



HOME OF SIDNEY KIMMEL MEDICAL COLLEGE

COLLEGE of ARCHITECTURE and the BUILT ENVIRONMENT







ECONOMIC GROWTH HAS SPURRED RAPID DEVELOPMENT RESULTING IN A WAVE OF **GENTRIFICATION**







Ε

W

N



S





What if commercial development could help break the cycle of multi-generational displacement in gentrifying communities?



SITE SELECTION

Sharswood

ublic transit line/ potential

W.D. Kelley Public School

SITE SELECTION

COMMUNITY IMPACT





















ENGAGEMENT



EDUCATION



EMPLOYMENT



What if energy independence didn't have to be a privilege for those who need it the least?



FORM GENERATIONSOLAR EXPOSURE



FORM GENERATION NEIGHBORHOOD CONTEXT



CUT GEOMETRY FOR NEIGHBORS

LOWER HEIGHT + GROUND COOLTH

FORM GENERATION



ATRIUM + CLERESTORY

ROOF ADJUSTMENTS & SETBACKS

SHADING + DRAINAGE





To address user needs, we begin by linking tangible comfort to building solutions.





Thermal Control



Indoor Air Quality



Natural daylighting



Biophilia



Adaptable Program



Convenient Circulation

THERMAL CONTROLEFFICIENCY + COMFORT



Super insulated airtight envelope



Efficient HVAC strategies

THERMAL CONTROLENVELOPE



TECHNICAL INFORMATION

WALLS	R-52	Prefab. Straw bale wall system w./ cont. Wood fiber insul.
EXT. FLOORS	R-16	4" rigid stone wool insul.
FOUNDATION	R-38	Insulated concrete forms
ROOF	R-45	8" stone wool insul + 3" wood fiber insul.
WINDOWS	U-Value .15	Triple pane alum. clad wood windows







THERMAL CONTROLHVAC | VRF

= Unconditioned Zones







"Employers can improve workforce performance by up to 10% through improvements in the quality of indoor air."

Lawrence Berkeley National Laboratory

Poor indoor air hinders comfort, attention span and productivity, and OSHA estimates that poor indoor air costs employers **\$15 billion annually** due to worker inefficiency and sick leave.

OSHA - Green Building Health in Schools

https://www.fsginspections.com/indoor-air-quality

https://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=federal_register&p_id=13369

https://www.huffpost.com/entry/how-employee-productivity_n_562094

AIR QUALITY

ELIMINATING VOCs





"According to the EPA, the air inside buildings can be two to five times more polluted than the air outside."

EPA - INDOOR AIR QUALITY

AIR QUALITY

FRESH AIR VENTILATION + ERV



PASSIVE VENTILATION STRATEGIES

ENERGY RECOVERY VENTILATION

<--- 🔽

. (- + - - - -

ERV Units










INTERIOR LIGHTING REDUCTION STRATEGIES

1.) Optimize natural daylight .

2. High efficiency overhead lighting

.) Adaptable task lights \ldots





INTERIOR DESIGN







STRUCTURE

DLT - DOWEL LAMINATED TIMBER

BENEFITS

- Durability & lifespan
- Acoustic performance (with profiled slab and conc. topper
- Reduction in thermal bridging
- Resistance to fire damage & seismic events
- Eliminates cost of ceiling finishes

-Reduced building weight \rightarrow decrease footing sizing





ENERGY CONSUMPTION

To achieve net zero, the first step is to reduce energy consumption.



ENVELOPE STRATEGIES



WALL ASSEMBLY

modcell[®] straw technology

FEATURES

Natural, low carbon materials (wood based products + straw bale)

Balances extreme thermal efficiency w/ cost

Airtight detailing to Passivhaus standards

Speed of construction (pre-fabrication near site)

Provides **acoustic** sound dampening (-50db)

Can achieve up to 2hr fire rating (1hr standard)

Constructed in "flying factories," near site, utilizing **locally sourced materials and labor** to reduce carbon footprint



NORTH WALL ASSEMBLY



ROOF ASSEMBLY | R-45 STANDING SEAM MTL. ROOFING SYSTEM

3" STEICO thermDRY© RIGID WOOD FIBER INSUL (R15) 5/8" ZIP SHEATING (COMBINED AIR & VAPOR BARRIER) 8" STONE WOOL INSUL. (R-30) 18" X 1 1/2" LVL @ 24" O.C. 1/2" (12MM) STRAWTEC PANEL

WALL ASSEMBLY | R-52

RECLAIMED 1X HORIZ. WOOD SIDING or BREATHABLE RENDERED FINISH (VARIES BY LOCATION) 1 1/2" STEICO thermDRY© RIGID WD. FIBER INSUL. (R-7)

MODCELL© PREFAB WALL SYSTEM (R-45) 1 1/2" X 16" GLULAM FRAME @ PERIMETER OF OPENING 1/2" EXT. OSB BREATHER BD. 16" STRAWBALE INSULATION 5/8" ZIP SHEATHING (COMBINED AIR & VAPOR BARRIER)

1X WD. FURRING 1/2" STRAWTEC PANEL

-AIR & VAPOR BARRIER WRAPPED AROUND SLAB EDGE & TAPE SEALED TO ZIP SHEATHING OF PREFAB STRAWBALE PANELS

MOISTURE CONTROL LAYER ----- AIR/VAPOR CONTROL



NORTH WALL ASSEMBLY













[Openstudio]

ENERGY ANALYSIS

OPENSTUDIO PROCESS



Model thermal zones in SketchUp

NEW EUI: 17

R Value (ft^2*h*R/Btu)

Model high performance envelope:

strawbale walls, roof + windows

Geode Strawbale

51.05



Adjust occupancy schedules and lighting loads

HVAC



Apply measure NZEHVAC: VRF with DOAS



Air Loop and VRF automatically produced - we adjusted

FINAL EUI: 16	
Total Site Energy	529,015 kBtu
Total Building Area	32,575 ft^2
Total Site EUI	16.24 kBtu/ft^2

ELECTRICAL USAGE

INTERIOR EQUIPMENT & PLUG LOADS



Monthly Overview



Plug Loads Summary

Open Office (7,770 sq. ft.) = 15,000 kwh

Private Office (3,273 sq. ft.) = 7,385 kwh

Second Floor Kitchen (309 sq. ft.) = 11,754 kwh

Cafe (870 sq. ft.) = 34,396 kwh

Second Floor Copy Room (126 sq. ft.) = 4,419 kwh

Educational Programs (885 sq. ft.) = 3,862 kwh

Screenshots from OpenStudio

GEOTHERMAL

For every 50 ft of bore, 1 tonne of energy is gained towards mechanical systems.



PRODUCTION : CONSUMPTION

REPLACES THE NEED FOR ROOFTOP PACKAGE UNIT/OUTDOOR CONDENSER



SYSTEM SYNTHESIS [VRF + ERV + GEO]









20.1% EFFICIENCY

327W / 1000 = .327kW

.327kW x 3.607 hr x 365 days = 430.51 kWh / panel per year 430.51 x 437 panels = 188,134.4 kWh per year

CONSUMPTION

Net Positive Energy

HVAC Systems

Interior Equipment



SCHOOL CONNECTION

OFFICE BUILDING

430.51 x 437 panels = 188,134.4 kWh per year

POTE

WILLIAM D. KELLEY

430.51 x 1174 panels = 505,418.74 kWh per year





LOW CARBON



STRATEGIES

ELIMINATE OPERATIONAL ENERGYMASS TIMBER STRUCTURESTRAW BALE WALL ASSEMBLYALTERNATE INSULATIONSMINIMIZE ON SITE CONSTRUCTION ENERGYMINIMAL FINISHESON SITE WATER MGMT.

LBC







33% OPEN SPACE WITH NATIVE PLANTING

100% WATER RETENTION WITH ADDITIONAL REUSE

BEAUTY VISUALLY COMPELLING - ENCOURAGES COMMUNITY TO CARE AND UTILIZE BUILDING







SURPLUS ENERGY SOLD BACK TO GRID

COMMUNITY PROGRAMMING

SOCIAL EQUITY

ZERO VOC MATERIALS



WATER CALCS





YES: 81

LIKELY: 17

LESS CERTAIN: 3

UNLIKELY: 3

SCORECARD TOTAL: 98 LIKELY OR BETTER **SCORECARD TOTAL:** 101 TOTAL LIKELY EASILY ACHIEVABLE



Awarded											
0	d Yes	Likely	Less Certa	Unlikely 3	0	Totals \$43	eCatthe IIIIINE ECat IIPatrice Total Likely or Better				
Aw	Tes	LA	Less	Uni,	No	101	Total Likely Easily Achievable				
0	1	4	0	0	0		Integrative Process	26 Points	1	24 Points	25 Pt
0	196 98	4	0	2	0		Location and Transportation	25 Points	31 points	24 Points	21 70
		_			16	Credit	LEED for Neighborhood Development Location		10		
		2				Credit	High Priority Sta		2		
-	5	_				Credit	Surrounding Density and Diverse Uses				
		1				Credit	Bigste Facilities		1		
	1	_		<u> </u>	-	Credit	Reduced Parking Footprint		1		
						-	CREATERING				
0	Yes 6	2	Less 0	Unit.	0		Sustainable Silve	NC Retail 26 Points	12 points	Schools 24 Points	21 Po
				_	_		Construction and A. B. Barton Decomposed (CBR Construct	Descind	Berning	Descind	
		1				Credit	Sile Assessment	1 I	1	Konquared 1	
-	1	_		1	-	Credit	Site Development - Protect or Resizee Habitat		2	1	
	3					Credit	Rainvolar Management	NA	3	4	
-	2	1		-	-	CINE	Heat Island Reduction	NA NA	2	1	
_											
A	7e5	0	Less 0	0	0		Water Efficiency	NC Retail 10 Points	NC 11 Points	Schools 11 Points	11.5%
_	_			_	_	-	Catholike Inc. Datastar	Duration 1	Output in 1	Burnin 1	
		_				Prereq	Indoor Water use Reduction	2 to 4	Required	2 to 4	1
-		-		-	-	Prereq	Building Lovel Water Metering Calders Water Dat Behaviors	2	Required	2	
	6	_				Credit	Indicor Water Use Reduction				
	1					Cristit	Cooking Taxeer Water Use Water Metering		2		
_							-				
0	25	2	0	0	No.		Energy & Atmosphere	NC Retail 33 Points	33 Points	Schools 33 Points	37 Po
_				_	_				1 - 1 - 2		
		_				Preseq	Minimum Energy Performance		Required	Required	
						Prereq	Building Level Energy Metering		Required	Required	
						Credit	Enhanced Commissioning		6	1 10 7	
-	15	_		-	-	Credit	Optimize Energy Performance Advanced Energy Materian		- 10	2	
		2				Credit	Demand Response		2		2 NA
-	3	_		<u> </u>	-	CINE	Renewable Energy Production Enhanced Balticered Management		2	-	
	2					Credit	Green Power and Carbon Offsets		2	2	
Ar	Yes	LR	Less	Uni.	No			NC Retail	NC	Schools	
٥	6	5	0	0	0		Material & Resources		13 Doints		43.00
				-					-	13 Points	uns
		_				Prereq	Storage & Collection of Recyclables	Required	Required	13 Points Required	,
F		5				Preneg Credit Credit	Strange & Collection of Noryclabins Construction and Denotition Waste Management Planning Dubling Life-Coloi Impact Reduction	Required	Required Required	Required 1 to 2	,
	2	5				Prenerg Credit Credit	Bionage & Collection of Recyclables Construction and Denvillion Waste Management Planning Building Life-Cycle Impact Moducto Building Product Disclosure and Cyclinization - Environmental Product Declarations	Required	Required Required 5	13 Keine Required 1 to 2 . 1 1 to 2	,
	2	5				Preneg Credit Credit Credit Credit	Renage & Collection of Recyclables Construction and Denotition Waste Management Planning Dahley Unit-Cycle Impact Peterbotom Dahley Trockst Disclosum and Cyclemization - Environmental Product December December 2014 (Construction and Cyclemization - Sourcing of Raw Materials	Required	Required Required 5 2 2	12 Points Required 1 to 2 1 1 to 2 1 to 2	
	2 2 2	5				Prereq Credit Credit Credit Credit Credit Credit	Brouge & Collection of Recyclables Constraints and Denotion Vices Management Planning Boltry (D-Cycle Impect Relation Denotember and Cyclectorian - Environmental Photoc Denotember and Cyclectorian - Storating of Rue Materials Boltry Product Disclosure and Cyclectorian - Storating of Rue Materials Boltry Product Disclosure and Cyclectorian - Storating of Rue Materials Boltry Product Disclosure and Cyclectorian - Storating of Rue Materials Boltry Product Disclosure and Cyclectorian - Storating of Rue Materials	Required	Required Required 5 2 2 2 2 2 2 2 2	Required 1 to 2 1 1 to 2 1 to 2 1 to 2 1 to 2 1 to 2 1 to 2 1 to 2	,
	2 2 2 2	5				Prereq Credit Credit Credit Credit Credit Credit	Serger & Ocketien of Respitables Constantion and Dennillow Water Management Planning Dating Lin-Cycle Instantion Dating Tandon Disolations and Optimizations: Disologenetical Planded Dating Product Disolations and Optimizations: Disolated Planded Dating Product Disolations and Optimizations: Haland Ingradests Constraintion and Dennillow Yorks Management	Required	Required Required 5 2 2 2 2 2 2	13 20005 Required 1 to 2 1 1 to 2 1 to 2 1 to 2 1 to 2 1 to 2 1 to 2	
Au	2 2 2 2 7es	5 2" LB	Less	Usz.	No	Premery Credit Credit Credit Credit Credit Credit	Bange & Delvelen if Respitables Carlies (Le Cycle Transmission of Particip Bally Particip Transmission of Cycle Carlies (Constraints) Delvelen Particip Transmission of Constraints) Delvelen Particip Transmission of Constraints) Delvelen Particip Transmission of Constraints) Delvelen Particip Transmission of C	NC Retail 15 Points	Required Required 5 2 2 2 2 2 3 2 NO 16 Points	13 Polans Required 1 to 2 1	12 Po
Au 0	2 2 2 2 1	5 2' 1	Less	Und	No 0	Prema Credit Credit Credit Credit Credit Credit Credit	Broog & Cristelon of Resplation Constants on Elements Water Manymer Planning Brodge (Lick-pin) special holds: Brodge (Lick-pin) special holds: Defenders Def	NC Retail 15 Points	Required Required 5 2 2 2 2 NC 5 Fourts Required	13 Polans Required 1 to 2 1 to 2 1 to 2 1 to 2 1 to 2 1 to 2 5 shools 22 Polans Page 4 set	12 Pa
Au 0	2 2 2 7 88 11	5 2* 1	Less	Unit	No	Preneg Credit Credit Credit Credit Credit Credit Credit Credit Preneg	In any 50 characteristic and the public to account of a characteristic and characteristic	No Retail 15 Points	Required Required 5 2 2 2 2 2 3 2 3 2 3 2 3 2 3 2 3 2 3 3 2 3	13 Polance Required 1 to 2 1 1 to 2 1 to	12 Pai
A.	2 2 2 2 3	5 2* 1	Less	Und	No	Prenny Credit Credit Credit Credit Credit Credit Credit Credit Credit Credit Credit Credit Credit	Nang Ki Andre Y Mayakhi Delayakan ar Manuka Kangun Mang Mag La Cahang Manuka Mang Tahu Sanang Ang Kang Mang Tahu Shanan ar Pathasin. Suanang Patha Mana Mang Tahu Shanan ar Pathasin. Mana yang Patha Mana Mang Tahu Shanan ang Kang Mang Mana Shanang Ang Manang Mang Manana Mang Mang Mang Manana Mang Mang Mang Manana Mang	Preparent NC Pastal 15 Points	Required Required 5 2 2 2 2 2 2 3 5 6 Polices Required Required 2 3	Ibours Required 1162 1 1162 1162 1162 1162 1162 1162 1162 1162 1162 1162 1162 1162 1162 116 116 116 116 116 11	12 Pa
Au 0	2 2 2 2 2 2 2 3 1	5 2 ¹ 1	Less	Und	No	Prema Creski Creski Creski Creski Creski Creski Prema Prema Prema Creski Creski	In any 3-Constant of Internation Mark (and constant of Internation Markara) Mark (and the Specific Markara) Mark (and the Specific Markara) Mark (and Constant of Specific Markara) Mark (and Constant of Specific Markara) Mark (and Constant of Specific Markara) Markara (and Constant) Markara (and Constant) Mar	Negained NC Retail 15 Points	Required Required 5 2 2 2 2 2 2 3 2 3 2 3 3 3 3 3 3 3 3 3	13 Joans Repired 16:2 1 16:2 16:2 16:2 16:2 16:2 16:2 16	12 Po
Au 0	2 2 2 2 2 2 3 1 1 2 3 1 1 2 2 2 3	2" 1	Less	Und	No	Prereq Credit Credit Credit Credit Credit Credit Credit Credit Credit Credit Credit	In op 1 Constant Amphato Margis Legis and Margin Amphato Margis Legis and Amphato Margis Legis Amphato Margin Margin Amphato Margin Amph	Nopaired NC Retail 55 Points	Required Required 2 2 2 2 2 3 10 2 2 2 3 10 2 2 3 1 1 2 2 1	13 Joans Repaired 1692 179	12 Pol
	2 2 2 2 2 2 3 11 11	5 2" 1 1	Less	Unk	Ro 0	Preneg Gredit Credit Credit Credit Credit Credit Credit Credit Credit Credit Credit Credit Credit Credit Credit Credit Credit Credit Credit Credit	Neg Lindenskraftet	Norphiled NC Retail 15 Points	Required Required 5 2 2 2 2 2 2 2 2 2 2 2 2 3 1 8 POInts 8 8 Required 9 2 2 1 1 2 2 1 1 2 2 3 1 1 2 2 3 1 1 5 1 5 1 5 1 5 1 5 1 5 1 5 1 5 2 2 2 2	13 Joans Repaired 1692 162 162 162 162 162 162 162 16	12 Pal
Are 0	2 2 2 2 2 3 51 51 51 51 51 51 51 51 51 51 51 51 51	5 2 ¹ 1 1	0	Und	No 0	Premaj Credit	In egy Londerske herhedelse Marie Londerske herhedelse en forset Marie Londerske herhedelse Marie Lond	Required NC Retail 15 Points	Required Required 5 2 2 2 2 2 3 10 Pointed 11 2 1 2 1 2 1 2 1 2 1	13 Joans Repaired 1 to 2 1 to 2 1 to 2 1 to 2 1 to 2 1 to 2 1 to 2 2 Show 2 Planes Planes Planes 2 Lower 2 Lower 1 Lower 2 Lower 2 Lower 2 Lower 2 Lower 2 Lower 1 Lower 2 Lower 1 Lower 2 Lower 2 Lower 1 Lower 2 Lower 2 Lower 1 Lower 2 Lower 1 Lower 2 Lower 1 Lower 2 Lower 2 Lower 1 Lower 2 Lower 2 Lower 2 Lower 2 Lower 1 Lower 2 Lower 1	1276
	7es 11 22 2 2 11 11 22 2 3 5 ¹⁷ 2 2 1 3 1 1 3 1 1	5 2* 1	0	Und.	No	Prereq Credit Cr	Neg Lindenskrafter Markenskrafter Ma	Norpained NG Pastal 15 Points	Required 8 9 2 2 2 2 2 3 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1	13 Joans Repaired 1 to 2 1 to 2 1 to 2 1 to 2 1 to 2 1 to 2 1 to 2 2 Show 2 Planes Planes Planes 2 Planes 2 Lower 2 Lower 1 Lower 2 Lower 1 Lower 2 Lower 1 Lower 1 Lower 2 Lower 1 Lower	12 /64
Az 0	22 22 22 11 11 12 22 3 14 12 2 1 1 1 1 1 1 1	5 2" 1 1	Less 0	Unit	No	Preneq Credit Credit Credit Credit Credit Credit Credit Credit Credit Credit Credit Credit	In egy i Character Angeladis Maria Carlo Maria Maria Maria Maria Carlo Maria Maria Carlo Maria	Required NC Retail 15 Points	Required Required 5 2 2 2 2 2 3 10 2 2 3 1 1 2 2 3 1 1 2 2 3 1 1 1 2 2 3 1 1 1 2 2 3 1 1 1 2 2 3 1 1 2 2 2 2	12 Joans Registed 1162 117 117 12 1162 117 12 1162 1162 1	10 Pad
Au 0	22 22 22 11 11 11 22 3 11 1 2 2 3 11 1 1 1	5 2* 1 1	Less	Unit	No 0	Preneq Credit Credit Credit Credit Credit Credit Credit Credit Credit Credit Credit Credit Credit Credit	Neg Londersterfalter Marine and en under weiter Stepsterfalter Stepster Stepster Stepsterfalter Stepster	Norprived NC Retail 15 Points NC Retail 6 Factor	Required Required 5 2 2 2 2 2 3 NC 16 Points Required Required 1 2 2 1 1 2 2 1 1 1 2 2 1 1 1 2 2 2 1 1 2 2 2 1 1 1 2	12 Doors Registed 1562 1562 1562 1562 1562 1562 1562 1562 1562 1562 1562 1562 1562 1562 1562 157	13 Pai
Az 0	2 2 2 2 1 1 1 1 2 2 1 1 1 1 1 1 1 2 2 1 1 1 1 1 1 1 2	5 2* 1 1	Less	Ust	No 0	Prereq Credit Credit Credit Credit Credit Credit Credit Credit Credit Credit Credit Credit Credit Credit Credit	In egy classification of the set	Nepted NC Real 15 Points	Required S 2 2 2 2 2 2 2 2 3 3 5 6 Points 5 6 Points 1	12 Pounts Registed Total To	ti Rai
Au 0	7es 7es 11 2 2 2 3 11 1 2 2 3 1 1 1 3 3 1 1 1 3 9	5 2* 1 1	Less 0 Less 3	Ust. 9	No 0	Premy Credit Cre	Neg London Industri Marine Industri Ma	Propried INC Patel 15 Points NC Patel 5 Param	Required 5 2 2 2 2 3 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	12 Jours Registed 1 162 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	13 Fei
	7es 11 1 2 2 2 3 11 1 1 3 1 1 1 1 2 2 1 1 1 3 1 1 1 1	5 2* 1 1	Less 0 1	Unit	No 0	Premy Credit Cre	In egy classica school wat	Not Retail	Required Required 5 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	12 Points Registed 1592 1 102 1592 1592 1592 1592 1592 1592 1592 159	12 Pail
	22 22 22 3 11 11 22 3 11 1 1 3 3 1 1 1 1	5 2 ¹ 1 1	Less 0 1 1 1 1	Unit	Nic 0	Premy Credit Cre	Neg London Schulder Beigen und Schulder und Schulder Schule und Schule und Schule und Schule Schule Und Schule Und Schule Und Schule Und Schule Schule Und Schule	Nopuled NC Retail 13 Points 6 Paulot 1 1	Regint 5 2 2 2 2 2 2 3 1 2 3 1 2 3 1 2 3 1 2 3 1 1 1 1 1 1	13 Pouns Mexicol 16 2 16 2 16 2 16 2 16 2 16 2 16 2 23 Pouns Nequired Pagaled Pagaled Pagaled 1 2 1 1 2 1 1 2 1 1 2 1 1 2 1 1 2 1 1 2 1 1 2 1 1 2 1 1 2 1 1 2 1 1 2 2 1 1 1 2 2 1 1 1 2 2 1 1 1 2 2 1 1 1 2 1 1 1 2 1 1 1 2 1 1 1 2 1 1 1 1 1 1 1 1 1 1 1 1 1	t3 Poi
Are 0	2 2 2 2 2 3 11 3 5 ^r 2 2 1 1 3 1 1 1 1 1 1	5 2* 1 1 1	Less 3	UnL 9	No 0	Premy Credit Cre	Neg Charlen Argehalts De Carlos and Industria Margen Margin De Carlos and Industria Margen Margin De Carlos And Industria Margen Marg	Nepéred XC Real Shares VC Real Farmer	Regind Provide Sciences Scieno	137 Jones Repland 1562 1562 1562 1562 1562 1562 1562 1562 1562 1562 1562 102 102 102 102 102 102 102 10	t3 Pai
Az 0	2 2 2 2 2 3 3 5* 2 2 1 1 3 3 5* 2 2 1 1 3 3 1 1 1 7 8 8 7 8 7 8 7 7 8 8 7 8 7 8 7 8	5 2* 1 1	Less 0	Unc. 9	No 0	Perroj Gredit Cr	Neg London Information Proceedings of the State	Nopaled NC Intel S (Parts)	Repired Repired 9 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	12 Pounts Respired 1 to 2 1 to 2 2 3 1 1 1 1 1 1 1 1 1 1 1 1 1	12 Jun
Ar 0	Уев. 22 22 22 3 3 5° 22 3 3° 22 3 3° 2 2 2 3 3 1 1 3 3 1 1 3 1 1 1 2 2 2 2 2	5 2* 1 1 1 1	Less 0 1 1 1 1 1 0	Und. 0	No 0	Perroj Gredit Gredit Gredit Gredit Gredit Perroj Perroj Perroj Perroj Gredit Gred Gred Gred Gred Gred Gred Gred Gred	In egy classical relation in the second relation is the second relation in the second relation is the second relat	Nopered NC Intel S Distas S Distas S Distas S Distas S Distas	Negated 9 2 2 2 2 2 2 2 2 2 3 1 2 3 1 2 3 1	13 Jours Repta 14 2 14 1 14 1 1	E Pest
2 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Уев. 2 2 2 2 2 3 5° - 2 2 3 5° - 2 2 3 5° - 2 2 3 5° - 2 2 - - - - - - - - - - - - -	5 2 ¹ 1 1	Less 0 3 1 1 1 1 1 0	Und. 0	No 0	Premp Credit Cre	Neg Characterization in the second se	No field Shares	Reprint 9 2 2 2 2 2 3 3 3 3 3 4 3 3 4 3 3 3 3 3 3 3 3 3 3 3 3 3	1) Jines Repete 112 112 112 112 112 112 112 112 112 12	E Peak
	7 2 2 2 2 2 2 2 2 2 2 1 1 1 1 1 1 1 1 1	5 2 ¹ 1 1 1 1 1 1	Less 0 1 1 1 1 1 1 0	Und. 0	No. 0	Premay Credit Cr	Neg Charlen Angelde Margine per United and Angel Angel Margine per United and Angel Angel Margine per United and Angel Margine and Angel Angel Margine and Angel Angel Margine and Angel Angel Margine and Angel Margi	Nopieed NC Read 10 Read 10 Read 11 Read 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	Repired Regined 5 2 2 2 2 2 2 2 2 2 2 2 2 2	1) Jines Repht 1921 1921 1923 1923 1923 2000 2000 2000 2000 2000 2000 2000 2	12 Poi
Az 0	7 2 2 2 2 2 2 2 2 2 2 2 1 1 1 1 1 1 1 1	2* 1 1 1 1 1 1 1	Less 0 1 1 1 1 1	Und. 0	No 0	Prema Credit Cre	Neg 1 Source and sourc	Nopied NC Real SSNees SSNees I I I I I I I I I I I I I I I I I I	Reprint Reprint 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	1) Jindi Repaired 11, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1,	12 Poi
Are 0	72222 223 785 78 71 71 70 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7	2 ¹ Lik 1 1 1	Less 0 1 1 1 1	Und. 0	No 0	Premay Contit Co		Nopieed NC Intel SDARK.	Reprint Reprint 9 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	1 (1) (1) (1) (1) (1) (1) (1) (1) (1) (1	12 Hai
Are 0	7 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	5 2 ¹ 1 1 1 1	Less 0 1 1 1 1 0		No 0	Premay Credit Cr	Negl Schere Sche	Nopered NC Red S Practs S Practs I S I S I S I S I S I S I S I S I S I S	Reprint Reprint 9 2 2 2 2 2 2 2 2 3 3 1 1 2 2 3 3 1 1 2 2 3 3 1 1 2 2 3 3 1 1 2 2 3 3 1 1 2 2 2 2	1) Jine: head of the second s	12 Point
	22 22 31 31 22 33 37 37 37 37 37 37 37 37 37 37 37 37	5 2* 1 1 1 1 1	Less 0 1 1 1 1 1	Unit	No 0	Premay Condit Co	Negl Calendra Andrahami Margin Calendra Andraha	Nopiered In Childs Shares Shar	Registed Registed 5 2 2 2 2 3 3 2 2 3 3 4 5 5 5 5 6 7 7 7 7 7 7 7 7 7 7 7 7 7	1 (1) June: 1 (2) June: 1 (2) (2) (2) (2) (2) (2) (2) (2) (2) (2)	12 Point
Nor Nor Nor Nor Nor Nor Nor Nor	22 22 22 33 57 2 11 1 7 1	5 2* 1 1 1 1 1 1 1 1 1 1 1 1 1	Less 0 0 Less 3 1 1 1 1 Less 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Und. 0	No 0	Premay Credit Cr	New Control of Control	Nopeed NC Read	Registed Registed 2 2 2 2 2 2 3 3 3 3 3 3 3 3 3 3 3 3 3	13 Jines 14 Jines 14 Jines 14 Jines 14 Jines 14 Jines 14 Jines 20 Jines 20 Jines 20 Jines 20 Jines 20 Jines 1 1 1 1 1 1 1 1 1 1 1 1 1	6 Pret
Au 0	Увя Увя 11 Увя 2 2 2 3 11 1 1 7 1 1 1 7 1 1 1 1 1 7 1 1 1 1 1 1 1 1 1 1 1 1 1	5 2* 1 1 1 1 1 1 1 1 1	Less	Ust. 0	NC 0	Premay Credit Cr	Neg Charlen Angelde De Seiner and House Margel Margin Leger Angel Margin Leger Ange	No Total St Diales St Dial	Нецьяни Пецьяни 1 1 2 2 2 2 3 1 2 2 3 1 2 2 3 1 2 3 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	13 Jine: 19 Jine: 19 Jine: 19 Jine: 19 Jine: 19 Jine: 10 Jin	t) Point CPuel CPuel

LEED SCORECARD







COST ANALYSIS

Foundation: \$775,000

Structure: \$2,100,250

Interior Finish: \$700,000

MEP: \$5,212,000

Furnishing: \$485,000

Geothermal: \$650,550

Exterior Finish: \$913,000





TOTAL CONSTRUCTION COST: \$11,335,800

RESILIENCE

MATERIAL DURABILITY & LIFESPAN





BUILDING ELEMENTS

MARKET POTENTIAL

Operational Building Expenses (annually)

Power Utilities-	\$0
Grounds upkeep -	\$3,000
Building Admin -	\$65,700
Pest Control -	\$3,000
Waste removal -	\$8,000
Building Security (personnel & systems)-	\$60,000
TeleCom & WIFI-	\$3,000
Cleaning -	\$31,400
Insurance -	\$9,420

Total Expenses - \$182,820

Building Revenue (annually)

Greenhouse - 2,000 SF x \$20 = \$40,000

Office Space (Shared & Private) 36 shared desks x \$300/month/desk = \$129,600 8 private offices x \$900/month/office = \$86,400

Cafe - 700 SF x \$25/sf/month = \$210,000 Total Revenue - \$466,000.00

Net Annual Revenue: \$283,180

CUTY OF ATTACK	DEVELOPMENT
Driving growth to every corner o	Philadelphia
	CUTTON AND SOUTHER

ALENT O



FUNDING SOURCES	
NEW MARKET TAX CREDITS:	\$ 2,680,000
RACP:	\$ 4,000,000
PRIVATE DONORS:	\$ 2,800,000
CITY OF PHILADELPHIA:	<u>\$ 500,000</u>
TOTAL	\$ 9,980,000

CONSTRUCTION COST: \$11,335,800

FUNDING GAP: \$ 1,355,800

THE MODEL




EXPAND THE MODEL

COUPLING THE CITY GRID





Supplemental Materials

MODCELL WALL ASSEMBLY

INSPIRE BRADFORD BUSINESS PARK

LOCATION: Bradford, UK

TYPOLOGY: Office

COMPLETED: 2019

SIZE: 30,000sqft.

Highlights:

Largest straw bale development in Europe

Houses 14 serviced offices and 14 managed work spaces

Utilizes 260 thermally efficient, prefabricated ModCell^{(R)} straw bale wall panels assembled at the nearby Flying Factory^{TM}

Funding provided by a variety of local, federal, and EU funding sources as well as by non-profits









MODCELL WALL ASSEMBLY

YORK ECO DEPOT

LOCATION: York, UK

TYPOLOGY: Office

COMPLETED: 2007

SIZE: 14,000 sqft.

Highlights:

- Utilizes 78 large scale MODCELL panels

- The structure combines a thermally massive floor deck and a laminated timber frame

- Integrated with an entirely passive natural ventilation system









ModCell[®] Core - Manufacturing and install process



Straw bales are chopped to predetermined size and act as the insulation material.

G



Panels are closed and uniquely marked as part of ISO 9001 2017 quality management system



Engineered timber arrives 'flat packed' to flying factory minimising the embodied carbon resulting from transportation.



Panel frames are assembled in a flying factory.



Panel frames are assembled.



Panel assembled and closed to one side prior to being flipped over to have straw installed



Straw is installed into panel



Panel are delivered to site ready for installation



Panels are located onto a sole plate. This also assists when creating an air-tight seal between the base of the panel



Panels are joined together to create an airtight detail and maximise the integrity of the overall structure.



Panel now installed and await final internal and external finish surfaces.



Panels can act structurally or connected to other structural elements, depending on the clients

Standing Column Geo

Friends Center Philadelphia

LOCATION: 1501 Cherry Street, Center City Philadelphia

TYPOLOGY: Multi-Use, Religious Institution

COMPLETED: 2009

SIZE: 56,000 sqft.

Highlights:

Friends Center seeks to be a place that nurtures awareness of the presence of God, enlivens work for peace and justice, and invites the highest aspirations of the human spirit.



Vertical Geothermal = 40 bore holes @ ~500 ft Standing Column = 2 bore holes @ ~1200 ft

Viability + Potential

To determine the viability for geothermal in our region, we identified a successful application of the system within a 3 mile radius of our site. **The Friends School** uses a standing column geothermal with 6 bore holes penetrating between 1000-1500 ft into the earth. 80% of all geothermal on the east coast consists of standing column because it is the most viable option for a heating dominated climate zone. (source 2) Despite going deep into the ground, the standing column requires far less bore holes:

1: https://www.friendscentercorp.org/?page_id=657 2: http://northeastgeo.com/standing-columns/ 3: https://www.builditsolar.com/Projects/Cooling/EarthTemperatures.htm 4: https://www.researchgate.net/publication/303413357 Standing column wells/figures?lo=1

Geothermal

Fedigan Hall, Villanova Campus

LOCATION: 800 E. Lancaster Ave, Villanova, PA 19085

TYPOLOGY: Dormitory, Student Housing

COMPLETED: 2013

SIZE: ~12,000 sqft.

Highlights:

Villanova installed a geothermal system in Fedegan Hall to help reduce the building's dependency on electrically-generated heating and cooling. Geothermal systems use the constant temperature of the earth's crust to cool air in the summer-time, and warm air in the winter time.





https://www1.villanova.edu/villanova/sustainability/CampusSustainabilityBuildingsGroun dsStormwaterDiningRecycling/EnergyClimateSustainability.html

Water-Source VRF + Geothermal

Judge William Lewis House, Strawberry Mansion

LOCATION: 2450 Strawberry Mansion Dr, Philadelphia, PA 19132

TYPOLOGY: Residential, Fairmount Park Services

COMPLETED: 1789, 2009

SIZE: 10,000 sqft.

Highlights: A 2-pipe water-source VRF zoning system tied into the mansion's existing geothermal well field and saved S50,000 up front on installation costs when compared to a 4-pipe system.



http://www.mitsubishicomfort.com/sites/default/files/case-study/strawberry_mansion_ case_study.pdf

Space Type Breakdown



HVAC Load Profiles













REDLINING







The flexibility of the typical office floor plate enables optimal productivity and functionality



SOCIAL ENGAGEMENT



USER CIRCULATION



SOURCES

https://thenounproject.com/search/?q=job&i=1551321

https://www.huffpost.com/entry/how-employee-productivity_n_5620941

https://newscience.ul.com/indoorairquality

http://www.modcell.com/technical/

https://www.osha.gov/Publications/3430indoor-air-quality-sm.pdf

https://pvwatts.nrel.gov