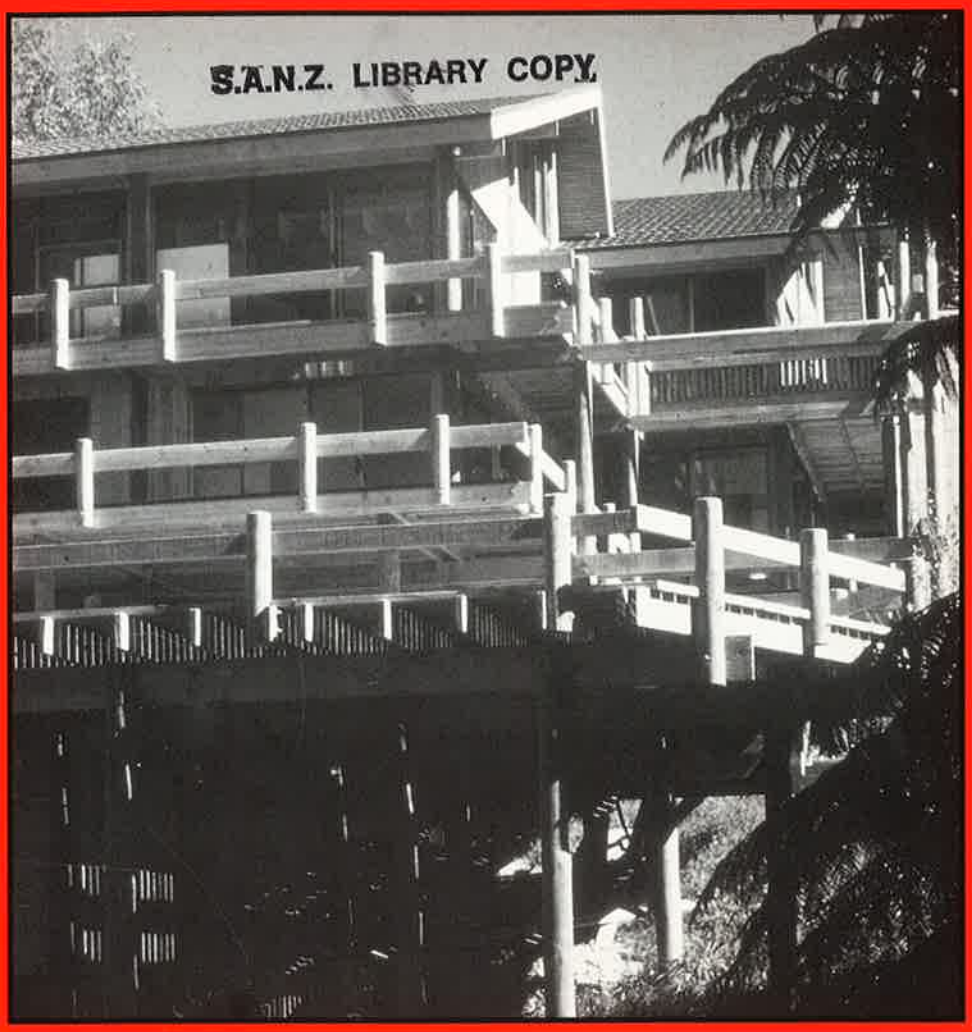
NZS 3605:1992 TIMBER PILES AND POLES

SANZ

NZS 3605:1992



NEW ZEALAND STANDARD

Specification for TIMBER PILES AND POLES FOR USE IN BUILDING

Revision of NZS 3605:1977

UDC 624.155.112 : 624.075.23 : 674.71

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Standards Association of New Zealand

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CONTENTS PAGE

RELATED DOCUMENTS

Reference is made in this Standard to the following:

NEW ZEALAND STANDARDS		Clause reference herein
NZS 3603:1990	Code of practice for timber design	1.2, 2.1, *C5.1*, 5.6, Appendix C
NZS 3604:1990	Code of practice for light timber frame buildings not requiring specific design	Foreword, 1.1, *C4.3*
NZS 3631:1988	New Zealand timber grading rules	4.1.3, 4.4.1, 4.4.2, 4.4.6
MP 3640:1992	Minimum requirements of the NZ Timber Preservation Council Inc.	4.2, 4.5, 5.1, 5.4, 5.7.2, 5.9.1
AMERICAN NATIONAL STANDARD		
ANSI 05.1-1987	Specifications and dimensions for wood poles	Figure 2
BRITISH STANDARD		
BS 1990:Part 1:1984	Specification for softwood poles	Appendix C

The users of this Standard should ensure that their copies of the above-mentioned New Zealand Standards or of overseas Standards are the latest revisions or include the latest amendments. Such amendments are listed in the annual SANZ *Catalogue* which is supplemented by lists contained in the monthly magazine *Standards* issued free of charge to committee and subscribing members of Standards New Zealand.

FOREWORD

This Standard specification updates and extends NZS 3605:1977 *Specification for load bearing round timber poles and piles* to include load bearing square sawn timber piles now allowed for in NZS 3604:1990, and is based on criteria established by BRANZ and the Ministry of Forestry.

Several options are provided by which piles and poles may be shown to comply or may be deemed to comply with the strength requirements. These are:

(a) Visual grading to limit the size and frequency of strength-reducing characteristics either in their entire length or in critical parts;

(b) Proof testing of all poles or piles to loads related to their length and intended application;

(c) Testing of batches of house piles on an annual basis.

REVIEW OF STANDARDS

Suggestions for improvement of this Standard will be welcomed. They should be sent to the Chief Executive, Standards New Zealand, Private Bag, Wellington.

NOTES

NEW ZEALAND STANDARD

Specification for
TIMBER PILES AND POLES FOR USE IN BUILDING

1 SCOPE

1.1 House piles
This Standard sets performance criteria for timber piles referred to in NZS 3604, and describes a means of compliance.

1.2 Construction piles and poles
This Standard sets performance criteria for naturally round timber piles and poles to meet the design data assigned in NZS 3603, and describes a means of compliance.

C1.2
This Standard does not cover transmission line poles although, with the addition of a specification of gaining and boring patterns, it could serve this purpose. The provisions for proof testing given in Appendix C are based on testing of transmission line poles.

2 DEFINITIONS

2.1
For the purposes of this Standard the following definitions shall apply:

BENDING CAPACITY. The 5 % lower probability limit of the maximum bending moments of piles of a particular category when those piles are tested by loading to failure under the arrangement of support and load application described in Appendix B. (The bending capacity of a pile corresponds to the product of its section modulus, its characteristic bending stress in accordance with NZS 3603, and such modification factors as are appropriate to the design of house foundations).

CHECK. A separation of fibres along the grain forming a fissure but not extending through the pile or pole.

DEBARKING. The removal of bark and cambium layer by any means including peeling and shaving.

DEFECT. A naturally-occurring feature of the pile or pole.

END SPLIT. A lengthwise separation of fibres extending completely across the end of a pile or pole.

KNOT. A section of a branch embedded in the pile timber, including decayed, intergrown and partly intergrown, loose, spike, loose-spike and tight encased knots.

PEELING. The removal of bark and cambium layer generally by machines fitted with cutter heads which follow the natural contours and irregularities of the pole or pile. Maximum depth of wood removal is not to exceed 6 mm at any point.

PILE. A round or square timber member which supports a structure to transfer axial and/or lateral loads to the ground and not extending above ground level more than 3 metres.

PITH. The central core of a stem, consisting of soft tissue.

POLE. A naturally round tree trunk used as a structural building component.

SHAVING. The removal of bark and cambium layer by machines fitted with cutter heads which do not follow the natural contours of the pole but remove nodal swellings sufficient to produce a uniform taper.

SHORT CROOK. A deflection from straightness affecting a maximum of 1.5 m of the length, the parts on either side of the short crook remaining straight.

SPIRAL GRAIN. A type of growth in which the wood fibres take a spiral course about the bole of the tree instead of the normal vertical course.

SWEEP. A deviation from straightness in a curve of large radius, which occurs in:

(a) One direction in a plane (single sweep);

(b) Two directions in one plane (reverse sweep);

(c) Two planes (double sweep).

TIMBER SOURCE. A plantation or grouping of plantations accepted as having similar timber properties, especially wood density.

WANE. The presence of original under bark surface, with or without bark, on any face of a sawn pile.

3 INTERPRETATION

3.1
In this Standard the word 'shall' indicates a requirement that is to be adopted in order to comply with the standard, while the word 'should' indicates a recommended practice.

3.2
The full titles of reference documents, cited in this Standard are given in the list of Related Documents immediately proceeding the Foreword.

4 ROUND OR SQUARE HOUSE PILES

4.1 Form

4.1.1 *Cross section*
Piles may have a round or square cross section provided:

(a) Round piles shall have a minimum diameter of 140 mm;

(b) Square piles shall have a minimum dimension of 125 mm.

4.1.2 *Length*
The following shall apply:

(a) Maximum length shall be 3.6 m;

(b) Preferred pile lengths are multiples of 300 mm.

4.1.3 *Straightness*
Round piles shall meet the requirements of 5.2, square piles shall meet the warp limitations for No. 1 Framing grade timber in NZS 3631.

4.1.4
Square sawn piles, of pinus species, 3 m or more in length, should have not less than 4 growth rings between the pith and the sawn face nearest the pith, whether or not the pith is contained within the cross section.

C4.1.4
This recommendation is intended to limit the distortion possible in long piles containing wood from close to the pith.

4.2 Durability
Any species of timber may be used provided that it can be treated to H5 Group B of MP 3640; provided that where a timber pile has been cut after treatment the cut surface shall be brush-treated in accordance with MP 3640 requirements.

4.3 Strength
At least 95 % of any consignment of piles shall have a bending capacity no less than as set out in table 1.

C4.3
The required bending capacities in table 1 are based on the use of square sawn and round piles as described in NZS 3604, as Anchor, Braced, Cantilevered, Deep Founded Cantilevered, Driven, Ordinary or Shallow Founded Cantilever piles. Anchor piles have a lateral load capacity requirement of 12 kN which, when applied at the maximum permitted height of 600 mm above cleared ground level produces a required bending capacity of 7.2 kNm. Deep Founded Cantilever piles with a lateral load capacity of 6 kN are required to have a bending capacity of 7.2 kNm when the lateral load acts at the maximum permitted height of 1.2 m above cleared ground level. Braced and Short Founded Cantilever piles have lower bending capacity requirements while Ordinary Piles carry vertical loads only and therefore have a minimal required bending capacity. Piles branded A grade are intended for use as Anchor, Braced, Cantilevered, Deep Founded Cantilevered, Driven or Shallow Founded Cantilever piles.

Table 1 – Bending capacity of house piles

Type	Length m	Bending capacity kNm	Means of compliance
Square	Up to 900 mm	1.8	Clause 4.4.1
	Over 900 mm and up to 1.2	3.6	Clause 4.4.2
	Over 1.2 and up to 1.8	7.2	Either (a) Clause 4.4.3 or (b) Clause 4.4.4 or (c) Clause 4.4.5 or (d) Clause 4.4.6
	Over 1.8	3.6	Either (a) Clause 4.4.7 or (b) Clause 4.4.8
Round	Under 1.5	3.6	Either (a) Clause 5.7.1 or (b) Clause 4.4.7 or (c) Clause 4.4.8
	1.5 and over	7.2	Either (a) Clause 4.4.4 or (b) Clause 4.4.5 or (c) Clause 4.4.9

4.4 Compliance

Piles shall be deemed to comply with 4.3 if they meet the requirements set out in table 1.

4.4.1
The piles shall have a minimum cross section of 125 mm x 125 mm and shall meet the defect limitations for No. 2 Framing grade as set out in NZS 3631.

4.4.2
The piles shall have a minimum cross section of 125 mm x 125 mm and shall meet the defect limitations for No. 1 Framing grade as set out in NZS 3631.

4.4.3
The piles shall meet 4.4.2 and shall have the central 600 mm of their length free of knots greater than 20 mm diameter.

4.4.4
All piles shall be proof tested to a bending moment of 6.0 kNm using a device which applies loads to the piles as described in Appendix B.

4.4.5
Batches of 100 piles shall be proof tested annually to a bending moment of 7.2 kNm as described in Appendix A.

4.4.6
The piles shall have a minimum cross section of 150 mm x 150 mm and shall meet the defect limitations for No. 1 Framing grade as set out in NZS 3631.

4.4.7
All piles shall be proof tested to a bending moment of 3.0 kNm using a device which applies loads to the piles as described in Appendix B.

4.4.8
Batches of 100 piles shall be proof tested annually to a bending moment of 3.6 kNm as described in Appendix A.

4.4.9
The piles shall satisfy 5.7.1 and have no knots greater than 20 mm diameter over the central 600 mm of their length.

4.5 Branding

All preservative treated round and square sawn house piles shall be branded to meet the requirements of MP 3640 including the provision that the brand shall be placed one third of the length from the top and facing the top. In addition, all round or square sawn house piles 1.5 m or longer, shall be branded with the letter A signifying that they meet the strength and other performance requirements of this Standard. The A shall be placed within 50 mm of the treatment brand (facing the top) and be of at least the same height. Alternatively, the A can be incorporated with the treatment brand if agreed by the Timber Preservation Council. Some examples of branding are shown in figure 1.

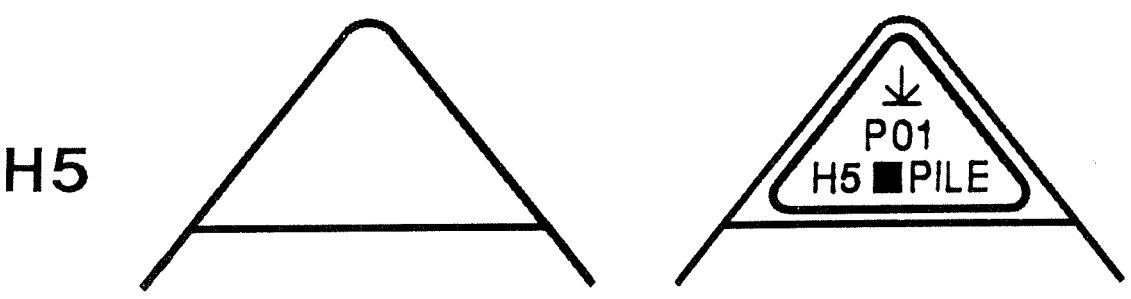


Figure 1 – Examples of branding

5 ROUND CONSTRUCTION PILES AND POLES

5.1 Species

Any species may be used provided:

(a) It can be treated with preservative to meet the H5 Group B hazard class specification of MP 3640 or has proven natural durability;

(b) Appropriate design data are available.

C5.1
Characteristic stresses for some New Zealand species are given in NZS 3603.

5.2 Form

The form of piles and poles shall be:

(a) Poles for domestic and commercial buildings shall be free from short crooks and any sweep shall be in one plane only;

(b) Piles and poles with a sweep in one plane in one direction measured by a straight line adjoining the edge of the butt to the edge of the tip shall have a deviation not exceeding 12 mm per metre for piles and 6 mm per metre for poles (see figure 2, diagram 1);

(c) Piles and poles with a sweep in two planes (double sweep) or in two directions in one plane (reverse sweep) measured from the mid-point at the tip to the mid-point at the butt shall have a deviation not exceeding 6 mm per metre for poles (see figure 2, diagram 2);

(d) Piles and poles shall be free from short crooks that deviate from straightness, relative to the axis below the crook, by not more than 65 mm for piles and 25 mm for poles in any 1.5 m length (see figure 2, diagram 3).

C5.2
For driven piles the sweep limitations should be those for poles.

5.3 Dimensions

In terms of taper the dimensions of round construction piles should be within the limits as shown in table 2 and those of round construction poles as shown in table 3.

Diagram 1 - Measurement of sweep in one plane and one direction

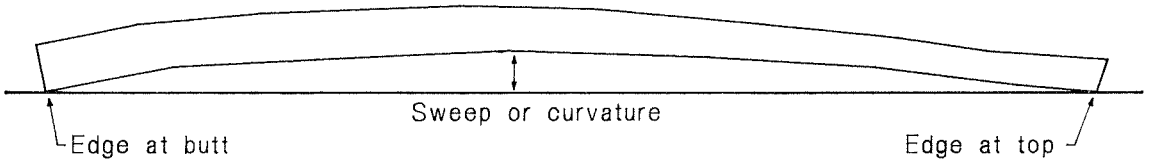


Diagram 2 - Measurement of sweep in two planes (double sweep) or in two directions in one plane (reverse sweep)

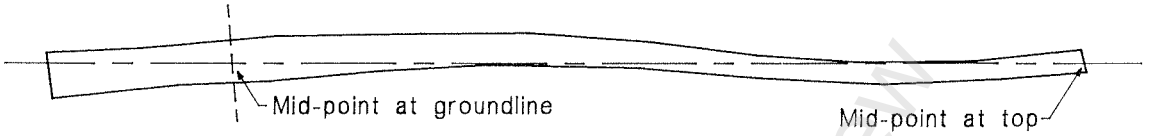
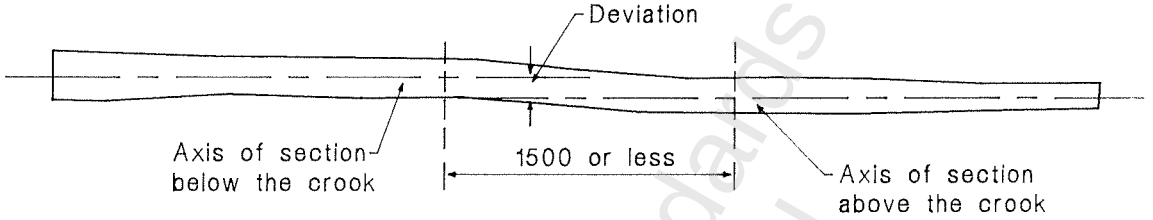
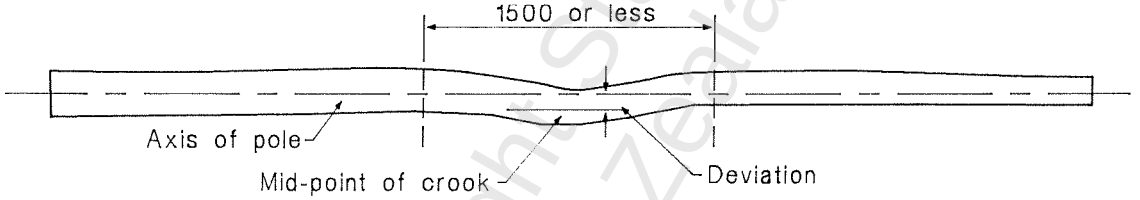


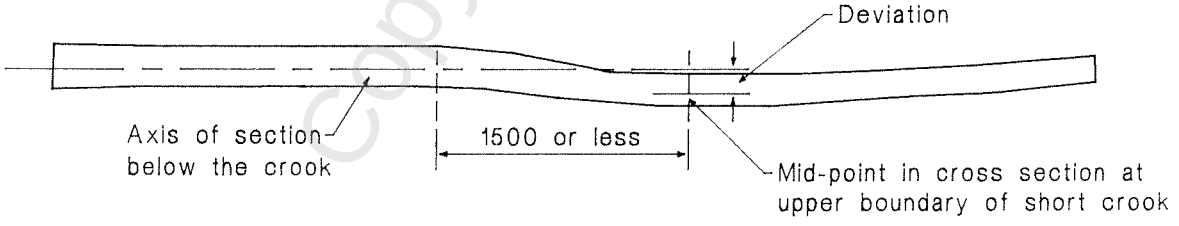
Diagram 3 - Measurement of short crook (three cases shown)



Case 1 - Where the reference axes are approxmately parallel



Case 2 - Where the axes of sections above and below the crook coincide or are practically coincident



Case 3 - Where axis of section above short crook is not parallel or coincident with the axis below the crook

NOTE –

(1) Figure 2 is based on figure 1 of American Standard ANSI 05.1-1987 *Specifications and dimensions for wood poles.*

(2) The three cases shown under diagram 3 are typical and are intended to establish the principle of measuring short crooks. There may be other cases not exactly like those illustrated.

Figure 2 – Measurement of sweep and short crook in round construction piles and poles

Table 2 – Round construction piles

Minimum large end diameters corresponding to specified small end diameters. (Taper of not less than 6 mm/m.)

Length (m)	Minimum large end diameter for a small end diameter of, (mm): 125	150	175	200	225	250	275	300
1.2	132	157	182	207	232	257	282	307
1.5	134	159	184	209	234	259	284	309
1.8	136	161	186	211	236	261	286	311
2.1	138	163	188	213	238	263	288	313
2.4	139	164	189	214	239	264	289	314
2.7	141	166	191	216	241	266	291	316
3.0	143	168	193	218	243	268	293	318
3.3	145	170	195	220	245	270	295	320
3.6	147	172	197	222	247	272	297	322
4.0	149	174	199	224	249	274	299	324
5.0	155	180	205	230	255	280	305	330
6.0	161	186	211	236	261	286	311	336
7.0	167	192	217	242	267	292	317	342
8.0	173	198	223	248	273	298	323	348
9.0	179	204	229	254	279	304	329	354
10.0	185	210	235	260	285	310	335	360
11.0	191	216	241	266	291	316	341	366
12.0	197	222	247	272	297	322	347	372

Table 3 – Round construction poles

Maximum large end diameters corresponding to specified small end diameters. (Taper of not more than 8 mm/m.)

Length (m)	Maximum large end diameter for a small end diameter of, (mm): 125	150	175	200	225	250	275	300
1.2	135	160	185	210	235	260	285	310
1.5	137	162	187	212	237	262	287	312
1.8	139	164	189	214	239	264	289	314
2.1	142	167	192	217	242	267	292	317
2.4	144	169	194	219	244	269	294	319
2.7	147	172	197	222	247	272	297	322
3.0	149	174	199	224	249	274	299	324
3.3	151	176	201	226	251	276	301	326
3.6	154	179	204	229	254	279	304	329
4.0	157	182	207	232	257	282	307	332
5.0	165	190	215	240	265	290	315	340
6.0	173	198	223	248	273	298	323	348
7.0	181	206	231	256	281	306	331	356
8.0	189	214	239	264	289	314	339	364
9.0	197	222	247	272	297	322	347	372
10.0	205	230	255	280	305	330	355	380
11.0	213	238	263	288	313	338	363	388
12.0	221	246	271	296	321	346	371	396

5.4 Preservative treatment

Piles and poles requiring preservative treatment shall be treated in accordance with MP 3640 *Specification of the minimum requirements of the NZ Timber Preservation Council Inc*, to meet the appropriate application.

C5.4
At date, Corsican pine and radiata pine are the only approved species.

5.5 Handling

5.5.1
Adequate precautions shall be taken against mechanical damage to piles and poles during handling, at all stages of production.

5.5.2
Poles are not acceptable if they contain indentations attributed to loading or handling damage 6 mm or more deep over 20 % or more of the pole circumference, or more than 12 mm deep at any point. Other indentations or abrasions, for example, forklift damage, chain-saw damage, etc., shall not be more than 1/10 the pole diameter at the point of damage up to a maximum of 25 mm deep. Such damage is permitted in an oversized section, where the excess of wood shall be taken into consideration in evaluating the effects of the damage.

5.6 Strength

Construction poles and piles shall be deemed to have adequate strength provided: either:

(a) They are a species for which characteristic stresses are given in NZS 3603 (or are available from other standards), and meet the compliance requirements set out in 5.7.

or

(b) They withstand the proof testing described in 5.8.

5.7 Compliance – visual grading

5.7.1
Visible growth characteristics or features shall not exceed the following limits:

(a) *Checks*
At any cross section of a pile or pole the depth of check singly or combined on any one plane passing through the centre shall not exceed one half the width of the pile or pole.

(b) *End splits*
End splits shall not be permitted.

(c) *Knots, 25 mm and over in diameter*
The diameter of individual knots shall not exceed 10 % of the circumference of the poles. The aggregate diameter of knots in any 300 mm length of the pole shall not exceed 20 % of the circumference of the poles.

(d) *Nodal swelling*
For poles the nodal swelling shall not exceed 20 mm when measured as shown in figure 3.

(e) *Spiral grain*
Spiral grain at the pile or pole surface shall not have a slope greater than 1:10.

***C5.7.1**(d)*
Producers should be aware that the limitations placed on nodal swelling are cosmetic only if the poles are manually or hydraulically debarked. However, if the poles are mechanically peeled or shaved, there is a loss in strength because the natural reinforcement around the knots is damaged or removed. Machines such as the "Morbark" which have a planer type cutter head are called machine shavers and generally reduce the pole to a smooth tapering form that handles well and has a good appearance but incurs a strength loss of about 25 %, depending on the amount of swelling initially present. The "Searle" machine which scrapes the bark off with rotating prongs is called a machine peeler and produces a stronger but more rugged looking pole. Pole damage due to debarking incurs a cost penalty in that debarking which reduces strength by, say 25 % implies that the pole diameter will need to be increased by one third this amount (i.e. by 8 %) to compensate for the strength loss and provide a pole with the same overall bending capacity as a manually or hydraulically debarked pole.

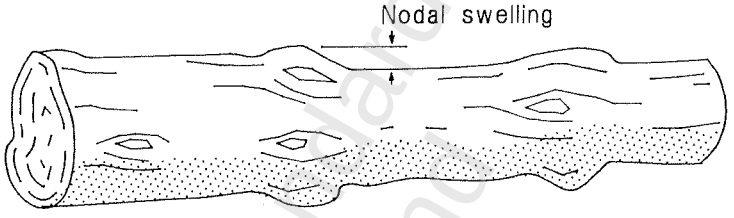


Figure 3 – Nodal swelling

5.7.2
For visual grading compliance either:

(a) Piles or poles should carry the Woodmark symbol which signifies that the plant has a quality assurance plan and is registered with the NZ Timber Preservation Council. This implies not only that required levels of preservative treatment has been achieved but also that the risk of strength reduction from inadequate wood preparation or air seasoning is minimal (most material is steamed rather than air dried before treatment).

or

(b) The specifier should demand evidence that procedures of wood preparation, air seasoning and treatment has been to the standard expected in the companion document to MP 3640 (Timber Preservation Quality Manual).

C5.7.2
Specific guidelines for round construction piles and poles should include the following statements:

Preparation
(a) Except for piles or poles to be subsequently machine shaved, not more than 6 mm of the sapwood surrounding the branches shall be removed in trimming.

(b) Round piles and poles shall be thoroughly peeled or shaved to remove all outer bark and inner bark before drying or pretreatment conditioning.

(c) Unless otherwise specified all ends shall be cut square to the axis. Where preservative

treatment is required, such cutting shall be done prior to treatment. Where possible all other shaping, notching and drilling shall be prior to treatment.

Seasoning

Piles and poles to be preservative treated shall, unless steamed, be seasoned in covered outdoor stacks and shall be stacked within the six month period July to December inclusive, unless a specific departure is agreed by the specifier.

5.7.3

Handling damage shall be within the limits laid down in 5.5.

5.8 Compliance – proof testing

Every pole shall withstand, without signs of distress, the loads prescribed in Appendix C as well as meeting the requirements of 5.7.1(e).

5.9 Branding

5.9.1

All preservative treated construction piles and poles shall be branded to meet the requirements of MP 3640 including the provision that the brand shall be placed one third of the length from the top and facing the top. In addition, all construction piles and poles shall be branded with the letter A signifying that they meet the performance requirements of this Standard. The A shall be placed within 50 mm of the treatment brand (facing the top) and be of at least the same height. Alternatively, the A can be incorporated with the treatment brand if agreed by the Timber Preservation Council.

APPENDIX A
ANNUAL CERTIFICATION OF STRENGTH OF SQUARE SAWN AND ROUND TIMBER HOUSE PILES

A1 Scope

A1.1
This Appendix sets down the requirements for strength testing of square sawn and round timber house piles as required in 4.4.5 and 4.4.8.

A1.2
This Appendix assumes that a manufacturer will have conducted tests to devise visual grading rules, which are specific to piles obtained from a particular source, in order that those piles have the required strength. The visual grading rules are to be verified or amended by annual tests of a random sample of at least 100 piles and a certificate issued accordingly.

A2 General

A2.1
Proof strength testing and later re-testing shall be carried out in a TELARC registered laboratory on every timber species used from each timber source milled, such testing to be repeated whenever species or source is varied, and otherwise annually.

A2.2
At least 100 piles shall be selected by random sampling procedures so as to fairly represent the manufacturers production.

A2.3
Piles shall be at the length and of the dimensions specified by the manufacturers.

A2.4
Piles shall be tested after sawing and grading. If piles are to be steamed as part of the drying/ preservation process then the piles to be tested shall be steamed before testing.

A2.5
Records of strength testing shall be kept by the manufacturer as follows:

(a) Initial proof test or subsequent test, with reason for subsequent test;

(b) Name of testing laboratory organization;

(c) Date of test;

(d) Timber species;

(e) Description of sampling procedures used;

(f) Pile dimensions;

(g) Number of piles tested;

(h) Number of failures;

(j) Minimum strength requirements;

(k) Pass/fail statement.

A3 Method of test

A3.1
The following method is appropriate for piles up to 3.6 m long.

A3.2
Moisture content shall be above 25 %.

A3.3
Test the piles in bending as described in Appendix B.

A3.4
The proof load shall be applied by applying the load gradually and evenly and maintaining it for not less than ten seconds. Pile supports and loading heads shall be positioned symmetrically about the centre of the pile.

A3.5
The test is successful if the pile carries the load without obvious signs of distress or permanent set.

A4 Test records

A4.1
The report from the testing laboratory shall include:

(a) Timber species;

(b) Description of sampling procedures used;

(c) Moisture content at time of test;

(d) Pile dimensions;

(e) Applied load;

(f) Number of piles tested;

(g) Number of failures;

(h) Number of piles offered for test which were outside grade or moisture content requirements.

A5 Verification of visual grading rules

A5.1
Divide the number of piles which failed to sustain the required bending moment by the total number of piles tested, and multiply this figure by 100 to establish the percentage failure.

A5.2
If the percentage failure is greater than 5 % the piles are not of adequate strength and remedial action must be taken.

A5.3
To assist remedial action, examine the failed piles and find which piles lay outside visual grading specifications. Deduct the number of failed piles which did not meet the visual grading specification from the total number of failed piles, then divide the number of visually acceptable piles by the total number of piles tested. Multiply this figure by 100.

A5.4
If the percentage failure thus established is 5 % or less, then the visual grading rules in use are adequate.

A5.5
If the failure rate is still greater than 5 % the visual grading rules in use are not adequate, and more stringent rules must be used to grade piles. A change of timber source may be required.

A5.6
If either A5.5 or A5.6 shows the percentage failure rate is greater than 5 %, a fresh sample of piles shall be tested.

APPENDIX B
TESTING OF HOUSE PILES

B1
Test equipment shall comprise a base with free pivoting or roller supports of full pile width at 1200 ±10 mm centres, and a spreader with two pivoting or roller loading heads of full pile width, at 600 mm ±5 mm centres as shown schematically in figure B1. The load applied through the loading heads shall act perpendicularly to the axis of the pile and in the same plane as the supports.

B2
Apply the bending force as given in table B1.

Table B1 – Applied total loads for required bending moments

Required bending moment kNm	Total load kN
3.0	20
3.6	24
6.0	40
7.2	48

B3
For proof testing batches of piles as required by Appendix A, the pile shall be stationary in the testing device and the proof load shall be applied gradually and evenly and be maintained for not less than 10 s.

B4
For proof loading of every pile to 4.4.4 or 4.4.7, the pile shall pass through the device such that the pile will be subjected to maximum bending moment for not less than 10 s.

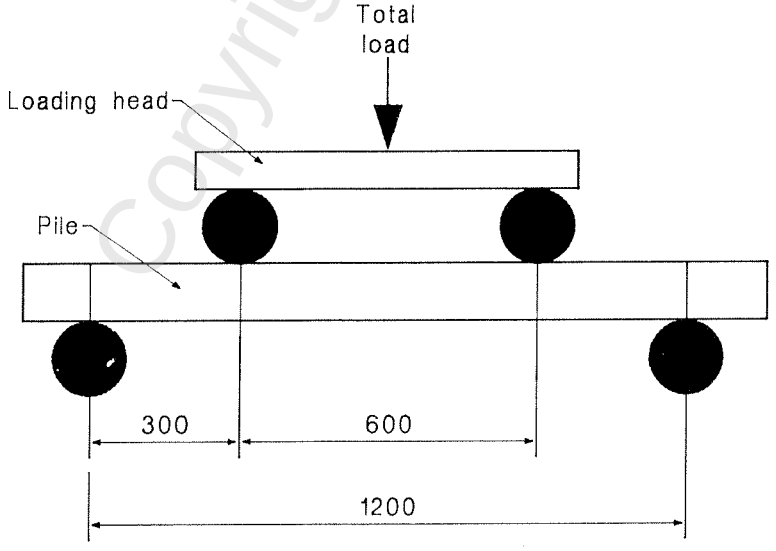


Figure B1 – Schematic plan diagram for testing house piles

APPENDIX C
PROOF TESTING OF ROUND CONSTRUCTION PILES AND POLES

C1 Loading arrangement

Loads shall be applied as shown schematically in figure C1.

CC1

It is recommended that the pole be orientated with its axis horizontal and with the load applied horizontally to avoid the complicating effects of self weight of the pole. (Refer to BS 1990, Appendix D for testing where the load is applied vertically). The poles are loaded as if they were transmission line poles which may not match the load distribution found in a construction pole. However, experience with proof testing transmission poles, shows that the weakest point between the groundline and the mid-length of the pole will be found.

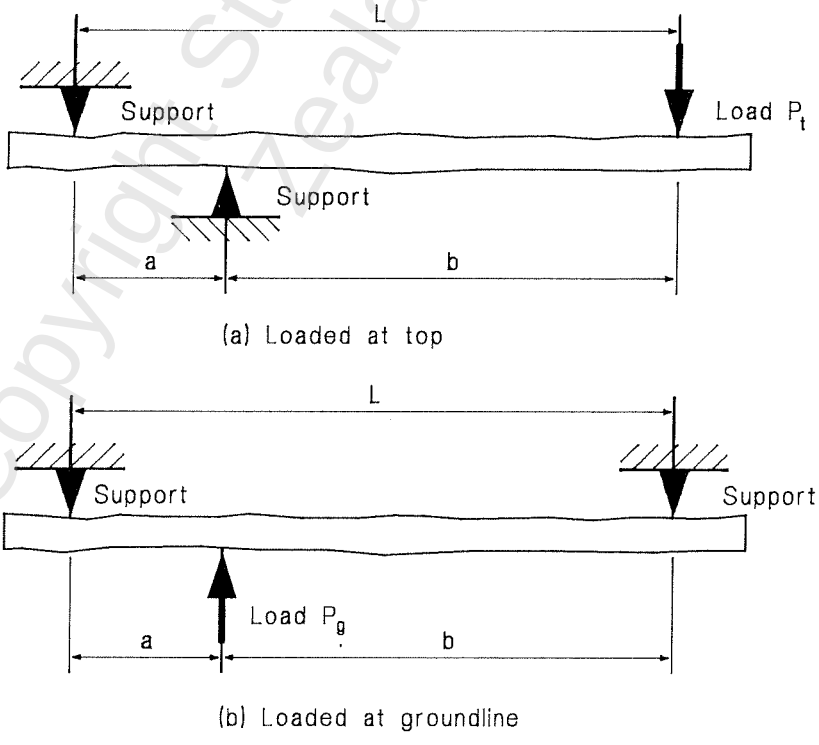


Figure C1 – Schematic plan diagram for proof test loading of round construction piles and poles

C2 Equipment
The equipment used shall:

(a) Have loading and reaction surfaces shaped to minimize damage to the poles;

(b) Apply and indicate loads to an accuracy of 5 %;

(c) Have the load and reaction points positioned to an accuracy of 1 %.

C3 Loading procedure
Load shall be applied to the pole at a rate sufficient to reach the required proof load in not less than 3 s nor more than 30 s, and shall be maintained at the proof load level for 15 s before unloading.

C4 Proof loading arrangement
Poles shall be loaded either:

(a) At the small end with load P_t as shown in figure C1 (a);

or

(b) At the groundline with load P_g as shown in figure C1 (b).

C5 Loads
Proof loads P_t and P_g are calculated from:

$$P_t = \frac{K\phi R^* \pi D^3}{32b} \times 10^{-6} \text{ kN} \quad \text{(Eq.C1)}$$

$$P_g = \frac{K\phi R^* \pi L D^3}{32ab} \times 10^{-6} \text{ kN} \quad \text{(Eq.C2)}$$

where

ø	=	capacity reduction factor from NZS 3603
	=	0.8
R^*	=	characteristic bending stress (MPa)
D	=	specified minimum diameter at the groundline (mm)
L	=	test span (m)
a,b	=	dimensions shown on figure C1 (m)
K	=	product of adjustment factors from NZS 3603 for shaving, steaming and moisture condition as appropriate to the pole at the time of test.

NZS 3605:1992

NZS 3605:1992