Durability, Strength and Cost, Why All Concrete is Not the Same.

By Kevin E Miller

The First Sign of Computerization

The average concrete supplier can produce hundreds of different concrete mix designs stored on a computer to suit a wide variety of applications. In the 1960s, IBM punch cards were used to assist plant operations for important commercial and transportation projects. The first true computerized batching systems were introduced to the Concrete Industry in 1977. The earliest of the Pyrrhotite affected homes in Connecticut were supplied in the 1980s, while computerization was still in its infancy and not required at all concrete plants. Tracing those records to determine what concrete mix designs were used and where it was delivered in 1980s and early 90s has not been possible due to limited computer record storage and the non-existence of hard copies from the supplier.

It’s Gray, and it Gets Hard.

We would like to think that it is effortless to always make a perfect cubic yard of concrete. In my earlier years in the concrete industry, the motto at our company was “The Least Expensive Cubic Yard of Concrete Is A Quality Cubic Yard of Concrete”. That statement goes a long way when we look at the replacement costs of any concrete structure. Liquid rock would best describe the product being placed in your foundation forms, removal and replacement at any point in time can be very costly.
Questions and Answers

Q: How long should concrete last?
A: The average lifespan of concrete is 30-100 years depending on the quality of the concrete, installation and type of exposure. The residential foundation should far outlast a wood structure, stated as lasting a lifetime.

Q: Does concrete dry?
A: Concrete does not dry, it cures. Concrete needs additional moisture to be applied after it is placed and finished. If the surface is allowed to dry completely the cement particles close to the surface will not contribute to the strength gains.

Q: How long does it take for concrete to reach full strength?
A: At 7 days the concrete should be at 65% of designed strength, 99% of designed strength at 28 days.

Why All Concrete Is Not the Same

Cement is the most expensive component in a concrete mix. The average residential concrete design will have between 460 to 500 pounds per cubic yard. Commercial concrete designs will contain between 550 to 750 pounds of cement depending on use and strength requirements. Increasing the cement reduces the permeability of the concrete.

When discussing concrete structures, the integrity and long term durability of transportation projects and commercial concrete placements relies on third party testing laboratories, prohibiting or limiting the amount of water to be added on the jobsite and requiring concrete to be placed within a definite time period, generally 90 minutes from batching.

The use of commercial below grade membranes for waterproofing, properly compacting concrete by vibration, weather protection and curing correctly all contribute to increased durability and reducing or delaying the effects of sulfate attack on the concrete. Science has not proven that the damaging effects of pyrrhotite laden concrete will not surface at some future time. A small number of commercial buildings have exhibited signs of damage common to the residential properties with pyrrhotite, although not as prevalent because of stricter quality control plans in place during construction.
Aggregate Testing Methods

There are many tests for the conformation of aggregates used in construction materials. Transportation and commercial construction share the basic requirements for sound, clean, quality aggregates to be used in building. The tests that are conducted most frequently include moisture percentages and sieve analysis. The process starts by extracting natural material from the earth, passing the large boulders through a series of rock crushers and screens to specific sizes suitable for use in concrete or asphalt. To verify the proper grading of sizes, a sample is obtained from the large stockpiles and run through a series of small screens, the weight of material passing each size screen is recorded and compared against required standards. This test is called a sieve analysis and the results are called gradations.

How Do I Know I’m Getting Quality Concrete?

The foundation is the most important part of your home so why would you make a decision based on a couple of dollars saved, rather than purchasing from a quality supplier of ready-mix concrete. Your greatest concern should be knowing the source of the materials used to produce the concrete. Is the supplier you choose using domestic or imported cements? Are the aggregates used in the concrete from a single source that are tested regularly? Once you have confidence that you have chosen the right concrete supplier, your next step should be the reputation of the concrete contractor doing the form work and placing the concrete. The importance of maintaining accuracy to foundation plan dimensions, elevations and squareness are paramount for a successful building project are just as important as not adding too much water to the concrete at the jobsite. You can reach out to the concrete supplier for recommended concrete contractors and request referrals from their customers on completed projects.
Quarry Standards in Connecticut

Currently Connecticut has proposed Legislation in the General Assembly that would require all quarries in the State supplying aggregate for the use in concrete prepare a geological source report.

The high-volume concrete producers in Connecticut currently supply ready-mix product to many large scale projects such as waste water treatment plants, Department of Transportation projects and Government Defense facilities.

The demanding projects listed above require a tremendous amount of aggregate testing and documentation including mortar bar expansion, abrasion, soundness, and petrographic analysis to name a few.

Additionally, most of the high volume concrete suppliers in Connecticut currently are testing their quarries for sulfur and magnetic susceptibility, testing that is specifically designed to determine the presence and concentration of pyrrhotite.

The Most Important Ingredient in Concrete

What a challenging research topic. The first and most essential ingredient in concrete according to many would be cement. Even though cement represents a small part of the total mix, it is the “glue” that binds the other materials together. As we scroll through numerous documents and articles on concrete, water takes the lead for ingredients, water and its quality plays an important role in a concrete mix. For it is water that ultimately controls the strength, durability and finally the overall quality of the concrete. We have learned that when the proper water/cement ratio is maintained the end product will survive a lifetime.

The crumbling foundation crisis in Connecticut has placed aggregates at the top of the list for importance. Without clean, hard durable aggregates, free from deleterious components the ability of the concrete to provide a lifetime of service could be at risk.

A Note from CFSIC

Background and Qualifications of Kevin E Miller

Kevin Miller has been employed in the concrete industry for the past 30 years. Kevin, well-versed and educated in concrete technology, troubleshooting concrete defects, and designing concrete mixtures for commercial and residential applications, is an industry veteran. Additionally, during his seven-year term as President of the Connecticut Ready Mix Concrete Association, he witnessed and was instrumental in supporting legislative changes and the incorporation of stricter quarry inspections to assure the long-term durability of concrete used in roads, bridges, and highways as well as in other commercial and residential uses. Kevin continues to remain active in the industry as a consultant on Government projects and as a troubleshooter on residential and commercial concrete issues. CFSIC has engaged with Kevin to create the only comprehensive concrete failure training course available in the state of Connecticut. He continues to serve as consultant and advisor to CFSIC.

Michael Maglaras
Superintendent, CFSIC