



**PROMAT**

**2015**

McCormick Place South | Chicago

March 23-26, 2015

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# *Best Practices for Getting the Most out of your Wooden Pallet*

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Presented by:

**Laszlo Horvath, Ph.D, CPLP**

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## Pallet Industry in the U.S.

- 1.9 billion are in use in the U.S. each year.
- Solid wood pallets are 92% of the market.
- 441 million new wooden pallets were manufactured in the U.S. in 2006.
- 321 million pallets were recovered/repaired/remanufactured in the U.S. in 2006.





## Common Pallet Sizes in the U.S. (2011)

Pallet Size (in.)	Annual production (%)
48X40	24.4
42X42	4.8
40X48	2.8
48X36	1.5
36X36	1.8
48X48	3.8
44X44	3.0
800 x 1200 (Euro)	0.7
Other	57.1



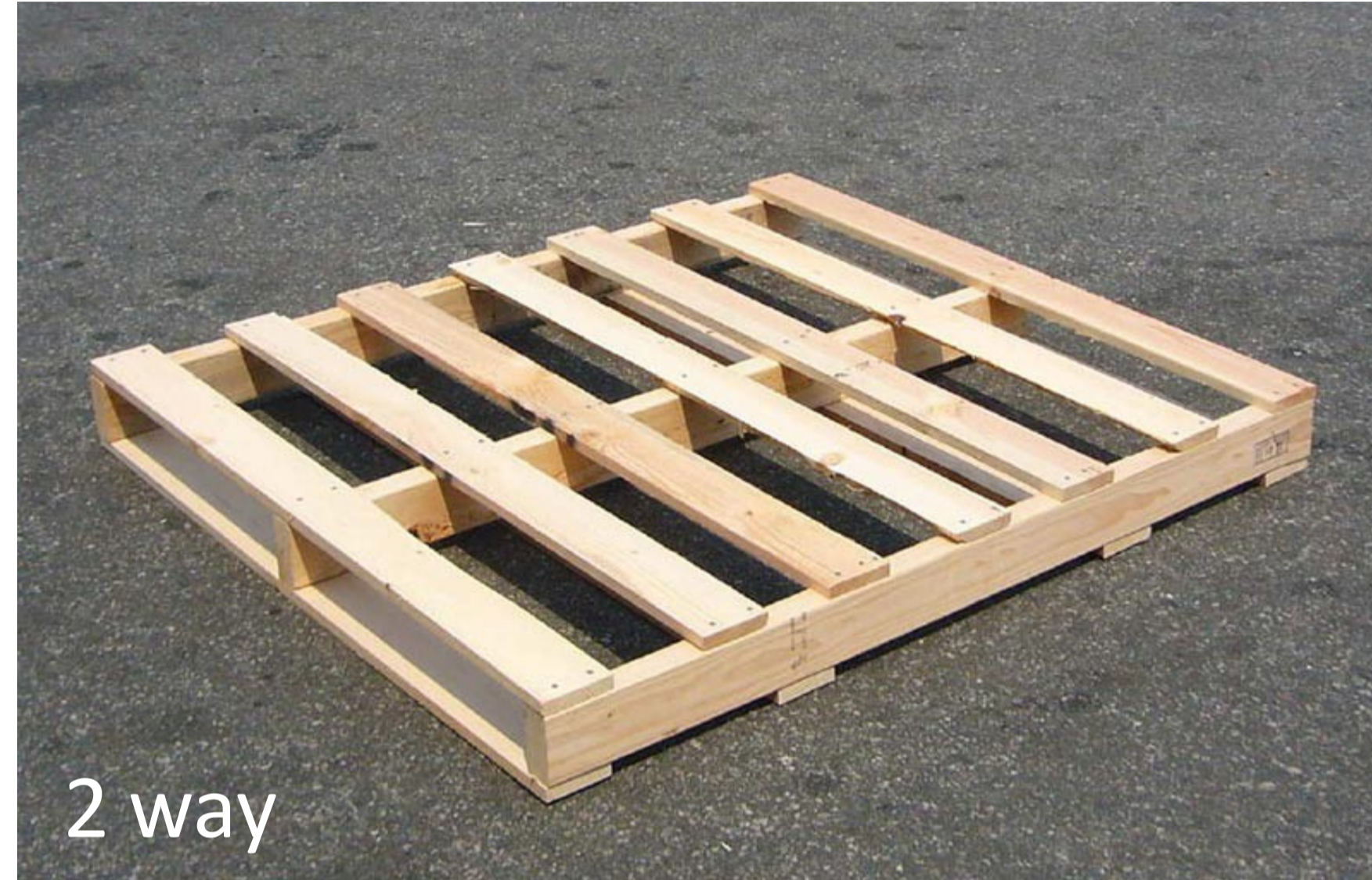
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2 way



Partial 4-way



Full 4 way



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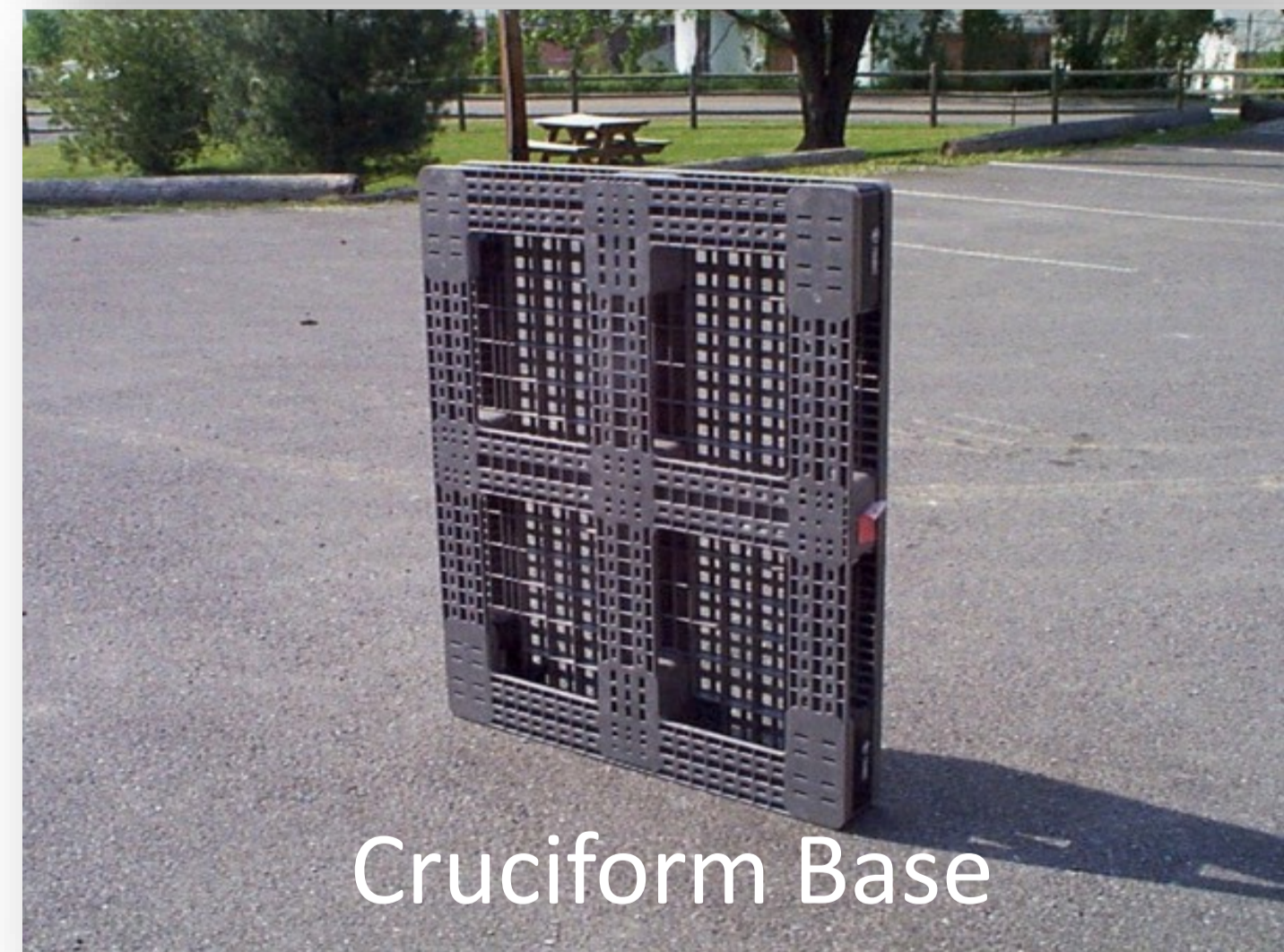
Unidirectional Base



Unidirectional Base



Perimeter Base



Cruciform Base





## Solid Wood Pallets

(79% of market demand and 92% of the users use it)

### Advantages

- Inexpensive
- Easy to prototype
- Strong
- Stiff
- Recyclable
- Can be designed using PDS
- Existing equipment and packaging is designed to the performance of wood pallets

### Disadvantages

- Fasteners
- Can harbor bugs
- Splintering
- Gaps between boards
- Give off moisture
- Variation between pallets
- Different lumber specs for different locations



## Plastic Pallets

**(11% of market demand and 37% of the users use it)**

### Advantages

- Bug Free
- Durable
- Washable
- No fasteners
- Weather resistant
- Design Potential
- Custom colors

### Disadvantages

- High purchase price
- Expensive to prototype
- Low Friction
- Low Stiffness
- Fire safety rating
- Not repairable
- Slower production times



## Composite Pallets (18% of the users use it)

### Advantages

- Smooth deck
- Dry
- Bug-free
- Good product protection
- Durable
- Design flexibility
- Can be designed with pallet design software

### Disadvantages

- High purchase price
- Expensive to repair
- Splintering
- Less recyclable
- Less water resistant
- Fasteners





## Paper Pallets

**(11% of market demand and 8% of the users use it)**

### Advantages

- Lightweight
- Ergonomics
- Smooth deck surface
- Recyclable
- Lower freight cost
- Dry
- Bug free

### Disadvantages

- High purchase price
- Susceptible to moisture
- Poor performance with flexible loads
- Not durable
- Less product protection





## Metal Pallets

(0.8% of market demand and 7% of the users use it)

### Advantages

- Strong and Stiff
- Durable
- Recyclable
- Fire Resistant
- Bug free
- Sanitary
- Dry
- No Fasteners
- Impervious to extreme temperature
- Excellent product protection

### Disadvantages

- High purchase price
- Weight
- Sharp edges
- Low friction
- Susceptible to rusting



## Fundamental Pallet Design Parameters:

- Strength
  - Racking
  - Static (Floor Stack)
  - Dynamic (Fork tine)
- Functionality:
  - Stiffness
  - Durability
  - Size
  - Weight
- **Cost!!!!!!!**





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# PALLET STIFFNESS



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## Cost breakdown of packaging within a typical unit load



Stretch wrap	\$1.80
Pallet	\$8 - \$9.00
Corrugated cases	\$45.00
HDPE 32 oz bottles	\$324.00



Stretch wrap	\$1.80
Pallet	\$8 - \$9.00
3 1/2 gallon pails	\$210.00



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# Buckling in walls of plastic pails





# Pail failures during storage







## Best Practices for Stiffness

- Always know the stiffness of your pallet design.
- Measure the the increase in stress distribution before you make a decision.
- Consider the stiffness change of the pallet before modifying the support conditions.
- Stiffer is better!!!!!!



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# DURABILITY





## Durability

- Life of a pallet specified in Number of Trips
- Expendable pallets need to last 1 trip
- Reusable pallets are designed to last for more than one trip.
- Don't design for more than 10 years.
- Don't design for longer than you can retain ownership of pallets.



# Pallet Durability







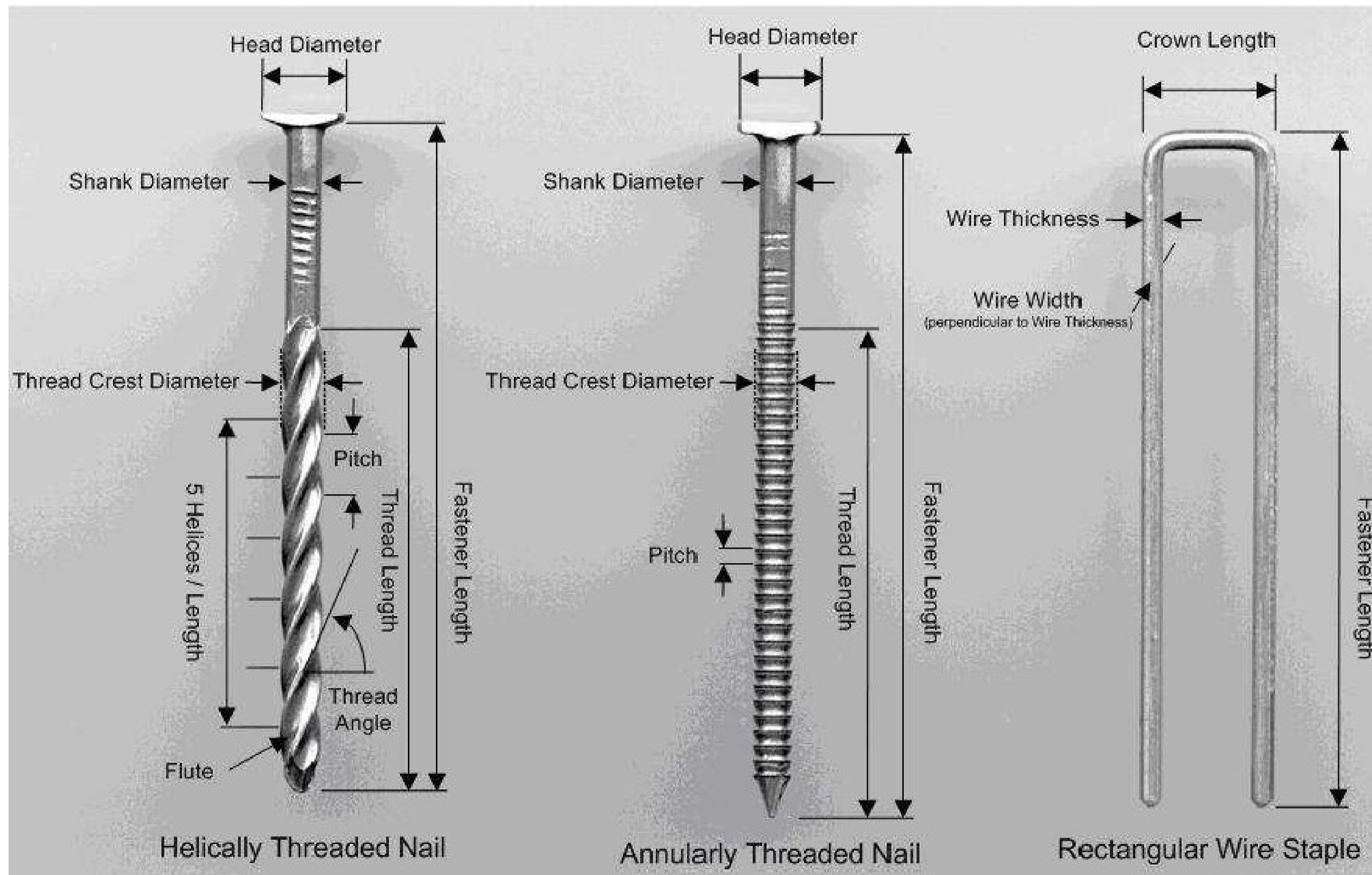
## Pallet Fasteners

- Helically Threaded Nail
- Twisted Square Wire Nail
- Annually Threaded Nail
- Plain Shank Nail
- Round Wire Staple



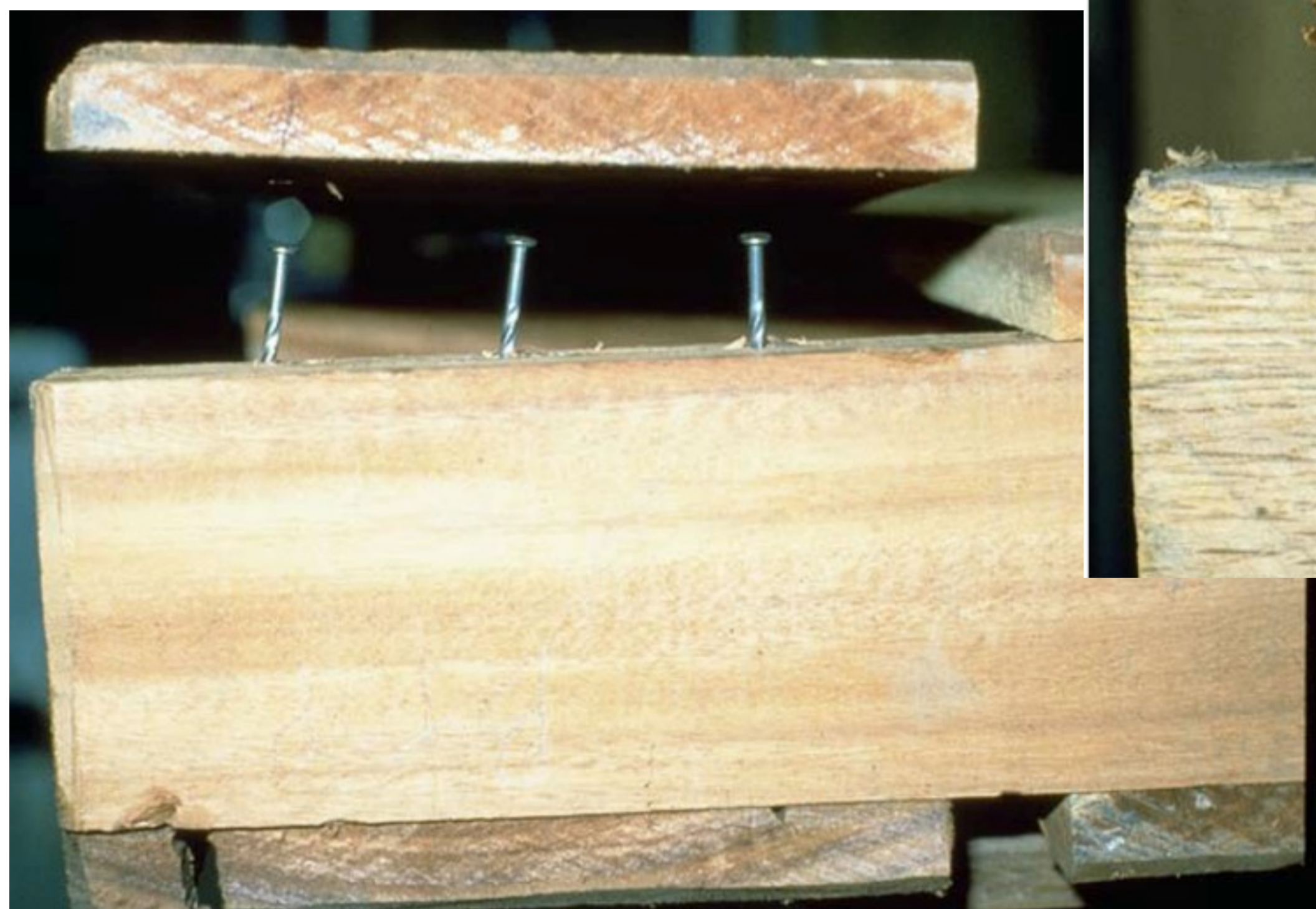


## Measurement of Fasteners





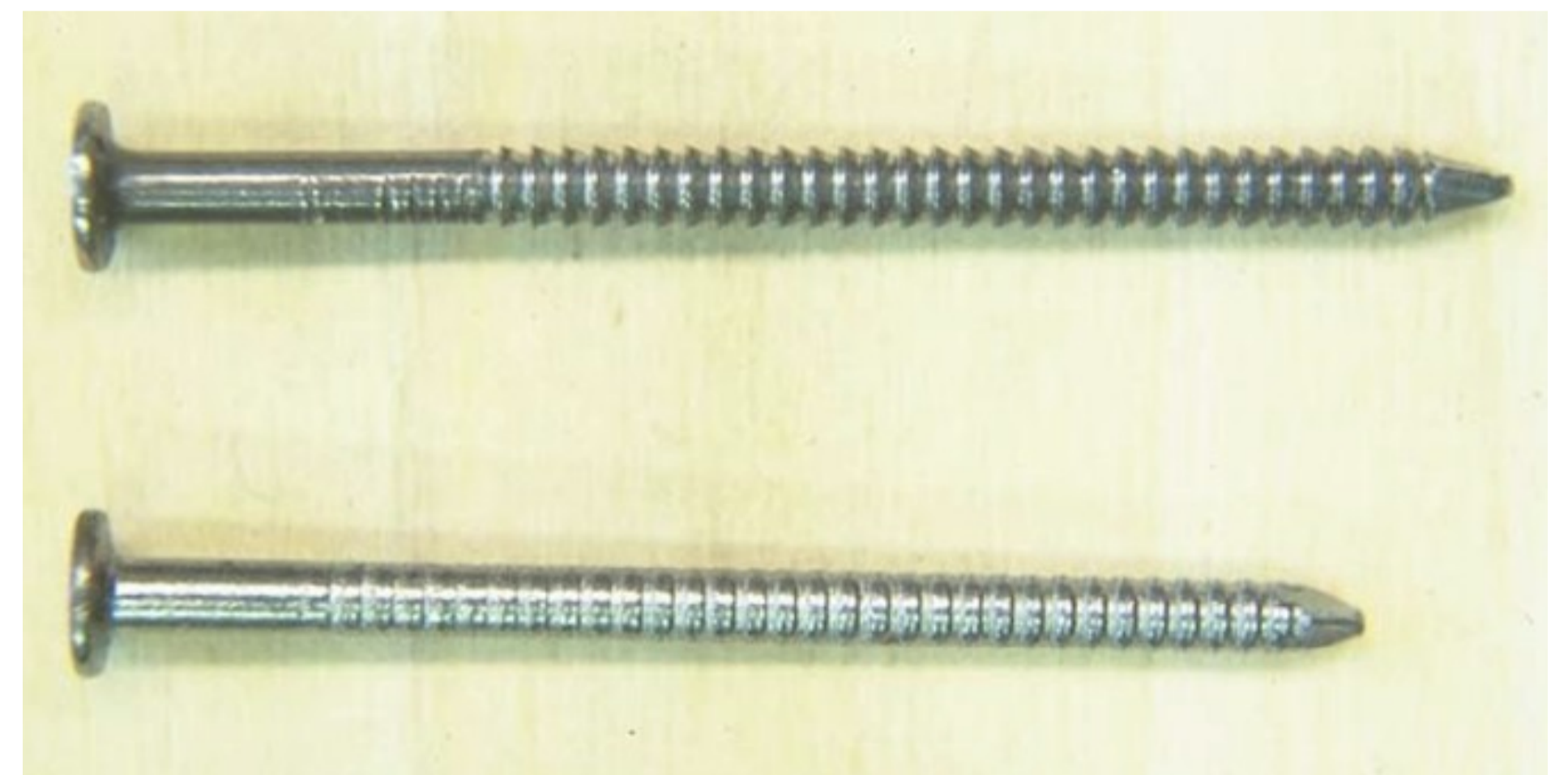
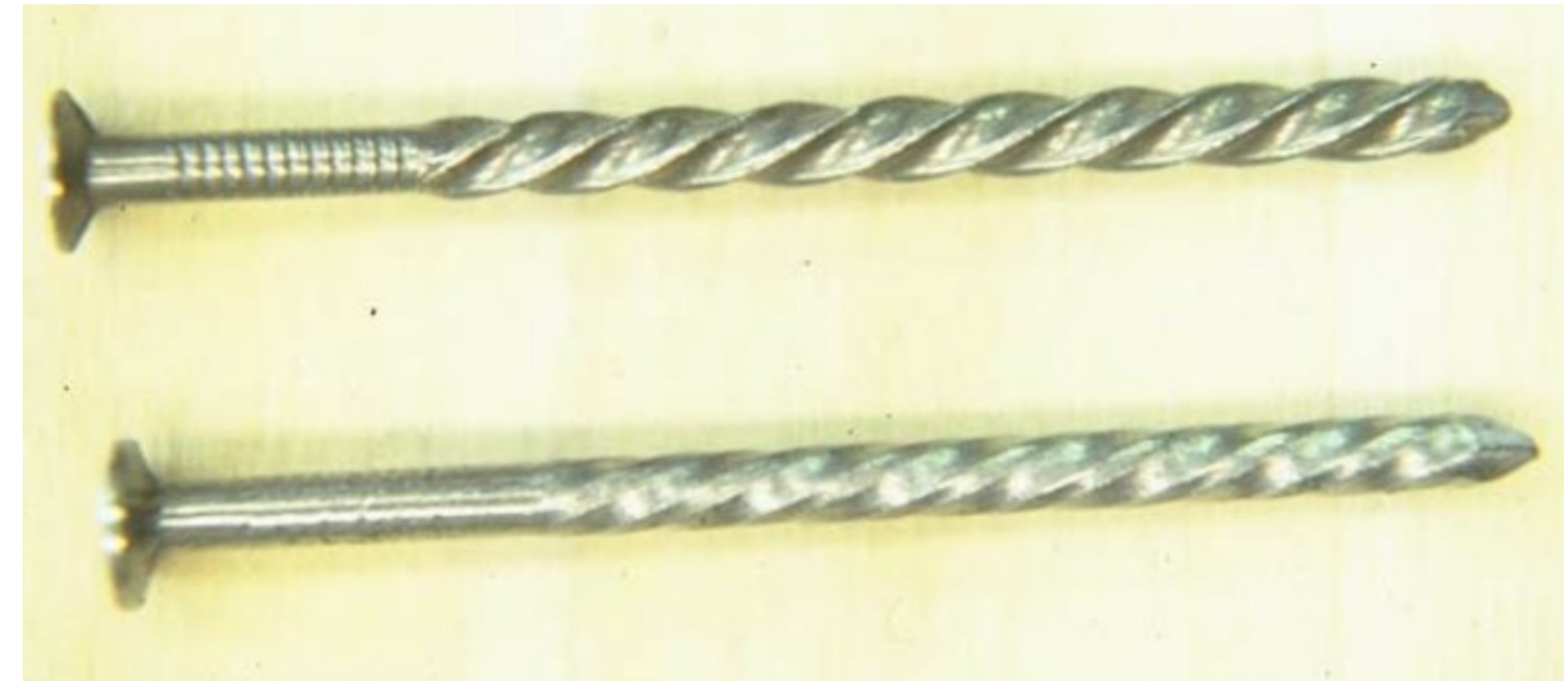
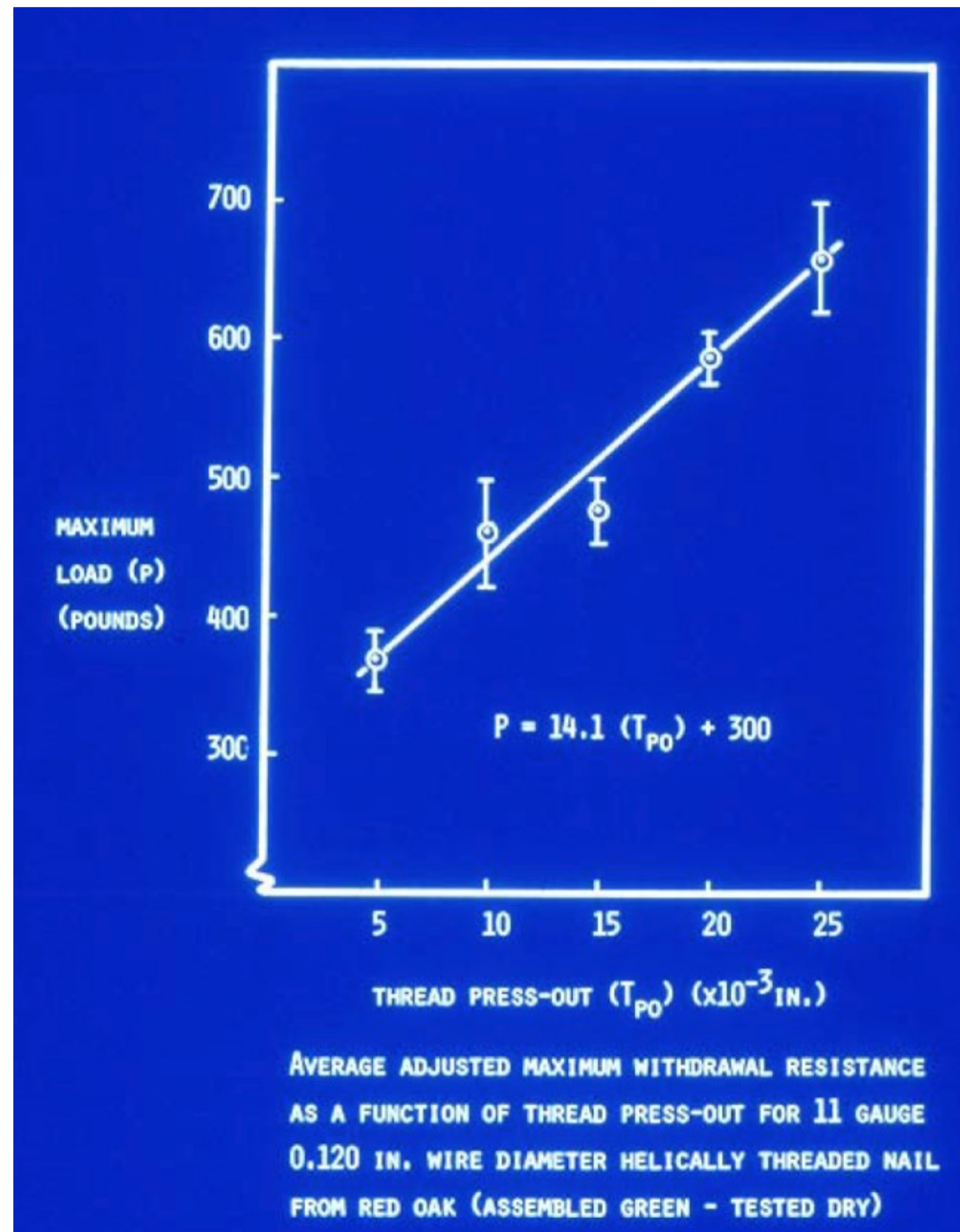
# Fastener Bending vs. Splitting







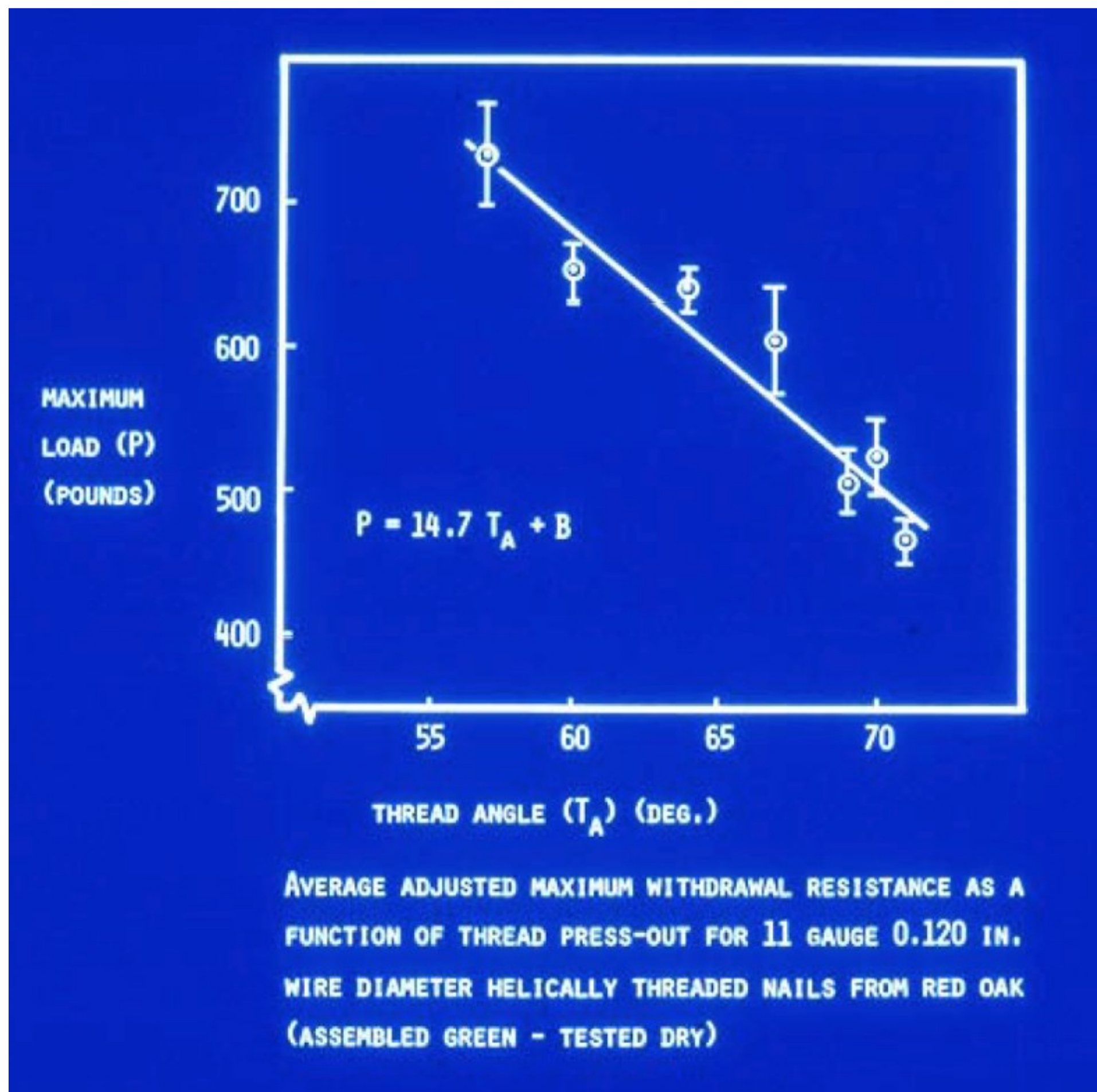
## Effect of Thread Press-Out







## Effect of Helix Angle





## Potential Durability Improvement

- 5–6% increase in the number of fasteners →→56% improvement.
- Butting lead-edge deckboards →→38% improvement.
- Split-inhibitors in leading-edge deckboard →→48% improvement.
- Use dense hardwood instead of medium density hardwood →→38% improvement.
- Use dense hardwood instead of Douglas--Fir →→165% improvement.
- Use air-dry pallet instead of green →→43% improvement.





## Technology to Improve Durability



- Pallet protector attached to fork tines
- Distributes the load on a larger area



- Pallet protector attached front of the pallet
- Reduces the severity of impacts on blocks and stringers and lead-edge boards





## Best Practices for Durability

- Use butted double nominal 6in boards as lead-edge boards.
- Use hardwood boards for the lead-edge of the pallet.
- Use BETTER nails.
- Protect the lead-edge and blocks or stringers from impacts.
- Don't design for more than 10 years.
- Don't design for longer than you can retain ownership of pallets.



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# Q&A



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Or visit ProMat 2015 Booth 676