



Brains, cranes, and COILS OF STEEL

Advanced automation meets green innovation at Hamilton warehouse

Steelcare's Plant 19 coil storage facility at the Port of Hamilton uses state-of-the-art automated equipment and a stripped-down labour model to push through more than four million tonnes of steel each year—all the while setting environmental standards for industrial sites. **Deborah Aarts** takes a look at how it all comes together.

Moving and storing steel is heavy business. It's very valuable, making it extra-important to handle properly and it's a volatile commodity—a slight change in humidity can rust and render useless an entire shipment. It's cumbersome, dense and awkwardly shaped into large coils. It also has to be moved efficiently. With shippers relentlessly working to cut waste, it's no longer practical or economical for a crew of 20 to take two or three days to unload a vessel.

Steel has been moving through the Port of Hamilton for the better part of a century. The handling of the product has evolved in that time, becoming less labour-intensive and more automated. The next frontier is to go hands-free, and one local company is doing it with a state-of-the-art new warehouse.

Steelcare Inc opened its Plant 19 facility in April 2004 to handle coils of steel headed for Dofasco Inc's galvanizing lines. Perched on Pier 25 near the mouth of the port, the 82,500-square-foot building is the first automated, two-high coil storage facility in North America. It's outfitted with proprietary software, high-tech climate sensors and turbo-charged cranes, which create a throughput capacity of 4.3 million tonnes annually. The system chugs along 24 hours a day, seven days a week, sorting and re-stacking the building's contents (an average about 55,000 tonnes) as needed to make optimal use of the space. And it all goes on under the supervision of a single employee per shift.

Steelcare's scope

Steelcare got its start in February 1999 when Demetrius Tsafaridis, a former Dofasco employee who had moved over to warehousing, received a fortuitous call from his old employer. The steel company was looking for quick storage space. Tsafaridis found it, contracted out a building, brought coils in and shipped them out again. The system worked—so well, in fact, that he started a company and did it four more times within a year. Since then, the company has opened 20 properties for different clients in the Golden Horseshoe (the swath of industrialized land hugging the west end of Lake Ontario). It currently operates four in the greater Hamilton area.

Steelcare operates largely on customer pull. It will only open a facility if a client requests it, and will adapt its own capabilities to suit those needs if necessary.

"Those sites have been opened for specific customers and specific reasons," Tsafaridis says. "We open and close according to customer needs."

Using this business model, the company has expanded significantly. A contract with CP Rail to build a steel transload facility led to rail car shunting, cleaning and repair, prompting the creation of a separate division called Railcare. A deal with Algoma Steel in Sault Ste Marie to deliver straight to customer led to the creation of Transcare, a trucking line with a fleet of 55 trucks and trailers. A year ago, the

An automated transfer cart shunts a steel coil into the warehouse

company purchased a small cross-dock operation and developed Careport, which now handles paper for the *Hamilton Spectator* newspaper. To manage all these operations, the company came to develop its own unique software products. In March it launched Carelynx, a separate arm to market the technology.

All five divisions—Steelcare, Railcare, Transcare, Careport and Carelynx—now operate under the Carego Group of Companies; Tsafaridis is the president.

“We’ve kind of morphed from being a pure warehouse to now looking at dozens of issues for our customers,” he explains. “From wherever they’re starting to wherever they’re going to, they’re trying to squeeze cost out. We try to do that by linking modes of transportation together.”

The Plant 19 process

Plant 19 came about with Dofasco as the end user. The building sits on reclaimed land (part of the Eastport Development program) leased long-term from the Hamilton Port Authority (HPA). It’s less than a kilometre from the steel company’s dock, making a short shunt on Transcare’s trucks.

Activity at the facility starts with the transmission of a vessel schedule from Dofasco, detailing the latest shipment of steel. The ship’s details—including all data for an average of 860 coils (or 17,500 tonnes)—are sent to Steelcare by electronic data interchange (EDI). The company then downloads that data into its facilities management system and digitally overlays all the coil specifications onto the floor of the building. Because each coil is unique in weight and circumference, the calculations must be careful.

“We map it as though it now exists in our building,” Tsafaridis says. “We then look on our computer systems, and if it says ‘it doesn’t fit, this coil doesn’t fit, those coils don’t fit,’ it’ll tell us what we have to do to the building [to make it fit].”

When a ship is due—about once every six weeks, depending on Dofasco’s schedule—the building prepares for it during the night. After 9:00pm, when electricity rates drop, that data is released to the building’s crane network, which repositions the coils to match the map generated by the system. By 7:00am the next morning, when the price of power goes back up, the cranes stop consolidating the building and get down to the daily grind of hauling coils in from docked ships in the nearby harbour.

“We have no clue how the vessel has been loaded,” Tsafaridis says. “We don’t care. We have all the barcoded information that was electronically sent to us, and every coil loaded in the vessel is barcoded.”



From there, a truck—carrying anywhere from one to three coils, depending on weight—enters one of Plant 19’s two drive-through bays. The worker on shift scans each coil’s barcode with a handheld reader. Information about the individual item appears on a screen, followed by instructions about where and how to put it away in the warehouse.

The operator then summons an overhead crane to remove the coil from the truck and place it on one of four transfer carts running from the bay into the adjacent storage area. There, one of two massive overhead cranes—one for each of the building’s two warehouse bays—running the length of the building will fetch the coil and place it in the predetermined area, assisted by another transfer car running back and forth between the two storage spaces.

One worker can unload the contents of a full ship in 32 hours. The same amount would take 16 workers 72 hours to complete manually.

This whole process is documented in real-time for Dofasco.

“With every coil we scan, the system is updated to say it’s in our building now,” Tsafaridis says. “We start with coil one and end at 863,

and they get updates with every one as it’s happening. It’s real, live, up-to-date information.”

The coils are stored in 55 rows, spaced 18 inches apart. Rather than the conventional single-tier format, they are stored in an interlocking honeycomb-like structure, with coils on the bottom level cradling those on the top. This unique two-high method requires extra precision to protect bottom coils from damage, but makes up for it by doubling the efficiency of the floorspace.

When Dofasco needs product for its galvanizing line (which is located across the street from Plant 19), it will send another EDI release about 72 hours in advance. Steelcare will then call out, unwrap, stencil and load the requested coils onto trucks to be delivered to the plant.

The path to automation

This entire process relies on one crucial component: Steelcare’s automation software.

The company knew it wanted proprietary software to complete tasks in a way that exactly complemented its business model. After an outside company was unable to do it, Tsafaridis decided to take a stab at it. He enlisted his resident tech guru Martin Boni and proceeded to create, develop and fine-tune the system in-house.

“We wrote the business language, programmed it, then brought in some PLC (programmable logic controller) programming skills to finish off the link between the systems and the crane automation.”

The result is five software modules, providing facilities management, inventory management, EDI, web portal and radio frequency (RF) tools. All are being sold individually or as a suite under Carelynx. And all were tested and perfected within Steelcare walls.

“We’d been looking to automate a facility for about five years,” Tsafaridis says. “We just couldn’t find anyone else who had done it in this type of application.”

This technology runs the crane system that forms the foundation of Plant 19. It dictates all movements and controls the speed, environment and effectiveness of the building. Co-ordinating this was no small feat. As Tsafaridis points out, no one had ever automated a facility quite like this before.

“Automated cranes are not new,” he admits. “There are lots of automated cranes that are being used for dangerous situations, like very hot environments or big bulk. But not for anything as specific as a cylinder, and especially not in an environment where there’s not one cylinder, but three. You’ve got a triangle of coils, and you’ve got to get the math exactly right.”

Tsafaridis and Boni spent months ironing out kinks in the software to make it work better. Finally, they found a formula that could do exactly what they wanted it to—starting with the cranes.

Controlling cranes

The company’s so-called “smart cranes” work in an interesting way.

The hardware is heavy-duty e-class P&H Cranes—beefier than necessary to guarantee that their capacity is not an issue. The rest comes down to mapping the layout with the software.

“The [warehouse] space has been gridded into our system, mathematically gridded,” Tsafaridis explains. “We’ve created 55 row grids in each bay, so that’s your basic structure.”

Each row is divided into zones, with specific width, height and coil size requirements that allow like coils to be grouped together. When a shipment comes in, the software reads the barcode information to determine where to place the coil. The facilities management technology becomes a virtual brain for the crane, telling the device exactly where to go, what to do and when to do it based on straight mathematics and what the company calls “slave functions.”

However, the company recognizes that this pure programming will not always accurately represent what is there. A coil that has been lightly damaged en route, for instance, may have different parameters in real life than those recorded in its barcode. To make sure the crane is picking up the proper dimensions, there is a backup system. Each crane is equipped with infrared beams that project down on a coil before pickup to read its actual size and location.

“If we’ve got a dented flap or something that throws off the width of the coil, the crane will stop and say ‘sorry, you’ve brought me to the wrong spot,’” Tsafaridis explains.

The company is then able to examine the problem and correct it.

In addition, the considerable brawn of the cranes makes other safeguards necessary. The two warehouse devices are capable of travelling at speeds of up to 640 feet per minute—considerably faster than the 330fpm normal standard. With the hands-off nature of the building this carries a modest amount of risk, but the company has installed elaborate shock absorbers at the end of each track nonetheless. This was expensive—roughly \$67,000—but according to Tsafaridis it allows the company to operate worry-free.

Controlling climate

Maintaining a proper atmosphere is essential to effective steel storage. Improper temperature or humidity levels can alter or rust the product, thereby devaluing it—a major concern when thousands of tonnes are at stake. While the optimal temperature of a steel coil is subject to debate, Steelcare chooses to keep it at 20 degrees above outside dew point. In its older facilities, the company used zone sensors and furnace heating to accomplish this. At Plant 19, it has taken a different path.

Two systems control the warehouse’s climate. The first is a solar heat collector. As long as it’s warmer outside a fan will pull outside air indoors. The second is infrared heating, which warms up the metal—

not the air—through a system of radiant tubes.

“Because there’s nobody working in there, we don’t have to worry about that environment,” Tsafaridis explains. “We just want to make sure the metal is being cooked, so to speak.”

Again, the facility is zoned to accommodate coils of different temperatures. Temperature sensors in the transfer carts register the status of every incoming item to determine where to place it. So if a ship comes in after a particularly chilly journey, for example, the cargo will be deposited in a certain area rigged to heat it up—but only gradually. Steelcare warms its coils at a leisurely pace of one degree per hour.

“It’s like if you pull a beer out from the fridge,” Tsafaridis says. “If you put it into a hot environment, it’ll condense quickly. You want to do it slowly, so it won’t condense.”

The computer system allows the company to constantly pay close attention to such details without hours of labour. It also facilitates unprecedented precision. For example, the crane bridges in the warehouse bays are each outfitted with infrared scanners that shoot the length of the building. The beams constantly gauge the distances between the walls, adding and subtracting while the bridge is in motion. Given Canada’s ever-changing temperatures, the company can thus get an exact grip on the ever-changing size of its building. In warmer months, when the building tends to expand slightly, the computer can recalibrate accordingly in real-time without affecting the accuracy of the floor grid.

LEEDing the way

Plant 19’s setting (on reclaimed portland soil) factored in determining its sustainability. The facility is the first industrial building in Canada to have achieved the Leadership in Environmental and Engineering Design (LEED) Gold Seal by the Green Building Council of Canada.

“We’re in a very sensitive area of Hamilton,” Tsafaridis says. “Whenever you get near port waters or lowlands, you always have folks coming out of the woodwork concerned with what you’re doing down there, what you’re building. We wanted to make sure we avoided all that, so we did this right from the get-go.”

Nearly everything about the facility—from the solar panels to the late-night crane repositioning to the direct radiant tube heating—is designed to conserve energy and minimize environmental impact. The system is programmed to turn off unnecessary lights and recover as much heat as possible. A rainwater cistern on the roof collects water to run the toilet system, while stormwater retention ponds minimize runoff and reliance on the city sewers. The lights are almost always off in the warehouse. Even the floor of the building is made with interlocking brick instead of concrete, making easy to tear up and reuse if needed.

The building cost just under \$8 million. About \$750,000 of that was the extra expense of becoming LEED-friendly. Still, Tsafaridis says the



Demetrius Tsafaridis

added expense was worth it—the company recouped the money through operating cost savings within 14 months.

“We’re excited about that, because we’re able to prove to the building market that you can in fact produce facilities that are for industrial end-use that can be environmentally friendly.”

Sparking change at the port

Plant 19 is the first facility of its kind at the Port of Hamilton, but it won’t be the last, at least if Bob Matthews has anything to do with it. The HPA’s vice-president of sales says the port is aggressively trying to attract more specialized handling facilities.

“We’re trying to get away from the old view of ports being just repositories for materials,” he says. “We’re trying to reposition the Port as a strategic distribution centre for the region.”

With this in mind, the HPA and Steelcare are in the very early phases of a much larger venture called the Poseidon project. The initiative would involve drive-through terminals much like those at Plant 19, only for cargo ships instead of trucks. It’s been done in Europe, but never in North America. Still, both Matthews and Tsafaridis are confident that if the right shipper can be found, the project would work in Hamilton. In that case, Plant 19 would serve as a model.

All that is a long way off, however. In the meantime, Tsafaridis says Steelcare is continuing to push Plant 19 forward. The company is working with researchers at McMaster University to look into RFID technology at its facilities. It’s tweaking the sensor equipment to recognize even more subtle details, such as sinkholes in the floors. It

regularly tests out different crane and aisle widths to enhance performance. In short: it’s working to push the technological envelope further. This, he hopes, will position Steelcare (and Carego) to secure more business down the road—not just in Hamilton, but nation-wide.

“It’s not just stopping at the basic things we need to do for our current customers,” he sums up.

“It’s taking it beyond that.”

MM&D

The hard facts on Plant 19

Location: Pier 25 of the Port of Hamilton

Opened: April 2004

Architect: Chamberlain Architects

Environmental Engineering: Enermodal Engineering

Operator: Steelcare Inc

(part of the Carego Group of Companies)

Size: 82,500sqf

Commodity: Steel coils destined for Dofasco Inc

Average capacity: 55,000 tonnes

Annual throughput capacity: 4.3 million tonnes

Doors: Two drive-through truck bays

Software: Proprietary suite created in-house

Cranes: P&H Cranes

Transfer carts: West Bend Equipment

Positioning laser hardware: Allen-Bradley

Barcode scanners: Teklogix



A crane lifts a coil to be stacked in the warehouse