The Farm Roadway Visual Assessment Booklet

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An Roinn Talmhaíochta, Bia agus Mara
Department of Agriculture, Food and the Marine

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Disclaimer

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INTRODUCTION

On farms in Ireland, internal roadways come in many shapes and sizes, with a variety of hard surfaces. These farm roadways often facilitate surface water flow along them for short periods during and after rainfall; this is termed roadway runoff. Unfortunately farm roadway runoff can also transport significant deposits of animal manure, urinate and machinery contamination and discharge them to adjacent waters such as streams and ditches. Such pollutant loads contain suspended sediment, dissolved nutrients (nitrogen and phosphorus) and bacteria such as E. coli and can result in significant deterioration of surface water quality. The loss of nutrients to watercourses can negatively impact water quality. In rivers, nitrogen and phosphorus loss can result in excessive plant and algal growth. This reduces the amount of oxygen in the river and suffocates sensitive fauna. Excessive fine sediment in a river can smother the streambed habitat and clog the gills of many sensitive mayfly species. From a human health perspective, bacterial contamination of watercourses is a significant issue,
particularly in the context of drinking water and bathing water quality. To safeguard water quality therefore, farm roadway runoff should be prevented from directly
entering waters

This handbook aims to describe visual assessment indicators that can be used to…..

a) Identify the extent of connectivity (direct or indirect) between roadway runoff and waters. This is of upmost importance as roadways near waters are potentially a high pollution risk and need to be identified and assessed as a priority;

b) Examine the structure and configuration of the entire roadway network and evaluate its pollution risk potential.

All visual indicators can be used to document areas where future farm roadway management will be needed. Routine assessment of farm roadways allows for improved management and maintenance; it is hoped that this handbook will provide a practical and useful guide for the management of any internal farm roadway network. Users of this guide should be aware that the European Union (Good Agricultural Practice for Protection of Waters) Regulations 2017 (S.I. No. 605 of 2017), Article 17 (20) states: "There shall be no direct runoff of soiled water from farm roadways to waters from 1 January 2021. The occupier of a holding shall comply with any specification for farm roadways specified by the Minister for Agriculture, Food and the Marine pursuant to this requirement". This new rule applies to all farms and every type of road, not just those used by animals. It should be noted that the definition for "waters" used in the present guide matches that of the current regulations (S.I. No. 605 of 2017).

See Appendix I of this booklet for frequently asked questions on these regulations and Appendix II for notes on farm roadway construction.

'waters' as defined in S.I. No. 605 of 2017:

'waters' includes-

a) any (or any part of any) river, stream, lake, canal, reservoir, aquifer, pond, watercourse, or other inland waters, whether natural or artificial,

b) any tidal waters, and

c) where the context permits, any beach, river bank and salt marsh or other area which is contiguous to anything mentioned in paragraph (a) or (b), and the channel or bed of anything mentioned in paragraph (a) which is for the time being dry, but does not include a sewer.

USE OF VISUAL ASSESSMENT INDICATORS

What are visual assessment indicators?
These are recognisable features that help identify connectivity between roadway runoff and waters. Additionally, visual assessment indicators identify sections of roadway that may need improvement.

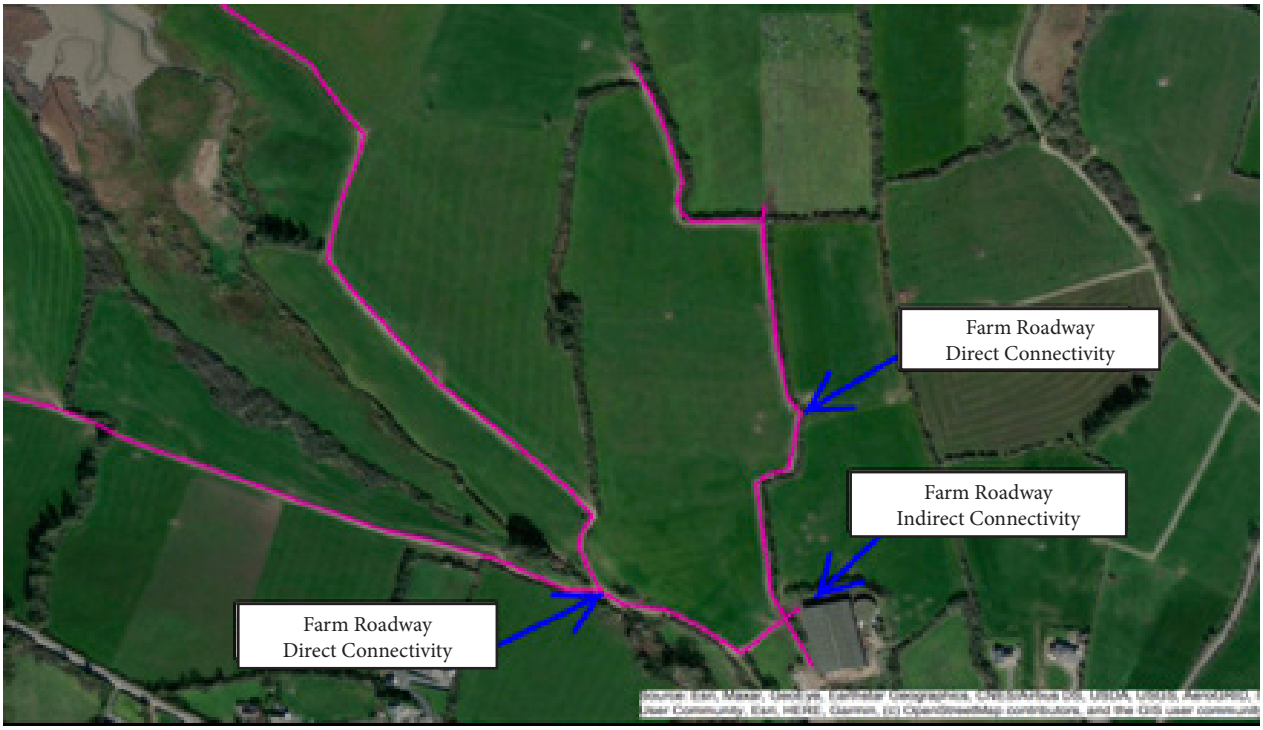
What is the first step?
This step identifies priority areas for runoff management away from waters.

Firstly, print off a farm map (e.g. Land Parcel Identification System, LPIS), satellite image or sketch out your own map of the farm/farm roadway network.

Secondly, walk the roadway network and using TABLE 1 find and note where direct connectivity occurs between roadway runoff and waters (see definition for waters in introduction) on your map. This exercise is best carried out during or immediately after a rainfall event, when farm roadway runoff is visible. Repeat over time.

FIRST STEP OUTPUT

Below is an example of a printed off satellite image of a farm noting all of the connections with waters.



FIRST STEP OUTPUT (CONT)

TABLE 1: The following table illustrates direct connectivity points where roadway runoff enters waters, the impact of this connectivity and the associated visual indicators.

Direct roadway runoff connectivity with waters established by identifying……	Impact
…runoff directly entering waters located beside the roadway	Transfer of sediment, nutrients and bacteria and to waters
…runoff directly entering waters below the roadway, at a bridge or culvert	

Visual Indicator	Photographic Example
Visible flow of roadway runoff during rainfall events, into waters; formation of permanent runoff channels or rills on roadway; visible discharge points	
	
At a bridge crossing, runoff channels on both sides and on bridge itself. Colour of waters affected by roadway runoff containing faeces and sediment.	
No barrier to break direct connectivity of roadway runoff with waters at a bridge	

FIRST STEP OUTPUT (CONT)

The following table illustrates indirect connectivity points where roadway runoff enters waters, the impact of this connectivity and the associated visual indicators.

Indirect roadway runoff connectivity with waters established by identifying……	Impact
….runoff indirectly entering waters from a farm roadway via a public roadway.	Transfer of sediment, nutrients and bacteria to waters when road is soiled.
….runoff from a public roadway indirectly entering waters via a farm roadway.	Transfer of sediment, nutrients and possibly bacteria to waters.
…runoff from an underpass via channels or connecting roadways.	Transfer of sediment, nutrients and bacteria to waters.
…runoff from a farmyard via connecting roadway	Additional soiled water due to increased effective area of farmyard.

Visual Indicator	Photographic Example
Evidence of flow from farm roadway onto public roadway and into waters, during rainfall events. Runoff channels and rills, discharge points present on public roadway.	
Evidence of flow from public roadway onto farm roadway and subsequently into waters. In this example during a rainfall event runoff from public road enters drain inside the farm gate.	
Evidence of flow from an underpass to waters. Direct connection may be at end of infrastructure.	
Flow from upslope roadways entering farmyard.	

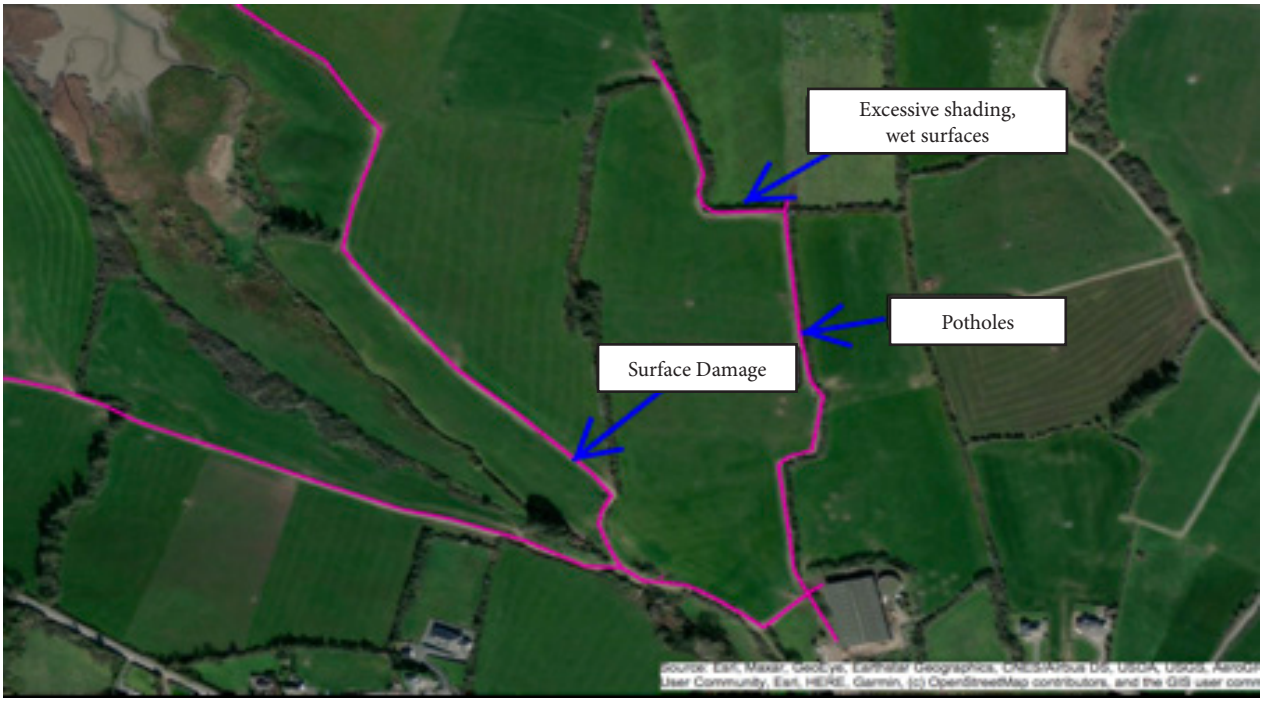
WHAT IS THE SECOND STEP?

This step will enable you to note sections of the roadway network that are problematic because of the structure or configuration of your network.

Using the same or a new map or sketch, note other visual indicators as presented in TABLE 2 for your roadway network. Take a look at the condition of your farm roadways for defects that may be causing problems. These relate to roadway structural deficiencies (see examples next section) which lead to poor roadway integrity and loss of sediment. Roadway configuration deficiencies (e.g. road too narrow, sharp bends, obstructions such as drinking troughs and inappropriately located gates or gaps) may also be evident and these can reduce the speed of animal movement and increase the level of soiling (i.e. create nutrient and E. coli sources) on the roadway. When it rains, such deposits can become temporarily mobilised and enter waters where direct or indirect connectivity exists. The occupier of a holding with farm roadways must comply with the minimum specification for farm roadways (Current specification S199, July 2020).

SECOND STEP OUTPUT

Below is an example of a printed off satellite image of a farm noting other visual indicators along the roadway network.



SECOND STEP OUTPUT (CONT)

TABLE 2: Additional visual indicators that indicate structural and configuration problems.

Problems	Visual Indicators
Structural problems can lead to insufficient foundation due to shallow depth of material or soft soil. Other structural aspects to consider are poor quality roadway material or use of poorly bound roadway materials.	Roadway sinking into subsoil, becoming progressively more pronounced with repeated animal and farm traffic loading. This causes sinking of roadway, uneven gradients, breakthrough of soil. Animals may be forced to walk in single file due to discomfort caused by poor surface conditions. This can contribute to problems with lameness.
	Failure of materials leads to structural breakdown of road surface and evidence of runoff rilling.
	Breakdown of unconsolidated material.
Structural and configuration problems may slow down animal flow.	Animals slow, soiling of roadway surface as full roadway width is not in use, this may lead to pot holes.

Photographic Example

SECOND STEP OUTPUT (CONT)

Problems	Visual Indicators
	Pot holes specifically around drinking troughs. This causes animals to slow, increasing soiling of roadway surface. Note: A farm with a grassland stocking rate over 170 kg N/ha must have livestock drinking points at least 20 m from watercourses (regardless of a barrier like a roadway or hedgerow between the trough and the watercourse). Animals cannot be given access to streams for drinking.
	Animal hoof prints. Evidence of animals slowing and soiling of an overly soft or dirty roadway surface. Poor quality roadway material or accumulation of dirt/muck.
	Same problems as above but this time due to machinery. Poor quality roadway material. Breakdown of surfacing material from the action of traffic, frost and rain. Roadway is not elevated above field surface so surface drainage not accommodated.
Configuration problems can lead to excessive roadway gradients	Build up of soiled runoff at bottom of slope with no diversion into a field. Scouring of roadway surface.

Photographic Example

SECOND STEP OUTPUT (CONT)

Problems	Visual Indicators
	Evidence of wheel rutting and surface scouring. Promotes runoff along roadway length to further increase surface scouring and prevents runoff into field.
Configuration problems due to tight bends	Evidence of animals slowing and soiling of roadway surface. Also evidence of wheel rutting.
Configuration and structural problems may lead to ponding.	No relief or crossfall on the roadway causes ponding. Buffer (Grass margin) here is <1.5 m and not considered enough to stop direct connectivity to waters. Ponding can lead to connectivity with waters.
	Combination of ponding and wheel rutting evident.

Photographic Example

SECOND STEP OUTPUT (CONT)

Problems	Visual Indicators
Configuration problems leading to excessive shading.	Natural shading of roadway with vegetation. Shading prevents roadway from drying out after rainfall events. This causes problems over time.
	Man-made feature shading beside farmyard, exacerbating surface wetness and erosion. Prevention of surface from drying and soiled surface leads to problems over time.
Configuration problems leading to elevation of roadway below surrounding land.	Roadway level same as the surrounding land does not enable roadway runoff management. For sections that have connectivity with waters this should be noted on your map. Entry of runoff to waters can be further along the roadway.
	Roadway lower that the surrounding land and does not enable roadway runoff management where connectivity to waters occurs. For sections that have connectivity this should be noted on your map.

Photographic Example

WHAT IS THE THIRD STEP?

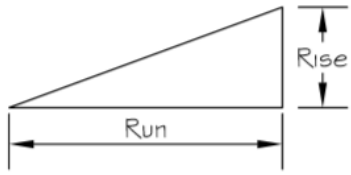
Other pieces of information should now be gathered for areas you have identified on your map in Steps 1 & 2. These should be added to your final map.

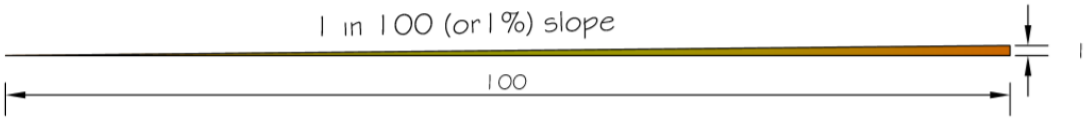
Gradient (% slope) along the length of a farm roadway:

This is estimated by dividing the difference between the elevations of two points by the distance between them and then multiply the result by 100.

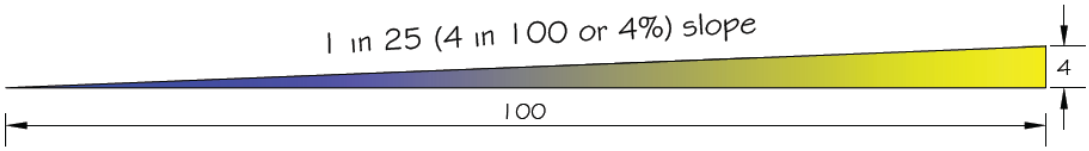
- The difference in elevation between points is called the rise.
  The distance between the points is called the run.
- Percent (%) slope equals (rise / run) x 100.
- Document this figure on your map
  E.g. 1% (gentle), 5% (moderate) or 10% (significant)

Illustration of roadway gradients

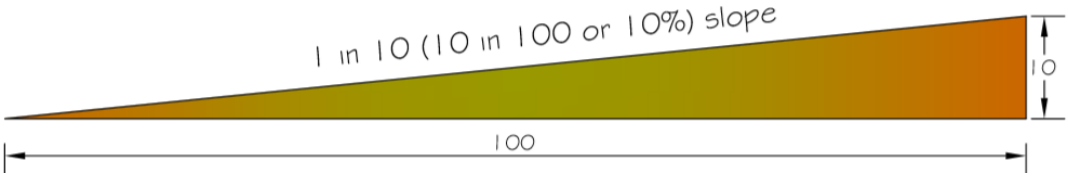




Example of 1 in 100 (1%) slope. This would be classified as a gentle slope



Example of 1 in 25 (4 in 100 or 4%) slope. This would be classified as a moderate slope



Example of 1 in 10 (10 in 100 or 10%) slope. This would be classified as a significant slope

Crossfall (also called camber) of a farm roadway:
Some roadways near waters may have a level or sloping crossfall towards waters which creates potential connectivity. It is extremely important to ensure a road has a good crossfall **away** from waters.

The life of the roadway will be extended by removing surface water as quickly as possible. This can be achieved by providing a crossfall of between 1 in 15 and 1 in 20 to one or both sides of the roadway, ensuring that potholes are less likely to develop with consequent reduction in maintenance costs. A roadway that slopes to one side is easier to construct and machinery runs better on it.

However, where there is a considerable gradient along the length of the roadway, the crossfalls may be insufficient on their own to prevent scouring due to fast flowing surface water. In such cases, additional measures such as low ridges, cut-off drains and shallow channels may be needed at intervals across the roadway, to divert the surface water to a non-connected area (e.g. field) before it builds up volume and momentum.

Roadway width:
The width of roadways depends on the number of cows in the herd. Guidance on standard sizes is given in TABLE 3.

TABLE 3: Herd size and corresponding roadway width (m)

Herd size	Roadway width (m)
50	3.5
100	4.0
150	4.5
200	5.0
250	5.5
300	6.0

TABLE 3 will help you decide if roadway sections are too narrow. A stock proof fence should be positioned about 0.5 m from the edge of the roadway. This will allow cows to utilise the full width of the roadway while at the same time prevent them from walking along the grass margin. A cow track in the grass margin usually means that the fence is too far out and the surface of the roadway is likely to be poor also.

Presence or absence of a buffer (riparian zone):
The 'area' between the roadway and waters, termed a buffer, is important as it can disconnect roadway runoff from waters. If this land is maintained in permanent vegetation next to waters, it is termed a riparian buffer and provides a physical barrier that helps prevent runoff from being washed from roads/fields into waters. The establishment of a dense grassy buffer strip either by Natural regeneration or sowing will provide help intercept surface run-off all year round. Sowing is generally best for quicker establishment.

A minimum 1.5 m wide buffer strip is considered suitable to disconnect roadway runoff with waters, while a buffer width less than 1.5 m or the absence of a buffer is considered unsuitable.

Note width (metres) of the buffer and its location on the map (see TABLE 4).

TABLE 4: Examples of buffer width and the corresponding connectivity

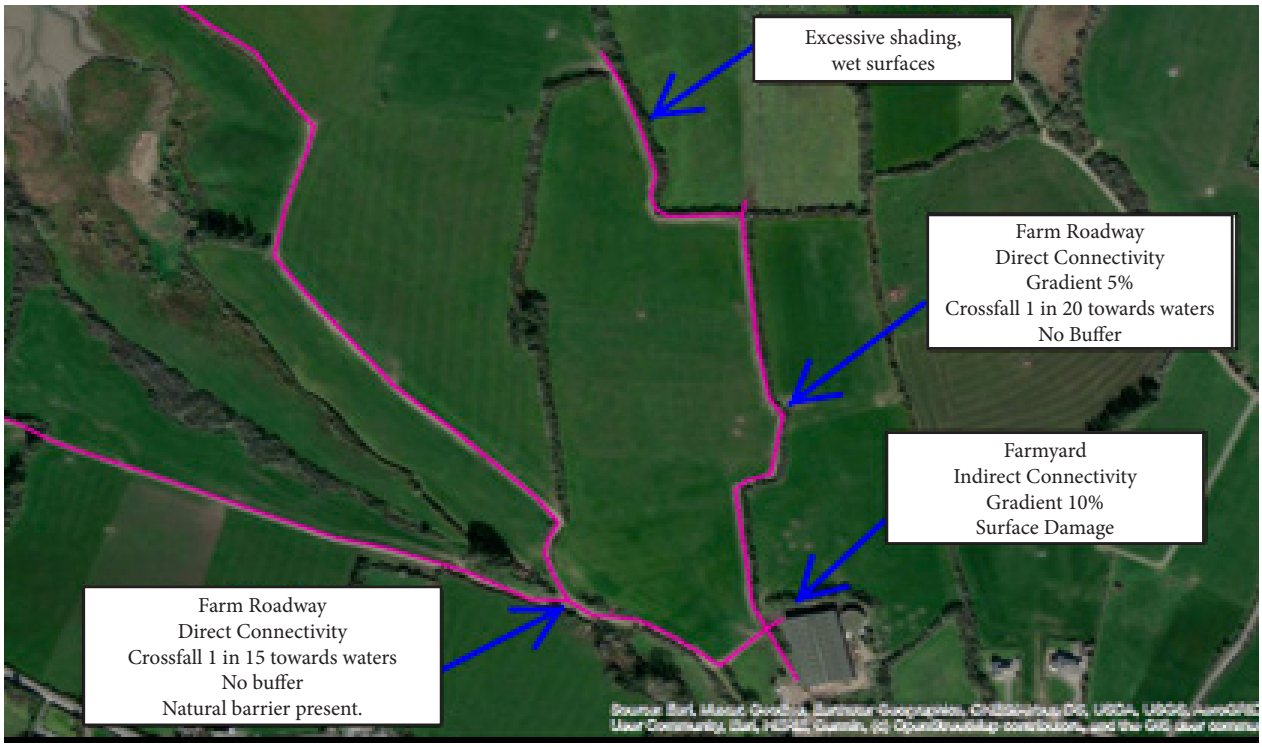
< 1.5 m indicates NO BUFFER with connectivity between runoff and waters.	1.5 m indicates BUFFER which breaks connectivity to waters.	> 1.5 m indicates BUFFER with high dis-connectivity to waters.
		
		e.g. field or wide riparian zone

Naturally or manmade occurring features:
It is important to note on your map where natural or man-made barriers occur that may prevent management options. In such cases more specific options such as roadway relocation or removal of the barriers may be considered.

Subsoil	Bedrock	Man-made
		
Watercourse on left with no stock proof barrier and exposed compacted subsoil on right.	Watercourse on left with stock proof barrier and bare rock on right.	Wall on right. Other examples could be a building or a storage facility. Especially relevant to note where waters are on opposite side.

FINAL OUTPUT

Here is a simple example of combining all the information gathered in Step 1 and 2 and noting some additional information where appropriate.



Appendix I

Frequently Asked Questions (FAQ) Nitrate Regulation

New Measures effective from 01/01/2021

- Applies to all farm (if farm roadways present on farms)
- The following is applicable to all holdings regardless of stocking rate.

ROADWAYS Prevention of direct discharge from farm roadways - Article 17.20 "There shall be no direct runoff of soiled water from farm roadways to waters from 1 January 2021.

The occupier of such a holding shall comply with the minimum specification for farm roadways." (Current specification S199, July 2020).

Q. What are the minimum specifications for farm roadways?
A. The minimum requirements are outlined in Specification S199 which is available on DAFM website under 'Farm Buildings' webpage.

Q. What is the requirement for new roadways?
A. In the case of new roadways, a minimum buffer of 1.5m shall be kept between waters and the farm roadway and incorporating a fence 1.5m from the edge of waters. The new road shall be cambered towards the field. Fencing on the opposite side is also a requirement i.e. fencing both sides of the roadway is a requirement

Q. If there is a possibility of direct runoff of soiled water from a roadway to waters, what action is required?
A. In all cases where there is a possibility of direct runoff of soiled water from a roadway to waters, the relevant sections of roadway shall be cambered/oriented away from waters. This applies even where the roadway is currently flat (with no camber present). Cambering is a prerequisite for compliance with the regulation (Article 17.20). Additional options may subsequently be required so as to comply fully with the regulation.

Q. What is required for compliance with the regulation (Article 17.20)?
A. Where a roadway needs to be adjusted to render it compliant with the regulation, cambering is a necessity in all cases. This may be sufficient on its own in some cases, but where not, additional options may need to be employed for compliance with the regulation; these options are detailed in the specification S199.

Q. Does run-off have to be directed to a soakaway (cross-fall of passageway is towards waters e.g. stream)?
A. Where the cross-fall of passageway is towards waters e.g. stream, the cross-fall must be altered to orient it away from waters.
A soakaway is one of a number of options available to deal with soiled water in preventing it from entering waters directly from the roadway. In all cases, the cross-fall must be oriented away from waters.

Q. Where a roadway exists alongside waters (e.g. watercourse) is it ok to camber road away from waters and have the earthen bank between the road and waters with a fence erected at field side of roadway?
A. Yes, but only on the basis that the earthen bank is successful as a stock-proof barrier. If not, a fence is also required on this side of the roadway.

Q. Do existing roadways, running parallel with waters have to be repositioned to comply with 1.5m buffer rule?
A. No, however fencing on both sides of the roadway is a requirement.

Appendix II

The occupier of a holding with roadways must comply with the minimum specification for farm roadways (Current specification S199, July 2020).

Notes on 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. Ideally remove a thin layer of topsoil before placing the roadway material. Be careful not to remove too much topsoil as the depth of the roadway will have to be increased to bring the roadway surface above field level. 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.

This foundation layer is made up of granular fill material. The usual depth is about 200-300 mm (8-12 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 100 mm down to dust. Crushed rubble can also be used. Compact with a vibrating road roller before the surface layer is spread. Compaction inter-locks the material to give a stronger roadway and helps prevent loose stones from mixing with the surface layer.

Geotextile

Consider using a geotextile membrane between the road materials and the soil. 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 material clean, free-draining and therefore dry and strong. A geotextile is highly recommended where soil is heavy or wet. It won't solve drainage problems; therefore, any necessary drainage should be tackled beforehand. A geotextile is also highly recommended on roadways used for heavy machinery. A geotextile suitable for farm roadways costs about 75 cent/square metre.

Surface layer

The roadway should be completed with about 50-75 mm (2-3 inches) of a fine material on the surface. If the surface is poor most of the benefits of having a farm roadway are gone. The surface layer needs to be laid evenly and compacted. Spread it out to the slope formed in the foundation layer. Many different types of fine material can be used for the surface layer.

Cross fall/ slope	1:25 one sided slope, 1:15 two sided slope
Construction	Geotextile (optional) 200 – 300 mm hard core plus 50-75 mm fine material
Cow walking speed	2-3 km/hr on good road surface
Road slope	Max of 3:1
Fencing	50 cm from edge of road
Approx. cost	€18 – 30 / metre

Costs

A 4.0 m wide roadway, with 300 mm depth of material will need one 25 tonne load to cover a length of approximately 10 metres. This assumes a density of about 2 tonnes per m3 for the material used. A similar sized load would cover 45-50 metres with a 63 mm (2½ inch) thick surface layer. The price of road making material, both crushed stone and dust for the surface, is typically €7-10 per tonne plus VAT. As the construction material amounts to over 80% of the overall cost, strict control over the depth and width of the roadway, in line with needs and good construction practice, is essential. Farm roadway costs range between €4.00 and €7.50 per square metre. Calculate costs in advance and monitor progress. VAT is refundable on new farm roadways but not on repairs.

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 m near the yard. This area can get very dirty, worn and low. This dirties stock coming in and going out, leading to management issues and potential health problems. It also predisposes foot disorders.

Typical areas that require on-going 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 75 mm (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.

Cow tracks/Spur roads

A depth of about 150 mm of material is laid on the surface of the ground. This should be compacted and topped off with a fine surface layer and the surface layer should be compacted also. The width should range between 1.8 m and 2.5 m, costing €8-€11 /metre run.


ROADRUNNER