



Notes from the Underground

July 1 Being Concrete

Concrete begins as careless, slovenly, and entirely feckless. It is promiscuous and easygoing, willing to flow this way and that, open to being shaped, doing what anyone wants if that person is strong enough to hold it.

Once it is committed, though, concrete becomes fanatically adamant.

I don't know about you, but I constantly find that the world is more complicated than I thought. Take concrete. It isn't just hard, heavy stuff. Once I started looking into it, I found hundreds of different kinds, applications, chemical reactions-it just goes on and on.

We were going to pour a multi-arched concrete roof to cap our home before covering it with earth, but the engineering specs and our bank account convinced us to go with timber framing-which, as it turns out, is a more aesthetically pleasing alternative, too. Still, we needed concrete for footings and the main slab floors.

First, we had to make sure our slab wouldn't get wet feet. We thought our site was mostly sand, but we hit the dreaded clay after excavating just a few feet. That meant we had to take special precautions about drainage because an earth-sheltered home's nemesis is moisture. So we put down 30 cm of clean stone and installed 15 cm drains before pouring the footings. Then, around the footings, we added the normal 20 cm of clean stone and 10 cm drains. We put down 5 cm of rigid foam insulation next, then wire reinforcing mesh, then installed the radiant floor heating lines. Finally we were ready to pour our 12 cm concrete slab. In the photo below you can see the completed parlour and kitchen slab with the rest yet to go.



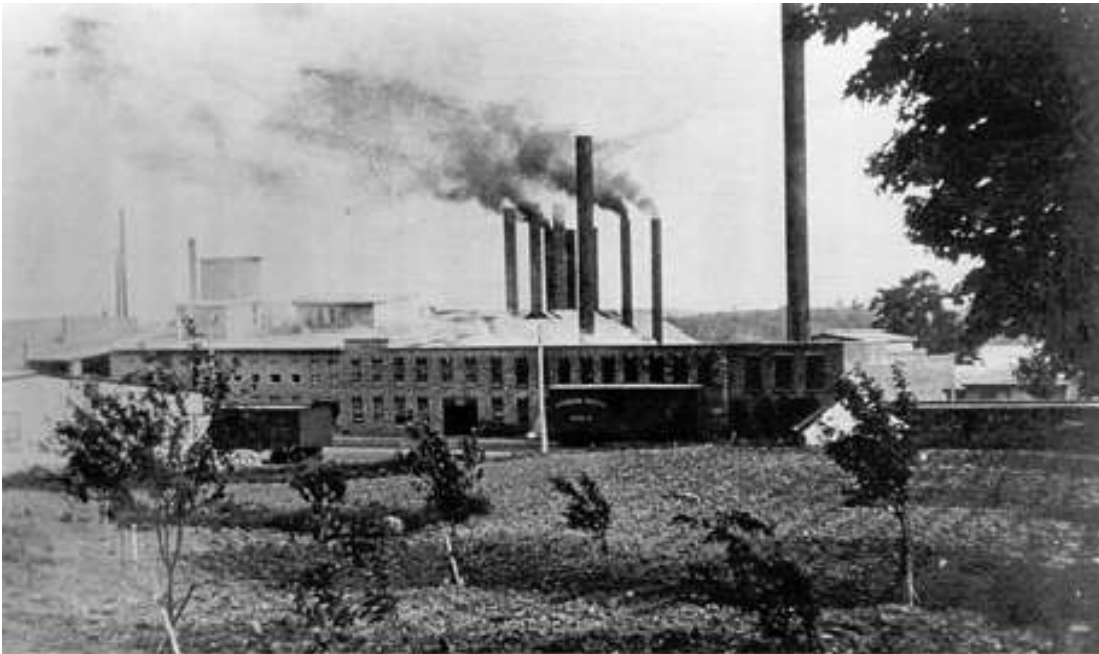
Concrete is composed of cement (commonly limestone with small quantities of other materials, such as clay, heated to 1450 °C in a kiln,) as well as other materials such as fly ash and slag cement, aggregate (generally gravel, limestone, or granite plus a fine aggregate such as sand), water, and chemicals.

Concrete may have been used to build the Great Pyramids about 5,000 years ago. The perfection of the technology was left to the Roman Empire and the widespread use of concrete in Roman structures has ensured that many survive almost intact. The word concrete comes from the Latin word *concretus* meaning compact or condensed.

The secret of concrete was reportedly lost for 13 centuries until 1756, when the British engineer and physicist John Smeaton pioneered the use of hydraulic lime in concrete, using pebbles and powdered brick as aggregate. Rumour has it that he first noticed the difficulty his workmen were having scraping a mixture of lime, water, and powdered brick off their metal shovels. Hmmm.

The website of the [Marlbank Phoenix Tavern](#) near us has some local history about cement. On December 11, 1890, the following appeared in The Tweed News: *"Marlbank promised to rise to some importance on account of the huge deposits of marl, which have been found to extend a depth of 30 feet and over a considerable area, making the deposits practically inexhaustible."*

Well, some of that was true. The unusual soil found in Marlbank was indeed excellent for making cement and several companies located there in the 1890s. Then, on May 24, 1900, The Tweed News carried the heading *"Cement Companies Amalgamate."* I guess *"Cement Companies Aggregate"* would have been too much of a pun. In any event, the Portland Cement Company had consolidated its interests.



Historical photo courtesy of Helen Tuepah

Eleven kilns were used to make 500 barrels of cement a day. "The cement they made there was among the best in the world," says Nina Jarmin. "It was used in the building of the Suez Canal." This cement was also used in building some of the piers of the Quebec Bridge. When the bridge collapsed some years later, the only piers left were those made of Marlbank cement.

The cement plant employed about 200 men at its peak. They were paid \$1 for a ten-hour day. There were 40 residences and a boarding house that slept 100 men in the empty fields opposite the factory. Many of the boarders and workers were of French or Hungarian nationality.

Today, concrete is used more than any other man-made material in the world. As of 2006, about 7.5 cubic kilometres of concrete are made each year-more than one cubic metre for every person on Earth. The People's Republic of China currently consumes 40% of the world's cement/concrete production.

The use of recycled materials as concrete ingredients is slowly gaining popularity, especially fly ash, a by-product of coal-fired power plants that is mostly dumped in landfills. This "green concrete" significantly reduces the amount of Portland cement, quarrying, and landfill space required. The high kiln temperatures create massive quantities of carbon dioxide, so cement-replacement technology such as this will play an important role in future attempts to cut our CO₂ emissions.

Concrete recycling is an increasingly common method of disposing of old concrete structures. Concrete debris was once routinely shipped to landfills for disposal, but recycling is increasing due to improved environmental awareness, governmental laws, and economic benefits.

Concrete can be put through a crushing machine, often along with asphalt, bricks, and rocks. Rebar and other metallic reinforcements are removed with magnets and recycled. The remaining aggregate chunks are sorted by size. Smaller pieces of concrete are used as gravel for new construction projects, such as the lowest layer in a road, with fresh concrete or asphalt placed over it. Crushed recycled concrete can sometimes be used as the dry aggregate for brand new concrete if it is free of contaminants, though the use of recycled concrete limits strength and is not allowed in many jurisdictions.

Recycling concrete reduces CO₂ emissions, conserves landfill space, and reduces the need for gravel mining.

We have two regrets in building this house so far. The first is that we ordered the concrete for the slab from a local company called Lefarge. They had a reasonably local plant and seemed cooperative enough when we placed the order but half of their loads were very difficult to finish. Luckily we had the two best cement finishers in Southeastern Ontario on the job. Normally they each run their own crews, but we poured before their busy season and they were both on site. The concrete set up so fast, they had a great deal of difficulty finishing it and, by the next day, the floor was full of hairline cracks that looked like varicose veins.

We called Lefarge and their inspector came out and claimed it was the finisher's fault. After a few phone calls, Lefarge offered us a discount if we bought more concrete from them but not a refund on the material already purchased. In my last conversation with them, I said I was

definitely not a satisfied customer and the Lefarge representative said he would kick the problem upstairs and get back to me. We never heard another word from them.

We never bought any more concrete from them, either.

The second regret is that we couldn't find a local source of green or recycled concrete. But if enough of us keep asking, perhaps the local suppliers will begin to carry it. Maybe we should revive the history of Marlbank or be as fanatically adamant as their finished product.

Steven Moore is a commercial writer, editor, and professor of sustainability at the Queen's School of Business. You can contact him at www.moorepartners.ca