Wilco Precast

Precast Concrete & Sustainability

Sustainability is about ensuring that development meets the needs of the present without compromising the ability of future generations to meet their own needs.

It covers a wide range of issues, including:

- social progress which recognises the needs of everyone
- effective protection of the environment
- prudent use of natural resources
- maintenance of high and stable levels of economic growth and employment

Sustainability is of increasing importance to businesses, because it provides a focussed way of addressing a range of economic, social and environmental issues that can help in the efficient, effective and responsible operation of those businesses. Consumers are increasingly demanding more sustainable products; products that are made using local materials; products that are durable and have good whole-life performance. Sustainability has become a watchword for owners and architects when designing new buildings, intermingled with terms such as “environmental friendliness” and “green building.” Today’s green-building approaches extend beyond the ability to renew or recycle resources and examine the embodied energy required to make use of that material. This accounting practice encompasses all the energy necessary to manufacture, deliver and install the product. This includes the fuel to extract materials, finish them and transport them to the site. While other building materials may have to alter their configurations or properties to be applicable to sustainable structures, precast concrete’s inherent composition provides natural advantages for sustainability. It contributes by incorporating integrated design, efficient use of materials, and the reduction of construction waste, site disturbance and noise. Wilco Precast concrete components can maximize benefits from integrated design strategies, which focus on all of the building’s materials and systems, as well as how they interact:

1. Reduce the amount of material used and the toxicity of waste materials.

Precast concrete can be designed to optimise or lessen the amount of concrete used. Industrial wastes such as slag cement and silica fume can be incorporated into the mix, reducing the amount of cement, which in turn reduces CO^2 emissions. As a manufactured product created under controlled conditions in the plant, precast concrete generates low amounts of waste, and the waste generated has low toxicity.

2. Reuse and repair products.

Precast concrete panels can be reused when buildings are expanded. Concrete pieces from demolished structures also can be reused in other applications. Because the precast process is self-contained, formwork and finishing materials are reused. Wood or fiberglass forms can generally be used 40 to 50 times without major maintenance, while concrete and steel forms have practically unlimited service lives.

3. Recycle and use products with recycled content.

Concrete can be recycled as fill or road base. Wood and steel forms are recycled when they become worn or obsolete. Virtually all reinforcing steel is made from recycled steel. Many cement plants burn waste-derived fuels such as spent solvents, used oils and tyres.

4. Concrete Reabsorbs CO^2 Emissions

During the life of a concrete structure, the concrete carbonates and absorbs the CO^2 released by calcination during the cement manufacturing process. Once concrete has returned to fine particles, full carbonation occurs, and all the CO^2 released by calcination is reabsorbed. A recent study indicates that in countries with the most favorable recycling practices, it is realistic to assume that approximately 86% of the concrete is carbonated after 100 years. During this time, the concrete will absorb approximately 57% of the CO^2 emitted during the original calcination. About 50% of the CO^2 is absorbed within a short time after concrete is crushed during recycling operations.

› Precast concrete's inherent composition allows it to naturally achieve sustainability

These characteristics decrease the contribution of solid waste to landfills, and reduce the depletion of natural resources and production of air and water pollution caused by new construction.

› Mitigating Urban Heat Islands

Cities and urban areas are 3°F to 8°F warmer than surrounding areas due to buildings and pavements taking the place of vegetation. The ability of a material to reflect solar heat is called albedo, and the higher the material's albedo, the better it reflects. Concrete has a relatively high albedo. Traditional Portland cement concrete generally has an albedo or solar reflectance of approximately 0.4 to 0.5.

› Precast Concrete Production

The production of precast concrete has many environmental benefits, including:

- Less material required because precise mixture proportions and tighter tolerances are achieved.
- Optimal insulation levels can be incorporated into sandwich wall panels.
- Waste materials are more likely to be recycled.
- Grey water can be recycled into future mixtures.
- Hardened concrete is recycled (about 5% to 20% of aggregate in precast concrete can be
- recycled concrete).
- Sand used for finishing surfaces is reused.
- Steel forms and other materials are reused.
- Less dust and waste are created at the construction site because only needed precast concrete

elements are delivered.

- No debris from formwork and associated fasteners.
- Fewer trucks and less time are required for construction because concrete is made off-site.
- Precast concrete units are normally large components, so greater portion of the building are completed with each activity.
- Less noise occurs at the construction site because concrete is made offsite.
- Less concrete generally is used in precast buildings compared to other concrete buildings because of the optimization of materials.
- A properly designed precast concrete system will result in smaller structural members, longer spans and less material used on-site. This creates economic and environmental savings.

› Constituent Materials

Concrete contributes to a sustainable environment because it does not use scarce resources. It consists of only a few ingredients, primarily cement, water, large and small aggregates, and admixtures, all of which are abundant locally. Although Portland cement, a key ingredient, is energy intensive, the cement industry has reduced energy usage per ton of cement by 35% since 1972. Fly ash, slag cement and silica fume can be used to replace Portland cement content. Aggregates, which make up about 85% of concrete, generally consist of materials that require low levels of energy to produce, comprising local, naturally occurring sand and stone. Their benefits can be further improved by using blast furnace slag or recycled concrete as aggregates.

› Local Ingredients

The use of local materials reduces the transportation needs for heavy building materials, along with the associated energy and emissions. Most precast concrete plants are within 50 miles of a building site. The cement, aggregates and reinforcing steel used to fabricate precast concrete components, along with the raw materials used to manufacture cement, are usually obtained or extracted from sources within 200 miles of the precast concrete plant.

› Energy Conservation

Energy conservation is a key tenet of sustainability. About 90% of the energy used during a building's life is attributed to heating, cooling and other utilities. The remaining 10% is attributed to manufacturing materials, construction, maintenance, replacement of components and demolition. Precast concrete's inherent capabilities to provide energy efficiency rely on the high thermal mass of the material, which benefits exterior wall applications. Mass works well on the inside surfaces by absorbing the heat gains generated by people and equipment indoors. Light-colored precast concrete will reduce energy costs associated with indoor and outdoor lighting. The more reflective surfaces will reduce the amount of fixtures and lighting required.

› How Does Life Cycle affect Climate Change?

Concrete is a locally produced material shipped only short distances – another environmental and energy saving plus. Its primary components, sand and gravel or crushed stone, are among the most universally available materials. Accordingly, as wood and steel become scarce materials, developing nations are relying more on concrete. Concrete can last a lifetime or longer: unlike wood, it does not rot or burn; unlike steel, it does not rust. Concrete's low maintenance needs and long service life requires less repairs and rebuilding, and, as a result, conserves additional energy and materials. When comparing construction alternatives, a life cycle assessment (LCA) provides a level playing field. An LCA is based on a consistent methodology applied across all products and at all stages of their production, transport, energy use, maintenance, and disposal or recycling at end of life. A number of published articles espouse the sustainability of one building product over another based on a few selected metrics instead of a full life cycle assessment (LCA). For instance, some articles representing themselves as LCA studies use only the metrics of embodied energy or embodied CO^2 emissions. These comparisons are flawed because they only consider limited metrics and do not cover a full life cycle assessment of the product or building. A full LCA includes the impacts of energy use and associated emissions over the life of the product or structure, such as climate change, acidification, materials acquisition, and human health effects. Studies show that the most significant environmental impacts are not from construction products but from the production and use of natural gas and electricity to heat, cool, and operate the buildings. For concrete houses compared to wood frame houses, the CO^2 emissions from the production of the cement used in the house is more than offset by the savings in CO^2 emissions from energy savings during the life of the house.

› Indoor Air Quality

Precast concrete contains low to negligible Volatile Organic Compounds (VOCs). These compounds degrade indoor air quality when they off-gas from new products such as interior finishings, carpet and furniture. Manufactured wood products such as laminate, particleboard, MDF and treated wood can also lead to offgassing. In addition, VOCs combine with other chemicals in the air to form ground-level ozone. Polished concrete floors do not require carpeting. Exposed concrete walls do not require finishing materials. The VOCs in concrete construction can be minimized further by using low-VOC materials for form-release agents, curing compounds, damp-proofing materials, wall and floor coatings and primers, membranes, sealers and water repellants. Concrete is not damaged by moisture and does not provide nutrients for mould growth.

For further information visit:
www.concretethinker.com
www.greenbuild.co.nz
www.sustainableconcrete.org.nz
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