AN ROINN TALMHAÍOCHTA, BIA AGUS MARA

DEPARTMENT OF AGRICULTURE FOOD AND THE MARINE

S. 123 **September 2017**

MINIMUM SPECIFICATION FOR BOVINE LIVESTOCK UNITS AND REINFORCED TANKS

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The receiving of this specification does not imply approval of a grant application. However, if written approval is issued, then this specification becomes part of the contract between the applicant and the Department of Agriculture, Food and the Marine.

This is a minimum specification. Where the word "SHALL" is used, then that standard (at least) **must** be followed in grant-aided buildings. Where a procedure is "RECOMMENDED", this is advice only on good practice.

Note that all references to other Department Specifications are to the current edition of that specification [available on the Department of Agriculture, Food and the Marine's Website (www.agriculture.gov.ie) under Farm buildings]. Similarly, references to Standards are to the current edition of the Irish, British or European Standard, as appropriate.

This specification covers only the design and internal layout of bovine livestock units, and the design and construction of slurry / effluent storage tanks. **For the design and construction of a building's superstructure, Department Specification 'S101: Minimum Specification for the Structure of Agricultural Buildings' shall be read and followed alongside this specification.**

This specification has thirteen sections, as follows:-

1 Safety

1.1 Responsibility for Safety

Applicants are reminded that they have a duty under the Safety, Health, and Welfare at Work Act 2005 to provide a safe working environment on the farm, including farm buildings, for all people who may work on that farm. There is a further duty to ensure that any contractor, or person hired to do building work, provides and/or works in a safe environment during construction.

1.2 Safety during Construction

Farmer/Applicant Responsibility: Please note that neither the Minister nor any official of the Department shall be in any way liable for any damage, loss or injury to persons, animals or property in the event of any occurrence related to the development and the applicant shall fully indemnify the Minister or any official of the Minister in relation to any such damage, loss or injury howsoever occurring during the development works. It is the applicant's responsibility to provide a construction stage project supervisor.

Dangers: Where the applicant/farmer is undertaking any part of the above work, it is his/her responsibility to seek competent advice and to undertake all temporary work required to ensure the stability of excavations, superstructure, stanchion foundations, wall foundations, to guard against possible wind damage and to avoid any other foreseeable risk. It is also his/her responsibility to ensure that any drains, springs or surface water are diverted away from the works.

Power lines: Due to the complex criteria involved, where buildings are proposed within 35 metres of the centre of any overhead power line, the landowner shall contact ESB Networks in advance to ascertain the specific minimum building clearance requirement. It is a requirement on landowners under The Electricity Supply Acts to notify ESB Networks, at least, two months before commencement of any construction works near overhead lines. As a guide, table 1 below sets out the usual minimum clearance distances required, however, ESB Networks shall be contacted and their advice followed for any structure within 35m of the centre line of an overhead power line. ESB will provide landowners with written confirmation of the required clearances. Landowners can contact ESB through phone numbers provided on their electricity bills.

Where building work is undertaken near power lines there is also a safety issue regarding Machinery, Tipper Trucks and Elevators operating without proper safety measures in place. When landowners contact ESB they will be provided with relevant safety literature.

Table 1: In general the following clearances apply to various voltage levels.

Voltage	**Clearance**
Low Voltage	0.5 to 3 Metres
Medium Voltage	3 to 6 Metres
38KV Lines	10 to 17 Metres
110kv Lines	23 Metres
220KV Lines	30 Metres
400KV Lines	35 Metres

Note:

- ESB overhead lines consist of lines at various voltage levels and require specific safety clearances from buildings depending on voltage level and construction type.

- Clearances are specific to the line voltage, building height, location in line span and ground levels.

Danger to children: It is the applicants responsibility to prevent children from playing or spending time in the vicinity of any construction work.

1.3 Safety Notices

A safety notice shall be securely fixed beside every new agitation point. The notice should be as close to the agitation point as possible. A typical agitation point safety notice is shown in Figure 1 below. The sign shall be not less than 490mm wide by 410mm high, and shall be printed on an aluminium alloy board.

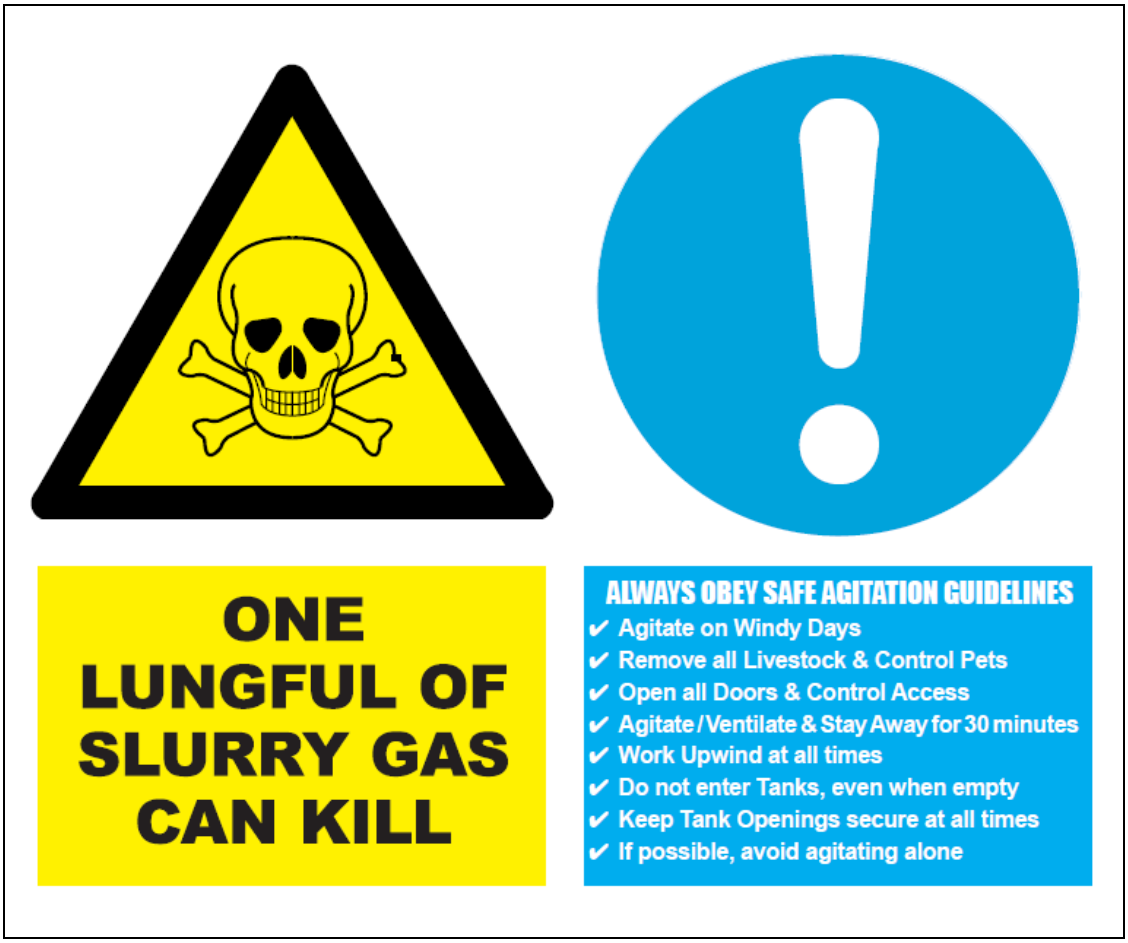

Figure 1: Typical agitation point safety notice.

1.4 Toxic Gases and Agitation

Harmful gases are generated in slurry stores and these have been responsible for both human and animal deaths. Good ventilation in slatted buildings is always important, and is vital during agitation or emptying of the tanks. Where silage effluent has been added to the slurry there can be a danger of more concentrated gases. Therefore:

1. Tanks shall always be agitated and/or emptied from the external agitation points, and never from openings within the house.
2. Agitation shall take place on windy days.
3. All animals shall be removed from the house before agitation commences. It is recommended that animal holding pens are installed close to the house to facilitate this removal.

4. All doors, and any feed-flaps, shall be fully opened before agitation/emptying begins and kept open until completion of tank emptying.
5. No person shall enter the house during agitation or emptying.
6. When agitating slurry always work upwind of the tank.
7. Some poisonous slurry gases are heavier than air. No person should climb down into an emptied or part-emptied tank without breathing apparatus. Such apparatus requires full training before it can be used.
8. Always keep the tank openings secure.
9. If possible avoid agitating alone. Always ensure that someone knows that agitation is being undertaken and the expected completion time.

1.5 Safety Tank Fencing

A stock proof and child proof fence, 1.8m high, shall be provided around all external tanks not already protected by safety covers as specified in Clause 4.7 (see also section 11).

Posts shall be 2.3m long minimum of either:-

a) Reinforced concrete 125mm x 125mm at butt end (to IS EN 12839)

b) Galvanised angle iron 60mm x 60mm x 6mm thick

c) Galvanised tubular steel, 75mm outside diameter, and 3.2mm thick

Uprights and strainers shall be embedded 400mm into the tank wall or in 0.5m square concrete base alongside the tank wall, not more than 3.0m apart. Alternatively they may be fixed to the outside of the tank with proprietary bolts to manufacturer's instructions. Four strands of 3.2 mm plain wire, to I.S. 126, shall be strained, and stapled or tied to the uprights with tying wire. Chain link fencing, 2.5mm, (to IS EN 10223-6), 1.8m high, shall be secured to the outside of the line wires over entire fence. One strand of 2.5mm barbed wire, to I.S. EN 10223-1, shall be placed along the top of the fence. The coatings of both the plain wire and barbed wire shall comply with I.S. EN 10244-2 (Galvanised to Class A or Class B using a Galfan type alloy).

A 3.5m wide gate, 1.8m high, of galvanised steel, or preservative treated timber, with closing bolts and locks, shall be fitted at each agitation or emptying point. The only horizontal bars shall be at the top and bottom of the gate. Chain-link fencing shall be fitted to the outside of the gate. The gate shall be designed such that neither people or stock can get through or under when closed. A safety concrete kerb, minimum 300mm x 600mm wide, shall be installed near the edge of the tank, across the width of the gate.

Other proprietary fence systems will be acceptable if the above criteria are met.

An agitation platform, as per clause 4.7, shall be constructed outside the fence line of all new tanks, so that the tank can be kept secure at all times. It is strongly recommended that such a platform is constructed when an existing tank is being re-fenced.

1.6 Backfilling of tanks

All tanks shall be backfilled prior to the installation of any cover, e.g. Slats or slabs. This is to prevent the possibility of the bank beside the tank collapsing under the weight of vehicles delivering and unloading slats or slabs. When slats, slabs or beams are being unloaded, care should be taken to ensure that the vehicle delivering them does not park on the recently backfilled area.

1.7 Maintenance

All farm buildings require regular maintenance to ensure the health and safety of personnel and animals. After each winter-season buildings should be thoroughly washed and cleaned out. Fittings such as slats, electrical fittings, drinking arrangements, etc., should be periodically checked, and all defective items replaced.

2 Design of Buildings

2.1 General Design

Proper design of tanks and buildings depends on stocking density; feed-face length; storage period; the management plan for land-spreading of slurry and effluents; the chosen systems of agitation and emptying; and the economics of construction. All these decisions should be taken before construction starts.

Cattle and sheep shall not be housed in the same building due to the possible transfer of common diseases. However, an exception to the rule applies where a wall to full height of building exists, separating both herd accommodation areas such that they have separate inlet and outlet ventilation facilities as well as separate access points.

The general superstructure of the building shall be constructed to the current edition of **Specification S101: Minimum Specification for the Structure of Agricultural Buildings.**

The use of a **Simple Steel Frame Structure** as specified in S101, is the strongly recommended option for cattle housing. Houses may also be built to the other designs given in S101. If trusses are being installed, they require a high standard of protection and ongoing maintenance in the aggressive livestock environment. If other structural designs not specified in S101 are used, then a full set of design drawings and full structural calculations shall be prepared by a chartered engineer, and given to this Department for prior approval before the start of construction.

2.2 Tank Gases

To maximise ventilation during agitation of slurry, and to reduce gas build-up in the house, sliding doors, unsheeted gates, or unobstructed openings shall be provided to both ends of the passageway in houses which exceed 15m in length. The minimum opening size at each end of the house shall be 3 metres wide by 3 metres high.

2.3 Ventilation of Structure

Permanent open ventilation shall be provided, as **specified in Specification S101**, as a strict condition of grant-aid, in order to protect animal health and the working life of the structure. Full ventilation shall also be provided in any conversion or extension of existing buildings.

Spaced sheeting for the roof is strongly recommended, and shall be installed as per S101.

2.4 Feeding Passage

This shall be solid or suspended as the design dictates. In the former case it shall consist of a 125mm concrete slab laid on 150mm compacted hardcore on solid foundation incorporating 1000 gauge polythene DPC. Suspended passages shall be constructed as per clause 11.4 mass concrete tank cover, or shall comply with clause 11.7 if precast.

In new buildings the minimum width of a central passage shall be 4.0m. It is recommended that the central feed passage in an animal house be, at least, 5.5m wide. Where animals are being fed silage at both the front and back of animal pens a strip of concrete, at least, 2 metre wide shall be provided along the feed face at the back of the pen in addition to the feeding passage at the front of the animal pen. In single-sided houses a concreted feed passage of at least 2 metres wide shall be provided at the front of the animal pens in all cases.

Note: All other solid floors within the building shall be installed to the above standard.

It is strongly recommended that the feed passage is at least 50mm above the level of the animal area.

2.5 Design of Slatted Houses

To maximise the capacity of slurry storage directly under the house, tanks should be installed under the entire animal area. [Extending the tanks under the central passage is also recommended]. It is recommended that no more than 500mm is provided at either the front or back of the pen. Larger areas of solid concrete flooring may make it difficult to achieve the required minimum slurry storage capacity. The solid concrete floor shall have a slope of at least 1:50, towards the tank, however, it is recommended that this be sloped at 1:14 to ensure self-cleaning.

2.6 General Suckler housing design

Suckler housing shall provide clean, comfortable, well ventilated, draught free accommodation for calves with suitable accommodation for cows. Housing should permit the accommodation of cows and calves in small groups according to calf age, to minimise the spread of disease from older to younger calves. A straw-bedded creep should always be provided for Autumn/Winter/early Spring calves.

There are three types of housing for cows with suckling calves:

1. Slatted housing with creep area
2. Cubicle housing with creep area
3. Loose housing with creep area

The above systems can be combined. The most usual combination is slatted and loose housing, where cows are easy-fed along slatted passages. A kerb 200mm to 250mm high and 200mm wide to retain bedding material shall be provided between slats and bedded area. The floor area required per cow and calves is the same as for loose housing.

Calving boxes shall be provided if calving is indoors. In slatted units where the creep area is at the back of slats, part of the creep area may be partitioned to provide a suitable calving box. In larger herds a further box may be provided to keep cows with calves for a few days after calving; floor area shall not be less than 14.5m^2. Calving box may be provided in an adjoining building. Calving boxes shall be as specified in S147.

It is strongly recommended that a calving gate, is provided in each calving box for suckler cows. It is recommended that the crush gate part of the calving gate faces onto the feeding passage. The calving gate shall be in accordance with specification S.138.

Outline drawings, Figures 2, 3, and 4 show some suggested lay-outs for suckler housing.

2.7 Design of slatted Suckler houses

When the slatted area is part of a suckler house it is recommended that slats with gaps between 35-38mm are used as these are best suited for young calves to avoid injury. The floor area per cow in slatted suckler housing depends on cow size and calving date. Autumn, winter and, early spring calving cows require more space than cows calving, post the housing period. A floor area of 2.5m^2 to 3.5m^2 per cow, depending on circumstances, is recommended.

Where feeding is rationed it is recommended that feeding space should be 0.6m per cow. The minimum space shall be 0.4m.

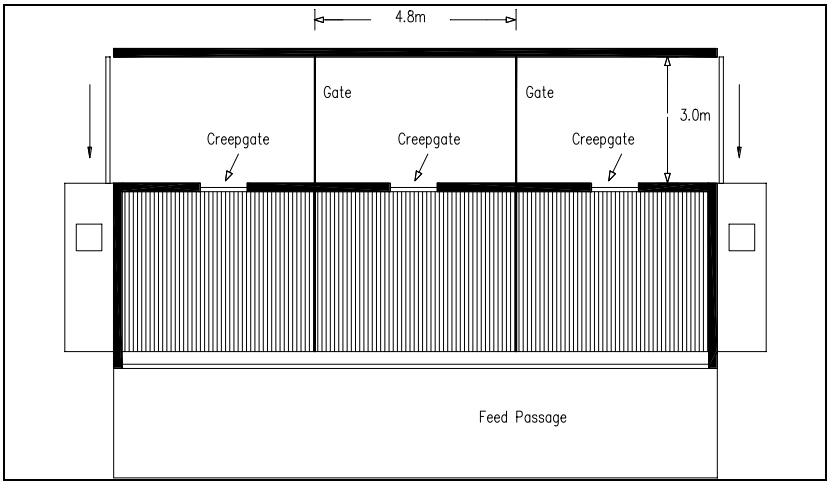

Figure 2 Slatted House and Creep

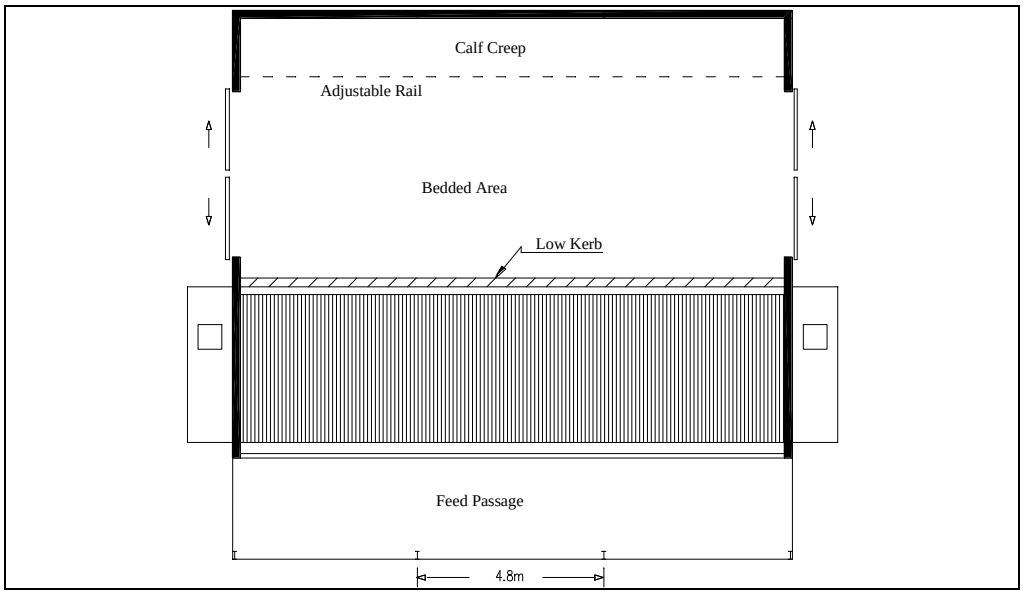

Figure 3 Bedded / Slatted House

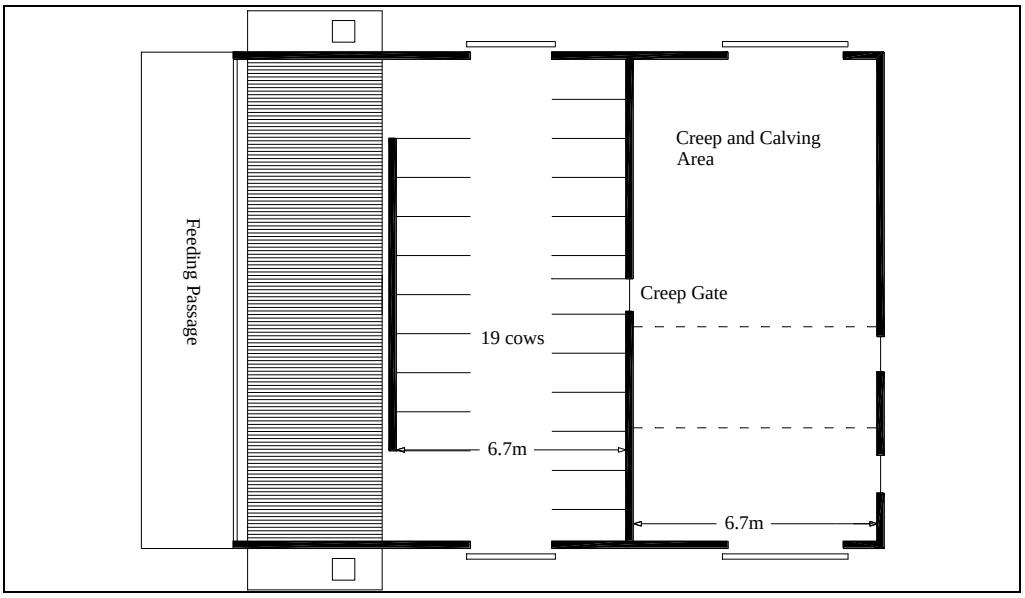

Figure 4 Adapted Existing Housing / Cubicle - Easy Feed

2.8 Design of Creep area

A creep area of at least 1m^2 per calf shall be provided for spring born calves and up to 1.75m^2 per calf for Autumn born calves.

A solid floor is preferred. Fall shall be at least 1 in 30 to a drainage channel discharging into the underground tank (it is recommended that the fall should be 1 in 20).

Slatted floor pens normally used to house cattle may be covered with straw bedding for creep use. Under floor draughts should, as far as possible, be excluded. It is recommended that slats are covered with a suitable material to prevent straw bedding entering the slurry tank.

To minimise draughts in creep area level, a temporary canopy may be installed over the lying area, of plywood, boards or other suitable material. It is very strongly recommended that the eave height of the creep area is 4m so as to facilitate mechanical cleaning.

The location of the creep area depends on:

- The preferred management system: Autumn, Winter, early Spring or late Spring calving. No creep area is required for late spring calving.
- Where part of the herd is early calving it is recommended that the creep area be located at the end of the house with calved cows accommodated in the adjoining pen.
- Where most of the herd is housed after calving the preferred location of the creep is at the back of the slatted area. The recommended minimum width is 3m.

Separate external access to the internal divisions of creep area shall be provided to facilitate meal feeding and inspection of calves. All creep pens shall be accessible without passing through another animal pen. Where possible, this shall be incorporated into all designs prior to July 2017, however, in all cases it shall apply to buildings where planning permission or Declaration of Exemption is sought after 6th September 2017.

Tight fitting sliding doors sufficiently wide to facilitate mechanical cleaning shall be provided at each end of a creep area more than 20m (5 or more bays) long and at one end of a creep area less than 20m (4 bays or less) in length. One sliding door shall have wicket door fitted, minimum 0.75m wide and 2m high to facilitate access for calf inspection etc. A channel 75mm x 75mm shall be provided across every opening and the effluent collected and diverted to a suitable holding tank. The channel shall be provided 600mm outside of the opening so as to collect any effluent seepage. The channel shall be constructed as specified in clause 2.11.

It is recommended that the barrier between the cow area and creep is a tubular steel gate framed with 50mm tubular steel and incorporating a creep gate. This barrier should stretch across the full divide between the cow area and creep area. The height of gate over floor level shall be 1.5m, hung either to suitable RSJ posts or to 100mm heavy gauge GB tubing, and provided with animal-proof closers. A kerb about 175mm high either of mass concrete or 75mm thick treated timber shall be provided under the tubular barrier to exclude bedding from creep area getting on to slats. Alternatively, the barrier may be of 150mm mass concrete or 150 mm solid concrete block walls (in accordance with clause B9 of S.101) built between 150 x 75mm RSJ uprights and incorporating a creep gate. To allow cows to see the calves the wall should be 1.1m to 1.2m high, and be installed with a horizontal top rail set at 1.5m over floor level.

One creep gate per pen shall be provided. The minimum opening shall be 350mm wide x 1m high.

2.9 Layout of Cubicle houses

In order to ensure a stress-free environment for dairy cows in houses with double or multiple rows of cubicles, the following shall be incorporated in the layout design of any new buildings:-

- At least two routes to the feedface.
- No dead end passages.
- Cross-over points between rows shall be a minimum of 2.3m (2 cubicles) wide, or 3.5m (3 cubicles) wide if a drinker is positioned at the point.

In all cubicle houses there shall be a minimum 3.5m standing area at the feed-face, and at least 2 drinkers, and preferably four, per 50 cubicle unit. It is recommended that where the heel of the cubicle bed faces the feed face that the standing area be at least 4m wide.

Solid-floor cubicle houses shall normally incorporate an easy-feed passage with barriers. If a self-feed design is chosen it is strongly recommended that all feeding areas be covered to minimise requirements for soiled water storage.

Scraped passages behind cubicle beds shall be at least 1.8m wide, and normally 2.0m or more. It is recommended that the passages be 2.7m wide. Channels to which slurry is scraped shall have slatted or gridded covers with max. 40mm slots, or alternatively be positioned to prevent any animal access. Mechanical scrapers shall be installed to manufacturer's specifications. See also clause 2.13.

For smaller cubicle units (no more than 8 cubicles on any side of each passage) where the cubicle beds run perpendicular to the feed passage the requirement for crossover points and no dead end passages is relaxed to a strong recommendation. Where there are more than 8 cubicles, crossover points shall be installed.

Cubicles are a less favoured option for suckler herds. Existing cubicle housing may be adapted by the provision of creep area and an easy feed arrangement. Where calves are present with cows, provision shall be made to ensure easy escape for calves from cubicles to avoid risk of injury.

Where calves are with cows, a suitable creep area must be provided either at the end of the house, at the head of the cubicles, or in an adjoining house.

Where a slatted feed area is being added on to an existing cubicle house it is strongly recommended that the cubicle house layout is adjusted, if necessary, to meet the above requirements.

2.10 Design of Loose Houses

Loose houses shall normally incorporate an easy-feed passage with barriers. If a self-feed design is chosen it is strongly recommended that all feeding areas be covered to minimise requirements for soiled water storage. All pens shall be directly accessible from either outside the building or from a suitable passage (recommended minimum width 1.2m) within the building – in no case can the only access to a loose area be through another animal pen. Where possible, this shall be incorporated into all designs prior to July 2017, however, in all cases it shall apply to buildings where planning permission or Declaration of Exemption is sought after 6th September 2017.

Loose houses with full bedding shall be designed with floors sloped at least 1 in 40 (it is recommended that the floor be sloped at 1 in 30) so that all liquid seepage is drained at source to an appropriate store. Where bedded floors are installed beside slatted tanks, a barrier (timber or concrete kerb) may be placed to prevent ingress of bedding material into tanks. A system of removal of the liquid effluent shall be provided in every loose house. A channel 75mm x 75mm shall be provided across every opening and the effluent collected and diverted to a suitable holding

tank. The channel shall be provided 600mm outside of the opening so as to collect any effluent seepage. The channel shall be constructed as specified in clause 2.11.

A floor area of 3.5m^2 to 4m^2 per cow is required. If calves are running with cows an additional area of at least 1m^2 is required per cow.

[The type of loose house which incorporates sloped floors with minimal or no bedding is not recommended, but if such pens are installed the floor shall have a slope of between 1 in 16 and 1 in 12. The length of sloped sections to channels in these specialised sloped-floor houses shall be 1.6m max. with no bedding, and 2.4m max. with limited bedding].

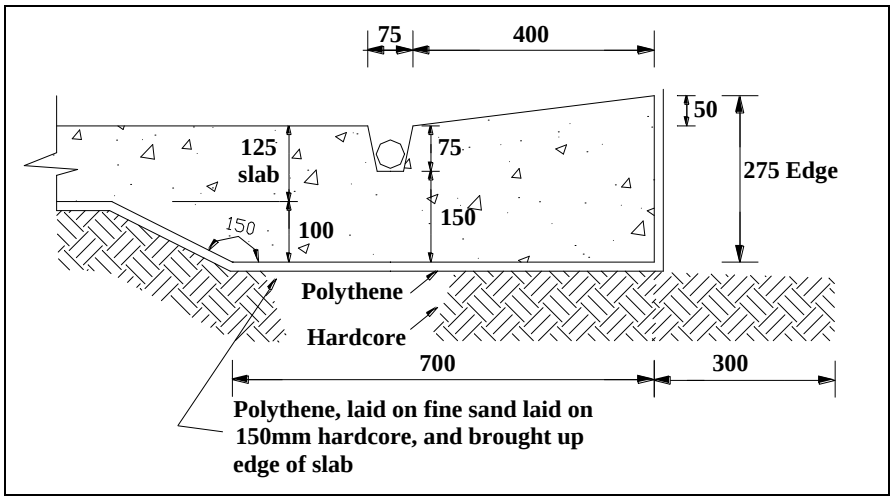

Figure 5: Channel design for use at edge of concrete.

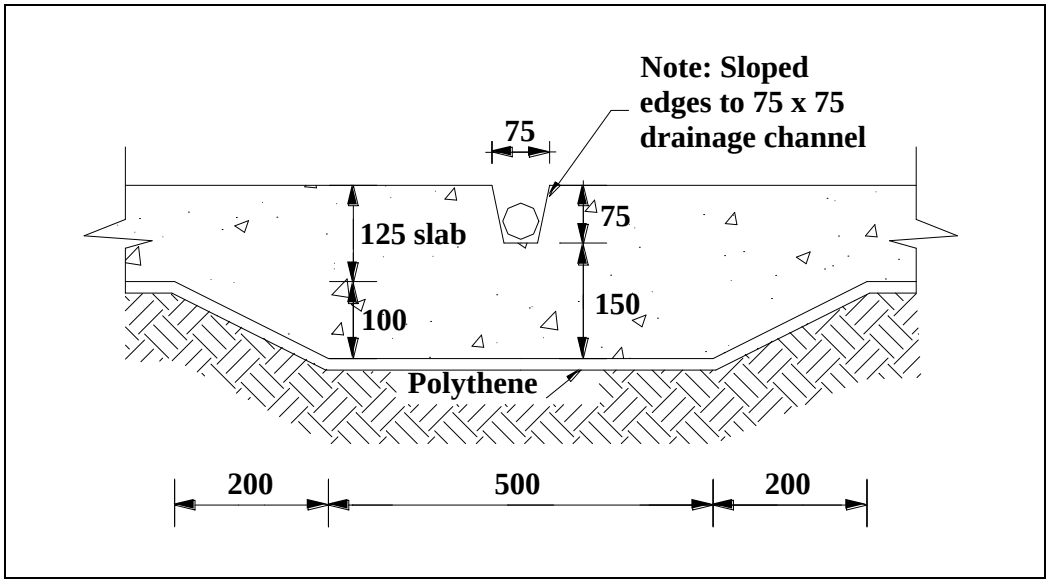

Figure 6: Channel design for use when concrete extends as working yard area.

2.11 Walls around bovine housing.

Walls are not mandatory for slatted, cubicle or loose housing. Walls, where installed, shall be constructed to the requirements of Specification S101. [It is recommended that walls be not more than 1.5m in height, or 2.0m for loose houses with 4m eave height.] Where walls are not provided appropriate barriers, constructed to the requirements of clauses 3.3, 3.4 or 3.5, shall be installed to ensure the proper control of animals. Houses without external walls shall not be used for accommodation of young calves, and are not recommended for dairy cows.

Where walls have been omitted in solid-floor cubicle houses and loose houses, channels shall be constructed around the house as per Fig. 5 and Fig. 6. The channel shall be not more than 600mm outside the barrier. The channels shall be connected to a suitable tank.

2.12 Walls over tanks

Walls shall not be built directly onto slats under any circumstances. As walls are not mandatory in most houses (Clause 2.11), steel barriers may instead be installed across the gable end of a building, with or without steel cladding. Prefabricated concrete wall panels may also be installed (Clause B9.2 in S.101), positioned at least 10mm above the top of the slats. If it is decided to install a blockwork or mass-concrete gable wall (as per clause B9 of S.101) then it shall be positioned on a supporting beam. This beam may either be prefabricated, or constructed on site (Clause 11.6 or 11.7), and shall have at least 150 mm support at each end. If it is decided to extend the slats under the beam, there shall be a gap of at least 10mm between the beam and the top of the slats. In all circumstances there shall be sufficient space outside the house to install, at least, a 1.2m wide slab or manhole slat on the walls of the extended tank.

Where a wall is erected on a tank wall, the tank wall shall be wide enough to carry the full width of wall **and** provide a full slat bearing of 150mm (see clause 11.1). Where walls are 200mm, 350mm (min.) tank walls are necessary.

2.13 Scraped passage outlets

Where an automatic / mechanical scraper scraps slurry through an opening in a wall to an uncovered slurry tank, the opening in the wall shall be no more than 25mm higher than the height of the scraper blade. The width of the opening shall be no greater than the width of the scraped passage. Additionally a steel hoop, minimum 16mm diameter, shall be attached to the wall at 1.2m above passage level to keep animals away from the opening. The hoop shall extend for the width of the passage and protrude 300mm into the passage way and have a solid cover over it to prevent animals legs from going down inside the hoop. If it is necessary to have the opening higher than 25mm above the scraper blade, then a slatted area shall be constructed directly behind the wall, with a safety fence or a mass concrete wall constructed around the slatted area.

Where passages are scraped using a tractor mounted scraper through a wall opening to an uncovered slurry tank, then a slatted area shall be constructed directly behind the wall, with a safety fence or a mass concrete wall constructed around the slatted area. The safety fence or wall shall be at least 1.8m high.

Channels to which slurry is scraped shall have slatted or gridded covers with max. 40mm slots, or alternatively be positioned to prevent any animal access.

Automatic / mechanical scrapers shall be installed to manufacturer's specifications and shall be set up that when not in use to be located in the opening in the wall at the end of the passage (if present).

Where robotic scrapers are used, they will need a slatted area to scrape the slurry into. Please refer to manufacturer's instructions in relation to the size of solid areas that can be scraped with robotic scrapers.

2.14 Recommended Minimum Animal Areas

These can be found on the Department of Agriculture and Food website (www.agriculture.gov.ie) under farm buildings.

3 Components

3.1 Cubicle Beds

3.1.1 Size of Cubicle Beds

Sizes of cubicle beds will vary according to animal size, but for dairy cows, beds shall be at least 2.1 m long when head to head and at least 2.4m long when up against a wall. The distance between divisions shall be at least 1.15m centre to centre, and not more than 1.35m (see Fig. 7). Larger cows require 1.25m to 1.35m wide by at least 2.2m length. It is recommended that cubicle beds should be 2.6m long when up against a wall and 2.4 m when head to head. In addition it is recommended that the width of a cubicle bed be increased by 10% where one of the long sides is bounded by a solid wall. Where cubicle beds are for young stock, the minimum dimensions may be reduced by not more than 20%.

Internal headwalls between cubicles and a feed passage shall be at least 100mm thick, and be supported by stub stanchions spaced at no greater than 4.8m intervals.

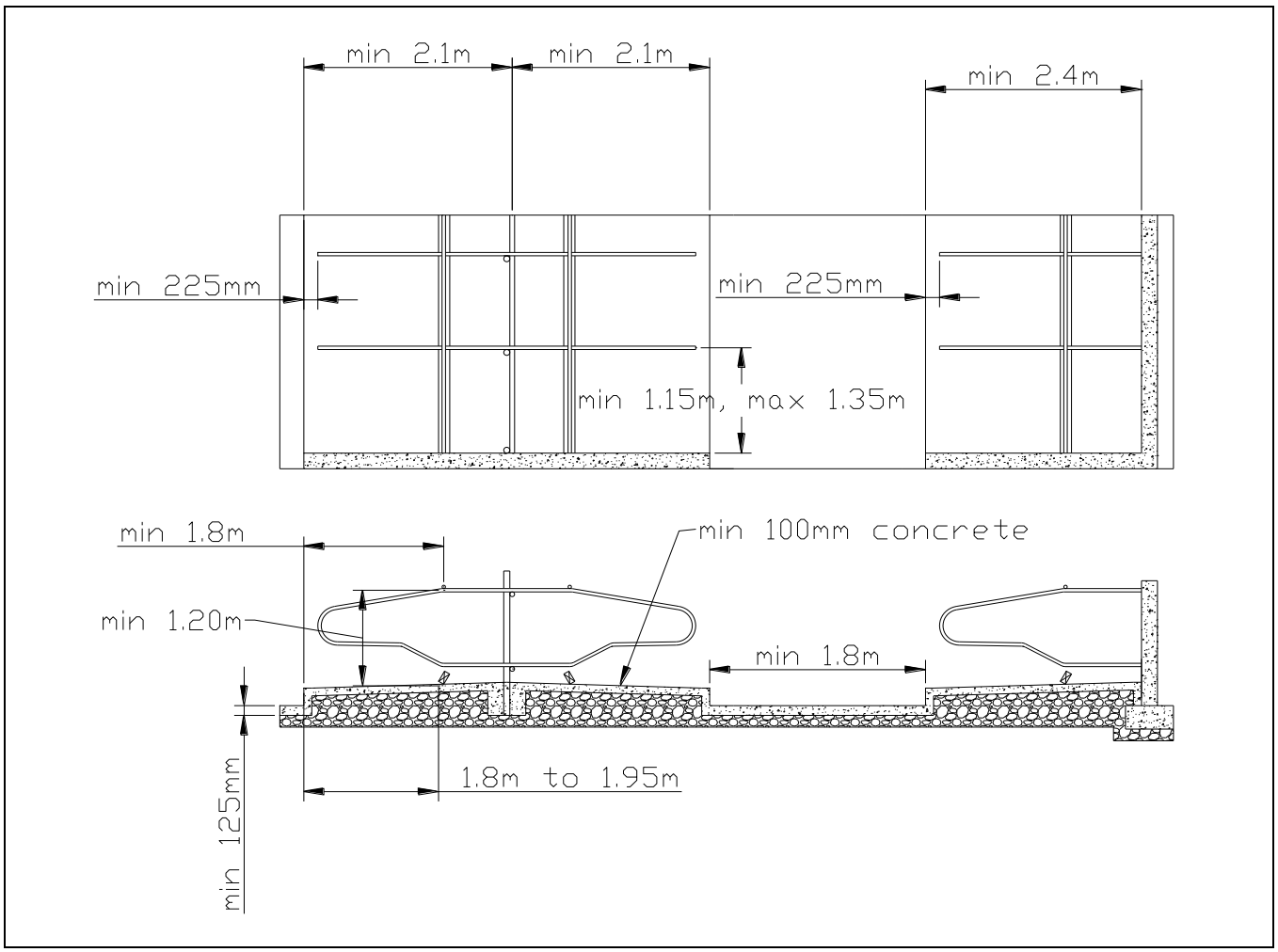

Figure 7: Cubicle bed layout for dairy cows

3.1.2 Cubicle Beds on Solid Ground:

These shall consist of 100mm concrete on 150mm well compacted hardcore. The finish shall be uniform, non-slip, capable of easy cleansing with a fall of at least 75mm from head to heel kerb.

The heel kerb shall be at least 100mm thick and the bed height at this point shall be a minimum 200mm over a solid passage and a minimum 175mm over a slatted passage.

Table 2: Mesh requirement for suspended cubicle beds with supports at no more than 3.2m centres.

Mesh Reference	Pitch of Wires (mm)		Size of Wires (mm)		Weight
A.142	200	200	6	6	2.22
B.196	100	200	5	7	3.05

Alternatively 10mm H.Y. bars may be used at 150mm centres with similar bars at 300mm centres as transverse steel.

3.1.3 Suspended Cubicle Beds:

These shall be supported at a maximum of 3.2m centres. The walls under the slab shall be raised level with the top of the slats. Reinforcement shall be placed in position having clear bottom cover of 50mm. Where meshes overlap, the cross wire on one shall overlap a cross wire on the other. Suitable meshes are shown in Table 2. If it is desired to support cubicle beds at greater intervals than 3.2m, then the reinforcement shall be as for a mass concrete tank cover (clause 11.4).

Well-supported leak-proof shuttering shall be provided to the underside of the slab area during construction.

3.1.4 Precast Cubicle Beds:

As an alternative to suspended cubicle beds and standard cubicle beds, precast cubicle beds with cast-in cubicle divisions are recommended.

Precast cubicle beds may be placed on slats under the following conditions only:

- Precast cubicle beds shall have the same fall from head to heel and same height above the passage level as cast in-situ cubicle beds.
- Precast cubicle beds may either be self supporting or supported on heavy duty slats or slabs.
- Where there are slats under the precast cubicle beds they shall be heavy duty slats.

All precast cubicle beds shall be CE marked and produced in a plant certified by a Notified body (e.g. NSAI or equivalent), to produce "Precast concrete products – Linear structural elements" to I.S. EN 13225. Precast cubicle beds shall be designed to withstand the same loadings as standard slats. All precast cubicle beds shall be listed on the Accepted Concrete Slat List of the Department of Agriculture, Food and the Marine.

3.1.5 Cubicle Beds Extending Over Slats:

Cast in-situ cubicle beds shall not extend more than 225mm over slats, and where they do the cubicle beds shall be designed and constructed such that slats can be replaced without damaging the cubicle beds. There shall be at least a 25mm clear space between the upper side of the slats and the under side of the cubicle beds. The cubicle beds shall be suitable reinforced.

The construction of cast in-situ **cubicle beds on slats is not permitted under any circumstances. Cubicle beds on slats, makes slat-replacement extremely difficult and expensive.**

3.1.6 Walls at end of line of slats

Where mass concrete or block walls are constructed at the end of a line of cubicle beds, then these walls shall not be built on cubicle beds over slats. Where necessary a removable barrier shall be constructed along the end of a row of slats. The barrier may be either solid or open frame.

3.2 Cubicle Divisions

Cubicle Divisions shall be of galvanised tubular steel, not less than 43mm O.D. and 3.2 mm thick or 42.4mm O.D and 4.0mm thick. They shall extend from the head wall to not more than 225 mm in from the kerb edge: if free-standing, they shall be installed close to the head wall. The top rail shall be at least 1.20m from the floor. An adjustable head-rail is strongly recommended, and is mandatory for cantilever cubicles. A brisket board is also strongly recommended and is mandatory for cubicle beds longer than 2.35m. Within the above limits, a range of cubicle designs is accepted.

Proprietary cantilever plastic cubicle dividers are also permitted. The outside diameter shall be in keeping with steel cubicle dividers. The length and height of the dividers shall meet the requirements for steel cubicle dividers.

3.3 Pen Dividers

Divisions between pens shall be at least 1.5m high with no more than 300mm clear spacing between bars and between bottom bar and floor. There shall be a minimum of 5 horizontal bars in each pen divider. Steel shall be a minimum of 42.0mm O.D. and 3.0mm thick, and up to 75mm O.D. depending on the width of the pen or on the weights of stock housed. Vertical bracing pieces shall be secured between each pair of horizontals at 2m intervals and staggered. Dividers may either be securely fixed, or hinged to form gates. Extendable gates are also acceptable, subject to a minimum overlap of 550mm, with the outer sleeve a minimum of 50.8mm by 2.0mm thick and the inner sleeve a minimum of 42.4mm by 2.5mm thick.

There is a wide range of dividers available and it is important that the divider installed is suitable for the size and type of cattle that may be housed in the unit at any stage. The lighter barriers specified above are only suitable for young stock, barriers of 75mm diameter are required when housing older cattle and fattening animals. Additional rows of lighter bars may be included, however, a minimum of 5 bars of at least 42.0mm O.D. and 3.0mm thick shall be in each divider.

3.4 Feed Barriers

A wide range of feeding barriers may be installed. Normally the rail shall consist of a 80mm O.D. and 4mm thick tubular steel rail, fixed approximately 1.0-1.3m from the floor of the pen, with capacity for height adjustment. A barrier approximately 450-600mm high shall be positioned under the rail, of 100mm solid concrete or block work, or secured timber planks. [Blockwork is likely to fall unless a second rail is fixed directly above it]. Other feeding barriers, of equivalent strength, may be installed, as may proprietary barriers that include locking devices, forward hinging, or moveable sections. [Designs with hinged or moveable barriers may require that support stanchions be strengthened by web-stiffeners]. Barriers shall be hinged or otherwise suitably fixed to allow access to animals in an emergency and to allow movement of animals.

Ordinary rail barriers are not suitable where calves are running with cows. Adjustable rails or angle barriers are more suitable.

3.5 Access to Pens

Where feeding is carried out along the central passage only, access to pens may be from the rear. The access shall be controlled by a door or a heavy-duty tubular gate 1.2m wide. Doors or sheeted gates wider than 1.2m shall be sliding. All access doors and gates shall be framed and hung to be strong enough to ensure safe stock management and protection of personnel.

3.6 Protection and fixing of Pen Divisions, Feed Barriers and Fittings

It is recommended that pen divisions, feed barriers, and access fittings (Clauses 3.3, 3.4, 3.5) should be galvanised. Any exposed ungalvanised steel other than structural steel shall be given 3 coats of anti-rust paint. Timber doors and other timber joinery shall be given a primary coat, 2 undercoats, and a hard gloss finish coat of lead-free paint.

Where pen divisions, barriers, etc., are being fixed to already galvanised or painted stanchions, it is recommended that bolts be used rather than welded connections. Alternatively any welding damage shall be made good as described in the protection of structural steel clause in Specification S101.

3.7 Drinking Arrangements

Houses shall have at least one drinker between every two pens, mounted at a suitable height and protected by a single 48.3mm rump rail located as tight as possible around the drinker. Alternatively, smaller drinkers may be protected by a proprietary wrap around steel protection of 75 mm x 6mm steel plate tight to the drinker. It is recommended that suitable proprietary drinkers with anti-dunging protection should be installed. Water supply shall be via a minimum 19mm ID flexible pipe located and securely fixed to prevent damage.

All water pipes shall be manufactured in compliance with IS EN 12201 and be a minimum of PE40. These will either be fully blue or have a blue longitudinal strip.

In all houses, drinkers mounted on concrete blocks, suitably located and protected may be used. Drinkers may be external to the house with access through a 600mm deep opening in the wall, provided they are protected against frost. Whichever system is adopted it should be capable of providing the large quantities of water required by housed animals, particularly cows in milk.

4 DESIGN OF TANKS

4.1 Capacity of Tank

A minimum of 16, 18, 20 or 22 weeks storage shall be provided in all new and converted structures in line with the requirements of S.I. 31 of 2014 European Communities (Good Agricultural Practice for Protection of Waters) Regulations and any subsequent amendments to the regulations. However, where the Local Authority has specified a higher winter storage period, then this must be complied with. It is recommended that the tank capacity should be sufficient for the entire housed period, where the tank is fully under an animal house, this is so that all animals will already be out of the house before agitation is required. Otherwise, it is recommended to provide external holding pens for all cattle in the house for use during agitation of slurry. This can be done by the use of securely fixed gates along the side of the building.

Note: The requirements for the capacities of slurry, effluent, and soiled water stores which are defined in S.I. 31 of 2014 Regulations shall be followed. The regulations require that an additional freeboard of 200mm must be provided for all covered tanks and 300mm for all uncovered tanks. A tank covered by slats only is not considered to be covered in respect of allowances for rainfall and freeboard.

Where a holding lies partly in one county and partly in one or more other counties, the slurry storage on the holding shall be designed in relation to the county in which the longest storage period is required.

4.2 Tanks within Buildings

All tanks shall be provided with facilities for **the full agitation of slurry from point(s) outside the building.** This is done by the extension of tanks beyond the building. In any tank more than 16.0m long (3 x 4.8m bays, with agitation point at one end), external agitation points shall be installed at each end of each tank, or a pipe circulation system (clause 4.4) or simple aeration system (clause 4.3) shall be installed. However, it is strongly recommended that any tank longer than 11m should have an external agitation point at both ends. Under no circumstances shall such extended tanks or access points be roofed over or enclosed. A tank shall extend at least 1.2m beyond the end of a building to provide sufficient length to install an agitation point. It is recommended that a tank extends 1.5m beyond a building to allow for the installation of the agitation point.

Adequate space shall be provided at all agitation points to ensure that an agitator can be installed into the tank and the tank both fully agitated and emptied. **All Buildings shall be designed so that there is good air-flow around agitation points.** There shall be at least nine (9) metres of a clear space left between the gables (ends) of two buildings, when an agitation point(s) is located between the gables of the two buildings. This clear space shall span across the full gables of the buildings. Where agitation point(s) are between the gable of one building and the side of a second building, there shall be a minimum of 6.0m clear space between the two buildings where the agitation points are located. This clear space shall span the full width of the building with the agitation point. This is to allow for sufficient air movement when agitating tanks. Agitation points shall not be surrounded on three sides by walls or solid barriers, where all three walls are less than 9 metres from the agitation point.

Access points shall not be installed inside any houses.

Full external agitation shall also be provided for in all designs involving the conversion or extension of existing buildings.

Where an existing building is being extended or converted and there is an internal agitation point, **then this agitation point shall be removed**. All necessary work shall then be done to allow for full **external** agitation of the existing building.

It is strongly recommended that all agitation points shall be outside any unroofed animal area. Agitation points within unroofed animal areas will need replacement before normal end of life.

4.3 Agitation

The design of the tank at the agitation ends, and the design of the external agitation points, shall suit the chosen systems of agitation and emptying. Manufacturers' specifications and dimensions on guide rails, dividing walls, access chambers etc., shall be followed. Some systems require agitation every 4-6 weeks. [see also Clause 1.4 on safety procedures).

Where concrete piers are used they shall be finished flush with tank wall on inside face so as not to interfere with slurry agitation.

The use of simple aeration systems for the continuous conditioning and mixing of slurry are permitted. These systems shall require prior Departmental acceptance and shall be listed on S.123 D: Accepted Simple Aeration Systems For Grant-Aid. Where these systems are used, the maximum tank length is increased to 75m for any tank layout (clause 4.4), however, there shall be external extraction points at no greater than 50m intervals and in cases where there are spine walls present, there shall be openings in the spine wall so that slurry does not have to flow more than 40m to the nearest extraction point. Where one of these systems is retrofitted into an existing building then the ventilation of the building shall be brought up to the standards as set out in Specification S. 101. The use of simple aeration systems is not recommended where the cattle are fed on bale silage or where straw bedding or other long material may get mixed into the slurry.

4.4 Circulation

It is recommended that tanks, where possible, should have a circulation system (Figs. 8A & 8B).

- Type “A” (Fig. 8A) is one recommended design that consists of a set of transverse tanks set across the width of the house, each with a spine wall and with separate external agitation points. This arrangement is very suitable for bay widths up to 6.4m, and allows for limitless extension of the building. The tank lengths shall be as per type B tanks.
- Type “B” (Fig. 8B) tanks are suitable for use with suspended central passages, or where a double row of slats are required in each pen. These tanks shall not be longer than 42m (8 x 4.8m bays, with agitation points at both ends). Where agitation points can be provided at one end only, the tanks shall not exceed 25.5m (5 bays) long.
- Type “C” (Fig. 8C) tanks shall be not longer than 32m (6 x 4.8m bays, with agitation points at both ends), but it is strongly recommended that Type “C” tanks are no longer than 27.0m. Where agitation points can be provided at one end only, the tanks shall not exceed 16m (3 bays) long.
- When a 150mm or 125mm pipe is permanently installed along the side of a tank, for agitation purposes, the tank length can be up to 37m for tank type B and C with an agitation point at one end. Where the pipe system is run from both ends of one tank, the pipes shall over lap by at least 4.8 metres and the total length of the tank shall not exceed 61 metres, for tank types A, B and C. The pipe shall run for the required length of the tank and be secured at regular intervals in such a manner that it cannot move while in use. For tank types A and B, the pipe agitation system shall be installed in all tank sections. It is strongly recommended that the pipe shall run along the floor of the tank, however, it is permitted for

the pipe to run along the top of the tank. If the pipe is located outside of the tank, it shall be concreted in place for its entire length. If being supported off the floor, the pipe shall be secured at least every 450mm with suitable heavy duty stainless steel brackets. If the pipe is on the floor of the tank, it shall be secured at intervals of no greater than 1.0m, using suitable brackets. Unless the pipe is securely fixed it will move under the pressure and weight of use. A suitable connection system shall be provided to enable the slurry pump to be easily connected securely on to the circulation pipe system. It is recommended that a nozzle is fitted to the end of the pipe in the tank to increase the mixing effect.

Alternative proprietary designs of agitation systems are permitted, however, prior acceptance by the Department of Agriculture, Food and the Marine is required when grant-aid is being sought.

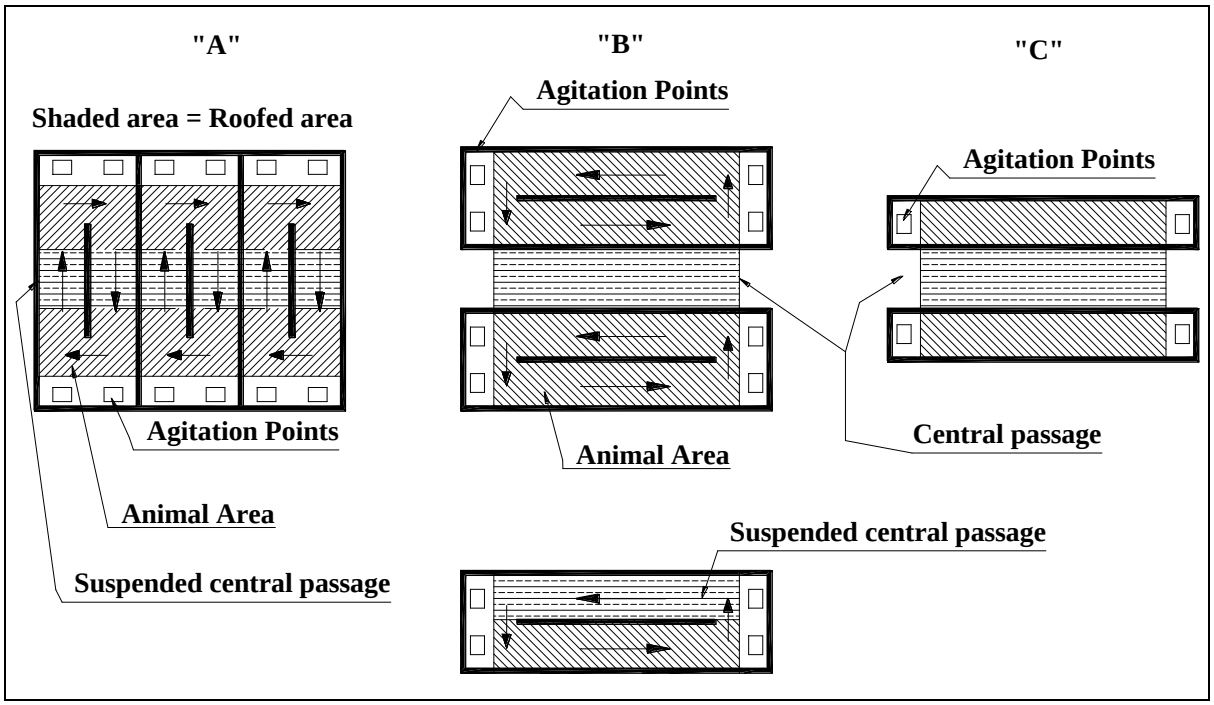

Figure 8 Slurry Circulation in Tanks (Examples)

Note: The length of tank that can be agitated from any given point depends upon the slurry consistency, agitator power and presence of circulation systems. Careful consideration should be given to these factors when deciding on tank layout. For buildings housing dry stock fed on a high meal diet, type B tanks should not exceed 32.0m and type C tanks should not exceed 27.0m as agitation of longer tanks will be extremely difficult.

4.5 Spine Walls

For ease in agitation and for structural reasons, (in particular the problem of full foundation support), pillar-and-beam type construction should preferably be avoided. Where pillar-and-beam type construction is used it is recommended that all pillars be circular. It is strongly recommended that solid spine walls, with opes, shall be constructed for the support of slats and suspended passages, however, pillar and beam type construction is permitted. It is strongly recommended that all internal wall corners be rounded.

It is strongly recommended that spine walls (whether fully solid or of pillar and beams) be positioned along the centre line of the tank. It is recommended that the space at each end of the wall should either be half the tank width or as wide as the wider of the tank divisions formed by the spine wall.

Note: Where it is desired to cover an existing concrete tank, a detailed report shall be commissioned from a Chartered Engineer for the tank and a detailed description obtained on how to install and construct any necessary spine walls or pillar and beam system.

4.6 The addition of slatted feeding area(s) to buildings

Where as part of a conversion or new building, it is required to build a slatted tank across the front of, or along the side of, a building to form a feed area, as shown in Fig. 9, it is very strongly recommended that the feed area be roofed. If it is decided, however, to omit the roof then the following additional conditions shall be complied with:

- The agitation points shall be outside the line of the sidewall of the house, and outside the line of any expected future roof. Only in exceptional circumstances may the agitation points be within the animal area.
- The agitation points shall be outside the feeding area. Only in exceptional circumstances may the agitation points be within the feeding area.
- In difficult or dangerous site conditions the tank can be up to 3.0 metres from an existing house. In other conditions it is recommended that the maximum distance is 1.5 metres. The maximum distance from a new house is 1.5 metres.
- The tank shall be designed with full allowance for rainfall within the catchment area.
- The stanchions supporting the feed-barrier shall be either:
  - Stub stanchions (maximum of 1.5m above ground level) of a maximum of IPE160, **or**,
  - Be of the correct size for a stanchion for a building of the span of the feed area. These stanchions shall be of the correct height to allow the installation of the future roof, and shall be set in foundations of specified size for the stanchion selected.
- If the new slatted area is the only point of access to the existing building, then the slats over the tank shall be heavy-duty (tractor) slats.

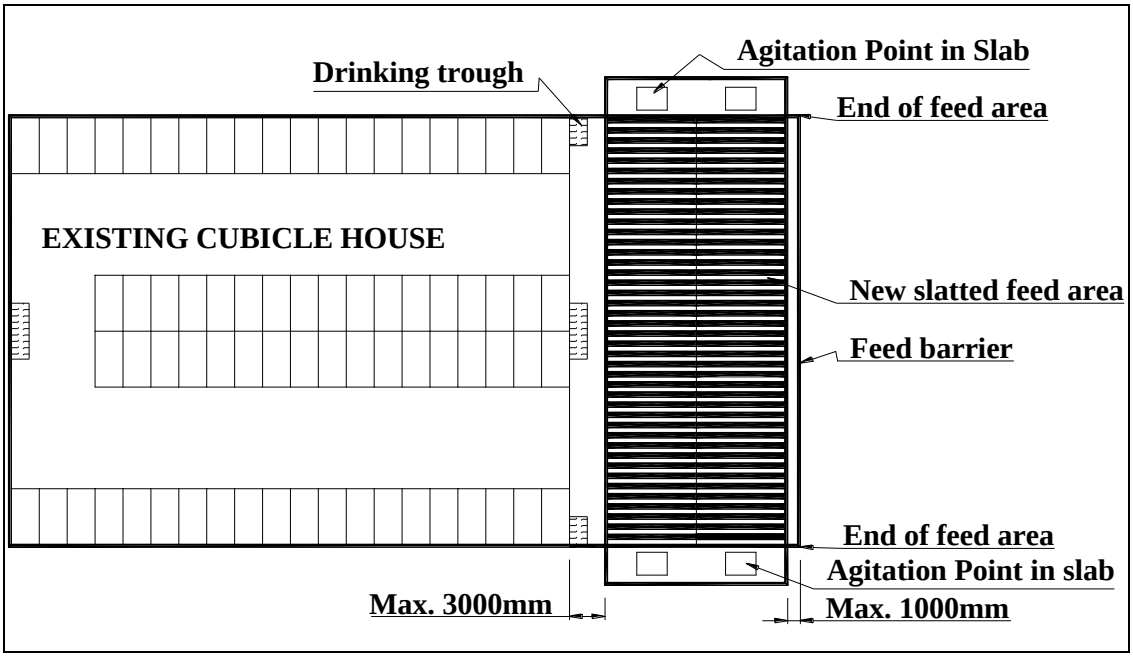

Figure 9: Slatted feed area in front of cubicle house.

4.7 External Tanks

Open external tanks shall be designed with full allowance for rainfall within the tank area, and shall conform to clause 4.1. External slurry tanks shall have at least two well-separated agitation points.

It is strongly recommended that all external tanks are covered, with a solid cover (not slats) for the control of odours, greenhouse gasses, ammonia and rainwater. Tank covers, where installed, shall conform to Section 11.0 below.

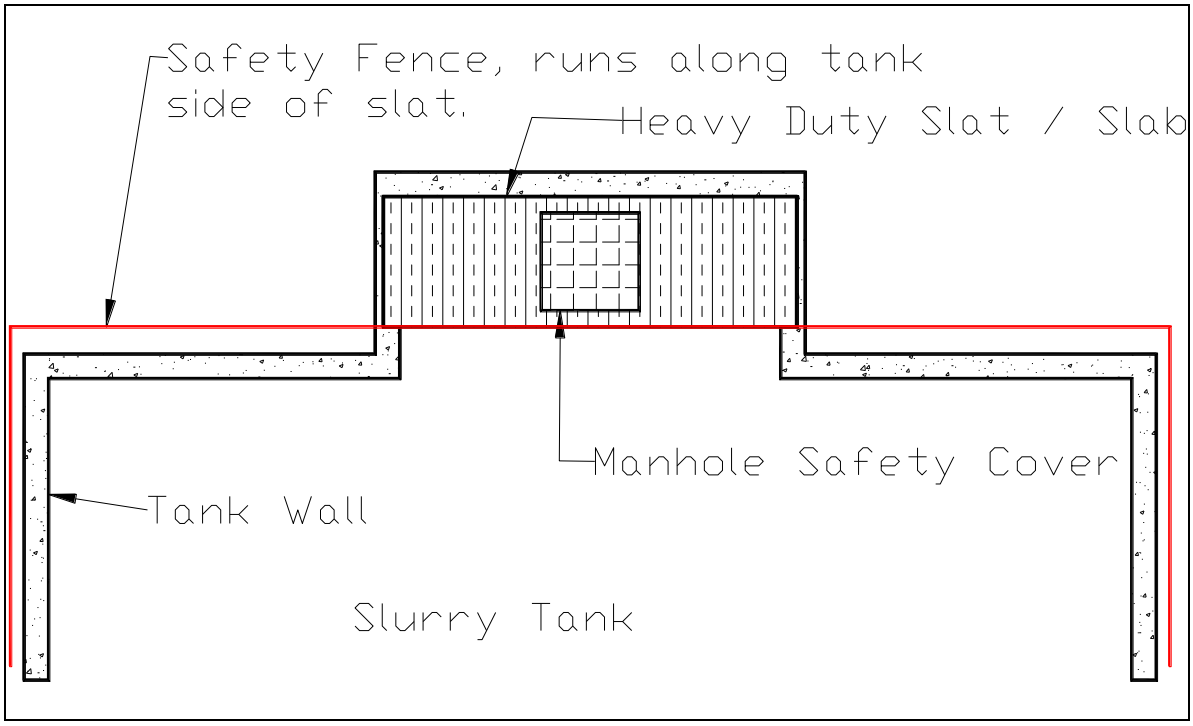

Figure 10: Agitation point for external tank outside of fence.

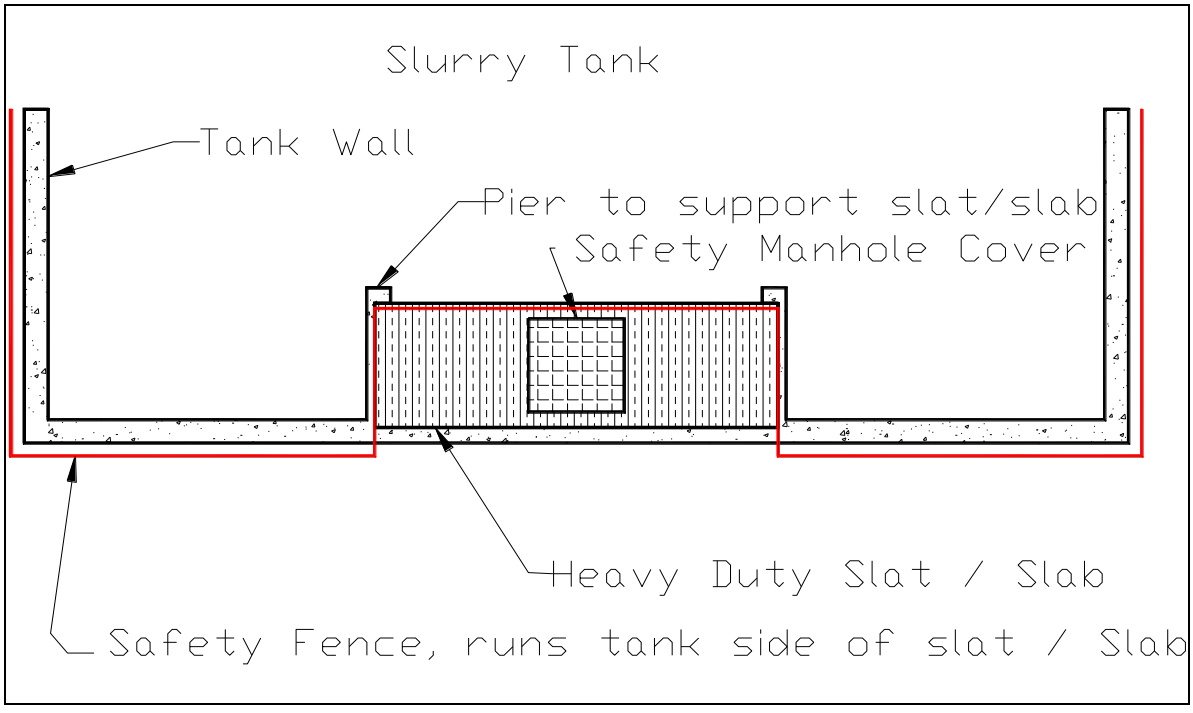

Figure 11: Agitation point for external tank outside of fence.

Where external tanks are either uncovered or are covered by a flexible cover, then they shall be surrounded by a safety fence constructed in accordance with Clause 1.5. The agitation point(s) for uncovered stores shall be outside the line of the safety fence and covered by a heavy duty manhole slab / slat as shown in Figures 10 and 11. There shall be a minimum distance of 450mm between the edge of the manhole safety cover and the safety fence. For the distance the fence runs along the

agitation point, the fence shall be over the slab / slat and not alongside. A fence post shall be erected midway along the slab / slat to secure the fence. Where the agitation point extends into the tank, the slab / slat may be supported on a combination of pillars and beam or solid walls along the side. Alternatively, proprietary agitation platforms are acceptable, once accepted by the Department of Agriculture, Food and the Marine and are manufactured by a company certified to EN 1090.

Proprietary flexible covers are recommended for control of odours, greenhouse gasses, ammonia and rainwater.

The layout of soiled water tanks, and sedimentation chambers, shall follow S129 (Farmyard Drainage).

5 SITEWORKS

5.1 Site

The site shall be carefully chosen with a view to minimising operational and constructional problems. It shall be well separated from potential fire hazards and sheltered if possible. As a general guide, a storage facility for silage effluent/slurry/soiled water should be located not less than 50m from any waterbody in the case of new farmyards, and not less than 10m in the case of extensions/modifications to an existing facility. The minimum distance between a storage facility and a public/private water supply source, either surface or ground, shall be 60m for new farmyards and this may be reduced to not less than 30m for existing farmyards subject to a hydro-geological survey. In vulnerable situations this distance shall be increased up to 300m.

Extreme care shall be exercised to prevent any pollutant getting into the backfill around storage facilities.

Note: Any land drains shall be stopped at least 10m on the upstream side of a site and diverted around to re-connect with the drainage system at least 10m on the downstream side of the storage area.

5.2 Setting Out

Great care is necessary in setting out tanks which are to be covered with slats and/or precast units to ensure that full bearing is provided. [Clauses 8.2, 8.3, 8.4, 11.1, 11.4, 11.6, and 11.7]. Inaccurate setting out can result in dangerous and unacceptable conditions, which are very costly to rectify.

5.3 Site Groundwater

Water table levels shall be checked by digging two holes deeper than the proposed tank floor level and covering them temporarily. After 48 hours the water level is noted. Where this is above tank floor level, flotation and structural problems may occur. Where the groundwater level is a problem, the water table shall be permanently lowered by providing field drain pipes with porous fill around the tank at floor level connected to an outlet drain. Any springs within the floor area of the tank shall be piped to this drain system under floor hardcore. If ground levels do not permit an outlet then a new site shall be sought, or the walls and floor of the tank shall be increased in thickness to counteract the flotation of the empty tank. Engineering advice shall be sought and followed.

5.4 Flooding

Flooding of open excavation around completed tank can cause floatation and extreme structural damage to concrete tank. **Precautions shall be taken to ensure this does not happen,** by preventing flood water from getting into the excavation, or by the addition of an outlet drain for the excavation, or by partially filling the tank with water.

6 General Tank Construction Standards

6.1 Mass Concrete Tanks and Channels

All tanks equal to or more than 1.20m internal depth and less than 3.0m depth, whether under buildings, partially under buildings, or entirely external, shall be constructed using the full concrete and reinforcement specifications in Sections 6, 7, 8, 9 and 10.

For tanks less than 1.20m internal depth, it is strongly recommended that they are constructed of mass concrete. The tanks shall be constructed in accordance with Sections 6, 7, 8 and 9. Where tanks less than 1.2m deep are constructed using mass concrete it is recommended that walls are reinforced with A142 steel mesh. Where mesh is used there shall be a minimum cover of 50 mm of concrete to the mesh.

Where it is desired to construct tanks more than 3.0m in depth, or otherwise not covered by this specification, then a full set of design drawings (including details of reinforcing) and full structural calculations for the entire tank shall be prepared by a Chartered Engineer, and given to this Department for prior approval before the start of construction. The design of the tank shall be in accordance with IS EN 1992: Eurocode 2: Design of concrete structures. The concrete used in the construction of such tanks shall meet the requirements of section 7 of this specification.

Where slurry flow channels are being constructed, the lip between sections shall be constructed to the same standard as any external mass concrete tank wall of the same height.

6.2 Solid Block Tanks and Channels

Tanks and channels less than 1.2m in depth, may be constructed with either 215mm solid concrete blocks or 100mm or 140mm solid concrete blocks laid on flat, that are certified to a minimum strength of 15N/mm², though it is strongly recommend that they be constructed of mass concrete. All blocks used in the construction of shallow tanks shall be Category 1 and produced in a plant certified to EN 771-3 and shall be CE marked and have a Declaration of Performance. Any such block wall longer than 10m shall incorporate [at max. 10m intervals] a 450mm x 450mm pillar extended on the outer face of the wall. Walls shall be plastered both sides to a thickness of 12mm. [3:1 washed sand/cement with plasticiser incorporated]. **No tank or channel in contact with silage effluent shall be constructed of blockwork.** All blockwork tanks and channels shall be coated on the inside with a proprietary acid resistant bitumastic coating.

Tanks of 1.2m depth or greater shall NOT be constructed of concrete blocks.

6.3 Proprietary Tanks and Wall Panels

Proprietary tanks, of precast concrete or other material, shall require prior acceptance by the Department of Agriculture, Food and the Marine and shall be listed on specification S.123Y Accepted Pre-Cast Tanks for Slurry Storage.

Proprietary wall panels for tanks, of precast concrete or other material, shall require prior acceptance by the Department of Agriculture, Food and the Marine and shall be listed on specification S.123Z Accepted Pre-Cast Concrete Tank Walls For Grant-Aid.

6.4 Excavation

Excavation shall be to a solid foundation, at least, 1.0m beyond the tank wall on all sides. Excavation shall be levelled, and suitable hardcore or gravel to a depth of at least 150mm shall be fully compacted with a plate vibrator over the whole area. In some excavations it may be necessary

to lay a 75mm layer of concrete to provide a working surface before placing steel on the concrete floor.

For all excavations deeper than 1.25m deep, the banks shall be battered back at an angle of at least 45^{o} or supported by suitable shuttering. Excavations shall at all times comply with the relevant Health and Safety requirements.

6.5 Rock

Where solid rock is encountered in excavations it shall be removed below the required depth and a 75mm cushion of broken stone shall be replaced over the bed rock, consolidated with a plate vibrator, and blinded over with gravel or fine sand.

6.6 Back Filling

Back filling shall not be carried out until walls are at least 28 days old. Suitable excavated clay may be used provided it contains no top soil or excess water. Back fill shall be placed in layers, and thoroughly compacted. To prevent the possible ingress of pollutants to ground water the top metre of backfill shall be of impervious material and sloped away from the tank. Back filling with very heavy plant or the use of heavy vibrating rollers should be avoided unless special precautions are taken. Particular care shall be taken in backfilling under central passageways and cubicle beds [see also Clauses 2.4 and 3.1].

6.7 Purchase of fill material

In cases where fill is purchased it shall be certified to EN 13242 and meet the requirements of Annex E of S.R. 21. It is important when ordering aggregate (fill) that this specification is clearly communicated to the supplier.

6.8 Leak detection System

It is recommended that a leak detection system be installed under every new tank constructed for the containment of slurry in vulnerable groundwater areas. The leak detection system shall consist of 100mm land drainage pipes distributed in a herringbone pattern under the tank. The greatest distance between two pipes shall not exceed 3 metres. The pipes shall be laid on a slope and connected to an inspection tank, of at least $2.5m^3$.

A leak detection system shall be constructed under all tanks for all pig and poultry slurry.

7 CONCRETE SPECIFICATION

7.1 Certificates

Concrete shall be produced in an audited plant only: It shall not be produced on site.

A numbered certificate, signed and stamped, shall be required for all concrete delivered to site. The certificate, the "Concrete Manufacturers' Specification Certificate", is produced in triplicate. **The top certificate, printed on light blue paper, shall be retained by the applicant** and given to and retained by the local AES Office of the Department of Agriculture for inspection upon completion of the works. A signed and dated copy of the concrete manufacturer's EN206 Factory Production Control Certificate shall be supplied to the Department along with the Concrete Manufacturers' Specification Certificate.

7.2 Curing of Concrete

Concrete produced and supplied is fit for purpose ONLY IF proper curing procedures are adhered to and the structure is not put into service until an adequate curing time (usually a minimum of 28 days) has elapsed. The curing regime shall take account of best practice appropriate to the concrete binder composition and prevailing climatic conditions at time of placing.

All concrete shall be cured by keeping it thoroughly moist for at least seven days. Wetted floor slabs and tank walls shall be protected by polythene sheeting, kept securely in place. Alternatively proprietary curing agents may be used in accordance with manufacturer's instructions. When frost is a danger, straw bales shall be placed over the polythene on slabs. Concrete shall be at least 28 days old before being subjected to full load, or to silage or silage effluent.

For further information on curing, see the website of the Irish Concrete Society.

7.3 Concrete for Silage Effluent

For **purpose-built** silage effluent tanks and channels, concrete shall be purchased on the basis of a characteristic 28 day cube crushing strength of 45N/mm^2 (strength class C35/45). Minimum cement content shall be 360 kg/m^3. The maximum water to cement ratio will be 0.5. The specified slump class shall be S2 or S3. Maximum aggregate size shall be 20mm.

The concrete shall be ordered using the appended form for 'S.100 Mix A' or by requesting '45N concrete with 360kg cement minimum, 0.50 water cement ratio maximum, and slump class S2 **or** S3, certified to IS EN 206, for use to Specification S.100'.

If the Concrete Supplier requires further information the following shall be quoted to them:

- The concrete is to be to I.S. EN 206-1: Strength Class: C33/45, 360 kg cement, maximum water cement ratio of 0.50, Exposure classes: XA3, XC4 (25 year life), Slump class: S2 or S3, maximum aggregate size 20mm.

7.4 Concrete

For all other purposes including slurry tanks to which silage effluent may be directed, concrete shall be purchased on the basis of a characteristic 28 day cube crushing strength of 37N/mm^2 (strength class C30/37). Minimum cement content shall be 310 kg/m^3. The maximum water to cement ratio will be 0.55. The specified slump class shall be S2 or S3. The maximum aggregate size shall be 20mm.

The concrete shall be ordered using the appended form for 'S.100 Mix B' or by requesting '37N concrete with 310kg cement minimum, 0.55 water cement ratio maximum, and slump class S2 **or** S3, certified to IS EN 206, for use to Specification S.100'.

In the case of exposed yard slabs where freeze/thaw action is a concern, 'S.100 Mix B' shall be used with 3.5% minimum air entrainment. Alternatively 'S.100 Mix A' may be used.

Note: Where silage effluent is allowed into a slurry tank the effluent shall discharge via a pipe at least 300mm from the inner face of the tank wall.

7.5 Fibres

Polypropylene fibres may be incorporated into the concrete mix to improve the properties of concrete. Only fibres which have been tested and approved by National or European approval authorities may be used. The use of fibres helps to reduce plastic cracking and improve surface durability but they are not a substitute for structural reinforcement (Section 10). Fibres shall be used in strict compliance with manufacturer's instructions and shall only be added at the concrete manufacturing plant. The concrete certificate (Clause 7.1) shall clearly show the amount and type of fibre added. The mix design, compacting, and curing of fibre concrete is the same as concrete without fibre.

7.6 Self-Compacting Concrete

Self-compacting concrete (SCC) may be used in vertical elements only. SCC must comply with all requirements of this specification, except for the slump class which must meet slump flow class SF2. SCC shall be produced by a manufacturer with experience in producing SCC and should be placed by a contractor with experience using SCC.

If it is proposed to use SCC, additional guidance shall be sought by the contractor undertaking the works. Particular care must be taken in the use of fully sealed formwork, designed to withstand the higher hydrostatic pressure exerted by SCC. Guidance can be obtained from the Irish Concrete Society website (www.concrete.ie).

7.7 Materials

Cement and other materials used in the production of concrete shall be in accordance with Department of Agriculture, Food and the Marine specification S.100.

Plasticisers and other admixtures shall be to EN 934. All admixtures shall be used in strict accordance with manufacturer's instructions, and shall be added only by the concrete-mix manufacturer.

7.8 Tests

The Department reserves the right to require that concrete should be tested in accordance with EN 12390 and EN 12504.

8 TANK FLOOR AND WALL THICKNESS

8.1 Tank Floor

The floor slab shall be not less than 225mm thick throughout. It shall extend 250mm outside the walls. Timber or steel forms 225 mm deep, shall be fixed around floor perimeter before placing footing steel, wall steel, and floor steel mesh where specified in Section 10. The concrete shall be thoroughly compacted, and compaction around steel reinforcement shall be carried out with a poker vibrator. The floor shall be finished smooth.

8.2 Tank Walls

Walls thickness shall be 225mm minimum, or 400mm **minimum** where tank walls are to support super structure and slats. [Where stanchions are carried on tank walls see Clauses 8.3 and 8.4].

Steel shuttering is recommended for tank walls but panels with timber may be used. All shuttering shall be clean and tight fitting to prevent loss of grout. To maintain cleanliness and facilitate removal they should be oiled lightly with proprietary mould oil prior to each use. Care shall be taken that oil does not get onto reinforcing bars and prevent bonding. All shuttering shall be properly tied and braced to withstand the pressure of the concrete.

8.3 Spine Walls

Spine walls shall be constructed of reinforced concrete as per Sections 7, 8, 9 and 10. In all cases the spine wall shall be a minimum of 300mm thick. It is strongly recommended that stanchions do not rest on spine walls. Where a stanchion is being supported on a spine wall the wall shall be a minimum of 500mm thick (depending upon stanchion size), with the base plate of the stanchion counter-sunk into the top of the wall (See also clause 8.4).

Where it is desired to use pillar and beam type construction, then a full set of design drawings and full structural calculations for the pillars and tank floor shall be prepared by a Chartered Engineer, and given to this Department for prior approval before the start of construction. The design of pillars shall be in accordance with IS EN 1992: Eurocode 2: Design of concrete structures.

Note: Where it is desired to cover an existing concrete tank, a detailed report shall be commissioned from a Chartered Engineer for the tank and a detailed description obtained on how to install and construct any necessary spine walls.

8.4 Stanchions Erected on R.C. Tank walls

Note: Stanchions shall not under any circumstances be carried on slats or on insitu cast beams.

Tank walls shall be a minimum of 400 mm thick (depending on stanchion size) where the superstructure is to be supported on the walls. Where the steel stanchions are to be erected on the walls then the wall reinforcement shall be fixed in the walls as per clause 10.7, for each stanchion. The stanchions shall be positioned such that there is at least 150mm clear gap between the stanchion and the nearest internal edge of the tank wall, to allow full bearing for slats. Alternatively a 300mm wall may be constructed with 600mm x 600mm concrete piers with inner wall to be flush.

The stanchions shall be secured to the walls in an approved manner using steel base plates welded to the base of the stanchion and holding down bolts as per clause B7 of S101.

Portal Frames may be carried on tank walls provided a 600mm x 600mm suitably reinforced concrete pier with foundation pad is incorporated into the tank wall at the time of tank construction, for each portal stanchion. Concrete piers shall be finished flush with tank wall on inside face so as not to interfere with slurry agitation. Where it is desired to carry a portal frame on a tank wall, then a full set of design drawings and full structural calculations for the piers shall be prepared by a Chartered Engineer, and given to this Department for prior approval before the start of construction. The design of the piers shall be in accordance with IS EN 1992: Eurocode 2: Design of concrete structures.

8.5 Stanchions on Suspended Slabs

Stanchions shall be welded to a 300 x 300 x 12mm base plate to be securely fixed to the concrete slab with 2 No. 20mm holding-down bolts for intermediate stanchions, or 4 No. 20mm holding-down bolts for corner stanchions, prefixed into concrete slabs. Alternatively, patent anchor-bolts may be used provided they are sized, and installed, in strict accordance with the manufacturer's specification and instructions. See also clauses 11.4, 11.6 and 11.7 in relation to the additional design requirements of the slabs and beams.

Structural stanchions shall not be resting on, or supported over slats.

9 CONCRETE WORKS AND CONTRACTION JOINTS

9.1 Wall/Floor Joint

A key shall be formed in the floor at the centre of the proposed wall by using a splayed oiled timber runner temporarily fixed in the freshly poured concrete and withdrawn before final set. Alternatively a 150mm patent water bar or approved water-stop shall be fixed along the centre line of the proposed wall. Care shall be taken that the water bar is tied to the vertical steel to keep it in position during the pouring of the concrete floor (Fig. 12).

Within an hour or so (depending on weather) the surface of the proposed joint shall be sprayed with water and brushed off with a soft brush to expose the coarse aggregate. If left overnight, a stiff brush may be needed. The best joints are obtained by light brushing soon after pouring.

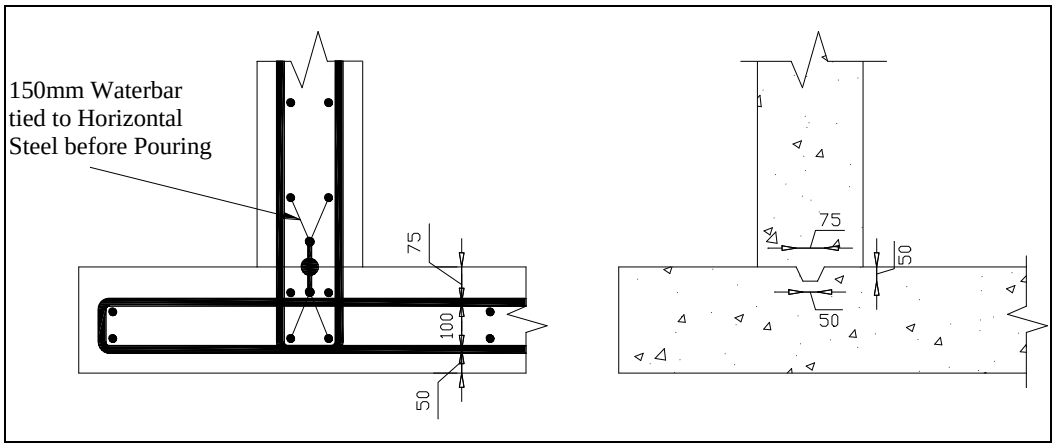

Figure 12 Wall-Floor Joints

9.2 Contraction Joints in Tank Walls and Floors

When an individual tank wall is more than 17m long, provision shall be made for substantially increasing the horizontal steel in the tank wall, or alternatively forming an induced type contraction joint with water bar. Where extra horizontal steel is adopted it shall be provided to all external walls of the tank to Table 3.

Table 3: Extra steel for tanks walls in place of contraction joint.

Length of wall	No. of extra bars in each face
17 - 19m	1
19 - 24m	2
24 - 30m	3

(Spacing of horizontal steel shall be adjusted to accommodate the extra steel).

Alternatively an induced crack type vertical contraction joint shall be provided as per Fig. 13 Fifty per cent of the horizontal steel shall be discontinued across the joint (remove 50mm of horizontal steel on each side of joint from every second bar). A 200mm patent water stop shall be provided in the centre of the wall, and a 200 mm rearstop placed on the subbase across the wall footing as far out as the bottom steel, or across the complete floor in tanks less than 4m wide and shallow tanks.

All waterstops, and junctions, shall be fixed as per manufacturer's instructions. The wall joint shall be brushed out and sealed with acid-resistant sealer. In tanks longer than 17m, such induced vertical joints shall be installed, equidistantly, at intervals of not more than 13m.

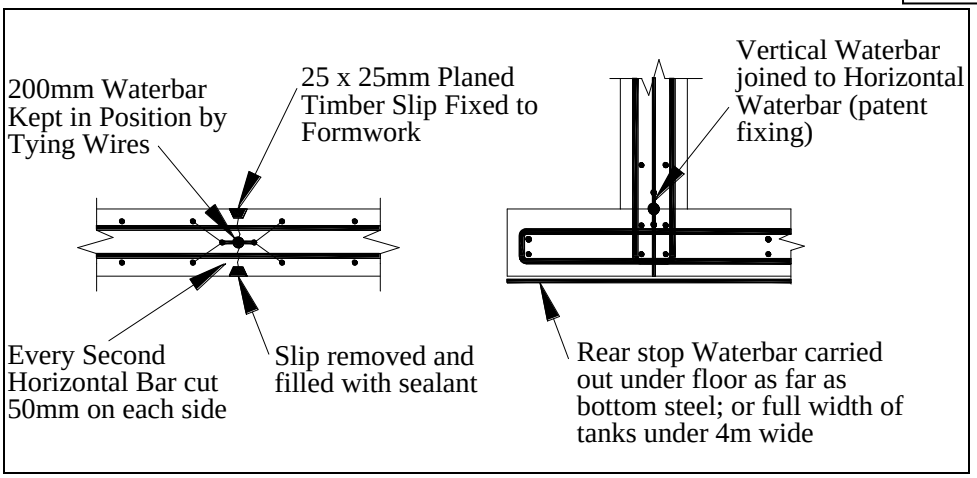

Figure 13 Contraction Joints in Tank Walls

9.3 Pouring Concrete to Tank Walls

All dirt and debris shall be removed from within the shuttering. Concrete shall be placed in evenly spread layers of not more than 600mm deep. Vibration, by poker vibrator of diameter not less than 50mm shall follow closely on placing. The poker shall be inserted at maximum 400mm centres. It shall be allowed to sink under its own weight to the depth of the layer plus 100mm into the layer beneath, and when air bubbles cease to rise, be withdrawn slowly but evenly leaving no significant depression in the concrete. Care shall be taken to prevent the vibrator making contact with either the shutters or the reinforcement. Concrete shall not be poured under 4 °C in a falling thermometer.

9.4 Removal of Shuttering

Shuttering shall not be removed from walls for at least 12 hours in warm weather, longer in cold weather. Shuttering under soffits of beams and slabs shall be left in position for at least 14 days. Tie bars on internal walls shall be cut or snapped off, and all small blemishes caused by removal of bolts and tie bars shall be filled with 1.5:1 washed sharp sand-cement mortar. Honeycombing, if it occurs, shall be repaired with a sand:cement mortar incorporating SBR (Styrene Butadine Rubber), or a water resistant polymer bonding admixture in accordance with manufacturer's instructions.

Tie–rod holes or pass through tie sleeve holes shall be sealed on both faces of every wall. It is not sufficient to seal the internal face only. There are a number of proprietary systems available, which comprise of either (1) a flupp (bung) and non-shrink mortar; (2) water-tight plastic caps, or (3) expanding bungs. All of these systems are acceptable once they are certified as suitable for use in liquid containing structures by the manufacturer. Tie-rod holes in spine walls shall be sealed unless it can be clearly demonstrated that all holes are greater than 50mm away for any reinforcing steel.

10 REINFORCEMENT

10.1 Concrete Cover to Steel

Steel reinforcement shall be protected by adequate concrete cover from the corrosion caused by slurry or silage effluent. Standard patent spacer blocks shall be used to provide the minimum cover shown in Table 4 below, fixed to the reinforcement at regular intervals so that specified concrete cover is maintained throughout.

Table 4 Minimum Concrete Cover to Steel

Walls (both faces)	50mm
Tank Floor (bottom steel)	50mm
Tank Floor (top steel)	75mm
Beams	50mm
Slabs (bottom steel)	50mm
Slabs (top steel)	30mm

10.2 Tank Walls

Where a tank is 1.2m or more deep, both inside and outside faces of each wall shall be reinforced. If a tank is divided into two or more **non-interconnecting** compartments the partition wall shall also be reinforced on both faces as per Table 5 or Table 7 for outer tank walls. When tanks are interconnected, the spine wall shall be reinforced as per Table 8. Floor steel under spine walls and under reinforced compartment walls shall be so placed that every second anchor U-bar is placed either side of the wall. Distribution steel shall be placed, evenly spaced, as per Figure 14 across the full wall foundation.

Note: Where it is desired to use pillar and beam type construction, then a full set of design drawings and full structural calculations for the pillars and tank floor shall be prepared by a Chartered Engineer, and given to this Department for prior approval before the start of construction. The design of pillars shall be in accordance with IS EN 1992: Eurocode 2: Design of concrete structures.

10.3 Steel Reinforcement

Steel reinforcement shall consist of high yield (H.Y.) steel with ribbed finish complying with the current edition of BS 4449 and is strongly recommend to be CARES approved. All steel shall be free from mill scale and heavy deposits of rust. Steel bars shall not be straightened and rebent. Where the length of bar required exceeds the length supplied, a lapped joint shall be adopted: the overlap shall be at least 40 times the bar diameter.

10.4 Cutting, Bending and Fixing Steel

Anchor steel in wall footing shall be cut and bent in a U-shape to suit wall height as shown in Fig. 14. Wall footing steel shall be of the same diameter as main steel for walls (Clause 10.5), except that 12mm steel may be used where wall steel is 16mm. It shall extend into the floor a distance 'E' as shown, and shall extend into the toe of the wall a distance of 200mm beyond the outside face of the wall. Reinforcement for the wall shall be cut and bent in a U-shape to suit the wall thickness, as appropriate (Table 5). Every second U-bar (long) shall extend to within 475mm of the top of the wall. Every other U-bar (short) shall extend up the wall at least one quarter the wall height (H) plus 300mm (Table 5). U-bar spacings are detailed in Tables 6 to 8.

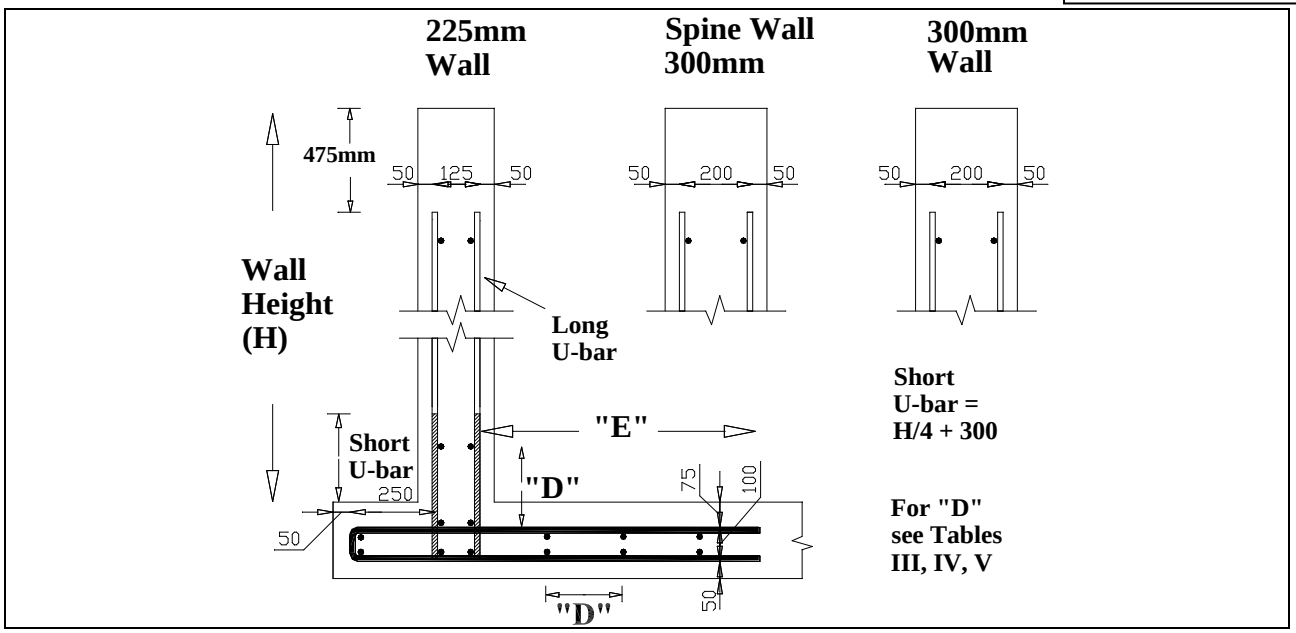

Figure 14 Floor and Wall Reinforcement

Distribution (horizontal) steel at spacing "D" as determined in Tables 6, 7 and 8 shall be placed **inside** U-bars in wall and floor as shown. Junctions of bars shall be secured with standard tying wire to ensure that steel is kept firmly in position during concreting. Tack welding may be used instead of tying wire.

Where the wall width increases above 300mm, the concrete cover over the reinforcing steel shall be maintained at 50mm. This will require the horizontal section of the "U-bar" to be increased in length.

Table 5 Floor and Wall Reinforcement

Long U	Short U	Wall Height		"E"
1.2m	0.85m	Up to	1.5m	0.55m
1.5m	0.95m	Up to	1.8m	0.65m
1.8m	1.0m	Up to	2.1m	0.8m
2.1m	1.1m	Up to	2.4m	1.0m
2.4m	1.2m	Up to	2.7m	1.25m
2.7m	1.25m	Up to	3.0m	1.7m

10.5 Details of Steel Reinforcement in Walls

Reinforcing steel shall be provided as shown in the Tables 6, 7 and 8 and bent as shown in Figs. 13, 14 and 15.

Table 6: Values of "D" for Outer Tank Wall At Least 225mm Wide

Tank Depth: Not more than	**U Bars:** Vertical Steel and Wall footing steel, Both Faces	**D values for Horizontal Steel*,** Both Faces
1.5m	10mm @ 300mm centres	12mm @ 400mm centres
1.8m	10mm @ 225mm centres	12mm @ 400mm centres
2.1m	12mm @ 225mm centres	12mm @ 400mm centres
2.4m	16mm @ 270mm centres	12mm @ 400mm centres
2.7m	16mm @ 175mm centres	12mm @ 400mm centres
3.0m	16mm @ 135mm centres	12mm @ 400mm centres

Table 7: Values of "D" for Outer Tank Wall At Least 300 mm Wide

Tank Depth: Not more than	**U Bars:** Vertical Steel and Wall footing steel, Both Faces	**D values for Horizontal Steel*,** Both Faces
1.5m	10mm @ 400mm centres	12mm @ 300mm centres
1.8m	10mm @ 300mm centres	12mm @ 300mm centres
2.1m	12mm @ 300mm centres	12mm @ 300mm centres
2.4m	12mm @ 200mm centres	12mm @ 300mm centres
2.7m	16mm @ 240mm centres	12mm @ 300mm centres
3.0m	16mm @ 190mm centres	12mm @ 300mm centres

Table 8: Values of "D" for Spine Wall At Least 300mm Wide With Opes

Tank Depth: Not more than	**U Bars:** Vertical Steel and Wall footing steel, Both Faces	**D values for Horizontal Steel*,** Both Faces
1.5m	10mm @ 450mm centres	12mm @ 400mm centres
1.8m	10mm @ 400mm centres	12mm @ 400mm centres
2.1m	10mm @ 250mm centres	12mm @ 400mm centres
2.4m	12mm @ 250mm centres	12mm @ 400mm centres
2.7m	12mm @ 200mm centres	12mm @ 400mm centres
3.0m	16mm @ 250mm centres	12mm @ 400mm centres

- Where vertical steel is 10mm, horizontal steel of 10mm @ 300mm centres is accepted in place of 12mm @ 400mm centres.
- Wall footing steel shall be of the same diameter as main steel for walls (Clause 10.4), except that 12mm steel may be used where wall steel is 16mm.
- In 2.4m deep tanks with 300mm outer walls where 12mm reinforcing steel is unavailable, it is permitted to use 16mm reinforcing steel at 350mm centres for the vertical and footing steel. In 2.4m deep tanks with 300mm spine walls where 12mm reinforcing steel is unavailable, it is permitted to use 16mm reinforcing steel at 440mm centres for the vertical and footing steel.

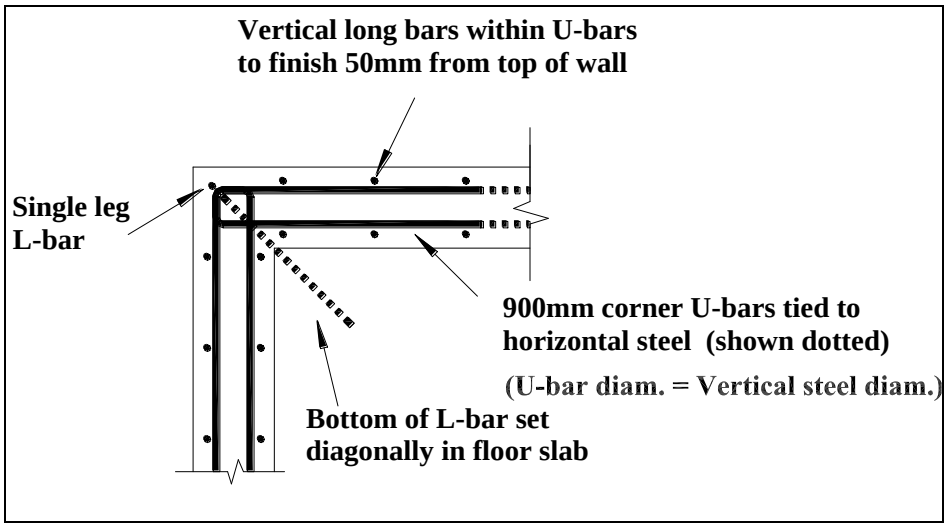

Figure 15 Reinforcing Details for Tank Corners

10.6 Reinforcing Steel at Corners

At each corner of the tank a series of two horizontal U-bars shall be fixed as per Fig. 15. Each leg of the U shall be at least 900mm long and equal in diameter to the vertical steel. Also the long

vertical wall bars within 900mm of the corners shall be extended up to within 50mm of the top of the wall to meet the top pair of horizontal U-bars. Each subsequent pair of horizontal U-bars shall be tied to each corresponding horizontal distribution steel bar in the height of the wall. A single leg vertical bar (L-bar) of the same diameter as the main vertical steel shall be fixed at the outside corner of the horizontal U-bars. The lower end of this vertical bar shall be bent diagonally into the floor for a distance of at least 500mm. The first vertical U-Bars along the line of the wall shall be at a distance, not greater than, the required vertical U-bar spacing from the corner L-bar, when measured along the outside face of the wall.

10.7 Reinforcing Steel Under Stanchions

Where stanchions are to be bolted to the wall all vertical steel (each face) shall be extended up to within 50mm of the top of the wall for a distance of 300mm each side of the proposed stanchion. Extended vertical bars shall be securely tied to a horizontal bar placed on each face within 100mm of the top of the wall.

Where it is intended to insert fencing posts into external tank walls, [Clause 1.5] the long bars shall be extended to within 50mm of the top of the wall for a distance of 300mm each side of the proposed post, and tied to a horizontal distribution bar on each face.

10.8 Steel Mesh in Floor

In tanks where the outer walls are more than 4m apart, and/or where tanks are subject to any groundwater pressure then the whole floor shall be reinforced with minimum A142 steel mesh. In tanks where the outer walls are more than 6m apart and there are no spine walls present, then the whole floor shall be reinforced with minimum A393 steel mesh. Individual sheets of mesh shall be overlapped by 200mm on each side. Mesh shall also be overlapped 200mm across footing steel. Mesh shall be laid close to the top of the slab with a minimum of 50mm concrete cover.

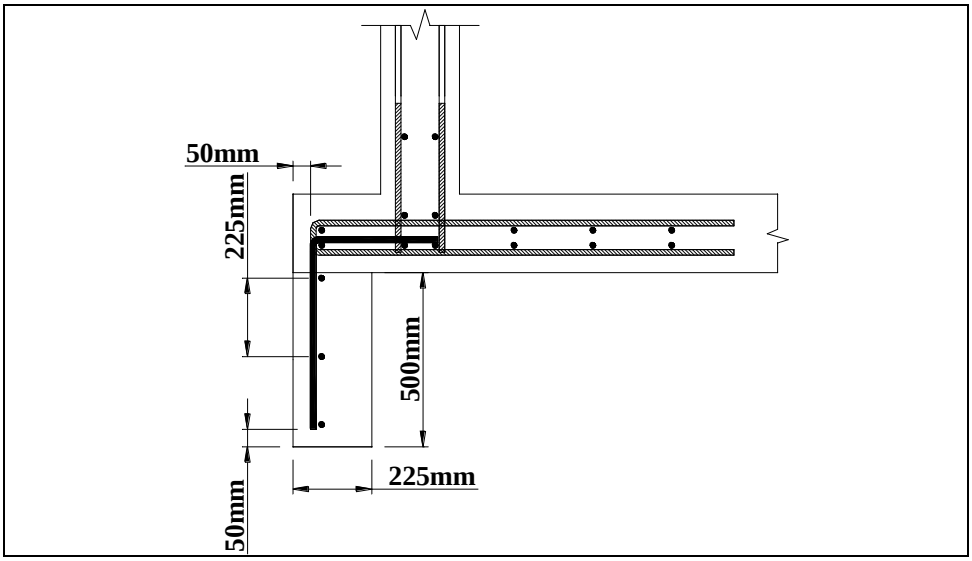

Figure 16 Details of Ground shear key

10.9 Ground shear key

A ground shear key shall be constructed when a tank is built on steeply sloping ground. The key shall be constructed on the downhill side of the tank. The key shall be constructed as shown in Figure 16. Vertical reinforcement shall be sized and spaced as per the tank wall being constructed. The horizontal reinforcement shall be 12mm diameter and spaced as per Figure 16.

11 Tank Covers

11.1 Concrete Slats

Concrete slats shall be produced in accordance with IS EN 12737, and all slats shall be CE marked and produced in a plant certified by a Notified body (e.g. NSAI or equivalent), to produce slats to IS EN 12737. In addition all concrete slats shall be load tested and be on the Accepted Concrete Slat List of the Department of Agriculture, Food and the Marine.

A **"Certificate of slat manufacture"** from a supplier approved by the Department shall be submitted. When laid, slats shall comply with the following requirements:-

1) Be free from any cracks, honeycombing, and chipping of the top corner arises.
2) **Have a full bearing of at least l50mm at points of support** (as per Figure 17)**.**
3) Finished slat floor shall be level and free from any rocking movement.
4) **Be capable of being replaced with minimum disturbance.** [Slats are components with a limited working life, and are unlikely to last as long as the building.]

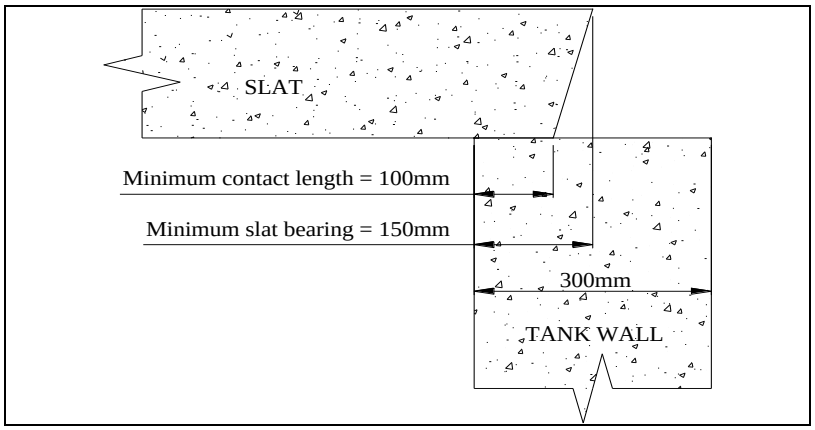

Figure 17: Diagram showing slat bearing.

Where it is possible that machinery may have to travel over slats, then the slats installed shall be designed as heavy duty slats. Where possible, slats should not be located along the travelling routes of machinery.

Slats shall not be cut on site for any reason. If shorter or narrower slats are required, they shall be purchased at the required dimensions from the manufacturer and shall be listed on the "Accepted Concrete Slat List".

11.2 Cover to Extended Tanks

To eliminate draughts and ingress of rainwater all extended tanks shall be covered by reinforced solid concrete slabs. External slats (maximum of 2 gang slats at each end) are permitted only when external slurry collection is essential. All external slabs and slats shall be designed to accommodate at least a 4 tonne dynamic wheel load (i.e. they shall be at least as strong as heavy duty slats). The specifications for reinforcement given are for the above stated loading, any heavier loadings will require a higher level of reinforcement. Where a tank is built under a cow collection yard it is permitted to have the collection yard fully slatted. All the slats used shall be heavy duty (tractor) slats.

11.3 Agitation points / Safety manhole covers

Agitation/emptying points shall be provided by covered access openings within the slab or slats. These covers shall be located and spaced as per clause 4.2, 4.3, 4.4, 4.6 and 4.7 above (i.e. all

agitation / access points shall be fully external). Covers in every location shall be manufactured in steel with all elements galvanised to I.S. EN ISO 1461. Each cover unit shall consist of a frame; a hinged top-cover, either with a lock or safety catch, or with element(s) too heavy for a child to lift; and a safety grid underneath, hinged on the same side as the cover and also supported on (at least) the opposite side. The cover shall be hinged to lie back fully when opened, and the safety grid shall lean back at sufficient angle to stay open and be clearly visible in that position. The safety grid of minimum diameter 12mm steel or the equivalent shall have a maximum gap of 125mm between bars with the exception of one or (maximum) two apertures 225mm square, incorporated for slurry extraction.

Covers shall be manufactured to withstand a test load of 40KN [test procedure in accordance with IS EN 124]. It is advised that where an access cover can be subject to heavy wheeled traffic it should be constructed to withstand at least an 80KN load.

Safety manholes covers should not be within an uncovered animal area, as such a location will severely shorten the expect life of the cover.

In cases where it is desired to install a fully steel tank extension cover over a slatted tank, the cover shall be certified to EN 1090, as for all structural steel. The cover shall be designed for the same loadings as heavy duty slats – i.e. 40 KN point load or 80kN axle load at 1.8m spacing. All elements of the steel tank extension cover shall be galvanised to I.S. EN ISO 1461.

11.4 Mass Concrete Tank Cover

Where tanks extend under a passage, the slab and supports shall be designed to match the required loading for the particular design of house. With standard plans this is taken to be a 7.8 tonnes axle load imposed by a single-axle feeder-wagon and a further 1.5 tonnes transferred to the tractor. The three specifications for reinforcement given below are for the above stated loadings, where it is expected that the suspended slab will be subjected to greater than 7.8 tonne axle loads, then a full set of design drawings and full structural calculations for the suspended slab shall be prepared by a Chartered Engineer, and given to this Department for prior approval before the start of construction. The design of the suspended slab shall be in accordance with IS EN 1992: Eurocode 2: Design of concrete structures.

TYPE A: Slab continuous over supports (Fig. 18a). Supports at a maximum of 3.2m.

- Type A design is suitable where tanks are running across the house, and the central passage is at right angles to the tanks.
- **Slab thickness:** 170mm minimum.
- **Bottom steel:** 12 mm @ 200mm centres.
- **Top steel over supports:** 12 mm @ 190mm centres. [Top steel shall extend at least 900mm into each span, measured from centre of support].
- **Distribution steel:** 10mm @ 300mm centres. [Fixed to both top and bottom steel with tying wire at each intersection].

TYPE B: Slab simply supported on wall (Fig. 18b.). Maximum span of slab 4.9 m.

- Type B design is suitable where slab is spanning the width of the central passage.
- **Slab thickness:** 195mm minimum.
- **Bottom steel across width of passage:** 16mm @ 150mm centres.
- **Distribution steel along length of passage:** 10mm @ 375mm centres. [Bottom steel should be bent up into the slab with a right-angled bend at the end of each bar.]

TYPE C: Slab spanning central passage with a central support wall running the length of the passage way (Fig. 18c). Maximum span between supports 3.2m.

- **Slab Thickness:** 170mm minimum
- **Bottom steel across the central passage:** l2mm @ 200mm centres.
- **Top steel over central support:** 12mm @ 190mm centres. [Top steel shall extend at least 900mm into each span measured from centre of central support.]
- **Distribution steel along length of passage:** 10mm @ 300mm spacing.

Note: When stanchions are to be erected directly on a suspended central passage, the bottom reinforcement in the slab for 300mm each side of the proposed stanchion shall be doubled across the span of the slab [i.e. spacing halved]. Also 5 No. 12mm top steel bars shall be placed across the full span of the slab at 150mm spacing and tied with standard tying wire to 12mm distribution steel placed at 300mm spacing. **The centre of the stanchion shall be no more than 500mm from the edge of the slab.** All suspended slabs shall have a minimum 150mm bearing on the support wall / beam at each end and the concrete cover over the reinforcing steel shall be as per Table 4.

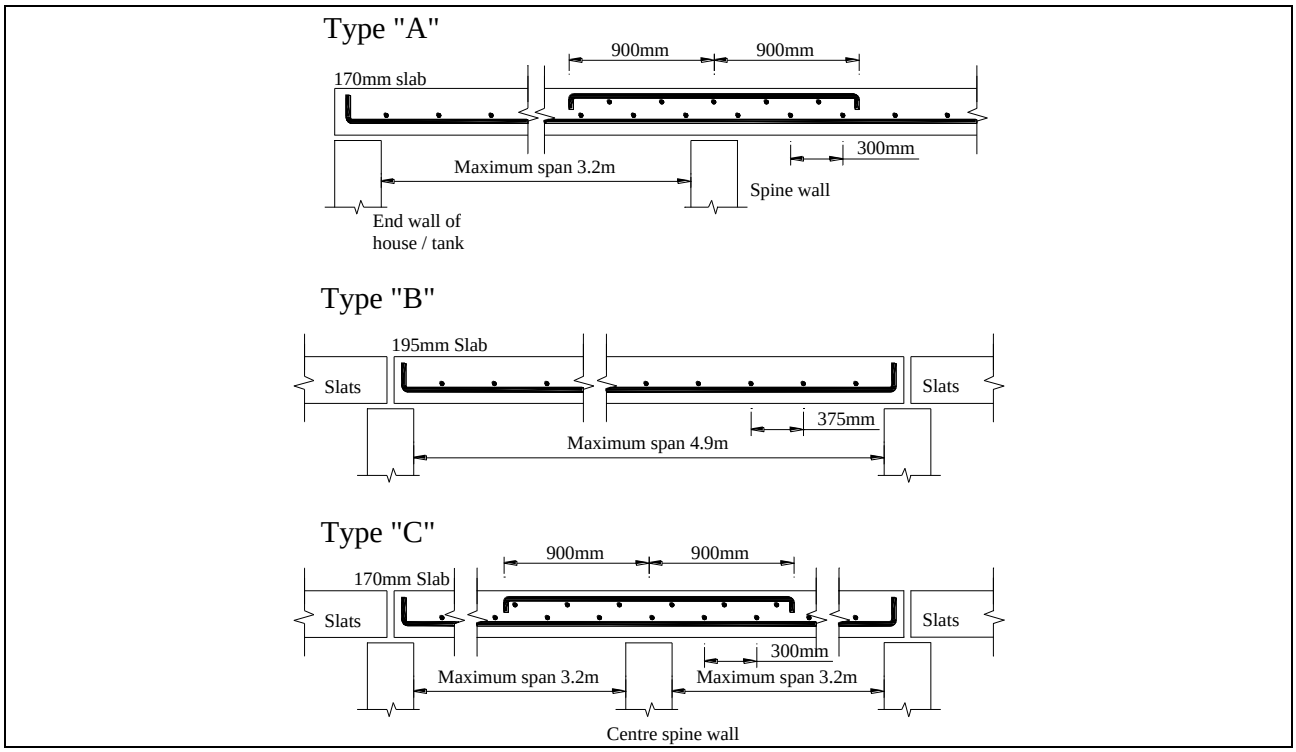

Figure 18 Suspended Slabs: Steel Details

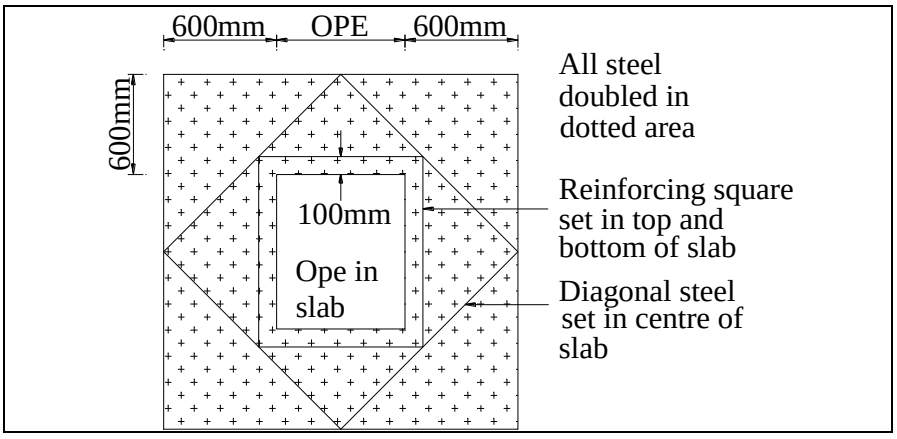

Figure 19 **Ope in Slab**

11.5 Access Opes within Slabs

Where openings are required in slabs they shall normally not be greater than 900mm square. All steel within a band 600mm wide on either side of such openings shall be doubled: i.e. spacing halved. A square reinforcing hoop of dimension equal to that of the opening + 100mm shall be used to trim all opes and a further square reinforcing hoop of dimension equal to the diagonal of the ope + 100mm shall be placed in the centre of the slab (Fig. 19). All opes in slabs/slats shall be fitted with safety access covers (see Clause 11.3) and shall be fully external.

11.6 Beams

- Maximum unsupported length of beam 3.8m.
- 320mm deep beam (Fig 20).
- Beams shall be installed with at least 150mm bearing.
- The beams shall be reinforced as per Table 9.
- Longer beams, and beams to carry stanchions, shall be precast and purchased as per clause 11.7.

Table 9

Beams Simply Supported	Bottom Steel	Top Steel	Stirrups*
320mm x 320mm deep	4 No. 20mm H.Y. bars	4 No. 20mm H.Y. bars	10mm @ 200 centres along full length of beam

*Mild Steel (M.S.) may be used only for stirrups

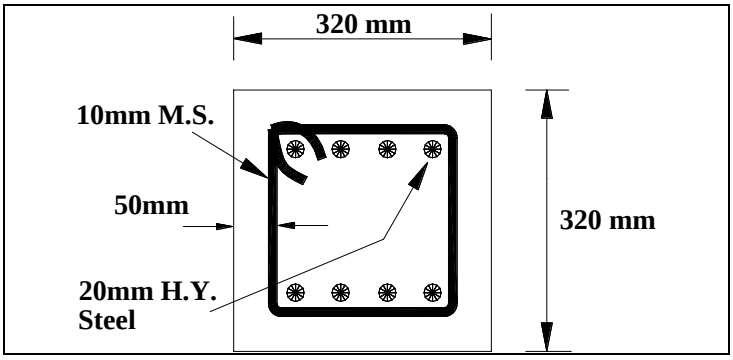

Figure 20 Beam

11.7 Precast Slabs and Beams

Precast slabs and beams may be used provided they meet the requirements set out below and are at least as strong as units specified in clauses 11.4 and 11.6 respectively and are suitably marked to prevent wrong installation. Precast units shall be installed with at least 150mm bearing, or greater if specified by the precast manufacturer. It is permitted for stanchions to be supported from either precast beams or precast slabs, once the beams or slabs are designed and certified for this use. Carrying stanchions from precast beams or precast slabs shall only be undertaken with direct consultation with the manufacturer of the beam or slab.

All Precast hollowcore slabs shall be CE marked and produced in a plant certified by a Notified body (e.g. NSAI or equivalent), to produce Precast hollowcore slabs to I.S. EN 1168. All hollowcore slabs shall be listed on the Accepted Concrete Slat List of the Department of Agriculture, Food and the Marine.

All precast solid slabs shall be CE marked and produced in a plant certified by a Notified body (e.g. NSAI or equivalent), to produce Precast solid slabs to I.S. EN 13225. All solid slabs shall be listed on the Accepted Concrete Slat List of the Department of Agriculture, Food and the Marine.

All precast beams shall be CE marked and produced in a plant certified by a Notified body (e.g. NSAI or equivalent), to produce precast beams to I.S. EN 13225 for beams longer than 4.5 metres or beams carrying mass concrete walls, slats or slabs and to I.S. EN 845-2 for beams to carry block walls where the clear span is less than 4.5 metres. All beams shall be listed on the Accepted Concrete Slat List of the Department of Agriculture, Food and the Marine.

Where slabs are being used as a rainwater cover for tank, all joints between slabs shall be sealed.

11.8 Proprietary flexible covers

Proprietary flexible covers require prior acceptance by the Department of Agriculture, Food and the Marine.

12 Certificates

The following certificates shall be collected, and given to the Department before grant-aid can be paid:

(1) "Slat" Certificate (Clause 11.1 & 11.7)
(2) "Concrete" Certificate (Clause 7.1)
(4) CE certificate and Declaration of Performance (clauses 2.8 & 6.2) for concrete blocks
(5) CE certificate and Declaration of Performance (clauses 5.8) for purchased fill material
(6) "Protection of Structural Steel" Certificate (where appropriate)

13 Related Department Specifications

The current edition of the specifications listed below shall also be followed as required:-

1) 'S101: Minimum Specification for the Structure of Farm Structures' for all superstructures.
2) 'S102: Cladding Materials' for all roof and side cladding.
3) 'S129: Farmyard Drainage'
4) 'S124: Calf Housing';
5) 'S147: Calving Pens and Isolation Boxes'; where applicable,

Copies of these and other relevant Department specifications are available on the department website at: **www.agriculture.gov.ie** under 'Farm Buildings' or by contacting the one of the local offices of the Department of Agriculture, Food and the Marine.

14 Definitions

Proprietary – factory made item.

Stanchion – steel pillar

Appendix I: Date of clause revisions and additions

All changes from the previous version are highlighted in red.

Version: July 2017 (published 14th July 2017)

Clauses modified: 2.1, 2.8, 2.10, 3.1.4, 3.2, 3.3, 4.1, 4.2, 4.7, 6.1, 6.2, 6.7, 6.8, 7.1, 10.5, 11.3, 11.7

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Clauses modified: 2.8, 2.10. Changes from the previous revision remain highlighted due to the short interval between revisions.