



**PEAKLOGIX**

AN ALTA MATERIAL HANDLING COMPANY

**WHITEPAPER**

**What Do You Need  
to Know About Pallet Rack?**



## What Do You Need to Know About Pallet Rack?

What are some of the major considerations when planning to implement a Pallet Rack System?

If you are thinking about a new distribution facility or reconfiguring an existing facility, then you may be thinking about a pallet rack solution. Although pallet rack, also commonly referred to as just “rack”, may seem simple, it can be complicated.

There are a multitude of factors to consider - from engineering to design and installation - to optimize the most efficient solutions. The major considerations when implementing a rack solution include the following.

### 1. Greenfield, Brownfield or Existing Facility

The constraints imposed by any building you are planning space for must be taken into consideration as a priority. A Greenfield project, a term utilized to indicate a new construction project, provides the most flexibility to allow customized design elements to enhance competitive advantage because there are no constraints imposed by prior work to be considered.

A Greenfield building can be designed with a rack system planned out in advance of building materials arriving at your construction site. It may be beneficial for an organizations’ pallet racking system to be designed into the structure of the building itself, so that the upright columns are simultaneously used to support the roof of a storage facility, as in a rack supported building.

Some of the prior work considerations include: historical significance, useable clear height, building column centers, sprinkler system, lights, available dock doors and floor design.

A Brownfield site can be a new industrial building built on the former site of some other industrial complex or the repurpose of an abandoned or underused industrial space into another industrial operation – a factory that is converted into a warehouse. Expansion or redevelopment of such a facility may be complicated by real or perceived environmental contaminations as well as considerations that can be limiting with an existing facility. Existing facilities pose some limiting factors to implementing a rack solution as well.



A new configuration of an existing space can potentially have many of the “Brownfield” considerations as well as the additional concerns that surround maintaining service levels within your existing operation during a project installation. Losing current customers, while improving the effectiveness of your racking system, isn’t a winning business strategy.

## Does Data Drive the Solution?

Once you account for the physical constraints imposed by the type of facility you are planning, you should allow your data to drive decisions. You need to implement the best solution for your business based on the data. Be sure to consider all of the factors that come into play, including but not limited to: the quantity, size, weight, and movement velocity of the existing SKU (Stock Keeping Unit) base. How many FTE (Full Time Employee) equivalents are in each area: Receiving, Quality Assurance (QA), Put Away, Replenishment, Picking, Packing and Shipping? Do you have cube and weight data included in all SKU's? This kind of data will help determine all of the possible rack system designs that are feasible for your operations.

## Work with an Integrator

Most pallet rack manufacturers do not manufacture the full range of potential solutions that should be considered when you are analyzing a new rack system. Some manufacture and provide

traditional selective style racks while others may manufacture and provide automated storage and retrieval racking solutions. No one manufacturer can help with all of the possible design options like a knowledgeable integrator is able to do. A material handling systems integrator has the knowledge and expertise within the industry to provide multiple solutions and help you select the proper system ideal for your operations, without any preference given to a specific manufacturer.

## Allow Plenty of Time

Project timelines for a rack project can range from a quick turnaround to a year or more depending on the complexity and scope of the project. Be sure to consider when the system needs to be operational and work backwards from that point in time. Think about preliminary structural calculations, additions and changes, final structural calculations, submittals to municipalities, submittals to insurance carriers, permit receipt, material production, shipping timelines, installation, stocking, testing and training. Training? Yes, training! If you are acquiring more of the same type of racking, that perhaps you already have, then little to no training is required.

However, if your system involves a new technology, or if you’ve implemented a new SKU slotting strategy, then training is essential. Thinking through all of these variables ensures that your new racking system will be ready to perform when you need it.

## What are the different types of Pallet Rack to consider?

Pallet rack is the material handling storage aid system designed to store materials on pallets. Although there are many varieties of pallet racking, all types allow for the storage of palletized materials in horizontal rows with multiple levels. All types of pallet racking create some level of increased storage density with the least dense being the least expensive and cost increasing with storage density.

*Here are the basic pallet racking configurations along with some key information for each:*

### Selective Racking

This is the most common pallet racking system seen and used in warehouses in the US today. A selective pallet rack system takes up the most amount of floor space because they provide a forklift aisle in front of each pallet position, but also allows for 100%

selectivity. Many installations include components such as: wire mesh decking, pallet supports, column protectors and guard rail. The cost per pallet stored in a selective racking system can range from \$60.00 to \$90.00 per pallet stored depending on project size, scope and specifications.

### Double Deep Racking

This is the same as the selective racking described above except there are two pallets stored front to rear in each storage location. Pallets are stored on a last in/first out basis, making this type of configuration a better option for operations who need to store multiple pallets of the same SKU. A double deep reach style forklift is required - it reaches into the rack structure to be able to select the 1st or 2nd pallet. Storage density increases approximately 30% versus traditional Selective Style Racking. Approximate cost per pallet stored is comparable to a selective pallet racking system, but forklift outriggers require a bottom beam, or space, to straddle a floor store load.



## Drive In and Drive Through Racking

This type of racking system allows dense cube utilization with configurations that allow the forklift to drive directly into the bay. The difference between Drive In and Drive Through refers directly to whether or not the bay has an entry at only one end or both. Drive In rack systems utilize a LIFO (last in, first out) storage method and Drive Through rack systems utilize a FIFO (first in, first out) storage method. Each vertical bay contains the same SKU so “honeycombing,” where only a percentage of the possible storage locations are utilized, can be a cause of concern with this type of system.

This is why, although this style was very popular in the 20th century, drive in and drivethrough rack systems are taking a back seat to newer styles (such as pushback and pallet flow). When managed well, Drive In and Drive Through racking can be used to “charge” the system (load it) and then “discharge” to load trucks or move to production. Productivity is relatively slow, since you are literally driving in and out of the racking structure. Cost per pallet stored is typically between \$125 and \$150 per pallet. Although this system may provide a cost effective storage solution, it is also subject to more abuse than any other rack configuration.

## PushBack Racking

These rack systems are designed by organizing space by depth rather than by width and are rapidly replacing Drive In and Drive Through systems. Organizing space by depth as in the PushBack Racking System reduces the number of aisles and increases storage density. Less “honeycombing” occurs as each lane can be an independent SKU

and productivity is enhanced as the putaway and pick is accomplished from the forklift travel aisle. In PushBack Racking Systems each bay can be up to six pallets deep, however; the most popular tends to be 2-3 pallets deep, as it can be effective to manage. Each pallet in a PushBack Racking System is stored on wheeled carts that fit onto rails. It is important to think about the “pitch” and slope when designing a PushBack Rack system because the load end is typically ½”-¾” per foot higher than the unload end to slightly angle the rails toward the unload side of the rack. A PushBack Racking system is a LIFO (last in, first out) storage system. Cost per pallet stored is between \$150 and \$175 per pallet.

## Pallet Flow Racking

This type of system features high density storage by utilizing a slightly inclined rail with rollers that allows pallets to move easily along the sloped plane. Pallet Flow Racking is also referred to as “Gravity Flow” and / or “Dynamic Flow” systems.

Pallet Flow Racking systems can serve as either a FIFO (first in, first out) or LIFO (last in, first out) storage system. When a Pallet Flow racking system is loaded from the back and unloaded from the front it utilizes FIFO (first in, first out) and when the system is loaded and unloaded from the front it utilizes a LIFO (last in, first out) storage system.

Pallet Flow Racking systems often have complex motion and braking systems to control the speed of the pallet. When you are considering a Pallet Flow Racking system, you need to pay particular attention to the pallet style, size, weight, and height to design a system that works best for

your operations. As with any mechanical system, there are considerations. Pallets can get jammed, pallets can be inserted that are broken and pallets may be used that are not designed to work with the system. Depending on the system size and specification, pallet flow can range from \$275 per pallet to \$400 per pallet stored.

### **Mobile Pallet Racking**

Also referred to as motorized mobile pallet racks, mobile industrial rack systems, and compact mobilized pallet racks are designed to maximize the use of warehouse storage space. Mobile Pallet Racking is a system of selective style racks mounted onto heavy duty mobile bases that allow the aisles to open and close as needed. Mobile Pallet Racking can reduce your pallet storage area in half, or double the capacity of your pallet rack storage system in the same floor space area.

Selectivity is limited to the speed of the system but for medium to slow SKU movers, this can double the effective capacity of a warehouse space. The price per pallet stored is similar to pallet flow racking systems. System controls allow integration to WMS or WCS systems to automatically route forklift operators while opening and closing aisles as needed.

### **Unit Load AS/RS (Automated Storage and Retrieval Systems)**

Rack supported buildings or crane accessed AS/RS systems are gaining traction as a potential solution for high volume distribution centers. Typical systems include narrow aisle, high storage systems that store and retrieve pallets based on

WMS or WCS instruction. Cost per pallet stored is dependent on the size of the system and can run to \$1,000 per pallet stored. Note: there are very few if any FTE's in these highly automated systems, which is why they can show an impressive Return on Investment (ROI).

Additionally, there are two material considerations regarding pallet racking:

### **Roll Formed Rack Cold rolled, or clip-in configuration.**

Roll formed pallet rack starts as a coil of steel. While it is flat, the steel is processed through a punch that creates the holes which will later be used to attach the beams. After the steel has been punched, it is sent through rollers to shape the steel into the shape of columns necessary for strength. It is most commonly manufactured in a "teardrop" style – named such because the column upright holes appear to be shaped like a teardrop. Horizontal beams are held into place by mounting clips into the teardrop holes. Clips on teardrop configurations can be more easily moved than structural beams which are bolted into place. Roll formed selective rack is an economical option that provides a lot of convenience for a warehouse that needs to store a wide variety of product sizes.

### **Structural Steel Hot rolled, or bolt-together configuration.**

Structural pallet rack systems are similar to roll formed systems in function, the horizontal load beams are attached to the uprights with bolts. Equipment uprights and beams have a much greater weight-bearing capacity than their roll

formed counterpart. Additionally, structural pallet rack can be designed into the structure of the building itself, with its upright columns serving to support the roof of the facility, replacing the storage buildings vertical support I-beams. This is referred to as a rack supported building. On average, structural rack costs approximately 15% more than roll form rack and you should expect installation costs to be slightly higher as well.

Structural pallet rack systems are heavier, require less maintenance and can withstand more forklift impact than roll formed systems. There are some applications where structural pallet rack must be utilized in order to support the required load capacity.

## Aisle Widths

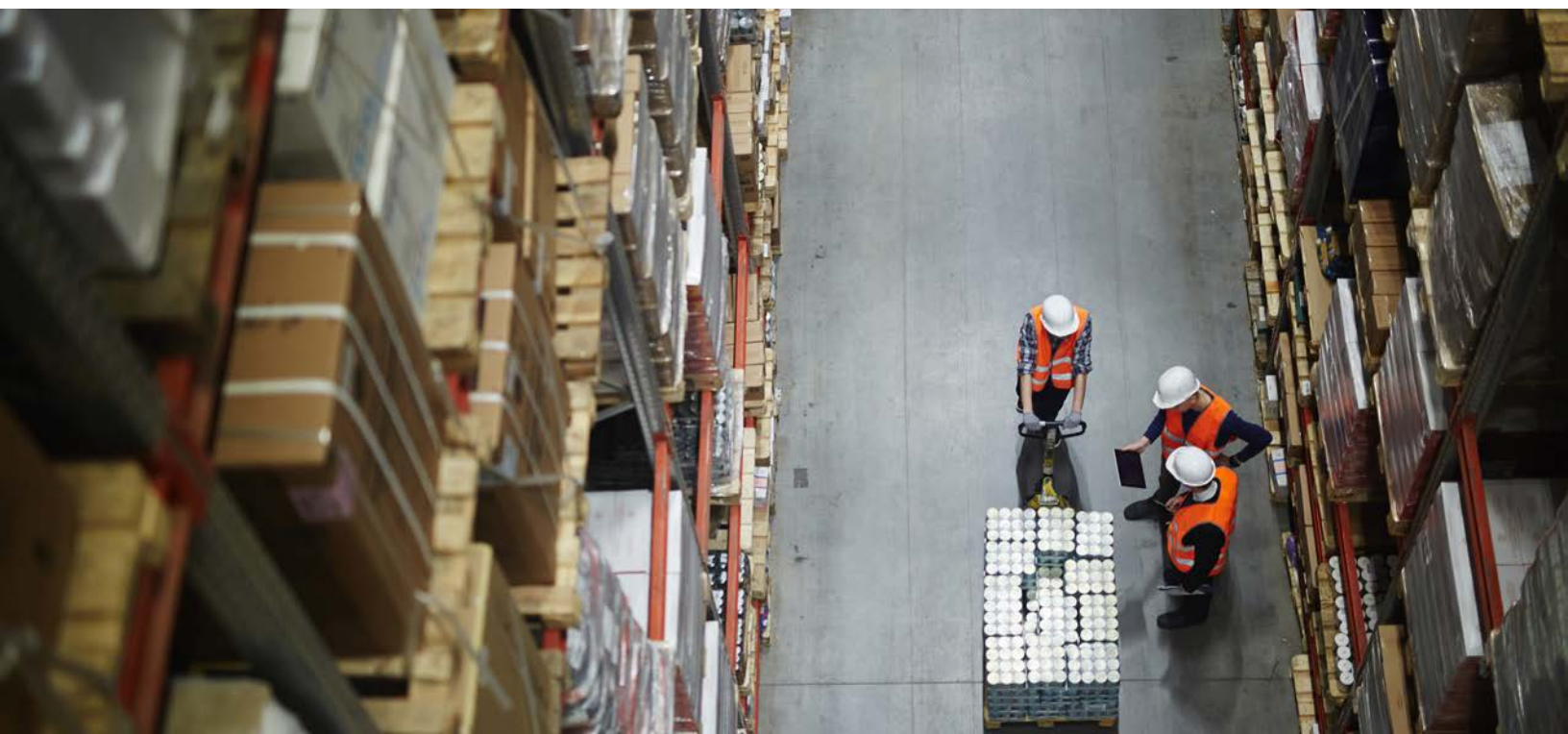
Determining aisle widths is an important part of your material handling strategy and should

be considered early on in your facility designing efforts. Some of the factors to consider prior to determining which aisle widths would be the best for your facility include:

Space Utilization – what kind of storage characteristics does your operation currently require and will they remain the same in the future? Does your operation require long-term, high-density storage or temporary selective storage?

Increasing productivity, space utilization, flexibility and safety while decreasing your equipment costs may require you to consider aisle widths that are different from what you currently have.

What kind of load requirements does your operation necessitate? What kind of forklift truck fleet do you currently operate and what are their limitations for the various aisle width options including:



- **Wide Aisle (WA)** – These aisles are generally 12’ and used for sit down lift trucks.
- **Narrow Aisle (NA)** – These are approximately 8’-10’ and require standup reach trucks and double-deep reach trucks to handle loads.
- **Very Narrow Aisle (VNA)** – These aisles are usually less than 6’ and often require a guidance system (wire, rail, optical) to ensure safe travel.

## Rack Maintenance

With the exception of the highly automated AS/RS systems, where there are usually no personnel to damage the rack structure, rack maintenance is a very important consideration. Generally speaking, if there is a forklift involved, then there is the chance of rack being damaged.

There are even instances where forklift accidents have resulted in warehouse collapses. YouTube, a video sharing website, features many videos of

these incidences. The United States Occupational Safety and Health Administration (OSHA) is the authority that can close down and/or heavily penalize facilities that have damaged racks. Any rack structure that has been bent, crushed or smashed is structurally compromised and should be repaired or replaced at once.

Any damage to a rack system reduces the load carrying capacity and compromises the integrity of that system. It is possible to replace the frames and beams that have been damaged or you can use a certified rack repair system, either correction is acceptable. It is imperative that any organization considering implementation of a rack system know the importance of keeping that system in tip top shape.

Pallet racking systems are sizable investments. Hopefully, you’ll choose the right team to assist you in working through the many details so you can select the system best suited to your operation.







## About PeakLogix

PeakLogix, an Alta Material Handling company, is a leader in material handling, excelling at making manufacturing facilities, distribution centers, and warehouses more efficient and more profitable by streamlining operations. PeakLogix specializes in concept design and engineering; automation, systems integration and equipment solutions; turnkey project management and implementation; and service and support. PeakLogix has experience within a number of industries, including healthcare/medical, food and beverage, fulfillment, third-party logistics, secured data centers, document storage, and the U.S. government. You can find case studies highlighting specific projects online at [www.peaklogix.com](http://www.peaklogix.com).