

Resilient Flooring and Concrete Porosity

The question has been asked by flooring contractors many times; “Why does the concrete substrate have to be rendered porous prior to the installation of resilient flooring in conjunction with a concrete sealer (non-silicate based), primer and cement based underlayment and flooring adhesives? Most manufacturers of these types of products require the substrate to be porous prior to the installation. This paper will attempt to explain the reasoning and justification of having to render a concrete or light concrete substrate porous prior to application of the above mentioned products. We will explore the benefits of the above mentioned products, coming to some conclusions at the end of this paper.

THE POROSITY of the concrete substrate affects flooring adhesives, concrete sealers, cement based underlayment and primer open times and drying times. When applied to a substrate, the flooring contractor would prefer to have fast drying times connected to these products. To the flooring contractor, time is money and the longer a product takes to dry, the contractor is losing money by having to wait to install the flooring. Flooring adhesives generally dry quicker over porous substrates, whereas sealers, primers and adhesives applied over non-porous substrates can take much longer. So, porosity is very important as it means lost or gained profits to all flooring parties involved in an installation.

Most people do not realize that concrete is porous. The pores constitute 12 – 18% or more of the concrete but they are invisible, much smaller than the diameter of human hair. After new concrete is poured, almost half of the water has to evaporate. As this surplus water pushes to the surface, it leaves behind a network of capillary pores in the concrete. The strength of concrete is directly related to the porosity of the concrete. Without going into detail, we can simply say that the more porous a concrete slab is throughout, the weaker it can be. Air and water fill the voids found in concrete. When concrete is mixed and poured, air becomes trapped in the mix causing the finished slab to contain air voids which often become filled with water. Concrete vibrators are used to clear out the air at the time of pouring the concrete. If the concrete is less porous, its strength will be increased and this is referred to as compressive strength. The most crucial source of porosity in concrete refers to the proportion of water to cement in the mix, called the ‘water to cement ratio’.

The porosity we are focusing on in this paper is the surface porosity of the substrate; referencing ASTM F3191 – 16, Standard Practice for Field Determination of Substrate Water Absorption (Porosity) for Substrates to Receive Resilient Flooring (also, sealers, primers, cement based underlayment and adhesives).

ASTM F3191-16; Significance and Use:

‘The ability of a substrate surface to readily absorb water is a key indicator in determining how to correctly install many types of flooring adhesives, primers, cement based underlayment, and other products. Several flooring industry publications such as CRI’s Carpet Installation Standard, RFCI’s Recommended Installation Practice for Homogenous Sheet Flooring, Fully-Adhered, as well as most flooring, adhesive, primer, and cement based underlayment manufacturers reference substrate surface porosity criteria in their application instructions since this directly impacts the spread rate of directly applied material, the open time, and other critical installation factors.’

ASTM F3191-16; concrete substrates may be tested for porosity by placing 0.05mL bead of water on the surface to observe absorption (see Fig 1). If the water is not absorbed within one minute, the floor should be considered non-porous. Non-porous concrete surfaces are generally rendered porous by mechanically abrading the surface of the concrete.



Fig 1

Substrate Porosity Testing

(continued)

Concrete Substrate Moisture and pH testing must always be performed on concrete substrates on every grade level. Moisture testing is specified to be performed using the latest versions of the following methods:

- ASTM F2170; in-situ relative humidity test to measure the internal humidity in the concrete. A 'resilient' product manufacturer and/or the adhesive manufacturer will set the RH % moisture specification/limits for specified products.
- ASTM F2659; substrate surface moisture using an electronic impedance moisture meter. A 'resilient' product manufacturer and/or the adhesive manufacturer will set the RH % moisture specification/limits for specified products.

Products that are affected by Porosity:

Concrete Sealers are designed to block moisture by blocking the pores of the concrete substrate, not allowing moisture from the substrate to permeate up to the substrate surface and hence into the installed flooring product. A higher porous concrete substrate allows the sealer to bond more aggressively to the substrate. Flooring adhesive can then be applied to the sealer and then the resilient flooring product on top of the adhesive.

Concrete Primers are designed to be used on a light weight concrete substrate. Primers neutralize the pH of a lightweight concrete substrate and render the substrate less porous. Using a primer increases the spread rate of the products being applied to it and increases bonding characteristics of the same products. Flooring adhesive can then be applied to the primer and then the resilient flooring product on top of the adhesive.

Flooring cement based underlayment is designed to coat and cover a concrete substrate to achieve an industry acceptable substrate flatness specification. Flooring adhesive can then be applied to a cement based underlayment and then the resilient flooring product on top of the adhesive.

Flooring Adhesives are designed to bond a resilient flooring product to the concrete substrate, primer, sealer and cement based underlayment. A more porous substrate will take less time for an adhesive to dry/cure. When installing over a porous substrate allows the installer to lay into the adhesive 'wet' or 'semi-wet'. A less porous substrate will take more time for an adhesive to dry/cure. A less porous substrate allows the installer to lay into the adhesive in a dry state, typically using a pressure sensitive adhesive.

The need to render a dense, hard concrete slab porous is a must when applying a sealer, primer, cement based underlayment or adhesive to the surface. To achieve the proper porosity as per ASTM F3191-16 the surface can be mechanically abraded ready to receive one of the above products and a resilient flooring product. Note: Adhesives and Resilient flooring should not be installed over any substrate where chemical or solvent cleaners or adhesive removers have been used. This Concrete Surface Profile (CSP) scale defines the texture of the surface of the concrete substrate and the texture of the surface is directly related to how porous the concrete will be. The CSP scale is set-up on a 1-10 scale, with 1 being the least textured and 10 being the most textured. Most manufacturers require a 1-3 CSP when applying the above mentioned products to a concrete substrate.

Proper substrate porosity does make a difference, the benefits of installing over a porous substrate are:

- The bonding properties of the products are enhanced; much stronger.
- The ease of installation, a faster installation, which saves money.
- Adhesives can be applied to the substrate; 'Wet' or 'Dry'.