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Robinia, LLC TP
Project #: A17-008
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ROBINIA, LLC

BLACK LOCUST FINJER-JOINTED SAMPLE TESTING

(TP Project A17-008)

Prepared for:

ROBINIA, LLC

Prepared by:

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Submitted:

April 11, 2017

Robinia, LLC

Black Locust Finger-Jointed Sample Testing

(TP Project A17-008)

Introduction

Timber Products Inspection, Inc. (TP), at the request of Robinia, LLC, has provided testing services on 3/4-in thick Black Locust finger-jointed samples to determine the compression-parallel-to-grain, compression-perpendicular-to-grain, shear parallel to grain and bending properties. All testing was performed at TP's laboratory in Conyers, GA.

Test Materials

As shown in Table 1, 13 pre-cut specimens for compression parallel to grain test and 12 pre-cut specimens for each of compression perpendicular to grain and shear parallel to grain test were received for testing. These specimens were cut from 3/4" thick black locust finger-jointed boards. 7 bending specimens were cut at TP's lab by TP personnel from the 5 finger-jointed boards (3/4" x 4" x 59") received separately. Each specimen had 1 finger joint in the middle.

Table 1. Test specimens

Test	Size (Th. x W x L)	Condition	Number of Specimens
Compression parallel to grain	3/4" x 3/4" x 4"	dry	13
Compression perpendicular to grain	3/4" x 2" x 6"	dry	12
Shear parallel to grain	3/4" x 2" x 2 1/2"	dry	12
Bending	3/4" x 4" x 20"	dry	7

Test Procedures

The compression-parallel-to-grain, compression-perpendicular-to-grain and shear parallel to grain tests were performed in a 75° F, 50% RH environment in accordance with the principles of appropriate sections of ASTM D 143-14.

The compression-parallel-to-grain specimens were tested in accordance with the principles of ASTM D143 Section 9 except for the size was smaller due to sample size submitted for testing. Each specimen was trimmed prior to testing to ensure that the end grain surfaces were parallel to each other and at right angle to the longitudinal surfaces. Each sample was weighed and section measurements and specimen length were recorded. A Tinius Olsen machine was used for the testing. The loading was axial compression. The sample was loaded until failure occurred. After testing, the maximum load was recorded and the compressive (crushing) strength was calculated. Figure 1 shows a compression-parallel-to-grain test was being conducted.



Figure 1. Compression parallel-to-grain test being conducted

The compression-perpendicular-to-grain specimens were tested in accordance with the principles of ASTM D143 Section 12 except for the size was smaller due to sample size submitted for testing. A Tinius Olsen machine was used for the testing. Each specimen was weighed and actual height, width, and length measurements were taken. The load was applied through a metal bearing plate 2 in. in width, placed across the upper surface of the specimen at equal distance from the ends and at right angles to the length. The specimen was placed so that the load was applied through the bearing plate to a radial surface. The speed of testing was 0.012 in/min. Compression readings were taken using a digital indicator, and the load-compression data were recorded. Figure 2 shows a compression-perpendicular-to-grain test was being conducted.

The shear specimens were tested in accordance with the principles of ASTM D143 Section 14 except for the size was smaller due to sample size submitted for testing. A Tinius Olsen machine was used for the testing. Figure 3 shows a shear-parallel-to-grain test was being conducted.

The bending specimens were tested in accordance with the principles of ASTM D4761-13 Section 7. A Tinius Olsen machine was used for the testing. The loading was center-point loading. The span was 18 in. with 1 in. overhang at each end. Figure 4 shows a flat-wise bending test was being conducted.



Figure 2. Compression perpendicular-to-grain test being conducted



Figure 3. Shear parallel-to-grain test being conducted

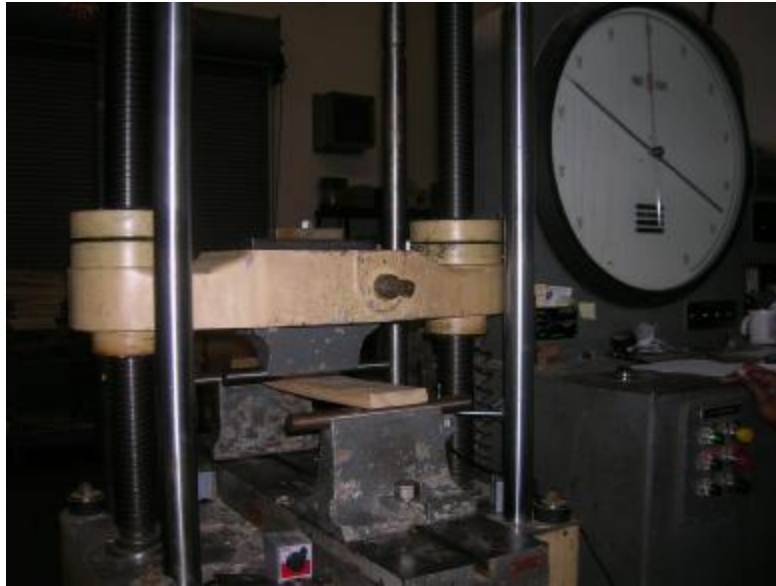


Figure 4. Bending test being conducted

Results

Test results are summarized in Tables 2 - 5. Detailed results for compression parallel to grain and shear parallel to grain tests are shown in Appendix 1. Individual bending test results are shown in Appendix 2.

Table 2. Summary of compression parallel-to-grain test results

Specimen #	Maximum Load (pounds)	Crushing strength (psi)	Moisture content (%)
1	5400	9461	9
2	5450	9939	9
3	5330	9351	9
4	4250	7566	10
5	5750	10168	9
6	4800	8628	10
7	5950	10342	10
8	6080	10780	9
9	4750	8664	11
10	5670	10040	10
11	5380	9451	9
12	5160	9263	10
13	4850	9403	9
Average	5294	9466	10

Table 3. Summary of compression perpendicular-to-grain test results

Specimen #	Stress @ 0.02" deformation (psi)	Stress @ 0.04" deformation (psi)	Moisture content (%)
1	993	2053	8
2	462	1715	9
3	1587	2778	8
4	792	1979	10
5	1132	1997	9
6	1321	2378	10
7	464	1788	9
8	1321	2378	10
9	927	1987	9
10	1120	2240	10
11	991	2114	10
12	468	1805	8
Average	965	2101	9

Table 4. Summary of shear parallel-to-grain test results

Specimen #	Maximum Load (pounds)	Shear strength (psi)	Moisture content (%)
1	5350	981	15
2	5400	988	16
3	6040	1065	16
4	6850	1232	16
5	6150	1113	16
6	5660	1030	16
7	8320	1489	16
8	5850	1034	15
9	6940	1217	17
10	6740	1213	16
11	6810	1227	16
12	5800	1039	15
Average	5958	1076	16

Table 5. Summary of bending test results

Specimen #	Width (in.)	Depth (in.)	Weight (g)	Max. Load (lbf)	MOR (psi)	MOE (psi)	Wood Failure (%)
1	3.903	0.818	695.1	1494	15446	2116262	100
2	3.853	0.797	810.1	1690	18644	2902728	95
3	3.849	0.809	819.7	1100	11790	2326585	100
4	3.901	0.814	888.4	1520	15878	2349018	95
5	3.903	0.811	811.3	1210	12726	2414896	90
6	3.880	0.817	818.7	1496	15596	2355775	90
7	3.893	0.818	774.9	1322	13703	2422115	95
Average					14826	2412483	
Std. Dev.					2293	239028	
COV (%)					15.5	9.9	

Tested and Submitted By:



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APPENDIX 1

DETAILED TEST RESULTS

ASTM D143 Compression Parallel to Grain Test

Project: A17-008 Date: 3/13/2017
 Sample: Black Locust (FJ samples) Tested by: CAH

Specimen #	Length (in.)	Width (in.)	Thickness (in.)	Weight (g)	Max. Load (pounds)	Comp. Strength (psi)
1	4.092	0.753	0.758	28.11	5400	9461
2	4.081	0.740	0.741	27.01	5450	9939
3	4.169	0.753	0.757	30.36	5330	9351
4	4.039	0.742	0.757	29.93	4250	7566
5	4.104	0.753	0.751	28.36	5750	10168
6	4.095	0.732	0.760	28.50	4800	8628
7	4.170	0.755	0.762	34.45	5950	10342
8	4.087	0.749	0.753	28.54	6080	10780
9	4.122	0.731	0.750	29.37	4750	8664
10	4.056	0.747	0.756	27.90	5670	10040
11	4.111	0.756	0.753	29.20	5380	9451
12	4.101	0.733	0.760	30.33	5160	9263
13	4.109	0.685	0.753	27.55	4850	9403
Average					5294	9466
Std. Dev.						844
COV (%)						8.9

ASTM D143 Compression-Perpendicular-to-Grain Test Results

Project No.: A17-008

Date tested: 3/14/2017
 Tested by: CAH

Sample: Finger-Jointed Black Locust

Width of plate: 2"

Speed of Machine: 0.012"

Specimen No.	Height (in.)	Thickness (in.)	Length (in.)	Weight (g)	Load @ 0.02" deformation (pounds)	Load @ 0.04" deformation (pounds)	Stress @ 0.02" deformation (psi)	Stress @ 0.04" deformation (psi)
1	2.146	0.755	6.117	134.2	1500	3100	993	2053
2	2.113	0.758	6.103	123.7	700	2600	462	1715
3	2.178	0.756	6.132	130.6	2400	4200	1587	2778
4	2.175	0.758	6.119	128.7	1200	3000	792	1979
5	2.118	0.758	6.101	124.7	1700	3000	1132	1997
6	2.137	0.757	6.115	118.3	3000	3600	1321	2378
7	2.188	0.755	6.158	133.1	700	2700	464	1788
8	2.16	0.757	6.138	119.2	2000	3600	1321	2378
9	2.17	0.755	6.11	121.6	1400	3100	927	2053
10	2.187	0.759	6.133	124.3	1700	3400	1120	2240
11	2.171	0.757	6.099	123.9	1500	3200	991	2114
12	2.147	0.748	6.140	116.9	700	2700	468	1805
Average	2.168	0.755	6.124	121.7	1300	3100	860	2053
Std Dev.							345	224
COV (%)							40.2	10.9

ASTM D-143 Shear Parallel to Grain Test Results

Project #: A17-008
Test Date: 3/13/2017
Tested by: CAH

Specimen No.	Width (in)	Shear Length (in)	Maximum Load (pounds)	Shear Strength (psi)
1	2.087	2.613	5350	981
2	2.140	2.553	5400	988
3	2.190	2.590	6040	1065
4	2.166	2.568	6850	1232
5	2.126	2.599	6150	1113
6	2.119	2.594	5660	1030
7	2.156	2.592	8320	1489
8	2.153	2.627	5850	1034
9	2.190	2.604	6940	1217
10	2.180	2.549	6740	1213
11	2.138	2.595	6810	1227
12	2.154	2.592	5800	1039
Average			5958	1076
Std Dev.				147
COV (%)				13.6

APPENDIX 2

INDIVIDUAL BENDING TEST RESULTS

Project No. A17-008
 Sample ID 1
 Material Black Locust FJ
 Date tested (dd/mm/yyyy) 4/3/2017
 Test span, *L* (in.) 18.0
 Half-shear span, *a* (in.) 9.0
 Speed of testing, *N* (in./min) 0.20
 Target low load P1 (lbf) 100
 Target high load P2 (lbf) 300
 Data sampling frequency (Hz) 0.2
 Ambient temperature (°F) 75
 Tested by CAH
 Length (in.), *L* 20.625
 Width (in), *b* 3.903
 Depth (in.), *d* 0.818
 Weight (g) 695.1
 Pre-loadf (lbf) 20
 Ultimate load (lbf) 1494
 MOR 15446
 MOE 2116262
 Wood Failure (%) 100

Load (lbf)	Defl (in)
0	0.0000
20	0.0075
40	0.0155
60	0.0225
80	0.0290
100	0.0350
120	0.0420
140	0.0480
160	0.0545
180	0.0610
200	0.0675
220	0.0740
240	0.0805
260	0.0870
280	0.0930
300	0.0995
320	0.1065
340	0.1130
360	0.1195
380	0.1255
400	0.1325

Project No. A17-008
 Sample ID 2
 Material Black Locust FJ
 Date tested (dd/mm/yyyy) 4/3/2017
 Test span, *L* (in.) 18.0
 Half-shear span, *a* (in.) 9.0
 Speed of testing, *N* (in./min) 0.20
 Target low load P1 (lbf) 100
 Target high load P2 (lbf) 300
 Data sampling frequency (Hz) 0.2
 Ambient temperature (°F) 75
 Tested by CAH
 Length (in.), *L* 20.375
 Width (in), *b* 3.853
 Depth (in.), *d* 0.797
 Weight (g) 810.1
 Pre-loadf (lbf) 20
 Ultimate load (lbf) 1690
 MOR 18644
 MOE 2902728
 Wood Failure (%) 95

Load (lbf)	Defl (in)
0	0.0000
20	0.0070
40	0.0130
60	0.0200
80	0.0255
100	0.0310
120	0.0370
140	0.0415
160	0.0465
180	0.0520
200	0.0570
220	0.0620
240	0.0670
260	0.0720
280	0.0775
300	0.0825
320	0.0885
340	0.0925
360	0.0975
380	0.1030
400	0.1085

Project No. A17-008
 Sample ID 3
 Material Black Locust FJ
 Date tested (dd/mm/yyyy) 4/3/2017
 Test span, *L* (in.) 18.0
 Half-shear span, *a* (in.) 9.0
 Speed of testing, *N* (in./min) 0.20
 Target low load P1 (lbf) 100
 Target high load P2 (lbf) 300
 Data sampling frequency (Hz) 0.2
 Ambient temperature (°F) 75
 Tested by CAH
 Length (in.), *L* 20.000
 Width (in), *b* 3.849
 Depth (in.), *d* 0.809
 Weight (g) 819.7
 Pre-loadf (lbf) 20
 Ultimate load (lbf) 1100
 MOR 11790
 MOE 2326585
 Wood Failure (%) 100

Load (lbf)	Defl (in)
0	0.0000
20	0.0090
40	0.0165
60	0.0235
80	0.0290
100	0.0355
120	0.0420
140	0.0470
160	0.0540
180	0.0600
200	0.0660
220	0.0730
240	0.0785
260	0.0845
280	0.0915
300	0.0970
320	0.1035
340	0.1100
360	0.1155
380	0.1225
400	0.1285

Project No. A17-008
 Sample ID 4
 Material Black Locust FJ
 Date tested (dd/mm/yyyy) 4/3/2017
 Test span, *L* (in.) 18.0
 Half-shear span, *a* (in.) 9.0
 Speed of testing, *N* (in./min) 0.20
 Target low load P1 (lbf) 100
 Target high load P2 (lbf) 300
 Data sampling frequency (Hz) 0.2
 Ambient temperature (°F) 75
 Tested by CAH
 Length (in.), *L* 20.125
 Width (in.), *b* 3.901
 Depth (in.), *d* 0.814
 Weight (g) 888.4
 Pre-loadf (lbf) 20
 Ultimate load (lbf) 1520
 MOR 15878
 MOE 2349018
 Wood Failure (%) 95

Load (lbf)	Defl (in)
0	0.0000
20	0.0095
40	0.0175
60	0.0255
80	0.0320
100	0.0395
120	0.0465
140	0.0530
160	0.0590
180	0.0645
200	0.0705
220	0.0760
240	0.0815
260	0.0870
280	0.0930
300	0.0985
320	0.1040
340	0.1095
360	0.1155
380	0.1215
400	0.1270

Project No. A17-008
 Sample ID 5
 Material Black Locust FJ
 Date tested (dd/mm/yyyy) 4/3/2017
 Test span, *L* (in.) 18.0
 Half-shear span, *a* (in.) 9.0
 Speed of testing, *N* (in./min) 0.20
 Target low load P1 (lbf) 100
 Target high load P2 (lbf) 300
 Data sampling frequency (Hz) 0.2
 Ambient temperature (°F) 75
 Tested by CAH
 Length (in.), *L* 20.625
 Width (in.), *b* 3.903
 Depth (in.), *d* 0.811
 Weight (g) 811.3
 Pre-loadf (lbf) 20
 Ultimate load (lbf) 1210
 MOR 12726
 MOE 2414896
 Wood Failure (%) 90

Load (lbf)	Defl (in)
0	0.0000
20	0.0080
40	0.0150
60	0.0220
80	0.0285
100	0.0345
120	0.0405
140	0.0465
160	0.0520
180	0.0580
200	0.0640
220	0.0700
240	0.0755
260	0.0815
280	0.0870
300	0.0925
320	0.0985
340	0.1045
360	0.1100
380	0.1155
400	0.1215

Project No. A17-008
 Sample ID 6
 Material Black Locust FJ
 Date tested (dd/mm/yyyy) 4/3/2017
 Test span, *L* (in.) 18.0
 Half-shear span, *a* (in.) 9.0
 Speed of testing, *N* (in./min) 0.20
 Target low load P1 (lbf) 100
 Target high load P2 (lbf) 300
 Data sampling frequency (Hz) 0.2
 Ambient temperature (°F) 75
 Tested by CAH
 Length (in.), *L* 20.625
 Width (in), *b* 3.880
 Depth (in.), *d* 0.817
 Weight (g) 818.7
 Pre-loadf (lbf) 20
 Ultimate load (lbf) 1496
 MOR 15596
 MOE 2355775
 Wood Failure (%) 90

Load (lbf)	Defl (in)
0	0.0000
20	0.0085
40	0.0160
60	0.0220
80	0.0275
100	0.0340
120	0.0400
140	0.0460
160	0.0515
180	0.0575
200	0.0635
220	0.0695
240	0.0750
260	0.0810
280	0.0865
300	0.0925
320	0.0985
340	0.1045
360	0.1100
380	0.1160
400	0.1220

Project No.	A17-008
Sample ID	7
Material	Black Locust FJ
Date tested (dd/mm/yyyy)	4/3/2017
Test span, L (in.)	18.0
Half-shear span, a (in.)	9.0
Speed of testing, N (in./min)	0.20
Target low load P1 (lbf)	100
Target high load P2 (lbf)	300
Data sampling frequency (Hz)	0.2
Ambient temperature (°F)	75
Tested by	CAH
Length (in.), L	20.625
Width (in.), b	3.893
Depth (in.), d	0.818
Weight (g)	774.9
Pre-loadf (lbf)	20
Ultimate load (lbf)	1322
MOR	13703
MOE	2422115
Wood Failure (%)	95

Load (lbf)	Defl (in)
0	0.0000
20	0.0075
40	0.0135
60	0.0200
80	0.0255
100	0.0315
120	0.0370
140	0.0425
160	0.0480
180	0.0535
200	0.0600
220	0.0650
240	0.0710
260	0.0760
280	0.0820
300	0.0880
320	0.0935
340	0.0990
360	0.1045
380	0.1105
400	0.1165