PROBLEMS ASSOCIATED WITH CONCRETE

PROBLEM: Peeling from Masonry and Brick

CAUSE: A common cause of peeling on surfaces composed of mortar, brick, building block or concrete is efflorescence, where soluble salts are present. When dissolved by water, they are carried to the surface and remain after the water has evaporated. These salts can push paint away from the surface resulting in peeling. Efflorescence occurs on brick walls of new construction. A common building practice is to treat new brick or concrete with muriatic acid, rinsing with water to clean away excess mortar. Rinsing removes only those salts on or near the surface. After painting, salts remaining within the bricks will absorb the moisture and travel to the surface, causing peeling. Peeling can also occur when alkyd or oil paint is applied over unetched concrete. Alkyd resins that come in contact with an alkaline surface form a soap film between the concrete surface and the coating, called saponification. This will cause softness and loss of adhesion of the alkyd coating.

PROBLEM: Peeling from Concrete Floors

CAUSE: Concrete floors present numerous potential adhesion problems for coatings. Concrete is a highly alkaline material which reacts chemically with oil or alkyd based finishes to weaken their adhesive bond. Concrete also transmits moisture bringing soluble salts, to the surface (efflorescence). This will gradually generate a sandy or dust-like condition at the surface. Grade level or sub-surface floors are continually subjected to moisture penetration. All concrete should be cast over a vapor barrier. Sub-surface concrete should also be cast over a generous level of gravel with further means to remove water when conditions are severe. Moisture is the primary cause for adhesion failure. Other possible causes include hard-troweled concrete which presents a physical barrier to adhesion by not permitting penetration of coatings. Older concrete can become crumbly, and accumulations of grease or oil create a barrier limiting adhesion.

PROBLEM: Porosity of Concrete

Normally, concrete is a mixture of four basic ingredients: sand, gravel, cement and water. In the mixing process, a certain amount of air is mixed into the concrete. The water and air take up space inside the concrete even after the concrete is poured in place and during the early stage of setting.

When the concrete is "worked" in place and begins to set up, the heavier ingredients have a tendency to settle to the bottom and the lighter ingredients often float to the top. Water being the lightest of the four basic ingredients, floats to the top and is evaporated away, or is squeezed out the sides or bottom. As the water is squeezed out, it moves in all directions. Water, being a solid in that it takes up space, leaves millions of small riverlets crisscrossed in all directions as it is squeezed out. As the air is squeezed out, it has the same effect.

These small riverlets, or hollow spaces, tie together, creating what we call pores. Quite often the pores create hairline cracks inside the concrete, weakening the concrete.

As the capillary action of the concrete draws water up into the concrete, or when rain hits the side of a concrete wall, or as water comes against a concrete basement wall, etc., the water travels via these pores, through the concrete.

The pores are interwoven and interconnected, thus allowing a slow seepage of water through the concrete. The denser the concrete, the tighter the pores, and, therefore, less water is allowed to pass through.

A pad of concrete, within itself, may resist 80% to 90% of the water trying to soak through the concrete. For this reason, a concrete sealant need not resist 100% absorption of water through the concrete. If the sealant can resist only that percentage which the concrete itself cannot resist then the sealant can effectively seal the concrete pad, and the concrete can absorb a limited amount of water at the same time.

Thus, a properly functioning concrete sealant can seal the concrete internally, resisting a penetration of water, oil, acid, and other such liquids, while at the same time, allowing the concrete to breathe to a limited degree.

PROBLEM: Wall Sweating

With respect to wall sweating, it should be remembered that surfaces of most common masonry building materials have an affinity for water molecules. The water molecular film is proportionate to the relative humidity. At saturation point, all voids, pores and capillaries can become completely filled. Then, when the atmospheric condition, inside or outside, which caused the excess of moisture in the first place is alleviated, the porous wall may be filled to saturation point with moisture in liquid form.

This condition then provides an excellent opportunity for vapor travel within a wall. In its travels, the vapor may strike a cold area or dew point, and condense in sufficient quantities to reach the interior wall surface and appear as wall sweat or bleeding.

Each of the above, if allowed to go unchecked, can be responsible for heavy maintenance costs by causing peeling paint, spalling, formation of mildew and efflorescence. All porous masonry wall materials will react the same way, unless proper steps are taken to avoid it.

PROBLEM: Concrete Dust Ruins Merchandise, Machinery and People

What is concrete dust? Every time a truck moves over your floors -- every time a person walks on them -- every time your sweeper sweeps them -- small particles of the concrete surface are ground away and form the concrete dust.

This is not ordinary dust; it is sharp silicate which cuts into your machinery -- into your merchandise -- into the lungs of your employees -causing damage in every direction.
Concrete dust is a sure sign that your floors are disintegrating and will soon demand expensive repairs. Concrete dust is a dangerous and costly foe of efficiency, but it is an unnecessary evil, for it can be prevented.

Chemical reaction with alkali and lime causes the billions of independent particles (concrete dust) of masonry to be solidified into one entity, virtually eliminating the cause of costly machinery repair, lung infection and annoying dust.

PROBLEM: "Alkali Problem" in Concrete Walls and Subfloors

The increased use of concrete subfloors in direct contact with the ground makes it more important than ever to completely understand the effects on surface sealers (paints) and floor coverings of moisture and alkali inherent in these subfloors.

Well-known as the "alkali problem," this condition is primarily a problem of moisture. Alkalis are present in every concrete slab, but become a problem with moisture present. On adequately ventilated, suspended concrete sub floors, moisture is not present in troublesome quantities.
Where the slab is in direct contact with the ground or is in a poorly-ventilated air space, moisture is brought up through the slab by capillary action. It dissolves the alkaline salts in the concrete and appears at the surface as a destructive alkaline solution.

The most serious difficulty caused by alkaline solutions is the chemical reaction, "saponification." This is essentially the same reaction that takes place when certain oils or fatty acids are mixed with alkali, as in the manufacture of soap.

Although moisture and alkali conditions may vary greatly, there is always sufficient moisture in the ground and alkali in concrete to present an "alkali problem" on subfloors affected by ground moisture. It is never safe to assume that a concrete slab will always be dry because it has been dry for several years. In many cases, a concrete floor will seem to be dry because the moisture content is very small and evaporates into the air as soon as it reaches the surface. When paint or floor covering is applied, evaporation is prevented or retarded and the alkaline solution collects under the paint or floor covering to start destroying that paint or covering.

PROBLEM: Capillarity Moisture

Capillarity, the transmission of moisture and water in masonry is the action by which the surface of a liquid, where it is in contact with a solid, is elevated or depressed (rises or falls). The attraction or revulsion is caused by capillarity. By capillarity, moisture may travel from a lower to higher elevation or can travel in any direction. The amount of moisture that can be transmitted from the ground by capillarity action is often underestimated. Tests* have indicated that as much as 12 gallons of water per 1,000 square feet per day can be transmitted through a concrete slab and, if permitted, evaporated into the air. When the slab is covered by floor covering, this moisture will collect and attack the bond of the adhesive. If, during the transmission, it carries alkalis, salts or additives from the concrete, it will destroy or deteriorate adhesives, resulting in failure.

The same applies to vertical masonry where fog, dew, and dampness can collect, also carrying alkalis that will attack and harm various paints. The distance which water will rise from the ground by capillarity is also underestimated. Tests* indicate that moisture can climb from a water table that may be 20 feet below the ground. Obviously, general ground dampness speeds the transmission of moisture. It is suspected that this transmission may result from a combination of capillarity, absorption, and various pressures rather than capillarity alone. Nevertheless, moisture can migrate from this depth.

Capillarity action usually takes place 24 hours a day, every day, over the entire area of a slab or masonry, so that a tremendous amount of water can migrate and be absorbed into masonry via capillarity alone.

* By Housing and Home Finance Agency U.S. Governmental Forest Products Laboratory