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# Saskatoon Civic Operations Centre

## Upgrading Saskatoon's transit

By Austin Wilson and John Wilson

The city of Saskatoon, Sask. has many nicknames, including "The Hub City." Historically this nickname arose because Canadian farmers brought their year's harvest to Saskatoon for shipping. The city still plays a vital role in the distribution of goods, acting as a hub to connect key highways, railways and the busiest airport in Canada.

The Hub City also acts as a hub for bus service, providing more than 200 towns in the province with public transportation to the metropolitan area and throughout Saskatoon city. The local part of this transit system is getting

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Keller Canada installed CFA piles for the Saskatoon Civic Operations Center using Soilmec R-516 and R-625 drill rigs


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Warm spring weather and fast snowmelts quickly caused the jobsite to become entrenched in mud, but Keller Canada still managed to install the piles ahead of schedule

a major upgrade with the construction of a new Saskatoon Civic Operations Centre (SCOC).

Located on 180 acres in the southwest quadrant of Saskatoon, the SCOC will replace a 100 year old transit facility - the Caswell Hill "bus barns." The new transit facility will have room to store 224 buses with the capacity for future fleet growth. It will also feature new administrative offices, fueling, wash lanes, maintenance bays and inspection pits. The 42,000 square meter, steel framed transit building will centralize key transit operations to a single location with direct access to the Circle Drive South Bridge, allowing the city to move equipment, materials and vehicles more efficiently.

The SCOC will also include the first permanent snow management facility, which will have the capacity to store up to 1 million cubic meters of snow and will feature an environmentally-safe, cost-efficient meltwater collection site.

All building foundations for the new SCOC were installed this spring by Keller Canada, using Soilmec drill rigs.

## Piling through the cold

Keller Canada installed the foundation piles in phases, beginning in February 2015 with the administrative offices the first out of the chute, because those offices were needed by mid-April.

Geotechnical field testing and laboratory results indicated that the subsurface conditions at the jobsite consist of interbedded layers of loose sand silts and soft, high-plastic silty clays in the top five to eight metres, followed by a series of soft to firm, high-plasticity silty clay to a depth of 13 to 18 metres. Below this is a thick layer of stiff, medium-plasticity clay and silt tills, which the rig operators could definitely sense when the augers drilled into it. Finally, the geotechnical investigation identified shale bedrock at depths greater than 29 metres.

The field exploration also indicated that the silty clay soils in the upper 15 metres have a high potential for swelling. This means that fluctuating water levels would cause shallow foundations to undergo distress due to volume changes in the soil, so shallow foundation systems were not recommended on the site. Due to the high probability of ground water seepage and/or sloughing conditions during installation, conventional drilled, cast-in-place concrete piles were not recommended either.

Instead, Keller Canada installed 640 continuous flight auger piles for the transit facility using Soilmec R-516 and R-625 drill rigs. CFA piles are installed by drilling a continuous flight hollow stem auger into the ground, and then pressure injecting concrete through the shaft of the auger as it is extracted. This eliminates any concerns of groundwater seepage or sloughing, as the hole is never left open without support. And casings are not necessary with the CFA drilling technique. Once the CFA pile bores are completely filled with concrete, steel reinforcement cages are pushed down into the fresh concrete.

The CFA piles for the transit facility had a diameter of 400 mm to 500 mm and a depth ranging between 12 to 23.5 metres. The majority of the piles were drilled deep into the stiff clay and till layer but above the shale bedrock. The deepest piles required the torque, power and crowd force of the Soilmec

R-625 rig. The piles were spaced three pile diameters apart centre-to-centre to avoid group effects and an overall reduction of bearing capacity. The piles consisted of 32 MPa type S-2 concrete and were reinforced with 15M rebar cages eight to 16 metres in length.

During construction of the CFA piles for the administrative offices, piling operations proceeded smoothly despite frigid winter weather with temperatures remaining between –10 and –15 degrees Celsius. Special measures were taken to maintain the workability and flow of the concrete at these freezing temperatures, including choosing a cold weather concrete mix. Keller Canada used a CFA concrete mix that included sulphate resistant cement, Super Plast and DELVO. Super Plast plasticizer helps increase the workability of the concrete without requiring extra water, keeping the water/cement ratio lower to reduce susceptibility to freezing. DELVO retards the setting time by controlling the hydration of the cement. In order to keep the concrete flowing, Keller Canada's concrete supplier also heated the water and warmed the aggregate with natural gas heaters.

However, there were three days of delay when the weather dropped below –15 degrees Celsius, causing Keller Canada to suspend piling to prevent soil from freezing on the flights and concrete from freezing in the pump lines.

Special measures were also required to prevent the uppermost part of the CFA piles from freezing as the concrete cured. All of the piles were covered with exterior, below-grade Batt insulation after setting the rebar cages; this insulation was later removed when the pile caps were installed. If the overnight temperatures had dropped any lower, tarps and heaters would have been required to protect against freezing as the concrete cured. Luckily the Batt insulation was deemed sufficient.

## Rising above the mud

Once the piles for the administrative offices were complete, Keller Canada moved on to install piles for the building's bus storage and maintenance areas. As the weather warmed up into spring, fast thaws quickly caused the job site to become entrenched in mud. Both Keller Canada and an earthwork contractor had front-end loaders and skidsteers clearing mud during the entire shift in order to keep access roads and work areas clear for the concrete trucks.


Winter piling operations proceeded smoothly despite frigid weather, thanks to the reliability of the Soilmec drill rigs

As soon as the ground would dry, another snowfall would happen – followed by a fast melt – and the jobsite was once again overrun in mud. Because muddy conditions continued to be a major issue, the client decided to install a layer of base gravel over the site to improve access. However, Keller Canada managed to complete the foundation piling for the bus storage and maintenance areas before the gravel was placed.

Keller Canada completed installation of the transit facility's foundations two weeks ahead of schedule, despite winter storms and muddy site conditions. Keller Canada attributed its success to careful planning and reliable Soilmec equipment, which allowed the crew to maintain an aggressive production rate.

## Managing the snow

One month after completing the transit building's foundations, Keller Canada installed piles for the adjacent snow management facility. In addition to storage space for a massive amount of snow, this facility will feature a meltwater collection site where the environmental safety of the meltwater will be monitored before release into the storm sewer system. This new facility will eliminate the set-up, maintenance and environmental remediation costs associated with the current temporary sites.

**During construction of the CFA piles for the administrative offices, piling operations proceeded smoothly despite frigid winter weather with temperatures remaining between -10 and -15 degrees Celsius.**

The snow management facility required Keller Canada to install an additional 12 CFA piles with a diameter of 400 mm to 600 mm and a depth ranging from 12 to 17 metres. Again, the Soilmec R-516 and R-625 drill rigs performed perfectly.

Keller Canada completed the foundation piling for the Saskatoon Civic Operations Center in June 2015. The project involved drilling 11,835 linear meters of piling, installing 70,000 kg of rebar and pouring 3,066 cubic meters of concrete. Pile caps and reinforced concrete grade beams have been installed. Construction works – such as excavation of the snow melt pit and erection of structural steel – are underway this summer, and the full facility should be operational by early 2017.

*Austin Wilson is project manager at Keller Canada. John Wilson is sales manager at Champion Equipment Sales, LLC and Soilmec North America. Soilmec manufactures drilling and ground engineering construction equipment. Reach John at john@championsales.net.*