Open-Graded Base Courses for Slabs-on-Ground

ASCC Position Statement #37

Some specifications for concrete slabs-on-ground call for concrete to be placed on a layer of granular material containing very few fines. ASTM No. 57 and No. 67 coarse aggregates are examples of such materials. Such open-graded (permeable) base courses are intended to serve as subdrainage layers in concrete pavements and as a capillary break that prevents liquid water from rising to the bottom of interior concrete slabs through capillary action in the base course.

Open-graded bases are not as stable as densely graded, well-compacted, crushed stone bases. Because of the low stability, rutting due to construction traffic is common. It is also difficult to fine grade an open-graded base to a relatively uniform elevation. This nonuniform surface elevation and the rutting result in restraint to concrete movement as the concrete cools or dries, thus increasing the probability of out-of-joint cracking. A stable construction platform is needed, as indicated by the following quote from Section 4.1.4 of ACI 302.1R-04, "Guide for Concrete Floor and Slab Construction":

"The base material should be a compactible, easy to trim, granular fill that will remain stable and support construction traffic."

Open-graded bases don't meet these requirements because they are relatively incompactible, difficult to trim, and unstable.

Section 4.6.4 of ACI 360R-10, "Guide to Design of Slabs-on-Ground," contains similar guidance:

"Base material should be a clean, densely-graded, granular material with a balanced fine content. It should produce an easily constructed, low-friction surface while minimizing wicking of moisture from below. These densely-graded crushed products are commonly referred to as 'crusher-run' materials."

Early-age and long-term cracking of slabs-on-ground are other problems related to placing concrete slabs in direct contact with open-graded bases. The American Concrete Pavement Association (ACPA) "Concrete Pavement Technology Series (TS204.10P)," states the following:

"Because of the openness of the permeable subbase [base] structure, mortar works its way into the voids during placement as the concrete is vibrated and consolidated. This penetration into the subbase [base] restricts slab movement, increasing the risk of both early-age and long-term cracking in the pavement."

If open-graded bases are specified, the surface of these bases should be choked off with finer material. A clean, fine-graded material with at least 10 to 30% of particles passing a No. 100 (150 μm) sieve but not contaminated with clay, silt, or organic material is recommended. This material should be covered with a vapor retarder if the slab will receive a moisture sensitive flooring material.

In "Moisture Migration—Concrete-Slab-on-Ground Construction," (*Bulletin* D89, Portland Cement Association, 1965), Brewer showed that a gravel layer beneath the slab reduced inflow of water by 10 to 25%, but adding a vapor retarder over the gravel layer cut the initial inflow by a factor of three and long-term inflow by a factor of two. Because the open-graded base reduced inflow by as much as 25% while adding a vapor retarder over the base reduced inflow by as much as 300%, it's obvious that the vapor retarder is a far more effective way to limit moisture migration into the slab. ASCC contractors believe that a dense-graded base covered by a 10 mil vapor retarder (as recommended in ACI 302.1R-04) is the best arrangement for interior slabs. For exterior slabs, the ACPA recommends neither an open-graded base nor use of a vapor retarder.

ASCC contractors will place slabs on an open-graded base course if required by specification, but only with the acknowledgment that the risk of cracked or thin slabs is entirely the responsibility of the specifier.

If you have any questions, contact your ASCC concrete contractor or the ASCC Technical Hotline at (800) 331-0668.

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