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On track

How voestalpine Nortrak Decatur's foundry facility achieves an upgrade and capacity expansion by improving its foundry logistics and maximizing the equipment's utilization, requiring minimum enlargement of the existing space

To increase its capacity railway supplier voestalpine Nortrak from Decatur, Illinois, USA, worked together with foundry engineering company Gemco (Photos and graphics: Gemco)

In 2009 voestalpine Nortrak acquired the assets of Leading Edge Enterprises Inc. of Decatur, Illinois, USA. 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 foundry facility produces both ductile iron and manganese steel castings entirely dedicated to railroad trackwork (**Figure 1**).

The plant has shown a continued growth trend with production increasing by more than 200 %. Consequently, voestalpine Nortrak had basically outgrown its Decatur production facility and in order to meet production growth a facility upgrade and capacity expansion was required. Expansion – as Nortrak envisions – allows the company to perform projected levels of production and maintain its workforce for the long-term with sufficient scope for sustained growth.

Railway crossings have very specific properties and must meet strict requirements. The maximum size of the manganese steel castings poured at the foundry has a maximum weight of roughly 4,800 lbs (approximately 2,175 kg) and a maximum length of roughly 288 inches (approximately 7, 3 m). For engineering and expert assistance with the project voestalpine Nortrak chose to work with Gemco En-

Figure 1: voestalpine Nortrak casts steel and iron pieces of railroad trackwork

gineers, Eindhoven, The Netherlands, who already worked with the VAE group on other projects and – among other – successfully designed and realized (turn-key) a VAE railway crossings foundry in Europe.

Project objectives

Before the capacity expansion the Decatur plant's casting capacity was for around 400 clean t per week (combined manganese steel and ductile iron). With the expansion the company aimed to gradually double the manganese steel castings production while maintaining the capacity level for ductile iron production. The expansion project should include all infrastructure and process improvements required to meet the project objectives. While project objectives and intention were clear, the project also had its constraints. The expansion, optimization and improvements should be planned, built and commissioned in a manner that minimizes adverse interference with the ongoing operation of the foundry. The entire expansion project also had to be compliant with existing permits as issued by the Illinois Environmental Protection Agency. It was then decided to split the realization of this foundry project in two phases.

The approach

In order to determine the best possible way to achieve the project objectives, the existing foundry layout needed to be reviewed and the actual functional capacity for large manganese alloy castings to be evaluated, followed by identification and a preliminary plan/design for (potential) foundry and process improvements necessary to meet the project objectives, including:

» the (required) equipment

INFO

voestalpine Nortrak is North 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 seven locations across the U.S. including a foundry in Decatur, Illinois.

Gemco Engineers counts for over 35 years of experience in the foundry industry and offers complete foundry solutions for iron, steel, aluminium and all other castable metals. The company provides a complete range of services that encompass process- and feasibility studies, (concept-) engineering, design, planning of complete new foundries, project management, contracting services and turnkey realization of foundry projects. Recent North American foundry (realization) projects completed or in progress: Blackhawk de Mexico, Rassini Frenos, Mexico, and voestalpine Nortrak, Decatur, USA (among other)

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

Emphasizing that any infrastructure and process improvements should be designed to minimize risks to worker safety. Achieving optimum health, safety, and environmental conditions are always prerequisites in a project.

The project started with an in-depth assessment of the existing facility/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 foundry.

Bottleneck analysis

In order to draw an initial conclusion where and to what extend additional equipment would be required to (gradually) achieve the targeted doubling in capacity, a bottleneck analysis was conducted for each foundry department: molding area, melting area, scrap charging, pouring area (including cope lifting and cooling), mold opening and the connection with the sand reclamation and heat treatment/quenching.

The bottleneck analysis clearly indicated the areas that required additional machinery. However, the analysis also indicated how certain equipment in place could be better utilized by changing/improving the operational flow (logistics) and (creating) buffers before and after appointed equipment (**Figure 2**).

Process Changes

The proposed process changes in certain departments such as conversion of the molding process to a dynamic production process by splitting it into multiple steps and changing the pouring process from a batch- into a continuous (and flexible) pouring process permits to increase the production capacity to the required expansion levels within the current available space. Mechanization in these departments optimizes the workflow and will reduce the labor/mold.

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

Phase 1, a new sand system

An imperative subject within the project was the sand system. Prior to the project, Decatur's manganese alloy production employed a no-bake sand molding system and primarily utilized flaskless molding with olivine sand and silica backing. Since US olivine sand has become more difficult for US foundries to source, Nortrak already envisioned changing the sand system. In order to mitigate sharp increases in the cost of olivine sand and to improve the surface quality of its castings, Nortrak intended to convert to a chromite sand molding system. However, before taking the final decision over the new sand system Gemco presented a comparison of olivine (current olivine-silica system and pure olivine system with thermal reclamation) vs chromite-silica systems (system with separation

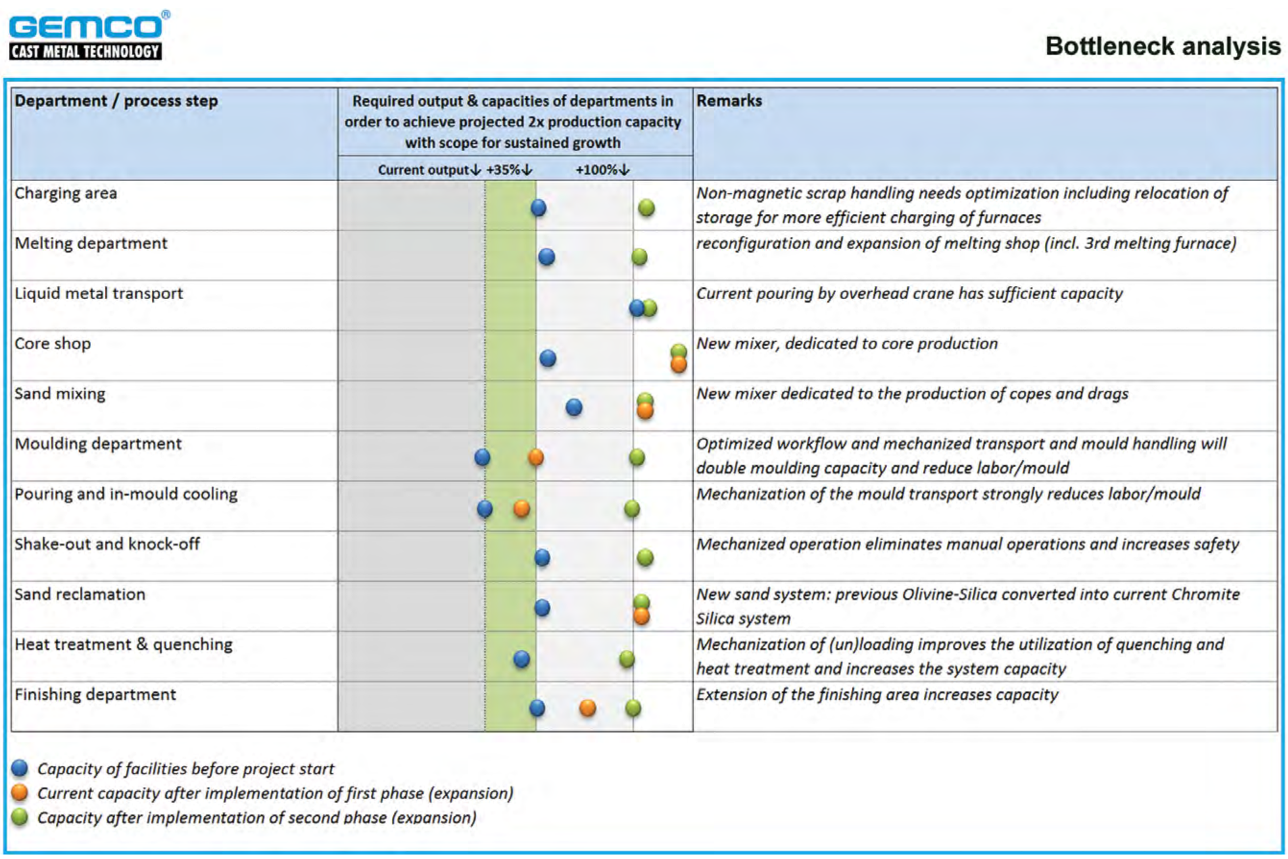

Figure 2: Summary of the outcome of bottleneck analysis

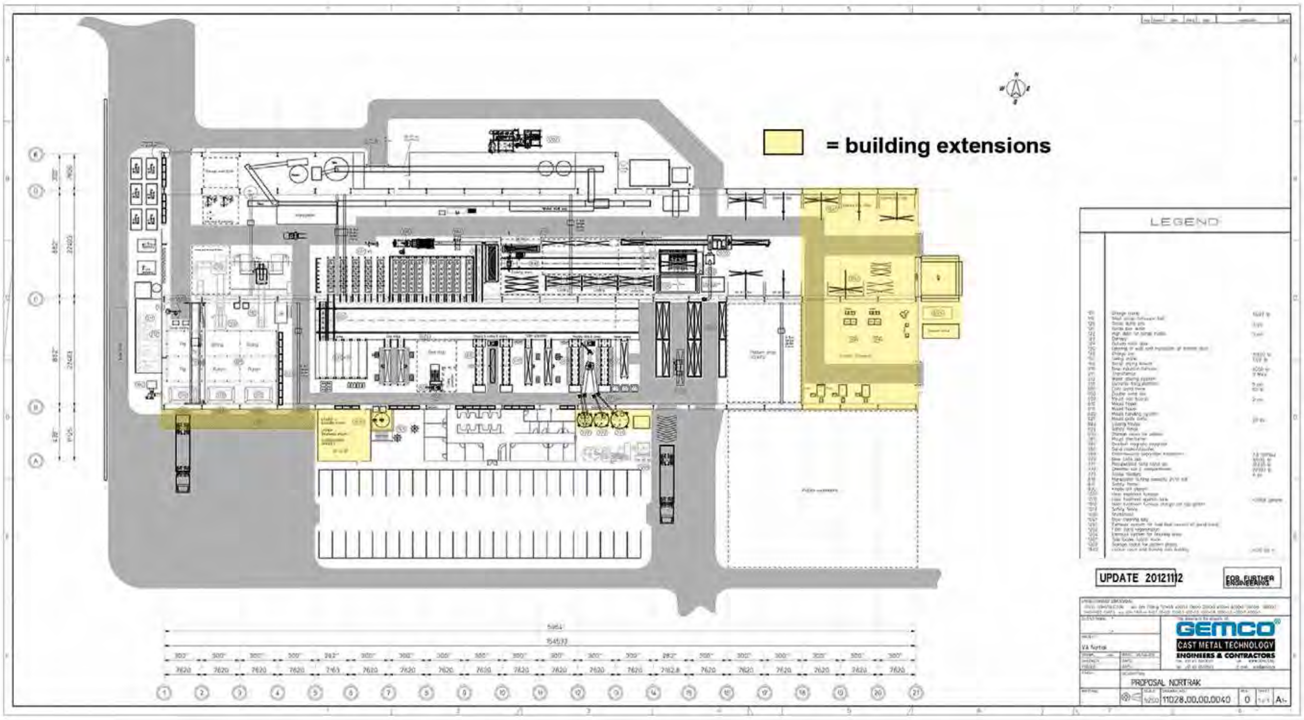

Figure 3: voestalpine Nortrak, Decatur, proposed layout in order to achieve projected capacity expansion (yellow= building extensions)

unit, system with furan binder system, or system with separation unit and thermal reclamation) and required equipment. voestalpine Nortrak decided on a chromite silica system with furane binder. When employing an olivine (basic) sand system, the furan (acid) binder system cannot be applied. In nobake sand molding, the furan binder system is however the most commonly used system (also within the voestalpine Group). Furan combines good binding properties with superior regeneration rates over other binder systems. Quartz sand would be the most economical molding material, but because of its pour thermal physic qualities and the inevitable quartz inversion of silica sand it cannot be applied for facing sand for the steel castings of Nortrak. 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 as 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 losses. The study showed that Cr/Si would be the most cost efficient system for Nortrak.

Phase 1 of the project also included moving of the plastics department to a new location and relocation of the pattern shop and cleaning bays. After which installation, commissioning and testing of the new sand system could be performed. Realization of phase 1 has been completed.

Phase 2, layout changes

The second phase of the project shall encompass the implementation of process changes and additional equipment as well as changing the foundry's logistics. By adopting the recommended process/operational changes to maximize the equipments' utilization on the one hand and mechanization in order to optimize the production flow whilst minimizing handling on the other hand, it will be possible to significantly improve the foundry logistics in the currently available space. Therefore expansion of the building could be limited to the strictly necessary to serve to the improved production flow/foundry logistics, already taking into account future sustained growth (**Figure 3**).

Capital Investment

The overall expansion project requires an estimated investment of approx. 6,850,000 US-dollar (6.5 million euro):
Phase 1: 1,850,000 US-dollar (1.7 million euro) for the sand system
Phase 2: 5,000,000 US-dollar (4.7 million euro) for molding, finishing and scrap hndling.
Despite economic 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.

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