

# Aggregates bring lifetime color to concrete

## Supply sources listed

BY M. K. HURD

**M**other Nature's palette comes alive in architectural concrete through the exposure of aggregates . . . quartz, granite, obsidian, basalt, limestone, and many more. Color effects range from traditional earth tones to greens and blues as well as to the more exotic pinks, purples, and plums as indicated in the names given by aggregate suppliers. Concrete Construction has updated its list of suppliers of decorative aggregates to help builders and designers find the colors they desire (see table on page 572). In addition to finding the right color of aggregate, users must also be sure its durability is appropriate for the planned exposure. Aggregate suppliers should be able to give helpful advice on this point.

### Aggregate exposure methods

Aggregate exposure is a valuable technique for architectural precast concrete, for cast-in-place formed surfaces, and for flatwork where decorative walks, drives, or plazas are desired. Varied methods of exposing aggregate described in Reference 1 include:

- Brushing and washing (early age)
- Chemical surface retardation
- Abrasive blasting
- High-pressure water jetting
- Acid washing or etching
- Mechanical tooling and grinding

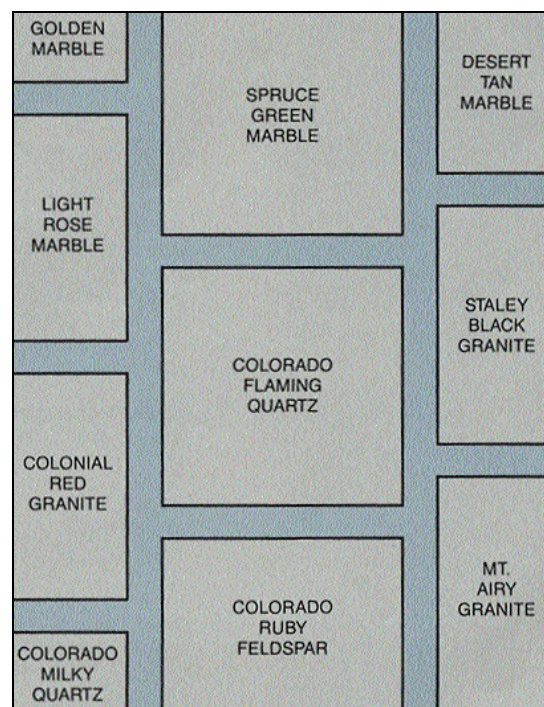
Frequently a combination of exposure techniques is used to provide added surface contrast. Owners have found that exposed aggregate concrete in combination with cut stone facing of the same material is frequently cost-effective as well as aesthetically pleasing.

Choice of a method for exposing aggregate may be governed by the method of casting, the composition of the aggregate, and the surface appearance desired. For example, acid etching works well with acid-resistant aggregates such as quartz and granite, but may discolor or dissolve limestones, dolomites, or marble.

Abrasive blasting, commonly called sandblasting, and chemical retardation are among the most

widely used methods. Abrasive blasting may be done with either air or water as the carrier of the abrasive; to be done effectively it requires considerable skill on the part of the operator. Chemical retarders delay the set of cement paste so that it can be readily removed from around the aggregate by brushing, washing, or water jetting. Retarders are available in several formulations providing varying degrees of aggregate exposure. Uniform application of retarder and maintenance of that uniformity during concrete placement are necessary for good results. Vertical surfaces call for added care.

Brushing and washing with water is an old method for aggregate exposure, used by Frank Lloyd Wright on



Identification of aggregates on this month's cover. The aggregates were photographed wet to show distinct color and texture. Pictures show approximately the true aggregate size, with particles averaging  $\frac{3}{8}$  to  $\frac{1}{2}$  inch. The actual concrete surface to be obtained will vary with cement and sand combinations as well as with the finishing technique. (Photos supplied by Fister/Warren).



Abrasive blasting fractures the surface of aggregate particles and tends to mute their color. Compare aggregate exposure by retardation (left) with the sandblasted finish on the right. These are actual size samples of identical concrete, made with 1/2 x 3/4-inch ruby feldspar coarse aggregate, white cement, and ruby feldspar sand.

the historic Unity Temple as early as 1905. It is frequently used for flat-work today and can be effective for vertical formed surfaces if the forms can be stripped before the concrete has gained full strength. However, chemical retardation is often preferred because it usually saves labor.

Other methods of exposing aggregate



Costly aggregates are not always needed for good results. Light-colored limestone aggregate on these precast white concrete panels was exposed using a chemical retarder. This kind of aggregate-rich surface is best achieved with gap-graded mixes as explained in Reference 1.

include: seeding additional decorative aggregate into horizontal slab surfaces; the aggregate transfer method described in Reference 2; and a proprietary method of preplacing decorative aggregate in a layer next to formed surfaces, then pumping in cement paste to surround the stone, followed by partial removal of the paste after the concrete has hardened. The latter two methods are seldom used because of the cost.

### Mix design for aggregate exposure


For best results with exposed aggregate, special attention must be given to mix proportions as well as to materials. White or colored cements, colored sands, and added pigments may be needed to complement the special aggregate chosen.

Exposed aggregate concrete generally requires a higher than normal proportion of coarse aggregate. Gap-graded aggregates—a gradation that omits certain intermediate

sizes—are usually chosen where the best surface exposure of large aggregate is desired. Sometimes only a single size of coarse aggregate is used. The mix design is best done by someone with experience in architectural concrete.

### Aggregate source list

Most of the aggregates shown in the accompanying table are special-purpose decorative materials, available at higher prices than ordinary structural concrete aggregates. The list, presented to inform readers of sources of these special materials, is based on information provided by the suppliers within the last few months before preparation of this article.

If your company name should be added to our list, contact the Aggregates Editor, 33742 Lyncroft Road, Farmington Hills, Michigan 48331. Please include information on aggregate colors, stone types, and principal uses. 

### References

1. ACI Committee 303, "Guide to Cast-in-Place Architectural Concrete," American Concrete Institute, Box 19150, Detroit, Michigan 48219, 1982, 30 pages.
2. "Color and Texture in Architectural Concrete," SP021A, Portland Cement Association, 5420 Old Orchard Road, Skokie, Illinois 60077, 1980, 32 pages.
3. "Jobsite Precast Panels—Textures, Patterns, and Designs," IS061A, Portland Cement Association, 1977, 12 pages.
4. "Finishing Concrete Slabs—Exposed Aggregate, Patterns, and Colors," IS206T, Portland Cement Association, revised 1987, 12 pages.
5. "Bushhammering of Concrete Surfaces," IS051A, Portland Cement Association, revised 1987, 4 pages.

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