*Theme 8: Animal housing*

# CONSTRUCT SMALL ZERO GRAZING UNIT (Level 1)

| Topic | Training & information Content |
|---|---|
| **8.1** | Farm structures & housing cows/calves/young stock |
| **8.2** | Construct small zero grazing unit (SNV handbook) |
| **8.3** | Prevention of heat stress in cow barns |
| **8.4** | Cow house ground floor plan design (SNV book) |
| **8.5** | Best management practice feed fences |
| **8.6** | Housing & cow comfort (animal welfare) |
| **8.7** | Housing & reduction greenhouse emissions |
| **8.8** | Use of sensors (activity meter) in dairy herds |

## 1. You will learn about (learning objectives):

- ❑ What to consider before constructing a zero-grazing unit.
  - basic principles of good cow barn design and types of barns for the cow and youngstock.

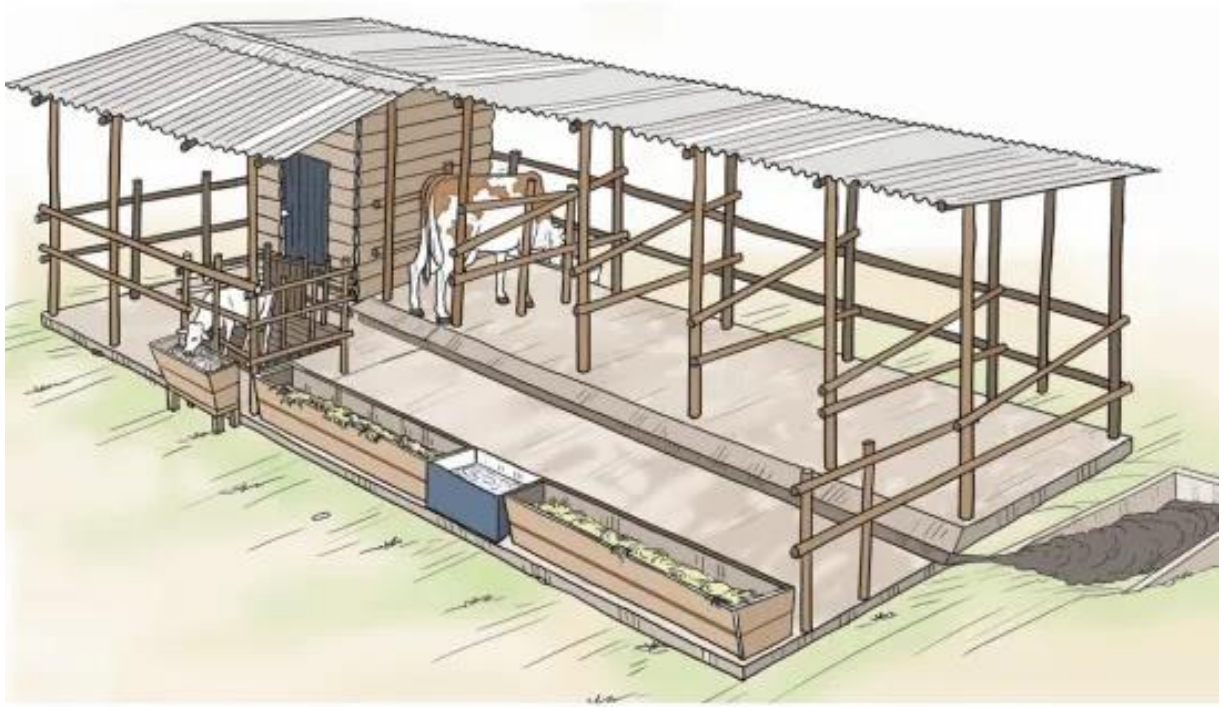
- ❑ Units to consider while designing farm structures.
  - Examples of smallholder cow barn designs and several types of materials used.

## 2. Background

- A cow barn requires a considerable investment. A proper design is crucial for cow comfort and health, optimal production and profitability of the enterprise.
- Use this link to download the handbook, https://cowsoko.com/programs/kmdp/publications/128/item.

# 3. Introduction to smallholder zero grazing unit

- The zero grazing unit is a shelter for animals that protects against unfavorable weather conditions e.g. heat, rain, wind and is well ventilated at the same time.
- A zero grazing unit should be designed to accommodate animals of all age groups separately.
- Resting, walking, feeding and milking areas need to provide cow comfort for maximum milk production.
- At the same time it must facilitate labour processes e.g. milking, feeding, and manure collection.

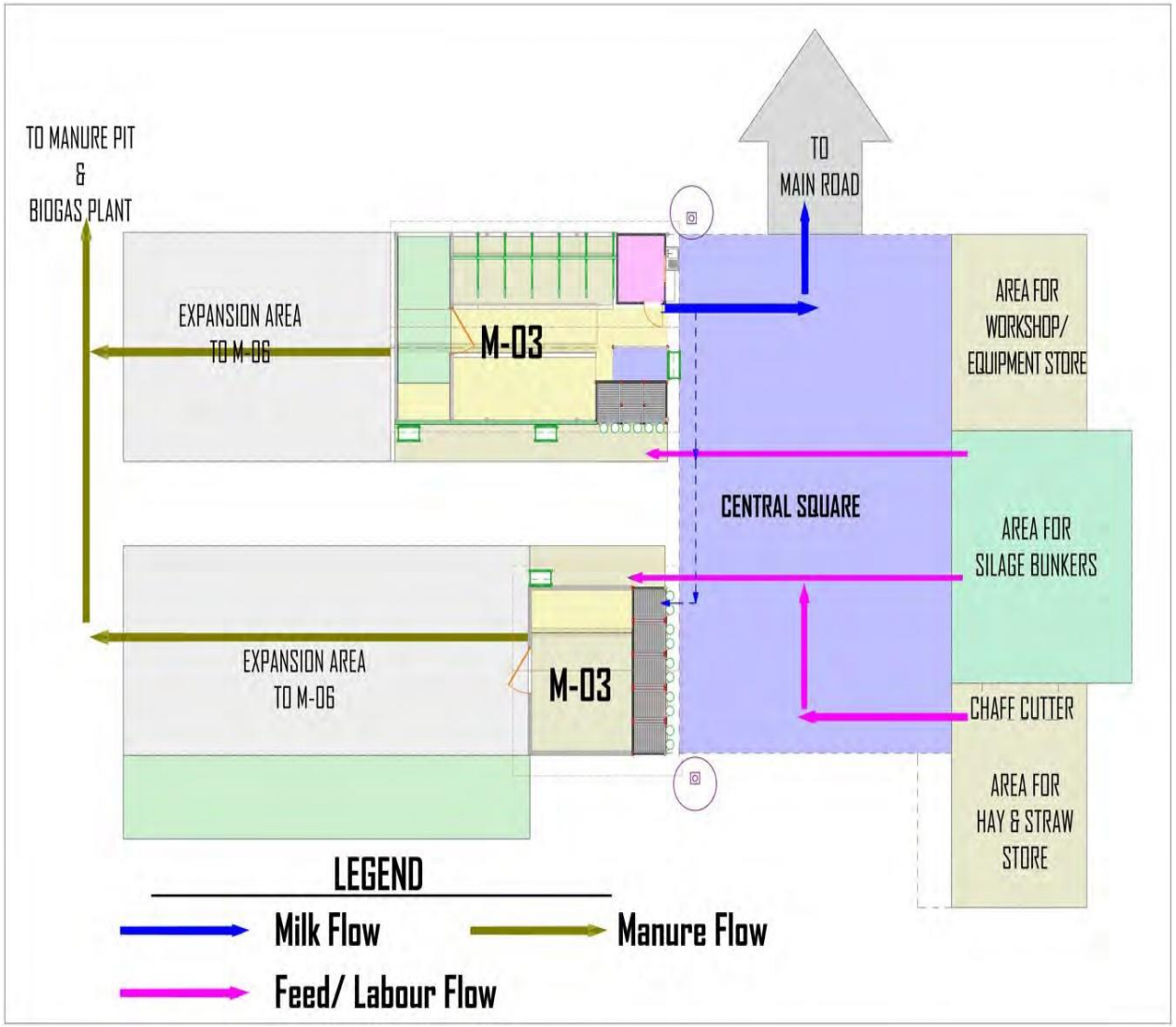


# 4. Basic principles of Cow barn design

- There are four (4) basic principles for good cow barn design;
  i. Cows must be comfortable,
  ii. Structure is flexible and expandable,
  iii. Structure is simple, robust and economical,
  iv. Allows optimization of movements/flow and labour efficiency.

# 5. Site plan

- The 4 basic principles, in particular expandability and separation of flows, require a good survey of the site and a proper site plan.
- An example of this is given in the figure on the right and arrows represent the flow.



# 6. Cow comfort

- Cow comfort means the cow lives in a comfortable environment without stress.
- For a cow to be comfortable, it means;
  - Providing adequate space.
  - Available and accessible feed and water,
  - A barn with a flow of fresh air and light,
  - No animals should be suffering from wounds, disease and infection.

# 7. Flexible and expandable

- Simplicity of the design and setup is very important. Straight lines and dedicated areas are essential for expandability and labour efficiency.
- This cornerstone can be managed by taking into account the space and layout of the next structure (expansion).
- The working environment must be open and easy to clean.

Overview plan of a dairy farm, with room for expansion

# 8. Simple, robust and economical

- The barn and support structures should be functional and durable for the estimated number of years of use. This starts with the type of building materials used.
- This cornerstone should be the last phase of the design and planning process.

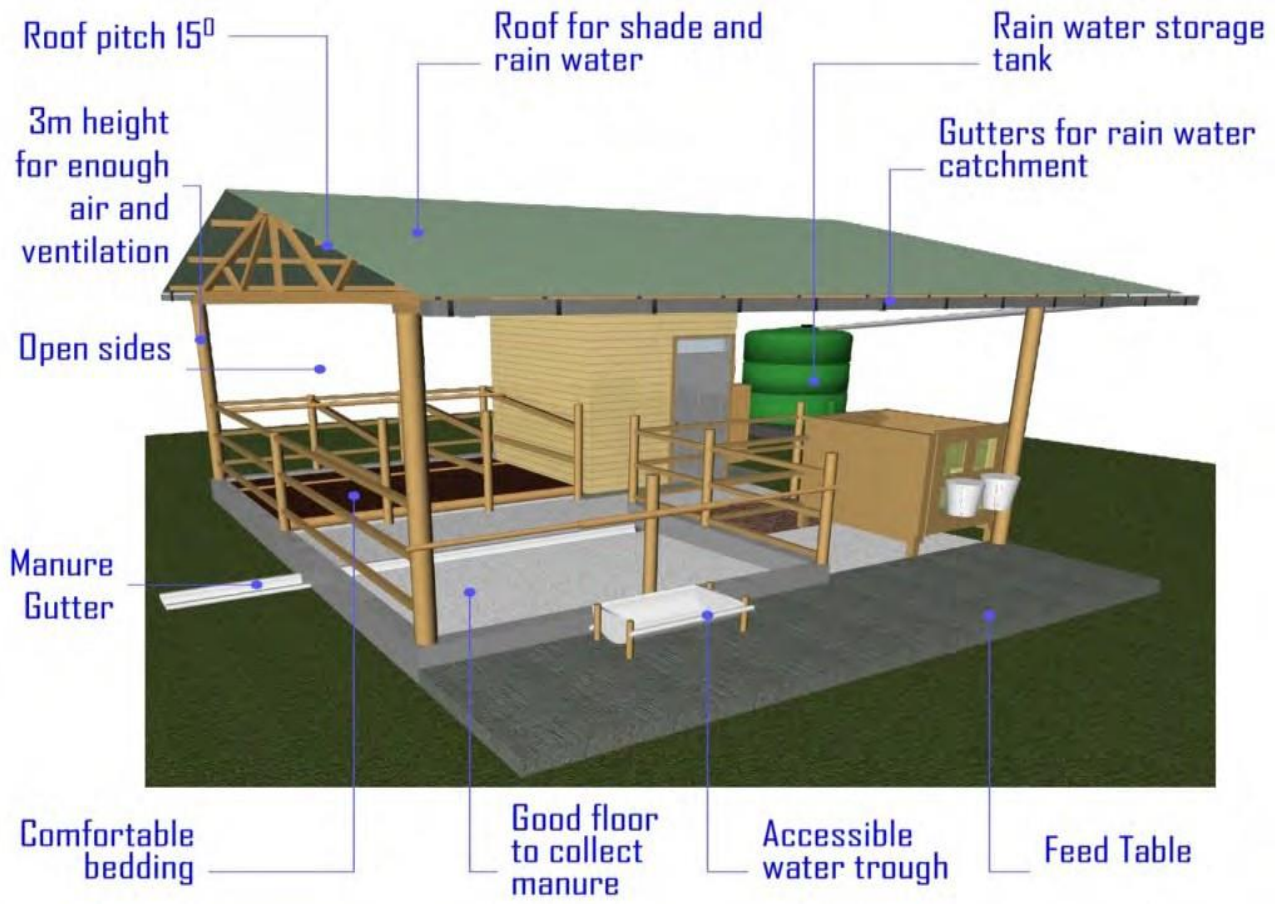
Which way, steel or wood?

# 9. Optimization of movements, flow and labour efficiency

- Feed flow: movement of all feed ration components (storage, feeding, cutting, mixing, feeding, etc.), feed push-ups, cleaning of feed troughs.
- Manure flow: movement of manure/urine and dirt from cleaning of floors.
- Cow flow: movements of all animals during the day, during the year/seasons and during their lives.
- People flow/work flow: movements of people during all the work they do in and around the barn.
- Materials flow: storage, use, handling, maintenance and disposal of all materials and equipment used.
- Information flow (including farm recording): how people communicate with each other.

# 10. Specific aspects for cow barn design

- A roof provides shelter against sun and rain; and can also be used to collect rainwater.
- No sidewalls, only bars to keep the animals in.
- Good flooring to collect manure and ensure cows can walk safely and comfortably.
- Comfortable cubicles (beds): soft flooring and bedding, good head-swing space.
- Accessible water points.
- Comfortable feed tables: easy to clean and for the cow to eat from.



# 11. Site preparation

- The area to be constructed should be prepared in a standard way to create appropriate levels and firm ground base, onto which the concrete floor will be laid.
- Unstable ground leads to a short life span of the concrete floor through cracking and disintegration.

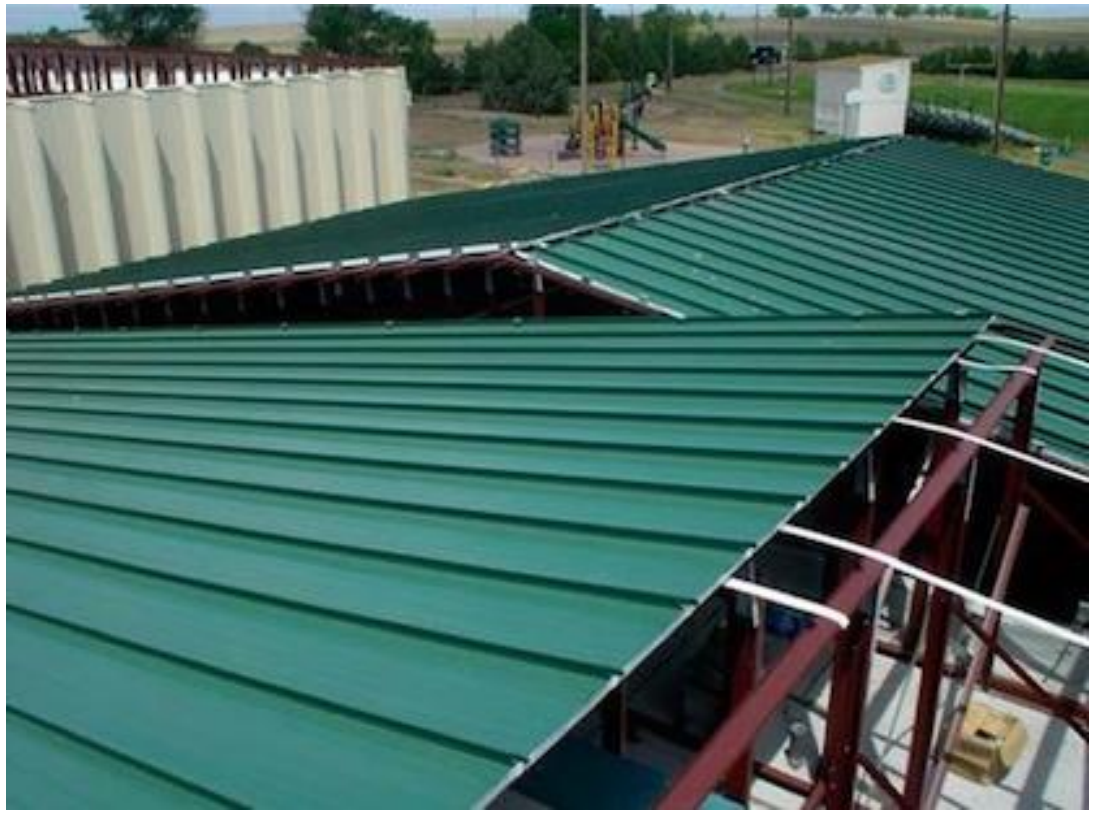
# 12. Proposed construction materials:

## Wood

- Use the 150 mm thick mass concrete with BRC mesh reinforcement (Cement: Sand: Ballast 1:2:4) finished in diamond pattern groves; 12mm wide by 5mm deep and 60mm apart, plus associated short walls up to 20cm high in areas defined in the detailed design drawings.
- Treated wooden posts of 15 feet long and 15 cm in diameter on average for structure construction.
- Treated sawn timber grade 2”x4” (50mmx100mm) sections, edges planned to bevel for cow comfort, proposed for fences, cubicle dividers and gates.

# 12.1 Proposed construction materials: Wood Cont'd…

- Galvanized corrugated iron sheets, pre-painted gauge 30. Roof cover on timber structure is complete with associated accessories.
- To match the structural strength of wood, grids of 2.4 meter and 3.6 meter intervals center to center combined to form an equivalent single grid of 6 meters as used in steel, are recommended.



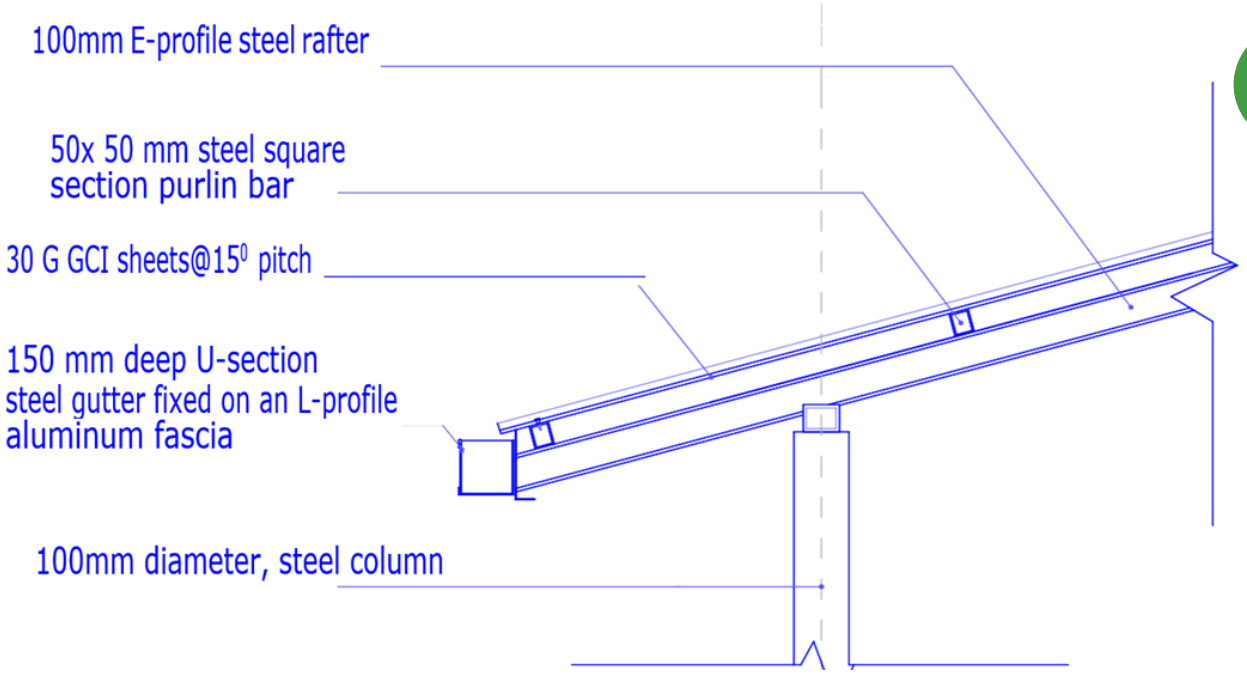
# 13. Proposed construction materials:

## Steel

- Use 150 mm thick mass concrete with BRC mesh reinforcement (Cement: Sand: Ballast 1:2:4) finished in diamond pattern groves; 12mm wide by 5mm deep and 60mm apart, plus associated short walls up to 20cm high in areas defined in the detailed design drawings.
- Consider 4” diameter 3mm thick mild steel columns/posts; height and anchorage as per the drawings.
- 2” diameter 3mm thick mild steel pipes bent to shape to details for fences, cubicle dividers, gates.

# 13.1 Proposed construction materials: Steel Cont'd…

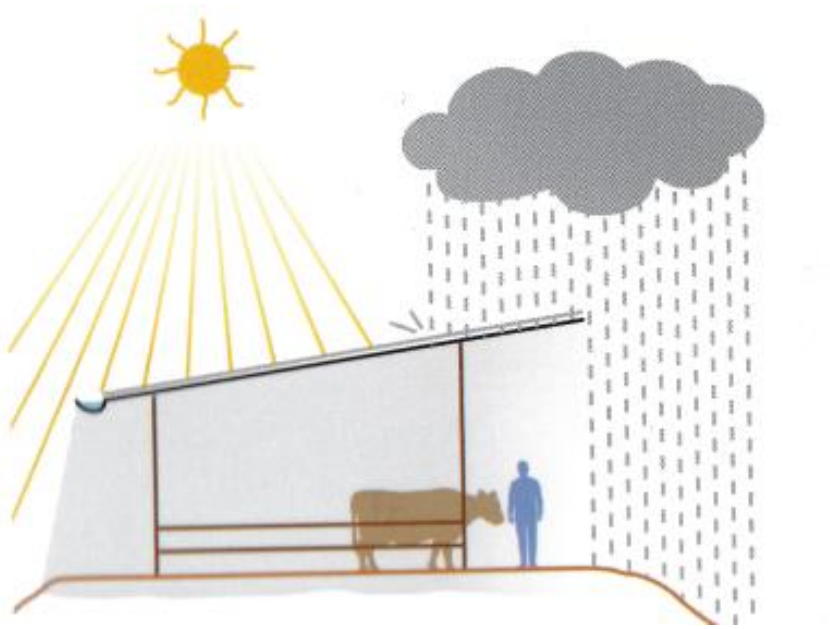
- Use galvanized corrugated iron (g.c.i) sheets, pre-painted gauge no. 30. Roof cover on mild steel structure to fabricator's specifications, complete with associated accessories.
- Grids of six (6) meters center to center for structural steel posts/columns forming the structure of the cow barn unit are adopted.
- This is to match standard steel members in the market. It is also a reasonable multiple of the standard width of a cubicle (1.2 meters).

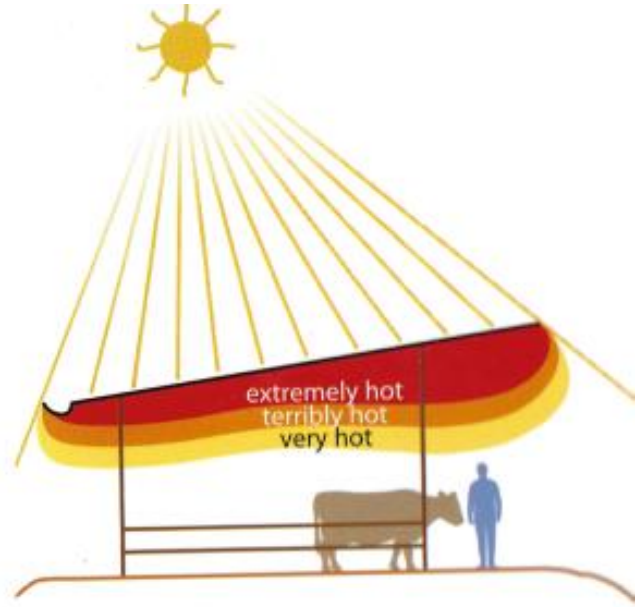



**Tip:** *Contact your farm advisor to explain the detailed contraction information in the drawing.

# 14. Roof structure and roof covering

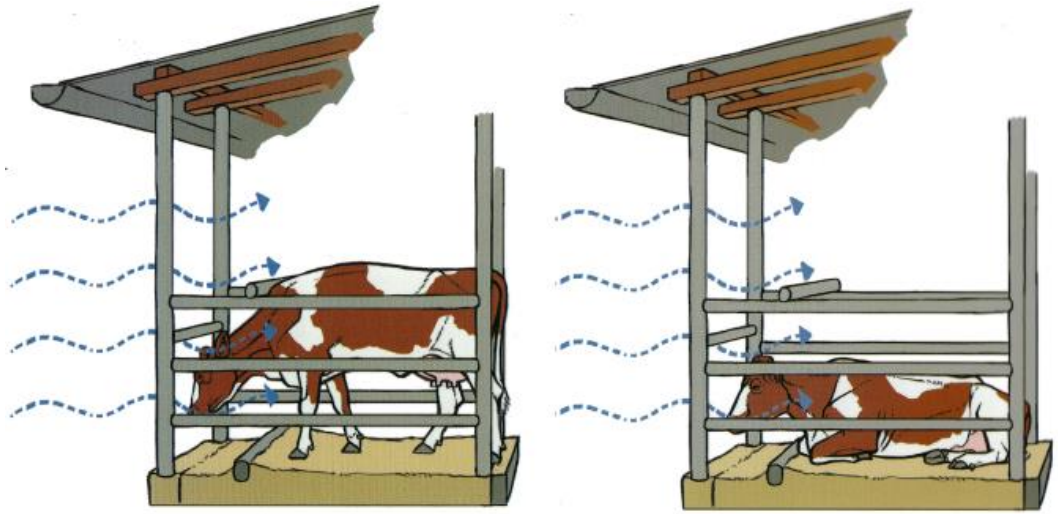
- The structure should be such that the lowest part (eaves) height is a minimum of three meters high and the pitch (roof slope) is 150 degrees. This allows for sufficient aeration and ventilation.
- Use overhangs and rain gutters to provide extra shade, to keep rain out and collect rainfall.
- Build the roof high. High roof keeps hot air right under the roof further from the cow.
- Roof covering should be a brightly colored galvanized corrugated iron sheet. Dull coloured sheets absorb and retain solar heat, contributing to cows' heat stress. Ordinary corrugated sheets of minimum gauge 30 are recommended.

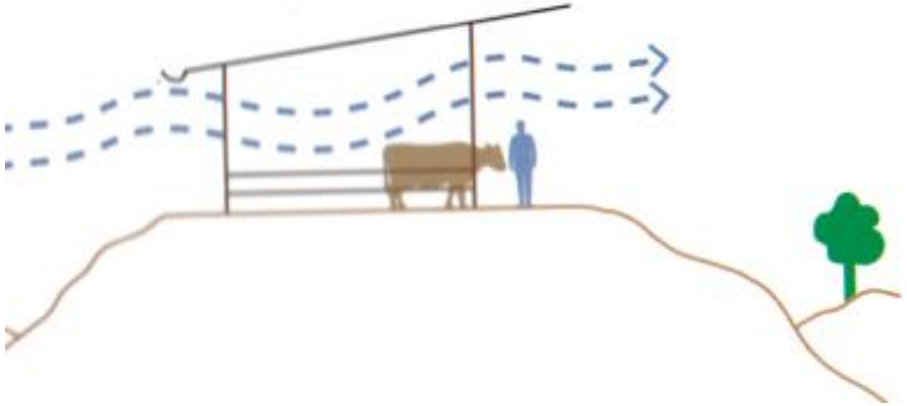


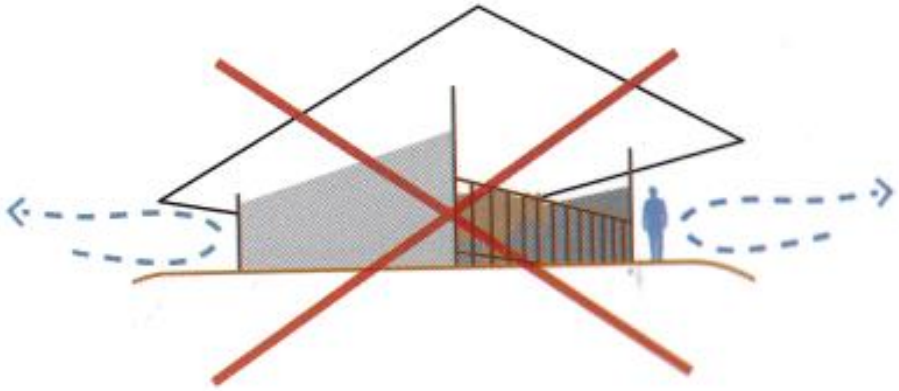


# 15. Fresh air

- A cow barn should not have walls or other obstacles that block the flow of fresh air and ventilation.
- Allow the wind and outside airflow through your barn and between the cows as much as possible.
- Build as few walls as possible. Walls are expensive to build, they block ventilation, and reduce space.
- Walls inside the barns also make it inflexible to change the size of the pens.
- Fresh air and ventilation are important for the cows' health and comfort.

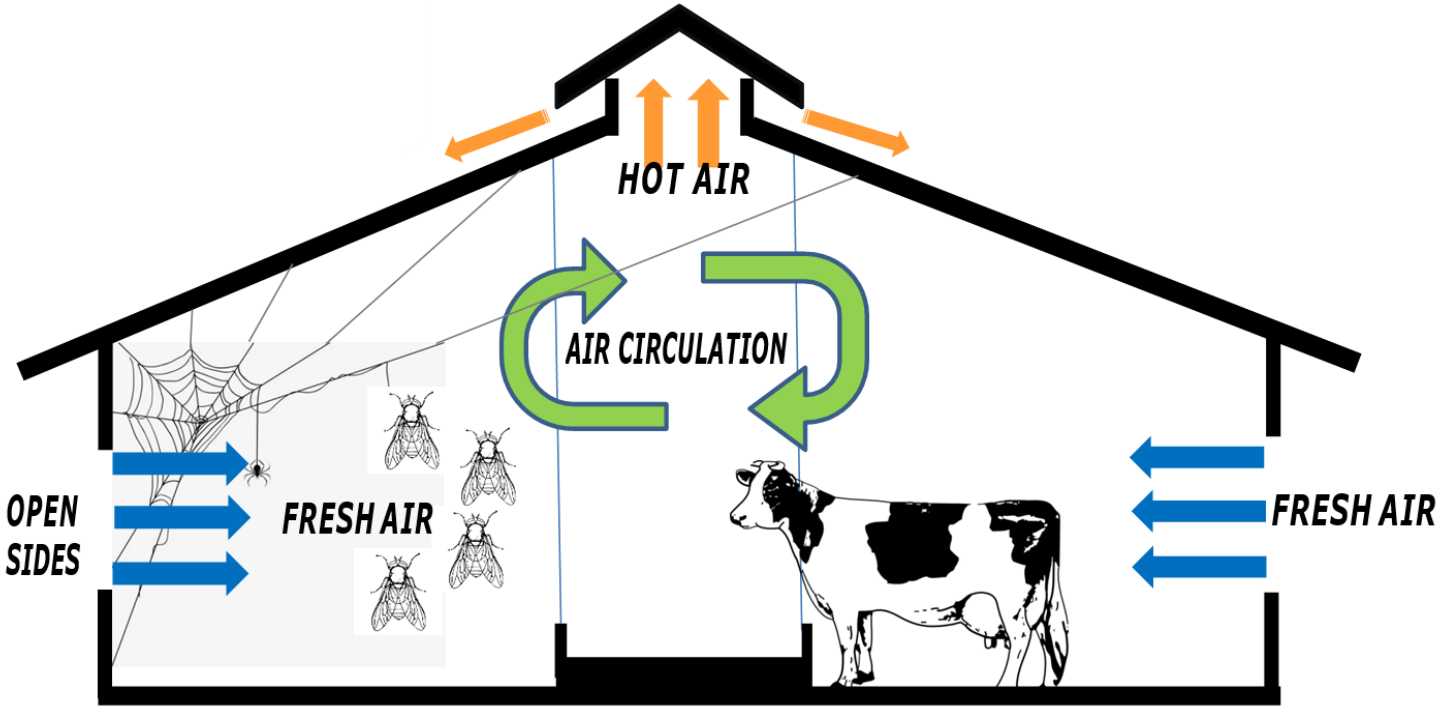






# 16. Cow barn ventilation

- A good ventilation;
  i. Reduces the population of flies and spiders and webs in the barn.
  ii. Reduces heat stress by directing hot air out through the roof and fresh cool air in the barn.
  iii. Reduces toxic gases such as Hydrogen sulphide, Methane, Ammonia and Carbon dioxide.
  iv. Makes the barn more durable.



# 17. Floors

- Floor construction and detailing is the same irrespective of the choice of materials (wood/steel) for other barn elements.
- Floor construction is making concrete all walking and feed alley areas.
- It is relatively inexpensive to install and provides an attractive, durable surface that is easy to maintain. Proper attention to the standard practices and procedures for constructing exterior or interior concrete, can yield a concrete surface that will provide long-lasting, superior performance.

# 17.1 Floors Cont'd…

For best results and quality concrete in construction projects, the following procedures are of great importance;

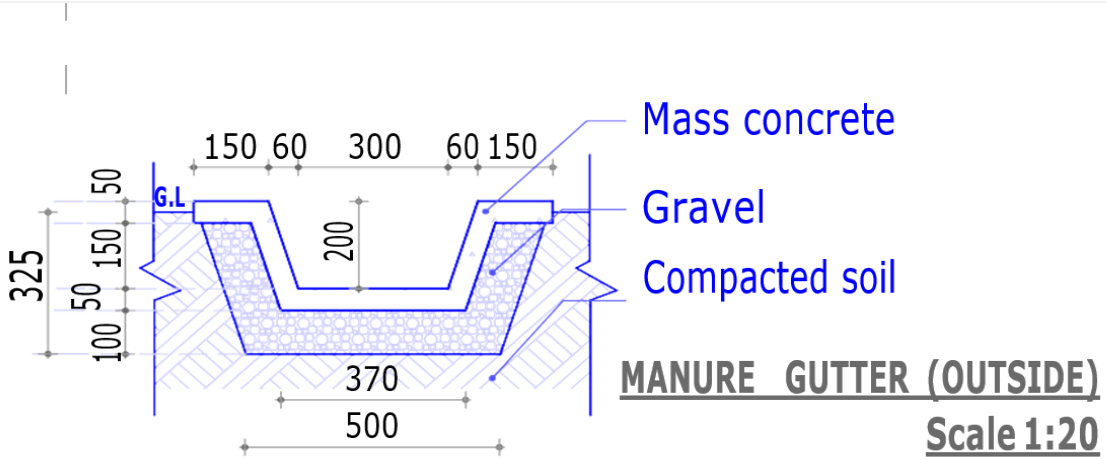

- Ensure support for the slab is uniform, on stable ground.
- Set forms so that the concrete slab surface slopes a minimum of two percent.
- Use a poker vibrator to drive off trapped air and increase bonding ability.

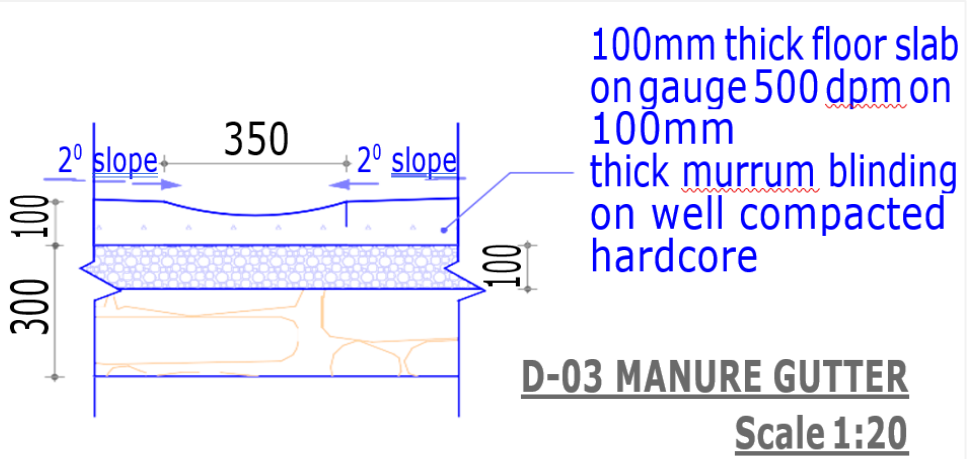
- Do not use high-slump concrete. Control water additions at the truck.

- Make grooves and/or contraction joints in the fresh concrete, to the depth of one-quarter of the slab thickness.
- Start curing immediately after finishing operations.

# 18. Flooring the walkway

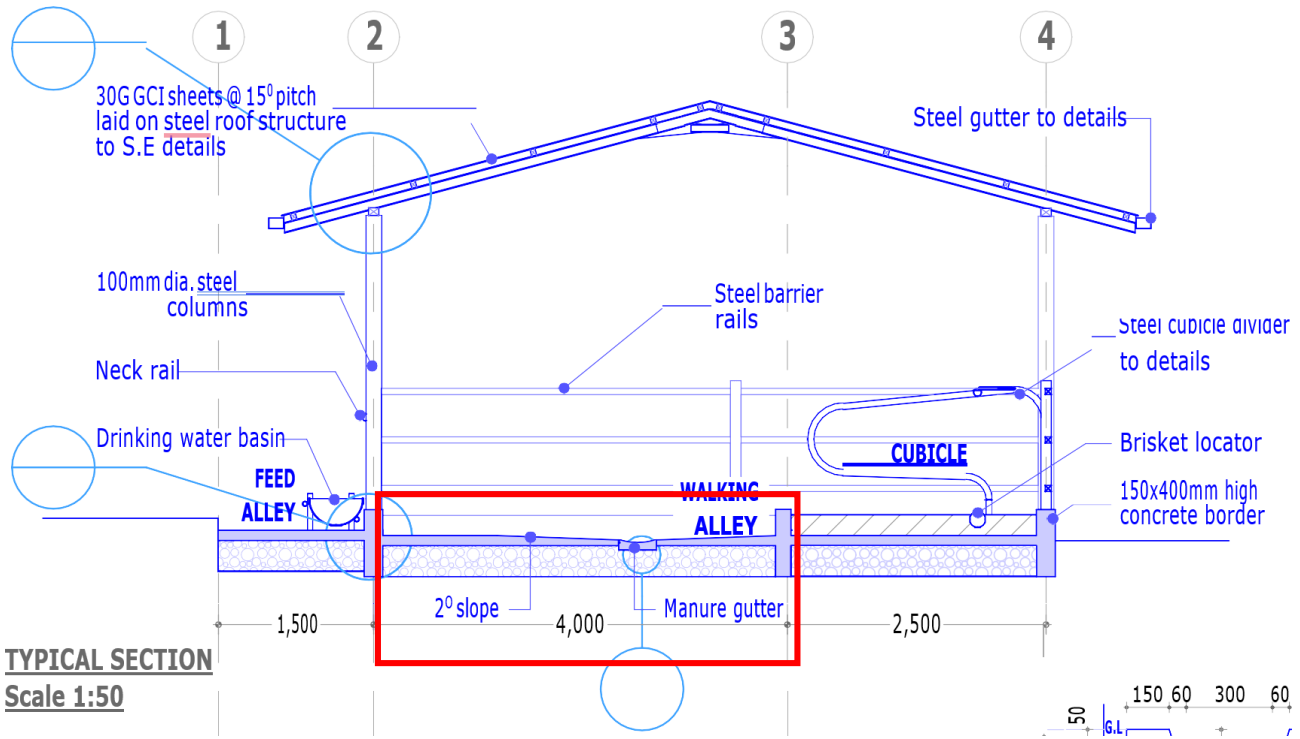
- Construct high-quality concrete walkways, resistant to erosion and able to withstand a high load (i.e. manure scraping with walking or driven tractors).
- Assure sloping towards the direction of the manure dump: 1 to 2% (the red arrow showing direction from highest point A to the lowers point B)
- Provide enough grip for the cows to walk: don't polish.

# 19. Instructions on construction of walkways for cows

- All walkways should be constructed of good quality concrete (15 cm thickness), with an iron concrete grid (diameter: 6 or 8 mm, grid distance: 15 cm).
- All longitudinal walkways should be on a slope of 1.5 to 2.5% (1.5 to 2.5 cm per 100 cm) in two directions: towards the centre and towards the manure dump.
- For easy cleaning, the holding pen can be built on a slope of 3-5 % away from the milking parlour towards the manure dump.
- To provide sufficient grip for the cows, the concrete must not be polished. And in most cases grooving is necessary.



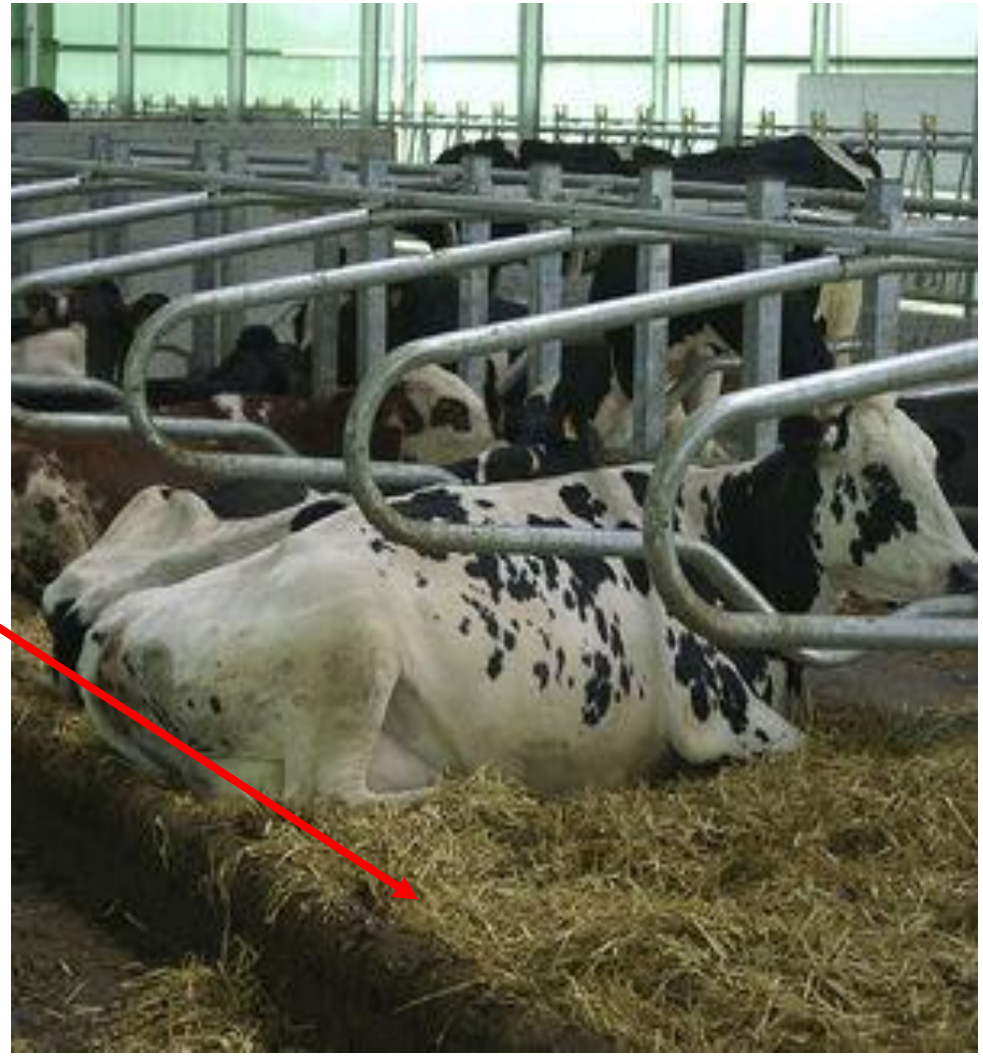

**Tip:** *Contact your farm advisor to explain the detailed contraction information in the drawing.

# 20. Resting/laying areas

- The most important aspect of a cubicles is the flooring/bedding; this should be soft and dry.
- It should also be non-skidding to avoid slipping and falling when the cow lies down or gets up.
- By far the best bedding material is sand.

# 21. Cubicle bedding depth and quality

- Sand and dried manure depth should be at least 20cm deep (knee test) - See module 8.6, Housing & cow comfort (animal welfare).
- Remove manure and wet spots.
- After this leveling of the soft bedding material should be done two to three times per day.
- And if need be replacing these materials should be done daily to maintain comfort.



# 22. Cubicle bedding rubber mattress quality

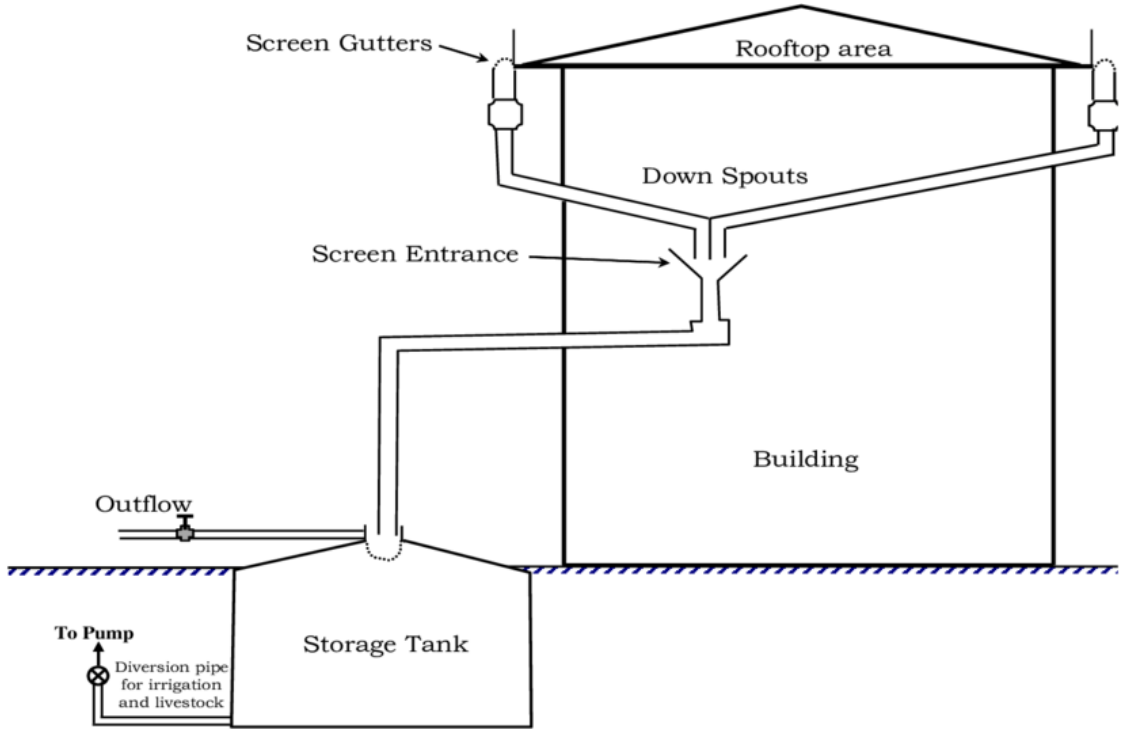
- For the rubber mattresses option, it is recommended to use mattresses with thickness ranging from 40mm to 60mm.
- The mattresses should be one piece, not two or more layers.

# 23. Manure collection drain and manure bunker/pit

- Manure must be collected daily and put in a storage facility or bunker.
- Manure (or biogas slurry, if the manure is first used to generate biogas) is stored over a longer period of time in a pit or bunker (preferably of concrete and with a cover) and later used as organic fertilizer.

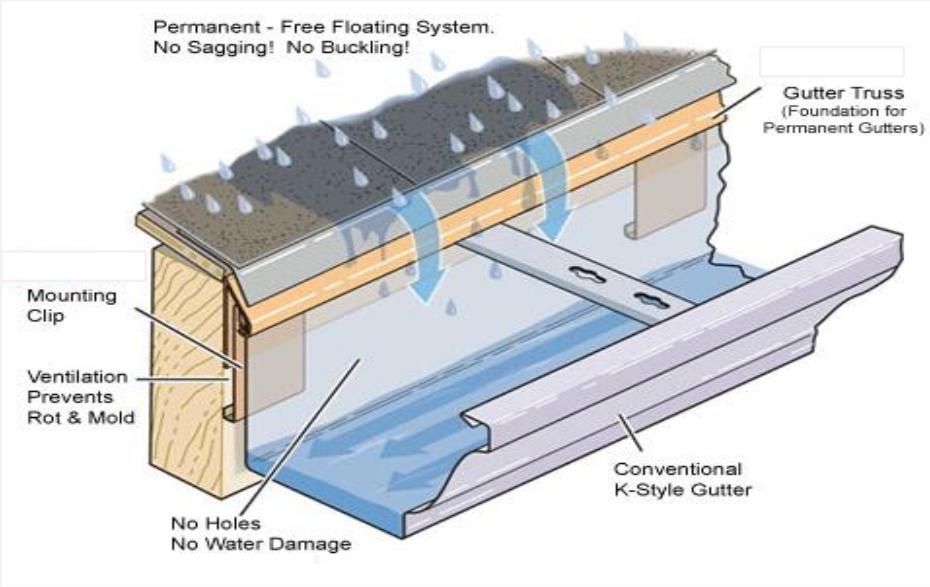
# 24. Rain harvesting

- A guaranteed supply of good quality water is important to provide cattle with their daily water requirement and for cleaning. Rainwater catchment may be used to provide part of this, but it will not be sufficient to guarantee sufficient volumes year-round.
- It is advised that the farm be connected to a piped water supply system, or if necessary sinks a deep-well or borehole.
- As a rule of thumb, water storage capacity should be equal to a minimum of two days water requirement of the cows plus water needed for cleaning.



# 25. Cow barn maintenance

- Roof gutters: should be cleaned periodically, especially before rains.
- Floors: should be maintained in good repair condition.
- Wooden and steel members such as structural posts and cubicle partition posts should be protected from long exposure to water and cow urine to guarantee longer life span of the cow barn.

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