Kobra Formen GmbH, 08485 Lengenfeld, Germany

Current problems in the wear behaviour of concrete block molds

The building of new settlements and traffic areas in urban and rural spaces takes up approximately 80 hectares per day in Germany. The trend in construction is headed upward, both nationally and internationally (cf. Bundesverband Boden e.V. [Federal Soil Association]). This opens up numerous possibilities for their design. The trend is toward the development of new blocks with individual formats and designs manufactured from concrete. This presents concrete block manufacturing companies with the task of developing innovative and functional products. Along with the concrete mix design and machine settings, the manufacturing process revolves around the concrete block mold as the decisive tool.

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Production trends and wear development

The concrete block mold is a precision tool that combines numerous functions for the manufacture of high-quality products. The value of the manufactured product is lowered if the tool is defective. It is therefore essential to minimize the wear of concrete block molds.
As one of the world's leading mold producers, Kobra Formen GmbH offers not only the development and manufacture of concrete block molds, but also their maintenance and repair. Kobra has compiled a list of typical signs of wear and their causes. The following article is intended to give an overview of the most common sources of error and to explain the criteria moldfor determining whether a mold is reparable or irreparable.

Wear of the lower edge of the mold

The experience of Kobra service engineers shows that wear at the lower edge of the mold has decreased in recent years and occurs only very rarely today. The causes of such wear could be on the one hand mechanical, i.e. in the machine itself, and on the other due to various incorrect settings.

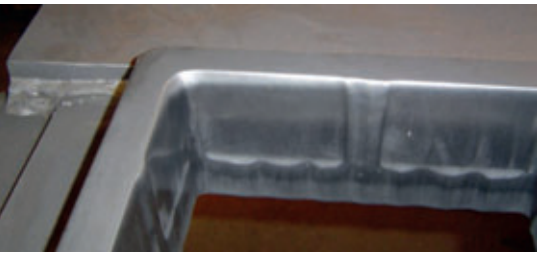

Figure 1: Checking for wear at the lower edge of the mold

Mechanically related wear can occur, for example, due to damaged rubber buffers on the vibrating table or broken bearings on the mold clamps. Cracks in the vibrating table, the machine frame or defective production boards can also contribute to higher wear, since the mold is subjected to greater stress. Thanks to regular maintenance, however, these defects are only found in exceptional cases in most concrete block plants.

Increased wear at the lower edge of the mold can also occur if the relationship between the vibration power and frequency settings is not balanced in the machine (i.e. not adjusted to suit the respective product), and the vibration is too strong.

A further interrelationship exists between the vibration power and the mold contact pressure. This must not be set too low, since otherwise the mold will lift up from the board and material will flow out. In this scenario, the concrete runs underneath the mold, which can wear enormously. If on the other hand, the mold contact pressure is too high, the mold will be overloaded and the vibration power of the machine absorbed. Therefore a product-related co-ordination of vibration power and contact pressure is necessary.

Ultimately, the type of materials used also plays a decisive role. Strongly abrasive material contributes more to wear than finer-grained aggregates.

Wear at the upper edge of the mold

Wear at the upper edge of the mold occurs much more frequently and can similarly be attributed to various causes. A central aspect here is the centring of the mold in the machine. To date there is no system on the machine side that can optimally align the mold and keep it in this position during the production process. Kobra molds exhibit a play of four tenths of a millimetre on all sides between tamper shoe and stone cavity in order to ensure the smooth plunging of the tamper head into the moldmold cavities. In order to keep the mold centered during the manufacturing process, however, there is at least a distance of 1 mm on all sides in the machine, depending on the make - larger than the gap between tamper shoe and stone cavity. The result can be one-sided loading of the mold, since the lateral forces move the mold and the tamper shoes thus moldmake contact with the tops of the cavity walls each time they plunge into the mold during the compaction process.

Since consistent centring cannot be guaranteed on the part of the machine, this type of wearing should be checked on a regular basis. One measure to reduce such wear is the periodic replacement of the plastic strips moldthat assist in keeping the mold bottom centered in the machine.

One of the internationally observable trends in the concrete block manufacturing

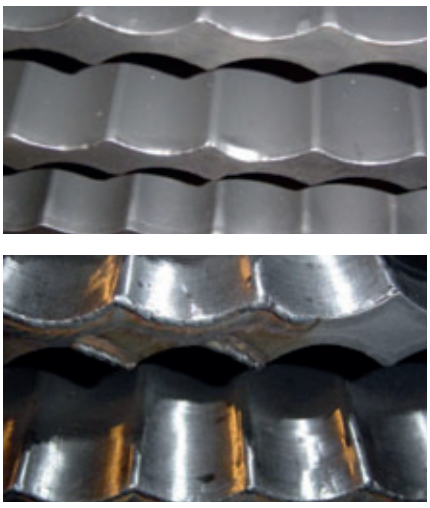

Figure 2: Build-up welding of the lower edge of the mold – before and after

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KOBRA set a new quality standard as the first manufacturer to offer a modular mold construction over 20 years ago.

The bolted mold assembly was developed by Kobra to allow for fast and easy replacement of wear parts on concrete block molds.

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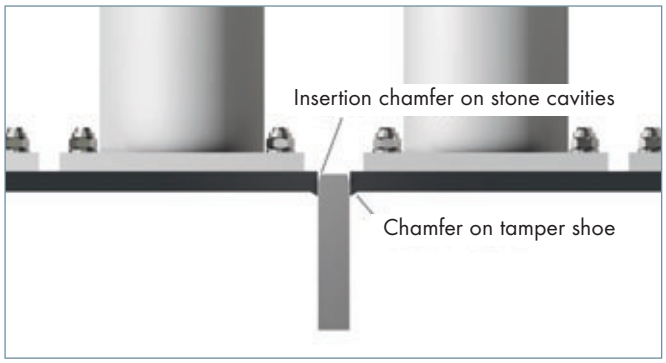

Figure 3: Mold with normal excess mold height

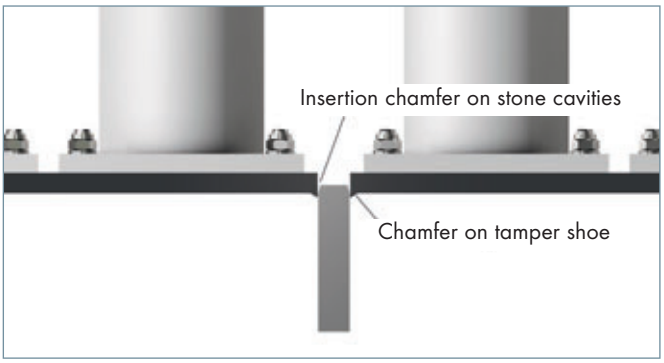

Figure 4: Mold with low excess mold height

process is production with a small excess mold height. The normal excess mold height according to Kobra standard can be explained by the following example:
A concrete block is to have a height of 80 mm and a shoe chamfer and insertion chamfer of 4 mm each. The mold height is 92 mm. Therefore, due to the difference between the block and mold heights, there is a circumferential insertion depth of 12 mm, which can adequately dissipate the forces created from the tamper head to the mold during main compaction.

If the block height including the chamfer and insertion chamfer is the same, but the mold height is now only 88 mm, the circumferential insertion depth is only 8 mm high during main compaction. Wear is increased because less area is available to dissipate the forces.

If the production settings provide for overfilling of the mold, the tamper shoes 'swim' on the concrete before plunging into the stone cavities when the tamper head is lowered during the compaction process. Characteristic in this case is one-sided wear at the upper edge of the mold during main compaction if the aforementioned centering of the mold in the machine is not ensured. The tamper shoes strike against the stone cavities and damage the chamfers. At this moment there is no centering or guiding between mold and tamper head and as a result, the wear at the upper edge of the mold may be too great for a repair to be viable.

If the wear is as advanced as shown in Fig. 5, there is no possibility to perform a build-up weld on the upper edge of the mold since the heat affected zone around the welding seam is too high. The hardness moldnecessary for long-term production is lost. A repair, which can be very complex and thus highly expensive, is only of short-term benefit, since heavy wear typically occurs next to the welding seam. In addition, the stresses induced due to the heat input during welding can result in an increased risk of cracking.

If no repairs are carried out to the upper side of the mold because the damage is only minor, then the tamper shoes must be separately adapted to the changed dimensions of the stone cavities. The tamper shoes are aligned at the narrowest point in the mold cavity with the aforementioned circumferential play of four tenths of a millimetre. This results in a significantly greater tamper shoe play in the worn areas of the stone cavities, which in turn can lead to sharp protruding edges on the block. The possible replacement of the tamper shoes by trained technical personnel should be considered in order to ensure constant quality of the concrete blocks.

Many of the listed causes of wear in concrete block molds, which are precision tools, can be attributed to the poor and impermanent centring of the mold in the machine; this is important for a high-quality end product however.

Against this background, Kobra developed the mold-based compulsory centring known as »Headguide™«, which has been successfully used for years. Headguide guarantees a circumferential play of two tenths of a millimetre, so that the tamper shoes and stone cavities cannot touch each other. Thanks to the special design of the centering bushing, the mold can move more freely in comparison with solutions from other manufacturers, but is at the same time consistently guided. The wear of tamper shoes and the upper edge of the mold is greatly minimized, since the guide bolts of the compulsory centring ensure precise plunging of the tamper head into the moldmold cavities. In addition, metallic abrasion and thus the so-called bloom formation are avoided. Nevertheless, the regular checking and correction of the machine settings is important, since Headguide cannot correct improper machine settings.

Kobra is interested in the overall process of moldmold use in the machine and in close co-operation with the customer. Therefore, all service engineers assess mold reparability according to economic considerations and in relation to the quality of the end product. If mold components are classified as irreparable, a modular moldmold construction enables Kobra to offer the uncomplicated replacement of wearing parts. This can take place at Kobra or on site in the concrete block plant.

Figure 5: Heavier wear at the upper edge of the mold

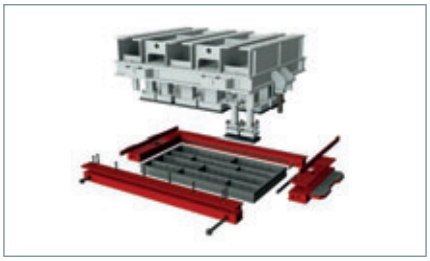

Figure 6: Modular mold system from Kobra with »Headguide™« compulsory centering system

In addition, Kobra has developed a system in which all feedback concerning the use of the mold is recorded, enabling conclusions to be drawn regarding possible improvements. Engineers, designers, production technicians and sales employees work closely together in order to offer the customer the best possible service in the after-sales phase and to minimise damage-related production losses. Kobra aims to form partnerships with its customers and offers much more than the manufacture of a tool. Support and transfer of knowledge from the development and manufacture of a concrete block mold through to its use are decisive tenets of Kobra's philosophy, which it has successfully applied worldwide for almost 25 years.

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