



Pre-assembled Cages Accelerate Precast Box Production for Highway 407 Culverts

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Construction of a 50km alignment of Highway 407 from Brock Road to Highway 35/115 in Clarington, Ontario is scheduled for completion in 2020 (<http://www.highway407east.com/>). The highway system is comprised of numerous structures and interchanges including culverts to support high-speed lanes and accommodate the hydraulics of streams and drainage systems. The supply of large-sized precast concrete boxes for the construction of culverts to convey tributaries of Oshawa Creek was accelerated by using pre-assembled rebar cages during production of the boxes. The cages were supplied by StelCrete Industries Limited, (<http://www.stelcrete.com/>) fully certified by the Canadian Welding Bureau (<http://eng.cwbgroup.org/Pages/default.aspx>).

The boxes were produced by M Con Pipe & Products Inc. in Ayr, Ontario (<http://www.mconproducts.com/>). Culverts (M51 - Oshawa Creek West Tributary and M56 - Oshawa Creek East Tributary) were specified originally as cast-in-place structures. Culvert M-51 was designed as an 8000mm span x 2500mm rise culvert, and M56 an 8000mm x 2100mm structure. Top and bottom slabs and walls were required to be 800mm thick.

After M Con was awarded a contract by the 407 East Construction General Partnership to manufacture five runs of precast concrete boxes for culverts of various sizes and lengths, M Con provided a precast concrete design alternative for culverts M51 and M56 that included thinner walls and slabs to reduce the weight of each box section for manufacturing, handling, shipping and installation. The precast boxes were manufactured with 500mm top and bottom slabs with a 500mm wall. The lay length for each culvert section was 1.205 metres. M Con produced 121 boxes for the M51 culvert and 72 boxes for the M56 culvert.



Cage placed into the form in preparation to receive concrete

Once the precast option was accepted, StelCrete became involved to supply reinforcement for the cages in the most efficient way. By supplying pre-welded rebar assemblies, M Con was able to cast two box sections daily. The design of the cages specified #30M to #35M reinforcing steel, compensating for the thinner slab and wall design of the precast culvert sections. This large size of rebar is rarely used to reinforce culverts and this was the first time that it had been installed during production at M Con.

The StelCrete Production System (SPS) allows for tight tolerances to be maintained in both the bent rebar components as well as the final assembled cages. Chairing spacers were attached to the cages at the StelCrete facility to create a product that was ready to be lowered into the form when it arrived at the M Con facility. Custom loading brackets were designed to assist with the loading and handling of the fully assembled rebar cages. Because of the size of the cages, only two could be loaded, transported and offloaded for each delivery. The use of the SPS ensured a continuous supply of quality pre-assembled cages that met the M Con production requirement of two complete precast boxes per day.



Rebar cages delivered from StelCrete, two cages per delivery, one stacked upon the other



8000mm x 2100mm x 1.205m precast concrete sections ready for construction of M56 culvert



Pre-welded cage being lowered into the mold jacket

Production of the box sections for the culvert over the Oshawa Creek West Tributary (M51) began in mid-October 2013. Shipment of sections with a total weight of 4,280 tonnes began in February, 2014. The contractor, Brennan Paving & Construction Limited (<http://www.millergroup.ca/index.html>) installed the sections in sequence based on the design of the earth cover. While confronted by record-breaking low temperatures, the contractor was still able to install 15 to 18 sections daily. Construction of the M51 culvert was completed in eight days. Production of the precast sections for the culvert for the Oshawa Creek East Tributary (M56) began in early April, 2014, with a completion in early July. The use of preassembled cages helped M Con meet the production schedule that was governed by the aggressive construction schedule of the owner.