Concrete Slab Design

Introduction

The following Guidelines For Concrete Slab Design are offered to help owners and specifiers better understand the importance that slab design has in a quality flooring installations. These guidelines should be incorporated in Division 3 to help assure a quality substrate to receive the new seamless floor.

Mix Designs

Poured in place concrete should be of sufficient strength to handle the structural load requirements. Concrete strengths should typically be a minimum of 3000 psi. Since the bond strength of resinous flooring to the concrete slab is critical to long term performance, mix designs should incorporate high cement factors (5-bag minimum) and lower water/cement ratios (.4 or lower). Generally, this combination will produce less bleed water and a stronger cement matrix at the surface where the flooring is bonded. A licensed structural engineer to determine their structural suitability for a particular use should approve all concrete mix designs. Also, lower water cement ratios reduce the permeability of the slab and reduce the incidence of moisture problems after installation of the flooring.
The Preferred Concrete Finish is a light steel trowel finish.

Type I Portland Cement Concrete is proportioned to hydrate and develop its design strength in 28 days. Minimum cure time prior to installation of seamless flooring is 28 days. However 28 days is not a magical number relevant to moisture problems. To ensure that moisture problems do not occur after flooring has been installed always check moisture vapor emission rates from concrete using the ASTM F 1869-98 Calcium Chloride Test Procedure.

Fly Ash Concrete is proportioned to develop its design strength in 56 days. Fly ash concrete also has a tendency to set very inconsistently, creating finishing problems for the concrete contractor. These finishing problems may result in areas of weak surface strength that will affect the bond and long term durability. Suggestion: All fly ash concrete should be vacuum blasted to help identify and repair substrate deficiencies.

Lightweight Structural Concrete (LSC) incorporates a shale aggregate that has a much greater porosity than standard concrete aggregates. This porosity leads to greater absorption and retention of water and results in an extended period of elevated moisture vapor transmission. Slabs must be tested for moisture content prior to installation of resinous flooring. LSC should not be used in buildings with high humidity or aggressive chemical environments. LSC is also more susceptible to outgassing problems. Owner or General Contractor must keep slab temperature from rising and driving off moisture vapor during and after flooring installation. Specifications should require a mandatory pre-job conference with Owner and/or Construction Manager and/or General Contractor and the flooring Contractor to review moisture testing, cure times, slab and ambient temperature controls and any other jobsite requirements.

Composite Metal Decks with concrete cast into a metal pan should require a vented metal pan to help entrapped moisture escape through the bottom after flooring installation.

Lightweight Insulating Concrete such as vermiculite or perlite concrete are not suitable substrates for resinous flooring systems.

Self-Leveling Underlayments may not be suitable substrates for thick build flooring systems. Thin-mil coatings may be applied over some higher strength cement based materials. Resinous flooring should never be applied over gypsum based underlayments.

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Curing

All concrete slabs should be cured in accordance with ACI-308 and ACI-302.1. Proper curing of concrete slabs is necessary to help retain moisture to allow the cement time to achieve the maximum hydration and attain the desired physical properties of concrete. The length of cure time between pour and covering with a flooring system is not necessarily related to subsequent vapor emission rates. The concrete industry views curing asa means to achieve strength gain.

It is a popular misconception that by using High Early Cement, which hydrates at a much quicker rate, the concrete can be surfaced with resinous flooring much sooner. This may or may not be true. The drying rate of High Early Concrete may be no better than conventional concrete. Suggestion: If floors or patching materials need to be resurfaced before the ***standard 28 day cure, consult your flooring representative or contractor.***

Joint Design

There are various types of joints located in concrete slabs. Treatment at these joints is critical in many applications to maintain a sealed, sanitary, seamless floor installation. In reviewing the various types of joints outlined below, the most important decision is to define whether the joint condition is moving or non-moving. Ideally, the architect and structural engineer should review all concrete joint conditions and determine whether movement is anticipated. Once movement parameters are determined the appropriate joint treatment may be selected.

Construction Joints are joints that separate different pours of concrete within a given panel. If these cold joints align with standard locations of control joints, they should be defined and treated as control joints. True construction joints typically are not moving and therefore, may be covered with the resinous flooring. These joints should be pre-treated with a flexible resin and/or fiberglass reinforcement prior to the installation of the flooring.

Control Joints are joints either saw-cut or formed in the concrete to control the plastic shrinkage in the concrete as it cures. Control joints are designed to help concrete crack at known locations in a clean, straight line, rather than random cracks, which may occur throughout the pour. In theory, control joints become static (non-moving) once the concrete has completed its volume change. In reality, control joints can become mini-expansion joints where they are improperly designed or installed, or where there is significant temperature (thermal) cycling in a building. Moving control joints should be referenced through the flooring system. Non-moving control joints may be referenced or treated like a construction joint and covered.

Note to Specifier: The seamless flooring should be installed when permanent HVAC systems are operational in the building. Control joints covered during installations with temporary heat may go through significant thermal cycling prior to permanent operation of the HVAC system. This cycling will cause movement that could induce cracks, which cannot be prevented by the flooring contractor.

Isolation Joints are located at load bearing columns and walls, or at equipment pads where the floor slab is independently supported. The wall and columns are isolated because of anticipated differential movement at that location. Isolation Joints should be treated as expansion joints with the joint referenced through the flooring system.

Expansion Joints are true structural expansion joints separating different sections of the building. These joints will move and need to be detailed with expansion joint systems designed specifically for the load, movement, and fire rating required.

General: It is important to discuss the joint treatment options with the end user in an attempt to understand the consequences associated with the joint treatment on subsequent facility operations.

Vapor Barrier Design

Moisture vapor transmission has been recognized for years as a problem in slab-on-grade and split-slab construction. Excessive vapor transmission can create condensation problems, corrosion problems and air quality problems, as well as adhesion problems for many finishes. Seamless floors are dense and impermeable by nature and do not readily allow vapor transmission.

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An excessive transmission rate through the slab will create large hydraulic pressures just below the concrete/seamless flooring bond line and lead to blistering and dis-bonding of the seamless system.Opinions regarding vapor barriers are varied. Generally the industry agrees that properly installed vapor barriers help to reduce vapor emission problems but they are certainly not a guarantee against such problems. (See “Moisture Effects on Flooring Systems”) Polyethylene vapor barriers should have overlapped and taped seams.

They should also be durable enough to prevent puncturing during concrete installation. Properly installed bentonite waterproofing products are excellent vapor barriers where site water problems may exist. Where vapor barriers are not present in existing slabs to receive resinous flooring, consult your local LSP representative or contractor.

Hydrostatic Pressure is the presence of a distinct head of water pressure. This term is misused in the industry to refer to problems related to vapor transmission.

Slope to Drain

In many applications, seamless flooring systems are used in environments that are often exposed to wash downs, water or process liquids. Most flooring systems will follow the contour of the structural slab. Unless slope is built into the structural design or specified as part of the seamless floor system, bird baths and ponding water is inevitable. In many environments this ponding water is unacceptable due to safety and health concerns. We offer two systems to create positive slope-to-drain on top of the structural slab: SeamTek UnderTop E and SeamTek UnderTop A. Consult your LSP representative andcontractor for specific information on design and specification of these systems. Please not that we recommend the use of polymer drains as opposed to metal drains when ever possible.

Drain Location

All drains should be set so that the finish elevation of the drain grate is at the final finish elevation of the proposed flooring system. In some applications, a sump or depressed area is desirable to help remove water from the floor. Sump detail should be cross-referenced with Plumbing, Concrete and Seamless Flooring Sections.

Waterproofing (Positive Side)

A number of applications of Seamless Flooring require the application of an elastomeric waterproofing membrane between the flooring and the slab. The intent is that elastomeric membranes will bridge potential cracks and prevent leaking. Standard seamless epoxy floors are waterproof; however, they have limited crack bridging capabilities. In multi-story facilities where the slabs cannot be allowed to leak

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