Feasibility of Reclaimed Lumber in Construction

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As sustainable building becomes more and more prevalent in the construction industry, builders and homeowners are experimenting more with different kinds of building materials. The focus of this paper is on reclaimed wood. One can find reclaimed wood almost anywhere, in an old barn, lumber yards, basically any place that has valuable wood that is not being used. This wood is then taken to a mill and cleaned up. Imperfections are removed, nails are taken out, and any finish that will be used is applied. Reclaimed wood has grown in popularity in construction projects over the last few decades. The rustic, antique feel that the wood has draws in contractors and homeowners alike. This paper looks to explore the different ways to incorporate reclaimed wood into residential or small commercial construction projects, examining both the cost-effectiveness and the sustainability of different kinds of reclaimed wood projects. Having personally worked with reclaimed wood on different kinds of projects, I wanted to provide more information on how to best use this unique material.

Key Words: Sustainability, Materials, Lumber, Recycled

Introduction

Reclaimed wood is considered more of a specialty item rather than a practical solution to large-scale wood flooring and siding projects. However, as it becomes more and more popular different contractors are starting to use reclaimed wood for different kinds of projects. This has created a need for a better understanding of the material and how it can efficiently be used. Reclaimed wood has a history of being used throughout the United States and can be traced back over 100 years. It is a popular addition to new homes as each piece of reclaimed wood has its own history. The need for reclaimed wood is growing exponentially. Timber is a finite resource, and as the world becomes more developed, trees are being cut down, creating higher demand and a smaller supply of quality lumber. Recycling wood may be the only way to keep up with the rate that humanity is currently building. According to the United Nations Food and Agriculture Organization, the world’s natural forests will steadily decrease over the next 40 years, as shown by the graph below. The projections show that global forest area could shrink by as much as 15% by 2030. As the world’s population increases, the need for timber products will grow exponentially. Combining that information with the fact that global infrastructure is expected to rapidly increase over the next few decades illustrates the problem. Estimates show that the volume of construction output will grow by 85% in just these three countries: China, the United States, and India. (Viet 2017) The use of timber products will skyrocket in these three countries alone, which could lead to a potential shortage of lumber across the world. A greater proportion of these forests will be used for non-construction related activities, and climate change activists will fight the logging of these forests for human use. All of these factors point to new solutions, one of which is increasing the world’s use of recycled lumber. In order to increase the amount of work that is done with reclaimed wood, customers need to be aware of the benefits. About 10% to 20% of all wood used in construction is currently being prevented from entering landfills. Estimates show that about 45% of wood that ends up in landfills could be reused for other purposes. (Kaye) This wood is essentially being wasted and as a result is contributing to the global deforestation problem. Promotion of information like this is a reason the use of reclaimed lumber grows year by year.
Not only is this great for the environment, contractors can advertise this in their campaign to be recognized as a green builder. Customers may be drawn towards builders who can demonstrate that they help to save the environment, particularly in a state like California. In addition to the environmental impact that comes with saving trees, reclaimed wood has also been proven to be more sustainable than its modern counter-parts. Sustainable building is a growing trend and recycled wood is one of the keys to creating environmentally friendly buildings. Studies have shown that an increase in reusable materials is on the rise in construction. The figure below demonstrates the market size of reclaimed lumber and its expected growth in the coming years. These estimates show that the market for reclaimed wood could double or even triple by 2050.

Figure 1 - Expected Decrease of the World's Forests
Source: Science Direct (2015)

Figure 2 - Expected Increase of Reclaimed Lumber Market Size
Source: Grand View Research (2017)
There are a number of different LEED credits that can be claimed by builders who reuse materials like reclaimed wood. As newer versions of LEED come out, there will be more and more credits that deal with reusable materials. (Longleaf Lumber 2019) Most older wood is much more stable and durable than modern treated wood because of its tightly packed growth rings. This makes the wood much denser and much more resistant to the elements and any additional wear and tear. The Janka Hardness Scale is a way to determine just how durable different kinds of woods are. The test measures how far a .444-inch steel ball can be driven into the wood until half the diameter of the ball is imbedded in the wood. (Tinytimbers 2019) Reclaimed wood typically has about 20 more points than its counterparts. For instance, Longleaf Pine, one of the most popular kinds of wood in the United States has a score of 870 on the scale. However, companies selling reclaimed long leaf pine from at least 30 years ago can boast that their wood has an 890 score on the scale. This means that the reclaimed wood is up to 4% stronger and more sustainable than the newer wood. (Goodwin) This results in less wear and tear and will save the client money in the future, as the reclaimed wood products will not need as much additional refurbishing. As these kinds of facts become more well known in the construction industry the demand for reclaimed wood products has increased. By interviewing to different contractors and woodworkers I attempted to find the ideal way for reclaimed wood to be incorporated into construction.

Climate change and a lumber shortage are not the only reasons customers want reclaimed wood in their homes and businesses. The recycled wood used in modern construction projects often was cut 30 or more years ago and thus captures a historic and rustic look that customers are looking for. This antique feel has driven the reclaimed wood market for decades and people still pay large amounts of money for reclaimed timber products in their homes or businesses. The idea of purchasing wood from all over the world is very attractive to certain builders and clients. A wealthy homeowner would pay top dollar for wood from a historically interesting place. The main issue with reclaimed wood has always been cost. It is cheaper to use new, treated lumber for construction as there are several added costs associated with older wood. Namely, reclaimed wood has to be found, salvaged, milled, and transported. New lumber does not need to be run through a mill, or be de-nailed at a certain location. This is a major factor that discourages people from using reclaimed wood. It is extremely important to understand where its use is most popular, and where it is most cost-effective. By understanding the process behind reclaimed wood, we can begin to more accurately estimate its value in different kinds of construction.

**Methodology**

The objectives of this project are as follows:

- Find the most practical uses for reclaimed wood
- Identify strategies that contractors can use to effectively and efficiently incorporate reclaimed wood into their projects
- Find the most effective ways to save money while using reclaimed wood.
- Provide an example estimate of a construction project that details the differences between regular treated wood and reclaimed wood.

My research was qualitative in nature, numerous interviews were necessary in order to get a full understanding of the topic. By talking with several different suppliers and distributors I was able to ascertain the post popular types of reclaimed wood as well as where it is most commonly used in construction. I found multiple contractors as well as direct manufacturers of reclaimed wood who provided me with valuable information regarding the current thought process behind reclaimed timber. Because this is the main issue that clients have when using reclaimed wood, it is one of the most important factors to discuss when talking about the advancement of the industry. To fully understand the advantages and disadvantages of building with reclaimed wood it is necessary to provide a real-world
example of the cost-effectiveness of building with this kind of lumber as opposed to something else. I did a detailed takeoff of a home in San Luis Obispo, a project with around 1250 square feet of flooring that needed to be installed. By talking to different contractors and getting different estimates on the cost of wood that would be needed I was able to compare and contrast reclaimed wood and new, treated lumber.

**Box Kite Barnyard**

Box Kite Barnyard is a lumber yard in San Luis Obispo that specializes in making reclaimed wood. They have a mill on-site and they provide their services to contractors and homeowners alike. Most of their business comes from specialty items like furniture, bar tops, tables, and doorways. Their process consists of taking wood from different places, mostly wineries. They then de-nail and treat the wood by putting it through their mill. Wood from wine barrels is used for its unique appearance, the wine stains create an antique look that consumers are looking for. This yard sells specialty made tables for around 50 dollars per square foot. They sell flooring panels between $5-$8 per square foot.

**Andrew Lino Construction**

Andrew Lino Construction is a contractor that works out of the Carmel area building specialty houses. Andrew’s father was a contractor and a carpenter and Andrew has been in the reclaimed wood business for over 30 years. Their business uses reclaimed lumber quite often, as Andrew has an on-site mill which he uses to turn different types of old wood into products his customers want. He has a standard reclaimed wood set-up, but Andrew is able to use the material more effectively than other contractors. He achieves this by taking old lumber that he takes from one of his construction projects and then mills it down for use elsewhere. For instance, if Andrew is tasked with the remodel of an old building where he has to completely strip the floorboards, he can take that old wood and take it to his shop. From there it is simply a process of de-nailing and running the wood through his mill, which produces a product that can be used on another project. Many different companies specialize in buying old wood from barns or wineries and turning said wood into reclaimed products. Andrew bypasses this step by taking his lumber from construction projects he is already working on. This provides him with a unique opportunity to use reclaimed wood cost-effectively. Seeing Andrew’s mill gives a great idea of what it takes to transform old lumber into the professional looking pieces of wood that decorate homes and businesses.

**Personal Project**

Jeff Banchero has his own woodshop at our home in San Mateo, equipped with equipment that enables him to turn old wood into finished products. By working with him on a few minor projects I was able to get a good estimate of the time and cost it takes to manufacture smaller, personalized items. Jeff is knowledgeable in the construction and woodworking industry and has been taking on projects with reclaimed wood for a number of years. His woodshop consists of a planer and multiple different sanders. The wood he uses for his projects come from various sites including fences, demolition sites, and old wood torn up from his old house.

**Results and Conclusions**

The following information was gathered through a series of interviews and extensive research. By creating categories and different areas where the average contractor can use reclaimed wood more effectively, more people will have an understanding of the advantages and disadvantages behind the material. I decided to approach the different aspects of the process through the lens of someone renovating their house with reclaimed wood. By examining the construction of my own home in San Luis Obispo, I was able to find the best ways to implement reclaimed wood into the existing building. The goal is to provide the best plan for homeowners to follow in order to use a significant amount of reclaimed wood products in their house or business.
Purchasing and acquisition

There are many different places to acquire reclaimed lumber. Purchasing ready-made reclaimed wood that is already milled and ready to be installed is the most expensive option. Different lumber sellers and timber yards will sell the milled wood for approximately $6 per board foot. While this may be the easiest way to acquire the lumber, it is not the cheapest. There are a multitude of different lumber yards who sell their old wood to homeowners or contractors who are interested in repurposing the wood. After visiting a few of these lumber yards it became clear that most places are selling the old wood for a significant profit, considering they get most of it extremely cheap. Wineries, old barns, and shipyards are often very eager to part with excess wood laying around. Therefore, acquiring wood from lumber yards or professional timber salesmen may be counterproductive. If a contractor has the means and ability to cut out this third-party seller it will save lots of money in final construction costs. By talking to different people and visiting old construction sites, it is very easy to get old lumber essentially for free. The Banchero family has been doing this for years, building different kinds of accessories for our house. It is not difficult to reach out to demolition contractors and wood manufacturers who are often more than willing to let someone take old wood off their hands. Whereas an outside lumber salesman will charge marked up prices for essentially the same kind of material. For my hypothetical home renovation, I was able to find plenty of old Douglas Fir wood just by visiting construction sites and places where I knew there were old fences and barns not being used. Hundreds of board feet of lumber can be acquired either for free, or very cheaply. It may be time consuming, but the advantages of searching for old lumber rather are far greater than purchasing the lumber from a supplier.

The Building Process

Once the old wood has been collected it is now a matter of milling the lumber in order to ensure the wood is safe for use. This can be done by a milling professional at a factory or in a personal woodshop. Milling can often be tedious and costly. This is why reclaimed wood is more expensive than ordinary treated wood. Because these pieces of lumber are coming from existing construction projects, they often have to be de-nailed, sanded, and finished. This can be expensive and time consuming, depending on the condition of the existing wood. Andrew Lino was able to provide valuable information on this process. According to Andrew the milling process costs between $1-$2 per board foot. The time length of this process, as well as the cost fluctuate greatly depending on different factors like type of wood, age of wood, and the previous use of the wood. By working straight out of his woodshop he can bypass any overhead charges that would normally be included in the cost of construction.

In San Mateo, we have a woodshop similar to Andrew’s in my garage and I was able to go through the process with different kinds of wood. While time-consuming and frustrating at times, the finished product is perfectly suitable for all kinds of construction. In San Luis Obispo my home has around 1250 square feet of wooden panels that could be replaced with Douglas Fir reclaimed wood. I reached out to different contractors in the city and inquired as to how much it would cost to upgrade my flooring using treated lumber. I found that the cost for new wood flooring in the city varied, but averaged at around $5 per square foot. This puts the cost for just the material of the new wood flooring at $6,250. However, with access to a reclaimed wood mill, like the one Andrew has, the cost of milling this much lumber is equal to about $1,400. This cost may vary, but it is still clearly cost-effective for contractors to mill their own lumber. Many people do not have an on-site mill that can handle all different kinds of wood. The milling process also can take a significant amount of time. From my personal experience a single 10-foot 2X4 can take upwards of 10 minutes before it is finished and ready for installation. This was confirmed by Andrew Lino and the other contractors I talked with. By my estimation this puts the total man-hours at 63 to completely manufacture all the wood needed for my flooring project. Even if we add an extra 15 hours for errors and discrepancy this puts the total time at 78 hours. Paying a woodworker 20 dollars an hour would result in a manufacturing cost of 1560. This brings the total cost to $2,960. Clearly this is much cheaper than the original estimate of the cost of flooring material. If I stick to the guidelines that I outlined for acquiring the wood, my overall cost of the project is much lower than the alternative of hiring a contractor. As long as there is a supply of free timber the construction costs of building a wood floor out of reclaimed wood can be just as cheap or cheaper than using new wood.
Reclaimed wood is rarely used as a cost-effective way to build homes. Many people simply do not have the time to research and visit the best spots to find the old timber. In addition, many contractors do not own their own mill and do not have time to process over 1000 board feet of lumber. This is why the majority of reclaimed lumber products are specialty items, built for specific purposes. Any amount of excess wood on a project would be better off being reused than sitting in a landfill. Specialty items like dartboards, cutting boards, bar tops, and cabinetry can all be built for relatively cheap. Jeff Banchero has built a number of these items, and his production costs are constrained to the price of varnish and nails. Below are a few of the items he has made, items that could be sold for a very high profit considering the minimal costs of construction. These items can be produced by an individual contractor or a team of hired carpenters, and the profit created from these items can bring down the overall cost of construction on the furnishing of a home or business.

From my research, I have learned that recycled wood could be the key to sustaining our built environment efficiently. Eventually construction could be a much more environmentally friendly industry, centered around reusable materials and sustainable building practices. In the present-day construction climate, few contractors are thinking about using reclaimed wood for large-scale timber projects. However, I believe that with the decreasing timber supply and the increasing demand for construction more and more companies are going to focus their resources into reusable building materials. The future of construction will be defined by reusable building materials and green building techniques, and I believe reclaimed wood will play a major role in the coming changes to the construction industry.
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