You Can't See the Forest Through the Trees

When European Pioneers came to the vast country called North America they left a European Continent that's resources had been under siege for close to 2,000 years. The great cities that had been built such as Rome, Paris and London had taken their toll on the virgin timberlands of even Europe. However the Europeans in their wisdom recognized that trees in many cases were a crop like product that could be reproduced over a long period of time.

The concept called forestry was created to convert Mother Nature's resources into love. When the early pioneers looked out across the vastness of this country it was very simple for them to realize that their depths of natural resources that were available to begin to build our initial cities were gargantuan. And of course they approached the job with a great deal of vigor.

In about one third of the time that it took to really colonize most of Europe, i.e. about 300 years America's forests were converted from tall timber into tall buildings. All one has to do is go visit the core areas of most of our cities that were built in the 1700-1800's to realize that construction based on wood industry was hugely successful. However there was a price to pay.

Unless of course land had been replanted and is managed, it is possible that the resource of wood lumber may not be so obtainable. The fact is that is exactly what occurred. There is a forestry industry in the United States whose sole job it is to replace the natural resources that existed for our pioneer forefathers.

The dilemma is that those original forests contained very large trees. The period of time it takes to recreate those trees is a lot longer than the life span of those in society that wish to employ wood products in the design and construction of contemporary buildings.

Why am I telling you this story? Well it is because many of the things that we have taken for granted in the world of building construction has been transformed as a result of that phenomenon. I will put it to you in the most straightforward fashion as possible. When you look at the building code classification entitled heavy timber, we need to understand that it was created back when there was a lot of timber that could be cut into dimensions that made it very heavy. That may or may not be the case today.

In the context of this article I will not even attempt to explain or to defend the environmentalist approach or the timber industries approach as to why we are where we are today. What I would like to focus on is the reality that the type of resource that is available for timber construction today is drastically different from what it was fifty years ago. As a net result industry and society are seeking alternative solutions that we in the fire service must be aware of.

And it may require a new vocabulary and a new perspective by those of us who are in the firefighting business. What I am referring to is the increasing phenomenon of engineered wood products. An engineered wood product is literally the opposite of dimensional lumber. If you take a tree and cut it into a bunch of 4 x 4's or 2 x 10's then Mother Nature did the engineering and all we did was cut out the stick and place it in the lumberyard. However, if you take that same tree and completely take it apart and put it back together using modern technology then it becomes an engineered wood product.

This definition is very essential in understanding what is going on in the industry. Engineered wood products are innovations in response to a change in the resource base for lumber. If you took a look at the types of logs that were taken out of our timberlands before the turn of the century it is not uncommon to see that they possessed huge diameters. Even as the process went on to reduce the size of the giants from the virgin forests the actual size of one diameter was probably easily up in the area of 18-24 inches at the turn of the century. That log diameter has now shrunk to the fact that it is possible that many of the engineered wood products are made from species that are less than twelve inches and in some cases smaller than six inches in diameter.

The good news is that it can be done. In fact, if engineered wood products were not available we would probably be experiencing a totally different level of quality of life. The bad news is that the fire service understands very little about these products and tends to deal with them in the same fashion that we dealt with dimensional lumber over the last fifty years. Simply stated that cannot be continued as engineered wood products move into the future.

In a sense we are dealing with fire service expectations. The fire community has already faced a set of fires in which engineered wood products have been involved and the outcomes have been different than they had in previous events. It is not that the outcomes were unpredictable but rather that they were unanticipated.

It is probably a good idea to fit all this into context. If we go back as far as 30 years ago and look at the types of products that would fall into the realm of engineered wood products there were very few. One way of illustrating this is to look at the number of alternative wood products that had gone through the evaluation services of the building code organization to be approved. Back in the early 70's there were less than ten products per year that had been submitted for approval. In the year 2005 it could be as high as 75. In the good old days of looking at dimensional lumber 2 x 4 remained 2 x 4 forever. But today in order to provide response to the changing resource base and a constantly evolving economic base no more innovation is occurring in creating products that the fire service is unfamiliar with.

One of the first steps the fire service needs to take in coping with this shifting technology is to become more familiar with the terminology and the process. This article is intended as a primer on some of

those basic concepts but will in no way provide in-depth knowledge of how engineered wood products find their way into residences and businesses in your community. The intent of this article is to merely provide a starting point to establish a knowledge base for fire officers to understand how these changes may affect firefighting operations in the future.

First and foremost we should look at the concept of how a log is turned into a piece of lumber. If you went to a log deck where these products are assembled after being removed from the forest you would find a wide variety of sizes and shapes. If you can visualize running that log through a sawmill it is in the process of converting a cylindrical object into a square one for the most part. As a result there is a considerable amount of waste. As that waste is also fiber in the old days it was somewhat of a problem to be disposed of. And with increasing environmental concerns the lumber industry has been attempting to seek ways of reducing that waste for a long time.

Among the very first concepts to find its way into the hardware store was the idea of creating plywood. Plywood consisted of turning the log sideways and peeling of the various layers as a form of a veneer. The manufacturing of the plywood essentially was nothing more than taking various sheets of this thin veneer and reorienting the grains in such a way that they mutually reinforce one another. Adhesives heat and pressure where then used to create a product that had a shape such as a plywood panel.

We have been seeing plywood on the fire ground for decades and have not necessarily felt that it was all that unusual. But, in fact, plywood was the first step of the development of products in which the tree was being disassembled and the reassembled under a specific set of conditions providing additional products.

There is a problem with peeling of the various layers as you cut the veneer from a tree. Not unlike the idea of unrolling a roll of kitchen hand towels there is a point in time in which you have a core that cannot be made any smaller. As a result there is an improvement in the use of the product ranging from about a 10% improvement but there is still about a 50% waste factor even in the use of the development of wood materials used to make plywood.

A third step in this innovation process was to take into consideration how you can make a wood product by reducing the fiber in the tree to very small wafers of wooden fibers which could then be treated somewhat like plywood with adhesives and other techniques to create another product. These products are also unique in that they could be remolded in the manner in innovating dimensional lumber. In other words, if fibers are relatively short in length and can be put under a sufficient amount of pressure to conform to a particular size or shape one can create a 2 x 4 a 4 x 8 or a 12 x 12 using these types of fibers.

In the scenarios I just described the lumber industry is able to increase the percentage of a given tree that is converted from raw material into a finished product. That effect is to reduce the amount of waste going back into the environment as well as improving the utilization of the resource for its intended purpose, i.e. building construction.

Before we leave this topic it is also interesting to note that the concept of creating layers of wood materials, i.e. the plywood approach and the new strand approach has resulted in a wide range of products that were very foreign to the average firefighter. Among these is a concept of a laminated beam that is designed to emulate dimensional lumber. The generic term for these in most vocabularies is "glu - lam". However, the actual proprietary names for these products are very extensive. In the case of an acronym creation gone wild there are a wide variety of products that fall into this category. The table listed below (place table) is a listing of some of the products that are already approved. It should be noted however, that this list of products might well be obsolete within six months. Moreover, within five years, it may be rendered totally useless. The numbers of products that are being generated out of this type of technology are innumerable.

Innovation is an ongoing process and the fire service must monitor this extensively or lose sight of the change.

Another side of this discussion that would be interesting if you could observe it is the difference between a sawmill and the production of these products. I think most of us have in our minds eye that when a log goes to a sawmill there are large whirling blades that convert round logs into square lumber. The accumulation of such things as bark and sawdust, which we normally associate with a sawmill, may be nonexistent in the new types of mechanical processes used to create engineered wood products.

In effect many of these machines are more like plastic Extruded devices than they are like sawmills. Utilizing a combination of pressure and adhesives they force various materials into molds at very high rates of speed.

The capital investment to create this kind of technology is probably on the nature of four to six times greater than what it would cost to build contemporary sawmills. Interestingly enough the old fashioned sawmills that were disassembled and replaced by this technology were actually sent off shore into other foreign countries that are still experiencing the existence of natural resources that they can convert into saw lumber.

Strength versus other attributes.

One of the questions that are often raised at looking at engineered wood products is that of strength. Basically individuals look at a product that has been fabricated out of a bunch of small parts and wonder

if it is as strong as a regular old piece of wood. The answer can best be found in understanding a couple of basic concepts about a piece of wood. When dimensional lumber is cut from a log, it is as is. That is to say that if there are knots and/or characteristics that induce warping, sawing the lumber in essence doesn't really prevent that from being mitigated. For any given dimension of lumber it is expected that that lumber have to be graded to determine how strong it is. The concept of grading lumber is not unlike that of grading any product. It creates a bell curve of very strong, very weak and then a period of distribution through the center in which average wood loads could be applied to that piece of lumber.

The concept of grading lumber initially was done visually, i.e. an inspector stood there and looked at a piece of lumber that went by and it was given some class or attribute based upon its physical appearance. Today there are actual machines that have the ability to take a dimensional lumber and determine exactly what its rate of strength is. This is referred to as machine graded lumber (MGL).

If we go back to the concept of strength then it would make sense that a very good piece of machine rated lumber is probably going to be as strong as one could expect for any given dimension. With relationship to other forms of products created out of adhesive and pressure bonding the net result is the distribution of flaws within the product that makes the assembly stronger than the components. Given that the flakes that are put into a oriented strand board (OSB) are now distributed throughout the entire piece instead of being present as a weak point it is natural to expect that that board may have a stronger rating. It doesn't necessarily mean that it is the strongest but it raises the point on the average curve in which most of these pieces would be measured.

One of the best ways that you can learn about these new products is to take a field trip to the Home Depot or a local hardware store and just see what options are currently available. A secondary means of observing how these new products are being used is to take a trip to a housing track that is under construction prior to it being wrapped and stuccoed. In almost all cases you are going to see products that have been engineered to serve. It is in our best interest to know everything possible about how that product has come into existence and what we can expect when we see it in the field.