

Project Documentation (ID 6558)

Gebäude-Dokumentation

Abstract | Zusammenfassung



5-Storey College Campus Building in Etobicoke, Canada

Data of building | Gebäudedaten

Year of construction Baujahr	2019	Space heating Heizwärmebedarf	15 kWh/(m²a)
U-value external wall U-Wert Außenwand	0,154 W/(m²K)		
U-value basement U-Wert Kellerdecke	3,749 W/(m²K)	Primary Energy Renewable (PER) Erneuerbare Primärenergie (PER)	61 kWh/(m²a)
U-value roof U-Wert Dach	0,105 W/(m²K)	Generation of renewable Energy Erzeugung erneuerb. Energie	26 kWh/(m²a)
U-value window U-Wert Fenster	0,88 W/(m²K)	Non-renewable Primary Energy (PE) Nicht erneuerbare Primärenergie (PE)	131 kWh/(m²a)
Heat recovery Wärmerückgewinnung	80 %	Pressurization test n_{50} Drucktest n_{50}	0,5 h ⁻¹
Special features Besonderheiten	Rooftop solar PV, fully re-cladded building, 100% electrification		

Brief Description

Located in Toronto, at Humber College's North Campus, Building NX has been transformed thanks to a retrofit that took the building from one of the campus' most inefficient and worst performing buildings to one of the best. Originally built in 1989, the five-story, 4,487 m² building was notorious for being cold in the winter, and hot in the summer—not a great atmosphere for the administrative staff whose offices are located there.

Guided by Humber College's 20-year Integrated Energy Master Plan (IEMP), a comprehensive design involving a complete envelope retrofit, energy efficient upgrades to heating and cooling systems and lighting, and a new Solar Photovoltaic system transformed Building NX into one of the most energy efficient buildings in North America. Through innovative design and methodologies, NX achieved a 70 percent reduction in energy use intensity, a 90 percent reduction in GHG emissions, and a 97 percent reduction in heating energy.

Responsible project participants Verantwortliche Projektbeteiligte

Architect Entwurfsverfasser	B+H Architects www.bharchitects.com
Implementation planning Ausführungsplanung	Morrison Hershfield www.morrisonhershfield.com
Building systems Haustechnik	Alejandro Ortega Garcia, P.Eng. Morrison Hershfield www.morrisonhershfield.com
Structural engineering Baustatik	Morrison Hershfield www.morrisonhershfield.com
Building physics Bauphysik	Steven Murray, P.Eng. Morrison Hershfield www.morrisonhershfield.com
Passive House project planning Passivhaus-Projektierung	Felix Chen, P.Eng., CPHC Morrison Hershfield www.morrisonhershfield.com
Construction management Bauleitung	-

Certifying body Zertifizierungsstelle

Passivhaus Institut Darmstadt
www.passiv.de

Certification ID Zertifizierungs ID

6558

Project-ID (www.passivehouse-database.org)
Projekt-ID (www.passivhausprojekte.de)

Author of project documentation Verfasser der Gebäude-Dokumentation

Felix Chen
Morrison Hershfield

Date
Datum

Signature
Unterschrift

18.03.2021



1. Ansichtsfotos

© Passive House Ins



North



North- West

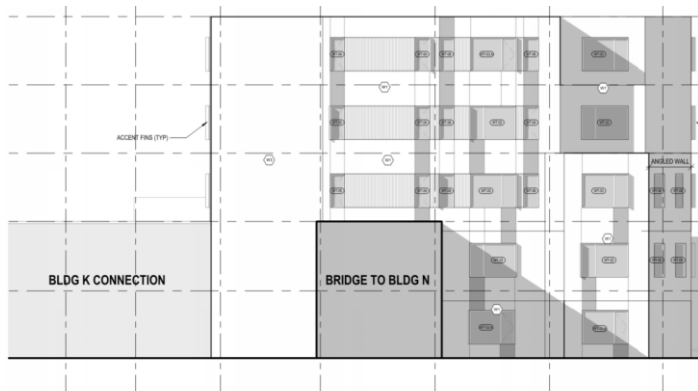


East

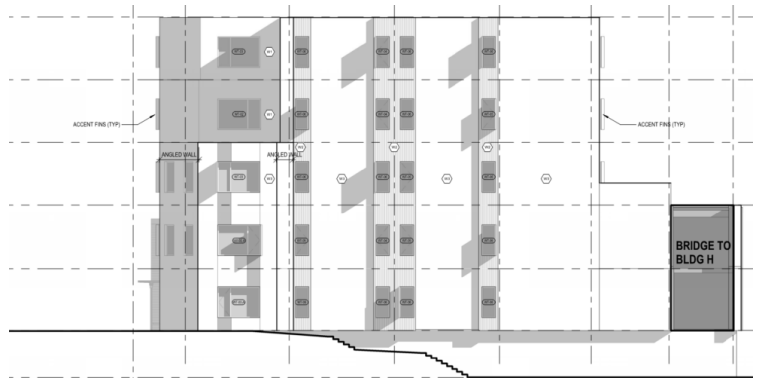
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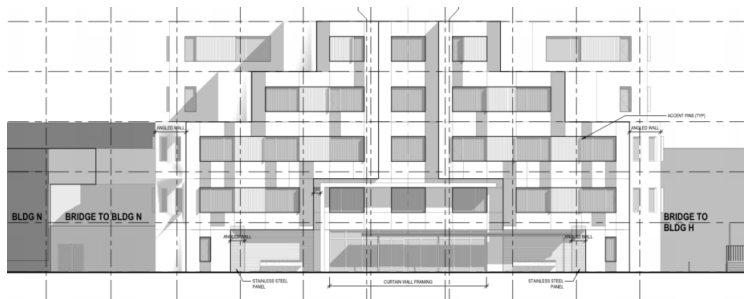
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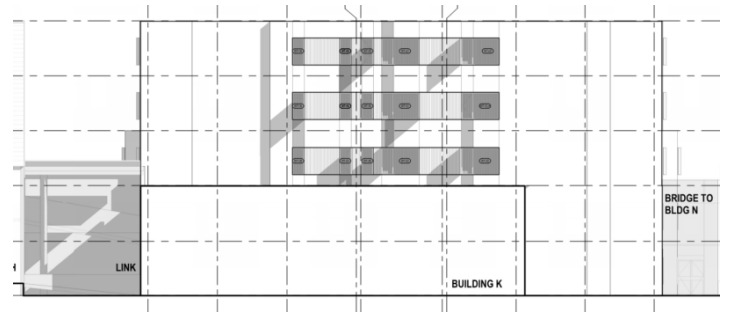
2 EAST ELEVATION
1:100



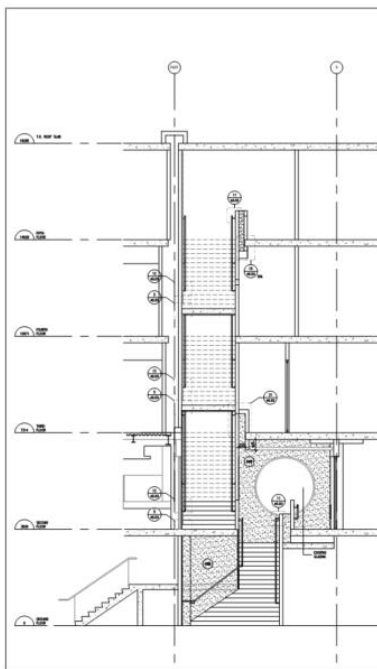
1 WEST ELEVATION
1:100



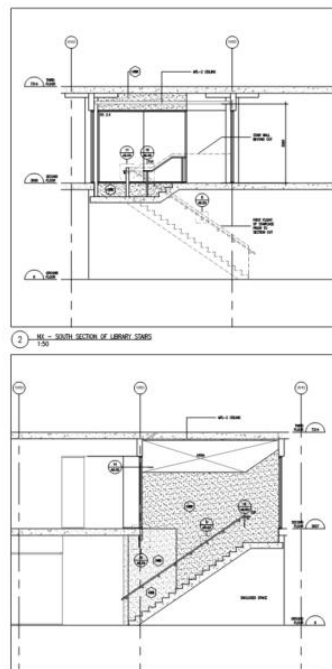
2 NORTH ELEVATION
1:100



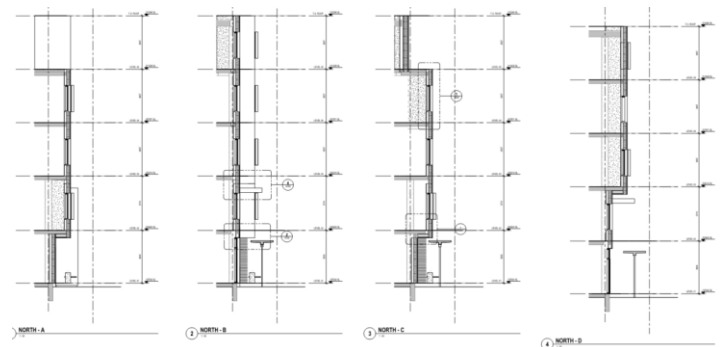
1 SOUTH ELEVATION
1:100



3 SE - EAST SECTION OF LIBRARY STAIRS
1:50

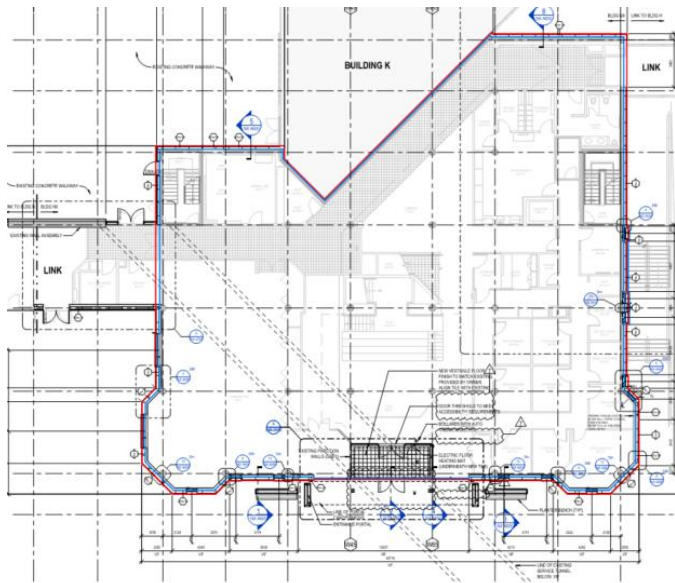


1 NE - NORTH SECTION OF LIBRARY STAIRS
1:50

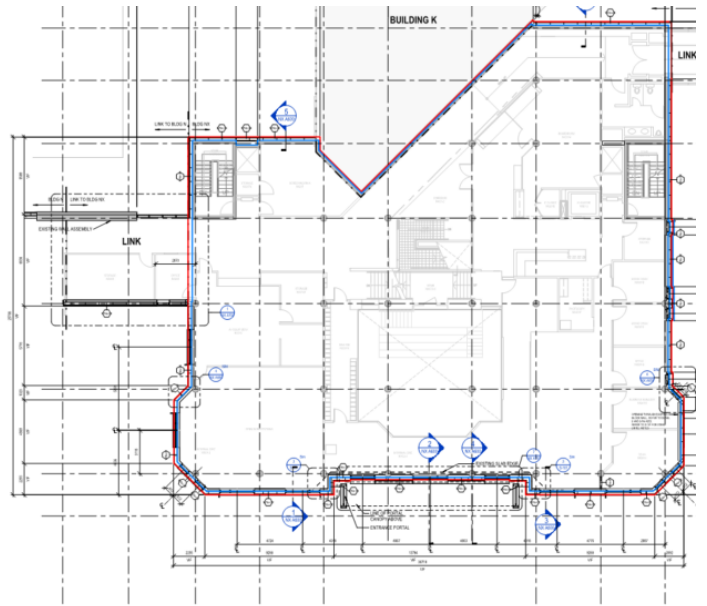


1 NORTH SECTION OF LIBRARY STAIRS
1:50

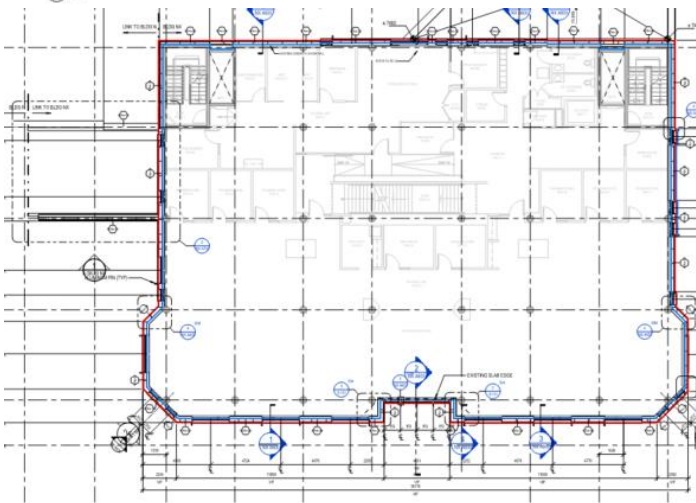
4. Grundrisse



1 LEVEL 01
1:100



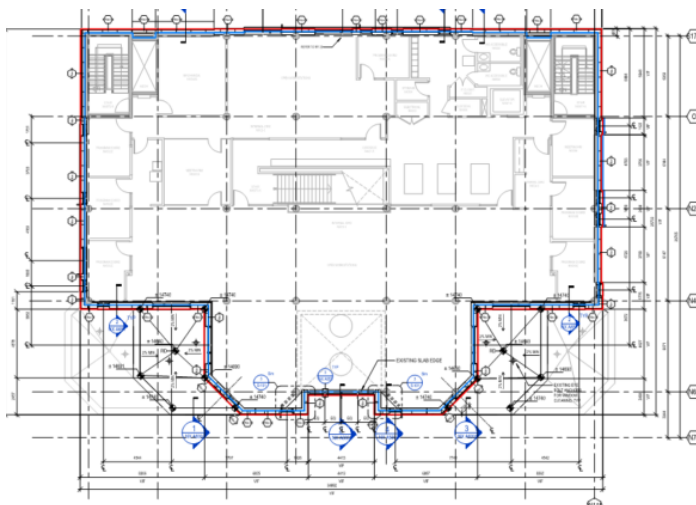
1 LEVEL 02
1:100



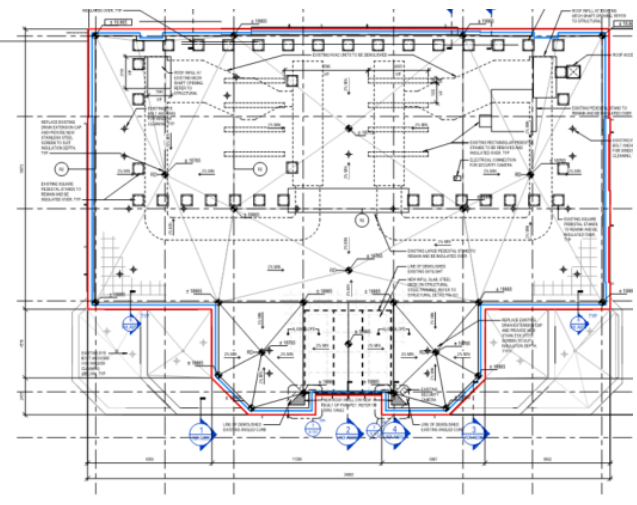
1 LEVEL 03
1:100



2 LEVEL 04
1:100



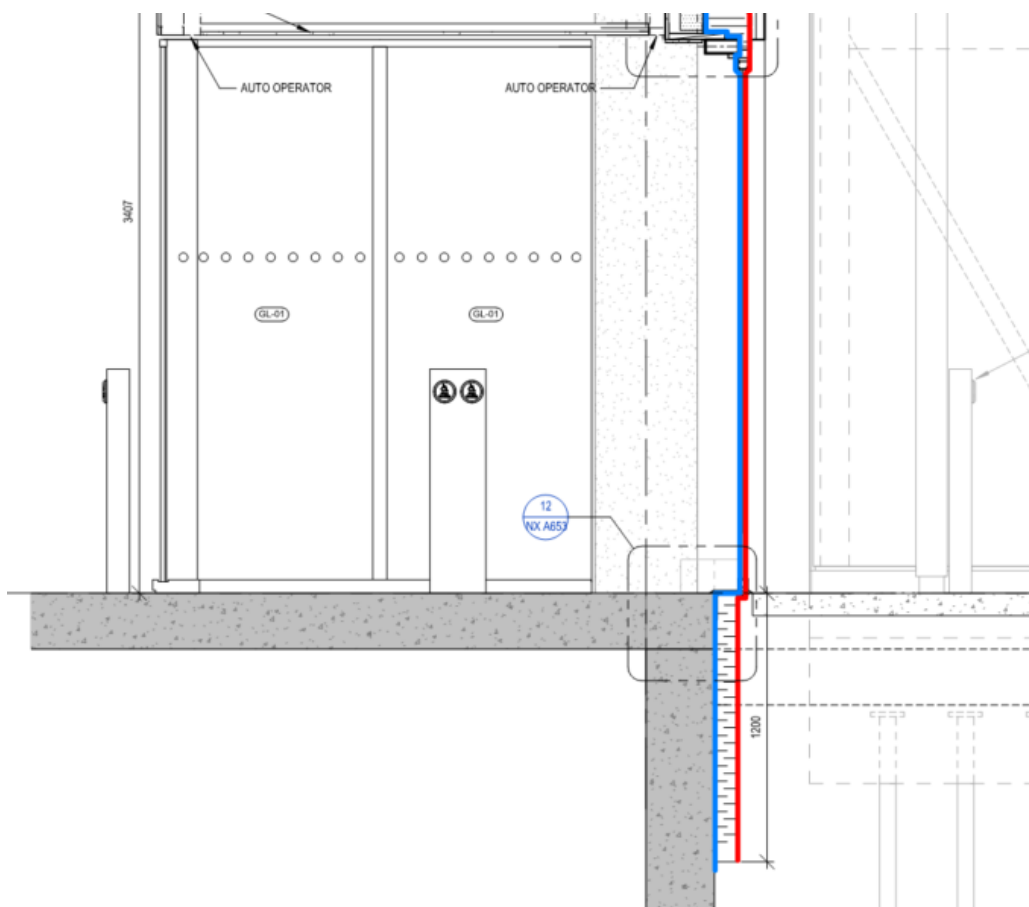
1 LEVEL 05
1:100



2 ROOF
1:100

5. Konstruktion der Bodenplatte

Due to the nature of the retrofit, the floor slab could not be insulated. Assembly only consists of concrete slab. 4" XPS of insulation added to exterior foundation wall.



Assembly no.

05ud

Floor (Uninsulated)

Interior insulation?

Orientation of building element

3-Floor

Heat transmission resistance [m²K/W]

interior R_{si}

0.17

Adjacent to

2-Ground

exterior R_{se}

0.00

Area section 1

λ [W/(mK)]

Area section 2 (optional)

λ [W/(mK)]

Area section 3 (optional)

λ [W/(mK)]

Thickness [mm]

Concrete

2.100

203

Percentage of sec. 1

100%

Percentage of sec. 2

Percentage of sec. 3

Total

20.3

cm

U-value supplement

W/(m²K)

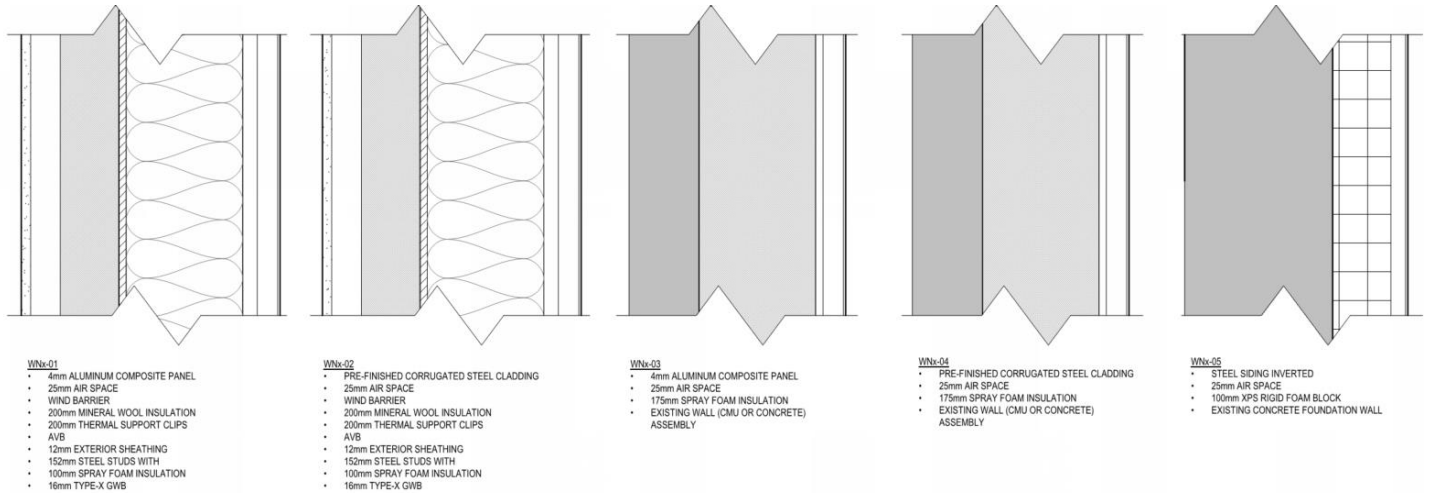
U-value:

3.749

W/(m²K)

6. Konstruktion der Außenwände

All wall types have either a concrete or concrete masonry unit backup wall. Insulation ranges from 100mm to 300mm, consisting of either spray foam or mineral wool. See graphic for specific description of wall assemblies.

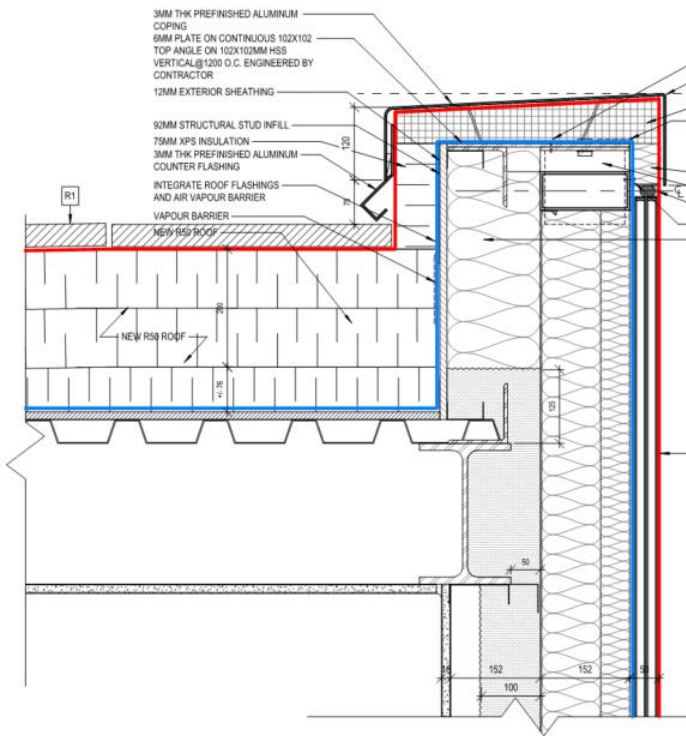


Bauteil Nr.	Bauteil-Bezeichnung		Innendämmung?	
01ud	Außenwand		<input type="checkbox"/>	
Wärmeübergangswiderstand [m²K/W]				
Ausrichtung des Bauteils	2-Wand	innen R_{si}	0.13	
Angrenzend an	1-Außenluft	außen R_{sa}	0.04	

Teilfläche 1	λ [w/(mK)]	Teilfläche 2 (optional)	λ [w/(mK)]	Teilfläche 3 (optional)	λ [w/(mK)]	Dicke [mm]
Innenputz	0.350					15
KS-Mauerwerk	1.000					175
EPS	0.040					275
Außenputz	0.800					20
Flächenanteil Teilfläche 1		Flächenanteil Teilfläche 2		Flächenanteil Teilfläche 3		Summe
100%						48.5 cm

U-Wert-Zuschlag	U-Wert:	0.137	W/(m²K)
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7. Konstruktion des Daches



XPS insulation outboard of concrete slab plus integrated roofing membrane. Exterior sheathing is mechanically fastened through to the roof infill.

Assembly no.

04ud

Roof

Interior insulation?

Heat transmission resistance [m²K/W]

Orientation of building element

1-Roof

interior R_{si} 0.10

Adjacent to

1-Outdoor air

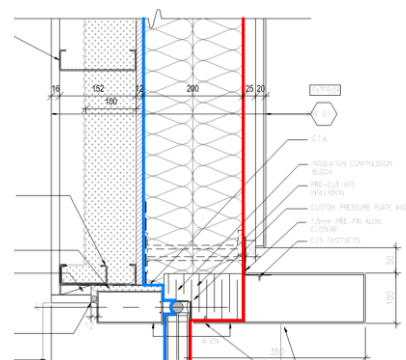
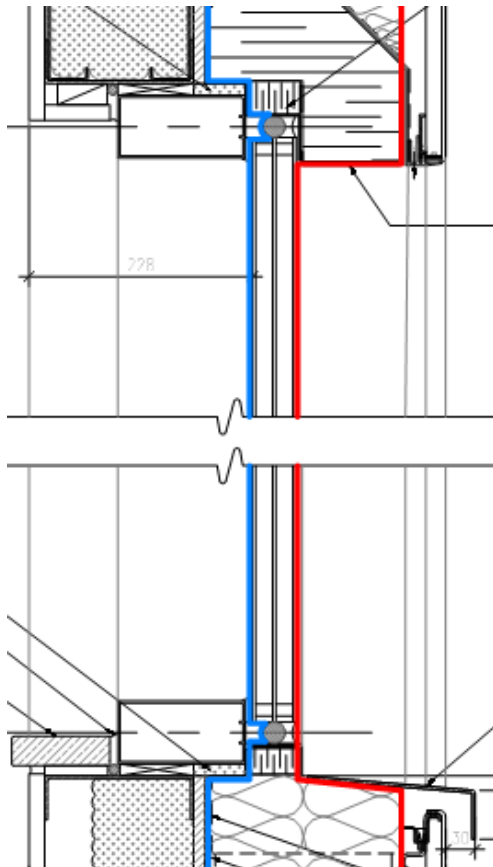
exterior R_{se} 0.04

Area section 1	λ [W/(mK)]	Area section 2 (optional)	λ [W/(mK)]	Area section 3 (optional)	λ [W/(mK)]	Thickness [mm]
Concrete Paver	2.100					13
XPS	0.029					273
Concrete	2.100					203
Percentage of sec. 1		Percentage of sec. 2		Percentage of sec. 3		Total
100%						48.9 cm

U-value supplement $W/(m^2K)$

U-value: 0.103 $W/(m^2K)$

8. Fenster und Fenster-Einbau



Beschreibung der Fenster (rahmen)-Konstruktion, Hersteller	Schuco AWS 90.SI (Windows) Schuco FW 50+ SI (Curtain Wall)
Fabrikat Fenster (rahmen; Produktname)	Aluminum frames with foam composite insulating bars and a co-extruded middle sealare added to the insulation zones.
Rahmen-U-Wert U_f	0,80 W/(m ² K)
Bauart der Verglasung	Tripled glazed, Argon filled
Glas-U-Wert U_g	0,68 W/(m ² K)
g-Wert der Verglasung	0,68

Outdoors

GLASS 1	Clear (NA) Thickness = 1/4" = 6mm	#1 ---- #2 SunGuard® SNX 62/27 (NA)
	GAP 1	10% Air, 90% Argon, 1/2" = 12.7 mm
GLASS 2	Clear (NA) Thickness = 1/4" = 6mm	#3 ---- #4 SunGuard® SN 68 (NA)
	GAP 2	10% Air, 90% Argon, 1/2" = 12.7 mm
GLASS 3	Clear (NA) Thickness = 1/4" = 6mm	#5 ---- #6 ----

9. Beschreibung der luftdichten Hülle

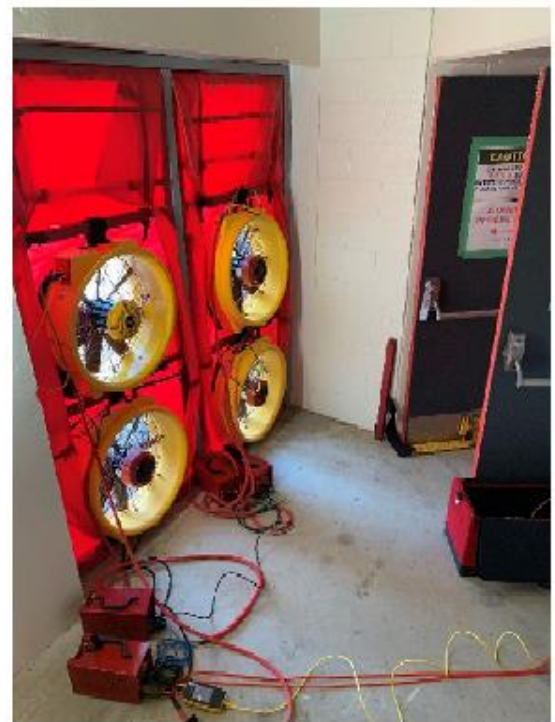
The final air tightness test was completed by Morrison Hershfield on December 19, 2019 after it was understood that all envelope and penetrations had been completed.



Building Envelope Airtightness Results³

Test Phase	ACH50	Result
Pressurization	0.55	PASS
Depressurization	0.51	PASS
Combined, Average	0.53	PASS

NOTE: The data in this table reflects the more conservative values of the 95% Confidence Interval for the measured results.



The building envelope consists of two basic wall types WNx-01 and WNx-03. Firstly, WNx-01 uses BlueSkin modified bitumen self-adhered membrane (SAM) applied to the exterior surface of exterior sheathing, supported on a structural steel stud wall assembly.

WNx-03 relies on spray foam insulation applied to the exterior surface of concrete or concrete block masonry. The transitions from WNx-01 to WNx-03 is facilitated by SAM membrane.



10. Lüftungsgerät

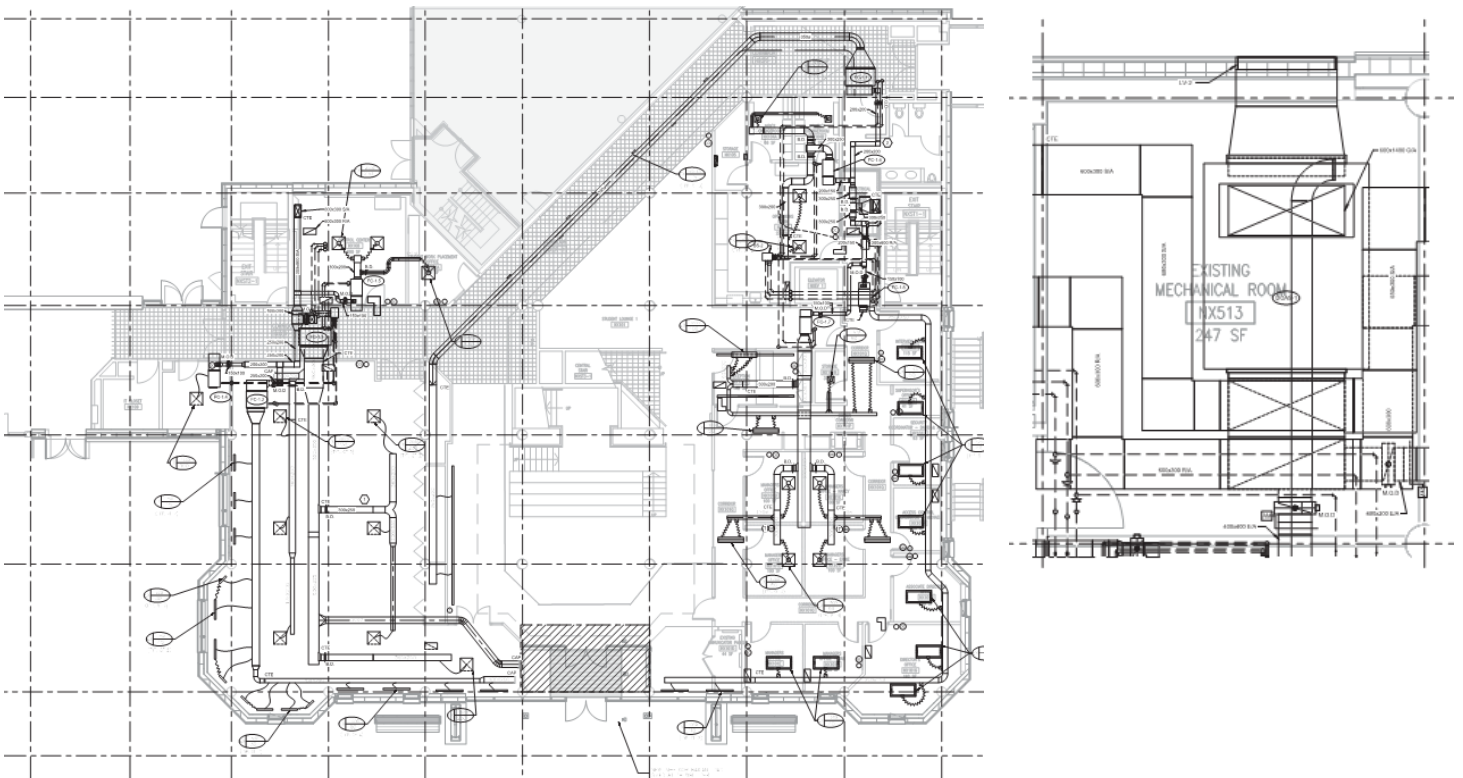
To greatly reduce ventilation heat losses, a balanced supply/exhaust air system with nominal 85% heat recovery was used.

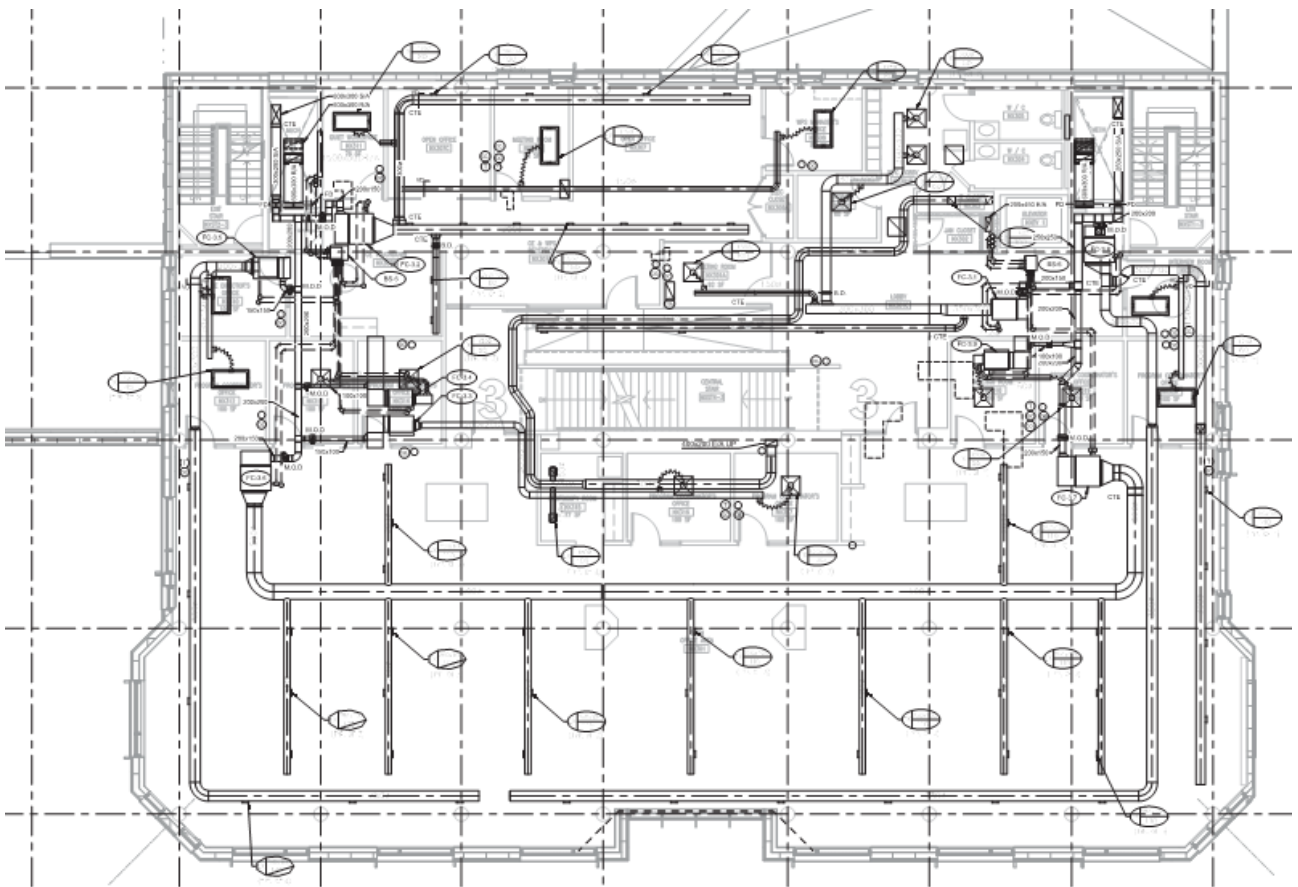
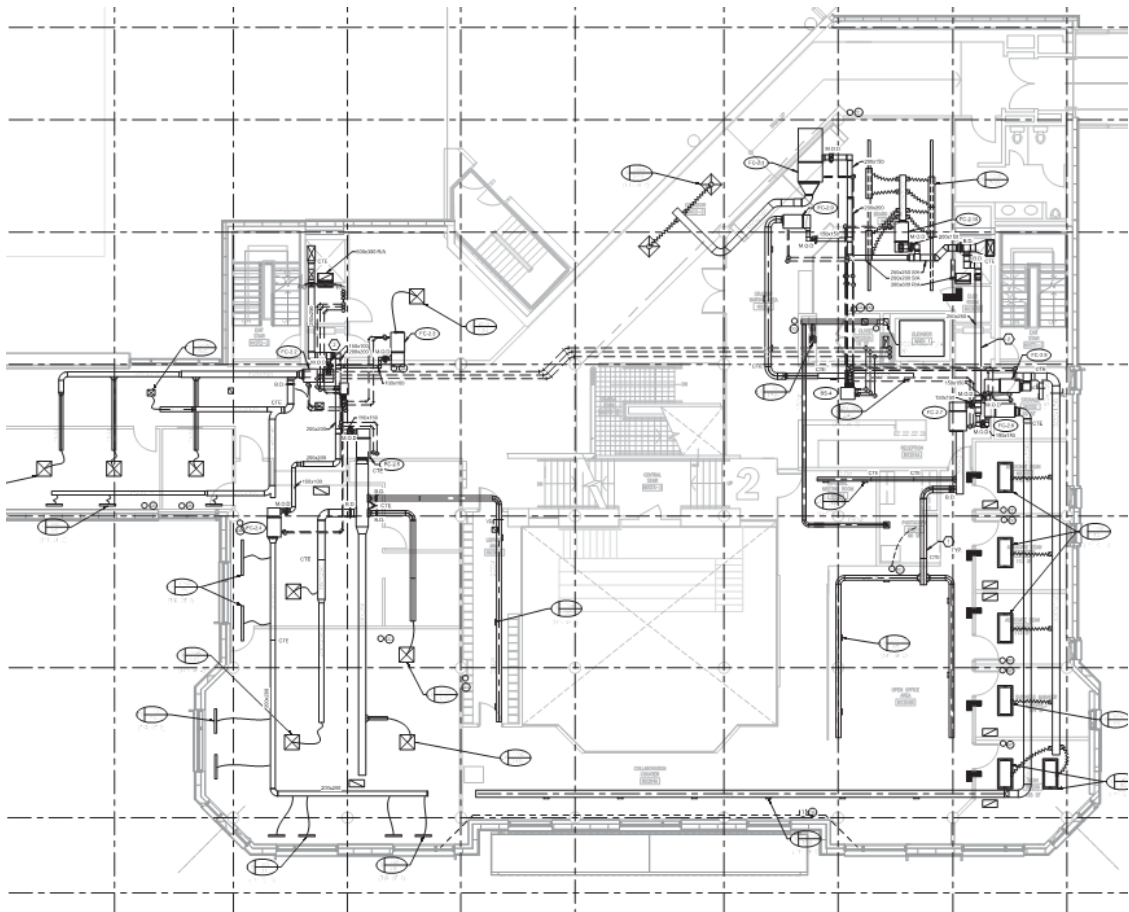


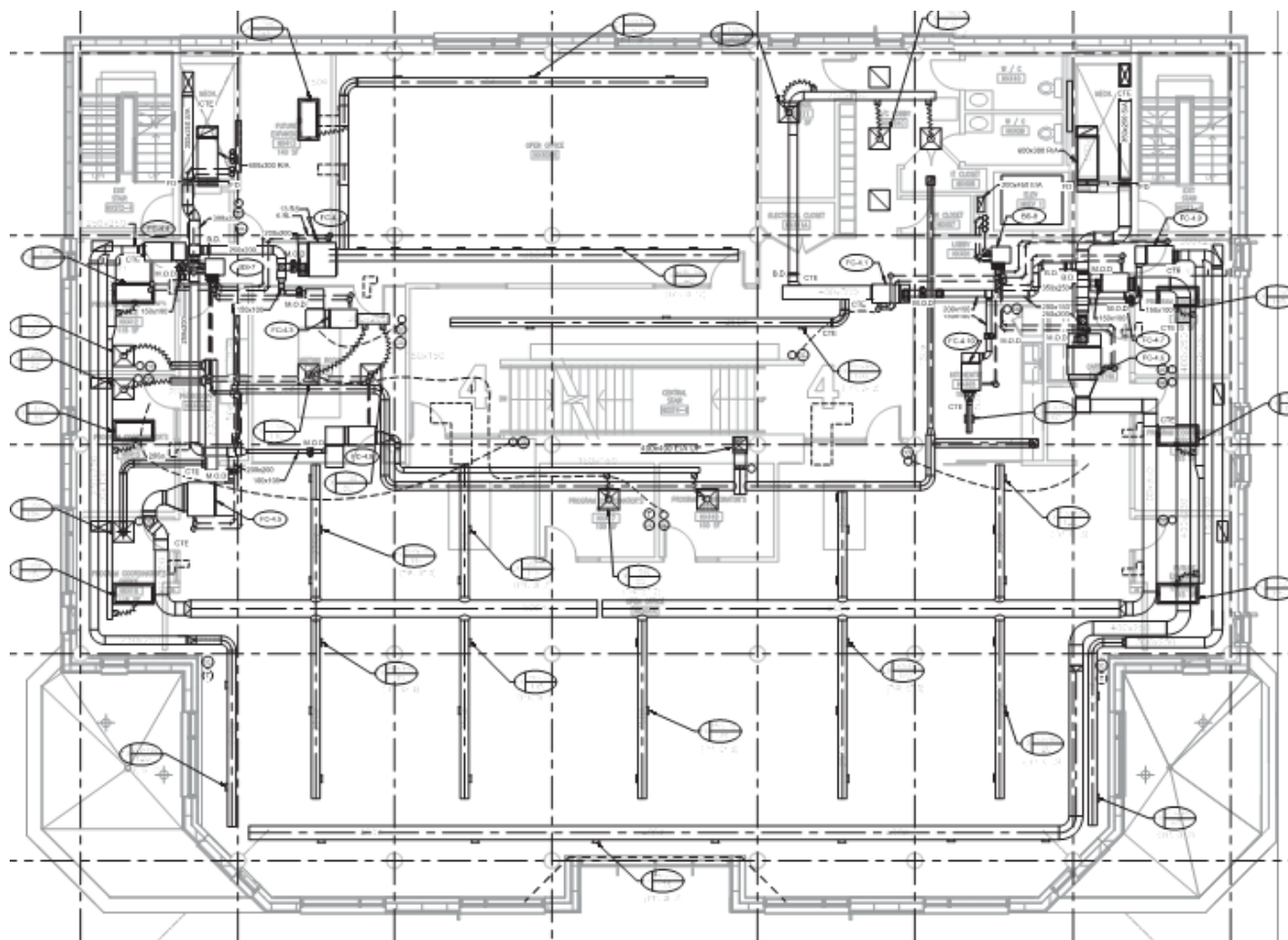
Fabrikat Lüftungsanlage	Swgon GOLD RX 35
effektiver Wärmebereitstellungsgrad	85 %
Elektroeffizienz	0,45 Wh/m ³

11. Lüftungsplanung Kanalnetz

One (1) Dedicated Outdoor Air system (DOAS) with 85% sensible heat recovery and 1900 l/s flow capacity. Refer to attached cut sheet. All existing sanitary and general exhaust ducting will be re-routed to the exhaust plenum of the proposed DOAS. New DOAS will be installed indoor on the 5th floor mechanical room.







12. Wärmeversorgung

Two (2) new air cooled Variable Refrigerant Flow-Heat recovery Heat Pumps will be installed on the 5th floor mechanical room Roof. Refer to attached cut sheets
Fan-coil units will be installed for each thermal zone and the existing ductwork distribution within the floors will be re-used for each zone distribution. Refer to attached cut sheets.
One (1) Dedicated Outdoor Air system (DOAS) with 85% sensible heat recovery and 1900 l/s flow capacity. Refer to attached cut sheet. All existing sanitary and general exhaust ducting will be re-routed to the exhaust plenum of the proposed DOAS. New DOAS will be installed indoor on the 5th floor mechanical room.
For the new vestibule located on the North entrance of the ground floor an electric radiant infloor system will be installed separately in two areas to accommodate the proposed foot grille. A radiant system will account for the perimeter glazing heat losses in a more efficient manner than a forced air system



13. Baukosten

The total construction costs for the entire retrofit, including soft costs such as design was \$9,500,000.00 CAD. Construction was completed in Summer 2019 and certification was granted in February of 2021.

15. PHPP-Ergebnisse

Passive House Verification



Architecture: B+H Architects
 Street: 300 - 481 University Ave
 Postcode/City: M5G 2H4 Toronto
 Province/Country: Ontario CA-Canada

Energy consultancy: Morrison Hershfield
 Street: 300 - 125 Commerce Valley Drive W
 Postcode/City: L3T 7V4 Markham
 Province/Country: Ontario CA-Canada

Building:
 Street:
 Postcode/City:
 Province/Country:
 Building type:
 Climate data set: CA0001b-Toronto
 Climate zone: 3: Cool-temperate Altitude of location: 170 m

Home owner / Client:
 Street:
 Postcode/City:
 Province/Country:

Mechanical engineer: Morrison Hershfield
 Street: 300 - 125 Commerce Valley Drive W
 Postcode/City: L3T 7V4 Markham
 Province/Country: Ontario CA-Canada

Certification: Passive House Institute
 Street: Rheinstr 44/46
 Postcode/City: 64283 Darmstadt
 Province/Country: Hesse Germany

Year of construction: 2019
 No. of dwelling units: 1
 No. of occupants: 200.0

Interior temperature winter
 [°C]: 20.0
 Internal heat gains (IHG)
 heating case [W/m²]: 3.5
 Specific capacity [Wh/K per
 m² TFA]: 204

Interior temp:
 summer [°C]: 25.0
 IHG cooling
 case [W/m²]: 3.5
 Mechanical
 cooling: x

Specific building characteristics with reference to
 the treated floor area

The PHPP has
 not been filled
 completely; it is
 not valid as
 verification

	Treated floor area m²			Criteria	Alternativ e criteria	Fulfilled? ²
Space heating	Heating demand kWh/(m²a)	3247.0	15	15	-	yes
	Heating load W/m²	8	8	-	10	yes
Space cooling	Cooling & dehum.kWh/(m²a) demand	0	0	15	15	yes
	Cooling load W/m²	3	3	-	11	-
	Frequency of overheating (> 25 °C)	-	-	-	-	-
	Frequency of excessively high humidity (> 12 g/kg)	1	1	10	-	yes
Airtightness	Pressurization 1/h test result n ₅₀	0.5	0.5	0.6	-	yes
Non-renewable Primary Energy (PE)	PE demand kWh/(m²a)			-	-	-
Primary Energy Renewable (PER)	PER demand kWh/(m²a)	61	61	60	61	yes
	Generation of renewable energy (in relation to pro- jected building footprint area) kWh/(m²a)	26	26	-	3	yes

² Empty field: Data
 missing; -: No
 requirement

I confirm that the values given herein have been determined following the PHPP methodology and based on the characteristic
 values of the building. The PHPP calculations are attached to this verification.

Passive
 House
 Classic? yes

16. User Experience

Since construction finished at the end of the summer of 2019, we now have over a year to enjoy the renovated space. Overall our experience has been very positive.

- Space temperatures are remarkably stable, with very little fluctuation. Office spaces in our Security office that would drop to 12°C on the coldest winter days are now the same as the rest of the building. Work order complaints for temperature dropped to zero after we worked the initial bugs out of the system.
- We have been about to remove supplemental cooling units from our Security Operations Centre where they have a lot of electronic equipment. This has reduced the background noise and made the space much more comfortable.
- Even with the very low window to wall ratio, there is plenty of natural light in the building. Glare is significantly improved now the glass block is gone.
- Operable windows have been very popular with office staff.
- Air quality is also very good. In recent months with concerns raised about Covid aerosolized transition we have been able to point to NX as best practice because it has 100% outdoor air with no recirculation.