

Nordimpianti System Srl, 66100 Chieti, Italy

Extruder or Slipformer? The choice may not be as clear as you think!

Two completely different casting machines with different names - Extruder and Slipformer - are generally used for the production of prestressed hollow core slabs. Determining which machine to choose is a difficult task especially if it is not clear which type of concrete element you wish to produce. This is a very common dilemma for producers intending to buy a casting machine for the very first time. The best course of action, then, is to find a company that can boast experience in both systems and that is able to produce and offer both technologies to its clients.

This was the problem that Gianluca Pertile, Managing Director of Esse Solai Srl, one of the best known Italian hollow core slab producers, had to confront. Based in northern Italy, Esse's three sites in Vicenza, Parma and Udine have been in the precast business since 1984 with a combined manufacturing capacity of 1,000,000 sqm prestressed floors, prefabricated walls and other concrete elements. The situation described here started in 1999 when Esse Solai decided to invest in a new hollow core slab production line.

At that time, the production of hollow core slabs in northern Italy was dominated by the use of the Slipformer. Esse Solai as a new producer found it hard to choose between the Slipformer and Extruder technologies. In fact, this decision took the company over a year of reflection and in-depth analysis. As a partner, Nordimpianti was chosen to help and supply the machines because of the company's wealth of experience in the sector. Having decided this, the next step then was to discuss which would be the best type of casting machine for the new plant. After all, it was not just another hollow core production site that was planned, but a truly exquisite and technically advanced facility to serve a mature and highly competitive market.

Initial Requirements

Esse Solai's goal was to produce hollow core slabs with heights ranging from 150 mm to 500 mm. Nothing extraordinary. Extruder and Slipformer machines are both capable of producing elements with these specifications. However, Gi-



Aerial view of Esse Solai Srl in Dueville, Vicenza

anluca Pertile's ideas went much further. One particular idea was that the reinforcement had to include the use of rebar as well as prestressing strands.

In the vast majority of cases, hollow core slabs are reinforced only with strands of various sizes, depending on the height of the desired product. However, sometimes there are special applications where the loads and spans of elements call for the use of additional reinforcement such as steel mesh and rebar to increase product performance.

Failure to meet this requirement would have put the entire project in jeopardy since it would not have been possible to compete in a market accustomed to special solutions. So Nordimpianti was asked to design a new hollow core solution capable of satisfying all customer needs and offering high product performance combined with great production flexibility.

After various studies and analyses derived from previous experience gained with other ambitious projects, Nordimpianti presented an interesting and innovative solution. The proposal was based on the assumption of a product comprising five voids, three larger and two narrower ones



Cross-section of hollow core slabs proposed by Nordimpianti

Reasons for such a particular void configuration are quite a few. The first is to allow the two smaller voids at the ends to be filled with concrete and additional reinforcement in order to increase the shear strength of the supports during installation. Unlike standard elements with constant void sizes, this

MAX

ENGINEERED FOR PERFORMANCE

The world 1st battery operated rebar tying tool

80 YEAR ANNIVERSARY



**MAX EUROPE B.V.
Head Office**

Antennestraat 45
1322 AH Almere
TEL: +31 (0)36 546 9669

**MAX EUROPE B.V.
GERMAN OFFICE**

Bonner Straße 203d
40589 Düsseldorf
TEL: +49 (0)211 5408 2877

www.max-europe.com
e-mail: office@max-europe.com



5 times faster
than handtying



Easy one hand
operation



Reduces health
problems



Reduces training
expenses



Increase
productivity



[www.facebook.com/
max-europe](https://www.facebook.com/max-europe)

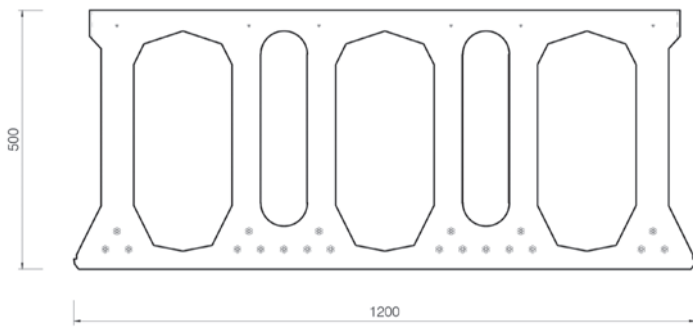


[www.linkedin.com/
max-europe](https://www.linkedin.com/max-europe)



www.youtube.com/





Cross-section of hollow core slab depicting positions of prestressing strands

arrangement makes it possible to minimize the amount of concrete required at the installation phase to benefit from considerable advantages in terms of weight and cost of the finished precast. Another reason is that the two smaller voids have been slightly raised. This way, the concrete body available for enclosing a greater number of prestressed strands is increased compared to standard products of the same height. As regards the size of the prestressing strands to be used, Esse Solai Srl decided to use strands up to a diameter of 6/10 " necessary to reach a maximum prestressing force close to 400 tons.

This slab design leaves little room to determine which of the two casting technologies is to be favoured. The Extruder machine is best suited for producing elements with largely identical voids whereas products comprising voids of different sizes will not present any problems to a Slipformer machine. Hence, the use of a Slipformer was the obvious choice to make.

Once the individual sections of hollow core slabs and the positions of the reinforcement were defined and approved, the project could be launched. The Dueville production plant



Construction of a road bridge using the "U" panel

was inaugurated in 2001 and included two Slipformers along with all auxiliary machines and equipment, as well as six steel casting beds of 150m length.

New opportunities

Based on the experience gained in the production of hollow core and its already existing presence in the north-eastern Italian market, the technical staff of Esse Solai looked at new challenges and objectives to be achieved. Staying one step ahead of the market has always been a central idea in Gianluca Pertile's philosophy, and this time as well he intended to make use of the technological and engineering skills of his company. In this case, his goal was to be able to offer new products to the infrastructure sector and, in particular, elements used in 1st and 2nd category road bridges.

Bridges are structures commonly constructed with prefabricated prestressed beams that require special fixed formwork and thus a lot of manpower for project execution. The growing demand for this type of infrastructure element pushed Esse Solai Srl to develop a new product which, while satisfying all technical performance requirements, could be produced with a Slipformer machine to achieve a more favourable method of production and advantages in terms of cost. The new product designed by Esse Solai Srl was a "U" element available in heights up to 1 m.



Prestressed "U" element produced by Esse Solai



"U" panels with stirrups protruding above vertical reinforcement

The new element had to be fully compliant with the stringent regulations applying to road infrastructure projects and had to include a series of construction features that are not immediately obvious. The spans to be reached were up to 28m and the elements had to comply with Bridge Traffic Regula-

tions EN 1991 - 1.2. To meet some of these specifications, even the "U" shaped elements had to include reinforcement consisting of steel mesh and steel stirrups in the slab and the vertical ribs.

To allow for structural connection during construction, steel stirrups had to protrude out of the vertical ribs, a requirement which gave rise to various production difficulties for the Slip-former machine.

The protruding stirrups were necessary to enable a final integration into the lower cast. The end result was a floor made up of box type sections.

Production of such a particular product is usually carried out using fixed formwork but the company's goal was to make use of the advantages of the Slipformer technology which Esse Solai was already employing to produce hollow core slabs. To be used for the production of the new element, the existing Slipformer had to be adapted by fitting a specifically modified forming insert.

The task of developing this machine was once again entrusted to Nordimpianti. Starting from 1987, Nordimpianti was well experienced in the production of ultra high pre-stressed elements. Its first Slipformer machine called "Jumbo" was designed in Italy for the production of hollow core slabs and inverted double T beams with heights of up to 1m.

This already existing experience now led to the development of a new Slipformer machine capable of continuously producing "U" sections with heights varying from 500 to 1,000mm. In order to guarantee the homogeneous compaction of such thick and high ribs, Nordimpianti designed a mould group equipped with special vibration units.

probst
handling equipment

Visit us at

bauma

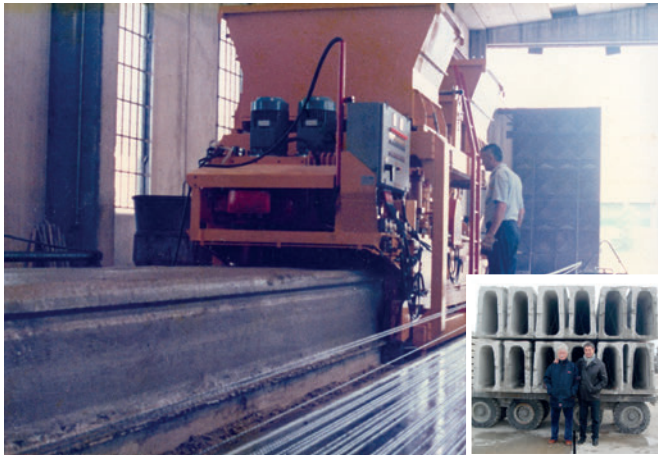
OCTOBER 24-30, 2022, MUNICH

booth FS.1307 outdoor
booth B1.435 halls



**making
hard work
easier**

www.probst-handling.com



In 1987, Nordimpianti designed the world's first Slipformer capable of producing hollow core slabs with heights of up to 1,000 mm

The new "U" section had to incorporate 24 6/10" strands in order to apply a total of 480 tons of prestressing force. The machine was commissioned in 2010 and meant a great success for Nordimpianti and especially Esse Solai.

The ability to manufacture this new range of special products has allowed Esse Solai to win numerous contracts for major infrastructure projects, one of the main advantages being the fact that the elements could be produced without the need of fixed formwork. Other important advantages of the Slipformer machine compared to traditionally cast beams with formwork are:

- Low manpower requirements from preparation of the casting bed to the cast of the element
- Higher production speed
- Flexibility

The numerous projects carried out with this new element include:



Malè, Trento - Construction of an overground tunnel using "U" elements H600 + 200 mm - 6,000 m²



Nordimpianti Slipformer casting 1m high "U" element at Esse Solai

To date, there have been no doubts in Esse Solai's decision to choose a Slipformer for the production of prestressed floors.

Market changes call for adaptations

Over the years, Esse Solai has become an industrial player that can be counted on. The company has developed numerous concrete products aimed at satisfying the needs of a constantly evolving market. In addition to a wider range of products, Esse has also extended its geographical reach beyond the Italian border through its subsidiary Giuliane Srl based in Ruda, Udine.

Its proximity to Slovenia and Austria has allowed Giuliane Srl to develop various solutions for the construction of both civil and industrial flooring in these markets. Among the solutions offered by the company are various prestressed products



Variante Zogno, Bergamo, - aqueduct enclosure for ENEL using H750 + 250 mm 2,500 m²



Production yard at Giuliane Srl in Ruda, Udine



Other prestressed elements can be cast by the Nordimpianti Slipformer: T beams, lintels and Predal slabs

such as T beams, lintels, Predal slabs and, of course, hollow core. Like Esse Solai Srl, Giuliane Srl also employs the Slipformer as a casting machine.

Over the years and encouraged by a promising market, the company also began to show interest in the Extruder technology. While Esse Solai was involved in a demanding market accustomed to particularly complex floor systems, Giuliane was committed to serving a clientele looking for more standard solutions featuring only pre-stressing strands with no additional steel mesh or rebar. Another aspect not forgotten by Gianluca Pertile as head of the Esse Team was the fact that the vast majority of new floor manufacturers, not only in Italy but also abroad, tended to choose the Extruder rather than the Slipformer technology.

This, however, posed a problem. Giuliane Srl produces a wide range of hollow core with heights of 150, 200, 250, 300, 350, 400, 450 and 500 mm. To produce such a vast range of slabs using the Extruder machine would require the purchase of four different forming insert types. And this again would have involved large investments making any changeover to an Extruder less appropriate.

This problem was addressed by Nordimpianti by proposing a new solution involving the use of only two forming inserts to cover the entire product range.



Normally the subdivision of standard heights for Extruder machine operation is divided as follows:

- 8 hole forming insert for the production of 150mm elements
- 6 hole forming insert for the production of 200mm elements
- 5 hole forming insert for the production of 250mm elements
- 4 hole forming insert for the production of elements from 300-350-400-450-500mm

In the case of Giuliane Srl Nordimpianti proposed only two forming inserts as follows:

- 7 hole forming insert for the production of elements from 150-200-250mm
- 4 hole forming insert for the production of elements from 300-350-400-450-500mm

This Extruder solution presented by Nordimpianti was convincing not only in terms of cost. It also offered some advantages regarding technical aspects related to the performance and characteristics of the hollow core to be produced. This is to say that the Extruder gave Giuliane Srl the ability to offer flexible solutions to the markets that the company wanted to address and hence a strong lever for the company in terms of future economic successes.

This flexibility also addresses the issue of fire resistance of hollow core slabs which is becoming an increasingly important factor.



7 hole H250 hollow core produced with Nordimpianti's Extruder machine

Elements to be produced with the new Extruder have to guarantee a fire resistance class up to REI 240. This is normally achieved by raising the positions of the prestressing material and those of the voids - with a corresponding increase in overall slab height. This approach, however, requires increased use of concrete and was thus rejected by the company as being uneconomical.



Casting the first elements with the new Extruder at Giuliane's production site

This caused the technical teams from Nordimpianti and Giuliane Srl to collaborate closely to come up with a solution that enabled the entire production range to meet the desired fire resistance class standards without changing the geometry and height of the elements.

The solution also entails a great advantage from a production point of view as a changeover from one resistance class to another does not require new settings on the Extruder. Another aspect is that the new Extruder machine was designed so as to comply with the Industry 4.0 incentive plan which allowed Esse Solai to take advantage of further benefits in terms of cost. In 2021, production began to the great satisfaction of Gianluca Pertile and his staff.

The first elements produced underwent load and strength tests conducted in-house. Obtained values turned out to be much better than expected, because the company was accustomed to data obtained with the Slipformer. The high level of concrete compaction combined with an accurate geometry of the manufactured elements have led to a re-evaluation of the Extruder technology in that the use of Extruders for the production of hollow core at the Vicenza plant is no longer ruled out.

In conclusion, it cannot be generally said that one casting machine is better than another. When choosing a particular technology, it is the desired product that must count. Hence, it is best, if both production technologies are available to ensure the highest degree of flexibility and the widest product range to be able to offer the best solutions to the customer. ■

FURTHER INFORMATION

nordimpianti

Nordimpianti System Srl
Via Erasmo Piaggio, 19/A
66100 Chieti (CH), Italy
T +39 0871 540222, F +39 0871 562408
info@nordimpianti.com, www.nordimpianti.com



Esse Solai Srl
Strada delle Fornaci 13
36031 Vivaro di Dueville (VI), Italy
T +39 0444 986440, F +39 0444 986440
info@essesolai.it, www.essesteam.it



Giuliane Srl
Via della Fornace, 16
33050 Ruda (UD), Italy
T +39 0431 99588, F +39 0431 999990
info@essesolai.it, www.essesteam.it



Shaping digital change with UniCAM.10

Paperless, ergonomic and intuitive
through large screens, touch displays
and mobile and mobile end devices.

Increase in productivity
by processing the orders in
synchronous cycle.

Modern quality management
through laser projection and
photo documentation.

Visit us on the

bauma

24. - 30.10.2022

Hall B1 Booth 151
unitechnik.com

Unitechnik

PERFECTION AUTOMATED.