Rod Beaton
ENVS 664 F08
Project: Green Products

Green Products:
Engineered Wood Products vs Natural Wood

Overview

For nearly as long as man has been building shelters, wood has been used as a building material. It is strong, easy to find and harvest, easy to shape, and can be used for a multitude of purposes, including structure, finishing, furniture and utensils. Being natural, wood is also an environmentally friendly building material; when the structure is eventually abandoned, the wood will rot and be reclaimed by the landscape.

For most of human history, wood has also been an essentially unlimited resource in many places. Its abundance made it a low-cost resource, which contributed to its widespread use in the building industry. In recent decades, however, it has become clear that wood is not the unlimited resource that it once appeared to be. Concerns about availability, deforestation, destruction of wildlife habitat and climate change have all contributed to a search for ways to better use the resources that we have available. This concern has lead to a new interest in the field engineered wood products.

Engineered wood products have been around for many years. Fiberboards such as Masonite and Homasote were invented in the early 1900s. Plywood has been used in various forms for thousands of years. Other materials, such as Medium Density Fiberboard (MDF), Oriented Strand Board (OSB), and I-joists have only been around since the latter half of the 20th century. These materials are all made of small pieces of wood, usually either thin veneers or ground or chipped pieces of lumber. Because of this, they can reduce the need for large timbers and take advantage of smaller trees and leftover pieces of wood that are too small to cut unto usable lumber (although these pieces would likely otherwise be used for wood chips or pulp for paper).

Although engineered wood products can often be stronger than natural wood and can use less material, they are generally held together with some sort of glue, or binder

(Masonite being an exception to this). This binder often contains chemicals that can cause a variety of health issues. Formaldehyde, for instance, is a compound that is found in many binders and is known to cause respiratory problems along with being a possible carcinogen. Various binders exist, some of which are more prone to off-gassing in the final product, others of which are more dangerous in the factory during production. In this paper I will look primarily at the costs and benefits of both natural and engineered wood products to try to determine if one is a better choice from an environmental standpoint.

Natural Wood

In order to determine the environmental impact of using natural wood for building, we must first look at where the wood comes from. Large timbers that are sourced from an old growth forest that harbors endangered species obviously have more of an impact than wood that is salvaged from the demolition of an old building. In terms of sustainability, wood can be separated into three general source categories: reused wood (salvaged, reclaimed, recycled, or otherwise reused), sustainably harvested virgin timber, and non-sustainably harvested virgin timber.

Reused or reclaimed wood can come from a variety of sources. If an old barn or factory building is being demolished, many large timbers can likely be salvaged. If a house is being torn down, it is likely that at least some of the structural lumber can be reused. Obtaining this wood is generally more time consuming (and thus more expensive) than cutting new trees, as the wood needs to be manually removed from the old structure without damaging it. Given the time and money, however, it can be a worthwhile experience. Old wood often has a historic feel to it, both in appearance and in the knowledge of its former use. This is also the most sustainable use of wood, as no additional trees need to be cut, and the wood likely would otherwise be sent to a landfill. Reclaimed wood can also be found in river bottoms, a legacy of the days of floating logs down the river from forest to sawmill. As with reclaiming lumber from a demolition site, reclaiming logs from a river is a time consuming and expensive process. Also similar, however, are the rewards: quality wood with a history, and no new trees cut.

Sustainably harvested virgin timber comes from forests that are managed with both the long term forest health in mind, and with respect to the people who live in and around the forest. Groups such as the Forest Stewardship Council (FSC) certify wood and wood products that are produced in such forests. Although new trees are being cut, FSC certification indicates that they are being cut in a way that is not detrimental to the long term health of the forest and those who depend on it. Sourcing lumber from a local sawmill is also a way to learn about the harvesting methods of your wood. It is likely that the owner of a small mill will know how and where his trees were harvested and can provide the information that is needed to make an informed decision.

Unsustainably harvested wood is exactly what it appears to be: wood that is harvested with little or no concern for the health of the forest or the rights and needs of those who depend on it. This could include clear-cutting, harvesting in the habitat of threatened or endangered species, harvesting illegally on land that is not owned by those who are involved, or cutting with disregard for those who live in and around the forest and depend on it for their livelihood. Unfortunately, much of the wood that is used today is harvested in this manner, and without the certification of a third party such as the FSC or direct knowledge of the source of the wood, it is often difficult or impossible to tell where lumber has originated and under what conditions it was harvested.

Engineered Wood

Like natural wood, engineered wood has many varieties as well. All engineered wood is composed of smaller pieces of wood pressed and bound together in some way. As described above, these glues, or binders range from non-toxic (masonite, which actually uses no binder) to highly toxic (methyl diisocyanate, or MDI in Medium Density Fiberboard). In the middle can be found UF and PF, or urea formaldehyde and phenol formaldehyde.

There are pros and cons to these various forms of binders. UF binders are often used for interior work, as they are pleasing in appearance and low in cost. Unfortunately they are very active in off-gassing of formaldehyde after they have been installed. MDI binders, on the other hand, off-gas very little once they have been installed but are

considered toxic during the manufacturing process and could prove to be harmful to workers in the factories that produce products using MDI.

Aside from concerns with the binders, however, engineered wood products are in many ways a good alternative to natural wood. Glulam beams (which, as their name implies, are beams composed of smaller pieces of wood that are glued together) can be used for long spans that would normally require a single large timber. Similarly, I-joists are manufactured beams consisting of long pieces of Oriented Strand Board (usually about 1 foot tall) mounted vertically between two small pieces of wood (forming an I shape). These can take the place of long natural wood joists, such as 2x10s. I-joists and OSB sub-floors are now used frequently for flooring solutions. As all of these products are made by combining small pieces of wood into large and strong wood products, they reduce the demand for large timbers, and thus reduce the pressure that our appetite for building is placing on our world's forests.

Improved Binders

As the negative impact of the binders is the main environmental drawback of engineered wood products, a binder that does not have harmful side effects would be a valuable find. Kaichang Li, at Oregon State University has been working on developing non-formaldehyde binders made to mimic the adhesives that mussels use to bind themselves to plants. Soy based binders that have resulted from his work are now being used in production, including in the PureBond line of hardwood plywood that is manufactured by the Columbia Forest Products company. The PureBond line also features FSC certified wood for its veneers. While these binders have yet to make a large mark on the industry, they are certainly a good beginning, and an option to those who are concerned with the effects of off-gassing formaldehyde.

Conclusions

As with many product comparisons, there is no clear winner in this case. While engineered wood products can take significant pressure off of our forests, they can also release harmful gasses into our homes. Whereas natural wood products can be simply returned to the environment after they have fulfilled their use for us, they are a limited

resources. Engineered products contain chemicals that may need to be treated in some manner before disposal and are often made in part with petrochemicals, which ultimately are also a non-renewable resource.

In addition to the environmental perspective, however, one must also look at the economical perspective. Currently, most non-formaldehyde products tend to be more expensive than their formaldehyde-based counterparts. Similarly, lumber milled from reclaimed logs will generally be significantly more expensive than that which is milled from a clear-cut forest. In this case, however, the economic differences can be brought much closer if comparisons are made across similar levels of sustainability, rather than between the environmentally preferable and non-preferable versions of the same product. Said differently, plywood products produced with a soy-based binder may be more expensive than standard lumber, but FSC certified lumber may cost more than standard UF-based plywood. By basing the comparison across similar levels of sustainability, we can effectively ignore the differences in cost.

Ultimately, the decision of which type of material to use must be made based on the individual situation. In the case of OSB made with a PF binder that will likely be mounted on the outside of a building, the engineered product is likely a safe and useful choice. In the case long structural joists, I-joists maybe be a more environmentally friendly alternative than 2x10s, however one may want to look for a product that is made with an MDI binder to reduce the amount of off-gassing that will occur in an enclosed space, such as a basement. In the case of kitchen cabinets that will be in a primary living area, natural wood may be the best choice, as only smaller dimension lumber will be needed and the risk of off-gassing from engineered products would be high.

If non-toxic binders gain more widespread use in the engineered wood industry, then they will likely gain a clear environmental advantage. Until that happens, however, there is a strong case to be made for both natural and engineered products, and the decision must be made on a case by case basis as to which is best for a given situation.

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