

AN ROINN TALMHAÍOCHTA, BIA AGUS MARA
DEPARTMENT OF AGRICULTURE, FOOD AND THE MARINE

**MINIMUM SPECIFICATION FOR STRUCTURES FOR GRAIN STORAGE ON
FARM**

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.

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.

Roof work: When working on any roof, it is essential to assume that the roof is fragile, unless confirmed otherwise by a competent person.

The HSA Code of Practice for Safety in Roofwork shall be consulted prior to any work being undertaken on a roof. All advice in the code of practice shall be followed.

The HSA code of practice gives recommendations and practical guidance on how to work safely on roofs, including the safe maintenance of roof mounted plant and services, and how to design and plan for safe working. It offers guidance on the design and construction of roofs on new buildings and the maintenance, cleaning and demolition of existing roofs. All work at height poses a risk and a risk assessment should be carried out to assess those risks and put appropriate controls in place.

2. CONCRETE WORK

2.1 Certificates

Concrete shall be produced in a plant audited to I.S. EN 206-1: 2002 by a certified body accepted by The Department of Agriculture, Food and the Marine (e.g. N.S.A.I., B.S.I., Q.S.R.M.C). Concrete 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 presented to the local AES Office of the Department of Agriculture Food and the Marine for inspection upon completion of the works.

2.2 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.

2.3 Concrete

For all grain stores, 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.

2.4 Compaction of Concrete

All concrete shall be compacted by either vibrating screed or poker vibrator depending upon the position of the concrete. Poor compaction leads to entrapped air, which will weaken the concrete and may cause premature failure. All concrete can be easily placed and compacted when using a vibrating screed or poker vibrator which helps ensure the concrete achieves its full strength.

2.5 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 (Clause 8). 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 2.1) 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.

2.6 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).

2.7 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.

2.8 Tests

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

3. GENERAL

This specification covers the construction of storage and allied facilities for cereal grains produced on the farm. It does not cover specialised stores for use by a group of producers.

A grain store shall be a dry, well-ventilated, and vermin-proof structure. It shall have reinforced concrete walls constructed to Clause 8 below. The design of any new grain store should, where possible, allow for future extension(s), and alternative possible methods of handling and conditioning grains.

4. SITE

The chosen site shall be dry; not subject to flooding in any circumstances; and shall facilitate access to the public road. It shall be sited at least 20 metres from any septic tank, and at least 20 metres from any stored animal waste.

5. STRUCTURAL DESIGN

All roof structures shall comply with Department of Agriculture, Food and the Marine's current edition of specification S101: Minimum Specifications for the Structure of Agricultural Buildings. Alternative proprietary construction systems (e.g. proprietary structural wall panels) may be used if such systems have received the prior acceptance of the Department of Agriculture, Food and the Marine. Gutters and downpipes shall be fitted to all roofs and arranged so as not to discharge onto soiled yards. All metal cladding fixed to timber rails or purlins shall be separated by a layer of DPC.

6. ROOF AND SIDE CLADDING

6.1 Single Sheet Roof and Side Cladding

Single sheet roof and side cladding shall conform to the current edition of Specification S.102.

6.2 Proprietary insulated Cladding Sheets

Proprietary insulated cladding sheets with a double metal skin may also be used for roof and side cladding. Where produce is loose-stored, or where there is any danger of mechanical damage, such cladding shall only be installed above mass concrete walls.

Double skin roof panels are strongly recommended, but panels with bonded insulation with a smooth hardened washable surface may also be accepted, if there is no risk of mechanical damage. Roofing felt, or other loose insulation, or wire netting shall not be installed.

7. FOUNDATIONS

7.1 Foundations to Reinforced Walls

Foundations to reinforced concrete walls shall be reinforced, and be installed in accordance with the details shown in Fig. 1. Reinforcement details for both walls and foundation/footings are given in Table 1, and in Fig. 1.

7.2 Foundations under large Proprietary Storage Bins

Foundations under large proprietary storage bins shall be strengthened according either to the detailed specifications by the manufacturer, or to the detailed design of a qualified structural engineer.

8. WALLS

8.1 Wall Heights

To facilitate easy loading and unloading of grain, the recommended minimum height of the side walls at the eaves is 4.5m. A preferred height for general purposes is 5.5m, and higher for specialist stores.

8.2 Reinforced Side and Rear Walls

Fully reinforced side and rear walls shall be mandatory for all houses for loose-stored grain stacked to a height of more than 1.4m. Reinforcement details for walls and associated footings are given in Table 1 and Table 2 for walls up to 3.0m high. To avoid the need for construction joints, reinforced walls shall be built into the web of roof stanchions, but not affixed to them. Any space between the top of the wall and the eaves shall be enclosed by cladding (Clause 6).

Walls for loose-stored grain stacked less than 1.4m shall be constructed using mass concrete. The walls shall be 225mm thick and it is recommended that they are reinforced with A142 steel mesh. Where mesh is used there shall be a minimum cover of 50 mm of concrete to the mesh. The use of block walls in any part of a grain store is not permitted. All un-reinforced walls shall be of mass concrete.

Table 1 Reinforcement for External Retaining Walls (225mm wide)

Wall Height	Vertical Steel (inside face)	Horiz. Steel (inside face)
up to 2.1m	12mm @ 200mm centres	12mm @ 400mm centres
up to 3.0m	16mm @ 200mm centres	12mm @ 400mm centres

Note: Steel to be cut, bent, and fixed as in Fig. 1.

Table 2 Reinforcement for Internal Retaining Walls (225mm wide)

Wall Height	Vertical Steel (both faces)	Horiz. Steel (both faces)
up to 2.1m	12mm @ 200mm centres	12mm @ 400mm centres
up to 3.0m	16mm @ 200mm centres	12mm @ 400mm centres

Note: Steel to be cut, bent, and fixed as in Fig. 2.

Where it is proposed to install reinforced concrete walls higher than 3.0m, then a detailed design for these walls shall be prepared by a qualified structural engineer, and submitted to the Department, with relevant structural calculations, for prior acceptance.

8.3 Reinforcing steel bars

Reinforcing steel bars shall be high yield (HY) with ribbed finish or equivalent; shall be free from mill scale and heavy deposits of rust; and shall not be straightened and rebent. Where bars are lapped, the overlap shall be at least 40 times the bar diameter. Standard tying wire, or tack welding, shall be used to ensure firm positioning of steel during concreting, and standard patent spacers shall be secured to steel to provide the minimum concrete cover of 40mm. When the wall-floor joint incorporates a water bar, top cover to steel shall be 75mm.

The junction between the wall and the wall footing shall incorporate a 150mm water bar placed at the centre of the wall as shown in Fig. 1. Alternatively, a key shall be formed in the freshly-poured floor slab by using a splayed oiled timber runner withdrawn before final set [shown in Fig. 2].

All dirt and debris shall be removed from within shuttering before concrete is placed in layers not more than 600mm deep. Poker vibrators, diameter not less than 50mm, shall be used after placing to eliminate air-voids and to compact concrete.

Shuttering shall not be removed from walls for at least 12 hours in warm weather, and longer in cold weather. Any blemishes or honeycombing shall be repaired with a sand:cement mortar incorporating S.B.R. (Styrene Butane Rubber) in accordance with manufacturer's instructions.

Concrete shall be cured by keeping it damp for a minimum of 7 days or by using a proprietary curing agent. Walls shall not be subject to loading until 28 days after concrete has been cast. [For more detailed information on the construction of reinforced walls, see Specification S.120: Concrete Walled Silos.]

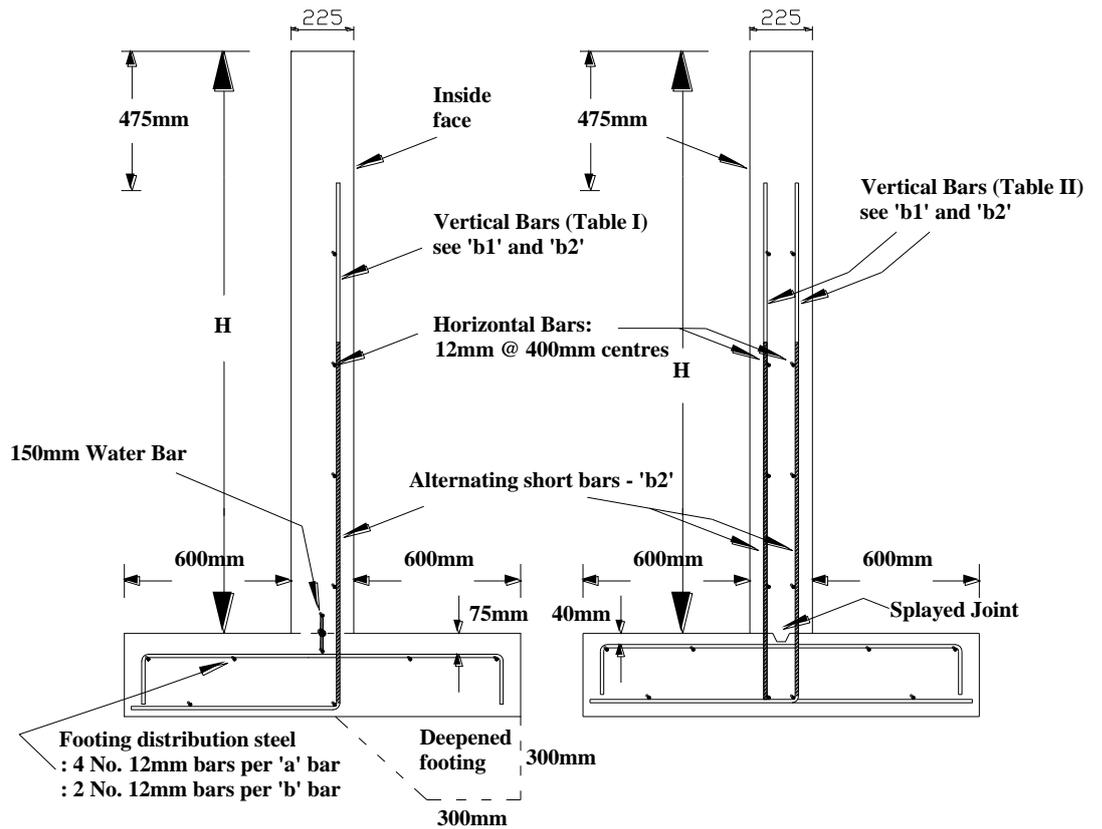
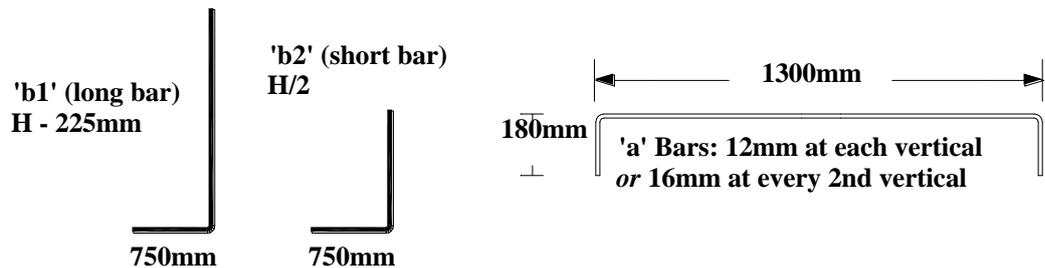


Figure 1 External Retaining Wall
(see Table 1)

Figure 2 Central Retaining Wall
(see Table 2)



8.4 Wall Finishes

The finish to mass concrete walls may be acceptable provided any small blemishes and honeycombing, should they occur, are repaired with a 1.5/1 washed sharp sand:cement mortar when the formwork is removed.

8.5 Insulated walls

Insulated walls are not normally required for grain stores. If installed, the recommended insulation on mass concrete walls is 40mm extruded polystyrene or polyurethane board nailed to the internal face, covered with expanded metal and plastered with two coats, as above.

Insulated cavity walls may also be used, provided that the inner leaf itself complies with the full requirements of 8.2 or 8.3 above.

8.6 Precast Wall Panels

Proprietary precast concrete wall panels shall require prior Departmental acceptance and be listed on specification S109A of the Department of Agriculture, Food and the Marine. All Proprietary precast concrete wall panels shall be CE marked and produced in a plant certified by a Notified body (e.g. NSAI or equivalent), to produce precast concrete wall panels to EN 14992:2007 +A1:2012.

8.7 Moveable wall segments

Proprietary moveable precast concrete wall panels (bunker walls) shall require prior Departmental acceptance and be listed on specification S109A of the Department of Agriculture, Food and the Marine. All Proprietary precast concrete wall panels shall be CE marked and produced in a plant certified by a Notified body (e.g. NSAI or equivalent), to produce precast concrete wall panels to EN 14992:2007 +A1:2012.

9. FLOORS

9.1 Standard floors

Standard floors shall be a minimum 125mm concrete. A 150mm hardcore base shall be provided, compacted with vibrating or heavy roller, and topped with fine sand. All floors shall incorporate 1000 gauge polythene D.P.C. membrane with 600mm overlaps laid on the sand under concrete, and taken up along walls to meet D.P.C., where this has been installed, or to finish 150mm above external ground level.

In grain stores with floors subject to heavy mechanised traffic, reinforced floors shall be installed. The design shall meet the requirements of the specific loading. In the absence of specific design data an A393 mesh to BS 4483 [10mm @ 200mm c/c : 6.16 kg/m²] shall be placed 40mm below the finished floor surface.

Depending on specific requirements the top surfaces of floors may require proprietary hardeners and/or sealing agents.

In cases where fill is purchased for use under concrete, it shall be certified to EN 13242:2013 and meet the requirements of Annex E of S.R. 21: 2015. This material shall also be used as the top 300mm of any backfill around stanchion foundations.

9.2 Underfloor Ducting

Stores for grain may require underfloor ducting. Design of ducting (size, spacing, and construction) is specific to the type of produce stored and the mechanical plant installed. Lay-out and design details shall be provided by the mechanical plant supplier or consultant. Prior approval is required. (See also Clause 16.)

9.3 Laying of Concrete Floors

Laying of concrete floors shall be done in alternate bays measuring not more than 4.5m wide by 6m long where there is no fibre additive, and not more than 4.5m wide by 8m long with fibre additive. In the case of mesh reinforced floors joint spacing can be extended to 12m by 8m. Concrete shall be placed about 20mm proud of the shuttering and tamped to the correct level using a vibrating screed. Concrete may also be laid in one operation as above and bays to the dimensions specified shall be cut by concrete saw 25mm deep x 12mm wide in the hardened concrete within 24 hours of pouring. All joints shall be brushed out and filled with mastic as per manufacturers' instructions.

9.4 Curing of Concrete Floors

As soon as concrete surface is firm enough (within about 1 hour) the slab shall be sprayed lightly with water and maintained in a damp condition for seven days. This is best achieved by covering the wetted slab with a polythene sheet. Care should be taken to ensure that polythene firmly fixed at the edges of the slab to avoid wind draught between the polythene and the concrete surface.

10. VERMIN-PROOFING

Produce store shall be constructed, and openings designed, so that no access is possible by farmyard or domestic animals, or any animal vermin. As far as is possible, all insect vermin shall also be excluded.

11. DOORS AND WINDOWS

All doors wider than 1.2m shall be sliding or roller shutter type. Doors shall incorporate such details [tracks, brushes, etc.] as are necessary for vermin proofing (Clause 10). The recommended minimum height of the main door(s) is 4.0m. A door at each end of the building can facilitate management. Windows, treated timber, uPVC or aluminium, where provided, shall be fitted within opes on standard concrete cills laid on damp proof course taken up at backs and along sides.

Note: Roof lights and windows should normally not be installed, as a dark interior discourages any access by birds through open doors. In cases where roof lights (translucent roof sheets) are installed, safety grids, as per clause B.14 of S.101 shall be installed underneath the translucent sheets.

11.1 Doorway grain retainer

Retainers are to be of proprietary manufacture and shall be capable of holding back the grain from the door so that the store can be filled to maximum capacity.

Each retainer shall have a system to release grain built up behind it, without the need to remove the retainer.

The full frame of the retainers shall be of steel construction and be designed to be moveable.

12. LIGHTING

Artificial Lighting shall be provided by florescent tubes in hose proof, impact proof (polycarbonate) fittings. The lighting shall be a minimum 200 lux.

Energy efficient lighting may be used and shall meet the requirements as for fluorescent tubes.

13. ELECTRICAL INSTALLATION

Wiring and fittings shall be installed, and all work shall be carried out in accordance with the Fourth Edition of the National Rules for Electrical Installations, ET101:2008 specifically Part 7-705: Requirements for special installations or locations - Agricultural and horticultural premises. An ETCI completion certificate shall be required, signed by the Electrical Contractor(s) or a person duly authorised to act on his/her behalf to certify that the electrical installation has been constructed and/or has been tested according to the National rules of Electrical Installations and has been found to be satisfactory. An associate certificate, specifically for agricultural work, the "Supplementary Agricultural Certification Form" shall also be signed by the Electrical Contractors or authorised persons and the number of the main ETCI completion Certificate clearly marked on it. If no valid numbered ETCI Certificate is available for the completed installation, then the Electrical Contractor shall complete a new numbered ETCI Certificate indicating that the new installation has been tested for safety and compliance, and note that number on the Supplementary Form. The signed printed "Supplementary Agricultural Certification Form" together with a copy of the ETCI Completion Certificate shall be given to the Department of Agriculture, Food and the Marine before grant-aid can be finally certified.

14. FINISH

Wall finishes other than specified in Clause 8.4 shall be such that they can be readily washed, and comply with the Food Hygiene Regulations. Any exposed ungalvanised iron other than structural steel shall be given 3 coats of anti-rust paint. All timber joinery shall be given a priming coat, 2 undercoats, and a hardgloss finish coat of paint.

15. VENTILATION

Annex 1: "Guidelines for Grain Ventilation Systems" shall be followed in the selection and installation of the appropriate ventilation system.

16. SPECIALIST SERVICES

16.1 Air Extraction and Cooling Systems

Grain stores shall require mechanical air extraction and/or specialised cooling systems. Such systems shall require a detailed design by mechanical plant manufacturer or qualified consultant, submitted for prior approval. Systems shall be installed to manufacturers' exact instructions.

16.2 Proprietary Storage Bins

Proprietary storage bins including any mechanised filling and extraction systems shall be installed in strict accordance with manufacturer's recommendations and instructions. Foundations suitable for the intensity of loading encountered shall be provided under all storage bins (see Clause 7.2). See also Department of Agriculture, Food and the Marine specification S.110 for a list of accepted Meal Bins and Grain Silos.

17. CLEAN WATER DRAINAGE

All roof water from grain stores or associated clean yards shall be piped directly either to an existing clean water disposal system or to an adjacent water course.

Annex 1

Guidelines for Grain Ventilation Systems

1. Ventilation system (in particular its capacity) should be planned to match the expected grain moisture, storage depth and building dimensions.
 - Ventilation rate should match expected intake moisture content as per Table 1.
 - Fans and ducting should be capable of delivering target ventilation rate.
 - Fans should be specified to match crop resistance roughly as per Table 2, with some additional allowance for duct pressure loss.
 - All ducting should be sized to keep air speeds below 10 m/s.

2. Storage of dried grain:
 - Is there adequate drying capacity for all the grain to be stored?
 - Overall ventilation rate should be at least 10 m³/h tonne (5 cfm/t)
 - Differential thermostat or time switch controls are recommended.
 - Some temperature monitoring capability is essential.
 - Pedestals are acceptable for this application, if they deliver the ventilation rate specified in Table 1. The ratio of pedestals to fans should be sufficient for easy management, but should not exceed four.

3. Air extraction from building:
 - All stores should make some provision for ventilation of the space above the grain. In most cases, stores should have an extraction fan in one gable wall and a matching air inlet in the opposite gable.
 - The extraction fan capacity should be sufficient to prevent condensation on grain surface and roof while ventilating.
 - The air inlet should have sufficient open area to facilitate the air change rate required to control condensation.

Table 1: Ventilation rates required to cope with expected intake moisture content

Intake moisture content (%)	Minimum ventilation rate needed	
	M ³ /h t	cfm/t
<16	10	5
16-20	35	20
20-22	70	40
22-24	150-180	80-100

Table 2: Approximate resistance to airflow in stored cereals.

Ventilation rate m ³ /h t	Grain depth (m)				
	2	3	4	5	6
	Airflow resistance (mm w.g.)				
10	2	4	8	13	18
20	4	9	17	27	39
30	6	14	26	42	62
40	8	20	36	59	88
50	11	25	47	77	116
60	13	31	59	97	147
70	16	37	71	118	180
80	18	44	84	140	215