

## THE COLORING OF CONCRETE.\*

Having been requested to make a few remarks on the coloring of concrete, I will endeavor to give you my experience in that line. Representing the pioneer block manufacturing company of the Northwest, we have made many experiments in coloring artificial stone.

First, I will state to you that we found the ground colored natural stone and mineral iron oxide were the most desirable and practical, from the fact that they in no way weaken or damage the setting qualities of our stone, but, on the contrary, they add very materially to the strength of the finished product. We tested many different coloring compounds, some with fair results, but all those containing acids or greases (among these are graphites and lamp blacks) are found to be detrimental.

We tested some very fine samples of ground crushed stone from Europe and from different sections of the States, always with the same result. They are too weak in actual coloring matter to bring about the desired shades, and always with the same complaint, "too expensive." Expensive at least in the manner we always use coloring, as we color our entire stone.

Very early in our manufacturing experience, we dropped the facing plan and adopted the plan of coloring the entire stone. Beginners are led to believe, as we were, that the facing of stone is desirable. In theory it is all right; in practice we found it undesirable, and were not satisfied with the results financially. That many beautiful results may be obtained is true, both in the facing and coloring of stone, but that the facing of blocks is not practical, and that they are not merchantable, on account of the cost of manufacture, is also a fact, and we have found that the best results are obtained by keeping as close to the manufacture of your primary product as possible. We may at times find customers that will pay the additional price, but they are the exception and not the rule.

To illustrate this, we will mention that we were recently asked to figure on a very elaborate design for an office building for one of our large manufacturing concerns, but when we made our estimate and named the price, the owners simply shook their heads. That one of our competitors made this building is a fact, and that it is a handsome building is true. However, the contractor recently asked me to condole with him on the results financially. The only satisfaction I could give him, was the old reply, "I told you so."

In making tests either with coloring concrete blocks, or concrete of any character, it is our motive to make our product at a minimum cost, and market it at a fair profit in competition with other non-combustible materials.

The colored stone that we are most frequently called upon to imitate in Wisconsin is what is known as "Portage Entry Red stone." This is a Northern Michigan product, and we are at a loss to know why they term it "red" stone, for, in fact, it is a very light shade of pink, and the most singular condition is that if we were to produce an artificial stone as light in color, the public would exclaim at once, "Why, how pale it is. It must have faded considerably." Our only test is to place the natural product by the side of the manufactured, and allow our customers to see the difference. Then they say, "Why, I did not imagine it was so light."

We have found it necessary to color our artificial stone several shades darker (when first made) than the natural product. We are frequently asked, "Will not this color fade?" That the stone grows lighter as the cement sets is true, and it will continue to grow lighter until it has attained a thorough initial set and has become dry. This setting and drying process (as all of you know) is governed largely by the temperature and time of year, and the exposure to which the manu-

factured product is subject. All of you who are contractors and builders, know that when you desire a deeper or darker shade of mortar coloring, you are obliged to make your wet mixture many shades darker than when it is finished and the action of the lime has taken place.

We are also frequently asked what proportion of coloring matter we use per stone. This is rather hard to answer, from the fact that different block manufacturers make many different sizes of stone, and that the material used in different localities varies so much in character. We also find that different cements change the coloring more or less. However, this is not perceptible to any great degree.

In the manufacture of red stone with such sand and cement as we are in the habit of using, to obtain a strong, deep, cherry red after final setting, we find it necessary to use from 5 to 7 pounds of the pure mineral oxide per cubic foot of concrete. In this mixture we use clean silica sand containing no loam or clay of any character and very little organic matter. We also found that the thorough mixing of the color with the cement, before adding sand, was very necessary.

We discovered that to get good results it was absolutely imperative to have our sand thoroughly dry, and that we were obliged to mix sand, cement and color together thoroughly, much more so than in making the ordinary concrete block. We learned this early in our contracting career, when at times we found it necessary to use lamp black in producing dark mortar color. We were at a loss many times to find some liquid mixture with which the lamp black would thoroughly assimilate. At times we used vinegar, at others stale beer (and incidentally will say that this very seldom grows stale in Milwaukee). By simply taking very fine dry sand and mixing the lamp black with it thoroughly, we found no trouble in getting an even, dark color for our mortar.

We have been for some time endeavoring to get a green stone for an architect and customer, but as yet have not been satisfied with the results. We did make a green stone, the body of the block being of a moss or olive shade, with streaks of livelier green color running through, but we have been somewhat afraid to recommend this stone to the architect, as we have not fully satisfied ourselves as to the action of this ultra-green on the cement. Our first trial was some six months ago, and we are watching the product of this trial very carefully; as yet it shows no signs of disintegration, and we are now subjecting it to the strong climatic changes, to see what effect the weather will have upon it.

We also found that to get an even and artistic product, it is essential to have our materials as nearly in the same condition as possible, as regards moisture and mixing, all these little details causing additional expense over the original product we made.

We are frequently asked, "Have you experimented with hydrated lime, stucco or other fine materials, in making colored concrete?" Yes, we have experimented with all of these, and, in addition, have used other fine filling materials, such as Warrenite ground flint clay, also ground silica. I found that hydrated lime and gypsum quickened the setting qualities of the material, provided enough water was used and added from time to time, to keep the concrete from burning or falling apart, as the lime or stucco absorbs the moisture more readily than the cement, and robs it of the moisture it must have. I also found that if I succeeded in keeping it moist enough, after a period of six months to a year, a condition almost akin to decomposition set in, and the mass would crumble and fall apart. However, the latter conditions did not occur with the ground Warrenite or fine silica, but we did find that it was necessary to add about 2 more parts cement to get desired results with the extremely fine material.

You ask, "Why use such fine material?" We found that in producing a beautiful colored artificial stone, it was necessary to have a very dense product, especially when your customer gives the stone a close and critical inspection. . .

\*From a paper read at the Initial Convention of the National Cement Users Association, held at Indianapolis, by Mr. J. P. Sherer of Milwaukee.