Lightweight Insulated Concrete (LWIC): Moisture Mitigation Techniques

By Peter Gross

Keywords: Lightweight Insulating Concrete, Cellular LWIC, Cellular-based LWIC, Aggregate LWIC, Aggregate-based LWIC, LWIC, Roof Insulation, Cementitious Roof Insulation, Reusable Roof Insulation, LWIC and Rain Events, Siplast

Lightweight Insulating Concrete (LWIC) is a favored material in roofing applications due to its thermal insulation value and potential reusability. However, managing moisture effectively during the installation phase is critical, especially when LWIC is exposed to rain. This paper examines how different types of LWIC handle moisture during and after rain events and strategies for preventing rapid drying or improper hydration.

Composition and Properties of LWIC Types

Aggregate-Based LWIC: Aggregate-based LWIC consists of Portland cement, vermiculite, and water. See Figure 1. Vermiculite, a key component, naturally absorbs water when exposed to moisture. This property helps slow down the drying process of aggregate-based LWIC and helps prevent shrinkage cracks. During rain events, vermiculite will also absorb the incoming water, which slows the rate at which moisture migrates through the concrete matrix.

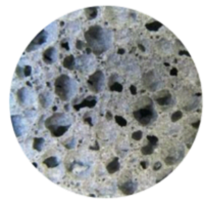
Aggregate-Based
Lightweight Insulating Concrete

Aggregate system's lightweight properties stem from the addition of lightweight aggregates (vermiculite) added to the cement mixture.

Figure 1: Photo and description of aggregate-based LWIC.

Cellular-based LWIC: Cellular-based LWIC incorporates cellular foam into the Portland cement and water mixture, creating air bubbles within the mix. See Figure 2. The air bubbles reduce the density of the concrete but also increase its porosity. While cellular-based LWIC is effective for thermal insulation, the increased porosity allows mix water to evaporate and rain water to penetrate more rapidly. This can result in quicker moisture migration through the concrete matrix and faster curing.

Cellular-Based
Lightweight Insulating Concrete



Cellular systems derive their lightweight properties from air cells formed in the concrete matrix.

Figure 2: Photo and description of cellular-based LWIC. The photo is magnified to show the open pores in cellular-based LWIC.

Moisture Migration, Hydration Control, and Curing Time

General Curing Time: LWIC generally cures and is ready for roofing within 48 to 72 hours from the time it is poured. This time frame allows the concrete to reach adequate compressive strength and moisture levels suitable for further roofing activities. It is recommended that fastener withdrawal tests be completed before commencing roof membrane installation.

See Siplast Flash - When is LWIC Ready to Roof for more information.

Faster Curing in Cellular-based LWIC: In some climates, particularly during the summer, roofing may commence within 24 to 48 hours on cellular-based LWIC decks due to the material's ability to dry out faster. The presence of air bubbles in cellular-based LWIC facilitates quicker moisture evaporation, allowing the concrete to cure more rapidly. This characteristic can be advantageous in fast-paced construction schedules, as it helps reduce the waiting time between pouring the LWIC and applying the roofing membrane.

Aggregate-Based LWIC: The moisture-absorbing properties of vermiculite in aggregate-based LWIC play a crucial role in managing hydration and drying. When aggregate-based LWIC is exposed to rain, vermiculite absorbs the water, slowing the migration of moisture through the concrete. This helps prevent build up of moisture at the slurry level of the LWIC. The absorbed moisture is gradually released, allowing for a balanced hydration process and reducing the risk of damage to the concrete surface.

Moisture Control in LWIC with Use of Sealers and Plastic Sheets

To manage moisture exposure effectively in cellular-based LWIC, the use of sealers is an option, but only if the roof system is mechanically fastened to the LWIC. Sealers used on LWIC may affect adhesion of subsequent roofing products. Sealers act as a barrier, helping to minimize rainwater absorption into the LWIC. By reducing moisture ingress and evaporation, sealers can also help slow the curing process and thus minimize the occurrence of shrinkage cracks in the surface.

In some instances, areas of exposed LWIC may be covered with a protective layer of plastic in lieu of a sealer to minimize rainwater absorption assuming the LWIC is ready to accept foot traffic. Plastic should only be used as a temporary measure and should be removed immediately after the rain event is over.

By implementing appropriate sealers and ensuring effective drainage, the risks associated with moisture exposure can be minimized.

Conclusion

All LWIC systems provide excellent thermal insulation value. Managing moisture effectively in aggregate-based and cellular-based LWIC systems, particularly during rain events, is critical to maintaining the long-term performance and durability of roofing systems. Aggregate-based LWIC, with the absorption properties of vermiculite, offers advantages in controlling moisture migration and preventing rapid drying or improper hydration, while cellular-based LWIC requires additional measures to manage its increased porosity.

By implementing appropriate sealers and ensuring effective drainage, the risks associated with moisture exposure can be minimized. Understanding the specific characteristics of different LWIC types and their behavior under moisture conditions is essential for designing and maintaining efficient and durable LWIC systems.