Comparative Properties of Bagasse Particleboard (BPB)

Sugar Cane Processing

Sugar Industry In Louisiana

- Second largest plant commodity in Louisiana
- Producing $500 Million/year in sugar-related products
- Producing 16 Million tons of bagasse as by-product

Harvested Sugar Cane

Sugar Extraction

Sugar Mill

By-Product - Bagasse

By-Product - Bagasse

About 30% of the 16 Million tons of bagasse available for fiber sources in Louisiana annually

Bagasse Fiber

- Bagasse contains about 65 percent fiber, 25 percent pith cells, and 10 percent water soluble.
- Bagasse fibers average 1.5 to 2 millimeters (0.06 to 0.08 inch) in length. They are relatively fine and their chemical properties are similar to those of hardwood fibers.
- An essential element in the conversion of bagasse to a satisfactory paper is the mechanical removal of a substantial proportion of the pith prior to the pulping operation.
- Bagasse particleboard (BPB) uses all bagasse.

Bagasse Particleboard Manufacturing

Baled Bagasse

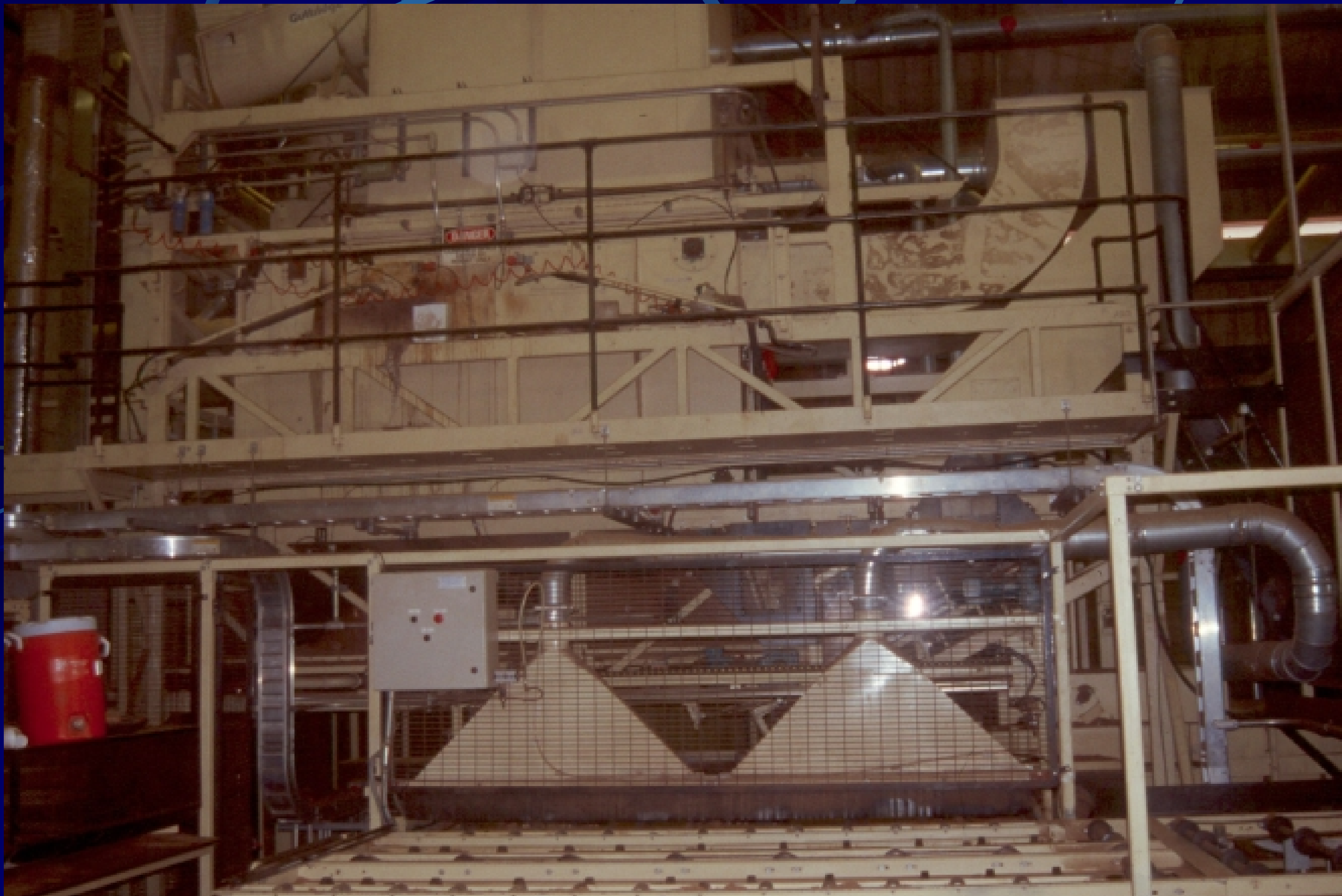
Bagasse Drying

Rotary Dryer

Bagasse Size Reduction

Bagasse PB – Blending

Bagasse PB - Forming



Bagasse PB – Pressing

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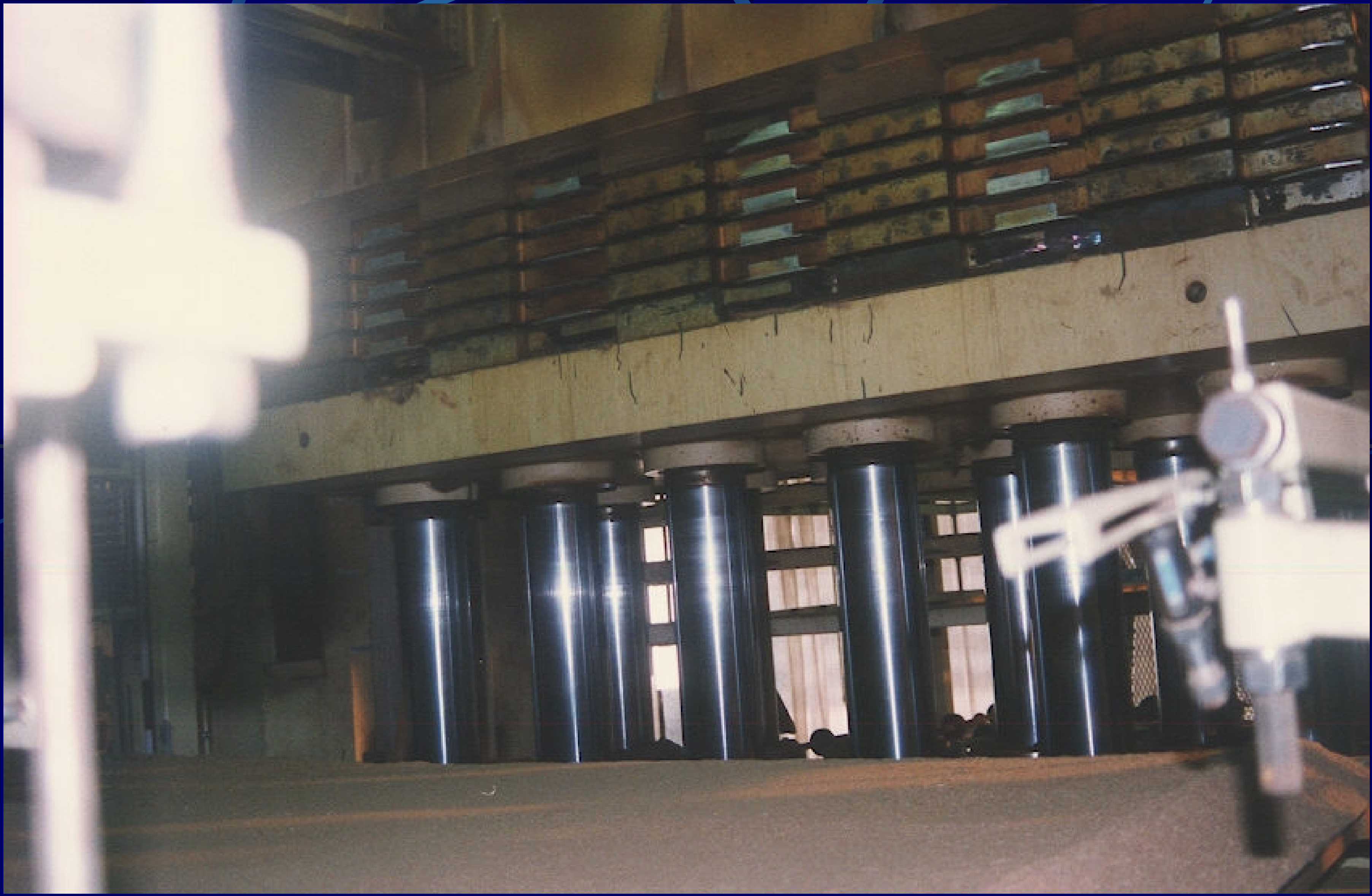
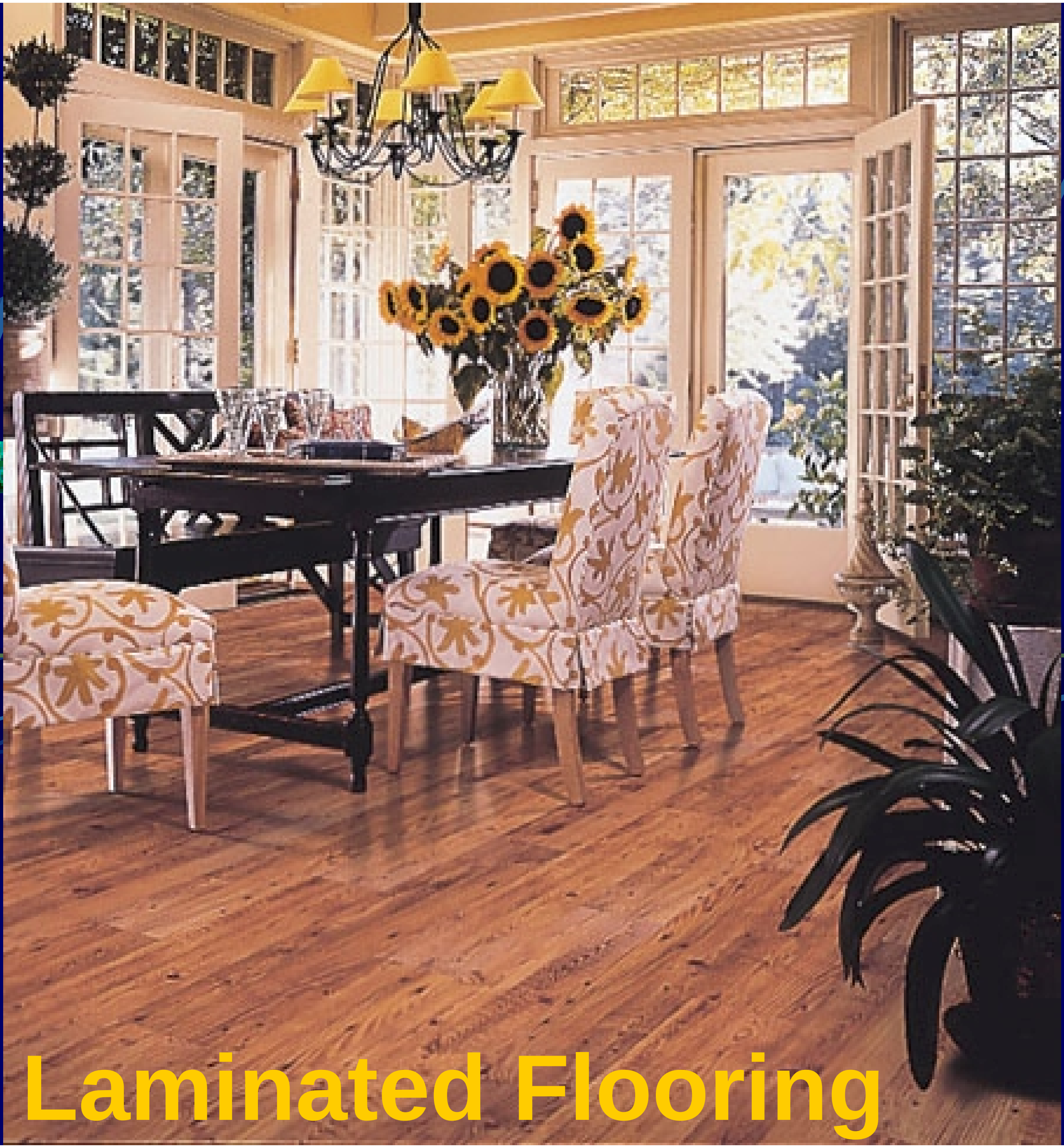


Bagasse PB – Panel Cooling

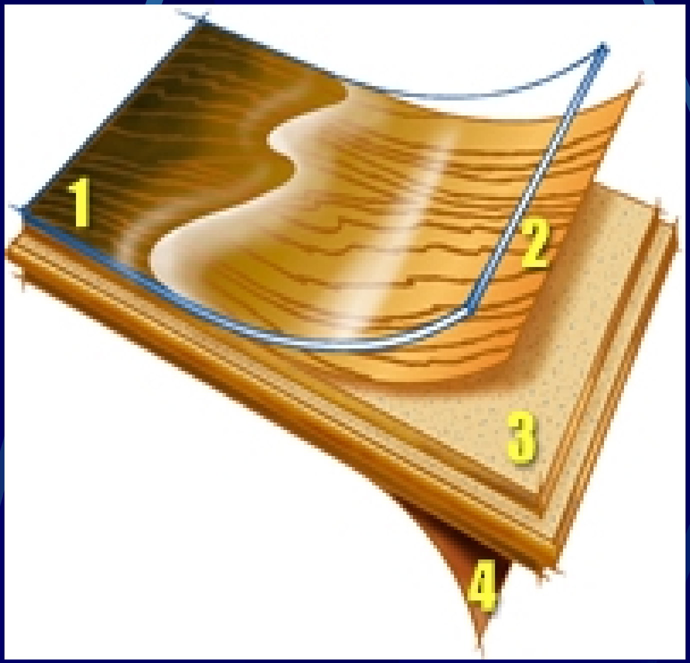
Bagasse PB –Sanding

Bagasse PB – Finished Panel



Laminated Flooring

Laminated Flooring



1. **The Laminate Surface.** A clear wear layer for super protection.
2. **The Image Layer.** This layer for providing a hardwood look.
3. **The Core. High Density Fiberboard (HDF)** for moisture resistance and indentations.
4. **The Laminate Backing.** A thermo-fused backing for additional strength and protection.

Objective

Developing bagasse particleboard (BPB) for laminated flooring applications

Technical Information of Bagasse Particleboard (BPB) Used in the Study

Fiber Type	Resin (pMDI) Content (%)	Target Thick-ness (mm)	Target Density (g/cm^3)	Resina-tion Time (Second)	Press Tempera-ture (C)	Press Cycle (Second)
1-year old bagasse fiber hammer milled through a 6-mm screen	5% 8%	6.35	0.72^a 0.88^b 0.72^c 0.88^d	240	185	165

Note: ^{a} – BPB1, ^{b} – BPB2, ^{c} – BPB3, and ^{d} – BPB4.

Testing of Bagasse Particleboard

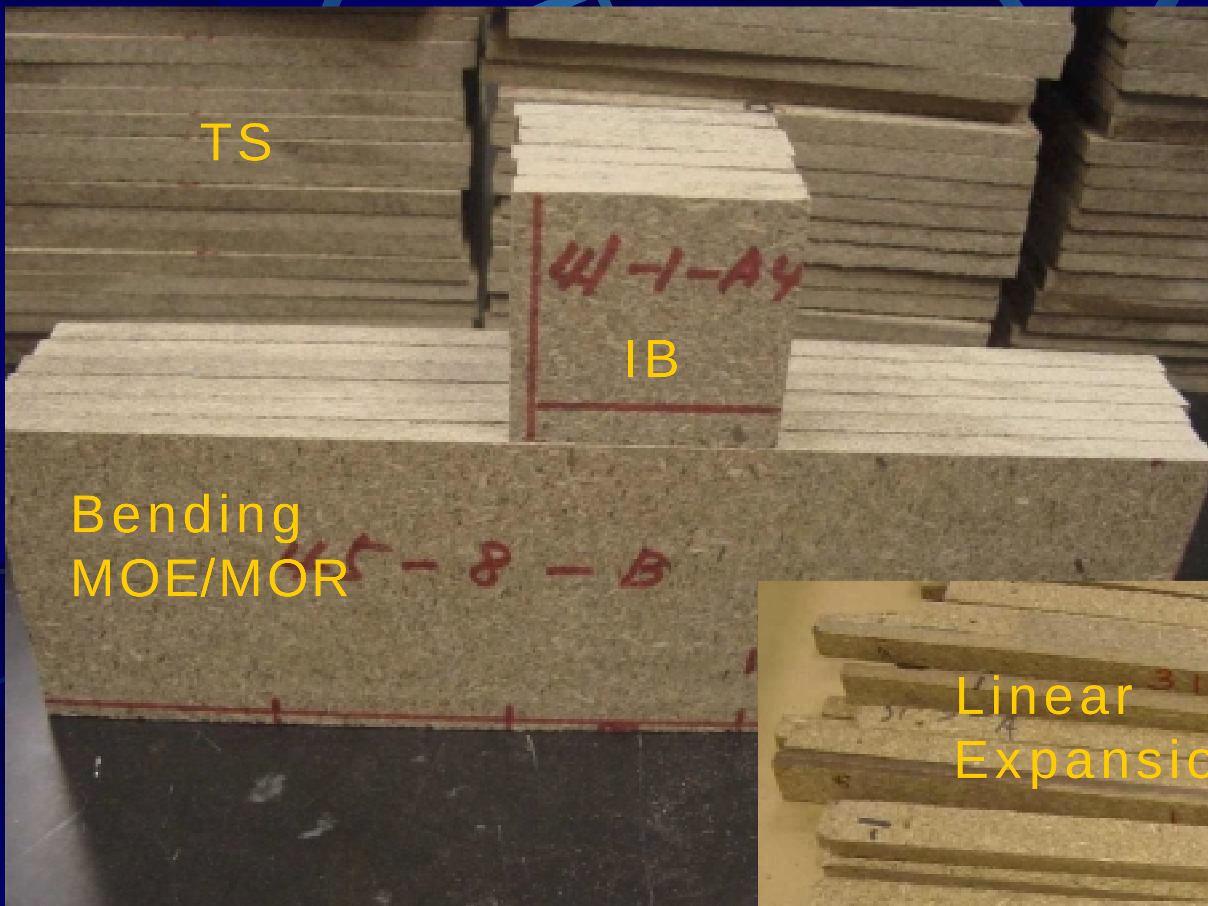
Test Performed:

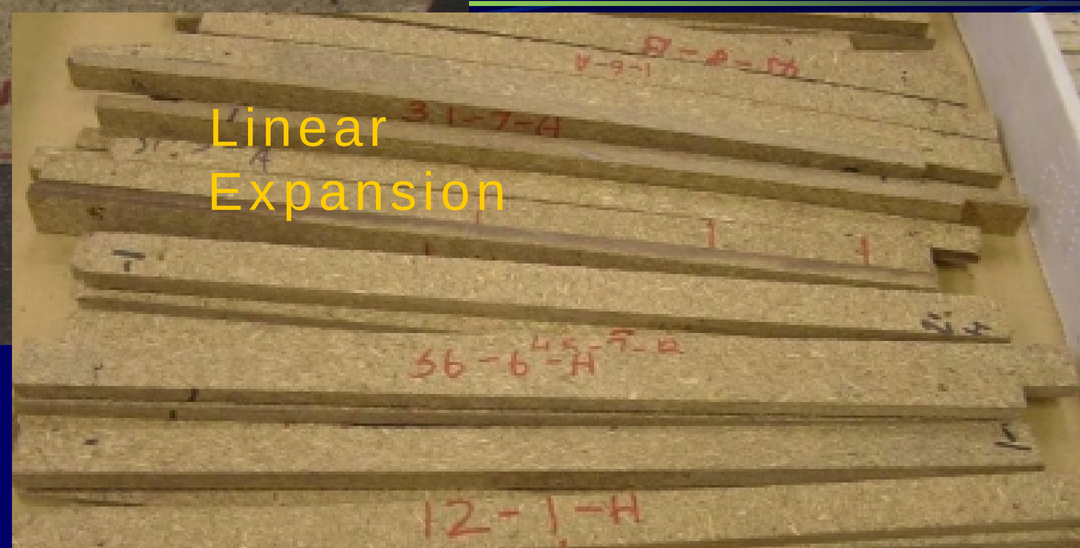
- Bending MOE/MOR
- IB and Hardness
- Screw Holding
- Linear Expansion
- Thickness Swell

Test Standards:

- ANSI/A208.1 (1999)
- ANSI/A208.2 (1994)
- ASTM D1037 (1996)

Bagasse PB Samples





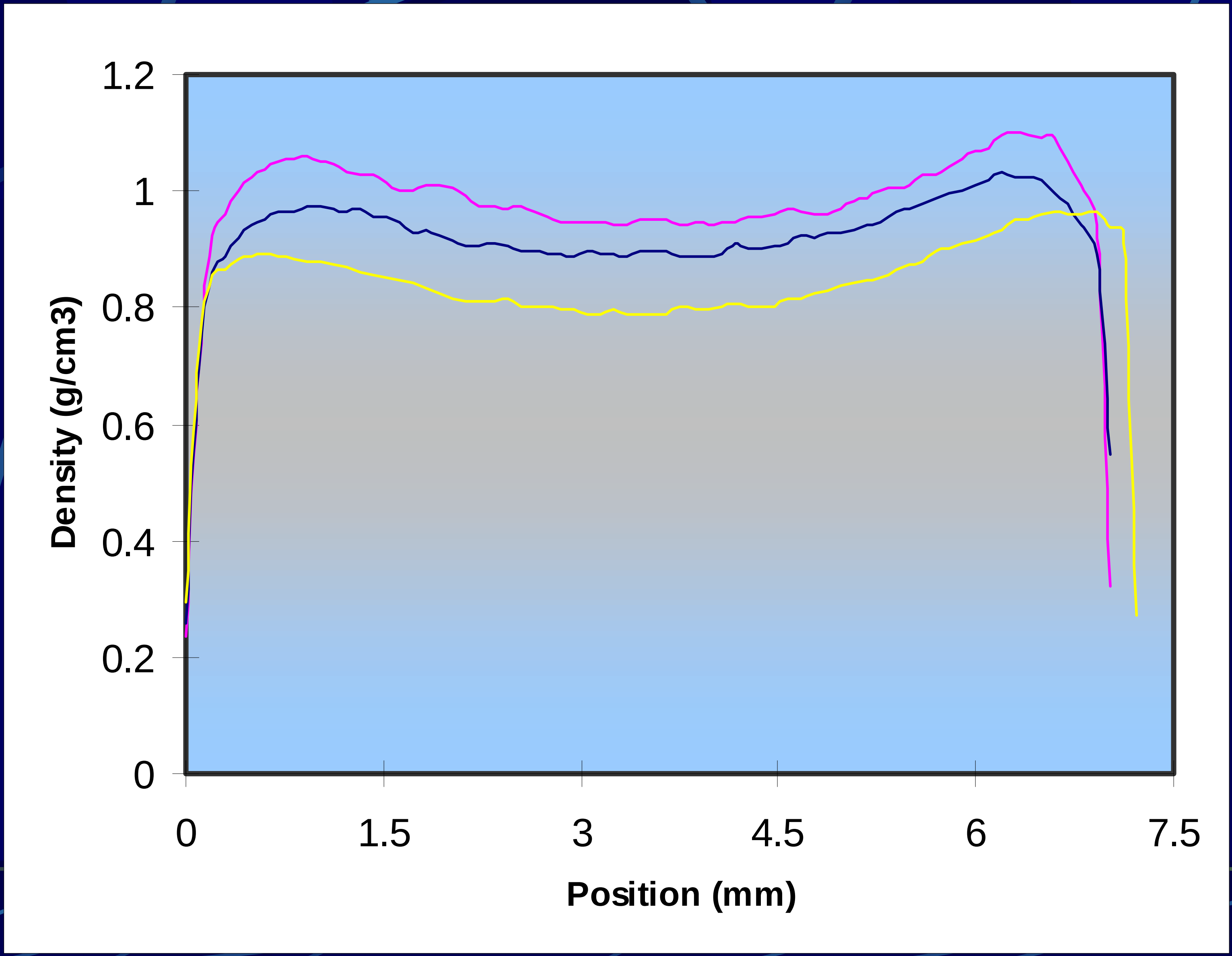
Bagasse PB Testing

Internal Bond

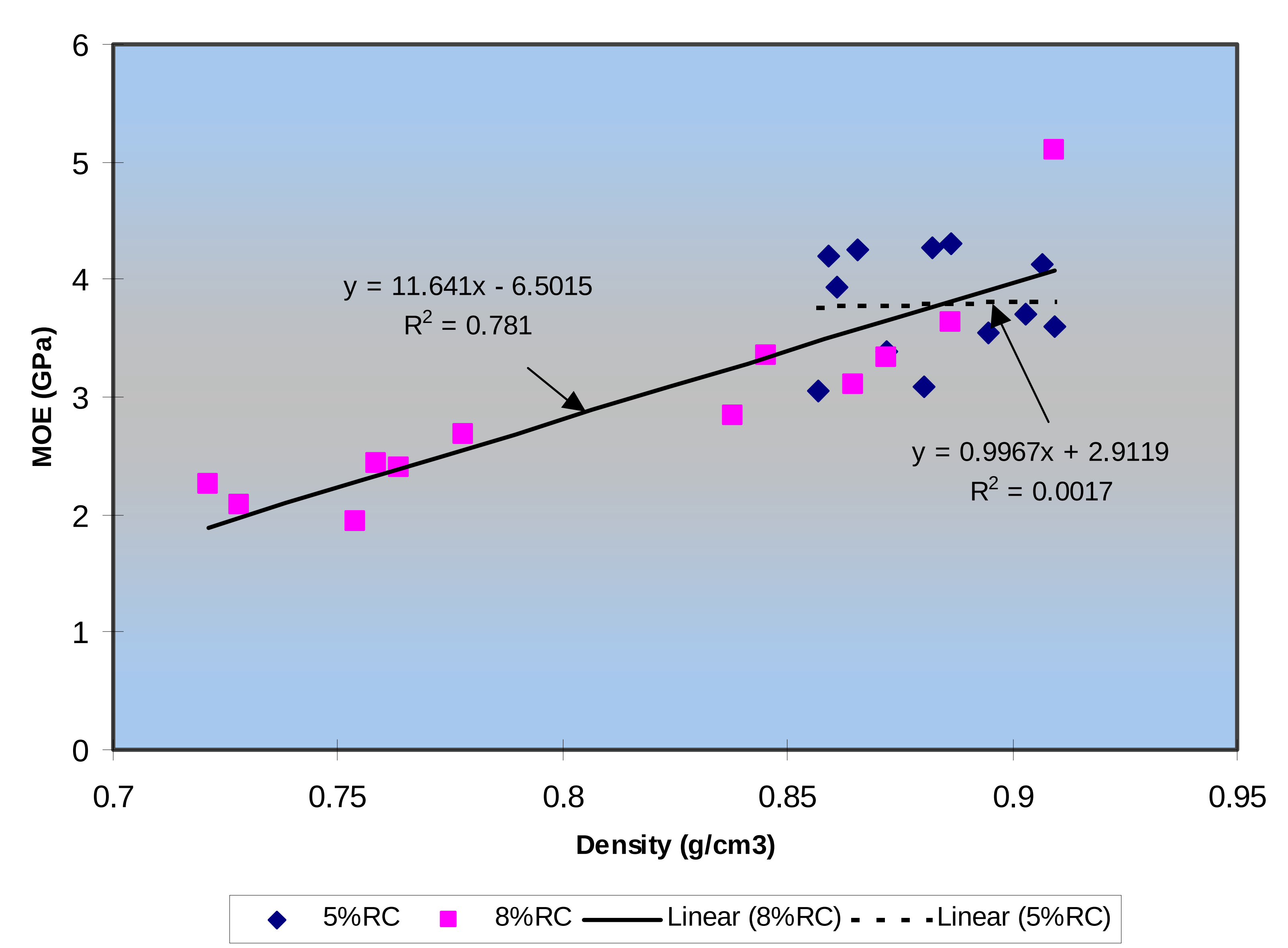
Hardness

Results and Discussions

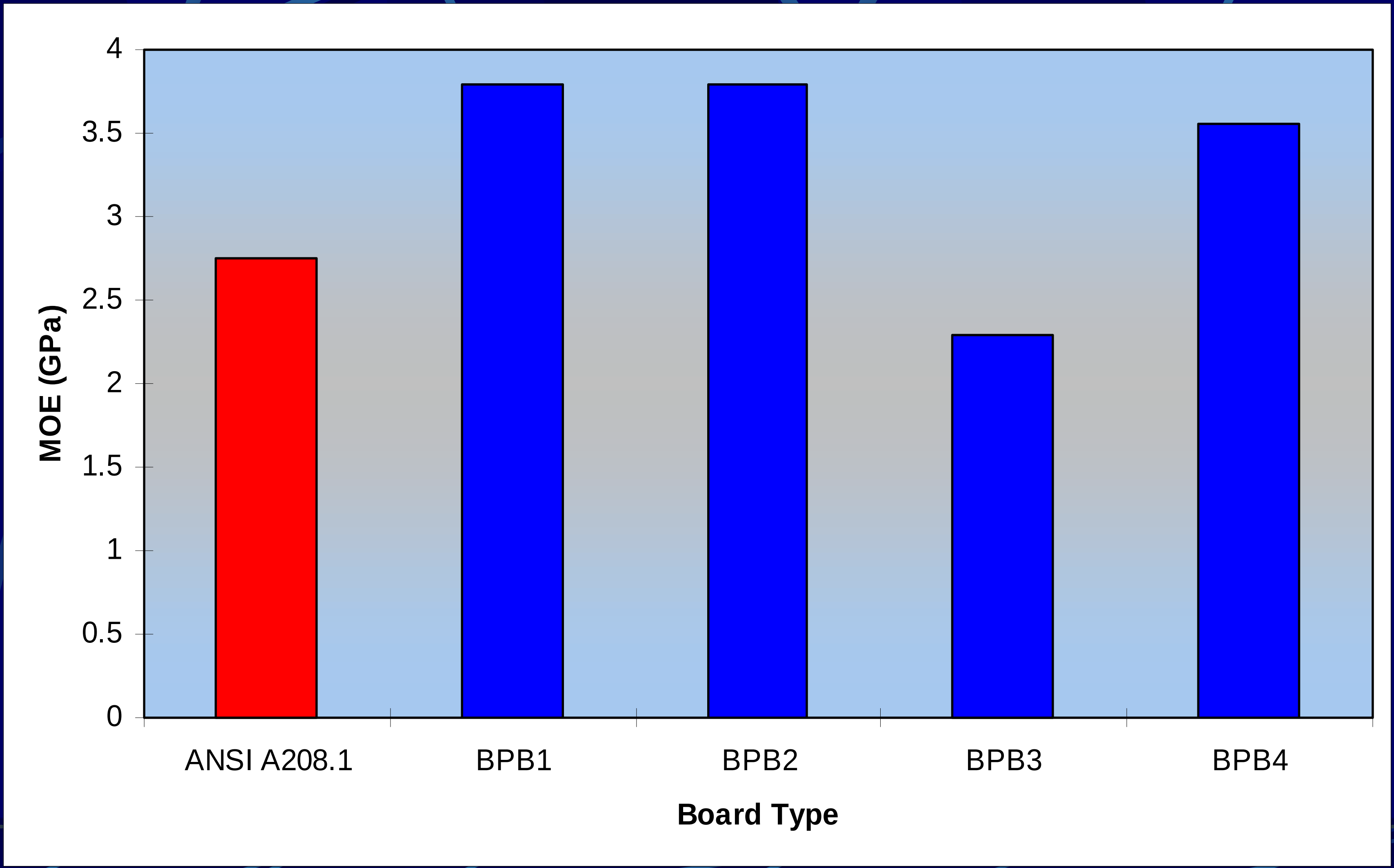
Density profile



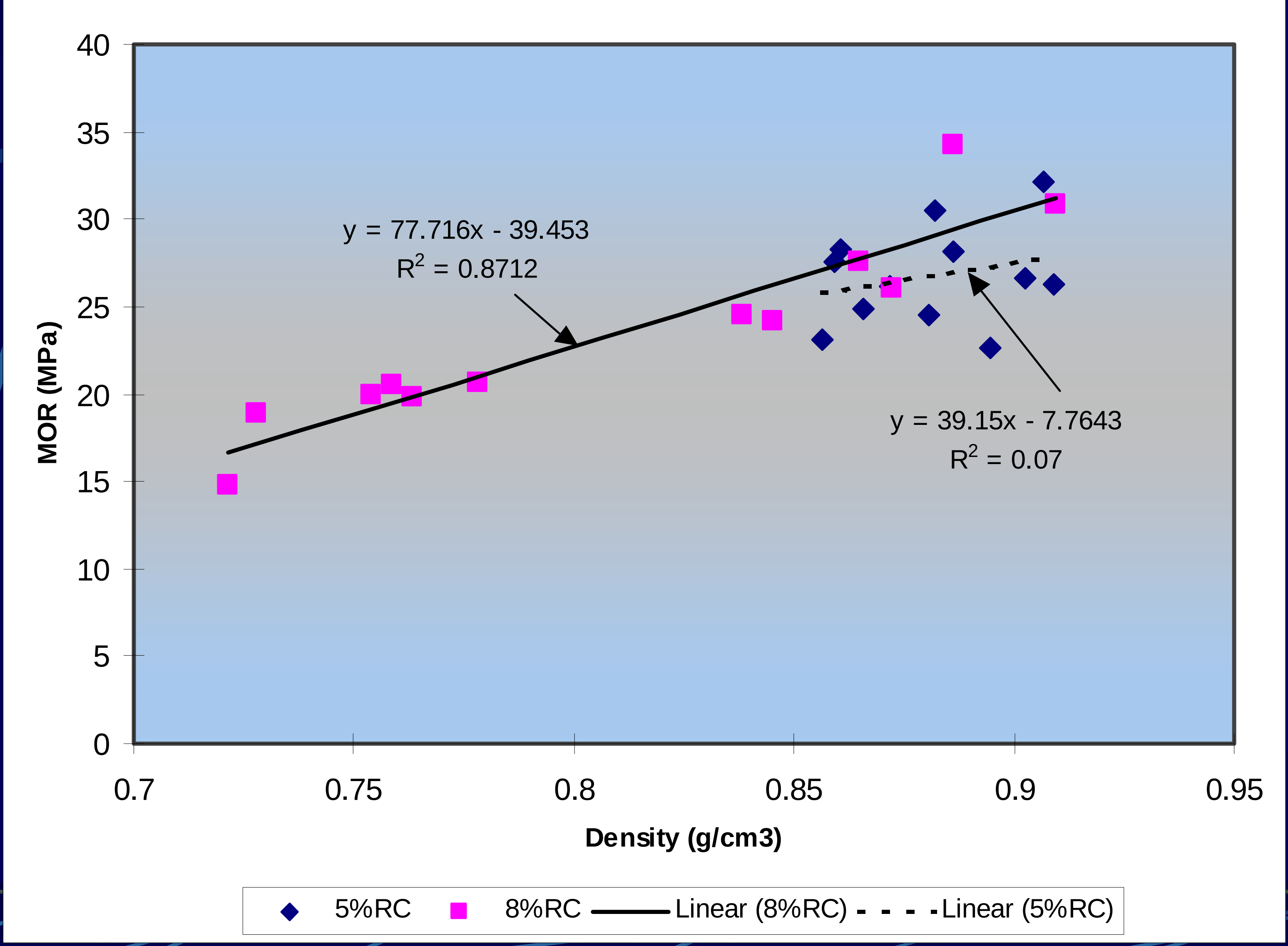
Bending Modulus



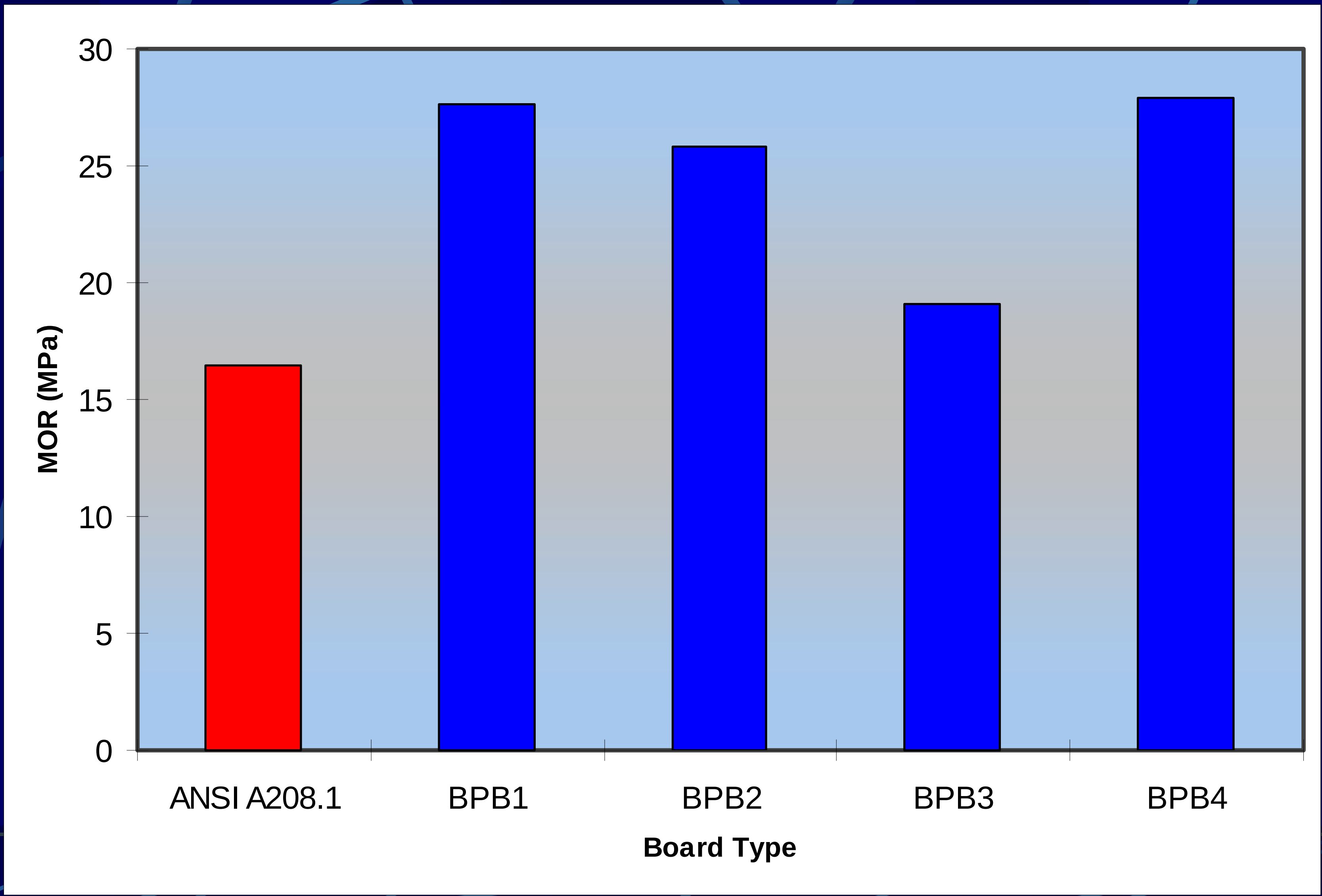
Bending Modulus



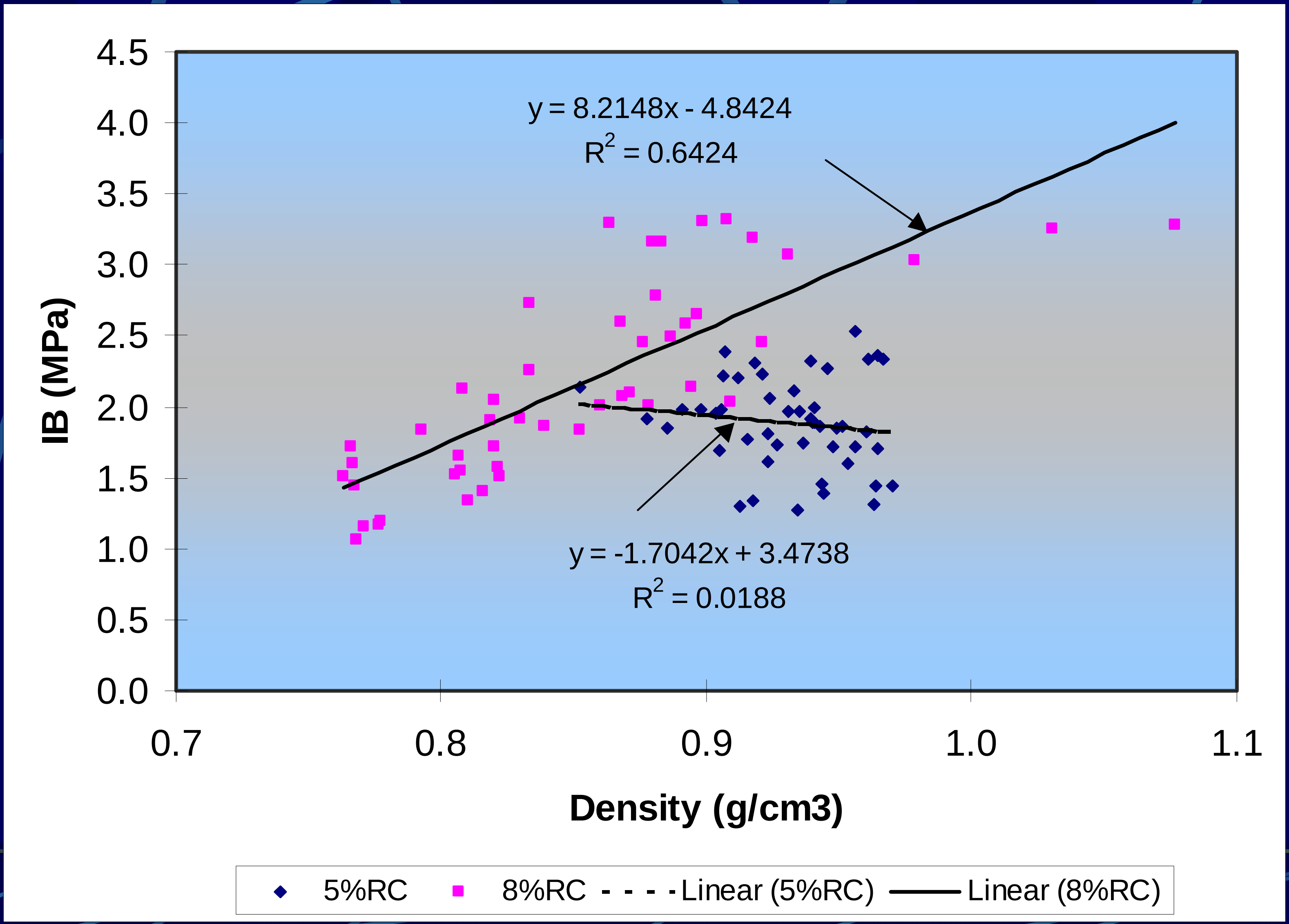
Bending Strength



Bending Strength

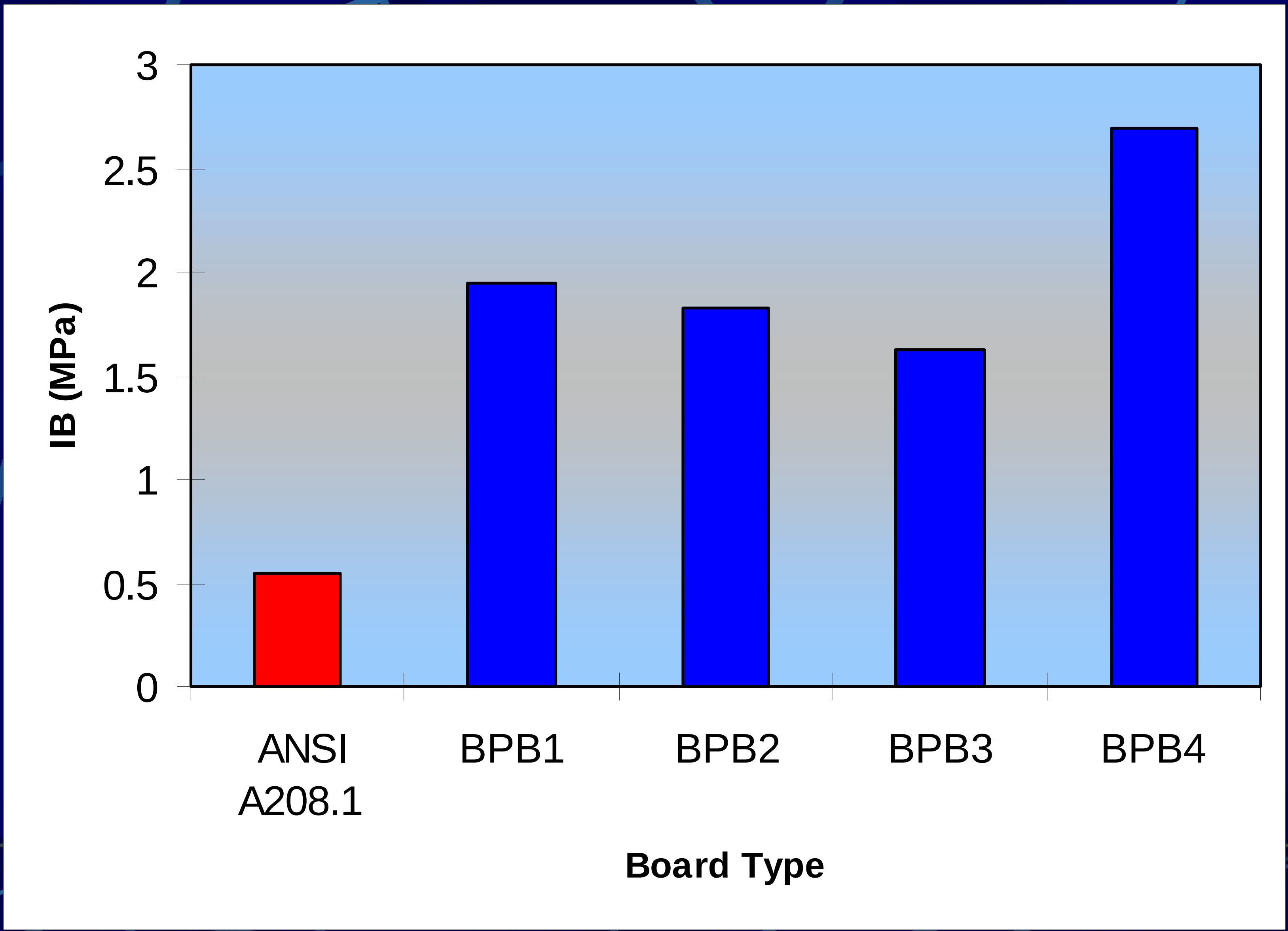


IB Strength

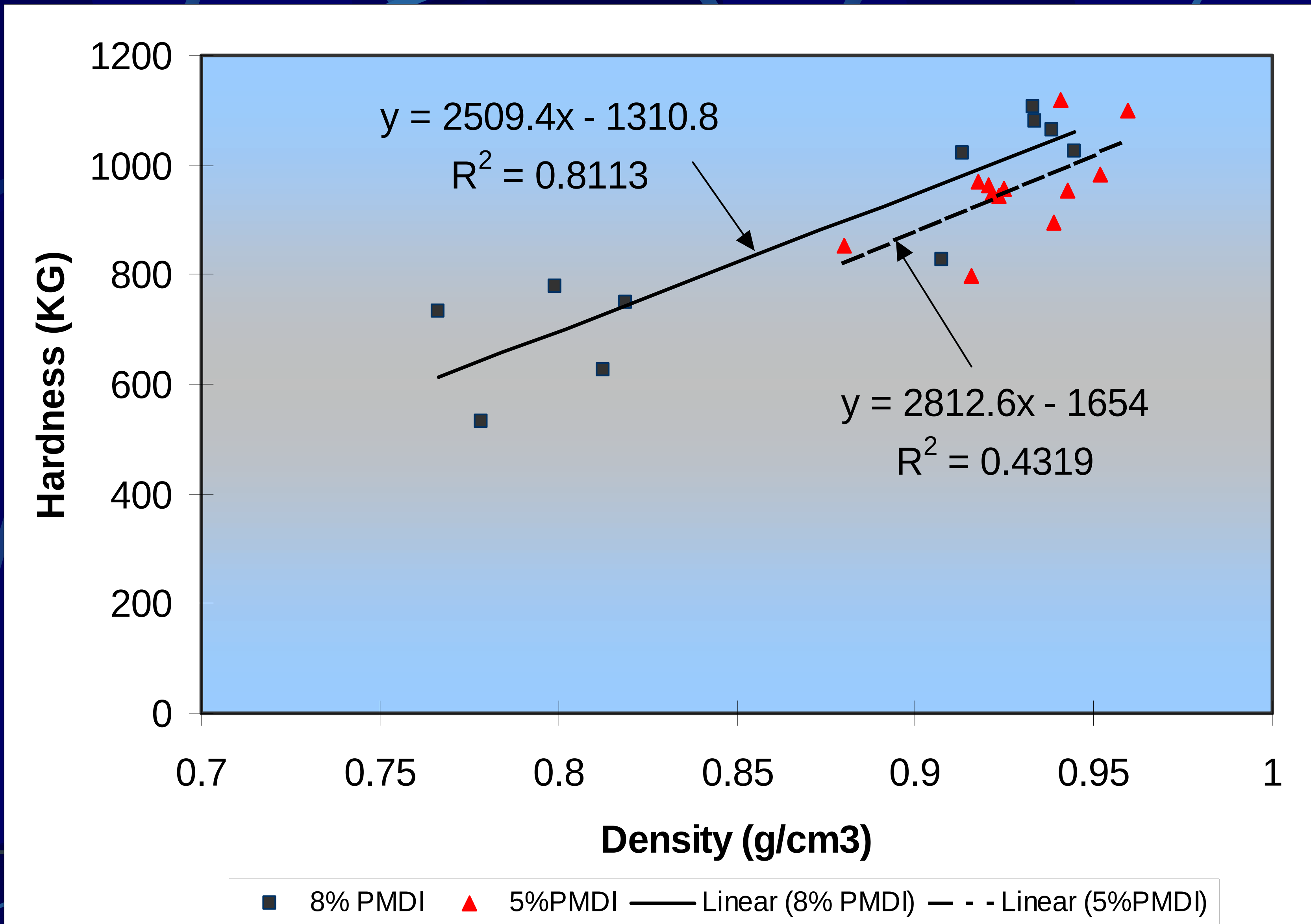


y = 8.2148x - 4.8424
R2 = 0.6424
y = -1.7042x + 3.4738
R2 = 0.0188
IB (MPa)
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
0.7
0.8
0.9
1.0
1.1
Density (g/cm3)
5%RC
8%RC
Linear (5%RC)
Linear (8%RC)

IB Strength

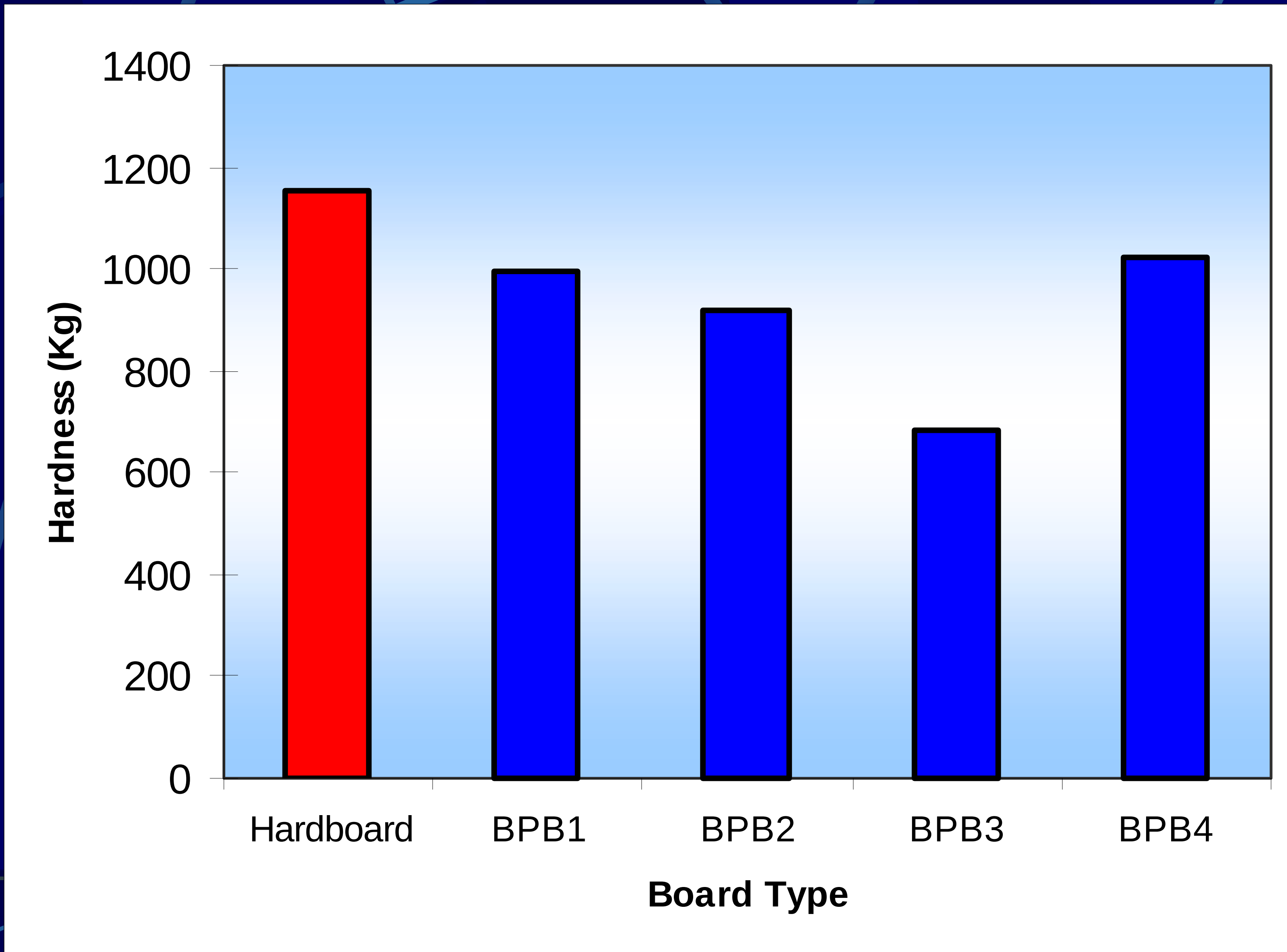


Hardness



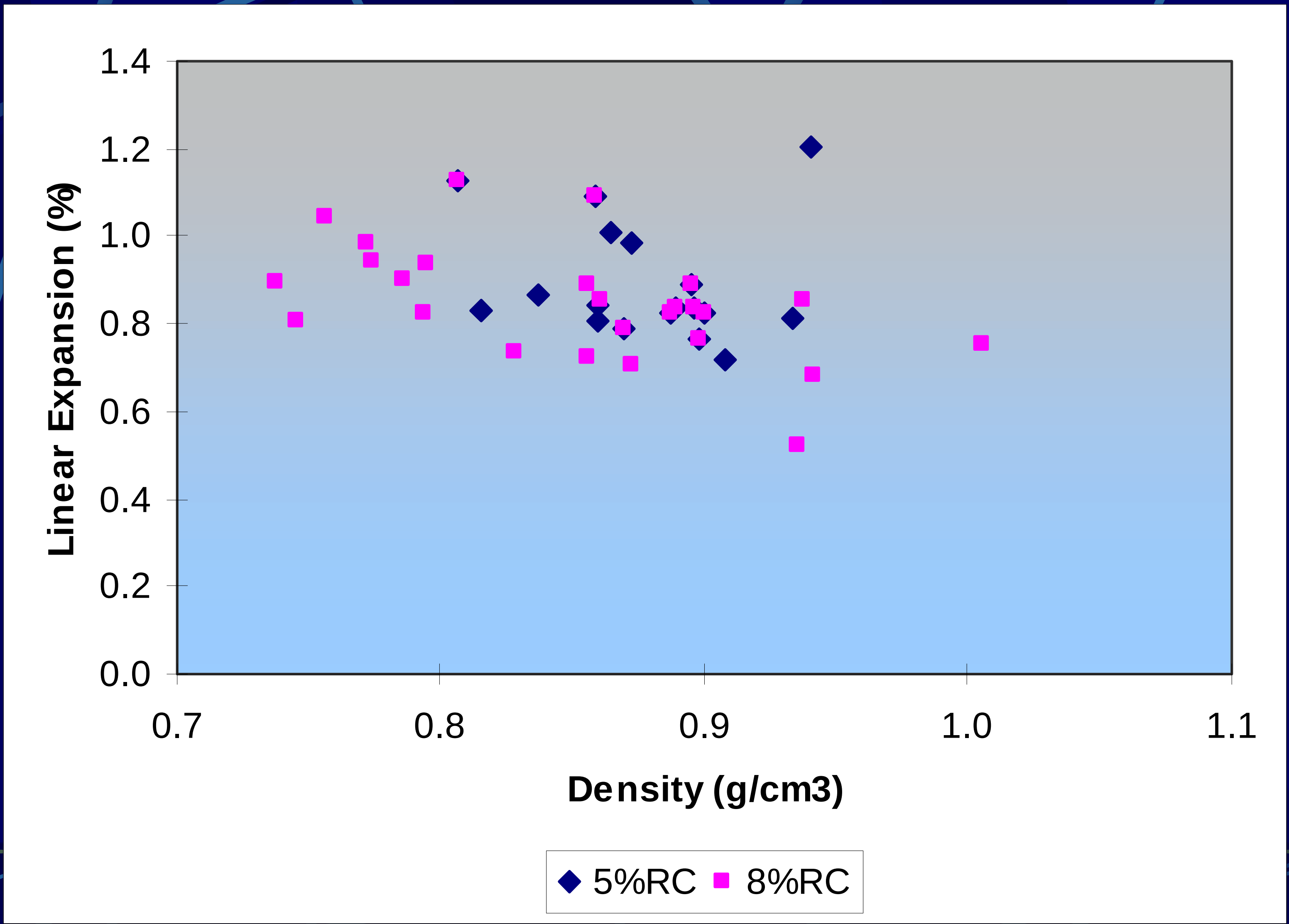
y = 2509.4x - 1310.8
R2 = 0.8113
y = 2812.6x - 1654
R2 = 0.4319
1200
1000
800
600
400
200
0
Hardness (KG)
0.7
0.75
0.8
0.85
0.9
0.95
1
Density (g/cm3)
8% PMDI
5%PMDI
Linear (8% PMDI)
Linear (5%PMDI)

Hardness

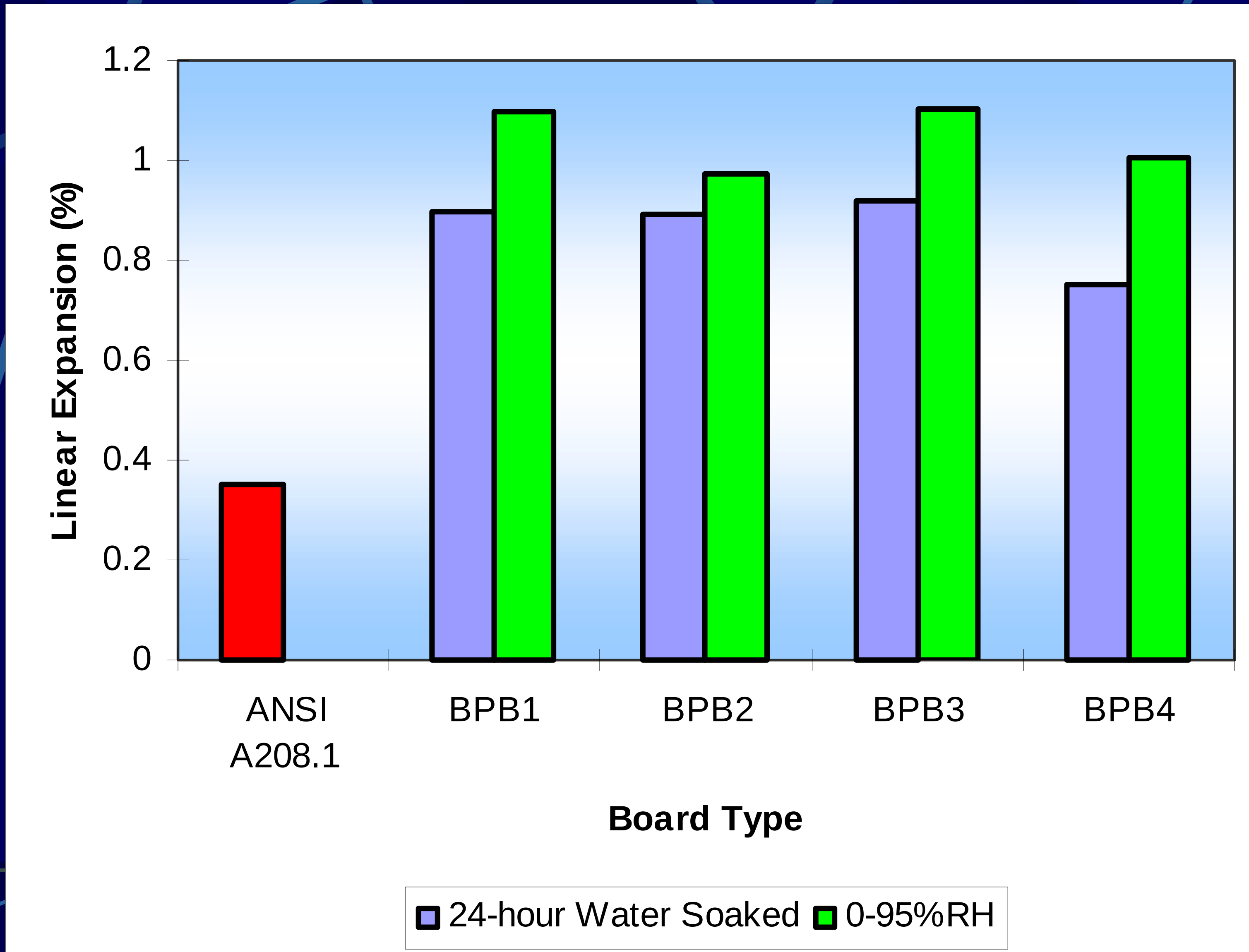


1400
1200
1000
800
600
400
200
0
Hardness (Kg)
Hardboard
BPB1
BPB2
BPB3
BPB4
Board Type

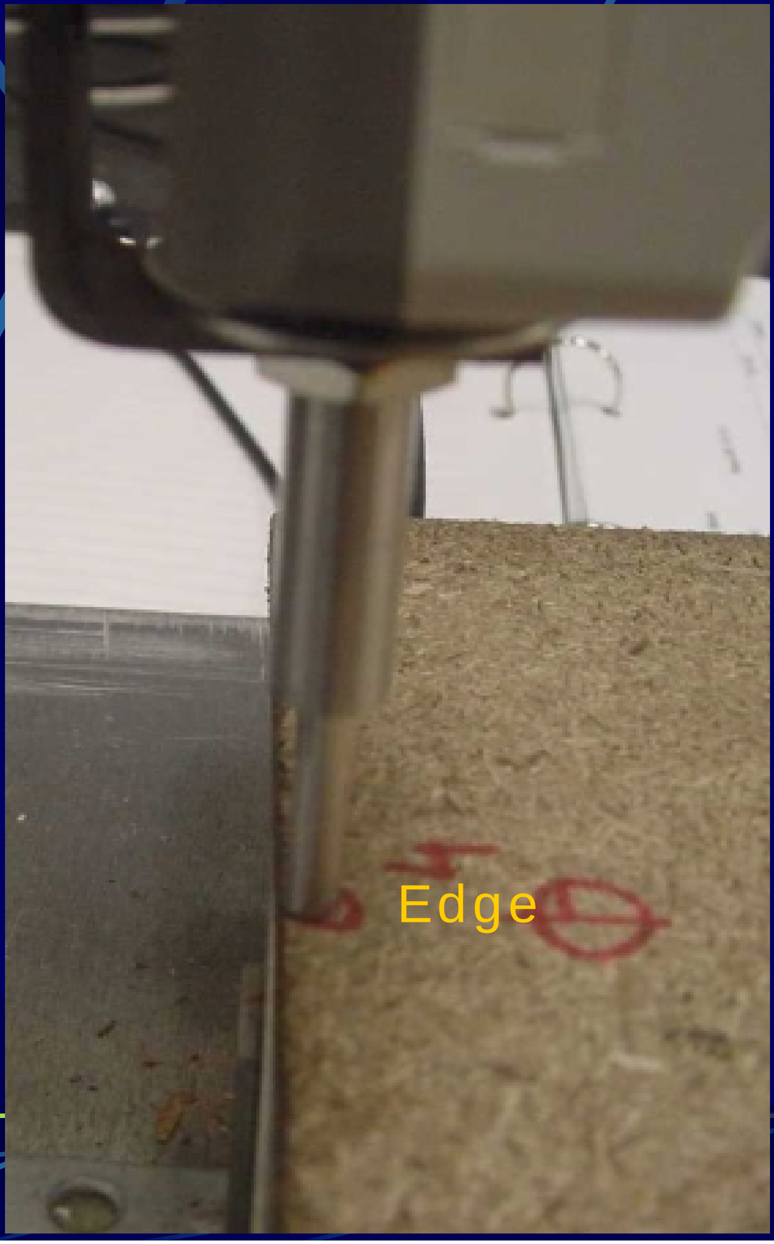
Linear Expansion



Linear Expansion

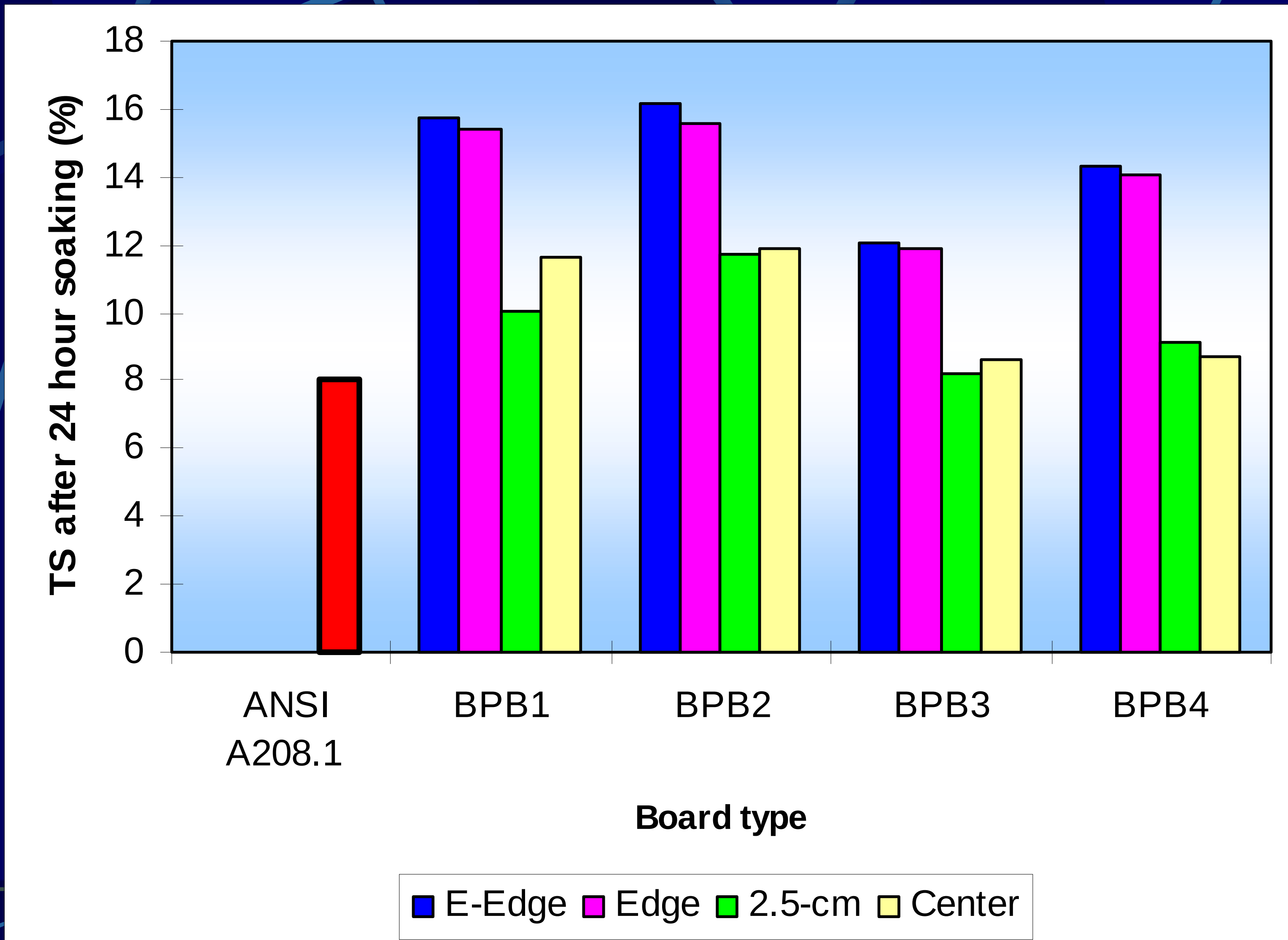


Thickness Swell



Thickness Swell

Thickness Swell



Conclusions

- **All mechanical properties are highly correlated with the panel density. LE and TS showed less dependence on the density.**
- **Increase in resin content level led to higher strength and less swelling in general. All products showed high strength properties, well exceeding the performance levels specified in the ANSI standard.**
- **LE was higher than the critical value of 0.35 percent prescribed in the standard. TS for panels at 8% resin level met the 8% TS requirement (based on 24-hour water soaking), while those at 5% resin level exceeded the level.**
- **A consistent, high performance agrifiber composite panel with desirable environmental attributes could be successfully developed.**