

# ARCHITECTURE

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## DESIGN

## APPROACH

The Alley House is an affordable, high-performance, two-family home that adapts to the changing needs of residents during their lifetime. Cardinal Studio created a home that addresses the occupants' needs by providing optimal comfort, functionality, adaptability, and aesthetic value design. Creating an interior layout to optimize circulation and reduce obstacles was especially important to reduce the risk of accidents with children in the home. Open spaces also allow adults to supervise children more effectively. Efficient room arrangement maximizes comfort by reducing corridor space, increasing access to daylight, and creating a seamless spatial flow. The team aimed to create flexible spaces that can easily adapt to changing needs during the growth of the family and to feel spacious in the compact unit while still providing private areas.

# CONTEST OVERVIEW



One of the biggest challenges when designing the Alley House was balancing high-performance goals, formal design principles, and cost reduction measures. Every design decision made by the team aimed to maintain the coherence between form, function, and energy efficiency in

the house. The Alley House is unique within the Englewood Neighborhood because of its duplex configuration and because the units are split front to back, rather than side-by-side or stacked. This configuration allows equal southern sun exposure to both units.



Alley House with Site Surroundings

## FLOOR PLANS

The first floor of the house is equipped with a spacious open kitchen and adjacent living space, which looks directly out to the south community alley. This design approach creates two quality, family-oriented living spaces with south-facing views that provide visual and physical connection and interaction with the neighborhood. Amenities are placed at the ground level to accommodate aging in place and include the circulation in the kitchen, a full bathroom, zero-step entrances for visitability and accessibility, and a bedroom on the main level. The second floor is conducive to family needs, with two bedrooms, a full bathroom, a laundry room, and a “flex space” where a variety of uses

can be anticipated, able to be adapted from an office to an exercise room or from a nursery to a bedroom, adapting to the family’s needs depending on the family’s stage of life. The flex space allows an additional separate living, office, playroom, or guest bedroom space away from the main ground floor living area, and it allows children and parents the opportunity for privacy and space from one another while still being at home together. This kind of space is particularly important in the aftermath of the pandemic, where family members may be self-isolating, doing e-learning, or working from home on a regular basis.



Second Floor Plan

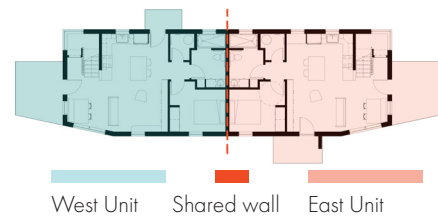


First Floor Plan

## INTIMACY GRADIENT AT ALLEY HOUSE

The Alley House is divided into public and private spaces so that residents can socialize with each other and guests, as well as retreat to private areas if desired. The first floor of each unit holds most of the public spaces, including the living/dining area and kitchen. These spaces are the primary gathering places, optimal for socialization and recreation. The bedrooms in this home are the most private spaces. The primary bedroom is on the first floor with the entrance behind the kitchen, while the other two bedrooms are upstairs. Both upstairs bedrooms have immediate access to the “flex space”, a semi-public open area for recreation, storage, or work. This space could act as a playroom while children are younger and later transform it into a study or an office space, a guest room, or a den as the family grows and changes over time. To prevent any abrupt transitions between spaces, the family’s bedrooms flow into semi-private spaces before opening

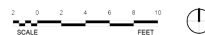
into the public zones. The open design of the public areas allows for an easy flow of movement and communication between the rooms. Circulation routes are incorporated into these spaces, maximizing traffic flow and livable floor area by limiting inaccessible or underutilized space such as dedicated corridors where little program activity can occur. By designing distinct living zones and incorporating seamless movement between them, the home becomes efficient, comfortable, and a secure place that facilitates varied family lifestyles. The porch of the Alley House also serves as a transition space between the indoors and outdoors.



- Public
- Semi-public
- Private



Second Floor Plan



- Public
- Semi-public
- Private



First Floor Plan

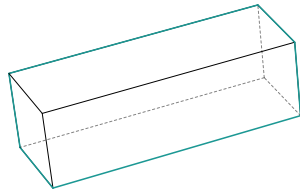


## FORM DEVELOPMENT

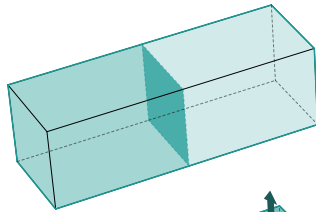
The Alley House form is influenced and elongated by the site orientation and its strong connection to the alley that runs east-west. South-facing massing ensures maximum exposure to the sun in the winter and natural wind flow in the summer. The south-facing angled roof is designed to generate solar energy through photovoltaic (PV) arrays. Through study, the team discovered that the front porch

presence plays a key social role in the community. This finding led to the development of open and inviting front porches for both units. The overall form pulls pedestrians around the home from Temple Avenue and down the east-west alley exposure to the sustainable elements of the Alley House.

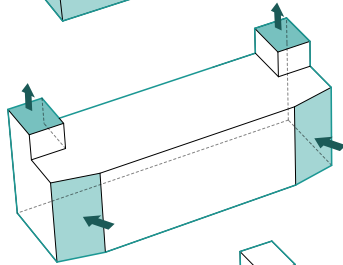
Long south face towards alley



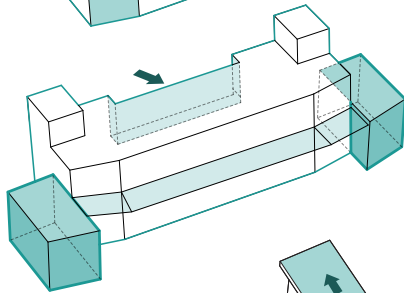
Short demising wall between units



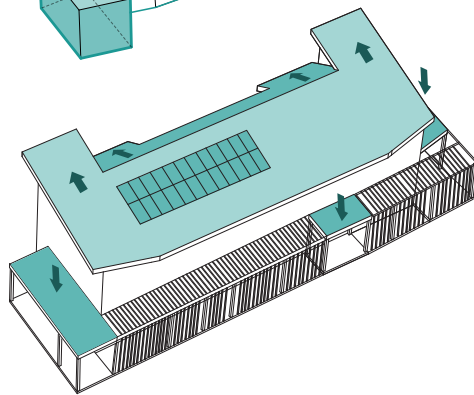
Elevated stair angled wall for view to alley



Porch Placement and secondary entries



Addition of PV array on 4/12 pitch facing south



### Initial Volume

East-west elongated simple rectangle shape limited surface area and optimal solar orientation.

### Create Two Units

Dividing the volume into two units, but giving both access to the south and the alley.

### Stair Core & Alley Activation

Simple formal changes to create architectural interest, to address the alley/corner site, and provide for natural ventilation.

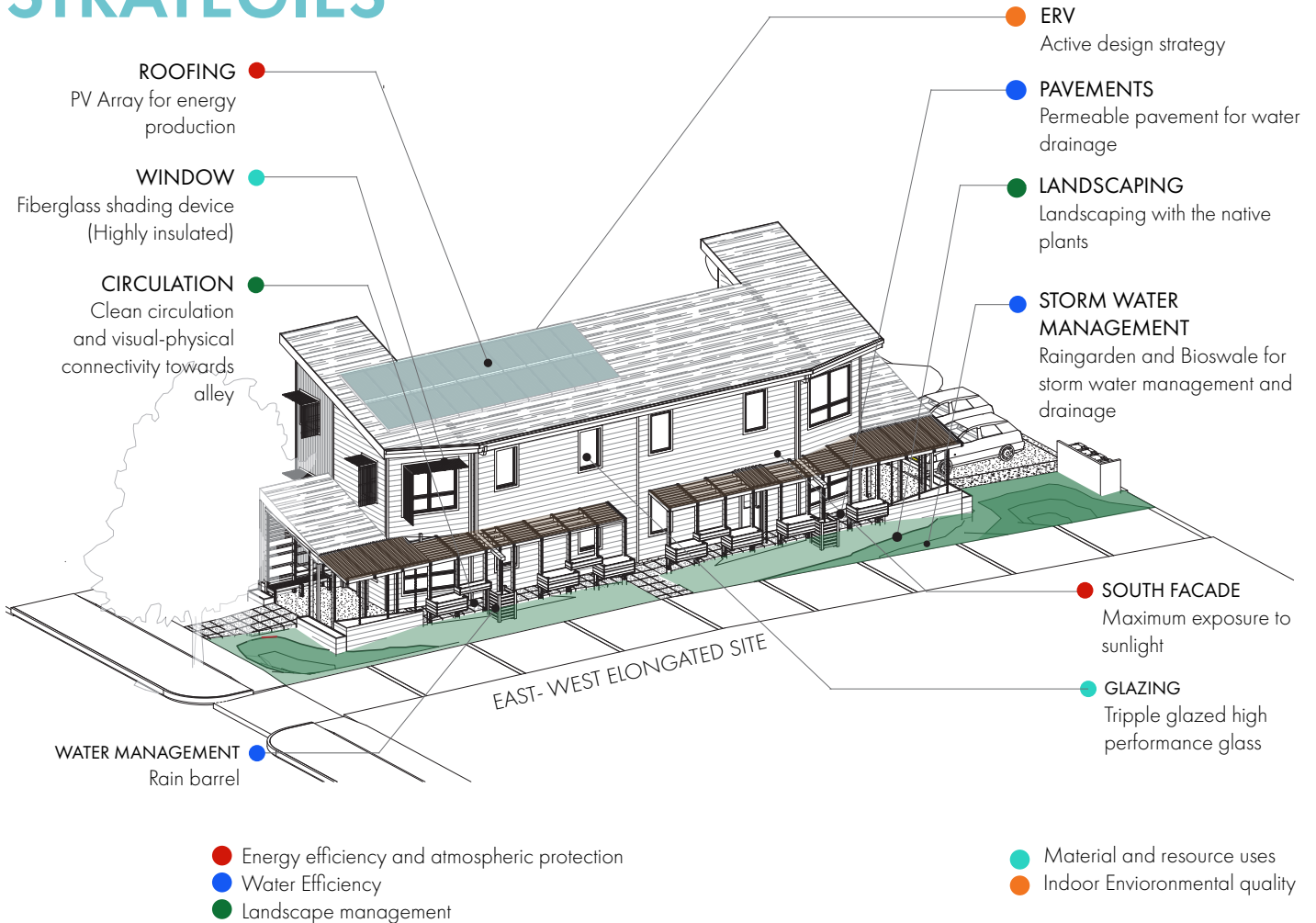
### Defining Entrances & Spaces

Giving each unit a porch for transitional space and community interaction.

### Roof Pitch Study & Addition of East and West Porches

Mono pitch to the south for optimal solar array orientation and area. Addition of pergola with the porches for creating enclosure for the connecting spaces.

# SUSTAINABLE DESIGN STRATEGIES



## SUSTAINABLE SITE CERTIFICATION

The Alley House design utilized the Sustainable SITES criteria. Cardinal Studio worked closely with faculty and consultants to align the requirements of the program with the needs of the residents. The team recognized that the Alley House’s design extends well beyond the envelope of the home. Site sustainability is an integral part of a high-performance home, such as the Alley House. To meet these criteria, the design incorporates rain barrels, rain gardens, bioswales, a gabion wall made of recycled material from the existing site, and a landscape made of native plants. Recycled limestone paving comes from a recently demolished Indianapolis Public Schools building. As with the design of the home itself, the team was attentive to every detail of the site, including material selection, orientation, and scalability.

## ADDITIONAL SITE FEATURES

The Site Includes:

- Raised Planters for Edible Gardens
- Rain Barrels for Water Collection
- View of PV Array on Roof
- EV Charging Station
- Permeable Pavers & Rain Gardens for Water Management

# PASSIVE STRATEGIES

## SUMMARY OF STRATEGIES

Passive design strategies were incorporated in the Alley House to reduce the dependency of active systems and to save energy.

### Envelope

Taped Zip Sheathing with minimal envelope penetration provides the Alley House with an extremely airtight envelope, increasing both energy efficiency and thermal comfort. These efforts resulted in an airtightness measurement of less than 1 ACH50, a significant improvement over the Indiana Code requirement of 5 ACH50. Thickly insulated exterior walls include dense-pack cellulose cavity insulation and rigid board mineral wool on the exterior.

### Passive Heating

To assist in heating the home in winter, strategically placed openings and overhangs allow winter sun to warm the ground floor thermal mass. The first-floor finish material of the Alley House is polished concrete, which has a high thermal capacity.

### Passive Cooling

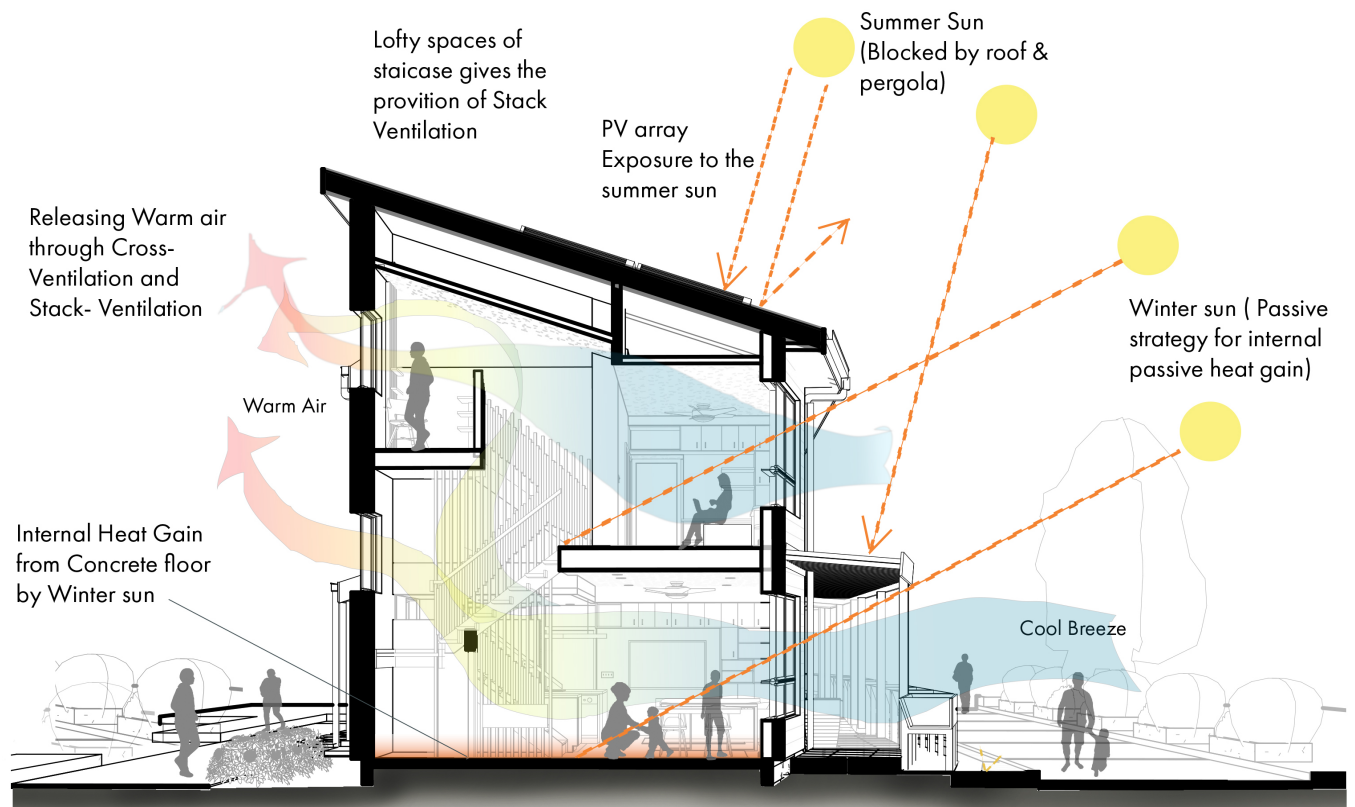
Stack ventilation and cross ventilation use operable windows that allow implementation of passive cooling strategies. The team designed two types of passive cooling to allow options for the occupants and to increase the number of hours per year that the home can be run without mechanical air-conditioning. Specifically calculated window sizes allow increased air circulation, and enhance natural ventilation.

### Daylighting

Ample high-performance glazing was provided on all exterior walls to achieve exceptional daylighting. Narrow floor plates with tall windows placed close to the ceiling allow light from both sides to evenly daylight the floorplates. Interior colors aid in daylight distribution.

### Storm Water Management

Several rain gardens collect rain collected from the roofs and allow the water to percolate back into the water table, reducing stress on municipal stormwater systems. All stormwater is dealt with onsite. The site also utilizes other storm water run-off mitigation strategies, such as specifically designed bioswales and permeable pavers. Rainwater is also collected in rain barrels for use in irrigation.



Passive Strategies Diagram for Alley House

# EDUCATIONAL ELEMENTS

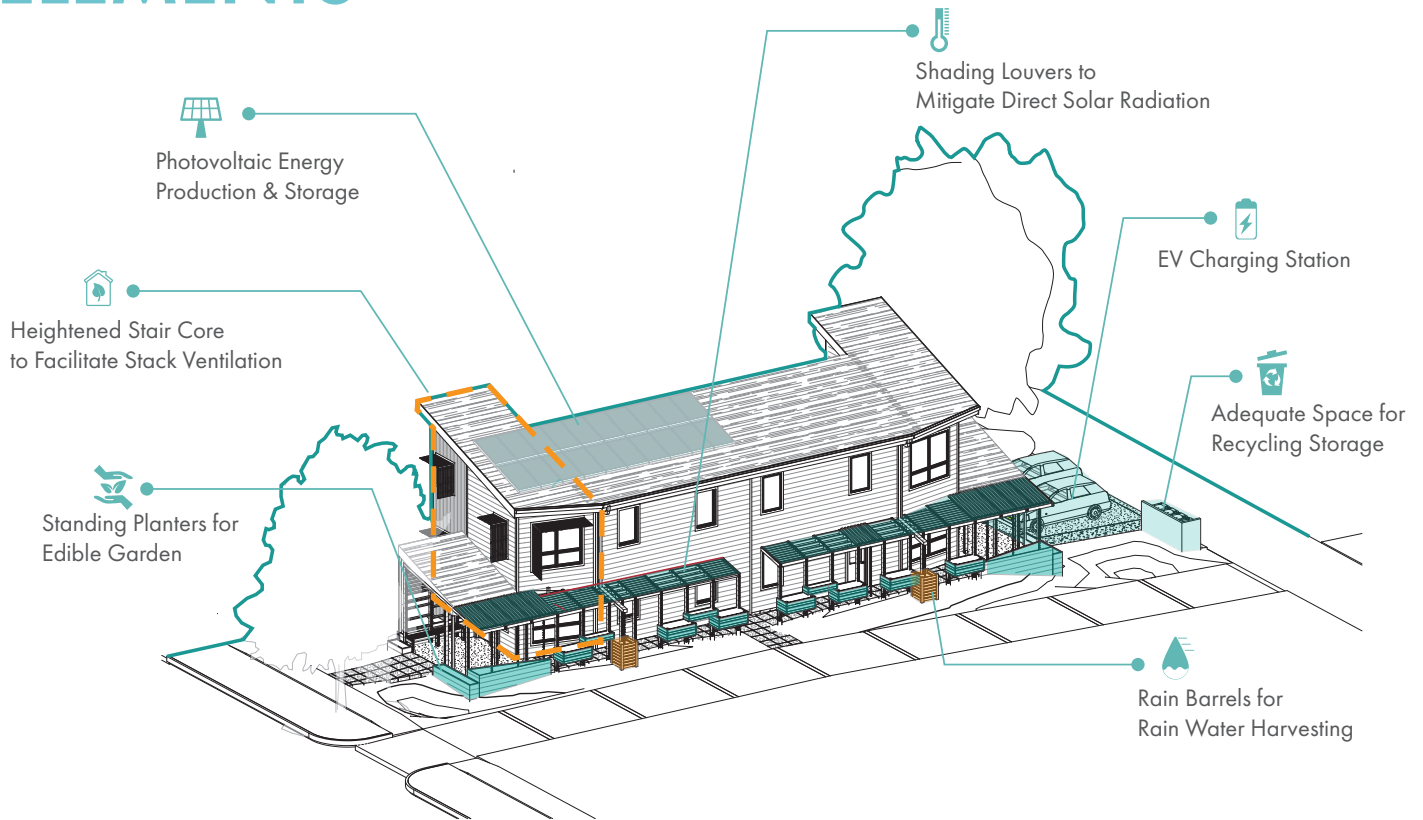


Illustration of Educational Elements at Alley House

## BIOPHILIC DESIGN CONSIDERATIONS

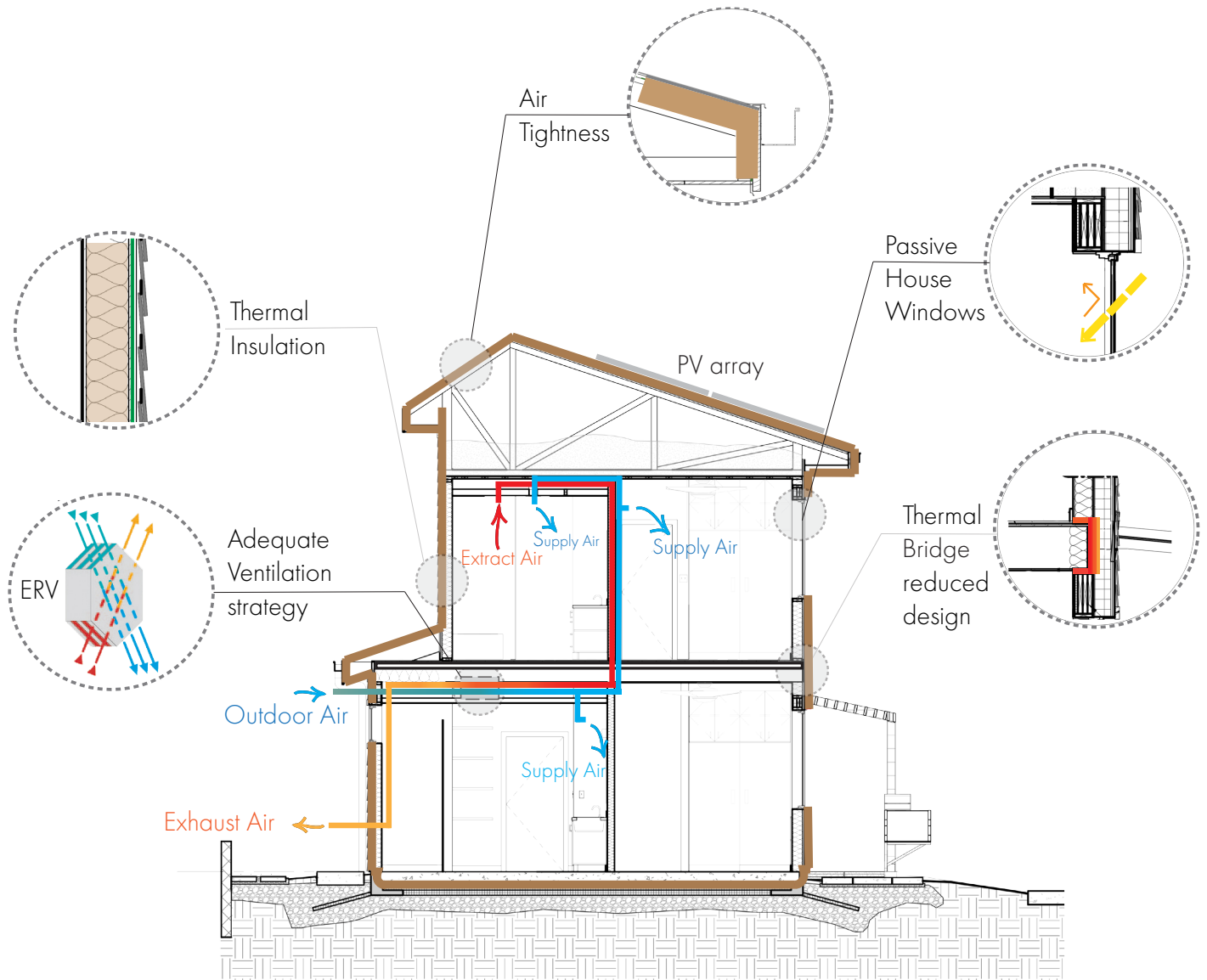
The Alley House was designed using sustainable approaches and incorporating biophilic design principles. Biophilic design follows six fundamental principles: incorporating environmental features in the design process, using natural shapes and forms, following natural patterns and processes, ensuring the correlation of light and space, establishing place-based relationships, and developing human-nature relationships through design. The Alley House design followed and respected the natural formation of the site by positioning the rain garden and bioswale in a natural shape and pattern. The large windows and pergola create harmony between the space and light, improving quality of life for the occupants. By creating a place-based relationship with nature, the biophilic design in the Alley House also enhances the relationship between humans and the natural world.



Incorporating Biophilic Design



# PHIUS Diagram in Alley House



## PHIUS | Passive House Certification Elements

- Continuous insulation breaks thermal bridges between inside and out
- Air-tightness stops heat and moisture
- Optimized windows keep heat in winter - and out in summer
- Balanced ventilation ensures fresh air and moisture control
- Minimal mechanical is needed in this super insulated building

# DETAIL DESIGNS

The west unit of the Alley House has several signature design features such as stairs with screens, built-ins for the interior, custom-made kitchen cabinetry, shading devices, and a pergola on the south side of the house. These unique design details distinguish the Alley House from other houses in the neighborhood.

## STAIR-SCREEN

The stairs located on the west side of the unit provide sufficient space to connect the spaces vertically ending in a mezzanine. The unique and sustainable design of the stair screen makes of leftover materials from the cabinetry and exterior cladding (thermally modified wood). The risers of the steps are made from pine, and the treads are made from hemp wood, a sustainable building material. The design of the stair railing follows the rhythms of the Fibonacci sequence. Using thermally modified wood panels on the stair screen allows this interior design element to echo a material used on the exterior.



Stair-Screen Design (Fibonacci sequence)

## PERGOLA DESIGN

The design of the Alley House includes a large outdoor porch area located along its east, west, and south façades that is covered and protected by a wooden pergola. With columns set four feet on center, the pergola relates directly to the advanced framing module of the house. It creates a transitional space that feels secure, but not enclosed, and it buffers the house from the adjacent alley. Integrated into the pergola design are several types of planters, addressing the need for small scale urban farming, and rainwater collection barrels. The pergola is made from locally sourced thermally modified wood.

## BUILT-INS & KITCHEN CABINETRY

Cardinal Studio students designed and built all the built-ins in the flex spaces of west unit, both as a design challenge and to reduce costs. The Alley House was designed as affordable housing in tight spaces and on a limited budget, and storage became an important design consideration. The inexpensive built-in storage units, the under-stair closet for bigger items, and the large kitchen pantry for food storage were designed to satisfy the needs of occupants who will not have the luxury of an attic or basement space for additional storage. The modular design of the built-ins allows occupants the option to configure them horizontally or vertically.



View Looking From Living Space To Dining Space



Pergola Design (South facade of Alley House)

## SHADING DEVICES

The team struggled to design an exterior window shading device that worked with the envelope design and could be built in a durable, cost-effective way. The solution was a series of wooden slats attached to a metal skeleton that attached directly to the inner trim of the window and protruded from the window to shade it effectively. The team chose specific windows on which to place the shading devices, creating both a functional design and a learning opportunity for the residents of the units and the community. The forms were determined by analyzing data to find the most thermally uncomfortable days and using those sun angles on those days to design overhangs and fins that block them.

## MATERIALS

The materials used in the Alley House were chosen to enhance the design aesthetic, while maintaining the energy efficiency, resiliency, and cost effectiveness of the home. The Alley House design team minimized the environmental impact by sourcing materials locally, when possible, and choosing materials with a low ecological footprint. The chosen materials are durable and low maintenance to ensure that upkeep is simple for occupants during the rental period and for owners later on.



Transitional space between indoor and outdoor space



Shading Devices (West and South-west facade)

## EXTERIOR-INTERIOR | INDOOR OUT-DOOR RELATIONSHIP

As its name indicates, the Alley House highlights the existing alley to the south of the home, which plays a vital role in the design and occupant experience of the home design. Plans to improve the alley's current deteriorated conditions will give the Alley House direct pedestrian access to Rural Street, a major Indianapolis thoroughfare near many major neighborhood amenities. The Alley House activates the alley through the design of the porch and pergola, increasing residents' use of the alley system. The Alley House is designed to support the intention of Englewood CDC to promote a strong porch culture in the neighborhood, which replicates the existing vernacular architecture and provides opportunities for residents to interact with neighbors. The large wrap around porch is a transitional area that provides residents a space to engage with others. Connection to exterior spaces is essential for the wellbeing of residents, especially in urban settings where it may be more difficult to find comfortable outdoor spaces which also reduce the need for air-conditioning in warm weather.

The Alley House is designed in a unique way that the duplex home engages a series of underutilized urban alleys adjacent to the project site for better visual, physical, and solar access. The design incorporates many residential design features uncommon in affordable residential construction in Indiana. For audio-visual report, here is the link of narratives to multimedia hosted online: <https://www.youtube.com/watch?v=qOOtvCZzmc>



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West-South Facade



© Robbie Mehling

West Facade



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West-South Facade



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Electrical Vehicle Charging Station - East Facade



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West Unit - Dining Room



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Second Floor - Flex Space



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East Unit Entry Pathway



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Utility Service Wall



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Alley House West Unit Kitchen



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Alley House in Context