

Section 8

Winter accommodation for beef animals

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Introduction

Expenditure on farm buildings is, by its nature, a long-term capital investment which needs careful planning both from a financial, and a technical, point of view. Good workmanship and correctly specified materials are also essential if the structure is to stand the test of time and prove good value for money.

- ① What should I consider when planning any building project?
- ② How do I estimate the cost of winter accommodation for beef animals?
- ③ What are the advantages/disadvantages of each system?
- ④ What slurry storage facilities do I need?
- ⑤ What should I consider when planning handling facilities?
- ⑥ What are the recommended space allowances (animal area and feed space) for animals in different types of housing systems?
- ⑦ What are the key points to consider in relation to ventilation?

Winter accommodation for beef animals

① What should I consider when planning any building project?

Checklist



- Virtually all new farm buildings will require planning permission. Consult your Teagasc adviser for guidance on planning requirements. A pre-planning meeting with your local council may be useful in some cases. The planning application process is a real cost to the project, which includes a planning fee, a fee for the drawings and perhaps a development contribution. Development charges and exemption limits for farm buildings can be found on your local council's website.
- Think ahead. When choosing the site, for example, consider whether there is scope for future expansion if needed.
- Get accurate costings. Shop around and get itemised quotations. An itemised quote will ensure that you know exactly what is and what is not being costed. When comparing quotes be sure that you are comparing like with like and that each is up to the same specification.
- Ensure that the building will be fully compliant with the requirements for storage of slurry, effluents, etc.
- Create a financial plan that identifies how you will pay for the building. Be careful that the proposed structure is affordable; otherwise it will have negative financial implications for your farm business.
- Maximise the use of TAMS grants, capital allowances and interest relief.
- Define the beef system that you will pursue and how it can help finance the building.
- Be sure the design is correct for the intended purpose.
- Begin 'with the end in mind', develop a project time-line for the building with the date you want to house cattle as the end point.
- Any infrastructure development, from planning to being fully operational always takes longer than expected so allow extra time.
- Don't be tempted to add on additional work that is not included in the plan.





② How do I estimate the cost of winter accommodation for beef animals?

Generally, the best approach is to divide up the proposed structure into its parts and write a detailed schedule of costs item by item. This is the method used by farm building contractors when they are writing a quotation. Alternatively, use the National Reference Costs compiled by the DAFM and available on their website, which can be used to estimate the cost of items eligible for grant aid under TAMS.

Having an itemised quotation is of benefit both to the farmer and the contractor. It helps to avoid disputes over what was or was not included in the price. Charges for extras or for modifications to the original plans should not come as a surprise. The contractor will need detailed drawings to write an itemised costing like this, so it is essential to have detailed plans/drawings of the proposed development.

Look at all options

In the initial stages of planning it is important to keep an open mind, look at all the options including the most expensive - building on a green-field site. It is only then that the best option can be chosen.

Existing facilities should be used as much as possible provided this does not involve too many compromises. An example of the use of existing facilities would be a new slatted tanks beside/in an existing building, or conversion of existing accommodation to a different use e.g. calving house or handling facility. Discuss options with your Teagasc advisor.

Winter accommodation for beef animals

Key Facts:

Price estimates 2016

Standard drawings of cattle houses and more details on the costs are available from your Teagasc adviser.

Calf housing

A calf house for 100 calves costs approximately €46,000 or €450 per calf. This equates to about €180 per m² of total internal area. It includes fittings and fixtures but not modern automatic calf feeders.

Slatted cattle house

To build a slatted unit for 1½ to 2 yr old steers each with a pen area of 2.5 m² costs approximately €1,000 per animal. For finishing bulls, each with a pen area of 2.9 m² /animal the cost would be approximately €1,150 per animal. For weanlings, each with a pen area of 1.7 m², the cost would be about €680 per animal.

The cost per m² of pen area is about €400. Costs include fittings and fixtures, but exclude slat mats. Slat mats would cost about €50 per m² of pen area.



Slatted suckler cow house

A slatted suckler cow house with a slatted cow area of 2.8-3.0 m² plus calving pens/creep areas and handling facilities costs €1,600- €1,800 per cow. The design will vary depending on whether the herd is spring or autumn calving. There is less of a requirement for a calf creep area in a spring calving herd. A straw-bedded suckler house an area of 4.5 m² per suckler cow and 1 m² per calf costs approximately €1,300 per cow place.

Table 1. Itemised costs for a 6 bay slatted unit as per drawing B24a

Items	Units Used	Cost per Item (€)	Measurement for the shed	Slatted Unit Costs (€ c x d)	Cost Per Bay
Roof	m ²	€65.00	576	€37,440	€6,240
Side-cladding	m ²	€25.00	138.24	€3,456	€576
Slatted Tank (storage for 122 1.5-2 yr olds)	m ³	€85.00	648	€55,080	€9,180
Stanchion Base	each	€100.00	28	€2,800	€467
Concrete floors	m ²	€24.00	60.48	€1,452	€242
Concrete Feed Passage	m ²	€24.00	175.68	€4,216	€703
External walls	linear metres	€150.00	57.6	€8,640	€1,440
External walls over tank	linear metres	€110.00	23.8	€2,618	€436
Beams for external wall at tank	linear metres	€25.00	20.6	€515	€86
Sliding Doors	m ²	€90.00	52	€4,680	€780
Feeding Barriers (diagonal or equivalent)	per bay	€385.00	12	€4,620	€770
Feeding Barriers Walls	linear metres	€27.00	57.6	€1,555	€259
Pen Divisions	linear metres	€75.00	59.5	€4,463	€744
Water Bowels	each	€150.00	6	€900	€150
Electrical work	per bay	€5.00	576	€2,880	€480
Concrete Apron adjacent to gable ends	m ²	€24.00	110	€2,640	€440
Storm Water Drainage	estimate	-	-	€600	€100
Slat Mats (€50 to €80)	m ²	€50.00	0	€0	€0
Planning Fee	actual	-	-	€0	€0
Planning Drawings and application	estimate	-	-	€0	€0
Total Costs (excl. VAT)	€	-	-	€138,555	€23,092
Number of 1.5 to 2yr old steers housed	number @2.5m ² each	-	-	140	
No of bays	Number	-	-	6	
Cost per 1.5 to 2yr old steers	€	-	-	€990	
Roof and Tank as a % of Total Costs	%	-	-	67%	
Pen area	m ²	-	-	348.5	
Cost per m ² of pen area	€	-	-	€398	
Number of weanlings housed	number @1.7m ²	-	-	204	
Cost per weanling	€	-	-	€679	
Number of finishing bulls housed	number @2.9m ²	-	-	120	
Cost per bull	€	-	-	€1,155	

Note: Bh24 a has enough space to house 140 1.5 to 2 year old steers or 120 finishing bulls or 204 weanlings.

Silage pit costs

- Build to Department of Agriculture, Food and the Marine (DAFM) specifications S100, S128, S120. It's a storage structure according to the Nitrates Directive; therefore it must be built, maintained and managed correctly and to DAFM specifications.
- Silage slab and apron: Silage occupies 1.4 m³ per tonne and typical storage height is 2.5-3.0 m, so each square metre of floor area can accommodate 2 tonnes of silage.
- Silage, pit floor and apron costs approximately €27-32/ m² (including 75mm x 75mm channel).
- Large front channel €50/linear metre.
- Silage pit walls (2.4 m) €310/linear metre.
- Guide rails €22/linear metre.

Key Facts:

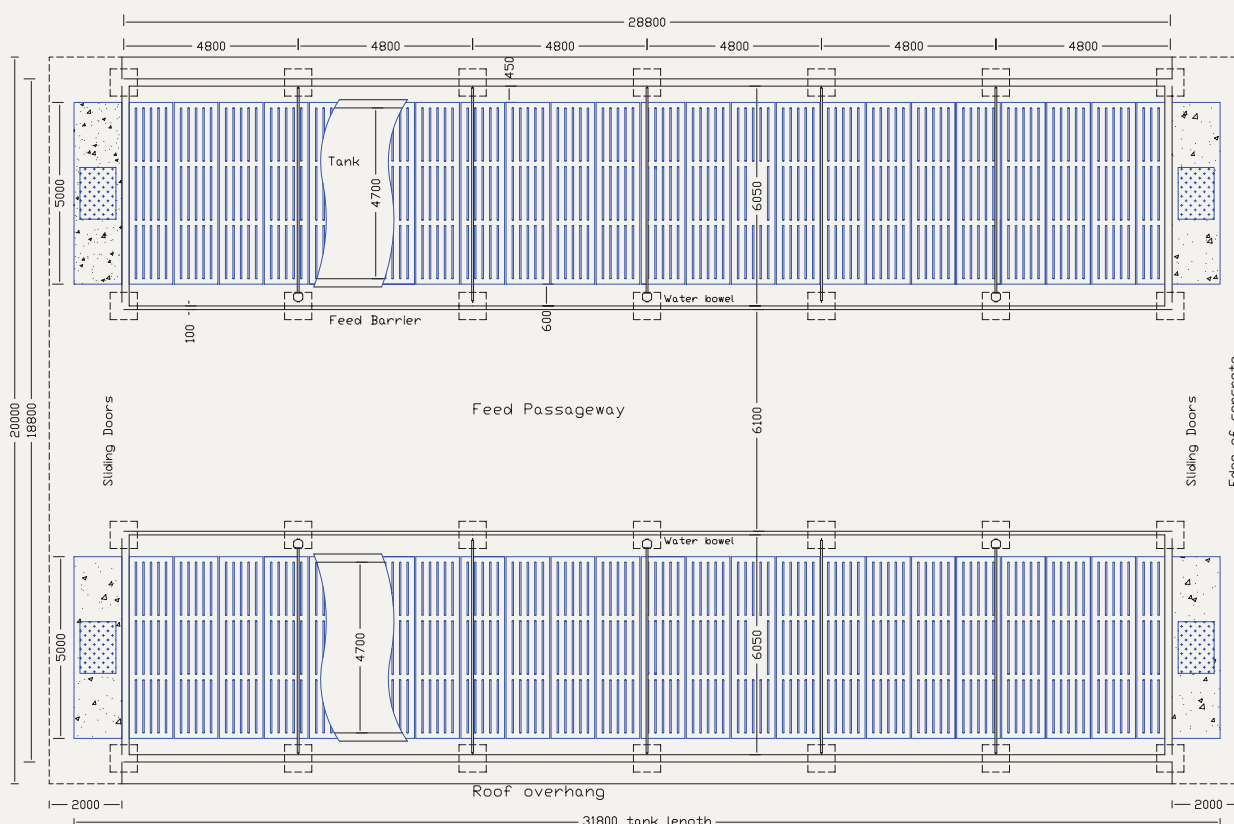
Any effluent from round bales must be collected, stored and disposed of, as for effluent from silage pits.

Notes – applies to all buildings

- All costs are excluding VAT. Keep good records to reclaim VAT.
- All buildings costed to grant standard using competitive contract rates.
- Mass-concrete walls (above ground); 0.2 m thick x 2.1-2.4 m high are costed at €140 to €160 per linear metre.
- Concrete floors are costed at €22 to €26 per m².

Slatted Shed – BH24a

This design is suited for diet feeding. Where meal is fed separately to silage a meal trough with shutters and access is required along the sides of the building.



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Key Facts:



Roof and tank costs have the biggest effect on overall costs.

- Roofs are costed at €50 per m² but can range from €45 to €60 per m², for standard steel frame structures, built to conform to DAFM specifications. See specifications S100, S101 and S102.
- The cost of slatted tanks can vary widely. Some builders may be building tanks to a specification lower than the DAFM specification S123. The cost used for costing tanks in the examples above is €80 per m³ of total tank capacity. This covers the cost of a completed slatted tank including, excavation, backfilling, carting away, slats, etc.

Key Facts:



Most quotes from building contractors do not include excavation, carting away or the provision of hardcore filling material.

- ③ **What are the advantages/disadvantages of each system?**

Slatted housing

Advantages

- Flexible shed for most livestock types.
- Low maintenance.
- Low running costs.
- Independent of weather for animals and farmer.

Disadvantages

- High initial capital cost.
- Shed cannot be used for other purposes.

Straw-bedded shed

Advantages

- Flexible shed for all livestock types.
- Shed can be used for other purposes.
- Choice may be dictated by availability of straw (location in the country).

Disadvantages

- Annual straw cost.
- Higher labour requirement.
- Machinery costs associated with straw use.
- Farmyard manure store required where sheds are cleaned out during winter closed period.

Out-wintering pads

Advantages

- Low initial capital cost.
- Flexible.
- Healthy outdoor environment for animals.

Disadvantages

- Annual cost of woodchips.
- Cost of spreading woodchips.
- Cost of spreading extra slurry/effluents.
- Extra slurry storage capacity required in counties with high rainfall and longer closed periods.
- Farmer exposed to weather for management activities.

④ What slurry facilities do I need?

Slurry storage

Slurry produced during winter is a major resource. Recycling this slurry to the grassland area is an essential part of nutrient planning on farms and reduces the amount of P and K fertiliser needed. Similarly, slurry can be used to replace N fertiliser, especially when applied early in the grazing season. Legislation defines minimum slurry storage capacities required on farms. These range from 16 to 22 weeks, depending on the zone a farm is located in. Similarly there are minimum closed periods when slurry cannot be spread. These range from 12 to 16 weeks. Providing more storage than the minimum will make slurry management easier at the end of the closed period.

Underground slatted tank

Advantages

- Low labour requirement.
- Low maintenance.
- Low running costs.
- Very suitable for slurry storage from cattle.

Disadvantages

- Expensive to construct.
- Difficult to increase capacity/expand tanks.

Overground tank

Advantages

- Cheaper to construct for large capacities.
- Can be designed to increase capacity by adding extra height.
- Slurry collecting system required.
- Can be conveniently located to allow expansion.
- Slurry can be agitated at any time as there is no risk from slurry gasses and so is readily available for spring application.
- Very suitable system where rock close to the surface makes slatted tanks difficult to construct.

Disadvantages

- Slurry must be pumped into tank.
- Slurry collection system required e.g. scrapers or slurry channels.
- Rainwater is collected.

Lagoons – earth lined or geomembrane lined

Advantages

- Cheap to construct for large capacities.
- Slurry is dilute - more efficient use of nitrogen.

Disadvantages

- Some sites not suited to earth-lined lagoon.
- Collects rainwater, extra volume to be managed.
- Some local authorities do not allow earth lined lagoons.
- Slurry collection system required e.g. scrapers or slurry channels.



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Slatted tanks

Figure 1 shows a cross-section of a slatted unit (BH24a) with two single tanks. Each tank has an internal width of 4.7 m with a 5.0 m slat on top. The net capacity of each tank is the internal length (31.8 m) by the internal width (4.7 m) by the net depth. A freeboard (0.2 m) allowance is taken from the internal tank depth to get the net depth. Therefore the net slurry capacity for each tank is 31.8 m x 4.7 m x 2.2 m which is 328.8 m³.

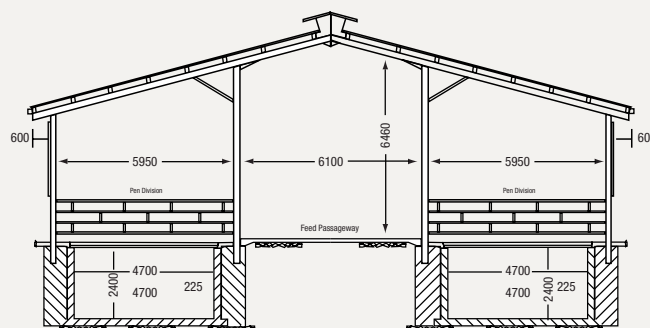
Net slurry storage capacity required

Livestock type	m ³ /week
Suckler cow	0.29
Cattle > 2 years	0.26
Cattle (18-24 months old)	0.26
Cattle (12-18 months old)	0.15
Cattle (6-12 months old)	0.15
Cattle (0-6 months old)	0.08

Average net rainfall during the specified storage period

County	Millimetres per week
Carlow	24
Cavan	27
Clare	32
Cork	37
Donegal	38
Dublin	17
Galway	34
Kerry	45
Kildare	18
Kilkenny	23
Laois	22
Leitrim	33
Limerick	26
Longford	23
Louth	20
Mayo	40
Meath	19
Monaghan	23
Offaly	20
Roscommon	26
Sligo	32
Tipperary	27
Waterford	31
Westmeath	21
Wexford	25
Wicklow	33

Figure 1: Cross section of a typical slatted unit with two single tanks (BH24a).



Slatted tanks

How to:

Calculate slurry tank size

- Slurry produced – 140 cattle x 0.26 m³/week x 18 weeks = 655 m³.
- Slatted tank capacity in BH24a – 2.4 m deep (net depth 2.2 m), 5.0 m slat (4.7 m internal width).
- To calculate tank capacity multiply the length by the width by the net depth.
Tank length is = to for 6 bays x 4.8 m per bay plus 3 m for external agitation = 31.8 m.
Effective width is 4.7 m.
The net depth is 2.2 m.
Capacity is 31.8 x 2.2 x 4.7 = 328 m³ x 2 tanks = 657 m³.
- Refer to current DAFM specification S123 for construction of slatted tanks.

Farmyard manure pit

- Bedding material cannot be stored on grassland over the winter closed period.
- Effluent must be collected where this material is removed from sheds over the winter. Refer to DAFM specification S108 for manure pits and dungsteads for construction details.

Overground circular tank

- Overground tanks (steel and concrete) are available in a range of sizes.
- The capacity of a circular tank is π (3.14) multiplied by the radius squared by the height. But remember that freeboard and rainfall must also be allowed for. For example, the net capacity for a tank that is 3.0 m high, radius of 10 m, rainfall of 32 mm per week and storage requirement of 18 weeks is $\pi \times \text{radius squared} (10 \times 10) \times \text{net height } (3 - (0.3 + 0.58)) = 666 \text{ m}^3$.
- Refer to DAFM specifications for full details of construction of overground slurry stores.
- S122 Minimum Specification for Proprietary Over-Ground Circular Slurry/Effluent Stores - January 2016.
- S122A Accepted Contractors for Proprietary Over-Ground Circular Slurry/Effluent Stores - October 2015.

5 What should I consider when planning handling facilities?

Good handling facilities are essential. Routine animal movement and handling are necessary for dosing, vaccination, herd testing, loading, weighing, etc.

Checklist:



Advantages of an efficient, carefully planned handling unit:

- Reduced labour requirements.
- Improved working conditions.
- Reduced risk of injury to both stock and the farmer.

Siting

The handling unit should be sited in a convenient location in relation to farm buildings, farm roadways and fields. Effluent or slurry from the handling unit must be collected, stored and properly disposed of. Handling facilities in, or adjacent to, buildings make control of effluent and slurry much easier by making cleaning easier and minimising the rainwater falling on soiled areas.

A satisfactory layout should include:

- collecting pen,
- forcing pen,
- race or chute,
- crush,
- holding/dispersal pen.

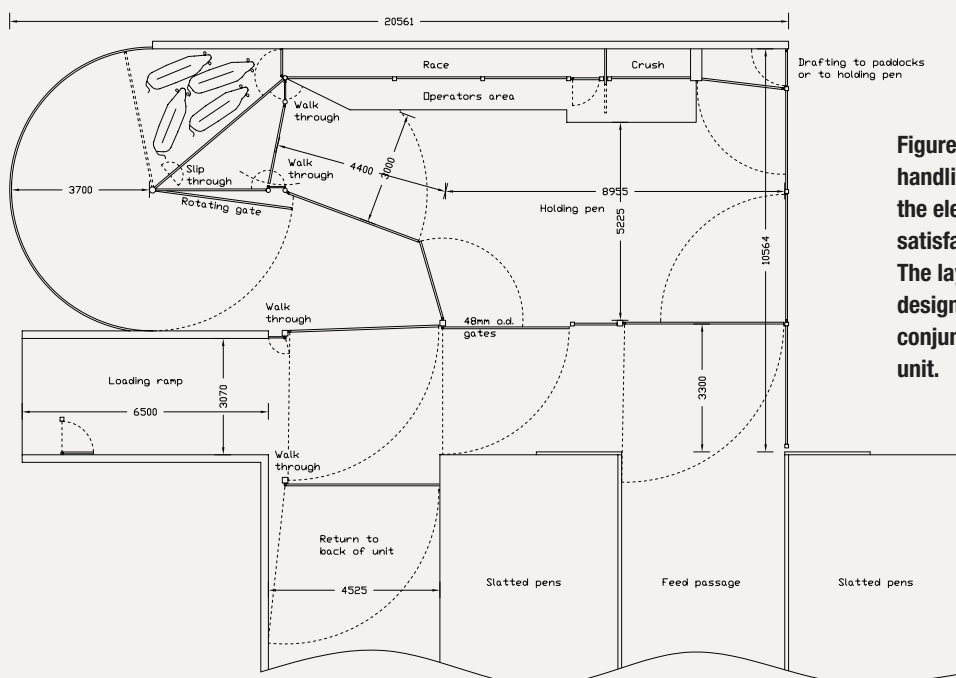


Figure 2 shows a typical handling layout with all the elements of a satisfactory system. The layout shown is designed to be used in conjunction with a slatted unit.

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Collecting pen

Where the handling facilities are located independent of buildings, the collecting pen should ideally be able to hold a number of cattle that fits in with group sizes within the herd. Where handling facilities are located in, or adjacent to, e.g. a slatted unit the pens in the slatted unit could be used for collecting and holding animals.

The floor area required per animal will vary depending on size. As a general guide allow:

- Young cattle: 0.9 to 1.1 m²
- Finishing cattle: 1.4 to 1.7 m²
- Suckler cows with calves: 2.3 to 2.75 m²

It is easier to control and move cattle in a long narrow pen rather than a wide square one. Pen widths of 4.5 to 6 m are recommended (depending on herd size). The entrance to it should be at least 3 m wide to allow easy access.

Forcing pen

The forcing pen leads from the collecting pen to the race. The forcing pen should be funnel shaped as it approaches the mouth of a race. One side of the funnel must be straight. The angle of the funnel is critical and should not exceed 30°. If the angles are wider, cattle may block or turn at the mouth of the race or two cattle may become jammed at the race entrance. The widest point of the pen should approximately be 3 to 4 m. The forcing pen should hold enough cattle to fill the race. Circular forcing pens leading to a funnel entrance to the race are preferred to rectangular ones.

Animals should not be tightly packed into the forcing pen as they may need to turn to enter the race.

Race

- Length: The race or chute should be 3.6 m minimum. A race of 9 m will hold 5 to 6 adult cattle. Long races (e.g. handling over 12 cattle) are not recommended.
- Width: the internal width of the race will depend on the size and type of the largest cattle using it. As a general guideline, allow: adult stock 700-750 mm clear internal width.

Exceptionally large stock (e.g. pedigree) may require facilities up to 900 mm wide. Young stock require an internal race width of approximately 500 mm. Very wide races may have to be altered temporarily for young stock e.g. fitting panels/planks to the side.

- Height: 1.4-1.5 m above floor level. All surfaces must be smooth. Avoid protruding objects. Uprights should be spaced about 2 m apart. Side bars are normally spaced 350-400 mm apart.
- Floor: Non slip concrete surface.
- Tailbar: It should be possible to use a tailbar at various points along the race to prevent stock reversing out.
- Facilitates drainage, e.g. via split drains.
- Incorporates opening side panels/gates for easy release of animals if necessary.

Catwalk

A catwalk running outside the race:

- Reduces risk of injury to the operator.
- Improves access and reach when handling stock.
- Prevents cattle's feet slipping out under the bottom rail.
- Catwalks should normally be 250-400 mm high. The width of the catwalk should be wide enough to facilitate a safe and efficient working area. The recommended width should be approximately 1.1 m. The catwalk can be omitted along side the crush section if it is seen to restrict the operator's access to the animal.

Crush

The crush may be part of the race or a separate facility at the end of the race. A well designed crush should incorporate the following features:

- Quick release restraining gate. Different designs of proprietary head gates are available and the choice depends on the frequency of use and type of work to be done.
- Have a tailbar/gate to prevent and control backward movement.
- All around access to the animal, including at the rear.
- A secure gate to hold back animals in the race is essential when accessing the rear of an animal. The animal in the crush must also be prevented from backward movement.
- Removable side bars/gate for access to feet, udder, etc.
- Have equipment for hoisting and restraining limbs.
- Facilitate weighing if necessary. The weighing facility can be in a separate section of the race behind the crush
- Preferably be under cover.
- Free from sharp edges.
- Non slip floor surface.
- Facilitate access of a vehicle for loading of animals.

Purpose-built crushes are commercially available.

Typical dimensions are:

- Length: 1,830 mm.
- Width: 790 mm.
- Height: 1,625 mm.

Dispersal Pen

This pen holds cattle until all cattle are treated or handled. It can facilitate the sorting of stock afterwards. Handling facilities in or near housing can use the pens in the housing for holding and dispersal.

Safety

Safety passes or personnel passes are narrow vertical openings in gates or fences. They typically provide 300 to 350 mm of clear space for people to pass through. Locate passes wherever it is expected that people would otherwise have to climb over a fence or open a gate on a regular basis.

Have a least one safety pass in each pen and one every 7.5-8 m in animal movement and handling passageways to allow someone to exit quickly.

Avoid locating passes where animal flow is directly in line with, or at the pass, as excited animals may try to use the safety pass as an escape route and become trapped. Safety passes also allow someone to get in front of or behind a group of animals safely and with relative ease.

Checklist



Animal behaviour

It is better to rely on animal behaviour principles instead of sheer force to restrain and control animals during handling. Fine tuning the design of animal handling facilities will enhance animal welfare and reduce stress and injuries.

Herd instinct

Cattle prefer to remain in groups. Isolating individual cattle from the group (unless sick) causes stress and agitation and should be avoided. Keep back a companion animal if necessary.

Vision

Cattle are poor judges of detail and distance. They dislike dark or shadowy areas. Provide good natural and artificial lighting in and around handling facilities, particularly where the crush is. Handling facilities under a roof overhang will have plenty of natural light. Use extra rooflights for facilities within buildings. Use extra double fluorescent lamps for artificial lighting.

Key facts



- Cattle are wary of any changes in their path, e.g. abrupt changes in floor material, outside visual distractions, etc.
- Cattle are less surefooted on downward slopes and prefer to move uphill.
- Excessive noise e.g. shouting, machinery and dogs can alarm them and cause unpredictable behaviour.

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6 What are the recommended space allowances (animal area and feed space) for animals in different types of housing systems?

Recommended animal areas

Livestock	House Types	Animal Areas
Suckler Cows	Cubicle House Slatted House (no cubicles) Slatted House (with calves)	1 per cow. 2.5 to 3.0 m ² per cow. Allow 1m ² extra for Spring born and 1.75m ² extra for Autumn born calves.
	Loose House or Combination of Loose House and Slatted Feeding Area	4.0 m ² to 5.0 m ² per cow. Where calves run with cows allow 1 m ² extra.
Other Cattle Over 275 kg	Cubicle House Slatted House Loose House / Sloped Floor House	1 cubicle per animal. Animal Area 2.0 to 2.5m ² per animal. Internal Area 4.0m ² per animal.
Smaller Cattle Under 275 kg	Slatted House Loose House	Internal Area 1.2 to 1.5m ² per animal. Internal Area 2.4 to 3.0m ² per animal.

On-farm requirements may exceed, or can be lower, than the above depending on:

- animal size,
- amount of bedding provided,
- shed design/ventilation,
- calving dates,
- diet,
- animal cleanliness requirements.

Requirements for pedigree stock may have to be adjusted significantly from those outlined.

Actual requirements may vary depending on animal, feeding system, feed barrier design, etc. Also, where concentrates are fed ad-lib or where complete diet feeding systems are used, space requirements may be significantly lower (See table below).

Recommended feed space allowances (mm per head)

	Suckler Cows	Finishing Cattle	Light Store Cattle	Weanlings
Feeding Regime				
Ad lib roughage	400-500	400-500	250-300	225-300
Restricted roughage	600-700	600-650	500-600	400-500
Concentrates/roots	600-700	600-650	500-600	400-500

Feed barriers and feed passages

The stub wall height required depends on animal type and, while 530 mm is ideal for adult animals, it restricts access to feed for smaller animals. Using timber planks allows different heights easily provided for a range of stock sizes. The simplest feed barrier can be provided by a single adjustable straight rail and a stub wall of timber planks. The straight rail should be easy to adjust.

The height of the straight rail should be adjusted to allow animals maximum reach while at the same time keeping animals confined. Pressure points or hair gone from the necks of animals indicates that the rail is too high.



Diagonal barriers have the advantage of less bullying and reduce the amount of feed taken into the pen. Allow for the bottom rail when deciding the height of the stub wall. The animal's neck should not normally come in contact with the top rail with diagonal feed barriers.

Other features of good designs are to have the feed passage floor 100 to 150 mm above where the animal stands.

Any concrete apron under animals' front feet at the feed barrier should not have an excessive slope as this reduces the animal's ability to access feed. Locate the head-rail on feed passage side of the stanchions. Keep stub wall/planks as narrow as possible to maximise reach.

Access for machinery is important for safe and efficient feeding. A minimum feed passage width of 5.0 m is generally recommended, however, wider widths can be justified where troughs are used with diet feeders.

Telescopic loaders with wide buckets, operating in long houses need passageways circa 6.0 m wide.

7 What are the key points to consider in relation to ventilation?

Ventilation

The climate in animal housing is determined by ventilation, temperature, humidity, draughts and dust.

- Good ventilation in buildings is required for the health and performance of housed livestock.
- The life-span of animal housing depends on how well ventilated it is. Corrosion due to condensation, gases and dust may weaken and shorten the life of any building.
- Observe and assess air movement and freshness during the housing period. Aim to have air quality close to that outside the building.
- Ventilation supplies fresh air, removes gases, odours, dust, bacteria and removes heat and moisture generated by the housed livestock.
- Freshness of air within a house is influenced by the air space and the rate of air entry and exit.

- Natural ventilation is the preferred method of ventilation of livestock housing. The ways in which natural ventilation occur are through
 - (1) the stack effect in calm conditions or through
 - (2) the combined stack effect and wind, or
 - (3) wind, but only when the outside air speed is more than 3m/sec.
- The stack effect is driven by the heat produced by the animals. Warm air is lighter than cool air, and as it rises, it is replaced by cooler air.
- The rate of ventilation is influenced by the size of the openings, the roof pitch and the height difference between inlets and outlets.
- Observations of animal houses for ventilation problems should focus on size, location and type of inlets and outlets, roof pitch, height of the eaves, proximity /interference from other buildings and the presence of stale air and condensation during the housing period. Look out for damp bedding due to high humidity and condensation. The presence of a lot of cobwebs, staining and drip lines on purlins and rust spots on metal cladding also indicate a problem.
- Doors should not be used to provide extra inlet or outlet area. Doors may be opened in mild/warm weather to supplement ventilation as long as they don't cause draughts. Doors used to supplement inadequate ventilation will lead to draughts.
- Draughts are just as bad, if not worse, than poor air movement and stuffy conditions. Doors left open continuously are just as bad as a shed with no doors.

Mechanical ventilation with fans can be used, as a last resort, to pump in fresh air and improve air movement in existing problem sheds. They need to be installed and used correctly so as not to create draughts at animal level. The ideal orientation for an animal house is for the side of a building to face the prevailing wind; however this is not always practical. Open sided buildings should be orientated with the open side sheltered from the prevailing wind.

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Improving ventilation in existing buildings

Poor ventilation in existing facilities is usually because inlets and/or outlets are absent or too small. Inlets and outlet areas should be at least brought up to the sizes outlined in the DAFM specification S101.

Inlets typically used in Ireland are vented sheeting and spaced boarding. These are effective as long as there is at least a 1.5 m depth along under each eave. Fabric mesh materials are also effective and have the added advantage of letting in more light.

Another method of improving airflow entry is to angle out the side cladding, at the bottom. Moving out the side cladding to leave a clear opening between the side wall of the shed and the side cladding, just below the top of the side wall, will provide a good inlet. Air is deflected upwards from the side wall as it enters. This can be done easily enough with box section steel. The box section will make it secure and will allow the gap width to be maximized.

Where sheds have a wall built right up, the easiest solution is to knock off a few lines of blocks to provide a continuous opening. Monitor how it works to see if any more needs to be done. Small, inexpensive, changes are the best approach, followed by careful observation for improvements during the following housing period.

Improving inlet airflow is not much good if air outflow is still defective. Air outflow improvement methods for existing sheds will depend on the size and type of outlets, if any. Perhaps the ridge outlet area can be increased by, for example, raising the ridge cap. Spaced sheeting is really not practical unless all the sheeting is being replaced. With round roofed sheds raising sheets (2 per bay) along the top by about 225 mm is effective and is a method outlined in DAFM S101.

Raising sheets is a practical method to turn the roof into a “breathing roof”. One or two lines of sheeting per bay can be raised above the plane of the roof by about 100 mm to 150 mm with an overlap of about 100 mm to 150 mm, at each side, to prevent in-blown rain. The raised sheets run up along the slope of the roof (which is usually across the width of the shed) and possibly up and over a round roofed shed, as well, if one is present. The size of the outlet can be calculated by multiplying the total length of all the openings by the raised height and comparing them to the guidelines.

Some new sheets will have to be used also. These are wider (960 mm or 990 mm) and may be used over the opening as a single line of sheets (most common way), or possibly could be cut into three strips to be used with existing sheets. The new sheets are available in the 750 mm width also. There are different ways to fix the raised sheets. The simplest way would seem to fix box irons (weld cleats on them and bolt to the purlins) above the purlins at the right height and secure the sheets to the box iron with tech screws. The box iron should be long enough to support the overhang of the sheeting at either side.

Light is also very important in animal housing, mainly for the animals but also for the person looking after and observing them. Any improvements to natural light that can be made in conjunction with making improvements in ventilation should be availed of. Replace, or put in more clear roof lights as necessary. The rooflights currently recommended by the DAFM are of a much higher quality than older types.

It is important to examine how the house can be made comfortable and draught free. Draughts are affected by the internal airflow pattern within the house. Airflow pattern is affected by the size and type of inlet and outlet, but also by, roof pitch, building orientation, and the effect of surrounding buildings and landscape.

Checklist:



Water

An adequate supply of clean water for housed livestock is essential.

- To avoid water freezing, locate pipes underground.
- Do not locate troughs on external walls.
- Use heavy gauge piping and minimise the number of joints.
- Consider feeding each trough individually with un-jointed pipe runs.
- 20 mm bore piping will provide adequate flow rates for most situations.
- Proprietary anti-fouling troughs will minimise requirements for cleaning.

Section 8

Calf Housing

by Tom Kelly and Tom Ryan



Introduction

Good calf housing facilities are key to trouble-free calf rearing.

- ① What are the major challenges for housing of calves?
- ② How does good building design improve calf health and welfare?
- ③ What are the major causes of problems in the design of calf houses?
- ④ What designs of calf house work well?

Calf Housing

① What are the major challenges for housing of calves?

Efficiency of operation.

The calf house design must allow for efficient use of time on routine tasks:

- Feeding: Bucket, teat on bucket, nipple bar, nipple feeder, automatic ad-lib feeder or automatic computerised feeding with auto id.
- Meal feeding; hay/silage feeding.
- Bedding of calves, straw big/small bales, peat, wood shavings, plastic slats.
- Handling of calves for e.g. dehorning, treatment.
- Grouping by age, etc.

Good working conditions for farmer/stockman.

While healthy calves can withstand rain, snow and very low air temperatures in open spaces, these are not ideal working conditions for rearing calves. Calves can be reared in low cost systems such as hutches which should be designed for labour efficiency.

Checklist

Features of a labour-efficient system.

- Adequately sized feed preparation area (if more than 20 calves).
 - 0.2 m² per calf.
 - Separate outside door.
 - Its own air space.
 - Lockable cabinet for chemical and veterinary products.
 - Sink and cold water supply, paper towel dispenser.
- Ease of inspection of sick calves.
- Access for tractor with loader to clean bedding.
- External access for calves to a grazing paddock.

Key fact

Calf housing is regulated by law.

The Department of Agriculture, Food and Marine specification S124 Nov. 2009 describes the minimum specification for calf housing.

② How does good building design improve calf health and welfare?

Essentials for good calf health and welfare:

- Adequate fresh air (minimum 5-6 air changes per hour).
- Adequate space (2.5 m²/calf floor area) (7m³ air cubic capacity).
- Dry lying conditions (straw, shavings, peat, mats).
- Clean feed and water.

Adequate fresh air

Fresh air without draughts is the objective. Calves outdoors have access to plenty of fresh air and can choose to find shelter if exposed to cold winds. In a house, fresh air is provided by ventilation which may be natural or mechanically generated.

Natural ventilation

With natural ventilation air is moved within the house, and to the outside, by wind or by the heat from calves which causes the 'stack' effect.

Ventilation due to wind

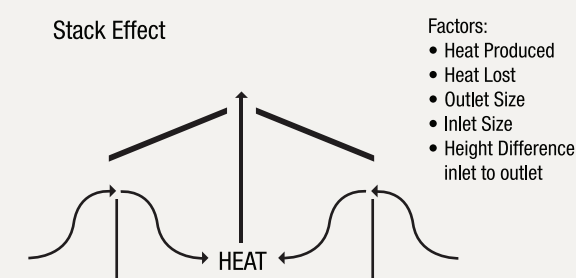
In Ireland, we have wind over 90% of the time even on sheltered sites, from the south west mostly. However, the coolest winds tend to be easterly and northerly. Naturally-ventilated houses should be sited and designed with this in mind.

Ventilation due to the 'stack' effect.

Calves generate and transmit heat mainly through their breath which warms and moistens the air. Warm, moist air is an ideal medium for disease spread but is also lighter and will, in calm conditions, rise and exit at the highest point of the house.

The 'stack' effect is the same principle which draws smoke up a chimney. In order to ensure good ventilation, i.e. a minimum 5-6 air changes per hour, the minimum outlet/inlet size is 0.08 m² on sheltered sites and 0.05 m² on exposed sites. The air space in the house or cubic air capacity should be 7 m³/calf.

Ventilation in calm conditions



For the 'stack' effect to work there must be adequately-sized outlets at the highest point in the roof and inlets lower in the house to allow cooler air in.

In non-calm conditions the stack effect is overridden and the ventilation rate will be many multiples of that provided by the 'stack' effect in calm conditions. A major problem can arise – draughts – which may cause chills for calves. The design of the calf house, its location and orientation, can be major influences on draughts and calf health.

Mechanical ventilation.

In poorly-located sites, and in existing houses not designed for natural ventilation, mechanical ventilation may be the only option.

- Mechanical extraction fans should always be fitted to the highest point of the house roof apex.
- Fixed speed fans are better than variable speed fans as variable speed fans can be over run by wind at slow speeds.

- Fans should have a minimum extraction capacity of 34 m³/hour/calf.
- In the Irish climate temperature-controlled mechanical ventilation is not needed. Manual controls are better.
- Inlet design is important to ensure good mixing of air without draughts.
 - Inlets should be long and narrow.
 - Inlets should be situated at eave height but not more than two metres above floor.

Adequate calf space.

Calves housed in small groups or in larger groups require 1.8m² of pen area and a total floor space of 2.5 m²/calf floor area). Young housed calves spend 60-70% of their time lying down and tend to lie in groups when in bigger pens. They have a requirement for space to exercise and socialise.

Calves may be kept in single pens or group pens or a combination of both

- For large herds, two rows of pens with central passage is suitable.
- Passages should be not less than 1.2 m.
- Moveable (eases cleaning and group size variation) or fixed pen divisions can be used.
- Individual pens should be at least 1 m x 1.5 m (1.7 m long recommended).

Key fact

Regulations (S.I. 14/2008) state that calves more than eight weeks old may not be kept in individual pens unless a registered veterinary surgeon certifies that its health or behaviour requires it to be isolated in order to receive treatment (see section 5.1.3 of S124).

Calf Housing

Key risks



With automated feeding, farmers tend to group calves into large groups at younger ages.

This has two effects:

- It is difficult to see an individual calf with a problem.
- Calves will tend to lie in groups, often in the most sheltered area of the house. This may cause a micro environment of stale air and increase disease spread.

These problems can be overcome by;

- Avoiding very deep pens, i.e. long and narrow pens.
- Ensuring good internal air flow patterns.

Key fact



Group pens should be sized based on the weight/age of calves.

- < 150 kg (calf age < 19 weeks) 1.5 m² minimum, 1.7 m² recommended.
- 150 - 220 kg (age 19 to 32 weeks) 1.7 m² minimum.
- > 220 kg (age > 32 weeks) 1.8 m² minimum.

Dry lying conditions.

Calves in houses do not suffer ill effects from cold if they are dry and sheltered from draughts. If renewed and replaced regularly, straw is an ideal bedding material for calves. Calves can require up to 20 kg/head/week to maintain dry conditions on bedded concrete floors. This quantity can be halved by using slats under the straw. Shavings, peat and rubber mats can also be used to provide dry lying conditions.

Drainage on concrete floors can be improved by having a 1:20 slope towards a channel. Channels should have a 1:60 slope and remove waste to an external, ventilated, storage tank. Shallow channels within pens 25-30mm deep and 100 to 150mm wide are easily cleaned by brushing and do not impede mechanical cleaning of straw beds.

Checklist



To ensure pens can be easily cleaned and disinfected.

- Quality materials should be used for pen divisions.
- Good workmanship on concrete floors and wall finishes.
- Falls 1:20, 1:60 in channels.
- Front drainage channel 75 mm x 75 mm (see S124).
- Use trapped gulleys to prevent back odours.
- Safety - no steps, electrical installation to ETCI standards.

Excess use of water for daily hosing down of feeding area is not needed. Well ventilated calf houses will have adequate air flow to dry up any spillages.

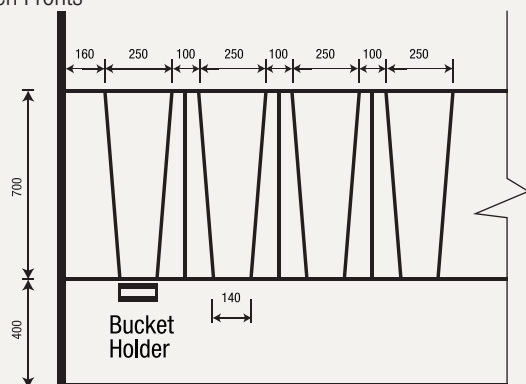
Clean feed and water.

Contamination of feed and water is likely from other calves, vermin and flies. This can be reduced by good design of penning, good ventilation and feed and water trough design.

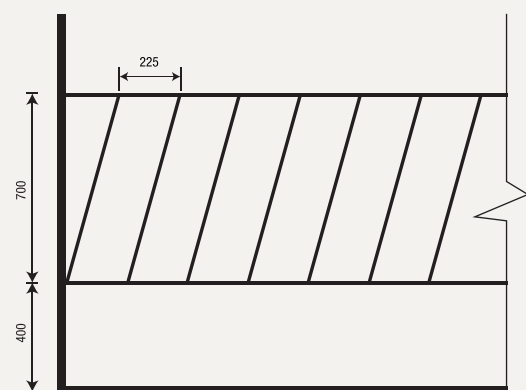
Hinged and removable gates and divisions have huge advantages for bedding and cleaning. Pen divisions should be at least 1.2 m high. For bucket feeding, calves need 350 mm of feed face. Automatic feeders require little space, there should always be more one teat per pen. This reduces the risk of calves being without milk and then gorging when a teat is fixed.

The number of calves per feeder varies; consult the manufacturer. Water bowls, leaver bowls, nipples and self-fill bowls are best. Fittings should be frost protected and protected from animal chewing. Meal troughs should be 450 mm above the floor, 100 mm deep and 250 mm wide.

Pen Fronts



Example of pen front for bucket feeding



Example of pen front for meal feeding

Services and labour efficiency

Artificial light – 50 lux (about five watts/ m² fluorescent).

Natural light – at least 10% of roof area, see S101
Power points for automatic feeders, feed store, infra-red lamp, power washer, etc.

Water supply – drinkers for group pens. Cold/hot (frost protection).

Key requirements

- Minimum 5-6 air changes per hour.
- Minimum outlet/inlet size 0.08 m² sheltered sites
0.05 m² exposed sites.
- Total house cubic air capacity 7 m³/calf.
- Mechanical Ventilation min capacity of 34 m³/hour/calf.
- Adequate space (2.5 m² / calf floor area).
- Compliance with DAFM specification S124 Nov. 2009 and Regulations (S.I. 14/2008).

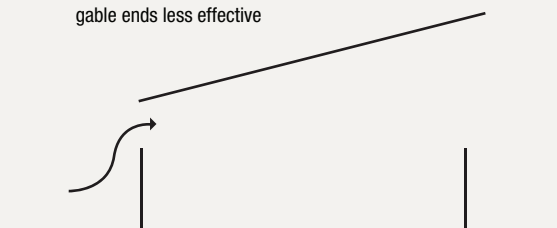
③ What are the major causes of problems in the design of calf houses?

Inadequate roof pitch. Air is deflected downwards causing draughts; less than 15° is inadequate, roof slopes of 22° are recommended.

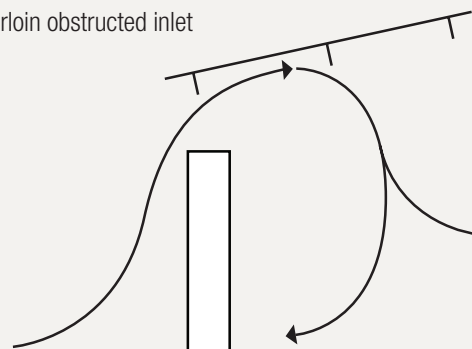
Poor inlet design: inlets that deflect air downward will cause draughts.

Inlet location

Eave inlets are ideal
1.2 to 1.6 m above floor
gable ends less effective



Purloin obstructed inlet

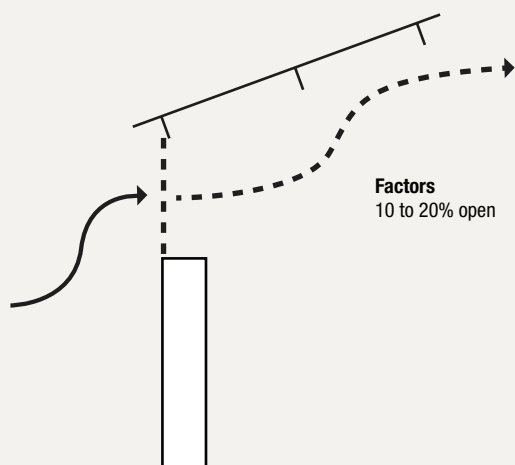


Calf Housing

Space boarding; perforated inlet material, will slow down air and give a more even distribution. However the space boarding should not restrict the inlet causing inadequate flow of air across the house, especially in wide houses.

Gaps of 20-25 mm between boards 50 – 200 mm to give an area 0.08 m² /calf are suitable for most calf houses. Reducing the gap to 12mm and the space to 0.05 m²/calf gives good results in exposed sites especially if the house is not more than 12m wide.

Space boarded perforated Inlet.

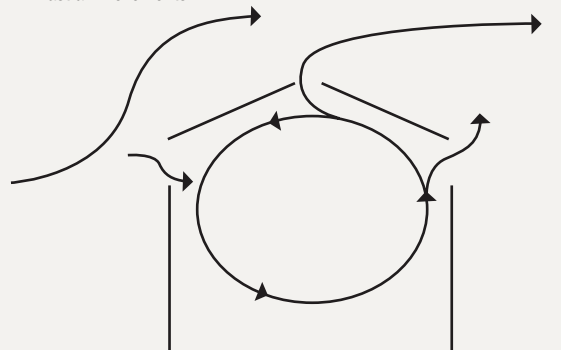


Draughts; spaces under doorways and pen divisions may cause low level draughts.

Large height difference: large height differences, greater than 3 m, between inlets and floor affect the pattern of airflow in windy conditions. It also reduces the effectiveness of the 'stack' effect in calm conditions. Foul air cools down before it reaches the outlet and is recycled without being replaced by fresh air.

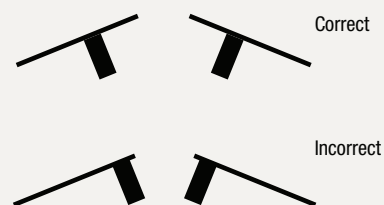
Excessively high eaves.

Factors
Down draughts
Fast air movements

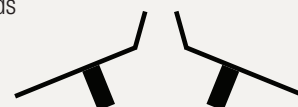


Poor outlet design. The size of outlet has a major impact on airflow and ventilation in calm conditions. Any obstruction to the outlet will reduce its effectiveness. Simple open ridge space works best. Capped ridge outlets should be properly designed and constructed.

Simple ridge outlet

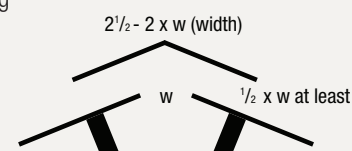


Ridge upstands



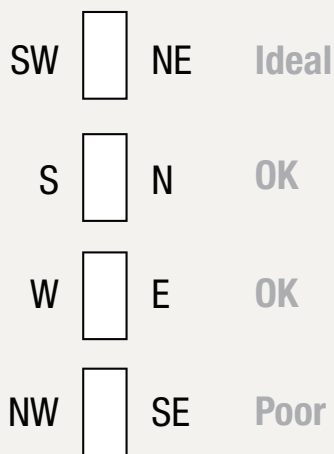
Upstands should not restrict the opening or interfere with air flow

Ridge capping



Excessively wide buildings; in buildings wider than 10 m it is difficult to get even airflow across the whole width of the building. The roof pitch is likely to be lower, resulting in poorer air circulation. This problem can be overcome by using spaced roof sheets or raised roof sheets which supplement the normal ridge vent and provide more even distribution of outlet.

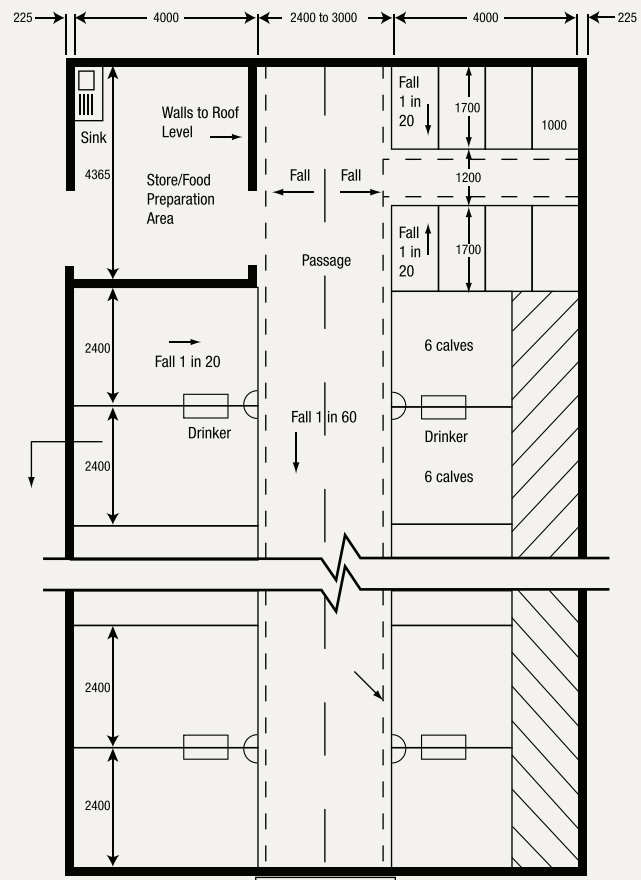
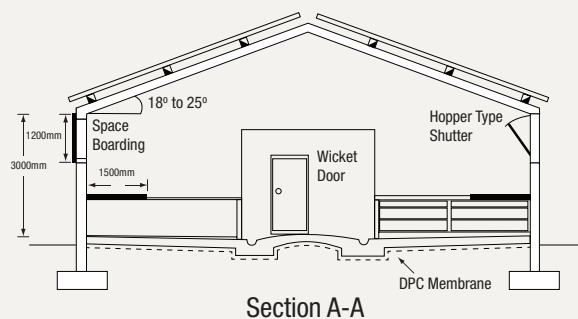
- Poor site location. The air flow characteristics of a building are hugely influenced by surrounding buildings, the orientation and the landscape.



④ What designs of calf house work well?

The following are examples of purpose-built calf houses, which will help to provide efficient rearing of calves up to eight weeks of age, at which stage weaned calves can be housed in larger groups or let out to grass.

1. Individual and group pens bucket fed.



This house (three bay) is ideal for bucket or nipple rearing 50-60 calves per batch. It can be scaled up with each extra 4.8 m bay catering for 24 additional calves.

Advantages are;

- Good feed preparation area.
- Wide access passage for rolling out straw bales.
- Small groups of calves, better batching.
- Good access to pens.

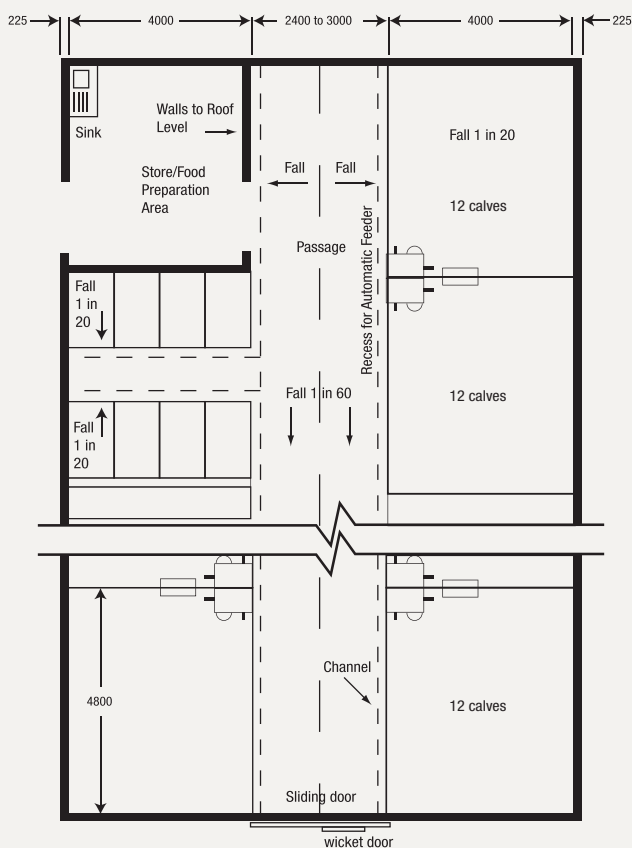
Disadvantages are:

- Manual clean out to centre passage.

Calf Housing

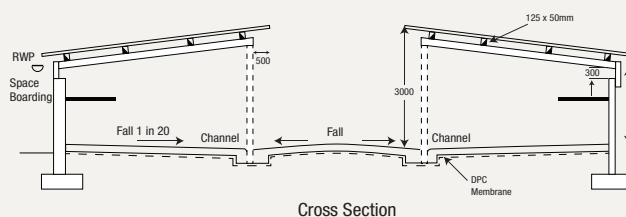
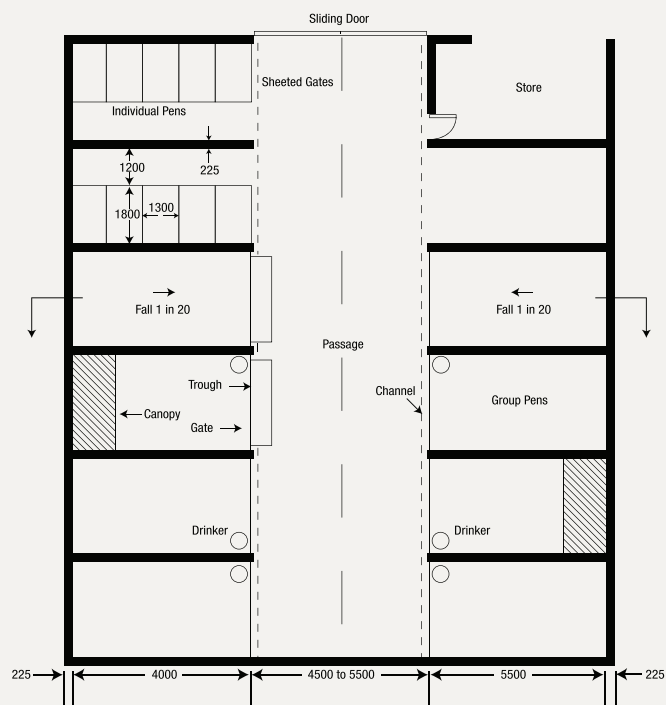
2. Automatic feeder

This house is similar to the one above, it is laid out to get the most out of automated milk feeding.



3. Patterson calf house

This design of calf house is well tested, it provides accommodation for 6 to 8 calves per pen, but can be scaled up to larger pens i.e. wider and deeper provided adequate eave inlet is provided.



Section 8

Mechanisation on Beef Farms

by Dermot Forristal



Introduction

While there are costs associated with all machinery operations, like all other inputs, there are benefits too. These benefits will include enhanced profits, e.g. reseeding can give better grass production; timely silage harvesting preserves quality; accurate fertiliser spreading improves fertiliser use efficiency, etc.

- ① What are the key machinery operations on beef farms?
- ② Should machinery just be considered a cost?
- ③ Own the machine or use contractors?
- ④ Is contractor price key?
- ⑤ How do you make a machinery purchase decision?

Mechanisation on Beef Farms

① What are the key machinery operations on beef farms?

The machinery operations on beef farms involving mobile machinery include:

- Fertiliser spreading.
- Manure handling including yard scraping, slurry agitation, FYM loading, Slurry and/or FYM spreading.
- Silage making: mowing, tedding, raking, baling, forage harvesting, transport, ensiling.
- Feeding: silage unloading and delivery, other feed handling, complete diet feeding, etc.
- General maintenance (transport and loading of materials, fencing, etc).
- Herding and personnel transport.
- Land rolling.
- Grass topping.
- Soil conditioning (aeration or sub-soiling).
- Reseeding (cultivation and seeding equipment).
- Grass weed control (herbicide spraying).
- Mechanisation associated with annual crop production such as maize or whole-crop cereals.

Some of these operations are carried out one or more times a year on all beef farms while others are carried out less frequently or not at all. Beef farms are extremely diverse – a summer grazing enterprise may only need fertiliser spreading, whereas an integrated intensive suckler or beef farm may use all of the operations listed above.

② Should machinery just be considered a cost?

While there are costs associated with all machinery operations, like all other inputs, there are benefits too. These benefits will include enhanced profits, e.g. reseeded can give better grass production; timely silage harvesting preserves quality; accurate fertiliser spreading improves fertiliser use efficiency, etc.

Mechanisation can also make tasks less arduous and improve working conditions. Some low-cost producers may question the value of spending on mechanisation that reduces the drudgery of certain manual tasks or to make working conditions more pleasant, but this does have a value. What is critical is to establish the full costs involved and make decisions based on this information.

③ Own the machine or use contractors?

The decision to use a contractor-supplied service in lieu of ownership depends on:

- Contractor costs vs ownership costs: This is critical and largely depends on the scale of the operation, i.e. number of hectares to be worked etc.
- Availability of contractor service.
- Quality and timeliness of contractor service vs owned service.
- Availability of farm labour and consequently value of labour supplied by contractor.
- Impact of adoption of contractor use on utilisation of existing machinery (e.g. tractors).

④ Is contractor price key?

A contracting service needs to be managed and controlled every bit as much as if you were doing the task yourself. Farmers need to consider factors other than price when choosing a contractor. Timeliness and quality of work are critical.

- Timeliness: Ability to get the task done within an appropriate working window.
- Machine suitability: Some machines are more accurate or do a different job than others, e.g. a trailing-shoe slurry spreader spreads slurry more evenly with less nutrient losses and less smell and grass contamination than a splash plate.
- Machine condition: A well-maintained machine will often do better quality work.

- **Operator skill:** Highly skilled operators can impact on the quality of work whether that is avoiding soil damage in wet conditions or better wrapping of silage bales.
- **Quality of work:** occasionally the contractor's decision to work carefully rather than as quickly as possible although for many jobs speed and quality can go hand in hand.
- **Compaction:** Contractors equipment is usually big and heavy to allow work to be handled efficiently. To avoid often invisible soil damage, the ground pressure of this equipment needs to be reduced by fitting larger tyres capable of working at low pressures. Key operations to be targeted include silage harvesting, slurry spreading and bulk fertiliser spreading although even a single round bale carrier can cause problems.
- **Machine size should be related to the working capacity required** which in turn depends on the time available to do the work. Excess capacity brings little production benefit and can be expensive, although long replacement life strategies and/or the use of second-hand machines can reduce the additional costs of some excess-capacity. Tractor size should be broadly matched with the main implements it will work with. All specification options should be justified.
- **New or second-hand:** The age at purchase and subsequent trade-in are key determinants of cost. These must be matched to the level of use. Smaller farms cannot justify new machines or short replacement cycles. Where use levels are low, long replacement cycles will reduce costs but it is important to plan carefully for replacement.
- **Make and model:** The make and model of machine can influence the quality of work, initial cost, re-sale value, reliability and running costs. Chose carefully.

5 How do you make a machinery purchase decision?

Where ownership is justified, avoid the temptation to follow machinery trends without justifying them. For example, typical tractor size has moved from 50 kW to 90 kW over the last couple of decades. While this may be justified where farm size has increased, it needs to be questioned where size is static. Consider the following:

For each of the machinery operations on the farm, the costs and benefits of alternative supply options should be considered. Individual operations should not be considered in isolation, as there is frequently a need to match implement size to tractor availability.





Section 8

Health and Safety on Drystock Farms

by John McNamara



Introduction

Accidents and illness related to farming are not inevitable and can be prevented through planning and careful work organisation.

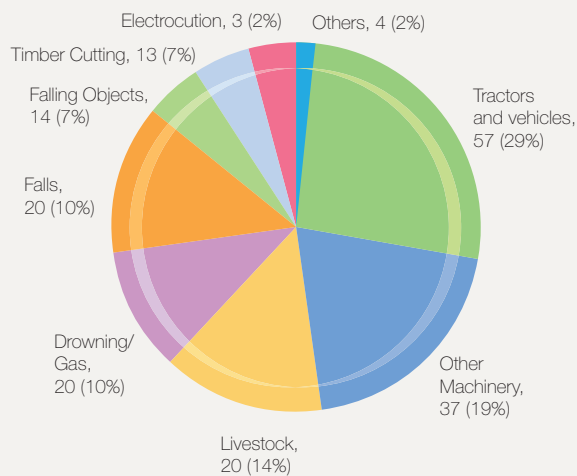
- ① What are the most common serious accidents on drystock farms?
- ② How can drystock farmers protect their health?
- ③ What legal obligations do farmers have?

Health and Safety on Drystock Farms

① What are the most common serious accidents on drystock farms?

Fatal accidents on Irish farms are linked to:

- Tractors and vehicles (29%) (more than one in four deaths on farms).
- Other machinery (19%) (one in five).
- Livestock (14%) (one in seven).
- Drowning in slurry or water and slurry gassing (10%).
- Falls (10%).
- Falling objects or collapse of buildings (7%).
- Timber cutting (7%).
- Electrocution (2%).



Key Fact

Farm machinery causes nearly half of all deaths on farms. Eight key areas account for 95% of farm deaths.(see pie chart). These areas are identifiable and accordingly are preventable.

A National Survey by Teagasc has found that a serious injury occurred on 6% of drystock farms (3,350) in the previous six years. The survey found that farms classified as 'fulltime' had over twice the level of injuries as 'part-time' ones.

② How can drystock farmers protect their health?

There is a belief that farming is a 'healthy occupation' because it is mostly an outdoor occupation. In reality farmers have a poor health profile when compared to other occupations.

How to:

Prevent ill health:

- Have regular health checks (at least once a year);
- Do health promoting activities (physical exercise, diet, weight and alcohol consumption control).
- Manage exposure to sun by wearing sun protection.
- Manage stress (through better work organisation, relaxation etc).

Key Fact

The risk of injury is higher if you suffer from poor health and stress.

Musculo-skeletal disorders (MSDs) are the greatest cause of drystock farmer occupational ill health, with more than half of farmers (56%) affected annually.

The main body parts affected are:

- Back (35%),
- Neck/shoulder (8%),
- Knee (15%),
- Hand-elbow-wrist (8%),
- Hip (12%),
- Ankle/foot (8%)

Over eighty percent (82%) of MSD injuries caused more than 3 work days lost with 24% causing more than 30 days lost.

The key preventative approaches are to avoid heavy lifting, over-reaching and twisting one's spine. Tidy farmyards greatly reduce the risk of trips or falls while modern livestock handling facilities reduce the risk of MSD and all injuries.

Infections from animals and contaminated material and inhalation of dusts and spores are also potential causes of ill health.

③ What legal obligations do farmers have?

Key Fact



Code of practice risk assessment.

Farmers must, by law, complete and implement a risk assessment. A Farm Safety Code of Practice (including a risk assessment document) has been issued to all farmers by the Health and Safety Authority (<http://www.hsa.ie>).

The risk assessment document fulfils the legal requirement to complete a safety statement for farms with three or fewer employees.

A book of Safe System of Work Plans is included in the farm safety code of practice pack. The purpose of this is to provide a quick and easy means of systematically revising your risk assessment regularly.

The risk assessment can also be completed and revised electronically by logging onto: <http://www.farmsafely.com>. A server at this site stores data and operates the system, and is totally confidential.

Health and safety training.

Teagasc regularly offer half-day courses on how to complete the farm safety risk assessment document.





Section 8

Grazing Infrastructure

by Derek O'Donoghue



Introduction

Good grazing infrastructure will allow more days at grass, provide easier management of grass at times of peak growth and make grazing less weather dependent. In a spring-calving suckler herd, one extra day at grass in spring is worth €44/day/40 cows in feed savings.

- ① How do I create a cost-effective and efficient paddock system?
- ② How can I create a roadway system that allows effective and efficient use of the paddock system?
- ③ What drinking water infrastructure do I need?

Grazing Infrastructure

① How do I create a cost-effective and efficient paddock system?

How to Design a paddock system



- Get a map of the farm with areas for each existing field or paddock
- Decide on the number of paddocks required; have at least six and preferably nine paddocks/grazing divisions for each separate grazing group of cattle. Minimising the number of grazing groups reduces the number of paddocks needed.
- Determine the most suitable road system so that each paddock can be serviced.
- Identify the most appropriate water trough positions. Where possible, share a trough between paddocks but, more importantly, position the troughs to allow further, possibly temporary, subdivision of paddocks.
- Allow for multiple entrances. This is useful during temporary subdivisions and allows moving livestock to exit at the end of the paddock irrespective of what direction they are moving on in.
- Keep paddocks square if possible. Where rectangular, the depth of the paddock should be no more than twice the width.

Key Risks



Paddock layout

- Long narrow paddocks – too much walking to reach the end of the paddock can lead to poaching in difficult grazing conditions.
- Large paddocks – it may take too long to graze the paddock out and regrowths are affected. It's difficult to take a paddock out in times of surplus if that paddock is too big, even though grass may be 'too strong' for grazing. Temporary fencing to subdivide the paddock takes time and if grass quality deteriorates, so will animal performance.
- Small paddocks – not enough grass for a day's grazing, grass intake suffers and animal performance can be adversely effected. More water troughs required.

Alternatives



To a paddock system

Have very large fields that are grazed using temporary wire divisions for all grazings. The area available for grazing and the size of the paddock at any grazing can easily be adjusted throughout the year. Larger paddock size can be given where grass covers are low, smaller paddock size when grass covers are higher. Surplus grass is easily harvested.

Key to success is having a least three temporary grazing divisions set up for each grazing group at any given time

- (i) the paddock cattle turned into today
- (ii) the paddock for grazing in two days' time
- (iii) the paddock for grazing in four days' time

Once a week, set all paddocks for the next seven days. Then it's just a matter of opening the wire, moving on cattle, and the front wire from the last grazing automatically becomes the back fence for current grazing.

Other advantages include:

- less expensive to construct
- suits farms with expanding livestock numbers or with big variation in livestock numbers
- very flexible
- less undergrazing or overgrazing
- can rotate silage and grazing area very easily
- easier for machinery to work
- no weeds under wire

A major disadvantage is that it takes time at each grazing change to move the temporary wire fence if it's not set up for at least six days at a time. Other disadvantages include;

- higher level of grassland management needed to allocate correct quantity of grass
- more difficult to manage calves unless two strands of temporary wire used
- requires a very adaptable water system

Key Facts



- 1 hectare equals 10,000 square metres (100 metres x 100 metres), 0.40 hectares equals one acre
- Rectangular paddocks work best, ideally the depth of the paddock being twice the width (depth:width ratio of 2:1). The depth should never exceed four times the width.

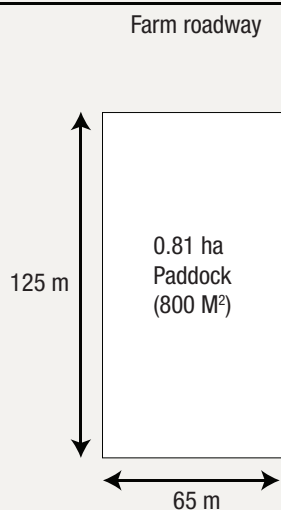


Figure 1:
 Dimensions of a 0.80
 Ha paddock with a
 depth:width ratio of 2:1.
 Cattle and especially
 grazing bulls walk less
 in rectangular paddocks
 which helps minimise soil
 damage in wet weather.

Key Targets



- Depth of paddock - maximum of 250 m from the entrance/roadway to back of the paddock
- Wet paddocks – maximum depth of 200 m from the entrance/roadway to the back of the paddock

Number of grazings per paddock

Normally a 48-hour grazing duration per paddock should be the target. However, in spring and autumn, the allocation may be for 12 or 24 hours to allow paddocks to be fully grazed out when numbers of cattle grazing may be low since not all cattle are at grass. These are also the two periods of the year when grazing conditions are likely to be most challenging and walking over previously grazed areas has to be avoided to minimise soil damage and subsequent regrowths.

For the greater part of the grazing season, 48-hour grazing paddocks/blocks should be the target. Where cattle/cows spend longer than 48 hours in a paddock, emerging regrowth will be eaten, less grass will be available at the next rotation, and overall grass production will be lower.



Grazing Infrastructure

Grazing per paddock	Advantages	Disadvantages	Best Practice
12-hour grazing (½ day per paddock)	<p>Excellent grass utilisation.</p> <p>Protects regrowth and grows more grass</p> <p>Makes wet grazing conditions more manageable</p> <p>Identifies surplus/deficit very quickly</p>	<p>Most labour intensive</p> <p>Risk of allocating too little area and cattle/cows are underfed</p> <p>Suckler cows and heifers can suffer severely, especially at breeding time</p> <p>More water troughs or coupling points required</p>	<p>Only recommended where the operator has excellent grass budgeting skills to allocate correct area for grazing</p>
48-hour grazing (2 days per paddock)	<p>Protects regrowth</p> <p>Cows/heifers less restricted</p> <p>Cattle more settled as not used to moving as often</p> <p>Larger paddock sizes make machinery operations easier</p>	<p>More difficult to manage in very wet periods when poor grazing conditions</p> <p>More difficult to graze out well when low number grazing in early spring or late autumn</p>	<p>Recommended as the option that optimises labour efficiency, grass utilisation and grass production</p>
72+ hour grazing (3+ days per paddock)	<p>Less movement of cattle required</p> <p>Fewer paddocks needed</p>	<p>Extremely difficult to manage surplus grass</p> <p>Much more difficult to graze out and to maintain grass quality</p>	<p>Least recommended option</p>

How to

Calculate paddock size: (48-hour grazing)



Step 1: Minimise the number of grazing groups and, by default, maximise the number of cattle per grazing group. This has the twofold effect of reducing the number of paddocks needed while keeping the paddocks as large as possible.

Step 2: Establish the number of cattle in the largest grazing group, usually the suckler cows + calves in a suckler herd. This will determine paddock size on the farm.

Step 3: Establish the daily grass demand, e.g. 40 spring calving suckler cows with calves at foot x 17 kg Dry Matter (DM) = 680 kg for 24 hours

Step 4: Ideal pre-grazing yield is 1,400 kg DM/ha for the main part of the grazing season

Step 5: A daily grazing 680/1,400
= 0.50 ha for 40 suckler cows/calves in 24 hours

Step 6: Two days grazing 0.45 x 2
= 1.00 ha for 40 suckler cows in 48 Hours

Step 7: Repeat with each remaining grazing group to determine the ideal paddock size and from that it should be possible to work out how many temporary divisions, if any, are needed in the paddocks established at Steps 2-6 above.

The essential requirement for an effective paddock system is to have enough paddocks during the peak period of grass growth in April and May. More and not less should be the target.

② How can I create a roadway system that allows effective and efficient use of the paddocks?

Without ease of access to paddocks and between paddocks, grass utilisation and stock management are much more difficult to operate to a high level of efficiency. The road layout must allow for good flow movement of cattle between all paddocks and between the paddocks and the yard.

Construction of a roadway

Table 2. Grazing Infrastructure

Roadway Type	Options
1. All topsoil removed	<ul style="list-style-type: none"> • Build up with stone • Recommended if a lot of heavy machinery will use the roadway • Most expensive option
2. No topsoil removed	<ul style="list-style-type: none"> • Requires dry weather during construction • Not suitable for heavy machinery • Geo-textile membrane to be placed on topsoil and built up with stone from there • Less expensive option
3. Invert roadways	<ul style="list-style-type: none"> • Requires dry weather during construction • Topsoil removed to one side • Subsoil removed and replaced by topsoil • Subsoil then shaped into the road • Roll with vibrating roller

Key considerations

Is the roadway to be used for cattle only? If so, then an invert roadway would be the cheapest option. Is the roadway to be used for machinery on a regular basis? If so, then a roadway designed for cattle only could easily be damaged.

Does topsoil need to be removed? A roadway placed on top of wet soil will invariably sink and is likely to lead to water pooling at that point. Where heavy machinery is likely to use the roadway, topsoil should be removed.

Stone is a major cost in farm roadway construction. A 100 m length of farm roadway that is 5 m total width, actual width of stoned roadway being 4 m, will require 80 m³ of stone (100 x 4 x 0.2) which is equivalent to 160 tonnes of stone (1 m³ of stone weighs about 2 tonnes). In addition, approximately 20 m³ of binding material will be required to finish off the top of the farm roadway, this being equivalent to a further 40 tonnes.

How to Construct a roadway



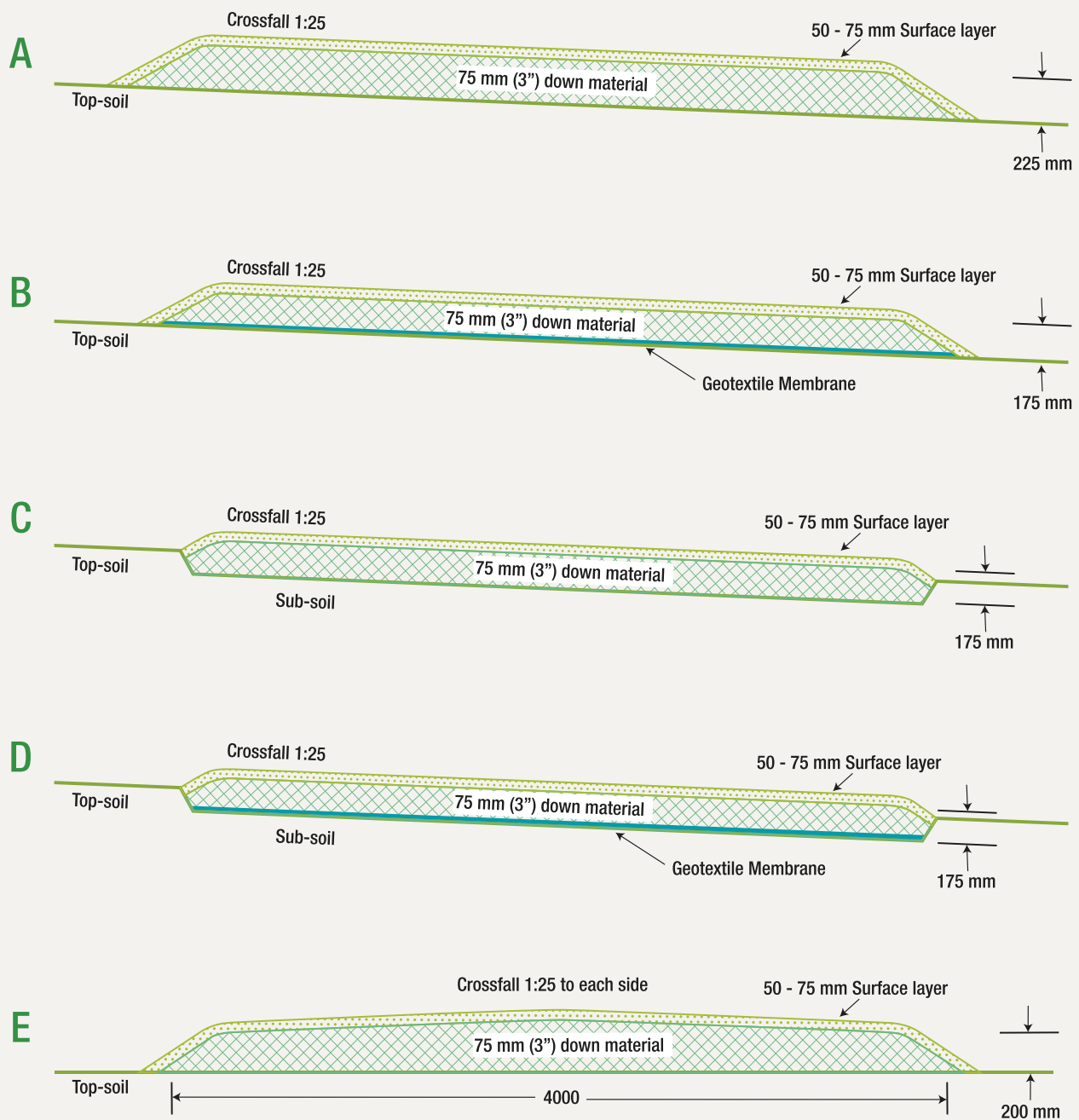
1. Remove topsoil.
2. Lay base material ensuring that the top surface of the farm roadway is at least 150 mm above adjoining field at either side.
3. Shape so that surface water will move freely off the roadway to the outer edge or edges and onto the adjoining field.
4. Compact with a vibrating roller and allow the roadway settle.
5. Finally cover with a 75-100 mm layer of fine binding material, and roll with a vibrating roller.

Estimated cost of roadway construction (4m wide)

	Cost per metre length (2016 estimates)
Removal of topsoil to 100 mm depth	€5
Hardcore base material to 200 mm depth	€18
Binding material to 100 mm depth	€6
Roller hire	€1
Total	€30

Grazing Infrastructure

Farm road profile options



Roadways

Key Facts



Road width required	50-cow suckler herd or similar number of beef cattle – 3 metre
Good slope (camber)	Minimum 1:25 if all the slope is to one side Minimum 1:15 if sloped from centre to both sides
Construction	Minimum 200 mm hardcore plus minimum 75 mm fine material
Fencing	500 mm from the edge of roadway and at least a double strand electric fence wire where sucklers/weanlings being moved
Approximate cost	€25 - €35 per metre length all in

How to

Set up a road system



- Once paddocks have been decided on, the roadway system follows next, using the farm map.
- Design a system that allows the roadway system to reach every paddock on the farm.
- Ideally, once stock exit onto the roadway, they should be able to be moved to any other paddock with ease.
- Decide what parts of the roadway are for cattle only and what parts are dual purpose, in that they will be required for both heavy machinery and cattle movement.
- Minimise bends and sharp corners, especially where the farm roadway is 3-4 metres wide and this slows down movement of cattle and makes movement of long machinery, e.g. tractors and trailers, more difficult.
- Avoid 90 degree bends as both livestock and machinery find these extremely difficult to navigate around even at moderate speed.

- Once the roadway system is planned on paper, walk the proposed route and adjust for any issues that do not appear on the map, e.g. ESB poles, drain crossings, wet areas, etc.
- Consult with the Sites & Monuments Records maps to ensure that no archaeological site lies on the proposed farm roadway. Just because there is not any visible monument present, does not mean that a recognised site does not exist on the farm.
- Construct roadways on the southern side of hedgerows if possible as surface will dry quicker and have a longer lifespan.

Key Risks



Roadways

- Narrow roads - cattle can stop walking due to any obstruction or unusual object in their path, e.g. branches, dead bird, water pond, etc.
- Uneven surface – slows movement and increased incidence of lameness, especially when moving more regularly in wet weather and at a time when hooves are softer.
- Sharp bends – slows movement and greater risk of pushing at bends leading to damaged fences along the roadway.
- Water troughs on road – slows or even stops movement as cattle stop to drink.
- Single strand fence along roadway – smaller stock, especially calves and weanlings easily get pushed under the fence and end up where they should not be.
- Not enough roadway in place – some paddocks not serviced leads to poor grass utilisation with excessive walking over paddocks occurring.

Grazing Infrastructure

Alternatives



There is no alternative to a good internal farm road system. However, for some remote parts of the farm, narrow cow tracks may provide an option where access for grazing is the only requirement.

Cow tracks, as they are commonly known, are usually 0.6 metres to 1.8 metres in width and are not designed for machinery use. These cow tracks, just like the farm roadway, need to shed water and so must be raised above the field level.

3 What drinking water infrastructure do I need?

The water requirement of beef cattle or suckler cows varies with the dry matter of the grass, the air temperature and the production level of the animal. On an average day, a 40 cow suckler herd with calves at foot could drink up to 2,000 litres (50 litres per cow and calf). On a very hot day, that requirement can double. Forward store cattle will have a total water requirement of 40-55 litres per head per day, and depending on grass dry matter, could require anywhere up to 30 litres per day as drinking water per animal.

The water system in place must be sufficient to deliver this quantity of water to the paddocks. There should always be a reserve of water in the paddocks, especially for suckler cows with calves at foot. This is normally six litres per suckler cow and calf, equivalent to 240 litres for a 40 cow suckler herd.



Water

Key Facts



Water intake	10 litres on wet day to 100 litres on a warm day for a suckler cow
Trough size	Allow 6 litres per suckler cow or forward store, 240 litres for 40 suckler cows/stores
Main waterline	35-40 mm internal diameter where 100 cattle or more being served
Connecting pipe to trough	Minimum 20 mm internal diameter
Ballcock	Medium pressure
Main pipe layout	Loop system preferable
Water trough height	Minimum 750 mm high to prevent fouling by badgers or other wild animals


How to

Set up a water system



- Decide on the main water line loop.
- Decide on whether 1 or 2 troughs are needed per paddock and their location.
- If only a single trough is installed, locate midway along dividing wire with adjoining paddock so that a temporary subdivision halving the paddock can be made if required.
- Mark trough locations on paddock and farm roadway map.
- Mark the positioning of main water loop line and connectors to water troughs for future reference.
- Identify location of shut-off valves.
- Decide on pipe sizes for the main water line and connectors to water troughs.

Key Risks




Water pipe too small	Reduced water pressure at trough so trough slower to fill
Trough too small	Inadequate reserve, bullying at drinking. Risk of empty trough being overturned.
Ballcock too small	Slow filling trough

Laying water pipes

- Either by a digger or mole plough
- Do not lay pipes under the roadway. The side of the roadway or along roadway/field edge is preferable in case pipes have to be accessed at a future date for any reason.
- If using a mole plough, do a test run of the proposed route before inserting the water pipe.

Key performance indicators

- 
- No queuing at the water trough.
 - No leakage or ponding around the trough.
 - No cow tracks leading to the trough, indicating a long walking distance for water.
 - No moss or algae growing on the water surface, with a drain plug in the bottom of the trough and the water system drained periodically.
 - All troughs drained in the winter months to prevent damage to troughs from expanding ice as water freezes over.

Ballcocks

- Size – 12.5 mm (½ inch) is the standard. 20 mm (¾ inch) also available.
- Ballcock pressure – Low gives a flow rate of 42 litres/minute, Medium gives a flow rate of 32 litres/minute, High gives a flow rate of 8 litres/minute. The Medium pressure is the preferred option.

Water Costs

Water

- Deep well, submersible pump CA. €0.14 per 4,500 litres
- Mains - €2.50 to €6.00 per 4,500 litres

Well

- Deep well pump supplied and installed for CA. €1,500 plus VAT
- Pump house built in suitable location, housing pressure tank and electrical components, for CA. €1,000 plus VAT
- Cost of drilling and lining a well to 60 m depth (200 feet); with 12 m of steel lining and 60 m of PVC lining is approximately CA. €2,300 plus VAT

Water pipes

- 38 mm (1½ inch) pipe costs approximately €255 per 150 m roll length or CA. €1.70 per metre
- 20 mm (¾ inch) pipe costs approximately CA. €95 per 150 m roll length or €0.65 per metre

Water Troughs

- Cost is approximately €1.00 per 4.5 litre trough capacity, or CA. €300 for a 300 litre trough.
- Ensure that there is a drain plug at the bottom of the trough.
- Plastic troughs require a more level and firm base than concrete troughs as they are less rigid but are equally as effective.
- Troughs with the water inlet near the base of the trough operate with a suspended ball and the chain/rope attaching the ball to the arm of the ballcock stopper can wear over time from movement.
- Ideally water troughs should be located at the centre of a paddock.