Storage of materials in construction

El almacenamiento de los materiales en la construcción

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Abstract

This research aimed to expand the information known about the processes and types of storage of existing materials in the field of construction, the methodology used was made from a previous research on the subject of storage of materials in the construction sector, through scientific journals and institutional databases, information was extracted that helped us to make a reflection on this same topic which led us to create a common thread to build this article. The research gave us as a result a reflection, among the main ones the importance of logistics processes in a warehouse because it can define the good or bad performance of the storage places, therefore, in these processes it is essential to optimize time, organization and effectiveness. Another of the results obtained was that the dimensions of the warehouse and the processes involved are closely related to the scale of the work, being this the one that defines the aforementioned parameters and that they must necessarily be located as close as possible to the work since this also defines primarily the efficiency of this. Thus, it is concluded that all internal and external processes that take place in a materials warehouse on site have a positive or negative influence on the development of construction activities, impacting the development time.

Key words: Storage, materials, efficiency, construction.

Resumen

Esta investigación tuvo por objetivo ampliar la información conocida sobre los procesos y tipos de almacenamiento de materiales existentes en el ámbito de la construcción, la metodología usada se realizó a partir de una investigación previa al tema sobre Almacenamiento de los materiales en el sector de la construcción, a través de revistas científicas y bases de datos institucionales, se extrajo la información que nos ayudó a realizar una reflexión acerca de este mismo tema el cual nos condujo a crear un hilo conductor para construir este artículo. La investigación nos dio como resultado una reflexión, entre las principales la importancia que tienen los procesos de logística en un almacén ya que puede definir el buen o mal funcionamiento de los lugares de almacenaje, por consiguiente, en estos procesos es imprescindible la optimización de tiempos, organización y efectividad. Otro de los resultados obtenidos fue que las dimensiones del almacén y los procesos que conllevan están estrechamente relacionados a la escala de la obra, siendo esta la que define los parámetros mencionados y que necesariamente se deben ubicar lo más cercano posible a la obra ya que esto también define primordialmente la eficiencia de esta. Es así como se concluye que todos los procesos internos y externos que se llevan a cabo en un almacén de materiales en obra influye positiva o negativamente en el desarrollo de las actividades en la construcción, impactando el tiempo de desarrollo.

Palabras Clave: Almacenamiento, materiales, eficiencia, construcción.

Introduction

The following article aims to deepen and learn about the importance of the storage of materials in construction, taking into account its determinants of design, logistics, time optimization and type of material to be stored depending on the conditions of both the construction site and the place of storage of the inputs of the work.

Documentations on storage practices:

Initially, one of the most frequent problems in the construction industry, according to Díaz, et al. (2015), is that architectural projects are carried out in small lots where no logistics are taken into account to properly store materials and control their entry and exit, which is why in many cases losses of money, time and quality are generated in the works. It is necessary that the planning to store the materials and the logistics of purchase and acquisition of these go hand in hand from before the execution of the project to avoid bad expenses and significant losses of these resources.

Therefore, it is necessary to control the storage of materials, taking into account that according to Carcaño, et al (2009), construction materials, depending on their type, require storage either in closed spaces for those materials that react when in contact with the atmosphere, are small in size or are expensive and require storage in warehouses, or in open spaces for those materials that are relatively inert, take up a large amount of space or are delivered in bulk, and these materials are also stored near the construction site to facilitate their transportation or "hauling" as it is called in construction.

In fact, according to Taborda (2006), there are several techniques for storing materials on site depending on the size and characteristics of each one, since some may simply require a shelf or complex systems that involve an investment and the use of technologies. In order to choose an adequate storage system for materials, factors such as available space, the type of material to be stored, the number of items to be stored and the type of packaging must be taken into account. From the moment the materials arrive and are removed from the warehouse, they need to be properly handled until their subsequent removal and installation at the construction site.

To delve a little deeper into the functioning of warehouses in construction, it is pertinent to mention Radchenko & Petrochenko, who in 2014 took as the basis of integrative creation the production and storage areas of the construction industry, because correctly this unit helps to deliver the necessary materials, equipment and tools for the smooth development of buildings on site. However, this area is the most disorganized and, as such, suffers from lack of demand due to lack of construction production planning. Poor site management causes delays at the construction site, resulting in increased costs and reduced productivity.

Similarly, Agila et al. (2021) state that inventory management is a tool that assists companies in the proper administration and regulation of their products by establishing clear policies, methods and procedures. The purpose of this study was to identify an inventory management approach that allows effective management of materials in small and medium-sized enterprises (SMEs) engaged in construction. The results indicated that many companies manage their inventories with the help of tools such as Excel or even manually. The incorporation of software would make it possible to automate and consolidate processes and information, although this would require the acquisition of new knowledge and tools to achieve more effective control. In this sense, we propose the creation of a process diagram that presents a deterministic model, with the purpose of carrying out the process in an organized and detailed manner, with predefined policies that facilitate the periodic review of inventories for continuous improvement.

Diagnosis of current practices:

Image taken from: Temporary storage warehouse for the storage of construction products and materials (2015, August 24).

On the other hand, Romero et al (2018), talk about construction being behind in resource management, specifically that of materials, materials management is a responsible function that encompasses planning and flow control. This includes comprehensive planning of the following activities: material sourcing, evaluation, supplier selection, purchasing, expenditures, transportation, receipt of the material in warehouse and subsequent proper distribution. The aforementioned activities are indispensable to guarantee the quality and precise quantity of materials and equipment in order to have an adequate and timely handling, to obtain a moderate cost and to dispose of them when they are needed.

Likewise, Hualpa & Lopez mentioned different techniques used in warehouse design, the most common being linear programming, design based on inventory cost and cubic order index, etc. These methods deal with dimensional variables, unit loads and material turnover rates. However, the use of mathematical and computational models and the application of algorithms have been used in fields other than architecture. Therefore, it is necessary to propose a warehouse-scale algorithm suitable for construction site delivery characteristics to facilitate the implementation and standardization of the temporary warehouse design process in this industry.

On the contrary, González, et al (2010) in their publication of "Sistema para la administración de materiales en proyectos de construcción masiva de vivienda", establish the creation of a global and integrated approach of the steps, stages and management processes that are considered essential in a global and integrated approach of the stages, phases and administrative processes that are considered essential in a materials management system (SAM). The authors present their recommendations with the objective of increasing company productivity, taking into account the direct and indirect costs of poor materials handling. In addition, they cite cost implications such as delivery delays (affecting material shortages in key operations), transportation due to poor distribution planning, budget cost overruns due to lack of control, among others.

Storage models

Image taken from: Edition, T. (2021).

According to López (2006), one of the types of warehouses that should be taken into account is the distribution warehouse; this space is used to store merchandise, especially those products whose production phase is finished. The purpose of these warehouses is to buy certain merchandise from the national market, then dispatch and distribute them to the different department stores. For example, if the hardware stores need cement, they request it from the distribution warehouse, and the distribution warehouse requests or imports the products, stores them, and then distributes them to the requested points.

However, some types of warehouses used on site are usually mixed, Escudero (2019) stipulates that many industrial companies often use several types of warehouses due to the variety of materials or elements that must be safeguarded. One of these is the raw materials and auxiliary materials warehouse, which is located inside the premises and stores materials, supplies, equipment, etc., that are used throughout the production or construction process. Depending on the characteristics of the material, it can be open or closed, but in many industries both are used at the same time.

Another primordial point to take into account regarding storage is the design of the same, as mentioned by Hualpa and Suarez (2018), the designs of the warehouses are one of the key factors, since this can be fundamental for the logistic processes that are carried out as in turn serves to improve the timely management of materials and decrease time, costs and benefit customer service. Taking this into account it is clear that a storage place must comply with logistic processes in an efficient way, for this reason a warehouse that complies with the mentioned requirements can reduce the invested capital, have greater control over the inventory, reduce time of the processes and reduce the cost of maintenance.

With this in mind it is very important to mention that storage and logistics control is essential to have inventory control, Manosalvas, et al (2020), stipulate that the purpose of inventory management is to have an adequate management of the merchandise and that it is essential to have control over them, The inventory benefits the achievement of projected goals and the neglect of these can lead to negative economic effects that affect the development of the company or the work due to inadequate management, this can also lead to problems such as stock neglect, misidentification, disorder and corrosion of products.

Therefore, the correct functioning of the warehouse areas in a construction site is intimately linked to a strict and rigorous administrative control; however, in most construction companies it is not taken into account in the way it is described. Therefore, it is necessary to establish that the administration referred to by Serpell and

Alarcón, 2003, starts with planning, a stage in which it is necessary to determine what actions are needed, how to perform them and what actions to take; subsequently, with this information it is possible to define who is responsible for the execution of each one of them, this allows anticipating possible difficulties and anticipating risks that will arise during the execution.

The administrative management in a construction project is an indispensable pillar for a good development of the same, which is why all the resources that a company allocates in planning is an investment that will help mitigate unnecessary expenses and thus generate higher profits, but today, despite this, many project managers still do not want to attract these resources, so many constructions are poorly planned, which in most cases leads to unsatisfactory results for construction companies and investors. For these reasons, it is worth mentioning (Sanvido et al., 1992) refers to a U.S. report, where 47% of projects were over budget and 71% over schedule.

On the other hand, the steel industry is one of the most important industries in the world since it is a raw material that supplies many industries such as automotive, construction, household appliances, food, machinery, etc. Given the importance of production in the industry, administrative, logistic and inventory control is necessary to meet market demands. Considering the importance of steel production and marketing in the world, Juárez et al (2018) states that inventory plays a very important role in the growth of this same, since this allows quantifying the supply of raw materials, work in process, finished products, channels and production points in logistics. Also, according to Agudelo and Lopez, 2018), warehouse maintenance costs are related to the amount of inventory stored, therefore, storage costs are expressed in 30% to 35% of the value of the company..

Inventory control oriented approaches:

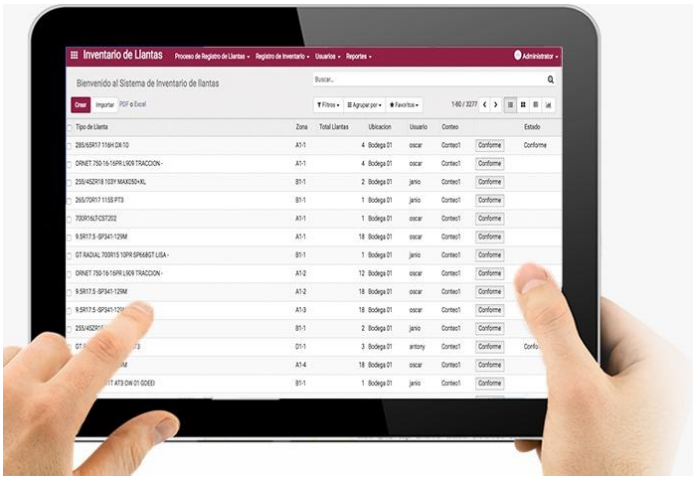

Image taken from: Moreira, C. D. (2021).

While it is true that the improvement of storage processes is intended to achieve market stability and economic growth. For this, storage processes must be increasingly efficient and agile. According to Hurtado and Ortiz (2018) a proposal for the improvement of the storage process would be to apply engineering tools to increase efficiency in the operations that are responsible for storage, taking into account many aspects such as volume, type of goods and costs. In addition to this, the improvement of the warehousing process seeks to improve the distribution of resources, take advantage of each additional space in the warehouse and reduce costs and delivery time.

In fact, Meza, et al. (2010) propose the implementation of an integrated system, which consists of a desktop application that facilitates the control of materials in the warehouse and also a system that allows uploading files to the cloud for better organization of resources. With the implementation of these systems, an improvement in the methodology of storage of construction materials is sought for a better control, but above all a better performance of these, as well as to know the current status of the materials in the warehouse.

Likewise, a construction company such as Coinfra s. a also has a great complexity in the management of storage and distribution of materials which causes them to lose both time by not having the right material when needed which affects the delivery time of the works adding to this the loss in costs that this generates, so Zambrano, et al. (2014) propose the implementation of a web application through the MIDAS methodology to improve these storage processes, thus allowing greater control, since this system provides information on each movement made with any material and the person responsible for such action, thus allowing a better effective and detailed organization.

On the other hand, according to Tocto Correa, (2020). in a study conducted at the Cesar Vallejo University (Peru) carried out a work in a company called Energoprojekt Niskogradnja S.A. in order to improve the control of the entry and exit of materials in the warehouses of the work through the use of a web development methodology called XP. This study was carried out with the support of the workers of the company together with the records of entry and exit of materials from the warehouse in a period of one week, this determined an improvement in many aspects such as the decrease in times of registration and search of the outputs of materials, development of stock requests, access of information for stock reports and reduction of time for the preparation of summaries of inputs and outputs of materials. It could be concluded that this study evidenced the positive influence that the use of web methodologies has for the efficient development of the storage of materials and time on site.

Operation of warehouses

Image taken from: Do you know the main functions of the warehouse (2022, March 15).

According to Taborda (2006), the entry of materials or raw materials is done by order of the purchasing manager, who is in charge of receiving the list and the quantity of materials needed, thanks to the site resident. A copy of this list is given to the suppliers with whom the company has a connection, another copy goes to the resident and he is in charge of setting the dates for delivery and receipt of materials. When the material is delivered, it is received in the warehouse and entered into the system for greater control over these quantities.

Another fundamental factor in site warehouses is how these same materials are grouped or handled, as mentioned by Herrero (2006), who says that the unit load is an element that can be handled by mechanical elements, these can be composed of one or several elements of smaller dimension than the "final unit load". Some materials can be handled individually just by analyzing their qualitative characteristics such as shape, size, weight, etc. Other pieces or elements can be very tedious to handle individually, such as boxes, bricks, packages, etc. This is why it is better to group the elements for handling, which saves time, speed and economy.

Image taken from: Ingetek, E. (2022, February 28).

Conclusions:

When reviewing the different sources of information consulted, we found that certain organizations are apathetic to the implementation of automated processes for inventory control because of the large investment that must be made, but the results show that investment in the control of planning processes helps to significantly reduce delays, cost overruns and unforeseen events, which translates into higher profits for the organization.

The creation of a strategy for inventory control is essential in this technological era, because organizations focused on the construction sector need to have a process automation, to have a clear roadmap that leads to effective solutions to the unforeseen events that arise daily during the implementation of a project.

For the realization of a construction project it is more feasible to invest time and money in planning, even if this stage delays the beginning of the execution, because it will be possible to have greater control of the activities to be carried out and this will result in fewer delays and unforeseen events and a good working environment.

In summary, the storage area is a fundamental process for the proper functioning and distribution of time, which is why in this area logistics and time control is a crucial factor for the proper functioning on which depends the late or early development of a construction site and at the same time, it is a task that executes a comprehensive set of activities within which we can highlight the control over the quantities of work, materials, packaging and their disposal. That said, it is necessary that there is a professional team in charge of monitoring and innovating in the area of organization and control within the work, in charge of designing strategies and making clear the routes and instances so that the storage processes are optimized and effective in time, cost, production, quality and execution. Currently there are several methodologies which are at the free choice of the organizations, for this it is necessary that they are willing to invest and change the internal processes that will determine satisfactory results in the operation of the warehouse.

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