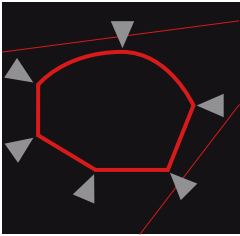


USE OF LASERPROJECTORS FOR PLACING PARTS ON CIRCULATING PALLETS - APPLICATION REPORT

MANUFACTURE OF PRECAST CONCRETE ELEMENTS





LASER PROJECTORS INCREASE ACCURACY WHEN PLACING COMPONENTS ON CIRCULATING PALLETS AND LOWER COSTS

Demands are growing constantly in the manufacture of precast concrete elements: walls and floors are becoming more complex, delivery times shorter and changes 'at the last minute' more frequent. Nevertheless, the customers of precast factories have a right to expect that quality and dimensional accuracy will still be maintained. In the Bürkle concrete works, laser projectors simplify many of the work processes involved in the manual placement of formwork elements and built-in components on the circulating pallets. They create 'visual templates' on the working surface that make fast, exact positioning of the parts possible and ensure the dimensional accuracy of the finished elements.



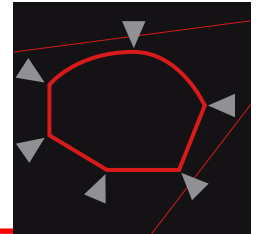
The projector is mounted at a height of around nine metres above the crane track at the first placement station

In the manual placement of components on circulating pallets for precast concrete elements, exact positioning is of crucial importance. The positioning of built-in components – for example, electrical sockets or screw sleeves – as well as the cutouts for doors and windows must be marked exactly in order to ensure the dimensional accuracy of the finished elements. However, the manual measuring and marking of geometries is elaborate and prone to errors – especially in the case of complex contours.

The Bürkle concrete works in Sasbach in Baden-Württemberg is already one of the most modern precast plants in Europe. Most sequences are integrated; the control of the circulation and of the placement of components as well as material planning are linked to one another and communicate with one another automatically via a computer system. With 75 circulating pallets, the factory achieves a cycle time of 10 minutes on average.

LIGHT REPLACES MECHANICAL SYSTEMS

The manual placement of components on pallets has always been a source of error. Bürkle had already replaced manual measurement by a mechanical plotter several years ago. It was attached to the formwork robot, but had severe disadvantages. An accuracy of one to two millimetres was only realisable with difficulty due to the width of the spray jet alone. Not only that, the plotter took up the formwork robot's time, hence reducing the throughput of this bottleneck machine. In addition to that, it caused high operating and



A clearly visible laser line marks the target position to the exact millimetre and facilitates precise working

maintenance costs on account of the highly-stressed mechanical parts. The ink also created problems: if it was diluted too much it did not adhere to the pallet. If it was too thick, the plotter drew lines that were too thick and positioning to the exact millimetre could not be achieved. In addition to that, the nozzle became blocked from time

to time. This meant that there was a risk of parts not being installed because the corresponding position was not marked.

A further disadvantage was that the ink had to be wiped off the pallet before the adhesive for the built-in components could be applied. It was then no longer possible to

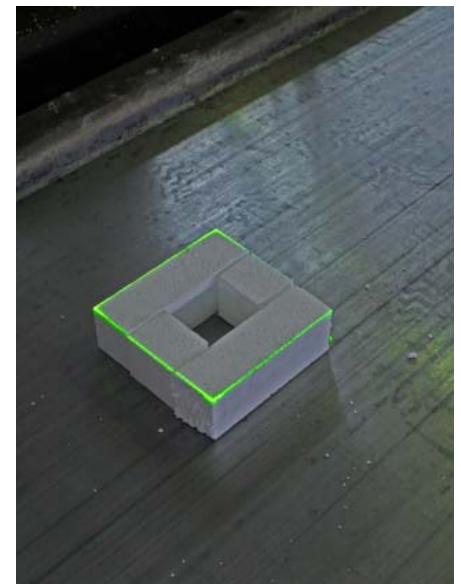
double check whether or not the position was correct.

Therefore Bürkle was looking for a solution that would guarantee precise and complete placement of components on the circulating pallets.

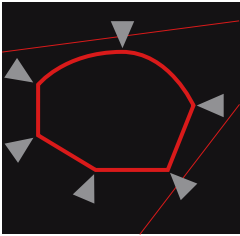
PRECISE AND COMPLETE

The new CAD-PRO 2D laser projectors by LAP offered a welcome alternative here: they project the outlines of all built-in components onto the formwork table to the exact millimetre and 'at the speed of light'. They are virtually maintenance-free and don't 'forget' any parts. Not only that, they do not take up the formwork robot's time.

Bürkle installed three laser projectors by LAP at two of the stations in the circulation: one at the placement station immediately behind the formwork robot and two at the placement station at which the built-in components for complex wall elements are inserted. This station was set up in order to give the employees more time to install the components for com-



It can be seen at a glance whether or not the part has been installed correctly



plex wall elements but still maintain the cycle time of about ten minutes.

The formwork robot places the magnets and supports automatically at the beginning of the circulation. After that the pallets are transported to the first placement station. The

laser projector, which is mounted under the roof and above the crane track at a height of around 9 metres, images all built-in components here. These are, for example, the positions of the supports and the cutouts for doors and windows, the positions of the electrical sockets and conduits, and the positions of all

reinforcing elements and the lifting anchors. In the case of double walls, the second shell can be projected here in advance in order to check whether or not the two shells will coincide with one another when joined together. In addition to this - similarly for the purposes of checking - the entire reinforcement can be projected. The workers can thus see at a very early stage whether or not built-in components and reinforcement interfere with one another.

The work sequence is very simple. As soon as the circulating pallet arrives at the formwork station, its correct position is checked with the aid of reference points (targets). Once the position of the pallet has been determined, the projectors image the outlines of the cutouts and built-in components as clearly visible laser lines on the working surface. The workers need only place the parts at the marked positions.

The software takes into account that built-in components can be of different heights and projects the outlines so that they can fit precisely to the top side of the elements.

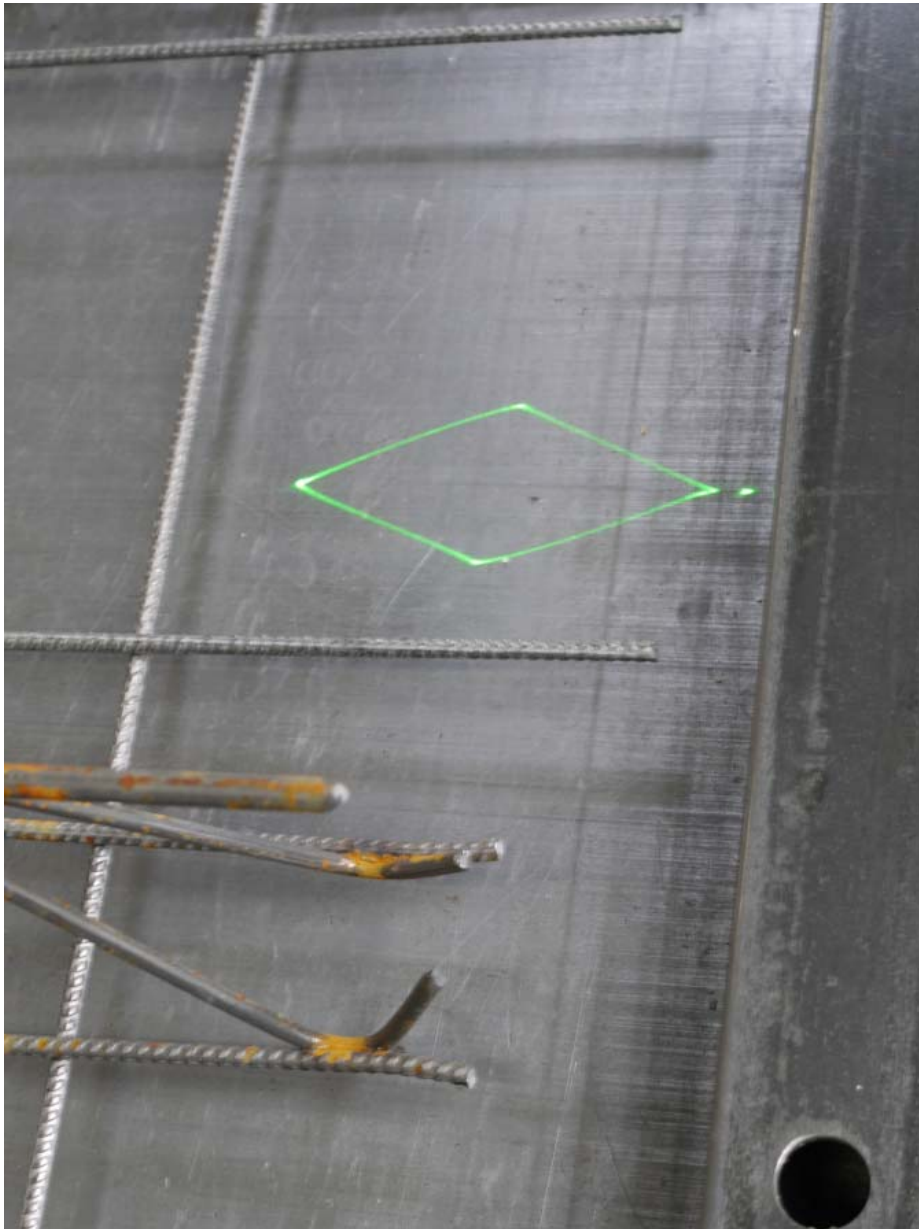
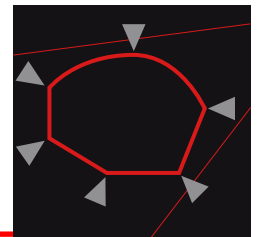
The height of the hall is only around 5 m at the second station. Two projectors are used here whose images overlap one another. The software takes that into account and projects a closed picture.

TIME SAVED, QUALITY ASSURED

The balance is absolutely positive after some two years of operation. The two top goals of saving time and assuring quality have been achieved with no trade-offs. Just the gain in time for the formwork robot, which now no longer needs to plot, ensures that Bürkle can easily maintain the average cycle time of ten minutes, even for more complex elements. Added to that is the accuracy: the laser projectors work to the exact millimetre; all parts are positioned precisely.



The software compensates for the different heights of built-in components



The position of the lifting anchor is also illustrated

A short glance at the populated pallet before it leaves the placement station is sufficient to check that all parts are present and are positioned correctly.

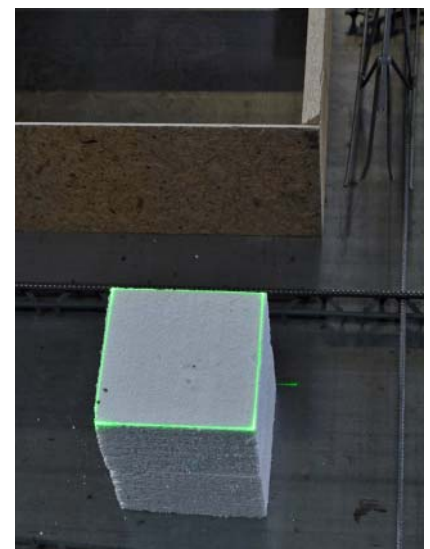
The conclusion is convincing: placement of components can be ruled out as a source of error. There are virtually no more complaints

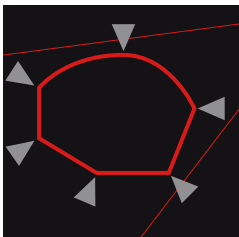
with regard to missing or falsely positioned built-in components. The plotter on the formwork robot was dismantled months ago.

A further advantage of the projectors is the simplicity of the work processes: manual measurement with all of its sources of error is dispensed with; the employees don't even

have to look at drawings. They just place the elements where the laser shows them. The employees accepted the new system immediately after it was commissioned, because it makes their work simpler and less prone to errors.

The projectors still provide benefits even after the precast element has left the factory. In the case of discrepancies - for example, if a drawing was used that was not the latest version - all images can be projected again at any time in order to find the cause of a complaint. The laser is right in the overwhelming majority of cases.





FUNCTIONAL PRINCIPLE

In order to project an outline onto a surface, two rotatable, electrically driven galvanometer mirrors divert a laser beam. The laser spot moves with such a high velocity over the working surface that the impression of a still picture is gained.

The outline to be projected is relayed to the system from the design via the placement computer in the form of CAD data. A digital signal processor creates the control signals

for the galvanometer mirrors from this data. A projection workstation essentially consists of the projectors and an operating PC with the projection software.

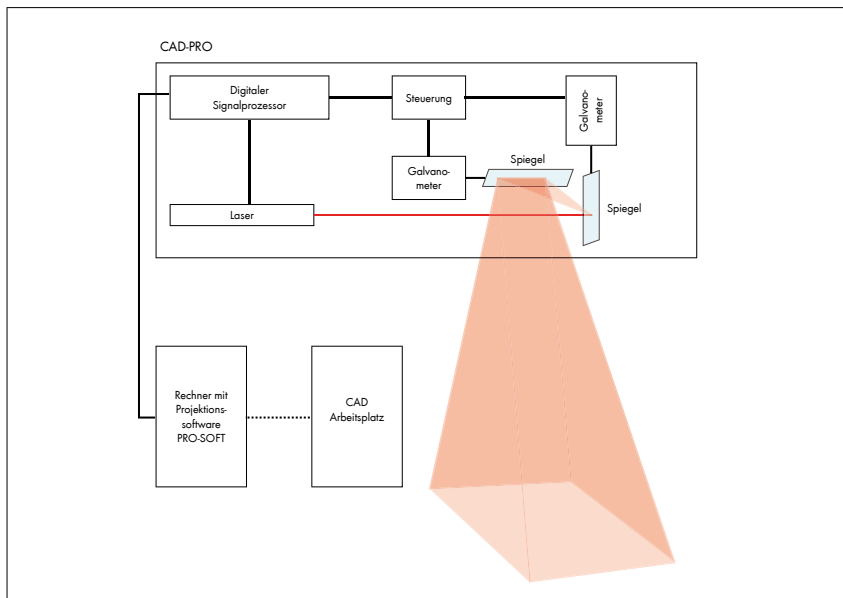
The output power of the laser is only around 5 W; the systems are therefore assigned to laser class 2M. For the user, this means that the laser area only needs to be identified by a warning notice. It does not need to be cordoned off, protective glasses are not necessary and the user does not need to appoint a laser protection officer. Dependent on requirements and ambient conditions laser modu-

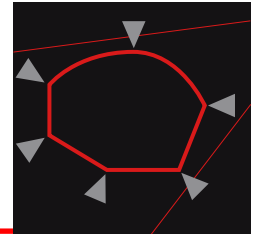
les with higher power are also available.

Following installation, a basic calibration of the system with at least four fixed reference points (targets) is performed manually. The calibration is checked automatically during day to day operation, at least once per day.

SUMMARY

Laser projectors are increasingly replacing the mechanical plotters that have been used up to now for the placement of components on circulating pallets for concrete precast elements. They project the outlines of cut-outs, built-in components and reinforcing elements as laser lines with accuracies to the exact millimetre on the formwork table. They ensure that the built-in components are positioned quickly, precisely and completely on the pallets. The placement of parts has been eliminated as a source of error at the Bürkle concrete works.





ABOUT LAP



For more than 25 years LAP has been developing, manufacturing and distributing laser measurement systems, line lasers and laser template projectors for industrial and medical applications.

LAP offers standard components and customised solutions. Components as well as complex systems can be designed according to customers requirements. LAP provides the planning, development, construction, programming and production to the point of commissioning and service.

Laser projection systems generate points, lines, crosses or free designed outlines, like true to scale CAD shapes. The well visible red or green laser lines are used to place or justify products or parts. The placing of high-tech carbon fibre parts in aircraft and automotive manufacturing is an important application area for laser projection. But also in other industries, like wood-working, textile and tire industry or for the manufacturing of precast concrete elements or rotor blades for wind power plants, laser projectors are used.

LAP has become a world leader in lasers for projection and measurement. LAP products are setting the standards in a wide range of

markets from manufacturing to heavy industrial environments and medical applications.



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