

A review paper on Inventory rack design for automotive industry warehouse

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Abstract- Industrial racks play a vital role in automobile storage warehouses as most of the parts of automobile are light in weight but high in volume and are often in high demand. It is common in all the storage that the stationary load is applied for short period. To ease and reduce the loading and unloading time a system must be designed.

In this article to design a inventory rack, thorough literature study is performed which drives ideas about the parameters affecting new design. A brief literature survey is represented and complete design and analysis of inventory rack will be the part of our next study.

Index Terms- Inventory rack, Design, Analysis.

1. INTRODUCTION

Storage is an inherent function in the automobile warehouses. The material storage system provides materials to be stacked for a specific time period, before introduced for the first time, into the automation system. The types of stored material are related to the product (e.g. raw materials, purchased parts, work-in-process, finished products, and scrap and rework), the process (e.g. process refuse, such as process waste products; and tooling), and the overall support functions in the factory (e.g. maintenance spare parts, office supplies, and plant records). Each of these material type is typically stored under different conditions and controls.

2. OBJECTIVES

- To analyze the process of Inventory Racks for low weight high volume applications
- Finding the different input factors responsible for the Inventory Racks for low weight high volume applications

- Modelling different component of the Inventory rack
- Analysis of Inventory rack by using FEA software(NASTRAN)
- Design modification and suggestions if required

3. LITERATURE REVIEW

Review paper on structural behaviour of industrial pallet rack with braced and unbraced frames by Sourabh R. Dinde, Rajashekhar S. Talikoti [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.

An explanation of some rack layout concepts for warehouses by Kees Jan Roodbergen [2] 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.

Stability analysis of steel storage rack structures by A Firouzianhaji, A Saleh and A Samali [3] 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 base plates 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.

Pallet racking operation and maintenance by Victorian WorkCover Authority [4] There have been reports of damaged or overloaded racking at many workplaces that store pallets in racking. This includes an incident where racking collapsed onto a worker

who was stacking goods. This advice is for employers and will also be useful for persons in charge of racking and those who work around racking, including warehouse managers, operations managers, general managers, maintenance managers, forklift operators, store persons and health and safety representatives. As an employer, you must ensure, so far as is reasonably practicable, that racking equipment and the way it is used and operated is safe for workers and others. Note: This information sheet is for standard ‘selective’ pallet racking. Additional safety measures may be required for cantilever, drive-in, double-deep, pallet-live, push-back or other specialized types of racking.

Working load limits should never be exceeded for the unit load (pallets of goods to be stored), pallet beam or bay. Provide information for workers about the safe working loads (SWL) for pallet racking.

SEISMIC BEHAVIOR AND DESIGN OF STEEL STORAGE RACKS by Claudio BERNUZZI, Claudio CHESI, Maria A. PARISI [5] An experimental and analytical study currently in progress at the Department of Structural Engineering of the Politecnico di Milano is devoted to the development of simplified rules for the design of pallet storage steel racks in seismic zones. The work presented here analyzes the sensitivity of different rack configurations both to static equivalent lateral loads and seismic excitation in the longitudinal direction. The analytical models include a semi-rigid formulation representing the partial continuity of the beam-to-column joints, calibrated according to the experimental results. First indications for improving the quality of the seismic response are discussed.

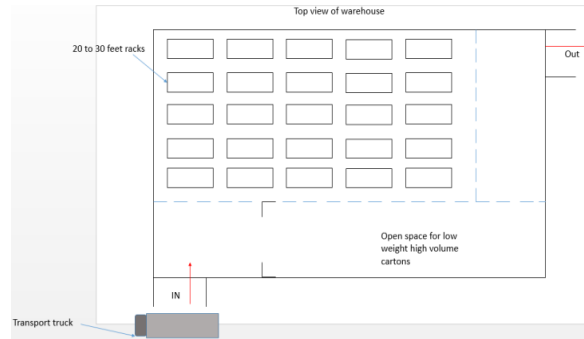
Rack systems for pallet storage are important industrial structures by number and commercial value, yet they have been considered only recently in studies aiming at defining practical design rules for their safe use. These structures are always composed with metal elements: the fabrication of rack structures constitutes, indeed, an important application of cold formed steel products.

The need for continuously loading and unloading the shelves in service has induced designers to avoid bracing elements in the longitudinal direction of the racks. Therefore, in many cases lateral stability in this direction is ensured only by the connections

between beam and column and by the constraint offered by the base of the columns.

4. PROBLEM FORMULATION

The scope of the project is limited to the design modelling and analysis of Inventory Racks for low weight high volume industrial automobile applications (Front and Rear bumpers of car). These parts are very high in supply and demand they are needed to be stored in large numbers for very less time. 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. So, to overcome this problem the project is undertaken.



5. RESEARCH METHODOLOGY

In present study, we have studied various literatures on design of inventory rack for storage purpose. after that collecting the requirement data, performing calculations for designing rack then cad modeling and analysis will be performed in further work study. Based on the results design will be finalised.

6. CONCLUSION

This article involves the brief study of the Literatures on inventory rack design for light weight high volume storage. from the study it is conclude that In order to reduce loading unloading time and simultaneously reduction in storage space, a rack must be design with high stack size capacity.

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