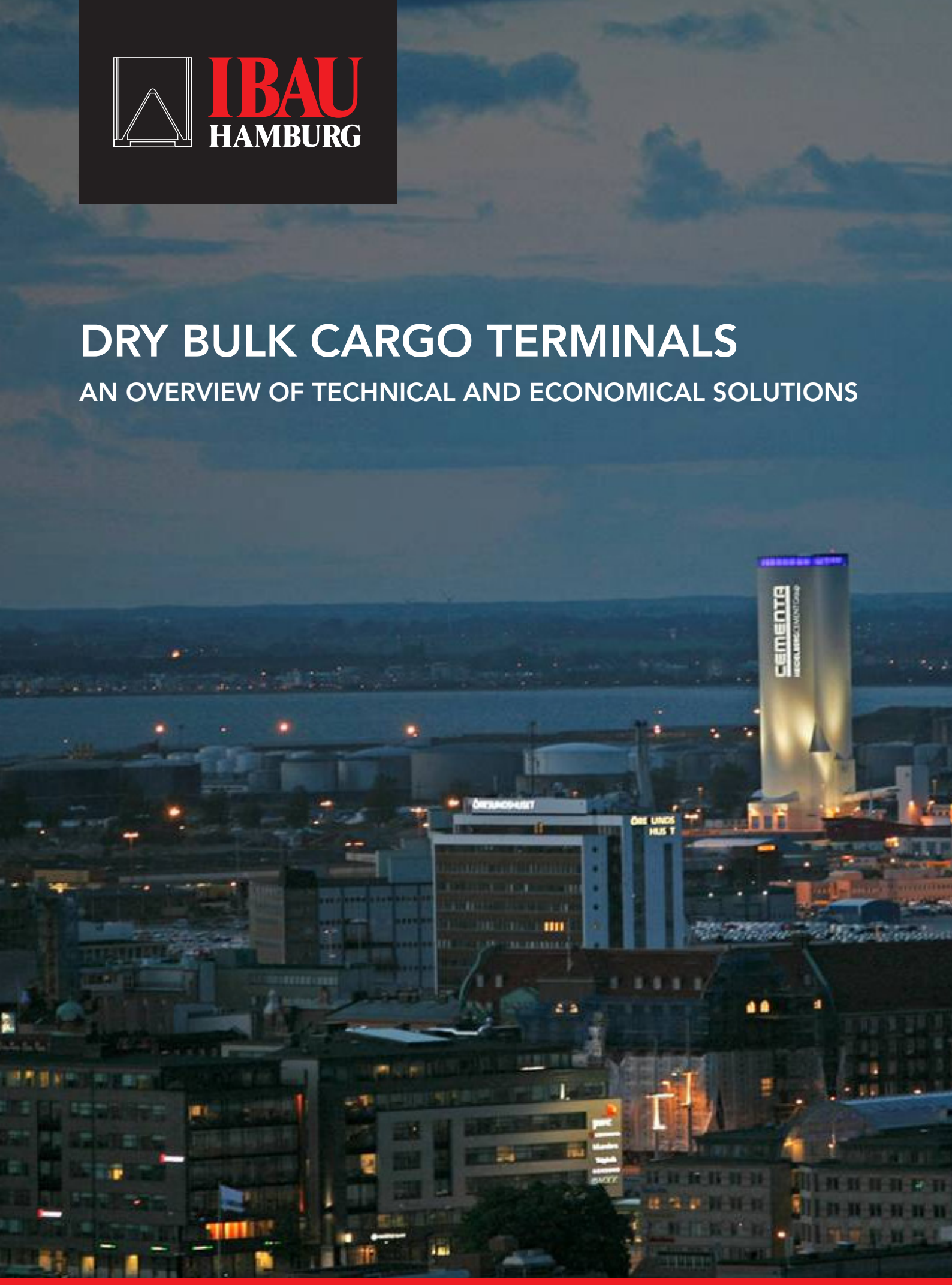
IBAU HAMBURG

DRY BULK CARGO TERMINALS

AN OVERVIEW OF TECHNICAL AND ECONOMICAL SOLUTIONS



Red Paper

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Worldwide, it is already uneconomical to build integrated cement plants in coastal areas, because of the huge export availability of low-priced cement and clinker in combination with low shipping prices. Furthermore, a large difference between CIF costs of imported materials and domestic prices, which are under carbon price pressure, makes importing highly attractive. Another issue is the growing global trade of cementitious materials such as fly ash, granulated blast furnace slag and other products. Accordingly, in the coming years, imports of bulk materials will become more and more economical. The latest forecast by Clarksons Research is projecting for the next few years significant growth rates in seaborne trade of all minor bulks such as cement and similar products. From a logistics point of view, import terminals also require the appropriate export and inland terminals.

However, expectations by terminal planners are largely increasing. On the one side this has to do with increasing regulations concerning environmental aspects such as dust generation, noise and fire protection, design requirements and ecological footprint. On the other hand, the local preferences and limitations of the investors require very different facilities and technologies, which mostly need a superior basic engineering to find the best and most economical solution. The energy consumption of the facilities shall be minimized, loading times shall be short to optimize truck traffic and waiting times. High storage efficiency, 99% emptying degree, full automation, high flexibility, easy expansion or relocation are other complex issues. Finally, the complete terminal operation depends largely on the ship size as well as train capacities that can be used.

CONTENT

"The Cement Plant of Tomorrow will blend naturally into its environment. It will be a part of our living space and day to day life."
Reiner Meyer - Managing Director

IBAU HAMBURG
Engineering background

Fig. 1: IBAU Multicompartment silo in Paris, France

IBAU HAMBURG has always been on the forefront with advanced material handling and storage technologies for bulk terminals. Founded in 1975 in Hamburg, Germany, the company introduced the central cone silo to the market. Since that time more than 12,000 silos have been built and designed and the technologies and project capabilities have been broadly expanded.
Today, the company is one of the few engineering providers and turnkey suppliers for the cement and other process industries with a broad range of their own bulk material handling technologies such as silo and storage systems, loading and unloading, different material transport solutions and specialized technologies such as mechanical mixers, self-unloading systems for cement carriers and different ship unloading systems */1/*.

To find always customer-oriented solutions, IBAU HAMBURG brings the best ideas to live /1/.
There are plenty of superior and state-of-the-art engineering solutions existing in the company's references. Take IBAU's latest multicompartment silo (Fig. 1) in Paris / France built for Ciments Calcia / Semapa. This is a clean and economic exemplary silo design, erected in midtown Paris. The silo integrates a railcar unloading station for incoming cements and a truck loading station for outgoing cements. Or take the flat storage facility (Fig. 2) of Golden Bay Cement in Auckland, New Zealand.

This terminal is designed for 30,000 tons of different cement types in a 4,750 m^3 building. The partition walls for the cement hall are made of prefabricated concrete, the storage height is about 6-7 m. Feeding of the storage facility is from cement ships, reloading of the cement is into trucks.

Energy efficiency, reduction of CO^2 emissions, optimal performance and advanced technical solutions are the strongpoints of each IBAU engineering and design. Processes and products are continually developed. One example is the IBAU Gdischarge (Fig. 3), which is an advanced aeration management system for efficient silo operation. In a test plant at one of the major cement producers, this system achieved a 40% higher loading capacity, compared to a conventional truck loading system, almost 30% quicker loading times and about 40% fewer energy consumption. Another example is the IBAU Fpipe (Fig. 4), which allows more flexible pipe routing, horizontal and even vertical conveying, low conveying velocities and accordingly significant lower energy consumptions when compared to conventional fluidslide conveyors.

Fig. 2: Flat storage facility in Auckland, New Zealand - designed & supplied by IBAU

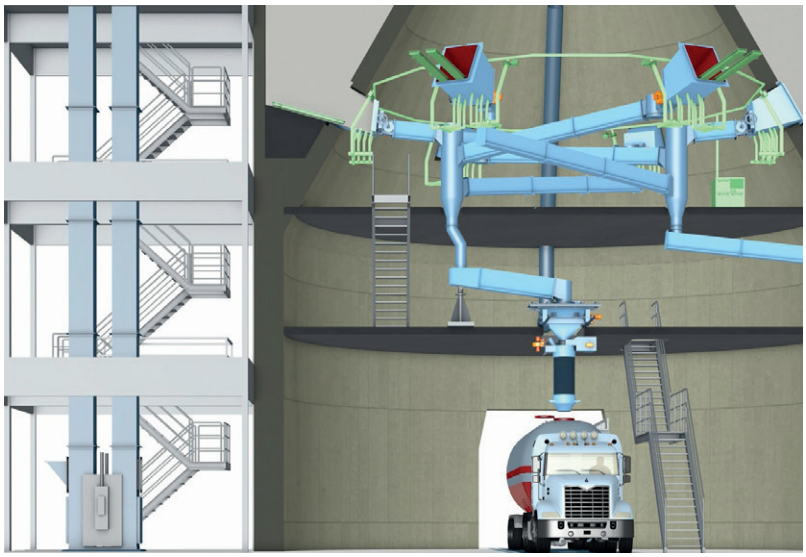
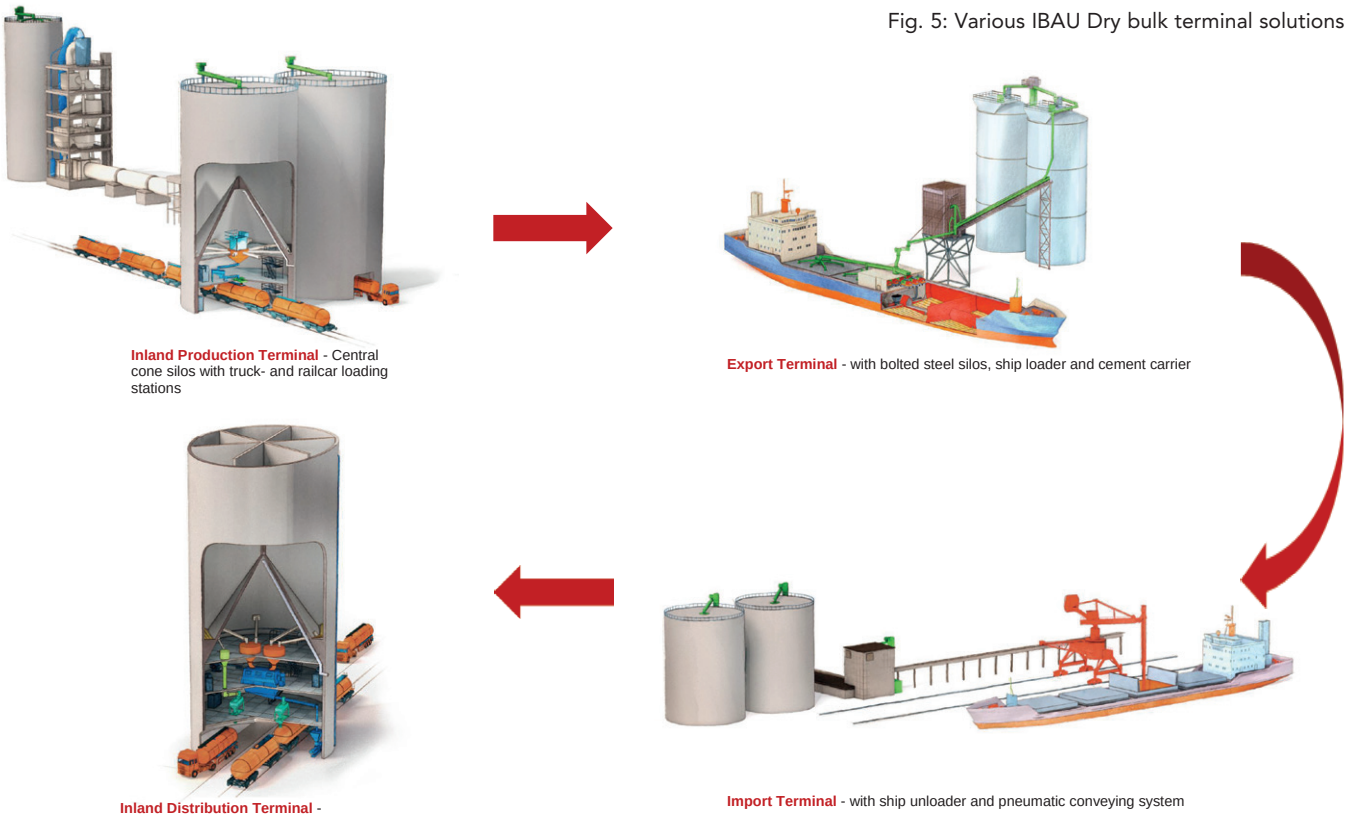


Fig. 3: IBAU Gdischarge system

Fig. 4: IBAU Fpipe system

Various dry bulk terminal solutions

Fig. 5: Various IBAU Dry bulk terminal solutions



Inland Production Terminal - Central cone silos with truck- and railcar loading stations

Export Terminal - with bolted steel silos, ship loader and cement carrier

Inland Distribution Terminal - Multicompartment silos with loading and unloading stations (truck + railcar)

Import Terminal - with ship unloader and pneumatic conveying system

For dry bulk terminals there is not just only one favourable design. Furthermore, the supplier selection is driven today more and more by the experience and know-how of the supplier to either deliver and integrate single packages and components into an existing design or to supply the complete system on a turnkey or EPC contract (Engineering - Procurement - Construction) basis. The latter is especially true for custom-designed solutions, when a project is based on narrow timetables, maximum performance and reliability, for a price that does not exceed the budget. Adequate suppliers need to have proven solutions, a good reputation, a large reference list and need to be able to provide:

- Assistance with permission procedures
- Plant engineering and system design of their own technology
- Procurement, construction/fabrication and commissioning of equipment
- Structural analysis for steel structures, piling, foundation and formwork
- Workshop drawings for steel structures, incl. material lists for fabrication
- Performance testing, guarantees

Fig. 5 illustrates the different principal examples for inland terminals, export terminals and import terminals. While inland terminals are mostly equipped with railcar unloading systems and truck loading stations, export terminals are mostly designed for ship loading. This may be solutions for loading selfunloading bulk carriers, which have onboard loading and unloading systems, or more sophisticated loadings systems for conventional bulkers. The largest range of possibilities exist for import terminals.

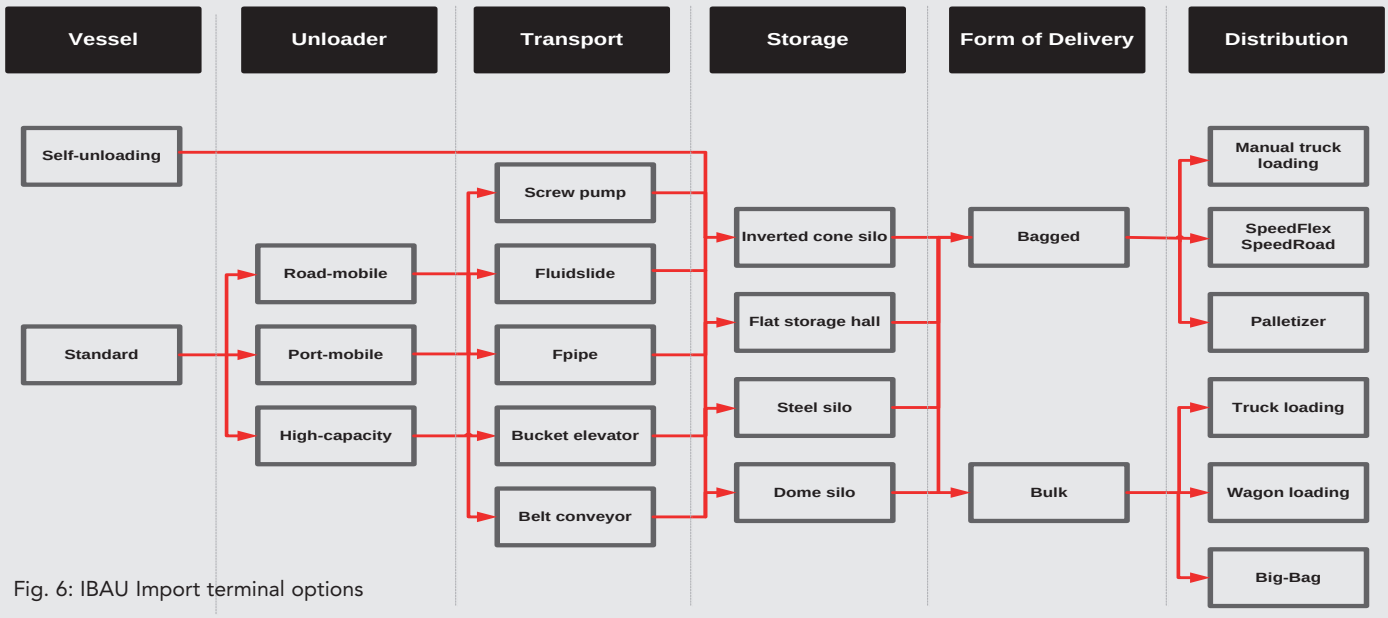


Fig. 6: IBAU Import terminal options

Fig. 6 shows the different options, from which the most suitable design can be chosen. For each package different options exist. The bulk material is either supplied by self-unloading vessels or standard bulkers. The final distribution of the material is either by bulk or bagged transport or a combination thereof. The largest possibilities can be found in the conveying and storage solutions.


Fig. 7 Cement train discharge at inland distribution terminal - designed & supplied by IBAU

Inland cement terminals are more and more erected in dense-populated areas, which have a high cement demand. Accordingly, such cement distribution terminals are confronted with space restrictions and huge environmental issues. Permissions are only given, if emissions levels are fully met. IBAU Hamburg has a large number of examples, how challenging requirements can be fulfilled and how cement deliveries by train (Fig. 7) and ship can be integrated and how the cement distribution by truck can be achieved without neighbourhood concerns. There are a large number of solutions available, including complete automated solutions, which need no terminal operators. Concept studies have already been done for flat storage facilities, which can be installed underground (Fig. 8), to offer fascinating, advanced distribution terminal designs.

THE FUTURE - UNDERGROUND TERMINAL IN A CITY

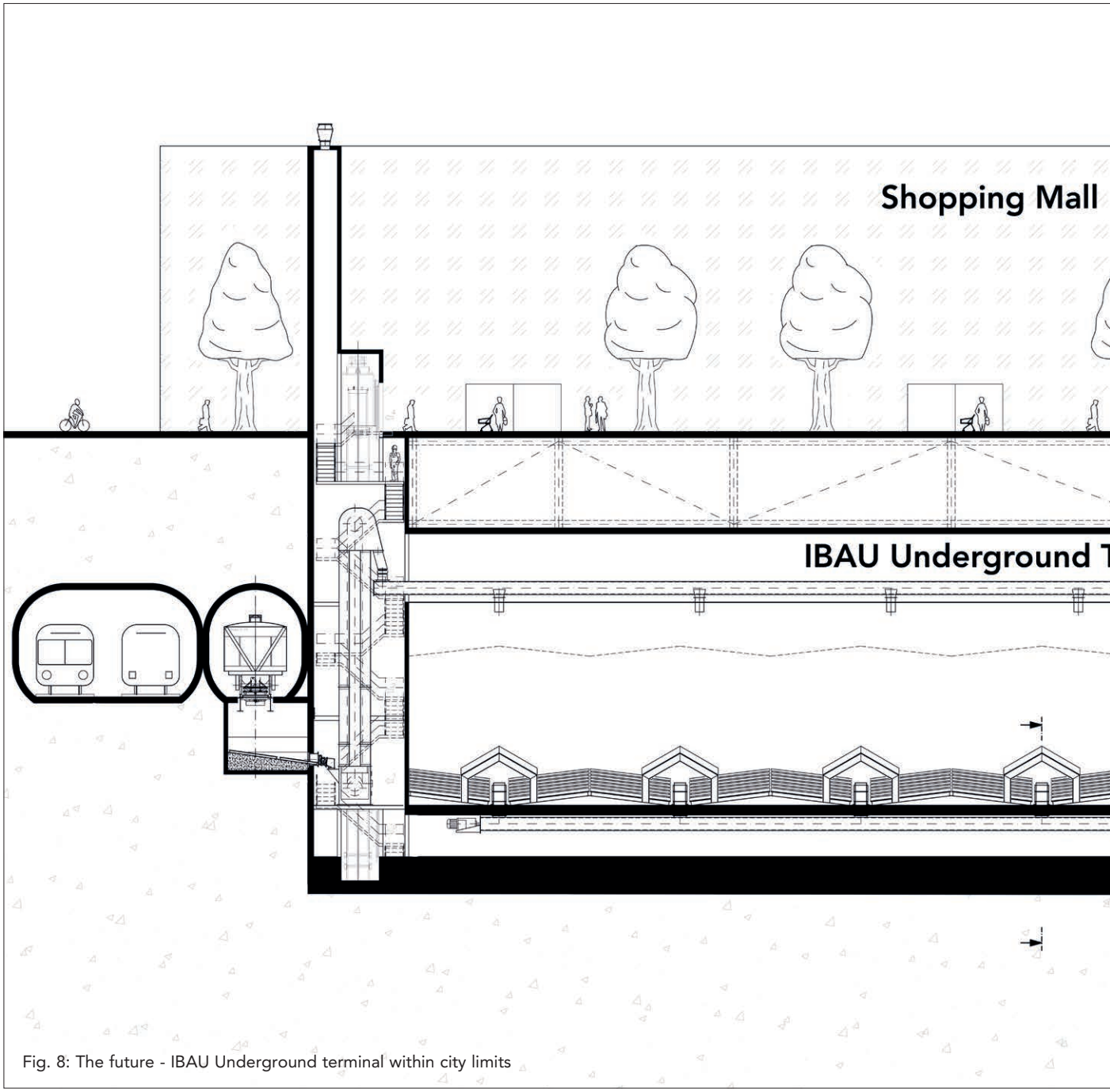
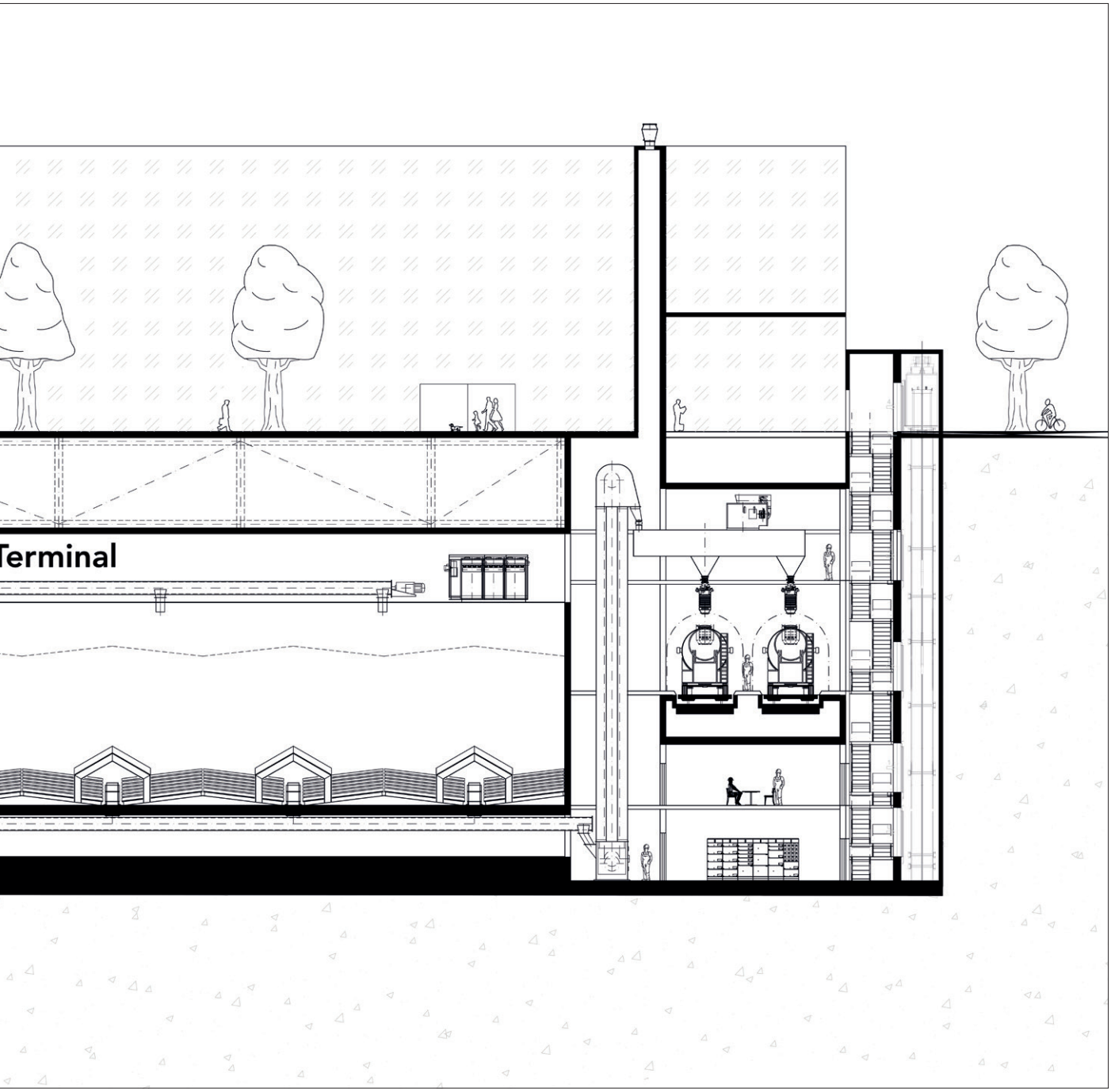


Fig. 8: The future - IBAU Underground terminal within city limits


Terminal

Silo technology

Silo technology can be chosen from various designs */2-4/*. Most common are steel and concrete silos or flat storage facilities. Steel silos of up to 10,000 t capacity can be elevated so that loading facilities for trucks and railcars can be located below the silo.

New is the IBAU Standard bolted system which is based on an innovative, economic and slim design to achieve flexible and reliable storage solutions (Fig. 9). For large storage quantities up to 40,000 tons concrete central cone silos are used, which can also be designed as multi-compartment silos for different cement types (Fig. 10). Such silos offer the possibility to integrate all bulk loading equipment as well as mechanical mixers, packers and other equipment below the silo cone. If there are height restrictions or weak soil conditions, then flat storage buildings and dome silos are an alternative.

Fig. 9: IBAU Bolted steel silo design

Fig. 10: IBAU Multicompartment silo in Sweden

The latest pulverized material extraction technology for all these storage facilities is based on pneumatic discharge solutions. The floor in the silos and flat storage facilities is covered with open fluidslides (aeration pads) which have an air-permeable fabric on the upper side (Fig. 11). The aeration air is blown under the fabric to fluidise the pulverized material on the fabric. The silo bottom is divided into aeration sections having discharge outlets with IBAU flow-control gates, which allow a controlled silo discharge from the silo sections. During discharge only one silo section is active at a time. This means only the fluidslides of one section are aerated and the relevant flow-control gate is opened for the material extraction. The silo bottom is aerated section by section, so that all sections are aerated in a complete cycle. This guarantees a fully automatic, reliable, safe and controlled operation with high emptying rates above 99%.

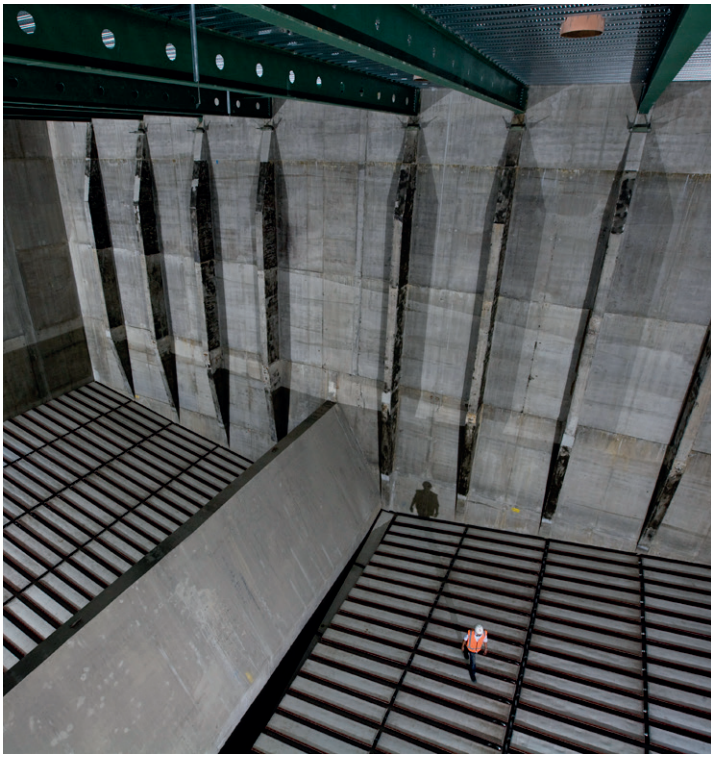


Fig. 11: Aeration panels in a flat storage facility - designed & supplied by IBAU

Design Examples

Spenner Zement, Germany
At its headquarters in Erwitte, North Rhine Westphalia, Spenner Zement is producing cement, lime and dry mortar of the highest quality.
In 2011, to coincide with the company's 75th anniversary, a first multicompartment blending silo was officially opened at the Erwitte location. The silo is equipped with 16 silo compartments and uses a state-of-the-art mixing technique from IBAU HAMBURG for the production of special cements. In 2018 the company decided for a 2nd multicompartment silo to be able to store larger cement capacities very close to the first silo from a newly installed grinding plant.
The new silo (Fig. 12) has a capacity of 13,500 t, a diameter of 20 m and 63.5 m height. The focus of the project was to be able to store the cements from both grinding plants in each silo and also to extend the loading capacities.

Spenner Zement decided to have a new silo built because of the necessity to be able to produce more efficiently and flexible for the market and to store larger batches of different kinds of Portland cements and different kind of Portland Composite cements. The new silo has 6 compartments to store all necessary types of cement. The silo design is divided into 5 outer compartments and 1 inner compartment. Two IBAU stationary truck loaders, each with a loading capacity of 250 t/h, are installed below the silo. Having a maximum flexibility for feeding the silo compartments from both grinding plants as well as being able to also feed the new silo from the mechanical mixer had the highest priority. The new silo went into operation this year.

Fig. 12: New IBAU Silo at Spenner Zement

Boral Cement, Australia
In 2018, Boral Cement announced the construction of a new clinker grinding and cement storage terminal at Geelong Port, Victoria, Australia. The facility has been designed to handle up to 1.3 million tons of cementitious products per annum and to supply cements to the fast-growing Victorian construction market. The new terminal (Fig. 13) will allow Boral to increase its capacity and expand the company's product offerings to its customers. The Geelong and greater Victorian market is experiencing unprecedented growth, which is driven by the population growth and associated governmental infrastructure investments. The terminal will use imported clinker. The facility comprises the grinding plant and the cement storage and distribution terminal as well as wharf side facilities with ship unloading equipment and clinker conveying systems between wharf and the import terminal.

IBAU HAMBURG will supply the cement terminal, which consists of 4 bolted steel silos, each with 14 m diameter, 28 m height and 14,000 t combined storage capacity. The silos are equipped with aerated steel cones and a central discharge to keep the costs for the silo extraction to a minimum. The silos have 2 integrated truck loading lanes so that 2 silos are discharged to one combined loading station.
The loading capacity for each station is 250 t/h.
It is expected that the terminal will be operational in the 2nd half of 2020.

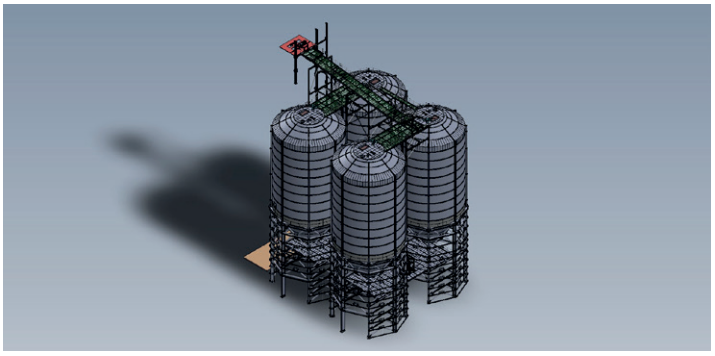


Fig. 13: Illustration of the Geelong Cement Terminal

Melbourne Cement, Australia

Melbourne Cement, which is a joint venture of Independent Cement and
Cement Australia, is planning to install in Melbourne a large concrete silo for cementitious products. IBAU HAMBURG has been awarded the contract to supply the design and key components for a large multi-compartment silo. The silo has a diameter of approximately 33 m diameter and 71 m height (Fig. 14). It is divided into 6 outer and 1 inner compartments to store different types of cement and cementitious materials. Feeding of the silo is directly from self-unloading cement carriers. The cement distribution is via 4 truck loading stations.

Fig. 14: Arrangement drawing of IBAU Silo installation at Melbourne Cement

Conclusion

Dry bulk cargo terminals have to be adapted to the local requirements to fulfil customer's needs. Accordingly, custom-designed solutions are required, because each project is different and there are different options available for coming close to the best solution. This is not only true for large but also for small projects. For the engineering it is recommended to involve a company that is able to design and supply the terminal in full compliance with project requirements, timetable and costs. To develop the most advanced, economical and reliable terminal solution a close cooperation between the investor and supplier is very important.

IBAU HAMBURG has a proven record of such solutions. Each terminal project by this company is handled by an experienced team of engineers, designers, project managers and supervisors together with partners who bring in specialized disciplines, if necessary. A great number of references and the resulting experience gives IBAU the unique ability to listen to the customer's wishes and thus design and engineer the terminal solution they need for the customer's benefit.

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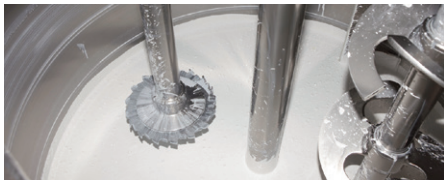
OUR TECHNOLOGIES / YOUR INDUSTRY	HAVER & BOECKER CEMENT	HAVER & BOECKER BUILDING PRODUCTS AND MINERALS
	Phone: +49 (0) 2522 30-678 E-mail: cement@haverboecker.com	Phone: +49 (0) 2522 30-8800 E-mail: bpm@haverboecker.com
IBAU HAMBURG STORAGE + HANDLING Phone: +49 (0) 40 361309-0 E-mail: info@ibauhamburg.de		
sommer MIXING Phone: +49 (0) 211-23082-32 E-mail: info@sommer-anlagenbau.com		
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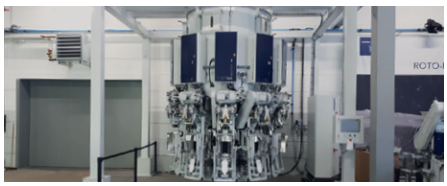
HAVER & BOECKER PACKING Phone: +49 (0) 2522 30-0 E-mail: haver@haverboecker.com		
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NEWTEC BAG PALLETIZING PALLETIZING+LOADING Phone: +33 389 633750 E-mail: info@newtecbag.com		

HAVER & BOECKER

CHEMICALS

Phone: +49 (0) 2522 30-664
E-mail: chemicals@haverboecker.com

BEHN+BATES

FOOD

Behn+Bates - Phone.: +49 (0) 251 9796-0
E-mail: food@behnbates.com

OUR SOLUTIONS FOR YOU

STORAGE + HANDLING

- Central cone silos
- Steel silos
- Mechanical material transport
- Pneumatic conveying systems
- Mixing plants for dry bulk products
- Bulk loading and unloading systems (ship, truck and train)
- EPC – Contracting for Complete Terminals and Plants

MIXING

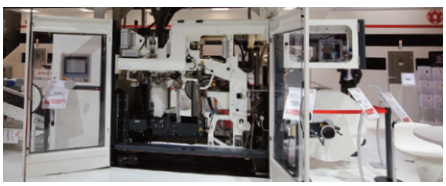
- Dissolver mixers
- Triple shaft mixers
- Coaxial mixers
- Lab mixers
- Turnkey mixing plants for pasty and liquid products

FILLING

- Drum filling systems
- Pallet and IBC filling systems
- Pail filling systems
- Can filling systems
- Complete intralogistics solutions

PACKING

- Semi-automatic, automatic and high performance packing systems for powdery products using all types of valve bags, FFS bags, open mouth bags, PE bags and big bags in weights ranging from 1 kg to 2000 kg



PACKING

- Complete packing lines for granular products using all types of FFS bags, open mouth bags and big bags in weights ranging from 25 kg to 2000 kg

PALLETIZING + LOADING

- Bag palletizing systems using layer deposit, automatic grippers and robot technology for overhead or on-ground feeding arrangements
- Automatic truck, container and train loading systems
- Complete end of line solutions

PLANET BLUE

Our planet is unique – as unique as the life that is on it.

Michael James Massimino spent 23 days, 19 hours and 47 minutes in outer space, seven hours of which were devoted to exterior repairs to the Hubble telescope. It took this one overwhelming moment of spacewalk to realize how not only unique and beautiful the blue planet is, but also how vulnerable and incredibly thin its atmosphere is. The Earth is a single living, breathing organism. It is our home.

We at HAVER & BOECKER understand that the environment needs no protection. It is people who need protection.

As a company, we can make a small but sure contribution to this protection. PLANET BLUE's message is to use the right technology from HAVER & BOECKER in order to create win-win-win situations in which both the resources of our planet and the financial resources of our customers are conserved.

IBAU HAMBURG · Ingenieurgesellschaft Industriebau mbH
Rödingsmarkt 35, 20459 Hamburg, Germany
Phone: +49 (0) 40 361309-0
Fax: +49 (0) 40 363983
E-mail: info@ibauhamburg.de
Internet: www.ibauhamburg.com

HAVER & BOECKER OHG
Carl-Haver-Platz 3, 59302 Oelde, Germany
Phone: +49 (0) 2522 30-0
Fax: +49 (0) 2522 30-403
E-mail: haver@haverboecker.com
Internet: www.haverboecker.com