Building a New Silage Base

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Good organisation and workmanship and attention to detail are vital in order to build new concrete silage pits to a high standard. While most farm building work nowadays is carried out by farm building contractors the farmer has a big part to play in the planning that goes into ensuring a successful outcome - a silage pit that lasts the test of time, will be effective in conveying effluent to storage and will be safe and easy to fill and empty. Good cooperation between the farmer and his contractor is needed to achieve this. Farmers should avail of advice, discuss the options and follow the detailed guidelines outlined in the Farm Development Service specifications for silage pits.

With the contract price of silage bases costing around €27/m^2 and silage walls costing over €280 per linear metre there is no room for getting it wrong.

Select a Suitable Site

Choosing a suitable site will depend on the layout of the existing facilities and the importance of leaving room for any future developments or extensions. The best location will usually be either in front of or alongside the winter housing. Look at all the options to come up with the most suitable site.

In all cases care should be taken to avoid endangering rivers, streams or wells by pollution. Surface water draining onto the site from higher ground and any drains passing through the site must be intercepted and diverted.

Avoid congestion around farmyards. Plenty of space is needed around the farmyard for the kind of machinery used by today's silage contractors. Industrial type loaders and 16, 18, and 20ft, trailers are the norm. If the pit is located in front of the housing a distance of 15 metres (50ft.) should be left in between for unloading silage trailers and loader work. The ideal is to have a drive-through system with no reversing to slow things down or get in the way of the loader. Loader operators are often put under pressure because of the size of the yard. They are hard pressed to shift loads out of the way in time for the next load and as a result don't have enough time for rolling the pit. With more space they can operate more quickly and safely. Needless to say, milking time should not hinder silage making activities.

Site Preparation

Excavate all topsoil to a minimum depth of 150mm. Any soft spots or areas of mud or dung on the surface will have to be excavated down to solid ground. A bit extra will need to be excavated where the channels are going to be located. The overall site should fall in the direction of the collection point(s). The fall in the site should reflect the fall on the finished surface and should lie somewhere in the range of 1 in 60 to 1 in 100.

The height of the slab in relation to other structures is very important. On a fairly level site a good rule of thumb is to have the front of the slab at the same height as the feed passage of nearby animal housing, making it easy to install systems to collect effluent and drain away clean run-off water. The main thing is not to have it too low in relation to nearby structures.

Foundation

Place a layer of graded hardcore over the site and extend it at least 300mm beyond the proposed edges of the slab. Compact the hardcore with a vibrating roller to a finished depth of at least 150 mm. Hardcore placed in excavated soft spots or on made-up ground should be compacted in 150mm layers. Be extra meticulous in compacting made-up ground.

Failure to compact the hardcore material adequately, leads to uneven settling out and lack of support for the slab and channels. This in turn leads to cracking of the concrete under the weight of machinery. The problem cannot be rectified once the slab is completed. Excavators on tracks and diggers exert relatively low ground pressure and so are almost useless for compacting loose filling.

Blind the compacted hardcore with sand or dust and run the vibrating roller over it one last time to bed it in. Lay a sheet of 1000 gauge polythene on the finished foundation.

Concrete

It is important to correctly specify concrete for silage pits. Order a 40N20 mix. This will ensure that the concrete will have a minimum crushing strength of $40N/mm^2$ (newtons/mm^2) and the biggest stone chips will be no bigger than 20mm. Specify also a minimum cement content of $350kg/m^3$ and a slump not exceeding 100mm. The slump gives an indication of the amount of added water. When the concrete is discharged from the lorry it's a good sign if it forms heaps, which means that too much water has not been added. Extra water is often added to make the concrete easier to place, but in the long run it will seriously affect its durability.

Ask your concrete supplier for a “Concrete Manufacturers’ Specification Certificate” for all concrete delivered to site. The certificate is a prerequisite for grant-aid for all farm buildings. Even if you are not entitled to a grant the certificate provides you with formal assurance that you are getting what you specified.

Place and compact the concrete to a finished depth of 125 mm. This again brings home the importance of having the foundation correctly laid. Low spots in the foundation will use up too much concrete and high spots can lead to cracks and a shorter service life for the slab. The concrete must be thickened to at least 150mm under the base of the channels.

It is essential to compact concrete to remove air trapped during the mixing process. The slab should be compacted using a vibrating screed and poker vibrator. The screed does most of the work of levelling and compacting and the poker vibrator gets the air out of the concrete near the forms and around the channels.

Tamping boards can also be used for compacting concrete, and they are effective if used correctly. Levelling the concrete with a board and taping the sides of the forms with a lump hammer is not good enough. The slab might look all right but it is almost certain to be weak and porous in places.

Curing

The curing of freshly laid concrete is recognised as one of the most important factors affecting concrete durability. Yet, it is one of the most neglected areas of workmanship and is frequently omitted or carried out in an indifferent fashion on site. Curing must be made a high priority. The curing process retains water in the newly placed concrete. This water is necessary for complete hydration (setting and hardening) of the concrete. As a result, the finished concrete has a harder, less porous, dust free surface with no hairline cracks. On the one hand it is important not to add too much water to the mix but on the other hand it is even more important to retain what water is added until the cement has a chance to react with it. Where curing is neglected it’s the concrete in the top 40-50mm that's most affected.

Curing should begin as soon as possible after placing the concrete. Slabs may be cured either by spraying on a proprietary curing compound or by covering with a new sheet of polythene.

The curing compound protects the concrete surface against the drying effects of sun, wind and light rain. A wax emulsion type of curing compound is regarded as best of the proprietary curing compounds.

Covering with polythene is probably the most practical method of curing concrete slabs. Problems with polythene arise because there is a tendency to use old sheets and not to secure the sheet properly, especially around the edges. Wind blows in under the sheet, causing the surface to dry rapidly. Check that all is well by looking to see that there is moisture on the surface of the slab and on the underside of the polythene. Other problems arise because the sheet is usually thrown back during the day to allow for further construction and it may be removed altogether before the concrete has enough time to cure properly. There is a tendency also, to move the same sheet on as the work progresses - when in actual fact it should be left in place for 7-10 days! Polythene will protect the surface finish if you have to contend with heavy rain just after the concrete is laid, but it can cause glazing if it is laid directly onto freshly laid concrete.

Hairline Cracks

Hairline cracks (plastic shrinkage cracks) occur due to rapid evaporation of water from the fresh concrete near the surface of the slab. These cracks will appear within one hour of placing the concrete in warm and windy weather. They tend to lie diagonally and parallel to each other on the slab. They are totally avoidable. They can be avoided by spraying water from a power hose up in the air and letting it fall as a light mist on the surface of the fresh concrete. This counteracts evaporation from the surface. Another option is to prevent evaporation by pulling a sheet of polythene over the screed as you go. It can be pulled back to allow for final finishing and then it can be pulled back over it again for the curing process.

Prevention is better than cure for hairline cracks because they are very difficult to seal and in many cases the crack extends fully down to the hardcore.

Contraction Joints

Heat is produced when concrete is mixed due to the chemical reaction between cement and water. As the concrete hardens it cools and starts to contract or shrink. Joints must be formed to control the degree of contraction and confine it to the joints. Most people refer to them as expansion joints, Concrete does expand when heated by the sun, but expansion joints are only necessary in long stretches of concrete roads and yards.

Joints are really controlled cracks. If no contraction joints are cut or formed, a crack or cracks will form in time, usually within the first year after construction. If a crack is left to develop it will zigzag all over the place, making it very difficult to seal, whereas a joint which is formed or cut in a straight line makes it relatively easy to seal.

If the silage base is laid in alternate 4.5, 5 or 6 metre bays, transverse joints should be cut at intervals of 6, 5 and 4.5 metres respectively across the bay (i.e. perpendicular to the length) within 24 hours of pouring the concrete. The depth of

this joint should be 1/4 to 1/3 the thickness of the slab. Shallow tracks are useless. The joint should be cut deeper near the channels (because the concrete is thickened there) and through the channel to the outside of the base. Across the base of the channel need only be cut to 20 mm or so, deep enough to hold the sealant.

A natural contraction joint is formed when two bays are cast alongside each other. This joint can be left alone until curing is complete and you are ready to seal all the joints. With these joints all you need to do is cut a shallow track with a concrete saw between the bays. The track only needs to be 12-20 mm deep and wide, enough to carry and hold on to the sealant.

If the silage base is poured in one complete slab, the joints should be cut out within 24 hours to form 5 x 5 metre or 4.5 x 6 metre sections. All joints will have to be cut to 1/4 to 1/3 the thickness of the slab in this case.

Sealing Joints

When the slab has cured properly the joints can be sealed. Assemble all the necessary equipment and products. Prepare all the joints already cut by widening out near the surface with a concrete saw to 12-20mm wide and deep. Cut a track in any joints between bays. Wash or brush out all the joints thoroughly to remove all dust and other debris. If the joints are wet allow them to dry. If a primer is required, use as directed to prime the sides of the joint and along the edges of the joint on the surface of the slab. Avoid getting primer on the base of the joint if possible. Omitting to use a primer is the biggest single cause of leaking joints.

Two broad types of sealant are commonly used, either hot poured (e.g. hot poured rubberised bitumen) or gun applied (e.g. polyurethane). Hot poured rubberised bitumen is only suitable for horizontal joints. Do not use non flexible blown bitumen (not rubberised and brittle when cold) for sealing joints in silage slabs, because it has no flexibility and with any small movement in the joint and it will shear and leak.

Gun applied polyurethane or bitumen based sealants can be used for wall joints and floor joints.

Safety

Care must be exercised in the use of concrete saws for cutting joints. Wear a suitable dusk mask (giving P2 protection) as well as ear, eye and foot protection. Hot rubberised bitumen is 165 - 170^{0}C when ready for pouring. So, be sure to read the safety precautions on the product information.

Channels

The need for effective drainage of silage effluent from pits cannot be overstated. A perimeter channel is an essential part of any silage base. The most important feature of any channel is that it has a vertical edge to trap the effluent and an open space to carry it away. Silage effluent should enter the channels under the cover of the silage polythene and the edge of the ensiled grass should not extend onto or over any channel. A selection of different types of channels taken from the Farm Development Service specification S128 is shown in figures 1, 2 and 3. The open space is maintained by placing a suitable plastic drainage pipe in the channel or a cover over the channel as in figure 3. Channel dimensions can be increased to 100mm by 100mm.

The effluent should be conveyed from the channels to the effluent tank in properly sealed uPVC sewer pipes. Figure 4 shows how a drainage pipe elbow can be used to drain effluent from the channels and also be used to divert clean water when the pit is empty. The beauty of this system is that any liquid flowing towards the clean water drainage system is flowing over the surface, making it easy to see.

In walled pits, as well as providing front and rear channels, it is necessary to use drainage pipes at the walls to allow effluent to drain away quickly and relieve effluent pressure on the floor and walls. If no drainage is used there is a chance that the silage will split and shift under the pressure of trapped effluent.

Drainage pipes can either be placed at the butt of the wall or in channels in the floor beside the wall. There are pros and cons to both systems. The pipe at the base of the wall has to be replaced, usually every year. It is more difficult to manage, causes more effluent damage at the base of the wall but provides good drainage. The pipe in the channel will not be damaged by machinery crossing over it but it is not as good for drainage unless the channel is located near the wall. Constructing channels near the wall in the floor over the wall foundation needs to be well done if they are not to leak. It is more common to locate the channel in a thickened part of the floor about 0.9m from the wall.

It is vital that the ensiled glass is kept back behind the front channel when the pit is being finished off. The silage cover should extend out over the channel to let off the rainwater. In walled pits the front and rear channels must extend fully from one wall to the other with no gaps for effluent to escape. If two pits are placed side by side each should be drained separately to the storage tank. If a pit has three walls a continuous drainage pipe should be placed across the back and along the sides.

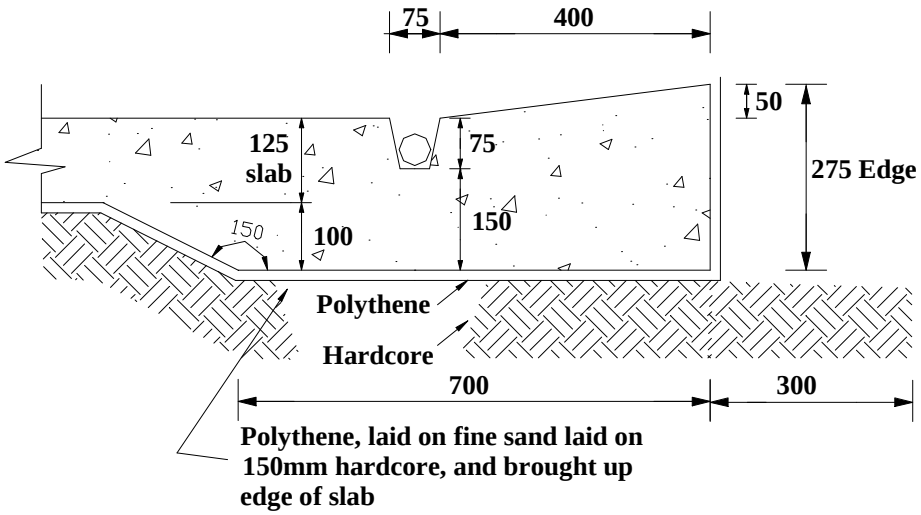

Figure 1 Side edge or back edge channel for a silage base

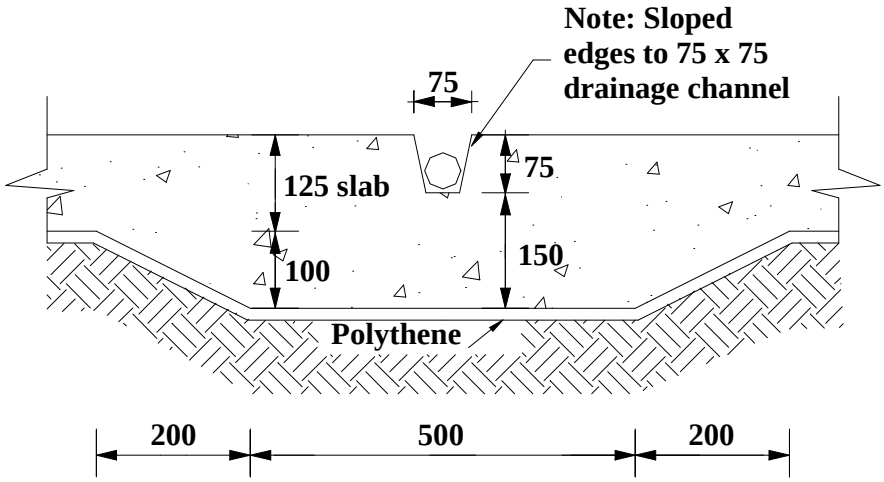

Figure 2 Front channel/cross channel

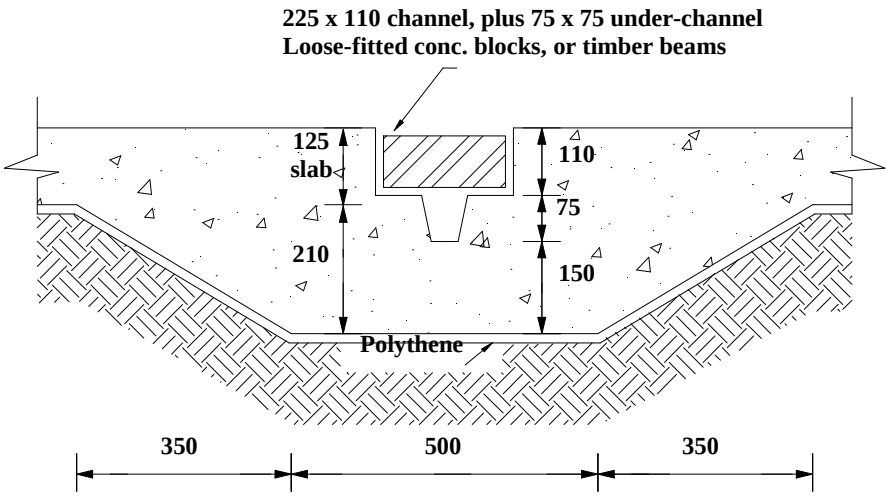

Figure 3 Alternative front channel

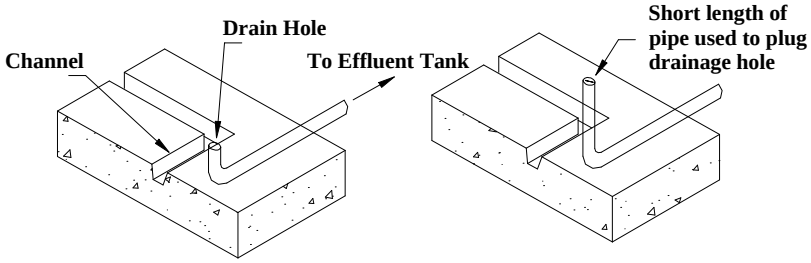

Figure 4 Channel drainage and clean water surface diversion system