

A COMPARISON OF PALLET STRENGTH AND FUNCTIONALITY

LITCO'S INCA MOLDED WOOD PALLETS COMPARED TO GMA-STYLE NEW AND REPAIRED WOODEN PALLETS

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USED IN THIS COMPARISON



**Litco's Inca
Molded Wood
48'' x 40'' Pallets**



**New GMA-Style
Wood Pallets**



**Repaired (Used) GMA-Style
Wood Pallets**

THIS COMPARISON:

Assumes the use of the pallets for one-way shipping of product

AND

Is based on published testing reports

RESEARCH OBJECTIVES

- 1) To compare the strength and functionality of the 48" x 40" heavy-duty Litco Inca molded wood pallet to heavy-duty GMA-style new and repaired wood pallets.
- 2) To determine from this comparison, the relative impact of each design on supply chain operating efficiency.

LIMIT STATES OF PERFORMANCE OF LOAD BEARING STRUCTURES [PALLET]

Generally, pallet characteristics can be grouped into two categories:

- **Strength** - The structure must be designed to safely carry the intended load.
- **Functionality** - The structure must fit the load and the environment in which it is to be used.

STRENGTH: The average load-causing failure using a standard pallet test method such as ASTM 1185 “Standard Test methods for Pallets and Related Structures Employed in Materials Handling and Shipping.”

There are two strength measures for non-rackable, shipping pallets:

1. Dynamic Strength – Pallet capacity when lifted by forklifts.

2. Static Strength – The capacity of the pallet top deck when on the warehouse floor.

FUNCTIONALITY: Term applied to all other characteristics of the pallet that affects its use.

Functionality characteristics of a pallet include:

Stiffness	Recyclability
Weight	Durability
Size	Moisture Content
Design	Cleanliness

COMPARATIVE PALLET STRENGTH

Pallet Type	Static Strength (Lbs.)	Dynamic Strength (Lbs.)
Inca Molded Wood Pallet Heavy-Duty	12,432 – 17,259	3,814 – 5,260
GMA-Style Wood Pallet (New)	9,546 – 14,342	6,542 – 8182

- The static strength of Litco's Inca molded wood pallet tested, is greater than the static strength of the GMA-style pallets tested
- Though the dynamic strength of the Inca pallet tested is less than the GMA, when the safety factor of 2.0 per ISO 8611 is applied, the Inca pallet safely handles uniformly distributed loads up to the 2,500-pound range

WHY ARE STIFFER PALLETS BETTER?

- 1) More stable when moving palletized product on forklifts
- 2) Reduces the compression of packaged product and reduces product compression damage
- 3) Reduces the vibration stresses on packaged product when being transported
- 4) Causes product shipped, to be more stable and resistant to load shift during transportation
- 5) Reduces the effect of vertical vibrations on product compression

THE INCA PALLET DECK IS TWICE AS STIFF AS THE GMA'S

Pallet design tested	Stiffness
Inca Molded Wood Pallet Heavy-Duty	20,000 – 22,000 pounds/inch
GMA-Style Wood Pallet (New)	10,000 – 11,000 pounds/inch

The stiffer Inca pallet will reduce product damage and packaging costs.

LITCO'S INCA MOLDED WOOD PALLET DECK IS ABOUT 50% MORE RESISTANT TO IMPACTS AND DAMAGE BY FORKLIFTS THAN THE GMA-STYLE WOOD PALLET

Pallet design tested	Cumulative kinetic energy at failure
Inca Molded Wood Pallet Heavy-Duty	8500 ft-pounds
GMA-Style Wood Pallet (New)	5587 ft-pounds

The Inca pallet solid deck will better protect the product as it moves through the supply chain.



This will result in lower product damage due to nail pops and packaging failures.



This will result in lower packaging costs and a more efficient supply chain.

COMPARISONS OF OTHER PALLET FUNCTIONALITY CHARACTERISTICS

Pallet design	Avg. weight (pounds)	Moisture content (%)	Variation Range of top deck board thickness (inches)	Top deck coverage (%)
GMA- A grade	48.1 ^{1, 2, 3, 4, 6}	11.6 ^{1,2,3,4,6}	0.147 ^{1,2,3,4,6}	66 ^{1,2,3,4,6}
GMA- B grade	50.3	11.9	0.158	65
GMA- C grade	46.4	10.2	0.186	65
GMA- Reman.	44.8	10.8	0.192	65
GMA- New	50-60	50	0.092	65
Inca Molded Wood Pallet Heavy-Duty	40.2 ^{1,2,3,4}	7 ^{1,2,3,4}	Flat	55 ^{1,2,3,4}

The Inca pallet **weighs less**, contains **less moisture**, and has a flat deck (compared to the GMA-style wood pallet).

LIGHTER-WEIGHT PALLETS

- The average Litco Inca molded wood pallet weighs 10% to 33% less than the typical GMA-style pallets
- Shipping the pallet empty or underload requires less energy
- Ergonomically easier to handle manually and therefore less likely to cause work-related injuries
- Less solid waste and more sustainable supply chains

**LITCO'S INCA PALLET TYPICALLY
CONTAINS:**

86% LESS MOISTURE THAN A NEW GMA

AND

30% LESS MOISTURE THAN A USED/REPAIRED GMA

LITCO'S INCA MOLDED WOOD PALLET'S MOISTURE CONTENT IS TYPICALLY 8% AT THE TIME OF MANUFACTURE

- Increased product protection for moisture-sensitive products and packaging
- High resistance to the growth of mold
- The pallets are sanitized in the press at >350 degrees Fahrenheit
- Not regulated by IPPC-ISPM 15 – Considered “Processed Wood”; the molding process kills pests
- No need for additional heat-treatment and a special stamp

THE UNIFORM FLAT DECK OF THE INCA PALLET

- Improves materials handling efficiency during product distribution
- Engineered consistency of the flat, stiff deck improves the efficiency of automated handling systems such as rider-less Automatic Guided Vehicles and Stacker Cranes
- No protruding fasteners (from improper nailing practices, wood shrinkage and fork impacts) to cause damage to the product in transit or injuries while being handled manually
- The Inca pallet will operate better in automatic pallet dispensers than a more variable GMA-style pallet

THE 48" X 40" INCA PALLET IS A NEST-ABLE, FULL 4-WAY DESIGN

(THE GMA PALLET IS NOT NEST-ABLE AND IS A PARTIAL 4-WAY ENTRY DESIGN)

This means:

1. Pallet-jacks can enter the pallets from all four sides
2. The Inca pallet makes better use of trailer and container floor space
3. Unit loads on the Inca pallet are easier to load and unload from trailers
4. Less space is required in warehouse shipping and receiving areas
5. 2.5 times more stacks of empty Inca pallets can be stored in the same space

CRADLE TO CRADLE CERTIFICATION

Sustainability benefit of Litco's Inca Pallet

- Litco's Inca molded wood pallets are the first pallets to achieve the honor by McDonough Braungart Design Chemistry (MBDC)

Earned by:

- Demonstrating leadership in integrating recycled content into products and working to design eco-intelligent products
 - Being eco-efficient, which means doing more with less materials
 - Being eco-effective, meaning products are intentionally designed and environmentally-friendly
 - Using materials and chemicals that have been assessed for human and environmental health down to 100 parts/million
- *Note: This slide is not part of the research and has been added by Litco*



SUMMARY

Litco's Inca molded wood pallet is a significantly more functional pallet than a new or used GMA-style wood pallet

WHY?

- The Inca pallet improves supply chain operational efficiency
- Less product damage and product contamination
- Fewer injuries associated with the use of the Inca pallets
- Significantly increases shipping and materials handling efficiency
- Reduces packaging costs
- Certified Sustainability (Eco-efficient and effective)

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ABOUT THE AUTHOR

MARSHALL S. (MARK) WHITE, President of White and Company LLC. White and Company LLC (www.whiteandcompany.net) is a consulting and software development company specializing in pallet, packaging, and unit load design. Dr. White is also Professor Emeritus at Virginia Polytechnic Institute and State University, Blacksburg, Virginia, and a graduate of Colorado State University and Virginia Tech with B.S., M.S. and Ph.D. degrees. He taught graduate and undergraduate courses in the Packaging Science option and served as Director of the Center for Unit Load Design and The Pallet & Container Research Laboratory. He was responsible for the research, technical assistance and educational programs offered by the Center on behalf of the pallet, packaging and container manufacturers and user industries. The main thrust of these efforts has been the investigation of the relationship between the design of unit loads and their performance during storage and distribution of consumer and industrial products. The focus is on studying the dynamic and static mechanical interactions between packaging, pallets and unit load handling equipment. He has published widely on the subject of CAD/CAM design of pallets and containers and the dynamic sequence of palletized unit-loads in shipping environments. Dr. White was recognized by Modern Materials Handling Magazine as one of the Top Ten Materials Handling Professionals for his revolutionary ideas on the “Systems- Based” alternative to the existing “component based design” of Global supply chains. Dr. White has been a member of The US Institute of Packaging Professionals, and the American Society of Testing and Materials D-10 Committee on Packaging. For the latter, he co-chaired of the pallet Testing Task Group. He has also served as Head of the U.S. Delegation to the International Organization of Standardization (ISO) TC-51 Technical Committee on Pallets, and past Chairman of the MHI/ANSI MH1 Committee on US Pallets Standards. As convener of various ISO working groups, Dr. White was responsible for drafting many of the current ISO pallet standards. As Chairman of the MHI/ANSI US Pallet Standards Committee, he was responsible for drafting many parts to the MHI/ANSI MH1 “Pallets, Slip-sheets, and Other Bases for Unit Loads”.



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