

Century's VRPM upgrade

Vertical roller pre-grinding mills (VRPMs) have emerged as an alternative solution to upgrade existing ball mills in the grinding of raw materials and cements. They offer an enhanced grinding capacity as well as lower specific power consumption. At Century Cement's Tilda works in India, the VRPM was upgraded to function in semi-finish mode.

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In India AMCL Machinery Ltd (AMCL) has been manufacturing its VRPM vertical roller mill system since 1996, which it designed based on the technology developed by Nihon Cement Co, Japan. Currently, over 30 VRPMs are running successfully in India and the Middle East, but development is ongoing. Early VRPMs were installed with a vibrating screen in pre-grinding mode, followed by a ball mill system. However, these vibrating screens place heavy demands in terms of maintenance. As a result, later set-ups feature a static separator, converting them to semi-finish mode. In one project, at Century Cement's Tilda works, AMCL upgraded the VRPM circuit, increasing grinding capacity from 216 to 252tph while achieving a reduction of 4kWh/t in specific power consumption.

Before the upgrade: VRPM in pre-grinding mode

Century Cement's VRPM was commissioned in pre-grinding mode (see

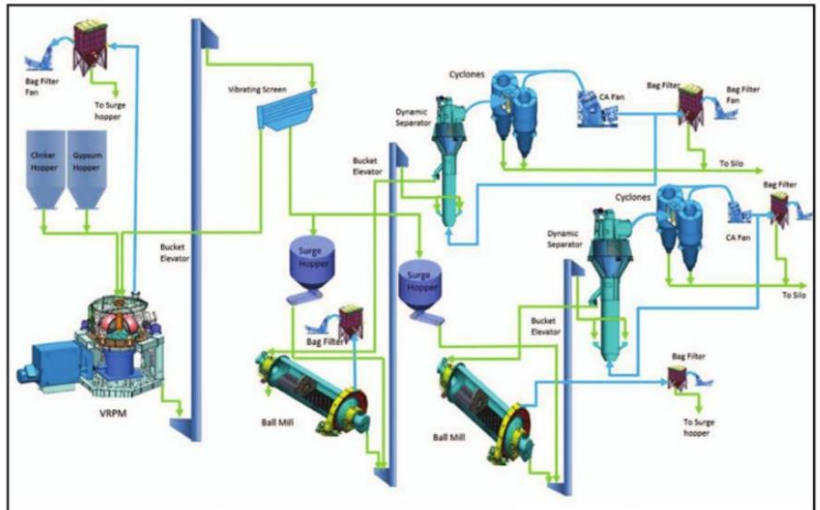


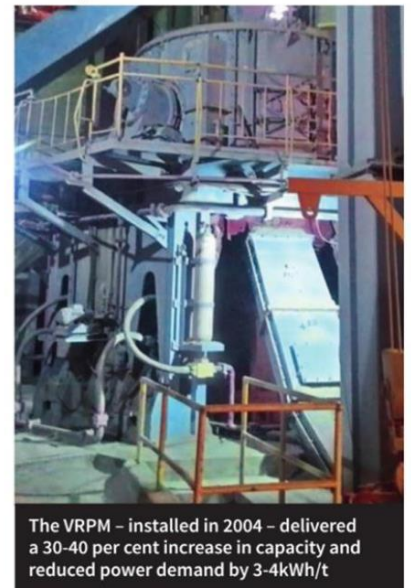
Figure 1: VRPM set-up before upgrade (pre-grinding mode)

Figure 1) in 2004. The set-up included a vibrating screen in closed-circuit with the mill. Following this initial round of grinding, clinker with a particle size of 3mm was sent to the ball mill.

The installation of the VRPM in pre-grinding mode at the Tilda works resulted in an increase in capacity of 30-40 per cent and a reduction of power consumption of 3-4kWh/t.



In pre-grinding mode, the VRPM was set up in closed-circuit with a vibrating screen



The VRPM - installed in 2004 - delivered a 30-40 per cent increase in capacity and reduced power demand by 3-4kWh/t

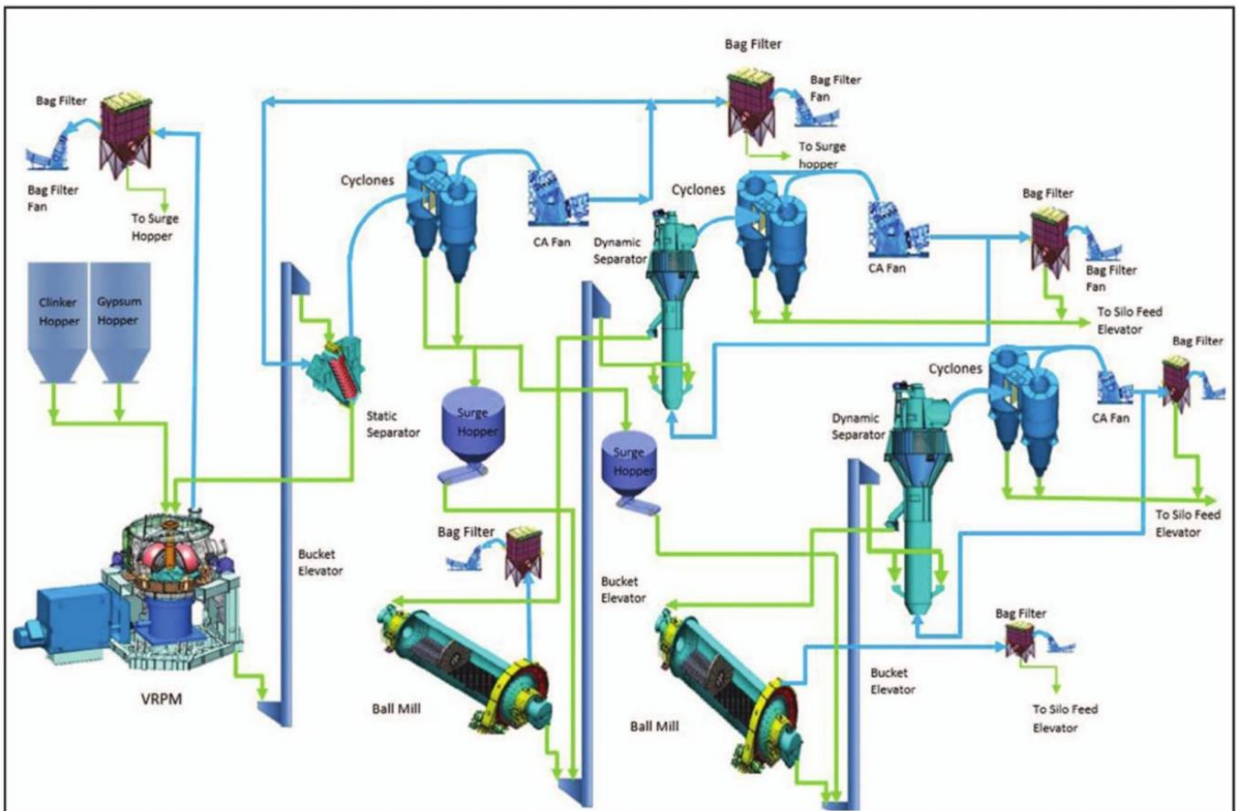


Figure 2: VRPM set-up after upgrade (finish-grinding mode)

Table 1: semi-finish grinding equipment

Equipment	Specification
Existing equipment	
VRPM	Model: AVM 230-3 Table ϕ (mm): 2300mm Roller x width (mm): 1400x500 No of rollers: 3 Motor: 1200kW/980rpm
Ball mill (2)	Mill ϕ x length (m): 3.6x14m
Sepax separator (2)	Make: L&T/FLS Model: 375-M-222 Motor (kW): 110
Circulating air fan (2)	Volume (m^3/h): 156,000 Static pressure (mmWG): 450 Motor (kW): 325
Added equipment	
Static separator	Air volume (m^3/h): 165,000
Circulating air fan	Volume (m^3/h): 200,000 Static pressure (mmWG): 400 Motor: 325kW/1000rpm
Separator bag filter fan	Volume (m^3/h): 35,000 Static pressure (mmWG): 330 Motor (kW): 40

However, the high maintenance requirements of the vibrating screen led to a reduced plant availability.

VRPM upgrade

To improve the performance of the existing grinding capacity and increase the output of the Tilda works, Century Cement contacted AMCL to carry out a feasibility study for converting the VRPM system from a pre-grinding to a semi-finish grinding system. As a result, AMCL designed the semi-finish grinding system shown in Figure 2.



The circulating air fan for the VRPM circuit

Table 2: particle size analysis results for fresh clinker to VRPM

Sieve (mm)	Cumulative retained weight (%)
50	3
25	16
20	24
12.5	48
6.3	75
3	93

Table 3: particle size analysis results for product from static separator to ball mill outlet

Sieve (mm)	Cumulative retained weight (%)
2	2
1	9
0.3	20
0.2	38
0.09	59
0.045	71

Much of the equipment was retained (see Table 1). The SL 3048 vibro feeder and Mogensen sizer combination with a 300tph capacity was replaced by a 165tph static separator with an air volume of 165,000m³/h. A circulating air fan and separator bag filter fan were also added.

Century Cement and AMCL worked together to develop a layout that enabled the new equipment to fit into the existing building.



A static separator with an air volume of 165,000m³/h was installed

Particle size analysis

A particle size analysis was carried out for the fresh clinker to the VRPM as well as for the product from the static separator to the ball mill outlet. The results are shown in Table 2 (fresh clinker) and Table 3 (static separator product).

Project management

Plant downtime to implement the upgrade was limited to 15 days. During this time, civil and structural modifications as well as the installation of the cyclone lower parts, bag filter, bag filter fan, belt conveyor and en-masse conveyor was carried

Table 4: cement mill performance before and after upgrade

Parameter	Before upgrade			After upgrade		
	CM4	CM5*	Total	CM4	CM5*	Total
Product	PPC	PPC	PPC	PPC	PPC	PPC
Output (tph)	108	108	216	129.5	123	252
Specific power consumption (kWh/t)	29.5	29.5	29.5	25.06	25.5	25.3
Fineness (Blaine)	3500	3500	3500	3600	3600	3600

* CM-5 is with old grinding pattern of grinding media. Further improvement is expected following the implementation of a new grinding media pattern.

out. Ducts, chutes and chimneys were also connected and electricians and controls were taken care of.

The last four days were spent with no-load trials and commissioning of the system.

Upgrade success

The upgrade of the grinding mill circuit from a pre-grinding to a semi-finish grinding mode has delivered the results required by Century Cement Ltd. The cement producer saw a 20 per cent increase in ball mill capacity and saved an additional 4kWh/t in specific power

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consumption (see Table 4). Moreover, the elimination of the vibrating screen in the new set-up has also reduced the need for maintenance. This lower downtime has increased plant availability.

The project also showed that with good coordination between the user and supplier it is possible to make best use of existing equipment. ■