The U.S. House of Representatives Committee on Highway and Infrastructure, Subcommittee on Highways and Transits, “Energy Reduction and Environmental Sustainability in Surface Transportation.”

“Effectiveness of Photocatalytic Cement in Concrete for Long-term Sustainability: Cleaner Pavements, Cleaner Air”

Testimony by:
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Essroc Italcementi Group research teams were commissioned to develop a breakthrough cement technology as a way to abate the ever-increasing air pollution affecting urban areas, to keep structures more aesthetically pleasing with less exterior maintenance and to contribute to a better quality of life. This unique technology does not only resist the buildup of atmospheric compounds that tend to discolor concrete over time, but also, absorb and reduce primary pollutants deemed harmful to human health and our environment. Although my opening remarks deal with a proprietary product produced by Essroc Italcementi Group, I make these points to underscore the technology that is coming from the cement and concrete industries, which among their many and varied constituent companies, are both committed to investing in technology that supports sustainable development. Equally important, we are in many cases, bringing technology to bear in the form of products and services that have a direct, measurable, and meaningful benefit to the environment and the world community at large.

Testimony:

My name is Dan Schaffer, U.S. based Product Manager for Essroc's line of **photocatalytic** cements. Headquartered in Nazareth, PA, Essroc Cement Corp. is a leading North American cement manufacturer whose roots date back to 1866 as the first portland cement manufacturer in the United States. Essroc is the North American subsidiary of the Italcementi Group, the fifth largest cement producer in the world. Italcementi is a member of the World Business Council for Sustainable Development and the current co-chair of the Cement Sustainability Initiative. Italcementi is a member of the prestigious Dow Jones Global Sustainability Index, which lists the top 2500 corporations most committed to Sustainable Development.

Accomplished by the use of proprietary technology and the principle of photocatalysis, TX Active photocatalytic cement will facilitate cleaner concrete surfaces and cleaner air. Photocatalysis is a natural phenomenon in which a substance uses light to alter the rate of a chemical reaction. In this case, the active ingredient utilizes the UV light from the sun to accelerate the formation of strong oxidizing reagents which decompose most organic and inorganic substances in the atmosphere. Most significantly, NOx, SOx, and VOC's which indirectly impact human health, are reduced at a substantial rate.

Photocatalysis is an accelerator of an oxidation process that already exists in nature. It promotes faster decomposition of pollutants and prevents them from accumulating. Figure 1 illustrates the concept in general terms.

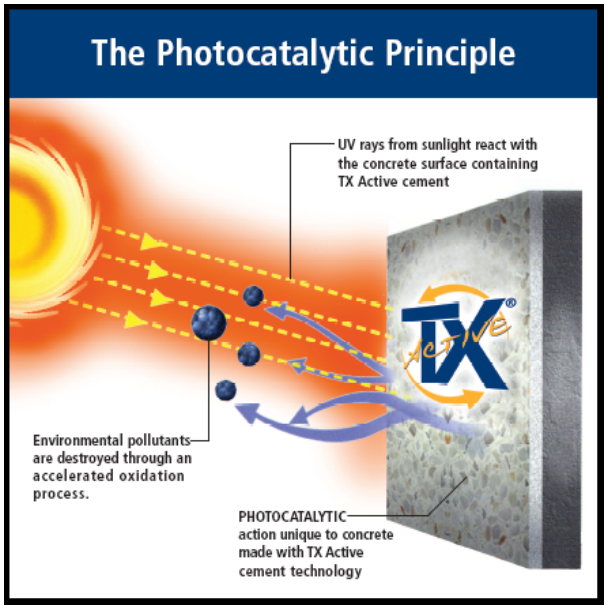


Figure 1

The initial research and development of the photocatalytic technology began over a decade ago (1996), in response to a market need to construct the precast panels for the Dives in Misericordia Church in Rome. The Church, constructed in 2001, to celebrate the new millennium and designed by renowned American architect Richard Meier, needed to maintain its brilliant white appearance long after initial installation. It was during this initial research that the results on the depolluting aspect were so overwhelming that an independent testing project formed.

In early 2001 the PICADA, **P**hotocatalytic **I**nnovative **C**overing **A**pplications for **D**e-pollution **A**ssessment, project was formed in Europe. This 4 ½ year long research study was conducted by a consortium of independent research laboratories, universities, contractors, and manufacturers to assess and validate the de-pollution effect of the photocatalytic cements(see figure 2).

Figure 2

Through state-of-the-art laboratory tests, pollution abatement models, and on-site field assessments, PICADA showed that concrete produced with TX Active cement is efficient in destroying atmospheric pollutants.

A compilation of the studies and projects associated with the PICADA project can be found on-line at www.picada-project.com.

In addition, PICADA developed testing procedures used to measure the performance of concrete products produced with photocatalytic cements.

- Self-Cleaning Test – after the initial reference color is determined by a standard colorimeter measuring device, a rhodamine dye is painted over the surface of a concrete panel/piece that is produced with photocatalytic cement. The concrete panel is subjected to 24 hours of ultra-violet light with the correct power and wavelength. Subsequent colorimeter readings are taken periodically. Figure 3 illustrates a typical result of such a test.
  Compounds diminished or eliminated by the use of TX Active photocatalytic cement and its self cleaning effect are: organic particulates, soot, grime, mold, mildew, fungus, algae, bacteria, allergens, and tobacco smoke stains.

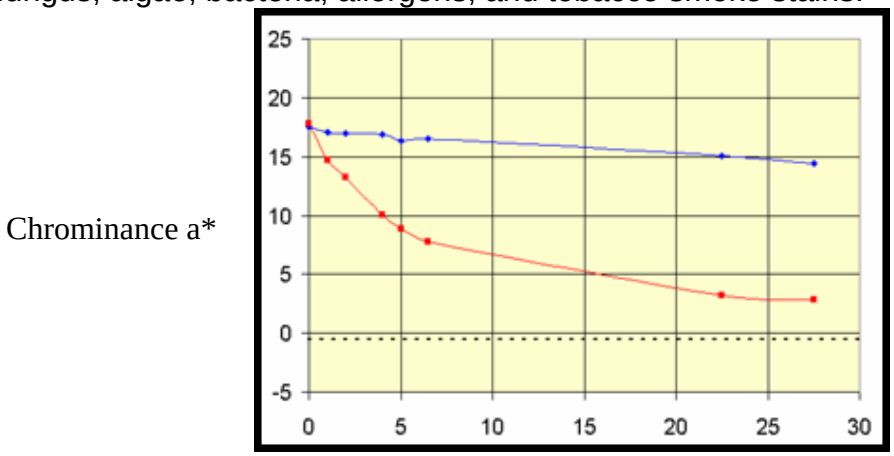
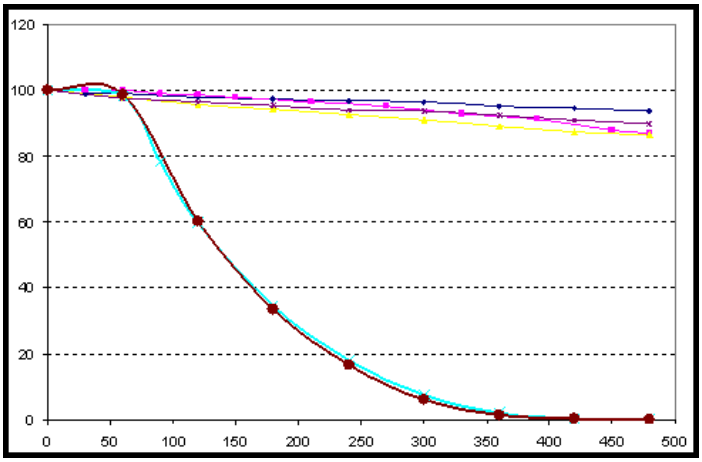


Figure 3

- De-pollution Test - Effectiveness against nitrogen oxides (NOx) is assessed in a chamber of known volume into which NOx is first introduced and then diluted with air to achieve a preset concentration of pollutant, typically 200ppb. The chamber contains a UV lamp, the light source, and a test specimen of known surface area produced with photocatalytic cement. The amount of time is determined that will eliminate all of the pollutant. Figure 4 represents typical results of the test.

Percentage



Time (min)

Figure 4

In the last decade, there have been many studies, experimentations and testing's carried out by CTG, the Technical Center of Italcementi Group, in collaboration with Universities and Regional Research Centers of different Countries (such as the CNR – National Research Center Air pollution institute in Italy, the Regional Laboratories of western Paris etc.). In each occasion, the effectiveness of the photocatalytic cementitious materials was evident, confirming they have a real eco - sustainable value. Laboratory tests showed how just a 3-minute exposure to UV light is sufficient to obtain a polluting agents reduction of up to 75%; large-scale experiments confirmed even greater abatement values.

TX Active has been proven to reduce Nitrogen Oxides (NOx), Sulfur Oxides (SOx), Volatile Organic Compounds (VOC's), ammonia, carbon monoxide, hydrogen sulfide, and ultimately urban smog.

A milestone of TX Active history is the Segrate Road Full Scale Test performed by the PICADA researchers. A heavy traffic road was treated with a thin coating just to allow measurement of the effectiveness of TX Active in real on-site conditions. An astonishing NOX fall of about 50% was the final proof that the era of testing was over and that the product was ready to be marketed. From then on, many significant projects have been realized; herewith you can find some of those ones where NOx measurements have been taken before and after treatment.

Borgo Palazzo street – Bergamo, Italy

The project involved the requalification of about 500 m of Borgo Palazzo street in Bergamo, accounting for an active surface area of about 7,000 m^2 with grey paving stones for the road and red ones for the sidewalks.

Two environmental monitoring campaigns, lasting two weeks each, the first one during November 2006 and the second one during January 2007, have been carried out to monitor the pollution level and compared to the asphalt reference along the same street.

Test results showed a pollution decrease between 30% and 40%. If we consider 500 meter long street, with traffic of 400 cars/hour, the benefits from the pollution decrease are comparable to a traffic reduction of 150 cars/hour. In other words, the smog produced by one car out of three gets neutralized by the depolluting action of TX Active.

Umberto I Tunnel – Rome, Italy

Located in the center of Rome, the Umberto I Tunnel is one of the most brilliant conceived projects to ease Roman road traffic. It has been built to connect Tritone street to Nazionale avenue under the Quirinale Palace (that is the official residence of the President of the Italian Republic), creating a direct route between Piazza di Spagna and Nazionale avenue. By doing so, traffic circulation between the Flaminio district and the Esquilino one has been greatly improved, resulting in a smoother traffic flow from Termini Railway Station to Rome historic center.

Before and after the Tunnel renovation(which included the incorporation of TX Active in the tunnel liner), there have been monitoring campaigns to measure the pollution level in both conditions. In particular, two monitoring campaigns were carried out before and after the renovation work of the tunnel for a significant period of time (three weeks for each period), in order to collect an adequate quantity of data collected for the numerical and statistical evaluation. The restored tunnel utilizing TX Active cement products and an artificial UV lighting system yielded a NOx reduction in excess of 25%.

Jean Bleuzen street – Vanves, France

Parallel to the Paris area highway, Jean Bleuzen street has been included in the Road Network Requalification Plan of Vanves. Jean Bleuzen street is a “Canyon Street” in a North-South position with a good exposure to the sun and perpendicular to the main winds, with more than 13,000 cars per day. The requalification project consisted of 300 meters of TX Active concrete overlay over a traditional concrete substrate, with sidewalks and curbs in paving stones made with TX Active as well, for a total of 6,000 square meters of depolluting surface.

The immediate result was an improved aesthetic landscape and noise reduction, thanks to a suitable concrete formulation and surface finishing together with a pollution decrease of at least 30%, that will be monitored closer to assess the contribution of photocatalytic cement on air and rainwater quality.

In addition to roadway applications, TX Active is now at work in several architectural landmarks, most notably the Dives in Misericordia Church in Rome, Air France headquarters at Charles DeGaulle Airport in Paris, a police department in Bordeaux, France and many commercial and residential facilities. Also, TX Active has begun to be used in highway dividers, noise/sound walls, concrete roof tiles, interlocking concrete pavers, and many other products manufactured with a portland cement base.

In the United States…

Currently manufactured at Essroc’s Front Royal, Virginia facility, TX Active is starting to be utilized in high profile projects throughout the country. A few recent

accomplishments worth mentioning are summarized below, which include architectural precast, permeable pavers, and a prestigious work-of-art.

TX Active was used to produce two 30 foot high Gateway Elements at the entrances to the new I-35 bridge in Minneapolis, Minnesota. These gleaming white concrete sculptures, each comprised of three wavy columns represent the universal symbol for water and serve as markers for travelers that they are crossing the very significant Mississippi River. The elements were developed by the design team of FIGG and Oslund, working with the Visual Quality Advisory Group set up by the Minnesota Department of Transportation.

Hyacinth Place, an affordable “green” housing complex in Highland Park, Illinois has also taken advantage of the properties of TX Active. Permeable concrete pavers containing the patented cement technology were installed in the courtyard areas. While the photocatalytic properties of the pavers clean the air on a clear day, on a rainy day their permeable solution allows rainwater to flow through their surface. Meaning, polluted rainwater filtrates naturally back into the ground, rather than pond or discharge into nearby streams.

Greg Sims, a Georgia-based architect completed a design for a white precast carillon bell tower for Dalton State College. The landmark tower soars 75 feet high and is the centerpiece of a new quadrangle project currently transforming the campus environment. It is important for this tall structure to remain pristine since it is visible both night and day to thousands of drivers on adjacent Interstate 75. TX Active will certainly assist while significantly reducing maintenance costs associated with such a tall structure.

TX Active is currently included in many other creative project specifications throughout the United States. The Chicago Department of Transportation will be resurfacing 70,000 square feet of pavement in a downtown location that will utilize TX Active cement. Also, Louisiana State University's basketball practice facility, currently under construction, will incorporate precast panels produced with TX Active…all leading to a cleaner, greener environment.

Certainly the use of a photocatalytic cement is enough reason to utilize concrete throughout the infrastructure; however, concrete has many other advantages that promote its use. Concrete, second to water is the most widely used construction material in the world. Concrete can be designed in any size and shape imaginable. It can be designed with a high degree of strength and durability, low permeability, and has a lengthy service life. And once its life-cycle is complete, concrete can be crushed and recycled.

Equally important, concrete pavements are also naturally light-colored, reflect light and do not retain as much heat as darker-colored pavements. This enhances night-time visibility, which in turn, improves both pedestrian and vehicle safety. These properties also can have a profound effect on energy savings, as concrete pavements require fewer lighting fixtures or lower wattage fixtures to illuminate concrete roadways in comparison to the darker pavement surfaces. When properly accounted for during design, cities and municipalities can save up to one-third on energy costs associated with street-lights. The potential savings are huge, considering that the cost of keeping street lights illuminated is often the third costliest item a typical city might incur, right behind schools and employee salaries.

Concrete pavements have a direct effect on mitigating urban heat island effects. Urban areas can be up to nine degrees Fahrenheit warmer than surrounding areas, related to among other things heat-absorbing dark-colored horizontal surfaces like roofs, roadways and parking areas, which translates to more pollution and more energy required for cooling buildings. Concrete has been used successfully, along with other light colored building materials and strategic planting, to reduce the urban heat island effect. Couple that with the use of a photocatalytic cement and the concrete original lighter color surface will remain for a longer period of time.

The concrete pavement industry and Essroc stand ready and willing to invest the time and other resources to advance our products and processes in pursuit of even more sustainable practices. We look forward to the support of the public sector to realize the American vision of the best highways and roadways in the world. Thank you for your time, for providing this opportunity to our industry, and for your invitation to the Subcommittee.