IBAU HAMBURG

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Information

High-Capacity Mixing Plants in Steel Construction

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Summary

In the cement industry conventional cement mixing plants consist of multicompartment silos made of concrete. However, with the continuing trend towards special cements the silo capacities for the main components are mostly sufficiently available.

Many cement manufacturers only lack a suitable high-capacity mixing system which can be integrated in an existing plant, offers short construction times and can be extended on a flexible basis.

IBAU HAMBURG has launched a special plant concept using structural steel, which completely fulfils these requirements. Below we describe plants which have been built and also follow the construction of a high-capacity mixing plant for Holcim, at the Lägerdorf Plant and Antwerp.

1. Introduction

A continuing trend towards special cements can be seen in the cement market. In Germany for example, the share of CEM II cements such as Portland slag cement and Portland limestone cement rose from 10% in 1995 to approx 25% in 2005.

The increase in the share of special cements is also associated with the expansion of silo capacities. However, this does not always involve completely new storage capacities. For the large components to be mixed it is often possible to make use of existing silos. This means that certain cement manufacturers only require a high-capacity mixing system with integrated mixer and suitable silo compartments for the mixing components and the finished special cement.

Considerable requirements are thus made on such high-capacity mixing plants as existing storage capacities have to be incorporated, and possibilities for later extensions are also of interest.

Besides the flexibility offered by the plant, other key factors are short planning and construction times, low investment costs and compliance with stringent environmental stipulations.

IBAU HAMBURG has taken account of these customer demands with its high-capacity mixing plants in steel construction design. In the face of the above requirements the plant concept offers major benefits over multicompartment silos made of concrete.

The flexibility and modular design has already allowed us to build plants of identical design for different customers and varying applications.

2. Plant Concept

Mixing towers in steel construction have already been used in dry mortar plants since the early Eighties. Here individual silo compartments are located above the mixer or the component weighers to create the shortest possible conveying distances and to make use of the principle of gravity for the flow of material. The benefit of such designs is that they can be extended outwards if the space allows.

IBAU HAMBURG applied this principle to a cement mixing plant for the first time in the mid-nineties. *Fig. 1* shows a layout of this plant. The plant is entirely constructed from structural steel. The silo compartments are equipped with a discharge cone that includes pneumatic aeration systems. The silo compartments can be completely emptied when there is a change in product type. Silo discharge is regulated by pneumatic flow-control gates. The components are fed via fluidslides and chutes alter-natively to the two bin weighers. The conveying ways are virtually identical.

The centre of the plant is the IBAU batch type mixer which is charged via the bin weighers. The IB-M (*Fig. 2*) is a single-shaft mixer which operates according to the principle of centrifugal mixing. The agitators are exchangeable and mounted on a rotating shaft. Lateral rotors ensure micro mixing of even the smallest components. 5 sizes are available with gross volumes ranging from 2.5 to 8.9 m^3 and throughput capacities from 50 to 200 t/h, depending on the mixer size, mixing time and apparent density of the components.

The IBAU mixer is equipped with two drop bottom doors as a standard for short discharge times. The doors are operated via a toggle-lever system, which ensures complete tightness through automatic interlocking during mixing.

From the mixer discharge bin the finished mixing product is directly fed to the truck loading system or stored in existing cement silos via fluidslides and downstream conveyors. Feeding of the steel silos is pneumatic using pressure vessel car discharge to one of the silo compartments as selected. Separate filters on the silos and bin weighers as well as separate material returns ensure the complete separation of product types.

With frequent product changes and high product quality the dedusting and venting technology used for the mixer and the mixer discharge bin is of great importance. All machines and equipment are incorporated in the mixing tower of the high-capacity mixing plant.

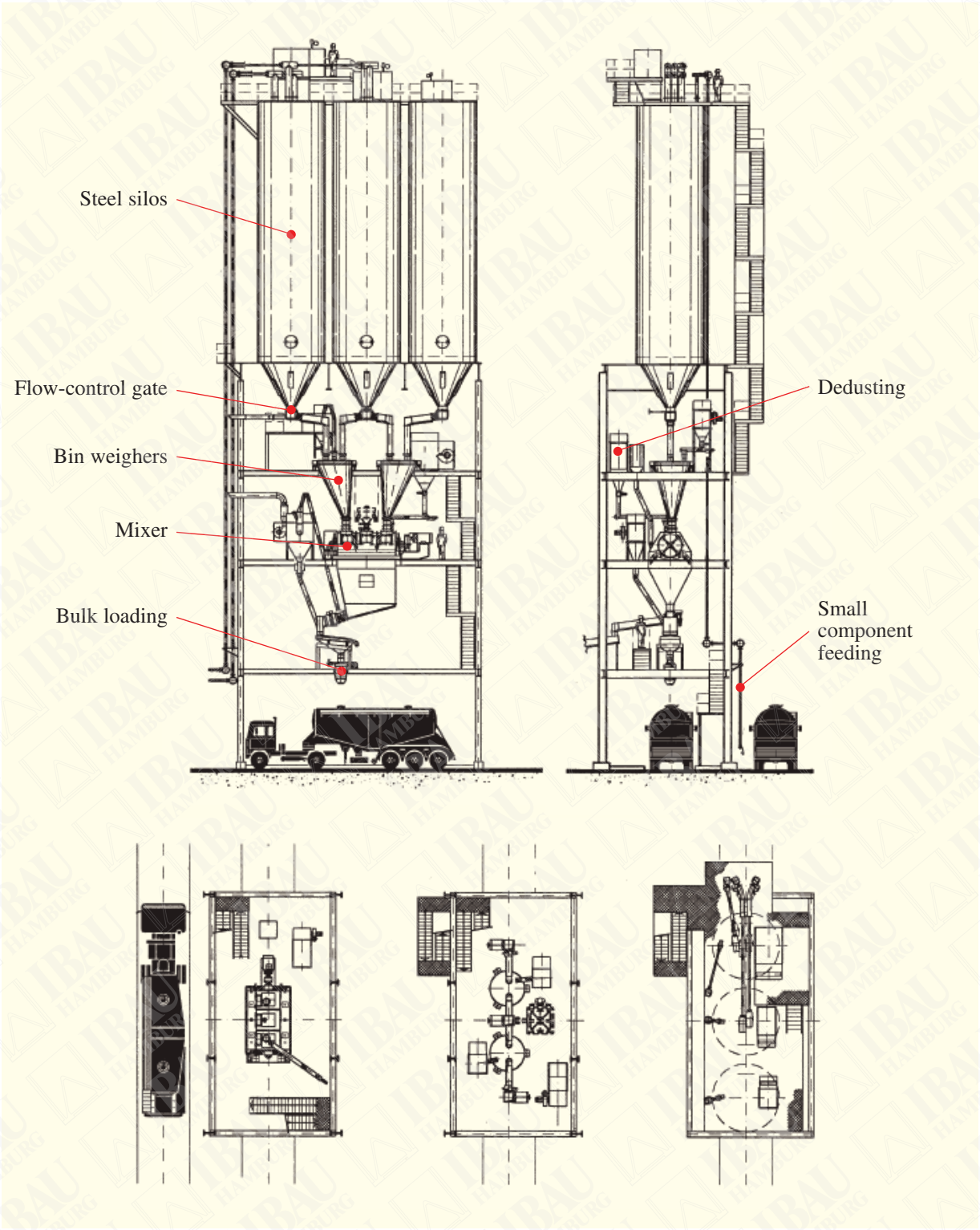

Fig. 1: Layout of a high-capacity mixing plant

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The basic concept described above can be varied with regard to the number of silo compartments, the type of silo feeding, the number of bin weighers for large and small components, the return of the finished product to the silos, etc. according to customer requirements.

3. Existing Plants

Fig. 3 shows the mixing system supplied to Rüdersdorfer Zement in Eisenhüttenstadt / Germany by IBAU HAMBURG.

The plant was successfully put into operation after a construction period of just 5 months. The mixing components are delivered by pressure vessel cars. 3 silo compartments with a diameter of 3.8 m and a total silo capacity of 480 m³ are available for storage. Silo discharging is carried out via two bin weighers in an IB-M 4500 with a net volume of 3.4 m³ and a throughput of 80 t/h. An IBAU mobile loader with a loading capacity of 80-100 t/h is used for truck loading. The largest high-capacity mixing plant built to date in steel construction was put into operation at dornburger zement at Dorndorf-Steudnitz / Germany.

The plant (*Fig. 4*) is equipped with a mixing tower of 47 m in height which had to be connected to the cement grinding and loading system of the nearby cement works. Raw materials and mixing products are stored in 8 steel-plate silos each 170 m³ in volume.

The equipment for dosing and weighing, for mixing and distribution/ loading of the mixing material is installed on four platforms below the silos. Two bin weighers with a net working weight of 7 tonnes each and a small-component weigher (*Fig. 5*) for the 0.2 tonnes control dosing of the components into the mixer.

The IB-M 8000 (*Fig. 6*) has a net mixing volume of 6.6 m³ and provides a guaranteed mixing rate of 150 t/h. From the mixer discharge bin the mixed material is either distributed to the direct loading system via two IBAU Simplex loaders with a movement path of 4 m and a maximum loading capacity of 200 t/h or to the finished product silos using a belt type bucket elevator and downstream fluidslides.

The plant was successfully put into operation in less than 9 months and since then has produced to the satisfaction of the cement manufacturer CEM II-cements.

For the plant operator key benefits of the plant concept are the improved cost-effectiveness ratio in comparison with installations made of concrete, the short construction time and flexibility for possible expansions.

Modern mixing plants for special cement

View of an IBAU mixer type IB-M

1. Mixing housing with inlet socket
2. Mixer shaft
3. Agitator
4. Rotors
5. Drop bottom doors
6. Control flaps
7. Drive unit

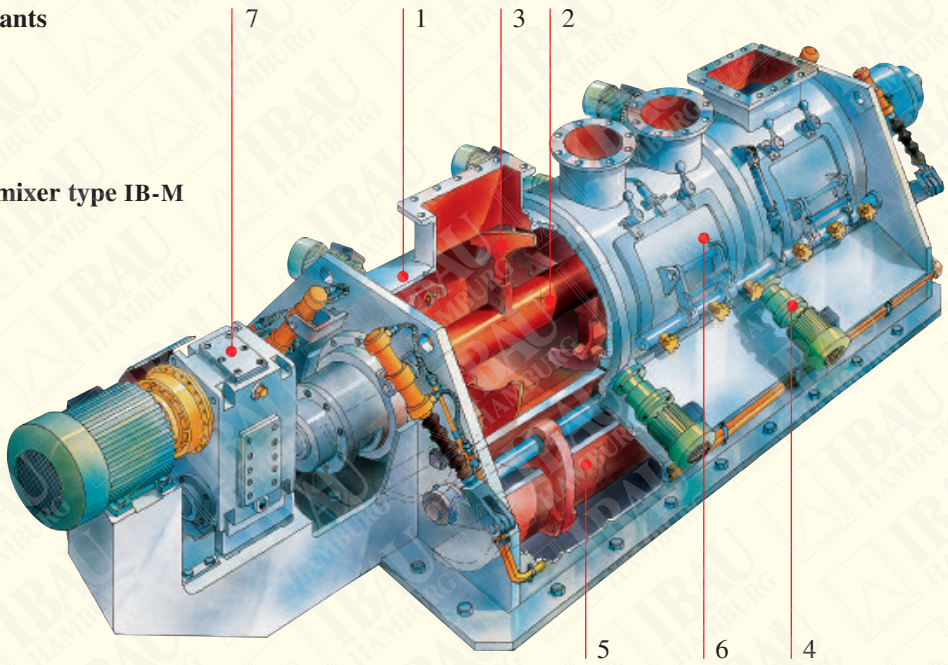

Fig. 2: IBAU single-shaft mixer, type IB-M shown in 3D

Fig. 3: Rüdersdorfer Zement plant

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Fig. 4: dornburger zement plant

Fig. 5: View of the weighing platform

Fig. 6: View of the mixer platform

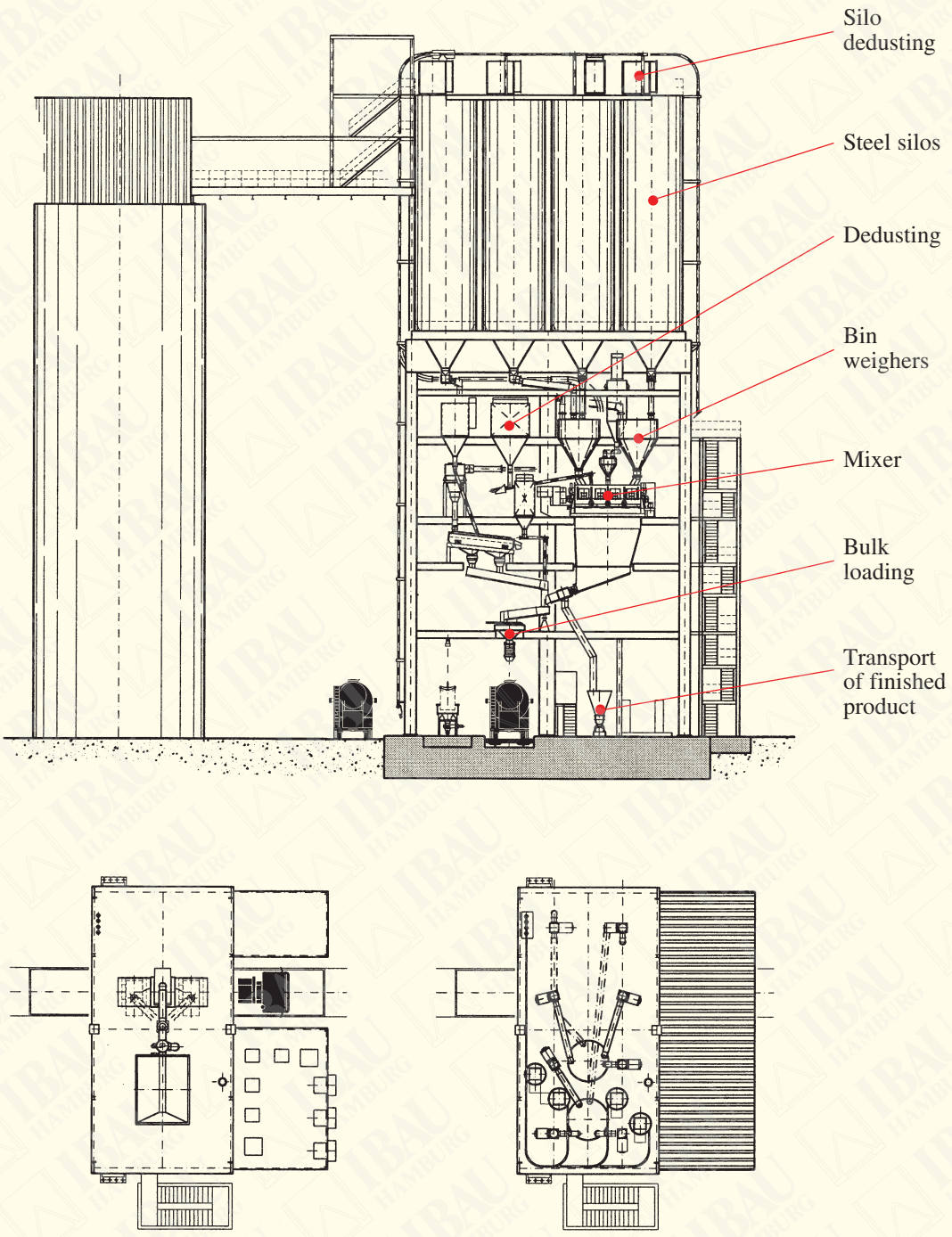

Fig. 7: Holcim – Lägerdorf plant, Germany

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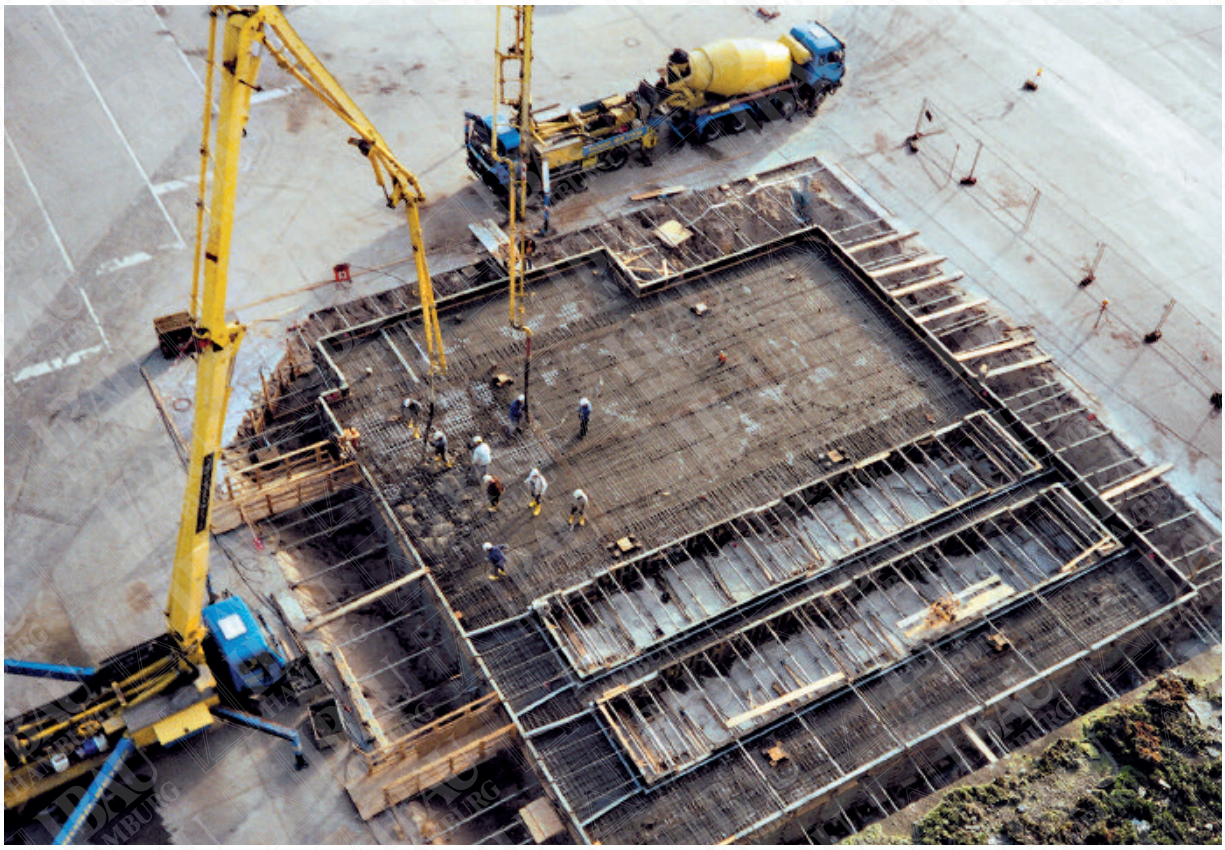

Fig. 8, *above*: Concreting of the foundations

Fig. 9, *left*: Installation of the mixer

Fig. 10, *right*: Installation of the steel-plate silos

Fig. 11: Installation of the steel-plate silos

Fig. 12: Holcim – Lägerdorf plant, after commissioning

4. Construction of a New Plant

In December 2001 IBAU HAMBURG was awarded a contract by Holcim, Germany to build a high-capacity mixing plant in Lägerdorf that is virtually identical to the plant for dornburger zement in terms of design. The plant is designed for an annual capacity of 150,000 t special cement and can also produce large quantities of standardised cements containing GGBS.

GEOROC Deutschland Nord GmbH was founded with the participation of Holcim to market special cement solutions for the special civil engineering sector, civil and foundation engineering as well as road construction and environmental engineering. Although two shifts are initially planned to operate the plant on weekdays, this can be stepped up to 24 hours a day, 7 days a week if required. The plant (*Fig. 7*) consists of 8 steel-plate silos each with a storage capacity of 170 m³, 2 bin weighers each for 6000 kg of large components and a small-component weigher with a volume of 170 kg. A batch type mixer IB-M 8000 can offer throughputs ranging between 150 to 180 t/h depending on the mixing components.

The silos are fed by 2 pneumatic pressure vessel car discharge systems, each with 50-60 t/h. Additives and small components are supplied using Big-Bags. A jet conveyor is used to convey the additives from a discharging station at a rate of 2 t/h to one of four receiving bins with a volume of approx. 2 m³.

Downstream of the discharge bin the finished product is either fed directly to the bulk-loading system or by an IBAU pump with a throughput of 180 t/h to the finished product silos. A diverter can also be used to charge an existing silo battery with finished product. In addition, conveying to a foreign body screening system installed above the bulk loading station is possible for injection cements.

The plant was commissioned in July 2002. The progress of construction is documented in the following *Figures 8-12*. The plant stands on concrete foundations measuring 20 x 21 m and with a thickness of 2.50 m *(Fig. 8)*. The stability of the plant is ensured by 900 m³ of concrete and 65 t of reinforced concrete.

The foundations include weighing pits for road vehicle weighing equipment of 18 m length. The 300 t structural steel supporting superstructure bears the platforms for the machines and silos. All machines and equipment were lifted onto the structure as the structural steel construction progressed.

The centre of the plant, the IBAU single-shaft mixer, was installed in the mixing tower completely mounted on a base-frame with motor and gears (*Fig. 9*). This was followed by the installation of the other machines and equipment such as the bin weighers, conveying systems and Big-Bag discharging station. Then a mobile crane was used to install the 8 completely pre-mounted steel-plate silos (*Fig. 10 and 11*). This operation did not take longer than 15 minutes per silo.

It is possible to extend the plant to a total of 16 silos at a later date, something that has already been taken into account for the design of the foundations and structural steelwork engineering. The mixing plant is connected to the existing silo installation by a bridge of 12 m length. The installation work then ended with the bulk loading station, plant control and external cladding so that commissioning of the plant (*Fig. 12*) took place as scheduled.

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Platform of the weighing bins

Single-shaft batch mixer

Feeding of a finished product silo

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Foreign body screen upstream of the bulk loading

Bulk loading with mobile loader

Material discharge from a steel silo

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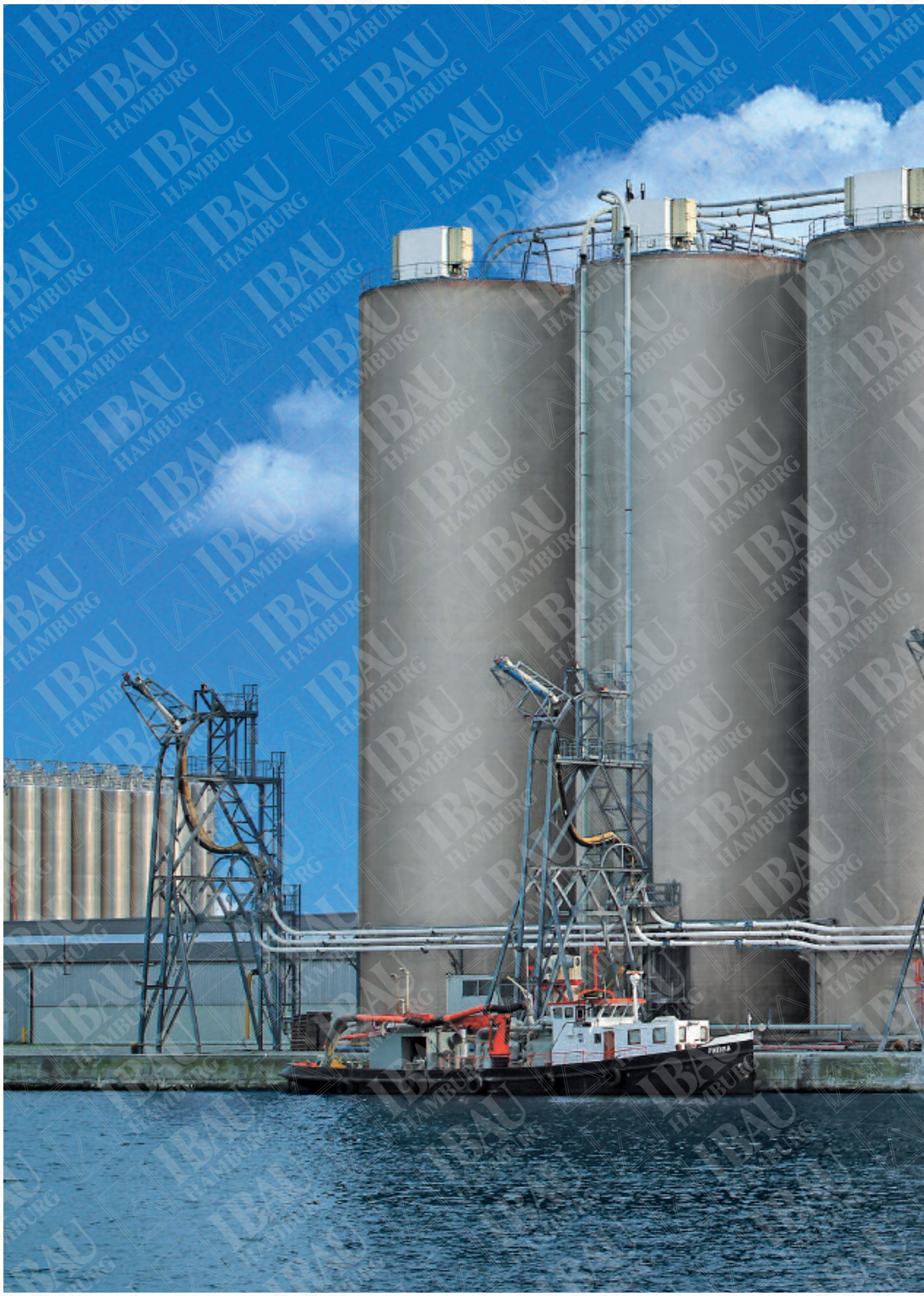
The performance test of the plant played a key role. This does not only involve testing the mechanical plant functions but also the recipe control, mixing quality, registration of the production data such as incoming raw materials, production order lists, batch records, stock management of finished products and loading jobs as well as the link to the automatic dispatch system.

5. Antwerp plant

The plant in Antwerp has 9 sheet steel silos, 8 silos with 200 m^3 storage capacity each, 1 silo with 2 chambers, each with 100 m^3 storage capacity, 2 weighing bins each for 6,000 kg of large components. The heart of the plant is a batch mixer IB-M 8000 which can deliver throughputs of up to 150 t/h depending on the mixing components.

The silo is fed as follows: four pneumatic truck unloading stations, each with 50-60 t/h are emptied alternately into one of the silo cells. Additives and small components are delivered via big bags. Separate filters on the silos and the weighing bins, as well as separate material feedbacks ensure that product sorts are kept completely separate from each other. After being fed into the mixer discharge hopper, the finished material is either forwarded to the bulk loading station or to the finished material silos by an IBAU pump



Mixing plant for

Holcim Antwerp / Belgium

Silo discharge with flow control gate

for 180 t/h throughput. A diverter can be used to feed an existing multi-compartment silo with finished material.

The IBAU HAMBURG plant design can be integrated into existing cement plants which already have sufficient silo capacities for the main components. The steel design keeps construction times short and allows flexible expansion compared to traditional multichamber cement silos. The new, simple plant design is largely modular in structure and allows nearly all customer requirements to be met. The favourable cost-benefit ratio of the high-capacity steel mixing plants has already proved highly beneficial to a series of mixing plant operators.

6. Outlook

In cooperation with cement manufacturers IBAU HAMBURG has succeeded in launching a new plant concept for high-capacity mixing systems.

The complete plant is designed as a steel construction installation, something that offers advantages over conventional multicompartment silos made of concrete particularly for the incorporation of systems, short construction times and possibilities for the expansion of the plant.

The new simple plant concept is largely a mod-

Shiploading at the Antwerp plant

High-Capacity Mixing Plants in Steel Construction

Conveying installation for small components

Dedusting systems of silo compartments

ular design and allows virtually all kinds of customer requirements to be taken into account.

The favourable cost-effectiveness ratio of these high-capacity mixing plants in steel construction has also attracted the interest of other cement manufacturers in addition to our existing customers.

High-Capacity Mixing Plants in Steel Construction designed by IBAU HAMBURG

- easy to integrate in existing cement terminals
- short planning and construction times
- low investment costs
- flexibility for future expansions
- modular design

IBAU HAMBURG – THE STATE OF THE ART

Cement silo installation with bulk loading
in Samalayuca / Mexico

Raw meal blending silo,
Dyckerhoff Zement / Germany

High capacity mixing plant
HOLCIM, Antwerp / Belgium

Coal-fired power plant
Mehrum / Germany

Shipunloader on rubber tyres for Continental
Florida Materials, Port Canaveral / USA

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