4.1 Yards and laneways

Holding yards, tracks and laneways need to be well planned to cater for intensification and for increasing regulation of the environment. A good, well-drained foundation is essential. The planning should involve sourcing information from other farmers, farm planning consultants, dairy system designers and earthmoving contractors. Involving these people in the decision-making process can be advantageous, as strangers to a site can come up with innovative solutions.

Surface conditions and the resilience of the surface under stock traffic are usually overemphasised in extension notes. This overemphasis derives from the role of surface conditions in lameness, hoof damage and all-weather access during wet weather. Better practice favours an appreciation of farm drainage and optimising the use of earth available on farm before using pavement or surface material.

To assist farm planning, an aerial photograph of the farm, a topographic plan with a contour interval of 1 m and a soil map are invaluable; if available, a geophysical survey plan is also useful (this is usually referred to as an EM survey plan). Geographical information system (GIS) data can be used to calculate the area of subcatchments on a farm to assist drainage design. Farm planning is a useful group exercise, particularly if neighbours are involved: the involvement of neighbours offers better prospects for integration of plans to control erosion and divert contaminated runoff. If waterways traverse the property and are crossed by roads, the size of culverts used by local road authorities can serve as a gauge for farm works. If possible, runoff should be delivered under or around holding yards, tracks and laneways via diversion banks, drains and culverts. The less water on the facility or draining off it, the easier will be surface management.

Planning approval may be required for farm earthworks, particularly if they are sited on a flood plain. In Victoria, excavations to increase farm water storage capacity need the approval of the regional water authority. Earthworks can lead to substantial landscape modification.

Laneway alignment

Where a new track or laneway is proposed or yards need reconstruction, the following points should be considered.

Terrain

The information obtained from an overview of the terrain is invaluable since the direction of the natural drainage can be studied. The best location for a track or laneway is obviously one which is not too steep, not liable to flood and permits all-weather access. In the alignment of all tracks and laneways, certain definite localities, or fixed points, on the alignment need to be set (e.g. a gap in a line of hills, the best point on a watercourse for a bridge, the best point on a stream for a ford or culvert, soaks or spring lines, soft ground, trees to avoid, shaded areas). The fixed points are determined first, and the track or laneway is then designed to run as directly as possible between one fixed point and the next. However, the laneway will not necessarily run in a straight line between these points, as a laneway should follow ridge alignments or catchment divides. This allows the natural drainage of the area to fall away from the laneway, reducing the cost of bridges and culverts and resulting in a more stable construction. Where hills or spurs obstruct or project into the line of the laneway, it is usually better to go around them rather cut through them. It is useful to allow a deviation equal to 20 units in length for every unit in height of the hill avoided. For example, if a hill is 10 m high, up to 200 m might be added to the length of the laneway to avoid it. Otherwise, the straightest and shortest route is the cheapest and best.

Natural stock movement

When investigating the route of a new track or laneway, examine stock movement patterns in detail, as it is easier to move stock along an alignment they have naturally selected, providing this is compatible with other requirements and with overall farm planning. This can involve the avoidance of hills and natural obstructions.

Drainage

Drainage is discussed in detail below. However, in siting, it is important to note all watercourse and drainage line crossings and the extent of any areas liable to flooding or inundation.

Slope

Set and adhere to the maximum and minimum slopes for tracks and laneways. The maximum slope should be 1 in 10 (10%), but its length must be short; for a long section, the maximum slope should be 1 in 20 (5%). Steeper gradients of 20% or even 33% can be encountered in mountainous terrain but should be avoided if at all possible.

Switchbacks

Switchbacks might be necessary in steep country, but wherever possible stock movement should avoid these. Usually dairy cows like to go in the same direction and to follow a defined movement pattern, which can be disturbed if animals appear to be going against the flow.

Foundation

Aim to source the material to serve as the surface and subsurface components of the laneway on site.

Shading

Observe the location of trees and sheds and the way these influence shading, as shading and tree roots can cause deterioration of a laneway.

Width

Take every opportunity to observe the proposed line of the laneway from adjacent vantage points, making sure that adequate width is allowed. Kilndworth *et al.* (2003) provide recommendations on the configuration for a range of herd sizes.

Drainage

An integrated drainage system for holding yards, farm tracks and laneways is essential; appropriate drainage may render a bad track good and a poor surface viable. It is necessary not only to divert the runoff from the surface of a track or yard, but also to block runoff from adjacent surfaces. If the track is well sited, the natural drainage of the land may be sufficient, as for example a track on a ridge. In any case, interfere with the natural drainage as little as possible. As the resistance of a track surface depends on the moisture content of the soil (the track must not be too wet or too dry), the degree to which drainage should be carried out has to be assessed. Surface and subsurface drainage techniques are explained below. The main concerns are cost and the fate of the runoff.

Surface drainage

A topographical map with contour plans can be used to plot a trial alignment. In rolling country, a design gradient range of 2% to 5% is usually appropriate. Avoid a flat laneway section unless it has an adequate camber or cross-fall to parallel drains; the desirable minimum design gradient of a laneway is 0.02%. In flat country, excavation is often required to build up the laneway so as to aid drainage, preferably with a cambered surface. Borrow areas should be located close to the proposed route of the laneway and capture runoff from it. Standard road design practice can be used for aligning laneways on large farm plans, particularly if future subdivision is mooted.

Surface water passes from the track to shallow gutters, and thence through dished drains to table drains. For those parts of the landscape where the surface falls away from the track, table drains can be omitted, and the gutter can drain into the paddock. Sandy soils do not need much surface drainage. Where table drains are necessary, and that is usually apparent, they must not be built at the edge of the track: allow at least 3 m (or, better, 5 m) between the track and the drain. Table drains (ditches) should be wide and shallow, and preferably vegetated and capable of being mown. The soil excavated from them should be spread well back so that it does not wash back into the drain. Table drains should spill into watercourses or drainage lines or into low places which fall away from the track or laneway. Sediment traps may be required; pollution control agencies encourage these in association with wetlands, or at very least diversions to paddocks rather than direct discharge to a watercourse.

The gradient of a drain is important: if it is too steep, the water will erode a drain into a deep chasm; if it is too flat, silting will occur. Guidelines on drainage design can be found in Underwood (1995). Design criteria are now under review in response to climate change modelling, which indicates that average annual rainfall in southern Australia will decline but higher-intensity fall will increase. If the gradient is too steep, erosion control barriers (or steps) should be built across the drain at frequent intervals to retard the flow and allow sediment to be deposited. Many tracks and laneways have been destroyed because the side drains that were meant to protect them were badly sited, sized and levelled.

Subsurface drainage

Subsurface drainage takes the form of either pipe-less drains (mole drains) or, more commonly, slotted HDPE or uPVC pipes installed below the natural surface. The size and depth are based on the desired depth for water table control, but the spacing is largely dependent on soil profile characteristics and rates of extraction. The pipes discharge by gravity to an outfall or a pumped sump. From here, leachate can be applied to land or discharged to a receiving waterway, as long as nutrient levels are not excessive. The recommended minimum diameter for an HDPE subsurface drainage pipe is 80 mm.

Fate of leachate

Runoff, especially from stock bridges, should not be allowed to discharge directly to a waterway or to a permeable stratum. It is preferable to mount bridges on abutments above the level of the bank and provide a slope to direct the drainage back to the abutments. This runoff should be channelled to sediment traps or paddocks rather than the waterway. Transverse drains are commonly used to direct runoff away from waterways and to direct laneway runoff from bridges.

Where a stock underpass is built, it is essential to locate that a transverse drain at the top of the exit and approach ramps to divert catchment and laneway runoff from it. A transverse drain consists of either a grated gutter or, preferably, a trafficable bund. Underpass drainage is a specialist area, and as underpasses form a retaining wall, they are commonly designed to weep to provide pressure relief. A dewatering sump is sometime installed to collect subway leachate and direct it back to the natural surface for safe disposal.

Construction

Site preparation

Where a laneway or a holding yard is to be established, clear the site of all trees, shrubs and stumps and pull out all tree roots to a depth of at least 300 mm below the natural surface, and remove them from the site: no vegetation should be incorporated into the earth to be used for construction. Because of its high organic matter content, topsoil is unsuitable for compaction, so all topsoil must be stripped from the surface to a depth of at least 150 mm and removed from the site.

Prepare the foundation to form a satisfactory surface for the placement of layers of selected material.

- Ensure that the surface is well-drained, with a slope exceeding 0.02%.
- Place and compact suitable material into any holes or depressions resulting from the removal of tree stumps and roots.
- Scarify or rip to a depth of at least 150 mm. If the exposed foundation material does not comply with specifications, further excavation will be required.
- Water to suppress dust.
- Compact to increase the density of the foundation material.
- Walk the area to ensure that all foreign material has been removed and to locate any potential areas of concern for subsequent remedial treatment.
- Lay crushed rock, rather than sand, to a depth of 200 mm.
- Ensure that no sharp rock sits proud of the surface.

Constructing the pad

Following preparation of the foundation, the pad (i.e. the compacted fill forming the desired slope) can be constructed. All fill placed on the pad must be within ±2% of the optimum moisture content (specified by laboratory testing or experience) and placed in progressive horizontal layers with a uniform thickness of not more than 200 mm before compaction. Wrigley (1996) provides more information on pad construction. Pads for yards and laneways do not have to provide an impervious surface; their main objective is to provide stable support for concrete and traffic.

Optimum moisture content

The moisture content of all material placed in the pad must be within ±2% of the optimum moisture content required to produce the maximum dry density when compacted in accordance with AS 1289 (Standards Australia 2000).

As a guide, the required moisture content for clay is as wet as can be rolled without clogging a sheep's-foot roller. The moisture content of clay can assessed by rolling a sample of it between the hands. If it can be rolled to spaghetti thickness without breaking, it should be satisfactory, particularly if it starts to crumble at the ends.

If water has to be added to achieve the required moisture content, add it to the borrow area to allow even distribution throughout the material *before* excavation. To achieve effective water distribution, rip the surface of the material in the borrow area before watering. Water can be added following placement on the pad, but only when it is not possible to add all the necessary water in the borrow area. Never place dry material on the pad. Generally, if dust is generated during placement of fill, the fill is too dry.

Compaction

Compact each layer of material to produce either a field dry density of at least 95% of the standard maximum laboratory dry density determined in accordance with AS 1289; or a Hilf-density ratio of at least 95% when tested in accordance with AS 1289.

This degree of compaction may generally be achieved in clay by rolling each layer at least eight times with a sheep’s-foot roller. As a guide, compaction of clay will generally be sufficient when there is a clearance of 100 mm between the drum of the roller and the compacted material.

Maintenance

Periodically scrape packed manure from the surface of yards and laneways for storage and reuse. But leave a residue rather than expose the surface of crushed rock or clay.

References

Klindworth, D., R. Greenall & J. Campbell (eds.) 2003, *Cowtime guidelines for milk harvesting*, Dairy Research and Development Corporation, Melbourne.

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