

ARCHITECTURAL MERIT

MATERIAL DEVELOPMENT & INNOVATION

STRUCTURAL DESIGN INNOVATION

YORK UNIVERSITY TTC SUBWAY STATION



ONTARIO
CONCRETE
Awards



PROJECT CREDITS

OWNER

Toronto Transit Commission

ARCHITECT OF RECORD

Adamson Associates Architects

ENGINEER OF RECORD

Arup Canada

GENERAL CONTRACTOR

EllisDon Civil Ltd.

FORMING CONTRACTOR

Avenue Building Corporation

MATERIAL SUPPLIER

St Marys CBM

ADDITIONAL PARTICIPANTS

- Aluma Systems Inc.
- BASF Canada Inc.
- Carpenters and Allied Workers Local 27
- EllisDon Research and Development Dept.
- Ironworkers Local 721
- LIUNA Local 183 & 506
- National Concrete Accessories
- Salit Steel

PROJECT FACTS

LOCATION Toronto, Ontario

CONTRACT VALUE: \$104 Million

CONCRETE VOLUME: ~40,000 m³

PROJECT SUMMARY

The new York University Subway Station is one of the six new stations along the Spadina line and located with the main entrance in the Harry W Arthurs Common in the heart of the Campus. This station will service 40,000 commuters daily and replace an existing surface bus system. One of the principle design philosophies was for bright open spaces. Easier said than done when less than 5% of the floor area is at grade and the concourse and platform levels are buried deep.





Sustainability

Many initiatives have been incorporated into the design of this structure to ensure compliance with the Toronto Green Standard, starting with the roof over the entrances and upper concourse incorporating a “cool” roof using a high solar reflectance that absorbs little heat along with emergency exit building using green roofs. The “Light Scoop” allows for significant light to be captured helping fill the concourse and provide natural light down to the platform levels to help reduce electric lighting power usage. The project also utilizes water efficient plumbing fixtures and reduced storm water runoff by utilizing the green roofs and landscaping in adjacent areas.

Specialty Concrete Construction/Material Development

Specialty concrete mixes and construction techniques were used throughout the subway. Two elements of particular interest were the “V” columns and the “Waffle Beam Slab”.

The V columns are HSS steel hollow core columns structurally reinforced with rebar and studs which gets encased in concrete. Further added to the complexity of these columns were that due to timing and logistics, the roof was already in place, thus the columns needed to be poured by pumping CBM SureFlow (Self-Consolidating concrete) from the bottom up, all the while ensuring that the outcome would render an acceptable architectural finish.

Multiple full scale placing mock-ups were conducted. Coordination and execution from all construction partners was required to ensure final outcome was acceptable.

The Waffle Beam Slab is the main roof slab / focal point of this station. It was designed as with a monolithic beam structure which when poured resembles a Waffle like structure.

Due to the deep beam design along with the heavily reinforced rebar cage, once again CBM SureFlow (Self-Consolidating concrete) was required in order to complete the pour.

The pour in question took just over 15 hours to place, using 338 truckloads of CBM SureFlow at a pour rate of approximately 180 meters an hour batched from 5 different CBM plants. It was truly an orchestrated event with all construction team members coming together to complete the pour.

To add to this list of challenges, temperature monitoring was pivotal because of the mass nature of the slabs and elements, and so nitrogen cooling was employed for majority of the concrete used.

Another construction challenge was the concrete smoke screens. The smoke screens were designed to extend down from lower concourse level to a height ranging from 2.8m to 3.1m above the platform and at an angle of 15° from the vertical. The primary function of the smoke screens is to collect smoke, preventing it from dispersing throughout the station and improve the safety of the station, in the case of a fire. Owing to the design and aesthetic requirements of the smokescreen, conventional SCC could not be used and a hybrid concrete mix was designed, whilst meeting colour, aesthetic and constructability demands of the project.

The sloped columns and unconventional concrete elements challenged the team to meet the architectural demands of the project. To avoid bugholes and mix streaking, a low viscosity-thixotropic, non-air entrained SCC mix was used with careful monitoring of this mix from production to placement. Agitation speeds in the ready mix trucks were adjusted and even pumping rates and pressures were selected to minimized entrapment of air.

