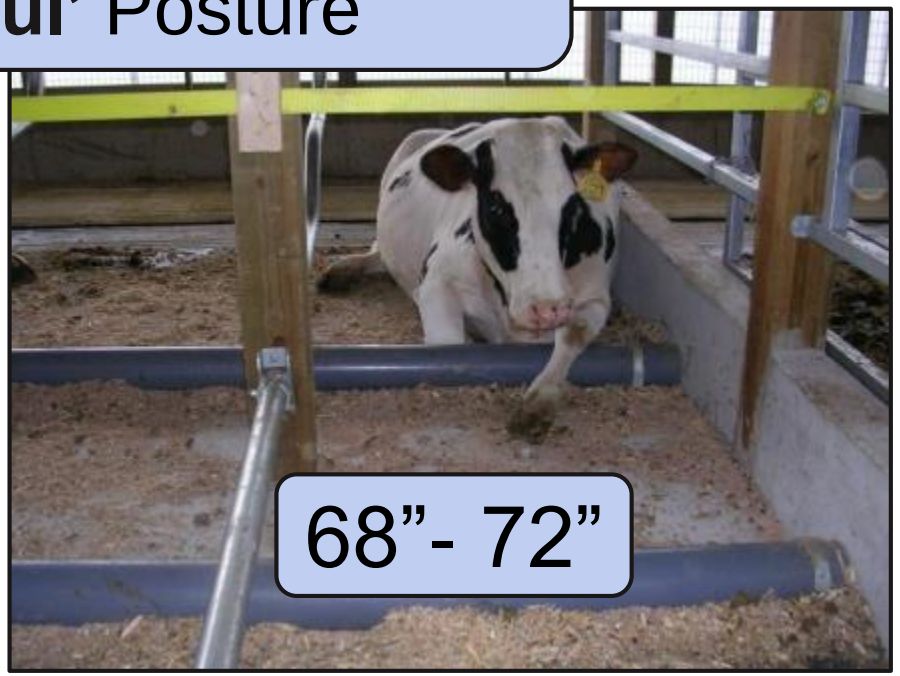


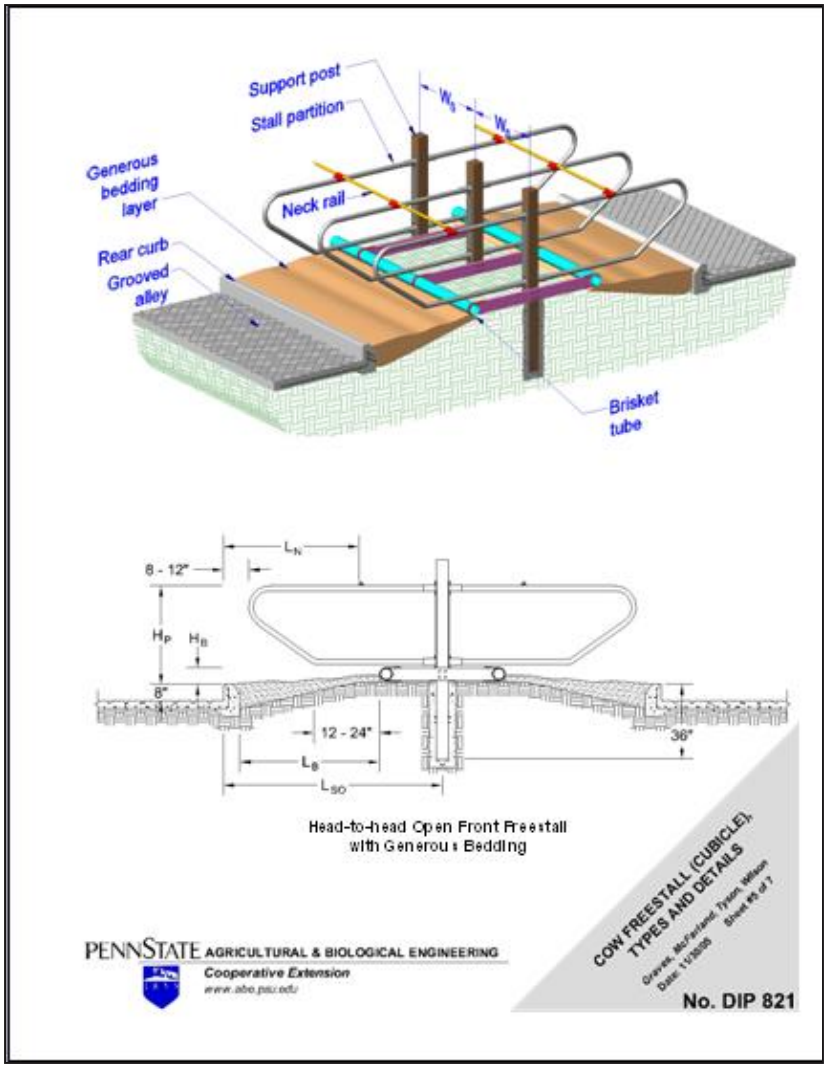


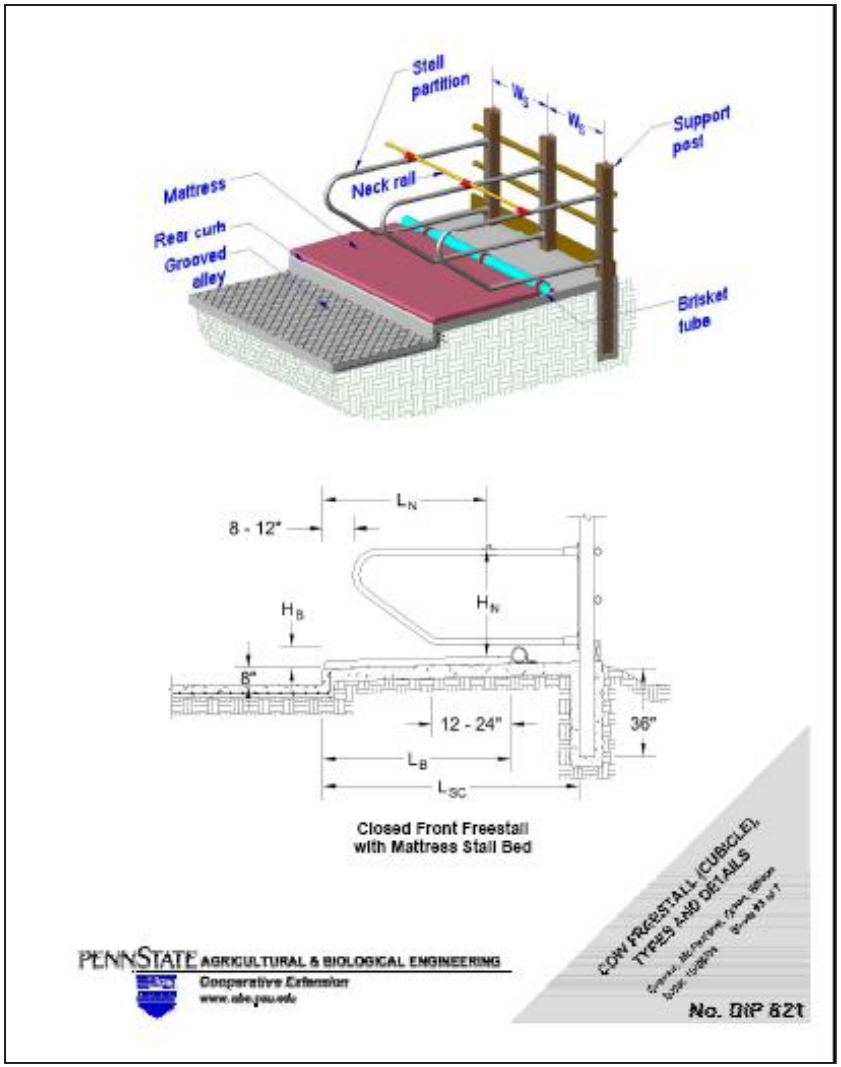


Proper Brisket Locator Position
Creates '**Restful**' Posture







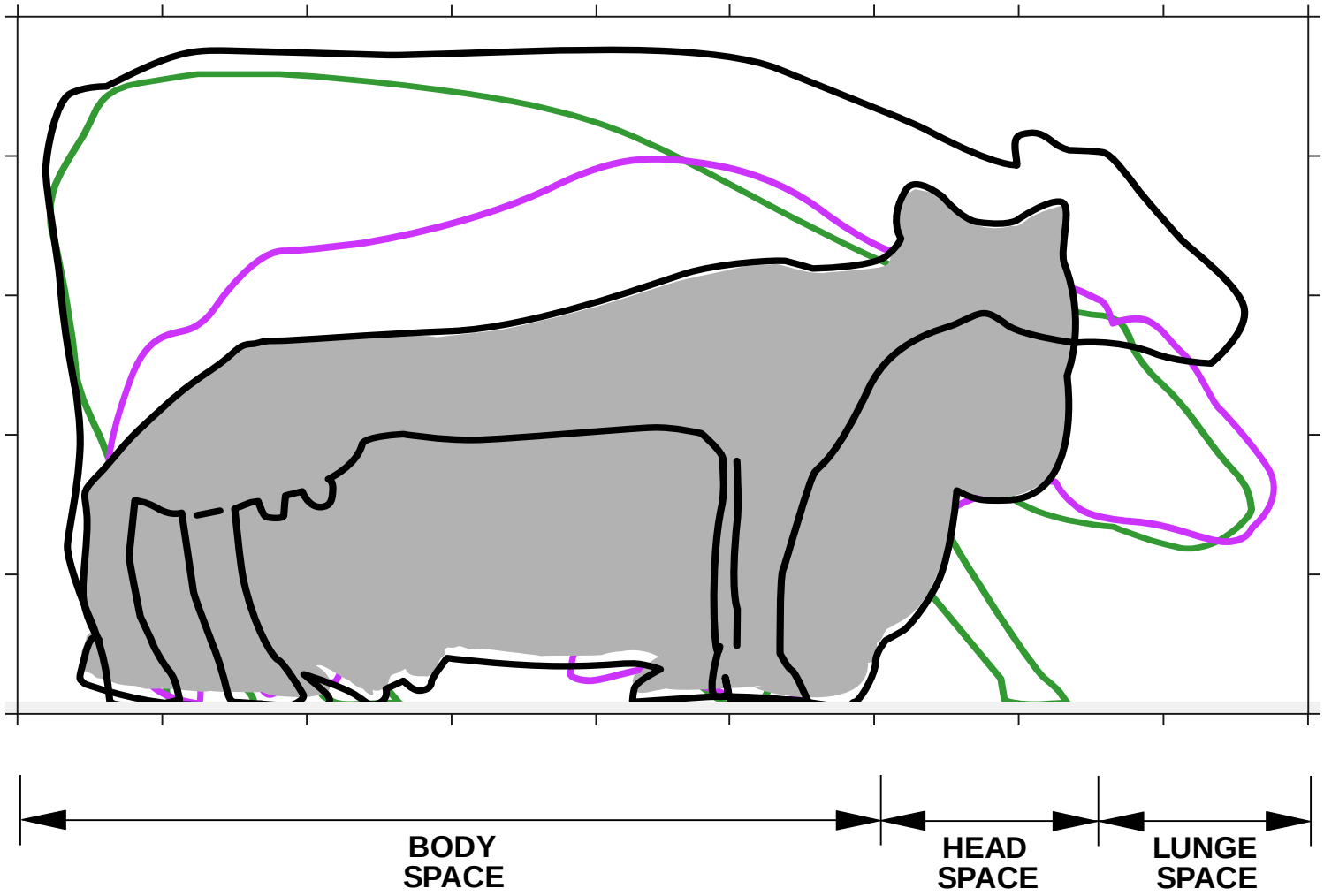


http://www.abe.psu.edu/extension/ip/dairyideaplans.html

Can you tell the difference between a 'freestall' cow and a 'tie stall' cow?

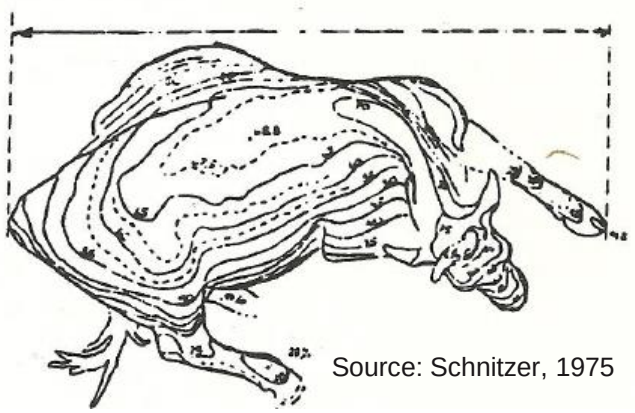
Tie Stall Dimensions

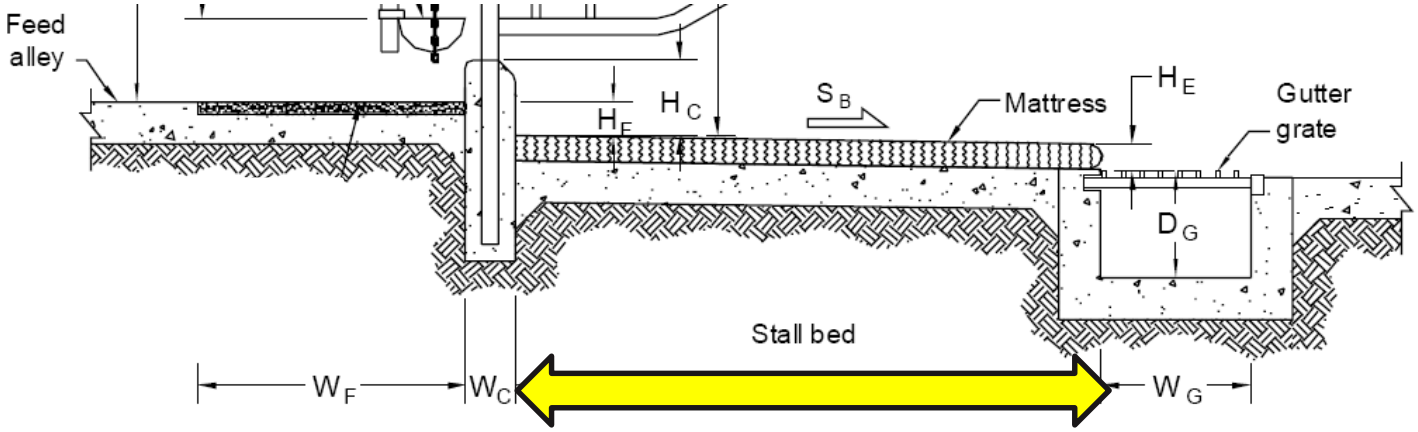
- Provide adequate body, head & lunge space

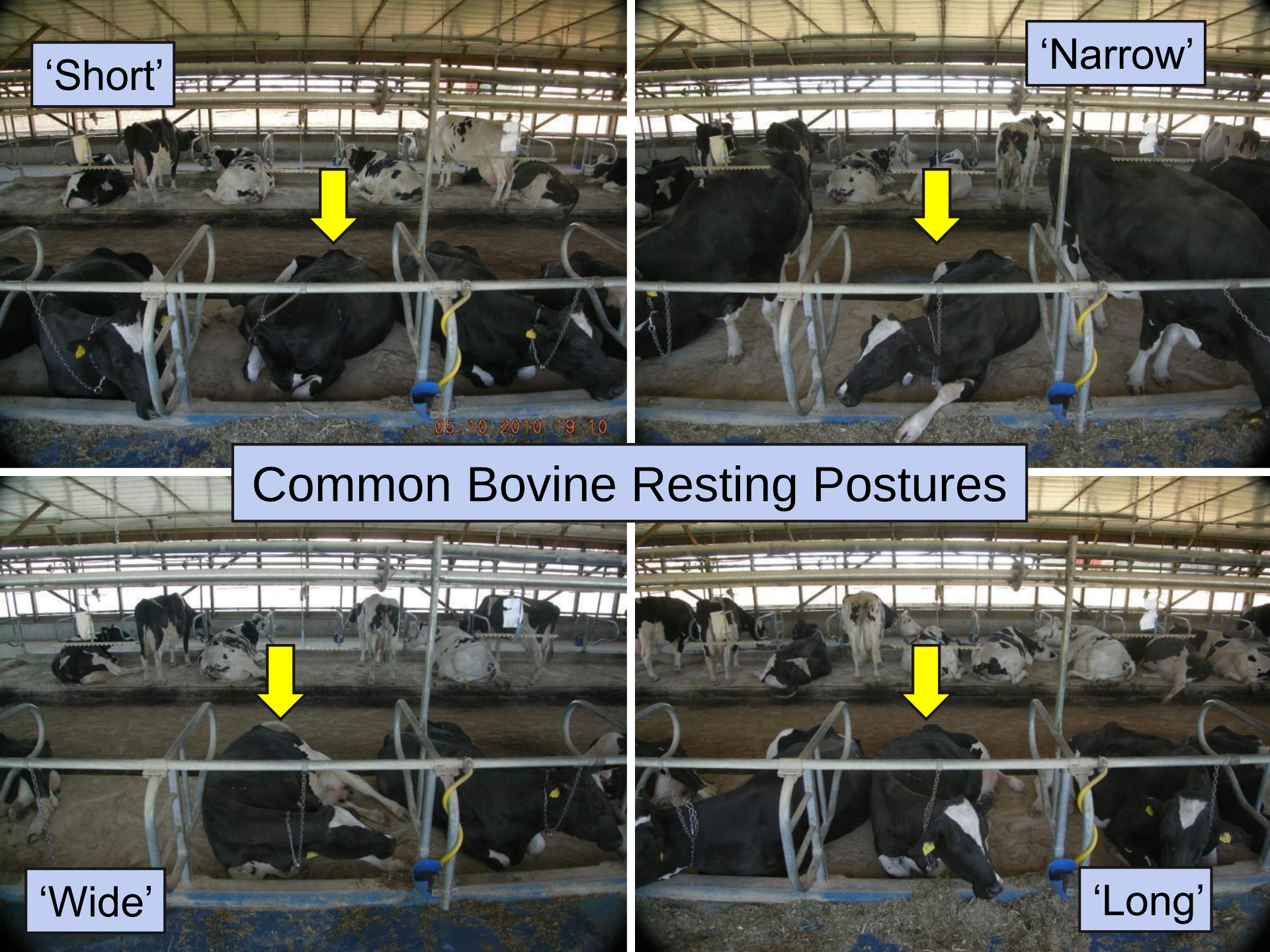


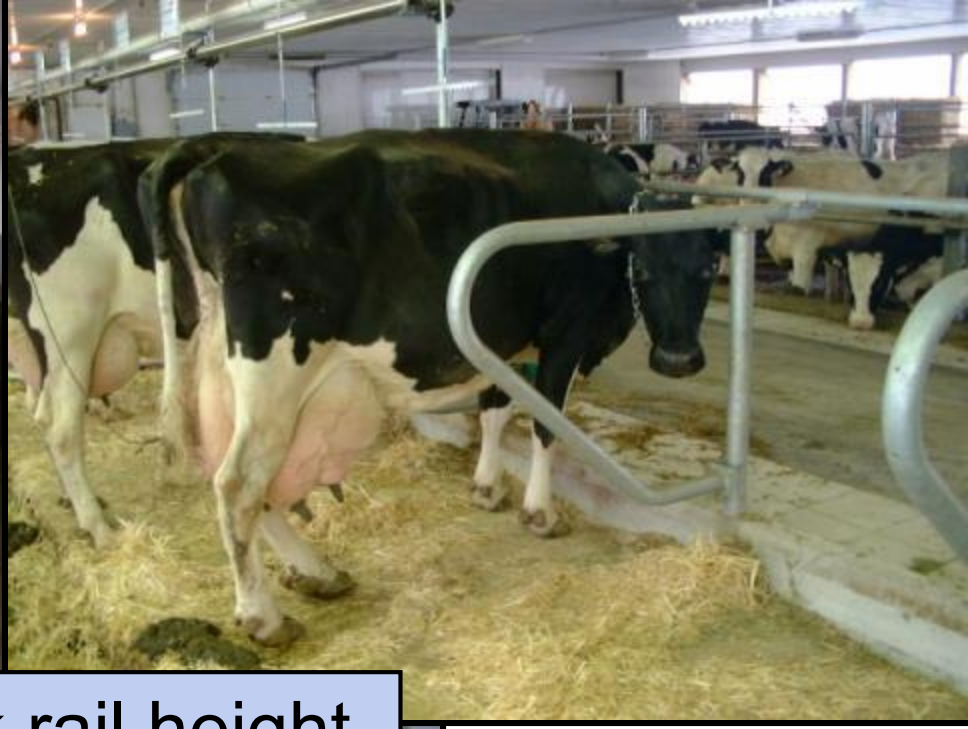
Tie Stall Length

- Large-frame breeds
  - 68” to 72”
- Medium-frame breeds
  - 64” to 68”

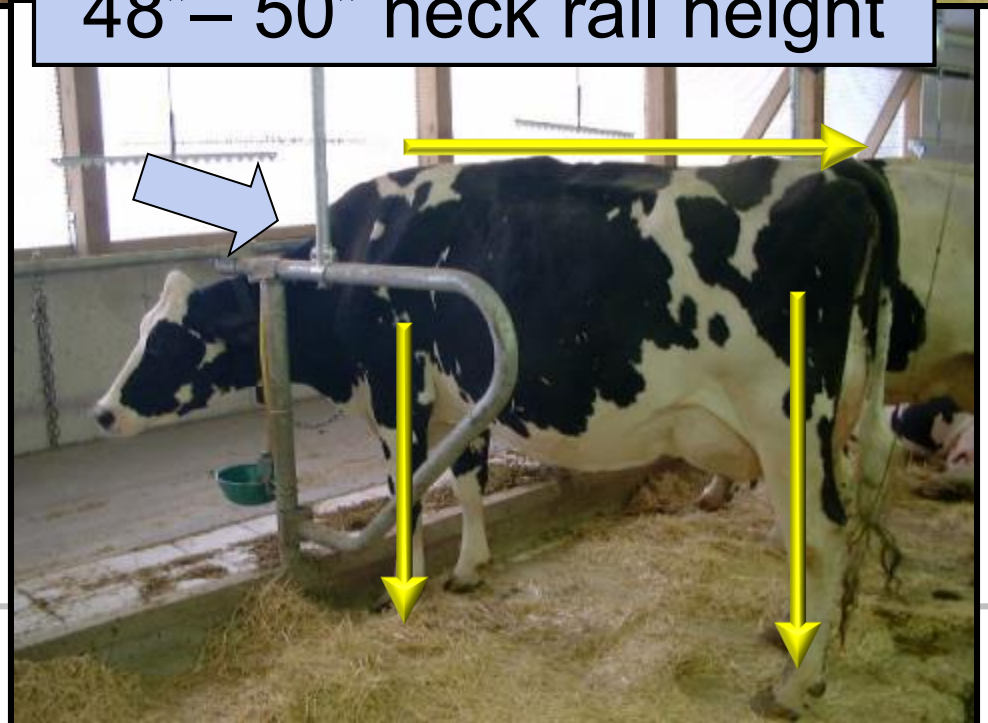

Source: Schnitzer, 1975




‘Short’
‘Narrow’
Common Bovine Resting Postures
‘Wide’
‘Long’



48”– 50” neck rail height

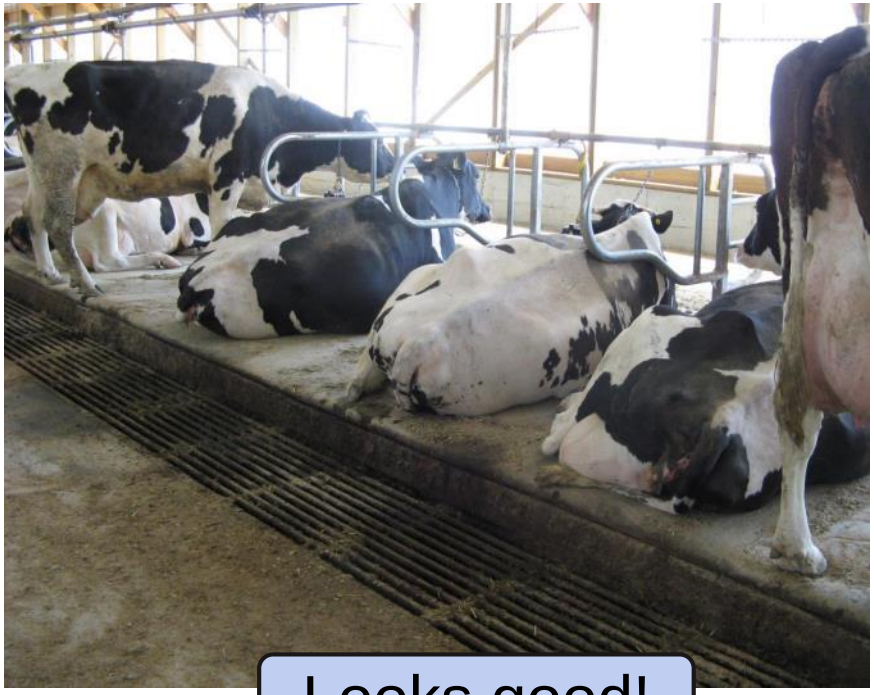


Images courtesy of Harold House

Improving Tie Stalls

- Increase Length
  - Move curb forward
  - Move gutter back

Too short



Looks good!

Improving Tie Stalls

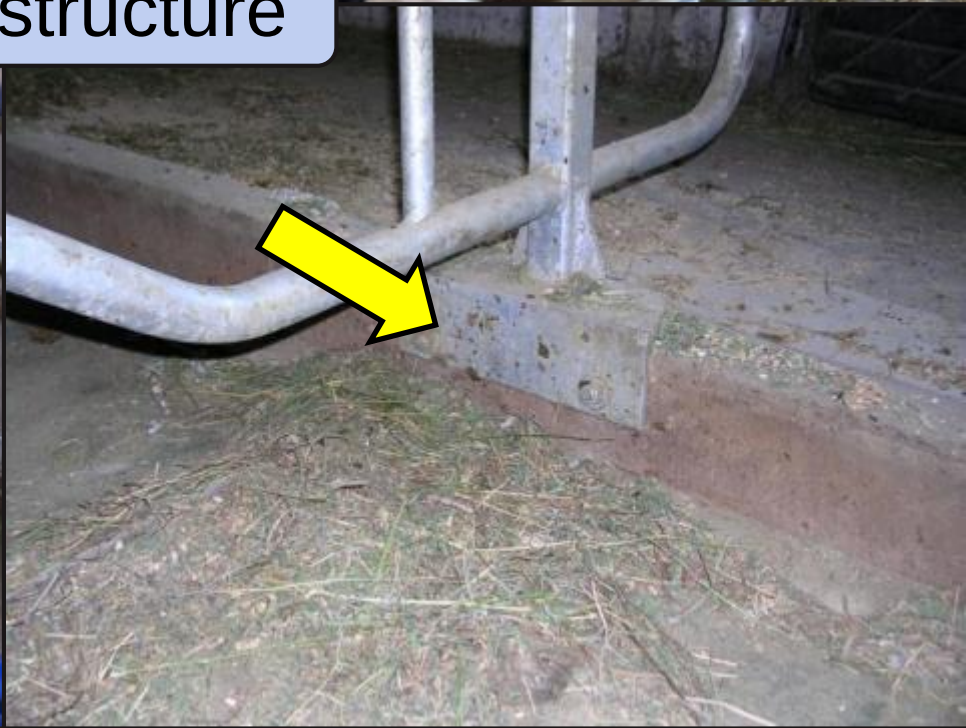
- Increase Length
  - Remove gutters

Improving Tie Stalls

- Increase Width
  - Suspended dividers
  - Reduce stalls per row

- Improve stall structure
  - Raise neck rail
  - Increase tie chain length

New stall structure




Select cows to fit existing stalls?

Resting Surface

- Generously Bedded
  - Organic
  - Inorganic

Bedding depth: 4”- 8”

Stall Bed

- Fabric-covered Mattress
- Resilient Mats

Replaces some % of desired bedding depth

Mattress / Mat Stall Beds

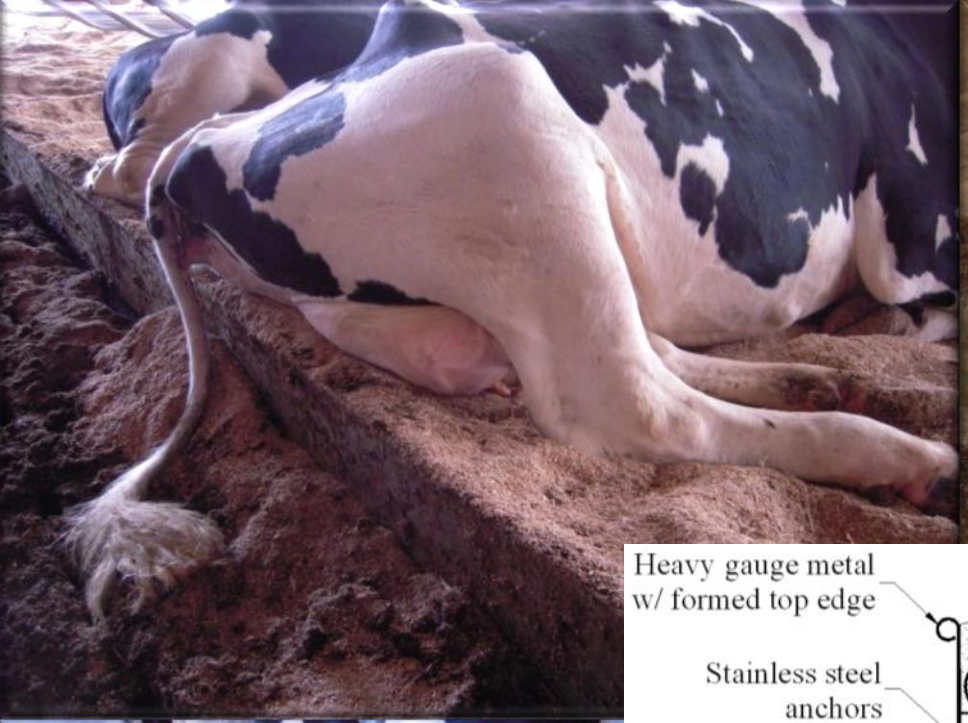
- Difficult to maintain adequate bedding layer

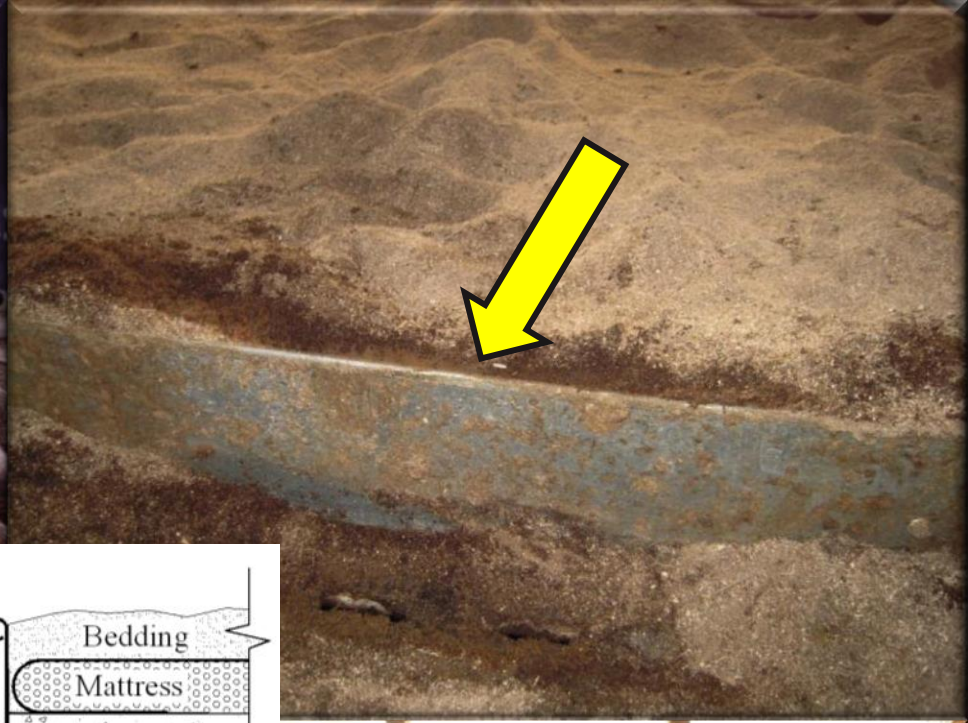
Bedding Retainers

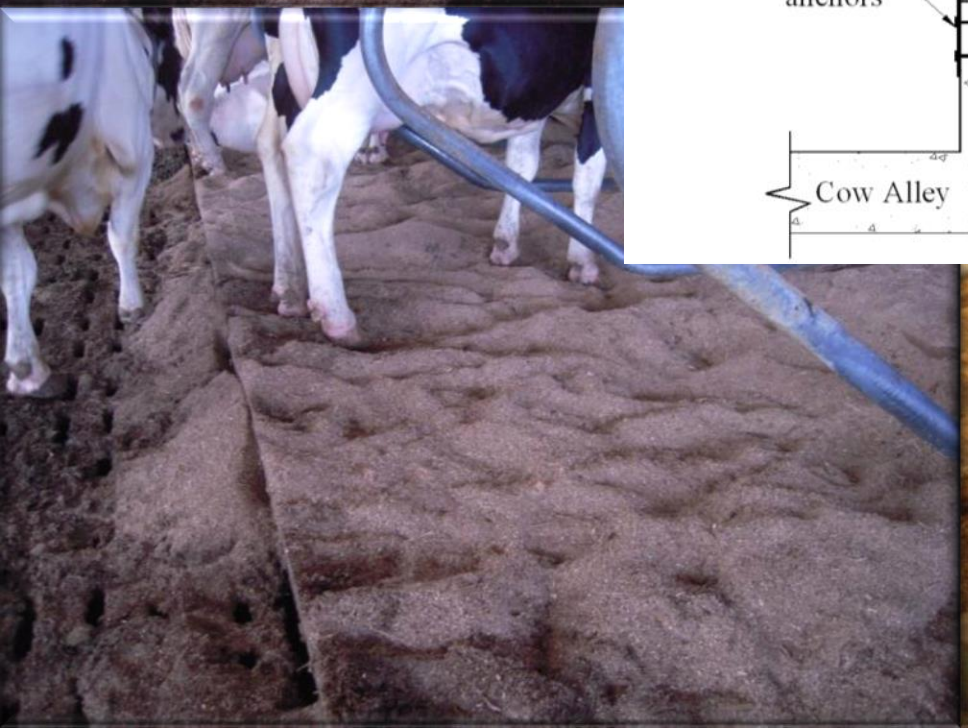
- Establish an adequate layer of bedding between the stall bed and cow
  - Reduce hock injury
  - Improve cushion
  - Improve cleanliness

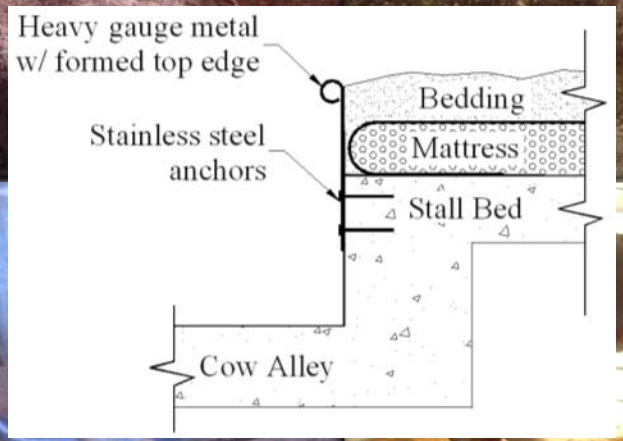
Bedding Retainers

- Retain more than bedding
- Can create a lump at the rear of the stall
- May reduce available body space





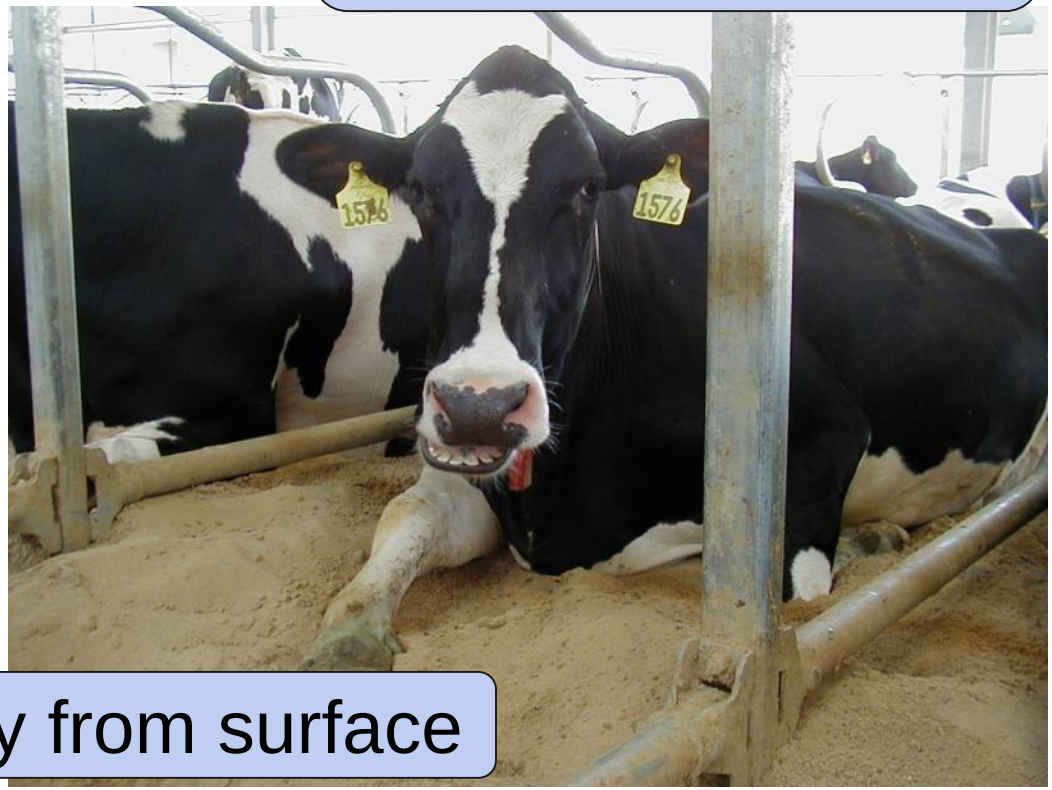



Heavy gauge metal
w/ formed top edge
Stainless steel
anchors
Bedding
Mattress
Stall Bed
Cow Alley

Inorganic Bedding Materials

- Sand
- Ground limestone
- Wet lime

Should not support bacteria growth



Drains moisture away from surface

Inorganic Bedding Management

- Typically requires 25 – 50 lbs/stall-day
  - Reducing volume reduces effectiveness
- Bedding addition – 1 x per week minimum
  - More consistent stall bed elevation
  - Reduced sand waste
  - Improved stall use
  - Easier manure handling

Inorganic Bedding Management

- Stall bed grooming
  - Levels & fluffs stall bed
  - May bring contaminated material to top

Inorganic Bedding Management

- Remove manure piles & soiled areas
  - 3 times per day minimum
  - Fill holes with dry material

Organic Bedding Materials

- Organic
- Sawdust
- Shavings
- Straw
- Paper
- Dried manure solids

Organic beddings absorb moisture increasing their ability to increase bacteria populations

Organic Bedding Management

- Remove bedding from rear half of the stall daily and replace with fresh bedding

Source: Reneau, 2001

Organic Bedding Management

- Groom stalls 3 times per day minimum
  - Remove manure & soiled bedding
  - Cover wet & bare areas with bedding

Resting Area Design & Management

- Resting area design and installation
  - Encourage cows to use
  - Provide comfort & confident footing
  - Promote cleanliness & udder health

- Caregiver Responsibility
  - Insure a clean, dry, comfortable resting space
  - Adjust management to realize cleanliness & good udder health.

Feeding Area Design

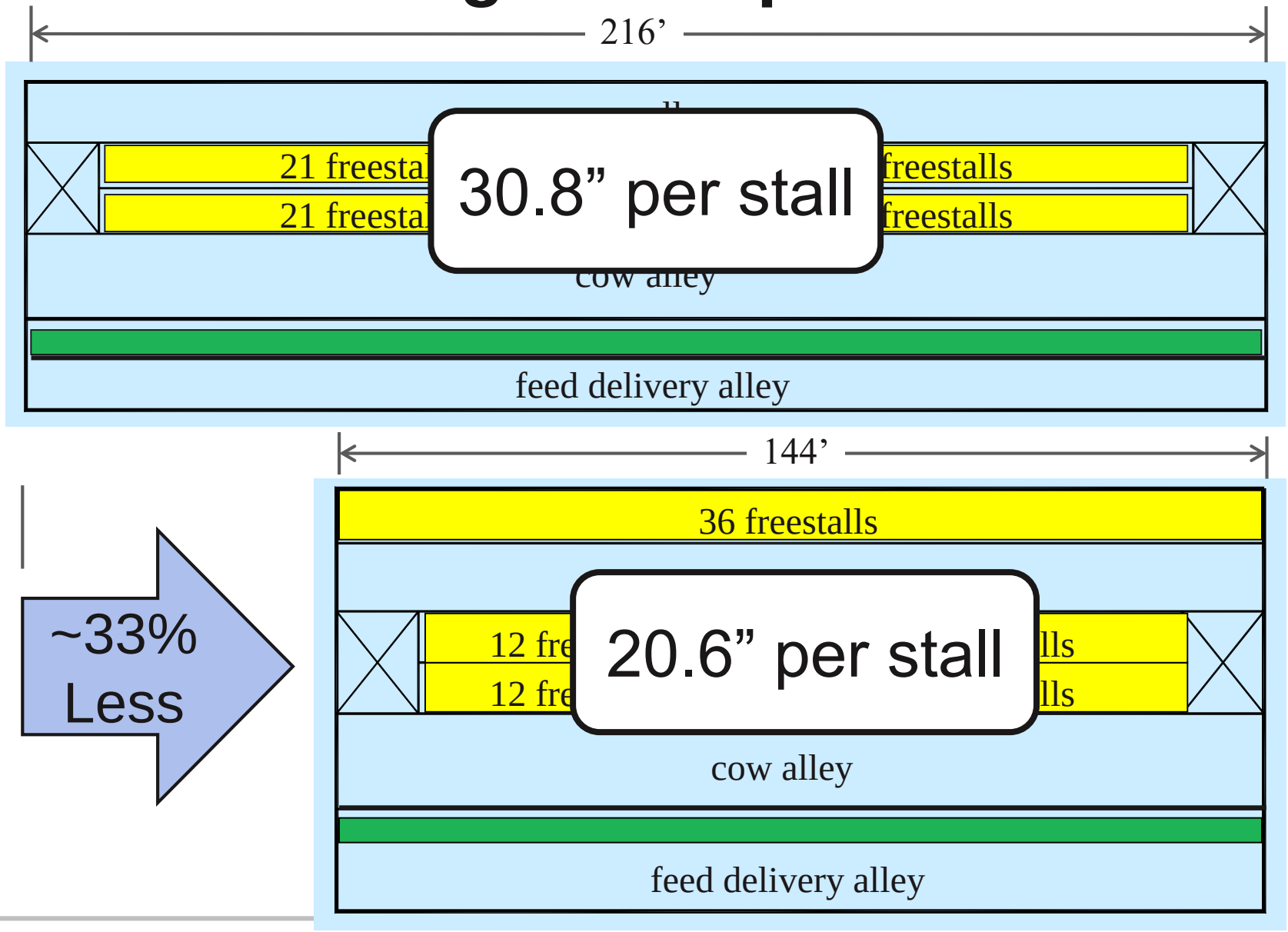
- Encourage & allow proper DMI for each cow
- Provide a comfortable feeding experience
- Feed available at least 21 hours/day
- Easy to clean & keep clean

“Even an engineer can feed a hungry cow.”

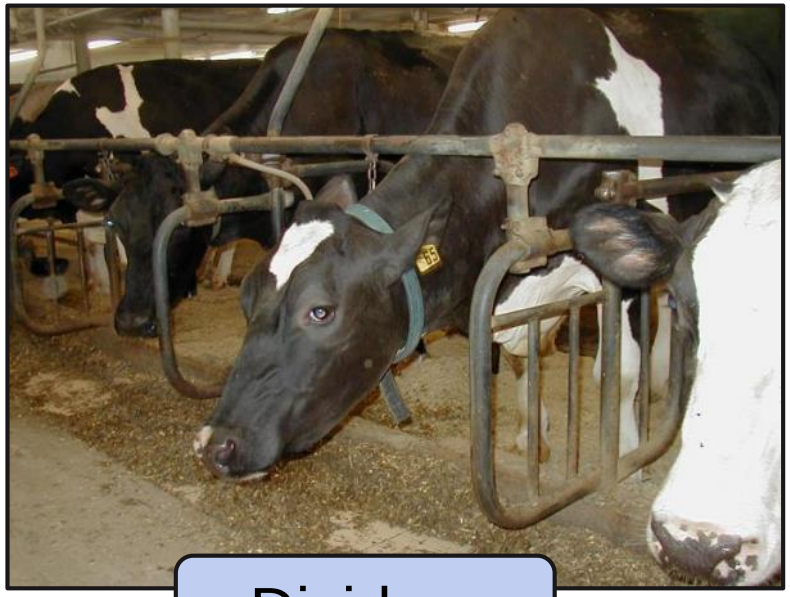
Loose Housing Feeding Space

- Lactating cows
  - All-at-once: 27 - 30”/ hd
  - TMR: 18”/hd
    - Good access & time
- Dry cows
  - All-at-once: 27 - 30”/ hd
- Post-fresh cows
  - All-at-once: 27 - 30”/ hd

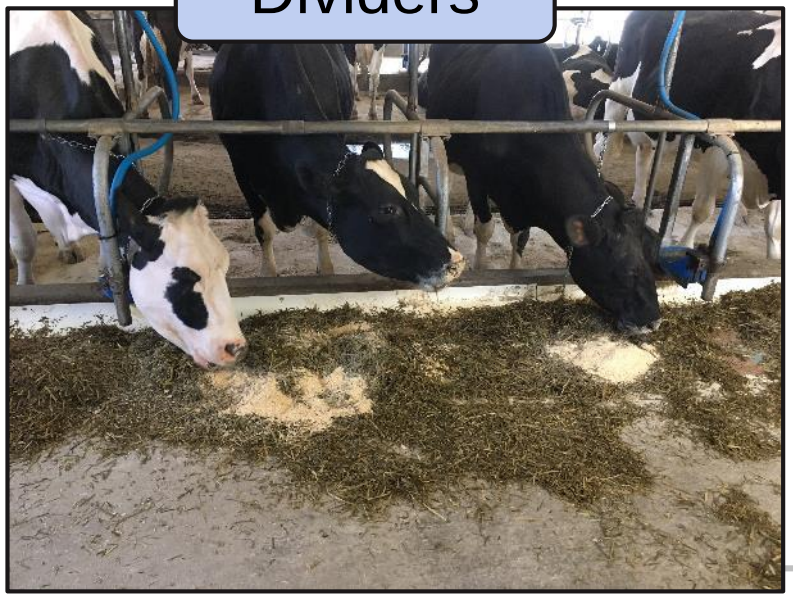
Feeding Area Space



Tie Stall Feed Space



Dividers



No Dividers

Feed needs to be delivered more often

Feeding Area Design

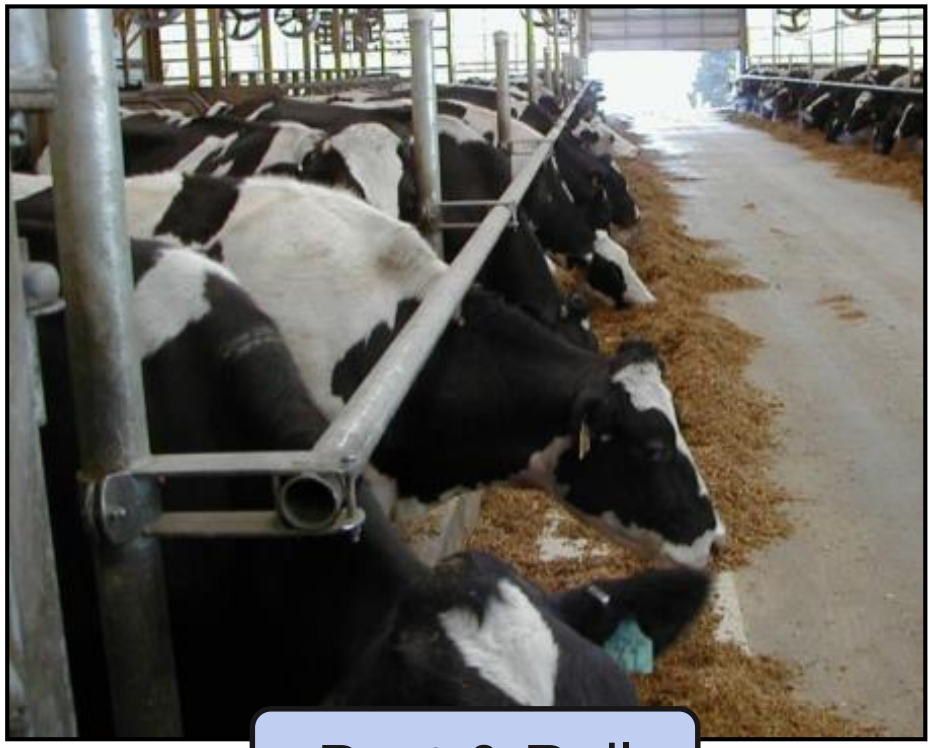
- Adequate feeding space
- ‘Head-down’ feeding position

Feeding Area Design

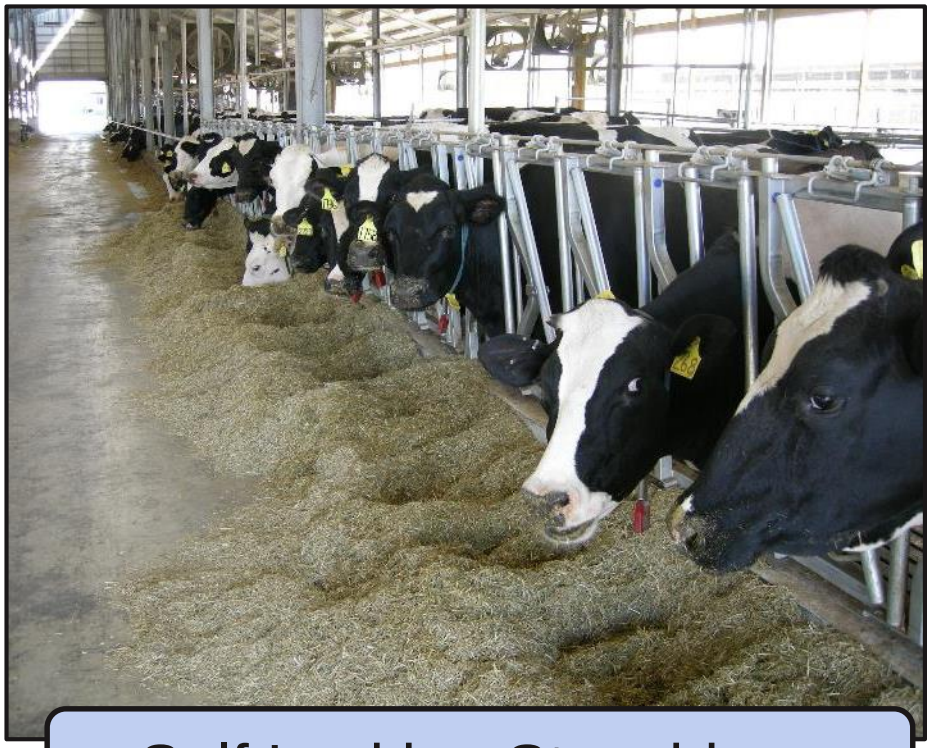
- Feed table
  - 2” to 6” above cow alley
  - ‘Natural’ eating position

Feeding Area Design

- Feed separation device
  - convenient access

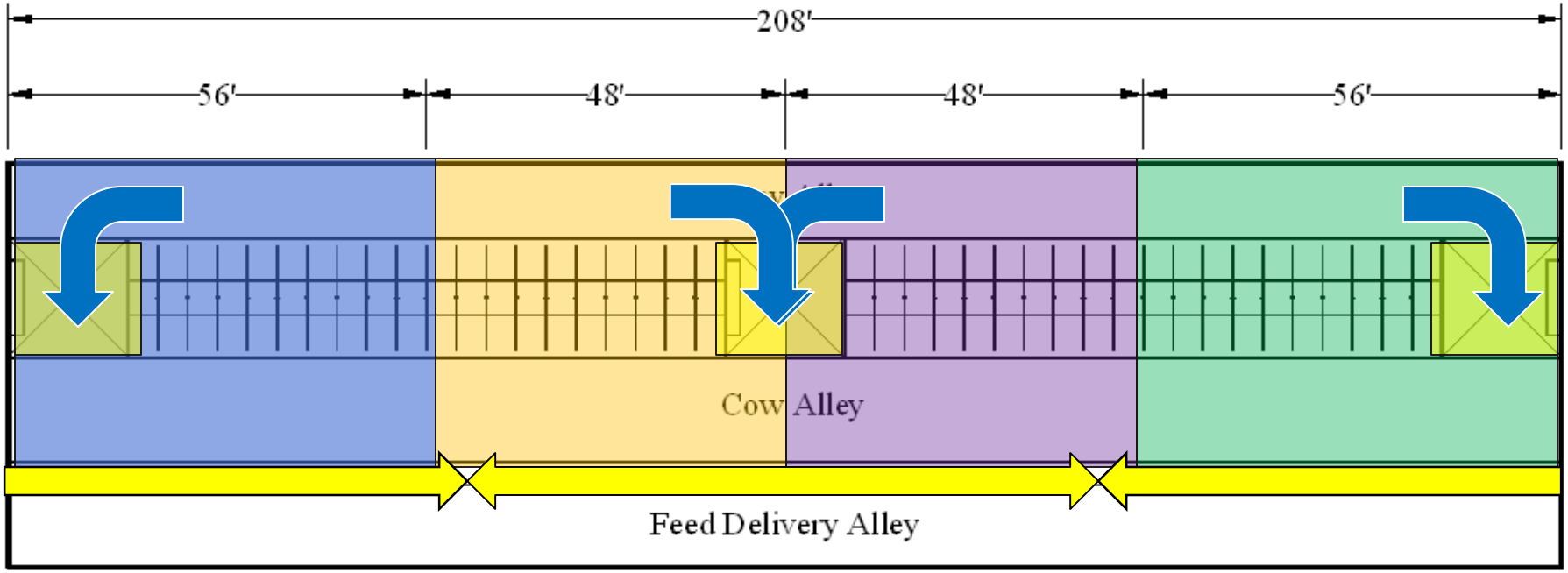


Post & Rail



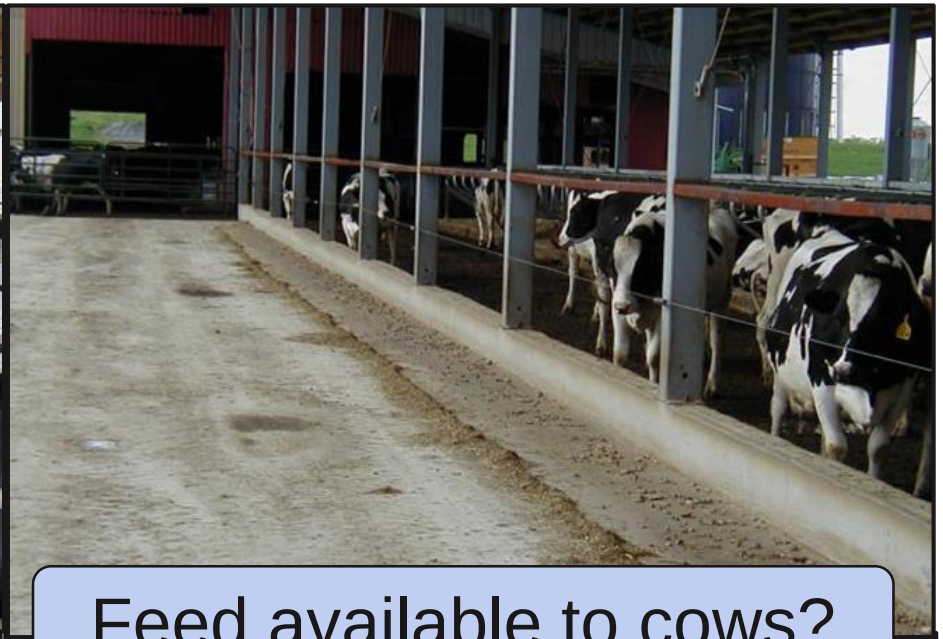
Self Locking Stanchions

Access to Feed



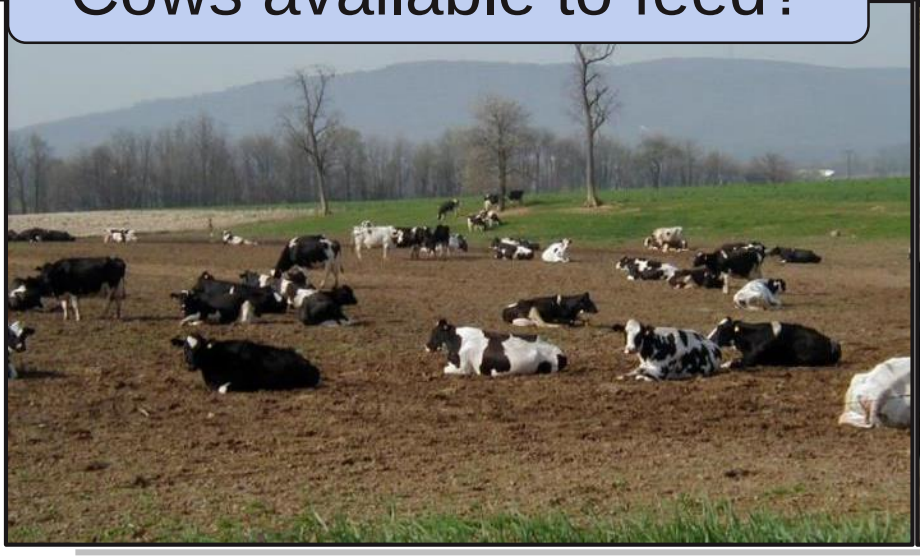
Locate crossovers every 60 to 80 feet

Feeding Area Management



Cows available to feed?

Feed available to cows?



Feed Area Management

- Feed available 21 hours/day
- TMR delivered 2 times/day
- Target for 3% refusal
- Bunk density < 100%

- ½ hour push ups for 2 hours post-feeding
  - *Focus on when, not how often*

Source: Grant, 2014

Tie Stall Feed Area Management

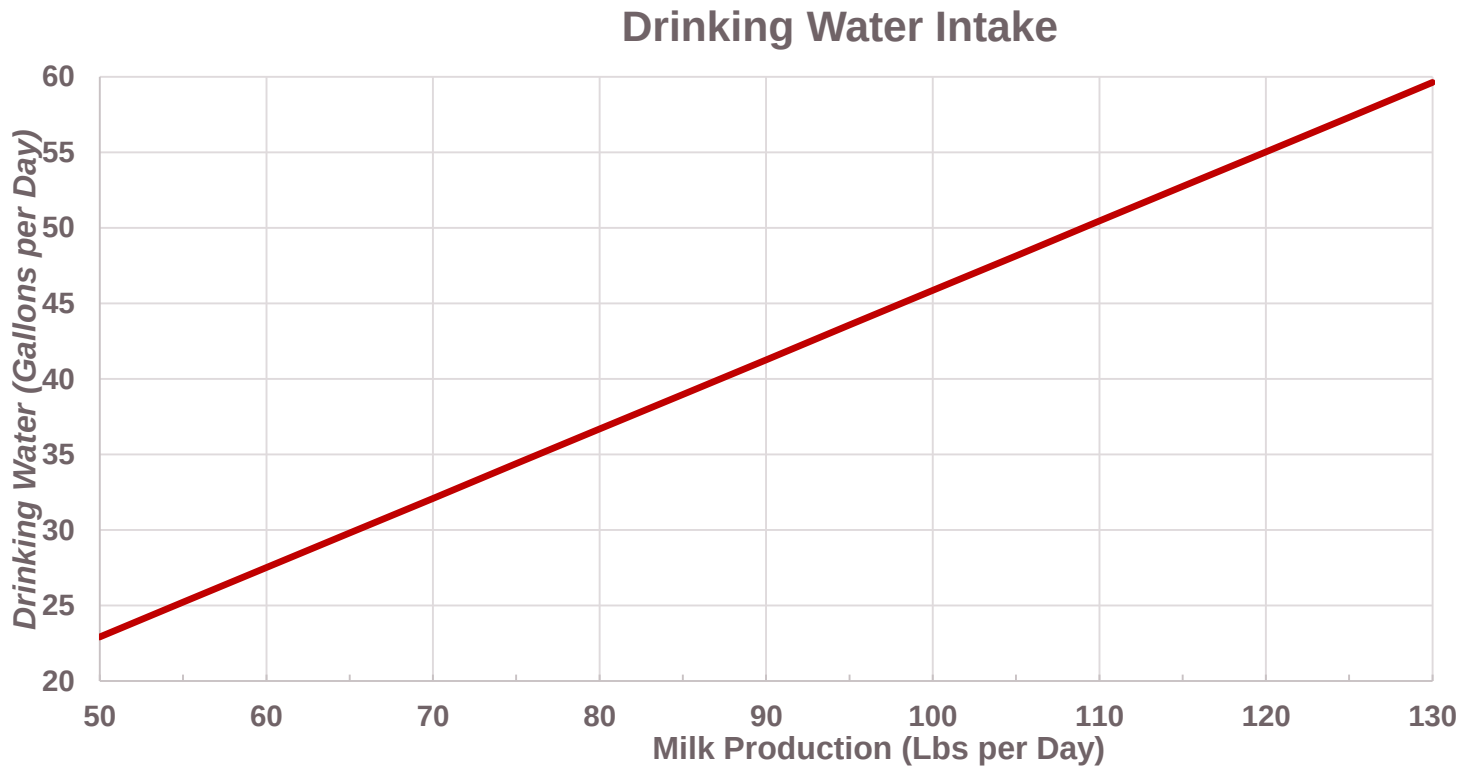
- Feed available 21 hours/day
- TMR delivered 3 or more times/day
- Target for 3% refusal
- Push up as needed
  - *Focus on need, not how often*

“Cows should be within 50 feet of drinking water.”

- J. Spain, University of Missouri

Drinking Water Intake

- 4 to 5 lbs. water → 1 lb. milk
- Drinking water satisfies 80% - 90% of total water requirement



Cows Drink Water

After eating

After being milked

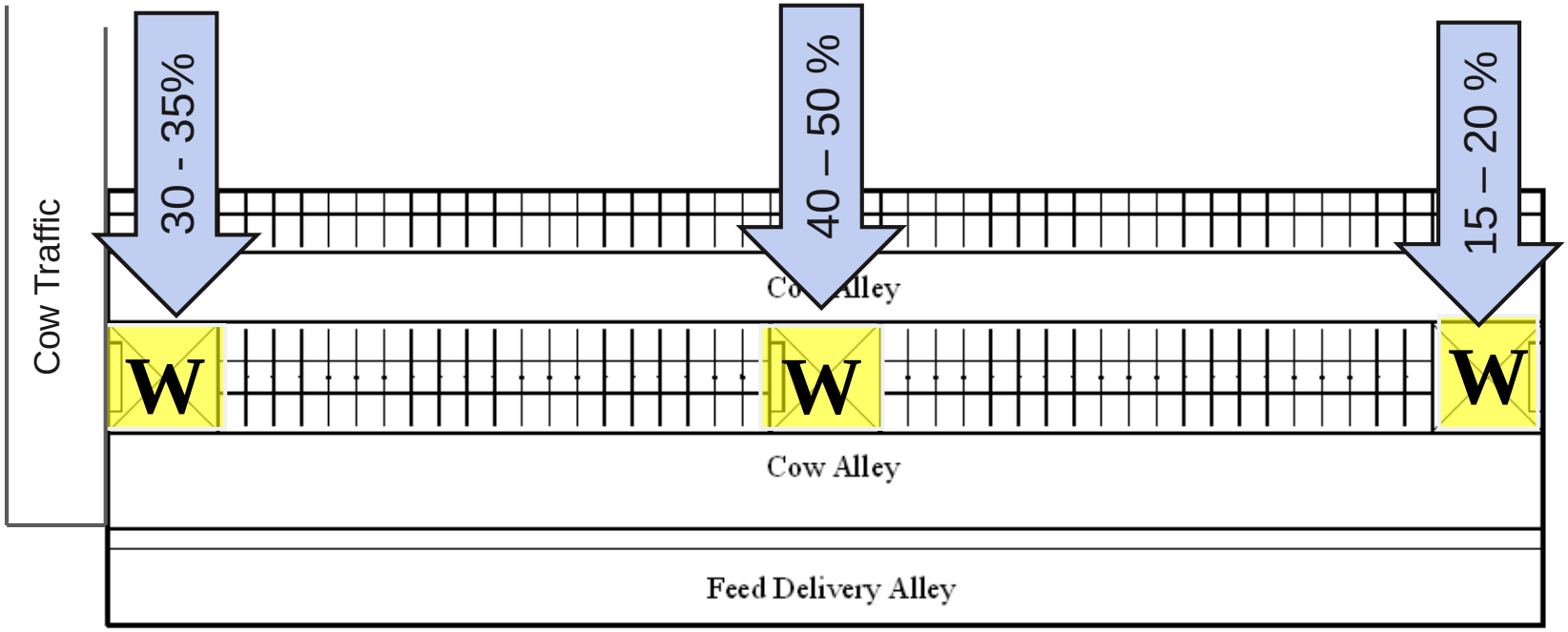
Drinking Water Considerations

- Convenient location
- Allows cows to draw water easily
- Good quality water
- Keep up with peak demand
- Be easy to clean & keep clean

Loose Housing Water Access

- Minimum of two drinking water units per group
- Allow 15 to 20% of group to drink at the same time
  - 3.5” – 4” accessible trough perimeter per cow
- Provide 3 to 5 gpm delivery at each water station

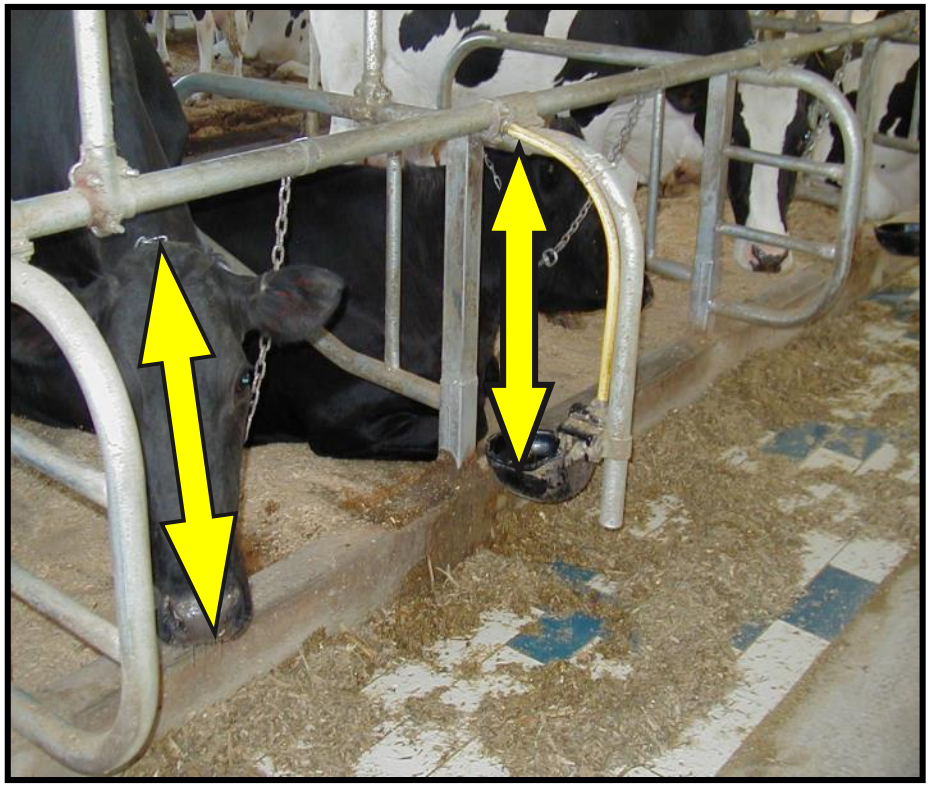
Water Station Location



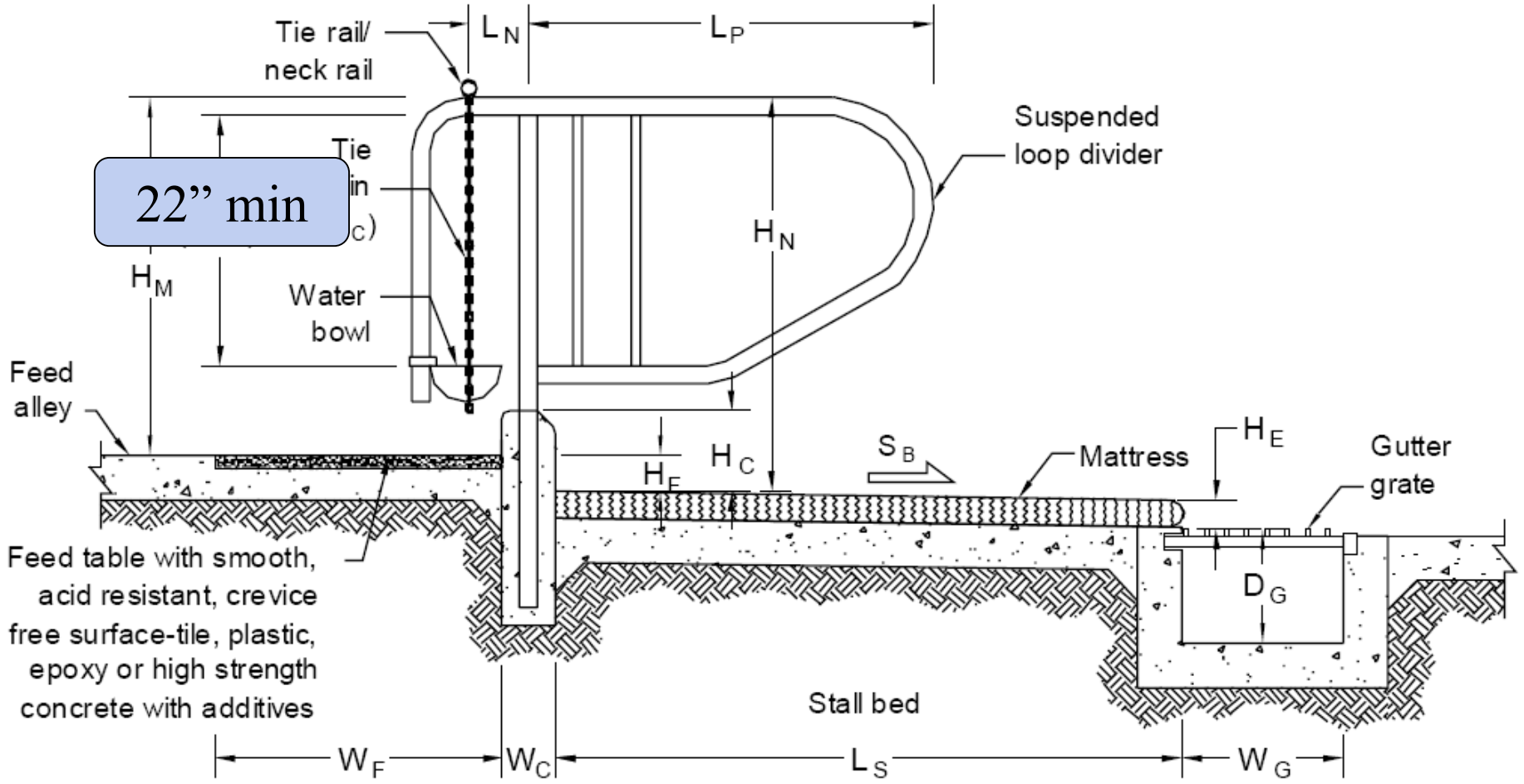
"Cows should be no further than 50 feet from water"

- J. Spain, University of Missouri

Tie Stall Water Access



Good Access to Water



Good Access to Water

- One water bowl per stall

Good Access to Water

Adequate supply to each water bowl?

Drinking Water Station Management

Easy to clean & cleaned regularly

Management Decisions that Affect Cow Comfort

Stocking Density

- Cows per stall

$$SD = \left\{ \frac{(Total\ cows)}{(Total\ stalls)} \right\}$$

$$SD = \left\{ \frac{(101\ cows)}{(84\ stalls)} \right\}$$

SD = **1.2** cows / stall

Cow Response to Overcrowding Summary

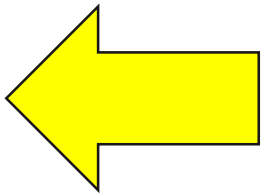
Behavior Change	Possible Economic Losses
Greater aggression& bunk displacements	Reduced milk yield
Faster feeding rate	Lower milk fat
Less resting time	Greater SSC
Increased idle standing in alleys	More health disorders
Decreased rumination	Increased lameness
Subordinate cows most affected	Fewer cows pregnant

Source: Grant, 2014

Effect of Resting Area Overcrowding

(Batchelder, 2000)

- 4-row shelter; 2 groups w/ 20 stalls
  - 0% overcrowded - 20 cows
  - 30% overcrowded - 26 cows
- Average stall use in 24 hours
  - 0% group – 61%
  - 30% group – 91%



    - ✓Cows standing waiting for stalls

Resting time reduced 12 to 27% with 120% and greater stocking density. -Grant, 2006

Stock Density & Milk Production

(Bach et al., 2008)

	<80%	80 – 100%	100 – 120%	>120%
Milk yield, lbs/d	**68.1**	**64.3**	**64.4**	**52.7**
Std. deviation	**±3.3**	**±6.4**	**±8.1**	**±5.1**

What are the economics associated with losing 12 pounds of milk per day?

(Grant, 2014)

Time Away From Pen

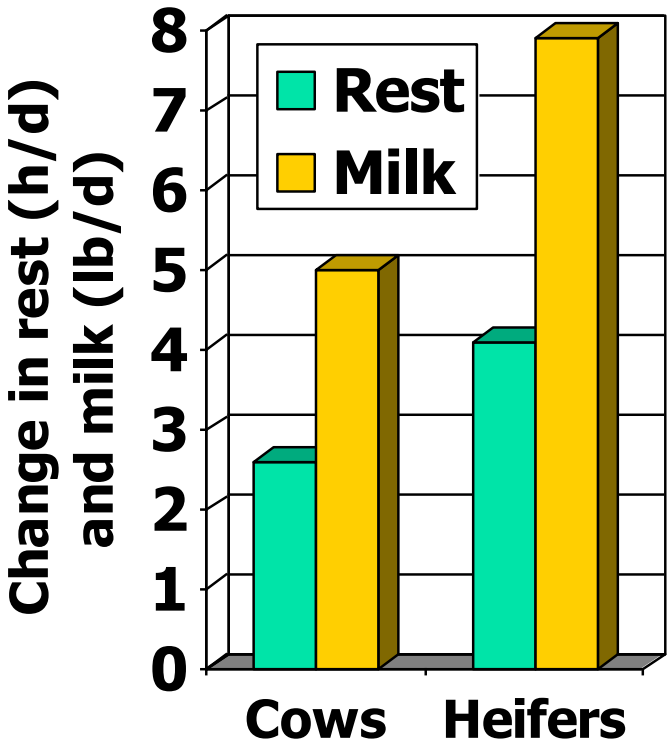
- May limit:
  - Resting time
  - Feeding time
  - Access to feed

Goal:
Less than 3 h/d

Time Away From Pen

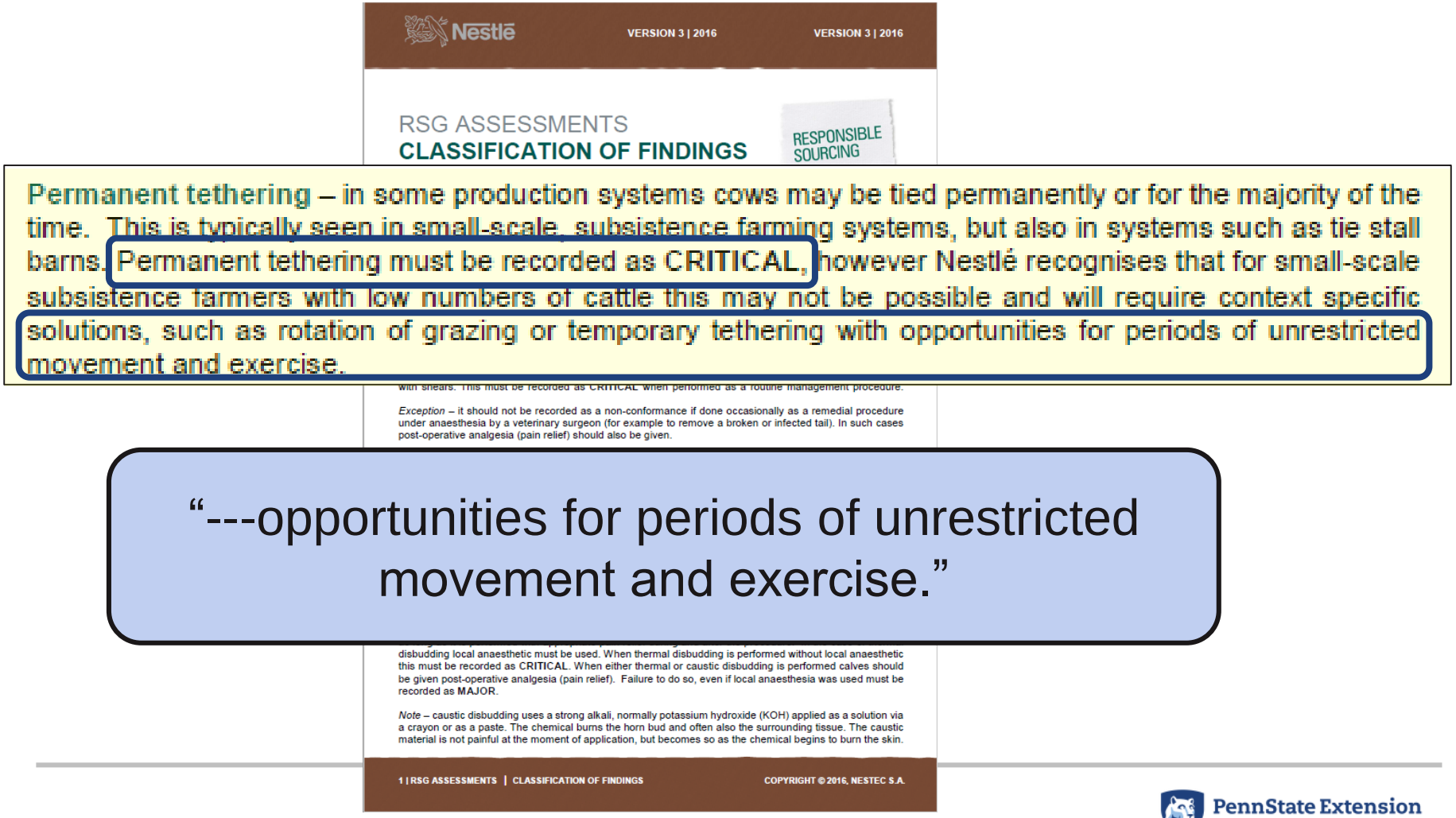
- 3 vs. 6 hours per day (Matzke, 2003)
  - ~ 2.5 to 4 h/d change in rest
  - ~ 5 to 8 lbs/d change in milk

- Lameness prevalence in productive herds highly associated with greater time outside pen (Espejo and Endres, 2007)



Exercise for Tie Stall Cows?

- What does your milk market think?



Nestlé VERSION 3 | 2016 VERSION 3 | 2016

RSG ASSESSMENTS
CLASSIFICATION OF FINDINGS

RESPONSIBLE SOURCING

Permanent tethering – in some production systems cows may be tied permanently or for the majority of the time. This is typically seen in small-scale, subsistence farming systems, but also in systems such as tie stall barns. Permanent tethering must be recorded as CRITICAL, however Nestlé recognises that for small-scale subsistence farmers with low numbers of cattle this may not be possible and will require context specific solutions, such as rotation of grazing or temporary tethering with opportunities for periods of unrestricted movement and exercise.

with shears. This must be recorded as CRITICAL when performed as a routine management procedure.

Exception – it should not be recorded as a non-conformance if done occasionally as a remedial procedure under anaesthesia by a veterinary surgeon (for example to remove a broken or infected tail). In such cases post-operative analgesia (pain relief) should also be given.

disbudding local anaesthetic must be used. When thermal disbudding is performed without local anaesthetic this must be recorded as CRITICAL. When either thermal or caustic disbudding is performed calves should be given post-operative analgesia (pain relief). Failure to do so, even if local anaesthesia was used must be recorded as MAJOR.

Note – caustic disbudding uses a strong alkali, normally potassium hydroxide (KOH) applied as a solution via a crayon or as a paste. The chemical burns the horn bud and often also the surrounding tissue. The caustic material is not painful at the moment of application, but becomes so as the chemical begins to burn the skin.

1 | RSG ASSESSMENTS | CLASSIFICATION OF FINDINGS COPYRIGHT © 2016, NESTEC S.A.

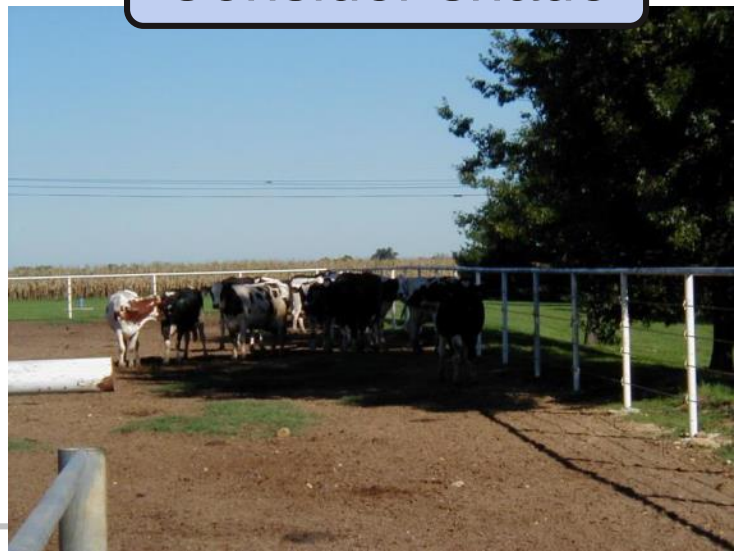
"---opportunities for periods of unrestricted movement and exercise."

PennState Extension

Outside ‘Exercise’ Lots

- Unpaved
  - Pasture
  - ‘Low’ density
  - ‘Medium’ density
  - ‘High’ density
- Paved
  - Confident ‘non-skid’ footing
- Water available > 1 hour
  - Paved apron
- Feed available > 3 hours
  - Paved apron

Consider shade



"Handling livestock requires that they be ***'outsmarted'*** *rather that* ***'outfought'*** *, and that they be* ***'out waited'*** *rather than* ***hurried****."*

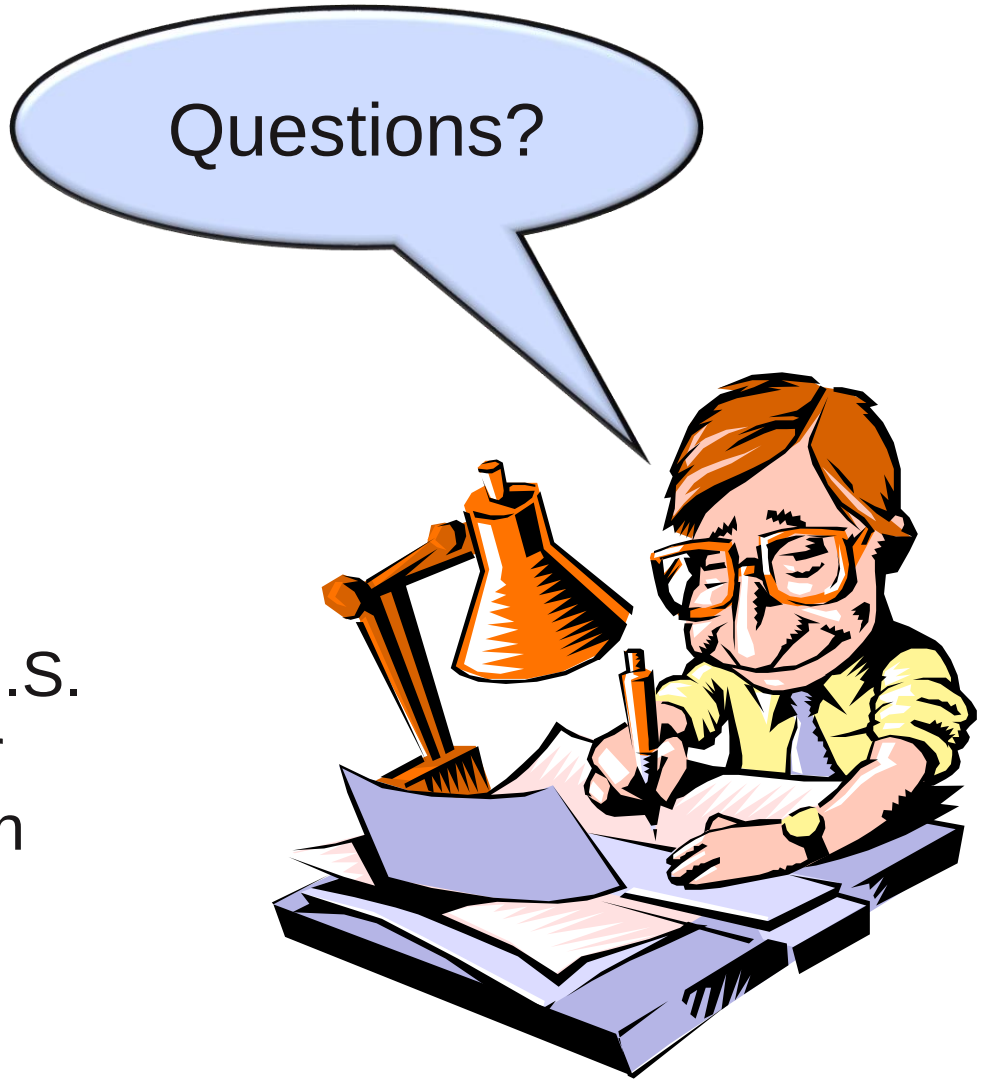
-Lemennager & Moeller, 1981

Benefits of Improving Cow Comfort

- Improved milk production
- Improved milk quality
- Improved health
- Reduced lameness
- Improved reproduction
- Improved longevity

www.everybodylovesyourmoney.com

Productive cows are most affected by comfort



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