

Nordimpianti System Srl, 66100 Chieti, Italy

# New production line for hollow core slabs implementing the highest levels of automation in the Republic of Korea

**The recent journey of growth for the Jisan company in the Republic of Korea has demonstrated the importance of having an open mind when dealing with investment decisions and also of finding the right supplier to help turn those decisions into a reality. This is the story of how Jisan's determination to implement high levels of automation into their new "smart" precast concrete factory was made real with the latest developments in technology being applied to machines from the Italian manufacturer Nordimpianti.**

Jisan was established in 1999 in Yongin, initially as a company to commission the building of logistics and distribution centers which they would manage and rent out as a total solution provider to their customers. In recent years due to the rise of on-line acquisition the demand for distribution centers has rocketed and this demand has been further amplified during the Covid-19 Pandemic crisis.

At the same time as the rise in demand for distribution centers, the government was encouraging more construction to be realised using prefabricated precast products. This was down to on-site safety concerns with traditional construction methods as well as trying to do anything possible to lower the level of carbon emissions.

## The decision

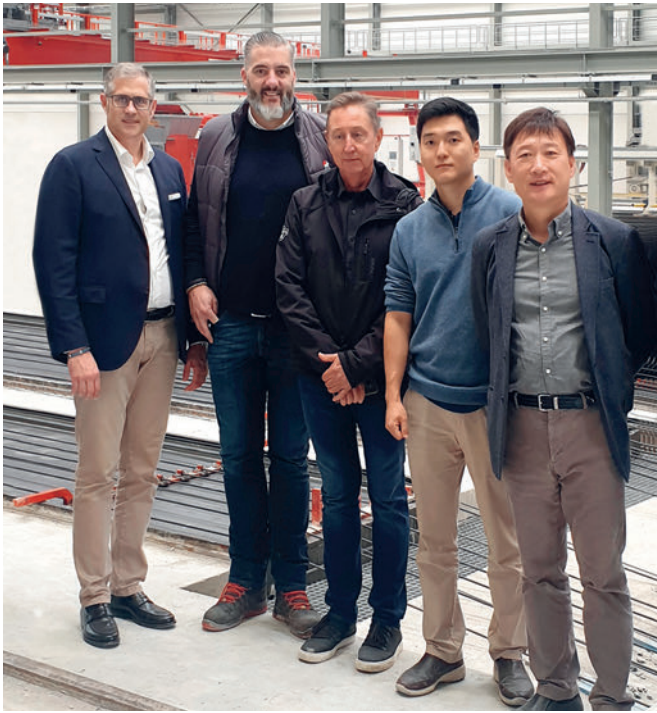
In order to meet the demand Jisan concluded that the best way forward was for Jisan themselves to become manufacturers of the hollow core slab elements that they needed to build their own distribution centers. The next step was to find the right supplier with the right expertise who could help them get their plant up and running.

Jisan already knew that they wanted high levels of automation. They were also fortunate that they were their own customers of the hollow core slabs and knew the specifications of the slabs they wanted to produce. However, the project still had some surprises awaiting them.

In October 2019 Jisan came to Europe to research the equipment that was available and to actually see the machines in action from three of the world's major suppliers. One of the companies tendering was the Italian company Nordimpianti. After visiting some plants in northern Europe, the Managing Director Mr. Byung-Min Han and Director Mr. Jae-Seung Han of JISAN were taken by Nordimpianti to visit the manufacturing site of Fingo, a Belgium company that Nordimpianti has worked with for many years. The visit was a game changer



*External view of the plant for the company "JISAN" which is located in Jincheon Korea*



At the Fingo Tessenderlo factory from left to right:  
 Mr. Gian Piero Gagliardi, CEO of Nordimpianti  
 Mr. Maarten Kreemers, Production Director at Fingo  
 Mr. Marc Detournay, Nordimpianti Sales Area Manager  
 Mr. Jae-Seung Han, Director at Jisan  
 Mr. Byung-Min Han, CEO of Jisan

in the eyes of the East Asian company and seeing how the machines from Nordimpianti were being used and managed, influenced many of Jisan's decisions.

It was interesting to note what they first noticed. Yes of course they were there to see the automation being employed but what struck them most was the cleanliness of the plant floor and the fact that production rate was high and achieved with

the minimum personnel. These aspects were direct results of the high level of automation and both in notable contrast to what they had seen on their other researches.

This visit led them to fundamentally to rethink their approach to their project and they now envisioned emulating the Fingo model as much as was possible.

This had immediate design consequences. Part of the reason that the plant could be kept so clean was that it used the dual rail production bed profile from Nordimpianti. One pair of rails is used for the wheels of the production machines, the other pair is used as the side edges of the element. This creates a channel between the two sets of rails where disc cutting water can accumulate and be dealt with instead of making the walkways between the beds a messy and potentially dangerous area.

After seeing the benefits for themselves Jisan completely changed their mind and opted for this profile configuration with all the knock on effects that this would have to Nordimpianti's other production machines.

On the basis of what they saw at Fingo Jisan was also more sure of what they wanted to achieve and how they would achieve it. Their target, inspired by how Fingo was implementing Nordimpianti's technology was as follows:

- Casting hollow core slabs 400 mm high
- Manufacture rate of 10 production beds in an 8 hour shift
- An incredible 300 cubic meters of concrete elements produced each day
- Using automation and software so that this could all be achieved with only 10 workers.

With all they had seen Jisan made their investment decision and chose Nordimpianti as their supplier of choice. Now it was time to make that decision real.



Nordimpianti's cutting saw. Note the cleanliness of the channels between the beds



Handshake between both CEO's of Jisan and Nordimpianti during the contract signing





*Installing a casting bed on site with underfloor bed heating for faster curing*



*Fully Automatic multifunction Vacuum Bed Cleaner*

## The decision made real

The first stage of the project was devoted to the construction of the production hall housing the 12 production beds. Nordimpianti designed the layout and sent its own specialists from Italy to assist in the construction in South Korea.

The civil works included everything that was required for the production beds, the reaction beams for the prestressing cables, the steel casting beds and an underfloor bed heating system to ensure that the concrete elements are cured in the quickest possible time.

## Bed preparation

Correct bed preparation is very important in order to produce a high quality product. This consists of removing the debris left by the previous production run, oiling the bed with detaching oil and pulling the prestressing cables from one end of the bed to the other.

Nordimpianti already had a machine that could do all these things in one run but it also developed a machine that could do this without operator intervention. Due to the automation on board it was enough to position the machine at the beginning of the bed, attach the stressing cables to the machine and send the machine on its way. The automatic multifunction vacuum bed cleaner would physically remove debris and water into its collection bin, spray and distribute oil on the production bed and pull the prestressing wires in one operation, automatically.

Once the wires had been pulled along the bed they could be stressed. For this Jisan opted for the single stressing solution to make sure that all strands were stressed to the same tension ensuring a high quality product.

## Concrete quality

It is a fact that to produce high quality elements it is necessary to use high quality materials and this especially applies to operating the Extruder to its maximum potential. When using this casting method it is very important to have the best mix design of the concrete because the Extruder system uses "zero slump concrete", essentially a very dry mix of concrete.

Nordimpianti's chief technical field engineer Mr. Sandro Chiurco was on site to advise and guide Jisan on this key aspect of hollow core slab production, even down to visiting the quarry from where the aggregates are sourced to make sure that only suitable material of the highest quality went into the design mix.

Mr Chiurco was also on hand to advise how environmental factors during the storage of the aggregates can change their characteristics and how that can be compensated for in the batching plant to help produce elements of a consistent quality.



*Compressive strength test after 8 hours curing.*





*Extruder EVO2 during casting*



*Marking of cutting lines made by plotter*

## Casting

Nordimpianti supplied Jisan with two Extruders which can be fitted with forming inserts for the production of hollow core slabs from 150 mm to 500 mm high. This extrusion casting process was chosen because of the inherently low running costs as well as the fast production rate of over 2 m/min required to meet the exacting production targets that Jisan had set. Not reaching this target rate would have meant compromising the project.

Nordimpianti's extruder has been designed to make operation as simple as possible and with the minimum of supervision.

## Element marking

Nordimpianti supplied a plotter machine which follows closely behind the Extruder. It marks out cutting lines, position of openings and product code information. This particular plotter is also fitted with a specially designed drill that makes weep holes in the concrete elements.

The operation of the plotter is completely automatic. Nordimpianti provides a comprehensive production system planning software. A part of this software is used to produce a "plot file" for the plotter, essentially telling the plotter the position of all the marks to be made on the element along the entire length of the bed as well as the position of the weep holes. After starting the plotter the machine needs no further operator intervention. The automatic plotter will work totally independently, knowing its position from a laser positioning system.

## Fresh concrete working

The plotter will mark out areas where openings in the element may need to be made. To make these openings a concrete Aspirator machine was supplied by Nordimpianti. This machine allows an operator to create openings by sucking up the concrete from the pre marked position, working on the fresh concrete closely behind the plotter.



*Openings made by the Concrete Aspirator.*





*Automatic Cover Roller*

## Curing

As stated earlier Nordimpianti supplied and oversaw the installation of a bed heating plant. This allows the production beds to be heated and the concrete cured faster than if it were to be allowed to cure naturally. For efficient curing the element has to be covered and for this Nordimpianti supplied an automatic covering machine, again minimising the need for labour. It is only necessary for the machine to be started and it will cover the element on the bed independently. The bed heating system together with the element covering means that the elements can be cured after just 8 hours.

## Cutting

The cutting procedure can only be carried out once the elements are fully cured.

Nordimpianti supplied an automatic C500AM Multi-angle cutting saw, capable of cutting elements up to 520 mm high at any angle, including longitudinal cutting. This saw operates by downloading a "plot file" instruction set detailing all the



*Automatic C500AM Cutting Saw with automatic Counterweight Trolley.*



*Traditional solution to bowing problem whilst cutting*

cuts that are required along the entire length of the bed. It can then carry out this work with the minimum of operator intervention. Accurate precision is achieved through the use of an on-board laser positioning system.

Nordimpianti was able to apply automation to many procedures across the production cycle but at this point Jisan realised that it could do more. A well known problem when cutting high elements is that as the cut is being made the tension in the prestressing wires cause the element to bow and then pinch on the cutting blade. This does not make for an efficient cut.

The traditional solution to this is to use a bridge crane to bring a weight to suppress the bowing. This needs an operator and makes the crane unavailable for other operations.

It seemed counterintuitive to have a saw with extensive automatic capabilities being used with such an inefficient method. At Jisan's request Nordimpianti designed and manufactured a fully automatic counterweight trolley which applies 8 tons of weight to the element close to the saw to resist element



*Telescopic lifting beam with clamps*



*Bundle lift*

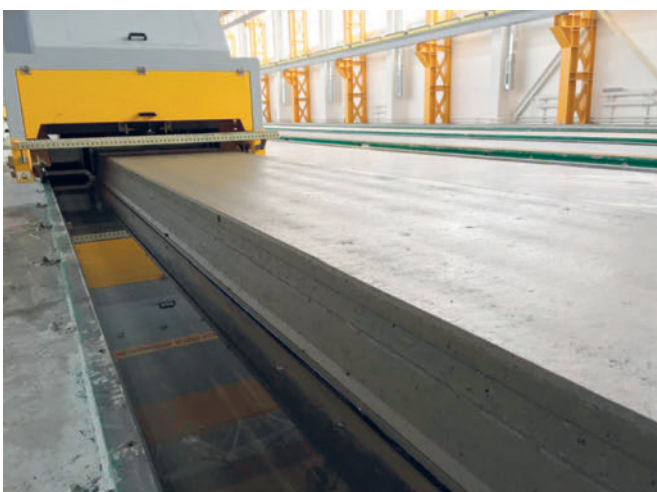
bowing. Not only does the counterweight trolley work fully automatically but Nordimpianti were able to modify the software on the saw retrospectively so that the counterweight trolley was controlled by the saw, again minimising the need for labour and freeing up the bridge crane for other tasks.

### To the stockyard and the end customer

Once cut the elements are removed from the bed using a telescopic lifting beam supplied by Nordimpianti from here to they are transported to the stock yard.

Stacking the elements one at a time onto a truck for delivery to site is time consuming. Jisan wanted to maximize efficiency wherever they could. Nordimpianti was tasked with supplying a hollow core slab bundle lifter capable of lifting the slabs onto the truck in just one operation. This Nordimpianti duly did.

The bundle lifter is able to lift elements up to 16 m long and to a maximum of 22 Tons.



*Special solution "Narrow slab"*



*JISAN logistics warehouse in Dang-Jin city*

Jisan now has a fully commissioned plant. It recently constructed a 80,000 m<sup>2</sup> distribution centre using the hollow core slabs they had produced themselves.

The goals they set themselves have been largely achieved by implementing production software, using all the automation that Nordimpianti can supply and organising as much of the production as they could based on the Fingo model.

With the original project being classified as completed Jisan has quickly turned its attention to other projects and after forming such a strong collaboration with Nordimpianti has wasted no time in returning to the Italian company to help develop an Extruder to manufacture narrow slabs. This project seeks to eliminate production waste and again drive down carbon emissions as much as possible.

This was a special project for Jisan and a special project for Nordimpianti the completion of which now sees Nordimpianti as the market leader in South (GP to check) Korea for the supply of production machinery and plant for prestressed concrete elements. ■

### FURTHER INFORMATION

**nordimpianti**

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