

Arizona modern
portland cement is
usually attributed



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ARIZONA CONCRETE John McCollam Geology 101, Section 12262 Randy

Porch 20 November 1996 ARIZONA CONCRETE According to the Mine Faculty

at the University of Arizona, cement is manufactured primarily from suitable

limestone and shale rocks. Arizona had two dry-process cement plants in

1969, namely the Arizona Portland Cement Company plant in Pima County,

near Tucson, and the American Cement Corporation plant at Clarkdale, in

Yavapai County (52-53). The use of cementing materials goes back to the

ancient Egyptians and Romans, but the invention of modern portland cement

is usually attributed to Joseph Aspdin, a builder in Leeds, England, who

obtained a patent for it in 1824. Currently, the annual world production of

portland cement is around 700 million metric tons (Danbury). Many people

use the words concrete and cement interchangeably, but they are not.

Concrete is to cement as a cake is to flour. Concrete is a mixture of

ingredients that includes cement but contains other ingredients also (Day 6-

7). Portland cement is produced by pulverizing clinker consisting essentially

of hydraulic calcium silicates along with some calcium aluminates and

calcium aluminoferrites and usually containing one or more forms of calcium

sulfate (gypsum) as an interground addition. Materials used in the

manufacture of portland cement must contain appropriate proportions of

calcium oxide, silica, alumina, and iron oxide components. During

manufacture, analyses of all materials are made frequently to ensure a

uniformly high quality cement.

Selected raw materials are crushed, milled, and proportioned in such a way

that the resulting mixture has the desired chemical composition. The raw

materials are generally a mixture of calcareous (calcium oxide) material,

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such as limestone, chalk or shells, and an argillaceous (silica and alumina) material such as clay, shale, or blast-furnace slag. Either a dry or a wet process is used. In the dry process, grinding and blending operations are done with dry materials. In the wet process, the grinding and blending are done with the materials in slurry form. In other respects, the dry and wet processes are very much alike.

After blending, the ground raw material is fed into the upper end of a kiln. The raw mix passes through the kiln at a rate controlled by the slope and rotational speed of the kiln. Burning fuel (powdered coal, oil, or gas) is forced into the lower end of the kiln where temperatures of 2600F to 3000F change the raw material chemically into cement clinker, grayish-black pellets about the size of 1/2-in.-diameter marbles. The clinker is cooled and then pulverized. During this operation a small amount of gypsum is added to regulate the setting time of the cement.

The clinker is ground so fine that nearly all of it passes through a No. 200 mesh (75 micron) sieve with 40, 000 openings per square inch. This extremely fine gray powder is portland cement (Kosmatka and Panarese 12-15). Dany Seymore of Show Low Ready Mix said that the cement used by Show Low Ready Mix is trucked in by Apex Freight Company and comes from the cement plant in Clarkdale, Arizona, now known as Phoenix Cement.

Their aggregate comes from Brimhall Sand and Rock in Snowflake, Arizona. Show Low Ready Mix uses Fly Ash from the A. P. S. power plant just outside of Joseph City, Arizona, in their cement. The mixtures they use are as follows:
Silica Dioxide Cement 21% Ash 62% Aluminum Trioxide Cement 4% Ash

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23% Ferric Oxide Cement 3% Ash 6% Calcium Oxide Cement 64% Ash 3.5% Mag.

Oxide Cement 2. 5% Ash 1. 2% Sulfur Trioxide Cement 3% Ash . 2% These combine to make: 1. Tricalcium silicate C_3S_2 . Dicalcium silicate C_2S_3 .

Tricalcium aluminate C_3A_4 . Tetracalcium aluminoferrite C_4AF_1 and 2 make up 75% of cement. 1 and 2 plus H_2O equal CSH (Calcium Silicate Hydrate) which is the glue. Fly Ash is C_3S plus C_2S which equals Calcium hydrazide which is a white stuff and water soluble. Calcium Hydrazide and Fly Ash equal CSH. The winter and summer mixtures are different due to the weather conditions. For winter, Fly Ash is not used because it inhibits the set time of the concrete.

Also used is accelerators to help the concrete set faster. A material called Fibermesh is used in the concrete for reinforcement and to control cracking as the concrete sets. Mr. Seymore also states that heat and moisture are the main components to make concrete set up. The concrete