- *Build permanent drain crossings before planting.*
- *Do not drive through drains that are carrying water.*
- *Build inexpensive log bridges where possible.*
- *Use removable steel pipes for temporary crossings.*
- *Use large diameter pipes in permanent crossings.*

Crossing drains

***Pieter D. Kofman*[1]**

During any harvesting operation the harvester and forwarder have to cross many drains as it is customary to plant lines of trees on mounds made from soil taken from drains. Typically 5-7 rows of trees are planted between drains. The more lines of trees between the drains, the wider and deeper are the drains because more soil is needed for the mounds.

The extraction rack system should be planned so that major drain crossings can be made before the stand is planted. A lot of time and effort can be saved if the bridges or dams are in place before the trees are placed in the ground.

Before the first tree is felled in a first thinning, it is very important that there is a plan of where the extraction racks are going to be and where drains have to be crossed.

Preferably the main extraction rack should be on the highest ground, but a case can also be made for the main rack being through the middle of the block, so that the drains only have to be crossed once. If an extraction rack is made at either end of the block, then more crossings are needed. In all cases, drains should be crossed at right angles.

When the extraction rack system is being planned, it should also be ascertained what kind of drains have to be crossed. Dry drains are easy to cross, but in some cases drains contain standing or even flowing water (Figure 1). Drains with standing water should be investigated to see if it is possible to open them to release water before harvesting operations commence.

In the case of flowing drains, a temporary or permanent crossing is possible. In general, the preference

Figure 1: Water carrying drain.

COFORD
Arena House, Arena Road,
Sandyford, Dublin 18, Ireland
Telephone: +353 1 2130725
Email: info@coford.ie
http://www.coford.ie

would be a permanent crossing that will facilitate subsequent thinnings, reduce overall costs and lessen sediment loads.

After the harvesting and forwarding operations, drain crossings should be inspected to see if they have become blocked. Blockages need to be removed to allow water to drain away. If drains remain blocked, the water table in the stand will rise and increase the risk of windthrow (Figure 2). Thinning exposes the stand to windthrow risk, and standing water will increase that risk.

Figure 2: Consequence of a blocked drain: windthrow.

Methods of crossing drains

At the outset, if the drain is too deep or too wide or contains permanent flowing water, it may be best to avoid crossing the drain at all and to see if it is possible to enter the stand on the other side of the drain from another direction.

There are many ways to cross a drain, from the very simple to very complicated and expensive:

- Drive through the drain;
- Put logs in the drain prior to crossing;
- Put a temporary pipe in the drain;
- Build a log bridge;
- Build a permanent crossing.

Drive through the drain

Driving through drains is not recommended except on very dry sites. Where it is used, brash and tops need to be placed in the drain and at the edges to prevent collapse. Brash and tops should be removed by the forwarder once the harvesting is completed.

Put logs in the drain

If the drain is too wide or too deep and there is a risk of caving in, it may be better to put a grapple-load of logs in the drain. This is done by the harvester before crossing the drain. The wood is covered by brash to protect the logs accumulating too much dirt and from damage by the machine tracks.

The logs have to be removed from the drain by the forwarder after harvesting and forwarding have been completed. If the logs become covered with mud they might not be suitable for use; however, pulpwood is usually debarked in the mills, so there are less problems with using pulpwood in drains. Even if small sawlogs are debarked at the sawmill, small stones may have become embedded in the logs and these will dull the blades. It is preferable not to use boxwood or small sawlogs to build temporary bridges.

Wood that has been used in a drain is not suitable for chipping for energy as too much dirt attaches to the logs and embedded stones might cause severe damage to the chipper knives.

Put a temporary pipe in the drain

The pipe should have a length of at least 3.5 to 4 m, with a diameter of at least 20 cm, to be useful as a temporary drain crossing. It not only has to be able to cope with a flow of water, but should also fill the drain, so that the machines do not cause the sides of the drain to collapse on top of the pipe.

The use of steel pipes as temporary drains is good if there are only a few water carrying drains that have to be crossed, because the pipes are expensive and have to be moved from forest to forest. Often the harvester has moved to another forest while the forwarding is continuing. The pipes can first be removed once the last wood has left the stand. The pipes then need to be transported to the next site where they are to be used.

Steel pipes can be carried by the harvester in the harvesting head from the side of the road (Figure 3). However, this

means that the machine has to travel all the way out of the stand and back in, with the consequence of lost time and extra passage on the brash mat of the main extraction rack. If it is known beforehand that such a pipe is needed, it could be taken part of the way by the harvester and moved forward until that particular drain is reached.

To protect the pipe and to fill in the drain for more easy passage over the drain, some logs and logging residues should be placed on top of the pipe (Figure 4). Bear in mind that the logs may be unsuitable for chipping because of the dirt that becomes attached to them.

Figure 3: Harvester carrying steel pipe from roadside to drain crossing.

Build a temporary bridge

If the drain is less than 0.8 m wide a temporary bridge of roundwood logs can be built over the drain. Trees around the bridge location are felled by the harvester and cut into 3 m lengths. The brash is piled to the side. The logs are placed by the harvester over the drain with at least 1 m on either side of the drain. The logs are placed side by side at right angles to the drain to form a width of at least 3 m (Figure 5). The two lines of logs should be placed sufficently far apart to accommodate the width of the machine. Once the logs are in place, they are covered with a layer of brash to distribute the weight of the machines over the logs (Figure 6)

The logs should be of a reasonable size (>12 cm in diameter). It is no good using the tops or very thin logs as the logs have to carry the weight of the harvester when crossing, as well as the weight of the loaded forwarder (Figure 7).

Unlike the other types of crossing, this bridge does not have to be removed, because it does not impede the flow of water in the drain. If the logs are a fair size, the drain might even last until the next thinning in 3-5 years time.

The wood and time lost during the construction of the bridge is offset by the time saved from travelling to the roadside to fetch a pipe (temporarily or permanent) and by the fact that the bridge does not have to be removed after harvesting.

Figure 4: Steel pipe in place in drain.

Build a permanent crossing

As a last resort a permanent crossing can be constructed. A corrugated plastic pipe (Figure 8) or sections of concrete pipes are laid down permanently in the drain and covered with soil to make a crossing. The diameter of the pipes is of the utmost importance and should be as large as possible. Permanent pipes have a tendency to block causing a large build up of water. The pressure can become too much for the dam or large areas of forest will have

Figure 5: Log bridge under construction.

Figure 6: Logging residues being piled on the log bridge to distribute weight.

Figure 7: Harvester crossing the log bridge.

a raised water table with the increased risk of windthrow as a consequence.

Permanent crossings should be constructed before the stand is planted and then only where heavy traffic on the main extraction racks can be expected, i.e. close to the landing.

Permanent crossings are difficult to build for the harvester or the forwarder since soil will have to be moved to cover the pipe. The soil will be loose and in rainy periods may turn to mud when crossed. Putting permanent pipes in place should be done by an excavator, but that means that the harvester will have to move to another part of the stand as it will not be able to cross the drain until the permanent crossing has been constructed. Calling in an excavator takes time and excavator drivers prefer not to drive over a row of stumps to the site where the dam has to be made.

Figure 8: Corrugated plastic pipe in the drain to be crossed.