

LIRA ROADING PROJECT

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1.0 BACKGROUND TO THE PROJECT

In 1983, a LIRA seminar on future research requirements identified several needs in the logging road area. From this LIRA developed a project outline in three phases :

- Phase 1 A comprehensive review of current logging road standards and practices in New Zealand.
- Phase 2 Research work in specific areas identified during the review phase as requiring additional research. Also the compilation of any handbooks or guidelines seen to be necessary for the Industry.
- Phase 3 The analysis and reporting of the project and the co-ordination of its results with related projects to present a comprehensive "economic analysis of logging road transportation systems".

A working panel was established to supervise and monitor the research work. This comprised :

Chairman : P. Farley, N.Z. Forest Service, Wellington
G. Manson, Manson Contractors, Rotorua
P. Reid, Carter Holt Central, Napier
P. Wallis, P.F. Olsen Limited, Rotorua
W. Yardley, N.Z. Forest Products Ltd, Kinleith
K. Steel, N.Z. Pine Forests, Nelson
J. Galbraith, Director, LIRA
J. Stulen, LIRA
W. Liley, LIRA

2.0 APPLICATION OF THE LIRA ROADING PROJECT TO LIMITED SCALE LOGGING

The roading project to date has specifically excluded consideration of forests with a production area of less than about 500 hectares. This of course excludes most farm woodlots and the minor forests which is specifically the concern of this seminar. The exclusion of these forests is because of the obvious differences which affect the economic analysis, i.e. much lower truck volumes on the access roads, and intermittent rather than continuous cash flows.

While these fundamental differences require a different

approach to the analysis of transport economics, there are of course many points of similarity between large forests and small woodlots including: handling the same product, subject to the same weather and soil conditions, using basically the same primary logging systems, frequently using the same transport systems.

For this reason much of that which has and which will flow from the LIRA roading project will have application to limited scale logging.

As an example consider an access road costing \$15,000 per km to a small forest with a recoverable volume of 700 cubic metres per ha :

	<u>2 hectares</u>	<u>5 hectares</u>	<u>10 hectares</u>
1 km of road	\$10.70/m ³	\$4.28/m ³	\$2.14/m ³
2 km of road	\$21.43/m ³	\$8.57/m ³	\$4.29/m ³

The message from these figures is clear - roading more than any other factor may increase to prohibitive levels the cost of limited scale logging. The second message is fairly obviously "don't plant your forest in the wrong place to start with".



".....roading more than any other factor may increase to prohibitive levels the cost of limited scale logging....."

(LIRA Photo CN183/7)

3.0 PARTICULAR ROADING PROBLEMS FOR LIMITED SCALE LOGGING

- 3.1 Roothing costs have to be carried by limited wood volumes.
- 3.2 A single bridge or large culvert can have a crucial effect on the viability of the logging proposal.
- 3.3 Because of the relatively small amount of roading that can be contemplated in limited scale logging, it is usually not possible to use sophisticated construction equipment.
- 3.4 The owner usually does not have the financial resources to meet large initial outlays.

The problems were well expressed at a workshop on low volume roads held in the United States in 1975, "I have always felt that in many respects it is easier to design a high type (standard) of road for several reasons. On the low volume road, for example, we are continually striving for low cost, which makes our design extremely sensitive from the standpoint of thickness, quality or paving (or surfacing) materials, geometric design and many other factors."

4.0 PROFESSIONAL ADVICE?

The response of any professional, well versed in self-preservation, is to advise that the first step in the solution to the problem is to call in a professional adviser. This view is based on the assumption that the cost of the professional advice will be more than offset by the savings that he or she will be able to achieve in the operation of the system. Unfortunately this assumption is not well documented in many areas, including the forest industry and in particular the area of limited scale logging.

It can be stated with confidence that the roles and functions of specialist engineering staff, whether they be engineers, technicians or construction supervisors, is not well defined in the forest industry, and their interaction with foresters and forest management staff depend more on personalities than the needs of the system.

The problem for the limited scale logger is to determine whether this bevy of people can offer anything which will have the required result at the bottom line. Engineers, technicians and supervisors do not have clearly defined roles and in fact functions and capabilities overlap to a considerable degree. As shown in Figure 1, there are various people who, in particular circumstances, will be able to offer the appropriate advice on road planning and construction. The trick is to forget about looking for a person with a particular label, but to concentrate on the function which you require for your operation and choose the person available who can carry out that function effectively and at the lowest cost.

5.0 WHAT CAN YOU ACTUALLY DO

- 5.1 The very first action must be to determine the value of your woodlot. What are those trees actually worth at the mill or loaded on truck or standing on the stump.
- 5.2 From this information, given a fair estimate of logging costs and the required profit margin, you can determine precisely the amount of money which you can afford to spend on the transport system, including the roads.
- 5.3 Inevitably roading engineers and contractors will be able to spend substantially in excess of the amount that you can afford. Do not be dismayed, they can be brought to heel.
- 5.3.1 Do you need all weather access? Can logging operations be moved in and out as weather conditions suit? A seasonal road will save you a vast amount of construction money and should be utilised providing it does not penalise your revenue excessively.
- 5.3.2 Can you obtain a transport unit which will operate on steeper grades and tighter corners than conventional trucks? If so, then consider the cost per cubic metre of using this truck with any savings in road construction cost that may arise.
- 5.3.3 Can you utilise any of the alternative systems such as long reach skyline systems or forwarders? Can a farm tractor act as a forwarder/skidder? Can you use a bush mill to cut flitches and fly them out? What about a team of horses and flog the rights to TVNZ? If such systems are available then is the extra cost more than offset by the savings on roading?
- 5.3.4 Can you arrange the timing of your road construction sufficiently far in advance to secure a contractor at a competitive price and to schedule the work to be undertaken during the most favourable time of the year?
- 5.3.5 If your forest is in an areas with limited contract resources available don't forget your friendly County Council. They will usually be prepared to consider assisting an individual, especially when the individual is a voting rate-payer, when alternative sources of plant are not available or exorbitantly priced. The fact that some Counties don't appreciate the true costs of operating their plant may in some cases be an added bonus.
- 5.3.6 Don't automatically assume that you have to do the roading working yourself. You may be able to get some other sucker to do it for you. That is, if you are the forest owner consider selling the wood

as a stumpage sale* and let the contractor worry about the weather and the plant and the Ministry of Transport. On the other hand, if you are the purchaser of the woodlot you will no doubt emphasise to the owner how vastly greater his profits would be, how much higher the price you offer could be if only he undertook the relatively simple task of putting in a minor motorway.



Strictly seasonal road, Northland

(LIRA Photo CN295/3)

- 5.3.7 If there are other small forest owners in the area then for goodness sake get your heads together. You may be able to combine resources to negotiate a better deal from the wood buyers and contractors.

* By stumpage sale I do not mean a Forest Service type of stumpage sale, I mean a lump sum sale where all the designated timber within defined boundaries is sold standing for a fixed sum.

5.4 Figure 2 shows the conventional basis for pavement design. Note that the depth of pavement required (this is what really costs the bucks) is dependent on two things; firstly, the strength of the subgrade and secondly the volume of traffic. You are stuck with the volume of traffic but there are various ways of improving the strength of the subgrade.

5.4.1 The first priority is to try and ensure that you don't weaken the subgrade. This is commonly done by allowing extra water to get into the natural subgrade. Subgrade strength is universally related to moisture content in all soils. The simple dictum is, first get existing water out, i.e. drainage, secondly stop additional water getting in. This requires drainage and compaction.

5.4.2 To achieve compaction water is added as a lubricant, however, if too much water is added and it fills all the voids in the soils then it is not possible to push the soil particles closer together, no compaction takes place, hydraulic pressures cause the soil to flow, you get bogged. In technical terms best results are achieved at a situation between dry and saturation called the optimum moisture content. This moisture content varies with the type of soil and the type of compaction equipment but could perhaps be described as a slightly moist soil condition.

5.4.3 While there is a vast range of rollers each designed to handle specific conditions and materials the simple fact remains that almost any form of rolling can be used and is better than nothing. Particularly for small scale operations do not underestimate the results that can be achieved simply by wheel rolling with a loaded truck. Even rolling with an unloaded truck or light runabout is sufficient to seal the surface and prevent rain getting in.

IF YOU REMEMBER NOTHING ELSE FROM THIS SEMINAR THEN
AT LEAST REMEMBER THAT COMPACTION WILL SAVE YOU
MONEY.

5.4.4 The colloquial expression that a road should be allowed one to two years to "settle down" before logging use is really an expression of the technical fact that compaction cannot occur at excessive moisture contents. As the formation is left after construction natural drainage takes place and compaction occurs progressively from light traffic.



"First, get existing water out"

(LIRA Photo CN40/2)

With adequate compaction of the subgrade it will often be possible to carry out limited scale logging operations with only a thin dressing of crushed metal on the road surface. This will provide good traction and low maintenance. Although the crushed metal will be substantially more expensive than the same volume of river run or screen metal, the total cost of the road metalling will be substantially less because a much lower volume will be required. Note again that this depends on the adequate compaction of the subgrade.

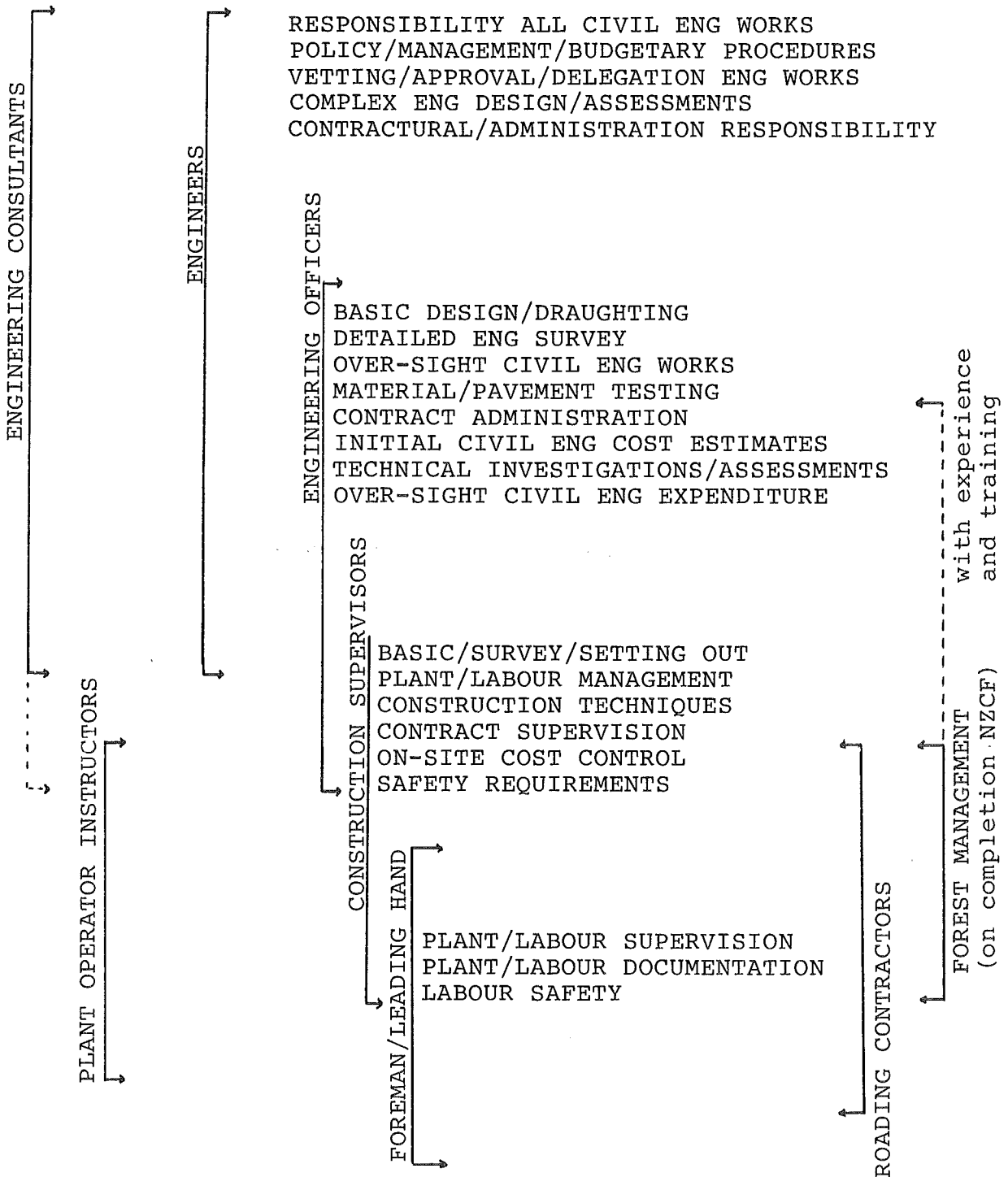
- 5.4.5 Elaborate surveys of the roadline will seldom be worthwhile in limited scale logging operations. However, in many cases, particularly where grades and curves are difficult, a simple survey with basic field setting out will often produce substantial improvements in the ease of truck operation and road maintenance costs. Long experience has shown, however, that it is vitally important that the people undertaking such quick and simple surveys and design are not only technically competent but also have a depth of understanding of construction and harvesting operations. A motorway engineer and most county engineers will be hopeless at the quick and simple approximations which are all that can be justified.
- 5.4.6 In particular situations it can be an advantage to use a variety of aids to road construction particularly fabrics, chemicals and fascines. These will seldom be cheap and for that reason are unlikely to have widespread application in limited scale logging. Dr Bill Stuart's conveyor belting is one of the most brilliantly simple and cheap ideas that I've come across.
- 5.5 The relationship between the standard of road construction and total transport costs is not well understood. Basically the cost of operating a truck is related to its average travel speed thus any improvement to a road which has a measurable effect on average vehicle speeds will probably reduce transport costs. The benefit of this must then be compared with the cost of the road construction or improvement work. In many cases the average truck speed is governed principally by the conditions on a relatively long length of County road and State highway between the forest and the mill rather than the relatively short length of in-forest road. This means that total transport costs will often be insensitive to the standard of in-forest road. You should be very careful before undertaking to build an in-forest motorway to ensure that the transport operators will in fact reduce the charges for the transport of the logs.
- 5.6 Clearly any load restriction applied on County roads or States highways will have a major impact on transport costs. The classification and standard of County roads can have a significant impact on the economies of harvesting small areas, for example, it would be quite feasible for nett stumpages to be reduced by the order of \$2-3/m³ simply on the classification of a public road.
- 5.7 When considering log transport over County roads which are, or are considered to be, substandard then discussions with the County to derive a system similar to that operating in Waimea County are imperative. In Waimea County overweight permits are granted to logging operators and others to cart on specific routes for specific periods subject to a bond

which ensures the operator repairs any damage occurring to the road. This provides the opportunity for the operator to ensure that operations are only undertaken during times when the environmental conditions in the road enable it to carry the extra loads without damage.

6.0 CONCLUSIONS

- 6.1 It is essential to determine before commencing roading in any area, particularly for limited scale logging, the maximum amount that can be spent on road construction. This amount must be determined taking into account not only road construction costs but also maintenance and log transport costs.
- 6.2 For limited scale logging it will in most cases be an economic necessity to utilise seasonal operations both for road construction and also transport and logging.
- 6.3 Following from the above, it is absolutely vital in limited scale logging that appropriate, adequate and thorough forward planning is carried out.
- 6.4 It will be very profitable in limited scale logging to apply sound but simple engineering principles to the design and construction of roading works. These will cover simple geometric design plus drainage and compaction.
- 6.5 In all cases evaluate all the alternatives - even the wildest. Don't let Engineers, Foresters or Contractors put you down.

FIGURE 1

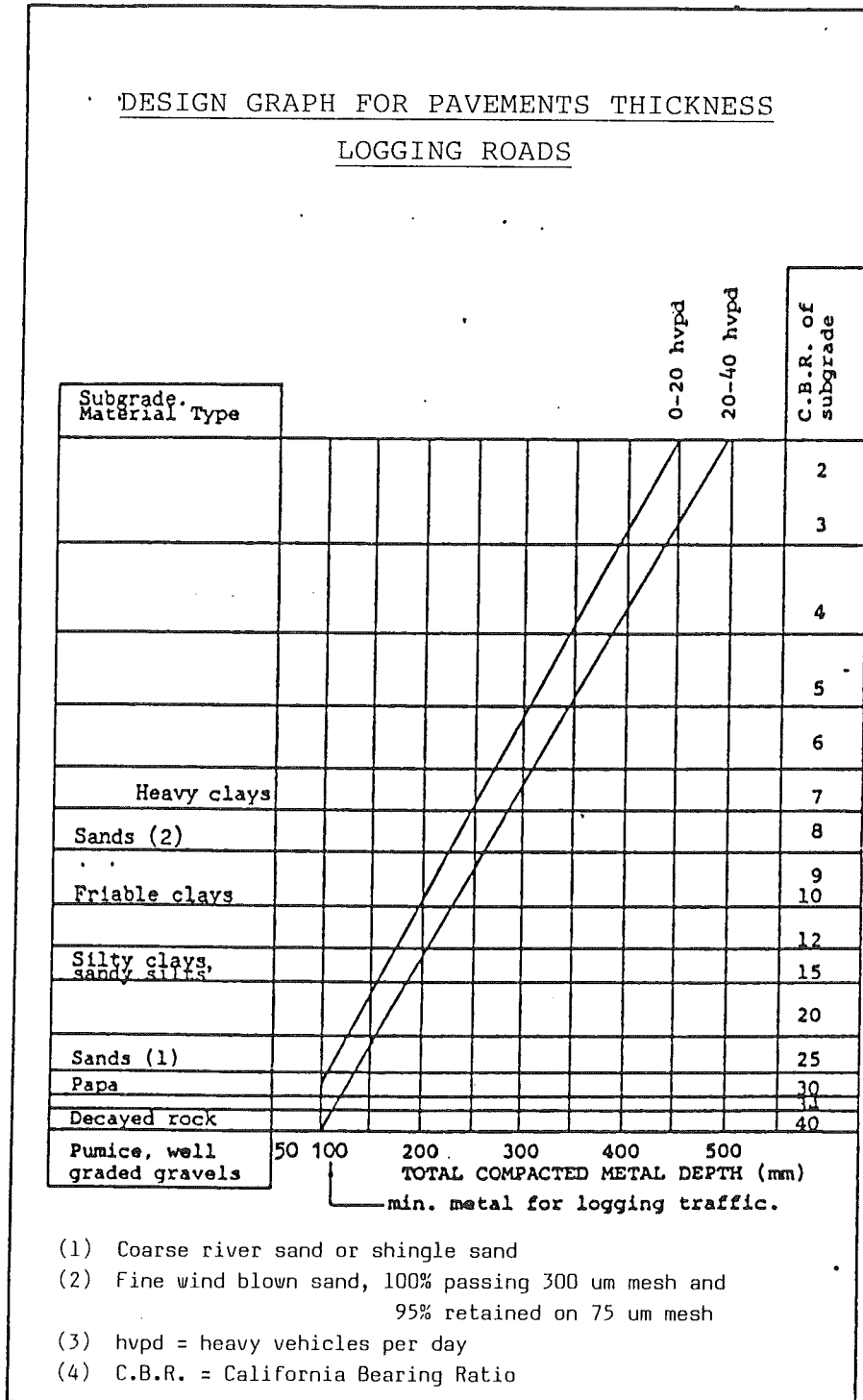


ENGINEER - B.E. DEGREE

ENGINEERING OFFICER - NZ CERTIFICATE IN ENGINEERING

CONSTRUCTION SUPERVISOR - NZ CIVIL ENG WORKS SUPERVISOR CERTIFICATE

FIGURE 2



TYPICAL ROAD CROSS-SECTION

