

"Federation Corner" column
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Smog-eating cement and other miracles

by Wayne Goldstein

What started out as a practical way for an architect to design an inspiring building that would remain free of the grime from severe air pollution has helped to rivet attention on what is the latest, simplest, yet seemingly miraculous way to control air and water pollution. All that remains is for the world to make widespread use of this material to have an immediate and positive effect on the environment. Using this material in the roads, ramps, bridges and sound walls that will make up the ICC would provide a direct means to immediately neutralize the harmful effects to our air and water caused by ICC traffic, rather than waiting decades for new generations of truck and auto engines to eventually provide a more general improvement to air and water quality.

This very public discovery had its origins in 1996 when American architect Richard Meier won a competition to design the Jubilee Church - Dio Padre Misericordioso - in a suburb of Rome. Meier was already internationally renowned for such work as designing the Getty Center Museum in Los Angeles, winning the prestigious Pritzker Prize in 1984. For this church, he wanted the simple but powerful effect of whitewashed buildings found in Mediterranean villages and the churches. To replicate this effect, he chose "... a beautiful white concrete with a smooth finish that resembles polished marble without veining." The church opened in October 2003.

"Titanium dioxide particles were added to the cement as the church was being built to ensure it stayed white, and clean, by resisting Rome's notorious smog. But then the company that made the cement for the church made a startling discovery. 'As research went on we discovered it destroyed pollutants in the air'," said the director of research and development of the company. "Three years after the Church in Rome opened it's still very white. On closer examination, you can see filmy streaks of grey and brown, but [the director] says that's just Sahara sand blown in by the notorious Scirocco wind. 'It comes off with a little water' he says."

The source of this miracle? It has been known for years that titanium dioxide - TiO₂ - acts as a photocatalyst, meaning that it causes other materials to break down without itself changing, when it is exposed to the ultraviolet light in sunlight. Thanks to much smaller particles with a far greater surface area created through nanotechnology, it can now cause these changes even when just exposed to visible light. When applied to objects, it breaks down organic materials like dirt and bacteria so that they can't stick to the surface and are instead washed off by rain. It causes reactions in the pollutants in the air that come in contact with the surface - like nitrogen dioxide, sulfur dioxide and carbon monoxide - and causes them to break down into carbon dioxide, nitrates, and water.

Italcementi, the world's fifth-biggest cement producer, the company that provided the concrete for the church, based on research it began in 1996, also applied the TiO₂-containing materials to a street in a test in 2003. "The company coated 75,000 square feet of road surface on the outskirts of Milan with photocatalytic cement. It found nitrogen oxide levels were reduced by up to 60 percent, depending on weather conditions. A similar experiment in France found nitrogen oxide levels were 20 percent to 80 percent lower in a wall plastered with photocatalytic cement than one with regular cement." Researchers have calculated that if just 15% of the visible surfaces of a large city like Milan, with its high levels of air pollution, were covered with this material, whether in cement, plaster or paint, it would reduce air pollution by 50%. The European Union is spending billions to research this and other uses.

For 2007, this "smog-eating" cement was the star of the National Association of Home Builders' "new model home to display the latest in building technologies and design techniques." "The exterior concrete walls of The

New American Home incorporate photocatalytic technology that eats smog and is self-cleaning. The new photocatalytic cement technology used for the exterior of the 2007 New American Home on display at the International Builders' Show (IBS) in Orlando, Fla. earlier this year eats smog and decomposes the air-borne microorganisms that would soil its façade, giving the home a self-cleaning exterior."

"The most fascinating application used in The New American Home® is a building material with benefits that are invisible to the naked eye at first glance. The exterior would appear to be the traditional cement-based stucco walls, which have long been known for their durable, beautiful, low-maintenance finish. However, the stucco used in the New American Home® features one of the most revolutionary sustainable building applications in the world - TX Active - a new photocatalytic cement technology that is not only self-cleaning, but also has been proven to reduce air pollution."

Now that photocatalytic cement technology has been accepted in Europe and embraced by the nation's largest homebuilder trade organization, it is time for Montgomery County and Maryland to put it to use. Since air pollution that will both harm people and the environment has been one of the key concerns about the ICC, the solution to this problem could literally be built into the highway itself. Rather than wait decades for new generations of gasoline and diesel engines to eventually replace the engines of the hundreds of thousands of vehicles that will use the ICC, we can stop much of the pollution at the source as soon as it comes in contact with the highway surfaces, the bridges and the sound walls of the ICC. While the ICC will generate 20% more driving as it also removes cars from local roads, the fact that the ICC will be built new will allow the displaced air pollution to be broken down on the ICC, pollution that would otherwise be released on the local roads which could not begin to provide such smog-eating power until they were resurfaced. Of course, it would be easy to coat existing sound walls and jersey barriers along the Beltway and other major roads.

Furthermore, if this material could be successfully incorporated into pervious concrete and asphalt parking lots, sidewalks, alleys and driveways - the future way to handle stormwater runoff - not only would the stormwater drain through the pavement and into the earth, but it could carry the broken down air pollution byproducts like nitrates with it.

Montgomery County knows how to be innovative, although too often it takes far longer than other jurisdictions to implement many of these innovations. The county now has a unique opportunity to make use of this affordable breakthrough in how we can be better able to afford the cost to maintain our infrastructure while also slashing the worst of our air pollution wherever this material is used. We can have clean buildings, clean transportation facilities and clean air all at the same time. Let's get started.