

## **HARD FACTS ON CONCRETE OR WHY WE SHOULD NOT BE SURPRISED WHEN OUR DRIVEWAYS CRACK**

Concrete is old. The Romans used it. Their version combines powdered limestone and volcanic ash to create the cement required to bind stone and water into the hardened mass that becomes a road, a walkway, a bridge, or an improvement over bare dirt.

Although civilized man temporarily lost sight of this useful mixture during the Dark Ages, it became common again during the 1800s.

You would think with all the time we have had to work on the recipe, we would have come up with one that doesn't crack. That goal is still being pursued, however.

Concrete is made from four ingredients: stone, sand, cement, and water. In some areas, at some times of the year, additives help prevent problems caused by temperature extremes.

The "cement" in today's recipe is *portland cement*. While many folks assume the "portland" in this phrase is our own Portland, Oregon, this is not the case. The name was given to the concoction by Joseph Aspdin, a British bricklayer.

Early in the 1900s, Aspdin was searching for a way to "manufacture" stone. After some experimentation with lime, clay, roasting, and grinding, he produced a powder (cement) which, when mixed with water, forms a pudding like mixture that hardens. To Aspdin, the appearance was similar to stone quarried on the Isle of Portland, so he named the product "portland cement".

There is a lot of the stuff around in our world. In 1990, annual global production of cement reached 1.3 billion tons per year. This translates into approximately one ton of concrete per human per year. The current value of concrete structures in the US is over \$6 trillion, much of it taxpayer sponsored and used.

On a personal level, if you ever took a spill off your bike or skates when you were a kid, you will recall that it is not only plentiful and useful, it is also very hard.

You might expect that something that hard would be difficult to damage. Unfortunately, although it withstands compression (holds up weight) very well, its tensile strength (ability to be stretched and bent) leaves something to be desired. In other words, the stuff is quite brittle; if the ground under it moves, swells, or shifts, the concrete can and often does, crack.

It is also susceptible to damage by such things as acid rain, pollution, road salt, animal urine, fertilizers and other landscaping chemicals, radiator fluid, sudden changes in temperature, and plain water.

The surface of concrete is porous. It is like a hard sponge. Water and various chemicals work their way into the porous surface and weaken the bond between the cement and the stone.

Researchers have worked for years looking for solutions. One example is the extensive experimentation that is in progress at Cornell University of Structural Engineering. The federal government, US Department of Transportation in particular, would very much like to have a formula that resists typical damaged we are all accustomed to experiencing -- potholes in streets, cracks in walks and basement floors.... roads, bridges, and dams crumbling.

Many different ideas are being tested. Until answers are found, homebuilders, homebuyers, and governments will continue to suffer in frustration that something so tough can also be so fragile.

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Resource note: Information for this handout was obtained from an article in Smithsonian, Volume 24, Number 10, January 1994: "Concrete: The Gray Matter You Bet Your Life On", page 22, written by Richard Wolhair.