PORTLAND CEMENT ASSOCIATION
RESEARCH AND DEVELOPMENT LABORATORIES

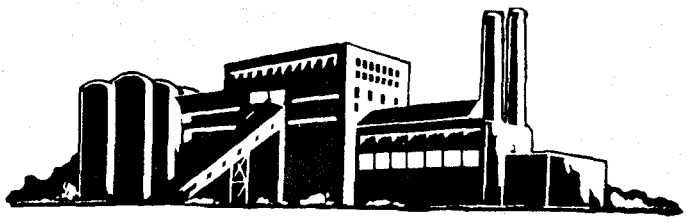
RESEARCH DEPARTMENT
M-171

PLANT DESCRIPTIONS

ALPHA PORTLAND CEMENT COMPANY
Lime Kiln, Maryland Plant

LEHIGH PORTLAND CEMENT COMPANY
Union Bridge Plant

STANDARD LIME AND CEMENT COMPANY
Martinsburg, W. Va., Plant



Presented at Fall Meeting of the General Technical Committee,
Portland Cement Association, at Baltimore, Md.,
September 10-13, 1962.

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5420 Old Orchard Road
Skokie, Illinois

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DESCRIPTION OF ALPHA PORTLAND CEMENT COMPANY'S LIME KILN, MARYLAND PLANT

by

D. W. Heineck*

The Lime Kiln plant of the Alpha Portland Cement Company is located in Frederick County, five miles south of Frederick, Maryland. The area is conspicuous because of its gentle rolling hills and beautiful farms protected by the Catoctin Mountains on the west and Sugar Loaf Mountain to the east. Construction of this plant began in late 1956 and the production facilities started operating in the spring of 1958. This two kiln wet process plant has an annual capacity of 2,250,000 barrels per year.

The Plant is situated on one of the main lines of the Baltimore and Ohio Railroad where an abundant supply of limestone and other raw materials are easily accessible on the property. Four lane dual highways leading to Baltimore and Washington, D.C., provide ready access to these two major metropolitan areas, approximately 46 miles each from the plant site.

A great deal of geological study went into the area before deciding upon this location, and some of the findings were not very favorable. A good deal of the stone fell into the category of either low Calcium or high Magnesia and so it was known that a sweetening stone would have to be added. Adequate supplies of sandy clay and clay were located in the overburden while iron ore was available in Delaware and high calcium stone could be purchased in western Virginia.

QUARRY

A quarry site was chosen on the basis of what was believed to be acceptable quality stone close to the crushing operation and with a reasonable small amount of overburden to be removed. The excavation began in an area with an overburden of 10' to 15' as indicated by core drilling in this area. The overburden removal was made somewhat difficult by the necessity of having to remove stone pinnacles. We presently excavate the top portion of the overburden, using a pan scraper until the

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*Plant Manager, Alpha Portland Cement Company

stone pinnacles are uncovered. The pinnacles are then removed with a truck and shovel type operation. This has been the pattern for all of our present stripping operation.

Since the initial start, this quarry was numbered #1 quarry and has been temporarily abandoned because of a high alkali content of this stone. Number 2 quarry was developed several hundred feet west of #1 quarry. Number 2 quarry is characterized by a stone which varies from a good calcium and slightly high magnesia on the west side, to a low calcium acceptable magnesia on the east side, with a compromise in the middle.

Further geological and chemical study revealed that blending stone from yet another area would render our quarry product much closer to the desired mix, thus #3 quarry was developed to blend with #2. Presently, seven to ten per cent of high grade limestone from near-by Virginia is required in our mix.

The drilling operation is presently accomplished with two air track drills with $3\frac{1}{2}$" bits and one Gardner-Denver P R 133 intermediate size drill with a 4" bit. A mixture of dynamite and ammonium nitrate blasting agents are used to break down the rock.

A fleet of 20 ton off the road self-dumping Euclid trucks are used for both stripping and hauling of stone and sand. Two Marion $2\frac{1}{2}$ yard electric shovels are used on the stone, while a $2\frac{1}{2}$ yard diesel P & H shovel is used to remove the overburden. A drop ball crane is used to break boulders and to load sand from pockets found in the overburden.

Three 50 H.P. pumps are used to de-water the quarries. This water is pumped to our reservoir and eventually used as process water.

CRUSHING

The stone from the quarry is dumped into a 60" x 120" Syntron feeder, which feeds the stone over a 60" x 78" Syntron grizzly, with the over size passing into a 48" x 60" Traylor Jaw Crusher with a 450 tons per hour capacity. This operation reduces the stone to a 6"

minus product. The material is carried from this operation to a secondary crushing operation by means of a 48" belt driven by a 60 H.P. motor.

The secondary crushing operation consists of a 450 tons per hour Pennsylvania Impactor driven by a directly connected 700 H.P., 900 R.P.M. drive and in close circuit with two 5' x 14' two deck TY-Rock screens. The product from this secondary crushing operation is controlled to ½" minus. All material handling in this area is accomplished by belting, as is the final product going directly to a covered storage building.

STORAGE

All materials used in the process, other than the finished cement, are stored under one roof and are shifted from the storage area to feed bins by means of two 11 ton overhead P & H Cranes with 4 and 5 yard buckets.

RAW GRINDING

From storage the raw material is fed into feed bins by means of the overhead cranes. Hardinge weigh type feeders are provided for metering the iron ore and sand, while volumetric type Link Belt reciprocating feeders are used to control the flow of both quarry stone and purchased stone. The raw materials are transported by means of a Carrier Vibro-Conveyor to the raw mills, all the feed being ½" minus at this point.

Two 9' x 37' three compartment, 1250 H.P., Allis Chalmers Compeb mills are employed for the purpose of raw grinding. Present production rates average 60 T.P.H. with a moisture of 38% and a fineness of 80% passing a 200 mesh screen. A screen at the discharge end of the mill scalps the 50 mesh particles and returns them to the mill by means of a 1" spitzer pump. The finished product is pumped by means of an 80 T.P.H. 15", 50 H.P. Wilfrey Centrifugal pump to the slurry blending silos.

There are eight slurry blending silos with a 600 ton capacity each or a total of 4800 tons. Two bins are used for kiln feed bins while the rest are used for blending and storing. Two 200 T.P.H., 6", 75 H.P. Wilfrey pumps are used for blending in the slurry silo while one 450 barrels per hour 5", 75 H.P. Wilfrey pump is used for feeding the kiln system. An exact duplicate of the kiln feed pump is used as a standby unit.

KILNS

The mixed raw material, having been adjusted and blended to meet certain chemical requirements, is pumped from the slurry silos to Allis Chalmers ferris wheel feeders. The ferris wheel feeders control the flow of feed into the kilns. The feeder-kiln speed ratio will not vary unless changed by adjusting the feeder rate directly.

The kilns are 11' 3" x 400' and are driven by dual D.C. motors. The capacity of each kiln is approximately 3200 barrels per day. These wet kilns have a heavy 1" circular chain system 66' in length with a weight of 97,114 pounds and a surface area of 9,517 square feet. The kiln lining consists of fifty feet of 6" basic burning zone with the remaining portion being lined with six inch 40% and 70% alumina liners.

A 140,000 C.F.M. kiln exhaust fan is driven by a 250 H.P. motor and is used to control the air flow through the kiln. A 573 Raymond coal mill equipped with a 250 H.P. motor is used to pulverize coal used to fire the kilns. The clinker discharging from the kiln flows through a Fuller 637 horizontal grate cooler and a good portion of the cooling air is returned to the kiln as preheated secondary air. Each cooler is equipped with a clinker breaker to keep the clinker size down to where it can easily be handled and fed into the next operation. Finally, the clinker being discharged from the coolers is transferred to storage by means of a Carrier Vibro-Conveyor.

The kilns are instrumented with basic instruments that have been proven useful. Most of our instruments are Bailey but a few other brands are evident. The following represents a list of instruments and a notation as to whether they are automatically controlled:

Back end temperature (coal mill cut off point)
Exit draft
Oxygen analyzer
Combustible Analyzer
Feed overflow indicator
Feed control
Thermo couple center of kiln
Kiln speed
Kiln drive load
Optical pyrometer
Hood draft (Automatically controlled by cooler exhaust fan)

Exhaust fan load
Overgrate temperature
Under grate pressure (Automatically controlled by cooler fan)
Cooler fan load
Cooler speed
Clinker breaker load
Vibro-Conveyor load
Coal mill load
Primary air inlet and outlet temperatures (automatically control tempering air)
Primary air inlet and outlet pressure

FINISH GRINDING

Clinker is transferred to the finish grinding feed bins by means of an overhead crane. A volumetric Link Belt reciprocating feeder is used to control the clinker feed into the finish mill while the gypsum is metered with a Hardinge weigh type feeder with good results. The feed is transported to the mills by means of a Carrier Vibro-Conveyor.

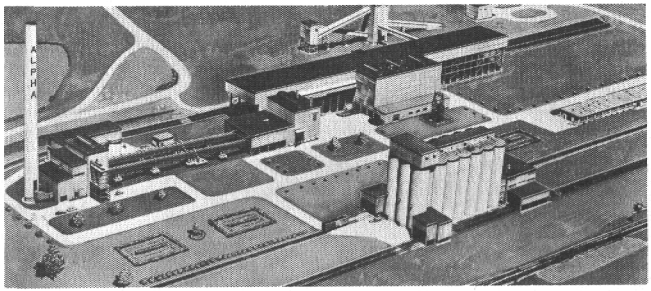
There are three 9' x 35' three compartment 1250 H.P. Allis Chalmers ompeb mills used to accomplish our finish grinding. Each mill is in closed circuit with a 16', 125 H.P. Sturtevant air separator. The capacity of this system at the acceptable surface area is 155 barrels per hour. The finished product is pumped by means of 7" and 8" Fuller-Kinyon pumps to individual bins in the cement storage silos.

Basically we make three types of clinker; I, II, and III. We also make masonry cement. Considering the various kinds of tested cement, we have had as many as 17 kinds of cement in our present battery of silos.

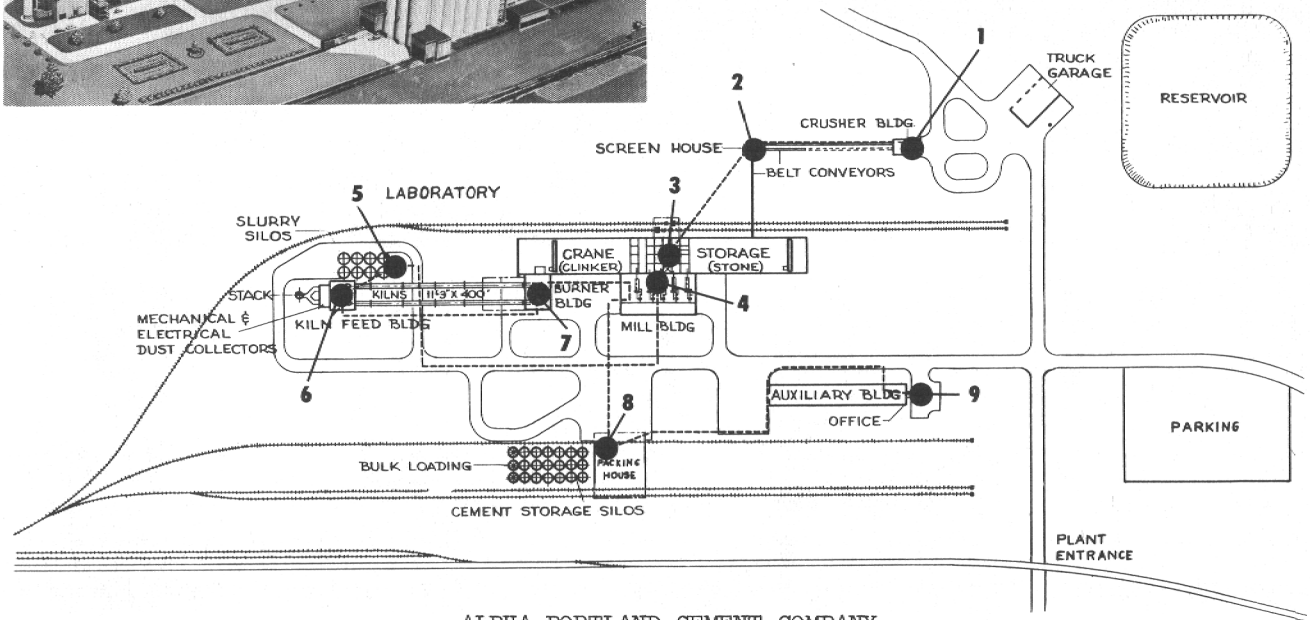
CEMENT SILOS AND PACKING HOUSE

The cement from the finish mills flows into three pipe lines which allow the selective filling of the silos. The main storage silos will hold 15,000 barrels each while the interses will hold 3,000 barrels. There are three quadrated bulk loading silos having a capacity of 8,000 barrels. The total capacity of this storage is 300,000 barrels.

The movement of cement is directed and controlled in one central location. Three 8" portable Fuller-Kinyon pumps can be moved from one silo to another to draw cement and pump



GENERAL PLANT LAYOUT



ALPHA PORTLAND CEMENT COMPANY

Lime Kiln, Maryland Plant

to either the bulk loading silos or the packing machine hoppers.

Packing is accomplished with three St. Regis packing machines. A packing conveyor from the Power Curve Company provides for quick easy load of trucks or rail cars with a minimum amount of effort.

Bulk loading is controlled from a scale house where the loader can cause the draw off of cement by means of Fuller air slides and load directly into trucks or rail cars which are spotted on scales. A truck can be loaded in from three to five minutes while it takes approximately 20 minutes to load a bulk car. About 65% of all shipments go out by truck while the remaining shipments go out by rail.

Our shipping clerk's office, which contains a Tele-Type machine, is located close to the loading facilities to insure fast and accurate handling of the orders.

POWER

Power is supplied by the Potomac Edison Company to a centralized power transformer rated at 7500 K.V.A. The power is transformed from 34.5 KV to 4160 Volts and distributed throughout the plant at this voltage. In general, all motors above 200 H.P. are 4160 volts and those below 200 H.P. are 440 volts. Most of the electrical equipment was supplied by Allis Chalmers.

GENERAL

We have a modern spacious laboratory equipped with all the latest instruments necessary to adequately evaluate and control the physical and chemical characteristics of our cement products. The lab is conveniently located below the slurry silos where the laboratory personnel can best control all phases of the operation necessary to insure a quality product. The laboratory is also charged with the responsibility of maintaining a first-aid room and giving first-aid when required.

Our utility building houses the machine shop, the storeroom, a wash house for the foremen and the workers, and the main offices. The shop is equipped to do a minimum amount of shop work since we are located so close to a large industrial area. The plant was designed with maintenance problems in mind in that each piece of major equipment has ready access to some

form of hoist for easy removal or assistance.

The stores area is adequate to store the small amount of inventory necessary to keep the plant in running condition. The locker rooms are spacious, easy to keep clean, and equipped with plenty of showers, basins, and hot water. All the offices are air conditioned and present an attractive appearance. A sizable conference room is used to hold meetings of various kinds in a bright comfortable air.

Our central Safety Committee meets once a month in the conference room to discuss various inspection reports, determine safety policies, discuss recommendations, and go over departmental meeting material.

MAIN STEPS IN THE OPERATION

1. Primary Crusher
2. Secondary Crusher
3. Crane Storage and Feed Bins
4. Raw Grinding and Finish Grinding
5. Slurry Silos
6. Kiln Feeding
7. Kiln Burner Building
8. Packing and Loading
9. Auxiliary Building