Case Study On The Reduction Of Electrical Packaging To Help With Overall Construction Waste

Hailey Rodriguez  
California Polytechnic State University, San Luis Obispo  
San Luis Obispo, California

The construction industry has a significant amount of waste accumulated on every job site. This study utilizes research on the types of materials that make up waste and the waste management strategies behind it. Waste materials range from building materials, such as lumber and steel, to packaging materials, like plastic and cardboard. This paper concentrates on material packaging and discovering ways to eliminate some of the construction waste before materials even arrive on the job site. A case study was performed on electrical lighting fixture packaging to observe and analyze the different amounts of waste accumulated. This examination focused on traditional light fixture packaging compared to the reinvented “Stack Pack” packaging. It was found that Stack Pack packaging is able to carry four times the amount of light fixtures compared to traditional packaging, and both produce a similar amount of waste. This is possible by modifying the original packaging by stacking the product and layering it with a cardboard cushion. This reduction of material is responsible for reducing factors such as time, cost and labor and has the ability to impact the amount of waste in all construction if incorporated in other trades.

Key Words: Material Waste, Packaging, Recycling, Electrical, Construction Waste

Introduction

Construction is one of the biggest industries in the world with high demand. There are 5 sectors of construction: residential, commercial, heavy civil, industrial, and environmental construction. With such an impact on the world, it is important to think about the amount of waste produced from this work. As much as 30% of all building materials delivered to a typical construction site can end up as waste (Gonzalez, 2014). Many of these disposed materials can be recycled or reduced. Materials like lumber, metals, plastic, pipe, paper, and cardboard, compromise a part of this significant percentage. These materials can be harmful to the environment and people when disposed of due to materials, like plastic, sticking around the planet for ages spreading toxins, and contributing to global warming. However, there is a way to reduce some of this material waste before it arrives at the job site. This can be done by focusing on material packaging, which is often excessive. "About one-third of construction waste comes from packaging, and it consists mostly of plastic, cardboard, and timber" (Tobias, 2019). These materials can be recycled but wouldn't it be easier to cut down on the amount of material before arriving onsite?
There are different strategies implemented that address this issue. In this paper, the focus will be modifying the physical product to allow for less packaging. The goal is to optimize results through packaging reduction. Companies like Acuity Brands are utilizing this on their "Stack Pack" packaging with promising results which show the effectiveness of this strategy. Methods like this help decrease overall waste and increase production rates by saving time, labor, and money. Many benefits come with taking this route as a company with the result of positively impacting the environment and the future of construction.

Literature Review

It is important to think about the several factors surrounding reducing waste. There is a bigger picture of how To begin, focusing on the bigger picture of how inferior the construction waste problem is in the world. Many people in the industry do not think about this so the topic is not discussed often. Secondly, dissecting this problem to identify the factors that contribute to this helps in realizing what can be solved. Lastly, think deeper about what is already being done to combat high waste percentages and decide if it is effective or not. Despite the negative connotation around the matter, many benefits come from reducing construction waste which should prompt people to participate in this waste reduction.

Construction and Demolition Waste

Many recycling and reuse implementations have been introduced to the construction industry with hopes of minimizing the harm that comes from waste, especially to the environment and people. There are several different types of materials that come from the disposal of construction waste, but altogether the amount of waste is remarkably high. In California alone, "Construction and demolition (C&D) materials are estimated to account for between 21.7 to 25.5 percent of California’s waste disposal (Cal Recycle, 2022)." Although California has a high volume of new construction and renovations, the fact that waste accounts for a quarter of the entire state's waste disposal is deranged. There are many possibilities of why this is happening and finding the underlying cause of it is critical for the long term.

Factors Contributing to Construction Waste

The construction industry accumulated a significant percentage of waste worldwide. Factors weighing into this issue can range from management to procurement and more. Researchers in Thailand conducted a study that narrowed these possibilities down, "A total of 28 causes of construction waste were identified and grouped into the four categories: design and documentation, material and procurement, construction method and planning, and human resources. (Luangcharoenrat, 2019)." The reduction of waste is determined throughout the entire construction process. The amount of waste can be increased due to design errors or change orders resulting in the material already ordered becoming waste. This can also be seen in the procurement stage where too much material was ordered, traced back to the project's planning and management. In addition to this, a study in the UK has concluded that the amount of waste depends more on the personnel and labor handling the materials than other factors (Skyoles, 2008). This calls attention to whether people are carelessly handling materials, which opens the conversation to educating personnel on the benefits of waste management.

Waste Management Practices

As previously mentioned, "About one-third of construction waste comes from packaging." (Tobias, 2019). Manufacturers and contractors should be encouraged to reduce this waste. Some methods can be practiced to achieve this. For example, the separation of materials on site so they can be recycled, reused, or disposed of properly. Another example would be examining the actual packaging the materials come in and figuring out a way to use alternatives to the harmful materials or eliminate them. Šerešová, Markéta, and Koči Vladimír researched how to best perfect the product and the packaging. They used an indicator called the Package-to-Product (PtP) indicator which allows them to assess the environmental impacts of the whole life
cycle of packaging materials related to the environmental impacts of the product (Šerešová and Vladimír, 2020) Using a system like this can help create more efficient packaging for materials and should be used to promote sustainability.

Benefits of Reducing Packaging Waste

It is no secret that minimizing the waste that comes from material packaging is beneficial in many ways. For the environment alone, construction waste is linked to pollution and greenhouse gases which negatively impact the planet. In addition to this, as a general contractor, developing and implementing a construction and demolition waste management plan and achieving points through waste prevention and/or diversion (U.S. Green Building Council, 2016). This should motivate contractors to lower amounts of harmful waste to reach a higher LEED score.

Methodology

This case study is aimed towards focusing on the waste that comes from material packaging on a construction site using both the traditional form of packaging and the reinvented form of packaging. First, getting access to job site waste bins was necessary. After finding this, the next step was to see which trade had a high volume of materials that came from packaging: plastic, cardboard, and styrofoam. After analyzing the packaging waste, it was found that electrical packing was a good place to begin exploration. The job site where this data was collected had many light fixtures, which generated waste. So, this became the focal point of this study.

Next, the electrical subcontractor was contacted to find out which manufacturer handles these light fixtures. Upon receiving contact information, further research into different light fixtures was done to differentiate between the packaging. It was found that a traditional packaging system typically comes with cardboard and plastic materials. The manufacturer, Acuity Brands, reached out after hearing about my interest in their packaging, and a meeting was set up to discuss their product and packaging. The sales manager met with me and gave me an insider look into their new packaging system called the Stack Pack. The Stack Pack is a modified version of the traditional packaging. We went over the process it took the company to land on this specific packaging and the work that went into it. Also, the benefits that have come from it and the impact it is expected to have on all manufacturers.

Acuity Brands was generous enough to send over a sample of their Stack Pack. Upon inspection, weight measurements were collected on the amount of plastic and cardboard used in the packaging. The next step was to get a hold of the discontinued traditional packaging from Acuity Brands to analyze the difference. After a few hard weeks of trying to recover the old packaging by contacting different departments of the company, contacting electrical subcontractors, and searching through the internet, the traditional version was finally found. Both packaging were then compared. Quantitative data was then collected and from this point, it was truly clear the difference in the packaging.
Data Analysis and Results

Figure 1. Front View of Traditional Packaging of 1 Product.

In this traditional design, the box was 4" deep and was able to hold one 2'x2' light fixture. This box weighed a total of 11.7 lbs. The materials found in this packaging were plastic, to wrap the light fixture and cardboard, for the box. Each pallet that was delivered to a jobsite contained 15-20 of these fixtures. This is a standard for most packaging systems in construction, Each fixture would come packaged individually with their own box.

Figure 2. Top View of Traditional Packaging of 1 Product.
The Stack Pack design is 5" deep with the ability to hold four light fixtures stacked on top of each other with a thin piece of cardboard in between the fixtures for support and to prevent damage. The entire box is 31 lbs including the four fixtures. This design has the capability of carrying 100 fixtures per pallet.

There is a significant difference between these two designs and the effectiveness of this design change is quite clear. With only adding 1 inch to the box and still having the ability to fit three extra fixtures inside, many wonder how this could be possible. When meeting with the product manager from Acuity Brands, he
explained the process behind how they were able to accomplish this. The physical product was altered to allow for each fixture to be stacked. The original light fixture had a curved lens and vertical edges that made it impossible to stack so more than one fixture could not fit without adding more height to the box. The company then decided to redesign the light fixture so the lens is flat and angle the edges so they can perfectly fit into one another as seen below:

The Stack Pack has affected many job sites and saved contractors a lot of time, money, and labor. Acuity Brands has seen the production rate increase by 80% and saved money on shipping costs and material costs. The benefits are substantial due to the decreased total amount of waste on the job site. Large amounts of plastic and cardboard are reduced. In addition to this, fewer pallets of product are necessary which reduces the number of trips made on the forklift. It starts a conversation about what the effect would be if all subcontractors with materials in packaging implemented this. Methods like this are proving to be a huge factor in the minimization of waste.

**Conclusion**

Overall, there is a substantial amount of waste that comes from construction job sites in all parts of the world. There are many ways to go about reducing this amount which varies from management practices to altering the packaging that materials arrive in. This case study focused on the packaging and methods of cutting a percentage of it before it ends up on the job site. The Stack Pack from Acuity Brands practices this by reinventing its packaging to allow for 4 times the amount of products that can be shipped using the amount of waste of 1 product. If more manufacturers incorporated this system into their packaging there would be a huge decrease in construction waste.
Future Research

For future research, implementing this packaging design into other trades could show huge results given how well it has worked for electrical materials. Possibly practicing this on mechanical units or materials. Even going farther than construction and utilizing these methods in all materials that come in a packaging especially to other fields who order in bulk like the medical or field. In addition to this, it would be very interesting to explore alternative materials in place of plastics and cardboard. Perhaps a sustainable biodegradable form of packaging. Some companies may prefer heavy-duty packaging to protect their materials and prevent tears. Aside from this, there are circumstances where a biodegradable type of packaging could be utilized. Conducting a trial on this and comparing the data to regular materials would be fascinating to see.

References


