



## Concrete Rocks Our World

*With apologies to Cotton Incorporated and its perfect pitch, in the world of industrial real*

*estate it's concrete that we call "the fabric of our lives."*

Next to water and air, concrete reportedly is the most heavily consumed substance in the world, with some 10 billion tons produced annually, worldwide. It also is the strongest – and therefore the most popular – building material in the world. In fact, the first concrete street in the U.S., which was built in 1891 in Bellefontaine, Ohio, is still in service today. Back then, concrete was referred to as “artificial stone.”

Concrete dates back to ancient Rome, created from a simple mix of water and what sufficed then as cement. Today, it's made of water and *portland* cement. From there, coarse aggregates such as rock or gravel and fine aggregates such as sand are added. Concrete is formed as the cement-and-water mix, or paste, binds through hydration to the surfaces of the aggregates to form a rock-like mass.

### **No two pieces of concrete are the same**

“It's not a homogenous product,” explained Rob Fischer, IDI's vice president of construction in Memphis. Fischer lays claim to pouring some 450,000 cubic yards of concrete in 58 buildings since joining IDI in 1989. “Every pour is different, and how the concrete turns out depends on any number of factors in the environment, such as the temperature outside or how hot the aggregates are.”

Before it hardens, the concrete mix can be molded and shaped into most any form, providing unparalleled versatility, particularly for a building material. Concrete can even cure under water, thanks to the chemical reaction of cement to water. But, it's not always at its hardest state.

“When it's first placed, concrete is quite delicate,” Fischer said. “Then, in those first several days it reaches about 90 percent of its strength. The next 10 percent of its strength is reached in the next 20 years.”

The key to strong, durable concrete lies in properly proportioned ingredients of the water-cement paste. Too much water (a lean paste) and you end up with



The versatile nature of concrete is one of the reasons tilt-up construction has become one of the fastest-growing industries in the United States. At least 10,000 tilt-up concrete buildings enclosing more than 650 million square feet are constructed annually, according to the Tilt-Up Concrete Association.

weak, shrinkage-prone concrete that's difficult to manipulate and that will produce a rough, porous surface that, once it hardens, can flake. An overly rich paste with too much cement can be dry and difficult to work with, resulting in a concrete that's more likely to crack and, again, flake. The goal for a high-quality mix is to lower the amount of water as much as possible without sacrificing the workability or economy of the mix, then to ensure the concrete is properly cured.

### **Properties used in tilt-up construction**

The remarkable characteristics of concrete explain why this one building material is used for superhighways, bridges, parking decks, skyscrapers, dams, and, of course, warehouses. In Class A industrial facilities such as those developed by IDI, tilt-up concrete panel construction is the standard by

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which others are measured. According to the Tilt-Up Concrete Association, tilt-up has become the preferred method of construction for industrial facilities and similar structures since the 1940s.

Why so popular? For starters, the architectural versatility of concrete, (and thus tilt-up construction) is unsurpassed. IDI's Gill Shaw, vice president of construction in Atlanta, notes that concrete's coming of age means more imaginative and architecturally pleasing structures that compete with even the most impressive pre-cast buildings. Concrete also has a natural ability to support heavy loads due to its durability and compressive strength. This strength allows a building to be designed with maximum floor space without, perhaps, all the load-bearing perimeter columns. That means flexible interior layouts – something especially important for warehouses and distribution facilities. And, a tilt-up building is a relatively quick construction project that's made easily expandable by detaching and relocating the concrete panels or by cutting new openings.

Concrete buildings typically are safer than other types of buildings. They are fire resistant, and they provide tenants unequalled protection against tornados, hail storms, hurricanes and earthquakes. Trucks and forklifts can do little damage to a concrete building, and security is less of a concern for a building made of solid concrete walls vs. other materials.

While it's not waterproof, the insulating properties of finished concrete do hold a number of advantages for concrete buildings. They absorb sound, so buildings located near airports or train terminals are quieter than those made of other materials. They also heat up quickly and cool down quickly, reducing the costs for heating and cooling peaks and loads.

With all these low-maintenance, high-performance attributes of this raw material, it's easy to see why concrete structures are so ubiquitous.

"When you have a product that's used everywhere – when everything from the walls to the flooring to even the storm pipe is all concrete product," Fischer said, "the importance of it is quite obvious."

## Facts about concrete and cement:

- Concrete gets stronger as it gets older because the hardening process, or "hydration", continues – and actually never stops. It even hardens under water.
- "Concrete" and "cement" often are confused. Here's a tip from IDI's Gill Shaw: "Cement is to concrete as flour is to cake." So, there's no such thing as a cement sidewalk or a cement truck; it's a *concrete* sidewalk and *concrete* truck.
- In addition to cement, concrete is a mixture of water (15%-20%), large aggregate (stone) and sand (60%-75%), and air (5%- 8%). Cement makes up the other 10 percent to 15 percent, along with "admixtures" – chemicals added to the mix to achieve specific, desired characteristics of the concrete.
- Today, cement is generically called "portland cement" because when the British stone mason who's credited for inventing this powdered ingredient mixed it with water, the resulting mass resembled a stone found on the Isle of Portland off the British Coast. It's similar to "stainless" used to describe a certain steel, or "sterling" used to describe a type of silver.
- Portland cement is made mostly of calcium, silicon, aluminum and iron, plus traces of other elements. It is blended, ground, and burned in a kiln, then designated as Type I, Type II, etc., depending on its structure and intended use.