HexaGain

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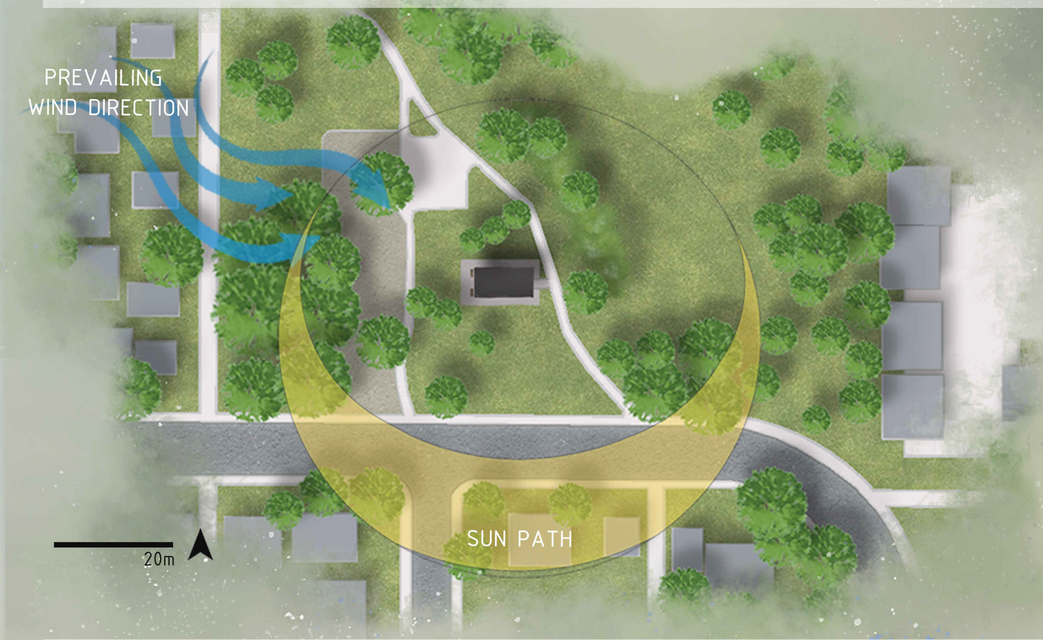
CHALLENGES AND OPPORTUNITIES

Edmonton's cold and dry climate presents many challenges towards designing for comfort in buildings; as a result it allows for unique building opportunities and heating strategies. As aforementioned, Edmonton is very cold and dry. This restricts buildings to closed environments year-round, as well as having thick walls to hold several layers of insulation. Furthermore, designing with intent to passively heat the building is crucial. This challenge led to the opportunity of utilising a ventilation system in the form of a wall on the south side of the library. Another opportunity that arose was the ability to create a facade out of several different types of aluminum hexagon panels. The benefit of these panels is that they are able to transition between different types of panels very smoothly due to their high surface area to volume ratio, as opposed to other shapes that can grid a surface such as triangles and squares. Additionally, hexagons provide a story-telling aspect for the building, as the ventilated wall can represent the way bees bunch up with and move one another during the cold to create warm air through friction within the hive.

SITE LOCATION: DR. FRANCIS CRANG PARK



EDMONTON'S CLIMATE DATA

FRIGID WINTERS
-18° C
average temperarture
in coldest month

COOL SUMMERS
15° C
average temperarture
in warmest month

ARID
57.5 cm
annual average
precipitation

WINDY
3.17 m/s
average annual
wind speed

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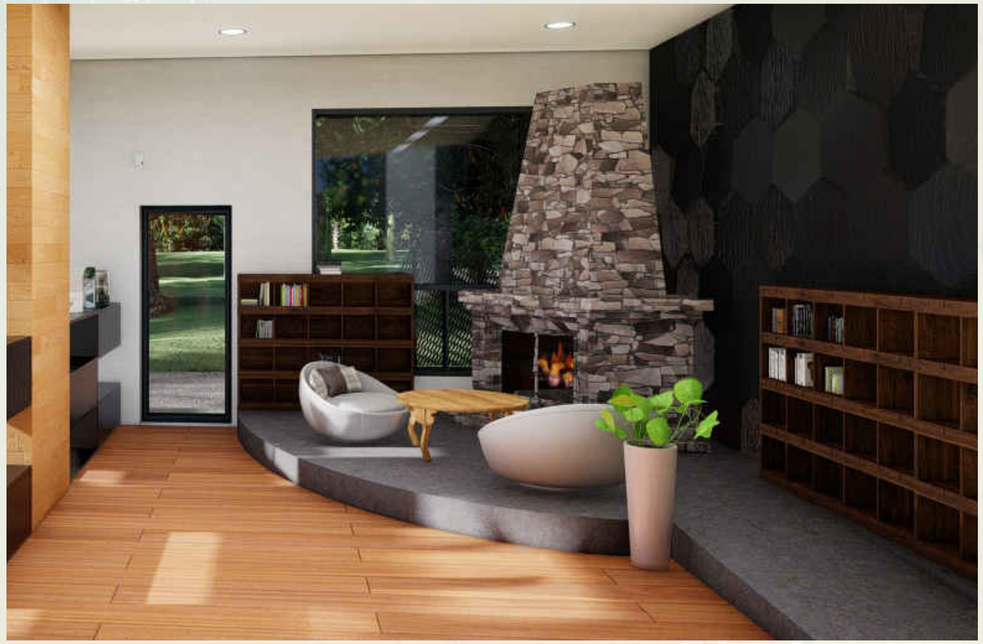
INTERIOR VIEW OF FIREPLACE



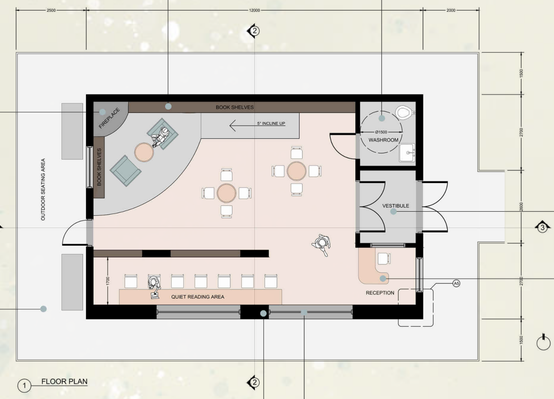
INTERIOR VIEW FROM RECEPTION DESK

THERMAL EXPERIENTIAL GOALS

Low sunlight effects on the north side makes it the perfect location for **bookshelves**.

The **washroom** located on the northeast side makes use of another otherwise cold and dark corner of the library.

The **fireplace** is found on the northwest corner or the building to warm and brighten what is otherwise the coldest, darkest portion of the library.



1 FLOOR PLAN

A **mechanical** heating system is implemented in addition to the passive heating strategies to warm the building on extremely cold days.

A **vestibule** maintains air-tightness and the unwanted free flow of hot and cool air through the building.

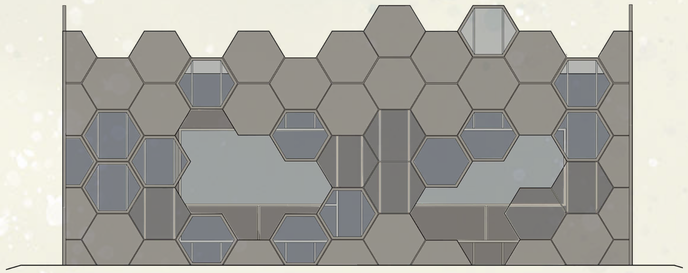
The **outdoor seating area** can be taken advantage of during the summer months, typically between mid-May to late August.

The **reception desk** is placed to experience sunlight from the east window for morning light and allows for a clear view over the library activities. A window between the vestibule and reception ensures visibility of visitors.

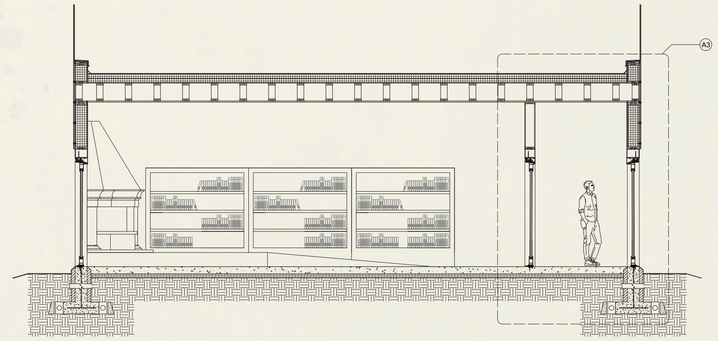
A **Passive Heating Ventilated Wall**. This user controlled ventilation system that allows the passively warmed air to heat the inside of the library. It can also be closed to keep the warm air out, providing a comfortable experience on both cold and warm days.

Windows on the south side within the ventilated wall assembly maximize daylight and provide solar heating. The strategic window placement in combination with typical overcast expectations allows for desirable lighting without shading devices.

SOUTH ELEVATION

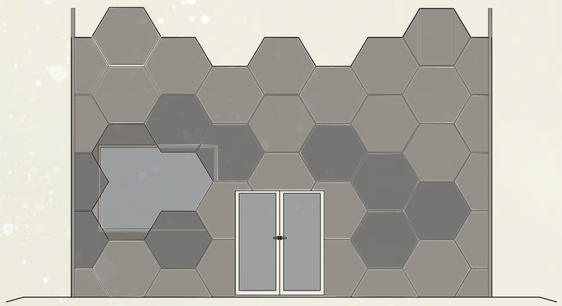


LONGITUDINAL SECTION

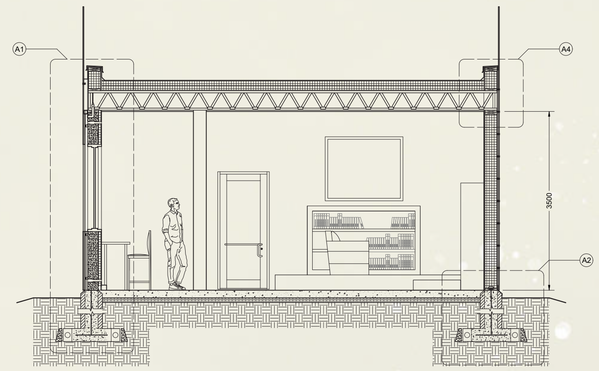


3 SECTION 2

EAST ELEVATION



LATERAL SECTION



2 SECTION 1

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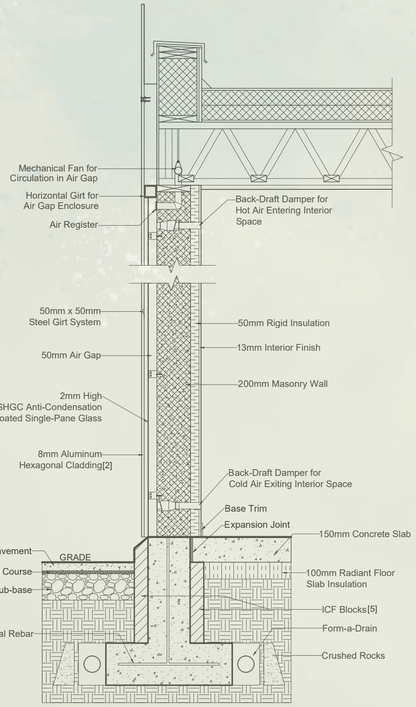
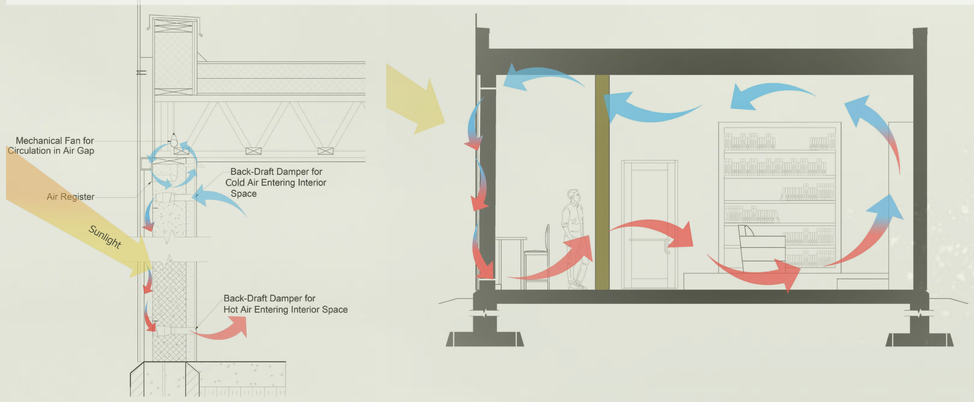
CLIMATE RESPONSE DESIGN: VENTILATED WALL

Heat gain passive strategies are critical in Edmonton. Through COMFEN and Climate Consultant analyses, the South facade receives maximal direct sunlight. Thus, a ventilated wall assembly is incorporated there for improved heat gains. As the sun heats up the enclosed air gap between the exterior glass and the grout-filled CMU wall, the warm air travels downwards the space and enters the interior through a back-draft damper. Simultaneously, cold air from the inside enters the air gap near the roof through a reversed back-draft damper. A mechanical fan is installed at the top of the wall assembly to create forced ventilation which pushes incoming cold air downwards in the air gap to complete the cycle.

A1. VENTILATED WALL ASSEMBLY SECTIONAL DETAIL



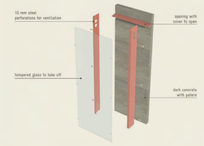
AIR CIRCULATION DIAGRAMS



EXTERIOR SOUTH VIEW

PRECEDENT

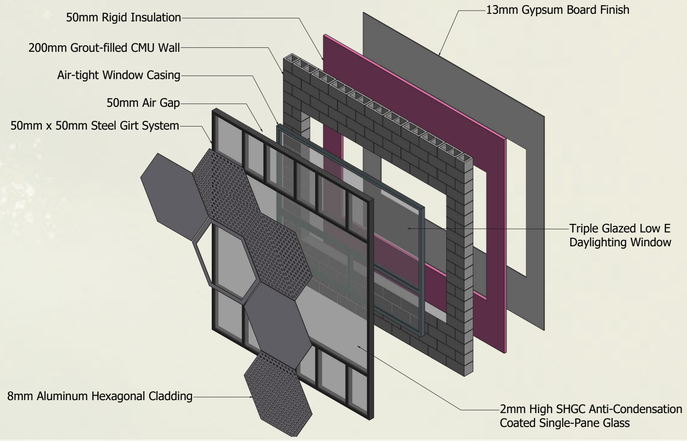
Name: Nature & Environment Learning Centre (NME)
Location: Netherlands
Architect: Bureau SLA
Date: 2015



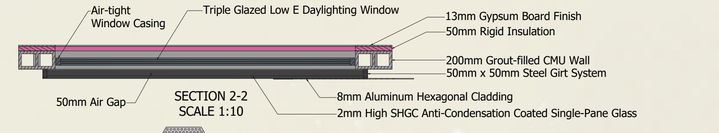
The Nature & Environment Learning Centre is an Energy Neutral Building in Amsterdam which utilizes placements of South-facing Trombe Walls. The air between glass and masonry gets easily heated and thus provide warm air for interior heating. It incorporates interior operable slats to allow slab-heated fresh air to warm the interior when needed [6].

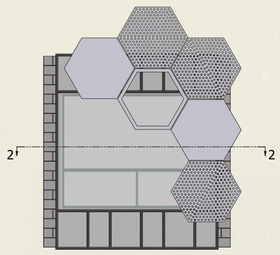
SOUTH VENTILATED WALL ASSEMBLY WITH DAYLIGHTING WINDOWS

EXPLODED DIAGRAM

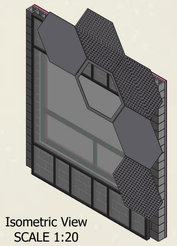


DETAILS





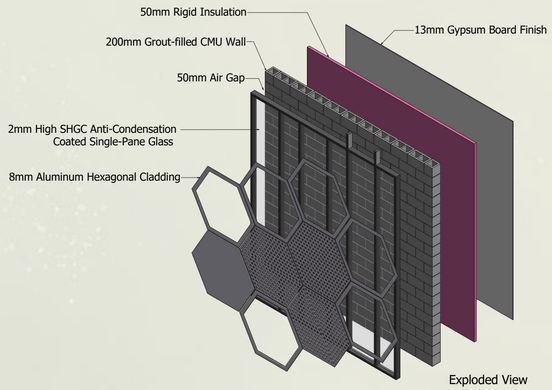
Front View
SCALE 1:20



Isometric View
SCALE 1:20

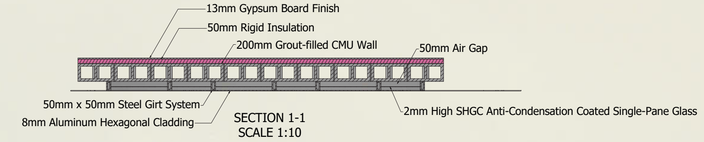
SOUTH VENTILATED WALL ASSEMBLY

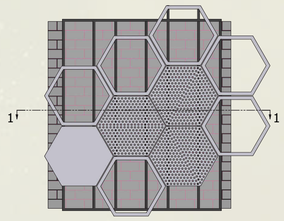
EXPLODED DIAGRAM



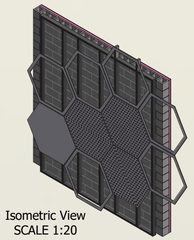
Exploded View

DETAILS





Front View
SCALE 1:20



Isometric View
SCALE 1:20

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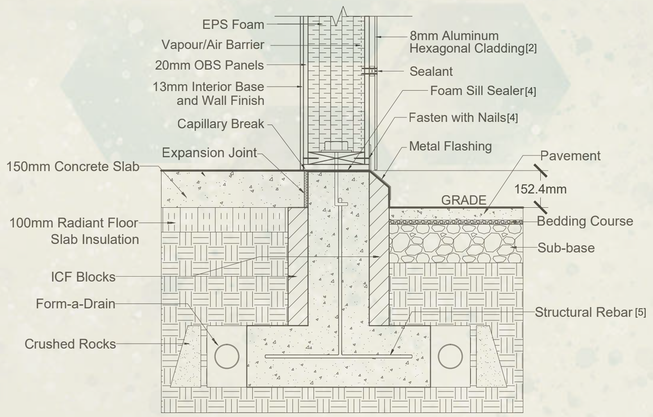
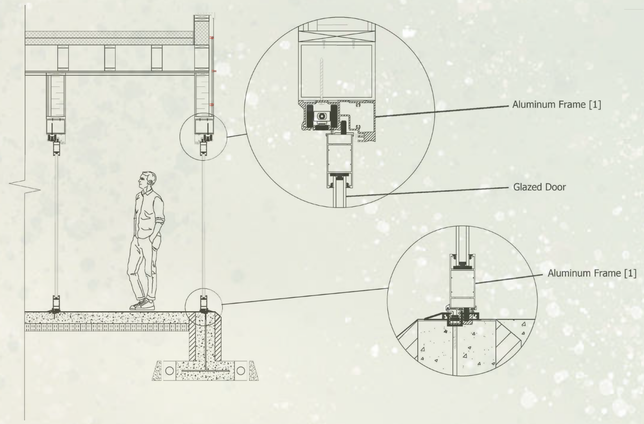
CLIMATE RESPONSE DESIGN: AIR TIGHTNESS

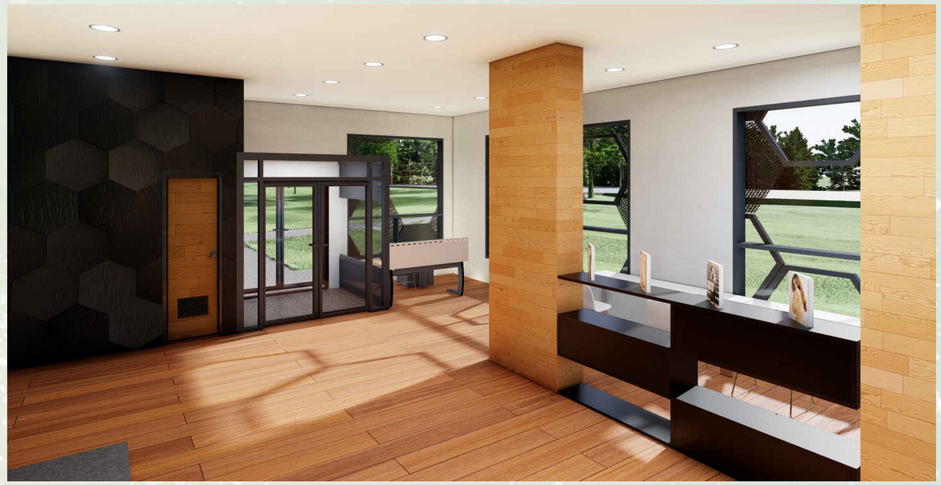
One simple yet fundamental concept for passive heating strategies is air-tightness. Throughout the entire building envelope, air and vapour barrier systems are constructed on the exterior of the insulation to control the exfiltration of moisture-laden air. Furthermore, aside from the ventilated south wall that brings in warm air, all other exterior walls are constructed as Structurally Insulated Panels (SIPs) walls. They demonstrate high thermal resistance and minimal air infiltration through their use of continuous insulation and ensuring tight joint lines, especially at corners and roof connections. A vestibule is also installed at the entrance of the library to trap air and minimize heat loss by reducing the in-flow of exterior cold air.

A2. FOUNDATION & WALL ASSEMBLY DETAIL

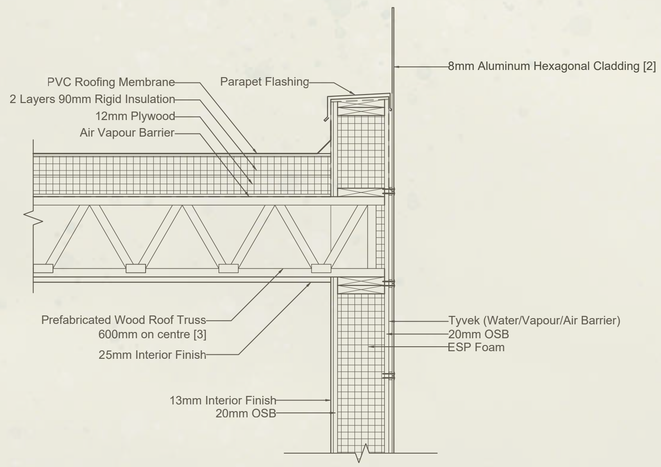


A3. VESTIBULE DETAIL

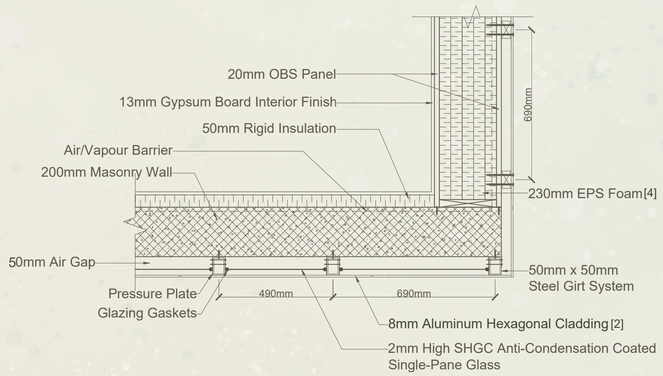




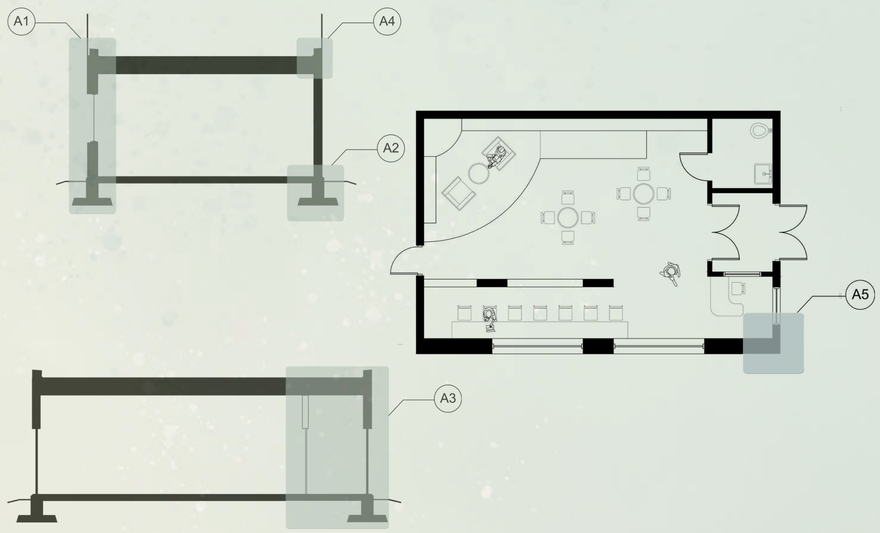
A4. PARAPET DETAIL



A5. FACADE CONNECTION DETAIL



DETAIL CALLOUT LEGEND



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[2] ACM details - with insulation. NorthClad. (2018, October 24). Retrieved December 1, 2021, from https://northclad.com/acm-details-with-insulation/.

[3] Burrows, J. (2008). Chapter 11: Ceiling and Roof Framing. In Canadian wood-frame house construction. essay, Canada Mortgage and Housing Corporation.

[4] Getting sip framing right. JLC Online. (2016, July 8). Retrieved December 1, 2021, from https://www.jlconline.com/how-to/framing/getting-sip-framing-right_o.

[5] The benefits of insulated concrete forms (ICF) foundations. TC Legend Homes. (n.d.). Retrieved December 1, 2021, from https://www.tclegendhomes.com/blog/the-benefits-of-insulated-concrete-forms-icf-foundations/.

[6] Nature & Environment Learning Centre / Bureau SL. (n.d.). Retreived December 1, 2021, from https://www.archdaily.com/778961/nature-and-environment-learning-centre-bureau-sla .