



**MILLWOOD**<sup>TM</sup>  
**INCORPORATED**  
 AND AFFILIATED COMPANIES  
*Providing Product Unitization & Logistics Solutions*

*Designing The Better Unit Load  
 From The Ground Up*

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REINVENTING  
**UNIT  
 LOAD**  
 TECHNOLOGY<sup>TM</sup>



# *Designing The Better Unit Load From The Ground Up*

**New legislation may allow shippers to haul more weight, which means bigger unit loads. Until then, getting the most from your pallets and packaging is a good best practice any time.**

Most of us are focused on lightening our loads if we know what's good for us. On the highways, bulking up could be a good thing, especially if Congress passes the pending Safe and Efficient Transportation Act (H.R. 1799/S. 3705). Under SETA, the federal vehicle weight limit would rise from 80,000 pounds to 97,000 pounds for vehicles equipped with a sixth axle.

New weight limits could put the spotlight on the pallets and industrial packaging materials, like stretch and shrink wrap and strapping that go into the unit load. After all, new unit load designs may be needed to make the best use of the existing cube and take advantage of the new higher weight limits. However, getting the most out of a unit load is a best practice any time, regardless of whether Congress passes new laws.

In the past, too many companies approached unit load design the same way they approached safety stock levels in the warehouse: If some is good, more must be better. That results in wasted – and expensive – packaging on the load and in the landfill.

Forward thinking end users and suppliers are taking a system-based approach to the design process. This approach looks beyond the weight of the load to include how that load will be transported and handled at each node of the supply chain. The best companies are also including sustainability in that mix by considering how their packaging products will be reused or recycled at the end of their journey.

Rather than throwing more packaging at the problem, a systems-based approach to unit load design uses software tools and lab testing to create a package that uses just the right amount of material to protect the product, make for safe handling and transportation and minimize the use of non-recyclable materials. Ideally, that process brings together the stakeholders who usually do their jobs in silos, like materials handling systems designers, packaging engineers and the transportation department, to work together to create the best overall solution. Think of it as the scientific method for building the optimal load.

Let's take a look at some of the considerations that go into the optimal unit load.

## **Building A Better Pallet**

The pallet is the basic building block of the unit load. The best design will safely handle a load throughout its journey through the supply chain at the lowest possible cost. The pallet is also unique in that the design has to work with both the materials handling equipment that will move the load and with the stretch and shrink wrap or strapping that will unitize the load to the pallet.



## The Sustainable Unit Load

Reduce, reuse and recycle: that's the mantra of the sustainability movement. While many sustainability efforts are focused on limiting the use of energy, sustainability plays a role in packaging too. Recently, SunChips introduced a 10.5 ounce consumer package designed to break down after 14 weeks in a hot, active compost pile. While no one has developed compostable stretch film or a biodegradable pallet, sustainability is increasingly important in unit load design and industrial packaging products.

Today there are two best practices around sustainable unit load design, and both are related to the concept of reducing, reusing and recycling: The first is to design the unit load with the minimal amount of packaging required for the application and with an eye towards what happens to the materials at their final destination; the second is to use materials and products that can be reused or recycled whenever possible.

Wood, for example, is a renewable resource and wood pallets can be reused. In fact, an estimated 70% of the wood pallets currently in the market are used pallets, according to the National Wooden Pallet & Container Association ([www.palletcentral.com](http://www.palletcentral.com)). When a pallet reaches the end of its repairable life, the component parts can be salvaged and used to repair other pallets. After that, any scrap pallet lumber can be turned into biofuel or ground into mulch or animal bedding. Even the nails can be collected and sold as scrap. The key is to choose common pallet sizes, like the 48 X 40, that are used by a number of industries rather than unique sizes that have no market.

Likewise, packaging materials like stretch and shrink wrap, steel strapping and corrugated can be collected and recycled. One limiting factor can be the fluctuating prices paid for recycled materials. If corrugated is selling for \$20 a ton instead of \$200 a ton, it doesn't pay to ship it very far to a recycling center. In that instance, the price could dictate using more stretch wrap and less corrugated.

By combining sustainability with unit load science, you not only create the optimal unit load, you reduce the amount of packaging material used to transport your load, maximize the materials that can be recycled and minimize what's going into the landfill.



Several considerations will impact the ultimate design of the pallet, including:

**Industry standards and customer requirements:** The 48 X 40 GMA is the standard pallet for the grocery industry. Other industries, like the glass and can industries, also have pallet standards. Similarly, some customers, like club stores and big box retailers, have pallet and unit load specifications. In those instances, the pallet design is already decided for you.

**One-time use or reusable:** Whether a pallet is used once or is reused impacts the design. Many manufacturers, especially in the food and beverage industries, reuse the pallets they receive from their suppliers to ship their products. For them, a heavier duty pallet costs more up front, but has a long-term residual value. On the other hand, building materials like shingles are typically shipped to a construction site and thrown in the dumpster. Those pallets only need to be strong enough to support the weight of the product during storage and transportation.

**Product matters:** The type of product going on the pallet affects the design. Cartons, for example, require less deck board coverage than bagged or printed material that can sag between the deck board gaps and get damaged by lift truck forks.

**Racked, stacked or floor loaded:** A product that will be stored in an unsupported pallet rack may require a more substantial pallet than one that will be stored on

the floor. Product that will be floor loaded in a trailer can be shipped on a lighter duty pallet than product that will be stacked two high in the trailer or four high in the warehouse.

**What's on the customer's dock:** Building a heavier unit load may cut down on a manufacturer's shipping costs, but those savings will be wasted if the distributor or retailer on the receiving end doesn't have a lift truck that can handle the extra weight.

## Materials Handling Counts

But it's not just the weight of the load and how it will be stored that's important. A systems-based approach also recognizes that the type of equipment that will handle a pallet is also important. That is also too often overlooked because systems, pallets and packaging are designed in silos. It's not uncommon to find a design change like an increase in the spacing of rollers on a conveyor that saved \$25,000 on a one-time capital investment but resulted in a \$4 to \$5 increase in the cost of every pallet, which is a recurring cost. The right combination of pallet design and material handling equipment, on the other hand, can lead to cost savings.

For instance, Millwood worked closely with a customer that was storing pallet loads of printed material in a 20-pallet deep push-back rack system. Like most end users, the customer was purchasing pallets manufactured from green hardwood lumber. Since green lumber has a moisture content of about 35% which can be absorbed by paper, the customer put a protective barrier sheet between the pallet and the load.

The dense storage provided by the push-back rack was a major space saver for the customer. The problem: green hardwood lumber can bend or warp slightly as it dries over time. That's not a problem for pallets that are stacked on the floor or in traditional pallet rack. Push-back and flow rack systems, however, require the pallets to roll on narrow diameter rollers. In this

situation, pallet deck boards sometimes became hung up on the narrow rollers as they dried. Sending a lift truck driver to dislodge a pallet in a 20-deep pallet rack took a toll on productivity.

To solve that problem, Millwood designed a replacement pallet built with southern yellow pine boards that were dry and stiff. A bevel was added to the lead boards, allowing the pallet to roll without getting stuck. As a side benefit, since the lumber was kiln dried the customer was able to eliminate the corrugated sheet that was used as a moisture barrier, saving \$1 a unit load in packaging.

Of course the opposite can be true as well. One manufacturer was buying new pallets with tall stringers because the facility had a dozen older pallet jacks on the dock that had been paid for and depreciated years ago. Replacing the pallet jacks with new equipment with a lower profile would have cost about \$1,000 per unit. That investment would also have allowed the facility to use a recycled pallet with a 3-1/2-inch high stringer, saving about \$3 per pallet. The manufacturer, however, was unwilling to make a modest one-time capital investment in new materials handling equipment that could have resulted in considerable savings on the recurring cost of pallets.

The point is that when looking at unit load design, it's important to remember that the choice of equipment can have a significant impact on the cost per trip of a pallet.





## Wrapping It All Up

Pallets and materials handling equipment are two of the three components that go into an optimized unit load. Industrial packaging is the third component. While some users still get by with a bead of glue or an adhesive between layers, three materials are commonly used.

Stretch wrap is the most versatile and the most common material. It provides a layer of protection from dirt, is the first line of defense against theft and keeps the load together during shipment. It is adaptable: stretch wrap can be used on mixed SKU loads that may not be perfect.

Strapping, which is made from a variety of materials, is used on loads that need strategic security and vertical compression. Printed material is often strapped to a pallet, as are building materials like bricks or lumber.

Shrink wrap is the most expensive of the load unitization methods because it uses heat to shrink the film around the load. Shrink wrap also requires a neat and uniform load. But shrink provides five-sided protection from the elements for loads that are heavy and may be stored outside like rolled roofing or shingles.

## Putting It All Together

How then do you put the three components of pallet, materials handling and packaging materials together to optimize the unit load in a sustainable way? Increasingly, the answer is more science than art.

First, look for standards. Just as industry standards and customer requirements dictate which pallet can be used, there are emerging standards that dictate how to build a unit load for some industries. The International Safe Transit Association ([www.ista.org](http://www.ista.org)), for example, has developed testing procedures and standards for shipments in a variety of situations and industries, like ISTA Project 3J for club store distribution. Anyone shipping a load of product into a club store needs to meet those standards.

Where there are no industry standards to follow, a good starting point is a pallet and unit load software design program. A unit load design system like the Cape Pack application from Cape Systems ([www.capesystems.com](http://www.capesystems.com)) helps an end user build efficient pallet patterns and improve material and cube utilization. The system can also consider data such as a carton size and stack pattern to determine how much coverage needs to be on the top and bottom decks.

The next step is to use an application to design a pallet around those parameters. The Pallet Design System (PDS), available to pallet suppliers who belong to the National Wooden Pallet & Container Association ([www.palletcentral.com](http://www.palletcentral.com)), allows a pallet manufacturer to input a proposed pallet design plus performance parameters like the height and weight of the load. The system will determine whether the design will work; if not, it will identify the component of the design that will fail first. A designer can change the height or weight of the load, the width and thickness of the boards or vary other components, like the nails, to design a pallet that will work.

Once a unit load is designed, the next step is to put it to the test at a unit load testing facility, such as the Center For Unit Load Design at Virginia Tech ([www.unitload.vt.edu](http://www.unitload.vt.edu)) or an independent lab in the packaging industry. These facilities can perform vibration tests, compression tests and simulate the racking of a load. In addition, incline, or sled tests, can determine the gage of film or strapping or how many wraps of stretch film are required to keep a load contained on a pallet during transportation.

With software, independent lab testing and a systems-based approach to the design of a unit load, you can truly get the most value out of your unit load while insuring that your product gets delivered from the end of the line to the end user in tact.

## About Us

Millwood Inc. is a worldwide industry leader and innovator of unit load and packaging systems, materials and services as well as a leading supplier of new, used and reconditioned pallets. Both small-to-midsize businesses and Fortune 500 companies have relied on Millwood's pallet management expertise, material handling solutions and logistics services to provide strategic sourcing initiatives for over 40 years.

Liberty Technologies, a Millwood Company, brings together industry knowledge and creative engineering experience to meet our customers' unique industrial packaging needs for stretch/shrink wrap film and equipment, strapping machinery and case packaging and palletizing throughout the world. By offering a wide variety of equipment, technologies, solutions and consumables backed by timely service, Liberty and Millwood are the "One Stop Connection" for your material handling and packaging needs. For more information, visit [www.millwoodinc.com](http://www.millwoodinc.com).



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