

LANDING SIZE OF HARVESTING OPERATIONS IN NEW ZEALAND

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Introduction

Landings (also called a deck, skid or skid site) are an integral part of forest harvesting operations, yet very little information can be found about either design, sizing or layout.

A 'landing' is not a well defined term. In general it is a designated area in the forest used during times of harvest to further process stems or trees extracted from the forest, store them, and then load for transportation to a market. It is usually cleared of obstacles such as trees and or stumps, and can vary in size depending on the processing, storage and loading out requirements.



Figure 1: a typical NZ yarder landing – this one is 2950m² in size.

Landing design is important for not only efficient production, but also for safety. Landings typically require extensive earthworks and are expensive to build, but can also have a permanent impact on the environment.

Understanding the factors that influence landing design will help with optimising future landings.

Landings Types

We can readily distinguish between four sizes of landing:

'Pad': is a small landing used in a two-staging operation. The pad normally serves the purpose of transferring the stems/trees from the primary to a secondary extraction machine. A common use of pads is in steep terrain, where a cable yarder will transfer to ground-based machine for further extraction to a larger processing landing. A contractor may attempt to integrate a mechanised processor onto a pad to delimb and top the trees. This aides subsequent extraction and avoid a build-up of slash on the processing landing.

'Skid': is by far the most common landing type. It will typically just service one harvesting crew. It will accommodate all processing, sorting, fleeting and loading activities. A skid will process approximately 140 – 600 tonnes per day.

'Superskid': is a processing area that services multiple crews over a larger forest area. In addition to offering economies of scale, and providing for a more consistent wood flow through the processing tasks, it provides an opportunity to increase the emphasis on value recovery. Stems are typically forwarded by off-road truck to the superskid. A superskid will process approximately 500 – 1500 tonnes per day.

Central processing yard (CPY): is the largest landing type, whereby stems are transported there by either off-road or on-road trucks and will typically process more than 1500 m³ per day. CPY's are normally located close to a mill, port or railway head. CPY's are also characterised by more automated, or sophisticated, processing to optimise value recovery. CPYs are still relatively rare with just a few in use around NZ.



Figure 2: Kawerau CPY – processes over 500,000 tonnes of logs per year and is 180,000m² in size.

Methods

Landings visited in 6 different regions of NZ, including new, in-use and used landings. This study did not include any CPY's, with the main focus on just standard skid sites. The perimeter of each landing was mapped with a *Garmin GPSmap 60 CSx*. A minimum of 30 points were recorded for each landings as tests showed the landing size error to be less than 2%. For each landing the forest manager provided:

- type of operation (ground base or hauler),
- type of processing (manual or mechanical),
- type of log loader used (front-end or knuckle-boom),
- number of log sorts,
- approximate daily productivity (tonnes/day),
- duration of the harvesting operation (weeks).

During the visits of active landings, the type, number and tasks of all machines were noted, as well as the number of the crew and the tasks of its members. At the same time, sketches were produced describing the wood flow through the landing



Figure 3: Front-end loader operating on a landing

Results

142 landings measured, with 131 landings captured in 2009, the remainder in 2010. 12 were new (un-used), 38 were in operations and 93 were recently completed.

Table 1 shows the mean, 5th and 95th percentile values for each of the parameters.

	Mean	5 th Percentile	95 th Percentile
Landing size (m ²)	3868	1944	7476
Weeks in Operation	4.3	1	10.5
Production (t/day)	287	150	450
Log Sorts (#)	10.2	1	15
Length/Width ratio	2.12	1.1	4.0

Other summary data include:

- 63 % of the landings were ground-based, 37% were cable settings
- 47% had manual processing, 53% mechanized processing
- 79% used knuckle-boom type loaders for loading out, 21% used front-end loaders

Landing Age: Old landings are 900m² larger than new, suggestion that during harvesting the crews will enlarge their operating area over time.

Manual vs Mechanized Processing: On average the manual processing crews will operate one week longer at a single landing and cut 13 log sorts. Their productivity is only just 26 tonnes per day less than a mechanised processing crew. The landing shape is the same.



Figure 4: Mechanised processing uses less space than manual.

Front-end Loaders versus Knuckle-boom: For the 21% of the landings surveyed that were operated by front-end loaders, they were on average 1100m² larger, produced 35t/day more, and worked with an average of 15 log sorts.



Figure 5: Landings where logs are loaded out with front-end loaders use more space.

Regression analyses: The best regression equation for the data is:

$$\text{Landing Size (m}^2\text{)} = 390 + 560 \times \text{LandingAge} + 173 \times \#\text{LogSort} + 3.5 \times \text{DailyProd.}$$

Whereby LandingAge =0 when new; =1 when in use; and =2 when complete.