CEEN 3320 - Behavior & Properties of Engineering Materials
Laboratory Experiment No. 8
Compression, Shear, Column Behavior, and Static Bending of Wood

OBJECTIVE: To determine the mechanical properties of wood when loaded in compression parallel to and perpendicular to the grain, in shear parallel to the grain, and to determine the modulus of elasticity and modulus of rupture for a wood member in flexure.

EQUIPMENT: Universal testing machine, dial gauges, shear apparatus, compression plates, hydraulic load ram, miscellaneous measuring devices, moisture meter.

ASTM REF: ASTM D 2555, D 143

PROCEDURES:

1. Record the number, mass, dimensions, moisture content, growth rings per inch, % of summerwood and % of sapwood for each specimen.

Shear Parallel to Grain, 1-1/2 x 2 x 2-1/2 inch notched specimen

1. Position the specimen in the shear tool so the load will be applied parallel to the grain. Record the primary orientation of the shearing plane as either radial or tangential. Place the loaded shear tool in the testing machine and zero all gauges.

2. Apply the load at a deformation rate of 0.024 in/min and record the maximum applied load.

3. Determine the shearing strength of the wood by dividing the maximum load by the shearing area.

Compression Perpendicular to Grain, 1-1/2x 1-1/2 x 8 inch specimen

1. Insert and center the specimen in the testing machine and zero all gauges.

2. Apply the load to the specimen using a 2 inch metal bearing plate and a constant deformation rate of 0.012 in/min. Record the compression at every 200 lbs of load until a total deformation of 0.10 inches has been reached.

3. Develop a Load vs Compression curve and determine the load and compression at the elastic limit, the maximum load, and the load at 0.1" compression.

CEEN 3320 - Behavior & Properties of Engineering Materials
Laboratory Experiment No. 8
Compression, Shear, Column Behavior, and Static Bending of Wood

Compression Parallel to Grain, 1-1/2x 1-1/2 x 6 inch specimen

1. Insert and center the specimen in the testing machine and zero all gauges.

2. Apply the load to the specimen at a deformation rate of 0.018 in/min. Record compression data at every 1,000 lbs of load until the proportional limit is well passed. Note the type of failure. Develop a Load vs Compression curve and determine the load and compression at the elastic limit.

Column Tests 1/12 x 1 and 1 x 1 1/2 inch specimens

1. Starting with the shortest specimen, insert and center in the testing machine.

2. Apply load to the specimen at the slowest rate possible. Record the maximum load for each specimen on the data sheet. Prepare a plot of the failure load vs. the slenderness ratio and comment on the trend.

Beam Tests, 2 x 4 x 96 inch specimens

1. Place the ***dimension lumber*** specimen in the load frame with the long side horizontal and the load piston centered on the supports. Lower the hydraulic rams until it just contacts the load cell button and apply a very slight seating load to the member. Verify alignment of all components and adjust as needed. Place the dial gauge under the midpoint of the span and zero all instruments. Record the diameter of the load ram and the distance between supports.

2. Apply the center point load slowly onto the member and record the load and deflection of the member for every 20 psi of ram pressure. Continue loading until a total deflection of 1 inch is recorded.

3. Place the ***dimension lumber*** specimen in the load frame with the short side horizontal and the load piston centered on the supports. Lower the hydraulic rams until it just contacts the load cell button and apply a very slight seating load to the member. Verify alignment of all components and adjust as needed. Place the dial gauge under the midpoint of the span and zero all instruments. Record the diameter of the load ram and the distance between supports.

4. Apply the center point load slowly onto the member and record the load and deflection of the member for every 20 psi of ram pressure. Continue loading until failure of the specimen and note the type of failure.

5. Place the LVL in the load frame with the short side horizontal and the load piston centered on the supports. Test as described in step 2 until a total deflection of ½

inch is recorded.

CEEN 3320 - Behavior & Properties of Engineering Materials
Laboratory Experiment No. 8
Compression, Shear, Column Behavior, and Static Bending of Wood

Calculations

1. Use the measurement data to determine the specific gravity of each test specimen. Prepare a plot of specific gravity versus % summerwood and comment on the trend.

2. Use the measurement data from the first three tests to determine the appropriate strength parameter. Compare these values to typical values presented in your text.

3. Use the measurement data to determine the moment of inertia for each beam test specimen based on the specimen orientation during testing.

4. Use the load/deflection data from the beam tests to determine a representative modulus of elasticity for each wood specimen.

5. Use the beam test failure load of the select test specimen to determine the modulus of rupture of the test specimen.

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Laboratory Experiment No. 8
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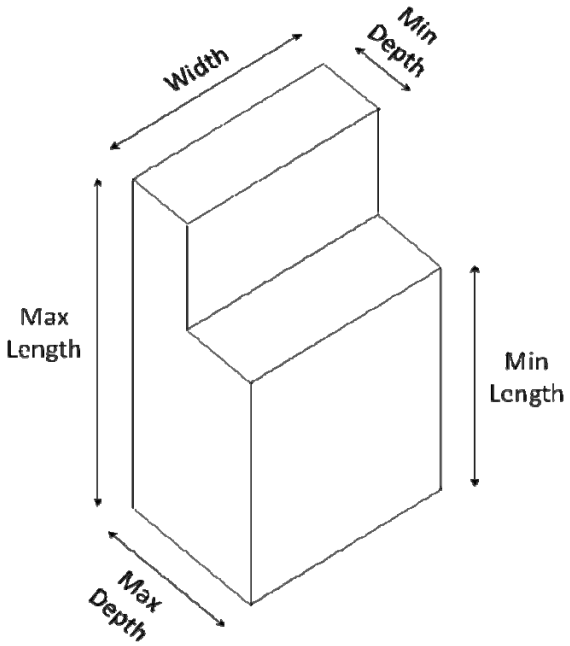
DATA SHEET 1
Shear of Wood Parallel to Grain

Specimen No.	
Mass, g	
Max Length, in	
Min. Length, in	
Width, in	
Max Depth, in	
Min. Depth, in	
M.C.	
Rings/in	
% Summerwood	
% Sapwood	
Shearing Surface	
Shear Area, in^2	
Max. Load, lb	
Shear Strength, psi	



CEEN 3320 - Behavior & Properties of Engineering Materials
Laboratory Experiment No. 8
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DATA SHEET 2
Compression of Wood Perpendicular to Grain

Specimen No.	
Mass, g	
Length, in	
Width, in	
Depth, in	
M.C.	
Rings/in	
% Summerwood	
% Sapwood	
Load, lb	Deformation Readings, 0.001 inch
0	
200	
400	
600	
800	
1000	
1200	
1400	
1600	
1800	
2000	
2200	
2400	
2600	
2800	
3000	
3200	
3400	
3600	
3800	
4000	
4200	
4400	
4600	
4800	
5000	

CEEN 3320 - Behavior & Properties of Engineering Materials
Laboratory Experiment No. 8
Compression, Shear, Column Behavior, and Static Bending of Wood

DATA SHEET 3
Compression of Wood Parallel to Grain

Specimen No.	
Mass, g	
Length, in	
Width, in	
Depth, in	
M.C.	
Rings/in	
% Summerwood	
% Sapwood	
Load, lb	Deformation Readings, 0.001 inch
0	
1000	
2000	
3000	
4000	
5000	
6000	
7000	
8000	
9000	
10000	
11000	
12000	
13000	
14000	
15000	
16000	
17000	
18000	
19000	
20000	
21000	
22000	
23000	
24000	
25000	

CEEN 3320 - Behavior & Properties of Engineering Materials
Laboratory Experiment No. 8
Compression, Shear, Column Behavior, and Static Bending of Wood

DATA SHEET 4
Static Beam Bending

WOOD SPECIMEN PROPERTIES

Specimen Select		Composite
Mass, g		
Length, in		
Width, in		
Depth, in		
M.C., %		
Rings/inch		
%Summerwood		
%Sapwood		
Slope of Grain, in/in		

BENDING TEST DATA

Specimen Select		Select	Composite
Width, in			
Depth, in			
Span Length, in			
Ram Diameter, in			
Ram Pressure, psi	Mid-Span Deflection, in		
20			
40			
60			
80			
100			
120			
140			
160			
180			
200			
220			
240			
260			
280			
300			
320			
340			
Failure Pressure, psi			
Failure Type			

CEEN 3320 - Behavior & Properties of Engineering Materials
Laboratory Experiment No. 8
Compression, Shear, Column Behavior, and Static Bending of Wood

Data Sheet 5
Column Behavior

Specimen No.				
Mass, g				
Length, in				
Width, in				
Depth, in				
M.C.				
Rings/in				
% Summerwood				
% Sapwood				
L/D				
Max Load, lb				
Failure Type				