LAYING TRACK FOR GROWTH

A booming producer of cast railway track looked for a way to engineer an expansion while using as much of its existing space and equipment as possible. KITTY EMAN, GEMCO ENGINEERS B.V., THE NETHERLANDS

With a four year growth trend at its Decatur, Ill., steel and iron metalcasting facility, railroad manufacturer voestalpine Nortrak had basically outgrown its current production facility. In order to meet future production growth, it needs a facility expansion and upgrade. Expansion—as Nortrak envisions—will allow the company to perform projected levels of production and maintain its workforce with enough scope for future sustained growth.

voestalpine Nortrak is North

Department/process step	Required output and capacities of departments in order to achieve a projected 2x production capacity with scope for sustained growth. Current output ↓ +35%↓ +100% ↓	Remarks
Charging area		Non-magnetic scrap handling needs optimization, including relocation of storage for more efficient furnace charging.
Melting department		Third furnace (considered in layout) will allow further expansion/ sustained growth.
Liquid metal transport		Current pouring by overhead crane has sufficient capacity.
Core shop		Existing mixer will be dedicated to core production.
Sand mixing		New mixer will be dedicated to the production of copes and drags.
Molding department		Optimized workflow and mechanized transport and mold handling will double molding capacity and reduce labor per mold.
Pouring, cope lifting, in-mold cooling		Mechanization of the mold transport strongly reduces labor per mold.
Shakeout and knock-off		Mechanized operation eliminates manual operations and increases safety.
Sand reclamation		New sand system: current olivine-silica to be converted to chromite silica system.
Heat treatment and quenching		Mechanization of unloading improves the utilization of quenching and heat treatment and increases system capacity.
Finishing department		Extending the finishing area increases capacity, mechanization foreseen for the future.

Capacity of Current Facilities
Capacity After Implementation on Second Phase (Expansion)

Fig. 1. Shown is a summary of the outcome of the bottleneck analysis.

America's leading manufacturer of special trackwork. It is uniquely positioned in the industry with specialized engineering and integrated manufacturing capabilities. If it's required in special trackwork, Nortrak can produce it, from concrete ties, to machined components, manganese and ductile iron castings, and injection molded synthetics. voestalpine Nortrak operates manufacturing facilities in eight locations across Canada (one) and the U.S. (seven), including the metalcasting facility in Decatur.

Nortrak emphasized any infrastructure and process improvements should be designed to minimize risks to worker safety.

In 2009, voestalpine Nortrak acquired the assets of Leading Edge Enterprises Inc. in Decatur. At the time of acquisition, the Decatur facility offered a wide range of cast ductile iron and manganese steel products as well as injection molded plastic items. At present, the Decatur facility produces both ductile iron and manganese steel castings entirely dedicated to railroad trackwork. Since its purchase, the plant's employment has increased 165% to 125, and production has increased 204%.

Railway crossings have very specific properties and must meet strict requirements. The maximum size of the manganese steel castings poured at the metalcasting facility will have a maximum weight of 4,800 lbs. (2,175 kg) and a maximum length of 288 in. (7.3 m). For engineering and expert assistance with the project, voestalpine Nortrak chose to work with the Dutch firm Gemco Engineers, which had worked with Nortrak's parent group on other projects, including a railway crossings metalcasting facility in Europe.

The Decatur plant's current metalcasting capacity is 400 clean tons of manganese steel and ductile iron per week. The company wants to double the manganese steel casting production while maintaining the current capacity level for ductile iron production. The expansion project will address all infrastructure and process improvements required to meet the project objectives.

The sand system was one of the most important areas to address within the project. Decatur's current manganese alloy production employs a nobake sand molding system, primarily utilizing flaskless molding with olivine sand and silica sand backing. Since local olivine sand is becoming more difficult for U.S. metalcasters to source, Nortrak already envisioned changing the sand system.

The project's objectives are clear, but it has its constraints. The expansion, optimization and improvements must be planned, built and commissioned in a way to minimize interference with the ongoing operation of the metalcasting facility. Additionally, the entire expansion project must be compliant with existing permits as issued by the Illinois Environmental Protection Agency.

The Approach

To determine the best way to achieve the project objectives, Nortrak reviewed the existing plant layout and evaluated the current functional capacity for large manganese alloy castings, before identifying a preliminary plan and design for potential foundry and process improvements. The plan included the following aspects needed to address the objectives of the expansion projects:

- required equipment.
- required process changes.
- future/required foundry layout.
- preliminary estimation of required capital investment (project costs).

Nortrak emphasized that any infrastructure and process improvements should be designed to minimize risks to worker safety. Achieving optimum health, safety and environmental conditions are therefore prerequisites in the project.

The project started with an in-depth assessment of the existing facility and operations to determine the functional capacity of the equipment in place and the interface challenges (logistics, communication, buffers, etc.) between the different production departments in the facility.

In order to determine where and to what extent additional equipment would be required to achieve the targeted doubling in capacity, a bottleneck analysis was conducted for each department: molding area, melting area, scrap charging, pouring area (including cope lifting and cooling), mold opening and area connecting the sand reclamation and heat treatment/quenching (Fig. 1).

The bottleneck analysis clearly indicated the areas requiring additional machinery. For instance, the melting department needs a third furnace for further expansion, and mechanizing mold transportation and handling will double molding capacity. The analysis also indicated how certain current equipment could be better utilized by changing or improving the operational flow (logistics) and creating buffers before and after certain equipment. In the charging area, for example, relocating storage will provide more efficient furnace charging.

Nortrak's proposed new layout adopts process and operational changes designed to maximize existing equipment use where possible (Fig. 2). In other areas, automation will be implemented to optimize the production flow while minimizing handling. Together, these changes will significantly improve the plant logistics in the currently available space. This allows Nortrak to limit the physical expansion of the building to the strictly necessary for improved production flow and foundry logistics to sustain future growth.

Process Changes

One of the major proposed process changes will occur in the molding area, which currently produces molds in batches for pouring. To gain productivity, the plant is being reengineered into a dynamic production process split up into multiple steps to accommodate continuous, flexible pouring. This allows Nortrak to increase production capacity to the required expansion levels within the current available space. Mechanization in these departments optimizes the workflow and will reduce

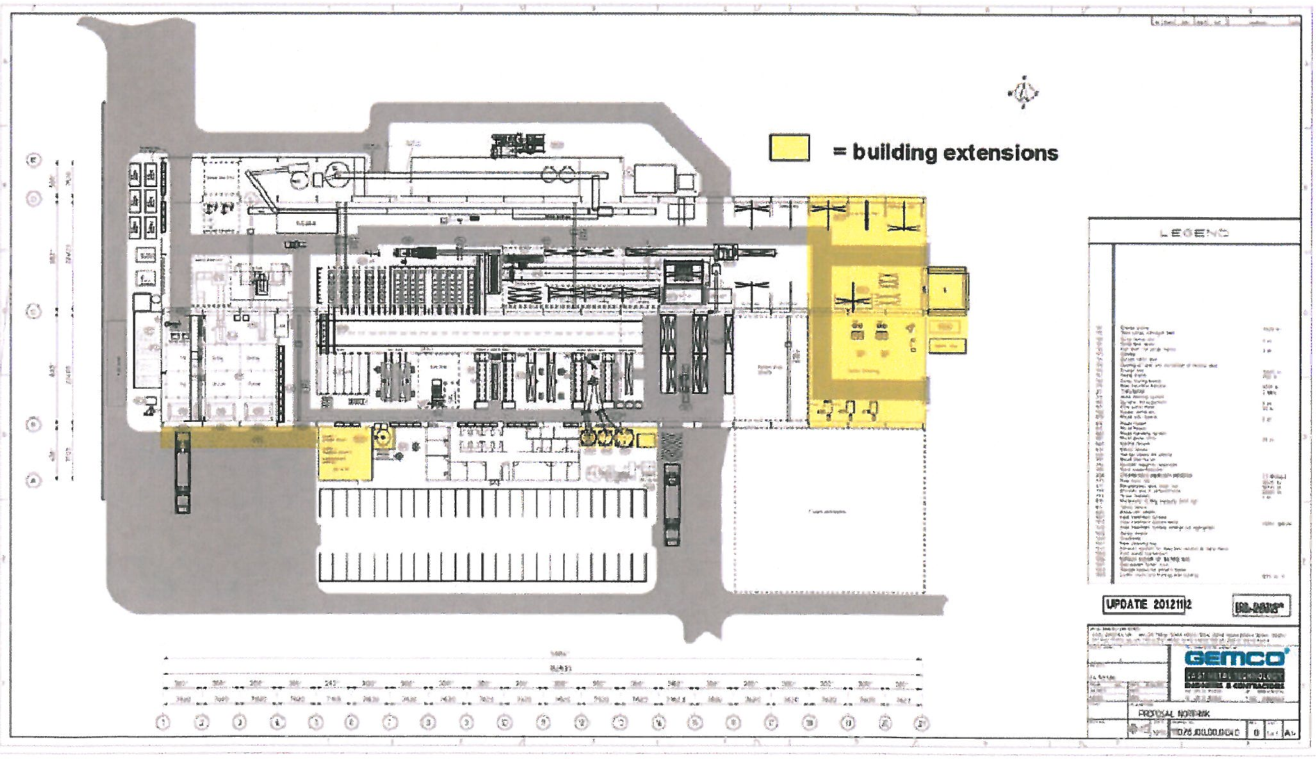
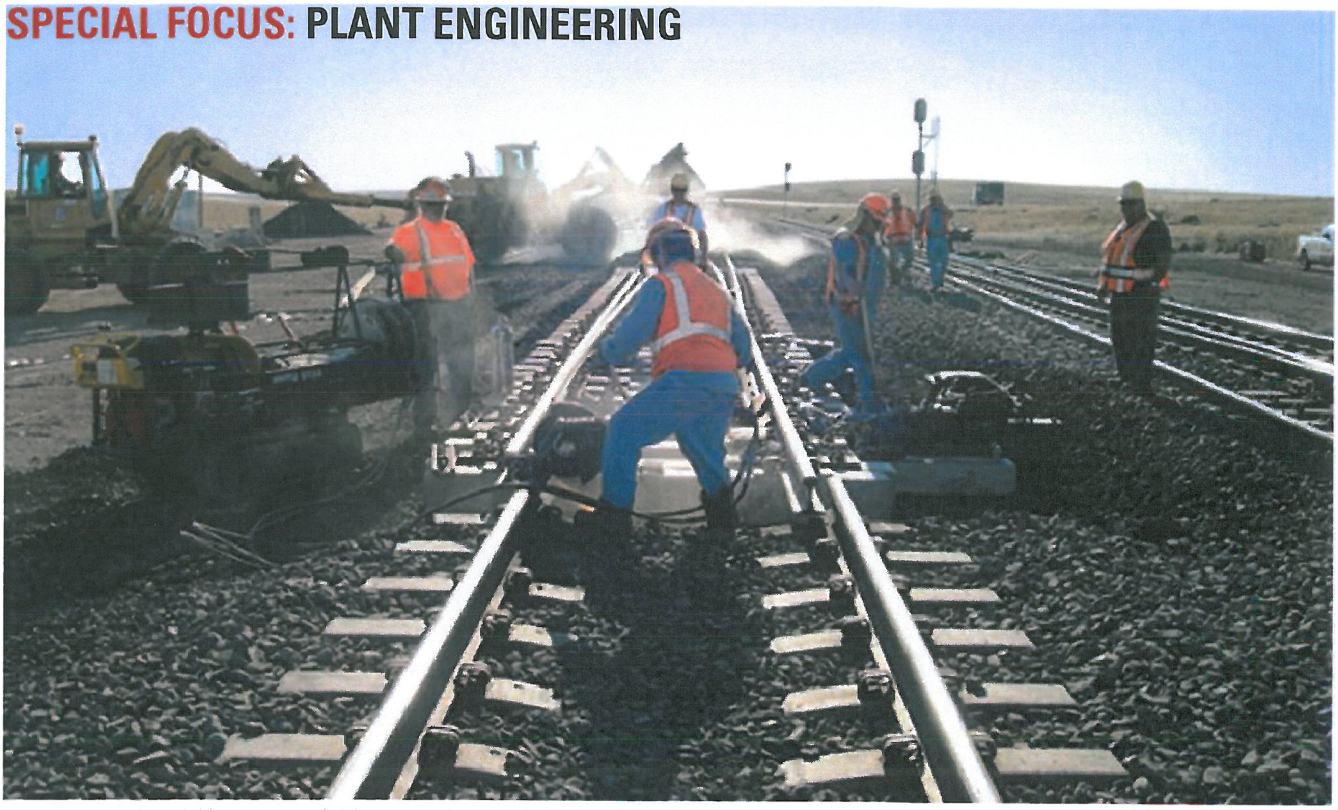


Fig. 2. The proposed layout to achieve projected capacity expansion a voestalpine Nortrak, Decatur, Ill., is shown. Building extensions are highlighted in yellow.



Nortrak casts steel and iron pieces of railroad trackwork.

labor hours per mold.

Furthermore, proposed mechanization in other departments will eliminate manual operations and increase workers' safety, a prerequisite in the expansion.

New Sand System

Nortrak intended to convert to a chromite sand molding system in order to mitigate sharp increases in the cost of olivine sand and improve the surface quality of its castings. Before making the final decision on the new sand system, Nortrak reviewed a comparison of olivine, which included the existing olivine-silica system as well as a pure olivine system with thermal reclamation, and chromite-silica systems,

Expansion Milestones	Date
Building extension completed	August 2013
Plastics department moved to a new location	November 2013
Relocation of pattern shop and cleaning bays	January 2014
Chromite/silica sand system commissioned	March 2014
Ramp-up of production with new molding and shot blasting	July 2014
Raw materials handling	September 2014

Fig. 3. The project is planned in logical steps with minimum interruption of production.

which included a system with a separation unit, a system using a furan binder and a system with a separation unit and thermal reclamation. The comparison included a look at the required equipment for each system.

Voestalpine Nortrak decided on a chromite silica system with furan binder. When employing a basic olivine sand system, the furan acid binder system cannot be applied. In nobake sand molding, however, furan binder is the most commonly used binder system, which is also true within the voestalpine group. Furan combines good binding properties with superior regeneration rates over other binder systems. Nortrak saw that quartz sand would be the most economical molding material, but because of its poor thermal physical qualities and the inevitable quartz inversion of silica sand, it cannot be applied for facing sand for steel castings. Although relatively expensive, chromite sand provides excellent facing sand qualities and is lightly magnetic. The latter quality enables the use of the more cost effective silica sand as backing sand, because the chromite sand can be separated from the return sand. In this way, it can be reclaimed and reused as facing sand with minimum addition of new chromite sand to compensate for losses. The study showed that a chromite silica system would be the most cost efficient system.

Expanding in Phases

In order to minimize interference with ongoing operations, voestalpine Nortrak decided to split the realization of the project in three phases:

Phase 1: Installation, which is currently under way, and testing of the new sand system.
Phase 2: Implementation of process changes, additional equipment, changing foundry logistics, etc.
Phase 3: Improve scrap handling system.

The structure of the physical building expansion was completed in August. The expansion plan is projected to be completed in stages through September 2014 (Fig. 3).

The project will require an estimated investment of approximately $6,820,000, as follows:

Phase 1: $1,850,000 for the sand system.
Phase 2: $4,530,000 for molding and finishing.
Phase 3: $440,000 for the scrap handling system.

Despite the economically uncertain times, voestalpine Nortrak's Decatur facility has demonstrated a continued growth trend over the years by providing quality trackwork to the rail industry. With the upgrade and capacity expansion of the facility, the company can continue to stay on that track for years to come. MC