Texas Aggregates and Concrete Association

Position Statement #4

Light Reflectivity and Albedo

Truth and Consequences with Green Building Specifications

The issue of pavement reflectivity comes up often in specifications where LEED® points are critical and in short supply. The standard unit of measurement for pavement reflectivity is albedo (ASTM C1549) which is a simple ratio of the amount of light reflected from a material to the amount of light projected on the material. The higher the albedo number the more light that is reflected from the surface. A typical asphalt surface can range from 0.04 to 0.12. Concrete pavements can range from 0.2 to 0.5 or higher.[1] As the albedo number increases, the light reflectivity increases as does the structures ability to reflect heat, i.e. creating a cooler structure and a potentially cooler surrounding atmosphere. From an environmental design standpoint all of these elements are extremely desirable, and contribute to a sustainable design.

A standard specification for a pavement used in a green building project might state,

"Concrete used for paving shall have a minimum albedo rating of 0.3."

Based on the above description, this would seem like a fairly straightforward and simple specification in which to comply. However, a specification like this is so vague that is causes a considerable amount of confusion for both the supplier and contractor. And while it is admirable to see that it is a performance-based specification, it can often be in direct conflict with other portions of the specification.

First, the specification gives no direction as to whether this value is used as a prequalifer for the pavement, or will actually be measured in-situ. If the measurement is used as a pre-qualifier, the issue of pavement age becomes important. At what time should the measurement be done? The limited amount of work that has been done on albedo testing has shown that the value changes over time. With concrete this makes perfect sense due to the changing appearance during curing and physical weathering.

Another point is that the actual testing is an arduous and expensive process. After the pavement has been placed, with all of the appropriate finishes applied (surface texturing and curing compounds) a core sample needs to be taken. The samples are then conditioned, and the top 2 inches removed, and shipped to a laboratory that is capable of running the evaluation, which are extremely limited in number. The whole process from the time the pavement is placed can take up to three weeks at a cost exceeding $2500. Then the question becomes, "what if the outcome is less than expected?" If the tests are done as a prequalifier, then the mix design will have to be changed to meet the specifications. But what if the test is applied in-situ? Would the entire pavement need to be removed?

Additionally, other parts of the specification can create conflict with the albedo rating. Limits on pozzolanic replacement, sack content minimums will both directly impact the outcome. In many cases, it is necessary to use a pozzolan and minimize total cementitious content to achieve higher albedo ratings, but the structural portion of the specification limits these combinations creating the conflict. Finally, there is no standard code or reference that gives guidelines on the acceptability or applicability of historical albedo numbers in the same manner that strength testing can be used.

From a practical point of view, does it even seem reasonable that the reflectivity of a pavement is different from pavement to pavement? It is not just a function of the materials in the mix design, but the surface treatment, texture, and age at sampling and eventual testing. Which means that every time there is a specification for pavement reflectivity of minimum albedo ratings, there is a host of questions that will need to be answered well in advance of the bidding process, let alone the placement of the concrete.

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