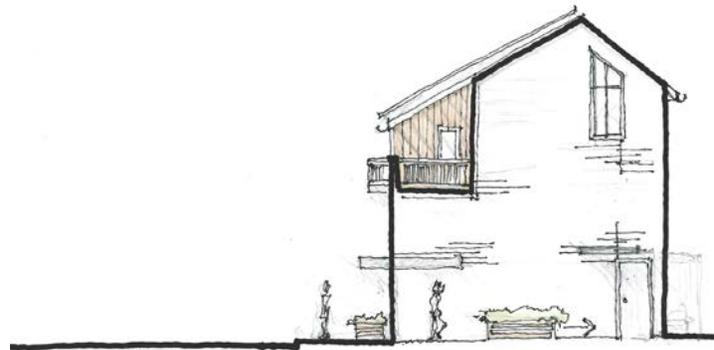
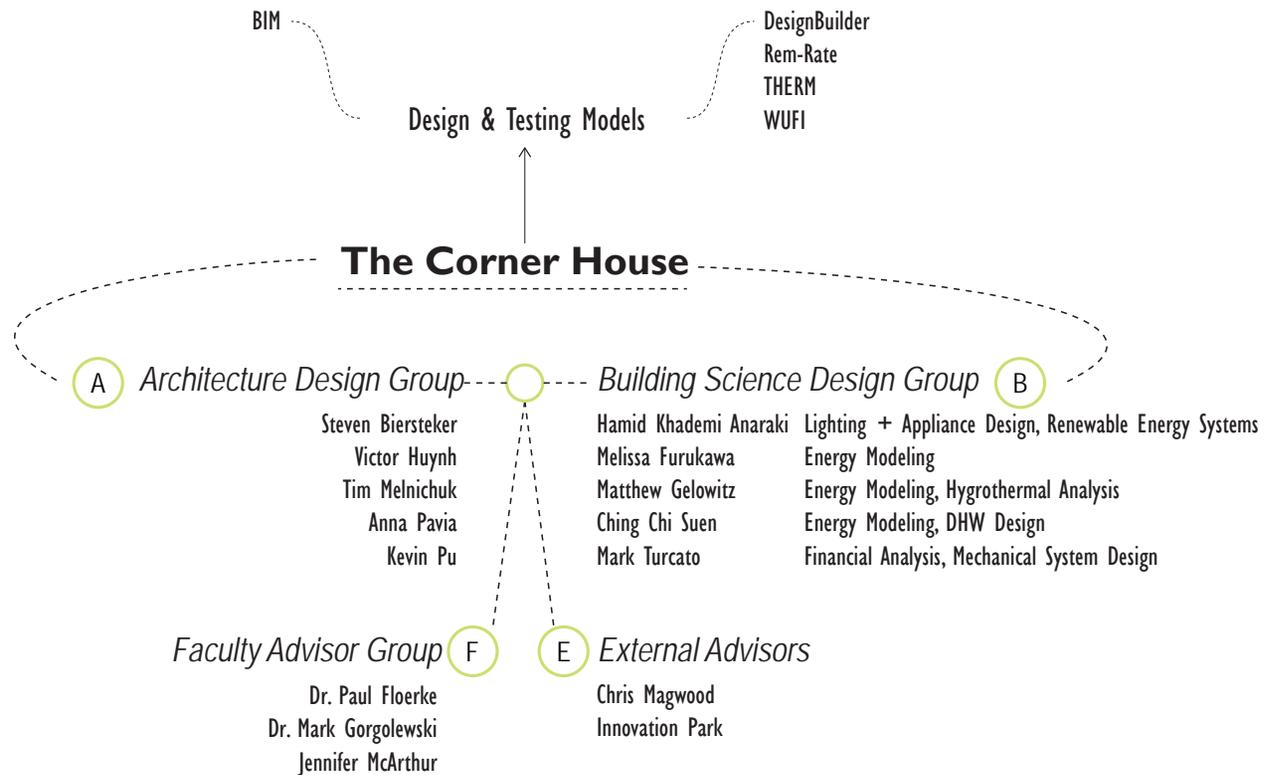


DASHAUS

.....THE URBAN CORNER
RACE TO ZERO U.S. DEPARTMENT OF ENERGY
2015 STUDENT DESIGN COMPETITION



I.1 TEAM PROFILE + INTEGRATED DESIGN PROCESS



1.2 STUDIO COLLABORATION



2.1 THE URBAN CORNER



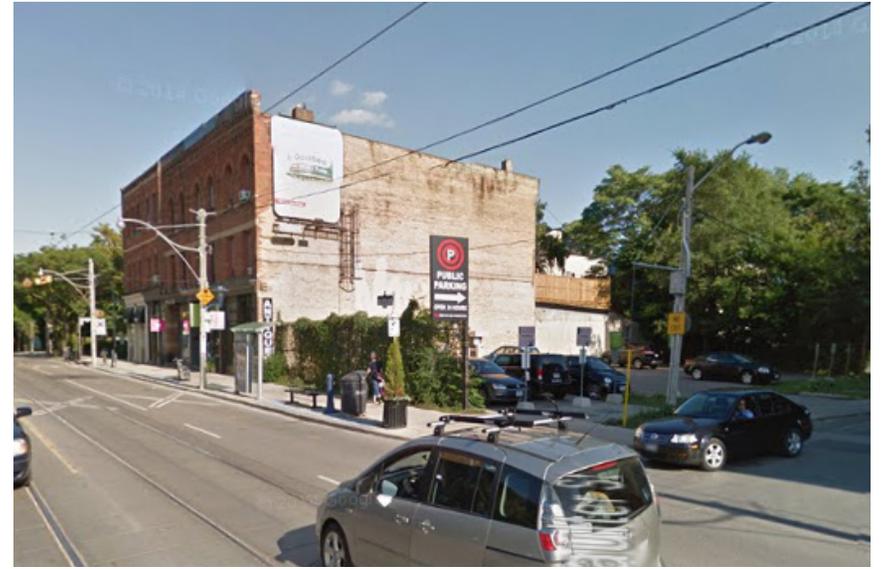
Surrounding Context

Corner Lot Overview

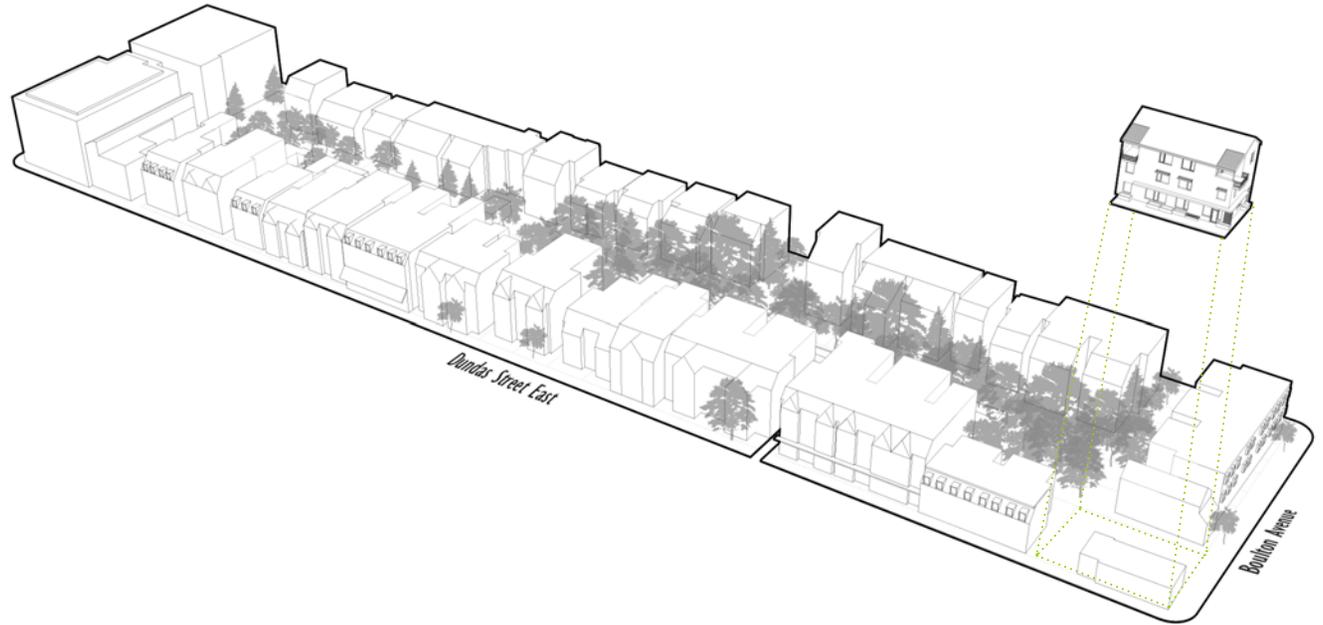
- Site Location
- Other Urban Corner Lots



2.2 UNDERUTILIZED CORNER CONDITION



2.3 PROJECT LOCATION



Streetscape; Corner Lot Location



CHURCH



SCHOOLS



BIKE LANES

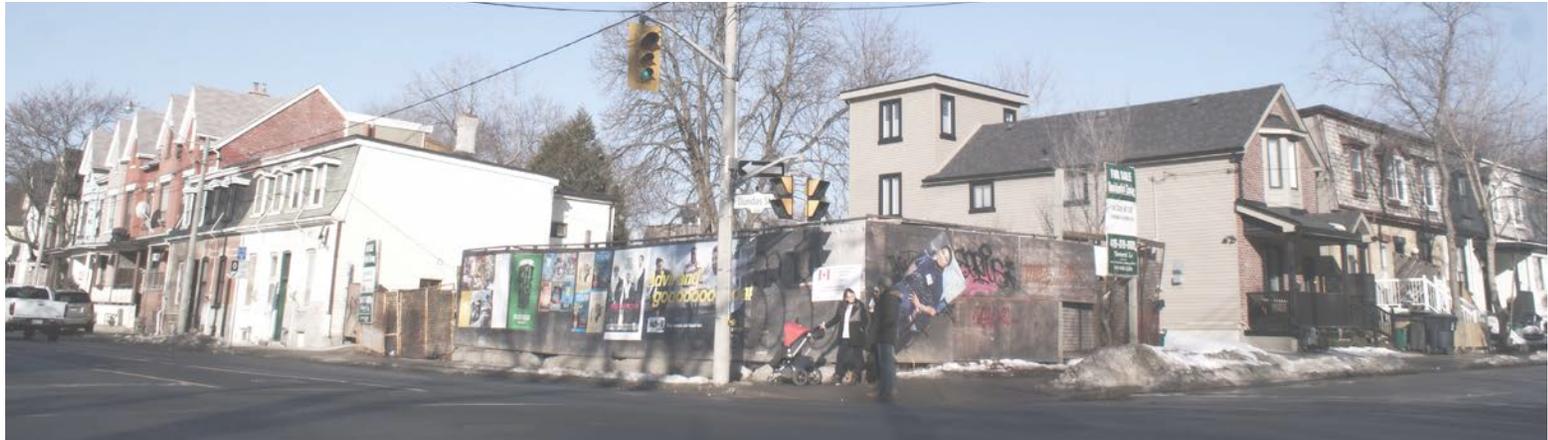


PUBLIC TRANSIT

Surrounding Context



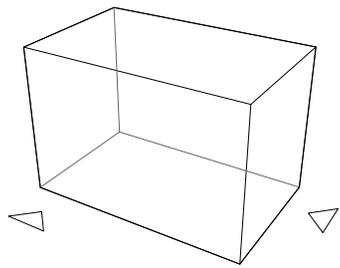
2.4 PROJECT LOCATION



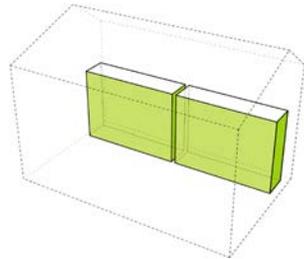
Streetscape;
Corner Lot Location



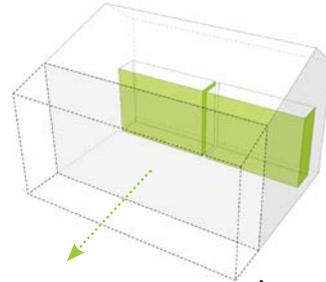
2.5 NEW TYPOLOGY



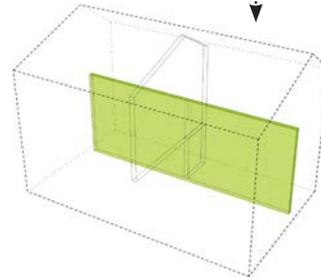
Typical Corner Lot Typology,
dual frontages



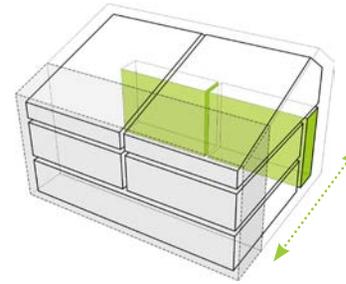
Fixed Service Core



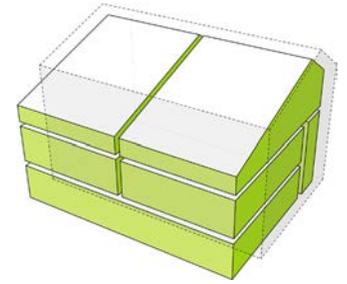
Expandability



Service Wall



Flexibility

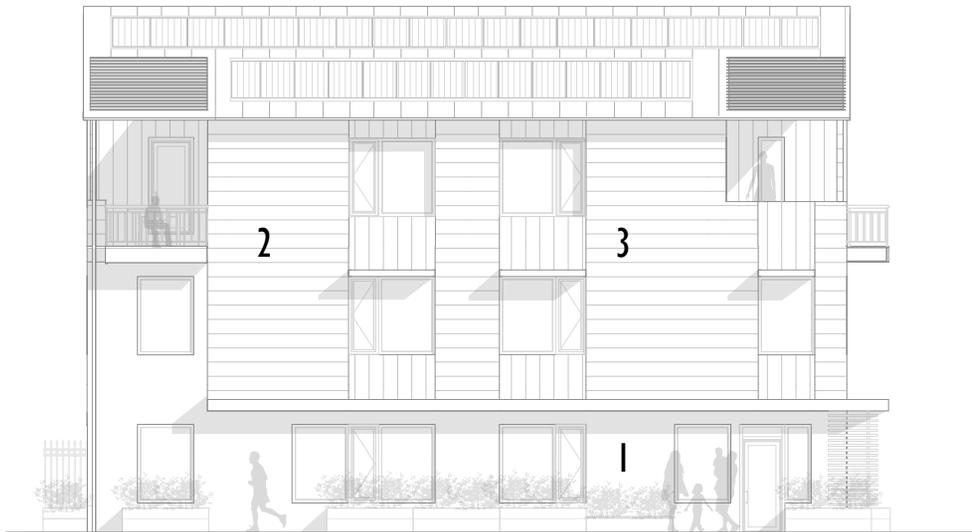


Adaptable Program

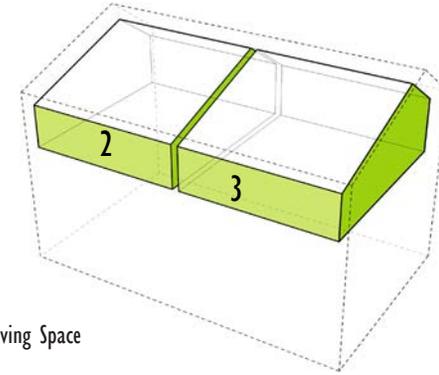
Reconfigured Corner Typology

2.6 PROGRAM DISTRIBUTION

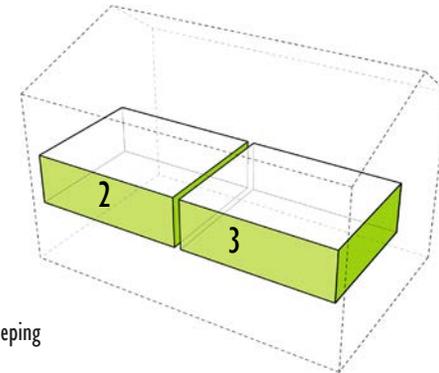
	Floor Area (ft ²)	Occupancy
Unit 1	943	Residential: 1 bedroom, 1 bathroom OR Commercial
Unit 2 - West	1,562	Residential: 2 bedrooms, 2 bathrooms
Unit 3 - East	1,562	Residential: 2 bedrooms, 2 bathrooms



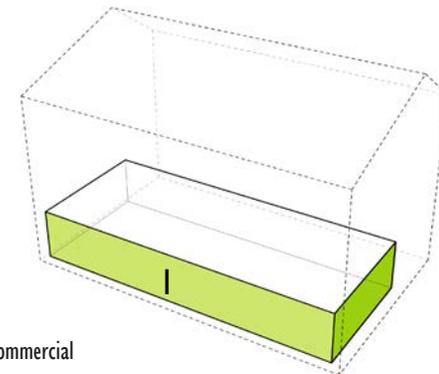
SOUTH ELEVATION



Living Space



Sleeping

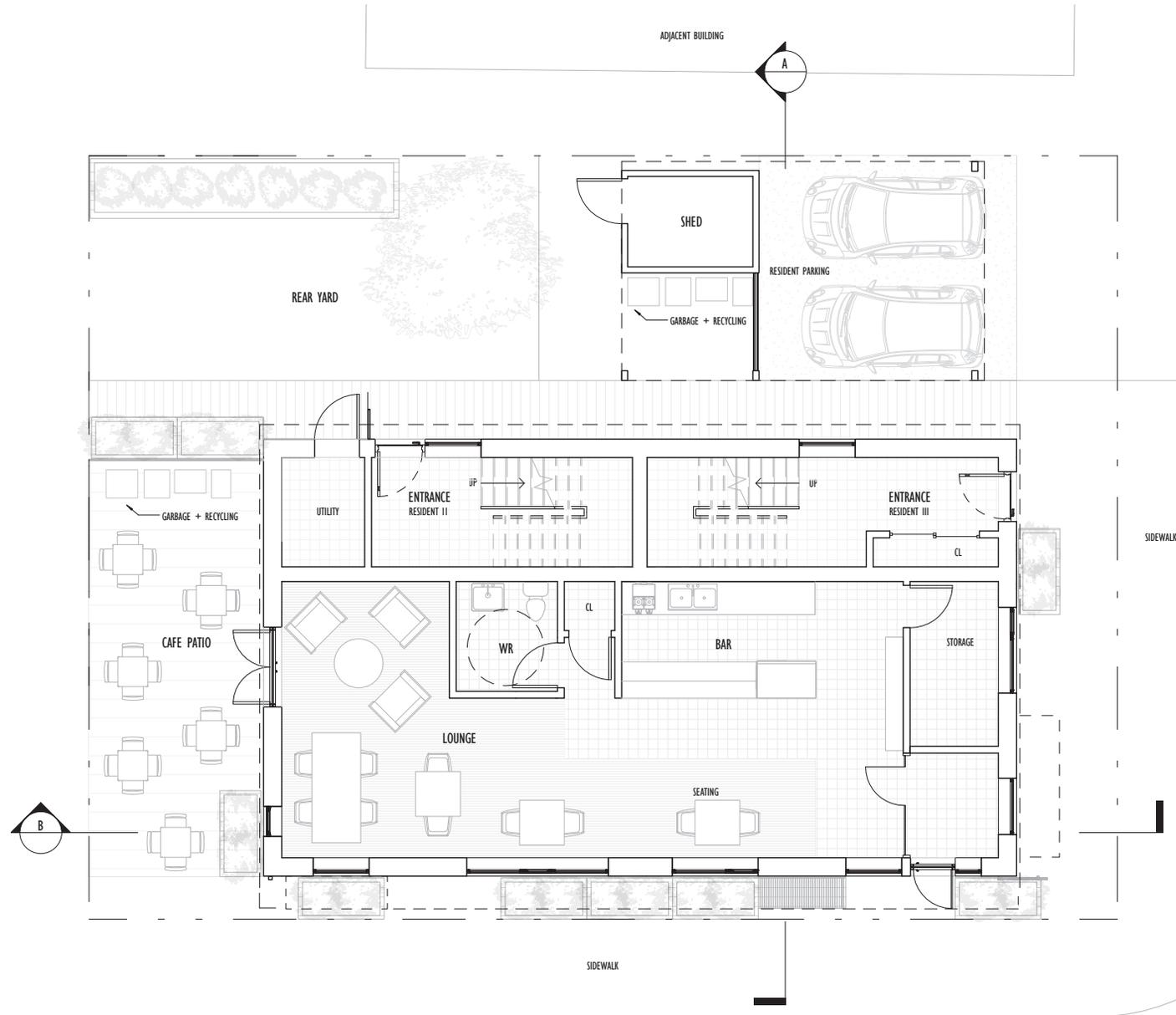


Commercial

Programmatic Design



South East Corner: Residential Entrance



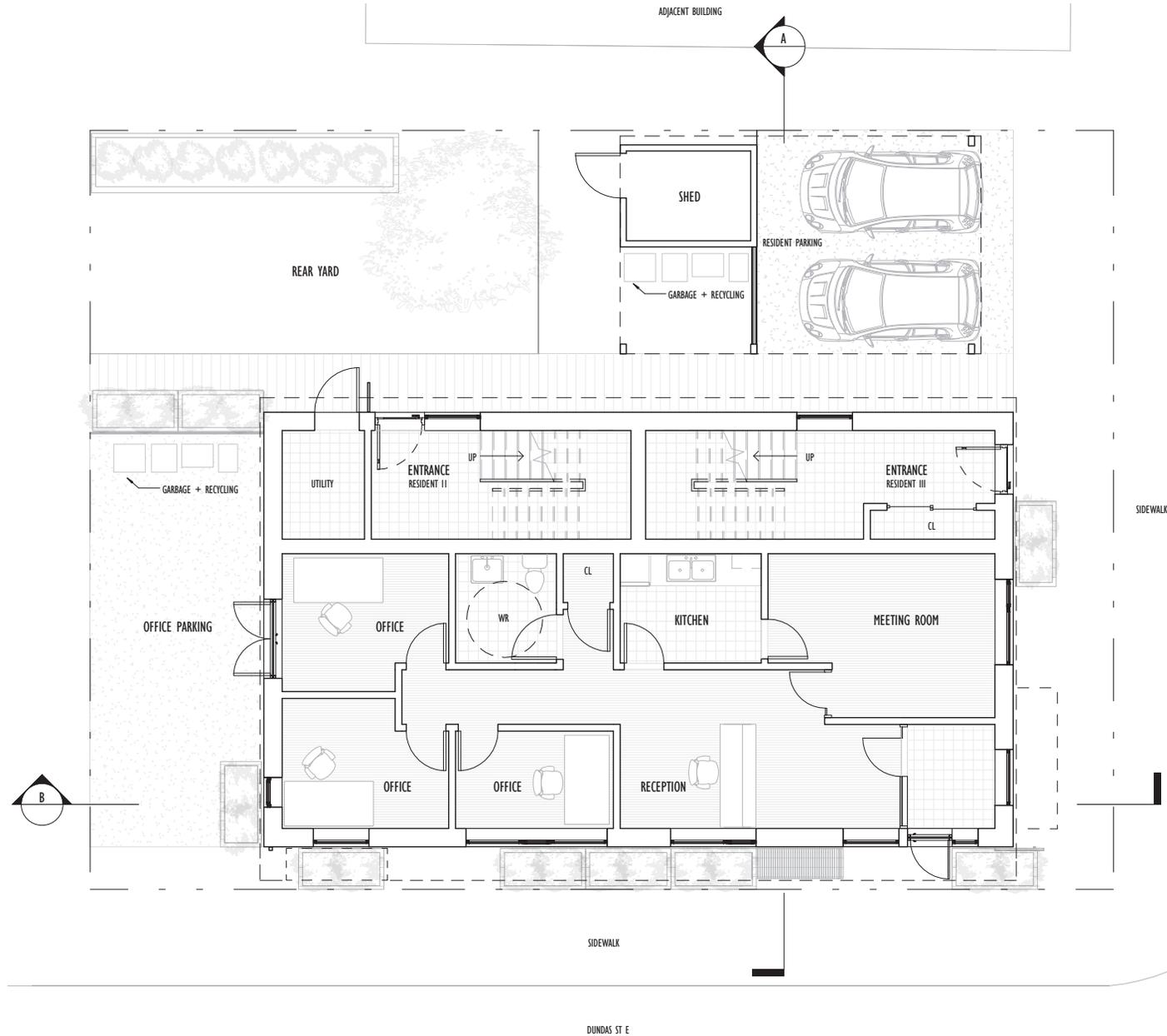
GROUND FLOOR PLAN Café

DUNDAS ST E



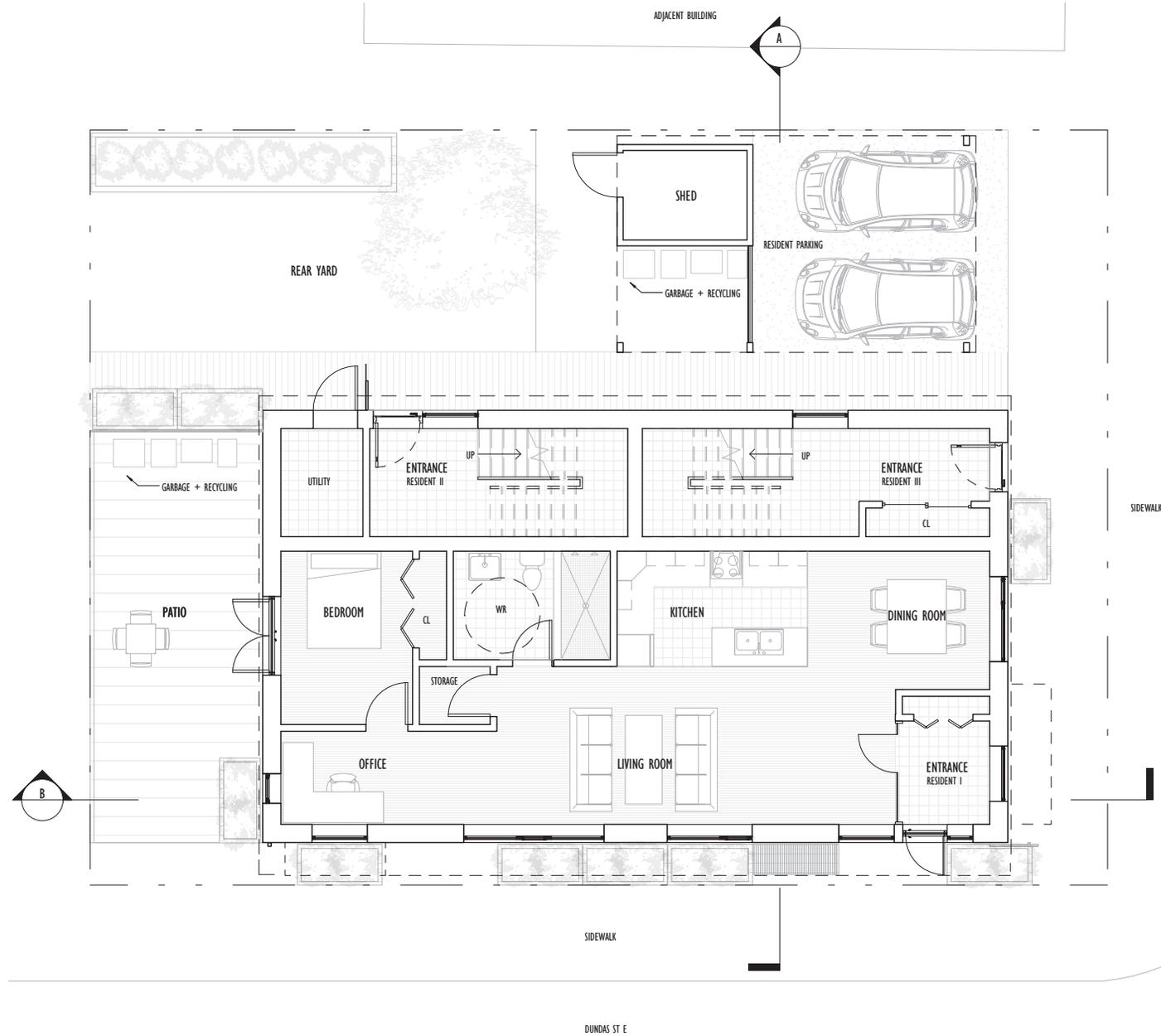


Ground Floor Café Unit



GROUND FLOOR PLAN Office





GROUND FLOOR PLAN Residential





Ground Floor Residential Unit



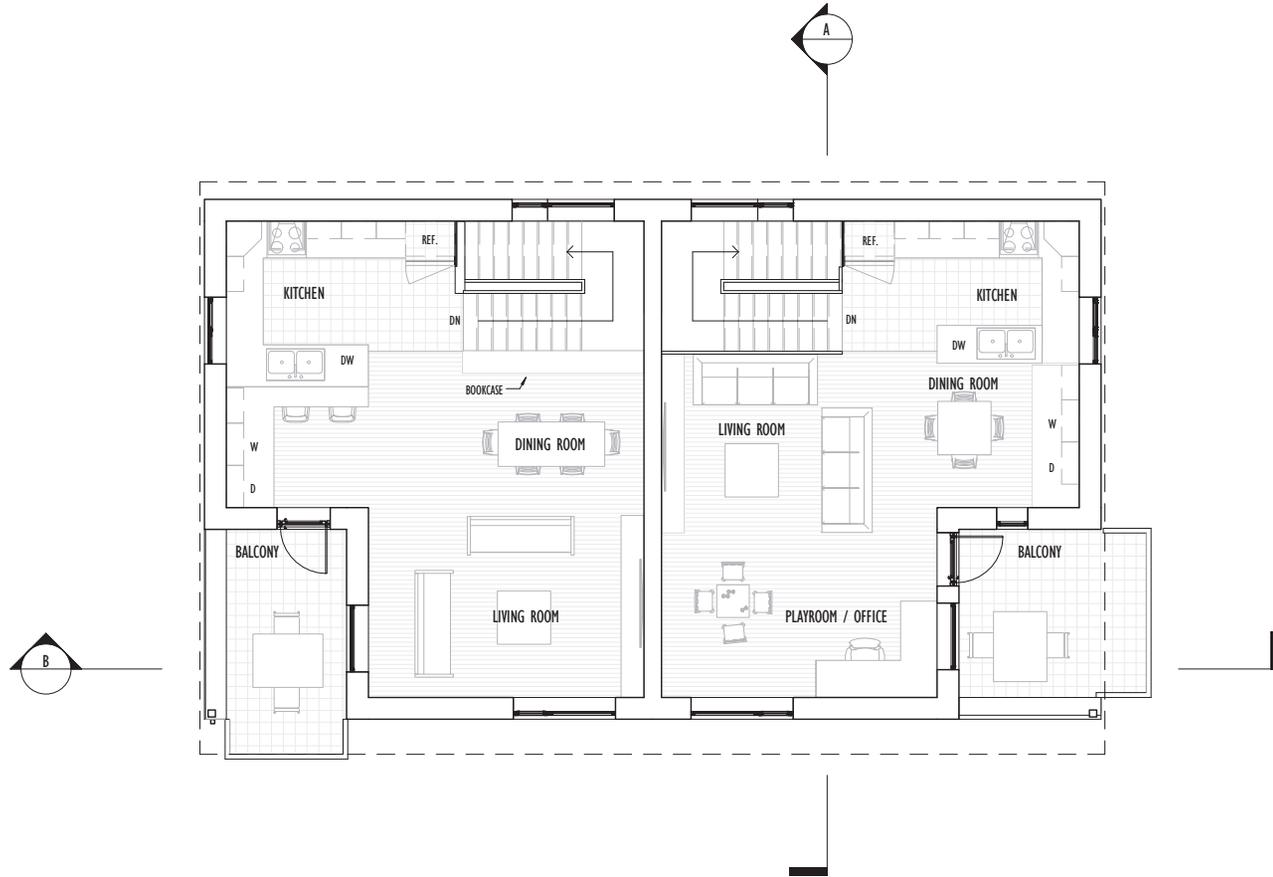
SECOND FLOOR PLAN





EAST SECTION AA



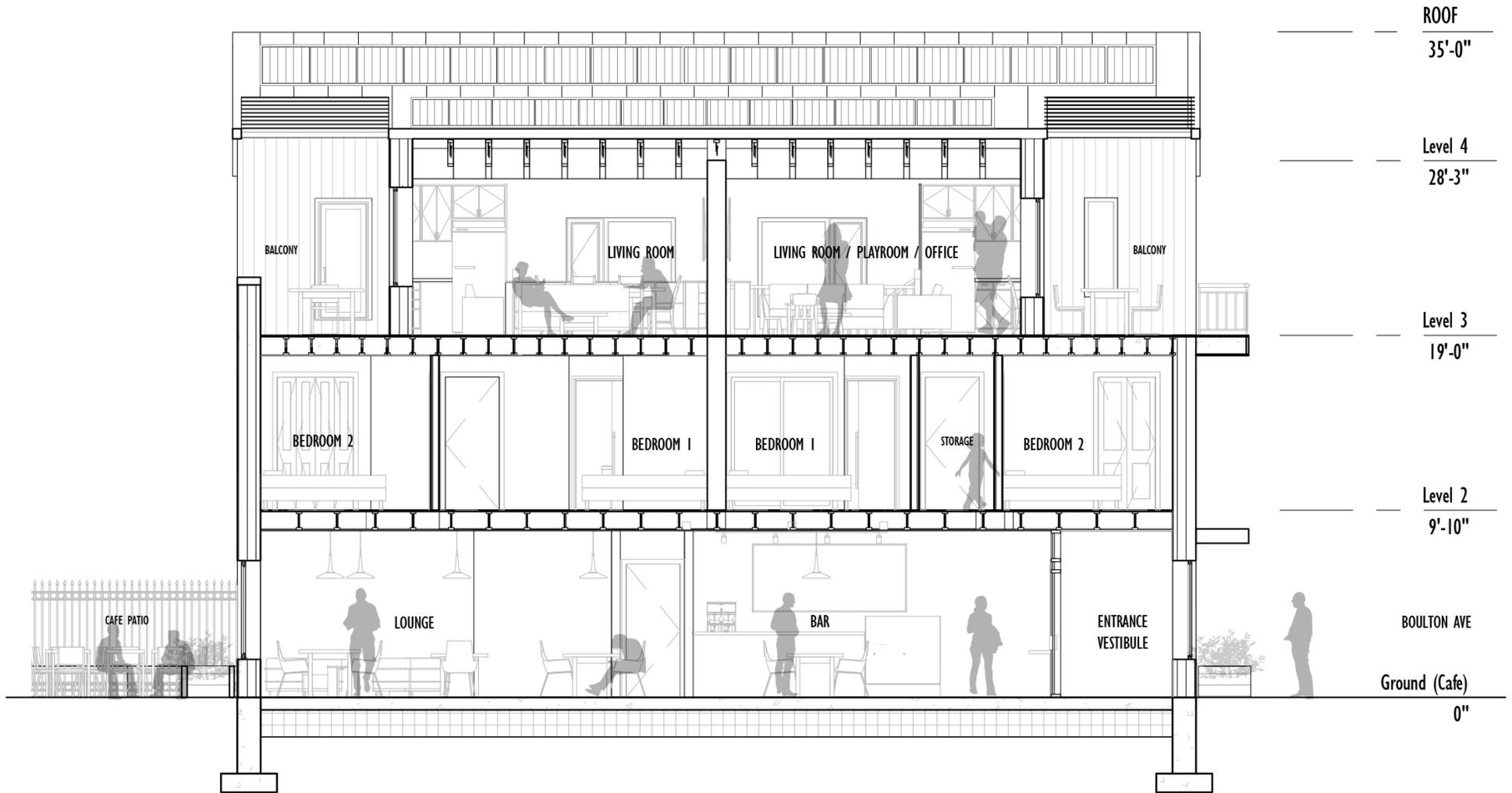


THIRD FLOOR PLAN





Third Floor Living Space



SOUTH SECTION BB





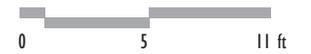
South East Corner



EAST ELEVATION



SOUTH ELEVATION





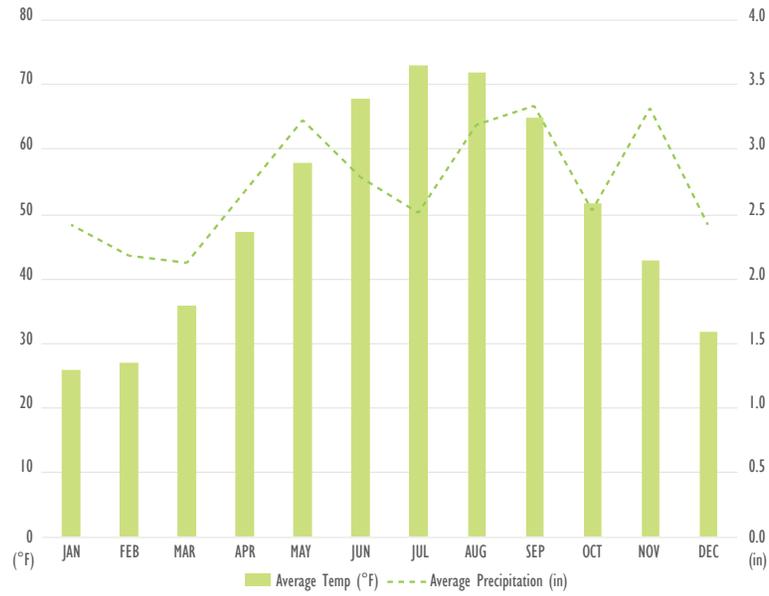
WEST ELEVATION



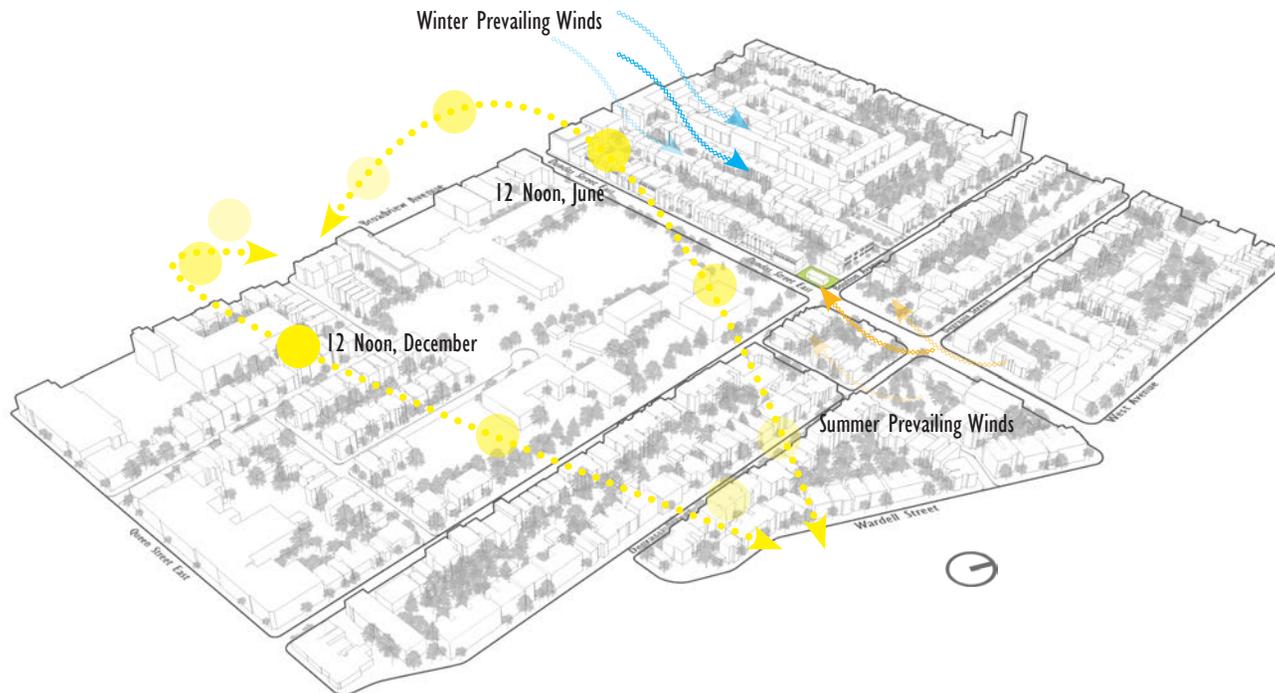
NORTH ELEVATION



4.1 CLIMATE DATA



Toronto Temperature and Precipitation Data



Prevailing Winds and Sun Path

4.2 PERFORMANCE STRATEGIES

Renewable Energy Generation

- Elongated southern roof slope

High Performance Envelope

- Increased thermal resistance reduces heating and cooling loads

Passive Solar

- South-facing windows to accommodate solar gain
- South-facing windows on third floor shaded by soffits during the summer
- Slatted window awnings on south facade shade two bottom floors during the summer

Daylighting

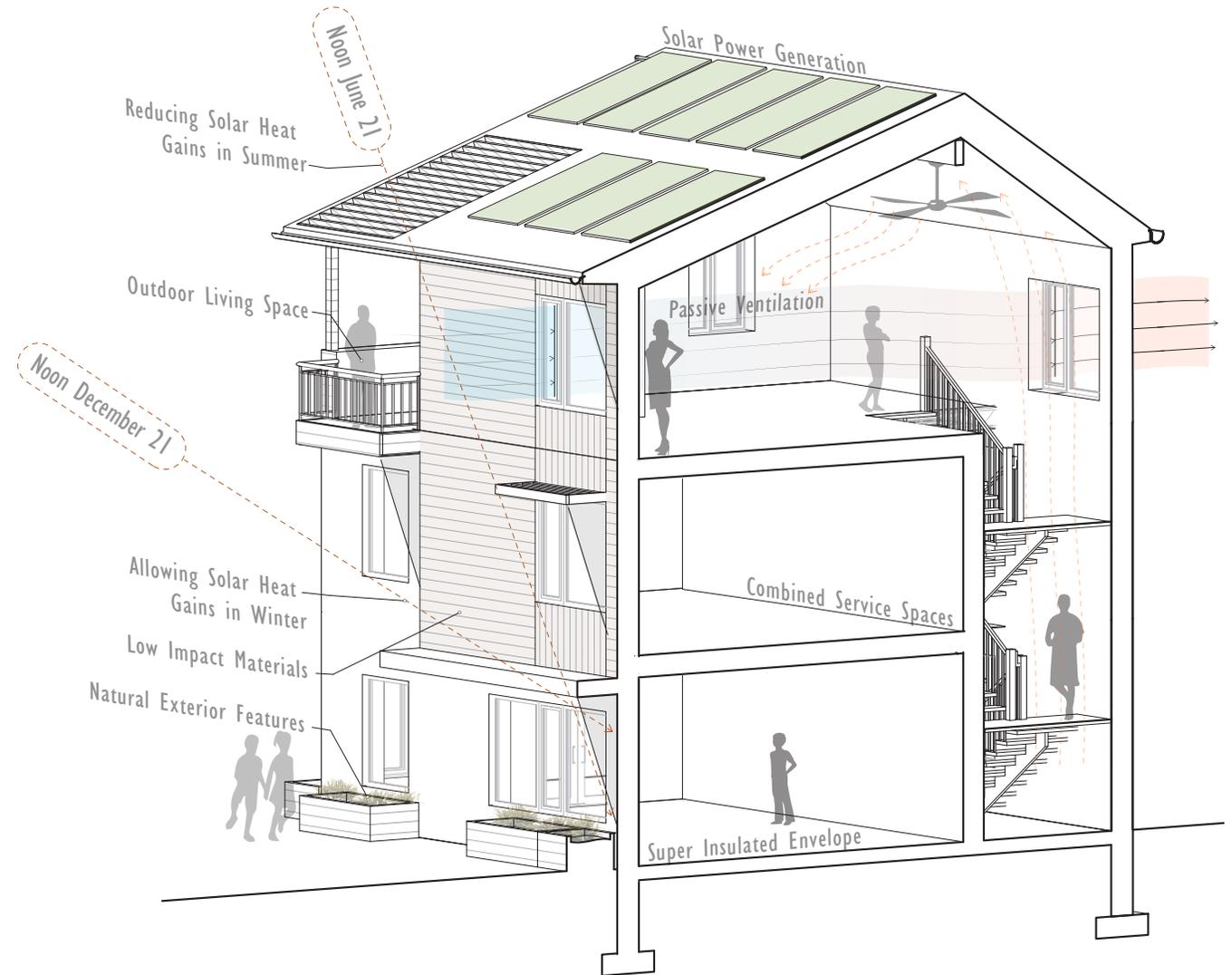
- Tall windows and high ceilings on third floor
- Reduced east and west glazing

Passive Ventilation

- Operable windows allow for natural ventilation
- Orientation takes advantage of prevailing winds

Indoor Environmental Quality

- Low-emission materials



4.3 DAYLIGHTING

Measures

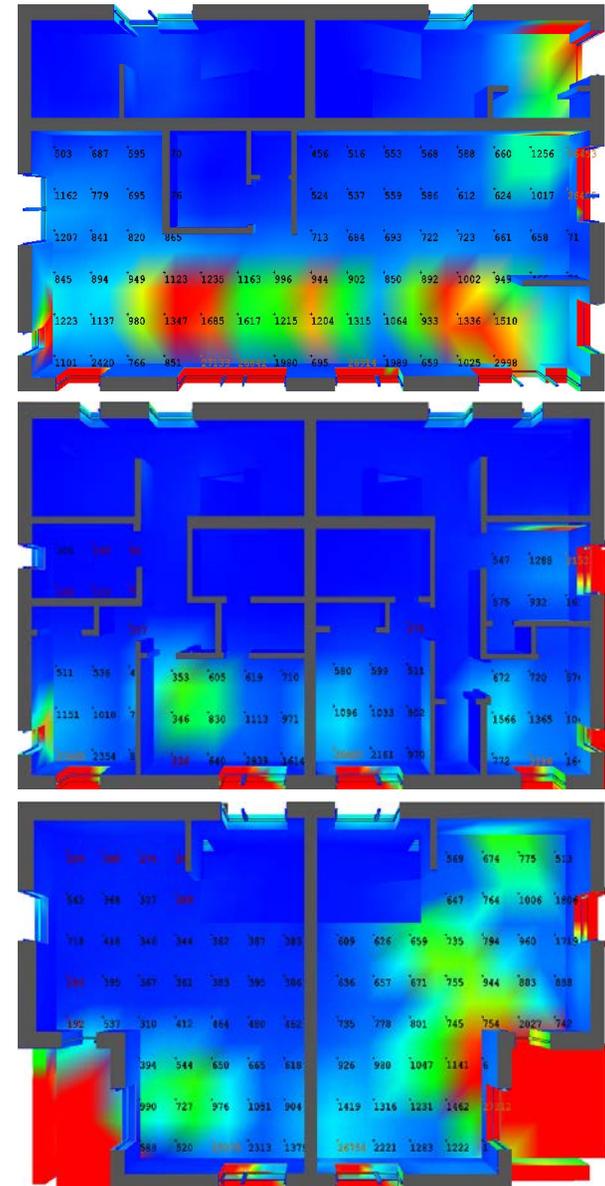
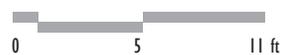
- Tall windows and high ceilings on third floor
- Reduced east and west glazing
- South facing windows on third floor shaded by soffits
- Slatted window awnings on south facade shade two bottom floors

Goals

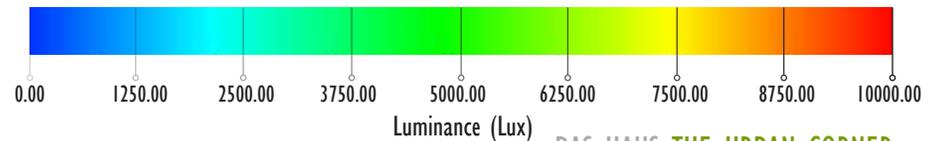
- Light levels between 300-3000 lux at 75% of regularly occupied space
- Average: 87%



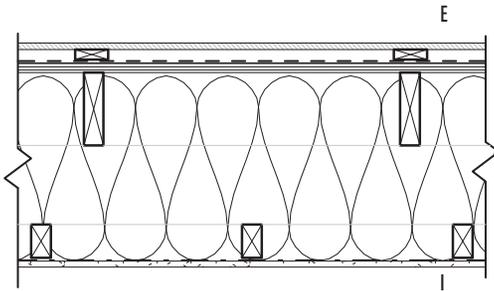
SOUTH ELEVATION



Daylight Simulation on March 21st at 9:00am

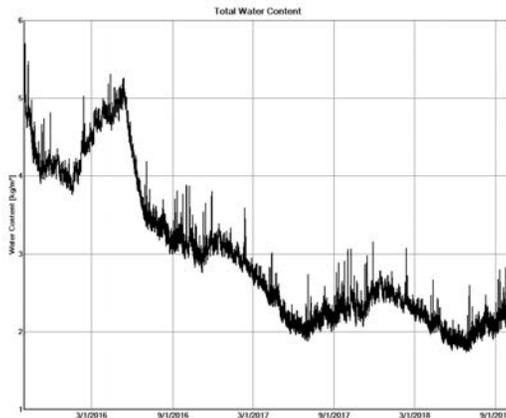


4.4 ENVELOPE DESIGN APPROACH

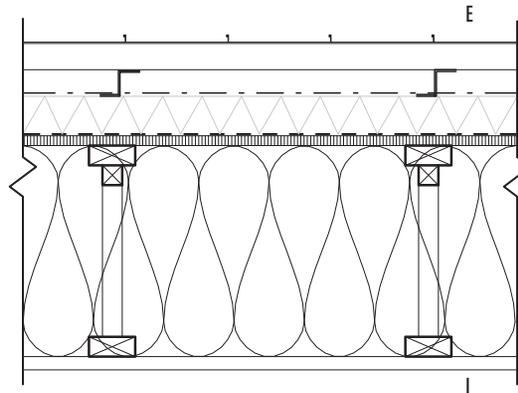


Typical Wall Section

Exterior
 Beetle Kill Ash 1"x 6" Siding
 Vertical 1"x 2" Wood Strapping including Air Cavity
 Continuous building wrap (Drainage Plane)
 3/4" Exterior grade Plywood Sheathing w/ taped joints (Air Barrier)
 2"x6" Structural Stud Wall at 24" O/C (FSC Certified)
 14" Dense Pack Blown-In Cellulose
 2"x3" Dimensional Lumber at 24" O/C (FSC Certified)
 6mil. Polyethylene Sheet (Vapour Retarder)
 1/2" Gypsum Wall Board
 Zero VOC Paint (EPA AirPLUS)
 Interior

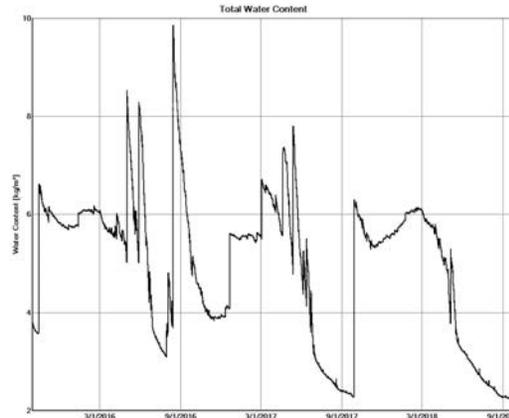


Total Water Content of the Wall Assembly



Typical Roof Section

Exterior
 Galvanized Standing Seam Metal Roof
 3" Air Cavity w/
 2-Ply Asphalt Impregnated Paper (Drainage Plane)
 3" XPS Insulation
 Roofing Membrane (Vapour Barrier)
 3/4" Exterior grade plywood sheathing w/ taped joints (Air Barrier)
 16" Engineered Wood Joists @ 24" O/C w/ dense pack cellulose
 1"x 2" Wood Strapping
 1/2" Gypsum Board
 Zero VOC Paint (EPA AirPLUS)
 Interior



Total Water Content of the Roof Assembly

Insulating Values for Building Components

Component	R-Value	U-Value
	hr-ft ² ·°F/Btu	Btu/hr-ft ² ·°F
Exterior Wall	45.0	0.0222
Sloped Roof	60.0	0.0166
Flat Roof (Balcony)	63.0	0.0158
Ground Floor Slab	12.0	0.0833
Operable Window Frame	3.85	0.260
Fixed Window Frame	2.94	0.340
Glazing Unit	4.55	0.220

4.5 ROOF-TO-WALL CONNECTION

Bulk Water Management

- Roof:
- Galvanized standing seam metal roof
 - 2-ply asphalt impregnated building paper drainage plane
- Wall:
- Ventilated rainscreen wall system
 - Housewrap drainage plane

Air Control

- Taped exterior plywood joints on wall and roof sheathing
- Continuity ensured at interfaces

Vapor Control

- Roof:
- Exterior vapor retarder to allow for inward drying
- Wall:
- Interior vapor retarder to allow for outward drying

Thermal Control

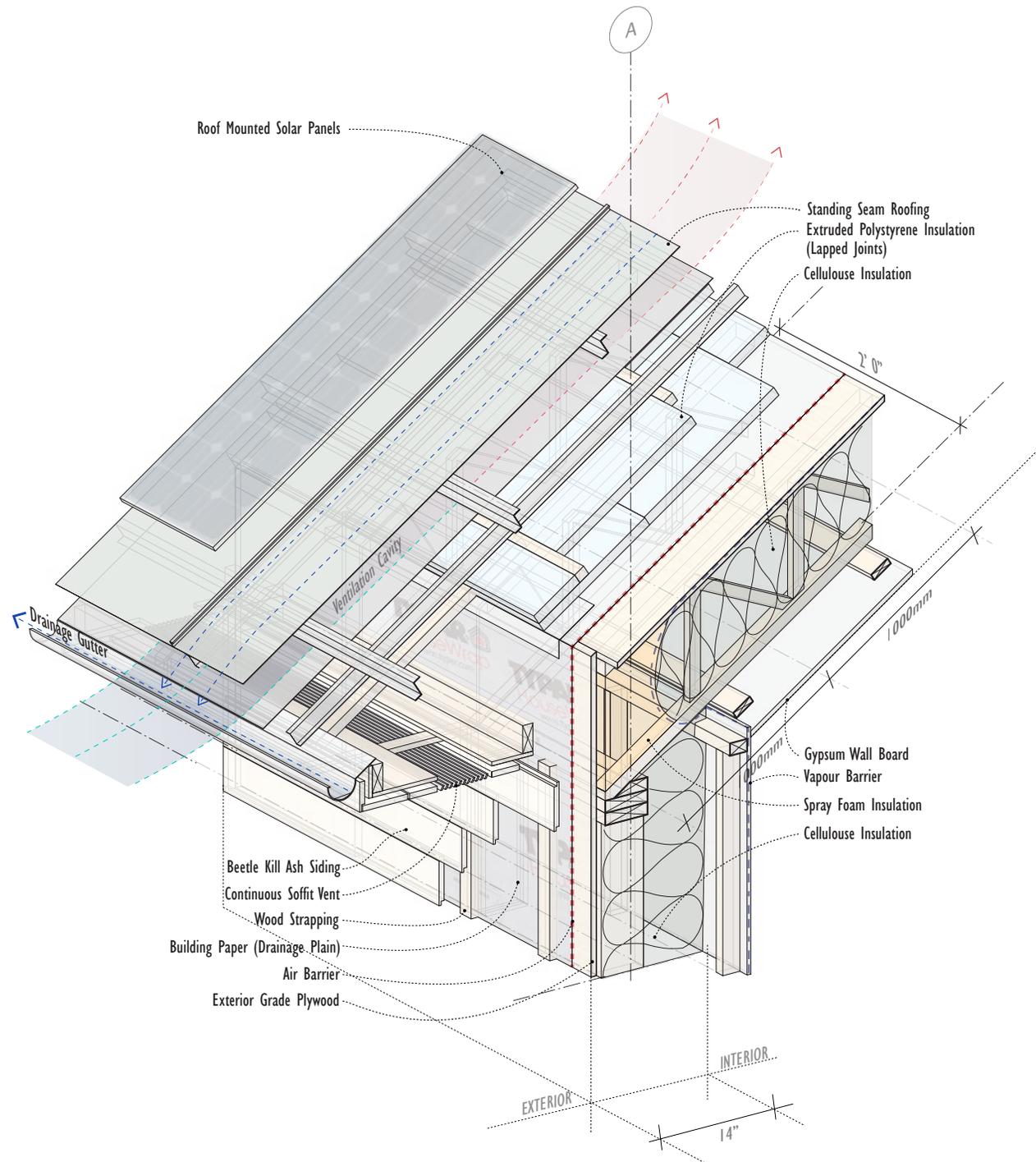
- Roof:
- External continuous roof insulation
- Wall:
- Double-stud wall system
 - 13" cavity filled with dense-pack cellulose

Cost & Constructibility

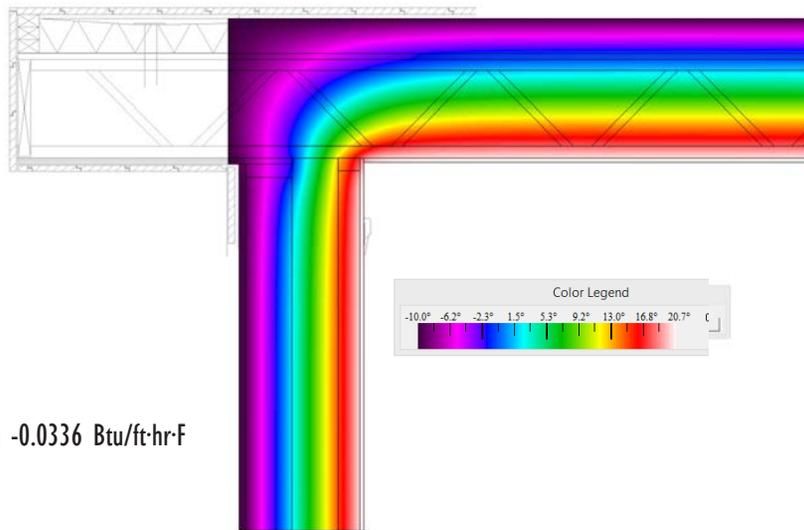
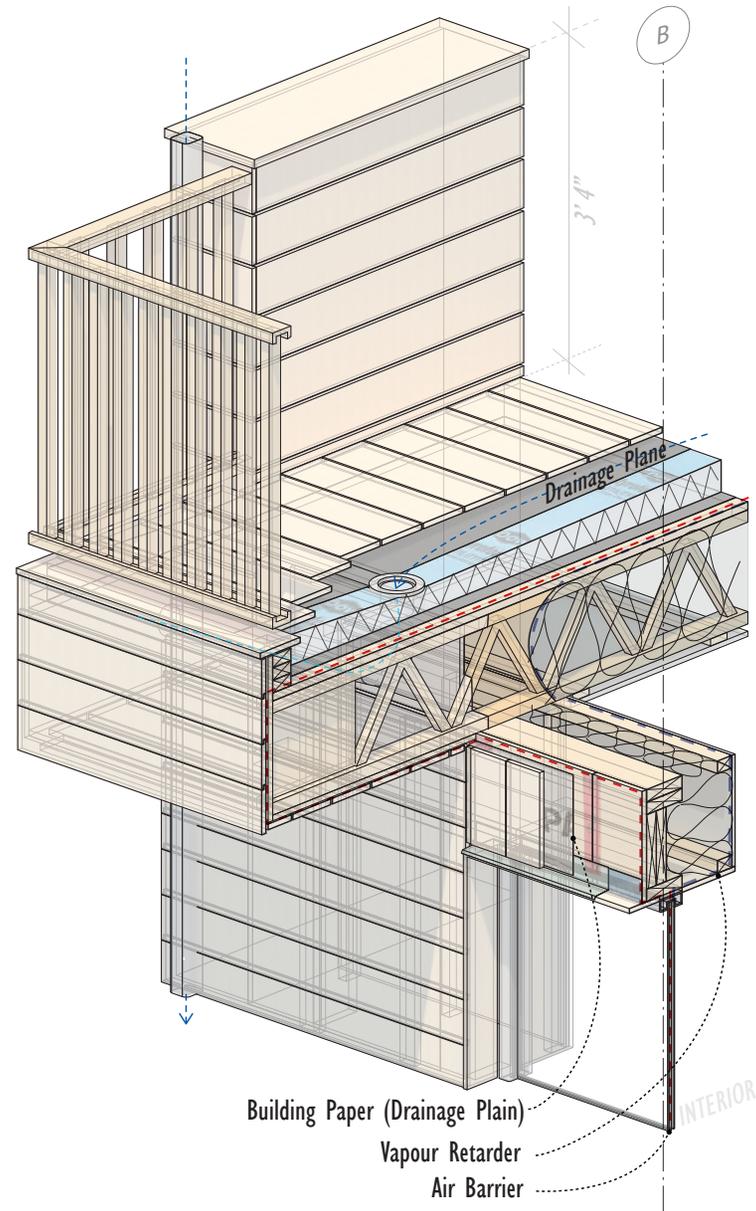
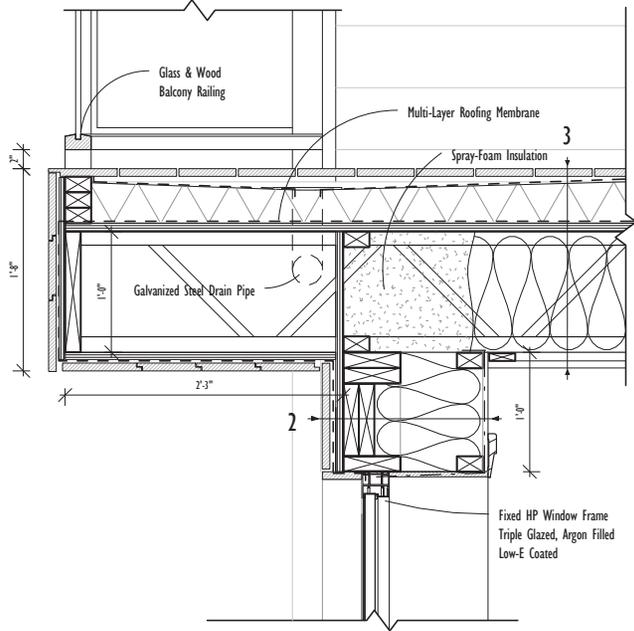
- Reduced high-cost materials
- Improved framing techniques for reduced material use
- Exterior structural wall maintains constructibility

Natural Materials

- Recycled and low-impact materials
- FSC certified wood
- Local reclaimed wood siding (Emerald Ash Borer)

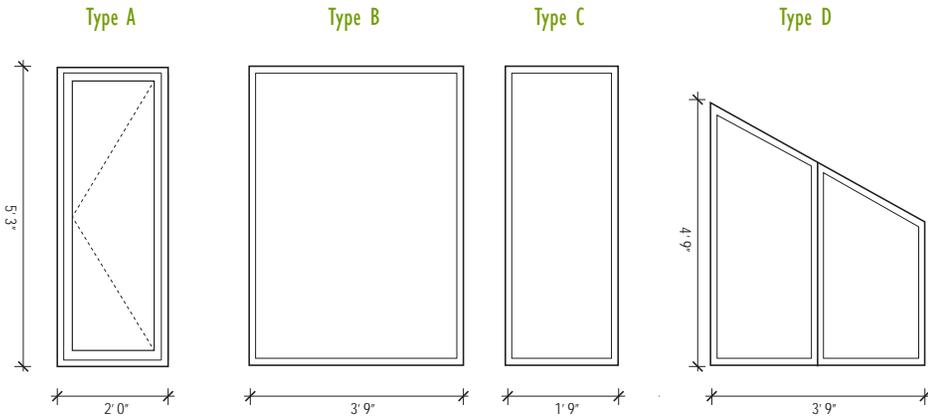


4.6 WALL-TO-BALCONY CONNECTION



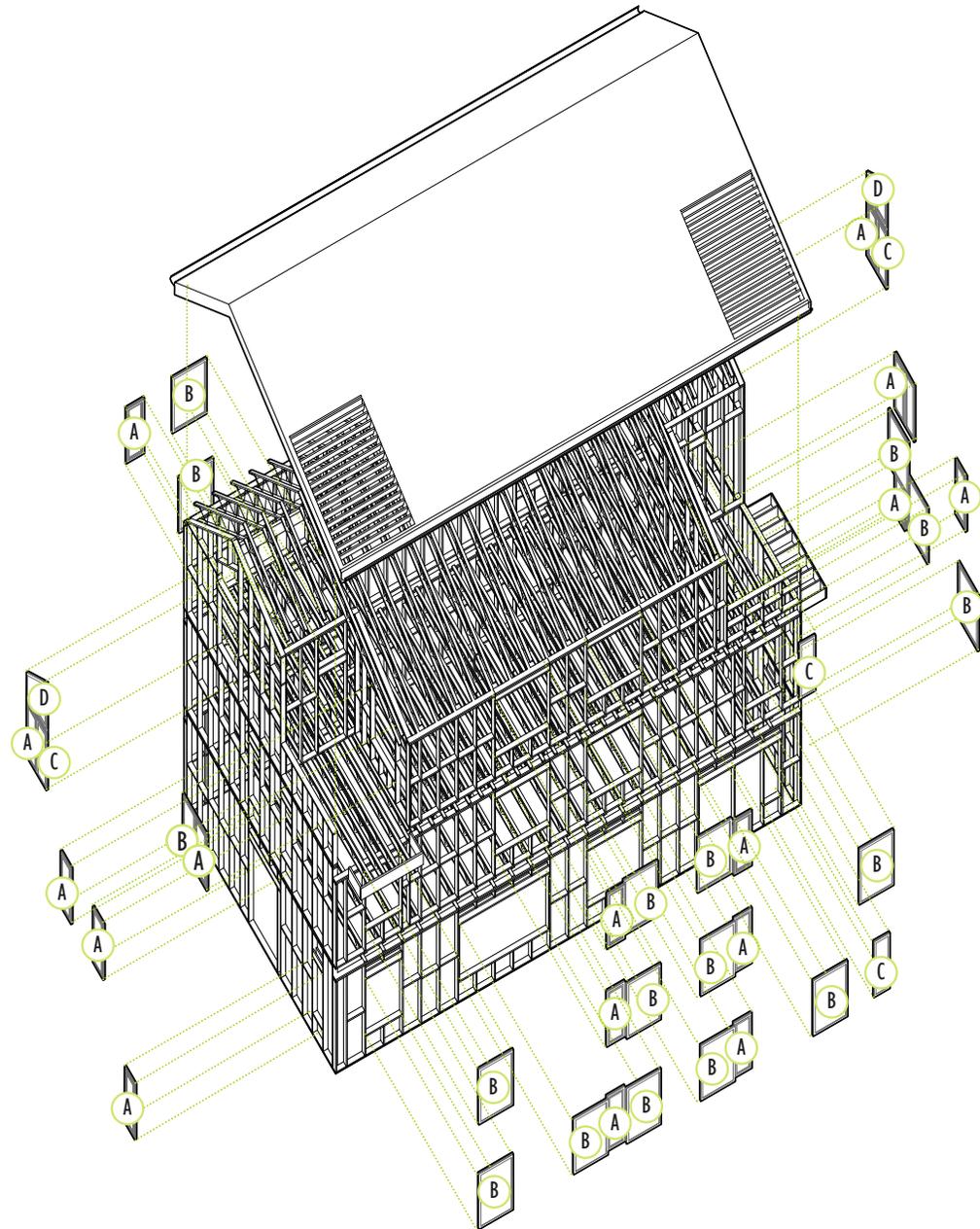
Average Psi -0.0336 Btu/ft-hr-F

4.7 GLAZING



Window Schedule

		A	B	C	D
SIZE	Width	2' 0"	3' 9"	1' 9"	3' 9"
	Height	5' 3"	5' 3"	5' 3"	4' 9"
	Area(SF)	10.5	19.7	9.2	10.0
WINDOW	Type	Casement	Fixed	Fixed	Fixed
	Material	Fiberglass	Fiberglass	Fiberglass	Fiberglass
GLAZING	Panes	Triple Glazed	Triple Glazed	Triple Glazed	Triple Glazed
	Cavity Fill	Argon	Argon	Argon	Argon
	Low-E Coating	Yes, Hard Coat	Yes, Hard Coat	Yes, Hard Coat	Yes, Hard Coat
	U - Value Window	0.22 BTU/hr-ft ² -°F			
	U - Value Frame	0.26 BTU/hr-ft ² -°F	0.34 BTU/hr-ft ² -°F	0.34 BTU/hr-ft ² -°F	0.34 BTU/hr-ft ² -°F
	SHGC	0.47	0.51	0.51	0.51
VLT	0.5	0.58	0.58	0.58	



5.1 MECHANICAL SYSTEM, SCHEMATIC DESIGN

Flexibility

- Meet conditioning requirements in 8 different zones
- Simultaneous heating and cooling

Comfort

- Increased adaptability under changing conditions
- Maximize occupant control

Reduced Service Space

- Distribution space consists of 1/2" pipes in service core and floor
- 90 ft² made available with centralized system

Space Conditioning

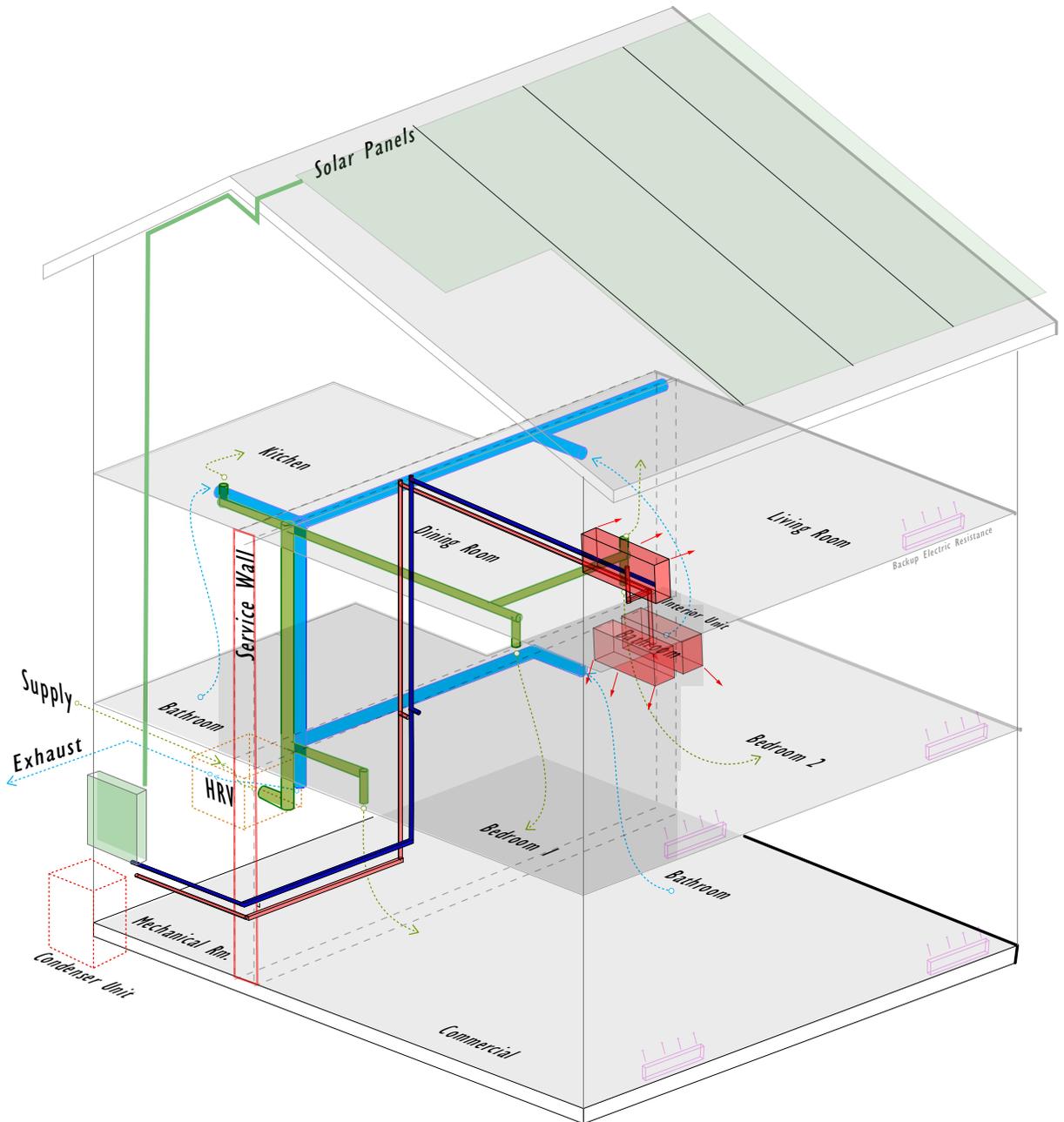
- Variable refrigerant flow heat pump
- 1 outdoor condensing unit
- 8 interior evaporator units
- Heat pump domestic hot water connected to VRF
- VRF redistributes heat between zones

Ventilation

- Dedicated outdoor air ventilation
- Heat recovery ventilation

Air Quality

- Filtration at HRV and interior evaporators



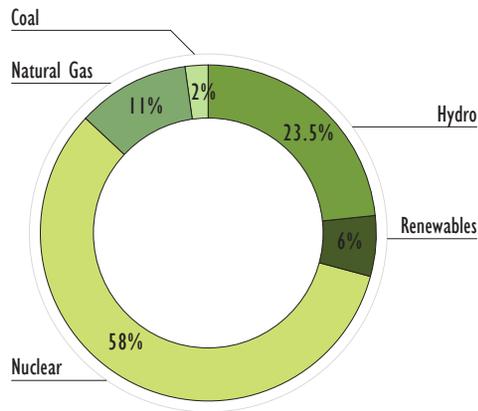
5.1 MECHANICAL SYSTEM, SCHEMATIC DESIGN

Emissions

- All electric mechanical system reduces emissions

Mechanical System Comparison Figures

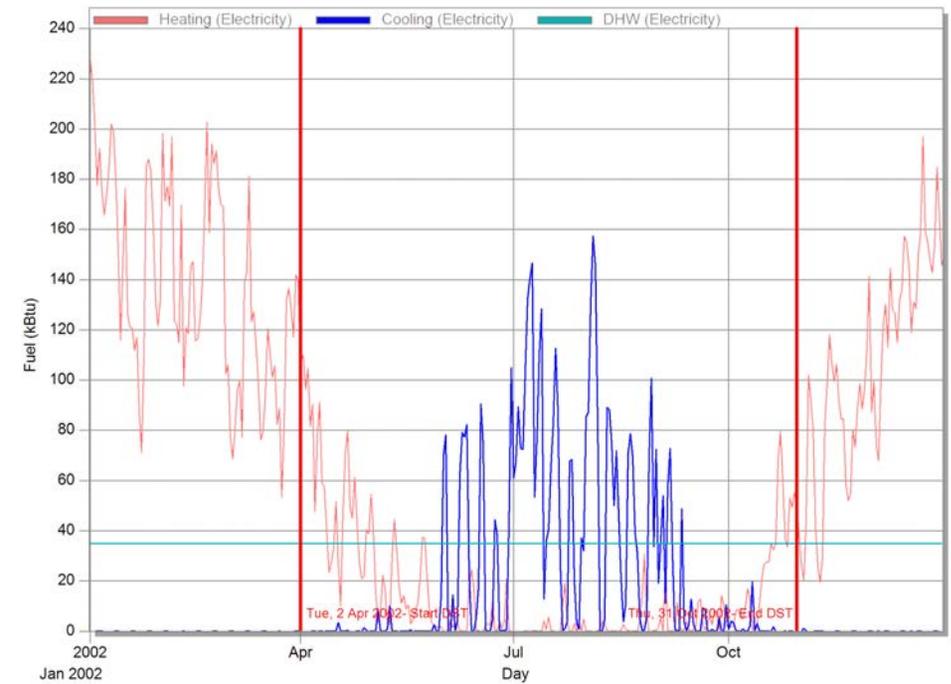
	Total Yearly Electricity Consumption (kBtu)	Total Yearly Natural Gas Consumption (kBtu)	Total Yearly Emissions (ton eCO ₂)
VRF System	75,100	-	2.7
Natural Gas Furnace	56,300	68,000	6.1



Ontario Electricity Generation Mix

Energy Consumption

- Redistribute heating loads for space conditioning and domestic hot water
- ~40% increased efficiency over comparable heat pump systems



Major Energy Consumption End Uses

5.2 RENEWABLE ENERGY SYSTEMS

Key Points

- System size: 8.84 kW
- Generation of 10339 kWh/year
- 9 year payback
- microFIT: feed-in tariff \$0.40/kWh generated and sent to grid



Shading at Dec 21st at 8:00am
(Sunrise 7:21am)



Shading at Dec 21st at 4:00pm
(Sunset 4:18pm)

Photovoltaic Total Cost Calculations

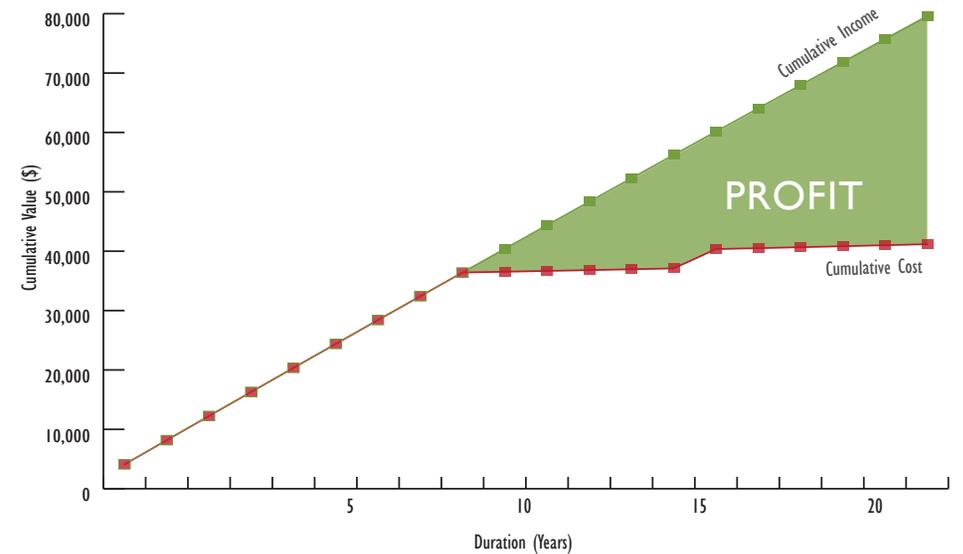
PV system size	kW	8.84
PV installation	\$/W	\$ 3.50
Electricity rate	\$/kWh	\$ 0.17
Loan (total installation cost)	Initial	\$ 34,940.00

Loan Payback

Interest	9 years	-\$ 453.19
Total Loan Cost	9 years	-\$ 35,353.19

PV Economy

Total Electricity Sold to Grid	20 years	\$ 79,592.64
Total Maintenance Costs	20 years	-\$ 2,687.04
Inverter Replacement	15 years	-\$ 3,100.00
Loan Payback Loss	9 years	-\$ 453.19
PV Replacement Cost (1.5% Inflation)	Future Value (20 yrs)	-\$ 41,671.69
Total Income After Renewable Energy Replacement		\$ 31,680.72

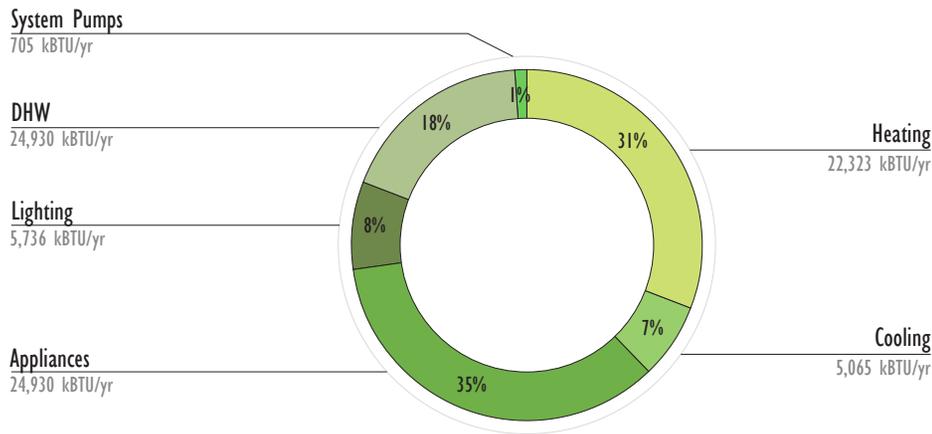


DesignBuilder

- Used for whole building energy simulation
- Commercial occupancy on first floor

REM/Rate

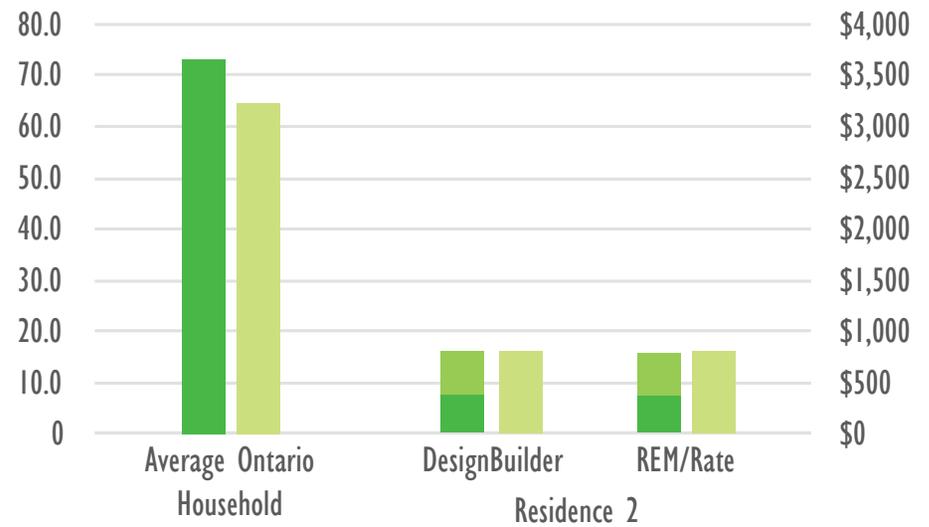
- Used for HERS Ratings
- Residential occupancy simulation only



DesignBuilder Energy End-Use Results

HERS Ratings

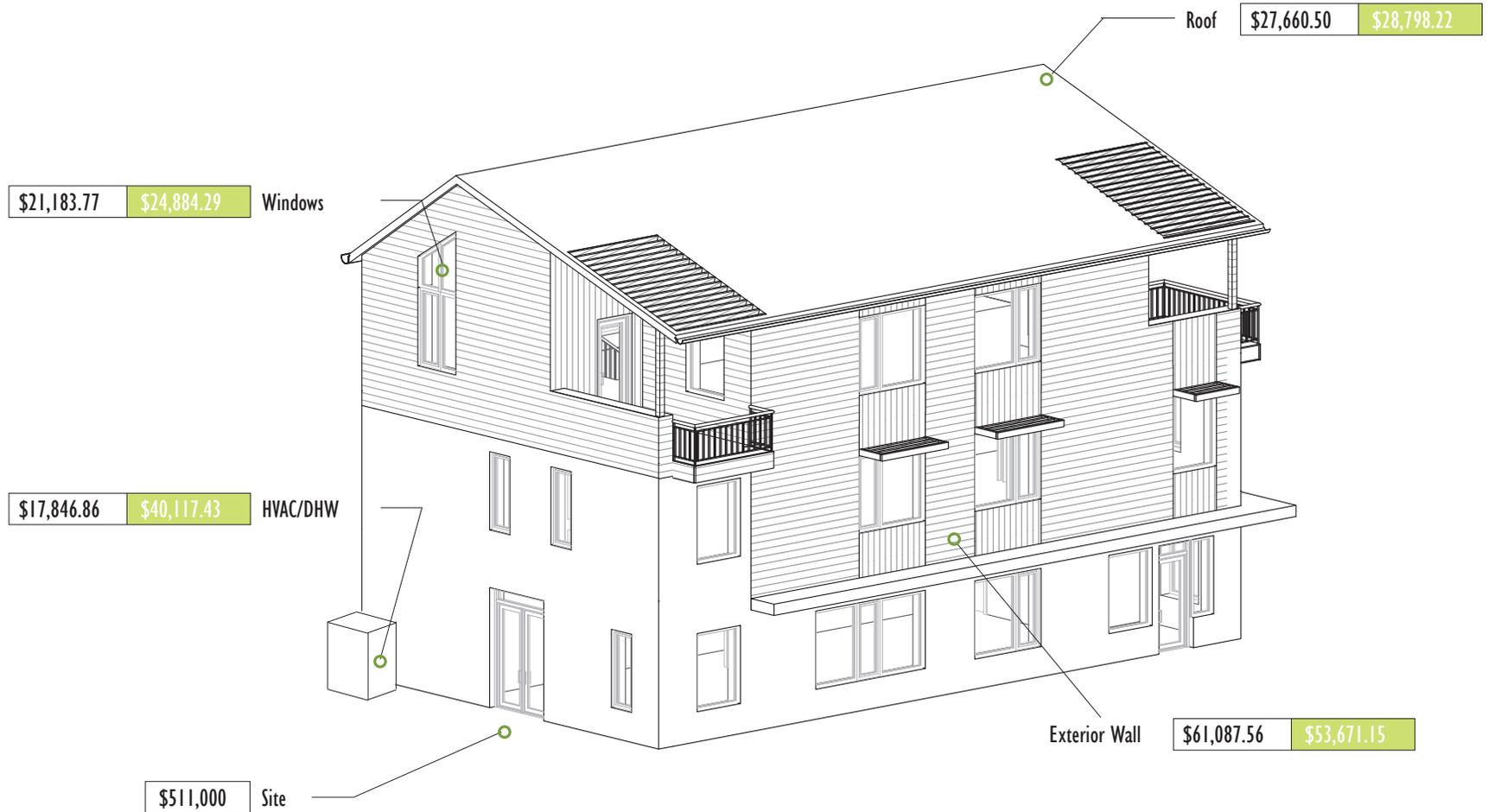
	HERS RATING		
	SAF Target	Without PV	With PV
Residence 1	43	42	17
Residence 2	39	39	20
Residence 3	40	38	20



- Net EUI (kBTU/ft²/yr)
- Energy Consumption Offset by Renewable Energy Generation (kBTU/ft²/yr)
- Energy Cost (\$/yr)

Energy Use Comparison

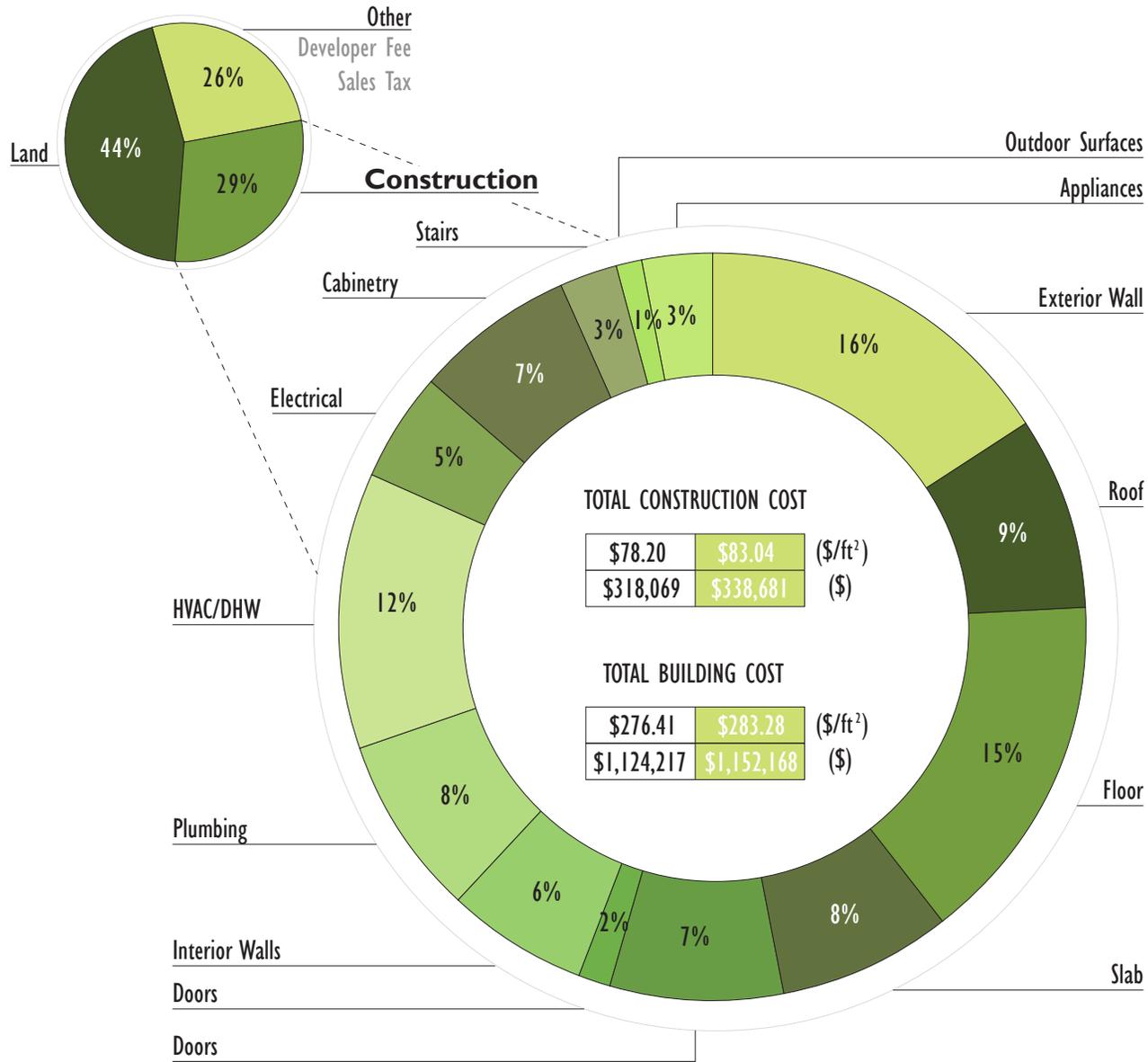
7.1 CONSTRUCTION COSTS



Legend:

Standard	High Performance
----------	------------------

7.1 CONSTRUCTION COSTS



7.2 AFFORDABILITY ANALYSIS

Typical Toronto Real Estate

	Cost (\$)	Square Footage (ft ²)	Cost / Sqft (\$/ft ²)
Comparable single detached home	800,000	1,500	533
Average condo unit	380,000	800	475
Proposed unit	435,000	1,500	280

Mortgage Affordability Analysis

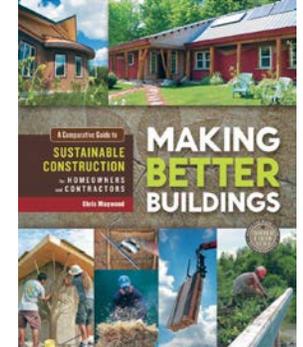
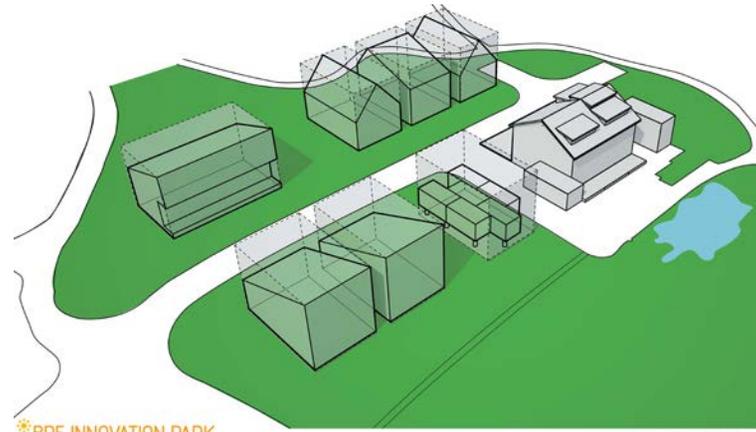
	Unit 1	Unit 2	Unit 3
Total Cost	\$ 267,010.43	\$ 442,578.93	\$ 442,578.93
Down payment	\$ 53,402.09	\$ 88,515.79	\$ 88,515.79
Cost per unit per year	\$ 17,585.15	\$ 27,454.00	\$ 27,454.00
Minimum Household Income Required*	-	\$ 72,247.37	\$ 72,247.37

*Average Neighborhood Income, \$74, 000

Kortright
centre for conservation

BRE INNOVATION PARK
@ The Living City CAMPUS
Part of the BRE Innovation Parks Network

ENDEAVOUR 
innovative learning, building & living



BRE INNOVATION PARK
@ The Living City CAMPUS
Part of the BRE Innovation Parks Network

SUSTAINABLE.TO
ARCHITECTURE + BUILDING



LEED RATING

The Corner House has achieved LEED Platinum.

LEED Platinum Possible Points: **82.0**

The Corner House Score: **96.5**

Categories

Location and Linkages: **10/10**

Sustainable Sites: **16/22**

Water Efficiency: **10/15**

Energy and Atmosphere: **28.5/38**

Materials and Resources: **11.5/16**

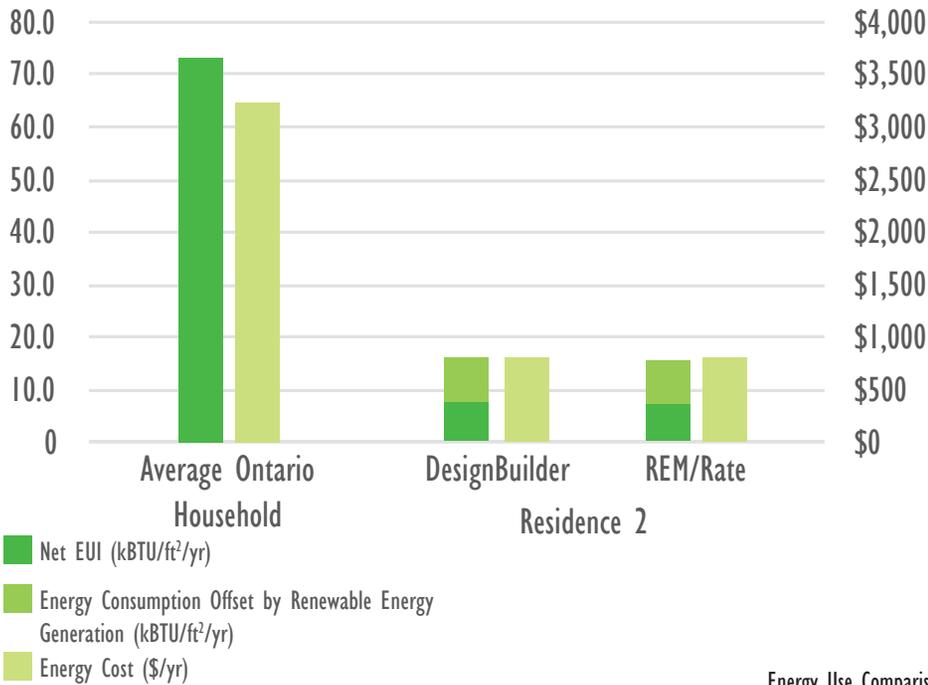
Indoor Environmental Quality: **14/21**

Awareness and Education: **3/3**

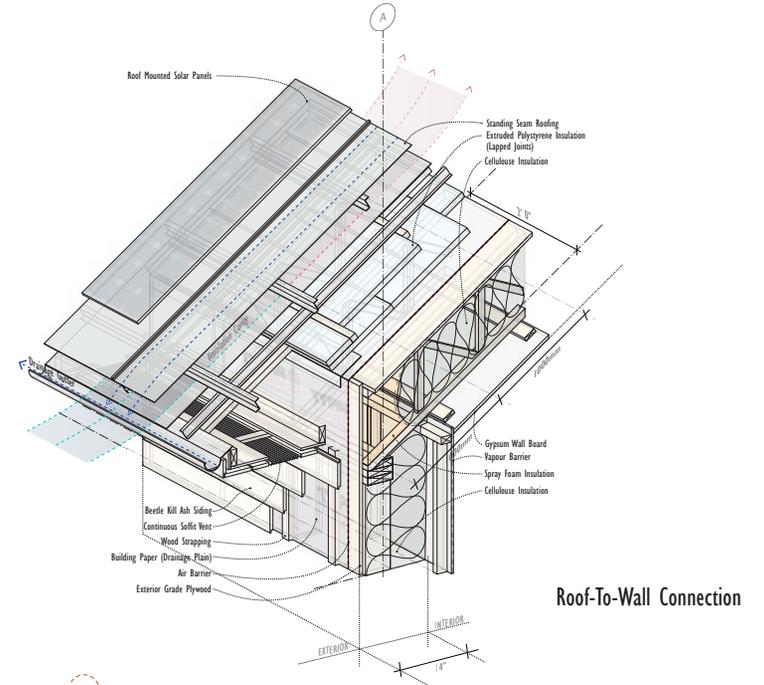
Innovation and Design Process: **3.5/11**



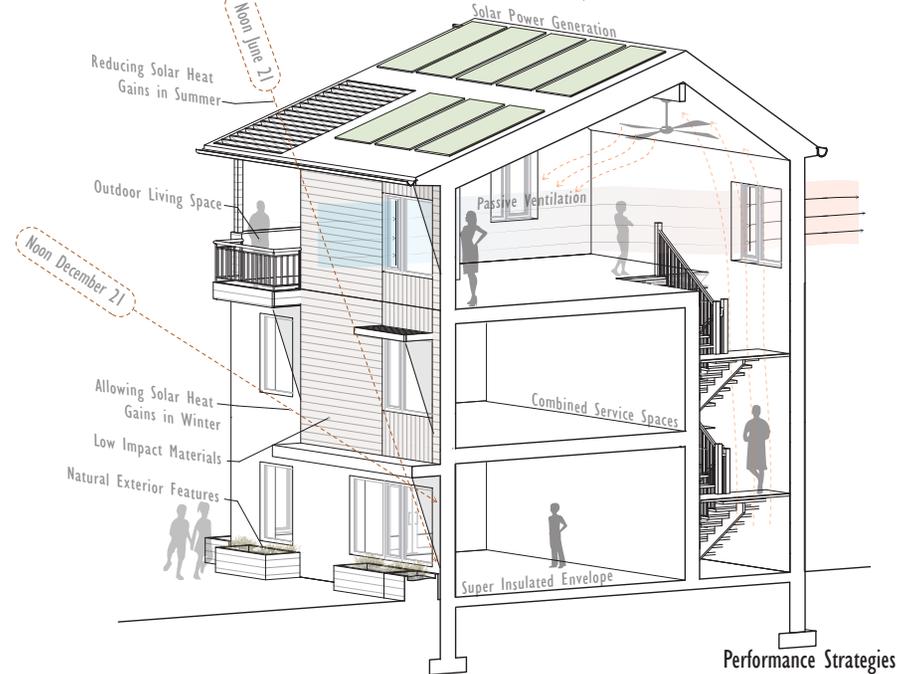
Third Floor Living Space



Energy Use Comparison



Roof-To-Wall Connection



Performance Strategies



Thank you