FUTURE FORESTS RESEARCH

DIVERSIFIED SPECIES TECHNICAL NOTE

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DURABILITY TESTING OF LOCALLY GROWN CYPRESS SPECIES

Graveyard, Field and Service Tests Conducted by Scion to January 2010

Summary

This Tech Note summarises all durability testing conducted by Scion over the last fifty years for wood obtained from cypress species. These tests include stake tests and post tests in the ground, weatherboard, lap joint, log and sapwood treatment tests exposed to weather as well as service tests of a number of components in privately owned buildings.

Ground-contact stake tests and above-ground tests completed to date all indicate that the heartwood of *Cupressus macrocarpa, C. lusitanica* and *Chamaecyparis lawsoniana* are in natural durability Class 3 (moderately durable). Tests of younger material, including *C. leylandii,* have been initiated but it is too early to determine whether they will be less durable. Field and service tests in these species show some "early" failures in moderate decay hazard situations indicating variable durability. In some cases timber from some trees failed early, while timber from other trees from the same stand remained sound. In other cases pieces that failed early were from near the pith.

The heartwood of the cypresses is suitable for weatherboards, exterior finishing timbers and joinery but may be less reliable in moderate to high decay exposure situations such as decking and exposed structural components. The heartwood and H1.2 treated sapwood should be a suitable alternative to equivalent grades of H1.2 treated radiata pine.

Overall, durability testing of cypresses here has been reasonably comprehensive in terms of numbers and diversity of tests and the range of environments. On the downside, some of this research has been ad-hoc where pieces of cypress timber were included with tests of preservative treated radiata pine and sample size has been relatively small in many of the tests. These tests were never set up with an experimental design specifically aimed at examining possible causes of variation in durability. Most were add-ons to tests for other purposes such as contracts from timber treatment companies, mainly because the wood was available for testing. Perhaps this shows a gap in knowledge. There is little to be gained by doing more general tests for durability at this stage. However, the installation of designed graveyard tests is recommended once the results from fungal cellar testing for durability are obtained and can point to suitable experimental design with consistent material chosen for the job.

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Test Details

The tests summarised here fall into three main categories:

- Ground contact stake tests at the various “graveyard” sites around the country.
- Above-ground tests at the Whakarewarewa graveyard on the Scion campus.
- Service tests of various commodities scattered around New Zealand.

Ground Contact Stake Tests

A ground durability stake test of local exotic and indigenous species (Test 10, Table 1) was established using 18 mm square stakes at Whakarewarewa in 1962. This included macrocarpa (*Cupressus macrocarpa*), Lawson cypress (*Chamaecyparis lawsoniana*) and Mexican cypress (*Cupressus lusitanica*).

In 1967 a test of 50 x 50 mm stakes (Test 12, Table 1) was installed at six graveyard sites, Glenbervie, Hanmer, Harihari, Waitarere, Washpool and Whakarewarewa. This included *C. macrocarpa* and *Ch. lawsoniana*.

A third test, installed in 1980 at Whakarewarewa, included 20 x 20 mm stakes of *C. macrocarpa, C. leylandii* and *C. lusitanica* (Test 26, Table 1). *C. lusitanica* was also included for comparative purposes in a 20 x 20 mm stake test of tropical plantation species installed at Whakarewarewa in 1989 (Test 66, Table 1). Unfortunately records of the source and age of the material used in these tests have not been located but it was most likely to have been all heartwood cut from mature trees.

In 2007, sets of 20 x 20 mm *C. lusitanica*, *C. macrocarpa* and *C. leylandii* from 20-year-old provenance trial trees were installed at Whakarewarewa and Waitarere (Test 86, Table 1). Stakes cut from mature *C. macrocarpa* and young *C. lusitanica*, supplied as framing by an Auckland specialist sawmiller, were also installed at the same sites (Test 98, Table 1). These tests were to determine whether timber from young plantation stands was less durable than timber from older shelter belt and amenity plantings.

TABLE 1
Summary of Results from Stake Tests – Cypress species

Test No.	Species	Test Site	Year/No. Installed	Years in Test[1]	Average Life[2]	I of C[3] Durability[4]
10	*C. macrocarpa*	Whaka.	1962/10	7	5.0	**3+**
10	*C. lusitanica*	Whaka.	1962/10	7	4.2	**3+**
10	*Ch. lawsoniana*	Whaka.	1962/10	4	3.9	**3-**
12	*C. macrocarpa*	Glen.	1967/10	7	5.3	**3-**
12	*C. macrocarpa*	Hanmer	1967/10	17	12.4	**3+**
12	*C. macrocarpa*	Hari.	1967/10	18	11.2	**3+**
12	*C. macrocarpa*	Wait.	1967/10	11	8.3	**3-**
12	*C. macrocarpa*	Wash.	1967/10	27	14.1	**3+**
12	*C. macrocarpa*	Whaka.	1967/10	15	8.6	**3-**
12	*Ch. lawsoniana*	Glen.	1967/10	14	7.7	**3-**
12	*Ch. lawsoniana*	Hanmer	1967/10	23	12.9	**3+**
12	*Ch. lawsoniana*	Hari.	1967/10	25	14.3	**3+**
12	*Ch. lawsoniana*	Wait.	1967/10	20	11.0	**3+**
12	*Ch. lawsoniana*	Wash.	1967/10	14	12.3	**3+**
12	*Ch. lawsoniana*	Whaka.	1967/10	16	10.8	**3+**
26	*C. macrocarpa*	Whaka.	1980/10	14	6.1	**2**
26	*C. lusitanica*	Whaka.	1980/18	12	6.1	**2**
26	*C. leylandii*	Whaka.	1980/10	8	3.1	**3-**
66	*C. lusitanica*	Whaka.	1989/4	11	6.1	**2**
86	*C. macrocarpa*	Wait.	2007/15	2	na	**7.5 *(1)***
86	*C. macrocarpa*	Whaka.	2007/15	2	na	**5.2 *(6)***
86	*C. lusitanica*	Wait.	2007/15	2	na	**7.6 *(1)***
86	*C. lusitanica*	Whaka.	2007/15	2	na	**5.1 *(4)***
86	*C. leylandii*	Wait.	2007/15	2	na	**7.2 *(2)***
86	*C. leylandii*	Whaka.	2007/15	2	na	**2.8 *(9)***
98	*C. macrocarpa*	Wait.	2007/10	2	na	**8.6**
98	*C. macrocarpa*	Whaka.	2007/10	2	na	**7.7**
98	*C. lusitanica*	Wait.	2007/10	2	na	**7.9**
98	*C. lusitanica*	Whaka.	2007/10	2	na	**7.5**

[1]This is the number of years until the last stake failed or, where some stakes still remain, the number of years the test has been running (for Tests 86 and 98).
[2] The average life (in years) for all samples in a group. "na" indicates that some samples in the group remain.
[3] Index of Condition is the average condition of all samples in a group where 10 = "as new" and 0 = failed. The number of stakes failed in a group is in parenthesis.
[4] Australasian durability class where 1 = "very durable" and 4 = "perishable". "+"is the more durable end of the class, "-"is the less durable end.

The ratings systems used when assessing stake tests are in Appendix I (a). The Australasian natural durability classes are in Appendix I (b).

Above-ground Tests

A major test of treated radiata pine roof shingles installed in 1977-78 included a *C. lusitanica* roof for comparative purposes (Test Bu14, Table 2). A *C. macrocarpa* shingle roof was added to this test in 2000.

In 1987, a test of naturally durable species was installed at Whakarewarewa. This included *C. macrocarpa* and *Ch. lawsoniana* as decking, L-joints and weatherboards plus *C. lusitanica* L-joints. *C. lusitanica* weatherboards were added to these tests in 1991 (Tests 54, 57, 53, Table 2).

The decking in this test was 45 mm thick and was placed directly on to preservative treated pine bearers, 100 mm above the ground. L-joint tests are a standard test of 45 mm square material which includes a right angle haunch joint to simulate the type of exposure common for exterior joinery. Half of these L-joints were installed with a white, 3-coat alkyd paint coating and half were uncoated. They are exposed in sloped racks about one metre above the ground.

TABLE 2
Summary of Results from Above Ground Field Tests – Cypress Species

Test No.	Species	Test Type	Year/No. Installed	Years in Test[1]	Index of Condition[2]
Bu14	*C. lusitanica*	Shingles	1978/na	14	**8.5**
Bu14	*C. macrocarpa*	Shingles	2000/na	5	**9.0**
54	*C. macrocarpa*	Decking	1987/10	20	**2.8 *(3)***
54	*Ch. lawsoniana*	Decking	1987/10	20	**3.6 *(2)***
57	*C. macrocarpa*	L-joint	1987/20	20	**2.7 *(7)***
57	*C. lusitanica*	L-joint	1987/20	20	**2.8 *(8)***
57	*Ch. lawsoniana*	L-joint	1987/20	20	**1.0 *(16)***
53	*C. macrocarpa*	Wboard	1987/39	20	**6.6**
53	*Ch. lawsoniana*	Wboard	1987/39	20	**6.5**
53	*C. lusitanica*	Wboard	1987/39	16	**7.0**
Ms06	*Ch. lawsoniana*	Flat Panel	1997/10	12	**6.6 *(2)***
FT17	*Ch. lawsoniana*	Decking	2005/5	4	**9.9**
FT22	*C. macrocarpa*	Lap joint	2007/6	2	**10.0**
FT22	*C. leylandii*	Lap joint	2007/8	2	**10.0**
FT22	*C. lusitanica*	Lap joint	2007/2	2	**10.0**
FT22	*C. macrocarpa*	Lap joint	2007/10	2	**10.0**
FT22	*C. lusitanica*	Lap joint	2007/10	2	**10.0**

[1] This is the number of years from installation until the latest assessment.
[2] Index of Condition is the average condition of all samples in a group where 10 = "as new" and 0 = failed. The number of samples failed in a group is in parenthesis.

The weatherboard tests included north facing uncoated and dark stained panels plus uncoated south facing panels. The stain coating was a dark coloured commercial oil-based stain widely available from coatings retailers at the time and was applied in two coats prior to installation. Assessments of weatherboard tests include ratings for surface condition, checking and distortion as well as decay.

Brush-on preservative/water repellent coatings were applied to Lawson cypress, radiata pine and Douglas-fir in flat panel tests at Whakarewarewa in 1997. These tests were to determine whether this type of product would extend the life of sapwood and heartwood from low to moderately durable species when exposed to the weather. Untreated control panels were included on 45^{o} sloping racks facing north (Test Ms06, Table 2).

Lap-joint tests were installed in 2007 using material from the same sources as in stake tests 86 and 98 (Table 1). These were 90 x 40 mm and included a 90 mm square lapped joint in the centre. They were installed without a coating in horizontal racks one metre above the ground.

A few boards of 19 mm thick *Ch. lawsoniana* decking were included with beech for comparative purposes with a test of mahogany decking in 2005 (test FT 17, Table 2).

C. macrocarpa and *Ch. lawsoniana* were also included in accelerated framing decay tests run for five years from 2004. This included heartwood samples and samples which contained sapwood. As well as untreated samples, sets of the sapwood samples were treated with the two main types of framing preservative approved for use with radiata pine at that time.

Service Tests

The service testing programme monitored the deterioration of timber components in use in all types of structures throughout the country. The bulk of the programme was abandoned in the mid 1990s and very few of the test sites have been visited since then. Almost all of the sites were owned by private individuals or companies and were visited every 3-5 years.

A comprehensive test of various types of preservative-treated and naturally durable timber fence posts and battens was installed on six farms in the southern half of the North Island in 1961 (tests Fm 7-12, Table 3). In 1976 posts from tests of sap displacement preservative treatment processes on a range of species from Westland, that included *Ch. lawsoniana* and *C. macrocarpa*, were installed at Notown and Whakarewarewa (test Fm 22, Table 4). Conventional preservative treatment trials, using dried posts from the same source and several preservative types, were conducted at Scion in 1979 and the resulting posts were installed at Whakarewarewa (test Fm 21, Table 4). The sapwood of cypress species is not very permeable and conventional pressure treatment with CCA preservatives usually results in patchy penetration. These trials were established to determine whether thinnings from stands of various species growing in Westland would be sufficiently durable for use as fence posts after preservative treatment.

TABLE 3
Summary of Results from Natural Durability Service Tests – Cypress species

Test No.	Species	Test Site	Comp. Type	Year Installed/ No. Installed[1]	Years in Test[2]- Average Life	Index of Condition[3] - Durability[4]
Fm7	*C. macrocarpa*	Inglewood	Posts	1961/8	26	**0.4 *(7)***
Fm9	*C. macrocarpa*	Masterton	Posts	1961/8	26	**1.4 *(6)***
Fm10	*C. macrocarpa*	Waipukurau	Posts	1961/1	10 *(10.0)*	**3-**
Fm11	*C. macrocarpa*	Fielding	Posts	1961/8	26	**0.4 *(7)***
Fm7	*C. macrocarpa*	Inglewood	Battens	1961/19	26	**4.3 *(1)***
Fm8	*C. macrocarpa*	Carterton	Battens	1961/15	26	**6.3 *(2)***
Fm9	*C. macrocarpa*	Masterton	Battens	1961/16	26	**5.4 *(1)***
Fm10	*C. macrocarpa*	Waipukurau	Battens	1961/15	26	**4.1 *(5)***
Fm11	*C. macrocarpa*	Fielding	Battens	1961/16	26	**6.4 *(1)***
Fm12	*C. macrocarpa*	Foxton	Battens	1961/15	26	**4.3 *(5)***
Bu16	*Ch. lawsoniana* (CCA)	Okarito	Wboards	1980	19	**8.7**
Bu30	*C. macrocarpa*	L. Rotoiti.	Wboards	1983/na	13	**9.0**
Bu30	*C. macrocarpa*	L. Rotoiti.	Framing	1983/na	13	**10.0**
Bu31	*C. macrocarpa*	Lynmore	Wboards	1984/na	12	**9.1**
Bu31	*C. macrocarpa*	Levin	Wboards	1985/na	11	**8.8**
Bu31	*C. macrocarpa*	Utuhina	Framing	1985/na	11	**9.5**
Bu31	*C. macrocarpa*	Utuhina	Wboards	1985/na	11	**8.5**
Bu31	*C. macrocarpa*	Utuhina	Joinery	1985/na	11	**9.5**
Bu31	*C. macrocarpa*	Ohiwa	Bd-batt.	1989/na	7	**8.2**
Bu31	*C. macrocarpa*	Ohiwa	Bd-batt.	1991/na	5	**8.7**
Bu31	*C. macrocarpa*	Ohiwa	Decking	1989/na	7	**8.5**
Bu33	*C. macrocarpa*	Taneatua	Framing	1985/na	14	**10.0**
Bu29	*C. lusitanica*	Kaharoa	Bd-batt.	1989/na	7	**8.5**
Bu29	*C. lusitanica*	Kaharoa	Framing	1989/na	7	**10.0**
Bu29	*C. lusitanica*	Kaharoa	Joinery	1989/na	7	**9.5**
Bu29	*C. macrocarpa*	Kaharoa	Bd-batt.	1992/na	4	**8.6**
Bu29	*C. lusitanica*	Kaharoa	Bd-batt.	1992/na	4	**8.6**
Bu41	*C. macrocarpa*	Pahiatua	Logs	1985/na	14	**9.9**
Bu41	*Ch. lawsoniana*	Kumara	Logs	1985/na	14	**9.2**
Bu41	*Ch. lawsoniana*	Hastings	Logs	1996/na	3	**9.3**

[1] n/a indicates that a variable number of items have been assessed.
[2] This is the number of years from installation until the latest assessment or until the last item in the test failed. The average life (in years) for the group, where all items have failed, is in parenthesis.
[3] Index of Condition is the average condition of all samples in a group where 10 = "as new" and 0 = failed. The number of items failed in a group is in parenthesis. For posts, battens, framing and logs in log buildings, the IoC is for decay only. For sheathing, joinery and decking, assessments include surface condition, checking and decay.
[4] Australasian durability class where all items in a group have failed, 1 = "very durable" and 4 = "perishable".

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Log buildings were included in the service testing programme from the mid 1980s and the regularly monitored buildings included a *C. macrocarpa* home near Pahiatua, plus *Ch. lawsoniana* houses at Kumara and Hastings (test Bu41, Table 3). These were last visited in 1999.

In the early 1980s there was renewed interest in the cypresses, particularly *C. macrocarpa*, as a naturally durable, general-purpose building species. In 1980 a wharf building was built at Okarito almost completely from *Ch. lawsoniana* treated with CCA preservatives (test Bu16, Table 3). In 1983 a house with *C. macrocarpa* framing and weatherboards at Lake Rotoiti was included as a service test (test Bu30, Table 3). Between 1984 and 1991 a further four sites where *C. macrocarpa* had been included as a major part of the buildings were listed as a single test (test Bu31, Table 3). These included weatherboards in Lynmore, Rotorua and Levin, weatherboards, joinery and framing at Utuhina, board and batten sheathing plus decking at Ohiwa. *C. macrocarpa* was also used as roof framing in a log building at Taneatua in 1985, reconstructed in 1990 (Bu33, Table 3). *C. lusitanica* was the main species used for framing, board and batten sheathing and joinery in a house and garage built at Kaharoa in 1989-92 (test Bu29, Table 3).

TABLE 4
Summary of Results from Post Preservative Treatment Tests – Cypress species

Test No.	Species	Test Site	Preservative /Process[1]	Year /No. Installed	Years In Test[2]	Index of Cond.[3]
Fm22	*C. macrocarpa*	Notown	CCA/HPSD	1976/1	24	**10.0**
Fm22	*Ch. lawsoniana*	Notown	CCA/HPSD	1976/4	24	**9.8**
Fm22	*C. macrocarpa*	Whaka.	CCA/HPSD	1978/3	17	**7.7**
Fm22	*Ch. lawsoniana*	Whaka.	CCA/HPSD	1978/4	17	**9.2**
Fm21	*C. macrocarpa*	Whaka.	AAC/FC	1979/3	21 *(14.0)*	**0.0 *(2)***
Fm21	*Ch. lawsoniana*	Whaka.	AAC/FC	1979/4	22	**4.0**
Fm21	*C. macrocarpa*	Whaka.	PCP/EC	1979/10	22	**6.8**
Fm21	*Ch. lawsoniana*	Whaka.	PCP/EC	1979/10	22	**8.0**
Fm21	*C. macrocarpa*	Whaka.	CCA/FC	1979/5	22	**9.2**
Fm21	*Ch. lawsoniana*	Whaka.	CCA/FC	1979/5	22	**8.2**

[1] CCA = copper-chrome-arsenate, HPSD = high pressure sap displacement, AAC = alkyl ammonium compounds, FC = full cell Bethell process, PCP = pentachlorophenol in oil, EC = empty cell Reuping process.
[2] This is the number of years from installation until the latest assessment or until the last item in the test failed. The average life in years, for groups where all items have failed, is in parenthesis.
[3] Index of Condition is the average decay rating at the ground line for all samples in a group where 10 = “as new” and 0 = failed. The durability classification is in parenthesis.

Discussion

The cypresses were grouped together in natural durability Class 3 (Table 1), towards the upper end of the range, i.e., 50 mm thick heartwood stakes in ground contact have an average life of 5-15 years, usually closer to 15 than 5 years. 20 mm stakes in the same class should have an average life of 2-6 years. Over all, results from the stake tests support this, although there are a few groups with durability averages outside this range.

In above-ground situations durability tends to be one class higher than indicated by stake tests alone, i.e., 50 mm thick cypress heartwood could be expected to have an average service life of 15-25 years. Above-ground exposure introduces a much wider range of decay hazards than simple ground contact stake tests. Features such as aspect, orientation, vertical or horizontal surfaces, degree of protection, close contact or open surfaces, and protective coatings may influence the decay hazard. For example, weatherboards with predominantly vertical exposed surfaces face a much lower decay hazard than decking where the wider surfaces are both upward facing and in close contact with supporting framework.

In the above-ground field testing at Whakarewarewa, the 20-year old decking is nearing the end of its life and the weatherboards, although they show some distortion, surface degradation and checking, are relatively free from decay. The first *C. macrocarpa* decking failure occurred after only five years and the first L-joint after 13 years. After 20 years only three pieces of *C. macrocarpa* decking have failed. This highlights the variability of *C. macrocarpa* and other species with heartwood of class 3 durability. In the post tests (Fm7-12, Table 3), the first *C. macrocarpa* post failed after only five years whereas there were still four in service after 26 years. Similarly, one piece of decking at Ohiwa (Bu31, Table 3) failed after 7 years but all the other decking appeared to be free from decay.

The service tests contained timber of mixed quality and there were many examples of large defects being included in weatherboards on the Lake Rotoiti and Levin houses in particular. The Levin weatherboards were also installed green, a practice which was supposed to reduce splitting and to avoid the need for pre-boring for nails. The poor quality and bad installation at both sites caused some distortion and splitting of boards but no sign of decay after 13 and 11 years.

Chamaecyparis lawsoniana has gained a “less reliable” reputation when used for buildings and its use in partly exposed, structural situations has been questioned by some territorial authorities. The stake tests and the L-joint tests also suggest that it may be slightly less durable than *C. macrocarpa* or *C. lusitanica*. However, in the original Whakarewarewa L-joint and decking tests most of the samples contained sapwood and early decay and this probably contributed to the reduced average life. In general use, the problems of relatively small logs with a high proportion of sapwood, not easily identifiable after processing, appear to be the main cause of the “less reliable” reputation. In the Whakarewarewa decking test there have been fewer failures than with *C. macrocarpa* even though decay developed very quickly in the sapwood on the *Ch. lawsoniana* samples.

The cypresses are less amenable to treatment than radiata pine, and this was demonstrated in the treatment trials conducted at Scion. However round posts treated with CCA are all still in service after 20 years and should have a service life of 25 years or more, an alternative to treated radiata pine, albeit slightly less reliable.

In log buildings sapwood is not removed and logs are seldom dried before installation. Macrocarpa and lusitanica trees tend to have slightly buttressed, more tapered logs than *Ch. lawsoniana*. The latter, along with Douglas-fir appears to be one of the two most preferred species for log building in this country. Log buildings rely on design, usually wide eaves to protect the sapwood on the logs from wetting, or on protective coatings. The *C. macrocarpa*

building at Pahiatua was hexagonal and logs were well protected from the rain by wide eaves but borer were slowly becoming established in the sapwood. The Kumara building was a good example of poor design with plenty of log ends and lower wall logs exposed to the weather. Severe sapwood decay in some of these sections resulted in trimming and reshaping of many of the logs, but there was no serious heartwood decay. The Hastings house also had problems with decay in sapwood, mainly the result of construction extending over several years, but it also has many of the lower logs exposed to the weather. The service life of cypress logs in log buildings will be more dependent on design, construction times and maintenance than on the durability of the heartwood.

In framing tests, decay was introduced to the samples using pre-infected feeder blocks nailed to the samples. After five years decay was becoming established in heartwood on a few of the untreated samples and in the sapwood of a few of the LOSP treated samples. The untreated sapwood had decayed but the boron treated samples were all free from decay. This indicates that cypress heartwood and boron treated sapwood should be of similar durability to H1.2 treated radiata pine framing.

There are very few data on the durability of some of the less common species although none of the results seen so far indicate that this will be any different from that of the three main species, although *Ch. nootkatensis* is expected to be more durable.

Some questions about variability and possible differences between timber from old, scattered, amenity plantings and younger, plantation-grown timber need to be addressed.

Variability, particularly in *C. macrocarpa*, is an aspect that has caused some problems. Some of the “early failures” appeared to be associated with wood from near the pith, i.e., core-wood, but proper identification of the cause maybe of benefit. The difficulty with identification of heartwood in *Ch. lawsoniana*, or of less durable heartwood, also needs to be looked at if the cypresses are to retain the reputation of being a naturally durable alternative to preservative-treated pine for exterior use.

Overall, durability testing of cypresses here has been reasonably comprehensive, but ad-hoc and sample size has been relatively small in many of the tests. These tests were never set up with an experimental design. Most were add-ons to tests for other purposes, mainly because the wood was available for testing. Perhaps this shows a gap in knowledge. There is little to be gained by doing more general tests at this stage. However, the installation of designed graveyard tests is recommended once the results from fungal cellar testing for durability are obtained and can point to suitable experimental design with consistent material chosen for the job.

For instance it would be helpful for tree breeders to institute a test using material from progeny trials of at least 20 years of age. The test could be designed to look at variation within families and variation between families using wood from alongside the pith (first 5 rings) as well as wood from the outer heartwood (rings 11-15). It appears that heartwood becomes more durable with age, so a test of pieces cut progressively from the pith out to the heartwood boundary could identify possible transition points within a tree.

APPENDIX I (a)
RATING SYSTEMS USED

ALL TESTS
DECAY/INSECT ATTACK

10 = No decay or insect damage.
T = Trace, discolouration or softening, not positively identified as decay.
9 = First stages of decay or damage up to 3% of cross-section.
8 = Lightly established decay, 3-10% of cross-section.
7 = Well established decay, 10-30% of cross section.
6 = Deep established decay, 30-50% of cross section.
4 = Severe decay, nearing failure, more than 50% of the cross section.
0 = Failed.

WEATHERBOARD TESTS
UNCOATED SURFACES

1 = As new, no discolouration or mould.
2 = Slight surface mould or weathering, light even colour.
3 = Prominent mould or weathering, minor surface erosion.
4 = Extensive mould or lichen, uneven surface due to erosion.
5 = Extensive surface breakdown, original profile details gone.

CHECKING

1 = No surface checks, fine knot checks not visible in damp weather.
2 = Minor checks to 0.5 mm wide, not obvious in damp weather.
3 = Well established checks to 1 mm wide and 50% board thickness.
4 = Many or deep and severe checks over 1 mm wide.
5 = Board completely split and allowing obvious water ingress.

DISTORTION

1 = Cupping to 0.8% of width (0.8 mm/100 mm or 1.2 mm/150 mm)
2 = Cupping to 1.5% of facewidth (1.5 mm/100 mm or 2.3 mm/150 mm)
3 = Cupping to 3% of facewidth (3.0 mm/100 mm or 4.5 mm/150 mm)
4 = Cupping to 6% of facewidth (6.0 mm/100 mm or 9.0 mm/150 mm)
5 = Cupping more than 6% or allowing obvious water penetration.

APPENDIX I (b)

DURABILITY CLASSIFICATION SYSTEM
(Probable life expectancy/average life based on 50 x 50 mm ground contact stakes)

Class 1	Greater than 25 years	Very durable
Class 2	15-25 years	Durable
Class 3	5-15 years	Moderately durable
Class 4	0-5 years	Non-durable/perishable

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