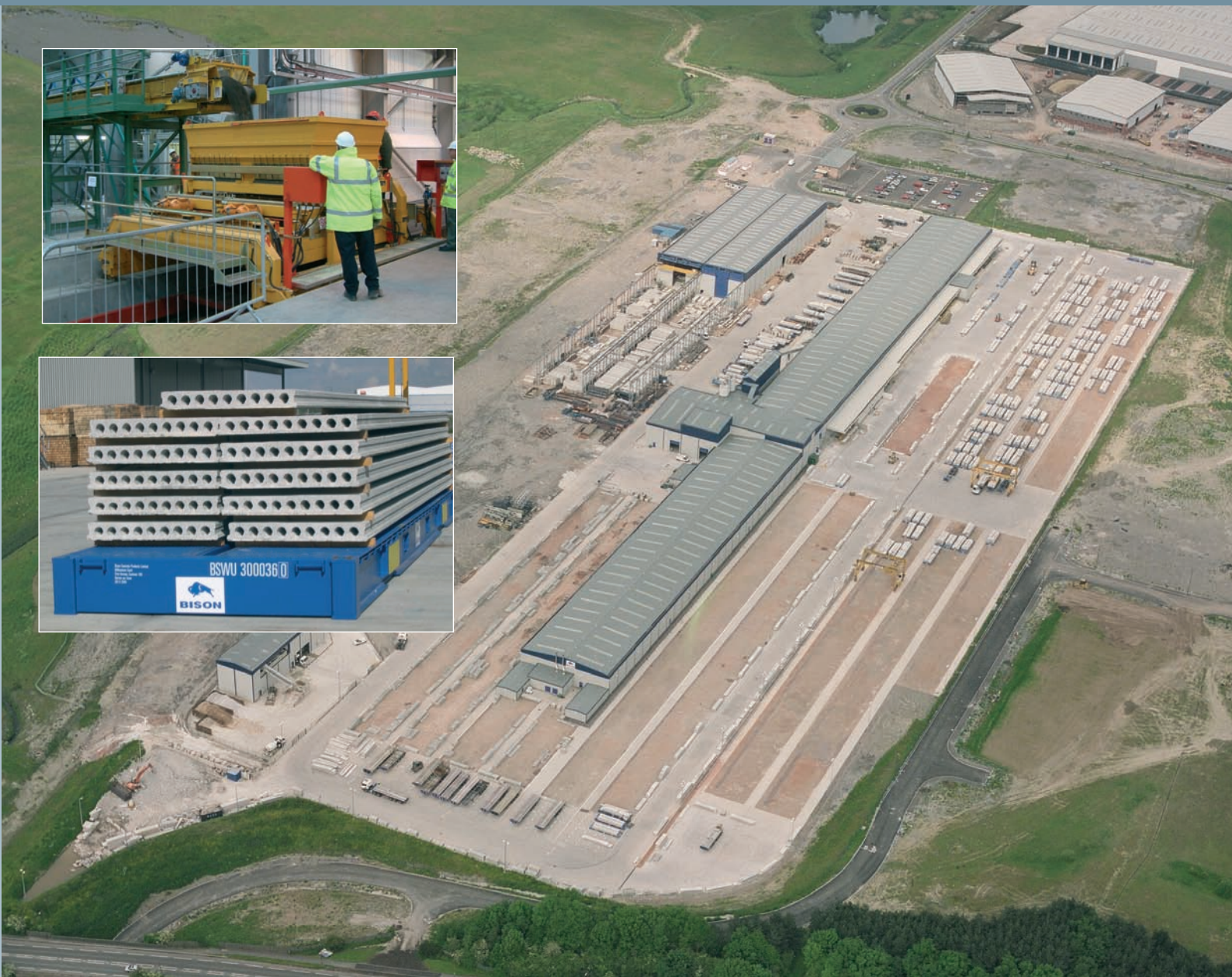


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SPECIAL PRINT



PRECAST CONCRETE ELEMENTS

nordimpianti
Technology for Precast and Prestressed Concrete Industry

A NEW APPROACH TO THE PRODUCTION OF HOLLOW
CORE PRESTRESSED PRECAST FLOORING

■ **Bison Concrete Products Limited, Swadlincote DE11 0BB, UK**

A new approach to the production of hollow core prestressed precast flooring

Bison Concrete Products Ltd. has been a dominant company in the production and sale of precast, prestressed hollow core flooring in the UK for more than 60 years. Founded in 1919 the company has enjoyed steady and sustained growth. In 1935 the invention by the Company of the pneumatic core revolutionised the manufacture of hollow concrete floors; worldwide patents were

obtained and licensees appointed. Post War Britain needed rebuilding and Bison was becoming a generic term for precast concrete. New methods of manufacture, notably prestressing, were being introduced and Bison was the first company to exploit this new technology commercially.

Alan Clucas,
Bison Concrete Products Limited, UK

As the Company continued to grow, production facilities were augmented to cover the United Kingdom with new factories in Scotland, the Midlands and the South-east. These factories were based on static long line bed manufacture with machines passing over the beds. As the millennium approached Bison decided that it was essential to reinvest in their production and factories to maintain their market leader status and a decision was taken to invest £ 50 million (Euros 70 million) in upgrading existing plants and in building

a new hollow core production plant that would be the most advanced in Europe. This factory is on a 35 acre site at Swadlincote Derbyshire in the centre of England and the economies achieved by the production process enable product to be delivered competitively within a 200 mile (320 km) radius.

A new approach to production

The new factory at Swadlincote is designed to manufacture Bison Concrete hollow core flooring products in a new way, combining the traditional 'long line' casting process with the circulating carousel

movement method. The manufacturing equipment for the whole project was supplied as a turnkey package by Nordimpianti Systems from Italy. The benefits derived from this method are:

- (a) The concrete batching and mixing plant and the concrete delivery system are closely integrated with the production casting machines, reducing the distance in which mixed concrete has to be conveyed to its point of use.
- (b) The production process machines located within the factory are at fixed



The new Bison plant is located at Swadlincote Derbyshire in the centre of England



Bison is combining the traditional 'long line' casting process with the circulating carousel movement method.

stations, thus avoiding extensive machine movement throughout the factory, reducing energy costs and Health and Safety risk exposure.

The Process & Raw Materials

Cement used in the plant is batched and mixed on site in a fully enclosed, centrally located, batching plant. The cement is delivered on a 'just-in-time' basis by Lafarge who monitor the cement levels at Swadlincote remotely. The deliveries arrive in 24 tonne loads by pressurised tanker trucks and discharged pneumatically via flexible and rigid pipework into storage silos within the batching plant enclosure. The total capacity is approximately 300 tonnes.

The constituent raw materials, cement, fine and coarse aggregates are delivered in bulk by road. Fine and coarse aggregates are delivered in 20-28 tonne loads by tipper trucks and discharged into a covered receiving ground bin from where it is conveyed into large fully enclosed storage hoppers at high level. The total capacity is approximately 1000 tonnes.

En route to the upper hoppers the aggregates pass through a vibrating mesh separating screen. At this point, should there be any unwanted oversized aggregate pieces they will be separated from the feed stock to avoid manufacture process problems.

Batching And Mixing

Cement is extracted from the storage silos by screw conveyors and fed into a weighing hopper equipped with load cells. An accurate amount, as prescribed by the mix menu, is weighed off and held for delivery into the mixing pan.

Coarse and fine aggregates are discharged sequentially from the respective storage hoppers, onto a weighing conveyor equipped with load cells to weigh the constituents accurately as prescribed by the mix menu. When the aggregate weighing is completed, making due allowance for varying moisture contents, the material is transferred from the weighing conveyor into a 'rising skip' for delivery into the mixing pan. The skip then rises upwards to a holding position immediately above the



The casting machine is static, straddling a pair of 'long line' casting beds of 150 metres length.

mixing pan, awaiting a control signal to discharge into the pan. To avoid delays in the batching and mixing cycle the weighing and transfer to delivery points will generally take place during the mixing function of the previous batch.

When required the pre weighed aggregates and cement are discharged into the pan and at this stage a prescribed volume of recycled cementitious slurry may be added.

Following a short dry mix time to ensure the constituents are totally blended, a prescribed volume of water and workability/accelerant admix is dispensed to provide a concrete mix of the required consistency. This water may be a combination of recycled (green) and mains water.

When the correct workability and consistency has been achieved the mixed concrete is discharged via a 'wet hopper'

to an automatic conveyor system to be transported to the casting station in the production hall.

The batching and mixing plant formed also part of Nordimpianti's package but was supplied by ORU, Italy.

Casting

The casting station is designed to accommodate a variety of interchangeable machines to suit the product range and features. The casting machine is static, straddling a pair of 'long line' casting beds of 150 metres length. The casting beds are prepared in advance with prestressed high tensile wires stretching the full length of the bed positioned in readiness for casting. The casting bed travels through the casting machine at a controlled and variable speed coordinated to suit the specific product type and the workability of the concrete. The casting



Alan Lucas, Managing Director, Bison Group, has been employed in the precast concrete sector for over 20 years, initially in technical and production management roles. He joined Bison in September 2000 as Operations Director responsible for managing a major investment programme of €70m in new factories and leading edge production technology, including the conceptual design of the Swadlincote factory. In January 2005 he was promoted to Group Managing Director. Alan Lucas is a Director of IPHA (International Prestressed Hollowcore Association) and The Concrete Centre and also a committee member of BPCF (British Precast Concrete Federation). He has an Engineering degree from Liverpool University, is a Chartered Civil Engineer and enjoys football and motorsport.

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machine distributes and consolidates the concrete in a mould, which is positioned immediately above and in close contact with the moving bed. The concrete is laid and compacted in the layers to provide the finished shape, encasing the pre-stressed wires. As the bed containing the finished section passes further along the casting station other machines and presses carry out a variety of indentations and pressings to provide further features to the product.

The casting process inevitably results in a small amount of waste concrete, generally at the start and finish of each bed and possibly along part of the production length if there is a machine malfunction or inconsistency in the concrete. All waste material from the production process is recycled.

On completion of casting the full line of products the whole of the casting bed is then moved sideways into the curing area and replaced by another prepared bed to repeat the sequence.

Product Curing

When the bed arrives in the curing hall a cloche, the full length and width of the bed, is automatically lowered onto the bed to cover the product. Installed along the full length beneath the cloche are a series of tubes with outlet nozzles, the purpose of which is to distribute steam and contain it over the product to accelerate the curing process. When the cloche is in place steam injectors automatically connect and provide a continuous supply of steam to the process.

Steam Raising Boiler House

The curing process is aided by the use of steam produced by natural gas fired steam generating plant located within a purpose built boiler room located at one end of the building. The steam plant comprises two steam boilers capable of generating up to 2000 kg/hr of steam at 12 bar. This equates to approx. 1.55 MW (5.1 million BTU/hr) total boiler output or 1.7MW (5.8 million BTU/hr) input.

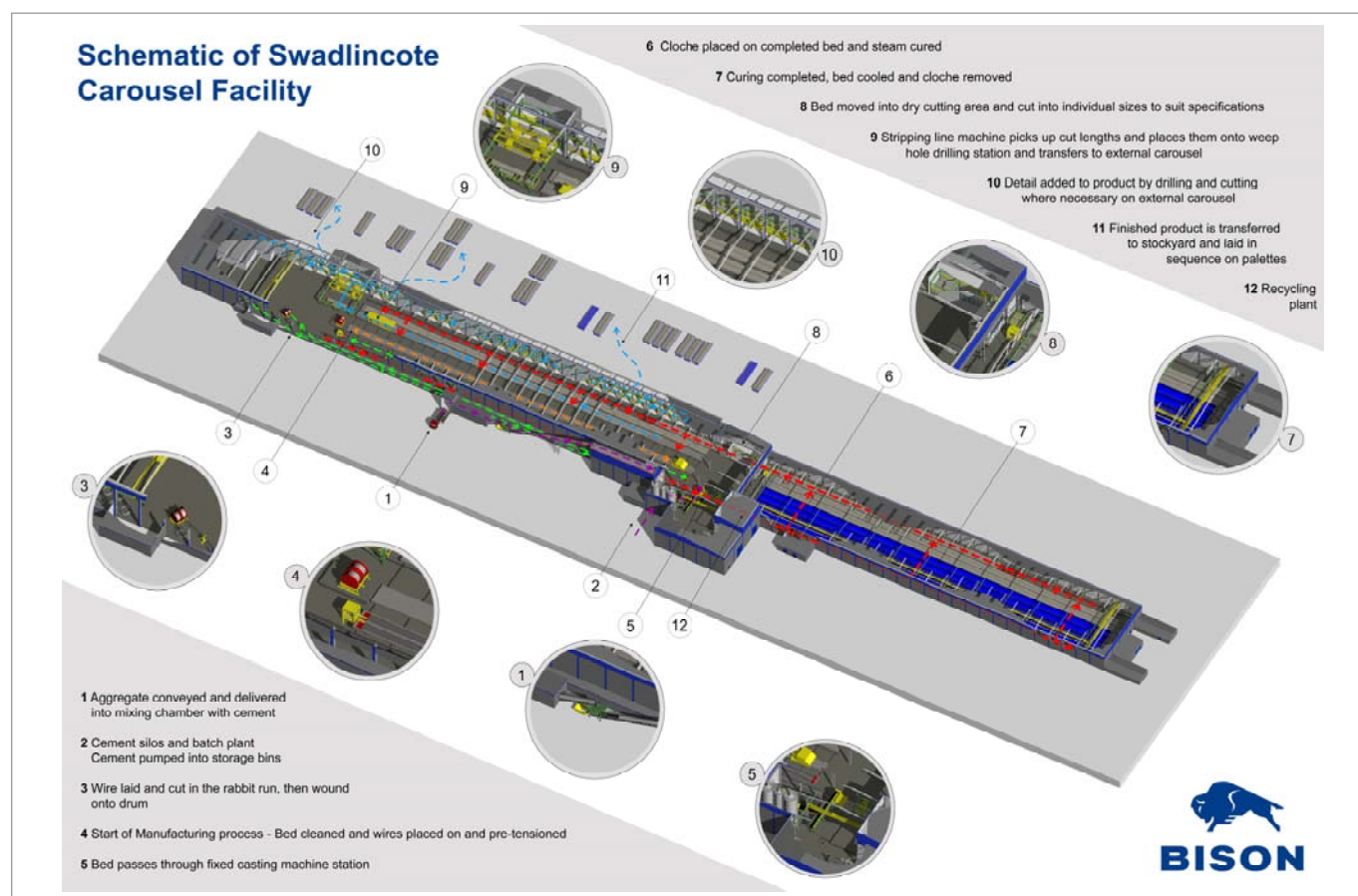
The boiler plant is natural gas fired. The gas supply is taken from the low-pressure site main, which is boosted locally to provide the boiler plant with a gas supply pressure of 300 mbar.

Each boiler has a dedicated chimney, which discharges over 1m above the highest point of the adjacent building. The steam curing system was part of Nordimpianti's package and was supplied by tecnositer, Italy.

Cutting & Stripping

Following a suitable curing period the cloche is removed (for transfer to another incoming bed) and the high tensile wires are de-tensioned.

It is at this point that a transponder is added and glued to the unit. The transponder technology adopted will allow client engineers in the future to take a reading off the transponder card and obtain general arrangements, unit details design, calculations and CDM data



Schematic of the Bison plant

should the building change use or loading conditions.

The bed arrives at the cutting station and at this stage the 150 linear metre long section of concrete is cut into individual product lengths. The cutting machine is equipped with diamond edge cutting blades which are cooled with water jets during operations.

The cementitious slurry created by the water-cooled cutting process is conveyed by a drag chain system beneath ground to the recycling plant.

After the cutting process is completed the bed is then moved sideways to a stripping line. With the use of a purpose made decanting machine the products are lifted and carried along the bed to a transfer station for conveyance to the second stage production process and loading. The bed, when emptied, will transfer sideways to the cleaning line.

Bed Cleaning & Waste Disposal

A small amount of cementitious waste, sweepings, bed end waste and unusable concrete results from the production process. This is cleaned and collected by a bed-cleaning machine and in some cases with the use of a crane and waste skip. Waste materials from the bed cleaning are discharged into a drag chain system below ground to the recycling plant. Larger pieces beyond the capacity of the cleaning machine are transported by skip to the crushing plant.

The bed is then prepared for another cast. Pre-cut wires, set out in a template, are paid out along the bed. The templates are secured against the bed end abutments and the whole arrangement of wires is extended, mass stressed, to suit the next planned production lines.

The sequence continues repeating for each bed.

Product Transfer. & Second Stage Processes – Dry Cutting

At the time of transferring products from the factory some individual pieces may

need further features forming or other processes unable to be completed prior to curing and cutting. The automatic transfer equipment establishes this requirement from the system database and directs the individual products to the appropriate second stage (dry cut) machinery.

In all cases where products are subsequently saw cut the task is carried out in suitable enclosures, with cooling/dampening jets to eliminate the potential for fugitive dust emissions. Cementitious slurry resulting from these tasks is channelled and discharged into the drag chain system below ground for conveyance to the recycling plant.

Finished Product & Storage

If the product requires additional feature work, this is carried out by fully and semi automatic diamond bladed saws which are driven directly from the data embedded in a micro chip within the transponder attached to each unit.

These saws are housed within a sound proof enclosure which minimise any noise emissions emanating from the site. Once the features are "cut" into the cured product the finished unit is then removed from the outload conveyor using a fork lift truck and stacked in load sequence order onto pallets designed specifically for the product.

Each fork lift truck is fitted with an LCD screen which enables the driver to "pick" the right product in the right sequence off the outload conveyor and transport it to its designated pallet using the data from the transponder sent by WIFI to each truck. The specially designed and certificated pallets will enable Bison to utilise any form of Rail, Road or Sea transportation now and in the future.

Two CMR straddle cranes were purchased through Techmart International Ltd. Each crane can lift a pallet with a complete load of hollowcore and either place it in the appropriate stockyard position or, conversely retrieve it from the stockyard to place it on a road trailer, ready for despatch. The combination of delivery pallet and straddle crane greatly increases handling efficiency and thereby reduces costs.

Batching Plant & Machinery Clean Down

At the end of a production shift or after a casting machine change residue of concrete or cement slurry is washed off with high pressure water and this water is taken by the drag chain system below ground to the recycling plant.

Recycled Products

Wet Recycling Plant

Adjacent to the batching plant is the wet concrete recycling plant which takes:

- Unwanted or waste concrete in its plastic state



A transponder is added and glued to the units. The transponder technology adopted will allow client engineers in the future to take a reading off the transponder card and obtain general arrangements, unit details design, calculations and CDM data should the building change use or loading conditions.



One Load – One Lift

- Cementitious slurry from the batching plant and production machinery wash down
- Saw cutting slurry from the saw station and dry cutting stations
- Sludge, slurry and small pieces of graded hardened waste from the bed cleaner
- Condensate from the steam curing process

All materials recycled arrive by the drag chain system.



Wet concrete batching plant (see CPI 4/2006 for details)

The plant first separates the coarse materials from the fines. Depending on the quality and grading of the coarse material a choice is made either to return it to the coarse material feed stock at the batching plant or transfer it to the on site crushing station (Dry Recycling Plant).

pieces where the pre-stressed wire is removed and segregated into a storage bin for onward recycling through specialist metal recycling merchants.

The remaining material is reduced in size by crushing and grading for reuse in the



Bison delivers competitively within a 200 mile (320 km) radius.

The fines and liquids are pumped to a silo for further treatment to filter out reusable (green) water, leaving slurry for reuse in the concrete mixing cycle. The green water is then transferred to a separate silo for reuse in the mixing plant, in addition to mains water, or for flushing out the channels leading to the drag chains. The installation saves approximately 1 million litres of mains water per annum and more than 70% of the water used on site in production and other processes is recycled.

Should the production of slurry exceed the capacity of the batching plant at any time the slurry is diverted to a filter press to be compressed into semi dry brick shapes that are disposed of at the dry recycling plant. A detailed article about the wet recycling plant can be found in issue CPI 4/2006.

Dry Recycling Plant

All waste, rejects and unsuitable products, bed end waste and hardened pieces beyond the capacity of the wet recycling plant are transferred by fork lift or skip to the site crushing plant. The waste is then reduced into smaller more manageable

production process. At present some of the material is being processed for resale as a Type 1 hardcore for ground works but the concept of the plant is that all waste materials are reused within the production processes ensuring that there is zero wastage.

Further information:



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