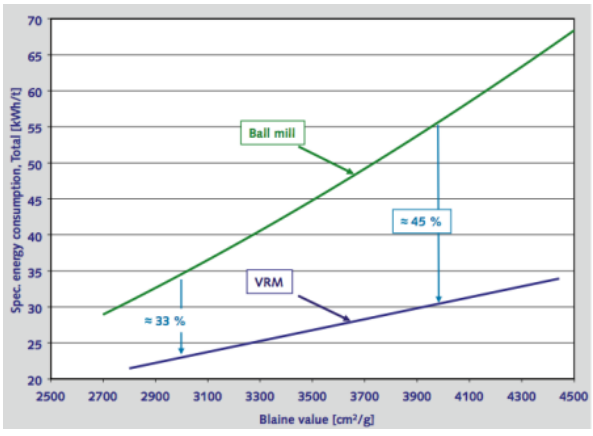
Cement plant vertical roller mill operational and maintenance

For several decades the cement industry has successfully utilized Vertical Roller Mills (VRM) for grinding of raw materials and solid fuels. Most recently, this technology has been employed for the comminution of Portland cement, blended cements and slag cements. The Vertical Roller Mills offer several benefits compared to the ball mill. However, the quality of the cement produced is extremely important in cement grinding and there is little experience with cement produced from a Vertical Roller Mill (VRM) in the US market. This paper relates the operational experiences from the first VRM for clinker grinding put into operation in the United States in 2002. Included in the discussion are operational data, maintenance discussion and laboratory data focused on product quality. All of the discussion is based on comparison to ball mill operation at the same plant.

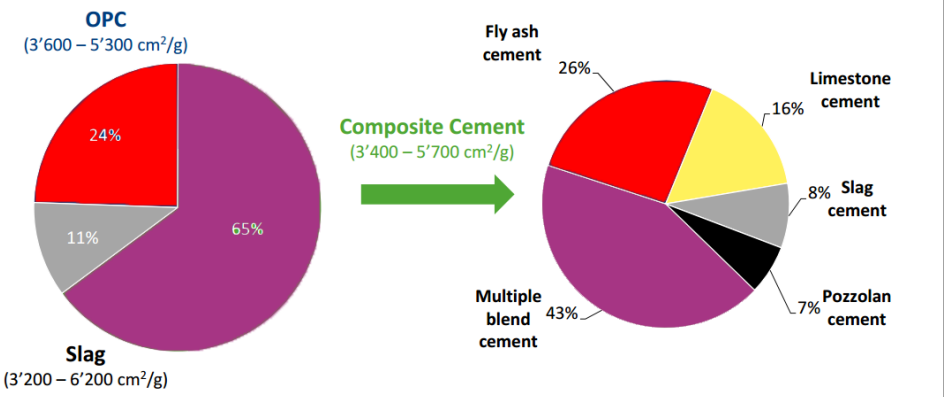
Introduction



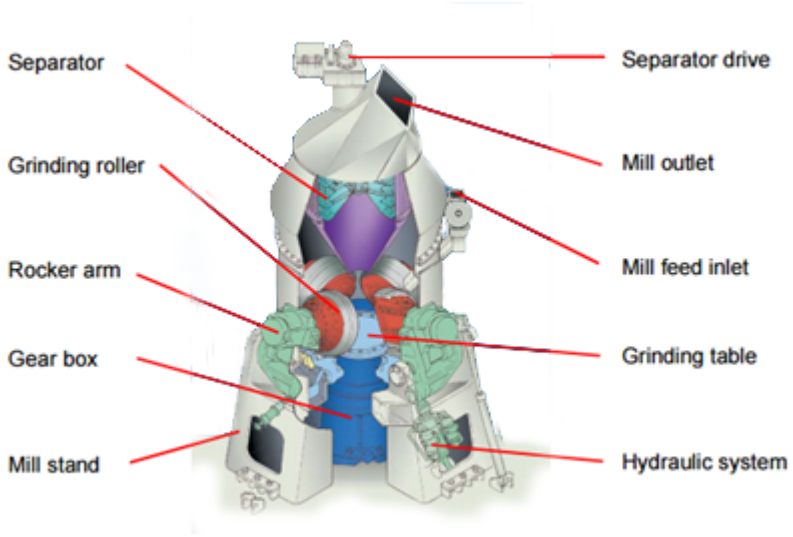
Traditionally, the closed circuit ball mill with high efficiency separator has been the most common system for cement grinding. However, as happened with raw grinding over the last 25 years, the vertical roller mill (VRM) is now successfully being used for many clinker grinding applications and is rapidly becoming the standard for new grinding installations. The first such vertical roller mill installation in the United States was part of a total plant expansion and began operation in August of 2002.

Energy consumption: VRM vs. ball mill

Cement Types and Slag produced



CEMENT VERTICAL ROLLER MILL



The differences between raw and cement grinding have been well documented in numerous publications and presentations over the recent past. Specifically, as compared to limestone, clinker and cement raw materials are finer and harder to grind. This, coupled with the finer and more stringent product particle size distribution requirements, entails design considerations to allow for continuous and stable operation of the grinding system.

Due to its design of grinding parts and integral high efficiency separator, the vertical cement mill, addresses all the difficult grinding conditions associated with the fine grinding of cement clinker and related products. The result is a high grinding efficiency and extremely stable mill operation.

Cement Mill Operating Data

Ordinary Portland Cement: 95% clinker, 5% gypsum			
		VRM	Ball Mills
Production	tph	144	31
Mill Diff. Pressure	mm WG	494	-
Mill vibration	mm/s	1.3	-
Grinding aid	%	0.018	0.018
Blaine target	cm^2/g	3900	3880
Specific energy consumption:			
Mill	kWh/t	18.3	35.2
Classifier	KWh/t	0.36	4.7
Fan	kWh/t	7.1	2.5
Total	kWh/t	25.7	42.4

The VRM for cement grinding offers a significant advantage in power savings. Typically, the VRM uses 50% less power than a ball mill when grinding the same clinker to 3900 Blaine. VRMs are also much more adept at handling hot feed compared to ball mills. The simple and compact vertical mill layout is cost competitive to build and offers many options for layout, even in existing plants. Today significant operating experience has been accumulated with vertical mills ranging from plant design and layout to operation with multiple types of product. One of the main focus points regarding cement VRM operation in the USA has been product quality and the product compatibility with existing ball mill systems.

MAINTENANCE OF WEAR PARTS

The vertical roller mill design allows the option of rotating the roller segments 180 degrees before replacing. They can also be hardfaced in place with a standard rewelding procedure. The table liners can also be replaced or hardfaced. As of this time both methods have been undertaken. After the mill was in operation for over 10,000 hours the roller and table wear rates have been measured 2 times, once through each method described above, roller segment rotation and rewelding of both the table and roller liners. The actual wear rate for both the roller and table liners before

hardfacing was 0.30 g/T. The measured wear rate with hardfaced liners was 0.12 g/T. The 50% reduction in wear rate with hardfaced liners was expected as data from other vertical cement mills indicated such a savings could be expected. In either case the wear rate has exceeded expectations and operation has not been detrimentally effected by wear.

The VRM continuously demonstrates the ability to make product equal to or better than existing ball mills with the tendency towards the better. The VRM product meets all market requirements in terms of both output and quality.

A higher level of operational flexibility and improved consistency has been maintained. Overall better efficiency allows for lower operating costs. And easy, predictable maintenance add further benefit to the bottom line. The Phoenix based cement producer is completely satisfied with the installation of a VRM for cement grinding.