



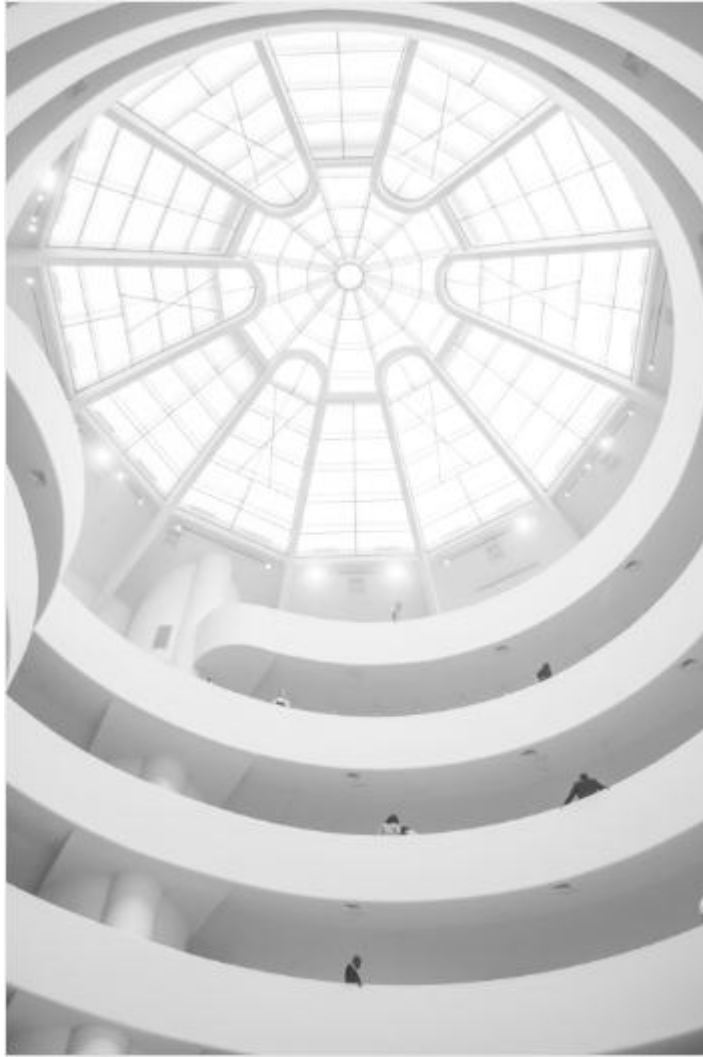
The Forum in

Barcelona is a prime example of the possibilities of colored concrete.

Image Source: Flickr user Rick Ligthelm

Concrete doesn't have a reputation as a particularly colorful building material; if you were to ask most people what color concrete is you'd get some variation on the word "gray." In fact, concrete comes in a virtual rainbow of colors, from the white ribbon of the Guggenheim to the warm orangey browns of the Guelmim Technology School to the ocean blues of the Forum in Barcelona. Once prized primarily for its strength and durability, concrete is now increasingly being looked to for its aesthetic beauty as concrete manufacturers introduce an ever-growing array of color options. Although historically colored concrete has been a niche market, today many producers of both ready-mix and precast concrete believe that offering pigmented options is essential to staying competitive in response to growing demand by everyone, from world renowned architects looking to create their next iconic masterpiece to suburban homeowners wanting a fresh look for their patio.

As interest in colored concrete continues to expand, so too does the need for innovative technologies that facilitate the production of attractive products. For example, liquid coloring agents added to concrete using automated liquid color dispensing equipment are increasingly replacing traditional dry powders, allowing for "increased batch-to-batch color consistency, reduced batching error, and the ability to produce an infinite array of colors while only keeping four or five primary colors in stock."¹ The highest level of color control, however, can be achieved through the strategic use of spectrophotometric instrumentation, giving concrete producers and users unprecedented flexibility and quality assurance.



The white concrete swirls of the Guggenheim Museum makes it one of the most iconic buildings in the world.

Image Source: Unsplash user Drew Patrick Miller

Spectrophotometric Evaluation of Colored Concrete Formulas

The formulation of colored concrete is a delicate art that requires precise integration of synthetic or natural pigments with a concrete base, taking into account multiple factors to ensure that the final product looks and behaves as you want it to.² These factors include:

- **Pigment type:** Natural pigments are often coarser than synthetic pigments and typically do not offer the same color intensity as man-made products.
- **Pigment ratio:** Adding too much pigment to the concrete can cause the mixture to require excessive water, compromising the strength of the material.
- **Aggregates:** Aggregates can greatly impact the color appearance of the final product and may be chosen to create unique color effects. In some cases, highly specialized aggregates must be sought out to achieve a particular appearance.

Spectrophotometric monitoring of colored concrete formulas through the development stages ensures that you have the data needed to create concretes that are both beautiful and practical,

able to hold up under scrutiny of the most discerning eye and the environmental stressors the material must withstand. By pairing your spectrophotometer with modern software packages, such as [HunterLab's EasyMatch QC](#), correlating color results with process variables is simple, allowing you to tailor your product with the highest level of precision to achieve your desired results. These advanced technologies can also be used to evaluate color quality over time when exposed to artificial aging processes that simulate the effects of sun, rain, pollution, and temperature fluctuation, giving you even greater insight into formula performance.



Liquid pigments are increasingly being integrated in concrete mixes to create an array of appealing colors in both public and private spaces.

Image Source: Petra Bensted

Ensuring Perfect Pigmentation

Once a formula has been perfected and moves into production, recreating the perfect shade starts with monitoring the color of the raw materials, as both the pigment and the concrete color can vary batch to batch and location to location, potentially compromising your ability to produce the hue you desire. Spectrophotometers offer the most precise color measurement possible and instantly distill color information to objective data, allowing you to determine whether the materials meet your standards. By catching [unwanted color variations](#) early, you can isolate chromatically flawed pigments and raw concretes and take corrective action immediately, preventing costly mistakes. If the materials do meet your requirements, the pigmentation process can begin.

In-line spectrophotometric monitoring of the concrete coloration process takes color quality control to its peak, as you are able to continuously assess your product throughout manufacturing, virtually eliminating the risk of releasing unsatisfactory products into the marketplace. This is particularly critical if multiple batches of colored cement will be used within a single project and must form a seamless color match. The versatility and flexibility of today's sophisticated color measurement

technologies mean that in-line monitoring may be performed on both powder and liquid products via reflectance analysis and the [integrated height measurement capabilities of HunterLab instruments](#) allows for accurate readings of even textured concretes, regardless of form.

However, the use of spectrophotometers is not limited to development and manufacturing stages; if builders are mixing colored concrete in the field, portable spectrophotometers offers operators the ability to evaluate concrete color on-site and in real time. The [one-touch, dual beam design of HunterLab's portable instruments](#) make them ideal for use by all operators, as they require no complex sample prep or specialized technical knowledge to operate. Users are instantly given the information they need to determine color quality, confirm color matches, and detect undesirable color variations. Not only can this help builders realize significant cost savings, it also has immeasurable benefits for protecting the integrity and reputation of your operation.

HunterLab Innovation

HunterLab has been a pioneer in the field of color measurement for over 60 years. Our commitment to ongoing innovation, technological excellence, and responsiveness to our customers' needs has made us the most sought-after name in spectrophotometry. Our comprehensive range of instruments include in-line, benchtop, and portable options to ensure you have the tools you need to easily obtain reliable color data in any situation, giving you the highest level of color quality control possible. [Contact us](#) to learn more about our sophisticated spectrophotometers, customizable software packages, and world-class customer support services.

1. "Changing the Color of Concrete," June 1, 2005,
<https://www.concrete.org/publications/internationalconcreteabstractsportal.aspx?m=details&ID=14454>
2. "Enhance Concrete's Value with Color," 1993,
http://www.theconcreteproducer.com/Images/Enhance%20Concrete's%20Value%20with%20Color_tcm77-1305602.pdf