



A Case For:

# A Comparison Of Rack-Supported vs. Conventional Buildings

The decision to construct a new warehouse often includes endless hours devoted to site selection and the type of material handling equipment and technology to be used to support the new facility. Often, it becomes a foregone conclusion that the facility will be a steel frame structure with freestanding rack. This conclusion, however, deserves greater debate as there are many attractive reasons to consider a rack supported structure . . . in some cases.

## STEEL FRAME vs. RACK SUPPORTED STRUCTURES

Structural steel frame buildings are the most common construction style in use for today's warehouses. Utilizing a "skeleton frame" of vertical steel columns and horizontal I-beams or trusses, the building is constructed in a rectangular grid to support the roof and walls which are all attached to the frame. The building is then equipped with freestanding rack for material storage. In contrast, a rack supported building is comprised of a complete storage rack system, with the rack system being the basic structural support for the building's roof and walls. In this scenario, the roof and walls are often referred to as the "skin."



Conventional

## COMPARISON

A side-by-side comparison of the two styles relies primarily upon the intended use of the facility. For pure storage purposes, the rack-supported structure has many benefits. On the other hand, if other business processes are interspersed with that of material storage, or if business requirements might force a change in the building's overall configuration, a steel frame building might prove the best choice.

For storage considerations, a rack-supported building will far exceed the space utilization that can be offered by steel frame buildings. The infrastructure needed to erect a steel frame building in excess of 45' becomes prohibitive when considering the relatively small amount of resulting storage. (Thus, rack-supported buildings are almost always preferred for tall AS/RS applications) The columns and aisles take up an excessive amount of space that decreases the overall utilization. Conversely, rack-supported buildings are generally targeted for applications that range up to 110', and provide a dramatic improvement in space utilization and footprint, as evidenced by the following example.



Rack-Supported

### Comparison For Building With 15,000 Very Narrow Aisle Rack Locations

Style	Building Height	Floor Space Utilization	Storage (Square Feet)	Square Feet Per Pallet Position
Steel Frame	40'	55%	126,000	8.3
Rack Supported	90'	72%	36,000	2.4

From an economic standpoint, a rack-supported building has some additional benefits. In many instances, open space laws require a set amount of acreage be set aside for every one acre that is built upon. As demonstrated, the rack-supported building can minimize the structural footprint, and can thereby also minimize the required "set aside." This can affect your bottom line directly by reducing the necessary investment in land, or by allowing for more acreage to be used for productive purposes.

Depending upon the tax laws and codes that apply to your particular company, a rack-supported building might also provide substantial tax benefits. Typically, buildings must be depreciated over the course of 30 years. But because the walls and roof of a rack-supported building are considered to be equipment enclosures, the cost can be depreciated over the course of 15 years (depreciation of equipment rather than of a building).

### Economic Comparison For Building With 15,000 Very Narrow Aisle Rack Locations

Style	Building Height	Initial Investment	Depreciation Per Year	Utilities Per Year
Steel Frame	40'	\$10,400,000	\$415,000	\$100,000
Rack Supported	90'	\$9,900,000	\$625,000	\$40,000

## CONSTRUCTION SEQUENCE

The construction process itself also yields some benefits for a rack-supported structure.

A steel frame building will typically have the foundations poured first, followed by erection of the structural steel. The roof deck and siding are added next. Once enclosed, the underground work is completed and the slab is poured. When the slab has cured, the rack is erected one frame at a time. The difficulty arises in that there is usually a limited amount of access and head room. Final bolt-up of the frames and bracing must be done in the air, making the plumbing and alignment more difficult and ultimately more costly. This issue is further complicated as the height of the rack increases and/or the width of the aisles decreases.

Construction of a rack-supported building begins with the pouring of the slab, and the erection of the rack. Since there is ample space due to the lack of enclosures, the multiple frames are assembled in fixtures while lying on their side. This allows the support steel to be assembled, and for bolt-up to be accomplished at or near ground level. These modules are then "stood up" on the slab. Fixturing also assures extremely accurate alignment, thus minimizing the time required to complete the plumbing of the rack during erection.

## RACK-SUPPORTED CONSTRUCTION



Pour Slab



Module Assembly Fixture



Begin Rack Erection



Set Additional Modules



Install SRMs



Start Siding



Complete Rack



Complete Siding and Roofing

## CONCLUSION

There are pro's and con's to both steel frame and rack-supported structures. While the traditional steel frame building still has its place in environments where the space has multi-functional uses or may be apt to be reconfigured, rack-supported buildings have clear advantages when material storage is the primary consideration. These advantages should be thoroughly investigated in order to ensure the best course of action is chosen.

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## SELECTION GUIDELINES

### Structural Steel Frame Building is preferable when . . .

- Business requires changes in building configuration periodically
- There may be a need to remove the storage later in time and still use the building
- Storage is interspersed with other processes such as manufacturing
- Building height over 45' becomes disproportionately costly

### Rack-Supported Building is preferable when . . .

- Storage density is to be optimized (storage/cu. ft.)
- Space utilization is optimized and footprint minimized (storage/sq. ft.)
- Accelerated depreciation is available and desirable
- Land is at a premium
- Site has high winds or seismic considerations (forces will be spread across multiple frames)

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