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Review Article

Advance in Environmental Waste Management & Recycling

Sustainability and green practices construction and their applications for commercial buildings

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Introduction

Cautiously choosing structure materials is a decent method to start consolidating sustainability to plan and develop structures. The expense is the essential thought when looking at comparable materials or materials assigned for similar capacity. The market value building parts speak to just the assembling and transportation costs, and natural expenses are not caught in this estimating.

These expenses are disseminated to the owner, the occupant, and the environment. To consider the lifecycle of building materials, manufacturing process from gathering raw materials, assembling, distribution, and extreme reuse or disposal; is analyzed for its environmental effect. The lifecycle of a material can be considered from the point of view of Pre-Building, Building and Post-Building stages. The assessment of the environmental impact of building materials at each stage considers a money-saving advantage analysis over the lifetime of a structure, instead of basically bookkeeping of starting construction costs. Life-cycle cost investigation (LCCA) is a technique for surveying the all-out expense of office possession. It thinks about all expenses of obtaining, owning, and discarding a structure or building framework. LCCA is particularly valuable when venture choices that satisfy similar act necessities however vary as for beginning expenses and working costs, must be contrasted with select the one that expands net investment funds.

Analysis

The Pre-Building Phase describes the production and delivery process of material up to, but not including the point of installation. This includes discovering raw materials in nature as well as extracting, manufacturing, packaging, and transportation to a building site. This phase has the most potential for causing environmental damage. Understanding the environmental impacts in the pre-building phase will lead to the wise selection of building materials. Raw material procurement methods, the manufacturing process itself, and the distance from the manufacturing location to the building site all have environmental consequences. An awareness of the origins of building materials is crucial to an understanding of their collective environmental impact when expressed in the form of a building. The basic ingredients for building products, whether for concrete walls or roofing membranes, are obtained by mining or harvesting natural resources. The extraction of raw materials, whether from renewable or finite sources, is a source of severe ecological damage. The results of clear-cutting forests and strip-mining once-pristine landscapes have been well documented.

The Building Phase refers to a building material's useful life. This phase begins at the point of the material's assembly into a structure, includes the maintenance and repair of the material, and extends throughout the life of the material within or as part of the building. Construction: The material waste generated on a building construction site can be considerable. The selection of building materials for reduced construction waste and waste that can be recycled is critical in this phase of the building life cycle. Use/Maintenance: Long-term exposure to certain building materials may be hazardous to the health of a building's occupants. Even with a growing awareness of the environmental health issues concerning exposure to certain products, there is a little emphasis in practice or schools on choosing materials based on their potential for outgassing hazardous chemicals, requiring frequent maintenance with such chemicals, or requiring frequent replacements that perpetuate the exposure cycle.

The Post-Building Phase refers to the building materials when their usefulness in a building has expired. At this point, a material may be reused in its entirety, have its components recycled back into other products, or be discarded. From the perspective of the designer, perhaps the least considered and least understood phase of the building life cycle occurs when the building or material's useful life has been exhausted. The demolition of buildings and disposal of the resulting waste has a high environmental cost. Degradable materials may produce toxic waste, alone or in combination with other materials. Inert materials consume increasingly scarce landfill space. The adaptive reuse of an existing structure conserves the energy that went into its materials and construction. The energy embodied in the construction of the building itself and the production of these materials will be wasted if these "resources" are not properly utilized. Some building materials may be chosen because of their adaptability to new uses. Steel stud framing, for example, is easily reused in interior wall framing if the building occupants' needs should change and interior partitions need to be redesigned. Ceiling and floor systems that provide easy access to electrical and mechanical systems make adapting buildings for new uses quick and cost-effective.

Evaluation

Steel

Steel requires the mining of iron ore, coal, limestone, magnesium, and other trace elements. To produce steel, iron must first be refined from raw ore. The iron ore, together with limestone and coke (heat-distilled coal) are loaded into a blast furnace. Hot air and flames are used to melt the materials into pig iron, with the impurities (slag) floating to the top of the molten metal. Steel is produced by controlling the amount of carbon in iron through further smelting. Limestone and magnesium are added to remove oxygen and make the steel stronger. The maximum carbon content of 2% is desired. Other metals also added at this stage, to produce various steel alloys. These metals include magnesium, chromium, and nickel, which are relatively rare and difficult to extract from the earth's crust. The molten steel is either molded directly into usable shapes or milled. Steel is the world's most recycled material, and in North America alone, more than 17 million tons of steel are recycled or exported for recycling annually. This constitutes a recycling rate of 69 percent in North America—more than paper, aluminum, plastic, and glass combined.

Figure 1

North America's #1 Recycled Material

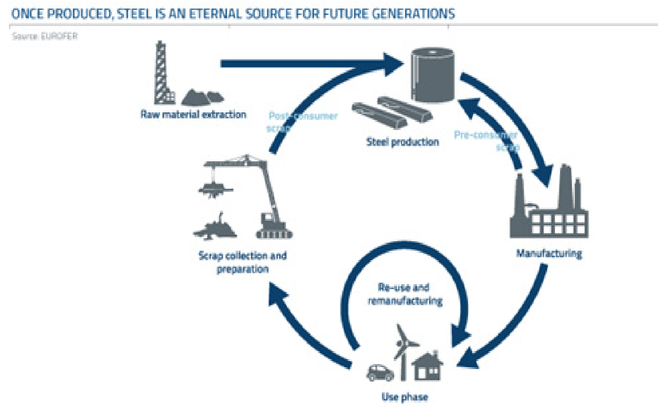
Material	Tons
Steel	17,149,965
Paper	11,636,669
Aluminum	1,039,391
Glass	707,238
Plastic	533,253

Estimated Tons Recycled By Material Since January 1, 2016

Source: Steel Recycling Institute

Steel is recycled for both economic and environmental reasons. Many steel applications remain in service for decades. Even though two out of every three pounds or kilograms of new steel are produced from "old" steel, the fact that cars, buildings, appliances, and bridges have such long service lives makes it necessary to continue to mine virgin ore to supplement the production of new steel. Economic expansion, here and abroad, also creates additional demand that cannot be fully met by available scrap supplies.

Figure 2



Wood

Wood is the harvested material most used in buildings and building products. Dimensional lumber is used in framing many residential buildings and many commercial structures. Wood products such as plywood, particleboard, and paper are used extensively throughout the construction industry. Until recent years, the most common method of harvesting wood was clear-cutting, a process wherein all vegetation within a given area is removed for processing. Now, where clear-cutting takes place, lumber companies are required to replant the area. Some lumber is now being produced on tree farms. However, replanting alone does not replace the natural biological diversity that existed before harvesting. Monoculture (same species) plantings are particularly vulnerable to disease and insects. More companies now practice "selective cutting": choosing only those trees large enough or valuable enough to remove and leaving the surrounding vegetation intact. Sustainable forestry practices include a professionally administered forestry management plan in which timber growth equals or exceeds harvesting rates in both quantity and quality. In addition, rivers and streams are protected from degradation, damage to the forest during harvesting is minimized, and biodiversity and fair compensation to local populations are emphasized.

Figure 3

Concrete
Sustainability is important to the well-being of our planet, the continued growth of a society, and human development. Concrete is one of the most widely used construction materials in the world. However, the production of Portland cement, an essential constituent of concrete, leads to the release of significant amounts of CO2, a greenhouse gas (GHG); production of one ton of Portland cement produces about one ton of CO2 and other GHGs. The environmental issues associated with GHGs, in addition to natural resources issues, will play a leading role in the sustainable development of the cement and concrete industry during this century.

For example, as the supply of good-quality limestone to produce cement decreases, producing adequate amounts of Portland cement for construction will become more difficult. There is a possibility that when there is no more good-quality limestone in, say, a geographical region, and thus no Portland cement, all the employment associated with the concrete industry, as well as new construction projects, will be terminated. As a result of limited natural resources, concern over GHGs, or both, cement production is being curtailed, or at least cannot be increased to keep up with the population increase, in some regions of the world. It is, therefore, necessary to look for sustainable solutions for future concrete construction. Green materials also use less energy and resources and can lead to high-performance cement and concrete. Concrete must keep evolving to satisfy the increasing demands of all its users.

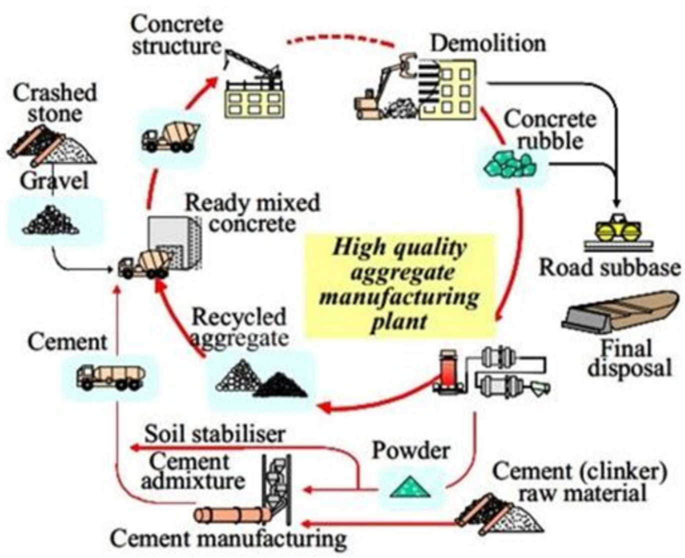


Figure 4: Process of waste concrete recycling

Conclusion
A sustainable structure is constructed to ensure that the total environmental impact during its life cycle, including its use, will be minimal. Sustainable materials should have a very low inherent energy requirement, be produced with little waste, be made from some of the most plentiful resources on earth, produce durable structures, have a very high thermal mass, and be made with recycled materials. Sustainable buildings have a small impact on the environment. They use "green" materials, which have low energy costs, high durability, low maintenance requirements, and contain a large proportion of recycled or recyclable materials. Designing for sustainability means accounting for the short-term and long-term environmental consequences in the design.

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