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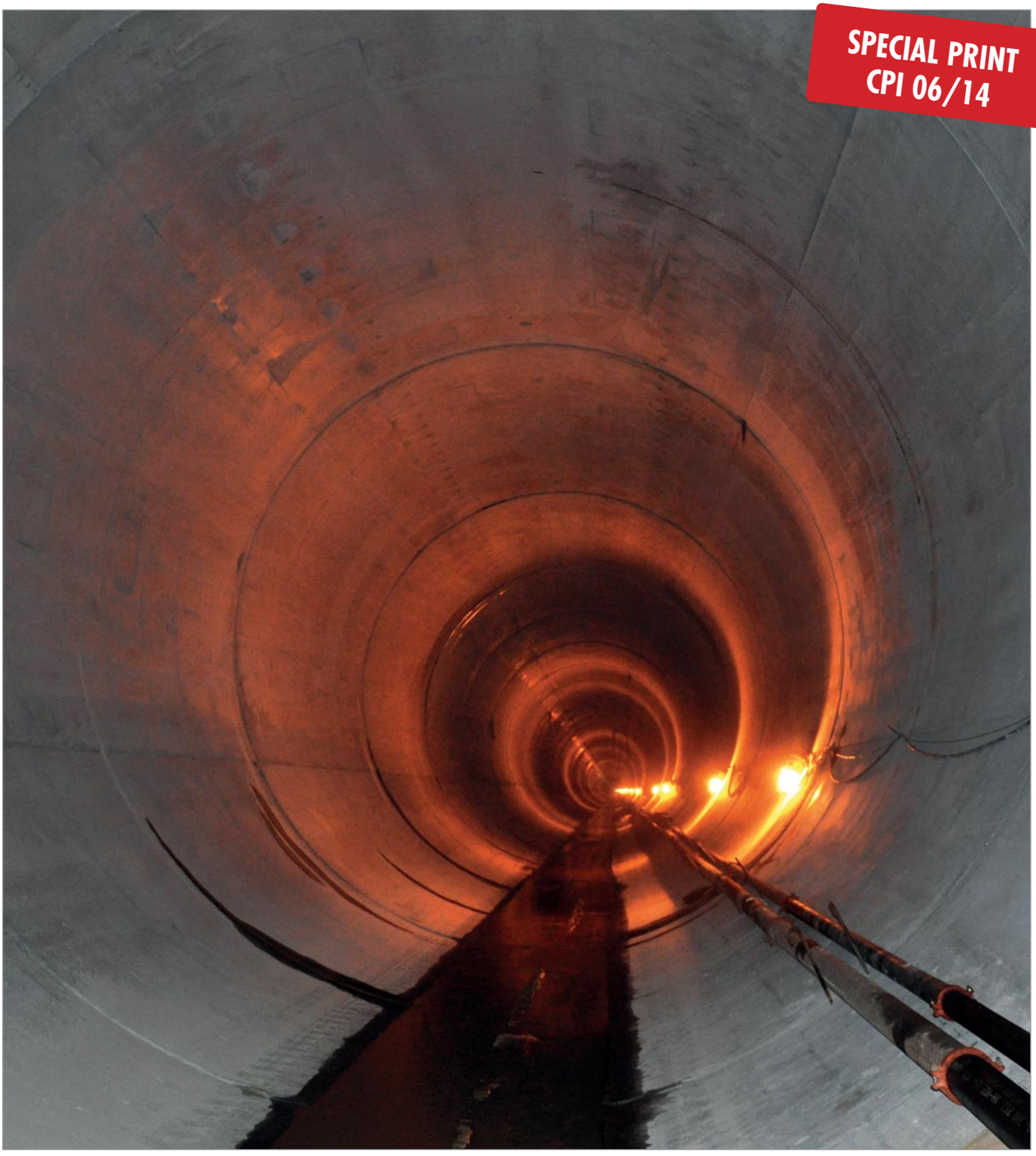

Concrete for a Cooler Climate

The Expansion of Green Concrete in the USA

The push for sustainable construction is gaining momentum at an astounding rate. As ecologically responsible concrete becomes more a part of everyday construction demand we must all think of how we fit into this rapidly emerging picture. Concrete fits well into our world, no matter what the demand, because of its ability to become what we need it to be. Flexibility of design has been what's made this ridged material so well suited for the aesthetics and engineering demands of construction worldwide. There are two obvious factors with which concrete can lend toward a sustainable design; the use of recycled materials and locally obtained resources.

Paul Ramsburg, Sika Corporation, USA
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What sort of recycled content can we use in concrete and what are the impacts to strength and durability? There are several recycled materials available which can be used as aggregate in a concrete mixture. Crushed glass has been used in architectural concrete, slag aggregate has been used in structural lightweight concrete, and recycled tires have been applied to concrete as a sound proofing measure. Most commonly unwanted concrete which has been reclaimed is crushed into usable aggregate and may be used in fresh concrete. These materials can be used successfully in most applications. Recycled materials used as cementitious or pozzolanic substitutes are much more assessable and commonplace.

Supplementary Cementitious Materials (SCM's) include Fly Ash, Ground Granulated Blast-Furnace Slag, and Silica Fume. These are all waste byproducts of other industry processes. These SCM's add to the desired properties of concrete in various ways, they can increase compressive strength, as well as protect concrete from the deleterious effects of some environments. The US Green Building Council's LEED program gives credit for using recycled materials, SCM's are pre-consumer recycled materials which means they count as ½ credit. But LEED recognizes the importance of SCM's, so there is special consideration made for their use. When calculating the percent of recycled content in a concrete LEED considers only the cementitious

A collapsable forming system coupled with SCC increased speed of construction

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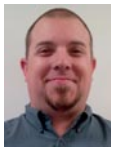

■ Justin Lazenby is the Georgia Technical Services Manager for Thomas Concrete Industries and has been with Thomas for over 13 years. Member of ASTM C 09, GRMCA, GRMCA Technical Committee, GA Chapter ACI.

material, giving more credit for using SCM's. Ground Granulated Blast-furnace Slag can be used at a replacement rate of 50% of the cementitious materials or higher, and Fly Ash can be used in addition to make a ternary mix (or three way mix), or on its own as a Portland Cement replacement.

Local content should be taken into account when designing concrete for a LEED project. The specification states that materials should be harvested and assembled within 500 miles of the project site. This is relatively easy for concrete, as it is mostly a local material to begin with. There are some considerations when selecting some materials though. For instance; has the cement clinker been imported to the cement grinding plant from outside the 500 mile radius? The same consideration applies to SCM's. Are the admixtures a locally produced material, or are they imported to a local distribution center? If there is a need for a specific material that is not available locally the concrete manufacturer may be able to find a suitable replacement material with a source close to the construction site.

Let's consider some other factors of Green Concrete. Although the USGBC's LEED program gives very little, if any, credit for utilizing recycled water in concrete mixtures this is an extremely important part of responsible concreting. When process wash water is collected at production facilities it's often called "Gray Water", but we should be thinking of this material as "Green". This water can be continually reused as wash water, used to wet aggregates, or best of all used as batch water in the concrete mixture. It has been proven in the Atlanta market that the use of 80% recycled water is easily attainable. It should be said that before using any amount of recycled water testing should be done to understand any effects it may have on both the plastic and hardened concrete properties.

By its nature Self-Consolidating Concrete contributes to the reduction of concrete's impact on the environment. Because of its high fluidity and ability to consolidate without mechanical vibration SCC can be placed faster than conventional concrete resulting in less fuel being spent in placing, and the elimination of energy consumed by vibrators. SCC can be pumped with greater ease as well, eliminating strain on the pump equipment and resulting in a reduction of fuel

A defect free concrete surface improves the longevity of the sewer system

consumption too. There is a clear benefit of SCC in its hardened state as well, a more consistently consolidated concrete is a more durable and long lasting concrete. Even if SCC is not utilized the Polycarboxylate based High Range Water Reducers that make it possible can be used at lower dosages to make concrete with a more conventional slump. This reduces water consumption as the specified slump can be achieved with less water. The resulting lower water-cement ration can allow for cement reduction, lowering the carbon impact of this specific concrete. Cement reduction is the holy grail of "Green Concrete", because for every ton of cement produced roughly one ton of carbon is released into our air.

When considering recycled materials in concrete some have assumed that compressive strength may be sacrificed, but this is not the case when we conduct the proper testing to understand the effects of each of our constituent materials. Thomas Concrete has successfully designed green mixes to achieve consistent compressive strengths ranging from 100 psi to 20,000 psi. When requesting an environmentally responsible concrete mixture you can simply request the desired performance criteria, including compressive strength.

Thomas Concrete has unveiled a family of proprietary concrete mixtures with an emphasis on increased use of SCM's, recycled aggregate, recycled water and multiple other materials resulting in a reduced carbon footprint without sacrificing performance. This branded concrete mixture, called THOMAGREEN™, has been employed successfully in a number of cases to achieve such benefits as; better solar reflectivity (less heat island effect), improved sulfate resistance, improved durability, lower lifecycle costs, as well as the additional benefits associated with the USGBC's LEED program.

Consider some of the success stories of the green construction wave. The East Atlanta Library, an 8,000 square foot neighborhood library built on a brownfield site, utilized a number of the eco-responsible features of Thomas Concrete's mixtures to contribute several points toward a LEED Silver certification. ThomaGreen was used in the construction of The RainShine House in Decatur, Georgia. This residence is expected to consume less than half of the energy normally consumed by a similar home built to standard code. This was the first home in the Southeastern U.S. to achieve the prestigious LEED for Homes Platinum certification. Concrete plays an integral part in this Modernist home, right up to the countertops.

Southface is an Atlanta Georgia based organization working with the construction and development industry, and government agencies to promote sustainable homes, workplaces and communities since 1978. When Southface began construction on their own new facilities they utilized ThomaGreen, with its measurable carbon reduction and ecological impact, to achieve a LEED Platinum certification.

The Cobb County Georgia sewer tunnel constructed in 2011-2012 consists of a 5.5 mile long bored tunnel, at 27 feet in diameter. It is lined with 18 inch thick cast in place concrete. The Cobb County Water System (CCWS) is addressing its future waste water capacity needs by constructing its second deep hard rock tunnel. The tunnel was lined with 115,000 cubic yards of ThomaGreen self-consolidating concrete for structural support and ground water control. The main reason for the use of self-consolidating concrete (SCC) on this project was ease and speed of placement, and for an improved appearance of the finished product. The concrete was batched at a portable plant located on site and was pumped from several locations above ground. At its furthest point the concrete mixture was pumped over 3000 feet, and still needed to maintain its flow. Mix design specifications required #57 stone, the admixture selection made it possible to pump this high-flow SCC without segregation. Early strength was also a concern, as the form system would need to be moved quickly to keep up with the production schedule. The entire construction was completed without any significant problems, and regular testing indicated absolutely no low strength batches.

Ecologically responsible concrete is readily available in all markets. Experiences in Atlanta prove that when a concrete producer draws upon all his available expertise and a history with green concrete the environmental aspects of ready-mix concrete can be improved, and green mixes can be proportioned to meet any specific project need. As demand for responsible concrete develops, so will the solutions for a cleaner tomorrow.

FURTHER INFORMATION

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