# Design of flexible Industrial Racks for Low Weight High Volume Applications

**Aamir Abdul Aziz Waghade[1] Siraj Sheikh[2]**
[1]M.Tech Student [2]Professor
[1,2]Department of CAD/CAM
[1,2]G.H. Raisoni Academy of Engineering and Technology, Nagpur, Maharashtra, India

*Abstract*— The material storage system permit the materials to be stored for a specific period of time, until they are re-introduced. The common feature of storage systems is that loads remain stationary or static in their storage locations until removed from the system. The storage systems are more likely to be associated with low turnover inventories where manual storage and retrieval is a cost effective mode of operation. This project based on the design and analysis of industrial rack for storage of low weight high volume automobile parts such as front and rear bumpers of car.
***Keywords:*** Storage System, Industrial Rack

## I. Introduction

Storage equipment is used for holding or buffering materials over a period of time. Some storage equipment may include the transport of materials (e.g., the S/R machines of an AS/RS, or storage carousels). If materials are block stacked directly on the floor, then no storage equipment is required. Storage racks are used to provide support to a load and/or to make the load accessible. Pallets are supported between load-supporting beams. Most popular type of storage rack. Special attachments and decking can be used to make the racks capable of supporting other types of unit loads besides pallets (e.g., coils, drums, skids) Load-on-beam racks are used to provide clearance for straddles; load-on-floor racks can be used when it is not necessary to use straddles.

Single position (slot) per position provides complete and fast accessibility to all loads with no honeycomb loss. Two pallets stored per position provides greater cube utilization than single-deep racks because more loads can be accessed from the same side of the rack. Typically used when the inventory level for an item is at least five or when loads are stored and picked in multiples of two pallets.Flow-through rack similar to push-back rack in terms of storage density, except greater storage depth is possible. Rack is loaded at higher end and unloaded at lower end, providing FIFO storage in each lane. Termed pallet-flow rack and carton-flow rack when pallets and cartons used, respectively.

## II. Literature Review

Sourabh R. Dinde, Rajashekhar S. Talikoti, Late G. N. Sapkal[1] According to the structural point of view Industrial Pallet rack structure can be considered typical steel framed structure. This work presents a general analysis of an industrial pallet rack structure, evaluating the influence of each of the components on the global stability. An analytical study for the sensitivity of pallet rack configuration in linear static equivalent lateral loads. The aim is to braced/unbraced frames were design and their analytical models are to be built in software. The finite element analysis is used to determine axial forces in beam and column, maximum storey displacement and buckling loads on braced/unbraced pallet rack structure. Bracing systems are mostly provided to enhance the stiffness factor of the structures with the seismic loads. Unbraced systems have mostly translational modes of failure and are very flexible due to excessive loads.

N. Baldassino and R. Zandonini [2] Industrial racks are one of the most common structures for the storage of palletized goods. The behavior of these structures, which are built-up from thin-walled cold-formed steel profiles, is quite complex. The sensitivity of the uprights to buckling, the presence of the perforations on the uprights, the non-linearity of the connections, the frame sensitivity to the second-order effects and the influence of the imperfections are the main sources of complexity. The large variability in terms of geometry of the profiles, of the joints and of the perforations, and the complexity of the phenomena which affects the member behavior do not yet allow performing a pure numerical design, but call for tests aimed at the characterization of the structural components. Traditionally, the design of the racks is carried out by a procedure combining experiments and numerical analysis. This approach follows the so-called 'design by testing'. This paper intends to provide an overview of the experimental part of the approach. The specifications in the European and the North American standards are reviewed for the main structural components, i.e., the uprights, the upright frames and the joints. Problems related to the clarity, accuracy and completeness of the specifications are pointed out. The main results of some studies carried out by the authors provide a key to better understanding of the importance of testing.

ABDUL ZARIF BIN ABDUL MALEK [3] The study of manufacturing was very important in order to carry out this project to ensure that student understand on what are needs to do. This project is about designing and fabricating the flexible rack for lecturer use to helps lecturer storing documents or paper works in their office more efficiently. This project involves the process of designing the rack by considering the shape and also the ergonomic factor for lecturer to use. After the design has completed, it was transformed to its real product where the design is used for guideline. This project also required analysis to make sure the strength of the product to ensure the safety for the user indeed of publishing. Numerous methods and process involve in this; project for instance shaping using bending machine. This project is mainly about generating a new concept of rack that would make storing documents at limited space become easier and more efficient. After all the process had been done, this rack may help us to understand the fabrication and designing process that involved in this project.

Kees Jan Roodbergen [4] The layout of the racks in a warehouse has a major impact on the efficiency of the

 

operations. Some recent results on this topic are presented in this paper. By applying the concepts as presented here, it will often be possible to obtain a substantial reduction in order throughput time and simultaneously a reduction of costs. Results have been confirmed by case studies as well as scientific research.

We focus on methods to find appropriate layouts for storage areas. This concerns the determination of the number of blocks, and the number, length and width of the aisles and cross aisles in the area. One layout concept that is regularly seen, is a one-block "square-in-time" layout. Square-in-time basically means that it takes the same time to walk from the front to the back of the area as it takes to walk from the left to the right of the area. It can easily be proven mathematically that this layout is optimal if there is only one stop per route (that is, if we are moving full pallets only). However, it is possible to do better nevertheless, as will be shown in the section "Layout for unit load areas". But first we will look into layout issues for order picking areas.

A Firouzianhaji, A Saleh, B Samali [5] Industrial racks are normally framed structures fabricated from cold-formed sections and relative to their self weight (Dead Load) carry very high Pallet Loads (live load) compared with conventional civil engineering structures. Lack of sufficient design rules and specifications provides an urgent need to better understand their performance under seismic loads as well as static load. Due to their slenderness controlling sway deformation is an important factor in the design of industrial racks and hence special attention must be given to factors such as 'beam to upright connections' and 'base plates connections'. This paper focuses on theoretical approaches to perform stability analyses of storage rack structures and considers the effects of incorporating the stiffness of baseplates and bracing elements in the critical buckling load. Also the effect of cyclic moment rotation deterioration on the global stability of the frame is highlighted. A stability limit has been defined for a maximum pallet load to be stored on a particular rack structure.

## III. PROBLEM FORMULATION

Low weight high volume automobile parts (Front and Rear bumpers of car) are stored in fixed racks for very short period. These parts are usually stored in the top section of the racks as they are light in weight. The usual height of the racks is 20 to 30 feet. As these parts are very high in supply and demand they are needed to be stored in large numbers for very less time. The process of placing and removing parts from heights is difficult and time consuming. Also, these parts are packaged in cartons and they cannot be placed one over the other for a stack size of three. Thus there is a need to design flexible racks on which these parts can be placed and removed easily within short time.

## IV. RESEARCH METHODOLOGY

First the data will be accumulated from Existing industrial racks. After this the loads calculation for flexible Industrial Racks will be calculated. Then the design calculations for the structure of flexible Industrial Racks will be done. Then the CAD modeling of the flexible Industrial Racks will be performed using CAD software SolidWorks. Then the analysis of the design of the flexible Racks will be done in FEA software NASTRAN. Then the results will be discussed and the design will be finalized on the basis of the results discussed.

## V. CONCLUSIONS

After the completion of this project the automobile industries will be directly benefited. This high volume low weight parts storage required a large space in warehouse. This solution will be reduce the space required by the parts, thus it save lots of space in the warehouse.

## REFERENCES

[1] Scandola, A., "Analysis of Industrial Racks" (in Italian), Master Thesis, University of Trento, 2007, pp. 129.
[2] Baldassino, N, Bernuzzi, C., "Analysis and behaviour of steel storage pallet racks", Thin Walled Structures, 2000, (37): 277-304.
[3] Giovannini, M., "On the Response of Industrial Racks" (in Italian), Master Thesis, University of Trento, 2008, pp. 137
[4] FEM. "Recommendation for the Design of Steel Pallet Racking and Shelving" Section X of the Federation Européenne de la Manutention, 1999.
[5] Kozłowski, A. and Ślęczka, L., "Preliminary Component Method Model of Storage Rack Joint", Proceedings of Connections in Steel Structures V, Amsterdam, June 3-4 2004, pp. 253-262.

 