WCA – Virtual Member Forum
10th March 2021

FCB Horomill® grinding plants in The Philippines

Fives FCB

PROCESS TECHNOLOGIES

Cement | Minerals

SUMMARY

—

Fives in Cement & Minerals (O. VANLERENBERGHE)

FCB Horomill® grinding technology

Success story of FCB Horomill® grinding plants in The Philippines

Customer Testimony

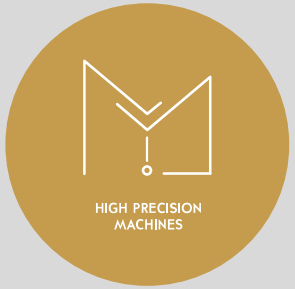
Effective remote support to FCB Horomill® operators

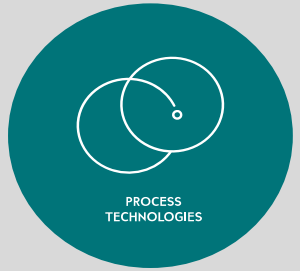
Fives, an international industrial engineering Group

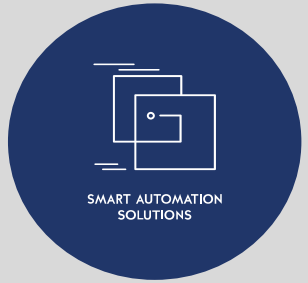
fives

fives
Industry can do it

Everyday, Fives contributes to demonstrating that **industry can do it.**







Fives designs and supplies **machines, process equipment** and **production lines** for the **world's largest industrial players, in 3 activities :**

- **High précision machines**
- **Process technologies**
- **Smart automation solutions**

Fives supports its customers **throughout the entire lifecycle of their equipment**, from design to revamping. This includes supply, installation, commissioning and maintenance.

A great industrial history, since 1812

An agile company, able to reinvent itself through **industrial revolutions**…

More than **200** years of history

Fives, an international organization

Teams located worldwide with expertise in international project management

MORE THAN
8,400
employees

MORE THAN
100 sites
IN **30 countries**

2019 key figures

A robust and resilient group

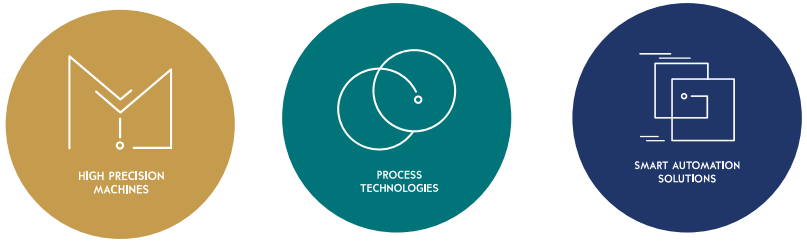
€ 1,999 million
of sales

€ 1 841 million
of order intake

ORDER INTAKE
BY GEOGRAPHICAL AREA

Americas	Europe	Africa Middle-East	Asia Oceania
26%	45%	8%	21%

ORDER INTAKE
BY ACTIVITY



HIGH PRECISION MACHINES	PROCESS TECHNOLOGIES	SMART AUTOMATION SOLUTIONS	OTHERS
19%	41%	32%	8%

As of Dec. 31, 2019

A pioneer group, innovating towards the factory of the future

Bringing added value to support industrial performance

Environmental compliance

Flexibility

Machine uptime

End-product quality

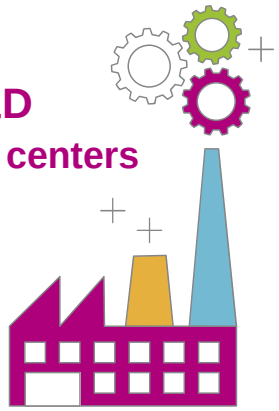
Process optimization

Lifecycle COST management

Productivity

Operational safety

The Group focuses its Research & Development programs on the development of proprietary and distinctive technologies and services performing over the whole product's life cycle.



30 R&D and **test centers**

€33.6M R&D INVESTMENT

1,952 patents IN FORCE in **609** PATENT FAMILY

2019 key figures

Fives Cement and Minerals business line

Within Fives' Process Technologies main activity, the Cement & Minerals business line is dedicated to design, supply and installation of **core process equipment, comprehensive systems** and **complete plants** with the **highest performances**.

Associate Corporate Member

CEMENT & MINERALS

PROCESS TECHNOLOGIES

For two end-markets :

- **Cement industry**
- **Minerals grinding industry**

Sales offices in China, India, Brazil, Russia, USA, Canada & Mexico

85 years

in Cement industry

A renowned experience since **1933**

A complete range of innovative & sustainable technologies

To **maximize product quality** and **plant output**

To **reduce environmental foot print**

To provide the **best Total Cost of Ownership**

For **smooth** and **reliable operations**

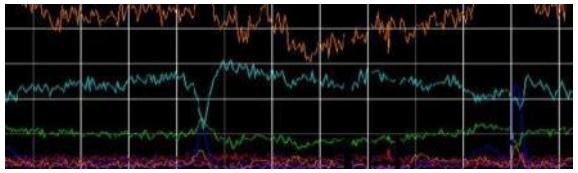
Crushing systems
(FCB Rhodax® 4D, FCB VIF™ crusher)

Combustion systems
(Pillard NovaFlam®, Pillard PrecaFlam®…)

Grinding systems
(FCB Horomill®, FCB B-mill, FCB TSV™ Classifier…)

Pyroprocessing systems
(Burning line, FCB Zero-NOx Preca, FCB Preca-Max®…)

Gas Treatment systems
(TGT® Filter, Sonair™ Filter…)



Control & optimization systems
(COSMA™, FCB Opti-Kiln™…)

SUMMARY

Fives in Cement & Minerals

FCB Horomill® grinding technology (E. EDET)

Success story of FCB Horomill® grinding plants in The Philippines

Customer Testimony

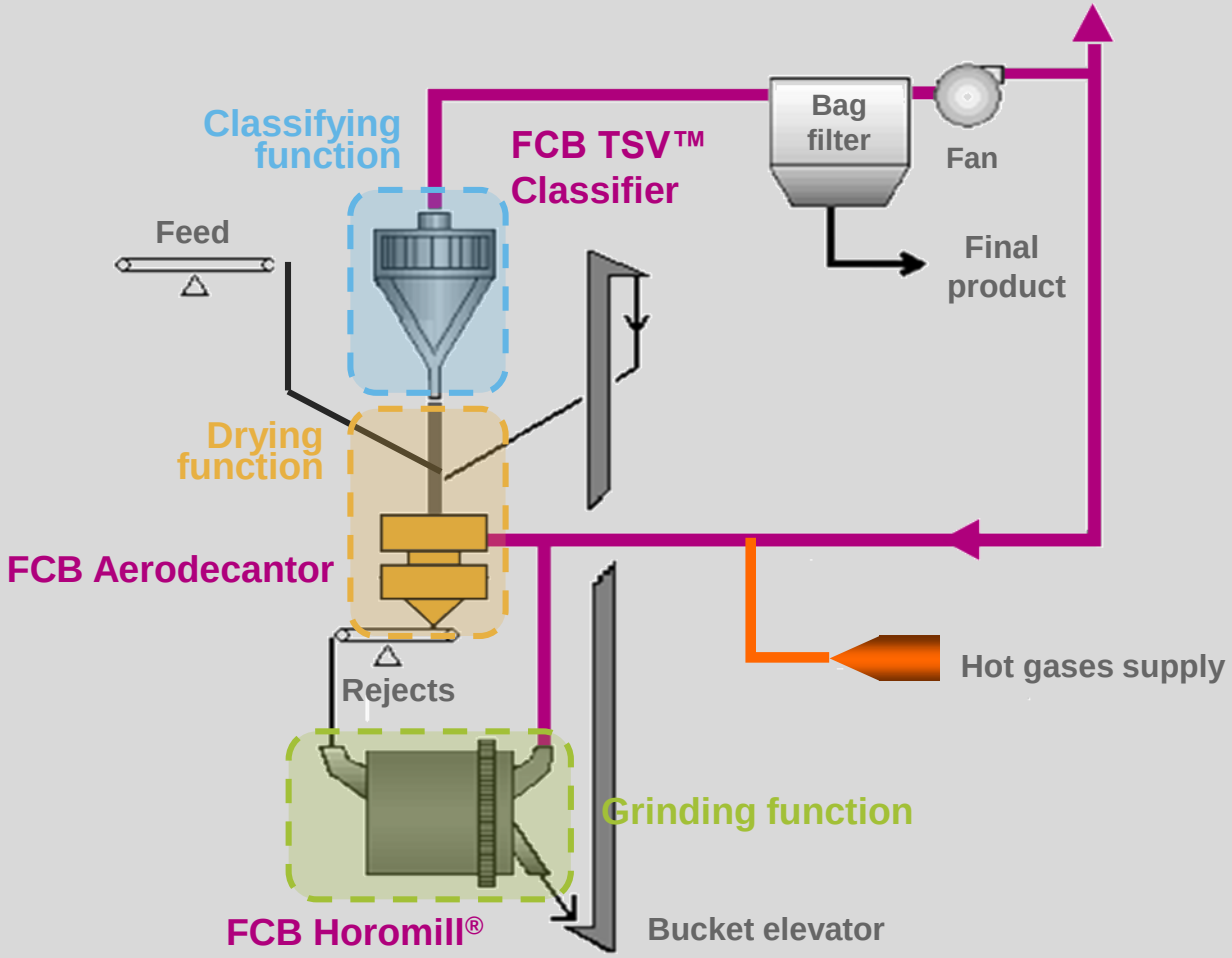
Effective remote support to FCB Horomill® operators

FCB Horomill® grinding plant

All **grinding, drying** and **classifying functions** within a **very compact workshop**

Link to video

FCB Horomill® workshop: full FCB Aerodecantor flow-sheet

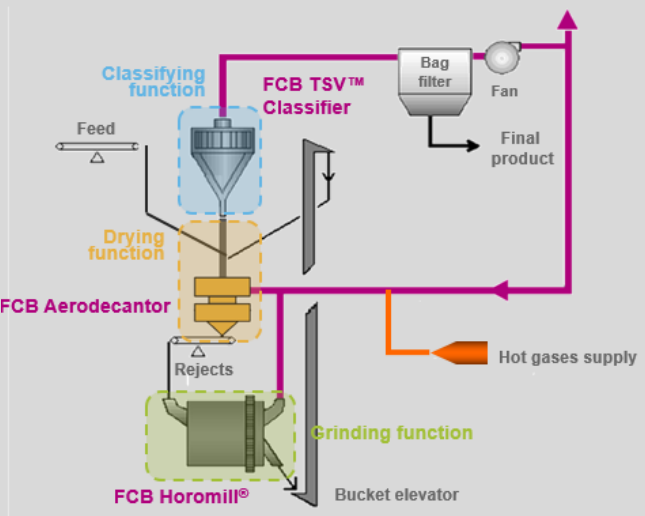


Feed and mill outlet to **FCB Aerodecantor**

→ Perfect layout for separate grinding centers or modular plants

→ Adapted for **high moisture content** feed product, clinker with **high content of fines** or from various sources

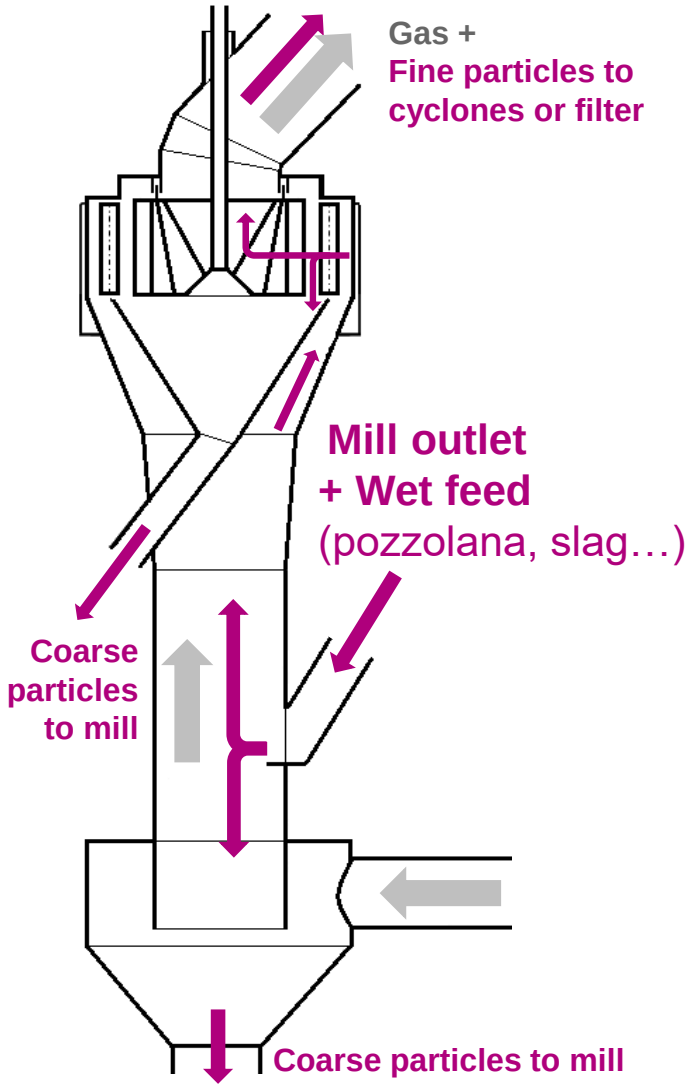
Drying in FCB Horomill® + Aerodecantor + FCB TSV™ Classifier



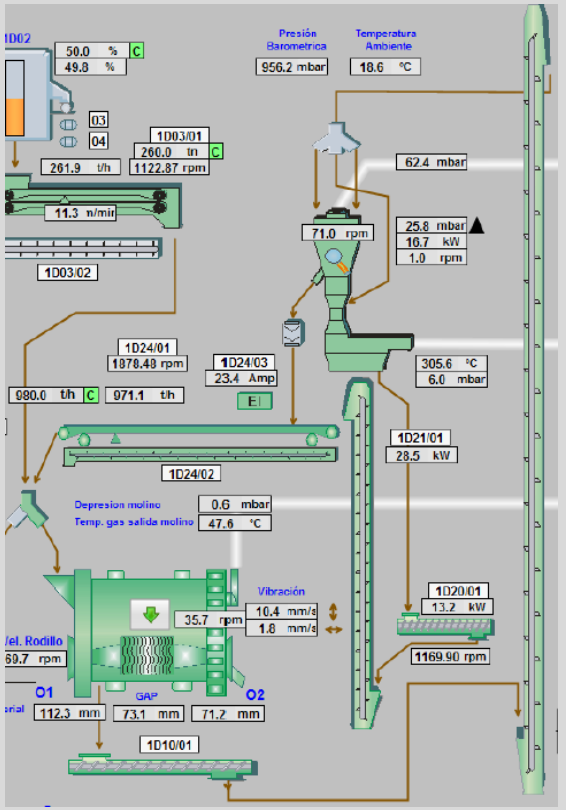
Advantages

→ **Increase of drying capacity**

→ Reduction of material load of the classifier and **improvement of selection performances** and consecutive **grinding efficiency**



Raw mill plant
(Apazapan – Mexico)



FCB Horomill® 3800+ADC+TSV™ 5500
Feed with up to **6,5% moisture**

Cement plant
(Teresa – Philippines)

pozzolana feed up to 80 mm coarse size

FCB Horomill® 3800+ADC+TSV™4500
Feed with up to **29% pozzolana with 25% moisture**

FCB Horomill® cement quality achieved - Industrial results

Grade 52,5 cements

High C/K ratios

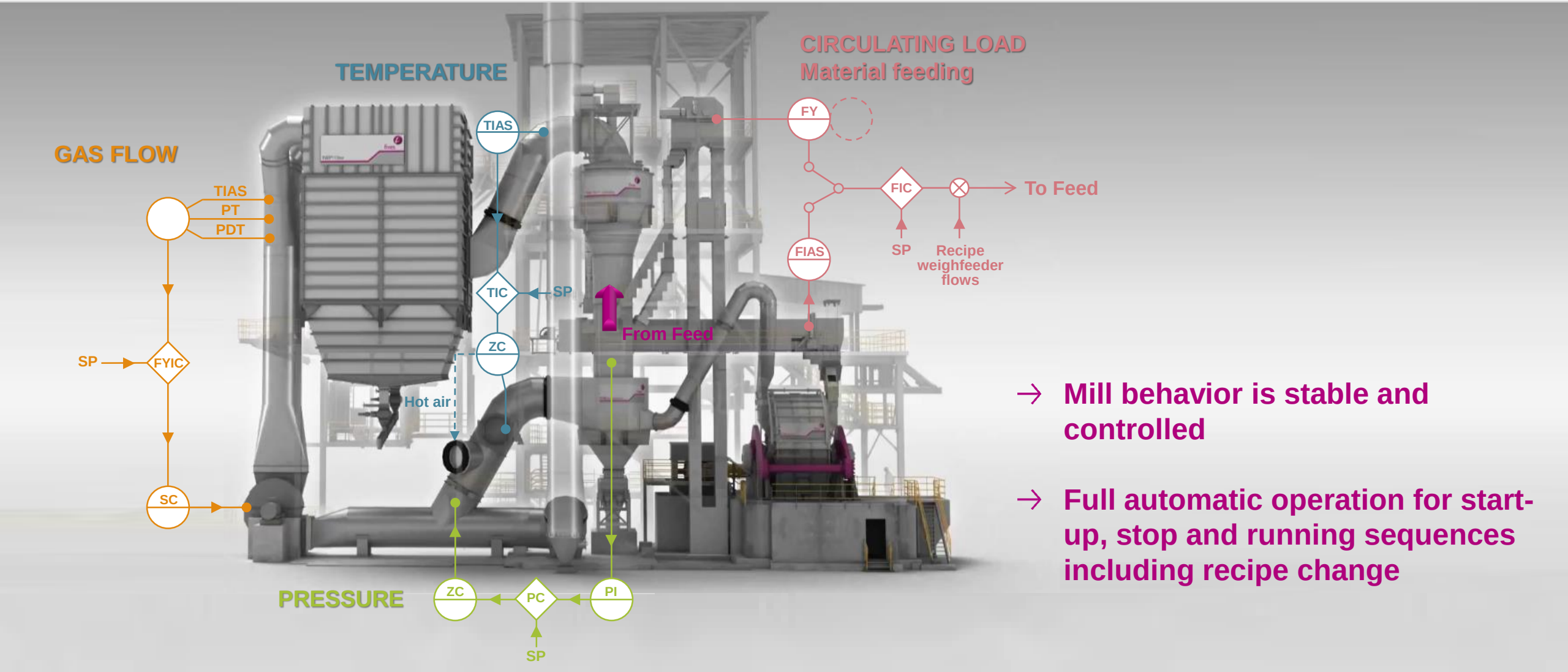
		Plant 1	Plant 2	Plant 3	Plant 4		Plant 1	Plant 5		Plant 6
		HRM	HRM	HRM	HRM	BM	HRM	HRM	HRM	HRM
Cement	EN type	I 42,5	I 52,5	I 52,5	II / B-P	II / B-P	IV / B-P	IV / B-P	IV / B-P	III / B
	Clinker %	92%	91%	91%	69%	69%	**56%**	**54%**	**51%**	**23%**
	main add	-	-	-	Pozz	Pozz	Pozz	Pozz	Pozz	BFSlag
Quality	cm^2/g	3560	3780 (*)	4480 (*)	**4420**	**4730**	4380	4630	5220	4400 (*)
	1D	17,2	23,1		19,6	19,0	6,0	7,3	9,0	
	7D	37,4	44,1		37,7	34,2	24,4	24,0	25,0	31,7
	28D	45,8	**56,4**	**60,2**	43,4	43,9	36,5	36,4	35,8	48,2

(*) from LASER analyser

Better resistance @ lower Blaine

(results expressed according to EN standards)

FCB Horomill® main regulation loops in full automatic operation



→ **Mill behavior is stable and controlled**

→ **Full automatic operation for start-up, stop and running sequences including recipe change**

FCB Horomill® - High availability and reliability

More than 7600 hours/year

average hours of operations on cement mills
and **> 6200 hours/year** on raw mills

Around 95%

average of **availability** of raw
and cement grinding plants installed

		Operation time (hours)	Availability (%)
Year 1	Raw mill 1	6576	**95,2**
	Raw mill 2	6352	**94,4**
	Cement mill 1	7828	**95,1**
	Cement mill 3	7831	**95,4**
	Ball mill + Roller press	*7038*	*93,3*
Year 2 (10 months)	Raw mill 1	5429	**94,7**
	Raw mill 2	5809	**96,2**
	Cement mill 1	6042	**92,9**
	Cement mill 3	6444	**94,1**
	Ball mill + Roller press	*5551*	*89,7*

Tepetzingo plant - Cementos Moctezuma (Mexico)

Long lifetime of wearing parts for reduced maintenance needs

Single shoe
Titanium carbide roller sleeve with zigzag welding
Chromium cast iron shell liners
Tungsten carbide reversible scrapers

> 50,000 hours

Shell liners

20,000 to 40,000 hours

Roller sleeve

(figures observed for cement applications)

FCB Horomill®: the best available and proven technology

Maximized production & quality

- Higher cement quality with less Blaine
- High drying capacity
- No water injection
- Capacity un-sensitive to wear

Smooth & reliable operation

- High production flexibility
- Fully automated operation
- Smooth operation
- Low wear rate and high availability

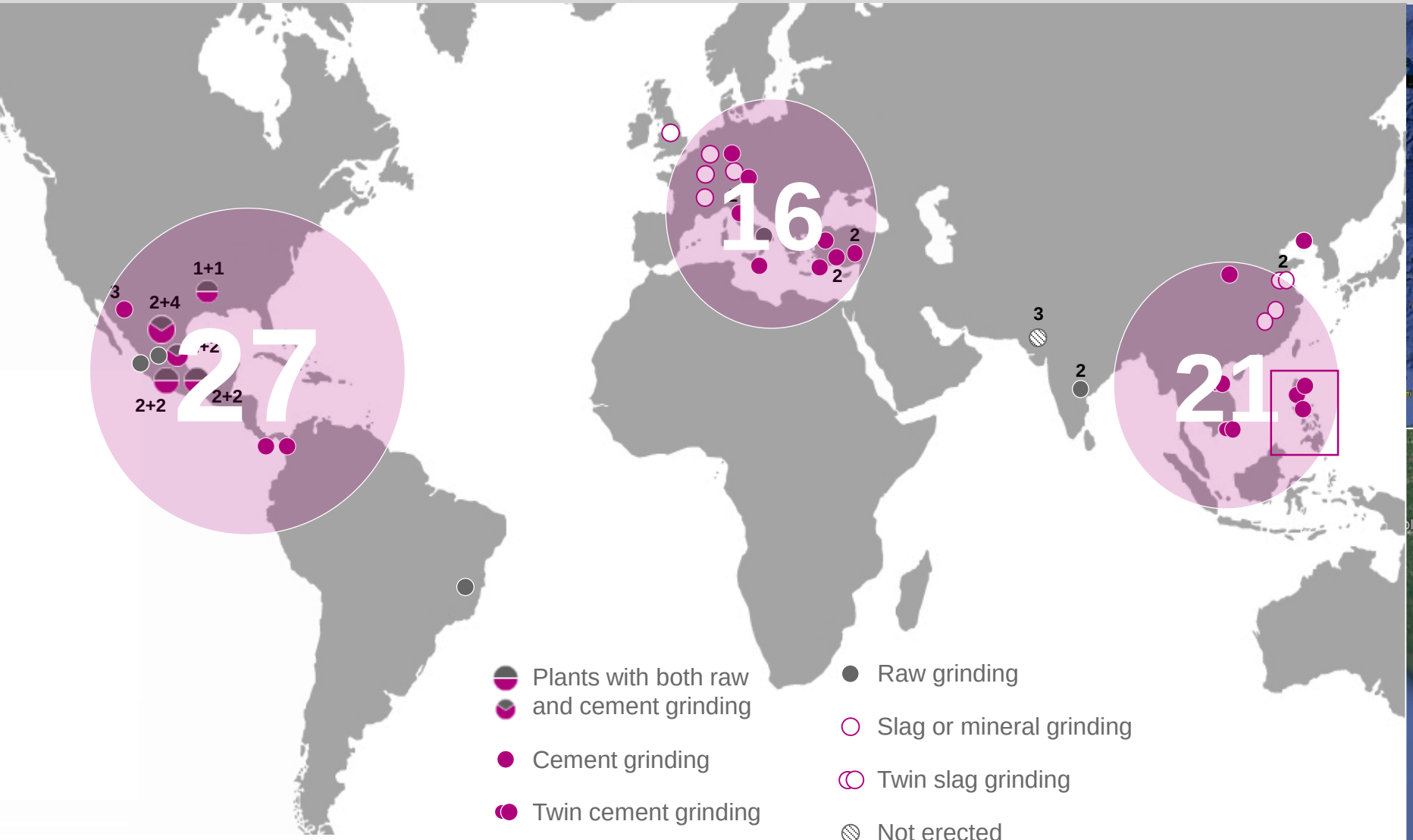
Minimized operating costs

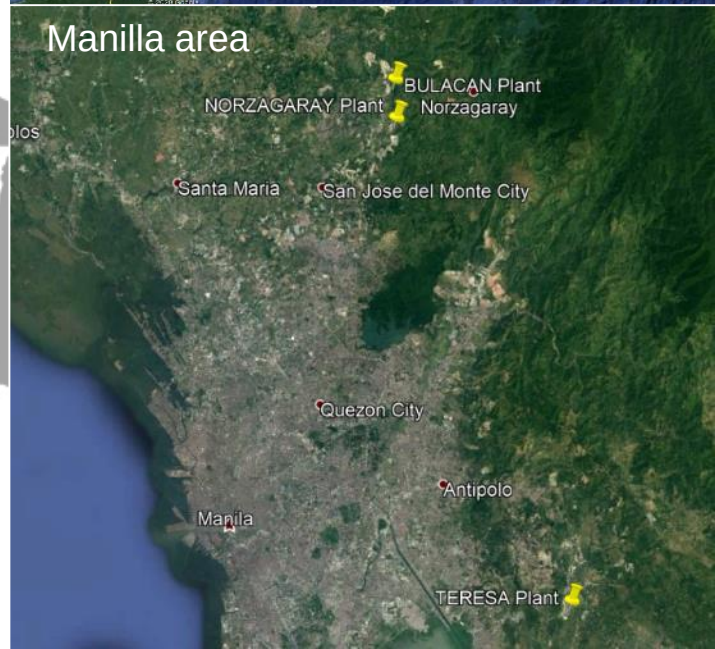
- Lowest electrical consumption
- Best overall thermal efficiency
- No need of grinding aid
- Low wear rate and maintenance cost

Low environmental footprint

- High energy efficiency
- Zero water consumption
- Higher c/k ratio reducing CO_2 levels
- Low noise emission

FCB Horomill® worldwide grinding plants





VIDEO

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FCB Horomill® Grinding plants in The Philippines and Norzagaray plant virtual visit

SUMMARY

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Fives in Cement & Minerals

FCB Horomill® grinding technology

Success story of FCB Horomill® in The Philippines (D. BOURBON)

Customer Testimony

Effective remote support to FCB Horomill® operators

Main project strategic decisions

Context in The Philippines

- **Strong market growth**;
- **Lack of drying capabilities** on existing grinding systems (2 small ball mills and 1 RP/ball mill combi grinding unit without pre separator) making them **unsuitable for new cement types production with higher additive content**, limitation being humidity in mills 1st chamber and/or circulation elevators.

MAIN EXPECTATION = increase **c/k ratio from existing 1.38** (original target 2013) **to expected 1.8**

- To do that, key issue was to enable **1P grade cement production** (55% clinker only, 5% gypsum, 5%limestone, 6% flay ash, and 29% pouzzolan) by adding a new grinding plant, the available pozzolan having good reactivity, but a high **moisture up to 25%.**
- The increased cement production has to be achieved by c/k ratio only, the burning lines remain unchanged.

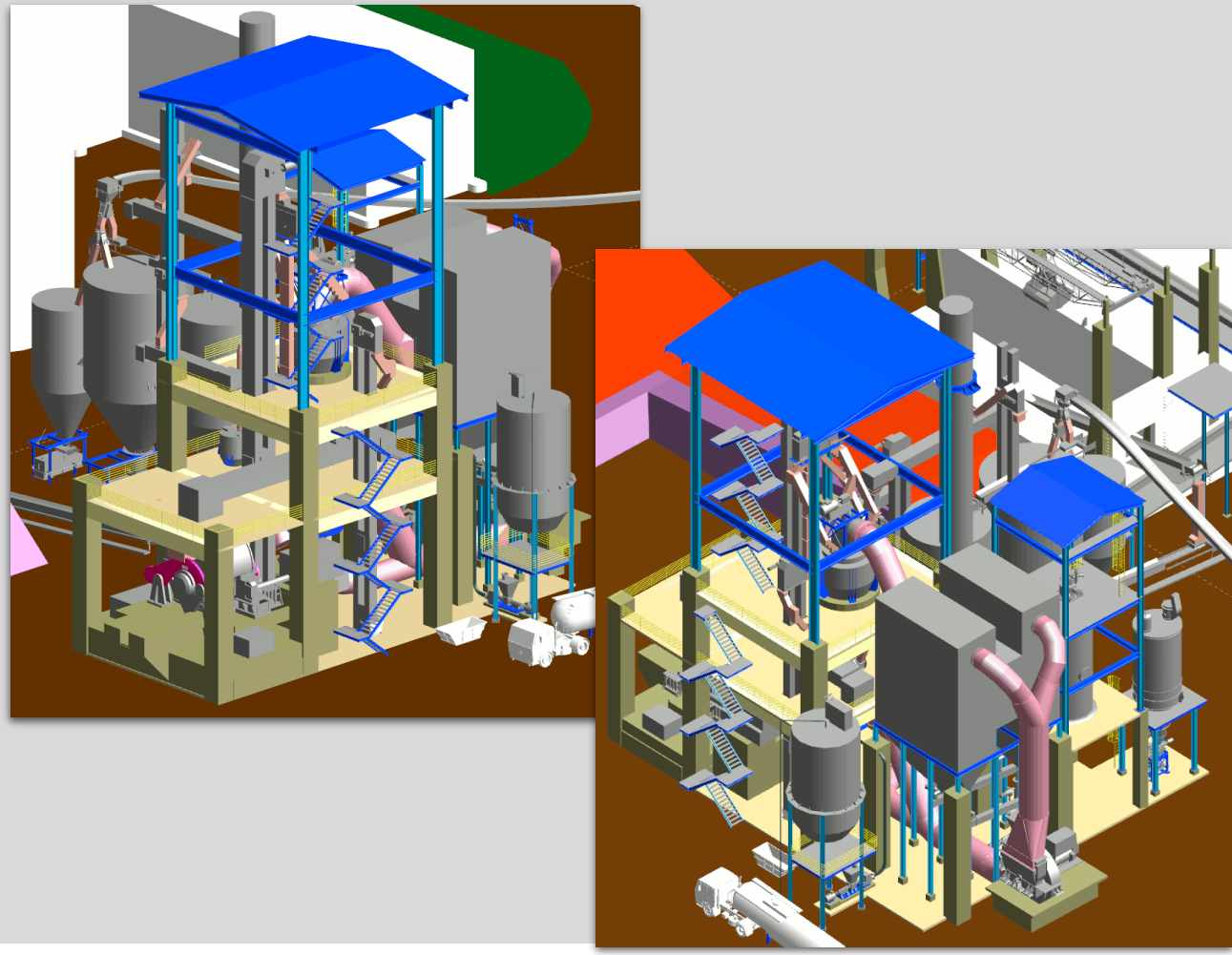
Main project strategic decisions

Solution selected

Co-grinding of the 1P cement,
with additional possibility to produce the other types produced in Teresa plant (OPC cement and masonry cement) by a new **FCB Horomill® size 3800** based plant.

Nota: very good market response to the cement quality from another Republic plant in Bulacan (with existing FCB Horomill® technology)

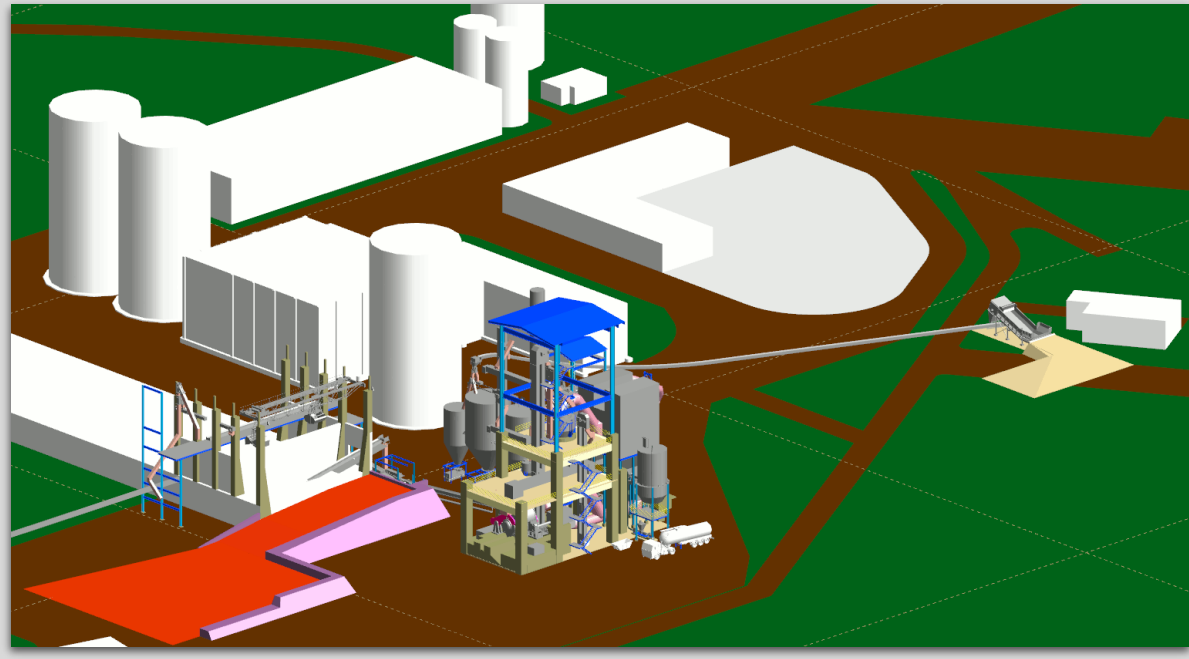
2nd unit ordered for Norzagaray plant.



Integration in the existing plant

Layout

- Interference with existing equipment has been limited to the minimum to avoid production disturbance during construction & erection.
  Only plant trucks circulation scheme has been slightly affected.
- Clinker was fed directly from the plant existing clinker storage transport system;
  Other components were delivered by dump trucks or tankers (for fly ash).
- Fine dried pouzzolan separate transport in the plant has been avoided, limiting dust emission.
- Product dispatch has been linked to the existing silos and packing systems for maximal production flexibility.



Key benefits obtained

- **Best energy savings** available compared to any other system: **15 to 35% savings**
- **Excellent and proven product quality**: 1st grade 1P cement reliably produced on the existing FCB Horomill®.
- Cement 1P is produced with **55% clinker content only**. Efficiency of the **external drying with FCB Aerodecantor** dryer, allowing use of hot clinker to **reduce thermal consumption** of the plant, while **maintaining finish product** temperature at ca. 85°C, in case of OPC production temperature control is achieved **without water injection**.
- Ease of operation with **fully automated control system**
- Ease of maintenance with **no critical maintenance operations**, mill availability allows for **high operating hours** (**more than 7500 h/y** average achieved in Mexico), **97% availability** achieved of existing size 3600 FCB Horomill® (2nd half of 2013 results).

In a tense market with strong demand, FCB Horomill® was selected as giving **maximal flexibility** and **competitive edge on power consumption and product quality**, as well as being **ready for additional blended cement** recipes. A repat order was placed for Norzagaray plant.

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Customer Testimony (N. BALLARAN)

Effective remote support to FCB Horomill® operators

Customer Testimony

Noel Ballaran

Norzagaray Plant Manager

Republic Cement

Noel Ballaran joined Republic Cement in 1997 as a Junior Engineer at its Batangas Plant. Through the years, he climbed through the ranks and in 2008 was appointed Maintenance Manager. In 2013, he joined the Norzagaray Plant as Maintenance Manager. In July 2020, he was appointed the Plant Manager of the Norzagagray Plant. In this role, Noel, manages the efficient use of resources, while leading the team to ensure that production targets, quality specifications, environmental regulations, and employee safety standards are met.

SUMMARY

Fives in Cement & Minerals

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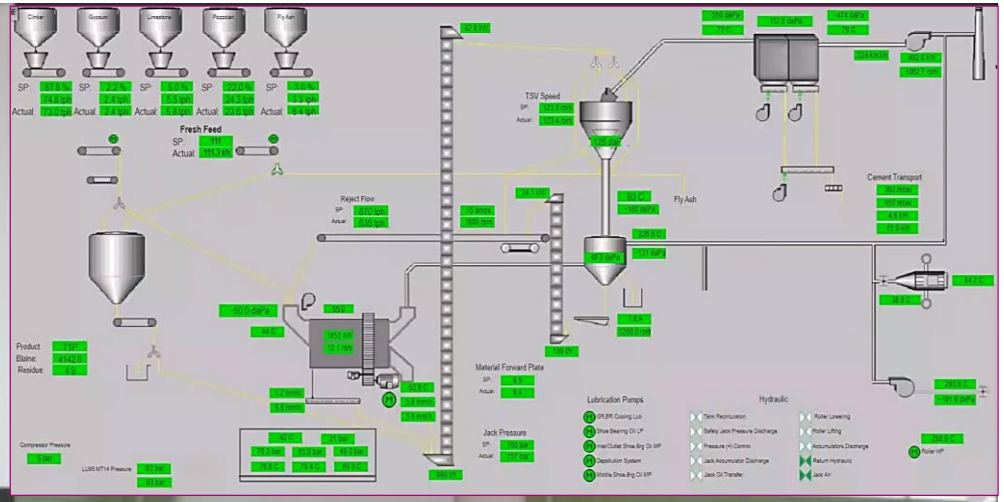
Fives FCB / Visual Remote Services



Covid19 lockdown and travel restrictions have demonstrated how remote services are powerfull: continuity, reactivity, low trends detection, anticipation,…

The key factor of success:
- **Direct or indirect access** to the control room (several secured tools available as « TeamViewer »)
- **Dedicated points of contact**
- Clear reports and **action follow-up**
- **Visual tools** for data analysis and predictive maintenance.

FIVES REMOTE SERVICES

TeamViewer

- ***Allows a secured connection to control the desktops in control rooms***
- ***Commonly accepted by IT policies***
- ***The remote access is opened during specific timeslots***

Analysis, Follow-up and Training = Continuous improvement

STEP 1 / REMOTE ANALYSIS & CLEAR REPORT WITH RECOMMENDATIONS

Dear NOR Team,
Hoping you are well safe from this pandemic era.
I would like to thank all of you for yesterday's successful start-up of TDM remote support session via "MS-Teams". This support will help us to track and optimize your mill performance during the current Covid19 situation and obviously after by giving fast and reliable solutions in case you need us for any troubleshooting.

As informed, me and my team, will be available in 24/7 if possible, to support you on this new service approach, adapting ourselves to the future.

Here in my mail I would like to update some operational/ mechanical observation points from my first remote Session1 (week 27) for your kind reference,

Product	Production *tph*	Grinding Pr *bar*	Do *mm*	Reject *tph*	Vibrations *mm/sec*	FMPS *	Mill *kW*	Shoe bearing *temp °C*	TSV Speed *rpm*	Blaine *cm2/gr*
T1P (MH)	98-105	160	+10 to +25	700-725	Hori 1-1.5 / Vert 8-10	6-6.5	1700-1750	75/82/72	127	3600±200

Clinker %	Gypsum %	Black Shale %	Limestone %	Flyash %
63.2	1.8	23	4	8

Process/ Production points:

- A new product of cement was introduced by RCBM in the beginning of May 2020 called "T1P(MH) medium heat. It ensures the minimal clinker recipe of 62-63% and with blaine target of 3600±200 cm2/gram.
- Escambro was replaced with 100% Black Shale to reduce the production cost of cement. And apparently, this change over is influencing in higher mill dynamics (Vertical Vib 8-10 mm/sec) due to higher feeding size of black shale. The mill vibration levels increased approximately 40% as compare to January 2020 operation.
- Main motor vibration levels were also quite high 4-5 mm/sec in both DE & NDE sides, the suspension springs underneath the motor block need to ensure from blockage.

Mechanical Points:

- The reject flow was limited at 700-725 tph and the bucket elevator BE47 kW limits the flow due to high absorbed power of 105-120 kW. Which is approximately 15-20% higher as compare to last January operation.
- Mill casing inspection need to perform to analyse the present shoe conditions.

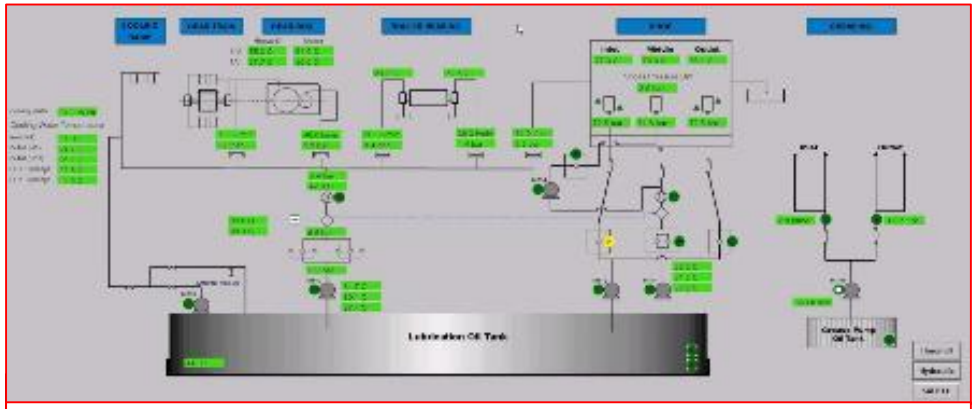
Automation Points:

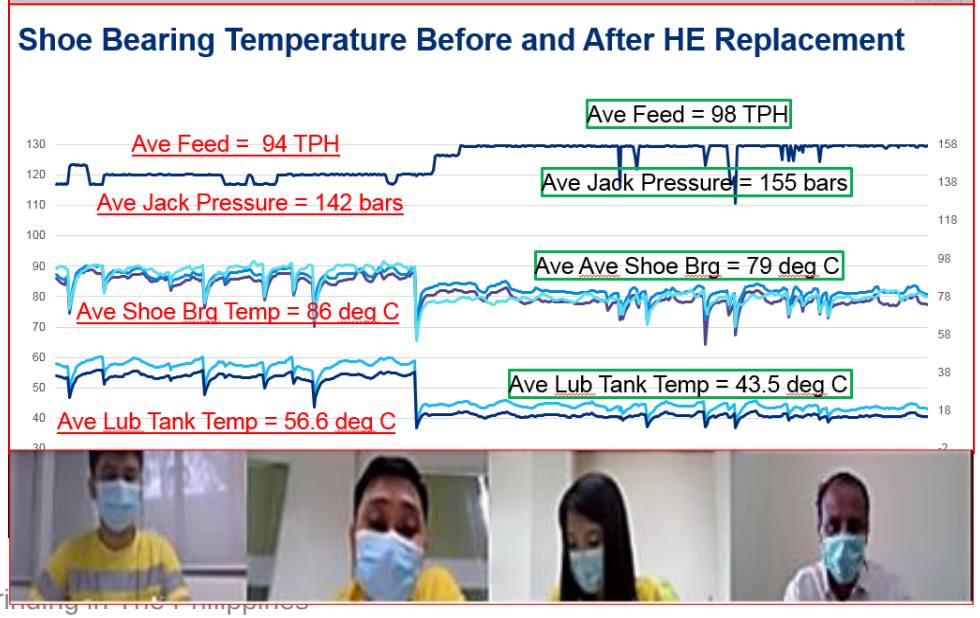
- Time to time high process filter DP degrades mill performance, purging sequence need to ensure for any deviation in sequence.

Conclusion,

- ✓ The performance of mill is running in optimised condition; however, the above highlighted points need to fix to avoid any further major issues.
- ✓ Process team can include the below parameters in TDM to have a complete access of operational parameters (the required parameters listed in this tailing mail).

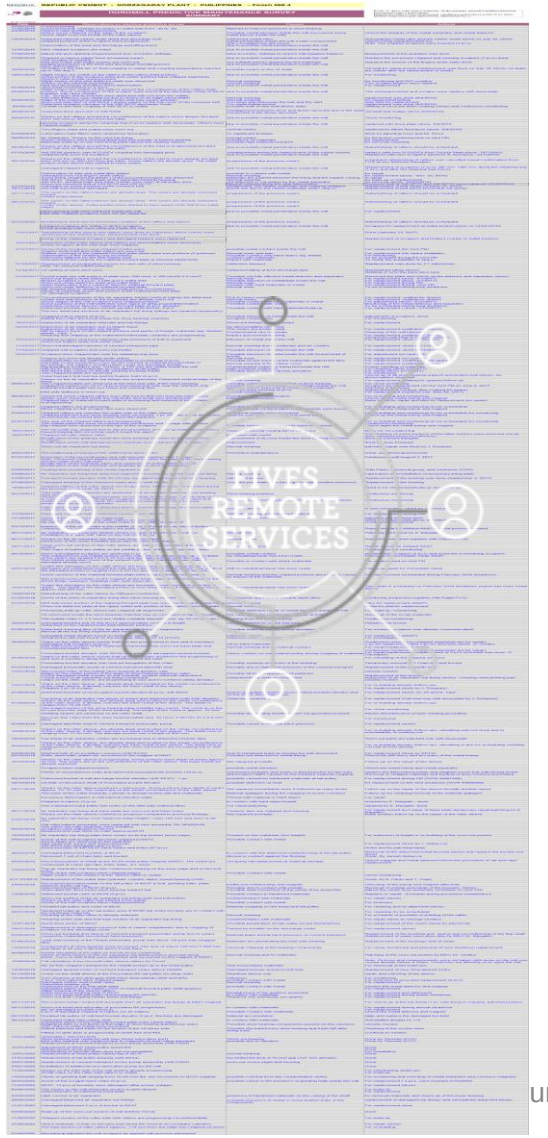
STEP 2 / ON LINE TECHNICAL REVIEW & ON-JOB TRAINING

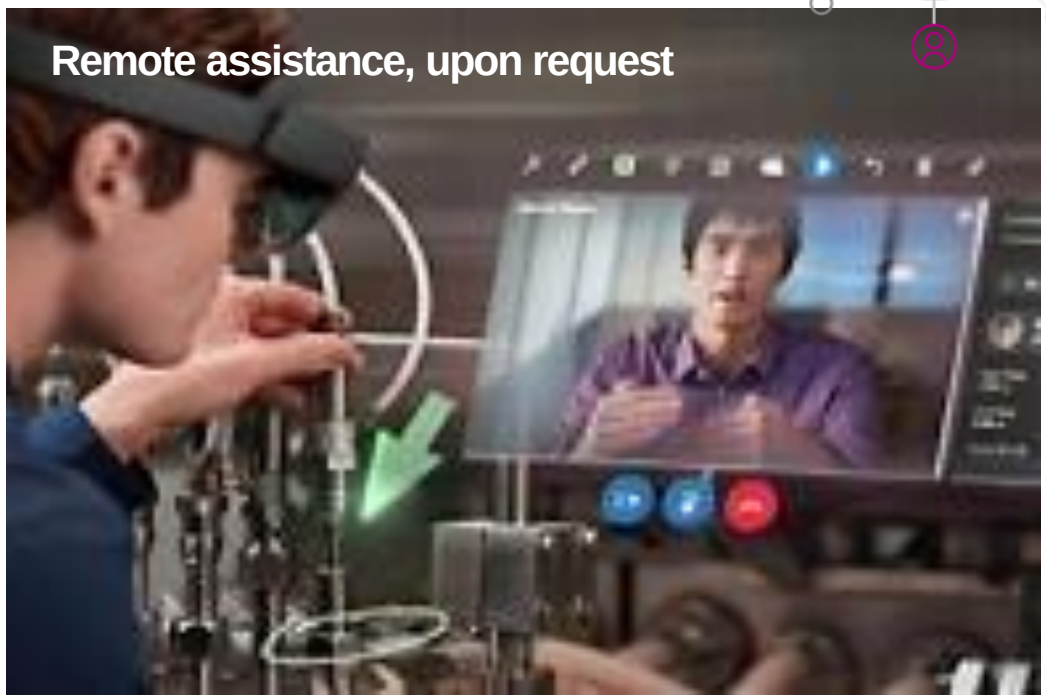




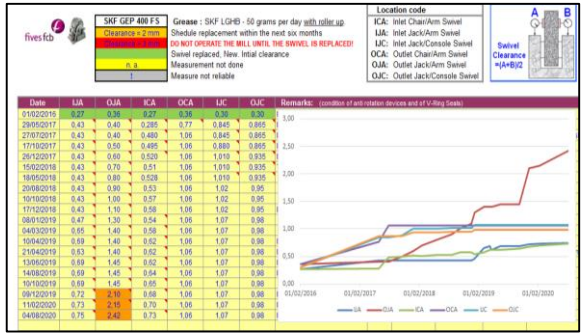
Visual survey file = easy information sharing for remote support and predictive maintenance

MAINTENANCE HISTORY

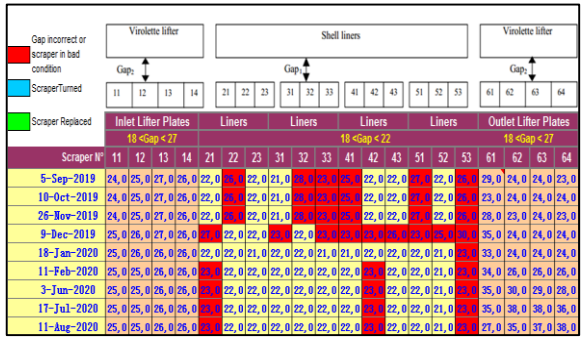




MECHANICAL CLEARANCES



WEAR PARTS DIMENSIONAL CONTROL



Scraper N°	11	12	13	14	21	22	23	31	32	33	41	42	43	51	52	53	61	62	63	64
	Inlet Lifter Plates				Liners			Liners			Liners			Liners			Outlet Lifter Plates			
	18 <Gap < 27				18 <Gap < 22												18 <Gap < 27			
5-Sep-2019	24,0	25,0	27,0	26,0	22,0	26,0	22,0	21,0	26,0	23,0	25,0	22,0	22,0	27,0	22,0	26,0	29,0	24,0	24,0	23,0
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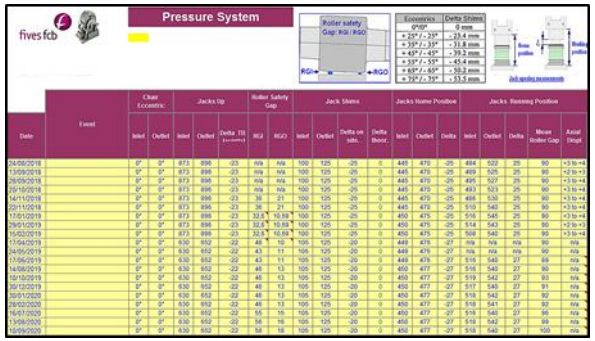
26-Nov-2019	24,0	25,0	27,0	26,0	22,0	26,0	22,0	21,0	26,0	23,0	25,0	22,0	22,0	27,0	22,0	26,0	28,0	23,0	24,0	23,0
9-Dec-2019	25,0	26,0	27,0	26,0	27,0	22,0	22,0	23,0	22,0	23,0	23,0	26,0	23,0	25,0	26,0	35,0	24,0	24,0	24,0	
18-Jan-2020	25,0	26,0	26,0	26,0	22,0	22,0	21,0	22,0	22,0	21,0	21,0	22,0	22,0	22,0	21,0	23,0	33,0	24,0	24,0	24,0
11-Feb-2020	25,0	25,0	26,0	26,0	23,0	22,0	22,0	22,0	22,0	22,0	22,0	23,0	22,0	22,0	21,0	23,0	34,0	26,0	26,0	26,0
3-Jun-2020	25,0	25,0	26,0	26,0	23,0	22,0	22,0	22,0	22,0	22,0	22,0	23,0	22,0	22,0	21,0	23,0	35,0	30,0	29,0	28,0
17-Jul-2020	25,0	25,0	26,0	26,0	23,0	22,0	22,0	22,0	22,0	22,0	22,0	23,0	22,0	22,0	21,0	23,0	35,0	38,0	38,0	36,0
11-Aug-2020	25,0	25,0	26,0	26,0	23,0	22,0	22,0	22,0	22,0	22,0	22,0	23,0	22,0	22,0	21,0	23,0	27,0	35,0	37,0	38,0

PRESSURE SYSTEM ADJUSTMENT …



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Anticipation

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