

Farm Roadways – Design and Construction

Tom Ryan, Teagasc, May 2009

With the way the weather has been over the last few years anyone without a good farm roadway system is under pressure with grazing management. The poor weather has also taken its toll on farm roadway surfaces, highlighting the need for ongoing maintenance. Investment in farm roadways will always pay dividends, making it easier to manage grass, save time and reduce lameness.

Planning is important and the best way to plan a roadway is to sit down with your advisor with the ordinance survey maps and discuss the complete roadway first. Visit the site and prioritise what sections are most important.

The job should be costed carefully to avoid any overruns. Bear in mind that as well as the roadway costs, the water supply system and extra fencing will also need to be taken into account.

Assessing roadway condition

Take a quick look at your roadways to look for defects that may be causing problems. These defects will include, potholes, a roadway that's too level, ruts from wheel tracks, a raised hump of soil under the fence at either side, and tracks made between the fence and the roadway or on the roadway.

Problems are caused by; pebbles and loose stones on the surface, bumpy surface with secure stones, lodged/trapped water on the surface, very dirty section near the farmyard, and a roadway level with or lower than the field. The reasons for these defects are many but quite often are due to flawed construction methods, unsuitable materials and lack of maintenance. The appearance of the roadway now bears little resemblance to what it looked like when it was initially constructed.

Width

The width of roadways depends on the number of cows in the herd, the general layout of the paddocks. If the roadways are the wide enough the herd will have sufficient room to move. Cows with enough space are less likely to push or be pushed. Typical widths of 3.7m to 5m are needed for herds up to 120 cows with wider roadways needed for bigger herds. If alterations to the width of roadways needs to be made the section closest to the parlour should be widened first.

The fence should be positioned no more than 450 mm (1½ ft.) from the edge of the roadway. This will prevent animals from walking along the grass margin. A track along the grass margin means that the fence is too far out and the surface of the roadway is probably poor also.

Many people feel that that roadways use up too much land. This is not the case; even an intensive roadway system will only take up between 1 and 2% of the grazing area.

Lameness

From the point of view of reducing lameness, it is essential to make and maintain a road that has a smooth, fine surface. Rough surfaces with protruding stones, gravel or pebbles lying on the surface are a major lameness factor. Research at Teagasc, Moorepark concluded that:

- The average number of animals which became lame per six month period (Jan-Jun or July-December) on 14 commercial dairy farms was between 12 and 16 per 100 cows. On individual farms the figure could be as high as 31 per 100 during any six month period.
- White line disease was the most common cause of lameness with sole ulceration being the second most common.
- Poor maintenance of roads with little use of top dressing with fine material increased the incidence of lameness. Thus, prevention of lameness at pasture entails maintaining roads in good condition
- The presence of concrete roadways on farms increased the incidence of lameness. Therefore, if concrete roads are used for cows, care must be taken to ensure that; the junction between the concrete and the roadway is maintained in good condition, the concrete is kept free of grit and run-off from the concrete should be diverted away from the roadway. A lip at the end of the concrete section may be useful
- Regular brushing/cleaning of the concrete may be required
- Holding cows for long periods on concrete before and after milking should be avoided

Roadway Construction

New farm roadways must be laid in good weather when soil conditions are dry. This is primarily to ensure that the roadway material does not mix or get pressed into soft soil.

Whether to lay the roadway directly on the soil surface or to remove a layer of topsoil first is open for debate. The best approach seems to be to remove a thin layer of topsoil before placing the roadway material. Topsoil contains pores, organic matter, is generally weak and is likely to deflect and shear under load. If it rains after removing topsoil it can create a costly mess, so if the weather is anyway dodgy remove the topsoil and cover with road material as you go. Stop work in wet weather. Resume work again when soil conditions are dry.

A roadway laid directly on the soil surface will, in the long run, be more difficult and costly to repair and maintain. Removing topsoil adds to the construction costs but if too much is removed the cost of the roadway will be very substantially increased. If too much soil is removed the finished roadway may end up being too low. The finished level of the roadway must be above the level of the field, otherwise drainage will be onto the roadway instead of off it.

In practice a lot of roadways are laid on the soil surface. This can work well in situations where the soil is strong enough to support the loads on the roadway without suffering deformation in use. Consider using a geotextile membrane between the road materials and the soil.

Geotextile

A geotextile is a synthetic porous fabric used to separate the foundation layer from the ground underneath. It prevents the stones from becoming mixed with the soil and vice versa. The geotextile keeps the roadway foundation layer material clean, free-draining and therefore dry and strong. Farm roadways can suffer considerable deformation in use and the role of the geotextile in this situation is to provide physical support, as well as separation.

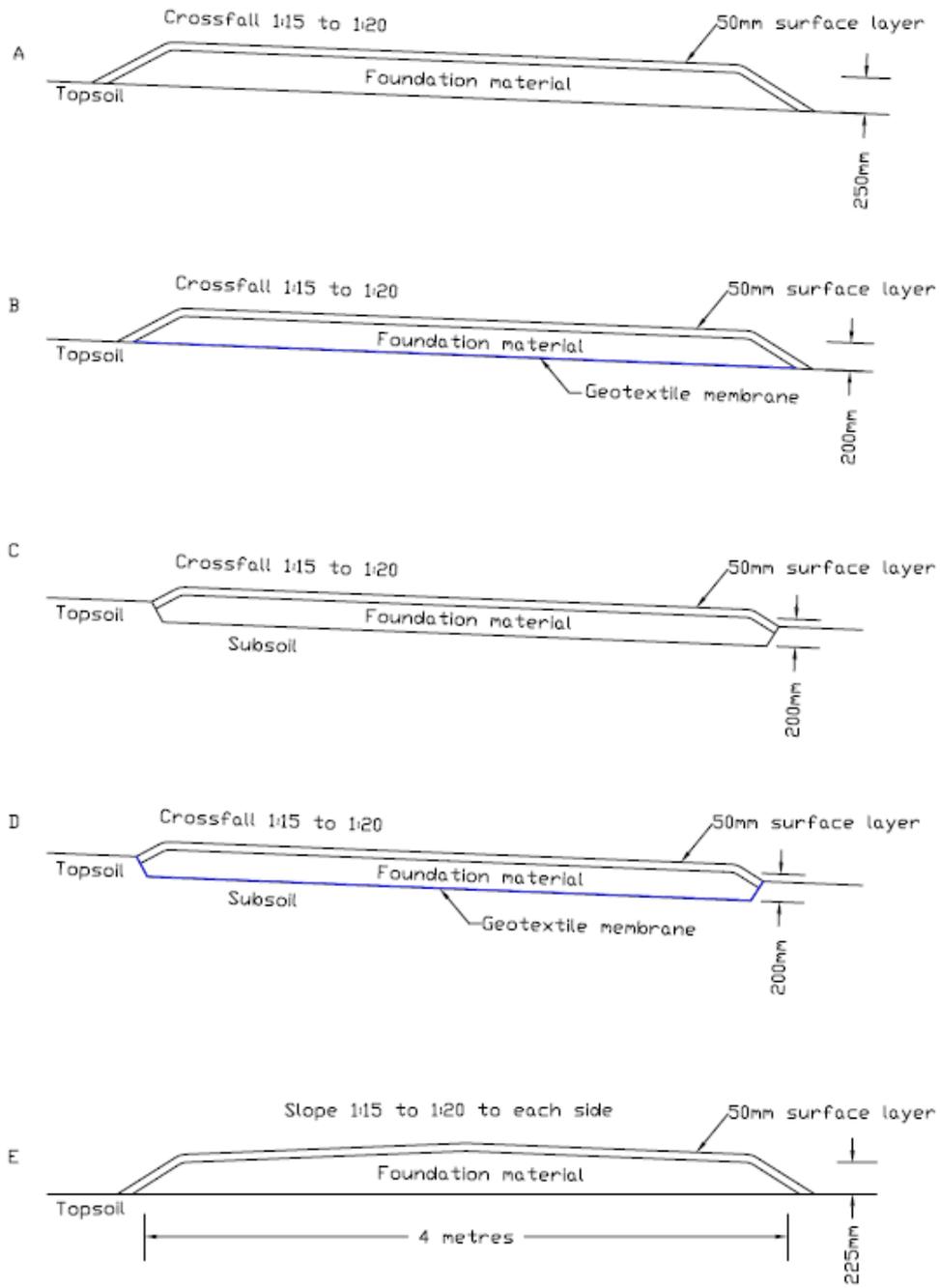
A geotextile is highly recommended where the roadway is being laid on topsoil and where ground is soft, wet, silty or clayey. It won't solve drainage problems; therefore any necessary drainage should be tackled beforehand. A geotextile also highly recommended on roadways used for heavy machinery.

A geotextile suitable for farm roadways costs about €0.75/ m² or €3 per metre run.

Construction options

Construction options for new farm roadways are detailed in the diagrams below. Diagram A illustrates a typical roadway laid directly on the soil surface. Diagram B shows a roadway on a geotextile membrane laid directly on the soil surface. Diagram C illustrates a roadway with the topsoil removed. Diagram D is the same as Diagram C with the inclusion of a geotextile membrane. This option would seem to be the best from construction viewpoint. Diagram E illustrates a roadway that slopes to both sides laid directly on the soil surface. The topsoil could be removed and/or a geotextile membrane used for this option also.

Farm Roadway Construction Options



Crossfall

Getting water off the roadway quickly will mean less maintenance by extending the life of the surface layer. Potholes will also be less likely to develop. To remove water quickly from roadways they should slope to one or both sides. A roadway that slopes to one side is easier to construct and machinery runs better on it. A crossfall of between 1 in 15 and 1 in 20 is about right. For a 4m (13ft) wide roadway with the fall to one side this would amount to a height difference of from 200-270mm (8-11 inches), or if the fall is to both sides the centre would be 100-135mm (4-5½ inches) higher than the sides. Water must not be trapped at the edge of the roadway; it must be shed completely and allowed to soak away in the soil.

Roadways on steeply sloping ground can be subjected to a stream of water during heavy rain. The 1 in 15-20 crossfall should be enough to divert this water away to the sides also, even where the ground falls considerably along the roadway. In existing situations on steeply sloping ground, where crossfalls are insufficient low ridges across the roadway every 50 metres or so will also divert the water off. Do not allow water to flow off at gaps, gaps are difficult enough to keep right, as it is, without adding to their problems.

Foundation Layer

A wide variety of locally sourced materials may be used as the main road material. If this material is available on the farm, so much the better, although some times it can cost more than expected to get it out.

This foundation layer is made up of granular fill material. The usual depth is about 200-250mm (8-10 inches). The biggest stones should be no bigger than about one third of the thickness of this layer. The intended slope should be formed in the foundation layer. This means that the surface layer will have the same slope and an even thickness.

Generally, 75 or 100 mm (3 or 4 inch) down material is used. This is a graded mixture of different sized stones from 75 or 100mm down to dust. Crushed rubble can also be used. Compact with a vibrating road roller before the surface layer is spread. Compaction interlocks the material to give a stronger roadway and helps prevent loose stones from mixing with the surface layer.

Surface

The roadway should be completed with about 40-60mm (1.5-2.5 inches) of a fine material. This surface layer or wearing course needs to be laid evenly and compacted. Spread it out to the slope formed in the foundation layer. The material used should ideally have only a very low proportion of pebbles and plenty of very fine and dusty material into which the small pebbles can embed. Any pebbles should be no bigger than 5 or 6mm. It will bind and compact better if it is laid and rolled when damp. The finished surface is impermeable to water; hence the importance of having a fall to one or both sides of the roadway.

Many different types of fine material can be used for the surface layer e.g. shale dust (slig), red sandstone dust, greywacke dust, etc. The type available locally depends on the type of rock in the quarries. Go and see the heap of dust for yourself so you can

choose what you want. Limestone dust can also be used; however, the very fine material in the limestone dust tends to dissolve away in the rain.

Repairing an Existing Roadway

Roadways should be repaired as necessary - probably needing some attention every year. Pay particular attention to the most used part of the roadway, especially the first 50-100 metres near the parlour.

Typical areas that require ongoing attention are drainage outlets, water diversion ramps/channels, filling potholes and adding extra surface material to rough areas. Roadways that are in a bad state will need a major repair job to get them right. Remove any grass and clay from the edges and the centre. If the roadway is lower than the level of the field it will have to be raised. If there is no crossfall, one will have to be created.

Generally, 40 or 50 mm (1½ or 2 inch) down granular fill material is used to raise the level. If it has to be raised a lot you may have to use 75mm (3 inch) down. This granular fill should be laid to the falls of the finished surface. Finish off with a suitable surface material and compact.

Costs

A 4.0m wide roadway, with 0.3m depth of material and will need one 25 tonne load to cover each 9-11metres in length. This assumes a density of about 2 tonnes per m³ for the material used. A similar sized load would cover 60-65 metres with a 50mm surface layer. The price of road making material both crushed stone and dust for the surface is between €5 and €8.00 plus VAT/tonne, depending on supplier. A typical contract price for a 4 metre wide roadway, laid on the surface of the ground, is around €18 to €22 plus 13.5% VAT per metre run for supplying materials and laying the roadway.

Cow Tracks

Cow tracks can be installed as extra roadways, as spur roadways off the normal wider roadways or at the end of the main farm roadway. They are useful for getting access to out of the way paddocks, to silage ground and making grazing management easier early and late in the season.

A depth of about 150mm of material is laid on the surface of the ground. This should be compacted and topped off with a fine surface layer. The surface layer should be compacted. A width in the range of 1.4 to 1.8 metres is the norm.

Suggestions to save time and reduce lameness

- Put in two gateways to paddocks to reduce gateway wear and tear
- Site water troughs in paddocks away from gateways and roadways
- Carry out regular roadway repairs. Aim to maintain the surface layer
- Take sharp corners out of farm roadways and fence them as broad curves
- Critically watch the cow movement and remove restrictions and distractions to cow-flow
- Remove trees that shade the roadway causing dirty wet surfaces

- Get cows to enter collecting yards towards the rear. This preserves their social order for milking. It also lines up the cows for milking
- Keep pebbles and stones off concrete yards
- If stones on the collecting yard are a problem consider a solution such as a load of sawdust or a timber board at the roadway yard junction
- Allow cows to move along roadways at their own pace to minimise lameness. This also keeps the cows calm
- Slow down with farm machinery and keep tractor use on roadways to a minimum