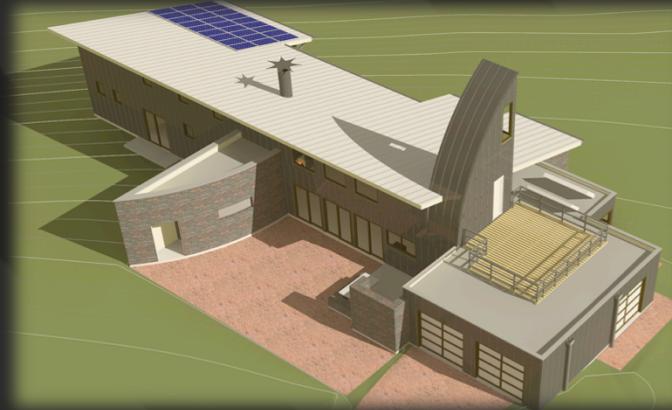


# BIM for Small Projects: Case Studies in Innovative BIM Use by Small Firms



## Presenters:

David Scheer, AIA, AIA TAP

Jeffrey Ouellette, Assoc. AIA, AIA TAP

Travis Young, AIA, Studio Momentum

François Lévy, AIA

Bradley Khouri, AIA, b9 architects Inc.

## 2011 AIA-TAP Webinar Series

October 14, 2011



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# AIA/CES Compliance Statement

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# AIA/CES Course Summary

There is a widely shared perception that small firms and sole practitioners cannot take advantage of Building Information Modeling due to such factors as its cost, complexity, training time, and productivity for small projects. These case studies, presented by architects who work in small firms or as sole practitioners, will demonstrate how BIM has enhanced their practices and enabled them to create excellent projects.

This webinar is co-sponsored by the following fellow KCs:

**Custom Residential Architects Network**

**Small Project Practitioners**

**Interior Architecture Knowledge Community**

**Small Firm Roundtable**



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# AIA/CES Learning Objectives

1. Learn how small practices are making innovative and productive use of BIM.
2. Learn how such practices are using BIM to offer integrated design and construction services to their clients.
3. Compare how various BIM platforms perform in a small practice environment, including ArchiCAD and Vectorworks.
4. Learn how your practice can implement BIM in a way that meets your specific needs and helps you achieve your goals.



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# Webinar Schedule

90 min. - Eastern Daylight Savings Time (EDT)

**1:00 - 1:15 pm**

Welcome, General Comments, and Introductions

*David Scheer & Jeffrey Ouellette*

**1:15 - 1:30 pm**

A case study of BIM utilization in a firm of one

*Travis Young, Studio Momentum*

**1:35 - 1:50 pm**

Boussoleil Case Study

*François Lévy, Architect*

**1:55 - 2:10 pm**

b9 architects and BIM

*Bradley Khouri, b9 architects inc.*

**2:15 - 2:30 pm**

Q & A



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2011 chair

**David Scheer**  
2012 chair

**Kimon Onuma**  
2013 chair



**Stephen Hagan**

**Kristine Fallon**

**Tony Rinella**

**Active Past Chairs**



**Brian Skripac**

**Jeff Ouellette**

**Karen Kensek**

**Luciana Burdi**

**Marty Doscher**

**Mike Kenig**

**Pete Evans**



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# TAP Upcoming Events

- **November 17, 2011 – “Faster Forward” TAP Conference**
  - In conjunction with Build Boston 2011
  - Hybrid, multi-venue, multi-cast event
  - [Details, Schedule, and Registration](http://network.aia.org/CenterforIntegratedPractice/Home/FasterForward2011/) <http://network.aia.org/CenterforIntegratedPractice/Home/FasterForward2011/>
- **December 05, 2011 – Building Connections - Washington, D.C.**
  - Conference of industry owners, vendors, service providers, and standards organizations
  - Current state of interoperability
- **December 06, 2011 – ecobuild america - Washington, D.C.**
  - AIA BIM Awards, Technology Education, BIMstorm, & IFC Awareness



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# BIM for Small Projects:

## Case Studies in Innovative BIM Use by Small Firms



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**Studio Momentum**  
Austin, Texas  
[www.studiomomentum.com](http://www.studiomomentum.com)



**François Lévy, AIA**  
Austin, Texas  
[www.francoislevy.com](http://www.francoislevy.com)



**Bradley Khouri, AIA**  
**b9 architects Inc.**  
Seattle, Washington  
[www.b9architects.com](http://www.b9architects.com)



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# BIM for the Small Firm

A case study of BIM utilization in a firm of one

Studio **Momentum**

Travis G. Young, AIA



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# History and Transitions

- Hand Drawing Hold Out.
- Switching to Autocad in the “Late” 90’s.
- Realizing the virtues of digital drafting.
- Final BIM Transition in 2006.



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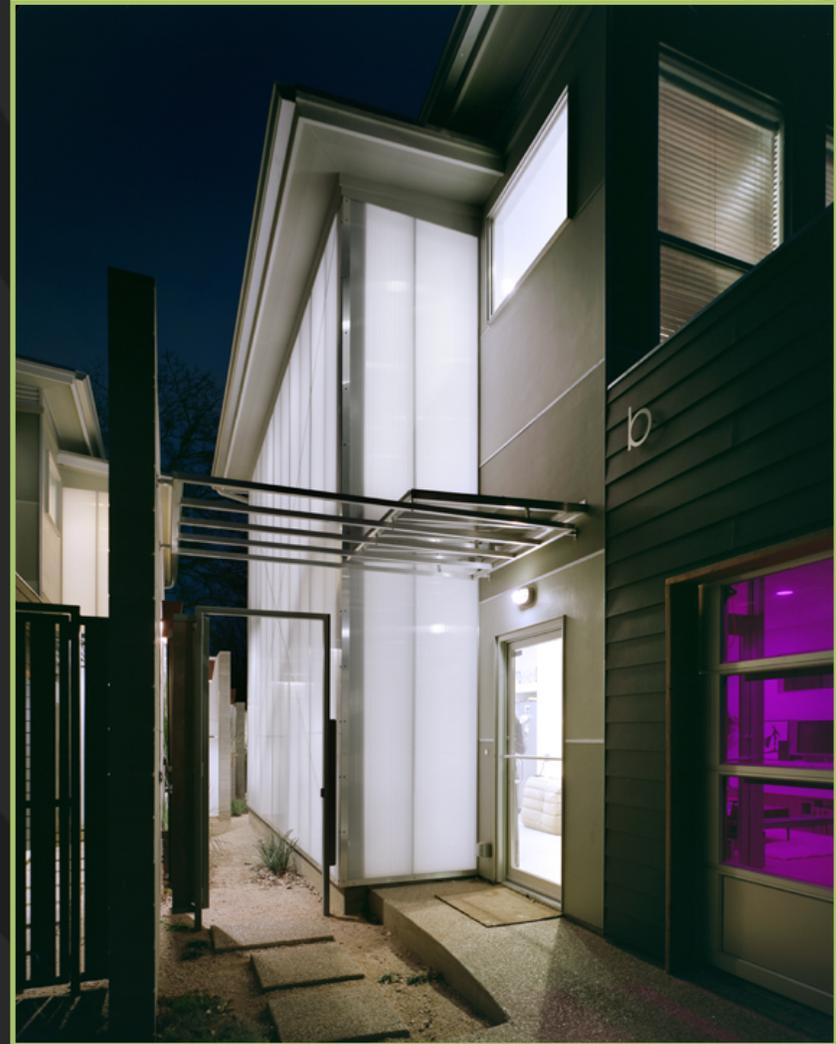
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# Economic Impact

- Expect \$3k to \$4k per suite.
- Expect \$2k to \$3k in hardware per suite.
- Expect update and maintenance in the \$1k range per year.
- Expect \$1k per person in continuing education.
- Expect significant cost associated with initial personnel training.



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# Effect on Work Structure and Billing

- More Time on Design.
- Increased feedback on design options.
- Design becomes primary commodity versus construction documentation.
- Once training is complete, faster turn around on CD's.
- Should increase up front billing to account for model creation.
- Personnel must be less specialized.



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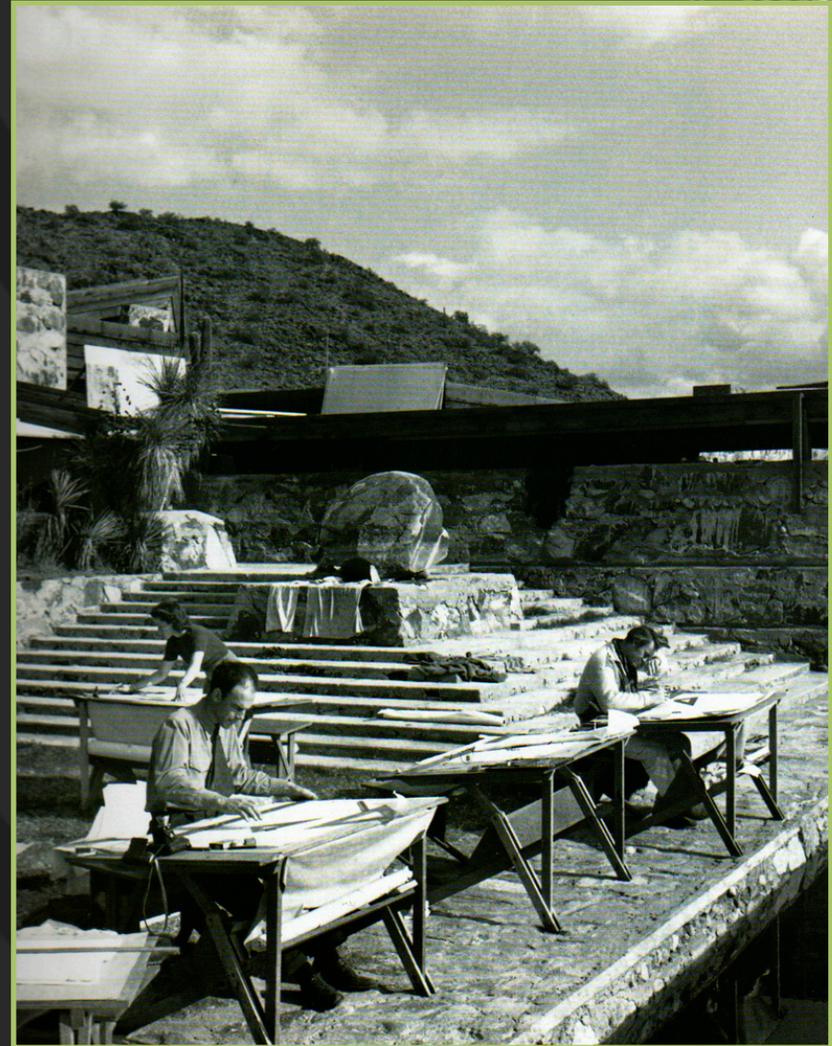
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## Personnel

- Traditional setup of designer w/ pool of draftsman is upset.
- Training costs are prohibitive.
- Need well rounded experiences.
- Software should have teamwork functionality, or at least address how multiple workers access the project file.



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# Contract Documents

- Traditional 2D format should be rethought.
- 3D walkthrough w/ contractor and subcontractors have become the norm.
- Onsite computers and tablets are becoming more common.
- Easy interface w/ model is essential for trades.
- Communication is the key as always.



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**1** Master Bath  
1:2.339



**2** Living Room  
1:2.339



**3** View From Nook  
1:2.339



**4** View From South  
1:2.339



**5** View From Garage Deck  
1:2.339



**6** North West View  
1:2.339



**7** North East View  
1:2.339



**8** South East View  
1:2.339



**9** South West View  
1:2.339

studio momentum  
architects, p.c.  
4334 Barrow Road  
Brooklyn, NY 11234-3005  
516-222-7763 fax



I, STEPHEN M. MURPHY, ARCHITECT, do hereby certify that the above described project was prepared by me or under my direct supervision and that I am a duly licensed architect in the State of New York. I am not providing any services to the client in any other capacity.

Project:  
**WEST RESIDENCE**  
14020 Lake View Drive

Date:  
FOR CONSTRUCTION  
JANUARY 30, 2006

Revisions:  
April 10th, 2006  
Revision #1

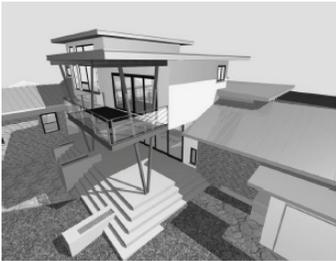
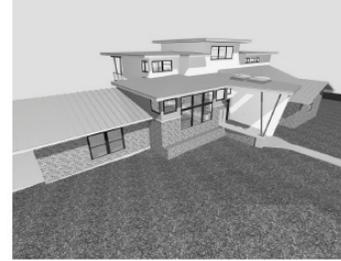
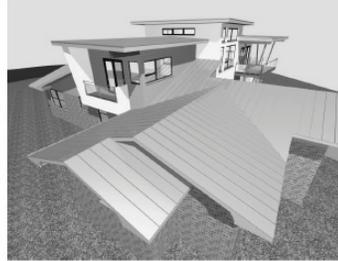
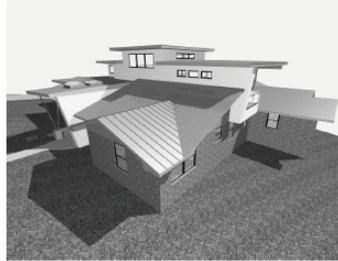
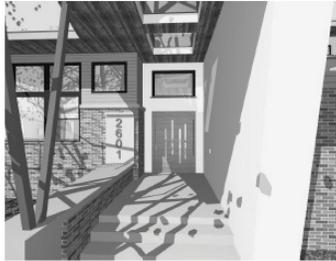
Sheet Title:  
**Three Dimensional Views**  
Sheet Number:  
**A1.1**



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Studio Momentum

1415 Justin Lane  
Austin, Texas, 78757  
817-452-7861



Project:  
**Turner  
Residence**  
2601 Pickwick  
Rollingwood  
Texas

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7/12/11  
For Construction

Revision:  
Revision #1

Sheet Title:  
Three  
Dimensional  
Images

Sheet Number:  
A6.1



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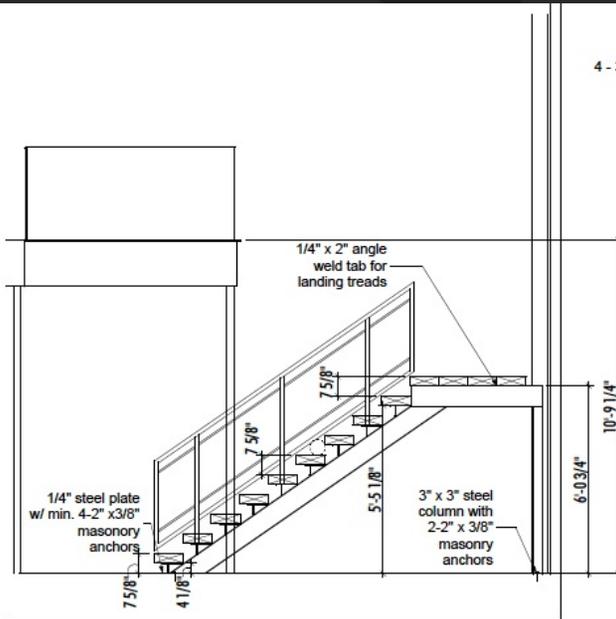


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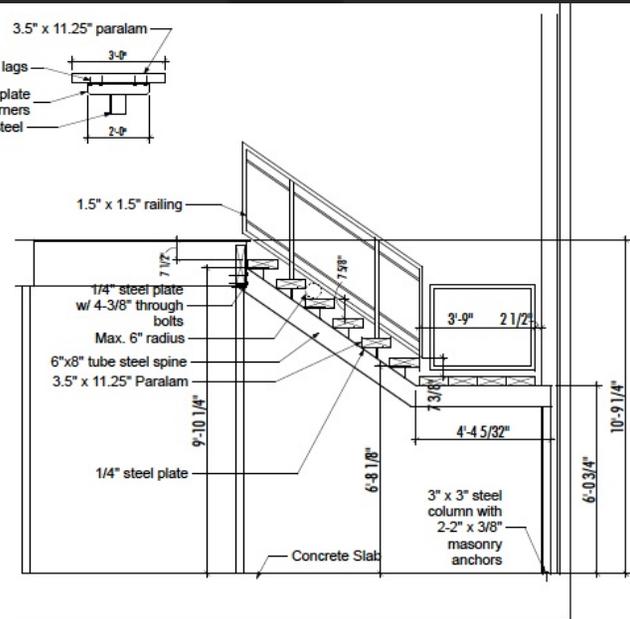
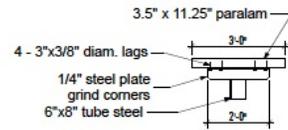
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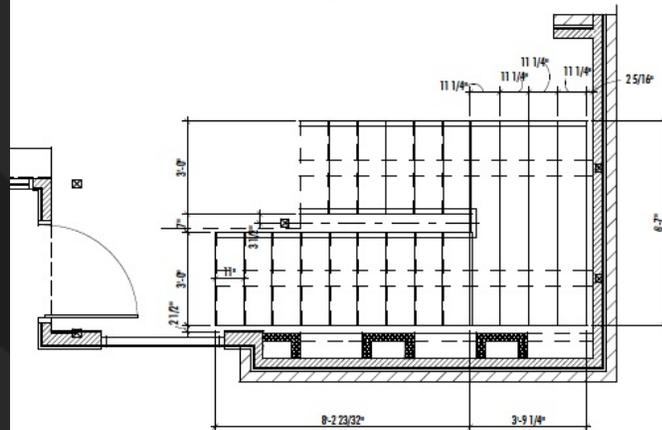
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Lower Run Stair Section



Upper Run Stair Section



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## Stair in Process



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Final Stair and Cat



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# Consultant Communication

- Saving Down.
- The lack of others involved w/ BIM
- Role of Architect is increased.
- Leading the Charge.



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# Shopping Software

- Up front cost is secondary to functionality.
- Program must integrate 3D and 2D, and be able to produce renderings, walkthroughs, and .pdf.
- Program must have teamwork coordination ability.
- Program must have very current national and international standards for Parametrics, and for “down saving”. (IFC).
- Program should consider impacts of the green building movement.



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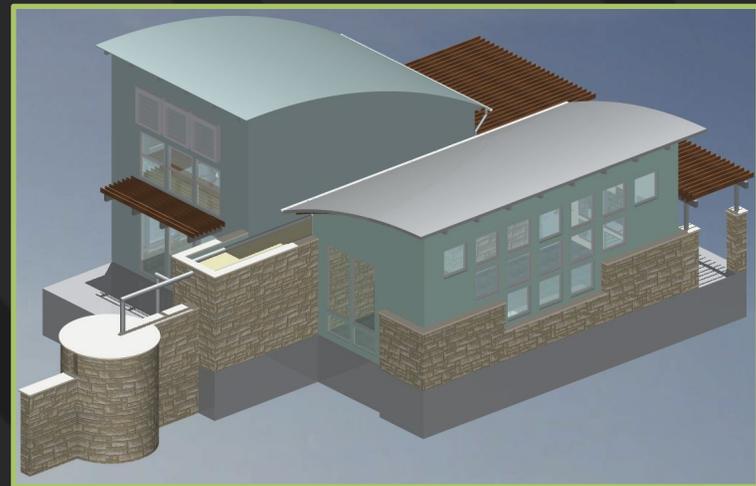
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## The Future

- “Cloud” technology and 3D visualization on the job-site.
- Selection of consultants who are BIM capable.
- Restructuring of the traditional Design-Document-Construct method of delivering buildings.
- Potential of bringing back the role of architect as master builder.
- Energy analysis during design, construction management, and post occupancy.



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# Visualization to Reality



BIM Rendering



Final Building

Studio **Momentum**

Travis G. Young, AIA

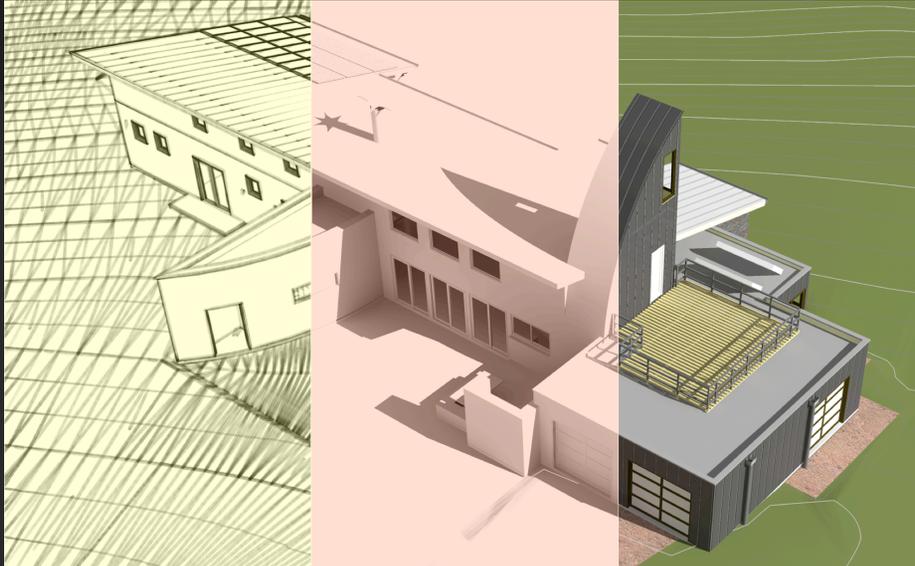


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## Boussoleil

*A case study of BIM for sustainable design*

François Lévy, AIA, AIAA  
M. Arch, MSE  
Author, *BIM in Small-Scale Sustainable Design*

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# Boussoleil Case Study

Detached single-family residence

- **Rural setting**
- **Client emphasis on:**
  - Quality
  - Performance
  - Budget
    - of course
- **BIM especially effective for:**
  - Visualization
  - Design for performance
  - Mid-level detail quantity takeoffs
  - Design documentation



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# Boussoleil

## Plan



① GROUND FLOOR PLAN



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# Boussolleil

## Roof Design



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# Roof

## Design Process

- **BIM used at conceptual design for optimal envelope design, including roof**
- **Azimuth, orientation optimized for summer solar collection**
  - Indexed for greatest loads
- **Area dynamically calculated for:**
  - Rainwater harvesting
  - Gutter sizing
- **Conceptual roof design is refined throughout design process**
  - Intelligent roof object continues to report values throughout
    - Roofing area (normal to slope)
    - Catchment area (plan-projected)
    - Conditioned area (for U·A)
  - Forms basis of roof framing model components



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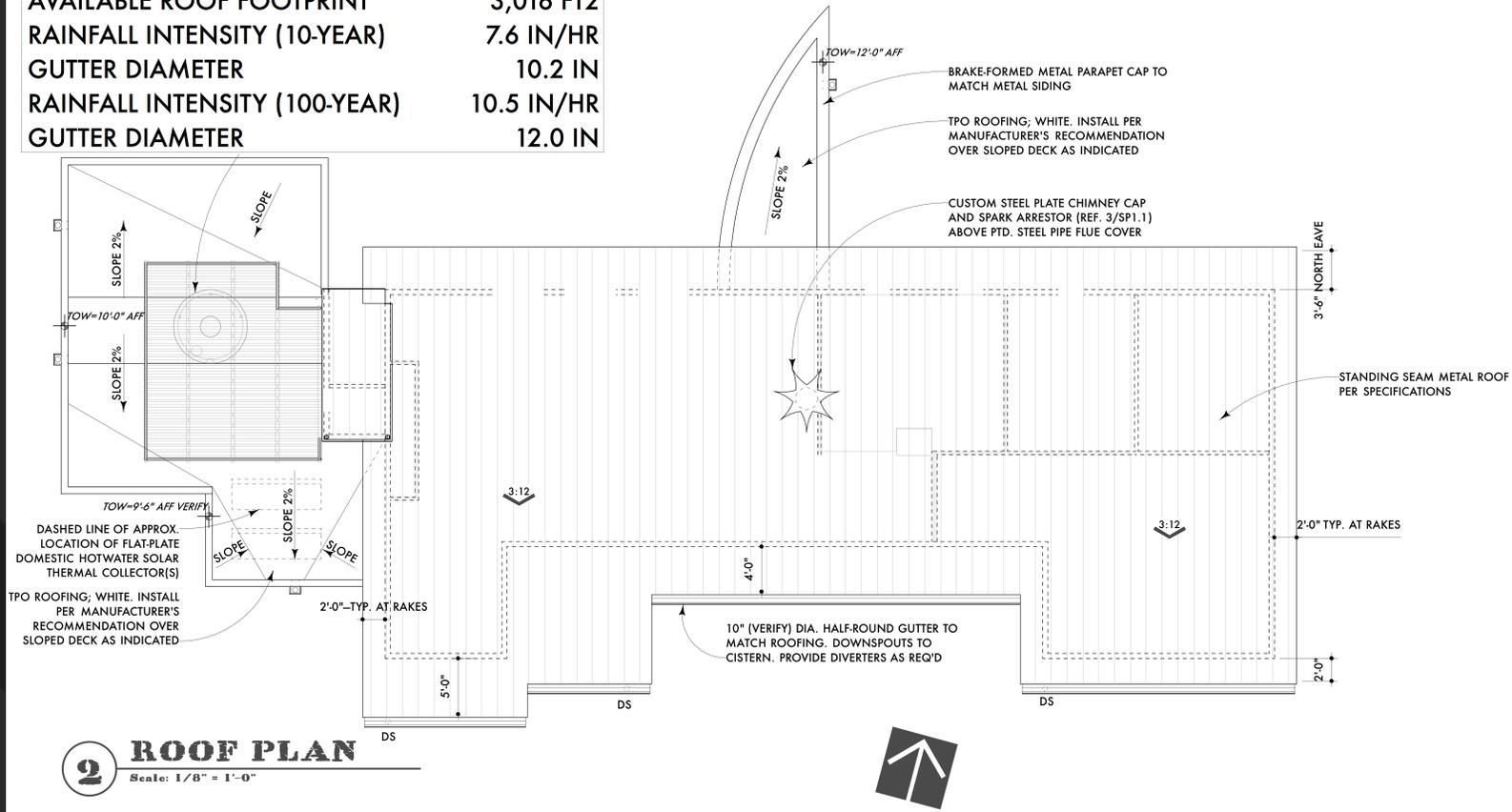
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# Boussolleil

## Sizing

### GUTTER SIZING

AVAILABLE ROOF FOOTPRINT	3,016 FT <sup>2</sup>
RAINFALL INTENSITY (10-YEAR)	7.6 IN/HR
GUTTER DIAMETER	10.2 IN
RAINFALL INTENSITY (100-YEAR)	10.5 IN/HR
GUTTER DIAMETER	12.0 IN



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# Boussolleil

## Rainwater

### RAINWATER HARVESTING

#### DESIGN DATA

AVAILABLE ROOF FOOTPRINT	3,016 FT2
HARVEST CAPABILITY	55,201 GAL

#### OCCUPANCY

OCCUPANTS	2
DAILY CONSUMPTION (FLUSHING ONLY)	10 GAL
DROUGHT	100
OCCUPANT CONSUMPTION	2,000 GAL

#### IRRIGATION

GARDEN REQUIREMENTS	3,602 FT2 1 IN
RAINFALL AREA COEFFICIENT	0.623
LENGTH OF SUMMER	17.5 WKS
REQUIRED WATER	39,286 GAL
SUMMER RAINFALL (JUNE-SEPT)	3.7 IN
NATURAL RAINFALL RECEIVED	8,366 GAL
DEFICIT	30,920 GAL
SUMMER ROOF HARVEST	5,844 GAL
IRRIGATION REQUIREMENT	25,076 GAL

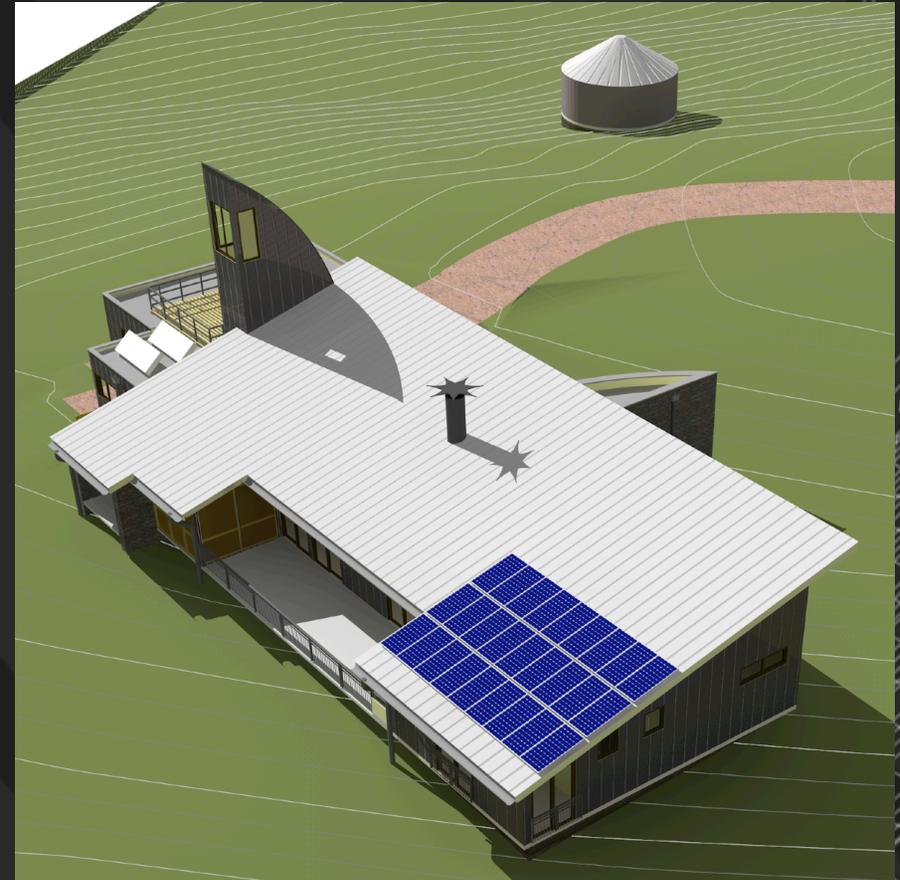
#### STORAGE REQUIRED

VOLUME	27,076 GAL
CISTERN DIAMETER	3,620 FT3 15 FT
REQUIRED DEPTH	20.5 FT

#### RAINFALL

J	2.31 IN
F	2.16 IN
M	2.48 IN
A	2.57 IN
M	4.79 IN
J	4.09 IN
J	1.84 IN
A	2.01 IN
S	3.24 IN
O	4 IN
N	3.19 IN
D	2.52 IN

ANNUAL RAINFALL	35.2 IN
ANNUAL EVAPORATION	90 IN
ANNUAL EVAPORATION	7.5 FT
GALLON/INCH RAIN/ROOF FT2	0.52
GALLONS PER FT3	7.48



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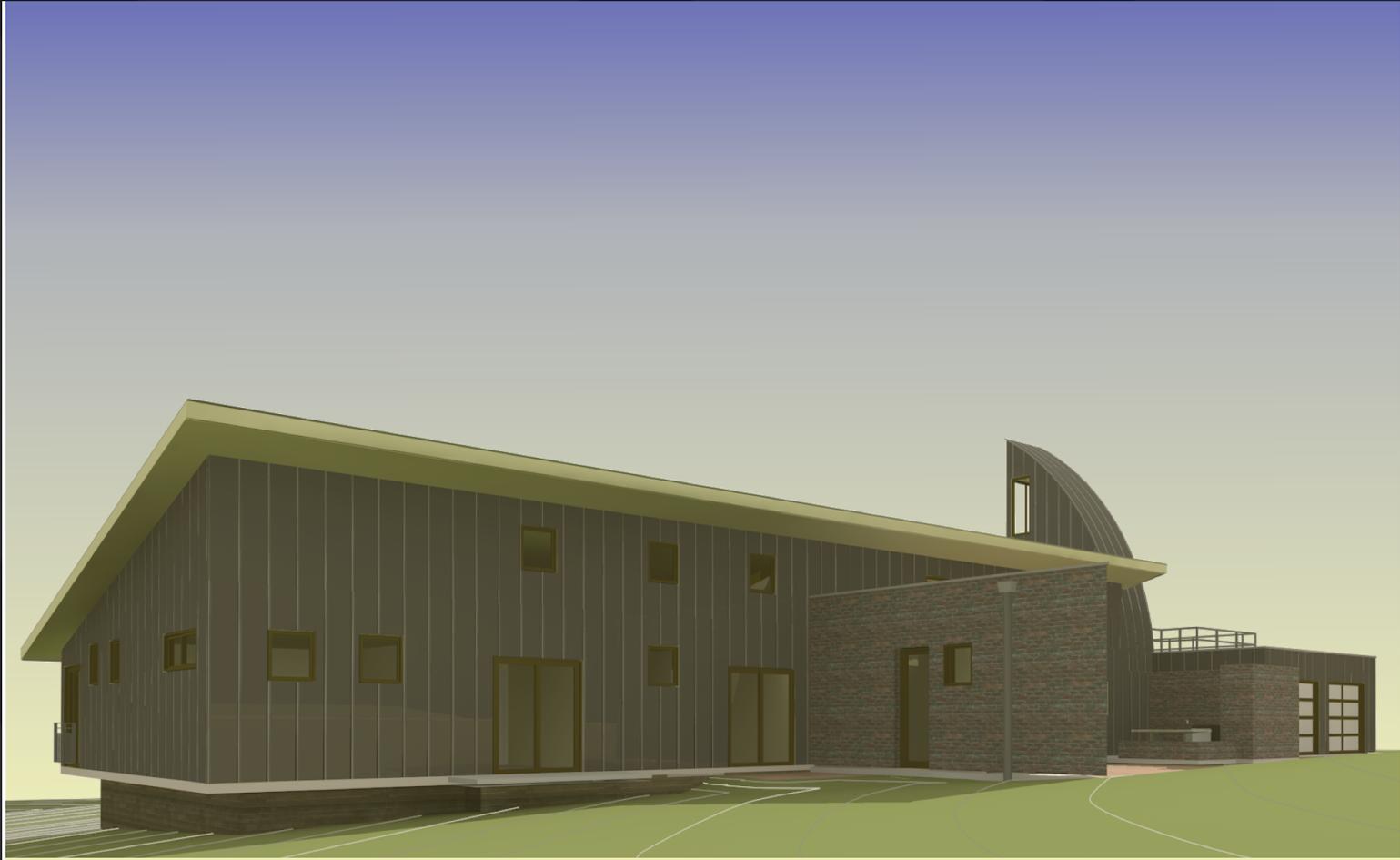
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North-South exposure maximized



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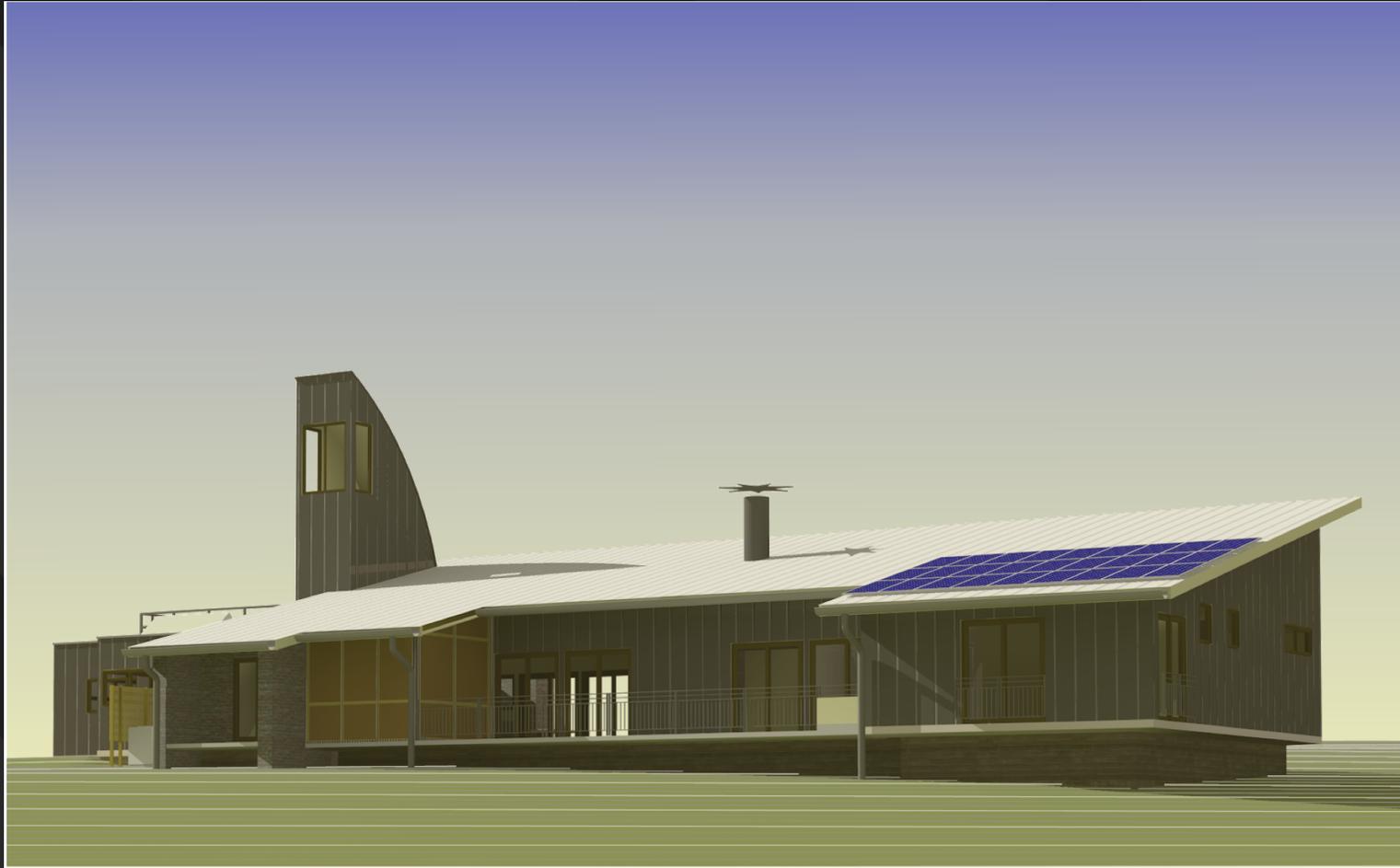
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# Boussolleil

Solar optimization



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# Building Performance

## Solar Savings Fraction

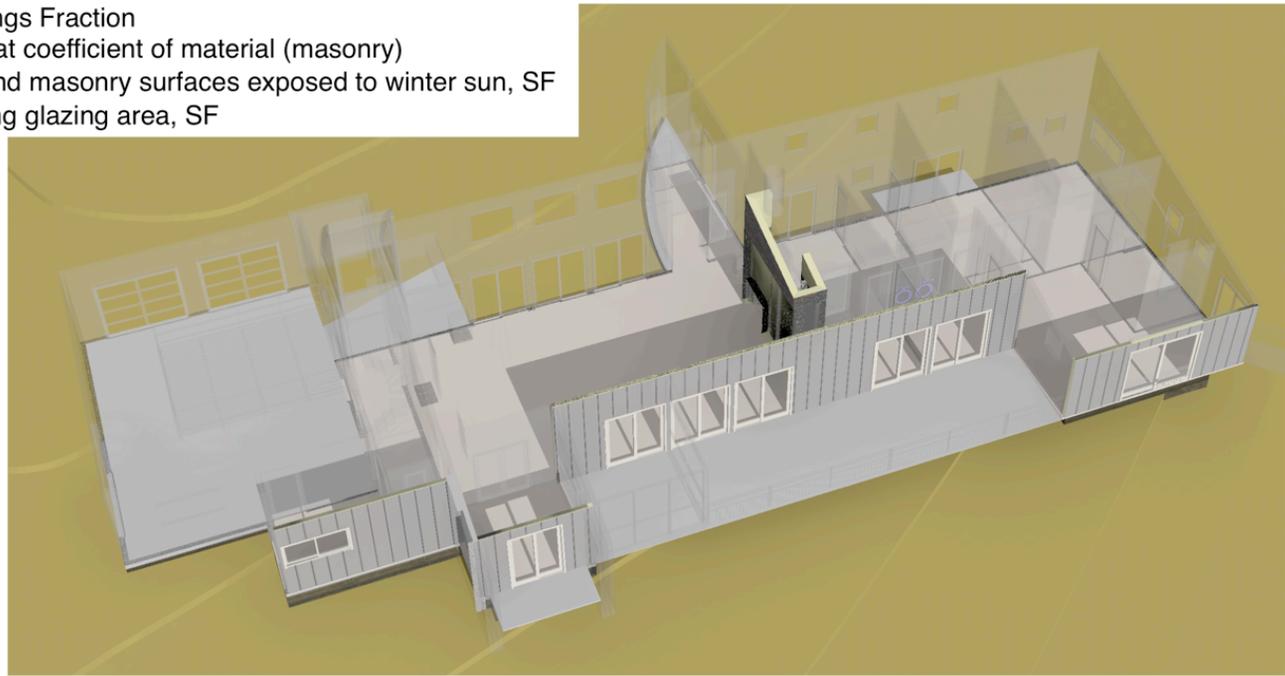
### Solar Savings Fraction estimate

K mass	A mass	A SG	SSF
0.137	1,254.3 SF	305.0 SF	<b>56.3 %</b>

$$SSF = K\ mass \cdot A\ mass / A\ SG$$

Where:

- SSF = Solar Savings Fraction
- K mass = specific heat coefficient of material (masonry)
- A mass = concrete and masonry surfaces exposed to winter sun, SF
- A SG = South-facing glazing area, SF



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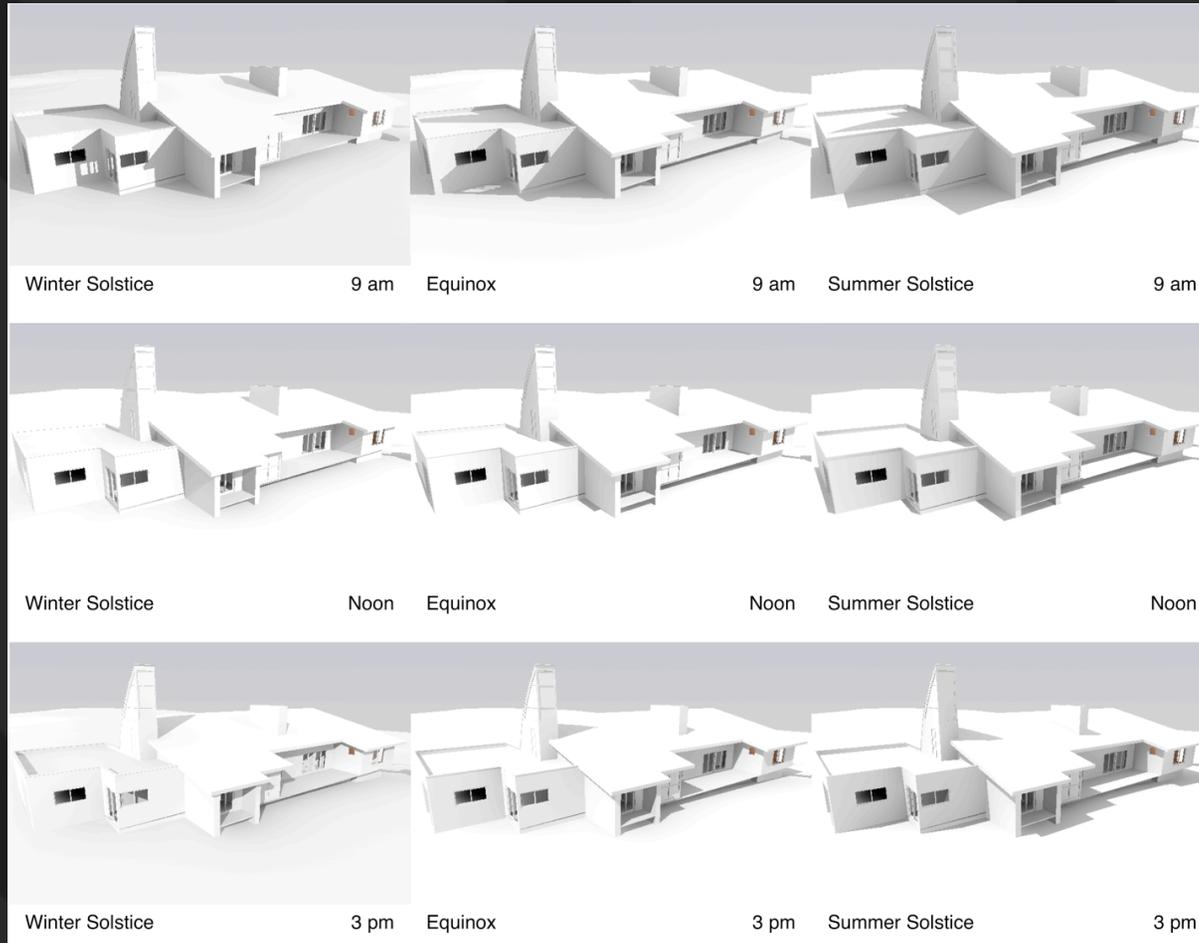
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## Sun studies



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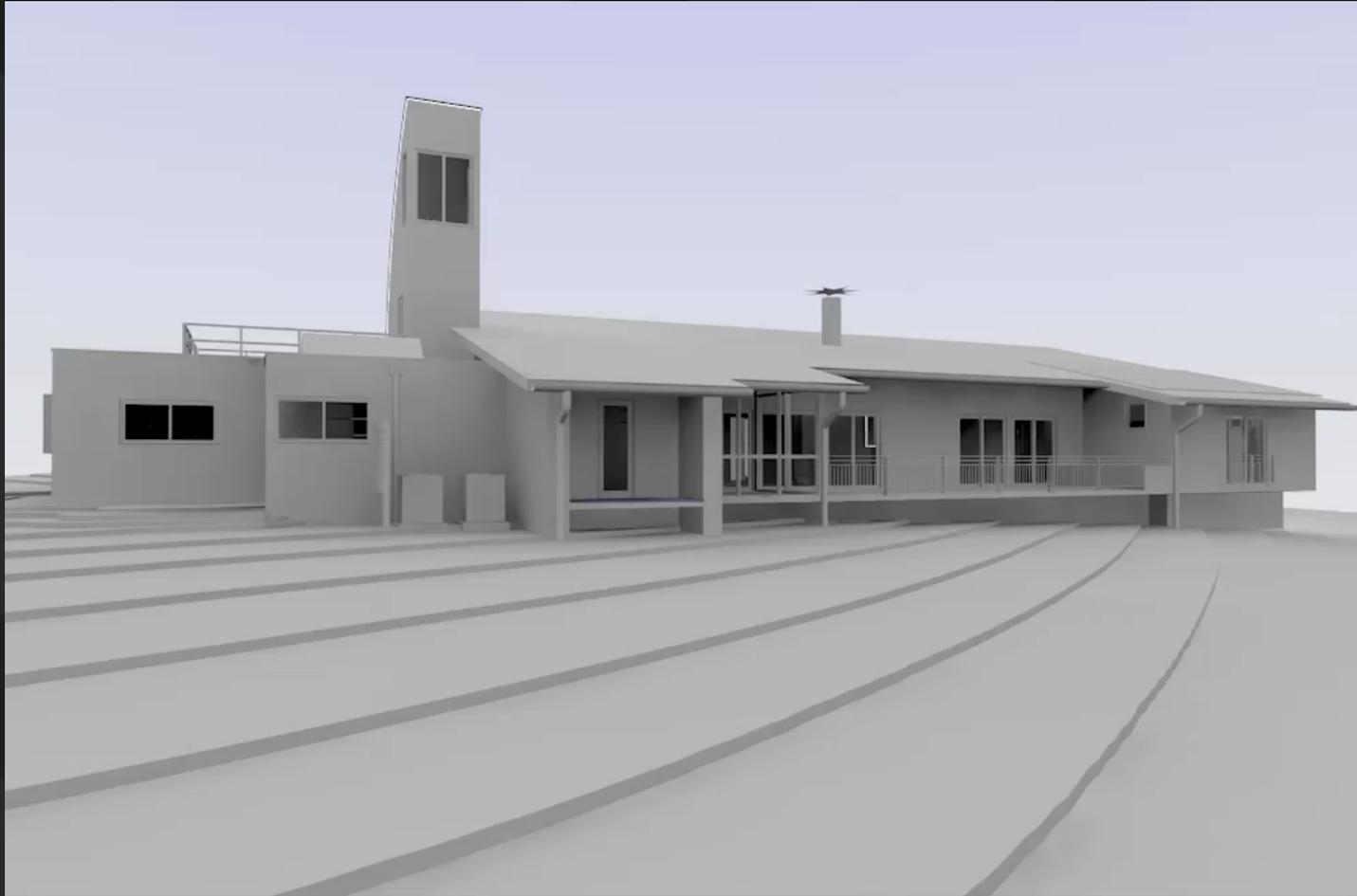
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# Boussoleil

Solar animation



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# Building Performance

## Thermal chimney calculations

### Thermal Chimney Calculations

Cd	T in	T out	A, lower	A, upper	A	K	g	Z, lower	Z, upper	$\Delta H_{npl}$	Q	V	V
0.45	85 °F	105 °F	55.0 SF	22.6 SF	2.4	1.3	32.2 FT/S2	3.5 FT	13.6 FT	5.1 FT	2,698 CFM	1.4 MPH	119.2 FPM

$$Q = 60 C_d A K (2g \Delta H_{npl} (T_o - T_i) / (T_o + 459.67))^{1/2} \quad \text{Source: ASHRAE Handbook of Fundamentals 2005, page 27.11}$$

Where:

$$C_d = 0.40 + 0.0025 |T_i - T_o|$$

A = Aperture area ratio, lower:upper

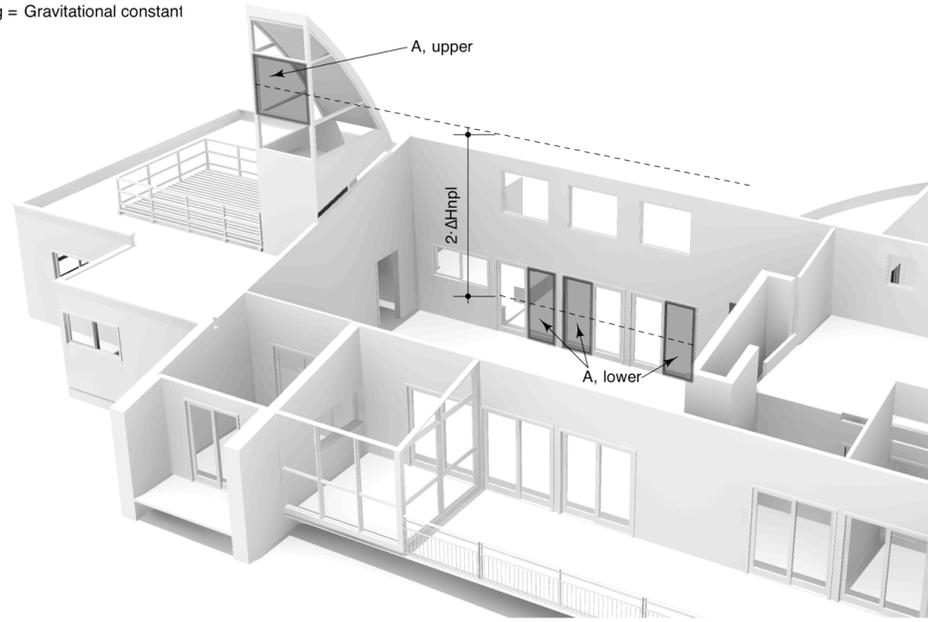
K = Aperture area ratio coefficient (empirical), where K is approximately  $1.388 - e^{-A}$  (Source: François Lévy, M.Arch, MSE)

$\Delta H_{npl}$  = Distance to neutral point, assumed to be half of  $\Delta Z$

T out = Temperature at outlet (upper) aperture (user supplies value in °F, automatically converted to °R (Rankine; °R = °F + 459.67)

T in = Temperature at inlet (lower) aperture (user supplies value in °F, automatically converted to °R (Rankine; °R = °F + 459.67))

g = Gravitational constant



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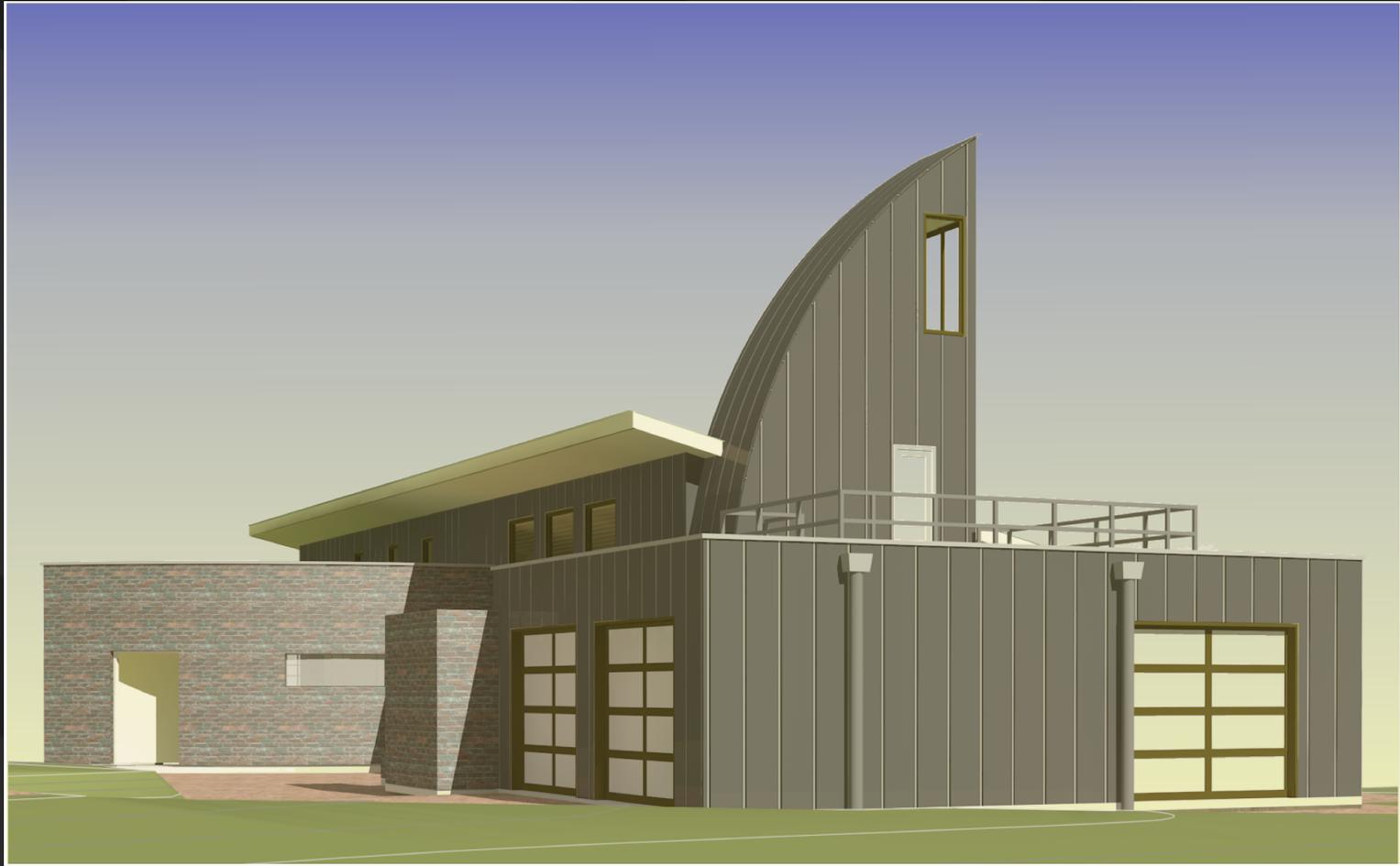
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# Boussolleil

## Exterior finishes



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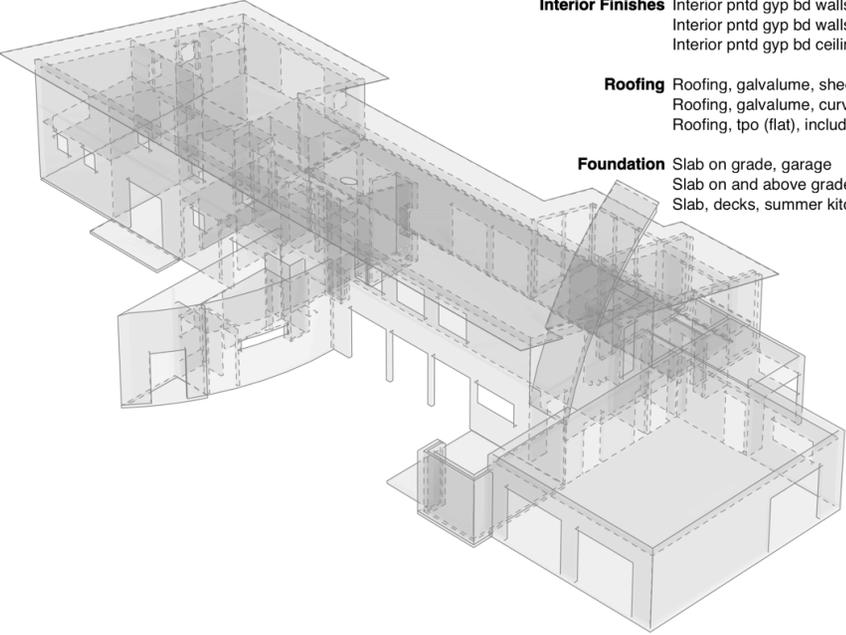
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# Building Performance

## Material takeoffs



Material Takeoffs		
<b>Framing/insulation</b>	Exterior 2x6 wall, insulated, gross	4,473 SF
	Exterior 2x6 wall, insulated, net	3,439 SF
	Exterior 2x6 wall, uninsulated, gross	777 SF
	Exterior 2x6 wall, uninsulated, net	583 SF
<b>Exterior Siding</b>	Exterior metal siding, gross	5,250 SF
	Exterior metal siding, net	4,022 SF
	Cor-ten metal siding, gross	588 SF
	Cor-ten metal siding, net	521 SF
	Brick veneer, interior, net	222 SF
	Brick veneer, exterior, net	636 SF
	Exterior cmnt fiber bd siding, net (studio)	1,059 SF
<b>Interior Finishes</b>	Interior pntd gyp bd walls, gross	4,772 SF
	Interior pntd gyp bd walls, net	3,860 SF
	Interior pntd gyp bd ceilings	3,718 SF
<b>Roofing</b>	Roofing, galvalume, shed (including studio awning)	3,214 SF
	Roofing, galvalume, curved	159 SF
	Roofing, tpo (flat), including studio	1,551 SF
<b>Foundation</b>	Slab on grade, garage	697 SF
	Slab on and above grade, conditioned	2,509 SF
	Slab, decks, summer kitchen, storage	780 SF



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Bradley Khouri, **b9 architects**

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October 14, 2011



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## How we use BIM:

- innovation
- designing
- client presentations
- sun studies
- presentation drawings
- project documentation
- marketing



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# innovation

- Every project is developed through a comprehensive design process, seeking innovation translating initial concepts into form through text, drawing and modeling



preliminary sketch of relationships between zones and circulation



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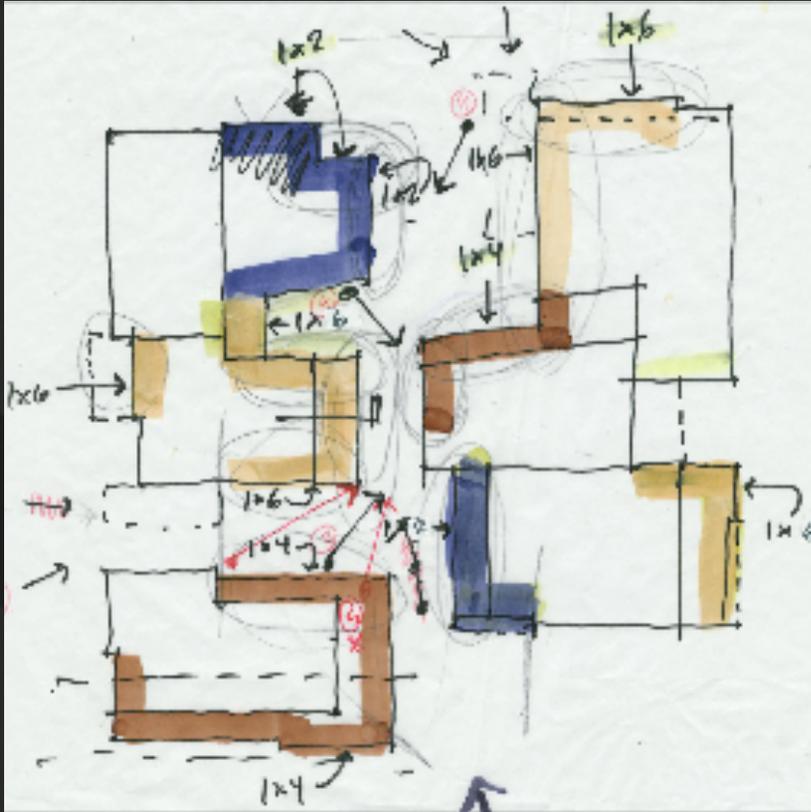
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# designing with BIM

- Hand Sketches translated into 3-d model



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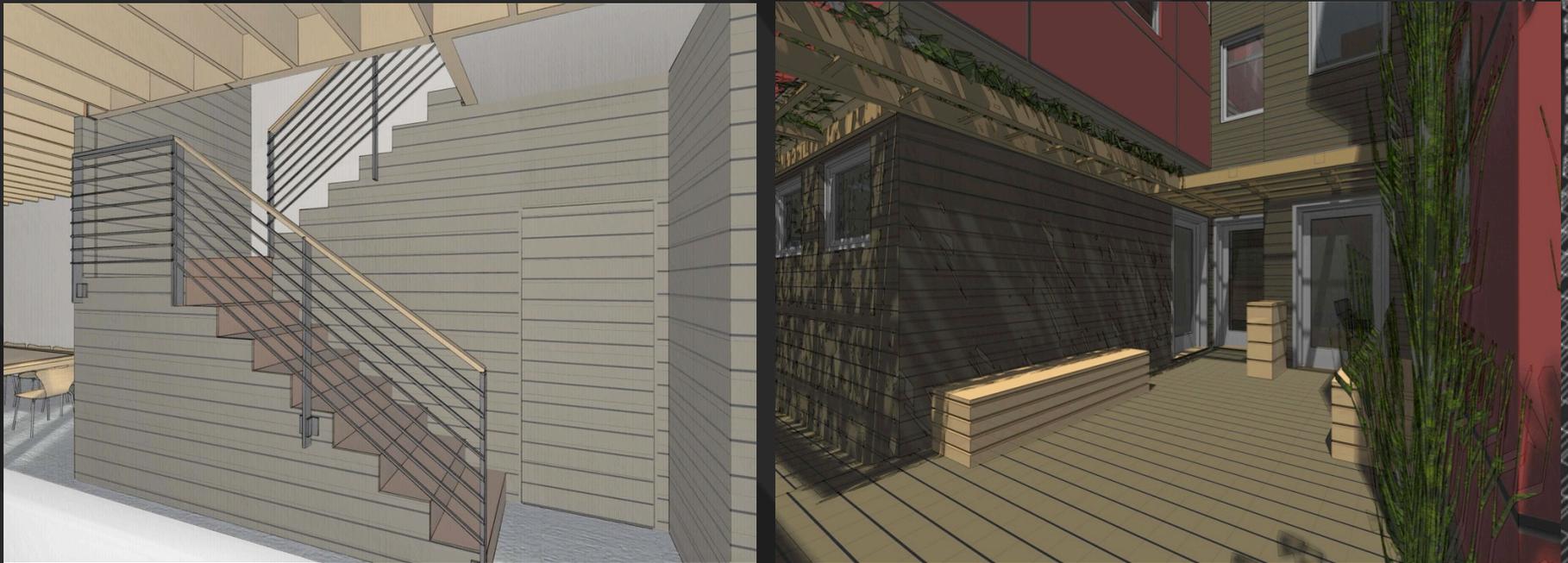
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# client presentations

- 3-d renderings used to illustrate detailed design



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# sun studies

- In plan and perspective, massing studies show lighting conditions



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# presentation drawings

- site plan + “watercolor”



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# marketing with BIM

- Presale accomplished as requirement for financing



urbanShareb9.com

urban Share

- community images
- availability
- site plan
- floor plans
- interior views
- selling packet
- mountain views
- walkscore.com
- press

the newest community by award winning b9 architect

These two new modern homes at 19th and Pike are stunning in design and intentional in principal by targeting 5-Star Built Green standards. They share the property with a 1904 renovated Seattle four square home creating an innovative, sustainable micro-community. The homes feature a solar heating and domestic hot water system, reclaimed materials for exterior and interior finishes and purposeful daylighting throughout. Clean, flowing interior spaces, modern details and custom design elements throughout the homes impress. The community spaces include pervious paving for the walkways and driveway as well as a central green woonerf. A view deck to the Cascades offers an additional attraction to these eco-friendly, affordable, distinctive modern homes.

Located in Seattle's Capitol Hill neighborhood just blocks from numerous neighborhood amenities including the Central Co-op's Madison Market and Trader Joe's helping to achieve a Walkscore of 94, a walker's paradise. Minutes to downtown and Lake Washington and great access to Volunteer Park, Pike-Pine Corridor, Bobby Morris Playfield, 15th Avenue commercial district, Madrona and Leschi.

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Built Green  
Logo goes  
here!

Information is provided as a courtesy and is not a warranty and should be independently investigated by buyers.

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## project examples

- Urban Canyon
- Urban Share
- Urban Trees



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- **Urban Canyon**
- **Urban Share**
- **Urban Trees**



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# Urban Canyon

- a village has been created in seattle. the development of seven unique homes on three existing lots activate a pedestrian canyon.
- community is prioritized, parking is moved to the edge, materials are sourced locally and reclaimed, and a solar powered shed and p-patch are included in the pervious canyon.



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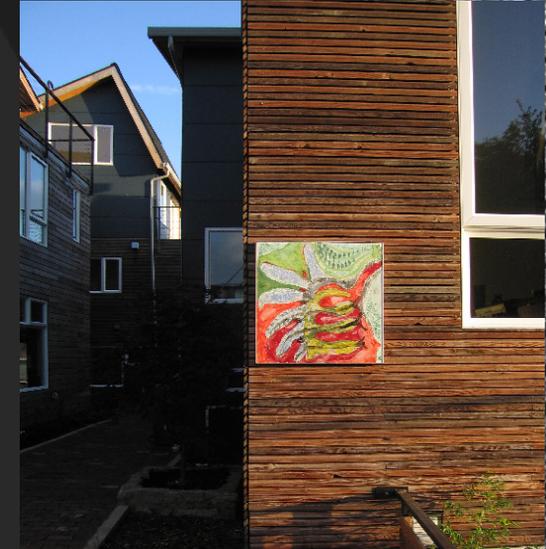


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*tied to the larger community as local artists  
infuse life and color...*

*lampshades, mailboxes, enamel paintings*



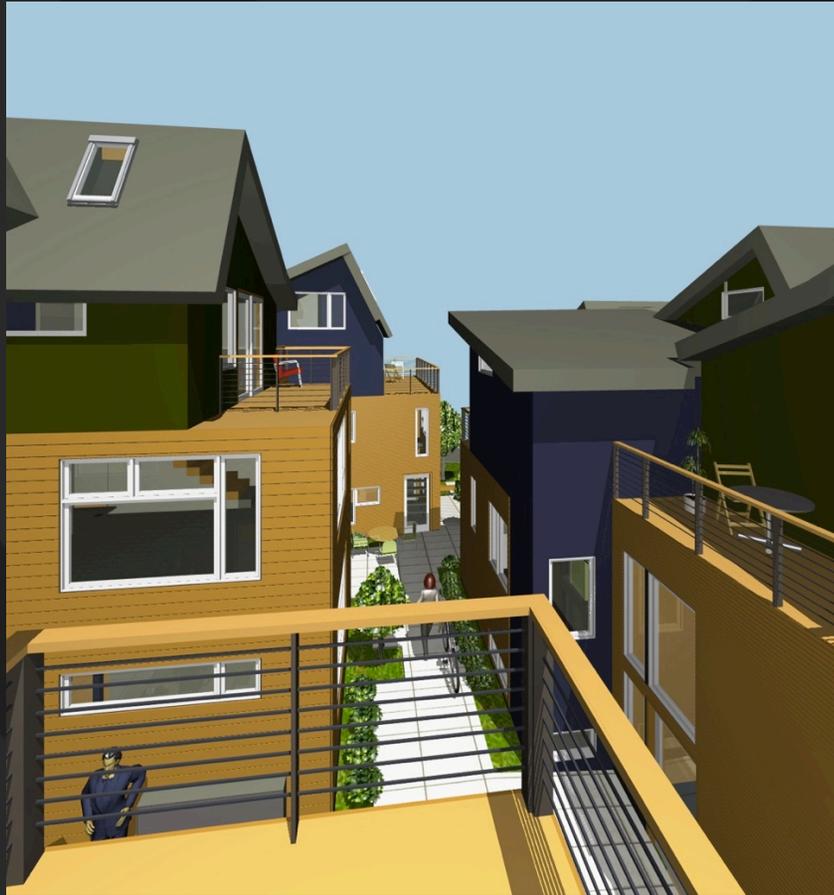
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# rendering with BIM



- Renderings with ArchiCAD incorporating hand drawing and other software produced watercolor drawings used for public design review meetings and for sales and marketing



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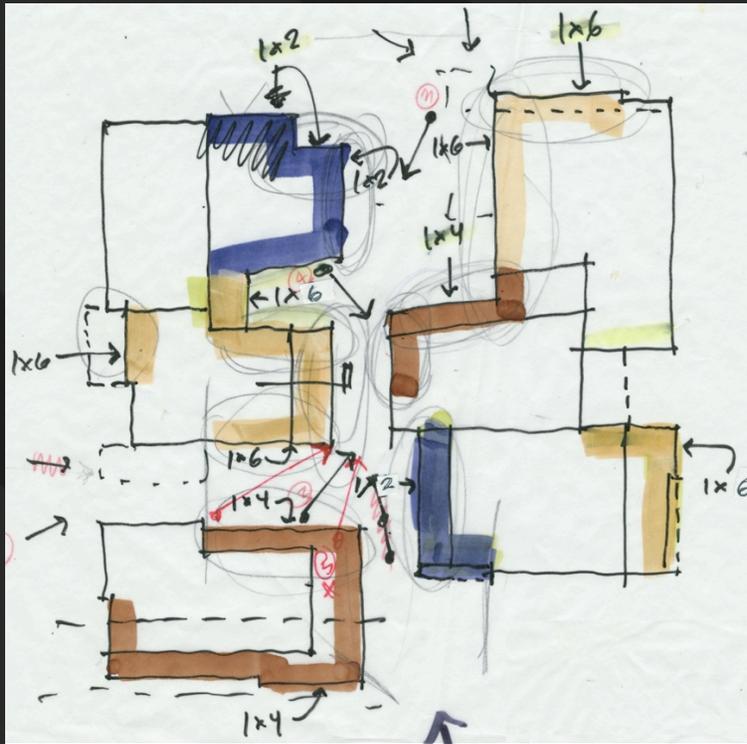
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# texture in the canyon

- Each home is clad in a different width of reclaimed fir siding, the walkway is reclaimed brick

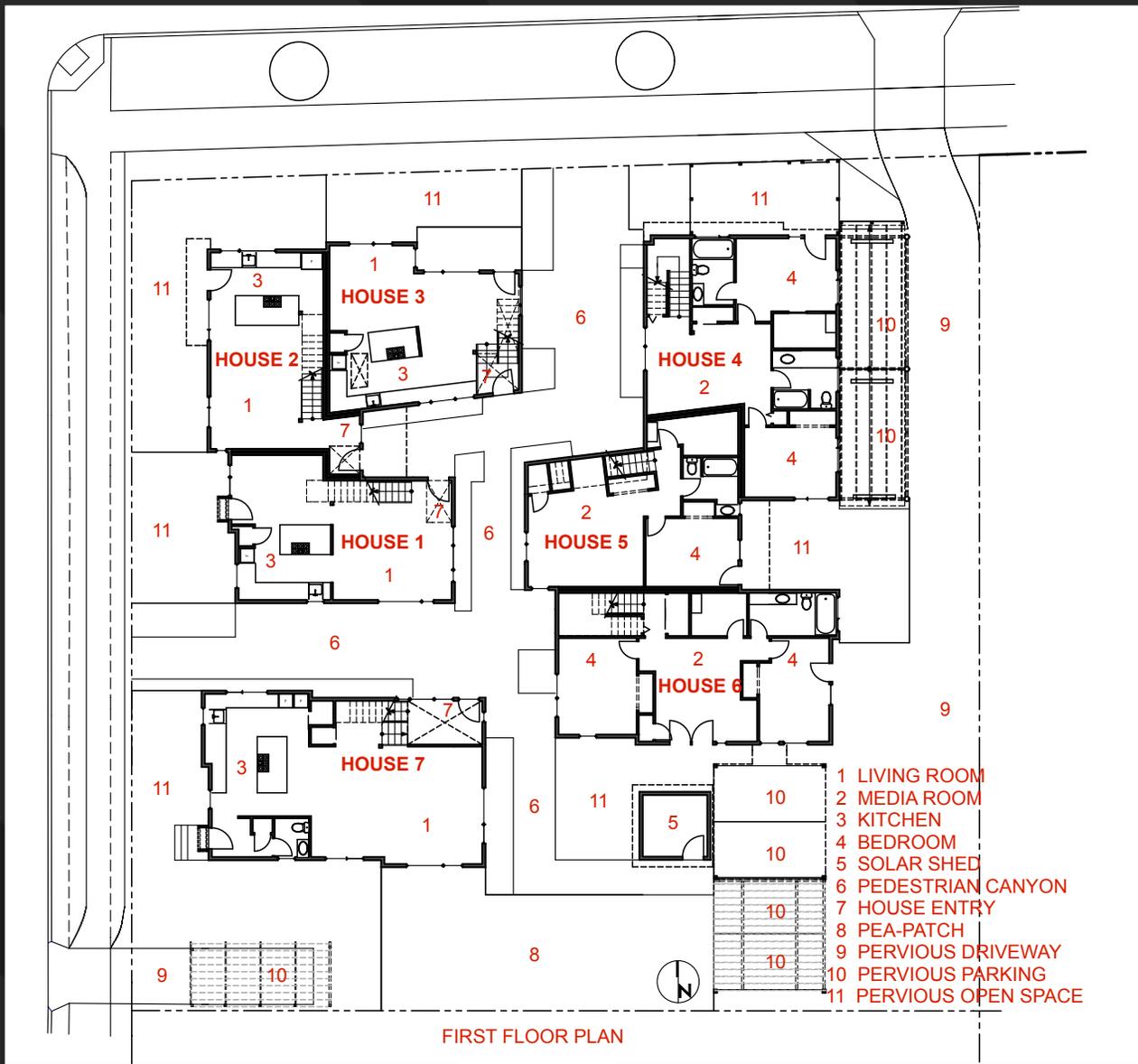


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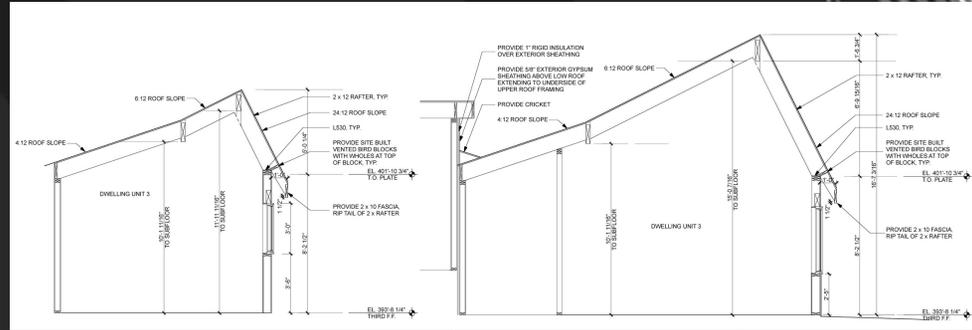


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BIM enabled detailing of complex roof shapes created in response to Seattle's Land Use Code restrictions and the surrounding context

## complexity in ArchiCAD

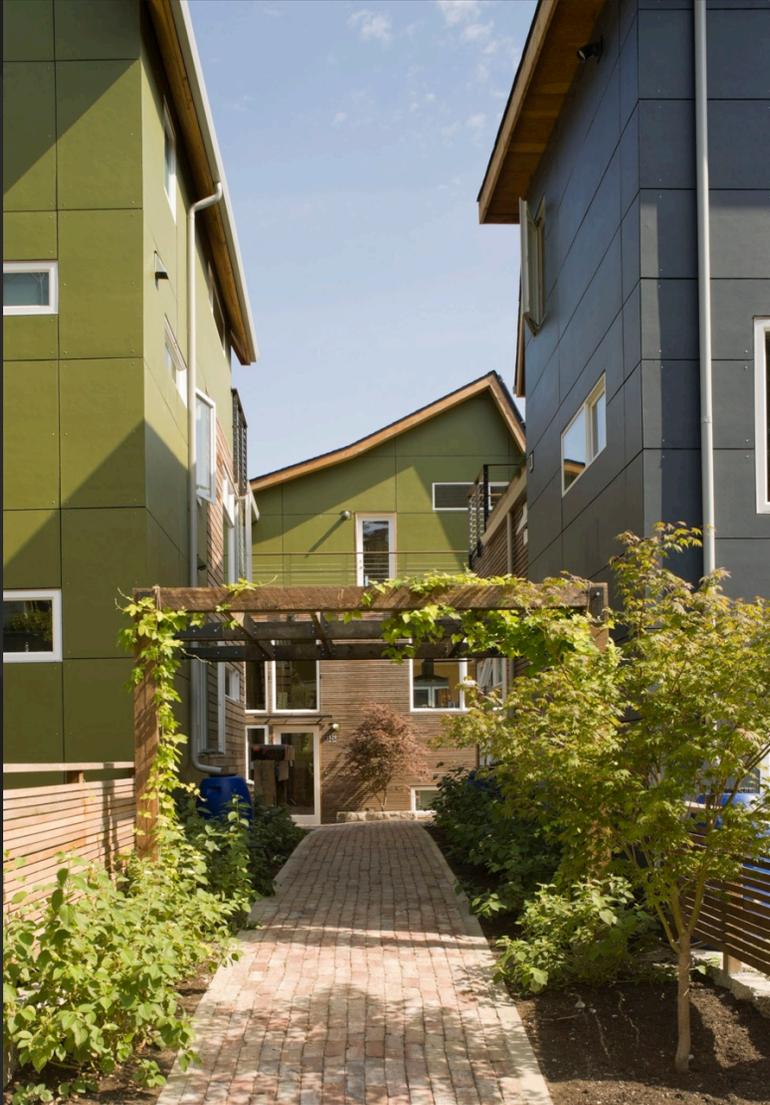


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pervious site



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# design realized



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- Urban Canyon
- Urban Share
- Urban Trees



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# Urban Share

- a speculative micro-community in Seattle's Central District.
- Motivated to increase density through a thoughtful and economically viable project in the current recession, we renovated the existing 1904 four-square home to improve its livability and performance while adding two new unique small townhouses behind.



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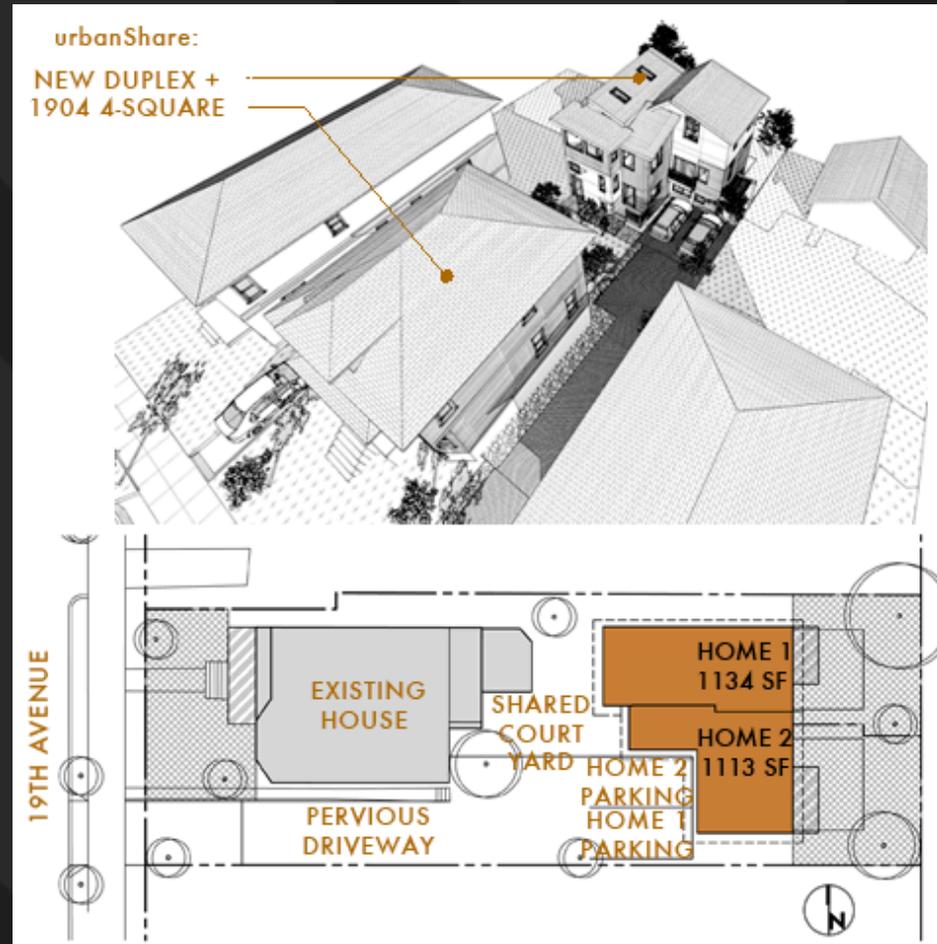
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# early process

## Modeling two distinct homes with small footprints



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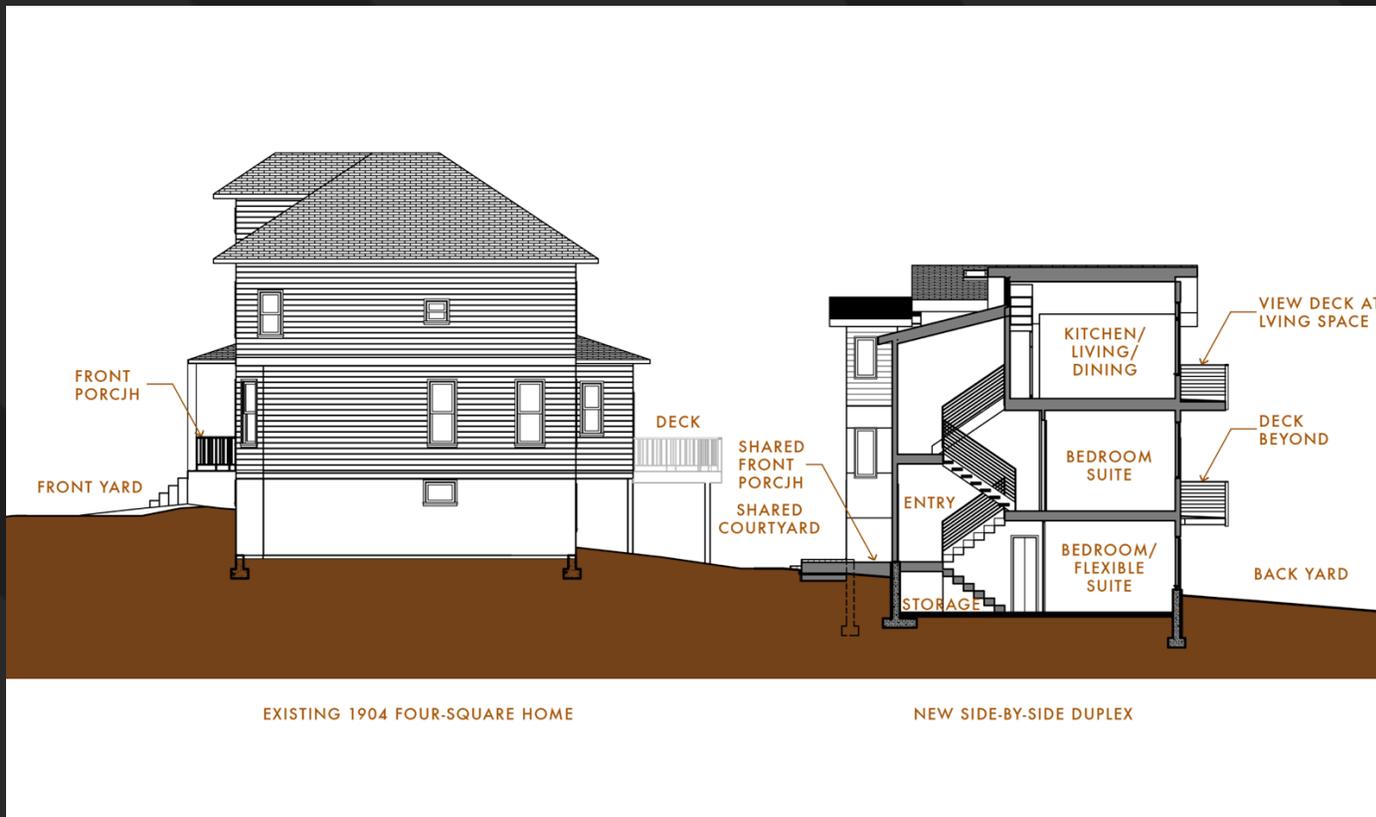
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# urban infill

Topography and zoning response created a micro-community in scale with the existing residence.



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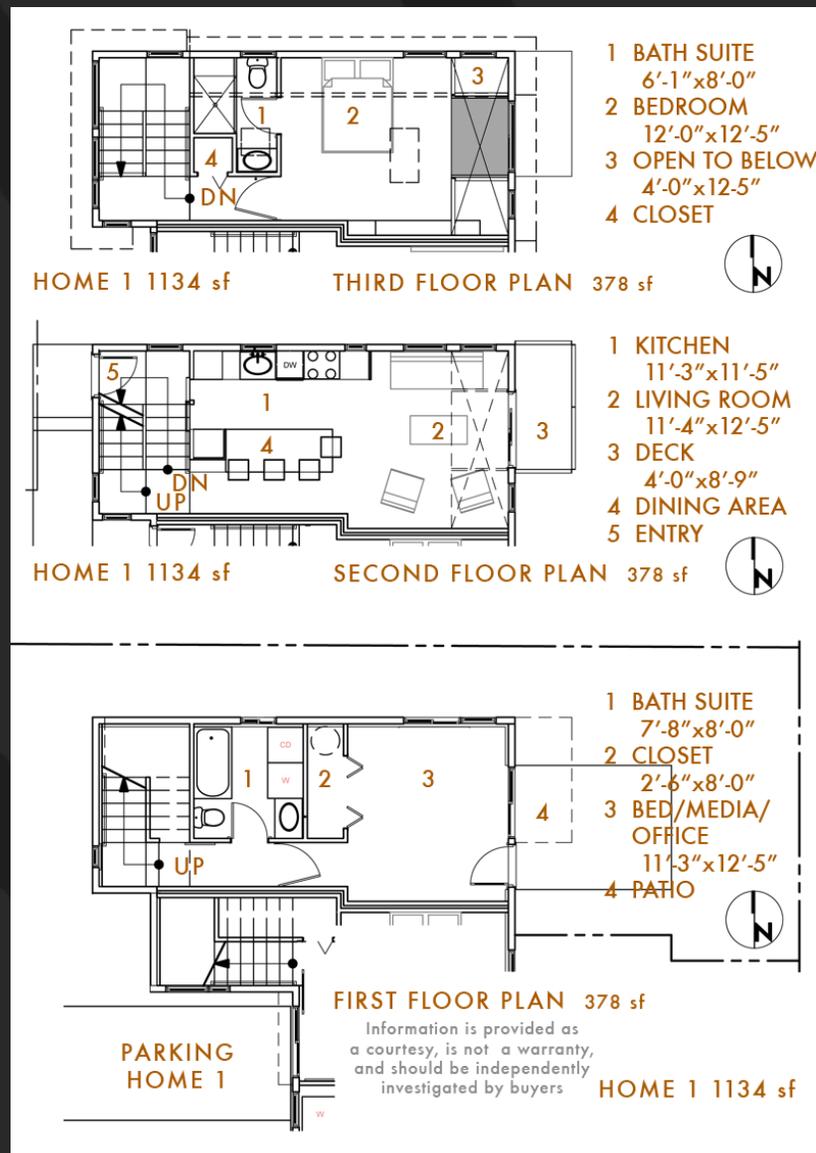
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# presale - client

- Architect and developer
- Financing required a presale



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# materials in ArchiCAD

modeling flexible open spaces with access to natural light from all sides



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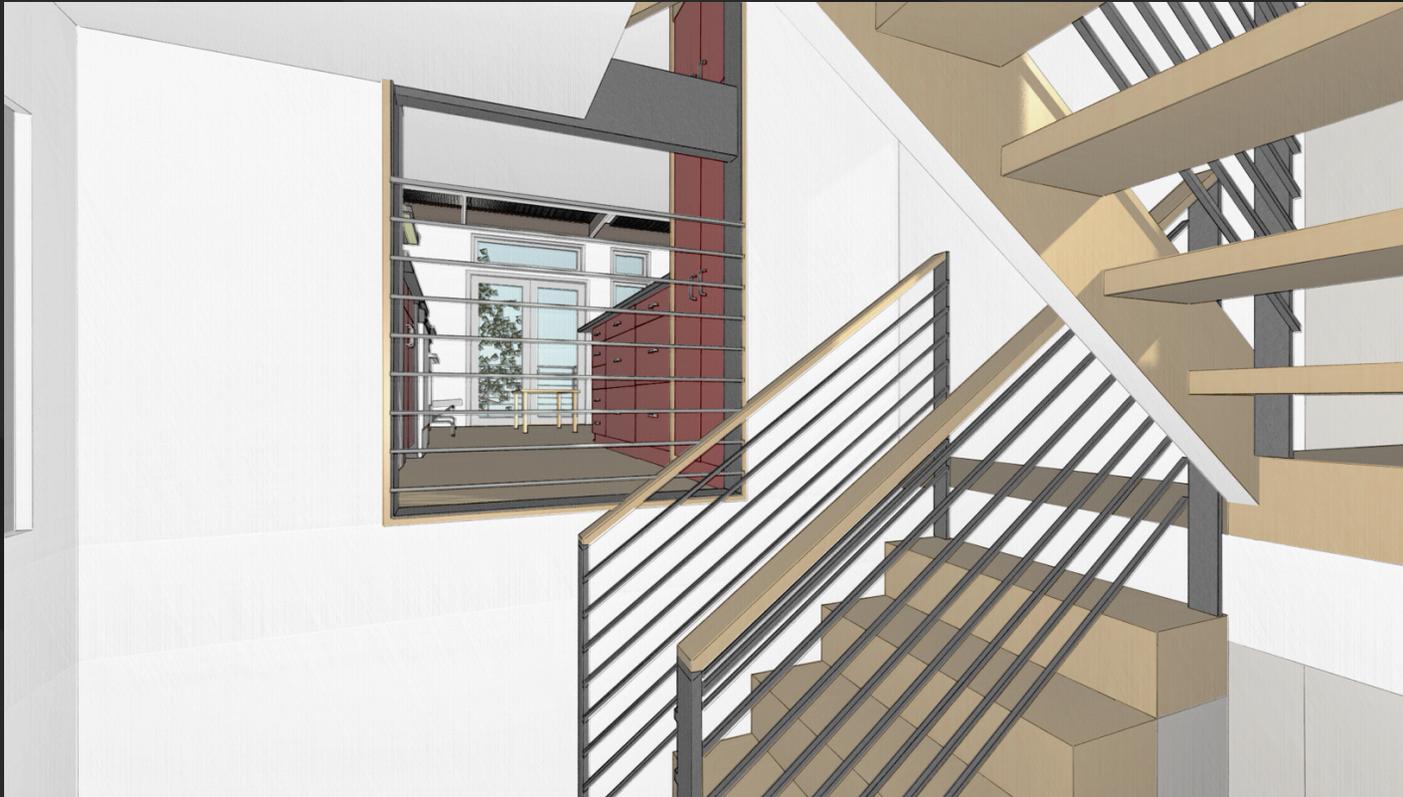
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# maximizing spaces

A framed view through the living space expands the entry and stair volume



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# execution of design intent

Accuracy of BIM enabled sale of second home during construction



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# exterior

reclaimed 85 year old cedar rainscreen



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# courtyard

Shared between all homes a courtyard performs double duty



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# Urban Trees

- a new woonerf provides access to the center of a split-zoned site, commercial to the south and residential multifamily to the north. at the center of the residential building sits a courtyard open to the south. this community space and its activities spill in the treed woonerf.
- the two buildings are conceived as a single development and detailed as such



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# approach



- the project has a single design concept although our site has two distinct sets of land use constraints. BIM enabled us to work with both buildings in the same file concurrently on two different computers.



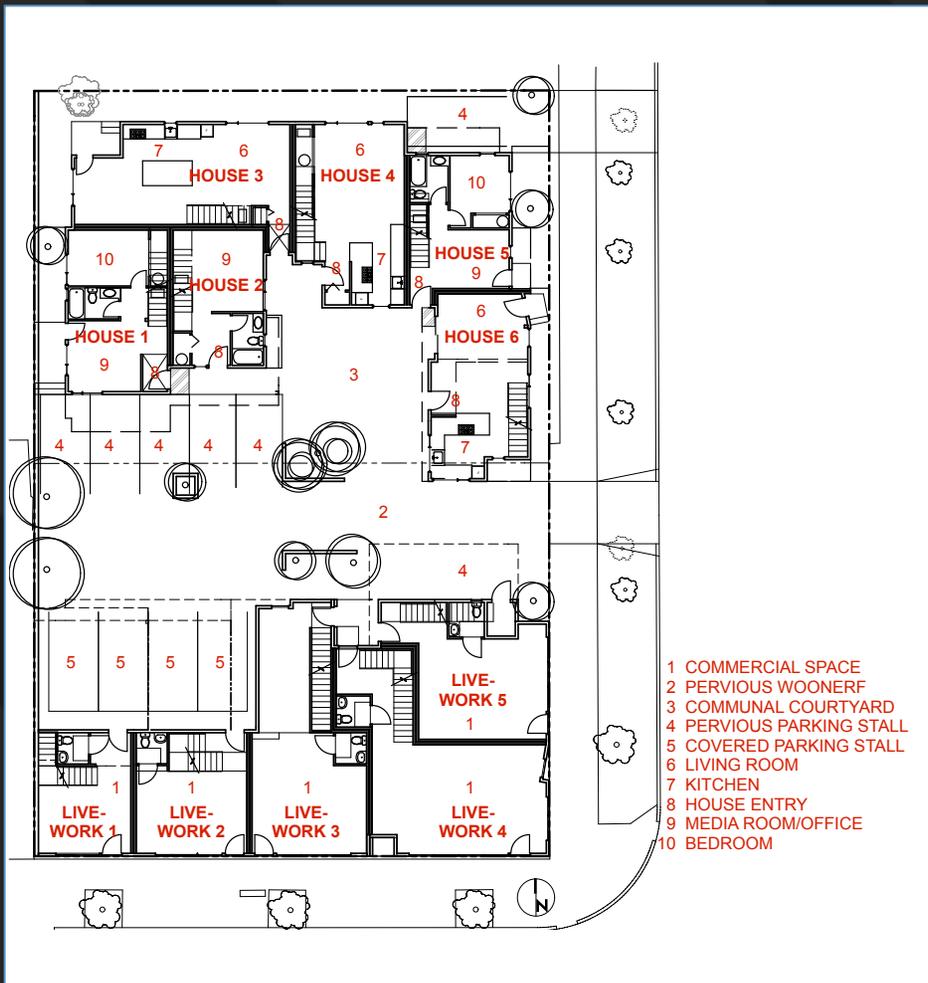
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# Live-work dwelling



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## Collage from BIM combined with hand-drawing and layered information



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# stitching together



- Commercial and Multifamily structures



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# woonerf



- BIM allowed us to investigate and communicate the complex massing and interior spaces created in response to Seattle's Land Use Code restrictions and the strong site concept to prioritize the pedestrian.



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# courtyard



- The woonerf provides pedestrian, bicycle and automobile access to the courtyard at the heart of the project. The two buildings are shaped to embrace and activate the courtyard and maximize its access to natural light.



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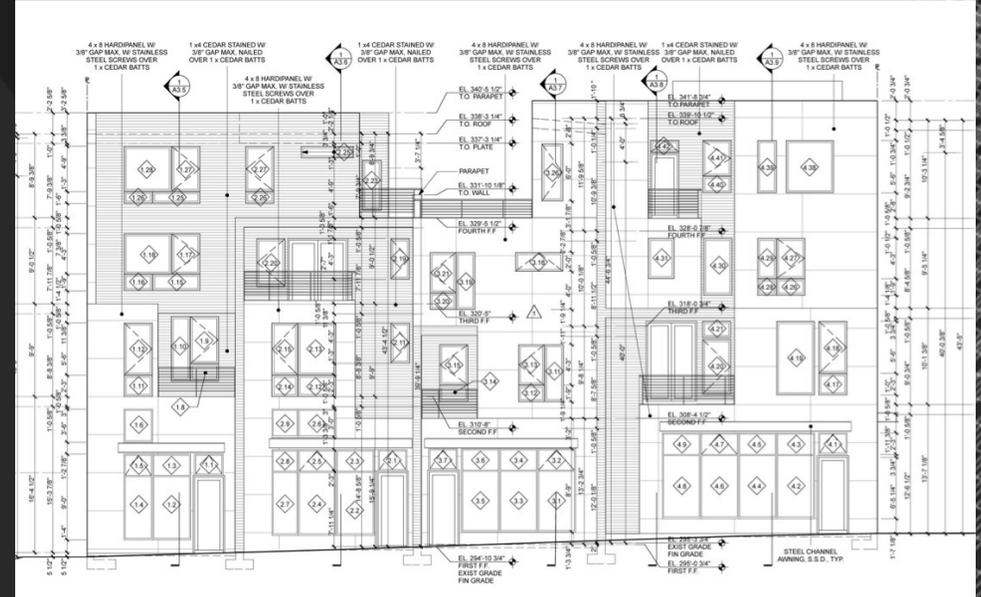
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*september 1*

- We used sun studies to demonstrate to ourselves, the client and the Design Review Board that the site planning and building design addresses any concerns of light accessing the central woonerf and courtyard.



# elevations



- Rendered, shadowed elevations produced directly in ArchiCAD save time and accurately demonstrate depth in these two-dimensional representations.



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our commitment  
to sustainability:

- thinking
- materials
- energy modeling



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# sustainable thinking

5100

square feet of reclaimed remilled fir flooring from Fort Lewis barracks, supplied by Windfall Lumber

3900

square feet of reclaimed fir siding from Fort Lewis barracks, supplied by Windfall Lumber

2230

square feet of pedestrian canyon area with pervious reclaimed brick paving and landscaping

1000

square feet of patio pavers from reclaimed concrete from the site and surrounding sidewalks

850

square feet of shared food garden

863

square feet of green roof area

450

square feet of 100% recycled paperstone counterrops from Hoquiam, WA



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# reclaimed materials

- Soulful and responsible - locally sourced



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# energy modeling

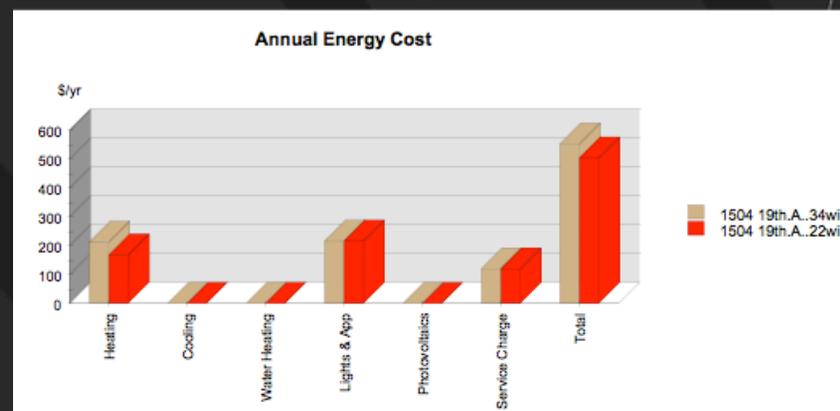
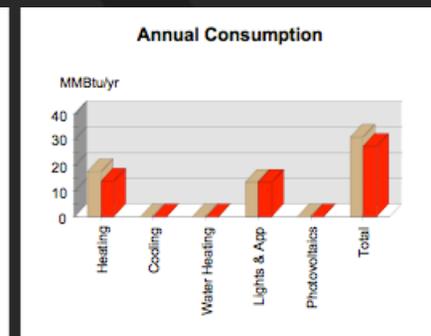
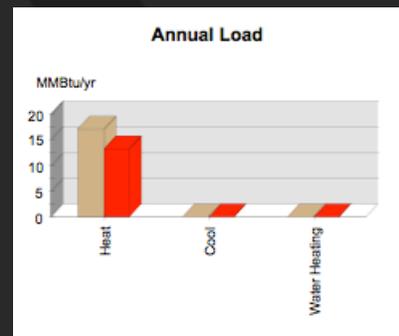
- Data exported from BIM used in REM/Rate - Residential Energy Analysis Software - used for Design Decisions and for Green Certification

COMPONENT DESIGN LOAD SUMMARY				
	1504 19th.A..34win	1504 19th.A..22win	DIFF	% DIFF
<b>HEATING (KBtu/Hr)</b>				
Ceilings/Roofs	0.4	0.4		
Rim/Band Joists	0.3	0.3		
Above Grade Walls	2.5	2.5		
Foundation Walls	0.0	0.0		
Doors	0.1	0.1		
Windows/Skylights	5.4	3.6	1.8	34.0%
Frame Floors	0.0	0.0		
Crawl Space/Unht Bsmt	0.0	0.0		
Slab Floors	0.9	0.9		
Infiltration	0.4	0.4		
Mechanical Ventilation	1.1	1.1		
Ducts	0.0	0.0		
Active Solar	0.0	0.0		
Sunspace	0.0	0.0		
Internal Gains	0.0	0.0		
<b>Total</b>	<b>11.1</b>	<b>9.2</b>	<b>1.8</b>	<b>16.7%</b>

EMISSIONS REPORT				
Emissions By End-Use				
	1504 19th.A..34win	1504 19th.A..22win	Difference	% Difference
<b>Carbon Dioxide (CO2) - tons/year</b>				
Heating	1.1	0.8	0.2	21.7%
Cooling	0.0	0.0		
Water Heating	0.0	0.0		
Lights & Appliances	0.7	0.7		
Photovoltaics	0.0	0.0		

Site-to-source energy multipliers and air emission data were taken from the US EPA eGRID2007 database.

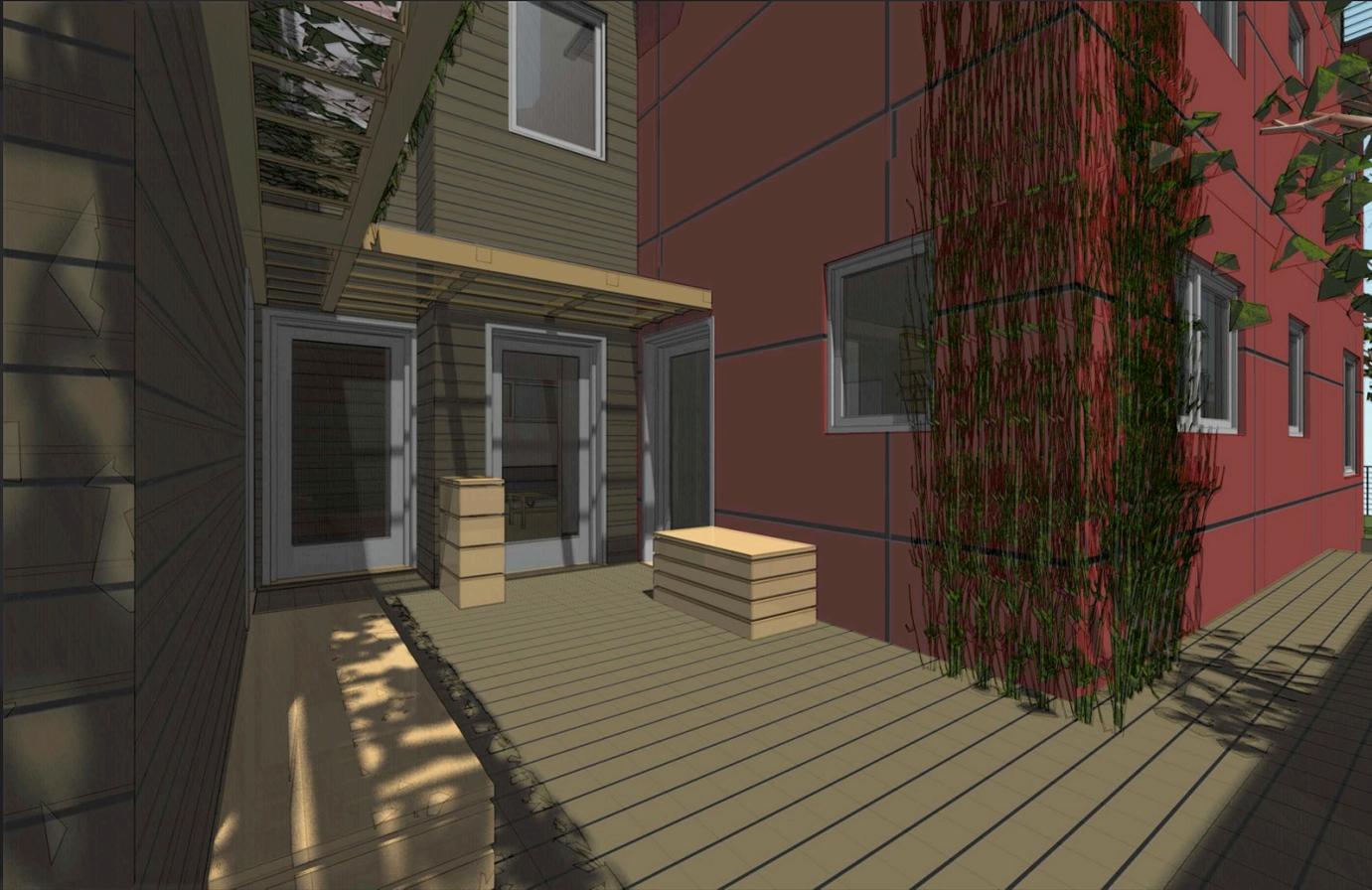


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# BIM for Small Projects

## Q&A



- Questions can be submitted via the Question/Chat pane of the GoToWebinar panel.
- We will sort and queue questions, as time permits.
- Please submit unanswered questions to the TAP Discussion area via our AIA KnowledgeNet website.



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