GINA CODY

SCHOOL OF ENGINEERING

AND COMPUTER SCIENCE

TEAM CARLS ANGELS

BLDG 490 - CAPSTONE



Concordia University Faculty of Engineering and Computer Science Department of Building, Civil and Environmental Engineering

April 9th, 2020

Structural Design:

Nanor Balian, 27864647 & Simona Oppedisano, 40027875 Supervisor: Dr. Jassim Hassan

Building Envelope Design:

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Supervisor: Dr. Hua Ge

HVAC Design:

Myriam Nasrallah, 40017068 & Megan Padvaiskas, 27412843

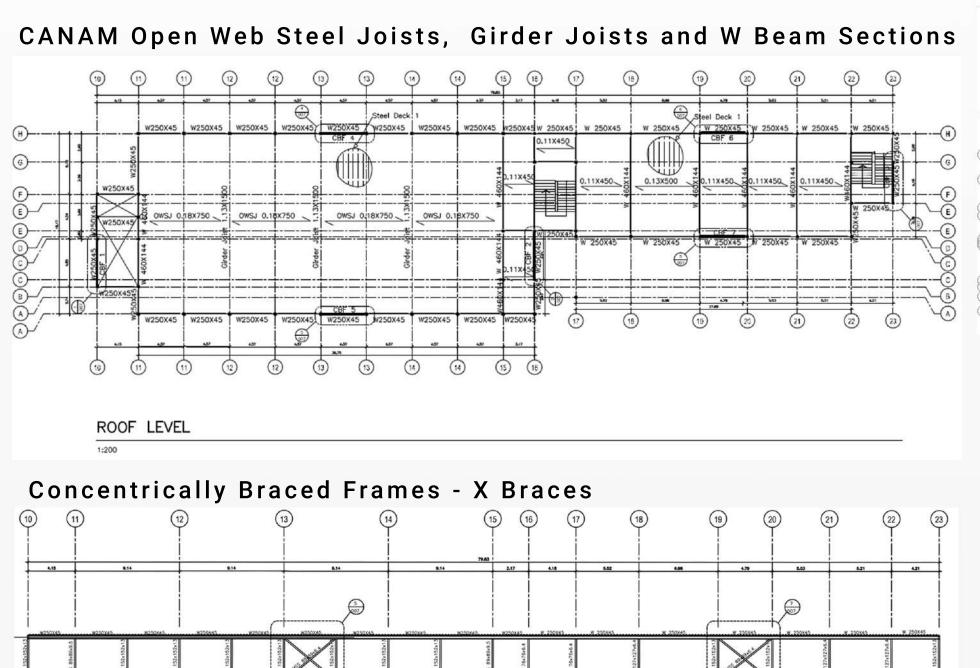
Supervisor: Dr. Radu Zmeureanu

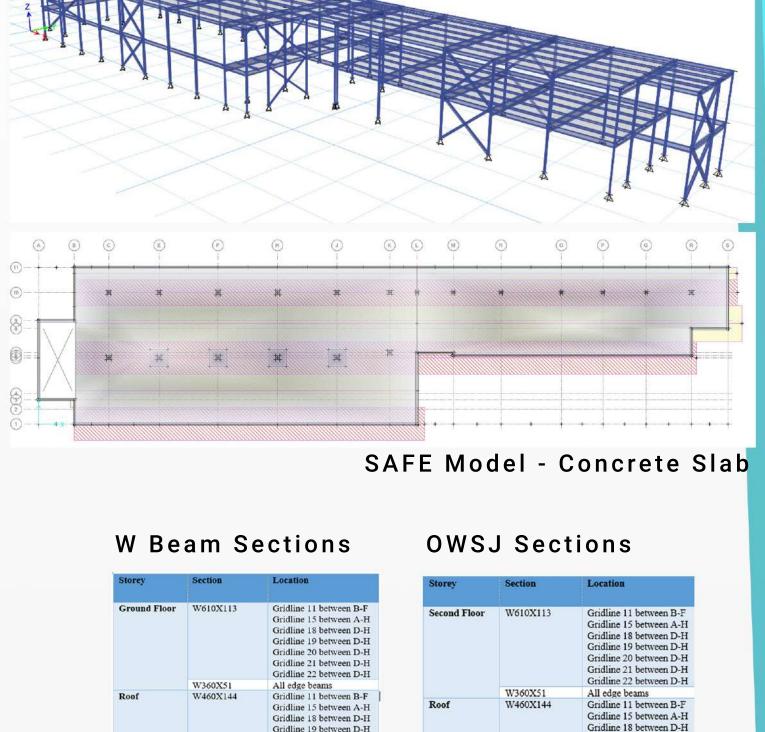


Initial Cost GWP $[\$/m^2]$ [ton eq. CO2/m²] 212.87 Structure 0.107Envelope 218.95 0.1007HVAC 264.59 0.1404

STRUCTURAL DESIGN

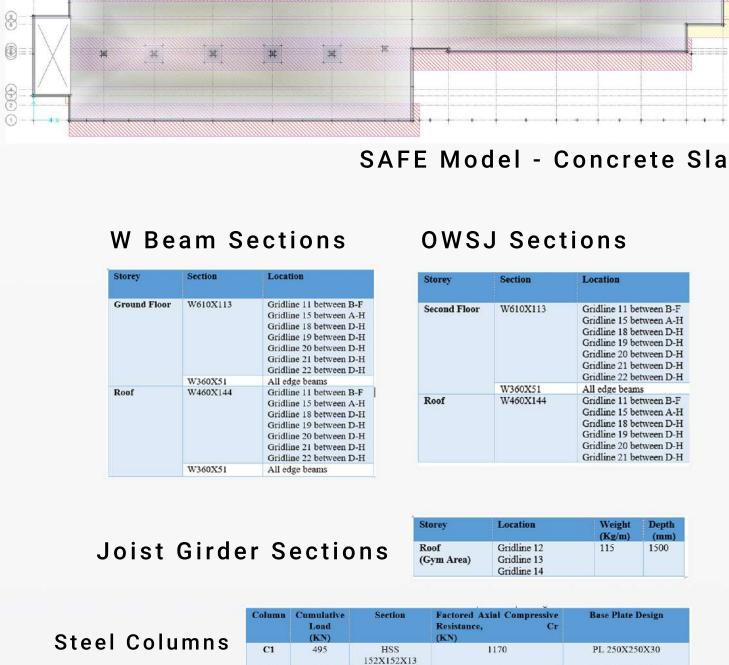
STEEL DESIGN





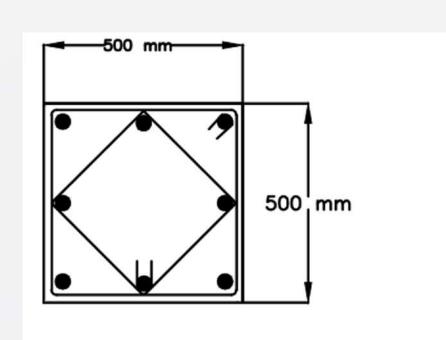
	W360X51	Gridli Gridli Gridli Gridli	ine 18 between ine 19 between ine 20 between ine 21 between ine 22 between	D-H D-H D-H			Gridline 13 be Gridline 18 be Gridline 19 be Gridline 20 be Gridline 21 be	etween D-F etween D-F etween D-F
<u> </u>		1,500000			Storey	Location	Weight	Depth
	0 :l	- C	o o t i c	nne I	Roof	Gridline 12	(Kg/m) 115	(mm) 1500
Joist	Girae	r 5	ectic	7113	Gym Area)	Gridline 13 Gridline 14		
Joist	Girae					Gridline 14	Race Plate 1	
		Column	Cumulative Load (KN)	Section		Gridline 14	Base Plate l	
Joist Steel Colu			Cumulative Load		Factored A	Gridline 14	Base Plate I	Design
		Column	Cumulative Load (KN)	Section HSS	Factored A Resistance, (KN)	Gridline 14 Exial Compressive Cr		Design 0X30
	ımns	Column	Cumulative Load (KN) 495	Section HSS 152X152X13	Factored A Resistance, (KN)	Gridline 14 Exial Compressive Cr	PL 250X25	Design 0X30 0X10

ETABS Model - Steel Structure

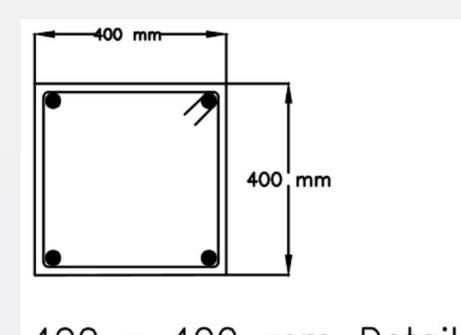


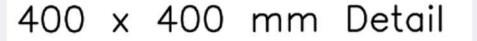
CONCRETE

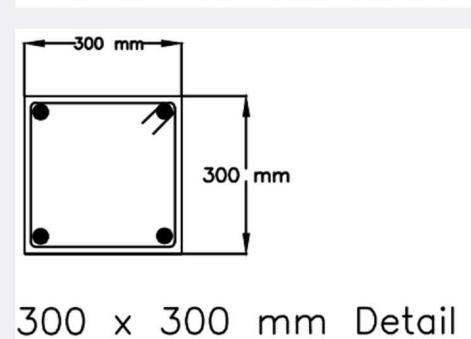
DESIGN

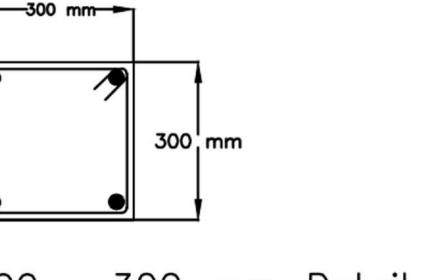




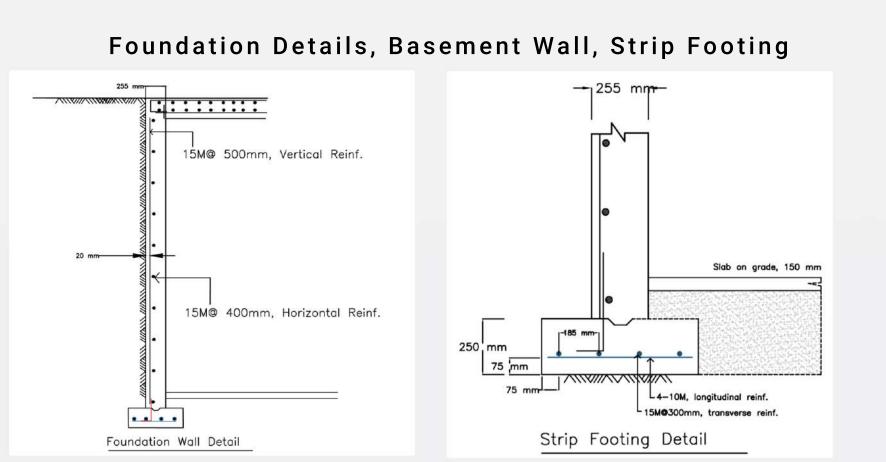








Underground Level - Columns, Footings, Basement Wall, Strip Footing



Footing Design below	Footin	ıg Size	H (height)	S (clear spacing)	Reinforcement Bars	
	1700x1	700 mm	300 mm	150 mm	10-15M	
Concrete Columns	1600x1600 mm		300 mm	225 mm	7-15M	
Concrete Columns	1500x1500 mm		250 mm	175 mm	8-15M	
		T 1 61				
Square Sections for	Load Group	Footing Size	H (height)	S (clear spacing)	Reinforcement Bars	
·	Load Group 400 – 600 kN	Footing Size 1600x1600 mm	H (height) 400 mm	S (clear spacing) 250 mm		
Square Sections for Strip Footing						

BUILDING ENVELOPE

in the gymnasium

Foundation Wall

- LIGHTWEIGHT CONCRETE
SLAB-ON-GRADE (152.4 mm)
- EXTRUDED POLYSTYRENE XPS (50.8 m)
COMPACTED CRUSHED STONES (355

membrane overlap

Waterproofing membrane acts

Polyurethane

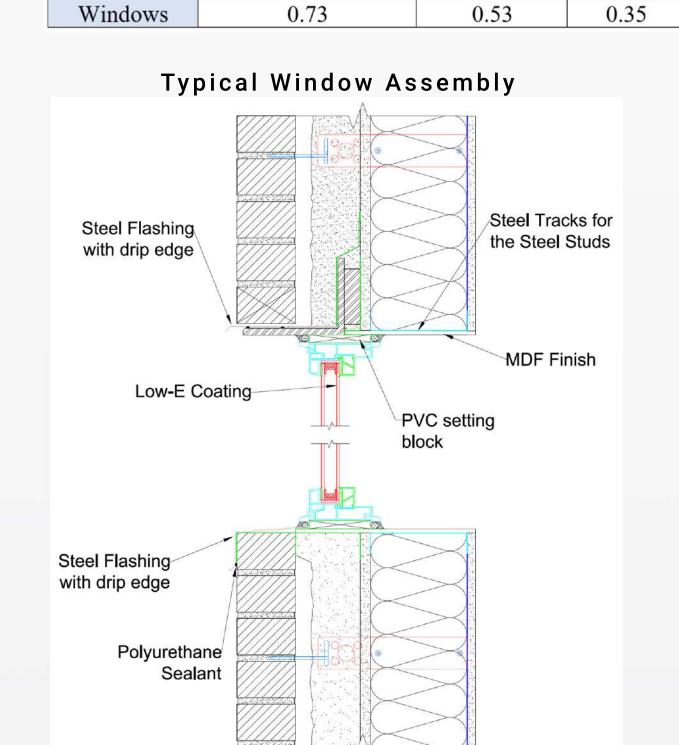
Backer rod and

polyethylene)

sealant (Closed-cell

as a capillary break

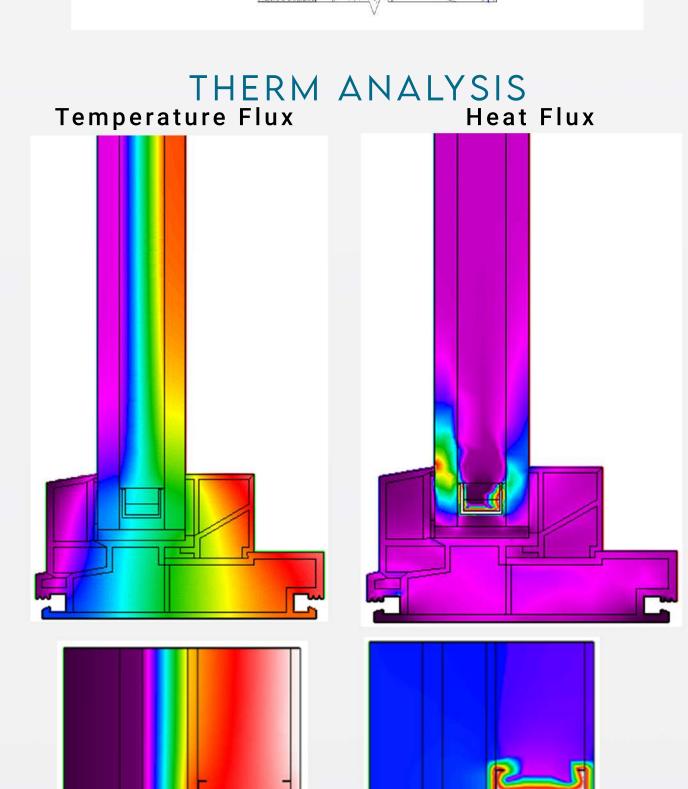
Typical Whole Building Wall Section Comaprison of R-Values 4.47 3.91

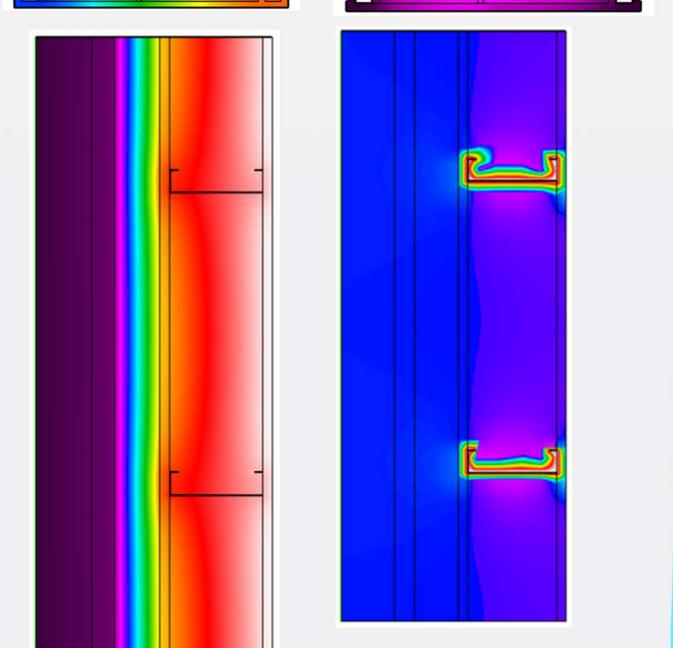


Sustainability is considered through the thorough selection of low GWP products.

4.28

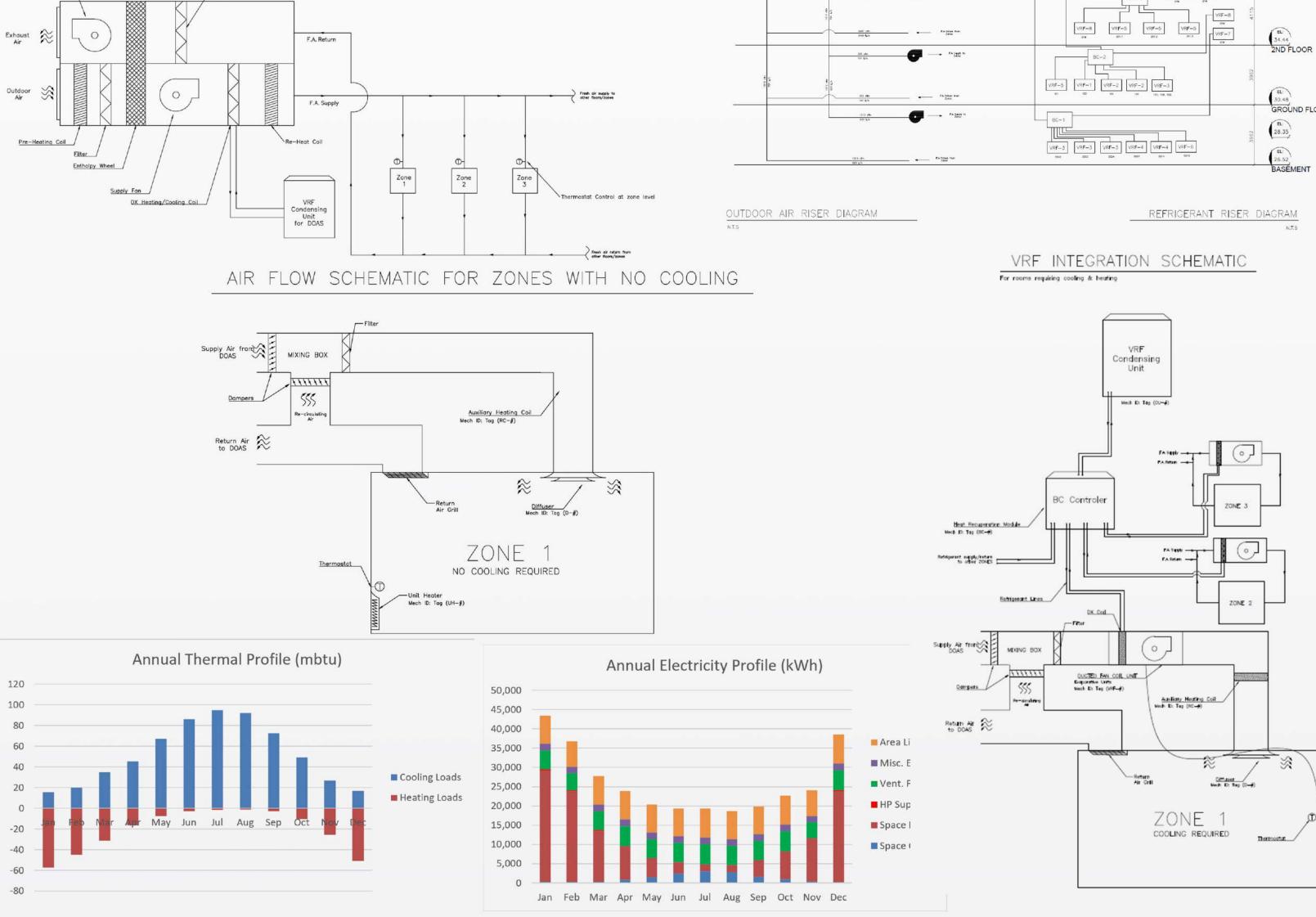
4.4



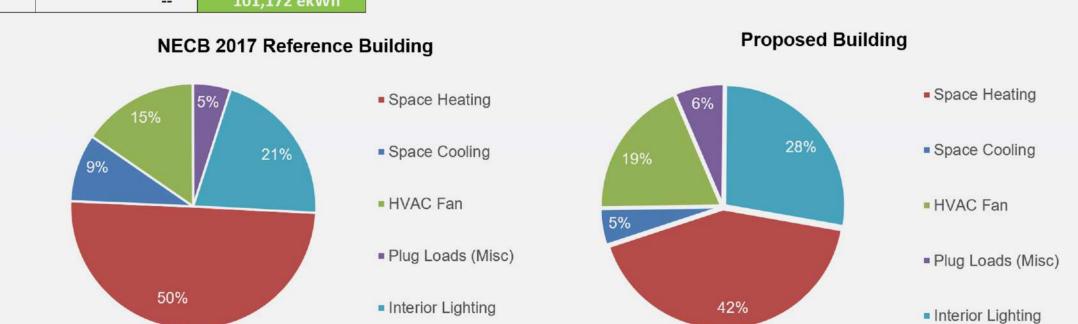


Reduced thermal bridging due to steel studs with mineral wool insulation inside cavity

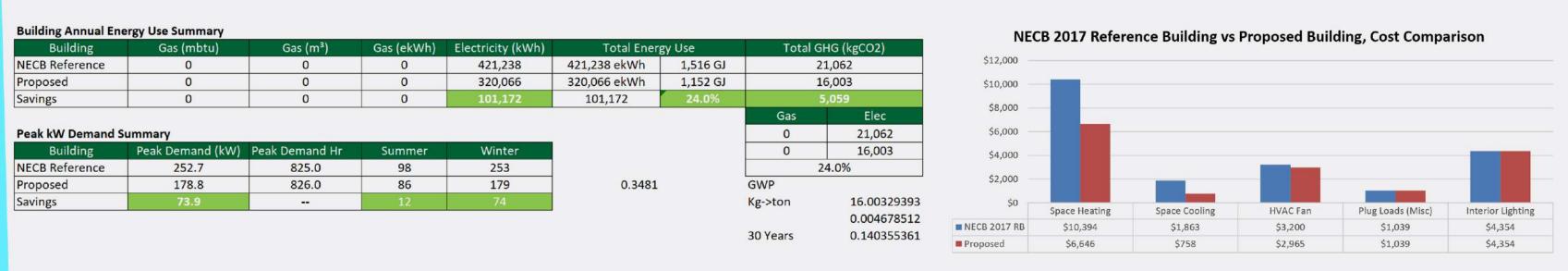
	11 1 110	1	0.1404	
	Total	696.41	0.3481	
VAC DESIGN	with heat recovery for t rooftop unit to bring fre Zones that did not requ	he cooling and heating, and	VRF (Variable Refrigerant Flow) units a DOAS (Dedicated Outdoor Air Systech recuperates energy using an enthationed by the DOAS directly.	em)
DOAS-1	CHEMATIC	DOAS-1	CU- BOAS CU-1 CU-2 CU-3 CU-GYM	(3
F.A. Return	Frish oir supply to other floors/cores	1000 L/o	FA 3445 TO VRF-B VRF-S V] S114 S268
F.A. Supply Filter Entholpy Wheel Zone 1 Zone 2	D Zone 3	49 U4	FA Serie 14 BC-1 VRF-3 VRF-4 VRF-6 VRF-6 VRF-6 VRF-6 VRF-6 VRF-7 VRF-8 VRF-8 VRF-8 VRF-8 VRF-8 VRF-8	200 (2)



building thu ose	NECD 2017 ND	Proposed baseline	Wodeled Area.	Total Allitual	Energy	Ailliuai	Ailliual	Energy Performance
Space Heating	206,634 ekWh	132,129 ekWh	36,806 ft ²	Projected Energy	Utilization Intensity	Electricity	Natural Gas	as Compared to OBO
Space Cooling	37,044 kWh	15,077 kWh	3,421 m ²	Consumption	Othization intensity	Consumption	Consumption	as compared to obt
HVAC Fan	63,623 kWh	58,952 kWh		ekWh/yr	ekWh/ft²-yr	kWh	m³	%
Plug Loads (Misc)	20,655 kWh	20,655 kWh		(GJ/yr)	(ekWh/m²-yr)	KVVII		70
Interior Lighting	86,565 kWh	86,565 kWh	NECB 2017	421,238	11.4	421,238	0	
HP Suppl. Heating	1,059 ekWh	1,172 ekWh	Reference Building	(1,516)	(123.1)	421,230	0	,
				320,066	8.7			24.00/
Total Annual Energy	421,238 ekWh	320,066 ekWh	Proposed Building	(1,152)	(93.6)	320,066	0	24.0%
Energy Savings	3. 7.5.	101,172 ekWh	<u> </u>	(-/202)	(53.0)			4



Fud Hea	NECB Reference Building				Proposed Building	Savings		
End Use	End Use kW	kWh	kWh/m²	kW	kWh	kWh/m²	kWh	kWh
Lighting	18.8	86,565	25.3	20.1	86,565	25.3	-1.3	0
Misc (Plug Loads)	5.2	20,655	6.0	5.4	20,655	6.0	-0.2	0
Heating (Elec.)	201.0	206,634	60.4	132.6	132,129	38.6	68.4	74,505
Cooling	12.0	37,044	10.8	4.6	15,077	4.4	7.4	21,967
Fans	14.9	63,623	18.6	13.8	58,952	17.2	1.1	4,670
HP Suppl. Heating	0.0	1,059	0.3	1.4	1,172	0.3	-1.4	-113
Sub-Total	252.7	421,238	123.1	178.8	320,066	93.6	73.9	101,172



Steel Stud Brick Tie

membrane overlap

bolted to bracket &

Shelf angle

with drip edge

Polyurethane Sealant

Plaster Cement finish and Cement Board

Compacted crushed

covered drain

Typical shelf angle

connection to steel

columns & Flashing

and WRB

connection

(self-adhesive)

Geotextile filtre fabric