



SCP Tech Brief: SCP Products and Special Purpose Aggregates

The choice of aggregates for a concrete mix design is a critical decision that affects fresh and hardened performance. When the need arises to use a special purpose aggregate for reasons such as making concrete that is heavier, lighter, or different in appearance, the considerations for properly blending sizes and shapes still apply. Changes in aggregate type, shape, size, and density can all affect fresh and hardened properties such as workability and strength and must be considered in the mix design process.

Spray-Lock Concrete Protection (SCP) products interact with the paste fraction of concrete. Entering through the bleed water channels and other capillary structures, SCP products react with available alkalis to primarily form calcium silicate hydrate (C-S-H) to fill void space. Because SCP products interact with the paste, the type of coarse aggregate used does not affect SCP product performance. There are a few things to consider when evaluating SCP product use with some special purpose aggregates.

Lightweight Aggregates

Lightweight concrete aggregates typically absorb, retain, and release significantly more water than normal weight aggregates. In fact, lightweight aggregates have been shown to contribute to the curing process by slowly releasing water over time as shown by Ben Byard and others.ⁱ Although a desirable behavior in many types of concrete, this slow release of water over time can be problematic for elevated floors that will be receiving flooring materials. Suprenant and Malisch found that lightweight concrete took nearly four-times as many days to reach a moisture vapor emission rate (MVER) of 3.0 lbs. as normal weight concrete in the same environmentally controlled conditions (183 days compared to 46 days).ⁱⁱ This behavior has led many contractors and specifiers to the conclusion that lightweight concrete slabs must receive moisture mitigation before flooring materials are applied.

When used at time of placement, SCP products allow application of flooring materials in as little as fourteen (14) days from the date of application to lightweight portland cement concrete slabs. No moisture mitigation or testing of slab moisture is required, but joints,

SCP products allow flooring materials to be applied to lightweight concrete slabs in as little as 14 days after application with no MVER or RH testing required.

penetrations, and any cracking must be treated normally with materials and methods specified by the designer.

Heavyweight Aggregates

Heavyweight aggregates consist of naturally-occurring materials that are more dense than normal aggregates or man-made materials such as iron or steel. They are most often specified in radiation shielding concrete projects such as x-ray rooms in hospitals and a number of places in nuclear power plants and spent-fuel storage facilities. Segregation (separation in the fresh state) of heavyweight coarse aggregate from the mortar fraction of the mix may occur and may need to be compensated for with the addition of fines to the mix.ⁱⁱⁱ

SCP products may be applied to portland cement concrete containing heavyweight aggregates using standard application methods. Heavyweight concrete treated with SCP products is available to receive adhesives, coatings or paint in as little as fourteen days after product application.

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Recycled Concrete Aggregate

The use of recycled concrete as aggregate has seen a growth in popularity in recent years due at least in part to the idea that using recycled materials is an environmentally-friendly initiative. ACI 555 provides specific and detailed guidelines for the removal and reuse of concrete as an aggregate. Even if all concerns outlined in ACI 555 are satisfactorily met, the consensus is that the absorption rate of recycled concrete aggregate is significantly higher than that of normal weight virgin aggregate.^{iv} This higher absorption rate may cause issues with MVER performance in similar ways to lightweight aggregate depending on the percentage of recycled aggregate used.

As long as the performance of the recycled concrete aggregate meets the requirements outlined in ACI 555 and the concrete is portland cement-based, SCP product performance can be expected to be similar to when used in conjunction with conventional concrete.

Architectural Aggregates

Sometimes aggregates are chosen for their inherent aesthetics. They may be exposed to view by grinding, polishing, or the use of surface retarders. SCP products will not interfere with the appearance of architectural aggregates, but because the methods used to expose aggregates in architectural concrete differ, attention to the timing of SCP product application is a key concern. Mock-ups may be required to evaluate the timing of both SCP product application and aggregate exposure methods.

Conclusion

SCP products work with almost all concrete that contains portland cement. Because SCP products react in and become part of the paste fraction of the mix, little interaction between aggregates and SCP products occurs. Architectural applications require attention to the timing of SCP product application and aggregate-exposure operations.

ⁱ Byard, Benjamin (2011) "Early-Age Behavior of Lightweight Aggregate Concrete," Auburn University. Retrieved 10/4/18 from: <https://etd.auburn.edu/handle/10415/2876>

ⁱⁱ Martin, David; Zimmer, Alec; Bolduc, Michael; Hopps, Emily (2013) "Is Lightweight Concrete All Wet?" *Structures Magazine* retrieved 10/4/18 from: <https://www.structuremag.org/wp-content/uploads/C-BuildingBlocks-Martin-Jan131.pdf>

ⁱⁱⁱ ACI International. *ACI 221R-96 Guide for Use of Normal Weight and Heavyweight Aggregates in Concrete*. American Concrete Institute Manual of Concrete Practice, Farmington Hills, MI.

^{iv} ACI International. *ACI 555R01 Removal and Reuse of Hardened Concrete*. American Concrete Institute Manual of Concrete Practice, Farmington Hills, MI.