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# L.B. Foster successfully introduces Long-line Production Technology to manufacture CXT® Concrete Ties

**L.B Foster Company, through its wholly owned subsidiary, CXT Inc., executed a long-term supply agreement approximately two years ago to provide concrete railroad ties for several Union Pacific Railroad expansion projects. These ties were planned to be supplied from two manufacturing facilities located in Grand Island, NE, and Tucson, AZ. The manufacturing process chosen to produce those ties was Grimbergen long-line technology.**

Four long-line mold lines, each with 180 tie molds, were installed in both plants. The capacity for these sister plants is approximately 1,260 ties per 24 hours. The facilities are designed to run 24 hours per day, seven days per week. The Grand Island plant, NE, has been in operation since late 2005. This was an existing L.B. Foster plant that was gutted and rebuilt using the new Grimbergen technology. The second facility came on-stream earlier this year in Tucson, AZ, and is a brand new plant, operating on Union Pacific property. Both plants produce the patented CXT Inc. ties (see illustration at the end of the article). Because the rail shoulders can be clamped in the mold bottom, it is possible to produce these ties with many different shoulder types. Scalloped sides are unique to this tie design. The scallops produce a more stable positioning of the tie in the ballast, resulting in substantial reduction of cross traction. Due to higher North American railroad track loads, the prestressing force of this concrete tie is substantially higher than European standards.

## *Why did L.B. Foster select the Grimbergen long-line tie system?*

There are a number of key reasons why the Grimbergen long-line system was chosen by L.B. Foster for this important opportunity:

- L.B. Foster had lengthy experience with concrete tie design and production
- In anticipation of, and following, the subsequent award of business to L.B. Foster by Union Pacific, a company-wide team evaluated concrete tie manufacturing technologies globally. The team concluded that the Grimbergen system was the best available for this project.
- Manufacturing system longevity - developed in 1990, it is still in use today by a company called Spanbeton to manufacture the NS 90 tie and in Korea to manufacture the KNR 90 and the HS 94 ties.
- L.B. Foster has viewed Grimbergen as a valued partner, not only because of their technology capabilities but also because of their positive, can do attitude.
- At the then uncompetitive exchange rate between the US dollar and the Euro, it is difficult for European companies to enter the US market. However, Grimbergen was able to overcome this obstacle.

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*Each of the four prestressing beds is capable of producing 180 concrete ties.*

- Both parties were able to negotiate a contract very efficiently, including the performance bond conditions, payment terms and risk evaluation.

- All contractual obligations were solved by creating a positive, trusting work environment between the two companies.

The financial arrangements for the project, including budget details for all activities, were established, negotiated and agreed upon in an open dialogue between both companies. The necessary price and quality requirements, along with suppliers, production locations and the split of European vs. US suppliers and manufacturers, was also negotiated fairly by the Grimbergen/L.B. Foster team. Possible project risks based on US laws and regulations we also determined, evaluated and quantified. The agreement developed by Grimbergen and L.B. Foster was based on best efforts by both sides in a spirit of mutual confidence in each other. The team realized this not by arguing about possible penalties but rather by discussing bonuses. The team of both Grimbergen and L.B. Foster employees have used their best efforts to deliver the completion of the project on-time and within budget without making concessions to issues such as safety, product quality and equipment performance.


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*Prestressing system*

## *Project Partners*

The project partners included L.B. Foster Company and Grimbergen. Since 1902, L.B. Foster Company has delivered products and services necessary to build and maintain the US infrastructure. The company is a quality manufacturer, fabricator and distributor of products for rail, construction, and utility and energy markets. The company entered the concrete tie business in 1999 when it purchased CXT, Inc., a manufacturer of both prestressed concrete ties and precast concrete buildings. The company has been able to grow the concrete tie business by focusing on new track construction using concrete ties for heavy haul, transit/commuter and industrial rail projects. Starting with facilities in Spokane, WA, and Grand Island, NE, the company has added additional capacity at Tucson, AZ. The company provides a diverse product offering for the North American rail industry, including new and relay rail, insulated rail joints, track lubrication systems, track panels, direct fixation fasteners, contact rail and concrete ties and turnout ties.

Grimbergen, established in The Netherlands in 1946, develops and produces molds and casting systems for the prefabricated concrete industry. During the last 20 years, Grimbergen has supplied approximately 30 highly automated production plants worldwide. For concrete tie production, Grimbergen has supplied several variations of twin-block carousel plants as well as long-line technology. The Grimbergen long-line system enables integration of a variety of shoulders into the mold design. Prestressing forces are adjustable and the lengths and shapes of the ties can be varied. The design department of Grimbergen has also supported railroad development activities in both slab track and transrapid girders.

## *Long-Line Production Method*

Each of the sister plants, Grand Island and Tucson, have four prestressing beds (**Fig. 1**). Each bed is capable of producing 180 concrete ties. **Fig. 2** gives an overview of the production plant and demonstrates the parallel prestressing tie beds. The production principle employed is based on the extensive prestressing line that allows for long-line production.

Prestressing wires for one bed are prepared and isolated from the production process (**Fig. 3**). In a single operation (see **Fig. 2** and **Fig. 4**), the prestressing wires are installed into the cavities of the forms in the correct position relative to the already installed shoulders. The entire prestressing bed has a length of about 115 meters (approximately 377 feet). The prestressed concrete tie incorporates 20 wires, each with a diameter of 5.32 mm (0.21 inches). Following appropriate preparation, the wires are prestressed in one work cycle, with 3.5 tons per wire, so that the prestressing force applied per bed is 280 tons. The prestressing plant equipment is designed for a capacity of 300 tons.

A 10-ton capacity gantry crane spans the entire production facility. A concrete bucket is incorporated into an overhead structure to supply all prestressing beds with concrete. As can be seen in **Fig. 5**, a flying bucket system handles the concrete.


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*Concrete handling and filling of moulds*

The concrete is discharged into a distributor to apply the concrete (**Fig. 6**). The concrete distributor is tailored to the specific requirements of this production line. It directly feeds the molds via augers that distribute the concrete mix to each cavity (**Fig. 7**). The concrete is then compacted via electronic vibrators arranged below each mold. This is done in sections, with the process being actuated by the operator of the concrete spreader. This operation can be visually monitored. To accelerate the concrete hardening process, a closed loop hot oil heating system is incorporated below the forms. The forms are laterally covered with insulation material to meet stringent environmental and working condition demands. The cement content is approximately 445 kg/m$^3$ supplemented by a special plasticizer. The aggregates used are gravel (up to 19 mm in diameter) and sand. When the forms are stripped from the mold, concrete compressive strength is 31 N/mm$^2$. The concrete hardens to a compressive strength of 48 N/mm$^2$ in 28 days. Production operations are such that seven beds can be easily cast in any 24-hour period.

## *A special demoulding technique*

Special mention needs to be made of the configuration and functioning of the forms. Initially, the mold is lowered, which


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*Demoulding of the hardened concrete ties*

is a novel and unique production process. During this operation, the partially hardened prestressed concrete ties are supported on special lifters (**Fig. 8**). The concrete tie is fixed at the same height. While the lowered mold remains at this level, a transport lorry is placed on the steel rail edge. There are 23 transport lorries over the entire production area (**Fig. 9**). The lifters are lowered to allow the ties to rest on the transport lorries over the entire line. Stress in the molds is now relieved and all prestressed concrete ties can be sent to the sawing station section by section. The ties are hydraulically pulled forward with the lorries in one lifting operation. The saw is combined with a transfer system that feeds the ties from each lorry to the saw (**Fig. 10**). This allows fixing at the exact length and precise cutting of four ties. The sawing operation takes about 2 minutes. Once the ties are cut, they are placed on the discharge-turning wagon. This wagon automatically transfers 4 ties from the sawing machine to the clipping line (**Fig. 11 and 12**). The clipping machine automatically fixes the rail fasteners into the ties (**Fig. 13**). The prestressed ties are now conveyed to the discharge unit via fully automated controls (**Fig. 14**). **Figure 14** also shows a portal crane with an integrated telescopic hoist system. This robot crane is programmed for automatic stacking of the finished ties and for loading train cars. Since precise functioning of this crane and the hoist mechanism are crucial, fully automated programming is required. The concrete ties are then transferred to inventory for later loading onto railcars for shipment to customers (**Fig.15**). The customer for this concrete tie design is Union Pacific. See **Fig. 16** for a view of the tie.

Per John Kasel, Senior Vice President and Chief Operating Officer of L.B. Foster, "These new facilities will consistently produce concrete ties to very accurate, critical dimensions. This gives us a significant competitive advantage. We also appreciate the relationship that we enjoy with Grimbergen and the excellent communications that they provided at every step along the construction path." According to Stan Hasselbusch, President and CEO, "This is a very unique manufacturing system that provides L.B. Foster with world-class technology, unsurpassed in North America. We are very proud of the work


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*Finishing the production process: cutting of ties, application of clippings for the rails, transport and storage*

that the team on this project, composed of both Grimbergen and L.B. Foster employees, was able to accomplish under very tight time constraints." Finally, from Henk-Jan Grimbergen, CEO, Grimbergen, "The confidence that L.B. Foster placed in the Grimbergen production system and our team motivated us to want to succeed. The teamwork between our two companies, based on fully open communications and trust in one another, served as a solid foundation for an enduring relationship as constructive partners."


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*The patented CXT® Concrete Ties*

**Further information:**

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Constructive partner

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