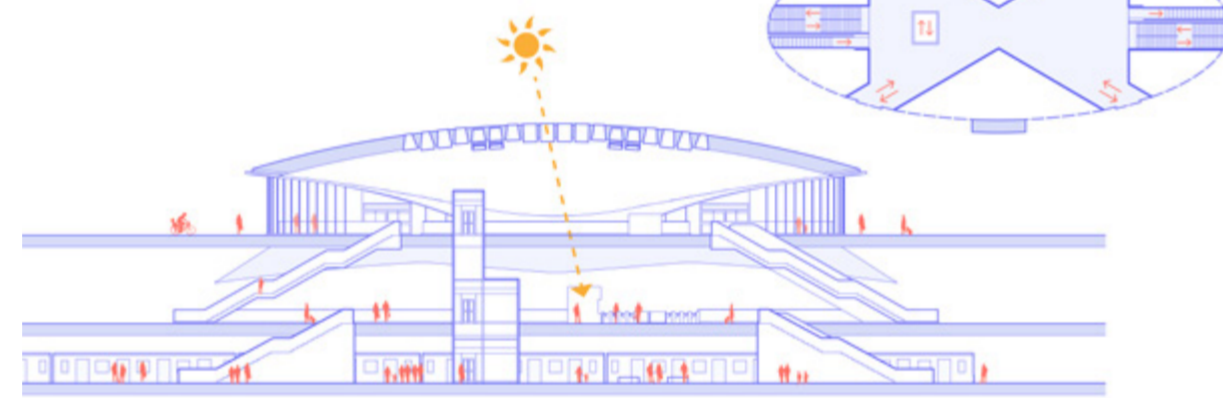


VAUGHAN METROPOLITAN CENTRE SUBWAY STATION



Location Vaughan, ON, Canada
Completion 2017
Client Toronto Transit Commission
Certification Toronto Green Development Standards (TGDS), 34 Points, or LEED Silver equivalent
Project team Grimshaw, Arup (prime), Adamson, Paul Raff Studio, Carillion Canada, MBTW Group

Project Partners/Lead Vincent Chang, Juan Porral (collaborating Partner)/ Nick Solomon



SUSTAINABILITY AND REGENERATIVE DESIGN CASE STUDY

The primary sustainability drivers for the Vaughan Metropolitan Center were supporting transit orientated development, enhancing health and happiness of passengers by means of integrated daylighting and public art, and the future-proofing of the station to allow flexibility for the station connections required to expand service in later development phases with minimal demolition and renovation.

The center forms the terminus of the Toronto Transit Commission's 8.6 kilometer, 2.6 billion-dollar Spadina Subway Extension. Serving one of Canada's fastest growing municipalities, the project provides access to the subway, Bus Rapid Transit, York regional transit bus station, vehicular drop-off and pick-up as well as facilities for cyclists. This new intermodal transit center acts as a catalyst for the 125-hectare mixed-use city centre developing around it.

Grimshaw's station design is integrated into the heart of the new development creating a pedestrian-friendly public realm that encourages transit use. Additionally, our design allows for adaptation as the city grows through future

connections to the station via knock-out panels along the perimeter of public concourse.

Design challenges included integrating our sustainability initiatives: roof apertures and entrance floor, an X-bridge structure, designed to maximize penetration of daylight to lower levels while maintaining sufficient structural mass to counter act upward geotechnical pressure, cool roof to minimize heat gain and temper conditioning requirements, and permeable green roofs over traction substations to collect storm water run-off, insulated cool roof of station box below and support biodiversity with native plantings.

Grimshaw, in collaboration with Paul Raff studio, designed a dynamic reflective soffit lining the domed ceiling and a series of the skylight apertures of the headhouse. The result both visually enlivens the passenger experience while its integrated mirrors introduce natural light deep into the underground concourse.

Grimshaw's design addressed three primary requirements of the TGS (Toronto Green Standards) including urban heat island reduction by use of green roofs, for storm water retention, and to reduce storm water run-off. In addition, the use of native species soft landscaping and the reduced surface of the entrance building structure allow for a reduction in ambient surface temperatures.

We overcame a constrained budget to design an affordable and distinctive station by sculpting the required mass of bracing structure at grade level into the central 'X' bridge, as a central aspect of the station's architectural expression. In turn this structural integration also eliminated the need for additional applied finishes and supported intuitive wayfinding through choreographed daylighting.



Beauty ↑
 The reflective soffit panels create an atmospheric lens that results in a dynamic, cubist collage of reflections of life inside the station with station commuters completing the passive kinetic effect by being in and seeing their reflection in the panels, becoming part of the ever-changing atmosphere above.

Key Sustainability Facts

- PROJECT SITE**
 Greyfield
- TRANSECT ZONE / CLIMATE ZONE**
 Suburban / 6 - cold
- ECOREGION**
 Nearctic/ Eastern Great Lakes lowland forests (Lake Erie Lowland, 7E Ontario Ecological land Classification Hierarchy)
- OPERATIONAL ENERGY/CARBON ENERGY USE INTENSITY**
- > Optimizations were focused on daylight design and high-performance HVAC
 - > Predicted energy use intensity (pEUI): 2,497.2 MWh/year
 - > Reduction of pEUI from an equivalent new building: 26%

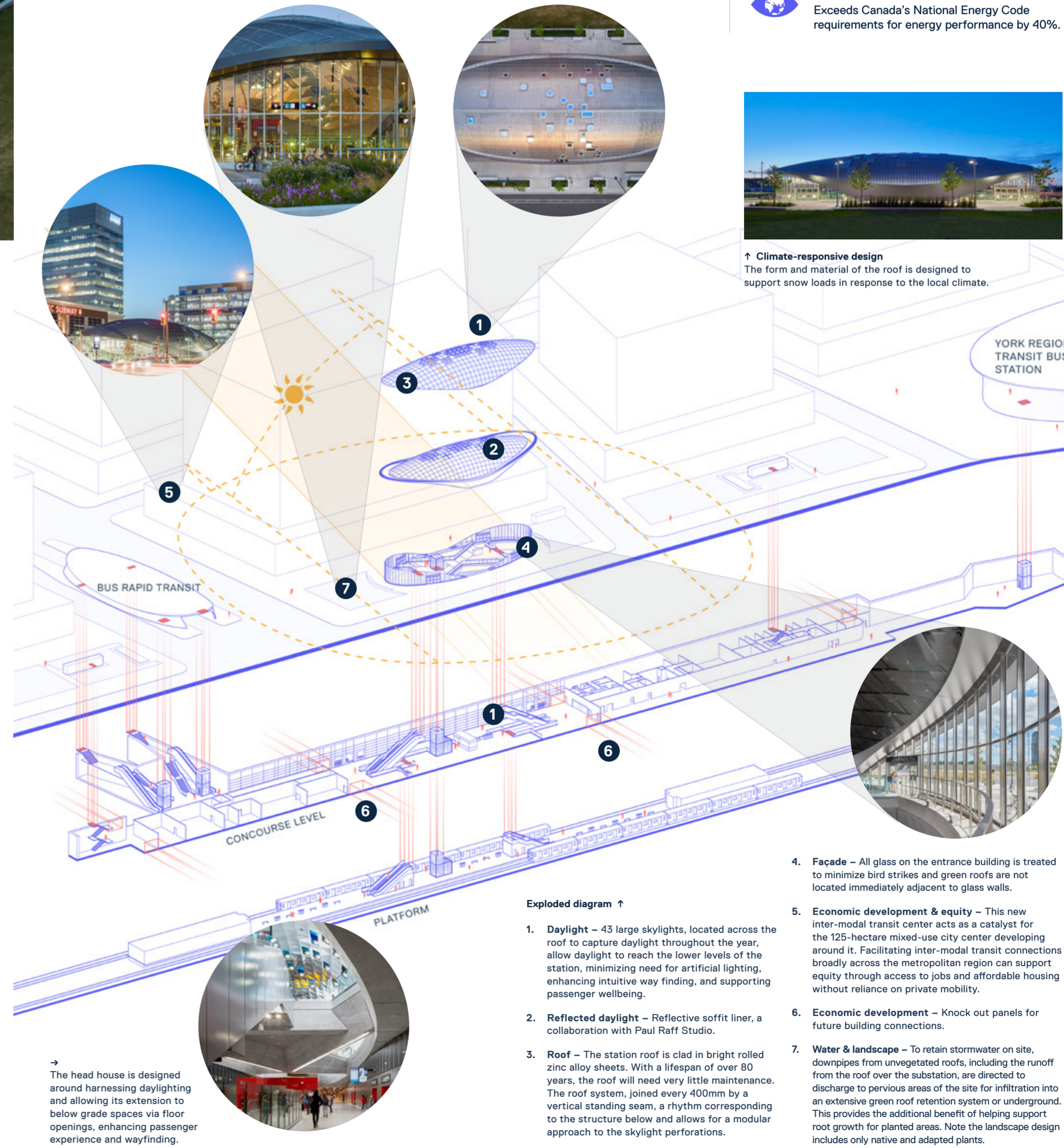
- EMBODIED CARBON**
- > Optimizations were focused on design for future flexibility and reducing carbon intensive materials.
 - > The design included flexibility for enhanced user connectivity and support of transit use in the future with 'knock out' panels on the lower concourse for connections to future station adjacent developments. Flexibility for future expansion/connection designed in to reduce embodied carbon required in future for demolition and renovation.
 - > By utilizing the required mass of concrete still required for bracing and resistance of upward pressure, the design team was able to integrate the structure into a distinctive architectural expression which eliminated need for the application of additional finish materials.

Alignment with UN Sustainable Development Goals

- SDG 3 GOOD HEALTH AND WELL-BEING**
 Design encouraging of mass transit use and integration into pedestrian friendly public realm and designed/configured to provide convenient intermodal connections.
- SDG 8 GOOD JOBS AND ECONOMIC GROWTH**
 New station provides broader access within the metropolitan area between housing and places of employment. New development around transit also creates opportunities for new business and additional jobs.
- SDG 11 SUSTAINABLE CITIES & COMMUNITIES**
 The station acts as an economic catalyst in the heart of a new transit-oriented city center as an alternative to urban sprawl.
- SDG 13 CLIMATE ACTION**
 Exceeds Canada's National Energy Code requirements for energy performance by 40%.



↑ Climate-responsive design
 The form and material of the roof is designed to support snow loads in response to the local climate.



Exploded diagram ↑

- Daylight** – 43 large skylights, located across the roof to capture daylight throughout the year, allow daylight to reach the lower levels of the station, minimizing need for artificial lighting, enhancing intuitive way finding, and supporting passenger wellbeing.
- Reflected daylight** – Reflective soffit liner, a collaboration with Paul Raff Studio.
- Roof** – The station roof is clad in bright rolled zinc alloy sheets. With a lifespan of over 80 years, the roof will need very little maintenance. The roof system, joined every 400mm by a vertical standing seam, a rhythm corresponding to the structure below and allows for a modular approach to the skylight perforations.

- Facade** – All glass on the entrance building is treated to minimize bird strikes and green roofs are not located immediately adjacent to glass walls.
- Economic development & equity** – This new inter-modal transit center acts as a catalyst for the 125-hectare mixed-use city center developing around it. Facilitating inter-modal transit connections broadly across the metropolitan region can support equity through access to jobs and affordable housing without reliance on private mobility.
- Economic development** – Knock out panels for future building connections.
- Water & landscape** – To retain stormwater on site, downpipes from unvegetated roofs, including the runoff from the roof over the substation, are directed to discharge to pervious areas of the site for infiltration into an extensive green roof retention system or underground. This provides the additional benefit of helping support root growth for planted areas. Note the landscape design includes only native and adapted plants.

→ The head house is designed around harnessing daylighting and allowing its extension to below grade spaces via floor openings, enhancing passenger experience and wayfinding.