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VOLUME AND VALUE LOSS IN K GRADE EXPORT LOGS

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Figure 1 - Logs being examined for small end defects.

ABSTRACT

Stockpiled export logs at four New Zealand ports were examined and measured to determine the effect of small end defects on scaled small end diameter and subsequent volume. Value losses caused by the defects were estimated from these measurements.

Amongst the four ports and three lengths of K grade logs examined, between 2% and 6% of the logs examined were found to have scale reducing defects. Of these defects, 92% were man-made, created by logs splitting during crosscutting, while the remainder were caused by bark-encased knots.

The average loss for the measured K grade log sample was $0.63 per JAS unit. If this value is applied to the total volume of log exports from New Zealand, value loss is about $2 million for 1991. Much of this loss is potentially avoidable.

INTRODUCTION

Export of sawlogs has been increasing steadily in recent years, from 830,000m^3 in 1988 to an estimated 3,295,000m^3 in 1992 (NZFOA, 1992). Logs from four major log exporting ports were examined to assess the effect of small end defects on scaled diameter, and the subsequent effect on log volume and value.

The reason for studying export logs was that the scaling rules are strict with each log individually inspected, measured and tagged. Any defects in the small end, such as splits and bark encased knots, can reduce the effective diameter measurement and have a considerable effect on the scaled volume and consequently value.

The sample base for this investigation consisted of about 54,000 K grade export logs of 11 7.3 and 3.6 metre lengths. All the small ends of these logs were examined for defects, and those assessed as having a defect (splits and knots only) were rescaled.

The results from the first port studied, Mount Maunganui, have already been published (Twaddle and Ellis, 1991). They have been included within this report to produce a New Zealand wide evaluation of potential losses in value through defects in the small end of export logs.

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LOG SCALING SYSTEM

The two most commonly used scaling systems are the Japanese Haakon-Dahl (JHD) and Japanese Agricultural Standard (JAS). Typically, A grade export logs are scaled with the JHD system, while most other grades, including K, are assessed with the JAS system.

As the bulk of the logs examined in the four ports were K grade, for consistency of measurement, the JAS scaling system was applied. Details of the scaling system are described in Table 1 (Ellis, 1988).

When examining export logs for defects, the emphasis throughout the study was concentrated on the small end as the JAS export log grading rules consider only the small end measurement and nominal log length for assessing log volume.

Any reduction to the small end diameter (SED) due to defects can have a major influence on the scaled volume. The longer the log, and the larger the log diameter, the greater the effect on volume and therefore value of any diameter reduction.

A variant on the measurement of the SED under the JAS system allows measurement through the log centre rather than the pith. At three of the four ports studied, all logs were measured using both methods to see if there were any major differences between the two methods. Unless a log was out-of-round and had an off-centre pith, the two measurements tended to be scaled the same, due to the rounding down to the nearest two centimetre interval.

SMALL END DIAMETER
(For SED's greater than 14 cm.)

(a) Measure the smallest SED inside the bark through the pith or centre of the log. Round down to the nearest 2 centimetre interval.

(b) Measure the SED diameter inside bark through the pith or centre at right angles to the smallest diameter. Round down to the nearest 2 cm interval.

(c) If the smaller of these two diameters is between 14 and 40 cm, for every difference of 6 cm add 2 cm to the smaller diameter.

(d) If the smaller of the two diameters is greater than 40 cm then for every difference of 8 cm add 2 cm to the smaller diameter.

VOLUME

(1) For logs less than 6 m long.

$$V(m^3) = \frac{(D^2 \times L)}{10000}$$

where
D = smallest diameter.
L = length.

(2) For logs greater than 6 m long.

$$V(m^3) = (D + \frac{[L' - 4]}{2})^2 * (\frac{L}{10000})$$

where
D = shortest diameter
L = length
L' = length to nearest whole metre
(L'-4)/2 = taper factor

Table 1 - Calculation of the Japanese Agricultural Standard (JAS)

STUDY PROCEDURE

Log stocks of known length and grade were inspected in the log storage areas of the ports. The small end of each log within the stack was inspected for diameter reducing defects. Detection focused on the defects which reduced the diameter of the normal small end (i.e. splits and bark encased knots) rather than those scaling reductions required to reduce an irregular enlargement of the stem back to a nominal diameter (trumpets or whorl cuts). Where a defect was observed, the small end of the log was measured according to the JAS scaling method.

All logs recorded had their volume calculated using the JAS method as if the defect were not present (Full-scale), and then re-calculated with the defect included (Defect-scale). Both through the pith (PM) and through the log centre (CM) measurements were taken. The proportion of logs with defects and the causes of the defects were also calculated.

All log value estimates are based on an assumed value of $85 per JAS unit. A JAS unit is about the same as a cubic metre.

Some defects were located on the long diameter axis and/or were so small they did not affect the measured diameter. These defects were not recorded. Occasionally (1% of inspected logs) a defect, usually a split, was so severe that the log was classified as a "reject". However, in practice, most marshalling companies cannot reject logs as it ultimately costs less to accept a log than have it rejected.

Port	Grade	Length (m)	Sample size	Average volume (JAS units)		Average scaled SED (cm)		% with defect	Grade average value loss ($/JAS)	
				PM	CM	PM	CM		PM	CM
1	K	11	1382	1.35	-	31	-	4.7	0.49	-
1	K	7.3	2000	0.85	-	32	-	3.9	0.51	-
1	K	3.6	1395	0.42	-	33	-	3.3	0.58	-
2	K	11	7779	1.06	1.05	27	27	3.2	0.45	0.43
2	K	7.3	5587	0.60	0.61	27	27	2.9	0.45	0.46
2	K	3.6	5210	0.34	0.34	29	29	2.3	0.37	0.38
3	K	11	3366	1.20	1.21	28	28	5.7	0.91	0.93
3	K	7.3	3299	0.78	0.78	28	28	3.9	0.79	0.79
3	K	3.6	2023	0.36	0.36	29	29	2.9	0.75	0.79
4	K	11	7700	0.99	0.99	25	25	3.2	0.79	0.78
4	K	7.3	7604	0.51	0.51	23	23	2.4	0.63	0.63
4	K	3.6	6908	0.25	0.25	24	24	2.7	0.68	0.66
		Total	54,253					Average	0.61	0.62

Table 2 - Defect proportions and average value losses for K grade export logs

RESULTS

At the time of this investigation the most common grade being exported from New Zealand ports was K grade. This analysis has therefore been confined to this grade only. Summarised results by port and log length class are given in Table 2.

Variation Amongst Ports

Value loss (JAS/PM) varied from \$0.37 cents to \$0.91. The average value loss for the ports 1 to 4 respectively were \$0.51, \$0.40, \$0.85 and \$0.73. Port 3 had the highest level of average value loss, although this could be due to the influence of the apparent higher proportion of logs from woodlots which had more large branches and bark encased knots.

While there is some variation in average loss between the highest and lowest observed, the range is not of an order to suggest major differences in the level of log preparation amongst the localities included within this study.

Impact of Location of Scale Diameter

When undertaking small end diameter measurements, both through the pith (PM) and through the log centre (CM) methods were used. As indicated in Table 2 little difference was found between the two methods.

A test of the scaled volumes derived from the pith and log centre methods of measurement showed no significant difference (P=0.006). A sample of 1500 logs showed a difference in volume of only 0.28%, with the total volume of the centre measured logs being slightly higher, 1052.5m^3 compared to 1049.5 m^3 for the pith measurement.

Overall, 3.2% of the measured K grade logs had a defect which affected the scaled diameter. The longer length, 11.0 metre logs, always averaged a higher proportion of defects, while the shortest length, 3.6 metres, had the lowest level in all but Port 4.

Cause of Scale Diameter Reduction

The vast majority of defects are man-made (see Table 3), i.e. splits created at crosscutting. They are therefore, to some extent, avoidable. The inherent defects occur mostly due to bark encased knots, which become visible when a cut is made on or near a whorl. Some of these are also avoidable by moving the cut slightly, away from the whorl.

PORT	GRADE	LENGTH (m)	MANMADE	INHERENT
1	K	11	93	7
1	K	7.3	84	16
1	K	3.6	78	22
2	K	11	97	3
2	K	7.3	98	2
2	K	3.6	97	3
3	K	11	92	8
3	K	7.3	89	11
3	K	3.6	81	19
4	K	11	96	4
4	K	7.3	97	3
4	K	3.6	93	7
		AVERAGE	91.3	8.7

Table 3 - Causes of scale diameter reductions (%)

Impact of Man-Made versus Inherent Defects

Man-made defects constitute the majority of occurrences where defects cause a diameter scale reduction. However, these two sources of value loss have different respective impact on log value each time they occur. Typically, inherent defects, primarily knots, cause a greater loss per occurrence than do man-made defects (Table 4).

GRADE	MAN-MADE		INHERENT	
	% OF TOTAL VALUE LOSS	COST PER OCCURRENCE ($)	% OF TOTAL VALUE LOSS	COST PER OCCURRENCE ($)
K 11.0	95	17.27	5	35.80
K 7.3	90	11.46	10	17.76
K 3.6	81	5.86	19	11.08

Table 4 - Proportions and costs of defects in K grade logs

Man-made losses are proportionately higher in the longer length logs than inherent losses. This indicates that splitting is more prevalent in the bigger logs than it is in smaller logs.

If the cost of individual defects are looked at as a proportion of the value of the log, shorter logs tend to loose a greater percentage of their value (26%), than longer logs (20%).

VALUE LOSS DISTRIBUTION

As illustrated in Figure 2, where a defect does reduce the logs value, in most cases the size of the loss is between $10 and $20. However there were losses in individual logs over $50.

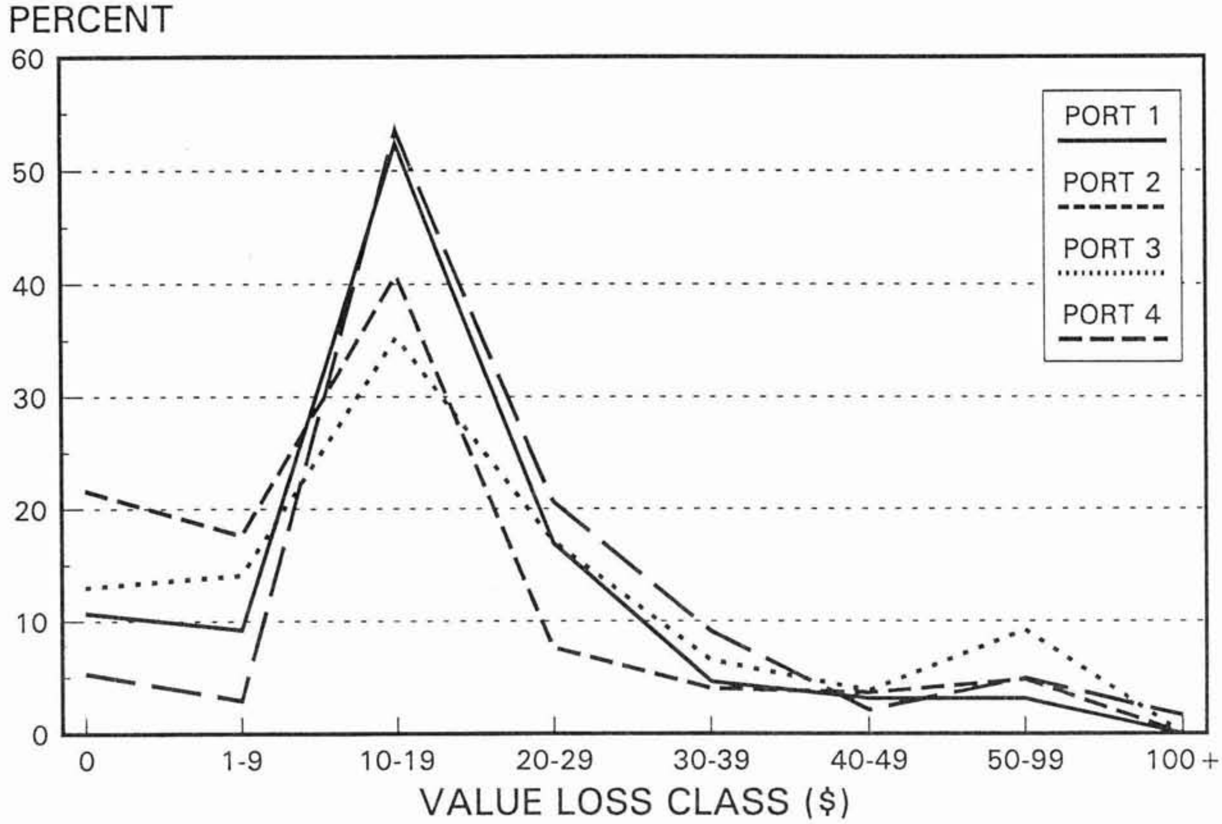

Figure 2 - Value loss distribution in 11m K grade logs

RELATIONSHIP BETWEEN DIAMETER AND DEFECT SIZE

Figure 3 illustrates the value loss for reduction in small-end diameter for defects of 5, 10, 25 and 50 mm in 11 m logs.

The results show a stepping effect caused by the 2 centimetre round-down rule within the JAS scale method (see Table 1). They also show that even a relatively small defect such as 5 mm can make a considerable difference to final log value if the diameter is close to the edge of a 2 centimetre increment.

Many log makers would not be concerned if they made a 50 mm split in the end of an export log. However, the cost of that split may be equivalent to the cost of over an hour of their time. The results of the study indicate that when preparing logs for export, care must be taken to ensure full value is recovered.

EFFECT OF CUTTING DAMAGED LOGS TO A SHORTER LENGTH

When export logs have an obvious end defect, particularly a large split, an option is to cut the log down to the next possible log length. For example, an 11.0 metre log may be shortened to an 7.3 metre length, leaving a section of waste.

A review of this option indicates that it is usually better to accept the scale reduction than to shorten log length. For example, an 11.0 metre K grade log having a Full-scale SED in the 300-319 mm range has a split defect. Cutting this 11.0 metre log back to the next length would make a 7.3 metre log in either the 340-359 SED range (0.93 JAS) or 320-339 SED (0.82 JAS). The JAS scaled 11.0 metre log remains of greater volume than the 7.3 metre log until the Defect-scale drops to the 200-219 mm range, i.e. a 10 centimetre reduction. This effect is illustrated in Figure 4.

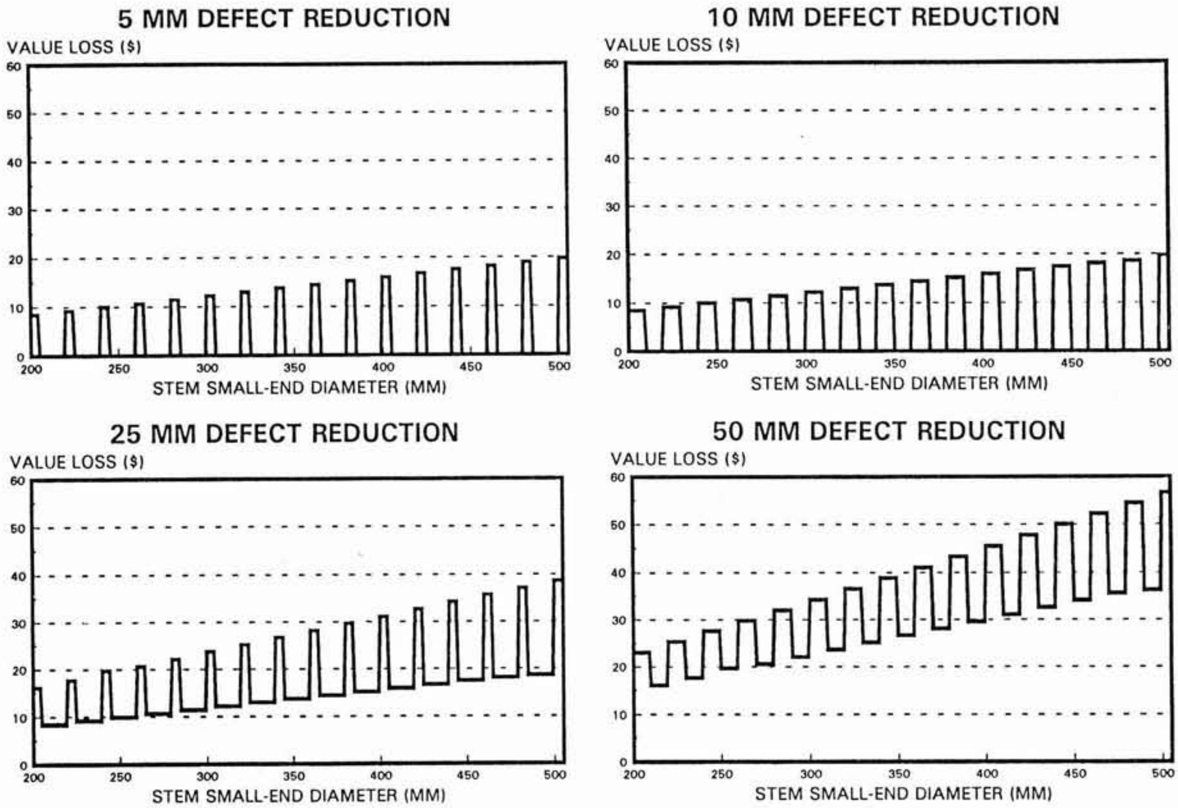

Figure 3 - Value loss caused by varying sized defects in 11m K grade logs

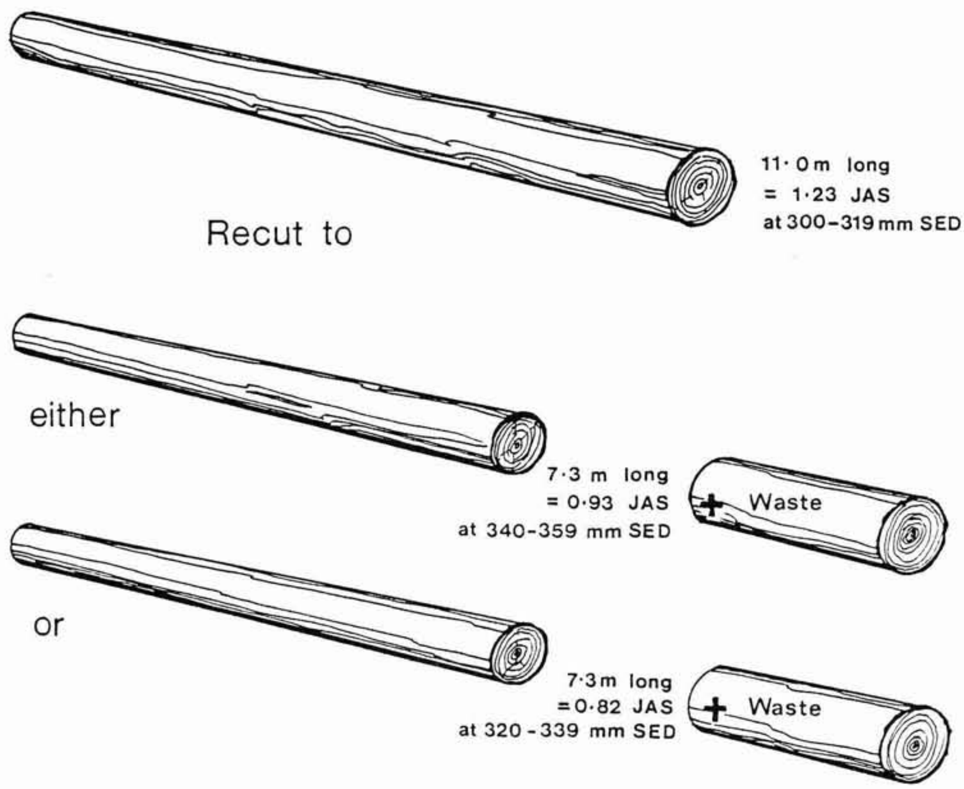

Figure 4 - JAS scale reductions for cutting an 11.0 metre log back to a 7.3 metre log

An 11.0m log with a small end diameter of 300-319 mm has a volume of about 1.2 JAS units. As the effective SED decreases with an increasing larger split, the Defect-scale JAS volume decreases. When the effective minimum diameter falls to the 200-239mm level, the JAS volume for the 11.0 metre log is about equivalent to that same log cut back to 7.3 metre (Figure 5).

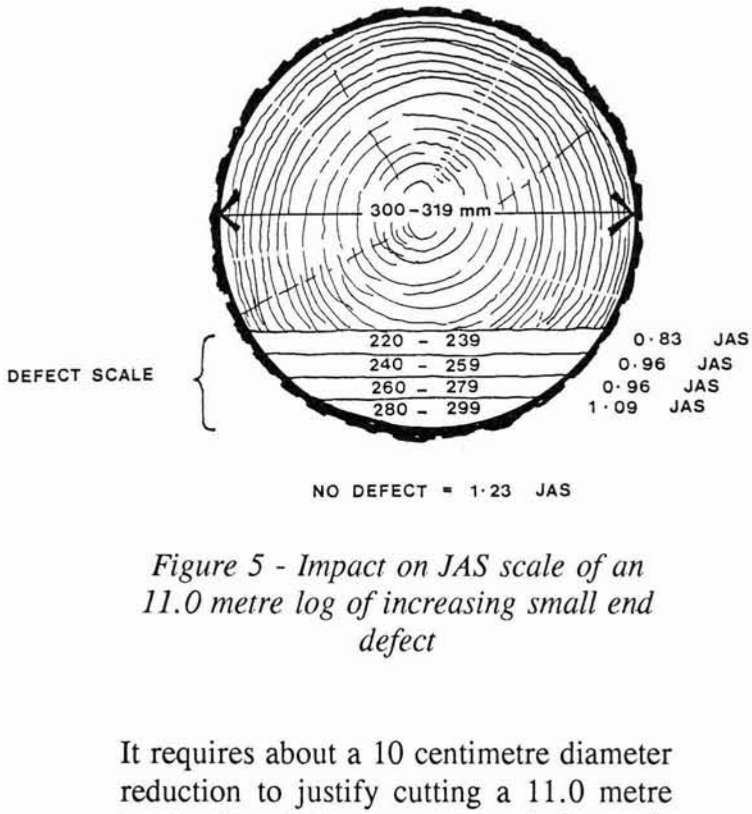

Figure 5 - Impact on JAS scale of an 11.0 metre log of increasing small end defect

It requires about a 10 centimetre diameter reduction to justify cutting a 11.0 metre log back to 7.3 metres to maximise scale volume. Other factors, however, such as a requirement to maximise the proportion of longer length logs, would also have to be considered by the log exporting organisation when making this decision.

CONCLUSIONS

This study, covering four log export ports, revealed that the proportion of K grade logs with some scale diameter loss averaged just over 3%. At that level, losses from defects could not be considered excessive, however, some measurements detected defect levels to nearly 6%. The higher value indicate that a continual watch needs to be maintained on quality.

The main cause of losses were end splits which are predominately created during cross cutting. Even small splits can reduce log value, and many are avoidable. Value losses from bark encased knots tend to be larger but were less frequent.

Overall there appears to be little difference between measuring through the pith or through the log centre in K grade logs which have a diameter reducing defect. The exception to this is the occasional log which is both out of round and has an off-centre pith. Small variations in roundness and slightly off-centre piths tend to be negated by the rounding down of the measured SED to the nearest 2 cm interval.

A review of the option of cutting back logs to eliminate a severe defect indicated that this policy were only justifiable where splits are very large.

The size of the estimated loss to log exporters ($2 million in 1991) indicates that this is an area where closer attention to log quality would be worthwhile.

It is not unreasonable to assume that the lowest level of defect occurance (2.3%) is achievable in all situations. Simply informing cross cutters of the impact of splits on log value and increasing the amount of quality management on export logs could significantly reduce this loss.

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