The New Nostra Plant

NOSTRA CEMENT LTD, A STRABAG COMPANY, HAS ESTABLISHED A NEW GREENFIELD PLANT IN HUNGARY.

Introduction

In 2003, STRABAG – one of Europe's leading construction groups – decided to invest in a new cement plant in Hungary. This decision followed many years of research into the company's limestone assets in Hungary. The result of this exploration was the discovery of a mine in Baranya County, where the required quality and quantity of limestone and clay was available for many decades of cement production.

Although the position of the raw material deposit suggested the location of the plant, the specialist entrusted with managing the project looked for another site, because the area was remote and the local people protested.

In 2006, when STRABAG founded the 100% owned project company Nostra Cement Ltd, the new location, Királyegyháza, where the local authority was ready to launch a cement plant, was also decided.

Figure 1. The Nostra plant.

Figure 2. Small clinker silo.

In spring 2007, after getting all the necessary permissions from the Hungarian authorities, Nostra began the realisation of this project. After much hard work, start up of the plant was scheduled for November 2010.

Engineering

For plant engineering, the following consultancy services were engaged by Nostra:

- Civil and structural engineering: MMI (Hungary).
- Hungarian local approval and building permits, general planning: TOTAL and INNOBER (Hungary).
- Process, plant lay out, tendering and tender evaluation: A TEC (Austria).

The aim was to design a plant with a capacity of 2350 tpd of clinker, using the most modern technology, taking into account all the latest environmental regulations, in cooperation with the local authority and community.

Plant engineering

Nostra decided against a turnkey solution in order to fit the plant with the most modern equipment, economically.

Guarantee values

- Power consumption: maximum 100 kWh/t cement.
- Heat consumption for clinker production: maximum 750 kcal/kg clinker.

The delivery of mechanical equipment was ordered by the Chinese company CBMI (a member of the SINOMA group), but key equipment had to be delivered by European sub-suppliers as follows:

- Milling systems – four mills (raw meal, coal mill and two cement mills): vertical mills from Loesche.
- 5-stage preheater – designed by A TEC, manufactured by CBMI.
- Burner – two burners for the calciner and one main burner for the kiln were provided by Unitherm.
- Grate cooler: IKN.
- Process fans: Venti Oelde.
- Automatic packing equipment: Haver & Boecker.
- Palletising equipment: Beumer.
- Electrical and automation system: Siemens.
- Construction – mechanical assembly: Ceminvest (Hungarian company); electrical assembly: Siemens.

Plant description

Quarry

The quarry is situated approximately 25 km to the north of the plant near the village Bükkösd. Equipment was delivered by SBM (Austria) and Bedeschi (Italy).

The raw material in the quarry consists of pure limestone and clay. Limestone is crushed to > 100 mm; clay is crushed separately and mixed to the limestone according to a given ratio, which is controlled by an online analyser from EADS Sodern.

Raw material transport

Premix (a mixture of approximately 80% limestone and 20% clay, prepared in the quarry) and pure limestone are loaded in the quarry into trains and transported to the cement plant at Királyegyháza. Transport capacity is 5 – 6000 tpd, meaning 5 – 6 trains per 1000 t.

Premix unloading

The train carrying the raw material arrives in the northern field of the cement plant where three railroad tracks are placed in parallel. The wagons are unloaded at the premix unloading station, from where the material is transported by a belt system to the raw material hall.

Unloading correctives, additives and coal

Nostra Cement will use sand, iron materials and limestone for correctives, and slag, synthetic gypsum, natural gypsum and limestone as additives.

These materials are unloaded at the correctives and additives unloading station where again three rails are placed in parallel. The station is designed for unloading both trains and trucks.

Raw material storage and transport to raw mill bins

Material storage hall sections

The material storage hall contains the following storage sections:

- 2 x 15 000 t for premix.
- 2 x 2000 t for pure limestone (for corrective or additive).

Figure 3. Raw mill.

Figure 4. Mill feed bin system.

- 1 x 2000 t for sand (corrective for raw meal).
- 1 x 2000 t for iron corrective (corrective for raw meal).
- 1 x 2000 t as reserve (corrective for raw meal).
- 1 x 12 000 t for slag (additive for cement grinding).
- 1 x 2000 t for natural gypsum (additive for cement grinding).
- 1 x 2000 t for synthetic gypsum (REA) (additive for cement grinding).
- 1 x 4000 t for coal (fuel for kiln burners).
- 1 x 4000 t for petcoke (fuel for kiln burners).

Disassembly of premix is carried out by reclaimer; transport to the premix bin is via belt conveyors.

Disassembly of the correctives is carried out by another reclaimer and transported by conveying belts to the corresponding bins.

Raw mill plant

Mill feed bin system

Premix, pure limestone, sand and iron material are fed by belt conveyors to the corresponding bins for feeding to the raw mill.

The premix is discharged from the bin by apron feeder and weighing belt. The correctives (iron and sand) are discharged by centrex silo discharger and weighing belts; pure limestone is discharged by weighing belt. (All weighing belts are controlled by automatic Polab® analyser corresponding to the given analysis requirements of the raw meal.)

All weighing belts are controlled by an automated production laboratory, supplied and installed by Herzog, Germany.

From the weighing belts, all materials are fed to a collecting belt and finally to the conveyor belt, which feeds the raw mill.

Raw mill system

The raw mill is designed as a vertical roller mill with integrated separator and capacity of 200 tph dry raw meal. The raw materials (moisture maximum 7%) are dried by kiln waste gas, which is piped to the raw mill.

Ground raw meal is conveyed with the gas stream out of the mill and separated by a double cyclone. The separated raw meal is conveyed by air slide to a bucket elevator, and from there it is fed via air slide to the raw meal silo.

In order to be able to check the quality, the raw meal is automatically sampled between the bucket elevator and raw meal silo.

Mill and kiln gas dedusting

A bag filter cleans the gas stream from the raw meal plant to ensure a residual dust content of 5 mg/Nm^3 (10 mg/Nm^3). The raw meal dust is collected in the bag filter and conveyed by chain conveyors to an air slide, which sends the dust back into the raw meal silo.

If the kiln gas is processed without going to the raw mill, the hot waste gas from the kiln system is cooled by water spraying system in the downcomer duct to below 150 °C and then cleaned in the bag filter.

Silo raw meal

Storage and homogenisation of the raw meal takes place in the 8000 t capacity raw meal mixing silo. This silo holds a reserve of two days for the kiln line in case of various raw mill interruptions. Mixing of raw meal is realised by an air flow distributor system at the inlet of the silo and by an air flow system at the discharge outlet of the silo.

Kiln line

Cyclone preheater with calciner

The cyclone preheater is designed as a 5-stage battery for optimal use of the heat energy with calciner and calciner burner system (two burners) and an external tertiary air line.

The hot gas is drawn off from the top cyclone stage through the hot gas cooler by means of a kiln ID fan.

Rotary kiln

The rotary kiln is 4 m dia. x 60 m long. The main burner is fired by coal dust; at the top of the flame a temperature of approximately 1460 °C is achieved.

Clinker cooler

Nostra Cement chose a grate clinker cooler from IKN. At the end of the cooler the clinker temperature has declined to approximately 70 °C, and it is then crushed to >50 mm.

The clinker is transported from the crusher by pan conveyor (bucket elevator) to the clinker storage.

Clinker cooler exhaust dedusting

The clinker exhaust air is dedusted in a cyclone and then cooled by means of air-to-air radiators in the cooling tower; the residual dust is finally dedusted in a bag filter.

Coal mill plant

Coal mill system

For grinding coal or petcoke a vertical roller mill with integrated separator is installed. It is designed for 18 tph dry coal or 12 tph petcoke. The coal (petcoke) is fed from the silos to the mill by weighfeeders via a rotary feeder. During grinding the coal dust is conveyed out of the mill with the mill gas circuit gas stream and the dust is separated in a bag filter.

To dry the raw coal in the mill, the kiln exhaust gas is carried to the mill circuit. The ready combustible coal (petcoke) dust is stored in the two dust silos for coal and petcoke, respectively, from where the dust is blown by air slides to the main kiln burner and the two calciner burners.

Clinker storage

The clinker storage is made up of three parts – one silo with an outer silo (50 000 t) for normal clinker and an inner silo (10 000 t) for special clinker. An additional 2000 t silo is installed for low burned clinker.

Cement mill system

Clinker is discharged from the silo via chain conveyors. Additives like limestone, slag, natural or synthetic gypsum, are discharged from the additives storage hall sections by one reclaimer and transported via conveyor belts to distribution belts, from where they are filled into the proper silos for cement line 1 and 2.

Cement grinding plant

For each mill there is a proportioning station 1 and 2 with identical equipment. Clinker is discharged from the bin with weighing feeder and transported via conveyor belt to a bucket elevator.

Additives are discharged from the silos by weighfeeders.

All additives are fed to a collecting belt, which transports the material to the bucket elevator.

Cement mills

There are two identical vertical cement mills, including separator and dedusting system. For each mill the capacity is designed for 130 tph OPC. Water injection for cooling is foreseen.

Hot gas from the clinker cooler is conducted by pipe to the cement mills and given to the mill gas circuit for drying of slag or gypsum.

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If the kiln line is not in use, mill 1 is equipped with a hot gas generator to be able to continue cement grinding without hot gas from the clinker cooler.

Fine cement particles are transported by the gas flow through the separator to the bag filter, where the cement is collected. Clean gas with maximum 20 mg/Nm^3 dust is emitted through the stack.

For both mills, clinker and additives are fed by separate bucket elevators and belts.

Cement silo plant

Cement transport to silos

The finished cement is collected for each mill line in a bag filter, from where the cement is blown by air slides to conveying belts.

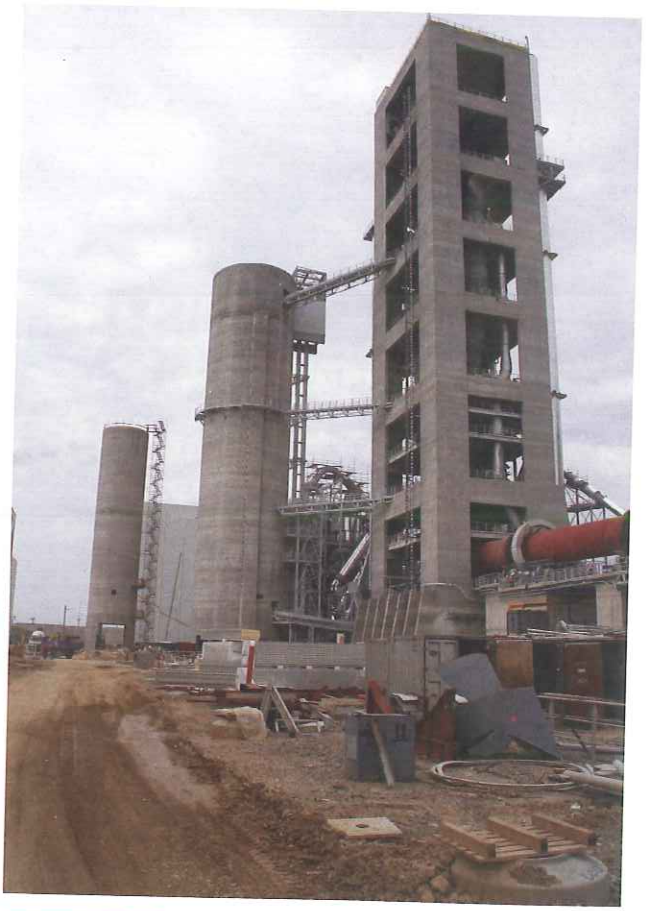

Figure 5. Preheater.

From these belts the cement is transported to the bucket elevators, then into the cement silos. An air slide distribution system is used to fill each silo from each bucket elevator.

Cement bulk loading for trucks

Each of the six storage silos is equipped with a bulk loading station for trucks; for the two silos with outer and inner silo it is possible to load the trucks from both silos.

Bulk loading train and transport to packing plant

From each silo cement is dispatched by air slides, which transport the material to the bucket elevator for train loading or for transport to the packing plant. Each bucket elevator can be supplied from each silo.

Packing and palletising plant

Packing and palletising is carried out completely automatically with the Roto Packer from Haver & Boecker. Palletising equipment is from Beumer.

Conclusion

The most important issue was the coordination of all interfaces, especially between the equipment suppliers, including all sub suppliers, civil buildings and mechanical and electrical erection.

It took all the efforts of Nostra and the consultancy companies to coordinate all activities of the different companies to be able to erect the new greenfield cement plant from tendering to start up within three years.

Table 1. Engineering and consultancy service	
Civil and structural engineering	MMI
Hungarian local approval and building permits	INNOBER, Total
Tendering and tender evaluation	A TEC, Nostra

Table 2. Main equipment details including supplier and capacity for quarry			
Main equipment	**Supplier**	**Country**	**Capacity (tph)**
Crusher for limestone crushing	SBM	Austria	800
Crusher for clay crushing	Bedeschi	Italy	200
Stacker for limestone and premix	SBM	Austria	1000
Reclaimer for limestone and premix	Bedeschi	Italy	1000
Wagon loading station	SBM	Austria	1000

Table 3. Main equipment details including supplier and capacity for cement plant			
Main equipment	**Supplier**	**Country**	**Capacity**
Reclaimer	CBMI	China	
Vertical roller mill (LM) for raw materials	CBMI/Loesche	China/Germany	200 tph
5-stage preheater	CBMI/A TEC	China	For 2500 tpd production
Calciner	CBMI/A TEC	China	
Rotary kiln 4 m dia. x 60 m long, 3% inclination	CBMI	China	For 2500 tpd production
Grate cooler	CBMI/IKN	China/Germany	
Vertical roller mill (LM 19.2 D) for coal grinding	CBMI/Loesche	China/Germany	18 tph
Heat exchanger (air to air type) for cooling cooler exit gas	CBMI	China	
Kiln/raw mill baghouse	CBMI/AAF	China	
Cooler baghouse	CBMI/AAF	China	
Coal mill baghouse	CBMI/AAF	China	
Main bucket elevator	CBMI/Beumer	China	
Clinker carrying pan conveyor	CBMI/Beumer	China	
Clinker mills 2pc. (LM)	CBMI/Loesche	China/Germany	2 x 130 tph
Weighing and dosing equipment	CBMI/Schenck Process	China	
Cooling tower (downcomer duct)	CBMI/A TEC	China	
Water pumps	CBMI	China	
Process fans	CBMI/Venti Oelde	China	
Electrical and automation system	Siemens	Austria	
Air conditioning	CBMI	China	
Plant compressors	CBMI/Atlas Copco	China	
Power plant	OVIT/ Siemens	Hungary/Austria	