Doka **Xpress**

The Formwork Magazine | Vol. 15 Issue 2

Forming Muskrat Falls

Canada's largest construction project underway with Doka

The Formwork Experts.

doka

Editorial

Dear Customers and Colleagues,

A quick review of the table of contents of this issue and it becomes clear that growth and diversity are the key themes for Doka as we enter the second half of 2015. Our project involvement ranges from the 824 megawatt hydroelectric generating facility, which happens to be the largest construction project in Canada right now, to a 250 room hotel in Charlotte, as well as a church facility in Los Angeles. Adding to this variety is our involvement in Atlanta's new MARTA Brady Mobility facility, plus a major wastewater treatment plant in Ontario and participation in the Greenwood College project in Toronto. No matter the industry, the geography or the project size, Doka is continuingly being selected as the preferred formwork partner for a wide range of projects because of our dependable, safe and cost-effective solutions.

In addition to our existing formwork solutions, Doka recently unveiled another advancement: Concremote. Designed to improve quality control for contractors, Concremote makes it possible to measure concrete strength on the site, in real-time using the weighted maturity method to provide reliable, standards compliant information on the strength development of the concrete. This process facilitates targeted management of the forming and cast-in-place concreting operations. The technology is being used at the Muskrat Falls project and has immediately proved to be beneficial.

Project growth in diversity has required Doka to continue to expand our operations and team members. To this end, we have relocated our Florida operations to a larger location in Pompano Beach near to Miami. Furthermore, Doka is hiring across the USA and Canada to ensure we have the best support staff to keep your projects safe and on schedule.

We look forward to helping you to successfully complete your project, no matter the size or sector.

Andrew Mair
Chief Executive Officer
Doka USA, Ltd. /
Doka Canada, Ltee.

Table of Content

Doka News

NYC's tallest residential building ▸

Construction is underway on the Nordstrom Tower at 217 West 57th Street. At 1,522 feet, it will have the tallest roof height of any building in New York City and the rest of the western hemisphere, surpassing 432 Park Ave.

Super Climber debuts in Seattle ▸

Doka expands presence in the Seattle market with innovative climbing formwork technology on a 40-story 300,000 sq ft mixed-use high-rise called 2nd + Pine.

◂ Miami's tallest tower

The Panorama Tower is going vertical with Doka. To be the tallest residential building on the eastern seaboard south of New York, Panorama Tower will rise 83 stories over the Miami skyline, as an iconic, global landmark.

▲ The Embassy Suites Charlotte Uptown project in the heart of Charlotte, NC, broke ground in late 2014 and the concrete frame is expected to be completed late summer 2015.

Embassy Suites Climbs High

Charlotte, NC is a city with growth on the horizon and Doka and Lithko Contracting at the center of it all. Lithko Contracting has enlisted Doka to provide formwork solutions for various jobs over the last 4 years. They have come to especially enjoy the cost savings and the service that they have received by using Doka's Frami lightweight formwork system for walls and columns and Dokamatic Tables with either 10K, Dokaflex, or Staxo 100 for a multitude of their many shoring projects. Lithko turns to Doka when interior and exterior platforms are needed for stair and elevator cores, or if work areas are needed on the exterior of the building. Doka has provided multiple formwork solutions including working and Climbing Platform K, Climbing Formwork MF240, shaft platforms, and are under contract to supply bridge formwork ParaTop, and automatic climbing system Super Climber SCP on upcoming projects.

▲ Lithko used Frami universal column forms with its 1,650 psf pour pressures for the 50 ft tall columns and jumped them in multiple lifts.

The Facts

Project name: Embassy Suites Charlotte Uptown

Location: Charlotte, North Carolina

Type of project: Hotel (250 rooms), Underground Parking, Retail.

Square footage: 292,000 sq ft

General contractor and/or architect: Chhabra Construction / Overcash Demmitt Architects

Concrete contractor: Lithko Contracting

Formwork used: 30,000 sq ft of Dokamatic Tables , Staxo 100, Frami, MF240, D22

Start and scheduled end date of work: December 2014 - July 2015

The Challenge

Assembly, erection and stripping of elevated CIP deck slabs with shoring heights varying from 30 ft to 50 ft tall, 50 ft tall columns, one-sided walls out of the basement poured against sheet pile with small stepped grade beams that offered little concrete to anchor into. Other obstacles Lithko faced on this project were that the site had very limited space for any laydown or loading and unloading of equipment.

The Solution

Dokamatic Tables and load-bearing tower Staxo 100 for the high shoring. The tables were on site on the lower level so the Staxo could be built in place and as the tables were stripped out of the basement they could be set directly onto the Staxo and the props from the tables on the lower height slabs in the basement could be left for the basement re-shore. This minimized the purchase of addition plywood for two levels of decking, the labor of stripping a loose forming system and having to reset all of same material, minimized the amount of space needed for storage.

▲ Doka was brought onto the job due to its reputation of safety, the quality of its products, as well as the Lithko Contracting's previous experience with Doka's products and services.

The Embassy Suites Charlotte Uptown is a project currently under construction located in the heart of Charlotte, NC. The project broke ground in late 2014 and the concrete frame is expected to be completed late-summer 2015. Doka was brought onto the job due to its reputation of safety, the quality of its products, as well as the Lithko Contracting's previous experience with Doka's products and services. Lithko and Doka have successfully been working together for 4 years on multiple projects in the Carolinas.

The Embassy Suites is a eleven-level CIP structure with shored slabs that vary in height from 9 to 50 ft tall. The project has one level of underground parking, a high bay truck entrance to provide delivery access to service meeting and conference room space, the 250 room hotel, and a pool and open air space on the 4th level. Some of the obstacles that had to be overcome were, 50 ft tall shoring, 50 ft tall columns, one sided walls on an entry ramp in the basement because of 0 ft lot lines, and excessive vertical concrete on one side of the building. To overcome these challenges Doka went to its arsenal of products to develop solutions for all of the challenges.

To combat the open air space and pool on level 4 combined with the high bay areas above the garage, Doka provided its Staxo 100 shoring system with Dokamatic Tables to shore the 20 ft to 50 ft tall shored slabs. Lithko used the Frami universal column form with its 1,650 psf pour pressures for the 50 ft tall columns and jumped them in multiple lifts. Because the structure was on a corner in downtown Charlotte across from the NASCAR Museum, Doka provided their D22 one-sided brackets as an A-frame system to form the one sided walls from the underground parking level to slab on grade level. The D22 gave a smaller footprint at the bottom to eliminate the amount of concrete needed for support. Staxo 100 was provided for all of the high shoring requirements. Lithko has been impressed with the Staxo 100 shoring system because of the ease of assembly, no loose parts, and the safety the system delivers. To ensure safety on the jobsite, load-bearing tower Staxo 100 was selected thanks to slip resistant ladders integrated into every frame, and clear safety tie-off points built directly into every frame. Additionally, Staxo was included in the plan for the high shoring elements of the project for ease of use in erecting and dismantling. 30,000 square feet of Dokamatic Tables were delivered to the jobsite as pre-assembled units with plywood to form the slabs. The versatile product and design allowed all tables to be used on the high bay levels in combination with Staxo 100 shoring frames and also on the typical levels with Eurex Props.

With the successful completion of their work at Embassy Suites Charlotte Uptown project, Lithko Contracting and Doka have added one more highlight to their forming history.

▲ Concrete contractor Aurora Forming, Inc. chose Doka solutions and services for the first time, selecting Doka above other suppliers due to their reputation for good service and relationships.

New Client Partnership Brings Success

Greenwood College is an independent school located in Toronto, Ontario, that focuses on a model of education that combines academic rigor, a personalized approach to learning, engagement in the arts and a structured program of physical activity. In order to continue growing in size as well as remaining up-to-date on technology and sustainable design, Greenwood is expanding its campus by constructing a new building that features a green roof with outdoor classroom and terrace, a new performance arts theatre, a number of new studios and labs, and LEED Gold Certification.

The Facts

Project name: Greenwood College Expansion

Location: Toronto, Ontario

Type of project: Expansion, Private College

General contractor: Graham Construction

Concrete contractor: Aurora Forming Inc.

Formwork used: Framax Xlife, MF240 climbing platforms, Dokaflex, Dokaflex Tables, Super Props

Start and scheduled end date of work: October 2014-July 2015

The Challenge

First time Doka customer utilizes a variety of formwork solutions on a College expansion project with no previous Doka formwork experience.

The Solution

Doka Site service and engineering established a good relationship with the client, by working on site to reduce the crew's learning curve of the system and improving productivity.

▲ The strong and versatile Super Prop Towers were used for high shoring areas.

Concrete contractor Aurora Forming, Inc. chose Doka solutions and services for the first time, selecting Doka above other subcontractors due to their reputation for good service and relationships. The owner's primary goals were meeting the schedule, safety and a good exposed concrete finish.

The building features an exposed concrete structure with no concrete plastering, painting or "cover ups." A smooth architectural concrete finish was required. The perfect solution for this design constraint was the use of Doka framed formwork panels, Framax Xlife, due to its special Xlife plywood face. To ensure the panels performed as required, they were individually inspected to make sure each panel had no scratches, patches, oil or other obstruction that could leave an imprint on the concrete. In addition to this challenge, there was a learning curve to the partnership as the client was a first-time Doka user. Site service and engineering helped make the customer feel comfortable and to reduce on-site assembly time.

For this project the following systems were in use:

Framax Xlife panels supported with C8 Channels were used for single-sided and double sided wall applications. The single-sided walls required approximately 3,000 sq ft of formwork to be assembled 8.1 m high; the double-sided walls required approximately 4,700 sq ft of formwork assembled 6.75 m high. The innovative Xlife facing special plastic surface produces an excellent concrete finish, as can be seen in the final product. To benefit the contractor, Doka reused the same assembled Framax panels through the entire single-sided wall.

MF 240 climbing platforms were used for exterior walls, permitting controlled, regular working cycles. The formwork and climbing scaffold are linked together as one single unit, making repositioning in just one crane-lift possible.

Flexible slab system Dokaflex S was used for the basement level and ground through third floors. This versatile system is fast to set up since it consists of only two different beam lengths.

Pre-assembled Dokaflex Tables were used from the ground floor through the roof floor, providing quick and easy re-positioning.

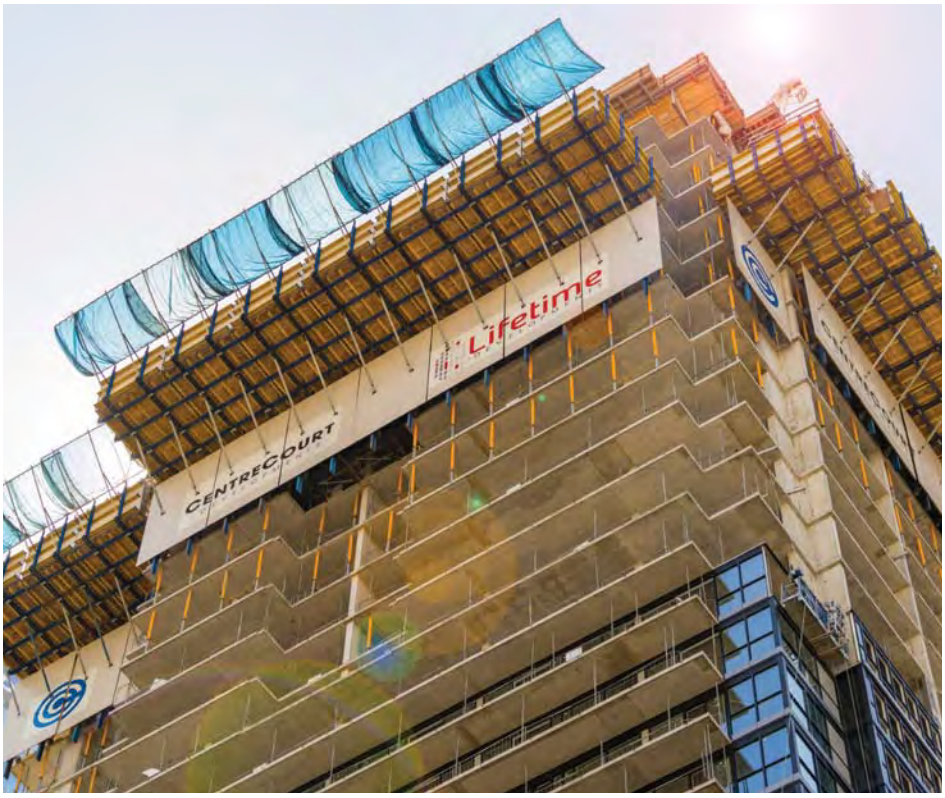
Doka Super Props were used for high shoring areas. Super Props were stacked to meet the required 6.50 m height from the lower basement to the ground floor. Two transfer beams (one meter and three meters) were supported by these props.

Detailed calculation was done for the reshoring of slab from the lower basement to the fifth floor, including the calculation of mud sills.

To ensure safety on the jobsite, site service and engineering inspections were completed.

As a result of the successful progress on the Greenwood College expansion project, Aurora Forming has awarded Doka with two more projects.

The proposed completion of this expansion project is set for the end of July 2015.



The Facts

Project name: INDX Condominium

Location: Toronto, Ontario

Type of project: Residential building, Condo

Square footage: 568 ft. tall, 54 stories

General contractor and/or architect: Lifetime Developments, Centre Court Developments

Concrete contractor: Hardwall Ltd.

Systems used: Protection Screen Xclimb 60 with integral loading platform, Framax Xlife

The Challenge

Under the premise of a lively jobsite surrounding, high safety was not only required for the site crew, but also for pedestrians. Limited space on the construction site together with a tight schedule called for innovative formwork solutions.

The Solution

The newly developed hydraulic protection screen system with loading platforms stood up to every challenge, capable of carrying 6,000 lbs per 12' x 16' platform and allowing for sufficient working space.

Seven Platforms at Once

On the INDX condominium project in Toronto, Hardwall Construction climbed seven platforms into the next casting step at once, in one hour with no crane.

Doka in partnership with Hardwall Construction developed a new hydraulic protection screen system incorporating a 16 ft loading platform to provide storage and laydown space outside the building perimeter at great heights. With the ability to hydraulically lift seven loaded platforms at once, Doka once again demonstrates its level of expertise and innovation to adapt to customer and market needs. Adding up to this, Doka was able to help reducing the formwork cycle time to 4 days versus 6 days, eventually saving the contractor 100 valuable days of construction time.

▲ 16 ft loading platforms

▲ Solid team work between Doka and Hardwall Construction

The Facts

Project name: Muskrat Falls

Location: Lower Churchill River in Newfoundland / Labrador

Type of project: Hydroelectric generating facility generating 824 megawatt (MW) output. 6 spillway piers, 3 transition dams and powerhouse

Owner: Nalcor Energy

Concrete contractor: Astaldi Canada Inc.

Overall project cost: $8 billion

Start date and scheduled end date of work: April 2014-2017

The Challenge

As the second-largest hydroelectric generating facility in Canada, the complexity of this project required multiple solutions to complete the main power-house structure including four turbines, three dam structures, six spillway piers, a large separation wall and smaller retaining walls. Additionally, Astaldi Canada has a zero tolerance policy for unsafe conduct and methods on their jobsites.

The Solution

Doka was selected above other competitors due to the company's level of experience with challenging and engineering-intense projects as well as their highly efficient products. The multi-scope services and materials provided by Doka will save the contractor Astaldi from using different suppliers on this project and therefore reducing the amount of time spent on procurement, training, logistics and quality control. Additionally, a reputation for safety, efficient formwork solutions and professional support made Doka the top choice supplier for the project.

▲ Spillway Piers - Downstream view, approximately 45 m high

Multi-Scope Solutions at Muskrat Falls Project

Doka Canada is the formwork supplier for Nalcor Energy's Muskrat Falls Project in Newfoundland and Labrador, Canada. The 824 megawatt hydroelectric generating facility is currently the largest construction project in Canada and is situated on the Lower Churchill River, approximately 30 kilometers west of Happy Valley-Goose Bay.

▲ 6 Spillway Piers under construction simultaneously

▲ D22 Dam formwork with large-area formwork Top 50

▲ Spillway Piers - Bullnose Custom Formwork

Project Overview

The facility will be the second-largest hydroelectric generating facility in the country when complete and will consist of the main powerhouse structure including four turbines, three dam structures, six spillway piers, a large separation wall and smaller retaining walls.

The new hydroelectric generating facility will power homes and businesses across Newfoundland and Labrador with clean, renewable energy for years to come. Sanctioned by the Government of Newfoundland and Labrador in December 2012, the Muskrat Falls project will help Nalcor Energy meet the province's growing energy demands with stable electricity rates.

When the generating facility is operational, approximately 40 percent of the power generated will be used to meet the island's electricity needs. Emera Inc. will purchase 20 percent of the power from Muskrat Falls for use in Nova Scotia, and the remaining 40 percent of the power may be either exported into Atlantic Canada or New England markets or retained for use in

▲ View of Spillway Structure and Powerhouse - rendering by Nalcor Energy

Newfoundland and Labrador. The province is projected to need 80 percent of Muskrat Falls' power by 2036, though possibly earlier depending on additional industrial growth.

Safe Jobsites as a Priority

Astaldi Canada has a zero tolerance policy for unsafe conduct and methods on their jobsites. To meet the client's requirements, Doka committed to on-site training and supervision, while maintaining the usual high safety standards built into the design of all their formwork solutions. Doka offers pre-assembly service to ensure that all formwork elements are assembled in a controlled environment and quality checked prior to shipment site. This reduces the risk of errors and avoids on-site formwork assembly to save time and increase productivity, as well as releasing the client from the responsibility of training and supervising an on-site assembly team.

Many proactive activities were put in place to ensure safety on the jobsite. A few of these include the production of detailed engineering drawings produced according to CSA standards and checked and stamped by a professional engineer, Doka Field Service Engineers and Doka Technicians are located on site throughout the project duration who provide regular

▲ Formwork installed on sloping base slabs and poured against bedrock

product and safety training to site personnel. Doka ladder systems with cages were utilized on all D22 climbing platforms, Doka Stair Towers were provided to allow access to formwork systems and working platforms, and pre-pour inspections are made on site together with the customer to ensure all material was installed correctly according to Doka engineering drawings.

Powerhouse

The largest structure on the project with a height of 70 m, width of 90 m and length of 150 m is the powerhouse. This complex structure houses four generating units, each consisting of a 206 MW Kaplan turbine, an intake, semi spiral case and draft tube area.

▲ Powerhouse construction during nightshift

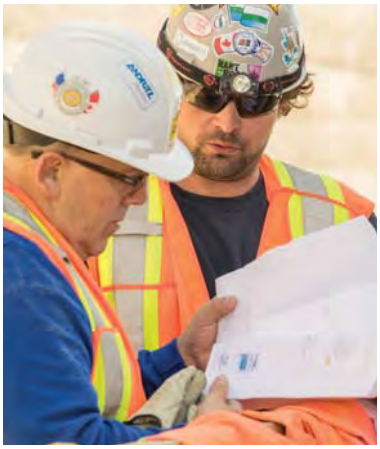
Intake

The Intake is characterized by up to 28m high piers, steep sloping top and bottom soffit and stop log shafts. Astaldi is using Doka's Large-area formwork Top 50 combined with D22 Dam formwork to construct the asymmetrical shaped piers. The top soffit form is also constructed with Large-area formwork Top 50 supported with Staxo 100 Load-bearing towers. The Staxo 100 system with its high load bearing capacity is ideal for such applications. It is possible to preassemble the shoring towers off site in a preassembly area and then ship and erect with the crane in a short period of time boosting productivity. The majority of disassembly is possible manually without the use of heavy lifting or material handling equipment. The Stop Logs are formed with Large-area formwork Top 50 and Doka Shaft platform system.

Semi Spiral Case

Constantly changing radius, sloping walls and soffits along with a segmented circular housing for the stay-ring make the semi spiral case a challenging structure in every way. Furthermore many vertical and horizontal elements are cast together. The Doka Engineering team uses state-of-the-art 3D design and dimensional design and simulation software to engineer a formwork solution that can be pre-assembled in large elements to high precision. Astaldi is using a combination of Doka's D22 Dam Formwork, Large-area formwork Top 50, Staxo 100 Load-bearing tower, Doka Super Prop and 3-dimensional shaped custom forms and tables. A large portion of the formwork can be reused between the four units minimizing waste and transportation costs to site.

▲ Downstream view from right to left: North Transition Dam, 6 Spillway Piers, Centre Transition Dam, Separation wall



▲ Doka Field Service Engineers based on site

Draft Tube

The Draft tube outlets also consist of piers and heavy soffits. A combination of Staxo 100 and D22 Dam formwork enables Astaldi to achieve tall pour heights with large concrete volume poured in a tight schedule.

All formwork solutions are designed to meet the aggressive construction schedule demanding versatile and heavy duty formwork solutions that perform reliable on multiple pours in extreme weather conditions.

Three Dam Structures

The hydroelectric facility consists of three dam structures: a North Transition Dam, a Centre Transition Dam and a South Transition Dam. All three structures have a similar design: a steep inclined surface changing to a straight/true vertical face. Unique solutions were developed to over climb the gallery openings and the change of direction of vertical surfaces, Doka's engineering team designed special support frames in order to anchor D22 Dam brackets securely to the structure.

Doka's D22 Dam formwork stands out for its high load-bearing capacity and operational safety.

One of the advantages of using this system on all three dam structures at Muskrat Falls was that the formwork is tiltable, and retractable, allowing cleaning and preparing of form face without the use of the crane. The ability to tilt the form independently from the bracket was very useful to over climb sloped and projecting wall sections without modifying the formwork. The wide working platform, integrated tie off points, lifting points, fixed handrail posts, preassembled platforms and an integrated ladder system provided maximum safety and comfort to the field personnel.

Spillway Piers

The six spillway piers have true vertical concrete surfaces, constructed in three monoliths. Every spillway consists of a bullnose on the upstream side with a large concrete block overhang on the downstream side, as well as eight box-outs required for the installation of mechanical gates. To reduce the risk of deflection and movement during pouring of the symmetrical bull noses, Doka designed and built the formwork using custom curved steel wailings to form the shape of the bull nose instead of the more traditional approach of wooden gussets. This ensured that the formwork element could be reused multiple times without any need to change.

Separation Wall

The large separation wall was poured in seven monoliths, wheras Monolith 1 was poured against the existing structure of Centre Transition Dam.

Large Area formwork Top 50 was a perfect fit on the separation wall because it is a modular gang form system that is suitable for all shapes, sizes and pour pressure requirements. Shape, size, tie pattern and plywood are all adapted based on project requirements. On the Muskrat Falls project, the system offers a high number of re-use cycles, short forming times, as well as large optimized gang units and flexibility to incorporate waterstops or metal embedments in the formwork elements.

North and South Service Bay

North and South Service Bay are access structures of the powerhouse; they contain shafts, stair cases and mechanical and electrical installations. Framax was used for the walls as it can withstand high concrete

▲ Stair towers permit safe access to work decks.

pressure for fast pouring rates. Since Framax is modular it was very flexible and fast to set up, requiring little skill. The strong steel frame of the Framax panel allowed an effortless stacking of panels to form tall walls with large openings. Staxo 100 Load-bearing system is used to support and pour the transfer slabs. Since crane access is limited in this area the towers can be dis-assembled manually and removed through a small opening. All components are lighter than 40 kg (88lbs.).

Concremote – Measuring Concrete Strength in Real Time

Concremote makes it possible to measure concrete strength on the site, in real time. It uses the weighted maturity method to provide reliable, standards-compliant information on the strength development of the concrete. This facilitates targeted management of the forming and CIP concreting operations.

The Concremote sensors regularly measure the temperature development of the fresh concrete and transmit the data to the Concremote computing centre. The strength development of the concrete is calculated by reference to the values from the previously effected calibration measurement, and the information is sent back to the site in real-time.

In total, 32 Concremote sensors were installed on site to provide continuous measurements of heat and strength development in the ongoing concrete pours. One of the challenges faced on this project are the extreme weather conditions and varying temperatures during concrete operations ranging from winter temperatures of -40 degrees Celsius and summer temperatures up to 30 degrees Celsius. This broad range of temperatures increases the risk of frost and thermal cracks in the concrete. Multiple concrete pours are measured and monitored at the same time, and Doka provided the client with custom programmed software to be able to generate customized reports.

Overall Challenges and Solutions

Muskrat Falls is located in the Northeastern part of Canada. This remote project location brings many challenges. One of them was the logistics and transportation of all formwork components to the jobsite. All material for the entire project is managed and handled through the Doka Toronto branch with a distance of 2,400 km (1,500 miles) and average transit time of 5 days to the jobsite. To meet this challenge, Doka and Astaldi prepared detailed planning schedules to ensure that all material is delivered in correct order that meets the project needs.

Pre-Assembly Service

Astaldi also chose Doka to preassemble all formwork elements off-site to ensure the highest level of quality, accuracy and productivity on site. This was a big challenge but also opportunity for the Doka Toronto Pre-Assembly Team. To meet this customer requirement, Doka Toronto is assembling formwork continuously for over 12 months already on multiple assembly stations under the close supervision of experienced Doka Assembly Supervisors. When this project is completed, Doka will have assembled approximately 5,000 pieces of working platforms and decks, over 100,000 sq ft of Large Area formwork Top 50 for all vertical walls, over 40,000 sq ft of Large-area formwork Top 50 for all horizontal slabs and more than 25,000 sq ft of Large-area formwork Top 50 for all curved bull noses and spiral scroll case areas.

Customized Solutions

To increase productivity on site, many custom solutions and products were developed for this project. A few examples include tie-loop anchors to tie down formwork diagonally to vertical rebar in order to avoid long horizontal ties running through the entire structure and the fabrication of custom off-set brackets to support the Top 50 formwork in complex applications. All of these helped Astaldi save on both labor and material as well as successfully adhere to the construction schedule.

Once operational, Muskrat Falls Project will help end the region's dependence on oil, connect to North America's electricity grid for export, provide lowest-cost power for homes and businesses and serve as a source of 98 percent sustainable energy.

▲ Powerhouse: Draft tube downstream

▲ 5.9 m shoring height using Doka Truss with Super Props

Upgrading to Expand Treatment Plant Capacity

▲ From left to right: Travis Pozzebon, Trevor Pozzebon, Todd Pozzebon and Nick Pozzebon, 3T Forming North Inc.

The Mid-Halton Wastewater Treatment Plant is located in Oakville, ON, within the densely-populated Greater Toronto Area. To meet increased demand due to growth, and continue to protect the waters of Lake Ontario, the plant needed to upgrade its capacity from 75 million liters per day (MLD) to 125 MLD and undergo other areas of improvement, including the building of a new ultraviolet (UV) disinfection system, an expansion of the plant operations and administration area, an expansion of the North Pumping Station, and the addition of a new primary digester.

Doka was carefully selected by 3T Forming North Inc. to supply formwork for the Mid Halton WWTP project because of their strong reputation for providing high-quality products and services; the reliability of their forms; the quality of the concrete finish; and the overall safety of their systems.

The major challenge on this project was the building geometry and cycling of material for different pouring heights and lengths. Through project planning and de-tailed design drawings, the Framax wall formwork was designed in such a way that gangs could be cycled over to different pours without having to dis-assemble

▲ Quality concrete finish was a requirement which Framax wall formwork was able to accomplish.

and reconfigure the formwork, which minimized the labor on site. Safety was of the upmost importance on the jobsite, so all of the Framax formwork supplied came with Doka pouring platforms, scaffold brackets and exterior handrail posts.

An innovative Doka Truss table was used for the slab shoring in the galleries where the height varied from 4.0 to 5.9 meters. The tables were designed to adapt to the varying shoring heights using Doka Super Prop with an extension and could be moved into pouring position with trolley wheels.

Doka also supplied custom circular large area Top 50 panels for the digester tank. The panels were a height of 8.4 m and included an offset for an exterior corbel. All of the panels were pre-assembled at Doka assembly shop and enabled the customer to erect panels directly into place as they arrived on site.

Overall, over 15,000 sq ft of Framax wall formwork and 1,000 sq ft of high shoring tables were used in this project.

"Doka provided us the service and quality of formwork to help make this project a success. We were impressed with the high quality finish and the speed and high functionality of the Doka tables for our high suspended slabs."
—3T Forming North Inc.

The Facts

Project name: Mid-Halton Wastewater Treatment Plant

Location: Oakville, Ontario

Type of project: Wastewater Treatment Plant

General contractor and/or architect: Maple Reinders

Concrete contractor: 3T Forming North, Inc.

Start and scheduled end date of work: December 2014-August 2015

Formwork used: 15,000 sq ft of Framax wall formwork; 1,000 sq ft of high shoring tables

The Challenge

The major challenge on this project was the building geometry and cycling of material for different pour heights and lengths. Also, to enable plant upgrades to be completed and water-tight in a facility with a tall pour height (5.9 m).

The Solution

The different pour heights and lengths were accommodated through planning and design drawings. Doka supplied Water stop G for all ties to ensure the walls were water-tight and accommodated the 5.9-meter pour height using Truss Tables with leg extensions. Custom built Top 50 panels were used to fit the geometry.

▲ Dokaflex is the fast, versatile floor-slab formwork for any desired layout. Any type of plywood can be used, so that any concrete surface finish can be achieved based on the requirement of the architect.

Growing Church Community Expands with Dokaflex

In Los Angeles area the Berendo Street Baptist Church enjoys popularity and a fast growing community. It has therefore started a development project that includes two buildings.

▲ Approximately 67,500 sq ft of Dokaflex slab formwork and 4,825 sq ft of Frami column formwork was used to complete the project.

Sea Pac Engineering wanted a slab shoring system that is productive, economical and adaptable to design changes. Dokaflex is a versatile slab shoring system that satisfied the needs of Sea Pac Engineering's project, which includes approximately 150,000 sq ft of total elevated slab.

With the expansion, there were many sequencing and logistical issues to resolve on the tight project site.

"We were satisfied with the productivity and labor savings. We are now looking into using Dokaflex on our next project." — Robert Park, Project Manager, Sea Pac

For this project, the structural design changes were on the structural slab, which included adding various sized structural beams throughout the deck. The Dokaflex Slab Shoring System was chosen since it is flexible enough to accommodate the challenges without delay. The elevated 12'' slab varies between floors up to 12 ft in height and only one type of post-shore was used, Eurex 30 300. In addition to the innovative flexibility of the Dokaflex Slab Shoring System, the system brought efficiency and labor savings.

For Sea Pac Engineering, the tight jobsite, material availability, and overall cost of formwork were all factors to be considered before the decision to use Dokaflex was made.

To efficiently construct the Berendo Street Baptist Church the contractor chose to use 67,500 sq ft of Dokaflex slab formwork and recycle this material throughout the project. Vertical columns were formed using 4,825 sq ft of Frami universal form panels.

As a first time user of Doka, Sea Pac Engineering quickly identified many benefits from using the Dokaflex Slab Shoring System. These key benefits included speed, simplicity, flexibility and safety. With only 6 main components to work with the crew was able to gain high productivity in a short period of time.

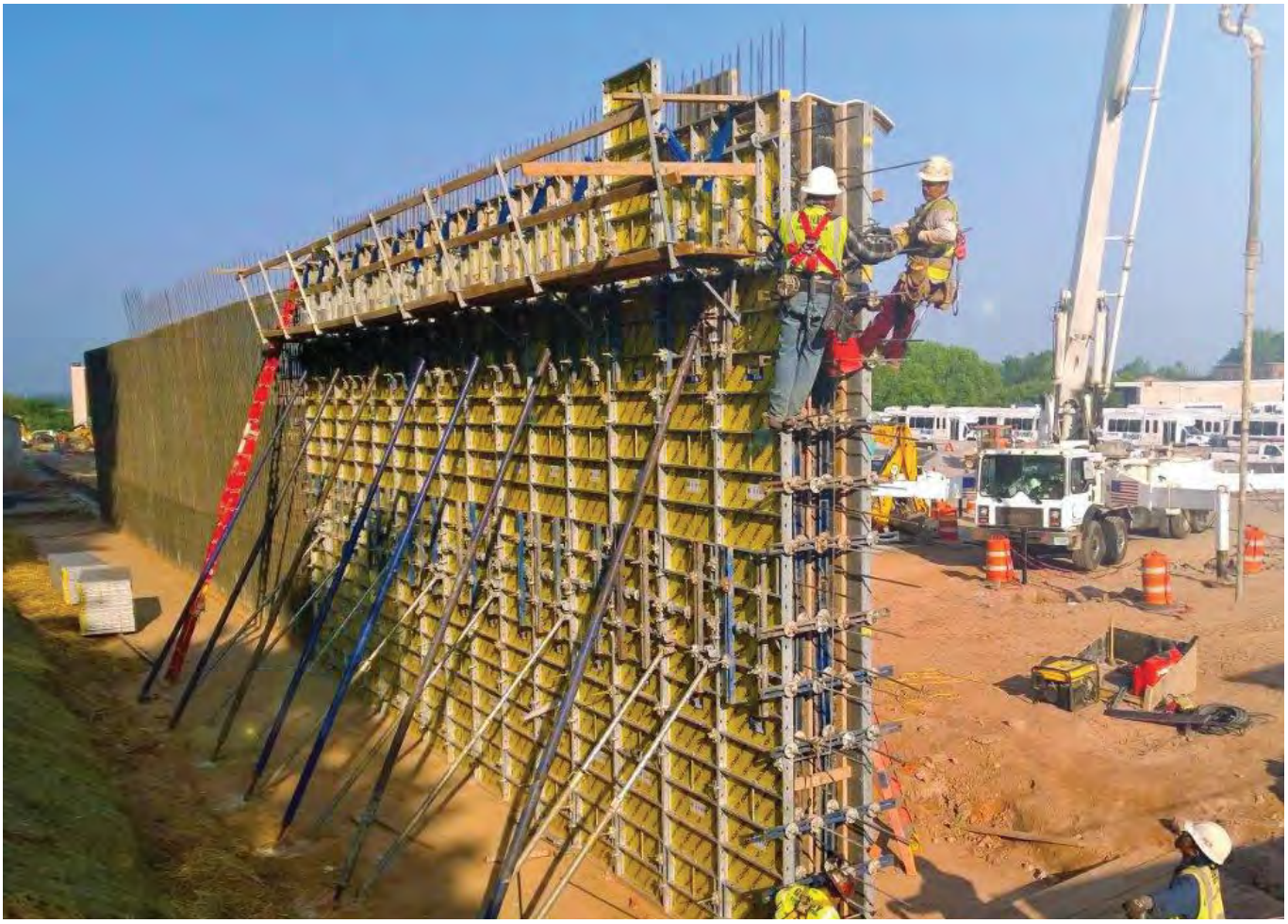
From Left to right: Denzil Day, Doka Sales Manager
Mr. Hans, Superintendent, Sea Pac Engineering
Robert Park, Project Manager, Sea Pac Engineering

Dokaflex Floor Formwork

Watch the simple assembly of our flooring system.

https://youtu.be/qUewKMqBqRk

◂ Dokaflex is a versatile slab shoring system that satisfied the needs of Sea Pac Engineering's project, which includes approximately 150,000 sq ft of total elevated slab.



▲ Gunby Construction selects Doka thanks to the strength of formwork combined with the lightweight and material availability in close proximity to the project.

Modern Transit Facility Keeps Tight Schedule

Atlanta will soon be welcoming a new MARTA Brady Mobility facility, built to accommodate the administrative functions, operations and maintenance needs for an entire fleet of mobility vehicles, including specialized vans and cutaway buses. The design includes maintenance functions on the first floor and administration operations on the second floor of the building as well as three levels of church facilities.

As a construction project, it will be exemplary of modern transit operations and maintenance design. The goal is for the new facility to be safe, functional, easy to maintain, and energy efficient as a LEED Silver facility.

The schedule is very tight for each area of this project, as there are multiple trades working in each area, and, the existing facility is remaining in full operation throughout the construction. To meet these demands, the contractor, Gunby Construction, needed the most versatile, easy to use, and fastest cycling material to keep only a minimal amount of formwork not in use that would take up the limited storage space. Gunby Construction Co. also required a high quality finish on all walls with minimal rubbing and patching.

Doka was brought in because of their previous relationship with Gunby Construction, the quality of Doka's material, efficiency of the formwork, and ease of use. The strength of Doka's formwork combined with the

light weight and material availability in close proximity to the project was a plus. Gunby Construction found that Doka's Frami Xlife formwork was the answer.

With minimal amount of storage room onsite, scheduling of formwork deliveries and returns are kept to just the essentials onsite. The area sequencing includes standard building walls, formliner building walls, four retaining walls, and wall bracing for backfill.

High capacity backfill bracing was required 12'-6" above grade and was horizintally attached to the retaining walls. The bracing was required to support the wall as heavy machinery placed backfill dirt against it. For this application, Doka designed and supplied strong pipe braces and spindle struts in multiple lengths to reach the varying distances. Additionally, to ensure safety on the jobsite, walkway brackets were used at multiple levels to access ties and top walkway.

As Gunby's Project Manager Massee says, "Doka's formwork really works!".

The project is still under construction as it also has thousands of yards of concrete paving to complete. The completed facility will allow for improved storage and for higher quality maintenance of all Atlanta's mobility vehicles.

▲ The main advantages with the Frami Xlife system is the time that you save with very few people working with it. There is very low labor involved as the panels easily move from wall to wall.

▲ The perfect panel size-grid gives you innumerable possible combinations, in both width and height. You can use the panels either vertical or horizontal, and the 6 in. increment grid allows for optimum adaptability of the formwork to the dimensions of the structure, at all times.

The Facts

Project name: MARTA Brady Mobility Facility

Location: Atlanta, GA

Type of project: Operations & Maintenance Facility Building

Square footage: 78,200 ft

General contractor: Archer Western Contractors

Concrete contractor: Gunby Construction Company

Overall project cost: $38,200,000.00

Amount of formwork: between 4,000 and 7,000 sq ft, based on location

Formwork used: Frami Xlife in various combinations

The Challenge

Minimal amount of storage room is available onsite, resulting in the scheduling of formwork deliveries and returns to keep just the essentials onsite. The schedule is also very tight for each area of this project, as there are multiple trades working in each area, while all along, the existing facility remains in full operation.

The Solution

The contractor needed the most versatile, easy to use, and fastest cycling material to allow only a minimal amount of formwork not in use that would take up the limited storage space. Doka's Frami Xlife formwork was the answer

The Professional

"Frami is the best of many worlds. It can be set by hand or gang-set by crane or forklift, it's super strong, and easy to put together, strip, adjust, and cycle to different parts of the job."

Adam Massee,
Project Manager, Gunby Construction

In Brief

Now Hiring!
Career Opportunities with Doka are available today

Doka's expansion and growth throughout North America has created opportunities in the USA and Canada: Sales, Management, Field Service, Engineering, Operations, and Administration.

Take the first step to your next challenge now. Apply today! Send your resume to employment@doka.com. Doka is an equal opportunity employer.

Upcoming Events

See us at the…

- American Society of Concrete Contractors Annual Conference
  - When: September 24-27, 2015
  - Where: Hyatt Regency, Dallas, TX
  - To register visit http://www.ascconline.org

- American Segmental Bridge Institute Annual Convention
  - When: November 2-3, 2015
  - Where: Omni Dallas Hotel in Dallas, TX
  - To register visit www.asbi-assoc.org

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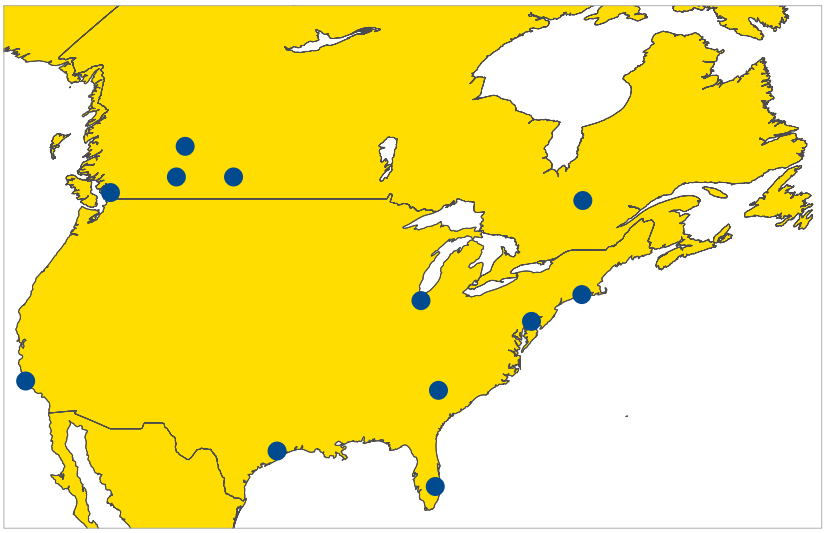

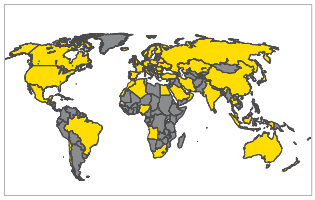

▲ **Doka offices worldwide.**

The Doka sales network with more than 160 sales and logistics centers in more than 70 countries.

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In some cases the site photos show the situation during formwork assembly and are therefore not always complete from the point of view of safety.

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Editorial

Dear Customers and Colleagues,

A quick review of the table of contents of this issue and it becomes clear that growth and diversity are the key themes for Doka as we enter the second half of 2015. Our project involvement ranges from the 824 megawatt hydroelectric generating facility, which happens to be the largest construction project in Canada right now, to a 250 room hotel in Charlotte, as well as a church facility in Los Angeles. Adding to this variety is our involvement in Atlanta's new MARTA Brady Mobility facility, plus a major wastewater treatment plant in Ontario and participation in the Greenwood College project in Toronto. No matter the industry, the geography or the project size, Doka is continuingly being selected as the preferred formwork partner for a wide range of projects because of our dependable, safe and cost-effective solutions.

In addition to our existing formwork solutions, Doka recently unveiled another advancement: Concremote. Designed to improve quality control for contractors, Concremote makes it possible to measure concrete strength on the site, in real-time using the weighted maturity method to provide reliable, standards compliant information on the strength development of the concrete. This process facilitates targeted management of the forming and cast-in-place concreting operations. The technology is being used at the Muskrat Falls project and has immediately proved to be beneficial.

Project growth in diversity has required Doka to continue to expand our operations and team members. To this end, we have relocated our Florida operations to a larger location in Pompano Beach near to Miami. Furthermore, Doka is hiring across the USA and Canada to ensure we have the best support staff to keep your projects safe and on schedule.

We look forward to helping you to successfully complete your project, no matter the size or sector.

Andrew Mair
Chief Executive Officer
Doka USA, Ltd. /
Doka Canada, Ltee.

Table of Content

Doka News

NYC's tallest residential building ▸

Construction is underway on the Nordstrom Tower at 217 West 57th Street. At 1,522 feet, it will have the tallest roof height of any building in New York City and the rest of the western hemisphere, surpassing 432 Park Ave.

Super Climber debuts in Seattle ▸

Doka expands presence in the Seattle market with innovative climbing formwork technology on a 40-story 300,000 sq ft mixed-use high-rise called 2nd + Pine.

◂ Miami's tallest tower

The Panorama Tower is going vertical with Doka. To be the tallest residential building on the eastern seaboard south of New York, Panorama Tower will rise 83 stories over the Miami skyline, as an iconic, global landmark.

▲ The Embassy Suites Charlotte Uptown project in the heart of Charlotte, NC, broke ground in late 2014 and the concrete frame is expected to be completed late summer 2015.

Embassy Suites Climbs High

Charlotte, NC is a city with growth on the horizon and Doka and Lithko Contracting at the center of it all. Lithko Contracting has enlisted Doka to provide formwork solutions for various jobs over the last 4 years. They have come to especially enjoy the cost savings and the service that they have received by using Doka's Frami lightweight formwork system for walls and columns and Dokamatic Tables with either 10K, Dokaflex, or Staxo 100 for a multitude of their many shoring projects. Lithko turns to Doka when interior and exterior platforms are needed for stair and elevator cores, or if work areas are needed on the exterior of the building. Doka has provided multiple formwork solutions including working and Climbing Platform K, Climbing Formwork MF240, shaft platforms, and are under contract to supply bridge formwork ParaTop, and automatic climbing system Super Climber SCP on upcoming projects.

▲ Lithko used Frami universal column forms with its 1,650 psf pour pressures for the 50 ft tall columns and jumped them in multiple lifts.

The Facts

Project name: Embassy Suites Charlotte Uptown

Location: Charlotte, North Carolina

Type of project: Hotel (250 rooms), Underground Parking, Retail.

Square footage: 292,000 sq ft

General contractor and/or architect: Chhabra Construction / Overcash Demmitt Architects

Concrete contractor: Lithko Contracting

Formwork used: 30,000 sq ft of Dokamatic Tables , Staxo 100, Frami, MF240, D22

Start and scheduled end date of work: December 2014 - July 2015

The Challenge

Assembly, erection and stripping of elevated CIP deck slabs with shoring heights varying from 30 ft to 50 ft tall, 50 ft tall columns, one-sided walls out of the basement poured against sheet pile with small stepped grade beams that offered little concrete to anchor into. Other obstacles Lithko faced on this project were that the site had very limited space for any laydown or loading and unloading of equipment.

The Solution

Dokamatic Tables and load-bearing tower Staxo 100 for the high shoring. The tables were on site on the lower level so the Staxo could be built in place and as the tables were stripped out of the basement they could be set directly onto the Staxo and the props from the tables on the lower height slabs in the basement could be left for the basement re-shore. This minimized the purchase of addition plywood for two levels of decking, the labor of stripping a loose forming system and having to reset all of same material, minimized the amount of space needed for storage.

▲ Doka was brought onto the job due to its reputation of safety, the quality of its products, as well as the Lithko Contracting's previous experience with Doka's products and services.

The Embassy Suites Charlotte Uptown is a project currently under construction located in the heart of Charlotte, NC. The project broke ground in late 2014 and the concrete frame is expected to be completed late-summer 2015. Doka was brought onto the job due to its reputation of safety, the quality of its products, as well as the Lithko Contracting's previous experience with Doka's products and services. Lithko and Doka have successfully been working together for 4 years on multiple projects in the Carolinas.

The Embassy Suites is a eleven-level CIP structure with shored slabs that vary in height from 9 to 50 ft tall. The project has one level of underground parking, a high bay truck entrance to provide delivery access to service meeting and conference room space, the 250 room hotel, and a pool and open air space on the 4th level. Some of the obstacles that had to be overcome were, 50 ft tall shoring, 50 ft tall columns, one sided walls on an entry ramp in the basement because of 0 ft lot lines, and excessive vertical concrete on one side of the building. To overcome these challenges Doka went to its arsenal of products to develop solutions for all of the challenges.

To combat the open air space and pool on level 4 combined with the high bay areas above the garage, Doka provided its Staxo 100 shoring system with Dokamatic Tables to shore the 20 ft to 50 ft tall shored slabs. Lithko used the Frami universal column form with its 1,650 psf pour pressures for the 50 ft tall columns and jumped them in multiple lifts. Because the structure was on a corner in downtown Charlotte across from the NASCAR Museum, Doka provided their D22 one-sided brackets as an A-frame system to form the one sided walls from the underground parking level to slab on grade level. The D22 gave a smaller footprint at the bottom to eliminate the amount of concrete needed for support. Staxo 100 was provided for all of the high shoring requirements. Lithko has been impressed with the Staxo 100 shoring system because of the ease of assembly, no loose parts, and the safety the system delivers. To ensure safety on the jobsite, load-bearing tower Staxo 100 was selected thanks to slip resistant ladders integrated into every frame, and clear safety tie-off points built directly into every frame. Additionally, Staxo was included in the plan for the high shoring elements of the project for ease of use in erecting and dismantling. 30,000 square feet of Dokamatic Tables were delivered to the jobsite as pre-assembled units with plywood to form the slabs. The versatile product and design allowed all tables to be used on the high bay levels in combination with Staxo 100 shoring frames and also on the typical levels with Eurex Props.

With the successful completion of their work at Embassy Suites Charlotte Uptown project, Lithko Contracting and Doka have added one more highlight to their forming history.

▲ Concrete contractor Aurora Forming, Inc. chose Doka solutions and services for the first time, selecting Doka above other suppliers due to their reputation for good service and relationships.

New Client Partnership Brings Success

Greenwood College is an independent school located in Toronto, Ontario, that focuses on a model of education that combines academic rigor, a personalized approach to learning, engagement in the arts and a structured program of physical activity. In order to continue growing in size as well as remaining up-to-date on technology and sustainable design, Greenwood is expanding its campus by constructing a new building that features a green roof with outdoor classroom and terrace, a new performance arts theatre, a number of new studios and labs, and LEED Gold Certification.

The Facts

Project name: Greenwood College Expansion

Location: Toronto, Ontario

Type of project: Expansion, Private College

General contractor: Graham Construction

Concrete contractor: Aurora Forming Inc.

Formwork used: Framax Xlife, MF240 climbing platforms, Dokaflex, Dokaflex Tables, Super Props

Start and scheduled end date of work: October 2014-July 2015

The Challenge

First time Doka customer utilizes a variety of formwork solutions on a College expansion project with no previous Doka formwork experience.

The Solution

Doka Site service and engineering established a good relationship with the client, by working on site to reduce the crew's learning curve of the system and improving productivity.

▲ The strong and versatile Super Prop Towers were used for high shoring areas.

Concrete contractor Aurora Forming, Inc. chose Doka solutions and services for the first time, selecting Doka above other subcontractors due to their reputation for good service and relationships. The owner's primary goals were meeting the schedule, safety and a good exposed concrete finish.

The building features an exposed concrete structure with no concrete plastering, painting or "cover ups." A smooth architectural concrete finish was required. The perfect solution for this design constraint was the use of Doka framed formwork panels, Framax Xlife, due to its special Xlife plywood face. To ensure the panels performed as required, they were individually inspected to make sure each panel had no scratches, patches, oil or other obstruction that could leave an imprint on the concrete. In addition to this challenge, there was a learning curve to the partnership as the client was a first-time Doka user. Site service and engineering helped make the customer feel comfortable and to reduce on-site assembly time.

For this project the following systems were in use:

Framax Xlife panels supported with C8 Channels were used for single-sided and double sided wall applications. The single-sided walls required approximately 3,000 sq ft of formwork to be assembled 8.1 m high; the double-sided walls required approximately 4,700 sq ft of formwork assembled 6.75 m high. The innovative Xlife facing special plastic surface produces an excellent concrete finish, as can be seen in the final product. To benefit the contractor, Doka reused the same assembled Framax panels through the entire single-sided wall.

MF 240 climbing platforms were used for exterior walls, permitting controlled, regular working cycles. The formwork and climbing scaffold are linked together as one single unit, making repositioning in just one crane-lift possible.

Flexible slab system Dokaflex S was used for the basement level and ground through third floors. This versatile system is fast to set up since it consists of only two different beam lengths.

Pre-assembled Dokaflex Tables were used from the ground floor through the roof floor, providing quick and easy re-positioning.

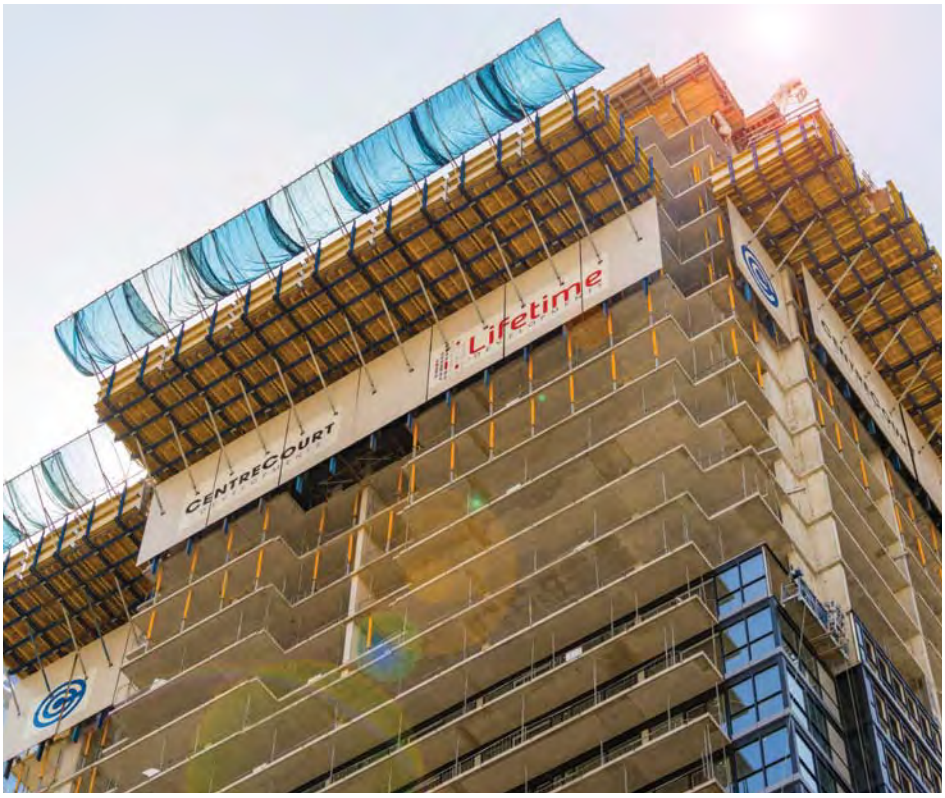
Doka Super Props were used for high shoring areas. Super Props were stacked to meet the required 6.50 m height from the lower basement to the ground floor. Two transfer beams (one meter and three meters) were supported by these props.

Detailed calculation was done for the reshoring of slab from the lower basement to the fifth floor, including the calculation of mud sills.

To ensure safety on the jobsite, site service and engineering inspections were completed.

As a result of the successful progress on the Greenwood College expansion project, Aurora Forming has awarded Doka with two more projects.

The proposed completion of this expansion project is set for the end of July 2015.



Seven Platforms at Once

On the INDX condominium project in Toronto, Hardwall Construction climbed seven platforms into the next casting step at once, in one hour with no crane.

Doka in partnership with Hardwall Construction developed a new hydraulic protection screen system incorporating a 16 ft loading platform to provide storage and laydown space outside the building perimeter at great heights. With the ability to hydraulically lift seven loaded platforms at once, Doka once again demonstrates its level of expertise and innovation to adapt to customer and market needs. Adding up to this, Doka was able to help reducing the formwork cycle time to 4 days versus 6 days, eventually saving the contractor 100 valuable days of construction time.

▲ 16 ft loading platforms

The Facts

Project name: INDX Condominium

Location: Toronto, Ontario

Type of project: Residential building, Condo

Square footage: 568 ft. tall, 54 stories

General contractor and/or architect: Lifetime Developments, Centre Court Developments

Concrete contractor: Hardwall Ltd.

Systems used: Protection Screen Xclimb 60 with integral loading platform, Framax Xlife

The Challenge

Under the premise of a lively jobsite surrounding, high safety was not only required for the site crew, but also for pedestrians. Limited space on the construction site together with a tight schedule called for innovative formwork solutions.

The Solution

The newly developed hydraulic protection screen system with loading platforms stood up to every challenge, capable of carrying 6,000 lbs per 12' x 16' platform and allowing for sufficient working space.

▲ Solid team work between Doka and Hardwall Construction

The Facts

Project name: Muskrat Falls

Location: Lower Churchill River in Newfoundland / Labrador

Type of project: Hydroelectric generating facility generating 824 megawatt (MW) output. 6 spillway piers, 3 transition dams and powerhouse

Owner: Nalcor Energy

Concrete contractor: Astaldi Canada Inc.

Overall project cost: $8 billion

Start date and scheduled end date of work: April 2014-2017

The Challenge

As the second-largest hydroelectric generating facility in Canada, the complexity of this project required multiple solutions to complete the main power-house structure including four turbines, three dam structures, six spillway piers, a large separation wall and smaller retaining walls. Additionally, Astaldi Canada has a zero tolerance policy for unsafe conduct and methods on their jobsites.

The Solution

Doka was selected above other competitors due to the company's level of experience with challenging and engineering-intense projects as well as their highly efficient products. The multi-scope services and materials provided by Doka will save the contractor Astaldi from using different suppliers on this project and therefore reducing the amount of time spent on procurement, training, logistics and quality control. Additionally, a reputation for safety, efficient formwork solutions and professional support made Doka the top choice supplier for the project.

▲ Spillway Piers - Downstream view, approximately 45 m high

Multi-Scope Solutions at Muskrat Falls Project

Doka Canada is the formwork supplier for Nalcor Energy's Muskrat Falls Project in Newfoundland and Labrador, Canada. The 824 megawatt hydroelectric generating facility is currently the largest construction project in Canada and is situated on the Lower Churchill River, approximately 30 kilometers west of Happy Valley-Goose Bay.

▲ 6 Spillway Piers under construction simultaneously

▲ D22 Dam formwork with large-area formwork Top 50

▲ Spillway Piers - Bullnose Custom Formwork

Project Overview

The facility will be the second-largest hydroelectric generating facility in the country when complete and will consist of the main powerhouse structure including four turbines, three dam structures, six spillway piers, a large separation wall and smaller retaining walls.

The new hydroelectric generating facility will power homes and businesses across Newfoundland and Labrador with clean, renewable energy for years to come. Sanctioned by the Government of Newfoundland and Labrador in December 2012, the Muskrat Falls project will help Nalcor Energy meet the province's growing energy demands with stable electricity rates.

When the generating facility is operational, approximately 40 percent of the power generated will be used to meet the island's electricity needs. Emera Inc. will purchase 20 percent of the power from Muskrat Falls for use in Nova Scotia, and the remaining 40 percent of the power may be either exported into Atlantic Canada or New England markets or retained for use in

Forming Muskrat Falls

Watch the video on Canada's currently largest construction project.

https://youtu.be/Hu9ODq2W_9Y

▲ View of Spillway Structure and Powerhouse - rendering by Nalcor Energy

Newfoundland and Labrador. The province is projected to need 80 percent of Muskrat Falls' power by 2036, though possibly earlier depending on additional industrial growth.

Safe Jobsites as a Priority

Astaldi Canada has a zero tolerance policy for unsafe conduct and methods on their jobsites. To meet the client's requirements, Doka committed to on-site training and supervision, while maintaining the usual high safety standards built into the design of all their formwork solutions. Doka offers pre-assembly service to ensure that all formwork elements are assembled in a controlled environment and quality checked prior to shipment site. This reduces the risk of errors and avoids on-site formwork assembly to save time and increase productivity, as well as releasing the client from the responsibility of training and supervising an on-site assembly team.

Many proactive activities were put in place to ensure safety on the jobsite. A few of these include the production of detailed engineering drawings produced according to CSA standards and checked and stamped by a professional engineer, Doka Field Service Engineers and Doka Technicians are located on site throughout the project duration who provide regular

▲ Formwork installed on sloping base slabs and poured against bedrock

product and safety training to site personnel. Doka ladder systems with cages were utilized on all D22 climbing platforms, Doka Stair Towers were provided to allow access to formwork systems and working platforms, and pre-pour inspections are made on site together with the customer to ensure all material was installed correctly according to Doka engineering drawings.

Powerhouse

The largest structure on the project with a height of 70 m, width of 90 m and length of 150 m is the powerhouse. This complex structure houses four generating units, each consisting of a 206 MW Kaplan turbine, an intake, semi spiral case and draft tube area.

▲ Powerhouse construction during nightshift

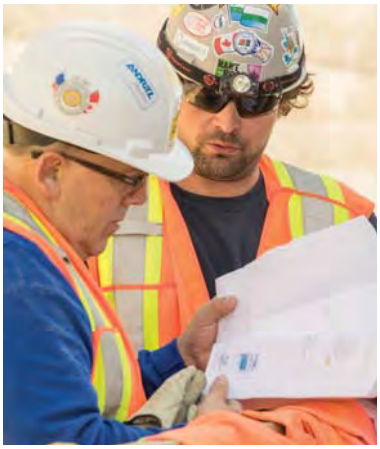
Intake

The Intake is characterized by up to 28m high piers, steep sloping top and bottom soffit and stop log shafts. Astaldi is using Doka's Large-area formwork Top 50 combined with D22 Dam formwork to construct the asymmetrical shaped piers. The top soffit form is also constructed with Large-area formwork Top 50 supported with Staxo 100 Load-bearing towers. The Staxo 100 system with its high load bearing capacity is ideal for such applications. It is possible to preassemble the shoring towers off site in a preassembly area and then ship and erect with the crane in a short period of time boosting productivity. The majority of disassembly is possible manually without the use of heavy lifting or material handling equipment. The Stop Logs are formed with Large-area formwork Top 50 and Doka Shaft platform system.

Semi Spiral Case

Constantly changing radius, sloping walls and soffits along with a segmented circular housing for the stay-ring make the semi spiral case a challenging structure in every way. Furthermore many vertical and horizontal elements are cast together. The Doka Engineering team uses state-of-the-art 3D design and dimensional design and simulation software to engineer a formwork solution that can be pre-assembled in large elements to high precision. Astaldi is using a combination of Doka's D22 Dam Formwork, Large-area formwork Top 50, Staxo 100 Load-bearing tower, Doka Super Prop and 3-dimensional shaped custom forms and tables. A large portion of the formwork can be reused between the four units minimizing waste and transportation costs to site.

▲ Downstream view from right to left: North Transition Dam, 6 Spillway Piers, Centre Transition Dam, Separation wall



▲ Doka Field Service Engineers based on site

Draft Tube

The Draft tube outlets also consist of piers and heavy soffits. A combination of Staxo 100 and D22 Dam formwork enables Astaldi to achieve tall pour heights with large concrete volume poured in a tight schedule.

All formwork solutions are designed to meet the aggressive construction schedule demanding versatile and heavy duty formwork solutions that perform reliable on multiple pours in extreme weather conditions.

Three Dam Structures

The hydroelectric facility consists of three dam structures: a North Transition Dam, a Centre Transition Dam and a South Transition Dam. All three structures have a similar design: a steep inclined surface changing to a straight/true vertical face. Unique solutions were developed to over climb the gallery openings and the change of direction of vertical surfaces, Doka's engineering team designed special support frames in order to anchor D22 Dam brackets securely to the structure.

Doka's D22 Dam formwork stands out for its high load-bearing capacity and operational safety.

One of the advantages of using this system on all three dam structures at Muskrat Falls was that the formwork is tiltable, and retractable, allowing cleaning and preparing of form face without the use of the crane. The ability to tilt the form independently from the bracket was very useful to over climb sloped and projecting wall sections without modifying the formwork. The wide working platform, integrated tie off points, lifting points, fixed handrail posts, preassembled platforms and an integrated ladder system provided maximum safety and comfort to the field personnel.

Spillway Piers

The six spillway piers have true vertical concrete surfaces, constructed in three monoliths. Every spillway consists of a bullnose on the upstream side with a large concrete block overhang on the downstream side, as well as eight box-outs required for the installation of mechanical gates. To reduce the risk of deflection and movement during pouring of the symmetrical bull noses, Doka designed and built the formwork using custom curved steel wailings to form the shape of the bull nose instead of the more traditional approach of wooden gussets. This ensured that the formwork element could be reused multiple times without any need to change.

Separation Wall

The large separation wall was poured in seven monoliths, wheras Monolith 1 was poured against the existing structure of Centre Transition Dam.

Large Area formwork Top 50 was a perfect fit on the separation wall because it is a modular gang form system that is suitable for all shapes, sizes and pour pressure requirements. Shape, size, tie pattern and plywood are all adapted based on project requirements. On the Muskrat Falls project, the system offers a high number of re-use cycles, short forming times, as well as large optimized gang units and flexibility to incorporate waterstops or metal embedments in the formwork elements.

North and South Service Bay

North and South Service Bay are access structures of the powerhouse; they contain shafts, stair cases and mechanical and electrical installations. Framax was used for the walls as it can withstand high concrete

▲ Stair towers permit safe access to work decks.

pressure for fast pouring rates. Since Framax is modular it was very flexible and fast to set up, requiring little skill. The strong steel frame of the Framax panel allowed an effortless stacking of panels to form tall walls with large openings. Staxo 100 Load-bearing system is used to support and pour the transfer slabs. Since crane access is limited in this area the towers can be dis-assembled manually and removed through a small opening. All components are lighter than 40 kg (88lbs.).

Concremote – Measuring Concrete Strength in Real Time

Concremote makes it possible to measure concrete strength on the site, in real time. It uses the weighted maturity method to provide reliable, standards-compliant information on the strength development of the concrete. This facilitates targeted management of the forming and CIP concreting operations.

The Concremote sensors regularly measure the temperature development of the fresh concrete and transmit the data to the Concremote computing centre. The strength development of the concrete is calculated by reference to the values from the previously effected calibration measurement, and the information is sent back to the site in real-time.

In total, 32 Concremote sensors were installed on site to provide continuous measurements of heat and strength development in the ongoing concrete pours. One of the challenges faced on this project are the extreme weather conditions and varying temperatures during concrete operations ranging from winter temperatures of -40 degrees Celsius and summer temperatures up to 30 degrees Celsius. This broad range of temperatures increases the risk of frost and thermal cracks in the concrete. Multiple concrete pours are measured and monitored at the same time, and Doka provided the client with custom programmed software to be able to generate customized reports.

Overall Challenges and Solutions

Muskrat Falls is located in the Northeastern part of Canada. This remote project location brings many challenges. One of them was the logistics and transportation of all formwork components to the jobsite. All material for the entire project is managed and handled through the Doka Toronto branch with a distance of 2,400 km (1,500 miles) and average transit time of 5 days to the jobsite. To meet this challenge, Doka and Astaldi prepared detailed planning schedules to ensure that all material is delivered in correct order that meets the project needs.

Pre-Assembly Service

Astaldi also chose Doka to preassemble all formwork elements off-site to ensure the highest level of quality, accuracy and productivity on site. This was a big challenge but also opportunity for the Doka Toronto Pre-Assembly Team. To meet this customer requirement, Doka Toronto is assembling formwork continuously for over 12 months already on multiple assembly stations under the close supervision of experienced Doka Assembly Supervisors. When this project is completed, Doka will have assembled approximately 5,000 pieces of working platforms and decks, over 100,000 sq ft of Large Area formwork Top 50 for all vertical walls, over 40,000 sq ft of Large-area formwork Top 50 for all horizontal slabs and more than 25,000 sq ft of Large-area formwork Top 50 for all curved bull noses and spiral scroll case areas.

Customized Solutions

To increase productivity on site, many custom solutions and products were developed for this project. A few examples include tie-loop anchors to tie down formwork diagonally to vertical rebar in order to avoid long horizontal ties running through the entire structure and the fabrication of custom off-set brackets to support the Top 50 formwork in complex applications. All of these helped Astaldi save on both labor and material as well as successfully adhere to the construction schedule.

Once operational, Muskrat Falls Project will help end the region's dependence on oil, connect to North America's electricity grid for export, provide lowest-cost power for homes and businesses and serve as a source of 98 percent sustainable energy.

▲ Powerhouse: Draft tube downstream

▲ 5.9 m shoring height using Doka Truss with Super Props

Upgrading to Expand Treatment Plant Capacity

▲ From left to right: Travis Pozzebon, Trevor Pozzebon, Todd Pozzebon and Nick Pozzebon, 3T Forming North Inc.

The Mid-Halton Wastewater Treatment Plant is located in Oakville, ON, within the densely-populated Greater Toronto Area. To meet increased demand due to growth, and continue to protect the waters of Lake Ontario, the plant needed to upgrade its capacity from 75 million liters per day (MLD) to 125 MLD and undergo other areas of improvement, including the building of a new ultraviolet (UV) disinfection system, an expansion of the plant operations and administration area, an expansion of the North Pumping Station, and the addition of a new primary digester.

Doka was carefully selected by 3T Forming North Inc. to supply formwork for the Mid Halton WWTP project because of their strong reputation for providing high-quality products and services; the reliability of their forms; the quality of the concrete finish; and the overall safety of their systems.

The major challenge on this project was the building geometry and cycling of material for different pouring heights and lengths. Through project planning and de-tailed design drawings, the Framax wall formwork was designed in such a way that gangs could be cycled over to different pours without having to dis-assemble

▲ Quality concrete finish was a requirement which Framax wall formwork was able to accomplish.

and reconfigure the formwork, which minimized the labor on site. Safety was of the upmost importance on the jobsite, so all of the Framax formwork supplied came with Doka pouring platforms, scaffold brackets and exterior handrail posts.

An innovative Doka Truss table was used for the slab shoring in the galleries where the height varied from 4.0 to 5.9 meters. The tables were designed to adapt to the varying shoring heights using Doka Super Prop with an extension and could be moved into pouring position with trolley wheels.

Doka also supplied custom circular large area Top 50 panels for the digester tank. The panels were a height of 8.4 m and included an offset for an exterior corbel. All of the panels were pre-assembled at Doka assembly shop and enabled the customer to erect panels directly into place as they arrived on site.

Overall, over 15,000 sq ft of Framax wall formwork and 1,000 sq ft of high shoring tables were used in this project.

"Doka provided us the service and quality of formwork to help make this project a success. We were impressed with the high quality finish and the speed and high functionality of the Doka tables for our high suspended slabs."
—3T Forming North Inc.

The Facts

Project name: Mid-Halton Wastewater Treatment Plant

Location: Oakville, Ontario

Type of project: Wastewater Treatment Plant

General contractor and/or architect: Maple Reinders

Concrete contractor: 3T Forming North, Inc.

Start and scheduled end date of work: December 2014-August 2015

Formwork used: 15,000 sq ft of Framax wall formwork; 1,000 sq ft of high shoring tables

The Challenge

The major challenge on this project was the building geometry and cycling of material for different pour heights and lengths. Also, to enable plant upgrades to be completed and water-tight in a facility with a tall pour height (5.9 m).

The Solution

The different pour heights and lengths were accommodated through planning and design drawings. Doka supplied Water stop G for all ties to ensure the walls were water-tight and accommodated the 5.9-meter pour height using Truss Tables with leg extensions. Custom built Top 50 panels were used to fit the geometry.

▲ Dokaflex is the fast, versatile floor-slab formwork for any desired layout. Any type of plywood can be used, so that any concrete surface finish can be achieved based on the requirement of the architect.

Growing Church Community Expands with Dokaflex

In Los Angeles area the Berendo Street Baptist Church enjoys popularity and a fast growing community. It has therefore started a development project that includes two buildings.

▲ Approximately 67,500 sq ft of Dokaflex slab formwork and 4,825 sq ft of Frami column formwork was used to complete the project.

Sea Pac Engineering wanted a slab shoring system that is productive, economical and adaptable to design changes. Dokaflex is a versatile slab shoring system that satisfied the needs of Sea Pac Engineering's project, which includes approximately 150,000 sq ft of total elevated slab.

With the expansion, there were many sequencing and logistical issues to resolve on the tight project site.

"We were satisfied with the productivity and labor savings. We are now looking into using Dokaflex on our next project." — Robert Park, Project Manager, Sea Pac

For this project, the structural design changes were on the structural slab, which included adding various sized structural beams throughout the deck. The Dokaflex Slab Shoring System was chosen since it is flexible enough to accommodate the challenges without delay. The elevated 12'' slab varies between floors up to 12 ft in height and only one type of post-shore was used, Eurex 30 300. In addition to the innovative flexibility of the Dokaflex Slab Shoring System, the system brought efficiency and labor savings.

For Sea Pac Engineering, the tight jobsite, material availability, and overall cost of formwork were all factors to be considered before the decision to use Dokaflex was made.

To efficiently construct the Berendo Street Baptist Church the contractor chose to use 67,500 sq ft of Dokaflex slab formwork and recycle this material throughout the project. Vertical columns were formed using 4,825 sq ft of Frami universal form panels.

As a first time user of Doka, Sea Pac Engineering quickly identified many benefits from using the Dokaflex Slab Shoring System. These key benefits included speed, simplicity, flexibility and safety. With only 6 main components to work with the crew was able to gain high productivity in a short period of time.

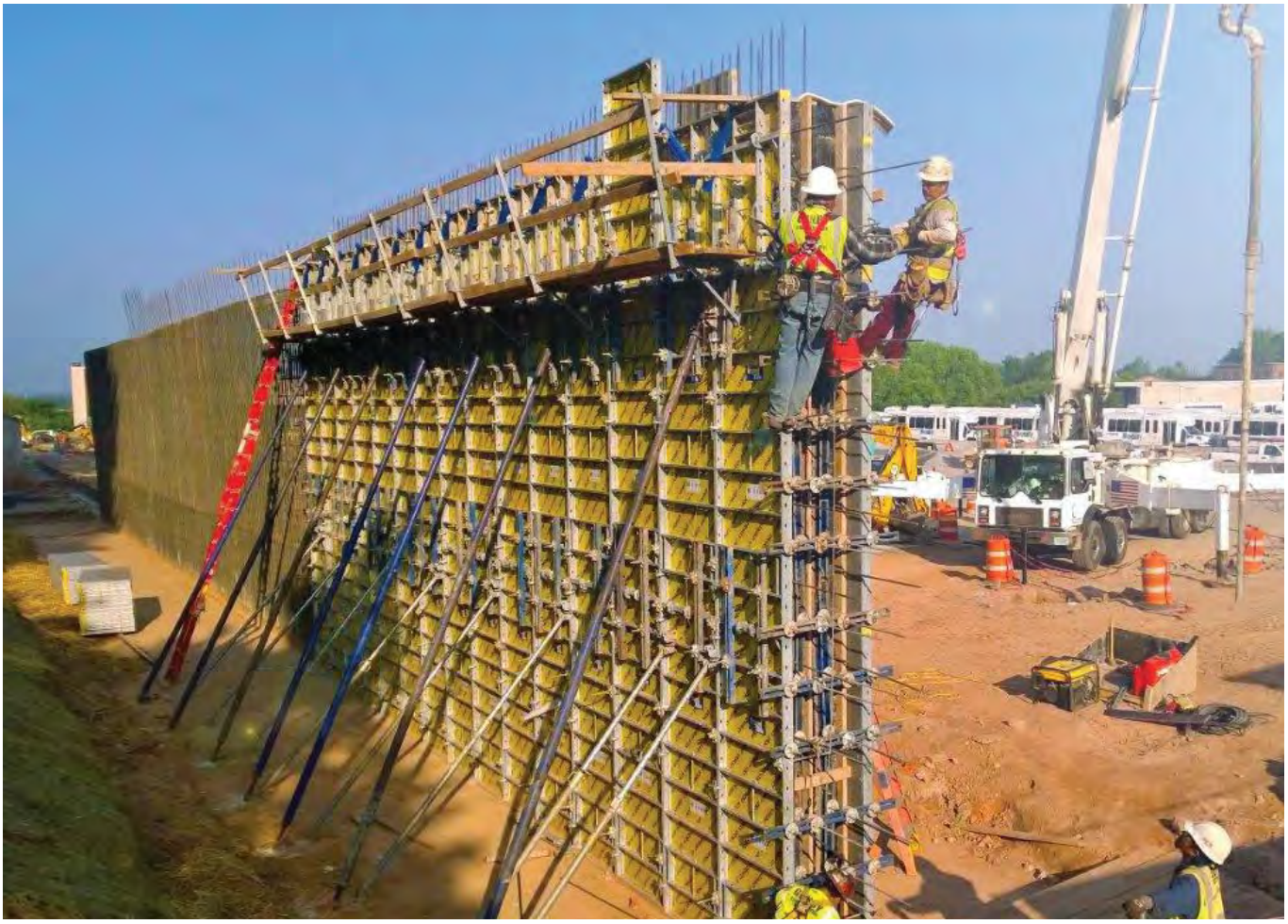
From Left to right: Denzil Day, Doka Sales Manager
Mr. Hans, Superintendent, Sea Pac Engineering
Robert Park, Project Manager, Sea Pac Engineering

Dokaflex Floor Formwork

Watch the simple assembly of our flooring system.

https://youtu.be/qUewKMqBqRk

◂ Dokaflex is a versatile slab shoring system that satisfied the needs of Sea Pac Engineering's project, which includes approximately 150,000 sq ft of total elevated slab.



▲ Gunby Construction selects Doka thanks to the strength of formwork combined with the lightweight and material availability in close proximity to the project.

Modern Transit Facility Keeps Tight Schedule

Atlanta will soon be welcoming a new MARTA Brady Mobility facility, built to accommodate the administrative functions, operations and maintenance needs for an entire fleet of mobility vehicles, including specialized vans and cutaway buses. The design includes maintenance functions on the first floor and administration operations on the second floor of the building as well as three levels of church facilities.

As a construction project, it will be exemplary of modern transit operations and maintenance design. The goal is for the new facility to be safe, functional, easy to maintain, and energy efficient as a LEED Silver facility.

The schedule is very tight for each area of this project, as there are multiple trades working in each area, and, the existing facility is remaining in full operation throughout the construction. To meet these demands, the contractor, Gunby Construction, needed the most versatile, easy to use, and fastest cycling material to keep only a minimal amount of formwork not in use that would take up the limited storage space. Gunby Construction Co. also required a high quality finish on all walls with minimal rubbing and patching.

Doka was brought in because of their previous relationship with Gunby Construction, the quality of Doka's material, efficiency of the formwork, and ease of use. The strength of Doka's formwork combined with the

light weight and material availability in close proximity to the project was a plus. Gunby Construction found that Doka's Frami Xlife formwork was the answer.

With minimal amount of storage room onsite, scheduling of formwork deliveries and returns are kept to just the essentials onsite. The area sequencing includes standard building walls, formliner building walls, four retaining walls, and wall bracing for backfill.

High capacity backfill bracing was required 12'-6" above grade and was horizintally attached to the retaining walls. The bracing was required to support the wall as heavy machinery placed backfill dirt against it. For this application, Doka designed and supplied strong pipe braces and spindle struts in multiple lengths to reach the varying distances. Additionally, to ensure safety on the jobsite, walkway brackets were used at multiple levels to access ties and top walkway.

As Gunby's Project Manager Massee says, "Doka's formwork really works!".

The project is still under construction as it also has thousands of yards of concrete paving to complete. The completed facility will allow for improved storage and for higher quality maintenance of all Atlanta's mobility vehicles.

▲ The main advantages with the Frami Xlife system is the time that you save with very few people working with it. There is very low labor involved as the panels easily move from wall to wall.

▲ The perfect panel size-grid gives you innumerable possible combinations, in both width and height. You can use the panels either vertical or horizontal, and the 6 in. increment grid allows for optimum adaptability of the formwork to the dimensions of the structure, at all times.

The Facts

Project name: MARTA Brady Mobility Facility

Location: Atlanta, GA

Type of project: Operations & Maintenance Facility Building

Square footage: 78,200 ft

General contractor: Archer Western Contractors

Concrete contractor: Gunby Construction Company

Overall project cost: $38,200,000.00

Amount of formwork: between 4,000 and 7,000 sq ft, based on location

Formwork used: Frami Xlife in various combinations

The Challenge

Minimal amount of storage room is available onsite, resulting in the scheduling of formwork deliveries and returns to keep just the essentials onsite. The schedule is also very tight for each area of this project, as there are multiple trades working in each area, while all along, the existing facility remains in full operation.

The Solution

The contractor needed the most versatile, easy to use, and fastest cycling material to allow only a minimal amount of formwork not in use that would take up the limited storage space. Doka's Frami Xlife formwork was the answer

The Professional

"Frami is the best of many worlds. It can be set by hand or gang-set by crane or forklift, it's super strong, and easy to put together, strip, adjust, and cycle to different parts of the job."

Adam Massee,
Project Manager, Gunby Construction

In Brief

Now Hiring!
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Doka's expansion and growth throughout North America has created opportunities in the USA and Canada: Sales, Management, Field Service, Engineering, Operations, and Administration.

Take the first step to your next challenge now. Apply today! Send your resume to employment@doka.com. Doka is an equal opportunity employer.

Upcoming Events

See us at the…

- American Society of Concrete Contractors Annual Conference
  - When: September 24-27, 2015
  - Where: Hyatt Regency, Dallas, TX
  - To register visit http://www.ascconline.org

- American Segmental Bridge Institute Annual Convention
  - When: November 2-3, 2015
  - Where: Omni Dallas Hotel in Dallas, TX
  - To register visit www.asbi-assoc.org

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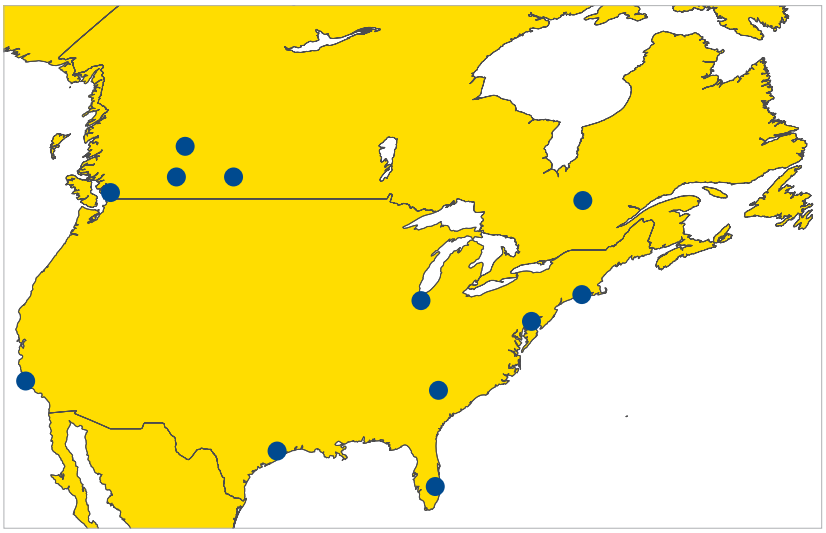

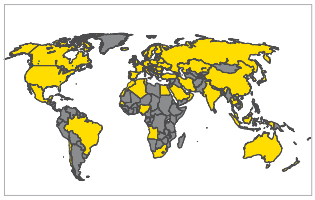

▲ **Doka offices worldwide.**

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In some cases the site photos show the situation during formwork assembly and are therefore not always complete from the point of view of safety.

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