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Northland Regional Council Thermally Modified Poplar testing

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Report information sheet

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Executive summary

Objective

To determine the characteristic bending strength and stiffness stresses for a sample of 90 x 45 Thermally Modified Poplar as supplied by Northland Regional Council, along with measuring the materials density and moisture content.

Key results

1. On the basis of the bending strength the 90 x 45 Thermally Modified Poplar could be assigned a grade Reject (limited by bending strength).
2. On the basis of the bending stiffness the 90 x 45 Thermally Modified Poplar could be assigned a grade SG8.
3. The Average moisture content at the time of testing was 5.7%
4. The average Density at test (using mass at test) was 390kg/m³

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Introduction

To determine the characteristic bending strength and stiffness stresses for a 31 piece sample of 90 x 45 Thermally Modified Poplar as supplied by Northland Regional Council.

The timber was supplied dry and planar gauged to 90x45 in approximately 2.0m lengths.

Ideally to determine characteristic properties we need to test full dimension timber, covering a range of structural sizes in bending, tension, compression, and shear. This would require a large volume of timber and for tension testing long lengths. However, 90% of the span tables in NZS3604 are governed by bending strength and stiffness

Thus, as a start on this process it was suggested that only bending strength and stiffness be tested for.

Materials and methods

Sample selection

- It is understood that the specimens supplied were supplied as “ungraded”, meaning that not all samples met the No1. Framing visual grade requirements.

Characteristic bending strength and stiffness testing

- All the timber was tested for bending strength and stiffness as a joist (on edge) in accordance with AS/NZS4063.1:2010 & AS/NZS4063.2:2010 over a span to depth ratio of equal to 18:1 at 1620mm. The test pieces were tested in their dry gauged state.
- All the bending testing was undertaken in our Grade 1 Baldwin Universal test machine. The strength testing was completed in the Timber Engineering laboratory of Scion, Rotorua over the period 12th – 14th April 2022.

Density and Moisture content

- From all the bending test samples a short cross section was then cut from an undamaged clear wood section close to the failure point of each test specimen for density, moisture content determination
- Moisture content was measured using the oven drying method.
- Nominal density was calculated for each section from the oven dry weight over volume at test.
- Density at test was calculated for each section from the test weight over volume at test.

Results and discussion

The characteristic strength and stiffness properties have been calculated using the calculations and procedures set out in AS/NZS4063.2:2010.

Table 1 shows the characteristic strength and stiffness values for the 90x45 Thermally Modified Poplar timber along with a statistical summary.

Table 2 lists the New Zealand characteristic grade stresses for the SG visual grades

Table 3 shows a statistical summary of the moisture content and density testing.

Appendix A lists the raw test data collected.

Table 1: Thermally Modified Poplar Characteristic Bending Strength/Stiffness & Density properties

Thermally Modified Poplar	90x45		
	Bending Stiffness MoEj (GPa)	Bending Strength MoRj (MPa)	Density at test (kg/m ³)
Mean	9.26	25.22	390.06
Minimum	6.89	5.51	343.60
Maximum	10.60	58.08	437.42
Range	3.71	52.56	93.82
Standard Deviation	0.92	12.43	25.95
Coefficient of Variation	9.89%	49.31%	6.65%
Count	31	31	32
Characteristic Strength (MPa)		6.68	
Characteristic Stiffness (GPa)	9.15		
Characteristic Density at Test (kg/m ³)			386.8
Assigned Grade	SG8	Reject	

Table 2: Characteristic stresses for SG visually graded timber NZS3603 A4

1. Moisture Content – Dry (m/c = 16%)					
Radiata pine and Douglas Fir	Bending Strength MPa	Compression Strength MPa	Tension Strength MPa	Bending Stiffness GPa	Lower bound Bending Stiffness GPa
SG10 (Dry)	20.0	20.0	8.0	10.0	6.7
SG8 (Dry)	14.0	18.0	6.0	8.0	5.6
SG 6 (Dry)	10.0	16.0	4.0	6.0	4.0
2. Moisture Content – Green (m/c = 25%)					
SG 10 (Wet)	15	14.0	5.0	8.0	5.6
SG 8 (Wet)	11.7	12.0	4.0	6.5	4.4
SG 6 (Wet)	7.5	11.0	3.0	4.8	3.2

Note:

- The shear strength for dry Radiata pine shall be taken as $f_s = 3.8$ MPa.

Table 3: Statistical Summary of Density and Moisture content results

	Moisture Content %	Density at Test kg/m³	Nominal Density kg/m³
Mean	5.70	390.06	369.04
Minimum	5.24	343.60	325.20
Maximum	6.32	437.42	412.57
Range	1.09	93.82	87.37
Standard Deviation	0.21	25.95	24.50
Coefficient of Variation	3.72%	6.65%	6.64%
Count	32	32	32

Conclusions

- On the basis of the bending stiffness and strength testing the 90 x 45 Thermally Modified Poplar could not be assigned a structural grade (limited by bending strength).

References

1. AS/NZS4063.1:2010, Characterization of structural timber Part 1: Test methods. Standards Australia/Standards New Zealand.
2. AS/NZS4063.2:2010, Characterization of structural timber Part 1: Determination of characteristic values. Standards Australia/Standards New Zealand.

Appendix A

Appendix A: 90x45 Thermally Modified Poplar - Test data

Lab No.	Board Reference	Width (mm)	Depth (mm)	MoEj (GPa)	MoRj (MPa)	Moisture Content (%)	Density at Test kg/m ³	Nominal Density kg/m ³
288835	1	46.14	90.49	10.04	35.91	5.44	386.94	366.98
288836	2	46.20	90.55	10.22	39.04	5.64	430.61	407.64
288838	4	46.24	90.70	10.39	30.94	5.82	396.31	374.50
288839	5	45.75	90.51	9.45	16.91	5.61	381.25	361.00
288840	6	45.79	90.91	9.86	42.34	5.52	404.46	383.29
288841	7	45.96	90.77	8.16	5.51	5.86	407.74	385.17
288842	8	45.79	90.72	9.52	43.28	5.53	384.59	364.44
288843	9	45.74	89.94	9.39	24.56	5.95	389.56	367.70
288844	10	45.83	90.88	7.70	17.17	5.64	411.66	389.67
288845	11	45.84	91.35	8.99	13.84	6.02	437.42	412.57
288846	12	45.90	89.99	9.05	15.12	5.66	343.60	325.20
288847	13	45.60	86.90	9.49	14.49	5.57	358.14	339.23
288848	14	45.74	91.32	8.82	36.84	5.83	411.41	388.76
288849	15	45.83	91.05	9.25	30.95	5.71	372.45	352.33
288850	16	45.82	90.86	9.78	37.58	5.77	373.00	352.64
288851	17	45.98	91.88	8.29	10.67	5.71	380.27	359.74
288852	18	45.63	90.68	10.6	35.17	5.24	363.32	345.24
288853	19	46.12	90.56	10.39	31.98	5.60	425.92	403.33
288854	20	45.81	90.54	9.47	26.50	5.74	425.26	402.17
288855	21	45.73	90.22	8.48	10.18	5.67	382.01	361.53
288856	22	45.72	90.57	10.58	31.18	5.70	390.33	369.28
288857	23	45.70	89.71	8.21	10.20	6.01	414.98	391.47
288858	24	45.86	90.23	10.42	27.00	5.82	347.36	328.26
288859	25	45.46	88.73	9.01	21.55	5.77	405.04	382.93
288860	26	45.74	90.76	8.70	20.76	5.65	397.37	376.13
288861	27	45.80	90.70	8.80	31.25	5.67	344.93	326.41
288862	28	45.54	90.67	9.55	19.39	6.32	363.91	342.27
288863	29	45.72	90.51	10.06	58.08	5.53	386.56	366.30
288864	30	45.72	90.89	6.89	10.53	5.46	397.10	376.55
288865	31	45.66	91.48	9.65	23.10	5.84	349.51	330.22
288866	32	45.87	91.32	7.99	9.73	5.30	397.23	377.23
288837	3	45.77	90.41	-	33.50	5.68	421.84	399.15