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## CENTRAL LOG YARDS — AN OPTION TO CONSIDER

A Report by Allan McKerchar, Engineer, N.Z. Forest Service, Southland and Alastair Twaddle,  
Harvest Planning Group, Forest Research Institute, Rotorua

### INTRODUCTION

What are log yards? Essentially they are surge areas that even the flow of wood from the extraction systems to the wood purchasers. A skidsite could be classified as a type of log yard but normally the term refers to log processing areas physically separate from harvesting operations.

Log yards have been used in New Zealand recently on a limited scale. In the early 1970's, yards were briefly set up at Reefton and Inangahua in association with beech logging trials. Currently a log yard handles the diverse species mixture of Hanmer State Forest Park. However, at present New Zealand does not have a log yard established to handle what will be the main output from our forests, tended radiata pine.

Most people are aware of the general principles involved in undertaking primary processing in a central yard rather than on the skidsite but they may not know when a centralised yard becomes a realistic option. This Technical Release raises many important points which must be assessed for each location where a yard is being considered.

### WHAT ARE THE ADVANTAGES?

To warrant a change from the traditional approach of skidsite processing and a single trucking link between skidsite and mill, there must be some advantages in centralised processing. Centralised processing would be advantageous when :

1. The traditional approach requires heavy expenditure on upgrading roading for logging traffic, particularly improving grade requirements;
2. There are difficult skidsite surface conditions in winter and spring which cause problems in clearly identifying and cutting the different products;
3. There are problems in inventory control of material scattered around the forest.

Any of these problems may lead to the consideration of a log yard as a harvesting option. The following are specific areas in which the use of the log yard concept could lead to more efficient harvesting :

- economy in road transportation
- easier product display
- reduced logging and skid site construction costs
- better log-making
- the opportunity to more closely supervise inventory
- an ability to cut for the spot market
- reduced roading costs
- the opportunity to double shift in the yard
- delivery to the seller of debarked logs
- utilisation of residues

### Transportation

Much of the future expansion of harvesting will be in forests that were established on difficult terrain, either in terms of topography or soil conditions. Therefore, road grades, alignment, and pavement constraints will require critical assessment in the future. Because of the costs involved with these transportation factors alone, they may well dictate future utilisation of existing forests.

The use of a log yard allows the splitting of wood transportation into two distinct phases: skidsite to yard, and yard to mill. This then allows the development of 'off' and 'on' highway trucks, with each type suited to the conditions and restrictions of its own roading network.

Off-highway trucks may concentrate on enhanced gradeability, low ground pressure, the ability to carry long length logs, shorts or some combination, and self-loading. The costs of modifying trucks for off-highway transport, which will depend on design, may be :



*Figure 1 - Several options are available for specialised transportation.  
This example is a Rolligon 8860 Forwarder capable of self-loading*

- (a) High capital
- (b) Low capital
- (c) Conventional approach

High capitalisation involves the use of equipment specifically designed for off-highway conditions. Articulated dump trucks, which cost about \$300,000, are proven performers in the construction industry. They are best suited to short lead distances of around 5 km, which theoretically could cover more than 7000 ha of forest. Such trucks with six wheel drive and the ability to lock up all their differentials have excellent gradeability. This means that the roads could be more readily sited on the ridges, thereby avoiding heavy earthworks on side slopes. These trucks would, however, need to maintain a high level of utilisation to offset the initial high investment.

In contrast, the low capital approach involves the use of other types of tractor units (such as second-hand log skidders, pulling trailer units). Set-out trailers could then be readily employed, with loaders at the skidsites being able to load directly into trailers instead of a hot deck. A major benefit from the roading point of view would be the reduced pavement requirements associated with the lower payloads and travel speed of such units. The advantages of a low capital investment will be offset by the lower payload and a reduced effective operating distance from the yard because of the lower travel speeds.

Conventional transportation implies truck units similar to those currently operating. Adaptations would include what are generally minor adjustments, to cope with the short hard hauls from the skidsite to the log yard.

Removing the difficult in-forest section from the on-highway trucks' task allows these trucks; to be lighter bodied, to have axle configurations and gear ranges better suited for on-highway use, to be more adaptable because of similarity with other on-highway trucks in the transportation industry and to maximise loads through use of the weighbridge. From a roading viewpoint, having the out going logs restricted to a small number of major routes provides justification for upgrading and maintaining those haul routes to highway standard.

Each of the above advantages may seem fairly minor. However, if roading and trucking costs are a large percentage of total costs, then these benefits become major. For example, if the total lead distance from the forest to the mill or port is over 120 km then these factors alone can be the major reason for considering a log yard.

### **Product Display**

The skidsite is not a very desirable place to show prospective log buyers their raw material. As well as being confined and often muddy, the skidsite can be deep in the forest.

Variations in log sort flow means that a buyer may not see a good selection of sorts when finally arriving at a site. A central yard could present a wider range of assortments and qualities to the buyer in less restricted conditions and at a more easily accessible location.

As wood becomes more plentiful in the future, log sellers may have to pay much more attention to product presentation than they have in the past.

### **Logging Costs**

Centralised processing may lead to modest savings in logging costs through reduced skidsite activity. Crew reductions of one or two men from the larger crews might be possible. These reductions would result in a saving of approximately \$0.50 - \$1.00/m<sup>3</sup>. There may be some additional gains in volume productivity by the removal of skidsite interference.

As there would be no requirement to manufacture and segregate several log sorts in the forest, variations in log handling could be contemplated. Extraction and stacking along the road edge, thereby eliminating skidsites completely, may be an option in certain locations.

### **Log-Making**

With more managed stands being harvested and a general rise in log values, there is a greater incentive to cut for value during log-making and to produce logs which closely match specifications.

Log-making on the skidsite can be difficult, particularly if several log sorts are to be produced, if the skidsite is constrained in size, or if the surface conditions are difficult. Measurements in good to average skidsite conditions have indicated value losses of about 10-15% (Murphy and Twaddle 1986; Twaddle 1986a). Log-making in the more difficult sites in winter and spring conditions are likely to exceed these levels.

Assuming that with a log yard the log-making crew would be working with cleaner logs under less restricted conditions, a higher level of both value recovery and of specification cutting could be maintained. Skidworkers with a high level of skill in log-making could be selected for the crew to ensure maximum value recovery. An increase in average value recovery of only 3-5% would increase the profitability of a forest by about \$1-\$2/m<sup>3</sup>.

### **Opportunity for Closer Supervision**

Having log-making and the log inventory in the same location allows for better supervision. The option of using hand-held microcomputers for training and auditing during log-making becomes much more feasible. By employing a full time supervisor on-site, log quality can be continuously monitored. Also, a supervisor can ensure that material leaving the yard closely matches the specifications under which it was sold, since out-of-specification logs are commonly produced during skidsite processing (Twaddle 1986b). The supervisor can also ensure that customers are regularly picking up their log allocation and that stockpiles are turned over to avoid sap-staining. In addition, having all trucks leave from a single constantly controlled site reduces the possibility of loads being incorrectly documented.

A supervisor's role in a log yard would be a very active and important one. In smaller yards where the work load did not warrant two staff positions, the yard supervisor could have to operate the weighbridge as well as monitor log-making and the log inventory.

### **Cutting for the Spot Market**

Log-making at one site, rather than several dispersed sites, allows for the production of speciality log assortments. In the latter, all the separate crews would have to receive instructions for a new sort and if the log sort is particularly specialised it may take a long time to accumulate a load. However, in the former, i.e. with a single crew working in a central yard, the option is more feasible since only one crew has to be instructed and it has a much wider selection of stems from which to locate the speciality sort.

### **Reduced Skidsite Construction Costs**

Although the size of skidsites probably will not reduce by adopting centralised processing (full length stems will still have to be landed, stockpiled, and loaded on the skidsite), the amount of metal used on skidsites could be significantly reduced. A high-standard surface will not have to be maintained, just sufficient to allow off-highway trucks to get close to the stockpiles for loading.

### **Roading Costs**

Roading costs might be reduced significantly by increasing the maximum road grade, and therefore promoting the use of specialised trucks. However, gains in reducing the surface standard by less metalling might be offset by the need for better road alignment to cart long-length stems.





*The N.Z. Forest Service is currently developing a log yard at Ngaumu Forest*

*(Photo courtesy of R. Allen, Ngaumu Forest)*

### **Opportunity to Double Shift in Yard**

There is better opportunity to work extended hours in central yards, particularly in the load-out phase at the yard. Although extended hours would normally be worked only under unusual conditions, load-out times could be quite easily extended in a log yard.

### **Debarking Logs**

Having a debarker associated with a log yard could have several advantages. The on-highway trucks could increase their solid wood cartage, sawmills might not need to install their own debarkers, and the bark residue could be used as a carpet on spur roads.

However, sawmills might not wish to rely on a single purchaser for debarked logs as they might get their raw material from several sources. Also, if the logs are sold by tender, yard operators might not be able to cover the costs of debarking.

### **Utilisation of Residues**

A log yard will accumulate debris material which would otherwise be dispersed on numerous skidsites throughout the forest. Because the residues would be accumulated 'free of charge', there will be sufficient volume to warrant exploitation. The most obvious avenue is the domestic firewood market, although this will vary considerably

by region. Another opportunity is to chip the residue on-site and use it as surfacing material on the skidsite or spur roads. However, residues in the log yard also have a negative aspect. They will constitute from 1% to 3% of the total incoming volume and therefore if they cannot be utilised their accumulation eventually will create a problem.

### **WHAT ARE THE DISADVANTAGES?**

Log yards will not be the best option everywhere. As a materials handling system they also have some drawbacks which need to be considered in certain situations. Some of these are the following :

- higher risk
- increased capital outlay
- repeated handling of the product
- a need for larger loaders
- major product to a single destination
- requirement for more intensive management
- payment for residues

### **Higher Risk**

The most obvious and least definable disadvantage of log yards is their risk. Log yards are untried in New Zealand in the form they are now being proposed. Their advantages and disadvantages are based largely on conjecture.

### Increased Capital Outlay

Although some of the savings, such as those in roading, logging and value recovery, will accrue over the life of the yard, most of the capital cost of the yard formation and of the associated weighbridge (\$100,000 to \$200,000) must be expended before it begins operation.

Having a weighbridge at each yard may seem excessive. However, for the logging contractor to be paid correctly his input to the yard must be measured. A weighbridge provides a quick and efficient method of doing this, and of controlling the output from the yard.

### Repeated Handling of the Product

Logs going through a log yard are handled more often than logs going through skidsite-to-mill systems. The additional handling not only incurs a materials' handling charge but also leads to degrade of the material, since the more times a log is handled, the more opportunity there is for that log to be damaged. Repeated handling will not be important for all grades of logs but for the premium grades, losses could be significant.

### Larger Loaders

At the skidsite log loaders seldom have to lift the whole weight of individual trees. They deal mostly with log lengths and so have more flexibility to match payloads to machine capacity. With long-length cartage to a central yard, the loader unit will be lifting tree lengths and so will not have the same opportunity to adjust the payload. Contractors, particularly those who operate small, hydraulic, excavator-based loaders, may have to scale up the size of their loader unit to cope.

### Most Logs to One Destination

Central log yards may be uneconomic if a substantial proportion of the volume of produce from a forest is of a single sort. For example, it may be more efficient to transport a shipment of long-length export logs from the skid directly to the port or railhead.



*Figure 3 - If short pieces are included in with long length loads some form of frame like that shown above may be necessary for safe transport to the yard.*

*(Photo courtesy of Dave Knight, Ed., Timber Harvesting magazine)*

## **More Intensive Management**

The installation of the log yard materials' handling system creates a new major work centre within the forest. Since the logging crews will still have to be supervised, this additional location will also need a high standard of control, particularly as it will become the point at which loads are documented for payment to both logging contractors and log purchasers.

### **Payment for Residues**

Residue material, particularly cutting waste that otherwise would have been left on the skidsite, will be included within the payment to the logging contractor if it is brought to the yard. This may cause logging costs to rise perhaps 2-4%. Since it will also be in the logging contractors interest to include as much non-merchantable material in his loads as possible, this aspect requires consideration.

## **OTHER POINTS TO CONSIDER**

### **Where Should the Yard be Sited?**

The log yard should be placed in a position central to the logical wood flow. The haul distances of the off-highway trucks will have to be balanced to avoid the need to have additional units for short terms. Back-tracking of loads should also be avoided.

In many forests the progressional method of planting and the main, established roading pattern will make the siting of the yard obvious. If the most logical location for a yard is outside the forest boundary, then an off-highway link must be secured between the forest and the yard since any yard which is isolated by on-highway links will be at a considerable disadvantage.

### **How Big Should the Yard be?**

A big yard might ease inventory problems but would be expensive to form. A yard of about 100 m x 100 m in size could handle from the minimum economic volume (around 50,000 - 60,000 tonnes per annum) up to around 80,000 - 100,000 tonnes per annum. Above this latter volume yard sizes will have to increase proportionally. An argument for keeping yards small is that their capital expenditure can be also kept small and therefore they can more feasibly be relocated as the major felling areas shift within the forest.

## **How Much will the Yard Cost?**

The cost of yards will depend on the amount of earthworks required, the type of subgrade, and the on-site facilities. Yards should be located so that they drain naturally. As well as the physical formation and metalling of the yard, some form of supervisor's building and construction of a weighbridge may be necessary.

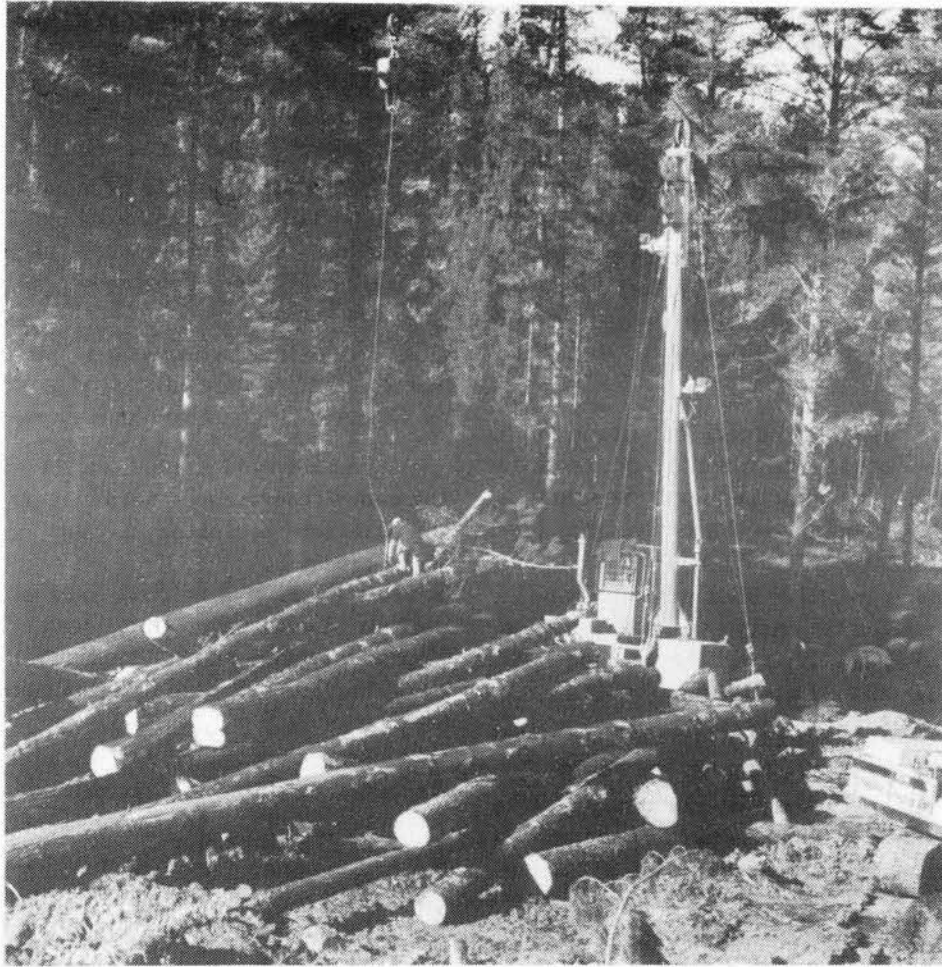
Since trucks coming from the skidsites and those going to the mills will be required to be weighed, the most appropriate weighing mechanism is a platform weighbridge. Its cost will depend upon the type used. A relocatable version would be about \$40,000 with the construction of concrete foundations costing an additional \$10,000 - \$15,000. If output from the yard is less than 100,000 tonnes, an alternative is a Loadrite weighing system mounted on a front-end loader. This weighing system costs only \$4,000. Although it is not approved by the Weights and Measures section of the Department of Labour, the Loadrite can be used as long as there is agreement between buyer and seller.

## **CHECKLIST OF MAJOR POINTS**

There are three options for wood handling :

- (1) Processing at the skidsite
- (2) Processing at one major log yard, in or near the forest
- (3) Processing at one or more small log yards, in the forest near the harvesting area. To determine which option is most suitable for current and future harvesting options, the following points should be considered :
  - Is the clearfelling volume at least 50,000 tonnes/annum?
  - Are a mixture of species to be handled?
  - Could roading costs be significantly reduced by using specialised off-highway trucks?
  - Are skidsite surface conditions in the wet months of the year such that log-making becomes difficult?
  - Is inventory control at the skidsite currently a problem, or likely to be one in the future?
  - Is there an opportunity to cater for a spot market in specialised log sorts?





*Figure 4 - Stockpiles like this make it very difficult for skidworkers to safely carry out their job.*

- In the future might customers want a greater number of log sorts, with the logs cut more closely to specification?
- Could at least one worker be dropped off each logging crew on the introduction of a log yard because of decreased skid work?
- Does the pattern of scheduled clear-fellings tend to be in distinct blocks with the forest?
- Does material flow from the forest on one main rather than several separate routes?
- Are there logical sites for log yards either in or near to the forest to which stems can be carted off-highway?
- Are there quality supervisors to manage the operations within a log yard?
- Will the disposal of residues in the yard represent a significant problem?
- Are the logging management, logging crews and the trucking fleet operators amenable to change?

A thorough economic analysis must be made, quantifying in dollar terms all of the points raised above before any earthworks are contemplated.

This Technical Release suggests that the potential benefits of the centralised processing concept cover the whole logging spectrum. If a decision to build a log yard is made, then the benefits on which this decision are based must be realised and maintained. Log yards will be no substitute for, but rather an enhancement to, good management.

#### REFERENCES

- Murphy, G.E. and Twaddle, A.A. 1986 : "Techniques for the Assessment and Control of Log Value Recovery in the New Zealand Forest Harvesting Industry". In proceedings 9th Annual Council on Forest Engineering Meeting. Mobile, Alabama, 5 p.
- Twaddle, A.A. 1986a : "Better Log-Making", LIRA Technical Release, Vol. 8, No. 5, 4 p.
- Twaddle, A.A. 1986b : "Forestry Companies Could Benefit from Systems to Control Upgrading". Forest Industries, Vol. 17, No. 3, Pp. 31-36.

## SUGGESTED READING

Most of the readily available literature discussing log yards is based on American or European experience. Despite this drawback some articles are useful to read as they outline the basic requirements of log yards. The following is a selection of references for those interested in the principles of centralised processing, available in either the Forest Research Institute library or the LIRA library.

Dummond, S.: "The Concept of using DJB Carriers for In-Forest Transportation on Low Quality Roads". In Proceedings, Session 5, Logging Industry Research Association, June 1986, Rotorua. 25 p.

This paper gives a detailed analysis of using a specialised transport unit to cart stems off-highway on low quality roads to a log yard. Mangatu Forest is used as a working example.

Ellis, J.C.: "Loadrite Two Years On". Forest Industries, 1986, Vol. 17, No. 9, Pp 36-39.

Outlines the correct operating technique for a Loadrite weighing system mounted on front-end loaders and details the precision of weight estimates.

Grammel, R: "Central Tree Processing Operations". Proceedings, Division 3, XVII IUFRO World Congress, Japan 1981. Pp 103-111.

Discusses some of the philosophy of central processing, including a historical perspective.

Hampton, C.M.: "Dry Land Log Handling and Sorting : Planning, Construction and Operation of Log Yards". San Francisco, Millar Freeman, 1981, 215 p.

This book gives a broad perspective of dry land sorting operations in the USA.

Hedin, I.B.: "Comparison of Two Logging Systems in Interior British Columbia : Central Processing Yard vs Conventional. Forest Engineering Research Institute of Canada Canada, 1980. Technical Report No. TR-45. 53 p.

Although it presents the problems of a forestry region outside of New Zealand, this article gives case studies which illustrate something of the methodology required to evaluate the sortyard option.

Kerruish, C.M.: "Centralised Processing can Increase Log Value. World Wood, Vol. 25, No. 2, 1984. Pp 21-23.

This brief article presents descriptions of centralised processing operations in Europe and North America and then focuses on the opportunities for Australia. A view by L.G. Shultz opposing the concept of centralised processing for Australia is also included.

Quinn, J.E.: "Log Yard Inventory Control". In Proceedings, 37th Annual Northwest Wood Products Clinic, May 1982, Spokane, Washington. Pp 141-150.

While not directly applicable to New Zealand, this paper outlines a system used by Crown Zellerbach to control yard inventory and indicates the possibilities for management control that exist with log yards.

OSU Forestry Extension : "Sort Yards of the Northwest". Proceedings of a conference held by Oregon State University, April, 1977.

The Proceedings includes 24 papers from a three-day conference held in the USA covering installation decisions, layout construction, and waste disposal.

Sinclair, A.W.J.: "Utilisation of Coastal British Columbia Log Sort Yard Debris". Forest Engineering Research Institute of Canada, 1981. Technical Report No. TR-46, 68 p.

This Report highlights the problems of debris accumulating in log yards and outlines tests conducted by FERIC to dispose or utilise sort yard debris.

Sinclair, A.W.J. and Wellburn, G.V.: "A Handbook for Designing, Building and Operating a Log Sort Yard". Forest Engineering Research Institute of Canada, 1984, 285 p.

This is probably the most comprehensive readily available publication, which details all of the procedures, from project evaluation to construction, of log sorting systems. It is targeted at the coastal British Columbia region and therefore deals extensively with water sorting and storage methods but is still well worth consulting.

Twaddle, A.A.: "Large Scale Log Merchandising - An Option for New Zealand Logging". Forest Industries, Vol. 16, No. 11, 1985, Pp 29-34.

The more capital intensive option of log merchandisers are reviewed for New Zealand using developments in the USA as a basis.

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For further information, contact:

N.Z. LOGGING INDUSTRY RESEARCH ASSOC. INC.  
P.O. Box 147,  
ROTORUA, NEW ZEALAND.

Telephone: (073) 87-168