Concrete

Concrete is the bedrock of urban civilization. You drive on it, walk on it, park on it and probably work inside of it. Your house stands on it. And you no doubt hurt yourself on it as a kid.

But did you ever imagine a concrete countertop? Many people are choosing concrete over granite or solid-surface composites for their kitchen remodels. Sure, concrete is hard and durable. But why would you want to make this rough, gray industrial workhorse a major feature in your kitchen, the heart of your home?

First of all, forget gray and rough. What started as a coarse, blocky, low-budget experiment of the 1970s housing industry has matured into an industry in its own right. Today's concrete artisans individually handcraft countertops to their client's exact specifications of form and function. Each one is an original work of art, an expression of the homeowner's personality.

Concrete countertops account for only a small portion of countertop replacements, but they're gaining popularity both as high-end upgrades and as do-it-yourself projects. In the following pages, we'll explore concrete countertops and the potential for a do-it-yourself project

What is Concrete?

A composite of cement, sand, pebbles and water, concrete is the oldest manmade building material. The Romans used it as early as 509 B.C. They built extensively and impressively during the Roman Republic era. The ruins that people flock to see -- the Pantheon, the Coliseum, Pompeii -- were built of, and stand in testament to the durability of, concrete.

After the Roman Empire collapsed around 400 A.D., concrete construction disappeared from Europe. Not until 1754 did concrete technology resurface. William Smeaton, founder of civil engineering in England, developed a mortar of limestone and clay that hardened under water. He used this on the limestone footings of the third Eddystone Lighthouse off Plymouth in Devon, England.

Seventy years later, another Brit, Joseph Aspdin, patented an improved version of Smeaton's hydraulic lime mortar and called it Portland cement. Still, building with concrete didn't take off until 1871, when David O. Saylor, an American, patented his own well-researched and tested formula of hydraulic cement and built a factory to produce it in large quantities.

Today, concrete is the most widely used building material in the world. Because of its hydraulic nature, concrete can be used as underwater support for bridges, docks and piers. Its compressive strength makes it ideal for roads and skyscrapers. And its fluid versatility lends itself to architectural grace in bridge arches and plaza fountains.

So how do these qualities translate into concrete being a desirable countertop material? Keep reading to find out.

Decorative Concrete Countertops

In the areas of form and function, laminates, solid-surface and granite don't measure up to concrete. It's hard, durable and heat-resistant, and it's impressively solid. Furthermore, it's not the same, tired upgrade granite. No other kitchen will have a countertop that's anything like yours.

If you've always dreamed of prepping dinner on a field of ocean blue, you can achieve that with a concrete countertop. Ditto if you want your countertop to match an antique pitcher, a fleck of color in your flooring or the shade of your first love's eyes. Think of the color selection in a paint store; the range of colors for concrete countertops is just as wide.

Adding pigments to concrete during the mixing phase produces a solid color countertop. Mixing in the pigment unevenly or using a trowel to add it in after the concrete is in the mold can achieve a variegated effect.

For more translucent color, substitute acid stains or dyes for pigments. These colorants are applied topically to the concrete after it has cured. The penetration into the concrete is extremely shallow, but acid stains and dyes distribute color shades and hues across the countertop surface in a manner that mimics nature.

The aggregates you choose, combined with a grind-and-polish finish method, are a great way to influence the final appearance of a concrete countertop. Aggregates are materials that bond with the sand and cement to add strength to concrete. For heavy-duty applications, like roads and building foundations, the aggregate is usually coarse gravel. Finer materials supply both strength and beauty in countertops, where appearance is as important as function. Grinding the countertop surface allows aggregates to peek through, revealing earthy river pebbles, luminescent marble chips or colored glass confetti. Polishing afterward gives the countertop a smooth, sleek finish.

For a truly personal touch, many people select meaningful artifacts or objects to imbed in the concrete. These items run the gamut from fossils and geodes to CDs and transmission parts.

Imbedded items aren't just decorative; they can be functional, too. A permanent trivet next to the stove is always ready to receive a hot pot. A pastry slab of marble beckons bakers and protects the concrete from oils and acids in dough. A removable cutting board stays firmly in place while you work.

Because concrete starts as a fluid mixture, it takes the shape of its mold. Through the structure of the mold, you can integrate other functionalities into a concrete countertop, like a drain board that slopes to the sink, a trough to hold eggs and convenient storage for knives.

Concrete's plasticity also allows you to think beyond the typical rectangle countertop with a bull nose edge. Cast in concrete, your countertop can take on curves, angles and a vertical sink face. The edges can show a Florentine relief, geometric pattern or spell out a favorite saying. If you can craft it into the mold, you can replicate it in your countertop.

Concrete countertops deliver beauty, individuality and high-function. So what should you think about before pouring concrete? Read on to find out.

Will the real concrete please stand up?

Concrete -- building material discovered by 5th century B.C. Romans. They mixed a powder of crushed rock and lava ash that solidified after exposure to water (cement) with sand and bits of rock, brick and pottery, and created a substance strong enough to build with. The Romans called it *opus caementicium*.

Concrete -- philosophical concept indicating something that you can touch, see, smell, taste or hear as opposed to an abstract theory, quality or value.

Concrete -- grammatical classification of a noun that indicates a person (Milton Hershey), place (Hershey, Pa.), or thing (Hershey bar) that is perceptible to the senses.

Concrete Countertop Factors

The National Kitchen and Bath Association recommends 132" (330 cm) or 11' (3.3 m) of usable counter frontage for kitchens under 150 square feet (13.5 square meters) and 198" (495 cm) or 16.5' (4.95 m) of counter frontage for kitchens over 150 square feet [source: Farris]. Countertops are typically 24 to 26" (60 to 65 cm) deep, and if you plan to integrate functional features like a sloping drain board into your concrete countertop, it will need to be 2.5" (6.25 cm) thick. Concrete of that thickness weighs around 30 pounds per square foot (150 kg per sq. m) [source: Cheng]. In a small kitchen, you'll have over 650 lbs (300 kg) of countertop sitting on your cabinets; it'll be almost 1,000 lbs (450 kg) for large kitchens.

The weight of concrete is a critical physical consideration. Countertops made of concrete are heavier than countertops of any other material, including granite. You'll need to assess the condition of your cabinets and floor to determine if they're strong enough to carry the weight of a concrete countertop. Factors include age, strength and condition. Location also comes into play for cabinets; are they against a wall or freestanding?

You can reinforce cabinets with 1/2" (1.25 cm) plywood glued and screwed to their sides and backs. To distribute the weight over the widest possible area, put 3/4" (1.875 cm) plywood over the cabinet tops. Keep in mind, though, that reinforcement changes the dimensions and possibly the appearance of your cabinets and raises your countertop height.

Beyond weight, you should also consider whether a concrete countertop is suitable to your lifestyle. Like all countertop materials, concrete has strengths and weaknesses.

Hard and durable as it is, concrete requires more frequent maintenance than granite. It must be stripped and resealed with wax every three months. Even with care, concrete changes in appearance with age. It accrues hairline cracks as it expands and contracts with temperature

changes. It won't melt if you put a hot pot on it, but it might chip if you put the pot down too hard. And none of the available sealants provides perfect protection from stains and scratches.

Concrete is not the best countertop material if you live in a seismically active area. Its strength is compressive, which is why it can take the weight of tractor-trailers and skyscrapers without shattering. But it's not good on a twist. If the supporting structures shift from level, concrete cracks.

While the materials to make concrete are not costly, the expertise of a concrete artisan is. Expect to pay around $70 per square foot of countertop for a simple professional manufacture and installation. If you want to incorporate special features, plan to fork over $200 or more per square foot. You can do the work yourself, but it may cost you in other areas. Read on to see what we mean.

Making a Concrete Countertop

Planning for a concrete countertop starts just like other countertops: with measurements and a template to indicate the size, shape, seam placement, location of the sink and faucets and other features.

While other countertop materials are cut from a slab, concrete countertops are formed in a mold. So the next step is building the mold. If you choose the pour in place method, the mold is built on top of your cabinets. Molds for precast countertops are built elsewhere, and the countertop is hauled to your kitchen after finishing and sealing.

After the mold is built, leak-sealed, cleaned and secured to a sturdy, level support surface, it's time to mix the concrete. The proportion of cement, sand, aggregate and water determine the fineness and strength of the concrete. Admixtures such as **water reducer** (an additive that allows you to mix workable concrete with minimal water), **retardant** (an additive that slows setting time), fibers (for added strength) and pigments are mixed into the concrete at this time.

When the wet concrete loosely holds its form in your (heavy-duty rubber gloved) hand, muster your strength for the pour. After testing the consistency, or **slump**, of the concrete, you'll transfer it by the shovelful from the mixing vessel to the mold. You'll have no time for coffee breaks here. Concrete starts setting, or losing its plasticity, about 30 minutes after mixing.

Shovel the wet concrete into the mold until it covers the bottom, then vibrate the mold with hammer taps or a palm sander to help the mixture flow into corners and around reinforcement bars. Repeat the layering/vibrating process until the mold is full. Use a clean, straight 2x4 to **screed** (level) the bottom edge. If you are pouring in place, this will be the top.

After about half an hour, smooth the surface with a wooden float. Give the concrete a chance to set up, and then smooth the surface with the flat edge of a trowel.

The concrete may take anywhere from three days to a week to cure. Curing time depends on temperature, humidity and the type of cement you use. Ideally, your countertop will cure in a climate-controlled area with a median temperature of 75 degrees Fahrenheit (24 degrees Celsius) and high humidity.

The concrete is **green**, or not fully hardened, when you remove the mold, so the countertop must be carefully supported when it's moved off the mold and flipped for finishing. The incompleteness of the hardening makes it easier to grind and polish the concrete, but it also means it's easier to scratch or gouge the surface.

Grinding begins with a coarse grinding pad and progresses to a very fine pad. Polishing follows the same order. This is a labor intensive, time-consuming and costly job that's best finished within 10 days of the pour.

When the surface is as smooth and sleek as you want it, you should apply several coats of a food-grade penetrating sealer and top that with a coat of beeswax. Install the countertop on prepared and leveled cabinets, and fill the seams with a color-matched caulk.

Are there sealants for my countertop that take less maintenance?

Epoxy and urethane sealers are an alternative to penetrating sealers. They create a shiny, plastic-looking barrier that’s better at protecting concrete countertops from stains, but they also have some drawbacks. They are not heat-resistant, are susceptible to scratches, may peel away from the countertop and may contain solvents that are unsafe in a food-handling environment.

Dangers of Concrete Countertops

If you're planning a do-it-yourself concrete countertop, or contemplating hiring a professional for a pour in place project in your home, you'll need to take precautions to reduce health risks associated with several of the materials of concrete manufacture.

- Cement is a fine powder that easily becomes airborne. Since it hardens when moistened, it's important to keep it away from the moisture in your eyes and lungs.
- Aggregates may contain silica dust that can harm lungs.
- Fresh concrete is highly alkaline and can burn skin.
- Some pigments and acid stains contain heavy metals. The waste from these products is hazardous to the environment.
- Some products available to seal concrete contain solvents that are not safe for food preparation. Choose only food-grade rated sealants.

These materials must be handled with care and proper safety gear.

And don't forget that concrete is very heavy. You'll be moving hundreds of pounds of material in every stage of the project, from bringing home the raw ingredients, mixing them, pouring the concrete, and installing the finished countertop.

Making a small, simple concrete countertop is an achievable do-it-yourself project. Creating concrete countertops for an entire kitchen is a challenging undertaking, especially if you haven't worked with concrete before. Potential hurdles include:

- Variations in the concrete mixture produce a non-uniform product.
- Imperfections in your form will show up in the hardened concrete.
- Mixing, curing and finishing a concrete countertop requires space, time and a climate-controlled environment.
- Concrete countertop professionals rarely share their mixture formulas and trade secrets.

Even if you take an incredible amount of care in creating your concrete countertops, there are several things that could possibly go wrong. You may encounter **ghosting**, shadows of reinforcing rods that appear on the surface. This is caused by insufficient vibration of the mold. Grinding to reveal the aggregate may minimize the appearance.

The concrete countertops may also crack because of too much water in the mixture or evaporation of water in hot, dry conditions. Another pitfall may be efflorescence, a white coating that blooms on the surface of concrete. Water stains may occur from discolorations in the concrete due to water pooling under the concrete or seeping through the mold.

Even without holes, cracks or chips, concrete is very porous. But a well-fabricated, properly sealed concrete countertop should be resistant to moisture and free of pits or pinholes that can harbor bacteria. A 1999 study by the Hospitality Institute of Technology and Management shows that a concrete countertop's resistance to bacterial contamination when cleaned with dish detergent and water is similar to that of stainless steel, and superior to wood, laminate and tile countertops [source: Hospitality Institute of Technology and Management]. Cleaning with vinegar kills significantly more bacteria than cleaning with soap and water, but the acid in vinegar eats through wax sealants commonly used on concrete countertops.

Is concrete a safer material to have in my house than granite?

Recently, news agencies reported that granite countertops might release unsafe levels of radon, a colorless, odorless gas that causes lung cancer. The U.S. Environmental Protection Agency states that radon "comes from the natural decay of uranium that is found in nearly all soils," and it does not believe that kitchen countertops are a significant factor in indoor radon levels. See page of radon from the ground through cracks in the foundation is the usual cause of radon in homes. If you're considering concrete countertops as an alternative to granite because of the radon scare, be aware that concrete contains earthen materials that may generate radon gas as well.

Environmental Implications of Concrete Countertops

Environmentally speaking, concrete countertops present a mixed bag of bad and good.

On the bad side, concrete uses a lot of cement. Cement production requires a great deal of energy for the high-temperature processing of limestone and other materials. Between the different stages of cement manufacture, the cement industry is one of two primary producers of carbon dioxide (CO_2), creating up to 10 percent of worldwide emissions of this gas [sources: van Oss and Brehm]. Limestone, sand, clay and aggregates are mined from the earth by tons to make concrete, disrupting habitats and leaving vast craters in the earth. Additionally, making concrete removes fresh water from the environment, currently at the rate of over 2.2 trillion lbs (1 gigatonne) per year [source: van Oss].

Heavy metals, which can cause health problems and contaminate soil, water and food supplies, are part of the make up of some pigments, such as chromium oxide and cobalt blue. Acid stains and sealants can release Volatile Organic Compounds (VOC) that pollute the air, creating respiratory problems and contributing to the formation of ozone in the Earth's atmosphere.

On the good side, your concrete countertop probably won't need to be replaced for generations. With care and maintenance, it can last for 75 years. When it needs replacing, the countertop can be recycled for different uses or broken into aggregate for fresh concrete.

Because concrete is so important to our everyday life, numerous institutions work to reduce its negative impact. The Concrete Countertops Institute promotes the use of waste materials as aggregate and cement supplements. Civil and environmental engineers at the Massachusetts Institute of Technology are experimenting with reorganizing the nanoparticles in concrete to reduce CO_2 emissions. And the U.S. Army has developed technology that makes concrete repel water without harmful sealants.

For lots more information on concrete countertops, interior decorating and related topics, design your eyes over the links on the next page.

Green Innovations

The U.S. Army uses Electro-Osmotic Pulse (EOP) technology to protect concrete basement walls in military base houses from water penetration and mold contamination. This electricity-based technology eliminates the need to coat the walls with conventional waterproofing materials that contain harmful chemicals. Instead, low-voltage direct current (DC) pulses push moisture to the outside of the wall, preventing seepage into the house.