TB-0001 — Concrete and Concrete Surfaces Technical Bulletin

Concrete is an extremely versatile construction material. When it is designed, placed, finished and cured properly, it can provide consistent, quality service for decades.

BITUTHENE®and PROCOR®waterproofing systems protect concrete structures from water infiltration and, like concrete, are long term performers. It is important to remember, however, that quality waterproofing requires a quality concrete substrate.

What is Concrete?

Concrete is a mixture blended from at least three ingredients — Portland cement, aggregate and water. Other ingredients may be added to modify concrete properties or to reduce cost.

1. Portland cement is the binder or adhesive which bonds the aggregate.
2. Aggregate, usually sand and stone, serves as a filler to give concrete the bulk of its volume. It is graded in various sizes depending on the intended use of the concrete.
3. Water has two essential functions:
   - To react chemically with the cement to form the binder in the hardened concrete. This reaction is called "hydration."
   - To provide workability for the concrete mix so that it can be properly placed and finished.

The amount of water normally required for hydration is approximately 30% of the weight of the Portland cement, i.e. 30 lbs (13.5 kg) of water per 100 lbs (45 kg) of cement. Unfortunately, the amount of water needed for good workability can be considerably greater — potentially two times as much water as is needed for hydration. Therefore, once the concrete is placed, a portion of the water is chemically bound by hydration and the remainder must be evaporated. Concrete cures by hydration and dries by evaporation.

General Properties of Concrete

Concrete is widely used as a construction material because of its excellent combination of high compressive strength and low cost. It withstands most environments quite well.

For all of its favorable properties, there are two relatively poor properties which must be recognized.

First, concrete has low tensile strength. As a result, most concrete structures are reinforced with mesh or reinforcing bars. When a beam or floor slab has a load placed on it, the load will tend to put the top portion of the concrete in compression. The lower part of the beam or floor will be in tension. Therefore, reinforcing steel is used to prevent the concrete from splitting.

Secondly, concrete will shrink as it dries and cures, causing cracks. Normal structural movement can also cause concrete cracks. These cracks, although normal, provide easy paths for water to penetrate concrete structures.

Placement of Concrete

Placement of the concrete has an important influence on surface quality. To ensure maximum performance from the BITUTHENE®or PROCOR®waterproofing systems, the surface of the concrete must be smooth and free of defects.

Concrete that is properly consolidated during and after placement yields good quality surfaces. Consolidation, including the use of vibrators, causes the cement paste and fine aggregate to flow uniformly into all areas of the formwork. This minimizes common defects such as “bugholes” and unconsolidated concrete at the base of a wall.

Concrete Surface Finishes

Horizontal surfaces can be either float finished or steel troweled. During finishing, all voids or unconsolidated areas must be filled. Finishers should be careful to avoid creating windrows of concrete which protrude above the otherwise smooth surface. Smooth formed vertical surfaces are dependent on several factors:

- Well constructed, clean, smooth forms treated with an acceptable form release agent
- Good concrete placement techniques
- Proper consolidation and vibration of concrete after placement

Forms can be metal, plastic or plywood. They must be clean, smooth and free of cracks or other defects which may result in a rough concrete surface. Forms must be treated with a commercial form release agent applied at a coverage rate recommended by the manufacturer. Excess form release agent must be avoided. The form release agent must not transfer to the concrete surface.

Curing of Concrete

As stated earlier, curing describes the hydration reaction of the cement in the concrete mix. Proper curing requires that sufficient water is retained in the concrete for the hydration reaction. Excess water must be allowed to escape by evaporation.

In order to achieve proper curing, the concrete must be prevented from drying out quickly by one of several methods:

- Wet burlap. This approach is most useful for small areas because the burlap must be kept wet and physically held in place. New uncontaminated burlap must be used.
- Plastic films. Plastic films are effective but are susceptible to damage and are difficult to keep in place.
- Membrane curing compounds. Membrane curing compounds are usually resins or polymers dissolved in a solvent. They are generally sprayed onto a concrete surface where they form a temporary barrier, thereby slowing the otherwise rapid evaporation of water from the concrete surface. The use of membrane curing compounds is the preferred curing method since it permits uniform, slow drying of the concrete. With burlap or plastic, the concrete must be allowed to dry after the covering is removed. Acceptable curing compounds are those containing resins of polymers (usually petroleum resins, chlorinated rubber or acrylics). Curing compounds containing waxes, oils, silicones or pigments must not be used because they could interfere with the proper adhesion of BITUTHENE® or PROCOR® waterproofing membranes.

Drying of Concrete

Normal weight structural concrete must dry a minimum of seven days prior to the installation of the BITUTHENE® waterproofing system. Lightweight structural concrete must dry a minimum of 14 days.

Certain conditions may require a longer drying time as follows:

- Unusually wet weather
- Late removal of forms on vertical placements
- Late removal of forms (particularly metal or plastic form pans) on horizontal placements

Double the above dry times of concrete if placed over non-vented metal decks.

The concrete must be surface dry and have a sufficiently low moisture content so that BITUTHENE®membrane can be well adhered. Moisture meters do not reliably indicate dry surface conditions. Surfaces must be dried to a light grey color. If BITUTHENE®primer curdles or does not bond well, the surface is too wet.

Two days in forms followed by five days of drying is recommended for vertical placements. Decks or floors formed with plastic or metal form pans can take longer to dry. Forms must be removed as soon as possible to enhance drying and also to allow moisture vapor to vent from the underside of the deck.

For placement of BITUTHENE®membrane sooner than seven days, BITUTHENE®Primer B2 LVC is recommended. See BITUTHENE®Primer B2 LVC Data Sheet for more detailed instructions.

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