Arch 330 | Collection 4

Parekh House | Sage House | Tye River Cabin

Part 1: Analysis | Proportion & Scale, Ordering Principles, Design for Local

Part 2: Comparison | Environmental Design

Michael Blakely |

Part 1 | Analysis

Intro

In the following Analysis, I will be examining the following case studies;

- Parekh House, design by architect Charles Correa and located in Ahmadabad, India.
- Sage House, designed by Architect Antoine Predock and located in Taos, New Mexico
- Tye River Cabin, designed by Architects Tom Kundig & Kirsten Murray and located in Skykomish, Washington.

I will be evaluating the key elements of each building, regarding proportion and scale, and the principles used to create order in each of the architectural compositions. I will also be discussing the possible decisions made by the designers in response to demands from the projects local.

Due to the differences in user, location, and overall purpose for each building, there will "exist a natural diversity and complexity in the program requirements" (Ching, 2007, p. 338). I will try to capture how the parts of the whole in each architectural response are ordered in hopes to "produce a harmonious arrangement" (Ching, 2007, p. 338) while still respecting their immediate landscape.

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▲ Figure 1 *(Serenyi, 1975)* Parekh House | Charles Correa, architect.

▲ Figure 2 *(Antoine Predock Architect, n.d.)* Sage House | Antoine Predock Architect

▲ Figure 3 *(Olson Kundig Architects, n.d.)* Tye River Cabin | Tom Kundig & Kristen Murray

Parekh House

Intro

Parekh House, designed by Charles Correa and completed in 1968, is located in western India in the city of Ahmedabad. In a city with a population of about five and a half million people, the context for the home consists of a dense urban setting with building types ranging from historical churches in traditional Hindu and Muslim styles to modern factories (Encyclopaedia Britannica, 2019). Houses of the area span from large, finely crafted villas to the decrepit housing of vast slums. Parekh house falls somewhere in between, serving the middle to lower class. Households of multigenerational families are quite common in India (Encyclopaedia Britannica, 2019), and could be the reasoning for the homes physical size which is rather large and spanning over three levels.

Ahmedabad consist of a warm, dry climate with summer temperatures ranging from 45 °C - 30 °C and winter temperatures of 24°C - 5 °C (Sreekanth, 2011).

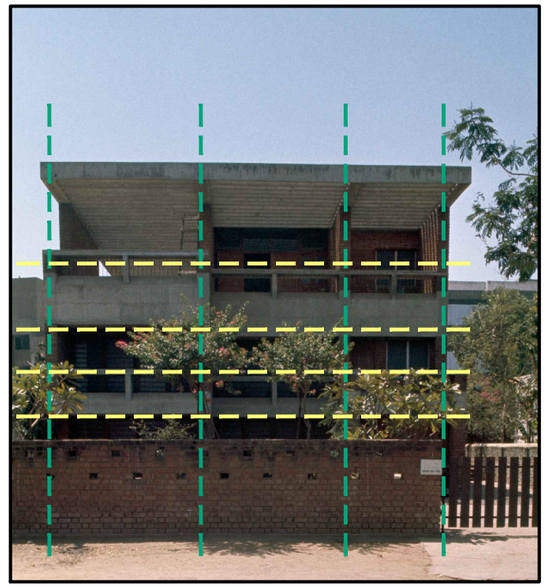
▲ Figure 4 *(Serenyi, 1975)*
Parekh House | View from the street

Proportion & Scale

From the street, the scale of Parekh House reads as quite large, as a result not only by its physical size but from its boxed form and choice of structural materials. The home is comprised of a combination of load bearing brick walls and either precast or cast-in-place concrete. The “inherent strengths and weaknesses” of these materials dictate their rational proportions (Ching, 2007, p. 295). In the case of the concrete balcony members, their scale is large and are perceived as being heavy, however they are proportionate with large massing of the house as a whole. The cantilevered concrete roof plane above is substantial in size and quite dramatic. Overall, at first glance the house comes across as intimidating and brutal.

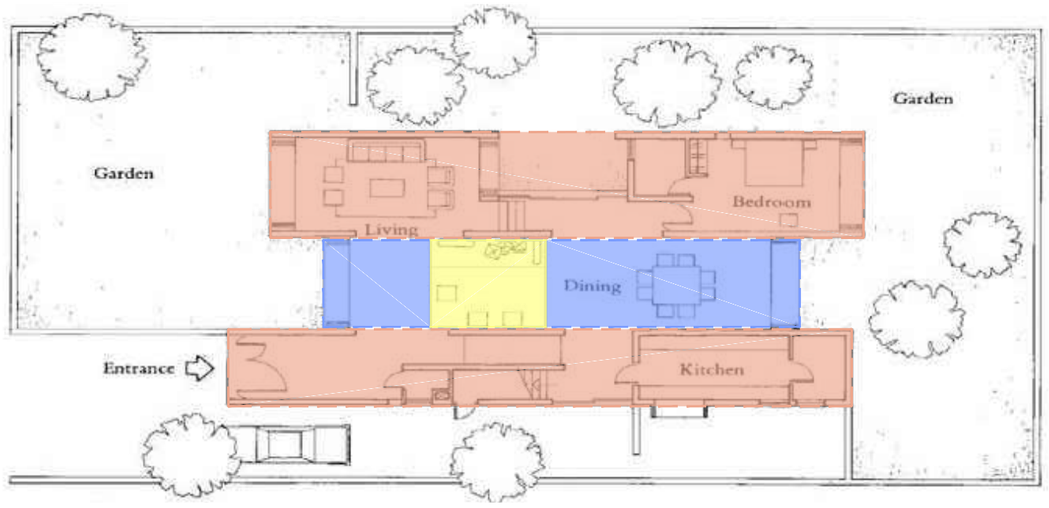
Due to the structural span limitations of the concrete floor slabs, the home is divided into three structural bays. These bays are articulated in elevation by continuing the bearing walls past the exterior wall of the building to support the balcony structures, creating three vertical bays. With the addition of the horizontal balcony elements, the front façade of the building is broken up in a grid pattern creating a more human scale (Refer to figure 5). Proportions of window and door openings also portrays a human scale at the building, as the landscaping wall with brick relief detailing and front entrance gate contribute in the same respect at street level.

In plan view, the three elongated structural bays as previously mentioned are clear (Refer to figure 6). Spaces within the larger overall space of the structural bays are defined by changes in floor level, the sunken living room being an example (Refer to figure 6). This produces more intimate spaces with room dimensions of more regular proportions, thus creating a space “static in nature”, and having “the character of a place to be in, rather than a space to move through” (Ching, 2007, p. 151), as a more elongated space would.



(Serenyi, 1975)/ overlay by author Figure 5 ▶
A grid created by vertical & horizontal structural elements helps break-up the massing into a more human scale.

▼ Figure 6 *(Sreekanth, 2011)/ overlay by author*
Ground floor plan comprised of three structural bays. Living room defined by change in floor level creates a space within a larger space.



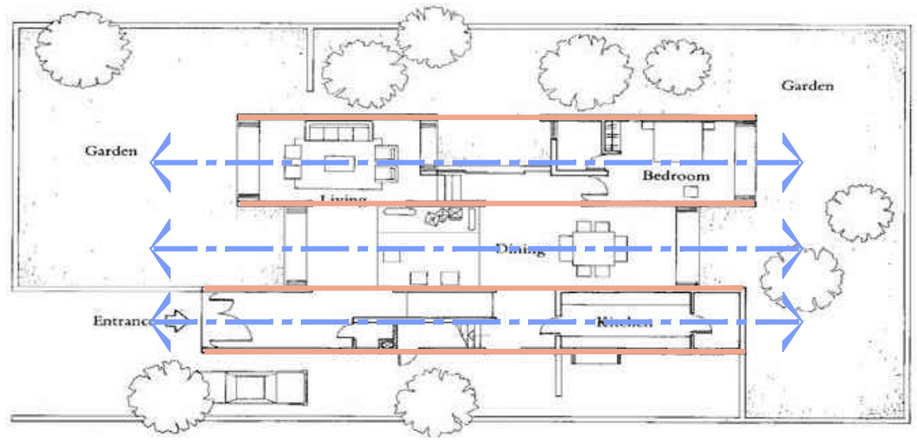
Ordering Principles

The three structural bays or “sections” previously mentioned which generate the building form of Parekh house, along with the subtraction method of creating balconies and courtyards, produces a series of forms, volumes, and voids ranging in size and relative position to each other. An ordering principle, which Ching describes as “visual devices that allow the varied and diverse forms of spaces of a building to coexist perceptually and conceptually within an ordered, and harmonious whole” (Ching, 2007, p. 338), is used for these very reasons. The concrete roof plane (Refer to figure 7), acts as a datum, organizing the varied forms and open spaces below it “through its regularity, continuity, and constant presence” (Ching, 2007, p. 366). The roof plane meets the requirements of Ching to be considered a datum of planar form by having “sufficient size and regularity”, allowing it to “gather together the elements being organized within its field (Ching, 2007, p. 366).

The regular intervals of the horizontal cross members of the roof or 'pergola' create a rhythm (Refer to figure 7), which Ching describes as “any movement characterized by a patterned recurrence of elements at regular or irregular intervals.” (Ching, 2007, p. 382). The movement required for the rhythm is provided both by our eyes as they move across the roof assembly, and by the sun, casting shadows that travel across wall and floor planes throughout the day.

In plan, the load bearing masonry walls are arranged parallel to each other or to an implied axis. “The notion of the axis” is reinforced by the vertical planes themselves, which “define linear space coincident with the axis” (Ching, 2007, p. 340). (Refer to figure 8). The use of the axis provides order in the arrangement of interior space.

▲Figure 7 *(Serenyi, 1975) overlay by author*
The overhead plane acts as a datum organizing the varied forms and spaces below it.
The cross members of the pergola create rhythm due to their reoccurrence at regular intervals.

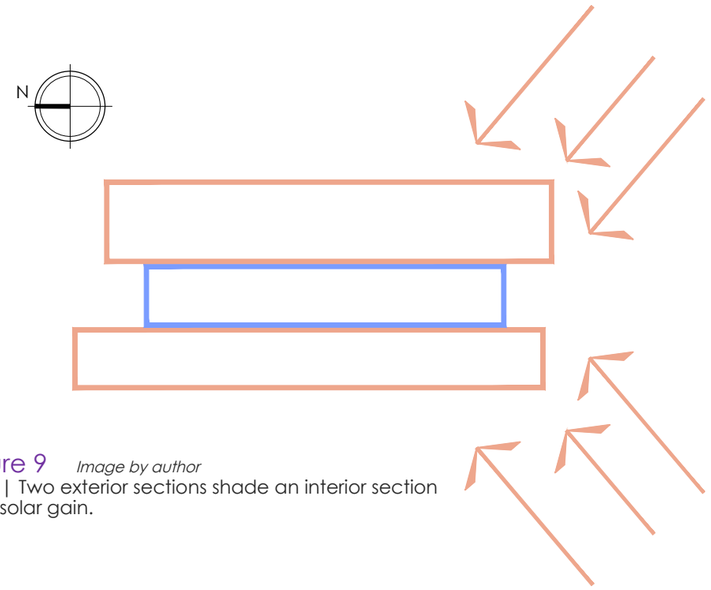


▲Figure 8 *(Sreekanth, 2011)/ overlay by author*
In plan, interior spaces are arranged along three axes, which are visually reinforced by parallel load-bearing walls.

Design for Local

The climate in Ahmadabad is hot and dry, with solar radiation being a dominant factor in building design. Since the urban plot of Parekh House doesn't allow for much flexibility when orienting the home, an east and west facing building is ensued. As a result, Correa chose to arrange the three previously mentioned sections in a manner that the two exterior sections would take the brunt of the solar exposure and provide shade to the interior section (Refer to figure 9). Individual spaces are then located throughout the home in either the warm sections or cool section based on their function and time of use. Further attention went to the articulation of the building's massing in providing large overhangs and recessed openings to further prohibit direct solar gain into the building's 'cool' core. (Refer to figure 10)

Brick and concrete which are the building's principle materials, can both be locally sourced, are rugged enough to withstand urban life, and will not require persistent maintenance.



▲Figure 9 *Image by author*
PLAN | Two exterior sections shade an interior section from solar gain.

▲Figure 10 *(Serenyi, 1975) overlay by author*
Overhead pergola and recessed terraces proved shade for exterior and interior spaces. landscaping further protects against solar gain. The building's materials of brick and concrete can both be locally soured and erected.

Sage House

Intro

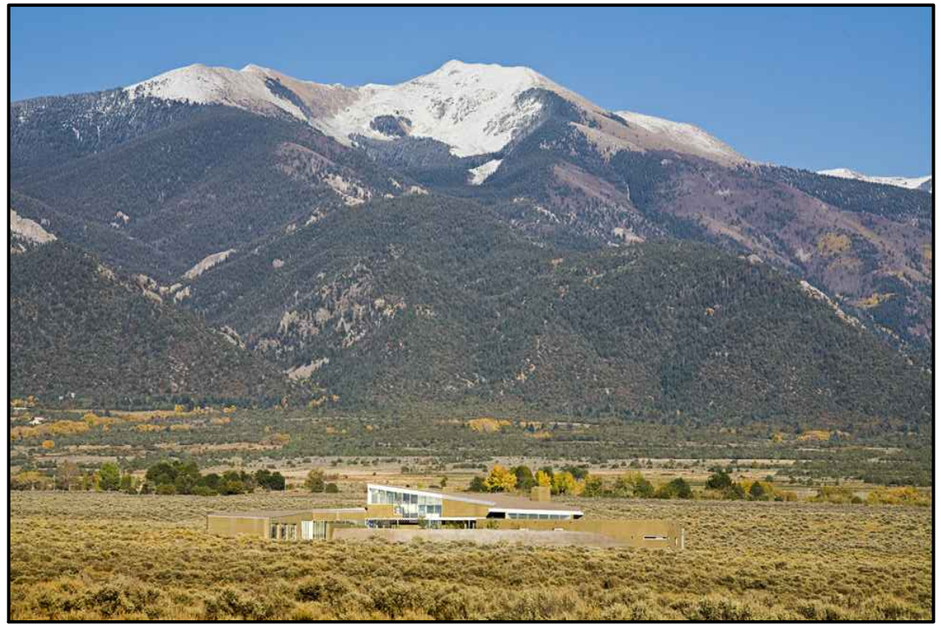
Sage house, designed by architect Antoine Predock and completed 2008, is located on a “1,200-acre cattle ranch near Taos, New Mexico” (Giovannini, 2010). The sprawling one storey home plus loft is organized in an arc formation, enclosing a courtyard on one side while allowing for uninterrupted views out the other. The setting for the home is unique considering that while the view outward from the site are so vast, still no other built form can be seen. “designed for a renowned local chef” and his “family of five” (Antoine Predock Architect, n.d.), the homes spaces for eating and cooking are of strong importance and located at the center of the home, both inside and out.

Taos has a dry climate, with average daytime temperatures of 24°C during the summer and 8°C during the winter while falling below freezing at night. (Weatherspak , n.d.)

▲Figure 11 *(Antoine Predock Architect, n.d.)*
Sage House | Aerial view

Proportion & Scale

Visual scale “refers not to the actual dimensions of things, but rather to how small or large something appears to be in relation to its normal size or to the size of other things in its context” (Ching, 2007, p. 330). Although the scale of sage house, with a floor area of 4,030-square-feet (Giovannini, 2010), is rather large for a single family home, there aren't any other homes within its context. This causes the physical size of the home to be dwarfed by the mountain ranges in the distance, and the size of landscape that surrounds it. (Refer to figure 12)



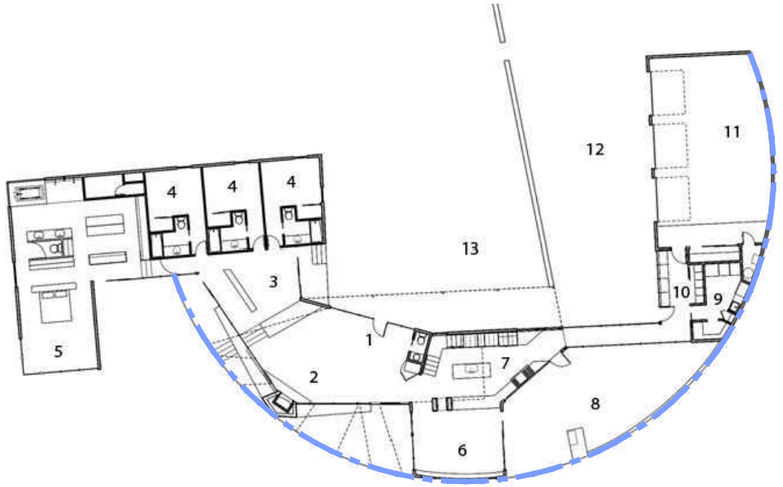
▲Figure 12 *(Antoine Predock Architect, n.d.)*
The large home has a fairly small visual scale when viewed in context with its large surrounding landscape and mountain ranges in the distance.

Ordering Principles

The many spaces of Sage House, which are located predominantly on one level, vary in size, shape, and function. These spaces are organized using linear, clustered, and radial formations. Order is kept within the composition of spaces by a curvilinear arc acting as a datum. The arc is comprised of portions of the exterior wall, landscaping walls, end edges of exterior patios (Refer to figure 13). The arc is able to act as a datum and “organize a random pattern of elements through its regularity, continuity, and constant presence.” (Ching, 2007, p. 366).

In elevation, a horizontal line is created by the roof over the garage wing, the roof of the bedroom wing, and the trellis in between which provides passage to the main entrance of the home. These roof lines are also acting as a datum, organizing building forms above and below it. (Refer to figure 14)

A hierarchy in the building's composition of form and space is evident through the protruding form with a sloped roof located above the principle horizontal roofline (Refer to figure 14). Ching defines hierarchy as “The articulation of the importance or significance of a form or space by its size, shape, or placement relative to other forms and spaces of the organization”. The importance of this particular building element is articulated by its unique roof line, amount of glazing used, and its height being the only two storey portion of the home. This element is the only building form located above the horizontal datum line. It is located horizontally at the center of the arrangement, identifying the main entrance below which leads to the homes living, dining, and cooking areas.



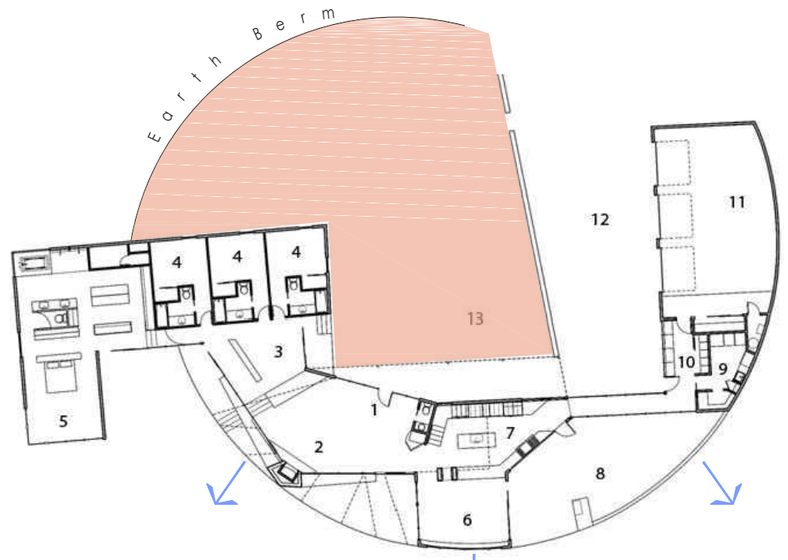
▲ Figure 13 *(Reck, 2010) overlay by author*
A curved arc acts as datum, bringing order to the wide range of spaces and forms it surrounds.

▲ Figure 14 *(Antoine Predock Architect, n.d.) overlay by author*
A horizontal roof line acts as a datum organizing forms above and below it. Hierarchy is evident with the unique shape of the loft, the only form above the horizontal datum line.

Design for Local

Located on a unique, large, and open site, space was available for a number of various options to configure and orient the building. Antoine Predock chose to organize the building's spaces “along a simple arc, focusing views outward to the dramatic landscape (Antoine Predock Architect, n.d.). Since the site is so open to the landscape, it is vulnerable to its climatic conditions causing measures to be taken to mitigate certain factors. The arc formation of the building not only allows for spectacular views outward from one side, but also semi-encloses an internal courtyard on the other side, which is then further “sheltered from prevailing southwestern winds with walls, an earthen berm and an orchard. (Antoine Predock Architect, n.d.) (Refer to figure 15)

From a distance, the overall massing of the building, consisting of a horizontal roofline with a protruding angular form above, mimics the horizontal planes of the building's immediate landscape and the mountain ranges in the distance. (Refer to figure 16)



▲Figure 15 *(Reck, 2010) overlay by author*
The arc formation of the house allows for uninterrupted views out one side while partially enclosing a courtyard on the other with help from landscape walls and earthen berm.

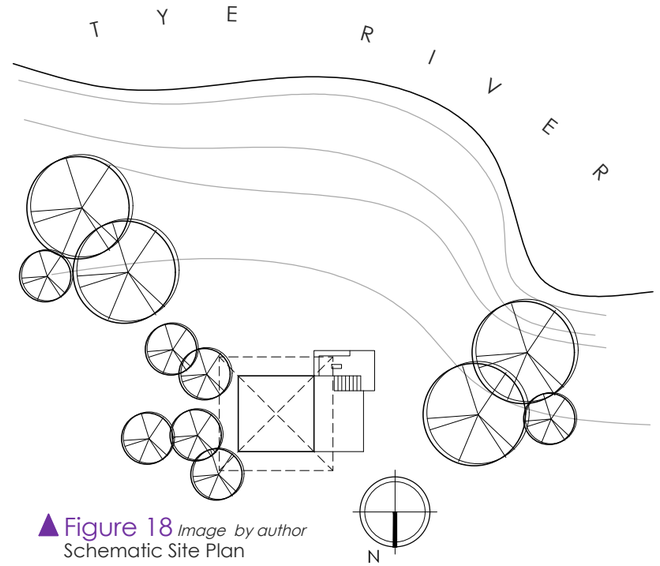
▲Figure 16 *(Antoine Predock Architect, n.d.) overlay by author*
The horizontal roof line alone with protruding angular element mimic the homes immediate landscape and distant mountain ranges.

Tye River Cabin

Intro

Tye River Cabin, designed by Olson Kundig Architects and completed in 2006, is located in Skykomish Washington, a forested mountainous region with a population of just over a couple hundred people that is within a little over an hours drive east of Seattle (City-Data , n.d.). Designed as a meditative retreat, the cabin is intended for a quiet weekend away rather than for large gatherings of family or friends (Teagarden, 2007). At just over 600 square feet (Teagarden, 2007) and arranged around a multi-sided concrete fireplace, The main level consists of a semi connected living room and kitchen along with “two bedrooms and a bathroom (that) are just large enough to fulfill their functions” (Olson Kundig Architects, n.d.).

The summer months in Skykomish bring average daily high temperatures of low to mid 70's (°F). The spring and fall are wet, and winter brings snow with temperature falling between 25-33 °F.



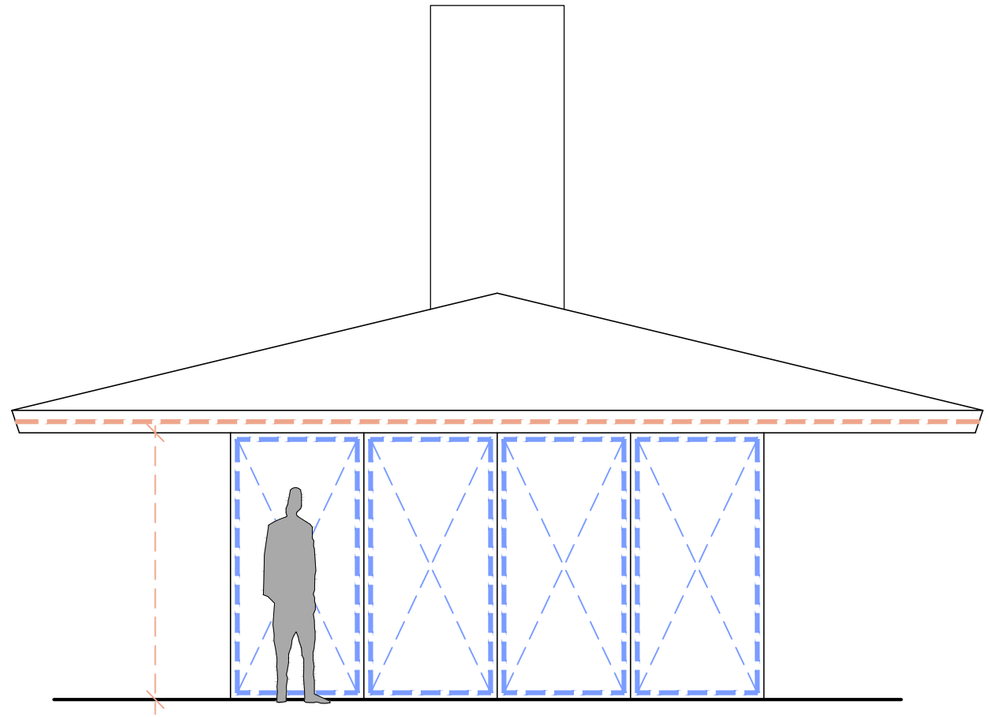
▲Figure 18 *Image by author*
Schematic Site Plan

▲Figure 17 *(Olson Kundig Architects, n.d.)*
Tye River Cabin.

Proportion & Scale

The proportions and scale of Tye River Cabin are directly related to its function. Designed and built as a personal space to be experienced by one or two individuals, the architecture depicts a human scale that "is based on the dimensions and proportions of the human body" (Ching, 2007, p. 332). Exterior glass walls are divided in equal increments into operable doors at human scale (Refer to figure 19). The low roof line portrays "qualities of shelter and intimacy", which relates to Ching's theory of a rooms height having "a greater effect on its scale than its width or length" (Ching, 2007, p. 333).

"A space that is intimate in scale makes us feel comfortable, in control, or important". (Ching, 2007, p. 332). I believe these qualities could all be found in Tye River Cabin, facilitating its function and purpose of a meditative retreat.

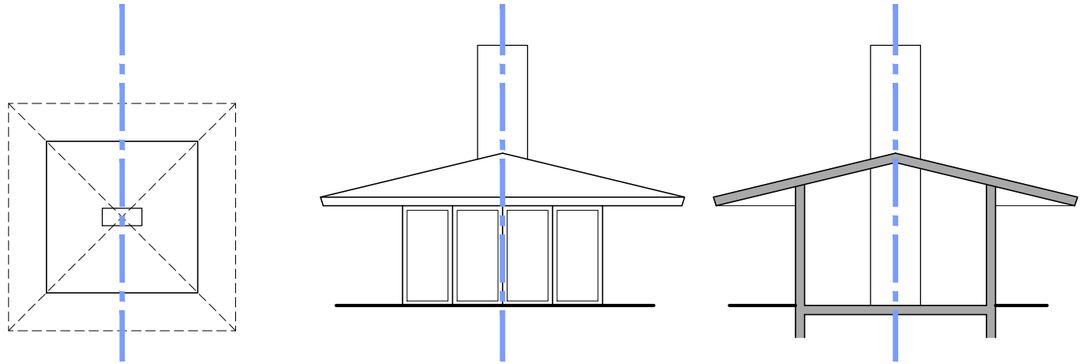


▲Figure 19 *Image by author*
Breaking up the glass facade into operable units portrays a human scale. The low roof line adds qualities of shelter and intimacy.

Ordering Principles

The interior spaces of Tye River Cabin are organized symmetrically within its square base. Ching describes symmetry as being “the balanced distribution and arrangement of equivalent forms and spaces on opposite sides of a dividing line or plane, or about a center or axis” (Ching, 2007, p. 339). A multi-sided concrete fireplace located along the axis of symmetry in the center of the cabin acts as a reference point, further organizing the spaces around it. The square floor plan, along with the centrally located fireplace and uniform hipped roof means that the cabin is symmetrical in plan, elevation, and section. (Refer to figure 20)

Since the transparent qualities of the exterior glass walls reduce the sense of enclosure and prohibits their ability to organize the spaces within them, the strong fascia of the overhead roof plane acts as a datum, “helping to gather the pattern of elements below it” (Ching, 2007, p. 267). (Refer to figure 21)



▲Figure 20 *Image by author*
Symmetry is used as an ordering principle in plan, elevation, and section.

▲Figure 21 *(Olson Kundig Architects, n.d.) overlay by author*
The strong roof line acts as a datum gathering spaces below.

Design for Local

Taking advantage of its setting of natural vegetation in close proximity, the glass panels of the exterior walls are operable, allowing the interior space to be opened to the exterior, creating unobstructed views and letting in sounds of running water from the nearby river. The panels opening at corners “deteriorates the volume of the form, allowing the interior space to leak outward” (Ching, 2007, p. 83) (Refer to figure 22). The large overhanging roof plane above shelters the interior from rainfall which is familiar to the area.

The wooden members that are used to construct the cabin were salvaged from an old nearby warehouse that the owner once often visited for breakfast (Teagarden, 2007). Due to expected weathering of the natural materials, “over time, the cabin will become more and more muted in appearance, blending in and eventually disappearing into the forest. (Olson Kundig Architects, n.d.)

▲ Figure 22 *(Olson Kundig Architects, n.d.)*
Corner openings deteriorate the sense of enclosure and allow interior space to leak outwards. Large overhangs protect the interior from rainfall.

Part 2 | Comparison

Intro

In part two, I will be using my analysis from Part 1 to compare each of the three case studies to one another. The areas of study will first be the position and orientation of the structures within their respective landscape. Next, I will analyse how each design addresses solar gain, ventilation, and natural lighting, and if there is any basic passive house design evident in the three projects. Finally, I will review each house to see if any regional materials were incorporated.

The purpose of this analysis is to examine how each project's **climate, context,** and **geography** may have influenced design decisions made by the architects in each area of study. I will identify any key similarities or differences between each project's architecture and how these compare to the respective landscapes of each home.

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▲ Figure 1 *(Serenyi, 1975)* Parekh House | Charles Correa, architect.

▲ Figure 2 *(Antoine Predock Architect, n.d.)* Sage House | Antoine Predock Architect

▲ Figure 3 *(Olson Kundig Architects, n.d.)* Tye River Cabin | Tom Kundig & Kristen Murray

Position/ Orientation

Intro

Before comparing how each of the homes are positioned and oriented within their respective landscape, the immediate differences of each site must firstly be mentioned. Of the three building locations, Parekh House is the only house set within an urban context, which consequently makes it the most restricted when positioning the home due to a smaller lot size and predetermined orientation by city planning. Tye River Cabin and Sage House are both rural sites, with Tye River possibly having a few more complications when laying out the site due to its topography (located on a hillside next to a river), and the existing vegetation on site. Located on a 1,200-acre cattle ranch within a flat desert landscape, the site of Sage House posses the most flexibility when considering the positioning and orientation of the building.

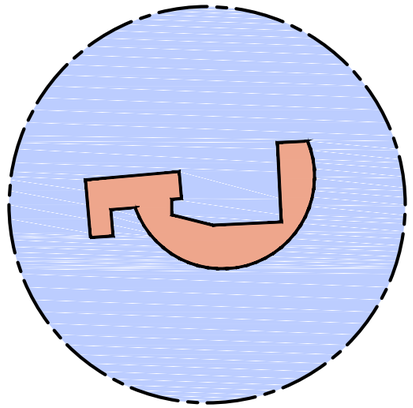
▲ Figure 23 *(Google Maps), (Reck, 2010), (Forest river [2] wallpaper, 2008)*
The urban context of Parekh House VS the open desert setting of Sage House Vs the forested waterside site of Tye River Cabin.

Possitioning | Whether through choices made by the architects or not, each house is placed within a landscape, and each type of placement differs from each other.

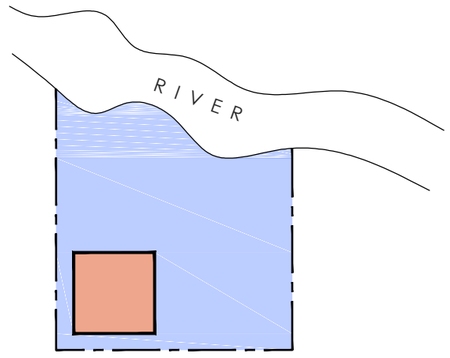
Firstly, there is Sage House, which is positioned right in the middle of a desert with its landscape completely surrounding it (Refer to figure 24). Having desirable views outwards 360 degrees, this is truly a rare piece of property for most.

Next is Tye River Cabin, with its plot consisting of a densely forested hillside next to a running river, the highlight feature of the site. The decision made was to not locate the home right next to the river (or on top of it), but instead towards the other end of the site, up the hillside away from the water (Refer to figure 25). The chosen positioning of the home allows for views of the river from interior and exterior living space, ensures the home stays dry in the case of heavy rainfall and flooding of the river, and avoids the chances of negatively affecting the waterway during the home's construction or lifecycle. Another decision was made to position the home not at the very top of the hill, but on its military crest or “shining brow”. This could have been for several reasons. Bainbridge and Haggard comment that “the top of the hill is the worst location (to locate a home) because it increases weather exposure, maximizes noise dispersal and impact from others, and is most visually disruptive for others”. (Bainbridge & Haggard, 2011, p. 27). They argue that a shining brow positioning would offer “less extreme winds and reduced visual and noise impact.” (Bainbridge & Haggard, 2011, p. 27).

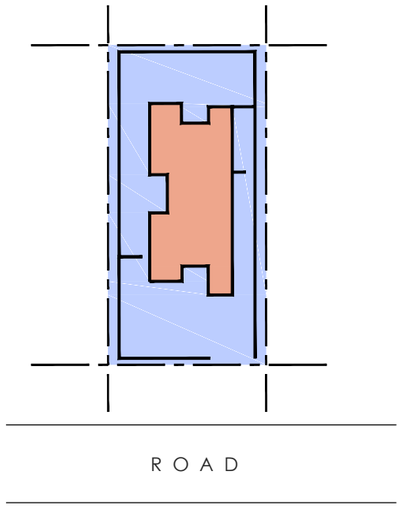
Lastly is Parekh House, which as previously mentioned had the least flexibility when positioning the home on its site due to its urban context and possible applicable bylaws. Nevertheless, the home is located approximately midway front to back on the site and close to middle side to side (Refer to figure 26). This allows for private gardens (defined by masonry landscape walls) to be located at both the front and rear of the home. With one side of the lot used for vehicle parking, the other allows for a garden running front to back. Having gardens located on three sides of the home means that they can be enjoyed at different times of the day, depending on the location of the sun.



▲ Figure 24 *Image by Author*
Sage house has a central positioning with its landscape completely surrounding it.



▲ Figure 25 *Image by Author*
Tye River Cabin is positioned to one side of its site, on the "shining brow" of the hill away from the water.

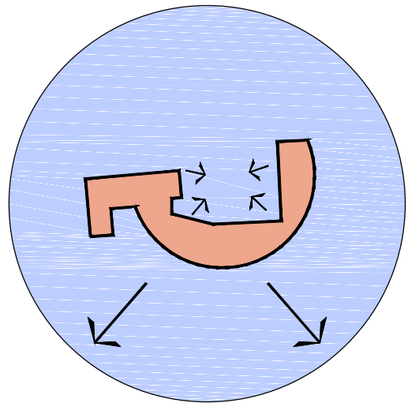


▲ Figure 26 *Image by Author*
Parekh House is located midway down its lot, allowing for a usable front and rear garden.

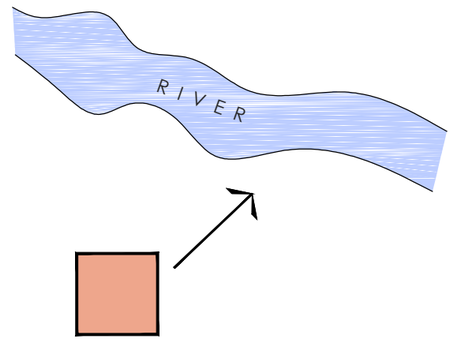
Orientation | Like the range of control when positioning each house on their sites, the similar applies when orienting them. The least restricted site of Sage House for positioning offers the same flexibility when choosing an orientation. Since there are desirable views in any direction, and nothing undesirable visually within its context that you'd want to turn your back to, the house could open or face in any direction. The architect chose to orient the house to face north/ east, allowing for views of the Sangre de Cristo Mountains from the interior communal living spaces and exterior terraces. The bedroom wing faces "south toward the Truchas Peaks" with the master "claiming the prime mountain view" (Antoine Predock Architect). Although its positioning along with its building form allow for spectacular views, it also utilizes a tool discussed by Ching for using form to "enclose a portion of the site as an outdoor room and shelter it from undesirable climatic conditions" (Ching, 2007, p. 98). The building form of Sage house defines an exterior courtyard that is "sheltered from prevailing southwestern winds" (Antoine Predock Architect) with added help from landscape walls, and earthen berm and an orchard. (Refer to figure 27)

The direction to orient Tye River Cabin was most likely an easier decision since the site possesses one principle feature, that being the Tye River itself. Agreeingly, the architects chose to orient the home so that the living and cooking areas, with exterior walls mostly of glass, have a prime view through the trees towards the river downhill (Refer to figure 28). These interior communal living spaces open onto an exterior patio sharing the same view of the water. Stairs from the patio, following the natural terrain of the site, lead to a seating area with fire pit, also opened and facing towards the river.

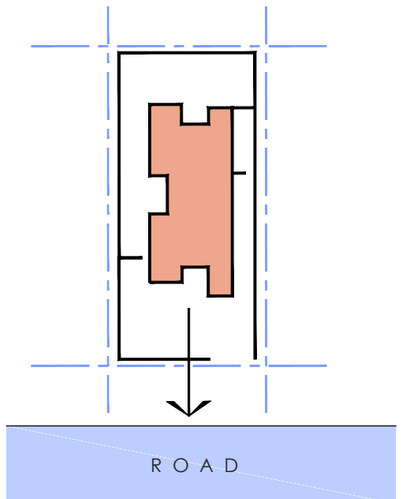
Further restrictions apply when orienting Parekh House, again due to its urban setting. Consequently, the home faces the street and the rear yard (Refer to figure 29), as most urban dwellings on narrow lots do. Having the homes terraces and windows facing the side yards runs a risk of the development of neighboring lots to diminish views or natural light.



▲ Figure 27 *Image by Author*
Sage House is oriented for views in one direction while is building form encloses a portion of its exterior and provides shelter from southwestern winds.



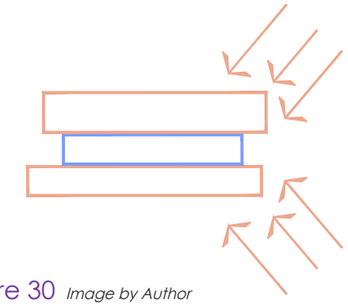
▲ Figure 28 *Image by Author*
Tye River Cabin is oriented for views of the water, the principle feature of the site.



▲ Figure 29 *Image by Author*
Parekh House faces the street as a result of auto-oriented city planning.

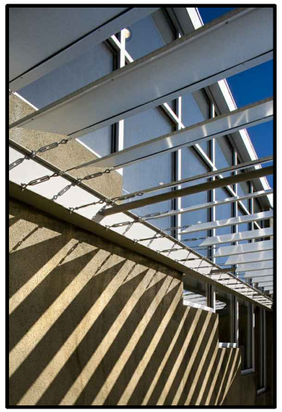
Solar Gain/ Ventilation/ Natural lighting

Solar gain plays a principle role in any sustainable design, since when utilized correctly, it "can dramatically reduce building energy demand for heating and cooling at no cost increase. (Bainbridge & Haggard, 2011, p. V)**.** "The first step is proper orientation for solar heating and natural cooling." (Bainbridge & Haggard, 2011, p. 8). As previously mentioned, the degree of control of orientation ranges with each case study. Nonetheless, to maximize on the benefits of solar gain, widows should be located on the south elevation. This allows for the greatest access to sunlight with the greatest control since in the south is where "the sun is high in the summer and low in the winter and can therefore be easily controlled with simple horizontal overhangs that still allow sun in during winter". (Bainbridge & Haggard, 2011, p. 13). The auto-based urban context of Parekh house with a car/ street approach to planning can "severely limit options for solar orientation, natural cooling, and meeting infrastructure needs on site. (Bainbridge & Haggard, 2011, p. 6). Considering its tropic climate, solar protection is of more concern than solar gain. The articulation of the building form into three sections allows the outer sections facing east and west to shade the interior core of the home (Refer to figure 30). Solar gain from the south elevation is controlled by recessing openings. Further protection is provided from a large overhead pergola which shades the house from the intense overhead sun, which in this location, stays fairly high year-round (Refer to figure 31). Similar shading devises can be seen at Sage House (Refer to figure 32a&b), which help keep the interior cool in the summer, but also allow for sun to enter in the winter for passive heating. Large overhangs help shade the large areas of glass wall at Tye River Cabin (Refer to figure 33). On this site, surrounding trees would also help shade the home, and through abscission, still allow sunlight through during winter months.



▲ Figure 30 *Image by Author*
Articulation of the Parekh House building form into three sections shades its core from solar radiation.

▲ Figure 31 *(Serenyi, 1975)*
An overhead pergola helps to shade Parekh House from the high sun.



◀ Figure 32a&b *(Antoine Predock Architect)*
Awnings provide shade at Sage House and help to diffuse direct light.

▲ Figure 33 *(Olson Kundig Architects, n.d.)*
Large overhangs provide shade to the interior of Tye River Cabin while the surrounding trees help diffuse the low direct sun from east and west.

Thermal Mass | All three projects utilize the use of thermal mass as a passive solar design tool. “Thermal mass provides the ability to store heat or coolth so that the interior temperature swings are dampened” (Bainbridge & Haggard, 2011, p. 15). The structural materials of Parekh House, comprised of brick and concrete, have great thermal mass, slowing the transmission of heat absorbed by the broad outer sections towards the building core. The concrete slab floor of Sage house will help retain heat from the sun and slowly radiate it during cool evenings. The same principle is seen at Tye River Cabin through the use of a large, central, concrete fireplace.

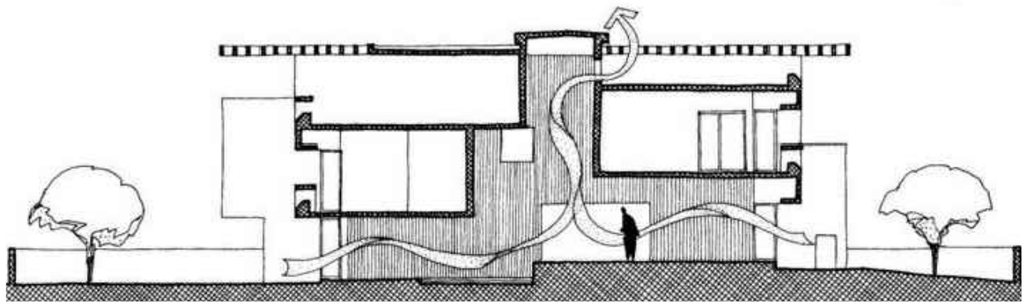
▲ Figure 34 *(Serenyi, 1975)*
Concrete and brick provide thermal mass at Parekh House, dampening the transfer of heat to the buildings interior.

▲ Figure 35 *(Antoine Predock Architect)*
Concrete floors at Sage House absorb heat let in by large windows.

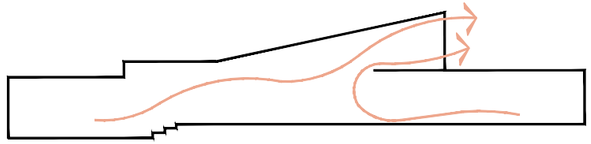
▲ Figure 36 *(Olson Kundig Architects, n.d.)*
The concrete fireplace at Tye River Cabin retains heat and radiates it during cool evenings.

Ventilation

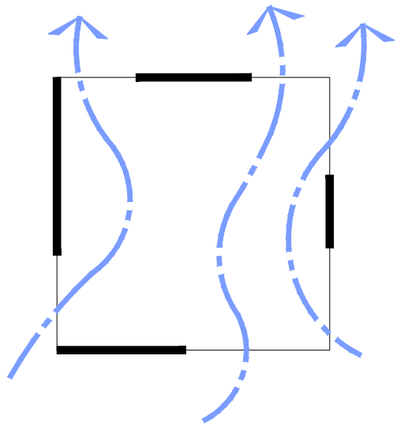
Proper ventilation is required for any healthy building. Just like heating and cooling, ventilation can happen naturally when passive design techniques are employed. “The goal is to have controlled ventilation so that air comes in when and where you want it and is fresh and healthy” (Bainbridge & Haggard, 2011, p. 14). The architecture of both Parekh House and Sage House provide opportunity for a stack affect to be used as a means of natural ventilation. Stack affect “utilizes the fact that hot air is less dense than cool air (causing warm air to rise) to generate air movement in a building with a low intake and high outlet” (Bainbridge & Haggard, 2011, p. 121). The height and articulation of form in section allow for a chimney affect to occur within Parekh House, allowing warm air to rise and exhaust from a high point, drawing cool air in from low, cool and shaded areas (Refer to figure 37). Similar is possible at Sage House given its double height loft area with sloped roof which is open to the lower level (Refer to figure 38). Given the single height space that is the main level of Tye River Cabin, stack affect will not occur. The vaulted ceiling allows a space for warm air to rise to, but no area to exhaust is provided. Instead, cross ventilation is made use of by locating large operable opening on multiple sides of the home (Refer to figure 39). Openings located on multiple elevations is critical for cross ventilation to work since “if there is only one opening into a room, breezes generally will not flow into it very far” (Bainbridge & Haggard, 2011, p. 117). The large glass panels act as wing walls when open providing the opportunity to “direct ventilation (…) and double the air penetration” (Bainbridge & Haggard, 2011, p. 126) in the home. (Refer to figure 40)



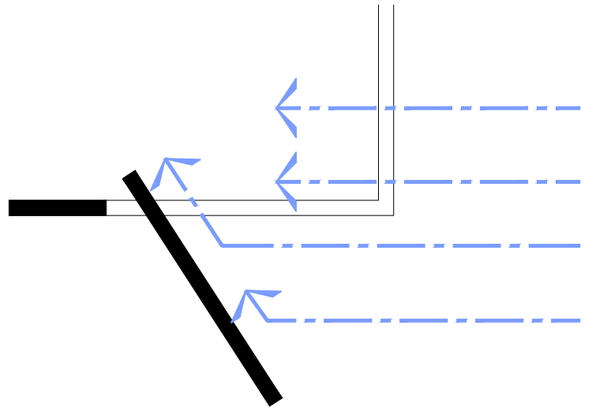
▲Figure 37 *(Brown & DeKay, 2001)*
The summer section of Parekh House creates natural ventilation by stack affect. Warm air rises and is vented at roof level, causing cool air to be drawn in from low openings.



▲Figure 38 *Image by Author*
Similar to Parekh House, natural ventilation by stack affect could be utilized at Sage House.



▲Figure 38 *Image by Author*
Openings at multiple sides of Tye River Cabin allows for a natural cross ventilation.

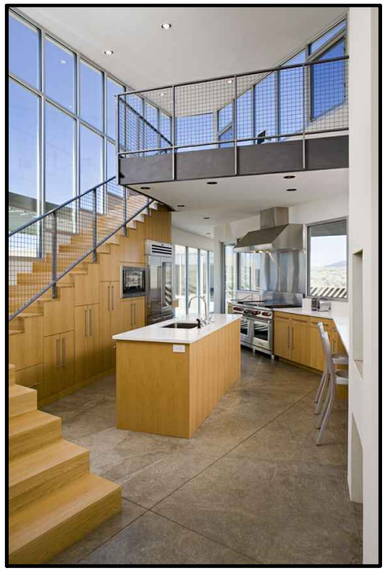


▲Figure 38 *Image by Author*
Operable windows/ doors at Tye River Cabin can help direct the wind inwards to the interior.

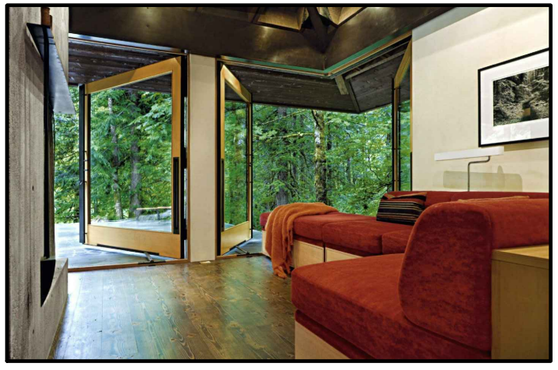
Natural Light

Natural lighting is yet another renewable resource readily availably to any building project, regardless of location. “Natural lighting uses sunlight and diffuse radiation from the sky to provide light inside buildings” (Bainbridge & Haggard, 2011, p. 136). Natural light is beloved by both architects and their clients by its ability to “delight our lives by providing movement, change, and connection to the outdoor environment” (Bainbridge & Haggard, 2011, p. 136). Natural light has obvious economic benefits over artificial light such as reduced energy consumption throughout the lifecycle of the building with little to no additional construction cost, but it can also provide great physiological benefits as well. “Studies have proven natural light can improve moods, spirit, performance, and health” (Bainbridge & Haggard, 2011, p. 136). For houses, windows may be all you need to sufficiently daylight your home. Placement of these windows is critical when considering light quality. North facing windows provide great indirect light, often referred to as artist's light. Direct “Sun from the east and west is very difficult to control owing to its lower angles, which cannot be blocked by simple overhangs” (Bainbridge & Haggard, 2011, p. 13) that the high southern sun can easily be. The control of east or west sun is better accomplished through vertical fins, wing walls, louvered screens, or landscaping” (Bainbridge & Haggard, 2011, p. 13). Direct sunlight into the home should be considered cautiously due to its ability to cause glare. “Since glare is a contrast problem, it is usually reduced by introducing light from multiple direction, thereby reducing the contrast” (Bainbridge & Haggard, 2011, p. 141). Sage house addresses these considerations well. Openings on the east and west elevations are kept to a minimum (Refer to figure 41). Sun entering through openings in multiple direction of north and south will prevent glare, with added protection from direct southern sun with louvered overhangs that both provide shade and diffuse the light. Light captures by the glazed, open two storey portion of the home acting as a light tower provides great indirect lighting to the center of the home (Refer to figure 42). Light coloured walls, ceilings, and finishes allow the light to travel further throughout the home. Tye River Cabin also allows light in from multiple directions while large overhangs shade its interior from direct southern sun (Refer to figure 43). In this location, low angles of the east and western sun is shaded by the surrounding trees.

▲Figure 41 *(Antoine Predock Architect, n.d.)*
Limited openings are located on the east and west elevations of Sage House due to low sun angles from these directions.



▲Figure 42 *(Antoine Predock Architect, n.d.)*
An open two storey portion of Sage House with maximum glazing provides indirect natural light to the floor area below.

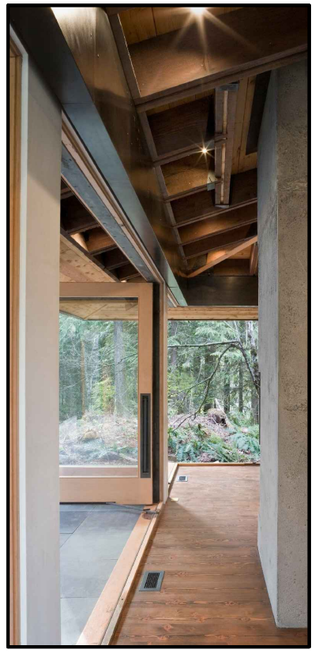


▲Figure 43 *(Olson Kundig Architects, n.d.)*
large openings facing multiple directions provide natural light to Tye River Cabin while surrounding trees diffuse low angled direct light.

Local Materials

Choice of construction materials play a major role in a project sustainability, which has been defined by the United Nations as “The ability to meet the needs of the present without compromising the needs of future generations”. The use of regional materials usually means that the material is readily available, energy in transportation is reduced due to proximity of manufacturing to the site, and local tradesmen are most likely skilled with the familiar material. Parekh house is comprised of brick and concrete (Refer to figure 44). Although concrete has a high embodied energy, the material still plays a necessary role in the majority of construction projects due to its structural properties and use in footings and foundations. Brick is a material that has a fairly simple manufacturing process which is used in most areas of the world with some variations. Highly skilled masons are not required for simple brick construction as seen at Parekh House which means that installers can likely be found locally. Brick also offers a durable and low maintenance finish which reduces maintenance cost and energy throughout the building's lifecycle. An obvious regional material for the forested area of Tye River Cabin is wood or lumber, which the house uses for its wall and roof structure (Refer to figure 45). Wood is a sustainable material due to its low embodied energy. It is also a renewable material when forested properly. What improves the sustainability of wood, or any building material in this case, is when the material is salvaged or re-purposed. All wood components in Tye River Cabin were “salvaged from an old warehouse slated for demolition” (Olson Kundig Architects, n.d.).

▲Figure 44 *(Serenyi, 1975)*
Brick and concrete can be locally sourced and installed at Parekh House and provide a durable, low maintenance finish.



▲Figure 45 *(Olson Kundig Architects, n.d.)*
Reclaimed wood, sourced from a an old warehouse was used for the structure of Tye River Cabin.

Conclusion

As first mentioned in this comparison, the differences in climate, context, and geography between the three case studies are extreme. From the open desert setting of Sage House, to the Urban context of Parekh House, to the forested waterside site of Tye River Cabin, each offer varying degrees of choices and restrictions for the architects.

Placement and orientation are two areas that can be heavily influenced and restricted by climate, context, and geography. A site like Sage House offers a great amount of options when placing or orienting the building due to a lack of neighbours and great views in all directions, whereas Parekh House has limited choice due to its smaller urban plot. Although always facing the equator, as mentioned by Bainbridge & Haggard, as being an important rule for a solar passive design, I don't trust each site always allows for it, nor should it be followed for some. For example, the site of Tye River Cabin is unique because it has a river that runs along side of it, a great asset to the property. The cabin is placed at the crest of the hill and oriented to face the water, as I believe it should no matter what direction the water is in. If the water was to the north and the service road behind the site was to the south, Facing the road and turning your back to the water would be a great waste of the site and a missed opportunity in my opinion.

Other areas such as solar gain, natural lighting, and natural ventilation can be achieved with greater options regardless of climate, context, and geography. Our knowledge of the path the sun takes allows for solar gain to be addressed despite building location. The use of simple overhangs or awnings to control solar gain by shading the intense high sun while letting in low sun in cooler months can be seen throughout all three case studies. Natural ventilation strategies such as stack affect, and cross ventilation can be achieved regardless of climate or geography. Warm air will always rise, and prevailing winds remain consistent. Natural lighting is probably the most accessible resource for passive design since all three sites have access to sunlight. Windows, which are already a standard component to any house, can be strategically placed to allow a desired light quality inside the home. The same principles apply in any location, such as diffusing direct light or providing light coloured finishes, abling light to travel further into the interior.

Whether they might limit the decisions made by architects, or provide possibilities for creative outcomes, climate, context, and geography play an important role in any building construction and should be carefully evaluated for each individual project.

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