# Maintenance and Repair of Silage Pits

*Tom Ryan, Teagasc, April 27th 2005*

Now is the time to examine silage pits to see what maintenance and repairs are needed this year. Defects or problems should be remedied before silage making commences. The objective is to ensure that all silage effluent is collected and safely conveyed to storage.

The condition of the silage pit is the most important factor in deciding what needs to be done. This can only be assessed by washing and thoroughly checking the pit for defects and problems.

Regular maintenance of the silage pit ensures that minor problems are attended to while still minor. Where problems are more serious, a decision must be made on appropriate remedies. In some instances a short term solution may work and allow time to plan and organise more elaborate remedies.

**Inspection**

The first step is to thoroughly wash down the pit, especially the floor, to enable problems to be fully assessed. Look out for cracks, porous patches, unsealed and eroded joints. The extent of the damage can be assessed by hacking away any unsound concrete at joints and at the base of walls. Structural failure, particularly subsidence and movement in the floor, should be looked for. Bouncing a fencing post off the floor is a handy method of checking the structural stability of the floor. A hollow sound indicates the presence of a poor foundation, whereas, a floor with full support and no cracks will emit a sharper thud when the post strikes it.

Silo walls should not be power washed severely until you are ready to plaster them because sound concrete will be exposed to acidic effluent attack.

**Repairs to Floors**

The condition of the floor will determine the extent of the repairs that need to be carried out. In situations where the old floor is extensively cracked by subsidence, the entire floor and its foundation needs to be taken up and a new floor laid in its place. This should be carried out in accordance with specifications S128, S128A and/or S120. These are the relevant Department of Agriculture and Food specifications for silage pits. S128 is the specification for concrete silage bases, S128A is the specification for re-

surfacing silo floors and S120 is the specification for concrete walled silos. Grant aid is available for new silage pits and for re-surfacing of silo floors.

**Guidelines for Replacing an Existing Silage Base Are:**

- Remove the existing floor and any hardcore material
- Excavate any soft spots down to solid ground
- Place a new layer of graded hardcore over the site and extend up to any wall foundations and at least 300mm beyond the proposed edges of the floor
- Compact the hardcore with a vibrating roller to a finished depth of at least 150 mm. Hardcore placed in excavated deep soft spots should be compacted in 150mm layers. Failure to compact the hardcore material adequately will lead to subsidence and lack of support for the slab and channels, causing cracking of the concrete under the weight of machinery. The problem cannot be rectified once the slab is completed and you'll be back to square one again in no time
- Blind the compacted hardcore with sand or other suitable blinding material 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
- For grant-aid concrete must be purchased from a concrete manufacturer; it cannot be produced on site. Order the concrete by requesting "40N concrete to be certified to grant-aid standard of the Department of Agriculture and Food". This will ensure that the concrete will have a minimum crushing strength of 40N/mm$^2$ (newtons/mm$^2$), a minimum cement content of 350kg/m$^3$, a slump (in unplasticised concrete) of 90mm or less and a maximum aggregate size of 20mm. Ask your concrete supplier for a "Concrete Manufacturers' Specification Certificate" for all concrete delivered to site. This certificate is a prerequisite for grant-aid for all farm building work. Even if you are not going for 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. The concrete must be thickened to at least 150mm under the base of the channels. The slab should be compacted using a vibrating screed and poker vibrator
- Curing 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. The curing process retains water in the newly placed concrete. This water is necessary for complete setting and hardening of the concrete. 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. Covering with polythene is probably the most practical method of curing concrete slabs

- Joints must be formed or cut in the floor to prevent cracks occurring. Joints are cracks that are induced to form in a straight line and are relatively easy to seal. If joints are omitted cracks will form of their own accord, due to shrinkage, in a zig-zag fashion and are very difficult to seal. Joints should be formed across and along the slab to create concrete floor sections 4.5m by 6.0m
- The last job to be done is to seal the prepared joints with suitable acid resistant sealant.

**Where only part of the floor needs replacing**

If the floor has subsided and cracked in a few local areas you need only break out and replace the concrete that's affected. Use a concrete road saw or hand-held consaw to avoid unnecessary damage to sound concrete and to provide straight cut edges to make it easy to seal the joints between the old and the new. Remove the old concrete and hardcore. Any soggy and blackened subsoil will have to be dug out and filled with new hardcore material. Place new hardcore material, compacting it with a plate compactor, and bring it up to within 125mm of the finished floor level. It's a good idea to make the hardcore material and the concrete be a bit thicker where the new joins the old. All the other recommendations above that apply to new silage bases also apply to this replaced section of slab.

**Over-slabbing with a Concrete Floor Slab and Resurfacing with Asphalt**

If there is very slight subsidence or "pitting" of the concrete surface, over-slabbing the existing floor can be considered. However, it can upset slopes and levels. As it would be awkward to lay side channels near walls it is probably better to leave them out altogether and depend on land drainage pipes placed along the butt of the wall for drainage instead. Front and rear channels in two-walled pits will have to be renewed/constructed. A layer of sand and polythene is placed on the existing floor to provide a more even

distribution of load from the new floor but there is still the possibility that cracks may appear in the new floor over those in the existing one.

Re-surfacing with hot-rolled asphalt is another option, especially for covering large areas. For over-slabbing with concrete and asphalt repairs follow the recommendations in S128A.

**Repairs to Joints/Cracks in Silage Bases**

Check joints to make sure the sealant is in place and doing its job. It must be replaced where it has been pulled out or where it is no longer bonded to the sides of the joint.

The appearance of the joint/crack after cleaning and cutting back to sound concrete will determine the type of repair that is required. Where the joint/crack is narrow and shallow, it is only necessary to prime its sides and use a sealant. The primer is a liquid that's brushed on to the sides of prepared joints or cracks. The primer sticks firmly to concrete and the sealant sticks firmly to the primer.

Hot-poured rubberised bitumen is a suitable sealant for floor joints/cracks. Non-flexible hot-poured blown bitumen (roof pitch) is brittle when cold and should not be used for sealing joints/cracks in silage pits. Some examples of hot poured rubberised bitumen are Liquafix J, Joint Fill A2 and Pliastic A2. These will be supplied with their appropriate primers. Gun-applied sealants, such as polyurethane, are also very effective. Some examples of suitable gun-applied sealants are Soudaflex 40FC and Sikaflex 11FC.

A guide price for a 12mm x 12mm joint using a gun-applied sealant is about €2/metre run and about half that with hot poured rubberised bitumen.

Cracks/joints which initially look narrow will often double in width when cut back to sound concrete. Their depth may extend to the sub-base (hardcore material). In these situations, the prepared joint may be filled with a repair mix consisting of sand, cement and a synthetic rubber or latex called styrene butadiene resin, or SBR as it is commonly known.

The SBR is used both in the repair mix and as a bonding agent. Wherever a repair mix is used it must be bonded to the existing concrete. The repair mix consists of sand, cement and SBR, e.g. 75 kg sharp sand, 25 kg cement and 5 liters of SBR. The aim is to achieve a stiff mix, but some water may be added if necessary. The bonding coat, or slurry coat as it is called, consists of two parts cement to one part SBR. These are mixed to form a slurry-type consistency.

The slurry coat is brushed on to the prepared surfaces followed by the repair mix, which must be packed into the joint/crack before the slurry coat dries (i.e. wet on wet). The manufacturer's recommendations must be followed carefully, because formulations and procedures vary from manufacturer to manufacturer.

Where the joint/crack is not very wide, fill it with the repair mix to within 15-20mm of the surface. The track that is left may be primed and sealed with sealant after about a week.

Where the joint/crack is wide (>25mm), the SBR repair mix should be brought to the surface. Ideally, when dry, a joint should be cut and sealed with sealant to allow for movement in the floor. Alternatively, the repair may be painted with a protective coating and after a year it should be checked to see if a crack has developed and a decision can then be made depending on the size of the crack as to what further work is required.

**Holes in the floor**

**T**he SBR repair mix and bonding coat may also be used to repair holes in the floor. The foundation in the vicinity of the hole must be secure. Power hose the edges of the hole and brush the SBR slurry coat onto the edges of the hole. Fill the hole with concrete to within 50mm of the surface and compact well. Top off the 50mm with the SBR repair mix and finish flush. Smooth the edges of the repair with the slurry coat. Joints/cracks will not generally open up around the edges of a hole.

When dry apply a protective coating. The success of these repairs depends on the structural stability of the floor and the attention to detail in carrying out the work.

**Vertical Joints and Cracks in Walls**

Cracks in silo walls can occur if contraction joints are omitted or incorrectly formed, if inadequate steel is used or where there is insufficient overlapping of the horizontal steel. The risk is greatest in long walls and where high strength concrete is used.

Again the success of any repairs will depend on the structural stability of the wall. Some defects to look out for in accessing the structural stability of silo walls are; a ledge in the surface of the wall either side of a crack/joint, the outside face of the wall not vertical (i.e. the wall and its footing have rotated), a gap between the wall and the floor, cracks that grow wider towards the top of the wall and horizontal cracks in the wall.

Hairline cracks in new walls may be sealed with a protective coating. Wider more clearly defined cracks, or those that have eroded over time, will require more work. If the crack is clearly defined (>0.5mm) but not too wide or eroded it can be cut back to form a track

to hold sealant. It can then be primed and sealed with a gun-applied sealant. Preformed joints in new silo walls should also be sealed in the same way.

Where cracks or joints are very wide and eroded they can be repaired with an SBR repair mix and slurry coat. The same procedure used for repairing joints/cracks in floors can be followed. However, the SBR repair mix may have to be built up in layers. When the crack/joint is filled brush over it with the slurry coat. Allow the slurry coat to dry and finally brush on a protective coating.

In a typical silo wall, it is only necessary to seal joints/cracks on the inside face but with a common wall between two pits, both faces should be attended to.

**Repairs to Walls and the Wall-Floor Joint**

The most practical method of repairing the surface of silo walls is to plaster them. This job is generally not urgent as the surface will not deteriorate much each year. However, it obviously should be done before the damage can lead to structural problems. It is good value when you consider that a contract job for a new 2.4m high silo wall costs about €325 plus VAT per linear meter, whereas two coats of plaster costs about €55 plus VAT per linear meter.

The wall should be thoroughly power washed back to sound concrete. The wall should be sufficiently damp to prevent soakage of moisture from the scud coat and plaster. SBR should be added to the scud coat to improve adhesion and make it tougher. I have heard of instances where new plaster has completely fallen off because the surface wasn't properly cleaned back to sound concrete.

If the surface of the wall is not too bad and you only want to repair the base of the wall and the wall/floor joint you can use an SBR repair mix and slurry coat. Get back to sound concrete as already described, brush on the slurry coat and apply the SBR repair mix in layers to replace the concrete that has been eroded. This repair mix can fill the joint and extend to the floor area near the wall as well. When this is cured, a joint may be cut and sealed or it may be left until the following year to see if and what size of crack develops. The repaired area should be painted with a protective coating.

The use of a slurry coat or scud coat with SBR is interchangeable; the scud coat with SBR is better for walls and the slurry coat is better for fiddly areas like cracks, etc. The slurry coat must be plastered over while still wet whereas the scud coat must be left to

dry. All these types of repairs should be cured by preventing them from drying out too fast.

**Protective Coatings**

Protective coatings tend to work well on new concrete and well cured repairs. Where walls are plastered they seem to adhere better to a wooden float finish than a steel trowel finish. Yearly touching up may be necessary to maintain effectiveness, e.g. machine damage. Consideration should be given to treating the most vulnerable areas in new or renovated silage pits, i.e. effluent channels and surrounding areas, and the environs of the wall floor joint. Examples of suitable protective coatings are; bitumen based coatings e.g. Liquafix S and polyurethane coatings e.g. Silage Protect 50 and Farmguard.

**Safety**

Care must be exercised in the use of concrete saws when cutting joints. A suitable dust mask as well as eye, ear and foot protection must be worn.

Hot-poured rubberised bitumen can be hazardous to use. When ready for pouring, the temperature of the melted bitumen is 165-170$^0$C - so, be sure to read the safety precautions on the product information.