Prototype Laneway Housing, University of Toronto

2021 Canadian Green Building Awards Submission

March 11, 2020

PART 1
PROJECT DESCRIPTION

Use for all categories. For binder submissions, place this form in the first plastic sleeve of your binder, followed by the Project Summary and the Main Project Description. Projects are judged based on criteria of sustainable design, architectural merit and innovation.

2021
CANADIAN GREEN BUILDING AWARDS
THE NATIONAL PROGRAM OF SUSTAINABLE ARCHITECTURE & BUILDING MAGAZINE SABMag

Project categories

Identify which Award category you are entering

☒ **1. Residential [small]**
Open to new or renovated buildings less than 600m² in area, of which a minimum of 75% is dedicated to single-family or multi-family residential uses.

☐ **2. Residential [large]**
Open to new or renovated buildings [typically multi-unit buildings or groups of related buildings] greater than 600m² in area, of which at least 75% is dedicated to residential uses.

☐ **3. Commercial/Industrial [small]**
Open to new or renovated buildings up to 2,000m² in area, of which more than 75% is dedicated to commercial or industrial uses.

☐ **4. Commercial/industrial [large]**
Open to new or renovated buildings [or groups of related buildings] greater than 2,000m² in area, of which at least 75% of the floor area is dedicated to commercial or industrial uses.

☐ **5. Institutional [small]**
Open to new or renovated buildings up to 2,000m² in area, of which more than 75% is dedicated to institutional uses.

☐ **6. Institutional [large]**
Open to new or renovated buildings [or groups of buildings] greater than 2,000m² in area, of which at least 75% of the floor area is dedicated to institutional uses.

☐ **7. Mixed Use**
Open to new or renovated buildings [or groups of related buildings] of any size, in which no individual use exceeds 75% of the overall floor area.

☐ **8. Existing Building Upgrade**
Open to buildings of any size or type in which the primary focus of the work has been to enhance the performance or extend the life of an existing structure. Entries in this category are required to respond only to the submission criteria appropriate to the project.

☐ **9. Interior Design**
Open to interior design projects of any size or type. Entries in this category are required to respond only to the submission criteria appropriate to the project.

An award will be given in each category at the discretion of the jury.

PROJECT DETAILS

Project name: Prototype Laneway Housing, University of Toronto

Address: 366 / 368 Huron St., Toronto, ON

Year completed: 2020

PROGRAM AND CONTEXT

Project type: [Identify all uses occupying 10% or more of gross floor area]

The projects consists of 2 Laneway Houses and 1 Infill House in the Huron Sussex neighbourhood of Toronto. The houses were designed as a prototype for the University to be rolled out across multiple sites in the neighbourhood.

Project site: [Check all that apply]

- ☐ Previously undeveloped land
- ■ Previously developed land
- ■ Urban
- ☐ Suburban
- ☐ Rural

Other Building description: [Check only one]

- ■ New
- ☐ Renovation
- ☐ Both [If both, list __% new and __% renovation]

STATISTICS* Provide the following metrics as applicable to your project.

- Site Area: 399 m^2
- Building gross floor area: 380 m^2
- Energy Intensity: 47.3 KWhr/m^2/year [Include both base building and process energy]

[optional: report energy intensity separately as follows:

- Energy Intensity, base building: 102 KWhr/m^2/year
- Energy Intensity, process energy: 2.4 KWhr/m^2/year

- Reduction in energy intensity: 54 %.
- State the reference standard on which the % reduction is based: MNECB, NECB or ASHRAE 90.1

[include version]: ASHRAE 90.1

- Recycled materials content: N/A % by value
- Water consumption from municipal source: 44,880 litres/occupant/year

[Include both base building and process consumption]

- Reduction in water consumption: 51 %
- State the reference on which the % reduction is based: LEED ■ or other ☐
- Construction materials diverted from landfill: 85* %
- Regional materials by value: 15-25 %

***NOTE FOR PART 9 RESIDENTIAL PROJECTS: PROVIDE THE STATISTICS ABOVE IF AVAILABLE.** Include in the Executive Summary [see next page] the EnerGuide or the Home Energy Rating System [HERS] ratings if available, and the WalkScore rating [see www.walkscore.com]. Also, a qualitative assessment of project performance should be included in the appropriate sections of the narrative.

Prototype Laneway Housing

University of Toronto

PROJECT SUMMARY

These prototypes are the vanguard of forty laneway and infill homes proposed for the Huron Sussex Neighbourhood, a historic precinct adjacent to University of Toronto's downtown campus. The project advances urban intensification in a location well served by public transit and existing municipal infrastructure, while revitalizing and helping to sustain its immediate heritage context.

Mandated to deliver affordable, sustainable housing for family living and co-habitation, the project utilizes a prefabrication approach to reduce community impacts during construction and enhance performance outcomes. Sympathetic to scale, massing, and neighbourhood context, the prototypes provide 'accessibility through proximity' and are clustered to create a shared outdoor courtyard and to initiate a 'living laneway' concept with homes accessed from the lane.

Designed using Passive House (PH) principles and all wood construction, the project optimizes prefabrication and on-site assembly methods and utilizes PH certified wall panels (R-45) with factory installed windows (R-7), Structural Insulated Panels (R-54) for the roof, and a shallow super-insulated foundation system (R-24) that minimizes site operations. Designed to achieve net-zero annual energy with no on-site emissions, the prototypes incorporate solar PV panels and earth-tubes for pre-conditioning fresh air - enabling higher levels of ventilation for a healthier indoor environment. The three prototypes include:

- 3 bedroom + 2 study (2100 gsf)
- 2 bedroom + study, (1100 gsf)
- 1 bedroom + study, (900 gsf)

1. Strategic Decisions

Securing community support was essential to the project's success. Community and University's interests overlapped in key areas, which influenced design:

- *Site Optimization* - Larger infill laneway homes suitable for family and co-habitation living were realized (vs. smaller laneway 'suites' advocated by the City).
- *Exemplary Sustainable/Affordable Housing* - Passive House concepts optimize energy and lifecycle benefits, and an all-electric approach enables Net Zero outcomes, which enhance resiliency for homes and community.
- *Community Responsive Design* - Applying micro-grid thinking, the prototypes share an integrated rooftop PV array, and an earth tube system which preconditions ventilation air. In the winter the earth-tubes pre-heat air by up to 15°C and in the summer cools and removes humidity eliminating mechanical cooling requirements. This system was realized due to the demolition of a derelict house – its basement provided the opportunity to install the system prior to backfilling and redevelopment of the site as a playground for the neighbouring daycare.
- *Prefabrication* - Reduce community impacts from construction while enhancing Quality, Cost, Scheduling, and Replicability objectives. Prefabrication enabled tighter construction, reduced air leakage and reduced construction by 2 months. The premanufactured, frost-protected slab-on-grade foundation enabled a single concrete pour versus three (i.e. footing, frost-wall, slab), reduced concrete usage and excavation.

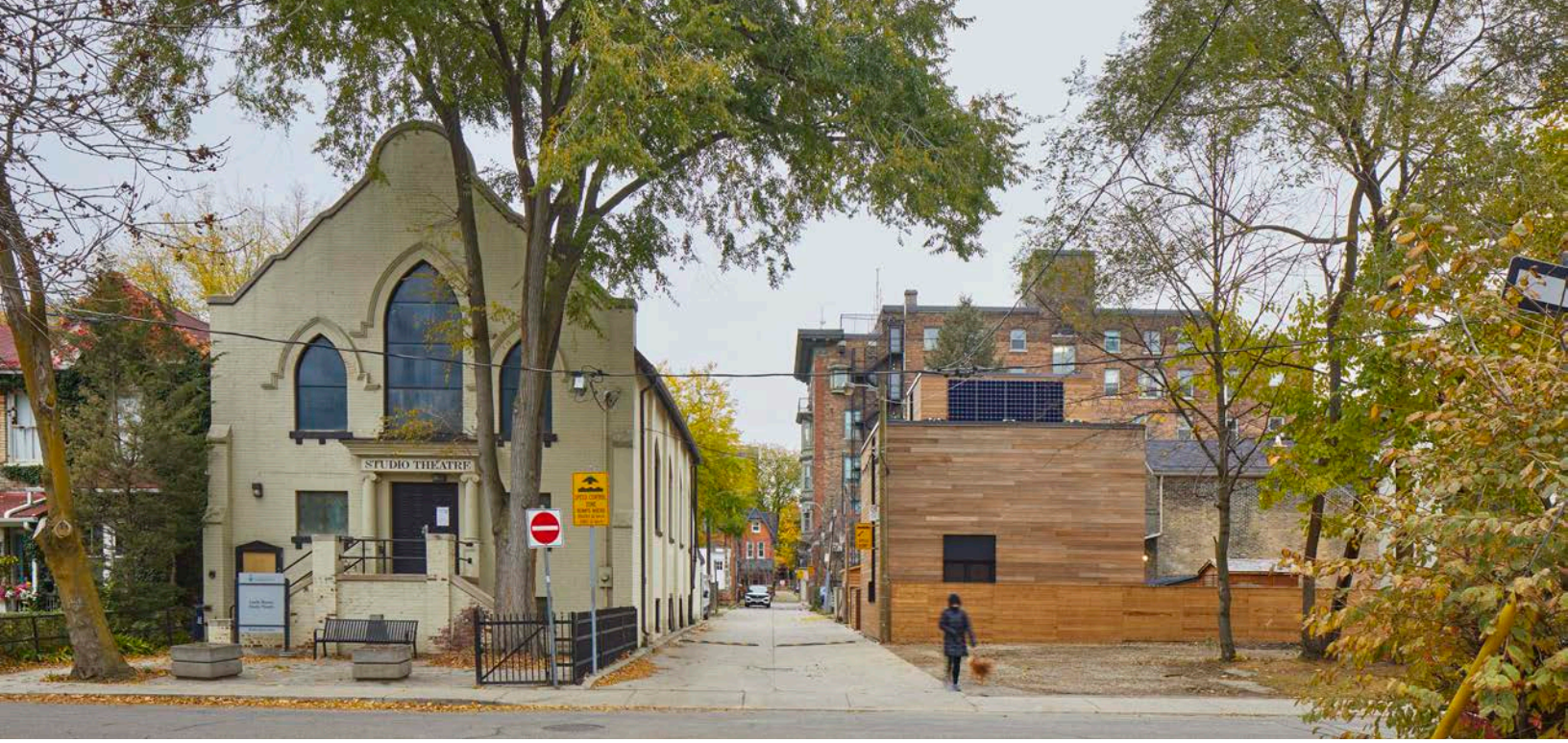

Photo by Tom Arban

2. Community

The neighbourhood has undergone a transition from family to student housing, leaving many of the existing residents and homeowners longing for closer ties with their neighbours. The Neighbourhood Association supported the construction of larger 'laneway homes' better suited for families and long term co-habitation (as opposed to 'laneway suites' suitable only for empty nesters) to encourage community investment, and discourage more impactful forms of neighbourhood re-development. Located within short walking and bicycling distances to campus, the prototypes provide 'accessibility through proximity' and eliminate automobile dependency, with zero parking provisions. The neglected laneway system is reinvented from a secondary parking lot into a pedestrianized 'living laneway' that complements the traditional streetscape. The project has implications well beyond the neighbourhood and is a prototype for housing in the 21 century.

3. Site Ecology

The prototypes are located on a tight urban lot in downtown Toronto. The large, mature tree to the south of the site was maintained by setting the building façade back from the street line and was protected during construction. The spacious internal courtyard serves the site for rainwater re-charge and allows residents to develop their own gardens.

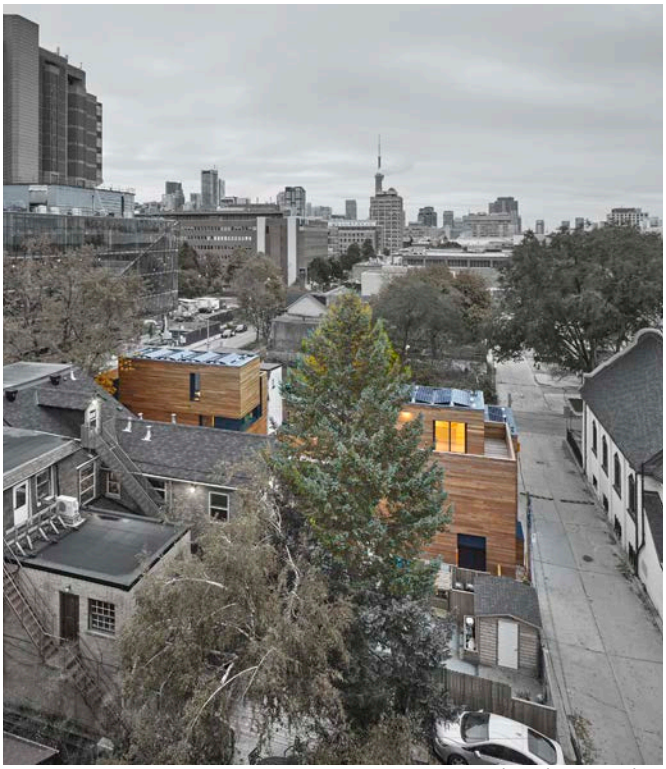

Photo by Tom Arban

Photo of Earth Tube Installation

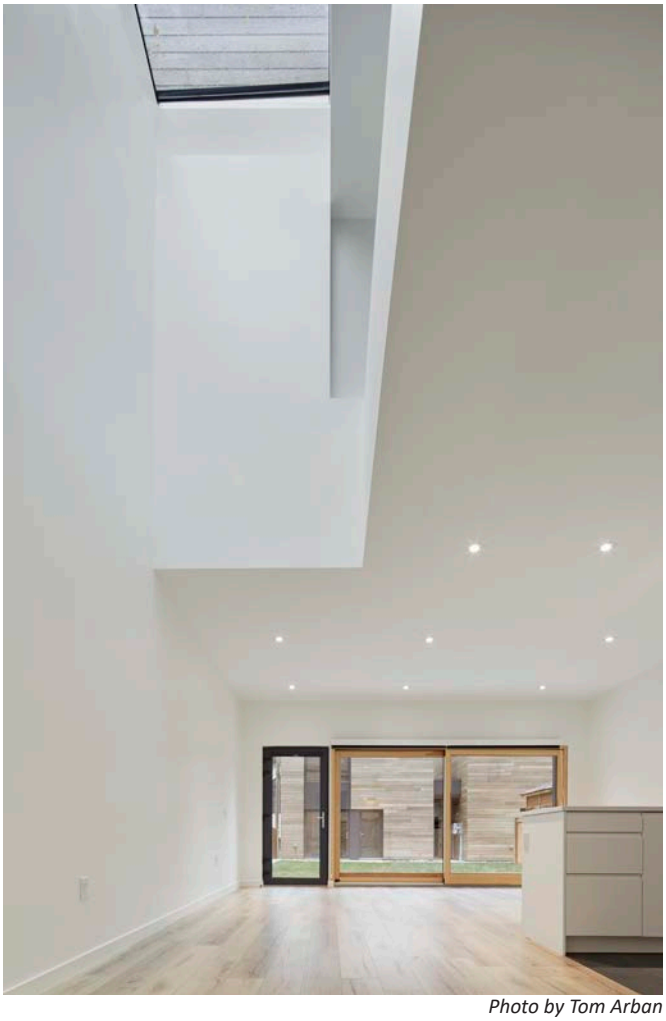

Photo by Tom Arban

4. Light and Air

The Infill House is “smart ventilated” using an automated Conditioning-ERV (CERV) system that monitors indoor air carbon dioxide and VOC concentration levels. It works ‘on demand’, or when it is more energy efficient to condition using outside air, to provide additional ventilation without an energy penalty. This is further enhanced by the integration of an earth-tube system that preconditions ventilation air. The CERV works automatically when it is nicer outside than inside. The increased efficiency of the heat pump system together with the earth tube enables fresh air to exceed minimum ASHRAE ventilation by 50% without increasing energy costs.

The modest floor plate of the laneway houses, and overhead skylight for the infill house, enable effective daylighting of interiors. All floor areas are within 7m of an operable window which enable direct user control of ventilation as part of a resiliency strategy and are distributed to facilitate stack effect across multiple levels. LED light fixtures augment natural lighting and have a projected annual energy consumption of 0.4kWh/m2/yr.

5. Wellness

Biophilic connections are embedded in the planning of the prototypes. PH certified windows and sliding doors are strategically positioned to provide through-views and direct connections to the outdoors/courtyard/sky. The two larger units feature rooftop terraces with expansive city views. The prototypes were blower door tested at or below 0.5 air changes per hour (ACH), exceeding the PH standard of 0.6 ACH - with no leak chasing required. In addition to enhancing energy performance, the pre-fabricated envelope approach provides improved thermal and acoustic comfort for occupants - free of mould. OSB floor, wall and roof sheathing systems use ‘no-added formaldehyde’ resins, and all internal finishes are VOC-free and/or CARB2 certified for a healthier indoor environment.

Photo by Guelph Solar

6. Water Conservation

The project utilises low-flow, WaterSense certified plumbing fixtures throughout and Energy Star rated washing machine and dishwasher. The inline water heaters provide instantaneous hot water and heat recovery is used on the shower drains. This enables a 51% reduction in water used over an OBC design building. 100% of storm water is recharged on site within the courtyard using a French drain system buried below grade.

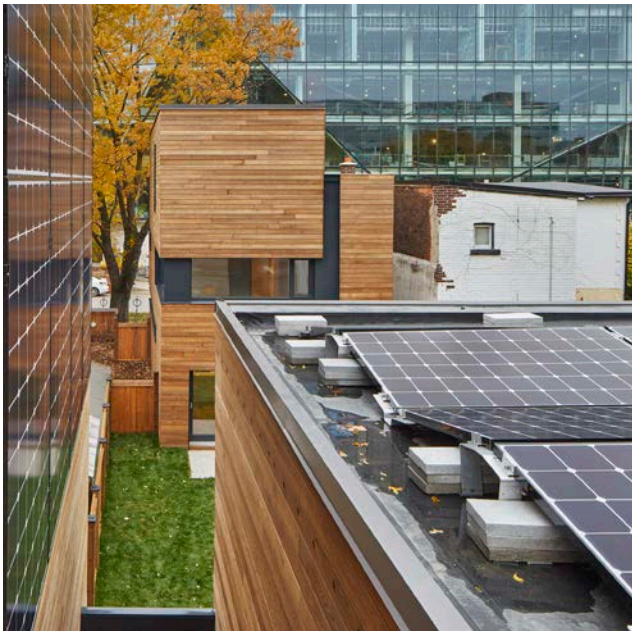

Photo by Tom Arban

7. Energy Present and Future

Designed using PH principles, the prototypes use an all-electric systems approach that operates in concert with rooftop solar PV systems and an earth-tube system for pre-conditioning ventilation air. With a combined projected annual energy use of 19,767kWh, and combined renewable energy generation of 20,075kWh, the prototypes are projected to realize net-zero energy operations in year one.

Projected annual energy for each of the three prototypes is noted in the accompanying chart, which slightly exceeds PH performance standards. This exceedance is due to site specific shading conditions / reduced solar access, and regulatory constraints which limiting glazing facing the southern property line. Future laneway houses located on east-west lanes with improved solar and reduced regulatory constraints should outperform the EUI benchmarking established by these prototypes.

Photo of Shallow foundation/ insulated slab system

Photo of Prefabricated PHI Certified Panel Installation

8. Materials and Resources

An 'all wood' approach was adopted for its renewable / carbon sequestering attributes and FSC custody framework. The shell is constructed using a PH certified panel system that eliminates the need for specialized labour and enables a replicable approach for environmental performance and cost predictability. The prototypes are clad in thermally treated ash – a locally harvested and manufactured product (Guelph, Ontario) which is readily available due to the devastating impact of the Emerald Ash Borer. The thermal treatment dramatically improves the hardness, rot / insect resistance, and durability (transforming Durability Class DC- 3 to the highest DC1 - EN 350 durability standard).

A super-insulated EPS foundation and forming system avoids the need for conventional concrete footings and formwork, further reducing the carbon footprint of the project. EPS insulating materials in the SIP's, wall panels, and slab are all HCFC free. Sealants and Flashings are all LBC Red List Free. The prefabrication approach of the shell, slab and pre-glazed windows provides an estimated 95% reduction in construction waste* (Buildsmart*).

9. Building Life Cycle Considerations

In addition to the life cycle considerations embedded in the project's prefabricated approach, the larger infill housing vision contributes directly to community stability. The infusion of new investment and intensification of built form in a manner that co-exists and enhances the scale and character of the neighbourhood's heritage housing stock serves to promote overall community sustainability and advance life cycle considerations at a community scale.

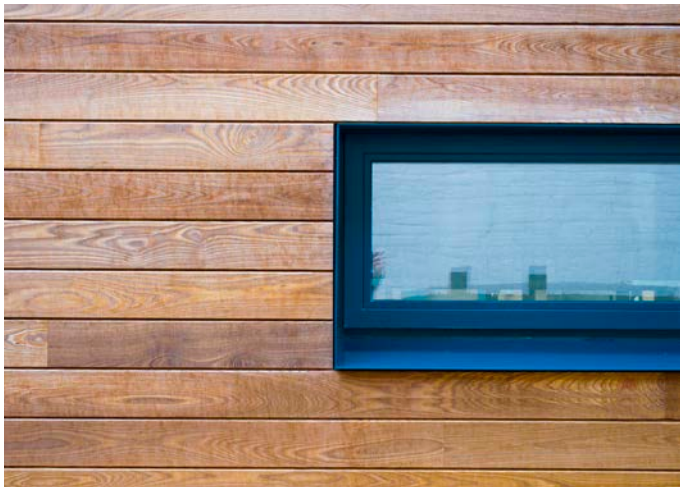

Photo of Thermally Treated Ash Cladding and PHI Certified window

Photo by Tom Arban

10. Education and Information Sharing

These first generation prototypes have demonstrated the concept of pre-fab + Passive House + net zero energy, confirming that high performance / low impact construction can be less complicated and delivered without a cost premium over traditional construction, helping make PH and compact laneway living accessible to wider audiences.

Monitoring for operational / performance effectiveness and using 'lessons learned' from residents will enable improvement as more affordable net-zero housing is rolled out throughout the Huron-Sussex Neighbourhood. As part of its educational sharing mandate, the University conducted daily tours of the homes before they were occupied (in keeping with COVID distancing recommendations!), and the houses have been featured in a range of local media, including UofT's newsletter.

Photo by Tom Arban

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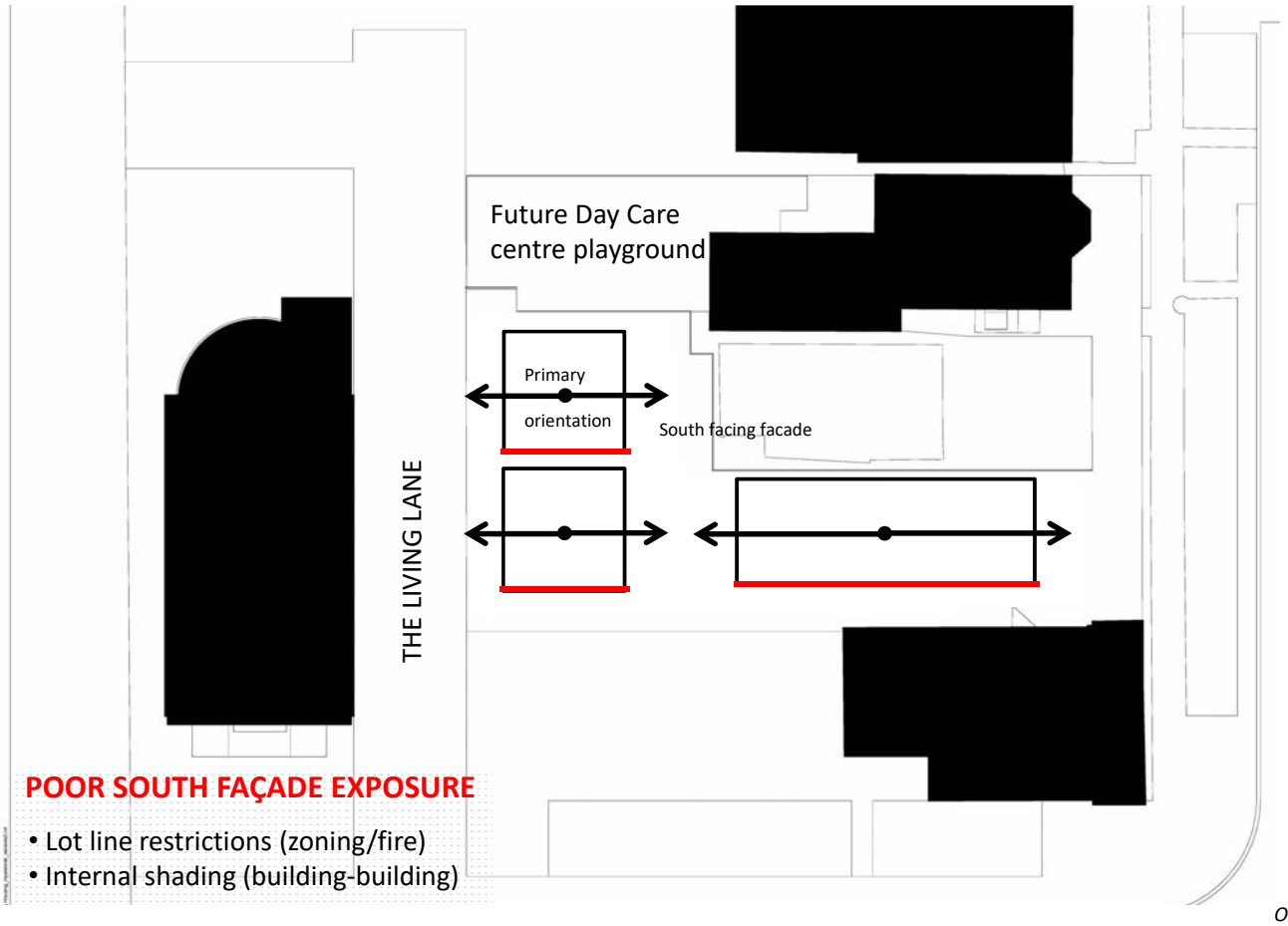
Photos by Tom Arban

Photo by Tom Arban

Huron Sussex Neightbourhood Planning Study - Identified Laneway and Infill Housing Sites (Neighbour Plan Prepared by Others)

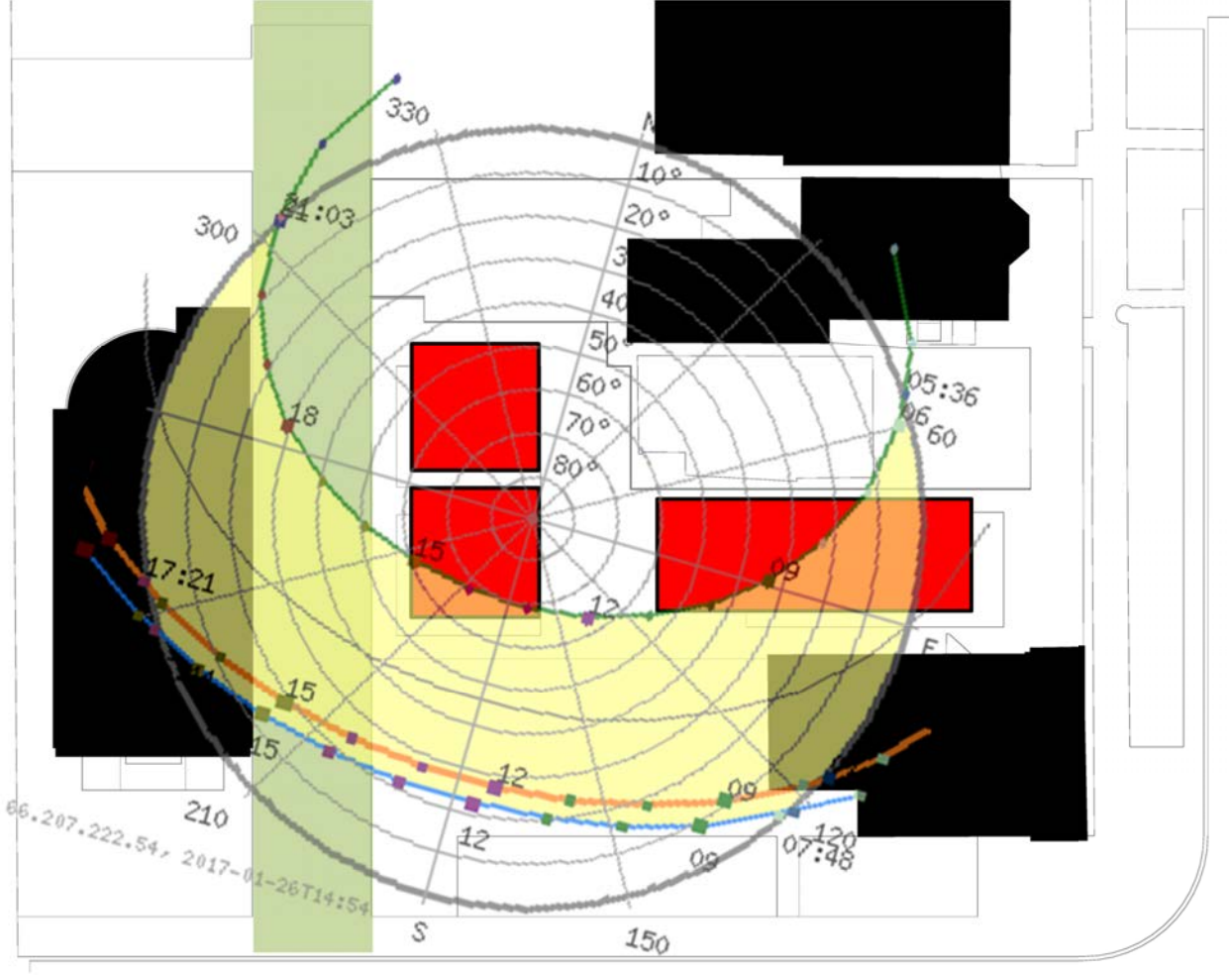
Immediate Context



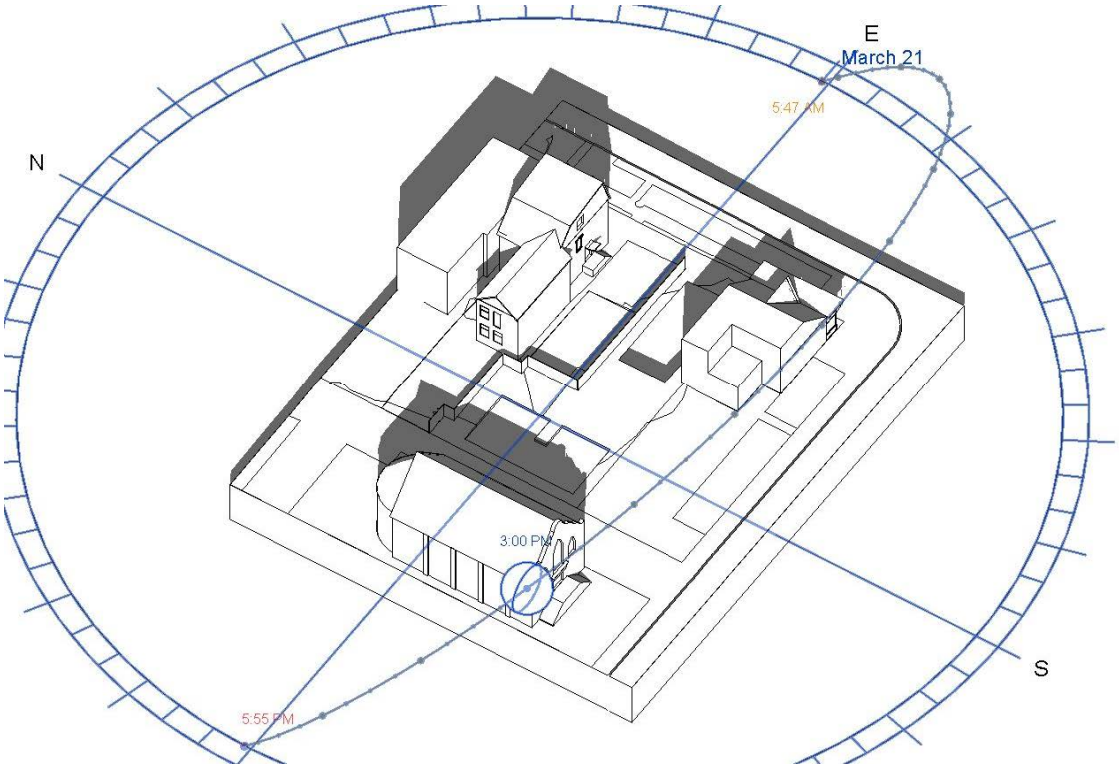
POOR SOUTH FAÇADE EXPOSURE

- Lot line restrictions (zoning/fire)
- Internal shading (building-building)

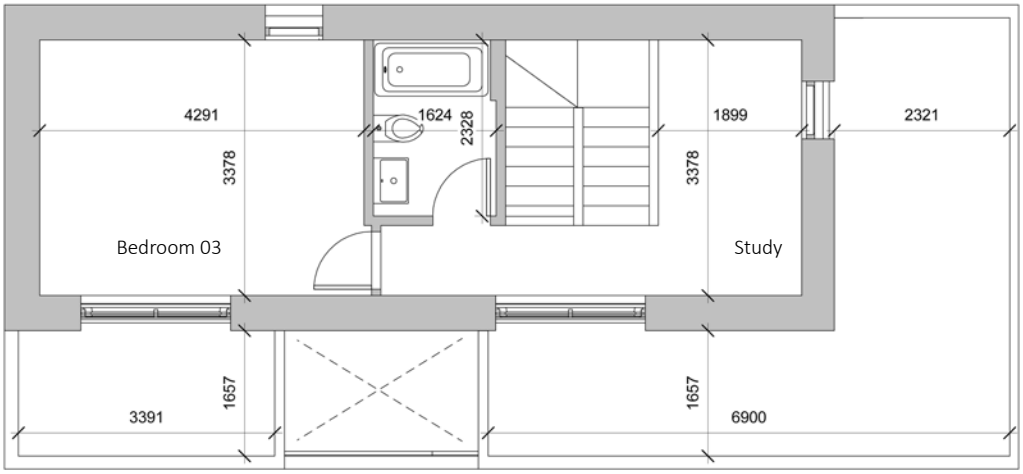
Orientation



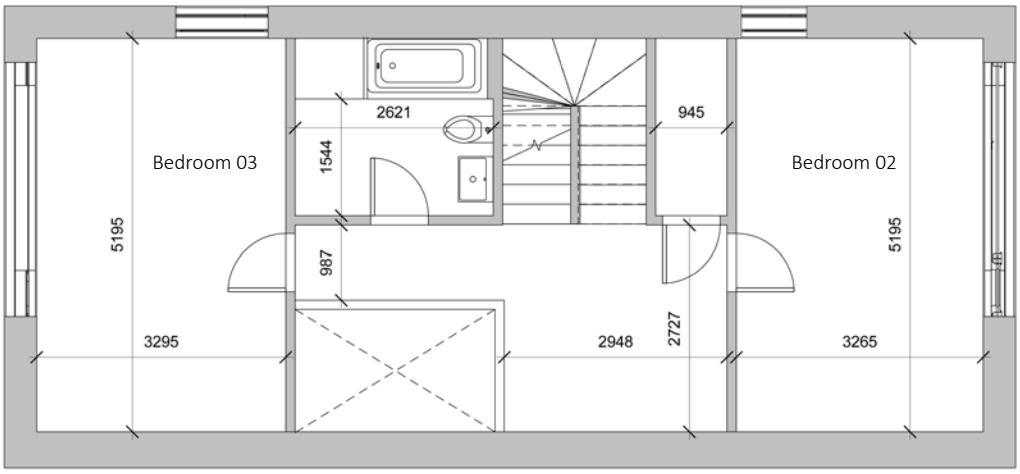
Sun Path



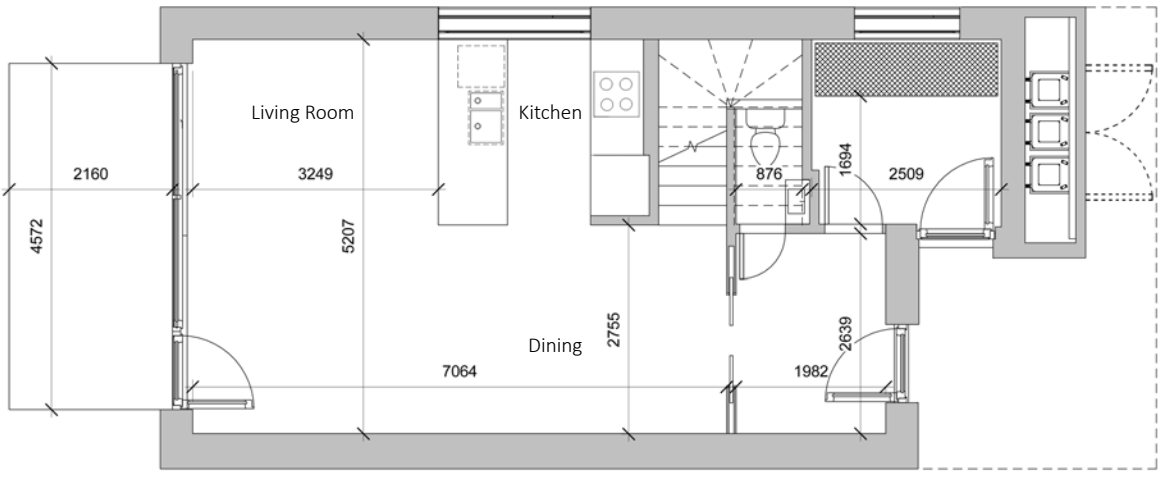
Solar Analysis - September/ March 21st 3:00 PM



3 Layout Drawings - Infill House - Third Floor



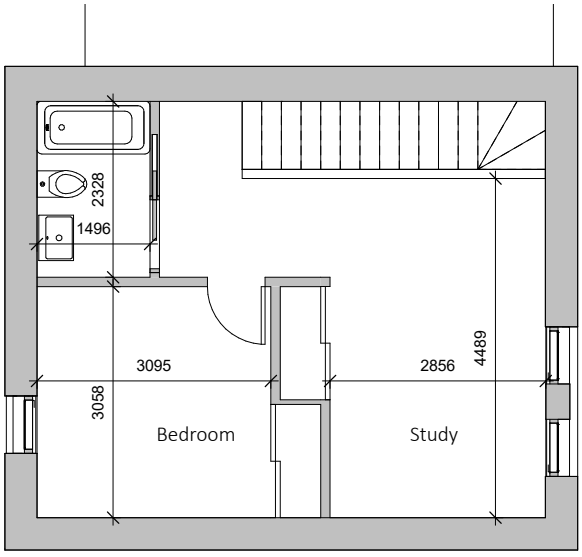
2 Layout Drawings - Infill House - Second Floor



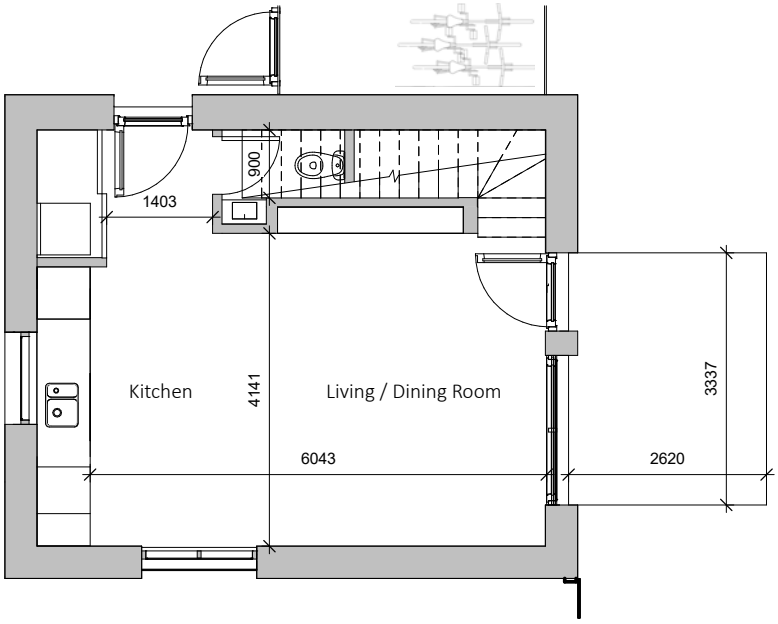
1 Layout Drawings - Infill - Ground Floor

Elevations - 3 Storey Infill House Prototype

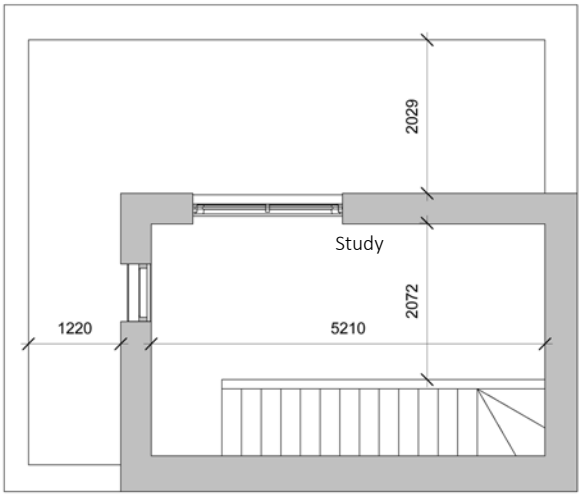
Section - 3 Storey Infill House Prototype



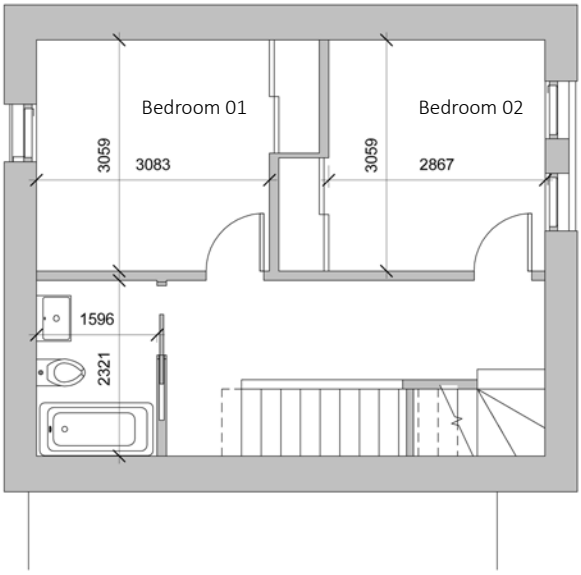
2. Layout Drawings - Two Storey - Prototype Second Floor



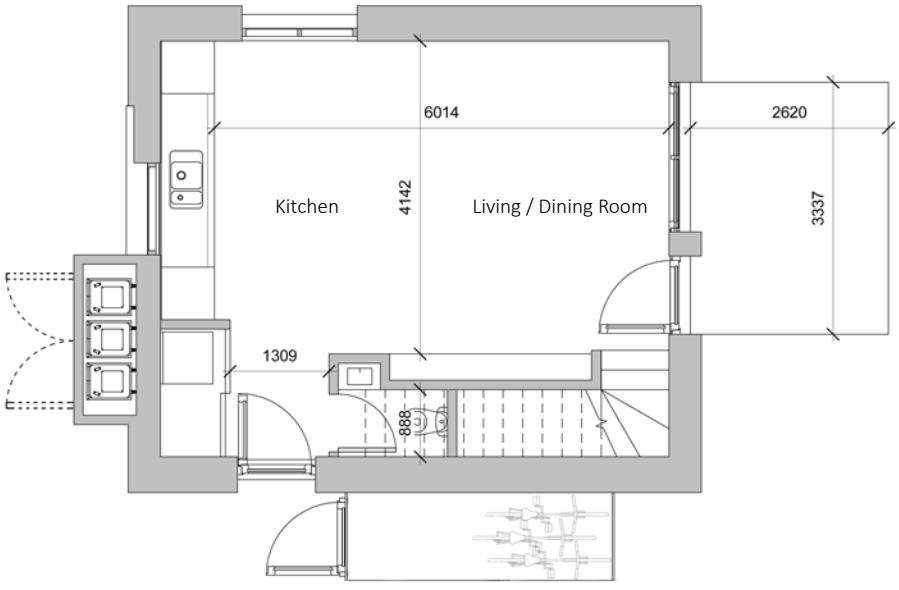
1. Layout Drawings - Two Storey - Prototype Ground Floor



3 Layout Drawings - Three Storey - Third Floor Copy 1



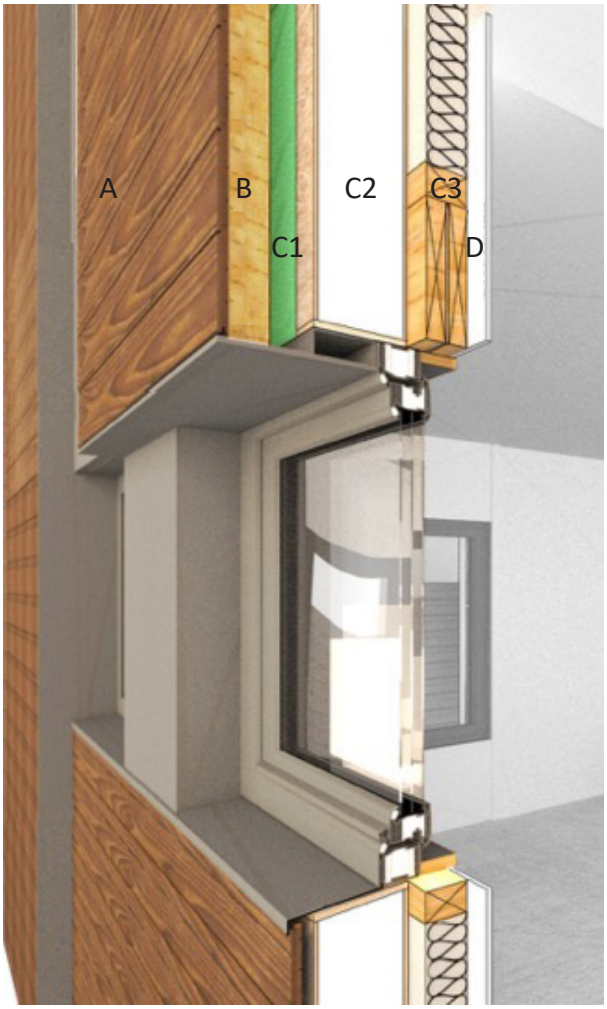
2 Layout Drawings - Three Storey - Second Floor



1 Layout Drawings - Three Storey - Ground Floor

Elevations - 2 Storey Laneway House Prototype

Elevations - 3 Storey Laneway Prototype

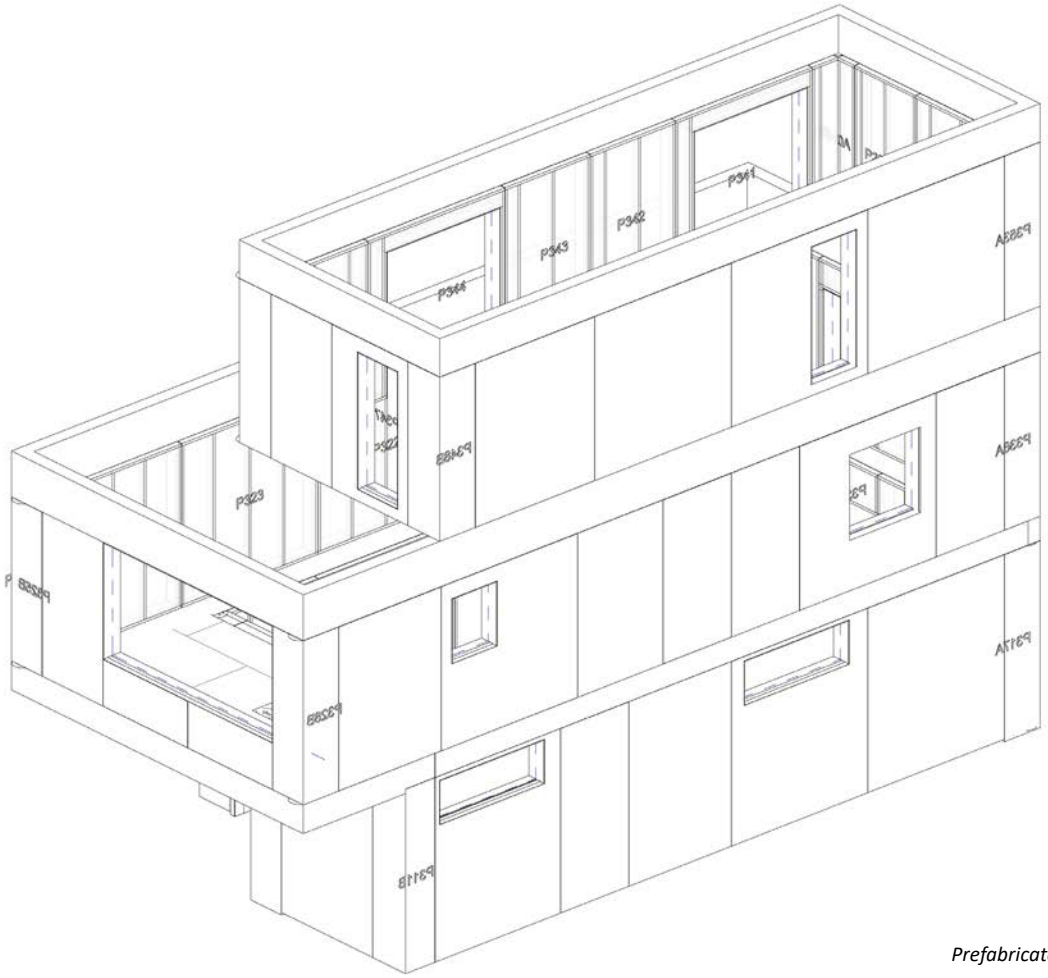


Assembly Detail

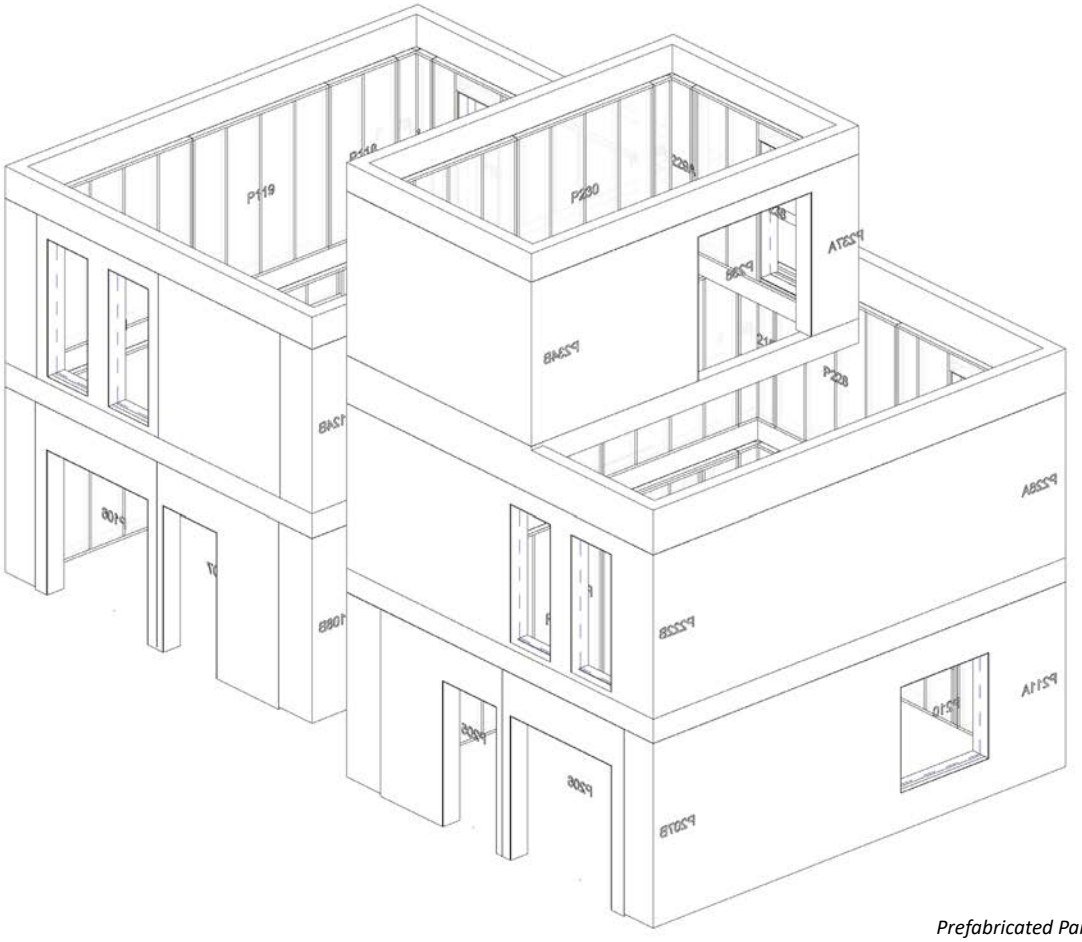
A Thermall Treated Ash Sliding
B Ventilated Cavity Space
C1 ZIP wall Weather Resitive Barrier
C2 EPS Insulation
C3 Sheathing/ VB
C4 2X4 Framing w. Field Applied M.F. Insulation
D Drywall

Perspective Section Through Site

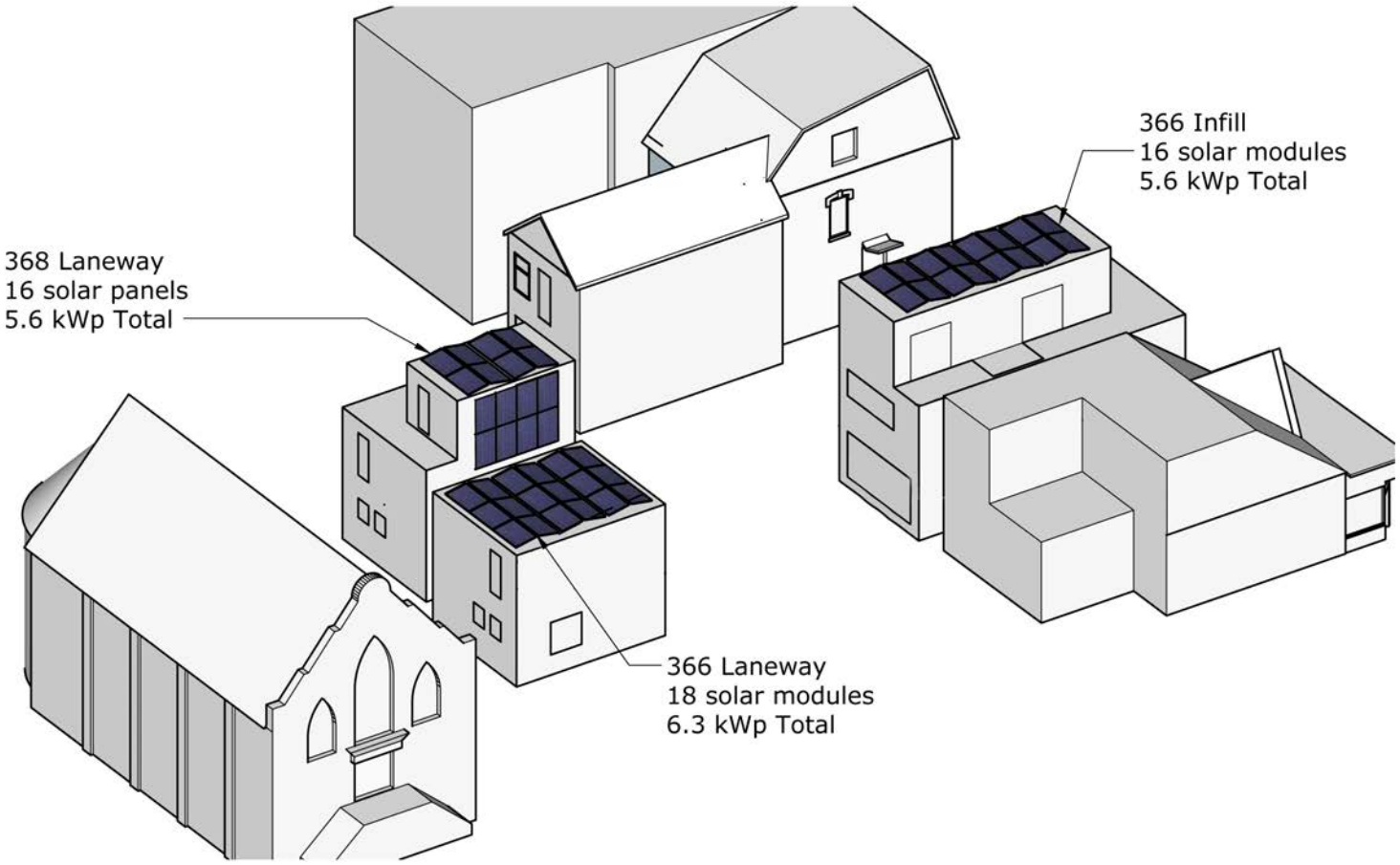
Prefabricated PHI certified envelope assemblies

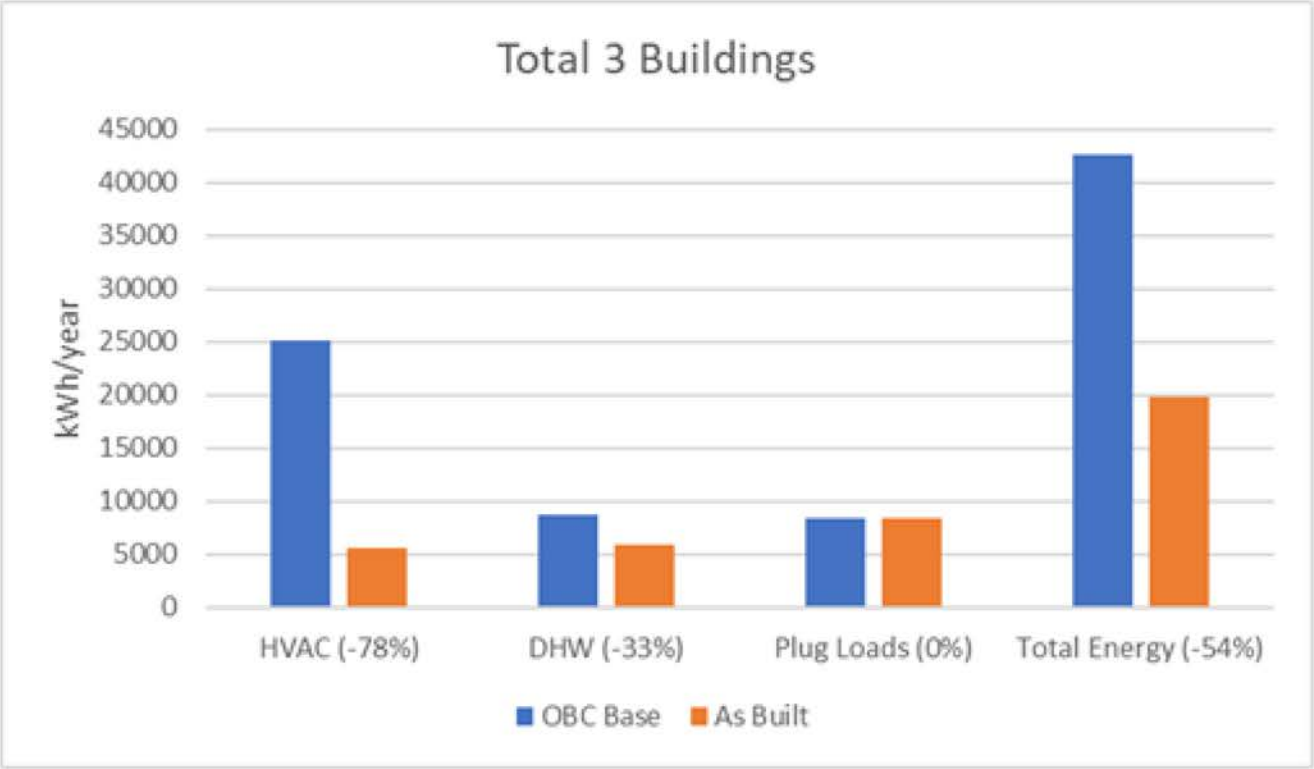


Prefabricated Panel Layout Drawings -
Infill House Prototype



Prefabricated Panel Layout Drawings -
Laneway Housing Prototype


366 Infill
16 solar modules
5.6 kWp Total
368 Laneway
16 solar panels
5.6 kWp Total
366 Laneway
18 solar modules
6.3 kWp Total



		Peak Loads (kW)		HVAC	DHW	Plug Loads	Total Energy
		Heating	Cooling	kWh	kWh	kWh	kWh
366 Infill	OBC Base	9.9	7.4	13376	4332	3504	21692
	As Built	6.9	7.3	2409	1451	3505	7364
		-30%	-1%	-82%	-67%	0%	-66%
366 Laneway	OBC Base	4.2	3.2	5394	1741	2190	9324
	As Built	2.5	2.8	1550	1741	2190	5483
		-40%	-13%	-71%	0%	0%	-41%
368 Laneway	OBC Base	5.3	4	6393	2611	2628	11632
	As Built	3.3	3.5	1680	2611	2628	6920
		-38%	-13%	-74%	0%	0%	-41%
Total	OBC Base	19.4	14.6	25163	8684	8322	42648
	As Built	12.7	13.6	5639	5803	8323	19767
		-35%	-7%	-78%	-33%	0%	-54%

Energy Saving - As Built versus OBC Baseline energy profile

366 Huron Street

University, Toronto, M5S 2G4

Commute to **Downtown Toronto**

4 min 16 min 7 min 27 min View Routes

Favorite Map Nearby Apartments

Walk Score 96

Walker's Paradise

Daily errands do not require a car.

Transit Score 100

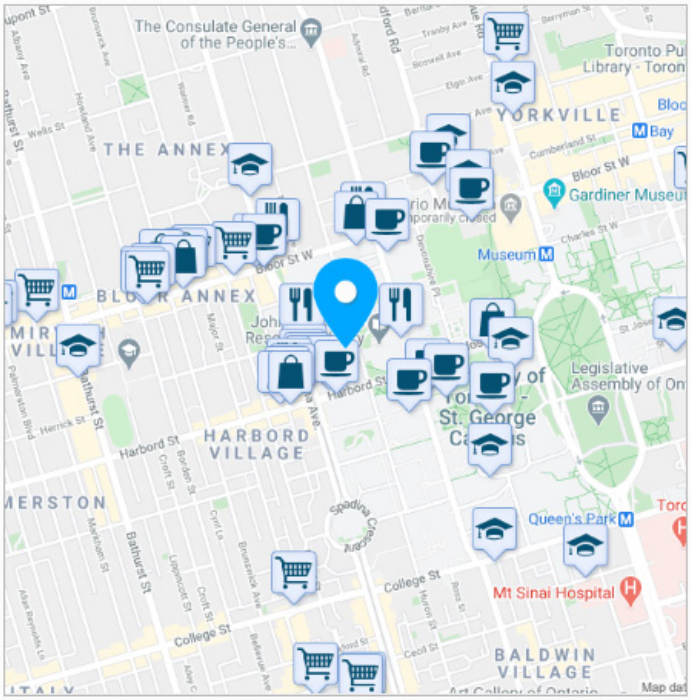
Rider's Paradise

World-class public transportation.

Bike Score 97

Biker's Paradise

Flat as a pancake, excellent bike lanes.



About your score

Add scores to your site

Walkscore Rating