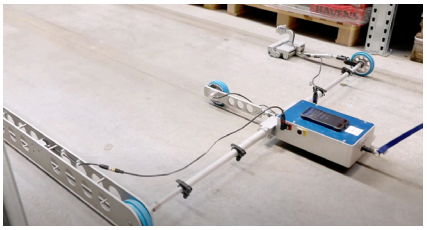
These days, floor flatness is everything with luxury vinyl planks and large format ceramic tiles being installed so prevalent. Many of these floor covering manufacturers require a high degree of flatness to be achieved within the subfloor before their sheet goods are installed. The flatness of the floor is most important when the full expanse of the floor is viewed. Any waviness or variation in the floor is easily observed when the flooring is installed and can detract from the beauty of the finished floor. ASTM / American Society for Testing and Materials, practice F710 – "Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring" defines the requirements for a flat floor that will receive resilient floor covering. It requires that the variation in floor flatness be no more than 3/16" in 10' and 1/32" in 12". Large format natural stone and ceramic tiles also benefit from increased floor flatness – see ACI / American Concrete Institute 117. For tile with one edge longer than 15" and for natural stone tiles, the ANSI or The American National Standards Institute defines the maximum allowable substrate variation can be no more the 1/8" in 10' and 1/16" in 24".



Floor Profiler/ Flatness Testing Equipment

More recently, the Flooring industry has begun to adopt the ACI method of measuring the levelness and flatness of a concrete slab after placement of the floor. F-numbers (Ff floor flatness) and (Fl floor levelness) are determined through testing procedures in ASTM E1155 and are also referenced in ACI 302. In some instances, the architect or designer will require the more stringent finish tolerance, and the subsurface specification or tile specification should reflect this. Construction efficiency is also improved using SLUs. Since it will be the substrate for the flooring finish, new concrete slabs can be left with a simple screed finish, eliminating the need for high-cost concrete finishing practices such as use of sealers or densifiers, hard troweling and power troweling equipment/workforce. Within days after concrete placement, a moisture mitigation membrane meeting ASTM F3010 can be applied to the concrete to mitigate excessive moisture vapor emission rates. This also helps prevent slab curling that affects floor flatness. An SLU placed over the membrane creates a very flat floor that can easily meet the requirements of the flooring and speeds the construction of interior walls and built-ins such as cabinets. Self-leveling underlayments are the surest way to achieve the highest degree of floor flatness required by flooring manufacturers and valued by architects, contractors and building owners.

Modern Self-Leveling Underlayment Formulas offer a range of technologies that can be used to make self-leveling underlayments. The most common products are based either on gypsum or a combination of Portland and Calcium Aluminate Cements. Gypsum SLUs have many benefits including fire ratings for many designs as well as the need for little floor prep before installation. SLUs derived from Calcium Aluminate Cements are self-drying and can be used in all interior locations. Unlike gypsum-based levelers, calcium aluminate levelers can shrink as they cure resulting in an enormous force on the subfloor and a tenuous grip to it. To increase odds of success, manufactures of calcium aluminate and Portland cement levelers often recommend a texturing of the subfloor through shotblasting or other method of mechanical scarification. Care needs to be taken to protect workers from the dust and silica released through these mechanical abrasion methods. Likewise, care needs to be given such that the dust does not interfere with the bond needed to hold the calcium aluminate levelers flat to the floor.

INSTALLING HYDROPHASE™

The first step in installing self-leveling underlayment is to understand the application and lay-out the room so that you can pour most effectively. The descriptions above and the information on the product Technical Data Sheets can serve as a useful guide. How much out of level or flatness is the floor – i.e., how deep will the lift of the leveler need to be to achieve level/flat? Does the floor need to be level or just flat? Will a feather edge be needed? How much load will the floor experience when in regular use? As with the

application most construction materials, planning and preparation are critical. All surfaces must be structurally sound, clean, dry, and free from contaminants that would prevent a good bond. Substrate surface absorptivity is also important to achieving good bond and can be measured according to ASTM F 3191–16 Standard Practice for Field Determination of Substrate Water Absorption (Porosity) for Substrates to Receive Resilient Flooring. If the substrate surface is weak, spalling, or contaminated, or if using levelers other than HydroPhase™, the surface should be mechanically scarified by shotblasting, sandblasting, water-jetting, scarifying, or diamond-grinding. Do not sand the surface, as this creates a fine dust that inhibits the bond. With HydroPhase™, just clean the surface to remove loose dirt and debris, prime the surface, and then apply HydroPhase™ for most service conditions and requirements.

Primers are essential to achieve a good result with SLUs. The best primers not only promote adhesion, but they also minimize outgassing of the slab (reducing air bubbles and pinholes) and minimize water loss from the SLU, thus retaining good flow and healing. Formulated Materials® offers an all-purpose primer to meet all installation and service conditions. HydroPhase™ APS, a water-borne acrylic primer, is the best choice for most situations. The applicator should maintain a wet edge for the duration of the pour.

Environmental conditions also need to be considered. SLUs have an optimal temperature range. If it is too hot, the reactivity of the formula will be too fast, leading to insufficient flow and healing. If too cold, several issues may arise. Effective mixing and dissolution of the chemicals in the SLU powder is difficult at low temperatures, which could lead to surface defects such as pin-holing and color discolorations. Additionally, the cure time will be slowed such that walk on time and the time when floor finishes can be installed will be delayed. When considering the application temperature, the SLU material, substrate, and air should be within the application temperature range of the product. Excessively cold or warm water may need to be conditioned prior to mixing with the SLU. Humidity is less of an issue; however, extremely dry, or windy conditions can desiccate the surface during the cure of the SLU. Conversely, very humid conditions can stretch out the period needed prior to installing some moisture-sensitive floorings. In all conditions, it is essential that thorough mixing is achieved by closely following the manufacturer's mixing instructions. This is often longer than is required for the mixture to appear homogeneous, as many of the chemicals require more mixing time to fully dissolve and become active. Thirty seconds more mixing time is better than 30 seconds' too little mixing time. It is common to use mixing barrels for smaller jobs and a mixing pump for larger jobs or where local staging of materials may be difficult. The choice often comes down to the labor cost in a particular region. Given sufficient labor, barrel mixing may be as effective as pumping, even for larger pours. When using a mixing pump, it is important to maintain the mixer to factory tolerances. Sloppy tolerances result in poorly mixed SLU and will lead to disappointing fluid and hardened properties. Carefully planning the actual application can solve many issues before they become problems.

One should consider:

- Lift heights should be determined by shooting the floor with a laser level and pinning the floor.
- Material staging should be done before the application starts
- Penetrations should be sealed, and barriers should be placed to honor movement joints. It may be useful to set boundaries to the pour using temporary dams for large rooms and creating bays or at door jambs down an office hall.
- Labor requirements – for larger pours with barrel mixing, six or more barrels may be needed to maintain a wet edge on the SLU. Several workers will be needed for mixing and transporting materials in addition to those pouring and spreading.
- If using a pump, one should identify a flush out area prior to beginning the application.
- It may be useful to pre-patch any large depressions with a cement-based patching compound to minimize SLU lift depth.
- Slab cracks should be evaluated and determined to be non-moving/ non-structural or static, then filled with an appropriate patch to eliminate SLU flowing through the crack.

A gauge rake should be used to control the pour depth and move material to where needed. While the material is still in its fluid state, a smoother is commonly employed to even out the pour and to release entrapped air bubbles that may lead to pinholes. Different SLUs flow at different rates and may take several minutes to achieve level. Observing reflections in the surface of the SLU provides an indication of the flatness achieved. Sharp, crisp reflections without undulations indicate a flat surface. Many installers like to use pin or spiked rollers, which tend to even out the appearance of the surface by reducing water marks; however, this can leave visible dots on the surface.

ABOUT THE AUTHOR

Michael Martin, Business Manager for Formulated Materials, 10+ years' experience with cementitious underlayment formulation, also having a background in Product Management for SLU's and other underlayments. Michael has more than 17 years in the construction industry and has seen the challenges that installers have with SLU's first-hand. Michael played a key role in the development and validation of the current formula, taking lessons learned from his experience to create this unique Hydrophase™ product.