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DEPARTMENT OF AGRICULTURE, FOOD AND THE MARINE

MINIMUM SPECIFICATION FOR CONCRETE SILAGE BASES

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.

2. Concrete Specification

2.1 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.

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.

Note: Uncured concrete is the chief cause of concrete failure in silage slabs.

2.3 Concrete

For walled silos, silage aprons, silo channels and **purpose-built** silage effluent tanks, 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'.

- The concrete is to be to I.S. EN 206-1:2002: 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.

Note: The resistance of concrete to acid attack by silage effluent depends on a high cement content concrete as specified, on the use of the least amount of water to produce a stiff but workable mix, which is thoroughly compacted and subsequently properly cured as specified (see Clauses 2.2 and 18). Plasticisers or superplasticisers may be incorporated in the concrete, particularly in warm weather, to improve workability. Under no circumstances shall additional water be added to the concrete to change the workability. Any additives used shall comply with British Standard 5075; they shall be used strictly in accordance with manufacturer instructions and shall be added at the ready-mix plant. Where an additive is used it shall be certified on the invoice by the ready-mix supplier that it was used and complies with BS 5075.

2.4 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. 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.

2.5 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).

2.6 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.

2.7 Tests

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

2.8 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.

3. The Site

Bases shall be sited on firm/solid ground that is not subject to flooding. Sites on made up ground, i.e. filled ground, or where differential settlement is likely to occur leading to structural cracks, shall be avoided.

The site shall be carefully selected having regard to existing and proposed animal housing, ease of access and possible future extensions. Extreme care shall be exercised to avoid pollution to rivers, streams and ground water. All surface water draining on to the site from higher ground or any under-drainage passing through the site shall be intercepted and diverted.

As a general guide, the site 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 silo base and a public/private water supply source, either surface or ground, shall be 60m. In vulnerable situations this distance shall be increased up to 300m.

4. Site Preparation

All top soil and soft material shall be excavated to a minimum depth of 150mm, or down to solid stratum, and the excavated material shall be removed from site to a suitable area. The site shall be excavated to the proper depth for channels as shown on Figs. 3, 4, 7, & 8 and the overall site graded to suitable falls towards a collection point. Minimum fall of 1 in 60 shall be provided for base, apron and channels.

5. Foundation

The Foundation shall consist of thoroughly compacted hardcore extended a minimum of 300mm in each direction beyond the edge of the finished structure. Hardcore placed in excavated soft areas or on made-up ground shall be compacted in 150mm layers using a suitable vibrating or heavy roller. Special care shall be exercised in compacting the edges of the slab, and under proposed channels. Where channels are constructed the level of the foundation shall be lowered in accordance with Figs. 3, 7 & 8. All hardcores shall be blinded over by fine sand or a 50mm layer of blinding concrete finished smooth.

A 1000 gauge polythene membrane shall be laid on the finished hardcore with 600mm overlaps. The overlaps shall be sealed with suitable adhesive tape. The polythene shall be brought up on the inside of the timber or steel formers.

5.1 Purchase of fill material

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.

6. Thickness of Concrete

The thickness of concrete shall be as shown on detail drawings but at no place shall it be less than 125mm. Under channels the concrete shall be thickened to at least 150mm below the invert level of the channels as shown in Figs. 3, 7 and 8.

7. Channels

Silage bases shall have channels at the back, sides and front to collect and convey all the effluent and soiled water that results from the use of the base and the apron to an approved storage facility. Side and back channels shall be set **400mm** in from the edge of the concrete base, to allow for sealing of silage clamp with sand bags or other suitable material. This 400mm concrete verge shall have a fall towards the channel as shown in Fig. 3. Channels shall be constructed as shown in Fig. 3. Care shall be taken when forming the channel to ensure that adequate depth and fall is maintained during construction and that sufficient concrete is provided at the sides and under the invert of channel as shown.

Where surface water from concrete yards or other surrounding areas is likely to gain access to the silage base, a kerb type channel as per Fig. 4 shall be constructed to the back and sides.

The front of the silage base shall have a recessed channel to convey the effluent to an approved storage facility. See Figs. 1, 2, & 8. An alternative front channel is given in Figure 7.

Cross channels may be constructed in the slab to facilitate two or more cuts of silage and to prevent effluent running over a partly filled concrete base. These channels shall be constructed as specified above.

8. Effluent Disposal

Silage effluent has a very high polluting potential. To facilitate efficient and rapid drainage of the effluent, it is recommended a 70mm land drainage pipe be placed in the channels.

Where a diversion system for clean water runoff is constructed (Fig. 2), pipe joints shall be carefully constructed and shall be watertight. All effluent or soiled water shall be collected in an approved effluent tank or other approved storage facility and only clean water runoff shall be diverted from the storage facility. The flow directions shall be designed so that if diversion plugs (which shall extend at least 500mm up from the finished base level when in place) are missing or damaged, the effluent shall flow to the storage facility.

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.

9. Silage Aprons

A silage apron shall be constructed at the front of a silage base, for the full width of the silo. The silage apron will normally extend 8m from the front of the silo and may be up to 10m, but shall not be less than 6m. The apron shall be constructed to the same standard as the silo base. The apron shall be cast at the same time as the silo floor. When the silage base is used for storing baled silage then the silage apron is optional.

Silage Aprons shall normally have channels at the side and at the front edge (Fig. 1). If the Apron has no front-channel, then the apron shall slope back towards the front channel of the silage base. The minimum slope of the apron in this case shall be 1 in 40. In all cases the apron shall have either channels or kerbs along its sides.

It is recommended that a channel be constructed along the back of the apron, forming a double channel so that rain falling on the apron can be separated from the silage effluent on the main base.

10. Placing of Concrete

The concrete shall be laid in alternate bays measuring not more than 4.5m wide by 6.0m long. Concrete should be allowed to harden for at least 2 days before the remaining bays are poured. The edges of the slabs (except where the slab abuts an existing bay) shall be supported by strong shuttering, set to the correct level. The concrete should be placed about 20mm proud of the shuttering and then tamped down to the correct level using a vibrating screed. Particular care should be taken to compact the concrete near edges and joints, preferably with a poker vibrator.

Joints between alternate bays should have a 25mm x 12mm recess preformed by the shuttering, see Fig. 3. This joint to be brushed out and filled with acid resistant mastic sealant. Alternatively, where concrete base is laid in one operation, joints (in bays not exceeding 6m x 4.5m) shall be cut by disc-cutter to a depth of 30mm and to a full

12mm width formed by a double cut in the hardened concrete within 24 hours of placing. These joints shall be brushed out and filled when dry with acid resistant mastic sealant installed in strict compliance with the manufacturer's instructions. Extra care shall be taken that joints running across effluent channels are completely sealed.

If the raised portion of the kerb (Fig. 4) is being cast separately to the surface of the slab, the slab under the kerb shall be well roughened, e.g. wire-brushed to expose coarse aggregate, prior to forming the raised portion of the kerb. In no circumstance shall a vertical join be made at the slab side of the kerb.

If it is thought necessary to strengthen the slab for any reason, A 142 steel mesh may be installed 50mm above the bottom of the slab. In all cases construction joints shall be formed.

11. Making of Silage Clamp

When a silage clamp is being filled, the silage shall be brought up to the channels, but not over or beyond them (Figs. 5 & 6). Channels shall be maintained in a free flowing condition. The making of a silage clamp is a high-risk activity for machinery operators and others: safety considerations are vitally important.

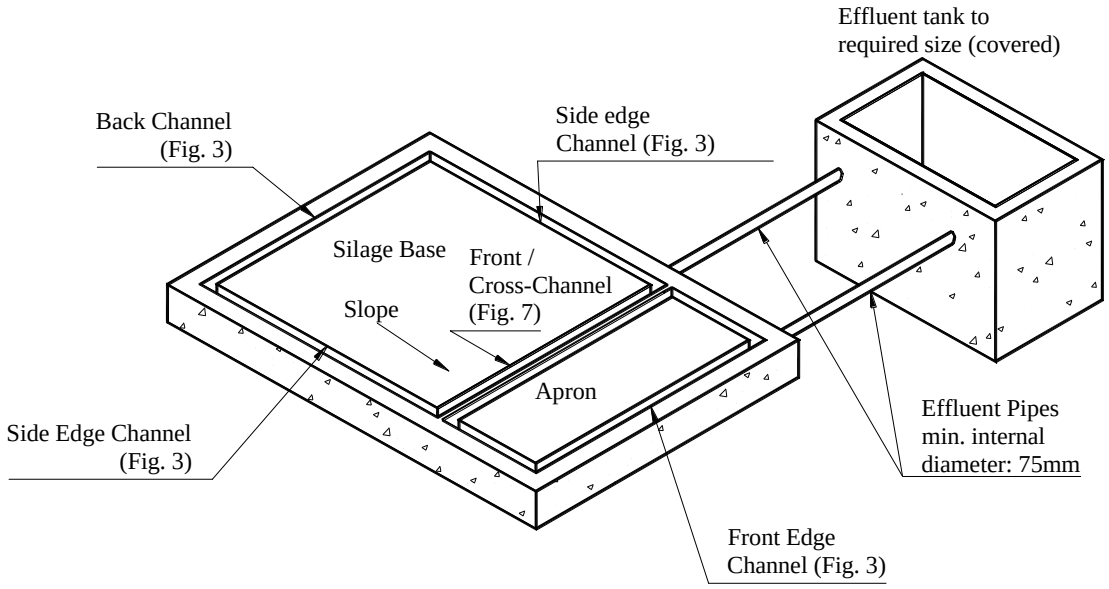

Figure 1 Construction of Silage Base and Tank

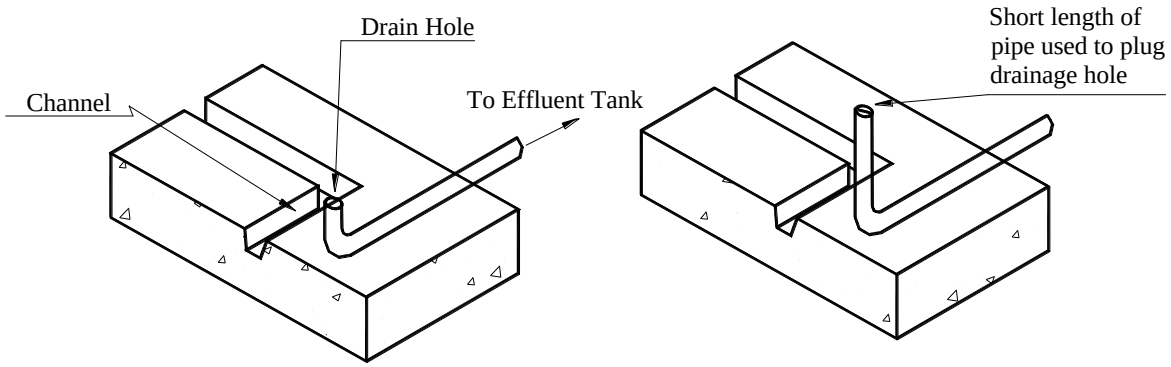

Figure 2 Diversion Trap for Cleanwater Run-off from Base

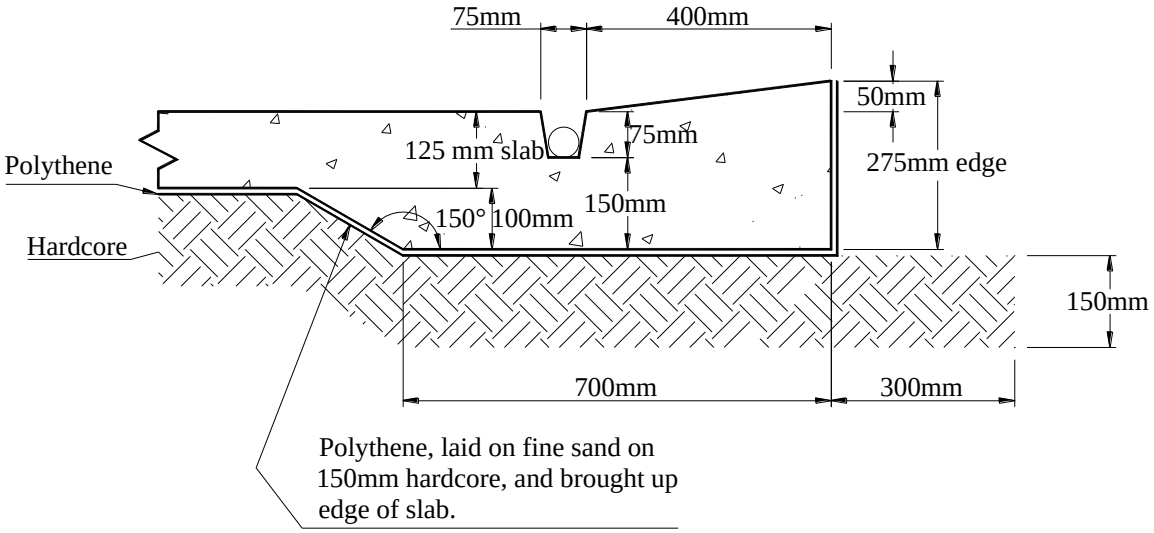

Figure 3 Side-Edge or Back-Edge (Standard)

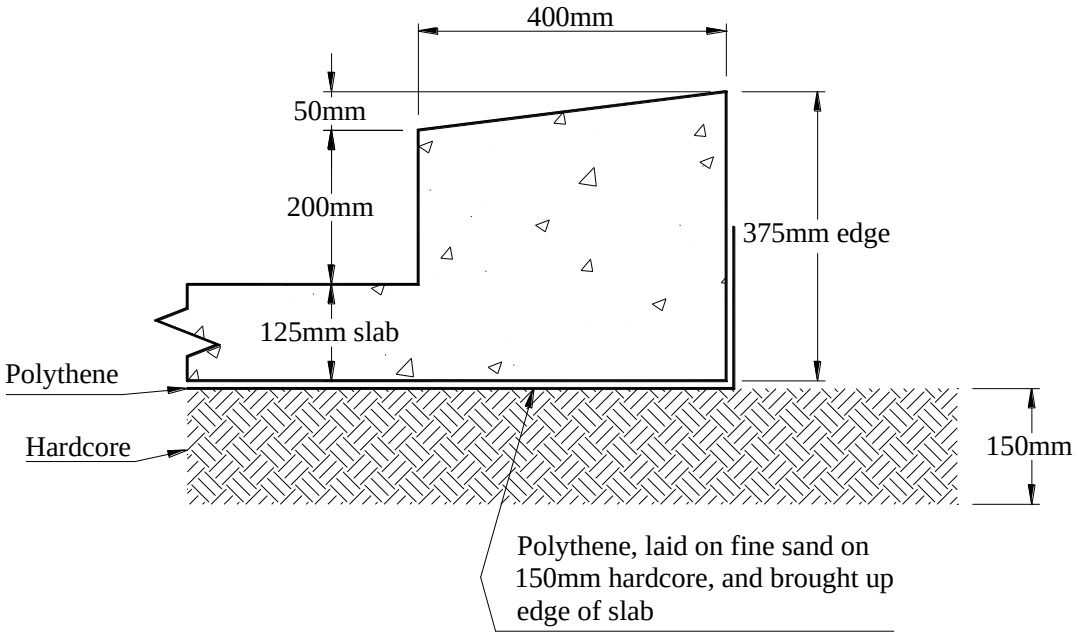

Figure 4 Side-Edge / Back-Edge (Kerb-Type)

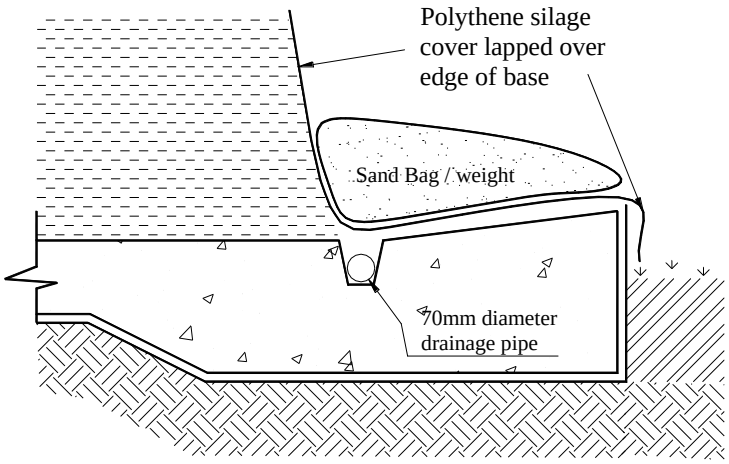

Figure 5 Side-Channel in Use

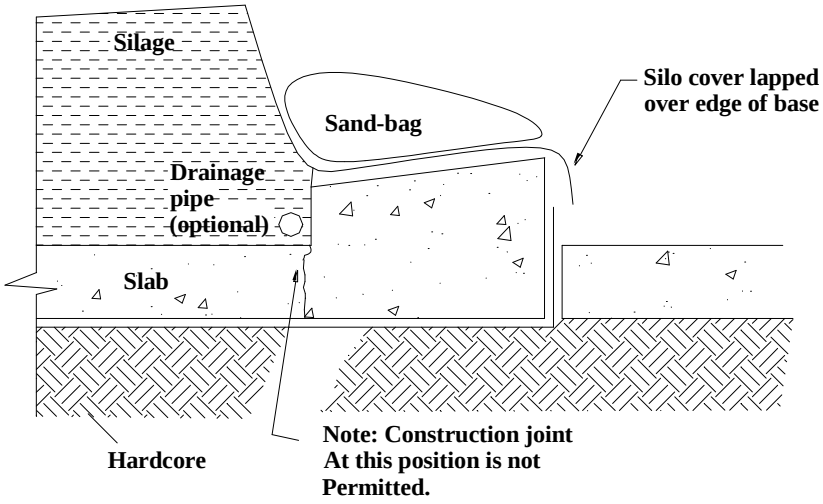

Figure 6 Side-Kerb in Use

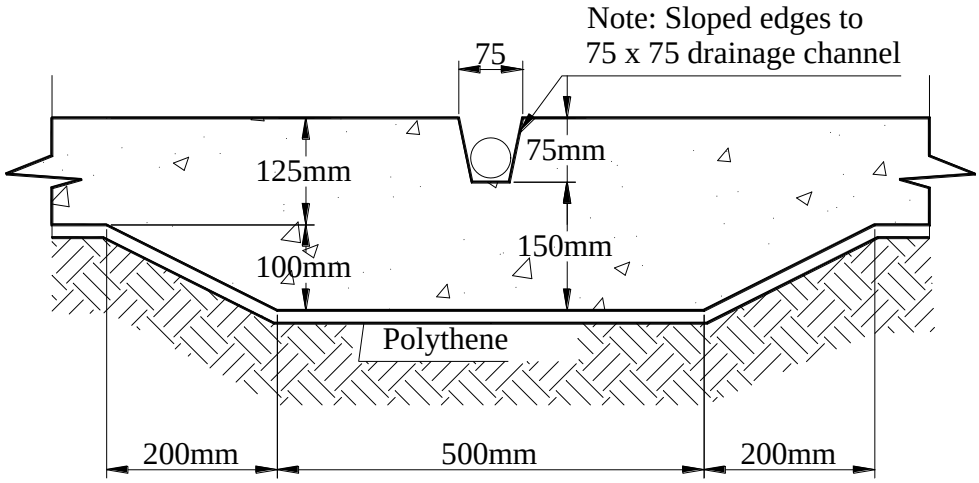

Figure 7 Cross-Channel / Alternative Front-Channel

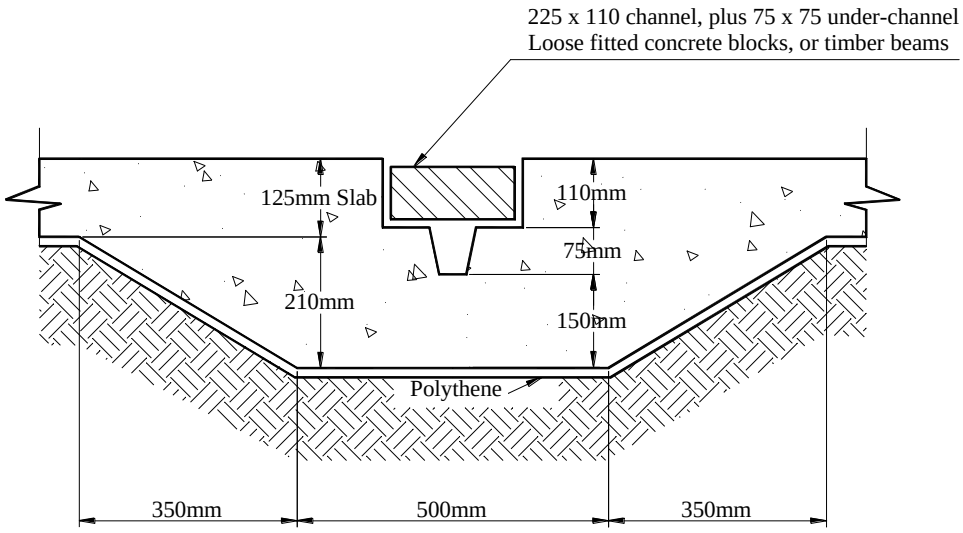

Figure 8 Preferred Front-Channel