

Nature vs. Nurture – Defining the Character of Deconstruction Lumber

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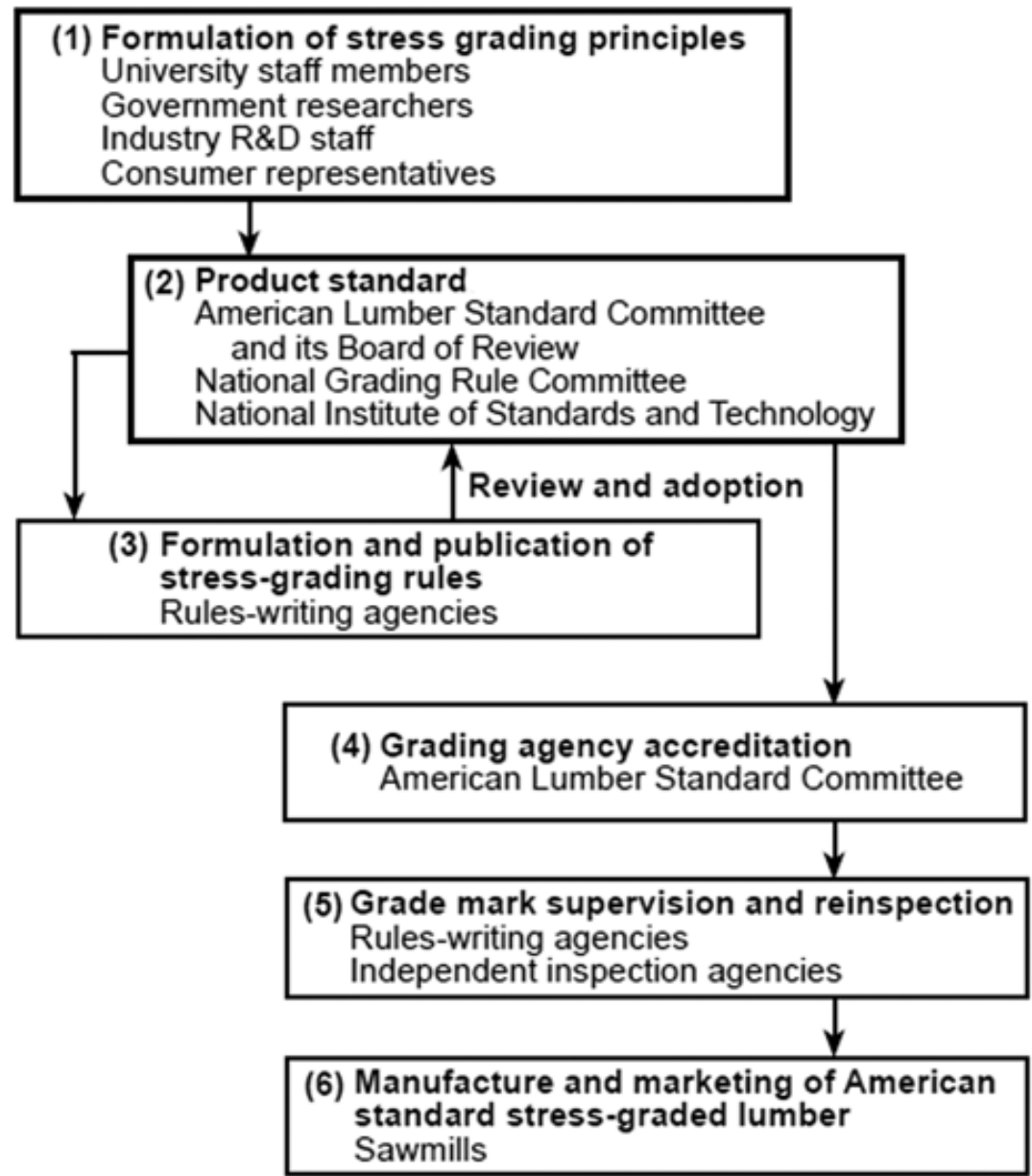
State University of New York
College of Environmental Science and Forestry

Department of Sustainable Construction Management and Engineering

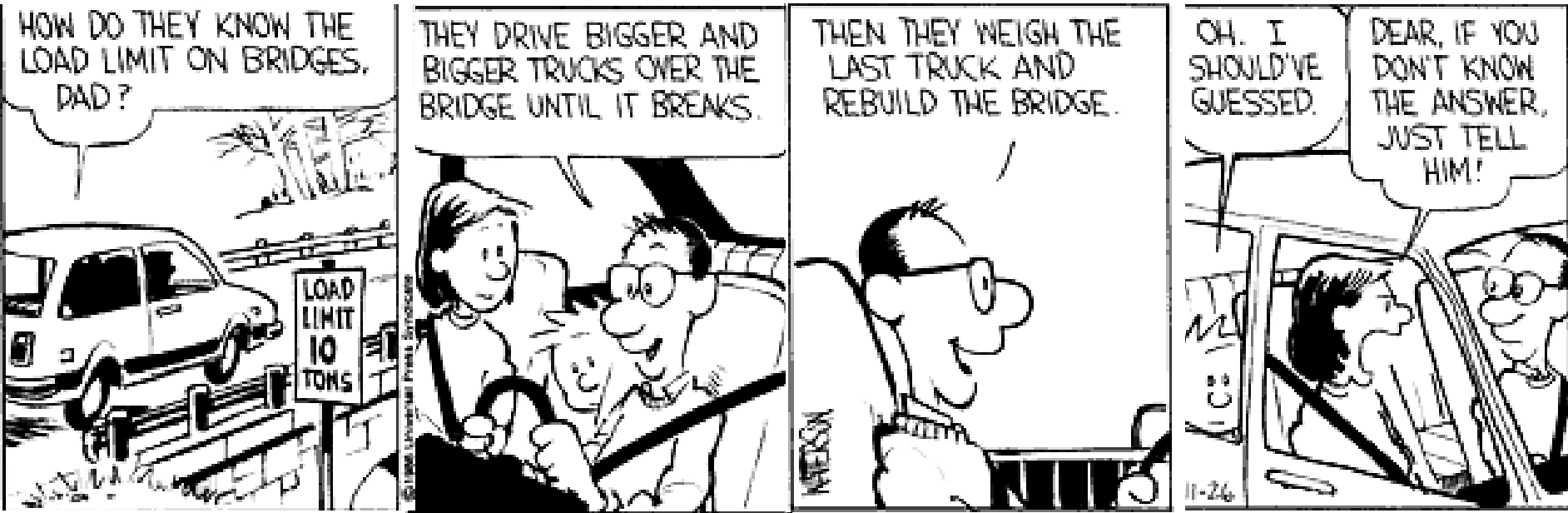
What am I doing here?

Basic Research Question

- Variability in fresh sawn lumber comes from forces of nature and genetic diversity.
- Variability in deconstruction lumber comes from the above as well as the load history
- How much greater is the variability in deconstruction lumber than fresh sawn lumber?



Non-destructive testing



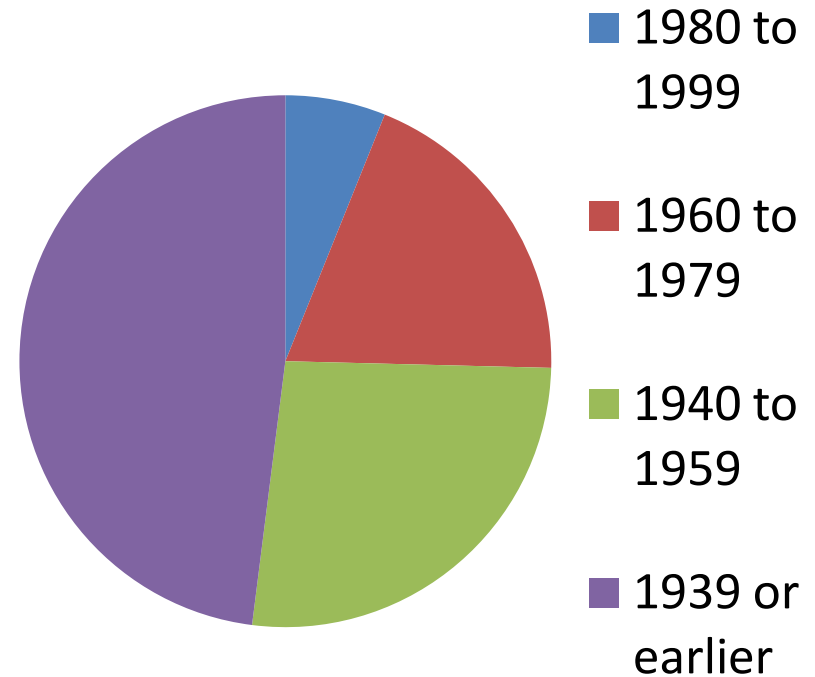
- What are common techniques to determine material properties non-destructively?
 - Visual Evaluation
 - Measured density
 - Measured dynamic stiffness
 - Measured static stiffness

Visual Evaluation

History of Lumber Sizes and Grading

- Construction lumber size standards were first published in 1924 and revised in 1926, 1928, 1939, 1953, 1964 and finally 1970.
- In 1924 the ALSC produced *the first* national standard for lumber grades, uniform strength values were applied in 1944

Demographics of Syracuse Housing



Modern Visual Grading

- Typically separated by Species and Region
- Species are mixed if they have similar strength properties
- Surfaced material is inspected with by a trained inspector under controlled conditions.

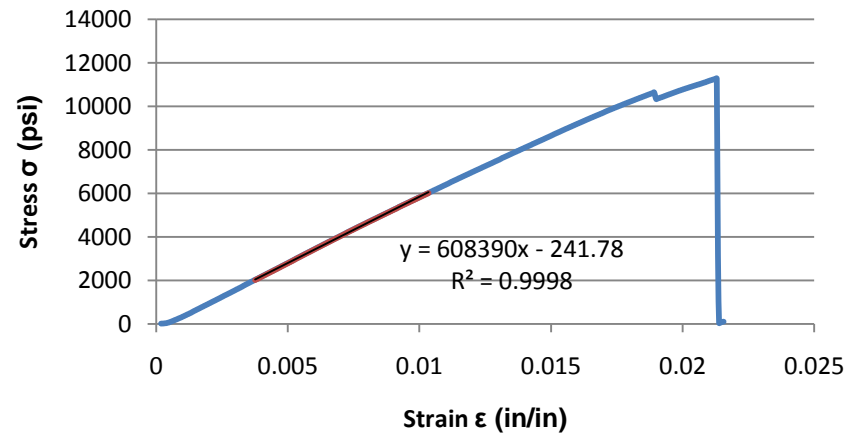


Image from Buffalo Re-Use

MOR Testing – Modified ASTM D198 (single point)



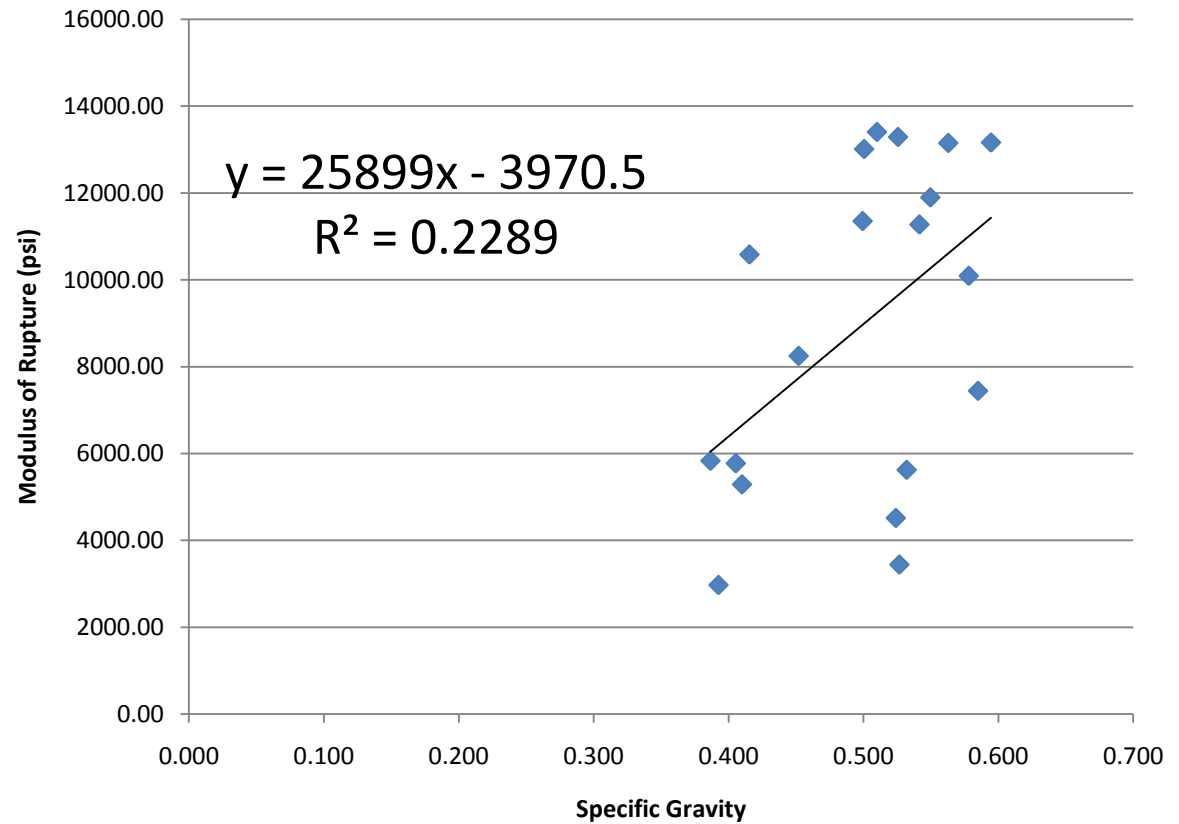
Stress vs. Strain - Board 18



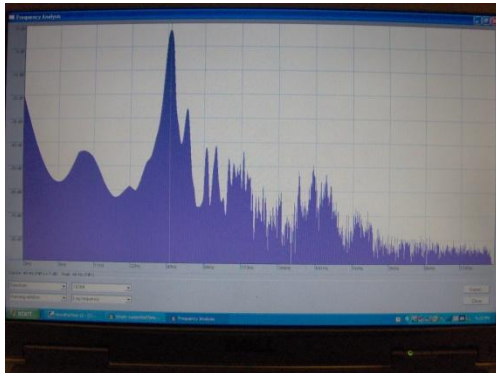
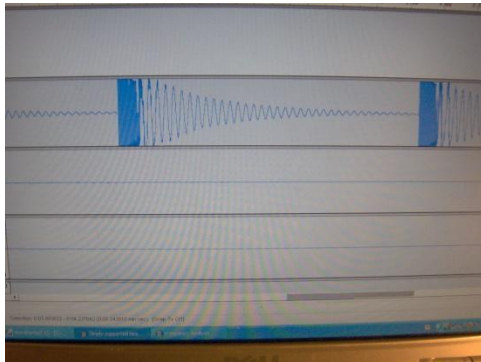
Density to Strength?

Label	Width (in)	Depth (in)	Length (in)	Weight (lb)	Specific Gravity G
1	2.000	3.750	98.750	11.11	0.415
2	1.500	3.688	80.000	6.55	0.410
3	1.500	3.500	93.250	10.51	0.595
4	1.625	3.813	92.125	11.60	0.563
5	1.500	3.500	87.750	8.76	0.527
6	1.500	3.500	82.000	8.27	0.532
7	1.750	3.625	85.000	11.75	
8	1.750	3.750	96.000	11.92	0.524
9	1.500	3.375	80.000	7.78	
10	1.750	3.750	86.750	9.29	0.452

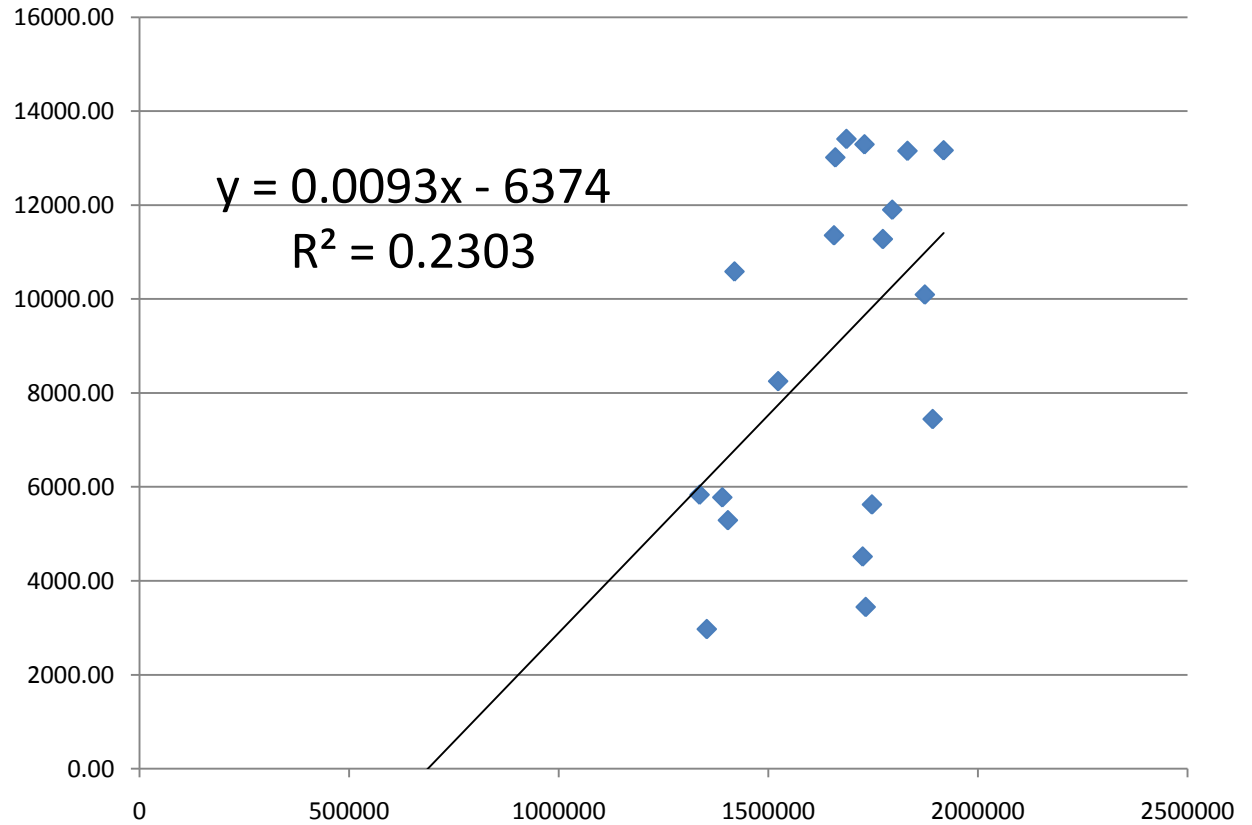
MOR vs. Specific Gravity



Vibration to Strength?

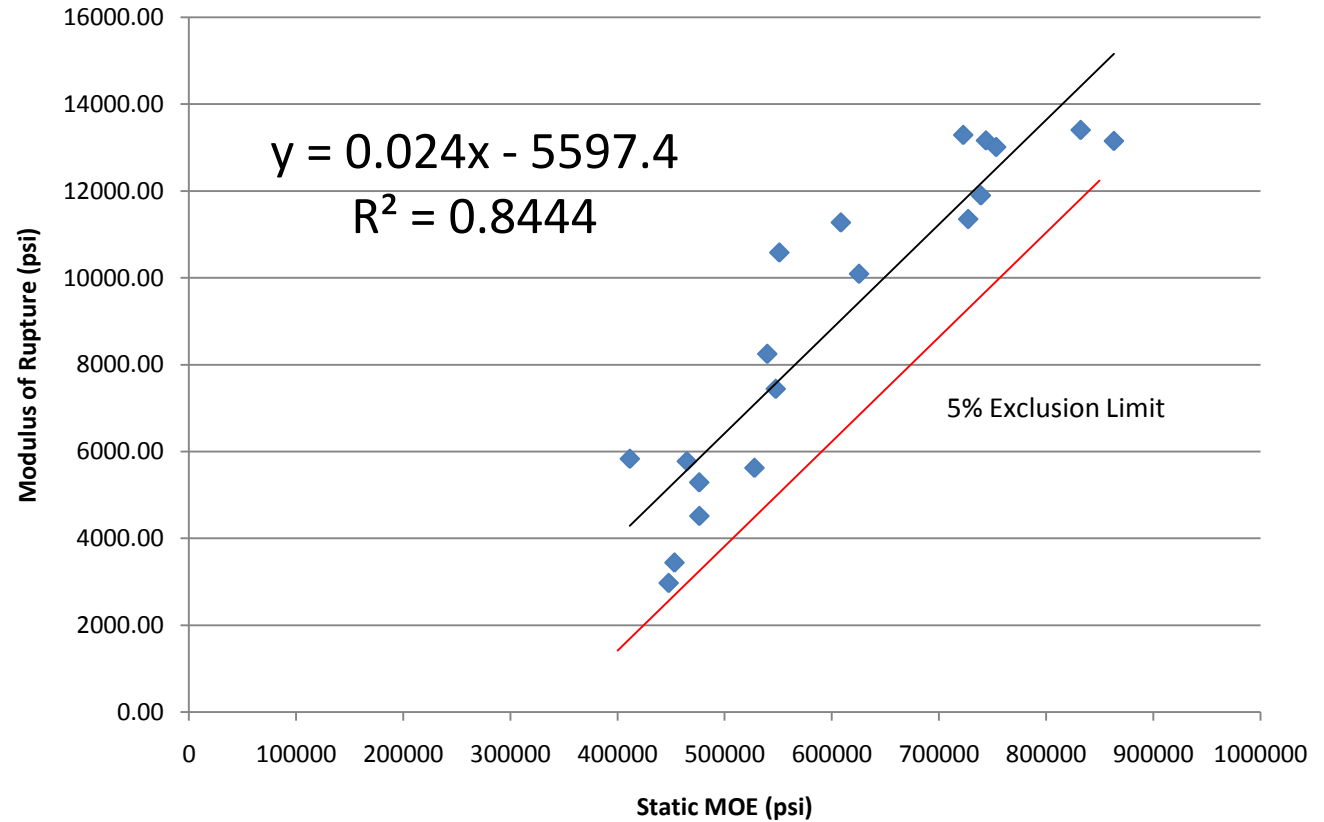


MOR vs. Dynamic MOE



Stiffness to Strength?

MOR vs. Static MOE



Fresh sawn
MSR lumber
MOR vs MOE
 $R^2 = 0.79$ flat
 $R^2 = 0.69$ edge

- Reference: Bodig and Jayne

Conclusions

- *Warning - Sample size small and not necessarily representative*
- Static MOE vs. MOR gave best results for NDT methods sampled
- Variability in sample of deconstruction lumber no worse than variability in machine stress rated fresh sawn lumber
- *This does not mean that the deconstruction lumber is stronger or weaker than fresh sawn (modern) lumber!*