SR Schindler, 93057 Regensburg, Germany

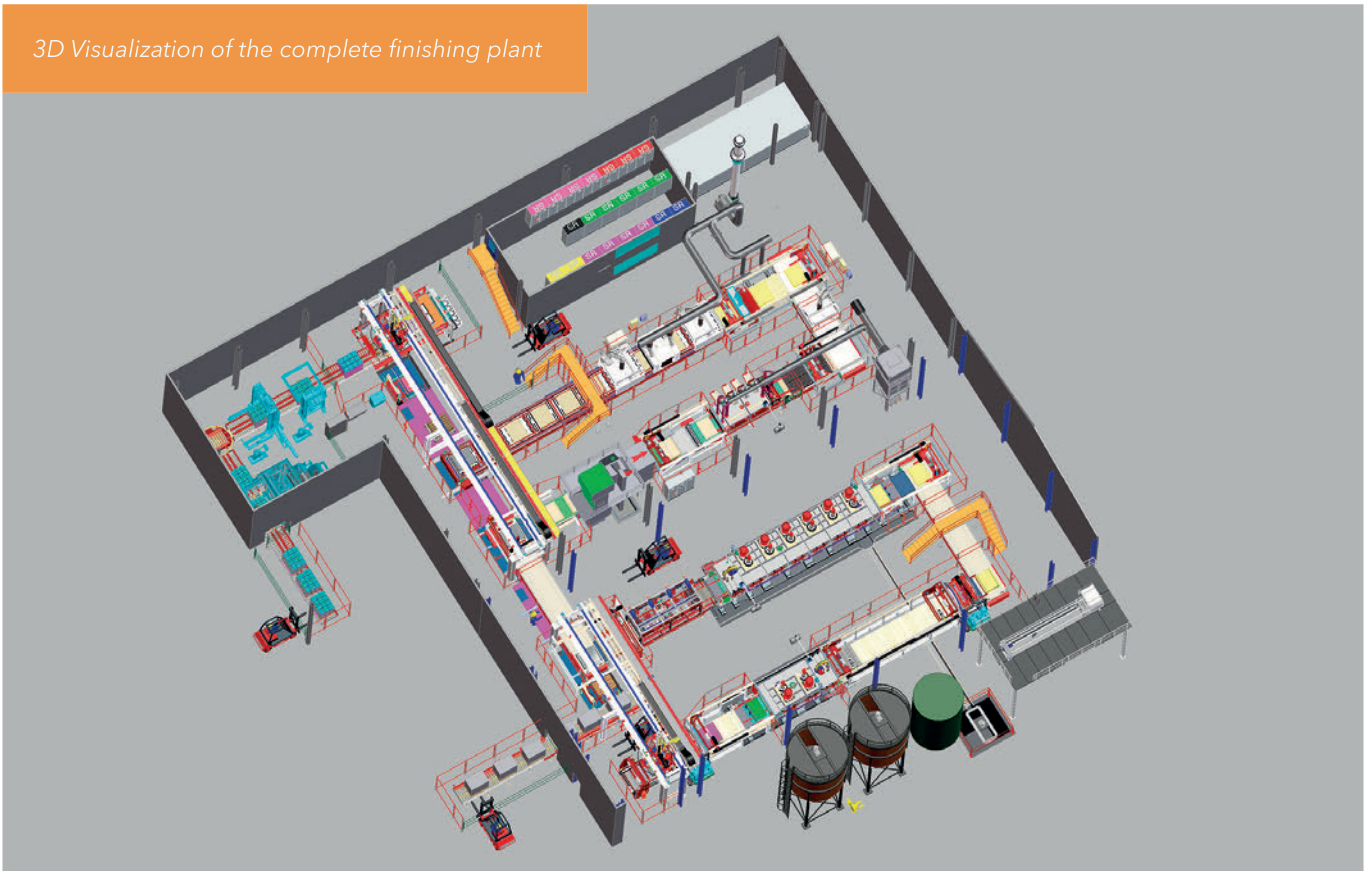
# Stand-alone Surface Finishing in Kazakhstan

**The first meeting between Avers and SR Schindler took place in December 2019 at the ICCX Russia in St. Petersburg. The company, Avers, from Kazakhstan, visited the booth of Topwerk Group and expressed immediate interest in the finishing of concrete blocks. Both parties exchanged relevant information and arranged a tour to Germany for spring 2020. Fortunately, this planned trip was timely in that it was before entry and travel bans due to the Corona pandemic. Ilya Andreadi and Nikolay Popandopulo of Avers came to Germany to visit several SR Schindler-equipped finishing plants in March 2020. So convincing were these visits that work began immediately on proposed design layout and quotations. Final discussions were completed at SR Schindler in Regensburg as early as September 2020, and the contract for a stand-alone surface finishing line was signed on Oct. 19, 2020.**

A dedicated new building was constructed adjacent to an already existing building to accommodate the finishing line and water recycling systems. Because the existing building had limited space and other obstacles, the new building and the surface finishing line had to deal with these limitations. The products are loaded and unloaded by two-layer stackers, each with a carriage with an electric motor-driven 4-sided gripper. Both stackers are installed in a line on the same side. The calibrating-grinding line and the shotblasting-curling-coating line are therefore both U-shaped. To allow for only one packaging line, the calibrating-grinding line and the shotblasting- curling-coating line operate independently but not at the same time. Either the products pass through both lines in combination, or only one of the two lines is used for production and subsequent packaging.

The working width of the line is 1,200 mm. The smallest single stone within a layer measures 100x100 mm. All products have spacers. The products are transported in packs on transport pallets on a heavy-duty roller conveyor to the de-stacking position. There they are taken layer by layer from the 1st layer stacker and placed on the hydraulic lifting table of the calibrating-grinding line or an apron conveyor. The apron conveyor transports the layers to the infeed position of the shotblasting-curling-coating line.

*3D Visualization of the complete finishing plant*



*Calibrating machine with drum turners*

The empty transport pallets are removed via an angular transfer and brought to the underfloor empty pallet transport via a lifting/lowering table. At the end of this empty pallet transport, another lifting/lowering table brings the empty transport pallets back to the top, and via an angular transfer, to the loading position. After quality control, all finished product layers - regardless of which finishing process they have passed through - are reassembled into packages exclusively at this position and then packaged. The transport pallets can also be stored on the approx. 16 m long underfloor empty pallet conveyor. Another backup position is located on the 0 level.

## Calibrating-Grinding Line

The hydraulic lifting table moves from the home position upwards towards the gripper of the layer stacker. After taking over the layer, the lift table lowers and a layer pusher pushes the layer into the downstream hydraulic drum turner to turn the layer by 180°. The lifting table prevents a collision between the layer pusher and the gripper of the layer stacker, the calibrating-grinding line is thus decoupled from gripper of the layer stacker.

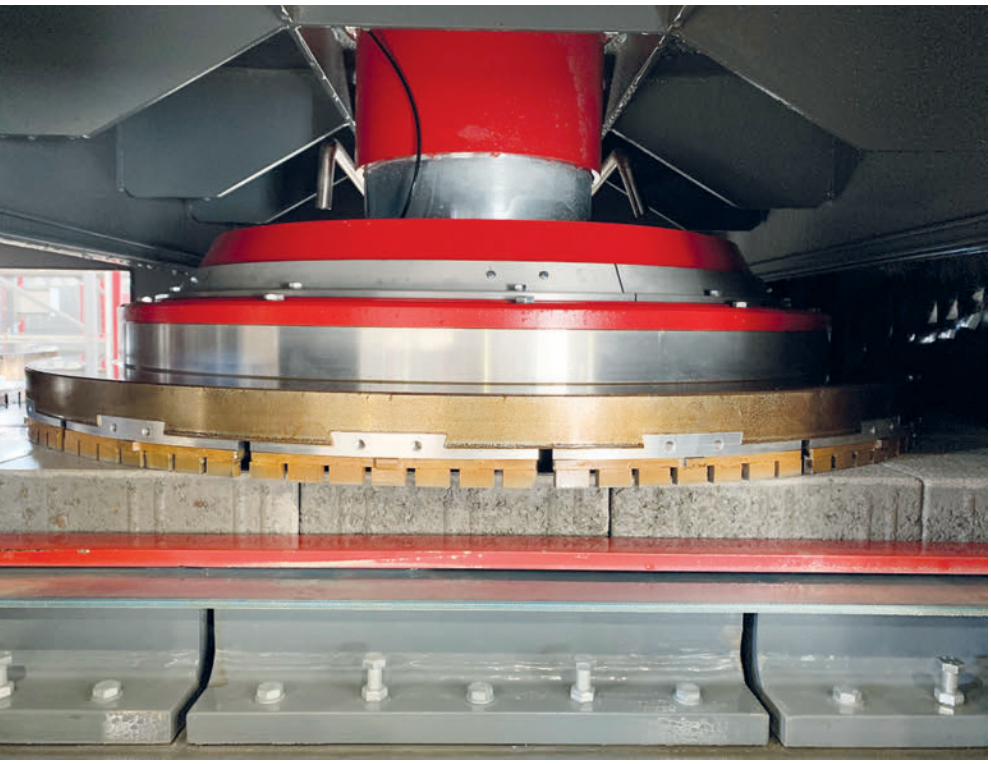
*Grinding machine*

After the 180° turning process using the drum turner, the back-mix concrete side can then be calibrated to eliminate production-related tolerances, such as conicity or variations in product thickness. For this reason, the individual layers are pushed out of the drum turner and transferred to the calibrating machine by a subsequent layer pusher in an endless row. The calibration is done in the wet process, using 2 grinding discs with diamond milling segments rotating around the vertical axis. The grinding discs are driven by an electric motor with frequency control and are motor-adjustable in height.

The products leave the calibrating machine in endless row and need to be formatted into individual layers again so that they can be turned by 180° again in the 2nd drum turner and the face side then points upwards for the grinding process. For this purpose, the products are pushed from the calibrating machine in an endless row to a non-driven roller conveyor. The subsequent layer pusher has 2 carriages. The 1st separates a layer from the continuous row and pushes it onto a table. From there, the 2nd carriage takes it over and moves it into the drum turner, at the same time, the layer in the drum turner is pushed to the following conveyor.

The slat conveyor is arranged at a 90° angle to the calibration section. It transports the layer to the subsequent transfer position, from which the next layer pusher inserts the layer in an endless row into the grinding machine with 6 stations. The grinding section runs parallel to the calibration section, in opposite feeding direction. The grinding is also done in a wet process. The necessary water treatment was provided by the customer.

During grinding, the visible side of the product will be smoothed, and the grain cut open, creating a visually appealing and pleasing-to-the-touch surface finish. Depending on the desired surface appearance, the number of processing stations can be varied. For example, a product that is to be shotblasted after grinding does not have to be processed with all 6 stations of the grinding machine. Depending on the mixture and the aggregates used, 4 stations are often sufficient to create the best appearance.
The tools used are milling tools set with industrial diamonds and smoothing and grinding segments. All tools are mounted



*Grinding station with diamond milling segments*

*Ground products and on the opposite side the calibrating machine*

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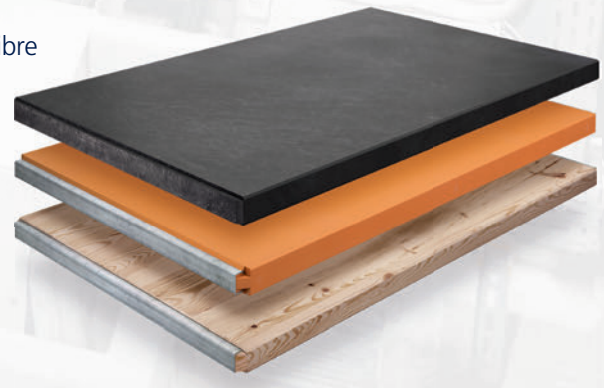

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on universal plates. All segments have dovetail guidance plates and can be replaced quickly. Due to the interchangeable plates and the frequency controls on all stations of the calibrating and grinding machine, all stations can be used universally.

After processing in the grinding machine, the products have to dry, so that they can either be further processed in the shotblasting-curling-coating line, or, packaged immediately after grinding. An enclosed drying line with a total of 10 high-performance blowers mounted above and below a conveyor ensures the necessary drying process. The rollers of the conveyor also break up the endless row, and a downstream layer pusher transfers the layers to a slat conveyor where visual quality control is performed. Here, any 2nd choice products are effectively replaced by 1st choice products. Afterwards, the controlled layers are conveyed on the apron conveyor to the infeed position in the shotblasting-curling-coating line or the pick-up position by the 2nd layer stacker. Ground products that are not to be further processed and are to be packaged immediately after grinding are picked up from this position by the carriage with an electromechanical 4-sided gripper of the 2nd layer stacker. The carriage then moves the layers to the waiting empty pallet for shipping cube formation.

## Shotblasting-Curling-Coating Line

The input is performed via a layer pusher, which transfers the products layer by layer from the apron feeder to the shotblasting machine. There, fine cement particles are removed from the surface of the concrete products, thus partially exposing architectural aggregates, such as granite inclusions. Shotblasted surfaces are characterized by high visual and tactile quality and slip resistance.

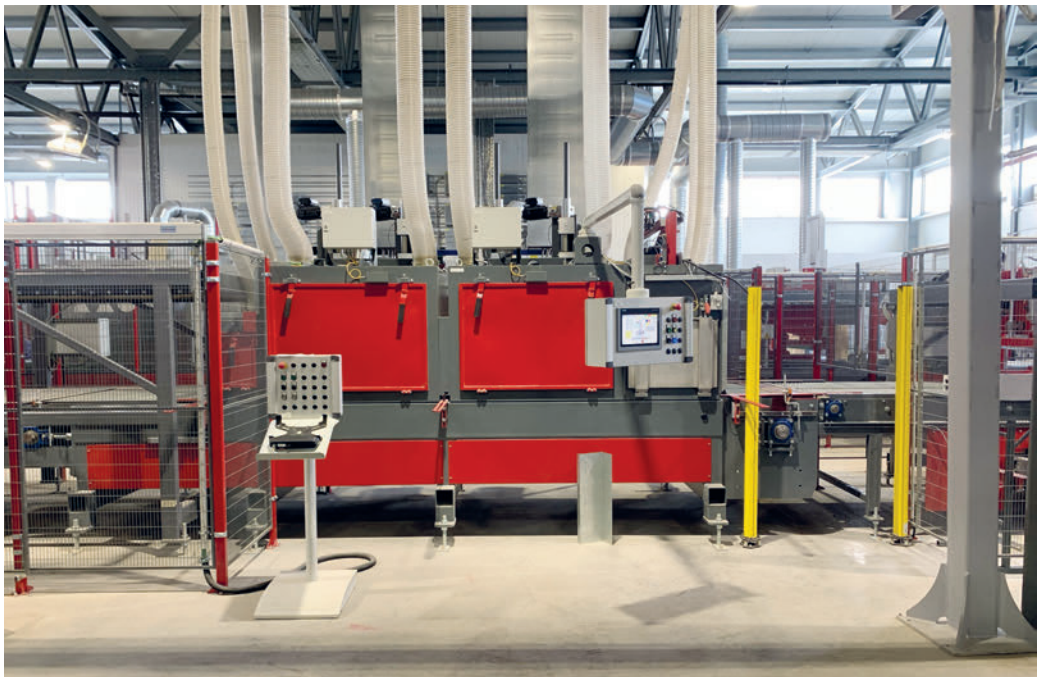
In the shotblasting machine, steel, or stainless-steel balls with a diameter of 0.6 mm to 0.8 mm are hurled onto the product surfaces by special turbines. The products that need to be shotblasted are placed on a perforated conveyor belt during processing and are cleaned after the shotblasting process with the help of a blow-off station. The abrasive balls fall through the perforated belt, get collected, cleaned, and fed back into the process. Any dust generated during processing is extracted by a filter device mounted on the machine.

At the output of the shotblast machine, the individual layers are assembled by means of a layer pusher into a continuous row and further processed in the subsequent curling machine.

The curling process removes any excess cement from the product surface. The grain in the surface is polished by the electrically height-adjustable and frequency-controlled curling brushes rotating around the horizontal axis. Curling is particularly suitable for structured surfaces because the structure is retained, and the flexible bristles allow processing in deeper areas. For products that need to be coated, curling is an indispensable upstream process step because it removes the residual dust on the surface using high-pressure cleaning.

The curling machine is equipped with two processing tunnels, each with two brush rollers. The brushes, which are arranged at an angle of several degrees, rotate alternately in opposite directions, thus avoiding line marks on the product surface. A separate filter system ensures virtually dust-free air in the hall. In both the shotblasting machine and the curling machine, the dust-laden air is not transported outdoors through pipes but cleaned by means of sinter lamellas and returned to the hall. This prevents cold air from entering the hall.

On a subsequent accumulating roller chain conveyor, the endless row is opened, and quality control is carried out. Defective products are removed from the product stream by the operator and replaced by defect-free ones. A stopping system integrated into the accumulating roller chain con-



*Curling machine with control panel on swivel arm*

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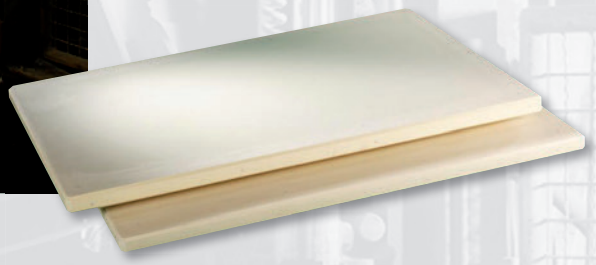

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veyor separates the ongoing continuous strand into layers, and a layer pusher transfers the individual layers to an apron conveyor. The apron feeder is arranged at right angles to the shotblasting-curling line. An electric motor-driven and height-adjustable infrared preheating tunnel is mounted on the apron conveyor. Depending on the chemicals to be used, it heats the products to be coated to approx. 30°C and ensures better adhesion of the primer. A downstream temperature sensor checks whether the desired temperature has been reached.

At the end of the slat conveyor, a layer pusher transports the products onto a special conveyor, spraying the layers with the primer simultaneously. The layer pusher is equipped with 2 carriages - carriage 1 pushes the layers onto a transfer table, from which carriage 2 takes over the layers and transfers them to the special conveyor. When carriage 2 reverses (when picking up the layer), the primer is sprayed onto the layers using nozzle bars.

The special conveyor is an approx. 18 m long construction with Hardox plates and surrounding sliding beams for layer-by-layer transport. The conveyor is self-cleaning.

An infrared heating tunnel for drying the primed products, a spraying module for applying the sealer, and an infrared heating tunnel for drying the coated products are positioned linearly above the special conveyor. The 3 heating tunnels, which can be moved by an electric motor, are identical in design and are each equipped with 6 heating cassettes, each with 7 infrared lamps. The special conveyor runs parallel in the opposite conveying direction to the shotblasting-curling line. The spraying units are designed for solvent-free coating agents.

Nikolay Popandopulo:
*"I have never seen such beautiful machines".*

After coating, the respective layer is moved by the sliding beam to the pickup position and picked up there by the 4-sided gripper of the 2nd layer stacker and placed on the waiting transport pallet. With a combined layer pad dispenser, a protective film can be inserted between the individual product layers or granules can be sprinkled in, and a film can be placed on the top package layer. The changeover between the respective media takes place automatically. The product packages protected in this way on transport pallets now run through the individual packaging stations on a heavy-duty roller conveyor. They are first strapped horizontally and then vertically. Afterwards, the finished packages are finally covered with a plastic hood, which is printed with the company logo, by a hood crusher to protect them during transport.

A Siemens S7-1500 control system in a total of 21 control cabinets controls the entire finishing line. The control cabinets are all placed on a platform provided by the customer according

*Special conveyor of coating line*

*Spraying tunnel*

to SR Schindler's proposals. For the plant operation, there are 9 operator panels - one each for calibrating machine, grinding machine, shotblasting machine, curling machine, heating tunnel, spraying, horizontal strapping, vertical strapping, hood stretcher, and the complete plant (main HMI). For the main machines, these are stationary Siemens touch panels mounted on swivel arms on the machines, mounted on pedestals, or designed as operator panels. An industrial PC mounted at the designated workstation is used to control the entire line and for recipe management. 3 wireless tablet PCs with Wi-Fi connections are also used to control the entire line. The line can be accessed online via a VPN router and support can be provided in case of problems.

The mechanical safety systems (doors, fences) were provided by the customer according to SR Schindler's specifications. Correct implementation and installation were checked by SR Schindler locally. SR Schindler was responsible for the design and implementation of the fail-safe electrical safety system. The overall plant is divided into 18 safety areas, thus allowing partial shutdown of individual areas without blocking production in other areas.

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