PLANNING, MANAGEMENT AND ENVIRONMENTAL CONCEPTS OF FOREST ROAD AND LANDING CONSTRUCTION

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ABSTRACT

The focus of my presentation today will be on the planning, management and environmental issues of construction rather than on the purely technical aspects.

I will speak a little on establishment roading but mostly on harvest roading, the emphasis being on large plantations - I will however touch briefly on woodlot construction activities. Both construction and maintenance aspects will be considered.

These observations are based on my experience in the Central North Island along with some experience in places such as the King Country and the Coromandel. I have also observed with interest roading operations inside and outside of the forest industry over most parts of New Zealand and a limited amount overseas.

ESTABLISHMENT ROADING PERSPECTIVE

From the establishment point of view I am looking for access to an area for land preparation, planting, silvicultural treatments, noxious animal and fire control.

Roading densities required can be calculated on a $ basis, eg comparisons of such items as road cost vs crew walking time.

Roading density on a metre length per hectare basis will also vary according to factors such as topographical, hydrographical and environmental constraints, economic considerations and existence of public roads.

The question of roading on final harvest road alignment or running with (generally) far cheaper options arises. My experience here, especially in more recent times, is to run with the cheaper options, including the steeper gradients. However three important factors should be considered

i) significant stream crossings, ie culverts of say > 1 m diameter or bridges.
ii) where a road traverses a steep face of significant length.
iii) intersections with public highways.

As best you can position such structures/infrastructures on final harvest roading alignment, not necessarily to final harvest specification - under RMA we need to be minimising our adverse impacts overall.

WOODLOT ROADING PERSPECTIVE

For woodlot harvesting (and especially woodlots < 20 ha) I would be looking at generally a roading structure that will permit loadout of wood in favourable conditions and most probably will be rehabilitated and returned to grass. Ensure such roads meet the relevant safety requirements and if designed for dry weather use then use only in dry weather. Such roads should still have adequate water control to meet environmental requirements.

Some points to pay special attention to in establishment and/or woodlot harvest roading construction are:

- location of services, eg water reticulation (underground), power line (overhead), width of gateways, turning restrictions in races, around cowsheds and implement sheds, vision for operators around homesteads where children may be present, stock access to new formation/landowners requirements for grazing, side cast material from construction/tracking, water control.

As at 1994 some 25% (up 2% on the previous year) of exotic plantation forest is in the ownership/control of the woodlot scenario. The industry must take care that operations in this sphere are done in accordance with the 'LIRO Code of Practice' so that this source of fibre can continue to be accessed in the future.

The one other important point I would like to make here is that in my experience it is good policy, both practicably and politically to use local contractors of good repute - they generally have the right sort of equipment for the lighter earthmoving required in either the establishment or woodlot areas. Most importantly they have the experience with the local soils.

PLANTATION FOREST PERSPECTIVE

From the harvest planning point of view the conventional systems in use in New Zealand at present; viz roads + landings are still in most cases the most viable option, others, eg helicopter or barging have their niche, along with roadside loading for some fully mechanised operations.

The Requirement

Planning; deciding on cable/ground based breakdown, valley vs ridge top roading, placement of landings, then joining by a roading system. In making the final decision include the cost of loss of sustainability for growing crop and the environmental cost.

Roading density depends to a large extent on topographical, harvesting and environmental constraints, economic considerations and the existence of useable public roads.

The final harvest roading infrastructure in the area in which I am associated is taken as a permanent asset and no parts are replanted. The landing sites, on the other hand are, except for some cable landings, rehabilitated.

Rehabilitation of landings involves the ripping of the landings with topsoil/slash distributed back over the landing site. This operation is expected to give some significant increase in replanted growth rates and also, very importantly, it gives some very real environmental advantages in terms of water control. Machines being used for this operation are in the 210-220 HP range.

To meet market requirements from large plantation resources at Kinleith Region an all weather roading infrastructure is the requirement.

I will cover from the technical perspective the standards and specification for harvest roading in Kinleith forest.

Arterial roads - sealed

A constructed width of 9.5 m between centrelines of watertables 7.5 m sealed width, 3% of camber, 10% target maximum gradient.

Secondary roads

A constructed width of 8.0 m between centrelines of watertables, metalled width to

permit 2 way travel, 11% target maximum gradient.

Stub roads

A constructed width of 6.5 m between centrelines of watertables, metalled width to permit 1 traffic lane, passing bays at selected points, eg landing sites, 13% target maximum gradient.

End of stub

A constructed width of 4.5 m between centreline of watertables, metalled width to permit 1 traffic lane, 13% target maximum gradient. Provision of turning bays for heavy vehicles and areas for parking of contractors vehicles.

Roads and landings should be located using the best topographical, photographic and GIS information/technology available and planned to conform to present and predictable future harvesting methods.

The following guides should be seriously considered:

- Formation to be on stable areas; avoid springs, previous slip and slump areas.
- Locate roads, where possible, on natural benches, ridge tops, flatter slopes and on stable areas clear of streams.
- Borrow and waste areas to be placed so as to avoid harmful effects on drainage and water flow.
- Stream crossings to be located where channel and bank disturbance will be minimal. Crossings to be properly culverted or bridged. (Log crossings, if traversed a number of times cannot be said to be 'minimising' adverse effects.)
- Material from construction must not be placed where it could reasonably be expected to enter a perennial watercourse.
- Long continuous grades to be avoided.
- Wherever possible a strip of undisturbed soil should be kept between the road and any gully bottom or stream or any sharp fall off from a ridge top it is parallelling.
- Landings and roads to be constructed so that they do not dam stream flow or result in ongoing sediment loss downstream.
- Where it is necessary to cross a defined gully by filling, a culvert/crossing must be installed.
- Road fills over three metres high are to be topsoiled and grassed.
- Road fills are to be protected by shoulders.
- Water must be flumed clear of fill to solid ground.
- Construction works shall not be left without a runoff control system that will minimise soil loss.
- Maintenance is to follow quickly behind construction as this is when malfunction of drainage systems is most likely.
- Earthworks must be planned with a view to later maintenance.
- Roads are to be located so as to avoid undue earthworks.

- Metalling to follow quickly behind construction.

When constructing roads separate out the topsoil and use to advantage elsewhere. When constructing landings stockpile the topsoil nearby for later use in landing rehabilitation.

Over the years and more especially in very recent years my Company has accumulated much information re machine capability related to machine rates ($'s) that has lead us to the undeniable fact that 'big is beautiful'. Based on this accumulated information the best sized tractor for the construction work undertaken in the Kinleith Forest is in the 250-300 HP range.

Motor scrappers (limited work now) are twin engined (front and rear) machines in the TS14 range, 300 HP.

Excavator size fits in the 30 t plus range - the working weight of the PC300 currently under contract to us is ≈ 38 t.

In Kinleith Forest the construction/maintenance/metal machine operational areas are totally contract - a small workforce is presently retained for forest operations work, handwork and culvert installation.

In Kinleith Forest metalling operations are undertaken using rock crushed to 100 mm all in, spread by underbody trucks and trailers which can be fitted with 'spreaders' when necessary.

Rock used is mostly ignimbrite. This tends to be a softer rock which packs down and forms a good running surface with use.

A little rolling is done for compaction on the steeper lengths - rolling needs to be minimised or too much crushing effect results.

Having covered some of the technical aspects of harvest roading in which I am involved, I would like to refocus again on some other planning and management aspects.

Take as an example the circulation system of a human being- strictly a harvest planners version.

The heart - the central unit to which veins and arteries lead. cf. roads leading to the logyard, wharf or utilisation centre.

The brain - controls the functions of the heart. cf. a controlling centre, eg a weighbrige.

The arteries - the main network for circulation. cf. the arterial roads.

The veins - feeding to the arteries and thus to the heart. cf. the secondary and stub roads linking onto the arterial system.

If we damage the brain the rest of the system will become chaotic and without a life support system will probably die. For the weighbrige (controlling centre) a balanced mix of human/computer expertise is required to keep operations running efficiently.

If we damage the heart the system will slow down (or at worst 'extinguish') - difficult and expensive to repair, ie jam up our utilisation centre and everything in time grinds to a halt.

If we damage an artery (arterial road) the system will be seriously impaired - less difficult to repair.

If we damage a vein (a secondary/stub road) the system will be inconvenienced - usually not difficult to repair.

To keep all parts functioning as required one requires initially an adequate design and construction and thereafter and most importantly an adequate and ongoing R & M programme. DO NOT WAIT FOR PROBLEMS TO OCCUR - have a functional R & M programme planned and in place.

As with the body look for the areas/conditions that are likely to cause problems, eg inactivity; roads that have had little/no use and are suddenly placed under high loadings.

High activity - high use leads to high wear, identify and monitor the weak spots eg, especially areas constantly in shade/damp.

Water - is adequate water control in place and is it working?

Any roading system is only as good as its weakest link - if the weakest link is in the head or the heart then one has a major problem for which one requires a contingency plan - a strategy to use if failure occurs!

How often do you still see on our public roading system major road upgrades with bottlenecks still left within an upgraded section.

On old existing roads where generally the carriageway is clear but shoulders carry a growth of scrub/fern consider using a roadside trimmer for clearing. Until recent times the bulk of this clearing type work in Kinleith Forest had been done using a Front End loader. This caused unnecessary soil disturbance and tended to mix organic material with the existing road surface. By using a roadside trimmer a much more environmentally friendly operation results - the green material spread over the road is insignificant and does not affect subsequent metalling operations. There are also cost savings with this method.

CONSTRUCTION MONITORING - AN ENVIRONMENTAL ASPECT

Our guest speaker at this seminar has indicated that he will cover in his roading session paper a wider perspective of roading - leading onto a paper entitled "Post Harvest Environmental Performance Monitoring".

I will give a NZ perspective from the road construction angle to this monitoring aspect which will enable participants at least at this seminar to make some effective comparisons.

Prior to 1991 all of the harvesting activity with which I was involved (and this has remained in the vicinity of 2.5 M tonnes annually) was done under bylaw or Sec 34 of the Water & Soil Conservation Act 1967.

Since the advent of the RM Act 1991, Councils have had even greater responsibilities thrust upon them by central government. Most harvesting activities including roading in virtually all Regions now require a Resource Consent from the relevant Regional Council. Research people within our industry have identified that about 80% of the sedimentation in forest operations comes from roading activity in the harvesting phase. Clearly council staff are likely to focus a significant proportion of their effort on the roading aspect of the total operation.

I have already covered the major items that should be taken into consideration in the planning/location/construction phases.

I would suggest that a monitoring programme similar to what I will outline to your shortly should be a feature of the road construction phase of the operation. The person actually undertaking the construction op, ie the machine operator, is in my opinion the person who should be taking ownership of the situation and signing off the monitoring sheet. In Kinleith Forest this aspect is covered in all our contractors Q-Base requirements.

A similar schedule is in operation for post harvest monitoring activities within the area in which I am associated.

Such a monitoring programme should include the following:

- Are any stream crossings incorrectly installed?
- Is any material from construction likely to enter a perennial water body?
- Has there been unnecessary soil disturbance?
- Has there been any construction on unstable ground?
- Has the natural soil been disturbed between construction and any immediate adjacent perennial water? (Exceptions are stream crossings, water supply sites etc)
- Is any material from construction likely to dam any intermittent stream flow or result in ongoing sediment loss downstream?
- Do any road fills over 3 m high require topsoil and grassing?
- Are shoulders required on any road fills?
- Is any fluming required?
- Has any construction work been left without runoff control where required?
- Has any foreign material been left in the forest?
- Has the Road and/or Landing been constructed outside the specified size?
- Could the Road and/or Landing have been located in a better position?

I am sure if operational people have ownership of a monitoring scheme based on the above concepts we could truly be saying that effective steps are being taken to minimise and/or mitigate adverse impacts.

In conclusion the sustainability of our country's plantation forests in part depends on an effective well planned, maintained and managed roading structure.

I suggest that the industry needs to be consistent in the standards of infrastructure that are being planned and constructed. The concept of continuous improvement should be at the forefront of our activities and innovative ideas should be sought and at very least be given fair trials.