

# Envision | Issue Statement Paper

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## Authors

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## Issue and Topic

Self-Cleaning Concrete in the United States

## Problem Statement

Over the course of recent years, the quality of life has decreased due to many factors. One of the main contributors to this issue is vehicular emission, which leads to the formation of smog in the ozone. While the daily routine of Americans traveling to and from work requires the use of a vehicle, the overuse of such transportation leads to the omission of high amounts of Nitrate into the air. Having extraordinary amounts of such gas poses many health issues, ranging from respiratory conditions in the human body to disturbing the pH levels present in lakes and streams. Ecofriendly tactics have been utilized by many companies in an effort to depollute the environment on a global scale. From an architectural standpoint, using the architecture itself as an affordable self-cleaning device by means of oxidation and deactivation of contaminants can contribute to depolluting the air one concrete building at a time.

## Sustainable Solution

One solution to the evolving issue of poor air quality is mixing a photocatalyst, in this case Titanium Dioxide, with cement in order to create a product which would break down the chemicals that cause pollution and emit ecofriendly gases into the atmosphere - by the use of sunlight. The use of Titanium Dioxide as an air purifier came about in Japan in 1996. A wide range of products were sold for different purposes in order to provide the public with self-cleaning inventions that would facilitate housework and other tasks. Through the past few years, Europe and Japan have found ground-breaking ways to apply Titanium Dioxide. In 2013, an Italian Chemist by the name of Luigi Cassar invented self-cleaning concrete simply by combining Titanium Dioxide and cement, applying it to building facades, and observing the activation of the self-cleaning process as the building comes in contact with light. This technology has made its way through Europe via the PICADA project (Photocatalytic Innovative Covering Applications for Depollution Assessment); its initial goal was to maximize the efforts in which countries such as France, Switzerland, Italy, and Germany use photocatalysts. Since this technology has not made its way to the United States, it would be beneficial for our great urban cities to make use of the idea of self-cleaning and integrate it into our buildings as well.

The significance of Titanium Dioxide is rooted in what is often used to describe this chemical; a photocatalyst. A photocatalyst, by definition, is a substance that accelerates the rate of a chemical reaction when exposed to sun. Contaminants such as fungus and bacteria are trapped by the Titanium Dioxide, and through the process of photocatalysis, are released into the air in the form of processes such as deodorization, sterilization, and air purification. The Concrete Society released an article in which they described the process in which Titanium Dioxide cleanses the environment:

“The energy in light causes the  $\text{TiO}_2$  to create a charge separation of electrons, which disperse on the surface of the  $\text{TiO}_2$  and react with external substances, decomposing organic compounds.”

In order for the Titanium Dioxide to reach its full potential, it has to be exposed to sunlight, which assists in carrying out the means necessary in order to purify our environment. Such technology's presence in our country is of utmost importance for various reasons. Self-cleaning concrete is affordable, as it costs little to no money to maintain it, which can be seen at the Jubilee Church by Richard Meier; the only item used to maintain the building is rain. Another reason as to why this method of sustainability works is because it contributes to the reduction of the depletion of the ozone layer, which affects our planet on a long term basis.

Bringing self-cleaning concrete would have to deal greatly with the branch of commerce in Foreign Affairs. It is time as an architecture student in my last year to imagine a world where a building is respected and protected in the same way that a building protects people under its roof.