The sustainability of concrete construction essay

Concrete is a mixture of cement, aggregates and water, with any other admixtures which may be added to modify the placing and curing processes or the ultimate physical properties. Initially when mixed, concrete is a plastic material, which takes the shape of the mould or formwork. When hardened it may be a dense load-bearing material or a lightweight thermally insulating material, depending largely on the aggregates used. It may be reinforced or prestressed by the incorporation of steel. Concrete can be used for any structure, small, big, low-rise or high-rise – in buildings, roads, bridges, tunnels, retaining walls, dams and so on. In one form or another concrete is used in almost every contemporary building, regardless of the geographic location.

As long ago as the Greek and Roman Empires concrete helped shape the built environment. Even today this natural construction material is still made in essentially the same way by mixing sand, water, cement and course aggregate. Throughout the last 100 years concrete has helped shape our homes, our places of work, our transport corridors and our everyday lifestyles. Its versatility and durability are unmatched. That’s why concrete is the world’s most widely used construction material and a key contributor to sustainable development. Only 7% of global co2 emissions are from concrete.

Precast concrete arrives on site ready for installation and typically does not require addition cutting or modification thereby reducing dust and waste. Many projects have used the inherent strength and flexibility of precast concrete to help reduce the heat island effects by creating green roofs, consolidating parking and using lighter colours. Concrete has thermal mass

which can be used to reduce the total energy needed to heat and cool a building. Concrete has a high heat capacity which means it can slowly absorb and store heat energy and likewise slowly release it when the temperature differential shifts. This helps reduce the magnitude of the heating and cooling peaks as well as shift peaks to times when utility rates are less expensive. This all translates to less energy needed to maintain a comfortable and more uniform indoor temperature. Precast concrete sandwich walls panels combine thermal mass with a layer of continuous insulation, thereby eliminating thermal bridges or cold spots. This has been verified using thermal imaging. Since energy efficiency is one of the greatest factors contributing to the total environmental impact this is a vital area to optimise. Precast concrete sandwich wall panels can greatly contribute to the optimisation of a building’s envelope and can help reduce total energy consumption of a building by as much as 30%.

Concrete is an inert material and does not contribute to poor indoor quality furthermore since precast concrete can be erected quickly buildings are enclosed faster providing a barrier between outside contaminants and moisture while shaving months off a project’s schedule. Precast concrete can be left exposed on the interior of a building eliminating the need for dry walling reducing waste and increasing the overall durability of the interior finish. Precast concrete does not provide a food source for mould thereby helping to improve indoor air quality.

Concrete is very durable and has been around for thousands of years. Precast concrete does not combust, rot or rust. In fact precast concrete can be designed for a 100 year service life or more. Concrete structures can be

built to not only withstand every day loads and forces but their inherent strength and properties also provide longevity against the extreme and powerful forces of nature. This can not only saves lives but can help reduce the environmental impact related to rebuilding due to storms, tornados, fires and earthquakes. An example is the impact testing performed on precast concrete sandwich wall panels which have proven superior resistance against projectiles launched at 100mph. Precast concrete wall panels provide an extremely energy efficient envelope system when designed correctly.

Manufacturers

Precast concrete manufacturers have already implemented sustainable practices such as zero waste programs, upgrading to more energy efficient equipment and implementing recycling programs.

Complementing the social and economic dimensions of sustainable development the concrete industry is above all conscious of its environmental responsibilities. The industry is proactive and researching better environmental practices and technologies. While cement production is an energy intensive process. The use of alternative kiln fuel, strict controls on co2 emissions and land rehabilitation programs. The utilisation of used oil and forestry wood waste as alternative fuels for kiln operation as an extremely responsible development in the manufacture of cement and has seen the industry reduce its dependency on non-renewable fossil fuel supplies and at the same time minimise co2 emissions. Another example of how seriously the concrete industry takes it environmental obligations is the use of industrial by-products that traditionally would of ended up in a land-fill

site. Substituting cement with industrial by-products and natural materials provides positive environmental benefits without compromising concrete quality.

Advances in concrete

Advances in cement technology have also led to the development of innovative eco-concretes. For example the addition of titanium dioxide has led to the development of photocatalytic or de-polluting concrete. While at a basic level the composition of concrete has remained largely unchanged for hundreds of years, research and development of concrete technology continues. Concrete manufacturers continue to find ways of improving the characteristics of concrete to meet specific demands. One such example is the recent development of self-compacting concrete. Ideal for achieving unblemished surface finishes. Self-compacting concrete has helped elimate the need for noisy machinery. As such construction sites are quieter and safer. Recyled roads- crushed concrete and recycled ashfelt were combined to produce an extremely durable road. Another aspect of concrete’s recycle ability is the reuse of waste water and machinery wash water in the concrete manufacturing process. There’s also a growing market for interlocking concrete block made with residual concrete from mixing trucks.