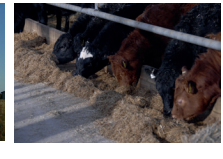
SRDP Farm Advisory Service

Beef Cattle Housing



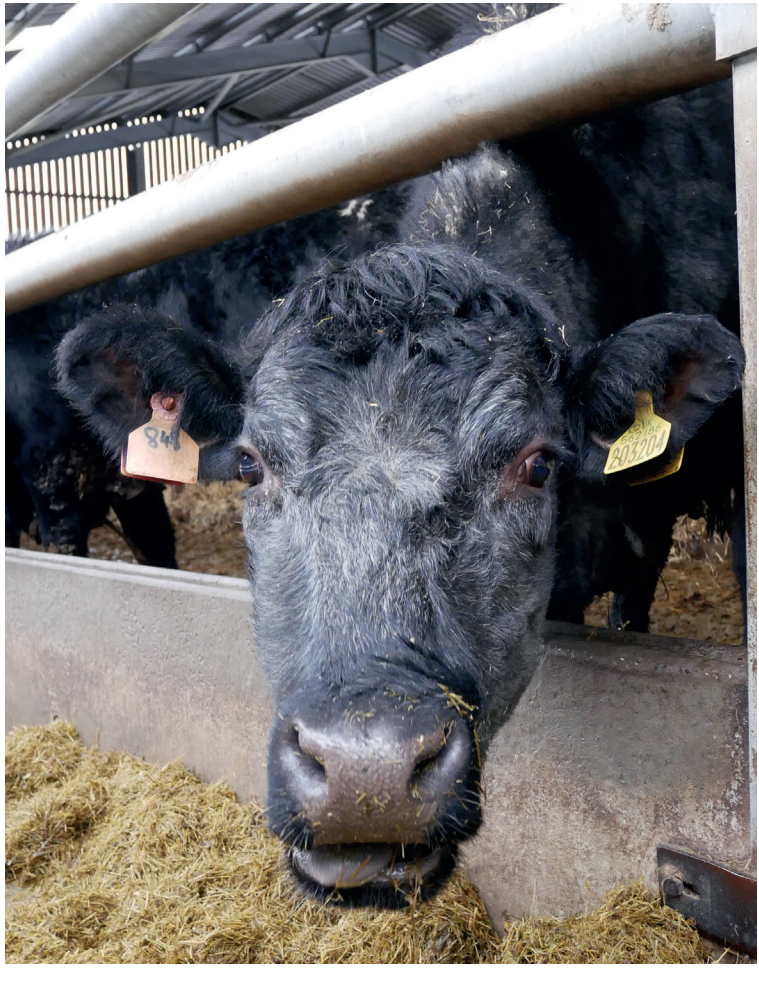
The European Agricultural Fund for Rural Development
Europe investing in rural areas

SAC CONSULTING

Scottish Government
Riaghaltas na h-Alba
gov.scot

Beef Cattle Housing

This booklet was funded by the Scottish Government as part of Scotland's Farm Advisory Service.



Contents

This booklet was produced for the FAS by:

Environment Team

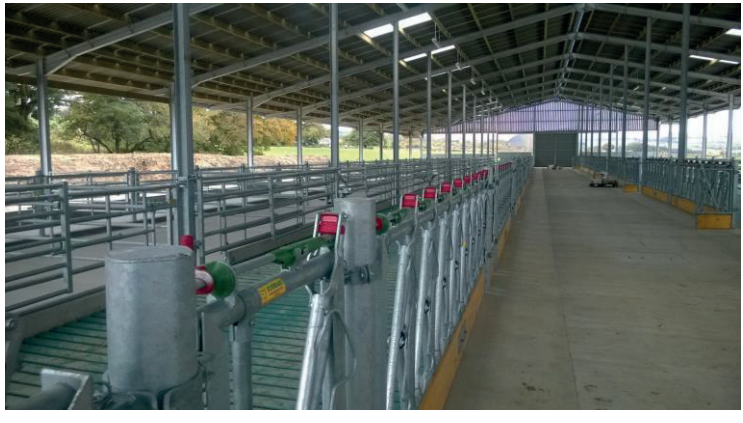
SAC Consulting (A division of SRUC)

2 Technopole Centre, Bush Estate, Penicuik, Midlothian, EH26 0PJ

Please contact the FAS National advice facility on 0300 323 0161 or email advice@fas.scot for more information

1. Introduction

Housing for cattle in the Scottish climate is required to provide stock with protection against extreme weather and to reduce damage to pastures from out-wintering. Design of livestock buildings should firstly support good health and welfare for the stock. They should be designed to facilitate efficient management, be operated safely and with least stress on the animals. The design should also aim to minimise pollution risk and visual impact on the surrounding environment.



1.1. Points to consider

- Long term plans for the business and not only the immediate need.
- Safety of staff during the construction and operation of the building.
- Planning, building and environmental regulations
- Identify the most suitable housing design for your farm by considering;
    - Welfare standards defined by legislation, welfare codes and quality assurance schemes
    - Biosecurity
    - Flexibility to accommodate changing market demands
    - Current and future availability and cost of bedding materials
    - Simplicity of operation including access and exit routes for stock and staff
    - Proximity to facilities for handling feed and waste
    - Labour requirements and future staff availability
    - Topography of the site and aspect to prevailing weather

2. Regulatory approvals

Farm buildings need to comply with a number of planning, building and environmental regulations. A new agricultural or forestry development will generally fall within one of the following categories - prior approval notification, planning permission or permitted development.

2.1. Prior Approval Notification

The Planning Authority has to be informed about the erection of any new agricultural or forestry building or significant alterations or extension to existing buildings which would result in the cubic content being increased by more than 10% or the height of the extension/alteration exceeds the height of the existing building. The formation or alteration of agricultural or forestry private ways and the carrying out of excavations or engineering operations in relation to a farm or forestry undertaking must also be notified.
The process involves the submission of a Determination of Prior Approval Notification to the Local Planning Authority who, within 28 working days, can ask for a full planning application to be submitted if the development is considered to have a significant impact on the surroundings or can confirm that the proposal will be allowed without further details having to be submitted. An application fee of £78 (February

2018) applies to notification for buildings, excavations and engineering operations.

2.2. Planning Permission

Planning permission is always required if any of the following apply to the proposed development:

1. development on agricultural holdings of less than 0.4 hectares
2. the construction, alteration or extension to a dwelling
3. any buildings or works not designed for agriculture
4. the construction, extension or alteration of any building over –
    a. 465m² in area (this is calculated by adding the area of the proposed development and the area of any development within the unit that is to occur or has occurred within the preceding 2 years and would be within 90m of the proposed development) or,
    b. 12m in height or
    c. 3m in height where the building is within 3km of an aerodrome
5. development which is within 25m of a metalled trunk or classified road

6. the construction or carrying out of any works to a building used, or to be used, for intensive livestock accommodation or storage of slurry or sewage sludge or being used to store fuel or waste from a biomass boiler or AD System where that building is within 400m of a "protected building" (a building normally occupied by people but does not include buildings forming part of a working farm or other agricultural unit or specialist industrial buildings).

The planning application must be submitted to the Local Planning Authority and must be accompanied by appropriate plans including a location plan, application fee and certification if required before the development can be commenced.

2.3. Permitted Development

Where the proposed work does not fall within any of the descriptions above then it will fall under the Permitted Development category. The Town and Country Planning (General Permitted Development) (Scotland) Order 1992 and current amendments sets out the qualifying criteria for permitted development; this is usually where the scale and nature of the development is considered to be of a minor, non-contentious nature.

NOTE: It is always worth checking with your Local Planning Authority even if you think that your proposal does not require planning permission.

2.4. Environmental Designations

Your permitted development rights may be restricted if your farm is situated in or near an environmentally designated area such as a Special Protection Area (SPA) and Special Area of Conservation (SAC), or within a National Scenic Area (NSA) or Site of Special Scientific Interest (SSSI). Your Local Planning Authority or Scottish Natural Heritage (SNH) should be contacted to discuss the implications for your application.

2.5. Historic Environment

Some farm buildings are also classified as a Listed Building, this is a building or structure determined by Historic Environment Scotland under the provisions of the Planning (Listed Buildings and Conservation Areas) (Scotland) Act 1997 to be of special architectural or historic interest and must not be demolished or altered in an way without obtaining Listed Building Consent from the Local Planning Authority. There is no application fee, however, it is considered a criminal offence to alter a Listed Building without consent.

2.6. Tree Preservation Orders (TPO)

The Local Authority is obliged to notify you of any trees on your land that are subject to a Tree Preservation Order. This is a device used to protect existing trees or woodland in the interest of amenity, which means you are not allowed to lop, prune or fell a tree without permission from the Council. It is an offence under The Town and Country Planning (Scotland) Act to do work or damage to a protected tree without the Council's consent.

2.7. Building Standards

The Building Standards (Scotland) Regulations 2004 and current amendments set out the requirements to ensure good building practice, public safety and pollution control. A Building Warrant application must be submitted before commencing most types of building or alteration work. Many categories of agricultural or forestry buildings are exempt from the requirement to obtain a building warrant. Cattle buildings will require a warrant under the following circumstances:-

1. Buildings over 280 m² in area
2. Buildings within 6 m (or the equivalent of its height whichever is less) of a property boundary

3. A dungsted, slurry store or farm effluent tank. **This includes slatted buildings with slurry storage cellars**.

An application for Building Warrant should be submitted to the Local Authority accompanied by the relevant application fee, which is based on the estimated cost of the works.

The British Standard (BS 5502) provides information and recommendations on the principles involved in the design and construction of agricultural buildings and structures in terms of wind, snow and other structural loadings, human/livestock occupancy restrictions and the layout, spatial and design criteria. The Standard subdivides agricultural buildings into four construction classes based on the level of human occupation, when submitting a building warrant application it will be necessary to state the class of construction. Certification by a structural engineer specific to the class is also required by the Local Authority in support of the building warrant application.

2.8. Pollution Control

The Control of Pollution (Silage, Slurry and Agricultural Fuel Oil) (Scotland) Regulations 2003 set out the requirements for those with custody or control of silage, of livestock slurry or of agricultural fuel oil who must take precautions to prevent

pollution of the inland or coastal waters. The aim is to reduce the number of silage, slurry and fuel related water pollution incidents. SEPA is the regulatory body and is empowered to serve notice on works required to bring storage systems up to the relevant standards. Any slurry storage incorporated within a cattle building is covered by these regulations and approval from SEPA is required before bringing such facilities into use following construction or substantial modification.

3. Services

3.1. Water

Volume requirements for water are covered in more detail in the section entitled “Feeding and Watering Arrangements”. Water pipes, fittings and storage tanks should be protected against frost and all water troughs must be able to be emptied for cleaning with the dirty water running to the slurry system or suitable disposal area and not into bedded pens. Contingency for supply failure should be put in place via an alternative supply or appropriately sized short-term buffer tank.

3.2. Electricity

The location of existing overhead and underground electrical services should be taken into consideration before finalising the location of a planned building. Advice should be sought from the local distribution network operator (DNO) where there are services in the vicinity of a building or to confirm their absence. Safe clearances should be maintained from power lines during the construction phase and also during normal farming operations. Where buildings cannot be located to ensure suitable clearances then having a power line re-routed may be necessary. This is often an expensive option and relocation of the building may be more viable. The health

& safety executive (HSE) publish guidance on safe working distances available here;
http://www.hse.gov.uk/pubns/gs6.pdf
All electrical installations should be installed in compliance with current IEEE standards by a qualified electrician. Particular attention should be paid to protection of wiring and equipment against the ingress of moisture and dust and also against damage by the housed stock, farm staff and machinery. Damage by rodents also needs to be protected against. Earth bonding of all metal work is particularly important in livestock buildings as farm animals will react to lower voltages than humans. Any installed electrical equipment should be “failsafe” in the event of a power cut.

3.3. Drainage

Any run-off from impermeable areas in and around a building that are or may be contaminated by animal waste or silage

effluent should be collected and disposed of in compliance with The Control of Pollution (Silage, Slurry and Agricultural Fuel Oil) Regulations 2003. This includes any yard area where stock are held or have regular access. Where a new tank or lagoon is constructed for this purpose, SEPA must be notified using their form SSA-F-001 at least 28 days prior to bringing the structure into use. The form should be signed by the designer and the builder as well as the person having custody of the facility to confirm its compliance with the SSAFO regulations. Run-off from roofs and any "clean" impermeable surfaces should be treated in accordance with SEPA's rural SUDS manual prior to discharge. (http://www.crew.ac.uk/sites/default/files/sites/default/files/publication/Rural%20SuDS%20Design%20and%20Build%20Guide%20November%202016%20.pdf)

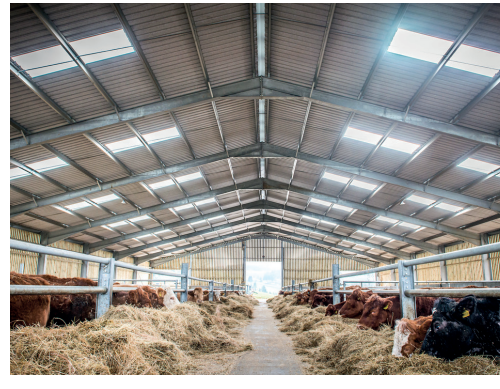
3.4. Lighting

Adequate lighting, that allows animals to see and move around freely, is necessary. It is also important that staff can observe and attend animals safely. Minimum levels of illumination should be in accordance with table 3.1.

Task/location	Standard service illumination (lx)	Comments
Animal inspection	300	Use local or portable lights
Sick Pen	50	For veterinary attention
Other beef cattle building	20	Achieve by natural lighting

Table 3.1 – Lighting levels for beef cattle buildings (BS5502-40:2005)

Natural light should be provided where possible and this can be achieved by cladding 10 to 15% of the roof with translucent sheeting. Artificial lighting will be required to provide adequate light levels in winter months. Modern LED lighting is a good choice for livestock buildings and has the following advantages;



- Good quality of light close to natural light
- Reduced energy costs of up to 70% over conventional lighting
- Long life (50,000 hours+)
- Less attractive to flies than traditional filament lamps
- Switch on and off instantly without flicker

3.5. Photovoltaic (PV) panels

With the requirement to reduce fossil fuel usage and the desire to reduce carbon footprint, generating renewable energy on-site may be a viable option. Construction of a new building presents an opportunity to install PV panels on the roof and should be given consideration at an early stage. Yield from solar panels will be greatest where they face in a southerly direction and a steeper pitched roof will provide a greater exposure to the sun's rays throughout the year than a shallow pitched roof. Inclusion of solar panels at construction will be simpler and less costly than retrofitting. To provide flexibility, it would be advantageous to, at least, confirm the structural suitability of a new building to accommodate panels before finalising the design. The financial viability of PV will be site specific dependent on the level and pattern of on-site energy use and the prevailing electricity tariffs and incentive payments at the time of construction.

4. Ventilation

To ensure that good health and maximum performance is obtained from housed livestock, the provision of effective ventilation is crucial. Natural ventilation is typically very effective and the least cost option for cattle sheds. A technical note (TN698) dealing specifically with the design of natural ventilation systems within cattle housing has been prepared to complement this guidance document. It can be downloaded from the FAS website at; https://www.fas.scot/publications/technical-note-tn689-cattle-housing-ventilation/

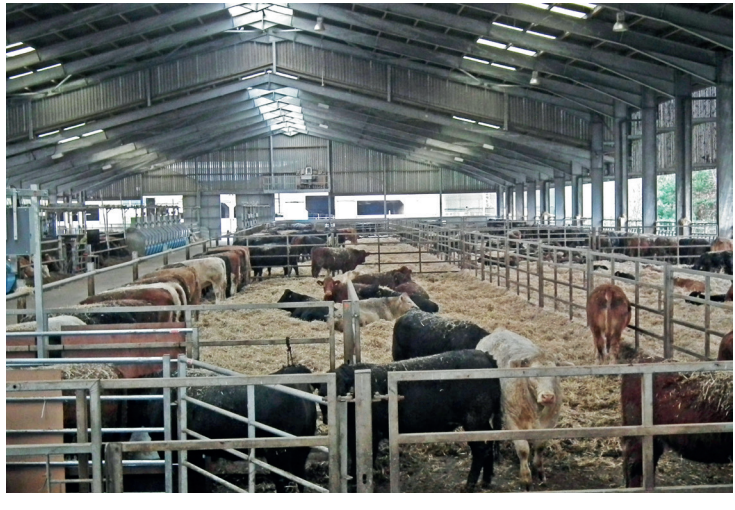
Key points;

- Ventilation should be designed to work effectively on a calm day when there is no wind.
- Draughts at stock level should be avoided.
- Ventilation design should start with calculation of the required outlet area.
- Inlet area should be a minimum of twice the outlet area and preferably more and should be split between the two sides of the building where possible.
- The provision of sufficient natural ventilation should be possible in new buildings and should be the first choice when altering older buildings. Mechanical

ventilation, however, may be necessary in some cases.

Note that the addition of a lean-to can inhibit the natural ventilation of an existing building. If relocation is not an option, consider design adjustments that minimise restrictions to air flow e.g. it may be possible to incorporate appropriate inlets below the existing eaves by keeping the lean-to roof to a lower level or by including some other suitable inlet.

Getting the ventilation right will not only provide a healthier atmosphere for stock but by removing moisture from a building will reduce the amount of bedding required.



5. Waste Handling

5.1. Farm yard manure (FYM)

The quantity of FYM produced in a bedded court over the housing period will depend on the number and size of stock housed and on the quantity and type of bedding material used. The figures in table 5.1 can be used to estimate quantities.

	Livestock weight (Kg)	Dry matter (%)	Typical weight of solid manure produced per day (tonnes)
Suckler cows	500	**25**	**0.024**
	600	**25**	**0.028**
	700	**25**	**0.033**
	800	**25**	**0.038**
Growing/finishing cattle	200	**25**	**0.010**
	300	**25**	**0.014**
	400	**25**	**0.019**
	500	**25**	**0.024**
	600	**25**	**0.028**
	700	**25**	**0.033**

Table 5.1 – Typical values of FYM produced by housed livestock (adapted from SAC technical note T309)

Ease of access to bed cattle and remove manure should be incorporated into the design of a new building. Easily removable pen dividers will facilitate access for tractors and telehandlers. FYM is a source of valuable crop nutrients that can be preserved through small changes in handling and storage. Where FYM is removed to a permanent midden, effluent run-off **must** be collected and spread to land. Roofing a midden will reduce the volume of this run-off that has to be handled.

5.2. Slurry

Quantities and dry matter content of slurry will depend on the size of stock and their diet. Table 5.2 can be used to estimate quantities.

	Livestock weight (Kg)	Dry matter (%)	Typical volume of slurry produced per day (m^3)
Suckler cows	500	**10**	**0.032**
	600	**10**	**0.038**
	700	**10**	**0.045**
	800	**10**	**0.051**
Growing/finishing cattle	200	**10**	**0.013**
	300	**10**	**0.019**
	400	**10**	**0.026**
	500	**10**	**0.032**
	600	**10**	**0.038**
	700	**10**	**0.045**

Table 5.2 – Typical values of slurry produced by housed livestock (adapted from PEPFAA code)

It is important to control water entering the slurry system. It can be desirable to add water to slatted housing, especially if cattle have been fed a high dry matter diet, to ease agitation and removal. This can be easily achieved by integrating a diverter valve at the bottom of a roof downpipe to divert some roof water before livestock are housed and as required thereafter. Care must be taken to ensure that the slurry cellar is not overwhelmed by rainwater or run-off from surrounding yards. A minimum of 300 mm freeboard should be maintained between the top of the slurry and the bottom of the slats.

Access points for mixing and abstraction of slurry should be provided and where possible these should be out with the building.

Slurry gases can and do cause deaths. The health and safety executive have published a guidance note on managing slurry on farms, which should be read and understood. It is available here:-
http://www.hse.gov.uk/pubns/ais9.pdf

DANGER OF DEATH
Slurry gas includes a number of constituents that can create risk to human and animal health. Hydrogen Sulphide in particular can cause nausea, disorientation, unconsciousness or death. Gas is released when slurry is mixed and at high concentrations can cause the loss of a sense of smell.

In summary;

Mixing should be undertaken on a breezy day and the building should be well ventilated during the mixing process.

Everyone on the farm should be made aware of the dangers and informed that mixing is taking place.

Livestock should be removed from the building.

A procedure should be in place to ensure that no one is present in any building connected to the slurry system and that no one gains access during and for a period after the process. The first 30 minutes after the mixing process begins is the most dangerous but gas will linger in poorly ventilated areas for much longer.

Even if the mixing point is outdoors you should not stand over it while mixing is ongoing.

Access points should be covered to prevent anyone falling in if overcome by gas.

Be aware of the fire risk associated with slurry gases.

6. Location

It is important to fully consider the impact of a building's location on the full system. Long-term inefficiencies can result from poor decisions at the planning stage. For example, a poor layout or proximity to fodder or bedding storage that results in 10 minutes extra labour each day will have huge implications over the lifetime of a building. A carelessly located building can also restrict the potential to expand a site at a later date. There are many factors that will influence the location of a new building, including:-

- Exposure to extreme weather
- Opportunity to provide suitable ventilation. Shelter provided by adjacent buildings or structures may limit the ability of a ventilation system to function properly.
- Options for drainage of the building, including roof and surface water from surrounding yards, without causing an unacceptable pollution risk
- Biosecurity
- Access to feed and bedding stores to minimise daily chores
- Access to a suitable water supply for stock and also for fire fighting.
- Interaction with existing buildings or potential future developments

- Access to and from the building for moving stock, feeding and manure or slurry removal
- Security/privacy
- Fire risk
- Proximity to watercourses in respect of pollution risk
- Access to and exclusion zones around overhead lines or underground services
- Local planning restrictions
- Building regulations
- Other pollution control regulations or local environmental designations
- Current and future needs of the business

7. Choice of Housing System

7.1. Variety of stock

Different classes and ages of stock can have different disease resistance. A large single span building accommodating different age categories of livestock will result in all of the stock sharing a common air space. This makes it impossible to isolate specific groups and difficult to maintain different conditions for each group. Ideally, each age group should have a separate building/air space, which may be possible to arrange at the design stage. To retain the ability to accommodate changes in policy or market demand however, a level of flexibility should be included.

7.2. Roof pitch

Steeper pitched roofs (in excess of 15°) will provide a greater airspace for a given floor space and will generally improve ventilation. In the likelihood of heavy snowfall a steeper pitch will also reduce the risk of collapse.

7.3. Internal layout

Many different factors will determine the most appropriate internal layout. How are the stock to be fed? A central feed passage will provide access to pens on either side but will also reduce the livestock numbers that can be housed under a given span of portal frame. Feed barriers on the outside of the building will allow feeding to take place from outside the roofed area. Cantilevered overhangs can be included to protect feed from rainfall.

External feed barrier with overhanging roof

At some locations external walls may be considered necessary although in many cases the ventilation inlet provided by open sides will be more advantageous. Where

stock are fed from the outside, the trough, feed fence and passage will minimise draughts in the central lying area.

Easily moveable internal pen dividers will allow pen sizes to be adjusted to suit size and number of animals and will also simplify mucking out. Post and socket pen dividers with plenty of floor sockets to allow for different pen layouts are easier installed when floors are laid than added later. Sockets should be capped when not in use to prevent them from filling up with FYM. In bedded courts, electric fence dividers work well and allow maximum pen size flexibility. The addition of a good earth for electric fencing is also easier to install at the construction stage.

7.4. Suckler cows with or without calves at foot

Straw bedded courts will keep cattle clean and comfortable and provide good welfare conditions provided there is ample straw and that pens are not excessively stocked (see table 8.1). Overstocking can lead to a reduction in performance and even injury.

The addition of a scraped or slatted feed passage will provide a clean standing area and reduce bedding requirements by a third. It also provides cattle with a separate “loafing” area.

Young calves should have access to a creep area where accommodated with cows or mature stock.
The availability and cost of straw bedding during the life of a proposed building should be considered and may result in this system being unviable in parts of the country particularly if straw needs to be bought-in from distance. Competition for straw is likely to increase its cost in the future. Some alternative bedding materials are discussed later in this section.

Fully slatted courts are also an option for adult and weaned cattle. They allow for a higher stocking density (table 8.1) and remove the requirement for bedding. Slip resistant rubber slat covers will improve comfort and reduce the risk of injury. Current quality assurance standards require that calving cows have access to a bedded area, which is also required for sick animals or those in need of treatment by a vet. Where calves (>1 month) are housed on slats along with their mothers they should be provided with a non-slatted creep area.

Cubicles as an alternative to bedded courts for cows will reduce the requirement for bedding material. For good animal welfare, the cubicles need to be correctly sized for the animals catered for (see table 8.2 for minimum sizes). Cows need to be moved to a separate bedded area prior to calving.

Where cubicle accommodation is provided, the total number of cubicles should exceed the stock number by at least 5%.

7.5. Finishing systems

Well maintained bedded courts provide good conditions for rearing and finishing stock and as with suckler housing they can be designed to include scraped or slatted feed passages. Where good quality cereal straw is used it can also provide a source of long fibre beneficial to rumen health. Fully slatted finishing units offer lower running costs due to the absence of bedding costs but are not considered to provide the same degree of freedom for animals to express normal behaviour[1]. Slot and slat widths should be suitable for the size of stock accommodated and rubber coverings for the slats will greatly increase animal comfort. Easily accessible bedded isolation pens should be included in building layouts.

7.6. Alternatives to straw bedding

Demand for straw for other uses, more limited availability and the resulting increase in cost are making it a less attractive bedding option in some parts of the country. Alternatives may include a range of wood based products, rape straw, peat and sand. Where other materials are considered it is important to

[1] Opinion on the welfare of cattle kept for beef production, FAWC, 2017

be fully aware of the practical issues and authorisations required:-

- Possible contamination with poor quality materials. Assurance should be sought from suppliers of the absence of any contaminants.
- Waste products may require waste handling licences and permission to spread to land.
- Some products may require composting before being spread to land.
- Undercover storage for delivered material prior to use may be required.
- Bedding frequency and mucking out interval will differ between products.
- Drainage and absorbency rates will differ
- The need to provide another form of roughage in the diet.

Table 7.1 provides a guide to some alternative bedding materials

	Physical Structure	Drainage	Mucking Out Interval	Fertiliser Value	Frequency of Bedding	Spreadability
Barley straw Oat straw Wheat straw	****	****	6 months	**** *	1-2 days	***
Rape straw	**** *	**** *	6 months	****	1-2 days	**
Sawdust	*	****	1 - 2 months	*	After mucking out only	**
Shavings	**	****	2 - 3 months	*	After mucking out only	**
Woodfines	***	****	2 - 3 months	*	After mucking out only	**
Wood Chips	****	**** *	6 months +	*	7 to 10 days	*
Peat	***	**** *	1 - 2 months	**** *	2 - 3 weeks	***
Sand	***	**** *	2 - 3 months	**	After mucking out only	*
	Star rating from ***** = Excellent to * = Poor					

Table 7.1: Alternative bedding materials

The Agricultural and Horticulture Development Board (AHDB) Beef and Lamb group have made a directory of bedding materials available on their website which can be accessed from the link below.
http://www.beefandlamb.ahdb.org.uk/wp/wp-content/uploads/2013/06/bedding_materials_directory_2011_low_res131011.pdf

8. Space Requirements

Space allowance needs to be appropriate to the livestock size allowing for growth during the housing period. Pregnant cows in particular require plenty of space and will seek isolation as calving approaches.

BS 5502 Part 40 (2005) Code of practice for design and construction of cattle buildings recommends minimum space allowances for different classes of cattle. Table 8.1 includes data from BS 5502 Part 40 (2005) but has been adapted for today's larger breed types. These are **minimum** space allowances More space per animal is recommended to enhance welfare, therefore, table 8.1 is a guide only. Also refer to the appropriate welfare codes and quality assurance scheme requirements at the outset of building design.

Animal type	Space Allowance (m^2)			
	Live Weight (kg)	Solid Floors		Fully Slatted
		Bedded Area	Total Area	
Suckler Cow & Calf (excluding creep area)				
	500	3.75	5.00	2.50
	600	4.35	6.00	2.75
	700	4.65	6.50	3.00
	800	5.15	7.30	3.25
				Space allowance should be based on age, weight and behavioural needs of the stock, together with the size of the group
Growing/ Finishing Stock	200	2.00	3.0	1.10
	300	2.75	3.95	1.50
	400	3.50	4.90	1.80
	500	4.25	5.85	2.10
	600	5.00	6.80	2.30
	700	5.75	7.75	2.50

Table 8.1: Cattle Court Space Requirements

Animal type	Space Allowance		
	Liveweight (kg)	Length (m)	Width (m)
Cows	500	2.35	1.12
	600	2.40	1.15
	700	2.50	1.18
	800	2.55	1.20
Growing/Finishing	200	1.45	0.75
	300	1.70	0.85
	400	2.05	1.05
	500	2.35	1.12
	600	2.40	1.15
	700	2.50	1.18

Table 8.2: Cubicle Sizes

9. Biosecurity

Biosecurity is a hugely important aspect often overlooked. New buildings should be designed to minimise the risk of disease introduction or spread of infection. Facilities for receiving deliveries of feed and supplies should be arranged so that these can be made without the need for vehicles or personnel to access areas frequented by livestock.

An isolation/quarantine facility for ill stock or to receive incoming livestock should be provided and access to it should not require vehicles, stock or external personnel to pass through areas frequented by existing farm stock. Similar provision should be made for disposal of deadstock to avoid the spread of disease from the dead animal or from the uplift vehicle. A suitable area for wash down of vehicles and footwear should be carefully located so that potentially contaminated wash water does not come into contact with livestock.

Access for members of the public to the vicinity of livestock buildings should be discouraged by providing well signed and easily accessed alternative routes for walkers, cyclists or horse riders where appropriate.

10. Feeding and Watering Arrangements

10.1. Feed Space

Unless ad-lib feeding is available, adequate space must be provided for all stock to feed simultaneously. This will prevent more dominant animals bullying more timid animals. Pregnant cows should be allowed additional space. Table 10.1 provides **minimum** feeding space requirements for different weights of cattle for both ration fed stock and stock fed ad-lib.

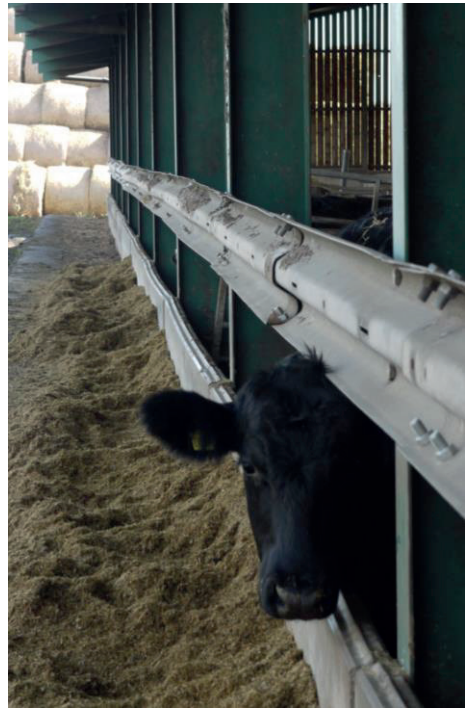
Mass of animal (kg)	Ration fed Feed barrier width (mm/animal)	Ad-lib fed Feed barrier width (mm/animal)
200	400	150
300	500	150
400	550	190
500	600	240
600	670	280
700	700	320
800	800	340

Table 10.1: Cattle – Feeding Space

10.2. Feed Barriers

There are many different types of feed barriers. The simplest and cheapest are two horizontal bars or ropes through which

the animals place their heads to eat. This type of barrier affords limited control of animal head movement allowing dominant animals to control large sections of the feed trough and preventing more timid animals from eating. Animals can also pull feed through this type of barrier with ease resulting in greater wastage. Calves can also escape between the bars or ropes. Horizontal barriers of this type are however safer from the point of view that the likelihood of a head becoming trapped is low and also the potential for ear tags to be lost through contact with barriers is reduced.



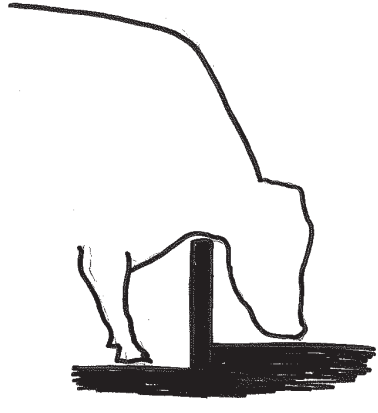
Horizontal barriers made from "Armco" traffic barriers. Open sided court with roof overhang and external feed passage.

Tombstone and diagonal feed barriers have been developed to restrict the head movement of the animal to minimise feed wastage and bullying. As a result both increase the risk of tag losses, injury or even death. With tombstones the risk is exaggerated with the animal having to lift its head right up to get out e.g. if the animal goes off its feet. A danger point with diagonal feeders which can be eliminated is the risk of animals becoming stuck and strangled in the triangles formed where the barrier is attached to uprights. These should all be filled in with metal before the barrier is even erected (as in the picture below).

Diagonal barriers with the triangles filled to prevent animal heads being trapped.

The bottom of the space through which the animal feeds should be set relative to the size of animals housed and for

adult cattle this height should be around 500 mm where only concentrates are fed. Where bulkier mixed rations are being fed, it may be desirable to increase this to 700 mm. The bottom of the feed trough should not be more than 100 mm above animal foot level. These dimensions will allow animals to feed in their natural position (see diagram below). In bedded courts the inclusion of a scraped or slatted feed stance will allow this dimension to be maintained and will have the added benefit of reducing the amount of bedding required.



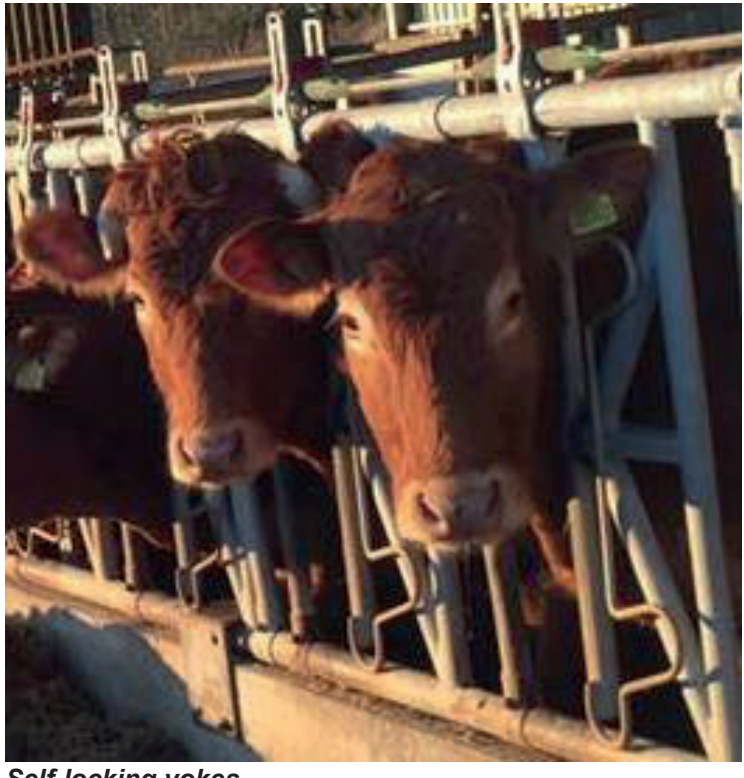
Feed Barrier Height

The top rail or neck rail should ideally be adjustable to between 1150 mm and 1250 mm for adult cattle and between 900 mm and 1100 mm for young stock.

10.3. Self Locking Yokes

Yokes are the most expensive feed barriers. However they have many additional advantages e.g.

- Feed wastage is minimised. (At today's prices saving just 1 MJ ME per day per winter for a 20 year lifespan will amount to savings of over £80 per feed space!)
- If required, animals can be individually fed while still being run as a single group (eg cows in terms of their condition).
- For many routine handling operations eg pregnancy diagnosis , checking ear tags, weaning, worming, vaccination, etc, self-locking yokes make very efficient safe and labour saving handling facilities.
- All animals in the group can be restrained to allow one man bedding of pens, scraping of passageways etc.
- It makes the isolation/removal of an individual from the group a quick, safe and easy operation by simply releasing the yoke of the required animal. This makes a very efficient and speedy way of selecting finished cattle.
- Self-locking yokes can also be helpful to train young animals and ultimately reduce stress when they are handled in a crush.



Self-locking yokes.

10.4. Water

All stock must have access to clean, fresh drinking water at all times and troughs or nipple drinkers should be in sufficient number and suitably located so that even timid animals have free access and are not denied access by more dominant animals. Strategic location of troughs should minimise the risk of bedding becoming poached around the trough. Where

possible access should be restricted to animals standing out with any bedded area. The location of water troughs should also allow for easy inspection and maintenance and protection from frost. Nipple drinkers are less likely to freeze than troughs. Where water supplies are provided at the bottom of the trough it is possible to completely insulate the inlet. Using a master header tank which can be completely insulated will also improve frost protection.

Enough space should be available for 10% of the stock to drink at any time and flow rates to the troughs should be sufficient to cope with peak demands. A buffer storage tank may be required if flow rate is inadequate. Trough height should allow for all ages of cattle in that shed/pen to access drinking water. They should be high enough to minimise the risk of foetal contamination and avoid the risk of young calves drowning. Equally, they must be flexible enough so as not to become too low as bedding levels increase. Troughs should be cleaned daily and particularly after bedding with a straw blower. If tipping troughs are used they should be arranged so that the contents do not drain to the bedded area. Drainage around troughs should be able to deal with any spillage without causing bedding or floors to remain damp. Ambient temperature, diet, liveweight and many other factors will affect actual water consumption but table 10.1 provides an estimate of water requirements.

Stock type	Estimated drinking water allowance (l/head/day)
Lactating suckler cows	40 - 70
Dry suckler cows	14 - 40
Growing cattle	15 - 50
Finishing cattle	25 - 75
Stock bull	30 - 80

Table 10.1 – Estimated drinking water allowance

Rain water harvesting

Rainwater collected from roofs can be used to supplement mains or private water supplies and can offer an opportunity for substantial cost savings. Care needs to be taken, however, to ensure that such water is consistently of suitable quality if it is to be used for livestock. Harvesting systems come in a wide variety of designs of differing complexity and it is important that a scheme is designed correctly to meet the site demand and includes appropriate filtration, treatment and storage.

Water for fire fighting

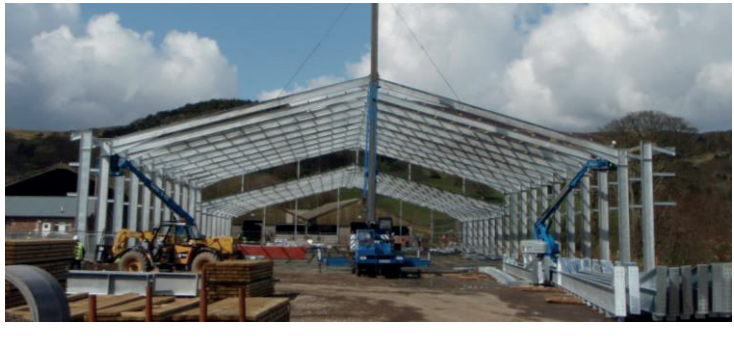
A suitable supply of water for fire fighting is required for any building and is likely to be a requirement of a building warrant for a new building. In the absence of an existing natural or man made source it will be necessary to provide this by means of a tank or pond. It is advised to consult with the

building standards department of your local council or the Scottish Fire & Rescue Service to confirm the volume required. See:- (http://www.firescotland.gov.uk/forms/contact-us.aspx)

11. Materials

11.1. Building frame

Portal frame steel buildings are by far the most common design for livestock housing. This design provides a clear interior space with unrestricted internal airflow and without restriction on internal layout, giving good access for mechanical handling of feed and manure. Internal feed passages can be accommodated within a basic portal frame design and cantilevered overhangs can provide cover over external feed passages if required. Hot dip galvanising of frame components prior to delivery will provide good resistance to corrosion.



11.2. External walls

Where a shed design requires external walls, the lower sections up to animal height will normally be constructed from concrete block, in-situ concrete or more commonly now with pre-cast concrete wall panels to provide a cost effective, quickly erected, robust and well finished solution. Above this level the wall is required to provide air inlet as described in the ventilation section. Further detail on ventilation and suitable wall inlet designs are available in a technical note which can be accessed here:- https://www.fas.scot/publications/technical-note-tn689-cattle-housing-ventilation/.

11.3. Penning

Internal dividing gates and pens, whether permanent or removable, should be well finished, free from sharp edges and small gaps where an animal could get its head trapped. Galvanising will provide good corrosion resistance. Removable gateposts socketed into a concrete floor will provide a more flexible internal space and ease access for mucking out.

11.4. Floors

Unbedded reinforced concrete floors should have a gradient to allow a fall to a suitable drainage system and maintain the surface as dry as possible; a fall of 1 in 80 is appropriate for passageways and feed stances. Within straw-bedded courts a fall of 1 in 20 is more appropriate. Care should be taken to avoid accumulation of high urine depositions or spillage around water troughs and feeders by positioning these only at well drained areas.

Floor surfaces should have a rough enough finish or grooved to prevent slippage.

11.5. Roofs

Corrugated fibre cement sheeting has been the preferred roofing material for livestock housing for many years mainly due to the fact that it has a natural permeability and good thermal insulation properties for a single skin material. It is therefore less prone to internal condensation than alternative materials. It also provides a waterproof skin with good noise insulation that does not corrode and therefore has low maintenance requirements.

Single skin steel sheeting has poor insulation properties and can therefore lead to condensation problems in livestock buildings. Some profiled steel sheet products are now available with coatings such as “anti-condensation fleece”

which will reduce the risk of condensation droplets forming and provide a viable alternative to fibre cement.
Where sufficient ventilation inlets cannot be provided at the side walls additional inlet area can be provided by spacing roof sheets either by leaving a small gap between each adjacent sheet along the pitch of the roof or alternatively by raising overlapping sheets on a batten to provide a gap between rows.

12. References

The Welfare of Farmed Animals (Scotland) Regulations, 2010

Codes of Practice for the Welfare of Cattle – The Scottish Government, 2012

BS 5502-40:2005 Buildings and structures for agriculture. Code of practice for design and construction of cattle buildings.

Opinion on the welfare of cattle kept for beef production – Farm Animal Welfare Committee, 2017

The Control of Pollution (Silage, Slurry and Agricultural Fuel Oil) (Scotland) Regulations 2003

Rural Sustainable Drainage Systems – A practical design & build guide for Scotland's farmers & landowners – CREW 2016

Useful Contacts

Scotlands Farm Advisory Service	https://www.fas.scot/
SEPA	http://sepa.org.uk/
Farming for a Better Climate	www.farmingforabetterclimate.org

National Advice Hub
T: 0300 323 0161
E: advice@fas.scot
W: www.fas.scot

@FASScot

356813AD 28.5.2018