McGraw Hill CONSTRUCTION Continuing Education

Materials Matter

Measuring the environmental footprint of wood, concrete and steel is a big factor in designing sustainable buildings.

March 2011

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According to the U.S. Department of Energy, buildings account for 38 percent of total U.S. energy consumption and 38 percent of U.S. carbon dioxide (CO2) emissions-statistics that have prompted the architecture and construction industries to search for ways to lower the environmental footprint of tomorrow's structures. The search is particularly pressing in view of the projection that the commercial building sector carbon dioxide emissions will grow faster than any other sector, averaging 1.8 percent a year through 2030. A complex problem, to be sure, but one with a relatively straightforward answer-stop burning fossil fuels, which emit the greenhouse gases (GHG) that fuel global warming. Reducing GHG emissions involves selecting materials with low embodied energy and emissions and high recyclability. But against a backdrop of competing claims it can be difficult to determine which materials truly stand out in these areas.

In terms of green building materials, wood remains a top choice. International scientific studies have shown time and again that using wood products from sustainably managed forests rather than non-wood building products, results in a reduction of GHG emissions. This article will address through research and facts, the overt differences between three common building materials-wood, steel and concrete-in terms of their environmental footprint at several stages of the life cycle process, including raw resource extraction, manufacturing, and transportation. The materials will also be discussed in terms of responsible procurement, sustainability and community issues.

Continuing Education

Use the following learning objectives to focus your study while reading this month's Continuing Education article.

Learning Objectives - After reading this article, you will be able to:

1. Discuss the life cycle costs of wood, concrete and steel
2. Explain recyclability vs. renewability for each material
3. Describe responsible procurement
4. Explain the advances each industry is making toward sustainability

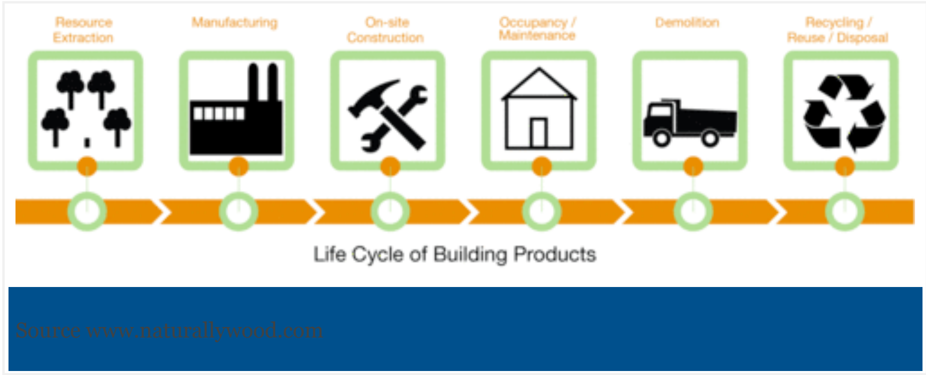
Vancouver Convention Centre, Media Centre for the Vancouver 2010 Olympics, Vancouver, British Columbia

In terms of green building materials, wood remains the top choice.

Photo courtesy of www.naturallywood.com

Life Cycle Assessment: A Scientific Way to Calculate Environmental Impacts

One approach to determining the environmental impacts of various building materials is Life Cycle Assessment (LCA), an internationally recognized decision making tool that acknowledges the fact that all phases of a product's life, from cradle to grave, have a quantifiable impact on the environment. Based on standards by the International Organization for Standardization (ISO) and based on science rather than assumptions, LCA assesses those impacts from the time materials are extracted through manufacture, transportation, storage, use, recovery, reuse and disposal. LCA, which can be done at the product level, the assembly level, and the whole building level, is gaining widespread acceptance as an impartial comparison of materials based on their potential to add to global warming.



Source www.naturallywood.com

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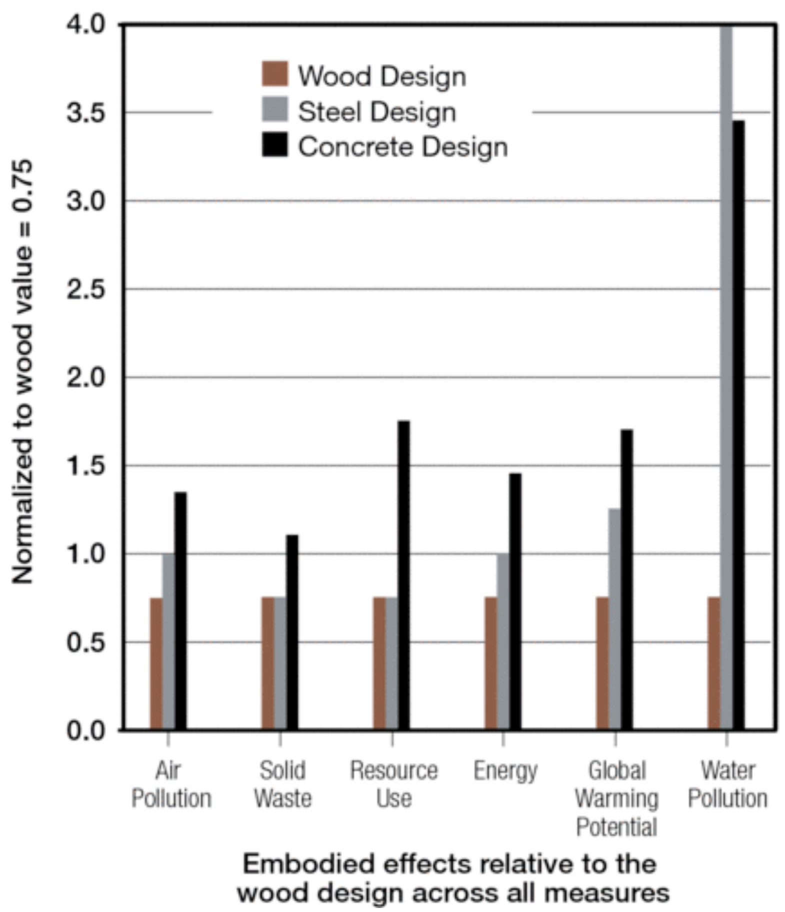
"There's been a tendency to look for simple answers to very complex questions. There is no perfect material, so we need to understand tradeoffs in terms of real environmental effects," says Wayne Trusty, President of the Athena Institute, a non-profit organization that seeks to improve the sustainability of the built environment by meeting the building community's need for better information and tools. "One simple answer is that, by definition, something that is agricultural or grown rapidly is better. But if we don't consider the fertilizer, pesticides, and water that's used, and the energy required to grow, process, and move these products, then we're only getting a little piece of the answer."

Trusty says it's critical to move toward answers that truly reflect environmental effects. "Life cycle assessment gets us to take as holistic a view of these products as we possibly can, and understand the full set of impacts," he says. "Sometimes the rapid renewable is going to come out looking OK, but lots of times it won't. Often it will turn out that a longer-rotation wood product or a different material altogether is going to come out looking good. But we have to take everything into account."

In several studies, the life cycle assessment of wood has been shown to have a better overall environmental impact than either steel or concrete, with wood showing the least impact on energy, climate and air pollution. In New Zealand, an LCA conducted by research institute Scion shows that a wood-predominant house has the lowest environmental impact option. LCAs by the Canadian Wood Council and by the Consortium for Research on Renewable Industrial Materials (CORRIM) in the U.S. also found wood to have the lowest environmental impact compared to concrete and steel, with the CORRIM study finding that the global warming potential of the steel-frame home was 26 percent higher than the wood-frame home, and 31 percent higher for the concrete-frame home than the wood frame house. In a Swedish study, researchers compared CO_2 emissions from the construction of a multi-story building with a timber and a concrete frame, from a life cycle and forest land use perspective. The primary energy input, predominantly fossil fuels, in the production of materials was found to be up to 80 percent higher in the concrete frames.



Source: Data compiled by FPInnovations using the ATHENA EcoCalculator with a data set for Vancouver, B.C., Canada

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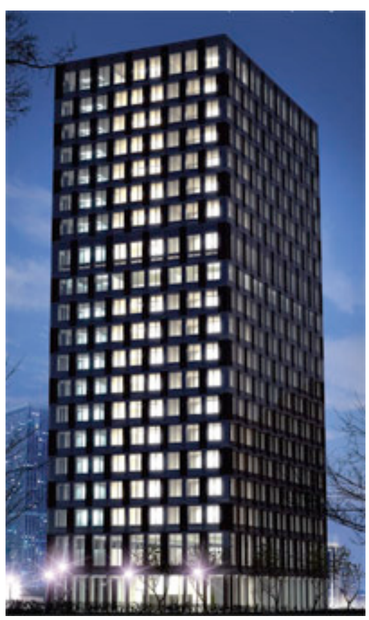
Because calculating life cycle impacts is complex and time consuming, tools exist to help architects judge the environmental merits of various materials. Online resources like the ATHENA® EcoCalculator for Assemblies, which provides LCA data on hundreds of common building assemblies, and the carbon calculator from Build Carbon Neutral are giving architects another tool to assess the sustainability of their building plans. By entering specific parameters, these resources can estimate the energy required to build the structure in question.



The 30-story LifeCycle Tower to be built in Dornbirn, Austria features a hybrid construction system based on wood.

Photo courtesy of www.creebyrhomberg.com

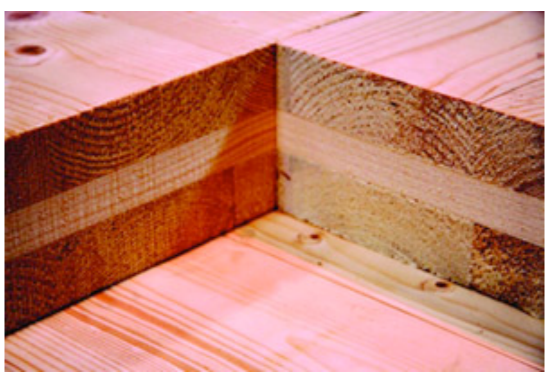
Calculations of LCA impacts have shown clear environmental advantages for timber, because of its low embodied energy, and because its carbon storage properties actually give wood a positive environmental impact. As Peter Busby, Managing Director of Busby Perkins+Will, likes to put it, "Wood is a renewable building material made by the sun. Trees are a major vehicle on the globe to reduce carbon," he says. "They're our ally in keeping the biosphere healthy."

Michael Green, MAIBC, AIA, MRAIC, Principal in mgb in Vancouver, British Columbia, Canada, believes that "All materials have their place, and no material is an all-out winner." But for Green, the overriding issue is carbon. "More than five percent of the carbon we put into the atmosphere comes from concrete. Steel, too, has a heavy environmental impact. As architects we have to ask ourselves: is there a material that minimizes or eliminates carbon in the environment? While some of the actual numbers in these analyses may be arguable, what's not in doubt is that wood stores carbon, and that it's our only carbon-neutral structural option."

As it turns out, architects are asking themselves that question. The CREE (Creative Renewable Energy and Efficiency) Group is designing a low-carbon 30-story mixed-use facility to be built in Dornbirn, Austria, with a hybrid construction system based primarily on wood. There will be a reinforced concrete basement, first and second floor; composite wood/concrete slab from the second floor upwards; and façade columns using wood. CREE claims that, compared to conventional construction, the aptly named LifeCycle Tower will require less than half the time to build and see a 90 percent reduction in carbon emissions. Busby, who calls the tower "amazing," says, "The technology to use wood in taller buildings is there. British Columbia has recently relaxed its codes to allow six-story wood buildings. As we see more changes in this direction, we'll see taller buildings in wood."

Moving Ahead

As the movement to carbon-neutral buildings takes hold, makers of building materials are well aware of the need to improve the environmental footprint of their products. Both the steel and concrete industries are working to improve the efficiency of manufacturing and construction processes as well as the environmental and structural properties of their products. According to the World Steel Association, in the last 30 years the steel industry has reduced its energy consumption per ton of steel produced by 50 percent. However, the association says that there is now likely only room for marginal further improvement on the basis of existing technology. Further environmental gains will come through breakthrough steelmaking technologies, next-generation steels in lighter and stronger products as well as recycling and the use of byproducts to power steel mills or other types of factories.



Cross-laminated timber will provide increased opportunity to use wood in commercial structures.

Photo courtesy of FPInnovations

In terms of concrete, new research out of the Massachusetts Institute of Technology indicates that Insulated Concrete Form (ICF) homes have been shown to provide 20 percent energy savings in the form of reduced heating, cooling and ventilation needs as compared to conventional wood-framed construction. The findings also note, "There are measurable differences between alternative construction systems, and that the thermal mass of concrete can provide energy savings over a life cycle of 75 years." While ICF technology has been around for some 50 years, only recently has there been a significant increase in ICF structures in cost-sensitive commercial, industrial and multi-family markets.

Technical innovations in wood, too, involve increased potential in the commercial sector. Architect Michael Green is part of the emerging movement to consider wood as a building material for larger, taller commercial structures. His firm won the 2009 Royal Architecture Institute of Canada's award for the Prince George Airport in British Columbia, a Douglas-fir glulam structure with a generous use of wood in both interior and exterior applications. But the real rationale for expanded use of wood: next generation wood structural systems like cross-laminated timber

(CLT) and large format panel products that have gained wide acceptance in Europe. CLTs are multi-layer panels in which layers of dimensional lumber are placed crosswise and glued under high pressure to create a stable, rigid component that can be used in all assemblies and for long spans. CLTs have been successfully deployed in European mid-rise buildings, both commercial and non-commercial.

Green sees new structural opportunities for wood beginning to mushroom, much like they did more than a century ago with the advent of steel. "We're looking at radically new systems made of wood that make sense from a carbon, sustainability and forestry standpoint and that are realistic competitors to steel and concrete," says Green, noting that his firm is currently tapping next generation wood products in a design study for a new 20-story residential tower for Vancouver. "We have to start pushing on the ceilings that stifle innovation. Design studies like this are important to show the science and engineering behind the next generation of buildings. It's the beginning of a systemic change towards truly sustainable structures."

Wood, Concrete and Steel: The Raw Materials

In understanding the carbon footprint of the various materials, it is useful to know how they are made. Wood, concrete and steel are end products, processed from various natural resources.

Wood is harvested by one of several silvicultural systems, based on the ecology of the site. The harvesting of forests conducted according to the principles of sustainable forest management, including their use as a source of wood products and biofuels, allows the greatest potential for reducing net carbon emissions. According to the Canadian Council of Forest Ministers, sustainable forest management is management that maintains and enhances the long-term health of forest ecosystems for the benefit of all living things while providing environmental, economic, social and cultural opportunities for present and future generations.

The embodied energy in wood is relatively low compared to concrete and steel, which rely on substances that must be mined and heated by fossil fuels to extremely high temperatures. Concrete is a composite construction material that is highly durable, low maintenance, and can be easily adjusted to meet various strength requirements. It is versatile in that it can create structures of any size and shape, and energy efficient in that it can reduce heating costs in winter and has a high rate of solar reflectance that reduces reliance on air conditioning.

Typically, a concrete mix is about 10 to 15 percent cement, 60 to 75 percent aggregate and 15 to 20 percent water, though proportions often change with the required strength and flexibility. While most of concrete's ingredients are manufactured products themselves or mined materials, it's the cement in concrete that has the highest embodied energy. The major ingredient needed for cement is limestone, which is found in abundance worldwide. In most cases, limestone is blasted from surface mines and removed in large blocks to a crusher, mixed with other raw materials and transferred to a rotating furnace and heated to about 2,700 degrees F, powered by coal or natural gas, in order for the materials to coalesce. The mixture is cooled and ground to fine gray powder (cement), which is then transported to its destination by truck, rail or ship. Sometimes, fly ash, a byproduct of coal burning plants can be substituted for a percentage of the cement, as can volcanic ash or magnesium oxide that is mined or processed from seawater, with substantial reductions in carbon footprint.

Steel is an alloy consisting mainly of iron and has a carbon content between 0.2 percent and 2.1 percent by weight, depending on grade. A durable, architecturally versatile material, steel is energy efficient, quick to construct and has a high strength-to-weight ratio and long-term cost effectiveness.

The process of manufacturing steel, however, is extremely energy intensive and consists of a number of procedures. Steel's main ingredient is iron ore, which must be extracted through open pit mining, and heated to extremely high temperatures via fossil fuels-two processes that take a toll on the environment. In surface mines, ground is removed from large areas to expose the ore. Ore is then crushed, sorted and removed by train or ship to the blast furnace where the iron is heated to 3,000 degrees F, usually with charcoal or coke, and charged with the ore and limestone. The molten iron then drains off and iron cubes are formed-this pig iron, as it's called, is the basis for steel.

For both concrete and steel, there are adverse environmental consequences from open pit mining, as well as from the significant fossil fuels expended and emissions generated in processing the raw materials-but both industries have made strides in lightening their environmental footprint.

Some minerals are extracted via surface mining.

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Mining, particularly open pit mining, is harsh on the environment. According to the Portland Cement Association, "Quarries invariably have an environmental impact on the surrounding environment since they require removal of the soil and vegetation." However, careful practices during operations minimize the impact, as does restoration of the sites to beneficial use. Sand, gravel, and crushed stone are typically mined in close proximity to their use, which gives quarry operators a strong incentive to be environmentally responsible and to maintain good relationships with the host community. Often, quarries are reclaimed for development, agriculture, or recreational uses.

The Association maintains that, since 1972, the cement industry has reduced the energy it takes to make a ton of cement by over 37 percent, along with associated combustion emissions. At current production levels, the savings are enough to power 2.3 million homes for a year. In 1990, U.S. cement manufacturers set performance improvement goals-among them, a means for continuous improvement through Environmental Management Systems that track, report and improve environmental performance. Specific goals per unit of production were set for 2020 and include reducing carbon dioxide by 10 percent, energy use by 20 percent, and cement kiln dust by 60 percent. The Association reports that the industry is likely to hit carbon reduction targets ahead of schedule.

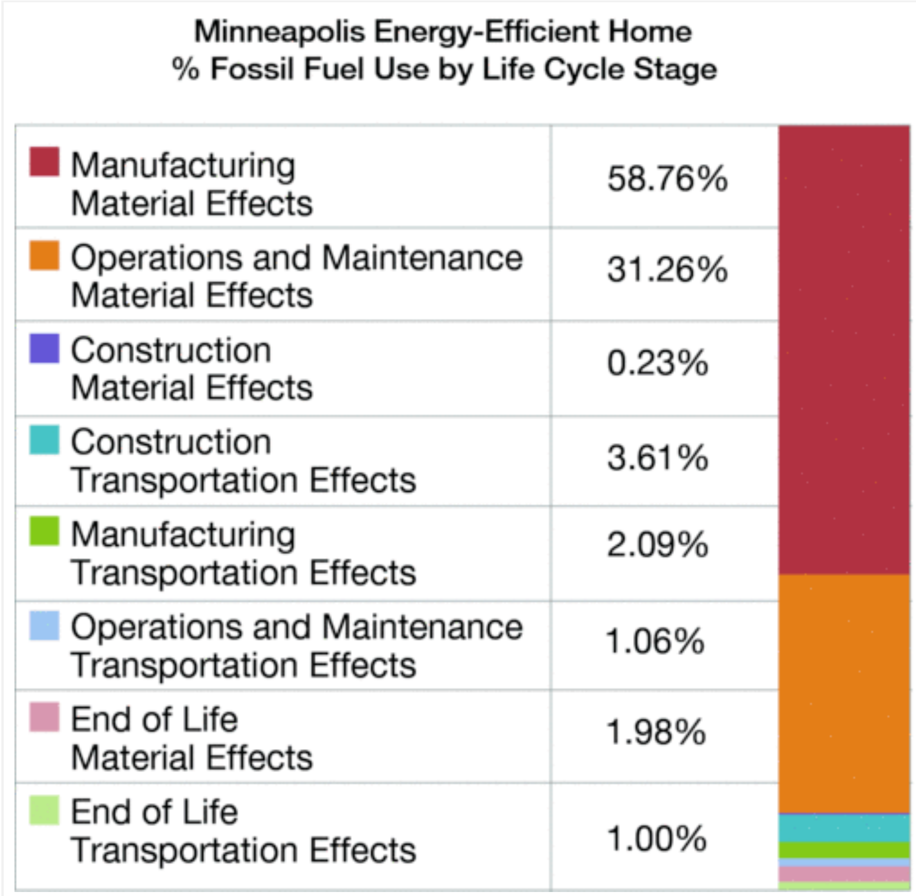
For its part, the steel industry has exceeded Kyoto accords for energy efficiency improvement by more than 240 percent and made sizeable reductions in GHG emissions. According to the American Iron and Steel Institute, the industry has reduced its energy consumption by 33 percent since 1990. Coal figures heavily in energy consumption, but as steel scrap is increasingly used to make new steel, natural resources are being conserved and energy consumption reduced, with manufacturers reducing annual energy consumption by an amount that would power 20 million households for one year. Between 2002 and 2003, the U.S. steel industry reduced its energy consumption per ton of steel shipped by approximately 7 percent, with the industry's overall carbon dioxide emissions per ton of steel shipped reduced by a comparable percentage. Nearly all hazardous waste previously generated by the steel industry is being recycled or recovered.

In terms of chemical material disposal, the Institute reports that via the U.S. EPA's Toxics Release Inventory (TRI), of the 636 million pounds of chemicals generated in U.S. steel production, more than 62 percent was managed through treatment, energy recovery or recycling. Of the remaining 38 percent of chemicals, 96 percent were properly disposed of and the remaining 4 percent was released into the air and water within allowable ranges. Internationally, the steel industry has established the COâ„ Breakthrough Program to fund the development of new steelmaking technologies that do not emit carbon dioxide and research into technologies that capture and sequester carbon dioxide.

Manufacturing

The manufacturing of materials requires the greatest amount of energy in the entire construction process. In comparing the three materials, wood uses less energy to process than steel and concrete.

A mill for producing lumber is relatively straightforward. Bark is removed, logs are sawn, trimmed to produce smooth, parallel edges, cut to square and precise lengths, dried, and then planed, grade-stamped and packaged.



Source: ATHENA® Impact Estimator for Buildings, version 4. 1.13. ATHENA is a registered trademark of the Athena Sustainable Materials Institute, www.athenaSMI.org

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The lumber industry has set its sights on getting the most out of every tree it uses. Industry in British Columbia is taking the lead, converting more than 90 percent of every harvested log to valuable products with minimal waste. The statistic is attributable to state-of-the-art sawmilling that maximizes the quality and quantity of boards that can be cut from a tree, combined with further processing fiber that is unsuitable for lumber production into composite products such as OSB or fiber boards and paper. As well, wood waste such as renewable organic materials like bark, sawdust, shavings, and other wood residuals can be used to generate electrical and thermal energy. Because its thermal energy requirements outweigh its electricity demand, the provincial forest industry is well positioned for substantial cogeneration opportunities with many forest products companies exploring that and other bio-energy opportunities to further maximize all fiber from the log.

Carbon Emitted in Manufacture

Material	Total Process Emissions (tons CE/ton of product)1/2/	Total Process Emissions Including Carbon Storage Within Material (tons CE/ton)3/
Framing lumber	0.033	-0.457
Concrete	0.034*	0.034
Concrete block	0.038*	0.038
Medium density fiberboard (virgin fiber)	0.088	-0.402
Brick	0.088	0.088
Glass	0.154	0.154
Recycled steel (100% from scrap)	0.220	0.220
Cement (Portland, masonry)	0.265	0.265
Recycled aluminum (100% recycled content)	0.309	0.309
Steel (virgin)	0.694	0.694
Molded Plastic	2.502	1.500
Aluminum (virgin)	4.529	4.529

1/ Values are based on life cycle assessment and include gathering and processing of raw materials, primary and secondary processing, and transportation.

2/ Source: Adapted from USEPA (2006), Exhibit 2-3. *Data for concrete from Flower and Sanjayan (2007); 10% increase in energy consumption assumed for production of concrete block.

3/Carbon content of 49% of moisture free weight assumed for wood.

Source: Dovetail Partners Inc

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Producing concrete requires mixing the cement, which has already been manufactured, with the mined aggregates. With the addition of water, the mixture starts to set. During this reaction, called hydration, the paste hardens to form concrete. Ready-mixed concrete is by far the most common form of concrete, accounting for up to 75 percent of the material made today. This is concrete that is "batched" from a central plant. Each batch is customized to the requirements of the specific job, and is delivered to site usually in cement mixer trucks. Concrete is used more than any other man-made material in the world.

Iron smelted from ore contains more carbon than is desirable. To become steel, the iron must be melted, again at extremely high temperatures, and reprocessed to reduce the carbon, and to remove silica, phosphorous and sulfur, which weaken the steel. Most modern steel plants use a basic oxygen furnace in which high-purity oxygen blows through the molten pig iron, lowering carbon levels and those of other impurities. Alloys are added at this time to create the desired properties of the steel product. Liquid steel is then cooled as bars or rods and later rolled and flattened into sheets for building ships, machinery and cans or made into steel girders for building skyscrapers and bridges.

Using wood products avoids the carbon emissions inherent in the industrial processes of concrete or steel products. While the concrete and steel industries are primarily powered by fossil fuels, many lumber companies use carbon-neutral wood waste to fuel their operations. Dovetail Partners, Inc., which provides information about the impacts and trade-offs of environmental decisions, calls the lumber industry 50 to 60 percent energy self-sufficient overall.

While acknowledging valid uses for steel framing, including high rise structures, the report "Materials Selection in Framing: Is Steel Framing a Good Environmental Choice?" states, "Even when considering steel framing that contains recycled content as high as 35 percent, considerable energy is consumed in the production process, and places steel products near the top of any embodied energy ranking of construction materials. The high conductivity of steel and associated need for energy-intensive insulation adds to the environmental burden of steel-framed structures. Finally, high energy intensity and manufacturing processes unique to steel translate to very high levels of emissions to air and water and global warming potentials. The bottom line of this analysis is that it is rarely appropriate to characterize steel as the more environmentally benign material when compared to wood."

Transportation

Transportation from the movement of building materials represents only a small fraction of total fossil fuel consumption of a structure. For a typical wood-frame house in Minnesota (see graphic in Manufacturing section of this course), construction transportation constitutes only 3.6 percent of total fossil fuel consumption. (ATHENA® Impact Estimator for Buildings, version 4.1.13. ATHENA is a registered trademark of the Athena Sustainable Materials Institute,Â www.athenaSMI.org.)

In the case of wood, typically, harvested logs are transported by road to the mill, though often further transport by rail and ship is necessary. Timber is relatively light compared to other materials and can require less energy to transport than concrete and steel.

Limestone, the main ingredient in cement, is very common around the world, and the concrete industry claims that because it can be processed locally, the amount of energy needed to transport the cement from the plant to the construction site is minimal. According to the Concrete Joint Sustainability Initiative, the average distance in the U.S. between a ready-mixed concrete plant and a project site is 14.2 miles. Wood and steel products, on the other hand, typically travel hundreds or even thousands of miles. Concrete transportation is mainly by truck, including transport for cement, admixtures and aggregate. Ready-mixed concrete is delivered to the job site in a liquid-concrete carrier, which typically has the same characteristics as a medium-heavy truck.

Most iron ore, the key ingredient in steel, is extracted in Australia and Brazil, carried to dedicated ports by rail, and then shipped to steel plants in Asia and Europe. Iron ore and coking coal are primarily shipped in huge bulk carriers that can hold a cargo of 154,300 tons or more. Due to its weight, steel is high in embodied energy when transported over large distances.

While it may seem somewhat counterintuitive, transportation impacts are not a function of distance-a product travelling a long distance in a highly efficient mode will actually have a smaller environmental footprint than a product with fewer miles to travel in an inefficient carrier. According to Helen Goodland, Executive Director of the Light House Sustainable Building Centre in Vancouver, road transport is by far the most carbon-intensive option, and is about six times more energy-intensive than rail transport, and 15 times more than sea transport. Goodland cites LEED's values of shipping by truck (2,127 KJ/tonne-km); rail (373 KJ/tonne-km); and ship (138 KJ/tonne-km). "So shipping one tonne of steel to Vancouver from Asia is roughly the same energy-wise as driving one tonne of wood from Calgary to Vancouver (973km) in a truck," she says.

A report by the Athena Institute on Japan's Woodmiles system corroborates the same principle, maintaining that "0.62 miles of truck travel is equivalent to 20 miles of ocean travel on a bulk carrier." The report, which is concerned with the transport of lumber from Canada to Japan, states that instead of doubling Japan's self-sufficiency in logs, a faster way to attain the same CO_2 reduction would be to shift some of Japan's imports from Canadian logs to Canadian sawn lumber, which is less dense and lighter to transport. In addition, the report indicates that while transportation impacts are not a function of distance but of mode of transport, the type of product being transported is also a key factor. Transport of wood is ultimately offset by the carbon sequestration properties of wood.

Renewable Versus Recyclable

A natural resource is renewable if it can be naturally replaced at the rate at which it is consumed. When the sand and gravel in concrete are mined from an area, they will not be replenished naturally in a reasonable time. Likewise, iron ore, the primary ingredient in steel, will not be replaced in a timely manner. Of the three building materials, wood is the only renewable resource. Trees can be quickly replenished, and managed forests encourage faster and higher quality growth and depending on the type of tree-even those requiring 100-year growth fit the definition of renewable resources.

Recycled wood can add beauty and aesthetic appeal to furniture design.

Source: Wood Anchor, http://www.woodanchor.com

Recyclability is another matter. All three materials are recyclable. Steel is said to be the world's most recycled material; in the U.S. nearly 75 million tons of steel were recycled or exported for recycling in 2008. Steel mills use one of two types of furnaces to make new steel-both recycle old steel into new steel, but each is used to create different products for varied applications. According to the Steel Recycling Institute, the basic oxygen furnace, uses a minimum of 25 percent steel scrap to make new steel used in flat-rolled steel products like cans and appliances. The electric arc furnace process melts virtually 100 percent steel scrap to make new steel used to make steel plate, rebar and structural beams. When one ton of steel is recycled, 2,500 pounds of iron ore, 1,400 pounds of coal and 120 pounds of limestone are conserved; however, the worldwide demand for steel outstrips the supply from demolished or scrapped steel. Steel can also be reused. The industry claims that steel frames with bolted connections can easily be dismantled and reused. Entire structures are easily demountable and can be dismantled and reconstructed in a different location in a matter of days, without creating any dust and dirt, and very little noise.

Concrete, too, is said to be 100 percent recyclable. Increasingly, recycling is becoming an accepted way of disposing of concrete structures that were once routinely shipped to landfills. Typically, concrete is collected and put through a crushing machine, often along with asphalt, bricks, and rocks. In reinforced concrete, the rebar is removed with magnets, and the remaining concrete chunks sorted by size. Smaller pieces of concrete can be used for gravel for new construction projects, or in shoreline protection or even as a road base.

Recycled or reclaimed wood has the added cachet of architectural quality and character. Older beams and timbers are dense with a high ring count, and are praised by builders for their low moisture content which makes them extremely stable, particularly in exterior situations, as opposed to green lumber that tends to shrink and split. Antique wood has a striking patina that comes from oxidation that occurs on its surface. The color of old wood used in interior applications is generally mellower than the original, and history may also shine through, with the scuffs and scrapes of warehouse flooring still visible after sanding. Seasoned old growth lumber from demolition of historic structures has found new life as beams, exposed trusses, millwork, flooring, and furniture. Still, recycling timber is time-consuming and labor intensive-demolition must be careful to preserve as much of the timber as possible, wall studs must be trimmed off, nails pulled out and the lumber refinished. Recycled wood may not always fit in a new project, either from a size or a building code perspective, and there is not a well-established supply in many areas.

Chain-of-custody ensures that wood is sourced from forests that are sustainably managed.

Source: www.naturallywood.com

Tracking Systems: Responsible Procurement

Responsible procurement relates to sustainability, comprising environmental, social and economic factors. Certified wood is the only one of the three products that can carry the added value of having a chain-of-custody certification that confirms its source from sustainably managed third-party certified forests. Similar to tracking packages, chain-of-custody tracks forest products through all phases of ownership, processing and transportation, from the forest of origin to the end consumer. The chain-of-custody system is verified through an independent third-party audit. The result is that buyers know that their building materials are coming from forests managed in accordance with strict sustainable forest management certification standards-and not from controversial sources such as illegal logging.

Environmental Product Declarations (EPD)

An EPD is a standardized (ISO 14025/TR) and LCA-based tool to communicate the environmental performance of a product or system, and is applicable worldwide. Much like a nutritional label, consumers can make side-by-side comparisons of different products. According to Dovetail, in Europe and Japan governments are starting to require EPDs as part of trade and purchasing program requirements, and EPDs are receiving attention worldwide. Kathryn Ferholz, Dovetailï¿½s Executive Director, calls EPDs a positive development for the architectural community. "To have robust, high quality information that allows apples-to-apples comparison is good news," she says. "Whether they take hold in one, two or five years depends on government procurement policies. But it's only the pace that can be debated, not the arrival of EPDs as a more responsible procurement system."

The concrete and steel industries have no such third-party sustainability certification or chain-of-custody certification. However, progress is being made in responsible procurement. In the steel industry in particular some companies report encouraging suppliers to adopt responsible practices, and/or management systems certified to ISO standards. In certain cases, companies dedicate on-line resources to screening potential suppliers, as well as to promoting and monitoring the performance of existing vendors. Steel, is often imported from developing countries, and the absence of a third-party certification program makes it impossible to accurately assess the environmental and social impacts of steel products.

Forestry: Sustainability and Community

Increasingly, the forestry sector is adopting high standards in accountability and due diligence to create a positive difference for future generations on a number of levels.

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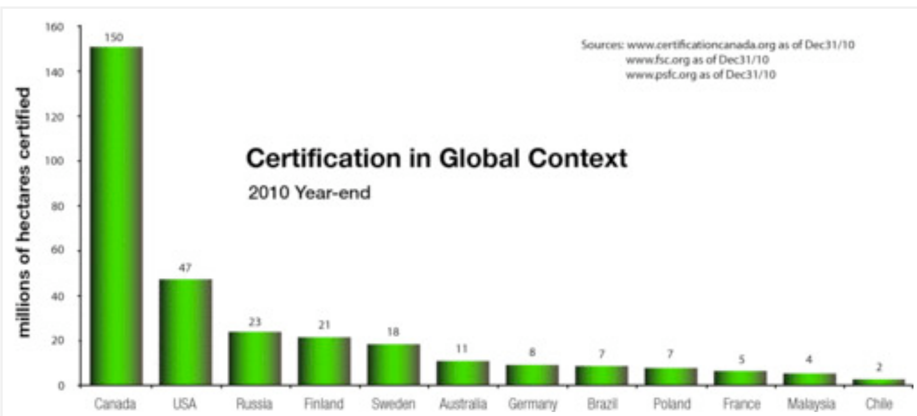

Source: www.certificationcanada.org as of Dec31/10
www.fsc.org as of Dec31/10
www.psfc.org as of Dec31/10

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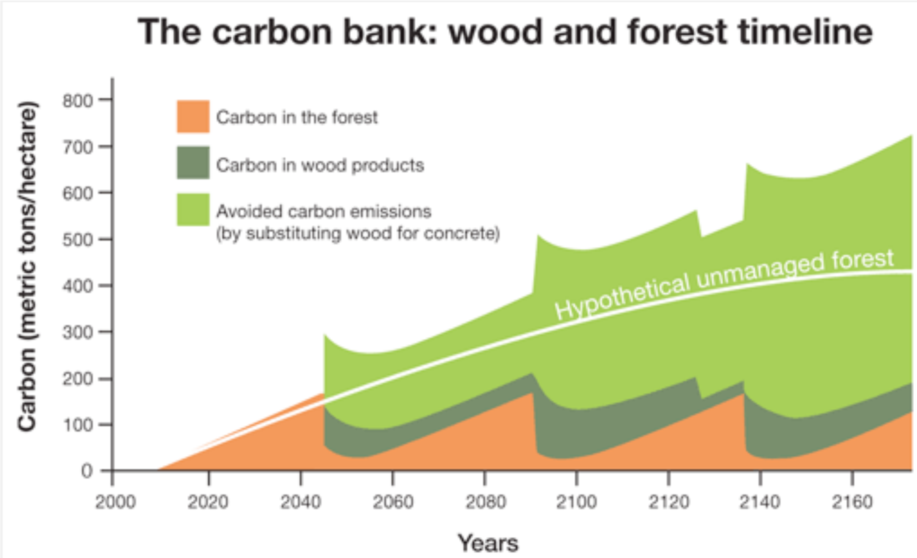
Forest Management

Canada is internationally recognized for its supply of quality wood products from well-managed forests. Only 10 percent of forest land worldwide is certified, and Canada has the most certified forest lands of any country in the world. The Province of British Columbia, in particular, has a substantial certified forestland and is a leader in third-party sustainable forest management, recognizing three globally-recognized forest certification programs, including the Canadian Standards Association's (CSA) Sustainable Forest Management Standard; the Forest Stewardship Council (FSC); and the Sustainable Forestry Initiative (SFI). Both the CSA and SFI are internationally recognized by the Programme for the Endorsement of Forest Certification Schemes (PEFC).

Growing a Forest-Carbon Benefits

Healthy growing forests recycle carbon naturally. When biomass is used instead of fossil fuels, it can reduce the build-up of carbon dioxide in the atmosphere. When trees are used for forest products, the carbon often remains stored in the products for decades, or longer. This is recognized by the Intergovernmental Panel on Climate Change (IPCC), a scientific body set up by the World Meteorological Organization and United Nations Environment Program. A 2007 report by the IPCC Working Group III says forests remove carbon from the atmosphere, and at the same time, provide products that meet society's needs for timber, fibre and energy. A stable market for forest products encourages landowners to manage forests sustainably rather than converting them to other uses such as agriculture or urban development.



Source: Source: "Forests, Carbon and Climate Change: A Synthesis of Science Findings," 2006, Oregon Forest Resource Institute

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In Consultation with the Community

Forests are home to an estimated 800 million people worldwide. Some 60 million Indigenous people are dependent on forests, and in developing countries about 1.2 billion people rely directly on agroforestry farming systems. As Indigenous Peoples struggle to protect their customary land uses and rights, Indigenous participation in the decision-making process is growing.

Landmark progress in this area has been made in Great Bear Rainforest on the central and north coast of British Columbia, the largest area of undeveloped coastal temperate rainforest on the planet. Communities, First Nations, loggers, government and environmental groups all had passionate views on the future of the rainforest. Land use planning began in 1997 and, more than ten years in the making, a consensus-driven land use plan was adopted by the government and the First Nations to set aside 8,100 square miles, roughly one third of the forest, to create a system of protected areas. The new paradigm, called Ecosystem-Based Management (EBM), is "an adaptive, systematic approach to managing human activities that seeks to ensure the co-existence of healthy, fully functioning ecosystems and human communities." Following the fulfillment of the Coast Land Use Decision commitment to "fully establish an EBM system for the Central and North Coast area by March 31, 2009," April 1, 2009 marked the beginning of a new phase of government–to-government implementation of EBM. The focus of implementation has shifted to developing strategies to improve human well-being and a strategic landscape reserve design, designating grizzly bear no-hunting areas, concluding conservancy management planning, and improving land use objectives with results from an adaptive management program.

Job Opportunities

According to the United Nations, at least 10 million jobs could be created in sustainable forest management, with Asia, Africa and Latin America benefitting the most. Jobs could come in a number of areas from forest management and improved fire management to development of trails and recreation sites and restoration of degraded forests, with activities tailored to local circumstances, labor, and socio-economic conditions. Because restoring forests requires people as opposed to capital investment, which translates to jobs for soil scientists, tree planters, equipment operators, water engineers, and people to nurture the trees over time, several countries have included forestry in their economic stimulus packages. In the U.S., which earmarks stimulus dollars for forestry, reforestation and restoration is said to outperform even the second-most jobs-intense activity by 74 percent, and exceeds other major job alternatives including new highway construction, and financial services.

Materials Do Matter

In reducing the environmental footprint of tomorrow's structures, wood is a sustainable building choice. It outperforms concrete and steel in life-cycle analyses. It stores carbon. Certified wood that has a chain-of-custody provides documentation of responsible procurement. The forestry industry creates jobs and well being for millions of people worldwide.

This is the first of a three-part series documenting the environmental footprint of wood, concrete, and steel. The second article will cover their performance during construction, operation and end-of-life, reaffirming that in the quest for carbon-neutral buildings, materials do matter.

Naturallywood.com is an online resource that provides the latest information on wood products from British Columbia that are used in markets around the world. Resources include an extensive wood products supplier directory, latest innovations in wood technology, green building tools and much more. Forestry Innovation Investment is an agency of the government of British Columbia (B.C.), Canada focused on promoting environmentally friendly certified wood products from B.C.'s sustainable forests. www.naturallywood.com/ceu1

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