Masa GmbH, 32457 Porta Westfalica, Germany

Approaches to improve the product portfolio and the profitability using the example of AAC production plants

Difficult economic situations require intelligent solutions. Many manufacturers of AAC products try to achieve a certain compensation by extending their range of products. Another possibility is to improve the production sequence. Masa GmbH, a German mechanical engineering company, have the expertise to advise companies regarding useful measures, and they can also supply the equipment. The following examples shall illustrate some of the various possibilities to invest into an existing AAC production plant.

Extension of the product range

In many markets, demand has continuously shifted from traditional blocks to large-size elements. An extension of the existing machine equipment can help to react to these changed market requirements.

In recent years, many newcomers in the field of AAC production started with the intention to extend their production at a later point of time so that they would be able to manufacture large-size prefabricated elements in addition to standard blocks. The prefabricated elements comprise plane elements, lintels, roof,

Placement of the prepared frame with steel reinforcement elements in the aerated concrete compound.

wall and ceiling elements as well as room-high inside wall panels. Depending on local requirements, the prefabricated elements can be equipped with a steel reinforcement to comply with statics requirements.

The advantage for the AAC manufacturers mainly is the higher profit margin of prefabricated elements in comparison to blocks. The client benefits from efficient logistics on the building site. The structure of the building is completed faster, and a high output of square meter per hour reduces the costs for the building considerably.

Intelligent concept

Most customers decide to set up the AAC production plant in several phases. Thus, a smaller initial investment can be sufficient to give the start impulse for the project. In further steps, an increase of the production capacity or an extension of the range of products can be focused on. The complete project should be designed for long-term success. Therefore, Masa emphasize to consider all economic and ecological aspects in the conception and projection phase already.

In the Masa Vario Block line, sand (containing silicate), lime, cement, aluminium, water, and gypsum, if applicable, as well as additives are used to manufacture autoclaved aerated concrete blocks. When planning a new AAC production line, European standards such as DIN EN 771-4 (quality class TLMB) are used as quality standards for the AAC block products.

The bonding agents lime, cement, and gypsum are stored in silos outside the production hall, by the side or above the mixing tower. Particularly in the CIS, the bouncing technology has been established in Masa plants beside the casting technology common in Western Europe. For this technology, Masa developed a bouncing table in cooperation with engineers from Belarus 15 years ago already and could thus gain a lot of experience in many plants.

Plant extension in just a few steps

For the manufacture of elements with steel reinforcement, the existing Vario Block line is extended. In case the extension steps have already been considered in the original concept, the required modifications and the implementation of the additional plant components and sections can mostly be carried out while the plant is in operation. This means a considerable saving of time and money.

Step 1

A preparation area for the steel reinforcement cages is set up. The actual production of the steel reinforcement cages can be carried out in an additional manufacturing area. In many cases, however, it is more efficient to buy prefabricated cages. As autoclaved aerated concrete is an open-pored building material, the reinforcement elements have to have an anticorrosive coating.

Preparation of the reinforcement frames.

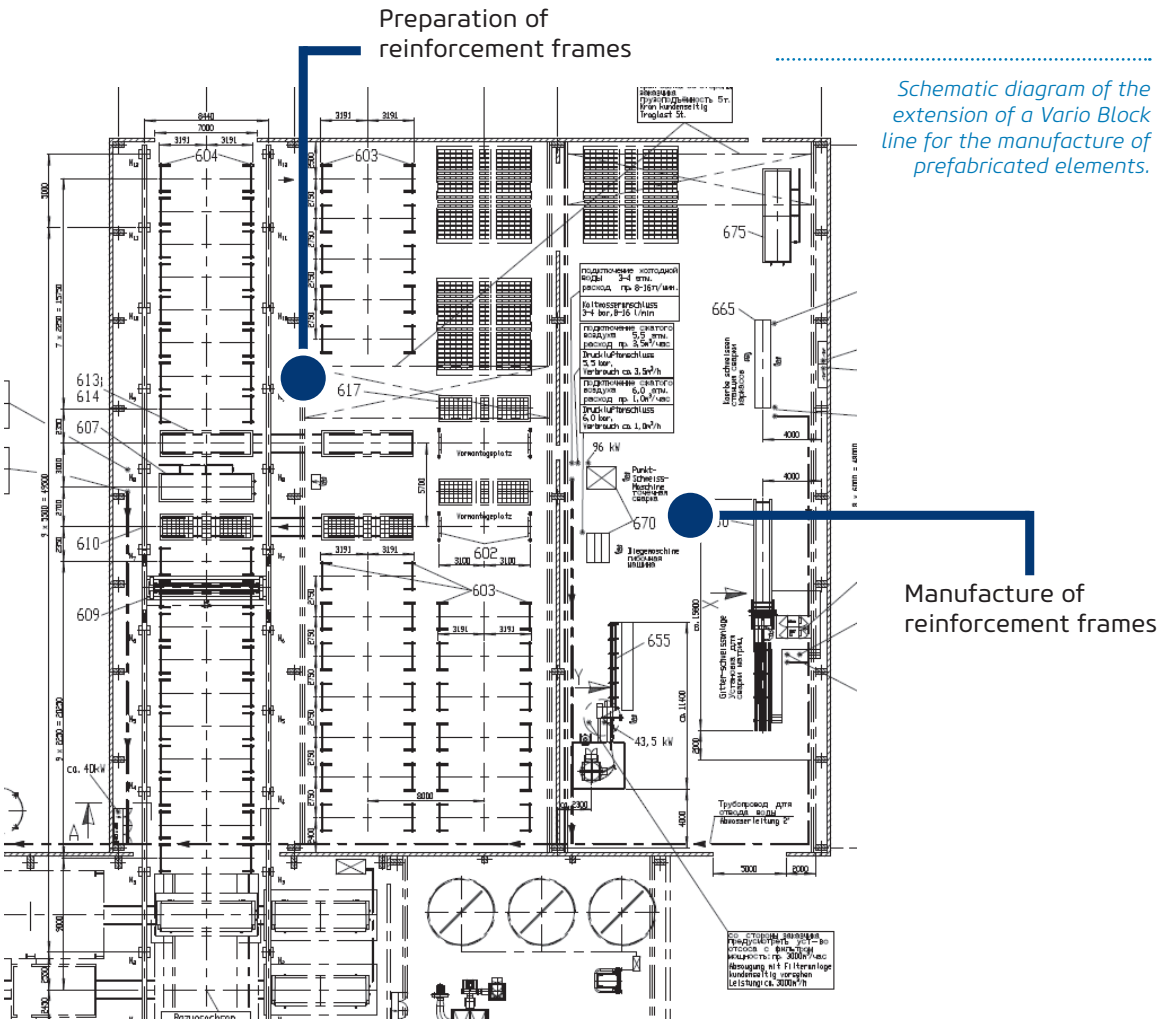
Step 2

Areas for the manual preparation of the reinforcement frames with the steel cages are set up. It is particularly important that the steel cages are precisely fixed to the holding needles. By means of a frame system with adjustable holding beams for needles, the reinforcement parts are exactly positioned for one mould.

Step 3

A loading and unloading unit are installed. This component serves to place the prepared reinforcement frames in the autoclaved aerated concrete compound while this is still fluid. This step is carried out immediately after the mould has been filled in the mixing plant. Centering elements installed at the frame and the mould provide for an exact positioning of the steel cages and thus for a high product quality. During the fermentation process, the frames remain on the moulds so that the reinforcement cages stay in their position properly. The fermentation area usually has a low ceiling height. This helps to improve the thermal balance and to reduce the energy consumption during the fermentation process.

When the fermentation process is completed, the loading and unloading unit takes the frame with beams and needles off the mould. The aerated concrete cake can now be transported to the cutting line by means of the existing transport unit. The steel reinforcement elements remain in the cake that is ready for cutting now.



Schematic diagram of the extension of a Vario Block line for the manufacture of prefabricated elements.

Filled mould in fermentation area.

The block transfer device of the Vario Block line passes the reinforced products to the separate packaging line.

Step 4

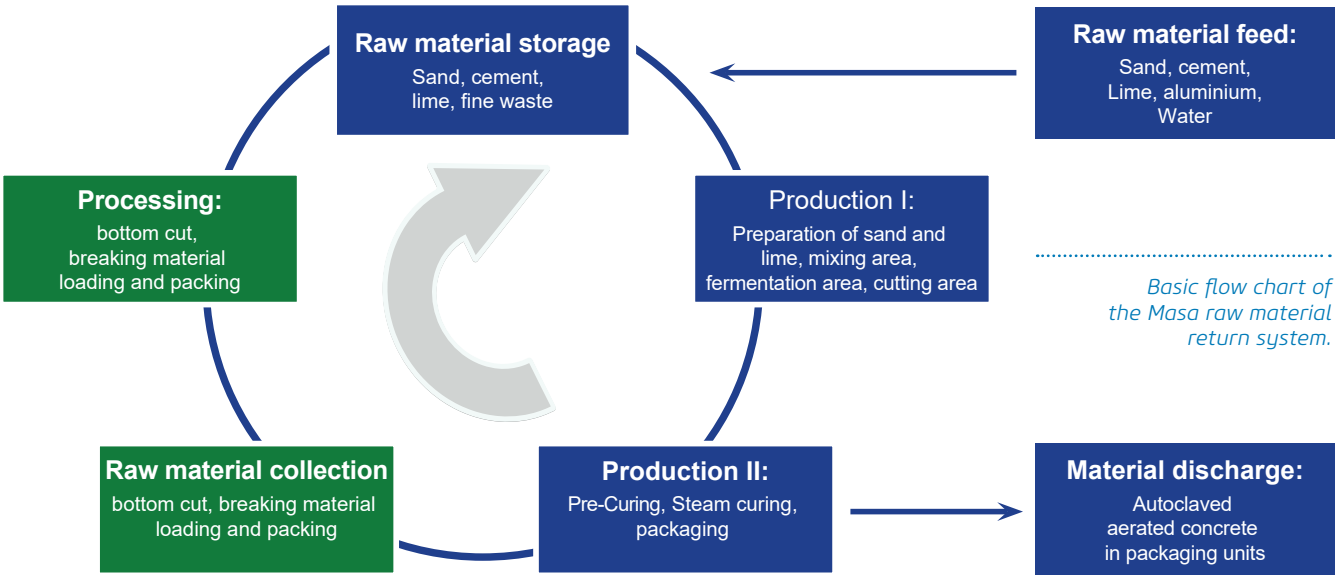
As the existing cutting plant of a Vario Block line is flexibly adjustable in any case, modifications are not necessary here. Various prefabricated elements can be manufactured.

Step 5

To achieve its final strength, the aerated concrete is hardened under steam pressure in autoclaves. For the hardening cycle, it has to be considered whether products with or without reinforcement elements are processed. Compared to the production of blocks, particularly the speed of pressure increases and pressure release has to be reduced. Thus, the complete hardening process is prolonged by approx. two to four hours. As the various autoclaving steps can individually be determined in the Masa autoclave control system, the conversion to high-quality reinforced products is quick and simple. For a profitable integration of the reinforcement unit into the production process, it is recommendable to manufacture at least one autoclave filling of reinforced products per day.

Step 6

When the hardening process is completed, the products are ready for use. They are transported to the packaging area. For the prefabricated elements,



Basic flow chart of the Masa raw material return system.

a separate packaging line is installed. The existing block transfer device can be used to position the products on transport pallets. This only requires a modification of the running track. The packaging process is carried out individually, depending on the products and local requirements.

This example of the extension of a mere block production plant to a plant with the possibility to manufacture reinforced products clearly shows that a small investment can substantially change the range of products.

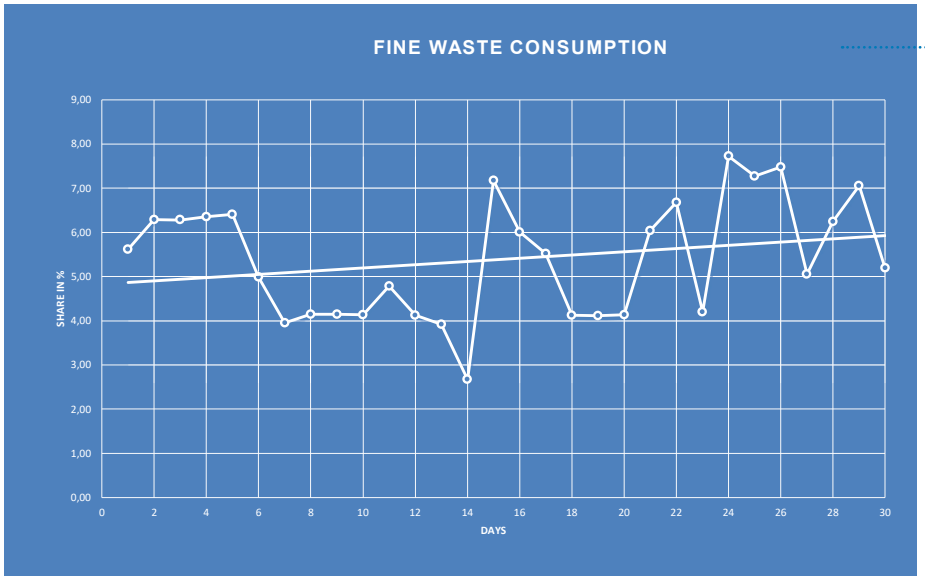
Improved efficiency

A careful and efficient consumption of raw materials leads to a higher efficiency of the complete plant. This has already been proven in many factories.

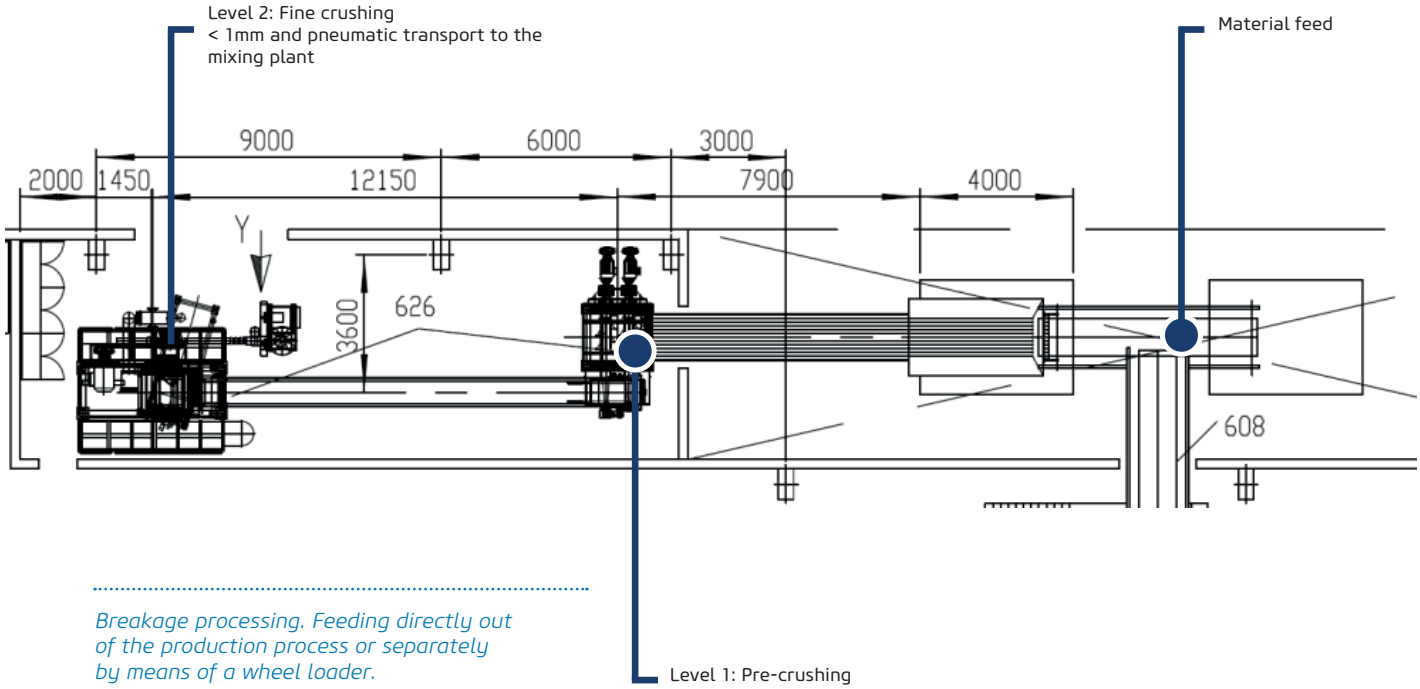
The complete utilisation of raw materials is an important criterion for the feasibility evaluation of an AAC plant project. The Masa Vario Block concept is based on a process that does not leave any waste at all. The waste generated in the cutting process is collected in a basin with integrated stirring device and reprocessed with water. This return slurry is then pumped into a return slurry tank and returned to the manufacturing process from there. The density of the slurry is monitored via the control system by means of a pipe loop weigher to make sure that the return slurry has a constant quality.

The return of breakage to the manufacturing process is considered as well. In a separate plant, blocks that are eg. broken during truck loading, or the bottom cut that is generated in the course of the production process are reprocessed.

In the latest Masa autoclaved aerated concrete block production plants, the cakes are autoclaved lying flat. In these cases, the green bottom cut is recycled right away. Thus, the reprocessing plant can be planned to be smaller.



Return of fine waste within a production period of one month. Depending on the product to be manufactured, various quantities can be processed.



Breakage processing. Feeding directly out of the production process or separately by means of a wheel loader.

Crushing plant for fine crushing of the material (level 2) and transport to an intermediate silo.

During production, usually a proportion of up to 10 % referring to the total quantity of solids (% by weight) can be added to the manufacturing process via the mixing plant. In some factories eg., approx. 5 % by weight of waste are used for the manufacture of products with a density of 500 kg/m³. This reduces the consumption of sand and bonding agents, and the production costs can thus be cut considerably.

Using the described measures to the full means that the complete autoclaved aerated concrete waste that originally could not be used anymore is recycled. No raw materials are lost. Many factories successfully work with this concept.

A Masa customer from Belarus who has successfully run an AAC factory for several years, comments on the concept for the use of raw materials as follows: „The return of broken blocks works very well. The processing of breakage material enables us to return – beside the bottom cut – waste material occurring during loading to the process. A clear economic advantage for us, as we can save a lot of raw material."

Another possibility to save resources – particularly in large AAC plants – is the immediate re-use of the steam that arises when the pressure is released. This can optimize and reduce the power consumption for the hardening process. This so-called direct transfer (the steam released from one autoclave is directly transferred into another autoclave to support the steam generating process there) can easily be carried out with the Masa autoclave control system.

Using a steam intermediate storage system can serve to optimize the energy consumption. Equipment required for this can be added to the factory equipment and the control system.

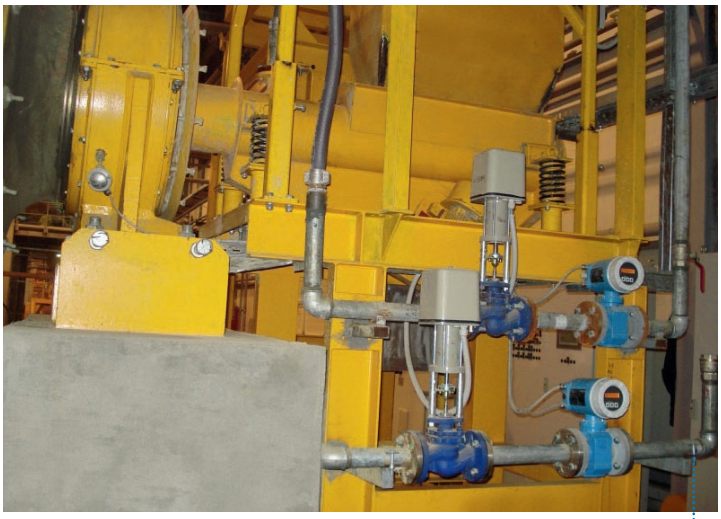
The produced condensate has to be cooled down before it can be used. In many plants, special heat exchange systems are installed so that the energy from the condensate can be used to heat up various plant sections. In many cases, this eg. serves as hot water for heating plants. When the condensate has cooled down, it can also be returned to the sand milling process. The maximum recommendable quantity for this has to be tested individually. Furthermore, the fermentation and rising process has to be monitored continuously, as the condensate is alkaline.

Reduction of the cement proportion

In recent years, Masa extensively researched the effect of a reduction of the cement proportion in the manufacture of autoclaved aerated concrete. For the reduction, the dual concrete mixing principle could successfully be implemented. For this method, the cement is specifically treated with water in a separate tank to achieve a certain activation of the surface of the mineral components in the suspension. The pre-processed cement is then fed into the main mixer to produce the aerated concrete mixture.

Extensive tests in the Masa Technology Center showed that it is possible to reduce the cement content by more than 10 % without negative effects on the physical characteristics such as the compressive strength. The tests also showed that the compressive strength can even be increased with pre-processed cement and a small reduction of the total cement proportion.

Early 2018, this system for the reduction of the cement consumption could successfully be implemented in a German factory with a Vario Block line. After its integration into the automatic sequence of the mixing plant, it turned out that the results of the Masa laboratory tests can be achieved in practice as well. An implementation of the Masa system for reduced cement consumption in existing plants can be carried out anytime. For new plants, this system can always be considered.



Precise control of the proportion of fresh water and condensate by means of two separate dosing units (flow measurement and regulating valve).

Suspension mixer installed in an AAC factory.