Concrete Keeps ALABAMA RAILCAR on TRACK

Concrete plays a pivotal role in the construction of a new railcar manufacturing plant in north Alabama.

Last summer, National Industries, Incorporated., the parent company of National Steel Car Limited, announced they would be building a 2.2-million-square-foot railcar manufacturing plant in north Alabama. The facility will be located on 640 acres in the Barton Riverfront Industrial Park about 15 miles west of Tuscumbia. The facility will be one of the largest railcar facilities in the world, capable of producing 10,000 to 12,000 cars per year when it becomes fully operational by the end of the year.

Concrete was a must for the building's infrastructure because it offers strength and durability that will withstand the projected heavy manufacturing process, said project manager Michael Hartel, PE, LEED® AP, with the Albert Kahn Family of Companies. The Detroit-based architecture, engineering, planning, design and management firm, was commissioned to serve as the project's architect/engineer.

Kahn employed process design and optimal plant configuration solutions to create a new single structure facility under one roof designed to provide a low-cost, flexible operation with enhanced product throughput. At nearly one mile in length, the plant will house the fabrication, construction, finishing and administration functions to support the company's manufacturing operations.

Because of the extreme weight of the railcars that would be manufactured, special provisions were made during the building's design and construction phases. For example, as railcars exit the construction line they are supported on steel floor rails embedded in the concrete floor slab. Below these embedded rail locations is a continuous track mat or concrete foundation designed to support the weight of the railcar as it continues to the painting and final finishing operations, Hartel explained.

The slab on grade is reinforced to accommodate the heavy material handling equipment requirements for the manufacturing operations needed to be reinforced. Initially, rebar was considered for the reinforcement, however, "upon further design analysis, it was determined that using steel fibers in lieu of rebar would produce a more economical slab and help facilitate the floor slab installation," Hartel said. "By their very nature, steel fiber reinforced slabs have a greater resistance to impact, which is also a key attribute preferred for the heavy industrial nature of this manufacturing process."

Fiber-reinforced concrete offers a host of benefits including increased structural capacity, resistance to impact, resistance to cracking, decreased permeability, and impact and abrasion resistance. The most common types of fiber reinforcement materials include steel or synthetic materials, such as polyester or acrylic. Steel fibers usually are about one to two inches long and are rough along the edges to help the concrete adhere to the fiber. Typically, the amount of fibers used in concrete mixtures ranges between 0.5

to 2.0 percent by volume, depending on the project.

For added strength to the building's exterior, Hartel chose Precast concrete panels or tilt up panels as they are most commonly known. Tilt up panels are many times chosen over more economical options, such as metal buildings, for their extreme durability and esthetics, Hartel said.

The project placed the concrete panel casting beds on site, which saved time to help meet the fast track construction schedule. Concrete is placed and cured in the casting beds, the precast panels are lifted or "tilted" out of the forms and set in place. Tilt-wall construction also helped simplify steel erection by allowing for timely installation of the concrete panels after steel erection reducing interference with the steel erection crews, Hartel said.

Not only can tilt-wall construction speed up a job's pace, it can also help minimize vandalism and maintenance inside and out, withstand high winds and weathering, and absorb sound for a quieter environment. Plus, they are naturally fire resistant, which can ensure safety and lower insurance premiums.

The demand for concrete was substantial, said Paul Panelli with Yates Construction, representing the project's construction management team of Yates-Walbridge. The project required more than 16,000 cubic yards of concrete for 1,150 concrete foundation pads and 130,000 concrete slabs.

In addition to steel fibers, large amounts of mid range water reducers were required on the job. The mid range reducers were necessary to allow the concrete to be pumped more easily. Much of the concrete on the project has been pumped as it was often impractical or impossible to service the pour out of the back of the truck. All admixtures used in concrete construction, whether they are chemical or mineral, should meet the specific requirements of each job. Testing is required to evaluate how the admixture will affect the properties of the concrete for a specific job and the job's anticipated ambient conditions. The railcar manufacturing plant was no exception. Approval was needed during the development of the mixes to ensure they stayed within the required specs. Regular testing of the mixtures was conducted during the plant's construction phase by both the ready mix supplier and the contractor.

Overall, concrete not only helps keep the railcar manufacturing plant construction on its fast-paced schedule, it offers the strength and durability needed to keep it functional for many years to come. "It was a very complex project with very specific needs," Panelli said. "For much of the project, there was really no other choice but concrete." ■ by Jennifer Walker