



Precast concrete offers significant practical and aesthetic advantages, including its broad range of color possibilities. Image Source: Unsplash user Luca Rüegg

Concrete is renowned for its remarkable strength and durability, affordability, and low maintenance requirements, making it ideally suited for use in a virtually endless variety of applications. From parking garages to railroad ties, agricultural products to retaining walls, concrete's extraordinary versatility makes it "the most used man-made material in the world."¹ However, the appeal of concrete doesn't simply lie in its practicality; it can also have significant aesthetic appeal. Homeowners turn to concrete to beautify their properties, whether via intricate modular paving, cutting-edge countertops, or contemporary exteriors. Meanwhile, designers are increasingly using concrete in aesthetically innovative ways to enhance the appearance of public spaces and shape our experiences of the world around us.

This broad appeal comes in part from the fact that concrete, particularly precast concrete, can be manufactured in an infinite variety of colors. Whether a customer is looking to create a bold new public building or simply update their kitchen, precast concrete manufacturers can use color to help them achieve their perfect look. However, with so many variables at play, achieving the ideal hue can be a challenge, and objective color measurement is necessary to develop manufacturing processes that will result in your desired appearance. As such, spectrophotometers are playing an increasingly vital role in the production of precast concretes.



The final color of concrete is influenced by a variety of factors, from raw materials to final finishing. Image Source: Unsplash user Denys Nevozhai

Variables Impacting Precast Concrete Color

Whether creating custom components or mass-producing concrete product, the primary benefit of precast concrete over [cast-in-place concrete](#) is predictability. “Since precast is manufactured in a controlled casting environment it is easier to control the mix, placement, and curing,” explains the Concrete Network. “Quality can be controlled and monitored much more easily.”² This control extends to color; creating concretes in a factory environment enhances your ability to carefully monitor each stage of production in order to achieve your desired final result. As such, precasting is typically the preferred method of production when color is a top priority.

However, while precast concretes are manufactured in stable environments, their final colors are influenced by a wide variety of factors, including:

- Cement color
- Aggregate type and processing
- Pigment type

- Pigment ratio
- Finishing (sandblasting, acid etching, etc.)

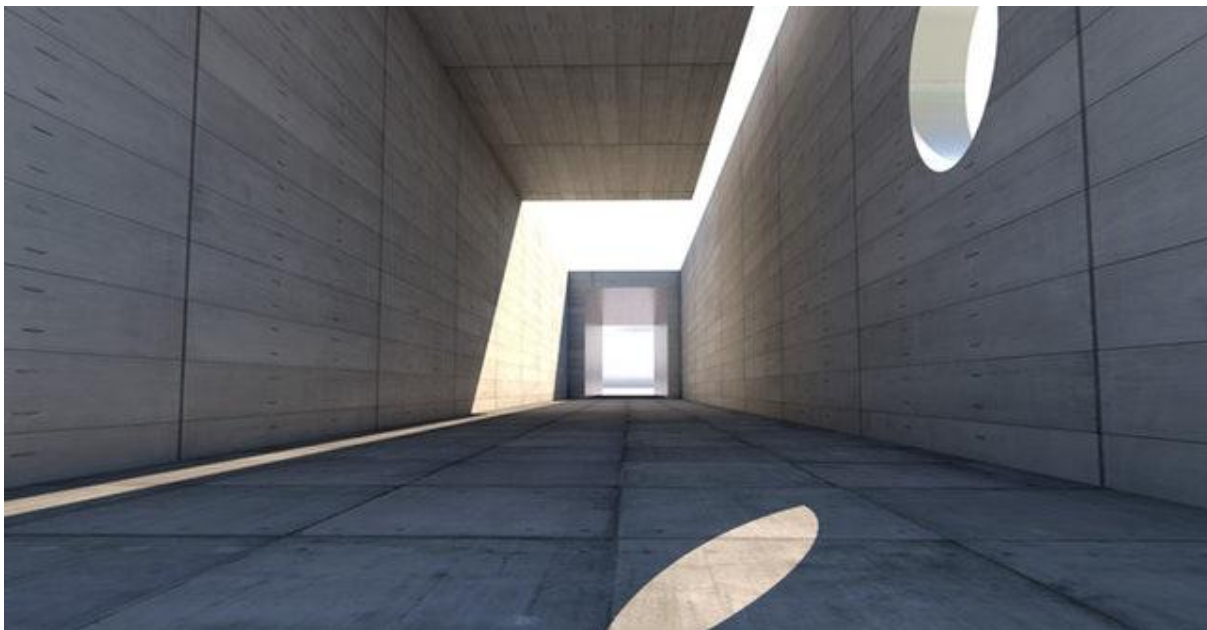
With such a large variety of variables impacting the final appearance of the concrete, each component must be carefully monitored in order to observe its impact on the color of the concrete and, ultimately, create your ideal hue. Spectrophotometric instrumentation allows you to easily identify the relationship between these variables and the final appearance of your products in order to create the best possible formula for your concrete products.

Spectrophotometric Analysis Improves Formulation

Spectrophotometers are essential tools for manufacturers of precast concrete, whether you're looking to create custom color matches or ensure consistency in the production of existing hues. Unlike the human viewer, spectrophotometers can capture objective color data accurately and precisely and distill that data into numerical values, allowing for the highest level of insight into color behavior.

One of the greatest advantages of spectrophotometric technology is the way it facilitates formulation. The variables inherent to precast concrete production means that there are virtually endless material and process combinations that can impact the final appearance of your product. Modern spectrophotometers come paired with advanced color measurement software packages, like [HunterLab's EasyMatch QC](#), that allow you to easily correlate material and process variables with color outcomes, providing a blueprint for how to move toward the result you want and improving the efficiency of the formulation process.

To optimize the aesthetic longevity of your precast concretes, you may also wish to observe how the color of your product responds to environmental stressors. Factors such as UV exposure, temperature variation, rain, and pollution can all have a detrimental impact on the color of your products.³ Using spectrophotometric color measurement, you can analyze how these factors impact color quality, allowing you to rework your formula to correct for any unwanted color changes and improve color durability.



Maintaining batch to batch color consistency is essential to producing satisfactory products, particularly when multiple components must create a cohesive whole. Image Source: Pexels user Pixabay

Maintaining Color Consistency in Precast Concrete

Of course, the value of spectrophotometers goes far beyond the formulation stage. Once your formula has been perfected, you can use your data to produce a set of color standards for both [your raw materials](#) and your final product. This allows you to create an end-to-end color quality control system that will ensure you detect any unwanted color variation as early as possible. Cements, for example, are susceptible to color fluctuation due to a host of production variables, including water content, temperature, and humidity fluctuation. By confirming that your cement conforms to your color standards prior to the start of production, you ensure that you have the foundation you need to create your desired appearance. Color measurements can then be taken at various points in the manufacturing process to monitor color development and ensure color is progressing according to expectations. The color of the final product is assessed to determine whether your expected result has been achieved by comparing the final color data to your established standard.

Choosing the Right Spectrophotometer

Spectrophotometric color measurement is critical for accurate, consistent coloration. However, not all spectrophotometers are the same; different geometries allow you to [analyze color in different ways](#), and [choosing the right instrument](#) for your needs is vital for ensuring you can capture the data you need. This is particularly true when manufacturing multiple components that must form a cohesive whole.

In order to analyze visual consistency between components, it's advisable to use a directional 45°/0° spectrophotometer that measures the appearance of your final product the way the eye sees it. If you wish to know the total color of your samples, a diffuse/8° instrument will be a better option. Whatever your preference, there is sure to be a spectrophotometer perfectly suited to your needs.

HunterLab Quality

HunterLab has been a pioneer in color measurement for over 60 years. Today, we offer a comprehensive range of [portable, benchtop, and in-line spectrophotometers](#) designed to meet the diverse needs of our customers. We understand the unique challenges faced by the precast concrete industry and offer innovative, user-friendly solutions to help you improve your formulation and manufacturing processes. [Contact us](#) to learn more about our renowned technologies and world-class customer support services.

1. "Sustainability Benefits of Concrete", <https://www.wbcdcement.org/index.php/about-cement/benefits-of-concrete>
2. "Advantages to Precasting", <https://www.concretenetwork.com/precast-concrete/advantages.html>
3. "Pigments for Integrally Colored Concrete", 1980, https://courseworks2.columbia.edu/files/601625/download?download_frd=1&verify=r=L7IFeYinK9Juzjya6R8pVpK0sg5Adv67JEoxgSTp

